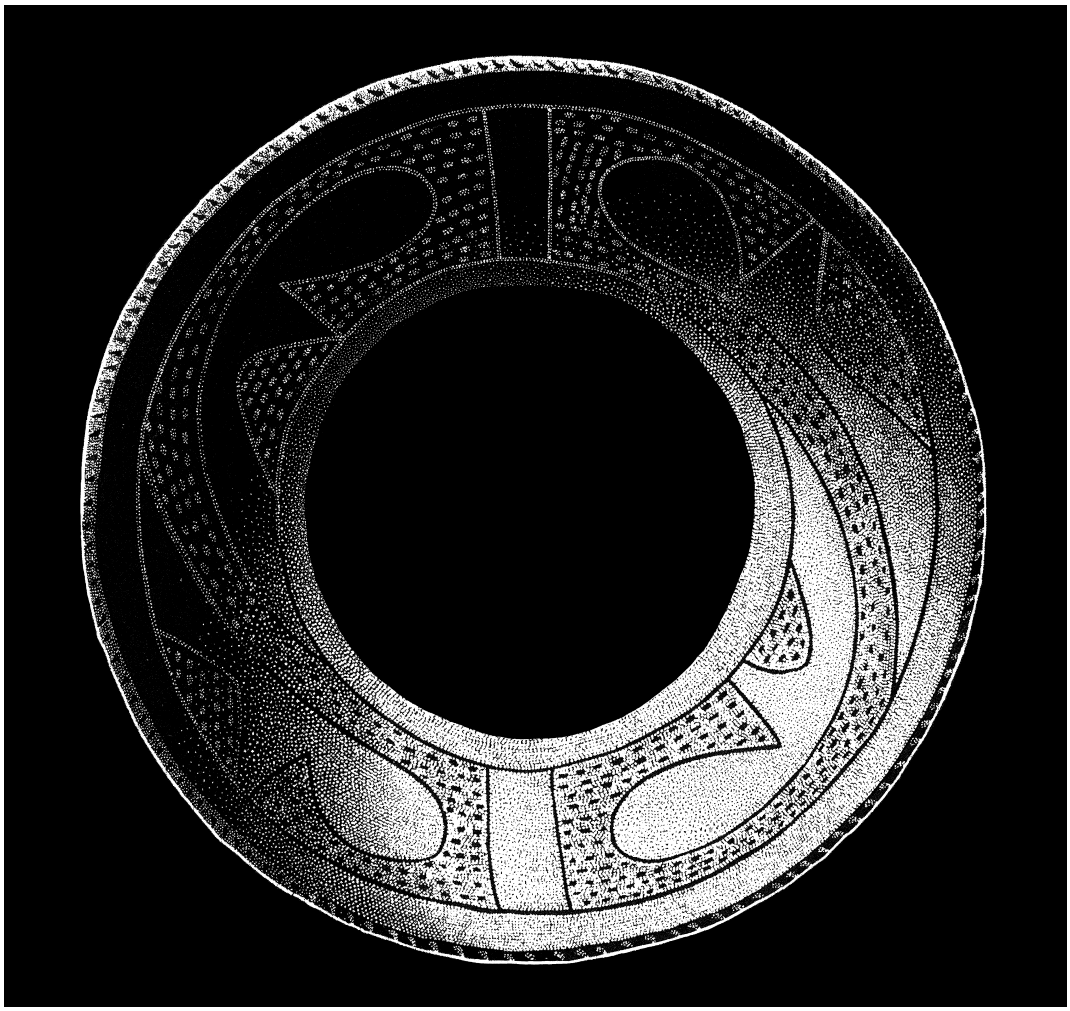
The Excavation of Khok Phanom Di,
A Prehistoric Site in Central Thailand
Volume VI: The Pottery, other Ceramic Materials and their Cultural Role
(The Material Culture, Part II)



Frontispiece: Pottery vessel from burial 11

Reports of the Research Committee

of the

Society of Antiquaries of London

No. LXX

The Excavation of Khok Phanom Di

A Prehistoric Site in Central Thailand

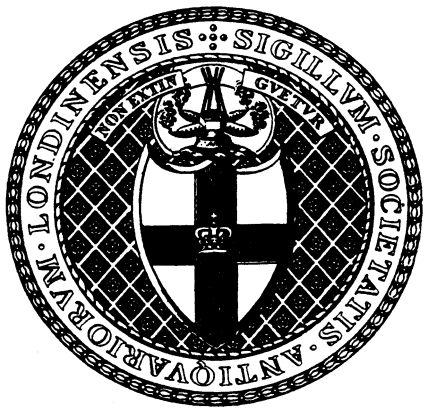
Volume VI: The Pottery

The Material Culture (Part II)

By

B. A. Vincent, B.A.(Hons), Ph.D.

Series editors: C. F. W. Higham, Sc.D., F.S.A., F.B.A. and R. Thosarat, M.Sc., Ph.D.



Published by The Society of Antiquaries of London
Distributed by Oxbow Books Ltd.
2004

© The Society of Antiquaries of London 2004

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

The excavation of Khok Phanom Di: a prehistoric site in central Thailand.
Vol. VI, The pottery, other ceramic materials and their cultural role (the material culture Part II)
(Reports of the Research Committee of the Society of Antiquaries of London) No.70
1. Thailand, Antiquities. Excavation of remains
I. Vincent, Brianm 1938
Series 959. 3021

ISBN 0-85432-282-X ISSN 0953-7163
ebook ISBN 9781782978046

PRINTED IN NEW ZEALAND BY
THE UNIVERSITY OF OTAGO

CONTENTS

PAGE
List of figures xiii
List of tables xxii

Preface xxix
Abbreviations xxxi

I INTRODUCTION 1
Methods 2
On-site procedures 3
The processing scheme 4
The principal features of the Khok Phanom Di processing scheme 6
A note on the structure of this volume 7

II THE PURPOSE OF TECHNOLOGICAL STUDIES 9
Fabric analysis and potting technology 11
Ceramic evidence for the cultivation of rice 16
Pottery types 17

III PREVIOUS RESEARCH 19
Previous technological studies 28
Central Thailand 28
West Central Thailand 28
Western Thailand 29
Central Highlands 29
North Highlands 31
Northeast Thailand 32
Malaysia 36
Indonesia 37
Vietnam 37
Previous technological studies: concluding remarks 37
The Bang Pakong Valley: Khok Phanom Di and Nong Nor 38
Nong Nor 38

IV THE CERAMIC SETTING 43
Geography and geomorphology 43
Climate 50
Geology 50
Potting clays 53
Temper 58
Fuel 62

V THE KHOK PHANOM DI POTTING CLAYS 69
Ban Pakong Valley clay 72
Clay samples 72
Methods 74
Results 78
Interpretations of the X-ray diffraction spectra 80
VI DEFINING THE CERAMIC PERIODS 93
The Ceramic Periods defined 95
Pottery and cultural sequences 99
Relative and absolute dating 100
Ceramic evidence 102
Corroborating ceramic with non-ceramic changes 105
Summary and discussion 106
VII CERAMIC PERIOD ONE 107
The stratigraphy (layer 11:2 to layer 10:25) 107
The pottery related artefacts of Ceramic Period 1 109
Prepared clay 109
The temper caches 114
Artefact caches 115
Ceramic anvils 115
The burnishing stones 117
Bone stylus points 120
The ceramic firing stands 122
The pottery of Ceramic Period 1 128
Rim descriptions and definitions 130
Coarse ware rims 131
Fine ware rims 134
Vessel base descriptions and definitions 153
The tripod vessel feet 158
Ceramic pellets 159
Decorative modes 159
“Complete” vessels 161
Firing temperatures 163
VIII CERAMIC PERIOD TWO 165
The stratigraphy (layer 10:24 to layer 10:3) 165
The pottery related artefacts of Ceramic Period 2 168
The potters’ equipment in burials 168
The ceramic anvils 170
The potters’ marks on ceramic anvils 171
Cord marks on ceramic anvils 179
Bone stylus points 180

The ceramic firing stands . . . 180
Prepared clay . . . 184
Miscellaneous ceramic artefacts: Ceramic Period 2 . . . 186
Ceramic pellets . . . 186
The ceramic net weights . . . 186
The pottery of Ceramic Period 2 . . . 188
Burnished and incised wares . . . 188
Incised fine ware sherds . . . 189
Burnished fine ware sherds . . . 189
Paddle-impressed ware sherds . . . 191
Painted and slipped fine wares . . . 191
Punctate ware sherds . . . 192
Appliqué sherds . . . 193
Miscellaneous shell-impressed sherds . . . 194
The rim sherds . . . 194
Coarse ware rims . . . 194
Fine ware rims . . . 201
Summary . . . 236
Vessel bases and tripod feet . . . 237
Tripod pot feet . . . 237
Vessel lids . . . 240
Decorative modes . . . 243
“Complete” vessels . . . 245
Non-mortuary vessels . . . 246
Mortuary vessels . . . 255
Ceramic Period 2: summary and concluding remarks . . . 295

IX CERAMIC PERIOD THREE . . . 303
The stratigraphy (layer 10:2 to layer 5) . . . 304
The pottery related artefacts of Ceramic Period 3 . . . 306
The potters’ equipment in burials . . . 306
The ceramic anvils . . . 307
The potters’ marks on ceramic anvils . . . 313
Cord marks on ceramic anvils . . . 317
Burnishing stones . . . 317
Bone stylus points . . . 318
Prepared clay . . . 319
Miscellaneous ceramic artefacts . . . 321
The ceramic pellets . . . 321
The ceramic net weights . . . 321
The pottery of Ceramic Period 3 . . . 322
Burnished and incised wares . . . 322
Incised fine ware sherds . . . 324
Burnished fine ware sherds . . . 325

Paddle-impressed ware sherds . . . 325
Painted and slipped fine wares . . . 326
Punctate ware sherds . . . 328
Vessel lids . . . 328
Appliqué sherds . . . 329
The rim sherds . . . 331
Coarse ware rims . . . 331
Fine ware rims . . . 343
Fabric summary . . . 390
Summary . . . 392
Vessel bases and tripod feet . . . 397
Tripod pot feet . . . 398
Ladle handle . . . 399
Decorative modes . . . 399
"Complete" vessels . . . 402
Non-mortuary vessels . . . 403
The mortuary vessels . . . 410
Notes to the mortuary vessels . . . 458
Ceramic Period 3: concluding remarks . . . 461
Summary and discussion . . . 461
Comparison of CP2 and CP3 pottery styles . . . 470
Comparison of CP2 and CP3 ceramic technologies . . . 473
Synthesis of CP2/3 developments . . . 475
Ceramic traditions and the environment . . . 477

X CERAMIC PERIOD FOUR . . . 479
The stratigraphy (layer 4 to layer 1) . . . 479
The pottery related artefacts of Ceramic Period 4 . . . 486
The burnishing stones . . . 486
The ceramic anvils . . . 486
The ceramic anvil fabrics . . . 490
The potters' marks on ceramic anvils . . . 518
Cord marks on ceramic anvils . . . 525
Bone stylus points . . . 525
Prepared clay . . . 526
Miscellaneous ceramic artefacts: Ceramic Period 4 . . . 528
Ceramic pellets . . . 528
Ceramic "counters" . . . 529
The pottery of Ceramic Period 4 . . . 530
Burnished and incised wares . . . 530
Incised fine ware sherds . . . 530
Burnished fine ware sherds . . . 531
Paddle-impressed ware sherds . . . 531
Painted and slipped fine wares . . . 531

Punctate ware sherds . . . 531
Appliqué sherds . . . 532
The rim sherds . . . 533
Coarse wares . . . 533
Fine wares . . . 539
Porcelain and stoneware rims . . . 578
Summary . . . 580
Fabric summary . . . 584
Vessel bases . . . 585
Tripod pot feet . . . 586
Vessel lids . . . 590
Decorative modes . . . 590
"Complete" vessels . . . 592
Notes to the Ceramic Period 4 "complete" vessels . . . 593
Ceramic Period 4: summary and concluding remarks . . . 602
Summary and discussion . . . 602
Comparison of CP3 and CP4 pottery styles . . . 605
Comparison of CP3 and CP4 ceramic technologies . . . 606
Synthesis of CP3/4 developments . . . 607
CP4 pottery production and the environment . . . 608

XI SUMMARY AND DISCUSSION . . . 609
Ceramic Period 1: Summary . . . 609
Ceramic Period 1: Discussion . . . 613
Ceramic Period 1 and relationships with other sites . . . 618
Nong Nor Phase 1 . . . 620
Ceramic Period 2: Summary . . . 623
Ceramic Period 2: Discussion . . . 627
Ceramic Period 2 and relationships with other sites . . . 632
Ceramic Period 3: Summary . . . 633
Ceramic Period 3: Discussion . . . 638
Ceramic Period 3 and relationships with other sites . . . 658
Ceramic Period 4: Summary . . . 661
Ceramic Period 4: Discussion . . . 662
Ceramic Period 4 and relationships with other sites . . . 663
The ceramic spectrum . . . 664
Pottery production compared with other Thai sites. . . . 682
Interpretation of the ceramic sequence . . . 683
Craft specialization . . . 684
Social stratification . . . 689
Food surpluses and social differentiation . . . 693
Rice and its role in Khok Phanom Di pottery . . . 694
Exchange and the CP3 containers . . . 696
Explanatory models . . . 697

XII CONCLUSIONS 701
Khok Phanom Di as a regional potting centre 701
Temporal changes in local pottery production 705
Temporal changes in exotic pottery 716
Ceramic production and exchange relationships 719
Social organisation 722
Khok Phanom Di in Southeast Asia 727
Conclusions and final comments 733
XIII APPENDIX ONE 737
Fabric descriptions 738
Fabric photomicrographs 747
XIV APPENDIX TWO 757
Rim forms 757
Carinated burial jars 760
Rim form weights by stratigraphic layers 765
XV APPENDIX THREE 789
Vessel types 789
Tripod pot feet 798
Carinated burial jars, bases, lids and decorated sherds 799
XVI APPENDIX FOUR 825
Grave goods 825
Grave depths 830
XVII BIBLIOGRAPHY 837
XVIII GLOSSARY OF TECHNICAL TERMS 869
Index 879

LIST OF FIGURES

		PAGE
1	The Khok Phanom Di Ceramic Periods	12
2	Sites mentioned in the text	22
3	Sites containing pottery subjected to technological analysis	25
4	Khok Phanom Di and Nong Nor radiocarbon determinations	40
5	The geomorphology of the Bang Pakong Valley	44
6	The soils of the Central Plain	45
7	Holocene sea levels	48
8	Geology of the Bang Pakong Valley region	52
9	Khok Phanom Di radiocarbon dates and pooled Nong Nor Phase 1 dates	56
10	Selected properties of grogs in thin-section	61
11	A schematic summary of the principal clay mineral structures	70
12	Clay quarries and sample sites mentioned in the text	76
13	Clay DN1 (*din niao*) 1,000 cps	82
14	Clay DN2 (*din niao*) 1,000 cps	82
15	Clay Z1 (padi field) 1,000 cps	83
16	Clay Z2 (padi field) 400 cps	83
17	Clay DD (*din dum*) 1,000 cps	84
18	Clay P1 (Ban Khok Raka) 400 cps	84
19	Clay P2 (Wat Phan Thong) 400 cps	85
20	Clay P3 (Phan Thong brickworks) 400 cps	85
21	Clay P4 (Nong Wua brickworks) 1,000 cps	86
22	Clay P5 (Nong Klang brickworks) 1,000 cps	86
23	Clay B1 (fishpond) 400 cps	88
24	Clay B2 (fishpond) 400 cps	88
25	Clay B3 (fishpond) 400 cps	89
26	Clay B4 (fishpond) 400 cps	89
27	Clay B5 (fishpond) 400 cps	90
28	Clay B6 (fishpond) 400 cps	90
29	Clay B7 (fishpond) 400 cps	91
30	Clay B8 (fishpond) 400 cps	91
31	Clay B9 (fishpond) 400 cps	92
32	Clay B10 (fishpond) 400 cps	92
33	Schematic summary of the ceramic and cultural sequences	110
34	The north section at Khok Phanom Di	111
35	The south section at Khok Phanom Di	112
36	The features identified in L11:2	113
37	Ceramic Period 1 potters' anvils: cats. 1932, 1933, 2001 and 2009	118
38	Ceramic Period 1 potters' anvils: cats. 1905, 1907, 1935 and 1963	119

39 Ceramic Period 1 vessel: cat. 1955, L11:2. 124
40 Ceramic Period 1 ceramic firing stands: cats. 1892 and 1901. 127
41 The two different versions of rim form 1 132
42 The orientation of rim form 1. Ceramic Period 1 and Ceramic Period 2 133
43 Rim forms 2 and 2b. Ceramic Period 1 133
44 A rim form 3 vessel. Cat. 1394. 134
45 Rim form 3 and variants. Ceramic Period 1 135
46 A rim form 4 vessel: cat. 1518. Ceramic Period 2 137
47 Rim form 4 and variants. Ceramic Period 1 138
48 Rim form 5 vessels: cats. 1519 and 1679. Ceramic Period 2 140
49 Rim form 5 vessels: cats. 1649 and 1691. Ceramic Period 2 141
50 Rim form 5 minor category vessels: cats. 1619 and 1890 142
51 Rim form 5 categories and variants. Ceramic Period 1 143
52 Rim form 5 categories and variants. Ceramic Period 1 144
53 Rim form 6 categories. Ceramic Period 1 146
54 Rim form 7 Ceramic Period 1 and a MP3 Ceramic Period 2 vessel (cat. 1431) . . 148
55 Rim forms 8 and 8a. Ceramic Period 1 148
56 A Ceramic Period 2 rim form 8 vessel: cat. 1384 149
57 Rim form 9. Ceramic Period 1 150
58 Rim form 10 and variants. Ceramic Period 1 151
59 Rim form 11 and 11a. Ceramic Period 1 153
60 Ceramic Period 1 base forms 155
61 Ceramic Period 1 base forms (cont.) 156
62 Appliqué form A1. Ceramic Period 1 161
63 The burnishing stones from burials 107 and 110 169
64 Ceramic Period 2 potters' anvils: cats. 1240, 1247, 1264 and 1379 173
65 Ceramic Period 2 potters' anvils: cats. 1307, 1403, 1423, 1435, 1571, 1571a and 1443 174
66 Ceramic Period 2 potters' anvils: cats. 1485, 1486, 1499, 1549, 1625 and 1626 . . 175
67 Ceramic Period 2 potters' anvils: cats. 1634, 1635, 1666, 1668, 1728 and 1732 . . 176
68 Ceramic Period 2 potters' anvils: cats. 1764, 1807, 1340, 1448, 1798 and 1867 . . 178
69 Ceramic Period 2 bone stylus points 181
70 Ceramic Period 2 ceramic firing stands: cats. 1228, 1255, 1277, 1324 and 1382. . 185
71 A Ceramic Period 2 bow pellet. 187
72 Punctate ware sherds. Ceramic Period 2. 193
73 Appliqué form A2. Ceramic Period 2. 195
74 The distribution of rim form 1 in Ceramic Periods 1, 2 and 3 196
75 Rim form 1 categories. Ceramic Period 2 199
76 Rim form 2 and 3 categories and variants. Ceramic Period 2 200
77 Rim form 4 categories. Ceramic Period 2 204
78 Rim form 5a to 5d categories and variants. Ceramic Period 2 206
79 Rim form 5e to 5l categories and variants. Ceramic Period 2 207
80 Rim form 5m to 5q categories and variants. Ceramic Period 2 208

81 Rim form 5r to 5y categories and variants. Ceramic Period 2 209
82 Rim form 5z to 5af categories and variants. Ceramic Period 2 210
83 Rim form 5ai to 5ak categories and 6b(vi) variant. Ceramic Period 2 211
84 Rim form 6 to 6b(v) categories and variants. Ceramic Period 2 225
85 Rim form 6f to 6k categories and variants. Ceramic Period 2 226
86 Rim form 6l to 6s categories and variants. Ceramic Period 2 227
87 Rim form 6t to 6y categories and variants. Ceramic Period 2 228
88 Rim form 6z to 6aag categories and variants. Ceramic Period 2 229
89 Rim form 11(i), 11(ii), 12, 12a, 12b, 12d and 12e. Ceramic Period 2 231
90 Rim forms 12c, 13, 14 and 15. Ceramic Period 2 233
91 Base Form L. Ceramic Period 2 238
92 Tripod footed vessel. Ceramic Period 2 238
93 Vessel feet. Ceramic Period 2 241
93 Vessel feet (cont.). Ceramic Period 2 242
94 Vessel lids. Ceramic Period 2 243
95 Decorative modes. Ceramic Period 2 244
96 Non-mortuary vessels: cats. 3244 layer 10:17 and cat. 3276 layer 10:14. Ceramic Period 2 247
97 Non-mortuary vessels: cats. 3277 layer 10:5 and 3278 layer 10:10 248
98 Non-mortuary vessels: cats. 1742 and 3245 layer 10:17. Ceramic Period 2 249
99 Non-mortuary vessels: cats. 1890 layer 10:24 and 3243 layer 10:17. Ceramic Period 2 250
100 Non-mortuary vessels: cats. 3242 layer 10:15, 3241 layer 10:12 and 3240 layer 10:10. Ceramic Period 2 251
101 Non-mortuary vessel: cat. 1438 layer 10:10. Ceramic Period 2 252
102 Non-mortuary vessels: cats. 3238 and 3239 layer 10:4. Ceramic Period 2 253
103 Non-mortuary vessels: cats. 3236 and 3237 layer 10:3. Ceramic Period 2 254
104 Mortuary vessels: cats. 1691 burial 130 layer 10:15 and 1638 burial 125 layer 10:14. Ceramic Period 2 264
105 Mortuary vessel: cat. 1659 burial 110 layer 10:15. Ceramic Period 2 265
106 Mortuary vessels: cats. 1678 and 1679 burial 120 layer 10:14. Ceramic Period 2 . 266
107 Mortuary vessel: cat. 1651 burial 113 layer 10:13. Ceramic Period 2 267
108 Mortuary vessels: cats. 1536 and 1537 burial 105 layer 10:11. Ceramic Period 2 . 268
109 Mortuary vessels: cats. 1542 and 1543 burial 102 layer 10:11. Ceramic Period 2 . 269
110 Mortuary vessels: cats. 1648 and 1649 burial 99 layer 10:11. Ceramic Period 2 . . 270
111 Mortuary vessel: cat. 1522 burial 101 layer 10:11. Ceramic Period 2 271
112 Mortuary vessel: cat. 1518 burial 91 layer 10:11. Ceramic Period 2 272
113 Mortuary vessels: cats. 1519 and 1520 burial 91 layer 10:11. Ceramic Period 2 . . 273
114 Mortuary vessels: cats. 1517 burial 91 layer 10:11 and 1620 burial 123 layer 10:10. Ceramic Period 2 274
115 Mortuary vessels: cats. 1619 and 1618 burial 123 Layer 10:10. Ceramic Period 2 . 275
116 Mortuary vessels: cats. 1450 burial 89 and 1454 burial 88 layer 10:10. Ceramic Period 2 276

117 Mortuary vessels: cats. 1453 burial 88 layer 10:10 and 1599 burial 103 layer 10:9. Ceramic Period 2 277
118 Mortuary vessels: cats. 1469 burial 93 and 1480 burial 92 layer 10:8. Ceramic Period 2 278
119 Mortuary vessels: cats. 1467 burial 90 layer 10:8 and 1468 burial 93 layer 10:9. Ceramic Period 2 279
120 Mortuary vessels: cats. 1466 burial 90 and 2019 burial 86 layer 10:8. Ceramic Period 2 280
121 Mortuary vessel: cat. 1465 burial 90 layer 10:8. Ceramic Period 2 281
122 Mortuary vessels: cats. 2020 burial 86 layer 10:8 and 1375 burial 75 layer 10:7. Ceramic Period 2 282
123 Mortuary vessels: cats. 1478 and 1479 burial 73 layer 10:7. Ceramic Period 2 . . 283
124 Mortuary vessels: cats. 1360 and 1361 burial 72 layer 10:7. Ceramic Period 2 . . 284
125 Mortuary vessels: cats. 1359 burial 72 layer 10:7 and 2016 burial 76 layer 10:6. Ceramic Period 2 285
126 Mortuary vessels: cats. 1391 and 1392 burial 74 layer 10:6. Ceramic Period 3 . . 286
127 Mortuary vessels: cats. 1390 burial 74 and 1432 burial 67 layer 10:6. Ceramic Period 3 287
128 Mortuary vessels: cats. 1320 and 1319 burial 64 layer 10:5. Ceramic Period 3 . . 288
129 Mortuary vessels: cats. 1431 burial 67 layer 10:6 and 1394 burial 79 layer 10:4. Ceramic Period 3 289
130 Mortuary vessel: cat. 3252 burial 76 layer 10:6. Ceramic Period 3 290
131 Mortuary vessels: cats. 1290 burial 57 and 1291 burial 60 layer 10:4. Ceramic Period 3 291
132 Mortuary vessels: cats. 1243 burial 56 layer 10:3 and 1288 burial 57 layer 10:4. Ceramic Period 3 292
133 Mortuary vessel: cat. 1284 burial 58 layer 10:3. Ceramic Period 3 293
134 Mortuary vessel: cat. 1283 burial 58 layer 10:3. Ceramic Period 3 294
135 Mortuary vessel: cat. 1384 burial 77 layer 10:2. Ceramic Period 3 295
136 Ceramic Period 3 potters' anvils: cats. 573, 569 and 904. 308
137 Ceramic Period 3 potters' anvils: cats. 975, 2038a and 2038b 310
138 Ceramic Period 3 potters' anvils: cats. 611, 802 and 1027 312
139 Ceramic Period 3 potters' anvils: cats. 847, 880, 907 and 954 313
140 Ceramic Period 3 potters' anvils: cats. 920, 1094 and 1310 314
141 Ceramic Period 3 potters' anvils: cats. 936 and 1099 315
142 Potters' marks on anvils: cats. 738 and 911. Ceramic Period 3. 316
143 Potters' marks on anvils: cats. 582 and 932. Ceramic Period 3 317
144 Vessel Lids. Ceramic Period 3 330
145 Appliqué sherds. Ceramic Period 3 332
146 Rim form 1a. Ceramic Period 3 333
147 Rim form 1 vessel. Ceramic Period 3 334
148 Rim form 1 vessel. Ceramic Period 3 336
149 Vessel fabrication: cat. 700. Ceramic Period 3 338

150 Vessel fabrication: cat. 852. Ceramic Period 3 339
151 Rim form 2b. Ceramic Period 3 340
152 Rim forms 3f(i), 3g and 3h. Ceramic Period 3 344
153 Rim forms 4f, 4f(i), 4i(i), 4au, 4av and 4ay. Ceramic Period 3 349
154 Rim form 4 categories. Ceramic Period 3 350
154 Rim form 4 categories. Ceramic Period 3 (cont.) 351
154 Rim form 4 categories. Ceramic Period 3 (cont.) 352
155 Rim forms 4aj, 4am, 4an and 4as. Ceramic Period 3 353
156 Rim forms 5ar, 5as, 5at, 5au, 5av, 5aw, 5ay and 5az. Ceramic Period 3 362
157 Rim forms 5ad(iv) and 5aax. Ceramic Period 3 363
158 Rim forms 5aab, 5aac, 5aad, 5aae, 5aaf, 5aag and 5aah. Ceramic Period 3 364
159 Rim forms 6w, 6y, 6z, 6ae and 6aa. Ceramic Period 3 375
160 Rim forms 6ac, 6ad, 6af, 6aag, 6am, 6an, 6ao and 6ap. Ceramic Period 3 376
161 Rim forms 6al, 6aq and 6ax. Ceramic Period 3 377
162 Rim forms 6aae, 6aah, 6au(i), 6ay and 6az. Ceramic Period 3 378
163 Rim forms 6au(vi), 6aw(i), 6aaa and 6aab. Ceramic Period 3 379
164 Rim forms 7b, 7b(i), 7d and 11 (layer 6). Ceramic Period 3 383
165 Rim forms 10f, 13b and 13c. Ceramic Period 3 388
166 Rim forms 13e, 13f, and 13n. Ceramic Period 3 389
167 Rim forms 14a, 14e and 14f. Ceramic Period 3 390
168 Rim form 15a. Ceramic Period 3 391
169 Base forms F, G and H. Ceramic Period 3 400
170 Base forms I, J and M. Ceramic Period 3 401
171 Non-mortuary vessels: cats. 3282 layer 10:1, 3281 layer 8:6 f81 and 3280 layer 7:4. Ceramic Period 3 405
172 Non-mortuary vessels: cats. 3230 and 3231 layer 10:1. Ceramic Period 3 406
173 Non-mortuary vessels: cats. 3232 and 3233 layer 10:1. Ceramic Period 3 407
174 Non-mortuary vessels: cats. 3270 layer 9:1 and 3267 layer 6:3. Ceramic Period 3 . 408
175 Non-mortuary vessels: cats. 3235 and 3286 layer 6:1. Ceramic Period 3 409
176 Mortuary vessel: cat. 1269 burial 37 layer 9:1. Ceramic Period 3 415
177 Mortuary vessel: cat. 1270 burial 37 layer 9:1. Ceramic Period 3 416
178 Mortuary vessels: cats. 2032 burial 41 and 2033 burial 39 layer 8:7. Ceramic Period 3 417
179 Mortuary vessels: cats. 2034 and 2790 burial 38 layer 8:7. Ceramic Period 3 . . . 418
180 Mortuary vessels: cats. 1039 burial 38 layer 8:7 and 988 burial 32 layer 8:5. Ceramic Period 3 419
181 Mortuary vessels: cats. 992 burial 30 layer 8:4 and 987 burial 31 layer 8:5. Ceramic Period 3 420
182 Mortuary vessels: cats. 990 burial 28 layer 8:4 and 1141 burial 47 layer 8:3. Ceramic Period 3 421
183 Mortuary vessels: cats. 914 burial 27 and 2030 burial 29 layer 8:3. Ceramic Period 3422
184 Mortuary vessels: cats. 1118 burial 33 and 1138 burial 45 layer 8:2. Ceramic Period 3423
185 Mortuary vessels: cats. 1117 and 1101 burial 33 layer 8:2. Ceramic Period 3 . . . 424

186 Mortuary vessel: cat. 1100 burial 33 layer 8:2. Ceramic Period 3 425
187 Mortuary vessels: cats. 1050 and 1051 burial 44 layer 8:1. Ceramic Period 3 . . . 426
188 Mortuary vessels: cats. 1049 burial 44 layer 8:1 and 2015 burial 43 layer 7:9. Ceramic Period 3 427
189 Mortuary vessels: cats. 2788 and 2789 burial 24 layer 7:7. Ceramic Period 3 . . . 428
190 Mortuary vessels: cats. 899 burial 24 layer 7:7 and 2791 burial 36 layer 7:6. Ceramic Period 3 429
191 Mortuary vessels: cats. 2029b burial 23 and 1024 burial 36 layer 7:6. Ceramic Period 3 430
192 Mortuary vessels: cats. 2029a burial 23 and 891 burial 22 layer 7:6. Ceramic Period 3431
193 Mortuary vessels: cats. 953 and 2787 burial 20 and 884 burial 22 layer 7:6. Ceramic Period 3 432
194 Mortuary vessels: cats. 1025 and 1026 burial 35 layer 7:5. Ceramic Period 3 . . . 433
195 Mortuary vessels: cats. 2785 and 2786 burial 16 layer 7:3. Ceramic Period 3 . . . 434
196 Mortuary vessels: cats. 933 and 2784 burial 16 layer 7:3. Ceramic Period 3 435
197 Mortuary vessels: cats. 2783 and 2794 burial 15 layer 7:2. Ceramic Period 3 . . . 436
198 Mortuary vessels: cats. 809 and 2794a burial 15 layer 7:2. Ceramic Period 3 . . . 437
199 Mortuary vessels: cats. 2781 and 2782 burial 15 layer 7:2. Ceramic Period 3 . . . 438
200 Mortuary vessel: cat. 913 burial 15 layer 7:2. Ceramic Period 3 439
201 Mortuary vessels: cats. 787 burial 14 layer 6:7 and 912 burial 15 layer 7:2. Ceramic Period 3 440
202 Mortuary vessel: cat. 853 burial 14 layer 6:7. Ceramic Period 3 441
203 Mortuary vessel: cat. 852 burial 14 layer 6:7. Ceramic Period 3 442
204 Mortuary vessels: cats. 823 burial 13 layer 6:5 and 854 burial 14 layer 6:7. Ceramic Period 3 443
205 Mortuary vessels: cats. 819 and 820 burial 13 layer 6:5. Ceramic Period 3 444
206 Mortuary vessels: cats. 763 and 765 burial 11 layer 6:4. Ceramic Period 3 445
207 Mortuary vessel: cat. 764 burial 11 layer 6:3. Ceramic Period 3 446
208 Mortuary vessels: cats. 794 and 795 burial 9 layer 6:3. Ceramic Period 3 447
209 Mortuary vessels: cats. 740 and 741 burial 8 layer 6:3. Ceramic Period 3 448
210 Mortuary vessel: cat. 697 burial 7 layer 6:3. Ceramic Period 3 449
211 Mortuary vessel: cat. 699 burial 2 layer 6:3. Ceramic Period 3 450
212 Mortuary vessels: cats. 979 and 980 burial 19 layer 5:2. Ceramic Period 3 451
213 Mortuary vessels: cats. 977 and 978 burial 19 layer 5:2. Ceramic Period 3 452
214 Mortuary vessels: cats. 3263 burial 19 and 3264 burial 18 layer 5:2. Ceramic Period 3 453
215 Mortuary vessel: cat. 618 burial 1 layer 6:1. Ceramic Period 3 454
216 Mortuary vessels: cats. 619 burial 1 layer 6:1 and 702 burial 12 layer 5:3. Ceramic Period 3 455
217 Mortuary vessels: cats. 701 and 703 burial 12 layer 5:3. Ceramic Period 3 456
218 Mortuary vessel: cat. 700 burial 12 layer 5:3. Ceramic Period 3 457
219 Features identified in layer 4:5, Ceramic Period 4 481
220 Features identified in layer 4:3, Ceramic Period 4 482

221 Features identified in layer 4:1, Ceramic Period 4 483
222 Features identified in lower layer 3 and layer 4 surface, Ceramic Period 4 484
223 Features identified in layers 2 and upper layer 3, Ceramic Period 4 485
224 Ceramic Period 4 potters' anvils: cats. 510, 534, 547 and 682 491
225 Ceramic Period 4 potters' anvils: cats. 527, 543, 549 and 553 492
226 Ceramic Period 4 potters' anvils: cats. 465, 497, 505 and 526 493
227 Ceramic Period 4 potters' anvils: cats. 385, 397, 482 and 671 494
228 Ceramic Period 4 potters' anvils: cats. 411 and 490 495
229 Ceramic Period 4 potters' anvils: cats. 394, 447, 449 and 484 496
230 Ceramic Period 4 potters' anvils: cats. 342, 359, 373 and 381 497
231 Ceramic Period 4 potters' anvils: cats. 317 and 358 498
232 Ceramic Period 4 potters' anvils: cats. 286, 288, 443 and 468 499
233 Ceramic Period 4 potters' anvils: cats. 257, 272, 278 and 282 500
234 Ceramic Period 4 potters' anvils: cats. 261, 268 and 477 501
235 Ceramic Period 4 potters' anvils: cats. 269, 274 and 478 502
236 Ceramic Period 4 potters' anvils: cats. 212, 214, 231 and 236 503
237 Ceramic Period 4 potters' anvils: cats. 156, 159, 160, 166, 167 and 177 504
238 Ceramic Period 4 potters' anvils: cats. 187, 188, 193 and 194 505
239 Ceramic Period 4 potters' anvils: cats. 164, 171, 173 and 206 506
240 Ceramic Period 4 potters' anvils: cats. 102, 103, 104 and 196 507
241 Ceramic Period 4 potters' anvils: cats. 105, 112, 115 and 130 508
242 Ceramic Period 4 potters' anvils: cats. 126, 128, 132, 133 and 144 509
243 Ceramic Period 4 potters' anvils: cats. 51, 55, 66, 69, 80 and 146 510
244 Ceramic Period 4 potters' anvils: cats. 43, 57, 58 and 63 511
245 Ceramic Period 4 potters' anvils: cats. 45, 86, 88, and 96 512
246 Ceramic Period 4 potters' anvils: cats. 5, 17, 20 and 32 513
247 Ceramic Period 4 potters' anvils: cats. 8, 52, 53 and 189 514
248 Ceramic Period 4 marked anvils: cats. 17, 57, 58, 66, 80, 96, 104 and 105 521
249 Ceramic Period 4 marked anvils: cats. 132, 144, 188, 212, 214 and 236 522
250 Ceramic Period 4 marked anvils: cats. 268, 274, 288, 342, 359 and 468 523
251 Ceramic Period 4 marked anvils: cats. 490, 385, 497 and 682 524
252 Appliqué sherds. Ceramic Period 4 533
253 Rim form 2e. Ceramic Period 4 536
254 Rim form 3k. Ceramic Period 4 538
255 Rim form 3j. Ceramic Period 4 540
256 Rim forms 4a, 4b, 4c and 4d. Ceramic Period 4 547
257 Rim forms 4e, 4h, 4i, 4j and 4k. Ceramic Period 4 548
258 Rim forms 4l, 4m, 4n, 4o, 4p and 4q. Ceramic Period 4 549
259 Rim forms 4r, 4s and 4t. Ceramic Period 4 550
260 Rim forms 4u, 4v, 4w, 4x and 4y. Ceramic Period 4 551
261 Rim forms 4z, 4aa and 4ab. Ceramic Period 4 552
262 Rim forms 4ac, 4ad and 4ae. Ceramic Period 4 553
263 Rim forms 4b(i), 4af, 4ag and 4ah. Ceramic Period 4 554

264 Rim forms 4ai, 4aj and 4ak. Ceramic Period 4 . . . 555
265 Rim forms 4aac, 4aad, 4aae and 4aaf. Ceramic Period 4 . . . 556
266 Rim forms 4aag, 4aah, 4aai and 4aaj. Ceramic Period 4 . . . 557
267 Rim forms 5aai, 5aaj, 5aak and 5aal. Ceramic Period 4 . . . 558
268 Rim forms 5aam, 5aan, 5aao and 5aap(ii). Ceramic Period 4 . . . 560
269 Rim forms 5aap(i), 5aav(i) and 5aaw. Ceramic Period 4 . . . 565
270 Rim forms 5aaq, 5aar, 5aas, 5aat and 5aau. Ceramic Period 4 . . . 566
271 Rim forms 6aab(ii), 6aae and 6aaf. Ceramic Period 4 . . . 570
272 Rim forms 8c and 8d. Ceramic Period 4 . . . 572
273 Rim forms 13f and 13h. Ceramic Period 4 . . . 575
274 Rim forms 13j, 13k, 13l, 13m and 13n. Ceramic Period 4 . . . 576
275 Rim forms 16, 16a and 16b. Ceramic Period 4 . . . 577
276 Rim form 17. Ceramic Period 4 . . . 578
277 Porcelain rim forms 5 and 6. Stoneware rim form 5. Ceramic Period 4 . . . 579
278 Ceramic Period 4 base forms . . . 587
278 Ceramic Period 4 base forms (cont.) . . . 588
279 Lid forms 4(a), 6, 6(a), A and B. Ceramic Period 4 . . . 591
280 Non-mortuary vessels: cats. 3271 layer 5:2 (in f10, L4:3) and 3269 layer 2:2. Ceramic Period 4 . . . 594
281 Non-mortuary vessel: cat. 3266 layer 4:2. Ceramic Period 4 . . . 595
282 Non-mortuary vessels: cats. 3265 layer 4:3 f7 and 3268 layer 3:3. Ceramic Period 4 . . . 596
283 Non-mortuary vessel: cat. 3272 layer 3:2. Ceramic Period 4 . . . 597
284 Non-mortuary vessels: cats. 3234 layer 3:2 and 3229 layer 3:1. Ceramic Period 4 . . . 598
285 Non-mortuary vessel: cat. 3227 layer 2:2. Ceramic Period 4 . . . 599
286 Non-mortuary vessel: cat. 3228 layer 2:2 f1. Ceramic Period 4 . . . 600
287 Non-mortuary vessels: cat. 3275 layer 2:3, cat. 3279 layer 2:1 f1. Vessel lids: cat. 48 layer 2:1 and cat. 13 layer 1:1. Ceramic Period 4 . . . 601
288 Suggested exotic pottery sources. Ceramic Period 2 . . . 634
289 Mortuary Phase 3b Burials . . . 650
290 Mortuary Phase Four Burial Jar Distributions . . . 651
291 Mortuary Phase Five Burial Jar Distributions . . . 655
292 Mortuary Phase Six Burial Jar Distributions . . . 656
293 Suggested exotic pottery sources. Ceramic Period 3 . . . 659
294 Exotic and local burnished and incised wares by Ceramic Periods . . . 672
295 The distribution of burnished sherds and burnishing stones . . . 673
296 Incised and burnished/incised wares and bone styles by stratigraphic layers . . . 675
297 Rim forms 4 and 5 burnished ware proportions . . . 676
298 The distribution of appliqué wares . . . 677
299 The distribution of painted and slipped wares . . . 678
300 The distribution of lids . . . 679
301 The distribution of local and exotic paddle-impressed and punctate wares . . . 680
302 The distribution of bases . . . 681
303 The distribution of porcelain and stoneware . . . 682

304 Temporal changes in local ware production: all sherds 709
305 Temporal changes in local ware production: plain and cordmarked distributions . 710
306 Temporal changes in the distribution of all incised wares 711
307 Suggested exotic pottery sources 718
308 Photomicrographs of petrographic thin sections: fabric groups 1 to 3 749
309 Photomicrographs of petrographic thin sections (cont.): fabric groups 4 to 6 750
310 Photomicrographs of petrographic thin sections (cont.): fabric groups 7 to 9 751
311 Photomicrographs of petrographic thin sections (cont.): fabric groups 10 to 12 . . 752
312 Photomicrographs of petrographic thin sections (cont.): fabric groups 13 to 15 . . 753
313 Photomicrographs of petrographic thin sections (cont.): fabric groups 16 to 18 . . 754
314 Photomicrographs of petrographic thin sections (cont.): fabric groups 19 to 21 . . 755
315 Photomicrographs of petrographic thin sections (cont.): fabric groups 22, 23 and sand cache 756
316 Vessel fracture patterns: cat. 1679, B120; cat 1384, B77 792
317 Vessel fracture patterns: cat. 1543, B102; cat. 1518, B91 793
318 Vessel fracture patterns: cat. 819, B13; cat. 1101, B33 794
319 Vessel fracture patterns: cat. 1288, B57; cat. 1141, B47 795
320 Vessel fracture patterns: cat. 809, B15; cat. 992, B30 796
321 Vessel fracture patterns: cat. 1319, B64; cat. 1270, B37 797

LIST OF TABLES

		PAGE
1	Khok Phanom Di sherd weights	3
2	Prehistoric tempers previously identified in Thailand	23
3	Technological studies in South-East Asia by region	34
4	Radiocarbon dates from cores in the vicinity of Khok Phanom Di	55
5	Radiocarbon dates from Khok Phanom Di	57
6	Ethnographically recorded open firing fuels	64
6	Ethnographically recorded open firing fuels (cont.)	66
7	Botanical species potentially suitable as pottery firing fuels	67
8	Prepared potting clay weights by stratigraphic layer	73
9	Prepared potting clay weights by Ceramic Period	73
10	Prepared potting clay weights in burials and other features	74
11	Locations of Bang Pakong Valley and Khok Phanom Di clays sampled	77
12	Clay shrinkage tests	78
13	Bang Pakong Valley and Khok Phanom Di clays: plasticity tests	79
14	Ceramic Period 1 anvils	116
15	Ceramic Period 1 anvils: size, colour and cord marks	117
16	CP1 firing stand fabrics	125
17	Ceramic Period 1 firing stand forms	128
18	Rim forms, categories, variants and weights by stratigraphic layer	129
19	Rim form complexity by Ceramic Period	130
20	Rim form 3 fabrics: Ceramic Period 1	136
21	Site total of rim form categories and variants	138
22	Rim form 5 fabrics: Ceramic Period 1	145
23	Rim form 6 fabrics: Ceramic Period 1	147
24	Rim form 8 fabrics: Ceramic Period 1	149
25	The fabrics of rim form 10 and variants: Ceramic Period 1	152
26	The fabrics of rim form 11 and 11a: Ceramic Period 1	152
27	Vessel base forms by stratigraphic layer	154
28	The fabrics of base forms A, B, C, D and E: Ceramic Period 1	158
29	The tripod pot feet from Ceramic Period 1	159
30	The Ceramic Period 2 burnishing stones	168
31	The potters' equipment in Ceramic Period 2 burials	170
32	The ceramic potters' anvils from Ceramic Period 2	172
33	Ceramic Period 2 anvils: size, colour and cord marks	177
34	Ceramic Period 2 bone stylus points	182
35	Ceramic Period 2 firing stand fabrics	183
36	Ceramic Period 2 firing stand forms	183
37	Ceramic Period 2 prepared potting clay	184

38 The ceramic bow pellets from Ceramic Period 2 . . . 186
39 The ceramic net weights from Ceramic Period 2 . . . 187
40 Ceramic Period 2 exotic burnished and incised sherds . . . 188
41 Ceramic Period 2 burnished and incised sherds . . . 189
42 Ceramic Period 2 burnished sherds . . . 190
43 Ceramic Period 2 paddle impressed sherds . . . 191
44 Ceramic Period 2 painted and slipped sherds . . . 192
45 Ceramic Period 2 punctate sherds . . . 193
46 Rim form 1 fabrics: Ceramic Period 2 . . . 197
47 Ceramic Period 2 rim form 1 samples from burials . . . 197
48 Ceramic Period 2 rim form 2 fabrics . . . 198
49 Ceramic Period 2 rim form 3 in burials . . . 202
50 Rim form 3 fabrics: Ceramic Period 2 . . . 203
51 Rim form 4 fabrics: Ceramic Period 2 . . . 205
52 Rim form 5 fabrics: Ceramic Period 2 . . . 218
52 Rim form 5 fabrics: Ceramic Period 2 (cont.) . . . 219
53 Rim form 5 sherds in burials: Ceramic Period 2 . . . 220
54 Rim form 6 fabrics: Ceramic Period 2 . . . 223
55 Rim form 6 sherds in burials: Ceramic Period 2 . . . 224
56 Rim form 6 fabrics: Ceramic Period 2 . . . 224
57 Rim form 8, 10 and 12 fabrics: Ceramic Period 2 . . . 232
58 Rim form 14 fabrics: Ceramic Period 2 . . . 234
59 Exotic rim forms: Ceramic Period 2 . . . 235
60 Local and exotic rim form fabrics: Ceramic Period 2 . . . 236
61 Vessel base forms: Ceramic Period 2 . . . 237
62 The tripod pot feet from Ceramic Period 2 . . . 239
63 Non-mortuary vessels: Ceramic Period 2 . . . 246
64 Mortuary vessels: Ceramic Period 2 . . . 257
64 Mortuary vessels: Ceramic Period 2 (cont.) . . . 258
65 Mortuary vessels: Upper Mortuary Phase 3 . . . 259
66 The distribution of ceramic artefacts: Ceramic Period 2 . . . 299
67 Burnishing stones and anvils in Ceramic Period 3 burials . . . 307
68 Ceramic Period 3 anvils . . . 309
69 Ceramic Period 3 anvils: size, colour and cord marks . . . 311
70 Ceramic Period 3 burnishing stones . . . 318
71 Ceramic Period 3 bone stylus points . . . 319
72 Ceramic Period 3 prepared potting clay petrology . . . 320
73 The ceramic bow pellets from Ceramic Period 3 . . . 321
74 The ceramic net weights from Ceramic Period 3 . . . 321
75 Ceramic Period 3 exotic burnished and incised sherds . . . 322
76 Ceramic Period 3 burnished and incised sherds . . . 323
77 Ceramic Period 3 incised sherds . . . 324
78 Ceramic Period 3 incised sherds from burials . . . 324

79 Ceramic Period 3 burnished sherds . . . 325
80 Ceramic Period 3 burnished sherds from burials . . . 326
81 Ceramic Period 3 exotic paddle-impressed sherds . . . 327
82 Ceramic Period 3 exotic painted and slipped sherds . . . 328
83 Ceramic Period 3 punctate sherds . . . 328
84 Ceramic Period 3 lids . . . 329
85 Ceramic Period 3 appliqué sherds . . . 331
86 Rim form 1 fabrics: Ceramic Period 3 . . . 337
86 Rim form 1 fabrics: Ceramic Period 3 (cont.) . . . 338
87 Rim form 2 fabrics: Ceramic Period 3 . . . 341
88 Rim form 2 dimensions: Ceramic Period 3 . . . 342
89 Rim form 3b fabrics: Ceramic Period 3 . . . 342
90 Rim form 3 fabrics: Ceramic Period 3 . . . 345
91 Rim form 4 fabrics: Ceramic Period 3 . . . 355
92 Rim form 5 fabrics: Ceramic Period 3 . . . 366
92 Rim form 5 fabrics: Ceramic Period 3 (cont.) . . . 367
92 Rim form 5 fabrics: Ceramic Period 3 (cont.) . . . 368
92 Rim form 5 fabrics: Ceramic Period 3 (cont.) . . . 369
93 Local and exotic rim form 5 fabrics: Ceramic Period 3 . . . 369
94 Rim form 6 fabrics: Ceramic Period 3 . . . 380
94 Rim form 6 fabrics: Ceramic Period 3 (cont.) . . . 381
95 Local and exotic rim form 6 fabrics: Ceramic Period 3 . . . 381
96 Rim form 5 and 6 fabrics in Ceramic Period 3 burials . . . 382
97 Rim form 7, 8, 9, 10, 11 and 12 fabrics. Ceramic Period 3 . . . 385
98 Rim form 13, 14 and 15 fabrics. Ceramic Period 3 . . . 391
99 Exotic rim forms: Ceramic Period 3 . . . 394
100 Exotic and local rim form fabrics: Ceramic Period 3 . . . 395
101 Regional rim forms: Ceramic Period 3 . . . 396
102 Vessel base forms: Ceramic Period 3 . . . 397
103 The tripod pot feet from Ceramic Period 3 . . . 398
104 Cord mark characteristics. Ceramic Period 3 . . . 399
105 Non-mortuary vessels: Ceramic Period 3 . . . 403
106 Mortuary vessels: Ceramic Period 3 . . . 411
106 Mortuary vessels: Ceramic Period 3 (cont.) . . . 412
106 Mortuary vessels: Ceramic Period 3 (cont.) . . . 413
107 Type L2b burial jar motifs and potting accoutrements . . . 463
108 Pottery densities by Ceramic Period . . . 467
109 Proportions of coarse and fine wares: All Ceramic Periods . . . 468
110 Fine ware rim distributions: Ceramic Periods 2 and 3. . . . 472
111 Rim form 1 quantities in Ceramic Periods 2 and 3 . . . 475
112 The distribution of ceramic artefacts: Ceramic Period 3 . . . 476
113 Ceramic Period 4 burnishing stones . . . 486
114 Ceramic Period 4 anvils . . . 487

114 Ceramic Period 4 anvils (cont.) . . . 488
114 Ceramic Period 4 anvils (cont.) . . . 489
114 Ceramic Period 4 anvils (cont.) . . . 490
115 Ceramic Period 4 ceramic anvils: size, colour and cord marks . . . 515
115 Ceramic Period 4 ceramic anvils: size, colour and cord marks (cont.) . . . 516
115 Ceramic Period 4 ceramic anvils: size, colour and cord marks (cont.) . . . 517
116 Ceramic Period 4 bone stylus points . . . 526
117 Ceramic Period 4 prepared potting clay . . . 527
118 Ceramic Period 4 ceramic pellets . . . 528
119 Ceramic Period 4 ceramic "counters" . . . 529
120 Ceramic Period 4 incised ware sherds. . . . 531
121 Ceramic Period 4 paddle-impressed wares. . . . 532
122 Rim form 1 fabrics: Ceramic Period 4 . . . 535
122 Rim form 1 fabrics: Ceramic Period 4 (cont.) . . . 536
123 Rim form 2 fabrics: Ceramic Period 4 . . . 537
124 Rim form 3b, 3b(ii) and 3k fabrics: Ceramic Period 4 . . . 539
125 Rim form 3 fabrics: Ceramic Period 4 . . . 541
126 Rim form 4 fabrics: Ceramic Period 4 . . . 561
126 Rim form 4 fabrics: Ceramic Period 4 (cont.) . . . 562
127 Rim form 5 fabrics: Ceramic Period 4 . . . 568
127 Rim form 5 fabrics: Ceramic Period 4 (cont.) . . . 569
128 Rim form 6 fabrics: Ceramic Period 4 . . . 571
129 Rim form 7 to 17 fabrics: Ceramic Period 4 . . . 581
130 Decorative modes on fine ware rims: Ceramic Period 4 . . . 583
131 Fine ware rim distributions: Ceramic Period 3 and 4 . . . 583
132 Exotic rim forms: Ceramic Period 4 . . . 584
133 Local and exotic rim form fabrics: Ceramic Period 4 . . . 585
134 Vessel base forms: Ceramic Period 4 . . . 589
135 Non-mortuary vessels: Ceramic Period 4 . . . 593
136 The distribution of ceramic artefacts: Ceramic Period 4 . . . 607
137 Pottery form variations for Ceramic Periods 1 and 2 . . . 617
138 Exotic and local rim form fabrics: Ceramic Period 1 . . . 619
139 Analysis of "potters' " grave wealth in Ceramic Period 2 . . . 629
140 Analysis of "non-potters' " grave wealth in Ceramic Period 2 . . . 630
141 Ceramic Period 2 potters' and non-potters' grave wealth compared . . . 631
142 Analysis of "potters' " grave wealth in Ceramic Period 3 . . . 641
143 Analysis of "non-potters' " grave wealth in Ceramic Period 3 . . . 642
144 Mortuary Phase 4 potters' and non-potters' grave wealth compared . . . 643
145 Mortuary Phase 4 changes in mean grave wealth distributions . . . 645
146 Mortuary Phase 3b burial grave wealth . . . 646
147 Mortuary Phase 5, 6 and 7 burial and grave cut depths . . . 648
148 Mortuary Phase 5 burial grave wealth . . . 652
149 Mortuary Phase 6 burial goods . . . 653

150 Mortuary Phase 6 burial grave wealth . . . 658
151 Firing stands by Ceramic Period and Mortuary Phase . . . 665
152 Prepared potting clay weights by layer and Ceramic Period . . . 665
153 Prepared potting clays in burials and dumps . . . 666
154 Khok Phanom Di anvils by Ceramic Period . . . 667
155 Anvil numbers as a percentage of site depth . . . 668
156 Anvils by Mortuary Phase . . . 669
157 Anvils with potters' marks by Ceramic Period . . . 670
158 Suggested exotic burnished and incised wares . . . 671
159 Burnishing stones by Ceramic Period . . . 674
160 Bone stylus points by Ceramic Period . . . 674
161 Estimated tripod vessel numbers by Ceramic Period . . . 681
162 Burial and sherd densities at selected Thai sites . . . 683
163 The ritual treatment of vessels by Mortuary Phases . . . 703
164 Ceramic Period 2 and Ceramic Period 3 coarse ware weights . . . 713
165 Mortuary vessel furniture distributions by Ceramic Period . . . 715
166 Mortuary vessels by Mortuary Phase . . . 715
167 Exotic fabrics: All Periods . . . 717
168 Rim forms, categories and variants by Ceramic Period . . . 757
169 Rim forms, categories, variants and weights by Ceramic Period . . . 758
170 Fine ware rim form elaboration by Ceramic Period . . . 759
171 Exotic and local fine ware rim form elaboration by Ceramic Period . . . 759
172 Rim forms, categories, variants and weights by stratigraphic layer . . . 760
173 Fine ware rims present in both Ceramic Periods 2 and 3 . . . 760
174 The distribution of Ceramic Periods 2 and 3 fine ware rims . . . 761
174 The distribution of Ceramic Periods 2 and 3 fine ware rims (cont.) . . . 762
175 Fine ware rims present in both Ceramic Periods 3 and 4 . . . 762
176 The distribution of Ceramic Periods 3 and 4 fine ware rims . . . 763
176 The distribution of Ceramic Periods 3 and 4 fine ware rims (cont.) . . . 764
177 Carinated burial jar distributions . . . 765
178 Carinated burial jar motifs . . . 765
179 The distribution of rims . . . 766
179 The distribution of rims (cont.) . . . 767
179 The distribution of rims (cont.) . . . 768
179 The distribution of rims (cont.) . . . 769
179 The distribution of rims (cont.) . . . 770
179 The distribution of rims (cont.) . . . 771
179 The distribution of rims (cont.) . . . 772
179 The distribution of rims (cont.) . . . 773
179 The distribution of rims (cont.) . . . 774
179 The distribution of rims (cont.) . . . 775
179 The distribution of rims (cont.) . . . 776
179 The distribution of rims (cont.) . . . 777

179 The distribution of rims (cont.) . . . 778
179 The distribution of rims (cont.) . . . 779
179 The distribution of rims (cont.) . . . 780
179 The distribution of rims (cont.) . . . 781
179 The distribution of rims (cont.) . . . 782
179 The distribution of rims (cont.) . . . 783
179 The distribution of rims (cont.) . . . 784
179 The distribution of rims (cont.) . . . 785
179 The distribution of rims (cont.) . . . 786
179 The distribution of rims (cont.) . . . 787
180 Tripod pot feet: additional data . . . 798
181 Vessel base weights by layer . . . 800
182 Vessel base sherd weights . . . 801
182 Vessel base sherd weights (cont.) . . . 802
182 Vessel base sherd weights (cont.) . . . 803
182 Vessel base sherd weights (cont.) . . . 804
183 Carinated burial jar details . . . 805
183 Carinated burial jar details (cont.) . . . 806
184 Appliqué sherd weights . . . 807
185 Burnished and incised sherd weights . . . 808
185 Burnished and incised sherd weights (cont.) . . . 809
186 Burnished sherd weights . . . 810
186 Burnished sherd weights (cont.) . . . 811
186 Burnished sherd weights (cont.) . . . 812
186 Burnished sherd weights (cont.) . . . 813
186 Burnished sherd weights (cont.) . . . 814
187 Incised sherd weights . . . 815
187 Incised sherd weights (cont.) . . . 816
187 Incised sherd weights (cont.) . . . 817
187 Incised sherd weights (cont.) . . . 818
188 Painted and slipped sherd weights . . . 819
189 Paddle-impressed sherd weights . . . 821
189 Paddle-impressed sherd weights (cont.) . . . 822
190 Punctate sherd weights . . . 823
191 Grave goods . . . 826
191 Grave goods (cont.) . . . 827
191 Grave goods (cont.) . . . 828
191 Grave goods (cont.) . . . 829
192 Depths of grave contents by Mortuary Phase . . . 830
193 Mortuary Phases 7, 6, 5, 4 and Upper 3 burial and grave cut depths . . . 831
194 Mortuary Phases 3, 2 and 1 burial and grave cut depths . . . 832
195 Ritual Treatment of Ceramic Period 2 Burial Vessels by Mortuary Phases . . . 833
196 Ritual Treatment of Ceramic Period 3 Burial Vessels by Mortuary Phases . . . 834

197 Burial jar motifs by Mortuary Phases 835

PREFACE

PREHISTORIC pottery holds enormous potential for understanding past societies. Production is a central focus for the study of potting traditions. It incorporates technology (raw material preparation and manufacturing methods), supply and demand, labour organisation and relationships between producers and other groups. Although technical aspects of potting may often be given little more than cursory attention, perhaps due to their sometimes intractable nature, their investigation can illuminate important socio-economic developments. Together, these topics often allow insights into past cultural developments of considerable importance. For these reasons the author is indebted to the excavators of Khok Phanom Di, Charles Higham and Rachanie Thosarat, for providing the opportunity to work with such an important ceramic assemblage. I am also indebted to many individuals who have helped and to several institutions whose assistance allowed me to complete the project. My travel costs and accommodation were funded by the Ford Foundation. The University of Otago and the Thai Fine Arts Department are thanked for their support. I particularly wish to thank the Thai people for allowing me the opportunity to work in their country and for the privilege of examining their outstanding prehistoric ceramic artefacts.

Funding for the excavation of the ceramic assemblage, on-site cleaning, sorting, packing and transportation to the University of Otago's archaeological laboratories in Dunedin, New Zealand, was provided by the Ford Foundation. Without the use of the University of Otago Anthropology Department's Archaeological Laboratories the analysis would have been extremely difficult if not impossible, and I thank the department for extending me these facilities. The New Zealand Government funded a "Project Employment Personnel" team to help with the sorting, reconstruction of fragmented vessels and the thin-sectioning of samples under the author's supervision.

Assistance has been provided by the University of Otago Anthropology Department's artists and technicians. Les O'Neill is singled out for special mention. Les drew the pottery vessels and most of the ceramic artefacts, formatted maps and other figures from sketches in preparation for printing and gave valuable advice on preparing many of the illustrations. His patience and expert contribution with these are most important. Nigel Chang and Rod Jansen photographed the rim and other sherds and formatted them for computer processing. All this involved many hours. Helen Leach is thanked for her kind support. Martin Fisher traced the X - ray Diffraction spectrographs of potting clays. Additional drawings of several vessel rims were contributed by Lisa Cluney. My warm thanks are extended to them all for their help.

A Masters Thesis, which included a study of decorative motifs on the Khok Phanom Di pottery, was completed by Dianne Hall during the course of this project. She is thanked for her

kind co-operation with the surface decoration themes and for providing her sample of decorated sherds for further analysis so that the resultant data could be incorporated into this volume.

Graeme McKinstry helped in setting up the LaTeX typesetting programme on the author's personal computer so that the volume could be prepared at home. His skills with this are without peer and his most generous help extends well beyond any measure of normal expectations in such projects. Thank you Graeme.

Over the years discussions with numerous individuals have helped expand my ideas. In particular I would like to thank Tony Reay, Chuck Landis and Doug Campbell for stimulating discussions regarding geological and petrographic aspects of the research. The late Donn Bayard read excerpts and made some interesting observations regarding the development of the Khok Phanom Di cultural processes. Colleagues Jill Thompson and Lee Aitken provided information on aspects of their botanical and sedimentological research respectively. Graeme Mason provided suggestions regarding shell impressions. Francis Allard and Joyce White read some chapters and their help is most appreciated. Robert Murowchick is thanked for his help with the index and for his expert advice with the spelling of Chinese words.

I would also like to extend my sincere gratitude to Charles Higham for his considerable input into editing the script. We have spent many hours discussing and debating this most interesting site as we developed our individual interpretations. His help and suggestions have been important and his skill as an editor invaluable. Any errors which may remain are, of course, entirely the author's responsibility.

Finally, and most importantly, my deepest gratitude goes to my family for helping in the field and tolerating 14 years of my being distracted from "normal" family pursuits while I indulged myself in the arcane world of prehistoric ceramics. My sons Matthew and David listened to endless discussions about pottery and David applied his computing skills to the large rim data table in Appendix 2. My wife Margaret is extended special thanks for her ability to endure never ending discussions on tedious aspects of prehistoric ceramics and for her painstaking proof-reading of the entire text. I dedicate this volume to her:

> Our separation so abides and flies,
> That Thou residing here go'st yet with me,
> And I hence fleeing here remain with thee.[1]

[1] William Shakespeare, Antony and Cleopatra: Act I, Sc. iii

ABBREVIATIONS

ARF: argillaceous rock fragment
BP: before present
B: burial
cat: catalogue number
cont: continued
CP: Ceramic Period
cps: counts per second
EDS: energy dispersive system
FG: fabric group
L: layer
LST: limestone
MP: mortuary phase
NAA: neutron activation analysis
PIXE: proton-induced X-ray emission
Qtz: quartz
RF: rim form
RFgs: rock fragments
SEM: scanning electron microscope
SST: sandstone
XRD: X-ray diffraction
XRF: X-ray fluorescence

I INTRODUCTION

EXCAVATIONS carried out during 1984-85 at Khok Phanom Di, a prominent mound in the Bang Pakong Valley, Central Thailand, yielded very large quantities of pottery. The excavations were co-directed by Charles Higham and Rachanie Thosarat who invited the author to take charge of the pottery analysis. Approximately 680 m^3 of cultural material, including 156 burials, often associated with pottery vessels and potting tools, were removed from the 100 m^2 excavation. The latter include ceramic anvils, burnishing stones, bone styli, firing stands and shells for impressing decorative patterns. Over 3,600,000 potsherds, weighing about 12 tonnes, excluding complete vessels, clay dumps, net weights and other ceramic artefacts, were recovered. Such quantities present major logistical problems. They also provide an outstanding opportunity to study scientifically an integrated ceramic assemblage from a site covering approximately five hectares. Radiocarbon determinations suggest, apart from a very brief initial occupation period and a potting workshop comprising the upper 1 m of deposits, a sequence spanning the period *c.* 2000-1500 BC.

In 1985, Khok Phanom Di was located in a region little understood archaeologically. Pottery was the most abundant cultural material and ceramic analysis held considerable potential for bringing into focus several key aspects of regional prehistory. It could provide cultural information concerning the site, the Bang Pakong Valley and the broader Southeast Asian region. Two earlier excavations, and an abundance of pottery exposed at the mound edges, indicated the likelihood that the site was a major pottery production centre. Prehistoric Southeast Asian ceramic assemblages have rarely been studied in a detailed, scientifically rigorous, manner. Khok Phanom Di is a major prehistoric settlement in the Bang Pakong Valley, amongst numerous less prominent sites (Higham and Bannanurag 1990:1-8), known to contain a deep and complex stratigraphy. It was therefore felt vital to formulate processing methods which would allow detailed potting and related socio-economic evidence to be evaluated. Previous experience suggested that ceramic assemblages can be sensitive indicators of cultural change, often helping to bring into focus, cultural subsystems such as exchange and subsistence. Craft specialization, technology and social settings are of particular interest. Modes of production, exchange relationships, technical change and innovation help in understanding prehistoric cultural processes. Relationships between local production and regional technologies, the environment and social structures are potentially accessible through ceramic analysis. Aspects of regional cohesiveness and socio-economic relationships may involve the movement of potters and pottery. Large pottery assemblages present an opportunity to examine these issues.

The previous five volumes have described the excavation, chronology and human burials (Vol. I), the biological remains (shellfish, fish, mammals, pollen, the physical environment, microfauna and bird remains, Vol. II), the non-ceramic material culture (Vol. III), the botanical evidence (Vol. IV) and the human remains (Vol. V). The seventh volume will set out the directors' summary and conclusions. This study will describe the ceramic industry, subdivided into four Ceramic

Periods (CPs), characterised by continuity and changes. The origin of each local tradition, the development of external relationships, as evidenced by exchange of exotic materials, and possible explanations for the development of each local potting tradition and CP are suggested. These contribute to an understanding of the mortuary sequence as well as the source and socio-economic role of potters. To achieve these objectives, the pottery and related materials have been studied with a scientific rigour which combines form and decoration with analysis of the fabric, including thin section petrographic study and the sourcing of clays. This has involved understanding local and regional clay deposits, identifying manufacturing and firing procedures, analysing pottery types, (defined by form and fabric, to distinguish local from exotic wares), and considering the development of exchange relationships. Decorative techniques have been characterised and changes with time help indicate possible sources of exotic wares as well as the adoption of exotic techniques by local potters. The presence of rice in pottery has allowed inferences to be drawn regarding its local and regional cultural role.

METHODS

In the field, under the author's supervision, a team of 10 local workers helped wash and sort the various wares received from the excavation. When dry, sherds were first sorted into two major groups, and then taken through a series of analytical stages. The principal features of the processing scheme are set out on page six. First, "whole" pots were separated from fragmentary form categories (body sherds, rims, bases, appliqué, carinated and miscellaneous forms, including lids). These form groups were then categorised by surface decoration, including cord marked, plain, incised, punctate, paddle-impressed, painted/slipped, burnished, glazed and other less well represented groups including shell impressed. Cord-marked bodysherds were then sorted into fabric groups, weighed and sampled so that duplicates could be discarded on site. Weighing, rather than counting sherds, is best for calculating form proportions in an archaeological assemblage (Orton *et al.* 1993:166-71). All other pottery was shipped to the laboratory for sorting into fabric/form categories and weighing. Form series for each fabric group were then compiled, and typical forms selected for drawing and scientific analysis. Once the pottery had been assembled, it was packed and shipped to New Zealand for detailed laboratory analysis, a process which took 11 years.

To reduce storage space, the directors agreed that the sample should be reduced to manageable proportions. On-site sampling was the most cost-effective solution. Previous experience had shown that most sampling was best undertaken adjacent to the excavation. A thatched roof was erected next to the excavation building to shade the pottery section. Three bamboo-slatted tables, covered with a fine nylon mesh, 10 m long by 1 m wide and another 2.4 m long by 1 m wide, provided an excellent sorting surface where washed pottery was left to dry, obviating the need to move it prior to sorting. At my suggestion, buckets of pottery from the excavation had colour-coded markers attached to them. Pottery could thus be traced from the excavation to sieving screens, washing basins and drying racks for sorting. A selection of cord-marked body sherds, providing a broad range of thicknesses, colours, textures and cord marking patterns, was retained from each 10 cm cultural context. All pottery was checked in hand specimen until confidence in

recognizing each fabric group was achieved. Samples were also thin-sectioned in New Zealand and then examined in the field under a petrographic microscope. The fabrics of all sherds were recorded on the basis of these analyses.

Initial laboratory analysis was aided by a team of 10 employees who spent six months under the author's supervision assisting in sorting the major sherd classes and reconstructing fragmented vessels. At this stage, the writer separated a broad range of pottery, selected on the basis of fabric and form, for thin-sectioning and petrographic analysis, taking particular care to choose sherds representative of each ware. In essence, this meant scanning every sherd to check for specific characteristics. This was, however, only the first of many sorting and sifting stages needed to identify key components without setting aside unique or rare types.

ON-SITE PROCEDURES

Two previous excavations revealed ceramic anvils and burnishing stones used in pottery manufacture and much pottery (Noksakul 1981, Pisnupong 1984). The 1982 excavation square lay just 15 m south of our 1985 excavation and it seemed reasonable to predict likely pottery concentrations, using Pisnupong's sherd data. But the two sequences contained quite different pottery distributions. The small 1982 excavation, covering 21 m^2, revealed a pottery density of 28.27 kg/m^3, whereas our larger 100 m^2 1985 excavation uncovered 17.08 kg/m^3, excluding potting clays and whole vessels. Equivalent depths shown in table 1 are due to differences in surface and basal (natural) contours.

TABLE 1: *Khok Phanom Di sherd weights*

1982 depth (m)	weight (kg)	1985 ≡ depth (m)	weight	predicted weight
0.0 - 0.5	4	-	-	-
0.5 - 1.5	1048	0.0 - 1.0	3982	4990
1.5 - 2.5	683	1.0 - 2.0	1433	3252
2.5 - 3.5	506	2.0 - 3.0	1380	2409
3.5 - 4.5	619	3.0 - 4.0	1806	2947
4.5 - 5.5	737	4.0 - 5.0	1136	3505
5.5 - 6.5	454	5.0 - 6.0	1007	2161
6.5 - 7.5	652	6.0 - 6.8	886	3104
7.5 - 8.6	403	-	-	1919
Total: 8.6m	5106	6.8m	11630	24300

THE PROCESSING SCHEME

Pottery production centres can be identified by defining the proportion of local against foreign materials present in a site or ceramic district. The present processing scheme allows a highly refined analysis of the available data through a series of sorting and sifting operations. For example, examining all rim sherds allows an understanding of the various wares represented in an assemblage. Rim sherds, provided the overall shape of their parent vessel is known, are diagnostic of complete vessel forms. Rim form classification studies, however, are heavily biased in favour of selection for exotic wares. This is because without quantification, rare or novel forms will be given prominence at the expense of more common varieties. It is important, therefore, that all such categories are quantified. Production centres are crucial to understanding the dynamics of cultural interactions which influence, and in turn are influenced by, ceramic technology. The wealth of detailed data from such a large production centre presented an ideal opportunity to address a range of pressing archaeological and cultural questions. Time and finance, however, are constant considerations when such massive amounts of complex research material are available. The processing scheme was therefore devised to preserve a scientifically coherent sample, arranged so that it could readily be utilized by future researchers, without discarding any valuable information. The sample needed to allow local and exotic wares to be identified, with particular consideration given to their impact on local and regional cultural systems. The scale, intensity and socio-economic importance of local production needed to be determined. Where feasible, intra- and inter-site relative dates, with special reference to possible ceramic relationships with other sites could be provided. These may be reflected in stylistic and/or technological variables.

When faced with the task of processing over 12 tonnes of pottery, however, a realistic processing strategy is essential. A procedure useful for other sites with similar assemblages would be prudent. Two major steps, sorting the material into broad fabric and form categories, then sifting these categories into representative groups by eliminating duplicates, established discrete diagnostic samples ready for final detailed analysis. Many analytical approaches have been applied to ceramic assemblages (Peacock 1970, 1982, 1984; Garden 1980; van der Leeuw and Pritchard 1984; Arnold 1985, 1993; Orton *et al.* 1993). Often, however, a superabundance of material has left researchers with little option other than to compile catalogues of sherd forms and reluctantly file the material away in the hope that more detailed analyses will be undertaken later. Kidder (1936:xxiv), for example, noted a combined assemblage in three Southwest American institutions of sherds from about 12,000 sites. While this situation has yet to arise in Southeast Asia, it is a cautionary tale worth noting. In other regions, for example the Mediterranean, researchers have noted that, "with a few exceptions pottery studies have remained unfashionable", and "publication has generally been restricted to a few 'significant' wares" (Peacock 1984:3). It is suggested here that large sherd quantities and the intractable nature of qualitative analysis, are the principal reasons why detailed pottery research has often been neglected. Statistical analyses of local assemblages, and even larger regional distributions of wares, are essential to any clear understanding of exchange, technology and local socio-economic variables. Regional issues, such as population movements and the rise of stratified societies, may be traced through changes in areal distributions of pottery and temporal changes in production.

The processing scheme was also designed to address issues defined within the research project. These were to establish "a soundly based chronology and cultural framework for mainland Southeast Asia," and "the origin and role of rice cultivation" (Higham and Bannanurag 1990:5), the latter being considered "of critical importance to an understanding of the processes involved in the massive expansion of human settlement now documented for the period 3,000 – 1,000 BC." (Higham and Bannanurag 1990:11). There is certainly sufficient pottery to examine these proposals.

One objective of the present processing scheme was to create a scientifically appropriate and logistically feasible sorting method. Ideally, we would prefer such methods to have wide application. A major difficulty is that research objectives vary from one programme to another. Prehistorians utilize analyses of excavated pottery for a range of often quite diverse research objectives, for example to create stylistic categories suited to inter-site comparisons, to compose comparative chronologies or "mental templates" (Arnold 1985:7), to characterise and/or compare ceramic technologies, or to consider socio-economic cultural variables. Many pottery reports focus on form typologies, which promote shape and stylistic aspects, in preference to fabric. Such studies often deem chronology as all important. Perhaps this style emphasis developed because ceramic materials are durable with an excellent survival rate. They are, therefore, often over-represented archaeologically. Such abundance, however, can present serious difficulties. It is not feasible to record and understand everything about large ceramic assemblages. To pursue a detailed analysis of all aspects of such assemblages risks becoming lost in a vast encyclopaedia of almost endless data. Strenuous effort has been made in this study to confine the research results to manageable proportions. Even so, the resultant text is long, but necessarily so if the results are to be presented as a coherent whole. Any research strategy must be cost-effective and the results need to be published as quickly as possible without impairing the data. It appears self-evident, therefore, that the only practical solution lies in the formulation of an appropriate processing strategy. Such a process needs to achieve three objectives. It must reduce the size of the sample while preserving its scientific integrity, be cost-effective, and retain the balance of the sifted sample *in a suitable format* for later research by others.

What to retain or discard is the essential question when sifting pottery into discrete diagnostic groups. What one researcher considers important another may consider irrelevant. Orton *et al.* (1993: *passim*), discuss three "main phases and themes"; (art-historical, typological and contextual), which they consider trace the history of pottery analysis. They note that "in Britain, for example, many field archaeologists seem still to be in the typological phase, demanding 'dates' and little else from their ceramicist colleagues." (1993:4). This suggests that the key issue is to try to capture data which satisfy *all* requirements. In any sampling strategy, particularly those which involve large groups of different artefacts, completeness and precision are important. It is, therefore, assumed that all pottery will be made available by the excavators for sampling.

THE PRINCIPAL FEATURES OF THE KHOK PHANOM DI PROCESSING SCHEME

Pottery from prehistoric contexts in Southeast Asia is dominated by cord-marked wares (Vincent 1988). Cord marking is produced when forming vessels with a cord-wrapped paddle. Although this technique may impart a decorative finish, its primary purpose is to more readily shape plastic potting clay when forming vessels. For utilitarian wares it is usually the only paddle and anvil stage employed. Fine wares produced using this method generally require several additional forming procedures, for example, final smoothing with a plain paddle and/or polishing with a burnishing implement. Coarse cord-marked sherds, therefore, almost invariably represent utilitarian wares.

Cord-marked bodysherds from layer one (L1) to L8:6 were sampled on site and the balance discarded. A representative sample, about 20 percent, of all body sherd forms was retained, for each stratigraphic context, only duplicates being set aside. All other sherds were shipped to New Zealand for further analysis. On-site processing ceased when L8:6, about four metres below datum, was reached and the writer returned to New Zealand. Sorted pottery, sampled cord-marked sherds, all plain ware, all feature pottery, diagnostic sherds and any remaining pottery was shipped to New Zealand for full laboratory analysis. At the L8:6 point excavated pottery totalled 7.454 tonnes, compared with the predicted weight of 13.598 tonnes (Table 1).

Washed pottery was received from excavations and then:

- Step 1: Separate “whole” pots from form categories: (body sherds, rims, bases, appliqué, carinations, miscellaneous). “Whole” pots, rims, bases, appliqué, carinations, miscellaneous sent to laboratory for analysis.
- Step 2: Sort body sherds into surface decoration categories: (cord-marked, plain, incised, punctate, painted/slipped, burnished, other), then record weights. Plain, incised, punctate, painted/slipped, burnished and “others” sent to laboratory for analysis.
- Step 3: Sort cord-marked sherds on site into fabric and form categories, weigh and sample. Duplicates are discarded and samples sent to laboratory for analysis.
- Step 4: Laboratory analysis: Sort all form categories (rimsherds bases, appliqué, carinations, miscellaneous), into form variants and fabric categories.
- Step 5: Compile a form series for each fabric group.
- Step 6: Select typical forms for description, drawing, scientific analysis etc.
- Step 7: Collate site and regional information to establish chronology and origin where possible.
- Step 8: Publication.

A separate study of motifs has previously been completed by Hall (*op. cit.* 1993). A summary of her research results will be integrated with the surface decoration categories presented, and in some instances slightly expanded upon, in the following chapters.

A NOTE ON THE STRUCTURE OF THIS VOLUME

Excavated pottery amassed from Khok Phanom Di in 1985 bestowed a rich source of ceramic data. Given the huge quantity of pottery recovered, previous experience (Vincent 1998a), suggested that this report would be large. Further, to make the information readily accessible to specialists and non-specialists alike would require a flexible format. With these parameters in mind, the first five chapters provide background information regarding methods, the purpose of technological studies, a summary of previous research, the regional environment and local potting resources. The four CPs identified in the pottery assemblage are then briefly defined and the manner in which the evidence is treated explained in Chapter VI. Chapter VII details the CP1 evidence, and Chapters VIII, IX and X the CP2, CP3 and CP4 data respectively. Chapters VII-X each begin with a short description of the stratigraphy and related cultural materials. Chapters VIII-X detail the CP2-4 pottery, the major part of the assemblage, and each ends with a summary and a discussion of points requiring further consideration. The entire work is summarized, along with some interpretative discussions, in Chapters XI and XII. Additional data is set out in appendices (Chapters XIII-XVI). A glossary of technical terms is included for the non-specialist (Chapter XVIII).

Finally, it is important to note that this study introduced previously unavailable information which required interpretation. The ceramic assemblage *sui generis,* and broader cultural events, required close examination. Socio-economic developments and external relationships are of particular interest. As the ceramic analysis proceeded the writer's attention was drawn to a major cultural change midway through the cemetery sequence. This new data made a fresh interpretation of the site essential, without which the report would fall short of its purpose.

II THE PURPOSE OF TECHNOLOGICAL STUDIES

ANALYSIS in this report follows established procedures for the scientific study of ceramics. Pottery encapsulates a wealth of information, due in part to its durability. In contrast, most cultural materials in archaeological contexts are subject to erosion, often leaving little or no trace. Perhaps because it survives for millennia, pottery has attracted the attention of a wide range of researchers from art historians to chemists, geologists, physicists and mathematicians. Ceramic materials and technology are inherently complex and best approached by combining a study of form with fabric. Form includes such parameters as shape, decoration, colour, texture and surface finish. Fabric includes all the materials pottery is composed of. Underlying cultural traditions are reflected in the technical complexity and artistic expression which comprise the fabric and form of pottery. Understanding fabrics helps identify their point of manufacture, while pottery forms often reflect discrete cultural styles, which can help identify cultural affinities. The study of superficial aspects in isolation such as decoration, however, risks misleading results because pottery styles are often copied across cultural boundaries.

Ceramic artefacts may not have been particularly important to those who made and used them, even if potting technology was an important aspect of their culture. Pottery producers and consumers can be conceived as representing opposite ends of a continuum. Producers may consume pottery, but consumers, at the other end of the continuum, do not produce. While the full range of economic modes of production, represented in prehistoric pottery assemblages, is unclear, it seems likely that most communities produced for their own consumption. Production centres, which supply pottery for export, lie at the opposite end of the continuum from those who only consume. It is, therefore, important to identify production centres, because of their influence over regional distributions.

Pottery probably had many functions in prehistoric societies. It may have been used for symbolic expression, as objets d'art, utilitarian household or ornamental wares for both local use and as exchange items. Various wares may have required skills in different techniques. The technology needed to make potters' ceramic anvils, net weights or bow pellets for hunting may differ from that needed for pottery. Ceramic technology and materials were also used in other technological fields, such as bronze casting. Production techniques may have been adapted to integrate with subsistence, particularly in regions where seasonal rains made potting impossible and crops needed to be cultivated. Pottery making is dependent on many factors, from the proximity of clays, temper, water and fuel for firings, to climate and local weather conditions.

Archaeologists often use pottery to help construct archaeological sequences and evaluate relative chronologies. It is important in assessing external relationships and many socio-economic variables, for example mortuary practices, where the potting technology may be modified for ritual purposes. In some instances special techniques are employed to signify group cohesiveness, for example the use of symbolic motifs on ritual wares. When local and exotic vessels carrying the same motifs are present in an assemblage, but are made using different techniques, these may

have regional implications. Due to durability and abundance, pottery is important in assessing technology and cultural styles on a regional scale. Technological studies are important when constructing culture histories because they help provide detailed background information without which the distribution of pottery styles may be misleading. The presence of pottery in any particular archaeological context is not proof that it was made where it was found. Further information, particularly the composition of its fabric, may be needed to establish its source.

Applying pottery styles to the characterization of cultural entities may be unwarranted without technological information. Although some terms may embody cultural concepts beyond pottery styles, and thus are appropriate for those familiar with underlying cultural parameters, the genesis of these terms lies in correlations between pottery style and cultural entities. Understanding both technological and stylistic aspects helps to remove doubt as to the origin of, and relationship with, a pottery style and a cultural entity; a serious problem for archaeologists elsewhere (Kidder 1942, Shepard 1956). Unless the origin of wares is understood, it remains uncertain whether pottery associated with any culture on solely stylistic criteria actually belonged to the culture which bears its name. This is not to suggest that stylistic labels are always wrong, but that without scientific verification it is impossible to determine with any certainty which are correct. For example, "Jomon" which means "cord marked" or "cord pattern" was coined by an American archaeologist in 1867 (Harris 1997:21). It defines a culture which lasted for ten millennia (Barnes 1993:71). Specialists now recognize six divisions (Incipient, Initial, Early, Middle, Late and Final Jomon), however, without detailed technical and stylistic evidence the sequence can be complex. Most studies of pottery production now incorporate "not only the technology and manufacturing processes involved but also the social and economic organisation and the relationship of pottery making to the physical environment" (Freestone and Gaimster 1997:11).

Technology plays a central role in cultural evolution and successful human adaptation. It characterises much human interaction with the environment and has long been considered a major stimulus to cultural change (Childe 1936, 1956, Adams 1966, Clarke 1968, Renfrew 1972, Redman 1978), and more recently an integral component of culture in a cognitive sense (e.g. Schlanger 1994:143). Successful techniques in one technological sphere may be integrated into another. For example, ceramic technological expertise could be applied to bronze metallurgy. Knowledge of such methods is unlikely to have been acquired without instruction from potters skilled in the craft. An understanding of physical properties, firing techniques and thermal reactions of potting materials could be fruitfully applied to bronze metallurgy. It this respect, it is important to note that a generalised sand → grog → rice tempering sequence is evident with time throughout Thailand, culminating in the association of rice temper with bronze technology. Thus metal workers applied specific techniques, which had their antecedents in potting technology, to metallurgical procedures and integrated them into their craft.

The adaptation of developments in one technology for use in another can promote the evolution of increasingly more complex processes. Thus pyrotechnical techniques used in potting were probably adapted for smelting ores, an essential step in the development of metallurgy. Although temperatures needed to melt metallic ores would normally be unattainable using standard open firings for pottery, knowledge of prepared clay thermal responses would be a prerequisite for its use in early metal working. Ceramic furnaces, crucibles and moulds were essential components of early bronze metallurgy (Bayard 1971, Chang 1986a, Higham 1996b, Weiss 1992, Vernon

1996).

Petrographic analysis has been carried out on the basis of thin sections and hand specimen analysis, in defining four Ceramic Periods (Fig. 1), each containing mainly locally produced wares. Pottery was produced on site throughout the sequence. The basal occupation layers contained CP1. It comprised abundant local pottery "wasters" in association with firing remains, potting clay, pebbles to be crushed for temper and potters' tools. CP2 and CP3 span a cemetery comprising seven Mortuary Phases (MPs), where local wares predominate in burial contexts. Local wares were interred in graves in association with burnishing stones, *Anadara sp.* shells used as impressing tools, and ceramic potters' anvils. In CP3, two adjacent MP5 graves, one an adult female (B15), the richest of all burials in terms of grave wealth, contained outstanding local vessels. Apart from jewellery and exotic vessels, she was also interred with mounds of prepared potting clay cylinders, burnishing stones, an exotic ceramic anvil bearing a potter's mark, and *Anadara* shells suited to impressing pottery decorations. Her wealth suggests that some potters achieved considerable status. CP4 comprised the upper metre or so of the site. Apart from a few stone tools and bone artefacts, it was dedicated to clay preparation and intensive pottery manufacture, evidenced by many dumps of prepared clay, numerous potting tools and dense concentrations of broken pottery.

The relative proportions of local coarse utilitarian and fine wares against imported pottery also help define the scale and intensity of local industries. Consequently all rimsherds have been categorised as to fabric and form. Rim form groups from each stratigraphic level have been examined petrographically, as have "whole" vessels, potters' anvils, clays and "firing stands". The remaining ceramic artefacts were examined in hand specimen, using the thin section results as a comparative data base. This allowed a broad range of exotic wares, imported throughout the sequence in varying amounts, to be isolated. Several local forms are replicated in a variety of exotic fabrics, which suggests that these styles, made at several localities, represent regional traditions. Their distribution can only be determined by identifying production centres and characterising their wares. This will provide a secure basis for constructing a soundly-based relative chronology. The present study is an initial step in constructing a regional chronology for the Bang Pakong Valley during the period when Khok Phanom Di was occupied.

FABRIC ANALYSIS AND POTTING TECHNOLOGY

Fabric analysis is a key aspect of this study, in part because potters display an almost unswerving conservation to technological procedures (Shepard 1942:178). Therefore changes in fabric composition are potentially significant. Provided the potting clay mineralogy, which comprises the fabric's parent matrix, can be characterised, and any added temper understood, pottery fabrics have the potential to furnish significant information. Fabric analyses often provide unequivocal information regarding a ware's source. When distinctive minerals are present, the source area or region can be suggested, or others excluded from consideration because the ware's mineralogy does not match their geological strata. One fabric or temper specie does not grade into another. Any changes are, therefore, significant. When these correlate with changes in style, important cultural changes are signalled.

<table>
<tr><th>Ceramic Period</th><th>Local Fabrics</th><th>Activity</th><th>Stratigraphy</th></tr>
<tr><td rowspan="3">Ceramic Period 4</td><td rowspan="3">Rice & Blebs</td><td rowspan="3">Workshop</td><td>Layers 1 & 2</td></tr>
<tr><td>Layer 3</td></tr>
<tr><td>Layer 4</td></tr>
<tr><td rowspan="8">Ceramic Period 3</td><td rowspan="8">Orthodox Grog</td><td>Mort. Phase 7</td><td rowspan="2">Layer 5</td></tr>
<tr><td rowspan="2">Mort. Phase 6</td></tr>
<tr><td rowspan="2">Layer 6</td></tr>
<tr><td>Mort. Phase 5</td></tr>
<tr><td rowspan="2">Mort. Phase 4</td><td rowspan="2">Layer 7</td></tr>
<tr><td rowspan="2">Layer 8</td></tr>
<tr><td>Hiatus</td></tr>
<tr><td rowspan="2">Mort. Phase 3</td><td rowspan="2">Layer 9</td></tr>
<tr><td rowspan="4">Ceramic Period 2</td><td rowspan="4">Sandy Grog</td><td rowspan="2">Mort. Phase 2</td><td rowspan="4">Layer 10</td></tr>
<tr><td rowspan="2">Mort. Phase 1</td></tr>
<tr><td rowspan="2">Ceramic Period 1</td><td rowspan="2">Sand</td></tr>
<tr><td>Occupation</td><td>Layer 11</td></tr>
</table>

FIG. 1: The Khok Phanom Di Ceramic Periods

Two principal kinds of evidence may be recovered. Raw materials, such as prepared clay, and ceramic artefacts are primary data. Secondary physical evidence involves socio-economic factors. Raw materials may be unprocessed or processed to varying degrees. Potters' tools, including anvils used to form and shape prepared clay, are an example of primary evidence. Residual marks left over from forming or decorating vessels, for example from cord-wrapped paddles, incising tools or moulds, reflect modes of construction and decoration. Wooden incising tools, paddles for shaping vessel walls or knives for dividing clay cylinders into workable portions, did not survive at Khok Phanom Di. The use of incising styles and paddles is, however, apparent in the pottery. The use of wooden tools can be implied from ethnographic analogy. For example, Fijian potters use wooden mixing boards, fibre ring supports and wooden clay knives (Geraghty 1996:425-8). A range of wooden paddles is used by present-day Thai potters (Moore 1993:105-18).

Comparison with present craft potting techniques helps in interpreting prehistoric fabrication methods and associated modes of production. Complex shapes require special methods and high levels of expertise. Understanding craft skill is useful in determining the capacity of production centres to meet customer demands. Centres with superior abilities could exploit them to advantage. Ceramic anvils are particularly important in tracing the movement of potters, since they may contain exotic minerals and/or technological characteristics. Distinctive minerals could indicate that the artefact was made from exotic material and argue for mobile potters. The personal nature of such "tools-of-trade" is confirmed by ownership marks on many of the anvils.

These, together with production volume, indicate an intensive large-scale industry. It is also significant to note that, as far as I am aware, potters' marks on anvils have not been reported from any other Southeast Asian prehistoric site of this period, although possible ownership marks were noted on ceramic moulds used for casting copper ingots at Non Pa Wai (Pigott and Natapintu 1996).

Petrographic analysis can distinguish local from imported clay, provided local deposits are understood. Expensive imported clays may be blended with inferior local material. Local availability, however, is no guarantee that it will be exploited; "the Gumawana speakers of the Amphlett group transport their clay some distance by sea from Fergusson Island" (Ross 1996:68). Natural clay deposits usually need modification to prevent excessive hydration, subsequent shrinkage, firing cracks and catastrophic shattering. These problems can be circumvented by adding non-plastic temper. Almost any non-plastic material has been exploited. Caches of unused temper, in archaeological contexts, indicate potting activity, but are seldom reported. The *association* of temper caches, clay preparation areas, pottery fabrication floors and firing platforms at Khok Phanom Di, is the first known in Southeast Asian archaeological contexts. Work area complexes, or funerary goods associated with potting families, persisted throughout the sequence. They indicate an intensive and permanent pottery industry.

Mineralogically distinctive tempering materials have been used to characterise and source production centres (Shepard 1956). When indistinct tempers, such as vegetable matter, shell, leather or crushed bone are employed, different diagnostic approaches may be required (Arnold 1985:21). These involve analysing natural inclusions in the potting clay deposits or distinctive clay minerals (Vincent 1988:87-93). Tempers can be *natural* or *artificial*. Almost any material which will reduce the quantity of chemically unbound water during drying and firing has been

used to minimize the risk of shrinkage, cracking and shattering. Artificial tempers, known as "grogs", are manufactured by the potter. They may be materials originally intended for other uses or, alternatively, prepared for mixing into the wet clay preparation as non-plastics. Selected properties of grogs in thin section are illustrated in figure 10. Some potters use crushed "wasters", potsherds from vessels which failed during drying or firing. Wasters are an example of the former kind of artificial temper. A more complex grog is prefired crushed clay ball temper known to Thai potters as *chua*. *Chua* is an example of a purposely prepared artificial temper. Two different kinds are known and can be distinguished petrographically:

1. *Orthodox grog* is crushed prefired clay which does not contain temper. Some exceptions exist, but by definition these will never contain rice remains as the tempering agent.

2. *Bleb grog* is crushed prefired clay balls which have been tempered with rice remains. The quantities of rice husk in bleb grog, prior to its initial firing, vary depending on the raw clay composition. Husk in the prepared clay balls accounts for the distinctive corrugated and arcuate shapes of bleb grog fragments (Vincent 1988:88).

Replacement of one grog temper by another more complex, long standing, tradition, such as "orthodox" grog being superceded by "bleb" grog, may indicate the influence of another ceramic tradition and a different cultural group. Such transformations are significant because no functional requirement would dictate such a change. When bleb grog replaces orthodox grog, the magnitude of the technological change is increased, because bleb manufacture is more complicated, requiring addition of extra material and an added fabric preparation step. Craft potters' inherent conservatism would mitigate against adopting more complicated methods in the face of simpler, proven, procedures (Vincent 1988:100). Given this technological conservatism, "temper typing" is potentially applicable to all species of temper. Some biological and botanical remains, such as shell, if the species is adapted to a specific habitat, can be sourced (Cooper 1982:161).

Industrial-associated evidence of clay processing and pottery firing is often either lacking in archaeological contexts or extremely difficult to detect. This can be due to the effects of ground water and chemical precipitation which transform unfired clay and firing ash into more-or-less homogeneous substances which merge with soil and other cultural deposits (Vincent 1988). Its fugitive nature requires particular care when uncovering such deposits. Fortunately the field team and the directors had a wealth of experience excavating such materials. Pottery firing evidence recovered from CP1, the initial occupation phase, included ceramic stands used to support wooden firing rafts. Petrographic evidence indicates that they were probably re-used but eventually shattered due to high temperatures.

Secondary physical evidence involves socio-economic factors, some explicit others implied. The quantity of pottery in a cultural assemblage is an explicit expression of its economic importance, while social status may be implied by differential access to rare or high quality wares. Some researchers have implied social ranking from the asymmetry of prestige ware distributions in cemeteries (Bayard 1984, Higham 1984). Potting tools interred as grave goods imply that in life the deceased was a potter or was associated with a potting group, and that potting was

important. Differential grave "wealth" has been used as a marker of differing social status during life (Peebles and Kus 1977, Bayard 1984, Higham *op. cit.*, 1984). Wealth associated with potting accoutrements suggest a potter of high status. Provided a potting centre's production modes are understood, production intensity can be implied from output quantities and the number of potters in the community.

Ethnographic studies indicate that potters can be accorded differing degrees of social status, depending on a society's socio-economic structure and other variables including symbolic expression. Trading conditions can affect the economic viability of potting and when consumers are limited, technical expertise may be important. Ceremonial activities and highly developed trade networks may also be important (Foster 1965, May and Tuckson 1982, Irwin 1977, 1978). A potter's status depends on the hierarchical structure of their society, high status reflecting relatively profitable production and/or trade, or pottery with special connotative (i.e. a pot which implies more than its apparent function denotes) or artistic qualities (Arnold 1985:196-8). In hierarchically structured societies, status can depend on the sexual division of labour and production demands. Males dependent on potting in agricultural societies are likely to be accorded low status, but females a relatively high status because their production supplements primary subsistence. Mythical and supernatural symbols confer high social status (May and Tuckson 1982), as do religious and/or "social structural symbols" (Arnold 1985:198).

Symbolic expression is often transmitted through iconography incorporated into pottery with designs often characterised as information carriers (cf Arnold 1985:157-65, Green 1990:33-52, Spriggs 1990:83-122, 1991:222-42). Pottery fabrics may also be a medium for symbolic expression *sui generis*, but may easily be overlooked because they mimic physical functions (Vincent 1988). Using forms and/or colours for symbolic communication is "graphic isomorphism" (Harris 1986:126). Pottery fabrics which include special additives are probably powerful carriers of non-visual communication, understood by those who prepared them and participants in the associated rituals. Clays, paints and potting methods can have material, symbolic and magical value (May and Tuckson 1982:136, 210-18 and 291, Vincent 1988:131-2). These modifications are often difficult to detect without supporting non-ceramic evidence, provided profane local production is understood, however, deviations from "normal" manufacturing techniques should be apparent.

Potting technical complexity, its integration with other complex industries, such as metallurgy, and the importance of such skills to a community's socio-economic infrastructure, underlie its cultural relevance. Characterization of these aspects allows inter-site and regional comparisons of their degrees of cultural integration. Significant changes in local potting technology following the arrival of immigrants could imply that the donor culture was more highly developed in technical expertise. Adoption of new techniques in potting, a technically complicated craft, are unlikely, unless the new methods prove superior to traditional practices. When they occur in the face of long-standing traditions, they usually reflect significant socio-economic or other cultural changes.

Although fabrics which lack distinctive mineral inclusions are not readily traced to geological sources, their method of manufacture can prove useful, particularly when different regions contain mutually exclusive methods. Provided that local clay sources and clay processing methods are understood, exotic fabrics can usually be identified. Differing preparation methods and

distinctive fabric compositions often act to distinguish different potting traditions, as do forming, construction and finishing techniques. Traditional styles may be reflected in a range of wares, some distinctive. Care is needed in characterising traditional styles, however, because fashionable styles are often copied. For example, at Ban Na Di, in the Sakon Nakhon Basin, (Fig. 2), pottery rendered in the so-called "Om Kaeo" style originated from six different production sites, only one of which was likely to have been the type site of Ban Om Kao (Preecha and Pukajorn 1976, Vincent 1988:194-203). Fabric analysis allowed the different types to be identified, a valuable procedure when design motifs are replicated in this manner. As Higham noted with respect to the large Non Nok Tha funerary assemblage:

> "As is the case for nearly all Southeast Asian sites, we will not know how many, if any, of these were locally made or were exotic to the area until a petrographic analysis of the fabric has been undertaken." (Higham 1989:102)

Copied styles can imply socio-economic adhesions, such as prestige or regional cohesiveness. Prestige attached to exotic wares is emphasized through local copies. Social cohesiveness may be reflected in regional adoptions of fashionable designs, their quality and spread, particularly if they cut across technological and stylistic tradition boundaries. Similar modes of decoration coupled with popular design elements and forms suggest close relationships between regional production sites. If production spans several pottery traditions, this further suggests regional homogeneity. The six "Om Kaeo" types probably represent a popular regional ware prior to *c.* 100 BC–200 AD, when they became rare. Paucity often precedes "a period of first appearance or imminent disappearance of a type" Shepard (1971:336). Om Kaeo styles probably enjoyed widespread popularity, for a millennium or so, but did not survive the arrival of a new bleb-tempered tradition, with new painted designs, from the south. These quickly spread over much of the region, a typical change following the diffusion of an exotic pottery tradition, with its associated new technology and styles. Seven different sites, using three different technologies with either orthodox grog, blebs or rice temper, produced the new "Ban Chiang Painted" wares (Vincent 1988:208).

CERAMIC EVIDENCE FOR THE CULTIVATION OF RICE

One important objective of our study is the origin and role of rice cultivation at Khok Phanom Di. Domesticated rice has been reported on by Thompson (1996). Particular care was taken to isolate the rare exotic rice-tempered sherds used in Thompson's palaeobotanical analysis of *Oryza* remains. This required the examination of much material, without which rice analysis would have been seriously limited. Rice temper is present, either alone or with grog, in rare exotic wares throughout the sequence, and in local wares as incidental inclusions during CP1–CP3 (Chapters VII - IX). Although rice remains were present throughout CP1–3 in cultural deposits (Thompson 1996:221), rice was not used to temper local wares, probably because consistently reliable supplies were lacking. During CP4, rice was variously used to temper local wares.

Insight into the widespread exploitation of rice in Southeast Asia can be gained from the analysis of pottery manufacture. Rice temper occurs at Ban Chiang and related Sakon Nakhon Basin sites from the earliest levels. Bleb grog is present at Khok Phanom Di and in the Bang Pakong Valley *c.* 2,000 – 1,500 BC. From *c.* 2,000 to 100 BC, bleb temper technology gradually spread northwards from coastal Central Thailand (Vincent 1991:345-6).

Rice, as with any temper, must function efficiently throughout the potting process. Potting technology is complex and often highly susceptible to failure due, for example, to a lack of quality clay. Supply of temper material must be consistent, and any change in temper is resisted unless reliable supplies are available. Use of rice husk for temper indicates that rice straw for firing fuel was also available. Potting in monsoon climates is normally abandoned during the wet season because of drying difficulties. This seasonality, which frees labour for agriculture, coupled with large scale pottery production with rice temper, strongly suggests a close association with cultivated rice. Unless rice surpluses were available, such an important food is unlikely to be sacrificed for pottery.

POTTERY TYPES

Technological studies are important if problems which beset early interpretations of Rio Grande pottery and recent reconstructions of Andean cultural histories are to be avoided. Pottery types in this report include considerations of form and fabric. Particular emphasis has been placed on potting materials, preparation methods, vessel forming, modes of decoration, firing and fabric composition. X-ray diffraction analysis of local clays has helped to characterise local potting traditions. Style analysis has assisted local and exotic wares to be more readily identified when fabric characterisation proved difficult. Confidence in style classifications relies on understanding fabric composition. Style analysis is discussed in the succeeding chapters.

III PREVIOUS RESEARCH

INITIALLY, studies of prehistoric Southeast Asian ceramics strongly emphasized style. Over the last two decades, however, an increasing focus on technological analysis has provided a clearer understanding of prehistoric ceramic industries and their cultural relationships. With this in mind, previous research will be considered in three parts. First a brief overview of ceramic studies in general including those undertaken in Southeast Asia will be considered. Particular reference will be given to pre-Iron Age Southeast Asian pottery. This will allow us to compare pottery spectra reported in earlier investigations to the potting industry described in the present report. Second, previous technological research in Southeast Asia will be outlined to give some insight into such work completed to date. Finally, a short outline of research conducted into recently excavated Bang Pakong Valley pottery will help place the Khok Phanom Di assemblage, reported on here, into its regional setting.

In contrast to stylistic analysis, which focuses on physical appearances (Shepard 1971:98, Arnold 1985:94-5, Orton *et al.* 1993), technological studies draw on the physical sciences. They are less subjective because physical phenomena exhibit predictable properties (Popper 1963:340, Kuhn 1961, 1963:347-60). Ceramic studies are a microcosm of archaeology, with vessel form and decoration data for art historians, graffiti and stamps for the epigraphist, and fabric analysis being undertaken by the geologist, chemist or physicist (Peacock 1982:173). Petrographic-based technological studies incorporate the explanatory rigour accorded methods involving physical laws. Shepard's Pecos study (or in Kidder's words "the paper is a restudy, from the technological point of view"), is one such example. This carefully composed analysis, emphasizing detailed petrographic and chemical data, overturned an established regional chronology long accepted by most Rio Grande scholars (Kidder 1942:i-iv). Kidder warned that rigorous testing is needed before firm conclusions can be made. In pottery studies, because archaeologists can provide in a few days more material than can properly be digested in as many months, these problems were magnified by an over-abundance of data.

Of course, some may respond, archaeology has moved on in the past 50 years or so and these problems have since been largely solved. Or have they? Arnold (1985:94-6), for example, reports that "most interpretations of Central Andean archaeology rest upon distributions of various ceramic styles which are assumed to reflect the culture history of the region." Ecological factors, however, such as favourable climatic zones, which meant that only a few locations could support full-time ceramic specialization, coupled with long distance pottery trade and exchange routes, which facilitated the distribution of products from these manufactories, *not cultural horizons,* are reflected in the archaeological data (see also Arnold 1993:34-47, 228-31). Unless the material from which pottery is made is understood, and its point of manufacture, therefore, can be established, or at least regions disqualified as possible sources, stylistic analysis should not be used indiscriminately.

As Orton *et al.* (1993:153) observe, the best type series are "perhaps those that define the

types *within* a fabric or ware" (italics Orton *et al.*). They conclude their detailed examination of pottery in archaeology by picking three areas of current practice which deserve "further attention". These are an increased knowledge of raw materials and their interaction with manufacturing technology; more use of "appropriate methods of quantification"; and the construction of reusable ceramic study resources such as quantified databases, standard fabric descriptions, as well as compositional analysis and distribution data results (Orton *et al.* 1993:229). Technological analysis is held to be central to ceramic study.

Two major parameters, technical and socio-cultural factors, influence pottery styles. Material qualities and potting skills determine the forms (styles) produced. Temporal, areal and functional constraints determine pottery distributions. Each is interrelated, interdependent and affected by scale. It would be misleading to compare forms so separated without corroborative evidence. The degree of separation affects corroborative significance. Khmer glazed stoneware pottery uncovered within Bronze Age strata along with earthenwares such as the sgraffito pottery excavated at earlier Roi Et sites by Higham (1977), will merely be classified as stratigraphically "mobile" artefacts. Form analysis helps to establish intended vessel functions because similar shapes suggest similar uses. Functional-form classifications may not be valid for cross-cultural comparisons. For example, Roman amphorae display a striking degree of form similarity with vessels from archaeological contexts at Ban-p'o, China (Watson 1961:43, Rawson 1980:189). Such anomalies are not accepted without corroborative evidence because they could represent, for example, exchange, diffusion or parallel development.

Pottery forms are easily adapted to fashionable styles. At Ban Na Di, for example, petrographic data revealed that some exotic vessels were copied by local potters (Vincent 1988:238 pots 63 and 64). Some local fabrics, used for mortuary ritual goblets, were treated differently by the addition of rice. Rice would not be needed for any practical reason, therefore a symbolic motive seems most likely. Such information is an important indicator of symbolic expression in funerary rites.

The above discussion is not intended to suggest that style analysis has no place in archaeology. It does bear, however, on some current broad-ranging hypotheses proposed by leading specialists in Southeast Asian prehistory which affect the present report. These hypotheses require rigorous testing if they are to be widely accepted. Of particular interest are those which envisage the broad-scale expansionary migrations of rice agriculturalists via the major rivers of Southeast Asia during the third millennium BC.

We will return to the important issue of style analysis in the final chapter. A detailed discussion of the Khok Phanom Di ceramic spectrum is set out in the intervening chapters. It will address such questions as economic organization, exchange relationships, technological change, innovation and the integration of pottery production with resources exploited for exchange. At this point, however, we need to consider the impact of style-dominated Southeast Asian studies on earlier research and the growing shift to a more technological approach evident in more recent work. We will commence with a summary of mainly subjective pottery descriptions published by the pioneering scholars of the region's prehistory.

Southeast Asian studies, prior to Freestone's petrographic analysis of Khok Charoen fabrics (Watson *et al.* 1986), were characterised by classification studies which grouped pottery into form classes. Form nomenclature often implied functions; designs and vessel shapes equated

with styles and cultural entities. Thus Quaritch-Wales (1957) equated Dvāravatī movements with pottery distributions from the Lower Chao Phraya area; Sørensen (1972), equated the presence of funerary wares at Ban Kao (Fig.2), with Lungshan migrations overland from Lungshan China, and Bayard (1970) related Ban Kao "fruitstands" to Non Nok Tha, Lopburi and Khok Charoen. Non Nok Tha revealed a rich pottery assemblage. Bayard's first impressions were that most wares were sand-tempered, cord-marked, open-fired earthenware, while some were "very probably" imported (Bayard 1976:146). A variety of tempers, forms, surface decoration and metric variables were included in a computer analysis to determine vessel classes. Funerary pottery assemblages and vessel styles were considered most important for phase designation verifications and as disturbed burial indicators. The 847 mortuary vessels recovered from Non Nok Tha represent the most comprehensive Bronze Age assemblage in Southeast Asia (Bayard 1970, 1971, 1976, 1977, 1984, 1996). Bayard used the metric data to generate six vessel groups and temper as a ceramic variable. Temper identifications help to group wares into pottery types.

Table 2 sets out temper types previously identified in Thailand. According to Bayard (1977), Non Nok Tha Early Period wares were tempered solely with sand. By the Late Period 50% of the pottery was chaff tempered. In view of potters' conservatism over temper use (Shepard 1956), it seems unlikely that two separate temper types would be concurrently utilized within a ceramic industry of this nature. Rice tempered wares followed a bleb temper tradition at Non Chai, Ban Chiang Hian, Ban Na Di, Ban Muang Phruk and Non Kho Noi. Both tempers are evident in sites surveyed throughout the Sakon Nakhon Basin (Kijngam *et al.* 1980). Rice and bleb tempers appear to be generally late in this area. It is possible that a similar situation prevailed at Non Nok Tha. The data in table 2 are from Watson *et al.*(1986) for Khok Charoen, Welch (1983) for Phimai, Bronson (1976) for Chansen, Rutnin (1979) for Non Chai, Higham (1977) for the Roi Et sites, and Bayard (1977) for Non Nok Tha. In each case the dominant temper is given, and the percentages have been rounded to the nearest number. The locations of these sites are set out in figure 2. The period designations for Non Nok Tha are those given by Bayard (1977); this was later (1984:88) changed to the Phu Wiang Phase (with an assumed initial occupation *c.* 3000-2600 BC), Non Nok Tha Phase (later 3rd millennium to between 500 BC and 200 AD), and after a hiatus, the "parahistoric" Don Sawan Phase.

According to Bayard, new temper types probably indicate increased external contact and "movement either of vessels or non-local potters" (1977:82). Distinctive "C" and "L" vessels are held to reflect "two distinct affiliative groups in Non Nok Tha Phase society" (1984:105). Petrographic assessments of the Non Nok Tha funerary vessels could help define the stratigraphy. The site layout may involve an initial core area, representing the first cemetery phase, followed by subsequent peripheral sequences of burial and/or occupation phases. Early burials included pottery tempered with sand. Subsequent burial/occupation phase pots contain different tempers. These changes in temper may be correlated with cultural changes.

Non Chai was a large site, located on a nodal position in the Upper Chi Valley, from which access to the Sakon Nakhon Basin to the north was direct and easy (Fig. 3). It was occupied from *c.* 400 BC to 200 AD (Bayard *et al.* 1986). During this period at Ban Na Di, within the Sakon Nakhon Basin, a major transition took place (Vincent 1988). Exotic pottery signals that exchange relationships with the southern Khorat Basin developed early in the Ban Na Di sequence. These gradually increased with time to culminate with a discontinuity approximately midway through

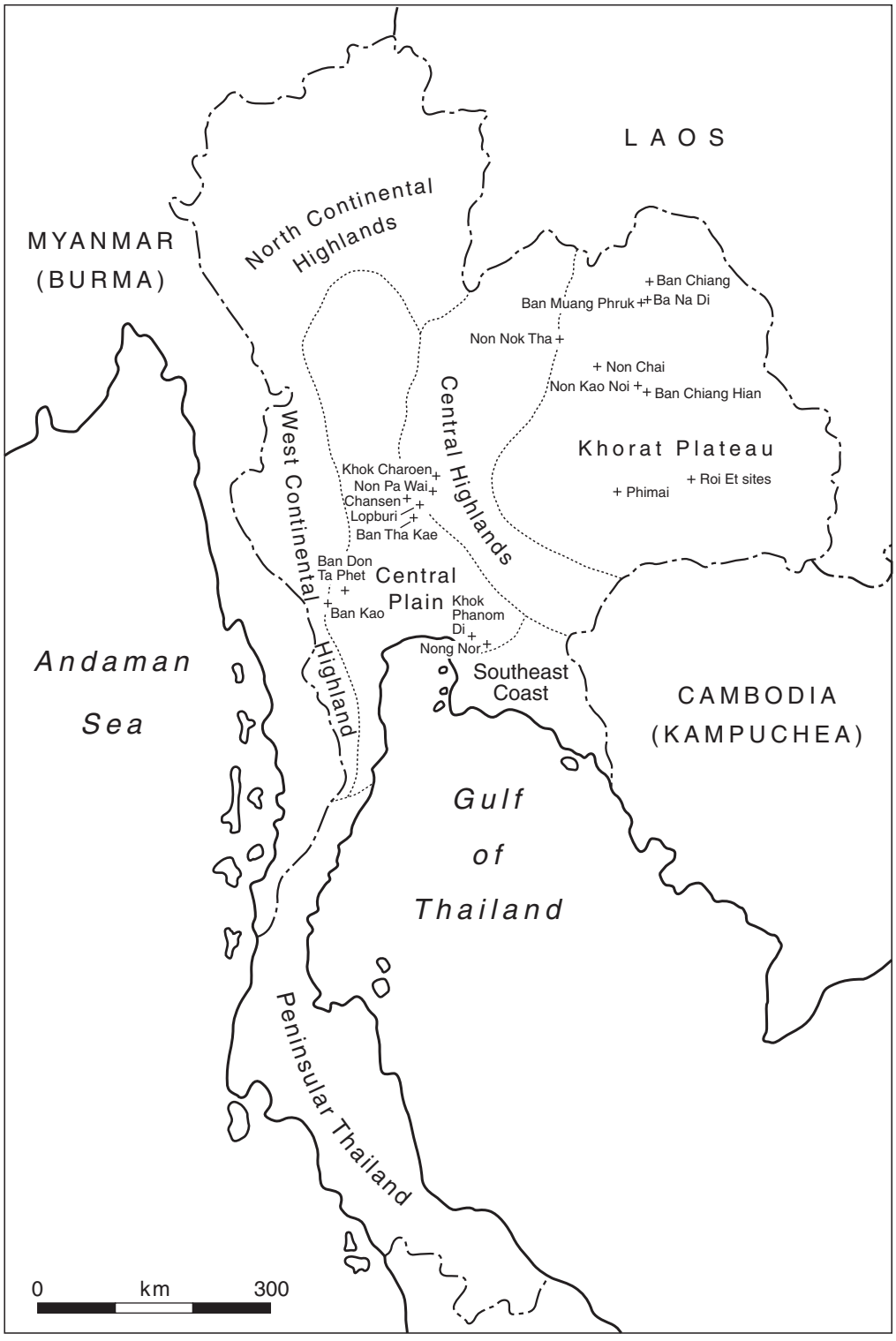


FIG. 2: Sites mentioned in the text

TABLE 2: Prehistoric tempers previously identified in Thailand

Site	Temper	Chronology
Khok Charoen	granitic rock fragments (fabric 6)	Period 1
	sand (probably weathered volcanics fabric 1)	Periods 2/3
	grog (containing fabric 1 material)-(fabric 2)	Period 4
Phimai	fine sand	Tamyae
	rice chaff	Phimai
	fine to coarse sand	Early Historic
Chansen	mineral dominant	Phase 1
	vegetable very common	Phase 2
	vegetable dominant	Phase 3
	vegetable dominant	Phase 4
	vegetable very common	Phase 5
	mineral dominant	Phase 6
Non Chai	clay, sand and chaff	throughout
Roi Et sites:		
Non Dua	fibre 62%, clay 38%	Phase 1
	fibre 68%, clay 23%, sand 8%	Phase 2
Bo Phan Khan	fibre 99%	Phase 2
Don Taphan	fibre 99%	Phase 2
Non Dua	fibre 31%, clay 48%, sand 19%	Phase 3
Bo Phan Khan	fibre 87%	Phase 3
Don Taphan	fibre 93%	Phase 3
Non Nok Tha	sand 92%	Early Period
	sand 67% , chaff 26%	Middle Period
	sand 50%, chaff 50%	Late Period

its prehistoric occupation which is marked by the first production of pottery containing bleb temper at Ban Na Di. Pottery excavated at Non Chai (Bayard *et al.* 1986), has been examined in thin-section (Vincent 1988:175). It is also composed of bleb-tempered fabrics.

The radiocarbon chronology at Ban Na Di is not entirely secure. Higham (1996b), a co-director of the excavation, shortened the sequence from that originally proposed (Higham and Kijngam 1984). The original suggested chronology spanned from "the second half of the second millennium BC until *c.* 900 BC" for the lowest stratigraphic layer (L8) through to *c.* 900-500 BC for L7 (Higham and Kijngam 1984:31-2). They suggested that MP1 spanned about 800 years (*c.* 900-100 BC) (Higham and Kijngam 1984:435). Higham (1996b:204) later favoured a compressed range for MP1 to *c.* 600-400 BC. These compressed dates do not seem to harmonize well with the sequence suggested by the writer for the Sakon Nakhon Basin based on changes in the ceramic spectrum at Ban Na Di (Vincent 1988:184-92). Exotic wares from outside the Sakon Nakhon Basin first appeared early in the first millennium BC. These wares, which heralded major changes in external relationships, then steadily increased in abundance. By the end of the first millennium BC a major transition probably impacted on the existing Sakon Nakhon Basin populations. At Ban Na Di, this process appears to have culminated with the arrival of a completely new ceramic tradition sometime between *c.* 500-100 BC according to the original published radiocarbon chronology (Higham and Kijngam 1984:32).

The Ban Na Di ceramic transition did not occur in isolation. It was coupled with the arrival of a broad range of other exotic goods, such as glass beads (Pilditch 1984:78), ceramic rollers, changes in the burial ritual, abandonment of the early cemetery, changes in the bronze technology and the introduction of iron (Vincent 1988:215-27). Further, imported ceramics from the Chi Valley in the first instance, and by *c.* 200 A.D. together with Mun Valley wares, increased at the expense of established Sakon Nakhon relationships. Given the wide range of supporting evidence for contact with a much expanded exchange system, it seems reasonable to suggest that the new ceramic tradition was introduced by immigrants from the Khorat Basin to the south, the suggested source of the exotic wares. These wares continued to increase in quantity at Ban Na Di throughout the first millennium BC and beyond. In order to help clarify this hypothesis we need now to consider some background information to help explain the proposed transition model.

Manufacturing grog from the raw potting clay is an ingenious response to a lack of suitable tempering material. Once adopted, this strategy affords a considerable degree of independence from a local paucity of suitable raw resources and further reinforces potters' inherent conservatism. Orthodox grog is simply fired clay crushed into 2-3 mm particles which are sometimes sieved. It is known from many Khorat Plateau and Central Highlands sites and Khok Phanom Di (Vincent 1987, 1988). Bleb grog superseded orthodox grog mid-way through the Ban Na Di sequence. Raw material variation would not dictate such a change, because either grog would function in an identical manner. Further, as bleb temper requires more effort and material, the change was not for economic reasons. The replacement of one grog tradition by another is significant because it would not be dictated by technical or functional requirements. Any such changes, in the face of established successful methods, clearly result from non-technological factors and their magnitude is increased when bleb grog replaces orthodox grog, because the former is more complicated to manufacture. Technical conservatism would mitigate against the

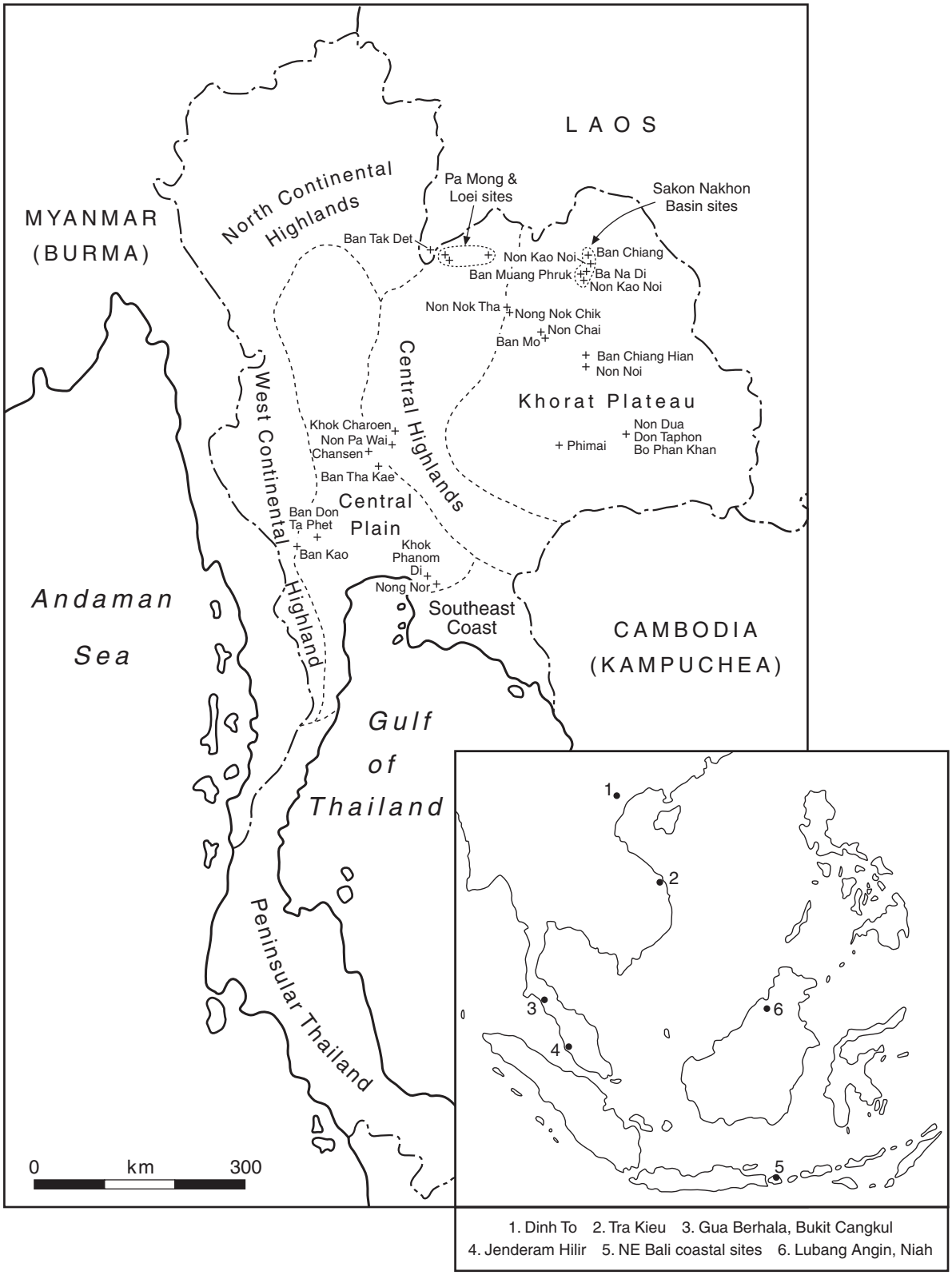


FIG. 3: Sites containing pottery subjected to technological analysis

adoption of a more complicated method. Therefore, such changes suggest the influence of one ceramic tradition, and *ipso facto* one culture, upon another.

At Ban Na Di the initial ceramic tradition was replaced by a bleb temper tradition associated with new forms and different construction methods. Burial ritual and metallurgy also changed (Higham and Kijngam 1984, Kijngam 1984:91). Such correlationships indicate important cultural changes. Their impact at Ban Na Di is reflected in a major shift in external relationships. The ceramic spectrum indicates that, prior to level 6, radiocarbon dated to *c.* 500-100 BC, exchange networks were concentrated in the Sakon Nakhon Basin. Relationships with Khorat Basin sites, however, gradually increased during the 1st millennium BC. Co-incident with the establishment of the new potting tradition, a vigorous, considerably expanded, exchange network opened up with the much larger, strategically situated, Khorat Basin. Exotic cylinder seals and glass beads also made their first appearance, yet the presence of exotic crucible fabrics suggests that strong links with an Eastern Sakon Nakhon Basin bronze industry network were also maintained. The changes suggest that the Sakon Nakhon Basin network was incorporated into a much larger exchange system which stretched far beyond the Khorat Plateau.

The spread of bleb grog technology can be traced from south to north during the 2nd and 1st millennia BC. It appears in Bang Pakong Valley pottery *c.* 2,000-1,500 BC, at Khok Charoen *c.* 1,350-900 BC (Watson 1979, Watson *et al.* 1986), Phimai *c.* 1,000-600 BC, Ban Chiang Hian *c.* 1,300-600 BC, Non Nok Tha *c.* 900-600 BC, and Non Chai *c.* 400 BC-200 AD. In an earlier publication (Vincent 1991:346), bleb wares were stated to first occur at Ban Na Di *c.* 100 BC and to then become common in the Sakon Nakhon Basin. In light of Higham's revision of the Ban Na Di radiocarbon chronology some clarification of the ceramic sequence may be warranted.[1]

It is difficult to place the inception of the bleb tradition at Ban Na Di within the revised chronology. According to Higham and Kijngam (1984:32), the level 5/6 (L5/6) interface lay somewhere between *c.* 500-100 BC and L5 dates to *c.* 100 BC-200 AD. L4 is undated and L3 post-dates 200 AD. Deposition of basal L6 saw the last use of the MP1 cemetery (Vincent 1988:188). During MP1 very few exotic wares originated from outside the Sakon Nakhon Basin. This emphasis changed markedly during the period levels 5-3 were laid down, when imports from the Khorat Basin became increasingly dominant. Four of five MP2 infant burial urns were bleb wares, the fifth contained orthodox grog. All were composed of local Sakon Nakhon Basin clay. Thus new tradition bleb wares were produced locally alongside orthodox grog wares of the earlier tradition. From the L5 period onwards, comprehensive pottery changes are obvious and reflect replacement of the old tradition (Vincent 1988:184-92). A key question is the origin of exotic bleb wares during the period preceding the L5 change. Clearly, the prime candidate is Non Chai.

[1]Notes: Freestone (Watson *et al.* 1986) reports grog and rice in association for Period III fabric 5 at Khok Charoen. This is taken to be diagnostic of bleb temper. Thin-sections of this fabric have also been examined by the writer. The Phimai fabrics have not been thin-sectioned, and in this case Welch's (1985:194, 199, 203, 232-5, and Appendix B) hand specimen description "chaff with grog" has been relied on. All other fabrics have been examined in thin-section by the writer including Non Nok Tha Phase, Non Chai Phases 1-4 and Ban Na Di MP2 fabrics. Pottery from 32 Sakon Nakhon Basin, 8 Khorat Basin, 8 Central Highland sites and Khok Phanom Di has been considered petrographically. It should be noted that data from many sites has not been included, either because they are peripheral or because of incomplete reporting.

The shortened chronology suggested by Higham creates a dilemma. If my understanding of this new chronology is correct, Higham considers that MP1 terminated *c.* 400 BC. Radiocarbon determinations for L6 and L5 suggest L6 was deposited between the end of MP1 (*c.* 400 BC under Higham's new compressed range) and the inception of L5 (*c.* 100 BC). But the stratigraphic data indicate that if MP1 lasted only 200 years L6 is unlikely to have spanned 300 years from *c.* 400 to 100 BC (Higham and Kijngam 1984:38-51). Section drawings (Higham and Kijngam 1984:33-9), suggest a 1.25 m depth for L7 (MP1), while L6-5 combined total 1 m. Higham considers that the former took 200 years to accumulate and the latter, 600 years.Unless some, as yet unrecognised, site deflation occurred, between these two periods, it is difficult to account for such differing rates of deposition. Given that the Non Chai radiocarbon dates are correct, the intrusive potting tradition at Ban Na Di should not be present prior to *c.* 400 BC. Chi Valley bleb wares, however, are present in L7 to L3 (Vincent 1988:248-60). Even allowing for bioturbation, surface deflation and posthole excavations, it is difficult to accommodate the presence of L5 pottery in L7 contexts. Assuming that all L5 pottery is unlikely to have migrated into L7, according to Higham's (1996b) compressed sequence, it seems that some Chi Valley bleb wares appear to have arrived at Ban Na Di before Non Chai was first occupied. Although it is possible an unknown Khorat Basin source was involved in the transition model discussed above, the spread of bleb wares from south to north fits well with the original sequence proposed by Higham and Kijngam (*op. cit.* 1984).

The chronology proposed for Non Nok Tha is closely tied to the ceramic sequence. Debate between Higham (1996c) and Bayard (1996) centred around the disposition of Bayard's style-based "C" and "L" burial vessels. One possibility, that the cemetery layout may, in part, represent a horizontal stratigraphy (Vincent 1988:20-21), was discarded by Bayard (*op. cit.*) because a lineal sequence did not harmonise with "the distribution of C and L burials". Analysis of the pottery fabrics could help to resolve this issue.

Excavations at Chansen uncovered *c.* 200,000 bodysherds and 50,000 rims. These were treated to an attribute-centred classification taxonomy, based on at least one shared distinctive attribute. These are descriptive characteristics which require technical examination for further subdivision (Bronson 1976:90-92). The classes are readily suited to fabric analysis. Chronology was a central issue and the ceramic phases are seen to mirror cultural episodes.

The relative chronology of Ban Chiang is principally based on "a detailed examination of the burial ceramics" and dating the sequence "a major controversy" (White 1986:133-4). An initial, notably early, cultural sequence (Gorman and Charoenwongsa 1976), has subsequently been shortened using "provisional pottery types", based on style, and correlated radiocarbon results (White 1986). A "formal typology" awaits sufficient "information on fabric" (White 1986:82).

Surface collected pottery from 159 "areas of artifact concentration" covering 60km^2 in the Lopburi Province "within the context of dryland agricultural systems" was used to construct "a preliminary regional prehistoric ceramic chronology" (Mudar 1995:157-94). The styles of pottery excavated at Non Pa Wai (Rispoli 1990), Tha Kae (Rispoli 1992), Chansen (Bronson 1976) and Khok Charoen (Ho 1984) were compared with the surface collection to create a sequence divided into Early, Middle and Late periods. Surface collected pottery sources are unknown. Based on styles, "Early Period Prehistoric sites (2500-1500 BC)" are considered contemporary with "Phase 1 occupation at Non Pa Wai (KS 25)" (Pigott and Natapintu 1988, 1990), where pottery

"is characterized by large jars whose tall necks are colored with a bright-red slip". Decoration motifs include fields of incised geometric curving designs, whose interiors are filled with dentate stamping (Rispoli 1992). Coarse basket impressions on large jars are also characteristic of this time period. Excavated samples are known primarily from burial contexts at Non Pa Wai (KS 25) (Rispoli 1990) and at Sab Champa (Mayurie 1982), in the Pa Sak River Valley. Examples of zoned incised decoration are also known from the Bang site in Kanchanburi (Sørensen and Hatting 1967), Early Period Ban Chiang (White 1992: pers. comm.), and the Phu Wiang Phase of Non Nok Tha (Bayard 1977, Mudar 1995:168). The origins of these wares are unknown.

PREVIOUS TECHNOLOGICAL STUDIES

Detailed technological studies of Southeast Asian ceramics began less than two decades ago. Since Freestone's important pioneering petrographic and electron microprobe analysis of sherds from Khok Charoen (Watson *et al.* 1986), the number of studies on excavated pottery has increased markedly.

The locations of sites from which pottery has been subjected to technological analyses are shown in figure 3. A summary of the studies, grouped into regions for convenience, is set out below. Table 3 lists authors, regions, publication dates and the analytical methods employed. Unless stated otherwise, physiographic regions of Thailand (after Moorman *et al.* 1964), are given.

CENTRAL THAILAND

Wares from Tha Kae, Lopburi, Central Thailand have undergone a preliminary X-ray diffraction analysis (Rispoli 1992:130). Central Thailand wares from Khok Phanom Di have been examined petrographically and preliminary descriptions have previously been published (Vincent 1987, 1989, 2000a, 2002). According to Debreceny (1994:385), a sample of Nong Nor potsherds have been submitted by Dr. Boyd to the Southern Cross University for X-ray fluorescence "analysis of clay minerals, in order to further identify fabric groups."

WEST CENTRAL THAILAND

Five fabric groups have been identified petrographically in the Ban Don Ta Phet ceramic assemblage (Johnson 1992:179-86, Glover 1990:139-83), with further work being planned (Glover 1990:172). The following is a summary of Johnson's fabric descriptions:

1. Fabric group A, tempered with rice plant material, is characterised by a greenish brown matrix with quartz, feldspar and biotite inclusions.

2. Fabric group B contains mainly ortho/meta-quartzite subangular to angular grains, which may be natural non-plastic inclusions, in a red-brown or brown-black matrix.

3. Fabric group C has a red or black-brown matrix. The major mineral inclusions are quartz and potassium feldspar grains (e.g. microcline and orthoclase). Rock fragments composed of quartz/feldspar and substantial numbers of biotite lathes are also present. Some rock fragments include garnet.

4. Fabric group D is similar to fabric C with the same range of mica and feldspar but fewer small quartz grains. Many of the feldspars are perthitic. There are also argillaceous inclusions and opaque minerals. The matrix is red-brown or red.

5. Fabric group E is characterised by an orange-brown matrix with medium to large well sorted mainly monocrystalline quartz and feldspar grains. Some small quartz grains and a few lathes of biotite are also present.

Johnson (1992:183-4) notes that "the five fabrics can be divided into three groups: Fabric A with organic inclusions; Fabric B with ortho/meta-quartzite inclusions; and Fabrics C-E with gneisso-granitic inclusions" and considers that the non-plastics in Fabrics D and E are probably deliberately added temper.

WESTERN THAILAND

Hoabinhian pottery from excavations in the Ban Kao area has been examined using chemical analysis (Pukajorn 1984:14-25). Recently, a sample of four Bang Site, Ban Kao rimsherds from layers 5, 6 and 7 have been kindly submitted to the author by Sørensen for petrographic analysis. It is intended to publish the results in a forthcoming paper (Vincent unpublished manuscript).

CENTRAL HIGHLANDS

Pa Sak Valley:

Freestone recognised six fabric groups at Khok Charoen. Type samples of fabric groups 1 to 5 inclusive have been examined in thin-section by the author for comparative purposes (Vincent 1988). None bear any significant resemblance to the Khorat Plateau fabrics discussed in this report. Freestone's detailed petrographic descriptions of these fabrics are summarized below:

- Fabric group 1 is characterised by an immature sand temper. Lava fragments and other minerals suggest the bulk of the sand derives from weathered volcanic rocks. Volcanic rhyolites outcrop immediately south of Khok Charoen and potting clays could be primary deposits located 6-7 km from the site.

- Fabric group 2, also considered to be local, is tempered with crushed sherd grog which probably derives from fabric group 1 pottery.

- Fabric group 3 is grog tempered but with no special mineralogical features suggesting its provenance.

- Fabric group 4 contains abundant rice husk temper and fine to medium grade quartz sand. It is clearly different from fabric 1 but no firm provenance is suggested.

- Fabric group 5 includes abundant fine sand, grog temper and rice husk. Although from a local shaped vessel, granitic minerals suggest an exotic source.

- Fabric group 6 is characterised by abundant quartz, feldspar, granitic rock fragments and much epidote. The non-plastics appear to derive from an epidotized granitic rock. The probability is high that it represents an imported ceramic. A source northwest of the site, at twice the distance of the primary volcanic clays, is suggested.

It is important to note that a meander design derived from an exotic fabric group 6 vessel was found reproduced in simplified form on a fabric group 1 pot. This is corroborative evidence of the prestige attached to the imported vessel (Watson *et al.* 1986).

Phu Wiang Region:

A preliminary petrographic study of selected Non Nok Tha pottery, excavated by Bayard, has identified eight fabric groups (Vincent 1985 (forthcoming report)). Their suggested sources are the Upper Chi Valley (two fabrics), Middle Chi Valley (two fabrics), Petchabun Region (one fabric), Upper Chi/Petchabun Piedmont (one fabric), Lower Mun Valley (one fabric) and one geologically non-specific rice-tempered ware. The fabrics are summarized below:

- Fabric group 1 is bleb tempered and compatible with Phase IV Non Chai pottery.

- Fabric group 2 is tempered with orthodox grog and is exotic to the Non Nok Tha region. It probably originated from within the Khorat Plateau *sensu stricto*.

- Fabric group 3 is tempered with bleb grog and matches pottery excavated at Ban Chiang Hian dated to *c.* 900-600 BC.

- Fabric group 4 is sandy and lightly tempered with what is probably rice straw. Igneous minerals clearly place this fabric outside the Khorat Plateau and a Petchabun Piedmont source is suggested.

- Fabric group 5 is heavily tempered with rice husk. No specific location can be identified, except to suggest a different source to the fabrics discussed above.

- Fabric group 6 equates with Don Taphan "thin white ware" (Higham 1977). It is probably tempered with coarse, sand-sized, orthodox grog in a matrix densely packed with sand and silt.

- Fabric group 7 is probably tempered with bleb grog. An Upper Chi Valley source is suggested, but this is unlikely to be the same location as fabric group 1 material, which is consistent with Non Chai.

- Fabric group 8 is mineralogically similar to fabric group 1. Quartz grains are less weathered and plagioclase feldspar is better represented which suggests an Upper Chi Valley source closer to the Petchabun Piedmont than Non Chai. This fabric is tempered with orthodox grog.

Preliminary petrographic analyses have also been completed on fabric groups represented in another series of potsherds selected by Bayard from Nong Non Chik and Nong Nok Tha. The results have been published elsewhere (Vincent 1988:182).

NORTH HIGHLANDS

Loei Region:

A preliminary petrographic analysis of Loei Province wares submitted by Rutnin from Noen Phrik, (Phrik Mound), and Tham Pha Phim, (Pha Phim Cave), (Vincent: preliminary report prepared for Rutnin 1987) has also been undertaken. Two fabrics are present in the five sherds examined:

- Fabric group 1, represented by four sherds from Noen Phrik (Phrik Mound), Ban Hua Na in Phu Luong sub-district, is characterised by coarse igneous rock fragments probably of volcanic origin possibly an amphibole-rhyolite. The mineralogy is similar to Pa Mong survey pottery labelled "Na Ngua buff" kindly provided for comparative purposes by Dr. Bayard (1980:70).

- Fabric group 2 is tempered with mainly very coarse sand. Again the mineralogy is igneous, in this case a granite or granodiorite. Only one sherd, from Tham Pha Phim, (Pha Phim Cave), in the Pha Doen Mountain Range near Ban Phia, Muang district, was examined.

NORTHEAST THAILAND

(i) Khorat Basin

Chi Valley:

A preliminary petrographic study of Chi Valley wares, from Ban Kho Noi and Non Noi, involving 36 samples, mostly rimsherds, has been completed (Vincent 1988:175, 273).

A more detailed petrographic analysis of Ban Chiang Hian pottery, involving 115 mainly rimsherds sampled by the excavator, (Chantaratiyakarn 1984), has also been undertaken. Radiocarbon determinations suggest that they date from *c.* 1,300-900 BC to *c.* 1-500 AD. Seven fabric groups (including three varieties tempered with orthodox grog, one with bleb temper, multiple fabrics tempered with sand (some of which is igneous) and two tempered with rice, (one being categorized as consistent with Phimai pottery)), were recognized (Vincent 1988:175-8).

Following detailed assessments of temper and surface finish by Rutnin (1979), under Bayard's supervision, examples of each Non Chai surface finish class have been examined in thin-section (Vincent 1988:175, 180). Over 88 per cent of the rimsherds and 82 per cent of other sherds are red painted or slipped wares tempered with bleb grog. Five other fabrics, most probably exotic to Non Chai, were also present:

1. A Phase 1 "red painted on black" sherd is tempered with bleb grog in a matrix similar to "Roi Et white" ware discussed below.
2. Another Phase 1 "red slipped and polished" sherd is tempered with orthodox grog in a sandy matrix containing some biotite. A Chi Valley, Northeast Thailand source is suggested.
3. A Phase 1, "red slipped with appliqué" sherd, is tempered with orthodox grog. The fabric contains bleached biotite, plagioclase feldspar and brown siltstone fragments.
4. A representative Phase 3 plain ware sherd is tempered with orthodox grog. The matrix includes biotite and possibly phlogopite and brown siltstone.
5. A characteristic "red painted on buff" Phase 4 sherd is lightly tempered with rice husk, in a dense, sandy, oxidized fabric similar to Roi Et "white ware".

Mun Valley:

Within the Mun Valley, a preliminary petrographic study of seven sherds, six of which are considered by the excavator to be "typical Phimai tradition chaff-tempered" and the other similar to Roi Et "white ware" (Welch pers. comm.), from four sites in the Phimai region has been

completed (Vincent 1988:176-81). In addition, an X-ray fluorescence (XRF) examination of "72 sherds from 8 excavated sites in the Phimai region" has been completed (McNeill and Welch 1991:332).

A preliminary petrographic study of Mun Valley wares, identified by the excavator as characteristic, from Non Dua, Bo Phan Khan and Don Taphan (Higham 1977), has also been completed (Vincent 1988). Higham proposed a chronology for the area, based on radiocarbon dates and ceramic styles from the three sites, with phase 1 spanning *c.* 500-1 BC, phase 2, *c.* 1 BC-700 AD, and phase 3, *c.* 700-1,000 AD. The temper and surface finish categories follow those used by Bayard and Rutnin. Pottery tempered with rice dominate at each site and include a distinctive sgraffito ware, dubbed "Roi Et" by Higham (1977). Five fabric groups were recognized in the 25 thin-sections examined (Vincent 1988:176, 180).

Non Dua:

1. A typical Phase 1 "smoothed plain" ware is tempered with orthodox grog. The mineralogy is different to later fabrics. It has possible igneous associations.
2. Phase 3 "white ware" is mineralogically similar to Phase 1 but tempered with rice.

Don Taphan:

3. Phase 2 "Roi Et ware" is tempered with rice. The fabric suggests a sedimentary source.
4. Phase 3 "coarse ware" and "white slipped ware" are tempered with rice in a moderately micaceous matrix.
5. Phase 3 "thin white ware" is tempered with orthodox grog in a moderately micaceous matrix.

(ii) Sakon Nakhon Basin:

Ban Chiang:

Technological studies in this region include petrographic and xeroradiograph analyses of Ban Chiang pottery. McGovern *et al.* (1985:104-13) used physiochemical methods involving standard petrographic techniques and point counting. They also assessed the "presence/absence of heavy mineral accessories" ... "by inclusion analysis of disaggregated 25 mg samples" (1985:105-6). Firing temperatures were assessed following Tite *et al.* (1982) and the presence/absence of slips and paints was established using a scanning electron microscope (SEM). The single slip detected was assessed with an energy dispersive system (EDS). Paint compositions were analysed by proton-induced X-ray emission (PIXE). Of the 12 vessels examined petrographically, five were tempered with grog and "plant material", four with grog only and three with rice.

Glanzman and Fleming (1985:114-21), in a pilot study, used macroscopic surface examination and xeroradiography to assess the fabrication methods used to form 15 individual Ban Chiang vessels. They noted that none of the vessels were formed using the mould technique reported from Ban Na Di (Vincent 1984). In a later expanded study, involving 59 vessels, at least seven vessel building techniques were identified (White *et al.* 1991). The major Early Period methods were coil-and-slab, moulded-base with coils or lumps, lump-and-slab and Late Period, coil-and-slab.

TABLE 3: Technological studies in South-East Asia by region

Author	Date published	Analytical method	Region
Watson *et al.*	1986	petrographic, microprobe	Central Highlands
Vincent	1988, 2002	petrographic	Central Highlands
Vincent	n.d.	petrographic	Central Highlands
Rispoli	1992	X-Ray Diffraction	Central Plain
Boyd	n.d.	X-Ray Fluorescence	Central Plain
Johnson	1992	petrographic	Central Plain
Glover	1990	petrographic	Central Plain
Vincent	1987, 1989, 2000b	petrographic	Central Plain
Pukajorn	1984	chemical	West Highlands
Vincent	1980	X-Ray Fluorescence	Khorat Plateau
McGovern *et al.*	1985	petrographic, heavy mineral SEM, EDS, PIXE	Khorat Plateau
Vincent	1984, 1988, 1991	petrographic, SEM, XRD	Khorat Plateau
McNeill & Welch	1991	X-Ray Fluorescence	Khorat Plateau
Glanzman & Fleming	1985	xeroradiography	Khorat Plateau
White *et al.*	1991	xeroradiography	Khorat Plateau
Vernon	1997	petrographic	Khorat Plateau
Vincent	1988	petrographic	Laos
Leong	1990	X-Ray Fluorescence	Malaysia
Datan & Bellwood	1991	NAA, XRD	Malaysia
Ardika & Bellwood	1991	NAA, XRD	Indonesia
Miksic & Yap	1990	X-Ray Fluorescence	Indonesia
Glover *et al.*	1996	petrographic	Vietnam
Vincent	(in prep.)	petrographic	Vietnam

Other Sakon Nakhon Basin sites:

Extensive technological investigations into Sakon Nakhon Basin wares excavated at Ban Muang Phruk, Ban Na Di and Non Kao Noi, 29 surface collected and two modern pottery site wares, have been completed with particular reference to Ban Na Di (Vincent 1984, 1988, 1991).

Two ceramic traditions were identified at Ban Na Di using a range of techniques including standard thin-section petrographic analysis, X-ray diffraction characterisations of clays and Scanning Electron Microscopy determinations of firing temperatures. The following are of note:

Ban Na Di:

- Of 15 Ban Na Di fabric groups characterised, groups 1 to 4 represent MP1 local wares, the earliest potting tradition.
- Fabric groups 5, 6, 8, 9, 10 and 11 are exotic, and in each case a Sakon Nakhon Basin source is suggested.
- Fabric groups 13 and 15 are also exotic, however, in these cases Eastern Sakon Nakhon Basin sources are suggested.
- The mineralogy of fabric group 7, also exotic, suggests close associations with the Petchabun Piedmont region to the west.
- Fabric group 14 is geologically non-specific, except to suggest a Mun Valley source. As the fabric is texturally similar to Ban Suai and Ban Prasat ware, and surface decoration sets it apart from the Ban Na Di local pottery, it is considered to be exotic.
- Fabric group 12 is characterised by the distinctive bleb temper which represents MP2 local Ban Na Di wares. This fabric is correlated with a proposed arrival of immigrants from the Khorat Basin. It heralds a transition to a new potting tradition which replaced the founding Ban Na Di tradition, characterised by fabrics 1 to 4 inclusive. The clay used in fabric 12 derives from a different source than that exploited by the earliest potters.
- Fabric group 16, a MP2 ware, contains the same parent matrix as fabric group 12, but, as with MP1 wares, it is tempered with orthodox grog. It is important to note that although a different clay was used during MP2, in this case, the earlier tempering method was retained.
- Petrographic analysis of modern pottery containing bleb temper has allowed the fabrics to be characterised for comparative purposes. Sakon Nakhon Basin craft potters were using bleb temper when field studies were carried out during 1980/81.

Surface collections, potting clays and modern pottery

Pottery surface collected from Non U Mung, Non Na Nong Khong (Pa Mong), Ban Tak Det (Laos), 29 Sakon Nakhon Basin sites and potting clays from 14 Sakon Nakhon Basin quarries

have been analysed petrographically, as well as with SEM and XRD techniques (Vincent 1988). For comparative purposes modern pottery fabrics have been analysed from Ban Chiang and Ban Phu (Sakon Nakhon Basin), Ban Na Kraseng and Non U Mung (Pa Mong), and Ban Mọ (Mahasarakham) manufactories (Vincent 1988).

Crucibles

Petrographic analysis of Ban Chiang crucible fabrics, involving about 87 specimens, has also been undertaken by Vernon (in White *et al.* 1991 and Vernon 1997). They were predominately tempered with rice chaff. Rice chaff with minerals and clay, or grog, are the dominant variants. Some slag is present in many fragments and significant in others. Crucibles from survey sites were tempered with rice chaff, clay and rice chaff, clay alone or quartz. Crucibles from Phu Lon, where copper ore was quarried, have also been examined by Vernon (1996).

The fragments of 26 Ban Na Di crucibles have also been examined petrographically (Vincent 1988). Slag was noted on surfaces and in some cases it had penetrated the ceramic fabric. The crucibles were all made from non-local clay, except one early specimen. Seventeen were tempered with orthodox grog. Three were rice-tempered. Five were composed of MP1 local fabrics. One contains sand. This latter specimen has clear mineralogical associations with clays to the east of Ban Na Di, close to the Phu Phan Range.

MALAYSIA

Tripod wares from Jenderam Hilir, Gua Berhula and Bukit Cangkul and clay samples from Tit Nam Hoong have been examined using XRF and a Bukit Cangkul tripod in thin-section (Leong 1990:65-76). Thin-section and heavy mineral separation analyses of Jenderam Hilir pottery have detected ilmenite, tourmaline and zircon. Angular quartz is also present in large amounts in these wares which contrast sharply with rounded and some fractured grains in the Gua Berhala tripod sample. Leong considers that the tripod forms "represent a local regional form and are quite different from the Lungshanoid and Lungshan tripods of China." (Leong 1990:65).

Neutron activation (NAA) and X-ray diffraction analyses of some Niah and Lubang Angin pottery indicate that "three-colour ware" and double-spouted vessels from Lubang Angin "were manufactured in more than one place" (Datan and Bellwood 1991:400). Preliminary findings indicate that Lubang Angin pottery came from one geological zone. The Niah fabrics differ from these on NAA results and trade between the two areas cannot be suggested. Niah pottery "has at least two rather different geological source regions." Some three-colour sherds from Lubang Angin contain aragonite presumed to be from marine shell. This suggests that they were manufactured on the coast.

INDONESIA

A preliminary 1987 survey revealed pottery in northeastern Bali coastal sites, including wheel made, slipped, "Indian Rouletted" ware, typically with fine, light grey to pale orange, fabrics (Ardika and Bellwood 1991:221-32). Motif styles all fall "within the range published for Arikamedu and other Indian/Sri Lankan sites such as Satanikota (Ghosh 1986: figure 34), Salihundam (Subrahmanyam 1964:41-7) and Anuradhapura (Deraniyagala 1973:figure 12)." Fine and coarse rouletted wares also occur in Indian sites. One Bali sherd and seven Indian sherds, analysed using XRD, indicate essentially the same minerals: mainly quartz with traces of mica, muscovite, potassium and plagioclase feldspar. All except one slip, which revealed traces of haematite, were of the same basic composition. "The XRD results conclusively support an Indian origin." Nine additional rouletted sherds (two from Anuradhapura, two from Arikamedu, one from Karaikadu (Tamil Nadu), three from Sembrian and one from Pacung) have been analysed using NAA. "The results indicate that all the Rouletted Ware is so close in composition that a single manufacturing source for all the samples listed, both Indian and Balinese, is a definite possibility." (Ardika and Bellwood 1991:224).

Miksic and Yap (1990), employed energy-dispersive XRF to analyse a range of Sumatrian wares. To test whether the "Kota Cina Fine Paste Ware originated from south Thailand, 38 sherds were analysed" and compared with two modern sherds. Only one fell within the south Thailand group, two fell far outside the range of any known group and 34 clustered with sherds from East Java.

VIETNAM

Excavations at Buu Chau Hill, Tra Kieu, in Central Vietnam uncovered a range of mainly cord-marked coarse earthenware pottery. A preliminary identification of "one small dark grey sherd with lines of triangular impressions" suggested that it might be a Indo-Roman Rouletted Ware bowl such as known from Arikamedu in eastern India. Thin-section mineralogical evidence "strongly suggests" a single geological origin. The fabric matches sherds from Arikamedu and Karaikadu in South India (Prior, in Glover *et al.* 1996:166-76). This petrographic evidence supports the above conclusions (Ardika and Bellwood 1991:221-32). Sherds excavated at Dinh To in the Red River Delta have been examined in thin section; they contain sand temper (Vincent manuscript).

PREVIOUS TECHNOLOGICAL STUDIES: CONCLUDING REMARKS

A variety of detailed analytical techniques have successfully been applied to a broad range of research projects since 1980, demonstrating their value in pottery studies. Research involving Mun Valley, Khorat Basin, Iron Age sites (Higham 1997), involves a team of specialists including Judy Voelker, a doctoral candidate, who will apply petrographic analysis to the pottery (Higham pers. comm.).

THE BANG PAKONG VALLEY: KHOK PHANOM DI AND NONG NOR

Previous Bang Pakong Valley research involves pottery from two earlier Khok Phanom Di excavations, undertaken by Noksakul in 1979 (Noksakul 1981), and Pisnupong in 1982 (Pisnupong 1984), and from Nong Nor, a small, shallow, shell midden and cemetery site located 14 km southeast of Khok Phanom Di (Higham *et al.* 1994). The earlier Khok Phanom Di excavations suggested major environmental change may have affected prehistoric occupation(s). Noksakul uncovered much pottery and potting tools, suggesting local manufacture. Many marine specie remains, associated with fishing equipment, initially abundant, declined in upper layers to be replaced by a terrestrial-dominated faunal assemblage. This shift suggested an initial coastal, or near coastal, location that later became somewhat remote from the sea. The site currently lies about 22 km inland from the Gulf of Thailand. This point is discussed further below in the section on the local and regional Bang Pakong Valley geomorphology.

Pottery from Pisnupong's 1982 excavation was carefully categorised, with particular attention paid to rimsherds and "whole" vessels. A marked change about 1.2 m below the site surface was evident. Whereas everted rims characterised pottery in the lower sequence, simple vertical, or inverted, rims dominated the upper layers. Identical rims were found in the 1985 excavations. The 1982 pottery weights were recorded in 10 cm stratigraphic units and this detailed data has been reformulated to allow comparison with the material in this study (Table 1). It is important to note that Pisnupong's 1982 excavation encountered natural strata at 8.4 m, while in the 1985 project this was reached at 6.8 m. Aspects of the Khok Phanom Di pottery decoration have been reported on in volume III of this series by Hall (1993:239-74). The present report expands Hall's results by adding some decorative modes and considering related technological environments at the site.

NONG NOR

Nong Nor, which demanded consideration because it could bear directly on developments at Khok Phanom Di, was excavated by Higham and Thosarat over several seasons from 1991 to 1993, to compare "a site which might have been contemporary with Khok Phanom Di, but located in a less wealthy habitat" (Higham and Thosarat 1994a:5). Khok Phanom Di is considered "enigmatic" by Higham and Thosarat (1994a:1). They wished to explore whether "two levels of settlement hierarchy were developing already during the Neolithic? Could it have been that the élite at Khok Phanom Di exercised a wider social dominance?" (Higham and Thosarat 1994a:5). Establishing whether interaction occurred between the two sites was considered of primary importance (Higham and Bannanurag 1992:184). The Nong Nor excavations were shallower and the site less elevated than Khok Phanom Di. Of particular interest are two Masters theses (Debreceny 1995, O'Reilly 1995, both supervised by Higham), summarised in Higham and Thosarat (1994a).

The excavations uncovered 404 m^2 (Higham and Thosarat 1994a:16). The stratigraphy, partially disturbed by looters, cultivation and possibly natural erosion, comprised at deepest about 1.6 m of cultural material, subdivided into two layers. The lower, ametallic Phase 1 (L2), which overlay the natural substrate, was composed of compacted shell midden containing potsherds, fish and marine animal bones. L2 varied in depth from *c.* 20 cm to *c.* 40 cm. It was interspersed with red lenses containing "much charcoal, ash and pottery" (Higham and Thosarat 1994a:17). This in turn was overlain by a Bronze Age cemetery (Phase 2 (L1)). L1 partially comprised riverine alluvium under recently cultivated rice fields. Inhumation graves cut into a lens within the alluvium and the underlying L2 shell midden. Two separate cultural contexts, perhaps interrupted by a period of flood-enforced site abandonment, have been proposed (Higham and Thosarat 1994a). The earlier period has been dated (from beneath the shell midden) to 2478-2333 BC (pooled *x* at one sigma for five determinations), and the later cemetery phase to between 1100-700 BC (Higham and Hogg pp: 20-23 in: Higham *et al. op. cit.* 1994a).

The radiocarbon determinations suggest that the cultural sequence at Nong Nor neatly bracket those from Khok Phanom Di (Fig. 4). This apparent dovetailing of the two chronologies provides an excellent opportunity to explore regional interactions between Khok Phanom Di and other Ban Pakong Valley sites by comparing their respective ceramic sequences. Further, and of equal importance, harmonising the Khok Phanom Di and Nong Nor ceramic sequences could help to reconstruct a regional relative chronology. This kind of data integration has been seriously lacking in Southeast Asia, due to the infancy of the discipline in general, and in particular because of the present state of ceramic classification. Firm chronological frameworks can be established when ceramic sequences from related sites are able to be correlated with absolute dates from radiocarbon determinations in much the same manner as tree rings in dendrochronological studies are inter-related to form a continuous extended sequence.

Ceramic materials from the initial occupation phase at Nong Nor include 168.8 kg of body sherds, 9.8 kg of rimsherds, vessel bases, 42 anvils, two 2.9 cm high by 4.5 cm diameter "cones", one pellet and 67 fired "wasters", described as squeezed "lumps", some with finger impressions (O'Reilly 1995:44). The presence of potters' anvils, "burnishing stones", "wasters" and "a red burnt lens indicating some form of pyrotechnic activity" (O'Reilly 1995:70) indicates that at least some of the pottery was produced on-site. Six rimforms and three decorative modes which parallel Khok Phanom Di forms are examined in detail in Chapter VII. O'Reilly noted that most sherds are sand-tempered and all anvil fabrics "contained silica as the major tempering agent" (*op. cit.*:38). According to O'Reilly, Nong Nor phase 1 may represent a temporary seasonal occupation by mobile hunter-gatherers in a fashion similar to the modern-day Chaw Lay (Engelhardt and Rogers 1997:177-92). He argues that pottery design motifs "unquestionably link Nong Nor and Khok Phanom Di" (*op. cit.*:117).

Nong Nor L1 comprises a Bronze Age cemetery, partially separated from the initial occupation phase by alluvium, through which the graves were cut. In total, 168 burials, 95 of which contained a total of 250 vessels, were uncovered, including 16 infant burials in pottery jars. Only 49 burials were undisturbed. Of these only 38 contained pottery (Debreceny 1994:375). Funerary pottery was found interred with all ages and both sexes. Mortuary wares are considered ceremonial and therefore distinct from the Phase 1 "generally utilitarian" midden pottery, with no similarities between the two wares either in form or fabric. Rice temper is present in burial

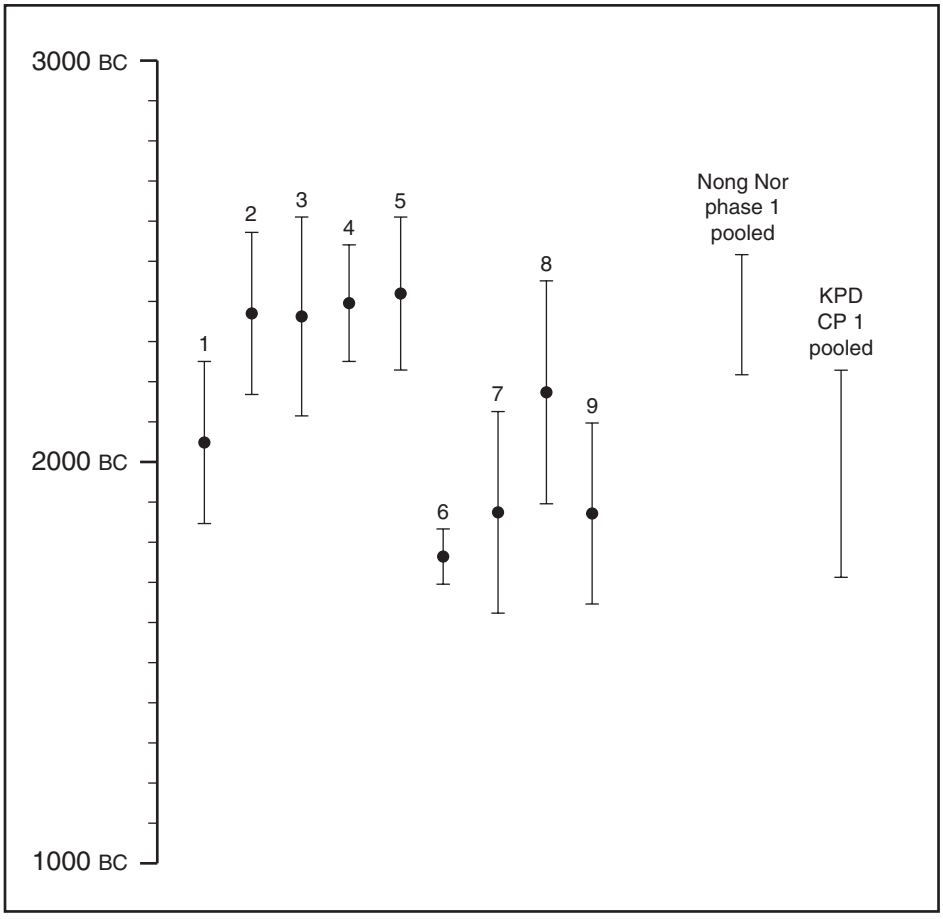


FIG. 4: Radiocarbon determinations from Ceramic Period 1 at Khok Phanom Di and Nong Nor phase 1. (1-6: Nong Nor phase 1 (Wk 2025-9, 2847); 7-9: Khok Phanom Di CP1). Sample 6 (WK 2847) from Nong Nor has not been included in the pooled 2 sigma dates because it involves shell which could be adversely influenced by reservoir effects. The pooled CP1 (L11:2 and L10:25) dates for Khok Phanom Di are ANU 5490, 5492 and 5493. Three Nong Nor determinations derive from hearths in soil underlying phase 1 and two were derived from charcoal impregnated in the surface of natural strata immediately underlying the phase 1 shell midden (Higham and Hogg 1998:23). The Khok Phanom Di dates relate to samples taken from within CP1 cultural material approximately 20 to 35 cm above the underlying natural surface

but not midden wares. One exception, burial 133, the only crouched interment, contained distinct vessel forms and fabrics, and the only burnishing pebble in mortuary contexts. This suggests that it may belong to the earlier midden deposits. Post-deposition disturbances and erosion dislocated many pottery fragments and meant that only 20 vessel forms could be identified. Vessel form groups were distinguished in terms of base forms, vessel and orifice shape (Debreceny 1994:377).

Two fabrics, the most common a friable "black, low fired rice tempered ware," and "a sand tempered grey ware," which is "harder and thinner" dominate the mortuary wares (Debreceny 1994:385). The ceramic assemblage does not appear to be related to Khok Phanom Di or other known Bang Pakong Valley pottery. Simple pedestalled open bowls are considered to be closest in form to those from Phu Noi (Mudar 1993), although they also occur at Ban Na Di, Ban Kao, Non Pa Wai and Non Nok Tha (Debreceny 1994:386). Other forms are also similar to Ban Kao and Phu Noi vessels, but without "fabric analysis and more detailed regional studies" (Debreceny 1994:387), cultural contacts cannot be assumed. Burial ceramics suggest that, in terms of vessel forms, different mortuary rituals were observed for each gender, with "younger individuals and females" having "a more restricted range of vessel forms" (Debreceny 1994:391). A low level of social ranking is evident from the funerary assemblages. They do not appear to mark any particular status, and the clearest interpretation of them is that "they suggest the presence of horizontal stratigraphy" (Debreceny 1994:394). We can note here that the cemetery at Nong Nor may have been in use during the as yet undated final pottery workshop phase at Khok Phanom Di. A schematic summary of the Khok Phanom Di sequence is set out in figure 1.

Environmental evidence from the Bang Pakong Valley is examined in Chapter IV, to help reconstruct the varied environmental conditions faced by the Khok Phanom Di potters. Understanding the general environment will help in interpreting physical evidence derived from the 1985 excavation and associated research. Excavation evidence and data from the nearby riverine/estuarine floodplain, an active region formed by natural processes over the last few millennia, will be considered. Erosion, transportation and deposition processes have resulted in the present sedimentary deposits which surround the site. Tectonic activity further altered regional landforms, in some places dramatically. Evidence summarized in the following chapters indicates these processes were fundamental to the success of potting technology and the rise of related socio-economic activities in prehistoric Khok Phanom Di.

IV THE CERAMIC SETTING

CERAMIC traditions closely interact with their contextual settings. Local and regional wares can be related to their natural and cultural environments. Natural and human resources interplay with and help characterise prehistoric potting industries. These influences model ceramic traditions. It is necessary, therefore, to consider these factors as a background to understanding the ceramic traditions under consideration in this report. They will be examined in two ways. Primarily, a brief overview of the Ban Pakong Valley environment and its resources will be considered. This includes summaries of the local geography, geomorphology, climate, regional geology and associated local potting clays, as well as potential temper and fuel resources during the prehistoric period. A brief assessment of whether some of the latter resources were readily accessible for exploitation will then be considered. These could have been available either as potential primary potting materials or other natural resources able to be exploited in concert with large-scale pottery production.

GEOGRAPHY AND GEOMORPHOLOGY

Ceramic industries can be affected by their environmental settings in several ways. Access to raw materials and, if the manufactory produces for external markets, potential customers, may be determined by the local and regional geography, geomorphology and climate. Distances from clay deposits, fuel sources and potential markets are important variables. If local production includes, for example, containers used in transporting other products for trade or exchange, then ready access to these markets is indicated. When the production of such wares exceeds possible local consumption, their use as exchange or trade items is further suggested. Amphorae, for example, an important component of the Roman wine trade, were produced on a single estate and widely marketed (Peacock 1982:154-9). Khok Phanom Di lay above, or close to, riverine/estuarine environs where water transport would have provided an excellent means of carriage. Water transport is of special value in importing potting clays, fuels for firing pottery, and for exporting manufactured wares along with any materials to be shipped in pottery containers.

Fluctuating Holocene sea levels and tectonic changes are reported to have markedly affected the local topography (Maloney 1991:17-19). The present location of Khok Phanom Di is shown in figure 5. Soil distributions are shown in figure 6 and eustatic sea-level curves in figure 7. Radiocarbon dates and sample depths published by Somboon (1988) and van der Kivie (1971) are set out in figure 6. The region has been tectonically active and Holocene sea levels have changed markedly.

As a result, the local flood plain surfaces, river courses and nearby Gulf of Thailand coastlines have been extensively reformed. Khok Phanom Di currently lies 22 km from the coast. During its prehistoric occupation, however, it was located close to the coast on estuarine/riverine waterways,

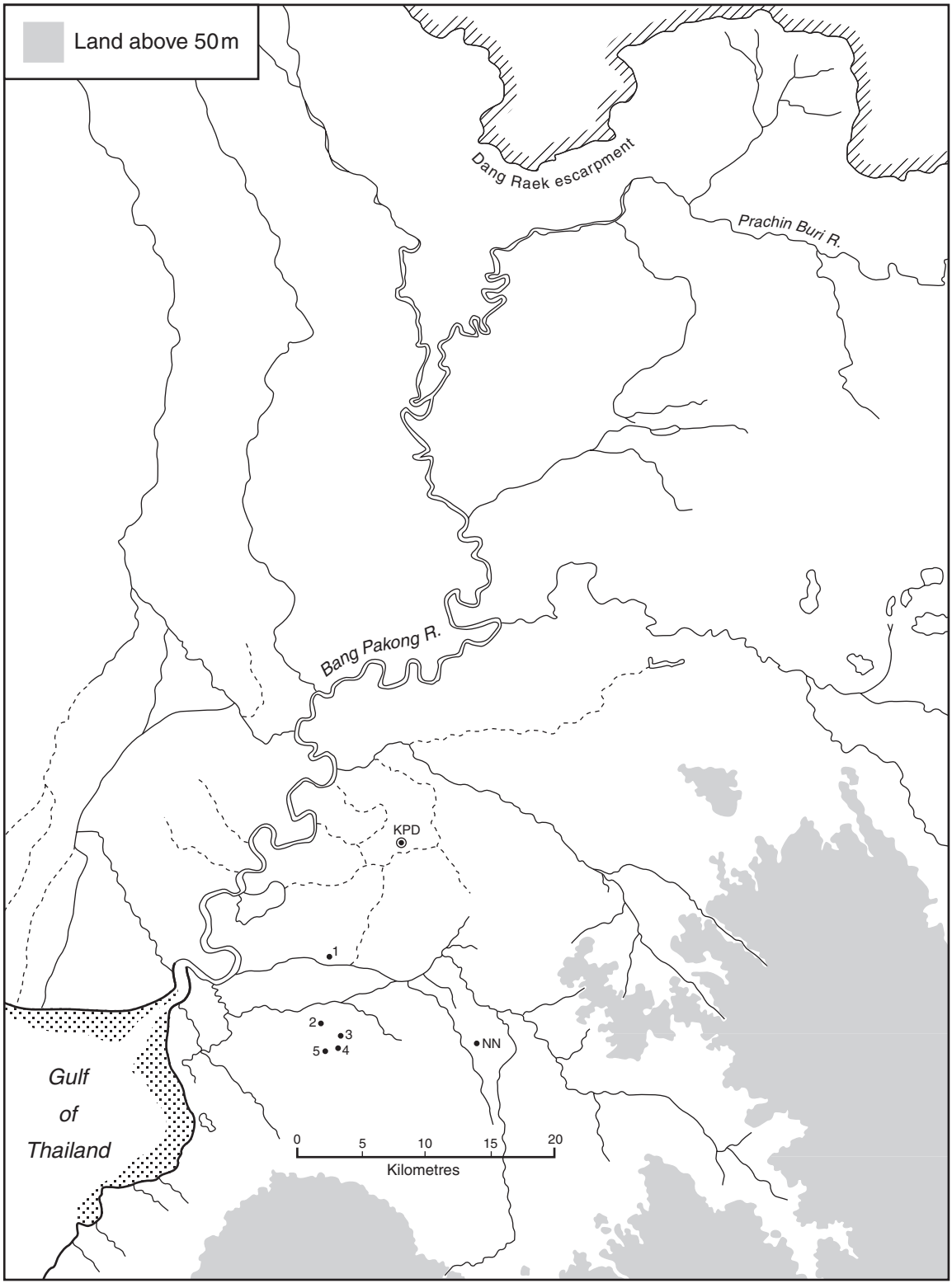


FIG. 5: The geomorphology of the Bang Pakong Valley

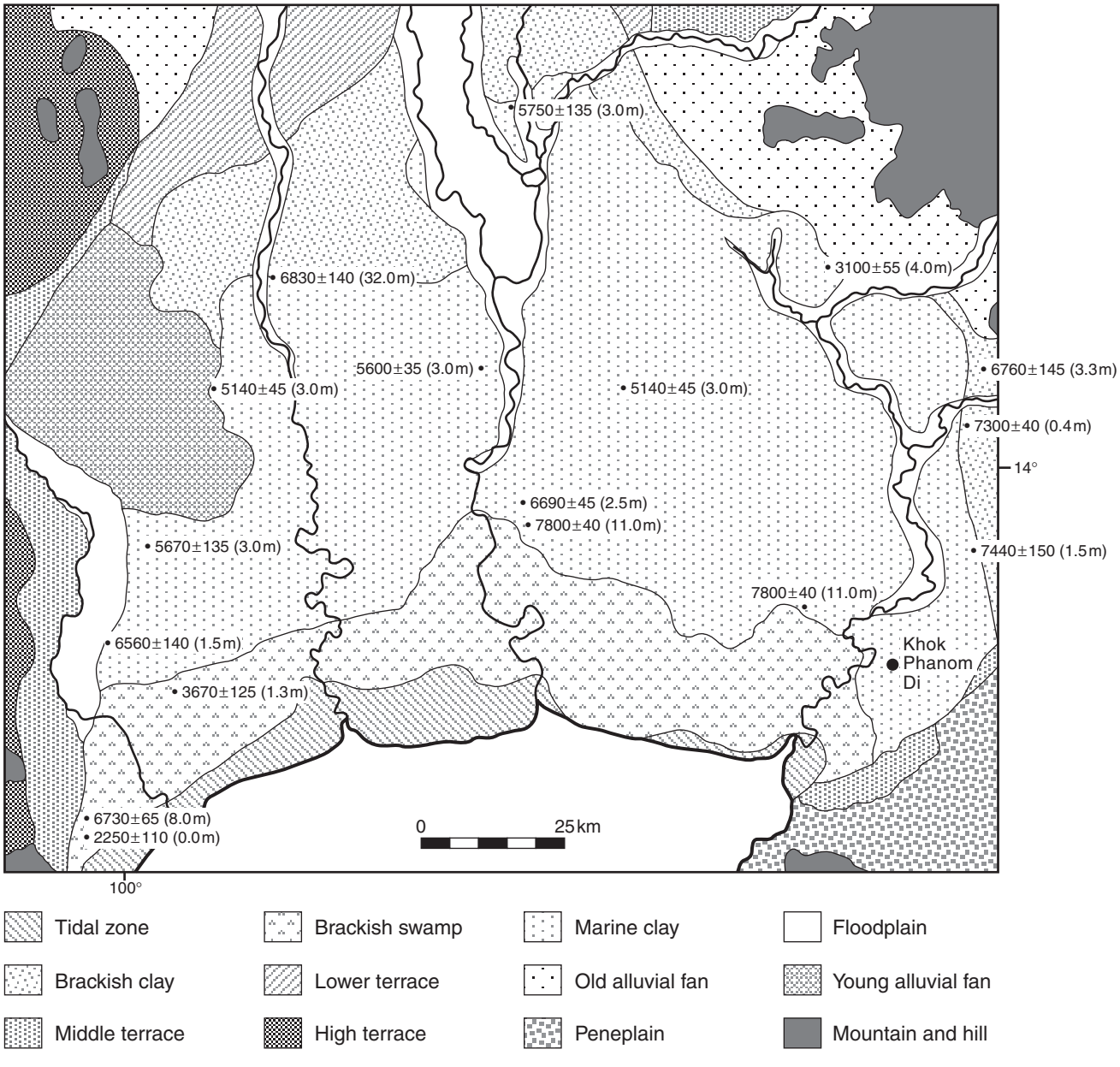


FIG. 6: The soils of the Central Plain (after Moorman and Rojanasoonthan, 1968)

or at least had free access to them. Water transport would have facilitated the movement of pottery along exchange networks from a major pottery production centre. Reliable access to navigable waterways is an essential component of such central places. Water transport would facilitate the movement of raw materials into the site and allow efficient, large scale, distribution of pottery and any contents.

Recent research into the Ban Pakong Valley's regional geography and geomorphology has provided data used to suggest likely palaeoenvironmental sequences with particular reference to the environs of Nong Nor (Boyd 1994, 1998). This evidence has relevance for part of the period Khok Phanom Di was occupied in prehistory. Other pertinent studies include Aitken's (1992) analysis of the Khok Phanom Di archaeological sediments. Maloney (1987, 1988, 1991) and Maloney and Brown (1990) have considered pollen from sediment cores taken close to Khok Phanom Di. Environmentally sensitive molluscs and micro-molluscs, the latter recovered from floated samples extracted by Thompson (1996), have been examined by Mason (1991, 1996). McKenzie (1991:139-46) has examined ostracodes and forams. Thompson (1996) has reported on the botanical remains. Data from each are considered below.

According to Aitken (1992:180), Khok Phanom Di lay "beside a river or stream that is dominated by fluvial land-derived (not reworked estuarine or marine) sediments." Evidence for increasing sedimentation suggests "an inland riverine setting followed by siltation and channel shift which caused diminished access to the estuary and coast and eventually led to site abandonment." Basal (i.e. natural) sediments suggest a granitic source to the southwest, as hornblende and biotite, which characterise granites upstream to the northeast, are absent (Aitken 1992:181). Location on a tributary of the Bang Pakong is therefore suggested, which "does not preclude it being tidally influenced and maintaining high salinities" (Aitken 1992:181). Calcium carbonates from shell middens, bones and ash spreads average 34.7 per cent (S.D. 13.6), "which is over 20 times greater than the carbonate levels in the non-cultural sediments" (Aitken 1992:184). Major elements detected in the cultural sediments whose proportions greatly exceed those in the surrounding natural sediments include phosphorous (x 25), magnesium (x 8) and manganese (x 3 - 10 greater). The concentration of haematite is almost twice that in Thai soils, while sodium and potassium are "within the range of non-cultural samples" ....."The pervasive presence of quartz, potassium feldspar, plagioclase and muscovite, plus traces of apatite, suggests that both the cultural and non-cultural sediments at Khok Phanom Di are leucogranitic in origin." (Aitken 1992:185). These are important data and we will return to them later.

Maloney (1991:56, 63) subjected five core stratigraphies, taken from the deltaic flat surrounding Khok Phanom Di, to pollen analysis and assessed their microfossil leaf and charcoal concentrations. He suggested that the site began as sand chenier and that the pollen derives from either a shallow-water sea or a lagoon (*op. cit.*:13, 52). With respect to possible local rice cultivation, Maloney (1991:91), concludes that "the size and distributions of the grass pollen grains from spectra as old as 4300 BC parallels those from a modern ricefield context." but cautions, however, that "definitive data can only be derived from the plant macrofossil remains uncovered during excavation and possibly, but less certainly, the inclusions in the temper of pottery" (*op. cit.*:9). In any case, "If rice was either cultivated or harvested wild around 2000 BC., it occurred at some place inland of Khok Phanom Di since the site was then in the intertidal zone" (*op. cit.*:94). Three main sedimentary "environments" were noted by Maloney (*op. cit.*:57), "in the

vicinity of Khok Phanom Di: brackish-water clays, green 'marine' clays and white, possibly kaolinitic, clays of probable subaerial origin." Estimating likely sea levels from the pollen data is difficult given the lack of modern comparative material. According to McKenzie (1991:144-5), however, the small size and "uniform rarity" of microfauna strongly suggests that the site was never inundated. Taxa such as *Cyprideis* (an ostracod), and *Ammonia* (a foram), however, "indicate that tidal and seasonal factors favoured polyhaline species, i.e. there were, probably, diurnal and seasonal variations in salinity."

Natural sediments surrounding Nong Nor have been described by Boyd (1994:24-104). Three major phases are recognized: (i) an inland undulating plain (completely different from the present plain), (ii) marine inundation and coastal conditions, and (iii) the present freshwater floodplain. Data derived from sequence descriptions of natural sediment exposures, the "interfingering" of archaeological and natural deposits and data from other archaeological sites, along with maps derived from aerial photographs, provided evidence of six major stratigraphic units. His palaeogeographic model extrapolated from these data allows "a possible chronological framework for site location in the region around Nong Nor", and "in general terms this framework contains five main Geo-archaeological Periods." Khok Phanom Di is placed within Period 3, when the shore was relocating seawards and considered by Boyd to have either been an island site, when Nong Nor was occupied, or younger than the mid-Holocene Palaeogeographic Phase 2. The latter was the second of three such phases. Palaeogeographic Phase 2 witnessed the culmination of sea level rises and shoreline progradation. Assuming a relatively constant rate of coastline displacement similar to that at present, the implication is that "occupation sites with a strong coastal emphasis would have been relatively short lived." (Boyd 1994:92). This "relative chronological framework ... provides independent support for the notable difference in the dates of occupation of Nong Nor and Khok Phanom Di." (Boyd 1994:96).

Palaeoenvironmental conditions may be reflected in archaeologically recoverable biological spectra. Biological remains, therefore, can be sensitive markers of prehistoric environments. In this regard, Mason (1991), reports that the molluscan fauna indicate:

> "the earliest inhabitants of Khok Phanom Di settled on a slightly elevated river levee close to an open coast bearing patches of clean, sandy and coralline sediment. There was also a substantial estuary not far from the site. With the passage of time, the diminution of seaward mangal species and those from clean water habitats suggests a prograding, muddy coastline and increasingly fresh water environment."...."There are strong indications that the inhabitants of the site encountered the advent of non-estuarine, even non-riverine, conditions certainly by the beginning of layer 6[1]. Such a change could have taken the form of the cutting off of a loop of the ancestral Bang Pakong River, or even the relocation of the river bed following a major flood." ...."this change could have occurred somewhere in lower layer 8 and upper layer 7[2]." (1991:314)

In a footnote Mason (1991:314) notes: "L. Aitken has informed the author that grain size

[1]Zone B, MP6 CP3. Footnote added

[2]Zone B, MP4/5 CP3. Footnote added

analysis of" ..natural sediments underlying basal occupation deposits are "consistent with a river levée." In a subsequent report, Mason (1996:254) noted that micro-molluscan and habitat data gained through collections of modern material completely agrees with and reinforces the earlier conclusions quoted, (those of Thompson (1996), and of Kealhofer and Piperno (1996)), the latter obtained through an analysis of phytoliths separated from Maloney's sediment cores.

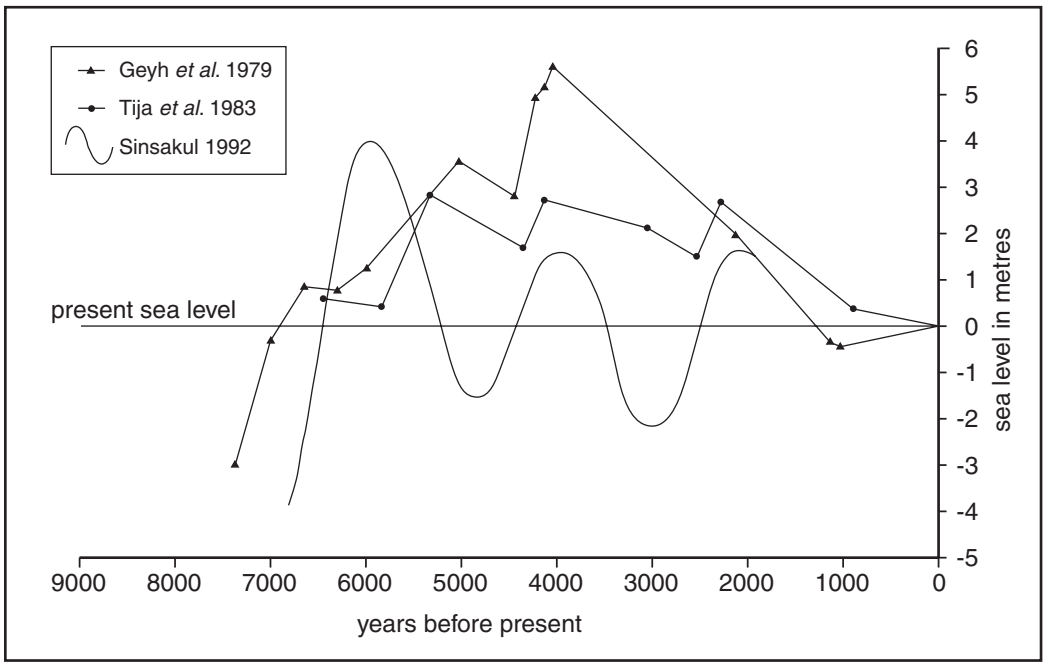


FIG. 7: Holocene sea levels (after Geyh *et al.* 1979, Tjia *et al.* 1983 and Sinsakul 1992)

Thompson (1996) provided detailed analyses of the Khok Phanom Di botanical remains excavated during 1985. Particular attention was paid to rice remains, charcoal, mineralized wood and seeds. When coupled with the sediment core data these results have important implications for understanding the initial and subsequent potting activities at Khok Phanom Di. According to Thompson, the site lay close to an estuary within or with access to a mangrove forest backed by open saline plains and herbaceous swamps. About halfway through the cultural sequence, just above L9, about the Zone A, MP3/4, CP2/3 boundary, charcoal density and fragment size decrease, indicating a shift from forest to an open plain setting. This is coupled with a change from mangrove-dominated to non-Rhizophoraceae charcoals. The presence of *Trianthema portulacastrum* and *Suaeda maritima* seeds indicate that a barren, dry, open saline or hypersaline plain, a habitat not recognized by faunal or pollen analysis, lay landward of the mangrove forest. These plant remains were most common in Zone A, especially L10 (i.e. CP2), and persist at much lower frequencies into L5 (Zone B, MP7, CP3), while they are absent from Zone C (CP4).

Many mangrove species represented at Khok Phanom Di are known to be suitable for use as firewood. Other uses include cooking, smoking fish, repelling insects and ritual feasting. Most charcoal throughout the cemetery probably represents the remains of funerary feasting

(Thompson 1996:29-38). The high proportion of *Rhizophora* type charcoals are compatible with estuarine or river bank deposits. According to Thompson, the archaeological zones set out in figure 1, are not evident in the charcoal spectrum, the only possible break being at the interface of L8 and L9 which postdates the Zone A/B boundary. Some outstanding concentrations of very large charcoal fragments are evident, for example, in L10:3 (lens 2) and L10:26. The latter may represent a second burn-off prior to a re-occupation of the site and the establishment of a new potting tradition (CP2).

Most seeds recovered belong to Cyperaceae (sedges) and Gramineae (grasses). A herbaceous halophyte plant, (*Suaeda maritima*), is the most abundant. It commonly grows in "swampy salty clayey soils in open areas behind mangrove" (Thompson 1996:91). Seed frequencies varied markedly, with unusually large concentrations in L10:19-20. These frequencies do not correlate with charcoal densities. *Suaeda maritima* is dominant in the seed frequencies which means that it was either growing in relative abundance in the area, or possibly being brought to the site for use by the community. It is a saltmarsh plant of limited cultural use which only grows in saline conditions and whose presence points to salt in the soil rather than saline groundwater. Salt flats may be quite bare of vegetation and desiccated in the dry season when evaporation brings salts to the surface.

According to Thompson (1996:136), shifting swampland rice agriculture may provide the nearest ecological analogues to prehistoric conditions at Khok Phanom Di, where "rice is sown in a mosaic of microenvironments." Modern Thai rice farmers use waste rice husk (*klæb*) as temper in pottery. This use has also been noted in Northeast Thailand in association with "bleb" temper (Vincent 1988). Rice husk in pottery was the most common form of rice remains at Khok Phanom Di. Some husks or husk impressions were also discovered in clay adhering to the surface of some potsherds from L8 to L10 (Thompson 1996:160). Diagnostic features, such as an absence of awns and a rounded apiculus, suggest that the husks at Khok Phanom Di came from domesticated plants (Thompson 1996:170). Consumption of domesticated rice does not confirm local production, however, and as rice is presumed to have been derived from freshwater areas, exchange with inland communities "should not be forgotten" (Thompson 1996:212). Apart from pottery and trochus shell jewellery, salt, plant resins, nipa products, dyes and preserved fish were possible items meant for export. Rice husks occurred throughout Zones A and B, suggesting within-site bulk processing and storage. It is important to note that both the quality and quantities of rice remains recovered were consistent throughout the archaeological sequence:

> "The remains of cultivated rice were found in some form in all levels of the site, both before and after the major change from a marine-estuarine situation to a more inland one, and they showed neither an increase in abundance nor a marked change in morphology through the sequence." (Thompson 1996:215).

CLIMATE

Global climatic fluctuations, as inferred from glacial deposits and pollen, indicate a generalised mid-Holocene climate which was warmer and drier than the present (Flint and Skinner 1977:499). Regional climates can vary markedly with local topography, vegetation cover and latitude. At present this portion of Thailand lies within the monsoon (Koppen Aw to Am) tropical climatic zone (Strahler 1973). Marked wet-dry seasons typify this region, with intermittent heavy rainfalls normally leading to seasonal river plain flooding. Wet-season rains result in heavy leaching and promote laterization. According to Hope and Hope (1976), New Guinea montane evidence suggests that the climate has been relatively stable for the last 5,000 years. This is supported by recent montane data from Thailand, which indicate a wet and warm climate for the last 11,000 years, with the present conditions extending back for at least 4,300 years (Hastings and Liengsakul 1983).

The Bang Pakong Valley, according to Maloney (1991:21), presently receives *c.* 1718mm of precipitation per annum, somewhat less than the 2725 mm received on the southern slopes of the Chanthaburi Mountains to the northeast, with the summer monsoon maximum monthly rainfall of 340 mm falling in September. Most rain comes with the southwest monsoon and decreases towards the mountains due to the rainshadow effect. Maloney reports that annual evaporation ranges between 1,000 and 1,200 mm, and that relative humidity is 70 to 75 per cent dependent on rainfall, evaporation, fog cover and distance from the sea. It varies hourly and daily. Prachinburi has a mean maximum temperature of 32° C, an annual mean of 27.8° C, and a mean minimum of 23.6° C. This places the Bang Pakong Valley in Koppen's Am wet equatorial climatic zone (Strahler 1973:175-8). It has important implications for craft potting industries of the kind under review.

Climates involving substantial rainy seasons, and consequent high humidity, seriously affect craft potteries (Arnold 1985:71-9). Excess atmospheric moisture, and/or long periods of heavy rainfall, prevent plastic pottery fabrics from drying sufficiently to ensure that they will hold their shape. Unfired pottery may crack, firing becomes hazardous and moving unfired pottery risks damage. In such conditions, firing is not warranted and production ceases during the wet season. These regulatory effects affect the integration of potting technology with subsistence.

GEOLOGY

Geological evidence has been collated principally from maps published by the Geological Division of the Department of Mineral Resources of Thailand. Where geological data are likely to have been affected by geomorphological changes during the periods under scrutiny, Boyd's stratigraphic units and related palaeographical model will be referenced. The "Palaeographical Phases" and related "Geo-archaeological Periods" which make up Boyd's model are specific to prehistoric occupation of the region during a period which includes Khok Phanom Di. These data are, therefore, clearly germane to the present study. In addition, Pisnupong (1993:45-104), has identified probable geological source areas for industrial stone raw materials. The geological map references are: ND 47-8: Changwat Phra Nakhon Si Ayutthaya; ND 47-12: Bangkok Metropolis;

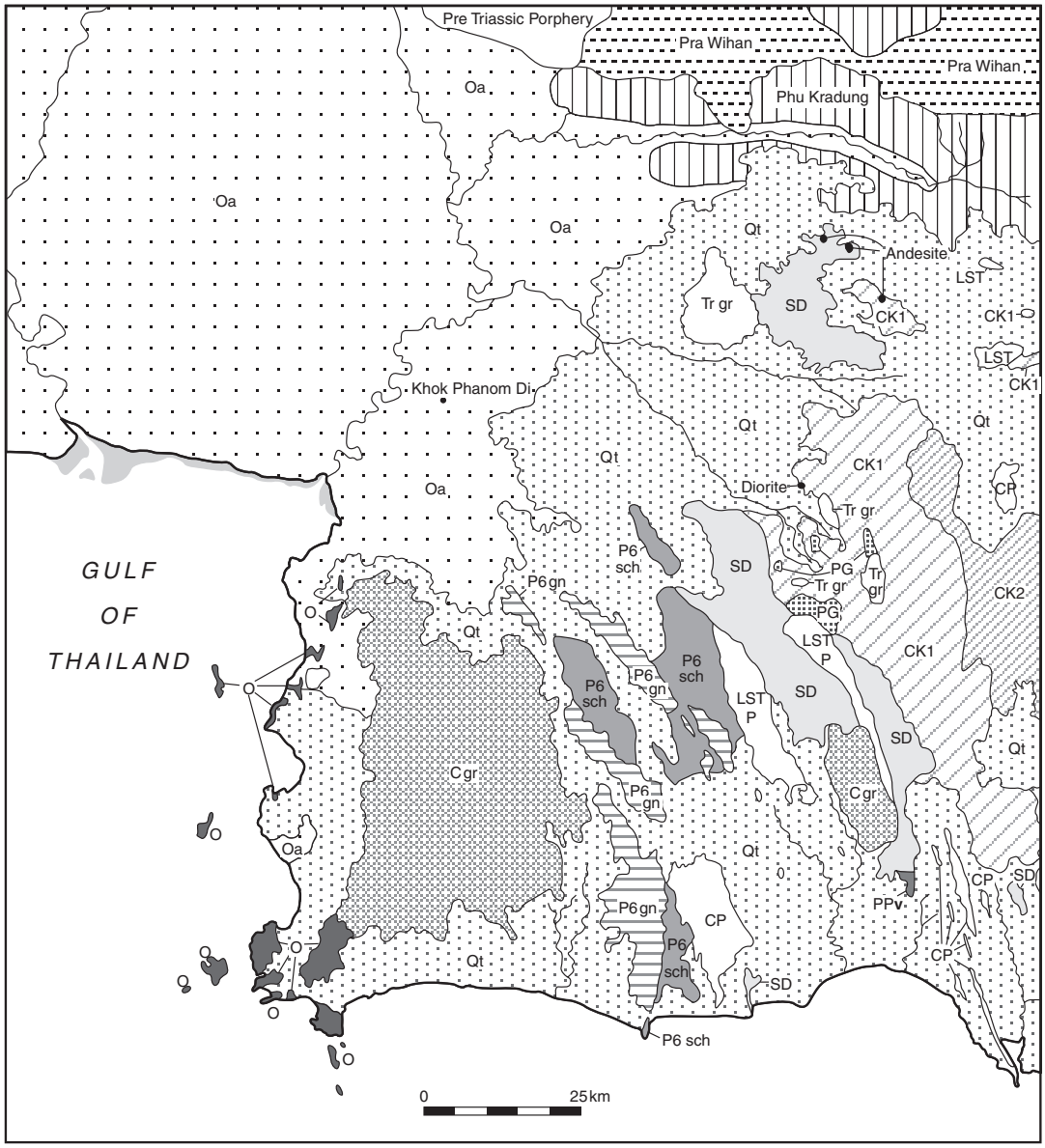
ND 47-16: Changwat Rayong, all drawn to a 1:250,000 scale. Boyd (1994:26 *cf* Nutalaya and Rau 1981:4) has summarised the geological setting of the Bangkok Plain:

> "The plain itself is a large embayment *c.* 150 km across, east to west, and extending at least 250 km northwards from its present southern edge on the coast of the Gulf of Siam. This embayment represents the long-term (Pliocene-Pleistocene) sedimentary infilling of a horst and graben block fault structural depression, within which alluvial sands and gravels, interbedded with floodplain silts and clays grading seaward into deltaic clastics and marine clays have been accumulating to thicknesses of, in places, at least 1,800 m."

Khok Phanom Di lies within the Bang Pakong Valley floodplain in the eastern section of the Central Plain, which is composed of Quaternary alluvia. Two major tributaries drain into the Bang Pakong which forks about 40 km north of Khok Phanom Di (Fig. 8). The Prachinburi, whose sources lies deep within the Chanthaburi Range about 170 km to the northeast, and the Nakhon Nagan, whose source streams lie further northwest on the margins of the Samkhan Phaeng Range are fed by streams which emerge from the Samkham Phaeng escarpment about 90 to 100 km to the north. These ranges are formed by the Khorat Group. They average about 500 m above sea level (Cruijs 1964:7), and mark the southern boundary of the Khorat Plateau. To the east, the Chanthaburi Mountains rise to over 500 m. The Banthat Range extends further to the southeast. A series of streams drains much of the Chanthaburi region into the Bang Pakong catchment. The mineral spectrum represented in the regional geology is relevant in the consideration of ceramic fabrics. The following summary traverses a broad sweep commencing in the north, then to the east and ends in the southern region.

Palaeozoic and Palaeo-Mesozoic igneous, sedimentary and some metamorphic, and Mesozoic sedimentary Formations comprise the Samkham Phaeng uplifted escarpment. To the south these are bounded by Jurassic rocks of the Khorat Group, and Palaeo-Mesozoic, Permo-Triassic volcanics of the Khao Yai Group: namely the Phu Kradung Formation (which comprises calcareous, micaceous siltstone, sandstone and conglomerate), and the Phra Wihan Formation which is composed of quartz, quartzite sandstones, siltstone and claystone of the Khorat Group as well as andesite and rhyolite porphyries, tuff and breccia of the Khao Yai Group. The Phra Wihan Formation rises to over 1,000 m. A small localised outcrop of the latter, and the Mid-Permian, Khao Khad Formation, of the Ratburi Group, comprising limestone, chert-bedded dolomite, intercalated shale, sandstone and rare volcanics lie near the Prachinburi tributary about 85 km to the northeast of Khok Phanom Di. Small exposures of Khao Yai diorite and hornblende diorite also occur about 120 km to the northwest in the Chao Phraya catchment.

Three separate Silurian/Devonian outcrops of quartz-mica schist, quartzite and medium-grained sandstone interbedded with tuffaceous sandstone and chert bed with fossil of nautiloid, of the Kanchanaburi Formation, lie about 62 km northeast, 55 km east and 41 km southeast of the site. The latter probably extended to the coast, and was thus accessible by water, during the prehistoric occupation of Khok Phanom Di (Boyd 1994:92). Post-Permian fine-grained dark greenish-grey to purple andesite occurs 65 km to the northeast, and was also probably located about 180 km along the south coast during the prehistoric occupation, but now lies about 12 km



SEDIMENTARY AND METAMORPHIC ROCKS

Jurassic	Quaternary	Permian	Permo-Carboniferous	Carboniferous	Silurian-Devonian
Phu Kradung Formation Pra Wihan Formation	Oa Alluvium Qt terrace deposits	P Limestone	CP Sandstone	CK1 Shale, SST CK2 Siltstone, LST, tuff, chert	SD schist, SST, chert

Ordovician	Precambrian	
O Quartzite, schist shale, slate, SST, LST	P6sch	Quartz, mica, schist, sch + qtz, kyanite schist
	P6gn	Gniss, amphibole + calc silicate

IGNEOUS ROCKS

Triassic	Permo-Triassic	Post-Permian	Post-Carboniferous	Carboniferous
Trgr Granite, hornblende-biolite	PTrdi Diorite	PPv Andesite	PG Rhyolite tuff	Cgr Granite

FIG. 8: Geology of the Bang Pakong Valley region

inland. Triassic batholiths of medium to coarse-grained porphyritic hornblende-biotite granite, mesocratic hornblende granite and porphyritic mesocratic biotite granite lie 39 km northeast and 59 km east.

Pre-Cambrian quartz mica schist and quartz kyanite schist outcrops lie 23 km east, 31 km southeast and about 150 km along the previous south coastline. Exposures of Carboniferous reddish-brown micaceous siltstone, medium-grained sandstone with brachiopod and bryozoa, shale interbedded with chert, quartzite, dark grey limestone and andesitic tuff of the Kaeng Krachan Formation occur 56 km to the east. Shale, graywacke and tuffaceous sandstone belonging to this Formation outcrop 76 km east of the site. Permo-Carboniferous deposits of fine to medium-grained sandstone, conglomerate, pebbly sandstone and light grey tuffaceous shale with chert interbedded, of the Ratburi Group, occur 87 km to the east, and 150 km on a higher sea level coast. Permian/Permo-Carboniferous deposits of the Ratburi Group comprising grey to dark grey, bedded and massive limestone with bryozoa fossils, crenoid, fusulinid, some part of re-crystallized limestone with marble interbedded with shale and some fine-grained sandstone lie 84 km east and 55 km southeast.

Carboniferous igneous intrusives of coarse-medium-grained, leucocratic, locally porphyrite biotite muscovite granite; pegmatite vein and quartz dyke occur 79 km southeast of the site. Exposures of this granite also occur 30 km south and 25 km to the southsouthwest, and at a headlands 35 km to the southwest, which was probably an island during the prehistoric occupation of Khok Phanom Di. Veins or dykes are also evident about 47 km to the south, on the probable prehistoric high sea level coastline (Boyd 1994:92), and at several possible headlands and island locations during this period. Post-Carboniferous massive greenish-grey to greyish-purple rhyolite tuff is exposed 56 km to the southeast. Pre-Cambrian amphibolite and calc-silicate gneiss form a headland 37 km to the southwest. Ordovician quartzite, quartz schist, grey slatey-shale, blackslate and quartzitic sandstone interbedded with dark grey argillaceous limestone with nautilid fossil, of the Thung Song Group, lie 32 km southsouthwest.

POTTING CLAYS

Quaternary terraced sediments, and alluvia which blanket the adjacent floodplains, variously join with the margins of the geological structures. Sediments within the surrounding floodplain include clays suited to potting and brickmaking. Field work undertaken in 1985 established that, while no potteries were active, several large-scale quarries were exploited for brickmaking. Samples from quarries, within distances considered economic to transport clays in prehistory and from clays adjacent to Khok Phanom Di, have been subjected to detailed analysis. Given that large-scale pottery production was carried out at Khok Phanom Di, it is important to establish, as far as is possible, the quality and quantity of locally-available clays suited to ceramic manufacture. Any mineralogically distinctive inclusions will be noted as they may assist in distinguishing local against exotic wares.

Boyd (1994) tested 44 locations, including pits, water holes, canal banks, a modern fish pond, drainage ditches, probable fossil sand dunes, sand quarries, various holes and surface exposures, and test pits at Nong Nor and five nearby archaeological sites. A variety of natural sediments are

described, "freshwater clay" being present in over 50 per cent of the locations. Boyd recognised a sequence of six "stratigraphic units":

- *Unit 1,* bedrock of Palaeozoic metasediments and crystalline rocks variously weathered, some probably for millions of years, and "may extend back at least into the middle to early Pleistocene if not the Tertiary period." Importantly, this unit is the source of sediment for Unit 3.

- *Unit 2,* probably comprises a pre-Holocene laterised silty clay sediment. Although "sediment size and characteristics analysis is equivocal" shoreline progradation and "at least two periods of high sea level" are indicated at four locations, and these may account for the Unit 2 sediments whose undulating upper surfaces underlie remaining deposits. This chronological interpretation is not without difficulty, however, because increased aridity and associated deflation during the Quaternary are known elsewhere in eastern Thailand and the sediments may have been reworked during high sea levels, or alternatively, some dune-like sediments may be reworked coastal materials representing "glacial period modification and partial relocation of prior interglacial sediments." (Boyd 1994:77-8).

- *Unit 3,* comprises at least 1.6 m of river sand and gravel alluvium derived from crystalline and ancient bedrock outcropping from local easterly hills. These coarse-grained sediments suggest increased erosion and "higher energy river flow than at present," and imply lower sea-level than during Units 2 and 4, and at present. A late Pleistocene interstadial or early Holocene wet warm periods (*c.* 30,000 y.b.p. and from the local Holocene onset *cf* Pramojanee and Hastings 1983:35-51), deposition regime may, therefore, be indicated (Boyd 1994:78-9).

- *Unit 4,* is composed of "fine-grained clay-dominated sediments deposited under estuarine conditions," and "are clearly related to the mid-Holocene high sea level." It may represent natural conditions contemporaneous with the occupation of Nong Nor (Boyd 1994:79-80).

- *Unit 5,* "represents sediments deposited under freshwater floodplain conditions similar to those prevailing at present throughout most of the Bangkok Plain, and includes the thick blanket of blue-grey clays which cover the previous units..." Evidence for a change to freshwater from estuarine conditions is lacking, however possible causes are: (i) the sea-level lowered; (ii) sedimentation filled estuaries and coastal bays; (iii) seaward coastal barrier development. Major channels such as the Bang Pakong River, subsequently infilled and now extinct, were active (Boyd 1994:80).

- *Unit 6,* includes sandy and clay-rich levée sediments, some of which appear contemporaneous with parts of Unit 5, but continue to be deposited today. This highlights "the dynamic nature of the late Holocene drainage of the floodplain" (Boyd 1994:80-1).

Units 1, 2 and 3 make up "Palaeogeographical Phase 1: probably middle to late Pleistocene." Unit 4, and "possibly superficial soils and sediments" on Unit 1 comprise Palaeogeographical

Phase 2. It "represents the culmination of the sea level rise and shoreline progradation around 4,000 to 5,000 years ago." ... "To the west and north of Nong Nor, open shore became present lining the eastern edges of an open marine embayment." The region experienced its greatest environmental diversity during this phase. Palaeogeographical Phase 3, (Units 5 and 6), is dominated by freshwater seasonal flooding and deposition of fine-grained clay-rich sediments (Boyd 1994:81-6).

The dynamic floodplain formation processes involved in creating the Bang Pakong Valley are characterised by laterization, sediment reworking, derivation from crystalline bedrocks, clay-dominated sediments deposited under estuarine conditions, blue-grey clays deposited under freshwater conditions similar to the present regime and finally sandy and clay-rich levée sediments which continue to be deposited today. A mosaic of sediments has been deposited and re-deposited through the variety of natural processes discussed above to create the local and regional strata. Dating the local strata is critical in assessing the availability of suitable clays to the prehistoric potters of Khok Phanom Di. Clearly any clays of a suitable quality deposited prior to the initial occupation of Khok Phanom Di would have been available for potting.

Charcoals excavated from cultural strata within the site and from cored natural sediments surrounding it have been radiocarbon dated (Higham and Bannanurag 1990:19-23, Maloney 1991:61). The core dates are summarised in table 4 (Maloney 1991:61, Table 5). Calibrated ages are based on a 5570 year half life, calibrated according to Klein *et al.* (1982), expressed at the 2 sigma range.

TABLE 4: *Radiocarbon dates from cores in the vicinity of Khok Phanom Di*

Context	Source	Lab. No.	Radiocarbon age	Calibrated age
KL 2	0.87-0.91m	OxA 1354	3360±120	1910-1435 BC
KL 2	1.46-1.50m	OxA 1355	560±150	AD 1235-1595
KL 2	2.25-2.29m	OxA 1356	5560±160	4710-3960 BC
KL 2	3.50-3.54m	OxA 1357	6060±200	5330-4555 BC
KL 2	4.82-4.86m	OxA 1358	6280±130	5530-4935 BC
KL 2	4.91-4.95m	OxA 1359	6400±300	5800-4755 BC
BMR 2	0.88-0.92m	OxA 1449	3960±100	2855-2185 BC
BMR 2	3.96-4.00m	OxA 1360	6560±100	5767-5230 BC
BMR 2	6.60-6.64m	OxA 1361	6610±140	5855-5230 BC

A modified version of the radiocarbon results published in volume I of this series (Higham and Bannanurag 1990:23, Table 1), is set out in table 5. Sample weights, following standard pre-treatment procedures, undertaken by the author in 1985, have been added and are shown in the right hand column. The pre-treatments consisted of carefully removing any likely modern contaminants, such as rootlets and twigs, and washing in distilled water, until all sediment was removed, then air-drying for 48 hours at 34° C. The radiocarbon laboratory was requested to leach for possible carbonate and soluble humic compounds. Data as to likely botanical species were unavailable when the samples were submitted for analysis. When the samples were submitted in

1985, a dry weight of 12 g was recommended as a minimum where possible to reduce counting errors (B.F. Leach pers. comm.).

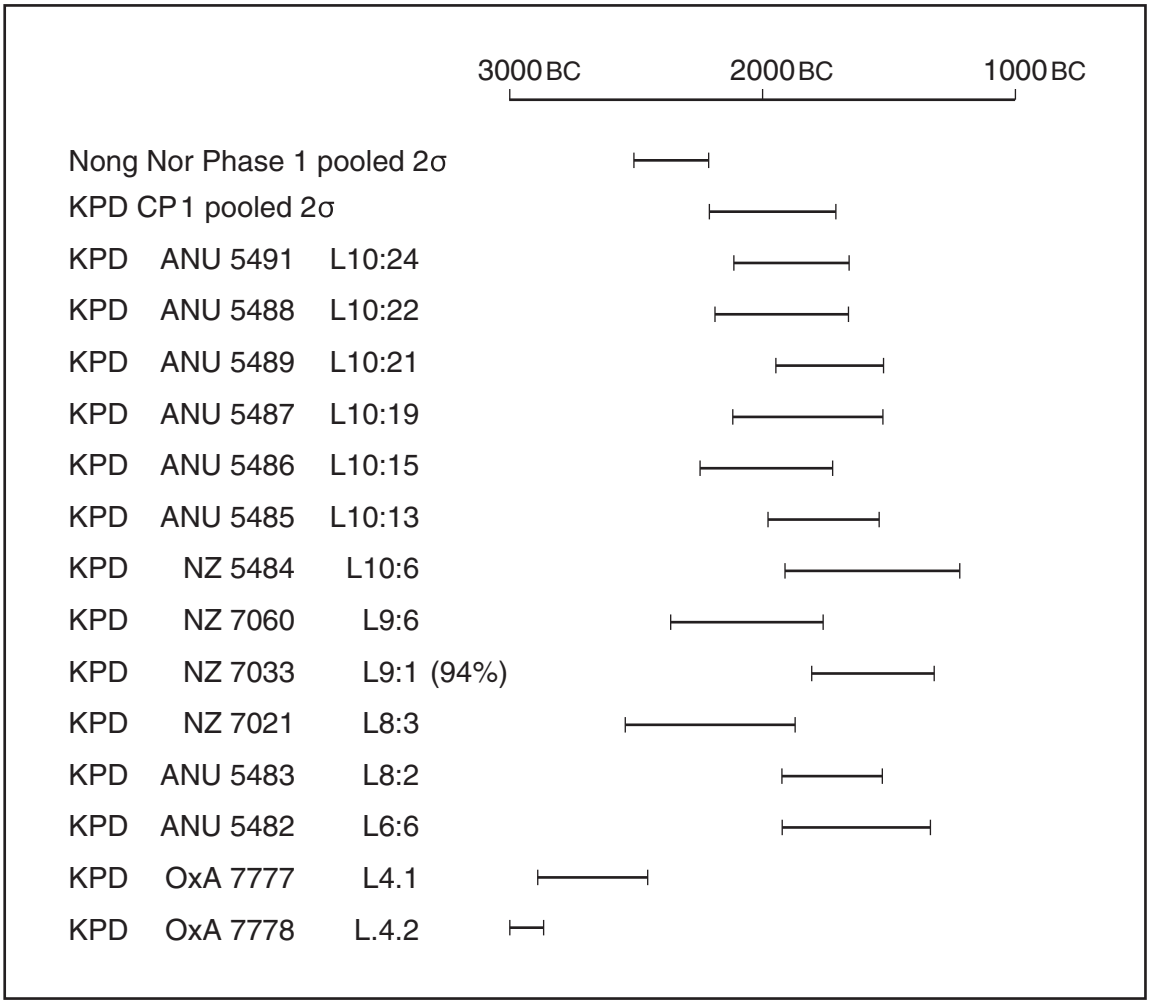


FIG. 9: Khok Phanom Di radiocarbon dates (NZ samples weighing under 10 g excluded)

It should be noted that Higham and Bannanurag (1990:19) rejected two of these dates from further consideration: "NZ-7020 is clearly too late, while NZ-7063 is much earlier than the other sixteen determinations from cultural contexts." The former sample weighed only 4.046 g after standard pre-treatment was completed, and NZ-7063 weighed 6.95 g (Table 5). The only other light sample is NZ-6973 which weighed 6.37 g. The date obtained from this sample was accepted as consistent by Higham and Bannanurag (1990:19).

Figure 9, sets out radiocarbon dates from Khok Phanom Di and pooled Nong Nor Phase 1 determinations (see Fig. 4). The latter sequence partly overlaps the earliest dates from Khok Phanom Di. These dates suggest that CP1 at Khok Phanom Di was deposited during the period

Nong Nor Phase 1 was active. Although it should be noted that pooled dates derived from five charcoal samples recovered from the natural substrate or hearths within it give the following pooled mean:

TABLE 5: *Radiocarbon dates from Khok Phanom Di*

Context	Source	Lab. No.	Radiocarbon age	Calibrated age[a]	weight
Layer 6:6	charcoal	ANU-5482	3310±128	1930-1310 BC	-
Layer 8:3	lens 4 (ash)	NZ-7020	1910±235	590 BC-AD 665[b]	4.046
				755 BC-AD 680[c]	4.046
Layer 8:2	lens 4 (ash)	ANU-5483	3430±80	1930-1525 BC	-
Layer 8:3	lens 6 ash charcoal	NZ-7021	3780±120	2565-1895 BC	10.32
Layer 8:7	lens 10 charcoal	NZ-6973	3280±140	1925-1225 BC	6.37
Layer 9:1	white ash lens	NZ-7033	3290±110	1812-1310 BC[d]	17.15
				1871-1842 BC[e]	17.15
Layer 9:6	under lens 9	NZ-7060	3680±90	2390-1780 BC	12.00
Layer 9:7	hearth	NZ-7063	4410±300	3685-2275 BC	6.95
Layer 10:6	lens 3 hearth	ANU-5484	3280±140	1925-1225 BC	-
Layer 10:13	lens 10 charcoal	ANU-5485	3410±110	1975-1545 BC	-
Layer 10:15	lens 11 (ash)	ANU-5486	3610±90	2270-1740 BC	-
Layer 10:19	hearth 7	ANU-5487	3490±110	2130-1525 BC	-
Layer 10:21	hearth 15	ANU-5489	3420±90	1950-1515 BC	-
Layer 10:22	hearth 19	ANU-5488	3580±100	2200-1680 BC	-
Layer 10:24	ash lens charcoal	ANU-5491	3530±80	2125-1680 BC	-
Layer 10:25	hearth 27	ANU-5492	3480±110	2120-1525 BC	-
Layer 10:25	charcoal	ANU-5490	3730±100	2450-1905 BC	-
Layer 11:2	hearth 1	ANU-5493	3560±80	2130-1700 BC	-

[a]based on a 5570 year half life. Dates in the range 500-2500 BC based on Pearson and Stuiver (1986) calibration. Klein *et al.* (1982) used to correct all others. All dates expressed at the 95% confidence interval except where stated.
[b](92% confidence interval)
[c](2% confidence interval)
[d](94% confidence interval)
[e](2% confidence interval)

> "The terrestrial calibration data were compiled using Pearson and Stuiver's (1993) bidecadal dataset (method A) and they show that the pooled mean (*A'p*) of the five basal dates is 3908 ± 58 (T' = 2.18), compared with X^2:0.05=9.49 (Case II Method, Ward and Wilson, 1978:19-31). The calibrated age ranges for the mean are 2465 - 2288 (1 σ) and 2561 - 2527 and 2499 - 2197 (2 σ)." (Higham and Hogg 1994:25)

Maloney (1991), details the sedimentary stratigraphy of cores and a fishpond column taken from within 200 m of the site. A variety of clays are recorded. Colours, such as "dark brown, buff and orange", are emphasized and correlated with depositional histories, such as marine (green), brackish water (dark-grey to grey), and probably subaerial (white). He notes that detailed references to clay mineralogy is generally lacking, apart from those reported by Hattori (1972) such as haematite and goethite, pisolitic or plinthitic laterite and van der Kevie (1971), who describes a zone of older acid sulphate soils without gypsum. In addition, Takaya (1972), noted fluvial deposits, near the Bang Pakong, which overlie post-glacial marine and brackish water sediments containing gypsum crystals (Maloney 1991:22-57). Correlations between the cores clearly demonstrate a highly variable sedimentary sequence over short distances around Khok Phanom Di which, according to Maloney (1991:92, 94) lay in the intertidal zone during CP1, CP2 and CP3. We have noted above that according to Aitken (1992:181), basal (i.e. natural) sediments, beneath the excavation, suggest a granitic source to the southwest, as hornblende and biotite, which characterise granites upstream to the northeast, are absent.

Fluctuating sea levels, tectonic activity (Pramojanee and Hastings 1983:48), and fluvial erosion, accelerated by monsoon flooding, have deposited sediments in two different processes: (i) directly via the Bang Pakong River and minor rivers originating in uplands to the east and south, and (ii) indirectly via tidally-influenced longshore drift, including some from the Chao Phraya River (Boyd 1994:27). These processes have created a complex sedimentation regime which has left a mosaic of clays. Many of these clays, as the results set out in the following chapter demonstrate, are well suited to pottery manufacture. Once a suitable clay has been secured by potters, however, it may need to be modified through the addition of temper to reduce the quantity of chemically unbound water prior to shaping into the desired forms. Once the pottery is formed and dried it needs to be fired to create a ceramic body. This requires fuel. A wide variety of fuels have been successfully used to fire pottery. The availability of these materials during the prehistoric occupation of Khok Phanom Di is also considered below. We will consider temper first.

TEMPER

Tempers (non-plastic materials), apart from clay, fuel and water, are such critical components of the kinds of ceramic materials under examination here that we need to consider them in some detail. All raw clays normally contain some non-plastics (Shepard 1956:18). Sometimes enough is present so none need to be added (Shepard 1956:24). Most raw clays are too plastic, however, and some non-plastics must be mixed into the fabric to reduce shrinkage, improve workability and assist drying (Shepard 1956:25), and firing (Hamer 1975:150). Temper is any material deliberately added to plastic clays, before firing, which improves their ceramic qualities. Temper is often the most important item of primary physical evidence in prehistoric pottery. It may be natural or artificial. Natural tempers include geologically derived materials such as rock fragments, sand, ash, silt, and biogenetic products, as well as modern biological materials, either faunal or floral. Raw clay deposits, however, may contain wood, shell, plant material, diatoms, phytoliths, sponge spicules, foraminifera, and other palaeontological, or modern, faunal and floral

remains. Such clastic and organic nonplastics are not tempers, but natural inclusions. If present as major and distinctive components in the parent ceramic fabric, they can help identify clay sources. Often just clay-sized, their chemical and thermal responses differ from clay minerals.

When characterising and distinguishing between natural or purposely added inclusions, care is needed as these different species may provide important cultural insights. This applies equally to rock fragments (Whitebread 1986:79-88), or volatile plant remains, such as rice husks (Yen 1972, Vincent 1988). Rice husks and/or straw may be accidentally included during quarrying or manufacturing processes. Many modern Khorat Plateau potting clays are quarried from beneath rice fields. When ceramic and crop subsistence activities are closely interrelated, the unintentional inclusion of plant fragments into plastic clays is almost inevitable. It is important to note, therefore, that the presence of rice remains in prehistoric fabrics, whether accidental or deliberate, is *prima facie* evidence of close relationships between subsistence and technology.

Artificial tempers are manufactured materials, either originally intended for other uses, or purposely prepared as fabric additives. Crushed potsherds may be either unintentional and/or deliberate inclusions. Prefired and subsequently crushed clay ball temper, (*"chua"*), is an example of purposely manufactured temper. Such prepared tempers carry the generic term "grog". *Chua* has been previously described by the writer as "blebs" (Vincent 1984, 1988). In thin section, bleb temper can be differentiated by its shape and association with rice remains. A different kind of crushed clay grog, which lacks the characteristic bleb shape, is also present in many prehistoric fabrics. It was probably widespread within the Khorat Plateau prior to the first appearance of bleb temper (Vincent 1988). This kind of grog has also been reported in Europe (Whitebread 1986). For these reasons it is referred to as *"orthodox grog"*. Thus three different, petrographically distinguishable, subspecies of grog exist:

1. crushed potsherd grog, i.e. crushed remains of once entire ceramic artefacts, and/or pottery firing failures, ("wasters").

2. orthodox grog, i.e. crushed prefired clay which does not normally contain temper. Although exceptions to this maxim may exist, by definition they never contain rice remains.

3. bleb grog, i.e. crushed prefired clay which has been purposely tempered with rice remains prior to its initial firing.

Bleb grog has a distinctive shape because rice husk was added to the prepared clay balls and this gives rise to its name. Crushing the rice-tempered balls, after firing, disintegrates the mixture and dislodges any surviving unburnt rice. This is probably because rice acts to weaken the composition, and fracture planes coincide with its distribution. Disintegrated particles of rice remains and broken ceramic material are mixed together with additional raw potting clay to form the final plastic preparation. Rice husk impressions, therefore, are common to the grog, while the parent body characteristically often contains rice husk. In the grog particles these are rare. Selected properties of the above grogs are illustrated in figure 10. Care is needed when identifying grog subspecies in thin section, and Whitebread's cautionary tale (1986:79-88), regarding argillaceous material, applies equally to the analysis of Southeast Asian ceramics.

Ethnographic evidence and comparison, in hand specimen and thin-section, of modern bleb-tempered fabrics, allows confidence that the bleb temper characterisation set out above is correct. Prehistoric and modern bleb temper characteristics coincide, thus providing direct evidence of the production processes involved. Bleb temper is currently used by many potters in Northeast Thailand and their relationship with rice cultivation is understood (Vincent 1988). Not all potters in rice growing areas use bleb temper, however, thus its regional extent is not understood in detail and the distribution of modern tempering methods appears somewhat heterogeneous. Present day immigrant potters usually bring their methods with them which may account for the apparent heterogeneity.

Large areas of Thailand, particularly the Central Plain and Khorat Plateau regions, are composed of sedimentary materials, much of which is alluvium and colluvium (Thiramongkol 1983:6-23). Clays in these regions are often unsuitable for pottery production in their natural state (Vincent 1988). These data are further expanded in this study. Raw clays often require processing to render them suitable for pottery (Grim 1962, 1968; Hamer 1975). Normally this means that temper is added to reduce excessive shrinkage during forming, drying and firing. A wide variety of suitable natural materials can often occur locally and many have previously been identified with handcrafted pottery production elsewhere (May and Tuckson 1982, Shepard 1971). Hodges (1965:121) suggested that traditional grog use may indicate origins in an area lacking locally suitable mineral or organic tempers and implied that tradition may dictate a continued preference for grog even when other suitable tempering materials became available.

The widespread use of grog temper in Thailand may be in response to a lack of natural tempers suited to the kinds of raw potting clays available. Khorat Plateau clays feature either mixed-layer clay minerals and/or a high proportion of silt-sized nonplastic material, and this may be significant. They probably often lack a sufficient proportion of clay minerals to tolerate additions of fine sand to sand-sized temper. Granule-sized nonplastic temper would reduce the proportion of clay minerals needed for a satisfactory aggregate. They would also allow chemically unbound water to escape rapidly, and thus reduce shrinkage, although this does not appear to be generally excessive (Table 12). A local paucity of suitable natural materials may favour manufacture of artificial temper, particularly when pottery is a vital cultural component. Grog could have originated in sedimentary regions before reliable supplies of suitable alternatives, for example rice by-products, became available. This is, of course, speculative. Evidence set out in the following chapters, however, could be interpreted as supporting such a sequence.

Grog in ceramic fabrics has undergone a primary firing as prepared clay balls, followed by a second firing in the parent body. Pottery containing grog composed of the same raw clay as the parent body includes twice fired clay. Depending on the respective temperature, grogs are either “hard” or “soft” (Hamer 1975:150). Those previously fired to temperatures lower than the parent body firing are soft. Hard grogs are first fired to temperatures above the final body firing. Grogs, as with their parent ceramic bodies, may be untempered or tempered. Untempered grogs should not be confused with “clay temper” or “clay pellets”. Clay temper is unfired plastic clay accidentally included as dry lumps or deliberately added by the potter. A wide variety of natural processes can form clay pellets which, along with clay temper, may be difficult to identify petrographically. Localised variations in moisture content are a major problem in hand-formed fabrics. A heterogeneous fabric, with lumps of relatively dry material isolated within the moister

containing material, can develop during preparation. When fired, these may be indistinguishable from natural inclusions. Whitebread (1986:83-4), discusses some aspects of clay temper and pellets in detail.

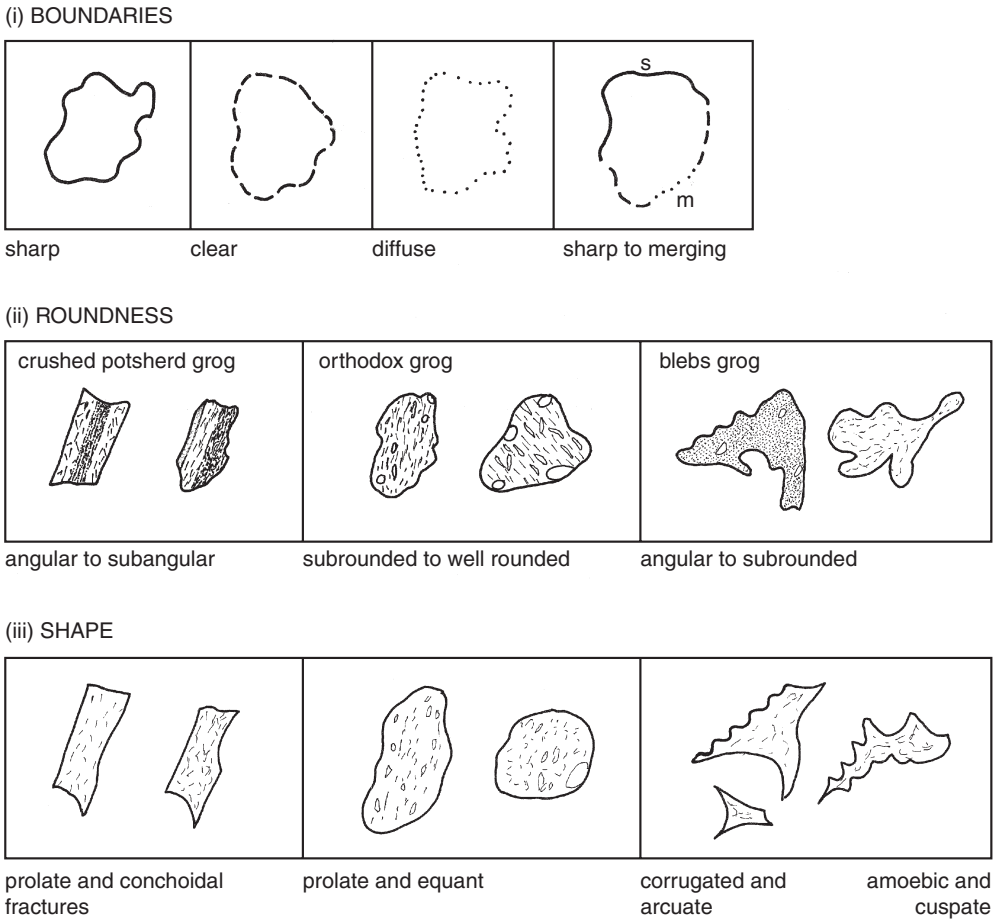


FIG. 10: Selected properties of grogs in thin-section

The manufacture of artificial grog implies a knowledge of clay mineral properties. Initial firing transforms an unsatisfactory raw clay into a useful temper, less susceptible to shrinkage, even when refired within a parent matrix of the same clay. The method is a kind of "self-tempering" requiring the extraction of only one resource from the environment. Given that most raw clays require tempering, potters with such skills are less reliant on local resources than others who do not utilize the grog manufacturing technique. Such independence is likely further to reinforce their inherent technological conservatism. Potters familiar with artificial grog, therefore, may be less likely to change their temper concept than others. Khorat Plateau evidence supports this conservatism, because in spite of an availability of alternative materials, grog traditions endured. Some contemporary production sites, for example, used grog but others preferred rice temper

for clays of similar ceramic quality (Vincent 1988; in prep.).

Artificial and natural inclusions can be indistinguishable in thin-section (Whitebread 1986). The comparison of fabrics, whose composition and manufacturing history are known, with pottery of uncertain fabrication, is particularly valuable for characterising artificial grog tempers in thin-section. Their manufacturing history can thus be established. Grogs may contain any of the natural and/or artificial inclusions listed above in combinations which make identification difficult. We need not rely on one form of petrographic evidence, however, or infer that because some argillaceous inclusions are difficult to characterise, the identification of grog tempers is hazardous. It is not. Shepard (1971:97-100), noted that observing and handling large quantities of pottery develops a "pottery sense", by this she meant a "process of organization of impressions" (1971:97-100). This referred mainly to hand specimen studies, but they equally apply to petrographic microscopy. "It is not simply a matter of familiarization through repetition. It is seeing continuous variations and their limits, and recognizing associations and discontinuities" (Shepard 1971:98). As with potsherds, so with argillaceous inclusions in thin section. The optical comparison of known with unknown fabrics allows positive identifications. It also allows confidence in defining the limits of optical variations displayed by argillaceous inclusions.

Figure 10 sets out a schematic summary of some of the properties argillaceous inclusions display in thin-section. These are often present in the kinds of pottery produced by craft potters during the period under consideration. During CP2 and CP3 the local wares were composed of grog-tempered fabrics. These two CPs can be characterized in part by differences in the parent clay matrix although the method of tempering each clay remained the same.

Utilization of rice husks for temper, including bleb temper, indicates a close relationship between subsistence and technology. Consistent use of rice husk, in quantity, is pivotal because any temper selected must be technologically dependable and readily available. A key factor is access to a consistently reliable supply. It also suggests that this valuable source of food was exploited on a permanent basis. As noted above, Thompson (1996:170) considers the rice remains at Khok Phanom Di were from domesticated plants, but it is highly unlikely to have been grown locally. One possibility is that rice was imported as an exchange item. This point is very important and we will return to it later. In either event, an intimate knowledge of the plant is obvious.

FUEL

Reliable supplies of suitable fuel are a critical component of pottery production. Firing alters clay mineral chemical bonds (Grim 1962, 1968), and modifies the overall structure of potting clays. Thus, dependent on the firing temperature, the amount of unbound and bound water able to be adsorbed is greatly reduced or eliminated. Unusually high temperatures of over 1000° C. have been recorded for open firings (Lauer 1972, 1974a, Irwin 1977). This would produce initial vitrification in many clays (Maniatis and Tite 1975). Mineral phase changes have been noted in some CP1 ceramic stands (Vincent 1987, in Higham *et al.* 1987). The presence of mullite in these stands signals that the firing temperatures reached above 1050° C. As the stands would have been designed and intended for repeated use, such relatively high temperatures were

probably only achieved in rare instances when the firing conditions were optimal. A strong steady wind throughout the firing sequence, coupled with a high caloric fuel type, would produce such temperatures. Firing test results, to establish shrinkage rates, carried out on the Bang Pakong and Khok Phanom Di clays are set out in Chapter V.

Almost any combustible material is known to have been exploited by craft potters for firings. Forbes (1958:13-28), for example, reports the use of bird, fish and animal bones. Table 6 summarizes some fuels used by craft potters. These can be compared with those identified by Thompson (1996) in the Khok Phanom Di deposits (Table 7). Although animal dung is unlikely, large wood, bark, twigs, selected leaves and fronds, charcoal, wild grasses, refuse and shell could be exploited. Arnold (1985:31-6, 51-4, 219), discusses economic distances to such resources, threshold models and technical innovations used to minimize fuel consumption and/or overcome adverse firing effects due to climatic conditions. May and Tuckson (1982: *passim*) detail fuel types from potting villages in and around Papua New Guinea (Table 6).

Firing times vary from 20 minutes to over one hour. Fuel is selected for its pyrotechnic properties and must be neither too cold nor too hot. Aibom village potters in the Sepik use a firing platform typical of many potteries in the area. On top of four large rocks they build a platform of dried coconut palm ribs. A grid of interlacing split bamboo, followed by dry twigs or slats of "limbum", (Pidgin for several species of palm, most commonly black palm), are then laid over this frame. Finally, dried grasses are placed on top of the entire arrangement. Firing takes from 30 minutes to one hour, with extra fuel being added as needed.

By weight, fuel and clay are the major components of pottery and often require considerable effort in acquiring them. Not all clays are appropriate for potting, however, and similarly not all fuels are suitable. Some fuels produce excessive temperatures, others insufficient. One kind of fuel may suit one particular firing but not another. Inclusions in the clay affect expansion rates and these must suit the firing sequence and the ware being manufactured. Cooking pots, for example, need to accommodate repeated thermal shocks when used for cooking (Rye 1976:117). According to Rye and Evans (1976:165), the fuel to pottery ratio is less than that of clay, with fuel comprising about 25 to 50 per cent the weight of finished pottery.

Sheehy (1988:199-226), however, notes that Rye and Evans's ratios are not based on individual measurements of clay and fuel, but relied on "educated guesses" of the local potters "based on past experience", and the weights:

> "were given in *Maunds*, a Pakistani unit of weight that varies from region to region. Rye and Evans were clearly aware of the problem and state that there was an error factor present in their calculations of at least $\pm 10\%$."

Whether the Rye and Evans data reflect dry or wet weights is unclear. Further, they did not record firing schedules and were therefore unable "to determine to what extent the clay/fuel ratio varied with temperature." Different fuels have different heat values, therefore low heating fuels could need more fuel than those with higher values. Finally, kiln sizes were not recorded. Their size, volume and wall thickness could also affect the results (Sheehy 1988:206-7).

Accordingly Sheehy carried out evaluations which included weighing vessels as they were sun dried, before being loaded into the kiln, and re-weighing them after firing. Temperatures

were carefully monitored during firings in individual kilns allowing variations for different fuels, temperatures and kiln sizes. Negative correlations were noted as the required temperature rose. "So, as temperature increases ... the clay/fuel ratio decreases, along with the economic efficiency of the kiln: You need more fuel to fire a given quantity of clay." (Sheehy 1988:214).

TABLE 6: *Ethnographically recorded open firing fuels*

Site	Fuel type	Quoted source
India	cow dung, sawdust	Gupta 1969:18
Peru	llama dung, grass	Winterhalder *et al.* 1974
Yucatan	wood (specific woods and parts of tree used for different firing stages)	Arnold 1985:30-31
Pakistan	cow dung, specific woods	Rye and Evans 1976:166
Wanigela New Guinea	coconut husks, fronds, wood scraps	Key 1968:654
	palm fronds	Lauer 1973:37
	brush	Egloff 1973:67
	dry tropical grass, coconut butts & husk	Palmer & Shaw 1968:17
	twigs or brush	Voyatzoglou 1974:23
Greece	olive tree prunings	Matson 1972:213
Spain	olive prunings & old trees	Curtis 1962:496
Quinua Peru	straw from harvest	Arnold 1985:36
Ticul Mexico	swidden cleared firewoods	Arnold 1985:36
Guatemala	charcoal by-products (pine cones, needles and bark)	Arnold 1985:36
Temascalcingo Mexico	sawdust	Arnold 1985:53
Acatlan Mexico	cactus	Arnold 1985:53
Goodenough Island	sago, coconut fronds, split logs	Lauer 1974a:54
Goodenough Island	dry branches, split logs	Lauer 1974a:61
Amphlett Island	coconut fronds, dry wood	Lauer 1974a:151
Pucara Peru	llama and cow dung	Litto 1976:36
Simbila Peru	straw, animal dung, rags, refuse	Litto 1976:14
Chitapampa Peru	cow dung or hay	Litto 1976:22
Mono, Western Yokuts	wood and oak bark	Gayton 1929:244
India	cow dung, husks, straw, refuse, dry leaves & brushwood	Arnold 1985:219

We are concerned here with determining the size and extent of the Khok Phanom Di pottery industry and its role as a production centre. To estimate fuel consumption several factors need assessing. For example, the amount of clay fired, the frequency and type of firings, the type of fuel, the size of the workshop(s), breakage rates, the quantity of wares leaving the site, and probably other less obvious factors need quantifying. Clearly this is not possible. Ethnographic evidence, through the observation of present day manufactories can, however, help in estimating

likely values. Even with this evidence such estimates can never be more than approximations. Sheehy (1988:219), using modern Mexican data, estimates that about 95 per cent of fired vessels leave the potting site and "would not be recovered within an archaeological assemblage." Even the wasters are depleted with time through non-ceramic related activities such as for ammunition in bird hunting.

Unwanted by-products of subsistence activities are sometimes readily available for fuel. Matson (1972:220), for example notes that olive grove and vineyard prunings are used as fuels. In Thailand, Solheim (1964), described pottery making at Ban Nong, about 55 km northwest of Khon Kaen. Men and women carefully select clay and prepare temper by mixing it with rice husks into balls about 15 cm in diameter and, when dried, firing them. The balls are then pounded by women in a wooden mortar before being sieved through a 3 or 4 mm basket weave mesh. Clay is mixed with the temper and vessels constructed from solid cylinders of the prepared clay mix. Each potter produces between 12 and 14 vessels per day and when 200-300 are ready men fire them on a raft of wood with grass fuel heaped over them and replenished as required over a period of three to five hours. Similar firings on grass-fuelled timber rafts were recorded by Solheim (1967) at Ban Phan Luang near Luang Prabang. At Ban Na Kraseng, Loei Province, vessels were fired for two to three hours, or until they were glowing hot, on a log platform fuelled by straw and bamboo (Bayard 1977).

Raft firings are common to many Northeast Thai manufactories, but firing durations vary from two to five hours, and possibly longer, with generally oxidizing atmospheres. At Ban Kham O, for example, pots were fired on a bamboo raft packed with rice straw. Pots are placed upside down without straw between them, and then covered with straw for firing. The fired pots generally have oxidized exteriors and slightly reduced interiors. Fire clouds, which occur when unburnt fuel lying against the pot surface creates pockets of reducing atmosphere in an otherwise oxidizing firing, cover up to 10 per cent of the exterior surfaces of most vessels (Vincent 1988:134). The Khok Phanom Di ceramic assemblage can be subdivided into two distinct firing-related surface finishes, on the basis of firing atmospheres. Ornamental wares have mainly black surface finishes, reflecting a reducing firing atmosphere, whereas utilitarian wares nearly always display oxidized surfaces. To create a reducing atmosphere, the potter must prevent fresh oxidized air from entering the firing atmosphere throughout the firing sequence. Firing with grass fuel, alone, could present difficulties in controlling oxidization. With the above in mind we need now to consider the kinds of fuel potentially available to the prehistoric potters carrying out their craft at Khok Phanom Di.

Thompson has set out species of various botanical remains recovered from the 1985 excavations. In terms of the charcoal remains, mangrove species, principally *Rhizophora, Bruguiera and Ceriops* dominate the spectrum during CP1, CP2 and much of CP3. During CP4, however, Non-Rhizophoracae species dominate (Thompson 1996:60, Fig. 9). During CP1 (L11), dense deposits of charcoal accumulated. This, along with microscopic charcoal from the natural base (Maloney and Brown 1990), is presumed by Thompson (1996:66), to represent debris from the initial clearance of the site. Another possibility is that the charcoal could have been washed into the site from an earlier clearance in the vicinity. Layer 11 charcoal "is made up entirely of Rhizophoracae-type woods, indicating that the site had been vegetated with *Rhizophora, Bruguiera* or *Ceriops* trees prior to occupation." High Rhizophoracae-type charcoal proportions continue throughout L11 to

TABLE 6: *Ethnographically recorded open firing fuels (cont.)*

Region/Site	May & Tuckson (1982): reported fuel types	Ref.
Yule Island	coconut husks, fronds & hardwood	1982:71
Amphlett Island	coconut husks, fronds & splitwood	1982:84
Goodenough Island	sago fronds	1982:93
Normanby Island	charcoal & wood	1982:94
Tubetube Island	coconut palm, husks, fronds, shell & leaf bases	1982:97
Brooker Island	wood	1982:108
East Cape	coconut husks, fronds, palm spathe, wood & chips	1982:115
Binandereau (N. Prov.)	wood & sago leaf stalks	1982:118
Wanigela	palm fronds & wood	1982:131
Kalapit Azera	coconut fronds & split hardwood	1982:138
Waria Valley	soft & hardwood, tuperua tree bark	1982:149
Sipoma, Uliawa Is.	sticks or split wood	1982:150
Gitua/Sio	slow burning logs, sticks, coconut fronds & bamboo (no furious flames allowed)	1982:155
Pomasi	split hardwood	1982:161
Mindiri	coconut fronds, wood, leaves, dry coconut ribs & grass	1982:173
Pila Group	no particular wood	1982:179
Malu hamlet	logs or split wood & dry leaves	1982:183
Sumau/Usino/Urigira	hardwood & dry pandanus leaves	1982:191
Rawa	wood & bark	1982:194
Tangu	coconut fronds	1982:196
Bosmai	coconut fronds & wood	1982:201
Rao	any wood (not sago palm leaves or coconut palms)	1982:204
Kwoma (Sepik)	dry sago fronds	1982:222
Koiwat	coconut palm leaves, 'pangal" sections (Pidgin for various parts of the sago palm leaf *Metroxylon ssp.*)	1982:131
Aibom	sago, coconut fronds & shells	1982:239
Yaul	dry grasses & 'pangal' strips	1982:247
Yar	various soft & hardwoods	1982:249
Toanumbu (Boiken)	any wood	1982:261
Soanlogum	several varieties of wood	1982:265
Ali (Lumi)	'pangal' & hardwood	1982:299
Kalep	sago/coconut fronds, leaves, driftwood, split logs, sticks	1982:307
Tumleo Island	coconut leaves, fronds, bamboo, driftwood	1982:314
Vanimo	dry coconut fronds & leaf bases	1982:323
Hus Island	coconut fronds	1982:332
Rumba (Bougainville)	*Macaranga tanavius* logs & splitwood	1982:346

L8 (CP1, CP2 and lower CP3), and then decline rapidly to be replaced by Non-Rhizophoracae woods. Bamboo charcoals were not detected (Thompson 1996:68).

A change in relative frequencies of charcoal types near the L8/7 boundary suggests "continued burning of the preferred Rhizophoraceae woods in progressively smaller volumes" after being replaced first by backswamp mangroves and then, "conjecturally, by open plains." These changes could reflect habitat change, new activities, or changes in preferences for the plants involved, but habitat change seems to be the most likely (Thompson 1996:69-71).

> "All strands of ecological data point to a change from a forested situation to open swamp-grasslands which could well have brought about a change in the consumption of increasingly scarce timber and fuelwood resources by the occupants of the site. The combination of increasingly limited firewood supplies and different activities in this part of the site could therefore explain the paucity of charcoal in the upper part of the stratigraphy." (Thompson 1996:71).

TABLE 7: *Botanical species potentially suitable as pottery firing fuels*

Botanical species:	Known traditional uses of plants (Thompson 1996:29-34)
Aegiceras sp.	firewood
Bruguiera spp.	a particularly good firewood
Ceriops spp.	firewood: too hot for domestic uses - cracks cooking pots
Excoecaria agallocha	firewood
Guettarda speciosa	fire-making (Thai vernacular: *kong kaang huuchang.* Not positively identified in botanical spectrum)
Nypa fruticans	petioles burnt as fuel (Thai vernacular: *chaak.* Not positively identified in botanical spectrum.)
Pemphis acidula	hardwood fuel (Thai vernacular: *chaak.* Not positively identified in botanical spectrum.)
Rhizophora spp.	excellent firewood, preferred for charcoal manufacture
Scyphiphora hydrophyllacea	good firewood (Thai vernacular: *chee ngam.* Not positively identified in botanical spectrum.)
Sonneratia spp.	fuel but inferior to other species

Charred seed remains "are dominated, in terms of ubiquity, by members of the Cyperaceae" (sedges and grasses), "and, in terms of absolute frequency, by *Suaeda maritima*..." the latter indicates "brackish to freshwater swamps and flat, open, saline plains behind the mangrove." (Thompson 1996:103). This plant is common to "swampy salty clayey soils in open areas behind mangrove." (Thompson 1996:91). Seed frequencies were generally higher early in the sequence with unusually high concentrations in L10:19-20 possibly linked to the dominance of *Suaeda maritima*, which either indicates relative abundance in the area or possibly "that it was being

used by the community." (Thompson 1996:98). Rice as an exchange item from inland, away from saline coastal conditions which were ecologically unfavourable, "should not be forgotten." While consistent amounts of domesticated rice remains were present throughout the sequence, coasts or mangroves are unlikely places to domesticate the plant (Thompson 1996:212-15). Rice husk was widespread through CP1 to CP3, and this suggests bulk processing and storage within the site, and was probably "reliant on good boat transport" (Thompson 1996:221). As mentioned above, rice by-products are favoured by many potters for fuel. Several other fuels were reported to be present in the mangal botanical spectrum by Thompson (Table 7).

In Chapter V we will commence a detailed examination of the initial ceramic industry at Khok Phanom Di, including a consideration of firing methods and temperatures. The data set out above will bear on these findings. Chapter V also sets out the results and technical interpretations of clay properties, X-ray diffraction and petrographic analyses undertaken on the Bang Pakong and Khok Phanom Di potting clays.

V THE KHOK PHANOM DI POTTING CLAYS

POTTING clays, water and firing fuels are the essential ingredients needed to create ceramic materials. Clays are fine-grained earthy materials which become plastic when mixed with water (Shepard 1956). Their composition is complex. Most raw potting clays, as quarried from natural deposits, contain a variety of inclusions (Shepard 1956:18). *Clay minerals* are common to all clay deposits. When heated sufficiently, clay minerals fuse together and bond to form a ceramic body. Three important classes of clay minerals are recognised: (i) the kaolinite group, (ii) the montmorillonite group, and (iii) the illites (Shepard 1956). Potting clay qualities are dependent on three major components: the type(s) of clay minerals present, the kinds of non-plastic and combustible inclusions, and their relative proportions. Non-plastic material (or temper) is less important than clay minerals because all raw clays usually include some naturally occurring non-plastics (Shepard 1956:18). Some raw clays may include sufficient non-plastics and can be used by the potter unmodified (Shepard 1956:24). Natural deposits of pure clays, such as kaolinite, which may not require modification, are extremely rare and can be omitted from further consideration.

Clays with a high proportion of kaolinite $Al_2O_3.2SiO_2.2H_2O$ are generally preferred by potters. This is a reflection of its "workability" and strength after firing when chemical changes associated with the dehydration of the aluminium silicate act to form a metakaolinite (ceramic fabric). Rigby (1948:96) describes kaolinite the "primary constituent of china clay and fireclays". Modern potters consider kaolinite a "pure clay" (Hamer and Hamer 1977:3-4). Disordered kaolinite, which is less pure, also qualifies as a clay. According to Hamer and Hamer, any other mineral, montmorillonite and mica for example, does not qualify. Such concepts, common among potters, are not accepted by mineralogists. Grim (1968:15), for example, notes "that there are many clay minerals in which there is no kaolinite present". While precise detailed classifications are as yet incomplete, the basic major clay mineral groups are well understood and generally accepted (Grim 1968:34, Folk 1980:89-94, Williams *et al.* 1982:317-24, Lewis 1984:151-7).

Kerr (1977:454), recognised four distinct clay mineral groups, (i) kaolins (kandites), (ii) montmorillonites (smectites), (iii) illite (hydromuscovite) and (iv) palygorskites. Many include halloysite with kaolinite (Mason 1966, Folk 1980, Tucker 1981, Williams *et al.* 1982, Lewis 1984). Illites, smectites, kaolinites, chlorite, gibbsite and halloysite are recognised by Williams *et al.* (1982:317-20). Deer *et al.* (1966:253-4), provide an alternative classification. Montmorillonite is now usually recognised as a member of the smectite group. The critical factors, for ceramic purposes, are crystallinity, perfection and the manner in which layers are stacked, and the number and type of chemically bound layers in any clay mineral (Fig. 11).

The number and type of chemically bound layers directly affects the amount of water a clay can adsorb (Grim 1968:234-5). This is a crucial concern in ceramic technology. XRD determinations indicate a variety of clay minerals, including kaolinite in varying proportions, are present in Ban Pakong Valley clays. Kaolinite has a dioctahedral structure of one silica

tetrahedral sheet and one alumina octahedral sheet which combine to form a common layer (Grim 1968:234-5), to form sheets stacked vertically along the C crystallographic axis (Deer *et al.* 1966:256, Fig.87). Because it is normally well crystalline, kaolinite is subjected to little substitution and relatively few hydroxyls compared to other clay minerals. Its layers are bound by hydrogen- or hydroxyl-type bonds (Deer *et al.* 1966:256, Fig. 88). The OH lattice water is lost from temperatures above 300° C and most dehydration happens from about 400° to 525° C. At *c.* 750 to 800° C dehydration is essentially complete (Grim 1968:298). Adsorbed water (i.e. in pores, on surfaces and edges of mineral particles), is lost at little above normal room temperatures. Clay minerals, except well crystalline kaolinite, usually lose adsorbed water well below 300° C and pore water between 120° to 150° C. Air drying removes the balance of adsorbed water.

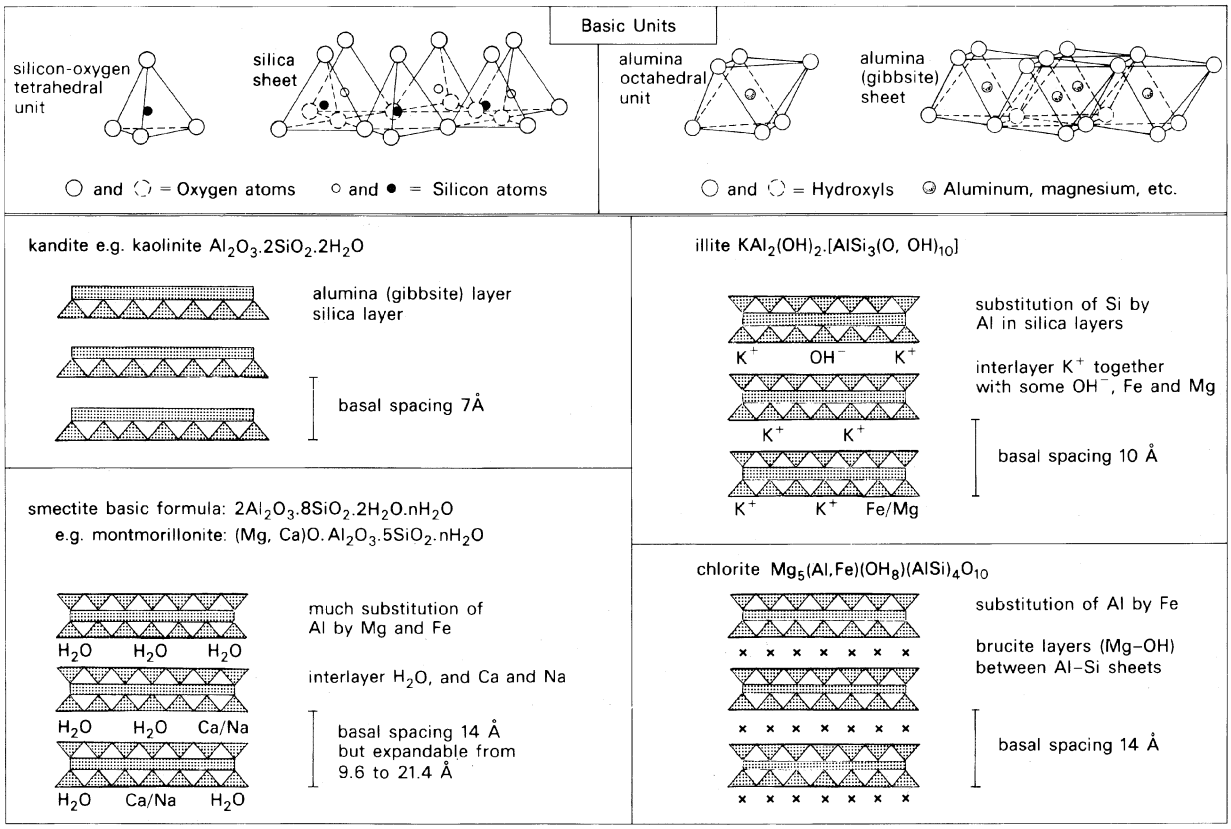


FIG. 11: A schematic summary of the principal clay mineral structures (after Tucker 1981:82)

Kaolinite probably grades from well crystalline to disordered kaolinite, where mineral substitutions, usually titanium or iron for aluminium, can occur (Grim 1968:66). Modern potters consider that such clay minerals form the fine plastic portion of "secondary" clays, for example ball, stoneware and low-grade fire clays (Hamer 1975:100). Smectites, illites and vermiculites are structurally related to micas, which, apart from some silica replacement, have the same basic structure as montmorillonite (Grim 1968:93-8). Micas generally contain little interlayer water.

Illites lose adsorbed water rapidly below 100° C, gradually between 100° and 350° C, a large relatively abrupt loss occurs about 350° to 600° C, and above this water is gradually lost again (Grim 1968:334-5). The basal cell spacings of smectites range between about 10 to 21Å, resulting in varied water adsorption rates (Deer *et al.* 1966:265). They are, therefore, often referred to as swelling clays, of limited use to craft potters.

Sericite is either characterised as a true clay mineral or a degraded mica. Considered "probably just fine-grained slightly impure or K-deficient muscovite", by Folk (1980:90), and set aside by Grim (1968:42) who defines "clay-mineral micas of both dioctrahedral and trioctahedral types and of muscovite and biotite crystallizations" as illites. Others consider sericite a weathered mica or a hydrothermal secondary mineral (Heinrich 1965:28, 281, Kerr 1977:430, 433, 462), "fine-grained white mica which may be muscovite or paragonite" (Deer *et al.* 1966:202, 261), or that "illite (hydromuscovite) grades into sericite" (Lewis 1984:151). The term sericite is avoided, however, from a strictly petrographic perspective, by Williams *et al.* (1982), and such materials are described as "fine-grained muscovite" or "white mica". In this study Grim's characterization of illite is applied to chemical and X-ray data because it refers to the chemical structures of clay minerals, while fine-grained, optically identifiable muscovite, is termed sericite.

Chlorite is composed of alternate brucite-like and trioctrahedral mica-like layers and, dependent on particle size and layer orientation, shows minor water loss to about 500° C, a sharp loss between 500° to 550° C, and most chlorites completely dehydrate about 850° C (Grim 1968:100, 103-4). A mineral group described as "swelling chlorites", has a 14Å spacing which expands to about 16Å to 18Å on glycolation (Grim 1968:103-4).

Potters require clays to be "workable". Kaolinite alone, however, may not confer this quality to potting clays. Potting clays must be strong, plastic and thixotropic. This last property is the ability of clay to retain its shape while remaining viscous and easily worked (Grim 1968:236-8, Hamer 1975:295). Plasticity, the property of moistened clay to be reformed when subjected to mechanical pressure, with the new form retaining its shape when the pressure is removed, is achieved by adding just sufficient water to make clays readily workable. It is primarily due to water adsorption, the overall clay-mineral composition and the relative proportions of nonplastics and non clay particles. Plasticity is also influenced by clay mineral and colloidal nonplastic particle sizes, their uniformity, textures and shapes.

Many clay deposits are composed of mixed-layer clays. It is important to note, therefore, that clay-mineral composition "refers to the identity and relative abundance of *all* the clay-mineral components" (Grim 1968:4). This affects the overall composition of the potting clay *material*. Quality potting clays need to include either a mixture of clay minerals or, as for low fired wares such as biscuit or stonewares, a mixture of clay mineral(s) and from about 25 to 50 per cent of nonplastic materials. Many commercial clays contain about equal amounts of kaolinite and illite, often with minor quantities of chlorite. Only small amounts of montmorillonite are acceptable due to shrinkage and drying problems. Overall, such commercial clay mixtures generally display relatively low shrinkage and good plasticity and firing qualities (Grim 1962:131).

BAN PAKONG VALLEY CLAY

Bang Pakong Valley clays probably originate from complex interactions involving sea level changes, tides, variously and occasionally superimposed by estuarine or lagoon conditions, as well as river floodwater deposits (van der Kelvie 1971, Takaya 1972, Hattori 1972, Maloney 1991, Aitken 1992, Boyd 1994). According to Maloney (1991:25), soils "near Khok Phanom Di (Fig. 9) are derived from former tidal flat, acid marine and brackish-water deposits." They "are fine textured, very acidic and have a high sulphate content and prominent yellow (jarosite) mottles in a subsoil horizon. They cover about 800,000 ha of Central Thailand and are formed on non-calcareous heavy green, reduced, marine clays and dark grey to grey brackish-water clays." Maloney considers that the former were laid down during post-glacial sea level maxima and the latter as the sea levels fell away. Aitken (1992:180 *op. cit.*), however, argues that Khok Phanom Di lay in a riverine-dominated environment surrounded by fluvial deposits derived from a land-based erosional sequence.

Modern nearshore marine sediments are held clearly to reflect their source (Blatt *et al.* 1972:376). Worldwide, kaolinite abundance ranges from 8 to 20 per cent of total oceanic clays. Where tropical rivers empty into water bodies, such as estuaries, abundant maxima occur. "In brief, kaolinite is a low-latitude clay mineral." For example, Griffin (1962) notes that the Apalachicola River draining subtropical southeast United States carries 60 to 80 per cent kaolinite, but the Mississippi, because it receives most suspended sediment from the temperate northern portion of the United States, contains only 10 to 20 per cent kaolinite. Chlorite ranges from 10 to 18 per cent of the clay mineral assemblage in the various ocean basins and averages about 13 per cent. These variations are due to temperature and weathering processes. As temperature and rainfall increase, metallic cations are progressively lost from clay mineral structures. Thus illite may convert to montmorillonite; montmorillonite may further degrade to kaolinite; and if conditions are extreme kaolinite may be replaced by gibbsite, an aluminium hydroxide (Blatt *et al.* 1972:376, Folk 1980:93, Tucker 1981:86). Folk (1980:94) notes that "chlorite forms on marine diagenesis, particularly in lagoonal or near-shore marine environments where rivers bearing iron from weathering enter the sea." Jarosite, $KFe_3(SO_4)_2(OH)_6$, is a sulphate which forms in the zone of oxidation above the water-table and "is probably often lumped with limonite" (Battey 1972:229, 233). It also forms in hydro-thermal solutions (Heinrich 1965:81). According to Tucker (1981:180), "limonite" is a term "best restricted to the yellow-brown amorphous product of subaerial weathering of iron oxides and other minerals".

CLAY SAMPLES

Three kinds of clay samples are available for analysis. Potting clay recovered from the archaeological excavations, modern clay quarry specimens up to 17 km distant and clays sampled from up to 100 m from Khok Phanom Di. Archaeological samples include the remains of prepared clays. These were recovered either as fragments of prepared potting clay cylinders or clay dump residues.

The cylinders range from small shattered fragments to near-complete examples. When intact,

TABLE 8: Prepared potting clay weights by stratigraphic layer

Layer	Weight	Feature or Burial containing clay	Notes
2	75.39	F1 and 2	cylinder fragments - local clays
3	152.22	F1.	cylinder fragments - local clays
4	64.88	F1, 2, 3, 4, 5, 6, 7, 8, 9	cylinder fragments - local clays
5	8.14	F1, 2[a], F4 (ash), Pl 2, Burials 6 &19	cylinder fragments - local clays
6	3.42	F19[b], 44, B4, 7, 8, 9, 11 lens 2, 3, 6	cylinder fragments - no temper
7	15.50	F2, Burials 15, 16 & 36	cylinder fragments - local clays
8	0.55	Burials 27 & 28	clay fragments - fishpond fabric
9	0.88	F6, 33, 36, Burial 49	clay fragments - no temper
10	1.13	F8, 11, lens 2[c], Burial 58	dumps - sand or no temper
11	0.05	catalogue # 1962	dumps- granitic sand temper

[a]Platform layers 7, 12 (F2) and 33 to 34 (F2)
[b]shell midden
[c]shell midden

they are estimated to have been about 30 to 40 cm long and 8 to 9 cm in diameter. Some bear what are probably the impressions of banana (*Musa sapientum*) leaf stems which spiral around the cylinder surfaces. The leaves appear to have been wrapped around the cylinders when the clay was wet, a method employed, according to ethnographic studies, by potters when storing clay for later use (May and Tuckson 1982:127, 138). Amorphous dumps of clay were also recovered ranging in size from about 2 to 30 cm in diameter. The total weights of prepared clays by layers are set out in table 8. Discussions of the prepared clay compositions for each Ceramic Period are set out in Appendix 1.

TABLE 9: Prepared potting clay weights by Ceramic Period

Ceramic Period	Weight (kg)	% of total
4	292.49	90.79
3	28.56	8.86
2	1.02	0.31
1	0.09	0.03
Total	322.16	99.99

The combined weights and percentages of the total sample for each Ceramic Period are set out in table 9. Table 10 lists clay cylinder and dump weights from burials and other features. The

stratigraphic units follow those employed by the excavators (Higham and Bannanurag 1990:14-16), where homogenous layers were removed in stages using 10 cm units, until each layer was completely excavated or a new layer or feature was encountered.

METHODS

Wet samples of clay weighing about 1 kg each were selected at each potential quarry site. Care was taken to select a range of samples from different areas within each site to ensure as far as possible that the samples were representative. The various sources are shown in figure 12. Five clay quarries which had been exploited by brickworks, at some distance from the excavation, were sampled in order to compare the qualities of their clays with clays excavated adjacent to Khok Phanom Di. None of the quarries was currently in use by potters but four were still being mined on a large scale for brick making. At Khok Phanom Di, ten samples were taken from a nearby freshly-excavated fishpond (samples B1 to B10), two from an old water hole (samples Z1 and Z2), one from an old pit termed *"din dum"* by local residents (sample DD), and finally two from a similar location termed *"din niao"* (samples DN1 and DN2).

TABLE 10: Prepared clay potting weights in burials and other features

Layer	Features (kg)	% of total	Burials (kg)	% of total	Total weight (kg)
2.1 to 2.3	0.46	0.61	-	-	75.39
3.1 to 3.5	0.26	0.17	-	-	152.22
4.1 to 4.5	24.25	37.37	-	-	64.88
5.1 to 5.4	2.76	33.90	0.13	1.59	8.14
6.1 to 6.7	1.58	46.19	0.92	26.90	3.42
7.2 to 7.8	0.06	0.58	15.08	97.29	15.50
8.1 to 8.7	0.01	1.82	0.02	3.64	0.55
9.1 to 9.7	0.55	62.50	0.01	1.14	0.88
10.1 to 10.26	0.40	35.40	0.03	2.65	1.13
11.1	0.05	100	-	-	0.05
Total	30.38	9.43	16.19	5.02	322.16

In the laboratory, dry samples weighing about 50 g were immersed in 400 ml of distilled water for approximately 30 minutes when they were fully flocculated. They were then thoroughly stirred, allowed to settle for 90 seconds, and the upper half was then decanted into another beaker. After this fine fraction was allowed to settle for a further 24 hours, excess water was decanted and the remaining $< 2\mu$ fraction gently poured onto a glass slide and allowed to dry for at least 24 hours. These dried samples were examined, following standard procedures, on

a X-Ray diffractometer using a Cu K*a* radiation at 40 KVA and 20MA and a chart speed of 20 mm/second. Some samples gave diffraction intensities of a 14Å crystal lattice consistent with either chlorite or smectite. These were left in an ethylene glycol atmosphere for 16 hours overnight and re-examined in the diffractometer.

The preparation procedure follows Gibbs (1971:535). This technique has been tested previously and found to be satisfactory (Vincent 1988:45). Care needs to be taken when pouring the $< 2\,\mu$ fraction onto the glass slide as suspensions which are too aqueous will result in coatings which lack sufficient solid particles for a homogeneous coating. Such heterogeneous coatings may produce weak spectral peaks and be mistaken for poorly crystalline minerals. The 5 µ particles fall 1 mm in approximately 30 seconds and 2 µ particles fall about 1 mm in 4.8 seconds (Gibbs 1971:534). Although some $> 2\,\mu$ particles will probably be included in the initial decant, the method is considered satisfactory because the second (24 hour) settling period means that the $< 2\,\mu$ fraction will settle last and as only the upper portion of the second preparation is used, a homogeneous $< 2\,\mu$ coating will normally result.

Characterisation of the overall X-Ray diffraction (XRD) spectrum in terms of the presence and relative proportions of clay minerals in the raw clays is our primary concern. Clay mineral compositions are of crucial importance for ceramic purposes. The determinations set out below were undertaken to assess the clay materials' qualities as potting clays, and to complement petrographic data. Quantitative amounts of the individual clay species represented, with respect to the overall samples, therefore, have not been assessed.

None of the clays was collected while accompanied by a potter. This presents difficulties because, without empirical knowledge of a clay's behaviour, and a lack of field precision in sampling potential potting clay quarries, such procedures risk experimental error. At worst they can be reduced to mere conjecture. The critical question, therefore, is "were these clays, or clays similar to them, those which the prehistoric occupants of Khok Phanom Di exploited in the manufacture of pottery?" Without the assurance of local craftspeople who were currently practising their skills when the fieldwork was undertaken, as was the case in North East Thailand earlier in the decade, we must rely on alternative evidence (Vincent 1988). We are fortunate that several such avenues were available.

First, large-scale quarrying of clay for brick making (sites PT1 to 5), in the Phan Thong area, was being undertaken during the period of fieldwork. The scale of brick making underlines the ready availability of quality clays. At Ban Khok Raka, for example, bricks were fired in continuous sequences lasting for 6 days and nights. This required 40 tonnes of fuel to be transported 60 km to the kilns. Approximately 200,000 bricks were produced from each firing. Clay was brought to the brickworks from the Phan Thong quarries 4 km away because to lease land adjacent to the quarries was too expensive. The quarries were huge. At clay site PT2 the quarry extended for at least 5 ha. The top 30 cm of strata is categorized as *"din dum"* (dark soil). Mottled clays extended to about 2 m depth beneath the topsoil. These were similar in appearance to the clays surrounding Khok Phanom Di. The third sample (PT3) was collected from another Phan Thong quarry which supplied at least four further brickworks nearby. Nong Wua quarry (PT4), also supplies clay to brickworks. This quarry was operated by landowners who sold large quantities of clay to various brickworks in the district. Reddish-brown mottles are prominent in the raw PT4 clay. Nong Klang (site PT5), the last of the brick works clay sources, was abandoned

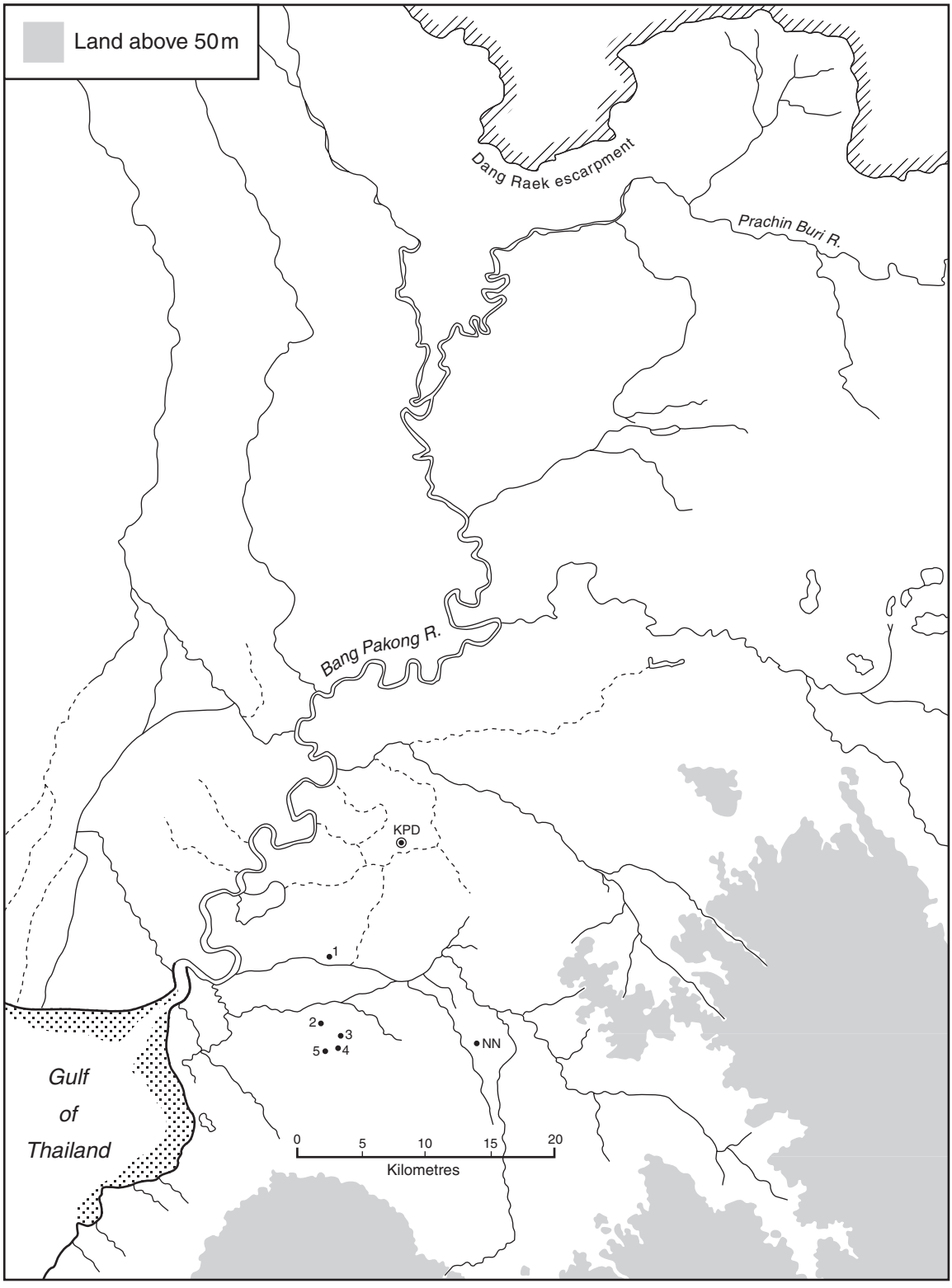


FIG. 12: Clay quarries and sample sites mentioned in the text

when visited. The excavated area at this quarry covered at least 1.5 ha.

TABLE 11: Locations of Bang Pakong Valley and Khok Phanom Di clays sampled

Clay	Source	Location	Notes
DN1	Khok Phanom Di	13°35'N,101°8'E	disused pit or fishpond
DN2	Khok Phanom Di	as above	disused pit or fishpond
DD	Khok Phanom Di	as above	old local quarry
Z1	Khok Phanom Di	as above	disused pit or fishpond
Z2	Khok Phanom Di	as above	disused pit or fishpond
PT1	Phan Thong	7_{257}, 14_{933}[a]	Ban Khok Raka brickworks clay
PT2	Wat Phan Thong	7_{253}, 14_{885}	quarry covers about 4 to 5 hectares excavated to water level at 2m depth
PT3	Phan Thong	7_{273}, 14_{877}	behind brickworks
PT4	Nong Wua	7_{271}, 14_{863}	brick clay purchased from landowners
PT5	Nong Klang	7_{259}, 14_{864}	large abandoned quarry
B1	KPD: Fishpond	as above	from bottom 20 cm of column
B2	KPD: Fishpond	as above	from next 20-40 cm of column
B3	KPD: Fishpond	as above	from next 40-60 cm of column
B4	KPD: Fishpond	as above	from next 60-80 cm of column
B5	KPD: Fishpond	as above	from next 80-100 cm of column
B6	KPD: Fishpond	as above	from next 100-120 cm of column
B7	KPD: Fishpond	as above	from next 120-140 cm of column
B8	KPD: Fishpond	as above	from next 140-160 cm of column
B9	KPD: Fishpond	as above	from next 160-180 cm of column
B10	KPD: Fishpond	as above	highest 180-200 cm of column

[a] 1,000 metre UTM grid, zone 47P, 1:50,000 map Amphoe Phanat Nikhom, edition 1-RTSD, series L7017, sheet 5235 IV

Second, we can test the clay deposits immediately adjacent to Khok Phanom Di for their suitability as potting clays. To accurately assess the clay samples, they were subjected to the technological processes considered to have been used to manufacture the prehistoric earthenware pottery. This involves preparing, forming, drying and firing the clays under similar conditions to those known to be employed by modern craft potters working under the kinds of conditions the prehistoric potters at Khok Phanom Di are assumed to have encountered. It is necessary, therefore, to test these clays as comprehensively as possible in the manner described. The results are detailed below.

Finally, we can compare the Khok Phanom Di clays with those of known quality from Phan Thong. The use of these latter clays for brickmaking means they would also be appropriate for producing the types of earthenware assumed to have been manufactured at Khok Phanom Di. Good quality bricks require raw clays which contain a similar proportion of suitable clay minerals as low-fired ceramic wares. Bricks are normally fired to temperatures up to 900° C,

temperatures comparable to those achieved by craft potters employing open air firings to create the kinds of earthenware under examination here.

RESULTS

Twenty XRD determinations are set out in figures 13 to 32. These should be compared with the shrinkage tests results in table 12 and read in conjunction with the detailed petrographic data set out in Appendix 1. Each clay was prepared for shrinkage tests by first thoroughly mixing the wet sample and then forming a bisque measuring 15 x 2.5 x 0.8 cm from the mixed clay. A 10 cm long mark was then inscribed into the surface of each bisque while it was still soft to allow the shrinkage rates to be calculated after the bisques had been dried and fired (Howard 1982). All of the bisques were fired in an oxidizing atmosphere, after air drying to the leather-hard stage, following standard modern potting practice, to test their likely firing behaviour (Howard 1982).

TABLE 12: Clay shrinkage tests (mm) at 800°C firing temperature

Clay	Dry length	Fired length	Clay	Dry length	Fired length
DN1	93.0	92.5	B1	89.0	88.5
DN2	92.0	91.5	B2	89.0	88.5
DD	93.0	92.5	B3	91.0	91.0
Z1	96.0	96.0	B4	89.0	88.0
Z2	95.5	95.5	B5	89.0	88.5
PT1	91.5	91.5	B6	89.0	88.5
PT2	93.0	92.5	B7	92.5	92.5
PT3	92.0	91.5	B8	97.0	96.5
PT4	92.0	91.5	B9	96.0	96.0
PT5	93.0	93.0	B10	94.0	94.0

Clays B3, PT5, and B8, B9 and B10 have little plasticity, due to a disproportionate amount of non-plastics. In modern potting terminology the former can be described as “short” and B8-9 “very short”. The shrinkage rates do not preclude any of the clays for use in potting. “Short” clays are not necessarily unsuitable, but a lack of sufficient appropriate clay minerals would be critical. Therefore such clays are unlikely to fire well without modification. Non-plastic inclusions help to reduce shrinkage by providing a coarse open textured potting clay mixture which allows gases to escape more freely during the drying and firing processes. Importantly, however, they may also weaken the potting clay mixture by reducing the clay mineral proportion. Clay minerals are critical to the fusion of the whole potting clay body into a satisfactory ceramic material. The amount of non-plastic material any potting clay mixture can tolerate is, therefore, limited. Plastic clays are those which contain a high proportion of suitable clay minerals. Modern potters will normally blend a “plastic” clay with any “short” clay to make it “workable” (Hamer 1975:264).

The location of clays sampled in the field are set out in table 11. Brickwork clay quarries (P1 to P5), lie between 16–17.5 km from Khok Phanom Di. Arnold (1985:34-50), reports that 84 per cent, of 111 pottery communities surveyed, obtained their clay from within 7 km of their production sites "and this distance probably represents the upper limit of the maximum range of exploitation." In spite of these findings "Long distance transportation of primary ceramic materials like clays and tempers is unusual, but by no means impossible" (Arnold 1985:56).

These data indicate that quality clays were probably readily available to the prehistoric potters of Khok Phanom Di. Substantial quantities of good clay probably lay adjacent to the site. Given the nature of the local and regional topography, even if this had not been the case, heavy materials such as clay could have been imported using water transport. People living in riverine/estuarine/coastal locations are likely to have been efficient users of waterways. Evidence set out in previous volumes indicates that the prehistoric inhabitants of Khok Phanom Di were actively exploiting such waterways to varying degrees throughout the archaeological sequence. Subjective tests of clay plasticity were undertaken in the laboratory by a potter (Table 13).

TABLE 13: Bang Pakong Valley and Khok Phanom Di clays: plasticity tests

Clay	Source	Plasticity	Rating (%)	Clay	Source	Plasticity	Rating (%)
DN1	KPD	very plastic	100[a]	B1	KPD: fishpond	medium	50
DN2	KPD	very plastic	100	B2	KPD: fishpond	plastic	70
DD	KPD	plastic	70	B3	KPD: fishpond	short	40
PT1	Phan Thong	very plastic	100	B4	KPD: fishpond	plastic	60
PT2	Phan Thong	plastic	70	B5	KPD: fishpond	plastic	60
PT3	Phan Thong	very plastic	100	B6	KPD: fishpond	short	40
PT4	Nong Wua	plastic	70	B7	KPD: fishpond	short	30
PT5	Nong Klang	short	30	B8	KPD: fishpond	very short	10
				B9	KPD: fishpond	very short	10
				B10	KPD: fishpond	short	20

[a]Scale: 10 = very short, 100 = very plastic

Two clay samples taken from a nearby disused pit or fishpond (Z1 and Z2) were not tested by the potter for plasticity. During the flocculation procedures in preparation for the XRD analysis, as described above, note was taken of the reactions of each sample. Flocculation is the action of fine particles placed in a suspension where their physical properties are altered so that they no longer repel one another, but aggregate into larger bodies called flocs, these settle by gravity (Hamer 1975:127). The following flocculation reactions were noted:

Clay Flocculation Reactions

1. Clay DN1 flocculated easily, and appeared silty.
2. Clay DD flocculated easily.
3. Clays Z1 and Z2 appeared very sandy. They flocculated almost immediately.
4. Clay P1 flocculated easily.
5. Clay P2 flocculated easily, but was sticky.
6. Clay P3 flocculated easily.
7. Clay P4 flocculated easily, but was very slightly sticky.
8. Clay P5 flocculated easily, but was sticky.
9. Fishpond clays (B1 to B10), were progressively easier to flocculate towards the 10 end of the sequence.

The XRD results are considered below. It was not possible to establish with confidence in the field whether any of these clays were suitable for pottery making because potting is presently not known to be carried out in the district. Large-scale and widespread use of clays for brickmaking clearly signalled that several were potentially of sufficient quality. Plasticity tests were also conducted in the field. These indicated that four of the brickworks clays were highly suitable. Of the remainder only the very short clays from the Khok Phanom Di fishpond and the abandoned Nong Klang quarry (PT5), would not have been satisfactory for potting without modification. It is important to note that the sample taken from Nong Klang may not be representative of the quality portion of the clay deposit as this clay had already been extracted for brick making.

INTERPRETATIONS OF THE X-RAY DIFFRACTION SPECTRA

All the quarried clays contain more than one clay mineral specie and are, therefore, *mixed-layer clay materials* (Grim 1968:121). Several of the spectra displayed prominent 14 Å peaks which could indicate either a chlorite or montmorillonite (smectite). For the purposes of this discussion, those minerals displaying a 14 Å reflection have been defined as chlorites. The term smectite is preferred to montmorillonite for the sake of consistency (Vincent 1988). To determine which clay mineral was present, those clays with 14 Å reflections were glycolated and re-examined. A summary of the main constituents, including approximate estimates of the various mineral

quantities represented, follows:

- *Din niao* clay 1: a strong 14 Å peak suggested that either chlorite or smectite was present. The clay was re-examined following glycolation and as no shift in the peak occurred, chlorite is confirmed. Kaolinite and mica are also evident, but less prominent.
- *Din niao* clay 2: this spectrograph closely replicates that for *din niao* 1.
- *Din dum* clay: when glycolated, and re-examined, the 14 Å peak appears to have shifted marginally. In this case as the count time was increased, this shift is considered to be insignificant and chlorite is most likely indicated. Kaolinite and mica are again present in what appear to be slightly lesser proportions than some of the other clays examined.
- Disused pit clay Z1: diffraction reflections are weak. Chlorite is again indicated. Following glycolation and re-analysis, it becomes prominent. Kaolinite, mica and possibly jarosite are again indicated.
- Disused pit clay Z2: after glycolation the 14 Å reflection that again indicates chlorite is present along with mica and kaolinite.
- Phan Thong clay 1: chlorite is indicated following a post-glycolation re-analysis. Kaolinite, mica and jarosite are again also present. The reflection peaks are all well defined.
- Phan Thong clay 2: sharply defined reflections at 3.08, 3.11, 5.09 and 5.93 Å indicate jarosite. Post-glycolation re-analysis indicates that chlorite is again present. Kaolinite and mica are also indicated.
- Phan Thong clay 3: this clay was also glycolated and re-examined. Chlorite is indicated and kaolinite, mica and probably jarosite are present. The reflection peaks, apart from those considered to represent jarosite, are well defined.
- Phan Thong clay 4: the reflections in this spectrum are relatively weak. Chlorite is indicated following a post-glycolation re-analysis. Kaolinite, mica and probably jarosite are also indicated.
- Phan Thong clay 5: reflections in this spectrum, following glycolation, indicate that chlorite, kaolinite, mica and probably jarosite are present.

Chlorite appears to be prominent in all clays analysed. As no clay appeared to hydrate or dehydrate excessively during drying, shrinkage and firing tests, this mineral is not considered to disqualify any of the clays analysed as suitable for potting. It should also be noted that chlorite was present in some of the potting clays traditionally used by Sakon Nakhon Basin potters (Vincent 1988:57).

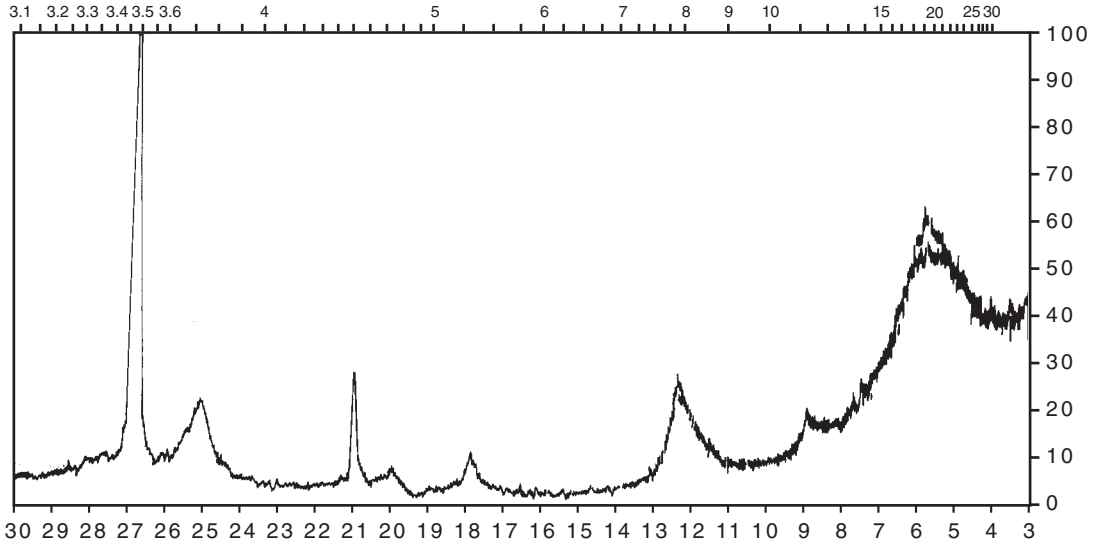


FIG. 13: Clay DN1 (*din niao*) 1,000 cps

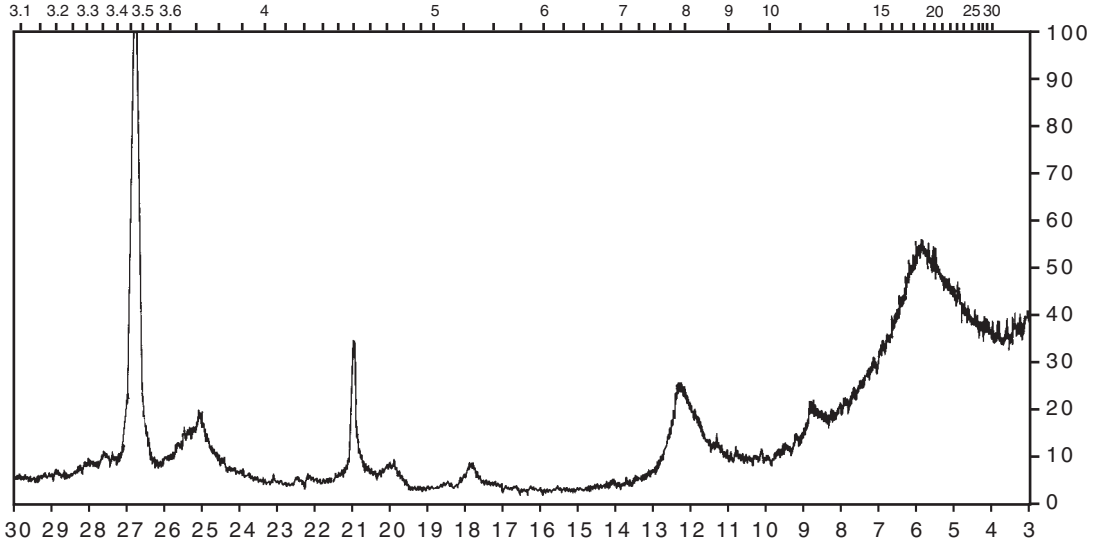


FIG. 14: Clay DN2 (*din niao*) 1,000 cps

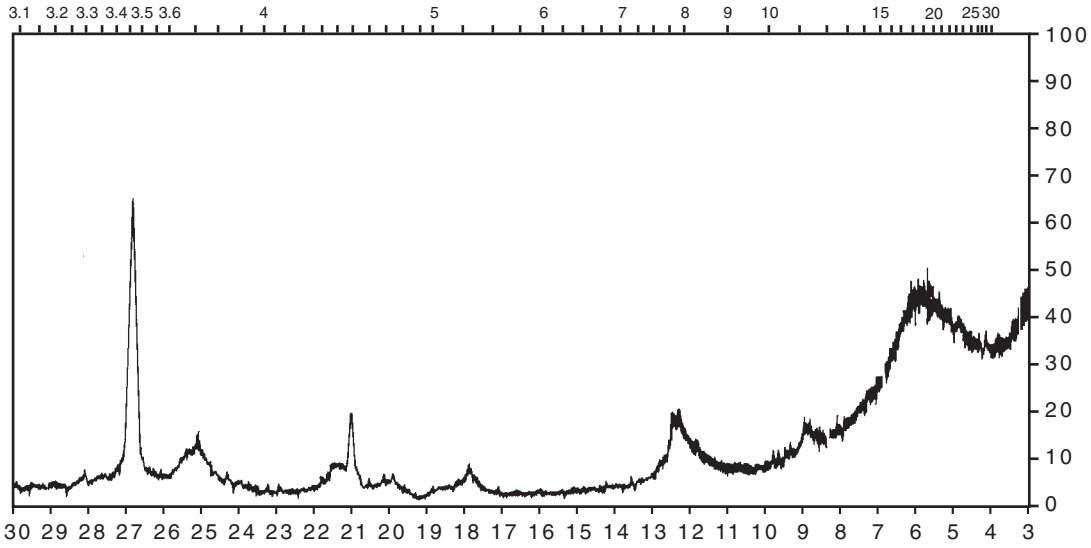


FIG. 15: Clay Z1 (padi field) 1,000 cps

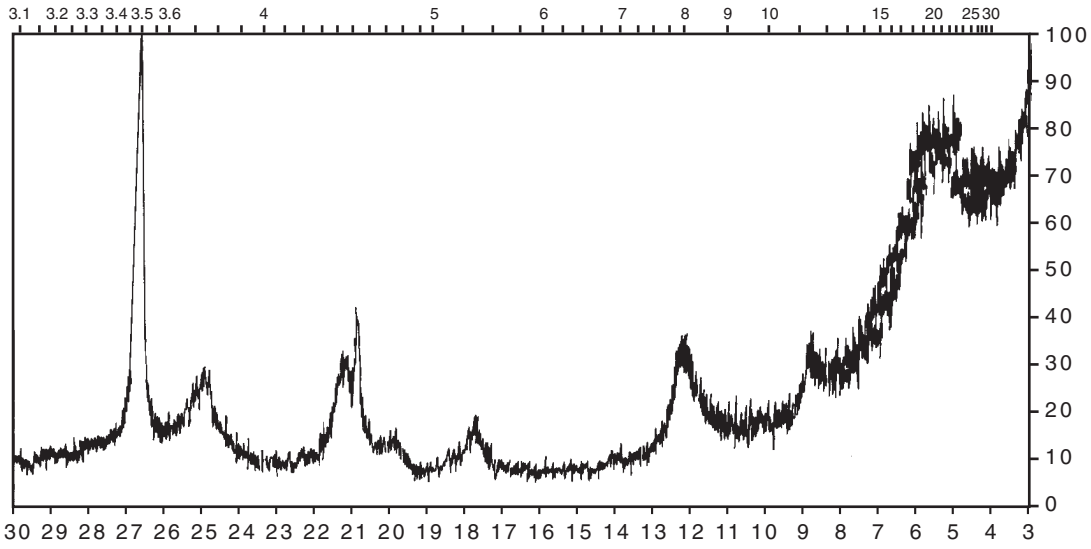


FIG. 16: Clay Z2 (padi field) 400 cps

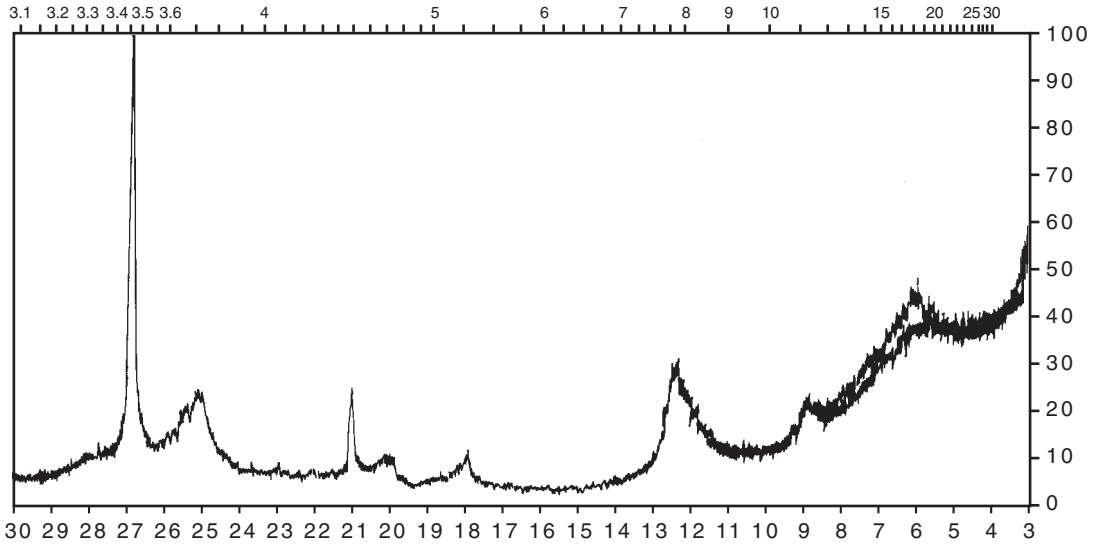


FIG. 17: Clay DD (*din dum*) 1,000 cps

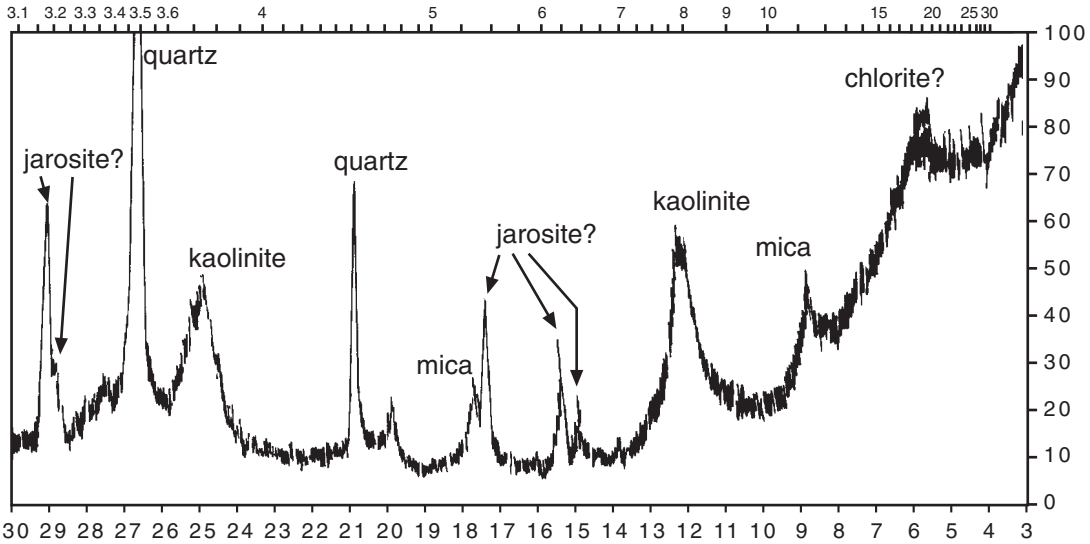


FIG. 18: Clay P1 (Ban Khok Raka) 400 cps

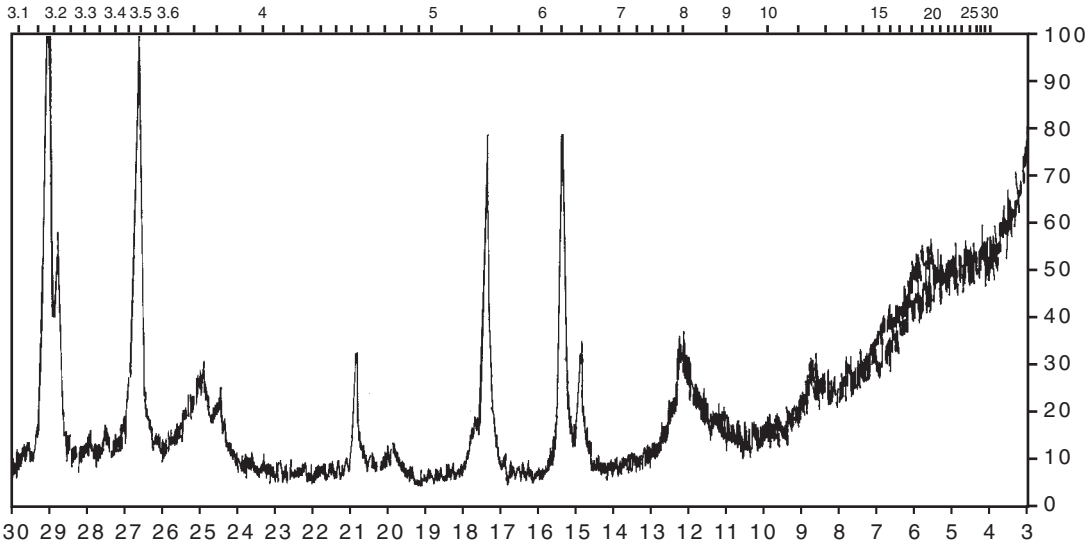


FIG. 19: Clay P2 (Wat Phan Thong) 400 cps

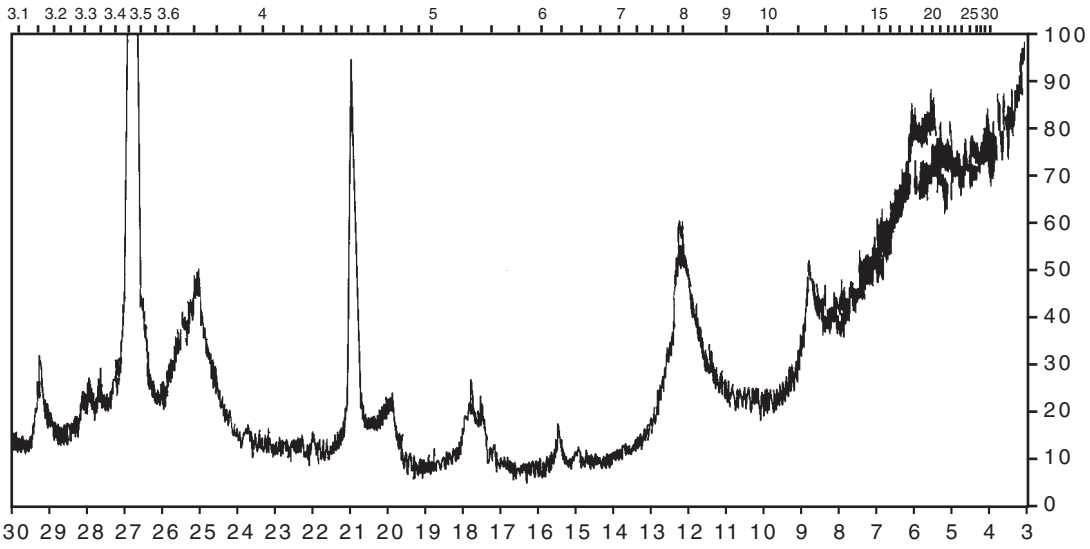


FIG. 20: Clay P3 (Phan Thong brickworks) 400 cps

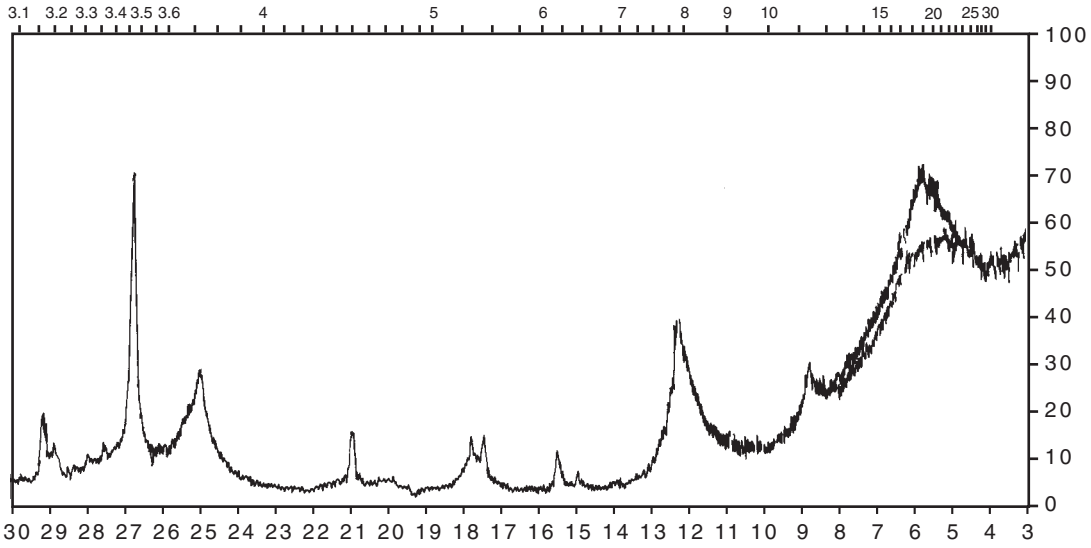


FIG. 21: Clay P4 (Nong Wua brickworks) 1,000 cps

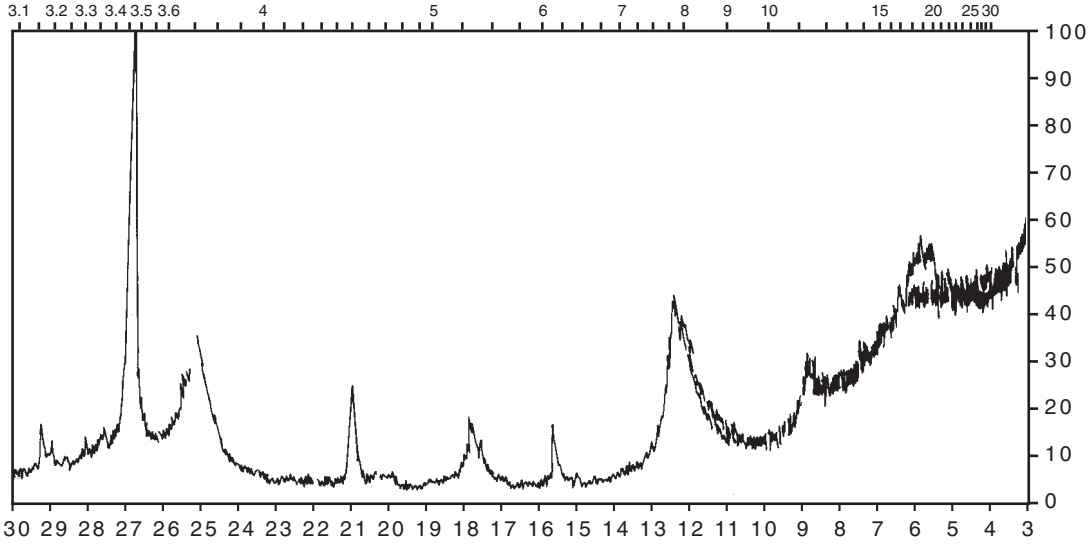


FIG. 22: Clay P5 (Nong Klang brickworks) 1,000 cps

- Fishpond clay B1: chlorite, mica and kaolinite peaks are present. Peaks at 3.08, 3.11, 5.09, 5.7 and 5.9 Å indicate the presence of jarosite.
- Fishpond clay B2: this sample was glycolated and re-examined for smectite; as no shift in the 14 Å peak is apparent, chlorite is indicated. Mica, kaolinite and jarosite are present.
- Fishpond clay B3: chlorite, kaolinite, mica and jarosite are present. In this case the peaks are more defined than for samples B1 or B2.
- Fishpond clay B4: chlorite, kaolinite, mica and jarosite are present.
- Fishpond clay B5: chlorite, jarosite, kaolinite and mica are present, but in what appear to be slightly different amounts.
- Fishpond clay B6: this clay was also re-run after glycolation as a check for smectite. No shift in the 14 Å peak is obvious which again indicates that chlorite is present. Jarosite, kaolinite and mica are also evident.
- Fishpond clay B7: chlorite, mica, jarosite and kaolinite are present. The peaks in this spectrum are much weaker.
- Fishpond clay B8: mica, kaolinite and jarosite are again present. The peaks, however, are very weak.
- Fishpond clay B9: a very prominent 14 Å peak suggests that chlorite is present. Since this sample was not glycolated, such a large peak could mask smectite. Given the results set out for samples B2, B6 and B10, however, this seems unlikely. Mica and kaolinite are prominent, but jarosite is absent.
- Fishpond clay B10: a second spectrum after glycolation indicates that chlorite is present. Kaolinite and mica are again reasonably prominent, but in what appear to be slightly smaller amounts than the previous sample.

  It should be noted that although clay samples B9 and B10 displayed sharp clay mineral XRD profiles, it is the overall composition of the raw potting clay that is important. Thus the mix of *clay mineral* species and their relative *proportions,* along with those of the non-plastic inclusions, are the critical determinants for defining good quality potting clays.

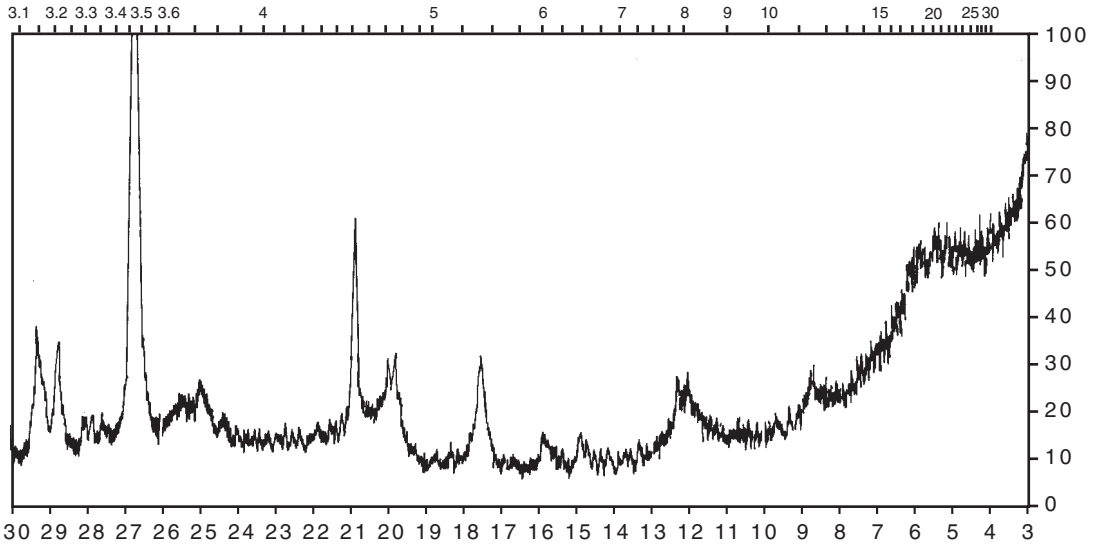


FIG. 23: Clay B1 (fishpond) 400 cps

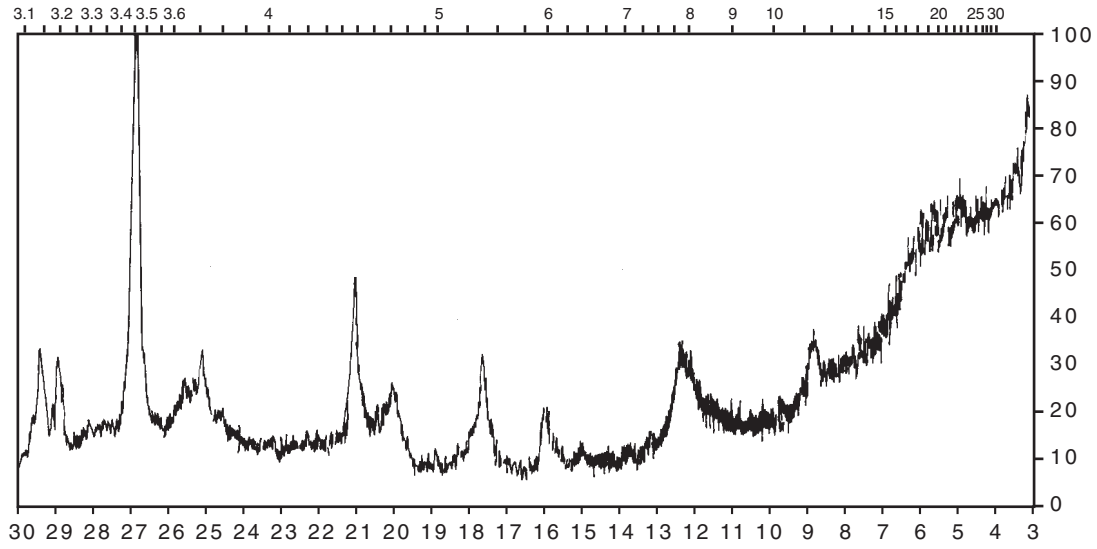


FIG. 24: Clay B2 (fishpond) 400 cps

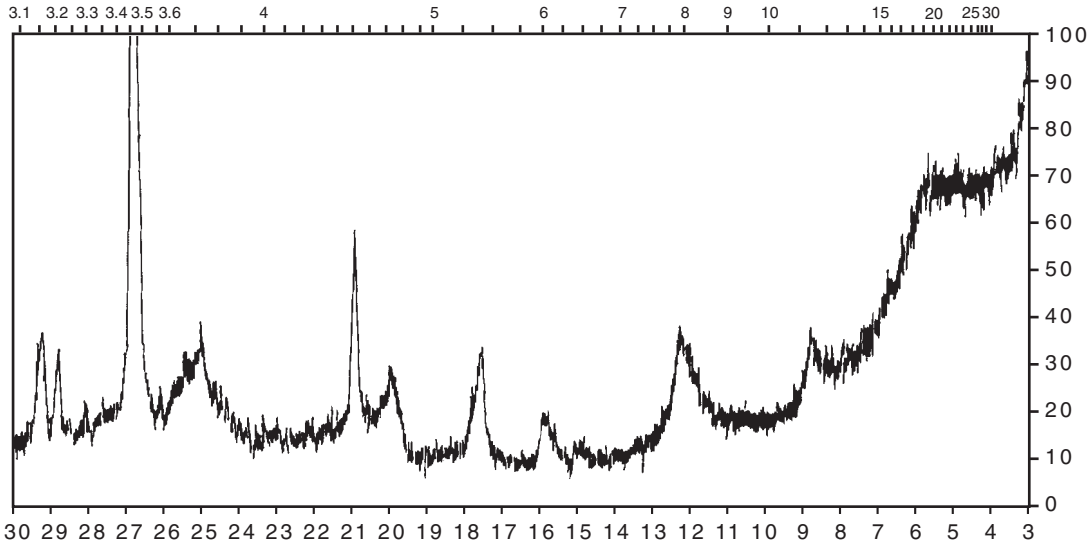


FIG. 25: Clay B3 (fishpond) 400 cps

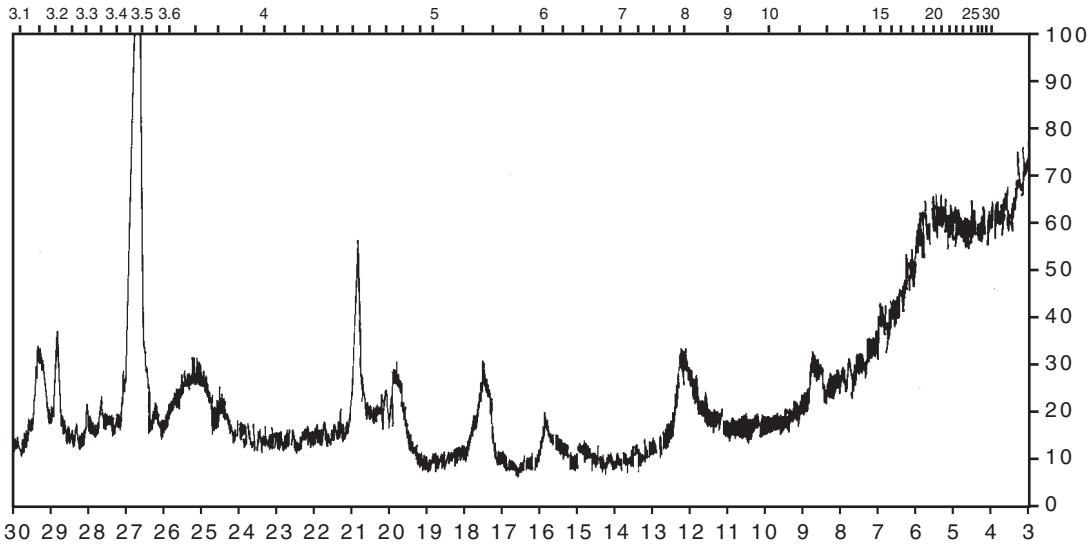


FIG. 26: Clay B4 (fishpond) 400 cps

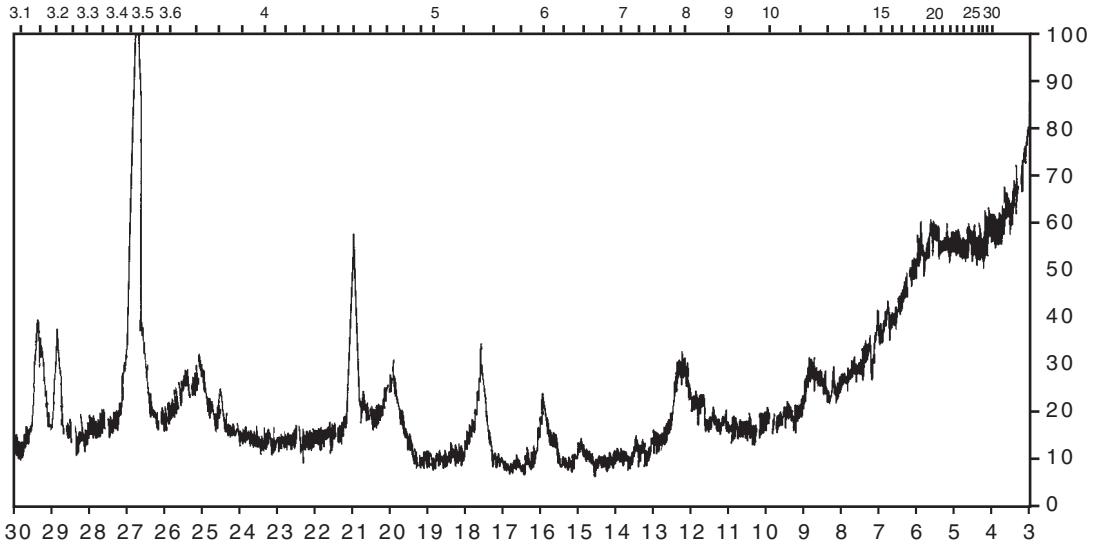


FIG. 27: Clay B5 (fishpond) 400 cps

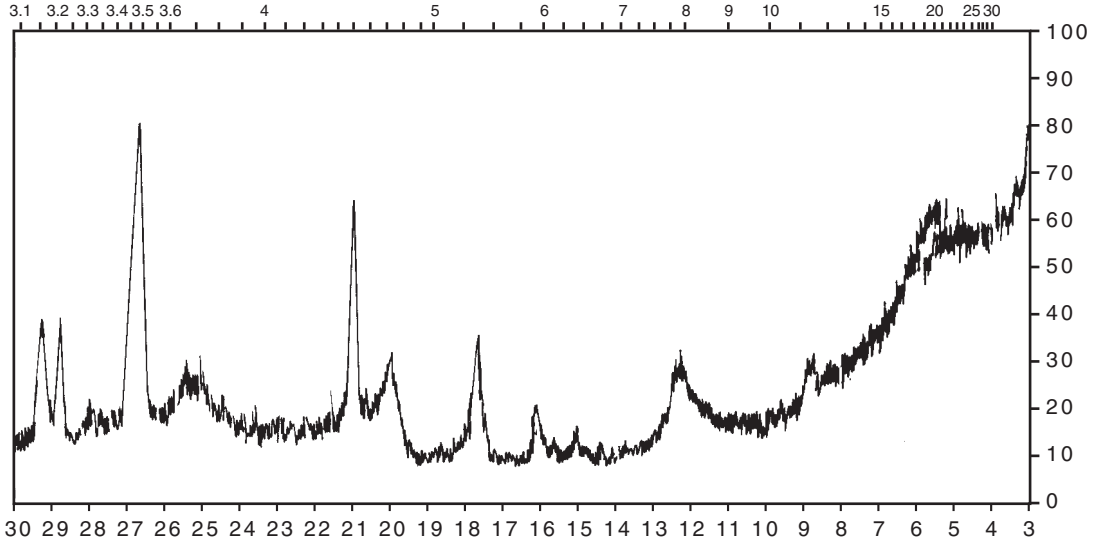


FIG. 28: Clay B6 (fishpond) 400 cps

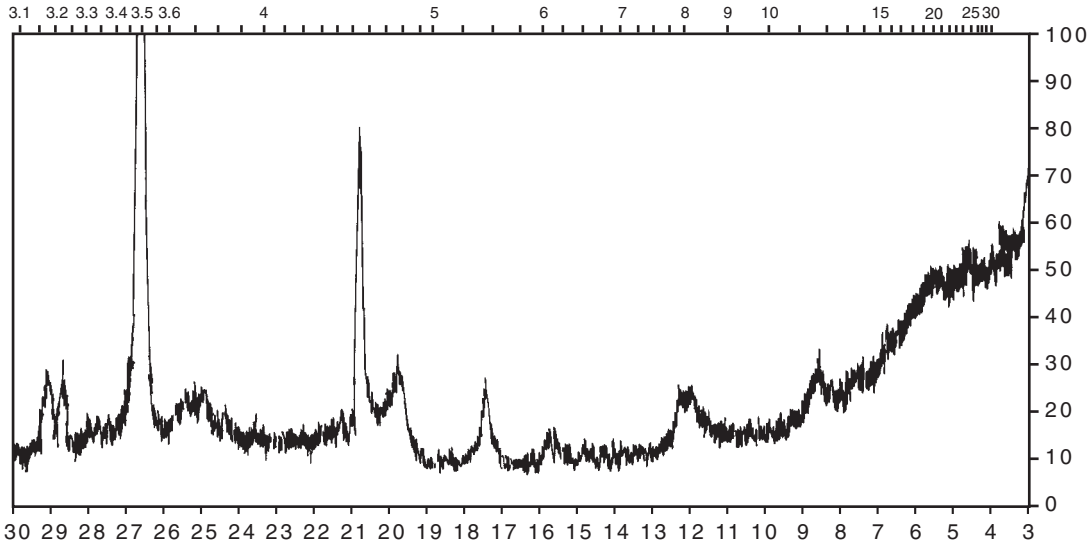


FIG. 29: Clay B7 (fishpond) 400 cps

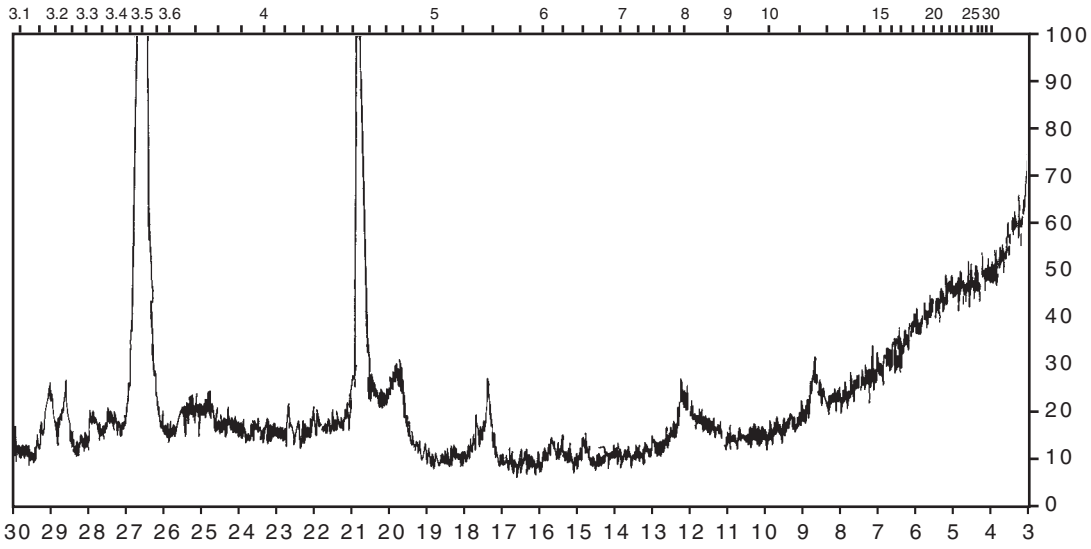


FIG. 30: Clay B8 (fishpond) 400 cps

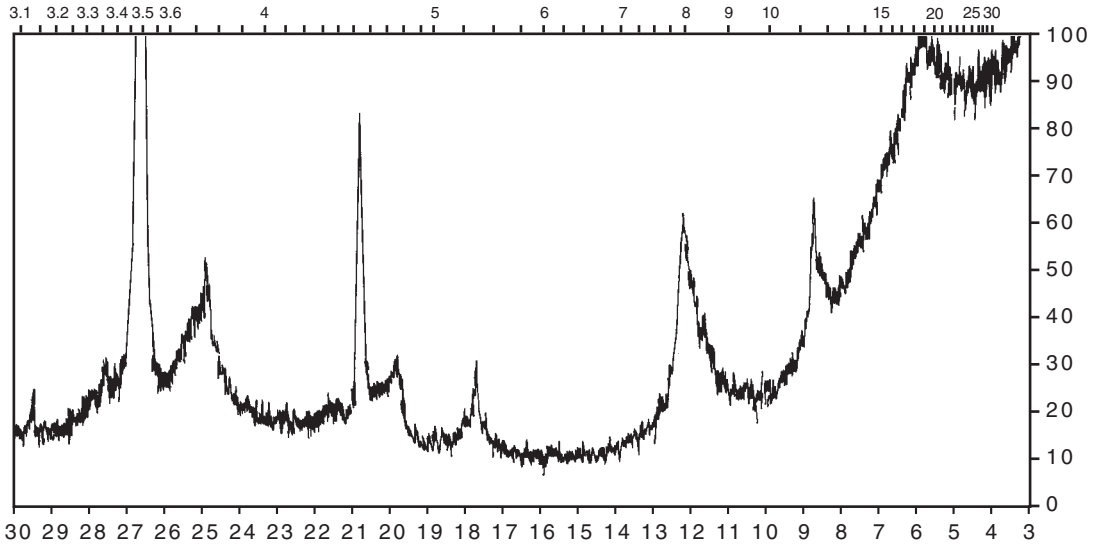


FIG. 31: Clay B9 (fishpond) 400 cps

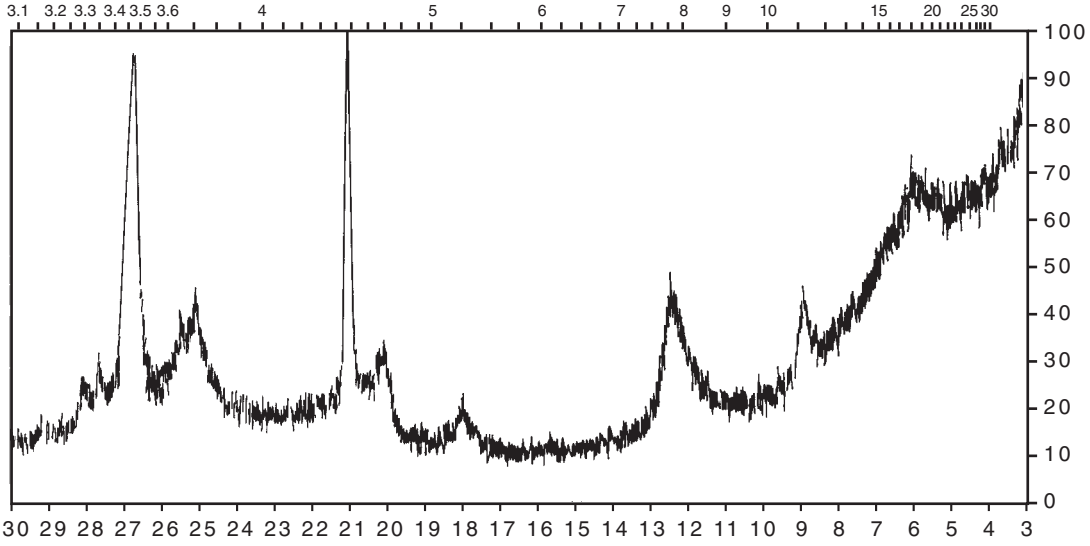


FIG. 32: Clay B10 (fishpond) 400 cps

VI DEFINING THE CERAMIC PERIODS

POTTERY STUDIES are often useful in constructing cultural sequences. Ceramic evidence has the potential to bring into focus and help characterise the rate of any pertinent local and regional change. As Orton *et al.* (1993:24) observed "Pots vary." This variability includes technical and social factors which are critical to an understanding of ceramic sequences and any associated cultural change. Pottery is ideal for the characterisation of cultural changes through time because of a unique combination of durability and the plastic nature of clay. Changes in pottery often parallel cultural changes. This evidence is enhanced when production centres and craft specialization are involved, because a continuous ceramic record through time will be available for detailed examination. This means that a rational sequence can be observed in the detailed body of data preserved in the durable ceramic materials themselves.

> "At any site, the pots in use vary over time in terms of how they were made, of what they were made, for what they were used, probably where they were made and certainly by whom they were made. Such differences will be reflected in the fabric, form, technology and decoration of the sherds excavated from different contexts." Orton *et al.* (1993:24).

Plastic clay in the potter's hands, however, can create for archaeologists the illusion of cultural affinities because almost any conceivable form is possible and copying the style of exotic wares, using local methods, is a relatively simple procedure for the accomplished artisan. It is therefore essential that the origins of prehistoric pottery are identified. This requires determining whether the pottery was produced on site and, where appropriate, combining any changes in the local ceramic spectrum with changes in exotic wares. Changes in potting technology, including materials, production methods and the presence of craft specialization, either through local evolution or its introduction, perhaps through the arrival of immigrant potters bringing new methods, often signals cultural changes. Provided these variations are taken into account, ceramic assemblages play an important role in relative dating and defining cultural patterning. Once these are established such patterns can be examined in order to detect the existence of cross-cultural affinities.

At Khok Phanom Di, four consecutive potting traditions have been identified. They are described in Chapters VII, VIII, IX and X. This chapter will examine the criteria used to define them, beginning with the role pottery has played in defining cultures and cultural sequences. Pottery continues to be used as a means to construct chronologies through the relative dating method. Although absolute dating, using radiocarbon determinations, has gained considerable recognition from the archaeological community, pottery still appears to be favoured by most archaeologists for the construction of prehistoric sequences and chronologies. For example, at Ban Kao (Sørensen 1972), Chansen (Bronson 1976), Non Nok Tha (Bayard 1976, 1977, 1984),

Roi Et (Higham 1977) and Ban Chiang (White 1986). In addition, some radiocarbon determinations are combined in computer programs, with data from relative sequence chronologies, which use Bayesian statistics to further refine the calibrations. Many of these relative sequences feature pottery typologies (Orton *et al.* 1993:191). Ceramic evidence will be employed to detect technological as well as stylistic changes, and to determine whether these are significant. These methods were particularly valuable in defining the Khok Phanom Di ceramic traditions. Finally, the importance of corroborating any ceramic changes with non-ceramic evidence in the archaeological record is stressed. This incorporates changes in the local and regional environments which may have affected the local inhabitants. These may have been caused by cultural or natural developments. Such corroboration may be drawn from events directly related to potting, or unrelated evidence, or both. Corroboration is important because independent verification, drawn from non-ceramic data, reinforces conclusions derived from the ceramic evidence and helps confirm that they are culturally significant.

> "Pottery and dating are inextricably linked in archaeology, or at least in the minds of those involved in it. ... The advent of and/or wider application of techniques such as ^{14}C dating and dendrochronology has not significantly reduced the need for ceramic-based chronologies. A majority of excavation reports (83% in a recent survey of Romano-British site reports, see Fulford and Huddleston 1991, 5) continue to employ, to some extent at least, dates derived from the study of ceramics." (Orton *et al.* 1993:182).

Non-ceramic evidence includes faunal (Cassaidy 1991, Grant and Higham 1991, Kijngam 1991, Mason 1991, 1996, McKenzie 1991, West 1991), and botanical (Thompson 1996) remains from within the site and the Bang Pakong Valley region. Pollen core (Maloney 1991), and phytolith (Kealhofer and Piperno 1996) data have been reported on previously, as have the details of a sediment column taken from within the excavated area at the site (Aitken 1992). The bone, antler and turtle carapace technology (Higham 1993), industrial stone technology (Pisnupong 1993), burnishing stones (Moore 1993), personal ornaments (Pilditch 1993), shell knives (Higham, T.F.G. 1993), miscellaneous shell artefacts (Higham 1993), and aspects of the pottery decoration (Hall 1993), have been reported on in volume III of this series. In addition, clay samples from natural deposits immediately adjacent to the excavation, and from further afield, have been analysed for comparison with the clay dumps and the local pottery excavated from the archaeological contexts at Khok Phanom Di. The results are set out in this report. Relevant data drawn from each of these studies have helped to define each of the CPs and are detailed in the text. Finally, variations in the stratigraphic deposits within the site provide evidence of culture changes which, where possible, have been correlated with the ceramic evidence. A detailed report on the stratigraphic sequence is provided by Higham and Bannanurag (1990).

THE CERAMIC PERIODS DEFINED

Once the ceramic assemblage had been sorted and categorized, attention was turned to examining the non-ceramic evidence, such as stratigraphic changes noted by the excavators, environmental, floral and faunal shifts, as reported by others, and any differential use of the site by the prehistoric inhabitants. In essence, determining the boundaries of each CP initially involved the characterisation of the complete ceramic assemblage through an assessment of the excavated ceramic and related potting materials, and ordering them into the different stratigraphic units. These materials included potting tools, clays and tempering additives. The characterization of local potting clays assisted in defining changes in local production techniques, an important factor in ascribing the four different assemblages represented. In the first instance this requires the recognition of similarities and differences in the corpus of ceramic artefacts. Secondly, evidence for pottery making, such as unused potting materials, potting tools and firing remains was sought. These data were then collated and compared stratigraphically where three clearly definable changes were noted. Correlations with the non-ceramic data were then sought. A summary of some of the more salient evidence is set out below.

During CP1 on-site pottery making is evident in the remains of firing, including ash, charcoal and areas of "burnt clay" reported by the excavators. Dumps of unused potting clay, which matches the mineralogy of the majority of the finished pottery designated as belonging to CP1, were retrieved in association with the pottery from the lowest 30 cm or so of the excavations. This clay is distinctive and differs from any other found in the excavated deposits. Caches of pebbles, mineralogically identical to the sand temper, which helps to characterise CP1 local wares, were also uncovered within the lower stratigraphic layers. These pebbles are considered to have been crushed in order to reduce their size so as to render them suitable for mixing with the potting clay as temper. That this crushed material was included into the prepared clay is verified not only by the mineralogy but also by the presence of weathered boundaries to some of the sand grains. These grains otherwise display fresh boundaries consistent with unweathered fracture surfaces. They had been fractured prior to being added to the potting clay.

Several ceramic anvils were also uncovered from within lower layer 10 and layer 11. These anvils are also tempered with the same mineralogically distinctive sand. They are composed of the same fabric as the local CP1 sand-tempered pottery. The shape of these anvils also differs from anvils recovered from the overlying later deposits and a different range of anvil sizes are present. Within the series of ash and pottery lenses, which made up this lower portion of the stratigraphy, were fragments of several large ceramic stands. Initially these were thought to be large anvils. The anvil-like appearance, however, was limited to their shafts and fragments of what appeared to be anvil heads. Petrographic evidence revealed the presence of a mineral phase which only occurs at temperatures higher than anticipated in the kinds of earthenwares which made up the ceramic assemblage. Several of the stands were coated with carbon-rich ash which further suggested that the artefacts were associated with firings. Ethnographic data are available which indicates that ceramic stands of similar size and shape are used to support wooden firing rafts. The stands are limited to CP1 and the upper portion of layer 10. The latter are composed of a different fabric to the CP1 sample.

Rim sherds, which are diagnostic of whole vessel forms, provide an important outline of the

overall pottery assemblage. Defining and classifying rim forms, therefore, is a major aspect of the ceramic analysis. Because vessel forms provide insight into the style of pottery involved, they are important indicators of cultural styles, provided of course, that their point of manufacture is understood. Considerable attention has been paid to defining the various rims present throughout the sequence. This detailed study of vessel forms, coupled with fabric analysis, shows that different vessel spectra are present in each of the CPs. Within the local wares changes are evident in both the coarse and fine pottery through time. The rims from CP1 differ in several respects from those which characterise the other three CPs. Some similarities in vessel forms are also evident. This, however, is predictable given the regional nature of cultural styles. Changes in the number and kinds of rim forms and form variants are evident throughout the sequence. These data have been formulated to reveal that the degree of decorative elaboration varies throughout the sequence and between each CP. The trends in decorative elaboration, it is proposed, are a valid measure of the development of a ceramic tradition. Hence traditions which are in modes of florescence can be anticipated to display continuous trends towards increased elaboration, whereas those in decline will display a decrease. Tracing the overall trends in elaboration, coupled with the evidence discussed above, therefore, helps to define the presence of different traditions represented in the four CPs at Khok Phanom Di.

Some vessels featured an attached "ring foot" base. As with the rims, vessel bases have also been categorised in terms of both their fabrics and forms. Their distributions throughout the site have been traced and these also demonstrate that discrete assemblages of wares are present in each CP. While some base forms are common to all the CPs, others are restricted, as are specific types of tripod feet. Form and fabric analyses have allowed both local and exotic types to be identified.

In addition to "whole" vessel types, decorative modes have also been considered and variations between each CP noted. The distributions of ceramic bow pellets, burnishing stones and bone stylus points, of a kind known to be used by craft potters elsewhere to incise decorative lines onto pot surfaces, have also been considered. Burnishing stone distributions differ from one CP to another and their presence correlates closely with the presence of locally-made burnished wares. Similar correlations between incised wares and bone stylus points are also evident.

During CP1, the excavated portion of the site was used to manufacture and fire pottery. No graves were recovered. This contrasts sharply with CP2 and CP3, which together comprise the major proportion of the deposits, when this section of the site was reserved for inhumation burials. Local wares recovered from these two cemetery CPs differs from the CP1 local ceramic spectrum in terms of vessel forms and fabrics. Sand temper is no longer apparent. It is replaced by grog temper, an artificial method of securing suitable nonplastic material for mixing with the raw potting clay. The use of grog temper by the local potters is a critical change under the circumstances given that sand temper is a simple technique favoured by many craft potters throughout Asia during the second and third millennia BC. It is particularly prominent in coastal sites and in Thailand it was also used at several inland sites such as Ban Kao and Non Nok Tha. Sand is an excellent tempering agent, often readily available and easily added to raw clays as a nonplastic. To replace sand with grog temper, even when the sand needed to be processed from pebbles, is a major, technically unnecessary, deviation from a reliable process. Apart from coastal sites, sand tempers are usually found where natural geological strata contain suitable deposits

in relative abundance. Grog temper, however, is probably a technical response to a paucity or the total lack of alternative tempering materials. Grog requires more effort than using naturally occurring tempering materials, such as sand, because it involves an extra processing stage in preparing the potting clay. This extra stage is needed in a process that is already detailed and complex. Potters who are unfamiliar with such a procedure are unlikely to adopt it when they already have the technical skills to make pottery using a much simpler and familiar traditional method.

Ceramic anvils also changed. Two new local fabrics make their first appearance. One is identical to the new grog-tempered local ware material, designated as fabric group two. The other involves use of a local silty clay which matches clay sampled from the exposed cut of a modern fishpond. Use of this clay for a variety of local ceramic artefacts continued from this point throughout the site. Some anvils feature ownership marks and several are probably exotic, which suggests that some of the potters at Khok Phanom Di were linked, perhaps through marriage alliances, to other potting centres in the region.

Coupled with the change in local ware fabrics, a range of new vessel forms is evident in CP2. Their degree of decorative elaboration increased throughout this portion of the sequence. Although the earliest burials lack any vessels as grave furniture, pottery soon became common. The number of vessel forms increased and their quality quickly improved. Intricate designs, particularly burnishing, became more prominent reaching a maximum for the entire site, except for one anomalous mid-sequence deposit, when they declined markedly. The number of rim forms reached a maximum during CP2, but their complexity, although far greater than that for CP1, is less developed than those in the following CPs. Overall, rim forms show a trend towards an increase in vessel complexity. The difference between CP1 and CP2 is most marked. CP3 had the most elaboration. CP1 contained nearly as many forms as CP4, but elaboration is minimal. CP2 funerary vessels are generally high quality with much intricate burnishing and incising. The range of CP2 vessel forms differs from other CPs and several forms are unique.

Just below the junction of layers 9 and 10 a major shell midden, known as layer 10 lens 2, was encountered. It extended down from layer 10:3 to the base of layer 10:10, or from 4.36 m to 5.13 m below datum. The midden skirts a series of burial groups which the excavators describe as "burial clusters" (Higham and Bannanurag 1990:35). They consider that the midden "was built up against a pre-existing structure or structures ... between burial clusters". It could have been a pathway. The shell midden terminated abruptly. A hiatus in mortuary activity, between MP3 and MP4, then occurred. A point just below this marks the boundary between CP2 and CP3. Firing stands make a reappearance in the upper level of layer 10. Apart from a single fragment in layer 10:15, which is readily explained as the result of post-depositional disturbance, due to posthole excavation (Higham and Bannanurag 1990:36), the remaining ceramic stands uncovered in CP2 contexts derive from layer 10:3 to 10:5. Their presence is, therefore, considered to represent pottery firing activities during a hiatus in use of this area as a cemetery. An ash lens protruded into the southeast corner of the excavation square and this may have been associated with pottery firing.

Corroboration that funerary activities had ceased in this area is clear from the dramatic increase in charcoal density at this point in the stratigraphic sequence when charcoal deposits reached their maximum for the site (Thompson 1996:54, Fig. 6). These "outstanding concentra-

tions" of very large charcoal fragments are considered to have been deposited following multiple fires or by rapid deposition (Thompson 1996:69). Whether the charcoal derives from pottery firings or some other events, such as clearing of vegetation from the site following a period of abandonment, is unclear. Coupled with the ceramic firing stands, ash and charcoal, is an outstanding increase in the quantity of potsherds in layer 10:2. The excavators found no evidence of abandonment (Higham pers. comm.) but for *this portion of the site* at least, these changes could suggest abandonment. The charcoal and pottery concentrations could have resulted from a brief period of non-mortuary activities following re-occupation of the area. Hence both ceramic and non-ceramic evidence are in concordance confirming that a major cultural change occurred at this point. We will examine these and other data in more detail in Chapter VIII. The abrupt transition from CP2 to CP3 is marked by the hiatus in burial activities, which followed, and is related to changes in upper MP3 mortuary rituals. Evidence presented in Chapter XI clearly demonstrates that this hiatus separates two cultural traditions, defined by changes in the ceramic spectrum and mortuary ritual.

Rim sherds indicate that several vessel forms ceased to be produced following the hiatus in mortuary activity and that a range of new wares made their first appearance during CP3. In conjunction with these changes in vessel forms, local ceramic fabrics also changed. A new clay source was exploited by the local potters and, in terms of grave furniture, potters achieved recognition and some appear to have been accorded high social status. But the quality of local fine wares did not exceed that of the preceding local tradition. Anvils, several with what appear to be potters' ownership marks, were often included as grave goods. It is unclear whether the CP2/3 hiatus represents a dislocation in local social groupings. The possibility that genetic relationships run through the sequence, bridging the stratigraphic hiatus, is discussed elsewhere in this series (Tayles 1999). Burials in CP2 are in groups and in CP3 they are aligned in rows. Initially the CP3 grave groupings follow a similar pattern to those in CP2, but then soon change to clearly defined rows. This suggests that both groups were aware of the presence of earlier interments, but not necessarily that the later inhabitants were directly connected in any familial way with the preceding people. Certainly the burial urns in both halves of the cemetery are similar, however this is most likely a consequence of regional style rather than familial affinities.

In pottery terms, a major change took place in tandem with the establishment of CP3. Concurrent with a change in the overall rim form spectrum, a new style of local coarse ware was substituted for the earlier dominant form. These vessels were made as containers and they form by far the largest proportion of the pottery recovered from all levels throughout the sequence. The CP3 version replaces a form which was preferred by local potters during both CP1 and CP2. These vessels are simple in form and probably quickly constructed. Their coarse cord-marked surfaces and rudimentary rim construction, coupled with their abundance and ubiquity, clearly signal their utilitarian purpose. Changes in such wares are unusual in pottery sequences, because one form is just as expedient to make as another. Thus no technological reason would appear to exist to change from a well established form to another unfamiliar one which fulfilled an identical function and was constructed from essentially the same material and in the same manner. The differences between the two form shapes are obvious but technically subtle. This kind of change in form is considered an important indicator that cultural changes occurred with the advent of CP3. It suggests that a new group, which included potters who made wares under the same

regional rubric of the earlier potters but who were different to the preceding inhabitants in some respects, had re-occupied Khok Phanom Di following a brief abandonment. These changes are comprehensive and unlikely to have been caused by the arrival of one or two potters whose foreign methods were copied by locals. The simple utilitarian containers clearly reflect that a change in potting methods, and by implication a different group of potters, was initiated with the resettlement of the site, which took place following a period of abandonment. Although the forms, fabric and range of wares produced on site changed, the use of this portion of the site as a cemetery, in a similar fashion as before, strongly suggests that while the personnel may have changed, their cultural affinities probably continued in much the same manner as before. Just as the pottery forms and fabrics are similar, but clearly different. This point is expanded upon and discussed in more detail in Chapter IX.

At 1.32 m below datum the excavated portion of the site ceased to be employed as a cemetery. From this point the excavated area was mainly given over to potting activities. This is abundantly evident in the numerous discarded dumps of unfired prepared potting clay, in the form of cylinder fragments, potting tools and masses of pot sherds. Potsherd concentrations reached their maxima in this portion of the excavation and numerous potters' anvils, burnishing stones and bone stylus points were also recovered in association with the pottery and clay. This portion of the site is, therefore, considered to have been used as a pottery workshop during this period (CP4). Many of the ceramic anvils again feature what appear to be ownership marks, confirming that potting at Khok Phanom Di, at least during CP3 and CP4, was carried out by craft specialists. The forms and fabrics of local wares change during CP4. The range and style of local wares differs from the previous CPs, although some regional forms continue as before. Rice husk is used for the first time to temper local coarse wares. In addition, bleb grog is also made on site for the first time. It was mainly restricted for use in fine wares. A new clay source was exploited and, in addition, the local fishpond clay is sometimes used for coarse utilitarian wares. Again, although overall the style of the local potting tradition follows, in many respects, the earlier traditions, major stylistic and technological changes are apparent.

Changes are also apparent in the faunal spectrum, with marine species giving way to terrestrial taxa. According to Grant and Higham (1990:188), these changes in the faunal spectra are correlated with environmental changes related to a fall in the sea level. They are also mirrored in the pollen spectrum (Maloney 1991), the molluscan and micromolluscan spectra (Mason 1991, 1996) and the botanical remains (Thompson 1996). Potting was carried out in this area of the site until its final prehistoric abandonment perhaps sometime during the middle of the second millennium BC following its intermittent habitation and exploitation as a pottery centre, on four separate occasions.

POTTERY AND CULTURAL SEQUENCES

In this study, pottery is used to define different ceramic periods. These periods are considered to have cultural significance beyond the parameters of the potting traditions themselves. The definitions are achieved through approaching the data in several ways. First, each period is defined in terms of the excavated pottery and related evidence for potting. Second, changes in

the stratigraphic sequence, as reported by the excavators, are considered to determine whether they coincide with the ceramic evidence. Third, non-ceramic data from both within the site and the broader environs are examined for possible changes which may have had an impact on the local pottery production. Such data include both cultural and physical evidence from the natural environment. The former include mortuary ritual and non-ceramic artefacts. The latter, floral and faunal data researched by others. Finally, the local and regional geology, geomorphology and external relationships will be taken into consideration.

Pottery is ideal for tracing cultural changes because of its unique qualities of plasticity and durability. To extract the maximum information from prehistoric pottery, both the form and fabric of wares needs to be considered. This concept of the pottery type lies at the core of cultural sequences constructed from ceramic assemblages. In this study fabric refers to the material which comprises the finished ceramic body of pottery wares. The term form is used to describe all the morphologic aspects of the ceramic body including its shape, colour, texture, density, surface decoration and firing characteristics. When the fabrics of local wares are understood, the significance of changes in the forms of wares can reflect cultural events. Similarly, and equally, changes in pottery fabrics are important, even in the absence of changes in the form of the wares. When both change in unison, then major cultural changes may be indicated.

RELATIVE AND ABSOLUTE DATING

The importance of pottery for dating has not been significantly reduced by the advent and development of radiocarbon dating and dendrochronology, according to Orton *et al.* (1993:182). For example, the majority of excavation publications (83 per cent), in a recent survey of Romano-British site reports, continue to use, at least to some extent, dates derived from the study of ceramics (Fulford and Huddleston 1991:5, as cited by Orton *et al., op. cit.*). Radiocarbon dating carries flaws. First the values given need to be treated statistically. They are approximations only. Second, adjustments have needed to be made for fluctuations in the rate of production of ^{14}C over time. Because this rate has not been uniform throughout the past, re-calibration based on dendrochronology has been applied with some success. For these and other reasons discussed below, there is always a margin of error involved in radiocarbon determinations. As Rosenfield and Smith (1997:409) observe, however, "so far radiocarbon determinations have been privileged on the basis of their status as the results of objective, scientific research" ... "an attitude clearly rooted in what Feyerabend (1975) called the socially privileged status of science". These comments refer to the dating of rock-art, but equally apply to any aspect of relative dating which employs the typological seriation of material remains to establish cultural sequences or chronologies. To adherents of this new scientific Kuhnian paradigm, radiocarbon dates may often seem to provide a quick, relatively simple, answer with apparently impeccable scientific credentials. The actual situation, unfortunately, is less simple.

The reconciliation of radiocarbon chronologies with relative sequences has often been fraught with difficulties. For example, in a recent review of Iron Age dates for Inner Asia, Hall (1997:863-74), using a Bayesian calibration program, which involves "the incorporation of dendrochronological data, historical information and stratigraphic relationships that can refine the calibration

of radiocarbon determinations" notes that some of the calibrated radiocarbon dates do not correspond with the art-historical stylistic approaches because some artefact types and art styles were in fashion for longer than previously supposed. According to Hall, many of the dates were published before the ^{14}C calibration curve had been determined, and because the statistical nature of ^{14}C dates were not fully appreciated they were rejected or ignored and the chronology was largely based on cross-dating with artefacts and art styles. Hall notes, however, that "the calibration of ^{14}C from charcoal and wood does pose some chronological problems" because the radiocarbon dates only reflect the calendrical time of the tree rings dated (outer rings reflect when the tree was felled and not necessarily when it was used; inner rings are earlier). Therefore, "without detailed information, it is often hard to assess what the date represents." Old wood needs to be taken into account because the outer 30 per cent of a tree radius represents approximately 50 per cent of the volume, whereas the inner 30 per cent accounts for only about 10 per cent (Asch and Brown 1990:185, as cited by Hall *op. cit.*). When dating charcoal or wood, it is, therefore, crucial to establish both the age of the tree and its species so that these data can be taken into account. Hall (1997:872) recommends that "multiple samples of short-lived species" should be used, or, if wood samples are involved, "the dendrochronological sequence should be determined." In essence this means that, when dating charcoal, in addition to establishing the species of tree involved, the part of the tree the wood was derived from also needs to be known. In the above example species such as birches, larches and poplars, commonly with a life span of about 100 years, and pines which rarely exceed 200 years, were most likely involved. Finally, Hall notes that averaging, or "pooling" of radiocarbon determinations was only done on ^{14}C determinations from the same context and from similar materials. This has important implications for the Khok Phanom Di radiocarbon determinations as it is unclear whether the charcoal samples were speciated.

Another example, perhaps more pertinent to the present study, because it involves a coastal site, is reported from Southern New Caledonia (Galipaud 1995:77-109). Initial settlement at TON-7, in Naïa Bay, was at first dated by a single determination from charcoal in a big oven at the base of layer 1 (ANU-96). Additional charcoal from the same oven was later submitted for AMS dating (BETA-73012), however, the date was several hundred years younger than the initial date (the conventional age is about 600 years adrift). This problem has been recognised elsewhere where AMS dates have been considered to be too early (see Bellwood *et al.* 1992). At Nong Nor, AMS dates are also highly variable, with "two of the five determinations are rather earlier than the other three, and the one securely provenanced conventional date" (Higham 1996b:246).

Clearly radiocarbon determinations need to be considered in conjunction with other archaeological evidence. They should not be accepted as precise on their own, without this support, because they may be thrown into doubt when they are at variance with the larger body of available archaeological evidence. Pottery assemblages provide an important relative measure against which such absolute dates can be compared. At Ban Na Di, for example, ten radiocarbon determinations were "all taken from charcoal in firm contexts relating to the burials in group B. No charcoal from *in situ* features was found in area A, but the related ceramic styles between the two areas encourages the application of the dates to both" (Higham 1996b:203).

A measure of the status accorded radiocarbon dating, by the archaeological community, can be gauged by the reliance placed on such determinations, in spite of the difficulties often

encountered when attempting to correlate them with archaeological sequences. For example, the editor of a highly respected journal noted:

> "There has been a great deal of radiocarbon chronology in ANTIQUITY these last few years. There is more in this issue -"..... "I make no apology, even when their tables are hard going. Sound chronology is fundamental, and for much of prehistory and early history a sound chronology largely means radiocarbon. I wish radiocarbon was not so messy, either in its statistical uncertainty, or in the intricacies of calibration, or in the scattered publication (and non-publication) of determinations since *Radiocarbon* date-lists no longer kept up, but radiocarbon is what for most part we have." (Chippindale 1993:196 (quoted verbatim)).

This quotation followed Anderson's detailed analysis of radiocarbon dates derived from archaeological contexts, with particular reference to the colonization of New Zealand, and it accompanied publication of Spriggs and Anderson's examination of dates for the colonization of the rest of East Polynesia. They applied Stuiver and Pearson's (1986) standard calibration curve to the available dates. This calibration curve was later revised and updated (Stuiver and Reimer 1993:215-30). Advice to archaeologists on how to apply this updated calibration curve followed the next year (Buck *et al.* 1994:252-63), including a caution that radiocarbon results are imprecise, and the suggestion that "a Bayesian statistical approach that incorporates the radiocarbon results, the archaeological information and the high precision curve into one calibration process" be used. When determining a single event, replicated samples are advised in order to reduce the high range of calibrated dates which are sometimes encountered. Such samples are best derived from the same archaeological context and be of the same material. The authors "feel that radiocarbon calibration should not be seen as divorced from the rest of the archaeology of a particular site or in a given region." Pottery is common in Southeast Asian sites and important for establishing relative dates.

CERAMIC EVIDENCE

> "Pottery has traditionally been the most important artifact for purposes of dating. It is durable, being made of fired clay, and therefore accumulates in quantity rather than decays and disappears after it is broken and discarded. ... Like any aspect of culture, the manufacture and functions of pottery are subject to patterning. That is, any single social group will not make every pot differently (or, of course, every one exactly alike), but will usually settle on a limited variety of shapes and decorative styles so that the pottery becomes definable and recognizable as a ceramic pattern of the society. Like all parts of a culture, pottery changes over time; by detecting these trends of change, an archaeologist can trace associated cultural changes and make short-term time distinctions after careful study of the ceramic remains." (Hole and Heizer 1973:293).

Relative dating relies on distinguishing changes in artefacts which are predictable through time. This requires the construction of a temporal sequence so that isolated samples can fit logically into the standard scheme. The very elementary "Stone, Bronze, and Iron Age" system is an example of a very generalized temporal system. At its core, relative dating relies on the presence or absence of artefacts in an archaeological sequence. Sequences of artefacts are central to relative chronologies. Seriation, a kind of sequence dating which depends on detecting changes in artefact styles, and their relative abundance, was originally used by Petrie (1899) to order grave-groups from cemeteries with little or no stratigraphy (as cited by Orton *et al.* 1993:11). A similar approach was employed by Bayard (1984:87-122) in an attempt to date the Non Nok Tha sequence using the largest current assemblage of pottery vessels from archaeological contexts in Thailand. Seriation has also been widely used to create regional chronologies based on surface collections of sherds. The technique was first devised by Kroeber in 1915 to order surface collected pottery.

We have noted that seriation depends on the fact that different kinds of artefacts change stylistically, and in their relative abundance. Stylistic changes, however, are not the same as technological changes. Even when marked stylistic changes have taken place, potting techniques may often continue in the same manner as before. Technical continuity, in potting, can be maintained independently of stylistic changes because a wide variety of forms can be created using even quite rudimentary methods. More sophisticated techniques allow even greater flexibility in creating new styles using traditional potting methods. For example, Trachsler (1965:140-60), reports that during the "so-called Urnfields and the later phases of the Hallstatt period" potters were imitating the highly decorated metal vessels both in form and surface decoration. The latter extended to punched, embossed, incised, engraved or inlaid decoration, so that the pottery closely imitates the metal vessels. "A number of pottery types are represented in identical shapes among the contemporary metal vessels" (Trachsler *op. cit.*). There are copies of bronze cups with band-shaped handles "in pottery showing pseudoedges of pseudosheet metals and pseudo-rivets" (Trachsler *op. cit.*).

> "The most striking aspect of the "metallic look" of the Urnfield pottery is its aim to endow the outside of vessels with a brilliance equaling that of a polished metal surface. For the first time in the Swiss Alpine region, ceramic vessels received a graphite coating which gave then a surprising metallic aspect. The nearly mathematical precision in the shaping of the Urnfield pottery is all the more astonishing because none of the vessels were thrown on the wheel." Trachsler (1965:146).

In ceramic studies, therefore, when stylistic and technological data are combined, an added dimension is incorporated into the analysis which is not available to style-only studies. Stylistic-based dating sequences are restricted to artefact forms and related fashions. It is important to note that, although fashionable styles may endure for long periods, technology is the subject of almost constant review. Technical improvements and modifications are a central part of the potter's craft. Technical innovations are important markers of the evolution of any potting tradition through time. Arnold (1985:202), for example, describes labour-saving innovations, some of which create new feedback mechanisms. This does not mean that potters are technologically whimsical; on the

contrary, they tend strongly towards conservatism in critical technical aspects of their craft such as the use of materials and the drying and firing of formed wares. Improvements will usually only be adopted when proven. Further, changes in the kind of pottery fabric composition in a ceramic sequence do not necessarily indicate cultural changes other than technological change. Determining the degree to which such changes are culturally significant requires examining both the stylistic and technological aspects of a ceramic sequence.

Provided the origins of pottery types are understood, changes in pottery styles can signal significant cultural changes. Similarly, technological changes may also be culturally significant. This is strengthened, however, and cultural events of considerable magnitude can be anticipated, when both change in tandem. For example, at the Sakon Nakhon Basin site of Ban Na Di, major cultural changes were heralded by a gradual increase in the number of exotic wares imported from the Khorat Basin. This occurred prior to the introduction of a new potting tradition which featured a different technology and different pottery styles (Vincent 1988:188-93). This new tradition, characterised by bleb grog and red painted geometric designs, mirrored that of Non Chai. A range of non-ceramic changes, such as the abandonment of a centuries-old cemetery (replaced by a bronze working area featuring local crucibles) and the introduction of infant urn burials, occurred in unison.

These comprehensive changes are considered to mark the arrival of new groups into the Sakon Nakhon Basin from the south (Vincent 1984:689-90). The same ware types were also recovered from Ban Muang Phruk, a site probably settled at about the time the new potting tradition appeared in the Ban Na Di sequence. The new pottery styles replaced a substantial portion of existing Sakon Nakhon Basin traditions. Ceramic evidence was “perhaps the clinching point” in determining that a major cultural change had occurred at Ban Na Di and in the wider Sakon Nakhon region (Higham and Kijngam 1984:700).

The whole process of determining whether changes in assemblages of prehistoric pottery are relevant, therefore, gains in importance when both stylistic and technological changes occur simultaneously. Such developments are further reinforced when they coincide with changes in the body of non-ceramic evidence in the archaeological record. This concordance is significant and signals major cultural changes. In some cases it may be difficult, in the first instance, to detect whether change occurred in any separate aspect of a ceramic spectrum. This is because apparently minor, but technologically significant, changes may not be immediately obvious. Some may occur independently of ceramic styles. In this manner the continuing overall stylistic patterns may mask important underlying technical adjustments. Distinguishing whether changes in the technological components of a ceramic tradition have affected its stylistic patterns requires a detailed assessment of the local pottery typology. This is achieved by comparing wares made under the new technology with the overall ceramic spectrum. If the style of the contemporary wares has changed, or if the balance of the assemblage differs in some respects from the earlier local pottery spectrum, then significant changes can be anticipated. Major changes in the local technology may sometimes occur without any obvious change in the style of local wares. This is because cultures may identify with regional styles or contemporary fashions. Only through a detailed assessment of the complete ceramic assemblage can changes in the local traditions be detected with confidence.

Major components of any potting tradition are the members of the potting community, who

possess the necessary technical and artistic skills to create the pottery, the raw materials used to form and fire the wares, and, finally, the consumers. At Khok Phanom Di, evidence for each is available from the excavated materials. For example, from the lowest levels evidence for preparing potting clay and forming vessels is present. This is derived from clay dump residues and pebbles for tempering material. Ceramic potters' anvils and burnishing stones used to form and then to polish the shaped vessels were also recovered. Several areas of ash and burnt clay, associated with ceramic stands considered to have been used to support pottery firing rafts, suggest pottery firing activities. During this CP local pottery featured sand temper. Following shortly after this the area was used as a cemetery and local wares were tempered with grog. Some graves contained this local pottery. The basal area has been interpreted as CP1 and the overlying deposits as CP2.

CORROBORATING CERAMIC WITH NON-CERAMIC CHANGES

Corroboration of changes in the ceramic spectrum with other aspects of the archaeological record helps confirm conclusions derived from the ceramic evidence alone. Because ceramic change often reflects cultural change, the characteristics of the latter can be closely linked to ceramic styles and ceramic technology. Links between any changes in the pottery industry, site use and non-ceramic evidence, therefore, need to be examined for any correlations. For example, simultaneous changes in more than one cultural subsystem, such as pottery technology and subsistence, can signal important cultural developments and reflect local and/or regional changes of importance. One example of change in site use, from a pottery firing area to a cemetery, has been given above. Changes in the non-ceramic evidence, such as that reflected in other artefacts or inferred changes in the environment derived from floral or faunal data, are also considered. When one or more such change has been detected, these have been considered corroborative evidence suggestive of cultural change. When an interruption in a ceramic tradition occurs contemporaneously with, for example, changes in flora and/or fauna, this further strengthens the case for cultural change. Such cases have been considered for possible co-relationships with the larger corpus of archaeological data.

The criteria used to define the four CPs recognised in the Khok Phanom Di sequence concern two aspects of the evidence, ceramic and non-ceramic. The ceramic data were used to define differences in the assemblage following the principles discussed in the previous chapters, particular attention being paid to both the material the pottery was made from as well as the style of the various wares represented. In the first instance this involved evidence derived from the excavated material. Once these data had been analysed, evidence from further afield was considered using the Khok Phanom Di material as a database. The non-ceramic evidence involved both the excavated materials and any external evidence which might suggest that cultural change local to Khok Phanom Di was correlated with concurrent external developments. Such changes were sought in both the archaeological and environmental aspects of the available evidence.

SUMMARY AND DISCUSSION

The ceramic spectrum at Khok Phanom Di can conveniently be divided into two major subdivisions, pottery making and pottery, including pottery related artefacts, interred as grave goods in two cemetery sequences CP2 and CP3. The first part of the spectrum (CP1), and the last (CP4), are characterised by potting activities. They bracket the cemetery phases. The former was mainly associated with firing pottery, the latter with preparing potting clay and forming wares from the prepared clays. Lower layer 10 and layer 11 contained much ash and numerous complex lenses. This, coupled with the presence of clay dumps, temper caches, anvils and ceramic firing stands, suggests that during CP1 a mixture of pottery clay preparation, pottery making and firing was carried out. By contrast, during CP4 no evidence for firing was found but an abundance of prepared clay, the highest proportion of anvils and the greatest concentration of potsherds were identified. The intensity of pottery making during CP4 is outstanding and suggests that during the final occupation phase pottery construction was concentrated in this area of the site.

Ceramic materials derived from the cemetery include local and exotic pottery and potting accoutrements. The fabrics of these local wares varies from one cemetery phase (CP2) to the other (CP3), indicating a change in the local potting tradition took place. This is also evident in the style and range of wares present in the different CPs. During a hiatus which separates the two cemeteries, and CP2 from CP3, the deposits revealed evidence for the firing of pottery. This suggests that pottery was briefly manufactured in this portion of the site before burial activities were re-established during CP3.

This chapter has set out the criteria used to define the four CPs at Khok Phanom Di. These criteria comprise ceramic as well as non-ceramic evidence. Included in the latter are faunal and floral data, along with physical evidence related to changes in the local and regional environment. Some of this has been briefly summarized. A more detailed discussion of these points is covered in the following chapters, VII to X inclusive, which detail the various prehistoric ceramic traditions. The data discussed in these chapters should also be considered in terms of the results as set out in the appendices at the rear of this volume. In Chapter VII we will consider the initial ceramic tradition at Khok Phanom Di which predates the earliest human burials.

VII CERAMIC PERIOD ONE

CERAMIC PERIOD ONE (CP1) is represented by pottery, potting accoutrements and the remains of pottery firing areas from L11 to 10:25. It is defined on the basis of its distinctive local fabric and potting procedures. It comprised occupation and pottery working areas.

The cultural deposits mainly consist of grey ash-rich materials with much charcoal. They span L11, which the excavators report reached a maximum depth of 26 cm, from 6.55 to 6.81m below datum, and the lowest portion of L10. Layer 11 included an ash/charcoal lens, a hearth radiocarbon dated to 2130-1700 BC (ANU-5493) and two caches. These caches were in small pits cut into the natural substrate and "must represent the earliest cultural activity in this part of the site" (Higham and Bannanurag 1990:31). Detailed north and south sections (Figs. 34 and 35) indicate the extent of ash and other lenses encountered. These lenses continue into lower L10. In terms of the ceramic spectrum at Khok Phanom Di the following stratigraphic sequence has been designated to the deposits. In each Ceramic Period the stratigraphic units mentioned are inclusive.

Pottery from the basal deposits clearly differs from the overlying contexts. In order to determine whether this material represents a discrete potting episode, produced by a different potting tradition to the succeeding one, it is important to establish whether the basal deposits represent a separate period of occupation by a different group of inhabitants to those who later used this part of the site as a cemetery. There are several avenues open to consideration. First we will consider whether the pottery preparation and firing detritus in the basal deposits extended into Mortuary Phase One (MP1) which was the first of seven such phases in a cemetery used for approximately 500 years. We can also look for similarities and differences in the ceramic spectrum and consider whether it differs from the later traditions. Finally we can investigate whether there is any non-ceramic corroborative evidence to suggest that a hiatus occurred between CP1 and CP2.

THE STRATIGRAPHY (LAYER 11:2 TO LAYER 10:25)

In determining the depth below datum of each feature, the four corners of the 10 m excavation square have been averaged to give a working value of 6.809 m. The values given here may differ slightly from those previously published by the excavators, but any variations are generally considered to be insignificant. Where exceptions occur these will be noted. As the section drawings show, the first metre or so of deposits feature a series of complex lenses. Their colour varies considerably with ash at Munsell 7.5YR/4/6 (strong brown), 7.5YR/7/2 (pinkish grey) to 7.5YR/6/4 (light brown), and the so-called pink lensing at 5YR/5/3 (reddish brown), 5YR/6/4 (light reddish brown) to 5YR/4/6 (yellowish red). From L10:25 to 10:17 (5.60 below datum) the deposits are characterised by lenses of ash, charcoal and shell together with numerous hearths

and patches of burnt clay (Higham and Bannanurag 1990:33-4). From L10:24 a series of postholes are present and by 10:22 these become numerous. In L10:21 at 6.01-6.10 m below datum, a lens measuring 2.4 m by 1.5 m of "fire-hardened clay" is present. At this point in the sequence MP1 ended.

According to the excavators, burial (B) 153, the earliest, was cut from 6.51 m below datum (Higham and Bannanurag 1990:19). It is important to note that of the six graves assigned to MP1, only B147 and B150 were complete or undisturbed. B147 was cut from a depth of 5.88 m and B150 from 6.01 m (Higham and Bannanurag 1990:33). It is possible, therefore, that the CP1 pottery activities accumulated as much as 93cm of ash and clay deposits prior to the use of this portion of the site as a cemetery. Wind and water deflation may have acted to spread and erode the surface of the site during this initial occupation period. Some of the ash could have resulted from burning off the vegetation (Bannanurag 1989:346). Two earlier excavations at different locations in the site reached depths of 8 m and 8.5 m, which suggests that the 1985 excavation may have encountered the highest point of the underlying natural ground surface. If so, the effects of deflation could reasonably be expected to be at a maximum in this part of the site. Within L10:25 at between 6.40-6.52 m below datum a hearth provided a radiocarbon date of 2120-1525 BC (ANU-5492) a charcoal concentration a date of 2450-1905 BC (ANU-5490), and an ash lens within L10:15 is dated to 2270-1740 BC (ANU-5486) at a point 5.44 m to 5.54 m below datum (Higham and Bannanurag 1990:33). These radiocarbon inversions are relatively minor in terms of the overall chronological sequence, however they could indicate that the lowest 90cm or so of the deposits belongs to an initial occupation period unrelated to the overlying cemetery.

Unfortunately none of the MP1 burials included pottery vessels. Within the lowest deposits, however, (Fig. 36) feature 2 revealed two vessels and these are considered in the following section. In terms of the ash, charcoal and clay deposits it is argued that MP1 was cut into pottery firing and manufacturing debris which had accumulated during CP1 to a height of at least 90cm. It is likely that these deposits were subsequently reduced through deflation. Small pits but no postholes were found in L11 or L10:25. Postholes first occur in L10:24 (Higham and Bannanurag 1990:33). The earliest burials (MP1) were in graves no more than 20 cm deep, again suggesting some form of site deflation. The very fine lensing in lower contexts, according to Higham (personal communication), probably reflects redeposition by flooding due to monsoon downpours. The graves were in or next to shell middens and ash lenses. The oldest individual, a 37 year-old male, was the only burial which included offerings. One infant was wrapped in *tapa* and red ochre is also evident. "This practice continued until the end of the burial sequence." (Higham and Bannanurag 1990:143).

A schematic summary of the ceramic and mortuary sequences along with their relationship with the excavated layers is set out in figure 33 as a general guide. The vertical scale is approximate only. Apart from CP4 when a concordance between the excavated stratigraphic layers is clear, none of the other Ceramic Periods coincide precisely with these layers or the Mortuary Phases. These variations will be considered in later chapters when the remaining Ceramic Periods are examined in detail.

The pottery related artefacts of CP1 will be detailed in the following section. In some instances it is useful to consider some artefact groups in terms of their similarities and differences throughout the entire prehistoric sequence. In examining these artefacts in this manner we can

look for subtle changes and relationships between each Ceramic Period. Scanning the complete assemblage not only brings into focus temporal changes but should also help to identify any potentially mobile artefacts. The identification of cultural differences, in terms of the various ceramic traditions represented, is of critical importance. It may be possible through an examination of the ceramic spectrum to detect any continuities and discontinuities.

When an interruption in a ceramic tradition occurs contemporaneously with, for example, changes in flora and/or fauna, it may be possible to identify evidence for cultural change. Such cases will be considered for possible co-relationships.

THE POTTERY RELATED ARTEFACTS OF CERAMIC PERIOD 1

PREPARED CLAY

Dumps of prepared potting clay were recovered from all except the uppermost layer. All have been examined in hand specimen and some in thin section. Only three small dumps were located in CP1 (Table 8). In two, the clay was not tempered. The other from L11:2 was tempered with a sand which is consistent with fabric group one (FG1). Some of this unfired clay was still attached to a cord marked sherd typical of this Period which was itself composed of FG1. This is a clear association of the prepared clay with a contemporary local ware ceramic body. The clay is coloured a light grey (10YR/7/2). The presence of pottery with the prepared clay from which it was formed is a clear and unequivocal correlation which establishes the presence of potters at Khok Phanom Di. The author is unaware of any other such associations, which have been previously been reported, from Southeast Asian archaeological contexts.

The mineral composition of the dumped clays matches local clays retrieved from sample points in fields bordering the site. They are moderately micaceous and contain mostly medium-sized silt comprising mono- and polycrystalline quartz, rare chert, microcline, plagioclase and potassium feldspar and very rare sponge spicule fragments. Authigenic calcite, often micritic, is common and sometimes abundant in the archaeological sample. What appear to be diatom fragments are present in clay from L10. It is important to note that in some instances, dumped clay samples have been almost completely altered by the post-depositional effects of ground water. The mechanisms by which such mineral replacement takes place are outside the scope of this report, although the relationships between pH and the solubilities of some minerals is well known (Blatt *et al.* 1972:361-8, Tucker 1981:58-60). In view of such extensive mineral replacement, the use of X-ray diffraction analysis to determine clay mineral presence would obviously not produce the desired results and was not pursued. In contrast to the later clays, those recovered from CP1 appear more micaceous in thin section.

Stratigraphy	Activity	Ceramic fabrics	Cultural features
Layers 1 & 2	Workshop	Rice & Blebs	potting tools
Layer 3			
Layer 4			
Layer 5	Upper cemetery	Orthodox Grog	burials in rows
Layer 6			
Layer 7			
Layer 8			
Layer 9			
Layer 10	Lower cemetery	Sandy Grog	cluster burials
Layer 11	Occupation	Sand	pottery firings

FIG. 33: Schematic summary of the ceramic and cultural sequences

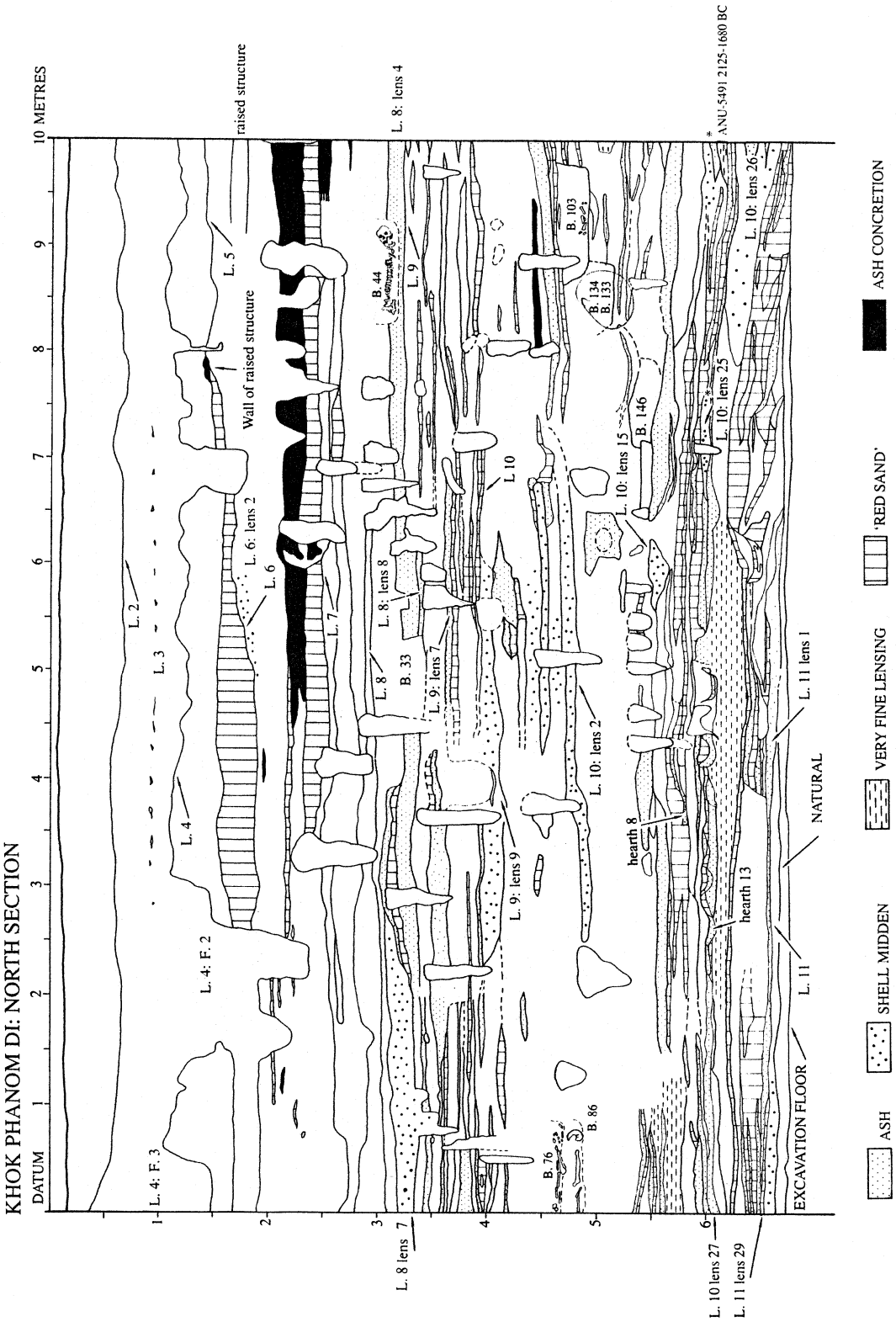


FIG. 34: The north section at Khok Phanom Di

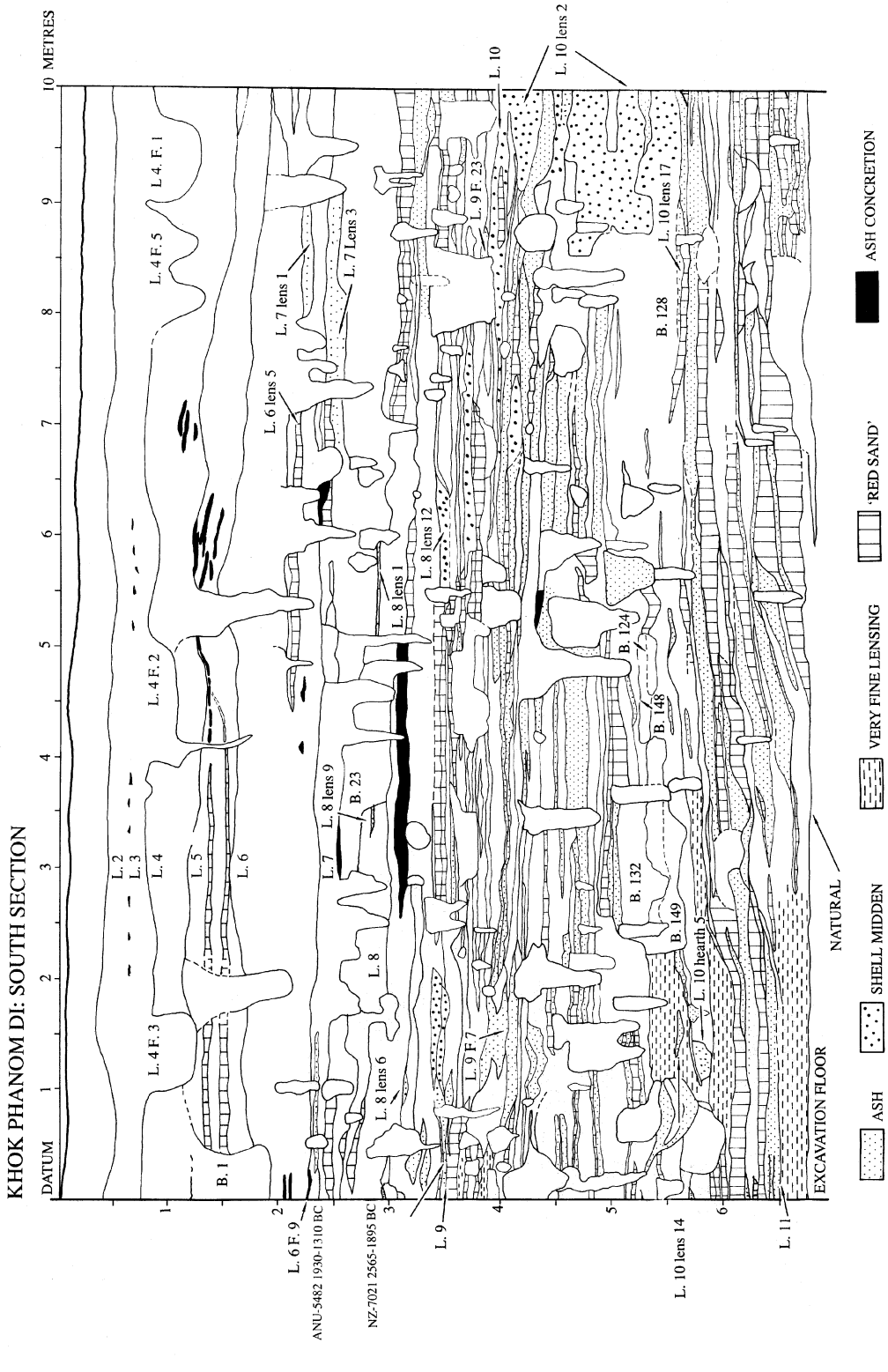


FIG. 35: The south section at Khok Phanom Di

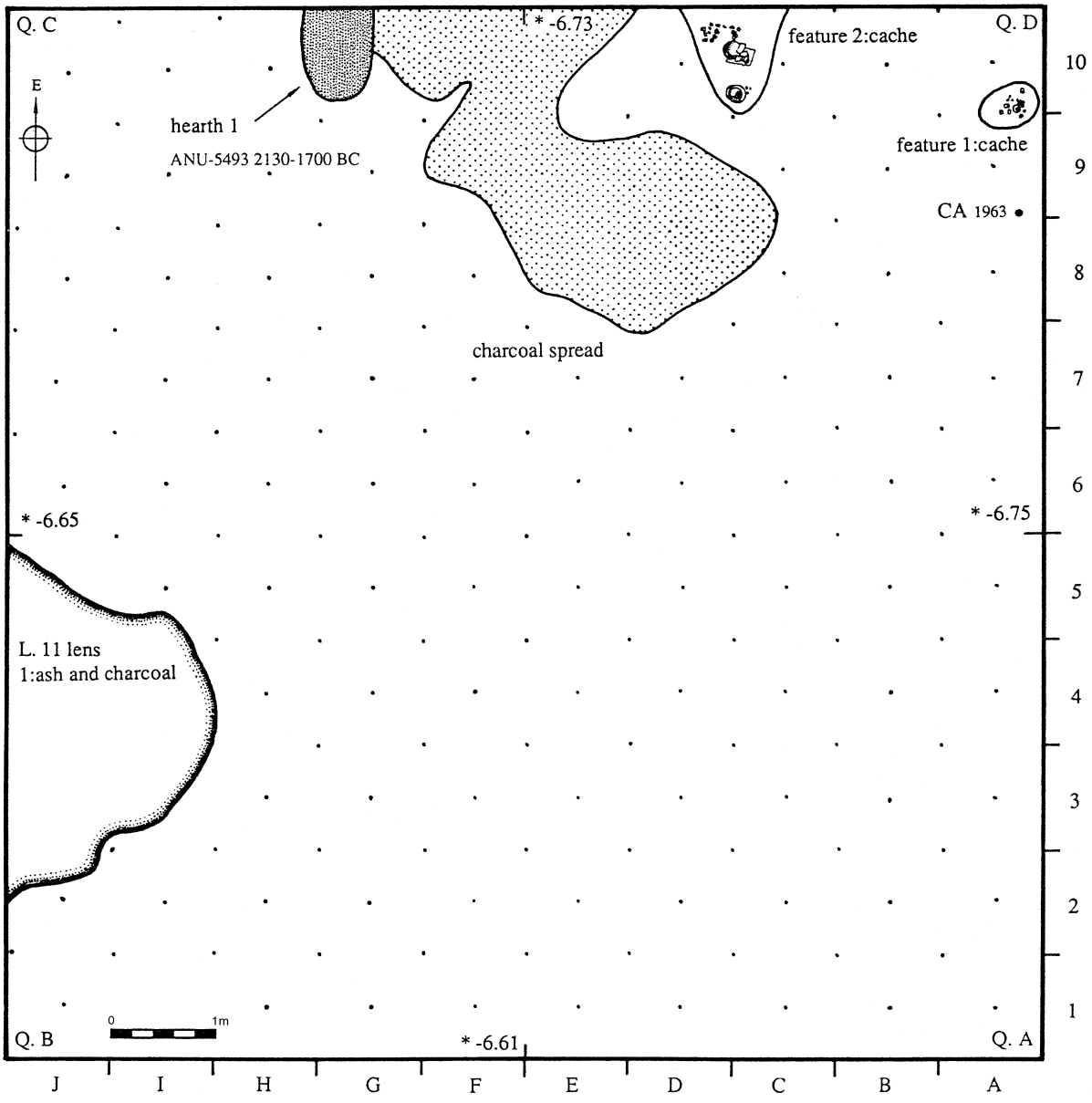


FIG. 36: The features identified in layer 11:2. *Abbreviations:* *: depth below datum, Q: quadrant, L: layer, CA: potters' anvil

THE TEMPER CACHES

Several caches of coarse sand to medium pebble-sized grains of mono- and poly-crystalline quartz, and ferruginous rock fragments were recovered from the lowest sections of L10. Eight of these grains were thin sectioned and examined petrographically. In thin section, some of the quartz grains are composite with some lenticular-shaped units, clear sutures and crenulated or granulated unit boundaries and strong undulose extinction which together suggest a metamorphic source (Folk 1980:69). Some polycrystalline grains contain units which are elongated in a preferred direction thus defining stretched metamorphic quartz (Folk 1980, Adams *et al.* 1984:5). Reddish brown "staining" is present between some of the units. The pebbles are subrounded with smooth surfaces. Also present are subrounded fine pebbles of ferruginous silty sandstone. These contain angular to rounded mostly mono- with some polycrystalline quartz grains. Some of the latter are defined as stretched metamorphic. Some grains are cemented by calcite. Surficial post-depositional authigenic calcite is also present on many of the grains. The latter probably derives from the leaching of shell midden.

The source of these pebbles is most probably inland from Khok Phanom Di where they were collected from stream gravels which had been weathered from a conglomerate and/or sandstone formation. Their size, shape and surface texture and the presence of an iron-rich cemented silty sandstone lends support to a possible conglomerate source. At least two sources within the Khorat and Ratburi Groups seem worthy of consideration. Conglomerate formations within the former Group do not contain pebbles and therefore can be excluded from consideration. Pebbly sandstone is present in the Ratburi Group about 87 km east of Khok Phanom Di along with fine to medium red to deep red sandstone and conglomerate. The presence of granitic quartz, and perhaps some plagioclase feldspar, suggest that some of the grains have been freshly weathered from granitic outcrops. It is possible, therefore, that the pebble and sand grains represent a mixture of source material. Tributaries of the Bang Pakong River originate adjacent to outcrops of the Ratburi Group which is considered the most likely ultimate source of the cache pebbles. Calculating the likely downstream transportation distance from source rock lies outside the scope of this report. We can be confident, however, that other lithic materials during CP1 were imported from the same area.

The Ratburi Group pebbly sandstone also outcrops about 170 km to the south east at several points along the coast. The texture of the cache grains, however, is inconsistent with a beach front source and the quartz is derived from a granite, not directly but from a sediment (pers. comm., J. D. Campbell). While it is possible that the cache pebbles were derived from streams in the latter location, and perhaps first used as water craft ballast, the distance involved is considerable. Threshold models for clay and temper resources are very similar and the optimum distance is 1 km or less (Arnold 1985:54). Long distance transportation of clays and tempers, however, is unusual but should not be ruled out. Quinua potters, for example, transport clays, tempers and slips 340 km (Arnold 1985:56). Canoe distances to resources greatly exceed non-canoe distances. For example, Amphlett Islanders travel 24 km by canoe to their clay source on Fergusson Island (Lauer 1974a:131,143). The Motu of Papua New Guinea undertake an annual long distance *hiri*

coastal trading round which extends about 400 km along the Gulf of Papua. The main commodity of the *hiri* exchange activities is pottery (Arifin 1991:373-4).

Volcanic silt and sandstones dominate the adze assemblage recovered from basal deposits at the site (Pisnupong 1988:134). This material lies adjacent to a tributary of the Bang Pakong River about 60 to 70 km distant to the east in a direct line. Most of the polished stone artefacts from the 1982 excavations derived from extrusive andesite and andesite tuff (Pisnupong 1993:45). Such rocks outcrop in uplands 60-100 km east of the site adjacent to the headwaters of the Bang Pakong River and are considered to be the most likely sources for the stone artefacts at Khok Phanom Di (Pisnupong 1993:102).

The stretched metamorphic quartz and subrounded fine pebbles of ferruginous silty sandstone are mineralogically identical with smaller mainly angular fragments of such nonplastics which were used to temper CP1 local fabrics (FG1). Local pottery from CP1 is distinct from any of the later local ware traditions in that it was tempered with sand. It is considered that the cache pebbles were used to temper the FG1 local pottery. These pebbles were crushed into smaller fragments to suit their inclusion as temper in the prepared clay fabric. The temper grains are angular and range in size from approximately 0.04-1.6 mm. The clay matrix and nonplastic inclusions of FG1 differ mineralogically from the temper. The clay matrix is micaceous and the minerals suggest an igneous association. A full description of FG1 is set out in Appendix 1.

ARTEFACT CACHES

Two caches were found within the lowest cultural context (Higham and Bannanurag 1990:31). The first included a potter's ceramic anvil "ringed by twenty-one burnishing stones and three stone adze heads." A second cache contained "two pottery vessels, a burnishing stone and seven stone adze heads." In addition to these artefacts several further burnishing stones and anvils were recovered.

CERAMIC ANVILS

Artisans' tools used to form, shape and compact the prepared clay fabric so as to render it suitable for firing, are an essential component of potting. Anvils are an important part of this equipment in non-wheel potting traditions. Some potting traditions merely employ smooth, approximately hand-sized, stones as anvils. Normally the anvil is held inside the vessel being formed while a wooden paddle is beaten against its adjacent outer surface to compact and shape the moist plastic clay. Ceramic anvils, in conjunction with wooden paddles and other potting tools, are an extension of their owners' skills as well as their cultural and individual styles. Just as burnishing stones signal a preference for a lustrous surface finish, the size and shape of anvils reflects the form of the finished vessels. Ceramic anvils can sometimes also provide important cultural information.

At Khok Phanom Di, 216 anvils, including fragments, have been identified from the 1985 excavations, the majority (62.96 per cent) being recovered from CP4 contexts. It is important to

keep in mind that the anvils are composed of fired ceramic materials. Ceramic anvils are strong, like stone, because they are in a sense composed of reconstituted rock. This ceramic composition affords the opportunity to investigate the origins of the material they are fashioned from. If they have been manufactured from exotic materials this is important *prima facie* evidence as to the possible movement of their owners as immigrants into the area. The distribution, condition and fabrics of CP1 ceramic anvils are set out in table 14

TABLE 14: *Ceramic Period 1 anvils.*
Thin section/h.s: K denotes thin section number, h.s. hand specimen

Cat.	Layer	Condition	Thin section/h.s.	Fabric
1988	10:25 lens 29	fragments	h.s.	grog local
2001	10:25 lens 29	fragment	K252	sand local
2009	10:25 lens 29	fragment	K250	sand local
1932	10:26 lens 31	fragment	K256	grog local
1933	10:26	frag-use wear	K184	grog local
1905	11:1	complete	h.s. (K252)	sand local
1907	11:1	fragment	-	no data
1923	11:1	fragment	h.s.	sand
1935	11:1	fragment	h.s.	sand?
1937	11:1	fragment	h.s.	sand
2006	11:1	fragment	h.s.	sand?
2006b	11:1	fragment	h.s.	sand
1963	11:2	complete	h.s.	sand local

Only 13 anvils have been recovered from CP1. Three, (cats. 1932, 1933 and 1988), are composed of the CP2 local sandy grog (FG2). The last sample has been assessed on the basis of hand specimen examination only. Given the tonnes of material considered, it is almost certain that they were displaced in prehistory from L10 where evidence for the making and firing of pottery was noted by the excavators (Higham and Bannanurag 1990: figures 23-28). In terms of their fabrics and form, the remaining anvils belong to CP1. A representative sample of the fragments is illustrated for comparison with anvils from later CPs (Figs. 37-38).

Four CP1 anvils have been examined in thin section and nine in hand specimen. Cat. 1905 is considered to be composed of the same fabric as cat. 2001 which was thin sectioned. Apart from cats. 1932 and 1988, all were tempered with sand. Those listed as local sand are composed of FG1. The remaining fragments are sand tempered.

Table 15 summarizes CP1 anvil sizes, colours and, where present, cord mark details. Only two of the 13 anvils are cord-marked. Anvil head diameters relate to vessel forms and two small anvils at 36-48 mm suggest that some small vessels were produced. The other samples are consistent with anvil sizes during subsequent CPs. Handle diameters were measured at the bottom of the handle. The colours range from red (oxidized surfaces) and reddish black (reduced surfaces) to very pale brown and dark greyish brown (reduced surfaces). The surfaces were often

TABLE 15: *Ceramic Period 1 anvils: size, colour and cord marks (mm)*

Cat.	Layer	Head: Diam.	Handle: Diam.	Height	Colour	Cord marks
1988	10:25 lens 29	-	-	-	10YR/7/3	n.d. 2-2
2001	10:25 lens 29	77	26 (est.)	53	10YR/5/4	-
2009	10:25 lens 29	70	-	-	5YR/7/3	Z 1-0.5
1932	10:26 lens 31	84	-	-	10YR/6/6 to 10R/4/8	-
1933	10:26	-	60	184	10YR/5/2 (reduced)	-
1905	11:1	36	15	40	10YR/5/4	-
1907	11:1	-	27	-	10R/5/8 to 2.5/1	-
1923	11:1	-	-	-	10YR/6/4	-
1935	11:1	48 (est.)	28	62 (est.)	10YR/4/2	-
1937	11:1	-	-	-	10YR/4/2	-
2006	11:1	-	-	-	10YR/7/2	-
2006b	11:1	-	-	-	10YR/4/2	-
1963	11:2	95	19	64	-	-

darkened by ash. Only two anvils were cord marked. Cat. 1988 is probably a CP2 anvil fragment and cat. 2009 is too fragmentary to determine whether it is an anvil or part of a firing stand.

This evidence is presented to help characterize the nature and extent of pottery activity during this initial period of site occupation. In assessing these data, we need to take into account any changes in the site use over time. CP2 and CP3 are predictably under represented in anvils because the site was used during these periods as a cemetery. Lower L10 and L11 contained much ash and a "complex and at times quite bewildering series of interlocking lenses" (Higham and Bannanurag 1990:32). This, coupled with the presence of clay dumps, temper caches, anvils and ceramic firing stands, suggests that during CP1 a mixture of pottery clay preparation, pottery making and firing was carried out.

THE BURNISHING STONES

Thirty small polished stones, considered to have been used to burnish local fine wares, were present in CP1. Layer 11:2, feature 1, contained 21 and feature 2 contained three burnishing stones. Four stones were recovered from L11:1, one from 10:26 and another from L10:25. Moore (1993:105-18) reported on over 300 mainly quartz "modified river pebbles" which "probably came from the stoney bottomed streams which issue from Khao Kirirom, the highest hill on the margins of the Bang Pakong flood plain, about 7 km south east of Khok Phanom Di." Their diameters range from 1-5 cm (Moore 1993:109, Fig. 37) and they display unidirectional use-wear striations and related facets. Burnishing stones were recovered from all layers in the matrix of

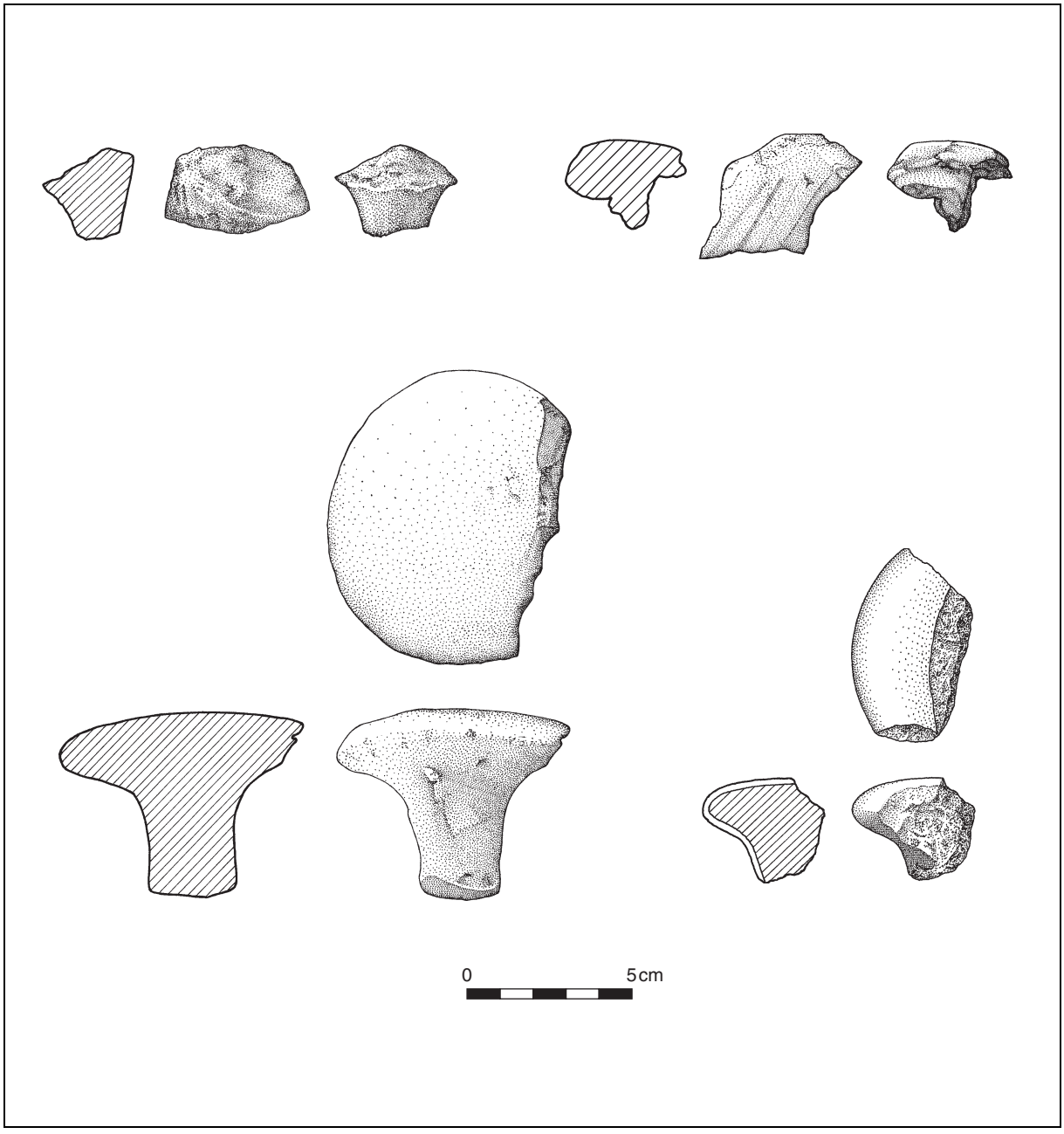


FIG. 37: Ceramic Period 1 potters' anvils. *Top* left: cat. 1933, right: cat. 2009, *Bottom* left: cat. 2001, right: cat. 1932. Shading indicates firing results (shaded areas are not oxidized)

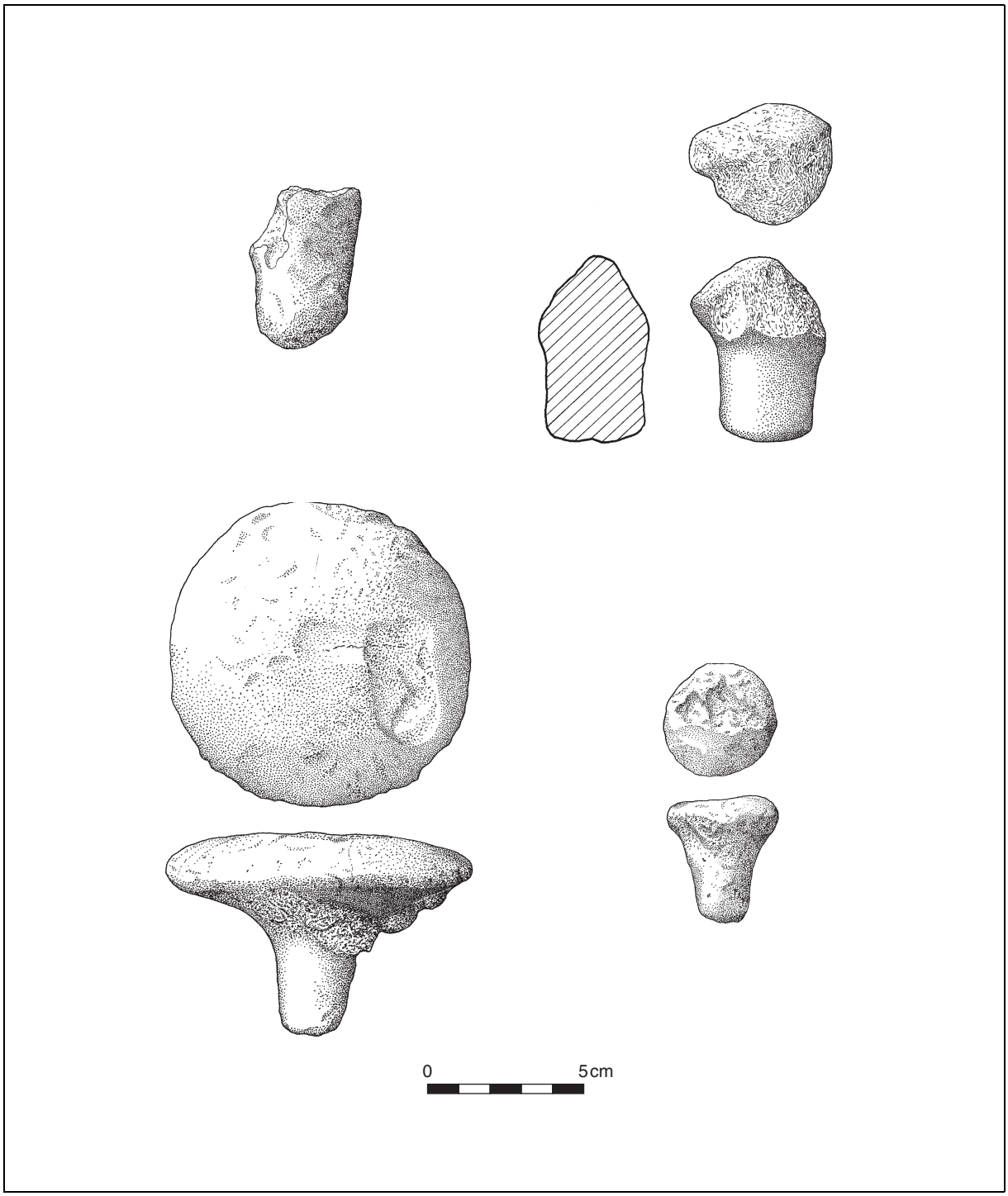


FIG. 38: Ceramic Period 1 potters' anvils. *Top* left: cat. 1907, right: cat. 1935, *Bottom* left: cat. 1963, right: cat. 1905. Shading indicates firing results (shaded areas are not oxidized)

the cultural deposits, in features such as caches, ash lenses and graves (Moore 1993:106, Fig. 34).

According to Moore (1993:107, Bannanurag pers. comm.), in 1986 women were burnishing pottery with such stones at Bang Paeng in Northern Thailand. Bannanurag collected samples of these stones and Moore notes that they exhibited "almost identical wear-patterns to those from Khok Phanom Di." The author provided Moore with a sample of local clay which was polished using an unworn pebble from Khok Phanom Di and after about 5 hours striations identical to those observed on the prehistoric specimens were clearly evident. This experiment was of insufficient duration to produce a facet which suggests that burnishing stones were used repeatedly over a long period of time. Bannanurag also noted that the Bang Paeng potters were reluctant to give up their stones because of the time needed to form suitable wear facets. Parallels between modern specimens, the consistent form of the wear patterns, the association with ceramic anvils in burial contexts, ethnographic analogy and the presence of burnished pottery at the site all point to the use of the stones to burnish pottery at Khok Phanom Di (Moore 1993:108). We will test this hypothesis in chapter XI by comparing the distribution of local burnished wares with the stones.

BONE STYLUS POINTS

A group of small bone artefacts of varying shape have previously been subdivided into three classes described as bobbins, awls and micro-awls. Bobbins are considered to have been used for weaving, awls for puncturing a "somewhat resilient medium such as fabric or leather," but no specific function has been assigned to the bone micro-awls (Higham 1993:1-44). An alternative function is proposed for some of these artefacts in this report. Some of these points are considered to have been used for incising the intricate decorative lines into fine wares and possibly some of the coarse ware vessels in the assemblage. The bone points were recovered from throughout the cultural sequence. It is possible that some of the bone bobbins and larger awls were used for incising pottery, but confirming this would require a more detailed investigation than is possible here. Their use by the Khok Phanom Di potters, however, should not be ruled out.

Striations within some of the incised grooves on pottery surfaces are similar to those produced by bamboo points used experimentally on leather-hard local clays while in the field. Many of the incised lines preserved in the prehistoric pottery, however, are smooth and lack any striations. It is these which may have been the product of the bone points. The incised grooves are mainly 1–2 mm in diameter and this corresponds with the size of the bone stylus points. Detailed analysis of the striations has not been carried out, nor has any investigation of whether these might correspond precisely with the incised lines in the pottery. The use of the points for incising is therefore speculative. Other materials, such as bamboo, could readily fulfil the function of an incising stylus, however, these would need regular replacement compared to harder bone points. A single such CP1 bone tool, cat. 2007, was recovered from L10:25 lens 29.

When potting clay is leather-hard, it is pliable and easily marked. This is because during the forming processes fine colloidal clay mineral particles migrate to the surface to form a more-or-less fine texture depending on the amount of coarse nonplastic material in the fabric. The paddle and anvil method of forming and shaping intensifies this process by compacting the fabric and

forcing unbound water and the finer particulate fraction to the surface. This plastic surface is ideally suited to receiving decoration. Potters are known to use a variety of tools to decorate their wares such as carved wooden paddles, shells, wooden sticks, combs, stamps, fingernails, probes, wooden knives, rollers, stamps, clay slip and paint.

Detailed ethnographic evidence shows that both bone and bamboo points are used to incise pottery in Papua New Guinea (May and Tuckson 1982). For example, at Saragum village, inland Sepik, a bone stylus is used to incise leather-hard clay vessels (May and Tuckson 1982:44, Fig. 2.28). According to these researchers "some of the most exquisite pots made in Papua New Guinea come from the people living in the foothills of the Torricelli Mountains north of Dreikikir, and designs are incised either with a bone, a sago thorn or a piece of wire" (May and Tuckson 1982:294). Judging from a photograph of one of these bone tools, they measure about 50 mm long by about 5 mm wide. It is important to note that a bone point was considered just as suitable as a fine tipped thorn or a piece of wire. This corroborates the utility of bone points for fine incising of the kind which characterises the assemblage at Khok Phanom Di.

The ethnographic styli were made from flying fox and pig bones. Unfortunately the former were unavailable for research. Fragments of modern *Sus scrofa* bones were used to test the effects of forming a point by grinding the bone on a sandstone abrader and then using this point to incise leather-hard clay. A sharp chisel point was easily formed by rubbing the bone fragment back and forwards across a sandstone block for about 50 strokes on each edge. This process imparted striations to the bone surface. The bone chisel was then used to incise lines into a leather-hard lump of Khok Phanom Di fishpond clay. The point was then examined after 50 and 100 strokes for use-wear facets. The surface of the bone point had isolated areas of polish after 50 and by 100 strokes the surface was completely polished. None of the abrasion striations were visible. Clearly the use of bone for incising pottery made from the local clays would produce polished use-wear surfaces similar to those visible on the archaeological sample. Grant and Higham (1991:147-91) have previously reported on the mammalian large fauna and note that pig remains "are present but rare throughout zones A and B but became much more abundant with the decline in marine resources which occurred at the beginning of zone C (L2–4). The bones were fragmented, indicating that the animals were butchered."

Most of the prehistoric bone points are simple round needle-like rods, or styli, about 50 mm long. Many are broken, however the longest intact stylus measures 70 mm, the longest point is 62 mm and the longest chisel measures 68 mm. This suggests they were designed to be held with the distal end pressed against the palm of the hand which would be appropriate for incising lines onto pottery. The distribution of the total bone artefact assemblage is set out in Higham (1993:8-10, tables 3–5). Of the intact portion of the sample, six stylus points range in length from 27 to 70 mm, three ridged points range from 43 to 52 mm, nine chisel points range from 33 to 55 mm and the two unmodified points measure 33 and 47 mm respectively. Of particular interest are the "bobbins" or shuttles. These may have been multi-use tools used to burnish the edges of fine ware rims, using the curved groove on one edge of the tool; to incise fine lines, when held edge-wise along the direction of the line; and to finish areas difficult to reach with a burnishing stone, such as carination point edges. This would explain the striations at 90° to the leading edge of the tool. The body and grooved edge of the tools display polished surfaces. These are consistent with polishing due to repeated rubbing when held in the hand, a process

which artisans or tradespeople, who habitually use hand-held tools, are familiar with.

THE CERAMIC FIRING STANDS

Within the complex lenses of ash and potsherds were broken fragments of what at first were considered to be oversized ceramic anvils. When examined petrographically, several revealed the presence of mullite, $3Al_20_3.2Si0_2$, a mineral which only forms at temperatures in excess of 1050°C. Such temperatures are normally beyond the capability of craft potters using open-air firing methods, although they are known to have been achieved occasionally. Open firing temperatures of up to 940°C were recorded for dung fuels by Shepard (1956:78), who noted that 1000°C is rarely achieved in direct open-air firings. Lauer (1971:73) recorded a maximum of 920°C for dry wood and coconut leaves. Irwin (1977) recorded a maximum temperature of 1018°C on Mailu Island, but most ranged from between 900°C to 950°C. May and Tuckson (1982:47) reported that "the top temperatures reached in open firings are between 900°C and 1000°C". Prior to describing the stands in detail, it is necessary to consider some ethnographic reports and re-examine the ashy deposits and associated artefacts in L10 and L11 in an attempt to reconstruct the conditions which may have led to the disposition and condition of the stands.

Studies of potting methods in Papua New Guinea (Tuckman pers. comm.) and North-East Thailand (Wichakana pers. comm.) have provided important ethnographic information with respect to firing methods which involve the use of firing stands. Tuckman noted that large stones were used by the potters to raise their firing platforms above the ground surface by about 10 cm. They fired between 25 and 30 vessels in each sequence. Wichakana observed open air firings on rafts made from thin timber joists at Ban Mọ, a modern potting village in the Khorat Basin. Bundles of rice straw were placed on top of the timber structure and another framework of support timber. This structure is in the form of a grid with bearer joists first placed lengthwise on top of ceramic stands about 15 cm high. Further joists are then laid at right angles across the bearers at about 30 cm intervals. The pots were fired upside down with additional bundles of straw placed over and round the pots. More straw was added as required during the firing sequence. The entire structure was supported by the ceramic stands. The Ban Mọ potters carry out large scale production using an assembly line method of processing their output. They fire about 200 vessels in each firing. At Ban Kham O, in the Sakon Nakhon Basin, pots are fired on a bamboo raft packed with rice straw (Vincent 1984). The pots are placed upside down, without straw in between them, and then covered with straw for firing. Fired pots generally display oxidized exterior surfaces and slightly reduced interiors. Fire clouds, formed when fuel lying against a pot prevents oxygen reaching its surface during the firing sequence, cover up to 10 per cent of the exterior surfaces of most pots. Raft firing is common to many modern North East Thai pottery producing villages, but firing durations vary from approximately two to five hours, and possibly longer, with generally oxidizing atmospheres.

Ethnographic studies allow insights into the likely firing parameters in ceramic technology as practised by household or individual workshops employing relatively simple production methods. Elevating the firing raft above the ground surface allows air to pass under and through the mesh of raft timbers, fuel and pottery. The Venturi effect thus created would act to increase

any draught both over and under the firing platform. Open-air firings are often critically dependent on suitable weather conditions (Shepard 1956:213-20). Warm, dry days with a steady breeze are generally best. If the wind is too strong, the fire will burn unevenly and may even burn out without achieving an adequate temperature over all the firing structure. Insufficient air movement can result in firing temperatures which are too low to produce a satisfactory ceramic body. Temperatures of 700–750°C are normally needed to produce a sufficiently strong ceramic structure.

According to Hamer (1975:120), temperatures of at least 600°C are needed to fuse clay particles into a ceramic material. Below this clay disintegrates in water. Vitrification typically begins at 800°C but this may increase to 850°C if the clay is calcareous and contains more than 6 per cent of calcium oxide (Maniatis and Tite 1978, 1981). We have noted above that some raft firings with rice straw fuel loosely packed around the pots produces generally oxidized pottery with some fire clouds. If the pots are placed upside down on the firing raft, the interior surfaces are usually reduced. Such reduction is due to oxygen being excluded from the interior of pots lying upside down during the firing sequence. This traps colloidal carbons and reducing gases in the atmosphere and also prevents any carbonaceous materials which may be in the potting clay, such as plant remains, from being burnt out. The resultant ceramic material will be blackened due to the presence of these carbonaceous materials.

Many of the firing stand fragments were thickly coated with dark grey ash noted as Munsell 10YR/4/1. The ash lenses which form L11 were stated as grey by the excavators who also note that lensing in L10 varied in colour from strong brown 7.5YR/4/6, pinkish grey 7.5YR/7/2 to light brown 7.5YR/6/4 and reddish brown 5YR/5/3, light reddish brown 5YR/6/4 to yellowish red 5YR/4/6 (Higham and Bannanurag 1990:32).

There are at least three possible sources of the ash deposits in L11. First they could represent an initial burning to clear the natural vegetative cover from the site. They might be the remains of fires used for cooking meals or the firing of pottery. During the accumulation of L10 they could also relate to graveside ritual feasting. They could also represent any combination of these proposed sources. It is useful when two or more separate items of evidence can be linked so that they form a corroborative set of data. It may be possible to narrow some of the possible activities down by a process of elimination. Layer 11 will be considered first.

No burials or postholes were evident in L11. A hearth was present in one quadrant, two caches in pits cut into the natural strata were in another. Both contained pottery-related artefacts, including an anvil, burnishing stones and two pottery vessels (Fig. 36). One cache also included seven stone adze heads. Several further adze heads, anvils, clay dumps and burnishing stones as well as grinding stones, bone points, ceramic pellets and a bone fish-hook were also recovered. The bone points have variously been interpreted as tools for working with soft material(s) or shuttles, however, at least some are considered by the author to have been used to incise pottery. Finally, an extensive shell midden (lens 31) containing 2557 *Anadara* valves was uncovered.

Adzes and sharpening stones suggest forest clearance and dense charcoal deposits support this possibility. Thompson (1996:66) notes that this charcoal is entirely made up of Rhizophoraceae-type woods which suggests a mangrove environment and "perhaps these were desiccated stands of mangrove stranded above the high water mark after a change in the local hydrology." Bone points, ceramic pellets, shell midden and a fish-hook indicate that subsistence related activities

were carried out. Anvils, clay dumps, pottery and firing stands in association unequivocally signal that pottery forming and firing also took place in this area. Given that the excavations covered only 100 m^2, and that the depth of deposits was just 0.35 m, this represents an intensive phase of occupation. The range of cultural activities is broad and diverse. Forest clearance, tool sharpening, food consumption and its possible preparation as well as pottery manufacture are indicated.

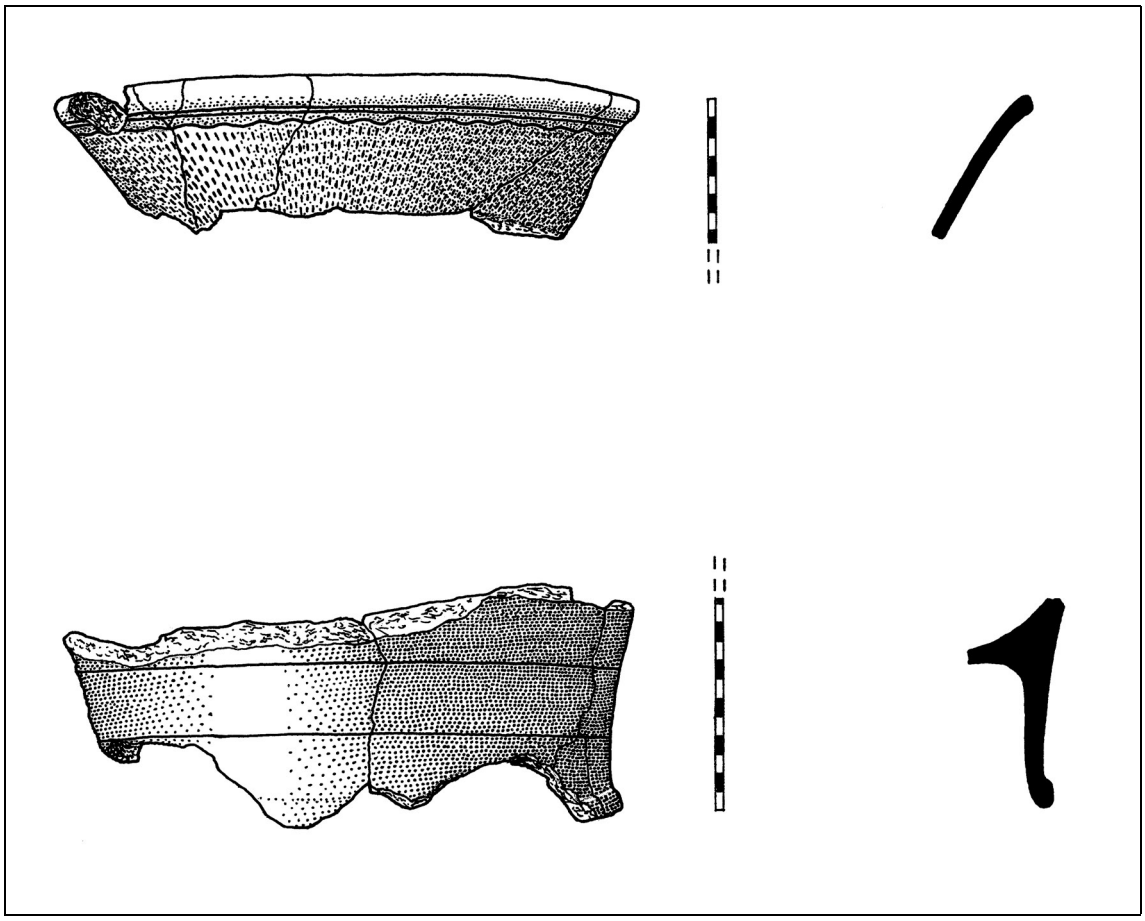


FIG. 39: Ceramic Period 1 vessel: cat. 1955, layer 11:2. Rim diameter: 180 mm, base diameter: 155 mm. Scale segments are 5 mm

Provided they survived a firing sequence undamaged, the ceramic stands could be re-used repeatedly until they finally fractured. None of the stands is complete and many are coated with ash both on their original outer as well as the fractured surfaces. This suggests that they were abandoned because they had fractured during a firing. Repeated use would increase the likelihood of fracturing due to thermal shock as the temperature changed during the firing sequence.

Ceramic bodies are poor heat conductors and the differential application of heat to the top of the stands compared with their bases would create thermal stresses. At each firing to about

600°C, silica inversions would occur at 226°C and 573°C. Cracks which form during firing and cooling are known to modern potters as "dunts" and their main cause is the silica inversions (Hamer 1975:107). Cat. 1906 has clearly attained the initial vitrification stage as glassy phases are readily visible in hand specimen. This signals that this stand had been subjected to temperatures of at least 800°–850°C. The presence of mullite shows that at least five and possibly six of the remaining stands in the sample were heated to higher temperatures (Table 16). The local pottery was fired to temperatures below initial vitrification (800°C). Cat. 1892 (t.s. K263R) contains very few nonplastics, cat. 1906 has no temper and appears to have been fired to high temperatures, cat. 1962 (t.s. K248) is highly micaceous, which suggest a non-local clay source, and cat. 2006a appears to lack any temper and has very few nonplastics.

Stands located in the centre of raft firings would, for the latter part of the firing sequence, be likely to have been covered and enclosed by the collapsing wooden raft, burning fuel and a mass of the newly-fired pottery. In effect they would, for at least part of the sequence, be encased within a kiln-like environment surrounded by the hottest portion of the fire. Whether vitrification developed or mullite formed would depend critically on the clay mineralogy of the fabric and the temperatures the stand was exposed to. In any event, provided the temperatures were high enough, both these phases would eventually develop. Which ceramic stands would vitrify or form mullite would depend on their location in the raft, their mineralogy and the temperature of the firings. Not all contain mullite, which suggests that only some had been subjected to a sufficiently high temperature. All, however, had suffered sufficiently high temperatures to crack from thermal shock. It is important to note that when a previously fired ceramic body is refired to temperatures above initial vitrification, the arrested vitrification will recommence and continue (Hamer 1975:125).

TABLE 16: *Ceramic Period 1 firing stand fabrics*

Cat.	Layer	Condition	Thin section	Fabric
1812	10:25	stand	K263	mullite (grog?)
1891	10:25	stand	K264	mullite (grog?)
1892	10:25	stand	K263R	local (grog?)
1901	10:26	frag. stand	K265	mullite (grog?)
1906	11:1	frag. stand	h.s.	no temper
1906a	11:1	frag. stand	h.s.	grog?
1909	11:1	stand?	h.s.	sand
1962	11:1	frags. stand	K248	sand
2006a	11:1	frag. stand	h.s.	no temper?

We can now turn to a consideration of the ceramic stand forms. Because all were fragmentary, only those from L10 were drawn (Fig. 40). Enough shattered pieces of cat. 1906a survived, however, to permit comparison of some portions with the better-preserved samples and it was possible to determine that the base of this stand closely follows the form of cat. 1892 depicted in the above figure. In both cases, the base is deeply concave. Cat. 1906, which is not illustrated,

is the broken off head portion of a stand. It shows that, for some of the stands at least, the head was formed as an extrusion of the stem which extended about 3 cm to one side. Cat. 1901 is a fragment of such a head, and cat. 1909 is probably a stem fragment with part of the head still attached.

Most of the nine CP1 firing stands are cord marked (Table 17). The only exception is cat. 1901, which has been carefully smoothed. Cat. 1892 and 1909 have been formed using a cord-wrapped paddle and then the surface has been partly smoothed but not enough to obliterate the cord markings. The drawings do not show these marks. All CP1 stands are smooth surfaced. The cord marks identified represent residual impressions from the first stage of forming which have not been completely smoothed over. The colours were recorded using Munsell soil charts. Cord mark widths and spaces between cords were recorded where possible. The helix twist terms "Z" and "S" follow Osborne and Osborne (1954), and indicate the direction of cord twist followed by the average cord width/gap in mm.

Cat. 1891 (10:25), is the most complete stand. Its surface is heavily cord marked. Along with cat. 1906, its shape differs from the rest of the sample. Both are tapered from top to bottom, but differ in that they also lean to one side (Table 17). They have heads about 70–80 mm in diameter which extend about 30 mm in the direction of the lean. The side opposite the lug is sloped 20° from the perpendicular and the lug side 5°, so that the whole stand leans about 12.5° from the perpendicular towards the lug side. It is possible that these stands were designed to fit into bamboo poles placed at the edges of a firing raft and the poles had slots cut to accommodate the lugs. Perpendicular stands would be suited to supporting the central poles (joists). Angling the outer stands inwards would counteract any spreading tendency the loaded firing structure might develop.

An indication of firing conditions at the point when pottery is removed from an open firing can be gained through assessing the amount of oxidization or reduction the ceramic body has been subjected to. Oxidized ceramic materials are clear without any blackened or cloudy surfaces. If they are fully oxidized, the interstices have also been cleared of any carbonaceous materials. This is because the firing atmosphere has been sufficiently oxidizing for long enough to combine all the carbon and allow it to be driven off with the fire's gases as carbon dioxide. With open firings, it is common for pottery to be only partially oxidized. Often oxidization is complete to only about 1 mm beneath the surface. This suggests that the firing was only oxidizing during the final phase, which was of too short a duration for all the carbonaceous material to be removed.

Stands located at the bottom of the firing would be covered with ash, wasters and fired pots and would therefore probably be reduced. All stands are covered with ash and none is fully oxidized. A stand showing typical oxidization, cat. 1228, is shown in figure 70 (Chapter VIII). The section drawing indicates that the stem of the stand is partly oxidized and the interior of the base is fully reduced. Contact with the ground during the firing would prevent oxygen from reaching the basal portion of the stand and explain this reduction.

The presence of "Z" and "S" twist cord marks to the stand surfaces from cord-wrapped paddles suggests that the stands were made by more than one potter and that both left and right-handed individuals were involved in making the cords (Osborne and Osborne 1954). Cord helix angles have not been assessed due to the poor condition of the stand surfaces. The cord thicknesses indicate a coarse-textured twine fabric.

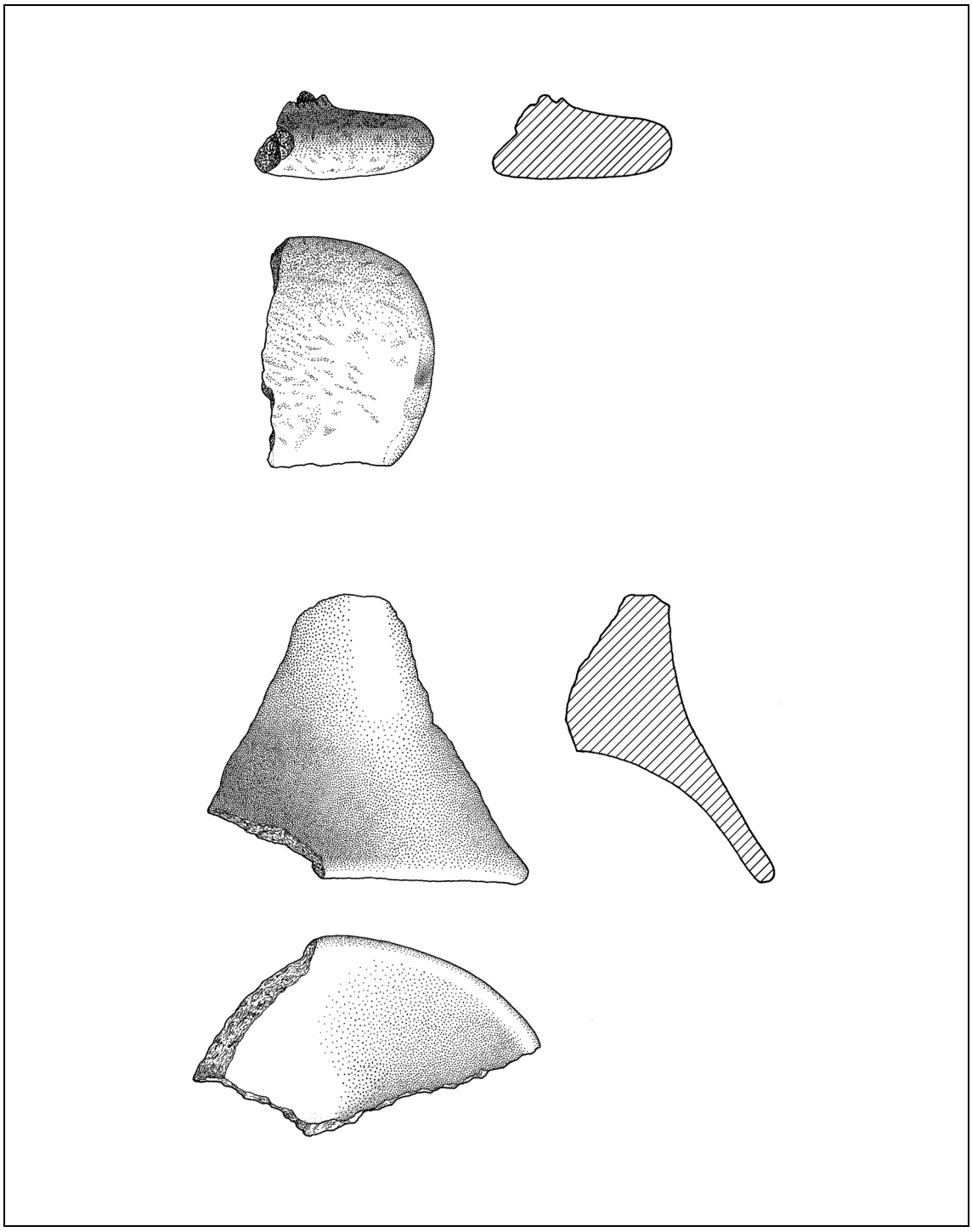


FIG. 40: Ceramic Period 1 ceramic firing stands. *Top*: cat. 1901, *Bottom:* cat. 1892. Shading indicates firing results (shaded areas are not oxidized)

TABLE 17: *Ceramic Period 1 firing stand forms*

Cat.	Layer	Size: (mm) Base	Head	Height	Colour	Cord marks
1812	10:25	140	-	-	10YR/6/4	S 1-1
1891	10:25	90	70	130 (est.)	10YR/5/4	Z 2-1
1892	10:25	140	-	-	2.5YR/5/4	indistinct
1901	10:26	-	80	-	10YR/6/4	fragmentary
1906	11:1	-	70	-	10YR/5/6 to 7/4	indistinct
1906a	11:1	-	-	-	10YR/7/3	Z1-1
1909	11:1	-	-	-	10YR/5/2	Z 2/2
1962	11:1	-	-	-	7.5YR/7/4	indistinct
2006a	11:1	-	-	-	10YR/7/4	S 2-1

Stand fabrics differ from other ceramic fabrics in the assemblage because of the temperatures they have been subjected to. When ceramic materials have been subjected to temperatures over 1000°C and the vitrification phases have commenced, nonplastic inclusions gradually fuse in stages until, if the temperature is high enough, the body melts into a fully vitrified glass. During CP1, cat. 1962 can be characterised by a sand temper and a micaceous matrix and, although the clay source is unknown, it has been assigned to FG1 because the temper matches this group. The hand specimen fabrics are as set out in table 16. Cats. 1812, 1891 and 1901 are probably tempered with grog. A lack of boundary clarity, however, probably due to heat distortion, means that these features may be natural inclusions. Cat. 1892 is probably also composed of this fabric, but this cannot be confirmed because of what appears to be heat fusion of the nonplastics and clay particles.

THE POTTERY OF CERAMIC PERIOD 1

Provided the complete form of a pottery vessel is known, rim sherds are usually diagnostic of the form from which they derive. They are, therefore, indicators of the range of vessels in any ceramic assemblage. Particular care has been taken to separate rim sherds for analysis. Every rim sherd has been assigned a form category and as many as practicable have been categorized for fabric in hand specimen with a hand lens at 10x, or a binocular microscope at up to 25x magnification. This has helped to separate coarse and fine wares, to assess the proportions of local and exotic wares in the assemblage, and to suggest possible regional styles. The relative proportions of CP1 rim sherds are discussed at the end of this section.

A total of 17 rim forms (RF) have been identified in the complete assemblage. Each was subdivided into categories according to surface decoration, minor shape changes and, in some instances, further subdivided into decorative variants. For example RF5 is an everted fine ware with a plain smoothed or burnished surface. Form 5a has from one to seven straight horizontal

TABLE 18: *Rim forms, categories, variants and weights by stratigraphic layer*

Layer	Forms	Categories	Variants	Weight (kg)
1	8	5	1	22.30
2	10	46	6	159.68
3	12	72	16	179.25
4	13	80	13	89.97
5	11	38	7	36.63
6	10	42	17	43.69
7	12	34	14	27.50
8	13	33	14	25.65
9	15	27	17	24.78
10	15	112	57	88.88
11	12	23	5	9.46
Total	17	-	-	707.79

incised lines running parallel to the rim edge, 5b has a mixture of straight and wavy lines. Variations such as shell impressions to the rim edge in addition to the previous decorative modes were also noted. Therefore "form 5ai" is everted, smooth and burnished with horizontal incised lines and *Anadara* shell impressions to the rim edge. The number of forms by layer is set out in table 18. As with any typology, the question whether to split or lump must be resolved. In this study, rim forms lump together the split categories and variants. Unless the researcher intends to analyse the decorative categories and their variants in detail, the purpose of the 17 forms is to allow a clear division of the assemblage into easily-understood groups which represent the various wares present.

The progression from form to decorative categories is designed to allow stylistic variables to be considered systematically. The categories and their associated variants do not necessarily progress in any logical manner themselves. This means that the annotations do not represent any kind of orderly progression towards increasingly more complex decorative elements, or by implication, any increase in the energy expended in creating them. The process aims to sift discrete categories into recognizable groups. These are a means to separating rims by sorting them into the different forms. While any rim category, for example 5a, refers to the same rim throughout the site, the suffix does not indicate increasing or decreasing complexity or divergence from the form. Rim form categories and variants are set out in Appendix 2. The data are separated into layers and spits by weight, with the total weight for each rim form given for each stratigraphic layer. Fabrics are not included, but are considered, when appropriate, in the text. A detailed summary of rim fabrics for each CP is also set out in the appropriate chapters.

The rim form weights are estimated to represent approximately 211,500 sherds. For the purposes of the present report, it is considered that a fully detailed stylistic analysis would be

TABLE 19: *Rim form complexity by Ceramic Period*

CP	Forms	Categories	Variants	Elaboration
4	15	117	24	10.63
3	15	128	44	11.46
2	15	96	58	10.26
1	13	35	11	3.54
Site total	17	-	-	-

excessively large and complex. In order to keep the report to manageable proportions, only those aspects of the decorative styles considered relevant to the overall objectives will be discussed. An attempt will be made to gauge whether the varying complexity of the ceramic spectrum is reflected in the number of rim form elaborations associated with each CP. Although 17 rim forms were identified in the complete assemblage, not all were present in every context. The elaboration factor has been calculated by adding the number of categories and variants together and dividing the total by the number of forms present in each CP. The method is suggested as an approximate guide to the degree of elaboration. No account of the source of wares or the proportions of each form present has been assessed. Although the data presented are unrefined, it is suggested that they are sufficiently rigorous to indicate that pottery styles became increasingly elaborate over time. A short discussion of the methods used to define rim forms is set out below.

RIM DESCRIPTIONS AND DEFINITIONS

Rim descriptions and the methods used to determine rim orientation closely follow those proposed by Shepard (1956:225-47, 1971). Each rim was first grouped into a shape category and then subgrouped according to surface treatment. Rim shapes are mainly direct or indirect, restricted or unrestricted. They may be simple and perpendicular, inverted or everted. Inflection points define end points, maximum and minimum vertical tangental points, where curvatures change from concave to convex or *vice versa,* and corner points which mark a sharp change in contour. Several vessels have rims with similar shapes. This makes it difficult to separate the rims into groups which represented specific vessels without creating an excessive number of shape categories. These instances are discussed in more detail under their relevant rim form groups.

Decoration may be intentional, such as burnishing; or unintentional, such as cord marks which are a function of the forming process (when the potter intended to shape utilitarian vessels without further elaboration). Such vessels may display cord marks which represent the most efficient

method to achieve the desired shape using a paddle best suited to mechanically shaping the clay. This is because the undulating surface of the cord-wrapped paddle imparts proportionally more force than a plain smooth-surfaced paddle. The potter's choice is not primarily for decorative purposes but to mobilise the clay more easily during the shaping process. Care needs to be taken when assessing the potter's intentions, however, because cord marks are often used as a decorative medium. In this study, cord-marked impressions on crudely made utilitarian wares are considered to be the result of expediency rather than decorative intent. This examination of the rim forms will begin with the coarse wares, because they are the most abundant. Each rim form was first assigned a number which designated its shape. The most abundant shape was processed first for each stratigraphic layer and finally for each CP. The lengths of direct rims lacking an inflection point are indefinable, those with inflection points have been measured from the terminus to the inflection mid-point.

COARSE WARE RIMS

Rim form 1

Rim form one (RF1) predominates throughout the entire stratigraphic sequence (CP1-4). This shape is unique in the site because it changes at the end of CP2 (Fig. 41). The earlier version is inverted and indirect with a concave inflection about 30 mm below the rim terminus. Under Shepard's structural class system this vessel can be characterised as an independent restricted form with composite contours (1971:228, 231, Figs. 21-2). The rim has been reinforced by simply folding the vessel wall inwards flat against itself so as to double its thickness. Unfortunately, it was not possible to reconstruct an entire vessel from the body sherds found in association with these rims because the fabric was too friable. Several concave rounded sherds were noted which suggests that the lower portion of these vessels were semispherical. Thus their overall shape was probably globular with an equator which measured about 300–350 mm. The upper hemisphere of these vessels was interrupted by the inflected rim which formed an orifice ranging in size from 200–220 mm. The rims measured from 30–38 mm in length and were from 5–8 mm thick. Care is needed when assessing whether these rims are inverted or everted as some fragments may appear to be everted (Fig. 43). Figure 42 illustrates a typical CP1/2 RF1 sherd.

The texture varies from medium to coarse with typical cord marks up to 2.5 mm wide with less than 0.5 mm gap between the cords. Most cords are "Z" twist with a helix angle of 25° from the horizontal. The cord marks are generally vertical or near vertical which suggests that the paddle was held horizontal to the circumference of the vessel during the final shaping process. No assessment of the fabrication method has been attempted due to the fragmentary condition and irregular shape of the sherds. The largest of the body sherds measured approximately 50–70 mm at most.

A CP3 coarse ware recovered from B15, in MP5, was sufficiently intact for much of the vessel form to be reconstructed. The fracture lines suggest that these vessels were constructed either using slabs or modelling directly from a cylinder. Given the texture of the fabric, it appears unlikely that such tall cylindrical vessels could be modelled directly from a cylinder and slab

fabrication is considered the most likely method. This would fit well with the suggested use of slabs in other local forms which will be detailed below for each CP. It is most likely that these vessels were formed with a paddle and anvil from slabs built upwards from the bottom to the rim which was formed from the wall terminus, although construction from a single lump of clay cannot be ruled out. Similar methods are known ethnographically (Glanzman and Fleming 1985). Four RF1 sherds have been assessed, both in thin section and hand specimen, and each assigned to FG1. Two of these sherds are from 10:25 and one each from 10:26 and 11:2.

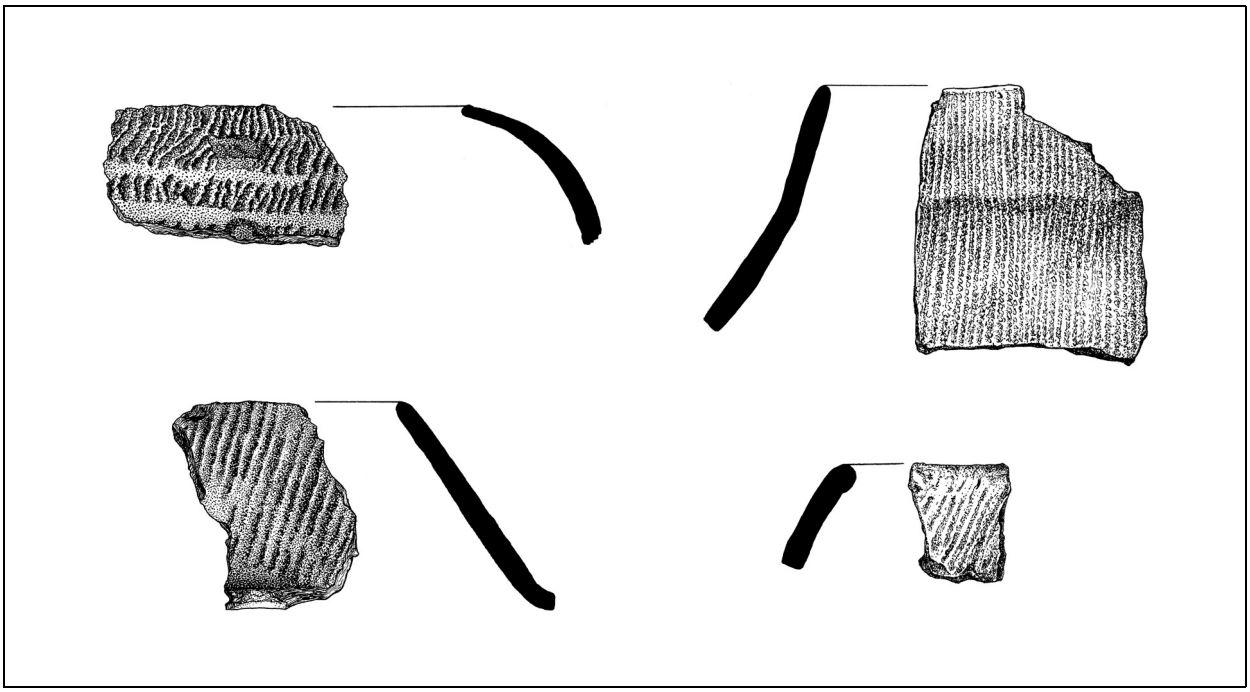


FIG. 41: The two different versions of rim form 1. *Top row*: Ceramic Periods 1 and 2. *Bottom row*: Ceramic Periods 3 and 4. Scale: 1:2

Rim form 2

Compared with RF1, more care has been taken over the shaping and finishing of these everted rims. From the inflection point to the terminus, most measure about 50 mm. About 10 mm of the rim projection has been folded outwards to reinforce the terminus and this exposes the plain wall interior. Slight concavities indicate that an anvil held inside the vessel during the forming process produced this finish. In section, the rim curves outwards slightly. Vertical cord marks which have been partially smoothed over, probably during the folding procedure, are present. A variant lacks the folded terminus and instead it has been flattened to produce a rudimentary end point. In some, the tapered ends of the rim may have been folded inwards and smoothed down by hand prior to the terminus being flattened and made even with a cord-wrapped paddle.

It is convex in cross section (Fig. 43). Several large body sherds suggest that these vessels were cord marked all over. A lack of suitable fragments again precluded reconstruction, but sufficient sherds could be joined to suggest a globular shape. Fracture lines indicate that a slab fabrication technique was used to form the vessels.

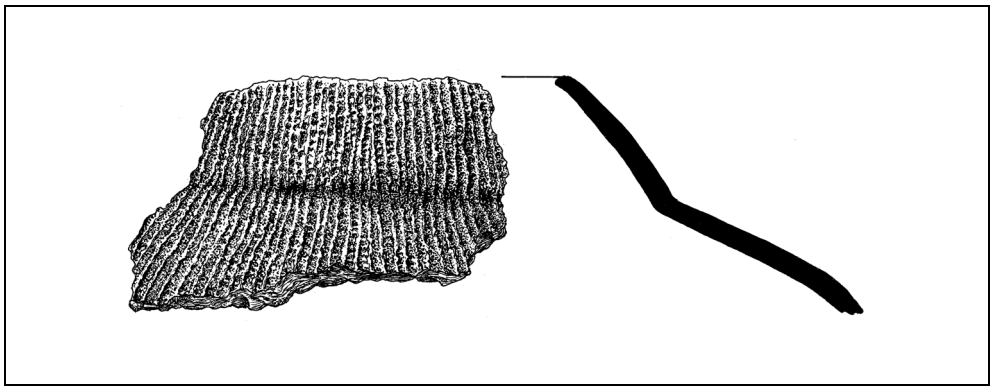


FIG. 42: The orientation of rim form 1. Ceramic Periods 1 and 2. Scale: 1:2

The diameter of these rims ranges from 180–360 mm, their length from 20–66 mm and their thickness from 5–10 mm. The external fold varies in width from 8–20 mm. In most, the exposed outward fold surface has been left smooth, as are the interior surfaces, due to the application of an anvil to the interior of the vessel during the forming process. Some rims have cord marks to the terminus indicating that a paddle has been used to even out the edge. During the later traditions this practice changes and the outward fold is cord marked all over. RF2 sherds are generally less coarse than RF1 samples. Most cord marks are "Z" twist and 1–1.5 mm in diameter with little gap between the strands. The helix angle is again 25° from the horizontal.

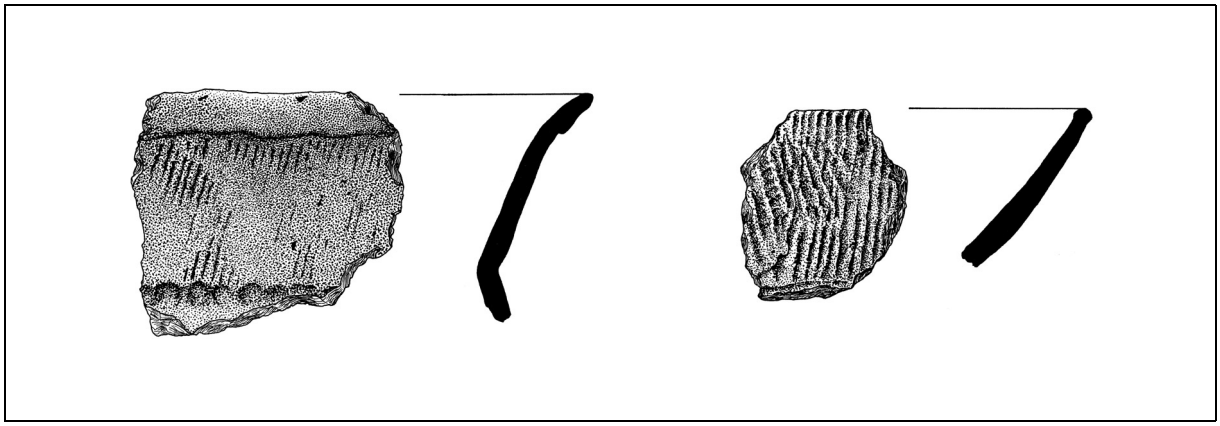


FIG. 43: Rim form 2 (left) and 2b. Ceramic Period 1. Scale: 1:2

CP1 coarse wares are represented by RF1 and RF2. Their surfaces are fully oxidized with few fire clouds although the interior of the fabric is generally more-or-less reduced. The colour

of the oxidized surface is light grey (10YR/7/2). These coarse wares are composed of either the sand-tempered FG1 or the local fishpond clay which has probably not been tempered. A notable feature of the sand-tempered sherds is that they are friable and easily fractured.

FINE WARE RIMS

Rim form 3

Comparison with "whole" vessels included as burial furniture has provided a comparative pattern for this, a slightly inverted or perpendicular and direct rim. Their surface decoration, texture, size and shape suggest they are portions of shallow bowls measuring from 160–360 mm in diameter and about 45–50 mm in height. Some of these bowls have a small central "ring" base about 85–90 mm in diameter and 10 mm high. A CP2 example is illustrated in Chapter VIII (Fig. 133 B58, MP3, cat. 1284). Slab construction is indicated by the fracture patterns. These patterns can easily be seen in a smaller example which lacks a base (Fig. 44). In some instances, traces of cord marks are visible where the surface has delaminated. This signals that two shaping steps are involved. Initial fabrication and shaping would be carried out using a cord-wrapped paddle. This was followed by smoothing with a plain paddle. After a period of air drying, until the unfired clay had reached the leather hard stage, the fine textured surface was burnished with a smooth stone. The rim sherds measure from 25–45 mm in length and average 5 mm in thickness.

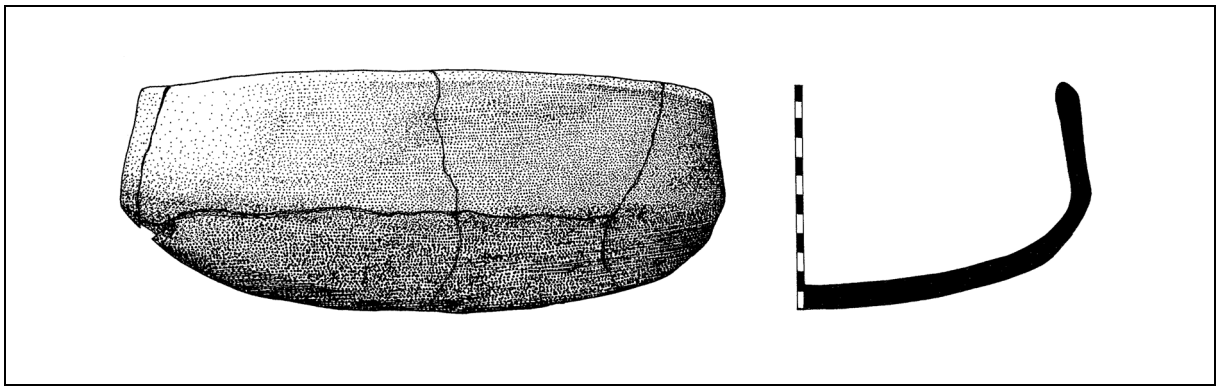


FIG. 44: A rim form 3 vessel. Cat. 1394. (Scale segments are 5 mm)

A high degree of precision is evident in the fine surface finish and particularly in the care taken to produce an even shape in most of the vessels. Considerable expertise is reflected in such high quality wares fashioned by hand without the assistance of a wheel. A few are less carefully finished and only roughly smoothed. A range of firing environments is indicated. Most sherds are reduced, some only partially, and a few are fully oxidized. Fire clouding zones and complete reduction to the bottom and under the bases suggests that these vessels were fired in an upright position. Seven variants are present, one with a square or hammerhead, rather than the

usual round terminus and a related variant which is burnished inside and out, and another nail-head variant. Another is inverted sharply to give an inflection angle of 40° from the horizontal, whereas most are perpendicular or angled about 80° from the horizontal. Two further variants feature respectively six and ten horizontal incised lines about 1 mm wide with rounded channel bases (Fig. 45). The oxidized colour is light grey (10YR/7/2) and reduced is light brownish grey (10YR/7/2). Some are highly burnished.

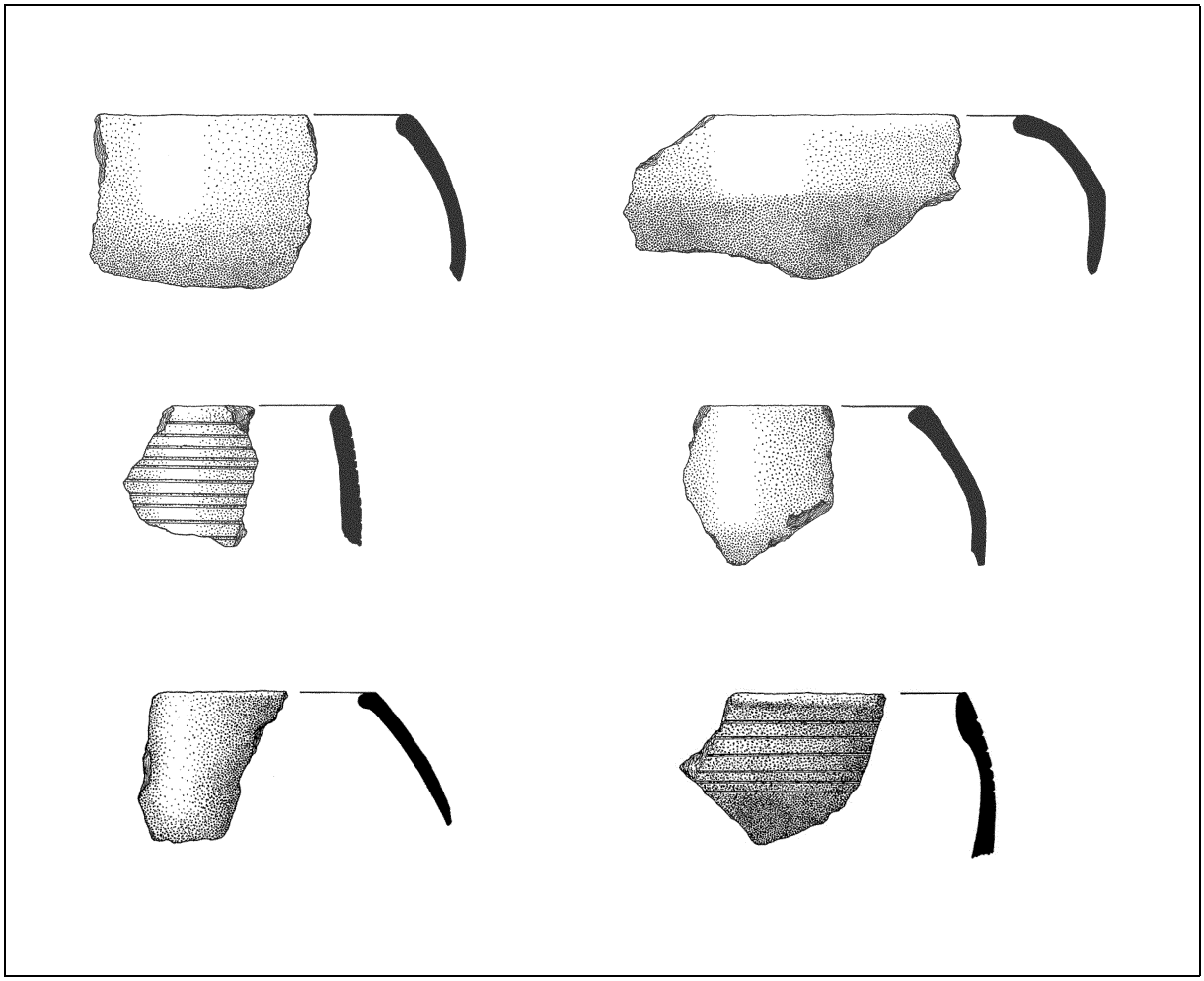


FIG. 45: Rim form 3 and variants. *Top* left: 3(i), right: 3c(iii), *Centre* left: 3a(iv), right: 3, *Bottom* left: 3, right: 3a. Ceramic Period 1. Scale: 1:2

A sample of RF3 and variant rims has been examined in thin section to reveal four different fabric groups (Table 20). RF3 is present in local FG1-2 as well as an exotic fabric, FG6 (Appendix 1). FG6 contains subrounded to rounded coarse to very coarse sand-sized argillaceous rock fragments, probably weathered from a micaceous siltstone. A few coarse sand-sized siltstone

fragments which include silty chert and quartz are also present. Within the matrix are silt-sized chert and plagioclase feldspar grains. The likely source of this fabric is difficult to determine because its mineralogy is geologically non-specific. It is tempered with orthodox grog.

Another exotic RF3 fabric is composed of crushed shell temper and is the only representative of FG7 (Appendix 1). Only one rim sherd weighing 10 g is involved. Most present-day potters from Papua New Guinea use beach sands for temper which contain shell (May and Tuckson 1982:30). According to Rye (1981:31-3), provided pottery containing shell is not fired above 750° C it will remain relatively stable. Above this temperature, unless "sodium chloride and possibly other salts" are added to the clay, the pottery is likely to disintegrate because of CaO hydration. Identification of the shellfish species is not possible due to the condition of the shell fragments. In hand specimen, many fragments appear to be burnt beyond recognition and in thin section any unburnt fragments are too small to identify readily. One possibility is that they are from bivalves or some other molluscs (Adams *et al.* 1984: Figs. 87, 143). Given the quite broad range of fabric compositions at Khok Phanom Di and the considerable mix of different geological deposits they represent, it seems reasonable to infer that this fabric stands out because it derives from a beach front or some similar environment rather than from the numerous sedimentary shell-bearing structures in the region. It is also distinctive because it probably represents a potting tradition familiar with the use of shell temper. Given a location near the coast, it seems highly likely that it was the product of a maritime community.

TABLE 20: *Rim form 3 fabrics: Ceramic Period 1*

Form	Thin section	Fabric group	Layer	Suggested source
3	K738	1	10:25	local
3	K1164	7	10:25	exotic
3a (iii)	K644	2	10:25	local
3	K799	1	10:25 lens 29	local
3f	K667	2	10:25 lens 29	local
3a (iii)	K658	2	10:26	local
3	K670	2	10:26 lens 31	local
3	K723	6	10:26 lens 31	exotic
3	K674	1	10:26 lens 31	local

Rim form 4

Burnishing and intricately-incised fields signal that the vessels from which these inverted indirect rims derive were probably highly valued as ornamental wares. A high energy input is reflected in the increased elaboration which sets these rims apart from the coarse utilitarian wares. Three variants have been recognized based on surface decoration. Although no RF4 vessel, or sufficient fragments to reconstruct such a vessel, were recovered from CP1, a "whole" vessel

with a typical form four rim from CP2 is illustrated in figure 46. These vessels are shallow plates or platters measuring from 166–207 mm in diameter at their widest point and with ring bases from 117–140 mm in diameter. The rims are sharply inverted with a carination point about 12 mm below the terminus. Decoration is confined to shell-impressed fields bounded by incised lines running parallel with the rim below the carination point. These fields vary from 5–10 mm in width. The incised lines are single or multiple. An *Anadara* shell has been used to decorate the fields in a variety of ways. The corrugated edge of a small shell has been applied diagonally, vertically or horizontally with great care. One variant has fields which have been impressed with the exterior surface of a large shell to give a "pricked" effect. Another, RF4c, has a stippled design.

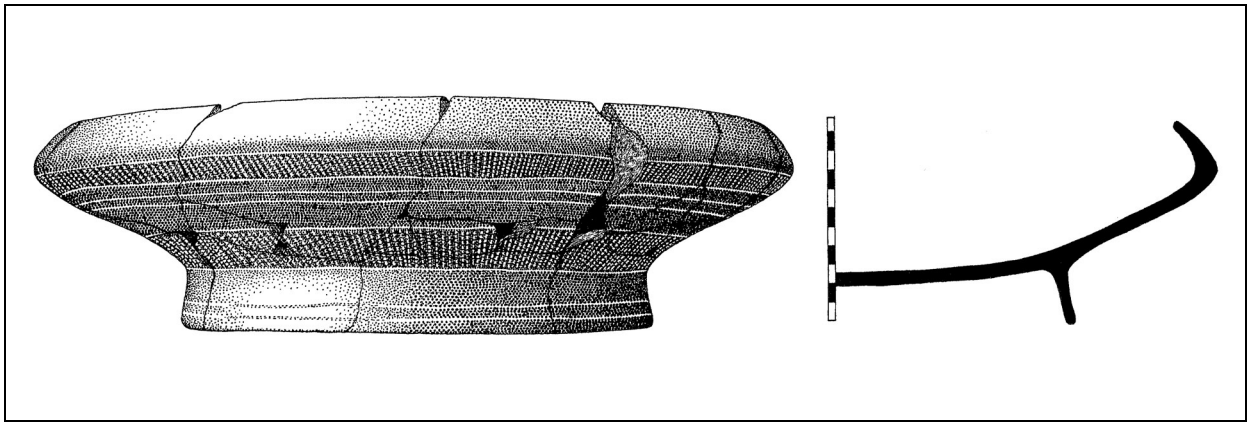


FIG. 46: A rim form 4 vessel. Cat. 1518, Ceramic Period 2. (Scale segments are 5 mm)

The construction method for the platter floor is slabs with the walls forming a continuum with the rim and base. Bases from these vessels vary in depth from 15–25 mm and 140–180 mm in diameter. Firing atmospheres appear to have been expertly controlled as almost all rim fragments as well as one of the "whole" vessels are evenly reduced. The combination of a high burnish and reduction provides a high lustre to the surface. The colours are very dusky red (2.5YR/2.5/2) for the reduced sample, to red (10R/5/6) for oxidized examples. Three of the four variants are illustrated in figure 47. Three RF4 samples, two from 10:26 and one from 10:25 lens 29, were thin-sectioned and each is composed of local FG2. Forms 4, 4a and 4b were also examined in hand specimen and compared with thin-sectioned samples. In each case FG1 was present. Only one RF4c sherd was identified and this was assigned to FG2.

Rim form 5

These direct everted rims are also mainly burnished and reduced. Their angle of inclination from the horizontal varies from about 20°–70°. They vary in length from 20–115 mm, in thickness from 4–7 mm and in diameter they range from 88–360 mm. In cross section they have either a concave exterior or in some instances they are straight. Form 5 is either plain or burnished but

undecorated (Fig. 48). Correlating variants of RF5 with vessels became increasingly complex as the number of categories and variants increased and their shapes diverged from the basic form. They comprise the largest fine ware assemblage throughout the sequence (Table 21).

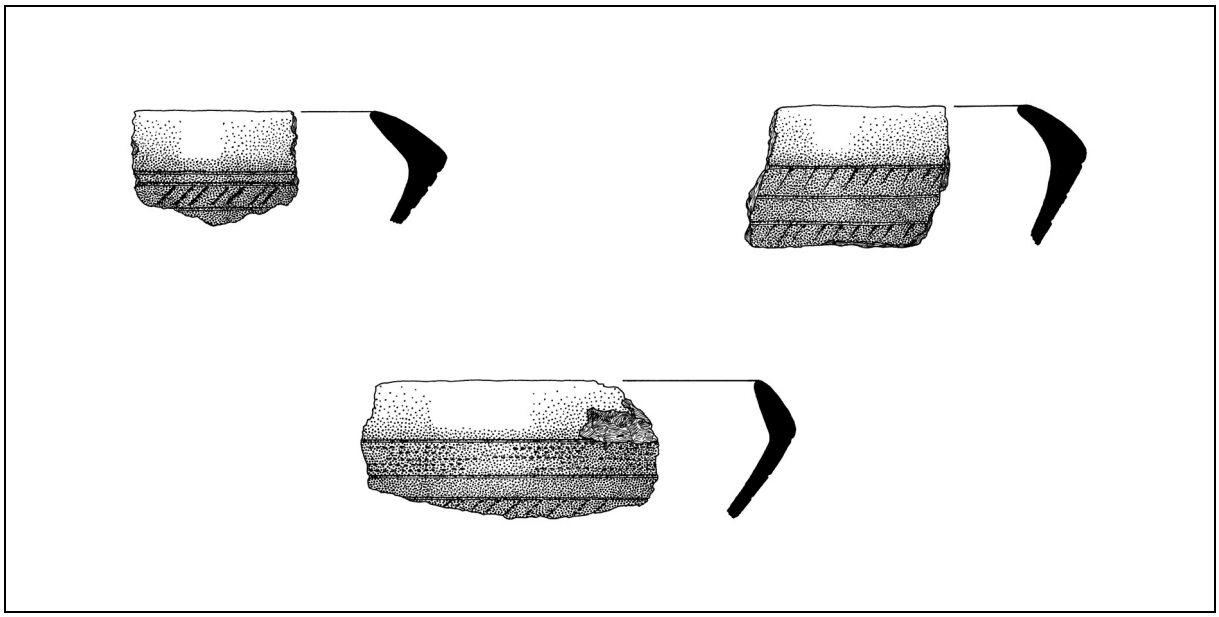


FIG. 47: Rim form 4 (top left), 4a (top right) and 4b (bottom). Ceramic Period 1. Scale: 1:2

TABLE 21: *Site total of rim form categories and variants*

Rim form	Cats/variants	Rim form	Cats/variants	Rim form	Cats/variants
1	11	7	6	13	21
2	14	8	5	14	8
3	46	9	0	15	2
4	78	10	10	16	2
5	174	11	5	17	0
6	127	12	6	-	-
Total:					615

By following a method which concentrated on rim shapes, a relatively small number of basic forms could be classified. This was useful in condensing such a large sample into manageable proportions. Through a series of sifting stages, the rim sherds were gradually reduced to smaller

groupings. The method was most useful in separating out the local coarse wares which formed the bulk of the sample. Except for RF5, and some RF6 variants, it also coped well with fine wares. Two major difficulties were encountered. The first occurred when the cross section changed from concave to almost straight or slightly convex. In each case the rim was everted, with an inflection point marking its lower boundary, the basic criterion for this form. The second difficulty was determining the acuteness of the inflection point angle for small rim fragments. A selection of vessels with rims categorised as RF5 is shown in figure 50. These represent minor categories of this form in term of their quantities. It was not possible to define or correlate the rims to specific vessels on the basis of shape and surface decoration due to their fragmentary condition, or to calculate their relative proportions within the group, although it seems reasonable to assign some, for example RF5f which closely matches cat. 1649 (Fig. 49), to "complete" vessels. Additional rim form categories readily assignable to "complete" vessels are noted in the text.

Two RF5 vessels (Fig. 48) illustrate that this style has a regional distribution because cat. 1519 is a local FG2 ware and cat. 1679 is exotic. The fracture pattern of the latter is typical of slab fabrication and no fracture is evident at or near the carination point. Similar carinated vessels are present throughout the sequence and in later samples a prominent carination fracture suggests that a two-stage construction method was employed. We will consider this aspect further in the following chapters. The surface texture is fine and the colours are from an oxidized light grey (10YR/7/2) to a reduced dark grey (10YR/4/1). They were probably fired upside down in a mainly reducing atmosphere. The potters appear to have intended to produce a dark burnished surface finish. Thirteen form 5 variants have been identified in the CP1 assemblage (Figs. 50 to 52).

A different construction method is proposed for the fine ware vessel, cat. 1955, (Fig. 39). This vessel was recovered from L11:2 feature two, a small pit cut into the natural substrate. In contrast with the utilitarian wares, the quality of this vessel is excellent. Unfortunately as the central section is missing, its overall shape cannot be determined with confidence. We can infer from the size of the rim (180 mm) and base (155 mm) portions, which are similar to other vessel forms late in the sequence, that the central section probably gradually tapered outwards to the rim section. Alternatively, the centre section could have been carinated. This is considered unlikely given that none of the "complete" vessels in the assemblage would fit such a form.

Several carinated sherds, which in hand specimen appeared to be composed of the same fabric as this vessel, were present in L11, however, they need not have been of the same form as carinated wares are present in a variety of fabrics. The base of cat. 1955 is unique to CP1. Apart from this base, sherds of this form weighed just 300 g in L11, 70 g in 10:22 and 110 g in 10:25, a total weight of 480 g for the heaviest portion of the vessel. For comparison, a large globular coarse ware vessel weighs approximately 1.65 kg. All these sherds matched in terms of colour, texture and decoration mode and each contained the same coarse, sandy fabric. This suggests that only one or perhaps two vessels are involved. The rim closely matches the form 5c decoration. Caution is needed, however, because RF5c (ii) clearly has an inflection point at the bottom of the decorated field which suggests that it came from a globular, possibly carinated, vessel. This underlines one of the difficulties in assigning rim forms to vessel forms when only small fragments are available. Surface decoration is partly determined by construction methods. The surface of cat. 1955 is smoothed, then burnished and finally decoration has been applied to

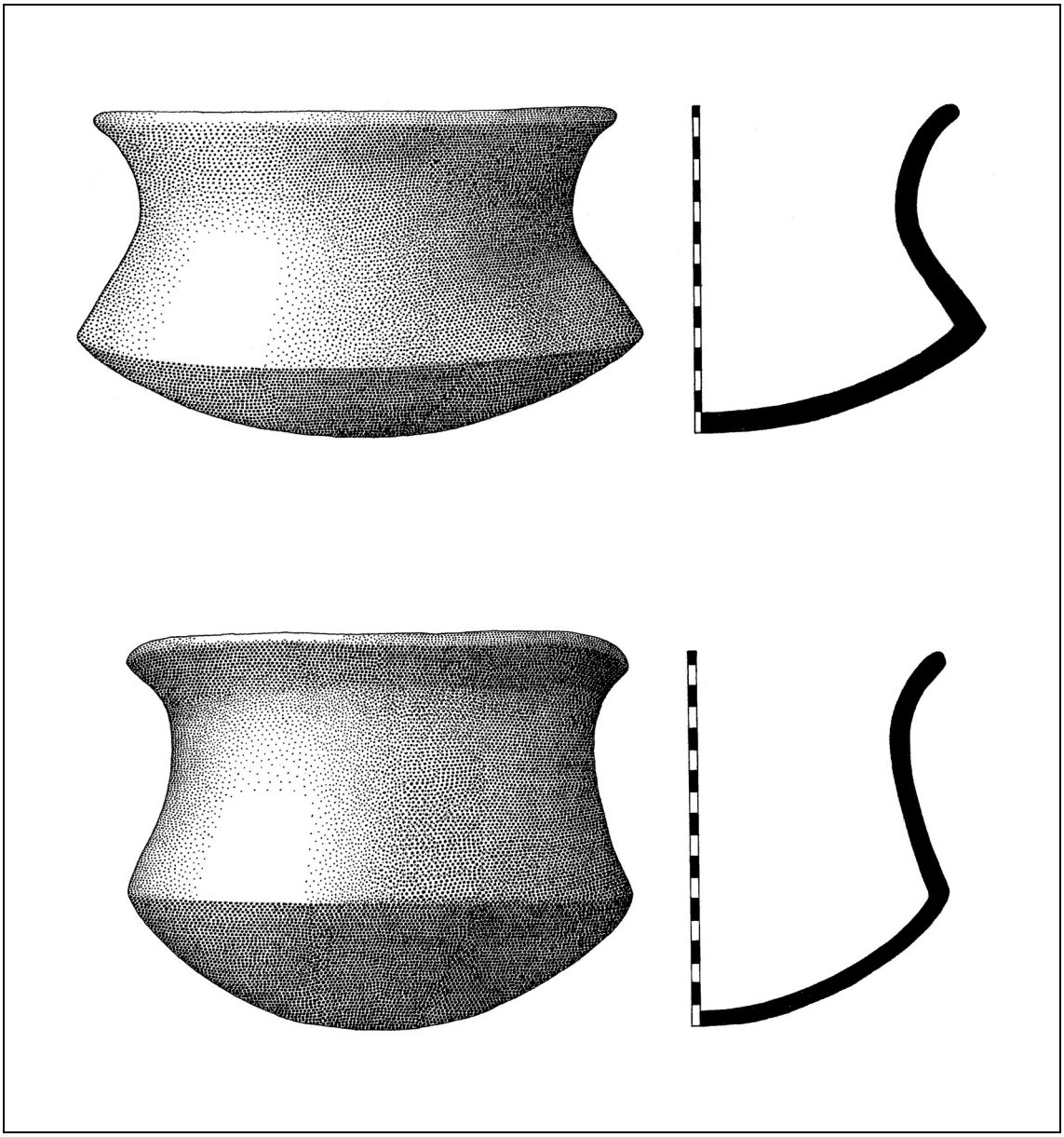


FIG. 48: Rim form 5 vessels. Cat. 1519 (top) and 1679. Ceramic Period 2. Scale segments are 5 mm

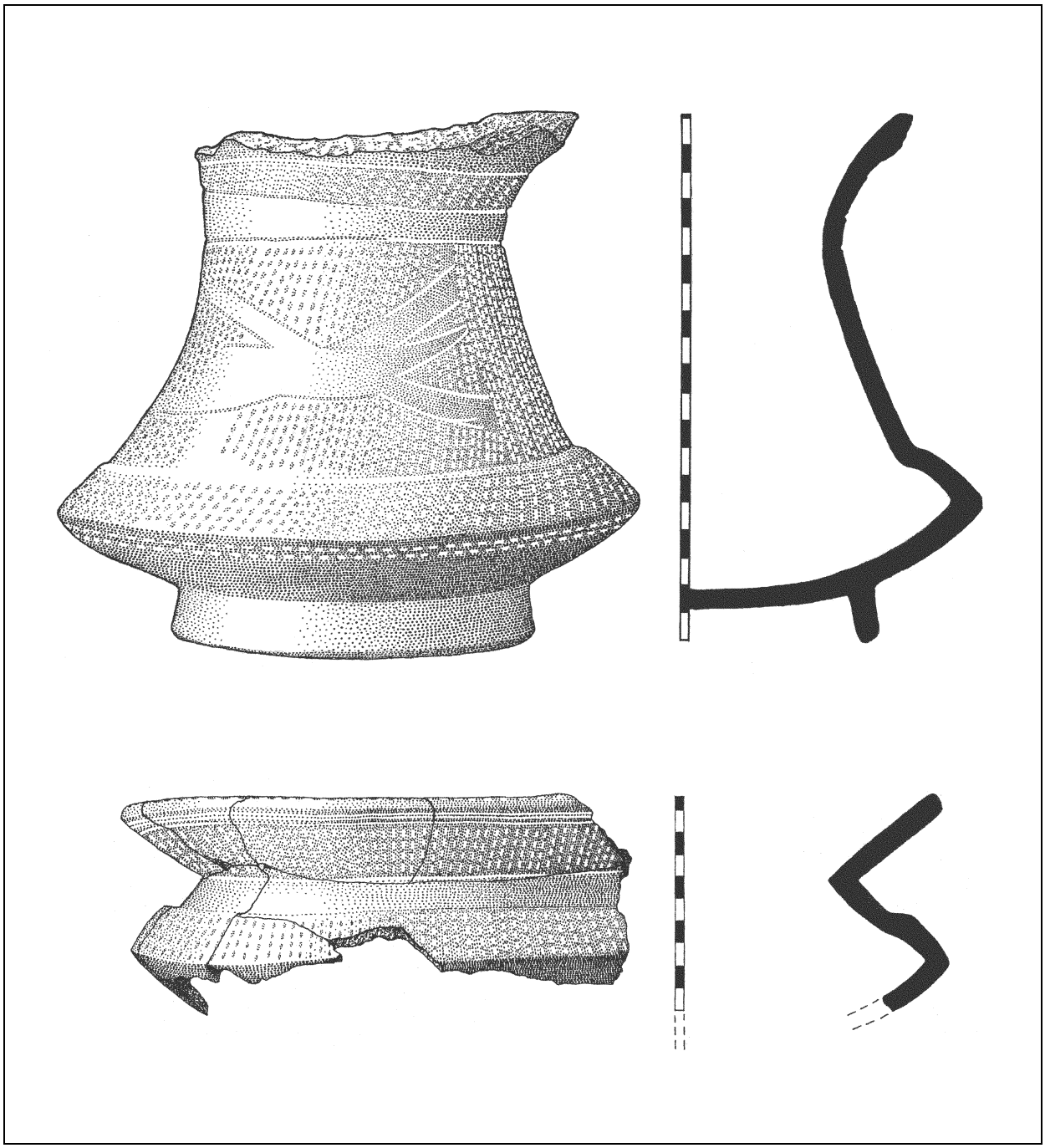


FIG. 49: Rim form 5 vessels. Cat. 1649 (top) and 1691. Ceramic Period 2. Scale segments are 5 mm

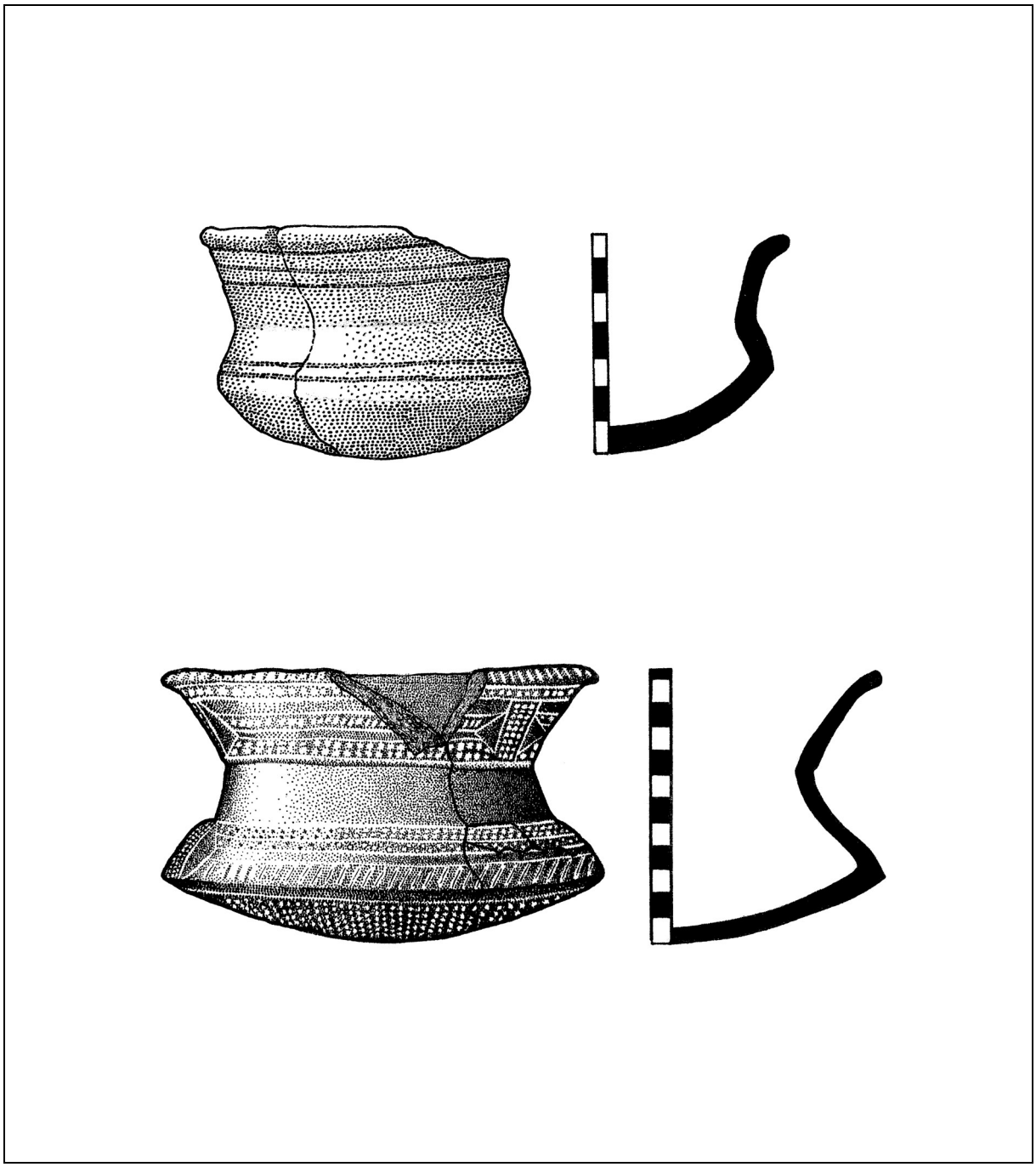


FIG. 50: Rim form 5 minor category vessels. *Top*: cat. 1890 (10:25 lens 29), and cat 1619 (MP 2). Ceramic Periods 1 and 2

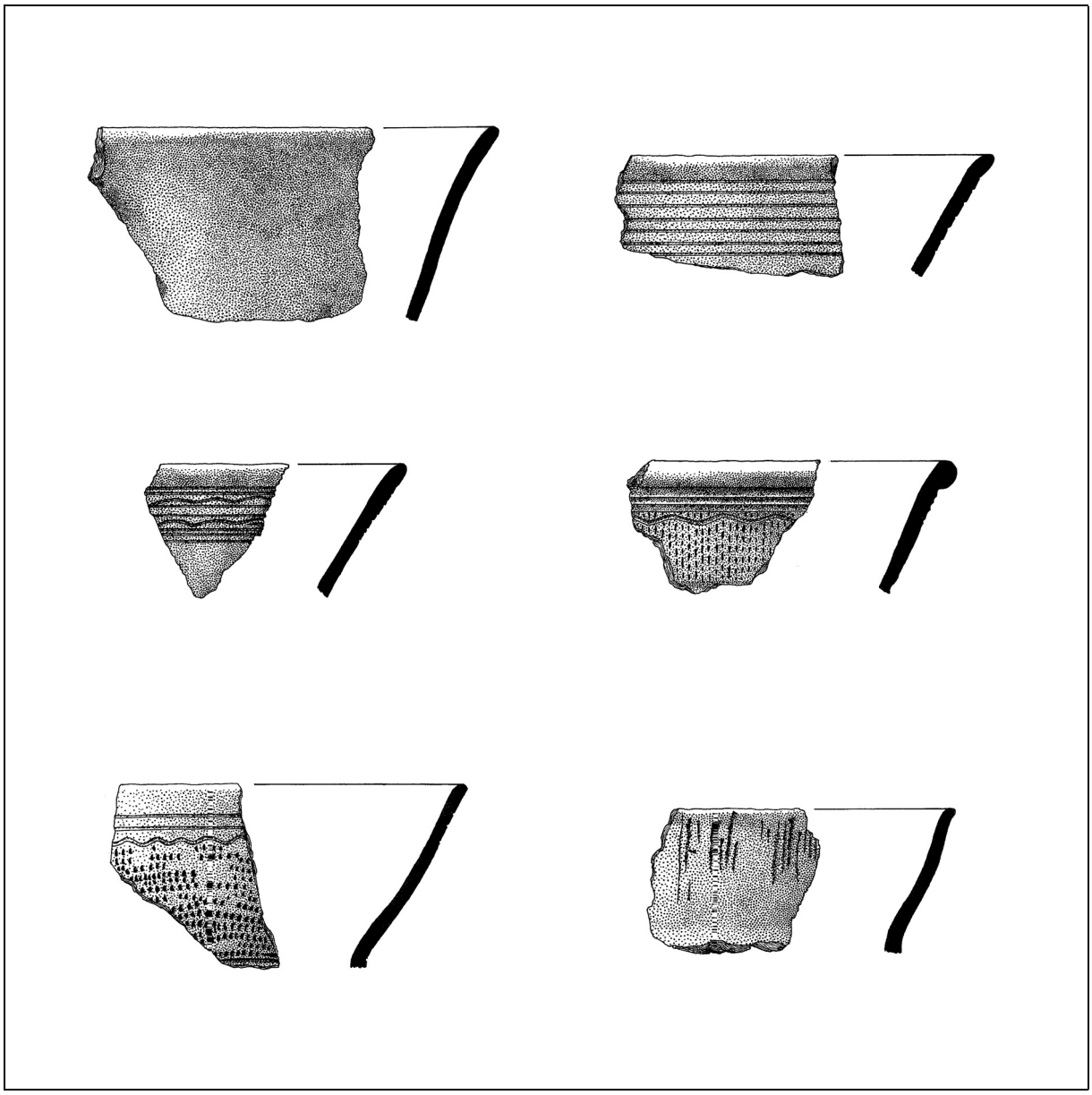


FIG. 51: Rim form 5 categories and variants from Ceramic Period 1. *Top* left: 5, right: 5a, *Centre* left: 5b, right: 5c, *Bottom* left: 5c(i), right: 5c(ii). Scale: 1:2

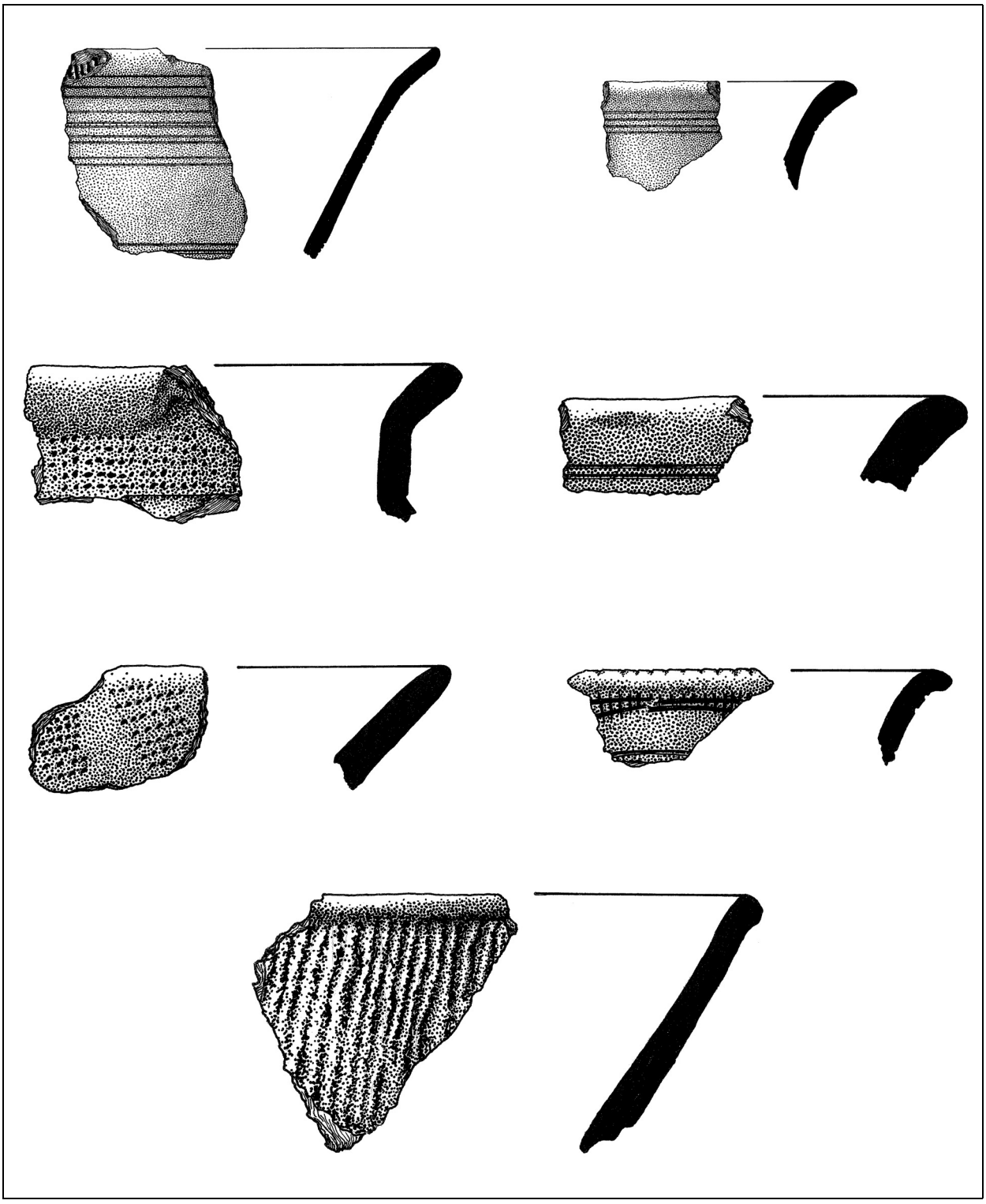


FIG. 52: Rim form 5 categories and variants from Ceramic Period 1. *Top* left: 5d (Scale: 1:2), right: 5e (Scale: 1:2), *Centre* top row left: 5f, right: 5g, bottom row left: 5h, right: 5i, *Bottom:* 5j(ii). Scale 1:1 (5f to 5j(ii) inclusive)

panels or "fields" defined by incised lines. The base has a 10 mm wide panel filled with sloping incised lines which have been heavily eroded but are visible at 10 x magnification.

TABLE 22: *Rim form 5 fabrics: Ceramic Period 1*

Form	Thin section	Fabric group	Layer	Suggested source
5	K719	8	10:25	exotic
5	K1117	2	10:25	local
5	K1119	2	10:25	local
5	K1162	1	10:25	local
5	K1173	2	10:25	local
5	K1177	2	10:25	local
5	K1180	2	10:25	local
5	K1181	1	10:25	local
5	K1184	8	10:25	exotic
5	K1185	8	10:25	exotic
5	K1186	2	10:25	local
5	K1187	2	10:25	local
5	K1189	8	10:25	exotic
5	K1190	8	10:25	exotic
5	K1192	9	10:25	exotic
5b	K1200	8	10:25	exotic
5w	K706	2	10:25	local
5	K149	1	11:1	local

A selected sample of CP1 RF5 fabrics is set out in table 22. Distinctive fabrics were selected in hand specimen for petrographic analysis. Care was taken to identify what appeared to be exotic wares. No complete RF5 vessels were recovered from CP1, however, most of the rim sherds examined in hand specimen are composed of FG1. Sample K1173 included incidental rice husk within the matrix of the fabric.

Rim form 6

This rim is everted and direct with a rounded terminus. It represents a range of bowls with walls inclined 37° to 85° from the horizontal. RF6 is undecorated with either plain smoothed or burnished surfaces. They range in diameter from 101–260 mm and from 3–8 mm in thickness. Apart from RF5, this form has the most decorative variants, ranging from incised lines to shell impressed, paddle impressed, cord marked and punctate. The designs are geometric and curvilinear. Several rims are decorated to the terminus only while others are decorated to exterior walls or walls and terminus. As discussed previously, rim categories are based on differences in rim shape and/or decoration. Variants are minor additions to the basic categories, such as discrete

decoration added to a rim terminus, the same form with different rim terminus decoration or a squared rather than a rounded rim. For example, CP2:RF6c (i) has diagonal *Anadara* shell edge impressions to its terminus and RF6c (ii) three rows of "pricked" round 1 mm impressions. Both have square rim termini, while RF6c (iii) has a rounded terminus with longitudinal *Anadara* shell edge impressions.

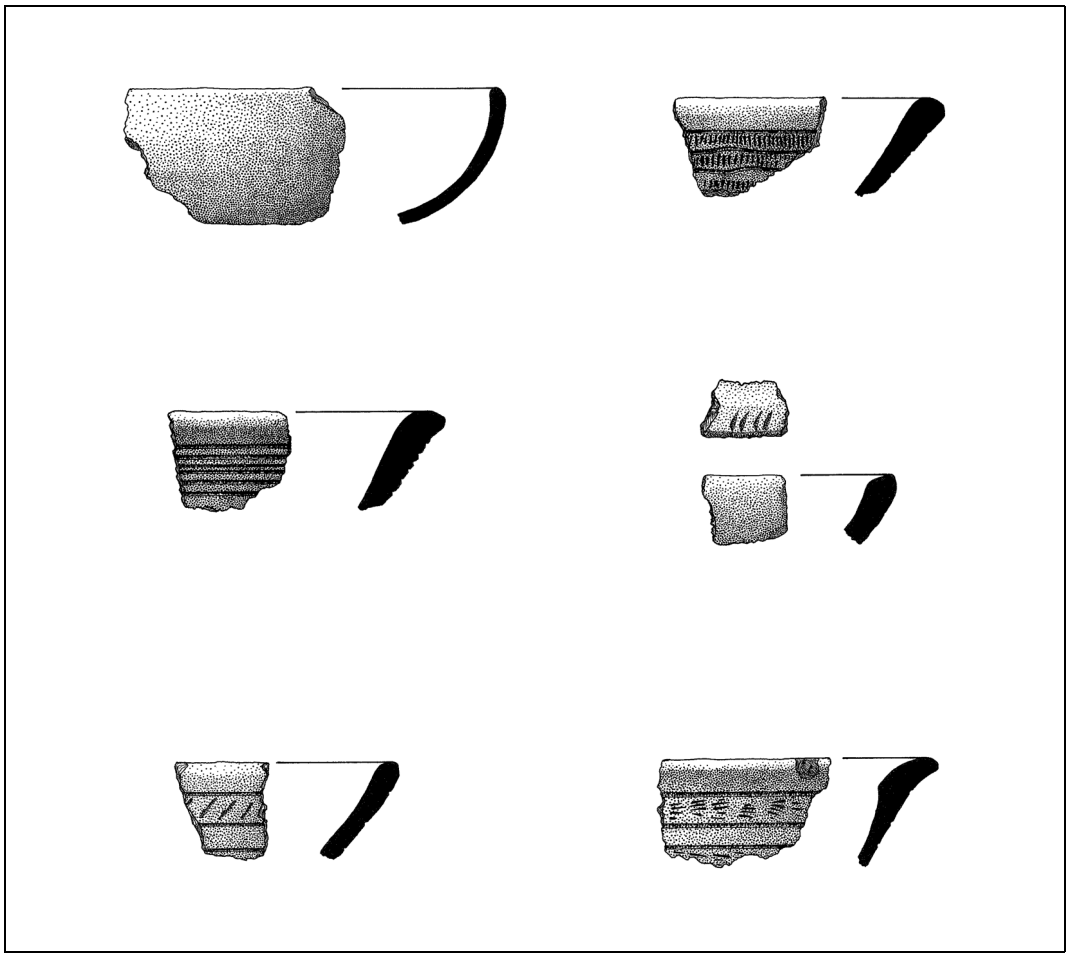


FIG. 53: Rim form 6 categories from Ceramic Period 1. *Top* left: 6, right 6a, *Centre* left: 6b, right 6c, *Bottom* left: 6d, right: 6e. Scale: 1:2

Form 6a has a plain rounded terminus with a series of horizontal incised 1 mm wide lines about 6 mm apart commencing 10 mm below the rim terminus. These lines have been applied over vertical cord marks. RF6b is burnished and has from 6–9 horizontal incised lines about 2–3 mm apart. RF6b (i) has vertical *Anadara* shell edge impressions as a band between the second and third upper incised lines. RF6c is burnished and has an angled terminus decorated with diagonal incised lines, RF6d is burnished and has horizontal incised lines about 7 mm apart

with diagonal *Anadara* shell edge impressions in a band between the upper two incised lines and RF6e is burnished and decorated in similar banded fields with *Anadara* shell edge impressions arranged in fan shapes and in addition diagonal *Anadara* shell edge impressions to the interior face of the rim terminus (Fig. 53). Several RF6 bowls are illustrated in chapter VIII.

Most RF6 wares are either reduced or only partially oxidized, which suggests that the intention was to produce a dark lustrous surface finish. They were probably built up from slabs using both cord-wrapped and smooth paddles. Their texture is mainly fine, but some are slightly coarser. All can be considered as fine wares. The colour of local wares ranges from light brownish grey (10YR/6/2) to very dark grey (10YR/3/1). Three RF6 fabrics from CP1 are set out below. Hand specimen examination of each of these above rim forms has shown that all are tempered with sand consistent with the local FG1. It is important to note that sample K714 is composed of a fabric indistinguishable from the local wares which belong to CP3. Incidental rice husk is present both within the fabric matrix and in surface deposits. It is equally possible that this fabric is exotic, but it cannot be readily separated on mineralogical criteria. Given that the overlying cultural strata are over 2 m deep, this sherd has either been very mobile or it is exotic.

TABLE 23: *Rim form 6 fabrics: Ceramic Period 1*

Form	Thin section	Fabric group	Layer	Suggested source
6	K714	3	10:25	local
6b	K1191	8	10:25	exotic
6b (i)	K708	2	10:25 lens 29	local

Rim form 7

Rim form seven is a plain inverted and indirect rim with a rounded terminus (Fig. 54). From the inflection point the rim measures 22 mm in length, it is 5 mm thick and 120 mm in diameter. The rim is inclined at 50° to the horizontal. The surface finish is either plain or burnished. A single sherd weighing 20 g was recovered from L11:1 and another from 11:2. It is difficult to assess the overall vessel shape from such small fragments. It may derive from a carinated bowl similar but larger than cat. 1431 (Fig. 54), with the rim inverted. Alternatively it could represent a large cylindrical or globular vessel. The size of the fragments precludes any consideration of possible construction methods except to note that the rim is no thicker than the vessel wall, which indicates that the wall terminus was probably simply smoothed and neatly rounded off. RF7a is a burnished reduced local FG2 variant. RF7a(i) has a bulbous terminus.

Again, a reducing firing atmosphere is indicated. Oxidized surface colours are reddish yellow (7.5YR/7/6); reduced are very dark grey (7.5YR/3/0). The texture is fine and the fabric, dense. Hand specimen analysis indicates the CP1 ware was tempered with sand consistent with FG1. Thin sectioned CP2 samples are composed of the local FG2 and this petrographic evidence supports a local derivation.

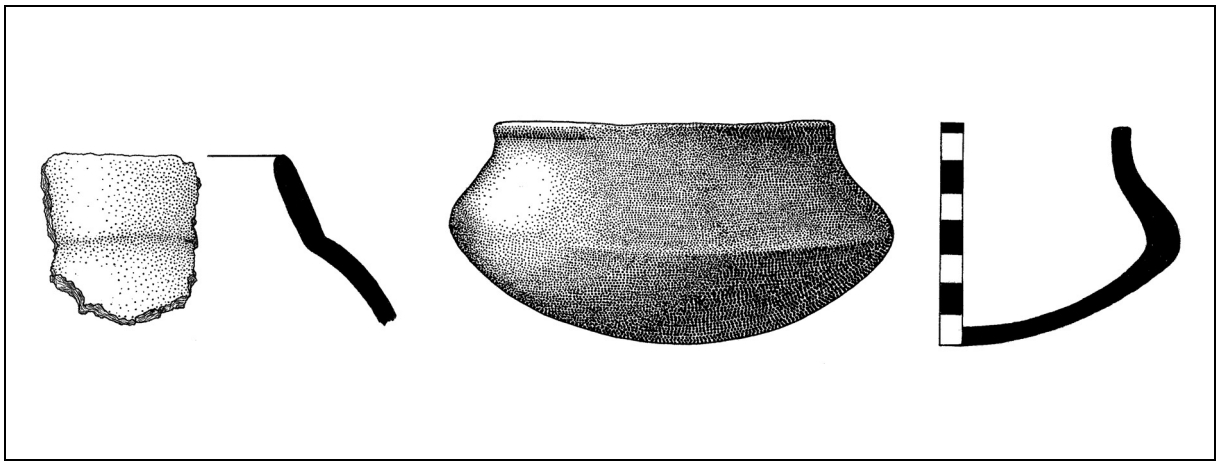


FIG. 54: Ceramic Period 1 rim form 7 sherd (L11:1, scale 1:2) and a Ceramic Period 2 (Mortuary Phase 3) vessel (cat. 1431). Scale segments are 5 mm

Rim form 8

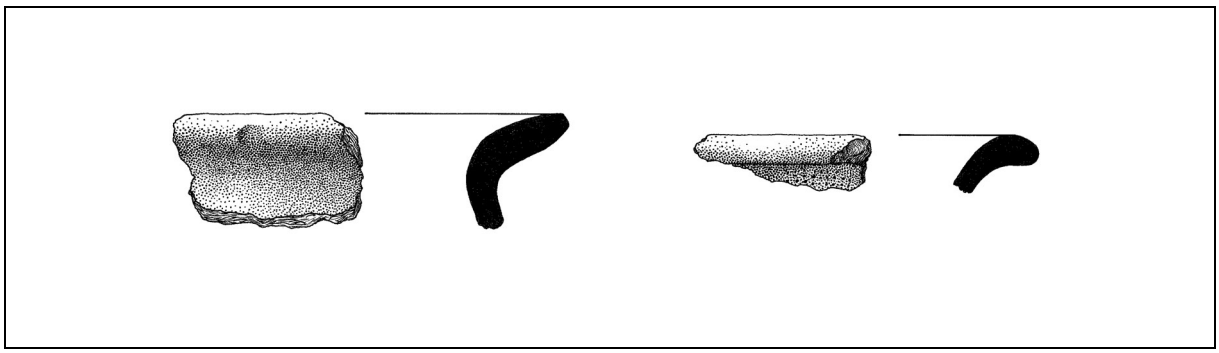


FIG. 55: Rim forms 8 (left) and 8a, Ceramic Period 1. Scale: 1:2

These short rims are indirect and sharply everted. They measure 16–22 mm from the inflection point and are from 3–6 mm thick. Form eight lies from approximately horizontal to 58° while RF8a is inclined 34° to the horizontal plane. One sample is tapered from 5 to 3 mm towards the terminus. Form 8a is 160 mm in diameter and RF8 ranges from 220–240 mm. The total weight of these sherds from CP1 is 400 g, making an assessment of the overall vessel shape difficult. Most are burnished and RF8a has vertical *Anadara* shell edge impressions to the exterior wall from just below the rim inflection point (Fig. 55).

Comparison with cat. 1384 from CP2 MP3 suggests that these rims represent an open, steep-sided bowl (Fig. 56). This latter vessel was probably constructed from slabs. Most of the

TABLE 24: *Rim form 8 fabrics: Ceramic Period 1*

Form	Thin section/h.s.	Fabric group	Layer	Suggested source
8	K707	2	10:25	local
8	K737	2	10:25	local
8	h.s.	1	10:25	local
8	h.s.	bleb grog	11:1	exotic
8	h.s.	2	11:1	local
8a	h.s.	1	11:1	local

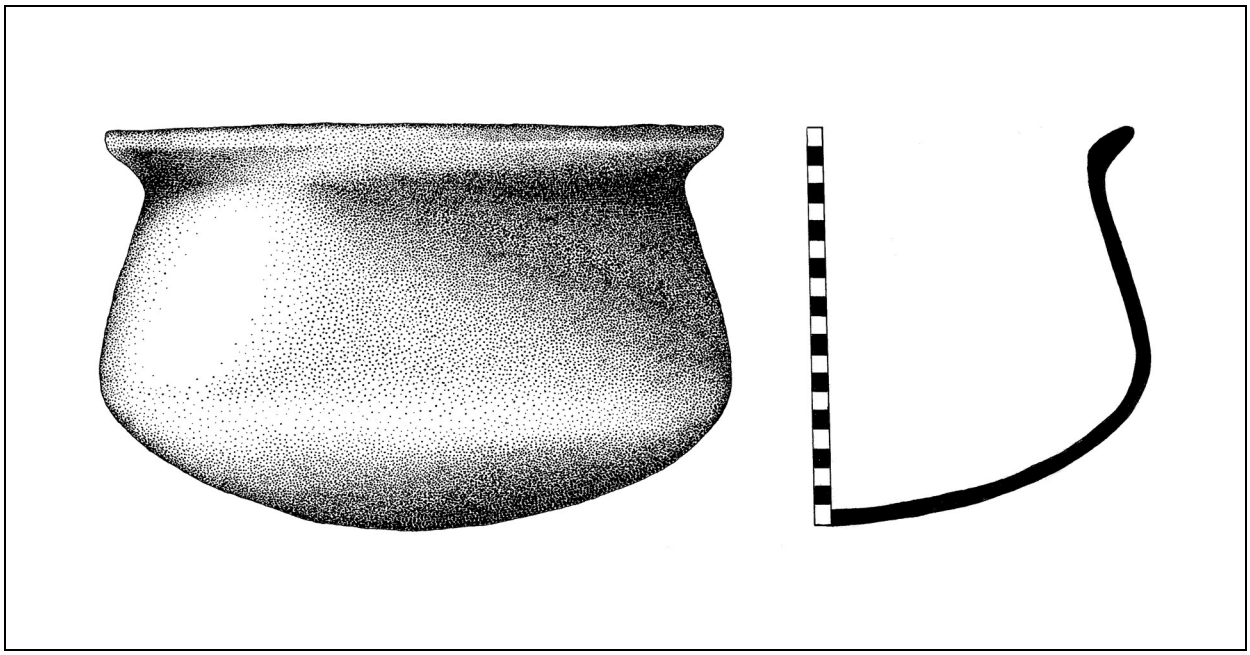


FIG. 56: A Ceramic Period 2 rim form 8 vessel (cat. 1384). Scale segments are 5 mm

fabrics are more-or-less reduced with a greyish brown exterior (10YR/5/2) and a grey interior (10YR/5/1). Oxidized samples are light brownish grey (10YR/6/3). They were probably fired upside down. The texture is very fine. In hand specimen most are either sand or grog tempered consistent with local FG1 and FG2. Fabric assessments are set out in table 24.

Rim form 9

Only two of these inverted and indirect rim sherds were recovered from CP1 (Fig. 57). They are only slightly inverted or perpendicular, measure 46 mm in length and thicken from 7 to 10 mm towards the terminus. The vessel diameter is estimated at 220 mm. They are fine textured and have been carefully burnished. Assessment of the construction method is limited given the small fragments available, however the fracture pattern suggests that slabs were used to form at least the rim section. Each sherd is reduced or only partially oxidized to less than 1 mm below the surface. Their colours match the light grey to light brownish grey for those local rim form three fabrics set out above. A sand temper consistent with FG1 was determined by hand specimen examination.

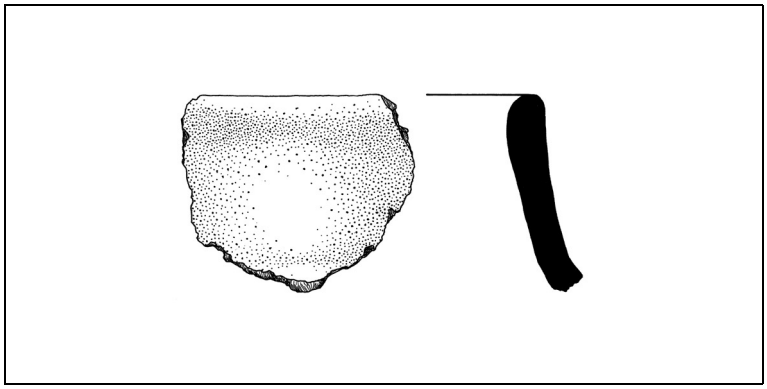


FIG. 57: Rim form 9, Ceramic Period 1. Scale: 1:2

Rim form 10

Two sharply-angled inflection points set this rim apart. It is everted and indirect. The length from the lower inflection point to the rim terminus is 38 mm, it tapers from 7–13 mm thick at the wall junction and is inclined 8° from the horizontal. The estimated diameters are from 220–260 mm. The texture is very fine and carefully burnished. The sherds are either reduced or only slightly oxidized. Assessment of the construction method was not possible because only small fragments were recovered, except to suggest that these examples may have been turned on a slow wheel, however most were built from slabs. The fabric colour is very pale brown (10YR/8/3) to dark brown (10YR/3/3).

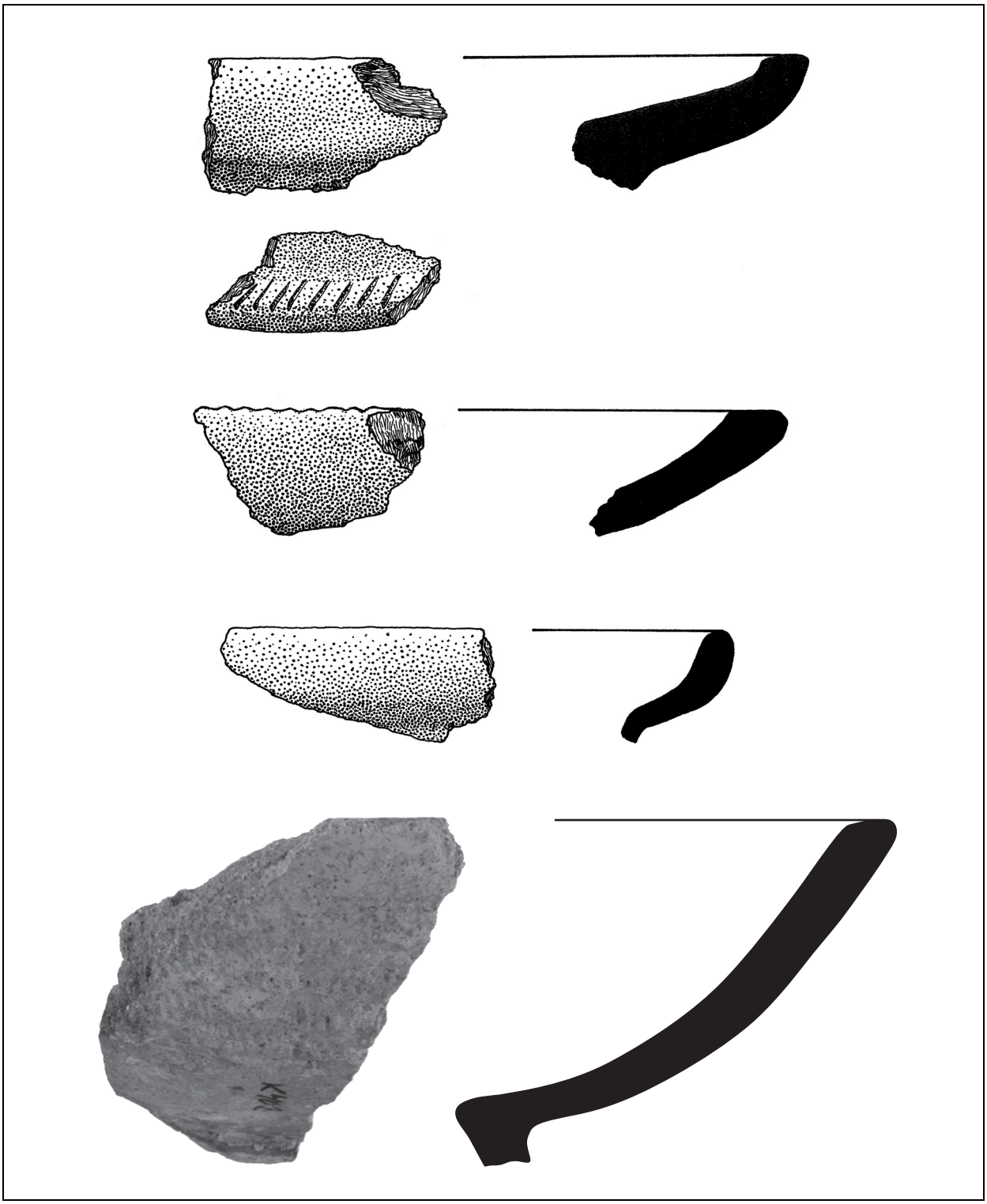


FIG. 58: Rim form 10 and variants. Ceramic Period 1. Top: 10, centre top: 10a, centre bottom: 10b, bottom: 10e. Scale: 1:1

No vessel has a comparable rim, although two MP5, special ornamental CP3 vessels (cats. 853 and 913) are similar. In each case the fabric is tempered with sand.

Variant 10e is burnished, 7 mm thick, 82 mm long, the exterior is convex by 8 mm in this length, and angled 42° to the horizontal (Fig. 58). The exterior is decorated with *Anadara* shell edge impressions within a 33 mm wide horizontal field bounded by incised lines. The fabric is tempered with sand and its suggested source is exotic to Khok Phanom Di. A summary of RF10 fabrics is set out in table 25.

TABLE 25: *The fabrics of rim form 10 and variants: Ceramic Period 1*

Form	Thin section/h.s.	Fabric group	Layer	Suggested source
10	h.s.	sand	10:25	FG1
10	h.s.	grog	10:25 lens 29	-
10	h.s.	sand	11:1	exotic
10a	h.s.	sand	11:1	-
10b	h.s.	sand	11:1	FG1
10e	K702	10	10:25	exotic

Rim form 11

These everted direct rim fragments are part of a small jar measuring 100 mm in diameter at the rim. The inclination of the rim ranges from almost perpendicular to 42° from the horizontal (Fig. 59). It is 7 mm long and 6 mm thick. The surface is smoothed or burnished and oxidized to less than 1 mm deep. Where oxidized, the fabric colour is very pale brown (10YR/8/3) and the reduced interior is dark brown (10YR/3/3). The vessel wall of form 11 is perpendicular, whereas 11a is inclined outwards slightly. Rim form 11a has vertical "Z" twist 1 mm wide cord marks to exterior surfaces and horizontal paddle-like marks to the interior. Only 30 g from rim form 11 and 50 from 11a were recovered, consequently construction methods were unable to be assessed. Hand specimen comparison indicates that some of these vessels are composed of FG10, which is exotic to Khok Phanom Di, while possibly one was local.

TABLE 26: *The fabrics of rim form 11 and 11a: Ceramic Period 1*

Form	Thin section/h.s.	Fabric	Layer	Suggested source
11	h.s.	sand	11:1	exotic
11a	h.s.	orthodox grog	10:25	local?
11a	h.s.	sand	11:1	exotic

Rim forms 12 and 13a

Single plain RF12 and 13a sherds tempered with sand were recovered from L10:25. Both are probably local. Similar forms are illustrated in figures 89 and 90 respectively.

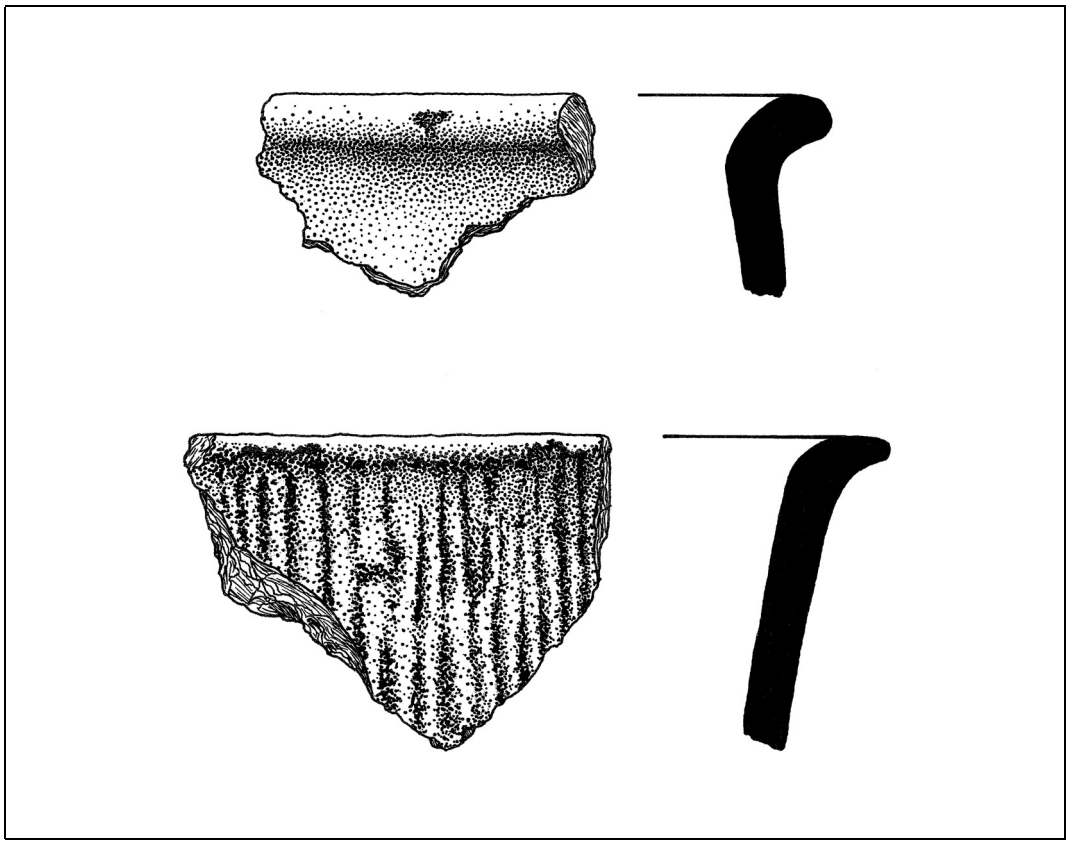


FIG. 59: Rim form 11 (top), and 11a Ceramic Period 1. Scale: 1:1

VESSEL BASE DESCRIPTIONS AND DEFINITIONS

Most vessels have round bases. Others with a ring foot, concealed or flat bases are present throughout the sequence (Appendix 3). Fourteen forms and two variants have been identified and many are readily associated with the "complete" vessel assemblage (Table 27). To avoid confusion with rim form classes, the base forms have been labelled alphabetically. Five base forms from CP1 are illustrated in figures 60 and 61. The remainder will be considered in the following three chapters which deal with CP2 to CP4. Table 28 provides a summary of CP1

base fabrics.

Base form A

Apart from one sherd in L10:22, this form is restricted to CP1. The vessels they represent have been made to such a high standard of precision that it is extremely difficult to determine whether some type of wheel was used for shaping and this possibility cannot be excluded (Fig. 60). A series of three parallel horizontal lines are incised about 20 mm apart from the base upwards. One sherd has vertical cord marks less than 1 mm wide which have been precisely arranged in a field between the second and third of these lines. Although this could suggest that the vessel was fashioned with a paddle and anvil, the marks are clearly decorative and they do not necessarily denote such a construction method. The imitation of metal artefact designs by potters and the reverse where "a number of pottery types are represented in identical shapes among contemporary vessels" has been reported from Early Minoan and first millennium Central Europe (Trachsler 1965:144). In this manner, favoured styles can be carried forward into new technologies because they are fashionable. The precision with which the cord marks have been applied clearly signals that they were valued for their decorative style. The overall surface finish is highly burnished and this, coupled with a heavily reduced fabric, has produced a high lustre. The base shape is similar to cat. 1955 (Fig. 39) and its diameter is 160 mm. Unfortunately the skirt portion is missing. Above the vessel floor the fabric is reduced to give a black (10YR/2/1) to very dark grey (10YR/3/1) colour, and below is oxidized to a very pale brown (10YR/7/3). These differences suggest that the vessel was probably fired in an upside down position. In hand specimen, the sand-tempered sample is comparable with the exotic FG10.

TABLE 27: *Vessel base forms by stratigraphic layer*

Form:	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Layer 1				x	x		x							
2			x	x	x		x		x	x				x
3		x	x	x	x	x	x		x	x				
4		x	x	x	x		x		x	x	x			
5			x	x	x				x	x				
6		x	x	x	x		x	x	x					
7		x	x	x	x								x	
8			x	x	x		x						x	
9		x		x	x		x							
10	x	x	x	x	x	x						x		
11	x	x	x	x	x									

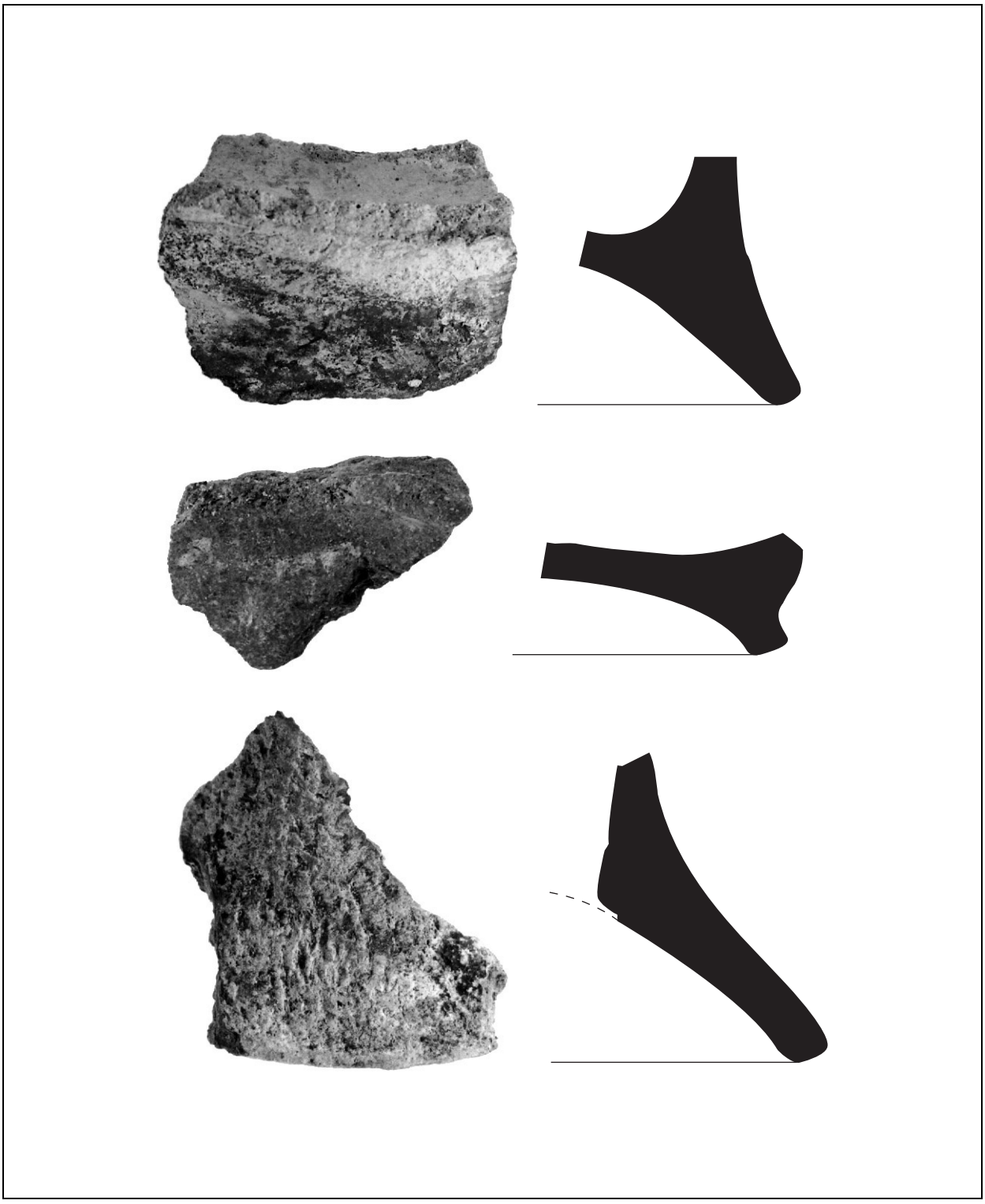


FIG. 60: Ceramic Period 1 base forms. Forms A (top), B (centre) and C. Scale: 1:1

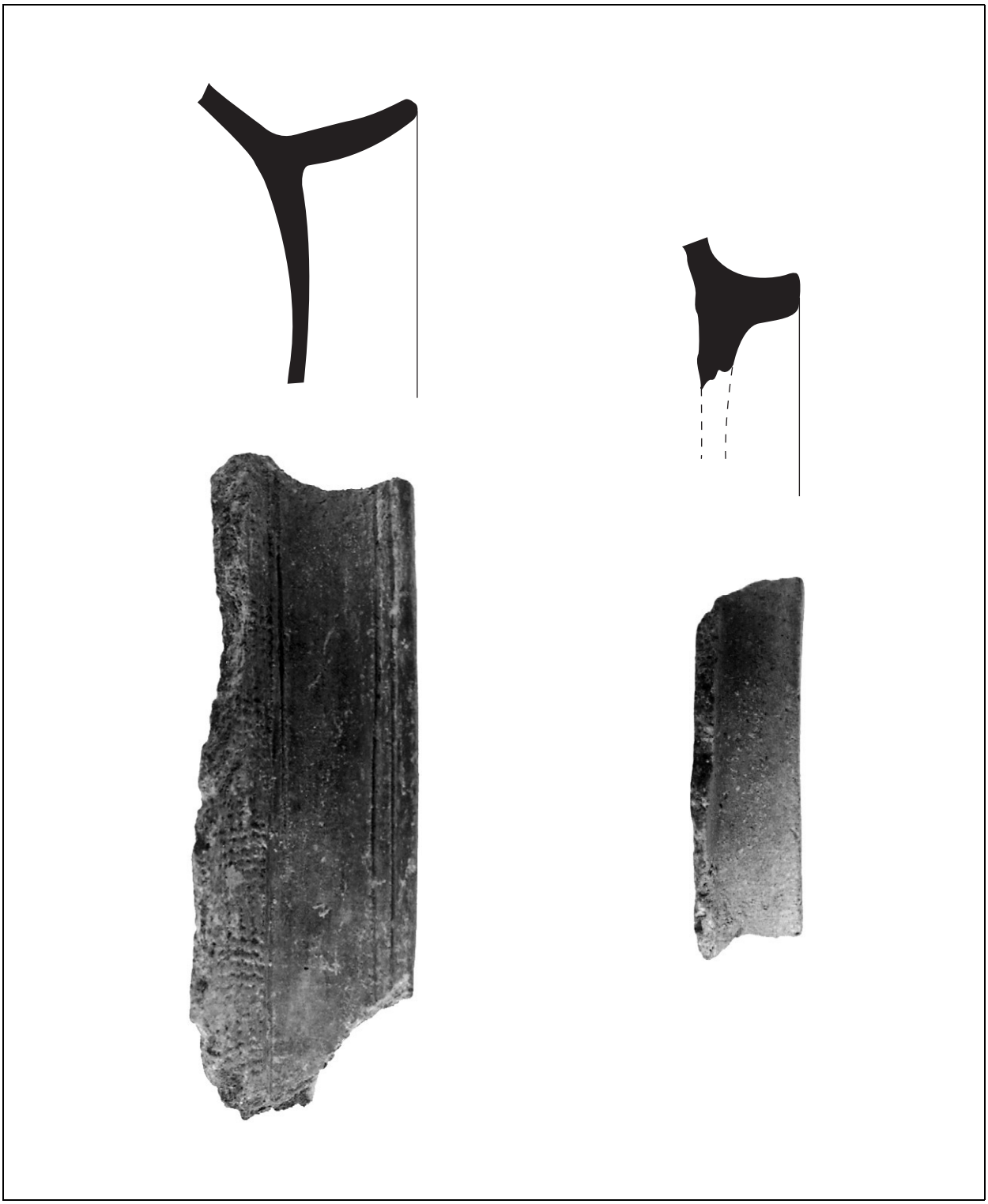


FIG. 61: Ceramic Period 1 base forms (cont.). Forms D (left, cat. 1518) and E (right, cat. 1678). Scale: 1:1

Base form B

This form is defined by a small rounded base foot which slopes outwards on a 45° angle. It extends 5 mm, is the same thickness and measures 200 mm in diameter. The surface is burnished a reduced black (10YR/2/1) to very dark grey (10YR/3/1) and is undecorated. Some later versions are decorated with two incised lines about 10 mm above the lowest point. The texture is very fine. Only two sherds are present in CP1 and in hand specimen one fabric is consistent with FG10 and the other with FG2.

Base form C

In contrast to the previous two forms, this base is from a coarse cord-marked ware readily identified as fashioned with a paddle and anvil as an integral part of the overall construction process. It stood 120 mm in diameter, is 52 mm long and tapers from 8 to 15 mm in its length and is inclined 48° from the horizontal. The fabric is tempered with orthodox grog, oxidized and coloured a yellowish brown (10YR/5/4).

Base form D

Funerary "platters" such as cat. 1518 from burial 91 MP2 are the source of these bases. The base thickness is 5 mm, the length varies from 15–25 mm, it slopes outwards about 10° and is up to 220 mm in diameter. Two or three lines 3 mm apart have been incised adjacent to the base edge. An *Anadara* shell impressed field about 20 mm wide is arranged from the inflection point upwards. The surface is highly burnished and reduced a brown (10YR/5/3) colour. These bases are from high quality fine wares which have been expertly fashioned.

Base form E

This is an undecorated burnished "ring" base which has been formed separately and attached to the bottom of the vessel. It varies in length from 13–30 mm and from 5–6 mm in width and is 90–100 mm in diameter. The oxidized colour is light brownish grey (10YR/6/2) and reduced areas are brown (10YR/5/3). The highly-decorated funerary urns such as cat. 1678 from B120, MP2, are probably the source of these high-quality bases.

Summary

Of the five base forms present in CP1, forms D and E are clearly from local wares and they can readily be associated with funerary vessels included as grave furniture during MP2. One of these, form D, represents high quality fine ware shallow platters, and both local and exotic versions of this type tempered with bleb grog are present. Form A is present in exotic and local types, the latter belonging to CP2 as is Form B. Both types are also fine wares. The single coarse ware base type contains orthodox grog and is probably exotic.

TABLE 28: *The fabrics of base forms A, B, C, D and E: Ceramic Period 1*

Form	Thin section/h.s.	Fabric group	Layer	Suggested source
A	h.s.	sand	11:2	exotic?
A	h.s.	2	11:1	local
B	h.s.	2	11:1	local
C	h.s.	orthodox grog	11:1	exotic?
C	h.s.	orthodox grog	10:25 (lower)	exotic?
D	h.s.	2	11:1	local
D	h.s.	bleb grog	10:25 (lower)	exotic
E	h.s.	2	11:1	local

THE TRIPOD VESSEL FEET

Tripod-footed vessels were locally made at Khok Phanom Di throughout the sequence but only in small numbers. All are solid and undecorated with smooth plain surfaces. Five pot feet were recovered from CP1 contexts and all are considered to have been locally made. Some of the feet from CP2 are almost certainly exotic. Of the 27, possibly 29, feet recovered, five are from CP1, 19 are from CP2, three from CP3 and two equivocal samples are from CP4. Thus nearly 90 per cent of the sample was recovered from CP1 and CP2. Cat. 3250, a small CP3 round-ended cylinder, and cat. 3249, a small CP4 cylinder with a hollow end, are fragmentary, thus making positive identification difficult. The former may be the broken end of a ladle handle and the latter a decorative nubbin. Apart from these two artefacts, the tripod feet can be subdivided into five morphological groups: 1. pointed round cones; 2. truncated cones; 3. rounded cones; 4. pointed ovoid cones; 5. dome shaped cones. All CP1 tripod feet are locally made conical 1 forms. The different forms are illustrated in figure 93.

It is important to note that the feet have been examined in hand specimen only, with reference to known fabric groups where possible. Particular caution should be accorded those feet considered as possible imports, although clear form correlations are apparent with several of them. This aspect is discussed further in chapter VIII.

Tripod vessels are known from other South East Asian sites and the implications of these associations will be considered in the final chapter. The tripods at Khok Phanom Di are small and have, therefore, been classed as feet rather than legs. They are solid rather than hollow, as is the case with tripod legs from other sites. Some of the feet, such as the dome versions, have been formed as an integral part of the vessel base rather than as separate components which have been joined to the body fully formed as a final step in the construction process prior to drying and firing (Appendix 3). Finally, we can note that during CP1, some wares with pointed conical shaped feet were made by the local potters. Unfortunately none of these wares was able to be identified in the CP1 sample.

TABLE 29: *The tripod pot feet from Ceramic Period 1*

Cat.	Layer	Length (mm)	Diameter	Fabric (h.s.)	Shape	Suggested source
1997	10:25 l.29	58	38/3	grp. 2	conical 1	local
1933	10:26 l.31		no data	-	-	-
1914	11:1	34	38/5	sand	conical 1	local
1916	11:1	34	30/5	sand	conical 1	local
1990	11:1	40	32/5	sand	conical 1	local

CERAMIC PELLETS

Three ceramic pellets measuring from 14–23 mm in diameter were recovered from CP1. They are assumed to have been ammunition for pellet bows used in hunting birds and small game. Cats. 1934 and 1938 were recovered from L11:1, cat. 3262 from L10:25 lens 29. The latter pellet was unfired and coloured a light grey (10YR/7/2). It measured 16 mm in diameter. In each case the pellet fabrics are consistent with local clays.

DECORATIVE MODES

Pottery is an outstanding medium for artistic expression. Plastic clay is readily formed into complex shapes and decorative forms. The techniques used to create these shapes and decorations are preserved in the pottery and can usefully be analysed as to their modes of application. Design motifs are often used to characterise cultural styles. Subjective classifications, however, have often rendered much of this research difficult if not impossible to replicate by later researchers working with similar material. As Orton *et al.* (1993:86) note "The description and classification of decorative patterns is a difficult and contentious area, especially if attempts are made to understand the symbolic content of the pattern."

Leaving aside symbolic expression for the present, surface decoration can be classified through determining modes of application, as this reflects technical aspects rather than artistic expression alone. An initial study identified eight motif groups and 30 variants "based on the mode of application:" incised, impressed, incised and impressed combination, cord marked and incised on a smoothed band, paddle-impressed, ridged and notched, appliqué and burnished (Hall 1993:239-74). To these the following CP1 appliqué variant has been added:

7:1 A triangular added strip applied to a burnished and incised vessel (L11:1).

The following non-mortuary decorative modes were present during CP1. They should be read in conjunction with the rim form weights set out in Appendix 2. The modes are annotated and the weights are as reported by Hall (1993:240-52) except where indicated:

(1) Incised

Incised sherds weighing 1206 kg were recovered. They were rendered in both geometric and curvilinear designs on plain smoothed or burnished surfaces. FG1, as well as exotic wares tempered with sandy and silty orthodox grog and bleb grog were present.

(2) Impressed

Stamped fine pointed impressions, *Anadara* shell edge and square probe impressions were all noted by Hall (*op. cit.*) Fine wares also included fine cord-marked impressed fields and these are included with this category. Their total weight for L11 is 509 g.

(3) Incised and impressed

This mode comprises wares decorated with geometric and curvilinear fields of impressed designs which themselves include both random and lineal impressed patterns weighing 644 g.

(5) Paddle impressed

A total of 101 g were recorded by Hall for L11. A selection of these sherds was examined in hand specimen. A variety of fabrics is represented, suggesting that a broad range of potting traditions was involved. These fabrics were tempered with sand, orthodox and bleb grog and a sandy bleb grog. Such a diversity of wares indicates that paddle-impressing was a regional decorative mode.

(6) Ridged and notched

This mode is rare, being confined to CP1 and CP4. It was formed by reducing the vessel wall by scraping the leather-hard clay in strips to create a raised convex strip, or by modelling the wet clay into such a relief. Sherds weighing 166 g represent the mode in L10 and L11.

(7) Appliqué

To the 28 g recorded by Hall one further burnished and incised form A1 sherd weighing 1 g and composed of a sandy bleb-tempered exotic fabric was recovered from L11:1 (Fig. 62).

(8) Burnished (incised, impressed, incised and impressed, paddle-impressed, ridged and notched and appliqué)

Burnished fine wares are common throughout the stratigraphic sequence in varying proportions. Locally-made burnished vessels dominate this decorative mode, although several imported

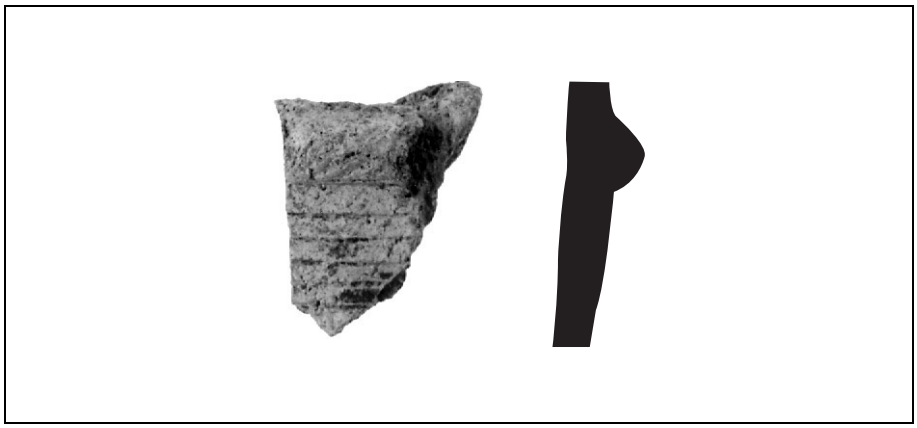


FIG. 62: Appliqué form A1. Ceramic Period 1. Scale: 1:1

wares were also burnished, reflecting that this was a regional decorative style. In some cases, both interior and exterior vessel surfaces were treated in this manner. During CP1, local burnished wares were composed of FG1. A total of 1041 kg was noted by Hall. The fabrics have not been assessed except as they occur in the rim forms.

''COMPLETE'' VESSELS

Archaeological reports commonly list pottery vessels as "whole" or "complete" when they are not intact but more-or-less entire. Unless these terms are clearly defined it is often not possible to determine the condition of vessels as received by the archaeologist. Excavated pottery is often recovered extensively fractured and fragmented. Such wares require careful, often painstaking, laboratory reconstruction before an accurate assessment of the artefact's overall condition can be established. Hence apparently "whole" vessels in the field may, after detailed laboratory analysis, only represent a fraction of the vessel because parts have been deliberately removed or accidentally lost in prehistory. From an analytical perspective, provided all the relevant portions of a vessels form are present in an assemblage, it seems reasonable to infer that even when parts of an individual vessel are missing that the whole form can be inferred from morphologically identical vessels in the assemblage in which the missing portion is present. Such a definition of "whole" is followed in this report. Most of the vessels are illustrated as entire, however a selected sample has fracture patterns added to assist interpretation of fabrication methods. An estimate of the percentage of the vessel surviving is given where possible.

Two vessels were recovered from the lowest cultural context at Khok Phanom Di in feature 2 (Higham and Bannanurag 1990:31). One of these, cat. 1955, is illustrated (Fig. 39). Insufficient fragments of the other, cat. 1956, survived for reconstruction. Both are composed of the same coarse sandy fabric and were decorated in a similar manner. Cat. 1955 relates to rim form 5c and base form "A". The surface is highly burnished and decoration comprises horizontal fields

bounded by parallel incised lines. The base has a 10 mm deep band with diagonal lines only visible with a hand lens due to post-depositional erosion. The rim section is similarly eroded, however, the 12 mm deep field has faint punctate impressions probably imparted with an *Anadara sp.* shell. The vessel was fired in a reducing atmosphere. Its surface finish is excellent and its overall shape is so precise that it suggests that a slow wheel or turntable was used to ensure an accurate form was achieved. It is unfortunate that the surface was burnished following the final forming process because this would obliterate any residual turning marks which are diagnostic of a vessel having been turned on a wheel. It is important to note that the absence of such marks does not rule out the possibility of the use of a turntable in the final stages of forming the vessel shape. For example Hamer (1975:41) notes that "thrown pots can be burnished after turning". The base of cat. 1955, and several further bases of this form recovered from L11 are particularly even and symmetrical and this is consistent with the use of a turntable or slow wheel.

Petrographically the fabrics of these vessels are composed of a sandy micaceous matrix tempered with a silty orthodox grog. It is mineralogically compatible with FG2, the local CP2 fabric. Further, the form and surface decoration matches rim forms from the latter Period. Rim 5c is present throughout all CPs which suggests that it represents a regional style. Base form A, apart from one sherd in L10:22 is only present during CP1 and represents a construction method not readily associated with local wares. In hand specimen all the base "A" fragments recovered are composed of either FG2 or a sand tempered fabric. This suggests, therefore, that cat. 1955 does not actually derive from CP2 but that it was imported from a site which manufactured under the same rubric as this later local pottery tradition.

Recent ethnographic work in Shan State, Myanmar (Burma), has provided a detailed description of hand-made pots which were so symmetrical that they appeared to have been thrown on a wheel (Reith 1997:66-9). At the village of Compani, each pot was made on its own small board which was turned on the potter's thigh using coils to form the walls. A flat coil was stuck on edge to the board. This created the wall of a pot without a bottom. The pot and board were rotated with the palm of one hand while holding the index knuckle against the internal wall. Pressing the knuckle against the palm compressed and mobilised the wall upward. Coils were added until the pot was about 17 cm high. The potter then began "one-handed throwing" using a damp cloth held over the rim between thumb and forefinger of one hand and turning the board and pot with the other. It took six turns to complete each revolution "at a speed of 19 revolutions per minute". When video recordings of this process are speeded up it appears as if the potter is throwing the pot on a fast wheel. This stage in the process created a basic form comprising a bottomless cylinder with a thrown rim.

According to Reith, in many villages a potter's wheel would be used to make this basic form which would then be "cut off the wheel and shaped with a paddle and anvil". In Compani, however, the basic form, still on its board, was placed against the curved bottom of a large upturned pot so that the board could be turned. The potter held an anvil inside the pot and rotated it while applying a paddle to the exterior wall. The other hand directed a paddle against the outer pot surface as the vessel wall was being slightly rotated. After shaping and decorating, the pot, still attached to the board, was placed on the potter's knees and turned to check its roundness. A rounded stick was held vertically and ran around inside the lip to ensure the pot shape was consistent. It was then removed from the board and the bottom was closed over using

a paddle and anvil.

The method recorded by Reith at Compani involved a process which produced a symmetrical vessel with wheel-thrown upper section and a round paddle and anvil finished base. The Khok Phanom Di vessels have flat bases which would require a different process. It is possible that such bases could have been created by the addition of further steps using the rotating board method. This could be achieved by constructing the vessel in two stages, one to make the upper section and another, again using a rotating board, to make the lower portion. Construction could then be completed by joining the upper and lower sections together.

FIRING TEMPERATURES

A detailed discussion of firing temperatures is presented in Chapter XI. We can note here, however, that the local fabrics in the firing stands were fired to temperatures of at least 1050°C when mullite was formed. None of the pottery fabrics contain mullite and therefore they were fired to lower temperatures. We have previously considered clear evidence for open firings on rafts and this, coupled with the comparison with Ban Na Di samples, which have been subjected to detailed firing analysis, suggests that the Khok Phanom Di pottery was fired in the range between 800–950°C.

VIII CERAMIC PERIOD TWO

FUNERARY wares are an important component of any ceramic assemblage because they can provide insight, not only into symbolic expression associated with burial ritual, but also into the technological, artistic and socio-economic parameters of the ceramic traditions themselves. The organization of production, its context, concentration, scale and intensity are all important aspects of any ceramic tradition (Costin 1991). Specialization is a strategy used to organize production. As Costin asserts, what sets it apart from non-specialized production is the time devoted to it, the proportion of subsistence obtained from the activity, the presence of a recognized title, name, or office for the person, or the activity, and the payment, in money or in kind, for the specialist's products. Many of these factors are encapsulated and potentially revealed in mortuary as well as mundane contexts. The evidence may be direct or indirect. The Khok Phanom Di assemblage provides both kinds of evidence from ritual and profane contexts which bear on several of these issues. In addition, indirect evidence is also available from non-ceramic parameters which are in various ways associated with the ceramic traditions.

In this chapter we will examine the ceramic spectrum from the first of two Ceramic Periods which are associated with and reflected in mortuary rituals. We will commence our examination of this portion of the site with a brief consideration of the stratigraphy. This is followed by descriptions of pottery-related artefacts. Craft specialization is implied by the presence of many potting accoutrements, including such potters' tools as anvils, burnishing stones, incising styli and ceramic stands used to support firing rafts. Materials used to make pottery were also uncovered. Pottery and other ceramic materials from non-mortuary and mortuary contexts will then be considered.

One important question is whether we can reasonably assume that ceramic traditions do not change, or change only very gradually with time. In this chapter we can test the hypothesis that ceramic traditions tend to be technologically static and do not evolve, or at least that they change only gradually with time. We commence with an assessment of the ceramic spectrum from Ceramic Period Two (CP2) when the excavated part of the site was used as a cemetery.

THE STRATIGRAPHY (LAYER 10:24 TO LAYER 10:3)

Ash, charcoal spreads, hearths, *Anadara* sp. shell middens, and the first postholes encountered at the site feature in layer 10:24 (Higham and Bannanurag 1990:31), designated here as the lowest portion of CP2. A lens rich in large pieces of charcoal gave a radiocarbon date of 2125-1680 BC (ANU-5491). Charcoal spreads, ash lenses and hearths continue into layer 10:23 at a depth of 6.22-6.34m below datum. Burial 151, the deepest grave encountered at the site, was uncovered at this point. Charcoal and ash lensing continued into Layer 10:22. Shallow midden pits, four hearths and numerous postholes were also present in this context as was a stone adze head and

a fish-hook. Layer 10:21 featured an *Anadara* sp. shell lens, eight hearths, one of which gave a radiocarbon date of 1950-1515 BC (ANU-5489), a lens of fire-hardened clay and burial 150 (Higham and Bannanurag 1990:33). Charcoal and shell lenses, ash spreads and another grave from Mortuary Phase One (MP1), burial 147, were located in layer 10:20. Sherds sealed by ash, a thick deposit of burnt clay, bow pellets, a whetstone and an adze head were also present. Layer 10:19 included ash lenses, pits, postholes and hearths, charcoal from one of which was radiocarbon dated to 2130-1525 BC (ANU-5487). The excavators posit that ash lenses in layer 10:18 may have been redeposited in prehistory, as ash and charcoal are still prominent. A row of five hearths was cut by a trench following the same axis as most of the six graves in MP1. Ceramic bow pellets, net weights and anvils and a stone adze were recovered. Layer 10:17 contained ample evidence of burning with several charcoal-rich ash lenses but no hearths. An extensive *Anadara* sp. shell midden containing 61,116 valves and postholes were uncovered. Ceramic net weights, anvils and adze heads dominate the artefacts.

Seven burials were present in layer 10:16 in association with postholes, a hearth and one ash and charcoal lens. Burials in MP2 were interred with the first funerary wares at the site and these will be discussed in detail below. Artefacts recovered included a ceramic anvil, a net weight, stone adze heads, whetstones, burnishing stones, a bone tool and worked shell. Layer 10:15 contained a rich ash and charcoal lens, radiocarbon dated to 2270-1740 BC (ANU-5486). Five pits were filled with shell, mainly *Anadara*. Ceramic net weights and a firing stand fragment, burnishing stones, whetstones and adze heads were also recovered. Very rich deposits of ash and charcoal formed the matrix of layer 10:14. Rice chaff, shellfish and bone and some postholes were recognized but no hearths or lenses. Ceramic anvils, netweights, and burnishing stones were recovered. Layer 10:13 saw an increase in postholes with rare ash lenses and hearths. An ash lens was radiocarbon dated to 1975-1545 BC (ANU-5485). Artefacts included a whetstone, a bone tool, burnishing stones, ceramic pellets and a net weight. These trends continued into layer 10:12 with pits associated with burials and postholes evident. A whetstone, burnishing and grinding stones and a ceramic net weight were uncovered. Postholes and pits in association with burials continued into layer 10:11. Five ceramic anvils were recovered from this context.

Layer 10:10 included the first deposits of a clearly-defined shell midden which accumulated between a series of burials beginning with the end of MP2 and extending through the rest of the period as MP3 was being laid down. This midden, known as layer 10 lens 2, has been interpreted as being built against structures due to its clearly-defined boundaries. The shell could have been initially deposited following funerary ritual and subsequently used as a well-defined pathway between burials. This use could have been continued as each succeeding burial phase was built up. Erosion and compaction of the path from continued use could have formed a channel effect which was periodically replenished with shells to above ground level. This could have created the straight edges. Six pits and further postholes were added during this period of cultural deposition.

Apart from burial goods, two ceramic net weights were found in layer 10:9. Some further postholes were dug at this point. Layer 10:8 contained several pits, an ash lens and a hearth at the feet of burial 67. Four ceramic anvils, one with a possible ownership mark, were recovered. Five further pits, seven postholes and a charcoal lens were encountered in layer 10:7, B72 included the first slate artefact, a chisel, encountered in the sequence (Pisnupong 1988:135). Further postholes

and three pits were excavated into layer 10:6, and a leucogranitic hoe signals another change in stone sources (Pisnupong *op. cit.*). Twelve postholes, two pits in association with burials 60 and 79, along with three small ash spreads associated with other burials, indicate that funerary activities continued unabated as the layer 10:5 material was deposited. Artefacts included ceramic anvil and firing stand fragments, a whetstone, a pounder and grinding stones. The shell midden layer 10 lens 2 began to reduce in area. Five postholes and two pits were dug in layer 10:4 and three ceramic anvils, one with possible ownership marks, a possible firing stand fragment, a net weight and a whetstone were uncovered. The final stratigraphic unit associated with CP2, layer 10:3, witnessed a marked decrease in activity with seven postholes and one small ash lens evident along with the remnants of shell midden layer 10 lens 2. Artefacts included three ceramic net weights, fragments of six ceramic anvils and fragments of at least one, or possibly three firing stands, burnishing and grinding stones and a stone tool. A hiatus in mortuary activity occurred in layer 10:2 between MP3 and MP4. Postholes and one pit are the only features in this level.

In summary the principal cultural remains are human burials and their funerary furniture which in MP1 comprised unwoven *tapa* fabric and red ochre (Higham and Bannanurag 1990:143). In MP2 funerary furniture included a wooden coffin or bier, *tapa* or asbestos fabric (Higham and Bannanurag 1990:151 and *passim*), red ochre, a fish vertebra bangle, a *Rhinoceros* tooth, a polished stone adze, burnishing stones, disc, funnel and barrel shaped shell beads, cowrie shells, a pierced snail shell, a bored canine tooth, a bone fish-hook, a pig scapula, a polished stone adze, ceramic vessels, bow pellets and prepared potting clay. It should be noted, however, that according to Higham (pers. comm.), the MP1-3 burial fabrics were made of "bark cloth or asbestos".

Burials during MP3 included red ochre, *tapa* fabric, disc- and barrel-shaped shell beads, a fish-vertebra bangle, a turtle carapace ornament, *Nautilus* shell, a shaped animal tusk, a shark dorsal spine pendant, a polished stone chisel, burnishing stones, a miniature ceramic anvil and pottery vessels. In addition much pottery, ceramic anvils, firing stands, netweights, bow pellets, potsherds, burnishing stones, prepared potting clay, whetstone grinding stones, stone adze and granite hoes, small bone tools and fish-hooks, extensive shell midden, ash and charcoal spreads, hearths, postholes and pits were uncovered from the matrix. From a ceramic perspective it is important to note that firing stands make a re-appearance near the uppermost level of CP2, apart from a single fragment in layer 10:15. The distributions of firing stands, burnishing stones, bone stylus points, bow pellets, vessel bases and potting clays are set out in the following sections.

THE POTTERY RELATED ARTEFACTS OF CERAMIC PERIOD 2

THE POTTERS' EQUIPMENT IN BURIALS

Burnishing stones are present in 11 CP2 burials and within the general matrix of layer 10, which contains the entire CP2 spectrum. A total of 197 stones, 21 in association with burials, were recovered (Table 30). Those recovered from CP2 represent 53.5 per cent of the total assemblage. This signals that burnishing was an important component of pottery production during this period. The stones are included as funerary furniture in both female and male graves. Of 97 MP2 and MP3 burials, 11 included burnishing stones. A miniature ceramic anvil (cat. 1448) and the burnishing stone (cat. 1449) were found in the grave fill of burial 82. Their association with the burial is uncertain. A clay cylinder (cat. 1555) was found next to the head of B109 (Table 31). Burnishing stones interred with B107 and B110 are illustrated in figure 63 (from Moore 1993:112, Fig 38).

TABLE 30: *The Ceramic Period 2 burnishing stones (n = 197)*

Layer	No.	Feature	Layer	No.	Feature	Layer	No.	Feature
10:3	9	-	10:10	1	B123	10:14	3	B132
10:3	43	lens 2	10:11	13	-	10:14	1	4
10:4	5	-	10:11	1	B96	10:15	6	-
10:5	3	-	10:11	1	16	10:15	1	B107
10:6	4	-	10:11	1	B94	10:15	5	B110
10:6	1	B82	10:12	1	6	10:15	1	5
10:6	2	B83	10:12	3	9	10:16	4	-
10:7	3	B72	10:12	1	B109	10:17	2	-
10:7	5	-	10:12	12	-	10:18	2	-
10:8	7	-	10:12	1	12	10:19	1	-
10:9	4	-	10:13	14	-	10:20	1	-
10:9	1	32	10:13	4	12	10:21	1	-
10:10	11	-	10:13	1	-			
10:10	2	B91	10:14	15	12			

Some burials included stones placed in shell valves. Such shells could have been used to decorate fine wares but as many are not directly associated with burials and numerous other suitable shells were scattered throughout grave fill and the general matrix no assessment of their function has been made (see Higham and Bannanurag 1990).

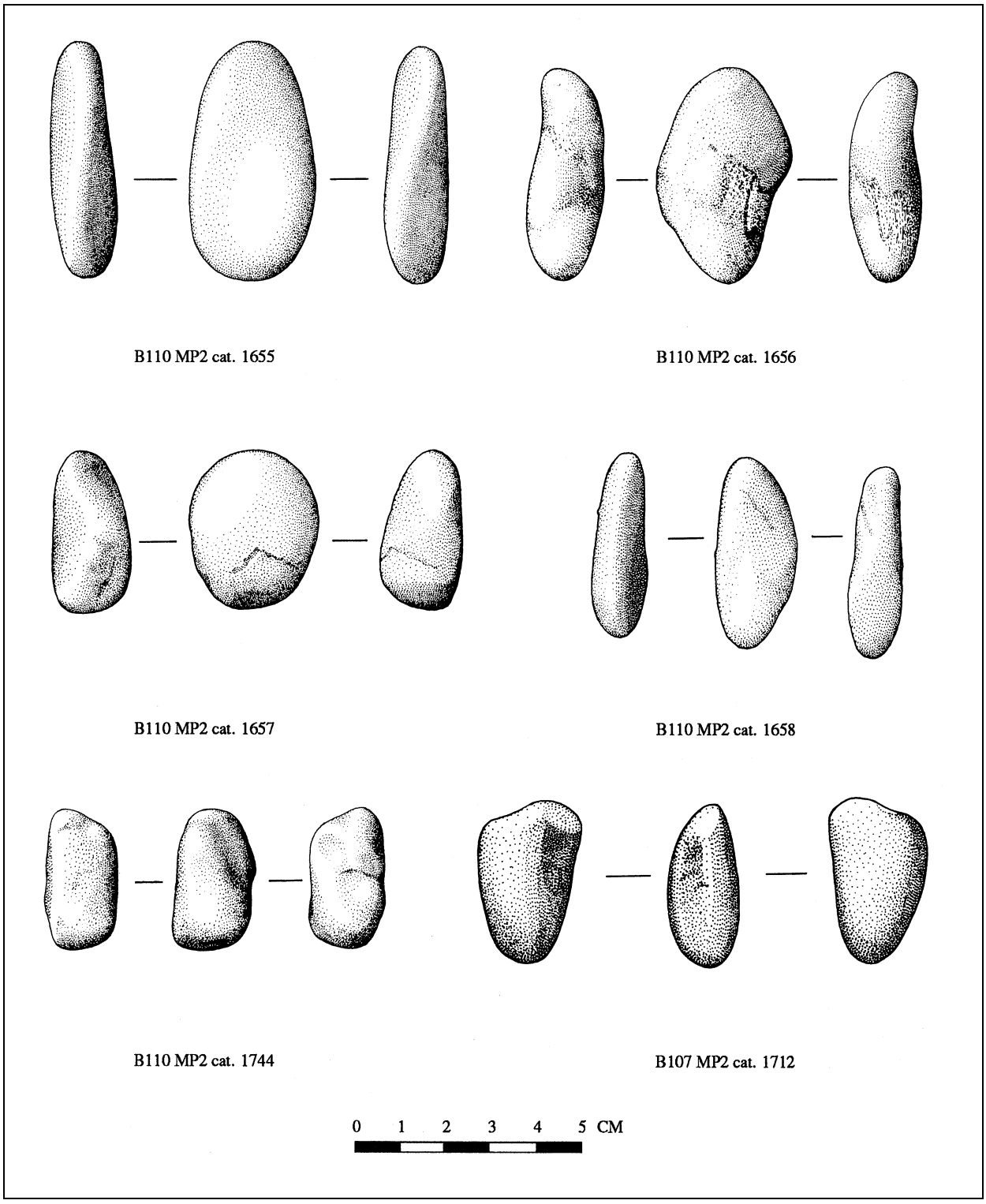


FIG. 63: The burnishing stones from burials 107 and 110

TABLE 31: *The potters' equipment in Ceramic Period 2 burials*

Burial	Layer	MP	Age (yrs)	Sex	Burnishing Stones	Ceramic Anvils	Clay
82	10:6	3	6 mths	-	1	1	-
83	10:6	3	30	female	2	-	-
72	10:7	3	32	male	3	-	-
91	10:10	2	45	male	2	-	-
123	10:10	2	2	-	1	-	-
94	10:11	2	31	female	1	-	-
96	10:11	2	4	-	1	-	-
109	10:12	2	31	female	1	-	1
132	10:14	2	34	male	3	-	-
107	10:15	2	40	female	1	-	-
110	10:15	2	36	female	5	-	-
Total					21	1	1

THE CERAMIC ANVILS

Ceramic potters' anvils were recovered from non-burial contexts throughout CP2 (Figs. 64 to 68, tables 32 and 33). The handle diameters were measured at the bottom of the handle. The fabric of cat. 1728 includes incidental fragments of rice husk. No nonplastics were visible in the fabric of cat. 1798. It is important to note that some layer 10 burials, which were cut from approximately 10:2 to 10:7, are considered to belong to the phase when the subsequent local potting tradition designated as CP3 was active at Khok Phanom Di. Cat. 1448 was only provisionally assigned by the excavators to B82 because the grave was disturbed.

Fourteen anvil fragments have been examined in thin section. Where appropriate, complete anvils have been compared in hand specimen with fragments that were examined petrographically. The fabric described as 'fishpond' has not been assigned to a group because this local clay was used throughout the sequence by a succession of potters for utilitarian wares, anvils, bow pellets and net weights. Often this clay was used unmodified. When temper was added this will be noted. None of the local CP2 anvils made from fishpond clay was tempered. One anvil fragment recovered from layer 10:7, cat. 1412, was unable to be assigned to a fabric group. This fabric is micaceous with few nonplastics, very rare sponge spicules, some fine to medium sand-sized angular to subangular monocrystalline quartz, chert and coarse silt-sized iron-rich opaques. It is tempered with orthodox grog and was probably imported, but this cannot be firmly established without detailed analysis which is beyond the scope of the present report. It is important to note that the anvil figures given include both complete and fragmentary specimens. Where feasible, fragments belonging to the same anvil have been reassembled and recorded as one artefact.

One of the 37 anvils assigned to CP2 was unavailable, 16 were fragmented and 20 were complete, or nearly so. Fourteen anvils were examined petrographically and 22 in hand specimen.

Two anvils, cats. 1448 and 1626, were assigned to fabric groups through comparison with known fabrics in hand specimen. Of the latter group, cats. 1379 and 1807, based on differences in fabric, are probably exotic. Cat. 1435 is bleb tempered, and a different colour to the locally-made anvils. Both these factors suggest that it also is exotic. The balance of the sample is difficult to separate from the local assemblage, however, cats. 1485 and 1798 are a different shape and colour which may suggest that they are exotic. Cat. 1273 is eroded and probably composed of untempered fishpond clay. Cats. 1443, 1666 and 1668 probably belong to fabric group two (FG2), and 1867 to FG1. The remaining anvils are probably local but without detailed petrographic evidence, this cannot be confirmed. Complete ceramic artefacts are often considered to be too precious for cutting thin section samples from and these anvils share that consideration.

This gives a total of seven exotic anvils, five of which have been assessed in hand specimen only. Of these five, cats. 1379 and 1798 differ in shape and fabric. Thus, of the 14 anvils examined in thin section, two are exotic, as are at least two, and possibly five, of the 22 hand specimen sample. If this assessment is correct, it suggests that the site was receiving immigrant potters on an irregular basis throughout this period. Caution is warranted, however, because even the thin-sectioned fabrics are difficult to assign to foreign sources. The fabric of cat. 1412 is composed of a micaceous matrix with very few nonplastic inclusions. It is tempered with orthodox grog. Monocrystalline quartz and some chert, of fine silt to medium sand size, very rare sponge spicules and coarse sand-sized iron-rich opaques are present along with what is probably post depositional authigenic calcite. A lack of distinctive minerals sets this fabric apart from the local sample. The fabric is geologically non-specific in terms of suggesting any particular source, except almost certainly to exclude it from the local fabrics. The fabric of cat. 3246 is composed of a micaceous matrix tempered with mostly fine to medium sized angular to rounded sand. This is mainly monocrystalline quartz, although some is polycrystalline. Some of the latter are crenulated and appear stretched, suggesting they have been metamorphosed. A few fragments of angular to subangular, very coarse sand-sized ferruginous siltstone are also present. Overall this suggests a reworked sedimentary source perhaps located to the east of Khok Phanom Di near the Kaeng Krachen Formation.

We can be confident that several of the anvils are exotic. Unfortunately sources are not easy to identify. We can, however, eliminate individual anvils from this assemblage by using at least two criteria: (i) they are clearly exotic in terms of their fabric (ii) they are not composed of any of the local fabric groups associated with this period. We have considered the first criterion above. The second relates to the kinds of local fabrics which characterise CP2, namely the sandy grog-tempered fabric designated FG2, or fabrics composed of the local fishpond clay. Any other fabric can reasonably be considered as either being misplaced stratigraphically, for example FG3 which characterises CP3 local wares, or to be exotic.

THE POTTERS' MARKS ON CERAMIC ANVILS

Of the 37 ceramic anvils recovered from CP2 contexts, three displayed a variety of possible ownership marks. The earliest was found in layer 10:11 about halfway through this section of the sequence. The source of this artefact is uncertain, however there are no distinguishing

TABLE 32: *The ceramic potters' anvils from Ceramic Period 2*

MP	Cat.	Layer	Condition	Feature	Thin sec.#	Fabric
3	1379	10:3	complete	-	h.s.	sand exotic?
3	1230	10:3 ls 2	-	-	-	no data
3	1232	10:3 ls 2	fragments	-	K271	fishpond
3	1240	10:3 ls 2	fragment	-	K255	fishpond
3	1247	10:3 ls 2	fragment	-	K249	FG2
3	1264	10:3 ls 2	fragment	-	K268	FG2
3	1784	10:3 ls 2	fragment	-	K347	FG3
3	1273	10:4	fragment	-	h.s.	local?
3	1279	10:4	fragment	-	K260	fishpond
3	1280	10:4	complete P.M.	-	h.s.	grog
3	1307	10:5	fragment	-	K258	fishpond
3	1340	10:5	fragment	-	K368	fishpond
3	1448	10:6	complete	B82	h.s. (K260)	fishpond
3	1403	10:7	fragment	-	K270	FG2
3	1412	10:7	fragment	-	K257R	orth. grog exotic?
3	1423	10:8	comp. small	-	h.s.	grog
3	1435	10:8	complete P.M?	-	h.s.	blebs?
3	1571	10:8	fragment	F14	K267R	FG2
3	1571a	10:8	fragment	-	K158	fishpond
3	1443	10:9	fragment	-	h.s.	FG2?
2	1485	10:11	complete	-	h.s.	grog
2	3246	10:11	fragment	-	K162	sand exotic?
2	1486	10:11	complete P.M.	-	h.s.	grog
2	1499	10:11	complete	-	h.s.	grog
2	1549	10:11	complete	-	h.s.	grog
2	1625	10:13	complete	-	h.s.	grog
2	1626	10:14	near complete	-	h.s. (K252)	FG1
2	1634	10:14	near complete	-	h.s.	grog
2	1635	10:14	complete	-	h.s.	grog
2	1666	10:14	complete	-	h.s.	FG2
2	1668	10:14	complete	-	h.s.	FG2?
2	1728	10:16	fragment	-	K251	fishpond
2	1732	10:16	complete	-	h.s.	grog
2	1764	10:17	complete	-	h.s.	grog
2	1798	10:18	complete	-	h.s.	grog
2	1807	10:18	complete	-	h.s.	sand
2	1867	10:21	near complete	-	h.s.	FG1

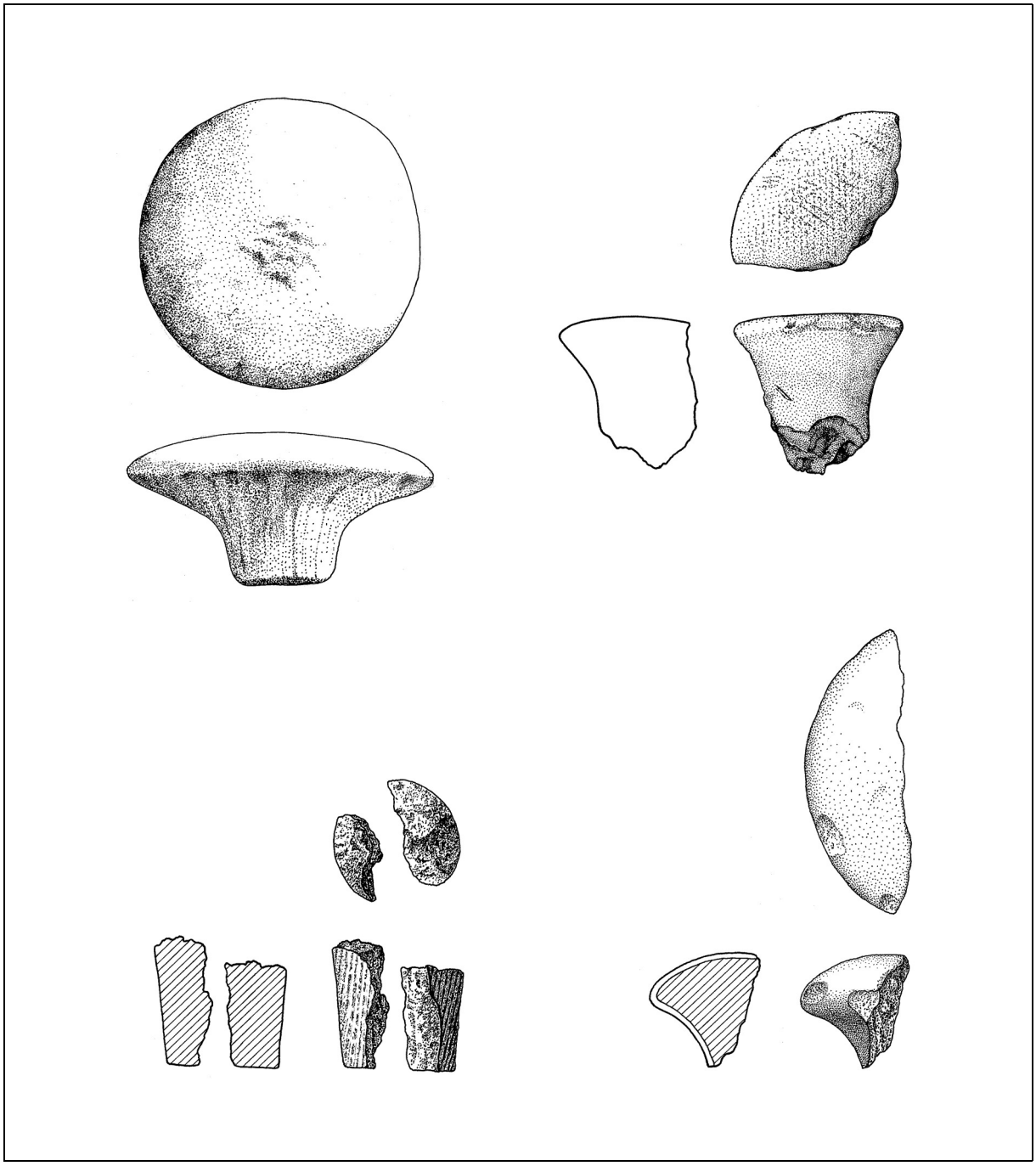


FIG. 64: Ceramic Period 2 potters' anvils. *Top* left: cat. 1379, right: cat. 1247, *Bottom* left: cat. 1240, right: cat. 1264. Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

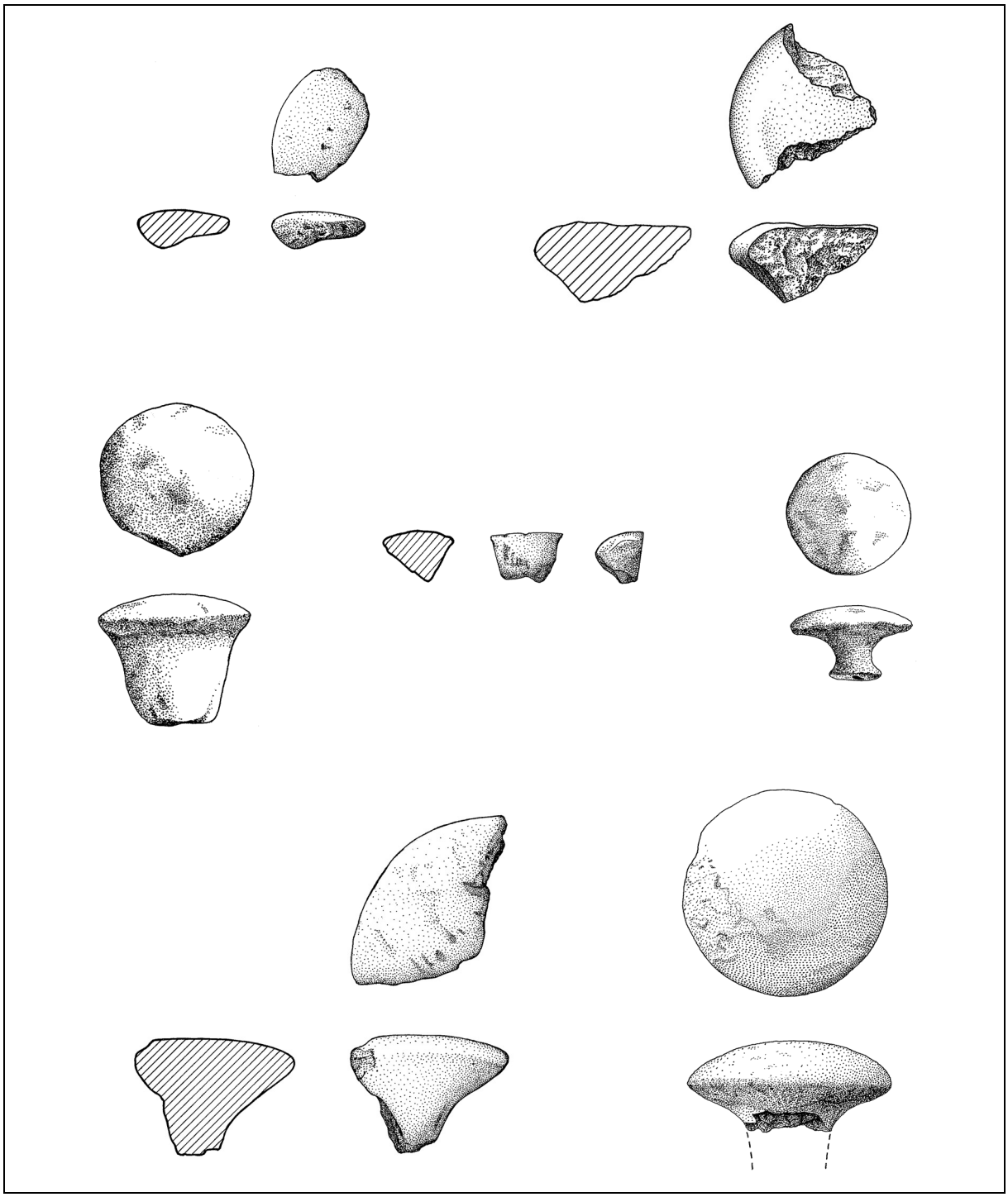


FIG. 65: Ceramic Period 2 potters' anvils. *Top* left: cat. 1403, right: cat. 1307, *Centre* left: cat. 1435, middle: 1571a, right: 1423, *Bottom* left: cat. 1571, right: cat. 1443. Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

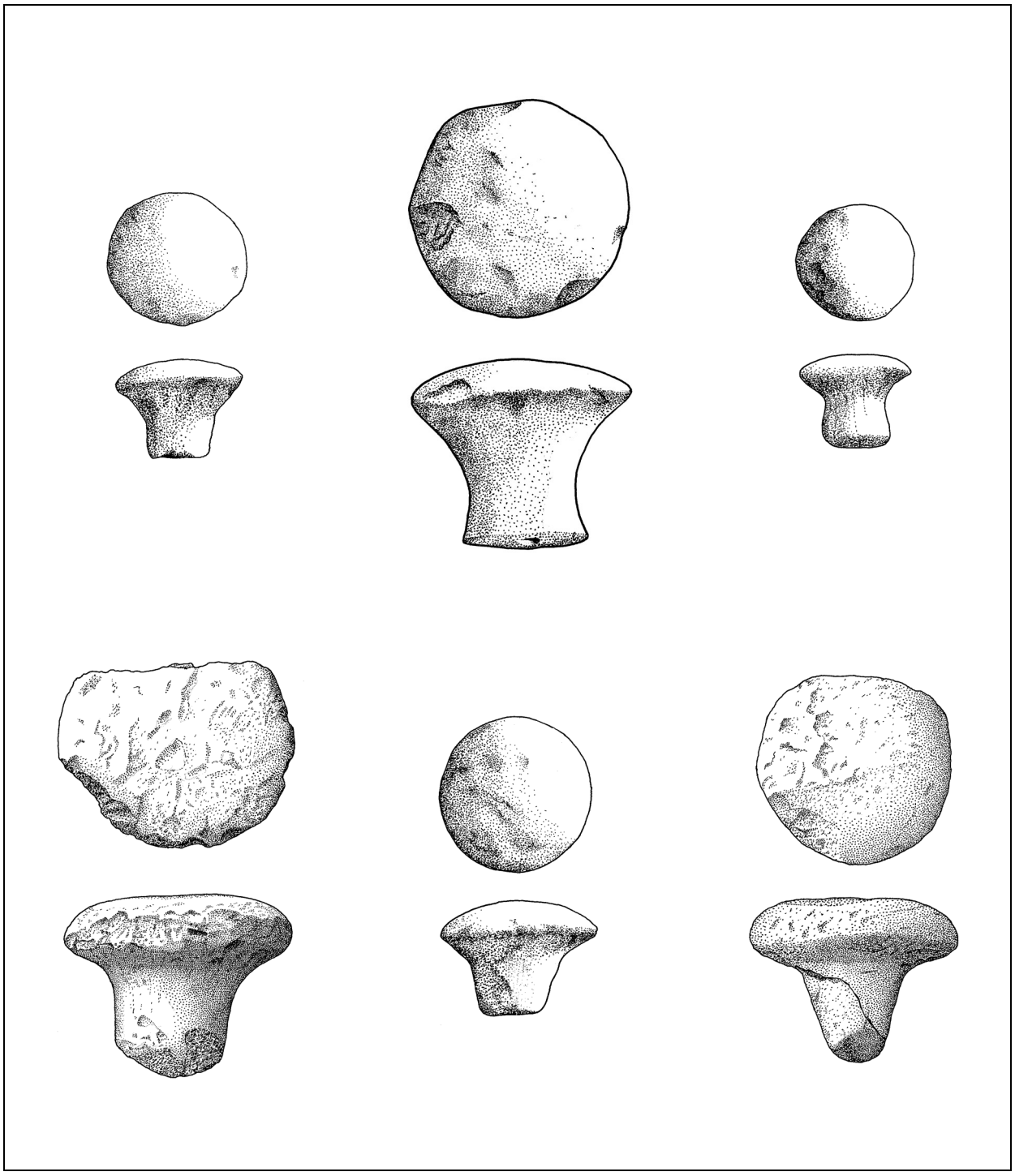


FIG. 66: Ceramic Period 2 potters' anvils. *Top* left: cat. 1485, centre: cat. 1486, right: cat. 1499, *Bottom* left: cat. 1549, centre: cat. 1625, right: cat. 1626. Scale: 1:2

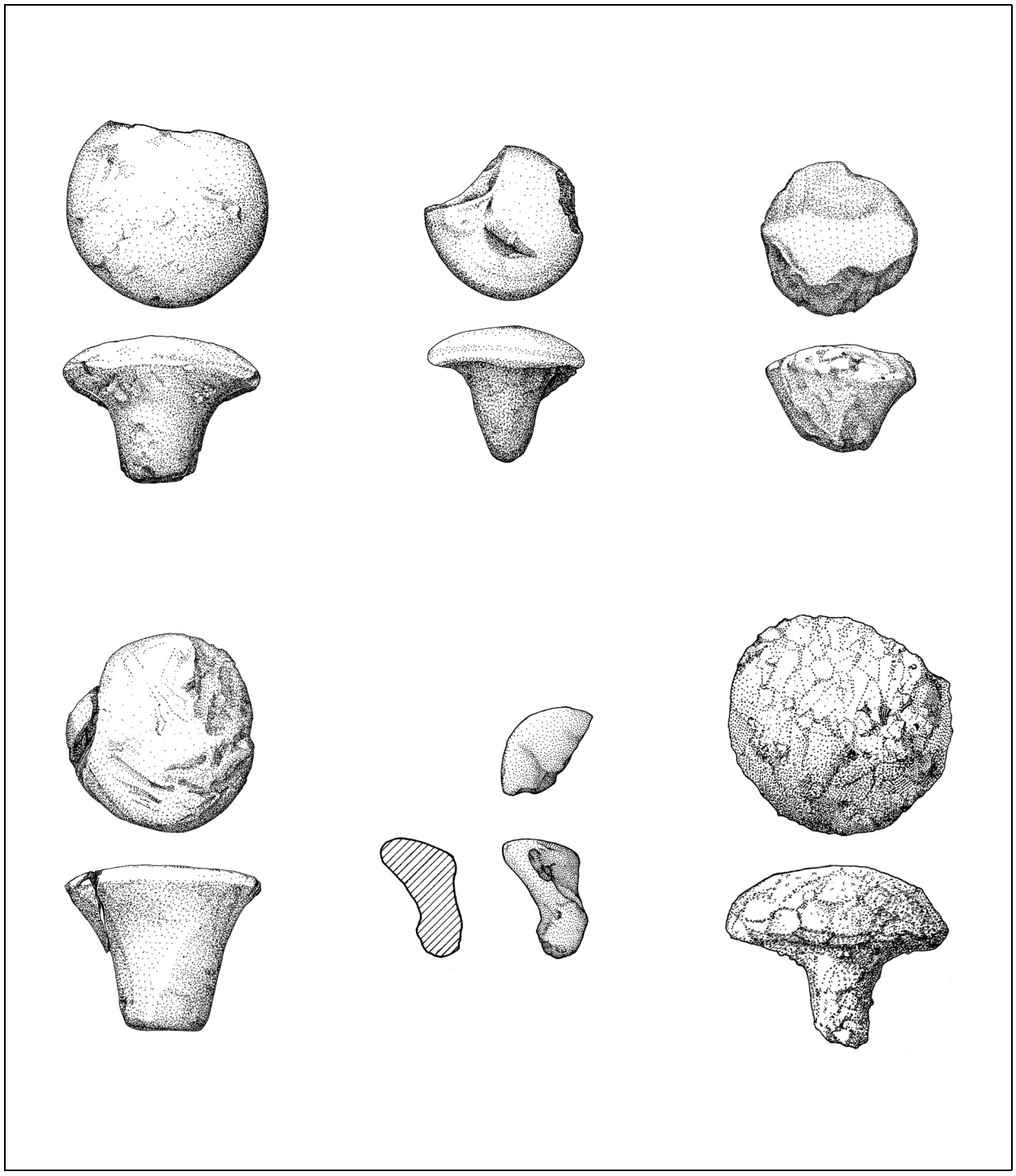


FIG. 67: Ceramic Period 2 potters' anvils. *Top* left: cat. 1634, centre: cat. 1635, right: cat. 1666, *Bottom* left: cat. 1668, centre: cat. 1728, right: cat. 1732. Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

TABLE 33: *Ceramic Period 2 anvils: size, colour and cord marks*

Cat.	Layer	Diam. (mm) Head	Diam. (mm) Handle	Overall Length	Colour	Cord marks
1379	10:3	87	33	47	10YR/6/3	Z 2-1
1240	10:3 ls 2	-	40	-	10YR/5/4	S 2-1
1247	10:3 ls 2	72	-	-	2.5YR/6/6	indistinct
1264	10:3 ls 2	97	-	-	10YR/7/3	-
1273	10:4	-	-	-	2.5YR/6/6	indistinct
1280	10:4	55	34	44	10YR/6/4	-
1307	10:5	70	-	-	10YR/7/3	Z 0.5-0.5
1340	10:5	100	-	-	2.5YR/6/6	-
1448	10:6	44	10	35	-	-
1403	10:7	60	-	-	-	-
1412	10:7	60	-	-	2.5YR/6/6	-
1423	10:8	39	17	24	5YR/7/4	-
1435	10:8	49	23	43	7:.5YR/6/6	-
1571	10:8	90	-	-	10YR/6/3	-
1571a	10:8	50 (est.)	-	-	2.5YR/6/6	-
1443	10:9	64	23 (est.)	-	10YR/7/3	-
1485	10:11	43	21	32	5YR/7/4	-
1486	10:11	71	40	62	10YR/6/2	-
1499	10:11	38	22	30	5YR/6/6	-
1549	10:11	74	34	-	10YR/6/4	-
1625	10:13	51	20	37	5YR/6/4	-
1634	10:14	65	23	48	5YR/6/6	-
1635	10:14	48	10	44	10YR/6/4	-
1666	10:14	51	21	35	10YR/5/2	-
1668	10:14	64	24	54	10YR/5/3	-
1728	10:16	42	-	38	5YR/6/4	-
1732	10:16	76	18	60 (est.)	5YR/3/2	-
1764	10:17	40	19	40	10YR/6/3	-
1807	10:18	81	28	72	10YR/6/3	-
1798	10:18	42	13	37	10YR/6/3	-
1867	10:21	63	15	46	5YR/3/2	-

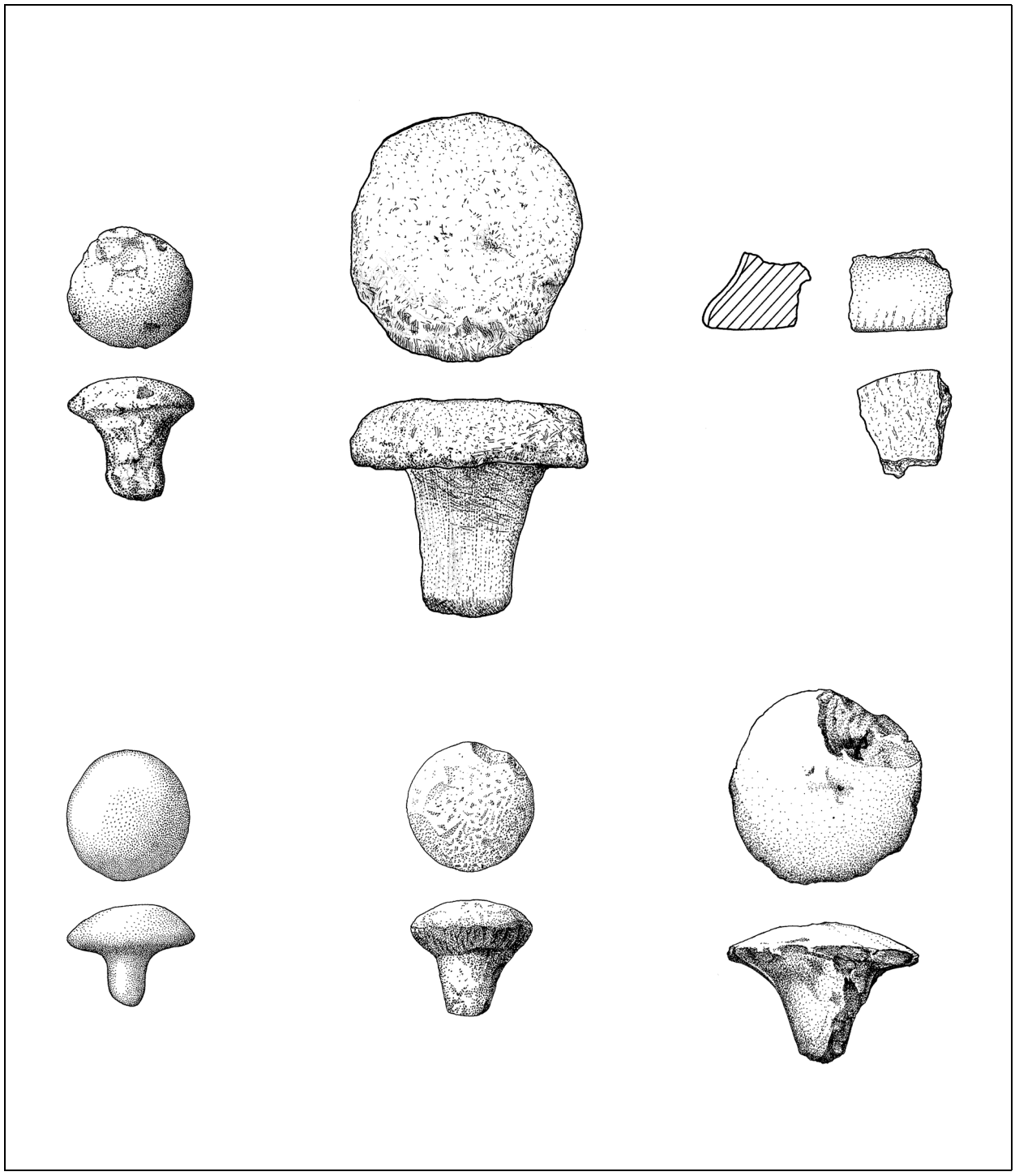


FIG. 68: Ceramic Period 2 potters' anvils. *Top* left: cat. 1764, centre: cat. 1807, right: cat. 1340, *Bottom* left: cat. 1448, centre: cat. 1798, right: cat. 1867. Shading indicates firing results (shaded areas are not oxidized). Scale 1:2

features to suggest that it was other than local to the site. Cat. 1486 is dense and well fired, with a smooth carefully-finished surface. In the centre of the handle base, a 25 mm deep lenticular shaped hole, 7 mm wide by 4 mm high at its apex, is considered to indicate ownership. Striations within the orifice suggest that a bamboo probe was used to form the hole before firing when the clay was still soft (Fig. 66). Slightly later in the sequence, a differently-shaped anvil, cat. 1435, was recovered. This artefact, which may be exotic, has a 20 mm segment of the head cut away, suggesting that a distinguishing mark was intended. Alternatively the shape may reflect a functional purpose such as allowing the anvil head to fit tightly against an internal angle of a vessel during the forming process. The purpose of this mark, therefore, remains equivocal. Cat. 1280 completes the group with potters' marks. It displays a highly distinctive series of curved parallel incised lines, about 5 mm apart, extending from the lip of the anvil head to the handle base. Alternate panels formed by these lines were infilled by broader, diagonal lines scraped into the surface to form barber's pole-like stripes around the handle. The handle was further modelled by forming a ridge round its circumference and cutting a 10 mm deep 16 mm diameter circular hole into the base. The hand specimen evidence suggests that only cat. 1435 may be exotic.

Marks on ceramic moulds have been reported from Non Pa Wai, a large metal-working complex located in the Khao Wong Prachan Valley of Central Thailand (Pigott 1992, 1994, Pigott and Natapintu 1996). These incised markings could also indicate ownership. Non Pa Wai was probably occupied *c.* 1500-1000 BC, about the time the portion of Khok Phanom Di excavated in 1985 ceased to be used as a cemetery.

Although attempting to decipher these marks fully is beyond the scope of this report, some possible interpretations are warranted in order to help understand the parameters of the prehistoric ceramic traditions. One possibility is that these potters' marks are "identifying-mnemonic" devices "which identify the maker by means of an arbitrarily chosen symbol" (Harris 1986:59-60). This symbolic device is considered by some authorities to lie at the beginnings of writing because what the symbol represents will have a name in the spoken language. According to Harris (1986:127), "a writing system, whatever else it may be, is a system of signs; and all systems of signs presuppose communicational purposes for which they are used". Clearly, the potters at Khok Phanom Di employed such a system of communication to identify their anvils. The importance of these tools to the artisans is signalled by the ownership marks. We will examine the range and variety of marks in Chapters IX and X. It is important to note at this point that the three marked anvils discussed above each displayed a different mark distinct in design, method of application and location on the artefact.

CORD MARKS ON CERAMIC ANVILS

Only eight of the 37 anvils had cord-marked surfaces (Table 33). Three fragments with indistinct cord marks have not been included because they are too fragmentary. The distribution of cord-marked anvils varied from none in CP1 to just over 10 per cent of the sample for CP2, about five per cent for CP3 and 84 per cent of the CP4 assemblage. Some anvils from CP2 and CP3 were noted where the cord marks had been almost completely smoothed over during the final shaping stage prior to firing, thus clearly demonstrating a preference for a smooth rather than a coarse

surface finish. Such a preference is not easy to explain, except to suggest that the tools used by artisans often reflect the artefacts they make. Fine wares need extra care when shaping and finishing the vessel form, particularly when delicate wares with thin easily-fractured walls are involved. This contrasts with the thick irregular fabrics of coarse ware which require increased effort to shape and finish. Given that coarse wares are usually utilitarian, the amount of time devoted to their construction is less and a quick, less careful, method will suffice. We will return to this question after a full description of the ceramic assemblage has been completed. This will allow us to make a comparison of anvil surface finishes with the relative quantities of coarse and fine wares.

BONE STYLUS POINTS

The distributions of CP2 bone stylus points, proposed as pottery-incising tools, are set out in table 34. Those annotated with the letter 'R' are pointed needle-shaped rods, but without a hole in the distal end. They range in diameter from 4–7 mm. Two stylus points, cat. 1462 and 1560, have been heavily abraded and also have use-wear striations. Other bone tools, some with lengthwise grooves along one edge, have been variously interpreted as awls or "bobbins" used for weaving or working with pliable fabrics. A further group of bone points, previously described as micro-awls (Higham and Thosarat 1993:9), has been suggested in this report as having been used for incising designs into leather-hard pottery surfaces. For example, to incise the lines to the rim margins on the carinated burial jars, the potter would first place the vessel upside down and then make the incisions with the stylus held between the index finger and thumb while using the middle finger to set the gauging distance from the rim edge. Only artefacts considered to have been used for incising pottery are included in this review. This leaves just eight points derived from CP2 contexts. Many of the bone points considered to have been used for other purposes could, however, readily fit the criteria for incising tools. If the bone awls (Higham and Thosarat 1993:9, Table 4) are included, this would give an additional 33 points, 16 from CP2 making a total of 24 for the Period. A sample of these latter points is illustrated in figure 69.

The grooves in the sides of the bone awls, as opposed to the micro-awls, could represent wear patterns stemming from the burnishing of fine ware rim termini. Experiments needed to determine whether wear patterns consistent with burnishing can be reproduced have not been undertaken because the artefacts have been returned to Thailand. If we leave aside this question, and consider only awls and micro-awls without side grooves, their distribution follows the distribution of incised wares closely (Chapter XI).

THE CERAMIC FIRING STANDS

Seven ceramic firing stands were identified in CP2. All were broken in prehistory, probably as a result of thermal expansion. That the stands were subjected to such thermal shocks can be confirmed through the presence of mullite. It is most likely that the shattered fragments represent

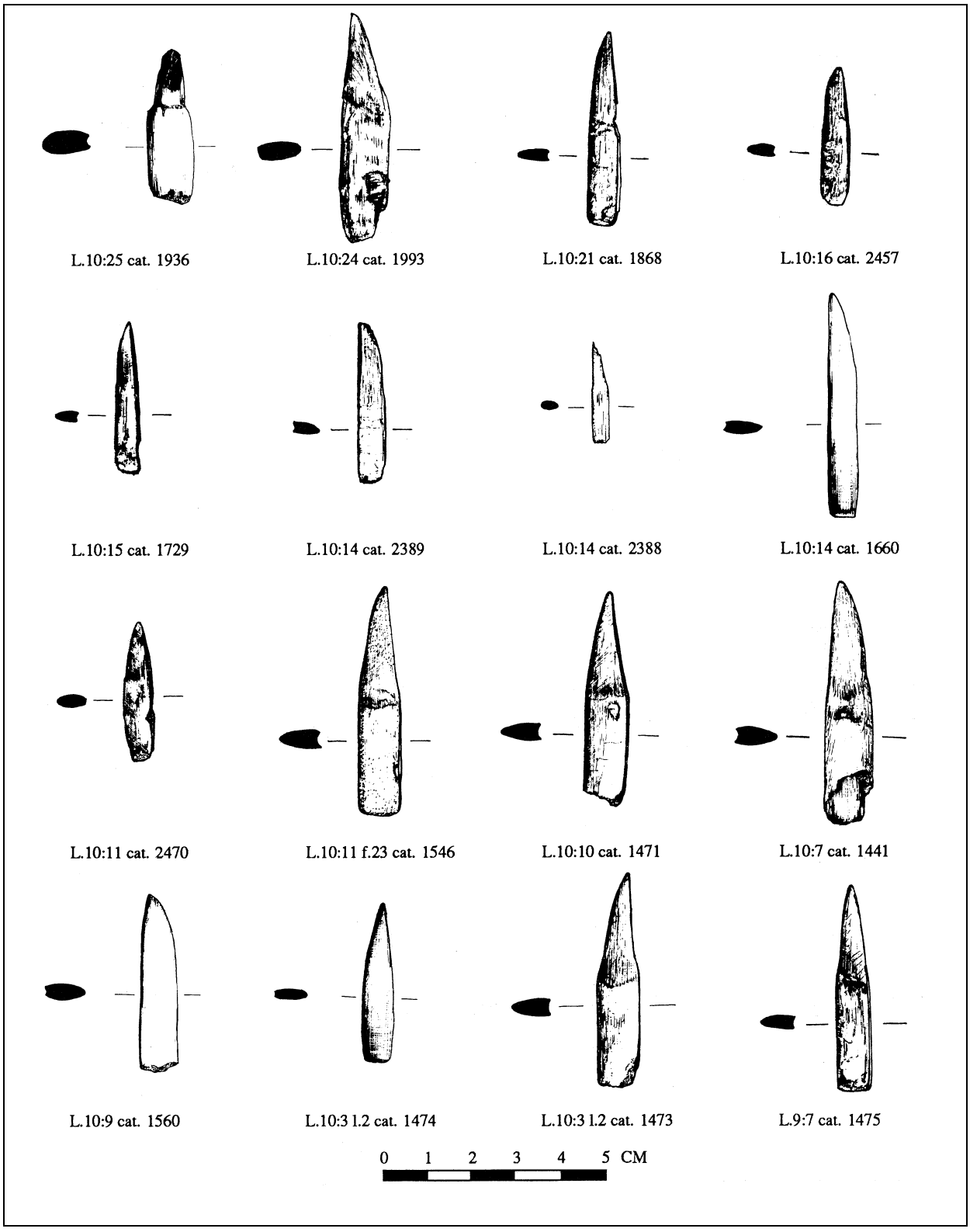


FIG. 69: Ceramic Period 2 bone stylus points

TABLE 34: *Ceramic Period 2 bone stylus points*

Cat. no.	Layer	Shape	Cat. no.	Layer	Shape
2017	10:6 burial 76	-	1539	10:12	point R
1560	10:9	point R (wear)	1633	10:12	chisel
1462	10:10	stylus (wear)	1684	10:14	stylus
1489	10:11	stylus	1725	10:16	point
1631	10:11	point R			

discarded stands. They were probably abandoned immediately after their final use, in or near the location where the firing took place.

Apart from a fragment of one large stand from layer 10:15, the balance of the sample forms two groups. The first is confined to CP1 and the other group is tightly clustered around layer 10:3 to 10:5. Five of the latter group are composed of fishpond clay. The remaining two were probably constructed with FG2 material, the fabric which characterises local wares during this Period. It seems plausible, therefore, to accept that the single outlier in layer 10:15 migrated down from the cluster deposited slightly higher in the sequence due to cultural activities which occurred in prehistory. The two groups can be distinguished in terms of their fabrics and forms. CP1 firing stands are either sand or grog tempered while five of the seven stands from layer 10:3 to 10:15 are composed of the fishpond clay and rather than a plain surface finish, the stands in this last group are cord-marked (Fig. 70 cats. 1228 and 1324).

The shape of CP2 stands differs from the CP1 sample in several respects. Their bases are flat rather than concave, little effort has been made to smooth the cord marks and their finish is generally less precise (Fig. 70 cat. 1228). Only the base dimensions could be measured because of their fragmentary condition (Table 36). The colours and textures are relatively uniform. Cat. 1962 from basal deposits is shattered into fragments no larger than about 2-3 cm across. It is tempered with sand in a micaceous matrix and belongs to FG1 in terms of the sand temper mineralogy. The matrix is coloured pink, which sets it apart from the rest of the sample. Most stands fall in the light grey to greyish brown or the light red to reddish brown range. This suggests that the source of the clay may be exotic. The distribution of CP2 stands is set out in table 35. Most of the CP2 fabrics are composed of the local fishpond clay with one stand (cat. 1698), possibly containing FG2. The remaining stand fabrics have been so altered by heat that the original pre-fired fabric can no longer be recognized.

It is difficult to explain the presence of firing stands at the top of MP3, other than that they represent a non-mortuary activity in this part of the site. Given that this was the case, we need now to explain such a concentration of pottery firing components in a cemetery. We have previously noted that a hiatus in burial activity occurred somewhere between MP3 and MP4. It is important to note that charcoal deposits, throughout CP1 and CP2, were generally associated with ash lenses, however, according to Thompson (1996:69), “throughout this period, charcoal was deposited in large amounts, with a number of lenses such as 10:3 lens 2 having outstandingly high concentrations of very large fragments.” Thompson (1996:68-9), also notes

TABLE 35: *Ceramic Period 2 firing stand fabrics*

Cat.	Layer	Thin section	Fabric
1228	10:3	K261	fishpond mullite?
1255	10:3	K269	fishpond clay
1382	10:3	K254	fishpond clay
1277	10:4	K253	fishpond clay
1295	10:5	K266, K266R	fishpond/mullite
1324	10:5	K393	local (FG2?)
1698	10:15	K262	mullite (grog?)

that throughout layers 11 to 8 proportions of "Rhizophoraceae-type" charcoals are consistently high and then decline rapidly from over "90 per cent at the top of layer 8 to less than 10 per cent of the assemblage in layer 5." One exception is 9:6 lens 9 where non-Rhizophoraceae form the majority of the charcoal by weight. This could suggest that environmental change was already underway at, or just prior to, the close of MP3.

TABLE 36: *Ceramic Period Two firing stand forms*

Cat.	Layer	Base diam:(mm)	Colour	Cord marks
1228	10:3	80	10YR/7/2	Z 2-1
1255	10:3	120 (est.)	10YR/6/3	S 1-1
1382	10:3	100	2.5YR/6/8	indistinct
1277	10:4	95	5YR/7/3	S 2-1
1295	10:5	80 (est.)	10YR/6/3	indistinct
1324	10:5	120 (est.)	2.5YR/6/4	indistinct
1698	10:15	140	10YR/6/4	S 1-1

High concentrations of very large charcoal fragments, in association with ceramic firing stands, strongly suggests that pottery firing took place during the hiatus in burial activities between MP3 and MP4. Such an interruption is difficult to explain unless some kind of cultural dislocation is invoked. We have noted that changes in the local ceramic fabrics occurred. In addition, Higham (1993:205-6), has argued that 406 shell knives of the genus *Pseudon inoscularis*, a freshwater mussel, which were mainly concentrated in layer 9, were most likely used for scraping rice grass in a cutting motion and this activity was carried out *in situ* because "it seems likely that the ricefields may have been close to the site." Clearly this is a marked departure from the coastal environment reflected in the botanical and molluscan data during the preceding period. The mineralogy and typology of stone tools also changes from mainly volcanic silt and sandstone adzes, which dominate layer 11 and lower layer 10, to leucogranitic hoes, a slate chisel

and a metabasaltic siltstone flake. Slate makes its first appearance in B72 layer 10:7 (Pisnupong 1988:134-5). These lithics show that new sources of stone were being exploited. Such a change would be of critical importance to people reliant on stone tools for use in forest clearing, wood working and perhaps agriculture, although, as Thompson (1996) has argued, local cultivation of rice is extremely unlikely given the saline nature of the soils. The correlation of environmental change, as reflected in botanical and faunal species, with changes in stone sources and lithic technology, is compelling. We will defer further consideration of cultural change until the full spectrum of ceramic artefacts has been examined, but need to keep in mind that, because the local environment was unstable, adaptations to such a physically dynamic location are likely to have been culturally disruptive.

PREPARED CLAY

Discarded dumps of prepared potting clays were found throughout the sequence. During CP2, a total of 1.02 kg was recovered in small, mainly isolated, lumps. All are considered to be of local origin. The clay sample from layer 10:15, and some of the material from 10:23, were examined in hand specimen for temper and it was noted that both contained sand. Although the sand has not been quantified, it seems likely that these two samples represented the sandy clay used for local wares during CP2. Grog temper was not obvious in these samples, although several small lumps were observed. Given that CP2 local wares were tempered with grog, such temper is unlikely to be obvious in unfired clays particularly when the grog is composed of the same material as the parent body. On balance, the clays are considered to be consistent with the fired CP2 local fabric.

TABLE 37: *Ceramic Period 2 prepared potting clay*

Layer	g	Layer	g	Layer	g	Layer	g
10:3 B58	3	10:12	1	10:17 F11	4	10:22	2
10:3 lens 2	19	10:13	2	10:18	3	10:23	2
10:3 F8	14	10:15	11	10:19	7	10:23	1
10:8	2	10:16	2	10:20	5	10:23	5
10:11	6	10:17	3	10:21	8	10:24	2

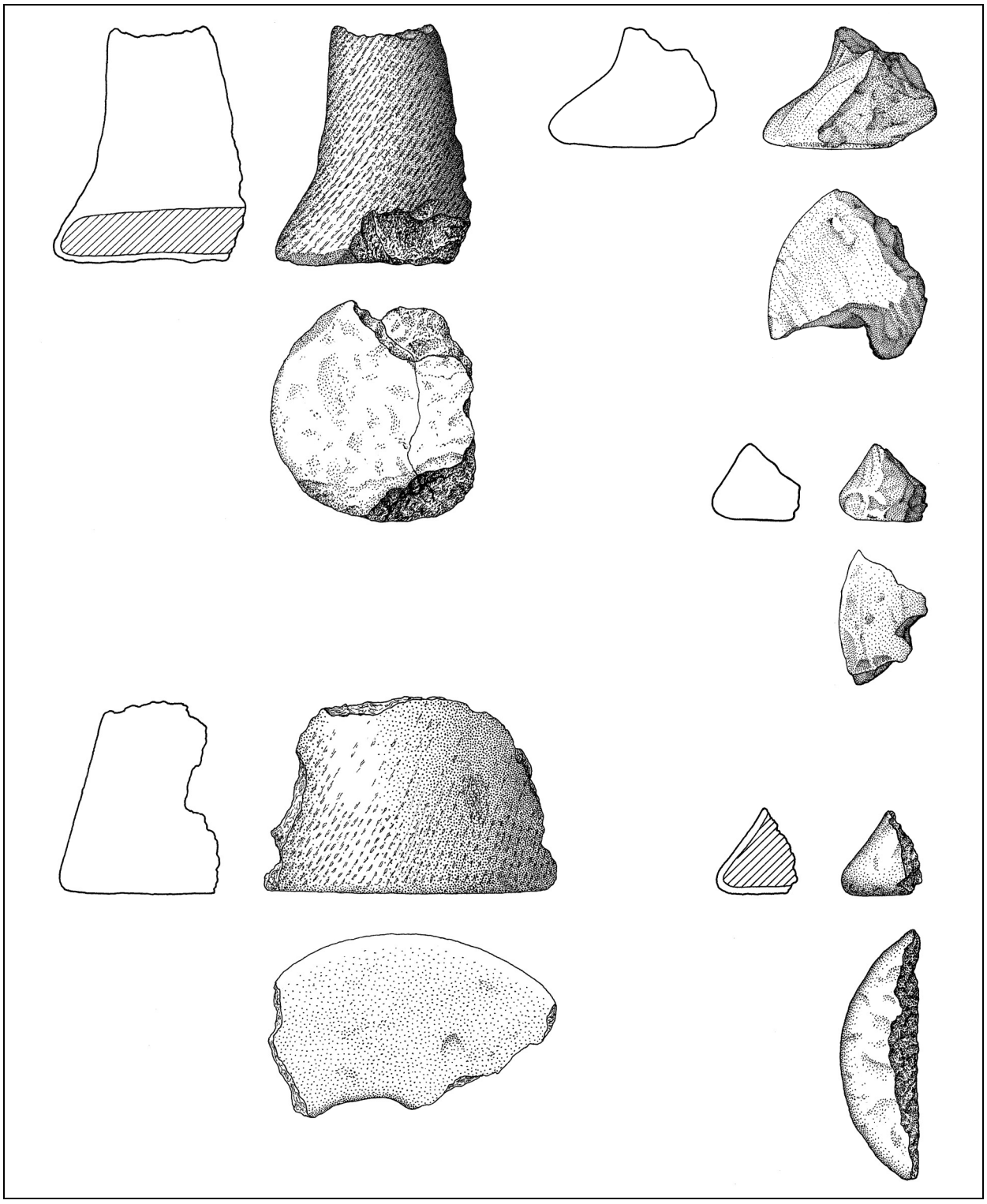


FIG. 70: Ceramic Period 2 ceramic firing stands. *Top* left: cat. 1228, upper right: cat. 1277, centre right: cat. 1382, *Bottom* left: cat. 1324, right: cat. 1255. Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

MISCELLANEOUS CERAMIC ARTEFACTS: CERAMIC PERIOD 2

CERAMIC PELLETS

A total of 39 ceramic "bow" pellets were recovered from CP2. A sample has been examined in hand specimen and in each case the fabric is consistent with local clays.

TABLE 38: *The ceramic bow pellets from Ceramic Period 2*

Cat.	Layer	Diam. (mm)	Cat.	Layer	Diam.
1415	10:3 lens 2	18	1828	10:13 feature 13	22
1251	10:3 lens 2	20	1613	10:13	20
1260	10:3 lens 2	19	1842	10:13	19
1263	10:3 lens 2	18	1661	10:14	18
1284	10:4	20	1662	10:14	14
1334	10:6	22, 22, 17	1717	10:15	16
1787	10:8	25	1726	10:16	17
1446	10:9	17	1736	10:16	20
1457	10:10	20	1802	10:18	22
1460	10:10	16	1809	10:18	16
1461	10:10	20	1834	10:19	20
1487	10:11	22	1845	10:20	14
1488	10:11	17	1846	10:20	15
1491	10:11	18	1863	10:20	13
1796	10:11	15	1876	10:22	18
1597	10:11 B96	17	1882	10:23	18
1573	10:12	21	2003	10:23 lens 26	22
1574	10:12	23	2004	10:23 lens 26	22
1713	10:12 B109	17			

THE CERAMIC NET WEIGHTS

Thirty four ceramic spheres or prolate spheroids with a 2-3 mm hole running through the length of the long axis where recovered. The hole was often splayed wider at the openings probably to ease the passage of a line through its length for use as a net weight (Table 39).

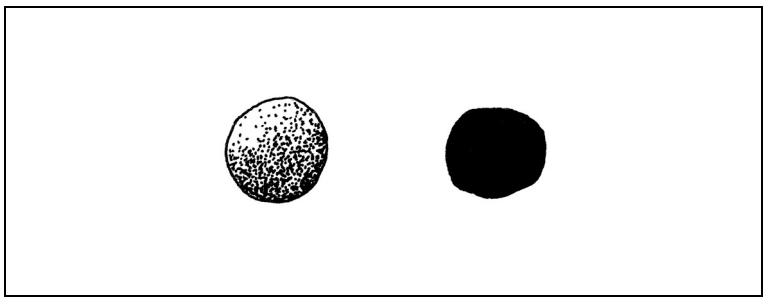


FIG. 71: A Ceramic Period 2 bow pellet (cat. 1863)

TABLE 39: *The ceramic net weights from Ceramic Period 2*

Cat.	Layer	Size (mm) Length	Width	Cat.	Layer	Size (mm) Length	Width
1209	10:3 l.2	29	18	1612	10:13	25	20
1224	10:3	28	24	1646	10:14	25	21
1229	10:3	22	18	1664	10:14	30	27
1278	10:4	36	28	1669	10:14	27	22
1440	10:9 B89	29	27	1644	10:15 l.8	25	22
1494	10:9	28	19	1693	10:15	37	34
1496	10:9	46	30	1710	10:15	25	24
1588	10:10	27	20	1711	10:15	26	24
1490	10:11	30	21	1752	10:15	38	36
1589	10:11 f.27	46 (est.)	32	1746	10:16	30	27
1552	10:11	36	36	1765	10:17	24	22
1590	10:12 f.15	22	20	1769	10:17	42	39
1541	10:12	47	31	1771	10:18	47	30
1576	10:12	32	24	1779	10:18	43	29
1586	10:12	30	22	1801	10:18	50	46
1754	10:12 B109	25	25	1833	10:19	30	30
1604	10:13	43	37	1857	10:20	33	30

THE POTTERY OF CERAMIC PERIOD 2

BURNISHED AND INCISED WARES

A hallmark of the locally-made CP2 fine wares is that they often feature dark brown to black highly burnished exterior surfaces, which have been incised to create a variety of geometric and curvilinear designs. The distributions of burnishing stones, burnished body sherds and burnished and incised sherds for the entire site are set out graphically in Chapter XI, and the sherd weights are detailed in Appendix 3. These wares are most prominent during CP2. Burnished and incised sherds sharply increase to reach their maximum in layer 10:12 and then gradually decrease almost to disappear in layer 10:1. Burnishing stones and burnished sherds together follow a similar distribution pattern with a similar decrease to that noted for the burnished and incised sherds. A major feature in layer 10, known as lens 2, contained 52 burnishing stones and 9.23 kg of burnished sherds compared to a mean per stratigraphic unit of 2.72 kg. Excluding layer 10:3, the burnished sherd and burnishing stone distributions increase throughout the early part of CP2 peaking at layer 10:14, both then steadily decline to layer 10:4 and the mean value for burnished sherds decreases to 2.41 kg. This equates to a 383 per cent increase in burnished sherd weights from layer 10:23.

The distribution of burnishing stones follows a similar trend to that of the burnished sherds. A total of 196 stones give an overall mean of 8.9 stones for the entire period. When layer 10:3 is excluded the mean reduces to 6.86 stones. Layer 10:3, including lens 2, contained 52 stones.

TABLE 40: *Ceramic Period 2 exotic burnished and incised sherds*

Layer	Feature	g	Temper	Layer	Feature	g	Temper
10:3	B56	1	rice	10:12	B109	4	orthodox grog
10:4	B57	1	rice	10:12	B115	4	orthodox grog
10:10	27	1	orthodox grog	10:12	-	6	sand
10:12	B87	1	bleb grog	10:13	30	2	bleb grog
10:12	B87	1	orthodox grog				

The distributions of CP2 burnished and incised and exotic burnished and incised body sherds are set out in tables 40 and 41. These data are further detailed in Chapter XII and should be read in conjunction with the rim data in Appendix 2 and the whole vessel descriptions in this and Chapter IX. These sherds have been examined in hand specimen only. Those not designated as exotic are considered to be local. The local sherds are mainly comprised of FG2, the early local sandy grog, although some from higher in the sequence are probably FG3. It should be

noted that the exotic fabrics include sand, rice and bleb tempers. The exotic sherd weights are also included with the overall sherd weights in table 41.

TABLE 41: *Ceramic Period 2 burnished and incised sherds*

Layer	Burial	kg	Layer	Burial	kg	Layer	Burial	kg
10:3	B56	0.14	10:8	-	0.12	10:12	B109	0.04
10:3 lens 2	-	0.07	10:8	B90	0.04	10:12	B115	0.08
10:4	B57	0.08	10:9	-	0.46	10:12	-	0.38
10:4	B60	0.01	10:9	B103	0.01	10:13	-	0.03
10:4 lens 7	-	0.02	10:10	B91	0.04	10:14	B120	0.08
10:5	-	0.08	10:10	B123	0.01	10:15	B110	0.02
10:6	-	0.01	10:10	-	1.95	10:15	B131	0.02
10:6	B67	0.05	10:11	B102	0.01	10:16	-	0.02
10:7	B72	0.03	10:11	-	0.33	10:23	-	0.01
10:7	-	0.12	10:12	B87	0.06	10:24 lens 28	-	0.07

INCISED FINE WARE SHERDS

The distribution of CP2 incised fine ware body sherds is as follows: Layer 10:3, 6.17 kg; 10:4, 0.55 kg; 10:5, 0.35 kg; 10:6, 0.80 kg; 10:7, 1.17 kg; 10:8, 1.26 kg; 10:9, 0.52 kg; 10:10, 0.55 kg; 10:11, 0.31 kg; 10:12, 0.07 kg; 10:15, 0.01 kg, for a total of 11.76 kg. These figures should be read in conjunction with the balance of the pottery data set out in the appendices. Three burials, B57, B96 and 115 contained incised sherds, the first weighing two grams and the latter burials one gram each.

BURNISHED FINE WARE SHERDS

Burnishing was a feature of the local potting tradition during CP2 (Table 42). These sherds are almost invariably either partially or fully reduced to produce a distinctive dark lustre. Their fabrics match those of the rim sherds. Almost all are composed of the local FG2. Exotic fabrics are represented by sand, bleb and orthodox grog wares in minor quantities. As these will parallel the rim sherd fabrics, further description is unnecessary. The overall site distribution of burnished and other wares is set out in Chapter XI.

TABLE 42: *Ceramic Period 2 burnished sherds*

Layer	Feature	kg	Layer	Feature	kg
10:3	F1, 5, 26	0.10	10:12	B87	0.06
10:3	-	9.13	10:12	B109	0.16
10:4	F16, 18, 22, 25	0.17	10:12	B115	0.04
10:4	B79	0.04	10:12	-	1.71
10:4	lens 7	0.11	10:13	F7, 11, 13, 19 30, 32	0.23
10:4	-	1.00	10:13	B113	0.21
10:5	F3, 11, 15-17, 20, 34, 37, 44, 53, 56	0.47	10:13	-	2.94
10:5	-	0.72	10:14	F2, 6, 12-16, 18, 19, 26, 28	0.78
10:6	F8, 11, 38, 41, 43 46	0.21	10:14	B145	0.08
10:6	B65	0.02	10:14	-	4.60
10:6	B67	0.16	10:15	F6, 8, 11, 15, 20, 23	0.44
10:6	-	1.29	10:15	B107	0.18
10:7	B72	0.17	10:15	B110	0.12
10:7	B73	0.09	10:15	B129	0.01
10:7	F5, 6, 19, 29	0.93	10:15	B131	0.17
10:7	-	1.58	10:15	-	3.16
10:8	F6, 8, 10, 11, 32	0.12	10:16	F1, 5, 7, 8, 14	0.16
10:8	B90	0.16	10:16	B100	0.10
10:8	B92	0.04	10:17	-	2.27
10:8	B95	0.06	10:18	F1, 4	0.06
10:8	-	1.82	10:18	-	2.56
10:9	F1, 4, 6, 11, 25-27, 30	1.07	10:19	F2, 3, 7	0.22
10:9	B89	0.03	10:19	-	2.01
10:9	B103	0.03	10:20	F3, 7, 10, 11	0.49
10:9	-	1.48	10:20	-	1.01
10:10	F1, 7, 21, 23, 24, 27, 28	0.44	10:21	B150	0.03
10:10	B88	0.02	10:22	F6, H15	0.05
10:10	-	2.38	10:22	-	0.85
10:11	F3, 5, 13, 15,17, 18, 21, 22, 24	0.57	10:23	-	0.35
10:11	B94	0.10	10:23	lens 26	0.40
10:11	B101	0.05	10:23	F1	0.02
10:11	B103	0.14	10:24	F1	0.02
10:12	F1, 7, 9 10, 11, 13, 21	0.36	10:24	lens 28	0.07
10:12	-	3.28	10:24	-	1.07

PADDLE-IMPRESSED WARE SHERDS

A small quantity of paddle-impressed body sherds was recovered from layer 10:21 onwards (Table 43). These distinctive wares are characterised by alternating ridges and hollows impressed into the soft clay surface during the vessel-forming stage by shaping the pot with a carved wooden paddle. The data presented here are in addition to those published by Hall (1993). Each sherd has been examined in hand specimen and these data supplement the rim form fabrics discussed below. In each case the pottery is exotic.

TABLE 43: *Ceramic Period 2 paddle impressed sherds*

Layer	g	Temper/fabric	Layer	g	Temper/fabric
10:3	10	sand	10:7	1	sand
10:3 lens 2	4	orthodox grog	10:8	5	sand
10:3 lens 2	1	bleb grog	10:9	3	sand
10:3 lens 2	14	sand	10:9	2	orthodox grog
10:3	10	sand	10:12	4	bleb grog sandy matrix
10:4	6	sand	10:12	7	sand
10:5	3	sand	10:15 F20	1	orthodox grog
10:6	7	sand	10:21	2	sand

PAINTED AND SLIPPED FINE WARES

Painted and slipped fine wares were extremely rare during CP2, only 71 g being recovered (Table 44). All sherds are exotic. Two slipped rims (RF6ai, thin section K492) have been examined petrographically. They are composed of an exotic fabric tempered with bleb grog. This ware was probably imported from the Eastern Highlands.

Slipped body sherds weigh 0.36 kg for the entire site and each sherd has been examined in hand specimen. All were imported with the possible exception of one sherd from layer 10:24 and another from 10:12 which are composed of FG2. Without a more detailed examination of these fabrics, the presence of a slip is difficult to determine. Modern potters are familiar with a process termed "self-slipping" (Shepard 1956), which refers to the accumulation of fine colloidal particles which sometimes occurs on the surface of pots as they are smoothed on a wheel. A similar phenomenon is possible when leather-hard vessels are being burnished and this can be difficult to detect. Sixteen exotic sherds, eight each from both CP2 and CP3, were slipped in the orthodox fashion by applying levigated clay to the unfired surface of the ware. Whether these slips were applied by dipping, pouring or painting has not been possible to determine because the sherds are eroded and fragmentary.

TABLE 44: *Ceramic Period 2 painted and slipped sherds*

Layer	Surface Decoration	g	Temper	Layer Decoration	Surface	g	Temper
10:3	painted	1	bleb grog	10:12	painted	8	bleb grog
10:3	painted	2	orth. grog	10:13	slipped	7	bleb grog
10:3	slipped	2	orth. grog	10:13	painted	4	orth. grog
10:6	slipped	2	orth. grog	10:13	slipped	1	orth. grog
10:7	painted	5	orth. grog	10:15	paint/slip?	3	orth. grog
10:9	painted	5	bleb grog	10:15	painted	6	bleb grog
10:10	painted	7	bleb grog	10:16	paint/slip?	1	orth. grog
10:10	slipped	2	sand	10:17	painted	7	orth. grog
10:11	painted	2	bleb grog	10:23 l.26	paint/slip?	3	sand?
10:12	paint/slip?	2	bleb grog	10:24	slipped	1	orth. grog

The use of clay slips signals a level of technical sophistication not often present in South-East Asian pottery during this period. Coupled with the bleb grog tempering method, it indicates that the potters who fashioned these wares were highly skilled. From the perspective of craft technology, they possessed an excellent understanding of the properties of clay. They were familiar with potting clay shrinkage and its fractionation into coarse and fine portions during levigation. To create such a vessel, many technically detailed steps would need to be completed. Apart from the quite complex steps needed to compose a bleb grog-tempered fabric, clay would need to be treated by adding water until it was sufficiently fluid for the finer clay minerals to be separated from coarser particles, so that the slip could be prepared. The prepared slip would then be applied to the formed vessel, which had previously been air dried to the leather-hard stage. In the case of the sample examined in thin section, from a decorated bowl with a thickness of 14 mm, the clay used for the 1–2 mm thick slip is different to that of the body, which is composed of FG11. Hence two different clays were used. The slip contains micaceous siltstone and angular limestone fragments. This fabric probably derives from the Kaeng Krachen Formation in the Prachinburi River catchment of the Eastern Highlands. The other rim sherd is also composed of this fabric but without the thick slip.

PUNCTATE WARE SHERDS

Punctate surface decoration involves the use of a probe to impart a pattern of small holes applied singly in a freehand fashion. This contrasts with impressed motifs applied using a tool with a series of raised points which impart multiple impressions with a single application, such as an *Anadara* shell or a carved paddle. Punctations can adopt a variety of shapes. At Khok Phanom Di they are square, round, diamond or oval (Fig. 72). These have been annotated P1, P2, P3 and P4 respectively. In some instances, this decorative mode has been combined with incising

and/or impressing. Thus P2 and P4 are also incised and impressed with *Anadara* shell fields. A representative sample of punctate sherds has been examined in hand specimen (Table 45). Most have been burnished and all are considered exotic. The single P3 rice-tempered sherd from layer 10:3 is also coated with a red slip or paint.

TABLE 45: *Ceramic Period 2 punctate sherds*

Layer	Mode	g	Temper	Layer	Mode	g	Temper
10:3	P2	4	bleb grog	10:11	P1	1	orthodox grog
10:3	P3	4	rice	10:12	P1	3	orthodox grog
10:7	P1	1	orthodox grog	10:12	P2	3	bleb grog
10:8	P1	1	orthodox grog	10:18	P2	9	bleb grog
10:8	P2	2	bleb grog				

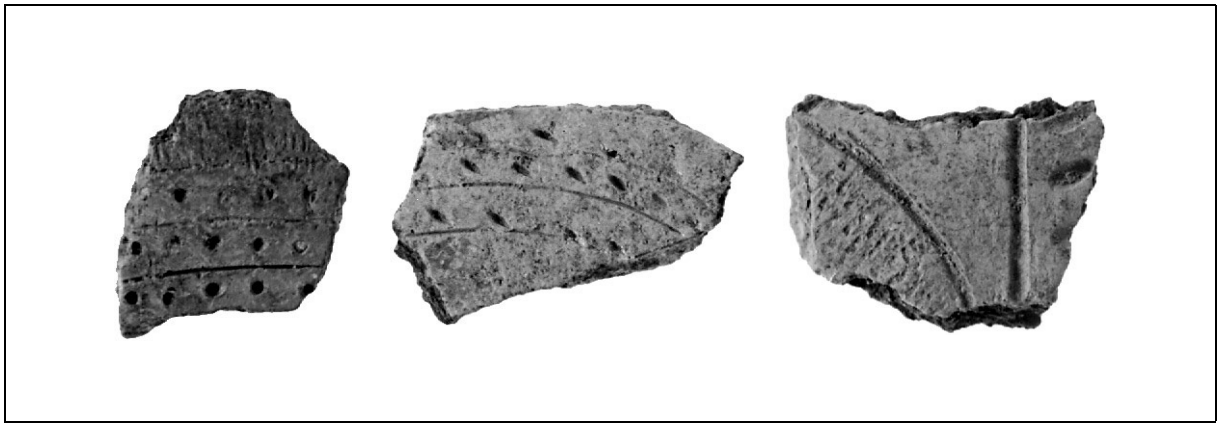


FIG. 72: Punctate ware sherds: form P2 (left), P3 (centre) and P4. Ceramic Period 2. Scale: 1:1

APPLIQUÉ SHERDS

A single form A1 sherd, weighing 1 g, was recovered from layer 10:12. Another sherd, from 10:21, has a horizontal paddle-impressed surface with a notched band. Thin section examination, (K1205), revealed that it is composed of the exotic sand-tempered FG10. It weighed 1 g. Form A2, a semi-fine ware, also derived from this context. It is fully oxidized and tempered with bleb grog. In cross-section the appliqué band forms a half round. Immediately below the band are three incised parallel lines above a single *Anadara* shell-impressed line. Fine cord marks run

vertically down from this latter line to cover the remainder of the sherd (Fig. 73). Only 41 g were recovered.

MISCELLANEOUS SHELL-IMPRESSED SHERDS

Shell impressing features on numerous local wares either as decorative bands on the rim, beneath the rim terminus, adjacent to the carination point, or within fields defined by incised lines. These modes have been discussed in detail by Hall (1993). A few sherds were noted with what appear to be mainly incidental shell impressions, often to interior surfaces of coarse cord-marked utilitarian vessels. According to Mason (pers. comm.), a range of shells is involved, but only *Anadara granosa* could be identified with confidence. They involve the shell hinge line, inner margin of the ventral surface or, in some instances, the proximal umbo. Impressions from such surfaces feature on several of the surface decoration modes noted for the local wares during CP2 as discussed by Hall (*op. cit.*).

THE RIM SHERDS

Rim form distributions by stratigraphic layers are set out in the previous chapter. Rim descriptions and definitions also follow those discussed previously, however, any differences in forms will be noted as necessary. RF complexity increased from 3.92 in CP1 to 10.26 in CP2. The number of forms increased from 13 to 15, categories increased from 35 to 96 and variants from 16 to 58. This elaboration is most marked in RF5 and 6. The former derive from the carinated jars often employed as funerary furniture, although several forms may relate to mundane uses. RF6 probably represents semispherical, prolate or oblate bowls. Surface finish and decoration on both forms range from coarse cord-marked, without further decoration, to highly burnished with at times quite intricate, possibly symbolic, decoration.

COARSE WARE RIMS

Rim form 1

These cord-marked inverted rims retain the same form as for CP1. Four additional categories and one variant are also present (Fig. 75 and Appendix 2).

- 1a includes an incised curvilinear decoration immediately below the rim.
- 1b is vertical or almost so.
- 1c is inverted, but the rim is folded externally rather than internally.



FIG. 73: Appliqué form A2. Ceramic Period 2. Scale: 1:1

- 1c(i) has an incised curvilinear decoration immediately below the rim.
- 1d is folded externally with a smoothed, sometimes straight and bevelled lower boundary rather than the usual cord-marked and untrimmed finish.

The fabrics are composed of FG2 (Appendix 1), apart from a few exceptions considered to be mobile sherds through post-depositional activities such as posthole and burial excavations. A sample of RF1 fabrics has been analysed in thin section and hand specimen (Table 46).

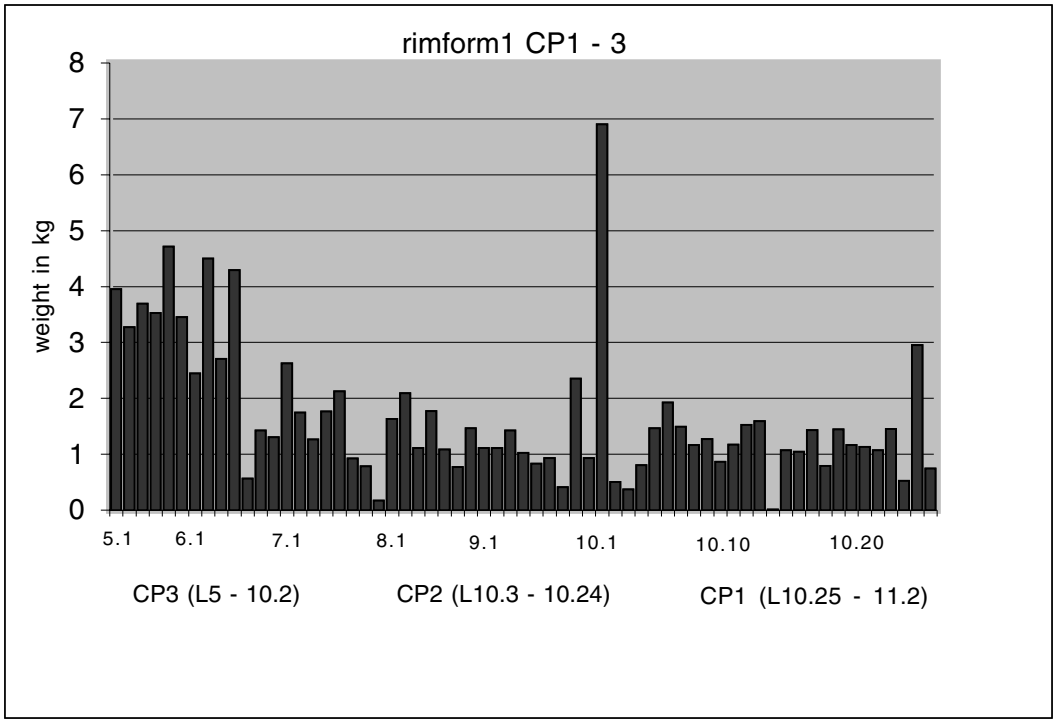


FIG. 74: The distribution of rim form 1 in Ceramic Periods 1, 2 and 3

These rims, all local wares, are the most abundant recovered. It is uncertain whether they were in direct association with any CP2 burials, however their presence in graves (Table 47), helps underline their ubiquity throughout the site (Fig. 74). Caution should be exercised when applying pottery data in this manner, however, because both micro- and macro-deposits need to be taken into account. Thus excavations may follow cultural micro-deposits which hold significance for some activities but not others. Fragmented pottery distributed throughout the general matrix of cultural deposits, for example, may need to be viewed in its overall context rather than in terms of carefully excavated micro-units because such units may at times be quite arbitrary.

In circumference the rims range from 280–320 mm and in thickness from 5–7.5 mm. Both "Z" and "S" twist cord marks are present, but no attempt has been made to quantify these

because of the large sample. The fully oxidized colour of CP2 local coarse wares is generally a very pale brown (Munsell 10YR/7/4), whereas during CP1 they are a light grey (2.5YR/7/2). Combined with a different temper species, this has produced a distinctive change in colour and texture.

TABLE 46: *Rim form 1 fabrics: Ceramic Period 2. TS/h.s.: Thin section/hand specimen, FG: Fabric group, OG:orthodox grog*

Layer	Form	TS/h.s.	FG	Feature	Layer	Form	TS/h.s.	FG	Feature
10:3	1	h.s.	2	lens 2	10:15	1	h.s.	2	B110
10:3	1	h.s.	OG	B58	10:15	1	K438	2	-
10:3	1a	h.s.	2	-	10:15	1	K439	1	-
10:3	1a	h.s.	2	lens 2	10:18	1	h.s.	2	-
10:3	1b	h.s.	2	lens 2	10:21	1b	h.s.	2	-
10:7	1	h.s.	2	-	10:22	1	K442	1	-
10:7	1b	K650	2	-	10:22	1	K443	1	-
10:8	1a	K476	2	-	10:22	1	K444	1	-
10:9	1a	h.s.	2	-	10:23	1	h.s.	2	-
10:10	1	h.s.	2	B89	10:23	1c	h.s.	2	-
10:11	1	h.s.	2	B91	10:24	1b	K436	1	-
10:11	1	K440	2	-	10:24	1b	K437	1	-
10:14	1	h.s.	2	B120					

TABLE 47: *Ceramic Period 2 rim form 1 samples from burials*

Layer	grams	Burial	MP	Layer	grams	Burial	MP
10:4	1	B57	3	10:11	1	B94	2
10:4	1	B60	3	10:11	1	B96	2
10:4	1	B79	3	10:11	2	B113	2
10:6	2	B67	3	10:12	2	B109	2
10:7	4	B72	3	10:12	3	B87	2
10:8	5	B90	3	10:12	15	B115	2
10:8	2	B92	3	10:15	1	B107	2
10:8	1	B95	3	10:16	5	B100	2
10:9	2	B103	3	10:21	1	B150	1

Rim form 2

Rim form 2 also continues in the same form as the CP1 assemblage. Categories 2a, 2c, a rare form with an inturned rim fold and form 2d are added in layer 10:3 (Fig. 76). The latter features a bevelled upper terminus, and a carefully trimmed lower margin with an incised line immediately below.

TABLE 48: *Ceramic Period Two rim form 2 fabrics*

Layer	Form	Thin section/h.s.	Fabric group	Burial	Layer	Form	Thin section/h.s.	Fabric group	Burial
10:3	2	K513	2	-	10:11	2	K729	3	-
10:3	2	K1210	2	-	10:11	2	h.s.	2	B101
10:7	2c	h.s.	2	B73	10:12	2	K505	2	-
10:8	2	K434	2	-	10:14	2	h.s.	2	B120
10:11	2	K460	2	-	10:16	2	K1208	2	-
10:11	2	K461	2	-	10:16	2	K1209	2	-
10:11	2	K462	2	-	10:21	2	K435	2	-
10:11	2	K463	2	-					

Rim form 3b

Except for this coarse cord-marked example, the remaining rim form 3 categories are all from fine wares. It is difficult to determine whether rim form 3b represents a shallow bowl or a lid used in conjunction with the large cylindrical vessels represented by rim form 1.

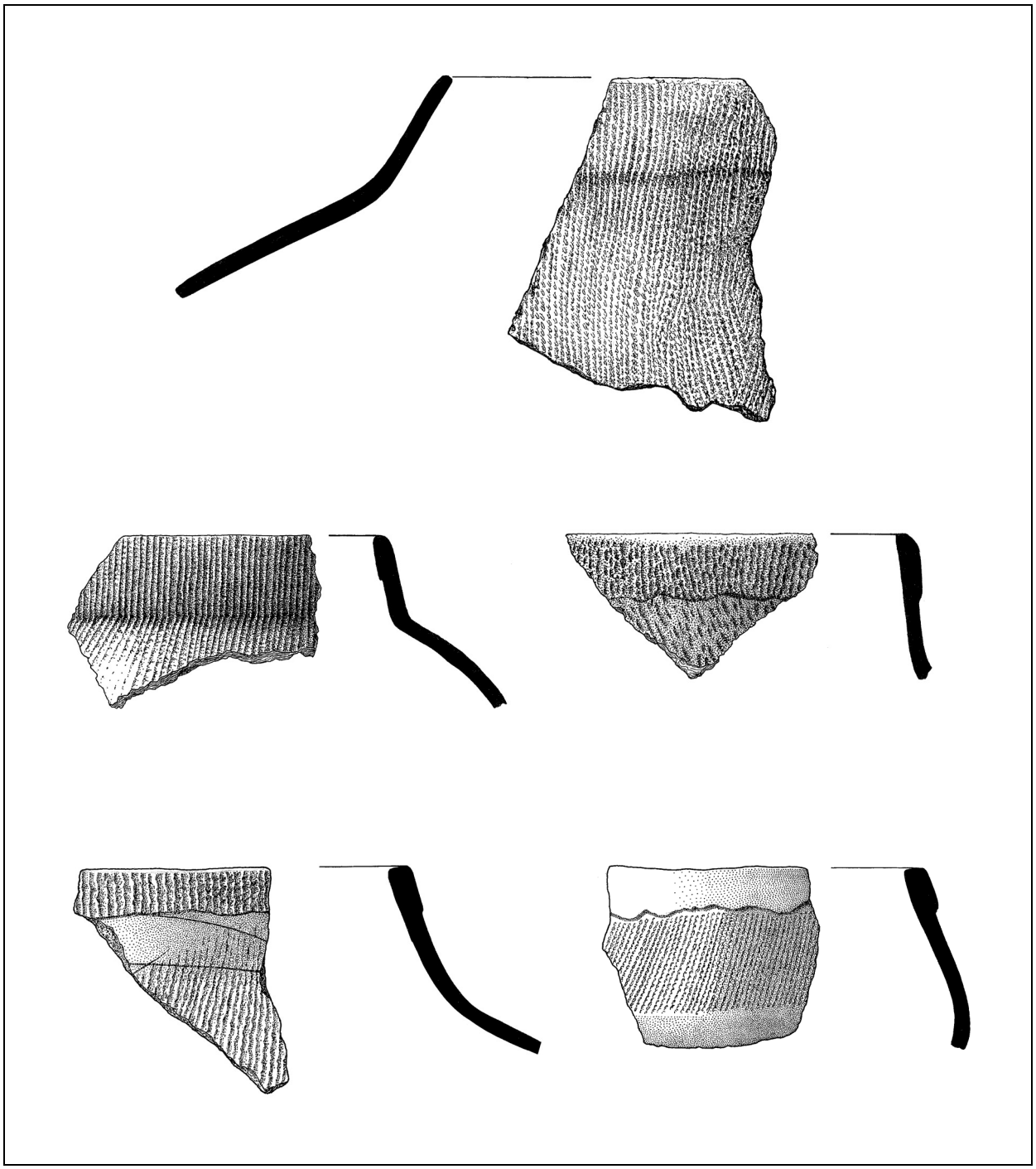


FIG. 75: Rim form 1 categories. Ceramic Period 2. *Top*: rim form 1, *Centre* left: 1b, right: 1c, *Bottom* left: 1c(i), right: 1d. Scale: 1:2

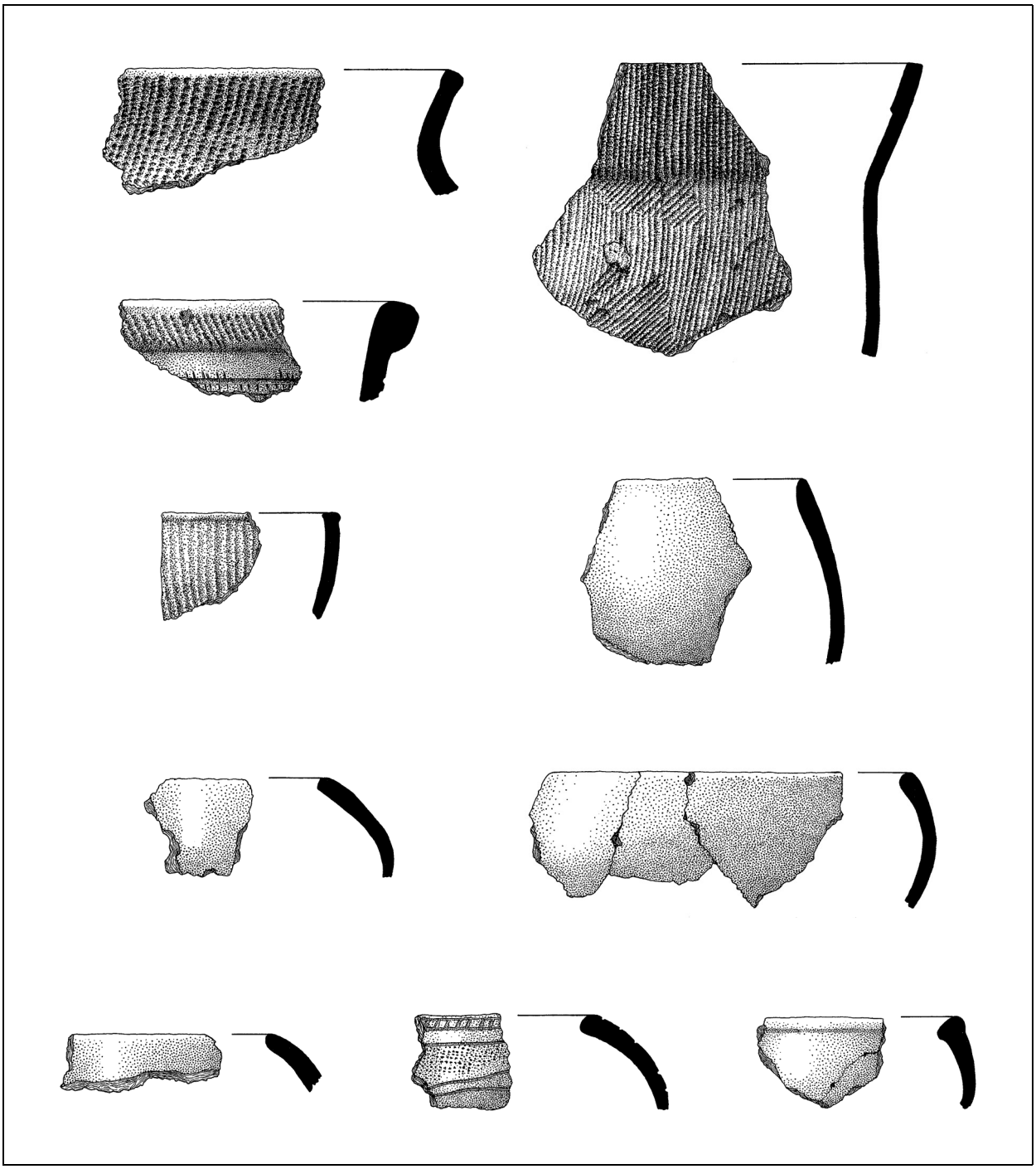


FIG. 76: Rim form 2 and 3 categories and variants. Ceramic Period 2. *Top* left: 2b, left: 2d (below 2b), right: 2c, *Centre* upper row left: 3b, right: 3, *Centre* lower row left: 3c, right 3c(i), *Bottom* left: 3c(ii) middle: 3c(iv), right: 3i. Scale: 1:2

FINE WARE RIMS

Rim form 3

The number of these wares increased from five in CP1 to 13 in CP2 (Appendix 2). Rim form 3 represents a group of shallow bowls which range in circumference from 220–360 mm and in depth to about 80 mm. The rims are inverted from almost vertical to between 20° to 30°. The basic form 3 is plain with a range of termini from rounded to square or hammer head. The latter were formed by folding the vessel wall inwards. Form 3 variants are listed below:

- 3a features a band of horizontal incised lines.
- 3a(i) is burnished with horizontal incised and decorated fields.
- 3a(ii) is similar to 3a(i) but with alternate curvilinear incised lines bounding punctate fields which have probably been decorated with an *Anadara* shell.
- 3a(iii) has a squared terminus and burnished interior and exterior surfaces. It is tempered with rice which suggests it is exotic.
- 3a(iv) has an additional series of horizontal incised lines commencing immediately below the rim.
- 3b(i) is plain with a square terminus. It has red slip to both interior and exterior surfaces.
- 3c(i) has a rounded terminus with red slip to either the interior or both surfaces.
- 3c(ii) is burnished with *Anadara* shell impressions to the terminus.
- 3c(iii) is similar to the previous form but without the shell impressions.
- 3c(iv) is burnished with intricate geometric design fields outlined by incised lines. Each alternate horizontal panel is decorated with either *Anadara* shell impressions or punctate fields. The latter were probably achieved by changing the shell tool from its side to its edge to create a finer pattern.
- 3c(v) has a rounded terminus. It displays horizontal fields decorated with diagonal *Anadara* shell impressions. These are bounded by incised lines.
- 3e exterior is cord marked and the terminus rounded.
- 3f features a square “nail head” terminus with 7–8 mm thick walls.
- 3i is burnished with a square or hammerhead terminus.

Local rim forms 3 and 3b were sometimes less carefully made and a few tend to be coarse in texture. Form 3b is shown in figure 76 and a selection of these rims is shown in figure 45 (Chapter VII). Table 50 sets out the fabrics for a range of these wares. All sources are local except 10:11 K661 and K648 which are considered exotic. The latter is non-specific in that it can not be assigned to any particular fabric group. Rims recovered from graves are set out in table 49. In each case the ware is local. All burnished rims have been fired in a reducing atmosphere to produce a dark lustrous surface.

Of the 50 RF3 sample examined petrographically, 38 of the local wares were composed of FG2, eight of FG3, two of FG1 and two are exotic. FG3 is the local ware which characterises CP3 and these rims are considered to have originated from this context. One exotic fabric is non-specific in the sense that its mineralogical source is unclear except to note that it is composed of material consistent with sedimentary strata. Although it lacks distinctive mineral inclusions, it is tempered with orthodox grog. The remaining exotic fabric, FG12, is tempered with sand and is probably derived from a metamorphic source.

TABLE 49: *Ceramic Period 2 rim form 3 in burials*

Layer	Form	g	Burial	MP	Surface finish
10: 4	3b	2	79	3	coarse cord-marked
10: 8	3	1	90	3	fine plain
10:11	3	1	102	2	fine plain
10:12	3	4	109	2	fine burnished
10:13	3	1	113	2	fine burnished
10:14	3	1	145	2	fine burnished
10:15	3	1	131	2	fine burnished
10:16	3	2	107	2	fine burnished
10:20	3	1	147	1	fine burnished

Rim form 4

Highly-burnished surfaces and complex design fields are a feature of the vessels these rims represent. Forms 4, 4a(i) (Fig. 77), and 4az are present in CP2. Although the decoration varies slightly from the CP1 examples, because the designs are quite complex and only fragments of these wares were recovered, they were given the same designation. Similar design motifs are present on two complete burial vessels, cats. 1390 (B74) and 1518 (B91). A detailed description of the ware is set out in Chapter VII. The illustrated form 4a(i) sherd is the largest of just three such rims identified in the entire assemblage. This is a unique form and may represent a single vessel. Apart from an upward curve to the rim terminus, it closely conforms with the criteria for other members of this group of vessels which are characterized by an inverted rim and a carinated body. Care has been taken to fire the vessel in a reducing atmosphere, another hallmark

TABLE 50: *Rim form 3 fabrics: Ceramic Period 2*

Layer	Form	Thin section	Fabric group	Layer	Form	Thin section	Fabric group
10:3	3	K690	2	10:13	3c(iii)	K656	2
10:3	3c(iii)	K796	2	10:14	3	K793	2
10:3 ls 2	3b	K645	3	10:14	3c(iii)	K627	2
10:3 ls 2	3a(ii)	K646	2	10:14	3i	K630	2
10:3	3c(iii)	K669	2	10:15	3c(iv)	K679	2
10:3	3c(iii)	K692	2	10:15	3a(i)	K659	3
10:4	3c(ii)	K675	2	10:16	3b	K441	3
10:4	3	K684	2	10:16	3	K742	3
10:6	3b	K642	3	10:17	3	K687	3
10:6	3b	K643	2	10:17	3a(iv)	K660	2
10:7	3c(iii)	K689	2	10:17	3	K673	2
10:7	3c(iii)	K631	2	10:18	3a(iii)	K641	2
10:7	3c(iii)	K662	2	10:18	3c(iv)	K648	non specific
10:8	3b	K725	2	10:18	3c(v)	K682	2
10:10	3c(iii)	K657	2	10:18	3c(iii)	K795	2
10:10	3	K680	2	10:19	3c(iv)	K640	2
10:11	3c(iii)	K653	2	10:19	3c(v)	K665	2
10:11	3c(iii)	K654	2	10:19	3c(iv)	K647	2
10:11	3	K661	12	10:20	3c(iii)	K651	2
10:12	3c(iii)	K602	1	10:20	3c(v)	K664	2
10:12	3c(iii)	K603	2	10:21	3	K685	2
10:12	3c(iii)	K652	2	10:23	3b(i)	K655	2
10:12	3c(iv)	K676	2?	10:24	3	K671	1
10:12	3c(iv)	K677	2	10:24	3	K724	2
10:13	3	K721	2	10:24	3	K741	2
10:13	3	K681	3	10:24	3	K683	2
10:13	3i	K678	2				

of ornamental wares during this Period. The circumference of the rim is 180 mm and the vessel wall thickness is an even 3.5 mm. Such precision would be extremely difficult to attain by any but the most skilful of potters working without the benefit of modern technology. That the quality of this ware is outstanding is further reflected in the care taken to prepare the ceramic fabric as well as to shape, burnish and decorate the vessel with intricate geometric fields of *Anadara* shell impressions. Several of these CP2 rims, including the unique specimen discussed above, have been examined petrographically (Table 51). All are deemed of local origin.

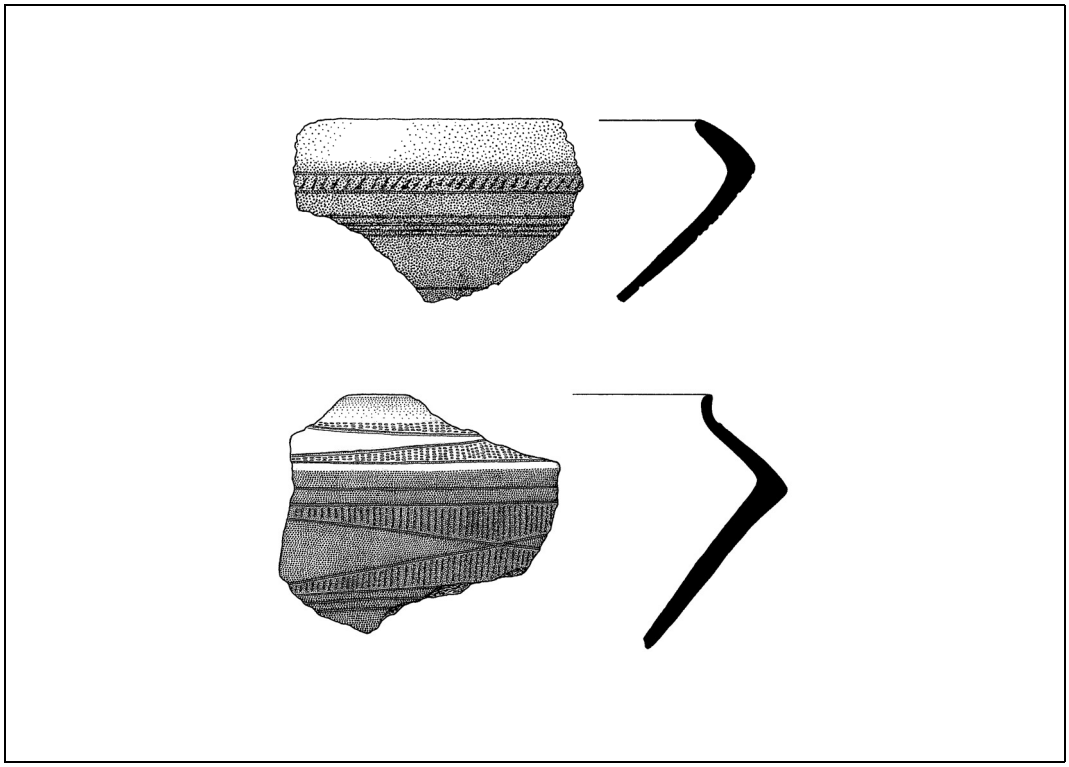


FIG. 77: Rim form 4 categories. Ceramic Period 2. Top: 4, bottom: 4a(i). Scale: 1:2

Rim form 5

During CP2, rims of this form proliferate so that, of the 109 total variants, 65 make their first appearance (Figs. 78-83 illustrate a selection). Several of the minor variants are present as single small sherds weighing no more than 1 g. These include categories and variants from RF5a to RF5ap (Appendix 2). Vessels which feature these rims are illustrated in Chapter VII. Shapes vary in terms of length, curvature and angle of inclination. This range of shapes extends to the variants also and it is important to note that some variants differ markedly in size from several of the larger rims in the form group. The exceptions are RF5d, which is an exotic ware

TABLE 51: *Rim form 4 fabrics: Ceramic Period 2*

Layer	Form	Thin section	Fabric group	Layer	Form	Thin section	Fabric group
10:3	4	K479	3	10:16	4	K475	2
10:3	4	K480	2	10:19	4	K1195	2
10:10	4	K457	2	10:20	4	K473	2
10:10	4	K458	2	10:20	4	K474	2
10:12	4	K468	2	10:22	4	K459	2
10:12	4	K469	2	10:22 ls 27	4	K464	2
10:12	4a(i)	K705	2	10:22 ls 27	4	K465	2
10:13	4a(i)	K481	2	10:23	4	K456	2
10:15	4	K467	2				

decorated with 11 horizontal incised lines spaced about 2 mm apart and extending down 20 mm from the rim, and RF5l which has six or eight such lines. No distinction has been made between undecorated rims or those which have from one to three horizontal lines below the rim. Of the rims which derive from undecorated wares, approximately 77.5 per cent are burnished. To this should be added some eroded sherds which were categorized as plain because their original surface was too badly damaged. It can reasonably be assumed, therefore, that at least 80 and possibly 90 per cent of these wares had been burnished.

Form 5a is a burnished 65 mm long rim with two horizontal and one wavy line just below the terminus. The straight lines were incised with a sharp tool and the wavy line has been impressed into the wet surface with the edge of an *Anadara* shell. Fine shallow vertical striations, probably made by lightly drawing a thin bamboo stylus across the leather-hard vessel surface, run down from the wavy line. Form 5a(i) in addition includes *Anadara* shell impressions to the rim terminus. Local wares feature these kinds of decorative techniques arranged in a wide variety of modes. As the illustrations show, these are sometimes very detailed. As many of the rim sherds also include these decorative techniques, variants will be detailed when considered to be of cultural or technological significance.

Unless noted otherwise, all the following rim sherds have been burnished and fired in a reducing atmosphere.

- Rim form 5b has two horizontal incised lines with vertical striations which have been applied prior to the incising.
- Five b(i) has the same shape with only one horizontal incised line and narrower striations.
- Five b(ii) has vertical striations only.

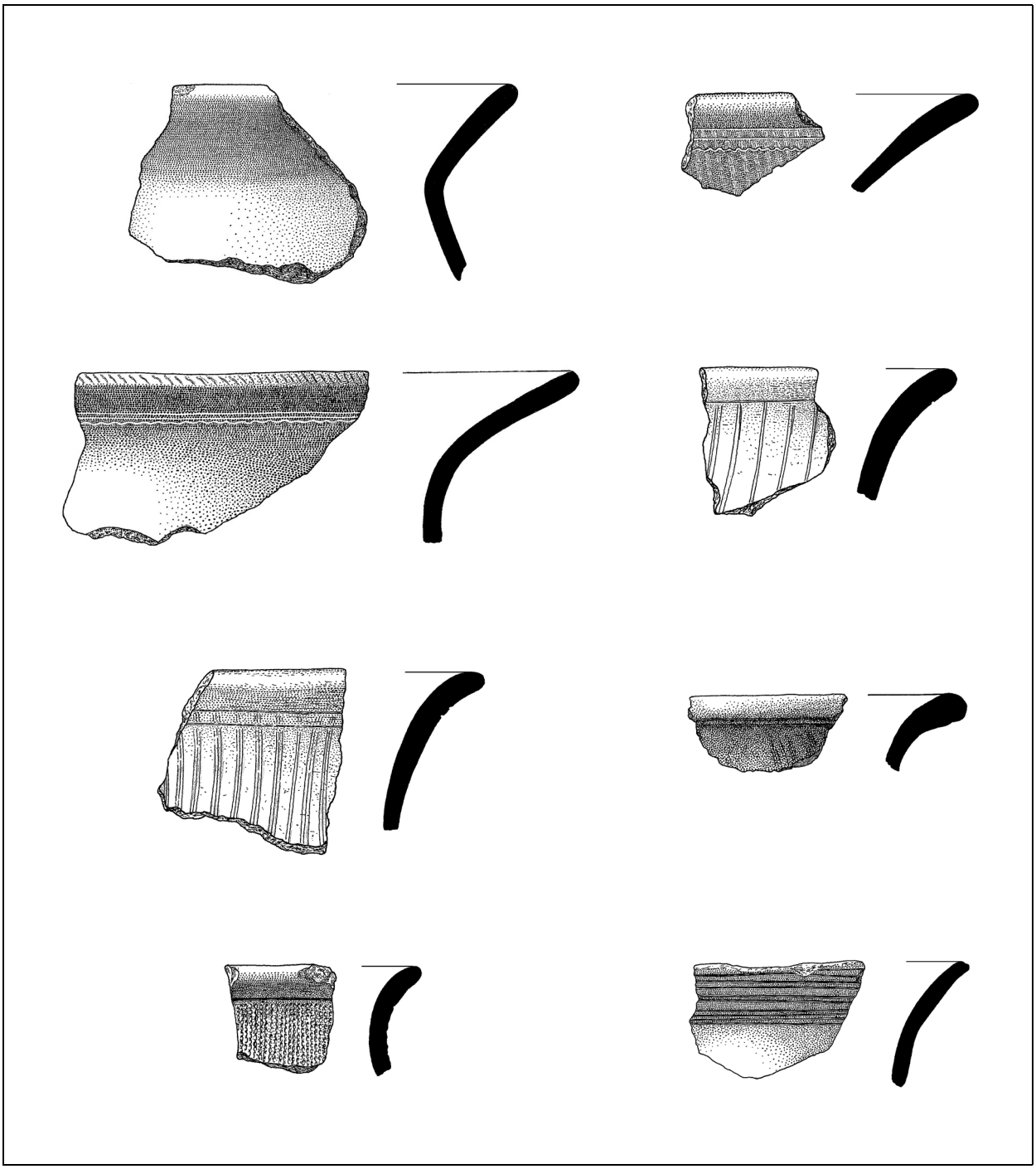


FIG. 78: Rim form 5 categories and variants. Ceramic Period 2. *Top* left: 5, right: 5a, *Centre* upper row left: 5a(i), right 5b(i), *Centre* lower row left: 5b, right: 5b(ii), *Bottom* left: 5c, right: 5d. Scale: 1:2

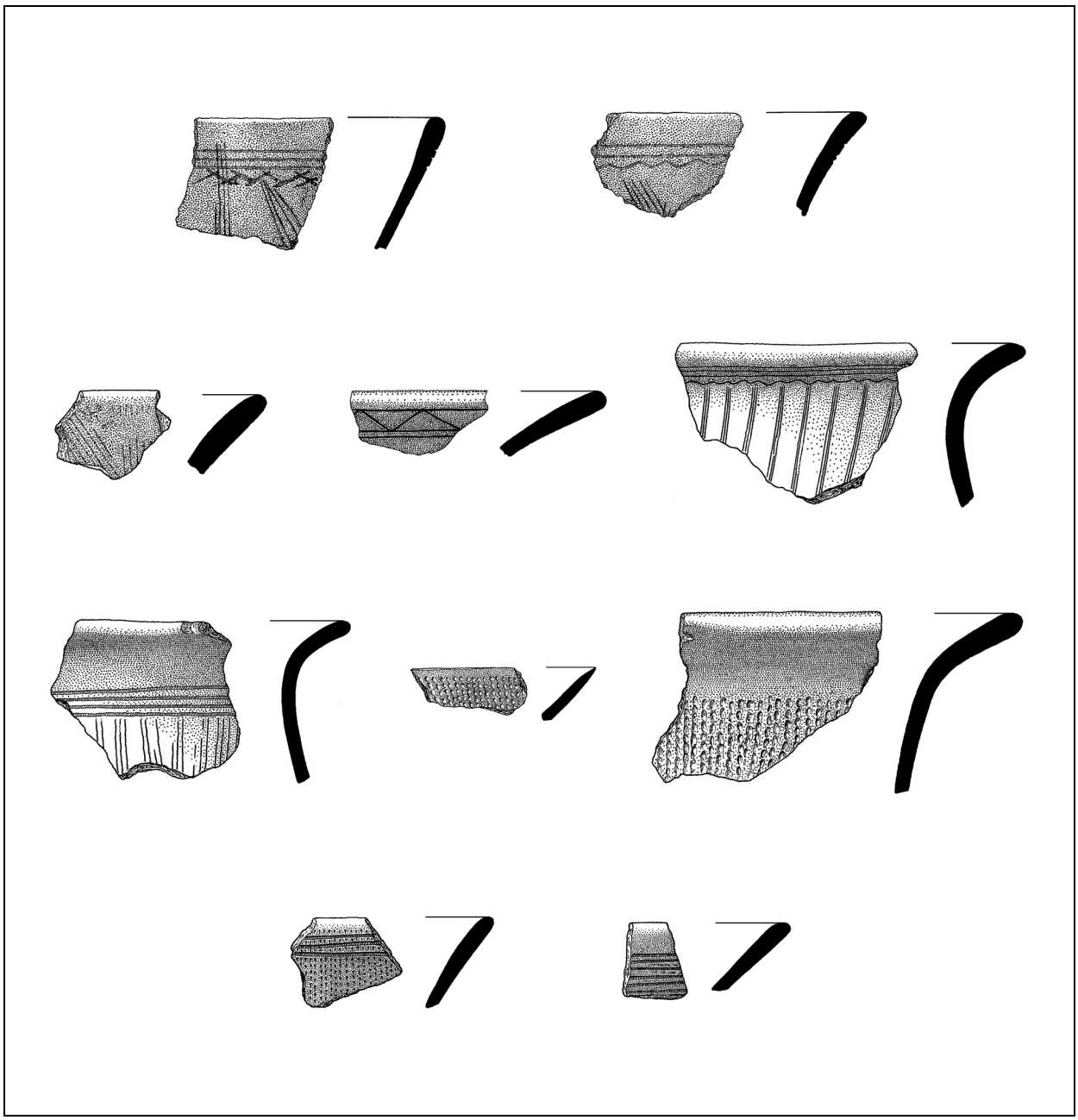


FIG. 79: Rim form 5 categories and variants. Ceramic Period 2. *Top* left: 5e, right: 5e(i), *Centre* upper row left: 5f, centre: 5g, right: 5i(i), *Centre* lower row left: 5i(ii), middle: 5j(i), right: 5j(ii), *Bottom* left: 5k, right: 5l. Scale: 1:2

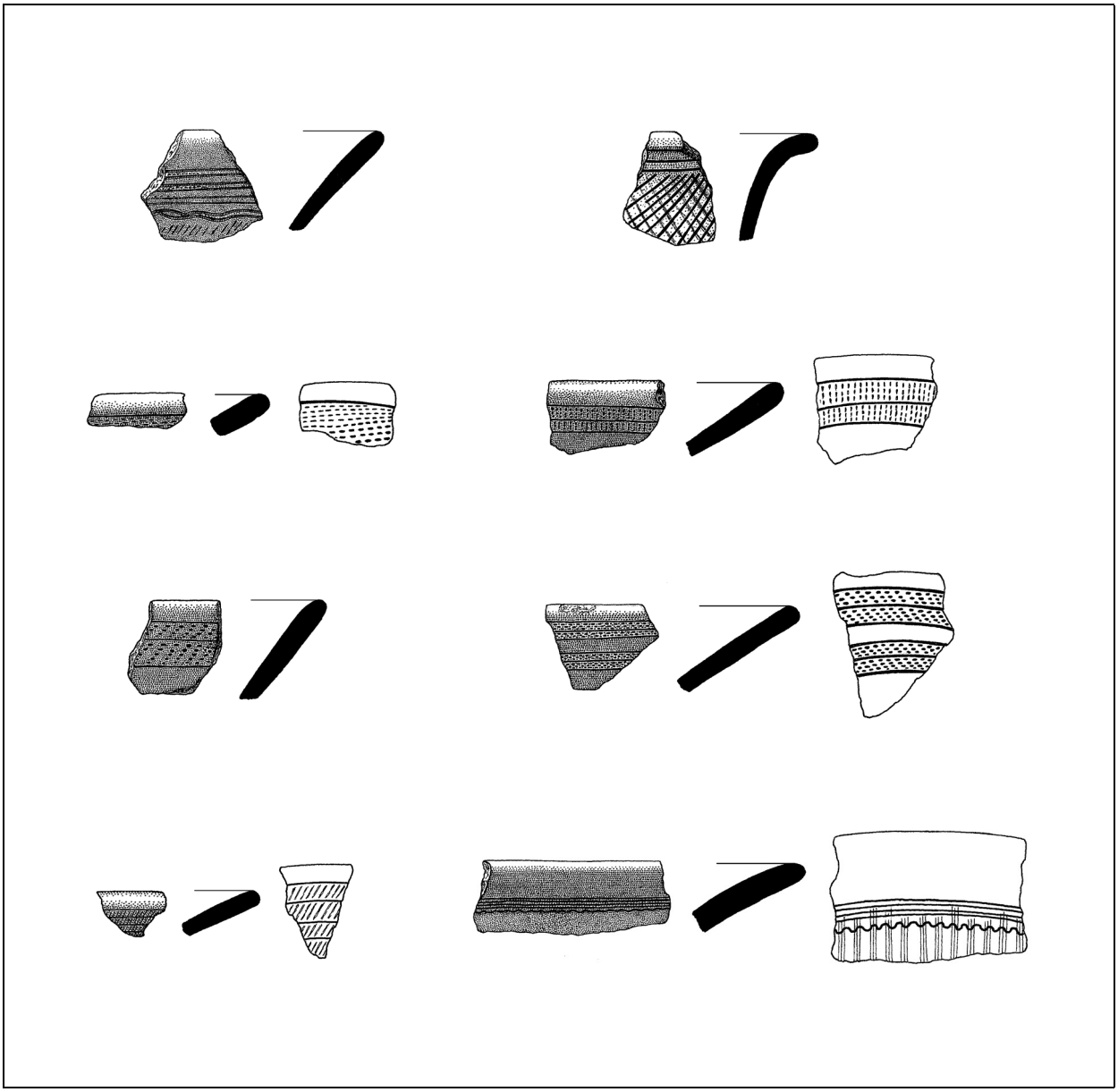


FIG. 80: Rim form 5 categories and variants. Ceramic Period 2. *Top* left: 5m, right: 5n, *Centre* upper row left: 5o, right: 5p(i), *Centre* lower row left: 5p(ii), right: 5p(iii), *Bottom* left: 5p(iv), right: 5q. Scale: 1:2

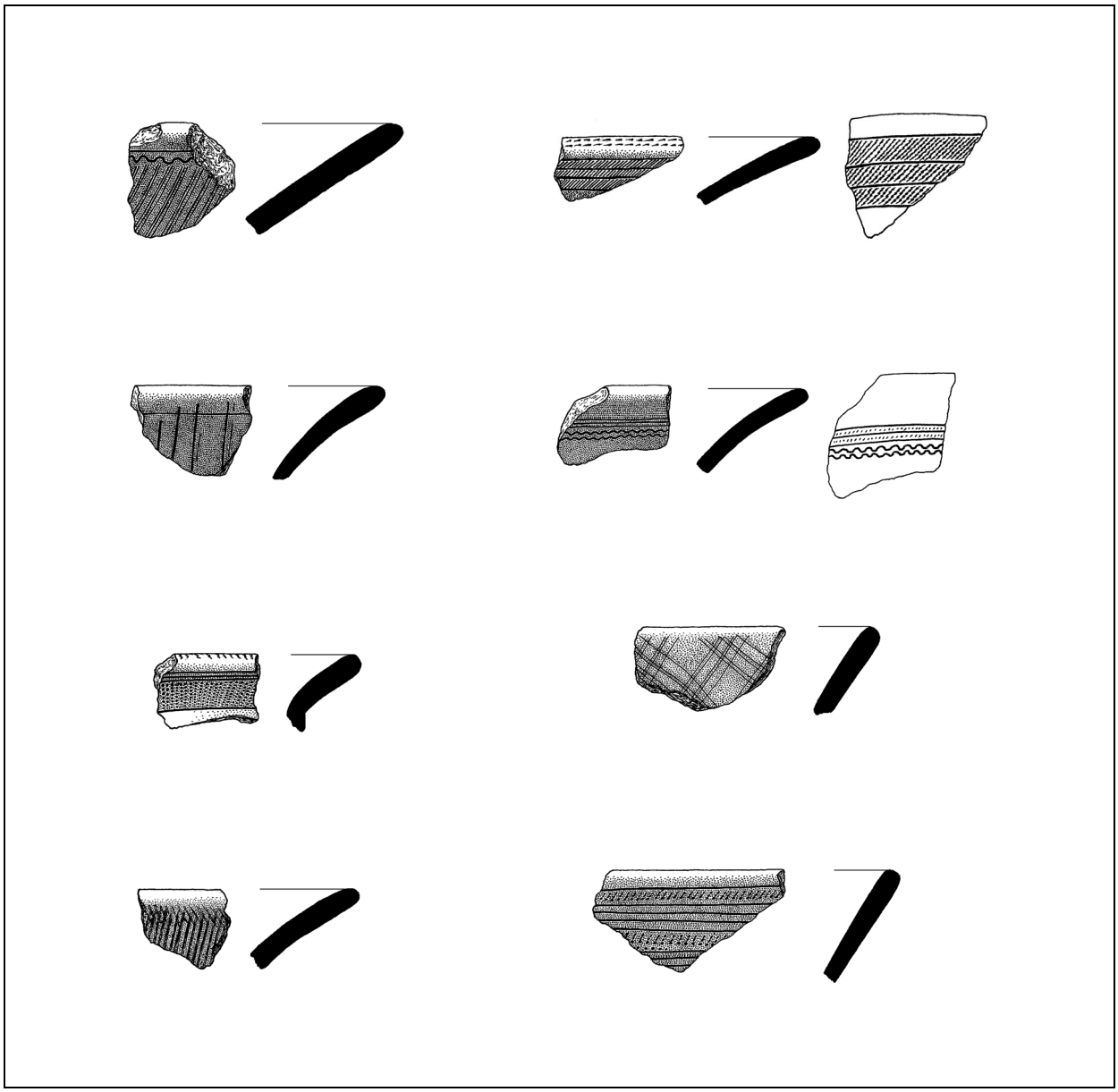


FIG. 81: Rim form 5 categories and variants. Ceramic Period 2. *Top* left: 5r, right: 5s, *Centre* upper row left: 5t, right: 5u, *Centre* lower row left: 5v, right: 5w, *Bottom* left: 5x, right: 5y. Scale: 1:2

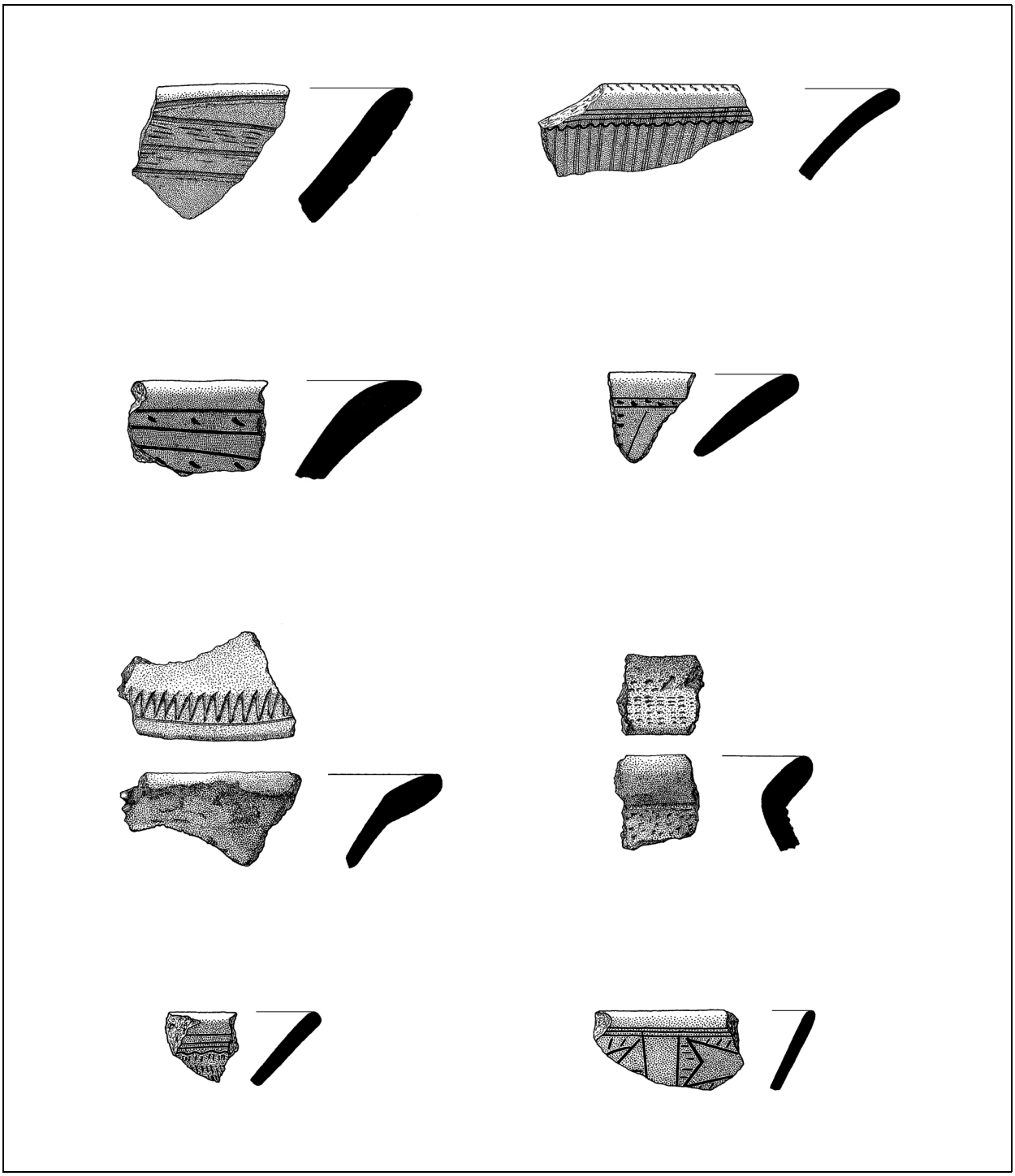


FIG. 82: Rim form 5 categories and variants. Ceramic Period 2. *Top* left: 5z, right: 5aa, *Centre* upper row left: 5ab, right: 5ac, *Centre* lower row left: 5ad (iv), right: 5ad (v), *Bottom* left: 5ae, right: 5af. Scale: 1:2

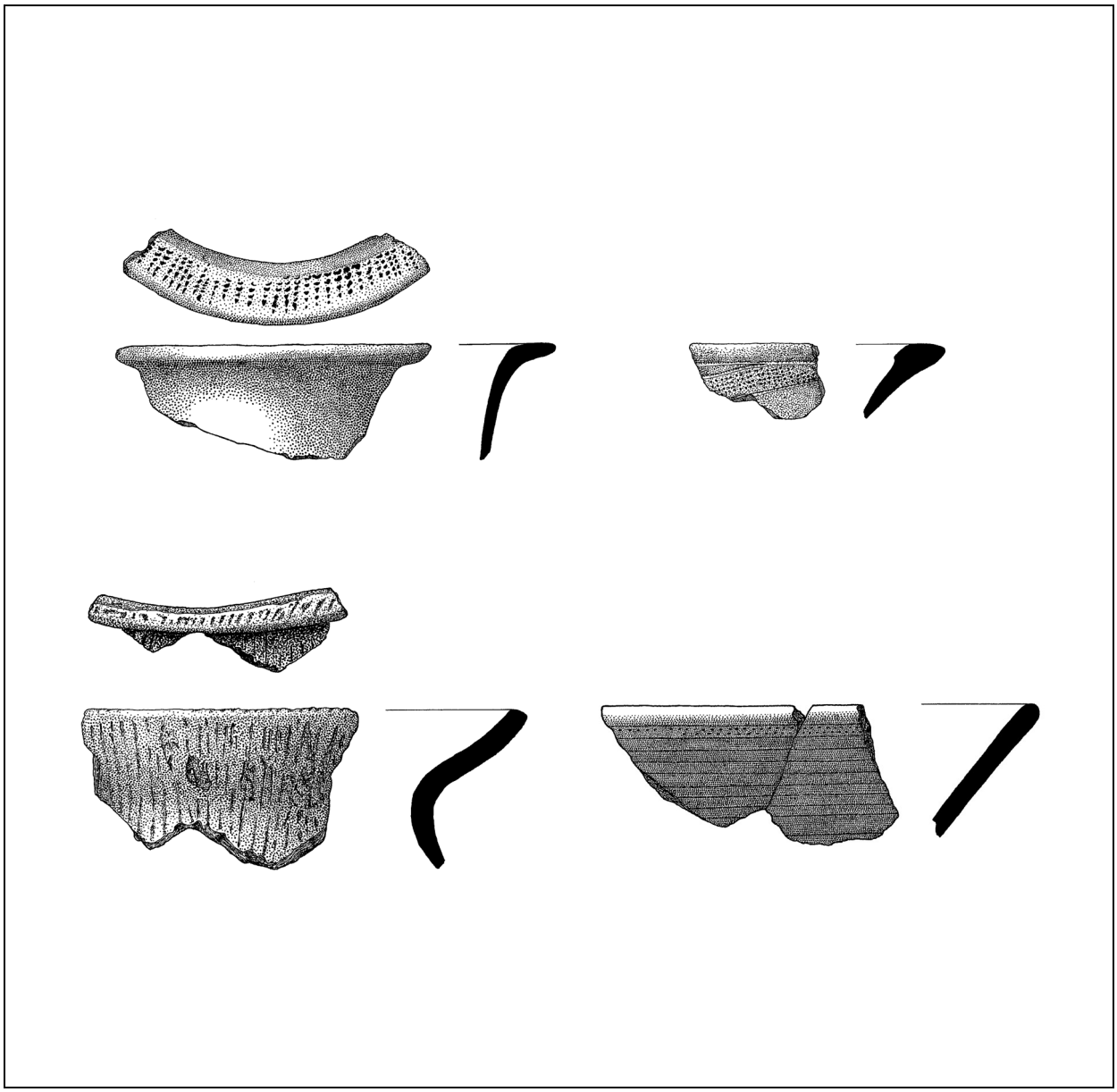


FIG. 83: Rim form 5 categories and 6b(vi) variant. Ceramic Period 2. *Top* left: 5ai, right: 5am, *Bottom* left: 5ak, right: 6b(vi). Scale: 1:2

- Five b(iii) is the same as 5b(i) but with the addition of *Anadara* shell impressions to the rim terminus.
- Rim 5c has one or two horizontal incised lines with vertical *Anadara* shell impressions below. In this case the impressions appear to have been made with the exterior surface of the shell.
- Rim 5e has an incised chevron pattern below three or four horizontal incised lines, with vertical striations further below this.
- Form 5e(i) is similar to 5e, but with an incised chevron pattern below two horizontal incised lines and diagonal striations to the field below.
- Rim 5f has been finished with vertical and near vertical paddle impressions, a technique not used by local potters during this CP. This sherd has not been burnished and it is partially oxidized.
- Form 5g has a upper panel of incised running chevrons bounded by parallel incised horizontal lines about 8 mm below the rim terminus. A further parallel incised horizontal line runs about 2 mm below this panel.
- A variant, 5g(i), includes *Anadara* shell impressions applied horizontally to give a pricked effect in every upper triangle within the panel, thus creating a band of repeating impressed triangles, similar to Hall's motif 3:11 (1993:247, Figure 101a). This latter motif has been impressed with the shell edge, whereas the motif described here features impressions imparted by the shell back.
- Rim 5g(ii) is similar to 5g(i) except that, instead of triangles, the fields are curvilinear segment shaped and the *Anadara* shell impressions are arranged vertically. In addition, the rim terminus is decorated with these impressions.

Several rim forms are common to CP1 and CP2. These include 5a–f, 5i and 5j(ii). Note that 5a, 5o, 5s, 5t and 5u probably derive from CP3.

- Rim 5i(i) has a horizontal band of three straight and one wavy incised lines commencing 7 mm below the rim terminus. Near vertical striated lines spaced about 7–9 mm apart run down the vessel wall from this band.
- Form 5i(ii) has a band of four straight lines about 20 mm below the rim terminus and vertical cord marks, which have been partially smoothed over, to give a similar effect to the striations on rim 5i(i).
- Five j(i) is cord-marked to within 2 mm and 5j(ii) to within 25 mm of the rim terminus. These minor variations also reflect differences in fabric compositions with local FG1 and FG2 represented.
- Rim 5k is decorated with vertical *Anadara* shell impressions, which cover the entire wall surface. Three horizontal incised lines are positioned just below the rim. As with most of the sample, the incised lines were applied after the wall treatment was completed.

- Form 5l has 6–8 horizontal incised lines in a band, similar to CP1 form 5e.
- Rim 5m has partially smoothed vertical *Anadara* shell impressions overlaid by six straight and two wavy horizontal incised lines forming a band about 12 mm below the rim terminus.
- Form 5n also features a horizontal band of three straight lines just below the rim. The vessel wall is incised in a cross-hatched fashion with diagonal lines running along both diagonals.
- Form 5o has a single horizontal incised line just below the rim. The vessel wall is covered with horizontal *Anadara* shell impressions.
- Rim 5p(i) features a band composed of three horizontal incised lines infilled with vertical *Anadara* shell impressions.
- Form 5p(ii) is similar but with diagonal *Anadara* shell impressions.
- Form 5p(iii) has two such bands separated by about 6 mm.
- Rim 5p(iv) has more than four lines all filled with diagonal *Anadara* shell impressions.
- Two further rims, 5q and 5i are similarly decorated. Rim 5q has a band of four straight incised lines and one wavy *Anadara* shell impressed line which together form a band about 12 mm below the rim terminus. The vessel wall is burnished but otherwise undecorated, whereas 5i has partially smoothed over cord marks covering the wall surface.
- Form 5r displays a single straight incised line over one wavy *Anadara* shell impressed line. These two lines form a border about 8 mm below the rim. The vessel wall is covered with diagonal striations.
- Rim 5s is decorated with a band comprising four incised lines infilled with diagonal *Anadara* shell impressions. This band is about 7 mm below the rim terminus which has *Anadara* shell impressions arranged parallel to its perimeter.
- Form 5t has a single incised line about 10 mm below the rim with randomly arranged vertical lines covering the vessel wall.
- Rim 5u features two straight incised lines coupled with two wavy *Anadara* shell-impressed lines.
- Rim 5v has a decorative band composed of a group of three straight upper incised lines separated from a single lower line by a panel infilled with vertical *Anadara* shell impressions. These impressions are also arranged round the rim terminus at right angles to the perimeter.
- Form 5w is decorated with a series of cross-hatched, very shallow, diagonal incised lines.
- Rim 5x has near vertical paddle impressions and is not burnished.

- Incising and impressing on rim 5y comprises an alternating series of panels with diagonal *Anadara* shell edge impressions defined by straight incised lines. Two or three further lines fill the area between these panels to give a continuous design which covers all the sherd. In one case these panels are arranged so that the incised lines lie above the first impressed panel which is separated by a plain band from a second impressed panel.

- Five y(i) has a more rounded rim terminus and incised lines arranged in a geometric pattern. Two form a single panel with vertical impressions and four incised lines beneath this panel. The remainder of the sherd is undecorated.

- A different method was used to decorate the area between deep 2 mm wide incised lines on rim 5z. In this case the panel has been marked with a series of short parallel incisions. One parallel line runs about 4 mm below the rim terminus and then three further lines about 10 mm apart run at an angle of about 14° from this.

- Form 5aa is decorated with a band comprising three straight incised lines and a single wavy line formed with an *Anadara* shell edge. Vertical light striations fill the vessel wall and the rim terminus is marked with diagonally arranged *Anadara* shell edge impressions. One sherd was oxidized.

- Rim 5ab has geometric fields comprising a series of impressed probe marks bounded by incised lines. This ware is exotic and represented by two sherds, one of which, in addition to the above decoration, has a series of probe marks arranged in short diagonal lines to form an interior band extending down from the rim terminus for about 20 mm.

- Form 5ac also features similar probe marks distributed within and round straight incised lines.

- Rim 5ad is difficult to assign to a form group as it may either represent a portion of an everted carinated jar or alternatively it could belong to a large shallow bowl with an everted rim. In the latter instance it would belong to a different form group. Several of these rims, initially assigned to group five, were subsequently re-assigned to form group 14 because they clearly were parts of a bowl. The vessels these rims represent range in diameter from 220–300 mm and from 6–9 mm in thickness. Those rim forms which are not readily identified with bowls have been included, however, caution needs to be exercised when assessing their distributions as some may fit the form 14 criteria. Rim 5ad first occurs in CP2. It is everted with a flattened internal border from 12–15 mm wide which is decorated with light *Anadara* shell impressions running parallel to the rim perimeter.

- Form 5ad(i) has an additional exterior field of *Anadara* shell impressions extending down from the inflection point and two straight incised lines running parallel with the external inflection point.

- Five ad(ii) is undecorated.

- Rim 5ad(iii) has the same decoration as 5ad(i) plus two straight incised lines, about 2 mm apart, following the external inflection point.

- Form 5ad(iv) is decorated along the internal border with a single scribed incised line running 4 mm from and parallel to the rim terminus. For the 12 mm from this line to the internal inflection point a zig-zag pattern forms a continuous field.
- Rim 5ad(v) has *Anadara* shell impressions covering the internal panel, a single incised line at the external inflection point and the vessel wall below this is covered with small angular probe marks.
- Rim 5ad(vi) is the same as 5ad(v) except that it lacks the exterior incised line.
- Rim form 5ae is similar to 5i except that it has vertical *Anadara* shell impressions, instead of cord marks, covering the vessel wall below three or four straight incised and one wavy line.
- Form 5af also has three parallel incised lines 6 mm below the rim terminus with an intricate geometric motif below this.
- Form 5ag is decorated on the exterior with a field of punctate impressions (Hall 1993:241, Figure 100e-g motif 3:6), which covers the vessel wall except for the upper 10 mm, where it terminates at a single incised line running parallel to the rim terminus. Two other such lines run 20 and 40 mm below the terminus on the interior surface bordering a panel of incised vertical lines spaced at 2 mm intervals.
- Form 5ah has a folded rim, square in cross section, which has been carefully trimmed about 10 mm below the terminus. When intact, it measures 260 mm in diameter, 35 mm in length and 6–7.5 mm in thickness. This ware is exotic and tempered with bleb grog.
- Rim 5ai describes an arch about 50 mm long and ends with a flat, horizontal terminus 9 mm wide. This has been decorated with *Anadara* shell impressions either arranged parallel or at right angles to the rim edges. Its diameter was 200 mm.
- Form 5ai(i) has additional fan-shaped *Anadara* shell impressions to the vessel wall arranged in rows. This ware is also exotic and tempered with bleb grog.
- Rim 5ai(ii) is decorated with *Anadara* shell impressions to the rim terminus and also has a single incised line about 20 mm below on the vessel wall. This ware is oxidized and sand tempered.
- Only the rim terminus of 5aj is decorated with deep diagonally arranged *Anadara* shell impressions. This ware is partially oxidized.
- Form 5aj(i) has been carefully modelled to form a square terminus.
- The terminus of 5ak is also squared. In this instance a cord-wrapped paddle has been used. Partially smoothed over vertical cord marks cover the exterior vessel walls.
- Rim 5al is decorated with deep grooves cut diagonally to the exterior terminus point and to the interior terminus inflection point. A thin round probe about 2 mm in diameter was used to cut these grooves. They are similar to those illustrated by Hall (1993:248, Figure 102g, motif 3:25).

- Form 5am features a straight incised line gauged 5 mm below the terminus and forming a border for a curvilinear field 8 mm wide which has been infilled with *Anadara* shell impressions.
- Form 5an has a bevelled terminus with *Anadara* shell impressions arranged at right angles to the rim perimeter. The exterior wall of this vessel also featured these impressions deployed parallel to the rim edge.
- Rim 5ao is decorated with diagonal *Anadara* shell impressions to the rim interior to form a 20 mm band.
- Form 5ap has a sharp 90° inflection point 22 mm below the rim terminus from which the vessel turns outwards. An incised line runs parallel with the rim edge to form a 10 mm band. Below this line a 20 mm high continuous horizontal panel is filled with punctate impressions. Within the panel two further incised lines, one straight and the other forming a continuous chevron pattern circle the vessel wall. This rim has been examined in thin section (Table 52).

In summary, RF5 wares during CP2 can be grouped according to the following modes of decoration. Forty seven were burnished and incised. Thirty six were decorated with *Anadara* shell impressions. Twenty seven were burnished, incised and decorated with *Anadara* shell impressions. Two were burnished, incised and decorated with striations. One was burnished and decorated with striations only. Incised chevrons were used to decorate two burnished wares. One was burnished and decorated with incised chevrons and striations. One was burnished and decorated with incised chevrons and *Anadara* shell impressions. Two wares were paddle impressed. Three were cord marked. Two wares were burnished and incised and decorated with probe-marked fields. Two were burnished and incised and decorated with punctate fields. One was grooved. One was cord marked and incised. Two were plain and undecorated. Five vessels were decorated with geometrically incised motifs. Six were identified in hand specimen as being exotic. These groups can be further consolidated into 55 rim forms, or 84.6 per cent of the sample, which were incised and/or shell impressed.

The above descriptions are only as complete as the surviving sherds allow and the kinds of surface decorations involved in each form group. Motif designs are particularly difficult to assess when only small portions of the vessel are available. In some instances, however, reference to the "whole" vessels assists quantification of these design motifs and decorative fields. Confidence in the completeness of many of the decorative fields is warranted when they can be related to vessels in the assemblage. Stylistic conformities within the sample signal that several decorative modes represent regional styles. Many cut across different manufacturing methods and technologies, a clear signal that pottery with similar decorative modes was produced simultaneously at several sites within the region under a variety of potting traditions. Thus different potting traditions within the region often shared the same styles.

Rim form 5 fabrics

A total of 114 form five rims have been thin sectioned and examined petrographically. Particular attention was paid to identifying any likely exotic wares through choosing those

which were visually distinctive. Several different exotic sources are present in the assemblage representing a variety of different geological terrains (Appendix 1). This rim form represents the most abundant fine-ware vessel, a carinated jar, present in graves as mortuary furniture. The presence of many exotic wares of this form in the cemetery deposits, if not actually in the graves themselves, signals they may have been important aspects of the mortuary ritual. In each case they can be considered as high-energy wares because they were skilfully constructed and involved burnishing, a process which would take extra care and expertise. Several of the exotic rims are exceptionally thin and their surfaces are burnished to a high lustre.

Some exotic fabrics are mineralogically distinctive enough to suggest a source with some precision, or at least indicate the closest stratum which contains appropriate geological deposits. Limestone fragments, for example, are present in one exotic RF5 fabric. The closest outcrops of this stratum lies about 55 km south-east of Khok Phanom Di. It is important to keep in mind the highly sensitive nature of the rim form evidence when the complete spectrum has been brought into focus through a detailed examination of the rim forms and fabrics. This is because these sherds are diagnostic of all the various wares represented in the excavated pottery.

Samples 5t and 5, thin sections K1068, K604 and K606, contain incidental rice husk. Sample K692 has very few non-plastics and its source is therefore geologically non-specific. The fabric of sample K1095 has bloating pores within some of its grog particles indicating that it has been fired to higher temperatures than usual.

Rice husk is present in several of the fabrics as incidental inclusions. This indicates that rice was present in the potting environment but not deliberately used as an additive when the potting clay was being prepared. The presence of rice husk strongly suggests that the inhabitants of the potting location were familiar with this plant and that it formed part of their subsistence regime. The rice is so fragmentary that it is not possible to distinguish wild from domesticated or cultivated varieties.

Suggested exotic wares comprise 47, or 41.2 per cent, of the sample. In addition to the limestone-tempered fabric, igneous, sedimentary and metamorphic minerals are variously present. This demonstrates that a very broad range of pottery sources were involved with this particular ware. Rim form five sherds were also recovered from graves, clear evidence that they formed a significant role in many mortuary rituals. One implication of their close association with burials is that they were tributes either in their own right or as containers of food or other substances consumed during the ritual. The sherds found in burials are set out in table 53. Each rim has been examined in hand specimen only.

Of these 20 burials, 11 were interred with “whole” vessels. The remainder were without any pottery that could be recognised as complete. As the above tables show, not all variants have been examined in thin section. The balance have been assessed in hand specimen. All except the following are considered to have been locally made. In addition some, for example the 5ad series, may also have been present as regional wares. This latter ware is present in a variety of exotic fabrics, such as orthodox and bleb grog, rice and sand temper, as well as the local FG2 ware. This ware is decorated with *Anadara* shell impressions, signalling that the shell-impressed style is regional. Each of the form variants which featured these shell-impressed decorations is considered to have been locally made, however, several may have been made at other sites in the region and are thus exotic to Khok Phanom Di. Those considered to represent exotic wares

TABLE 52: *Rim form 5 fabrics: Ceramic Period 2*

Layer	Form	Thin section	Fabric group	Suggested source	Layer	Form	Thin section	Fabric group	Suggested source
10:3	5	K601	3	local	10:13	5	K1095	3	local
10:3	5	K619	3	local	10:13	5	K1099	2	local
10:3	5	K629	3	local	10:13	5	K1100	2	local
10:4	5t	K1068	10	exotic	10:13	5	K1098	15	exotic
10:4	5	K730	3	local	10:13	5	K1123	15	exotic
10:5	5	K604	3	local	10:14	5	K1101	2	local
10:5	5	K606	10	exotic	10:14	5	K1086	8	exotic
10:5	5	K1065	2	local	10:14	5	K1083	8	exotic
10:6	5	K609	9	exotic	10:14	5	K1088	8	exotic
10:7	5	K605	2	local	10:14	5e(i)	K1124	8	exotic
10:7	5	K727	2	local	10:14	5c	K693	3	local
10:7	5a	K1063	2	local	10:14	5	K697	9	exotic
10:7	5	K1077	8	exotic	10:14	5	K1084	2	local
10:8	5	K1091	8	exotic	10:14	5	K1094	10	exotic
10:8	5b(iii)	K736	2	local	10:15	5	K1106	8	exotic
10:9	5b	K1059	8	exotic	10:15	5	K1118	8	exotic
10:9	5	K1060	14?	exotic	10:15	5y(i)	K1107	8	exotic
10:9	5	K1078	2	local	10:15	5ae	K691	2	local
10:10	5af	K732	2	local	10:15	5	K745	2	local
10:10	5	K1053	2	local	10:15	5	K1104	2	local
10:10	5b(iii)	K1055	2	local	10:15	5	K1113	2	local
10:10	5	K1062	10	exotic	10:15	5	K1114	15	exotic
10:10	5	K1076	14?	exotic	10:15	5	K1120	2	local
10:10	5	K1102	2	local	10:15	5	K1121	8	exotic
10:11	5	K1061	9	exotic	10:15	5	K1126	2	local
10:11	5	K692	11	exotic	10:16	5	K1116	2	local
10:11	5a	K1058	2	local	10:16	5ap	K700	2	local
10:12	5	K1064	10	exotic	10:16	5	K1110	2	local
10:12	5	K1054	2	local	10:16	5	K1111	2	local
10:12	5	K1056	8	exotic	10:16	5	K1127	8	exotic
10:12	5	K1057	2	local	10:17	5	K1112	13	exotic
10:12	5	K1080	14	exotic	10:17	5	K1074	2	local
10:12	5	K1085	15?	exotic	10:17	5	K1108	2	local
10:12	5aa	K1092	2	local	10:17	5	K1109	2	local
10:12	5	K1125	15	exotic	10:17	5	K1103	13	exotic
10:13	5	K1090	15	exotic	10:17	5	K1105	8	exotic
10:13	5	K1075	14	exotic	10:17	5	K1122	8	exotic

are rim forms 5d, 5f, 5x, 5y, 5ac and 5ai(i) which are tempered with bleb grog. Suggested forms which were made locally and at exotic sites are 5b(ii), 5e, 5j(i), 5j(ii), 5r, 5t, 5v, 5ah, and 5an. Of these, all except 5r and 5an included FG2 examples. To the six exotic wares mentioned above can be added three included in the tables containing thin-sectioned wares. This means that at least nine CP2 RF5 categories or variants in the Khok Phanom Di assemblage were exclusively made at foreign sites.

TABLE 52: *Rim form 5 fabrics: Ceramic Period 2 (continued)*

Layer	Form	Thin section	Fabric group	Suggested source	Layer	Form	Thin section	Fabric group	Suggested source
10:13	5	K1087	14	exotic	10:18	5	K1156	15	exotic
10:13	5	K1089	14?	exotic	10:18	5ae	K733	2?	local
10:13	5	K717	2	local	10:18	5	K1151	2	local
10:13	5	K1096	2	local	10:18	5	K1153	2	local
10:13	5	K1097	2	local	10:18	5	K1198	2	local
10:18	5	K1196	9	exotic	10:22	5	K1183	2	local
10:18	5	K1197	16	exotic	10:22	5	K1165	2	local
10:19	5	K1152	9?	exotic	10:22	5	K1168	2	local
10:19	5	K1194	9	exotic	10:22	5	K1171	1	local
10:20	5	K1147	2	local	10:22	5	K1193	2	local
10:20	5	K1148	2?	local	10:23	5	K1172	1	local
10:20	5	K1158	2	local	10:23	5	K1179	1	local
10:20	5	K1159	2	local	10:23	5	K1181	1	local
10:21	5	K1160	8	exotic	10:24	5	K1174	1	local
10:21	5	K1149	2	local	10:24	5	K1161	13	exotic
10:21	5	K1150	2	local	10:24	5	K1163	2	local
10:21	5	K1154	2	local	10:24	5	K1167	2	local
10:21	5	K1155	2	local	10:24	5	K1176	2	local
10:22	5	K1157	2	local	10:24	5	K1170	13	exotic
10:22	5	K718	2	local	10:24	5	K1188	15	exotic
					10:24	5	K1201	1	local

We can assess the importance of RF5 wares during CP2 through a comparison of the various rim sherd weights. The weight of all rims is *c.* 76.16 kg. Coarse wares contribute *c.* 38.38 kg and fine wares, 37.78 kg. The group, at 18.69 kg, makes up 49.47 per cent of the fine wares and 24.54 percent of all rims. Apart from RF1, it is the single largest group. Twenty burials contained RF5 sherds and 23, RF1. The local coarse wares are relatively fragile and often fracture easily. Some have a friable fabric. In contrast, the RF5 fine wares are dense and robust. The interior of sample K1183 is more heavily reduced in comparison with the exterior, indicating that the parent vessel was fired upside down.

TABLE 53: *Rim form 5 sherds in burials: Ceramic Period 2. Bur.: burial, BG: bleb grog, OG: orthodox grog, SG: sandy grog, ND: no data*

Layer	Bur.	MP	Form	Fabric	Source	Layer	Bur.	MP	Form	Fabric	Source
10: 3	56	3	5	ND	-	10:11	102	2	5	ND	-
10: 4	57	3	5	ND	-	10:12	87	2	5	ND	-
10: 4	60	3	5aa	OG	local	10:12	109	2	5	ND	-
10: 4	73	3	5	sand	exotic	10:12	115	2	5	ND	-
10: 4	73	3	5	SG	local	10:13	113	2	5	ND	-
10: 4	73	3	5b(i)	SG	local?	10:14	120	2	5	sand	exotic?
10: 6	64	3	5	OG	local?	10:14	120	2	5	SG	local
10: 6	67	3	5	ND	-	10:14	132	2	5	ND	-
10: 7	72	3	5	ND	-	10:15	107	2	5	ND	-
10: 8	92	3	5	ND	-	10:15	129	2	5	ND	-
10:11	94	2	5c	BG	exotic	10:15	131	2	5	ND	-
10:11	94	2	5v	ND	-	10:20	147	1	5	ND	-

Rim form 6

The variety of bowls represented by RF6 increased when compared with CP1. A total of 19 categories and 12 variants are present compared to four categories and three variants in CP1, (Figs. 84–88 and Appendix 2). The vessels in question measured from 180–360 mm in diameter and from 4–12 mm in thickness. Vessel walls are inclined from between 60°–65° from the horizontal to almost perpendicular, indicating that most derive from round, steep-sided bowls. A few smaller examples are shallower at about 25° from horizontal and 100 mm in diameter. Most are direct, but a few are indirect with an exterior inflection point. Forms 6a–c continue as for CP1. Forms 6b(i) to b(vi) are added variants. In each case, unless otherwise stated, external surfaces only are decorated. The essential features of the RF6 sample are:

- 6b(i) is decorated with three horizontal incised lines and *Anadara* shell impressions.
- 6b(ii) has an incised geometric design.
- Variant 6b(iii) has three or four horizontal incised lines.
- Form 6b(iv) is burnished with a band of six horizontal lines,
- Rim 6b(v) differs in that it has a square rather than the usual rounded terminus.
- Rim 6b(vi) is burnished and has 11 lines, the upper two decorated with shell impressions. It measures 5.5 mm thick and 180 mm in diameter.

- The terminus of 6c(i) is square and burnished with diagonal *Anadara* shell impressions. It thickens from 5 to 7.5 mm at the terminus and measures about 240 mm in diameter.
- The shell impressions are replaced in 6c(ii) by three rows of pricked or punctate impressions.
- Rim 6c(iii) has a rounded terminus with *Anadara* shell impressions. It is burnished.
- Form 6f is rounded with two or three straight horizontal incised lines and one wavy shell impressed line with vertical *Anadara* shell impressions covering the exterior rim wall.
- Variants 6f(i) to (iii) use the 6f design elements in different arrangements.
- Rim 6g displays a broad parallel band bordered by two incised lines. A range of such rims from different vessels is present as plain or burnished, and apart from their fabrics, the rim terminus varies from rounded to an externally rolled ridge nearly double the rim wall thickness (from 6 to 10 mm). A base may have been attached to one example, thin section K698.
- Form 6g(i) is burnished. Decoration consists of a band of four or five straight lines combined with one wavy line and a field of diagonal *Anadara* shell impressions.
- Rim 6g(ii) has seven horizontal lines and broad vertical impressions between the upper third and fourth line.
- Form 6h has a square, 5.5 mm thick, terminus with two parallel bands of vertical incised lines bounded by horizontal lines. The vessel is an estimated 320 mm in diameter.
- 6i is also square, 6 mm thick, with partially smoothed over vertical cord marks to the exterior wall. Its parent vessel measured an estimated 160 mm in diameter.
- Rim 6j has a "hammer head" terminus with 13 closely spaced horizontal incised lines to the exterior. It tapers from 5 to 3.5 mm and measured 160 mm in diameter.
- The terminus of 6k is also squared and decorated with three parallel lines of *Anadara* shell impressions. It is burnished.
- Form 6k(i) has two parallel lines of *Anadara* shell impressions to the terminus.
- Rim 6l is burnished and rounded with abstract geometric and curvilinear impressed designs to the exterior surface.
- Form 6m is burnished and has a tapering band of vertical *Anadara* shell impressions bounded by incised lines to the exterior wall and diagonal *Anadara* shell impressions to the terminus.
- Rim 6n is present in two versions, both burnished. One is decorated with a band of three straight and one wavy incised lines above a field of diagonal striations arranged in bands or stripes around the exterior vessel wall. The other has two straight lines above a band of vertical striations. These probably extended down to the vessel body.

- Rim 6o features intricate fields of geometrically arranged incised lines, some bordering a field of vertical *Anadara* shell impressions. It is burnished.
- Form 6p has a single band of round pricked or punctate impressions within a narrow band defined by two incised lines.
- 6r is burnished with five parallel incised lines to the exterior wall and a row of shallow probe impressions to the terminus. It tapers from 6.5 mm thick at the terminus to 4.5 mm and is 260 mm in diameter.
- Rim 6s has a horizontal decorative band composed of three straight incised lines and one wavy *Anadara* shell-impressed line.
- The exterior of 6t is decorated with vertical paddle impressions topped by a smooth 20 mm deep band. Part of another diagonal incised line is visible but interrupted by the broken sherd edge. It is burnished.
- Form 6u is burnished and has three horizontal incised lines spaced about 20 mm apart defining a field of vertical *Anadara* shell impressions. The terminus is also decorated with these impressions.
- Rim 6v is burnished and decorated with geometric and curvilinear fields of *Anadara* shell impressions within incised lines.
- Curvilinear fields of deep round probe marks, defined by incised lines, form "punctate" fields below a horizontal incised line on the exterior of form 6x. It is burnished.
- Form 6aa(i) also has *Anadara* shell impressions to the rim terminus.
- Rim 6ab is burnished and square with a series of horizontal incised lines. All the exterior wall, except the area above the upper line, is filled with diagonal *Anadara* shell impressions (Fig. 88).
- Rim 6ab(i) also has *Anadara* shell impressions to the rim terminus.
- Form 6ac curves sharply outwards. It is burnished and decorated with light vertical striations beneath a horizontal incised line about 20 mm below the terminus.
- Rim 6ad has a sharply-everted rim extending from angular internal and arched external inflection points. The exterior wall is decorated with a narrow horizontal band bounded by double incised lines and filled with vertical probe impressions. It is burnished.
- Rim 6af is a similar shape and is decorated with three horizontal incised lines, the lower two being filled with vertical impressions.
- Form 6ag is decorated with vertical paddle impressions and two horizontal incised lines.
- Vertical paddle impressions also fill the wall of 6ah. They terminate at a burnished band delineated by two horizontal incised lines.

- Rim 6ai has six horizontal incised lines containing three fields decorated with deep round probe marks.
- 6ai may have been attached to a base. The exterior is completely covered with horizontal lines of *Anadara* shell impressions. It measured an estimated 220 mm in diameter.
- The exterior wall surface of the final form six rim, (aag), is decorated with pricked or punctate fields interspersed with incised geometric designs.
- A single bulbed rim sherd replicating cat. 1517, interred with B91, was recovered from L10:19.

Many of the undecorated rims have been carefully smoothed but not burnished. Some of the bowls these rims represent may have included a ring base. Sample K698, rim form 6g (Table 54), for example, may have been part of such a vessel. It is not possible to determine whether bases were attached to any other vessels of this form as insufficient portions survived. We can note from the "whole" vessel assemblage, however, that none of these bowls includes a base portion. Bases are an integral component of the shallow bowls represented by RF3.

Rim form 6 fabrics

Thirteen RF6 sherds have been examined petrographically and each form category not analysed in thin section has been examined in hand specimen (Table 56). Selecting rim forms for variation will bias the sample in favour of exotic wares. The mineralogy of the fabric of sample K492 is geologically non-specific; the slip on this specimen, however, includes limestone fragments.

TABLE 54: *Rim form 6 fabrics: Ceramic Period 2*

Layer	Form	Thin section	Fabric group	Suggested source	Layer	Form	Thin section	Fabric group	Suggested source
10: 3	6ai	K492	11	exotic	10:13	6	K722	2	local
10: 3	6	K672	11	exotic	10:13	6	K728	11	exotic
10: 8	6x	K1079	11	exotic	10:14	6s	K712	2	local
10:12	6g	K1081	2	local	10:14	6b(vi)	K716	2	local
10:13	6g	K694	2	local	10:16	6f(iii)	K789	2	local
10:13	6g	K698	2	local	10:24	6b	K1166	8	exotic
10:13	6j	K715	2	local					

A selection of different categories and variants has also been analysed in hand specimen. RF6 is present in a variety of fabrics, mainly the local FG2, but also in several exotic wares. The latter include bleb grog, orthodox grog, rice and sand-tempered wares. A broad range of sources is again suggested. The fabrics of RF6 sherds recovered from burials are listed in table 55.

TABLE 55: *Rim form 6 sherds in burials: Ceramic Period 2*

Burial	MP	Form	Fabric group	Suggested source	Burial	MP	Form	Fabric group	Suggested source
56	3	6	no data	-	115	2	6b(iv)	no data	-
79	3	6	no data	-	113	2	6	no data	-
64	3	6	orth. grog	local	110	2	6	no data	-
87	2	6	no data	-	100	2	6b	orth. grog	local
115	2	6b(i)	2	local					

TABLE 56: *Rim form 6 fabrics: Ceramic Period 2*

Layer	Form	Temper	Fabric group	Suggested source	Layer	Form	Temper	Fabric group	Suggested source
10: 3	6c(iii)	bleb grog	11?	exotic	10:12	6b(iii)	orth. grog	2?	local
10: 3	6r	sand	8?	exotic	10:12	6c	orth. grog	-	-
10: 3	6t	sand	8?	exotic	10:12	6o	orth. grog	-	exotic?
10: 3	6u	sand	8?	exotic	10:12	6aag	rice	-	exotic
10: 3	6u	orth.grog	3	local	10:13	6ac	orth. grog	2	local
10: 3	6v	sand	8?	exotic	10:14	6m	orth. grog	3?	local
10: 3	6ad	orth. grog	3	local	10:14	6ad	orth. grog	2	local
10: 3	6ah	bleb grog	11?	exotic	10:15	6b(v)	orth. grog	2?	local
10: 4	6c(iii)	orth. grog	2	local	10:15	6c(i)	orth. grog	2	local
10: 4	6p	bleb grog	11?	exotic	10:15	6c(ii)	orth. grog	2	local
10: 5	6aa(i)	orth. grog	3	local	10:15	6g	sand	8?	exotic
10: 5	6ab	orth. grog	3	local	10:15	6l	bleb grog	11?	exotic
10: 6	6ac	orth. grog	3	local	10:17	6k	orth. grog	3?	local
10: 6	6ag	no temper	-	exotic	10:18	6b(iv)	orth. grog	2?	local
10: 7	6ac	bleb grog	11?	exotic	10:18	6h	orth. grog	-	exotic?
10: 8	6c(i)	orth.grog	3?	local	10:18	6i	orth. grog	-	exotic?
10: 9	6n	orth. grog	3?	local	10:21	6c	sand	1	local
10:11	6af	orth. grog	2	local					

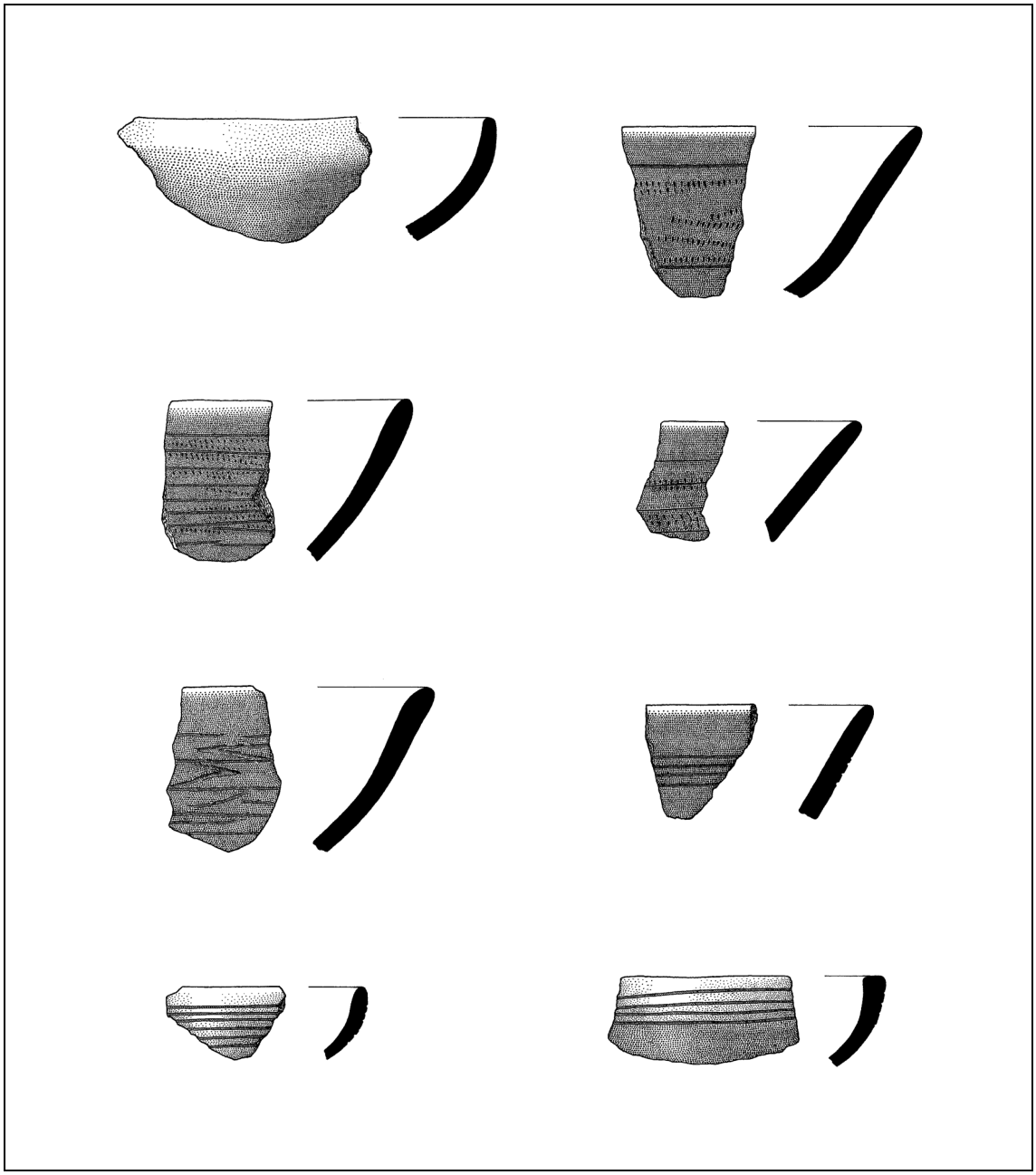


FIG. 84: Rim form 6 categories and variants. Ceramic Period 2. *Top* left: 6, right: 6a, *Centre* upper row left: 6b, right: 6b(i), *Centre* lower row left: 6b(ii), right: 6b(iii), *Bottom* left: 6b(iv), right: 6b(v). Scale: 1:2

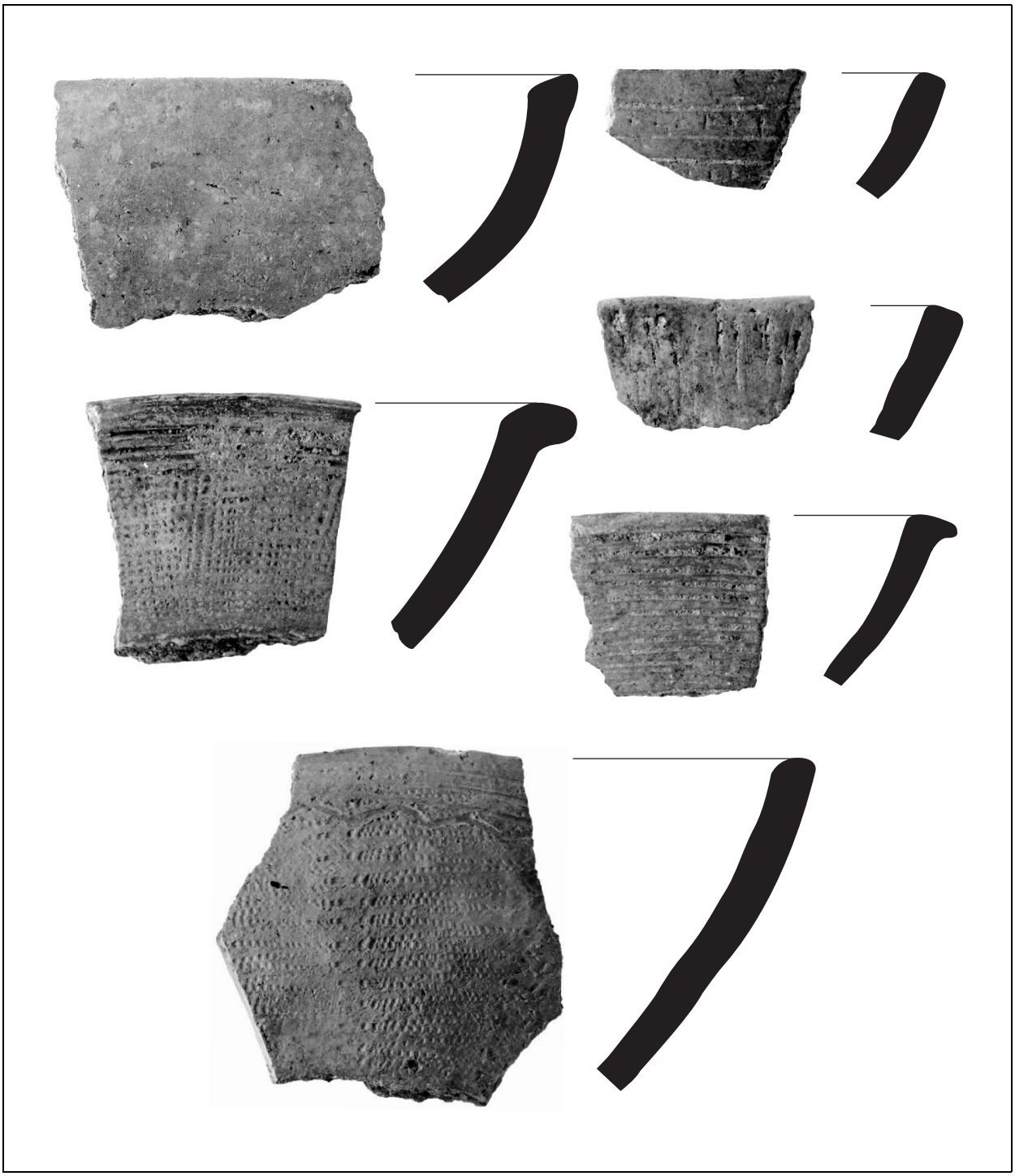


FIG. 85: Rim form 6 categories and variants. Ceramic Period 2. *Top* left: 6k, right: 6h, *Centre* left: 6g, upper right: 6i, lower right: 6j, *Bottom*: 6f. Scale: 1:1

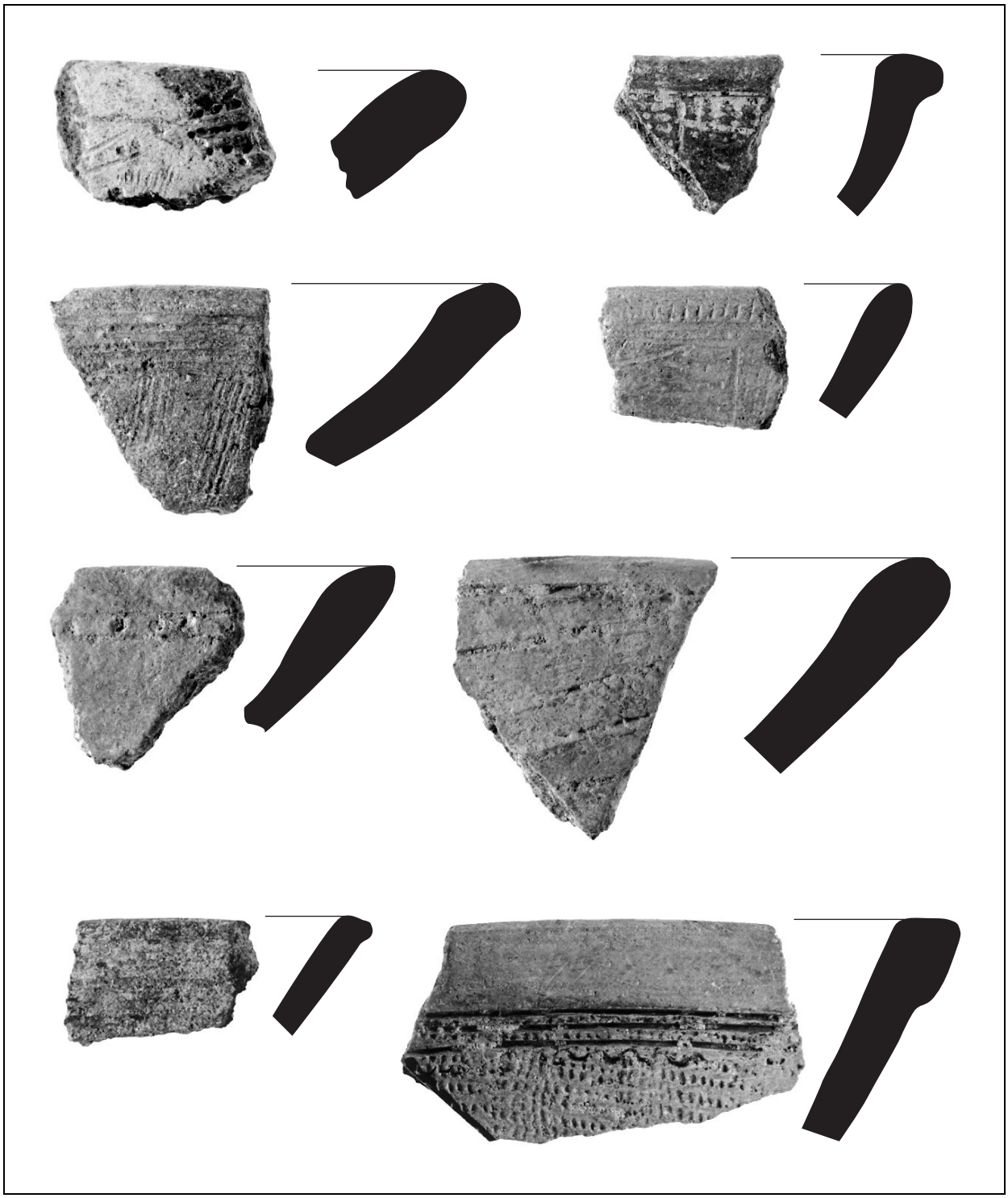


FIG. 86: Rim form 6 categories and variants. Ceramic Period 2. *Top* left: 6l, right: 6m, *Centre upper* left: 6n, right: 6o, *Centre lower* left: 6p, right: 6q, *Bottom* left: 6r, right: 6s. Scale: 1:1

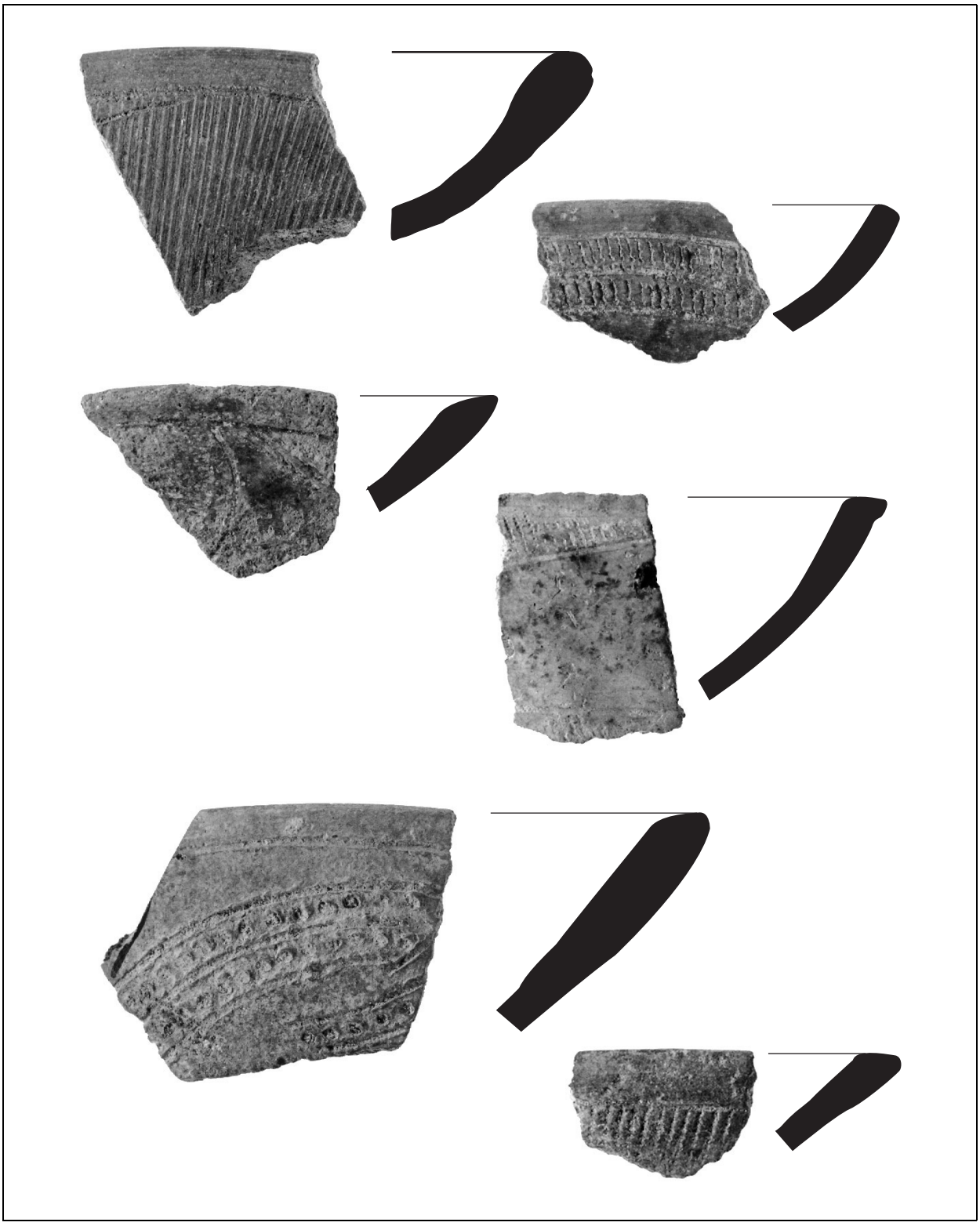


FIG. 87: Rim form 6 categories and variants. Ceramic Period 2. *Top* left: 6t, right: 6u, *Centre* left: 6v, right: 6w, *Bottom* left: 6x, right: 6y. Scale: 1:1

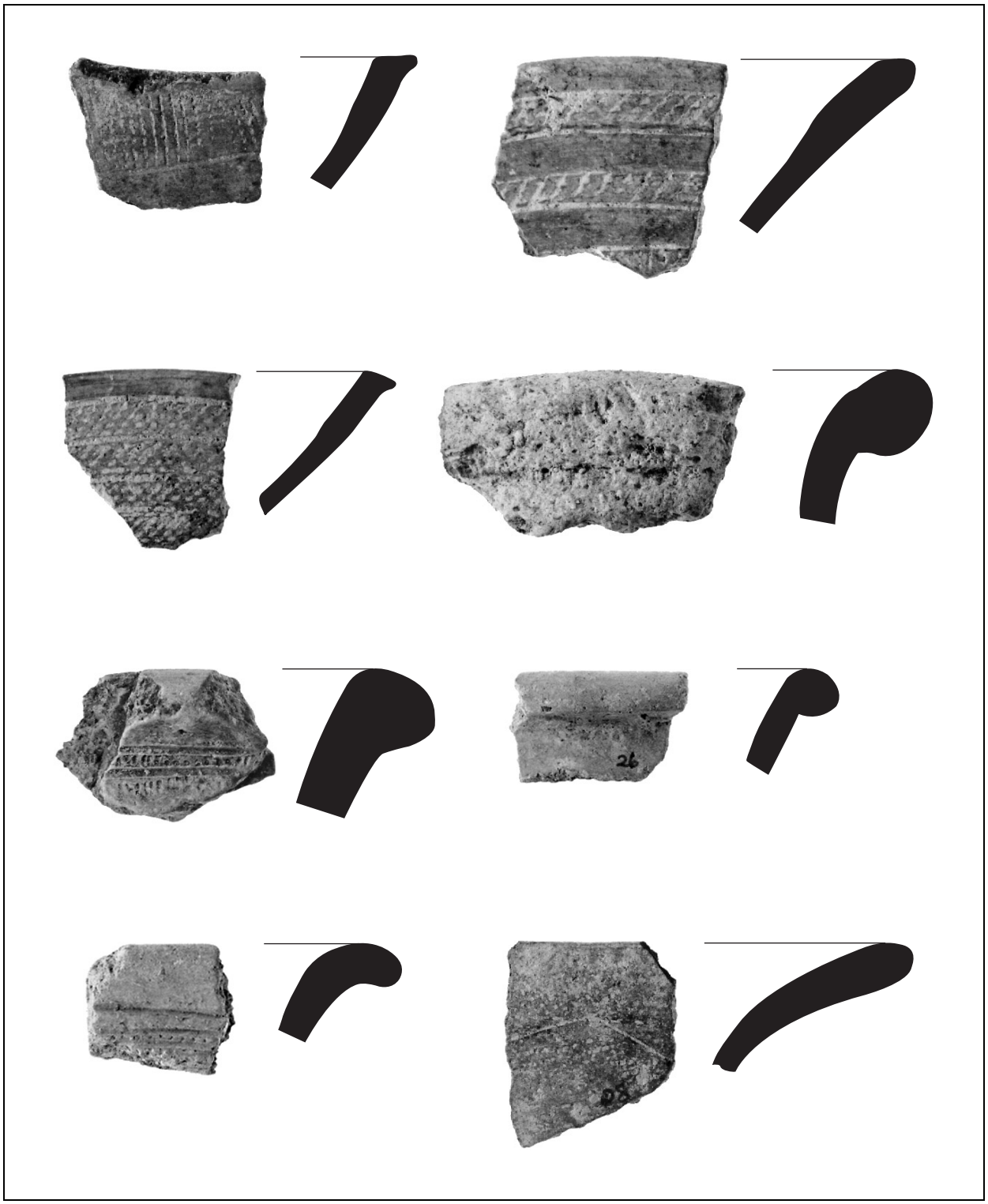


FIG. 88: Rim form 6 categories and variants. Ceramic Period 2. *Top* left: 6z, right: 6aa, *Centre upper* left: 6ab, right: 6ac, *Centre lower* left: 6ad, right: 6ae, *Bottom* left: 6af, right: 6aag. Scale: 1:1

Rim form 7

Two of these rim sherds, one from layer 10:11 and another from 10:15 have been examined in thin section. Both are composed of the local FG2. A sample is illustrated in the previous chapter.

Rim form 8

Both RF8 and 8a continue into CP2. Another category, 8b, is represented by just two burnished sherds. These are decorated at the external inflection point with a narrow band of horizontal punctations. The band is bordered by incised lines. The first two are described and illustrated in the previous chapter (Fig. 55). These rims represent small thin-walled jars measuring from 80–220 mm in diameter and from 4–7 mm in thickness. FG1 and FG2 are again present. Three sherds have been examined in thin section (Table 57).

Rim form 9

Examples of both square and rounded termini with either plain or burnished surfaces were recorded (Fig. 57 Chapter VII). All are tempered with orthodox grog. One grog-tempered sample examined in hand specimen may be exotic. It was probably coated with a resin.

Rim form 10

Rim forms 10, 10a, 10b and 10e are described and the former two illustrated in the previous chapter. Form 10c and 10d first occur in CP2. The former has *Anadara* shell impressions to the rim terminus. It contains sand non-plastics. The latter includes an incised line at the external concave inflection point. It is tempered with orthodox grog. A sample of these rims has been examined petrographically (Table 57). FG11 is tempered with bleb grog. At this point in the sequence it is the only such fabric in the assemblage and, although mineralogically non-specific, it is readily identified. The presence of a thick slip containing limestone fragments *in association* with this fabric, previously described for rim form 6ai, places it outside the sedimentary plain within which Khok Phanom Di is located. Thus while mineralogically indeterminate, the clay preparation method is highly distinctive. This is an instance, therefore, where a distinctive technology defines an exotic fabric.

Rim form 11

These rims, which continue from CP1, concentrate in the upper portion of layer 10. One sherd from layer 10:21 has been examined petrographically. It is composed of FG1, which characterizes CP1 local wares. Form 11a has vertical cord marks to within 20 mm of the rim terminus, 11(i) is

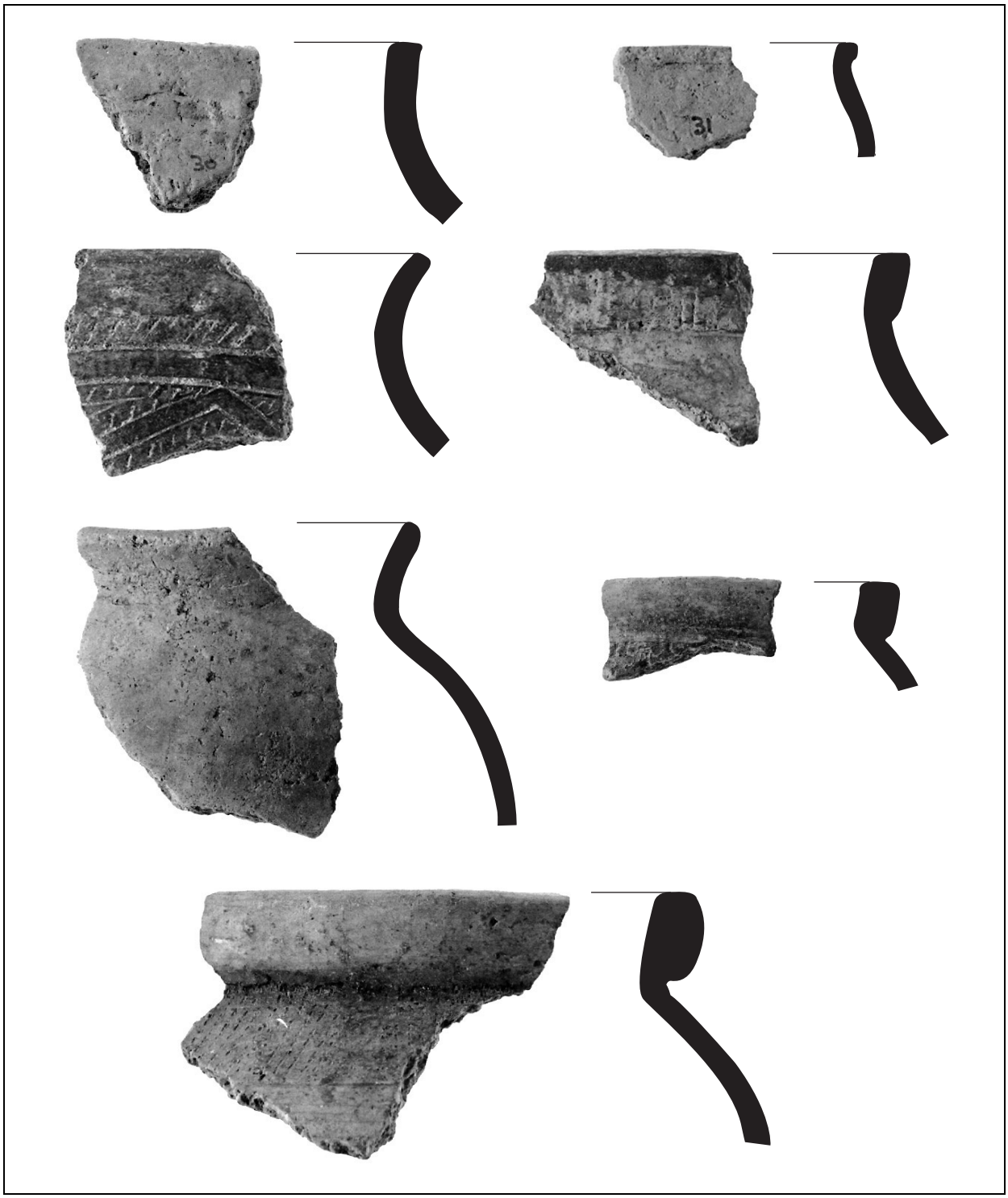


FIG. 89: Rim forms 11 and 12 categories. Ceramic Period 2. *Top* left: 11(i), right: 11(ii), *Centre upper* left: 12a, right: 12b, *Centre lower* left: 12, right: 12d, *Bottom*: 12e. Ceramic Period 2. Scale 1:1

TABLE 57: *Rim form 8, 10 and 12 fabrics: Ceramic Period 2. TS: thin section, h.s.: hand specimen, OG: orthodox grog*

Layer	Form	TS	Fabric group	Suggested source	Layer	Form	TS	Fabric group	Suggested source
10: 4	8b	K734	11	exotic	10:13	10	K696	2	local
10:19	8	K452	3	local	10:17	10e	K704	10	local
10:20	8	K720	2	local	10: 7	12d	h.s.	OG	local
10: 4	10	K726	11	exotic	10:16	12a	h.s.	sand	exotic?
10: 8	10c	K735	2	local	10:16	12e	h.s.	11	exotic
10: 8	10	K791	11	exotic	10:18	12c	K1199	2	local
10:10	10c	K744	2	local	10:21	12b	K701	2	local
10:13	10	K713	11	exotic	10:21	12c	K699	2	local

plain with cord marks to the rim edge and 11(ii) has punctate impressions to this edge (Fig. 89). Some RF11 wares are burnished and oxidized. All these three rims are tempered with orthodox grog and probably represent local wares. A RF11 example is illustrated in Chapter VII (Fig. 59).

Rim form 12

A series of small jars measuring from 100–180 mm in diameter make their first appearance in CP2. One outlier sherd recovered from layer 10:25 is considered to belong to this group.

- Rim form 12 is plain with a smooth, unburnished surface.
- Form 12a is burnished and fired in a reducing atmosphere to produce a black lustrous finish (Fig. 89). The exterior wall is decorated with intricate incised lines arranged in geometric patterns similar to those illustrated in Hall (1993:246, Figure 100, motif 13:10). The rim interior is impressed with punctate marks.
- Form 12b is reduced, smoothed and burnished with remnant vertical cord marks visible on the exterior rim.
- Rim 12c (Fig. 90). The rim length from the inflection point varies from 10–14 mm.
- Form 12d is decorated with vertical cord marks to the vessel wall. It has a smooth rim portion.
- Form 12e has a horizontal, about 20 mm deep, *Anadara* shell-impressed band, defined by incised lines, running about 20 mm below the rim terminus. A sample of these rims has been examined in thin section and the results are set out in table 57, along with hand specimen assessments. The rim sherd 12e was recovered from the grave of B100.

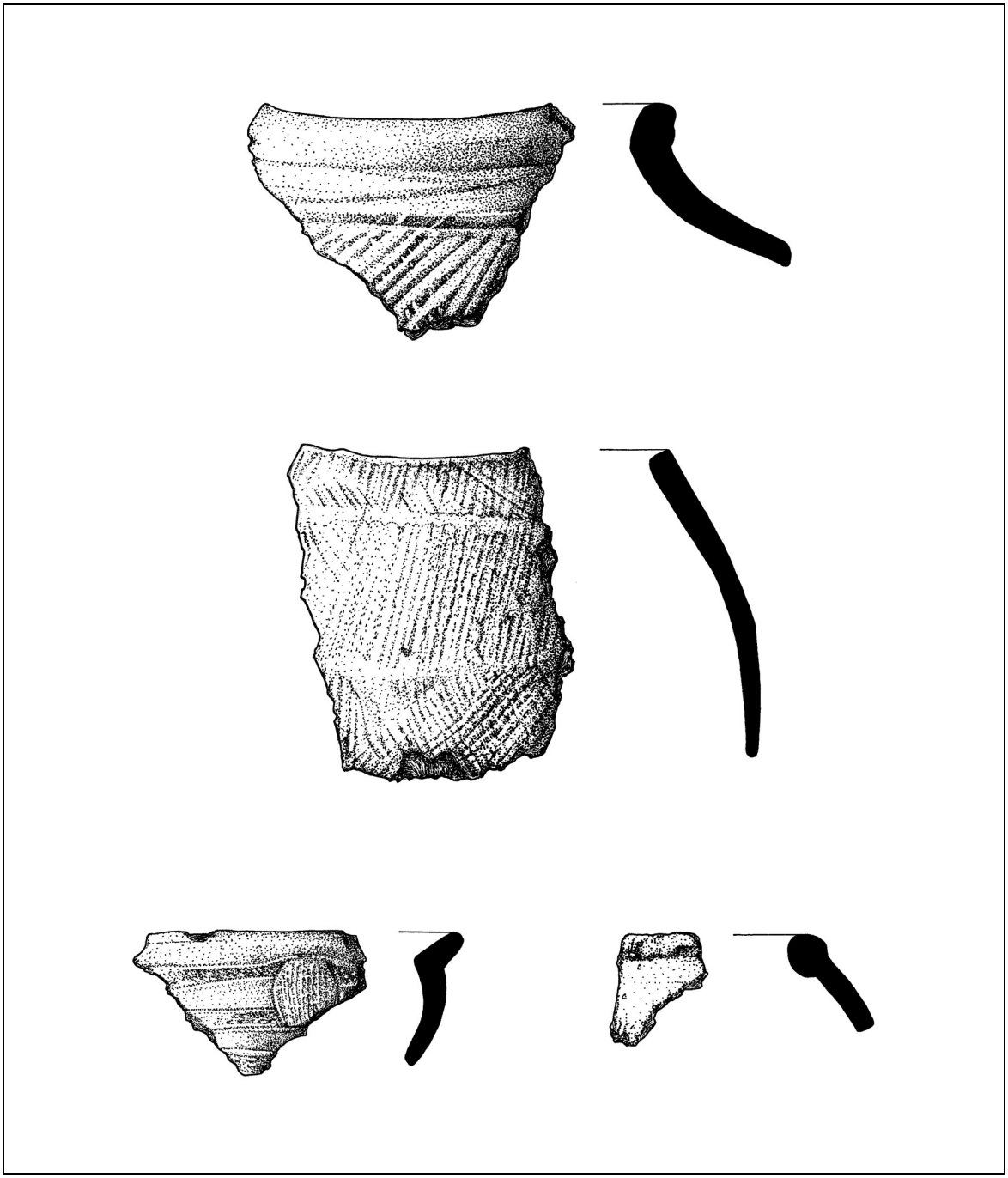


FIG. 90: Rim forms 12c, 13, 14 and 15. Ceramic Period 2. *Top:* 12c, *Centre:* 13, *Bottom* left: 14, right 15. Scale: 1:2

Rim form 13

Two of these rim sherds, one from layer 10:11 and another from 10:15 have been examined in thin section. Both are composed of the local FG2.

This is a direct inverted cord-marked rim angled at *c.* 65°–75° which represents a vessel 180 mm in diameter (Fig. 90). The terminus is often concave. Category 13a is plain, 13a(i) is decorated with vertical striations, 13a(ii) has a band of deep alternate impressions as recorded by Hall (1993:248, Figure 102, motif h 3:26), but without the incised lines. A decorated variant includes *Anadara* decorative fields and is probably of a similar form to cat. 1522 interred with B101 (Fig. 111). In hand specimen, orthodox grog, probably representing FG3 and FG2, is present, suggesting that these forms are all local wares.

Rim form 14

Eight categories of this form were recovered, five from Ceramic Period Two contexts and three from CP3. Only one, form 14a is clearly associated with the latter contexts. The rest are included here. Form 14 is illustrated in figure 90. These rims probably represent a shallow burnished dish or bowl measuring from 220-360 mm in diameter and from 5.5-11 mm in thickness. The decorative panels contain *Anadara* shell impressions. The inner rim features shell impressions arranged parallel to the perimeter. On rim 14b, these form a chevron pattern with three straight horizontal incised lines beneath a smoothed exterior rim above vertical *Anadara* shell impressions to the vessel wall. Form 14c has a plain exterior with a decorated rim interior and 14d is similar but includes a single incised line to the exterior. Form 14g has both interior and exterior *Anadara* shell impressions with incised lines. The fabrics of a sample of these rim sherds are set out in table 58. Sample K747 is exotic and RF14c is probably exotic.

TABLE 58: *Rim form 14 fabrics: Ceramic Period 2*

Layer	Form	Thin section/ hand specimen	Fabric group	Layer	Form	Thin section/ hand specimen	Fabric group
10:4	14	K711	2	10:9	14g	K747	14
10:7	14	K746	3	10:9	14d	K790	3
10:8	14b	K740	2	10:13	14c	hs	sand

Rim form 15

A single sherd derived from layer 10:12 represents RF15, an inverted direct plain rim with a thick bulbous terminus composed of the local FG3 (Fig. 90).

The remaining rim sherds retrieved from CP2 burials are: RF8b from B110; RF10, tempered with orthodox grog from B103 and RF13 from B96. In each case a single sherd was recovered.

TABLE 59: *Exotic rim forms: Ceramic Period 2*

Layer	Form	Thin section	Fabric	Layer	Form	Thin section	Fabric
10:3	6ai	K492	11	10:13	5	K1087	14
10:3	6	K672	11	10:13	5	K1123	15
10:4	5t	K1068	10	10:13	6	K728	11
10:4	8b	K734	11	10:13	10	K713	11
10:4	10	K726	11	10:14	5	K1088	8
10:5	5	K606	10	10:14	5e(i)	K1124	8
10:6	5	K609	9	10:14	5	K697	9
10:7	5	K1077	8	10:14	5	K1094	10
10:8	5	K1091	8	10:15	5	K1118	8
10:8	6x	K1079	11	10:15	5y(i)	K1107	8
10:8	10	K791	11	10:15	5	K1114	15
10:9	5b	K1059	8	10:16	5	K1127	8
10:9	5	K1060	14?	10:16	12e	hand specimen	11
10:9	14g	K747	14	10:17	5	K1112	13
10:10	5	K1062	10	10:17	5	K1103	13
10:10	5	K1076	14?	10:17	5	K1122	8
10:11	3	K661	12	10:18	5	K1156	15
10:11	3	K661	12	10:18	5	K1196	9
10:11	5	K1061	9	10:18	5	K1197	16
10:11	5	K692	11	10:19	5	K1194	9
10:12	5	K1064	10	10:21	5	K1160	8
10:12	5	K1056	8	10:24	5	K1170	13
10:12	5	K1080	14	10:24	5	K1188	15
10:12	5	K1125	15	10:24	6b	K1166	8
10:13	5	K1090	15				

TABLE 60: *Local and exotic rim form fabrics: Ceramic Period 2*

Form	Local fabric groups	Exotic fabric groups	No.
1	2	-	-
2	2 and 3	-	-
3	1, 2 and 3	12	1
4	2 and 3		-
5	1, 2 and 3	8,9,10,11,13,14,15 & 16	8
6	1, 2 and 3	8 and 11	2
7	2	-	-
8	2 and 3	11	1
9	-	11? and non specific	1
10	2	10 and 11	2
11	1 and 2?	-	-
12	2	11 and non specific	2
13	2 and 3	-	-
14	2 and 3	14 and non specific	2
15	3	-	-

SUMMARY

Exotic wares are represented in eight of the 15 CP2 rim form groups (Tables 59 and 60). Nine different exotic fabrics are present in the complete assemblage. These fabrics relate to eight different forms. Of these, seven also have a local type. A feature of the assemblage is that, although selecting for different form variations will heavily bias a sample for exotic forms, only one form lacks a local type. This reinforces the notion that the ceramic traditions at Khok Phanom Di comprise local expressions of a regional ceramic stylistic tradition. In this respect, we have noted the close association with Phase One pottery forms at Nong Nor. The typological evidence embodied in the rim forms and fabrics is unequivocal and signals that pottery-producing sites, responsible for the various exotic wares in the Khok Phanom Di spectrum, were operating within and influenced by a regional ceramic stylistic tradition.

A summary of the 15 CP2 rim forms and their fabric groups is set out in table 60. Note that for sample K492, although the mineralogy of the parent fabric is geologically non-specific the slip includes limestone fragments. The fabrics of rims K1068 and K606 contain incidental rice husk. Rim K692 is composed of a fabric which contains very few non-plastics and it is therefore geologically non-specific. The single example of rim 12e was recovered from B100, layer 10:16.

During CP2, of the 15 rim forms recognized, only one, RF9, lacks a local type. All the exotic types are fine wares. Of the 13 fine ware forms only four, RF4, 7, 11, and 13, are exclusively local types. Of these RF7, 11 and 13 are rare. Only one of the eight exotic forms identified is associated with more than two different fabrics. Rim form five wares are represented by eight of

associated with more than two different fabrics. Rim form five wares are represented by eight of the nine separate exotic fabric groups. The only one lacking is a fabric associated with a minor cord-marked coarse-ware variant, RF3b. RF5 represents and characterises the carinated burial jars found in many graves throughout the mortuary sequence. We will consider these wares in more detail following an examination of the "whole" vessels.

VESSEL BASES AND TRIPOD FEET

Base forms (BF) A, B, C, D, and E were all present during CP1 (Chapter VII). One BFD has been examined in thin section and it is composed of the local FG2. Form L, composed either of exotic bleb-tempered FG11 or local FG2, is restricted to L10:16 and 10:19 respectively. It is reduced, burnished and decorated with *Anadara* shell-impressed fields (Fig. 91). The distribution of the complete base sherd assemblage for the site is set out in Chapter XI (Fig. 302) and Appendix 3 (Tables 181 and 182).

TABLE 61: *Vessel base forms: Ceramic Period 2*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
10:12	E	h.s.	2	f.9	10:15	D	h.s.	11	B105
10:12	D	h.s.	11	-	10:19	L	h.s.	2	-
10:15	C	h.s.	2	B110	10:23	D	h.s.	2	-

TRIPOD POT FEET

Only two tripod-footed vessels were recovered, one with the feet attached and the other with circular fractures marking where the tripod feet had detached. Both vessels were recovered from CP2 contexts. They are local wares composed of FG2. Three attachment marks arranged in a triangular pattern are visible on the bottom of cat. 2019 (Fig. 92). Another vessel, cat. 3252, recorded by the excavators as belonging to B76, also included tripod feet. This vessel is probably best described as a small platter or plate with feet, and as with cat. 2019, it is highly burnished and expertly fashioned. This high standard is only very slightly blemished by small inaccuracies in decoration and small spalling pits or flakes a few millimetres in diameter to both interior and exterior surfaces.

Burial 76 was just within the excavated area (Higham and Bannanurag 1990:76, Figure 43). Burial 86 was within the north section (Fig. 34). The vessels were recovered from the sections at the completion of the excavation. The miniature vessel from B86 is highly burnished and decorated with curvilinear design fields infilled with *Anadara* shell impressions (Fig. 120). The surfaces are generally oxidized a weak red (2.5YR/4/2) with the interior showing slight traces

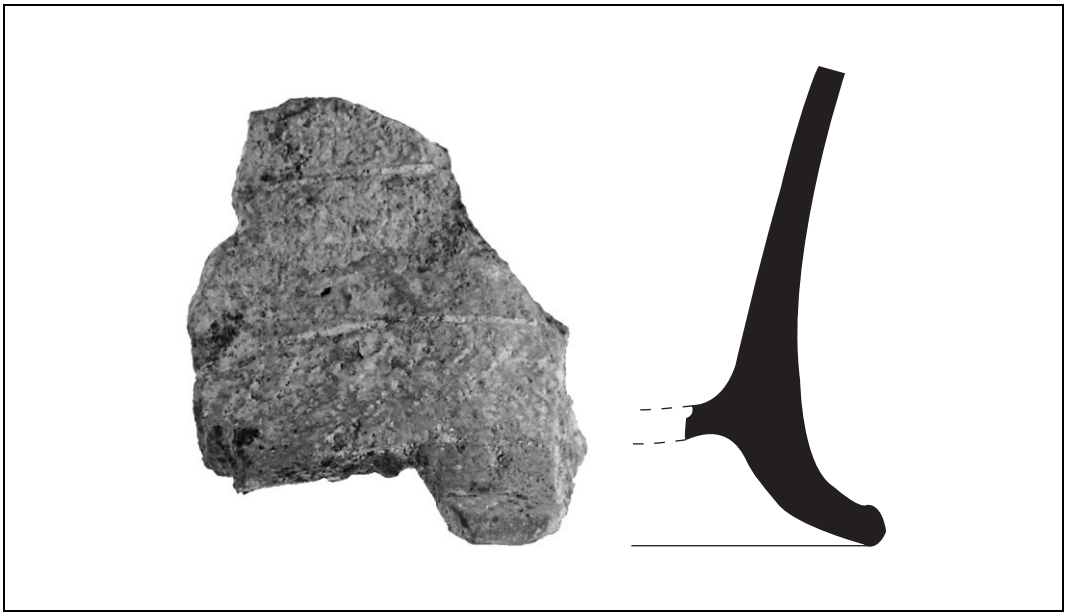


FIG. 91: Base Form L. Ceramic Period 2. (scale: 1:1)

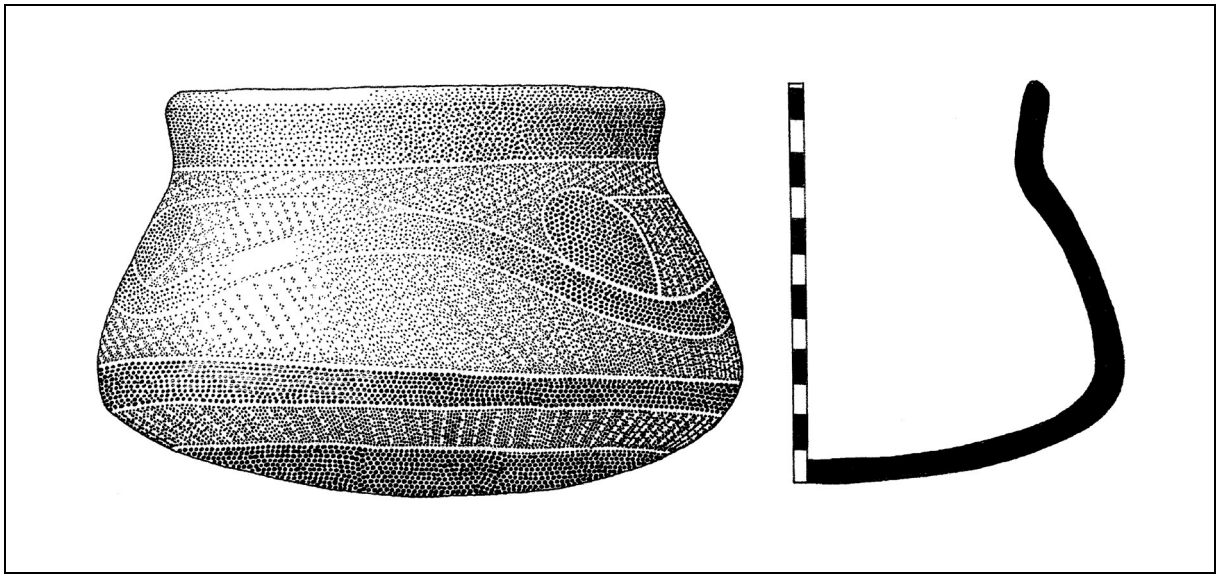


FIG. 92: Tripod footed vessel (cat. 2019). Ceramic Period 2. Scale segments are 5 mm

of reduction and the exterior bearing a few fire clouds. The walls are 3 mm thick and the vessel appears to have been hand modelled directly from a lump of clay. Three circular fracture surfaces, 15–16 mm in diameter, form a triangle on the bottom within a shell impressed decorated band 7 mm wide. The vessel measures 89 mm wide and 54 mm high, the rim is 10 mm high and the orifice 72 mm in diameter. The incised lines have been cut with a round probe or stylus 1mm in diameter. Traces of powdered haematite, (Fe_2O_2), coat the interior surfaces.

TABLE 62: *The tripod pot feet from Ceramic Period 2*

Cat.	Layer	Length (mm)	Diameter	Fabric (h.s.)	Shape	Suggested source
1248	10:3 l.2	21	23/5	orth. grog	conical 3	local?
1262	10:3 l.2	18	23/7	FG2	conical 3	local
1272	10:3 l.2	17	23/10	FG2	conical 3	local
1311	10:3 l.2	85	58/42/5	rice	conical 4	exotic?
1398	10:3 l.2	74	51/44/4	bleb grog	conical 4	exotic?
1410	10:4	17	19/16	orth. grog	conical 2	local?
1341	10:5	30	25/5	orth. grog?	conical 1	local?
1790	10:7	frag.	-	orth. grog?	no data	local?
1408	10:8	11	22/7	FG2	conical 3	local
1409	10:8	8	20	FG3?	dome	local?
1795	10:9 f.25	frag.	30/22	orth. grog	conical 2	local?
1510	10:10	90	80/15	bleb grog	conical 3	exotic?
1553	10:11	22	28/10	sand	conical 2	exotic?
1606	10:13	60	55/30/10	sand	conical 4	exotic?
1714	10:15	68	58/44/5	bleb grog	conical 4	exotic?
1889	10:20	45	37/5	FG2	conical 1	local
1870	10:22	27	25/4	FG2	conical 1	local
1877	10:23	24	22/4	FG2	conical 1	local
1881	10:24 l.28	21	18/3	FG2	conical 1	local

Burial 76 included a unique round plate or platter with curved or rounded inflection points. The rim is everted and matches RF14, discussed in the following chapter. The feet are rounded cones 20 mm in diameter and 22 mm high. The platter measures 300 mm in diameter and is 60 mm high excluding the feet. The surface is burnished and decorated with three parallel horizontal bands of *Anadara* shell impressed fields 10 mm wide to the external wall and 22 mm wide to the rim. The vessel floor is 4.5 mm thick and the walls another millimetre thicker. Slight reduction to the interior and an oxidized exterior suggest that the vessel was fired upside down. It was probably constructed from slabs.

Firing difficulties, such as sudden expansion or contraction due to rapid temperature changes or, alternatively, as the result of silica inversions, can cause spalling or dunting. These blemishes are often created when pottery fabrics with a high proportion of quartz are not carefully fired. If, during the firing sequence, the temperature rapidly exceeds and then suddenly falls below

the silica inversion points, when the ceramic body can expand and contract by up to three percent, spalling or cracking can occur. Earthenware, such as that under examination, is typically fired to temperatures less than 1000°–1100°C, and it therefore includes a silica inversion at 573°C, when quartz changes from its alpha to beta form, and at 870°C, when quartz converts to tridymite (Hamer 1975:268). The important factor is that if the quartz inversion is rapidly passed, when fabrics with high silica contents are involved, thermal shock causing fractures can occur (Bronitsky and Hamer 1986:89-101). The potter, therefore, must take care not to increase the firing temperature too rapidly when such wares are involved. Both tripod-footed vessels are composed of FG2 which includes a relatively high proportion of quartz (Table 62).

Cats. 1398 (conical form 4, Fig. 93) and 1714 are almost identical in shape and both were tempered with bleb grog during a period when such tempering methods were not employed at Khok Phanom Di. The former is marked with comb(?) punctations and a deep incision. Their ovoid shape and size also place them outside the majority of the sample which is considered on fabric and form criteria to represent local wares. Similarly, cats. 1311 and 1606 are large pointed ovoids. The former was tempered with rice at a time when local wares contained orthodox grog. Cat. 1510 also stands out because it is large and tempered with bleb grog when orthodox grog was used by the local potters. The remainder of the sample is considered to be part of the local ware assemblage. The fabrics, tripod feet dimensions and their suggested sources are set out in table 62. The first measurement given is the top of the foot where it joined the vessel. The second is the distal end. Three dimensions are given for ovoid feet. The first is the long axis, the short axis is the second. Cat. 1272 is probably from the same vessel as cats 1262 and 1408 (conical form 3, Fig. 93). Cat. 1877 is from the same vessel as cats. 1870 and 1881.

During CP2, pointed conical-shaped feet (cat. 1889, conical form 1, Fig. 93), dome and conical form 2 feet (cats. 1409 and 1410 respectively), were made by the local potters. Wares with rounded cones, as well as pointed ovoid feet, were imported.

VESSEL LIDS

Two forms of small lids, measuring from 10 to 16 cm in diameter, were found in the upper levels of CP2 (Fig. 94). All have been examined in hand specimen (Chapters IX, Table 84; Chapter XII and Appendix 3).

- Lid form 1 (LF1), is a burnished fine ware, reduced and probably tempered with bleb grog. From the terminus it tapers from 10 to 5 mm in thickness.

- The second form (LF2), is present in both sand and bleb-tempered wares. Although both have a plain surface finish, the sample tempered with blebs displays cord marks at the terminus. In each case they are 5 mm thick with oxidized surfaces and reduced cores.

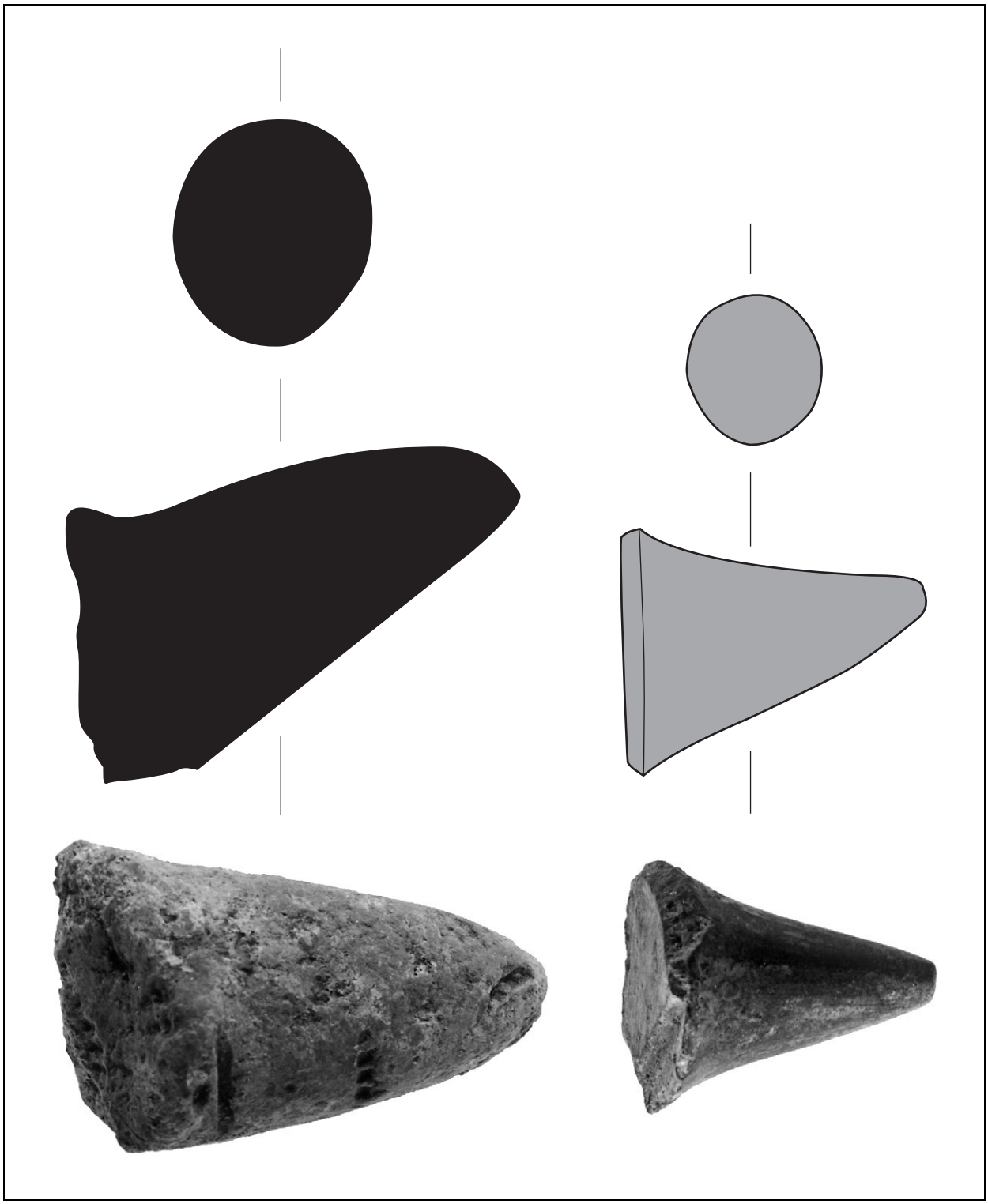


FIG. 93: Vessel feet. Ceramic Period 2. Left: cat. 1398, right: cat. 1889. Scale: 1:1



FIG. 93: Vessel feet (cont.). Ceramic Period 2. *Top:* cat. 1408, *Centre:* cat. 1409, *Bottom:* cat. 1410. Scale: 1:1

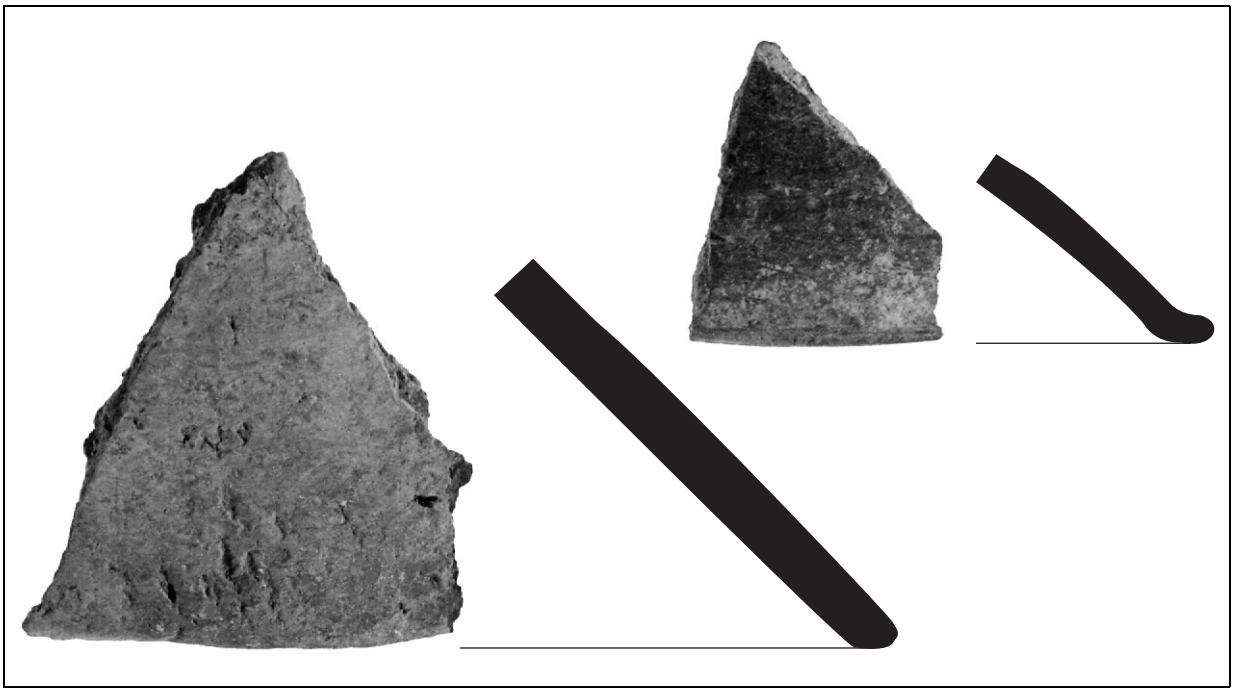


FIG. 94: Vessel lid forms 1 (left) and 2. Ceramic Period 2. Scale: 1:1

DECORATIVE MODES

In addition to the modes discussed in the previous chapter the first true ceramic slip, rather than the effect sometimes caused by surface smoothing, known as self-slipping, was encountered in association with a bleb-tempered exotic ware during CP2. The true slipping technique was not used by local potters. Overall, the decorative modes employed follow on from the previous tradition in both local and several imported wares. Incising and *Anadara* shell impressions are featured on both local and exotic wares. This suggests that these modes belonged to a regional or sub-regional tradition.

Five distinctive modes, some which are related to Hall's (1993) motif categories, were recorded as follows:

- A: Small square probe impressions applied either in rows or randomly similar to those reported by Hall (1993:245, figure 99i, 2:5).
- B: *Anadara* shell impressed or punctate set in burnished surfaces, often in fields defined by incised lines. Impressing was achieved by applying the shell edge to create a wavy line and the shell outer surface for a stippled effect when fields were decorated. The shell hinge point or beak was also used to punctuate some fields. One example from layer 10:18 is decorated with these marks within a narrow running chevron similar to that reported

by Hall (1993:246, figure 100, motif 3:10), but in this case the fields describe a single chevron only. This ware is composed of FG11, which is exotic.

- C: A combination of evenly-spaced horizontal incised lines alternating with carefully arranged lines of deep round probe punctation marks placed next to a field of vertical *Anadara* shell impressions (Fig. 95). This is an unusual use of these two decorative fields. The ware again involves FG11. One sherd was recovered from layer 10:12 and another variant, with double incised lines, from layer 10:3.
- D: One sherd from layer 10:5 featured a combination of a field of vertical *Anadara* shell impressions in a separate band above the carination point of a vessel. Below this point, the vessel was decorated with a field of cross-hatched incised lines. The fabric is probably local (Fig. 95).
- E: A distinctive sherd with arcuate incised lines alternating with diamond-shaped punctate probe marks coupled with a red paint was recovered from layer 10:3. This example was tempered with rice husk and it is therefore probably exotic (Fig. 95).

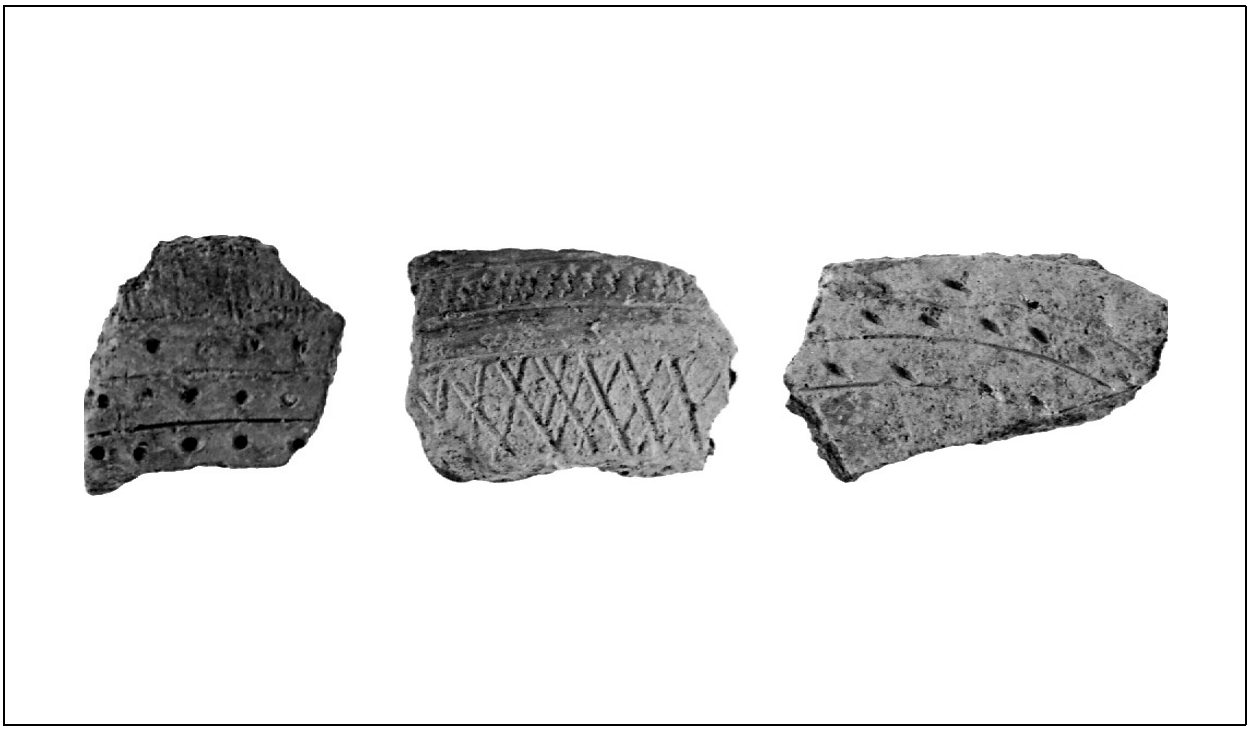


FIG. 95: Decorative modes. Ceramic Period 2. *Left:* mode C, *Centre:* mode D and mode E

''COMPLETE'' VESSELS

Technological ceramic analysis differs from stylistic classifications in that, provided the shape and surface decoration of a pottery vessel, including any motifs, are understood, the ware can be defined. This is considered a valid approach to defining ware even when motifs have not completely survived. Such incomplete pottery could seriously limit the interpretation of pictograms, epigraphs or symbolic motifs incorporated into their designs. Motifs and designs displayed on the Khok Phanom Di assemblage, however, consist principally of repeated motifs with only a few exceptions. One possible important carrier of symbolic meaning is the vessel form itself. The number of vessels and the combinations of different types, whether local or exotic wares, placed in burials can also have meaning to the participants in burial ritual (Arnold 1985:162-5). Some vessels may be deliberately broken or ritually "killed". This could involve removal of a portion of the vessel, such as the rim, or completely smashing vessels and laying the broken fragments over the corpse. Some vessels may be included in the burial rituals by covering them with the same coatings as the corpse, perhaps to signify that they were also being consigned to the "other world". Particular note should be taken of burials which contain vessels which have been ritually treated in different ways and whether burial wares are in pristine condition or show signs of having been previously used. Finally, we can compare local ware mortuary with non-mortuary fabrics in order to determine whether mortuary wares were treated differently for ritual purposes. We will commence with the non-mortuary vessels, all of which are considered to be local ware (Table 63, Figs. 96 to 103). Note that most of the vessels are incomplete. Where possible, an estimate of the total portion recovered is included. A sample of vessels showing fracture patterns is set out in Appendix 3. The vessel illustrations follow standard conventions which tends to remove blemishes. Others include them. Vessel qualities and "as received" conditions are detailed in the relevant captions.

The assemblage has been classified into types based on the formula fabric plus form equals type. The morphological classes have not been subjected to a mathematical analysis, simplicity being the prime criterion in the classification. Thus an attempt has been made to group local vessels into the minimum number of forms possible (Appendix 3). These are: (1) bowls, (2) jars and (3) platters. Bowls may be shallow, deep, narrow or broad. Jars are deeper than bowls, either direct or indirect or carinated. Platters are either wide and shallow with a base which forms part of the vessel wall, or wide and shallow with an attached base much smaller in diameter than the rim. Any of these forms may also have a base. Their rims are either perpendicular, inverted or everted. Miniature vessels are treated separately.

NON-MORTUARY VESSELS

Other than fine wares, several of the non-mortuary vessels are crudely made and some have been fractured during firing. Significantly, the walls and bases of these "test" pots are thicker than normal wares, possibly in an attempt by the prehistoric potters to minimize the effects of thermal stress.

TABLE 63: *Non-mortuary vessels: Ceramic Period 2*

Layer	Cat.	MP	Thin section/h.s.	Fabric group	Type
10:3	3236	3	h.s.	2	L2e(m)
10:3	3237	3	K204	3	L1a
10:4	3238	3	h.s.	2	L2a
10:4	3239	3	h.s.	2	L2e
10:5	3277	3	h.s.	3	L3d
10:10	3278	2	h.s.	2	L2eb(m)
10:10, f.1	1438	2	K225	3	L1b
10:11	3240	2	h.s.	2	L1d
10:12	3241	2	h.s.	2	L2e(m)
10:15	3242	2	h.s.	2	L1d
10:17	1742	1	h.s.	3?	L2a(m)
10:17	3243	1	h.s.	2	L2g(m)
10:17	3244	1	h.s.	2	L1b(m)
10:17	3245	1	h.s.	2	L1a(m)
10:24, l.29	1890	-	h.s.	2?	L2b(m)

When potters need to test the quality of clays, apart from shrinkage tests, they must also ensure that the prepared clay body will not crack during firing due to thermal shock, usually as the temperature passes the silica inversions at 226° and 573° C during heating and cooling. Some of the small non-mortuary pots, for example cats. 1742, 3236, 3244 and 3245, are probably experimental vessels used to test the firing characteristics of the prepared clay. Such a procedure would only be required when some aspect of the potting sequence was varied, such as when a different clay was being investigated. In essence this is a trial designed to test the parameters of a new potting procedure. It is notable that two of these vessels are badly cracked with large deep spalls or "dunts" to the exterior surfaces. These spalls result from thermal shock, a phenomenon carefully guarded against by potters because of its catastrophic effects on otherwise satisfactory pottery. Such fractures are not generally evident in any of the local wares, suggesting that the potters were normally able to control firings successfully.

The decoration on the interior of cat. 1438, a shallow bowl, is unique at Khok Phanom Di in that it displays an abstract design covering the interior surface. The design features a circle and a series of straight incised lines describing a grid or checker-board pattern. The purpose of this design is unknown. The miniature vessel cat. 1890 was excavated from the top of layer 10:25 which stratigraphically places it within CP1, however because it is composed of FG2, it has been included here.

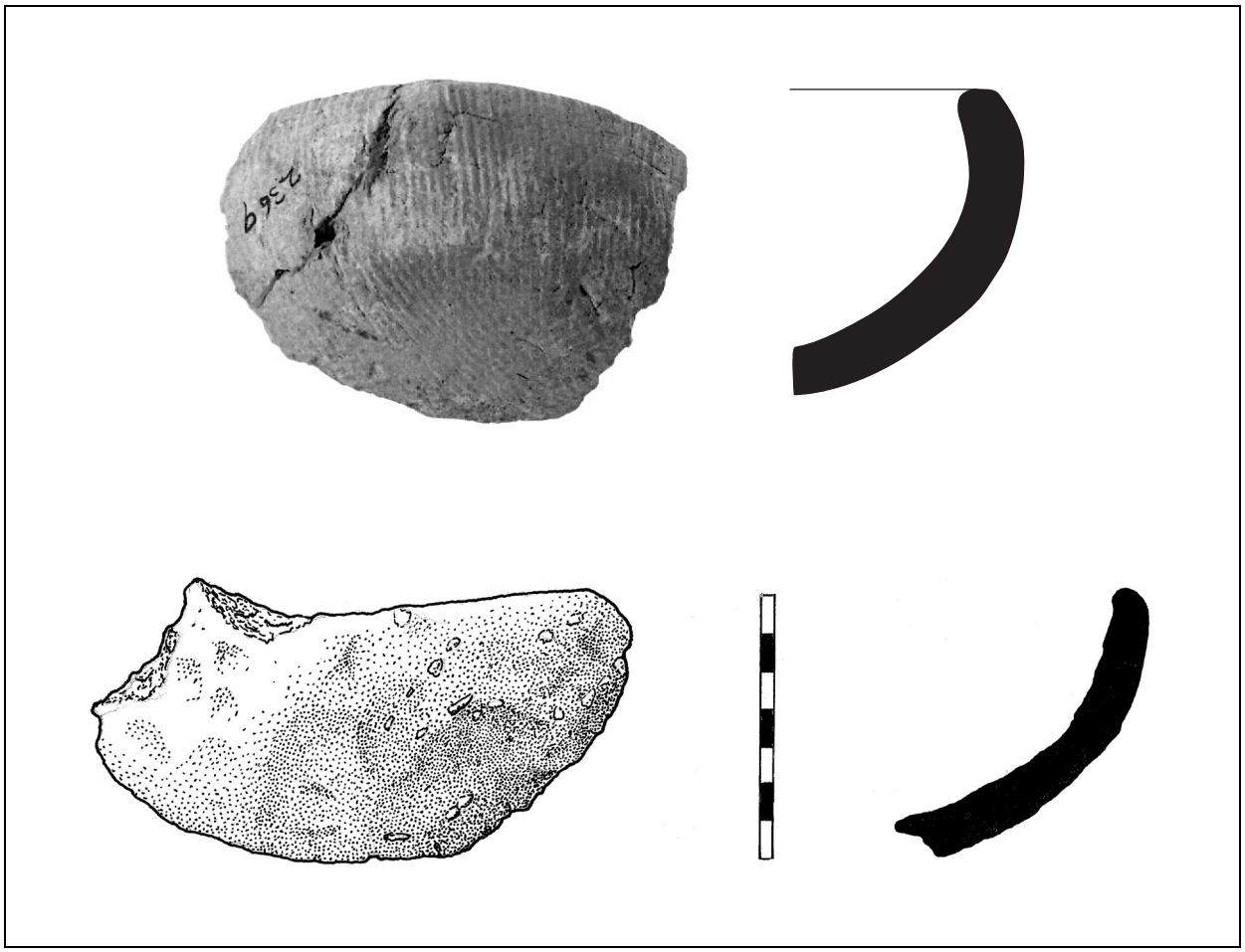


FIG. 96: "Whole" Non-mortuary vessels. *Top:* cat. 3276 layer 10:14. A miniature, roughly formed, cord-marked 7-8 mm thick test pot. Biscuit fired with oxidized surfaces. Diameter: 95 mm, height: 34 mm. "Z" 0.5/0.5 mm cord marks. Fishpond clay, no temper. Colour: 2.5YR/6/4. Scale: 1:1. *Bottom:* cat. 3244 layer 10:17. A very crude 7 mm thick experimental(?) bowl. Low biscuit fired upright and oxidized with fire clouds, a coarse FG3. Height: 44 mm (est.), diameter: 120 mm (est.). Colour: 2.5YR/6/4 to 2.5YR/4/0. Scale segments are 5 mm



FIG. 97: Non-mortuary vessels. *Top:* cat. 3277 layer 10:5. A burnished, incised, inverted fine ware platter. Rim diameter: 220 mm, base: 228 mm, height: 23 mm. Biscuit fired, reduced. FG3. 4-5 mm thick. Colour: 2.5YR/5/2. Quality: excellent. *Bottom:* cat. 3278 layer 10:10. A small burnished carinated jar. Biscuit fired, exterior oxidized, interior mainly reduced. 7 mm thick. FG2. Rim diameter: 140 mm (est.), carination: 150 mm (est.), height 84 mm (est.). Slab construction Colour: 2.5YR/6/4. Quality: very good. Scale: 1:1

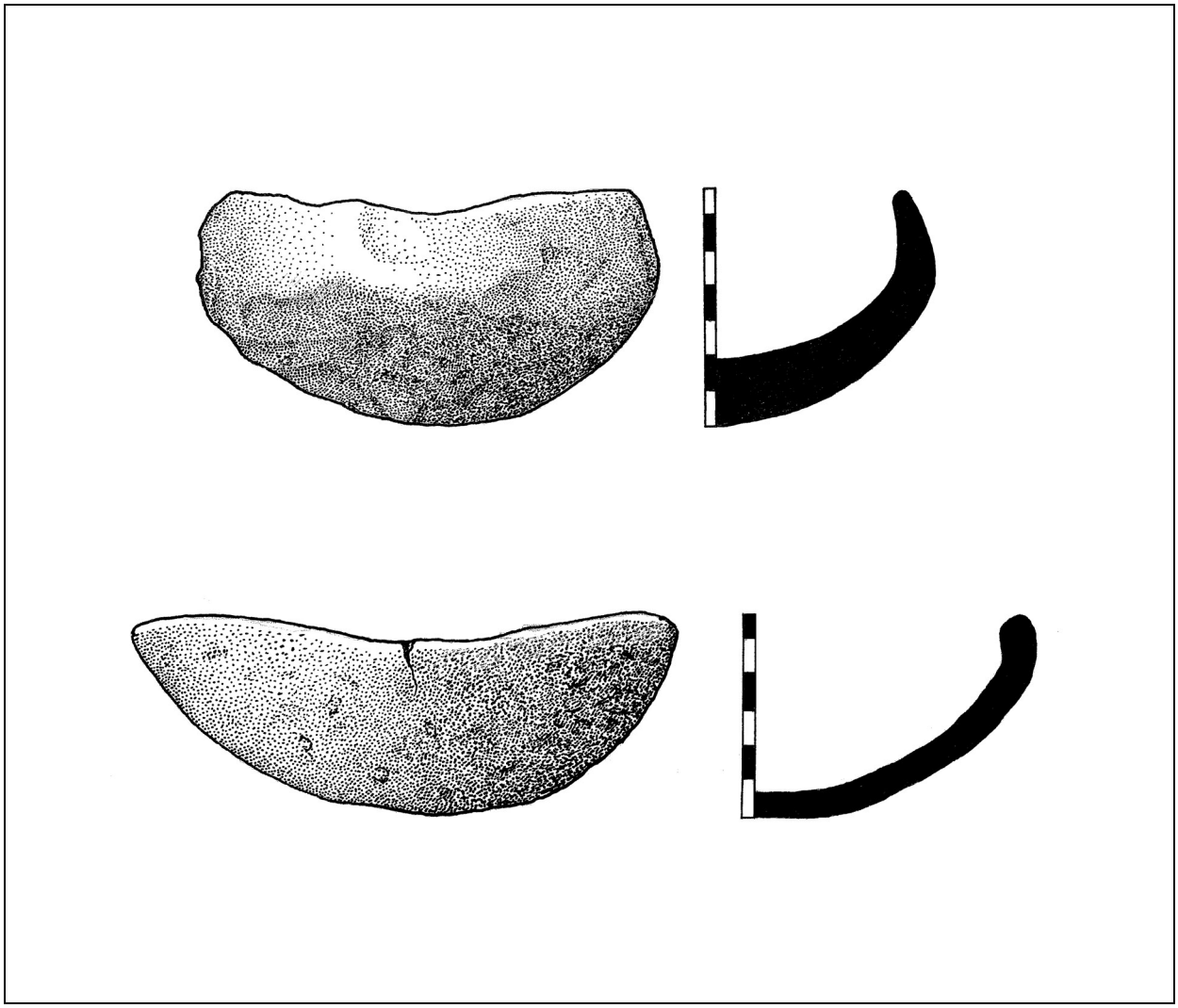


FIG. 98: Non-mortuary vessels. *Top*: cat. 1742 layer 10:17. A miniature, very crudely smoothed, "cup" 60 mm wide and 28 mm high, 5 mm thick, biscuit-fired with interior and exterior both half oxidized and half reduced. Colour 2.5YR/6/6. *Bottom*: cat. 3245 layer 10:17. A very crude 4 mm thick experimental (?) bowl 75 mm wide, 28 mm high, biscuit fired, oxidized. FG2(?) Colour 5YR/7/4. Scale segments are 5 mm

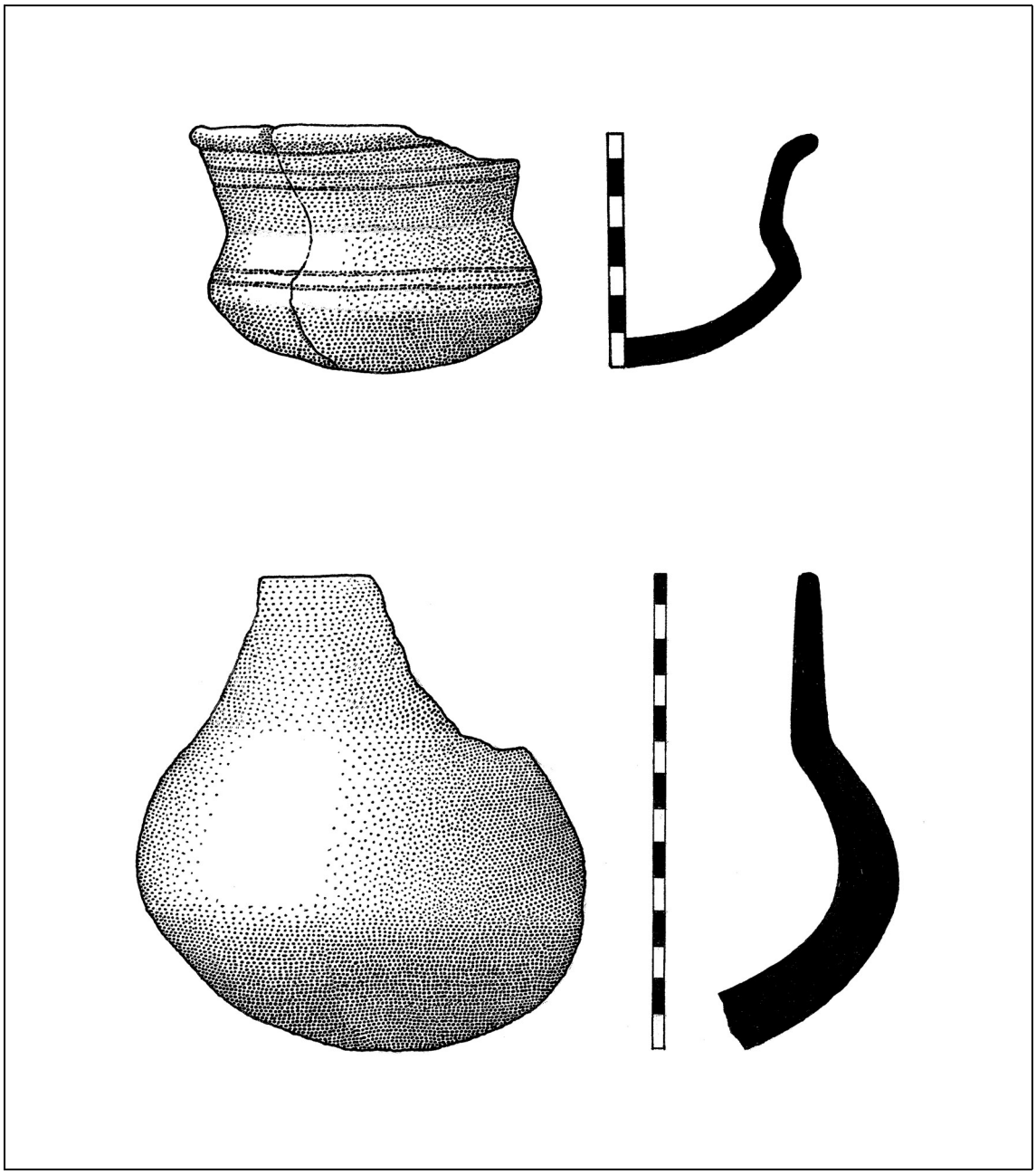


FIG. 99: Non-mortuary vessels. *Top*: cat. 1890 layer 10:24. A miniature carinated bowl 52 mm wide, 38 mm high, FG2(?), Colour: 2.5YR/6/4 to 2.5YR/4/0. *Bottom*: cat. 3243 layer 10:17. A miniature utilitarian, plain surfaced jar 65 mm wide, 69 mm high, probably formed by modelling. The thickness tapers from 9 mm at the base to 5 mm at the rim. Biscuit fired and oxidized with a fire cloud at the rim indicating an upside down firing. Colour: 2.5YR/6/4. Quality: moderately crude. Scale segments are 5 mm

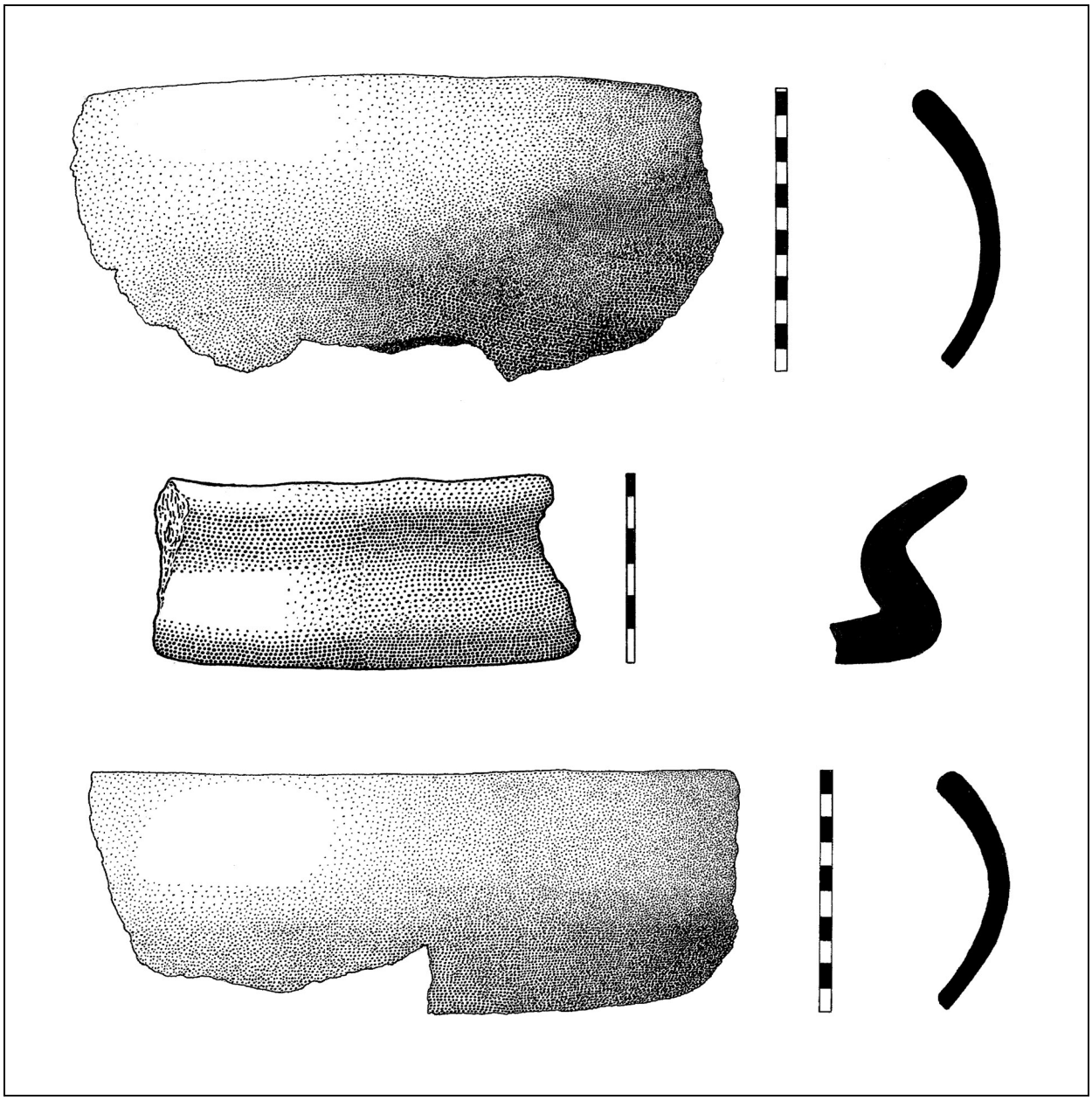


FIG. 100: Non-mortuary vessels. *Top*: cat. 3242 layer 10:15. A shallow smooth-surfaced utilitarian 4 mm thick bowl of moderate quality. The estimated diameter is 300 mm, and the height is 70 mm. Biscuit fired and oxidized. Probably constructed from slabs. FG2. Colour: 2.5YR/6/6. *Centre*: cat. 3241 layer 10:12. A small shallow, smooth surfaced utilitarian "bowl". Estimated at 100 mm in diameter at the rim, 94 mm at the base and 28 mm high. Probably formed from slabs. The thickness tapers from 8 mm at the base to 6 mm at the rim. Biscuit fired and oxidized indicating an upright firing. FG2. Colour: 5YR/7/4 to 2.5YR/6/6. Quality: moderately well finished. *Bottom*: cat. 3240 layer 10:11. A shallow burnished bowl estimated at 310 mm diameter at the rim, 320 mm maximum diameter, 50 mm high and 3.5 mm thick. Probably built from slabs. Biscuit fired with interior and exterior both oxidized with fire clouds. FG2. Colour: 5YR/6/4 to 5YR/3/1. Quality: excellent. Scale segments are 5 mm

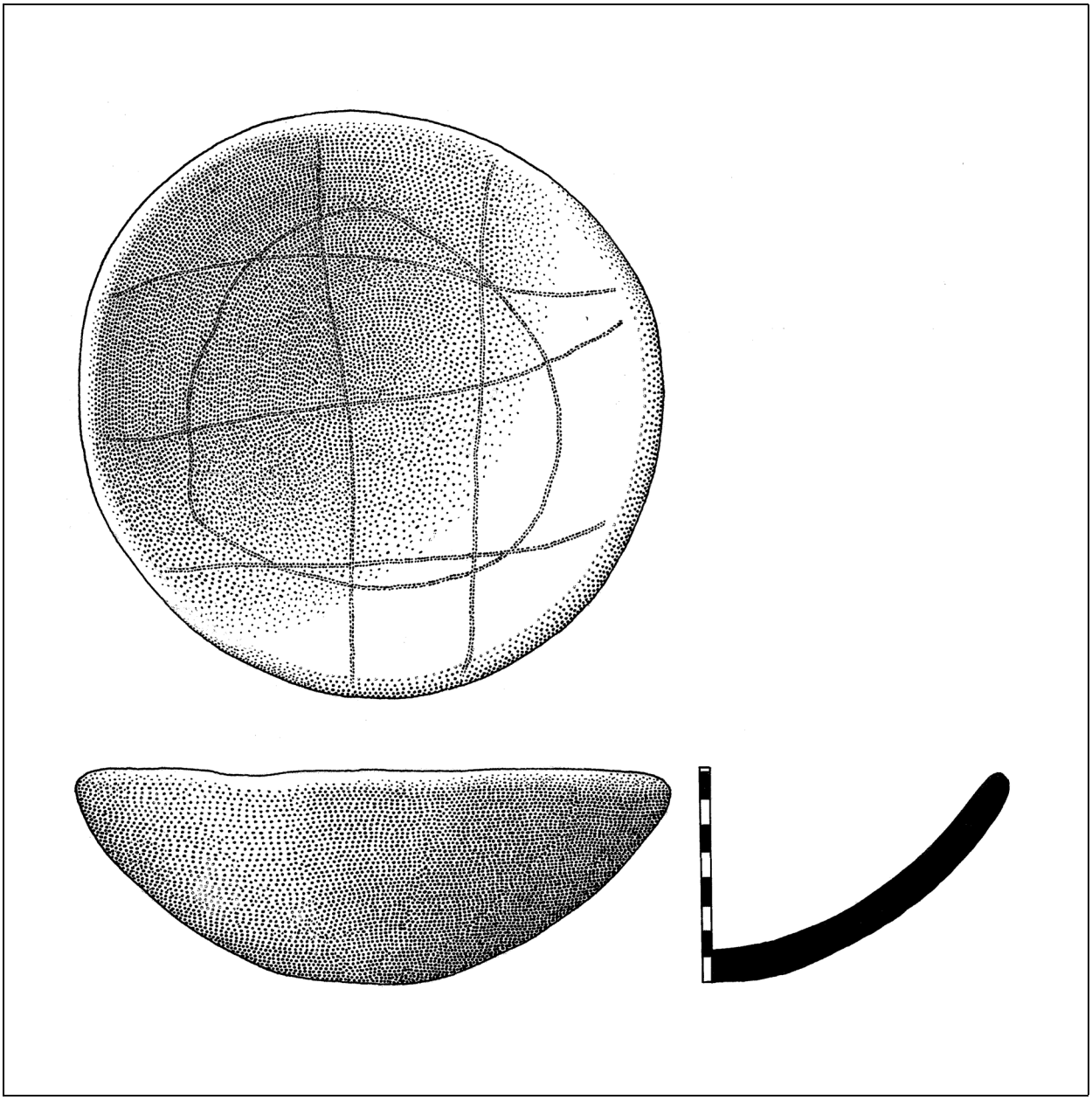


FIG. 101: Non-mortuary vessel. Cat. 1438 layer 10:10. A small smooth-surfaced shallow utilitarian 6.5 mm thick bowl (diameter: 110 mm, height: 41 mm). The interior is decorated with incised lines. Biscuit fired and partially oxidized. Probably constructed from slabs. FG3, with incidental rice husk. Colour: 2.5YR/6/4. Quality: moderately well made. Scale segments are 5 mm

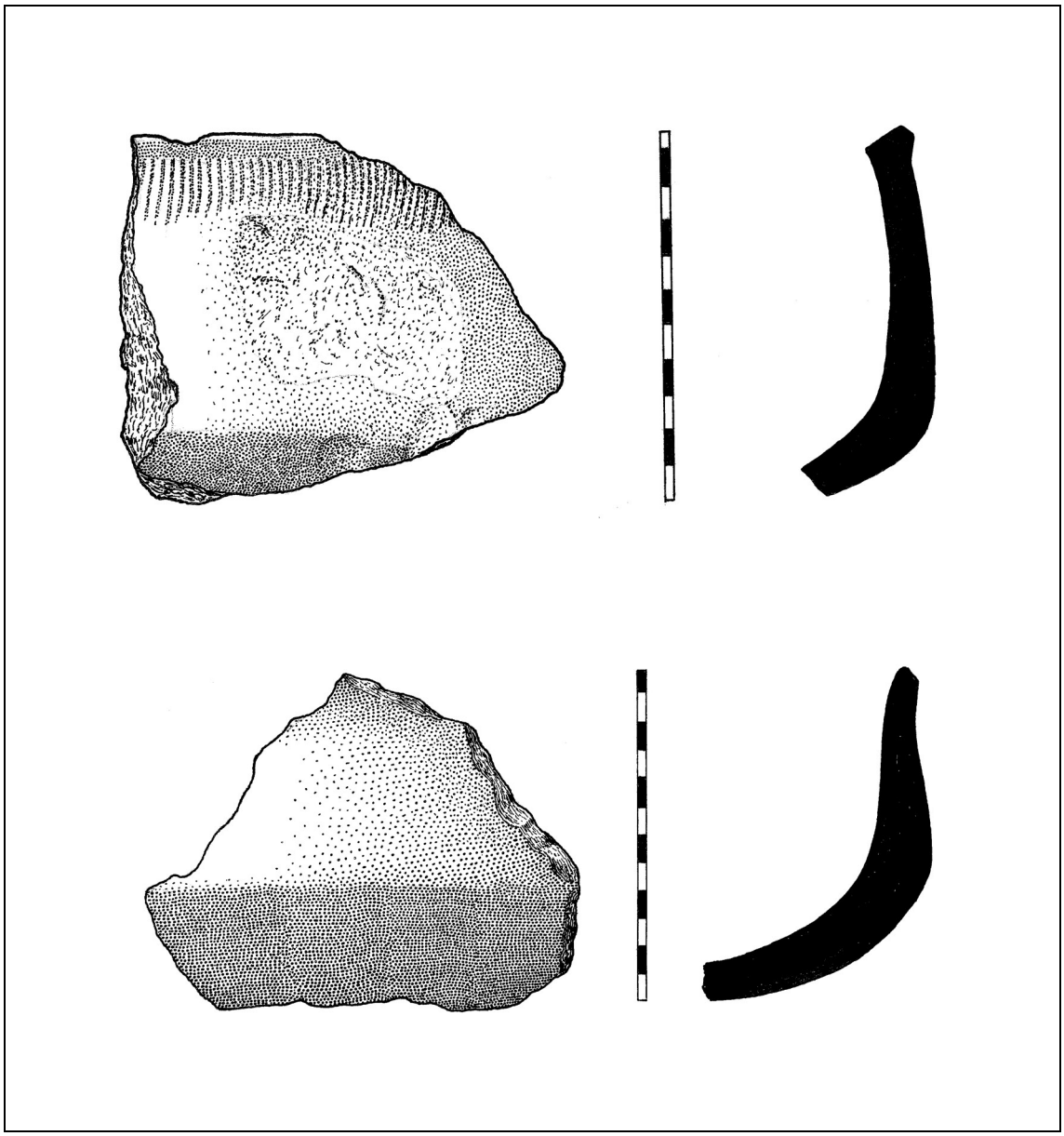


FIG. 102: Non-mortuary vessels. *Top*: cat. 3238 layer 10:4. A small utilitarian 6 mm thick bowl with a smoothed surface. Partially smoothed over cord marks are visible. The estimated rim diameter is 220 mm, base 180 mm and the height is 50 mm. Biscuit fired and partially oxidized. Probably modelled from a clay lump. FG2. Colour: 2.5YR/5/4. Quality: moderately well made. *Bottom*: cat. 3239 layer 10:4. A small smoothed utilitarian bowl. The estimated rim diameter is 140 mm, base 120 mm and the height is 55 mm. The wall is 5 mm and the base 8.5 mm thick. Probably modelled from a clay lump. Biscuit fired with interior and exterior both oxidized. FG2. Colour: 2.5YR/6/6. Quality: moderately well made. Scale segments are 5 mm

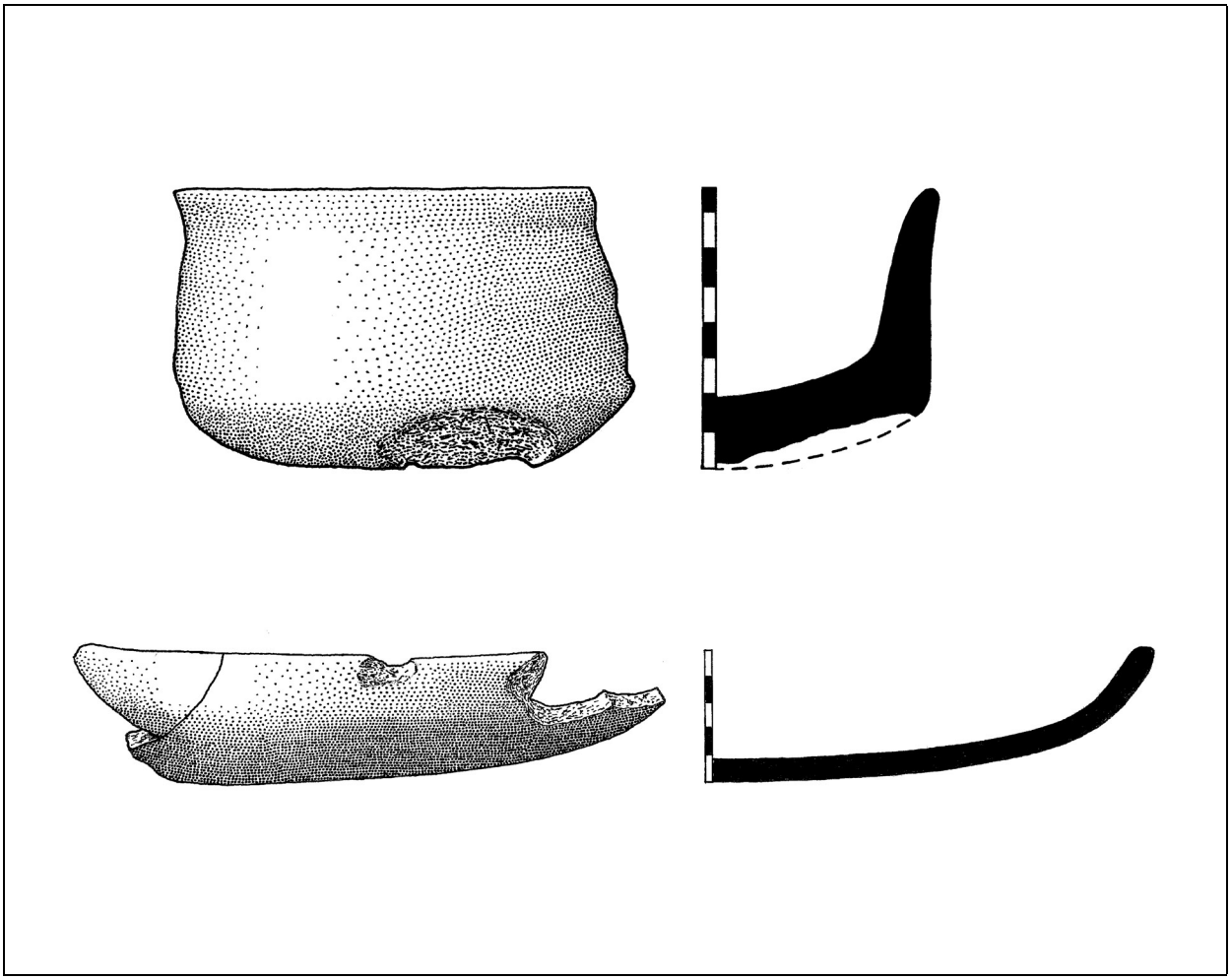


FIG. 103: Non-mortuary vessels. *Top*: cat. 3236 layer 10:3. A very small utilitarian or "test" bowl with a smoothed surface. The interior is roughly smoothed over. The estimated rim diameter is 70 mm, base 68 mm and the height is 34 mm. The thickness is 3 mm at rim, 7 mm mid-wall and 8 mm base. Biscuit fired probably to a low temperature. A large firing spall has fragmented off the exterior which is partially oxidized. The interior is oxidized with fire clouds. Probably modelled from a clay lump. FG2. Colour: 2.5YR/6/6. Quality: moderate with crude interior. *Bottom*: cat. 3237 layer 10:3. A shallow burnished plate with 2 lines at the rim edge (estimated rim diameter: 160 mm, height: 20 mm). The 4.5 mm thick wall was probably constructed from slabs. Biscuit fired upright with the interior oxidized with fire clouds and the exterior reduced. FG3. Colour: 2.5YR/5/4 to 2.5YR/3/0. Quality: very good to excellent. Scale segments are 5 mm

MORTUARY VESSELS

The layer 10 portion of the Khok Phanom Di cemetery, which continues throughout CP2, has been subdivided into three Mortuary Phases by the excavators. MP1 burials lacked vessels. A total of 62 vessels were recovered from MP2 and MP3. Twenty five vessels were assigned to the former Phase and 37 to the latter (Higham and Bannanurag 1990). Their proposed MP3 does not correlate exactly with the ceramic sequence, however there is no particular reason why it should without the benefit of detailed ceramic evidence. In order to define the sequence more clearly, in terms of the ceramic evidence, the depths of grave cuts and grave contents for the upper portion of MP3 (designated U3 in table 64) need to be considered in detail. This will assist in establishing more precisely any correlations which may exist between the CP2 and CP3 and the MP3 and MP4 sequences. These data, along with stratigraphic, burial and mortuary vessel fabric and types are set out in tables 64 and 65, following the sequence proposed by Higham and Bannanurag (1990). A full definition of the types is set out in Appendix 3. Local ware types are prefixed "L", exotic types with an "E". Miniatures are suffixed (m), and tripod vessels (t). The dimensions given are in metres and they indicate the depth from datum to grave base, to the contents (usually the skull) and the depth that the grave cut was first recognized by the excavators (Higham and Bannanurag, 1990). Burials 76 and 86 were cut from the north section.

Of the 37 vessels provisionally assigned to MP3 six were lost somewhere between the excavation and the ceramic laboratory. Two of the 25 MP2 vessels are also missing. Although a serious absence, some of these vessels were drawn *in situ* and this allows some tenuous observations to be made regarding their possible affiliations. Where possible, this evidence will be set out in the following text. Illustrations of each available vessel are set out along with detailed descriptions in figures 104 to 135.

The overall quality assessments are subjective and relate to the care taken in forming and finishing the vessels rather than their artistic merits. Unless mentioned in the caption text, the vessels are intact or only very slightly damaged. Construction methods have been assessed through visual inspection with the aid of a hand lens or a low powered binocular microscope. Most shell impressions were made with an *Anadara* shell, using the shell edge, exterior surface or the hinge beak. Mason (pers. comm.) advises that other shell species may also have been used. Where a different shell has been used, or the impressions are indistinct, they are simply described as shell impressions.

We need now to consider the disposition of the burials in MP3 to test whether they correlate with the ceramic evidence. A critical question is whether all the burials in CP2 form a stratigraphically coherent sequence or not. All "whole" vessels for MP2 and MP3 have been included in this chapter in order to determine whether the boundary between CP2 and CP3 coincides with the MP3 and MP4 division. The fabrics of local funerary wares change from FG2 to FG3 with the interment of B74, and all such vessels are subsequently composed of FG3. The contents of this grave were encountered at 4.64 m, however, the grave cut was not detected until a depth of 4.65 m. A lack of clear definition can result from the site being subjected to deflation due to natural erosional factors, or some other kind of disturbance, following the closing over of the

grave. As a result prehistoric graves are often truncated so that the grave depth detected during excavations is considerably less than the original. Several graves uncovered at Khok Phanom Di appear to retain most, if not all, their initial form. The deepest of these is B15 which measured 86 cm (Higham and Bannanurag 1990:20). During MP1 the maximum grave depth recorded was 20 cm which clearly reflects substantial site erosion and/or compaction, because graves of 20 cm would be too shallow to cover an adult corpse. Compaction is suggested by the decrease in distance from the top of the contents to the grave base of burials. This value steadily increases from just 0.05 m in B110, 0.11 in B112, 0.14 in B101, 0.2 in B103 and 0.26 in B92. All are adult interments except B62 which involved a six month old child. The average distance from the top of the grave contents to the grave base for MP3 burials, for which data are available, is 23.5 cm. It seems reasonable to assume that a similar depth would be required to adequately cover adult burial contents to give a total depth of approximately 50 cm. Given that 86 cm is the deepest grave recorded and that 50 cm would seem a reasonable minimum depth it is suggested that adult graves at Khok Phanom Di were cut to an average depth of approximately 68 cm.

In terms of the mortuary wares, burials with FG3 vessels are all considered to have been cut from above 4.31 metres, the datum level of layer 10:2. These burials, therefore, are considered to belong to CP3. The deepest is B74, estimated to have been cut from a point between layer 10:1 and 10:2. The remaining burials (67, 64, 63, 62, 79, 60, 57, 58, 56 and 77), are all higher in the sequence. Burial 62, a six-month-old infant, was cut down to 4.75 m below datum or 44 cms below layer 10:2, which also indicates that the grave was cut from above layer 10:2. Two burials without vessels, 61 and 83, may also have been cut from above layer 10:2. The latter was interred with two burnishing stones. The highest burials which include CP2 local wares are numbers 72 and 92. Given that these graves were originally about 68 cm deep, they could have been cut from no higher than layer 10:2. A clear separation between the remaining MP3 burials and the above group is therefore evident. In terms of the mortuary sequence this seems to leave at least three options. Either the ten burials cut from above layer 10:2 belong to MP4 or they represent a separate Mortuary Phase, or there was a change in ceramics during MP3. Resolution of this point is best postponed until we have examined the CP3 ceramic spectrum in detail so that the mortuary wares in this spectrum can be placed into their appropriate stratigraphic order. The fabrics of local mortuary wares from the nine uppermost layer 10 burials, for which ceramic data are available, belong to the succeeding ceramic tradition and not to that which characterizes CP2. Four of these, B58, B60, B67 and B74, however, contained vessels rendered in the CP2 style. They are the deepest of the group (Table 65).

Burials 60 and 67 contained type L2b vessels decorated with a band running just below the rim which comprises two straight incised lines above a single *Anadara* shell-impressed line. These vessels are composed of FG3 which relates to CP3. The same motif appears on two vessels interred with B72, but these are constructed from the CP2 fabric (FG2). Clearly these changes indicate a subtle shift in the ceramic tradition. When the styles of L2b jars are compared, a clear separation is evident between the style of vessels in the lowest four burials and those above them, although all are constructed of the CP3 fabric.

Further, the ceramic data indicate that this group of burials represents a different mortuary episode to that designated MP3 (see Chapter XI). The possibility that the MP3 inhabitants changed their ceramic fabric, to that current during CP3, is untenable, because this would run

TABLE 64: *Mortuary vessels: Ceramic Period 2*

Layer	Burial	Cat.	MP	Thin sec/h.s.	Fabric group	Type	Base	Depth Contents	Cut
10:2	77	1384	U3	K227	3	L2e	-	4.17	4.21
10:3	56	1243	U3	K357	3	L2b	-	4.47	4.32
10:3	58	1283	U3	K187	3	L2b	-	4.55	4.42
10:3	58	1284	U3	K200	3	L3c	-	4.55	4.42
10:4	57	1288	U3	K191	3	L2b	4.65	4.43	4.41
10:4	57	1290	U3	K231	6?	E2b	4.65	4.43	4.41
10:4	60	1291	U3	K196,209	3	L2b	4.73	4.56	4.45
10:4	79	1394	U3	K215	3	L1d	-	4.37	4.33
10:5	62	1312	U3	missing	-	L3c?	4.75	4.49	4.48
10:5	62	1314	U3	missing	-	-	4.75	4.49	4.48
10:5	63	1309	U3	missing	-	-	-	4.46	4.47
10:5	64	1319	U3	K222	8	E2e	-	4.54	4.50
10:5	64	1320	U3	K358	3	L2a	-	4.54	4.50
10:5	67	1431	U3	h.s.	3	L2f(m)	4.80	4.62	4.50
10:5	67	1432	U3	K164	3	L2b	4.80	4.62	4.50
10:6	74	1390	U3	K166	3	L3b	-	4.64	4.65
10:6	74	1391	U3	K172	3	L1a	-	4.64	4.65
10:6	74	1392	U3	K218	3	L2f	-	4.64	4.65
10:6	76	2016	3	h.s.	2	L2b	-	-	-
10:6	76	3252	3	h.s.	2	L3e(t)	-	-	-
10:7	72	1359	3	K178	2	L1e	-	4.71	4.72
10:7	72	1360	3	K175	2	L2b	-	4.71	4.72
10:7	72	1361	3	K377,379	2	L2b	-	4.71	4.72
10:7	73	1478	3	K246	2	L2b	-	4.88	4.75
10:7	73	1479	3	h.s.	2	L2b	-	4.88	4.75
10:7	75	1375	3	h.s.	2	L1b	-	4.85	4.74
10:8	86	2020	3	K193	6	E2b	-	-	-
10:8	86	2019	3	h.s.	2	L2e(mt)	-	-	-
10:8	86	2021	3	missing	-	-	-	-	-
10:8	90	1465	3	K287,376	2	L3a	-	4.90	4.78
10:8	90	1466	3	h.s.	2	L2b	-	4.90	4.78
10:8	90	1467	3	h.s.	2	L2b	-	4.90	4.78
10:8	92	1480	3	h.s.	2	L2b	4.93	4.67	4.67
10:8	92	1481	3	missing	-	2b?	4.93	4.67	4.67
10:8	93	1468	3	K199	2	L2b	-	4.90	4.78
10:8	93	1469	3	K192	2	L2b	-	4.90	4.78

counter to the overall ceramic evidence set out in this volume and summarized in Chapter XI. In this respect it is important to note that in addition to technical and stylistic changes, the overall quality of local mortuary wares, with some notable exceptions, declined during CP3. Critically, the technical changes did not, in any respect, confer production advantages. The clay source changed for reasons that are unclear and the clay preparation method was not in any way better than that employed during CP2. Technological innovations are likely to be adopted when they improve existing methods. The technique used by local potters during CP3 does not represent an improvement on the CP2 method.

TABLE 64: *Mortuary vessels: Ceramic Period 2 (continued)*

Layer	Burial	Cat.	MP	Thin sec/h.s.	Fabric group	Type	Base	Depth Contents	Cut
10:9	103	1599	3	h.s.	2	L2f(m)	4.98	4.78	4.78
10:9	103	1600	3	missing	-	2b?	4.98	4.78	4.78
10:10	88	1453	2	h.s.	6	E2b(m)	-	5.10	5.03
10:10	88	1454	2	K224	2	L2b	-	5.10	5.03
10:10	89	1450	2	h.s.	2	L1d	-	5.13	5.04
10:10	123	1618	2	K177	2	L3a(m)	-	5.03	5.00
10:10	123	1619	2	K232	2	L2c(m)	-	5.03	5.00
10:10	123	1620	2	K221	6	E1a(m)	-	5.03	5.00
10:11	91	1517	2	K285	2	L1a	-	5.13	5.04
10:11	91	1518	2	K198	2	L3b	-	5.13	5.04
10:11	91	1519	2	h.s.	2	L2b	-	5.13	5.04
10:11	91	1520	2	h.s.	2	L2b	-	5.13	5.04
10:11	99	1648	2	h.s.	2	L2g(m)	-	5.14	5.12
10:11	99	1649	2	h.s.	2	L2d	-	5.14	5.12
10:11	101	1522	2	h.s.	2	L2g?	5.30	5.16	5.12
10:11	102	1542	2	K284	2	L3a	-	5.16	5.10
10:11	102	1543	2	K176	2	L2e	-	5.16	5.10
10:11	105	1536	2	K220	2	L1a	-	5.14	-
10:11	105	1537	2	h.s.	2	L2e	-	5.14	-
10:13	112	1654	2	missing	-	-	5.34	5.23	5.23
10:13	113	1651	2	K173	2	L3a	-	5.21	5.21
10:14	120	1678	2	K189	2	L2d	-	5.36	5.36
10:14	120	1679	2	K359	6	E2b	-	5.36	5.36
10:14	125	1638	2	h.s.	2	L1a	-	5.35	5.30
10:15	110	1659	2	h.s.	2	L2d	5.62	5.57	5.42
10:15	130	1691	2	K213	2	L2c	-	5.49	5.48
10:15	130	1641	2	missing	-	-	-	5.49	5.48

At least three primary factors, environmental, processual and cultural, or some combination

of them, could have influenced the change to a different clay. In the first instance, it is possible that changes in the local geophysical environment could have prevented access to traditional clay sources. Alternatively, intensive potting processes could have completely worked out the customary clay deposit. Given the broad expanse of regional deposits, however, this seems unlikely, even although the scale of pottery activity during CP2 would have required many tonnes of clay. It is difficult to quantify this aspect of the ceramic sequence, except to note that throughout the following CPs, which involved a greater amount of material, the same clays were exploited. Although variations in the clay are evident, these are considered consistent with the mixed nature of clay deposits laid down by a combination of fluvial and marine activity. On the other hand, conservation of higher quality clay for ornamental wares is suggested by the use of the less plastic fishpond clay for utilitarian vessels. This is particularly evident during CP3 when production of utilitarian wares increased markedly (Chapter IX).

TABLE 65: *Mortuary vessels: Upper Mortuary Phase 3*

Burial	Cat.	Style	Fabric group	Type	Base	Depth Contents	Cut
77	1384	CP3	3	L2e	-	4.17	4.21
79	1394	plain	3	L1d	-	4.37	4.33
57	1288	CP3	3	L2b	4.65	4.43	4.41
57	1290	exotic	6?	E2b	4.65	4.43	4.41
63	1309	missing	-	-	-	4.46	4.47
56	1243	CP3	3	L2b	-	4.47	4.32
62	1312	missing	-	L3c?	4.75	4.49	4.48
62	1314	missing	-	-	4.75	4.49	4.48
64	1319	exotic	8	E2e	-	4.54	4.50
64	1320	plain	3	L2a	-	4.54	4.50
58	1283	CP2	3	L2b	-	4.55	4.42
58	1284	plain	3	L3c	-	4.55	4.42
60	1291	CP2	3	L2b	4.73	4.56	4.45
67	1431	plain	3	L2f(m)	4.80	4.62	4.50
67	1432	CP2	3	L2b	4.80	4.62	4.50
74	1390	CP2	3	L3b	-	4.64	4.65
74	1391	plain	3	L1a	-	4.64	4.65
74	1392	plain	3	L2f	-	4.64	4.65

Perhaps the most likely reasons for change are cultural. Several possibilities warrant consideration. One is that immigrant potters, for example as exogamous wives, introduced a different potting method. This seems unlikely, however, because only the clay and not the clay preparation method changed. Further, it is most unlikely that the style of burial jars would change simply because new potters arrived at the site. This is underlined by the contemporary presence of both CP2 and CP3-style burial jars in the same stratigraphic contexts. Yet both styles were

made using the clay selected throughout CP3. In addition, burial jars fashioned following the CP2 style include decorative motifs restricted to the earlier CP. A band below the rim features a combination of two or three straight incised lines above a crenulated *Anadara* shell-impressed string. Shell impressions are also present at the carination point. This decorative mode is absent from CP3 burial jars. It is suggested below that burial jar motifs could signal clan or similar such familial associations. If this is correct, then the changes set out above in the upper CP2 burial jar assemblage could signal the final phase of some such familial association.

Another possibility is that a new population established a different potting tradition. Such an event usually involves both material and stylistic changes (Vincent 1988). Traditions introduced from within the immediate region are likely to differ less than those introduced from more exotic sources (Shepard 1956).

A new range of forms is evident during CP3. This is apparent in terms of rim form elaboration and variations in vessel shapes and decorative treatments, although these can be readily related to the extant regional style. The same range of forms was produced during CP2 and CP3. Rim categories increase from 96 in CP2 to 128 in CP3 and variants decrease from 58 to 44 respectively (Table 168). Vessel forms change. Local type 2b burial jars, the most numerous funerary vessels, are strikingly different. CP3 versions lack the decorative detail displayed by the CP2 vessels (Figs 118 and 131). Their proportions change. Whereas the rim diameters of the CP3 burial jars is greater than that of the carination point, during CP2 the reverse is true. The carination point is wider than the rim diameter (Appendix 3). Three type 2b burial jars, (cat. 1432 (B67), 1291 (B60) and 1283 (B58) and one 3b carinated platter (cat.1390, B74), are decorated in the CP2 style. Yet all feature the CP3 local fabric (FG3). Clearly changes in the local typological spectrum occurred at this point in the sequence. Why? Was this simply a deviation due to the introduction of exotic techniques, or a major change effected by a new population with a different ceramic tradition?

If new clay preparation methods were taken up by indigenous potters, for instance because favoured local clay deposits had been exhausted, existing styles could be retained. There would be no technical reason for traditional styles not to be conserved. When both potting technology and styles change in tandem, however, this suggests the replacement of one tradition by another. When these changes are incomplete and vessel shapes and/or modes of decoration fall within the rubric of regional styles, then this suggests that the new potting activities represent the arrival of potters from within the catchment area of the recipient production centre. That these potters belonged to a new social group is signalled by the change in burial jar forms. The presence within the same mortuary contexts of the earlier forms suggests that a potter or potters who were familiar with the earlier tradition provided the four vessels discussed above.

The presence, within the cemetery, of firing stands, high concentrations of very large charcoal fragments, ceramic anvils, burnishing and grinding stones, and a stone tool, suggests some kind of cultural dislocation. This temporary change in site use is marked by the absence of mortuary activity. The MP3/Upper MP3 boundary also demarcates that of CP2/3. It is the only context within the cemetery where evidence for pottery manufacture occurred. Perhaps the most significant evidence is the firing stands associated with a marked increase in charcoal deposits. These stands differ in form from those recovered from CP1 occupation contexts, the only other such artefacts encountered within the excavation area.

Changes in the ceramic spectrum are reflected in a major shift in the rim forms generally, and specifically in the most common rim form associated with coarse cord-marked utilitarian vessels (RF1, Appendix 2). The significance of morphological change is increased when utilitarian vessels are involved because simple forms relate more closely to function than to the decorative aspects of ornamental wares, where elaboration often reflects artistic expression. It is unlikely that artefacts which have fulfilled their intended function for many generations would be replaced unless a new form provided advantages. In this instance it is difficult to perceive any improvement other than that their function had changed. The change in RF1 is considered to be both technical, in that the rim form became simpler to fashion, and functional because the vessel shape also became simpler.

Taken together, the ceramic changes suggest that a different tradition, involving an essentially different social group, replaced the potting tradition responsible for the CP2 wares. As the pottery deposits within the cemetery are principally local wares, it can be assumed that they reflect trends in the overall local ceramic production. During CP2, 2.15 tonnes were deposited compared to 4.278 in CP3. Production increases of this magnitude could indicate a dynamic florescence in craft specialization. Increased production suggests increased consumption. This could have been stimulated by better access to trade or exchange relationships. Accelerated production could also involve improved techniques and additional potters. A different population may be correlated with the improvement in the overall health of the local population. It is important to note that levels of infant mortality are markedly different in MP4 compared to MP3 (Tayles 1992:74). Further assessment of this aspect of the changes in the ceramic spectrum are considered in the final chapter.

Pottery vessels placed in graves at Khok Phanom Di were sometimes used as containers for food. They are also considered to be carriers of symbolic expression. As vehicles for such expressions plastic potting clay surfaces are without peer and many display decorative fields, but the shape of vessels can also be employed to transmit symbolic messages. In this case carinated burial jars, which dominate the burial ware assemblage, are considered to have been reserved for mortuary ritual. Although when recovered many of these vessels were badly broken and fragmented, they appear to be otherwise in pristine condition, lacking any sign of use. Several appear to have been hurriedly made. Overall the impression is that the carinated burial jars were intended as burial furniture. This suggests they were offerings to the dead as marks of respect. Several are exotic, perhaps indicating the degree of respect accorded some individuals. If this is correct, they may signal that external relationships were maintained and valued by both the contributors and recipients of these wares.

It is important to note that subtle changes in the carinated burial jars are correlated with the change in the local ceramic fabrics. For example, during MP2 and MP3 all carinated burial jars which feature decorated fields are impressed with shell, except for jars in the ten uppermost burials discussed above. In the latter group cord marks replace shell impressions. Cord marking on these vessels continues throughout CP3 alongside other jars which have shell-impressed decoration. Burial jars below layer 10:2 only display shell-impressed decorative fields. Cord marking *only* occurs on burial jars during CP3.

Modes of decoration can provide important technological evidence. We have previously noted that a variety of tools was employed to form and decorate the vessels. Burial jars were

first probably formed into slabs which were then welded to the wall sections, because a join is often visible at the carination point. A series of rings were probably added to the base above the carination point to complete the vessel. A cord-wrapped wooden paddle would have been beaten against the outside of the vessel directly opposite a ceramic anvil held firmly against the inner wall surface. These actions would act to mobilize and thin the plastic clay. A degree of smoothing could be achieved when the clay was still quite wet, but in many cases some drying would be essential to avoid surface damage and shape distortion. Once fully formed, the vessel would have been left to dry long enough to allow the unfired clay to harden sufficiently so that additional surface treatments could be applied if desired. Initially this would involve smoothing the surfaces with some kind of tool. At Khok Phanom Di most of the burial jars were burnished with a smooth stone. Some vessels received no further treatment. Others were decorated with incised lines, shell impressions, punctation marks, made by a variety of differently shaped probes, or with cord-marked paddles. In some, striated lines were created by drawing a pronged tool, such as a serrated bamboo stylus, across the surface. The decorations range from simple to quite complex in technical detail. Some also appear to signify membership in social groups such as clans. The decorative techniques *themselves*, however, may also carry symbolic messages. Some of these could be quite distinct from, and underlie the superficial symbolic designs of which the potters' group insignia discussed previously are an example.

Symbolic designs, for which there is *prima facie* evidence, decorate a variety of differently shaped vessels in the CP2 mortuary assemblage. They are detailed in the following sections. Motifs include male and female symbols, possible stylised human forms (cat. 2019 Fig. 120), turtles and the postulated potters' group insignia. Many ceramic anvils have been marked with what appear to be ownership symbols. Some utilitarian vessels, considered to have been manufactured as containers for the carriage of local resources which were exported, were decorated with incised lines. Such designs could represent ownership or trade marks such as those reported by Arifin (1991:373-87) for the Motu of the Port Moresby area of Papua New Guinea. This point will be discussed in more detail in the following chapter. Aside from these issues is the question of whether the potters' tools were perceived by the participants as having symbolic meanings *sui generis*. Ceramic anvils, for example, are often shaped in the form of a phallus. Without ethnographic evidence, however, it is difficult to support the concept that symbolic meanings may have been attached to the tools themselves. Certainly potting materials such as clays and paints are accorded spiritual or magical qualities by present-day potters in Papua New Guinea (May and Tuckson 1982: *passim*). In some villages, there is a division of labour between males and females for different aspects of pottery making such as digging the clay. Some decorative motifs are also restricted to one or other sex. Motifs in some Sepik Provinces are simple "parallel bands of horizontal or vertical zig-zag incised lines running around the top edge of the pot. This pattern is *uku wandja,* meaning waves of water" (May and Tuckson 1982:220). A series of running triangles which are infilled with pricked fields represents the track of the bush rat. Motifs taken from fauna, flora, those representing *"masalai"* and spirits have also been recorded. They "are selected from objects or things which appear in mythology" (May and Tuckson 1982:221).

> "Some Sepik believe there is a connection between clay and religious life and there are sanctions and taboos governing all aspects of pot making, from the division

> of labour and the age at which the potters are allowed to make pots to clay gathering and the use of certain ceremonial vessels." (May and Tuckson 1982:218)

Some of the Sepik motifs include a group of parallel lines which represents the wings of a bird or parallel semi-circular lines which represent a profile of a man's leg. These designs are either clan markings or are connected to the *"tambaran"*, or cult activities. Numerous further motifs have been recorded. In the Northern Province, pots are sometimes important in "bride price" transactions and in the initiation of boys and girls. When someone dies, pots may be smashed in grief displays. A widow may sometimes wear mementoes of her dead husband such as a piece of the pot in which she prepared his food. At Khok Phanom Di some cord-marked sherds, typical of cooking wares, about 30 to 50 cm in diameter, have a small hole pierced through the centre which would allow them to be strung on a cord for wearing around the neck.

When considering the "whole" vessel data it is important to keep in mind that their shape and surface decoration may have extra-somatic dimensions not readily apparent without a deep understanding of the cosmological perceptions of their creators. Cognitive archaeology is concerned with inferring such thoughts from material remains (Renfrew 1994:3). It is not the purpose here to address this important aspect of prehistoric research, however, our eyes should not be blinkered to the phenomena so expertly laid before us by the prehistoric craft specialists of Khok Phanom Di. Even if we cannot decipher the messages, we can at least acknowledge that we are aware of their presence and record them diligently in the hope others will. With this in mind we can now examine the mortuary wares in detail.

Based on the ceramic evidence, it is proposed that the uppermost eleven burials assigned to MP3 do not belong to CP2. Vessels from nine of these burials are included in the following discussion in order to help clarify the distinction between the ceramic traditions of CP2 and CP3 at Khok Phanom Di. In the following figures vessels recovered from these burials, namely, in stratigraphical order, 74, 67, 64, 79, 60, 57, 58, 56 and 77, have been referenced as CP3 wares.

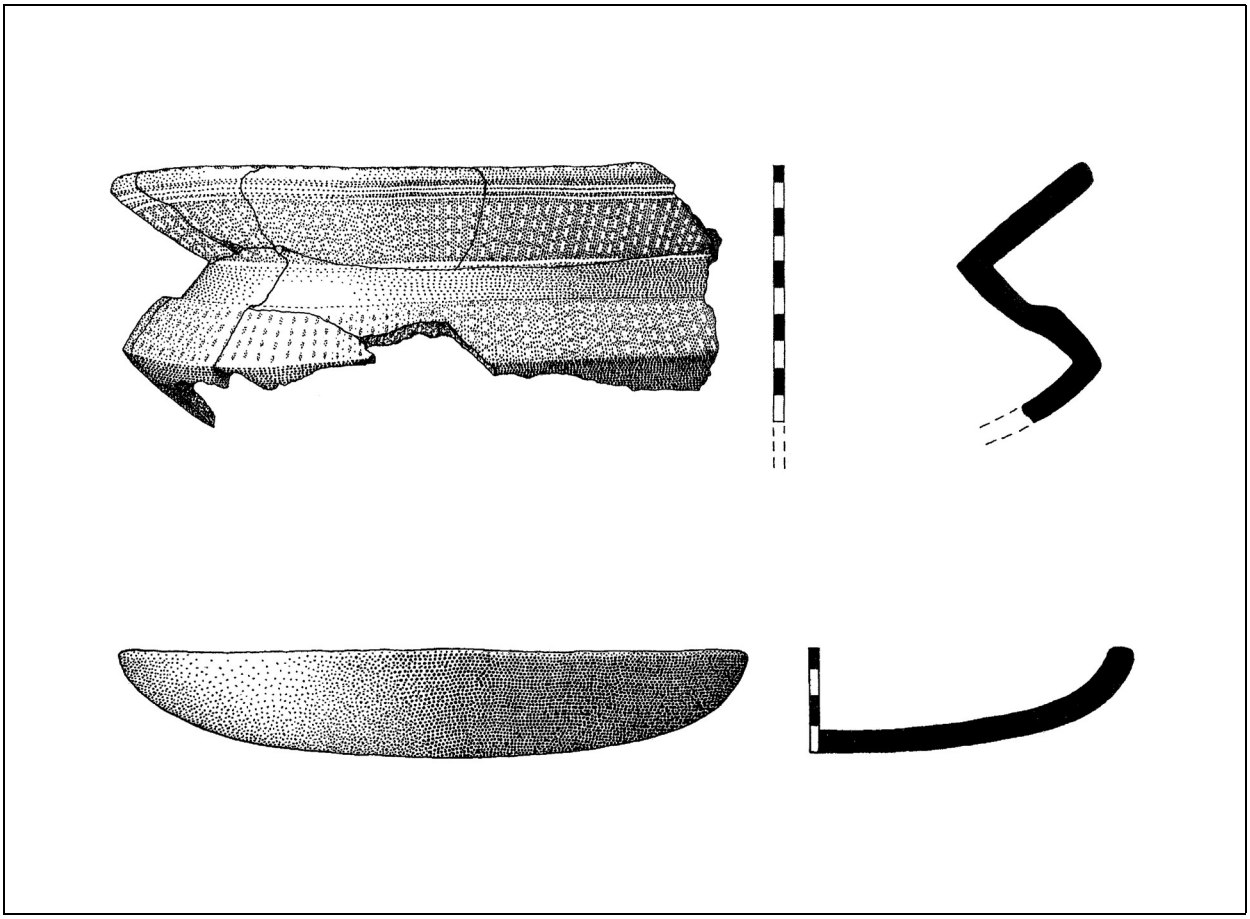


FIG. 104: Mortuary vessels. *Top*: cat. 1691 B130 layer 10:15. More fragments survived than shown. A burnished and highly decorated carinated jar. The rim edge is horizontal with punctate impressions.The diameters are: rim 158 mm, carination point 156 mm, overall height 60 mm, rim 15 mm, thickness 3 mm. *Anadara* shell impressed fields. Biscuit fired, interior and exterior oxidized with fire clouds. Probably constructed from slabs. Remnant cord marks to base. FG2. Colour: 5YR/6/4. Quality: very good to excellent. *Bottom*: cat. 1638 B125 layer 10:14. Intact. A miniature highly burnished shallow bowl. Diameter 103 mm, height 21 mm, thickness 5 mm at rim. Biscuit fired, interior reduced and exterior reduced with minor oxidized "flares" at the rim edge. Probably fired upright. Probably constructed from a slab. FG2. Colour: 2.5YR/6/6. Quality: excellent. White fibres are attached to the base. Scale segments are 5 mm

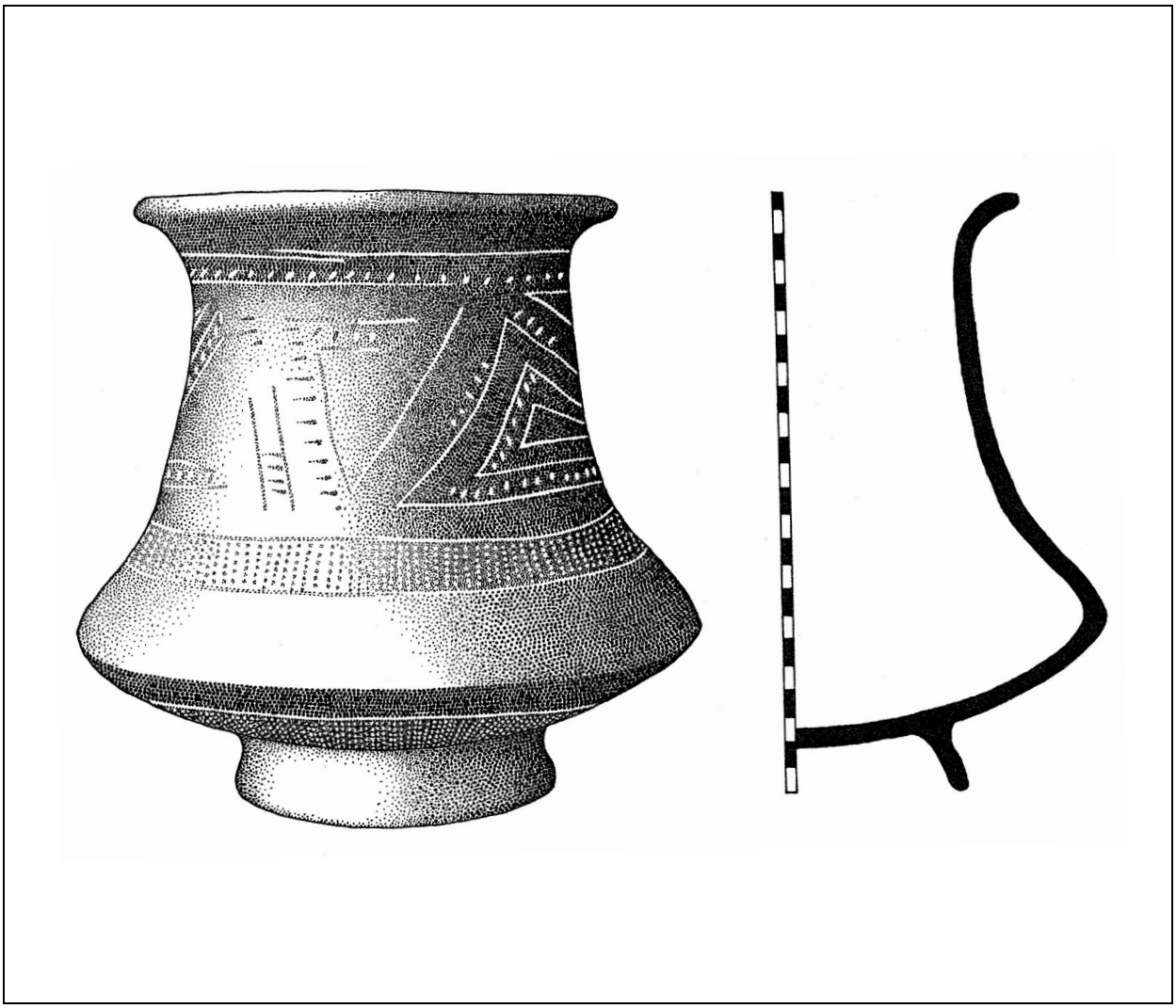


FIG. 105: Mortuary vessel: cat. 1659 B110 layer 10:15. A carinated jar which is intact except for a triangular fragment extending from rim to carination point. It is highly burnished over a medium fine fabric. The diameters are: rim 96 mm, carination point 122 mm, base 60 mm, overall height 119 mm, base 12 mm, carination 34 mm, thickness 4 mm. The central motif consists of a double triangle impressed with a shell and the point of a sharp probe. The vessel was probably constructed from slabs. Biscuit fired, the surfaces are barely oxidized. It was probably fired upright because the area under the ring-foot base is reduced. FG2. Colour: 2.5YR/5/6. Quality: the shape is excellent, however, the decoration is less perfect. Scale segments are 5 mm

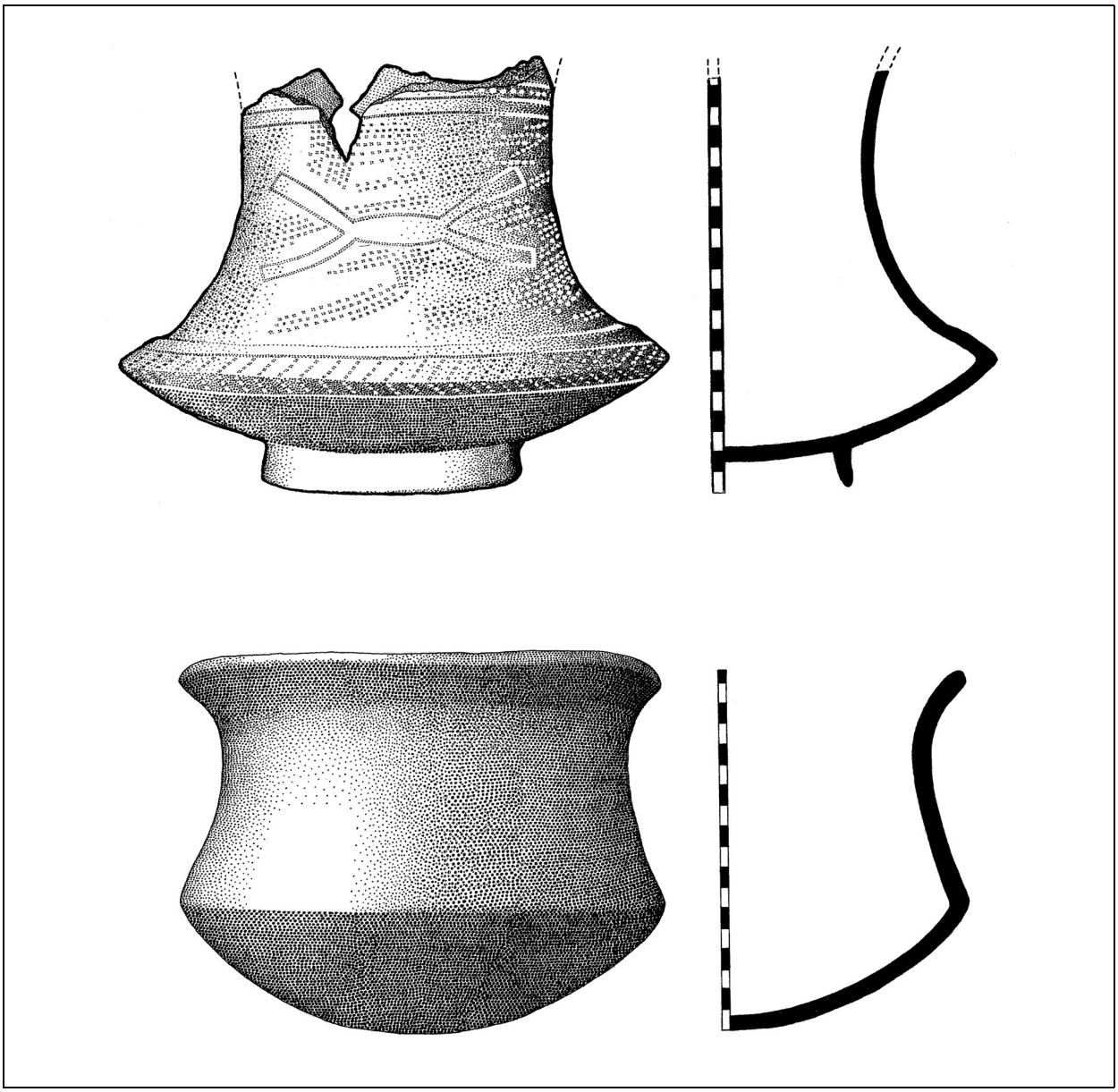


FIG. 106: Mortuary vessels. *Top*: cat. 1678 B120 layer 10:14. A burnished highly decorated motif jar. Both interior and exterior surfaces are burnished. *Anadara* shell impressions decorate the carination point. A punctate field above the carination point outlines a stylised turtle (the left legs are actually pointed), which is defined by smooth burnished surfaces. The rim was removed in prehistory. The diameters are: rim 95 mm(?), carination point 136 mm, base 64 mm, overall height 120 mm (?), base 11 mm, to carination 33 mm, thickness 3.5 mm. The vessel was probably constructed from slabs. Biscuit fired upright and completely oxidized except under base. FG2. Colour: 2.5YR/6/8. Quality: excellent. *Bottom*: cat. 1679 B120 layer 10:14. A burnished carinated jar. The diameters are: rim 123 mm, carination point 122 mm, overall height 92 mm, to carination 35 mm, thickness 3 mm. Probably constructed from slabs. Biscuit fired upright and completely oxidized. FG6. Colour: 7.5YR/7/4. Quality: good, the surface finish is excellent but the shape is slightly irregular. Scale segments are 5 mm

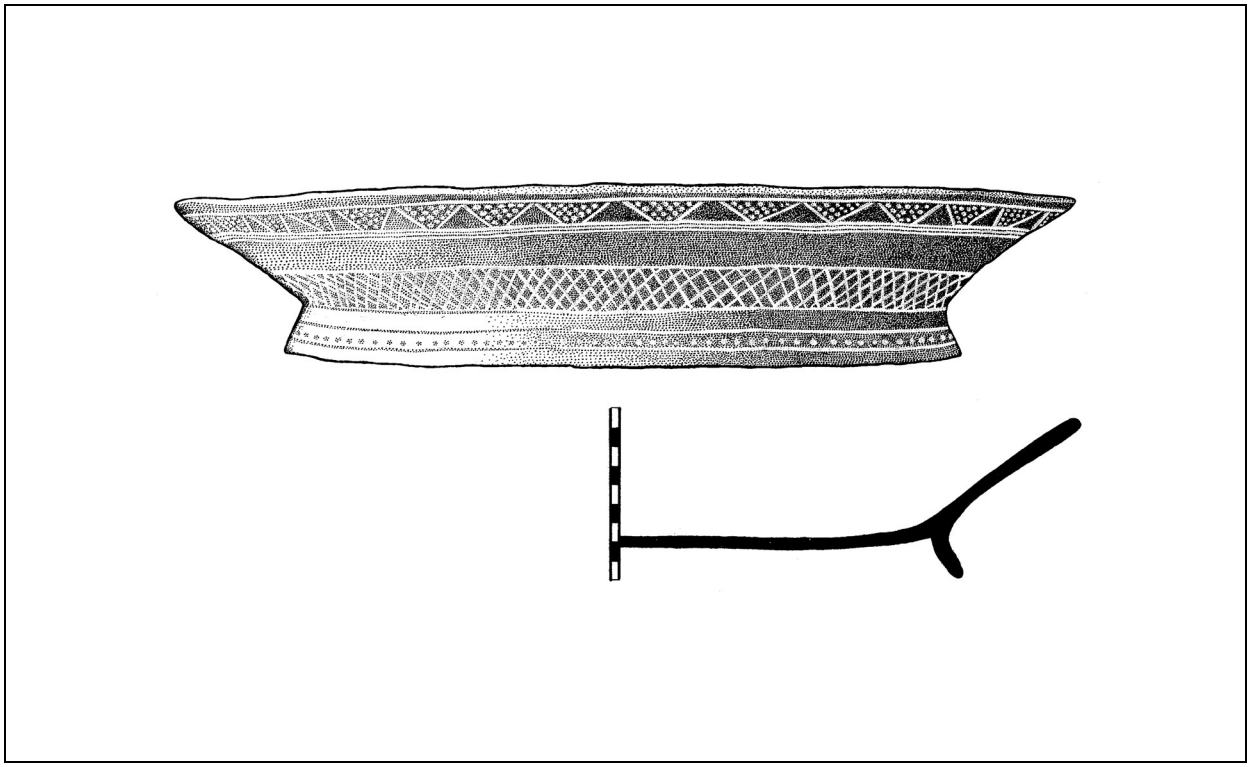


FIG. 107: Mortuary vessel: cat. 1651 B113 layer 10:13. A highly decorated burnished platter with a concealed base. Although badly fragmented, about 80% was able to be reconstructed. The vessel is composed of a medium fine fabric. The running triangles and the narrow band around the base were decorated with round (1 mm diam.), probe points about 2 mm apart. The incised lines were made with a 1 mm wide rounded stylus to a depth of 0.5 mm. The vessel diameters are: rim 244 mm, base 182 mm, overall height 44 mm, base 15 mm, thickness 4 mm. Constructed from slabs. Biscuit fired, the interior is extensively reduced with a slightly oxidized centre.The exterior is about 80% reduced with oxidized patches within the base. Probably fired upright. FG2. Colour: 2.5YR/5/4 (oxidized), 2.5YR/4/2 (reduced). Quality: very good to excellent. Scale segments are 5 mm

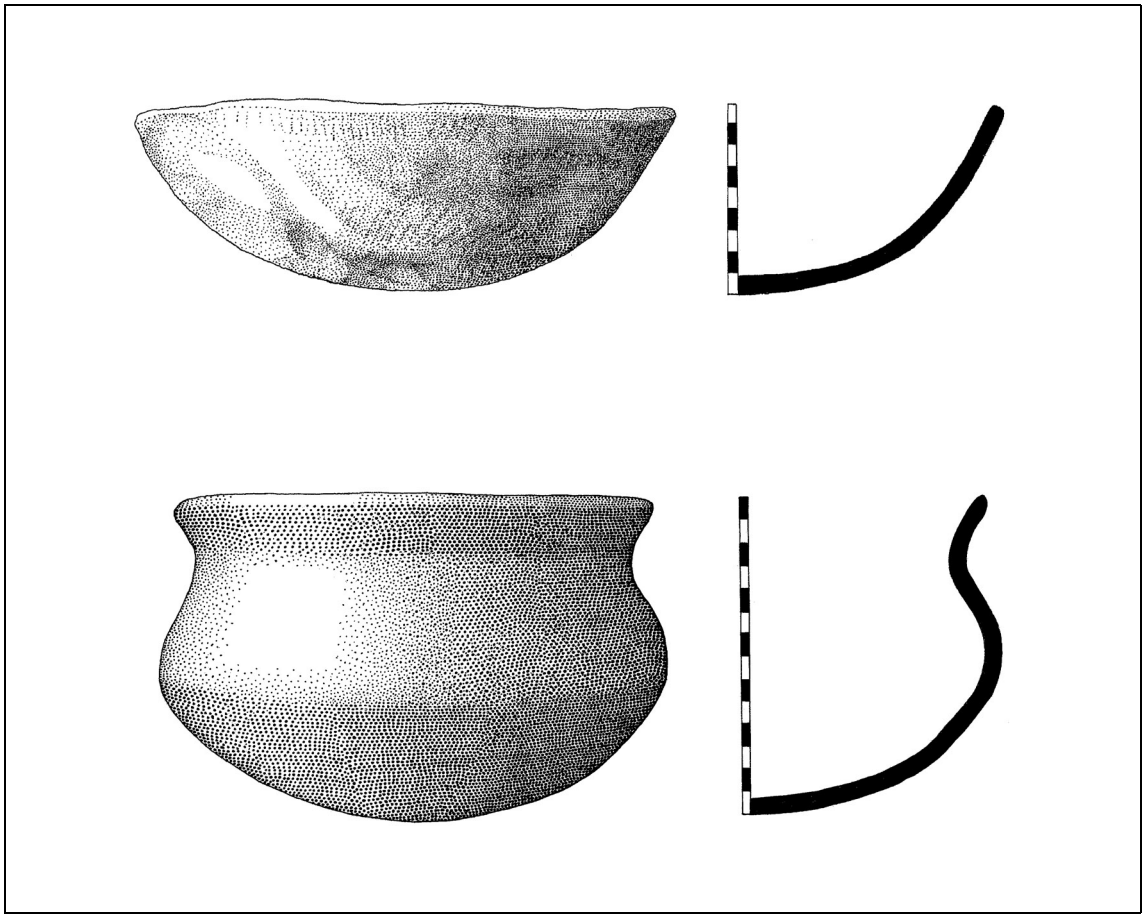


FIG. 108: Mortuary vessels. *Top*: cat. 1536 B105 layer 10:11. An intact shallow utilitarian bowl. The interior is carefully smoothed, however, the exterior displays incompletely smoothed-over cord marks. Diameters: rim 122 mm, height 44 mm, thickness at the rim: 3-4.5 mm. Constructed from slabs. The vessel has been biscuit fired, upside down, because although all of the surfaces are oxidized, fire clouds cover about 40% of the interior. FG2. Colour: 2.5YR/6/6. Quality: crudely formed and finished. *Bottom*: cat. 1537 B105 layer 10:11. A small intact jar. The body is almost carinated. Both the interior and exterior surfaces are carefully burnished. Diameters: rim 104 mm, carination point 110 mm, overall height 68 mm, to "carination" 32 mm, thickness 3 mm at rim. It is likely that this jar was constructed from slabs and/or rings. Biscuit fired, the interior is reduced and the exterior oxidized with fire clouds to about 25% of the base. This indicates an upside down firing. FG2. Colour: 2.5YR/6/6 to 5YR/6/4 (oxidized), 2.5YR/3/0 (reduced). Quality: good, although the shape is irregular the burnishing is very carefully applied. Scale segments are 5 mm

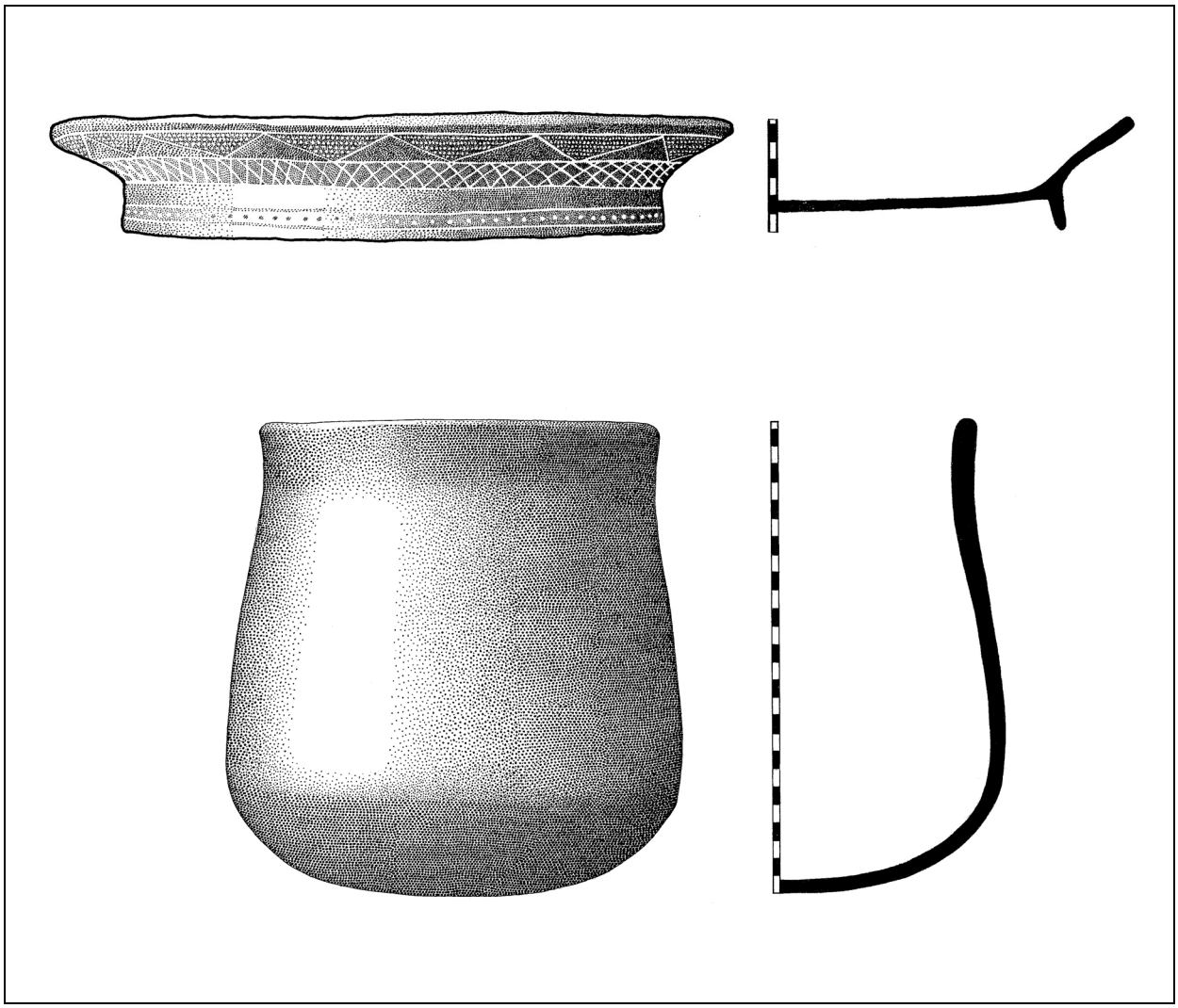


FIG. 109: Mortuary vessels. *Top*: cat. 1542 B102 layer 10:11. A highly decorated and burnished platter. Extensively fragmented, about 95% survives. Two small holes were made through the edge. Triangles decorated with shell(?), base field decorated with round probe points about 2 mm apart, 1 mm in diameter. Rounded incised lines 1 mm wide by 0.5 mm deep. Diameters: rim 194 mm, base 154 mm, overall height 31 mm, base 13 mm, thickness 4 mm. Slab construction. Biscuit fired. Essentially oxidized with fire clouds to about 20% of the interior. Smudges to exterior wall and base. Fire clouds cover about 30% of the area within the ring base. Probably fired upright. FG2. Colour: 2.5YR/5/6 to 2.5YR/4/2. Quality: excellent. *Bottom*: cat. 1543 B102 layer 10:11. A utilitarian smoothed jar. Some cord marks are incompletely smoothed over. Extensively fragmented, about 98% survives. Diameters: rim 115 mm, base 130 mm, height 133 mm, thickness 6 mm at rim. Base constructed from slabs with rings to walls. Biscuit fired upright. Oxidized with fire clouds to the base. The interior wall has a 20 mm diameter circular thermal stress spall fracture. FG2. Colour: 2.5YR/6/4. Quality: slightly irregular shape and moderately well made. The interior is roughly smoothed. Scale segments are 5 mm

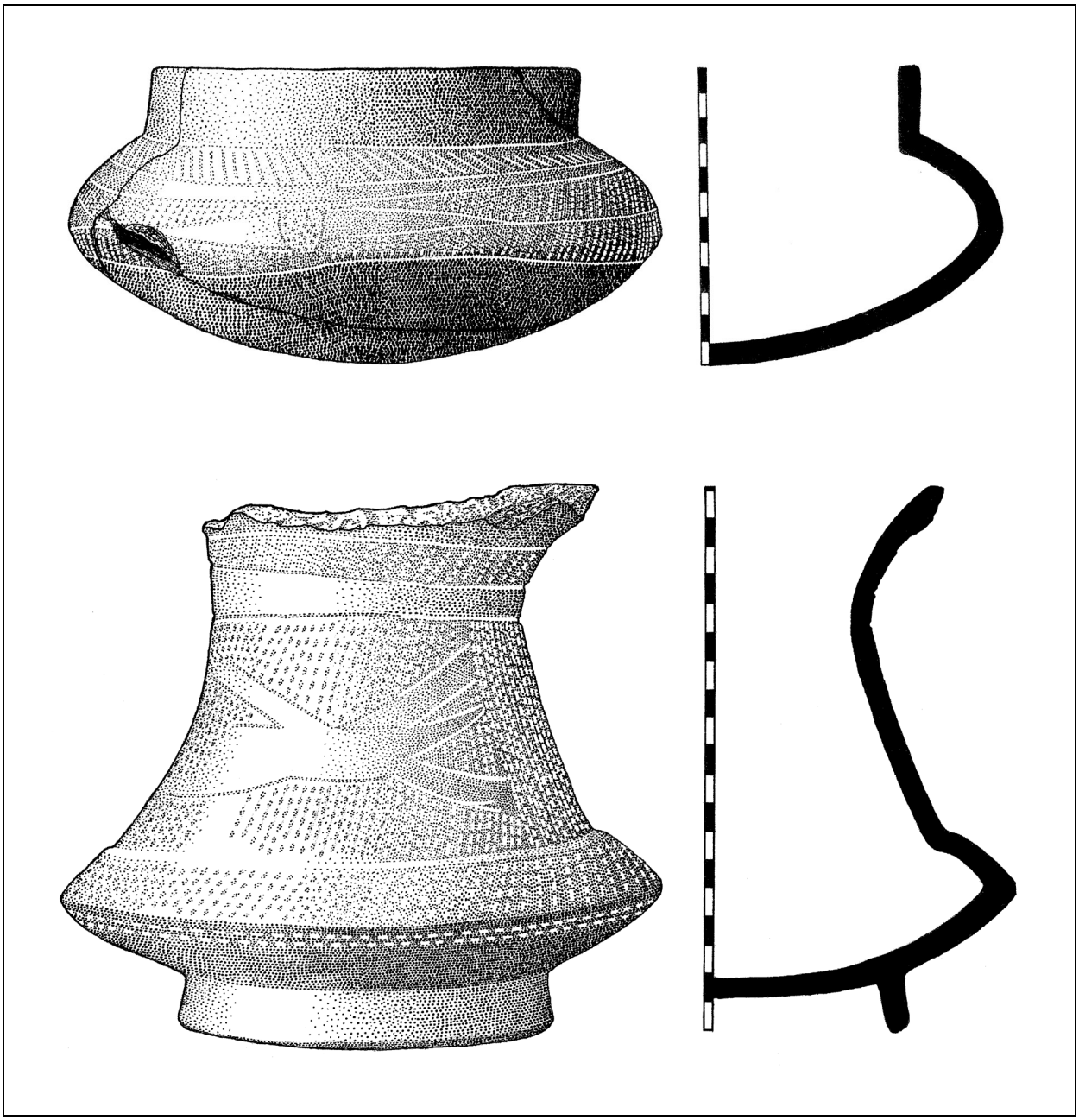


FIG. 110: Mortuary vessels. *Top*: cat. 1648 B99 layer 10:11. A miniature highly decorated burnished jar. Fractured into four pieces, about 98% survives. Upper field cross-hatched. The lower *Anadara* shell-impressed lozenge motif field is repeated around vessel. Impressed rim terminus. Diameters: rim 88 mm, carination point 122 mm, height 58 mm, thickness 6 mm at rim. Slab construction? Biscuit fired upright. Oxidized, minor fire clouds, some spalling and associated firing cracks. FG2. Colour: 2.5YR/6/6 to 2.5YR/4/2. Quality: very good, but irregular shape. Pristine condition. *Bottom*: cat. 1649 B99. A burnished, highly decorated turtle motif jar with base. Rim removed in prehistory. Impressed fields (either fine cord marks or shell (not *Anadara*)). Diameters: rim 74 mm, carination point 99 mm, base 62 mm, overall height 86 mm, to "carination" 21 mm, base 9 mm, thickness 3 mm at rim. Slab construction? Biscuit fired. Oxidized with very slight fire clouds to base. FG2. Colour: 2.5YR/5/4. Quality: very good except slightly irregular in shape. Scale segments are 5 mm

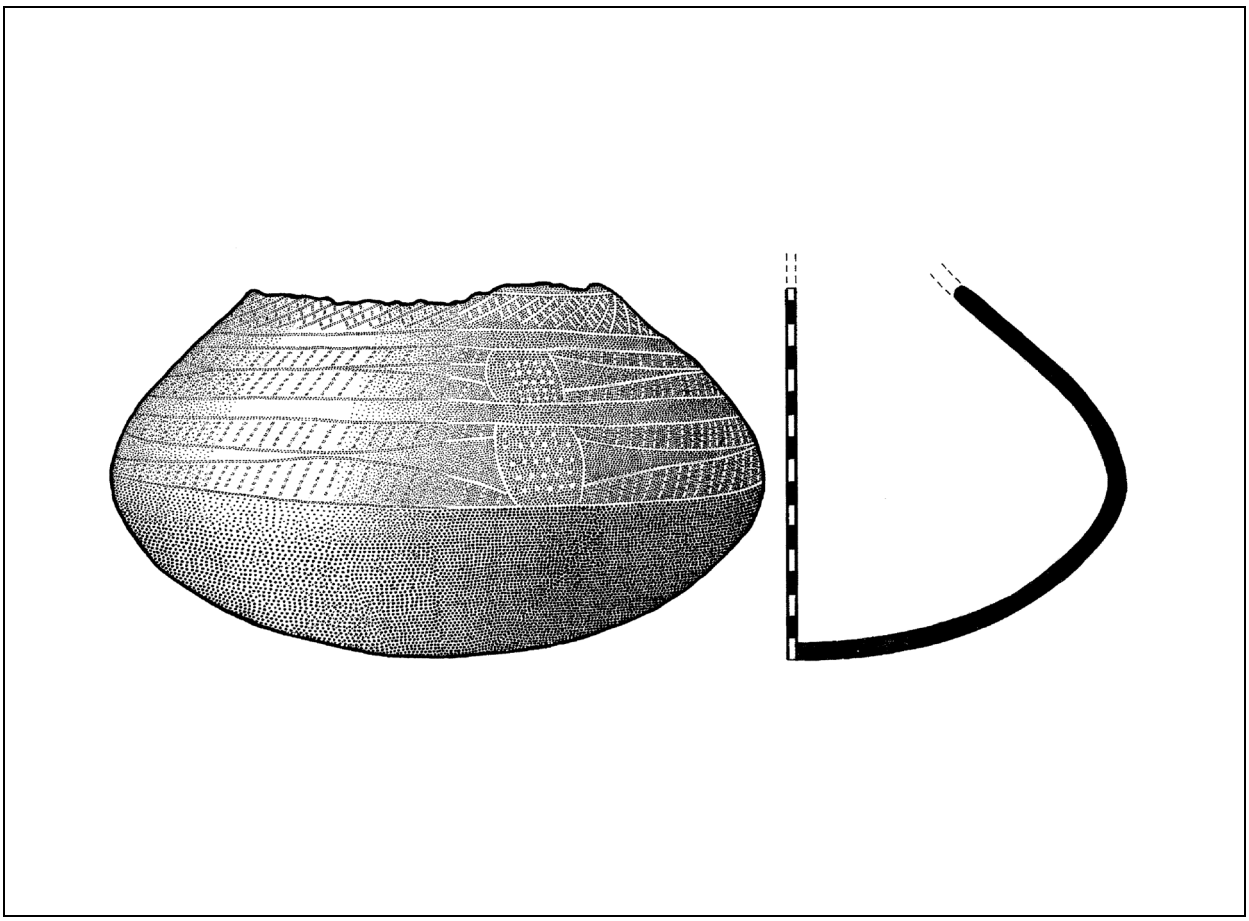


FIG. 111: Mortuary vessel: cat. 1522 B101 layer 10:11. A highly burnished and decorated globular jar. Intact except for the rim which was removed in prehistory. The fabric texture is medium fine and carefully prepared. An upper field is composed of cross-hatched 0.5 mm wide incised lines made with a round stylus. Beneath this is a distinctive motif described by Hall (1993:242) under incised and impressed as "3:12 a bi-convex lens is bisected by an oblong/oblate figure filled with small impressions. This motif is contained in a band of stamped impressions (Fig. 101b)." They have probably been infilled with *Anadara* shell impressions. Diameters: bowl width 146 mm, est. height 100 mm, thickness 3 mm. The lower hemisphere was probably constructed from slabs with rings above. Biscuit fired. Reduced throughout. A small vertical shrinkage crack indicates incomplete drying and minor surface spalling signal that the firing was not perfectly controlled. FG2. Colour: 2.5YR/3/0. Quality: excellent, although the high energy decoration has some minor imperfections. See also cat. 1648, which has a similar shape and decoration and an intact rim. Cat. 1649 employs a similar decorative mode. Scale segments are 5 mm

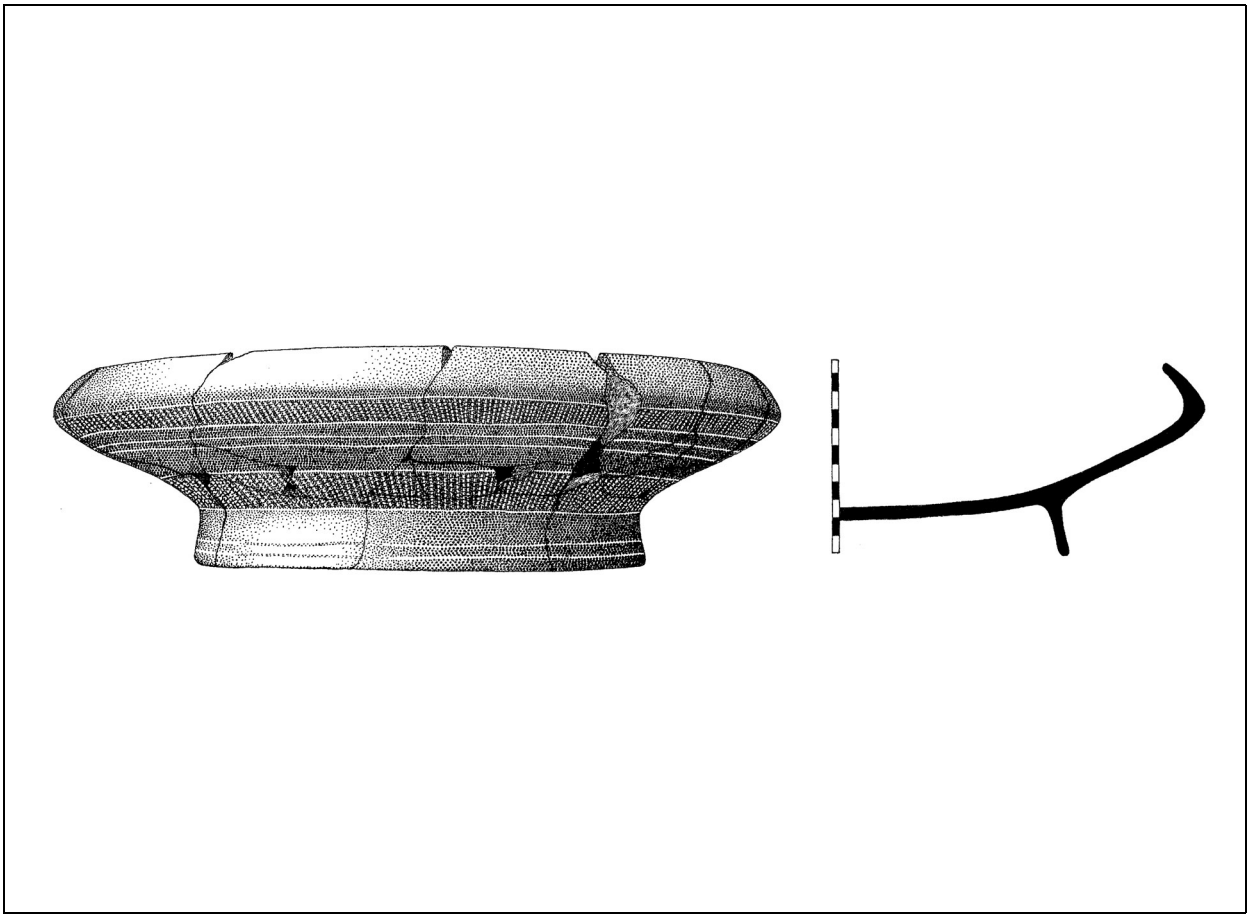


FIG. 112: Mortuary vessel: cat. 1518 B91 layer 10:11. A highly decorated platter with a ring foot base formed as continuation of the walls. Intensive burnishing has produced a highly lustrous surface finish over a medium fine fabric. Although fractured into numerous small thin sherds, their condition was stable enough to enable about 98% of the original to be reconstructed. All of the incised lines are carefully applied. The bands are filled with impressions made with the back of an *Anadara* shell. Diameters: rim 186 mm, carination point 207 mm, base 129 mm, overall height 52 mm, to carination point 40 mm, base 15 mm, thickness 2.5 to 4 mm. Slab construction. A controlled biscuit firing has produced a complete deeply reduced lustre. FG2. Colour: 2.5YR/2.5/2. Overall, a high level of energy has been expended to produce an excellent vessel, only marred by minor shape distortions. Scale segments are 5 mm

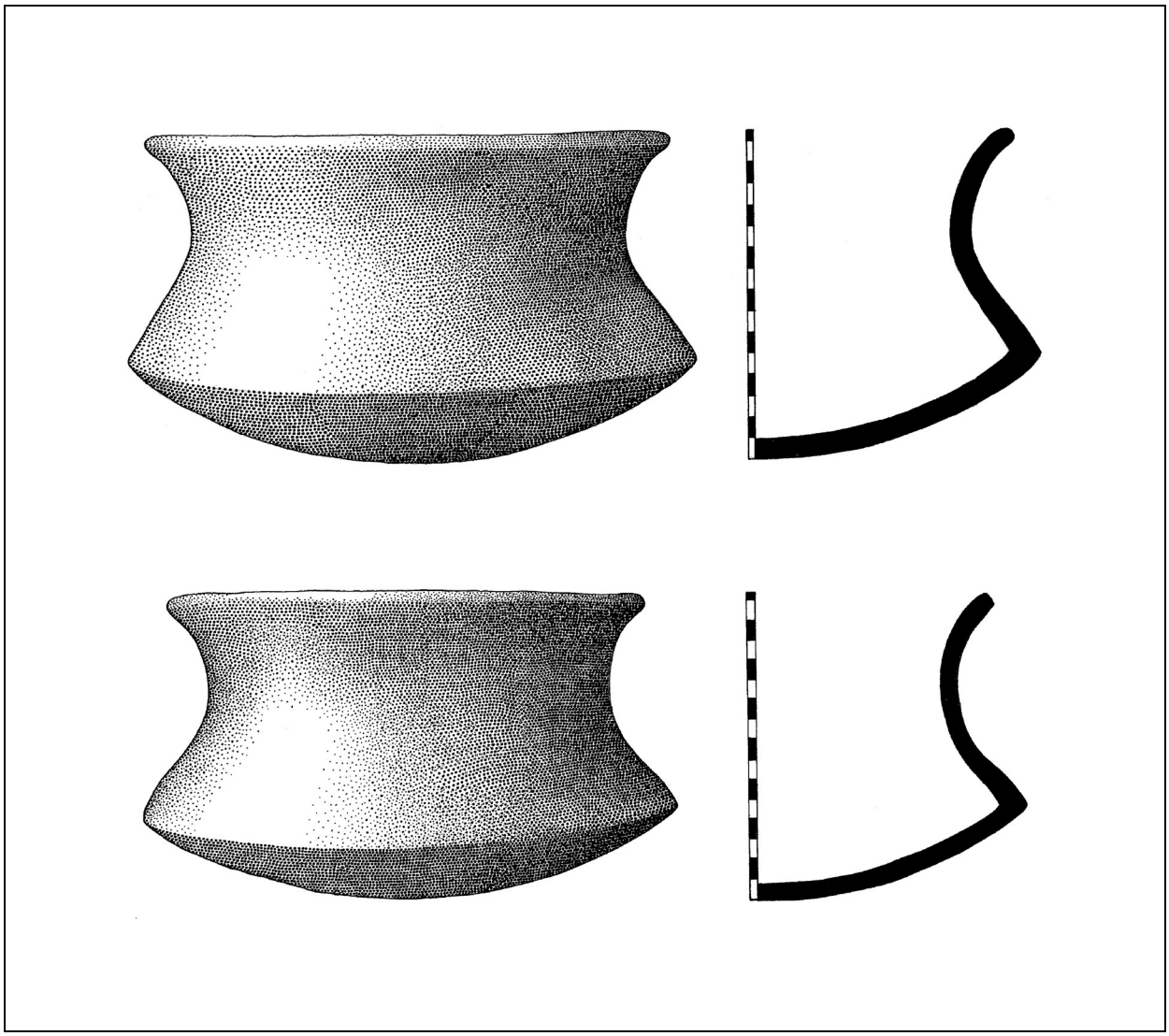


FIG. 113: Mortuary vessels. *Top*: cat. 1519 B91 layer 10:11. A carinated burial jar in pristine condition. Smoothed and imperfectly burnished over a medium fine fabric. Diameters: rim width 119 mm, carination point 129 mm, height 73 mm, to carination 24 mm, thickness at rim 4 mm. Slab construction? Biscuit fired. As interior surfaces are reduced and exterior oxidized, with fire clouds near the rim, this vessel was probably fired upside down. FG2. Colour: 2.5YR/6/4 (oxidized), 2.5YR/2.5/0 (reduced). Although the form is slightly distorted and the thickness is irregular, overall the quality is very good to excellent. Fragments of what are probably fish bone were adhering to the interior wall. *Bottom:* cat. 1520 B91 layer 10:11. A carinated burial jar in pristine condition. The surfaces are smooth and burnished over a medium fine fabric. Diameters: rim width 120 mm, carination point 135 mm, height 73 mm, to carination 20 mm, thickness at rim 4 mm. Slab construction. The fabric texture suggests a biscuit firing. Interior surfaces are reduced and the exterior is oxidized with fire clouds near the rim, which together suggest that the vessel was fired upside down. FG2. Colour: 2.5YR/6/4 (oxidized), 2.5YR/2.5/0 (reduced). Quality: very good to excellent. This jar is almost identical to cat. 1519. Scale segments are 5 mm

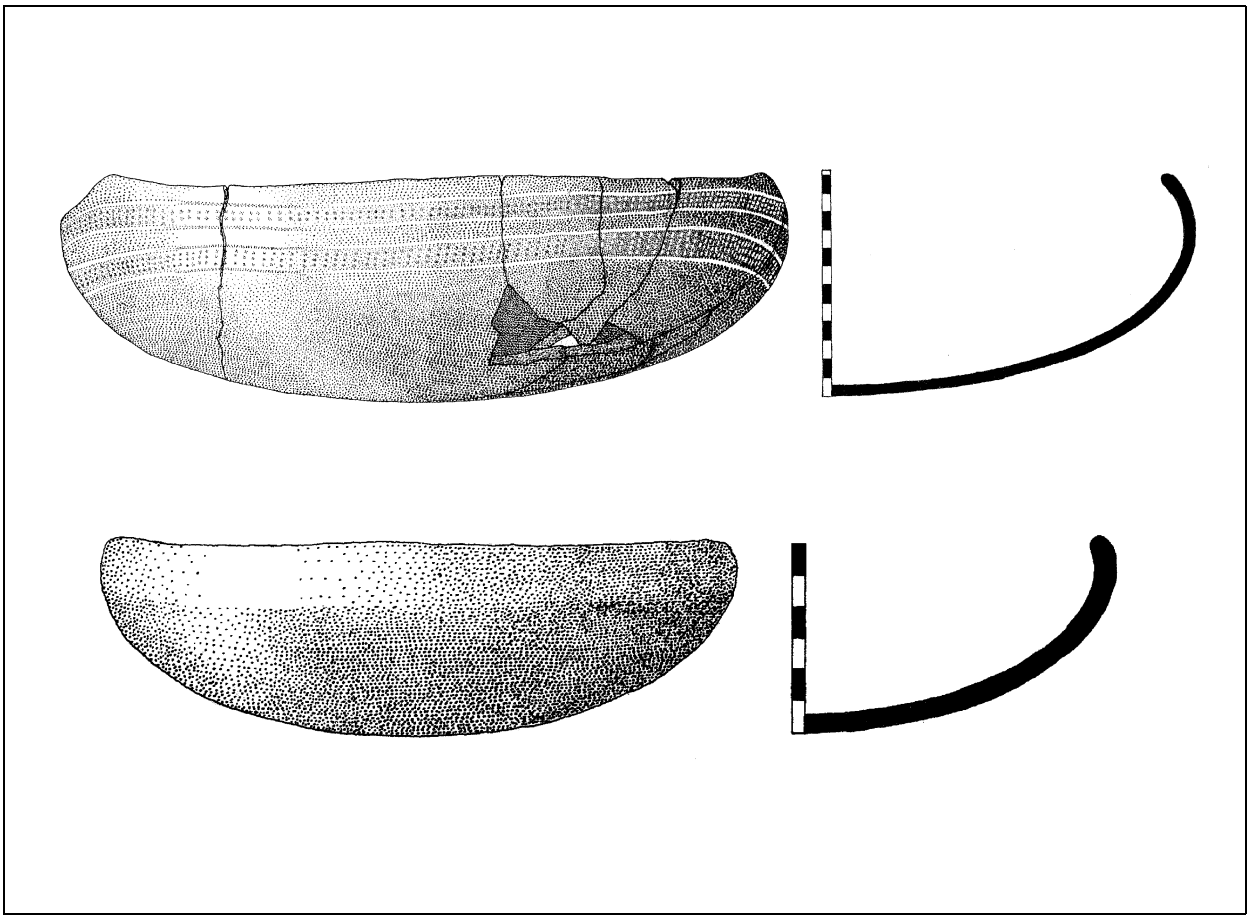


FIG. 114: Mortuary vessels. *Top*: cat. 1517 B91 layer 10:11. A shallow decorated bowl. The surface has been meticulously smoothed and burnished to produce a lustrous sheen. A single rim with a similar profile to cat. 1517 was noted in the general matrix, however this vessel is unique in the mortuary assemblage. The surfaces are smoothed and burnished over a medium fine fabric. Although badly broken, about 90% was recovered for reconstruction. Three decorative "peaks" are triangulated precisely around the rim circumference (170/165/165 mm). The rim edge and decorative bands have been impressed with the side of an *Anadara* shell. Diameters: width 196 mm, height 44 mm, thickness 4 mm. Slab construction. The fabric texture suggests that this vessel has been biscuit fired. Within the vessel the surfaces are essentially oxidized while about 30% of the exterior is covered with fire clouds. FG2. Colour: 2.5YR/5/4 (oxidized), 2.5YR/4/2 (fire clouds). Although the vessel was shattered, it is otherwise in pristine condition. This could indicate that it was purposely created for inclusion as funerary furniture. It is a vessel of outstanding quality. The form is gracile, the finish expertly rendered, while the colour and lustrous surface finish provide a rich warm quality; clearly the work of an expert potter. *Bottom*: cat. 1620 B123 layer 10:10. A simple miniature bowl. The medium fine fabric is smoothed and burnished. Two large fragments are missing. Diameters: width 101 mm, height 29 mm, thickness 3.5-4 mm. Slab construction. Biscuit fired. The surfaces are barely oxidized leaving a black core. FG6. Colour: 2.5YR/6/6. Quality: average; the shape is slightly irregular and the surface is incompletely burnished. Scale segments are 5 mm

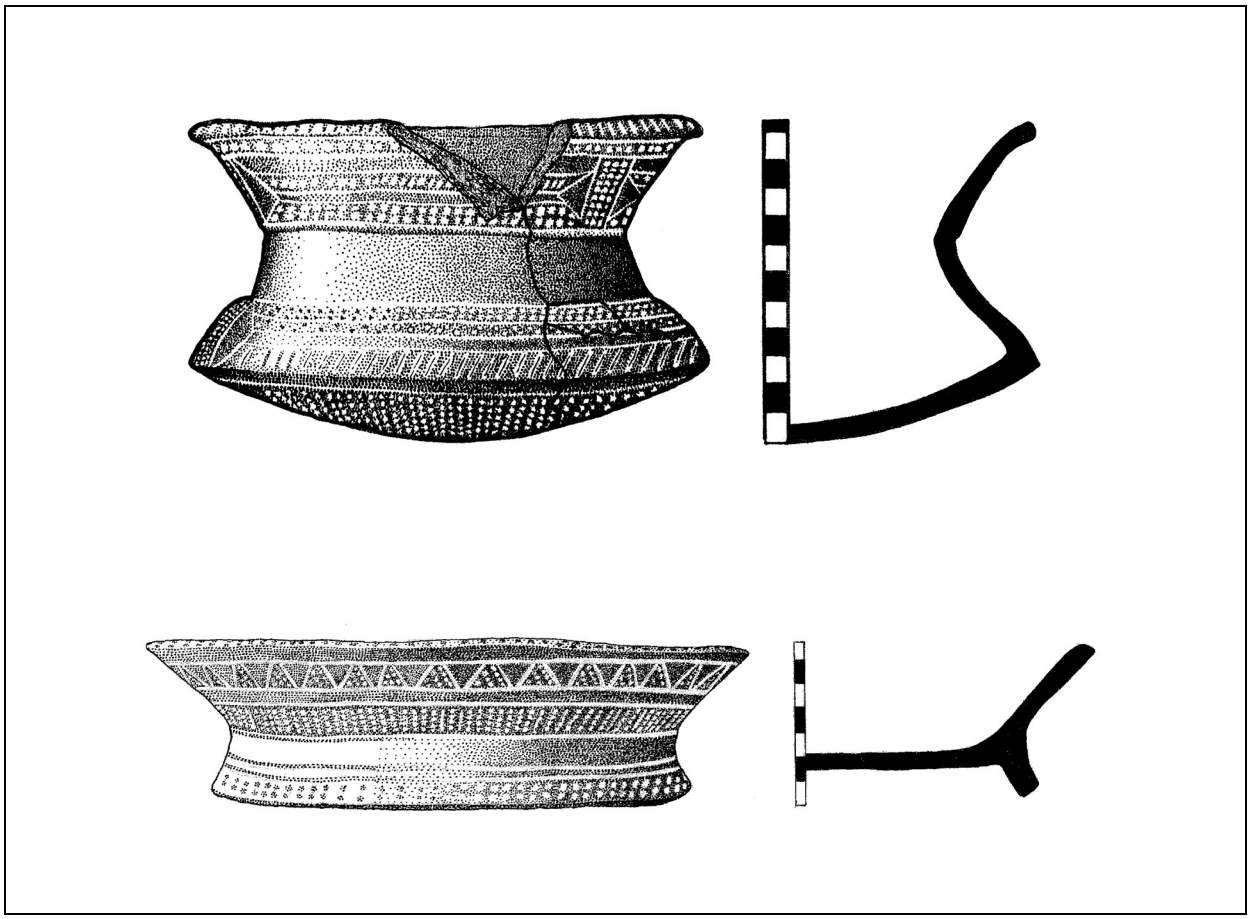


FIG. 115: Mortuary vessels. *Top*: cat. 1619 B123 layer 10:10. A miniature carinated jar. The surfaces are smoothed and carefully burnished over a medium fine fabric. Although badly broken, about 80% was recovered for reconstruction. The rim edge is decorated with *Anadara* shell impressions. Beneath the rim are distinctive geometric motifs (Hall 1993:247, Fig.101:c3:13) which feature a central medallion composed of a vertical rectangle filled with punctate impressions and bounded on either side by a plain outwards facing triangle. This motif is repeated once on a band immediately above the carination point. The base is also covered with punctate impressions. Diameters: rim width 88 mm, carination point 90 mm, height 54 mm, to carination 14 mm, thickness 4 mm. The vessel was biscuit-fired. The interior and lower half of the exterior is reduced and the upper half oxidized with fire clouds near rim. FG2. Colour: 2.5YR/5/4 (oxidized), 2.5YR/3/2 (reduced). Although a high energy vessel, much of the detailed decoration is irregular. *Bottom*: cat. 1618 B123 layer 10:10. A miniature burnished and decorated platter. Extensively fractured, about 95% was recovered for reconstruction. The rim edge and decorative fields have been impressed with the side of an *Anadara* shell. Diameters: rim 119 mm, base 97 mm, height 30 mm, base 15 mm, thickness 5 mm. Slab construction. Biscuit fired upright. The interior is mainly reduced, the exterior fully reduced with flares to the rim edge. FG2. Colour: 2.5YR/5/4 to 2.5YR/3/2. Quality: the shape is distorted and the decoration detailed but imprecise. Scale segments are 5 mm

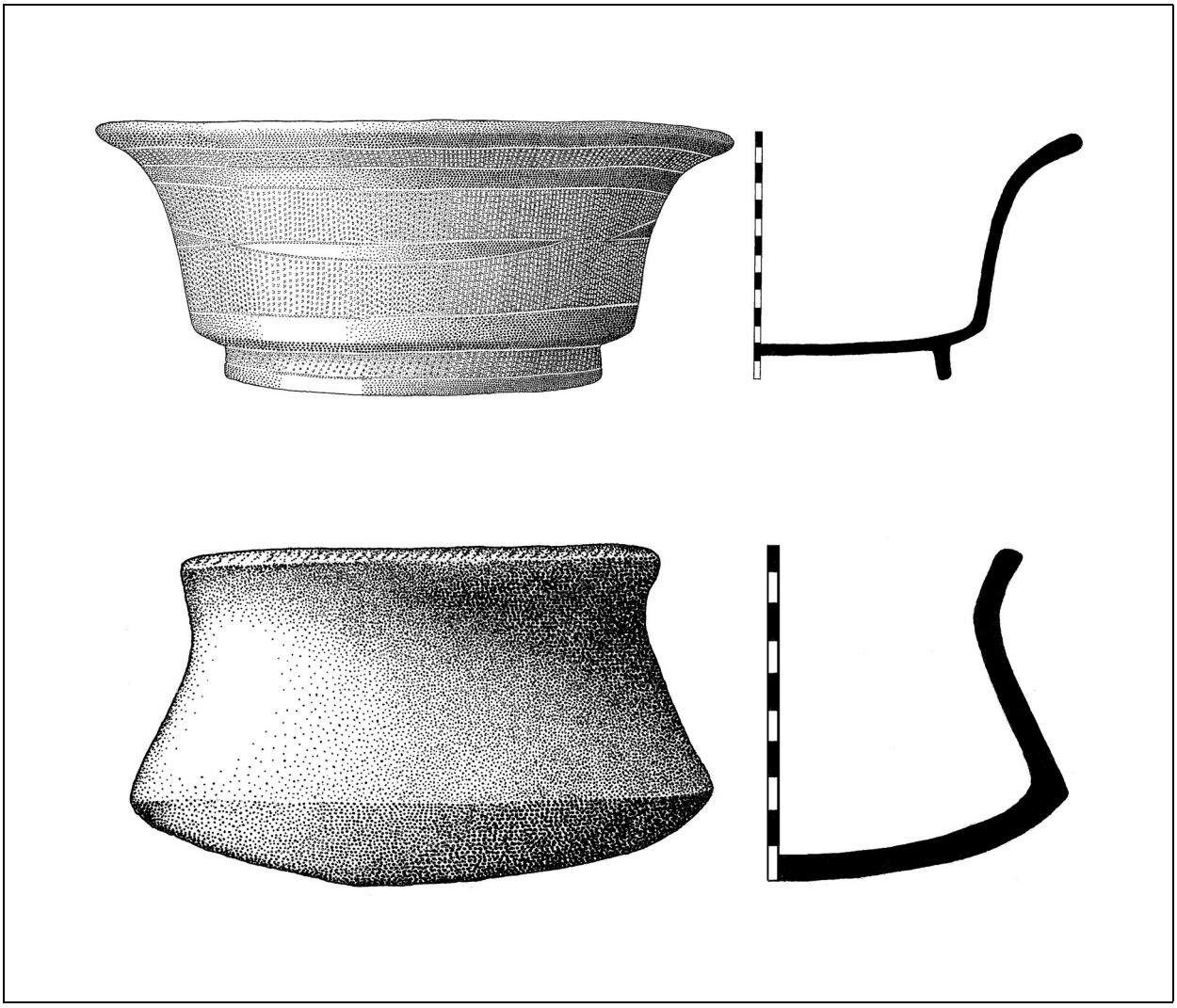


FIG. 116: Mortuary vessels. *Top*: cat. 1450 B89 layer 10:10. A burnished and decorated bowl. Extensively fractured, about 80% was recovered for reconstruction. The fields and rim edge have been impressed with an *Anadara* shell. Diameters: rim 176 mm, bowl bottom 120 mm, base 105 mm, height 59 mm, base 10 mm, wall thickness 2.5 mm. Biscuit fired upright. Pitting and spalls to the base and lower walls indicate firing difficulties. The surfaces are reduced with interior flares. FG2. Colour: 5YR/2.5/1 to 5YR/5/6. Quality: excellent, an outstanding vessel. *Bottom*: cat. 1454 B88 layer 10:10. A roughly smoothed miniature bowl. Diameters: rim 68 mm, carination point 87 mm, height 45 mm, to carination 12 mm, thickness 4.5-5 mm. Residual cord marks are visible on the base ("Z" - 1.2/0 mm). Slab construction. Biscuit fired and oxidized throughout. FG2. Colour: 2.5YR/5/4. Quality: crudely made with a rough interior. Scale segments are 5 mm

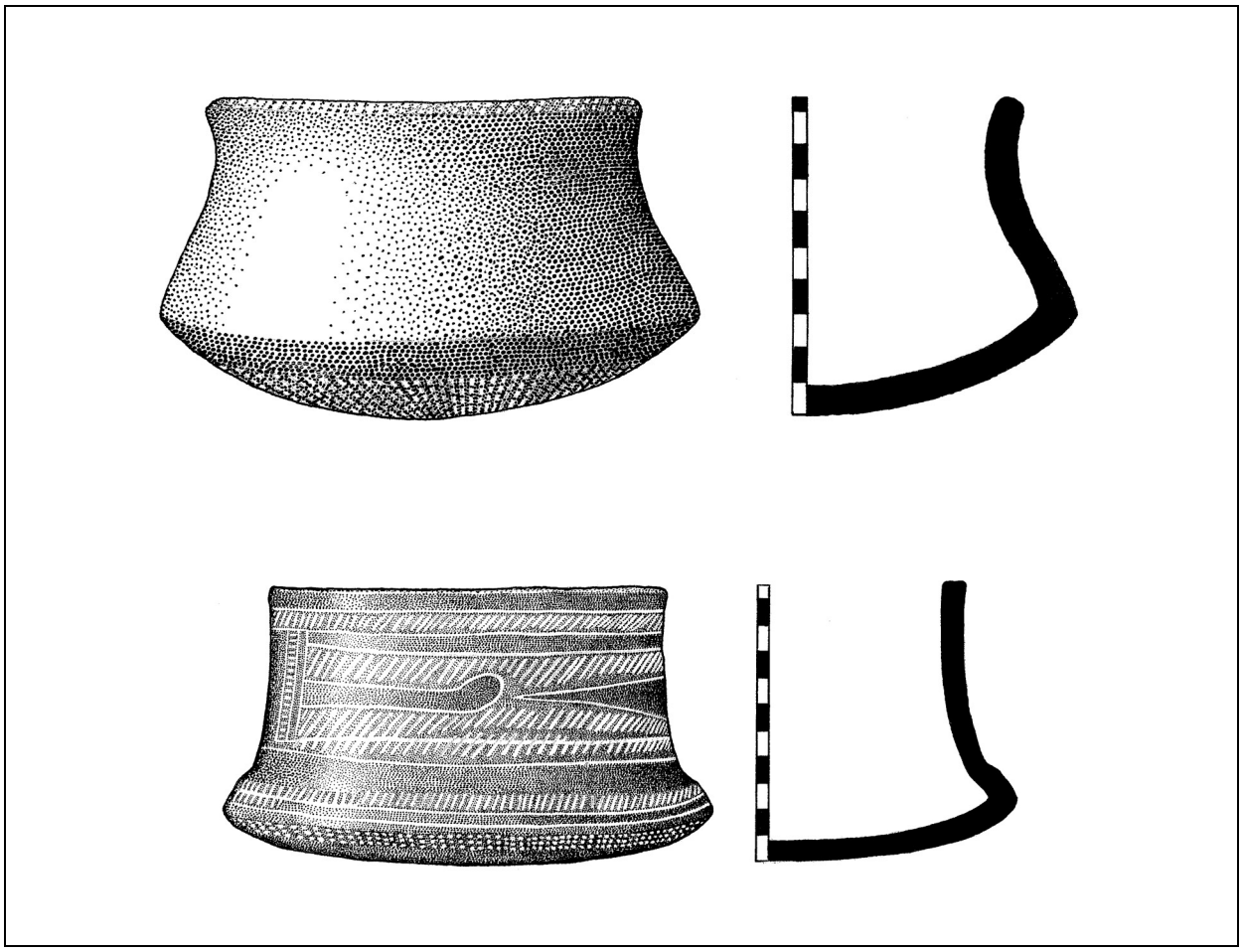


FIG. 117: Mortuary vessels. *Top*: cat. 1453 B88 layer 10:10. A miniature carinated burial jar, recovered intact. The carefully smoothed exterior contrasts sharply with a roughly smoothed interior and rim edges, over a medium fine fabric. Both the rim edge and the central portion of the base are cord-marked ("Z" - 1/0 mm). Diameters: rim 60 mm, carination point 75 mm, height 44 mm, to carination 15 mm, thickness at rim 4 mm, base 6-7 mm (est.). The vessel has probably been modelled from slabs rather than from a lump. Low(?) biscuit fired. Oxidized throughout apart from a small exterior fire cloud. FG6. Colour: 2.5YR/6/4. Quality: the impression from this crudely made vessel, which is in pristine condition, is that it was quickly made for interment. The smoothing is particularly rudimentary. *Bottom*: cat. 1599 B103 layer 10:9. A miniature decorated jar recovered intact. All of the surfaces are smoothed and burnished over a medium fine fabric. The decorative fields, base and rim edge have been impressed with an unidentified shell. Two opposing geometric motifs appear to symbolise a male phallus and female pubes. Diameters: rim 77 mm, carination point 96 mm, height 51 mm, to carination 8 mm, thickness 4 mm. A moderately high(?) biscuit firing. All of the surfaces are reduced except for the base which indicates the vessel was fired upside down. FG2. Colour: 2.5YR/5/6. Quality: excellent. This is a high energy miniature vessel with expertly finished surfaces. The form encapsulates much of the essence of the Khok Phanom Di CP2 ceramic style. Scale segments are 5 mm

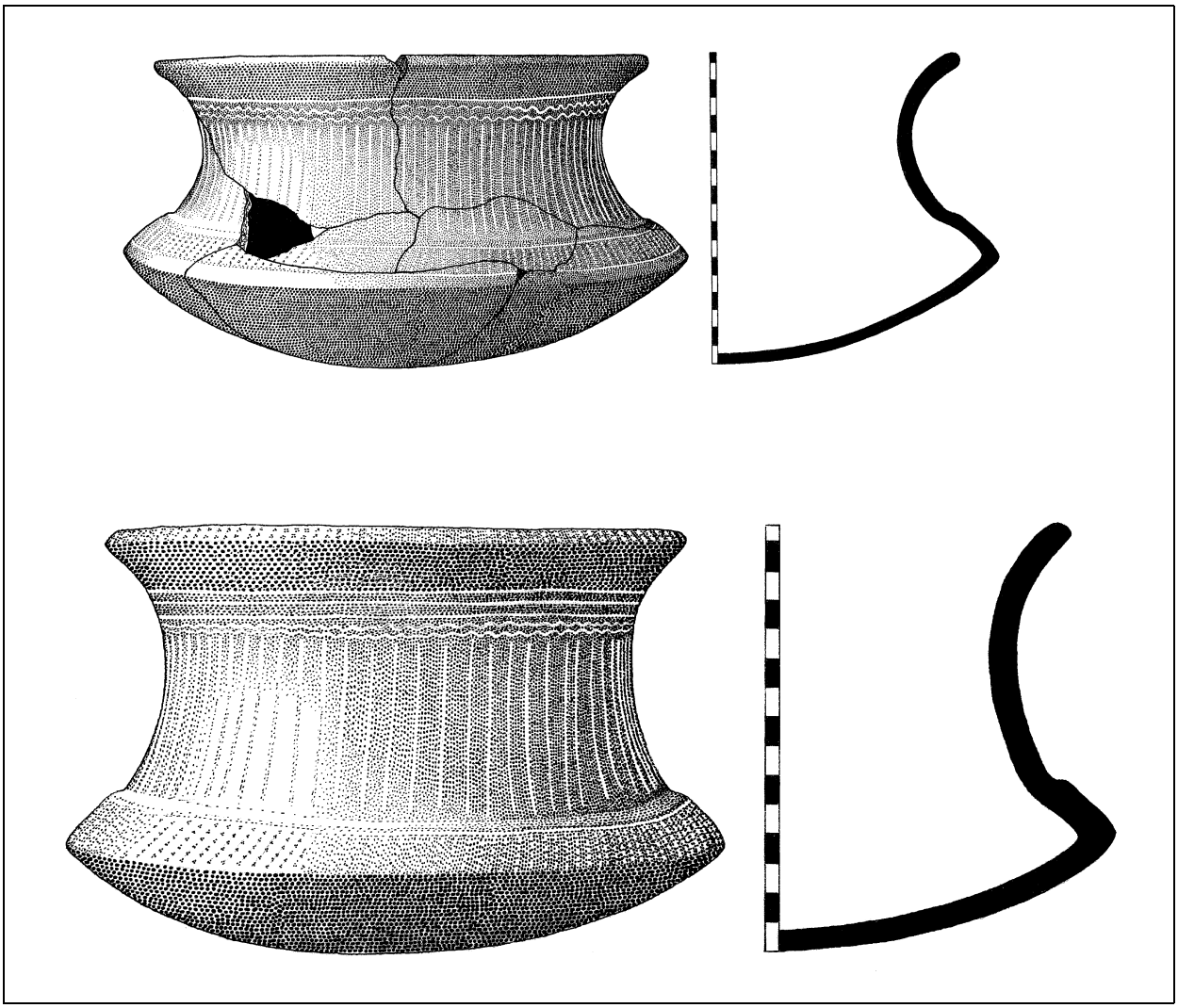


FIG. 118: Mortuary vessels: *Top:* cat. 1469 B93 layer 10:8. A carinated burial jar. The surface is smoothed and burnished over a medium fine fabric. Although badly shattered, about 80% was reconstructed. A band comprising one straight and two wavy incised lines circuits below the rim. The latter are *Anadara* shell impressions. A central field above the carination point is covered with equally-spaced vertical striations. A 6 mm wide field of *Anadara* shell impressions decorates a raised band extending 14 mm above the carination point. Diameters: rim 139 mm, carination point 162 mm, height 90 mm, to carination 37 mm, thickness 3 mm. Biscuit fired. All surfaces are reduced, except for the base, which displays several oxidized flares. This suggests an upside down firing. Slab construction. FG2. Colour: 2.5YR/5.5/4 to 2.5YR/2.5/0. Quality: excellent, both the shape and decoration are nearly perfect. *Bottom:* cat. 1480 B92 layer 10:8. A miniature carinated burial jar. The surfaces are smoothed and burnished over a medium fine fabric. Apart from severe spalling to the rim and adjacent wall, the vessel is essentially intact. Decoration comprises three straight and two wavy incised lines below the rim, an *Anadara* shell-impressed rim edge and raised carination field. Above the carination point is covered with equally-spaced light vertical striations made with a blunt stylus. Diameters: rim 97 mm, carination point 108 mm, height 67 mm, carination 17 mm, thickness 3 mm. Slab construction? Biscuit fired upside down. Reduced with a large flare on the base. FG2. Colour: 2.5YR/6/6 (oxidized), 2.5YR/2.5/0 (reduced). Quality: excellent (very thin walls reflect expert construction). Scale segments are 5 mm

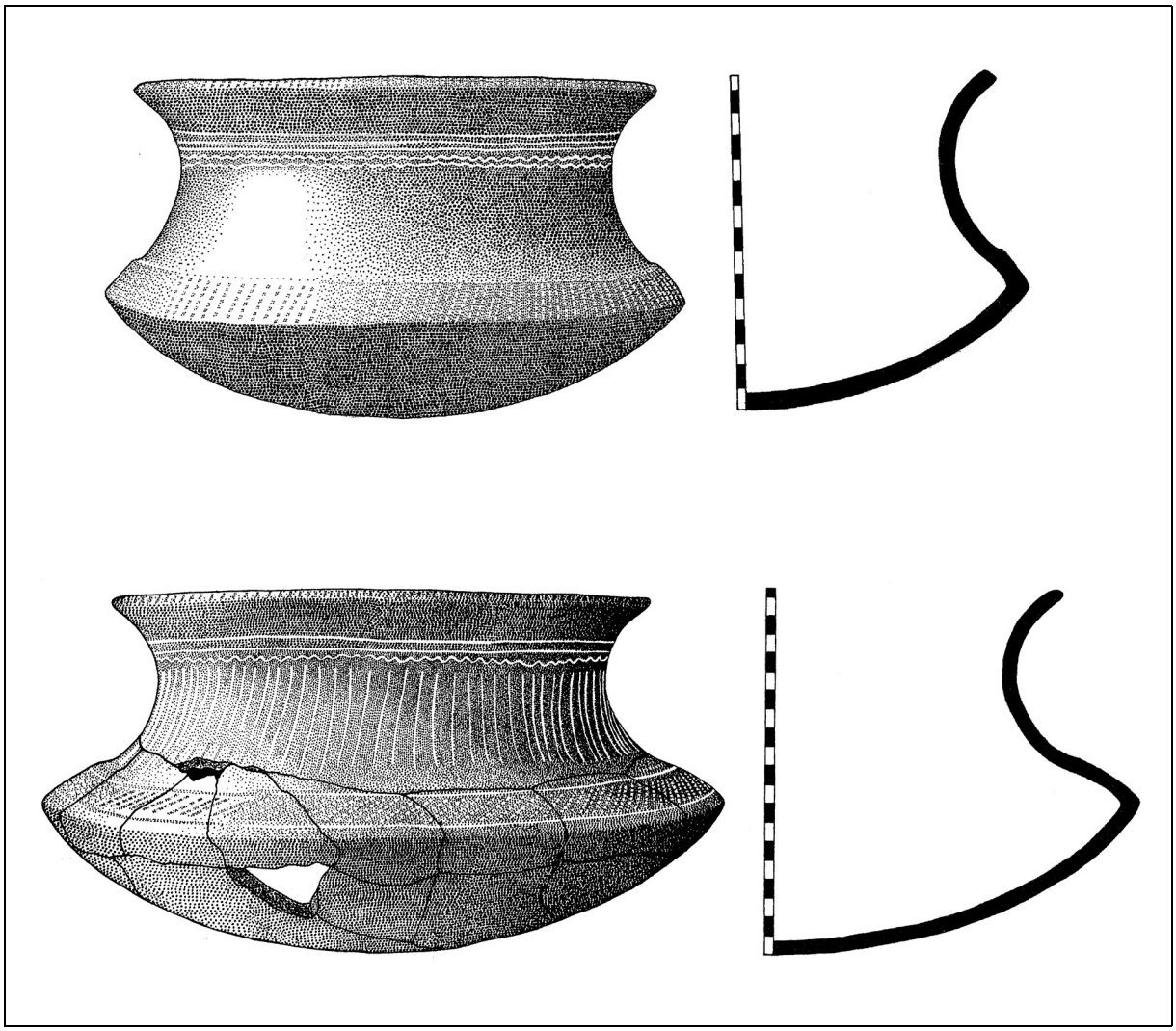


FIG. 119: Mortuary vessels. *Top*: cat. 1467 B90 layer 10:8. A carinated burial jar. Intact, with smoothed and burnished surfaces over a medium fine fabric. The interior has prominent ripples. A band comprising three straight and two wavy incised lines circuits below the rim. Vertical *Anadara* shell impressions decorate the 8–10 mm wide raised carination field and the rim edge. Diameters: rim 112.5 mm, carination point 127 mm, height 70 mm, carination 26 mm, rim thickness 3 mm. Slab construction? Biscuit fired upright, the interior is oxidized with faint fire clouds and the exterior half reduced with large oxidized flares on the base. Some spalling indicates firing or drying difficulties. FG2. Colour: 2.5YR/6/6 (oxidized), 2.5YR/2.5/2 (reduced). Quality: excellent, a high-energy vessel made to exacting standards. *Bottom*: cat. 1468 B93 layer 10:9. A carinated burial jar. The surfaces are carefully smoothed and burnished over a medium fine fabric. Recovered in a badly shattered condition, about 90% was reconstructed. A band comprising one straight and two wavy incised lines (*Anadara* shell impressions), circuits below the rim. A central field above the carination point is covered with equally-spaced vertical striations made with a blunt stylus end. A 12 mm wide field of impressions made with the side of an *Anadara* shell decorates a raised band which extends for 18 mm above the carination point and the rim edge. Diameters: rim 154 mm, carination point 194 mm, height 92 mm, to carination 40 mm, thickness 3 mm. This vessel was constructed from slabs and biscuit fired upside down. It is completely reduced except for flares at the rim and the base, particularly near the carination. Minor surface spalling is evident. FG2. Colour: 2.5YR/5/6 (oxidized), 2.5YR/2.5/2 (reduced). Quality: excellent, a high energy ware precisely formed and decorated. Scale segments are 5 mm

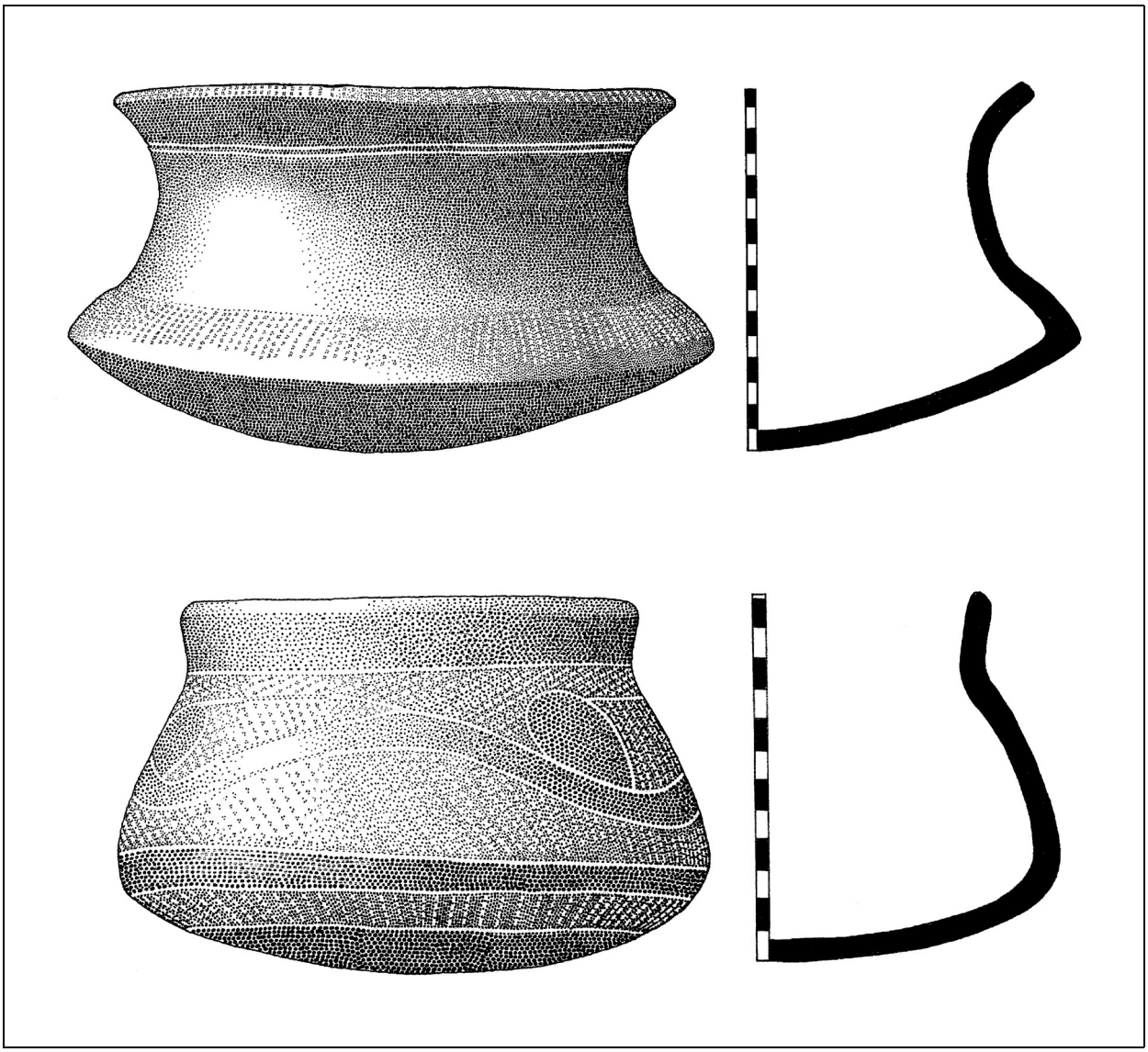


FIG. 120: Mortuary vessels. *Top*: cat. 1466 B90 layer 10:8. An intact carinated burial jar with carefully smoothed and burnished surfaces over a medium fine fabric. Two straight incised lines circuit below the rim. Vertical impressions, some made with the side of an *Anadara* shell, decorate a 18 mm wide raised band above the carination point and the rim edge. Remnant cord marks are visible on the central body. Diameters: rim 119 mm, carination point 139 mm, height 77 mm, carination 26 mm, thickness 3 mm at rim. Slab construction. Biscuit fired. The surfaces are oxidized except for slight flares on the base. FG2. Colour: 5YR/6/4. Quality: excellent. *Bottom*: cat. 2019 B86 layer 10:8. A miniature tripod jar. Intact, except for very minor chipping around the rim and missing tripod feet. The surfaces are carefully smoothed and burnished over a medium fine fabric. A distinctive motif comprised of an undulating band with near oval forms located near the minima is located within a broad central band filled with *Anadara* shell impressions (see Hall 1993:247, Fig. 101e 3:15). A narrow *Anadara* shell-impressed band skirts the base. Round (15–16 mm diam.), fracture points are visible on the base where three feet have been detached. Diameters: rim 72 mm, base 89 mm, height 54 mm, rim 10 mm, thickness 3 mm at rim. This vessel was probably modelled. Biscuit fired (oxidized), with minor fire clouds. FG2. Colour: 2.5YR/4/2. Quality: excellent, an important vessel linking local traditions with tripod wares. Scale segments are 5 mm

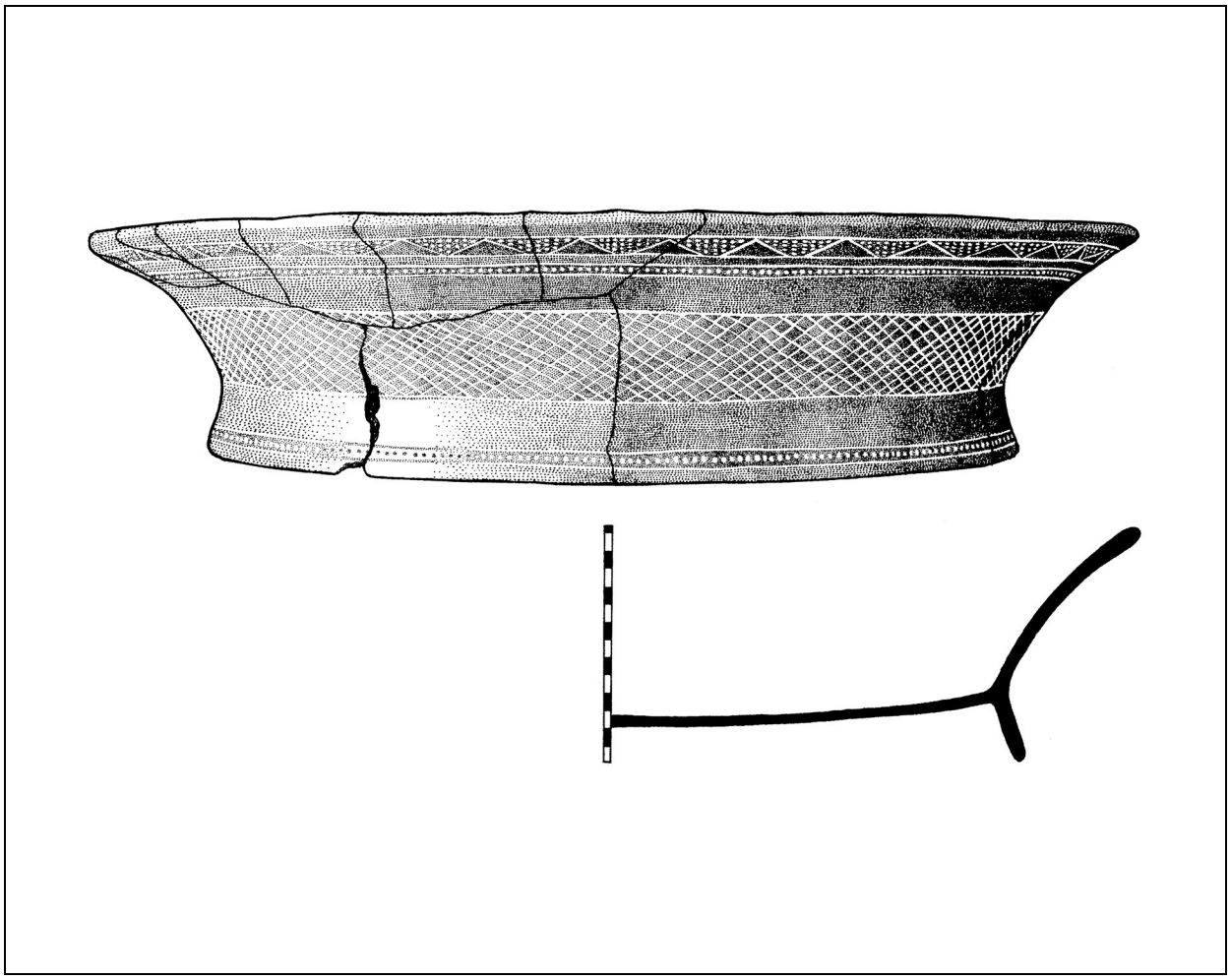


FIG. 121: Mortuary vessels: cat. 1465 B90 layer 10:8. An ornamental platter with a concealed base. The surface is smoothed and highly burnished over a medium fine fabric. Although the platter was very badly shattered when recovered about 90% was able to be reconstructed. Beneath the rim is a narrow band decorated with running triangles filled with *Anadara* shell impressions, underlined by an even narrower band filled with circular stylus impressions. A broad central band displays cross-hatched incised lines 1.5 mm wide, 0.25 mm deep made with a rounded stylus. A lower band filled with irregular-shaped probe marks skirts the base. Diameters: rim 303 mm, base 237 mm, height 63 mm, platter floor 21 mm, thickness 4.5 mm. Slab construction. Biscuit fired upright. All surfaces, except the platter floor, which is slightly oxidized, are reduced. The exterior wall has several firing spalls, the largest, measuring 25 by 15 mm, has damaged the central band. Any incised lines lost by the spalling have been re-instated by scratching with a hard point after the vessel was fired. FG2. Colour: 2.5YR/5/4 (oxidized), 2.5YR/2.5/0 (reduced). Quality: excellent, with very careful attention paid to burnishing all surfaces. Considerable effort was required to re-instate incised lines lost to spalling. Repairs of this kind suggest that a high value was attached to such vessels. Scale segments are 5 mm

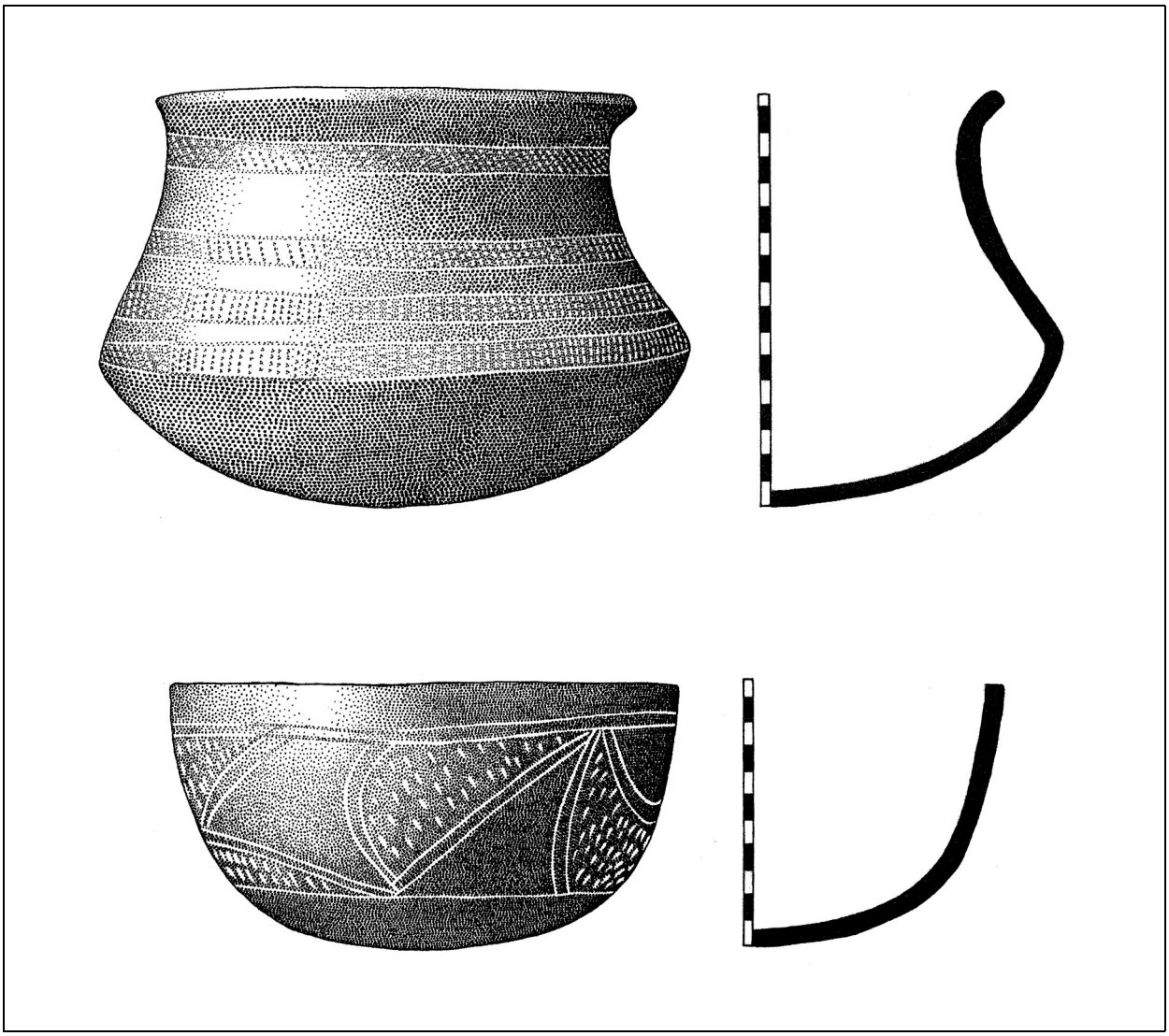


FIG. 122: Mortuary vessels. *Top*: cat. 2020 B86 layer 10:8. A carinated burial jar. Both interior and exterior surfaces are smoothed and highly burnished over a medium fine fabric. Although badly shattered when recovered about 75% of the vessel has been reconstructed. Two narrow bands filled with *Anadara* shell impressions circuit the body. An undulating motif runs through a broad band above the carination point. This and the rim terminus are filled with *Anadara* shell impressions. The incised lines were cut to 0.5 mm with a 1 mm wide round stylus. Diameters: rim 96 mm, carination point 107 mm, height 80 mm, carination 29 mm, thickness 4-5 mm. A clear join is visible at the carination point indicating slab construction. Biscuit fired upright, the surfaces are oxidized with fire clouds. FG6. Colour: 7.5YR/6/4. Quality: excellent. Some post-deposition surface erosion. *Bottom*: cat. 1375 B75 layer 10:7. An intact burnished cup. Smoothed and burnished over a medium fine fabric. A curvilinear, apparently abstract, motif encompasses the body (see Hall 1993:247, Fig. 101, f 3:16). The fields are filled with triangular punctate impressions made with the end of a 1.5 mm wide square stylus. Diameters: rim 101 mm, height 51 mm, thickness 4 mm at rim. The base is deeply concave upwards for stability (not shown). Modelled from slab? Biscuit fired with a barely reduced interior and oxidized exterior with fire clouds on the base. A vertical shrinkage crack and two firing spalls (30 by 15 mm and 6 mm^2) have damaged the motif. FG2. Colour: 5YR/6/4. Quality: very good, marred by an irregular shape, a shrinkage crack and spalling. Scale segments are 5 mm

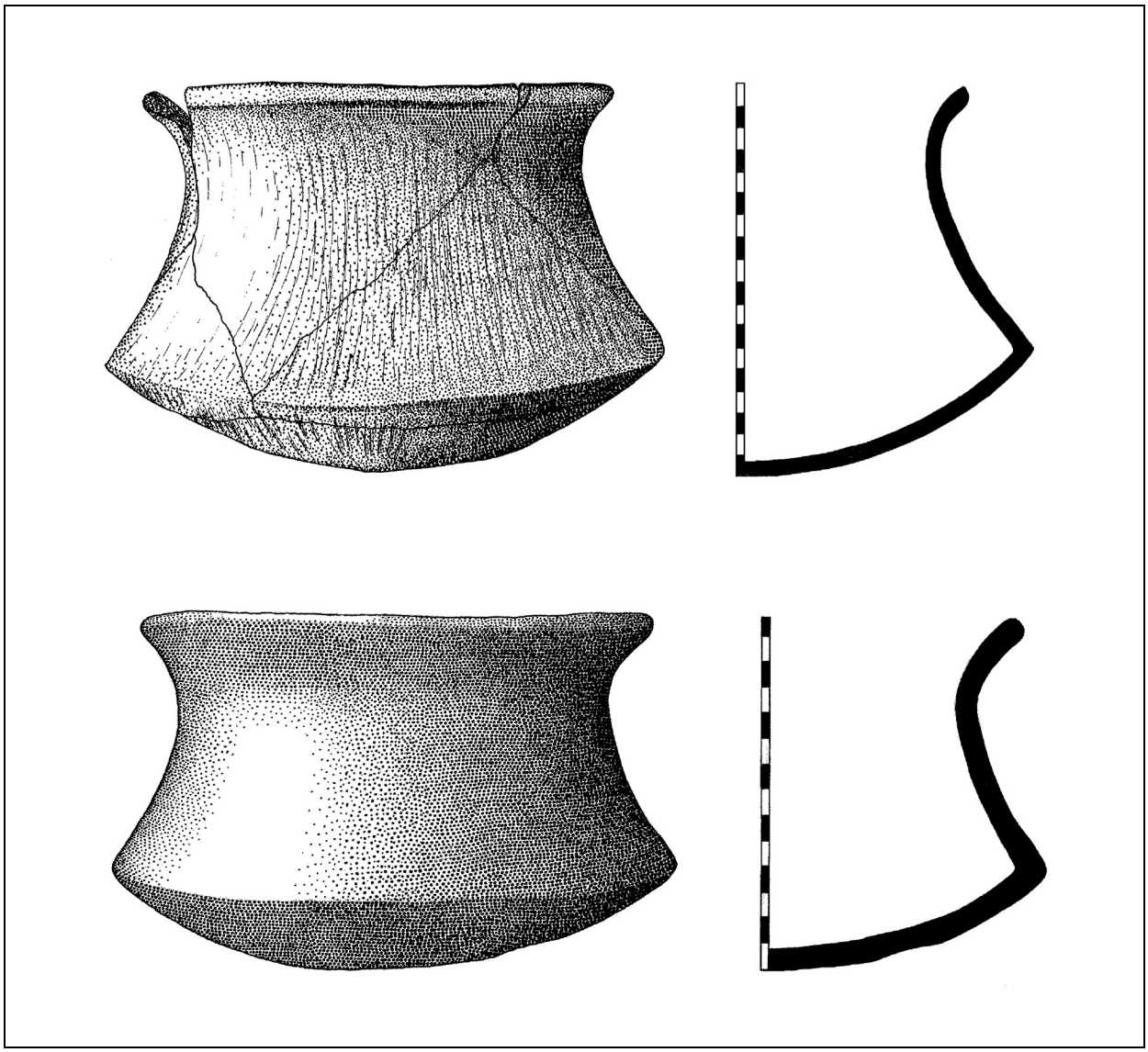


FIG. 123: Mortuary vessels. *Top*: cat. 1478 B73 layer 10:7. A carinated burial jar. The interior surface is roughly smoothed over a medium fine fabric. Vertical striations, probably made by wiping the plastic clay with a soft material, cover the exterior above the carination. Although badly shattered, about 90% of the vessel has been reconstructed. Several remnant cord marks are visible on the base where the smoothing is incomplete ("Z" - 1/1 mm). Diameters: rim 112 mm, carination point 134 mm, height 87 mm, carination 27 mm, thickness 4 mm. Slab construction. Biscuit fired. Oxidized with fire clouds. FG2. Colour: 5YR/6/4 (oxidized), 5YR/3/1 (fire clouds). Quality: good proportions, however the surface finish is rudimentary. *Bottom*: cat. 1479 B73 layer 10:7. A carinated burial jar in pristine condition. The surface is smoothed over a medium coarse fabric leaving some cord mark remnants visible ("Z" - 1/1 mm). Diameters: rim 100 mm, carination point 111 mm, height 65 mm (est.), to carination 16 mm (est.), thickness 3.5-4 mm. Slab construction. Although probably biscuit-fired upside down, three important features suggest an excessive firing duration. A major vertical shrinkage crack extends from the rim to below the carination point, a 60 mm diameter circular spall about 3 mm deep is missing from the base and except for a very minor smudge the vessel is oxidized. FG2. Colour: 2.5YR/6/6. Quality: average. This burial jar was probably quickly made. Scale segments are 5 mm

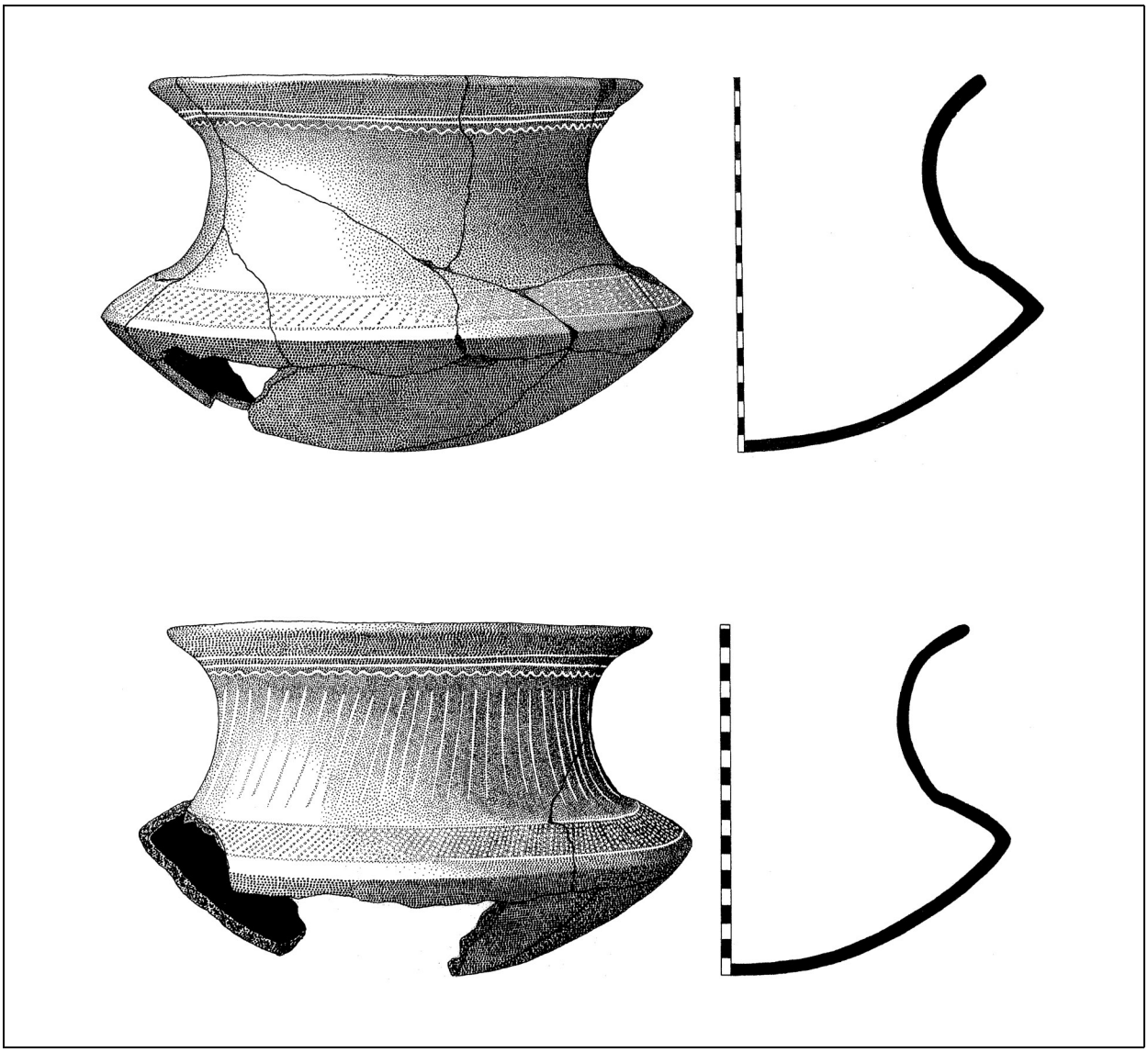


FIG. 124: Mortuary vessels. *Top*: cat. 1360 B72 layer 10:7. A carinated burial jar. Smoothed and burnished over a medium fine fabric. Extensively fractured, about 85% was reconstructed. The decoration mirrors cat. 1361 except that it lacks a central field. Diameters: rim 139 mm, carination point 166 mm, height 100 mm, carination 36 mm, thickness 4 mm. Slab construction. Biscuit fired. The exterior is oxidized with one fire cloud, the interior is partly oxidized with extensive fire clouds. FG2. Colour: 2.5YR/6/4 (oxidized), 2.5YR/2.5/0 (reduced). Quality: excellent, except for minor shape distortions and micro-fine surface shrinkage(?) fissures. *Bottom*: cat. 1361 B72 layer 10:7. A carinated burial jar with smooth burnished surfaces over a medium fine fabric. Although badly shattered when recovered about 60% has been reconstructed. A band of two straight and a wavy *Anadara* shell-impressed line circuits below the rim. Above the carination point is covered with vertical comb-like striations (2–4 mm apart), probably made with the end of a bamboo style. Each striation includes 4 or 5 micro-lines about 1.5 mm wide. A 14 mm wide field of impressions made with the side of an *Anadara* shell decorates a raised band which extends for 22 mm above the carination point. Diameters: rim 141 mm, carination point 169, height 108 mm, carination 49, thickness 3 mm. Slab construction. Biscuit fired upside down. The interior is mainly reduced with oxidized flares at the rim. Above the carination is oxidized, below is mainly reduced with flares. FG2. Colour: 5YR/6/4 to 5YR/4/1. Quality: excellent, the surface is only marred by a few minute firing spalls. Scale segments are 5 mm

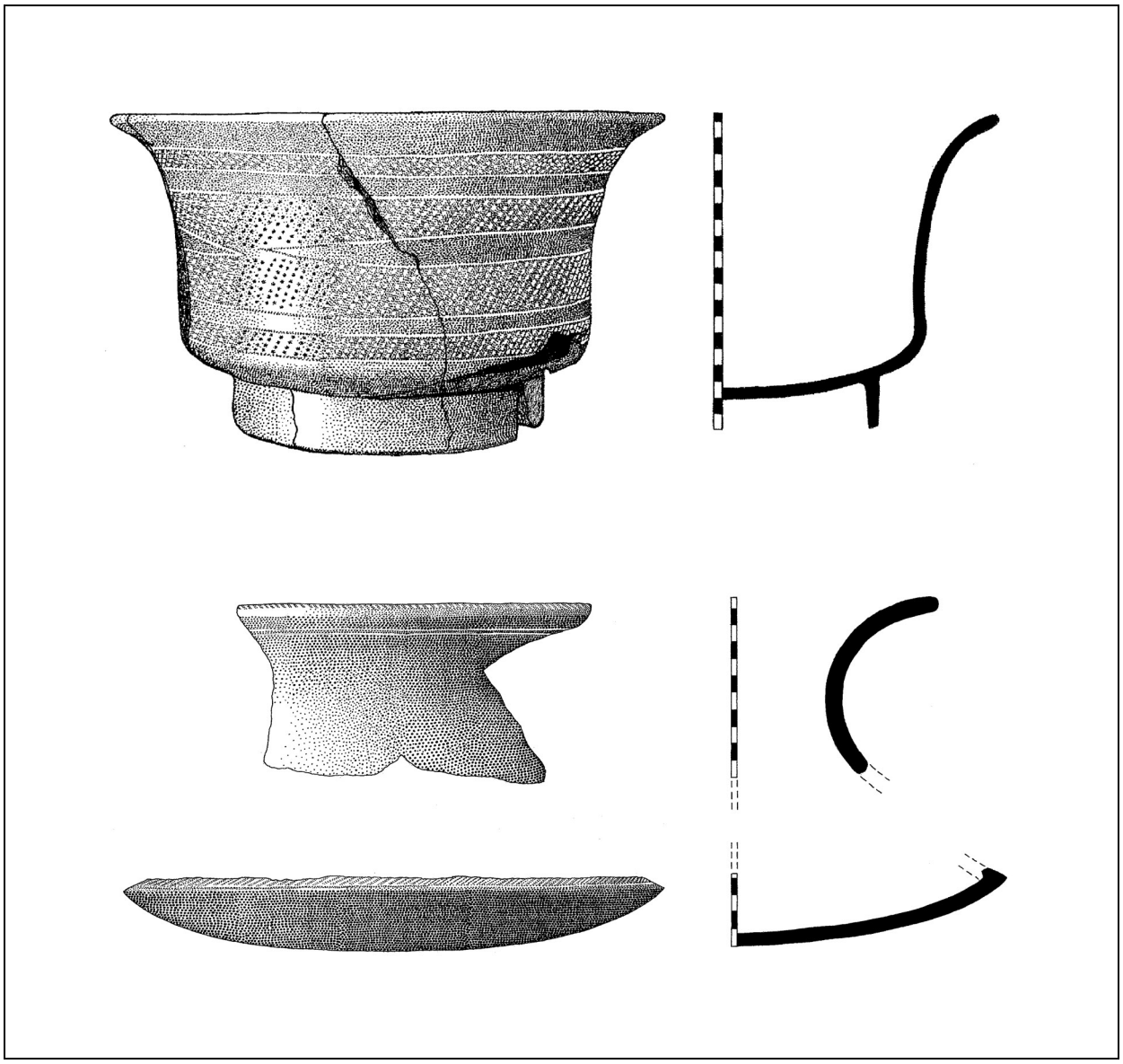


FIG. 125: Mortuary vessels. *Top*: cat. 1359 B72 layer 10:7. A small footed ornamental bowl.The surface is smoothed and burnished over a medium fine fabric to produce a lustrous effect. About 95% of the vessel was able to be reconstructed from broken sherds. A 10 mm wide band, filled with *Anadara* shell impressions, decorates the interior rim lip. The exterior displays three such bands, the wider central field includes a burnished double lentiform motif along its central axis. The incised lines have been made with a 1 m wide round stylus. Diameters: rim 68 mm, bottom 125 mm, base 98 mm, height 98 mm, base 18 mm, thickness 3.5-5 mm. Slab construction? Biscuit fired, and reduced throughout. FG2. Colour: 5YR/2.5/1. Quality: excellent in all respects, a very high energy creation. *Bottom*: cat. 2016 B76 layer 10:6. A carinated burial jar. The surfaces are smoothed and burnished over a medium fine fabric. About 60% has been reconstructed from sherds. See cat. 1361 for a close comparison. Two incised lines circuit below the rim which, along with the carination point, is decorated with *Anadara* shell impressions. Diameters: rim 180 mm, carination point 160, height 82 mm (est.), carination 28, thickness 3.5 mm. Slab construction. Biscuit fired upright. Most of the interior and upper exterior are reduced. Two thirds of the base is oxidized. FG2. Colour: 7.5YR/6/4 (oxidized), 7.5YR/2/0 (reduced). Quality: excellent. Scale segments are 5 mm

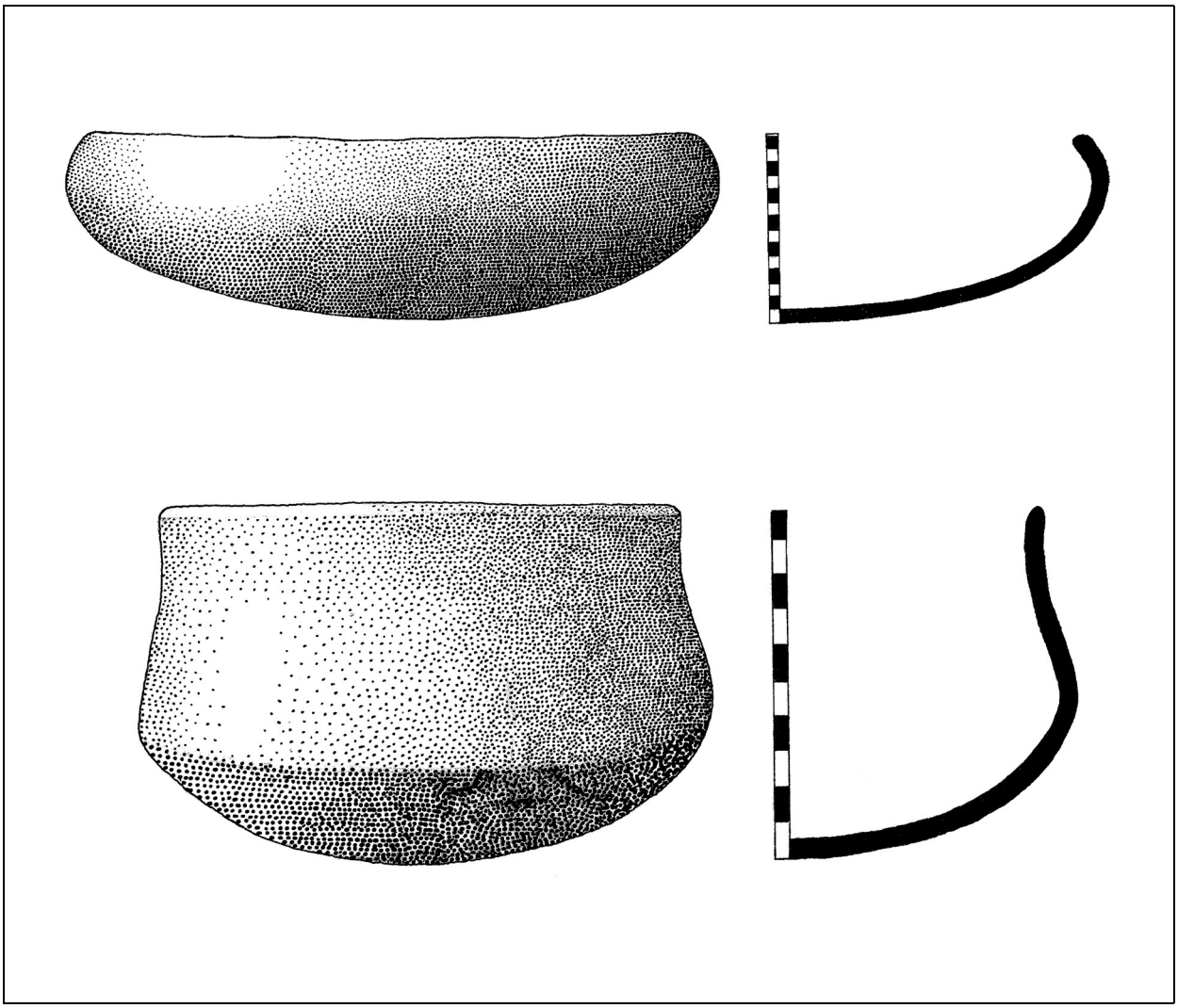


FIG. 126: Mortuary vessels. *Top*: cat. 1391 B74 layer 10:6. A large shallow inverted bowl. Although badly shattered when recovered, about 90% of the vessel was able to be reconstructed. The surfaces are smoothed and burnished over a medium fine fabric. Diameters: rim 218 mm (interior), wall 240 mm, height 77 mm, thickness 4–4.5 mm. Slab construction. Low(?) biscuit fired upright. The vessel is oxidized except for fire clouds which cover about 20% of the base. FG3. Colour: 7.5YR/6/4. Quality: average, the shape is irregular. It is likely that such vessels were difficult to shape and fire. *Bottom*: cat. 1392 B74 layer 10:6. A small utilitarian jar. The rim was removed in prehistory. About 90% of the vessel survived intact. Remnant cord marks are visible where the surface has been incompletely smoothed over a medium fine fabric. The interior is roughly smoothed. Clear cord marks show a "S" twist, (1/0.25), with a steep helix angle. Diameters: rim 74 mm, carination point 84 mm, height 52 mm, thickness: rim 3 mm, body 6.5 mm (at maximum diameter). The bowl was probably modelled directly from a lump of clay. Low(?) biscuit-fired, the interior is oxidized with minor "smudges" and the exterior fully oxidized. FG3. Colour: 2.5YR/6/4 to 2.5YR/2.5/0. Quality: average, roughly made with a minimum of effort. Scale segments are 5 mm

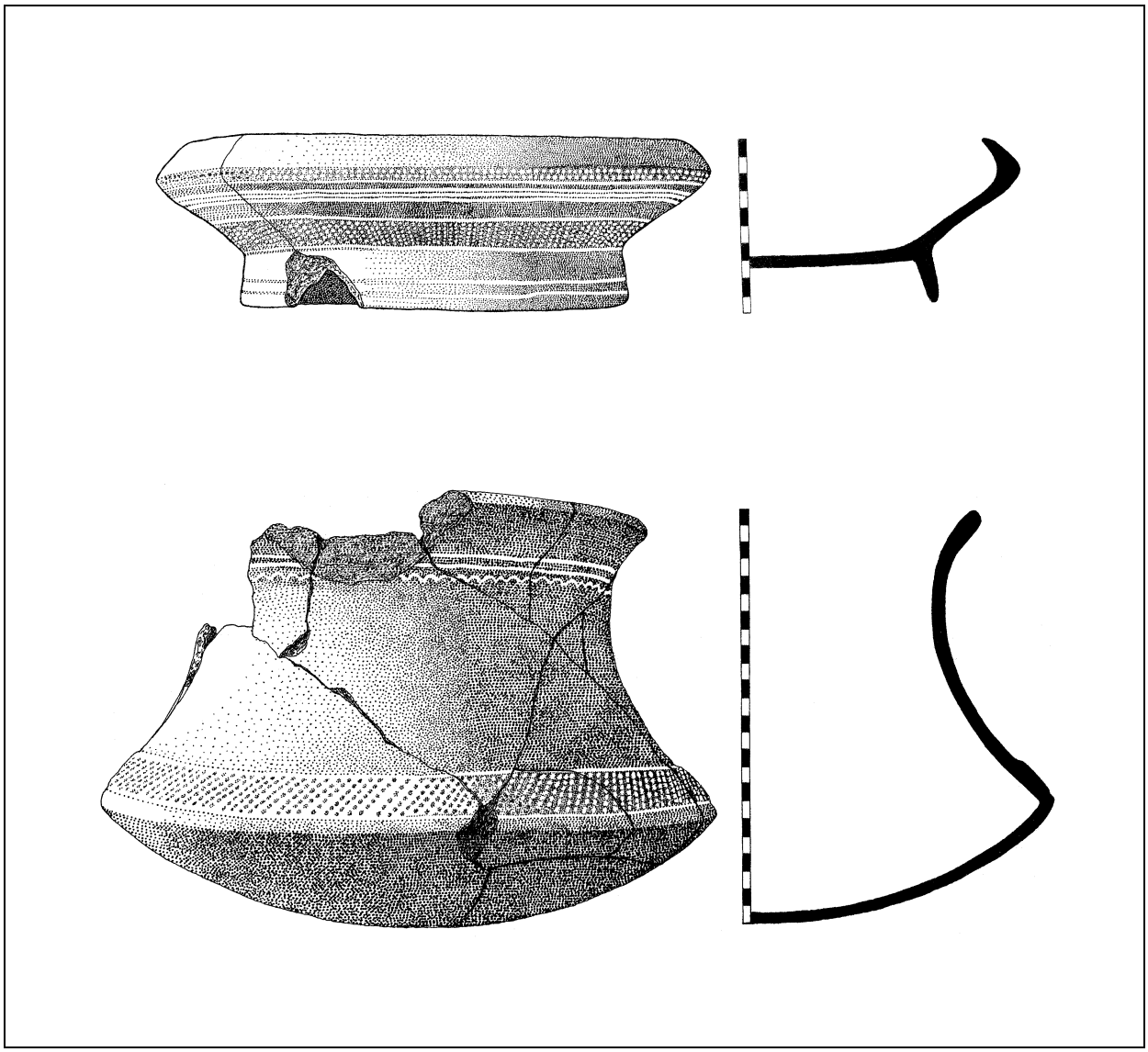


FIG. 127: Mortuary vessels. *Top*: cat. 1390 B74 layer 10:6. An ornamental carinated platter with a ring foot. Although badly shattered when recovered, about 90% of the vessel has been reconstructed. The surfaces are smoothed and burnished over a medium fine fabric. Two bands filled with *Anadara* shell impressions decorate the bowl. Three incised lines circuit between these bands and two at the base. Diameters: rim 148 mm, carination 166 mm, base 117 mm, height 49 mm, carination 40 mm, base 16 mm, thickness 4–4.5 mm. Constructed from slabs and biscuit-fired upright. All surfaces, except within the ring base, which is reduced, are oxidized. FG3. Colour: 10R/5/6. Quality: although highly decorated the effect is marred by slight shape and decoration imperfections (see also cat. 1518). *Bottom*: cat. 1432 B67 layer 10:6. A carinated burial jar. Smoothed and burnished inside and out over a medium fine fabric. Extensively fractured, about 70% was reconstructed. The decoration mirrors cat. 1360 (the carination field is 12.5 mm wide). Remnant cord marks are visible beneath eroded surfaces. Diameters: rim 160 mm, carination point 186 mm, height 118 mm, thickness 4 mm. Constructed from slabs and biscuit-fired upside down. The surfaces are slightly reduced with some "flares" on the external base. Very fine surface cracks suggest drying difficulties. FG3. Colour: 2.5YR/5.5/4 (oxidized), 2.5YR/3/0 (reduced). Quality: excellent, only blemished by slight shape irregularities. Scale segments are 5 mm

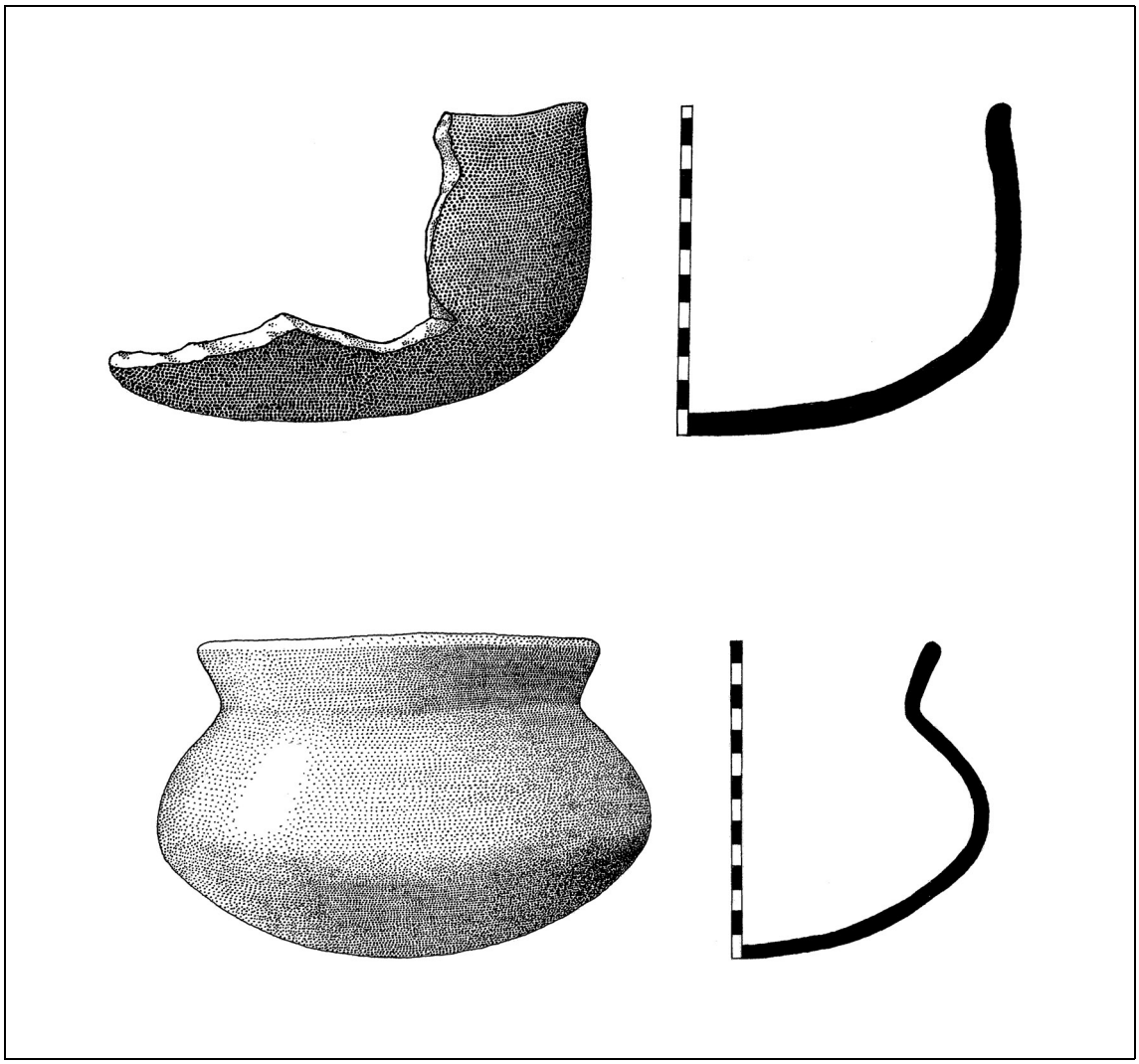


FIG. 128: Mortuary vessels. *Top*: cat. 1320 B64 layer 10:5. A small utilitarian jar. Approximately 40% is missing. All surfaces are roughly smoothed over a coarse fabric. The rim slopes inwards about 45°. Diameters: rim 120 mm (est.), height 65 mm (est.), thickness, (wall) 5 mm, base 8–10 mm. Modelled from slabs(?) and biscuit-fired upside down. All surfaces, except both sides of the base, which is reduced, are oxidized. FG3. Possible remnant cord marks are visible on the rim. Colour: 2.5YR/5.5/4. Quality: crudely formed. *Bottom*: cat. 1319 B64 layer 10:5. A small carinated jar. Four pieces were recovered which represented about 90% of the complete vessel. All surfaces have been carefully smoothed over a moderately coarse sandy fabric. Diameters: rim 89 mm, carination point 106 mm, height 68 mm, rim 15 mm, thickness 3–4 mm. It is not clear whether this vessel was modelled or made up from slabs and rings. Biscuit-fired. Except for the exterior base, which displays small fire clouds, the surfaces are oxidized. FG8. Colour: 2.5YR/5.5/4. Quality: Very good. The surfaces are very carefully smoothed with only slight shape irregularities. Scale segments are 5 mm

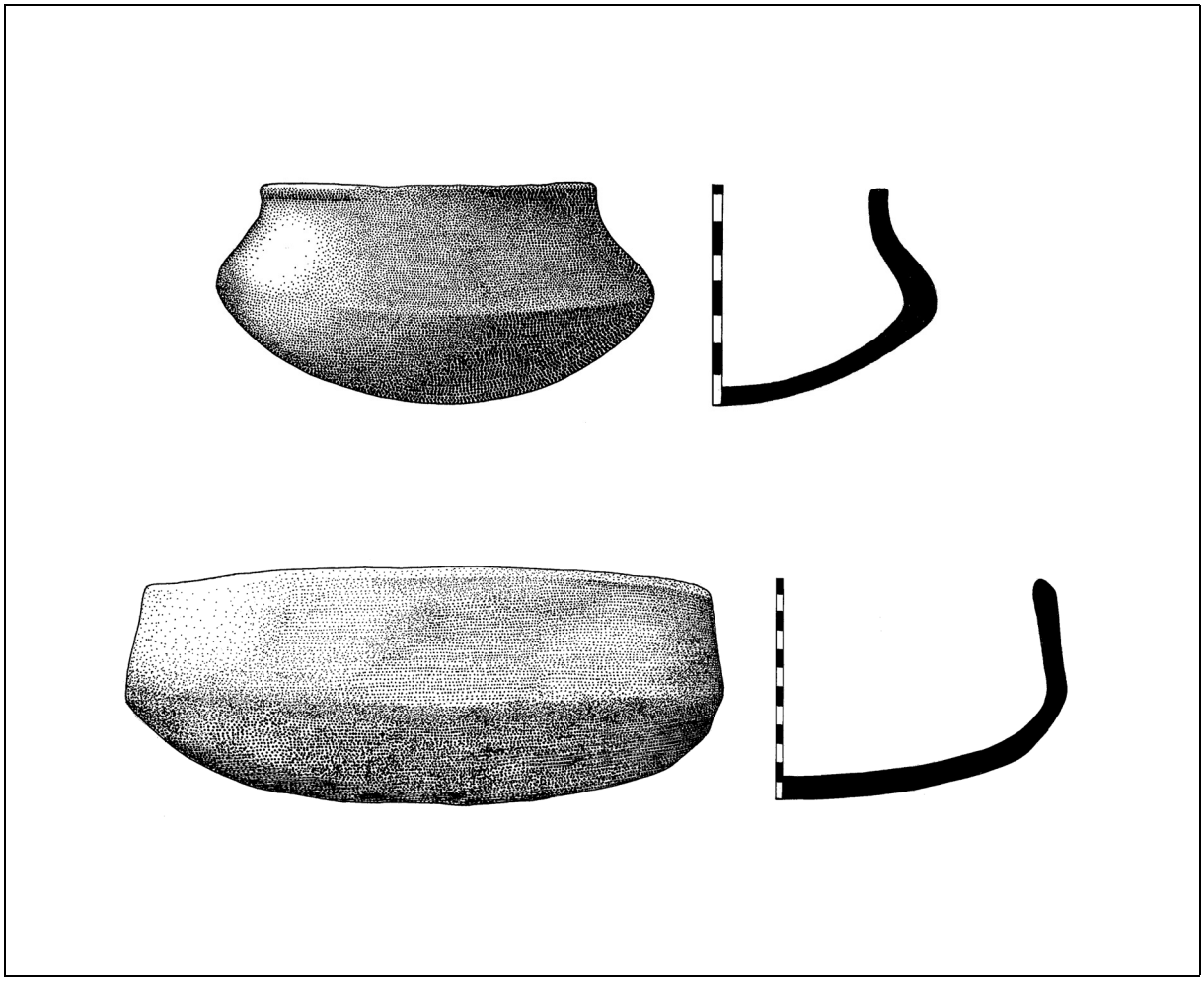


FIG. 129: Mortuary vessels. *Top*: cat. 1431 B67 layer 10:6. A miniature carinated burial jar. When recovered the jar was fractured vertically into two halves. The surfaces are roughly smoothed over a medium coarse fabric. Diameters: rim 57 mm, carination point 75 mm, height 38 mm, carination 22 mm, thickness 3.5 mm. Construction joins at the rim interior and body indicate that this vessel was fabricated from slabs. Low(?) biscuit-fired and oxidized throughout. FG3. Colour: 5YR/5.5/4. Quality: crudely made from a coarse roughly-smoothed fabric. The direct rim is angled inwards. *Bottom*: cat. 1394 B79 layer 10:4. A shallow bowl. Although badly shattered when recovered, about 65% of the vessel was able to be reconstructed. The surfaces are smoothed and burnished over a medium fine fabric. In places the surface has suffered post-depositional erosion. Diameters: rim 162 mm, base 168 mm, height 61 mm, base 24 mm, thickness 4–6 mm. The fabrication technique probably involved slabs and the vessel was clearly biscuit-fired upright. About 30% of the oxidized interior is covered with fire clouds. The exterior, apart from the base, which is mainly reduced, is also oxidized. FG3. Colour: 5Y to 5YR/5/2 (oxidized), to 5Y/2.5/1 (reduced). Quality: very good, better than the drawing suggests. Scale segments are 5 mm

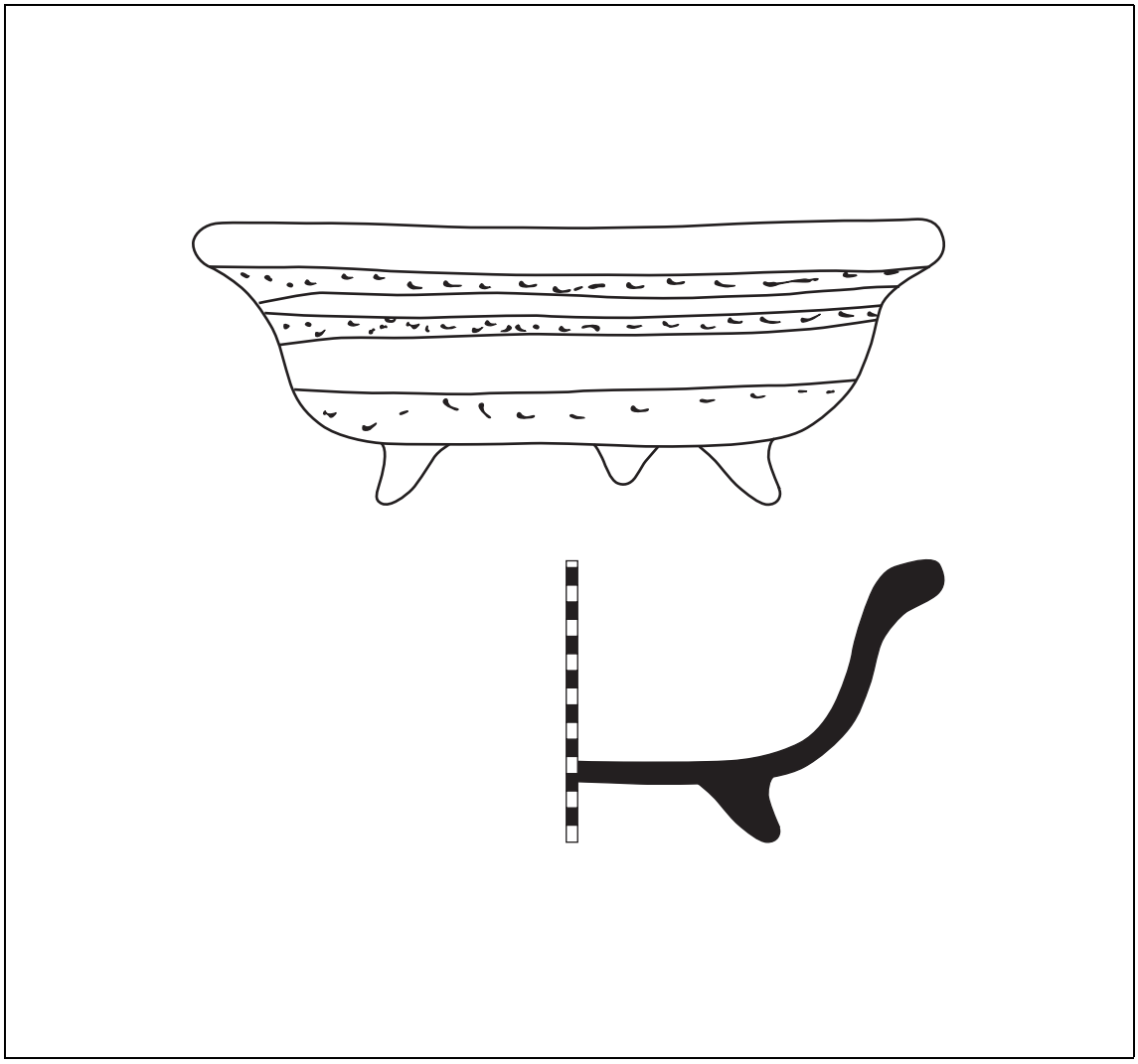


FIG. 130: Mortuary vessel cat. 3252 B76 layer 10:6. A shallow tripod-footed platter or plate. The texture is smooth and burnished with a medium fine fabric. Diameters: rim 300 mm (est.), height 38 mm (est.), thickness 4.5 mm (base), 5.5 mm (walls). Slab construction. Biscuit fired. The interior is slightly reduced, exterior oxidized, suggesting that the vessel was fired upside down. Micro spalling pits to both interior and exterior surfaces indicate minor drying and/or firing problems. The tripod feet, recovered with the vessel, were detached in prehistory. They are conical, with rounded ends, 20 mm in diameter at the attachment point and 22 mm long. The vessel exterior is decorated with three horizontal bands, defined by incised lines, filled with *Anadara* shell impressions. The rim, a 22 mm wide RF14a variant, also displays these impressions. FG2. Colour: 2.5YR/5/4 (oxidized), 2.5YR/3/4 (reduced). Quality: excellent. A high energy vessel to which considerable attention has been paid to every detail. Scale segments are 5 mm

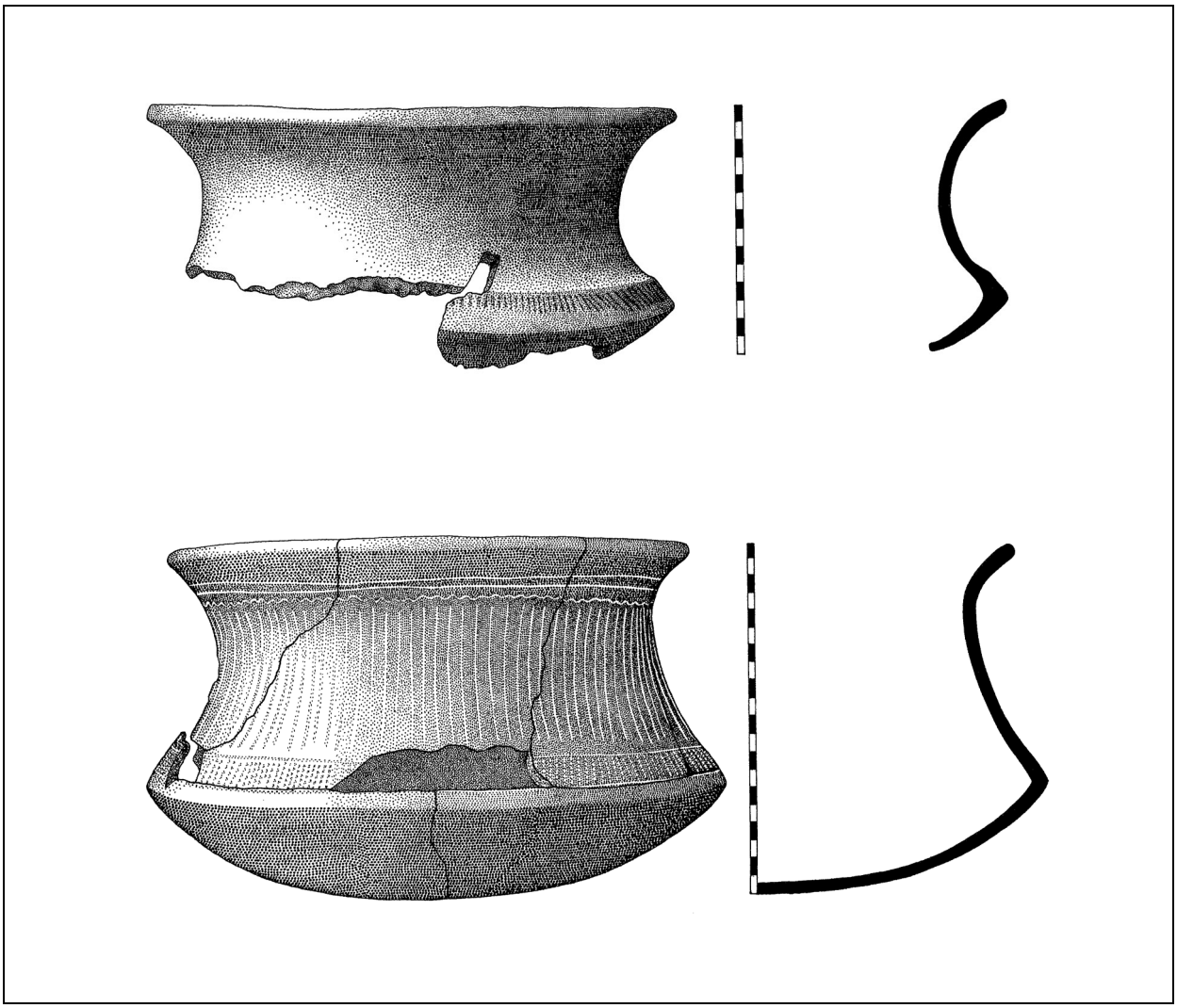


FIG. 131: Mortuary vessels. *Top*: cat. 1290 B57 layer 10:4. A carinated burial jar, smoothed and partially burnished over a medium fine fabric. About 60% was reconstructed from fractured sherds. The carination field, and all of the base, except for the outer 10 mm, is cord-marked ("Z" - 1/1 mm). Above the carination is smoothed and burnished over underlying cord marks. Diameters: rim 148 mm, carination point 160 mm, height 80 mm (est.), carination 24 mm (est.), thickness 4 mm. Probably biscuit-fired upright, oxidized, except for small fire clouds above the carination and on the base. FG6. Colour: 7.5YR/6/4 (oxidized), 7.5YR/4/0 (reduced). Quality: an excellent shape marred by some burnishing imperfections. *Bottom*: cat. 1291 B60 layer 10:4. A carinated burial jar with smoothed, burnished surfaces on a medium fine fabric. About 80% of the vessel was able to be reconstructed from fractured sherds. Two straight, and a wavy line of *Anadara* shell impressions, circuit below the rim. A central field above the carination point is covered with vertical impressions, probably made by scraping the edge of a coarse cord-wrapped paddle across the smoothed surface. Cord marks also decorate a 22 mm wide band above the carination point. Cord marks: "Z" - 1/1 mm. Diameters: rim 146 mm, carination point 158 mm, height 98 mm, to carination 31 mm, thickness 4-5 mm. A two-stage fabrication technique from slabs is revealed where cord marks have been smoothed over. Low(?) biscuit-fired upright? Interior: reduced. Exterior walls are oxidized with fire clouds and the base is reduced. FG3. Colour: 5YR/5/4 (oxidized), 5YR/2.5/1 (reduced). Quality: very good to excellent. Scale segments are 5 mm

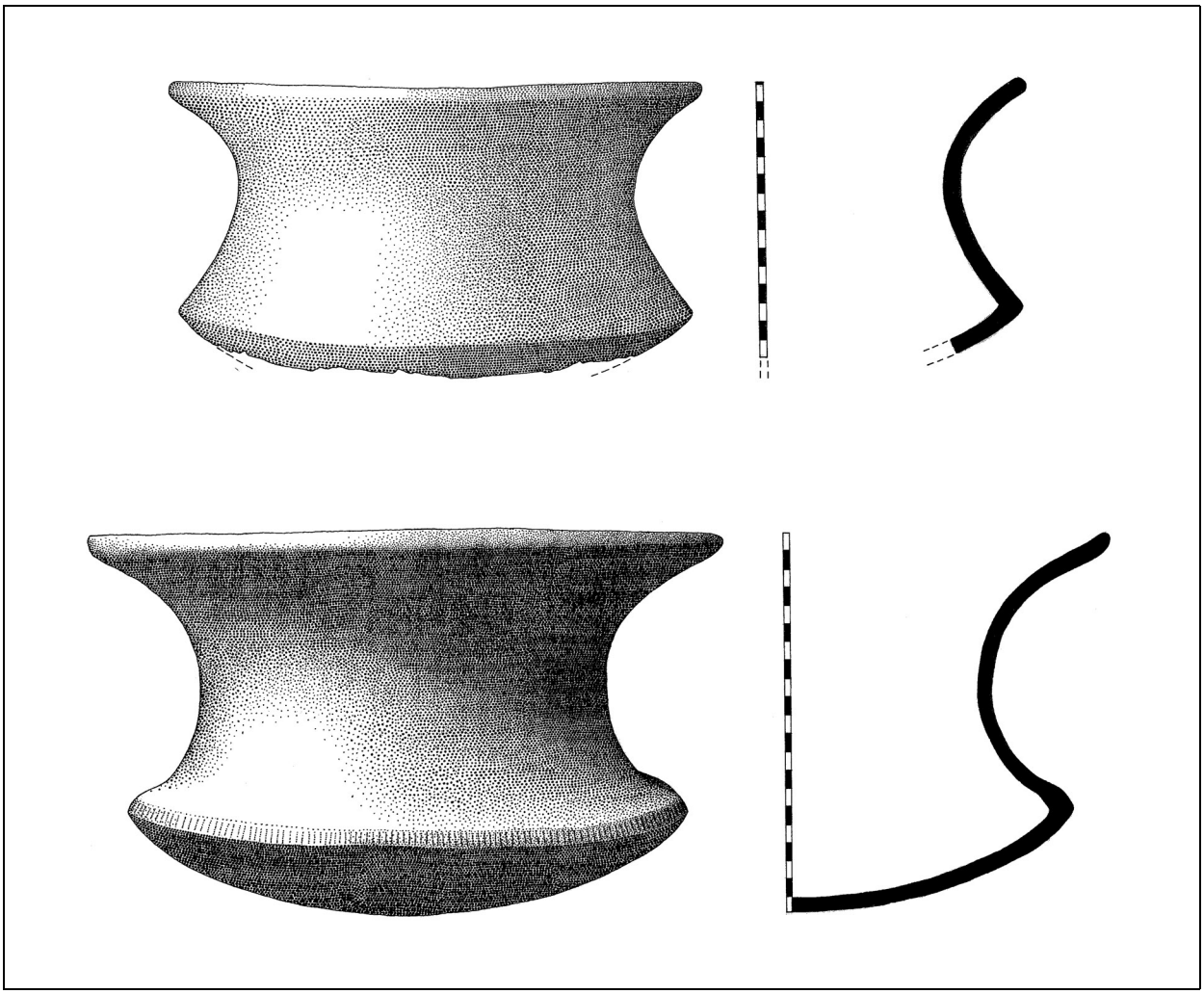


FIG. 132: Mortuary vessels. *Top*: cat. 1243 B56 layer 10:3. A carinated burial jar. Most of the base is available, but the vessel is extensively fractured. About 95% survives. The interior and exterior surfaces are burnished over a medium fine fabric. Residual cord marks are visible on the exterior base. Diameters: rim 148 mm, carination point 143 mm, overall height 56 mm, to carination 15 mm, thickness 3.5-4 mm. This vessel was probably fabricated from slabs. It was biscuit-fired. A few hairline drying and/or firing shrinkage fissures are evident. The surfaces are completely oxidized except for extensive fire clouds. FG3. Colour: 7.5YR/6/4 (oxidized), 7.5YR/3/0 (reduced). Quality: excellent, except for slight shape distortions. *Bottom*: cat. 1288 B57 layer 10:4. A carinated burial jar with a smooth burnished surface over a medium fine fabric. About 85% of the vessel was reconstructed from fractured sherds. The narrow carination field is decorated with vertical cord marks ("Z" - 1/0.2 mm). Diameters: rim 172 mm, carination point 149 mm, height 99 mm, carination 29 mm, thickness 4 mm. The vessel was probably fabricated from slabs and biscuit-fired upright. The upper portions of interior and exterior surfaces are oxidized with fire clouds. Below the carination is essentially reduced, apart from minor fire clouding. FG3. Colour: 7.5YR/6/4 (oxidized), 7.5YR/3/0 (reduced). Quality: excellent, only blemished by very minor surface shrinkage fissures and burnishing imperfections. Scale segments are 5 mm

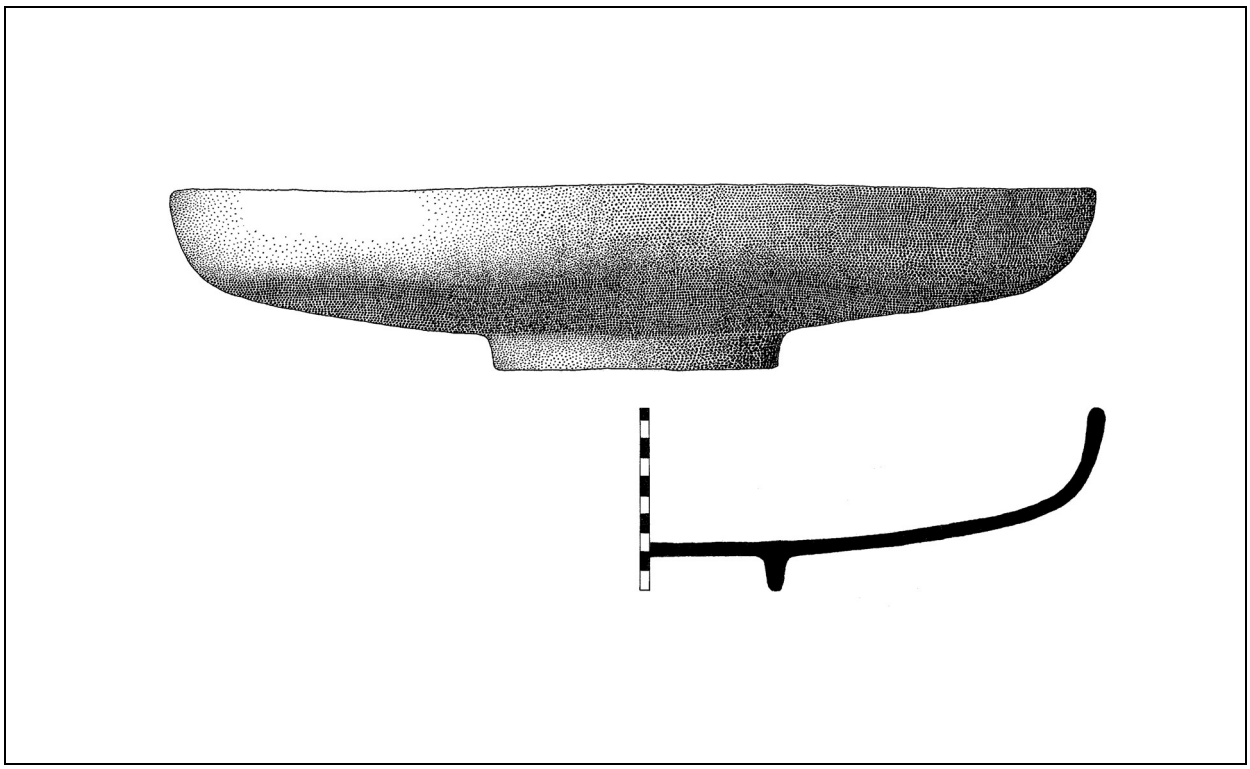


FIG. 133: Mortuary vessel: cat. 1284 B58 layer 10:3. A shallow footed platter. The interior is smoothed and burnished over a medium fine fabric. Although this surface treatment was probably also applied to the exterior, serious post-depositional erosion prevented assessment. Surface delamination, however, has revealed a cord-marked subsurface. About 85% of the vessel was able to be reconstructed from fractured sherds. Very small obscure cord marks (?) are visible on the rim terminus. Diameters: rim 244 mm, base 88 mm, overall height 56 mm, base 10 mm, thickness 3.5-5 mm. The vessel was fabricated in two stages from slabs. The slab joints have been exposed by the surface erosion, leaving the slab edges which have been fused by paddle impressions clearly visible. Low (?) biscuit-fired upright. All of the surfaces are barely oxidized, except for within the base ring, which is reduced. FG3. Colour: 2.5YR/6/4 (oxidized), 2.5YR/3/2 (reduced). Quality: excellent, only marred by some minor rim irregularities. This would be a very difficult vessel to manufacture by hand. Scale segments are 5 mm

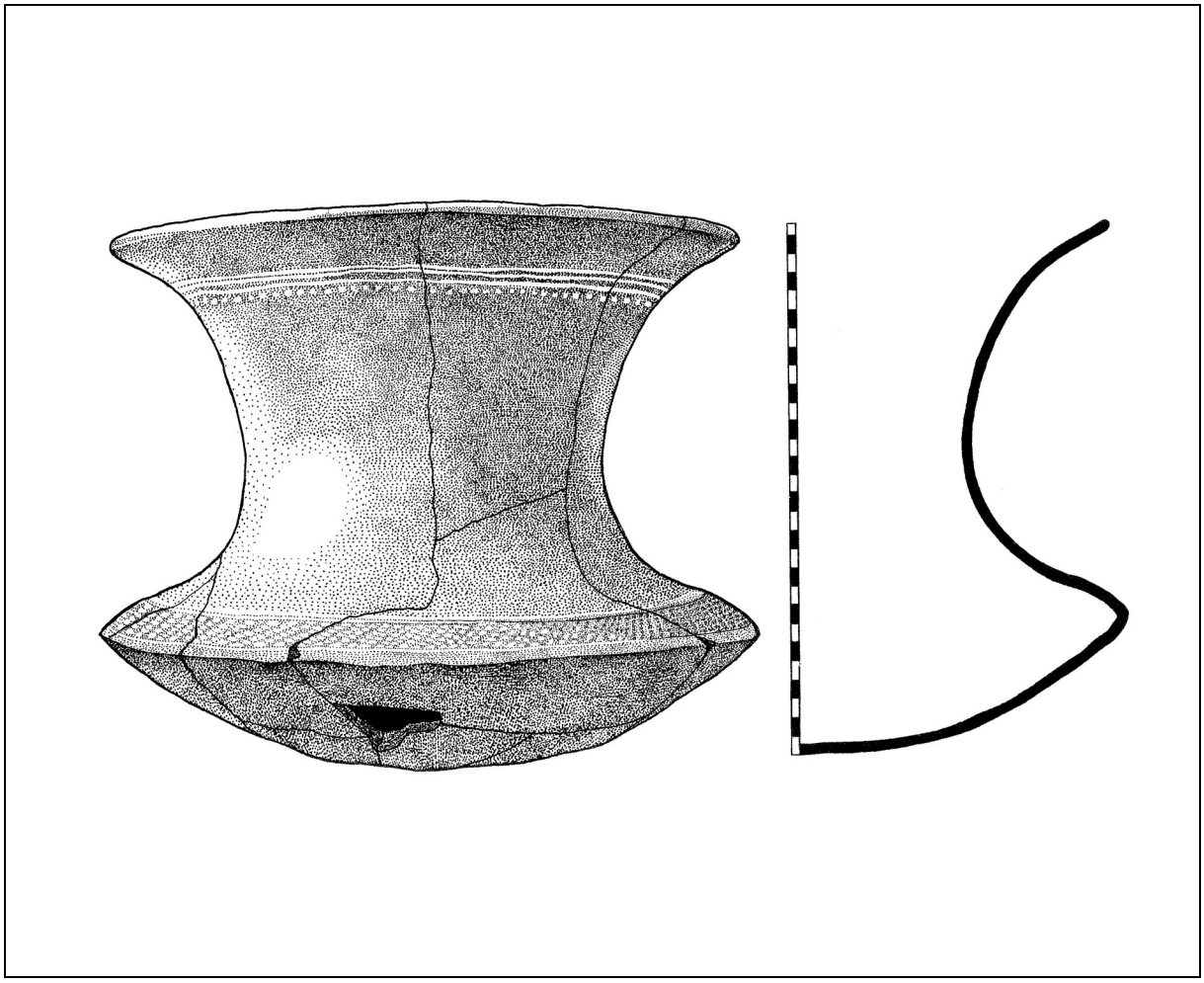


FIG. 134: Mortuary vessel: cat. 1283 B58 layer 10:3. A large carinated burial jar. The surfaces are smoothed and burnished over a medium fine fabric. About 85% of the vessel was able to be reconstructed from numerous fragments. Three straight and a wavy line of *Anadara* shell impressions circuit below the rim. Cord marks, ("S" twist?), may decorate a 26 mm wide raised band above the carination point. Cord marks are also visible under the burnished wall surfaces. Diameters: rim 177 mm, carination point 180 mm, height 138 mm, carination 29 mm, thickness 3–3.5 mm. This vessel was fabricated from slabs and biscuit-fired upright(?). The interior surfaces are essentially reduced and almost oxidized in places with some fire clouding. Exterior surfaces, except for the base, which is reduced, are also almost oxidized. Minor surface spalling is evident on the base. FG3. Colour: 5YR/3/2 to 5YR/2.5/2. Quality: excellent, marred only by some very minor incising and rim shape imperfections. Scale segments are 5 mm

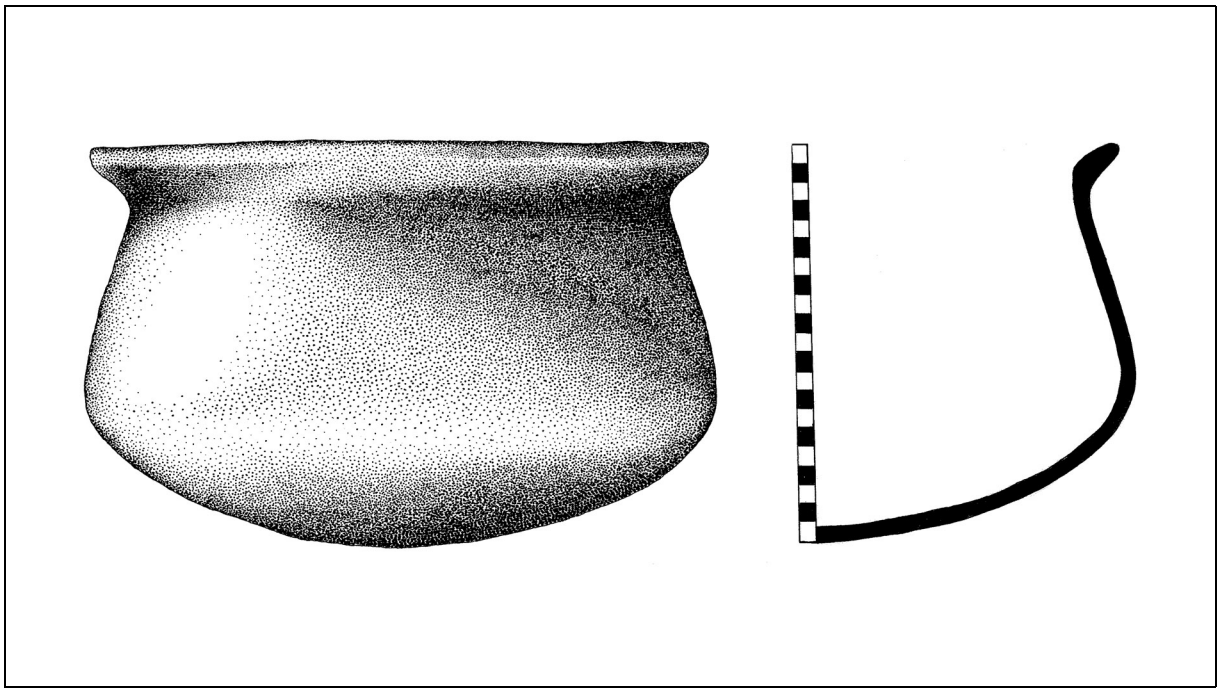


FIG. 135: Mortuary vessel cat. 1384 B77 layer 10:2. A small jar. The surfaces are smoothed and burnished over a medium fine fabric. About 65% of the vessel was able to be reconstructed. Cord marks are visible under the smoothed surfaces. Residual cord marks are also present on the base, however they are too obscure to determine their form. Diameters: rim 160 mm, body 172 mm, height 100 mm, thickness 3–4 mm. Slab construction? Biscuit fired upside down. The interior is reduced. The exterior is oxidized with fire clouds to about 40% of the walls. FG3. Colour: 5Y/5/2 to 5Y/3/1. Quality: excellent. Scale segments are 5 mm

CERAMIC PERIOD 2: SUMMARY AND CONCLUDING REMARKS

We now need to bring the data detailed in this chapter into sharper focus. This can be achieved by first summarizing some of the ceramic evidence. This will allow us to synthesize the CP2 pottery evidence discussed previously. Once this has been completed we can cast our net beyond the ceramic evidence and scan the environmental and non-ceramic data for any possible corroboration of conclusions drawn from the ceramic spectrum. This will allow a clearer definition of the local potting tradition and help identify the parameters of any temporal changes. Armed with this interpretation we can then consider whether the inhabitants of Khok Phanom Di were likely to have been influenced by environmental changes or not. At this stage our investigation is limited to the period bracketed by the CP2 potting tradition. The overall local CP2 potting tradition, therefore, will be closely examined for any changes. In particular, variations in potting materials,

the range of local wares produced, and the kinds of exotic wares arriving at the site, will be scrutinised for signs of any trends which could signal impending developments. These will be reflected in the types of local wares and the manner in which they were produced, and in the type and sources of exotic wares present at the site during this period. All the CP2 evidence will then be reviewed for signs of craft specialization in terms of Costin's (1991) criteria. A full discussion of these latter data will be reserved for Chapter XI, following a more complete assessment of the overall ceramic spectrum. They need to be touched upon here, however, so that the evidence can be viewed from both within the CP2 perspective while keeping the broader overall sequence in mind. We will commence with a review of the mortuary pottery, because this material is derived from the most secure stratigraphic contexts, and burial ritual can be a sensitive barometer of the condition of the population. The wealth of the inhabitants, for example, can be abundantly reflected in mortuary ritual and any associated social activities.

It is important to note that the three major stratigraphic subdivisions initially recognized by the excavators (Higham *et al.* 1987:149), and defined as zones A, B and C, do not exactly coincide with the CPs. Zone A was described by the excavators as being made up of a complicated series of lenses comprising ash, charcoal, pottery and biological remains, shell middens and "lenses of what is probably overwash deposit from high or storm tides" (*op. cit.*:150). In addition, there were some postholes, with wood from prehistoric structures, and numerous small hearths. Zone A, which contained CP1 and CP2, was about 3 m thick with 104 inhumation burials. The earliest six were isolated from each other and, apart from a single shell bead, were without grave goods. Higham (pers. comm.) advises that these zones are no longer employed.

With respect to the mortuary vessels it is important to note that several of the local wares appear to have been quickly made for the ritual. For example, although the decoration on cat. 1648 (B99) is similar to that on cat. 1522 (B101), the former was probably purposely made for burial because the finish is inferior to most, and although the shape is moderately well fashioned, and it displays high energy decoration, it is blemished by shrinkage cracks. In addition, the fabric is oxidized, which is most unusual for these wares. Together, these factors suggest a relatively quickly-made vessel. It is also in almost pristine condition, again suggesting it was quickly made for interment. Two vessels, cat. 1520 and cat. 1519, also interred with B91, are almost identical. Fish bones were recovered from inside the latter vessel. Another local mortuary vessel, cat. 1465, is blemished by a spalled area. This meant that much of a cross-hatched decorative field, located in a central portion of the vessel, was lost during firing. The damage later repaired by scratching lines into the fractured surface of the spalled area in an attempt to re-instate the lost decoration. The repairs were partially successful as the scratches are only visible under close inspection. Such repairs stress the value placed on these fine, high energy, ornamental wares. Two tripod-footed mortuary vessels, cat. 2019 and 3252, were locally made. These are important vessels linking local traditions with tripod wares. Another local vessel, cat. 1479 displays three important features which suggest an excessive firing duration. A major vertical shrinkage crack extends from the rim to below the carination point, a 60 mm diameter circular spall about 3 mm deep is missing from the base and all of the vessel, except for a very minor smudge, is completely oxidized. These factors point to a quickly-made burial jar intended specifically for interment. Similarly, cat. 1478, a local type 2b carinated burial jar, is carefully shaped but the surface finish appears to have been quickly applied with less attention to detail. In general, the high quality

burial jars have the thinnest walls. For example, a burial vessel interred with B72, cat. 1361, has walls 3–4 mm in thickness. Vessels considered to have been made quickly have thicker walls. Cat. 1319, B64, is a small carinated jar possibly used to store fish paste. Little variation was evident in fabric colours. Mortuary vessel cat. 1390, B74 is notable for its red (10R/5/6) colour and cat. 1384, B77, is olive grey to olive (5Y/5/2 to 5Y/3/1).

Five of the exotic wares present in the mortuary ware assemblage derive from one source and one type 2e from another source. Four of the former are type 2b carinated burial jars, one of which is a miniature. The other is a miniature type 1a bowl. Some appear to have been hurriedly made. For example, cat. 1679, a type 2b jar interred with B120, has an irregular shape and although burnished, has no further decoration. Similarly, cat. 1620, a miniature burnished type 1a bowl, interred with burial 123, although smoothed and partly burnished, is also irregular in shape. One exotic vessel, cat. 1453, (B88), is a crudely made miniature type 2b. Type 2b vessels were the most common vessel interred with burials throughout CP2 and most were made to exacting standards. The surfaces of cat. 1453, however, are roughly smoothed, particularly the interior, and it has cord marks to the exterior base. Overall, such a lack of attention to detail is unusual and gives the impression of a vessel which was quickly made. Further, it is in pristine condition. Together, these factors suggest that this exotic miniature vessel was purposefully made for the funerary ritual. In contrast, cat. 2020 (B86), is a high quality burnished type 2b vessel with only slightly irregular decorative fields. The shape of the last two vessels differs slightly from the more well-defined local type 2b funerary wares. Their form, however, is considered close enough to include them in the burial jar category. The presence of what are generally less carefully finished exotic vessels, one of which is in pristine condition, suggests that they may have been funerary tributes to the deceased. As they all derive from a single source area, together, these factors further suggest that some kind of socio-cultural links were involved. These may have been kinship ties or some other social links, such as clan groupings.

None of the several vessels recovered from the general matrix of the deposits is exotic. Of the 13 vessels identified, seven are miniatures. Some are very coarse and others are miniature versions of full-scale local wares. This suggests that miniatures were used to test such factors as the drying and firing properties of locally prepared clays. Some, such as cat. 1890, may have been intended for use as a small ornamental ware, because this vessel has been decorated with incised lines. Most of the non-mortuary wares, however, are probably test pots or utilitarian wares. But in the main non-mortuary wares can be conceived as minor components of the CP2 whole vessel assemblage, which was dominated by high-quality mortuary vessels.

Rice continued to be present in several fabrics, apparently by accident. Such incidental rice husk is present in both exotic and local rim fabrics, the former in layer 10:4 and the latter in 10:5. Rice temper is also present in an exotic layer 10:3 sherd, and in rice-tempered bleb grog sherds in layer 10:4 and 10:8. Rice was also present in exotic pottery during CP1. Surface decoration, involving *Anadara* shell impressions, as well as burnished, incised and striated fields, is evident in both exotic and local wares. RF5, categorized as belonging to type 2b burial jars, makes up 41.2 per cent of the exotic rim forms. Igneous, metamorphic and sedimentary sources are represented in the exotic wares. Exotic RF5 fabrics recovered from burial contexts include sand in B120 (layer 10:14), blebs in B94 (layer 10:11), and sand in B73 (layer 10:4). They are represented in eight different exotic fabrics, the largest variety of exotic sources for a single

type. This suggests that socio-cultural ties or exchange relationships were maintained with several different groups. Exotic RF6 fabrics include the first true slipped ware. The slip contained minute limestone fragments. RF6 wares are present in exotic FG8 and FG11. These rim forms occur in four different exotic variants and they can be traced from layer 10:24–10:3. RF4, which represents a type 3b platter, only occurs in the CP2 spectrum as a local fine ware.

In order to create a temporal cross-section of the CP2 deposits, the stratigraphy has been subdivided into a series of units, based on the excavation procedure. These subdivisions are arbitrary and bear no relationship to the MPs. The distribution of a selected group of ceramic artefacts and changes in rim complexity (categories and variants), are summarised in table 66. These include exotic ware sources, as represented by the number of exotic rim forms in each unit, the overall numbers of net weights, bow pellets, tripod pot feet, burnishing stones, firing stands, anvils, non-mortuary and mortuary vessels. Burials calculated to have been cut from above layer 10:3 have been excluded. They are considered to derive from CP3 contexts. A clear trend is evident in the CP2 ceramic spectrum. Overall, it suggests a more-or-less normal statistical curve with an overall artefact maxima about midway through the CP2 stratigraphic sequence. In addition, bone stylus points, incised wares and burnished wares follow the same generalised distribution trends as ceramic artefacts. The distribution of bone stylus points uncovered from non-mortuary contexts correlates with incised wares (Chapter XI). Burnished sherd distributions are detailed in Chapters XI and XII. A difficulty in determining these changes accurately is that layer 10:3 lens 2, a large shell midden, tends to skew the distributions because it contained a highly disproportionate number of artefacts due to the unusually dense composition of its matrix. We can note here, however, that firing stands, with a single exception, only occur in CP1 and at the top of CP2 in layer 10:3 and 10:5. This suggests a change of use for this part of the site.

Burnished and incised wares are the hallmark of the local CP2 pottery tradition. Painted and slipped wares are rare and they are all probably exotic. They occur in both bleb and orthodox grog-tempered fabrics. The decorative modes of the local tradition follow on from CP1 with burnishing, incising and shell impressing dominating the sequence. Incised chevrons, striations, cord marking, paddle impressing and punctate surface decoration modes are present, but only in very limited quantities. Paddle-impressed wares, which are present in minor amounts, are also all probably exotic. As with the local fine wares, burnishing and incising is also common to many of the exotic wares. Exotic mortuary wares feature three carinated jars similar to the local 2b type, the most numerous CP2 burial vessel. Rim form 5 correlates with these types, and it dominates the exotic rim form assemblage. Such concentrations suggest two possibilities. First, their selection for use as grave goods infers that the carinated jars played a special role in mortuary ritual. Second, their prominence in exotic wares suggests that they were intended as offerings to the deceased as some kind of tribute. This possibility is further reinforced by the apparent haste with which the exotic vessels were made. Perhaps this was necessary given the relative urgency of the funeral ceremonies compared to the time required to complete such fine ware vessels. Many of these vessels, however, may have not been actually interred with the deceased, because they were distributed throughout the cemetery amongst the graves in the general matrix. It is possible, therefore, that some played a part in the funerary rituals, perhaps as offerings or food containers for mourners taking part in the mortuary rituals.

When a pottery type is represented in such a comprehensive range of exotic wares it signals

TABLE 66: *The distribution of ceramic artefacts: Ceramic Period 2*

Artefact Layer:	10:3-10:5	10:6-10:10	10:11-10:15	10:16-10:20	10:21-10:24
rim complexity	94	76	100	64	30
exotic rims	8	12	19	10	3
exotic sources	4	5	6	6	3
net weights	4	4	18	8	-
bow pellets	5	9	14	8	4
tripod feet	7	5	3	1	3
burnishing stones	60	41	85	10	1
anvils	12	8	11	5	1
firing stands	6	-	1	-	-
vessels:					
non-mortuary	4	1	3	4	1
mortuary	-	25	18	-	-
Totals:	204	186	278	116	46

that it was very important to the inhabitants of this region. Such an overwhelming representation clearly signifies that these vessels performed a critical part in external relationships. This role may have had economic as well as social implications. Although the majority of the rim sherds discussed here were recovered from other than contexts directly connected with the burials, it is important to keep in mind that many of the graves were disturbed in prehistory, some seriously. At least 30 of the 154 burials were disturbed and a further 20 were only partially within the excavation square (Higham and Bannanurag 1990). Therefore, although a large proportion of the pottery cannot be directly attributed to burial contexts, the carinated jars, which were recovered in quantity from the cemetery, were clearly connected to mortuary ritual, some directly as grave furniture. Others may have also been used in the mortuary ritual surrounding the burial activities themselves. That so many different exotic potting sources provided these fine ware jars, and judging from the rim sherds they were often made to a very high quality, strongly suggests they were intended as a tribute to the deceased.

Ceramic anvils are present from non-mortuary contexts throughout CP2. They include several which are composed of exotic fabrics. Donor traditions, which are characterised by both their different technologies and the exotic mineralogical composition of the anvil fabrics, are present in this assemblage. These exotic traditions employed sand, orthodox and bleb grog tempers which set them apart from the local potting methods. Craft specialization is hinted at by the presence of what appear to be ownership marks on three of the CP2 anvils and the presence of intricate decorative motifs on some of the mortuary vessels. Type L2d vessels, for example, include a decorative turtle motif which might suggest that social groups, such as clan groups, were recognized in the mortuary ceramics. Similarly, the type L2b carinated burial jars are decorated

with a range of different designs, some of which may be clan markings or some form of rank insignia. We will explore these possibilities further in Chapter IX.

It is pertinent to consider here whether environmental evidence is available to corroborate the ceramic data. Evaluation of this evidence may help establish whether environmental conditions could have precipitated an abandonment of Khok Phanom Di at the close of CP2. The change in local pottery between CP2 and CP3 can reasonably be characterised as a transition in a regional potting tradition. This transition was abrupt. One possibility is that the site was abandoned and then re-settled later by a group familiar with both the site and the regional potting tradition.

Botanical evidence is one sensitive indicator of prevailing environmental conditions. Thompson (1996:68), notes that *Rhizophora* type charcoals were consistently high throughout layers eleven to eight and they then declined rapidly. An exceptional, perhaps single purpose, fire occurred in layer 9:6 lens 9. Overall, Thompson notes that the archaeological zones proposed by Higham and Bannanurag (1990:31), are not evident in the charcoal spectrum, except at the zone A/B boundary where the only possible break occurs. Outstanding concentrations of very large charcoal fragments are present in layer 10:3 lens 2 and significantly no evidence of trampling was detected (Thompson 1996:69). Charcoal concentrations are notably heavy from layer eleven through to layer nine. From layer eight onwards, as concentrations decline, a change in charcoal types is evident. Near the layer eight/seven boundary (2.78-2.88 below datum, Higham pers. comm.) *Rhizophora* type charcoals occur in smaller quantities and are replaced by backswamp mangroves. From layer six to the top of the site charcoal is virtually absent and any presence is sparse and highly comminuted. The change in charcoal types near the layer eight to seven boundary is significant. Thompson (1996:69-71) considers it most likely that the habitats around the site changed from forest to open swamp grasslands and then possibly to open plains. This shift from a timber rich to a suggested open plain setting is supported by molluscan evidence.

Environmental change is unequivocally signalled about midway through CP3 (Chapter IX) when pulmonate landsnails suddenly appear, however, “some provision must be made for the elapsed time between such a change and its reflection in the distribution of molluscan species” (Mason 1991:314). It is important to note in this respect that freshwater species replace the marine - mangal - estuarine molluscan sequence from “upper layer nine” (Mason 1991:314). Micromolluscs from brackish/freshwater habitats reduce sharply about the layer ten/nine interface and then increase throughout layer nine (Mason 1996:252). Intertidal to subtidal clean sand molluscs, clean water shallow to intertidal coralline associated and marine mangal molluscs all decline about the layer ten/nine boundary (Mason 1991:312-17). Landward mangal and estuarine molluscan species also fluctuate at this point. Freshwater species are consistently low throughout layers 11 and 10. Shortly following the commencement of CP3 “a marked and sustained increase” in fresh water species developed (Mason 1991:313). Freshwater ostracodes were also recovered from layer eight (McKenzie 1991:143-5).

The distribution of mammalian, fish, bird, crustacean and reptilian species identified at Khok Phanom Di also suggests environmental changes (Higham and Bannanurag 1991:336, Figure 77). These are subtle, however, and less pronounced than the molluscan data. When considered together, the floral and faunal evidence clearly point to environmental change at approximately the CP2/CP3 boundary. Marine species are essentially replaced by freshwater taxa and this trend continues on throughout CP3. A hiatus in the mortuary activities underscores this shift and

indicates that cultural change is correlated with the environmental shift. The ceramic evidence detailed in this chapter clearly demonstrates that a major change coincided with the environmental modification.

Along with the introduction of a new potting technology, a modification in pottery styles, as reflected in funerary furniture, corroborates that cultural as well as environmental changes occurred. Site abandonment is again a possibility. In this instance, however, the hiatus appears to have been very brief and more of an interruption to a well-established occupation of a highly valued location favoured for its access to naturally rich sources of food, raw craft materials and transportation routes.

If local pottery was destined for exchange, water transport would have been needed to access distribution points for the large quantities of locally-produced pottery. This factor alone suggests that Khok Phanom Di occupied a nodal location, or central place, pivotal to the successful articulation and integration of subsistence, technology and its associated developing craft specialization with perhaps the most critical element, an efficient transportation network. Floral and faunal evidence, taken in combination with the physical data discussed previously, indicate that major changes in the region's local environment affected the inhabitants of Khok Phanom Di. As Boyd (1994) has reported, this region was eustatically and isostatically dynamic. Post-Pleistocene sea levels and tectonic activity combined to create geomorphological changes to both the coastline and the local landscape. The existing riverine floodplain topography would render the region's waterways highly sensitive to these geophysical movements.

Specifically, these changes point to the increasing isolation of the site from the sea with time. It is possible that gradual, perhaps slightly oscillating, changes in sea levels would alternatively inundate and then re-create tracts of dry land. Any such oscillations would be superimposed on the overall trend of coastal progradation as new tracts gradually extended seawards from the site. These effects would have been magnified by the site's position in an extensive sedimentary coastal plain. Mason (1991, 1996:314) and Aitken (1992) consider that Khok Phanom Di was first settled on an elevated river levée close to the coast. As sea levels lowered, local streams and rivers could be subject to changes in course. Meandering tributary streams could easily be cut off from their parent water courses and major river loops isolated as ox-bow lakes. When sea levels oscillate, isolation from such waterways can be brief, particularly when the local terrain comprises a flat coastal plain. This, coupled with a monsoon climatic regime, and its characteristic seasonal flooding, could explain the brief hiatus in cultural activities (suggested by the presence of pottery firing activities within the cemetery), while local water courses were being reformed. The major environmental changes reflected in the flora and fauna indicate that the coastal progradation had so distanced the site from the sea that a new and different habitat had established, but that access to freshwater was available. From the perspective of access to raw materials and pottery distribution points, water transportation would have been critical to the successful continuation of the Khok Phanom Di potting infrastructure. Acquiring materials and distributing pottery outputs directed to external recipients would be untenable without such an efficient means of transportation. This means that if access to these waterways was ruptured, they were re-established some time after the close of CP2. In the next chapter we will examine the ceramic evidence deposited in the upper half of the cemetery during CP3.

IX CERAMIC PERIOD THREE

MORTUARY activities continued, after the brief hiatus mentioned in the previous chapter, throughout Ceramic Period Three (CP3), the final CP associated with mortuary ritual. The ceramic spectrum spans five Mortuary Phases (MPs), upper MP3 and MPs 4-7 inclusive. A continued presence of vessels, potting tools and clays in funerary contexts, indicates that potting remained an important component of local technological, artistic and socio-economic activities. Examination of these will allow local ceramic production to be characterised and help determine whether craft specialization was involved in its organization. Further, a holistic assessment of potting-related evidence may indicate the identity of some individual craft specialists. Of particular interest are vessel shapes, surface decorations, potting techniques and materials. Symbolic expression, such as the insignia of discrete social groups, may be represented in vessel motifs. These will be examined for co-relationships between various individuals interred in the cemetery. Indirect evidence from non-ceramic aspects, which may be connected with the pottery tradition, will be considered. Ceramic and related evidence follows a summary of the stratigraphy.

The CP3 sequence is similar to CP2 in that craft specialization is implied by the presence of potting accoutrements and potting materials. The recognition of relatively high-status individuals is suggested in the outstanding wealth associated with some CP3 burials. These indicate that potters achieved considerable personal wealth and were accorded high status. Status may have also been inherited by infant members of some potting families. This suggests that potting was a highly valued activity. Whether craft specialization played a central socio-economic role within the community during this period, therefore, requires detailed examination. If craft specialization can be detected in the ceramic record, it would be important to determine to what degree this affected the local community. Comparison of the CP3 with the CP2 assemblage may help identify any social-economic changes, particularly those involving craft specialization. Any changes which could suggest that potting had increased in importance, such as the recognition of individuals or groups of potters in mortuary ritual, will be closely examined. It is important to establish the origin of any changes and to determine, if possible, whether they represent an indigenous evolution or the diffusion of exotic initiatives, perhaps through the arrival of immigrants. Finally, a detailed examination of the corpus of data will allow the CP2 and CP3 sequences to be compared and defined. This will bring the boundary between the upper and lower sections of the cemetery into a sharper focus, and, *ipso facto*, help highlight any differences associated with the two periods. Changes in the ceramic spectrum could represent a local transformation or the diffusion of exotic socio-economic variables.

THE STRATIGRAPHY (LAYER 10:2 TO LAYER 5)

A temporary hiatus in mortuary activities marked the boundary between CP2 and CP3, partially coinciding with the transition from MP3 to MP4 (see chapter VIII). Postholes, some apparently arranged in alignments, were cut through layer 9 into the surface of layer 10 (Higham and Bannanurag 1990:36). Small lumps of prepared potting clays were recovered from layer 10:1–2 and layer 9, including a fragment from B49 (Table 72 and Chapter XI, Table 153). Two isolated infant burials, lacking grave goods and both interred at the same time, were cut from 4.14 and 4.17 m below datum respectively. They are separated from earlier graves by a "substantial" shell midden (Higham and Bannanurag 1990:192). Layer 9 comprised ash and midden lenses, postholes, pits and a rich variety of biological remains in the general matrix. Layer 9:7 featured nine postholes and a large lens of mainly shellfish. The latter contained "80,522 specimens of *Anadara* valves", and extended into layer 9:6 (Higham and Bannanurag 1990:37). Its areal distribution approximated that of layer 10 lens 2. A single infant burial was uncovered at this point. The extensive shell midden continued into layer 9:6 which revealed 13 postholes and two shell pits. Ash, charcoal, shell midden, pits, areas of burning, burnt clay and 12 postholes were found in layer 9:5. Layer 9:4 contained a hearth, 13 postholes and the edge of another shell midden. A circular pit, 11 postholes, a lens of white ash and shell (L.9 lens 7), and another, (L.9 lens 6), of shell featured in layer 9:3. Shell and ash lenses, interspersed with 9 and 4 postholes respectively, continued through layer 9:2 and 9:1. Ceramic anvils, pellets and net weights, burnishing stones, stone adze heads, whetstones, stone and shell jewellery, shell knives and a shell point were recovered from layer 9.

According to Higham and Bannanurag (1990:38), "two principal determining features" characterise layer 8. Following a hiatus during layer 9, "a major episode of burial activity", (MP4), occurred. The same areas were used for burials, however changes occurred in the types of deposits. Circular pits were less common; ash lenses, possibly reflecting mortuary activity, along with small lenses of shellfish are common. Layer 8:7 contained an ash lens, designated L8:10 which was later cut through by burials 39-42. Other lenses, one containing 74,082 *Anadara* shells, were interspersed between further burials. Two small pits and 10 postholes were also located. Layer 8:6 included 20 postholes and a small hearth but was devoid of burials. Layer 8:5 featured more burials, a shellfish lens which continued into 8:4, a lens of hard ash mixed with *Anadara* shell, two pits and 12 postholes. A large lens of white ash, cut through by four burials, and a smaller lens cut by a single burial, were uncovered in layer 8:4 along with 10 postholes. Further lenses of shellfish and/or ash, two circular pits and eight postholes occurred in layer 8:3. A further three burials, including B33, a very rich child burial, two new shell lenses, a circular pit and nine postholes were present in layer 8:2. The top of layer 8 included two further burials, two circular pits, a thin ash lens and seven postholes. The layer 8 deposits included ceramic anvils, bow pellets and net weights, burnishing stones, stone hoes, whetstones, shell, stone and turtle shell jewellery, shell knives, a bone awl and a fish-hook. Small isolated lumps of prepared potting clays were again present throughout the general matrix of layer 8. Two fragments were recovered from B28.

Layer 7 was distinctive. It involved abundant charcoal and a very ashy matrix "interspersed with burnt red soil (Munsell 5YR/4/4)" (Higham and Bannanurag 1990:40). Layer 7:7–8 con-

tained one new grave and 15 postholes. Six burials, including one double grave, associated ash, more postholes and a pit occurred in layer 7:6–5. Burial 17, a small lens of pottery and shell, another of sherds, and two postholes were noted in layer 7:4. An outstandingly rich burial, B15, and B16 cut through two of three ash lenses within layer 7:3. Twelve postholes were dug into this level. Layer 7:2 lens 3, an extensive, shallow, ash and shellfish midden, accumulated just prior to the interment of B15. Nearby, and 7cm higher, an infant, B16, was buried with rich grave furniture. This level also revealed 12 further postholes. Layer 7:1 displayed 14 new postholes, up to 14 cm in diameter, a large ash and charcoal lens which partly covered B15, and two shell lenses. The principal artefacts recovered from layer 7 were ceramic anvils, ladles and net weights, burnishing stones, an adze head, ivory as well as turtle shell and stone jewellery, shell knives, and bone points. About 11 kg (dry weight) of prepared potting clay cylinders covered the corpse of B15 and nearly 4 kg B16. Small fragments of clay were also present in B27 and B36.

Burials continued into layer 6, along with ash lenses and shell midden. Two postholes were noted in layer 6:6 and 22 in 6:5. A rectangular floor, comprising about 28 earthy laminations, bounded by a low clay upstand and large postholes, spans layer 6:4-3. Higham and Bannanurag (1990:339), note that, given the lack of disturbance, the clear horizontal bedding and the clear edge of the structure, in section, "it is considered probable that the initial construction was a single event which followed very soon after the interment of burials 18 and 19." It is unclear whether this feature represents parts of a house or a raised mortuary structure. The floor aligns with adjacent burials, and associated ash and shell lenses suggests ritual behaviour, rather than occupation remains. Higham and Bannanurag (1990:340), note that "final resolution of this issue is not yet possible but it is felt that the balance of evidence now available indicates a ritual rather than an occupation structure". Burial 6 was probably interred after the completion of the structure. Seven further burials were interred about the same time as the structure was built, along with 35 postholes and a circular pit containing 35 *Anadara* valves. Layer 6 was rich in shellfish and potsherds. Small lumps of prepared potting clay were recovered from B7, B8, B9 and B11. Almost 1 kg of such clay was associated with B4, along with a ceramic potter's anvil and four burnishing stones. Layer 6:2-1 featured two midden lenses lying on north-south axes. One ceramic anvil, ceramic or clay bow pellets, several burnishing stones, two adze heads, ivory, bone and stone jewellery, and a shark tooth pendant were found in layer 6 contexts.

Artefacts recovered from layer 5 included ceramic anvils and bow pellets, burnishing stones, a stone hoe and three stone adze heads, shell and stone jewellery, worked bone points and an awl. A change was evident, from a predominant solidified white ash, (Munsell 10YR/5/3), in layer 6, to a reddish, (Munsell 5YR/3/4), sandy matrix in layer 5. Layer 5:5 lacked burials or postholes. Within the general matrix which surrounded the layer 6 structure were a red burnt soil lens and six pits. Three further pits and a solidified ash lens were present in layer 5:4. Burial 3 and three further pits were cut into layer 5:3. Two large postholes (or pits), and three pits which cut through the structure, were recorded in layer 5:2. Layer 5:1 involved the interment of B12. The amount of prepared potting clay increased markedly in comparison to layer 6, but much of this may have been derived from activities connected with CP4 which directly overlay layer 5. One small lump was included with B6. Potting clay was also recovered with B19, along with two burnishing stones and a ceramic anvil.

During CP3 many of the burials were laid out in rows. Nearly all were coated with red ochre and several included *tapa* fabric. Diachronic sequences of super-imposed graves suggest that some of these may represent familial lineages because they appear to have been arranged in "clusters" (Higham and Bannanurag 1990:22, Fig. 6). The depths of burials which contained vessels or potting artefacts are set out in table 106 and Appendix 4.

In summary, CP3 comprised a cemetery, in which several burials were arranged in orderly rows. In some cases they appear to form sequences where later interments were placed directly over earlier ones. The precision with which they were laid out, in this portion of the cemetery, suggests that their placement was strictly formalised. Red ochre is associated with almost all CP3 burials and several included *tapa* fabric, however, wooden coffins or biers are no longer evident. Postholes appear to define graves and groups of graves. Shell midden (some mixed with white ash), lenses of ash, charcoal and burnt areas (some involving clay), as well as a variety of pits were common throughout the sequence. Several of the graves contained artefacts and materials associated with potting. Ceramic anvils, burnishing stones, and bone points suited to incising the surfaces of pottery, were present either in graves or amongst them. Bow pellets, ceramic ladles and net weights were also recovered. Small discarded dumps of prepared potting clays were retrieved from pits, lenses and the general cultural matrix throughout the CP3 sequence. Larger amounts of this clay were placed in some burials. Pottery continued its prominence as funerary furniture.

Stone adze heads, hoes and whetstones, ivory, stone, shell and turtle shell jewellery, a shark tooth pendant, pierced mammal canines, shell knives, shell points, bone awls and a fish-hook complete the range of artefacts identified. Turtle artefacts were restricted to male graves. In terms of grave goods, some of these were rich. Three major features were associated with CP3. The first involved an apparent hiatus in mortuary activities between MPs 3 and 4. This is in addition to the one which marked the change from CP2 to the CP3 ceramic traditions, at the layer 10:2 interface. Second, a rectangular floor, constructed of compacted clay and soil, was aligned along an east-northeast to west-southwest axis. The third was an outstandingly rich 35 year-old female burial. This individual was adorned with masses of jewellery, numerous potting accoutrements, eight ceramic vessels (the most accorded any burial), and a mound of broken cylinders of prepared potting clay. Several further graves also contained potting tools. Some of these, in terms of grave goods, were also rich. Potting tools and potting materials, miscellaneous ceramic artefacts, and the pottery of CP3, will be detailed in the following sections.

THE POTTERY RELATED ARTEFACTS OF CERAMIC PERIOD 3

THE POTTERS' EQUIPMENT IN BURIALS

It is important to note that of the 62 burials in CP3, 39 included grave goods and of these 16 included potting tools (Table 67). Burnishing stones were recovered from 15 and potters' anvils from nine graves. Seven female adults, four male and five children are represented. Anvils are

only present in female burials. Burnishing stones recovered from the general matrix are set out in table 70. Thirteen graves, B4, B6, B7, B8, B9, B11, B15, B16, B19, B27, B28, B36 and B49, also contained potting clay (Table 72).

TABLE 67: *Burnishing stones and anvils in Ceramic Period 3 burials*

MP	Burial	Age	Sex	Stones	Cat.	Anvils	Cat.
7	1	9	-	1	620	2	2038a & b
6	4	26	F	4	739, 2182-4	1	738
6	6	9	-	2	2079, 2193	-	-
6	9	30	M	1	796	-	-
6	13	35	F	8	821	-	-
6	18	42	F	1	958	1	904
6	19	25	F	2	976	1	975
5	15	35	F	2	908, 2214	1	911
5	16	15mths	-	1	934	1	932
4	20	12	-	1	2190	1	954
4	23	30	M	1	2026	-	-
4	29	27	M	1	2174	-	-
4	33	child	-	-	-	1	1099
4	35	21	F	3	1040, 2760	1	1027
4	36	21	F	1	1023	-	-
4	42	32	M	2	2023-4	-	-
Totals:	16			31		10	

THE CERAMIC ANVILS

A total of 29 ceramic anvils were recovered from CP3 contexts, including three in MP4, two in MP5, three in MP6 and two in MP7 burials (Table 68). One anvil, cat. 1155, contains only a few very small nonplastics. In hand specimen it features what appear to be initial vitrification surfaces. This indicates that it was fired to relatively high temperatures. Cat. 1115 is unusual in that the handle has been painted red (10R/5/6). Some anvils examined in hand specimen have been assigned to fabric groups based on comparisons with thin-sectioned samples. The relevant thin section numbers are shown in brackets. Anvil dimensions, colours and surface finish are set out in table 69.

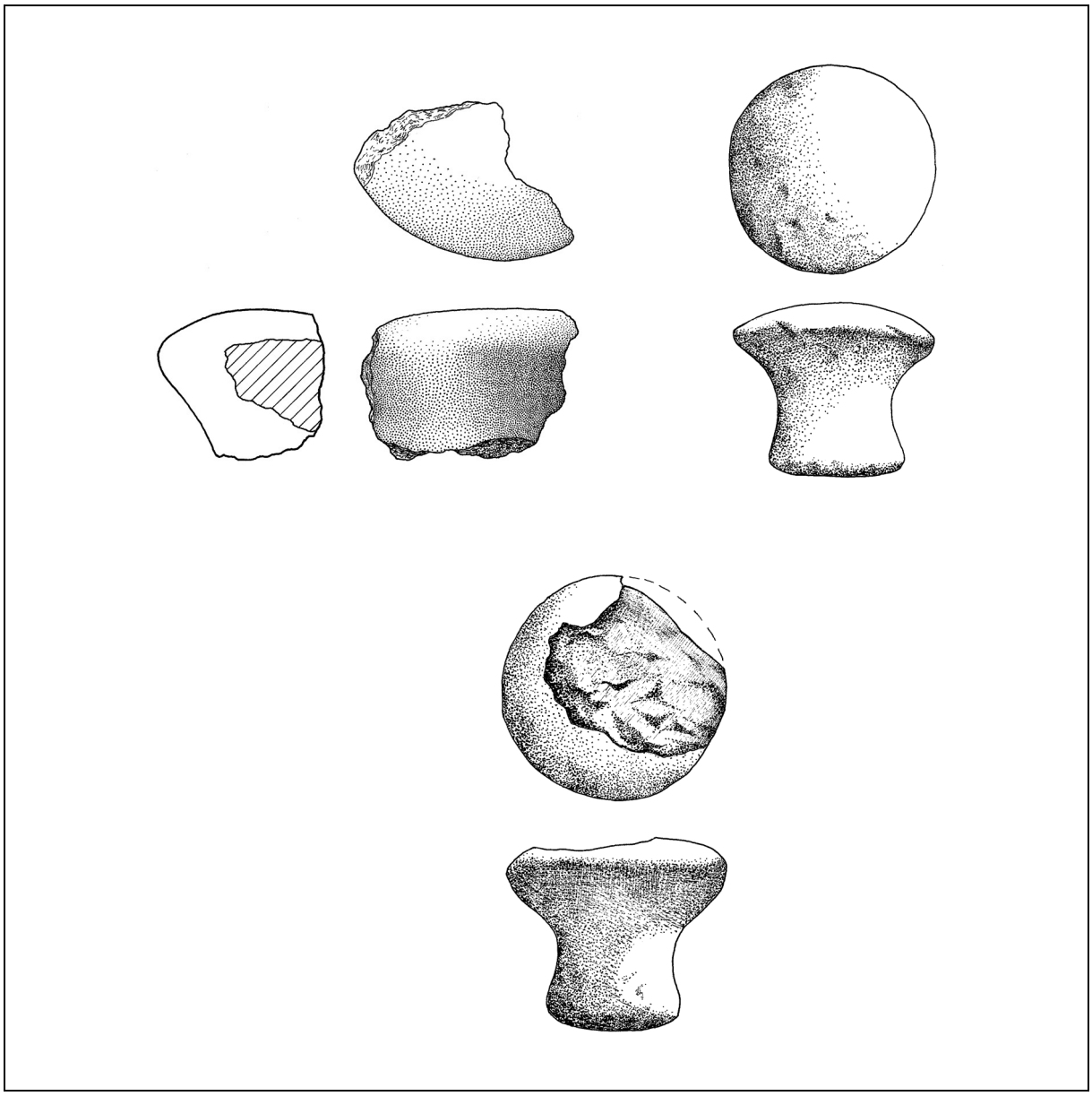


FIG. 136: Ceramic Period 3 potters' anvils: *Top* left: cat. 573 right: cat. 569, *Bottom:* cat. 904 Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

TABLE 68: *Ceramic Period 3 ceramic anvils*

MP	Cat.	Layer	Condition	Feature	Thin section/h.s.	Fabric
-	569	5:1	complete	-	h.s. (K323, 366)	grog local
-	573	5:1	fragment	-	K335	FG3
6	904	5:2	near complete	B18	h.s. (K323, 366)	grog local
6	975	5:2	complete	B19	h.s. (K323, 366)	grog local
-	582	5:3	frag. P.M?	4	K395	fishpond
7	2038 (a)	6:1	complete	B1	h.s. (K323, 366)	grog local
7	2038 (b)	6:1	complete	B1	h.s. (K323, 366)	grog local
6	738	6:1	complete P.M.	B4	h.s. (K323, 366)	grog local
-	611	6:2	fragment	-	h.s.	grog local
5	911	7:2	complete P.M.	B15	h.s. (K983)	sand exotic
5	932	7:3	complete P.M.	B16	h.s. (K323, 366)	grog local
-	802	7:4	fragment	-	K396	FG3
-	811	7:4	fragment	-	K365	FG3
4	1027	7:5	complete	B35	h.s. (K323, 366)	grog local
-	847	7:6	fragment	-	h.s.	grog local
4	954	7:6	complete	B20	h.s. (K323, 366)	grog local
-	907	7:8	fragment	-	h.s. (K395)	fishpond
-	880	8:1	near complete	-	h.s. (K346)	fishpond
-	920	8:2	fragment	-	K366	FG3
-	1094	8:2	fragment	-	h.s.	grog local
-	1310	8:2	fragment	46	h.s.	grog local
4	1099	8:2	complete	B33	h.s. (K323, 366)	grog local
-	936	8:3	fragment	-	h.s.	grog local
-	1155	8:3	fragment	-	h.s.	grog
-	2046	9:2	fragment	-	h.s.	blebs? exotic?
-	1115	9:6	fragment P.M?	-	h.s.	rice exotic?
-	1142	9:7	fragment	-	h.s.	grog exotic?
-	1353	9:7	fragment	-	h.s.	grog exotic?
-	1354	9:7	fragment	-	h.s.	grog exotic?

Only three anvils display distinct cord marks, six indistinct and the remainder are plain. The presence of both "S" and "Z" twisted cords could indicate left and right handedness. Handle diameters were measured at the base. Cat. 975 B19 L5:2, was smeared with red ochre and a white powder, possibly gypsum. The handle is corroded, probably by ground water following deposition.

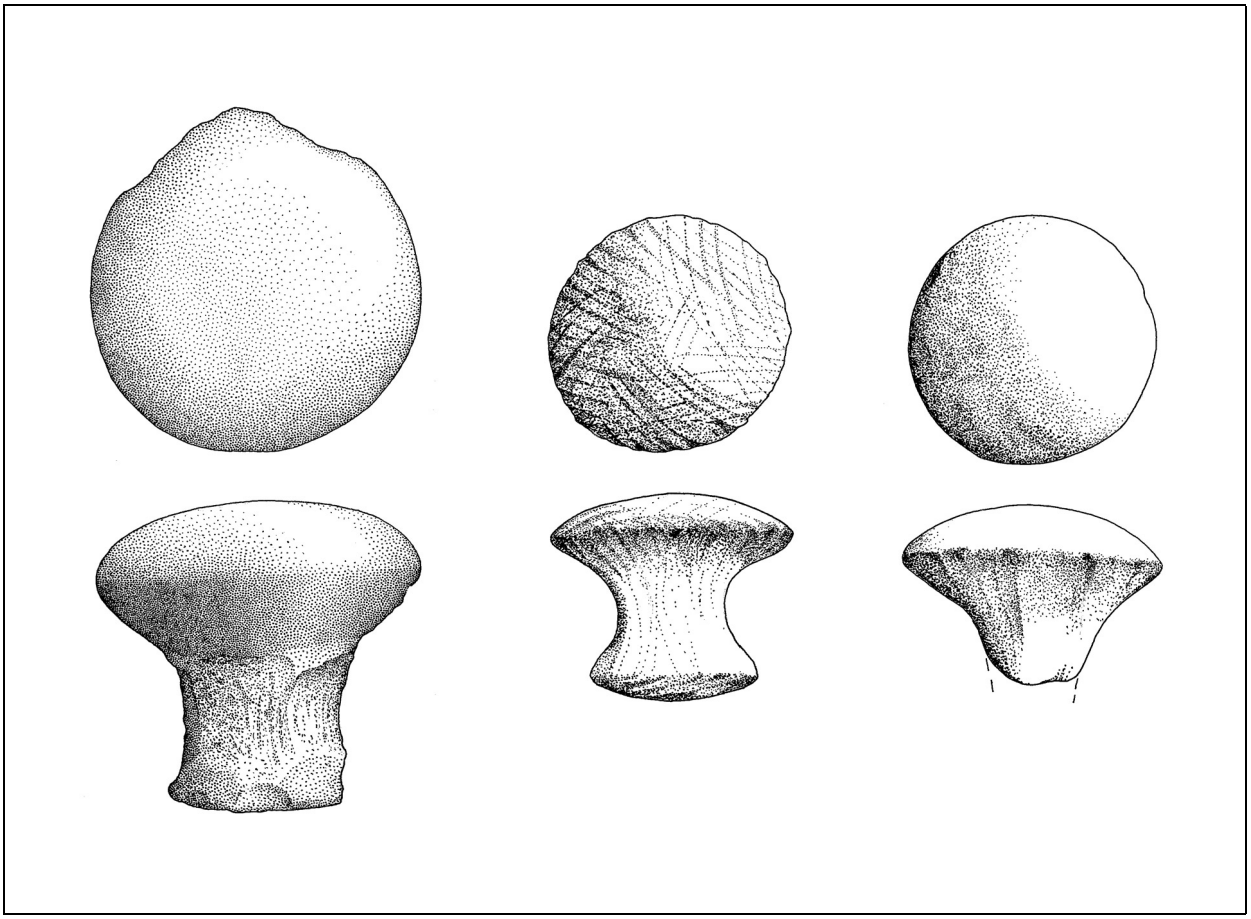


FIG. 137: Ceramic Period 3 potters' anvils: cats. 975 (left), 2038a (centre) and 2038b. Scale: 1:2

Local anvils are dominated by local grog, FG3 and the fishpond fabrics. Together, these account for 22, or 75.86 per cent, of the sample. Seven are exotic or probably so.

Nineteen of the local fabrics are tempered with orthodox grog, three are composed of the fishpond clay. Of these cat. 880 contains orthodox grog as for FG3. Cats. 907 and 582 share this material, however incidental rice husk is also evident. Deliberate addition for tempering purposes can be ruled out because the rice is present in extremely small quantities. The balance of the assemblage either contains or is consistent with FG3.

Seven anvils are considered to be exotic. Cats. 2046 and 1115 are tempered with bleb grog and rice respectively. Although their provenance cannot be suggested with confidence, it is significant

TABLE 69: *Ceramic Period 3 anvils: size, colour and cord marks*

Cat.	Layer	Diam. (mm) Head	Diam. (mm) Handle	Overall Length	Colour	Cord marks
569	5.1	61	39	51	2.5YR/6/6	-
573	5.1	100	–	-	2.5YR/6/6	indistinct
904	5.2	66	39	58	2.5YR/6/4	-
975	5.2	89	50 (est)	82	-	-
582	5.3	-	62	-	2.5YR/6/6	-
2038 (a)	6.1	63	44	55	2.5YR/6/6	indistinct
2038 (b)	6.1	63	44	55	2.5YR/6/6	-
738	6.1	62	46	54	2.5YR/6/6	'Z' 1-1
611	6.2	-	42	-	2.5YR/6/6	indistinct
911	7.2	82	38	55	7.5YR/5/2	indistinct
932	7.3	44	28	40	2.5YR/6/4	-
802	7.4	-	40	-	2.5YR/6/4	-
811	7:4	-	-	-	2.5YR/6/4	-
1027	7.5	77	53	64	2.5YR/6/6	'Z'? 1/1
847	7.6	48	28 (est)	-	2.5YR/6/6	-
954	7.6	55	29	51	2.5YR/6/6	-
907	7.8	38	18 (est)	-	2.5YR/6/6	-
880	8.1	29	20	28	2.5YR/6/6	-
920	8.2	58	32	58	2.5YR/6/6	indistinct
1094	8.2	69	36	53	2.5YR/6/6	-
1310	8.2	-	46	-	2.5YR/6/6	-
1099	8.2	68	35	59	2.5YR/6/6	indistinct
936	8.3	30 (est)	21	30 (est)	2.5YR/6/6	-
1155	8.3	-	-	-	10YR/4/1	-
2046	9.2	-	-	-	10YR/6/2	-
1115	9.6	-	-	-	7.5YR/7/4	-
1142	9.7	-	-	-	10YR/5/2	-
1353	9.7	-	-	-	10YR/5/2	-
1354	9.7	-	-	-	10YR/6/6	-

that both differ in colour to local anvils and cat. 1115 is coated with red paint (10R/5/6), an exotic technique. One fabric contains orthodox grog but is indeterminate (cat. 1155). It should be noted that the colour of the lowest six anvils differs from the rest of the assemblage. This could suggest that they are all exotic.

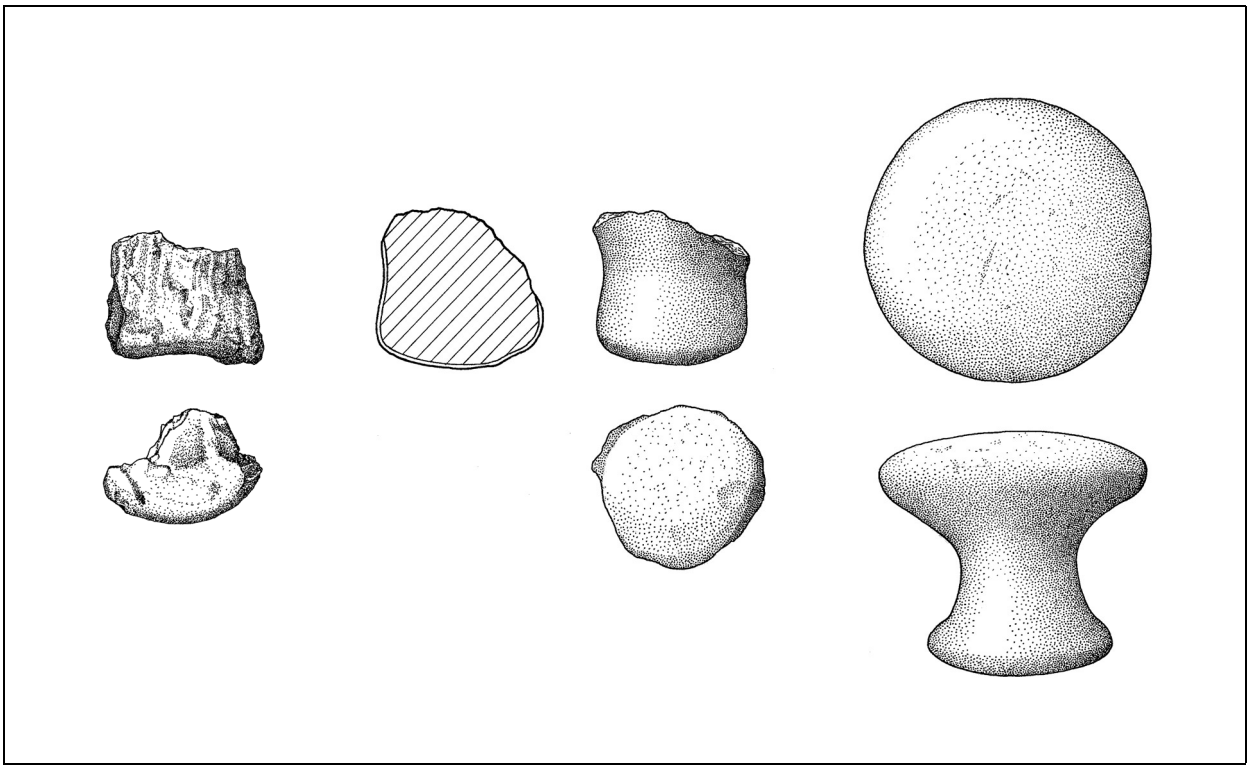


FIG. 138: Ceramic Period 3 potters' anvils: cats. 611 (left), 802 (centre) and 1027. Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

Perhaps the most significant exotic anvil is cat. 911 (Fig 142), interred with B15. In hand specimen, the fabric of this anvil can readily be identified with FG8. Its nonplastic constituents feature feldspars, probably including plagioclase, as well as quartz and abundant mica. This mixture has resulted in a particularly dense and robust ceramic composition, well suited to pottery and anvils. FG8 makes its first appearance in E2b fine wares during CP2, the earliest in layer 10:21 (Chapter VIII). Rim fragments from these burial jars were retrieved from the general matrix of L10:21, 10:17-14, 10:12, 10:9-7 and with B64 (layer 10:5). Two other FG8 fine wares, represented by rim forms 6b and 10e, were also recovered from within the general matrix of layer 10.

Nine of the ten anvils interred with burials were complete and the other nearly so. Several anvils show signs of usage wear and/or damage, for example cats. 880 (Fig. 139), 904 (Fig. 136), 907 (Fig. 139), 936 (Fig. 141), 975 (Fig. 137) and 1099 (Fig. 141). Two complete anvils, one nearly complete, and 17 fragments were scattered throughout the general excavation matrix,

the lowest from layer 9:7. None were located in either layer 10:1 or 10:2, a hiatus of 20 cm from 4.16 to 4.36 m below datum (Higham and Bannanurag 1990:36). Anvils were also absent from layer 10:10 (12 cm), 10:12 (4 cm), 10:15 (10 cm), 10:19-20 (22 cm) and 10:22-24 (30 cm).

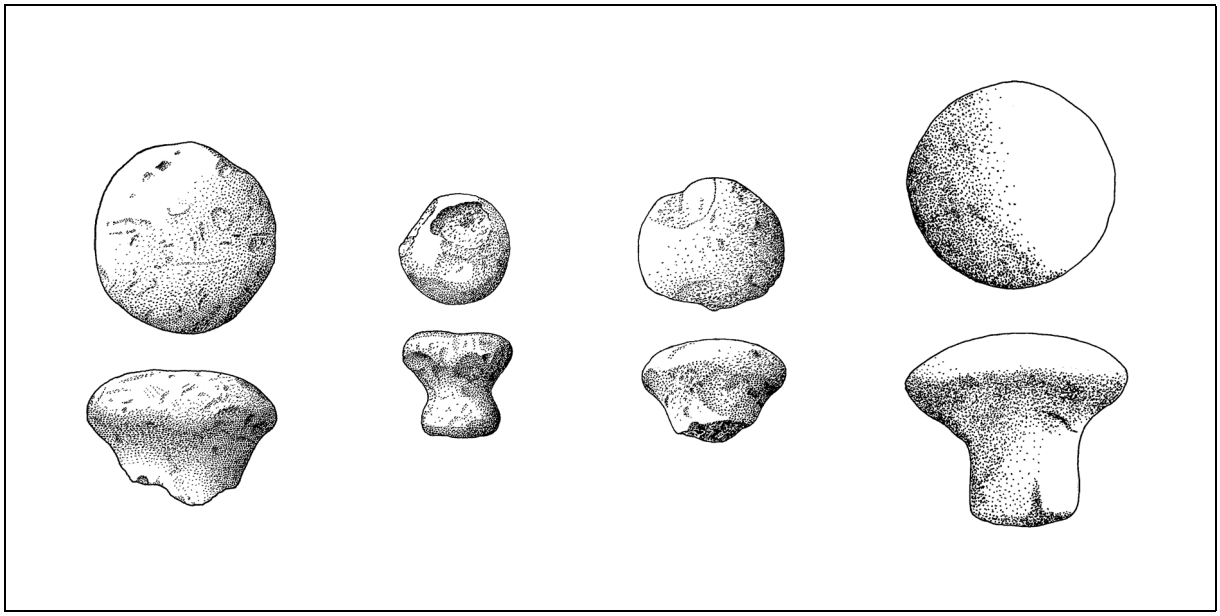


FIG. 139: Ceramic Period 3 potters' anvils: cats. 847 (left), 880 (2nd left), 907 and 954 (right). Scale: 1:2

A broad range of local ware forms of differing sizes was constructed and this is reflected in anvil head diameters, from less than 30 to 100 mm. Handles greater than 50 mm long could readily be held in a power grip, however shorter versions would be best suited to a precision grip. This suggests that smaller anvils were designed for intricate functions, such as forming complex vessel rims and similar details.

THE POTTERS' MARKS ON CERAMIC ANVILS

Potters' marks are present on three anvils included as funerary furniture and possibly two fragments, one recovered from layer 9:6 (cat. 1115), and the other from layer 5:3 (cat. 582, Fig. 143). The former comprises a fragment of handle about 45 mm long and 25 mm thick. When complete it measured about 80 mm in diameter. It is painted red and tempered with husk. As rice temper was not employed up to this point in the sequence, and red paint was not a local technique, this anvil is considered to be exotic. A single "V" shaped groove, which has been cut after the anvil was fired and painted, runs at right angles to the perpendicular plane. It measures 2 mm deep and about 5 mm wide. Cat. 582 is local with two pairs of fine vertical parallel lines 6 mm apart and about 20 mm between each set.

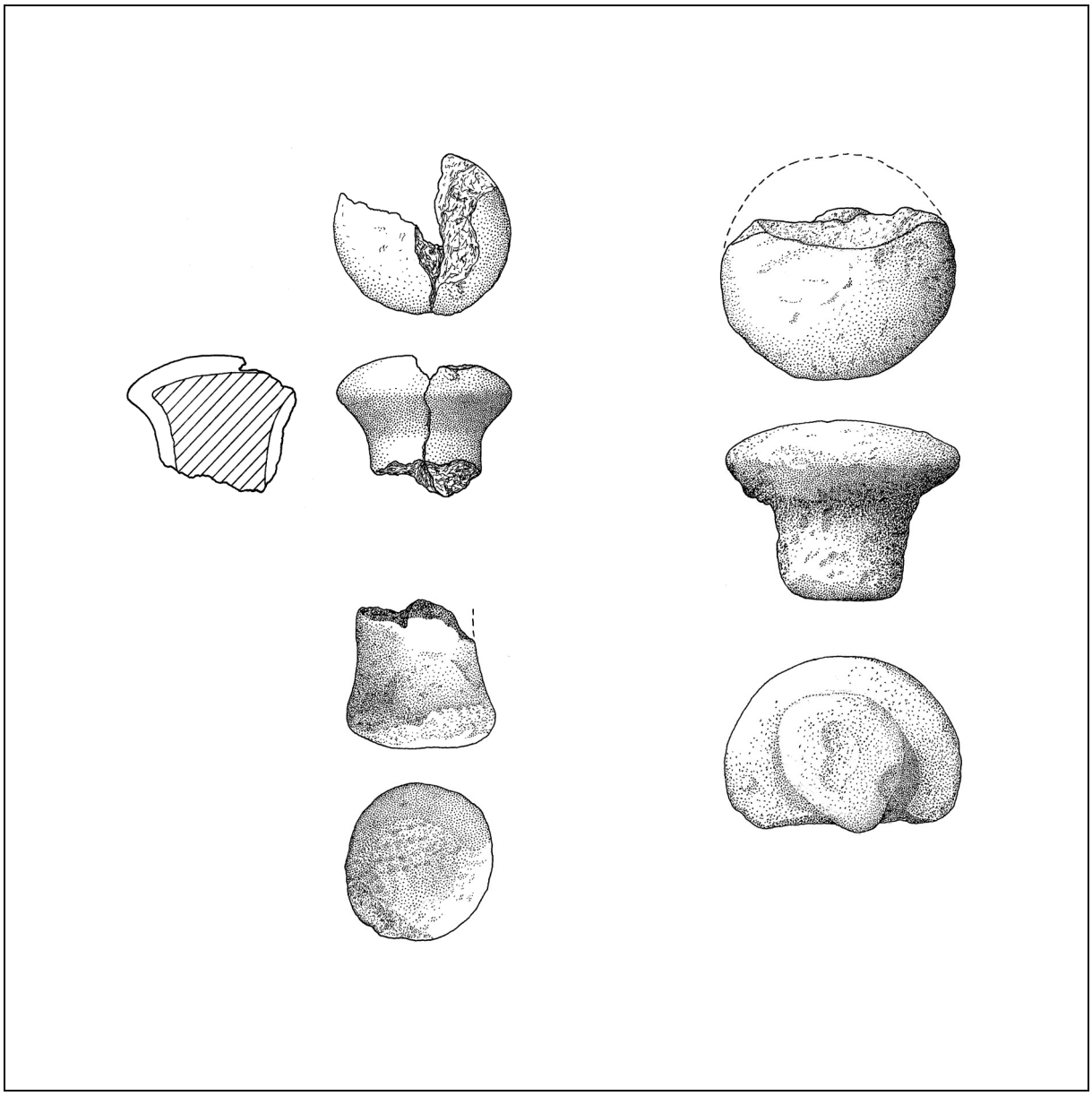


FIG. 140: Ceramic Period 3 potters' anvils: cats. 920 (top left), 1094 (right) and 1310 (bottom left), Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

Five geometrically arranged circular holes, 3 mm in diameter and 20 mm deep, are arranged on the handle base of cat. 738 (Fig. 142) interred with B4, a 26 year old female. This area has been partially smoothed, however, faint cord marks are visible. This intact anvil is composed of the local fishpond fabric.

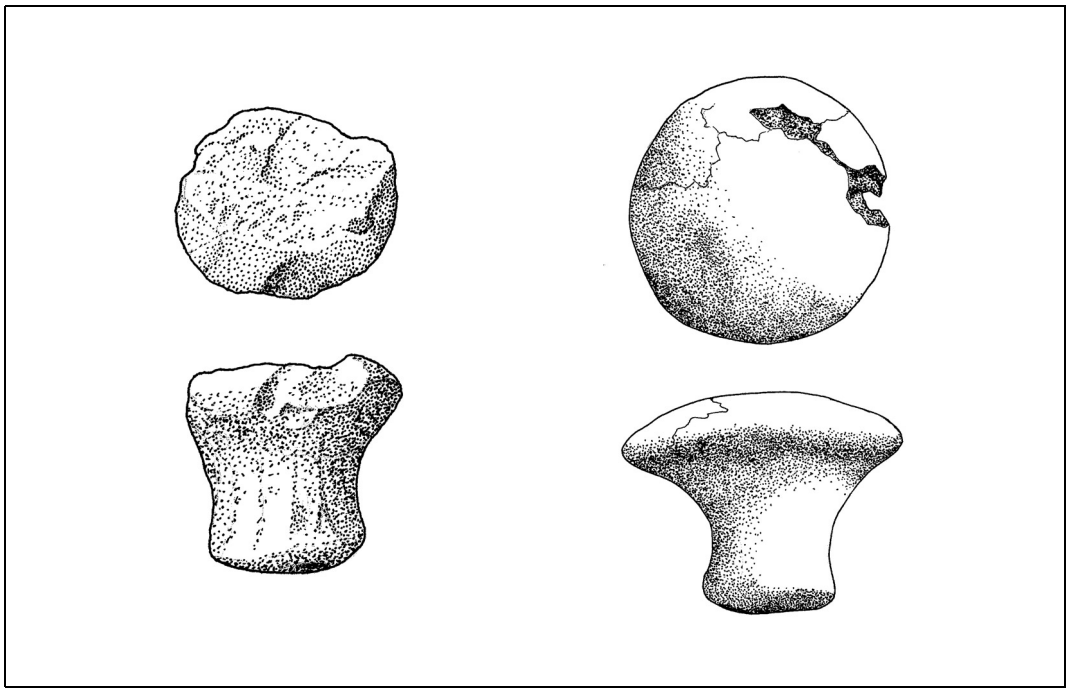


FIG. 141: Ceramic Period 3 potters' anvils: cats. 936 (left, scale: 1:1) and 1099, (scale: 1:2)

A single hole marks the handle base of cat. 911 placed alongside the right ankle of B15 in association with a *Polymesoda* shell containing two burnishing stones (cat. 908). A mass of potting clay overlay the body. The anvil mark consists of a 4 by 7 mm diameter orifice comprising two 4 mm holes made by a circular probe at the centre of the base (Fig. 142). In outline it forms a figure eight 20 mm deep. The handle sides and lower head surfaces display partially-smoothed vertical cord marks. Apart from slight chipping and a fine crack radiating from the edge of the head, this exotic anvil is otherwise intact.

At 70 cm north, and shortly following that of B15 (Table 106), B16, a 15 month infant was interred with similar jewellery and four L2b burial jars. As with B15, clay cylinders were amassed over the corpse and the grave was much larger than required to receive the body. It was positioned parallel and in line with B15. A small anvil (cat. 932) mirrors in overall form that disposed with B15 (Fig. 143). Significantly, it also displays a single central hole to the handle base. Curvilinear in section, it measures 4.5 mm long, 1.8 mm wide and 13 mm deep. The shape is consistent with penetration by a bamboo probe into the wet clay. This intact anvil is composed of the local FG3. As with B15, it was placed beside the right ankle.

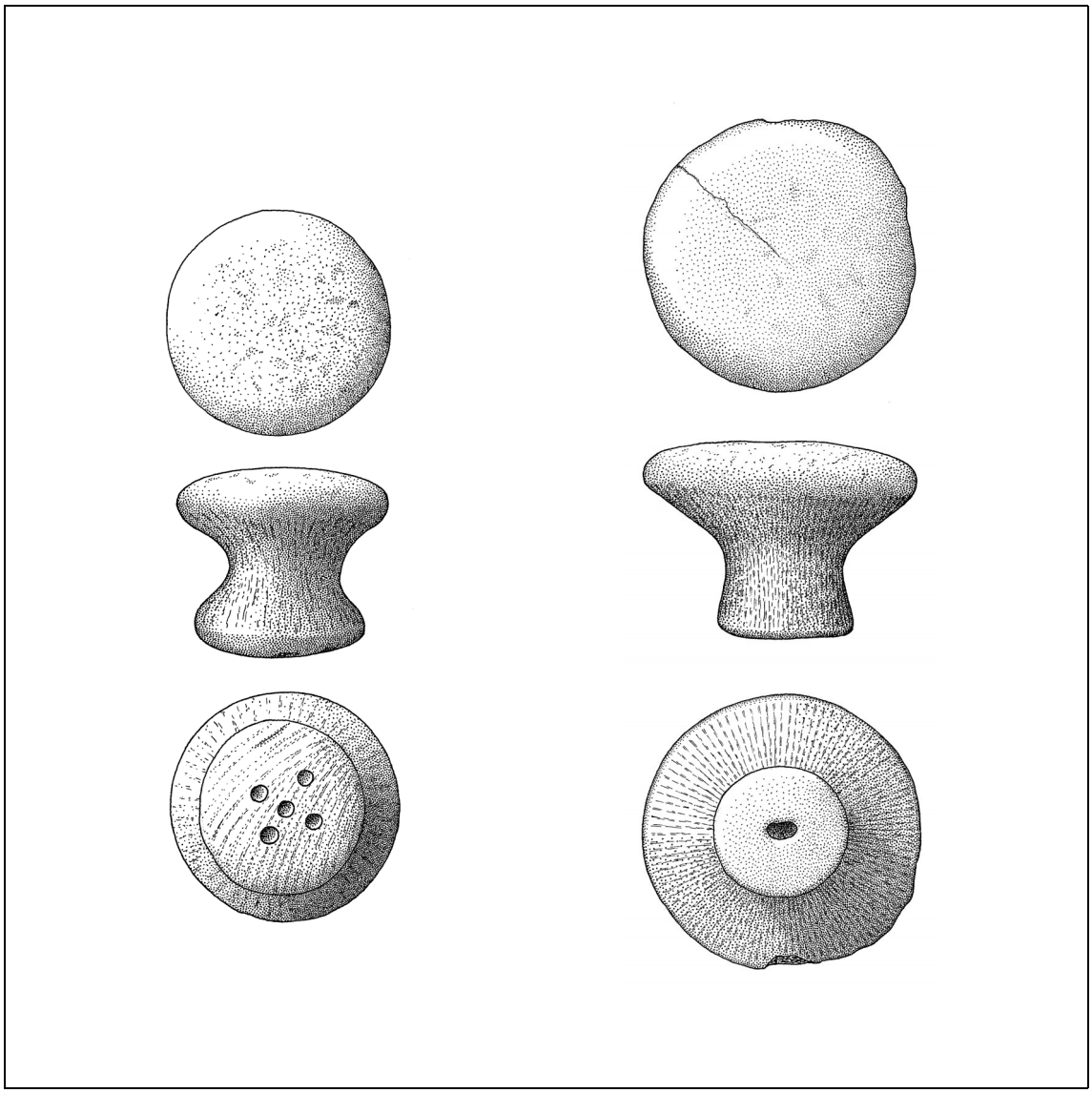


FIG. 142: Potters' marks on anvils: cats. 738 (left) and 911, Ceramic Period 3. Scale 1:2

CORD MARKS ON CERAMIC ANVILS

Nine anvils display cord marks (Table 69). All, except cat. 911 are probably local. Marks on six were indistinct. Cat. 1027, interred with B35, a 21 year old female, retained what are probably "Z" twist marks. It was placed next to her right ankle. Two E2b burial jars, included as grave goods, feature cord-marked bases. On cat. 1025 the impressions are clearly "Z" twist and these are probably repeated on the other, cat. 1026. Both vessels are exotic.

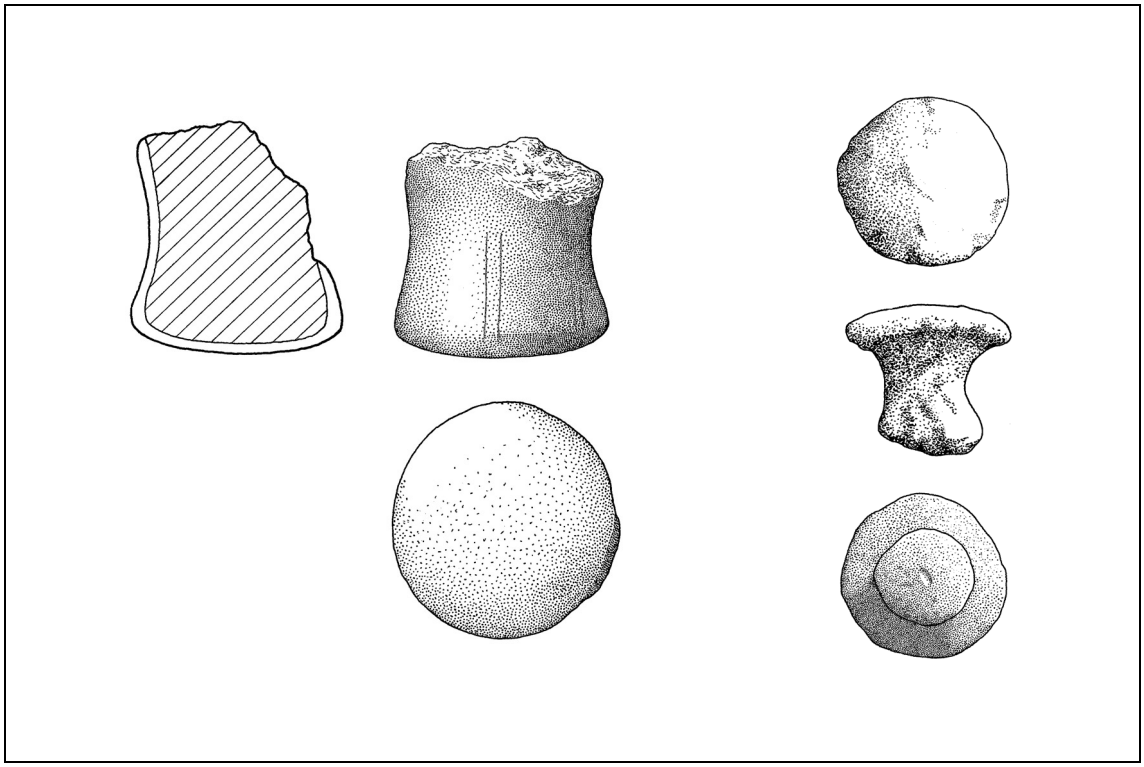


FIG. 143: Potters' marks on anvils: cats. 582 (left) and 932, Ceramic Period 3. Shading indicates firing results (shaded areas are not oxidized). Scale 1:2

Cat. 738, which was laid between the lower legs of B4, a 26 year old female, has clear "Z" twist cord marks to the waisted shaft. Further indistinct cord marks are visible over the basal surface.

BURNISHING STONES

The presence of burnishing stones, in burials and within the general matrix, indicates that burnishing continued to be an important aspect of pottery production throughout CP3. Stones in

burials increased, from 21 in 11 CP2 burials, to 31 in 15 CP3 burials. A total of 116 stones were recorded in CP3 contexts (Table 70), which represents 31.52 per cent of the total site assemblage. This compares with 197, or 53.53 per cent, in CP2. Four individuals were too young to sex, four were male and seven female. Two males, B23 and B29, were buried with carapace ornaments. No male included an anvil, however, these were present in four of the juvenile burials (1, 16, 20 and 33), which may suggest that they were females (Table 67). All female burials, except B13 and B36, also contained anvils as grave goods. Males were aged 27, 30 (2), and 32 years, females 21 (2), 25, 26, 35 (2), and 42.

TABLE 70: *Ceramic Period Three burnishing stones*

Layer	No.	Feature	Layer	No.	Feature	Layer	No.	Feature
5:2	2	B19	6:6	1	-	8:7	2	28
5:2	1	B18	6:8	1	-	8:7	1	lens 12
5:3	2	B6	7:1	2	-	9:1	2	B42
5:4	1	-	7:2	2	B15	9.1	2	-
5:5	1	-	7:3	3	-	9:2	7	-
6:1	1	B1	7:3	1	B16	9:2	1	17
6:1	4	B4	7:4	1	-	9:3	6	-
6:1	1	-	7:5	3	B35	9:3	1	lens 7
6:2	2	-	7:6	1	B36	9:4	5	-
6:3	2	68	7:6	1	B23	9:4	1	37
6:3	1	-	7:6	1	B20	9:5	3	-
6:3	1	B9	7:7	1	-	9:6	2	-
6:3	1	6	8:1	4	-	9:6	4	lens 9
6:4	2	-	8:2	2	-	9:7	3	-
6:4	1	46	8:3	1	B29	10:1	7	-
6:5	1	-	8:3	4	-	10:1	1	1
6:5	8	B13	8:5	1	-	10:2	6	-
Total							116	

BONE STYLUS POINTS

Bone stylus points were recovered from the general matrix of CP3 (Table 71). One, cat. 894, recovered from layer 6:2, is a chisel-shaped tool 34 mm long, 24 mm wide and about 2 mm thick, suited to incising pottery. A further group of bone points may also have been used to

incise designs into leather-hard pottery surfaces. These are set out in Volume III (Higham and Thosarat 1993:4-10).

TABLE 71: *Ceramic Period 3 bone stylus points*

Cat. no.	Layer	Shape	Cat. no.	Layer	Shape	Cat. no.	Layer	Shape
591	5:4	chisel	895	6:4	chisel	1475	9:7	point
1530	5:4 f.2	point	2379	7:2	chisel	1184	10:1	chisel

PREPARED CLAY

A variety of petrographically different potting clay remains is present in CP3 contexts. They total 28.56 kg, including 16.16 kg associated with burials. This represents 56.58 per cent of the CP3 potting clay recovered. Samples of these clays have been analysed in thin section and hand specimen. This accounts for about 60 per cent of the total clay, by weight, recovered from CP3 contexts (Table 72). The remaining portion of the sample has not been examined in detail, however, on visual inspection it all appeared to be consistent with local clay deposits. Incidental rice husk is present in the B19 clay and sample K431. This latter clay is petrographically consistent with the modern local clay Z2 recovered from a pit a few metres from the edge of the site. Sample K428, from layer 8, contains a medium silt-sized angular grain of schorlite. Other prepared clay samples include what appears to be andesine. Along with biotite, these minerals suggest a granitic or leucogranitic source.

Sample K425, again from layer 8, is of particular interest. This prepared clay contains orthodox grog which was manufactured using the silty fishpond clay. The grog particles are mainly reduced; some, however, are fully oxidized. This suggests that they derive from fired balls, of otherwise unaltered fishpond clay, which has been crushed. The use of silty fishpond clay, as a grog temper, suggests that more plastic clays may have been conserved for fine wares. Micritic authigenic calcite appears to have completely replaced the clay matrix of the parent prepared clay body, because, apart from the fired grog, only the silt-sized nonplastic fraction, which comprises mostly quartz, has survived. Grog in the CP3 samples probably survived chemical replacement by calcite because it had been fired. Authigenic micritic calcite is evident within the interstices of the grog fragments in sample K425 and calcite also appears to be replacing some of the silt-sized quartz grains (Blatt *et al.* 1972: 364-5). Sample K429 also contains orthodox grog, but in contrast to sample K425, no replacement of the parent clay matrix is evident. As it is possible that both were composed of the same fabric, careful attention was paid to the disposition of calcite in the thin sections. In K429, calcite is present in only small amounts, mainly on outer surfaces of the clay where it has only just penetrated into one or two small orifices near the surface. Two factors may have caused these contrasting effects. Shell middens are present in abundance in some parts of the site (Aitken 1992), and, provided sufficient ground water, of an appropriate composition,

was available, these could have given rise to the authigenic calcite deposits. Hence the vagaries of location with the deposits could have contrasting effects. Ground water leaching through the prehistoric shell middens would carry calcium carbonates down through the cultural deposits, where they could subsequently be precipitated as authigenic calcite. Modern clay collected from about 20 m beyond the margins of the site, and referred to as "*din dum*" by local inhabitants, matches the prehistoric sample K430.

TABLE 72: *Ceramic Period Three prepared potting clay petrology*

Layer	Feature	Thin section/h.s.	Clay	Temper	Wt. (kg)	% for layer
5:2	B19	h.s.	fishpond	none	0.11	1.35
5:3	B6	h.s.	fishpond	none	0.02	0.25
6:1	B4	h.s.	fishpond	none	0.80	23.39
6:3	B7, 8 & 9	h.s.	fishpond	none	0.10	2.92
6:4	B11	h.s.	fishpond	none	0.02	0.58
7:2	B15	h.s.	fishpond	none	10.99	65.56
7:2	B16	h.s.	fishpond	none	3.99	23.84
7:6	B36	h.s.	fishpond	none	0.05	3.31
8:2	-	K428	fishpond	none	0.01	1.75
8:3	-	K425	micaceous	grog	0.03	5.26
8:3	B27	h.s.	fishpond	none	0.05	3.31
8:4	B28	h.s.	no data		0.02	3.64
9:1	-	K431	fishpond	none	0.10	10.10
9:5	f.6	K426	fishpond	none	0.28	31.81
9:7	B49	h.s.	fishpond	none	0.01	1.14
10:2	-	K427	fishpond	none	0.02	5.88
10:2	-	K429	micaceous	grog	0.10	29.41
10:2	-	K430	Din Dum	none	0.15	44.11
Total					16.85	

Potting clay, weighing over 8 kg, or about 28 per cent of the total CP3 sample, was recovered from the general matrix of layer 5 (Chapter V, Table 10). This lay immediately beneath CP4, which comprised a pottery workshop. Much of the clay in layer 5, therefore, is likely to have migrated down from the potting work floor. Its colour and composition matches the prepared clay residues found in large quantities throughout CP4 contexts. It is mineralogically consistent with local clay deposits.

MISCELLANEOUS CERAMIC ARTEFACTS

THE CERAMIC PELLETS

Twelve ceramic "bow" pellets measuring from 14–23 mm in diameter were recovered from CP3 (Table 73). Pellets annotated "un." in the table had only been air-dried. These four unfired pellets were coloured light red (2.5YR/6/6), or a light brownish grey to light grey (10YR/6/2). The latter being consistent with the local fishpond clay.

TABLE 73: *The ceramic bow pellets from Ceramic Period 3*

Cat.	Layer	Diam. (mm)	Cat.	Layer	Diam. (mm)
3254	6:6	21	3259	7:6	16
3255	7:1	18 un., 16	3260	7:7	17 un.
3256	7:2	16	3261	7:9 feature 1	19
909	7:2 B15	-	1322	9:4	22
3257	7:3	17 un.	1339	9:6	19
3258	7:5 feature 50	20 un.	-	-	-

THE CERAMIC NET WEIGHTS

Eight ceramic net weights were recovered from CP3 contexts (Table 74, The dimensions of those broken in prehistory have been estimated and annotated "est").

TABLE 74: *The ceramic net weights from Ceramic Period 3*

Cat.	Layer	Length (mm)	Width (mm)	Cat.	Layer	Length	Width
1015	7:4 l.5	50 (est.)	25	1257	8:7	56 (est.)	26 (est.)
906	8:2	28	19	1316	9:3 l.7	34	23
939	8:3	56	28	1321	9:4	28	21
1137	8:3	28	18	1143	9:7	41	32

THE POTTERY OF CERAMIC PERIOD 3

BURNISHED AND INCISED WARES

Burnished fine wares with incised geometric and curvilinear designs continued to be manufactured throughout CP3. Several such exotic wares were also entering the site during this period. Compared to CP2, burnished and incised sherds are more evenly spread. They disappear briefly in layer 9 and then return, increase slightly and then maintain an irregular presence for the remainder of CP3. They reach their maxima in layer 6:1 and then disappear in layer 5:2. Burnishing stones and burnished sherds together follow a similar distribution pattern with a similar decrease to that noted for the burnished and incised sherds. CP3 contained 116 burnishing stones and 17.46 kg of burnished sherds (31.52 and 20.49 per cent of the site totals respectively). Overall, the burnishing stone and burnished sherd distributions closely match each other throughout CP3.

The distributions of CP3 burnished and incised and exotic burnished and incised body sherds are set out in tables 76 and 75. They total 1.81 kg and 22 g respectively. These data are further detailed in Chapter XI and should be read in conjunction with the rim and whole vessel information. The sherds have been examined in hand specimen only. Those not designated as exotic are considered to be local. The local sherds are mainly comprised of FG3, the later local grog, although five sherds from layer 5:5, 6:1, 6:2 (B4), 6:3 and 6:6, which weigh 1, 2, 3, 2 and 2 grams respectively, are probably FG4 blebs. Three sherds from layer 8:6, 9:5 and 9:7, each weighing 1 gram, are comprised of FG2. All eight sherds are included in the local ware table. It should be noted that the exotic fabrics include orthodox grog, sand, rice and bleb tempers. The exotic sherd weights are also included with the overall sherd weights in table 76.

TABLE 75: *Ceramic Period 3 exotic burnished and incised sherds*

Layer	Feature	Weight (g)	Temper	Layer	Feature	Weight (g)	Temper
5:2	4	1	sand	8:3	-	4	sand
5:3	B6	4	sand	8:4	lens 7	2	sand
6:1	-	3	sand	8:7	28	1	orth. grog
6:2	-	3	sand	9:4	36	2	bleb grog
7:8	B27	1	sand	10:1	41	1	rice

TABLE 76: *Ceramic Period 3 burnished and incised sherds*

Layer	Feature	Weight (g)	Layer	Feature	Weight (g)
5:2	B19	10	7:5	5	2
5: platform	lens 28	2	7:5	24	3
5: platform	B6	1	7:5	39	1
5: platform	lens 12 f.2	2	7:6	29	2
5: platform	lens 31	2	7:6	35	1
5: platform	lens 32	9	7:7	-	8
5:5	-	1	7:8	31	1
6:1	B4	15	8:1	36	1
6:1	-	6	8:2	41	1
6:2	-	3	8:2	61	1
6:3	8	2	8:3	B29	1
6:4	68	1	8:3	39	1
6:4	8	5	8:4	B28	2
6:6	28	2	8:5	B30	1
6:6	21	1	8:5	B33	12
6:6	37	1	8:5	lens 8	2
6:6	-	1	8:6	17	1
6:7	-	9	8:6	38	1
6:8	8	2	8:6	78	1
6:8	-	4	8:7	3	1
7:2	1	2	8:7	36	1
7:2	2	1	8:7	-	16
7:2	B15	4	9:1	-	4
7:2	22	2	9:5	40	1
7:2	33	4	9:7	18	1
7:2	37	2	9:7	10	5
7:3	B16	2	10:2	54	1
7:3	13	2	10:2	-	5
7:4	-	4			

INCISED FINE WARE SHERDS

Incised fine ware body sherds increased from 11.76 kg in CP2 to 39.42 kg, including burial sherds, during CP3, or from 22.97 to 77.03 per cent of the incised wares recovered from the cemetery. The total weight for each CP3 stratigraphic unit is set out in table 77. These figures should be read in conjunction with the balance of the pottery data set out in the appendices. A detailed list of the incised sherd weights is presented in Appendix 3. Incised sherds recovered from CP3 burials are listed in table 78. They total 1.03 kg.

TABLE 77: *Ceramic Period 3 incised sherds*

Layer	Weight (kg)	Layer	Weight (kg)	Layer	Weight (kg)
5:1	1.99	7:1	1.33	8:6	0.23
5:2	1.19	7:2	1.55	8:7	0.50
5:3	2.00	7:3	0.92	9:1	0.39
5:4	2.00	7:4	0.56	9:2	0.68
5:5	2.01	7:5	1.22	9:3	0.72
6:1	1.90	7:6	0.54	9:4	0.63
6:2	0.94	7:7	0.91	9:5	0.38
6:3	2.52	7:8	0.02	9:6	0.80
6:4	2.95	8:1	0.87	9:7	0.38
6:5	2.98	8:2	1.29	10:1	0.83
6:6	0.38	8:3	1.02	10:2	0.52
6:7	0.43	8:4	0.54		
6:8	0.31	8:5	0.99		

TABLE 78: *Ceramic Period 3 incised sherds from burials*

Layer	Burial	Weight (g)	Layer	Burial	Weight (g)
6:1	B1	2	7:2	B20	12
6:3	B2	2	7:3	B16	5
6:3	B3	5	7:4	B17	3
6:3	B8	8	7:5	B35	4
6:3	B9	5	7:6	B21	1
6:4	B11	4	7:6	B22	7
6:5	B13	16	7:7	B24	2
7:2	B15	24	7:7	B25	3

BURNISHED FINE WARE SHERDS

Burnishing continued as a distinctive local technique during CP3. Weights for each stratigraphic unit are given in table 79. Most sherds are again either partially or fully reduced (Appendix 3). As with the incised wares, their fabrics match those of the rim sherds. In hand specimen, the majority appear to be composed of the local FG3. Exotic fabrics are represented by sand, rice, bleb and orthodox grog wares in minor quantities. A few of the earlier local FG2 ware sherds were also present and these are considered to have migrated upwards into CP3, probably as a result of prehistoric activities such as the excavation of graves and postholes. Because body sherd fabrics will be represented in the rim sherds further description is unnecessary. The overall site distribution of burnished wares is set out in Chapter XI. Burnished fine ware sherds decreased from 59.99 kg in CP2 to 17.80 kg during CP3, including 1.92 kg from burials, or from 77.11 to 22.88 per cent of the burnished wares recovered from the cemetery (Table 80).

TABLE 79: *Ceramic Period 3 burnished sherds*

Layer	Weight (kg)	Layer	Weight (kg)	Layer	Weight (kg)
5:platform	1.82	7:5	0.93	8:8	0.02
6:1	0.06	7:6	0.35	9:1	0.64
6:4	0.07	7:7	0.28	9:2	0.38
6:5	0.03	7:8	0.04	9:3	0.40
6:6	0.36	8:1	0.35	9:4	0.49
6:7	0.16	8:2	1.18	9:5	0.78
6:8	0.36	8:3	0.30	9:6	1.23
7:1	0.24	8:4	0.22	9:7	0.17
7:2	0.67	8:5	0.70	10:1	1.42
7:3	0.55	8:6	0.69	10:2	1.14
7:4	0.62	8:7	1.15		

PADDLE-IMPRESSED WARE SHERDS

Minor amounts of paddle-impressed potsherds were deposited intermittently from layer 10:1 onwards. Each sherd has been examined in hand specimen. Their distribution and fabrics are set out in table 81. These data supplement the rim form fabrics discussed below and include sherds retrieved from postholes and other features. In each case the pottery is considered to be exotic to Khok Phanom Di. A single bleb-tempered sherd weighing one gram was also recovered with B15. They record a more-or-less steady increase from 5 g in layer 10:1, 4 g in layer 9, 9 g in layer 8, 1 g in layer 7, 28 g in layer 6, to 94 g in layer 5. A broad range of fabrics, including sand temper (16 g), orthodox grog (27 g), orthodox grog in a sandy matrix (14 g), bleb grog (83 g) and

TABLE 80: *Ceramic Period 3 burnished sherds from burials*

Layer	Feature	Weight (g)	Layer	Feature	Weight (g)
5: platform	B19	95	7:7	B25	2
6:1	B4	6	8:1	B40	3
6:4	B11	4	8:2	B45	2
7:2	B15	19	8:5	B30	19
7:3	B16	2	8:5	B31	3
7:4	B17	14	9:1	B42	1
7:6	B22	4	9:1	B37	5
7:6	B36	8	10:2	B77	5

bleb grog in a sandy matrix (1 g) were noted. Thus bleb-tempered sherds comprise 59.27 per cent of this ware. This compares with CP2 paddle-impressed fabrics where sand temper accounts for 85 per cent of the sample.

PAINTED AND SLIPPED FINE WARES

Only 47 grams of painted and slipped fine wares were recovered from CP3 contexts, confirming their rarity (Table 82). Each sherd is exotic, as was the case with the CP2 sample. One slipped sherd, from layer 7:7, was thin sectioned (thin section K297). It contained abundant rice husk and a bleb grog temper, as does a single RF5 fine ware (thin section K599). One slipped RF6R (thin section K1038), also examined petrographically, was composed of FG11. This fabric was probably imported from a source within the Prachinburi River catchment to the northeast, a major tributary of the Bang Pakong.

In CP3, 0.16 kg of slipped body sherds were recovered and each has been examined in hand specimen. This small sample included fabrics tempered with rice husk (0.12 kg) and orthodox grog (0.04 kg), while in CP2 one sherd was tempered with sand, demonstrating that, although not a technique available to, or favoured by, local potters, the method was not restricted to a single exotic manufacturing centre. Complex potting techniques are known to have been kept as closely guarded secrets in order to preserve access to valuable exchange networks (Shepard 1942, 1956). The presence of slipped wares in association with three different fabrics suggests that the technique was known in one particular region. Such a region may have fallen within the Khok Phanom Di exchange network, perhaps not in a direct one-on-one but as a down-the-line exchange relationship.

Painted wares are also rare in CP3; only 0.31 kg was recovered as single sherds scattered throughout the sequence, apart from L6 where they were absent. Although painted decoration was not employed by local potters, in some instances red ochre appears to have been rubbed into the surface of fine ware vessels during, or prior to, burnishing. Exotic painted wares are red and the use of ochre to colour a few burnished vessels suggests experiments may have been carried

out to test this colouring method. The practice did not develop further, however, and burnished wares continued to be made along traditional lines throughout CP3.

TABLE 81: *Ceramic Period 3 exotic paddle-impressed sherds*

Layer	Weight (g)	Temper	Layer	Weight (g)	Temper
5:1	17	bleb grog	6:2 L7	2	bleb grog
5:1	7	orth. grog	6:2 L7	1	sandy bleb
5:1	3	sand	6:3	2	bleb grog
5:1	4	sandy grog	6:3	1	sand
5:2	7	bleb grog	6:4	1	orth. grog
5:3	7	bleb grog	6:4	3	sandy grog
5:3	2	orth. grog	6:5	1	bleb grog
5:3	3	sand	6:5	2	sandy grog
5:3 platform	4	sandy grog	6:7	1	sandy grog
plat. L33-34	1	bleb grog	7:2	1	orth. grog
5:4	22	bleb grog	8:1	6	bleb grog
5:4	7	orth. grog	8:3	1	orth. grog
5:5	8	bleb grog	8:4	1	orth. grog
5:5	2	sand	8:5	1	bleb grog
6:1	7	bleb grog	9:2	4	orth. grog
6:1	1	sand	10:1	1	bleb grog
6:2	1	bleb grog	10:1	1	orth. grog
6:2	2	orth. grog	10:1	3	sand
6:2	3	sand			

If the few ochre-coloured burnished sherds identified represent attempts to add red to the range of local ware colours, it seems reasonable to assume some experimentation with exotic styles was carried out. This is a typical response by potters in contact with novel fashions. Copying of exotic styles has been reported at Ban Na Di (Vincent 1988). Many other instances have been documented by researchers in both North America and Europe (see Shepard 1956 for examples). Although slipping requires detailed knowledge of quite complex methods, applying paints is less demanding. Whether the fashion was not adopted for technical or cultural reasons remains unclear. It is possible that the technique for mixing and binding the paint onto vessels was not understood, or that the appropriate materials were not locally available. The latter seems less likely as plant extracts (such as resins and dyes made from the bark, roots, seeds and fruits of suitable trees), were locally available (Thompson 1996:107). On balance, given that suitable substances such as ochre, resins and dyes were locally available, the most likely reason for the failure of local potters to adopt painting as a decorative technique was probably cultural.

TABLE 82: *Ceramic Period 3 exotic painted and slipped sherds. BG: bleb grog, OG: orthodox grog, Wt: weight*

Layer	Feature	Surface	Wt. (g)	Temper	Layer	Feature	Surface	Wt. (g)	Temper
5:2	-	painted	1	BG?	8:3	-	painted	9	OG
5:3	-	painted	1	BG?	8:4	-	slipped	1	rice
5:3	B6	painted	1	BG?	9:2	f.4	painted	2	rice
7:3	-	painted	2	OG	9:3	-	slipped	1	OG
7:7	B24	painted	2	BG?	9:4	-	slipped	2	OG
7:7	-	slipped	5	rice	9:5	f.17	painted	1	rice
8:1	-	painted	2	BG	9:5	l.8	painted	8	BG
8:1	-	slipped?	6	rice	10:2	-	slipped	1	OG
8:2	-	painted	2	rice					

PUNCTATE WARE SHERDS

Only five punctate sherds were uncovered from CP3 contexts. All have been examined in hand specimen. A P1 sherd, recovered from B19, and another from layer 5 lens 32 are otherwise plain. Their origins are unclear. The single P3 rice-tempered sherd, weighing 2 g, from layer 9:7, is also coated with a red slip or paint. It is exotic. A single sherd, coded H3:30 following Hall (1993:242), from layer 10:2 is decorated with a zig-zag band enclosed by stamped punctate impressions.

TABLE 83: *Ceramic Period 3 punctate sherds*

Layer	Mode	Grams	Temper	Layer	Mode	Grams	Temper
5:0 B19	P1	3	-	10:1	P4	1	bleb grog
5:0 l.32	P1	1	-	10:2	H3:30	1	sand
9:7	P3	2	rice				

VESSEL LIDS

A series of lids, measuring from 10 to 20 cm in diameter (Fig. 144), were distributed throughout CP3 and these have been examined in hand specimen (Table 84). The L10:2 bleb-tempered lid is probably composed of FG11. Forms 1 and 2 continue from CP2. Lid forms 3, 4 and 5 were present within layers 8 to 5, all are simple and direct. No lids were recovered from layer 9. Accurate artefact determination requires an understanding of function, either through observable

utilitarian parameters, (i.e. unfired clay can not function as an anvil), ethnographic information or from analogy with similar artefacts. In this respect, lids may be particularly difficult to identify because their intended use and consequential orientation may be ambiguous. Thus they may be able to function equally as lids and/or containers. The following categories are promoted with this in mind:

- Lid form I (LF1), is a burnished fine ware, reduced and probably tempered with bleb grog. From the terminus it thins from 10 to 5 mm in section thickness.
- LF2 is present in both sand and bleb-tempered wares. Although both have a plain surface finish, the sample tempered with blebs displays cord marks at the terminus. In each case they are 5 mm thick with oxidized surfaces and reduced cores.
- LF3 is 5 mm thick. The exterior is burnished and decorated with incised bands filled with *Anadara* shell impressions. The core is reduced (diam: 160 mm).
- LF4 is a coarse 8 mm thick lid with vertical cord marks to the exterior. The terminus is cord-marked and the core reduced (diam:120–160 mm).
- LF5: Fugitive *Anadara* shell impressions decorate the exterior to the left of a vertical incised line. The lid is 9 mm thick with a reduced core. The decorative motif is as for Hall's 3:29, (1993:248, Fig. 102, k). Only two sherds were recovered from L6:3 (diam: 180).

TABLE 84: *Ceramic Period 3 lids. burn.: burnished, c.m'd: cord-marked*

Layer	Form	Surface Finish	g	Temper	Layer	Form	Surface Finish	g	Temper
5:1	L2	plain	2	orth. grog	6:4 B11	L1	burn.	1	bleb grog
5:4	L2	c.m'd	2	bleb grog	7:7	L4	c.m'd	2	orth.grog
5:4	L4	c.m'd	2	bleb grog	8:1	L1	burn.	2	rice
6:1	L4	c.m'd	4	orth. grog	8:2	L2	plain	5	orth. grog
6:2	L4	c.m'd	7	bleb grog	8:2	L4	c.m'd	2	orth. grog
6:3 f.52	L2	plain	2	orth. grog	8:4	L3	burn.	1	FG2
6:3	L5	plain	2	rice	10:2	L2	plain	3	bleb grog

APPLIQUÉ SHERDS

Apart from a single A2 sherd, within layer 9:6, forms A1 and A2 are absent from CP3 contexts. Four new forms, A3, A4, A5, and A6, were distributed throughout CP3 in minor amounts (Table

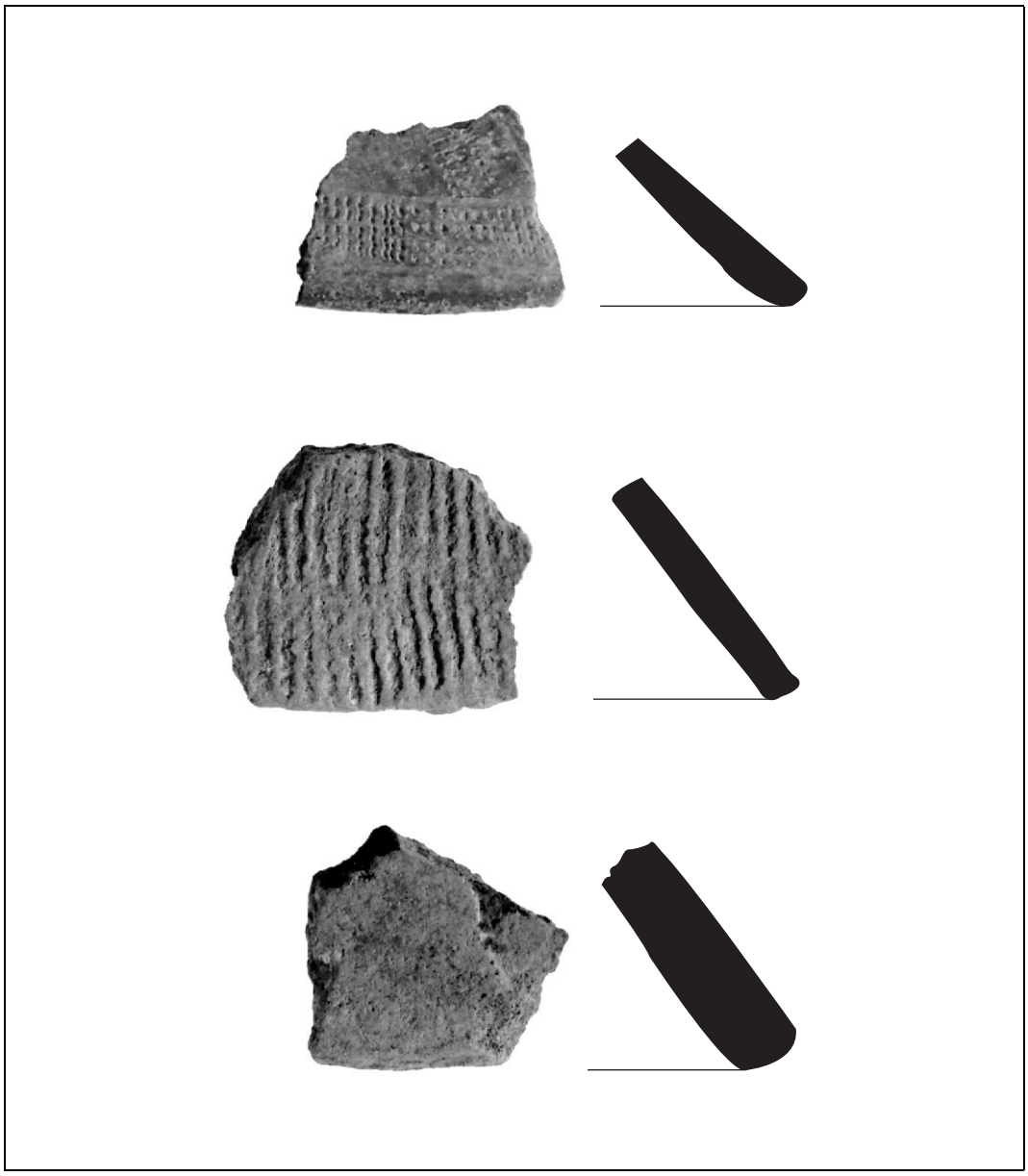


FIG. 144: Ceramic Period 3 vessel lid forms *Top*: Form 3, *Centre*: Form 4 and Form 5. (See chapter VII for Forms 1 and 2). Scale: 1:1

85, Appendix 3). Form A3 is attached to a burnished sherd. Cord marks on the sherd wall have been sealed by the appliqué band. This demonstrates that burnishing was carried out, at the leather-hard stage, after the band had been applied. The form A6 sherd features smoothed over cord marks (Fig. 145). Form A4 features plain bands, triangle shaped in section (Fig. 145). Form A5 (not illustrated) is decorated with vertical notches.

TABLE 85: *Ceramic Period 3 appliqué sherds*

Layer	Form	Grams	Temper	Layer	Form	Grams	Temper/fabric
5:1	A4	1	orth. grog	6:7 f.18	A4	5	orth. grog
5:1	A4	2	bleb grog	6:7 f.19	A4	3	orth. grog
5:1	A5	2	orth. grog	7:2 B15	A3	7	orth. grog
5:1	A6	2	bleb grog	7:3	A4	2	orth. grog
5:5	A4	17	orth. grog	7:7	A5	6	orth. grog
5: Platform l.26-29	A4	3	orth. grog	7:8	A4	4	orth. grog
6:1 f.1	A4	2	orth. grog	8:1	A3	1	orth. grog
6:2	A4	11	orth. grog	8:6	A4	8	orth. grog
6:3	A4	2	orth. grog	9:5	A3	2	FG2
6:4	A4	4	bleb grog	9:6	A2	5	orth. grog
6:5	A4	1	orth. grog	9:6	A3	4	FG2

Given the predominance of incised, burnished, cord-marked and *Anadara*-impressed surface finishes, all local skills recognised in other wares, it is likely that the appliqué technique was a minor focus of CP3 potting technology. Two further factors correlate with local processes: most wares are tempered with orthodox grog, the chosen CP3 clay preparation technique, and some form A3 sherds are composed of the local FG3. Two A4 and one A6 form are bleb-tempered and therefore either exotic or derived from CP4.

THE RIM SHERDS

COARSE WARE RIMS

Rim form 1

The most abundant rim form underwent a marked change at the beginning of CP3 (Fig. 41, Chapter VII). Both versions were recorded in L10:3 lens 2. Because it represents the largest proportion of the ceramic assemblage, the category label has been retained. Thus RF1 refers to the most abundant form in any given Ceramic Period (Fig. 146 typifies the CP3 form). Thus,

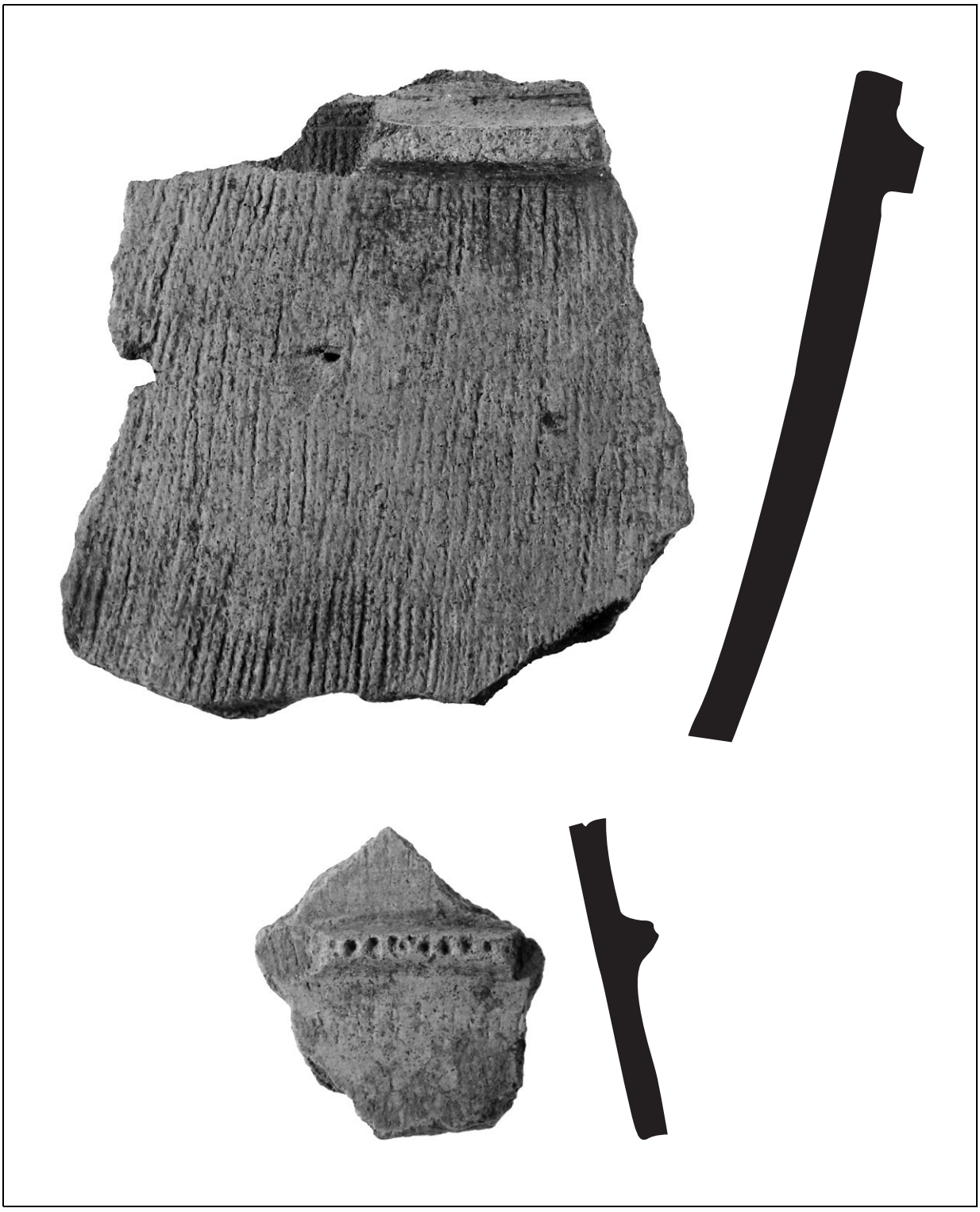


FIG. 145: Appliqué sherds. Forms A4 (top) and A6. Ceramic Period 3. Scale 1:1

although a different shape prior to CP3, both early and late versions have been categorised RF1. In both instances these rims derive from a utilitarian cord-marked vessel made in large quantities to a standard form. They were probably fashioned quickly, with a paddle and anvil, from slabs. Although clay cylinders, suited to shaping vessels directly from the cylinder, were recovered from mortuary contexts, the fracture patterns could equally reflect slab construction (Fig. 147 cat. 2794, Fig. 148 cat. 809). Slab and/or two-piece fabrication would be essential in forming the distinctive local carinated vessels (Fig. 149 cat. 700), and larger vessels clearly show that this method was adopted (Fig. 150 cat. 852). Both versions were recovered from layer 10 lens 2, a major feature which extended from L 10:10 to 10:3 (Higham and Bannanurag 1990:35-6).

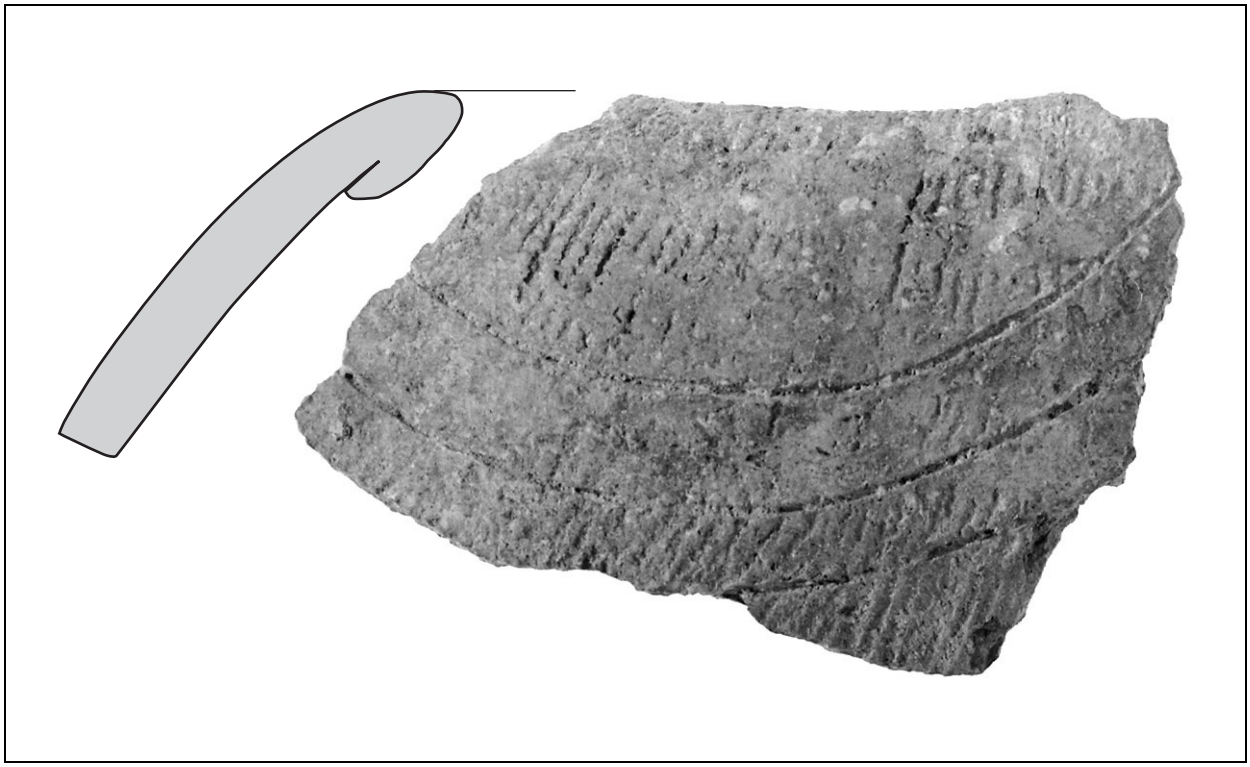


FIG. 146: Rim form 1a. Ceramic Period 3. Scale 1:1

While CP1 and 2 versions are inverted, up to 50° from perpendicular, and indirect, CP3 forms are only slightly inverted or perpendicular and direct. Often the terminus of the latter is incompletely folded and the interior lip left open. Most are fully folded inwards and flattened against the interior vessel wall to create a less rounded shape. Cord mark impressions parallel to the rim circumference are apparent on some examples. The vessel walls are usually of an even thickness, 5 mm being typical, and in diameter, about 200 mm. The rim curves for about 40–50 mm inwards from the upper wall at angles from about 45° to almost 90°. Variations in the earlier versions could suggest that the CP3 form evolved from it.

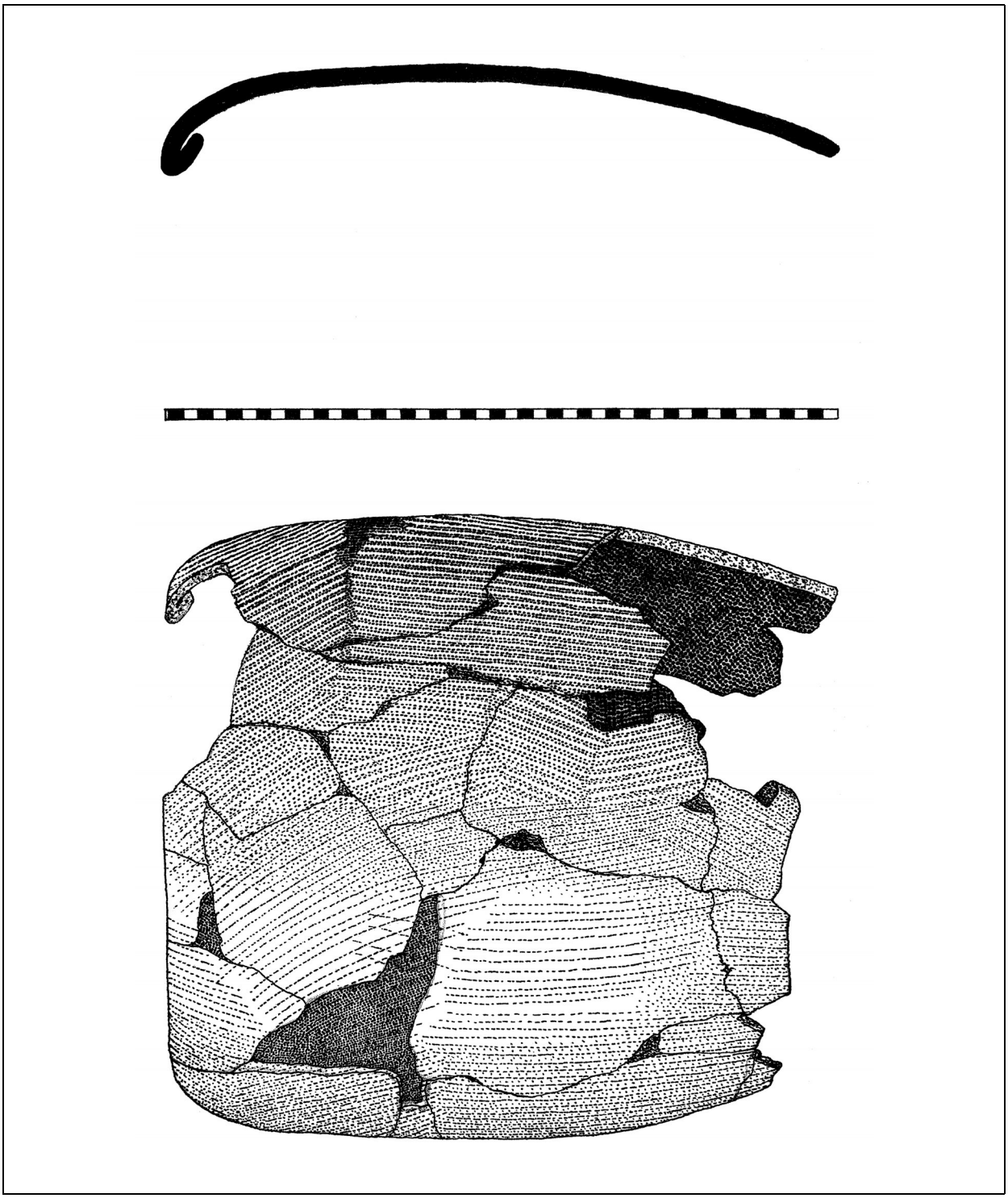


FIG. 147: Rim form 1 vessel (cat. 2794). Ceramic Period 3. Note internal fold, fracture patterns and missing base. Cat. 2794 and cat. 809 (Fig. 148) are typical Ceramic Period 3 standardized cylindrical containers. Their fragility prevented full reconstruction (see cat. 1118 Fig. 184 for a possible base). Scale segments are 5 mm

Another possibility is that early RF1 forms reflect a different vessel function to the later design and therefore represent a completely separate and unrelated construction. Folding the vessel wall inwards to produce a thickened rim remained the chosen method throughout CP1–3. This could suggest an indigenous development or a regional method covering several potting centres. Alternatively, a mixture of both developments may be present. That is, over several generations of indigenous potting, shifts in the traditional rim forming method are predictable. But when a form suddenly changes it signals the arrival of a new method introduced by an exotic potting group. A more detailed examination of this question will be postponed until all the evidence has been considered.

Many RF1 variations are minor and consistent with individual or group artisan diversity. For example, some rim termini have a pronounced roundness, some are squared and smooth or cord-marked. A further development may have occurred during layer 8 when RF1 is either rounded and open or without any internal fold. In layer 7, B15 included RF1 sherds which are morphologically compatible with both early and later categories. This underlines a difficulty with morphological classifications as it is not clear whether the early form has been produced locally during CP3, or represents an import, or an *in situ* upwards mobile sherd displaced in antiquity. Although these sherds have not been examined petrographically, both are probably local. The depth of B15 reached 3.45 m below datum. Adjacent postholes were even deeper (Higham and Bannanurag 1990:90-100, Figs. 57–67).

Rim form 1 fabrics

The fabrics are composed of FG3 (Appendix 1), apart from a few exceptions considered to be mobile sherds displaced through post-depositional activities, such as posthole and burial excavations. A sample of RF1 fabrics has been analysed in thin section and hand specimen (Table 86). Rice, mainly husk, is present as incidental inclusions in many examples. In thin section, some display a few grog fragments, probably due to variations in the manner the clay mixture was prepared. Authigenic calcite occurs on the surface and interstices of several sherds. Two versions of FG3 have been identified in the RF1 assemblage. One involves the fishpond clay, the other *din niao* clay. This latter material is slightly more micaceous in thin section. A few sherds are fully oxidized. In most only the surface is oxidized leaving a distinctive reduced, or black, core. The overall impression is of a ceramic fabric which has been quickly prepared and fired to relatively low temperatures in a partially oxidizing atmosphere. The resultant fabric is quite hard but brittle. Variations in clay quality within the local clay sources probably account for the selection of either the fishpond or *din niao* clays, with the best of either deposits being selectively exploited.

- 1a has an incised curvilinear decoration immediately below the rim similar to the CP2 style. Some have additional incised lines (cord marks?) running parallel to the rim circumference, others lack incised lines but have roughly smoothed bands about 2–4 mm wide.
- 1b is vertical, some are rounded, square and smooth or cord-marked. In layer 5, some derive from small, 120 m diam. jars.

- 1c is inverted, but the rim is folded externally rather than internally.

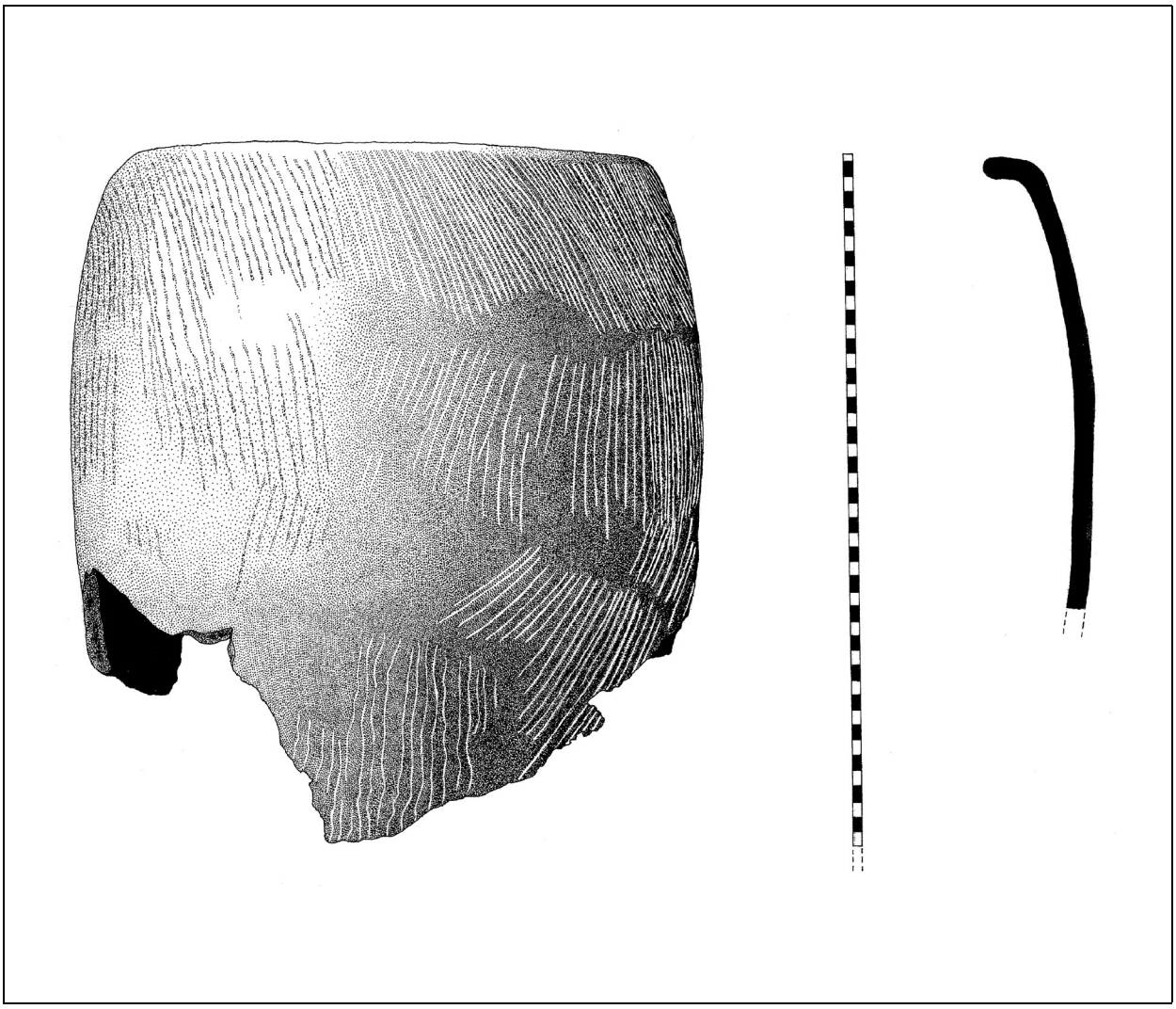


FIG. 148: Rim form 1 vessel (cat. 809). Ceramic Period 3. Scale segments are 5 mm

Rim form 2

Although the quantity of RF2 sherds is maintained throughout CP3, variants show a clear reduction from layer 10:1 onwards (Appendix 2). Only one RF2b sherd was recovered from layer 6. RF2a and 2c occur irregularly in minor amounts. The angle at which RF2 is everted from vertical ranges from 0° to 60° and the terminus sometimes has a wedge rather than square cross

TABLE 86: *Rim form 1 fabrics: Ceramic Period 3 T.S.: thin section, Pl:platform lens*

Layer	Form	T.S.	Fabric	Feature	Layer	Form	T.S.	Fabric	Feature
5:	1	K1073	3 fishpond	Pl.22-3	7:6	1	K975	3 fishpond	-
5:1	1	K1050	3 fishpond	-	7:6	1	K986	3 fishpond	-
5:1	1	K1051	3 fishpond	-	7:7	1	K969	3 fishpond	-
5:1	1	K1052	3 fishpond	-	7:8	1	K968	3 fishpond	B35
5:2	1	K1069	3 fishpond	B18	7:8	1	K582	3 fishpond	l.9
5:2	1	K1070	3 fishpond	B18	7:8	1	K597	3 *din niao*	B27
5:2	1	K1072	3 fishpond	-	7:8	1a	K598	3 *din niao*	B27
5:3	1	K1067	3 fishpond	f.3	8:2	1a	K507	3 fishpond	-
5:3	1	K1071	3 fishpond	-	8:2	1	K508	3 fishpond	-
5:4	1	K1131	4	-	8:2	1	K927	3 fishpond	-
5:4	1	K1141	3 fishpond	-	8:2	1	K928	3 fishpond	-
5:4	1	K1145	3 fishpond	-	8:3	1	K628	3 fishpond	-
5:5	1	K1082	3 fishpond	-	8:4	1	K926	3 fishpond	-
6:1	1	K585	3 fishpond	l.2	8:5	1	K925	3 fishpond	l.8
6:1	1	Ki	3 fishpond	l.2	8:6	1	K924	3 fishpond	-
6:1	1	K996	3 fishpond	-	9:1	1	K510	3 fishpond	-
6:1	1	K997	3 fishpond	-	9:1	1	K824	3 fishpond	-
6:2	1	K1041	4	-	9:1	1	K825	3 fishpond	-
6:2	1	K590	3 fishpond	-	9:1	1	K826	3 fishpond	-
6:2	1	Kii	3 fishpond	-	9:2	1	K827	3 fishpond	-
6:2	1	K157	3 fishpond	B12	9:2	1	K828	3 fishpond	-
6:2	1	K1032	3 fishpond	-	9:2	1	K829	3 fishpond	-
6:2	1	K1033	3 fishpond	f.30	9:3	1	K821	3 *din niao*	-
6:3	1	K572	3 fishpond	f.27	9:3	1	K822	3 *din niao*	-
6:3	1	K579	3 fishpond	-	9:3	1	K882	3 fishpond	-
6:3	1	K636	3 fishpond	-	9:4	1	K524	3 fishpond	-
6:4	1	K1000	4	-	9:4	1	K830	3 fishpond	-
6:5	1	K1007	4 *din niao*	-	9:4	1	K831	3 fishpond	-
6:5	1	K1001	3fishpond	-	9:5	1	K823	3 *din niao*	-
6:5	1	K1003	3 fishpond	-	9:5	1	K874	3 fishpond	-
6:5	1	K998	3 fishpond	l.6	9:6	1	K854	3 fishpond	-
6:7	1	K999	3 *din niao*	-	9:6	1	K859	3 fishpond	-
7:1	1	K964	3 fishpond	-	9:7	1	K518	3 fishpond	-
7:1	1	K967	3 fishpond	-	9:7	1	K887	3 fishpond	-

continued over

TABLE 86: *Rim form 1 fabrics: Ceramic Period 3 (continued)*

Layer	Form	T.S.	Fabric	Feature	Layer	Form	T.S.	Fabric	Feature
7:2	1	K965	3 fishpond	-	10:1	1a	K446	3 fishpond	-
7:2	1	K966	3 fishpond	l.3	10:1	1	K447	3 fishpond	-
7:3	1	K981	3 fishpond	B16	10:1	1a	K483	3 fishpond	-
7:3	1	K982	3 fishpond	-	10:1	1a	K484	3 fishpond	-
7:6	1	K551	3 fishpond	-	10:1	1a	K485	3 fishpond	-
7:6	1	K551	3 fishpond	-	10:1	1a	K485	3 fishpond	-

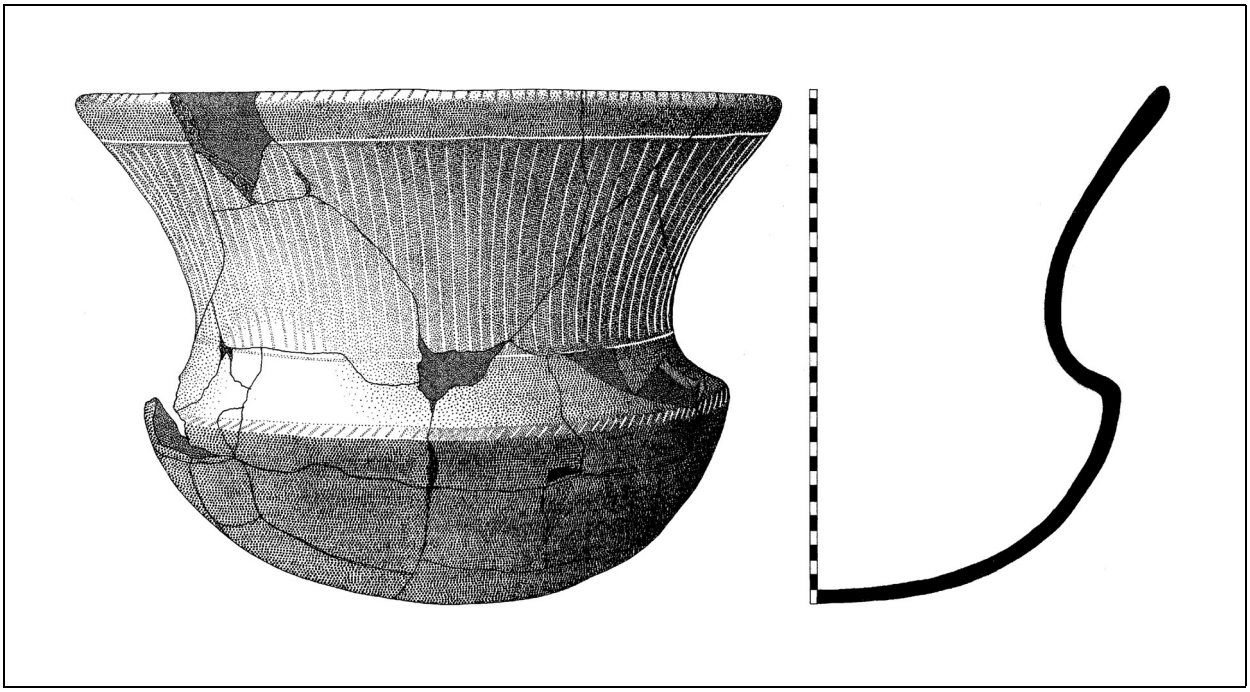


FIG. 149: Vessel fabrication (cat. 700). Ceramic Period 3. Scale segments are 5 mm

section. In layer 4:5, one example features vertical cord marks which terminate at an incised line 45 mm below the inflection point. The rim is everted 45 mm at right angles to the vessel wall. In hand specimen, this rim is consistent with FG3.

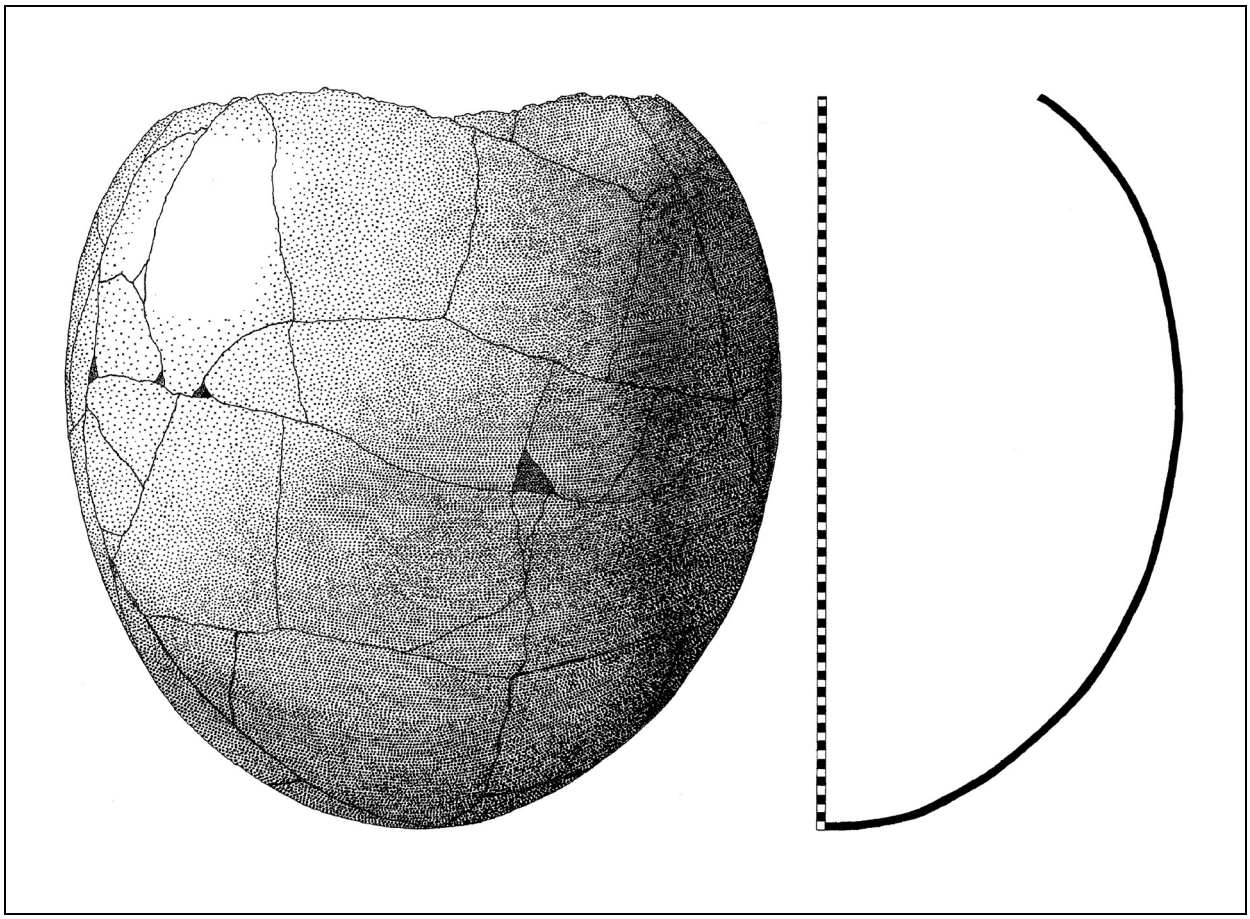


FIG. 150: Vessel fabrication (cat. 852). Ceramic Period 3. Scale segments are 5 mm

- 2a is everted with a cord-marked exterior and plain interior. The terminus is square, or oblique. Above the inflection point the exterior fold bulges outwards.
- 2b is an exaggerated version of RF2a (Fig. 151).
- 2c differs from other RF2 examples as the terminus folds in rather than outwards.
- 2d follows the CP2 style.

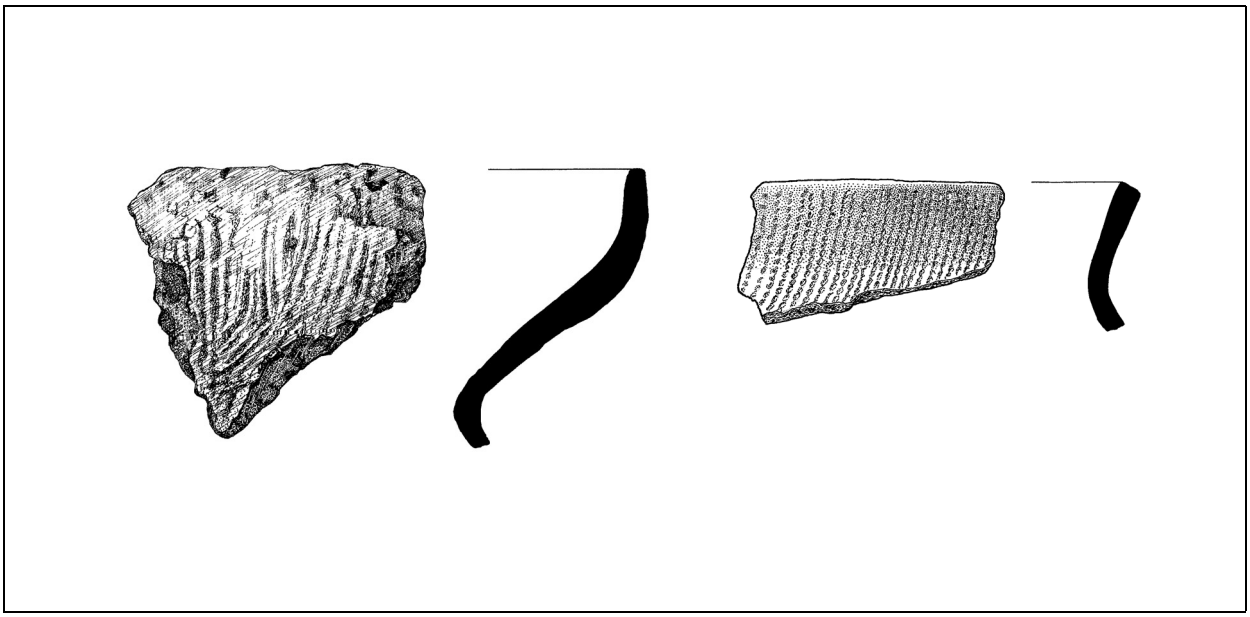


FIG. 151: Rim form 2b. Ceramic Period 3. Scale 1:2

Total rim length from the inflection point, rim wall and fold thicknesses and overall rim diameters for CP3 are set out in table 88. The external fold may be cord-marked or plain, square or triangular in cross section. In some the terminus is cord-marked, in others it is plain.

A L9:1 example (K873), has an unusual treble layer which appears to have been attached by folding a separate strip over the wall terminus.

RF2 fabrics have been examined in thin section and hand specimen (Table 87). Most mirror RF1 characteristics, but some fabrics are of a higher quality. Rather than the fishpond clay, a more plastic, micaceous material, similar to that used in local fine wares, has been exploited. The result is a less brittle ceramic. In some, the grog is composed of fishpond clay. Overall, they appear to represent more carefully fashioned coarse wares than the RF1 assemblage.

Rim form 3b

Layer 9 aside, the quantity of RF3b steadily increased throughout CP3, (L10:1-2: 18 g; L9: 56 g; L8: 31 g; L7: 34 g; L6: 95 g; L5: 1.3 kg, Appendix 2). No RF3b were present in layer 11. They first consistently occur from about L10:7, not long before the change in RF1 to the later style. This suggests that RF3b could have been the lid for some of these latter RF1 vessels. During CP3, a sample of the latter averaged 215 mm in diameter (n = 9; range: 120-340). Only one RF3b sherd from L6:1 was measured. It has a diameter of 220 mm. A more detailed analysis of the larger CP4 samples confirms that this relationship is feasible (Chapter X). Within CP3, RF1 and RF3b were recovered in association from B4, B6, B9, B13, B15, B17 and B79. Only two of these rims have been examined in thin section, but comparison with these in hand specimen

TABLE 87: *Rim form 2 fabrics: Ceramic Period 3. T.S.: thin section number, h.s.: hand specimen, fp: fishpond, fg: fishpond grog*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S.	Fabric	Feature
5:1	2	h.s.	3	-	8:2	2	h.s.	3	f.23
5:2	2	h.s.	3	f.4	8:3	2	h.s.	3	f.5
5:3	2	h.s.	3	B6	8:4	2	h.s.	3	-
5:5	2	h.s.	3	f.2, f.4	8:5	2	h.s.	3	B31
5:5	2	h.s.	3	pl. 24-40	8:5	2d	h.s.	3	l.8
5:5	2c	h.s.	3	pl. 35-36	8:6	2	h.s.	3	f.80
6:1	2	h.s.	3	f.1	8:6	2a	h.s.	3	-
6:2	2	h.s.	3	-	8:7	2	h.s.	3	-
6:3	2	K581	3	B3, B9	9:1	2	K846	3fg	l.9
6:3	2	K594	3fp	f.29	9:1	2	K873	3fg	-
6:4	2	h.s.	3	B11	9:1	2	K517	3	-
6:4	2c	h.s.	3	-	9:2	2	K512	3	-
6:5	2	h.s.	3	B13	9:3	2	h.s.	3	f.10
6:5	2a	h.s.	3	-	9:4	2	K881	2	-
6:5	2b	h.s.	3	l.5	9:4	2	K847	3	-
6:5	2c	h.s.	3	-	9:4	2a	h.s.	3	-
6:6	2	h.s.	3	-	9:5	2	K832	3	-
6:7	2	h.s.	3	f.18	9:5	2	K876	2	-
6:7	2c	h.s.	3	f.19	9:6	2	K878	3	l.9
7:1	2	K624	3fp	-	9:6	2	K879	3	l.9
7:2	2	h.s.	3	B15	9:6	2	K853	3fg	-
7:3	2	h.s.	3	B16	9:6	2	K855	3fg	l.9
7:4	2	h.s.	3	-	9:6	2	K509	3fg	-
7:5	2	h.s.	3	f.5	9:7	2	K516	3fg	-
7:5	2c	h.s.	3	f.5	9:7	2	K858	3	-
7:6	2	h.s.	3	B20	9:7	2	K860	3	-
7:7	2	h.s.	3	-	9:7	2	K861	3	-
8:1	2	h.s.	3	B44	10:2	2a	h.s.	3fp	-
8:1	2d	h.s.	3	-	10:2	2	h.s.	3fp	-

TABLE 88: *Rim form 2 dimensions: Ceramic Period 3*

Layer	Length (mm) Total	Fold	Thickness (mm) Wall	Fold	Rim diam. (mm)
5:1-5	25-60	8-25	4-5	6-10	220-280
6:1-4	37-48	10-25	5-6	6-7	180-260
8:2-4	45-60	22-28	5-8	5-10	180-260
9:2-4	30-47	16-25	5-7	6-9	180-260

TABLE 89: *Rim form 3b fabrics: Ceramic Period 3. DN:din niao, fp: fishpond*

Layer	T.S./h.s.	Fabric	Feature	Layer	T.S./h.s.	Fabric	Feature
5:1	h.s.	3	f.1	7:5	h.s.	3	f.3, 5, 37, 39
5:2	h.s.	3	f.4	7:6	K622	3DN	f.34
5:3	h.s.	3	B6, f.4	7:7	h.s.	3	-
5:4	h.s.	3	-	8:2	h.s.	3	-
5:5	h.s.	3	f.2, 4	8:3	h.s.	3	-
6:1	h.s.	3	B4, f.1	8:4	h.s.	3	-
6:2	h.s.	3	-	8:5	h.s.	3	-
6:3	h.s.	3	B9, f.44	8:6	h.s.	3	-
6:4	h.s.	3	-	8:7	h.s.	3	-
6:5	h.s.	3	B13	9:1	h.s.	3	-
6:6	h.s.	3	f.21, 38	9:2	h.s.	3	-
6:7	h.s.	3	-	9:3	h.s.	3	-
6:8	h.s.	3	f.3, 12	9:4	h.s.	3	-
7:1	h.s.	3	-	9:5	h.s.	3	f.16
7:2	h.s.	3	B15, f.5, 23	9:6	h.s.	3	-
7:4	h.s.	3	B17	10:1	K488	3fp	-

has allowed a more detailed assessment of the ware (Table 89). The ware was also scattered throughout the platform feature.

FINE WARE RIMS

Rim form 3

Five of the 14 CP2 variants are absent from the CP3 assemblage, however three new variants were recorded (Fig. 152 and Appendix 2). Nine variants present in CP2 contexts were also noted in CP3. These are RF3a, 3a(ii), 3b(i), 3c(i), 3c(ii), 3c(iii), 3e, 3f and 3i. Each is rare and variously scattered through the sequence. The new variants are detailed below:

- 3f(i) is unique to layer 7:5. It features two horizontal fields, decorated with horizontal shell impressions, bounded by incised lines.
- 3g is decorated with a running chevron pattern to the external surface infilled with fingernail impressions. It is unique to layer 6.
- 3h has a smoothed external 13 mm deep band below the rim terminus which is cord-marked. The vessel wall has diagonal cord marks. It is unique to layer 5.

New variants include RF3h which measures 25 mm from the inflection point. The vessel diameter is 220 mm, the wall is 5 mm and the smoothed band 6 mm thick. RF3g measured 389 mm in diameter, 7 mm long and 9 mm thick. The vessel wall is 5 mm thick. It is tempered with rice husk. RF3h is tempered with either rice or blebs. A selection of CP3 RF3 fabrics is set out in table 90. Three of these are composed of FG2, the CP2 local fabric. Twenty feature FG11, an exotic bleb-tempered ware. Of these, 14 include abundant amounts of rice husk. Rice husk was also noted in two rims examined in hand specimen. The remaining 45 rims, or 61.64 per cent, contain FG3, the local CP3 fabric. It is important to note that the sample was selected for variation and hence is heavily biased towards exotic wares (Vincent 1988). Incidental rice is present in several local examples. In one (K769, L9:3), rice husk was visible in a grog particle. This suggests that rice remains may have been unintentionally included during clay preparation procedures. Some local examples contain clay consistent with the *din niao* deposits.

A slight "hammerhead" effective was noted on five of the exotic rims. Shepard (1956), notes that such shapes may simply be a peculiarity of the potter's forming method, and not intended as a design feature as no two potters are likely to render such details in exactly the same manner. This particular variant could easily be the result of a potter simply holding their thumb over the rim terminus, rather than a crooked finger, during the final smoothing process. Hence these rims have not been assigned a variant group. Red slip is present on two 3b(i) rims recovered from L10:2. Red paint may also decorate K620, a L6:3 rim. In some instances both interior and exterior vessel walls are burnished.

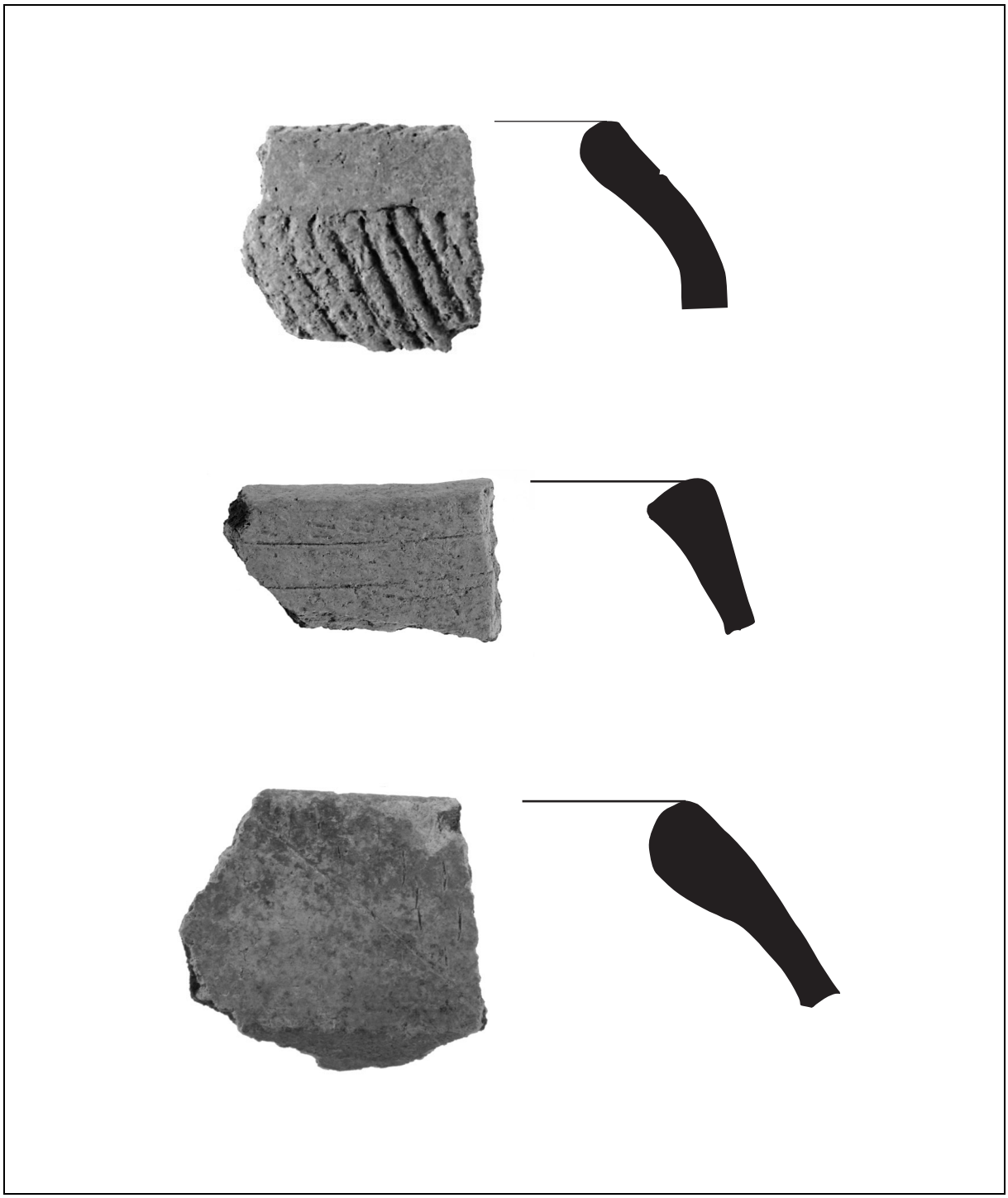


FIG. 152: Rim forms *Top:* 3h, *Centre:* 3f(i) and 3g. Ceramic Period 3. Scale 1:1

TABLE 90: *Rim form 3 fabrics: Ceramic Period 3. DN: Din Niao clay, r: abundant rice, f: fish pond clay, ham: hammerhead, R: red slip*

Layer	T.S./h.s.	Fabric	Form	Feature	Layer	T.S./h.s.	Fabric	Form	Feature
5:1	h.s.	3	3	f.1	9:1	K844	3	3	-
5:2	h.s.	3	3	f.4	9:2	K880	3f	3	-
5:3	h.s.	3	3	f.4	9:3	K523	3	3c(iii)	-
5:3	h.s.	3	3h	B6	9:3	K769	3	3	-
5:3	h.s.	3	3i	-	9:3	K770	3	3	-
5:4	K1027	3	3	-	9:3	K812	3	3	-
5:5	K1048	3DN?	3	-	9:3	K872	3f	3	-
6:1	h.s.	3	3	B4	9:4	K520	3	3c(iii)	-
6:3	K578	3f	3	l.3	9:4	K868	3d.n.	3	-
6:3	K607	3	3c(iii)	-	9:4	K890	3	3	-
6:3	K608	3	3	-	9:5	K836	2	3c(iii)	-
6:3	K620	11	3	-	9:6	K810	11r	3	-
6:3	K1012	11r	3b(i)	-	9:6	K820	11r	3ham	-
6:4	K988	11r	3g	-	9:6	K838	11	3c(ii)	-
6:5	K1008	3	3b(ii)	-	9:6	K849	2	3	-
6:7	K1004	11r	3g	-	9:6	K877	3	3	-
6:8	K580	3f	3c	-	9:6	h.s	3	3	l.9
7:1	K954	3	3	-	9:7	K806	11	3ham	-
7:1	K974	11r	3a(ii)	-	9:7	K811	11r	3ham	-
7:2	K639	3	3c(iii)	B15	9:7	K848	11r	3ham	-
7:2	h.s.	3	3	B15	10:1	K486	11r	3	-
7:3	h.s.	3	3	B16	10:1	K490	11r	3	-
7:5	h.s.	3	3	B35	10:1	K491	11r	3	-
7:3	h.s.	rice	3f(i)	-	10:1	K487	3	3	-
7:6	h.s.	3	3	B20	10:1	K494	3	3	-
7:7	K304	3	3	B24	10:1	K495	11	3c	-
7:8	h.s.	3	3	B22	10:1	K499	2	3c	-
8:1	K903	3f	3	-	10:1	K500	3	3c(i)	-
8:1	K929	3	3	-	10:1	K666	3f	3e	-
8:2	K923	11	3a	-	10:2	K489	11	3	-
8:5	K893	11r	3	-	10:2	K496	3	3b(i)	-
8:6	K895	3f	3	-	10:2	K668	11r	3f	-
8:7	K918	11r	3ham	l.2	10:2	K688	3f	3	-
8:7	h.s.	rice	3a(ii)	B39	10:2	K663	3f	3f	-
9:1	K514	3	3c	-	10:2	h.s.	-	3b(i)R	-
9:1	K816	3	3	l.9	10:2	h.s.	-	3c(i)R	-
					10:2	K686	2	3c	

Rim form 4

A wide range of RF4 variants developed during CP3. The design fields are either geometric or curvilinear. Decoration within the fields is either vertical, diagonal or, rarely, horizontal. One new form was recognized in layer 9; to this were added two further variants in L8, five in L7, eight in L6 and seven in L5. These changes represent a shift in designs from the earlier versions. The modes of decoration include shell, fingernail and punctate impressions, incising, grooving, burnishing and cord marking. Red ochre may have been rubbed into some L9 examples during the burnishing process. All are highly burnished, either reduced, black-cored or oxidized. Three forms recognized in CP2 (RF4, 4a(i) and 4az), were also present in CP3, however the latter two variants were rare in CP2.

A single 4a(i) sherd was recovered from layer 9:2 (Appendix 2). The following RF4 categories and variants were present in CP3 contexts. All are burnished unless otherwise stated.

- 4f is a simple inverted rim with a rounded terminus (Fig. 153). Decoration consists of a continuous field of vertical *Anadara* shell or fingernail(?) impressions, neatly applied to the burnished surface, whose upper boundary is bordered by a straight horizontal incised line, generally about 10 to 20 mm below the terminus. Some examples have vertical, others horizontal, fingernail impressions.

- 4f(i) features a horizontal band infilled with vertical *Anadara* shell impressions. The band is located below the carination point and defined by straight horizontal incised lines (Fig. 153). A series of up to four horizontal incised lines is present below the carination point in some examples.

- 4i is decorated with a running band of lunate segments which curve upwards from the carination point. These fields are infilled with vertical *Anadara* shell impressions. Some have an incised line following the carination point and the terminus has been decorated with a series of small "pricked" or punctate marks made with the point of a round stylus.

- 4i(i) (L6 only), fields are infilled with impressed lines or grooves to form a zig-zag pattern. Their half-round cross-section indicates that they were made with a round stylus (Fig. 153).

- 4au (L7 only), has running triangular downward pointing fields positioned about 5 mm below the carination point. These are bounded by incised lines (Fig. 153).

- 4av has a series of counter-opposing, elongated, wedge-shaped horizontal fields both above and below the carination point. The fields are infilled with *Anadara* shell impressions (Fig. 153).

- 4aw (L7 only), is decorated above the carination point with a sweeping elongated horizontal field within incised lines. Two further horizontal lines, one running about 4 mm below the terminus and the other at the carination point, complete the observable features (Fig. 154).

- 4ax (L7 only), decoration consists of a 20 mm band about 5 mm below the carination point. Within this are counter-opposed triangular fields, arranged apex to apex. The fields are infilled with *Anadara* shell impressions.

- 4aaa (L7 only), measures 35 mm from carination to terminus. Decoration is restricted to this zone and consists of a narrow (5 mm) band below the terminus defined by an incised line infilled with *Anadara* shell impressions. Another undulating band, from 8 to 15 mm wide, is deployed in rhythmic cycles, about 80 mm long, an equal distance up from the carination point.

- 4aab (L7 only), is burnished on both interior and exterior surfaces. The 15 mm zone above the carination is decorated with a band within two incised lines, the lower at the carination point, the upper 4 mm below the terminus. Equilateral triangles abut each other to form a continuous pattern. Each alternate triangle is infilled with *Anadara* shell impressions. These are also deployed along the 5 mm thick rim terminus parallel with the wall.

- 4al features fields arranged either as semi-circular scallops or running chevrons along the terminus edge above the carination. These are defined by 2.5 mm wide impressed or incised lines. A band comprised of diagonal *Anadara* shell impressions runs between the carination and a straight incised line below it (Fig. 154). Some examples include further such bands below this again. The terminus is also decorated with diagonal *Anadara* shell impressions.

- 4ap (L6 only), has two horizontal bands, infilled with vertical *Anadara* shell impressions, above the carination point. One borders the terminus and the other the carination (Fig. 154).

- 4aq (L6 only), displays a narrow band midway between the carination and the terminus, which is filled with diagonal *Anadara* shell impressions (Fig. 154). The terminus also shares these impressions.

- 4ar (L6 only), is decorated below the carination point with a field of horizontal fingernail impressions. An incised line is visible at the carination (Fig. 154).

- 4as (L6 only), incised lines are arranged to form a horizontal panel infilled with pairs of vertical fingernail(?) incisions above the carination point (Fig. 155).

- 4at (L6 only), features fields of incised lines which form a shallow elongated zig-zag pattern resting on the carination point (Fig. 154). The terminus is probably decorated with *Anadara* shell impressions.

- 4s (L5 only), decoration involves triangular fields infilled with punctate or "pricked" marks. The triangle apexes point down from the terminus. A single horizontal incised line is located below the carination point (Fig. 259).

- 4aj (L5 only), is essentially the same as RF4s above, with the exception that the triangular fields are infilled with *Anadara* shell impressions and punctate marks decorate the terminus (Fig. 155).

- 4am (L5 only), has a narrow band of diagonal *Anadara* shell impressions defined at its upper limit by an incised line. The lower band edge terminates at the carination point (Fig. 155). The rim terminus is decorated with diagonal *Anadara* shell impressions. It is unique to layer 5.

- 4an (L5 only), features a series of downwards pointing triangles, defined by incised lines, which are spaced around the terminus. The fields are infilled with vertical incised lines (Fig. 155). This rim is unique to layer 5.

- 4ao (L5 only), also features triangles pointing downwards from the terminus, however, in this instance they form an uninterrupted pattern. The fields are infilled with diagonal *Anadara* shell impressions. A narrow band of horizontal *Anadara* shell impressions runs underneath the carination point. Its lower border is defined by two incised lines (Fig. 154). It is unique to layer 5.

- 4ay is decorated with either parallel horizontal or tapering geometric bands infilled with *Anadara* shell impressions applied either vertically or at a slight angle. Additional incised lines are present on some examples (Fig. 153). It is highly burnished. Most are probably reduced and a L9:6 sample has red ochre rubbed into the surface during the burnishing process.

The RF4 design fields are usually arranged in either geometric or curvilinear horizontal bands. These panels are decorated with *Anadara* shell impressions carefully arranged in vertical, diagonal or horizontal alignments. While detailed assessments have not been undertaken, most seem to be vertical. Many RF4 sherds include a carinated point. Decorative fields are arranged from 10 to 20 mm below this point. Particular care has been taken to furnish this ware with a high degree of burnishing. Some, for example in bag 1932, layer 9:6, appear to have been coloured with red ochre which was rubbed into the surface during the burnishing process. Because this substance was almost ubiquitous within graves, some of these sherds could have been coated with ochre following deposition. On balance, it seems most likely that ochre was deliberately incorporated into the surface colloids of some vessels during the burnishing process. Most have been fired in a reducing atmosphere to produce a dark lustrous effect. Fully and partially oxidized sherds were also noted.

CP3 forms are finer, carefully burnished and delicately decorated in comparison with wares from later levels. Rather crude heavier variations were noted, but these are extremely rare. In cross-section, inflection points range from rounded to sharply angular. Rim thickness tapers from 3 - 9 mm at the terminus and 6 - 13 mm at the inflection point. The inflection angle ranges from 90° - 130° from the vessel wall plane. Rim lengths, from inflection point to terminus, range from 11 - 42 mm; vessel diameters from 260 - 300 mm (L9), 300 - 340 mm (L8), 280 mm (L7) and 340 mm (L5). All of the variants, except the following, were confined to a single layer (Appendix 2). Thus RF4f was recovered from layers 7, 6 and 5; 4f(i) from L9, 7 and 6; 4av from L8 and 7; 4i from L6 and 5; and 4al from L6 and 5. Some rim fragments are too small to categorize. For example, a layer 6:2 rim (T.S. K1020), has diagonal cord marks below the carination point. It is burnished on both sides. It is important to note that the above decorative field descriptions are restricted to rim fragments and should therefore be treated as incomplete but none-the-less representative of local pottery styles. Intricate, often complex, decoration on many of these fragments has prevented a clear separation of some into dedicated form classes. Where these were unable to be readily categorized, as specific variants, they have been grouped under the generic RF4.

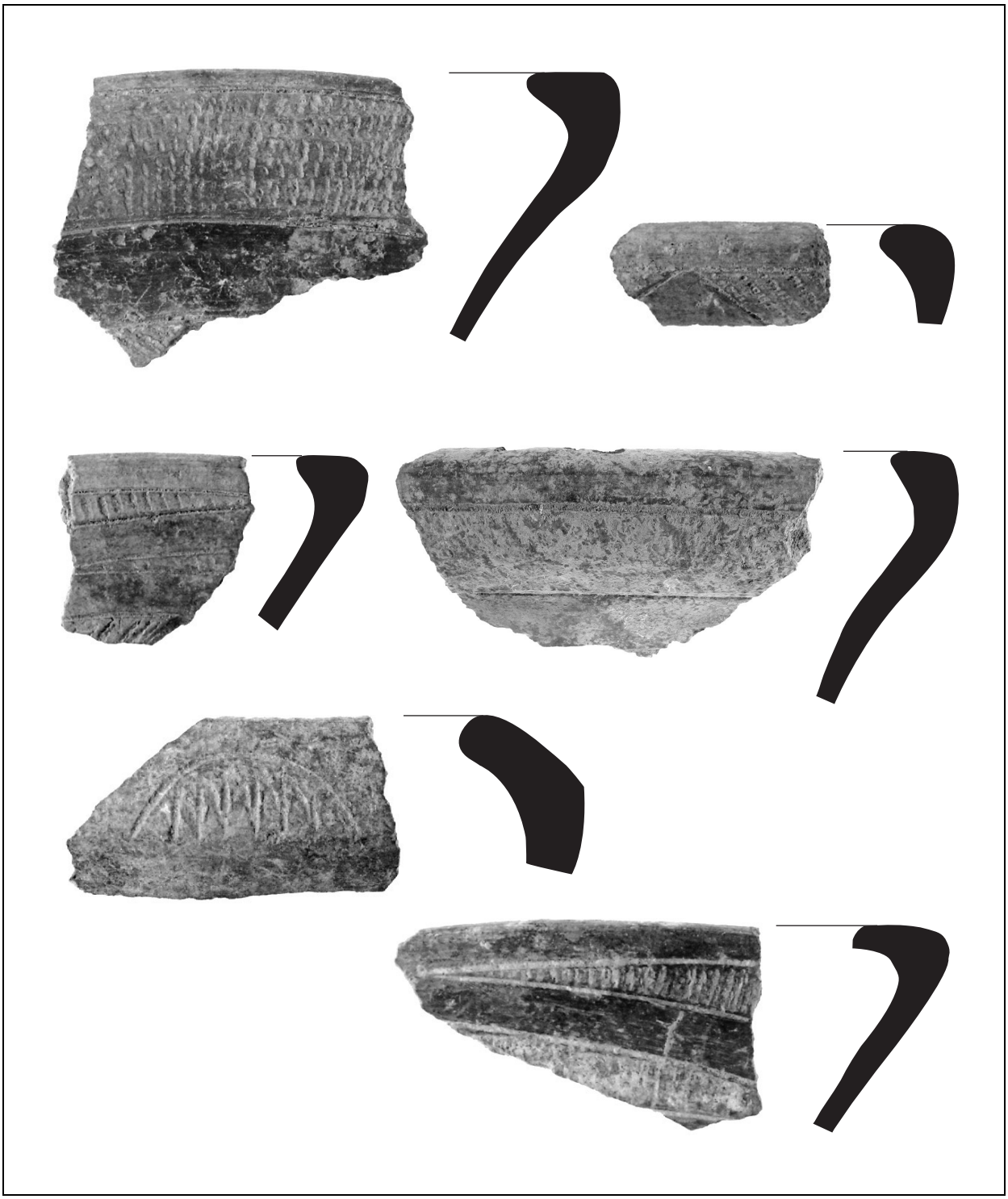


FIG. 153: Rim form 4 categories and variants. Ceramic Period 3. *Top* left: 4f, right: 4au, *Centre* left 4av, right 4f(i), *Bottom* left: 4i(i), right: 4ay. Scale 1:1



FIG. 154: Rim form 4 categories. Ceramic Period 3.*Top*: 4aw, *Centre*: 4aab, *Bottom*: 4al. Scale 1:1

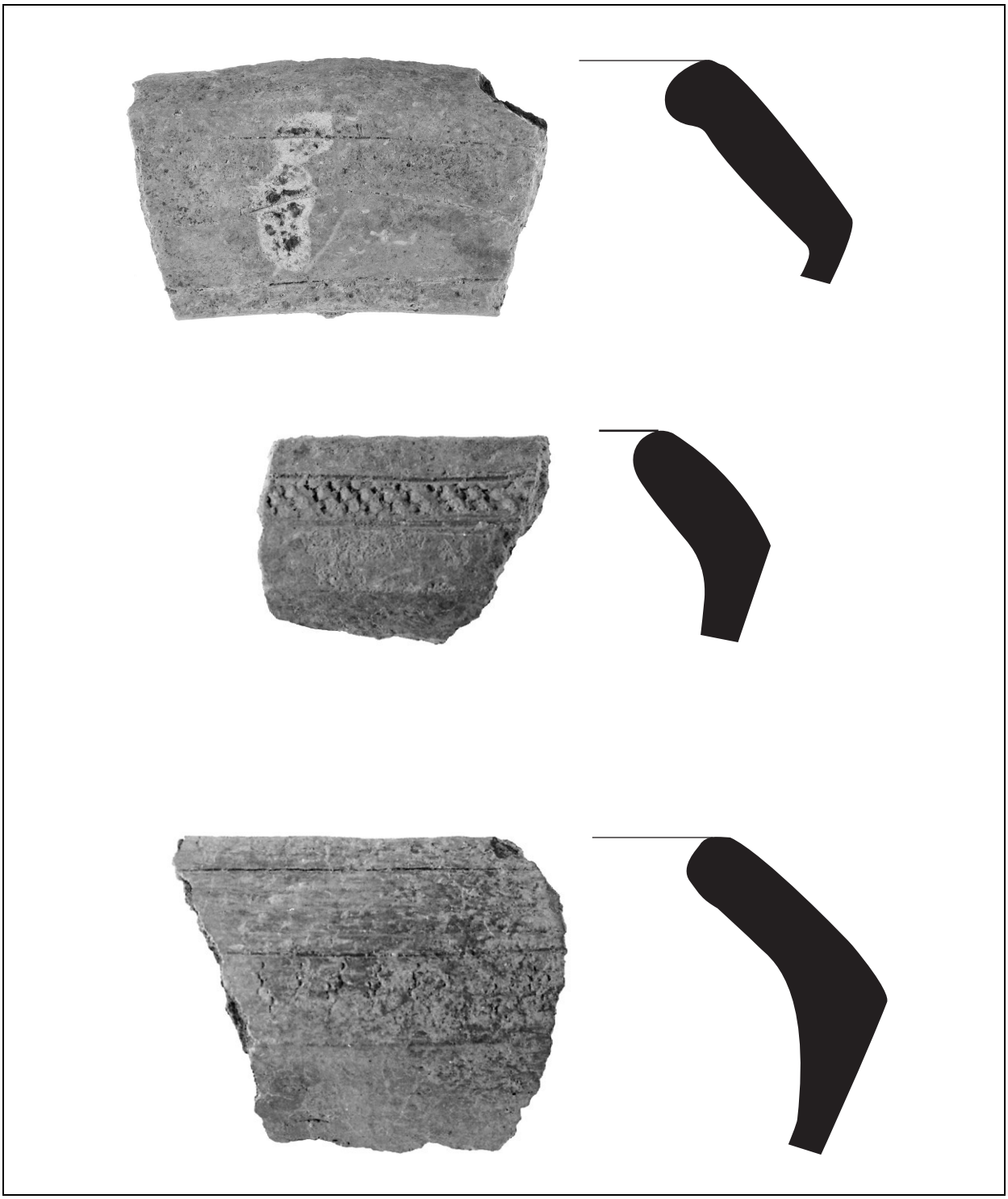


FIG. 154: Rim form 4 categories. Ceramic Period 3 (cont.). *Top*: 4aaa, *Centre*: 4aq, *Bottom*: 4ap. Scale 1:1

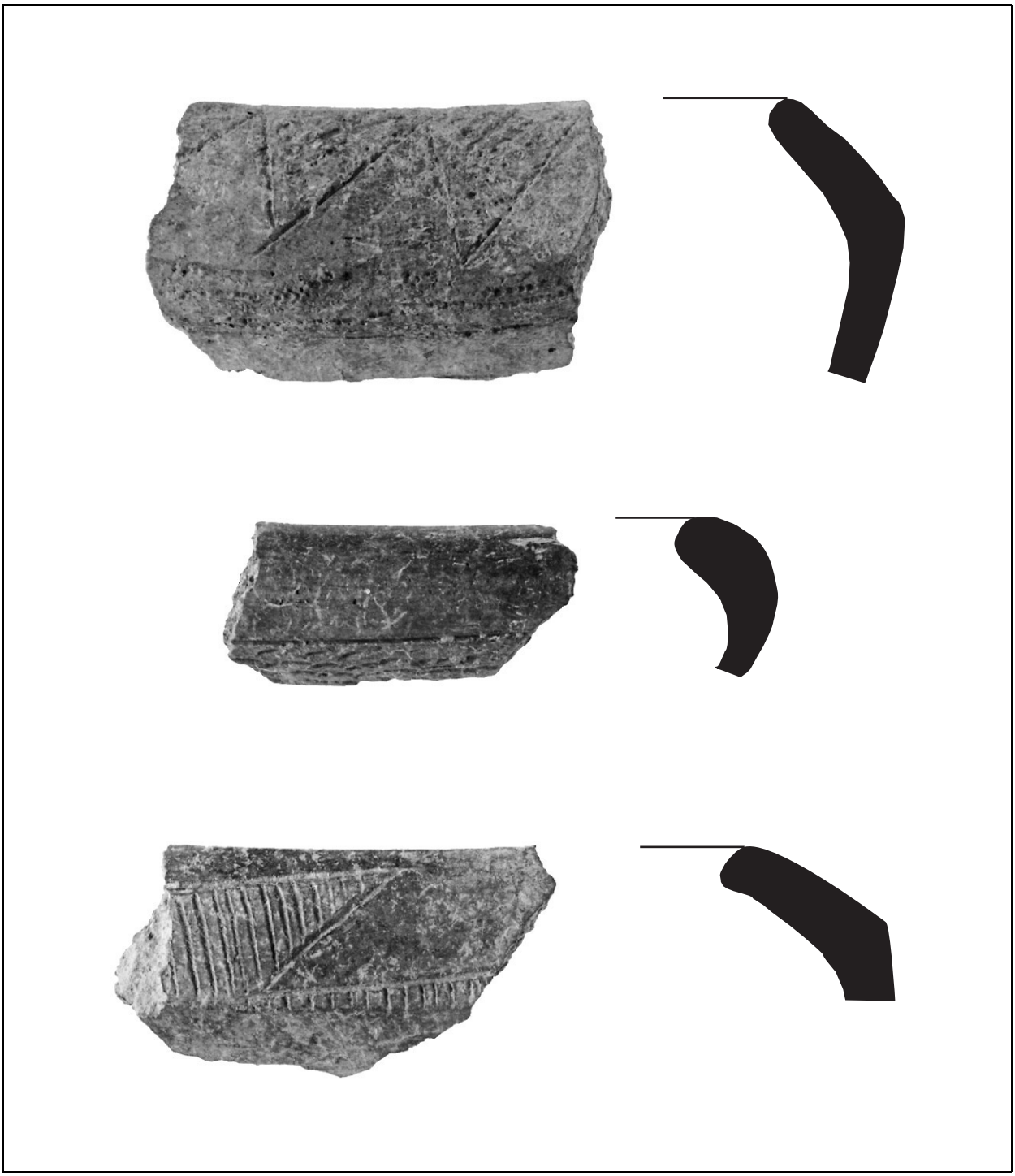


FIG. 154: Rim form 4 categories. Ceramic Period 3 (cont.). *Top*: 4ao, *Centre*: 4ar, *Bottom*: 4at. Scale 1:1



FIG. 155: Rim form 4 categories. Ceramic Period 3. *Top* left: 4an, right: 4aj, *Bottom* left: 4am, right: 4as. Scale 1:1

Rim form 4 fabrics

The RF4 sample relates to MP2 and MP3 vessels, for example cat. 1390, B74 and cat 1518, B91. In MP3, the RF4ay variants are composed of local grog in burial contexts, however, within the general matrix they occur in both the CP3 local grog (FG3) as well as FG2, the CP2 local fabric. Some layer 5 variants, decorated with geometric design fields (usually chevrons), are tempered with bleb grog. In layer 5:1 some of these wares are very crudely made. RF4aaa is represented by four sherds (8 g) which are tempered with rice husk. The exotic bleb-tempered fabric 11 is present in layers 9:7, 5:5 and 5:4 in RF4, 4an and 4 forms respectively.

A new exotic ware, FG19, makes its first appearance in L5:3. This fabric is tempered with orthodox grog. It contains rock fragments comprised of quartz and plagioclase feldspar (Appendix 1). These exotic wares are extremely rare, however, and the assemblage is dominated by FG3, the CP3 local preparation. A less silty, more micaceous, clay than the fishpond variety has been selected for this local fine ware. Some coarser examples feature a more silty clay matrix and the quantity of grog and natural nonplastics varies between thin section samples. Incidental rice fragments are also occasionally visible. In some instances, because the potter's intention was to produce a dark lustrous ware, heavy reduction has resulted in an extremely dark fabric, rendering the identification of some inclusions difficult under the petrographic microscope. Most are visible in plain light, however. Within layer 5 and upper layer 6, a few rims composed of FG5, a local bleb-tempered ware, were recovered. This fabric is discussed in detail in later sections and in Appendix 1.

Rim form 5

Several RF5 variants recorded under CP2 are also present in CP3, however, because of stratigraphic mixing, sequential boundaries, such as those promoted here, can be blurred so that the relationships of individual rim forms between each CP may be less acute than was the case in prehistory. Hence several RF5 variants assigned to CP2 may actually derive from CP3 contexts, but when forms and fabrics are considered together their stratigraphic divisions are readily understood. The reader's attention is drawn to the data set out in Appendix 2, where a clearer summary of rim distributions can be obtained. Note that several variants, such as those designated from RF5a to 5ac and 5ad(i) to 5ap are represented in extremely small amounts. Many probably migrated downwards from CP3 into CP2 during prehistory as the result of cultural activities. Rim form 5ad variants may all derive from CP3, although some were recovered from the upper levels of CP2.

Of the 164 site total RF5 categories and variants, five are unique to, or first noted in, layer 9; 10 in L8; four in L7; three in L6 and six in L5. This gives a total of 28 for CP3. Of the 66 recorded for CP2, when sherds located in L10:3 and above are included, 19 could derive from CP3 (Appendix 2). If so, this would give a total of 47 for CP2 and 64 for CP3. Similarly when only sherds recovered from layer 10:3 and above are considered, 5 RF6 categories and variants can reasonably be assigned to CP3 giving amended totals of 39 for CP2 and 59 for CP3. Rim descriptions set out below follow the criteria discussed in chapter VIII.

TABLE 91: *Rim form 4 fabrics: Ceramic Period 3*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
5:1	4	h.s.	3	-	7:6	4f(i)	h.s.	-	B22
5:2	4	h.s.	3	B18	7:7	4	K299	3	B24
5:2	4al	h.s.	3	-	7:7	4f(i)	K302	3	B24
5:3	4	K1039	19	-	7:7	4f(i)	K621	3	B24
5:3	4am	h.s.	3	-	7:8	4	h.s.	3	B26
5:3	4	h.s.	3	B6	7:8	4	h.s.	3	B27
5:4	4	K1030	11	-	8:1	4ay	K892	3	-
5:4	4ao	h.s.	3	f.2	8:2	4	h.s.	3	-
5:4	4i	h.s.	3	-	8:3	4	h.s.	3	-
5:5	4	K1211	5	f.2	8:4	4	h.s.	3	B28
5:5	4aj	h.s.	5?	-	8:5	4	h.s.	3	B31
5:5	4an	h.s.	11?	-	8:5	4	h.s.	3	B33
5:5	4	h.s.	3	B19	8:6	4	h.s.	3	-
6:1	4	h.s.	3	B1	8:7	4	h.s.	3	-
6:1	4ay	h.s.	5	B4	9:1	4	h.s.	3	-
6:2	4	K1020	5	-	9:2	4ay	K526	3	-
6:2	4f	K1037	5	-	9:2	4ay	K869	3	-
6:3	4	K587	3	-	9:2	4a(i)	h.s.	3	-
6:3	4	h.s.	3	B8	9:3	4ay	K527	3	-
6:3	4	h.s.	3	B9	9:3	4ay	K864	3	-
6:4	4f	K1018	3	-	9:3	4ay	K865	3	-
6:4	4f	K1040	3	-	9:4	4	K542	2	-
6:5	4	h.s.	3	B13	9:4	4f(i)	K842	3	-
6:6	4f(i)	h.s.	3	-	9:4	4	K843	2	-
6:7	4	h.s.	3	-	9:5	4	K862	2	-
6:8	4	h.s.	3	-	9:6	4	K543	2	-
7:1	4	h.s.	3	-	9:6	4	K870	2	-
7:2	4f	K584	3	-	9:6	4ay	K871	3	-
7:2	4f(i)	K987	3	l.3	9:7	4	K541	11	-
7:2	4	h.s.	3	B15	9:7	4	K850	3	-
7:3	4	h.s.	3	-	9:8	4	h.s.	3	-
7:3	4aaa	h.s.	rice	-	9:9	4	K856	3	-
7:4	4	h.s.	3	-	9:9	4ay	K857	3	-
7:4	4aab	h.s.	3	-	10:1	4	h.s.	3	-
7:5	4f(i)	K623	3	-	10:2	4	h.s.	3	-
7:5	4	h.s.	3	B35					

In each case the rims are burnished and reduced unless stated otherwise. Several variants, notably in the upper layers, differ from the majority fine, highly burnished, wares. These coarser wares include paddle-impressed and cord-marked variants. They are noted below in the descriptions. One or more external fine incised lines, running parallel to the rim terminus, are almost ubiquitous to the otherwise undecorated RF5 assemblage during CP2. During CP3, however, these are less prominent, although a few in L9 have some such lines. Some RF5 termini, for example K566 and K586, layer 6:2 and 6:3 respectively, were folded during forming, an extension of the local utilitarian ware construction method.

- RF5 categories and variants first encountered in, or restricted to, layer 9:
- 5ad(iii) follows the CP2 version with the addition of an internal field which borders the terminus. About 20 mm wide, the lower margin is defined by a straight incised line. It is infilled with *Anadara* shell impressions.
- 5ad(vii) is similar to 5ad(iv), in CP2, but with the addition of an exterior horizontal band, defined by two parallel incised lines, infilled with vertical incisions. It is unique to layer 9.
- 5ad(viii) in layer 9 is decorated with fingernail impressions to the rim edge.
- 5c(i) in addition to the 5c decoration also displays incisions to the rim terminus.
- 5aq occurs with two related versions, both highly burnished and deeply reduced. The first has two parallel horizontal bands, about 20 mm wide, defined by straight incised lines on the exterior vessel wall. The upper band is located 10 mm below the terminus, the lower 10 mm below the upper. Both are infilled with vertical *Anadara* shell impressions. The second has additional decoration to the interior surface. These mirror the external design with the exception that the lower band has not been infilled. Both versions have *Anadara* shell impressions to the rim terminus. This form is unique to layer 9.
- RF5 categories first encountered in, or restricted to, layer 8:
- 5ar is unique to layer 8, however similar versions were recovered from layers 7 and 6 (see below). It displays decoration to both wall surfaces. The exterior features vertical *Anadara* shell impressions. These finish at an incised line about 10 mm from the terminus. A broad horizontal band, bordered at its upper boundary by a straight and its lower by a curved incised line, is located on the interior. This is decorated with diagonal *Anadara* shell impressions, as is the internal rim terminus (Fig. 156).
- 5as has an internal broad band of horizontal or diagonal *Anadara* shell impressions bounded by the terminus and a straight incised line (Fig. 156). This rim is unique to layer 8 and similar to RF5ad(iii) and RF14c (L9).
- 5at is decorated in three zones: (a) an interior horizontal band of diagonal *Anadara* shell impressions located 10 mm below the terminus (Fig. 156). (b) diagonal *Anadara* shell impressions to the

terminus. (c) the exterior surface, below a straight horizontal incised line about 10 mm below the terminus, is textured to give a "stucco" or rippled effect. It is restricted to L8, L6 and L4.

- 5au features two parallel horizontal bands, defined by straight incised lines, infilled with near vertical curved incised lines, on the external surface (Fig. 156). The shape and depth of the infill lines suggests that a long fingernail may have been used to mark the clay. In another version the bands are infilled with vertical *Anadara* shell impressions. Both are unique to layer 8.
- 5av deep incisions also decorate the exterior of this rim. A straight horizontal line forms a margin about 5 mm below the terminus and a slanted ladder-like band descends at a slight angle to the perpendicular from this line. The terminus has a squared shape which differs from other rounded variants (Fig. 156).
- 5aax is particularly large, measuring about 140 mm from terminus to inflection point (Fig. 157), highly burnished and deeply reduced. The exterior is extensively decorated with recurring bands defined by horizontal and angled incised lines which form two narrow bands immediately below the terminus. These are infilled with *Anadara* shell impressions at a slight angle to the perpendicular. Beneath these are a series of larger bands arranged to form elongated lozenge shapes in the burnished surface. *Anadara* shell impressions fill these bands at right angles to the incised boundary lines. The terminus has also been impressed with an *Anadara* shell. It is unique to layer 8.
- 5 nubbin. The use of nubbins is rare. This conical example is 17 mm in diameter and 7 mm high. Its centre is located about 20 mm below the terminus on the vessel exterior. It overlies a 15 mm wide horizontal band of *Anadara* shell impressions located 12 mm below the terminus. Vertical cord marks extend downwards from about 40 mm below the same point. The interior has three incised lines parallel with and 10, 14 and 16.5 mm below the terminus. The rim is highly burnished, fully oxidized on the outside and slightly reduced inside. This suggests that the parent vessel was fired upside down in an oxidizing atmosphere. This rim is unique to layer 8.
- 5aw displays decoration on three zones: (a) the exterior has vertical *Anadara* shell impressions which extend down from a incised line running parallel with and 7 mm below the terminus. In places the surface has been left bare to create a striped effect (Fig. 156). (b) the terminus is marked with diagonal *Anadara* shell impressions. (c) a narrow band of such impressions runs around the interior terminus and a portion of an elongated lozenge shape, formed using the usual incised and impressed technique, runs parallel with and about 20 mm below the same point.
- 5ay displays a different mode of decoration than earlier variants. Rather than shell, fingernail impressions are deployed on three zones: (a) exterior curvilinear fields, defined in the normal manner by continuous incised lines, are infilled with fingernail impressions (Fig. 156). (b) on the internal surface, a horizontal 12 mm deep parallel band, 10 mm below the terminus, is also decorated in this manner. (c) the interior face of the terminus is decorated by a series of short fingernail impressions.
- 5az. The exterior surface of this variant, under a horizontal incised line 8 mm below the terminus, is covered with vertical fingernail impressions (Fig. 156).

- RF5 categories and variants first encountered in, or restricted to, layer 7:
- 5h is similar to the CP2 variant 5w, except that the field of cross-hatched incised lines are contained within horizontal incised lines to form a 25 mm deep band about 10 mm below the terminus.
- 5aw(i) differs from 5aw in that both surfaces are decorated in the same manner as the exterior of the latter example.
- 5aaa has a squared cord-marked terminus. The interior vessel surface is covered with vertical cord marks. The exterior is smoothed and plain.
- RF5 variants first encountered in, or restricted to, layer 6:
- 5aab displays three decoration zones: (a) the exterior rim margin is raised to a ridge 25 mm below the terminus and within this zone a running zigzag motif, defined by the ridge and incised lines, is infilled with vertical *Anadara* shell impressions (Fig. 158). (b) the interior margin is also decorated with these vertical impressions. Two incised lines demarcate the lower edge about 25 mm below the terminus. (c) the terminus is also decorated with shell impressions.
- 5aaf has a plain unburnished exterior. The interior has what appear to be a series of upwards pointing triangular panels bordering the rim terminus. These are infilled with horizontal *Anadara* shell impressions. They are also visible on the terminus edge.
- 5aat features a curvilinear punctate field bordered by a rim margin, both defined by incised lines. The field's lower boundary is arcuate but the left margin is straight. On the interior wall, two parallel incised lines define a narrow band about 10 mm below the terminus. It is filled with a squiggly line.
- RF5 categories first encountered in, or restricted to, layer 5:
- 5aac also has three decorated zones: the exterior (a), has a vertical panel, infilled with diagonal *Anadara* shell impressions, beneath a plain margin all defined by incised lines (Fig. 158). (b) the interior has two such panels, however, these are oblique to the margin. (c) the terminus has *Anadara* shell impressions.
- 5aad is decorated with vertical paddle impressions which cover the exterior surface. The rim terminus is square (Fig. 158). It is not burnished.
- 5aae is similar to RF5aad, however, the vertical paddle impressions terminate at an incised line about 10 mm below the terminus which is decorated with diagonal paddle impressions (Fig. 158).
- 5aag includes three decorative zones: (a) the exterior is covered with slightly slanted paddle impressions (Fig. 158). (b) the interior is bounded by a horizontal incised line 30 mm below the terminus. Within this is a downwards pointed arcuate panel located at the terminus margin. This panel is infilled with "prick" marks made by a pointed stylus. (c) stylus marks also decorate the rim terminus. It is coarser and unburnished.

- 5aah is burnished and reduced.The exterior, below a 7mm wide margin defined by two incised lines, is decorated with relatively thick vertical *Anadara* shell impressions. These have been inscribed over with rounded 2 mm wide diagonal "cross-hatched" lines (Fig. 158). The interior has the same upper margin with two 8 mm wide panels descending diagonally below it. Three incised lines run parallel with and about 30 mm below the terminus.
- 5aav is unburnished and decorated on both sides. The exterior has vertical paddle impressions. A deep incised line marks the internal inflection point and two "v" shaped lines, running at 30° to the horizontal from the inflection point, cross just below the terminus. The interior lower 8 mm margin, defined by an incised line, is infilled with horizontal *Anadara* shell impressions. A downwards pointed arcuate panel, located at the terminus margin, is infilled with diagonal *Anadara* shell impressions. This ware is coarser than most of the fine wares in the sample.

Several of the variants listed above have modified versions. To avoid incessant splitting, these have not been assigned to further variant categories. For completeness, the modifications are listed below under the relevant variant classifications.

- RF5 variant modifications noted in layer 9:
- 5c also has *Anadara* shell impressions to the terminus.
- 5ad(i). A larger sherd revealed three parallel horizontal bands, located between the terminus and inflection point, infilled with *Anadara* shell impressions. These impressions also decorate the terminus.
- 5ao is decorated with fingernail impressions to the internal surface.
- RF5 variant modifications noted in layer 8:
- 5c also includes 3 additional lines at the inflection point margin.
- 5ad(i) has only one external incised line.
- 5ad(iii). Fingernail marks replace the *Anadara* shell impressions employed during CP2.
- 5aax also presents in a slightly different design layout with triple parallel incised lines and infilled bands interspersed with plain bands in geometric patterns (see thin section K937).
- RF5 variant modifications noted in layer 7:
- 5a is identical to the CP2 version except that it lacks the fine vertical striations.
- 5c differs from the layer 10 version as the exterior decoration is either contained within a horizontal field about 20 mm wide and 10 mm below the terminus, a series of similar narrow but discontinuous geometric bands, or a curvilinear pattern. In each case they are infilled with diagonal *Anadara* shell impressions.

- 5v: In this version the fields are reversed with the decorative field about 10 mm below the terminus above a plain band and then three incised lines at the inflection margin. The field is decorated with cross-hatched *Anadara* shell impressions.

- 5ar employs, on the exterior surface, near vertical *Anadara* shell impressions beneath an incised line placed 10 mm below the terminus. The interior features a series of inclined and horizontal incised lines.

- RF5 variant modifications noted in layer 6:

- 5c displays two narrow decorative bands equally spaced between the terminus and the external inflection.

- 5j(ii) represents a relatively coarse cord-marked ware. This version differs from the CP2 sample because it also displays a diagonal incised line to the exterior surface.

- 5ar differs from the layer 8 version. The exterior has a double line below the terminus and the interior curvilinear fields are infilled with stylus prick marks. Finally, the terminus is decorated with *Anadara* shell impressions.

- 5at is identical to the layer 8 version except it lacks the terminal *Anadara* shell impressions.

- RF5 variant modifications noted in layer 5:

- 5c shape and decoration differ slightly to other versions. In this case the ware is composed of an exotic bleb-tempered fabric which suggests that it represents a regional style.

- 5aaf in this version the interior has what appear to be a series of downwards rather than upwards pointing triangular panels bordering the rim terminus. These are infilled with diagonal *Anadara* shell impressions. The terminus is plain.

In summary, RF5 variants display an extensive range of shapes, sizes, surface treatments and modes of decoration. Although square termini were noted, most are rounded. Many include decorative motifs. These are arranged in various combinations, some quite complex, others simple. Different colours suggest some firings were incomplete or less well controlled. A few variants are relatively coarse in texture. Most are burnished and reduced to produce a deeply lustrous surface. A variety of tools, from styli, shells, fingernails, carved and cord-wrapped paddles and burnishing stones were employed to impart patterns into the soft clay. Colour variations within single sherds indicate that some vessels were fired upside down. Most rims are burnished. Incised geometric and curvilinear designs are common. Many fields are infilled with impressed, punctate or pricked decoration. Paddle marks have been deliberately exploited as decorative features on their own, or incorporated into a variety of designs, some complex. Fingernail impressions are an alternative to *Anadara* shell in several variants. In one instance the surface is treated with a "stucco" effect. Infilling of fields is sometimes achieved with a series of incised parallel or cross-hatched lines.

Three decorative zones, exterior, interior and rim termini, are variously exploited. In contrast to the CP2 RF5 sample, in many instances, interior as well as exterior surfaces are utilized for decorative motifs or artistic expression. The rim termini are often treated as an alternative zone, sometimes in combination with the former zones or alone. Single or multiple horizontal lines or infilled bands are common. Decorative fields are usually infilled. One unusual rim included a single conical nubbin. Paddle-impressed wares, mainly later in the sequence, lack burnished surfaces.

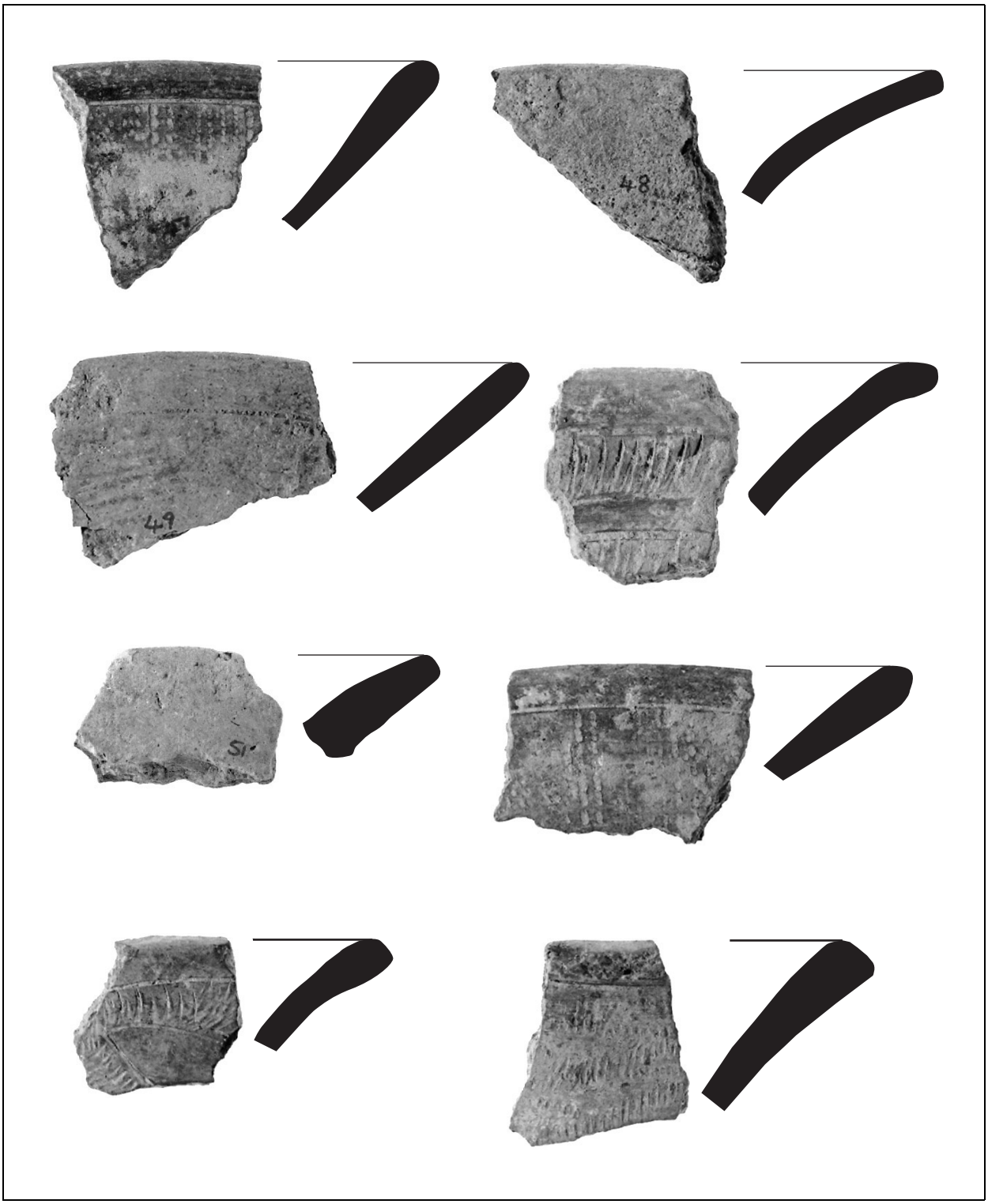


FIG. 156: Rim form 5 categories. Ceramic Period 3. *Top* left: 5ar, right: 5as, *Centre upper* left: 5at, right: 5au, *Centre lower* left: 5av, right: 5aw, *Bottom* left: 5ay, right: 5az. Scale 1:1

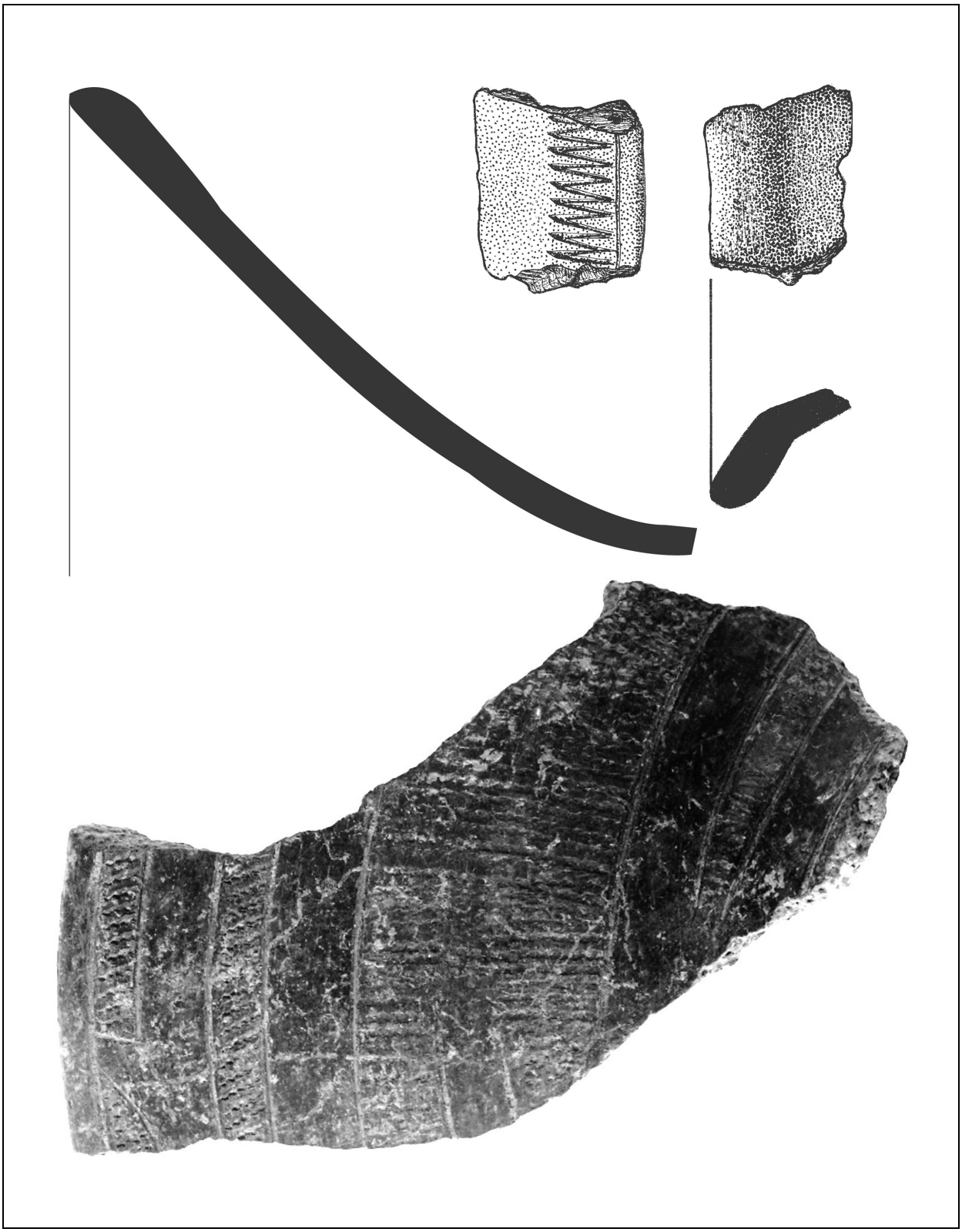


FIG. 157: Rim forms 5ad(iv) (top right) and 5aax. Ceramic Period 3. Scale 1:1

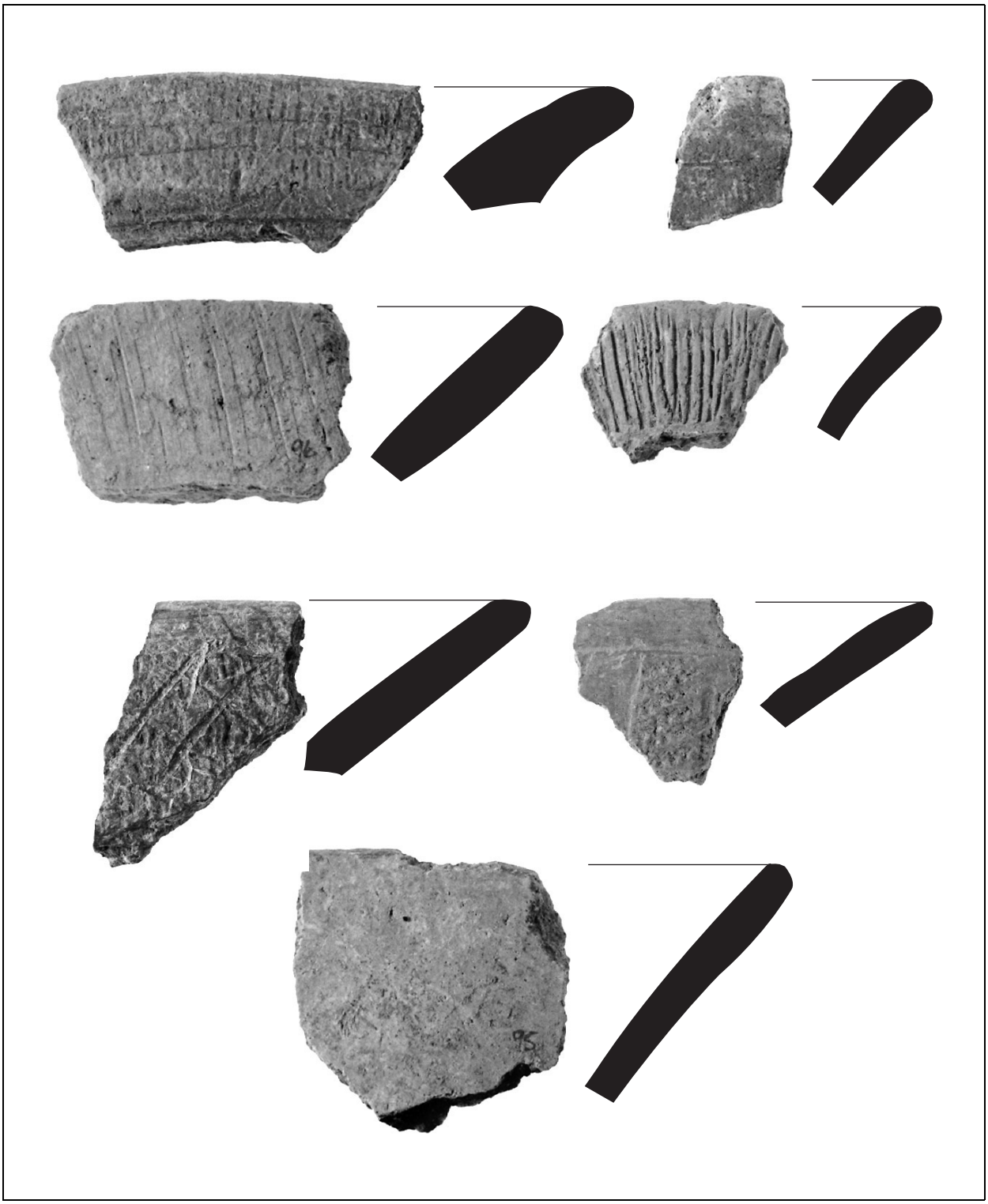


FIG. 158: Rim form 5 categories. Ceramic Period 3. *Top* left: 5aab, right: 5aae, *Centre upper* left: 5aag, right: 5aad, *Centre lower* left: 5aah, right: 5aac, *Bottom*: 5aaf. Scale 1:1

Rim form 5 fabrics

To help determine whether stylistic and technological changes are present in the assemblage a detailed examination of the most abundant rim type has been given particular attention. As rim forms are diagnostic of whole vessels, the rate and magnitude of any change is considered best achieved in this way. A selection of RF5 and variant fabrics are set out in table 92. Where present, incidental rice is annotated in the table. In some fabrics rice husk was noted in grog, in others the general matrix. Exotic vessels were entering the site from a wide variety of sources during CP3. These included wares derived from igneous, metamorphic and sedimentary zones. They were prepared with bleb, orthodox grog or sand temper. Of the 143 RF5 variants examined petrographically, 89, or 62.23 per cent, represent local wares. Ten of these, (layer 10, 1; L9, 8 and L8, 1), belong to FG2, the CP2 fabric group. When the hand specimen sample is included, data from 231 variants are available. Of these, 158 or 68.39 per cent are local. Selecting rim sherds for differences in form or fabric, however, tends to bias the sample in favour of variation, thus emphasizing exotic at the expense of local wares. The distribution of local versus exotic wares, excluding non-specific fabrics, is set out in table 93.

Two different exotic wares were recorded for RF5ai(i), FG11, tempered with blebs and rice, and a sand-tempered ware identified in hand specimen. Sample K910 may have been treated with a surface slip. This fabric is elsewhere associated with limestone inclusions. Fabric and form correlations are evident in several exotic variants. FG11, the bleb-tempered ware, which includes abundant rice husk, is present in RF5c, 5j(ii), 5R, 5ad, 5ag, 5ar, 5au, 5aw, 5aaf, 5aag and 5aat. Some of these are also represented in local variants, such as RF5c, 5j(ii), 5ad, 5ar, and 5aw, a reflection of the regional distribution of some styles. Similarly RF5aax has both local and exotic versions. This may represent local imitation of an exotic design or vice versa. Others, such as RF5x, are exclusive to an exotic variant. RF5c, decorated with incised lines and *Anadara* shell impressions, is present in FG2 and FG3, the CP2 and CP3 local fabrics. It is important to note that this variant also occurs in four exotic wares (fabric groups 8, 11, 20 and 22). RF5as is present in a local version (FG3), as well as the exotic FG8. Exotic and local versions of variant 5a(i) were noted based on hand specimen examination.

A selection of variants not examined petrographically are included for completeness. Exotic sources increased markedly during the latter part of CP3. They vary in mineralogical composition and technological treatments. Sand tempered exotic wares are common. In some, differentiation is difficult due to the presence of complex mixtures of mineral inclusions. These are discussed in Appendix 1. Exotic ware sources varied throughout the sequence: L10:1-2: 2; L9: 3; L8: 3; L7: 6; L6: 6 and L5: 1.

TABLE 92: *Rim form 5 fabrics: Ceramic Period 3. o.g.: orthodox grog, R: red painted*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
5:1	5	K1042	11	f.1	6:3	5	K573	3	f.27
5:1	5	h.s.	11	-	6:3	5	K586	8	B8
5:1	5	h.s.	3	f.1	6:3	5	K588	3f	-
5:1	5aad	h.s.	exotic,o.g.	-	6:3	5	K592	3	-
5:1	5aae	h.s.	rice	-	6:3	5	K593	3	-
5:1	5aav	K1036	5?	-	6:3	5	K632	8	-
5:2	5	K1043	3	-	6:3	5	K633	8	-
5:2	5	K1044	3	-	6:3	5	K634	14	-
5:2	5	h.s.	3	B19	6:3	5	K994	9	f.44
5:2	5c	h.s.	3	B19	6:3	5	K1022	3 rice	f.5
5:2	5af	h.s.	3	B6	6:3	5	h.s.	3	B2
5:2	5aae	K1025	5 rice	f.4	6:3	5	h.s.	3	B3
5:3	5	K1034	3	-	6:3	5	h.s.	3	B8
5:3	5	h.s.	3	B6	6:3	5	h.s.	3	B9
5:3	5aaf	h.s.	11	-	6:3	5	h.s.	sand	B9
5:3	5aag	h.s.	11	-	6:3	5	h.s.	3	B11
5:4	5aac	h.s.	3	-	6:3	5c	K556	8?	-
5:5	5aah	h.s.	exotic?o.g.	-	6:3	5aab	h.s.	3	B9
6:1	5	K583	9	-	6:4	5	K569	9	-
6:1	5	K610	9	-	6:4	5c	K568	20	-
6:1	5	K611	21	-	6:4	5aw	h.s.	11	-
6:1	5	K612	9	-	6:4	5aab	K991	3	-
6:1	5	K613	9	-	6:5	5	K574	8	f.41
6:1	5	K614	3	-	6:5	5	K993	3	l.6
6:1	5	K615	9	-	6:5	5	K1006	3	l.6
6:1	5	K616	21	-	6:5	5	h.s.	3	B13
6:1	5	K617	9	-	6:5	5b(iii)	K1031	3	-
6:1	5	K1029	3 rice	B1	6:5	5j(ii)	h.s.	11	B13
6:1	5	h.s.	3	B4	6:5	5R	K599	11	f.29
6:1	5c	h.s.	3	B4	6:6	5	K626	8	-
6:2	5	K566	3	-	6:6	5ar	h.s.	11	f.21
6:2	5	K567	8	-	6:6	5at	h.s.	3	-
6:2	5	K1002	3	-	6:6	5aat	h.s.	11	F36
6:2	5	K1023	3 rice	-	6:7	5	K1010	8	-
6:2	5	h.s.	sand	f.3 Pl.8	6:7	5	K1011	5	-
6:2	5aw	h.s.	3	-	6:7	5	K1014	3?	f.19
6:3	5	K554	8	-	6:7	5ar	h.s.	3	f.12
6:3	5	K555	8	-	7:1	5	K553	8	-

TABLE 92: *Rim form 5 fabrics: Ceramic Period 3 (continued).*
Feat.: feature, f: fishpond clay

Layer	Form	T.S./h.s.	Fabric	Feat.	Layer	Form	T.S./h.s.	Fabric	Feat.
6:3	5	K557	8	-	7:1	5	K596	3	-
6:3	5	K558	8	-	7:1	5	K944	11	-
6:3	5	K570	8	-	7:1	5	K945	11	-
7:1	5	K947	3	-	7:8	5	K575	3f	B27
7:1	5	K949	3?	-	7:8	5	K637	3	B27
7:1	5	K951	19	-	7:8	5	K638	3 rice	-
7:1	5	K952	12	-	8:1	5	K649	8	-
7:1	5	K971	11	-	8:1	5	h.s.	no data	B44
7:1	5	K972	3	-	8:1	5a(i)	h.s.	no data	B44
7:1	5	h.s.	3	f.30	8:1	5au	K936	11	-
7:1	5	K984	11	-	8:2	5	K896	2	-
7:1	5aw(i)	h.s.	3	-	8:2	5 slip?	K910	11	-
7:2	5	K956	3	f.2	8:2	5	K943	3	-
7:2	5	K958	3	l.3	8:2	5	K953	11	-
7:2	5	K962	3 rice	l.3	8:2	5	h.s.	3	f.23
7:2	5	K963	21	-	8:2	5	K935	10	-
7:2	5	K978	3	-	8:2	5as	K912	3f	-
7:2	5	h.s.	3	B15	8:2	5	K915	3	-
7:2	5	h.s.	rice	B15	8:2	5	K916	3	-
7:2	5v	h.s.	3	B15	8:2	5a(i)	K922	3	-
7:2	5ad(viii)	h.s.	3	B15	8:2	5j(ii)	K902	3f	-
7:2	5aaa	h.s.	3	l.3	8:2	5ad	h.s.	3	f.23
7:3	5	K955	19	-	8:2	5ad(viii)	h.s.	3	-
7:3	5	K977	10	-	8:2	5as	K932	8	f.23
7:3	5	K983	8	-	8:2	5av	h.s.	3	f.23
7:3	5	h.s.	3	B16	8:2	5aw	h.s.	3	-
7:3	5a	h.s.	3	-	8:2	5 nubbin	K901	3	-
7:3	5c	h.s.	3	-	8:3	5	K906	3f	-
7:3	5h	h.s.	3	B20	8:3	5	K913	3	-
7:4	5ar	h.s.	3	f.17	8:3	5ak	h.s.	3	-
7:5	5	h.s.	sand	B35	8:3	5ar	h.s.	3	-
7:5	5	h.s.	no data	B36	8:3	5aax	h.s.	3	-
7:6	5	K970	3	-	8:4	5	K934	3f	-
7:6	5	h.s.	3	B21	8:4	5	K940	8	-
7:6	5	h.s.	3	B22	8:4	5	h.s.	3	B28
7:6	5	h.s.	3	B23	8:4	5	h.s.	11	B28
7:6	5	h.s.	no data	B20	8:4	5c	h.s.	3	B28
7:6	5c	K976	3	-	8:4	5p	h.s.	3	-

TABLE 92: *Rim form 5 fabrics: Ceramic Period 3 (continued)*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
7:6	5a(i)	h.s.	3	-	8:4	5ad	h.s.	11	B28
7:7	5	K301	3	B24	8:4	5ad	h.s.	3	l.7
7:7	5	K303	3	B24	8:4	5ak	h.s.	3	l.7
7:7	5	K305	3	B24	8:4	5ay	h.s.	3	-
7:7	5	K300	3	B24	8:4	5aax	K937	10	l.7
7:7	5	h.s.	3	B25	8:5	5	K907	11	-
8:5	5	h.s.	3	B31	9:3	5ad(iii)	K751	3	-
8:5	5	h.s.	no data	B32,33	9:3	5aq	K752	3	-
8:5	5ad	h.s.	no data	B31	9:4	5	K515	3	-
8:5	5as	K904	3	-	9:4	5c	K766	2	-
8:5	5az	h.s.	3	-	9:5	5	K785	3	-
8:6	5	K938	3	-	9:5	5	K835	3	-
8:7	5	K939	3	-	9:5	5	K839	3	-
8:7	5	K941	3	-	9:5	5	K867	3	-
8:7	5	K959	3 rice	l.12	9:5	5ad(iii)	K798	2	-
8:7	5	h.s.	sand	f.26	9:5	5ad(iii)	K841	2	-
8:7	5	h.s.	3	l.12	9:5	5ao	K786	3	-
8:7	5l	h.s.	3	-	9:6	5	K511	2	-
8:7	5ad(i)	h.s.	3	-	9:6	5	K522	3	-
8:7	5at	h.s.	3	-	9:6	5	K817	2	l.9
9:1	5	K519	3	-	9:6	5	K883	2	l.9
9:1	5	K755	3	-	9:6	5a(i)	h.s.	3	-
9:1	5	K756	3	-	9:6	5c	K851	22	l.9
9:1	5	K788	3	-	9:6	5c	h.s.	3	-
9:1	5	K888	2	-	9:7	5	K889	3	-
9:1	5c	K768	11	-	9:7	5c	K866	2	-
9:1	5ad	K757	3	-	9:7	5ac	K503	11	-
9:1	5ad	h.s.	3	-	9:7	5ad(vi)	h.s.	3	-
9:1	5ad(iii)	K814	3	-	10:1	5	K600	3	-
9:2	5t	K521	3	-	10:1	5	K625	3	-
9:2	5x	K767	6	-	10:1	5	K739	3	-
9:2	5x	K884	6	-	10:1	5	K1093	13	-
9:2	5	K886	3 rice	-	10:1	5ag	h.s	11	-
9:2	5	K921	11	-	10:2	5o	h.s	3	-
9:2	5ad(iv)	h.s.	3	-	10:2	5p(i)	h.s	3	-
9:2	5ad(vii)	h.s.	3	-	10:2	5s	h.s	3	-
9:2	5ao	K819	3	-	10:2	5ad	h.s	3	-

TABLE 92: *Rim form 5 fabrics: Ceramic Period 3 (continued)*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
9:3	5	K782	3	-	10:2	5ad(vi)	h.s	3	-
9:3	5	K784	3	-	10:2	5ai	h.s	3	-
9:3	5	K787	3	-	10:2	5ai(i)	h.s	sand	-
9:3	5a	K885	3	-	10:2	5	K1066	3	-
9:3	5b(iii)	h.s.	3	f.1	10:2	5 special	K618	2	-
9:3	5ad(i)	h.s.	3	-					

TABLE 93: *Local and exotic rim form 5 fabrics: Ceramic Period 3*

	Local			Exotic											
Fabric group	2	3	5	6	8	9	10	11	12	13	14	19	20	21	22
Layer 5	-	9	2	-	-	-	-	4	-	-	-	-	-	-	-
6	-	27	1	-	13	8	-	5	-	-	1	-	1	2	-
7	-	33	-	-	2	-	1	4	1	-	-	2	-	1	-
8	1	35	-	-	3	-	2	6	-	-	-	-	-	-	-
9	8	31	-	2	-	-	-	3	-	-	-	-	-	-	1
10:1-2	1	9	-	-	-	-	-	1	-	1	-	-	-	-	-
total	10	145	3	2	18	8	3	23	1	1	1	2	1	3	1

Rim form 6

A degree of overlapping is again likely at the interface between CP2 and CP3, therefore, some variants included in the CP2 spectrum may actually related to CP3. These include RF6c(iii), 6k(i), 6p, 6r, 6t, 6v, 6aa(i), 6ah and 6ai (Appendix 2). Apart from these 21 are unique to CP3. A single large RF6 sherd, with a 'hammerhead terminus', has remnant cord marks near the lowest point which suggest it may have been fitted with a base. This rim matches a non-burial vessel recovered from layer 10:1, feature 1, cat. 3233, thin section K210. Variants 6b(v), 6c(i), 6c(ii), 6g, 6i, 6k and 6u continue from CP2. All the variants listed below are burnished and reduced unless otherwise stated.

- RF6 variants first encountered in, or restricted to, layer 10:1-2:

- 6q, an exotic FG11 ware, is decorated with a series of about 2 mm wide incised lines on the exterior. The uppermost is horizontal and gauged 5 mm below the terminus. Four further lines run at increasingly slanted angles, from right to left, across the vessel wall (Fig. 86).
- 6w is partially oxidized and burnished on interior and exterior surfaces. Decoration consists of geometric *Anadara* shell-impressed fields to the exterior and a series of "V" shaped notches cut into the outside edge of the angular terminus (Fig. 159).
- 6z reverses the 6y decorative sequence. Vertical shell impressions are placed above a slanted incised line running from 15 to 20 mm below the terminus (Fig. 159). This ware is essentially oxidized. The terminus is angled inwards.
- 6ae lacks decoration, however, the terminus is bulbous and acutely angled outwards at nearly 90° to the wall (Fig. 159). The surfaces are oxidized.
- 6aj exterior is completely covered with horizontal *Anadara* shell impressions.
- RF6 variants first encountered in, or restricted to, layer 9:
- 6y occurred with either a rounded or square terminus. Decoration consists of a field of near-vertical *Anadara* shell impressions bounded by a horizontal incised line 10 mm below the terminus (Fig. 159). Both grog and sand-tempered versions are present.
- 6ad(i) differs from CP2 RF6ad in that it displays a field of diagonal paddle impressions to the exterior wall and light paddle impressions to the terminus.
- 6ak decoration involves three zones: (a) the interior has been carefully smoothed to a high lustre. A double horizontal incised line is located 8-9 mm below the terminus. (b) the exterior has a single such line above very fine diagonal paddle(?) impressions. These are rounded in cross-section and 1 mm wide. (c) the terminus is also decorated with these impressions. Finally, the entire sherd is coated with a red paint. It is unique to layer 9 and represented by a single 5 mm thick sherd, 16 mm deep and 25 mm long.
- 6al is coarser than most fine wares, however, the interior and the upper exterior surface, 10 mm below the rim, has been carefully smoothed (Fig.161). Although the remaining cord marks are coarse, the overall vessel shape and finish are of a higher standard than vessels categorized as coarse ware. The terminus has also been carefully cord-marked.
- RF6 variants first encountered in, or restricted to, layer 8:
- 6aa is decorated with a series of parallel horizontal incised lines, 5 to 6 mm apart, alternatively infilled with diagonal *Anadara* shell impressions (Fig. 159).
- 6am surfaces are oxidized. A single incised line skirts 16 mm below the terminus on the exterior surface. Near vertical *Anadara* shell impressions decorate the field under this line (Fig. 160). A single large sherd, from layer 7:4, includes an attachment ridge at its lowest point. This is probably the vestige of a ring-footed base. This variant is unique to CP3.

- 6an has two fine incised lines 16-18 mm below the terminus on the exterior surface (Fig. 160). It is unique to layer 8. All surfaces are oxidized. The terminus is decorated with diagonal *Anadara* shell impressions.

- 6ao is level along the horizontal plane with a small 45° bevel at the external edge. The horizontal plane is decorated with smooth concave fingernail impressions lying at right angles to the vessel walls. These impressions alternate from either wall to the centre line in an intricate pattern. The ware is oxidized (Fig. 160). It is unique to layer 8.

- 6ap employs rows of mainly vertical fingernail impressions, in this case to an external field, below a horizontal incised line placed 7 mm below the terminus (Fig. 160). It is oxidized and unique to CP3.

- 6aq continues the *Anadara* shell-impressed decorative theme with geometric fields in three zones: (a) on the interior wall, a narrow, 5 mm deep, band, parallel with and 4 mm below the terminus, is defined by incised lines. Another parallel incised line runs 8 mm below this and forms the upper border of a vertical, 10 mm wide, panel. Two acutely angled lines form a junction with this panel at the border. These fields are infilled with shell impressions (Fig. 161). (b) the exterior displays two such parallel horizontal fields separated by another angular band. The upper band lies adjacent to the terminus and the lower at the fractured edge of the sherd. (c) the terminus is also decorated with *Anadara* shell impressions. This variant is unique to layer 8.

- 6aae also employs geometric fields defined by incised lines. In this instance, however, they are infilled with vertical cord marks (Fig. 162). This variant is probably exotic. It is partially oxidized and found only in layers 8 and 3 (Appendix 2).

- RF6 variants first encountered in, or restricted to, layer 7:

- 6b(vii) thickens to form a square terminus decorated with diagonal *Anadara* shell impressions. The exterior displays a parallel incised line 10 mm below the terminus, with two further lines running diagonally down from this. Apart from the oxidized surface, the fabric is fully reduced. A single sherd was identified in layer 7.

- 6ax is similar in shape and firing attributes to 6aah below. Decoration consists of a horizontal field, dotted with small pricks, within two incised lines (Fig. 161). The fabric is tempered with rice husk and/or blebs. A single sherd was recovered from layer 7.

- 6y(i) displays three decorative zones: (a) the terminus is decorated with diagonal *Anadara* shell impressions. (b) the exterior is decorated with vertical *Anadara* shell impressions beneath a horizontal incised line 8 mm below the terminus. (c) the interior has a plain circular 22 mm diameter disc within the vertical *Anadara* shell-impressed field which is under another horizontal incised line running 10 mm below the terminus.

- 6aa(i) in addition to the CP2 RF6aa decoration, also includes lozenge-shaped fields filled with *Anadara* shell impressions to the interior and along the terminus.

- 6aa(ii) includes geometric *Anadara* shell-impressed fields to the exterior and combined curvilinear and geometric fields to the interior. One sherd was recovered from layer 7 and one from layer 5.
- 6aah has a square terminus, slightly thicker than the vessel wall. Although essentially reduced, the surface is oxidized, a product of a fabric which contains abundant organic matter having been fired in an oxidizing atmosphere, at least during the final firing stage. The exterior is decorated with two fine horizontal incised lines, above rows of vertical fingernail impressions (Fig. 162). Sherds were recovered from layers 6 and 7.
- 6au features a smooth interior with a cord-marked terminus and vertical cord marks to the exterior. The rim shape varies from straight to inflected about 20 mm below the terminus.
- 6av: the interior is reduced, exterior oxidized, suggesting the vessel was fired upside down. The interior and exterior are burnished. The exterior is decorated with a horizontal incised line 8 mm below the terminus; 3 mm below this incised lines form horizontal diamonds 30 mm wide by 29 mm deep. These fields are filled with fingernail(?) impressions. The terminus is decorated with diagonal *Anadara* shell impressions. A single sherd was recovered from layer 7.
- 6aw also features burnishing to both sides. A horizontal incised line runs 10 mm below the terminus. Below this the exterior vessel wall is filled with horizontal *Anadara* shell impressions.
- RF6 variants first encountered in, or restricted to, layer 6:
- 6h(i) has a round rather than the distinctive square terminus of the CP2 6h variant.
- 6au(i) includes a smooth band defined about 10 mm below the terminus (Fig. 162). Some examples have an external fold and a cord-marked terminus.
- 6au(ii) features horizontal incised lines in addition to the 6au(i) finish.
- 6au(iii) unique to layer 6, has the same form as other 6au variants, but rather than cord marks, an exterior field of *Anadara* shell impressions decorates the upper 20 mm. A curvilinear incised line courses through the middle of this field.
- 6au(v) is oxidized. It has a smooth interior, an externally folded rim with diagonal cord marks to the fold, exterior wall and terminus. The wall is 5-6 mm thick.
- 6ay displays three decorative zones: (a) the exterior has a 10 mm margin below the terminus defined by a 1 mm wide incised line (b) the wall below this is criss-crossed by 2 mm wide lines incised by a round stylus. Fields between the lines are infilled with near vertical marks made by a stylus of the same width (Fig. 162). (c) the upper 25 mm of the interior is decorated with diagonal *Anadara* shell impressions running from the terminus to a horizontal incised line. The exterior is oxidized.
- 6az is plain and oxidized. An incised line forms a margin 7 mm below the terminus. It is decorated with a central horizontal row of fingernail impressions (Fig. 162). A single sherd was recovered from layer 6.

- RF6 variants first encountered in, or restricted to, layer 5:
- 6au(vi) differs from RF6au(i) (Fig. 163), in that the cord marks are arranged horizontally to cover the entire exterior. The terminus has cord marks running parallel to the circumference.
- 6aw(i) is slightly oxidized. The exterior has a 10 mm margin below the terminus defined by an incised line. The wall below this is filled with vertical *Anadara* shell impressions (Fig. 163). The terminus is decorated with diagonal *Anadara* shell impressions.
- 6aaa is oxidized and not burnished. The exterior is decorated with a 6 mm horizontal band below the terminus and another 7 mm below the upper. These are filled with "prick" marks made with a pointed stylus (Fig. 163).
- 6aab displays almost vertical paddle impressions below a 11 mm wide terminal margin defined by an incised line (Fig. 163). The terminus is decorated with what could be cord marks. This variant is similar to RF6ad(i), layer 9.
- 6R is smooth. The exterior is coated with either red paint or a slip.
- RF6 variant modifications noted in layer 9:
- 6v is similar to the CP2 version but includes *Anadara* shell impressions to the terminus.
- 6y is present with either square or rounded termini.
- 6aa(i) now includes three decorative zones: (a) the exterior is provided with a horizontal field of diagonal *Anadara* shell impressions contained within incised lines. (b) the interior displays another such field. (c) the upper 15 mm of the interior is decorated with diagonal *Anadara* shell impressions running from the terminus to a horizontal incised line.
- RF6 variant modifications noted in layer 7:
- 6c(ii) differs from the CP2 design by featuring fingernail impressions, arranged to form a running "V" pattern round the terminus.
- 6k has terminal impressions at 90° to the walls. One version also included an external field of vertical *Anadara* shell impressions beneath an incised line about 10 mm below the terminus. The finish is rather coarse with oxidized surfaces.
- 6y has a diagonal line filled with *Anadara* shell impressions below the horizontal incised line. The interior is plain and the surfaces are oxidized.
- 6aa an exotic bleb-tempered version of this ware was recovered. The surfaces are oxidized.
- 6am now includes *Anadara* shell impressions to the terminus.
- RF6 variant modifications noted in layer 6 or 5:

- 6y is present in oxidized and reduced versions.
- 6aa(i) includes a plain circular field within vertical *Anadara* shell impressions.
- 6aa(ii) has a diagonal exterior 14 mm panel, commencing at a horizontal incised line about 10 mm below the terminus, which is filled with horizontal *Anadara* shell impressions. These are also present along the terminus.
- 6ay thin section K1035 has a slightly different decoration and is burnished and reduced throughout.

Rim form 6 summary

Decorative modes closely follow those recorded for the RF5 range. *Anadara* shell impressions are common. Paddle and fingernail impressions, cord marking, incising and burnishing are present. One exotic rim, 6R, is coated with a red paint or slip. Indentations with a pointed stylus have been used to form "prick" mark decorative fields. Note that the impressions on some rims are less well defined than earlier versions which suggests that a different portion of the shell was used. In addition, the impressions appear to have been less carefully applied than on earlier variants. Rim termini present as round, square, hammerhead or bulbous. Incised lines are mainly fine, however 2 mm wide round lines were cut into two samples 6q and 6ay. The former is exotic, the latter, which includes *Anadara* shell impressions, is local. Three zones have been exploited on five rims, and both walls on another five. Fingernail impressions were recorded on six, cord marks on nine and paddle impressions on three variants.

Rim form 6 fabrics

Note that fabrics denoted "grog" in table 94 are considered to be the local FG3, unless otherwise noted. The distribution of fabric groups in burials of RF5 and RF6 are summarized in table 96. Differences are apparent in the number of RF5 opposed to RF6 exotic wares in the burials and the general deposits. Three exotic groups are represented in the RF6 wares. These are dominated by the exotic bleb-tempered fabric, which forms 88.88 per cent of exotic wares. One exotic ware is tempered with sand and another with orthodox grog from a geologically non-specific source. A single local FG5 was recovered from layer 5. This is an intrusive CP4 local bleb-tempered ware. The CP2 local ware occurred in two layer 10 and one layer 9 RF6 samples. Their presence is consistent with post-deposition disturbance in prehistory. A total of 35, or 87.5 per cent, of local wares are represented by the CP3 local FG3. Exotic wares form 31.03 per cent of RF6, compared with 37.77 per cent of RF5 wares in the sample. In addition to this data, RF5 sherds, for which fabric data is unavailable, were recovered from B4, B13, B15, B16, B19, B20, B31, B32, B33 and B44. It is likely that most are local wares. Fabrics tempered with rice or sand are considered to be exotic. It is important to note that six of the 22 burials with RF5 variants, or 27.27 per cent, contained exotic wares. Just two RF6 wares were recovered from burials; both were local.

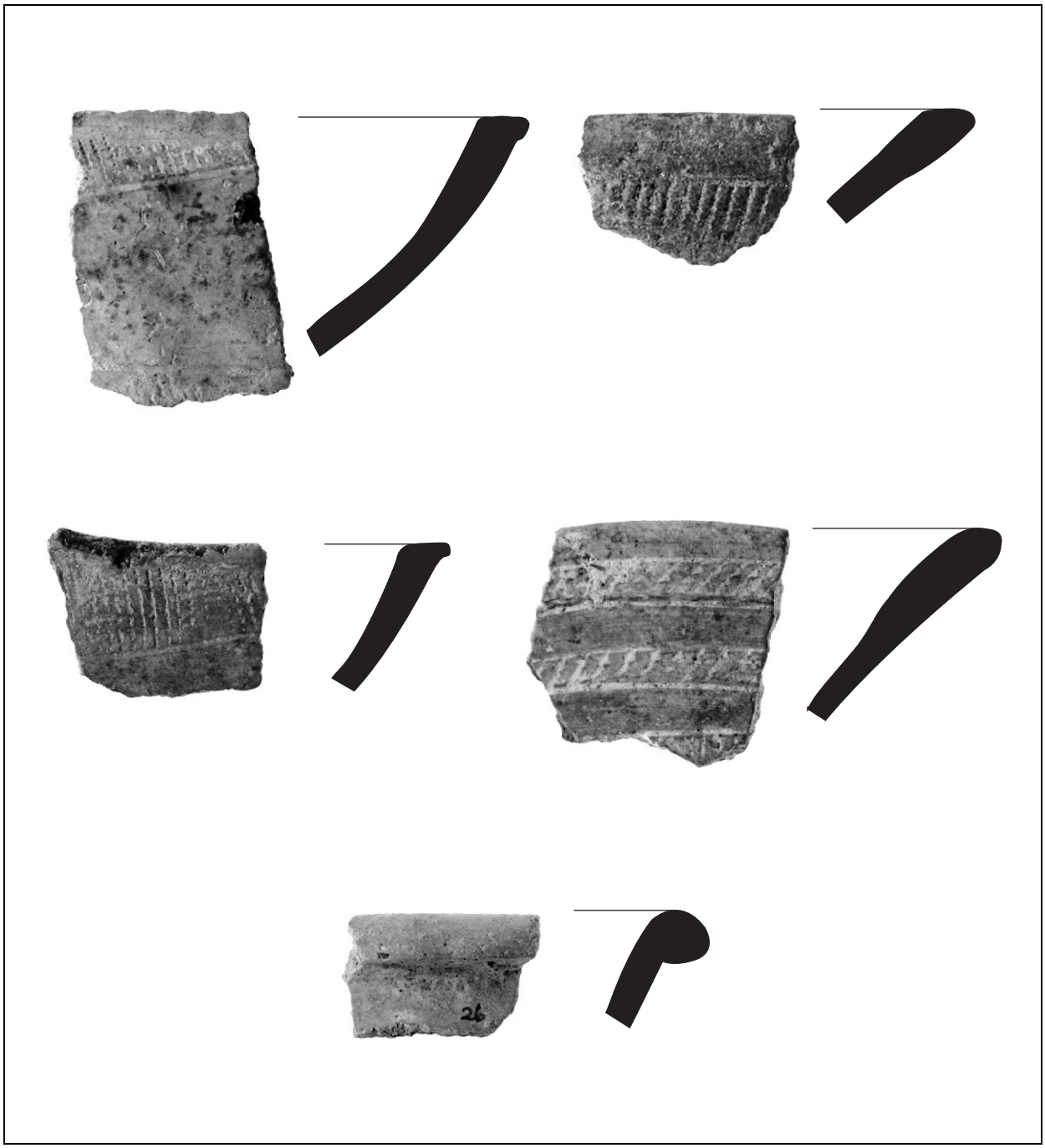


FIG. 159: Rim form 6 categories. Ceramic Period 3. *Top* left: 6w, right: 6y, *Centre* left: 6z, right 6aa, *Bottom*: 6ae. Scale 1:1

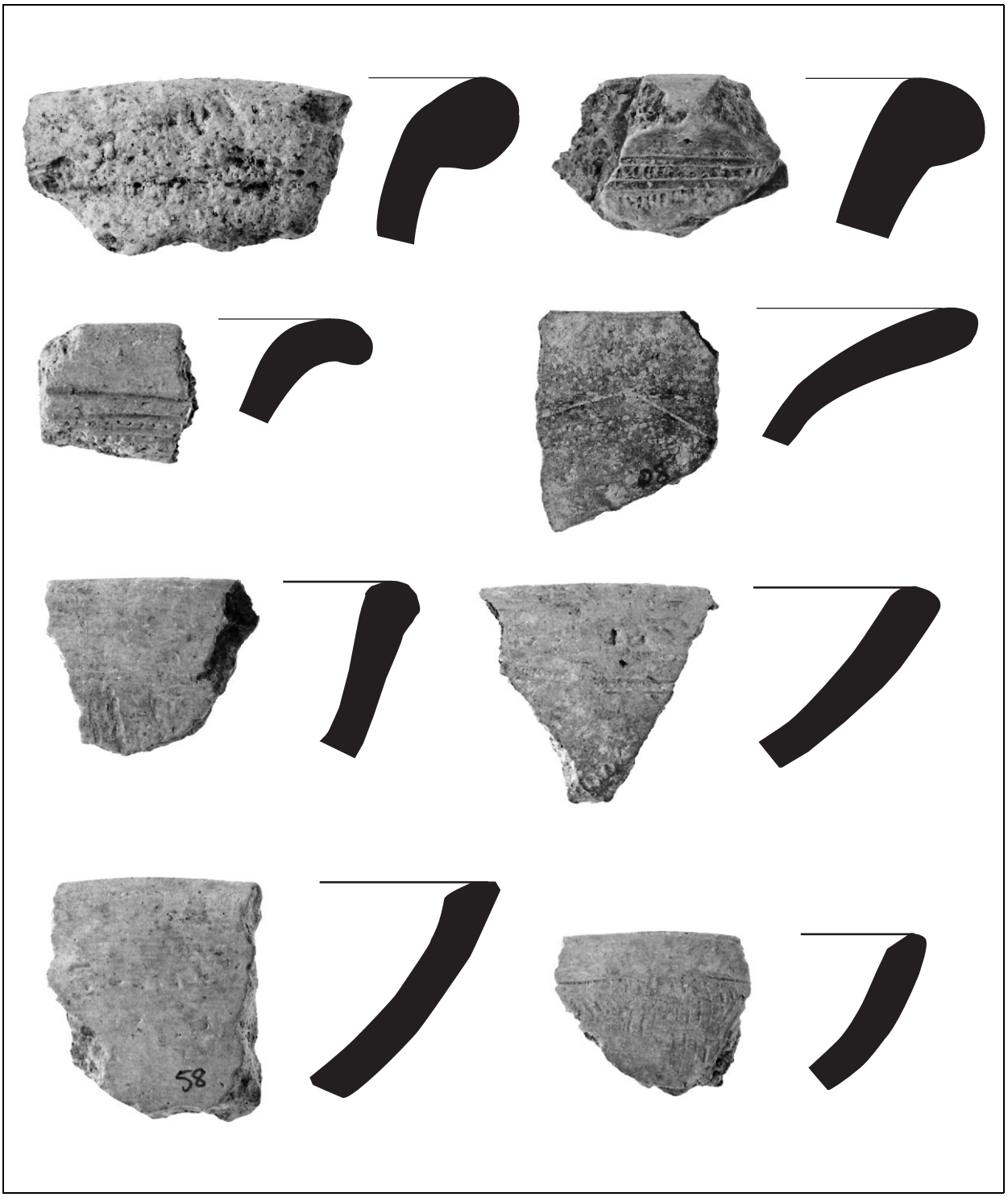


FIG. 160: Rim form 6 categories. Ceramic Period 3. *Top* left: 6ac, right: 6ad, *Centre upper* left: 6af, right: 6aag, *Centre lower* left: 6am, right: 6an, *Bottom* left: 6ao, right 6ap. Ceramic Period 3. Scale 1:1

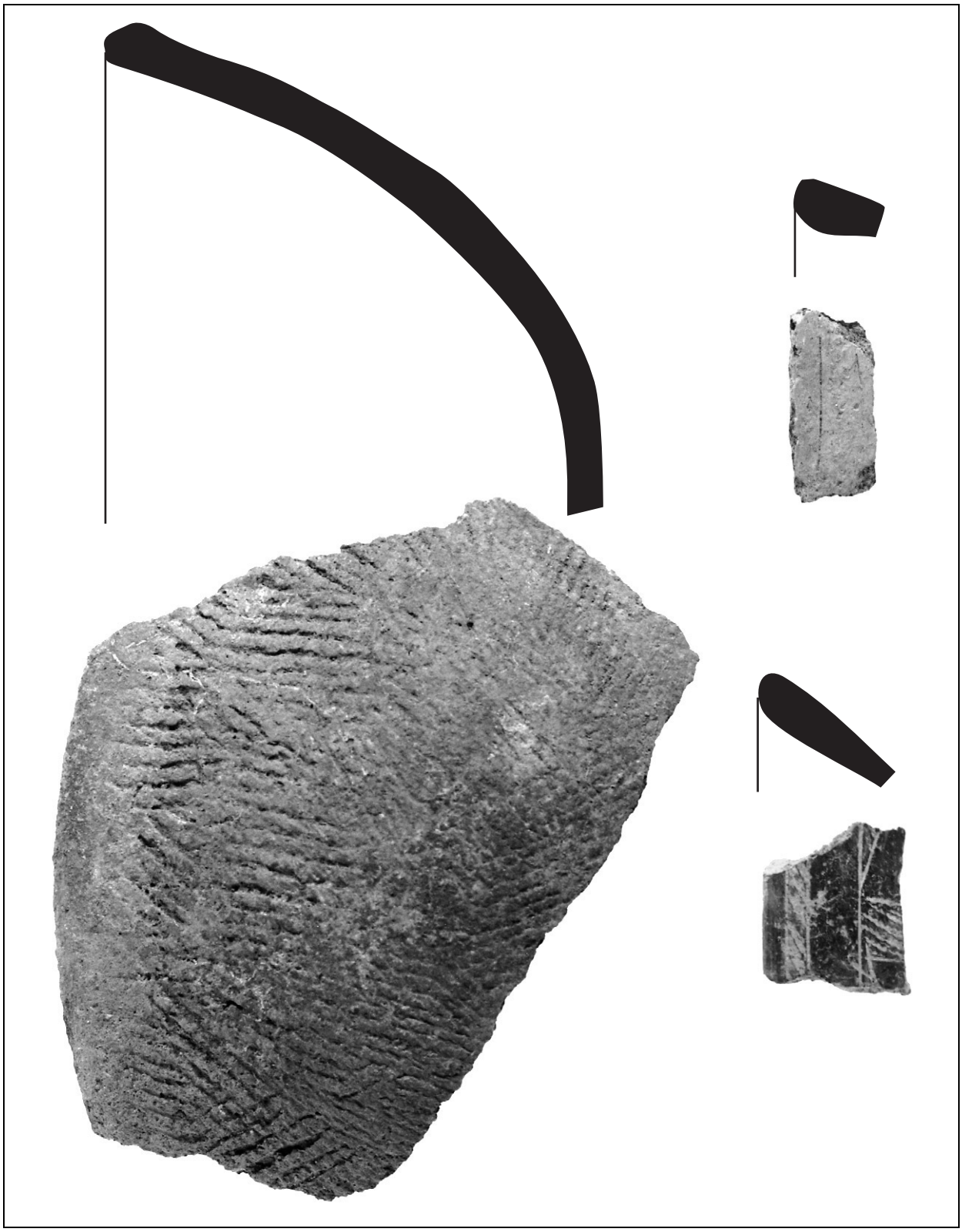


FIG. 161: Rim form 6 categories. Ceramic Period 3. *Left:* 6al, *Top* right: 6ax, and 6aq. Scale 1:1

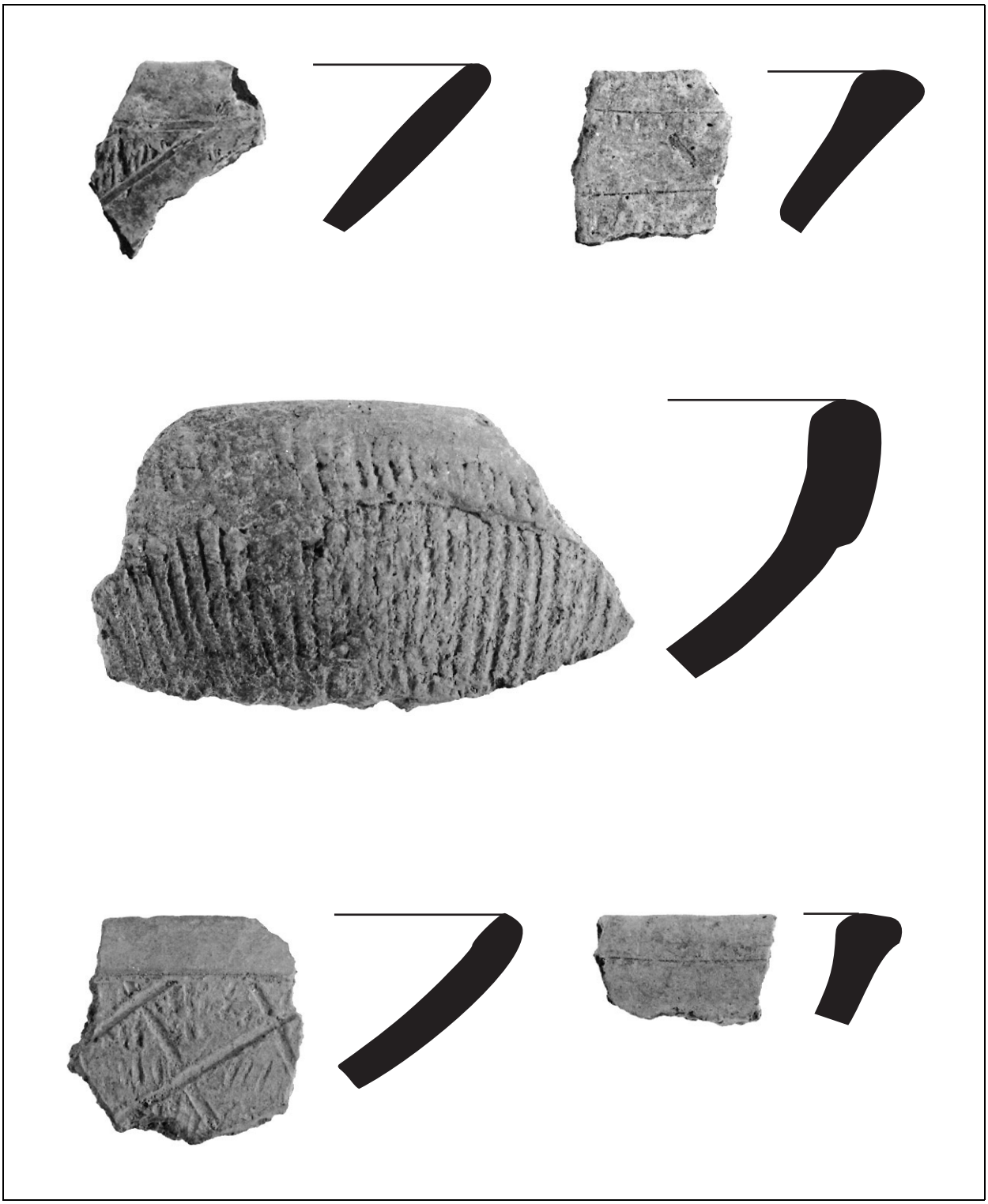


FIG. 162: Rim form 6 categories and variants. Ceramic Period 3. *Top* left: 6aae, right: 6aah, *Centre:* 6au(i), *Bottom* left: 6ay, right: 6az. Scale 1:1



FIG. 163: Rim form 6 categories and variants. Ceramic Period 3. *Top*: 6au(vi), *Centre*: 6aw(i), *Bottom* left: 6aaa, right: 6aab. Scale 1:1

TABLE 94: *Rim form 6 fabrics: Ceramic Period 3. Feat.: feature, f: fishpond clay, o.g.: orthodox grog, R: red painted, ham: hammerhead*

Layer	Form	T.S./h.s.	Fabric	Feat.	Layer	Form	T.S./h.s.	Fabric	Feat.
5:1	6	K1028	3	-	8:2	6aq	h.s.	grog	-
5:1	6R	K1038	11	-	8:3	6ao	h.s.	grog	-
5:1	6aaa	h.s.	exotic?o.g.	-	8:4	6	K933	3f	l.7
5:2	6	K1026	5	-	8:4	6k	h.s.	grog	l.7
5:3	6aab	h.s.	11?	B6	8:4	6am	h.s.	grog	l.7
5:3	6b(v)	h.s.	blebs	-	8:4	6ap	h.s.	grog	-
6:1	6	K995	3	-	8:6	6	K931	3	-
6:1	6ay	K1035	3	-	8:7	6	K891	3	-
6:1	6g	h.s.	grog	-	8:7	6aae	h.s.	exotic?o.g.	-
6:1	6h(i)	h.s.	grog	-	9:1	6	K765	3	-
6:3	6au	K576	3	-	9:1	6y	K833	13	-
6:3	6au	K577	3	-	9:1	6	K845	11	-
6:3	6au(i)	K591	3	f.12	9:1	6	K852	3f	-
6:3	6	K635	3	-	9:1	6ak	h.s.	exotic?o.g.	-
6:3	6au	K1021	3	-	9:2	6	K771	3f	-
6:4	6az	h.s.	rice	-	9:3	6	K803	3	-
6:4	6	K992	3	-	9:4	6	K758	11	-
6:4	6	K1005	3	f.2	9:4	6	K759	3	-
6:4	6aw(i)	K1016	grog	f.11	9:4	6	K863	3	-
6:4	6aw(i)	K1017	3	-	9:5	6	K805	11	-
6:5	6aw(i)	K1009	3	-	9:5	6ham	K875	3	-
6:5	6aah	K1013	11	l.6	9:5	6aa(i)	K801	3	-
6:7	6u	h.s.	grog	-	9:5	6v	h.s.	grog	-
7:1	6y	K960	3	-	9:6	6i	h.s.	grog	-
7:1	6aa	K961	11	-	9:7	6	K802	2	-
7:1	6au	K589	3	-	9:7	6	K804	3	-
7:1	6av	h.s.	grog	-	9:7	6	K815	3f,rice	-
7:1	6ax	h.s.	rice	-	9:7	6	K840	11	-
7:2	6y(i)	h.s.	grog	B15	9:7	6p	h.s.	11	-
7:2	6	K957	3	-	9:7	6al	h.s.	grog	-
7:4	6aah	h.s.	11	17	10:1	6c	K731	3	-
7:4	6ax	h.s.	11?	-	10:1	6aj	K748	3	-
7:4	6aah	K973	11	f.17	10:2	6k	h.s	grog	-
7:4	6y	h.s.	11	-	10:2	6k(i)	h.s	grog	-
7:5	6b(vii)	h.s.	grog	-	10:2	6q	h.s	11	-
7:7	6au(i)	K979	11	-	10:2	6r	h.s	2	-
8:1	6	K930	3	-	10:2	6w	h.s	2	-
8:2	6	K985	3	-	10:2	6x	h.s	11	-

TABLE 94: *Rim form 6 fabrics: Ceramic Period 3 (continued)*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
8:2	6aa	K908	3	f.23	10:2	6z	h.s	grog	-
8:2	6aa(i)	K905	3	-	10:2	6aa(i)	h.s	grog	-
8:2	6c(i)	h.s.	grog	-	10:2	6ac	h.s	3	-
8:2	6c(ii)	h.s.	grog	-	10:2	6ad	h.s	grog	-
8:2	6an	h.s.	grog	-	10:2	6ae	h.s.	2	-

TABLE 95: *Local and exotic rim form 6 fabrics: Ceramic Period 3*

	Local			Exotic			
Fabric group	2	3	5	11	13	non-specific	total
Layer 5	-	1	1	2	-	-	4
6	-	11	-	1	-	1	13
7	-	3	-	6	-	-	9
8	-	7	-	-	-	-	7
9	1	10	-	5	1	-	17
10:1-2	3	3	-	2	-	-	8
total	4	35	1	16	1	1	58

Rim form 7

The quantity of RF7 sherds increased during CP3 (Appendix 2). RF7a and 7a(i) are missing from the CP3 spectrum. The following variants are unique to CP3:

- Variant 7b, confined to CP3, is inverted and indirect with cord marks to the exterior. The surfaces are oxidized. The vessel it represents measured from 4 - 7 mm thick and an estimated 140 mm in diameter (Fig. 164).
- 7b(i) is decorated with incised lines forming a serpentine motif on a plain background (Fig. 164). A single line circumscribes 7 mm below the terminus. Unique to layer 7, it has oxidized surfaces and a heavily reduced interior.
- 7d is oxidized with a smooth finish. The exterior is decorated with a band of horizontal *Anadara* shell impressions defined by incised lines 7 mm below the terminus (Fig. 164).

- RF7 variant modifications noted in layer 8:
  Within layer 8, RF7 sherds were either plain or cord-marked.
- RF7 variant modifications noted in layer 7:
- The termini of some RF7 samples are decorated with *Anadara* shell impressions.
- RF7 variant modifications noted in layer 6:
- The terminus and exterior are decorated with cord marks. On the exterior they are vertical.

TABLE 96: *Rim form 5 and 6 fabrics in Ceramic Period 3 burials. f: fishpond clay*

Layer	Form	T.S./h.s.	Fabric	Burial	Layer	Form	T.S./h.s.	Fabric	Burial
5:2	5	h.s.	3	19	7:2	5ad(viii)	h.s.	3	15
5:2	5c	h.s.	3	19	7:2	6y(i)	h.s.	3?	15
5:3	5	h.s.	3	6	7:3	5	h.s.	3	16
5:3	5af	h.s.	3	6	7:3	5h	h.s.	3	20
5:3	6aab	h.s.	11?	6	7:5	5	h.s.	sand	35
6:1	5	K1029	3 rice	1	7:6	5	h.s.	3	21
6:1	5	h.s.	3	4	7:6	5	h.s.	3	22
6:2	5c	h.s.	3	4	7:6	5	h.s.	3	23
6:3	5	K586	8	8	7:7	5	K300	3	24
6:3	5	h.s.	3	2	7:7	5	K301	3	24
6:3	5	h.s.	3	3	7:7	5	K303	3	24
6:3	5	h.s.	3	8	7:7	5	K305	3	24
6:3	5	h.s.	3	9	7:7	5	K305	3	25
6:3	5	h.s.	sand	9	7:8	5	K575	3f	27
6:3	5	h.s.	3	11	7:8	5	K637	3	27
6:3	5aab	h.s.	3	9	7:8	5	K638	3 rice	27
6:5	5	h.s.	3	13	8:4	5	h.s.	3	28
6:3	5j(i)	h.s.	11	13	8:4	5	h.s.	11	28
6:3	5j(i)	h.s.	3	2	8:4	5c	h.s.	3	28
7:2	5	h.s.	3	15	8:4	5ad	h.s.	11	28
7:2	5	h.s.	rice	15	8:5	5	h.s.	3	31
7:2	5v	h.s.	3	15					

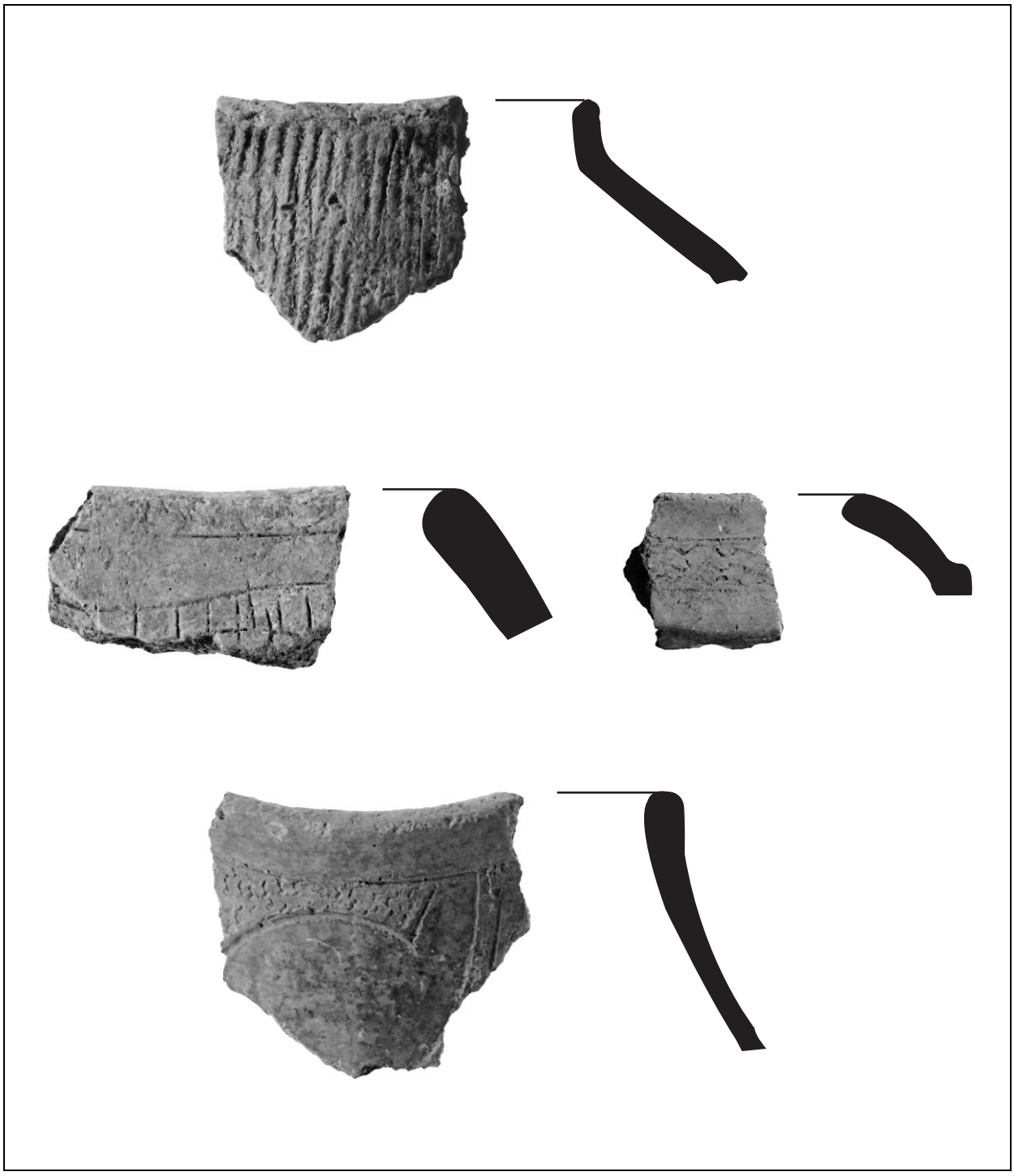


FIG. 164: Rim form 7 and 11 categories. Ceramic Period 3. *Top:* 7b, *Centre* left: 7b(i), right: 7d, *Bottom*: 11 (L6). Scale 1:1

Rim form 8

Just 5 g of this form were recovered from layers 8 and 9 and 6 g from layer 5 (Appendix 2). RF8 is related to cat. 1384, a whole CP3 local ware vessel interred with B77 (Fig. 135, Chapter VIII). A layer 5:1 sample, however, was tempered with abundant rice husk which could indicate that it was exotic.

Rim form 9

Only one sherd from layers 9 and 8 respectively was recovered. The former has a square terminus.

Rim form 10

In layer 9, this fine ware is expertly burnished and decorated with fields of *Anadara* shell impressions arranged in two narrow horizontal bands on the exterior wall and along the upper edge of the terminus. It is reduced. A layer 8 sample is more rounded at the inflection points than the earlier versions. Some lack decoration to the terminus, one has a broad decorated band with a single incised line at the upper edge. All are local wares. Fragments of the earlier form continue into layer 8. Some are intricately decorated with extra incised lines parallel to the bands. The inflection points vary slightly in curve and length. A single 10c sherd was recovered from layer 8. A layer 7:5 version has a sharply angular inflection point. It is 8 mm thick, 18 mm long and represents a very small vessel opening 90 mm in diameter. It is plain and probably composed of FG3. The rounded version with a single broad decorated band is also present in layer 7. In layer 5:2, another version is decorated with vertical paddle impressions which cover the area from the exterior inflection point to the terminus. Below this a segment of an arcuate field, defined by an incised line, filled with "pricked" stylus point marks, is visible. This ware is tempered with blebs and associated rice husk, typical of FG11.

RF10f, an important burnished variant, which includes both paddle and *Anadara* shell impressions, was recovered from layer 5:4 (Fig. 165). In cross-section the rim thickens to form an elongated bud shape. The exterior is decorated with vertical paddle impressions in a field beneath a 2 mm-wide horizontal incised line about 10 mm below the terminus. Another such line runs at 45° through the field. From the horizontal line to the terminus is burnished. The interior, however, is decorated with two bands filled with diagonal *Anadara* shell impressions. The upper is about 10 mm wide parallel with and bounded by the terminus. The lower edge is defined by a fine incised line. Another 10 mm wide band is located about 20 mm lower. It is composed of FG3 (sample K1045, Table 97).

TABLE 97: *Rim form 7, 8, 9, 10, 11 and 12 fabrics. Ceramic Period 3. f: fishpond clay, r: incidental rice inclusions*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
5:1	8	K1046	4	-	8:1	7	K919	3f	-
5:1	10	K1049	3	f.1	8:1	10	K899	3	-
5:2	7	h.s.	grog	-	8:2	10	K506	3	-
5:2	10	h.s.	11	f.1	8:4	10	K897	3f	l.7
5:4	7b	h.s.	grog	-	8:4	10c	h.s.	grog	-
5:4	10	K1024	3	-	8:5	9	K900	3r	-
5:4	10f	K1045	3	-	8:5	11	h.s.	grog	l.8
6:2	10	h.s.	grog	-	8:5	7	h.s.	grog	B31
6:3	10	K565	3	f.39	8:7	7	K920	3f	-
6:5	11	h.s.	grog	-	9:1	10	K813	2	-
7:1	7	K946	4	-	9:1	12	K763	5?	-
7:2	10	h.s.	grog	B15	9:1	12	K783	3	-
7:2	7b	h.s.	grog	B15	9:2	10	K764	3	-
7:5	7b(i)	h.s.	grog	-	9:3	7b	h.s.	grog	-
7:6	10	h.s.	blebs	B20	9:3	11	h.s.	grog	-
7:7	7d	h.s.	sand	-	9:4	10	K753	3	-
7:8	12b	h.s.	grog	B26	9:4	8	h.s.	grog	-
8:1	10	K909	3f	-	9:6	9	h.s.	grog	-
					10:2	12	K749	3	-

Rim form 7, 8, 9, 10, 11 and 12 fabrics

Forms 7, 8, 9, 10, 10c, 11, 11a, 12, and 12b continue into CP3 from CP2 (Appendix 2). A selection of these rims has been examined in thin section and hand specimen (Table 97). The fabric of K763, a RF12 sample from layer 9:1, is composed of a silty clay consistent with local deposits. It contains a bleb-like grog, but the matrix lacks rice remains diagnostic of bleb temper. Fabric variations in K1024 and K1049, which contain more nonplastics than usual, are probably due to local clay deposit variability. Sample K1046, a RF8 fabric, contains abundant rice husk in a micaceous matrix. All three are geologically non-specific, however, they probably represent local wares. Fabrics denoted grog or blebs are considered to represent local wares. The single RF7d sample, tempered with sand, is exotic.

Rim form 11

Rare fragments of RF11 and 11a are scattered through CP3. In layer 8 the rounded terminus is only slightly everted.

Rim form 12

This variant is extremely rare in CP3. Unlike the CP2 example, it is smooth and plain. A single RF12b sherd was recovered from layer 7.

Rim form 13

This minor form is concentrated in CP3 and CP4, which suggest that the CP2 deposits, where only 4 g were recovered, derive from post-depositional disturbances. RF13a(i) and 13a(ii) are unique to CP2. In addition to plain smoothed examples, which, except for layer 8, were distributed throughout CP3, the following variants were recognized:

- RF13 variants first encountered in, or restricted to, layer 9:
- 13a(iii) is represented by a single L9:3 sherd. It is burnished and almost fully reduced. The exterior is decorated with geometric fields defined by incised lines filled with *Anadara* shell impressions. A 15 mm deep band is located 3 mm below the terminus and a wedge-shaped field runs diagonally away from this band. A MP2 vessel, (B101, cat.1522), is decorated with a similar motif.
- RF13 variants first encountered in, or restricted to, layer 7:
- 13n resembles RF13c in texture. It includes an incised line about 14 mm below and parallel to the terminus. The exterior wall is decorated with vertical cord marks below this line (Fig. 166). The interior is smooth. It is unique to layer 7.
- RF13 variants first encountered in, or restricted to, layer 6:
- 13b a direct inverted rim decorated on the exterior with a band of vertical cord marks between the terminus and a horizontal incised line gauged 29 mm below (Fig. 165). The surfaces are oxidized.
- 13c has a bulbous terminus. The exterior is decorated with fields filled with *Anadara* shell impressions. One version involves a 9 mm margin at the terminus and a similar band about 20 mm below defined by incised lines and filled with horizontal impressions. Another features a curvilinear field filled with diagonal impressions (Fig. 165). They are unique to layer 6. The surfaces of these wares are oxidized.
- 13d is the reverse of 13b, with a plain band above vertical cord marks. The interior is reduced and the surfaces are lightly oxidized. It is unique to layer 6.

- RF13 variants first encountered in, or restricted to, layer 5:

- 13e decoration is restricted to the upper 30 mm or so. Overall the cord-marked wall surfaces have been only partially smoothed. Diagonal cord marks are clearly visible along the upper rim margin where two parallel incised lines are located 10 and 17 mm below the terminus (Fig. 166). The surfaces are oxidized. It is unique to layer 5.

- 13f employs vertical cord marks which terminate at a 6 mm deep plain margin at the terminus (Fig. 166). Incised lines cut through the cord marks. These are either horizontal, diagonal or cross-hatched. The surfaces only are oxidized.

  RF13 variant modifications noted in layer 7:

- Some versions display vertical cord marks over the entire exterior surface. Unlike some CP2 versions the terminus is always convex. Some burnished versions were decorated with horizontal incised lines above near-vertical *Anadara* shell impressions.

  RF13 variant modifications noted in layer 6:

- 13b variants are similar to RF1b, however they are more steeply inverted.

Rim form 14

Clear definition of this form was difficult due to similarity with RF5ad. Confidence that the following variant categories are appropriate is afforded by the size of rim sherds available. They are clearly portions of shallow bowls rather than the everted jars represented by the RF5 taxa. All are burnished and reduced. RF14 and 14c continue from CP2. The following are unique to CP3:

- 14a terminates with a broad horizontal margin 17 to 20 mm wide. This is decorated with *Anadara* shell impressions parallel to the rim circumference. An incised line runs below and parallel with the exterior inflection point 13 mm below the terminus (Fig. 167). Below this the wall is decorated with *Anadara* shell impressions. This variant is confined to L10:2, L9 and L8.

- 14e features diagonal *Anadara* shell impressions below two horizontal, 1.5 mm wide, incised lines placed 14 and 19 mm below the terminus (Fig. 167).

- 14f is highly burnished and more deeply reduced than the other variants. The terminal margin is decorated as for variant 14a. *Anadara* shell impressions fill a field within an incised line 18 mm below the terminus on the exterior wall (Fig. 167).

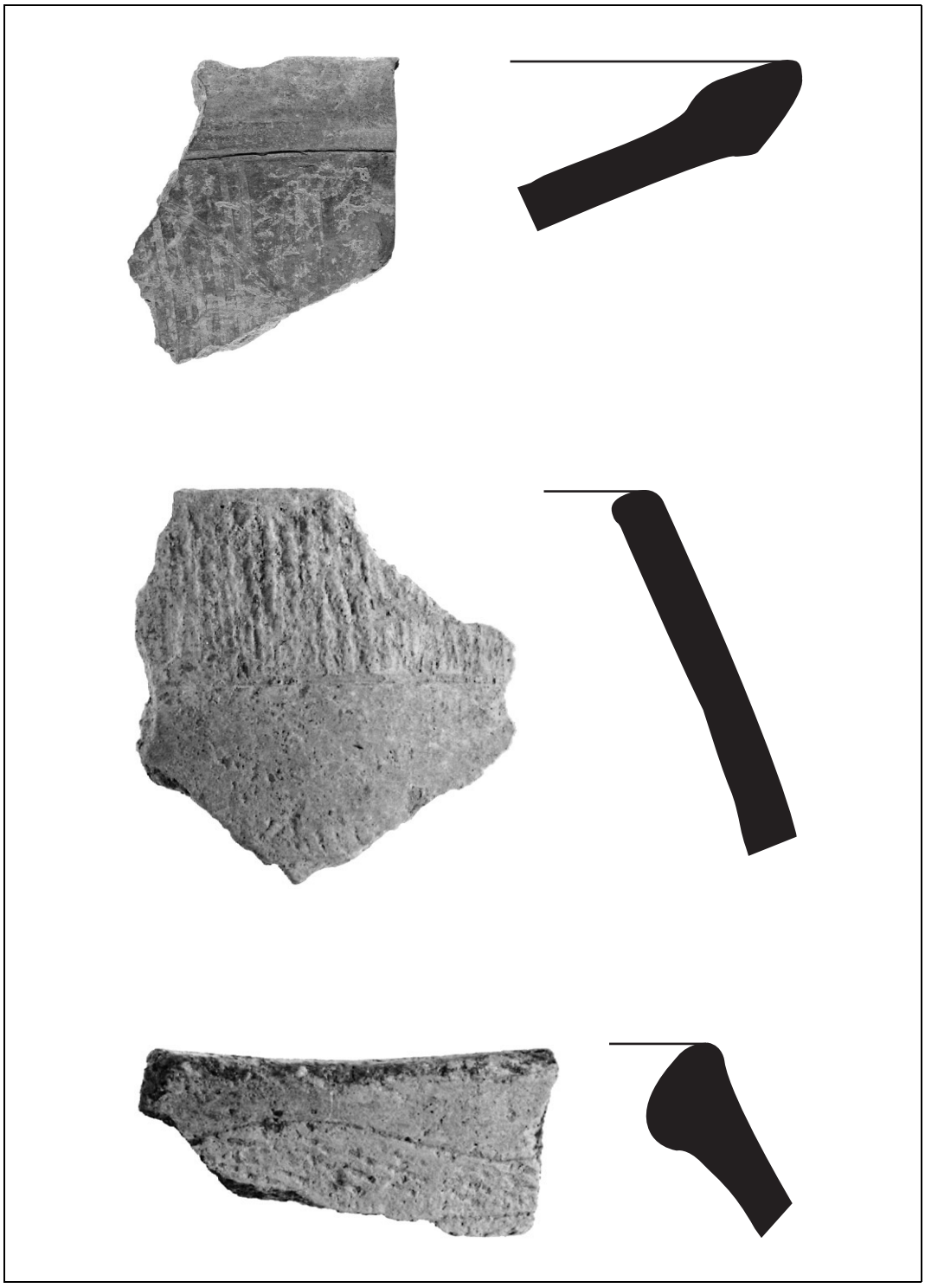


FIG. 165: Rim form 10 and 13 categories. Ceramic Period 3. *Top:* 10f, *Centre:* 13b, *Bottom:* 13c. Scale 1:1

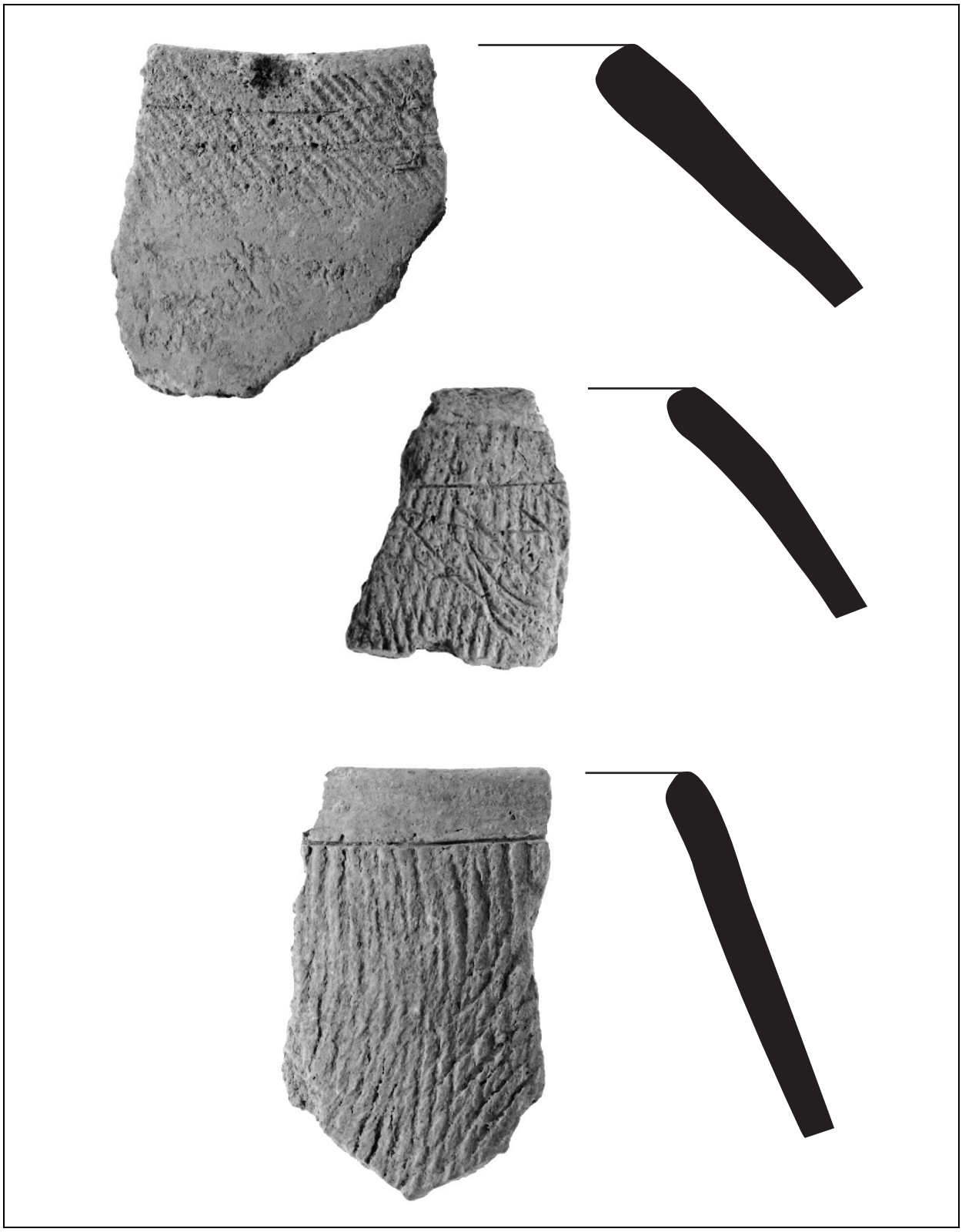


FIG. 166: Rim form 13 categories, Ceramic Period 3. *Top:* 13e, *Centre:* 13f and 13n. Scale 1:1



FIG. 167: Rim form 14e (left), 14f (right) and 14a (bottom). Ceramic Period 3. Scale 1:1

Rim form 15a

Only two and five grams of this variant were recovered from layer 9:4 and 5:1 respectively. This variant is plain with a squared, 14 mm wide, terminus which tapers down to a 10 mm vessel wall (Fig. 168). The surface is oxidized.

Rim form 13, 14 and 15 fabrics

A sample of these fabrics is set out below. Exotic and local RF14 wares suggest a regional style.

FABRIC SUMMARY

Exotic wares are not represented in utilitarian pottery. RF3 includes two exotic wares, FG11 and red slipped variants 3b(i)R and 3c(i)R. The slipping technique is clearly not part of the

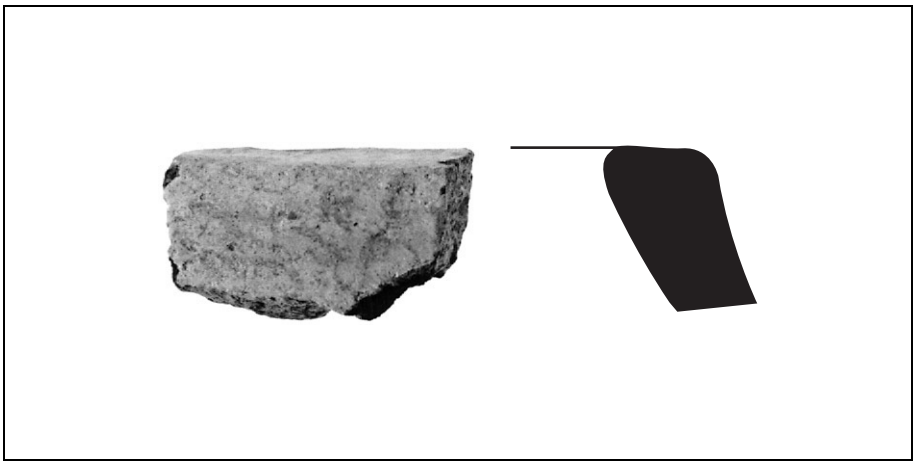


FIG. 168: Rim form 15a. Ceramic Period 3. Scale 1:1

TABLE 98: *Rim form 13, 14 and 15 fabrics. Ceramic Period 3*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
5:1	15a	h.s.	sand	-	8:4	14a	K914	3	-
5:3	13e	h.s.	grog	-	8:5	14c	K894	2	-
6:3	13c	h.s.	11?	-	9:3	13a(iii)	K760	3	-
6:4	13d	h.s.	grog	-	9:3	14a	K762	11?	-
6:5	13b	h.s.	grog	-	9:4	13	K754	3	-
6:5	13b	h.s.	grog	-	9:4	15a	h.s.	rice	-
6:5	13d	K990	3	-	9:5	14a	K807	2	-
7:1	13n	h.s.	11?	-	9:5	14c	K808	3	-
7:1	13	h.s.	11?	-	9:6	14c	K809	3	-
7:1	13	K948	3	-	9:6	14c	K834	2	-
7:1	13	K980	11	-	10:2	14e	hs	3	-
8:2	14c	K898	3	f.23	10:2	14f	K743	2	-
8:2	14a	K917	3	-					-

local technology. Variants 3a(ii) and 3f(i) are tempered with rice, therefore possibly exotic. They are not included because rice temper is associated with CP4 wares and because the former is a FG11 ware, the latter local. Among the fine wares, rice-tempered variant 4aaa is probably exotic, however, the possibility that it is a local ware dislocated from CP4 should not be discounted. This also pertains to RF5 and variants 14a 14c and 14f in which FG2 is present. Exotic RF5 wares include orthodox grog, sand and rice-tempered fabrics which cannot be allocated to any particular source. Exotic RF6 types also include orthodox grog and rice-tempered fabrics. These possibly increase the number of exotic sources. Eight of the 15 CP3 forms include exotic wares (Tables 99 and 100). Twelve exotic fabrics are represented in nine different forms, with at least 12, possibly 15, associated with RF5 and its variants. This compares with nine in CP2. FG11 is distinguished by the presence of bleb temper in a micaceous matrix containing few, if any, non-plastics. Note that bleb temper, (FG5), is present in some local CP4 fine wares. The matrix of FG5 is composed of a silty clay and thus differs from FG11.

Local wares are produced in either fishpond or "din niao" clay. For RF1 87.17 per cent (n = 78), are composed of fishpond clay. In RF2, however, this reduces to 6.89 per cent (n = 58). The orthodox grog temper in 10.34 per cent of RF2 wares is composed of fishpond clay. The balance is composed of less silty local clays which appear to be a better quality than the RF1 fabrics. The resultant material is less friable or brittle than RF1 fabrics. RF2 fabrics are generally more dense and robust compared to the often quite fragile RF1 fabrics. Based on hand specimen examination, only one of 32 RF3b coarse wares analysed was clearly composed of fishpond clay. This evidence should be treated with caution because some examples were difficult to distinguish in this manner. Given textural and colour similarities with RF2 wares, together with the restricted use of fishpond clay as grog in them, however, it is very likely that it was mainly reserved for RF1 vessels. Variation in clay preparation, vessel forming and firing resulted in a few dense less friable RF1 wares.

Although rice was present in local ceramics during CP2 (Chapter VIII), incidental rice inclusions in local wares increased markedly throughout CP3. Only one RF5 from CP2 contexts included rice, but this can be discounted because it is composed of FG3 and therefore displaced from CP3 in prehistory. In the CP3 sample, seven RF5, one RF6 and one RF9 included incidental rice remains. The RF6 thin section revealed 12 rice husk fragments in association with FG3. No husk is related to the grog temper, indicating an incidental inclusion. Such abundance, in terms of the Khok Phanom Di assemblage, suggests close association with rice remains.

SUMMARY

In terms of rim forms, local pottery proliferated in CP3. When compared to the earlier periods production of new forms expanded. In concert with this, the importation of exotic wares accelerated. During CP3, 101 new forms were introduced, 51 of which are represented by exotic wares. At least 20 of these forms are represented in local and exotic wares (Table 100 and 101). This underlines the influence decorative modes can play in regional pottery styles. Decorative designs, modes of decoration, as well as pottery forms, may be distributed intra- and inter-regionally. Several of the decorative motifs involve techniques common to local and exotic forms. A typical

example is RF5aax which displays *Anadara* shell-impressed fields. Other regional modes recognized are paddle-impressed (L5), with *Anadara* shell-impressed, incised and cord-marked wares present throughout CP3. Although RF6ak is represented in local and exotic wares, the latter was red painted, a technique not adopted by Khok Phanom Di potters. Apart from this exception, each of the exotic forms can be defined as regional types. Where they originated is uncertain. Regional distributions of wares may differ from regional distributions of decorative modes or vessel forms which have been copied by one or more manufacturing centres. Copies of types may be localised, thus confined to a few sites, or widespread over larger regions, in much the same way as other items may be exchanged.

There can be little question that during CP3 local potting underwent a marked florescence. Although contact with exotic techniques, such as paddle impressing, red painting and bleb tempering, could have provided stylistic and technological stimulation, these were not adopted. Fingernail impressing, a technique associated with the exotic FG11, is present on 10 local forms: 5ao (L9); 5ad(viii), 5ay, 5az, 6ao, 6ap, L8; 6c(ii), 6av, L7; 4f and 4as, L6. Fingernail impressing was probably copied from FG11 wares by the Khok Phanom Di potters, given their rarity. At least 12 and possibly 15 exotic fabrics are present in the CP3 ceramic spectrum. Of particular interest is FG11. A broad range is represented in this exotic ware, 10 from CP2 and 20 from CP3 (Tables 99 and 100). Ten these 30 rim forms are also represented in the local spectrum. Many of the decorative modes associated with FG11 wares are distinctive. Others include regional techniques. They are summarized as follows (for completeness CP2 decorative modes are included):

- Ceramic Period Two FG11 wares:
- appliqué bands.
- 3a: groups of horizontal incised lines.
- 3a(ii): decorated with alternate curvilinear incised punctate fields (shell impressions?)
- 3b(i): surfaces are slipped.
- 3c(ii): burnished and impressed with *Anadara* shell.
- 3f: “nail head” terminus.
- 5j(i): cord markings.
- 6p: “pricked” or punctate-impressed fields combined with incised lines.
- 6x: deep round probe marks.
- Ceramic Period 3 FG11 wares:
- 3g: fingernail impressions combined with an incised running chevron pattern (unique to L6).

TABLE 99: *Exotic rim forms: Ceramic Period 3*

Layer	Form	T.S./h.s.	Fabric	Layer	Form	T.S./h.s.	Fabric
5:1	5	K1042	11	7:1	13n	h.s.	11?
5:1	6aaa	h.s.	grog	7:2	5	K963	21
5:1	5aad	h.s.	grog	7:2	5	h.s.	rice
5:1	5aae	h.s.	rice	7:3	5	K977	10
5:1	6R	K1038	11	7:3	4aaa	h.s.	rice
5:1	15a	h.s.	sand	7:4	6ax	h.s.	11?
5:2	10	h.s.	11	7:4	6y	h.s.	11
5:3	5aaf	h.s.	11	7:5	5	h.s.	sand
5:3	5aag	h.s.	11	7:7	6au(i)	K979	11
5:3	4	K1039	19	7:7	7d	h.s.	sand
5:3	6aab	h.s.	11?	8:1	5au	K936	11
5:3	6b(v)	h.s.	11?	8:2	3a	K923	11
5:4	4	K1030	11	8:2	5slip?	K910	11
5:5	5aah	h.s.	grog	8:2	5as	K932	8
5:5	4an	h.s	11?	8:4	5ad	h.s.	11
6:1	5	K583	9	8:4	5aax	K937	10
6:1	5	K611	21	8:7	6aae	h.s.	grog
6:1	5	h.s.	sand	9:1	5c	K768	11
6:3	5	K554	8	9:1	6y	K833	13
6:3	5	K634	14	9:1	6ak	h.s.	grog
6:3	3b(i)	K1012	11r	9:2	5x	K767	6
6:3	5c	K556	8?	9:3	14a	K762	11?
6:3	13c	h.s.	11?	9:4	15a	h.s.	rice
6:4	5c	K568	20	9:6	3c(ii)	K838	11r
6:4	5aw	h.s.	11	9:6	5c	K851	22
6:4	6az	h.s.	rice	9:7	5ac	K503	11
6:5	5j(i)	h.s.	11	9:7	3ham	K848	11r
6:5	5R	K599	11	9:7	6p	h.s.	11
6:5	6aah	K1013	11	10:1	5	K1093	13
6:6	5ar	h.s.	11	10:1	5ag	Kh.s.	11
6:6	5aat	h.s.	11	10:1	3c	K495	11
6:7	3g	K1004	11r	10:2	3	K489	11
7:1	3a(ii)	K974	11r	10:2	3f	K668	11r
7:1	5	K951	19	10:2	3b(i)R	h.s.	-
7:1	5	K952	12	10:2	3c(i)R	h.s.	-
7:1	6aa	K961	11	10:2	5ai(i)	h.s.	sand
7:1	6ax	h.s.	rice	10:2	6q	h.s.	11
7:1	13	K980	11	10:2	6x	h.s.	11

TABLE 100: *Exotic and local rim form fabrics: Ceramic Period 3*

Form	Local fabric groups	Exotic fabric groups	No.
1	3 and 4	-	-
2	3	-	-
3	3	11 and slipped	2
4	3 and 5	11, 19, rice?	3
5	2, 3 and 5	6, 8, 9, 10, 11, 12, 13, 14, 19, 20, 21 and 22	12
6	2, 3 and 5	11 and 13	2
7	3 and 4	sand	1
8	4	-	-
9	3	-	-
10	2 and 3	11	1
11	3?	-	-
12	3 and 5?	-	-
13	3	11	1
14	2 and 3	14 and non specific	2
15	-	rice and sand	2

- 5: slipped (L5:1).
- 5c: *Anadara* shell-impressed with incised curvilinear and geometric designs.
- 5R: red painted (L6:5).
- 5ad: *Anadara* shell-impressed (L8:4).
- 5ag: punctate-impressed (L10:1, see also Hall 1993, motif 3:6).
- 5ar: vertical *Anadara* shell impressions to the exterior, within an arcuate field. Unique to L8.
- 5au: fingernail and *Anadara* shell-impressed fields. Both are unique to L8.
- 5aw: vertical *Anadara* shell impressions to the exterior, lozenge-shaped *Anadara* fields to interior (L6:4).
- 5aaf: triangular incised panels decorated with *Anadara* shell impressions (L5:3).
- 5aag: paddle-impressed exterior surface, arcuate panel with a "pricked" marked interior field (L5:3).
- 5aat: punctate field (L6:6).

- 6R: red paint or slip (L5:1).
- 6q: slanting incised line design, made with a 2 mm wide stylus (L10:2).
- 6y: near vertical *Anadara* shell impressions (L7:4).
- 6aa: incised bands with *Anadara* shell-impressed fields (L7, 8 and 9).
- 6au(i): cord-marked (L6 and 7).
- 6aah: "prick" marks, or fingernail impressions, combined with incised lines (unique to L7).
- 7b(i): serpentine motif composed with incised lines. Unique to L7.
- 10: plain (L5:2, 7:6 and 8:5).
- 13: cord-marked (L7:1).

In addition, RF4ar, L6; and 6az, L6:4; are probably FG11 wares. Both display fingernail impressions. Note that RF6y, L9:1, also represents a FG13 ware. Apart from the 20 variants in table 99, RF6y, decorated with near-vertical *Anadara* shell impressions, is also present in exotic grog and sand-tempered wares.

TABLE 101: *Regional rim forms: Ceramic Period 3*

Layer	Form	Local fabrics	Exotic fabrics	Layer	Form	Local fabrics	Exotic fabrics
5:1	5aae	3	rice	7:7	6au(i)	3	11
5:2	10	3 and 4	11	8:2	5as	3	8
6:3	3b(i)	3	11	8:4	5ad	3	11
6:4	5c	3	20	8:4	5aax	3	10
6:4	5aw	3	11	8:7	6aae	3?	grog
6:5	5j(i)	3	11	9:1	6ak	3?	grog
6:6	5ar	3	11	9:1	6y	3	13
7:1	6aa	3	11	9:3	14a	3	11?
7:1	13	3	11	10:1	3c	3	11
7:4	6y	3	11	10:2	3f	3	11

The FG11 decorative modes include appliqué bands, punctate fields, a "nail head" terminus, "pricked" and deep probe-marked fields, fingernail impressions, which are distinctive techniques extremely rare in the local Khok Phanom Di assemblage. Locally absent are slips or paints. Novel decorative motifs, such as punctate-impressed, incised triangular, lozenge or arcuate *Anadara* shell-impressed fields, fingernail and *Anadara* shell-impressed fields combined, broad incised

lines increasingly slanted to spiral around the vessel and a serpentine decoration, also set this exotic pottery apart from local wares.

Eighteen exotic *Anadara* shell-impressed rim forms were recorded: RF5c and 5as, (FG8); RF5aax, (FG10); RF3a(ii), 3c(ii), 5ar, 5au, 5aw, 5aaf, 6b(v), 6y, 6aa and 14a, (FG11); 6y, (FG13); 5c, FG22; 4aaa, (rice); 5ai(i) and 7d, (sand); and 5aah, (grog). Eight fabric groups are represented, emphasizing the regional distribution of this decorative mode. Paddle-impressed exotic forms are mainly bleb-tempered. One, RF5aav, is composed of FG5, a local CP4 fabric. RF5f, 5x, and 6ah (all CP2), 5aag and 6aab are composed of FG11. RF5aad, 6ad(i) and 6ak are tempered with orthodox grog; RF6ag (CP2), has no temper. Finally, RF5aae is tempered with rice. This suggests that three, possibly four, different exotic manufacturing centres favoured the paddle impressing technique.

VESSEL BASES AND TRIPOD FEET

Base forms, B, C, D and E continue from CP1 and CP2 (Appendix 3). Forms F, G, H, I, J and M were recovered from CP3 (Figs. 169 and 170). A variant, D(i) retains the shell-impressed band but lacks the double or triple incised lines. Form F first occurs as a single shell-tempered sherd in layer 10:2. Base form G, tempered with orthodox grog, is restricted to layer 9. Both are probably exotic. Miniature forms were also recovered: L6:5, form E (two samples, diam: 35 and 50 mm); L7:6, form C (diam: 60 mm). The former is composed of FG5, the latter, FG3. Although some bases are partially oxidized, so that only the surface is not reduced, it is likely that the intention was to produce a black lustrous finish.

TABLE 102: *Vessel base forms: Ceramic Period 3*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
5:1	E	h.s.	4	Plat.25	6:4	C	K989	5	-
5:1	E	h.s.	5	f.1	6:4	E	h.s.	5	B11
5:1	I	h.s.	5	-	7:1	B	h.s.	3	-
5:2	J	h.s.	5	-	7:1	M	K950	3	-
5:2	D(i)	h.s.	5	B18	7:2	E	h.s.	rice	B15
6:1	E	h.s.	3	B4	7:2	E	h.s.	3	B15
6:l	I	h.s.	5	l.1	7:3	E	h.s.	3	B16
6:l	M	K1015	5	B1	7:6	E	h.s.	3	B20
6:3	C	h.s.	sand	f.44	7:7	E	h.s.	-	B24
6:3	E	h.s.	-	B3	8:4	D	h.s.	3	l.7
6:3	E	h.s.	3	B8	9:3	G	h.s.	exotic/o.g.?	-
6:3	E	h.s.	3	B9	10:2	F	h.s.	shell	-
6:3	H	h.s.	3	f.95					

- Base form F: a roughly finished, moderately coarse, reduced plain ware, with a solid flat base (diam: 70 mm).
- Base form G: is burnished, partially oxidized, with a solid flat bottom (diam: 180–280 mm).
- Base form H: has a concealed 12 mm thick bottom 13 mm above the outer ring. The surface is oxidized and plain except for roughly arranged incised lines at the inflection point. It is probably composed of FG3 (diam: 160 mm).
- Base form I: is burnished, reduced with a plain appliqué 16 mm deep band attached to the lowest point. The base is solid (diam: 140 mm).
- Base form J: as with form H the 7 mm thick bottom is concealed 30 mm above the outer ring. Incompletely oxidized, the exterior is decorated with vertical paddle impressions running from a single incised line 10 mm above the terminus (diam: 210 mm).
- Base form M: displays a variety of narrow bands of diagonal *Anadara* shell impressions contained within incised lines. Single and double bands, either complete or interrupted with angled ends, were recorded. They are burnished and incompletely oxidized (diam: 180 mm).

TRIPOD POT FEET

The fabrics, dimensions and suggested sources of tripod pot feet recovered from CP3 are set out in table 103. The function of cat. 3250 is uncertain. It may not be a pot foot. The first measurement is the top of the foot which was joined to the vessel and the second is the distal end.

TABLE 103: *The tripod pot feet from Ceramic Period 3*

Cat. no.	Layer	Length (mm)	Diameter	Fabric (h.s.)	Shape	Suggested source
3250	5:1	8	15	FG5 (blebs)	see text	local
3251	6:6	15	26/10	fishpond	dome	local
1256	8:7	15	20/14	orth. grog	conical 2	local?
1069	10:1	40	38/10	rice	conical 1	local?

LADLE HANDLE

A 24 mm long, 18 mm diameter ladle handle fragment (cat. 3285) was recovered from layer 6:7 f. 19, a shell midden. It is probably composed of local FG5. The colour is 2.5YR/6/8.

DECORATIVE MODES

During CP3, local utilitarian coarse wares continued to be cord-marked. Fine wares also retain several earlier decorative modes, such as burnishing, incising, shell impressing and minor amounts of appliqué bands. Fine wares tend to be reduced, coarse wares oxidized with some fire clouding. Paddle impressing, paints, slips, probing and pricking punctate techniques are not employed. Local design motifs fall within a range limited by these methods. Burnishing is achieved with smooth pebbles, incising with a bone or wooden stylus, shell impressing with various portions of *Anadara* shells. Fields of these impressions, frequently defined by incised lines, are deployed in a wide variety of mainly geometric, sometimes curvilinear, designs. Many designs employed incised lines alone. For example, carinated burial jars, represented by RF5, are burnished, either undecorated or feature one to four incised lines just below the rim terminus and reduced. In some variants straight lines are combined with a line of *Anadara* shell impressions. Vertical striations or shell impressions descending below these lines are common in CP2 but rare in CP3 burial jars. *Anadara* impressions vary in pitch and resultant width. Where the shell has been applied at 90° to the pot surface a broad corrugated effect, up to 2 mm wide, results. Smaller shells give finer corrugations. A dotted effect was probably achieved by rolling the exterior surface of the shell over the wet clay. Very fine impressions were noted in densely punctate fields, whereas broader impressions tend to be spaced wider apart.

TABLE 104: *Cord mark characteristics. Ceramic Period 3 (Width, gap and sherd thicknesses in mm)*

Twist	Width	Gap	Sherd	Twist	Width	Gap	Sherd	Twist	Width	Gap	Sherd
"S"	2	1	8	"Z"	2	0.5	7	"Z"	2	1	8
"Z"	2	1	8	"Z"	1.5	0.5	5	"Z"	1.5	0.5	7
"Z"	0.75	0.75	4	"Z"	1.5	0.5	8	"Z"	1	1	8
"Z"	1	1	9	"Z"	1	0.5	4	"Z"	1	1	4.5
"Z"	1	1	7	"Z"	1.5	0.5	7.5	"Z"	1	0.5	4.5
"Z"	1.5	0.5	7	"Z"	1	0.5	6	"Z"	2	0.5	9
"Z"	1	1	6	"Z"	2	0.5	6	"Z"	1.5	0.5	4
"Z"	1	0.5	8	"Z"	2	1	7	"Z"	1.5	0.5	3
"Z"	1.5	1	6	"Z"	1	1	4.5				

Exotic wares are correlated with paddle, *Anadara* shell and fingernail "pricked" or punctate impressions, red paints, slips and cord marks. *Anadara* shell-impressed wares are present in FG8,

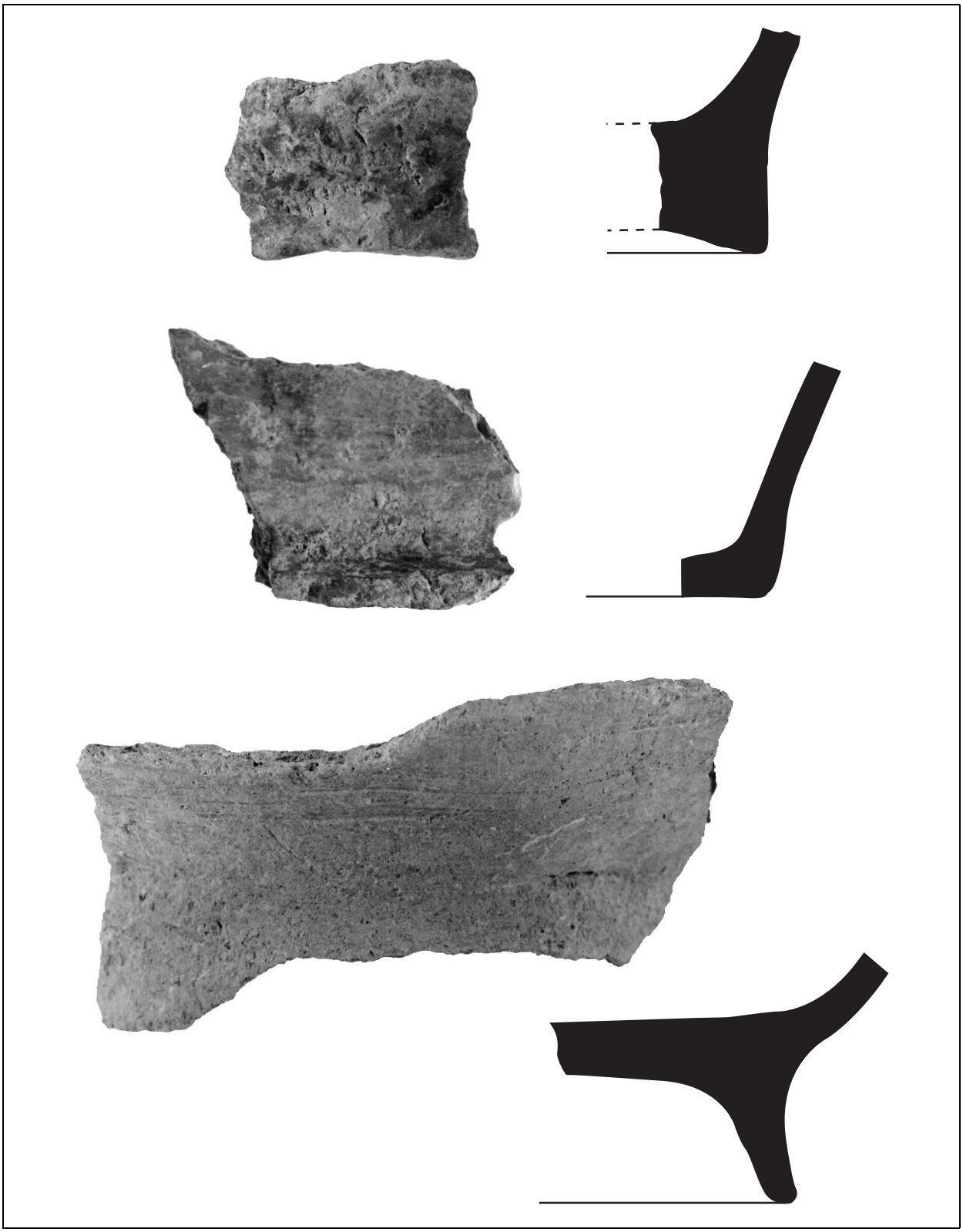


FIG. 169: Ceramic Period 3 base forms *Top*: F, *Centre*: G and H. Scale 1:1

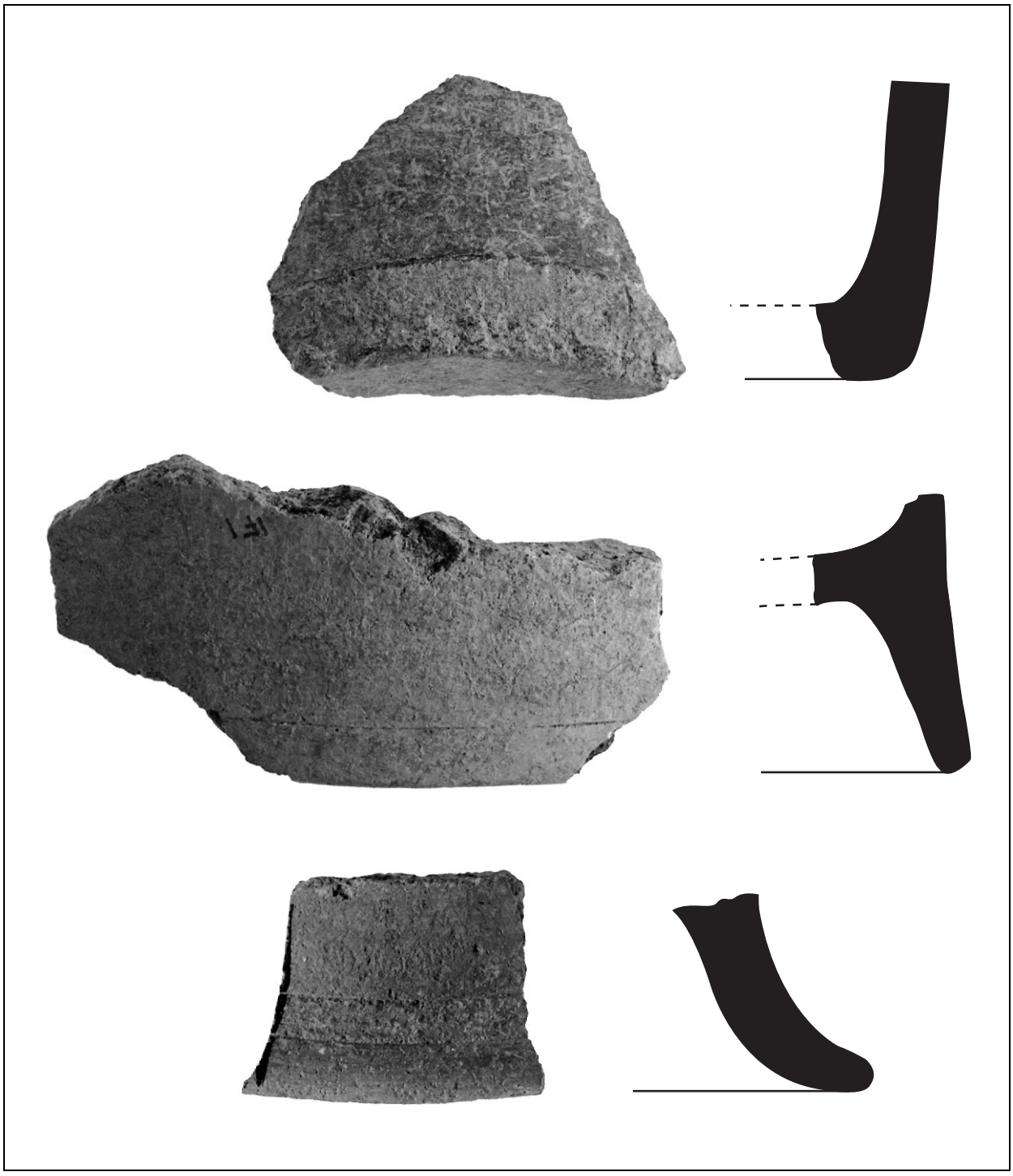


FIG. 170: Ceramic Period 3 base forms *Top*: I, *Centre*: J and M. Ceramic Period 3. Scale 1:1

10, 11, 20, rice and sand-tempered exotic wares, and paddle-impressed in FG6, 11, 22, orthodox grog and rice-tempered exotic wares. An important exception is a L5:4 variant RF10f, a local FG3 burnished ware decorated with both *Anadara* shell and paddle impressions. On rim fragments the paddle corrugations range from 1–1.5 mm wide with 1 mm wide grooves. Cord characteristics of a selection of local cord-marked sherds have been examined (Table 104). The maximum cord widths and the average gaps between the cords are shown. The helix pitches vary from 40° to 75° from the horizontal. Three of the five modes detailed for CP2, namely A, B and E were present as rare isolated sherds.

''COMPLETE'' VESSELS

As in CP2, most vessels with sufficient fragments to enable reconstruction derive from burials. A few of these are intact. In total, 88 vessels, 79 from mortuary and nine from non-mortuary contexts, are present. Several were recovered severely fragmented. The extent of damage ranges from insignificant to extensive. Many "complete" vessels present as less than 50 per cent of their original form. In spite of this, it is considered that enough fragments remain for each vessel to be represented with an acceptable degree of confidence. Familiarity with the entire assemblage has allowed many fragmentary vessels to be classified. The identification of critical portions has facilitated typological reconstructions. In this manner, because individual vessel components have been recognized through detailed sorting and sampling, complete forms were readily reconstituted. In some instances, for example, where a ring-foot base was missing from a bowl, provided diagnostic sherds showing where the base was originally attached could be identified, the overall form was able to be determined. Further, as handles, lugs or other attachments are absent, or extremely rare, they have been eliminated from consideration in all but a few examples. None of the "complete" vessels is considered to have been adorned with handles or lugs. It is important to note, however, that some mortuary wares designated by the excavators as "pots" were, following laboratory analysis, found to lack sufficient fragments for them to be categorized as complete with absolute confidence. In these instances the typologies are noted as provisional in the relevant figure captions.

Complete vessels advance our understanding of ceramic production centres considerably, because they provide fuller and more detailed information concerning their manufacture than may otherwise be available through a study of broken sherds. Modes of manufacture and stylistic details can be lost when vessels are broken. Complete vessels provide the fullest representations of technical and artistic expressions. It is fortunate in this respect that many vessels were interred as grave furniture. Given the very high standard of local wares, some are without peer, considerable insight into early potting techniques is available. This evidence is not only reflected in the forming, finishing and firing methods themselves, but also in the applied technical skill levels. Local potters clearly possessed different levels of expertise. This is evident across the complete spectrum. Utilitarian wares may be imperfectly formed and finished, or alternatively, be expertly crafted. Ornamental wares, on the other hand, tend to have attracted higher degrees of technical skill. Some are technically outstanding, given the range of techniques available at the time. See cats. 3233 and 618 (B1) (Figs. 173 and 215) for examples of high quality utilitarian

wares. Whereas the form and finish of cats. 988 (B32) and 1270 (B37) is relatively crude, local potters appear to have reached their pinnacle of achievement in making the ornamental vessels interred with burial 14 and 15 (cat. 853 and cat. 913) (Figs. 202 and 200). Captions beneath the illustrations include an assessment of vessel quality. Where these are at variance with the drawings they take precedence over the artist's impressions. Differences in technical skills are very important aspects of craft specialization. Characterization of the local pottery fabrics and forms affords an opportunity to assess closely any variations in quality which may present in the assemblage.

NON-MORTUARY VESSELS

Nine vessels, excluding ladles, were recovered from non-mortuary contexts (Table 105). Within 10:1 f.1, were two bowls, one type L1b (cat. 3233 Fig. 173), one L1g (cat. 3231 Fig. 172), a L2b jar (cat. 3232 Fig. 173) and a L2g jar (cat. 3230 Fig. 172). L2b jars are associated with mortuary ritual, often being interred as grave goods. Many graves were disturbed in prehistory and this could account for the presence of type 2b vessel fragments throughout the sequence. Fragments of a L2b miniature vessel (Fig. 174), with a central decorative motif similar to that displayed on cat. 1599, B103, L10:9 (Chapter VlII), were uncovered in L9:1 and a local type 1f, cord-marked coarse ware footed bowl with a form 3b rim in L6:3, f.5 (Fig. 174). Lens 1, L6:1, included fragments of a L1g bowl (Fig. 175), with an *Anadara* shell-impressed motif similar to that on an intact vessel recovered from B11 (cat. 764, Fig. 207), and L7:4 a diagnostic fragment of a miniature carinated jar (Fig. 171). A ladle or handled bowl was excavated from L8:6 f81 and a handle from 10:1 (Fig. 171). Finally, a cord-marked coarse ware L1c footed bowl, decorated with curvilinear incised lines, was uncovered in L6:1 (cat. 3235 Fig. 175).

TABLE 105: *Non-mortuary vessels: Ceramic Period 3*

Layer	Feature	Cat.	Thin section/h.s.	Fabric group	Type
6:1	-	3235	h.s.	-	1c
6:1	l.1	3286	K1019	3	L1g
6:3	5	3267	h.s.	3?	L1f
7:4	-	3280	h.s.	3	L2b(m)
8:6	81	3281	h.s.	3	ladle
9:1	-	3270	h.s.	3?	L2b(m)
10:1	1	3230	K207	3	L2g
10:1	-	3282	h.s.	2?	ladle handle
10:1	1	3231	K208	3r	L1g
10:1	1	3232	h.s.	3?	L2b
10:1	1	3233	K210	3	L1b

Considerable activity occurred in layer 10:1 with 41 features recorded. Prehistoric excavating could have dislocated FG3 vessels near basal CP3 contexts. The lowest MP4 burial was cut from 3.54 m below datum. Two infant burials cut from 4.14 m (B51) and 4.17 m (B52) were assigned to cluster B, stage 2, MP3 by the excavators who consider that "there may not be any cultural link between the two infants and the previous burials of cluster B, since infants were from time to time buried away from main clusters during MP2." (Higham and Bannanurag 1990:192). About 1 m of deposits built up, including a large shell midden, between the last cluster B burial and B51 and B52. Burials are absent from layer 9.

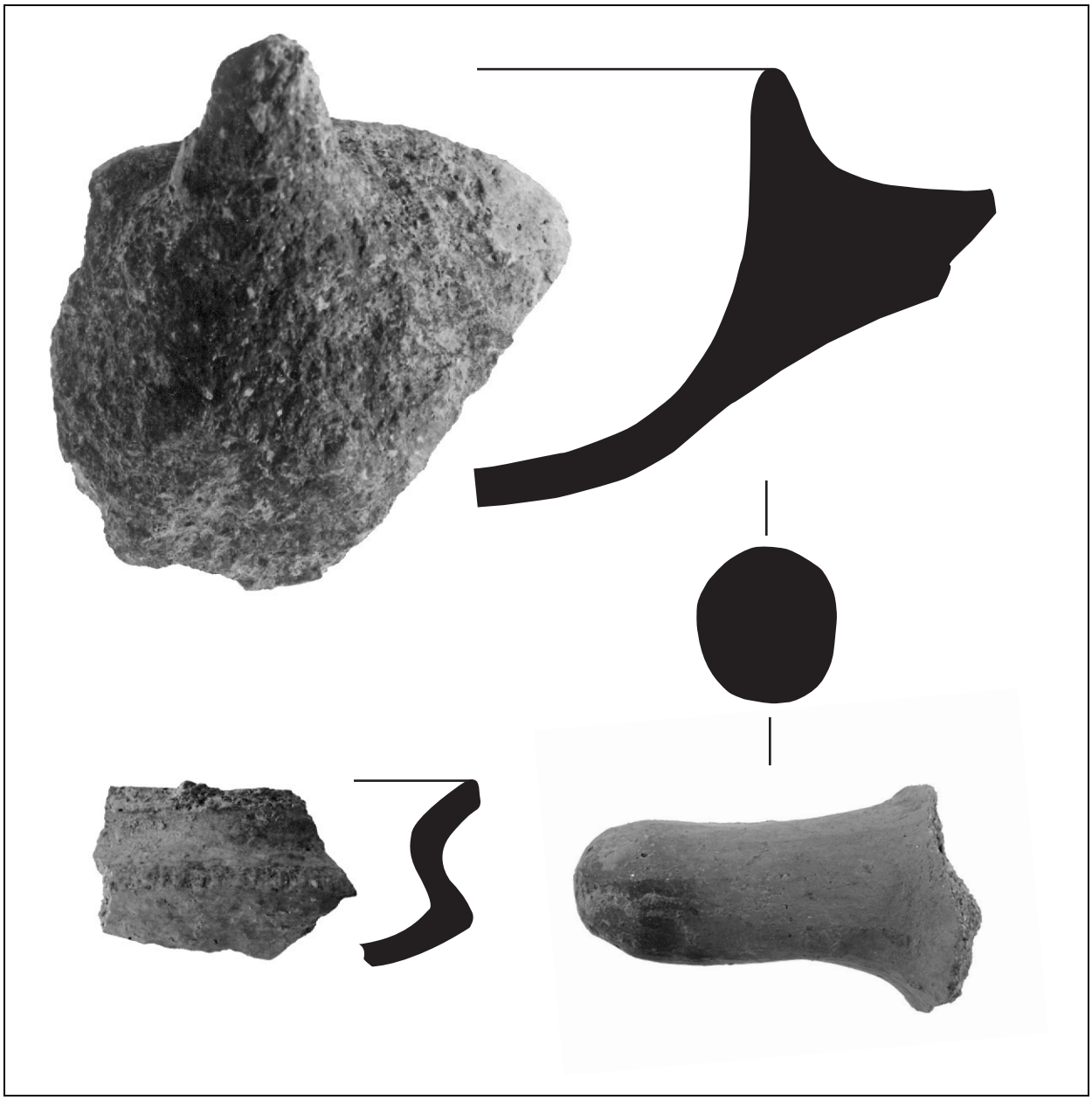


FIG. 171: Non-mortuary vessels. *Top*: cat. 3281 layer 8:6 f81. A utilitarian everted bowl with handle, 120 mm wide, 70 mm high (est.) 35 mm long tapered handle. The interior is smooth, walls an even 5 mm thick. FG3, medium fine. Biscuit fired, oxidized with reduced core. Colour: 2.5YR/6/6. Slab construction? Quality: very good. *Bottom left*: cat. 3280 layer 7:4. A miniature type L2b carinated jar fragment, rim diam: 120 mm (est.). carination: 110 (est.) height 25 mm (est.). Medium fine FG3, biscuit-fired and oxidized. Thickness: 3.5-4 mm. Carination cord marks are obscure. Colour: 2.5YR/6/4. Quality: excellent. *Bottom right*: cat. 3282 layer 10:1. A ladle or bowl handle, 48 mm long, shaft diam: 19 mm, attachment flange: 30 mm. Smoothed medium fine fabric, biscuit-fired, oxidized with fire clouds. "Z" twist 1/1 mm diam. cord marks are visible on the detached flange. Colour: 2.5YR/6/4. Scale: 1:1

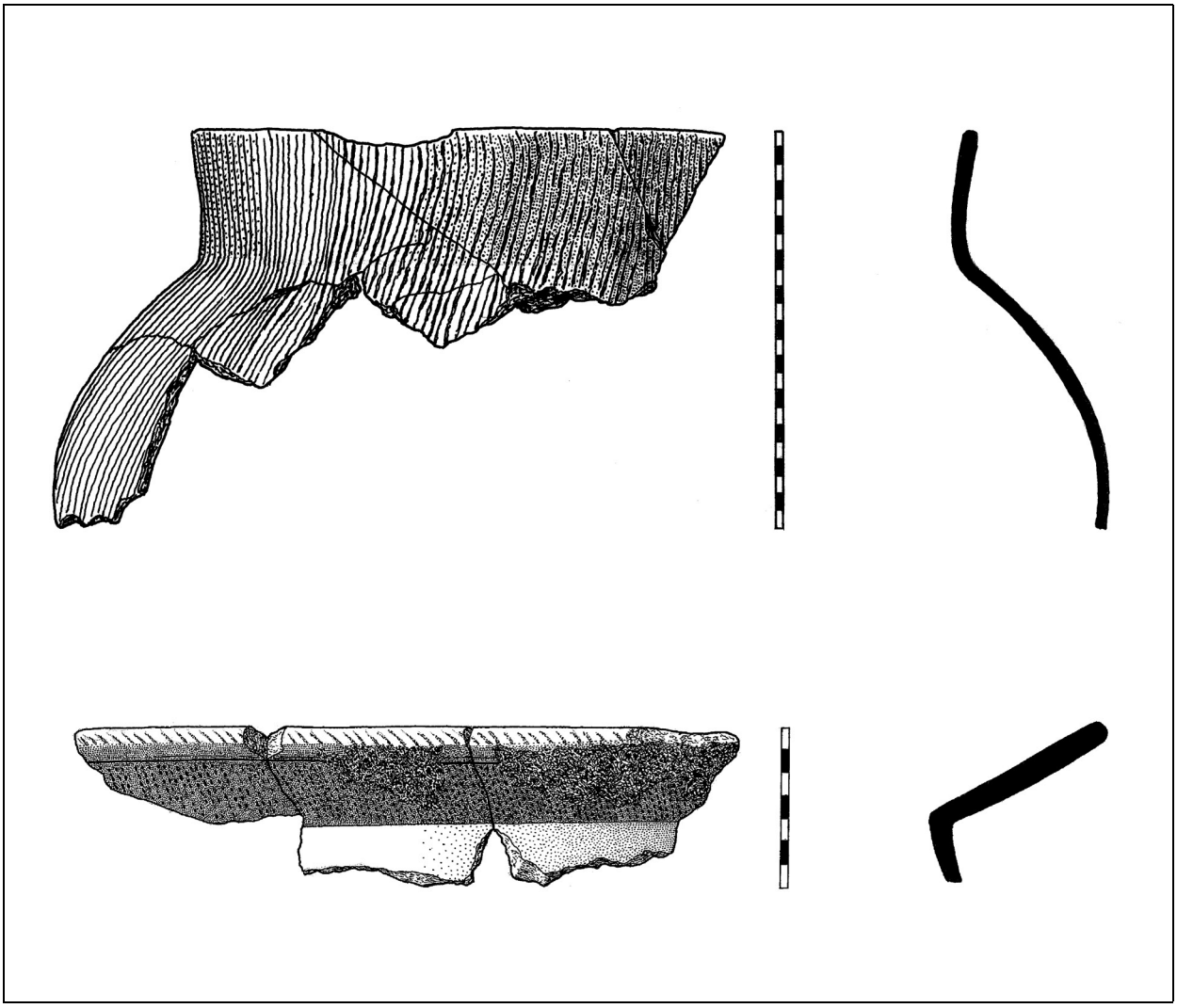


FIG. 172: Non-mortuary vessels. *Top*: cat. 3230 layer 10:1. A utilitarian cord-marked type L2g jar, 286 mm wide (est.) with a 180 mm diam., 40 mm high rim. The interior is smooth, walls an even 3 mm thick. FG3, medium fine. Biscuit fired, oxidized with fire clouds. Colour: 2.5YR/5/4. "S" cord marks 1/1 mm at 75° from the horizontal. Slab construction. Quality: very good to excellent. *Bottom*: cat. 3231 layer 10:1. An ornamental fine ware type L1g, 220 mm wide rim, 148 mm neck. Burnished medium fine fabric, biscuit-fired with oxidized surfaces. Walls 4–5 mm thick. "Z" twist 1/0.5 cord marks are visible on the lower hemisphere. The decorative fields are shell-impressed with other than *Anadara sp.* (see RF14 Fig. 90 and 167 for detail). Colour: 2.5YR/5/4. An excellent quality high energy vessel built from slabs. Extensively fragmented. A motif similar to that shown on cat. 1522 B101 (Fig. 111 Chapter VIII) decorates the central body. Scale segments are 5 mm

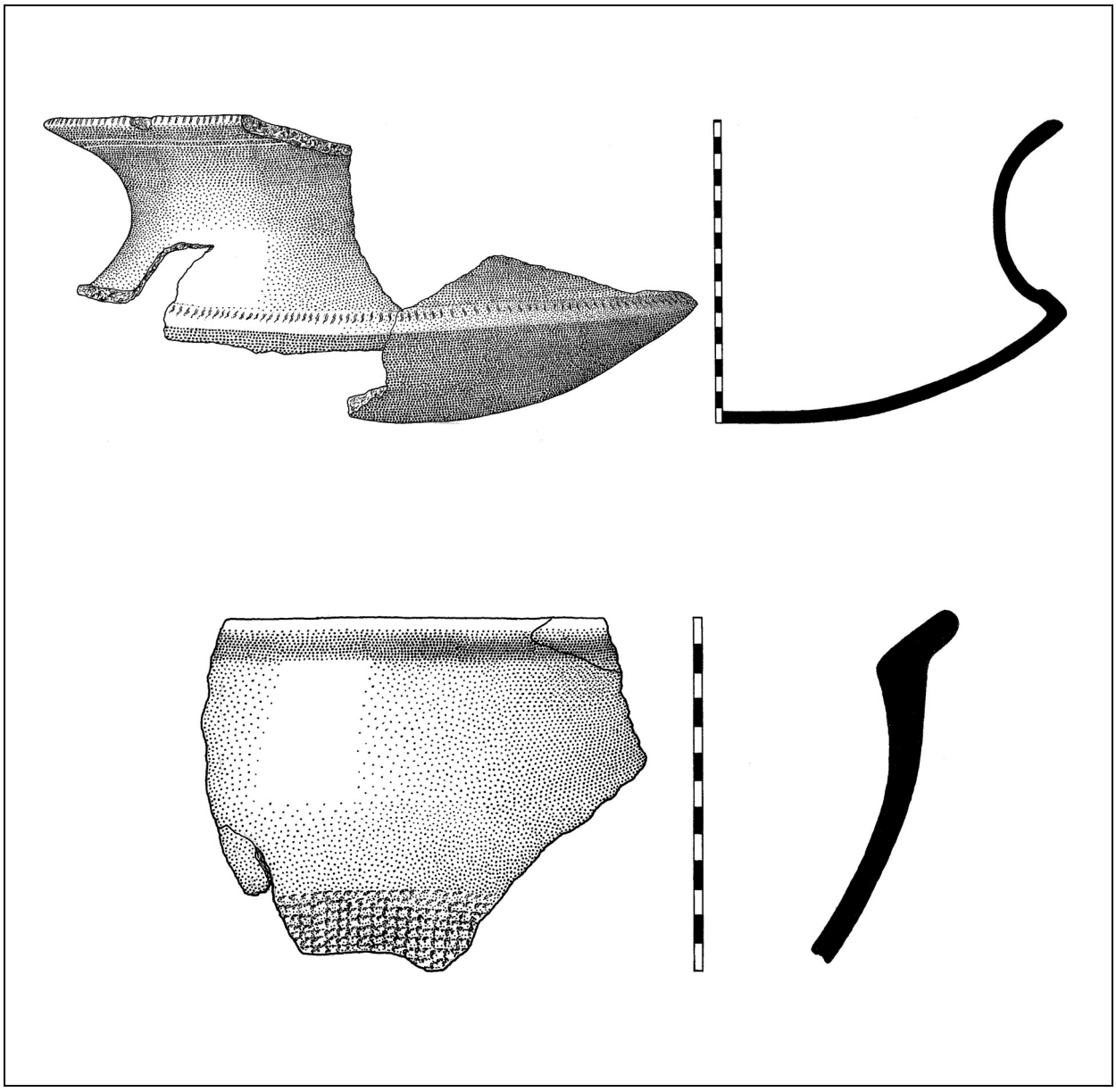


FIG. 173: Non-mortuary vessels. *Top*: cat. 3232 layer 10:1. A burnished carinated type L2b burial jar. Dimensions: rim width 225 mm, carination point 190 mm, height 93 mm to carination 28 mm. Slab construction, biscuit-fired and reduced. Walls 4–5 mm thick. FG3, medium fine. Colour: 2.5YR/6/4. Quality: excellent. Extensively fragmented. *Bottom*: cat. 3233 layer 10:1. A large burnished utilitarian(?) type L1b bowl missing its base. Dimensions: 320 mm (est.) rim width, height: 100 mm (est.). The surfaces are smooth, walls 4–5 mm thick. FG3, medium fine. Biscuit fired with oxidized surfaces. Colour: 2.5YR/6/4 to 5YR/6/4. Remnant "S" cord marks 1/1 mm, are visible on the lower hemisphere. Quality: Excellent. Scale 1:2

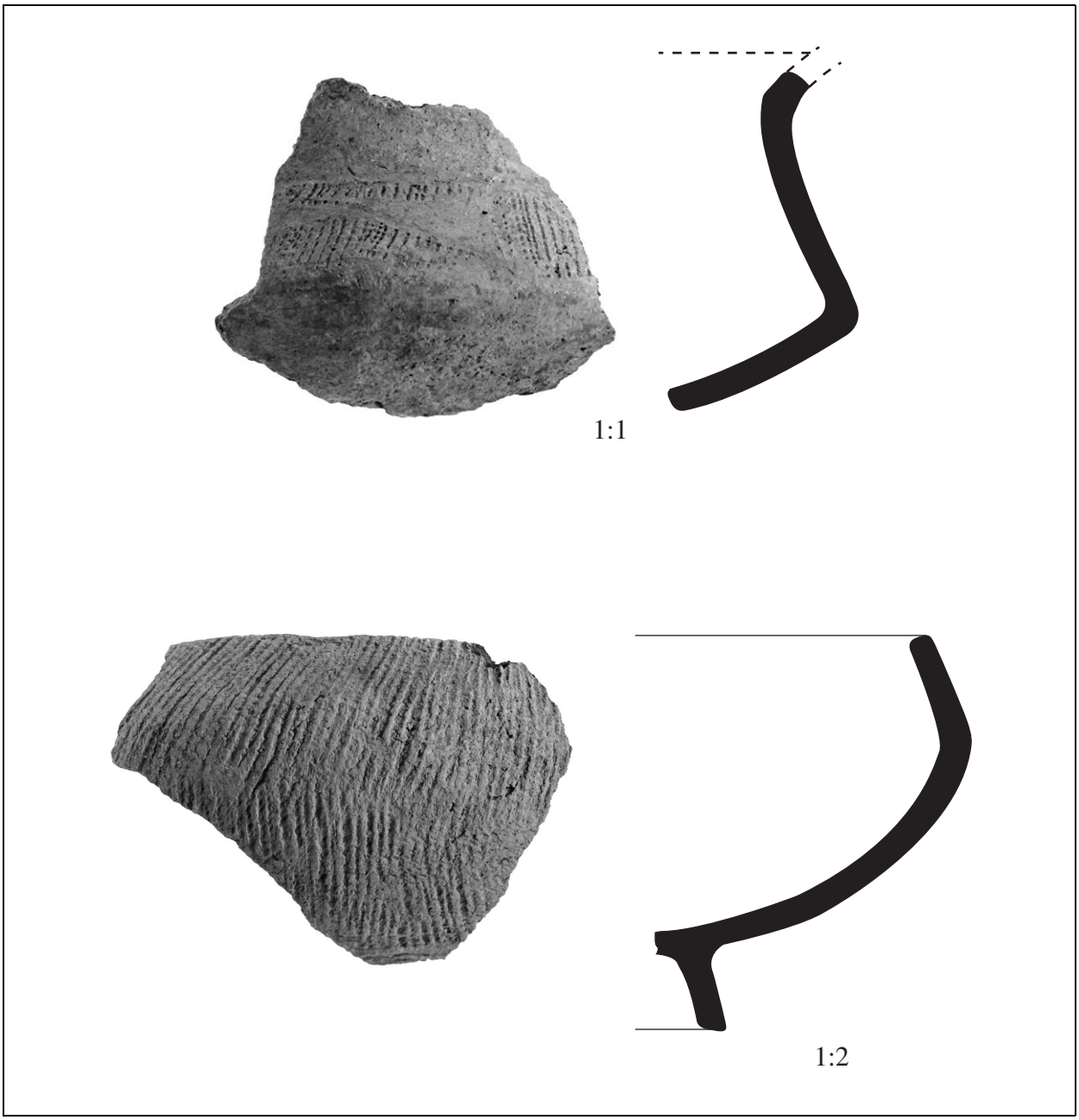


FIG. 174: Non-mortuary vessels. *Top*: cat. 3270 layer 9:1, f.29. A miniature burnished carinated type L2b(m) jar. Dimensions: rim width 5 mm (est.), carination point 100 mm (est.), height 55 mm (est.), to carination 10mm. Slab construction, biscuit-fired, exterior oxidized, interior partially oxidized. Walls 6mm thick. FG3?, medium fine. Colour: 2.5YR/6/4. Quality: very good. *Anadara* shell impressions. Note motif. Scale 1:1. *Bottom*: cat. 3267 layer 6:3. A coarse cord-marked utilitarian type L1f footed bowl with a form 3b rim. Dimensions: 220 mm (est.) rim 125 mm base diameters, overall height: 108 mm, base 23 mm. The surfaces are coarse, walls 7 mm thick. FG3?, coarse texture. Biscuit fired with oxidized surfaces. Colour: 7.5YR/6/4. "Z" cord marks 2/1 mm. Quality: good. Scale 1:2

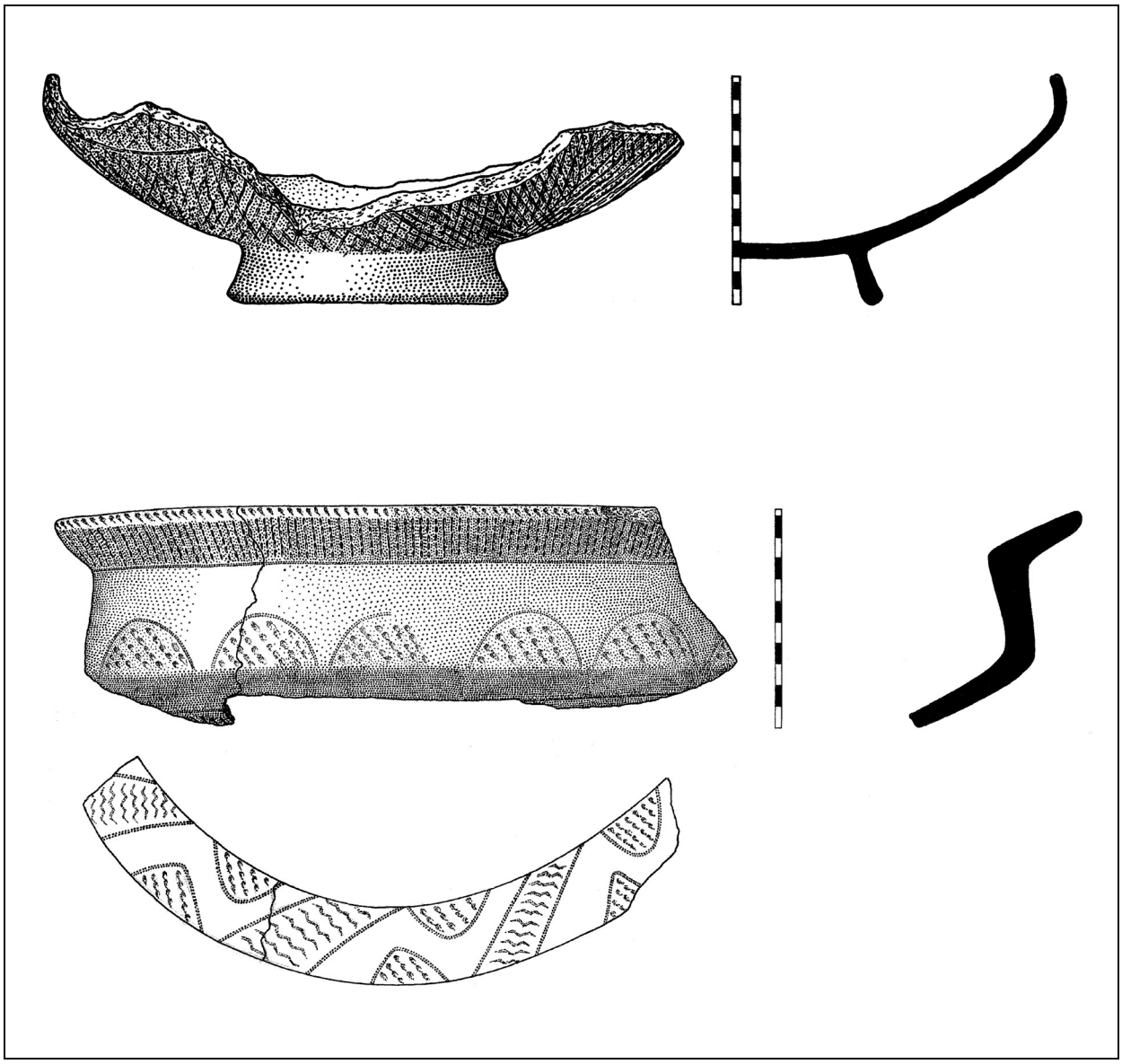


FIG. 175: Non-mortuary vessels. *Top*: cat. 3235 layer 6:1 lens 1. A coarse cord-marked utilitarian type L1c footed bowl with curvilinear incised decoration. Dimensions: 205 mm rim and 95 mm base diameters, overall height: 75 mm (est.), base 18 mm. The surfaces are coarse, walls 4.5 mm thick. FG3?, medium fine texture. Biscuit fired (low temperature?) with barely oxidized fire clouded interior, and oxidized fire clouded exterior surfaces. Fired upside down? Colour: 2.5YR/6/6 (oxidized), 2.5YR/3/0 (fire clouds). "Z" cord marks 1.5/1. Incised half round lines are 2 mm wide, 1 mm deep. Slab construction. Quality: very good. *Bottom*: cat. 3286 layer 6:1. A shallow ornamental type L1g fine ware bowl. Smooth surfaces with decorated fields. Dimensions: rim diameter 200 mm, bowl 186 mm, height 60 mm (est.). Slab construction, biscuit-fired interior and exterior reduced. Walls 5.5 mm, base 4 mm thick. Cord marks decorate the exterior rim flange ("Z" 1.5/1.5 mm). FG3, medium fine. Colour: 5YR/5/3 (partly reduced). Quality: very good to excellent. *Anadara* shell-impressed fields. Note motif. Scale segments are 5 mm

THE MORTUARY VESSELS

Of the 79 mortuary vessels recovered from CP3 burials, two are missing, 67 are local wares and six are exotic. Five of the latter are type 2b carinated burial jars, one an unique type 1i bowl (cat. 3264 B18) and the remaining exotic ware is an unique pot stand (cat. 820 B13). Each CP3 mortuary vessel fabric has been examined, either in thin section or hand specimen. These data are set out along with the relevant layer, mortuary phase, vessel type and burial depths in table 106. Incomplete data is available for cats. 654 and 655, which are missing, and cat. 1118 (B33) which is lacking its upper portion. Its shape suggests a bowl, or the base of a type L2j container cat. 2783 (B15). Of the local wares, three are type 1a; two type 1d; two type 1f; two type 1g; one type 1h; 40 type 2b; three special type 2b; one type 2d; six, possibly seven, type 2e; one type 2i; five type 2j; and finally three are specials. The L1h vessel is unique. Burial 12 included a special highly decorated vessel (cat. 700), and another which fabric contains rice inclusions and/or bleb grog (cat. 701). The former is large and thick-walled. Grave depth values suffixed "e" are estimates.

The fabrics of several local burial jars vary from the usual local fabric (FG3), which characterises CP3, in that either rice or bleb-like grog inclusions are present. These are usually minor and could have been either included deliberately, for non-technical reasons, or accidentally. At Ban Na Di, rice is considered to have been added for ritual purposes (Vincent 1988). It is unclear whether the bleb-like inclusions, in the present assemblage, represent the deliberate manufacture of bleb grog, or loose rice husk unwittingly mixed into the clays when they were being prepared. It is important to note that these variations are minor and therefore most likely accidental inclusions. The principal temper in all FG3 examples is orthodox grog. Two local clays were used in CP3 wares. Local fabrics composed of the silty fishpond clay have been annotated (f).

The carinated burial jars in the CP3 assemblage vary in shape and size. Their rim diameters range from 118–236 mm ($\bar{x}$ 158 mm, *n* 46). Carination point diameters range from 84–190 mm ($\bar{x}$ 114 mm, *n* 46). These dimensions have been factored to give a rim/carination width index by dividing the rim with the carination values. The indices range from 104–167 ($\bar{x}$ 140, *n* 46). Their overall heights range from 57–164 mm ($\bar{x}$ 83 mm, *n* 46). Carination point heights range from 13–56 mm ($\bar{x}$ 27 mm, *n* 46). The indices range from 20–46 ($\bar{x}$ 31, *n* 46). It is important to note that the rim/carination width ratios are the reverse of those for CP2 carinated burial jars, when rim diameters range from 96–180 mm ($\bar{x}$ 135 mm, *n* 21). Carination point diameters range from 107–194 mm ($\bar{x}$ 147 mm, *n* 21). The indices range from 79–115 ($\bar{x}$ 93, *n* 21). Therefore, the type 2b vessel diameters at the rim are wider in CP3, whereas the carination point diameters are wider in CP2. Overall and carination point heights, however, remain almost constant, although the CP3 vessels are slightly lower than the comparable CP2 sample (Appendix 3).

Although cat. 654 is missing, field notes indicate that it was probably a type L2e. No data are available for cat. 655. One badly broken artefact, initially classified as a vessel, cat. 820, is actually an open ended pot stand. Three vessels, cats. 852, 853 and 913, have been classified as special because of their unique shape. Rim forms recovered from the general matrix suggest the presence of similar vessels, but insufficient sherds were recovered to re-construct them.

TABLE 106: *Mortuary vessels: Ceramic Period 3*

Layer	Burial	Cat.	MP	Thin sec/h.s.	Fabric group	Type	Depth Base	Depth Contents	Depth Cut
5:3	12	700	7	121	3	L2b(sp)	1.85	1.70	1.30
5:3	12	701	7	157	4r	L2j	1.85	1.70	1.30
5:3	12	702	7	1	3	L1f	1.85	1.70	1.30
5:3	12	703	7	125	3	L2e?	1.85	1.70	1.30
6:1	1	618	7	139,169	3	L2e	1.90	1.86	1.20
6:1	1	619	7	134,168,206	3	L1f	1.90	1.86	1.20
6:3	3	654	7	131	3	missing	2.18	-	1.45
6:3	3	655	7	no data	-	missing	2.18	-	1.45
5:2	18	3264	6	h.s.	11?	E1i	2.96e	2.50	1.97
5:2	19	977	6	228	3r	L2b	2.95e	2.79	1.98
5:2	19	978	6	197,195	3r	L2b	2.95e	2.79	1.98
5:2	19	979	6	294	3r	L2b	2.95e	2.79	1.98
5:2	19	980	6	h.s.	3	L2b	2.95e	2.79	1.98
5:2	19	3263	6	h.s.	11?	E2b	2.95e	2.79	1.98
6:3	7	697	6	156	3	L1g	2.31e	2.15	2.01
6:3	2	699	6	130	3	L2i	2.52e	2.36	1.95
6:3	8	740	6	138	3	L2b	2.41e	2.25	2.01
6:3	8	741	6	127	3r	L2b	2.41e	2.25	2.01
6:3	9	794	6	122	3r	L2b	2.64e	2.48	1.97
6:3	9	795	6	2	3r	L2b	2.64e	2.48	1.97
6:4	11	764	6	h.s.	3	L2b(sp)	3.45e	3.29	2.05
6:4	11	763	6	h.s.	3	L2b	3.45e	3.29	2.05
6:4	11	765	6	3,375	3	L2b(sp)	3.45e	3.29	2.05
6:5	13	819	6	135	3	L2b	2.78	2.59	2.24
6:5	13	820	6	119,247	18	pot stand	2.78	2.59	2.24
6:5	13	823	6	120	3	L2b	2.78	2.59	2.24
6:5	13	823a	6	h.s.	3	L2b	2.78	2.59	2.24
6:7	14	852	5	12	3r	Special	3.12e	2.96	2.35
6:7	14	853	5	11	3r	Special	3.12e	2.96	2.35
6:7	14	854	5	7	3	L2b	3.12e	2.96	2.35
6:7	14	787	5	8	3r	L2b	3.12e	2.96	2.35
7:2	15	912	5	140,141	3	L2b	3.45	3.27	2.50

TABLE 106: *Mortuary vessels: Ceramic Period 3 (continued)*

Layer	Burial	Cat.	MP	Thin sec/h.s.	Fabric group	Type	Base	Depth Contents	Cut
7:2	15	2781	5	6	3	L2b	3.45	3.27	2.50
7:2	15	913	5	4	3	Special	3.45	3.27	2.50
7:2	15	2782	5	179	3	L2b	3.45	3.27	2.50
7:2	15	809	5	478	3(f)	L2j	3.45	3.27	2.50
7:2	15	2783	5	482	3(f)	L2j(i)	3.45	3.27	2.50
7:2	15	2794	5	13	3(f)	L2j	3.45	3.27	2.50
7:2	15	2794a	5	h.s.	3(f)	L2j	3.45	3.27	2.50
7:3	16	933	5	118,223,233	3r	L2b	3.25	3.15	2.43
7:3	16	2784	5	136,234	3	L2b	3.25	3.15	2.43
7:3	16	2785	5	229	3	L2b	3.25	3.15	2.43
7:3	16	2786	5	235	3	L2b	3.25	3.15	2.43
7:5	35	1025	4	174	17	E2b	3.03	2.87	2.65
7:5	35	1026	4	170	17	E2b	3.03	2.87	2.65
7:6	20	953	4	123,124,188	3	L2b	3.48e	3.32	2.81
7:6	20	2787	4	180	3	L2b	3.48e	3.32	2.81
7:6	22	884	4	133	3	L2b	3.16e	3.00	2.82
7:6	22	891	4	137	3	L1h	3.16e	3.00	2.82
7:6	23	2029a	4	h.s.	3	L1g	3.03e	2.86	2.84
7:6	23	2029b	4	h.s.	3	L2b	3.03e	2.86	2.84
7:6	36	1024	4	361	3	L2b	3.14e	2.98	2.65
7:6	36	2791	4	360	3	L2b	3.14e	2.98	2.65
7:7	24	899	4	132,190	3?	L2b	3.16e	3.00	2.80
7:7	24	2788	4	186	3	L2b	3.16e	3.00	2.80
7:7	24	2789	4	126	3r	L1a	3.16e	3.00	2.80
7:7	43	2015	4	165	3	L2b	2.80e	2.64e	2.45
8:1	44	1049	4	216	3	L2b	3.13e	2.98	2.77
8:1	44	1050	4	214	3	L2b	3.13e	2.98	2.77
8:1	44	1051	4	h.s.	3	L1a	3.13e	2.98	2.77
8:2	33	1100	4	378	3(f)	L2b	-	3.46	3.00
8:2	33	1101	4	293	3	L2b	-	3.46	3.00
8:2	33	1117	4	362	3	L2b	-	3.46	3.00
8:2	33	1118	4	203	3r	L2e	-	3.46	3.00
8:2	45	1138	4	363	3	L2e	3.27e	3.11	2.96
8:3	27	914	4	230	3	L2b	3.40e	3.24	2.97

TABLE 106: *Mortuary vessels: Ceramic Period 3 (continued)*

Layer	Burial	Cat.	MP	Thin sec/h.s.	Fabric group	Type	Depth Base	Depth Contents	Depth Cut
8:3	29	2030	4	h.s.	3	L2b?	3.49e	3.33	3.15
8:3	47	1141	4	167	3	L2b	3.40	3.24	3.05
8:4	28	990	4	129	3	L2e	3.58e	3.42	3.27
8:5	30	992	4	217	3	L2e	3.53e	3.37	3.32
8:5	31	987	4	10	11?	E2b	3.65e	3.49	3.37
8:5	32	988	4	9	3	L2e(f)	3.65e	3.47	3.37
8:7	38	1039	4	219	3r	L1a	3.74e	3.54	3.51
8:7	38	2034	4	205	3r	L1d	3.74e	3.54	3.51
8:7	38	2790	4	h.s.	3?	L2b	3.74e	3.54	3.51
8:7	39	2033	4	171	3(f)	L2b	3.74e	3.58	3.51
8:7	41	2032	4	194	12	E2b	3.83e	3.67	3.51
9:1	37	1269	4	212	3	L2d	3.83e	3.67	3.49
9:1	37	1270	4	211	3	L1d	3.83e	3.67	3.49

Of the 77 vessels able to be classified, 48, or 62.33 per cent, are type 2b burial jars. Five of these are exotic. Local coarse utilitarian wares comprise 18, or 23.37 per cent of the group. Two unique exotic wares include cat. 3264, a ring foot bowl decorated with paddle impressions and a pot stand (cat. 820 B13). Similar such stands are present at the Neolithic sites of Gua Cha and Bukit Tengku Lembu in Malaysia (Peacock 1959:121-56; Figs. 5 and 15). Pot stands are also reported at Po Yue Wan, Cheung Chau, Hong Kong (Crawford 1986:68). Unfortunately these have not been illustrated. The scaled dimensions of Gua Cha stands measure approximately 180 mm wide by 90 mm high, whereas the Khok Phanom Di example is 155 mm and 56 mm respectively. The Gua Cha stand is plain whereas cat. 820 is decorated with incised lines (Fig. 205). The Khok Phanom Di stand contains shell, rice and grog, a fabric unique in 12 tonnes of pottery examined. It seems appropriate to compare such highly distinctive artefacts with similar forms from other sites although fabric comparisons are not possible. It would be remiss not to observe similarities in, for example, the double-headed earrings from Ban Don Ta Phet with similar examples from Viet Nam and elsewhere, although the material they were shaped from has not been identified with any specific actinolite source (Glover 1990:166, 81 note 7; Higham 1996b:288).

Fine wares are represented by 55 vessels (71.42 per cent of the CP3 mortuary assemblage classified). Of these six, or 10.9 per cent, are exotic vessels. Decorative modes vary. Utilitarian vessels are either cord-marked or plain. Only one type, L2j(i), displays curvilinear incised lines (cat. 2783). Fine wares are either burnished, burnished and incised, with or without decorative fields, or plain. The latter term refers to a smoothed, but not burnished, surface finish. Burial jars form two groups based on different treatments to rim termini and carination points (Appendix 3). These have been impressed with either an *Anadara* shell or a cord-wrapped paddle. Some jars are completely plain or burnished, others display either a single incised or impressed line, either near

the carination point or below the rim terminus. Various combinations of decorative lines, either simple incised, *Anadara* shell-impressed, punctate or cord-marked were used. The latter two were restricted to rims and/or carination points. Some feature decorative fields within incised lines. Only one, cat. 3264 (B18), displays paddle impressions. Unfortunately this burial was seriously disturbed in prehistory (Higham and Bannanurag 1990:345), however, the site drawings indicate that the vessel fragments were located adjacent to the knees. The burial survived from the knees up, which suggests that cat. 3264 was associated with it. Many are highly burnished and skilfully finished. In contrast, others appear to have been hurriedly made with less attention to detail in shaping and finishing. This particularly applies to some of the cord-marked or plain vessels.

Overall the CP3 decorative treatments are less complex compared to CP2. The number of vessel forms decreases and the use of decorative detail diminishes. Raised bands are no longer employed and fields or panels are limited to a few vessels. The distinctive, highly burnished and intricately decorated, platters, found in CP2 burials, are absent. Three outstanding vessels, cats. 852 (B14), 853 (B14) and 913 (B15), however, demonstrate that local CP3 craft specialists possessed the ability to create vessels of excellent quality. Such expertise cannot be over-emphasized given the techniques available during this period. The overall size of these special vessels, their thinness, complexity of shape, decoration, and the firing methods needed to ensure an even dark lustrous colour, together illustrate the expertise of some local potters. The vessels also demonstrate high levels of artistic expression. Equal qualities were evident during CP2, although none of the vessels recovered was as large as the three CP3 vessels mentioned above.

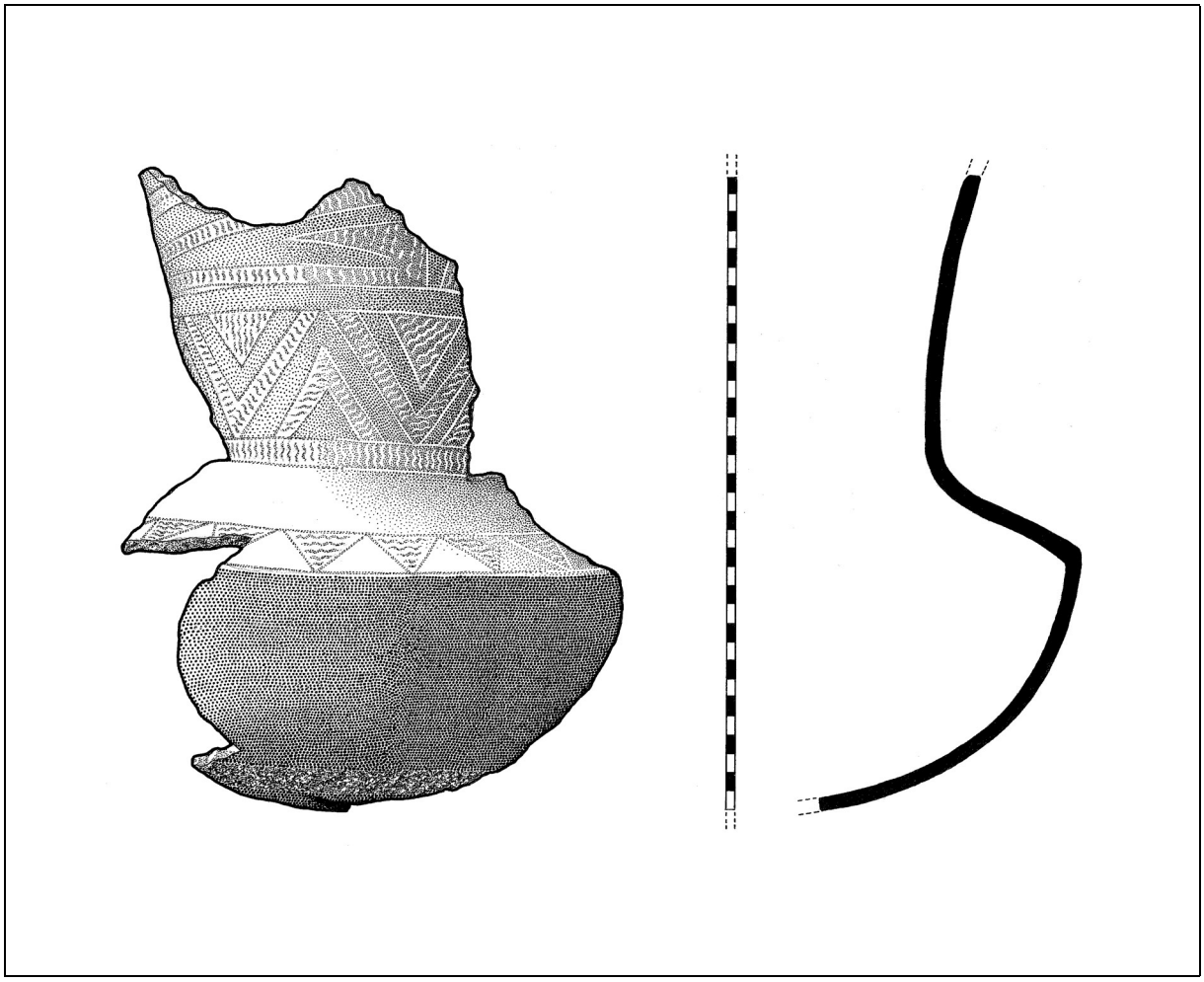


FIG. 176: Mortuary vessel, cat. 1269 B37 layer 9:1. A tall footed carinated ornamental type L2d fine ware jar. The surfaces are burnished, with highly decorated *Anadara* shell-impressed fields. Incised lines 1 mm wide, 0.5 mm deep. The rim and base have been removed in prehistory. About 30% survives. Dimensions: rim diam. 140 mm (est.), carination point: 200 mm, overall height: 190 mm (est.), to carination: 50 mm, base diam. 140 mm (est.). Slab construction, biscuit-fired, oxidized with fire clouds to base. Walls 3-4 mm thick, base attachment marks 12 mm wide. FG3, medium fine. Colour: 5YR/6/4. Quality: excellent, a complex intricately decorated vessel. Scale segments are 5 mm

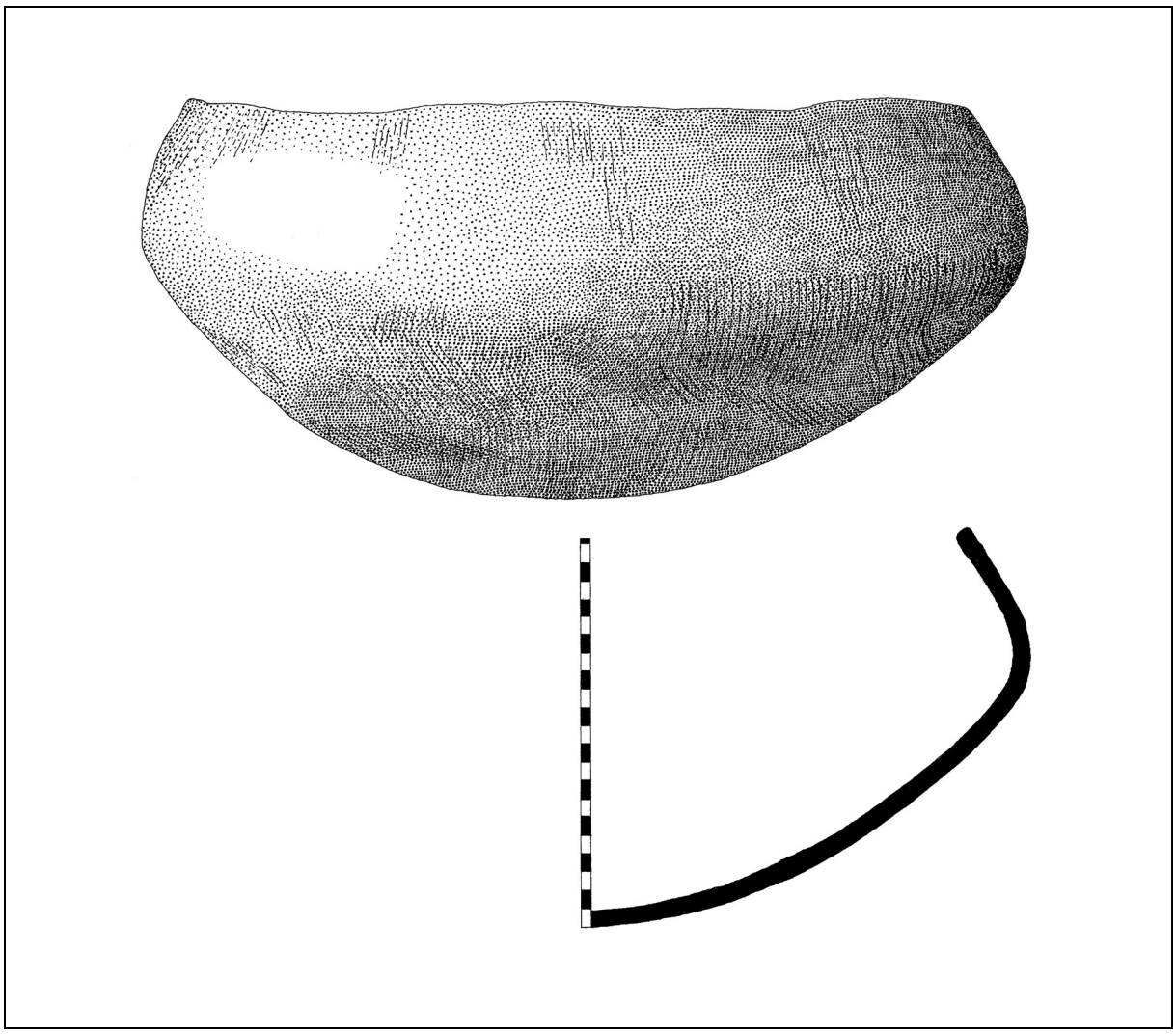


FIG. 177: Mortuary vessel cat. 1270 B37 layer 9:1. A coarse cord-marked utilitarian type L1d bowl. Interior and exterior upper 40 mm are roughly smoothed. Dimensions: rim diam: 210 mm, bowl: 240 mm, height: 93 mm, to inflection: 53 mm. The surfaces are coarse, walls 4.5 (rim) to 6 mm thick. FG3, medium coarse texture. Biscuit fired (low temperature?) oxidized throughout with small smudges to base. Colour: 5YR/6/4. Very obscure "S" cord marks 1/0.5 mm. Incised half round lines are 2 mm wide, 1 mm deep. Slab construction. Quality: mediocre. roughly shaped and finished. Scale segments are 5 mm

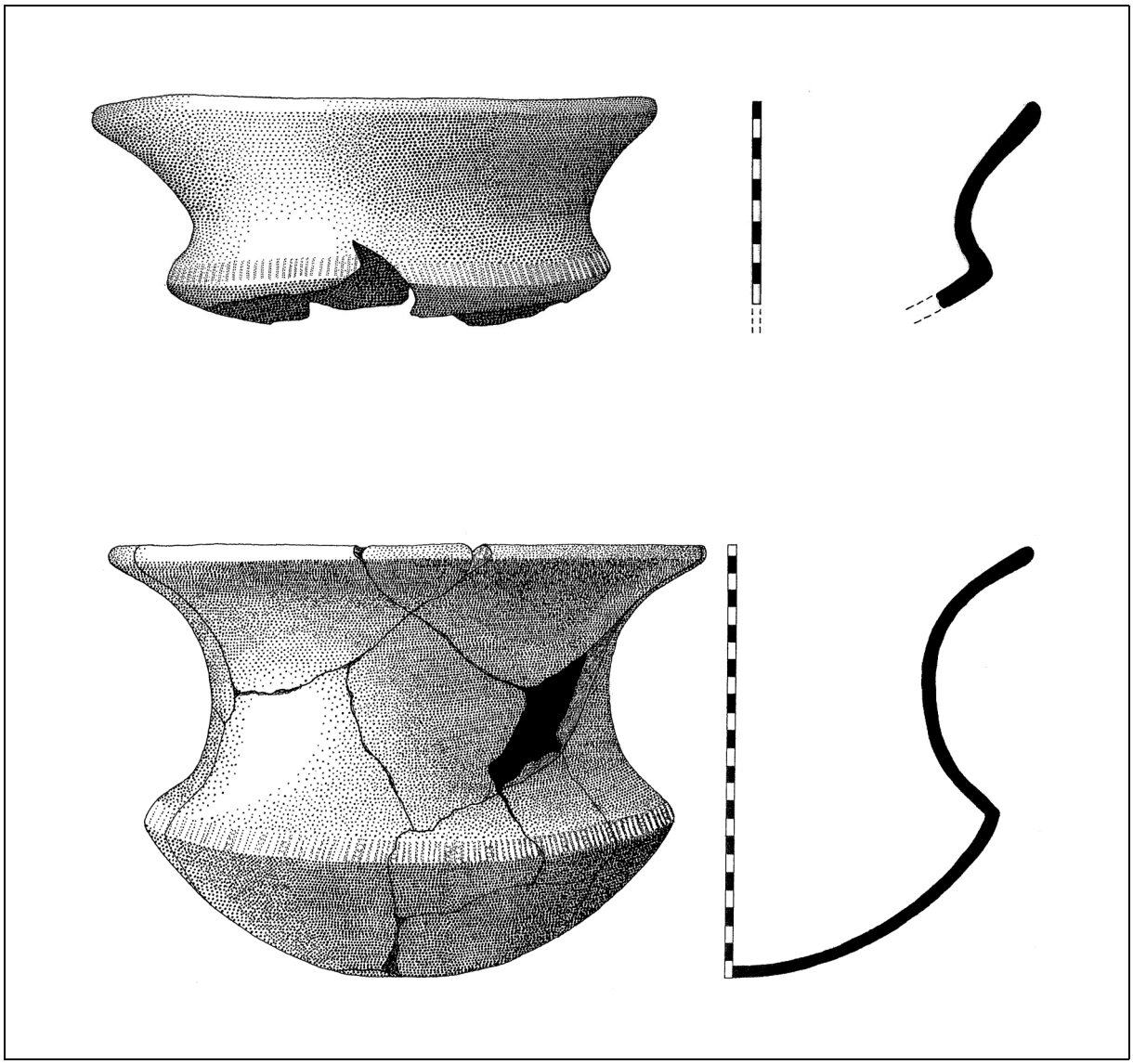


FIG. 178: "Whole" mortuary vessels. *Top*: cat. 2032 B41 layer 8:7. An exotic carinated type E2b burial jar. All surfaces are burnished, with cord mark impressions to the carination point. The base portion is missing. About 85% survives. Dimensions: rim diam. 160 mm, carination point 118 mm, overall height: 60 mm (est.), to carination: 15 mm (est.). Slab construction? Biscuit-fired, interior reduced, exterior almost oxidized with residual carbon. Fired upside down? Base 3 mm, walls 4.5 mm thick. Cord marks "Z" 1/1. FG12, medium fine. Colour: 5YR/5/4 (oxidized) 5TR/3/2 (reduced). Quality: very good, but below average. A severe rim distortion, plus the overall shape is irregular. *Bottom*: cat. 2033 B39 layer 8:7. A carinated type L2b burial jar with cord marks to rim terminus and carination point. Burnished to a moderately fine texture. Dimensions: rim diam: 170 mm, carination point 147 mm, overall height 127 mm, to carination 49 mm. Thickness: 5 mm. FG3. Biscuit fired and oxidized throughout. Colour: 5YR/6/4. "Z" cord marks 1/0.5 mm. Slab construction. Quality: Excellent, a typical large carinated jar beautifully shaped and finished. Scale segments are 5 mm

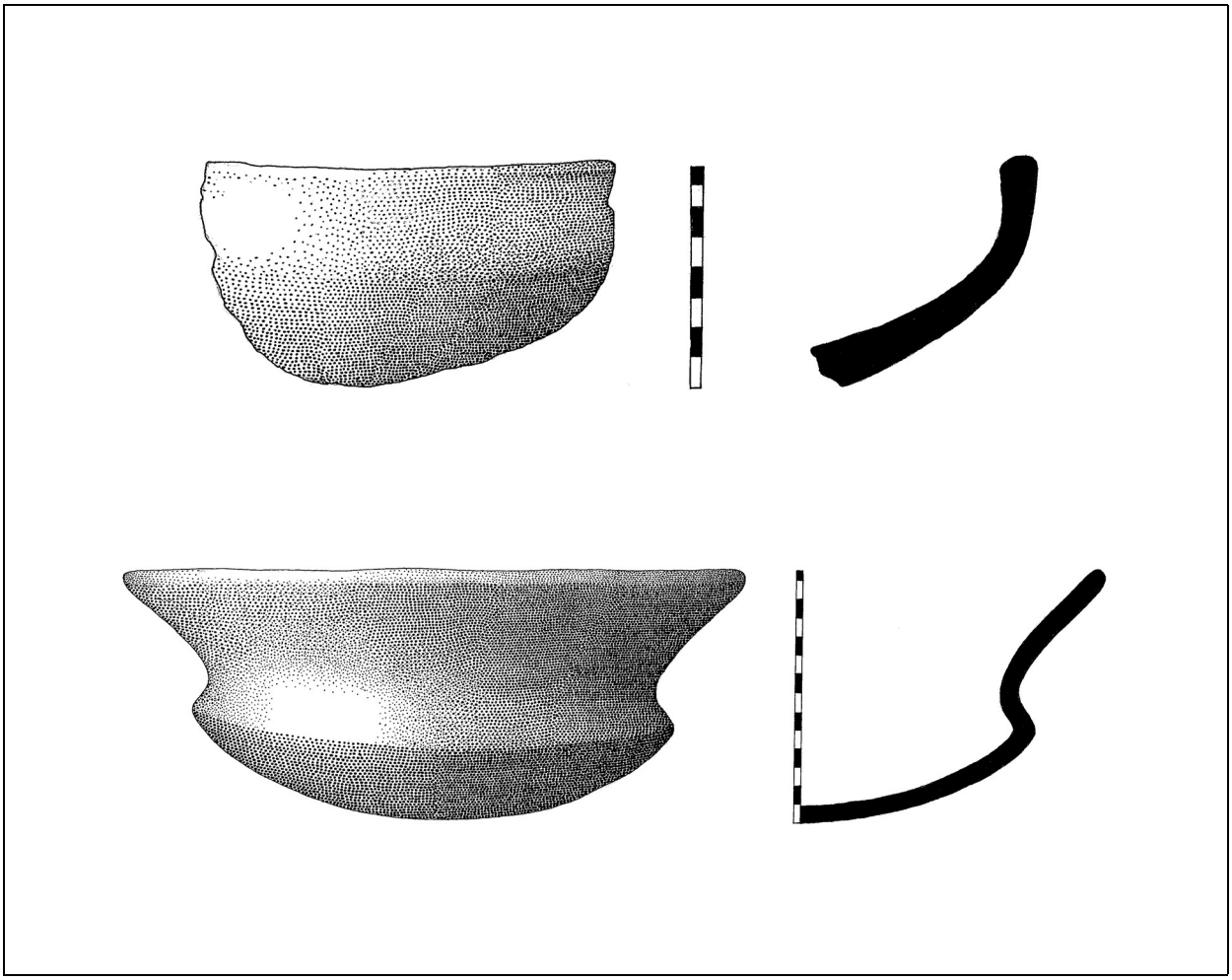


FIG. 179: "Whole" mortuary vessels. *Top*: cat. 2034 B38 layer 8:7. A small shallow type L1d bowl. A moderately coarse fabric with roughly smoothed surfaces. The base portion is missing. Dimensions: rim diam. 120 mm, height: 45 mm (est.). Probably modelled from a lump. Low(?) biscuit-fired, oxidized throughout. Base 9 mm, rim 5 mm thick. FG3r. Colour: 5YR/6/4. Quality: crudely fashioned and finished. The interior has been more carefully smoothed than the exterior. About 20% survives. *Bottom*: cat. 2790 B38 layer 8:7. A carinated type L2b burial jar. A roughly smoothed moderately coarse fabric. Dimensions: rim diam: 160 mm, carination point 120 mm, overall height 60 mm, to carination 22 mm. Thickness: 4–5 mm. FG3r. Low(?) biscuit fired with extensive smudges throughout. The surfaces are only just oxidized. Colour: 5YR/6/4. Slab construction? Quality: The shape overall is excellent, however, rough surface smoothing and irregular shape detract. Possibly quickly made by an expert or a learner sensitive to cultural forms. The overall effect is a beautifully proportioned form fashioned in a rudimentary manner. About 33% survives. Scale segments are 5 mm

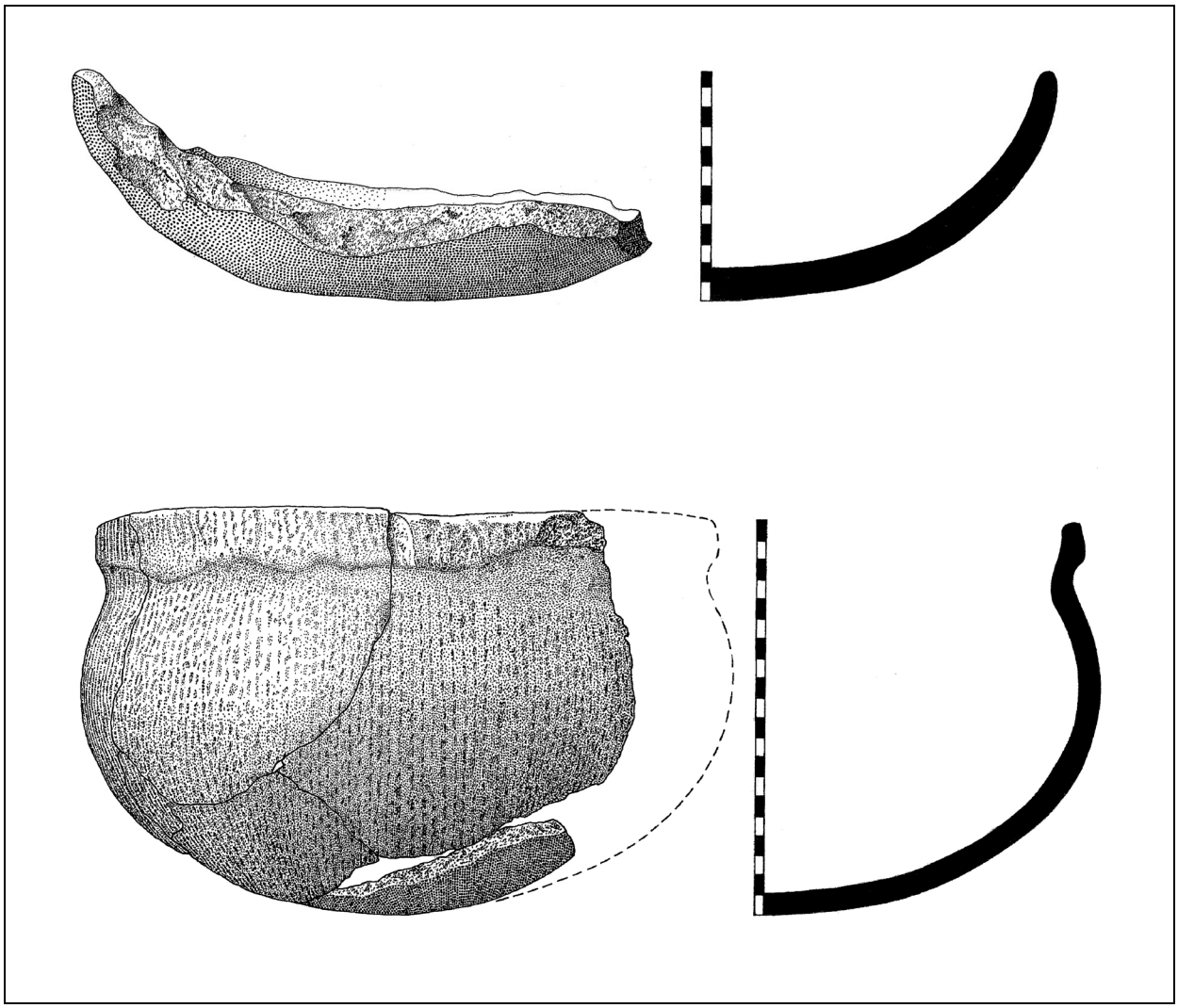


FIG. 180: "Whole" mortuary vessels. *Top*: cat. 1039 B38 layer 8:7. A small utilitarian shallow type L1d bowl. The fabric is coarse and very dense. Smoothed surfaces. Dimensions: rim diam. 200 mm, height: 44 mm. Probably modelled from a lump. Biscuit-fired, interior barely oxidized, exterior heavily coated with carbon, 8 mm thick (a functional requirement?). FG3r. Colour: 5YR/4/1. Quality: average. Heat spalling above heavy exterior carbon deposits covering the base indicates the vessel was used in a fire. About 60% survives. *Bottom*: cat. 988 B32 layer 8:5. A type L2e(f) utilitarian jar. The exterior is cord-marked and roughly smoothed over a coarse fabric, interior smoothed by anvil impressions. Dimensions: rim diam: 174 mm, body: 198 mm, overall height 130 mm (est.), rim fold: 15 mm. Thickness: 4–5 mm. FG3. Low(?) biscuit fired, oxidized with fire clouds to base interior and exterior. Surfaces have numerous shrinkage cracks. Cord marks: "S" 2/0.2 to no gap. The marks tend to vertical with cross-hatching on the base. Colour: 5YR/6/4 (oxidized), 5YR/2.5/1 (reduced). Slab construction. Quality: Crudely fashioned and probably carelessly fired. The overall shape, however, suggests an experienced potter. About 60% survives. Scale segments are 5 mm

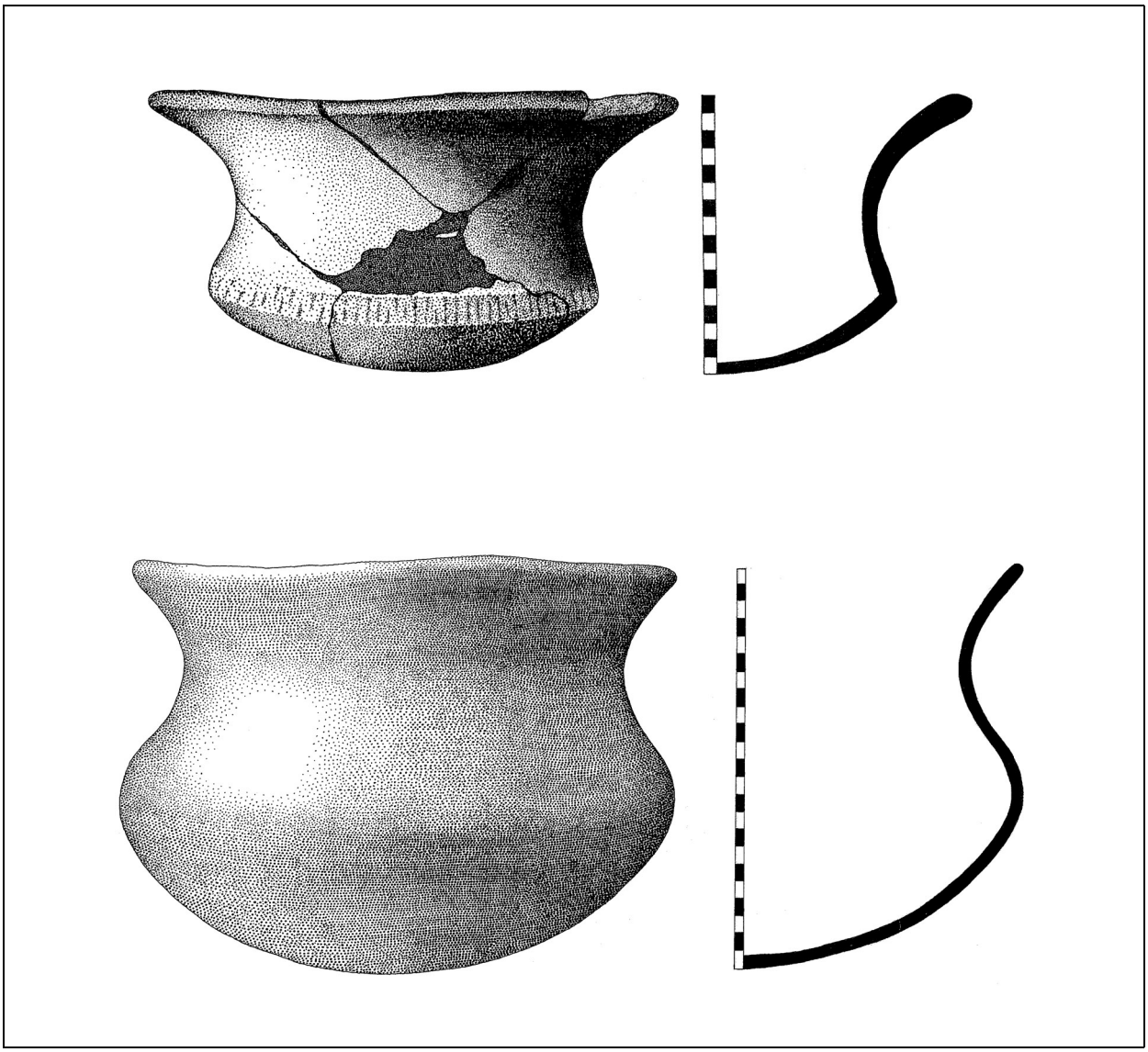


FIG. 181: Mortuary vessels. *Top*: cat. 987 B31 layer 8:5. An exotic type E2b carinated burial jar with a lightly burnished fine fabric. Dimensions: rim diam: 154 mm, carination: 111 mm, overall height 77 mm, to carination: 23 mm. Thickness: 5–7 mm. FG11? Low(?) biscuit fired, oxidized exterior with slight fire clouds, and minor clouds to the interior rim and base. The carination point (maximum width 10 mm), is probably cord-marked. Colour: 7.5YR/6/4 (oxidized), 7.5YR/4/0 (reduced). Slab construction. Quality: very good, however, the rim is distorted and the body shape is irregular. About 80% survives. *Bottom*: cat. 992 B30 layer 8:4. A small type L2e jar. The surface is slightly burnished over a medium fine fabric. Dimensions: rim diam. 165 mm, body diam: 158 mm, height: 121 mm, to mid-point: 56 mm. Slab construction. Low biscuit-fired, the interior is oxidized with a small fire cloud, and half the exterior is fire-clouded, suggesting an upright firing. 3 mm thick. FG3. Colour: 10YR/6/4 (oxidized), 10YR/3/1 (reduced). Residual cord marks are too obscure to identify. Quality: very good, however, marred by minor shape distortions. Scale segments are 5 mm

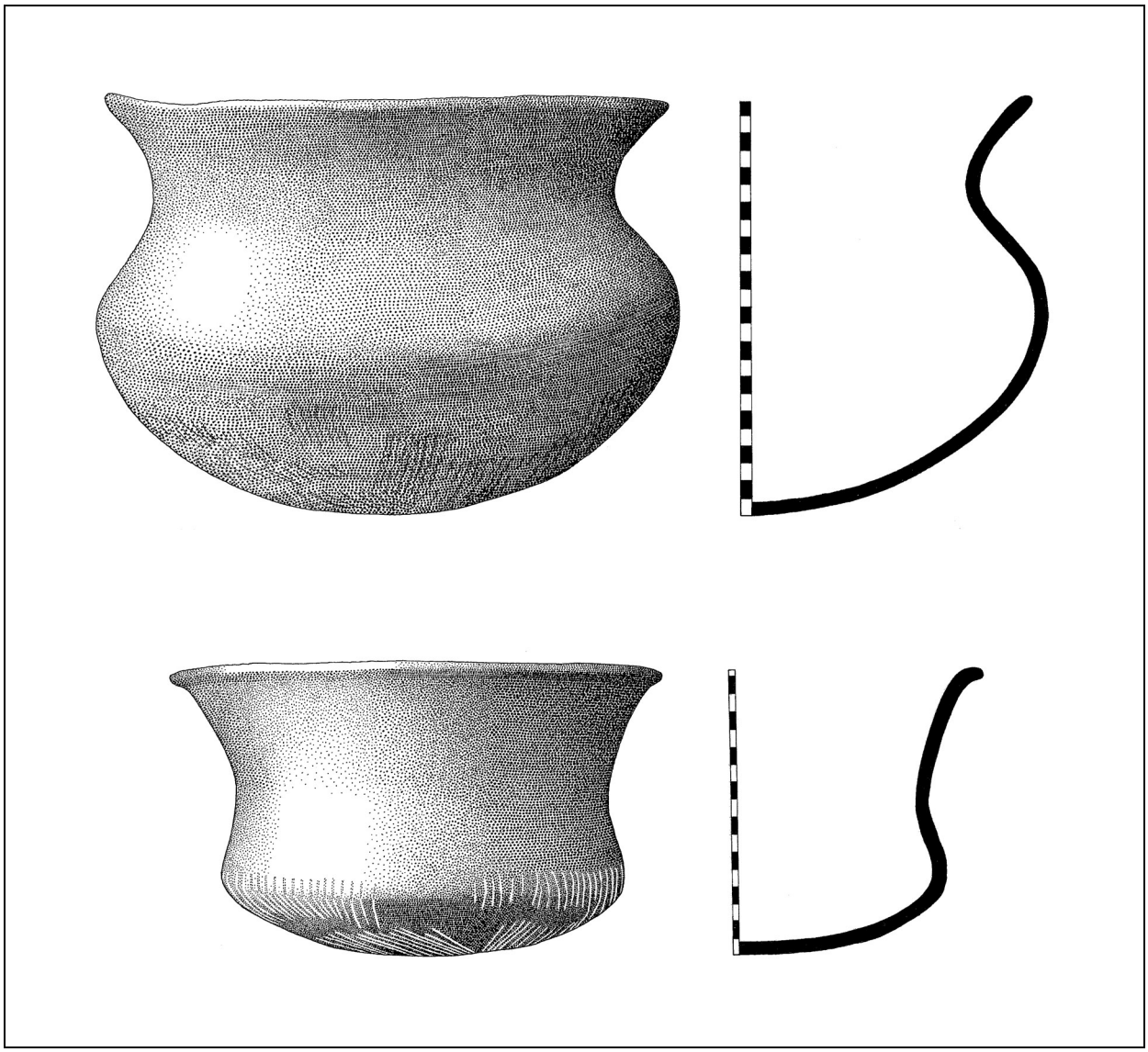


FIG. 182: Mortuary vessels. *Top*: cat. 990 B28 layer 8:4. A small utilitarian type L2e jar. The surface is slightly burnished over a medium fine fabric. Dimensions: rim diam. 166 mm, body diam: 175 mm, height: 110 mm (est.). Slab construction. Low biscuit-fired, the interior is oxidized with fire clouds. The upper half of the exterior is oxidized, the lower has carbon deposits from usage. 3–4 mm thick. FG3. Colour: 7.5YR/6/4 (oxidized), 7.5YR/3/0 (reduced). Residual cord marks on base: "Z" 1/1 mm. Quality: very good, some minor shape distortions but skilfully made. About 70% survives. *Bottom*: cat. 1141 B47 layer 8:3. A small type L2b carinated burial jar with a lightly smoothed fine fabric. Dimensions: rim diam: 132 mm, carination: 107 mm, overall height 82 mm, to carination: 24 mm. Thickness: 3.5–4 mm. FG3. Low(?) biscuit fired, oxidized throughout except for exterior fire clouds. Fired upright? Cord-marked base: "Z" 1/1 mm. Colour: 7.5YR/6/4 (oxidized). Slab construction. Quality: very good, however, some minor shape distortions and a rudimentary surface finish. About 70% survives. Scale segments are 5 mm

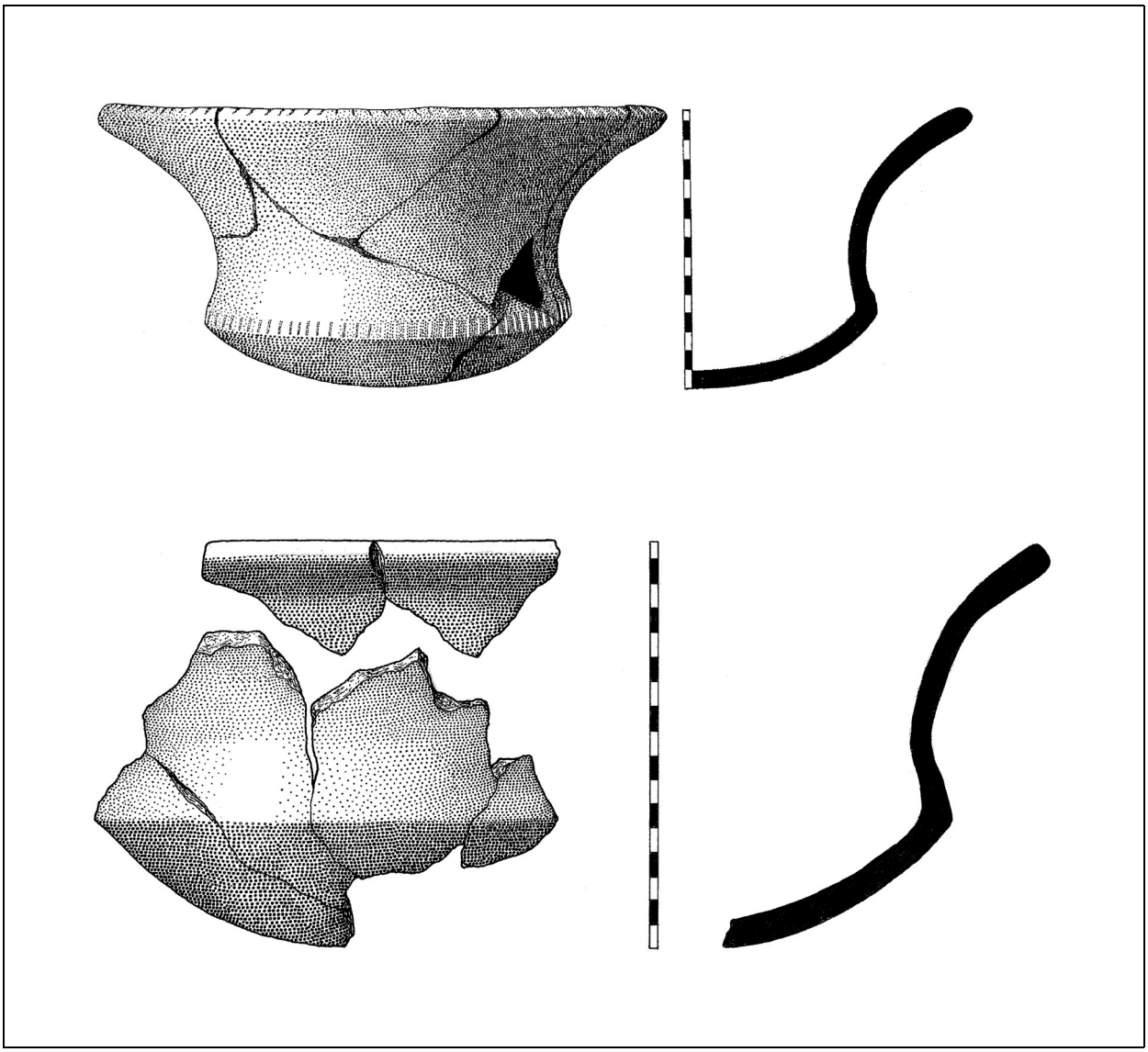


FIG. 183: Mortuary vessels. *Top*: cat. 914 B27 layer 8:3. A small type L2b burial jar. Burnished over a medium fine fabric. Dimensions: rim diam. 146 mm, carination point: 93 mm, height: 68 mm, to carination: 14 mm. Slab construction. Biscuit-fired, the interior is reduced, exterior base partially oxidized. Fired upside down. 5 mm thick. FG3. Colour: 7.5YR/5/4 (oxidized), 7.5YR/3/2 (reduced). The rim terminus is marked with *Anadara* shell impressions, the carination point with cord marks: "S" 1.25/0.25 mm. Quality: excellent, some very minor shape distortions and a few residual cord marks on the base. Extensively shattered, about 98% survives. *Bottom*: cat. 2030 B29 layer 8:3. A small type L2b carinated burial jar with a burnished fine fabric. Dimensions: rim diam: 140 mm (est.), carination: 140 mm (est.), overall height: 100 mm (est.) to carination 15 mm (est.). Thickness: 4 mm. FG3. Biscuit fired, oxidized throughout except for slight interior fire clouding. Fired upside down? Colour: 10YR/6/4 (oxidized), 10YR/3/1 (reduced). Slab construction. Quality: very good with some minor shape distortions. About 30% survives. Scale segments are 5 mm

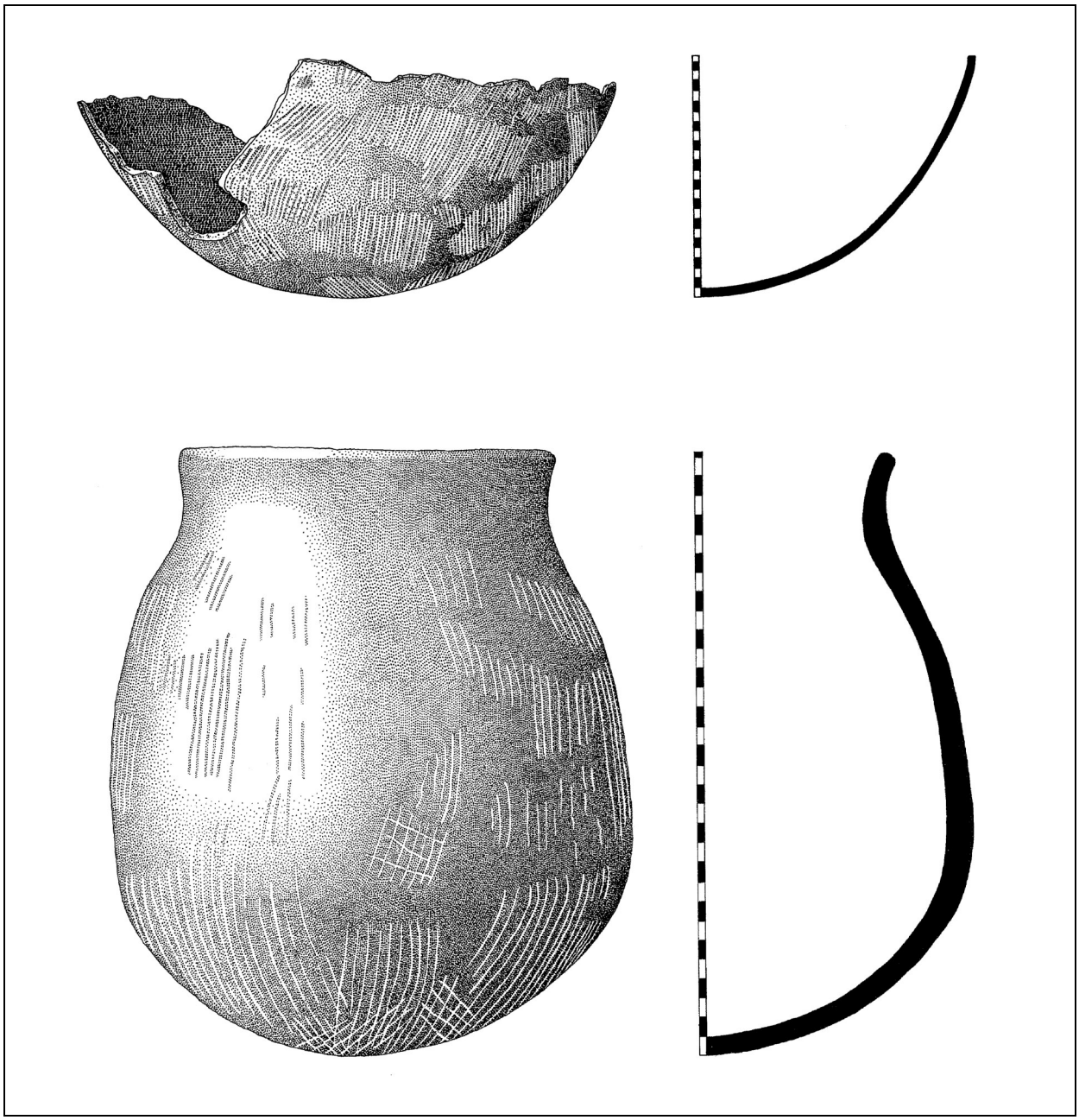


FIG. 184: Mortuary vessels. *Top*: cat. 1118 B33 layer 8:2. A portion of a possible type L2j utilitarian container. The exterior is cord-marked and the interior smoothed over a medium fine fabric. Dimensions: body width 275 mm, height: approximately 100 mm (?). Slab construction. Biscuit-fired and oxidized with fire clouds and smudging. 2.5–3.5 mm thick. FG3r. Colour: 5YR/6/3 (oxidized), 5YR/3/1 (reduced). Cord marks: "Z" 1/0.5 mm. Quality: very good, the shape is uniform. *Bottom*: cat. 1138 B45 layer 8:2. A type L2e utilitarian jar. The exterior and rim terminus are cord-marked and the interior smoothed over a medium fine fabric. Dimensions: rim diam: varies from 90 to 100 mm, body diam: 124 mm, height: 142 mm. Thickness: walls 8 mm, rim edge 5 mm. FG3. Biscuit fired, oxidized throughout except for smudges on the exterior base. Colour: 5YR/5/4. Cord marks: "Z" 1/1 mm. Slab construction? Quality: crudely made. Any smoothing is incidental to the forming process. About 90% survives. Scale segments are 5 mm

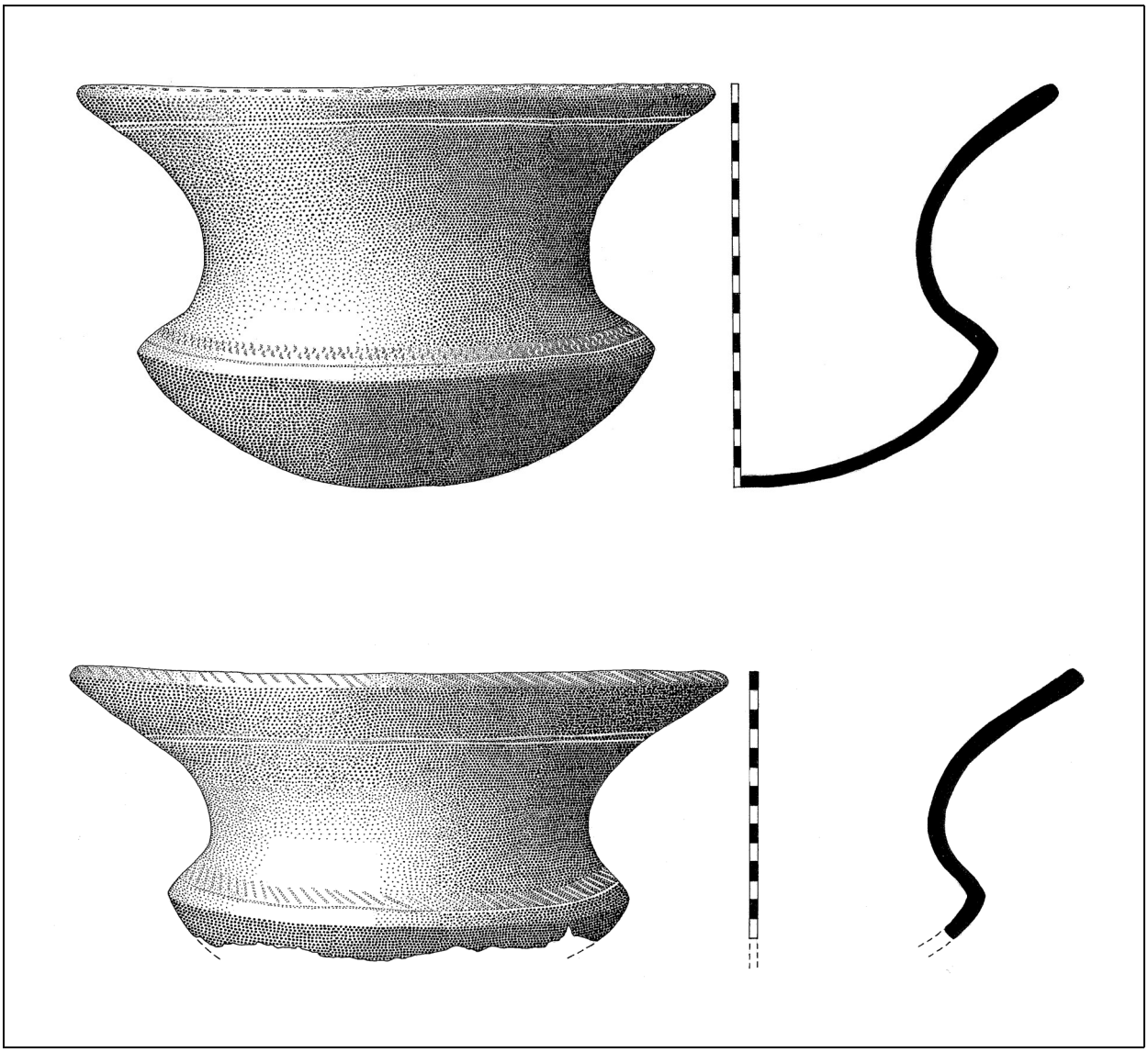


FIG. 185: Mortuary vessels. *Top*: cat. 1101 B33 layer 8:2. A burnished carinated burial jar. Highly burnished over a medium fine fabric. Two incised lines circuit below the rim. The rim terminus and the carination point are decorated with possible cord marks. Dimensions: rim diam: 160 mm, carination point: 124 mm, height: 98 mm, to carination 33 mm, thickness: 3–4 mm. Slab construction. Biscuit-fired. Interior and exterior oxidized with a small smudges. FG3. Colour: 7.5YR/5/4 to 7.5YR/4/2. Quality: excellent, only a minor rim distortion. Extensively shattered, about 95% survived. *Bottom*: cat. 1117 B33 layer 8:2. A burnished carinated burial jar. The carination point and rim terminus are cord-marked(?). A medium fine fabric. Two incised lines, 1 mm wide, 0.5 mm deep, circuit below the rim. Dimensions: rim diam: 172 mm, carination point: 123 mm, height: 88 mm (est.), to carination 30 mm (est.), thickness: 5 mm. Slab construction? Biscuit fired, oxidized throughout with minor smudges. FG3. Colour: 7.5YR/6/4 (oxidized), 7.5YR/4/0 (reduced). Quality: Excellent. Minor shape and incising distortions. Extensively shattered, about 70% survives. Scale segments are 5 mm

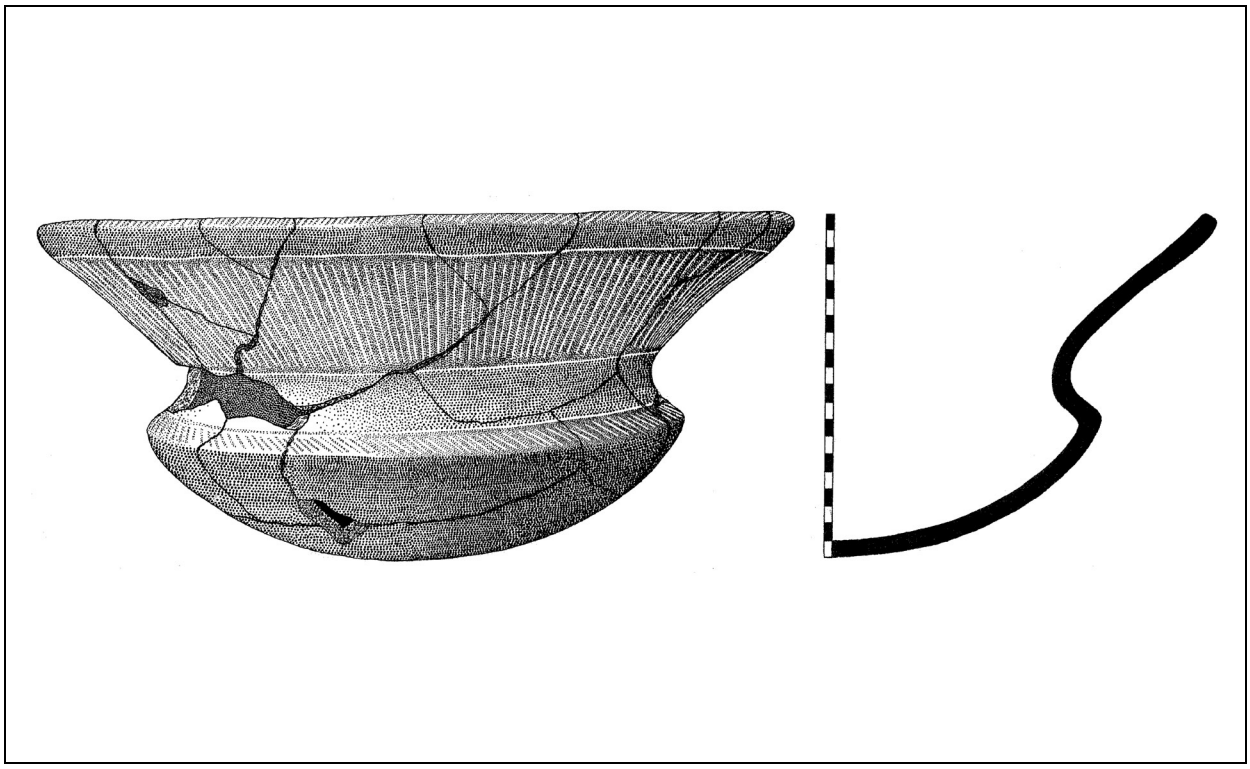


FIG. 186: Mortuary vessel. cat. 1100 B33 layer 8:2. A lightly burnished carinated burial jar. Highly decorated over a medium fine fabric. The deep field between the rim and carination point is filled with vertical cord marks ("Z" 1.5/0.5 mm gap). The rim terminus and the carination point are also decorated with cord marks ("Z" 1/0.5 mm gap). Incised lines are 1 mm wide, 0.5 mm deep. Decoration is similar to that displayed on cats. 700, 764, 794, 891 and 979. Dimensions: rim diam: 204 mm, carination point: 140 mm, height: 88 mm, to carination 26 mm, thickness: 4–5 mm. Slab construction. Low(?) biscuit-fired. Interior and exterior oxidized. Fire clouds partially cover over 33% of the interior and a small area of the exterior. FG3f. Colour: 7.5YR/6/4 to 7.5YR/3.5/0. Quality: very good, the only blemishes are minor shape distortion and incomplete burnishing. Extensively shattered, about 80% survived. Scale segments are 5 mm

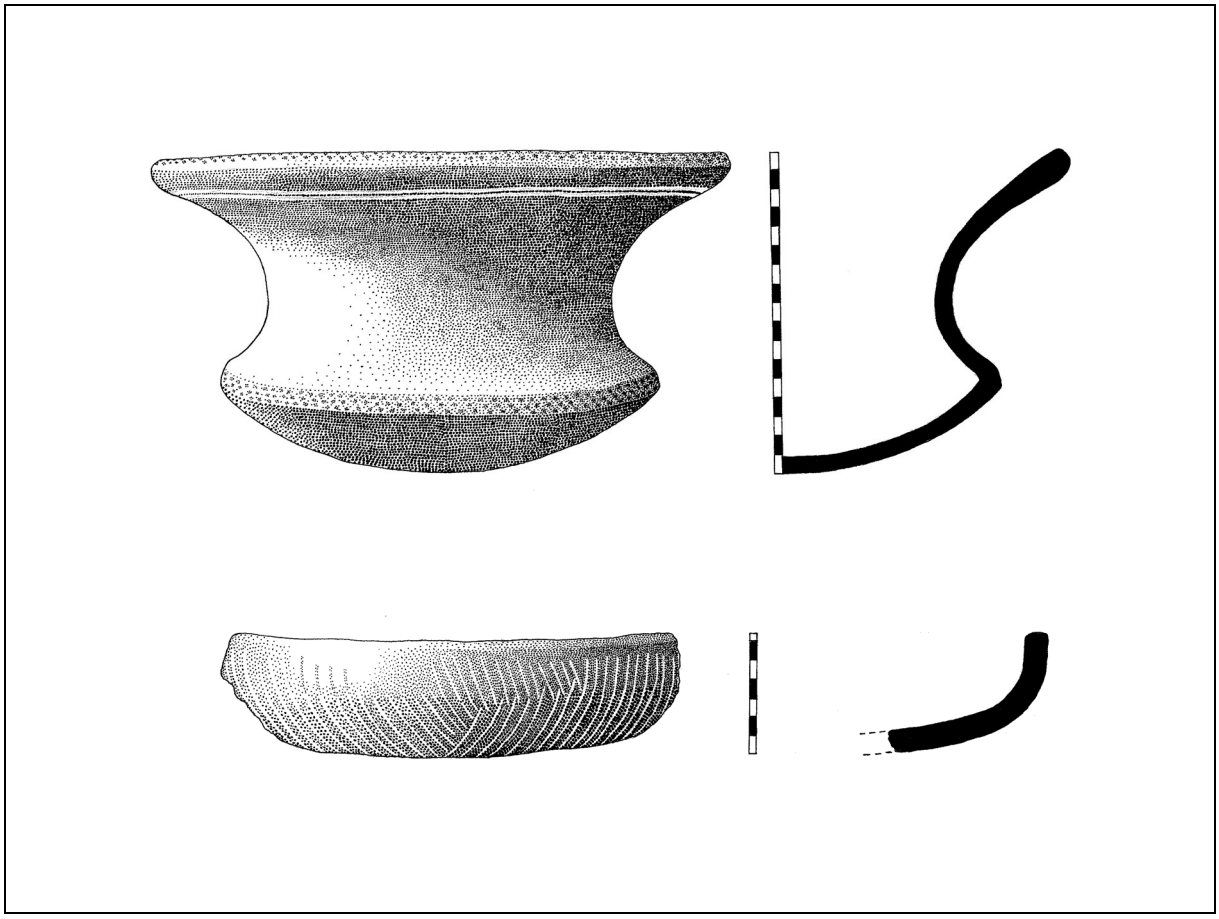


FIG. 187: Mortuary vessels. *Top*: cat. 1050 B44 layer 8:1. A burnished carinated burial jar. Highly burnished over a medium fine fabric. Two incised lines circuit below the rim. The rim terminus and carination point are decorated with *Anadara* shell impressions. Dimensions: rim diam: 154 mm, carination point: 107 mm, height: 85 mm, to carination 24 mm, thickness: 4.5 mm. Slab construction. Biscuit-fired. Interior almost oxidized, exterior reduced with lighter areas at rim. Fired upright? FG3. Colour: 10YR/5/3 (oxidized), 10YR/3/1 (reduced). Quality: excellent, almost perfect in all respects, very slightly uneven rim line. Five pieces, representing about 80%, were recovered. *Bottom*: cat. 1051 B44 layer 8:1. A cord-marked shallow utilitarian bowl. The exterior is cord-marked over a medium fine fabric. The interior is smoothed. Dimensions: rim diam: 184 mm, height: 35 mm (est.), thickness: 5–8 mm. Slab or modelled construction? Biscuit fired, oxidized with several fire clouds. FG3. Colour: 7.5YR/6/4 (oxidized), 7.5YR/3/0 (reduced). Cord marks: "Z"(?) 2/1 mm. Quality: good. The base has possible usage carbon deposits. One fragment, representing about 10%, was recovered. Scale segments are 5 mm

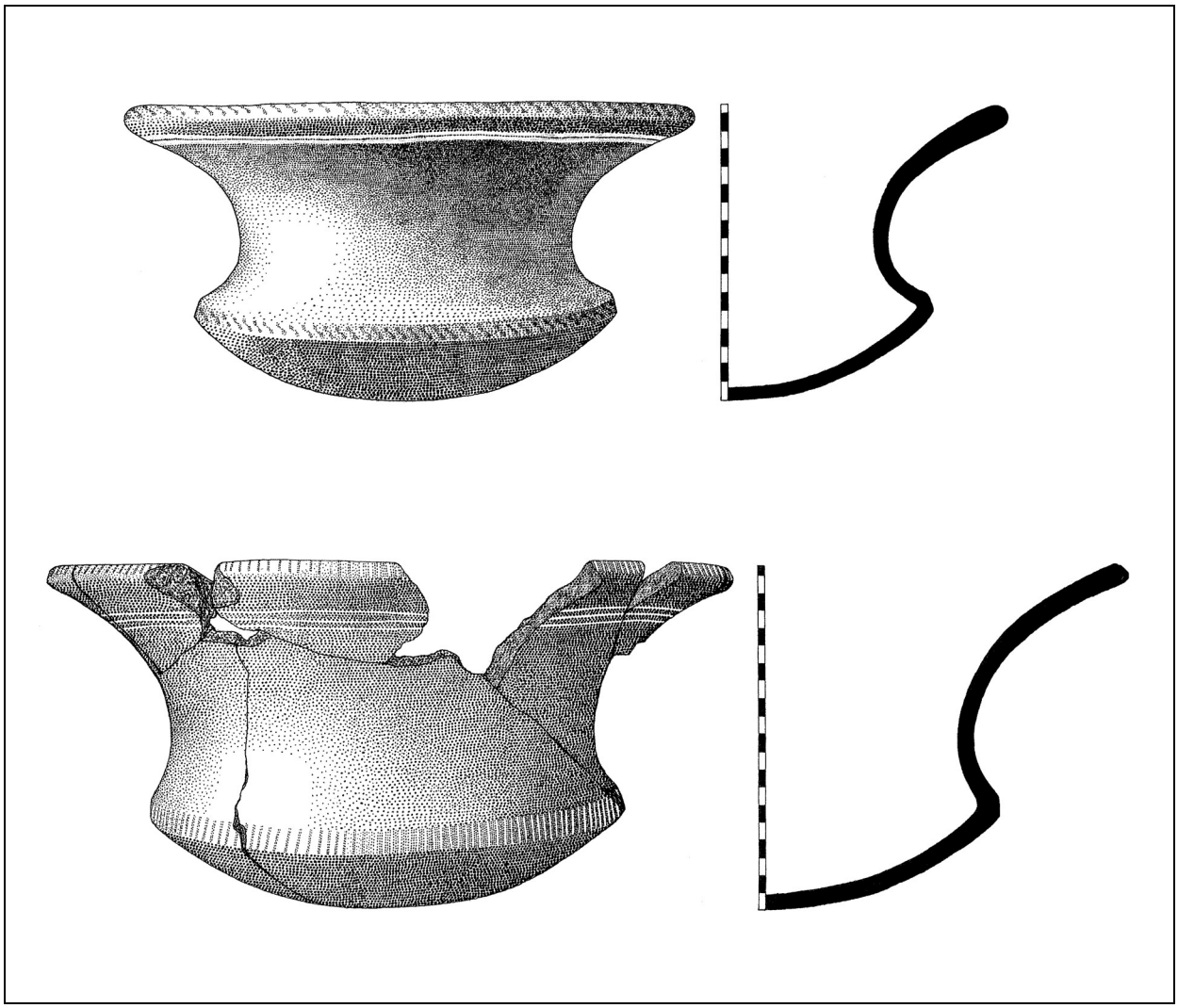


FIG. 188: Mortuary vessels. *Top*: cat. 1049 B44 layer 8:1. A burnished carinated burial jar. Highly burnished over a medium fine fabric. Two incised lines circuit below the rim. The rim terminus and the carination point are decorated with *Anadara* shell impressions. Dimensions: rim diam: 162 mm, carination point: 118 mm, height: 83 mm, to carination 25 mm, thickness: 4 mm. Slab construction. Biscuit-fired. Reduced throughout. FG3. Colour: 2.5YR/3/0. Quality: excellent, the shape is near perfect. Minor fractures, about 90% survived. *Bottom*: cat. 2015 B43 layer 7:9. A burnished carinated burial jar. Three incised lines circuit below the rim.The carination point and rim terminus are cord-marked. A medium fine fabric. Dimensions: rim diam: 194 mm, carination point: 127 mm, height: 96 mm, to carination 26 mm, thickness: 4.5 mm. Slab construction. Biscuit fired, reduced except for almost oxidized base. Fired upside down. FG3. Colour: 2.5YR/6/6 (oxidized), 2.5YR/4/0 (reduced). Cord marks: "Z" 1/1 mm. Quality: Very good. Only marred by slight irregularities in shape and incised lines. Extensively shattered, about 70% survives. Scale segments are 5 mm

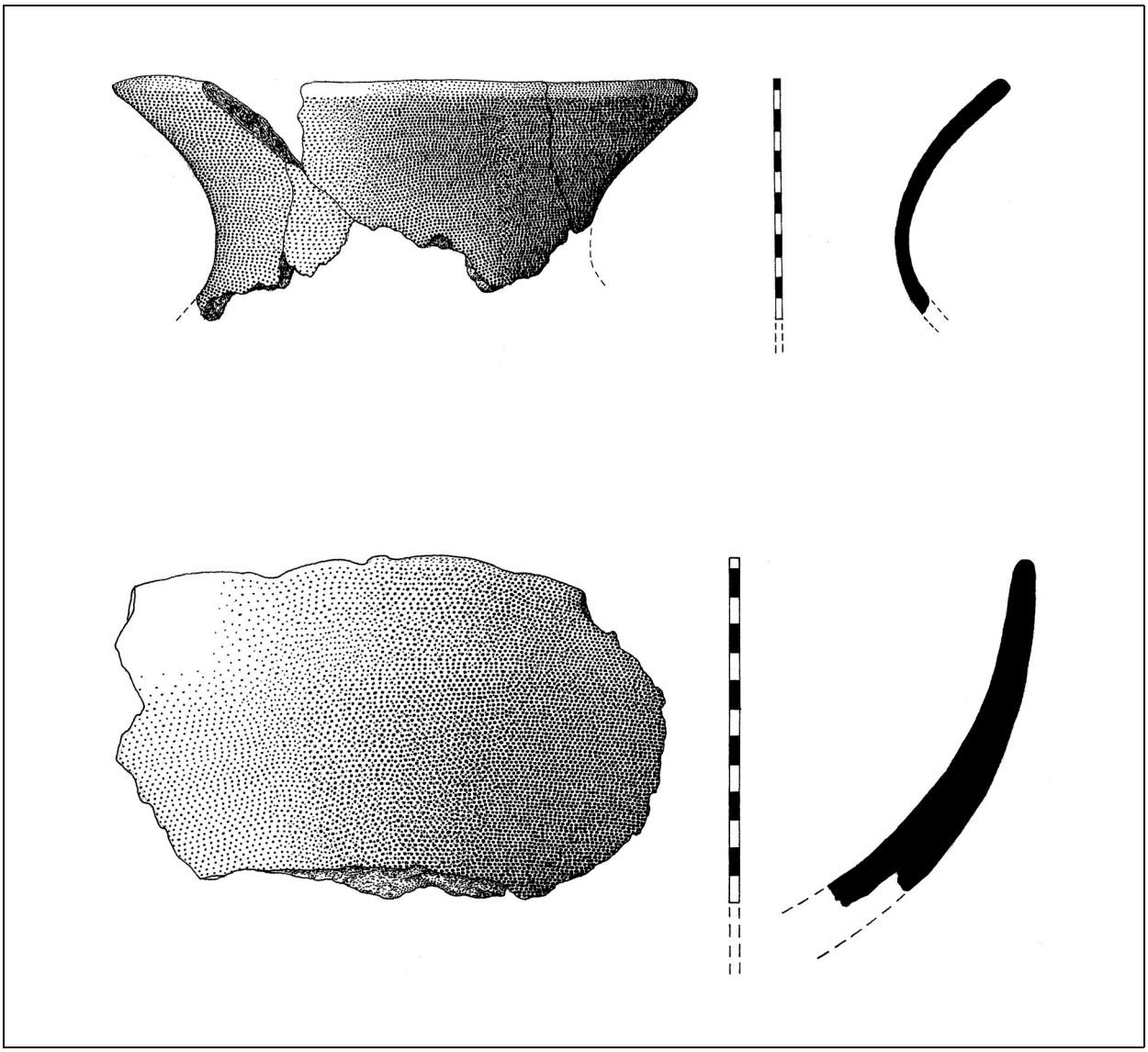


FIG. 189: Mortuary vessels. *Top*: cat. 2788 B24 layer 7:7. A burnished provisional type L2b carinated burial jar. Highly burnished over a medium fine fabric. The rim terminus is decorated with cord marks, however they may be merely left over from the forming process. Dimensions: rim diam: 140 mm, thickness: 4 mm. Slab construction. Biscuit-fired. Interior and exterior oxidized with some fire clouds. FG3. Colour: 7.5YR/6/4. Cordmarks: "S" (?) 1/1 mm. Quality: very good to excellent, only a minor rim distortion. Extensively shattered, the lower portion is missing. *Bottom*: cat. 2789 B24 layer 7:7. A small, shallow, provisional type 1a, utilitarian bowl. The surface is roughly smoothed over a medium coarse fabric. Dimensions: rim diam: 140 mm (est.), height: 50 mm (est.), thickness: 3 mm (at rim), 10 mm (at base). Modelled? Low(?) biscuit fired, oxidized throughout except for the core. FG3r. Colour: 7.5YR/7/4. Residual cord marks: "Z" 1–2/0.5–1 mm gap. Quality: A mediocre utilitarian vessel which may have originally included a ring base. Scale segments are 5 mm

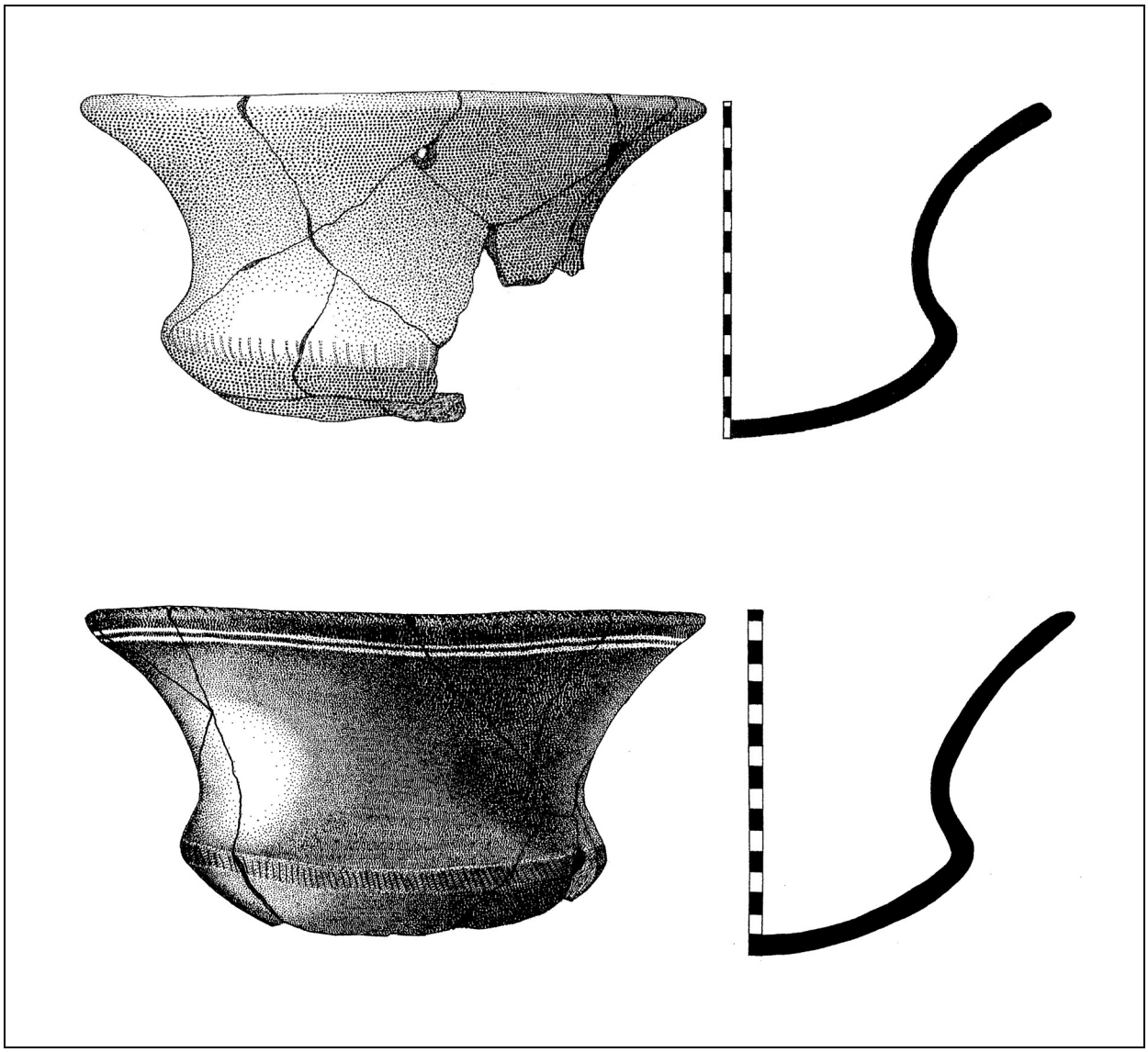


FIG. 190: Mortuary vessels. *Top*: cat. 899 B24 layer 7:7. A burnished carinated burial jar. Lightly burnished over a medium fine fabric. The rim terminus and carination point are decorated with cord marks. Dimensions: rim diam: 150 mm, carination point: 96 mm, height: 76 mm, to carination 23 mm, thickness: 3.5–4 mm. Slab construction. Low(?) biscuit-fired. The interior and exterior are oxidized with fire clouds to the rim and base areas. FG3? Colour: 7.5YR/7/4. Quality: very good, although the burnishing lacks detail, the carination is irregular and some cord marks are not smoothed over. Extensively shattered. *Bottom*: cat. 2791 B36 layer 7:6. A burnished carinated burial jar. The carination point and rim terminus are decorated with *Anadara* shell impressions. A medium fine fabric. Two incised lines circuit below the rim. Dimensions: rim diam: 150 mm, carination point: 104 mm, height: 84 mm (est.), to carination 24 mm, thickness: 4.5 mm. Slab construction. Biscuit fired, barely oxidized throughout with minor smudges to the base and rim interior. Probably fired upside down. FG3. Colour: 5YR/6/3. Quality: Very good. Minor shape distortions. Extensively shattered, about 60% survives. Scale segments are 5 mm

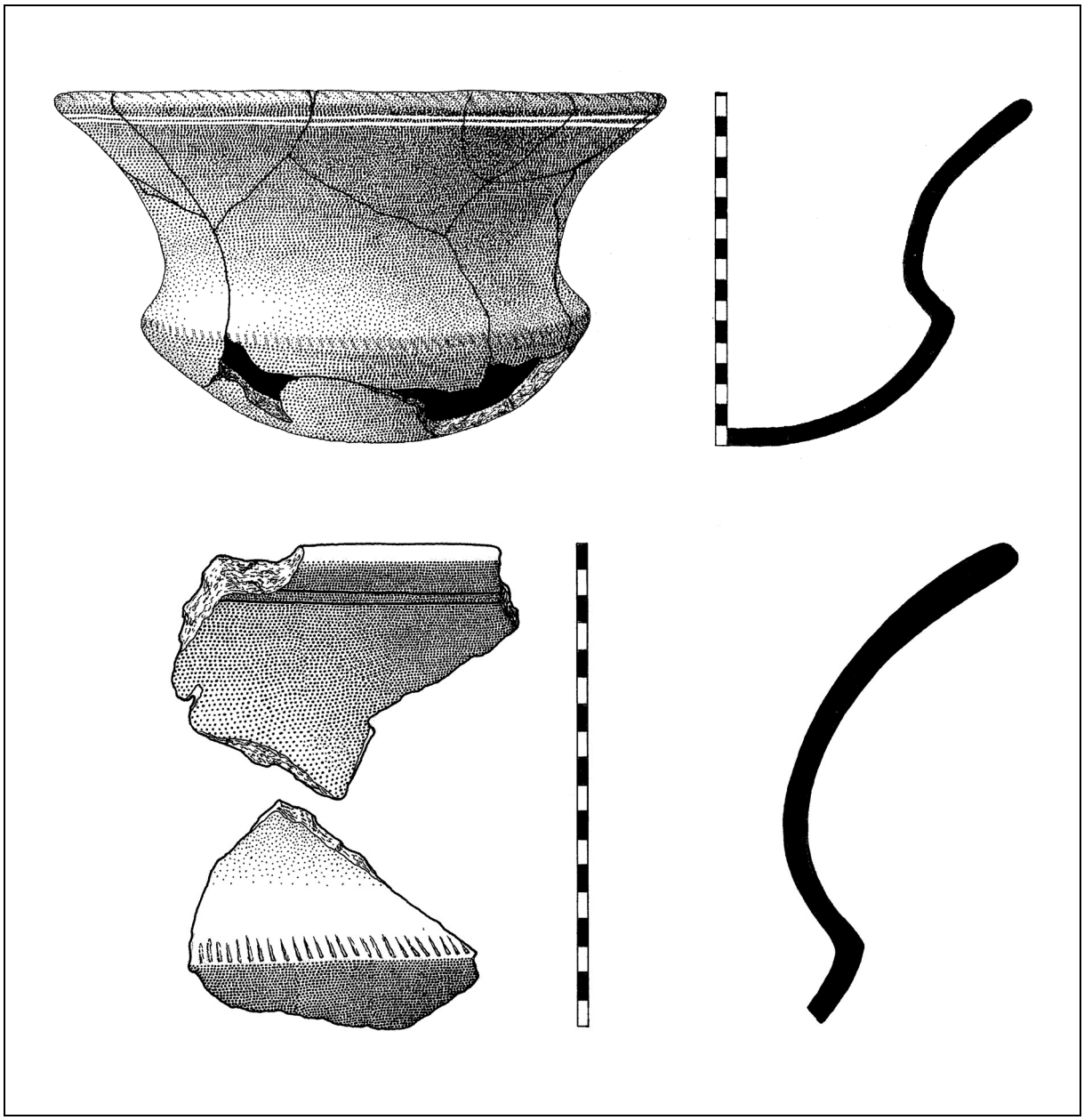


FIG. 191: Mortuary vessels. *Top*: cat. 1024 B36 layer 7:6. A smoothed carinated burial jar. The carination point and rim terminus are decorated with *Anadara* shell impressions. A medium fine fabric. Two incised lines circuit below the rim. Dimensions: rim diam: 150 mm, carination point: 109 mm, height: 82 mm, to carination 26 mm, thickness: 4 mm. Slab construction. Biscuit fired, barely oxidized throughout with minor smudges. FG3. Colour: 5YR/6/4. Quality: Very good. The surface is not burnished, and there are also minor shape and incising distortions. Extensively shattered, about 85% survives. *Bottom*: cat. 2029b B23 layer 7:6. A burnished carinated burial jar. Lightly burnished over a medium fine fabric. Two incised lines circuit below the rim. The rim terminus and the carination point are decorated with *Anadara* shell impressions. Dimensions: rim diam: 120 mm (est.), carination point: 64 mm (est.), height: 110 mm (est.), thickness: 4–5 mm. Slab construction. Biscuit-fired. Oxidized except for the core. FG3. Colour: 2.5YR/6/4. Quality: very good. Scale segments are 5 mm

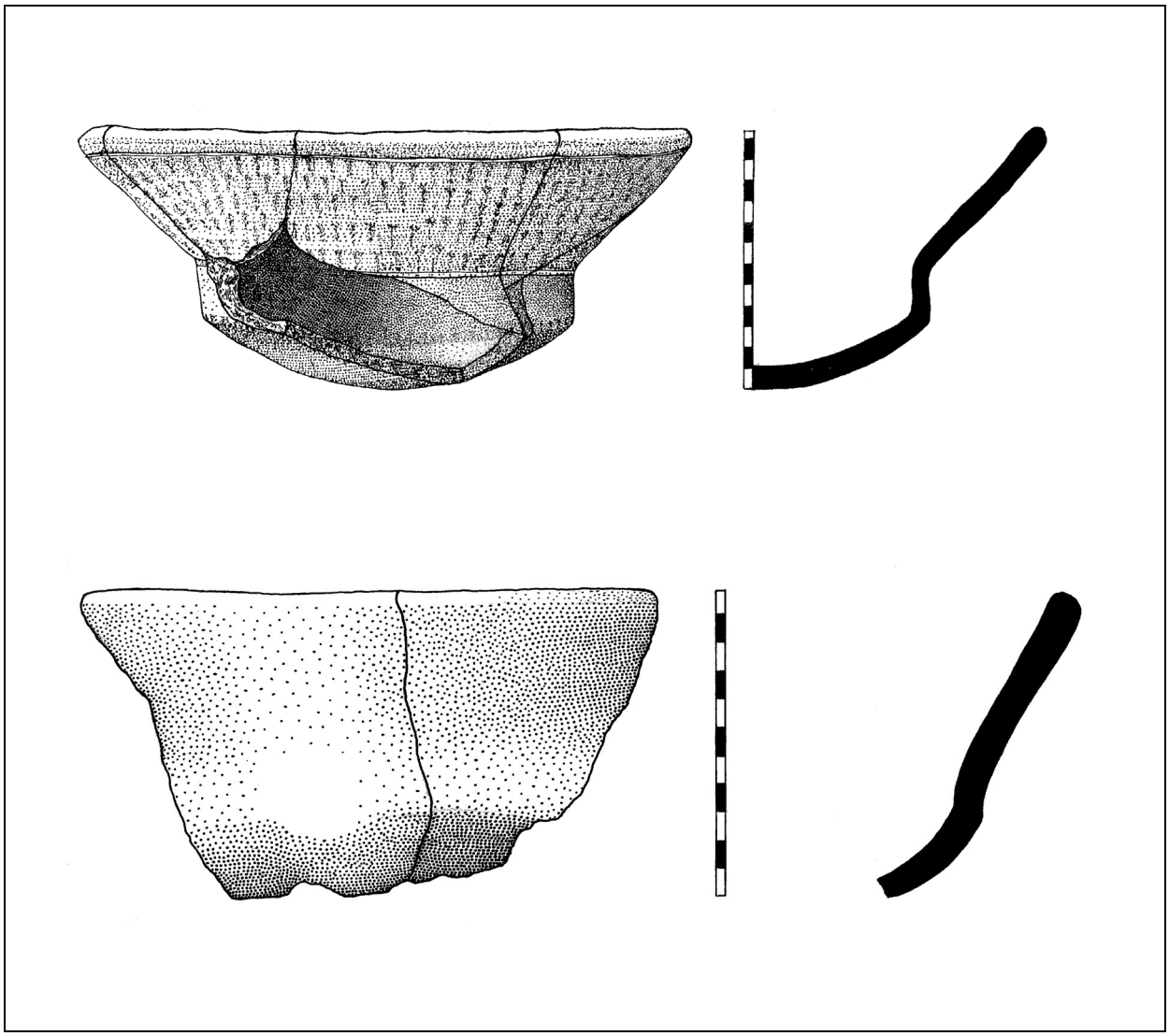


FIG. 192: Mortuary vessels. *Top*: cat. 891 B22 layer 7:6. A lightly burnished, decorated type L1h bowl. Smoothed and lightly burnished over a medium fine fabric. The central field is filled with coarse vertical cord marks bounded by incised lines 1 mm wide and 0.5 mm deep. Cord marks may also decorate the carination point. Dimensions: rim diam: 148 mm, carination point: 90 mm, height: 60 mm, to carination 15 mm, to inflection point 15 mm. thickness: 4.5–5 mm. Slab construction. High(?) biscuit-fired. The exterior is oxidized and includes minor fire clouds. The interior is reduced with oxidized rim 'flares" indicating that the vessel was fired upside down. FG3. Colour: 2.5YR/6/4 (oxidized), 2.5YR/4/2 (reduced). Quality: excellent, the decoration is skilfully applied. This vessel is unique in shape and decoration. *Bottom*: cat. 2029a B23 layer 7:6. A smoothed small utilitarian bowl with curved walls. The fabric is medium coarse. Dimensions: rim diam: 120 mm (est.), height: 65 mm (est.), thickness: 5 mm. Slab construction. Low biscuit fired and oxidized throughout. FG3. Colour: 2.5YR/6/6. Quality: average. Although the shape is uniform little attention has been paid to surface finish. Scale segments are 5 mm

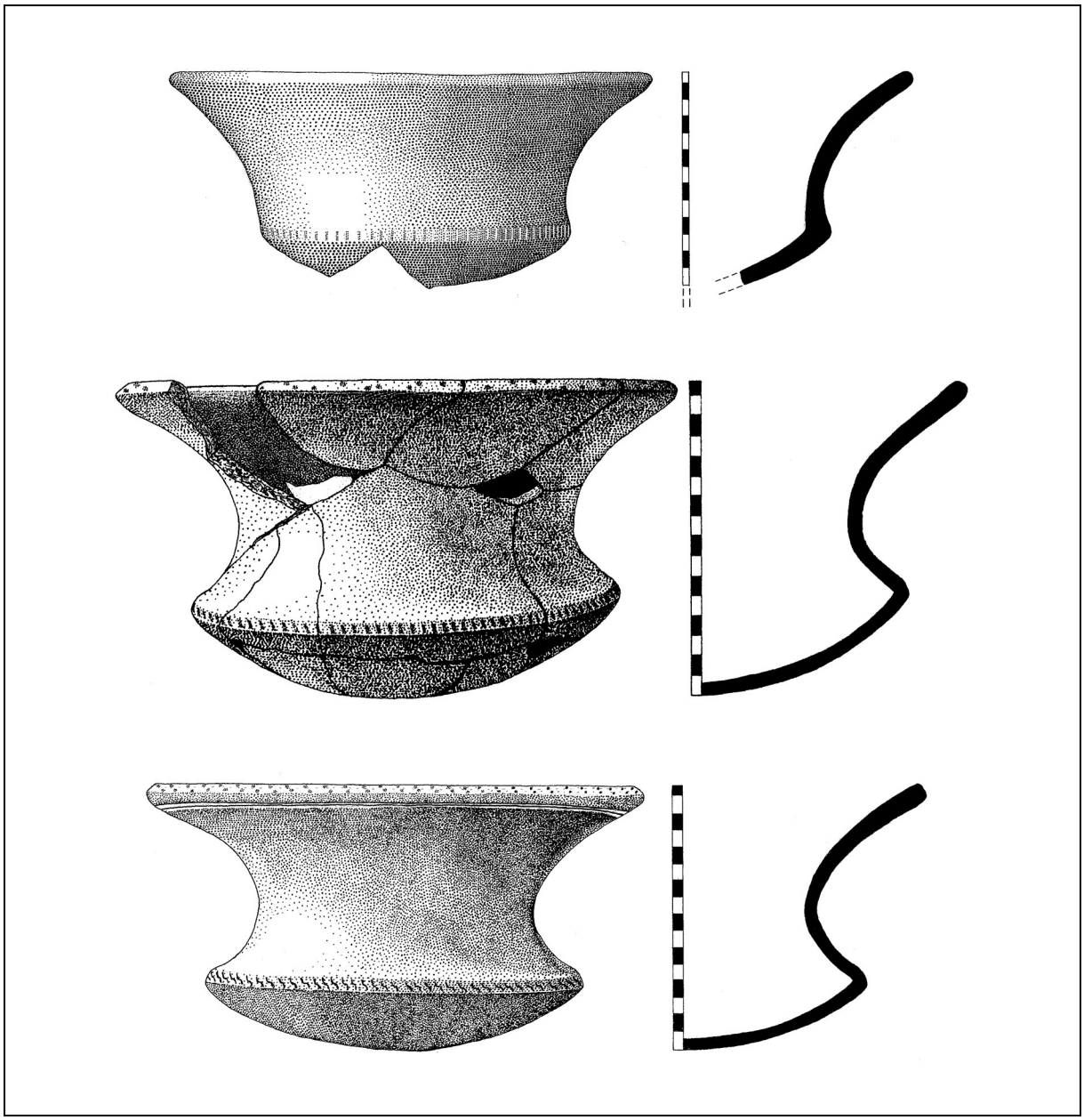


FIG. 193: Mortuary vessels. *Top*: cat. 884 B22 layer 7:6. A lightly burnished carinated burial jar with a medium fine fabric. The carination point is cord-marked. Dimensions: rim diam: 140 mm, carination point: 95 mm, height: 65 mm (est.), to carination 18 mm (est.), thickness: 3.5–5 mm. Slab construction. Biscuit-fired. Oxidized with extensive fire clouding. FG3. Colour: 2.5YR/6/6 (oxidized), 2.5YR/3.5/2 (reduced). Cord marks: "Z" 1.5/0.5-1 mm. Quality: excellent, except for imperfect carination decoration. About 80% was recovered. *Centre*: cat. 953 B20 layer 7:6. A moderately burnished carinated burial jar with a medium fine fabric. Obscure cord or stylus punctate impressions decorate the rim terminus. The carination point is cord-marked. Dimensions: rim diam: 141 mm, carination point: 105 mm, height: 80 mm, to carination 24 mm, thickness: 3–5 mm. Slab construction. High(?) biscuit-fired. Extensively oxidized. Fire clouds to interior and exterior. FG3. Colour: 2.5YR/5/4 (oxidized), 2.5YR/3/0 (reduced). Cord marks: "Z" 1/1 mm. Quality: excellent, only minor shape imperfections. Extensively shattered, about 80% was recovered. *Bottom*: cat. 2787 B20 layer 7:6. A burnished carinated burial jar with a medium fine fabric. The carination point has obscure (stylus?) punctate impressions. Two incised lines circuit below the rim. Dimensions: rim diam: 146 mm, carination point: 106 mm, height: 82 mm, to carination 32 mm, thickness: 3.5–5 mm. Slab construction. High(?) biscuit fired, oxidized with fire clouds at the rim. FG3. Colour: 2.5YR/5.5/4 (oxidized). Quality: Excellent. The shape and incising are near perfect. Extensively shattered, about 85% was recovered. Scale segments are 5 mm

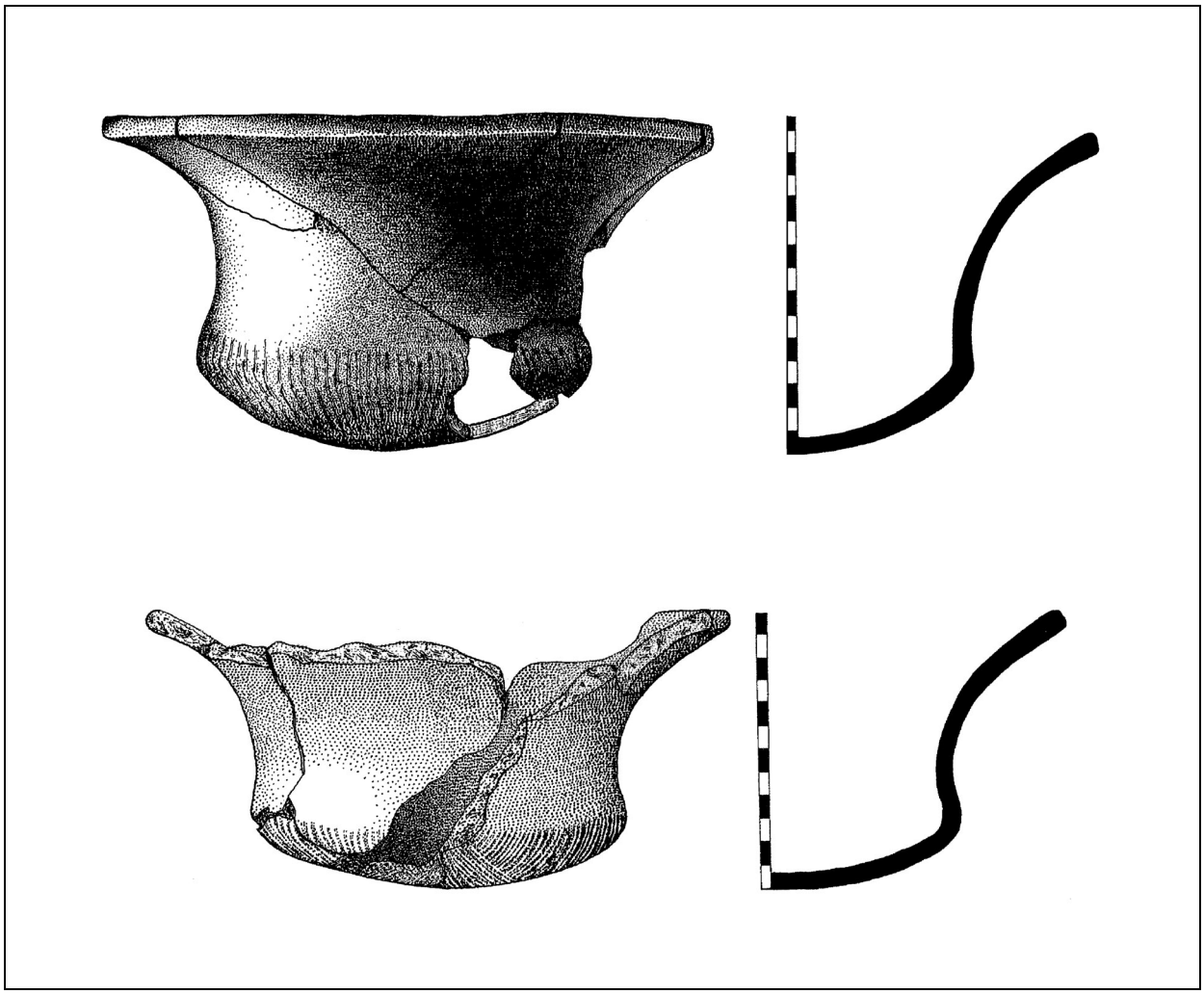


FIG. 194: Mortuary vessels. *Top*: cat. 1025 B35 layer 7:5. An exotic burnished carinated, type E2b, burial jar. Moderately burnished and cord-marked over a medium fine fabric. The base is completely decorated with cord marks. Dimensions: rim diam: 134 mm, carination point: 88 mm, height: 75 mm, to carination 27 mm, thickness: 3–4 mm. Slab construction. Biscuit-fired. The interior and exterior are completely reduced. FG17. Colour: 7.5YR/3/0 (reduced). Cord marks: "Z" 1/1 mm. Quality: very good, only marred by moderate shape distortions and somewhat careless burnishing. The cord marks are neatly arranged. Moderately shattered, about 80% of the vessel was recovered. *Bottom*: cat. 1026 B35 layer 7:5. An exotic smoothed carinated, type E2b, burial jar. The base is completely decorated with cord marks and the remainder only smoothed with no evidence of burnishing. Dimensions: rim diam: 122 mm, carination point: 78 mm, height: 57 mm, to carination 13 mm, thickness: 4.5–5 mm. Slab construction. Biscuit fired and reduced throughout. FG17. Colour: 7.5YR/3/0 (reduced). The cord marks are difficult to determine but probably a "Z" twist, 1/1 mm. Quality: The coarse fabric tends to present an overall substandard impression, however this is misleading because on closer inspection the vessel appears to have been quickly made by a competent potter. Minor shape and incising distortions. Although extensively shattered, about 75% of the sherds were recovered. Scale segments are 5 mm

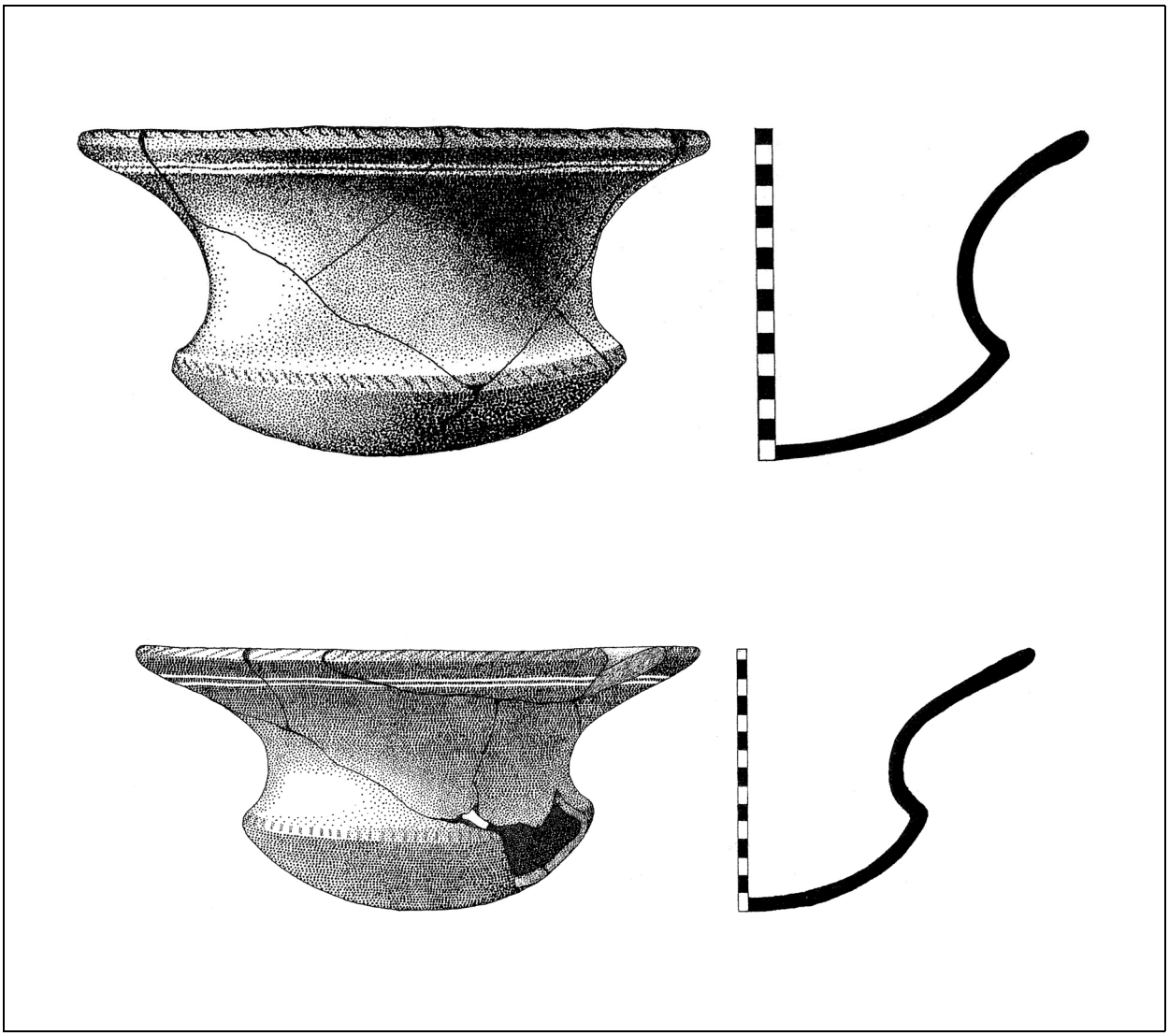


FIG. 195: Mortuary vessels. *Top*: cat. 2785 B16 layer 7:3. A burnished carinated burial jar. Carefully burnished over a medium fine fabric. Two incised lines circuit below the rim. The rim terminus and the carination point are decorated with *Anadara* shell impressions. Dimensions: rim diam: 152 mm, carination point: 108 mm, height: 78 mm, to carination 24 mm, thickness: 3–4 mm. Slab construction. High(?) biscuit-fired. Oxidized except for slight "smudging" to the interior rim surface and the exterior base. FG3. Colour: 5YR/5/4. Quality: excellent, with only very minor shape and incised line distortions. This vessel has several fractures, however, most sherds were recovered. *Bottom*: cat. 2786 B16 layer 7:3. A burnished carinated burial jar. The carination point and rim terminus are decorated with *Anadara* shell impressions. Carefully burnished over a medium fine fabric. Two incised lines circuit below the rim. Dimensions: rim diam: 150 mm, carination point: 94 mm, height: 70 mm, to carination 25 mm, thickness: 3–5 mm. Slab construction. High (?) biscuit fired and partially reduced. FG3. Colour: 5YR/4/3 to 5YR/3/2. Quality: Excellent, marred only by minor shape and incising distortions. Scale segments are 5 mm

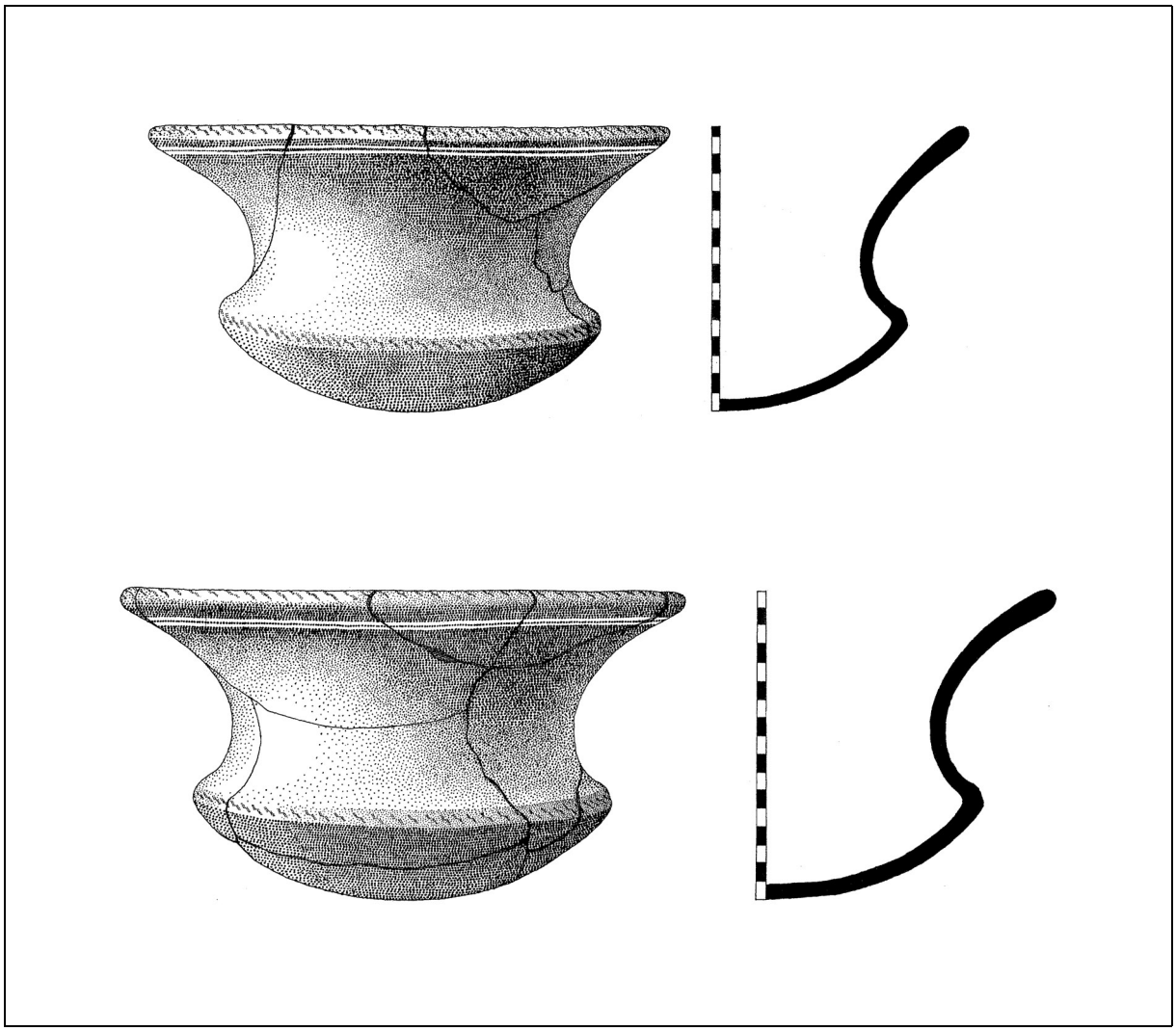


FIG. 196: Mortuary vessels. *Top*: cat. 933 B16 layer 7:3. A burnished carinated burial jar. Carefully burnished over a medium fine fabric. Two incised lines circuit below the rim. The rim terminus and carination point are decorated with *Anadara* shell impressions. Dimensions: rim diam: 142 mm, carination point: 107 mm, height: 82 mm, to carination 27 mm, thickness: 5 mm. Slab construction. High(?) biscuit-fired. The vessel is almost completely oxidized all over with only slight fire clouding to interior surfaces. FG3r. Colour: 5YR/5/4. Quality: excellent, only slight shape and incising distortions. Although badly fractured almost all of this vessel was recovered. *Bottom*: cat. 2784 B16 layer 7:3. A burnished carinated burial jar. Note that it is almost identical to cat. 933. A medium fine fabric. The carination point and rim terminus are decorated with *Anadara* shell impressions. Two incised lines, 1 mm wide, 0.5 mm deep, circuit below the rim. Dimensions: rim diam: 157 mm, carination point: 117 mm, height: 83 mm, to carination 28 mm, thickness: 4–5 mm. Slab construction. High(?) biscuit fired, oxidized throughout with slight smudges. FG3. Colour: 5YR/5.5/4. Quality: Excellent, the shape is near perfect and the incising only slightly irregular. Almost all of this vessel was recovered. Scale segments are 5 mm

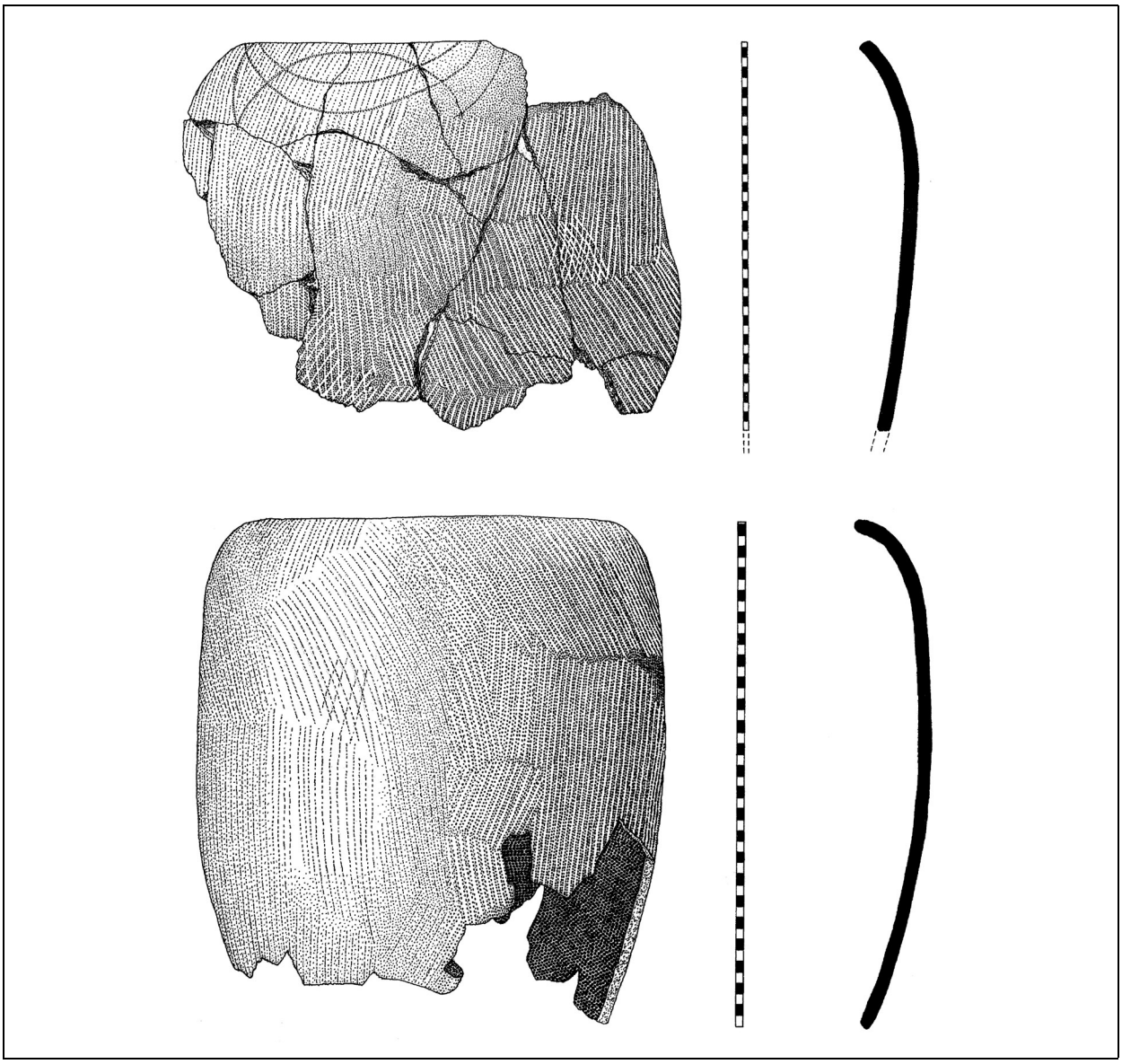


FIG. 197: Mortuary vessels. *Top*: 2783 B15 layer 7:2. A type L2j coarse storage jar. The base is missing. Roughly cord-marked over a moderately coarse fabric. Curvilinear incised lines, 1.5 mm wide, 0.5 mm deep, are located below the RF1a rim which was removed in prehistory. Dimensions: rim diam: 280 mm (est.), maximum body width: 320 mm (est.), height: 300 mm (est.), thickness: 8 mm. Slab construction. Low(?) biscuit fired, oxidized throughout with minor smudges. FG3f. Colour: 5YR/6/6. Cord marks: "Z" 1.5/0.5 mm. Quality: crudely made as for cat. 2794. Both vessels were completely shattered in prehistory and extremely difficult to reconstruct. *Bottom*: cat. 2794 B15 layer 7:2. This type L2j coarse storage jar represents the most numerous CP3 local pottery. Roughly cord-marked over a moderately coarse fabric. Anvil impressions are visible on the inside. The rim is folded completely over internally to form a hook shape in cross-section. Dimensions: rim diam: 160 mm (est.), maximum body width: 210 mm (est.). Height is unknown, but estimated at 300 mm, thickness: 6.5 mm. Slab construction. Low(?) biscuit-fired. Interior and exterior oxidized with small external fire clouds. FG3f. Colour: 2.5YR/6/4. Cord marks: "Z" 1.5/0.5 mm. Quality: irregular shape, probably quickly formed, with a brittle, easily fractured fabric. Scale segments are 5 mm

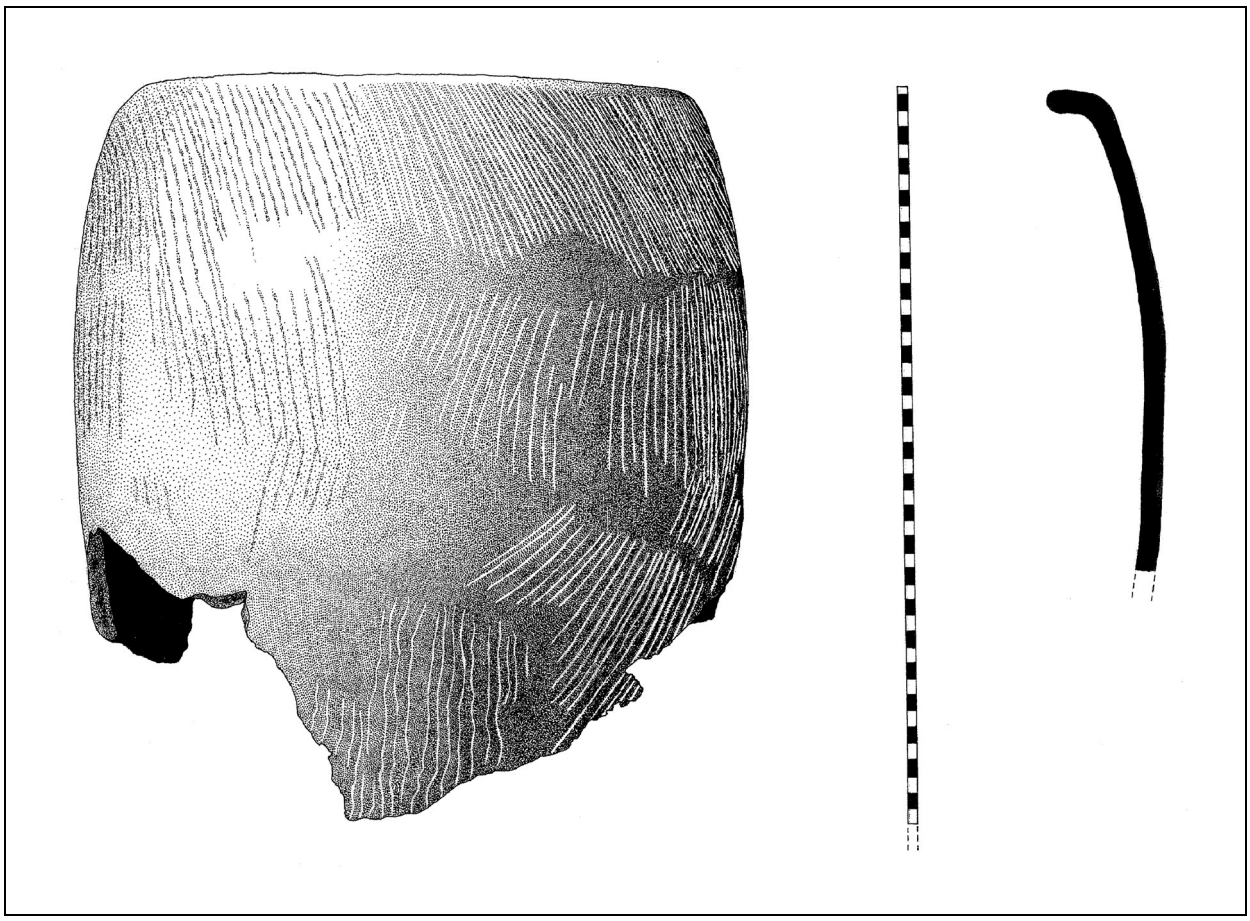


FIG. 198: Mortuary vessels. Cat. 809 B15 layer 7:2. A type L2j utilitarian storage jar. The base is completely missing or unable to be reconstructed (see text). The exterior surface is roughly cord-marked over a moderately coarse fabric. Anvil impressions are visible on the inside. The RF1 is folded completely over internally to form a hook shape in cross-section. Dimensions: rim diam: 205 mm (est.), maximum body width: 190 mm (est.). The total height is unknown, however it is estimated at 280 mm, thickness: 7 mm. Slab construction. Low(?) biscuit-fired. Both interior and exterior surfaces are oxidized. In section the exterior oxidation is 1.5 mm deep, the interior 1 mm, with a 4.5 mm black core. FG3f. Colour: 5YR/6/6. Cord marks: "Z" 2/1–1.5 mm gap. Quality: crude construction and irregular shape, obviously quickly formed. The fabric is brittle and easily fractured. Note that cat. 2794a (not illustrated) has the same overall characteristics as cat. 809. Dimensions: rim diam: 260 mm (est.), maximum body width: 240 mm (est.). The total height is unknown, however it is estimated at 300 mm, thickness: 5 mm. Slab construction. Biscuit-fired. The surfaces are oxidized over a black-cored fabric. Fire clouds near the interior base suggest the vessel was fired upside down. FG3f. Colour: 5YR/6/6 (oxidized), 5YR/4/2 (fire clouds). Cord marks: "Z" 1.5/1 mm. Scale segments are 5 mm

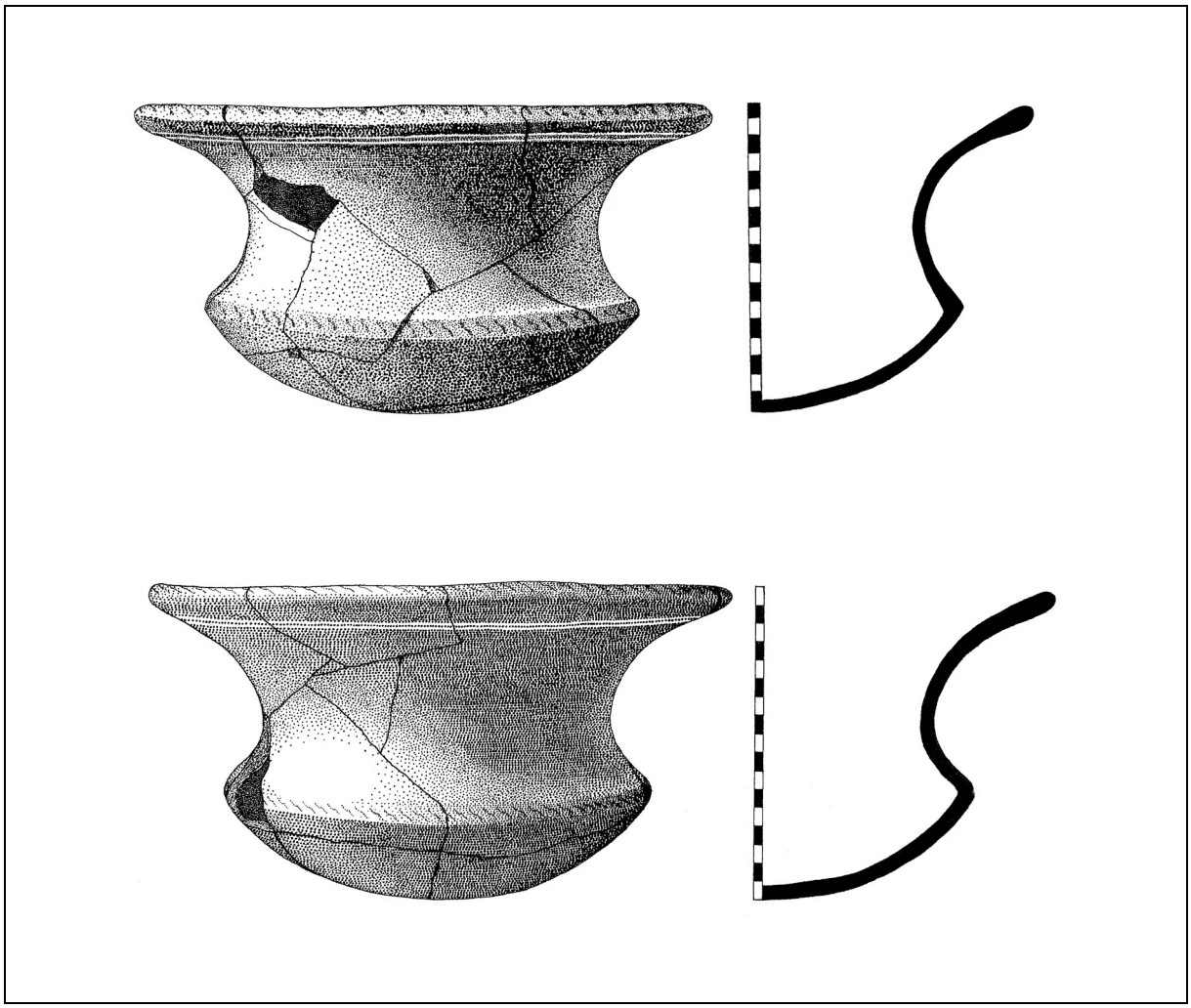


FIG. 199: Mortuary vessels. *Top*: cat. 2782 B15 layer 7:2. A burnished carinated burial jar. The carination point and rim terminus are decorated with *Anadara* shell impressions. A medium fine fabric. Two incised lines circuit below the rim. Dimensions: rim diam: 160 mm, carination point: 120 mm, height: 85 mm, to carination 30 mm, thickness: 3.5–5 mm. Slab construction (a join is clearly visible just below the carination point). High(?) biscuit fired (interior and upper exterior are reduced, lower exterior oxidized). Fired upside down. FG3. Colour: 5YR/5/4 (oxidized), 5YR/3/1 (reduced). Quality: Excellent, with a slight rim distortion. Although extensively shattered most fragments were recovered. *Bottom*: cat. 2781 B15 layer 7:2. A carinated burial jar. Highly burnished over a medium fine fabric. Two incised lines circuit below the rim. The rim terminus and the carination point are decorated with *Anadara* shell impressions. Dimensions: rim diam: 159 mm, carination point: 118 mm, height: 86 mm, to carination 33 mm, thickness: 3.5–4 mm. Slab construction. High(?) biscuit-fired. The interior is reduced, exterior base oxidized with small fire clouds to waist and base. Fired upside down. FG3. Colour: 5YR/5/4 (oxidized), 5YR/3/1 (reduced). Quality: excellent, only minor rim and incised line unevenness. Scale segments are 5 mm



FIG. 200: Mortuary vessel. Cat. 913 B15 layer 7:2. An outstanding vessel. The highly burnished fabric is medium fine. A complex series of decorative fields circuit the vessel. Incised lines, 1 mm wide, 0.5 mm deep, variously enclose geometric fields filled with meticulously applied vertical cord marks ("Z", 1.5/1-2 mm gap). These may be residual from the forming process because they are less prominent towards the rim which suggests that they were smudged during construction. Different cord marks ("Z", 1/0.5 mm gap), which angle slightly to the upper right, decorate the base. The rim terminus is decorated with *Anadara* shell impressions. Two incised lines are placed under the second field below the rim, three lines under the field immediately above the waist and a single line below the carination point. The second field above the carination lacks an upper enclosing line. Dimensions: rim diam: 281 mm, carination point: 218 mm, ring foot base: 118, height: 215 mm, to carination 85 mm, base height: 18 mm, thickness: 3–5 mm. Slab construction. High(?) biscuit-fired. The interior is reduced, the exterior below the carination is oxidized with prominent fire clouds and "flares". Fired upside down. FG3. Colour: 5YR/4/2 to 5YR/2.5/2. Quality: an outstanding creation. Although similar to some variants, the rim form is not prominent in the rim assemblage, which suggests that this vessel was reserved for a special function. It was extensively shattered within the grave (about 95% was recovered). The woman in B15 was interred with outstandingly rich grave goods. Scale segments are 5 mm

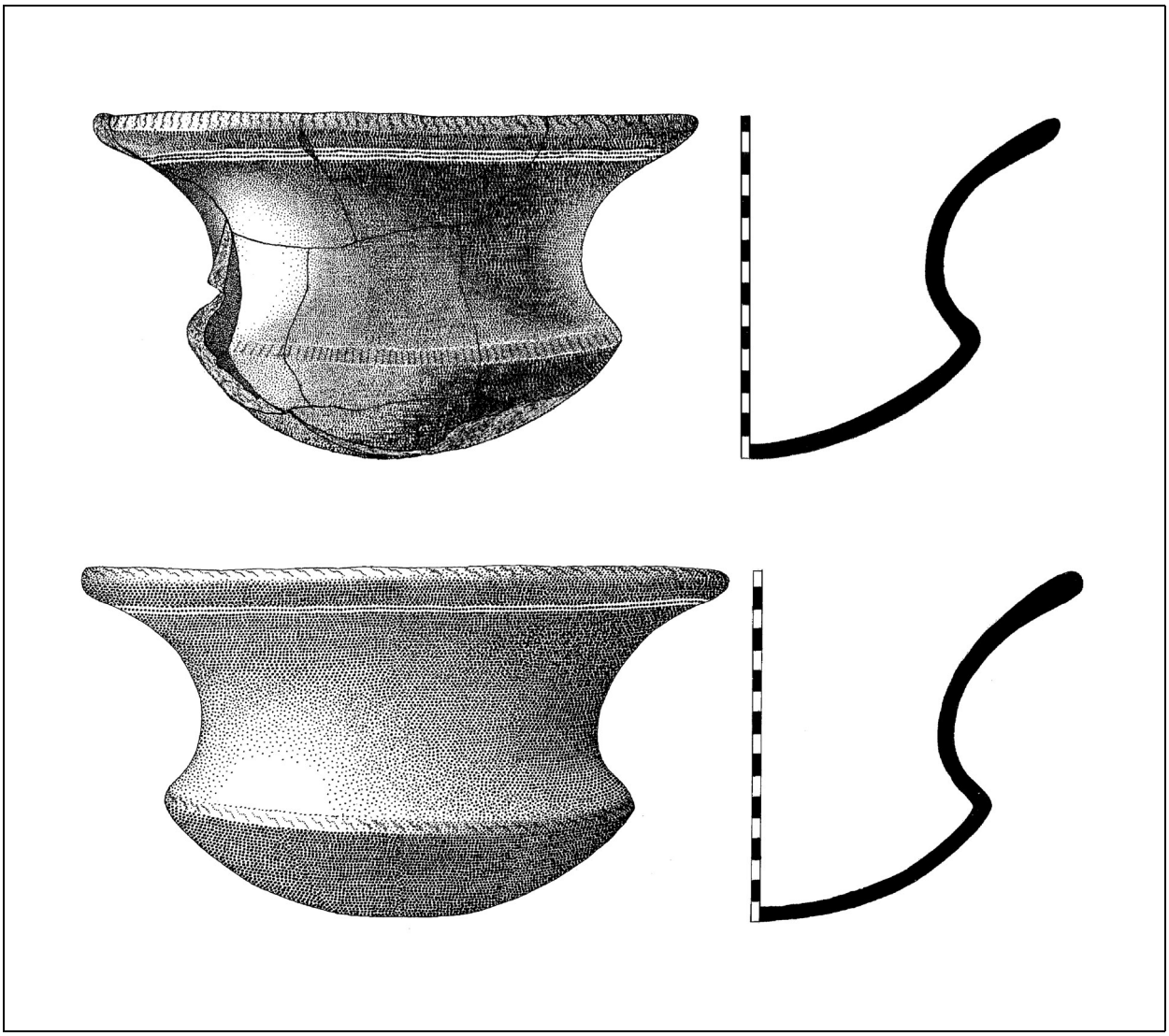


FIG. 201: Mortuary vessels. *Top*: cat. 787 B14 layer 6:7 A carinated burial jar. Highly burnished over a medium fine fabric. Three incised lines circuit below the rim. The carination point is decorated with possible cord marks. Dimensions: rim diam: 145 mm, carination point: 104 mm, height: 78 mm, to carination 28 mm, thickness: 4 mm. Probably slab construction. Biscuit-fired. The interior and exterior above the carination point are reduced. Below this is partially oxidized. Probably fired upside down. FG3r. Colour: 5YR/5/3 (oxidized), 5YR/3/2 (reduced). Quality: excellent shape and finish, the incised lines are slightly irregular. *Bottom*: cat. 912 B15 layer 7:2. A burnished carinated burial jar. The carination point and rim terminus are decorated with *Anadara* shell impressions. The fabric is fine. Two incised lines circuit below the rim. Dimensions: rim diam: 152 mm, carination point: 107 mm, height: 75 mm, to carination 24 mm, thickness: 3.5 mm. Slab construction? High(?) biscuit fired, oxidized throughout with one fire cloud. FG3. Colour: 5YR/5/4. Quality: Excellent. Although the incised lines are straight they just fail to meet exactly where they join. Extensively smashed. Scale segments are 5 mm

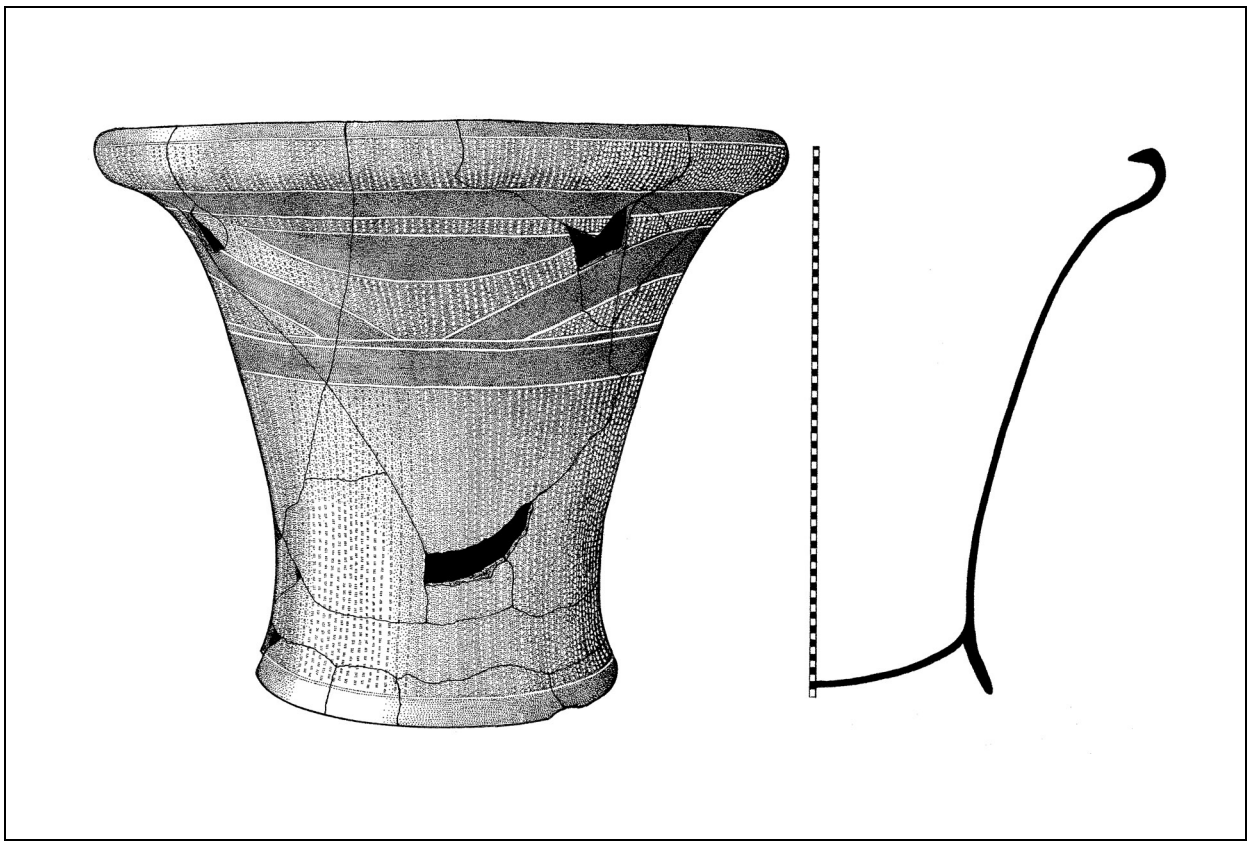


FIG. 202: Mortuary vessel. Cat. 853 B14 layer 6:7. An outstanding highly decorated funerary urn with a concealed flat base. This vessel is highly burnished over a medium fine fabric. The fields are decorated with meticulous vertically arranged rows of punctate impressions made with a stylus. On the large lower field they slant from vertical to 80° from the horizontal. Incised lines are 1 mm wide and 0.5 mm deep. Dimensions: rim diam: 422 mm, base: 231 mm, height: 344 mm, thickness: 4.5 mm. Slab and coil or ring construction. Biscuit-fired. The interior is just oxidized and the base is fire-clouded suggesting an upside down firing which was expertly controlled to produce a dark lustrous finish. FG3r. Colour: 2.5YR/6/6 (oxidized), 2.5YR/3/2 (reduced). Quality: excellent, a high energy vessel. This vessel and cat. 852 contained an infant about 12 months old. Scale segments are 5 mm

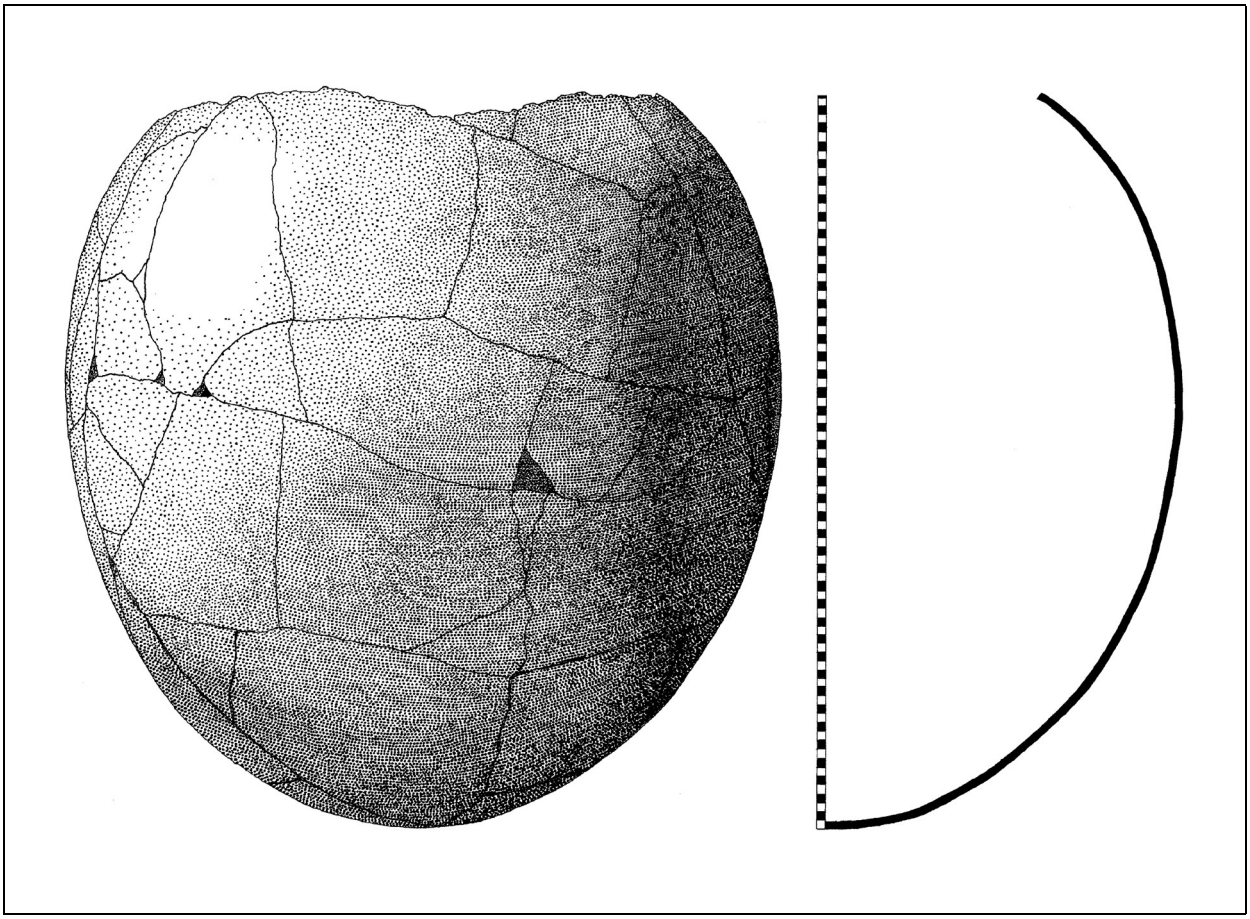


FIG. 203: Mortuary vessel. Cat. 852 B14 layer 6:7. An outstanding egg-shaped funerary urn lacking a rim (removed in prehistory). The exterior surface is smoothed (with some burnishing and probably red oxide colouring), over cord marks and a medium fine fabric. Dimensions: maximum width: 396 mm, height: 430 mm (est.), thickness: 4–6 mm. Slab construction. Biscuit-fired. The surfaces are oxidized with some external fire clouds above the equator probably due to contact with burning fuel. This pot was probably fired upside down. FG3r. Colour: 2.5YR/5/8 to 2.5YR/6/6 (oxidized interior), 10R/5/6 (exterior). Quality: excellent, a beautifully proportioned and finished vessel. It would be very difficult to manufacture. No effort appears to have been made to completely obliterate the cord marks. Coupled with cat. 853 this vessel contained an infant of about 12 months old. Scale segments are 5 mm

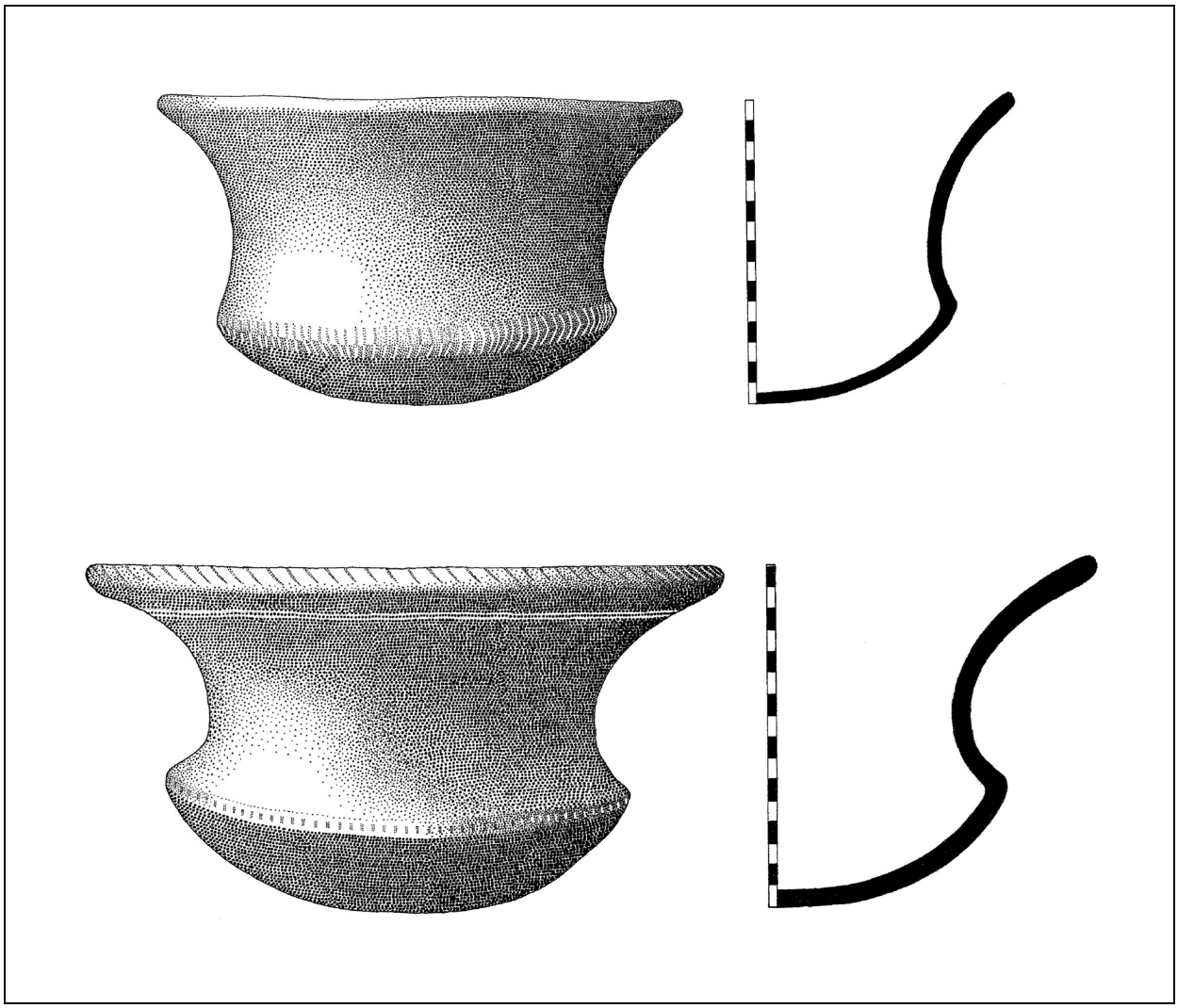


FIG. 204: Mortuary vessels. *Top*: cat. 823 B13 layer 6:5. A carinated burial jar. Highly burnished over a medium fine fabric. The carination point is decorated with cord marks. Dimensions: rim diam: 140 mm, carination point: 100 mm, height: 75 mm (est.), to carination 18 mm (est.), thickness: 5 mm. Slab construction? Biscuit-fired. Completely reduced except for rim terminus. FG3. Colour: 2.5YR/3/0. Cord marks: "S"(?) 1/0.6 mm. Quality: very good, the rim is slightly irregular. This vessel was severely shattered and only about 35% was recovered. *Bottom*: cat. 854 B14 layer 6:7. A carinated burial jar. Highly burnished over a medium coarse fabric. The carination point and rim terminus are decorated with *Anadara* shell impressions. Three incised lines circuit below the rim. Dimensions: rim diam: 153 mm, carination point: 107 mm, height: 78 mm, to carination 23 mm, thickness: 4–6 mm. Slab construction? High(?) biscuit fired, the interior is reduced and the exterior slightly oxidized. Fired upside down? FG3. Colour: 5YR/5/4 (oxidized), 5YR/2.5/1 (reduced). Quality: Excellent, although the incised lines are not straight. This vessel is almost a replica of cat. 787, B14. Scale segments are 5 mm

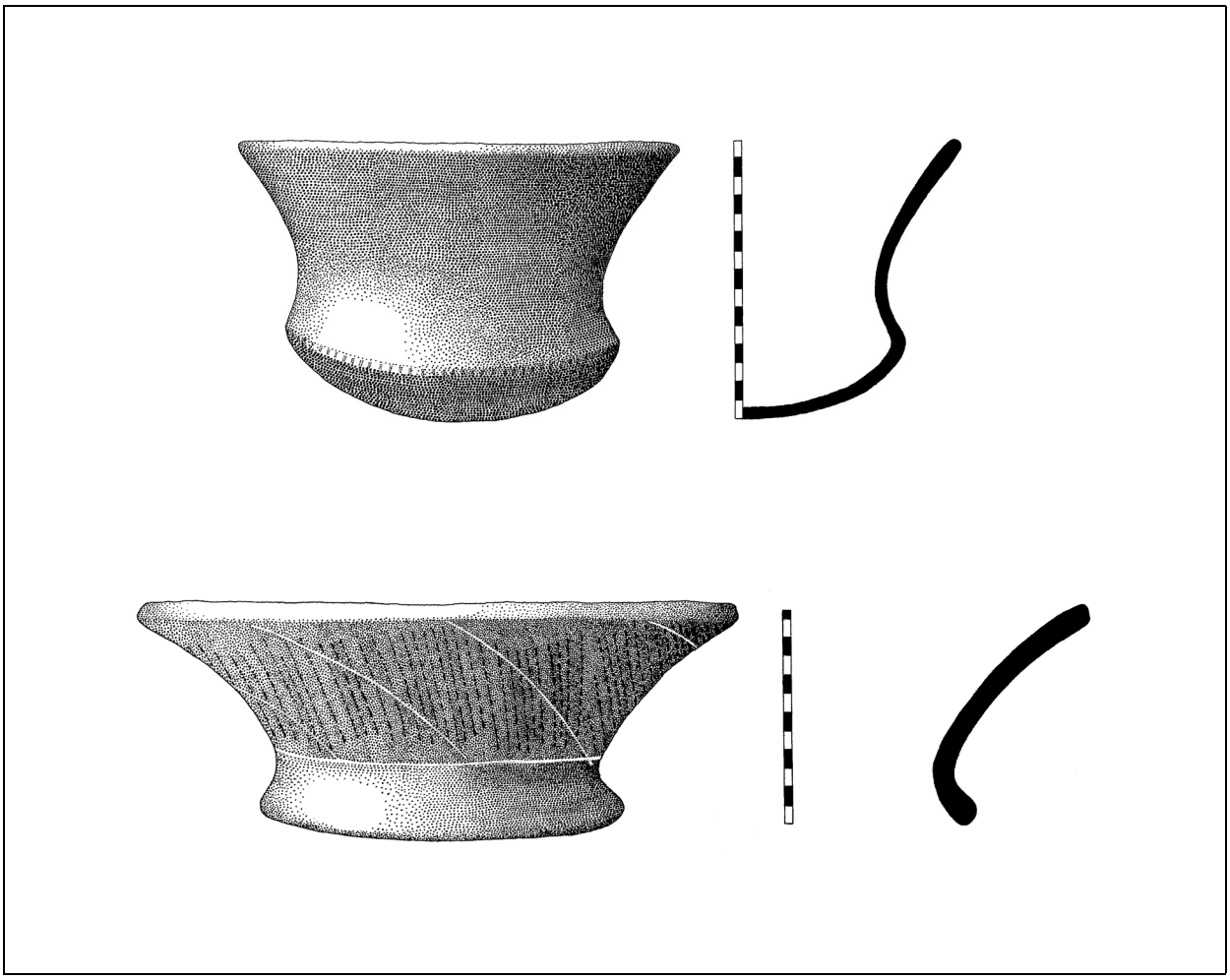


FIG. 205: Mortuary vessels. *Top*: cat. 819 B13 layer 6:5. A carinated burial jar. Highly burnished over a medium coarse fabric. The carination point is decorated with possible *Anadara* shell impressions, however, because the marks are blurred, this identification is uncertain. Dimensions: rim diam: 130 mm, carination point: 102 mm, height: 85 mm, to carination 26 mm, thickness: 4 mm. Slab construction. Biscuit-fired. Interior and exterior oxidized with a slight fire cloud. FG3. Colour: 5YR/6/3. Quality: excellent, only very slight shape irregularities. *Bottom*: cat. 820 B13 layer 6:5. A unique exotic pot stand constructed from a medium coarse fabric. The exterior is decorated with a single horizontal line at the waist and a series of diagonal incised lines curving upwards from it. The incisions are half round in section, 1 mm wide and 0.5 mm deep. Above the waist is cord-marked, below roughly smoothed. Dimensions: rim diam: 155 mm, base: 97 mm, height: 56 mm, thickness: 4–5 mm. Slab construction? Biscuit fired, oxidized throughout with very slight fire clouds to the "base". FG18. This fabric contains orthodox grog, shell and rice husk. Colour: 2.5YR/6/6 (oxidized). Cord marks: "Z" 1/1 mm. Quality: Very good, although the surface finish and decoration are rather crude. In addition serious shape and incising distortions detract from its overall appearance. Scale segments are 5 mm

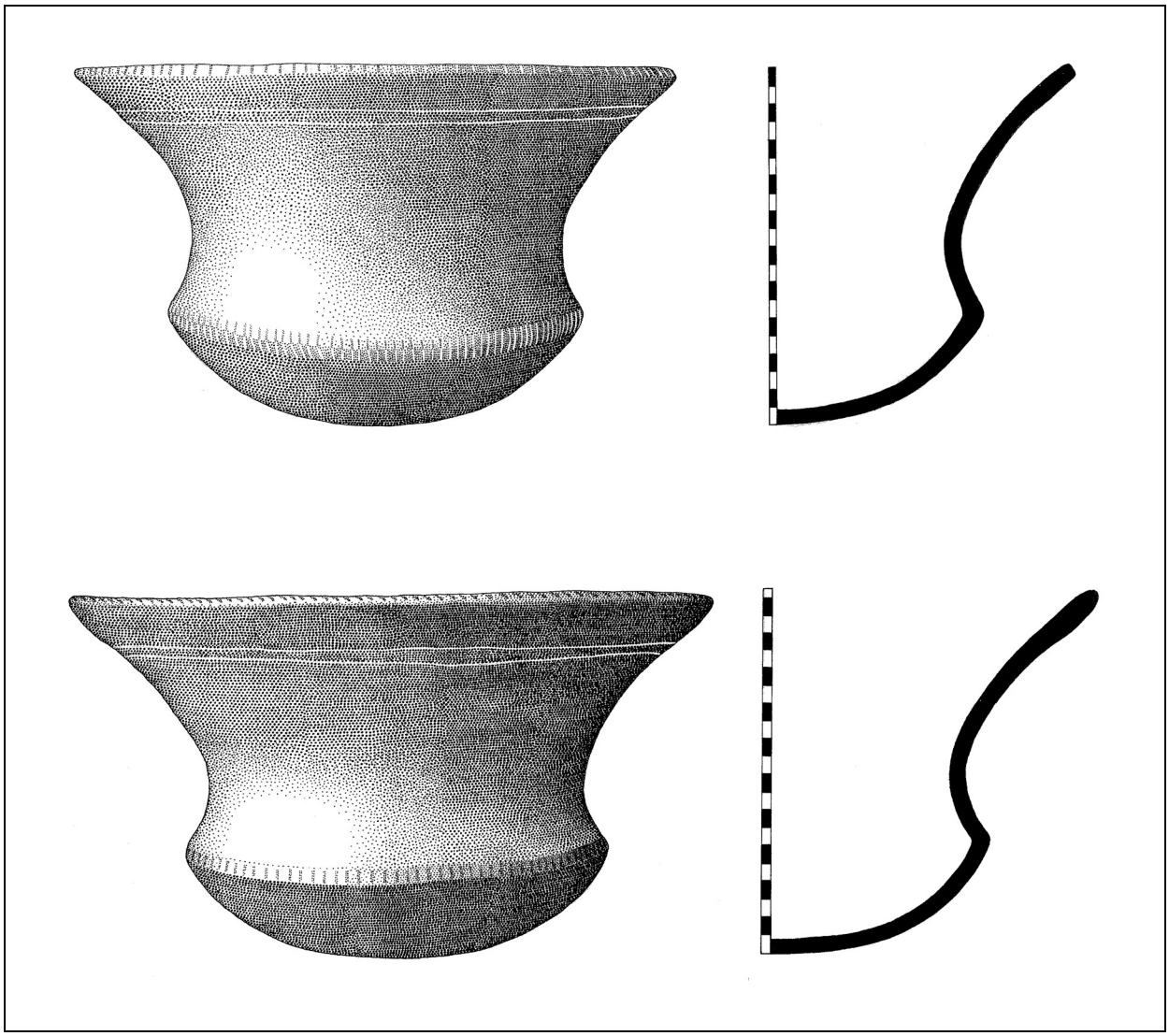


FIG. 206: Mortuary vessels. *Top*: cat. 763 B11 layer 6:4. An intact carinated burial jar. Carefully burnished over a moderately coarse fabric. The carination point and rim terminus are cord-marked(?). Two incised lines circuit below the rim. Dimensions: rim diam: 172 mm, carination point: 115 mm, height: 97 mm (est.), to carination 27 mm, thickness: 4 mm at rim edge. High(?) biscuit fired, the interior and exterior are reduced with a small oxidized area on the exterior base. Fired upside down? FG3. Colour: 5YR/5/3 (oxidized), 5YR/2.5/2 (reduced). Quality: Very good to excellent. The shape is almost perfect. *Bottom*: cat. 765 B11 layer 6:4. A carinated burial jar. Burnished over a medium coarse fabric. Two incised lines circuit below the rim. The rim terminus and carination point are decorated with possible *Anadara* shell impressions. Dimensions: rim diam: 185 mm, carination point: 120 mm, height: 105 mm (est.), to carination 35 mm (est.), thickness: 3 mm. Biscuit-fired and reduced throughout except the exterior base which displays a small oxidized area. Fired upside down? FG3. Slab construction? Colour: 2.5YR/5.5/4 (oxidized), 2.5YR/2.5/0 (reduced). Quality: Very good, the overall shape is excellent, however the incised lines are carelessly applied. Scale segments are 5 mm

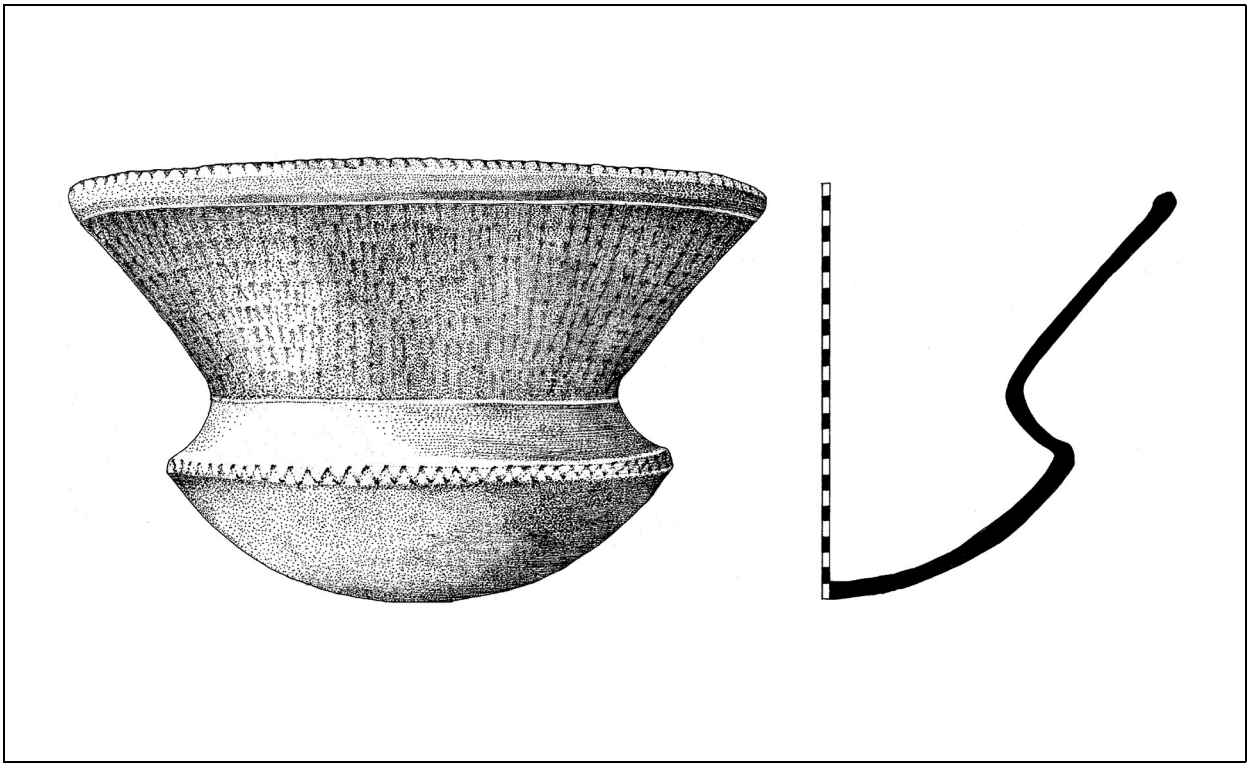


FIG. 207: Mortuary vessel. Cat. 764 B11 layer 6:3. A large intact carinated burial jar. Burnished and decorated over smoothed cord marks on a medium coarse fabric. An exterior field of vertical stylus marks (or a "S" twist corded paddle drawn across the surface), extends from just below the rim to the waist. The rim terminus and carination point are decorated with possible *Anadara* shell impressions. The burnished rim interior carries a running motif of stylised human figures (see frontispiece and Hall 1993, Fig.102:a 3:20), surrounded by fields of possible *Anadara* shell impressions. The human figures are traced with 1–2 mm wide, 0.5–1 mm deep, half round lines made with a stylus. Dimensions: rim diam: 226 mm, carination point: 160 mm, height: 137 mm, to carination 38 mm, thickness: 7 mm at rim edge. Biscuit-fired to a high standard, with a single minor shrinkage fissure. Almost completely oxidized with small fire clouds inside and out. FG3 (hand specimen). Colour: 2.5YR/5.5/6 (oxidized), 2.5YR2.5/0 (reduced). Quality: Outstanding. Although heavier and less refined than some vessels, its design, pristine condition, colour and careful construction set it apart. Scale segments are 5 mm

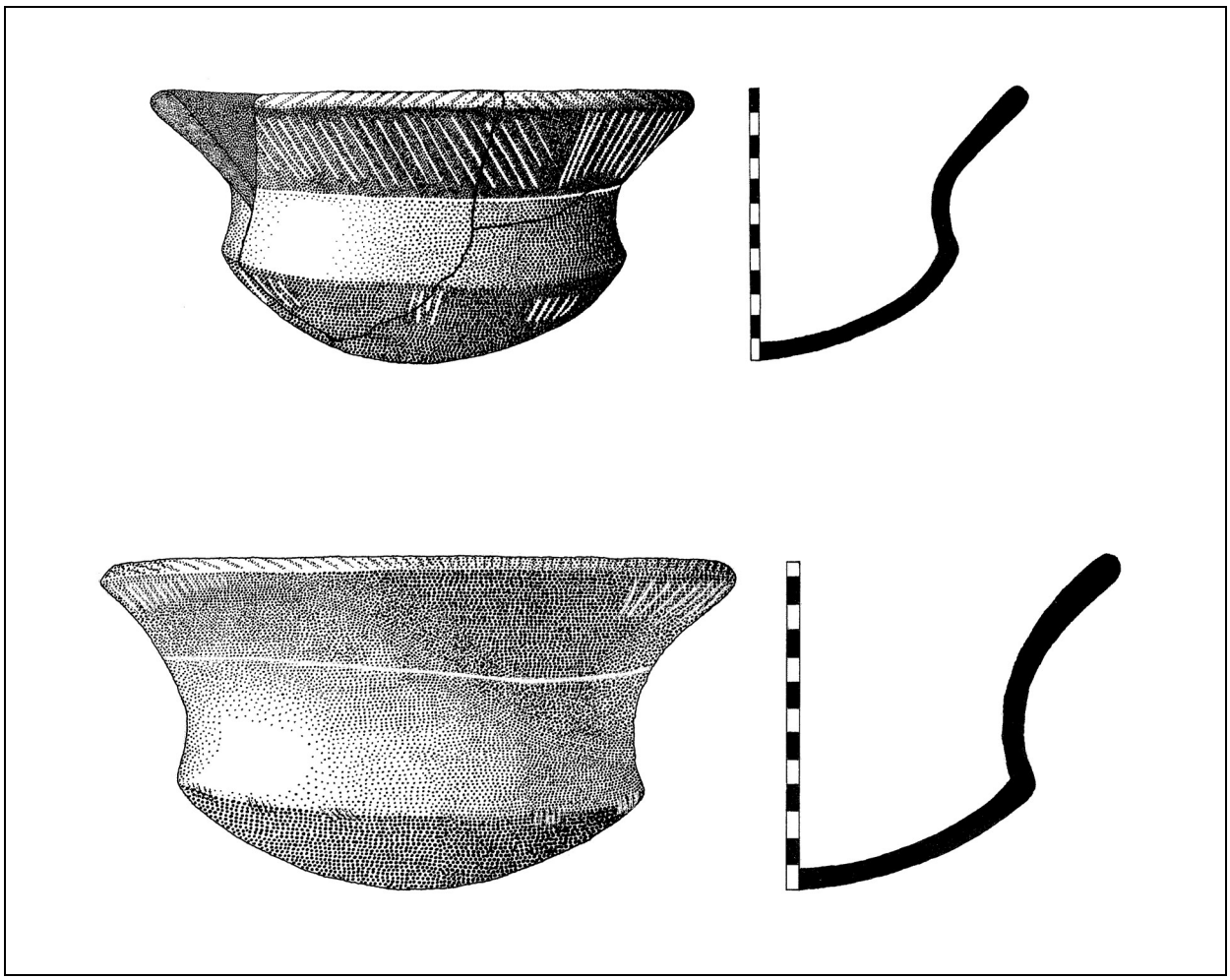


FIG. 208: Mortuary vessels. *Top*: cat. 794 B9 layer 6:3. A carinated burial jar. The surface is smoothed over cord marks on a medium coarse fabric. Cord marks slanted 28–30° fill above an incised line and mark the rim terminus. Dimensions: rim diam: 118 mm, carination point: 85 mm, height: 58 mm, to carination 23 mm, thickness: 5–6 mm. Slab construction? Biscuit-fired. A partially reduced interior and oxidized exterior with minor fire clouds. FG3r. Colour: 5YR/5/4 (oxidized), 5YR/4/2 (reduced). Quality: good to very good. *Bottom*: cat. 795, B9, layer 6:3. A carinated burial jar. The surface is smoothed over cord marks on a medium coarse fabric. The rim terminus is cord-marked and residual cord marks are visible on the carination point and above a (0.5 mm wide) horizontal incised line. Dimensions: rim diam: 120 mm, carination point: 84 mm, height: 58 mm, to carination 18 mm, thickness: 5 mm. Slab construction? Biscuit fired, oxidized exterior with slight fire clouds and a partially reduced interior. Fired upside down? FG3r. Colour: 5YR/5/4 (oxidized), 5YR/4/2 (reduced). Quality: good to very good. Scale segments are 5 mm

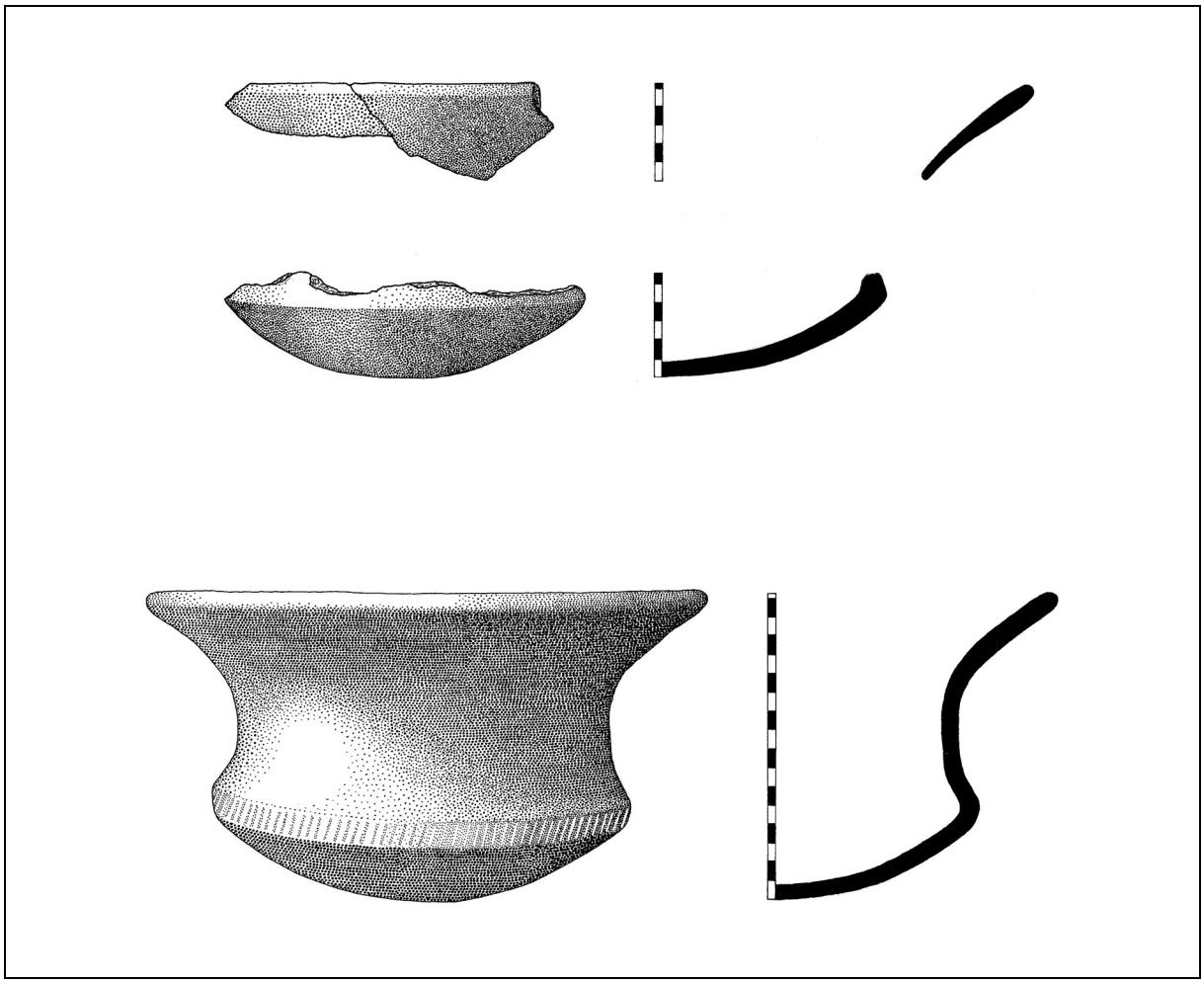


FIG. 209: Mortuary vessels. *Top*: cat. 740 B8 layer 6:3. A carinated burial jar. Burnished over a medium fine fabric. The carination point is probably decorated with cord marks. Dimensions: rim diam: 160 mm (est.), carination point: 98 mm (est.), height: no data, thickness: 4–5 mm. Biscuit-fired in a partially reducing atmosphere. FG3. Colour: 5YR/5/2. Quality: very good to excellent. Only the base and portions of the rim were recovered. *Bottom*: cat. 741 B8 layer 6:3. A carinated burial jar. Burnished over a medium fine fabric. Marks decorating the carination point were probably made with a cord-wrapped paddle. Dimensions: rim diam: 151 mm, carination point: 110 mm, height: 76 mm, to carination 20 mm, carination 4–5 mm, thickness: 5–6 mm. Slab construction? High(?) biscuit fired, reduced except for the exterior base. Fired upside down. FG3r. Colour: 5YR/3/1 (interior), exterior 5YR/5/4 (oxidized), 5YR/4/2 (reduced). Quality: Excellent – very good, with slight overall shape and rim irregularities. Scale segments are 5 mm

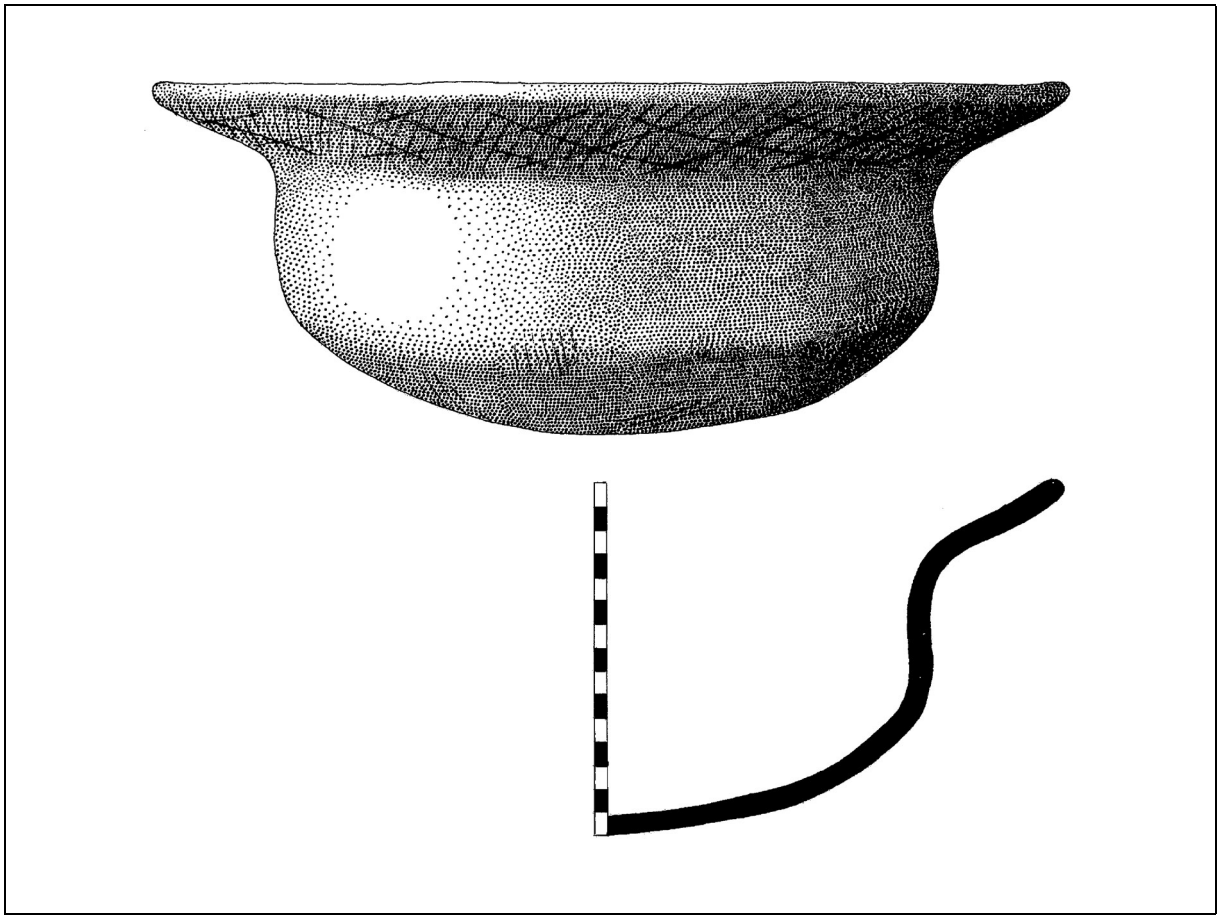


FIG. 210: Mortuary vessel. Cat. 697 B7 layer 6:3. A deep bowl with a wide, indirect, everted rim. Variously decorated with fields that are either moderately smoothed and burnished, cord-marked, *Anadara* shell or paddle impressed over a medium coarse fabric. Cross-hatched incised lines and paddle impressions(?) cover the exterior rim surface. Smoothed areas are moderately burnished on a medium coarse fabric. Running triangles, apexes pointing outwards and filled with *Anadara* shell impressions, decorate a band defined by gauged incised lines circuiting the rim interior. Residual cord marks are visible on the exterior surface of the bowl. Dimensions: rim diam: 198 mm, bowl: 138 mm, height: 82 mm, to inflection 52 mm, thickness: 3–4 mm. Slab construction. Biscuit-fired. Interior and exterior oxidized with minor smudging. FG3. Colour: 2.5YR/4/2. Quality: good to very good. Scale segments are 5 mm

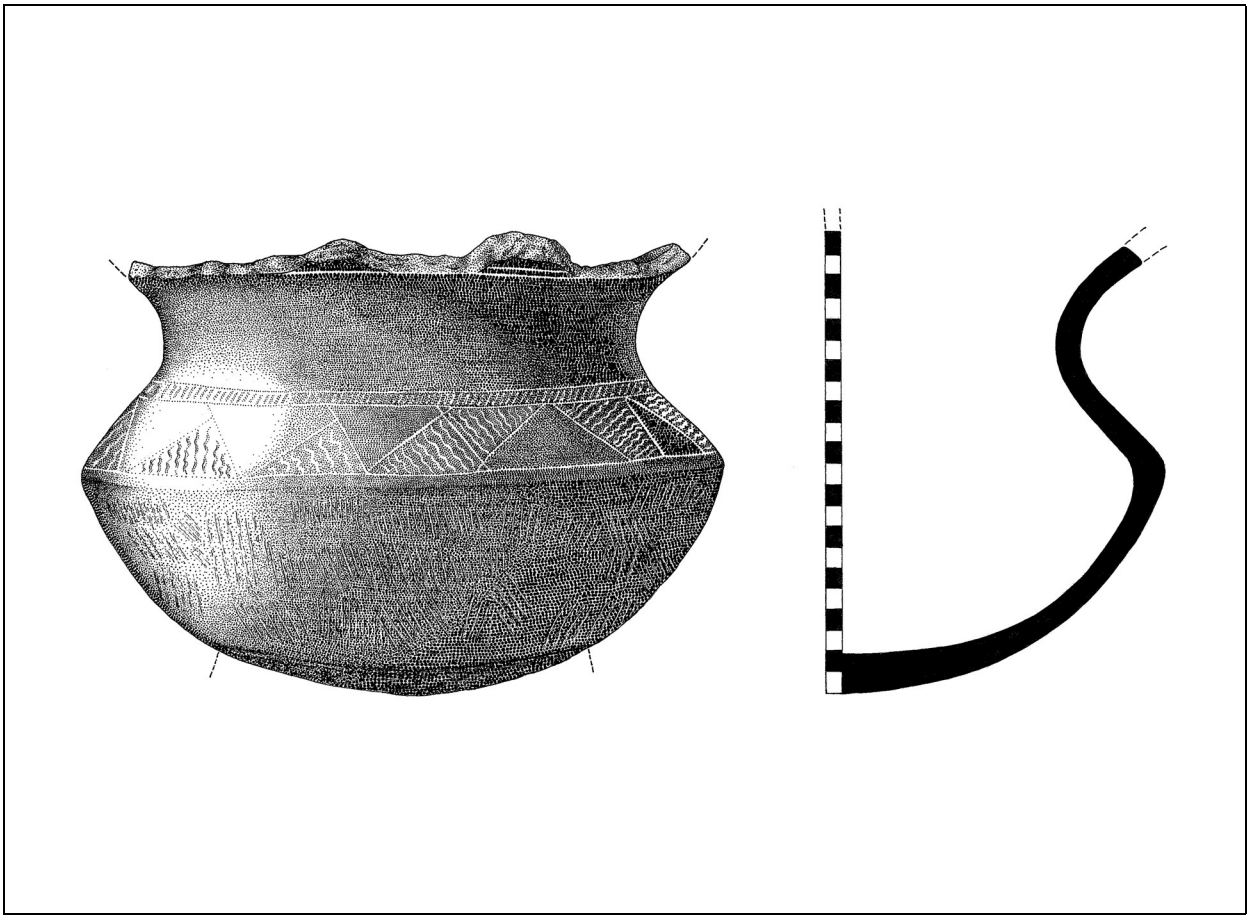


FIG. 211: Mortuary vessel: cat. 699 B2 layer 6:3. A carinated and footed jar. Above the carination point is smooth, burnished and decorated with triangles filled with *Anadara* shell impressions on a medium fine fabric. Most of the rim and all of the ring foot(?) base were removed in prehistory. The interior rim remnants are burnished. Below the exterior carination is decorated with mainly vertical cord marks. Two incised lines circuit the rim. Dimensions: rim diam: 150 mm (est.), carination point: 150 mm, height: 102 mm, to carination 60 mm, ring attachment marks diam: 92 mm, thickness: 5 mm. The walls thicken at the carination. Slab construction. Biscuit fired with minor fire clouds. FG3. Colour: 2.5YR/5/4 (oxidized). Cord marks: "Z" 1/0 mm. Quality: Very good, although the shape is not completely uniform and the decoration is imperfect. A moderate quality ornamental ware. Scale segments are 5 mm

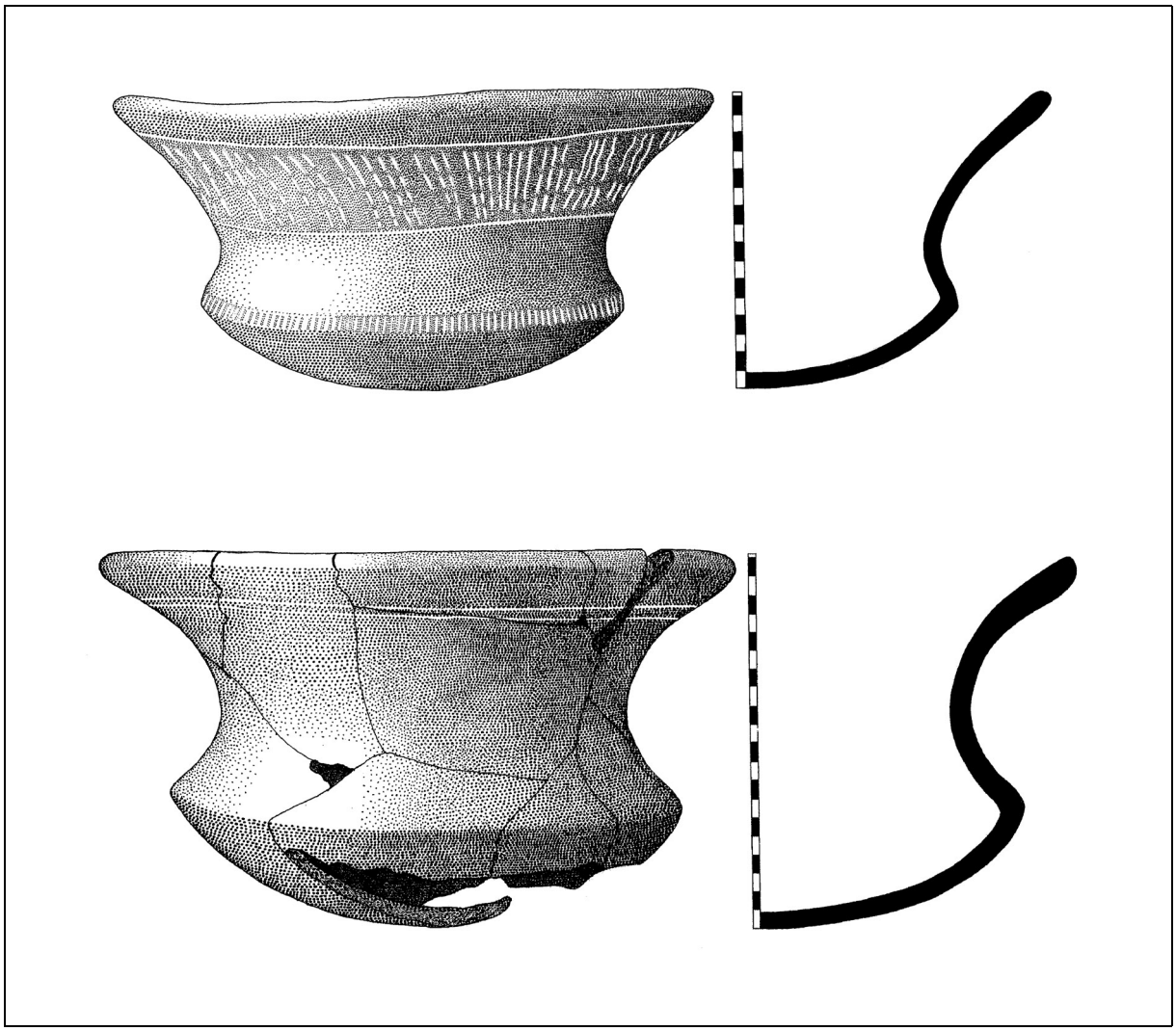


FIG. 212: Mortuary vessels. *Top*: cat. 979 B19 layer 5:2. A carinated burial jar. Smoothed and burnished(?) over a medium fine fabric. A *c.* 20 mm deep band filled with vertical scratch marks, 1.5 mm wide, 1–5 mm apart, circuits below the rim. The carination point is decorated with cord marks. Dimensions: rim diam: 165 mm, carination point: 106 mm, height: 78 mm, to carination 23 mm, thickness: 5 mm. Slab construction. Low(?) biscuit-fired and oxidized throughout. FG3r. Colour: 5YR/6/6. Half round incised lines are 1 mm wide, 0.5 mm deep. Cord marks: "Z" 1.5/1 mm. Quality: very good – excellent, with only a minor rim distortion. Although badly broken about 75% was recovered. *Bottom*: cat. 980 B19 layer 5:2. A carinated burial jar. Burnished over a medium fine fabric.The carination point is decorated with 1 mm wide by 0.25 mm deep stylus marks. Two incised lines circuit below the rim. Dimensions: rim diam: 167 mm, carination point: 129 mm, height: 98 mm, to carination 36 mm, thickness: 5 mm. Slab construction? High(?) biscuit fired, reduced throughout except for flares at the rim and carination. Fired upside down. FG3. Colour: 5YR/6/6 (oxidized), 5YR/4/ (reduced). Quality: Very good – excellent. Although badly broken about 90% was recovered. Scale segments are 5 mm

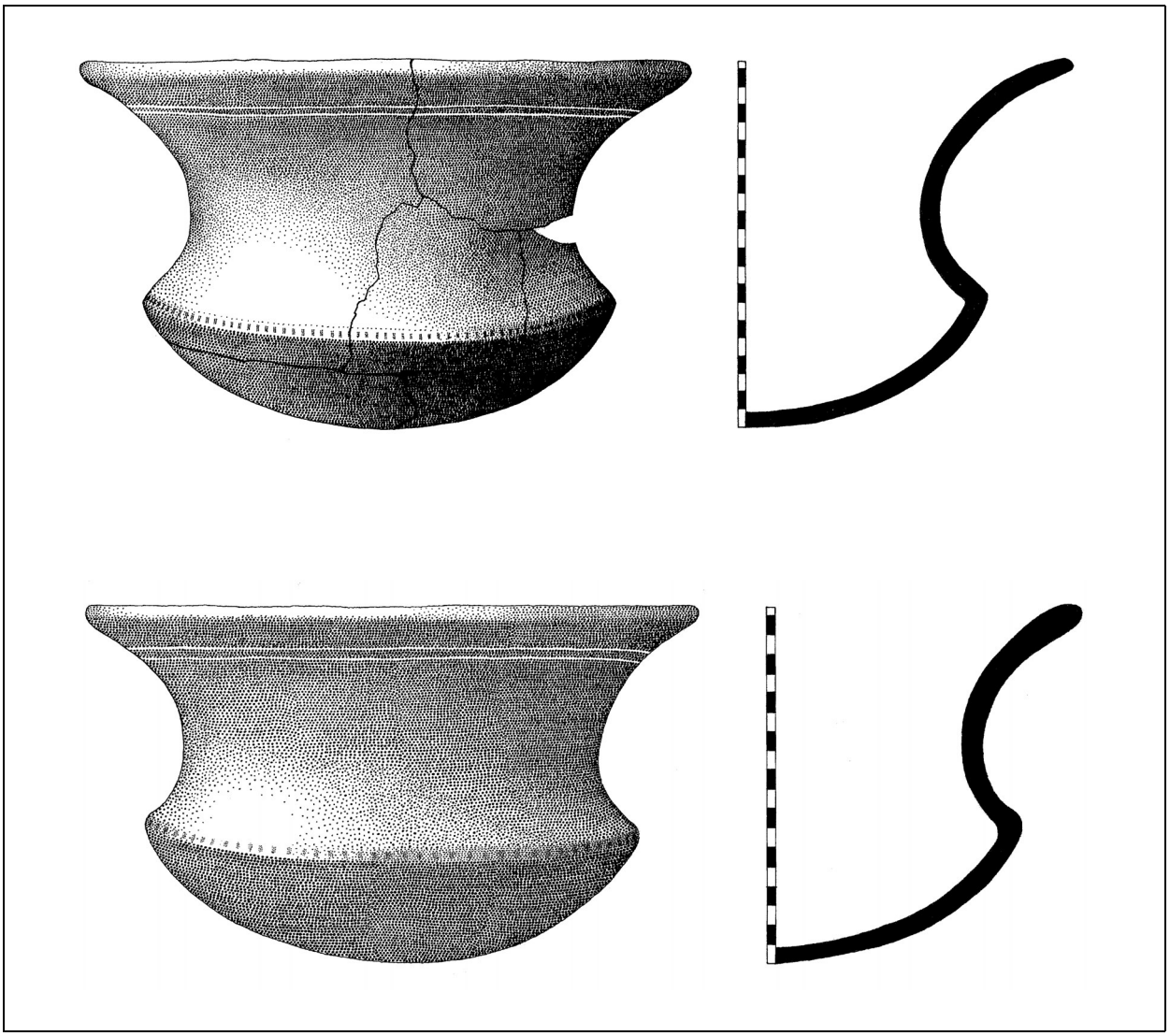


FIG. 213: Mortuary vessels. *Top*: cat. 977 B19 layer 5:2. A carinated burial jar. Burnished over a medium fine fabric. Two incised lines circuit below the rim. The carination point is decorated with *Anadara* shell impressions. Dimensions: rim diam: 168 mm, carination point: 130 mm, height: 97 mm, to carination 35 mm, thickness: 4–5 mm. Slab construction. High(?) biscuit-fired. The reduced interior and oxidized exterior indicate an upside down firing. FG3r. Colour: 7.5YR/5/2 to 7.5YR/3/2. Quality: excellent, only a few minor imperfections. Although badly broken, about 85% was recovered. *Bottom*: cat. 978 B19 layer 5:2. A carinated burial jar. Burnished over a medium fine to moderately coarse fabric. The carination point is probably decorated with *Anadara* shell impressions. Two incised lines circuit below the rim. Dimensions: rim diam: 180 mm (est.), carination point: 130 mm, height: 95 mm, to carination 30 mm, thickness: 5–7 mm. Slab construction. Moderately high(?) biscuit fired with an oxidized exterior, except for small fire clouds, and a reduced interior, except for rim flares. Fired upside down. FG3r. Colour: 5YR/5/3 (oxidized), 5YR/3/1 (reduced). Quality: Excellent, only minor imperfections. Although badly broken, about 55% was recovered. Scale segments are 5 mm

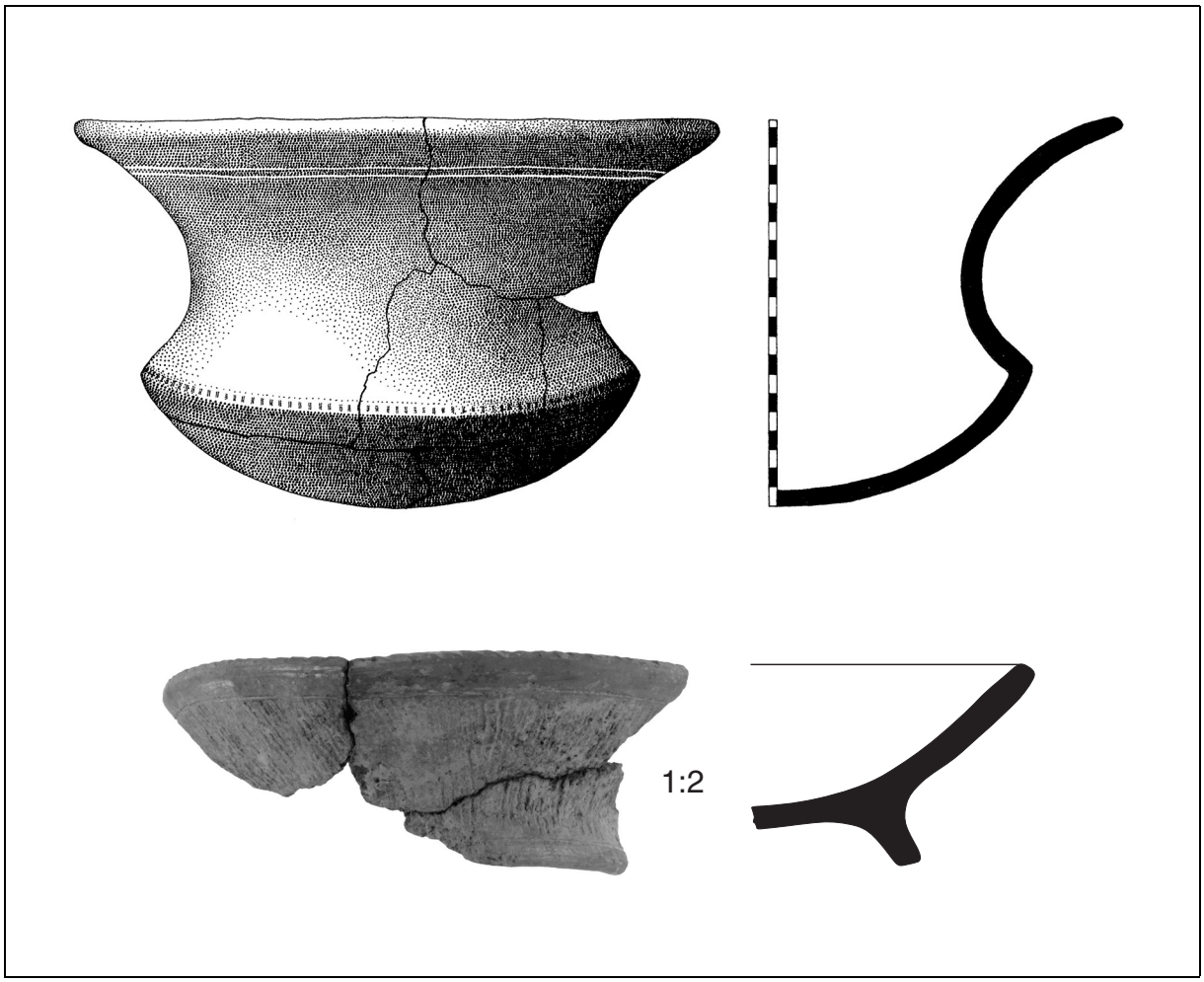


FIG. 214: Mortuary vessels. *Top*: cat. 3263 B19 layer 5:2. A carinated burial jar. Burnished over a medium fine fabric. Two incised lines circuit below the rim. The carination point is decorated with notches made with shaft of a round stylus. Dimensions: rim diam: 162 mm, carination point: 110 mm (est.), height: 88 mm, to carination 27 mm, thickness: 7 mm. Slab construction. High(?) biscuit-fired. Reduced interior and partly oxidized exterior indicate an upside down firing. FG3r? Colour: 2.5YR/6/4 to 2.5YR/3/4. Quality: excellent, only a few minor imperfections. Although badly broken, about 45% was recovered. Scale segments are 5 mm. *Bottom*: cat. 3264 B18 layer 5:2. An everted footed type L1i bowl. Burnished over a medium fine fabric. The rim terminus has decorative notches made with shaft of a round stylus. Two incised lines define a field filled with vertical paddle impressions. Dimensions: rim diam: 160 mm, ring foot: 110 mm, height: 42 mm, to bowl floor 20 mm, thickness: 5–7 mm. Slab construction. Moderately high(?) biscuit fired and oxidized except for small fire clouds. Fired upright. FG11?. Colour: 7.5YR/6/4. Quality: Excellent (only minor imperfections). About 45% was recovered. Scale: 1:2

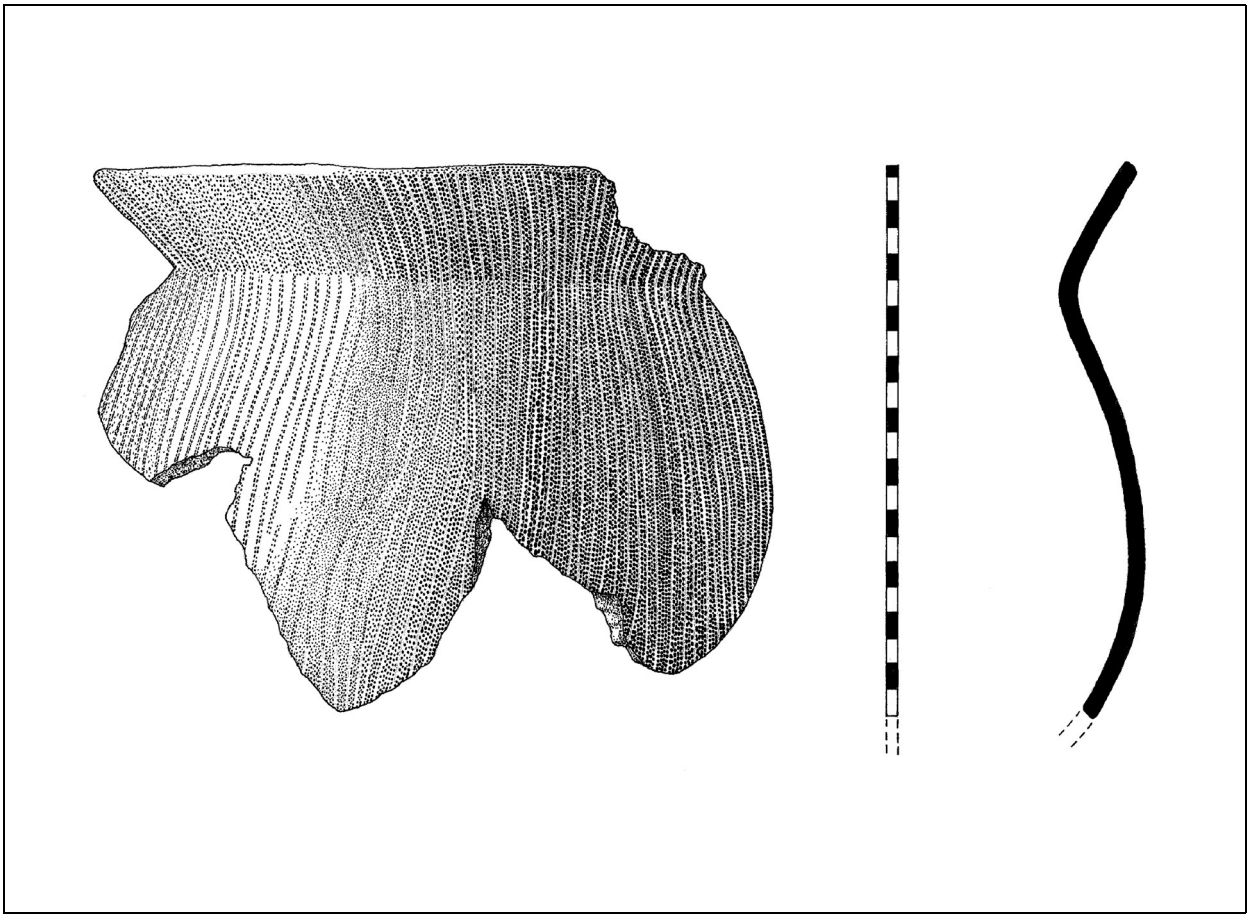


FIG. 215: Mortuary vessel. Cat. 618 B1 layer 6:1. A cord-marked jar. The interior is smooth over a medium coarse fabric. Anvil marks are visible on the interior wall surfaces. Dimensions: rim diam: 90 mm, height: 125 mm (est.), thickness: 5 mm. The rim has been formed as a continuation of the walls. Slab construction. Biscuit-fired. The interior and exterior surfaces are oxidized with some slight smudges to the exterior, with 2 mm of the central core remaining unoxidized and black. FG3. Colour: 2.5YR/5/8 (more red than yellow). The cord marks slant about 5° to the right on the walls and are cross-hatched on the base ("Z" 2/1 mm). Quality: a well proportioned utilitarian vessel made with considerable potting skill. Most of this vessel was recovered. Scale segments are 5 mm

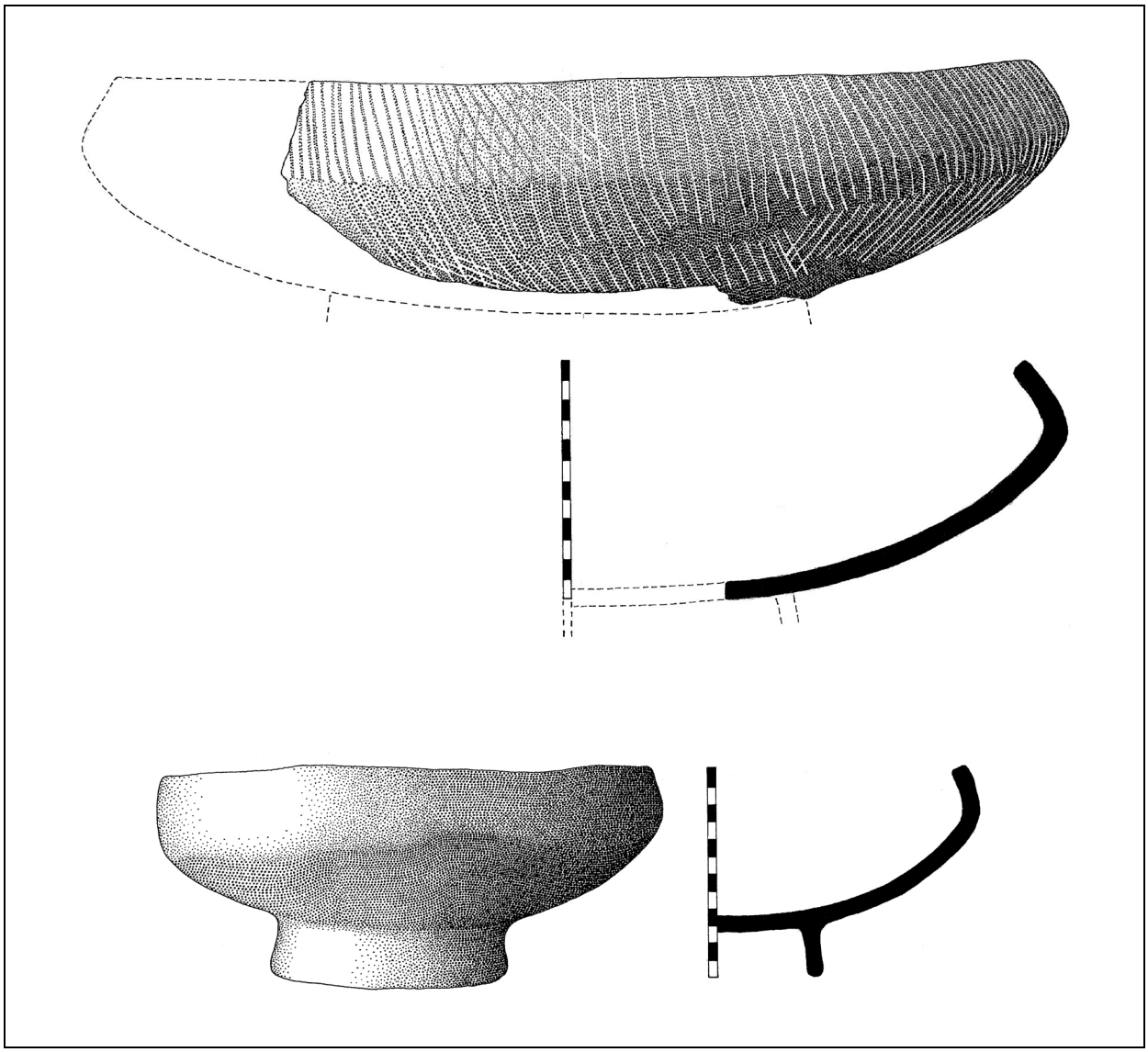


FIG. 216: Mortuary vessels. *Top*: cat. 619 B1 layer 6:1. A cord-marked ring-footed coarse ware bowl. The interior has been carefully smoothed over a medium coarse fabric. Dimensions: rim diam: 260 mm, diameter of base attachment marks: 80 mm (est.), height: 60 mm (est.), thickness: 5–7 mm. The rim has been formed as a continuation of the walls. Slab construction? Biscuit-fired with some slight smudges to the exterior and 3 mm of the central core remaining unoxidized and black. FG3f. Colour: 5YR/6/3. The cord marks slant about 10° to the left on the walls and are cross-hatched on the base ("Z" 1/1.5 mm). Quality: a utilitarian vessel which is well proportioned and displays obvious potting skills. *Bottom*: cat. 702 B12 layer 5:3. A footed utilitarian bowl. The surfaces are smoothed over cord marks. Dimensions: rim diam: 142 mm, base: 68 mm, overall height: 59 mm, base height 17 mm, thickness: 5 mm (walls), 6 mm (base). Slab construction? Biscuit-fired, oxidized with a small internal fire cloud and 3 mm of the core remaining black. Fired upside down? FG3. Colour: 5YR/7/6. Residual "Z" cord marks. Quality: average with shape distortions. The base is 9 mm off centre. Scale segments are 5 mm

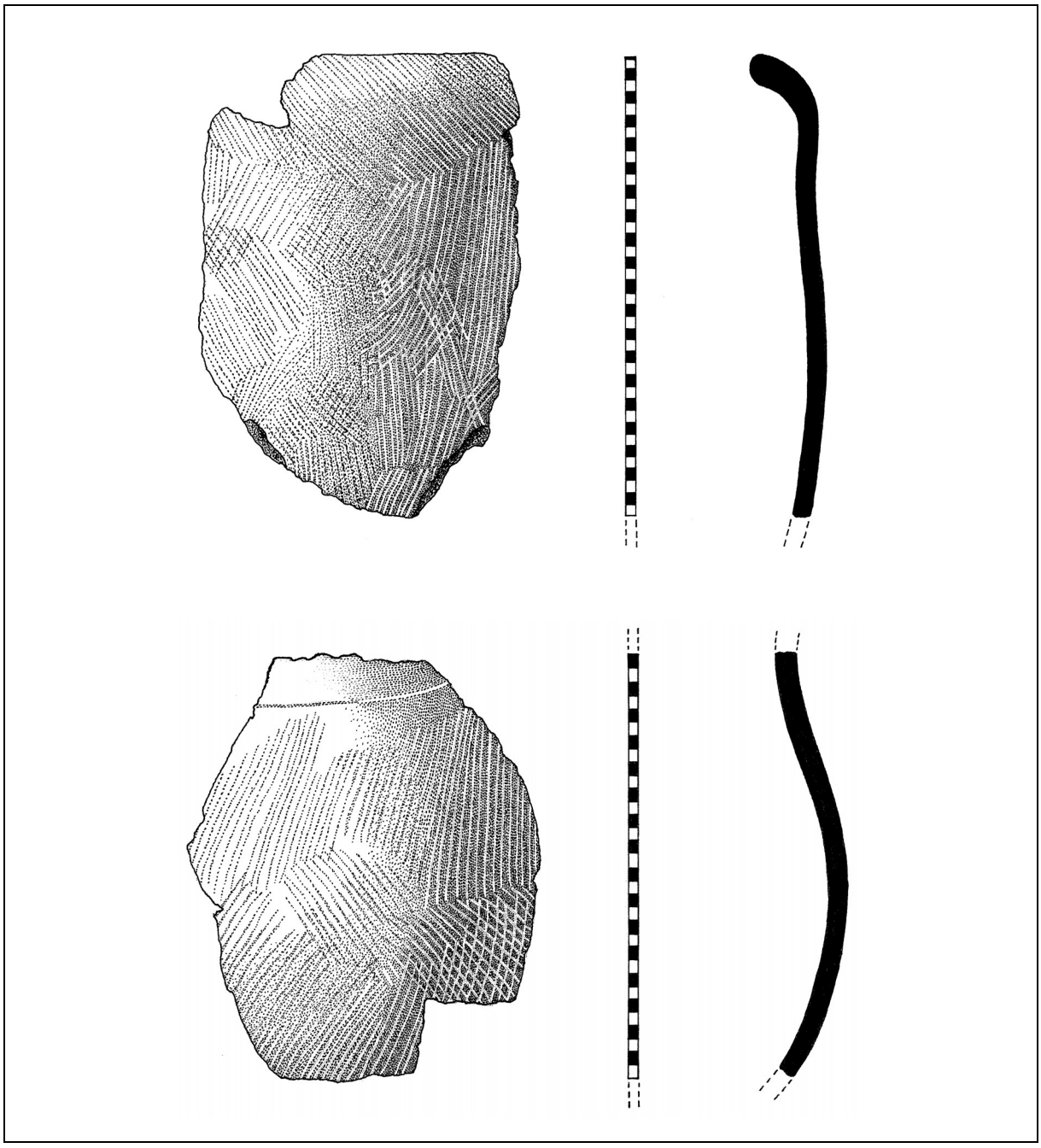


FIG. 217: Mortuary vessels. *Top*: cat. 701 B12 layer 5:3. Part of a CP3 RF1 coarse ware storage jar. Roughly cord-marked over a medium coarse fabric. The dimensions could not be determined. Thickness:7 mm. Slab construction? Biscuit-fired, and oxidized throughout. FG4r. Colour: 5YR/6/4. Cord marks: "Z" 1.5/1.5–2 mm. Quality: a crudely made utilitarian jar with cross-hatched cord marks. *Bottom*: cat. 703 B12 layer 5:3. Part of a coarse ware jar. Roughly cord-marked over a medium coarse fabric. The interior and exterior above an incised line, 1.5 mm wide, 0.5 mm deep, is smooth. The dimensions could not be determined. Thickness:6–7 mm. Biscuit fired and oxidized throughout. FG3. Colour: 5YR/6/4. Cross-hatched cord marks cover the exterior: "Z" 1/1 mm. Quality: average. Scale segments are 5 mm

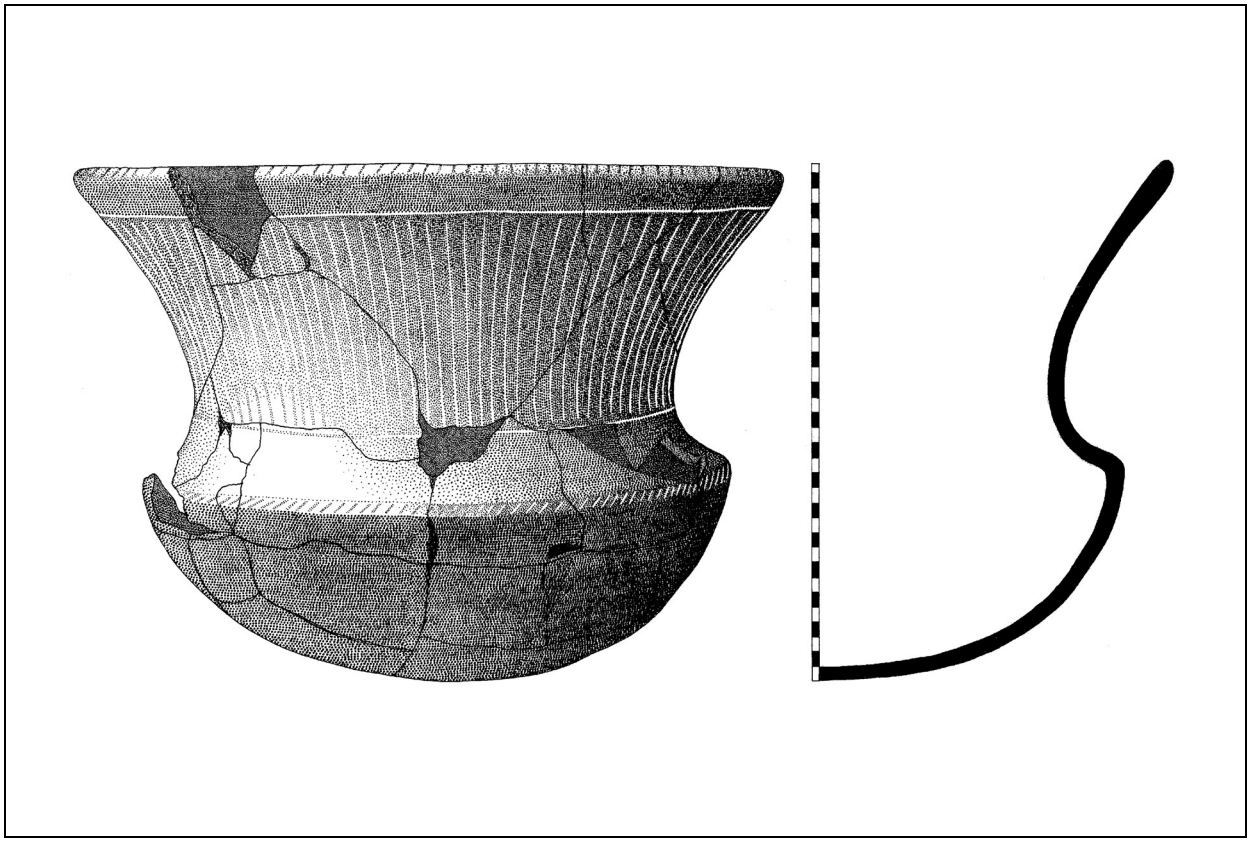


FIG. 218: Mortuary vessel. Cat. 700 B12 layer 5:3. A large carinated burial jar, burnished and decorated over a medium coarse fabric. A large field between the waist and rim is filled with near vertical lines, 1–5 mm apart, which have been scratched with a 1.5 mm wide blunt probe. The carination point is decorated with near vertical marks made with a sharpened stylus. Dimensions: rim diam: 232 mm, carination point: 190 mm, height: 164 mm, to carination 74 mm, thickness: 6–7 mm. Slab construction? Biscuit-fired and oxidized throughout except for exterior basal fire clouds. Fired upside down? FG3. Colour: 5YR/6/6 to 5YR/2.5/2. Quality: excellent, although some decoration irregularities are present. Scale segments are 5 mm

NOTES TO THE MORTUARY VESSELS

To assist interpretation of the CP3 assemblage the following notes expand the vessel descriptions detailed in the non-mortuary and mortuary vessel sections. They are intended to help clarify the descriptions of "whole" vessels. Where relevant, rim forms and categories are related to specific vessel types in the assemblage.

- Cat. 1269, B37, L9:1, appears to have been ritually smashed. The base was removed in prehistory. This vessel involves technically complex fabrication stages and highly detailed and intricate designs. Considerable skill would have been needed to produce it.

- Cat. 1270, B37, L9:1, contained heavy deposits of red ochre. Although this vessel was extensively broken when recovered, about 98 per cent was able to be reconstructed.

- Cat. 764, B11, layer 6:3. (see frontispiece and Hall 1993, Fig. 102:a 3:20). Technical treatment, design and pristine condition provide this vessel with distinctive characteristics which place it apart from others vessels in this period. It is larger, with heavier walls, than any other carinated burial jar. The fabric is moderately coarse rather than fine, oxidized rather than reduced, and the surfaces are very carefully finished. Fabrication, probably from slabs, involved exacting construction techniques and considerable care. The high degree of skill applied to a relatively coarse fabric has produced a very robust ornamental vessel, still intact when excavated. Stylized human figures decorate a 60 mm wide field on the inner rim. The field is divided into two, approximately equal, halves within a continuous circular band. The figures are arranged in pairs, one facing inwards the other outwards, heads pointing away from each other but towards the heads of the opposing pairs.

  Symmetry patterns in visual systems have been held by some researchers as equivalents of substantive universals in language (Hardin 1984:589). However, Harris (1986:80-84), notes difficulties in interpreting such pictorial representations as symbols or forms of mimesis. The binary relationship between these two pairs of figures is striking, however, both within and between each pair of figures and it is difficult not to assign some kind of symbolism to them. May and Tuckson (1982:240), record that the Aibom of the central Sepik region decorate and model vessels with forms and faces which represent "cultural deities within the mythology of the tribe and totems of different clans." "Sometimes these are abstracted or schematized into simple elements which are recognized by the people." Without additional information the function of this vessel remains unknown. Its form, pristine condition and unique figurative decoration suggest some kind of special, perhaps ceremonial, function. It was included, along with two carinated type L2b burial jars carrying a double-line motif, in a relatively rich burial of a 12-year-old female. Double-line type L2b vessels are correlated with burials interred with potting accoutrements. Another CP3 vessel, cat. 700 B12, is a similar shape and deploys similar decorative zones. The

fabrication techniques of both vessels, and wall thickness, sets them apart from other L2b jars in the CP3 assemblage.

- Carinated burial jars form the major portion of mortuary wares. They account for 22, or 40 per cent, of the 55 CP2 and 48, or 64 per cent, of the 75 CP3 vessels recovered. Half of CP2 and 83.33 per cent of CP3 exotic vessels are type 2b jars, a measure of their importance in mortuary contexts. Some type L2b burial jars are almost identical in shape and size, for example, cats. 1432 and 1360 in CP2; and cats. 2781, 2782 and 1101 in CP3. Their dimensions are set out in Appendix 3. Several L8 jars are oxidized, however L5–6 versions tend to be reduced. Variations in shape were noted in cat. 1290 B57 L10:4 and 1432 B67 L10:5. These vessels are related to burials considered, on typological criteria, to belong to CP3, although they were grouped with MP3, a CP2 phase, by the excavators. Cat. 1141 (B47 L8:3), has a much smaller rim/carination point index than most. Cat. 1243 B56 L10:3, lacks decoration which sets it apart from other burial jars at this point in the sequence. Cat. 2020 B86 L10:8, differs in shape and decoration. Cat. 1479 B73 L10:7, is marred by a shrinkage crack and surface spalling, however, it is otherwise in pristine condition which suggests it was intended for burial. Cats. 1467 B90 L10:8 and 1480 B92 L10:8, are highly decorated with spalling problems. Cat. 1360 B72 L10:7, has a fracture just below the carination point clearly indicating that the upper and lower portions were fabricated separately. Cat. 978 B19 L5:2, is heavier than most.

  Note that different decorative modes and different methods of gauging incised lines around the type L2b rims were employed. During L6 incised lines were generally made with a sharp point about 0.5 mm wide. In L5 the lines were generally about 1 mm wide and made with a blunt stylus, for example cat. 700. In general the quality of L7 type L2b jars is higher than later examples. Variations in decorative treatments at the rim, carination point, base and body should be noted.

  Rice is present in the fabrics of several type L2b jars. It is not possible to determine whether rice was deliberately or accidentally included in these fabrics, however, postulated intentional additives are a feature of several mortuary vessels recovered from Ban Na Di (Vincent 1988).

- A variety of tools have been used to decorate the fields, rims and carination points of type 2b burial jars. Variants are: cats. 700, 764, 794, 891, 979, 980, 1025, 1026, 1141, 1243, 1290, 1432, 1453, 1467, 1468, 1479, 1480, 1519, 1520, 2015, 2019, 2020, 2032 and 2790.

- Note that cat. 823a (not illustrated) has the same overall characteristics as cat. 823. A plain carinated burial jar with a highly burnished surface over a medium fine fabric. The carination point is decorated with cord marks. Dimensions: rim diam: 140 mm, carination point: 108 mm (est.), height: 75 mm (est.), to carination: 15 mm (est.), thickness: 5 mm. Slab construction? Biscuit-fired. The surfaces reduced except for slight oxidation at the rim and on the exterior base which suggest that the vessel was fired upside down. FG3f. Colour: 5YR/5/2 (incompletely oxidized), 5YR/3/1 (reduced). Cord marks: "Z"(?) 1.5/0.5 mm. Quality: excellent.

- Details of another mortuary vessel cat. 2794a (not illustrated) are included with cat. 809, with which it has the same overall characteristics.

- Type L2j storage jars (containers), are all missing their bases. It is difficult to assess whether the bases were removed in prehistory or because of their very fragmentary "as received" condition they could not be reconstructed in the laboratory, in spite of many hours of assessment. The sherds representing these jars presented a challenge of mammoth jig-saw puzzle proportions. In the event it was not possible to readily identify any likely basal sherds, or determine whether any were actually present. There are at least two possibilities for this difficulty. First, the bases may have been deliberately removed in prehistory prior to interment and excluded from the cemetery area. Alternatively, as the vessel fragments were small, base and wall sherds may have been indistinguishable from each other because the containers had semispherical bases. One clue to their shape is cat. 1118 (Fig. 184), which may be such a L2j container base. It is difficult to imagine an alternative shape which would satisfy the evidence. The container diameters vary from about 190 mm to over 300 mm, which is compatible with the cat. 1118 base.

- A smooth RF5 sherd, without any decoration, and with a micaceous sandy fabric was included with cat. 2015, B43, L7:9. It belongs to a type E2b burial jar. Fire clouds to the interior colour: 5YR/6/4 (oxidized), 5YR/3/1 (reduced).

- It is notable that rich burials did not always include many vessels, in spite of an obvious capacity to produce them on site.

- Cat. 697 B7 L6:3 is not only burnished but also carries paddle and *Anadara* shell impressions, cord marks and incised lines. This is unusual because, although this vessel is of only moderate quality, considerable effort has been expended in these decorations yet they have not been very carefully applied.

- Several vessels have been ritually "killed" by having the rim and in some instances also the base removed in prehistory. See CP2 vessels cat. 1522 B101 L10:11; cat. 1649 B99 L10:11; cat. 1678 B120 L10:14; and CP3 vessels cat. 1269 B37 L9:1 and cat. 699. B2 L6:3. Heavy deposits of red ochre were found inside the latter vessel. All are local. Cats. 1649 and 1678 feature stylized turtle motifs.

- Cat. 619 B1 L6:1, features a RF3b cord-marked coarse ware rim.

- Cat. 618 B1 L6:1, includes a CP3 style RF2 cord-marked coarse ware rim.

- Five exotic funerary wares, all type E2b carinated burial jars, were present in CP3 burials. Three different donor sources were represented in contrast to CP2 when the four type E2b vessels all derived from the same source.

- Two type L3b vessels, cats. 1390 and 1518, are the same form. Both are highly decorated and burnished platters, but of a different size, fabric and quality. The latter was interred with B91, during MP3 and cut from 5.04 m. Cat. 1390 was placed with B74, in the lower

portion of MP4, which was cut from above 4.64 m. The quality of cat. 1518 is excellent, however, cat. 1390 falls short of the former. Their colours differ from a weak red (cat. 1518) to red, a result of differences in firing effects. Cat. 1390 is much smaller with a maximum diameter of 166 compared to 207 mm.

- A small exotic CP2 type E2e vessel, cat. 1319 B64, may be a fish paste jar.

CERAMIC PERIOD 3: CONCLUDING REMARKS

This chapter has detailed the mortuary and non-mortuary ceramic evidence for CP3. At this point, therefore, all of the ceramic data from the cemetery have been presented and can now be summarized. The cemetery represented the largest portion of the excavation, spanning approximately five and a quarter metres, or over 75 per cent of the cultural deposits. A major stratigraphic discontinuity occurred at the interface between layer five and four, when the cemetery was abandoned after about twenty generations of mortuary activity. By combining the CP2 and CP3 evidence it will be possible to scan the two assemblages for any similarities and differences. A considerable amount of data are encapsulated in them. In order to help bring a degree of coherence to this material it will be considered from two interrelated perspectives, first from a ceramic and second from a cultural-environmental focus.

The ceramic evidence set out in this chapter will be summarized first, followed by a brief synthesis of any developments recognized during CP3, which are considered relevant to the overall ceramic sequence. In some instances data will be collated to help bring any changes into a sharper focus. Data from both CPs will then be combined and compared in order to illuminate any similarities and differences. To assist with this, close attention will be paid to critical aspects of any potting tradition, its style and its production techniques. In the former, continuities and discontinuities will be sought as these can often reflect homeostasis or important cultural changes. Variations in the latter can have greater significance, given the often entrenched conservatism displayed by craft potters. When both pottery styles and technologies change in tandem, however, cultural transformations of some magnitude may be signalled. Pottery styles are addressed first.

SUMMARY AND DISCUSSION

Material presented in this chapter complements and expands the data detailed in chapter VIII, which concerns CP2. This chapter defines the ceramic evidence recovered from the upper half of a cemetery in which the excavators recognized seven mortuary phases. When viewed in isolation, the mortuary activity appears to present a continuum with the seven phases apparently superimposed one upon another in an orderly succession. But the CP2 burials are clustered, whereas in CP3 they are arranged in rows. The ceramic evidence, however, acts to punctuate a series of changes within the cemetery, some abrupt, others gradual. At the interface between

L10:2 and 10:3, a change occurred in the local potting tradition. Pottery was no longer fashioned from clay tempered with orthodox grog in a sandy matrix, following the CP2 tradition, but from a less sandy clay or a distinctive silty clay which matches samples taken from a nearby fishpond. Use of this clay was restricted to utilitarian wares, a strategy which suggests that either the fishpond clay was selected for its technical properties or to conserve less abundant high quality clays. In some instances incidental rice remains were included in the local fabrics, probably accidentally. In concert with changes in pottery composition, local CP3 wares differ from CP2 styles. Although there is some minor continuity, significant differences are evident in both utilitarian and fine wares.

Potting equipment and materials concentrated in burials

Potting tools were present in 16 of the 39 CP3 graves which contained mortuary furniture. Burnishing stones were present in four male, seven female and four child burials. Ceramic anvils were restricted to five female and four child interments. Seven of the 29 anvils analysed are exotic. Six of these are tempered with grog or rice. One is coated with red paint, a surface finish not employed by local potters. The only exotic anvil recovered from mortuary contexts was interred with B15, a 35 year old female, the richest in terms of grave goods in the cemetery. This compares with CP2 where seven anvils are probably exotic. Two anvils were found in the grave of B1, one each in B4, 15, 16, 18, 19, 20, 33 and 35. Three anvils are composed of the fishpond clay, the remainder of another local clay tempered with orthodox grog. Potters' marks are present on the B4, B15 and B16 anvils. The latter two bear the same mark. B16 is a 15 month infant. Two anvil fragments found within the general deposits, one in L9:6 the other in L5:3, also probably carry potters' marks. This compares with CP2 where three anvils, one of which is exotic, carry such marks. All of the anvils in CP3 mortuary contexts are complete, or nearly so. Seventeen of the 20 anvils recovered from non-mortuary contexts are fragmentary which suggests they were discarded in prehistory. Anvils were associated with burnishing stones in three child and five female burials. Nine anvils are cord-marked, six indistinctly, one is impressed with what is probably a 'S' twisted cord and two display 'Z' twist cord marks. Anvil head sizes vary from 29 to 100 mm (mean 61 mm, n = 19), and reflect a broad range of vessel forms.

Tools used to burnish and decorate vessels were recovered from the CP3 deposits. Burnishing stones are distributed throughout the CP3 sequence. Burials contained 31, and 85 stones were recovered from the general matrix. Fewer were present than in CP2, however, where 21 were found in burials and 176 from non-mortuary contexts. A major feature, L10:3 lens 2 contained 43 of the latter. For CP3 this equates to 3.73 stones compared to 9.57 in CP2 for every cubic metre of deposits, a decrease in CP3 of 389.7 per cent. Six bone stylus points, suited to incising pottery, were recovered from CP3 compared to eight in CP2.

Potting clay, either unmodified or prepared for use, weighing 28.26 kg was recognized amongst the general detritus and as mortuary offerings in 13 CP3 graves. Six of these included anvils and/or burnishing stones. One particularly rich child, B11, lacked stones or anvils but contained two L2b carinated burial jars with two incised lines below the rim. Of the remaining six B7, 8, 27, 28 and 49 contained from 1–5 g of clay each. Given such small amounts of clay it is possible that some was relocated from adjacent deposits in prehistory. In mortuary contexts,

the quantity of clay varied from 10 g in B49 to 10.99 kg in B15, with a total 16.16 kg from the 13 burials. During CP2, 1.02 kg in small, mainly isolated, lumps was recovered. One grave, B58, contained 3 g. Thus of the 39 graves in CP3 which included grave goods, 13 contained potting clay. This contrasts with CP2 where of the 61 burials which included pottery only one featured potting clay. Notably this grave represents one of 11 MP3 burials (CP2) considered on ceramic criteria to belong to CP3. Clearly, potting clay played an important role in CP3 mortuary ritual. This was not the case during CP2. Three different clays make up the CP3 sample. About 20 per cent (2.86 kg) has been examined petrographically. Of this, 2.56 kg, or 89.51 per cent, is untempered fishpond clay. A small amount of untempered *din dum* clay along with a micaceous clay tempered with orthodox grog complete the sample. B15 and B16 contained only untempered fishpond clay. Incidental rice husk was noted in the B19 and a L9:1 sample, while authigenic calcite has altered other samples.

Potters' equipment and/or potting clay were present in 11 CP3 burials along with type L2b carinated burial jars. Throughout the cemetery such jars are decorated with a range of different designs, some of which may be clan markings or some form of rank insignia. Their CP3 distribution and their relationship with graves containing potting accoutrements shows a clear correlationship (Table 107).

TABLE 107: *Type L2b burial jar motifs and potting accoutrements*

Layer	MP	Burial	Age	Sex	Anvils	Clay	Stones	Type L2b motif
6:4	7	11	12	F	-	yes	-	2 vessels with 2 lines[a]
6:3	6	9	30	M	-	yes	1	2 vessels with cordmarks[b]
6:5	6	13	35	F	-	-	8	no motif[c]
5:2	6	19	25	F	1	yes	2	4 vessels with 2 lines[d]
7:2	5	15	35	F	1	yes	2	3 vessels with 2 lines
7:3	5	16	15mths	-	1	yes	1	4 vessels with 2 lines[e]
7:6	4	20	12	-	1	-	1	1 vessel with 2 lines[f]
7:6	4	23	30	M	-	-	1	1 vessel with 2 lines
7:6	4	36	21	F	-	yes	1	2 vessels with 2 lines
8:3	4	29	27	M	-	-	1	no motif[g]
8:2	4	33	child	-	1	-	-	2 vessels with 2 lines

[a] Another special L2b vessel was present (cat. 764)
[b] Two L2b variants with rice in the fabric were present (cats 794 and 795)
[c] Three L2b vessels were present (cats. 819, 823 and 823a), the carination point of the latter two is cord-marked
[d] All include rice in the fabric
[e] Rice is present in the fabric of one jar
[f] Two L2b vessels were present (cats. 953 and 2787), the carination point of the former is cord-marked
[g] This vessel, cat. 2030, is small and differs in shape from most type L2b jars (see also Appendix 3)

The only burial with the double line motif which lacked any obvious potting accoutrements is B44, a *c.* 18 year-old male. The upper portion of this grave extended into the baulk, a situation

which could increase the difficulty in recognizing small lumps of potting clay in the general matrix of a grave. A worked turtle carapace ornament was also interred with B44 (Higham and Bannanurag 1990:262, 266-7). It should be noted that several CP3 graves were disturbed to varying degrees, including B3, 6, 7, 11, 12, 18, 22, 35 and 36 (Higham and Bannanurag 1990:211, 306, 329, 339, 340, 353, 361 and 363). Turtle ornaments are restricted to CP3, except for B57, one of the 11 burials allocated to MP3 (CP2) by the excavators which may actually belong to MP3b (CP3). This individual also has a tooth ablation pattern matching the CP3 population (Tayles 1999:286). Burnishing stones were associated with turtle bone in B9 (cat. 801), B23 (cat. 2027, 2028) and B29 (cat. 2031). The grave of a 21 year old female, B35, which contained an anvil and three burnishing stones included two E2b jars (cats. 1025 and 1026), with cord-marked bases. One grave containing two anvils, B1, lacked type L2b vessels. No vessels were recovered from the graves of B4, B6 or B42. The former contained an anvil and four stones, B6 and B42 two stones each.

A clear correlation with potting tools and the double line motif is apparent with just one exception, B35. This burial was interred immediately behind B36, another adult female, also buried with potting equipment. These burials, both females aged 21, form an exact continuum in alignment and location which is unusual "because they are set out in a line rather than side by side" (Higham and Bannanurag 1990:243-4). The grave cut depths are identical. Both of the type E2b vessels placed alongside B35 are exotic. Although similar in overall form to local carinated type L2b mortuary vessels they differ in detail. They lack incised lines or a shell-impressed rim motif, but feature a cord-marked base. The base surfaces of all local 2b burial jars are plain and burnished. The anvil in this burial also features cord marks to its base. The reasons for these differences are unclear, except to suggest that this potter was an immigrant and therefore unrelated to the local potting group.

Ceramic anvils are restricted to female graves, whereas burnishing stones and clay were found with both males and females. Only two graves, B15 and B19, included anvils, clay and stones. Both are adult females interred with three type L2b vessels each with the double-line motif. The infant B16 was interred with four such vessels, along with a stone and an anvil bearing an identical potter's mark to that on the exotic anvil placed in the grave of B15. An alignment of eight late graves included two new-born infants without grave goods, B4, B9 and B13. B4 contained an anvil and 4 stones, B9 and B13 were interred with type L2b vessels. Three further graves, B2, B7 and B8 complete the alignment which revealed "a paucity of grave goods when compared with the burials of MP5 and other burials in MP6." (Higham and Bannanurag 1990:348-9, Fig. 249). All burials with anvils and type L2b vessels featured the double line motif.

Given that the only graves with type L2b vessels bearing the double line motif also included potting accoutrements, with the single exception of B44, a burial not completely within the excavation square, it is suggested that the motif denotes membership of a group. If this is correct, there are several implications. For example, the motif could signal association with a social group such as a clan. This possibility is supported by the presence of a motif vessel in B44 which lacks any grave goods related to potting activities. Caution must be exercised with this evidence, however, because in this case a burnishing stone and/or lumps of potting clay might readily be overlooked. At least two bivalve shells, possible potting tools, were found in

the B44 grave (Higham and Bannanurag 1990:267, Fig. 185). Another possibility is that the motif is some form of rank insignia. Other burial jars carry motifs composed of straight and/or wavy lines in various combinations. In terms of the evidence presented here, such rank would attach to individuals of any age. Alternatively, the motif could represent membership of a group of craft specialists, in this case potters. Individuals could be recognized, not only for their craft skills, but also for their affiliation with a group of specialists dedicated and connected to the craft through familial association. This possibility will be explored further in chapter XII.

Two burials with treble line motif vessels which lacked any potting accoutrements were B43, a *c.* 30 year-old male, and B14, a 15 month infant. The latter was interred in a circular grave, less than a metre from the foot of B15, within two outstanding vessels. Two type L2b vessels, cats. 787 and 854, each with a treble line motif, and 269 shell disc beads were laid at the feet and alongside the deceased. Three of these four vessels included rice in their fabrics. Unfortunately B43 "only impinged slightly into the excavated area" (Higham and Bannanurag 1990:327). Nonetheless it was associated with 56,200 disc-shaped shell beads, 435 I-shaped beads, one cylindrical shell bead, two large shell discs, a pierced mammal canine, a shell disc/bangle, one treble line type L2b vessel and a turtle carapace ornament. Clearly a rich array. The presence of turtle carapace ornaments with B43 and B44 is provocative and intriguing. It is disappointing that both were only partially within the excavation. The latter grave contained two type L2b vessels with the double line motif; B43 included two type L2b vessels with a treble line line motif, the same as B14. The presence of turtle carapace with B57 (MP3), along with one type E2b and one type L2b vessel, rendered in the CP3 style, provides a clear link with B43 and B44 from MP4. This is an association which helps to place B57 in CP3 rather than CP2 contexts.

Pottery variations and related changes

Twelve ceramic pellets and eight net weights, composed of fabrics consistent with local clays, were recovered from within L6–9. This compares with 39 pellets and 42 net weights from CP2 contexts. Four pellets from L7 are unfired, whereas all CP2 pellets were fired. One was included with grave goods in B15, compared with two, one each in B96 and B109, in CP2 mortuary contexts. Net weights were restricted to non-mortuary contexts during CP3 in contrast to CP2 where one was found in B89 and another in B109. Changes in the environment could account for the decline in net weight numbers during CP3 when reaching the sea became increasingly arduous due to coastline progradation. Access to waterways, however, would confer considerable transportation advantages and the CP3 net weights may indicate that fishing continued. One possibility is that fishing switched from marine to riverine habitats. A change to a terrestrial emphasis is suggested by molluscan (Mason 1991:301-14), botanical (Thompson 1996:207-10) as well as fish and crab remains (Kijngam 1991). Clear evidence of line fishing during CP3 is reflected in the inclusion of a fish-hook in B30.

Burnished and incised, incised, burnished, paddle-impressed, painted or slipped and punctate fine wares are present in CP3. Their distributions are detailed in Appendix 3. Burnished and incised wares continued to be emphasized by the local potters throughout CP3. Compared to mid–late CP2, however, they decline in quantity. Excluding vessels and rims, 16 CP2 burials, compared to nine in CP3, contained these sherds. Exotic burnished and incised wares continue

to enter the site. As in CP2, they are tempered with sand, rice and either orthodox or bleb grog. Incised fine ware sherds increased from about 12 kg in CP2 to over 39 kg in CP3. Only three CP2 burials, compared to 16 in CP3, contained incised fine ware sherds. In non-mortuary contexts they increased steadily to peak in L6 and then decline slightly in L5. Burnished fine ware sherds, however, followed the opposite distribution. They decreased from about 60 kg in CP2 to under 18 kg in CP3. Never greater than the minor amounts recovered from L11 (4.82 kg), they totalled 2.56 kg in L10:1–2; 4.09 kg in L9; 4.61 kg in L8; 3.68 kg in L7; 0.7 kg in L6 and 1.82 kg in L5.

Paddle-impressed wares occurred intermittently in very minor amounts from L10:1. All those examined are exotic apart from a L8:1 sherd and minor amounts in L5. In CP3 they total 1.42 kg compared to 0.69 kg in CP2. These figures are in addition to those published by Hall (1993), and to which should be added 1.08 kg for CP3 and 0.82 kg for CP2, to give combined totals of 2.5 kg and 1.51 kg respectively. In L10:1 they totalled 0.05 kg; 0.04 kg in L9; 0.11 kg in L8; 0.04 kg in L7; 0.5 kg in L6 and 1.76 kg in L5. Some sherds listed by Hall may be local wares which have been displaced from CP4 where paddle-impressed wares increased substantially.

Painted and slipped wares decreased from 71 g in CP2 to 47 g in CP3. All are exotic. They include sherds from the Eastern Highlands tempered with bleb grog, slipped sherds tempered with either rice, sand or orthodox grog and painted sherds tempered with rice and either bleb or orthodox grog. The surfaces of some local sherds appear to have been coated with red ochre prior to burnishing.

Punctate wares were extremely rare in CP3, only five sherds, each decorated in a different mode, being recorded. In total, 28 g were recovered from CP2 and 8 g from CP3 contexts.

Four new appliqué forms appeared during CP3. CP2 contained forms A1 and A2 weighing 3 g and 41 g respectively. In CP3 the total weight increased to 94 g, made up of A2 (5 g), A3 (14 g), A4 (65 g), A5 (8 g) and A6 (2 g). Most, if not all, are probably local.

Lids increased from two forms weighing 10 g in CP2 to five forms weighing 37 g in CP3. All are simple with a direct terminus. Exotic sources are suggested by the presence of rice and bleb grog tempers. Local wares are also present.

Changes in vessel types and coarse versus fine ware proportions

Perhaps the most sensitive index of pottery dynamics within a production centre is reflected in the distributions of rim types. This is because rims represent vessel types. When the complete CP2 and CP3 rim assemblage is considered, rim form complexity, gauged using an elaboration index, increased marginally from 10.26 in CP2 to 11.46 in CP3. The number of forms remained at 15, categories increased from 96 in CP2 to 128 in CP3 and variants decreased from 58 to 44. Fine wares, represented by RF5 and RF6, the most abundant forms during CP2 and CP3, are sensitive indices of any change in ornamental ware elaboration. In this respect they provide an accurate measure of the quantum of energy expended in producing ornamental fine wares. During CP2, RF5 is represented by 40 categories and 26 variants. In CP3, 40 categories and 14 RF5 variants were recorded. For RF6 the values are: CP2, 27 categories and 16 variants; CP3, 35 categories and 19 variants. These data give combined values of 67 categories and 42 variants for CP2 and 75 categories and 33 variants for CP3. In terms of the most abundant fine wares, this gives elaboration indices of 54.5 for CP2 and 54 for CP3. To gauge local production complexity, however, exotic rim forms need to be excluded from these calculations.

Exotic rim forms need to be deducted from the assemblage so that the levels of local production during CP2 and CP3 can be accurately compared. The total number of exotic categories and variants in the sample increased from 10 in CP2 to 45 in CP3. When these exotic wares are excluded, the elaboration indices for the total CP3 rim assemblage remain at 15 forms, while categories and variants combined reduce from 172 to 127 to give an elaboration index of 8.46; for CP2 there are also 15 forms, while categories and variants combined reduce from 154 to 144 to give an elaboration index of 9.60. The variety of local wares produced in CP3, therefore, decreased to 88.19 per cent of that achieved in CP2. Ornamental fine wares also declined (Appendix 2).

Local fine wares reduced from 137 (83 categories, 54 variants) in CP2 to 115 (77 categories, 38 variants) in CP3. Both included 13 forms to give an elaboration index of 10.53 in CP2 and 8.84 in CP3. In terms of the index, therefore, local ornamental fine ware production in CP3 decreased to just over 80 per cent of the CP2 output. However, an adjustment for differences in the depth of cultural deposits for each CP also needs to be calculated. The density of deposits in CP2 amounted to 10.51 kg/m^3 compared to 13.72 kg/m^3 for CP3. Thus CP3 contained 30.54 per cent more material per cubic metre than CP2. If this factor is included, the elaboration values for local ornamental fine wares become 1.00/kg m^3 (10.53 divided by 10.51 kg/m^3) for CP2 and 0.64/kg m^3 (8.84 divided by 13.72 kg/m^3) for CP3. This means that during CP3 local ornamental fine ware production, in terms of the elaboration indices, decreased to 64 per cent of that accomplished during CP2.

TABLE 108: *Pottery densities by Ceramic Period*

CP	Depth (m)	Pottery (kg)	Density (kg/m^3)
4	1.231	4,629	37.60
3	3.110	4,268	13.72
2	2.059	2,164	10.51
1	0.409	569	13.93
total	6.809	11,630	17.08

The proportion of coarse versus fine wares in CP3 compared to CP2 can be calculated by including all sherds (Table 109), and then comparing these data with rim sherds only. The rim weights are detailed in Appendix 2. Coarse ware rim representations can be summarized by combining RF1, RF2 categories and variants and RF3b weights. Although this excludes some minor coarse ware variants, they are not considered significant. Coarse ware rims during CP2 represent 49.82 per cent of all rims; during CP3 these increased to 55.99 per cent. The combined local coarse ware rim weights for CP2 are 38.11 kg and for CP3 they are 93.48 kg, or 0.18 kg/m^3 and 0.3 kg/m^3 respectively. This equates to an increase, during CP3, in local coarse ware production of 66.66 per cent in comparison to CP2 output. The total body sherd weights, excluding bases, burnished and incised sherds, lids, paddle-impressed, painted/slipped,

porcelain, stoneware, punctate, shell-impressed, miscellaneous body sherds, rims and "whole" vessels, show that during CP2 of the total pottery recovered, coarse wares represent 91.78 per cent and during CP3, 92.63 per cent. Fine wares make up 8.16 per cent of CP2 and 7.36 per cent of CP3 sherds. When the density differential is included these figures become, for CP2 coarse wares, 8.51 kg/m^3; CP2 fine wares 0.75 kg/m^3; CP3 coarse wares 10.991 kg/m^3; CP3 fine wares 0.87 kg/m^3. To this point in the sequence, applying the total weights without any allowance for sherd density differences, the proportions of coarse versus fine wares changes from 91.78 per cent in CP2, to 92.63 per cent in CP3. When sherd densities are included the calculations change to 91.9 per cent for CP2 and 92.66 per cent for CP3. Coarse ware sherds increased by 29.14 per cent during CP3 compared with CP2, (CP2: 8.51 kg/m^3, CP3: 10.99 kg/m^3), when sherd densities are taken into account. In this respect, a notable feature of the grave goods interred with B15 is the inclusion of three type L2j and one type L2j(i) coarse ware storage vessels and a mass of prepared potting clay used to fabricate this type of vessel. Inclusion of such vessels and potting clay suggests that they played an important role in the deceased's active life.

TABLE 109: *Proportions of coarse and fine wares: All Ceramic Periods*

CP	Total (kg)	Coarse (kg)	Per cent	Fine (kg)	Per cent
4	3862	3371	87.28	491	12.71
3	3693	3420	92.63	272	7.36
2	1910	1753	91.78	156	8.16
1	538	494	91.82	43.5	8.08
total	10,000.5	9038	90.37	962.5	9.62

The calculations of coarse versus fine ware proportions discussed above need to be treated with caution, however, because it is important when assessing quantities that differences in vessel sizes and shapes are taken into account. Without this factor the proportions of body sherds in each CP assemblage could reflect a change from small to large-bodied vessels, or vessels with disproportionate shapes which over-emphasize body proportions. Hence, by using the overall sherd weights, production is measured in terms of the amount of clay consumed rather than the number of vessels produced. Production of each vessel requires every step in the manufacturing procedures to be successfully completed. The number of vessels, therefore, is considered a more accurate description of the rate of pottery production in each Ceramic Period. Consequently, rim proportions are considered a more accurate reflection of actual production than the total sherd weights. If this is accepted, ornamental fine ware production during CP3 decreased markedly to 61.16 per cent of the CP2 output, and CP3 coarse wares increased by 66.6 per cent. The juxtaposition of a sharp increase in local coarse ware and a simultaneous decrease in local fine ware production is a critical change. These changes will be evaluated in conjunction with further evidence for a major shift in pottery disposal strategies during CP3 in Chapter XII.

Exotic rim form fabrics increased from nine in CP2 to 12 in CP3. Seven exotic fabrics are present in both CP2 and CP3 forms. Two CP2 exotic fabrics are absent in CP3. Five exotic fabrics make their first appearance in CP3. Ornamental wares entered the site from at least eight different sources during CP2 and 14 during CP3. During CP2, exotic rim forms include RFs 3, 5, 6, 8, 9, 10, 12 and 14. This changes in CP3 when RFs 3, 4, 5, 6, 7, 10, 13, 14 and 15 are included. Thus RFs 4, 7, 11, 13 and 15 are absent from CP2 and RFs 8, 9, 11 and 12 from CP3. All except RF9 in CP2 and RF15 in CP3 are present as local wares. This equates to eight of the 15, or 53.33 per cent, of local rim forms represented by exotic rims during CP2 and nine of 15, or 60 per cent, during CP3. Two important utilitarian wares, represented by RF1 and RF2, are absent from the exotic spectrum. Excluding them from the equations gives values of 61.53 per cent for CP2 and 69.23 per cent for CP3 exotic form representations. When all forms from the two periods are combined, only RF11 is not present in the exotic spectrum. This simple direct everted rim represents a small jar produced locally in very small numbers. Only 26 g were recovered from CP2 and 3 g from CP3 contexts. Overall, the presence of equivalent exotic forms clearly flags the marked regional nature of the distribution of wares during the period the cemetery was utilized. When each exotic ware is represented in a local ceramic spectrum, particularly when the local wares are produced at a large pottery centre, the ceramic region can be characterised as relatively homogeneous. This contrasts with other Southeast Asian regions during the first millennium BC (Vincent 1988, 1998). Consideration of whether some of the exotic wares were sourced from outside the Ban Pakong Valley will be deferred until Chapter XII.

Vessel base forms increased from four in CP2 to 10 in CP3. One exotic form restricted to CP3 is tempered with shell, another with orthodox grog and one with sand. Two forms are miniatures, another features an appliqué band. Three CP3 bases have solid flat forms and three are ring-footed. Excluding complete vessels, during CP3 vessel bases were recovered from 11 burials, whereas only two burials included base forms in CP2.

Nineteen tripod pot feet were distributed throughout CP2 whereas only three or possibly four were recovered from CP3 contexts. Five early forms, compared to three in CP3, have been recorded. Six of the CP2 feet are probably exotic and 13 are local as are all of the CP3 sample. Athough no tripod feet were uncovered in mortuary contexts, a single tripod-footed vessel was included as grave furniture in B76 and another in B86.

Decorative modes and mortuary vessel types

Decorative modes applied to local wares during CP3 closely followed traditional CP2 techniques. Burnishing remained the preferred surface treatment of fine wares, with incising, shell impressing and cord marking to decorative fields, rim termini and carination points. Some of the latter display punctation marks, however, they derive from shell or cord-wrapped paddle impressions rather than a stylus. One important L5:4 local variant combined both *Anadara* shell and paddle impressions. This is the first local ware known to be paddle-impressed. Exotic wares were often burnished and variously decorated with paddle, *Anadara* shell or fingernail impressions, red paint or slips and many with cord marks. Most type L2b carinated burial jars feature decorative treatments at the rim and/or carination point. Prior to MP4 local potters employed

Anadara shell impressions to decorate these points. Following the establishment of CP3 these zones on many of the type L2b vessels were cord-marked. The first local examples were laid down with the lowest of the 11 burials assigned to MP3b in this report because they are considered to belong to CP3. Prior to the completion of the ceramic analysis, they were initially placed in MP3 (Higham and Bannanurag 1990). In the light of simultaneous changes in local ware typology, as well as other ceramic and non-ceramic evidence, these burials are considered to relate more closely to MP4. One of this group, B57, contained two carinated burial jars, one local (cat. 1288) and one exotic (cat. 1290). Both feature cord marks at the carination point. It is important to note that included in the grave furniture with this 26 year-old male was a large turtle carapace, the only such artefact in a MP3 context, according to Higham and Bannanurag (1990:172). Turtle carapace ornaments, however, are a feature of, and restricted to, CP3 male burials. The first was interred with B57 in MP3b.

The lowest 11 CP3 graves included six type 2b burial jars. Two, cat. 1243 in B56 and cat. 1432 in B67, lack cord mark decorations but display remnant cord marks, left over from the shaping process, a phenomenon not often observed in type L2b jars. Two further jars, cat. 1283 in B58 and cat. 1291 in B60, also display cord-marked carination points. Excluding three special type L2b vessels, a total of 45 vessels make up the CP3 carinated burial jar sample. Four of these are exotic. Cord marks decorate 19 L2b vessels, one on the base, three on the rim, eight on the carination point and eight on both carination and rim. Two exotic carinated burial jars display cord-marked bases and two such exotic jars have cord-marked carination points. Their fabrics suggest three separate external donor sources. Cord-marked decoration on these important type 2b funerary vessels, therefore, was common to several exotic traditions, but not a local expression during CP2. An unique B4 vessel carries shell impressions and cord marks.

Complete vessels in mortuary contexts include five local bowl forms and seven jars. The bowls are types L1a (shallow everted), L1d (shallow inverted), L1f (shallow inverted footed), L1g (indirect inverted) and L1h also indirect and everted. The jars are types L2b (carinated indirect), L2b special (large carinated indirect jars with additional decorative fields), L2e (indirect everted), L2e(f) (indirect everted with an external folded rim), L2i (everted carinated footed), L2j (direct perpendicular) and L2j(i) (direct perpendicular incised). All except the latter two are fine wares. Three large unique ornamental vessels have been categorized as special. One exotic pot stand completes the CP3 mortuary ware typology. Eight non-mortuary vessels were also recovered. Seven and probably all were local. They include a deep everted type L1b bowl, a shallow footed type 1c bowl, a footed inverted type L1f bowl, two indirect everted type L1g bowls, a carinated type L2b burial jar, a type L2b(m) miniature carinated burial jar and a type L2g indirect perpendicular globular jar. Reconstruction of these vessels helped in the categorization of the numerous rim fragments recovered.

COMPARISON OF CP2 AND CP3 POTTERY STYLES

Ceramic styles can be approached in several different ways. In this summary close attention is paid to four aspects of the assemblage, local and exotic coarse and fine wares. Exotic wares continued to enter the site throughout CP3 from a variety of sources. Wares from 12 suggested

exotic sources are present in the rim form assemblage. Eight of these, however, are restricted to a single stratigraphic layer, two to two layers, one to three layers and one continues throughout the CP3 sequence. Two exotic rim forms were recovered from layer 10:1-2; three from L9; three from L8; six from L7; six from L6 and one from L5. Exotic and local rim form distributions are summarized in tables 99 and 100 respectively.

Cord-marked coarse wares, which utilized a simple folded rim, made up the majority of pottery recovered throughout the entire site sequence. Each rim was formed by folding the evened vessel wall terminus over on itself so as to reinforce and define the orifice. The method represents one of the most basic steps in pottery fabrication. This rudimentary technique changed at the CP2/3 boundary. Whereas during CP2 the folds were tightly compressed and the rims indirect and sharply inverted up to 50°, during CP3 the folds were invariably rounded and the rims only slightly inverted for 40–50 mm, from about 45° to almost 90°, or perpendicular and direct. Although no complete vessels were recovered, large rim sherds and partial reconstructions have allowed their overall shapes to be gauged. During CP2, the vessels represented by these rims were globular type L2h. In CP3, the rims represent cylindrical type L2j wares. Rim sizes varied from about 280–320 mm diameter in CP2 to 200 mm diameter in CP3. The CP2 vessels are globular from 320–400 mm in diameter, whereas the CP3 versions are cylindrical, narrower and no more than about 200–280 mm in diameter. This change in shape strongly suggests different functions. Globular shapes are suited to functions which require the vessel to stand alone. Cylindrical vessels with round bases are likely to need support.

Variations in CP2 RF1 versions could suggest that the CP3 form evolved from it. Another possibility is that the CP3 vessels fulfilled a different function. Folded rims continued throughout CP1–3 and the technique was occasionally extended to other forms. This could suggest an indigenous development or a regional method, or a mixture of both. Folding vessel walls in this manner is common to many other rim forms, both local and exotic. The method clearly indicates that the vessels were built from the base upwards, either in slabs, lumps, rings or coils. Fracture patterns, however, suggest that the last two methods can be discounted. A common practice in contemporary Northeast Thailand potting villages is to construct the rim first, then fabricate the vessel body upside down on top of the upturned rim. The folded Khok Phanom Di rims rule out this method because the rim is formed as an extension of the vessel walls.

Local fine ware styles also changed. The most numerous funerary vessel, type L2b carinated burial jars, display less decoration in CP3 than CP2. Their shape and decoration detail are also different (Appendix 3). Burnishing and incising remained the favoured method of decoration, however, exotic wares clearly demonstrate that these techniques were not restricted to Khok Phanom Di. Similar wares from several donor sources also followed these techniques which reflects their regional nature. An important development is the introduction of cord marks to decorate specific zones on type L2b carinated burial jars. Prior to CP3, fine ware decoration excluded cord marking, although remnant construction marks are occasionally visible where smoothing is incomplete. Intentional decorative cord marks during CP2 are restricted to exotic fine wares. Impressing with *Anadara* shells, a hallmark of CP2 ornamental wares, continued alongside cord marking throughout CP3. An outstanding vessel interred with B15 carries both forms of impressions.

Changes also occurred in the fine ware vessel repertoire in mortuary contexts. Ornamental

type L1a (a triple peaked shallow bowl), L1c footed bowls, L1e footed jars, L2c shallow carinated jars, L2c(m) miniature jars, L2e(mt) (a miniature tripod-footed jar), L2g globular jars along with type L3a a tripod-footed platter, are restricted to CP2. Types L1g and L1h indirect everted bowls, L2f inverted carinated jars, L2i everted carinated and footed jars and a L3c platter, however, are restricted to CP3. Thus nine local fine wares are confined to CP2 and five to CP3. Both CPs share type L1a, L1b, L1d and L1f bowls and type L2a, L2b, L2d and L2e jars. Type L2b carinated burial jars, however, differ in style. Therefore four bowl and three jar types occur as funerary wares in both CP2 and CP3. Apart from L1f footed bowls and L2d tall footed carinated jars, the remaining types have simple forms typical in many assemblages. Such simple forms have an almost universal distribution. There are, however, strong similarities in the styles of CP2 and CP3 mortuary fine wares. The differences mostly reflect detail rather than substance.

Fine ware rim form distributions changed between CP2 and CP3 (Table 110). The combined distributions of fine ware rim forms, categories and variants, excluding rare sherds of ambiguous provenance, show that 89 found in CP2 are absent in CP3, 99 present in CP3 are absent in CP2, and 62 were common to both. This gives a total of 250 rims. The CP2 sample equates to 35.6 per cent, the CP3 sample 39.6 per cent and fine ware rims common to both CPs comprises 24.8 per cent of the total CP2/3 fine ware rim sample assessed. Interpretations of this evidence could take into account different possibilities. For example, changes in rim form distributions could be held to reflect temporal changes in the local potting community. Individuals and groups of potters, of course, age and die; new potters are continually entering the craft and immigrant potters may intermittently join the local potting community. It seems likely, however, that unless some kind of catastrophe overtook the community, homeostasis would tend to promote continuity rather than change. Traditional styles tend to endure.

TABLE 110: *Fine ware rim distributions: Ceramic Periods 2 and 3*

Rim form	3	4	5	6	7	8	9	10	11	12	13	14	15
CP2 only	5	1	33	33	-	2	2	-	2	4	3	3	1
CP3 only	3	19	25	37	3	-	1	-	-	-	7	3	1
Both CPs	4	2	32	12	1	1	1	2	2	2	1	2	-

It may be useful to consider changes in potting traditions as falling on a continuum. At one end are traditions which are completely different from any other. At the other end are those which are identical. Given that styles reflect cultural traditions, and setting technological evidence aside for the moment, changes in potting traditions may be gauged by comparing similarities and differences between any two given entities. If this concept is applied to the CP2/3 data, it seems reasonable to postulate that the fine ware rim configurations demonstrate that, while there are similarities, the two traditions are clearly different. Only 24.8 per cent of fine wares are common to both periods. This suggests that these two traditions are more different from than similar to each other. Such conclusions should be treated with considerable caution, however, because this evidence needs to be incorporated into the larger body of information available. Further correlations are needed. In this respect it is important to keep in mind that the overall style and

modes of decoration of both traditions are similar. Taken together, style, decorative modes and fine ware assemblages suggest that the similarities are consistent with pottery created under the rubric of the same regional potting tradition. The differences, however, strongly suggest that two distinct potting traditions are involved, although some early CP3 mortuary vessels hint at the presence of a potter familiar with the CP2 style. This variation apart, it is proposed that CP2 and CP3 be treated as separate expressions of the same regional tradition but not the same potting community. Regional traditions are here defined as a predominance of potting traditions, within a discrete geographic region, which are similar in most respects (for a detailed discussion of regional traditions see Shepard 1956:336-41, 347-52; and glossary in this study).

COMPARISON OF CP2 AND CP3 CERAMIC TECHNOLOGIES

The material pottery is made from, the manner in which it is prepared, the fabrication and surface treatment of vessels and other ceramic artefacts and finally their drying and firing, together comprise the essential technical parameters of any potting tradition. Some of these production steps are critical. Successful potting manufacture can only be accomplished when each step is adequately carried out. Clay selection and preparation directly influence the overall quality of any ware. A variety of different techniques have been utilized by craft potters to improve and render substandard clays suitable for use. Prehistoric pottery is often composed of distinctive clays and additives. Petrographic analysis enables such fabrics to be characterized and, when related to geological information, their sources can often be suggested. Differences in potting technologies can often also be characterized using this technique.

Petrographic characterization of CP2 and CP3 pottery demonstrates that at least two clays were processed for use in local wares. Some fabrics were prepared by adding a grog temper. Others appear to lack any additives. During CP2, grog was added to a very sandy clay. The same kind of temper continued to be used in CP3, but the clay changed. During CP3 the clay to which grog was added was not sandy. Such a change could simply signal that the clay deposits favoured by CP2 potters had been exhausted, or that they had discovered a new deposit which was considered superior to the sandy clay and they gave up using it. Critically, however, the change took place in concert with changes in the kinds of pottery which had been made at Khok Phanom Di for about 200 years. When both the style and fabric of pottery alter in tandem significant cultural changes are signalled. Further, tests of local clay deposits show that the CP2 clay was not exhausted. Switching from an established clay to an untested new source, particularly when a change was unnecessary, runs counter to the inherent technological conservatism craft potters normally display.

Local CP2 fine and coarse wares were composed of sandy clay tempered with grog. A silty clay, petrographically consistent with samples taken from a modern fishpond next to the site, was also utilized for some other artefacts such as anvils, firing stands and bow pellets during CP2. CP3 coarse wares, however, were nearly all composed of untempered fishpond clay, although some were tempered with grog. Cylinders of prepared fishpond clay, some containing grog composed of the same material, were also recovered from CP3 contexts. A few CP3 anvils and other ceramic artefacts were also made from the fishpond clay. The adoption of fishpond clay

for use in the most abundant locally produced pottery during CP3 could be the result of a need to conserve dwindling higher quality local clay resources. As explained above, however, this can be ruled out because the clay used in fine wares was still available. A significant aspect of the use of fishpond clay is the absence of grog, or any other temper, in nearly all local coarsewares. This implies that CP3 potters had mastered the technique of utilizing a silty clay to make what appear to be readily disposable vessels. There is no obvious difference in skills reflected in the pottery produced during CP2 compared to CP3, however, which suggests the correct explanation lies elsewhere. This question will be considered further in Chapter XII.

One possible reason for the change in clays exploited for CP3 utilitarian coarse wares is a change in their function. A change in vessel shape coincided with the change in fabric. A corollary of the shape change was the introduction of cylinders of prepared clay into the excavated area. Their importance is underscored by the presence of several as grave goods in B15. The cylinders are composed of both tempered and untempered varieties of fishpond clay. Although CP3 type L2j coarse wares are composed of untempered fishpond clay, vessels with RF2 rims, which probably represent type L2e or L2e(f) globular jars, contain FG3 which is composed of either another local clay or fishpond clay tempered with orthodox grog. The type L2j vessels were fabricated from cylinders of untempered fishpond clay, while type L2e or L2e(f) vessels, were made from the same clay tempered with grog. Irregular fracture patterns suggest that some type L2j vessels were formed directly from the prepared clay cylinders. This contrasts with other local wares which were built up with slabs. Type L2j vessels are fragile and easily broken. The rim is gently folded inwards which suggests that the soft clay was easily fractured when the rim was being formed. Type L2e globular jar rims, however, are acutely everted and the termini tightly folded. This suggests that the tempered clay was more readily worked, an outcome which is consistent with mixing nonplastic material into plastic clay. As a result type L2e jars were stronger and more durable than type L2j vessels. Two different functions are, therefore, also indicated by the use of different clay preparations.

Fabricating cylindrical vessels directly from cylinders of untempered clay would be a simple and quick method of mass producing large quantities of coarse utilitarian vessels. Coarse ware sherd abundance, particularly during CP3, indicates that large quantities were produced. Control of the overall potting procedures, however, would require careful manipulation of the raw materials. Processing the clay involves quarrying, transportation to the site, storing it in a plastic condition, forming the vessel, stacking it to dry and then firing it. At each step confidence in the quality of the clay is essential. Shrinkage and plasticity tests detailed in Chapter V show that suitable clay was available just below the surface where a modern fishpond had been excavated close to the site. Clay quality within the fishpond column varied markedly. Care would be needed, therefore, to ensure that the best portion of the deposit was selected. To avoid quarrying any substandard clay, in such mixed sedimentary deposits, requires a detailed knowledge of clay properties from a potting perspective. A high degree of specialist skill in selecting the correct clay would be needed, at least at the outset until familiarity with the quarry was achieved. Clay selection is a crucial initial stage in potting. Local CP3 potters exploited unmodified fishpond clay in large numbers of type L2j storage vessels. Their fabrication method and shape was simple. They were successfully dried and fired. The result was an adequate medium-sized storage vessel with less durable properties than other local CP3 coarse wares. It is highly likely that

such pottery would not survive intact for long under normal usage conditions. This suggests that they were produced with a transient survival rate in mind. They were not designed or expected to last for long.

SYNTHESIS OF CP2/3 DEVELOPMENTS

Direct evidence for firing pottery was recovered from the top of CP2 in the form of ceramic firing stands, ash and charcoal. This coincided with an increase in potters' tools and a hiatus in mortuary activity. Following this hiatus, a cemetery was re-established. Local mortuary wares in the CP3 portion of the cemetery differ from those recovered from CP2 graves, in style and material composition. Other differences are also present. The number of burnishing stones reduced, particularly in the middle of CP3, and local coarse ware production increased sharply. Measured in terms of volumetric density, it represents a 65.99 per cent increase in output of the most common coarse ware during CP3 compared to that achieved during CP2 (Table 111). Conversely, local fine ware output reduced by a similar factor. The range and complexity of local fine wares reduced markedly and apart from some exceptionally outstanding examples, became less elaborate in CP3 compared to CP2. Potting clay became an increasingly important feature of grave furniture during CP3. It is absent from CP2 graves, apart from a MP3 burial, considered, on ceramic criteria, to belong to CP3. Following this same criterion, vessels deployed as grave furniture increased from 1.86 pots per burial in CP2 to 2.13 in CP3, when only burials with vessels are considered. Eight vessels were recovered from non-mortuary contexts in CP3 compared to 13 in CP2.

TABLE 111: *Rim form 1 quantities in Ceramic Periods 2 and 3*

CP	Depth	Pottery (kg)	Density (kg/m^3)
3	3.110m	71.28	22.91
2	2.059m	31.14	15.12

Other changes include the absence of vessels with large tripod feet. Net weights, prominent during CP2, decrease and then disappear from the assemblage about midway through the CP3 sequence (Table 112). Apart from L7, bow pellets are extremely rare in CP3. In CP2 they occur throughout the sequence, to peak at mid-point. Over 12 kg of potting clay was recovered from the general matrix of CP3, compared to 1.02 kg in CP2. In CP3 over 16 kg of clay, most in the form of prepared cylinders, was associated with burials. Only one CP2 burial contained a small amount of potting clay as grave furniture. A silty potting clay, little exploited by local potters during CP2, formed an important component of a much expanded coarse ware output in CP3. Ceramic anvils were interred with nine CP3 burials whereas only one CP2 burial revealed an anvil in doubtful association. Anvils were only placed in female graves, while other potting tools

were distributed amongst both sexes. Anvils are potentially sensitive indicators of their owner's origin. Only one clearly associated with an individual is considered to be exotic. It was placed in the grave of B15, an outstandingly wealthy female potter from CP3. The mortuary ritual surrounding the interment of this individual, and related burials, suggests that potters gained status through their craft during CP3 but not CP2. Burnishing stones were placed in 11 CP2 and 15 CP3 burials underlining the importance of burnishing in both CPs. The local modes of fine ware decoration, burnishing, incising, and shell impressing, throughout both CPs, mirror many exotic modes. This emphasizes that the local potters shared in a decorative style which carried a regional expression. A small proportion of exotic wares presented distinctive styles not replicated by Khok Phanom Di during CP2 and CP3, with one exception. A higher proportion of CP3 than CP2 graves included potting materials and equipment. Potting was an important activity during both CPs, however, the focus changed from fine wares in CP2 to coarse wares in CP3.

TABLE 112: *The distribution of ceramic artefacts: Ceramic Period 3*

Artefact Layer:	5	6	7	8	9-10:1-2
rim complexity	45	59	48	47	68
exotic rims	4	30	11	11	8
exotic sources	1	6	6	3	5
net weights	-	-	1	4	3
bow pellets	-	1	9	-	2
tripod feet	1	1	-	1	1
burnishing stones	7	27	16	15	51
anvils	6	4	8	7	5
vessels:					
non-mortuary	-	3	-	-	5
mortuary	8	21	26	20	2
Totals:	72	152	125	104	150

In terms of the ceramic spectrum, external relationships at Khok Phanom Di changed with the inception of CP3. Mortuary vessels included three from exotic sources during CP2. During CP3 this doubled to six. Exotic rim forms were represented by nine different sources in CP2. In CP3 this increased to 12. None of the CP2 exotic donor sources are present in the MP4-7 mortuary offerings. A similar situation prevails in the rim form spectrum. Two of the nine CP2 exotic rim sources are absent from the CP3 assemblage. Four of the 12 CP3 exotic rim forms are absent from CP2. In total, therefore, two of the 10 CP2 exotic ware sources are not represented in the CP3 spectrum and six of the 14 CP3 exotic sources are absent from the CP2 spectrum. Eight sources are present in both assemblages. Only one, FG6, is represented in the mortuary offerings of both CPs. Many of the similarities are in the exotic rim spectrum and many of these

are present in very minor amounts. Two sources dominate both the CP2 and CP3 exotic rim spectrum. The broadest range of wares came from a potting centre producing pottery using bleb temper which is associated with rice husk. The other prominent tradition involves the use of a distinctive microcline-rich sand temper. While the latter is absent from CP2 grave furniture, the former is present in the L10:16 rim fabrics and then became increasingly prominent. It is present in both CP3 mortuary wares and rims. Pottery associated in some form with rice is present throughout the cemetery sequence.

CERAMIC TRADITIONS AND THE ENVIRONMENT

Armed with conclusions drawn from the ceramic spectrum, it is now time to focus attention on any related cultural-environmental developments. In Chapter VIII, it was noted that the distribution of botanical and animal species, especially molluscan, within the cemetery changed over time. Some of these changes were gradual, others rapid. Taken together, they clearly point to environmental change at about the CP2/CP3 boundary. Marine faunae were essentially replaced by freshwater species. This initial change became a trend throughout CP3. A hiatus in mortuary activity was correlated with the environmental shift. A major change in the ceramic spectrum followed immediately the cemetery was re-established. Access to waterways would have been essential if close contacts with donor potteries, from which exotic wares were sourced, were to be maintained. Even more critical, for such a major potting centre, would be access to consumers. In this respect, it seems certain that the distribution of local wares, intended for exchange with consumer sites, could have only been maintained through the exploitation of suitable water transport routes. Given the volume of local pottery production, these routes would have needed to be close at hand. This, combined with the faunal evidence, suggests that the site was located on or very close to a river.

X CERAMIC PERIOD FOUR

FOLLOWING a major cultural discontinuity, a potting workshop occupied the area immediately overlying the cemetery used for about twenty generations. Unfortunately charcoal deposits suited to dating under standard radiocarbon methods were not encountered in this level. But rice-tempered sherds have provided AMS determinations (Fig. 9 and Chapter XII).

Prehistoric potting workshops provide a unique opportunity to study the organization, scale and intensity of production. Whether production was organized through specialization is of particular interest. Direct evidence of clay preparation and pottery forming is apparent in the mass of debris encountered. An extensive assemblage of ceramic anvils and other potting tools was recovered along with large quantities of prepared potting clays and broken pottery. This material will be examined in an attempt to establish the kind of pottery making strategy that was employed. The question of whether craft specialization can be detected through an analysis of the workshop remains will be addressed following a full summary of the four CPs in Chapter XI.

THE STRATIGRAPHY (LAYER 4 TO LAYER 1)

Soft, reddish brown, sandy deposits made up the matrix of layer 4 (L4) which represents about 25 cm of the cultural deposits. Some mixing with L3, probably partly due to bioturbation and cultural activities, rendered the L3-4 boundary difficult to detect. Over 20 pits, ranging in maximum diameter from 0.86 to 4 m and in maximum depth from about 10 cm to just over 1 m, were distributed across the square (Figs. 219 to 222). The pits in this portion of the site contained mostly marine shellfish, abundant mangrove fringe dwelling crabs and numerous fish and turtle remains. According to Higham and Bannanurag (1990:44) "mammals were relatively rare, but included the langur, macaque, pig and both a large and small species of deer." Ten pits were encountered in L4:4-5. Seven formed a rough line from the centre of the southwest wall of the raised floor platform built during the accumulation of L6 deposits. The top of the northwest corner of the exterior platform upstand or wall protruded into L4:4-5. Burnt reddish clay was present in the middle of the pit alignment (Fig. 219). A fragment of a ceramic anvil (cat. 565), was found in one pit and worked shell in another.

Stone adze heads, a stone hoe, bone, ivory, shell and stone disc/bangles, bone "bobbins", worked antler, bone awls and micro-awls and ceramic pellets were found in L4 contexts. A complete anvil and three fragments were recovered from L4:3-4. One pit and the top few cm of the platform wall were the only features identified. Layer 4:1-2 extended from 1.01–1.10 m below datum. A series of intercut pits ran from southeast to northwest. A cache of partially processed ivory, another of deer antler and bone recovered from the surface of L4 suggest that the area was reserved for processing. A turtle carapace in association with sherds, two clay

cylinder fragments and *Anadara* shells were buried in a shallow pit. Two fragmented cylinders of prepared potting clay lay near the centre of the previous three features. Four complete and 16 broken anvils lay across the surface of L4:1 (Fig. 221). The excavators note that with respect to this context:

> "It is hard to avoid the impression that the area was used for the preparation of a variety of raw materials for later modification." (Higham and Bannanurag 1990:46)

A huge increase in broken pottery and substantially more artefacts distinguish L3-1 (the latest prehistoric deposits, at a depth of *c.* 50–90 cm below datum), from preceding contexts (Fig. 223). These include eramic anvils, burnishing stones, stone adze heads and hoes, whetstones, ceramic pellets and net weights, bone "bobbins" and awls, bone, ivory, shark tooth, stone and turtle shell jewellery and ornaments, and worked deer antler. An oval concentration of potting clay 3 m by 1.6 m lay in the southeast quadrant at about 50 cm below datum. It was ringed by clay cylinders and potting anvils. Within L1-3:5 potting equipment included 17 complete, or near complete, anvils and 94 anvil fragments. Potters' marks are visible on 24 anvils. At least eight cylinders of prepared potting clay lay amongst the anvils. A complete lack of postholes contrasts this zone with earlier contexts. Patches of reddened silty sediments were noted, but no deposits of charcoal or ash suggestive of pottery firings.

Close examination of the dense mass of potsherds in L1 revealed a high degree of surface damage consistent with post-depositional rolling and re-deposition possibly due to natural site erosion. This damage affected some pottery as deep as the upper portion of L2, but sherds below this point did not display such characteristics.

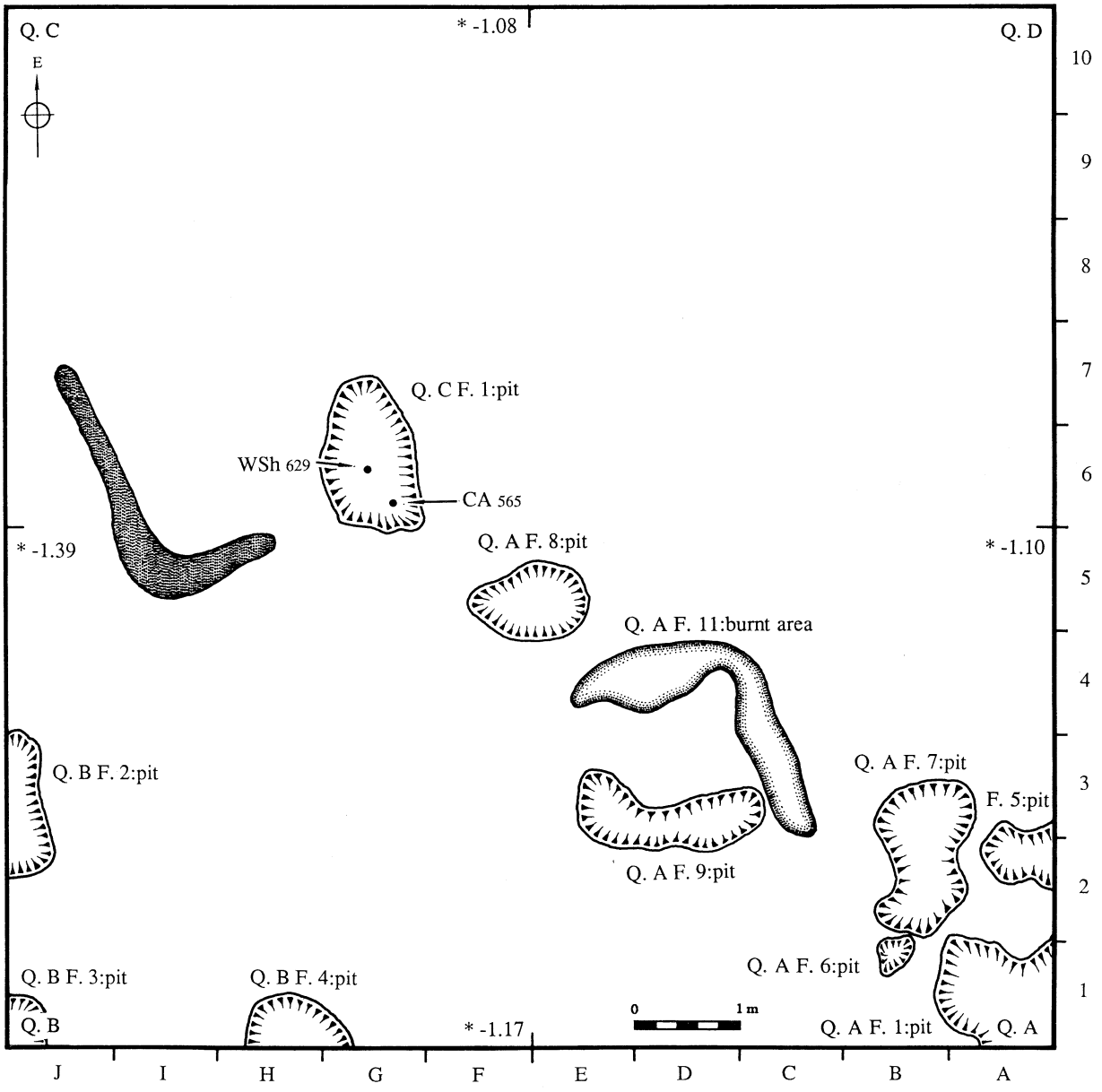


FIG. 219: Features identified in layer 4:5, Ceramic Period 4. F: feature, CA: ceramic anvil, WSh: worked shell. Catalogue reference numbers follow each artefact

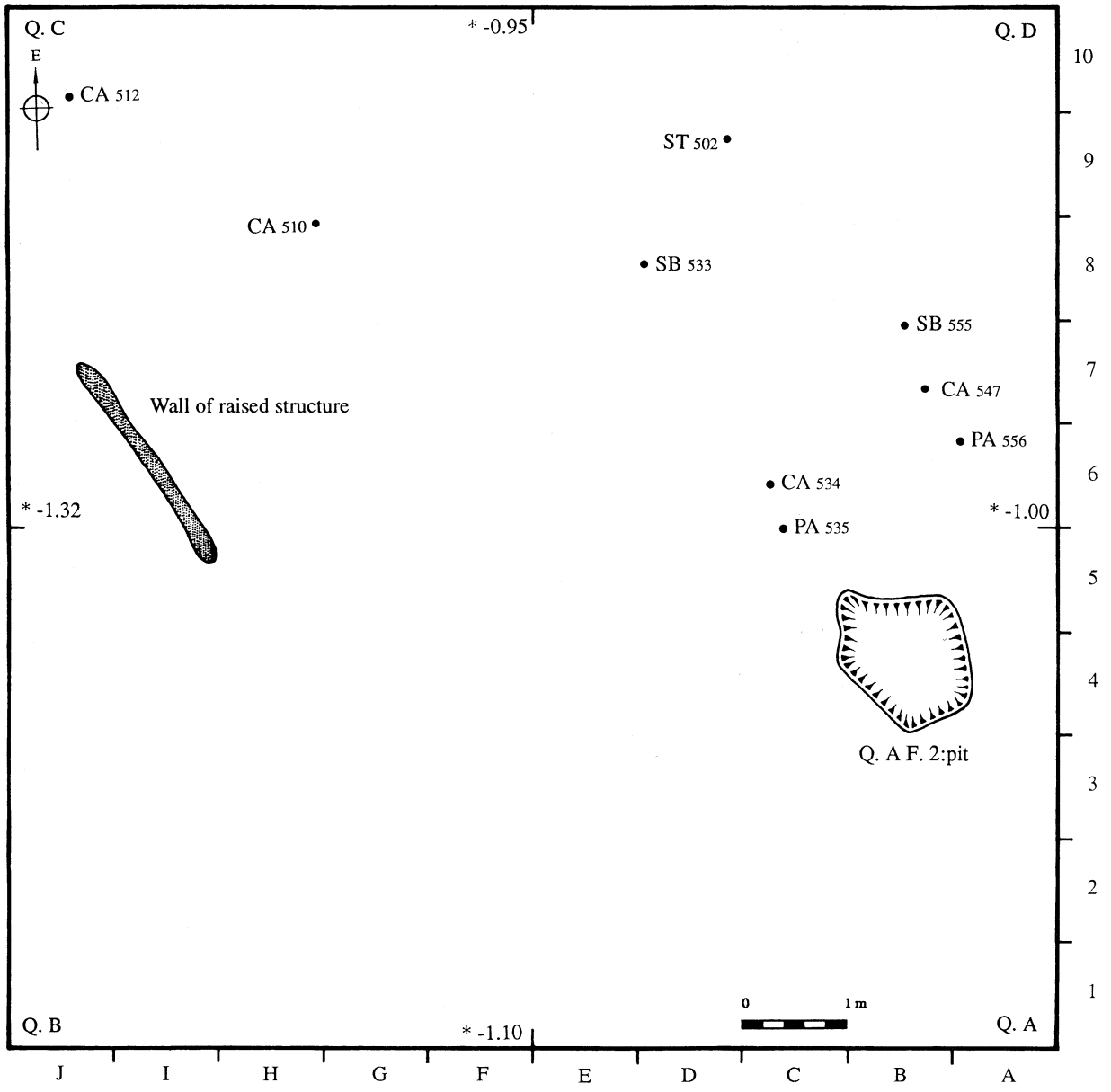


FIG. 220: Features identified in layer 4:3, Ceramic Period 4. F: feature, PA: adze head, CA: ceramic anvil, SB: shell disc/bangle, ST: stone disc/bangle. Catalogue reference numbers follow each artefact

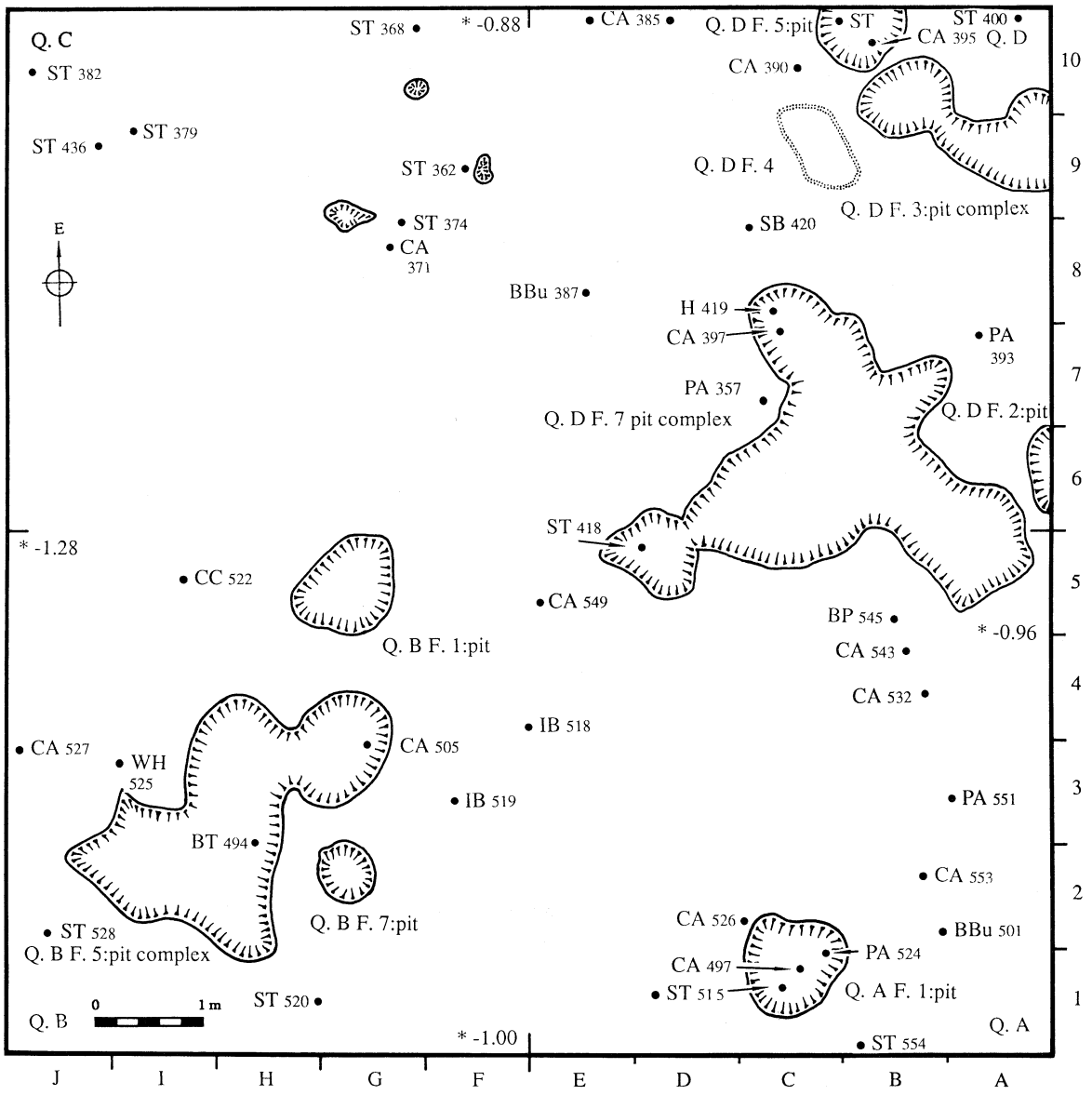


FIG. 221: Features identified in layer 4:1, Ceramic Period 4. F: feature, PA: adze head, BO: bone disc/bangle, IB: ivory disc/bangle, CC: ceramic counter, H: hoe, BP: bone point, BT: bone tool, BBu: bone burnisher, CA: ceramic anvil, SB: shell disc/bangle, ST: stone disc/bangle, WH: whetstone. Catalogue reference numbers follow each artefact

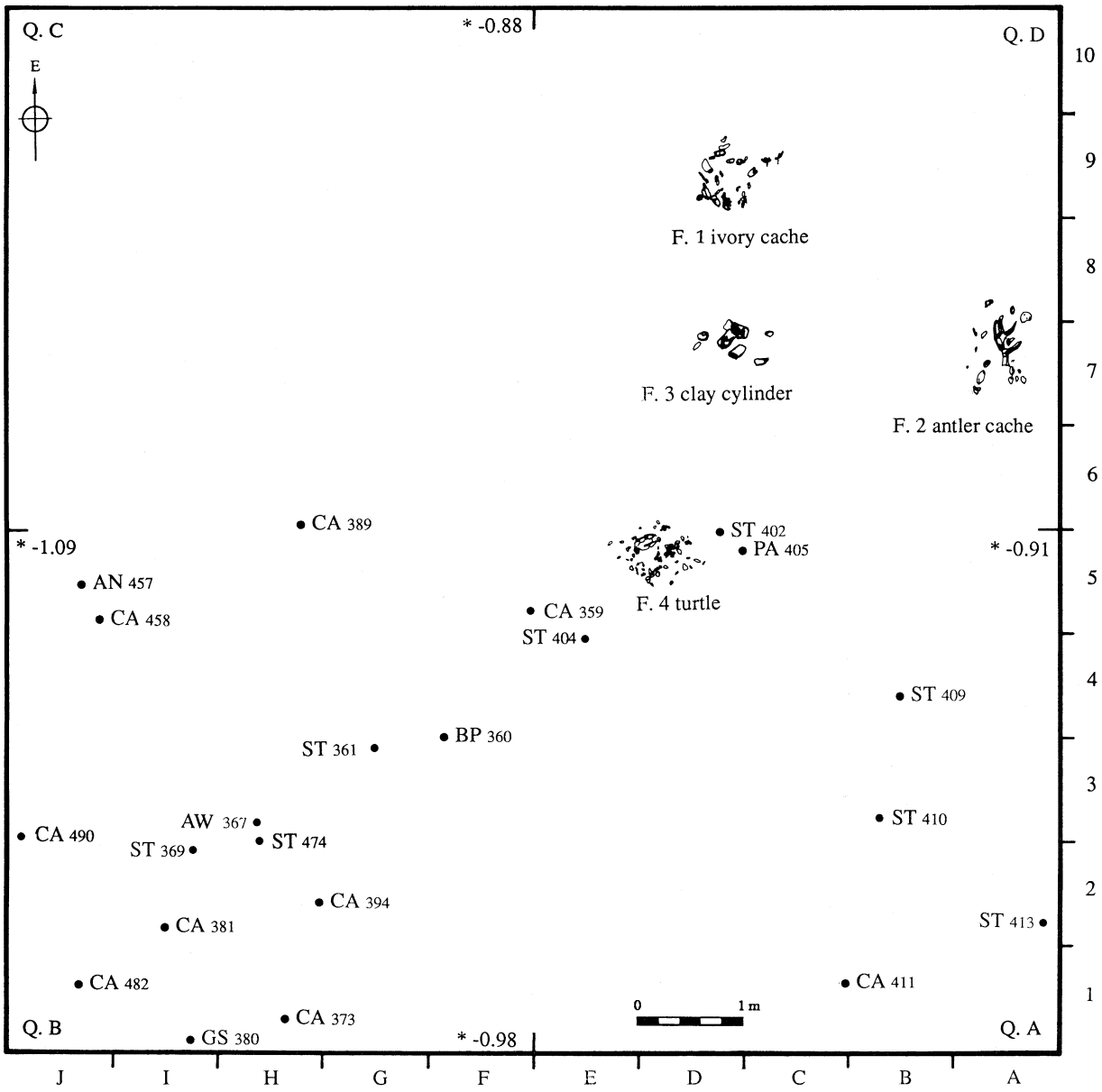


FIG. 222: Features identified in lower layer 3 and layer 4 surface, Ceramic Period 4. F: feature, CA: ceramic anvil, BP: bone point, SB: shell disc/bangle, ST: stone disc/bangle, PA: adze head, AN: worked antler, AW: bone awl. Catalogue reference numbers follow each artefact

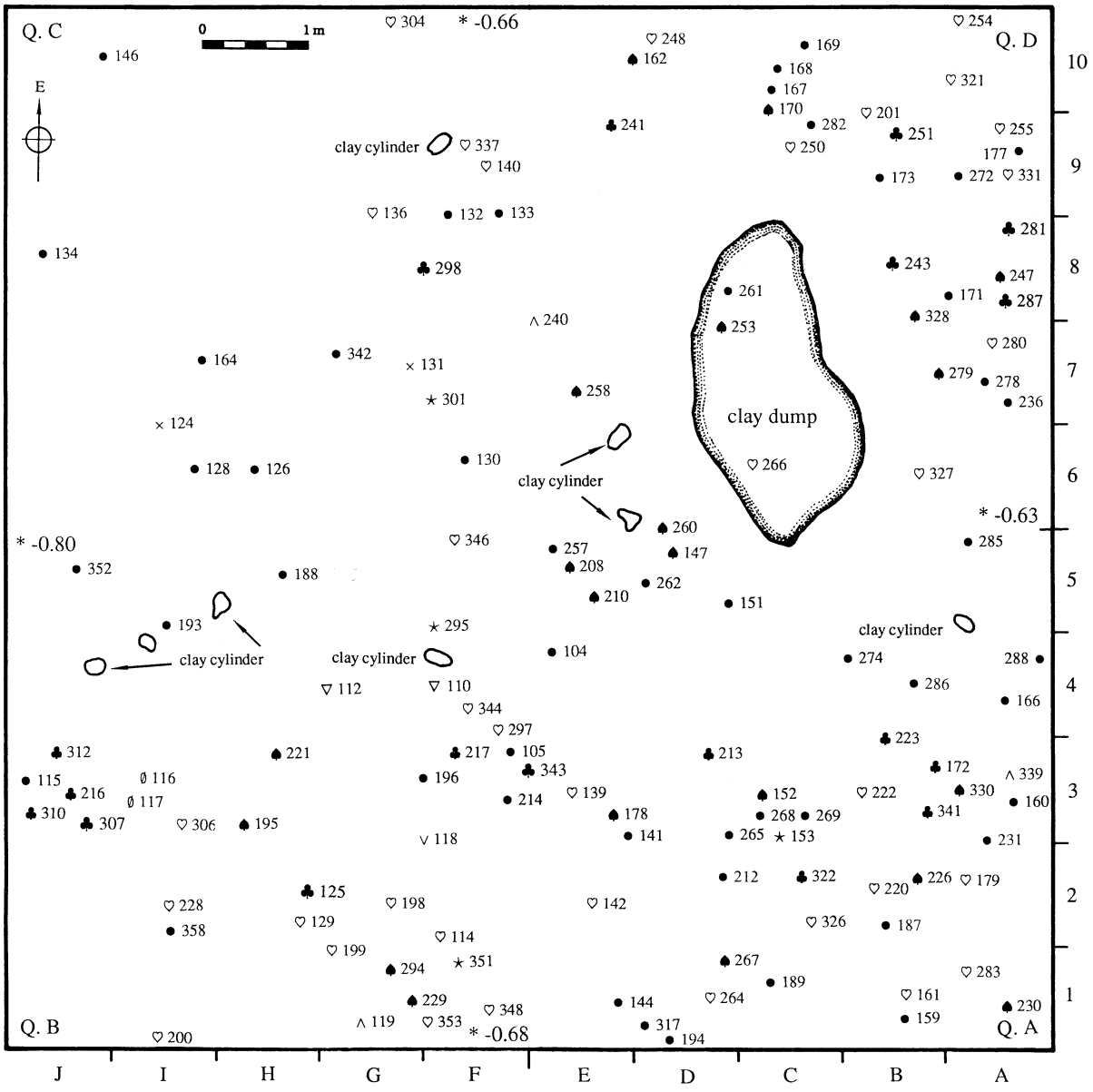


FIG. 223: Features identified in layers 2 and upper layer 3, Ceramic Period 4. heart: stone disc/bangle, club: adze head, dot: ceramic anvil, inverted V: bored shark tooth, delta: pottery ladle, zero: whetstone, V: worked antler, BO: bone disc/bangle, star: ivory disc/bangle, X: clay cylinder, club: BP: bone tool (125, 241, 322 and 341, bobbins; 307, 217 and 251, burnishers; 125, 281, 287 and 343 awls), diamond: grinding stone. Catalogue reference numbers follow each artefact

THE POTTERY RELATED ARTEFACTS OF CERAMIC PERIOD 4

THE BURNISHING STONES

Burnishing stones are restricted to the zone immediately overlying layer 4. A total of 27 were recovered, two from the general matrix of L1, eight from L2 and 17 from L3. The CP4 stones represent 7.29 per cent of the site total. It is highly likely that their distribution in CP4 is skewed due to the kinds of potting activities concentrated in this portion of the site. Their presence confirms that burnishing remained an important component of the local potting tradition.

TABLE 113: *Ceramic Period 4 burnishing stones*

Layer	Cat.	Feature	Layer	Cat.	Feature	Layer	Cat.	Feature
1.2	1	-	2.3	2192	-	3.2	2213	-
1.2	2119	-	3.1	2179	-	3.2	2212	-
2.1	70	1/1	3.1	2164	-	3.3	2301	-
2.1	940	-	3.1	2169	-	3.3	2634	-
2.1	2166	-	3.1	2197	-	3.3	2665	-
2.1	2167	-	3.1	2204	-	3.3	2300	-
2.1	2168	-	3.1	2173	-	3.3	2114	-
2.1	2191	-	3.1	2178	-	3.3	2097	-
2.1	2165	-	3.2	2616	-	3.5	2115	-

THE CERAMIC ANVILS

Although present throughout CP4, ceramic anvils were concentrated in L2–3 (Table 114). A total of 136 were recovered, seven from L1; 55 from L2; 49 from L3 and 25 from L4. One complete anvil was uncovered in L1:1 and another in L1:4, eight complete or near complete in L2:1–3, seven in L3:1–5 and five in L4:1–3. Potters' marks are present on 31 anvils, nine complete and 22 represented by fragments. A total of 22 complete or nearly so, derive from CP4. At least 20 per cent of the 136 CP4 anvils are considered to bear potters' marks. Nearly all are composed of local clay. Cat. 482 appears to have been constructed in two stages. Vertical cord marks cover the shaft of cat. 261, recovered from the general matrix of layer 3:2. They were probably created by a "S" twist cord (Fig. 234).

TABLE 114: *Ceramic Period 4 ceramic anvils.*
P.M.: potter's mark, h.s.: hand specimen, f: fishpond clay

Cat.	Layer	Condition	Feature	Thin section/h.s.	Fabric group
1	1.1	fragment P.M.	-	h.s.	local
5	1.1	fragment	-	K321	FG4f
8	1.1	fragment	-	K394	FG5f
17	1.1	complete P.M.	-	K334	FG5
20	1.2	fragment	-	K331	FG5
23	1.2	fragment	-	K355	FG5
32	1.4	complete P.M.	-	h.s.	local grog
43	2.1	complete	-	h.s.	local grog
45	2.1	near complete	-	h.s.(K237)	FG5
51	2.1	fragment	-	K291	FG5
52	2.1	fragment	-	K272	FG5
53	2.1	near complete	-	h.s. (K237)	FG5
55	2.1	fragment	-	K160	FG5
57	2.1	complete P.M.	-	h.s.	grog
58	2.1	fragment P.M.	-	K239	FG4
63	2.1	fragment	-	K391	FG5
66	2.1	fragment P.M.	-	K80, K292	FG5f
68	2.1	fragment P.M.	-	h.s.	local grog
69	2.1	fragment	-	K241	FG5
69b	2.1	fragment	-	K245	FG5
80	2.1	fragment P.M?	-	K237	FG5
86	2.1	near complete	-	K466	FG5
88	2.1	fragment	-	K163	FG5
96	2.1	fragment P.M?	-	K392	FG5
3247	2.1	fragment	-	K532	FG5
102	2.2	fragment	1/1	K182	FG5f
103	2.2	fragment	1/1	K280	FG5f
104	2.2	fragment P.M.	-	K243	FG5f
105	2.2	complete P.M.	-	h.s.	local grog
105a	2.2	fragment	-	h.s.	local
112	2.2	fragment	-	K281	FG5f
115	2.2	frag-use wear	-	K238	FG5
126	2.2	fragment	-	h.s.	FG4
128	2.2	fragment	-	h.s.	local grog
130	2.2	fragment	-	K275	FG5

TABLE 114: *Ceramic Period 4 ceramic anvils (continued)*

Cat.	Layer	Condition	Feature	Thin section/h.s.	Fabric group
132	2.2	fragment P.M?	-	K242	FG5
133	2.2	fragment	-	K240	FG5
134	2.2	fragment	-	K276	FG5
141	2.2	fragment	-	K288	FG5
144	2.2	fragment P.M.	-	K236	FG5
146	2.2	complete	-	h.s.	sand exotic
151	2.2	fragment	-	-	no data
156	2.2	fragment	-	K282	FG5
159	2.2	fragment	-	K181	FG5f
160	2.2	fragment	-	K279	FG5
164	2.2	fragment	-	K273	FG5f
166	2.2	fragment	-	h.s.	local grog
167	2.2	fragment	-	K161	FG5
168	2.2	fragment	-	-	no data
169	2.2	fragment	-	K354	FG5
171	2.2	fragment	-	K159	FG5
173	2.2	fragment	-	K183	FG5
173a	2.2	fragment	-	h.s.	FG5
206	2.2	fragment	-	K289	FG5
177	2.2	fragment	-	h.s.	local grog
187	2.3	fragment	-	K244	FG4
188	2.3	fragment P.M.	-	h.s.	local grog
189	2.3	complete	-	h.s.	FG5
193	2.3	fragment	-	h.s.	FG5
194	2.3	fragment	-	K277	FG5
196	2.3	fragment	-	h.s.	local grog
1501	2.3	fragment	-	K290	FG5
212	3.1	fragment P.M.	-	h.s.	local grog
212a	3.1	fragment	-	h.s.	FG5
214	3.1	fragment P.M.	-	K326	FG5
231	3.1	fragment	-	K344	FG5
236	3.1	fragment P.M.	-	K352	FG5
269	3.1	complete	-	h.s.	grog exotic
452	3.1	fragment	-	K332	FG5
476	3.1	fragment	-	K343	FG5
476a	3.1	fragment	-	h.s.	FG5
477	3.1	fragment	-	K319	FG5
478	3.1	fragment	-	K329	FG5

TABLE 114: *Ceramic Period 4 ceramic anvils (continued)*

Cat.	Layer	Condition	Feature	Thin section/h.s.	Fabric group
3248	3.2	fragment	-	K539	FG11
257	3.2	fragment	-	K306	FG5
261	3.2	complete	-	h.s.	local grog
262	3.2	fragment	-	K341	FG5
265	3.2	fragment	-	K349	FG5
268	3.2	fragment P.M.	-	K337	FG5
272	3.2	fragment	-	K316	FG5
274	3.2	complete P.M.	-	h.s. (K323)	FG5
278	3.2	fragment	-	K307	FG5
282	3.2	fragment	-	K313	FG5
285	3.2	fragment	-	K348	FG5f
286	3.2	fragment	-	K309	FG5
288	3.2	fragment P.M.	-	K336	FG5
443	3.2	fragment	-	K320	FG5
444	3.2	fragment	-	K333	FG5f
445	3.2	fragment	-	K372	FG5
468	3.2	fragment P.M.	-	K324	FG5
317	3.3	complete	-	h.s.	local grog
342	3.3	fragment P.M.	-	K308	FG5
352	3.3	fragment	-	-	no data
358	3.3	complete P.M.	-	h.s.	local grog
421	3.3	fragment	-	K338	FG5
359	3.4	fragment P.M.	-	K311	FG4
373	3.4	complete	-	h.s.	local grog
381	3.4	fragment	-	K312	FG5
389	3.4	fragment	-	K340	FG4
394	3.4	fragment	-	h.s.	local grog
411	3.4	fragment	-	h.s.	local grog
447	3.4	fragment	-	K325	FG5
448	3.4	fragment	-	K314	FG5
449	3.4	fragment	-	K310	FG5
450	3.4	fragment	-	K371	FG4
484	3.4	fragment	-	K323	FG5
485	3.4	fragment	-	K346	FG4f
671	3.4	fragment	-	K322	FG5
458	3.5	fragment	-	K350	FG5f
482	3.5	fragment (2 stage)	-	K315	FG5
490	3.5	complete P.M.	-	h.s.	blebs exotic?

TABLE 114: *Ceramic Period 4 ceramic anvils (continued)*

Cat.	Layer	Condition	Feature	Thin section/h.s.	Fabric group
371	4.1	fragment P.M.	-	h.s.	local grog
371a	4.1	fragment	5	h.s.	local
371b	4.1	fragment	1	h.s.	local
385	4.1	fragment P.M.	-	K339	FG5
390	4.1	fragment	-	K353	FG5
392	4.1	fragment	-	K369	FG5
395	4.1	complete P.M.	-	h.s.	FG5
397	4.1	fragment	-	K367	FG5f
465	4.1	fragment	-	K345	FG5
466	4.1	fragment	-	K370	FG4
497	4.1	complete P.M.	-	h.s.	grog
505	4.1	fragment	5	K330	FG11
526	4.1	fragment	1	K317	FG4
527	4.1	fragment	-	h.s.	local grog
428	4.2	fragment P.M	-	h.s.	local grog
682	4.2	fragment P.M.	-	K351	FG5f
549	4.2	complete	-	h.s. (K323)	FG5
553	4.2	fragment	-	K274	FG5
543	4.2	complete	2	h.s.	local grog
534	4.3	fragment	7	K328	FG5
562	4.3	fragment	7	K328	FG5
547	4.3	complete	7	h.s.	local grog
510	4.4	fragment	-	K342	FG5
512	4.4	fragment	-	h.s.	grog
433	4.5	fragment	-	K433	FG5
565	4.5	fragment	1	-	no data

THE CERAMIC ANVIL FABRICS

No data are available for four of the 135 anvils and fragments examined; 124 are local and seven exotic.

The composition of four local anvils examined in hand specimen is uncertain. Three samples annotated grog are probably local and 21 further anvils examined in hand specimen are also local. Local anvils include 88 composed of FG5, 10 of FG4 and 20 examined in hand specimen contain local grog. The last probably also represents FG5, but because rice could not be identified with confidence they have been assigned to the local grog group.

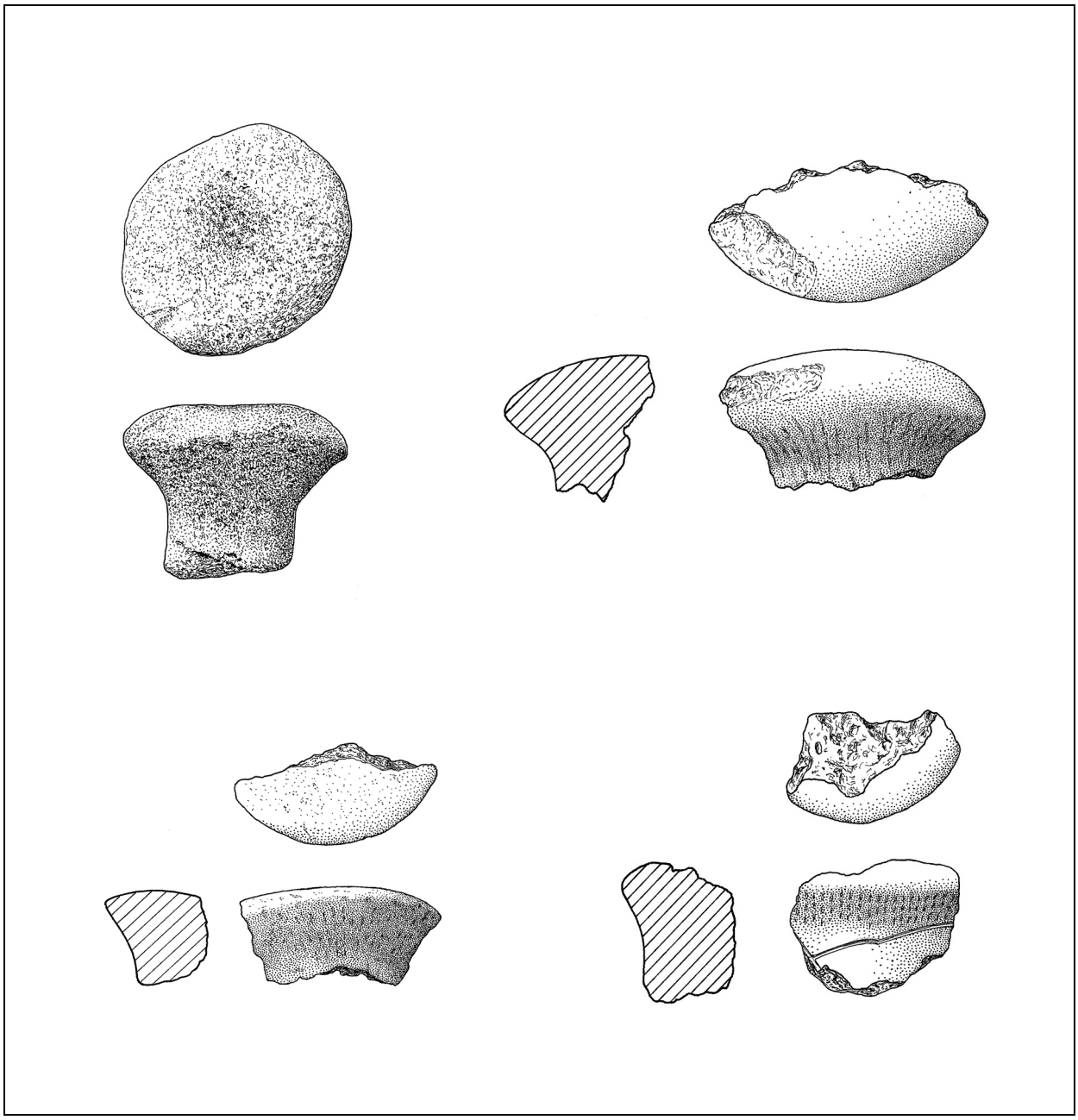


FIG. 224: Ceramic Period 4 potters' anvils. *Top* left: cat. 547 (L4:3), right: cat. 534 (L4:3),*Bottom* left: cat. 510 (L4:4), right: cat. 682 (L4:2). Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

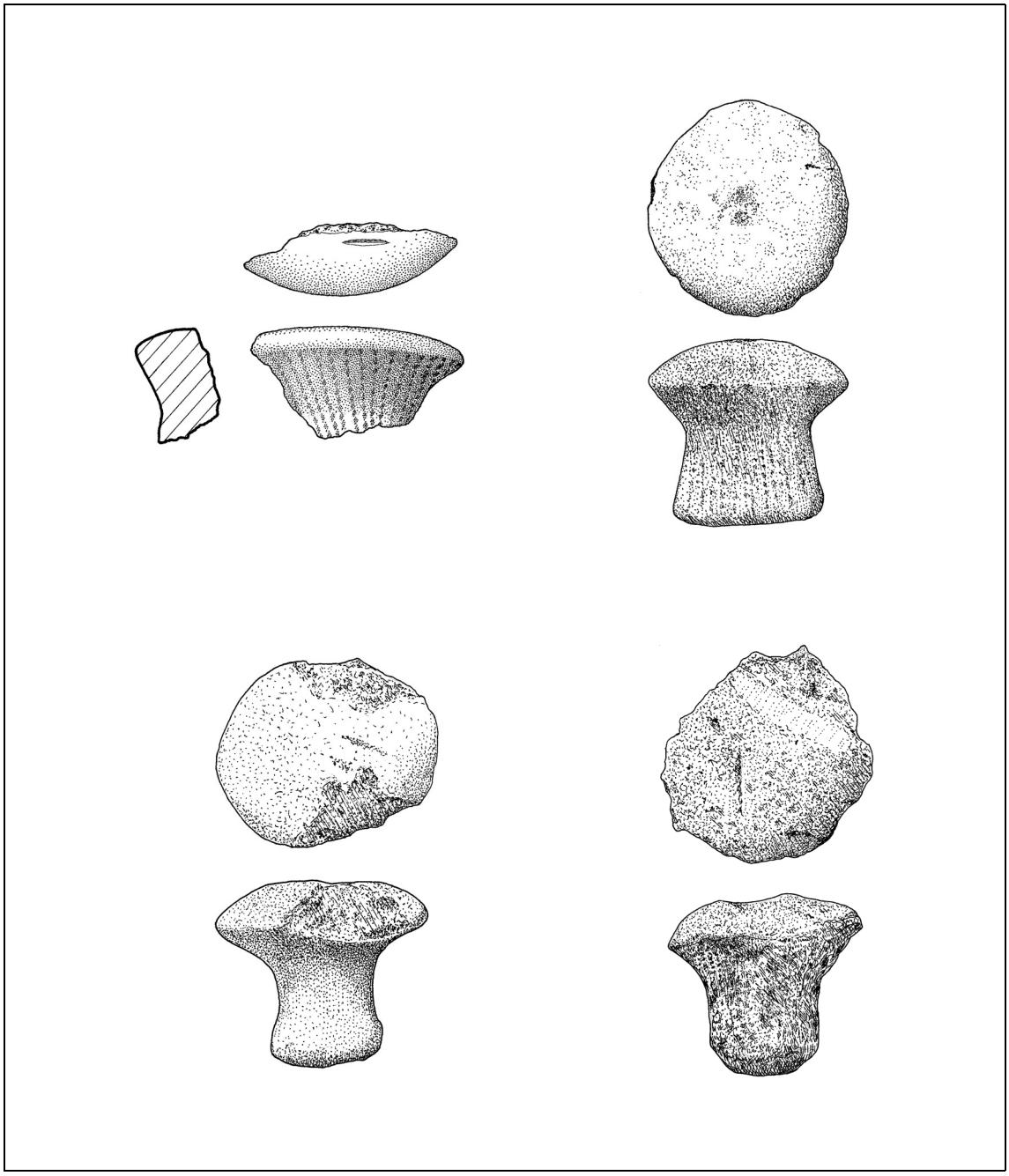


FIG. 225: Ceramic Period 4 potters' anvils. *Top* left: cat. 553 (L4:2), right: cat. 549 (L4:2), *Bottom* left: cat. 543 (L4:2), right: cat. 527 (4:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

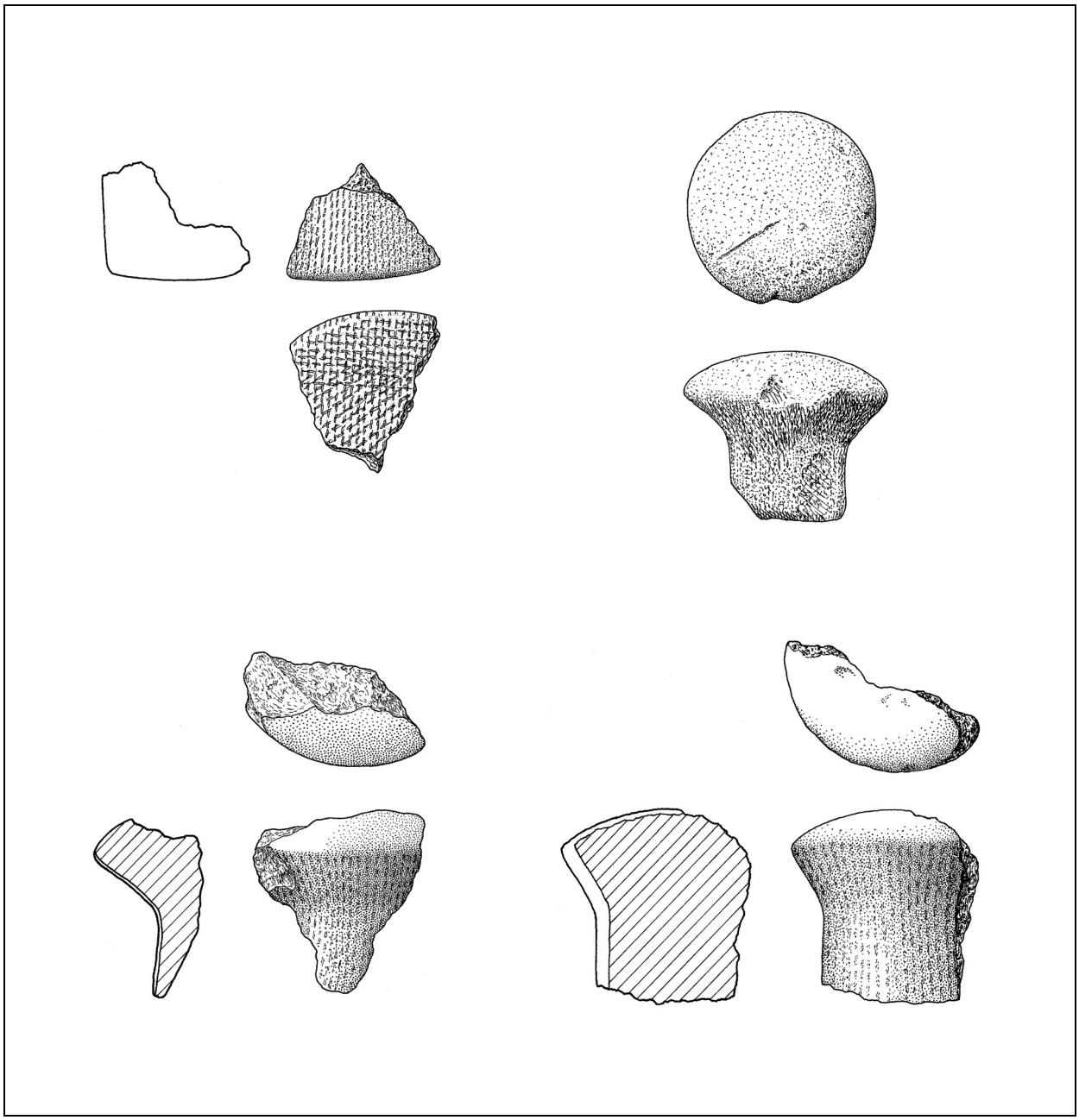


FIG. 226: Ceramic Period 4 potters' anvils. *Top* left (handle base): cat. 465 (L4:1), right: cat. 497 (L4:1), *Bottom* left: cat. 505 (L4:1), right: cat. 526 (L4:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

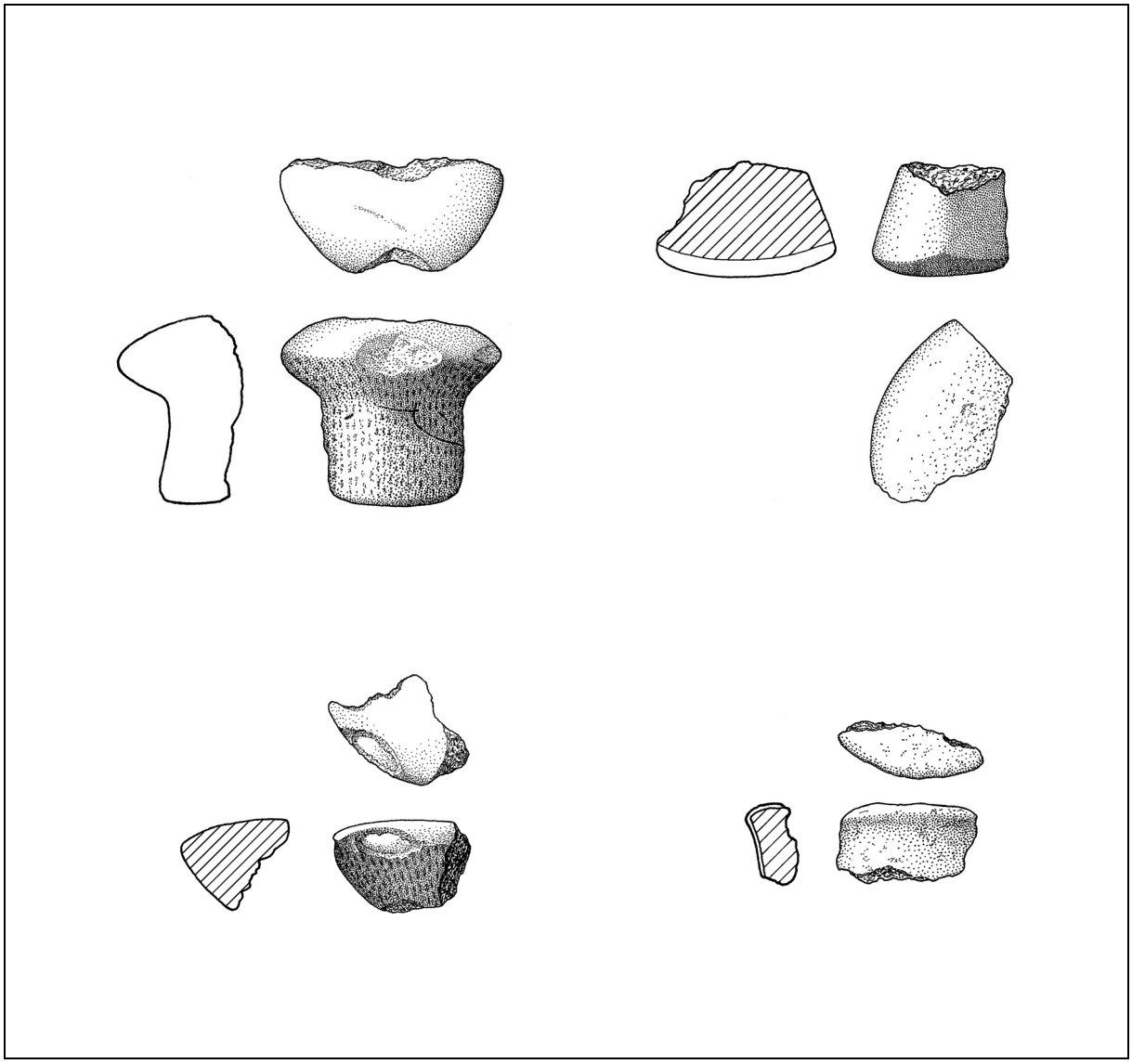


FIG. 227: Ceramic Period 4 potters' anvils. *Top* left: cat. 385 (L4:1), right (handle base): cat. 397 (L4:1), *Bottom* left: cat. 482 (L3:5), right: cat. 671 (L3:4). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

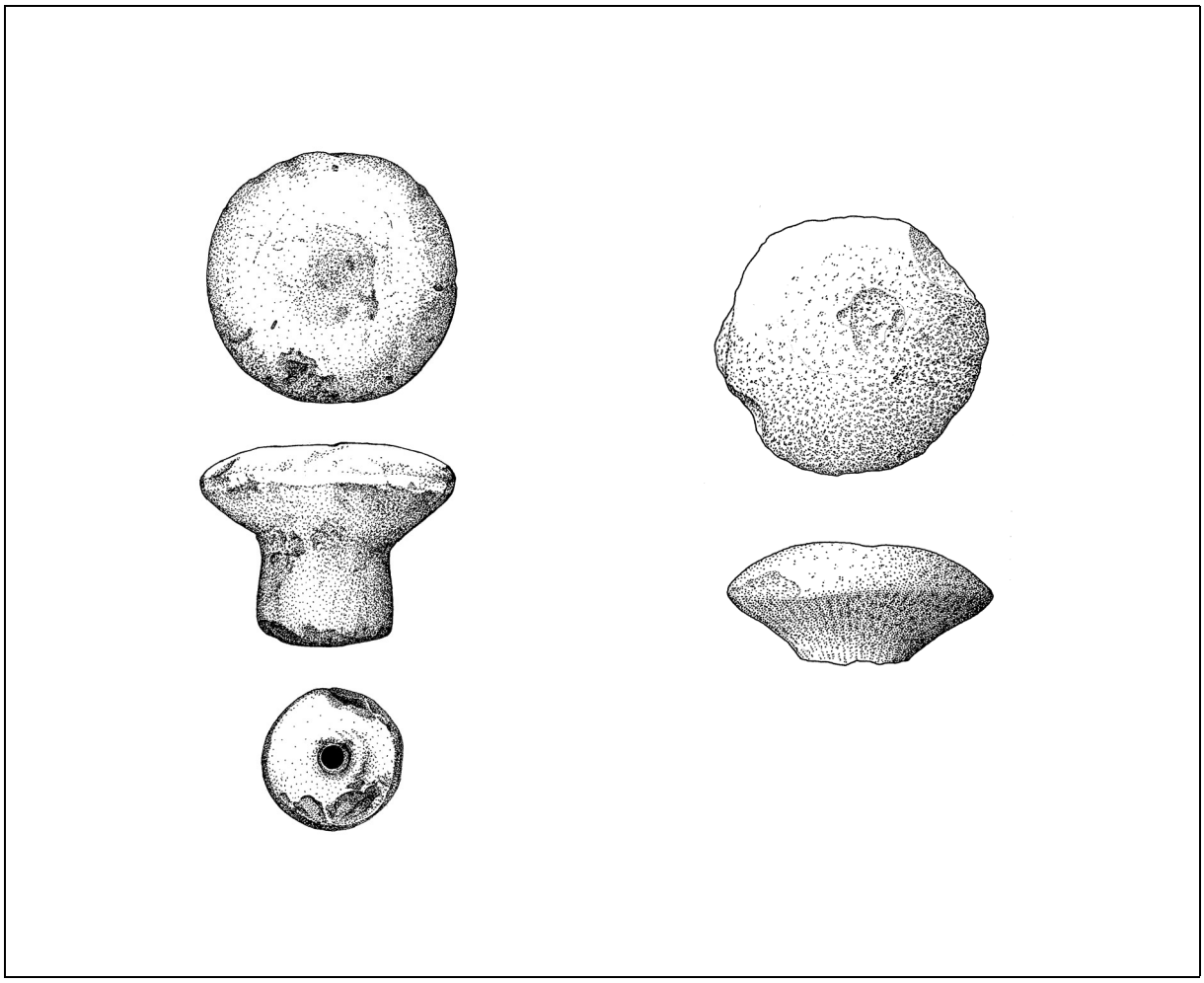


FIG. 228: Ceramic Period 4 potters' anvils. Left: cat. 490 (L3:5), right: cat. 411 (L3:4). Scale: 1:2

Rice, therefore, is clearly associated with 98 (77.77 per cent), and probably 119, or 94.44 per cent, of the local anvils. Fishpond clay is present in 15 (16.85 per cent) of the 89 anvils examined in thin section. Cat. 444 contained fishpond clay grog within local clay consistent with the *din niao* deposit. Cats. 381, 448 and 468 contained numerous rice husk remains as well as bleb grog temper.

The quantity of rice remains in the local anvils varied from rare to numerous. In some, what appear to be small fragments of straw are present along with husk. The latter is often very small. The anvil fabrics are dense, no doubt a requirement for tools designed to receive repeated percussive forces. A preponderance of FG5 local anvils suggests that rice temper alone produced a weaker fabric likely to shatter under pressure. This question will be discussed in more detail in Chapter XI.

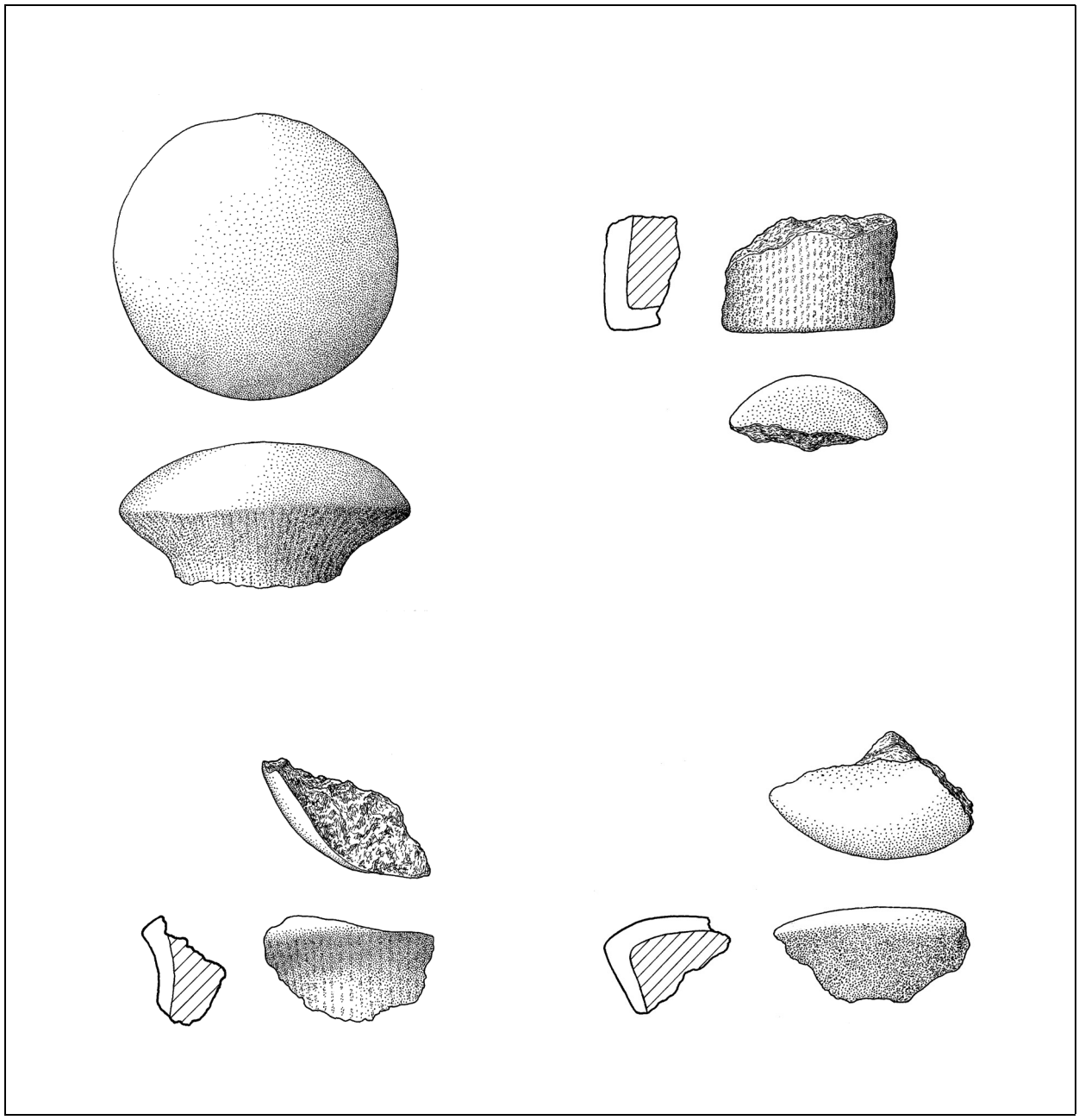


FIG. 229: Ceramic Period 4 potters' anvils. *Top* left: cat. 394 (L3:4), right (handle base): cat. 447 (L3:4), *Bottom* left: cat. 449, right: cat. 484 (L3:4). Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

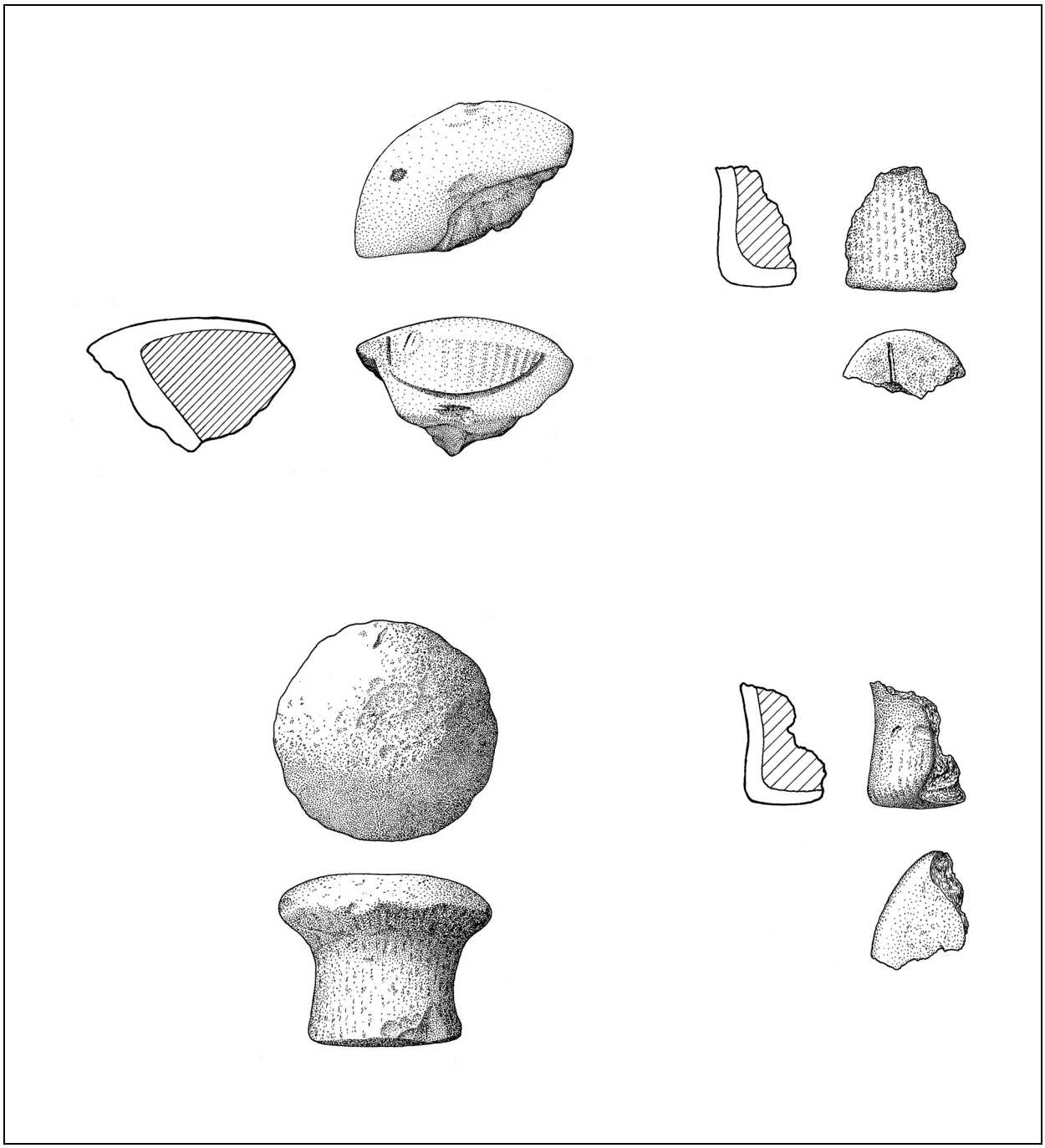


FIG. 230: Ceramic Period 4 potters' anvils. *Top* left: cat. 342 (L3:3), right (handle base): cat. 359 (L3:4), *Bottom* left: cat. 373 (L3:4), right (handle base): cat. 381 (L3:4). Shading indicates firing results (shaded areas are not oxidized). Scale: 1:2

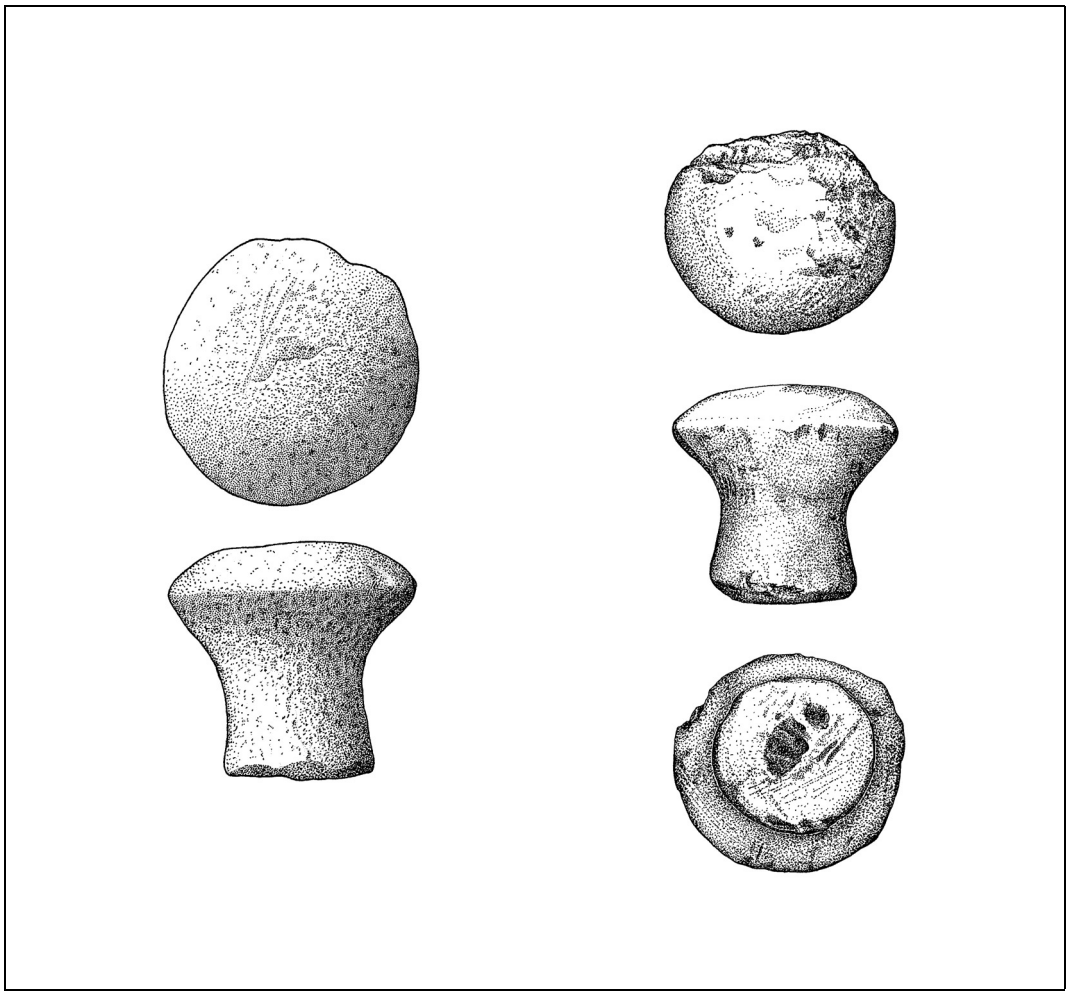


FIG. 231: Ceramic Period 4 potters' anvils. Left: cat. 317 (L3:3) and cat. 358 (L3:3). Scale: 1:2

A clear association is indicated between rice and bleb temper in the local anvils, although other methods of improving clay qualities, including blending, would have been available.

Blended clay is not obvious in the anvil sample, apart from the use of fishpond grog to temper another, more plastic, local clay. Further research would be required to resolve whether clay blending was utilised. Given a local abundance of suitable potting clays, however, blending is unlikely to have conferred any advantages, except perhaps for special purpose, relatively heavy, anvils. Dense, strong ceramic anvil fabrics may have been achieved through combining short with plastic local clays or the selection of quarried material which contained appropriate balance in the "as received" state. Given the mosaic of local clays available (Chapter V), it is unlikely that blending would be needed. Thus potters familiar with the variety of local clays available are likely to have selected clays suited to their various needs.

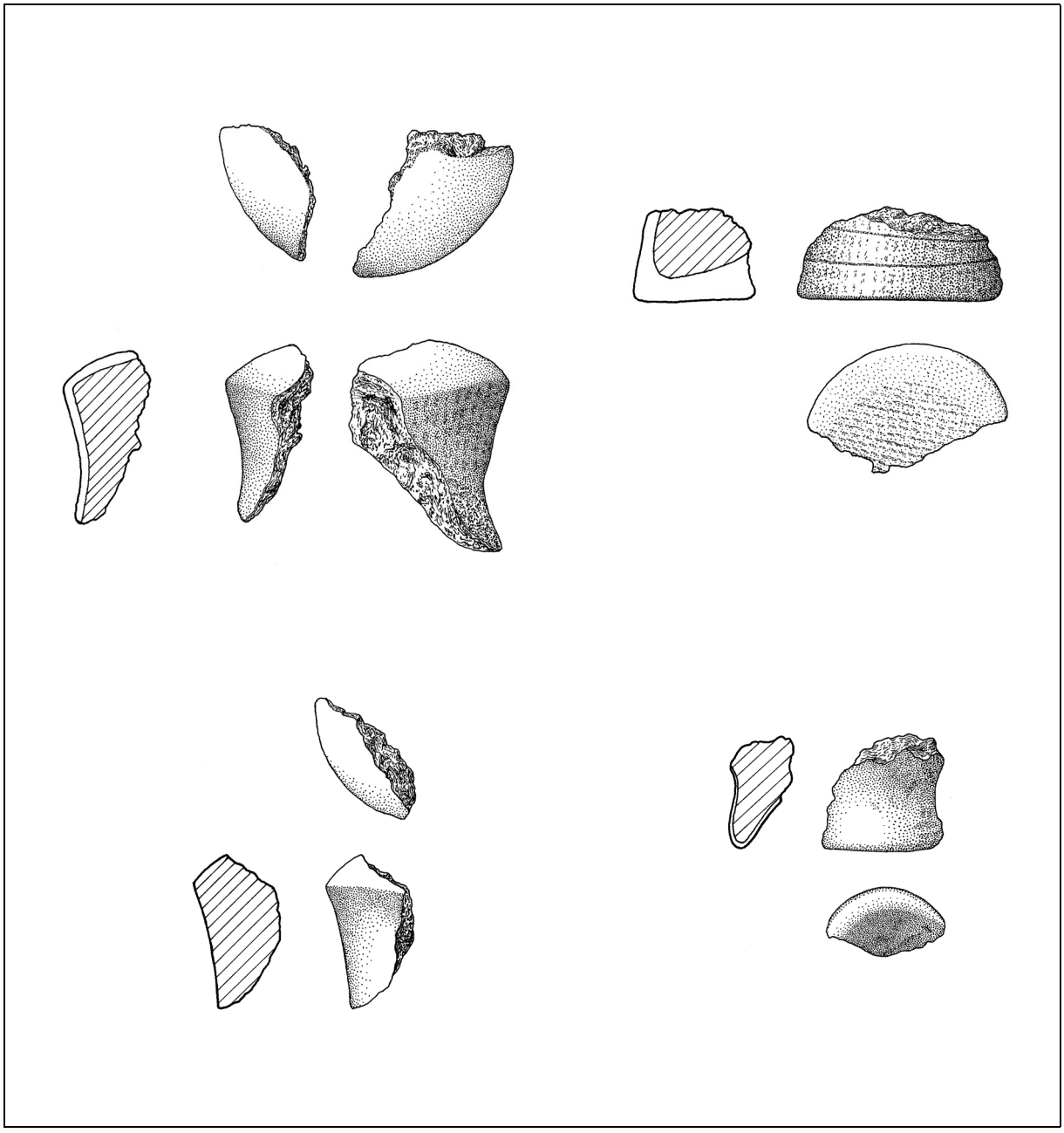


FIG. 232: Ceramic Period 4 potters' anvils. *Top* left: cat. 286 (L3:2), right (handle base): cat. 288 (L3:2), *Bottom* left: cat. 443 (L3:2), right (handle base): cat. 468 (L3:2). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

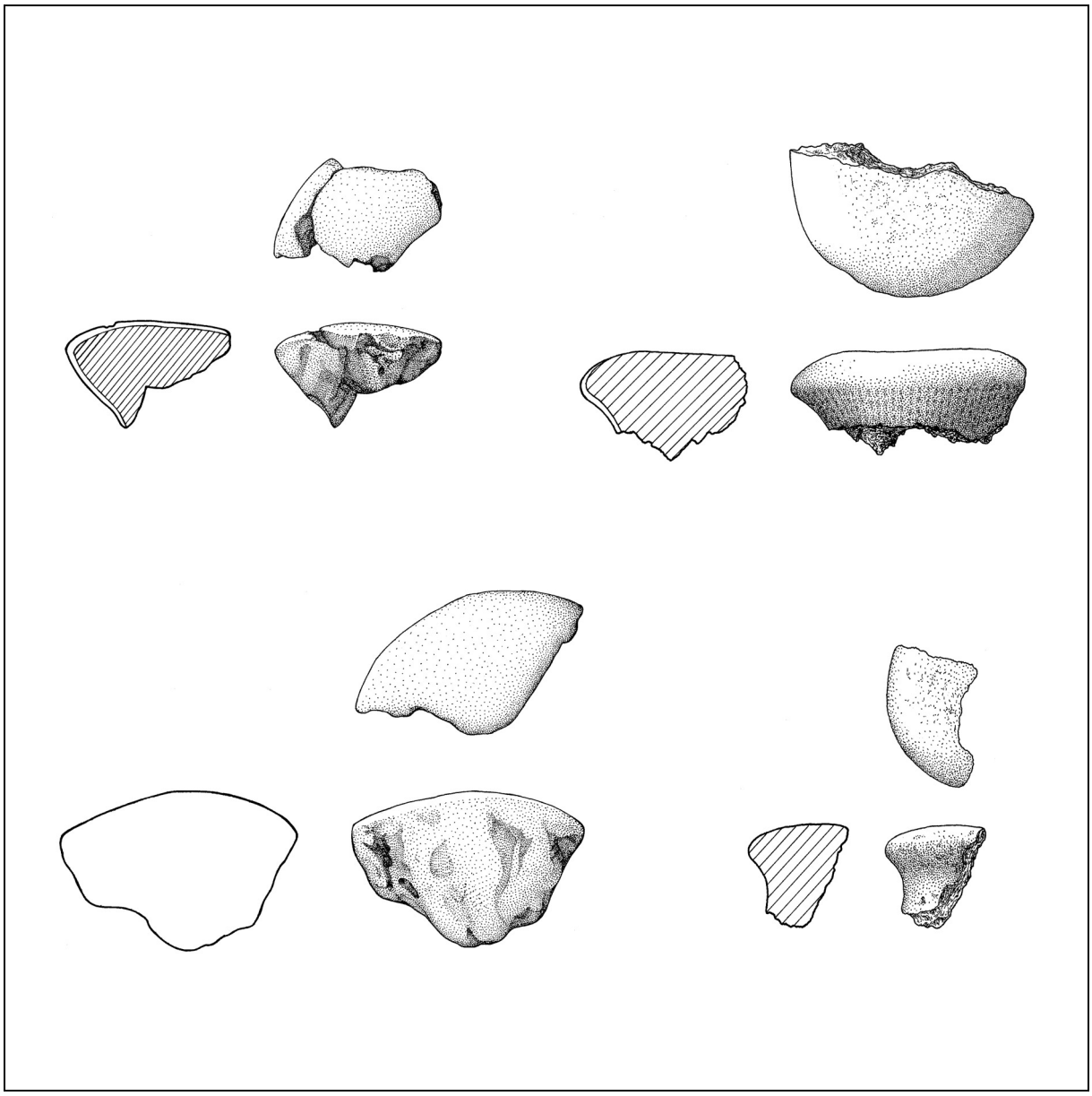


FIG. 233: Ceramic Period 4 potters' anvils. *Top* left: cat. 257 (L3:2), right: cat. 282 (L3:2), *Bottom* left: cat. 278 (L3:2), right: cat. 272 (L3:2). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

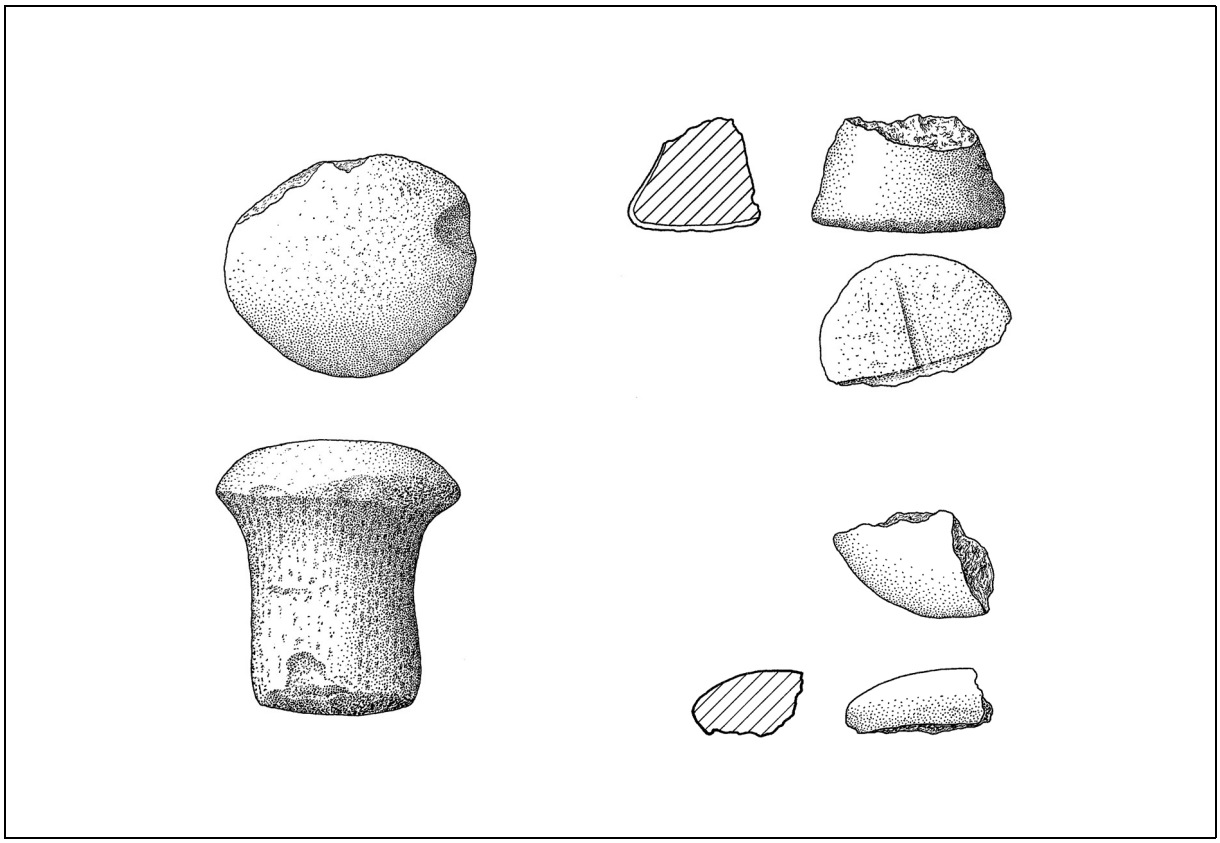


FIG. 234: Ceramic Period 4 potters' anvils. Left: cat. 261 (L3:2), top right (handle base): cat. 268 (L3:2), bottom right: cat. 477 (L3:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

Such choices are not always available to potters. At Ban Na Di, for example, poor quality local clays were blended, probably to preserve valuable high quality clay imported from 10 km distance (Vincent 1988).

Exotic anvils include two, possibly three, composed of FG11 and one containing sand temper. One anvil, cat. 269, tempered with orthodox grog is probably exotic, but because it was recovered intact, analysis was restricted to hand specimen examination and without detailed petrographic information this evidence should be treated with caution. Given its different colour values (10YR/7/3 as opposed to local 2.5YR/6/6), the likelihood that it is exotic is reinforced. It is important to note the prominence of FG11 anvils in the exotic assemblage. The local rice and bleb tempering tradition, which characterizes CP4, gives the presence of exotic anvils which share the same technology, increased emphasis. This aspect of the CP4 assemblage is considered further in Chapter XI.

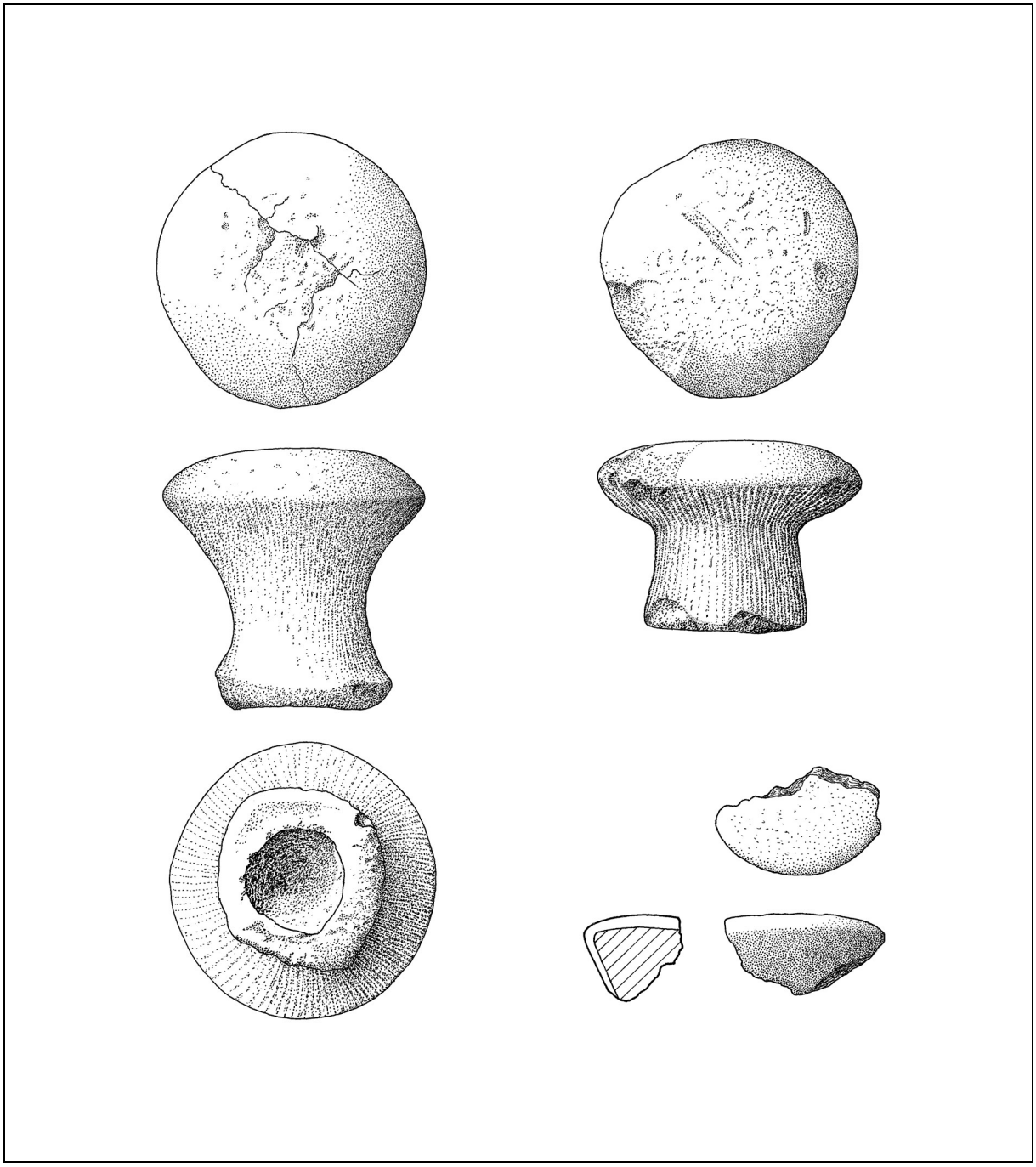


FIG. 235: Ceramic Period 4 potters' anvils. Left: cat. 274 (L3:2), top right: cat. 269 (L3:1), bottom right: cat. 478 (L3:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

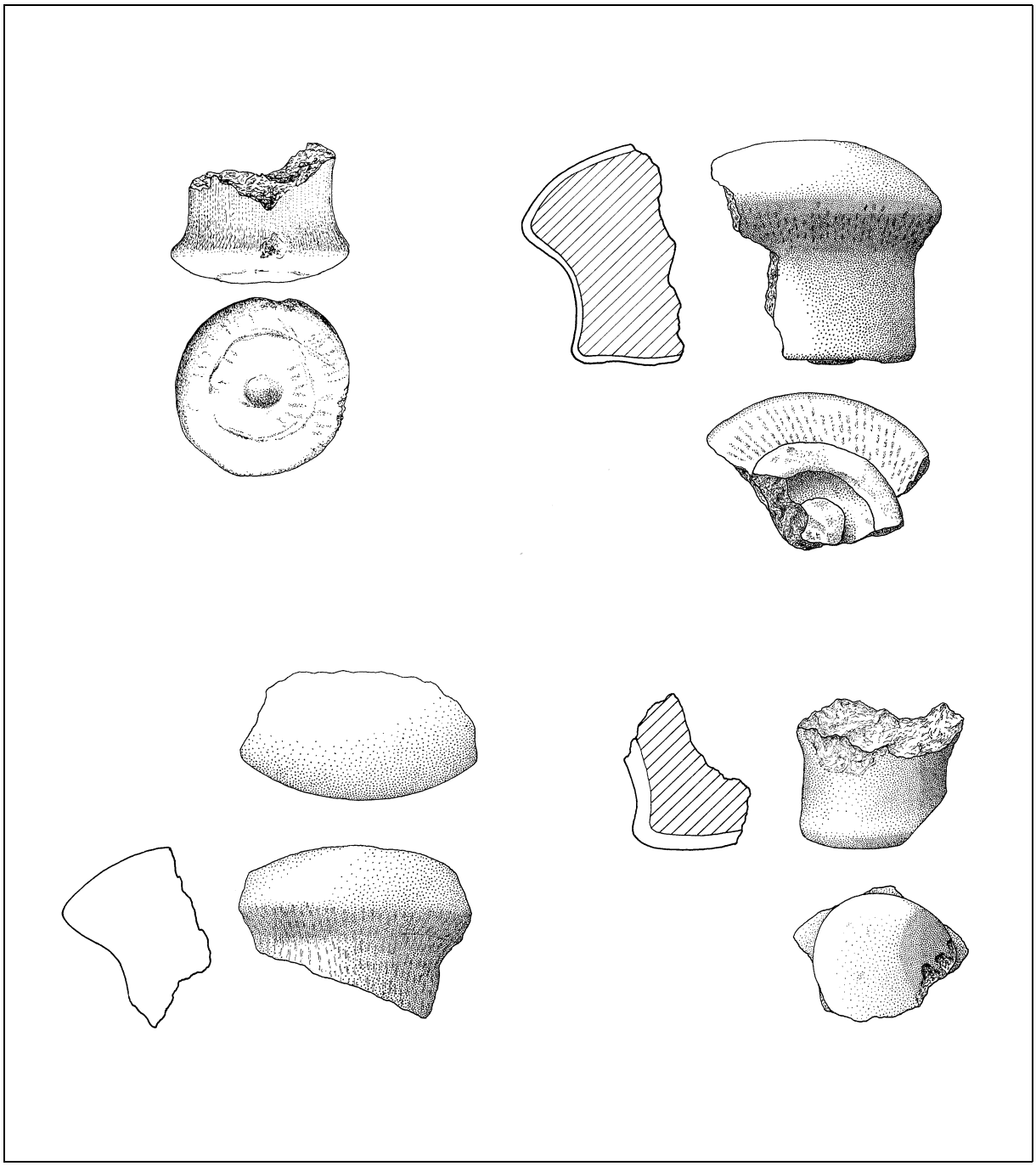


FIG. 236: Ceramic Period 4 potters' anvils. *Top* left (handle base): cat. 212 (L3:1), right: cat. 214 (L3:1), *Bottom* left: cat. 231 (L3:1), right (handle base): cat. 236 (L3:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

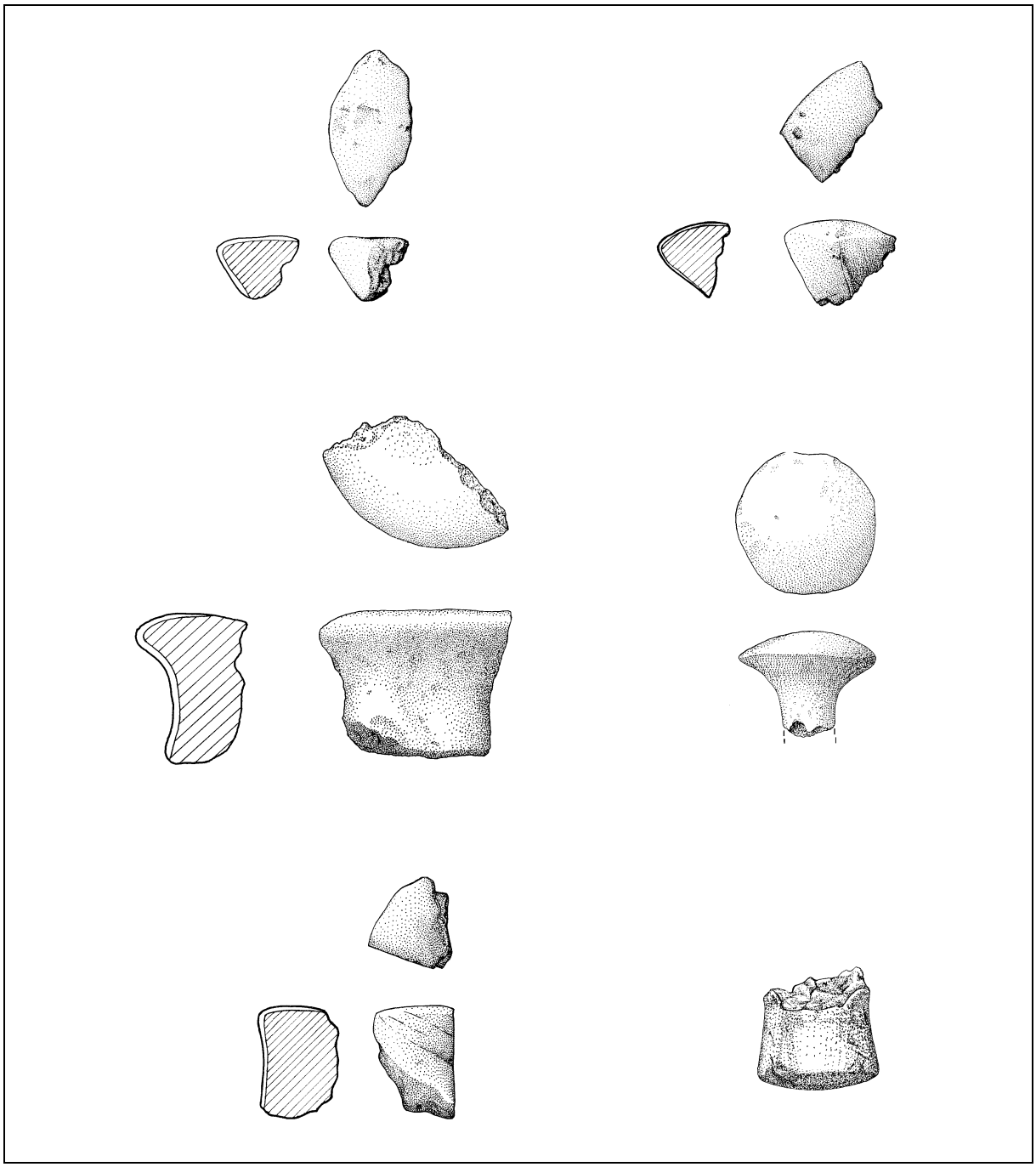


FIG. 237: Ceramic Period 4 potters' anvils. *Top* left: cat. 156 (L2:2), right: cat. 159 (L2:2), *Centre* left: cat. 160 (L2:2), right: cat. 166 (L2:2), *Bottom* left: cat. 167 (L2:2), right (handle base): cat. 177 (L2:2). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

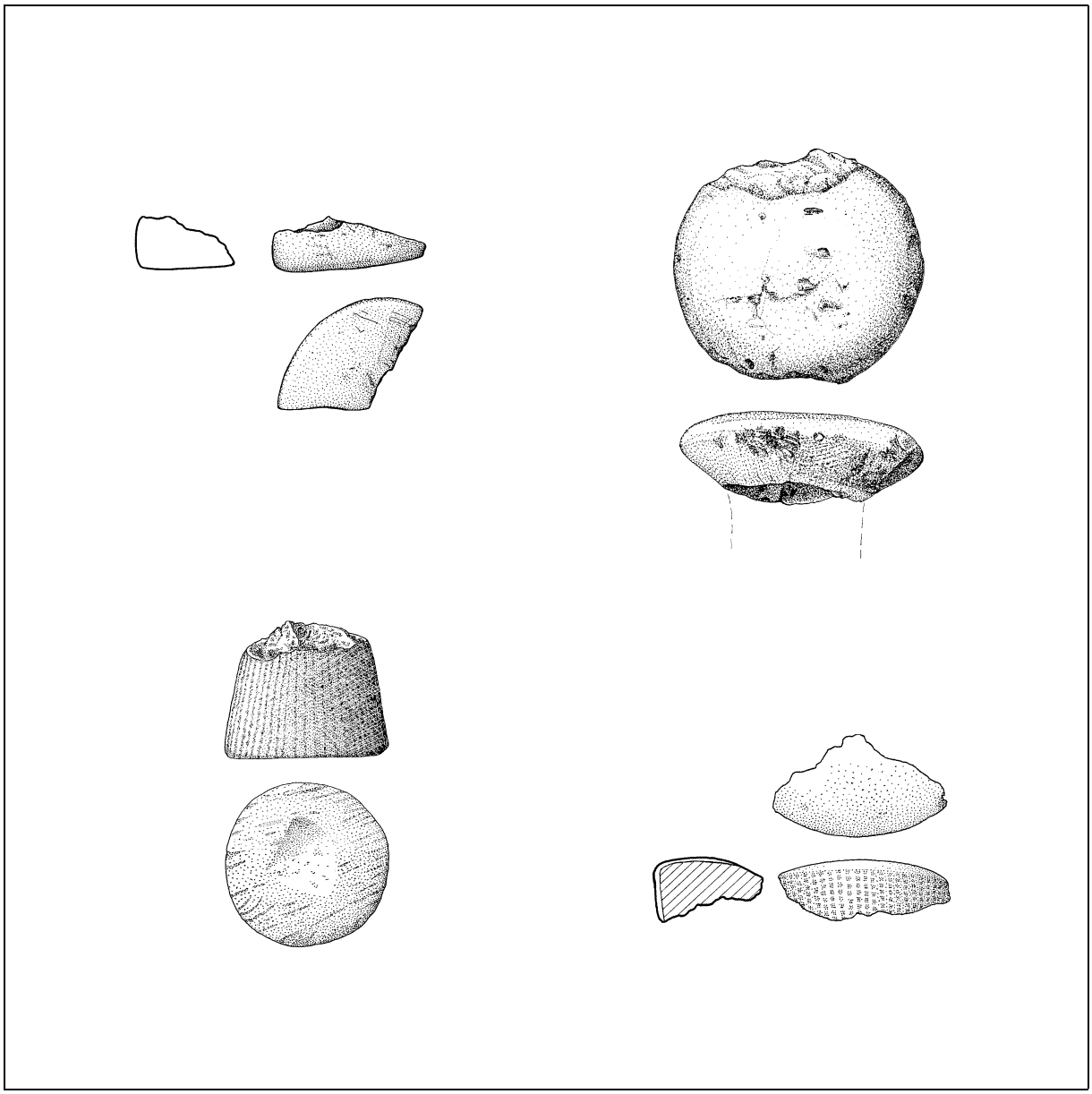


FIG. 238: Ceramic Period 4 potters' anvils. *Top* left: cat. 187 (L2:3), right: cat. 193 (L2:3), *Bottom* left (handle base): cat. 188 (L2:3), right: cat. 194 (L2:3). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

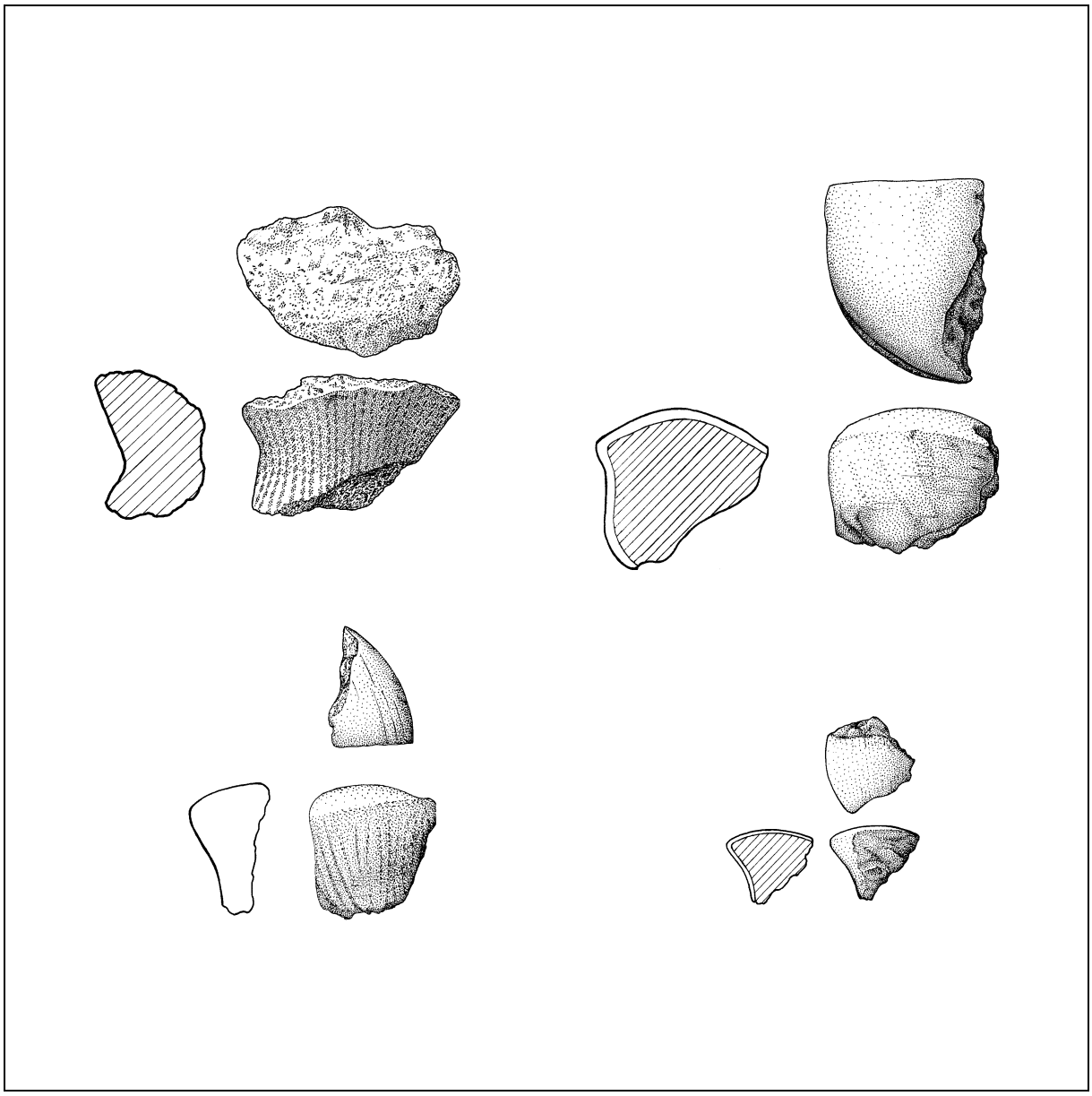


FIG. 239: Ceramic Period 4 potters' anvils. *Top* left: cat. 164 (L2:2), right: cat. 171 (L2:2), *Bottom* left: cat. 173 (L2:2), right: cat. 206 (L2:2). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

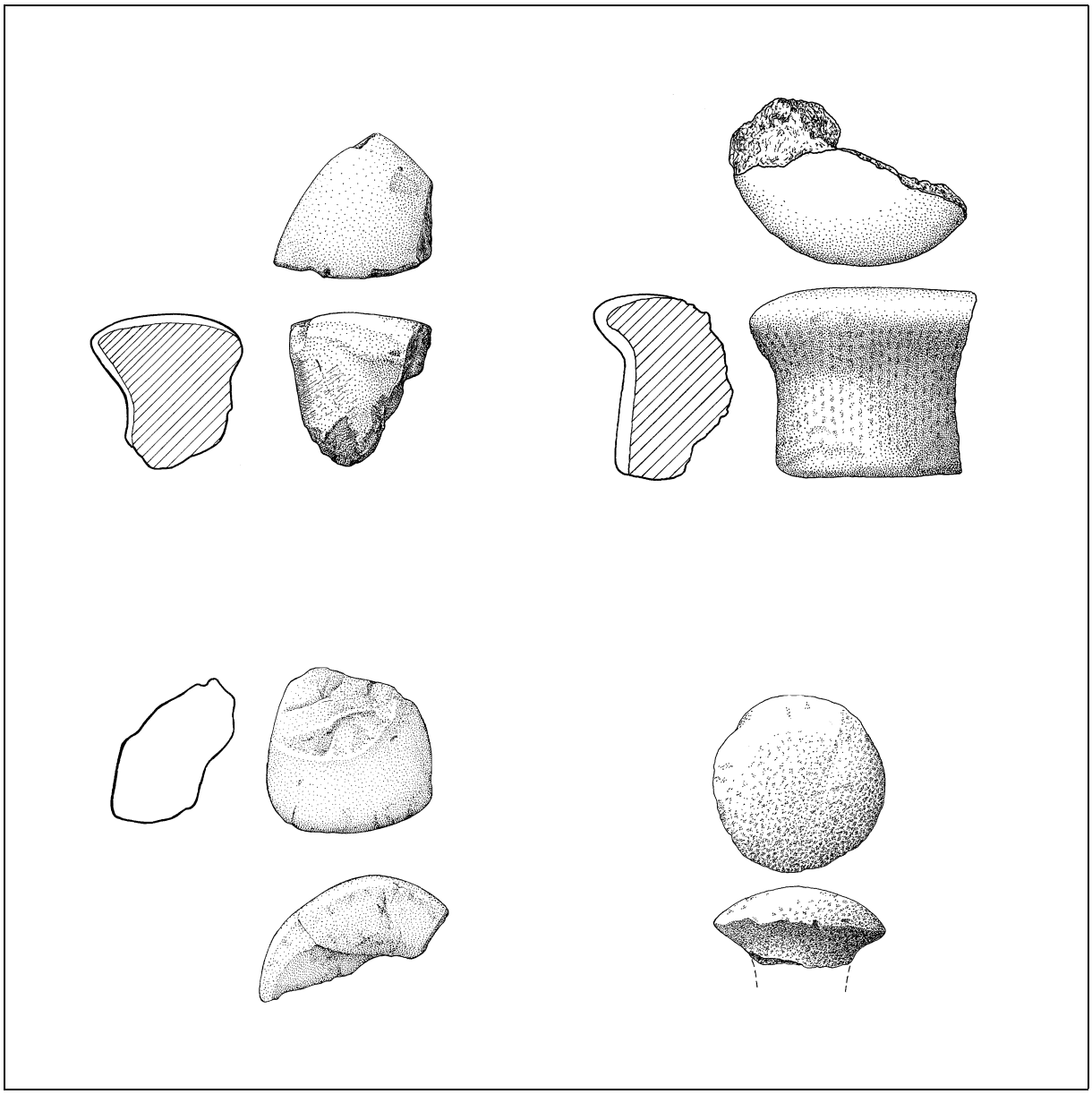


FIG. 240: Ceramic Period 4 potters' anvils. *Top* left: cat. 102 (L2:2), right: cat. 103 (L2:2), *Bottom* left: cat. 104 (L2:2), right: cat. 196 (L2:3). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

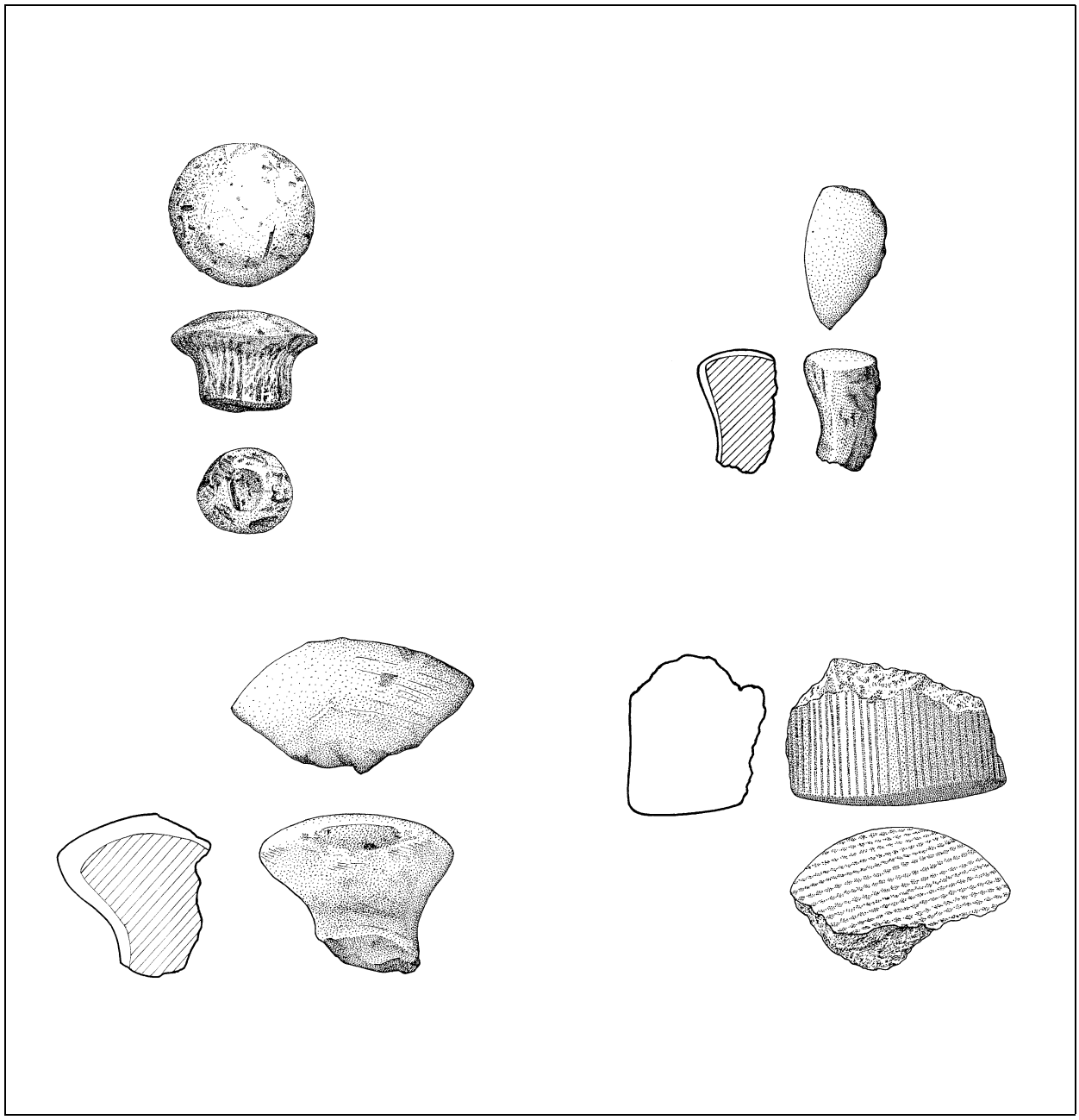


FIG. 241: Ceramic Period 4 potters' anvils. *Top* left: cat. 105 (L2:2), right: cat. 112 (L2:2), *Bottom* left: cat. 115 (L2:2), right (handle base): cat. 130 (L2:2). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

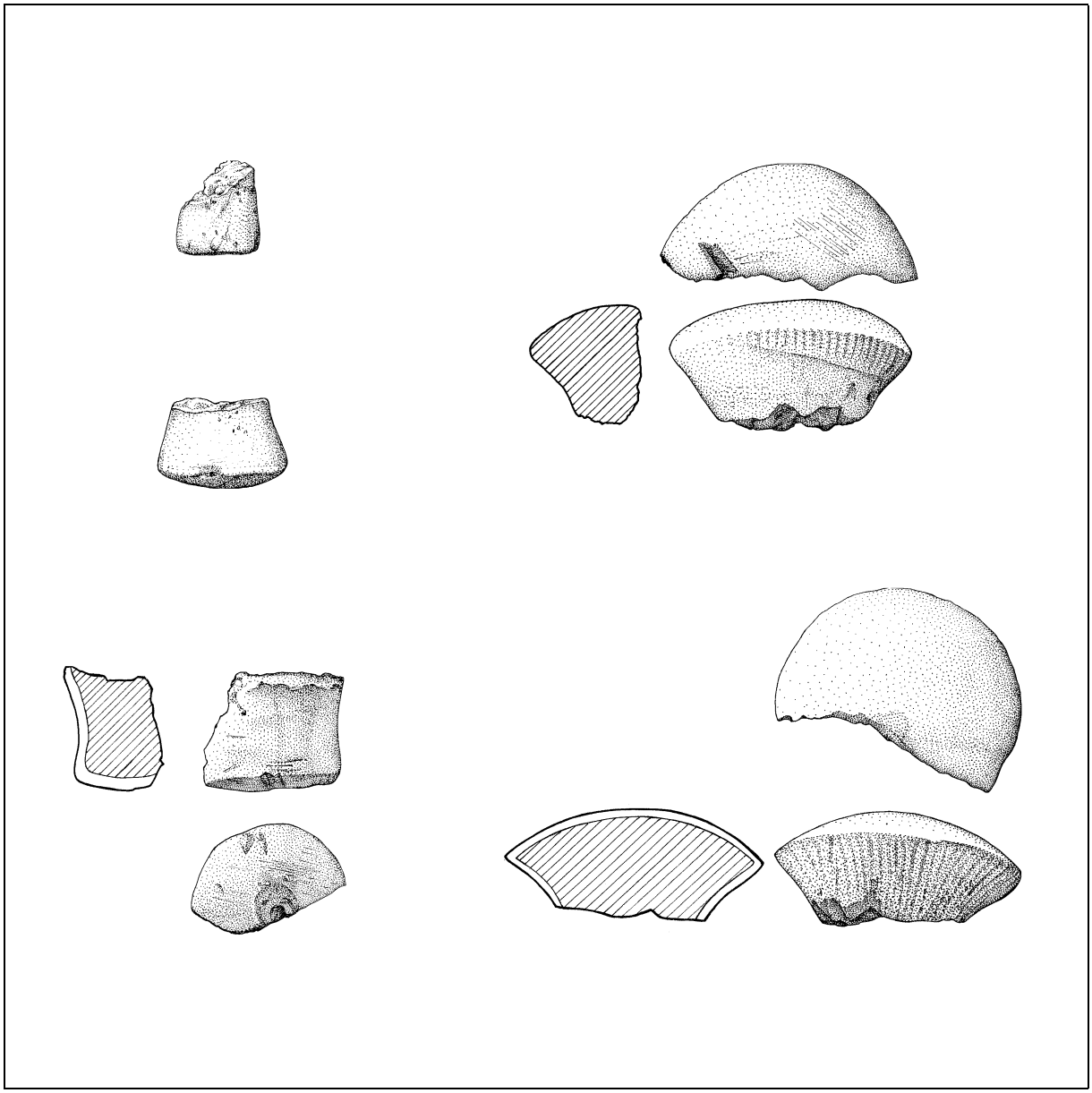


FIG. 242: Ceramic Period 4 potters' anvils. *Top* left (handle base): cat. 126 (L2:2), lower left (handle base): cat. 128 (L2:2), right: cat. 132 (L2:2), *Bottom* left (handle base): cat. 144 (L2:2), right: cat. 133 (L2:2). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

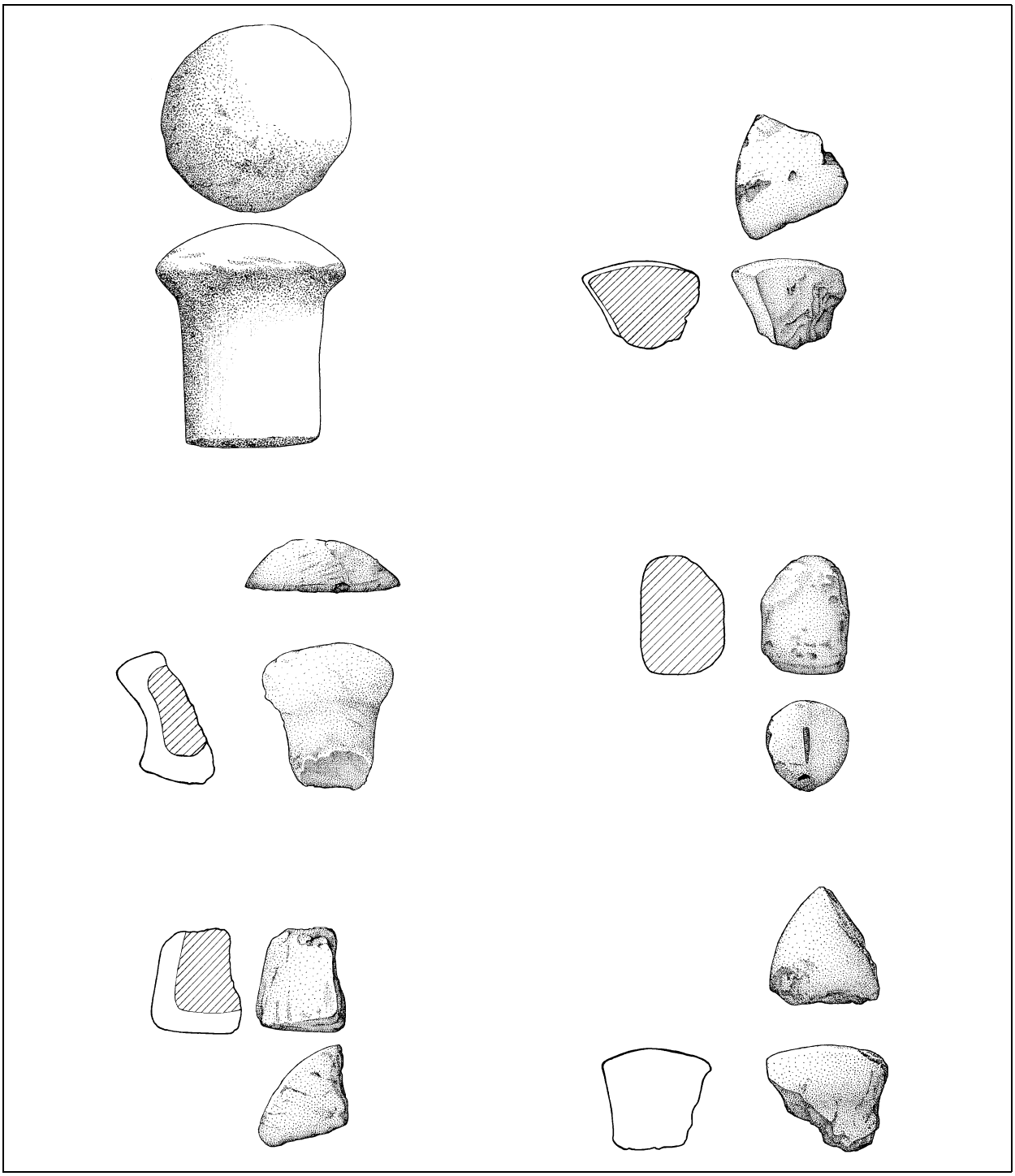


FIG. 243: Ceramic Period 4 potters' anvils. *Top* left: cat. 146 (L2:2), right: cat. 66 (L2:1), *Centre* left: cat. 69 (L2:1), right (handle base): cat. 80 (L2:1), *Bottom* left (handle base): cat. 51 (L2:1), right: cat. 55 (L2:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

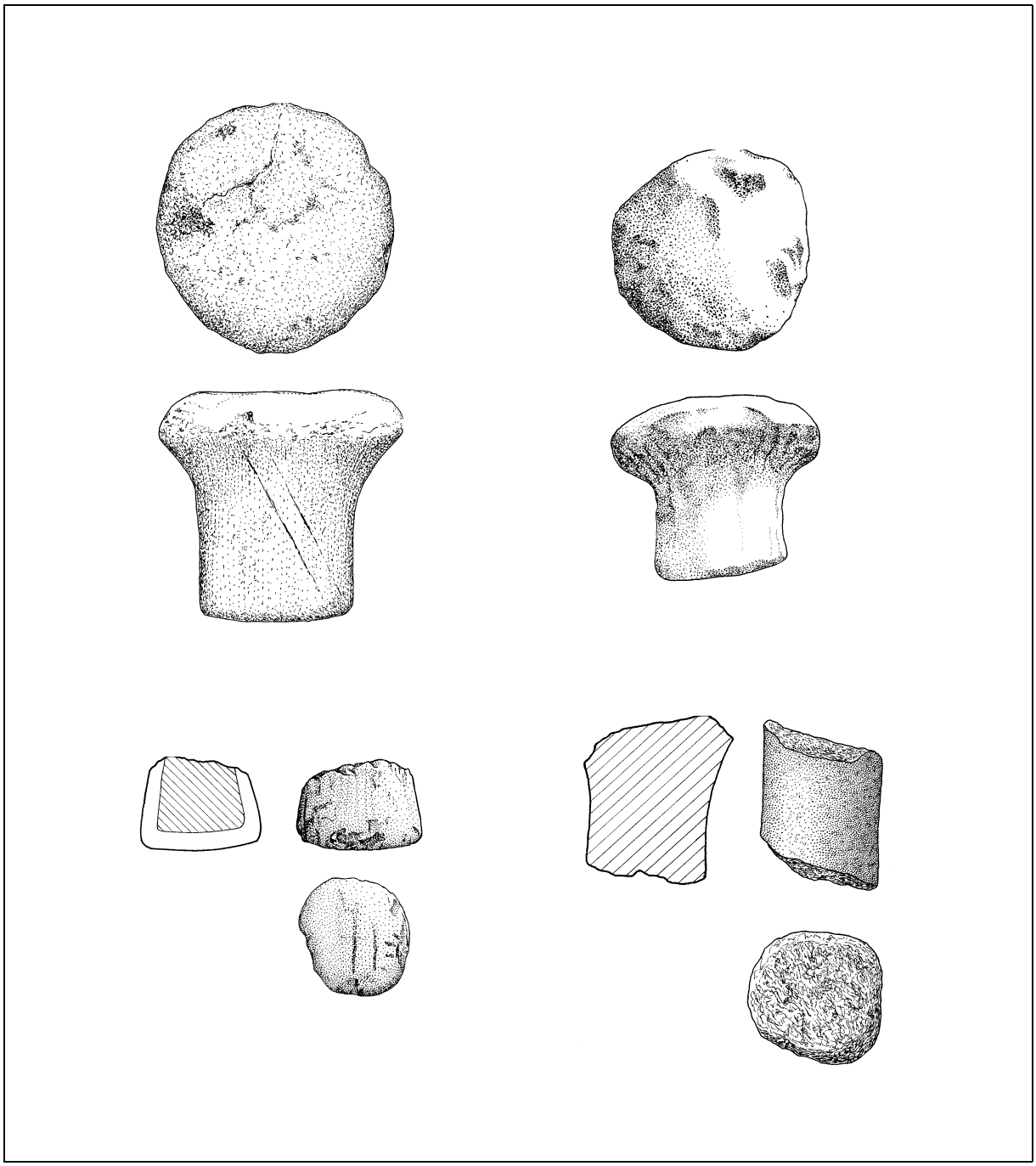


FIG. 244: Ceramic Period 4 potters' anvils. *Top* left: cat. 57 (L2:1), right: cat. 43 (L2:1), *Bottom* left (handle base): cat. 58 (L2:1), right (handle shaft): cat. 63 (L2:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

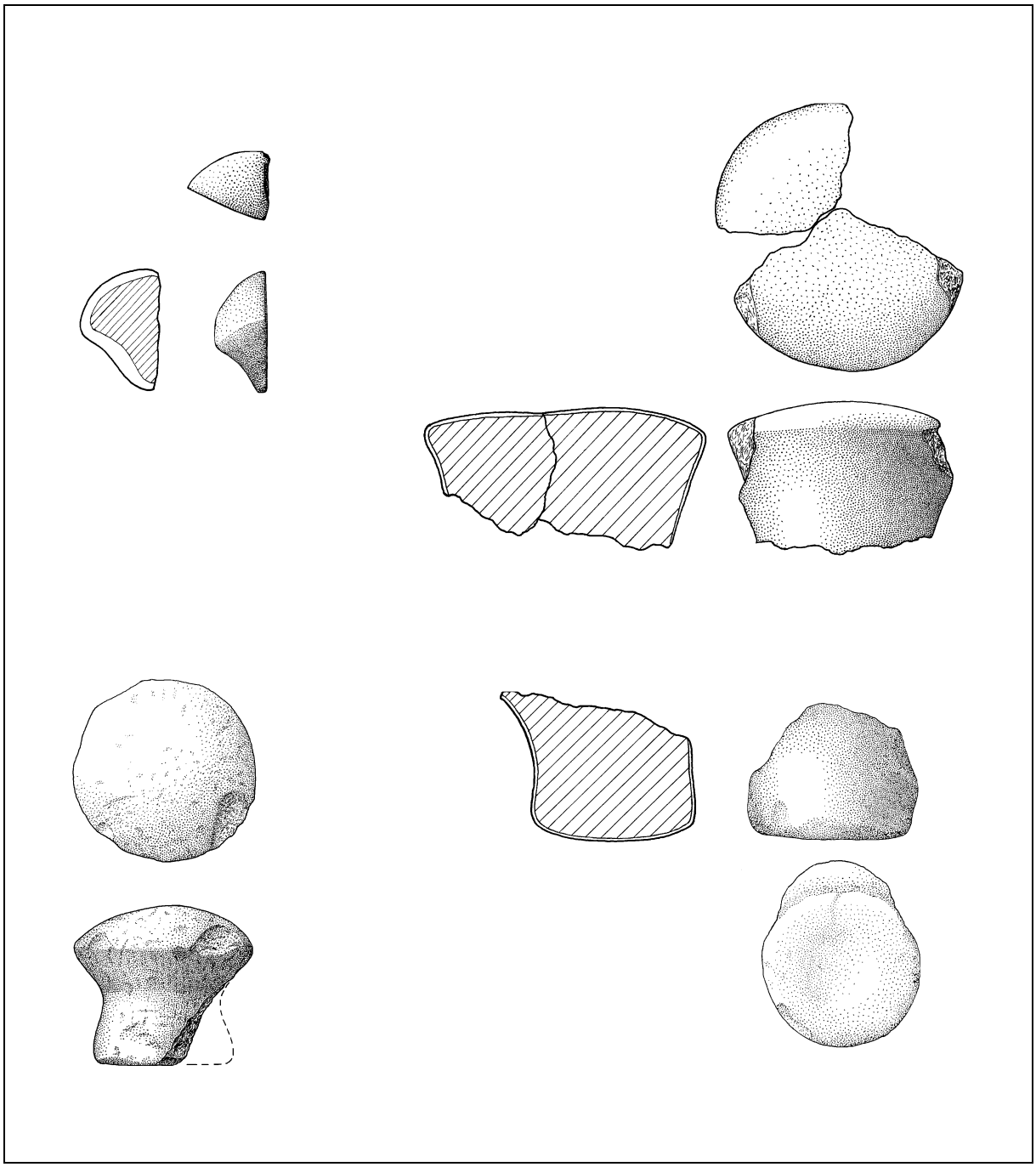


FIG. 245: Ceramic Period 4 potters' anvils. *Top* left: cat. 88 (L2:1), right: cat. 86 (L2:1), *Bottom* left: cat. 45 (L2:1), right (handle base): cat. 96 (L2:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

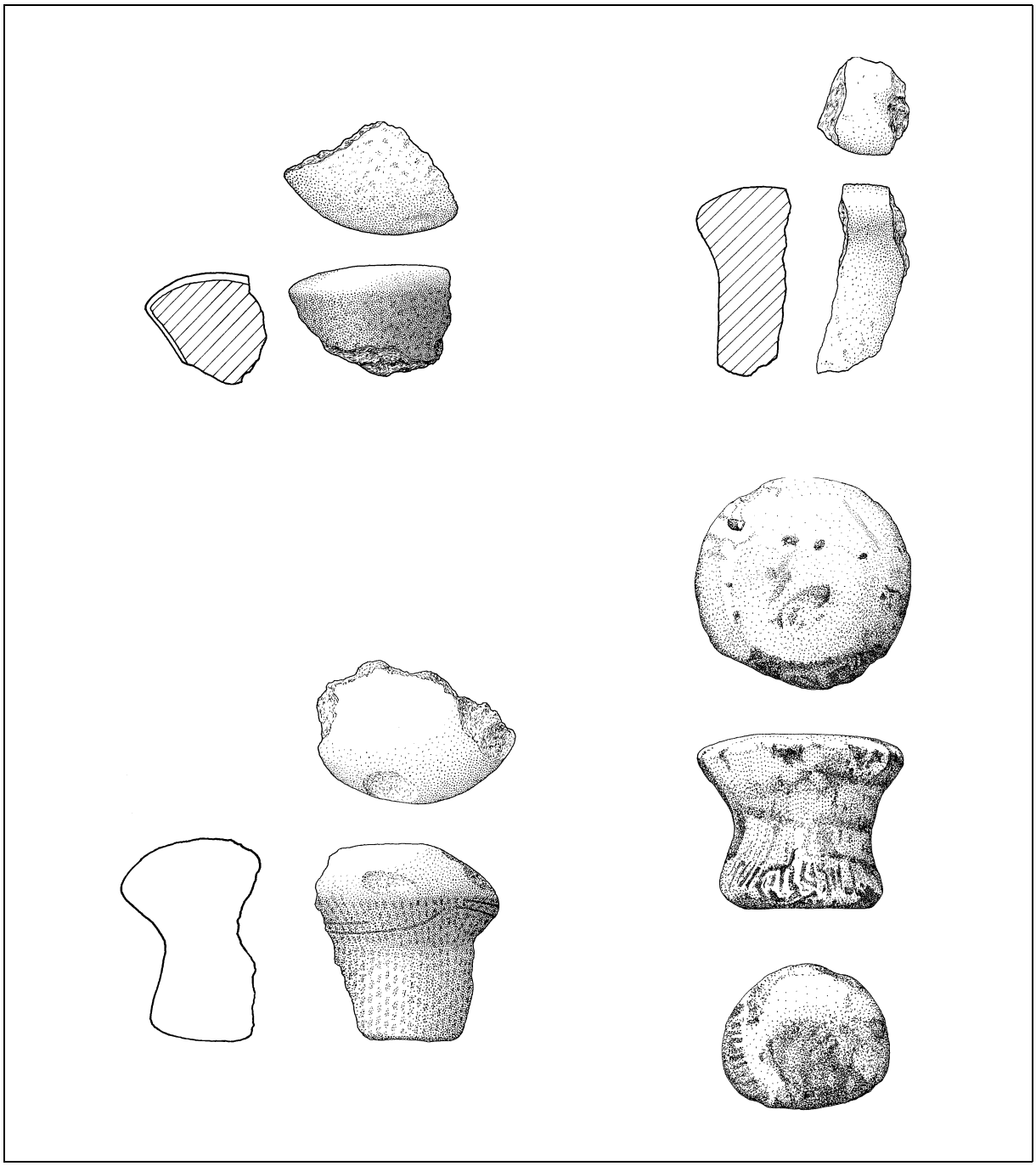


FIG. 246: Ceramic Period 4 potters' anvils. *Top* left: cat. 20 (L1:2), right: cat. 5 (L1:1), *Bottom* left: cat. 17 (L1:1), right: cat. 32 (L1:4). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

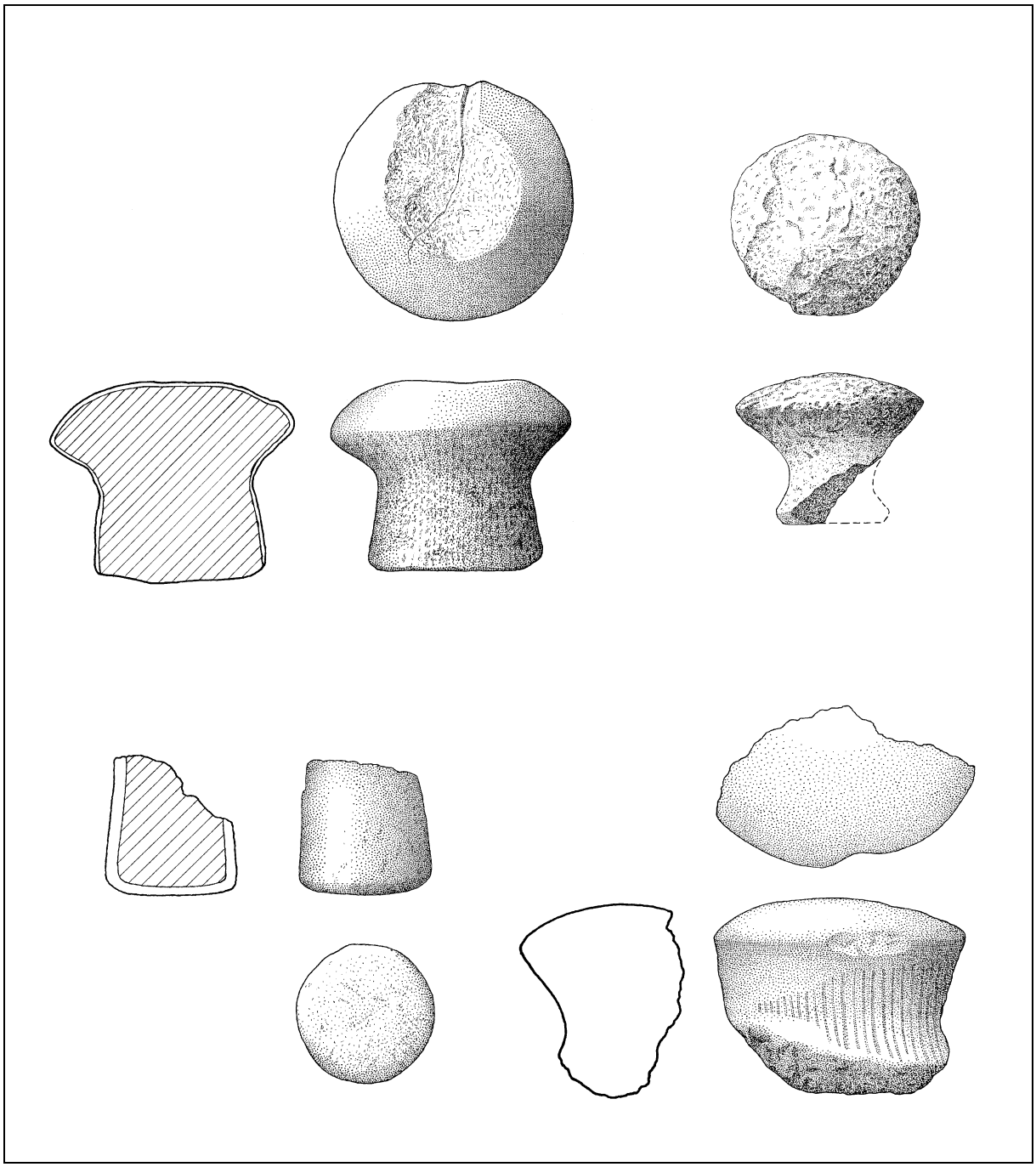


FIG. 247: Ceramic Period 4 potters' anvils. *Top* left: cat. 53 (L2:1), right: cat. 189 (L2:1), *Bottom* left (handle base): cat. 8 (L1:1), right: cat. 52 (L2:1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

TABLE 115: *Ceramic Period 4 ceramic anvils: size, colour and cord marks. (handle diameters measured at bottom, Z/S: twist direction and gap. Cat. 144 may be part of cat. 133)*

Cat.	layer	diam: head	handle	height	colour	cord marks
1	1.1	-	-	-	2.5YR/6/6	indistinct
5	1.1	60	-	-	2.5YR/6/6	indistinct
8	1.1	-	45	-	2.5YR/6/6	indistinct
17	1.1	80(est.)	40(est.)	62	2.5YR/6/4	indistinct
20	1.2	82	-	-	2.5YR/6/6	-
32	1.4	66	51	54	2.5YR/6/6	-
43	2.1	63	41	57	2.5YR/6/6	Z1-1
45	2.1	56	42	50	2.5YR/6/6	-
51	2.1	-	80	-	2.5YR/6/6	-
52	2.1	104	-	-	2.5YR/6/6	Z 2-1
53	2.1	178	56	65(est.)	2.5YR/6/6	-
55	2.1	85	-	-	2.5YR/6/6	-
57	2.1	74	48	72	-	-
58	2.1	-	36	-	5YR/7/4	-
63	2.1	-	40 (est.)	-	2.5YR/6/6	-
66	2.1	77	32 (est.)	-	2.5YR/6/6	-
68	2.1	80	-	-	2.5YR/6/6	-
69	2.1	50	24	48	2.5YR/6/6	-
80	2.1	-	30	-	2.5YR/6/6	-
86	2.1	84	-	-	2.5YR/6/6	indistinct
88	2.1	50	-	-	2.5YR/6/6	-
96	2.1	-	48	-	-	-
102	2.2	85	-	-	2.5YR/6/6	-
103	2.2	80	50	51	2.5YR/6/6	-
104	2.2	-	70	-	2.5YR/6/6	-
105	2.2	44	28	32	2.5YR/6/6	Z 1-1
105a	2.2	-	50	-	2.5YR/6/6	indistinct
112	2.2	80	-	-	2.5YR/6/6	-
115	2.2	80	-	-	2.5YR/6/6	-
126	2.2	-	25	-	2.5YR/6/6	indistinct
128	2.2	38-	-	2.5YR/6/6	indistinct	
130	2.2	-	77	-	2.5YR/6/6	Z 1-0.5
132	2.2	70	-	-	2.5YR/6/6	Z 1-1
133	2.2	70	40 (est.)	-	2.5YR/6/6	Z 1-1
144	2.2	-	60	-	2.5YR/6/6	-

TABLE 115: *Ceramic Period 4 ceramic anvils: size, colour and cord marks (cont'd)*

Cat.	layer	diam: head	handle	height	colour	cord marks
146	2.2	64	47	77	-	-
156	2.2	62	-	-	-	-
159	2.2	85	-	-	2.5YR/6/6	-
160	2.2	160	-	-	2.5YR/6/6	-
164	2.2	100	-	-	2.5YR/6/6	S 1.5-1
166	2.2	43	16 (est.)	-	2.5YR/6/6	-
167	2.2	60	-	-	2.5YR/6/6	-
171	2.2	85	-	-	2.5YR/6/6	-
173	2.2	90	-	-	2.5YR/6/6	Z 1-1
206	2.2	54	-	-	2.5YR/6/6	-
177	2.2	-	38	-	2.5YR/6/6	indistinct
187	2.3	-	58	-	2.5YR/6/6	-
188	2.3	-	48	-	2.5YR/6/6	Z 1-1
189	2.3	62	37	49	2.5YR/6/6	indistinct
193	2.3	74	37 (est.)	-	2.5YR/6/6	indistinct
194	2.3	85	-	-	2.5YR/6/6	-
196	2.3	51	24 (est.)	-	2.5YR/6/6	Z n.d.
212	3.1	-	55	-	2.5YR/6/6	indistinct
212a	3.1	-	50	-	2.5YR/6/6	indistinct
214	3.1	90	44	66	2.5YR/6/6	Z 1.5-1
231	3.1	120	-	-	2.5YR/6/6	Z 1.5-1
236	3.1	-	58	-	2.5YR/6/6	Z 1.5-1
269	3.1	79	50	60	10YR/7/3	Z 1.5-1
452	3.1	82	-	-	2.5YR/6/6	-
477	3.1	70	-	-	2.5YR/6/6	Z 1.5-1
478	3.1	60	-	-	2.5YR/6/6	-
257	3.2	90	-	-	2.5YR/6/6	S 1-1
261	3.2	66	44	72	2.5YR/6/6	S? 1-1
268	3.2	-	54	-	2.5YR/6/6	indistinct
272	3.2	60	-	-	2.5YR/6/4	indistinct
274	3.2	83	55	81	2.5YR/6/6	-
278	3.2	106	-	-	2.5YR/6/6	Z 1-0.5
282	3.2	84	-	-	2.5YR/6/6	indistinct
286	3.2	90	-	-	2.5YR/6/6	Z 1-1
288	3.2	-	70	-	2.5YR/6/6	indistinct
443	3.2	70	-	-	2.5YR/6/6	indistinct
444	3.2	82	-	-	2.5YR/6/6	-
468	3.2	40	-	-	2.5YR/6/6	-

TABLE 115: *Ceramic Period 4 ceramic anvils: size, colour and cord marks (cont'd)*

Cat.	layer	diam: head	handle	height	colour	cord marks
317	3.3	67	39	63	2.5YR/6/6	indistinct
342	3.3	92	-	-	2.5YR/6/6	S 1-0.5
358	3.3	62	42	58	2.5YR/6/6	Z 1-1
359	3.4	-	40	-	2.5YR/6/6	Z 1-1
373	3.4	71	48	54	2.5YR/6/6	Z 1-1
381	3.4	-	90	-	2.5YR/6/6	indistinct
394	3.4	87	50 (est.)	-	2.5YR/6/6	Z 1-0.5
411	3.4	73	28 (est.)	-	2.5YR/6/6	Z 1-1
447	3.4	54	-	-	2.5YR/6/6	Z 1-0.5
449	3.4	90	-	-	2.5YR/6/6	-
484	3.4	90	-	-	2.5YR/6/6	Z 1.5-1
671	3.4	70	-	-	2.5YR/6/6	-
482	3.5	85	-		2.5YR/6/6	-
490	3.5	66	38	55	10YR/8/2	Z 1-0.5
371	4.1	-	-	-	2.5YR/6/6	Z 1-1
371a	4.1	-	-	-	2.5YR/6/6	indistinct
371b	4.1	-	-	-	10YR/7/4	indistinct
385	4.1	64	38	55	2.5YR/6/6	Z 1-1
395	4.1	-	-	-	2.5YR/6/6	S 1.5-1
397	4.1	-	78	-	2.5YR/6/6	-
465	4.1	120	-	-	2.5YR/6/6	Z 1-1
497	4.1	57	35	52	5YR/7/4	indistinct
505	4.1	82	-	-	5YR/7/3	Z 1-1
526	4.1	70	-	-	-	-
527	4.1	62 (est.)	32	55 (est.)	-	-
428	4.2	-	-	-	2.5YR/6/6	indistinct
682	4.2	72	-	-	2.5YR/6/6	indistinct
549	4.2	-	–	-	2.5YR/6/6	-
553	4.2	96	–	-	-	-
543	4.2	67	33	55	2.5YR/6/6	plain
534	4.3	90	-	-	2.5YR/6/6	indistinct
547	4.3	74	39	60 (est.)	2.5YR/6/6	indistinct
510	4.4	106	-	-	2.5YR/6/6	Z 1-1
512	4.4	-	-	-	5YR/6/4	indistinct

THE POTTERS' MARKS ON CERAMIC ANVILS

Potters' anvils are marked in three different ways, either with a symbol or distinctive impression or inscription on the handle base or shaft, a symbol on the anvil head, or by shaping the handle base in a distinctive manner. Unless noted otherwise, all are considered to have been deliberately marked to denote some kind of ownership. In total, at least 17 distinct marks were recorded.

Anvils with marks impressed or inscribed onto the head:

- Cat. 17 (L1:1, Fig. 246), is inscribed with two parallel meandering lines made with a stylus. They run within the cord-marked flange of the anvil head above the handle and below the smooth worked surface of the head. Unfortunately less than half of the broken artefact was recovered.
- Cat. 132 (L2:2, Fig. 242), displays a single straight line, about 40 mm long, slightly sloping down from the smooth head from left to right. It is uncertain whether this mark was deliberately applied or an accident of the forming process.
- Cat. 66 (L2:1, Fig. 248), displays a series of small notches cut into the edge of the anvil head. They are 1 mm wide and 2.5 mm long. Five were noted on the 16 mm long by 16 mm wide fragment recovered.
- An arcuate 50 mm long line is inscribed into the head of cat. 342 (L3:3, Fig. 230). In section the line is "V" shaped indicating that it was cut with a sharp stylus. Blurred vertical cord marks run below the work face. Only a single fragment of this anvil was recognized.

Anvils with marks impressed, inscribed or carved into the handle:

- Cat. 1 (L1:1) is marked with grooves in the form of a chevron at the base of the handle shaft. Unfortunately only a single fragment of this anvil was able to be recognized.
- The base of cat. 32 (L1:4, Fig. 246), features a concave disc about 15 mm in diameter and 5 mm deep in the centre. Apart from use wear chipping to the head and handle base edges, this anvil is complete.
- The handle of cat. 57 (L2:1, Fig. 244), is inscribed with two parallel lines made with a stylus, 6 mm apart, sloped at 65° from the horizontal. The lines run from the base to the anvil head. The handle has cord marks running parallel with the shaft.
- The smooth handle base of cat. 58 (L2:1, Fig. 248), is inscribed with two parallel lines made with a stylus. One is 14 mm and the other 17 mm long. Only a small portion of the anvil handle was recovered. It included all of the base.

- Cat. 80 (L2:1, Fig. 248), is inscribed with a single 13 mm long, 1.5 mm wide and 0.5 mm deep line on the smooth handle base. Only a small eroded section of the handle was identified.

- A 23 mm diameter circular concavity, about 6 mm deep at its maximum, distinguishes the smooth handle base of cat. 96 (L2:1, Fig. 245). Only the base portion of the handle was available. The handle shaft and base are completely smooth.

- A large portion of anvil head and upper handle represent cat. 68 (L2:1). Parallel inscribed lines run diagonally across the upper shaft.

- Cat. 104 (L2:2, Fig. 248), features approximately 20 mm deep, 32 mm diameter, conical concavity which pierces the centre of the smooth handle base. The hole has probably been made by inserting a probe into the centre of the base when the clay was soft, then revolving the probe so as to remove a cone-shaped portion of clay from the handle. Only this portion of the anvil was recovered.

- Cat. 105 (L2:2, Fig. 248), was recovered intact. It is 31 mm long, the head measures 47 mm and the handle 27 mm in diameter. An irregular circular concavity, about 13 mm in diameter and 4 mm deep, has been removed from the handle base. Cord marks run parallel with the shaft, but the base is smooth.

- A conical concavity, 13 mm deep and 13 mm in diameter, marks the centre of the base of cat. 144 (L2:2, Fig. 242). Unfortunately only just over half of the handle was recovered. The surfaces are completely smooth.

- Cat. 188 (L2:3, Fig. 249), displays a quadrate (fan-shaped), concavity in the centre of the base. It appears to have been made by dragging a pointed stylus about the apex in a scooping movement. The radius is about 20 mm long and the quadrant about 3 mm deep at the apex. Apart from this smooth area the handle has cord marks running across the base and parallel with the handle shaft. Only the basal portion of the anvil has been identified.

- The handle base of cat. 212 (L3:1, Fig. 249), features a central circular concavity or depression, about 5 mm deep and 10 mm in diameter. A roughly inscribed circle made with a 1 mm wide stylus, approximately 30 mm in diameter, surrounds the cavity. The handle displays cord marks parallel with the shaft. Residual cord marks are visible on the base. Only the basal fragment was recovered.

- A 5 mm deep "U" shaped circular trough marks the handle base of cat. 214 (L3:1, Fig. 249). This leaves a 20 mm diameter centre point within the 58 mm wide base. The anvil is smooth apart from the head overhang, which has residual cord marks. About 30 per cent of the anvil was recovered intact.

- Cat. 268 (L3:2, Fig. 250), consists of a basal fragment of an anvil handle. It bears half of an inscribed cross. The mark has been made to a depth of 1.5 mm with a 4 mm wide round stylus. This is the only fragment identified. The surface is smooth.

- Use wear cracks and chips apart, cat. 274 (L3:2, Fig. 250), was recovered intact. The artefact is distinguished by a 12 mm deep, 30 mm diameter depression in the handle base. The waisted handle and lower head bear cord marks running parallel to the shaft. The base is smooth.

- Cat. 288, (L3:2, Fig. 250), consists of a basal fragment of a cord-marked anvil handle. Two almost parallel inscribed lines run about 10 and 20 mm above the base. Only this fragment was able to be identified.

- Cat. 358 (L3:3, Fig. 231), bears what appear to be marks to the handle base. They consist of two depressions where the soft clay has been carved prior to firing. A portion of the anvil head edge has been broken away, probably during use, otherwise the artefact is complete.

- Part of a single inscribed 1.5 mm wide line marks the base of cat. 359 (L3:4, Fig. 250). It was inscribed with the sharp point of a stylus. The handle shaft displays vertical cord marks while the base is smooth. This fragment could not be matched to others in the assemblage.

- Cat. 490 (L3:5, Fig. 251), was recovered intact. A 35 mm round central portion of the head has been worn from percussion impacts during use. The shaft and lower head walls are cord-marked and slightly eroded. A 6 mm diameter, 17 mm deep, circular hole marks the centre of the base.

- The handle shaft of cat. 385 (L4:1, Fig. 251), is inscribed with a distinctive curvilinear inscription made with the sharp point of a stylus. Cord marks run parallel with the shaft and continue on to the lower head. The fragment recovered is effectively a longitudinal cross section of the artefact. Unfortunately only one fragment was found.

- Cat. 682 (L4:2, Fig. 251), is a fragment of a 72 mm diameter anvil head with a portion of the handle shaft attached. An elongated wavy line is inscribed into the upper portion of the handle immediately below the lower head which displays indistinct cord marks. Only this portion of the anvil was recovered.

- A single 0.5 mm wide straight line is inscribed across the base of cat. 371 (L4:1). An almost complete vertical half section of this anvil was recovered. Apart from the head work face it is completely cord-marked.

- Cat. 395 (L4:1), features a 17 mm diameter circular concavity, about 3 mm deep in the centre, in the middle of its handle base. Although intact, the surfaces and edges of the head are slightly damaged through use. The handle shaft and base are cord-marked.

- A single vertical inscribed line marks the handle of cat. 428 (L4:2). Only about a third of the anvil was recovered. It is fractured vertically with no more than a quarter of the surface surviving. Eroded cord marks are visible on the handle shaft.

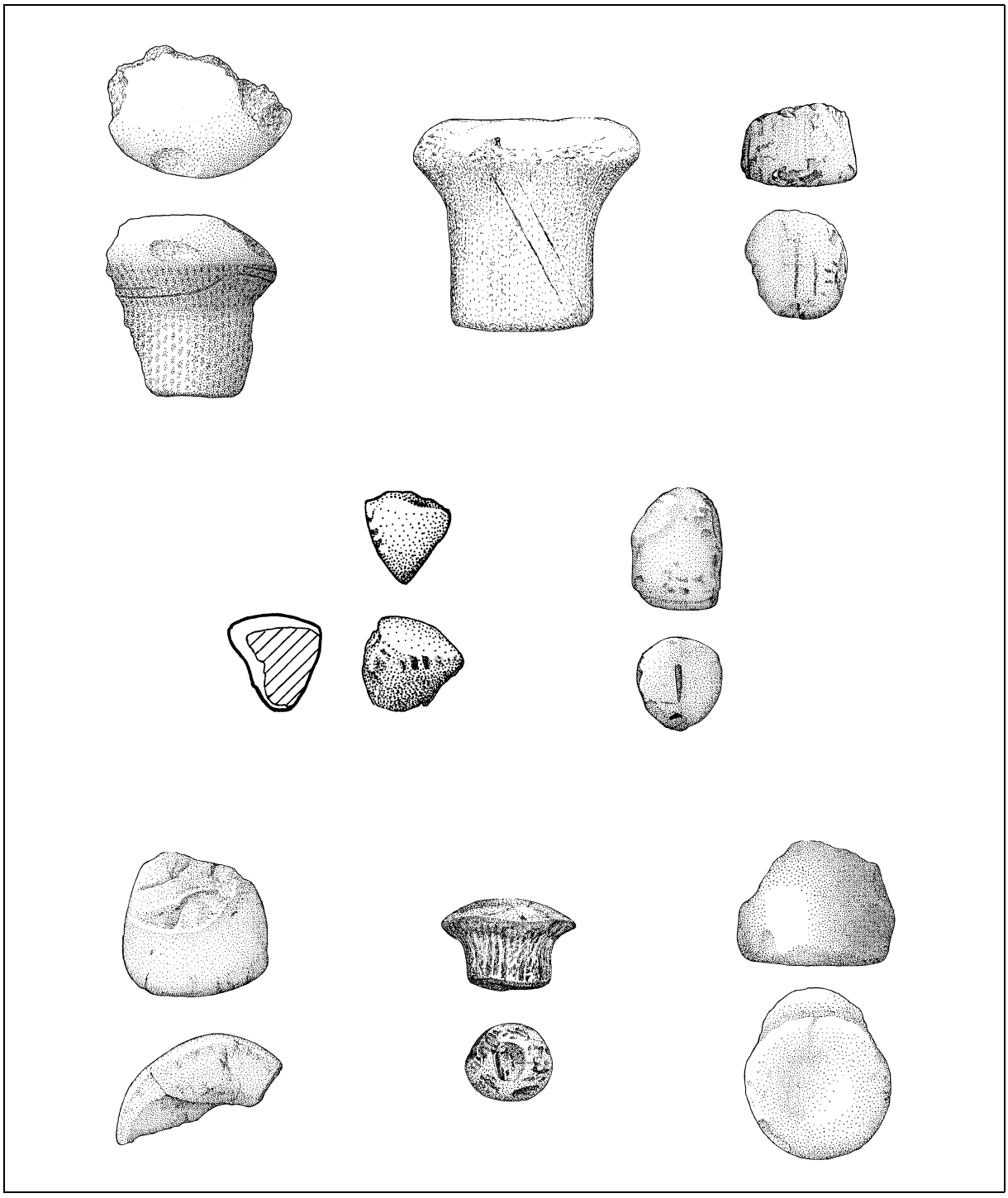


FIG. 248: Ceramic Period 4 marked anvils. *Top* left: cat. 17 (L1:1), centre: cat. 57 (L2:1), right (handle base): cat. 58 (L2:1), *Centre* left (scale: 1:1): cat. 66 (L2:1), right (handle base): cat. 80 (L2:1), *Bottom* left (handle base): cat. 104 (L2:2), centre: cat. 105 (L2:2), right (handle base): cat. 96 (L2.1). Shading indicates firing results (shaded area is not oxidized). Scale: 1:2

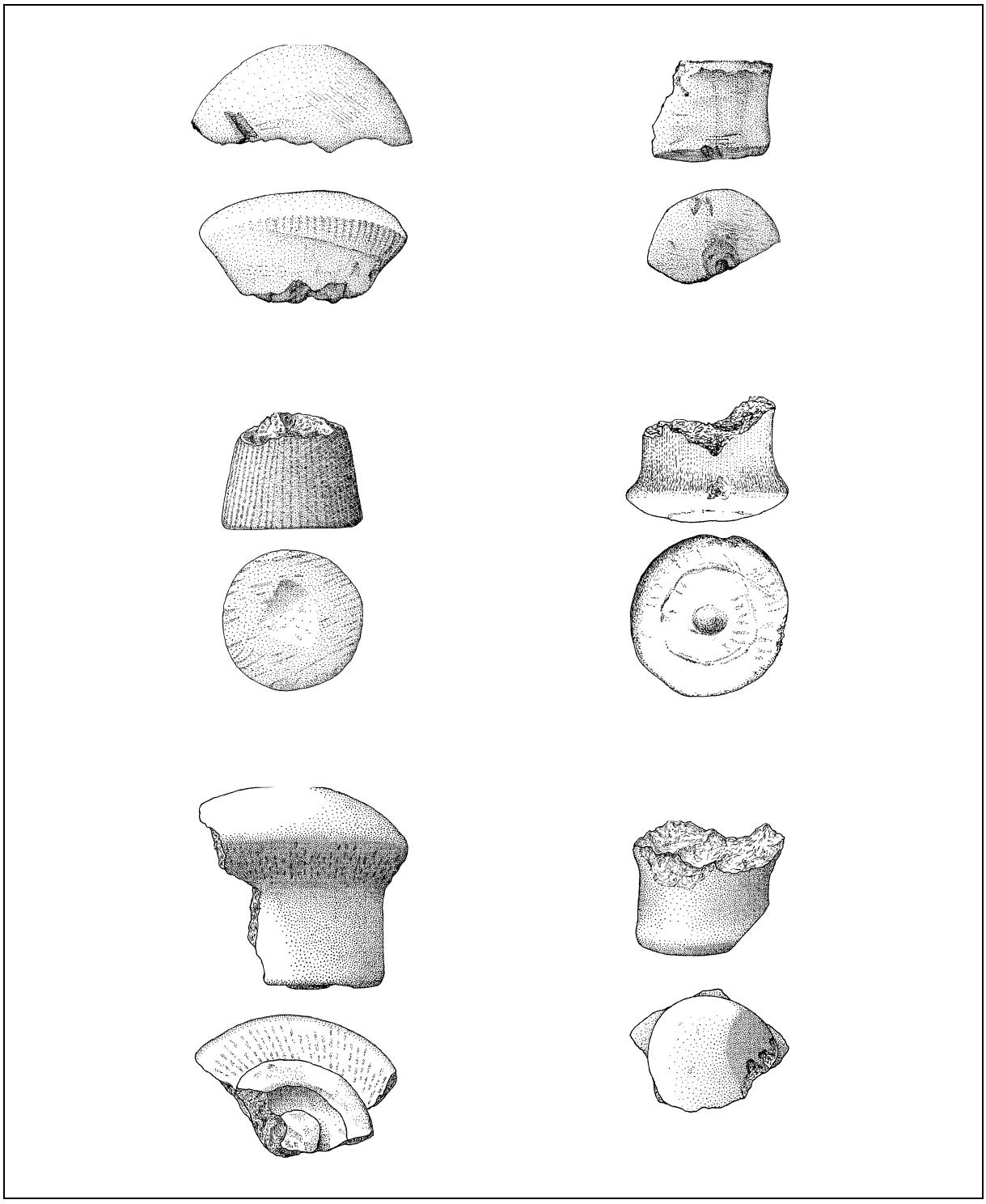


FIG. 249: Ceramic Period 4 marked anvils. *Top* left: cat. 132 (L2:2), right: cat. 144 (L2:2), *Centre* left (handle base): cat. 188 (L2:3), right (handle base): cat. 212 (L3:1), *Bottom* left: cat. 214 (L3:1), right (handle base): cat. 236 (L3:1). Scale: 1:2

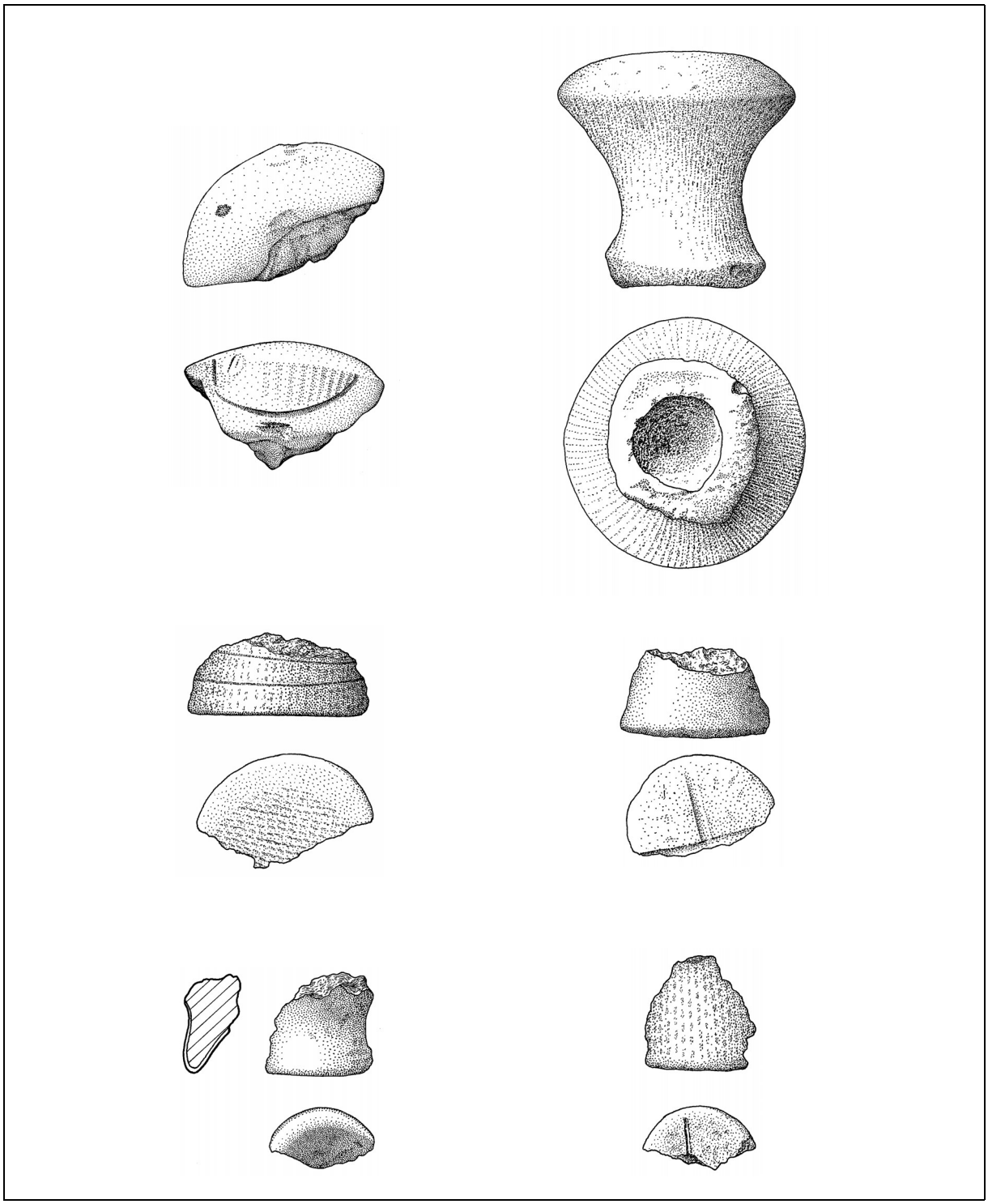


FIG. 250: Ceramic Period 4 marked anvils. *Top* left: cat. 342 (L3:3), right: cat. 274 (L3:2), *Centre* left (handle base): cat. 288 (L3:2), right (handle base): cat. 268 (L3:2), *Bottom* left (handle base): cat. 468 (L3:2), right (handle base) cat. 359 (L3:4). Scale: 1:2

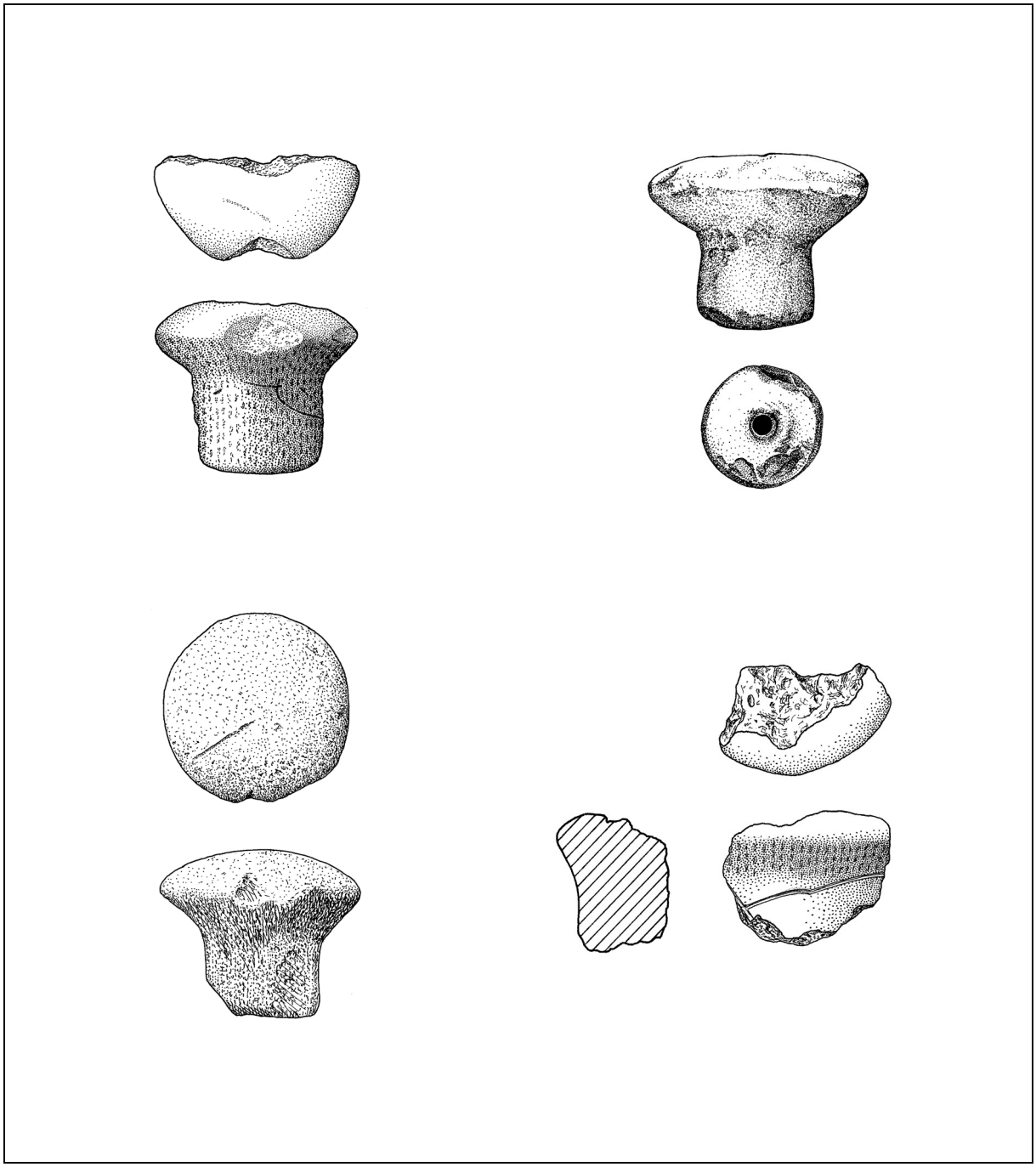


FIG. 251: Ceramic Period 4 marked anvils. *Top* left: cat. 385 (L4:1), right: cat. 490 (L3:5), *Bottom* left: cat. 497 (L4:1), right: cat. 682 (L4:2). Scale: 1:2

Anvils with a distinctively shaped base:

- The base of cat. 236 (L3:1, Fig. 249), is chamfered so that in elevation a triangular 15 mm by 15 mm section is missing from the 47 mm diameter handle. Only the handle, with a small fragment of the head still attached, was found. All surfaces are smooth.
- Cat. 468 (L3:2, Fig. 250), has a 22 mm deep inverted cone-shaped base. The handle base is 40 mm and the orifice about 30 mm in diameter. Only one small fragment was recovered. The surfaces are smooth.
- Cat. 497 (L4:1, Fig. 251), was recovered intact. The base is chamfered so that in elevation a triangular 11 x 9 mm section is missing from the 34 mm diameter handle. The handle and lower head surfaces are covered with indistinct cord marks.

Careful scrutiny has matched cats. 32, 96, 105, 188, 358 and 395 as possessing concave marks or dished centres to their handle bases. Cats. 104 and 274 share similar marks, in these instances 12–20 mm deep, 30–32 mm diameter circular concavities in the centre of their handle bases. A smaller more precise orifice marks the centres of the handle bases to link cats. 144 and 490. Cats. 236 and 497 share the same distinctive chamfered base shape. Small fragments of handles limit interpretation of the marks on cats. 268 and 359 which could represent crosses. Cats. 80 and 371 share an incised line to the handle base and these could also represent a shared mark. By comparing the marks on the above anvils, it is possible that 12 anvils shared the same or similar designs. In addition, the mark on cat. 132 is equivocal and this anvil has been eliminated from consideration. When these factors are taken into account it is considered that a minimum of 24 individual marks are present in the CP4 assemblage. Of this total, four anvil heads, seven shafts and 13 handle bases are marked.

CORD MARKS ON CERAMIC ANVILS

Cord marks are visible on 61, or 44.85 per cent, of the 136 CP4 anvils. Of these 27 are indistinct, 29 are “Z” and five “S” twist. Cord diameters range from 1–2 mm and the gaps between cord impressions from 0.5–1 mm. Cord twist helix angles have not been assessed except to note that the angles tend to fall within the range 40° to 75° from the horizontal. The presence of “Z” and “S” twisted cords suggests that both left and right-handed individuals were present in the community.

BONE STYLUS POINTS

Most styli are simple round needle-like rods about 50 mm long. Some are shorter and broader with faceted chisel edges at one end. For example cat. 1504 measures 36 mm long by 14 mm wide and 5 mm thick with a pronounced chisel-shaped bevelled terminus (Table 116). Such a

tool would be well suited to incising straight lines on to pottery while needle shaped points would be better suited to incising curvilinear lines. Several of the latter have been sharpened to a point for the terminal 10–15 mm which often has left a ridge about 2 mm high. This ridge could preclude their use as needles because the ridge would prevent the tool from passing through the material being sewn. They could, however, possibly be used as awls. Four points are made from unmodified bone fragments which have been simply sharpened to a point at one end. Of the 17 bone points considered to have been used for incising pottery, seven were broken and incomplete. Bone styli are pointed needle-shaped rods but without a hole in the distal end. Their diameters range from 4–7 mm. Styli and chisels annotated "B" were broken in prehistory.

TABLE 116: *Ceramic Period 4 bone stylus points*

Cat. no.	Layer	Shape	Cat. no.	Layer	Shape
137	2.2	stylus B	234	3.1	stylus
145	2.2	stylus B	456	3.1	chisel
148	2.2	stylus B	281	3.2	chisel B
172	2.3	stylus	343	3.3	chisel
174	2.3	stylus B	360	3.4	chisel
190	2.3	stylus B	387	4.1	chisel
1503	2.3	chisel	545	4.2 feature 2	chisel
1504	2.3	chisel	667	4.3	chisel B
217	3.1	stylus			

PREPARED CLAY

In contrast with the previous CPs, during CP4 no evidence for firing was found but an abundance of prepared clay, the highest proportion of anvils and the greatest concentration of potsherds were identified. Potting during CP4 was intensive and the volume of material recovered is outstanding. It suggests that during the final prehistoric occupation phases pottery construction was concentrated in this area of the site. Further consideration of the various activity areas encountered in each CP, and their relationship to the ceramic traditions, will be postponed until Chapters XI and XII.

During CP4, many cylinders of prepared clay, measuring 30–40 cm long and up to 10 cm in diameter, were recorded. Their colour under the Munsell soil chart system is reddish yellow (5YR/6/6). Some were incised with 1–2 mm deep parallel lines cut 20–30 mm apart. The lines often spiralled around the cylinder. In some instances they formed diagonal criss-crosses. Their purpose is uncertain except to note that they do not appear to serve any practical function. They may have indicated ownership of some kind and we will return to this question in the final chapter. As discussed in Chapter V, other cylinders appear to have been impressed with the

outline of banana leaves, a method known ethnographically as a means of storing moist clay (May and Tuckson 1982). At least one clear example from layer 3 displays such markings. Other cylinders appear to have been marked with a thick stylus, perhaps to identify them.

One cylinder recovered from L2:2 was belled out at one end. Expanding one end of the cylinder in this fashion suggests it represents the first stage in forming a type L2j vessel directly from the cylinder. It was composed of clay matching the fishpond material. Other cylinders may also have been treated in this manner, however, as most were recovered as fragments assessment of this question was not possible. A large dump of unfired unmixed clay was uncovered in L2:2 quadrant "D" (Fig. 223). Thin section analysis indicates that this dump was also composed of the local silty fishpond clay. Two small fragments of very soft local *din niao* clay, which is more plastic than the fishpond material, were found in layer 3. Thus at least two kinds of local clay appear to have been exploited during CP4.

Several CP4 clay cylinders included minor amounts of rice husk, and in hand specimen others include what appears to be grog fragments. Given the small quantities of rice husk detected, it probably represents incidental or accidental inclusions rather than a temper. Caution is needed, however, when assessing whether rice remains were added to such prepared clays, because it is doubtful whether it would survive in unfired clay for long periods. Thompson (1996:157-9), notes that rice remains in Khok Phanom Di soils were "very poorly preserved" although rice ploughed into the soil by modern-day farmers survives well due to its high silica content. The replacement of silica by calcite is well understood (Blatt *et al.* 1972:364-5) and authigenic calcite is present in abundance in the interstices of both the fossil prepared clay deposits and the fabrics of several local potsherds. This evidence suggests that at least some silica-rich rice plant fragments in unfired prepared clay cylinders is likely to have been replaced by calcite following deposition. The rate and degree of replacement is closely related to ground water distributions and the presence of calcite in the deposits.

TABLE 117: *Ceramic Period 4 prepared potting clay (weight in kg)*

Layer	Feature	Weight	Layer	Feature	Weight	Layer	Feature	Weight
2:1	-	11.03	3:5	-	7.10	4:3	3	0.40
2:1	1	0.32	4:1	-	18.32	4:3	4	0.04
2:2	1	0.06	4:1	1	3.02	4:3	5	0.17
2:2	2	0.08	4:1	2	0.50	4:3	6	0.45
2:3	-	63.90	4:1	4	0.52	4:3	7	9.32
3:1	-	41.39	4:1	5	4.63	4:3	8	3.26
3:1	1	0.19	4:2	-	11.34	4:3	9	0.40
3:2	-	60.18	4:2	2	0.01	4:4	-	3.71
3:2	1	0.07	4:3	-	7.26	4:5	1	1.10
3:3	-	21.84	4:3	1	0.24			
3:4	-	21.45	4:3	2	0.19			

Prepared clay weights for the entire site are set out in Chapter V and further detailed in Chap-

ter XI. Almost 300 kg, representing about 95 per cent of the excavated prepared potting clays, was recovered from CP4 contexts. Half of this was concentrated in L3 with about a quarter each in L2 and L4 (Table 117). Apart from L4, where almost 40 per cent of the clay was contained in shallow pits, the prepared material almost entirely lay on what appeared to be even work surfaces of compacted sherds and sandy sediments, probably derived from potting activities. The mineralogical composition of the CP4 clay cylinders helped determine the overall approach to clay dumps throughout the site. Some of the cylinder clays examined match modern local clays petrographically. They are moderately micaceous and contain mostly medium-sized silt comprising mono- and polycrystalline quartz, rare chert, microcline, plagioclase and potassium feldspar and very rare sponge spicule fragments. Authigenic calcite, often micritic, is common and sometimes abundant. Two samples from L2:1 and L2:2, sections K99 and K104, are consistent with moderately micaceous fishpond clay containing generally angular quartz and sericitic mica. Authigenic calcite is prominent, subangular plagioclase, rounded chert and tourmaline are rare. Fresh water sponge spicules are very rare. The composition of these clays is dense, and although quite short, given their overall appearance in thin section, sufficiently plastic for coarse earthenwares. Neither appears to have been tempered.

MISCELLANEOUS CERAMIC ARTEFACTS: CERAMIC PERIOD 4

CERAMIC PELLETS

Sixteen ceramic pellets measuring from 13 – 21 mm in diameter were recovered from CP4, five from L1 and 11 from L2 contexts (Table 118).

TABLE 118: *Ceramic Period 4 ceramic pellets*

Cat.	Layer	Diam. (mm)	Cat.	Layer	Diam. (mm)	Cat.	Layer	Diam. (mm)
6	1.0	17	47	2.1	15	113	2.1	15
21	1.2	20	64	2.1	13	121	2.2	15
25	1.2	20	76	2.1	16	127	2.2	17
30	1.2	18	84	2.1	17	3253	2.2	21
34	1.4	15	92	2.1	15			
40	2.1	17	108	2.1	15			

CERAMIC ''COUNTERS''

Isolated disc-shaped sherds fashioned from broken pottery occurred throughout the sequence. Sixteen were recovered from CP4 (Table 119). Their purpose is unknown; although often referred to as counters, they may be aerodynamically shaped as bow missiles. They are 4–8 mm thick.

TABLE 119: *Ceramic Period 4 ceramic "counters"*

Cat.	Layer	Diam. (mm)	Cat.	Layer	Diam. (mm)	Cat.	Layer	Diam. (mm)
7	1.1	30	37	2.1	30	97	2.1	60
15	1.1	35	44	2.1	40	107	2.2	35
16	1.1	32	54	2.1	55	122	2.2	37
26	1.3	28	59	2.1	59	522	4.1	40
28	1.3	30	65	2.1	45			
33	1.4	28	82	2.1	50			

A few enigmatic artefacts were present as isolated objects within the general matrix of the cemetery and the underlying occupation deposits. They are prominent in CP4 contexts. A summary of their characteristics follows:

- Cat. 31 (L1:3), is half of a 7 mm thick, 30 mm diameter, ceramic disc bead or ear ring which is pierced through the centre by a 6 mm diameter hole. The outer edges are smooth and rounded.
- Cat. 49 (L2:1), is a 35 mm by 30 mm sherd into one side of which a 25 mm diameter circular concave cutting edge has been ground. This modified sherd could have been used as a shaping or grinding tool, however, without further evidence its purpose remains uncertain.
- A 40 mm diameter domed ceramic disc with a flat base (cat. 94), was recovered from L2:1. Its purpose is unknown.
- A small ceramic cylinder measuring 102 mm long and 35 mm in diameter (cat. 124) was uncovered in L2:2. Its function is unknown.
- Cat. 175 (L2:3), is a small ceramic "tear drop" bead 22 mm in diameter.
- A perforated rim sherd was present in L2:3 (cat. 181), body sherds in L3:4 (cat. 453) and L4:2 (cats. 673 and 676). In each instance a hole has been bored through a broken potsherd with a drill.
- Cat. 423 (L3:3), is a 35 mm by 25 mm sherd which appears to have been modified as a polisher. It is semi-elliptical with a clearly polished edge, particularly at the ellipse arc.

- The function of cat. 471 (L3:2), a 27 mm long by 14 mm diameter ceramic cylinder, is unknown.

- Cat. 489 (L3:4), is probably a broken ladle handle. Fractured at both ends, it is 33 mm long and tapers from 16 to 13 mm in diameter.

- Cats. 706 and 710-12 (L3:3 and 3:2), are 40–78 mm square or irregular shaped sherds which have been ground flat and smooth on one side. They may have been employed as pottery burnishers.

- A cord-marked fragment of dome-shaped pottery (cat. 507, L4:4, f5), is penetrated by a tapered hole at the dome apex. The dome is 49 mm in diameter, about 50 mm high and 8 mm thick. The hole is 10 mm in diameter at the internal and 7.5 mm at the external surface. Its function is unknown.

The excavators report that seven net weights were recovered from layer 2:1 (Higham and Bannanurag 1990:48). These have not been examined by the author.

THE POTTERY OF CERAMIC PERIOD 4

BURNISHED AND INCISED WARES

Fine burnished and incised wares are restricted to L4:1, 4:3 and 4:5. All contain bleb temper. Their location in the lowest portion of the CP4 workshop, immediately above CP3 contexts where such sherds are relatively common, strongly suggests that they were misplaced in prehistory. One sherd was recovered from F1 and another from F8 (Appendix 3).

INCISED FINE WARE SHERDS

Fine, or medium fine ware sherds increase markedly during CP4 (Appendix 3). A selection has been examined in hand specimen. Apart from stoneware, restricted to L1:1, almost all are probably local. Their proportions are summarized in table 120.

These data contrast with incised fine and medium fine ware proportions throughout the site, with the exception of L10:9 and L10:10, because the proportions are reversed in all other contexts. Therefore CP4 is the only context where medium fine incised sherds exceed fine incised ware sherds.

TABLE 120: *Ceramic Period 4 incised ware sherds*

layer	fine	medium	layer	fine	medium	layer	fine	medium
1:1	0.42	1.39	2:3	-	5.55	4:1	0.27	10.78
1:2	0.02	1.18	3:1	0.52	12.53	4:2	0.94	5.09
1:3	-	0.74	3:2	0.45	12.27	4:3	1.11	4.07
1:4	-	0.44	3:3	0.88	7.98	4:4	0.35	1.60
2:1	-	9.98	3:4	0.02	6.23	4:5	0.22	0.07
2:2	0.04	13.47	3:5	-	2.18			

BURNISHED FINE WARE SHERDS

As with burnished and incised wares, burnished sherds are restricted to L4:0, 4:3 and 4:5 (Appendix 3). In hand specimen sand, orthodox and bleb grog tempers were noted. Given their proximity with CP3 contexts it is suggested that they were also disturbed in prehistory.

PADDLE-IMPRESSED WARE SHERDS

The quantity of paddle-impressed ware increased from a few scattered sherds in CP2 and CP3 to over 17 kg in CP4 (Appendix 3). In hand specimen, most appear to contain local bleb grog (Table 121). Exotic sand-tempered wares are also present in small amounts. All of the paddle-impressed wares recovered from CP2-3 are exotic, with the possible exception of several local ware sherds which have migrated downwards as a result of prehistoric disturbances. Exotic paddled wares tempered with either sand, orthodox or bleb grog were recorded. The latter, (thin section K571), is decorated with paddle impressions, cord marks and incised lines.

PAINTED AND SLIPPED FINE WARES

A single exotic painted sherd weighing 2 g was present in layer 4:1. It is tempered with orthodox grog.

PUNCTATE WARE SHERDS

The CP4 deposits yielded just 15 g of P1 punctate ware sherds, 2 from L2:3 and 13 g from L4:1 in feature 5.

APPLIQUÉ SHERDS

Appliqué wares in CP4 total 1.38 kg (Appendix 3). All, except two sherds from L3:2 and L4:3 respectively, which are probably exotic, represent local FG5 wares. They include forms A4, A5, A6, A7 and A8. Form A4 runs parallel with the vessel rim and consists of a simple band, triangular in section and 10-12 mm wide at the base attachment point. A5 has the same form as A4 with the addition of a series of vertical notches about 10 mm apart. A6 is trapezoidal in cross-section with an approximately 12 mm wide base and 8 mm outer plane. Decorative punctations, made with a round, 5 mm diameter, stylus and 2-3 mm deep, are spaced about 2-3 mm apart around the outer surface.

TABLE 121: *Ceramic Period 4 paddle-impressed wares (weight in kg)*

Layer	Feature	Fabric	Weight	Layer	Feature	Fabric	Weight
2:1	-	FG5	0.80	4:1	5	sand exotic	0.01
2:1	-	no data	0.65	4:1	8	sand exotic	0.01
2:2	-	FG5	2.41	4:2	-	FG5	0.70
2:3	-	FG5	0.73	4:2	2	FG5	0.01
3:1	-	FG5	1.01	4:2	-	no data	0.01
3:1	-	no data	0.35	4:2	-	sand exotic	0.12
3:1	-	sand exotic	0.01	4:2	2	sand exotic	0.01
3:2	-	no data	2.64	4:3	-	FG5	0.39
3:3	-	no data	2.03	4:3	3	FG5	0.02
3:3	-	FG5	0.09	4:3	5	FG5	0.06
3:4	-	no data	1.41	4:3	6	FG5	0.03
3:4	-	sand exotic	0.04	4:3	7	FG5	0.39
3:5	-	FG5	0.62	4:3	8	FG5	0.09
4:1	-	FG5	1.26	4:3	9	FG5	0.15
4:1	1	FG5	0.33	4:3	-	grog exotic	0.01
4:1	2	FG5	0.03	4:3	-	sand exotic	0.04
4:1	4	FG5	0.06	4:3	7	sand exotic	0.02
4:1	5	FG5	0.09	4:3	-	FG11 (K571)	0.01
4:1	8	FG5	0.02	4:4	-	FG5	0.18
4:1	8	FG4	0.03	4:4	-	sand exotic	0.01
4:1	-	sand exotic	0.03	4:5	1	FG5	0.03

Form A7, also triangular in section, rests within a 20 mm wide band of 1-2 mm wide triangular impressions made with a square blunt-ended probe (Fig. 252). Finally, form A8, also trapezoid in section, is decorated with cord marks to the outer surface and with 4 mm diameter notches made with a rounded probe to the upper surface (Fig. 252).

The appliqué technique was a minor focus of the local potting technologies throughout CP1–3. It is notable that early exotic examples (L10:12, L10:21 and L11:1) are present in the

assemblage. Of particular interest is the presence of bleb-tempered appliqué wares alongside local wares fabricated using a different clay preparation method. One sherd from L3:2 examined in thin section is composed of FG5. It seems that local potters during CP4 favoured using this distinctive decorative technique in contrast to earlier traditions. This point will be discussed further in Chapter XI.

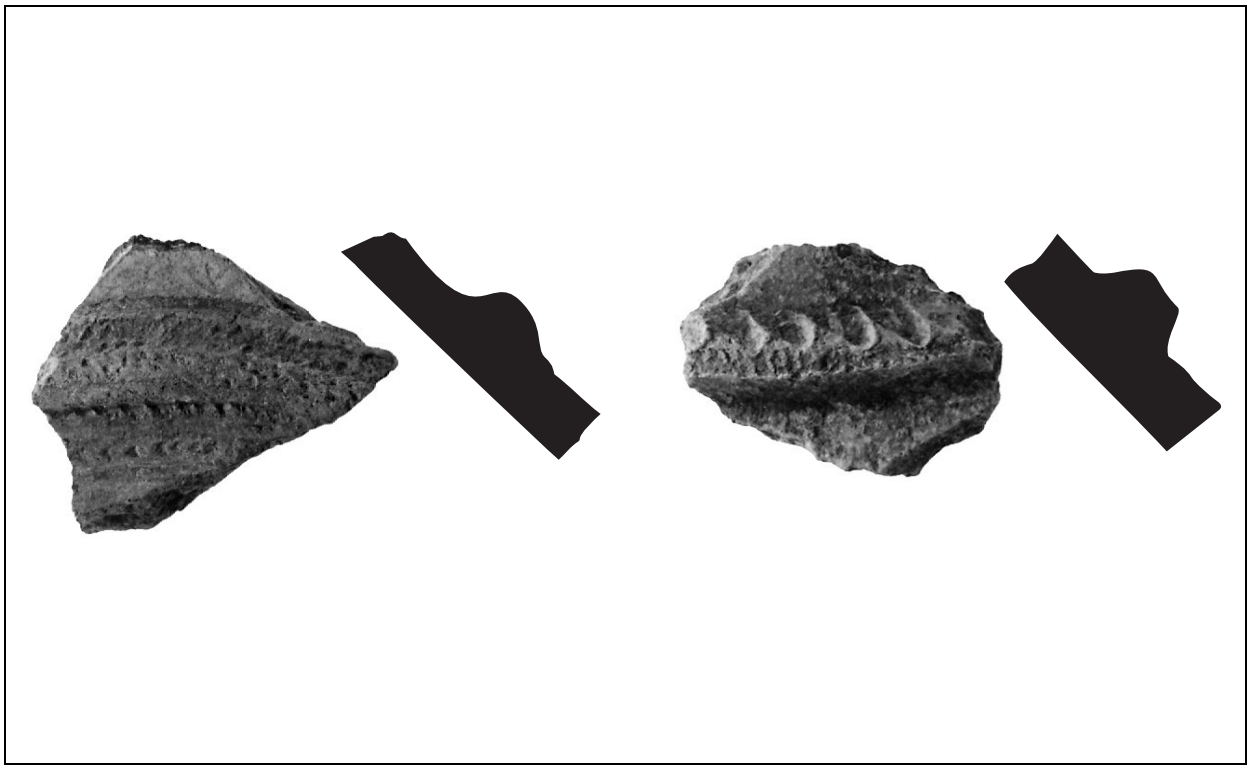


FIG. 252: Appliqué sherds. Forms A7 (left) and A8. Ceramic Period 4. Scale 1:1

THE RIM SHERDS

COARSE WARES

Coarse ware rims comprise in excess of 360 kg or over 80 per cent of the CP4 rim assemblage (Appendix 2). Over 75 kg were present in L4; 157.49 kg in L3; 112.63 kg in L2 and 15.6 kg in L1. These values equate to 35.53 kg/m3 for L1-2 combined; 37.5 kg/m3 for L3 and 16.71 kg/m3 for L4, when variations in the depth of cultural deposits are accounted for. According to the excavators (Higham and Bannanurag 1990:47), "layers 2 and 3 form the uppermost prehistoric

context at Khok Phanom Di." This conclusion was reached following examination of discontinuous colour changes and the observation that both layers "shared the same dense concentration of potsherds and range of artefacts" (*op. cit: 48*). Therefore, from a ceramic perspective it is not possible to separate the layers further, at this point, than into those defined by the excavators. The evidence will be reviewed, however, following a detailed presentation of the main corpus of ceramic data.

Rim form 1

Forms 1, 1a and 1b continue in the same form as the CP3 versions. One new variant, RF1b(i), is confined to a single sherd in L3:1. It is distinguished by a plain external border immediately below the rim defined by a single horizontal incised line. The surface below the line is filled with vertical cord marks.

Rim form 1 fabrics

All the RF1 fabrics are composed of the fishpond clay tempered with rice, except where noted (Table 122). The exceptions are composed of a more micaceous clay consistent with the *din niao* samples (Chapter V). Clay lumps are often present in the fishpond prepared clay and these could be mistaken for grog temper in hand specimen, which underlines the need for petrographic analysis to determine fabric composition. Variations in the amount of temper have not been determined precisely other than to note that some RF1 fabrics include more rice than others. Little or no rice is evident in some. Some fabrics are more micaceous than most, a phenomenon consistent with variations in the local clay deposits. This has not been quantified because such research lies beyond the scope of the present report.

Rim form 2

Two variants, RF2b and 2d, are absent from the CP4 spectrum, however, a new variant, RF2e was recovered from L4:2. This rim displays vertical cord marks and a series of cross-hatched incised lines immediately below the characteristic external rim fold (Fig. 253). The overall weights for RF2 and variants increase from 21.63 kg in L4 to 40.42 kg in L3; 39.51 kg in L2 and then fall to 3.50 kg in L1 (Appendix 2). For CP4 rims, the maximum diameter of RF2 is 360 mm and the minimum 180 mm; maximum rim thickness is 10 mm, the minimum 4 mm; maximum rim length is 66 mm, minimum 25 mm.

TABLE 122: *Rim form 1 fabrics: Ceramic Period 4.*
(T.S./h.s.: thin section/hand specimen, DN: Din Niao clay)

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
1:1	1	h.s.	FG4	1	3:4	1	K777	FG4	-
1:1	1	h.s.	FG4	-	3:4	1	K778	FG4	-
1:1	1a	h.s.	FG4	-	3:4	1	K779	FG4	-
2:1	1	h.s.	FG4	1	3:4	1	K780	FG4	-
2:1	1	h.s.	FG4	-	3:4	1	K781	FG4	-
2:1	1a	h.s.	FG4	-	3:4	1a	h.s.	FG4	-
2:2	1	K35	FG4	-	3:4	1b	h.s.	FG4	-
2:2	1	h.s.	FG4	1	3:5	1a	h.s.	FG4	-
2:2	1	h.s.	FG4	2	3:5	1	h.s.	FG4	-
2:2	1a	h.s.	FG4	-	4:0	1	h.s.	FG4	-
2:3	1	h.s.	FG4	-	4:0	1	h.s.	FG4	1-6, 8
2:3	1a	h.s.	FG4	-	4:0	1a	h.s.	FG4	-
2:2	1	K51	FG4?	-	4:0	1a	h.s.	FG4	1, 5, 8
2:2	1	K761	FG4	-	4:0	1b	h.s.	FG4	-
2:3	1	K31	FG4	-	4:0	1b	h.s.	FG4	1, 6
3:0	1	h.s.	FG4	-	4:1	1	K525	FG5	-
3:0	1b	h.s.	FG4	-	4:1	1	K1142	FG4	6
3:0	1b(i)	h.s.	FG4	-	4:1	1	h.s.	FG4	-
3:1	1	h.s.	FG4	-	4:1	1	h.s.	FG4	1-2, 6-8
3:1	1	h.s.	FG4	1	4:1	1a	h.s.	FG4	-
3:1	1	K545	FG4?	-	4:1	1b	h.s.	FG4	-
3:1	1	K800	FG4 (DN)	-	4:2	1	K1137	FG4	-
3:1	1a	h.s.	FG4	-	4:2	1	K1139	FG4	-
3:1	1b	h.s.	FG4	-	4:2	1	h.s.	FG4	-
3:2	1	h.s.	FG4	-	4:2	1	h.s.	FG4	2
3:2	1	h.s.	FG4	1	4:2	1a	h.s.	FG4	-
3:2	1a	h.s.	FG4	-	4:2	1b	h.s.	FG4	-
3:2	1b	h.s.	FG4	-	4:2	1a	h.s.	FG4	2
3:3	1	K797	FG4 (DN)	-	4:3	1	K1132	FG4	7
3:3	1	h.s.	FG4	-	4:3	1	K1135	FG4?	-
3:3	1	h.s.	FG4	1	4:3	1	K1136	FG4	-
3:3	1a	h.s.	FG4	1	4:3	1	K1138	FG4	-
3:3	1b	h.s.	FG4	-	4:3	1	K1144	FG4	7
3:4	1	K772	FG4	-	4:3	1	K1146	FG4	-
3:4	1	K773	FG4	-	4:3	1	h.s.	FG4	-
3:4	1	K774	FG4	-	4:3	1	h.s.	FG4	1-7
3:4	1	K775	FG4	-	4:3	1a	h.s.	FG4	-
3:4	1	K776	FG4	-	4:3	1a	h.s.	FG4	3

TABLE 122: *Rim form 1 fabrics: Ceramic Period 4 (continued)*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
4:3	1b	h.s.	FG4	-	4:5	1	K1128	FG4	-
4:3	1b	h.s.	FG4	7, 8	4:5	1	K1134	FG4	-
4:4	1	K1129	FG4	-	4:5	1	K1143	FG4	1
4:4	1	K1130	FG4	-	4:5	1	h.s.	FG4	-
4:4	1	K1133	FG4	-	4:5	1	h.s.	FG4	1
4:4	1	K1140	FG4	-	4:5	1a	h.s.	FG4	-
4:4	1	h.s.	FG4	-	4:5	1b	h.s.	FG4	-

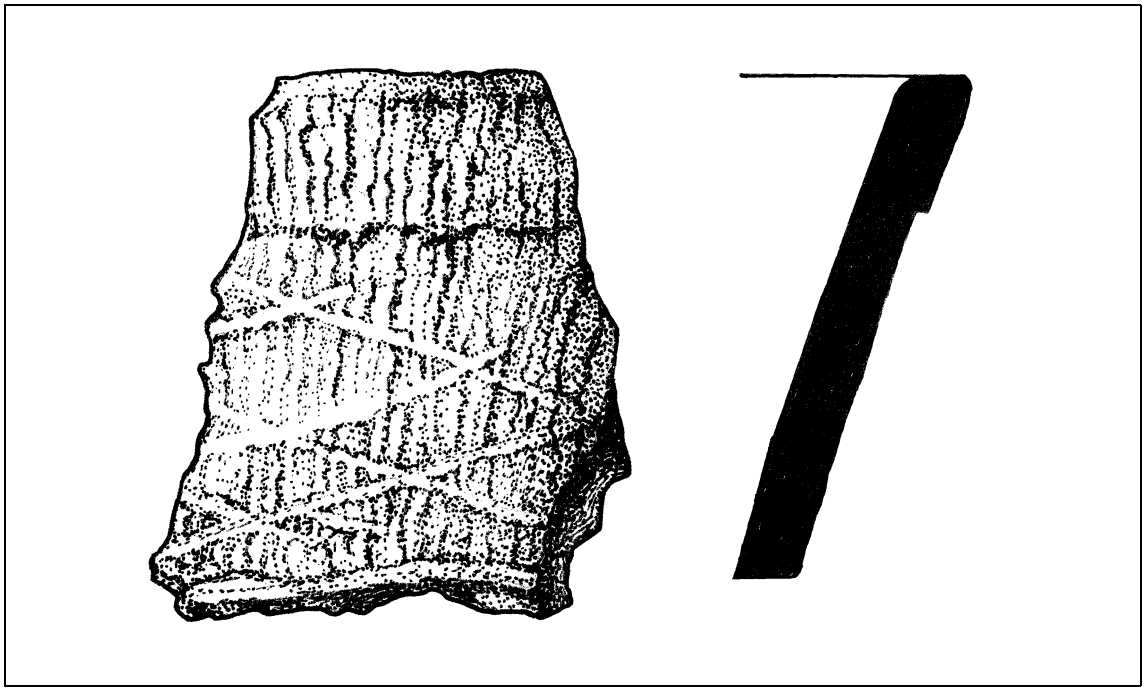


FIG. 253: Rim form 2e. Ceramic Period 4. Scale 1:1

Rim form 2 fabrics

In contrast to RF1 wares, a different treatment is apparent in RF2 fabrics. Rice as well as bleb grog tempers are present in varying amounts. The bleb grog often proved difficult to identify in hand specimen. Rice impressions and the characteristic bleb grog morphology can easily be overlooked. A 1.88 kg L3:1 sample examined under a low-powered binocular microscope resulted in the following proportions: Rice 39.36 per cent, bleb grog, and what initially appeared to be orthodox grog, about 30 per cent each. Examination in thin section of a sample of the fabrics initially categorized as containing orthodox grog revealed that all were tempered with bleb grog. The rice tempering method follows that employed for the type L2j coarse wares. A summary of RF2 fabrics is included in table 123. Overall fabric proportions are estimated in Appendix 3, however it should be noted that all CP4 local RF2 and 3b fabrics either contain rice or bleb grog temper.

TABLE 123: *Rim form 2 fabrics: Ceramic Period 4*
(T.S./h.s.: thin section number/hand specimen)

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
1:1	2	h.s.	FG4	-	3:2	2	h.s.	FG4	-
1:1	2	h.s.	FG5	-	3:2	2	h.s.	FG4	1
1:2	2	h.s.	FG4	-	3:2	2a	h.s.	FG4	-
1:1	2	h.s.	FG4	-	3:2	2c	h.s.	FG4	-
1:4	2	h.s.	FG5	-	3:3	2	h.s.	FG4	-
2:1	2	h.s.	FG5	-	3:3	2	h.s.	FG4	1
2:1	2	h.s.	FG5	1	3:3	2a	h.s.	FG4	-
2:2	2	K50	FG5	-	3:3	2c	h.s.	FG4	-
2:2	2	h.s.	FG5	1	3:4	2a	h.s.	FG4	-
2:2	2	h.s.	FG5	2	4:0	2	h.s.	FG4	-
2:2	2	K52	FG5	-	4:1	2	h.s.	FG4	-
2:2	2	K92	FG5	-	4:1	2a	h.s.	FG4	-
2:2	2	K93	FG5	-	4:1	2c	h.s.	FG5	-
2:2	2a	K67	FG5	-	4:2	2	h.s.	FG4	-
2:3	2	K2	FG5	-	4:2	2e	h.s.	grog	-
3:0	2c	h.s.	FG4	-	4:3	2	h.s.	FG4	-
3:1	2	h.s.	FG4	-	4:3	2	h.s.	FG5	-
3:1	2	h.s.	FG5	-	4:3	2a	h.s.	FG4	-
3:1	2	h.s.	FG4	1	4:4	2	h.s.	FG5	-
3:1	2a	h.s.	FG4	-	4:5	2	h.s.	FG4	-

Rim forms 3b, 3b(ii) and 3k

The quantities of RF3b increased from 3.6 kg in L4 to 5.4 kg in L3; 5.66 kg in L2; with just 36 g in L1 (Appendix 2). Two new variants, 3b(ii) and 3k, were present in CP4.

- Variant 3b(ii) features a series of cross-hatched incised lines which overlie vertical cord marks.

- The terminus of RF3k has a central notch running around the circumference. The exterior is plain above the inflection point and decorated with 2 mm wide incised lines over the cord-marked surface below it (Fig. 254).

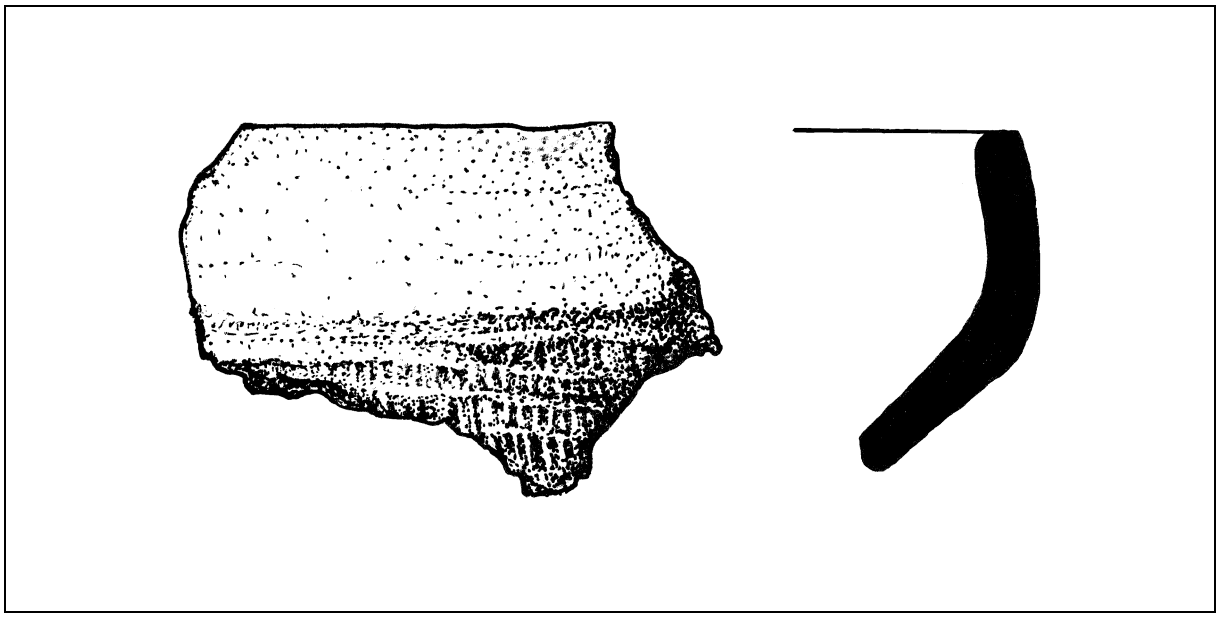


FIG. 254: Rim form 3k. Ceramic Period 4. Scale 1:1

Rim form 3b, 3b(iii) and 3k fabrics

A similar mix of fabrics to those noted for RF2 was evident in hand specimen examination of these RF3 variants. All are local.

TABLE 124: *Rim form 3b, 3b(ii) and 3k fabrics: Ceramic Period 4 (T.S./h.s.: thin section number/hand specimen)*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
1:1	3b	h.s.	grog	-	4:1	3b	h.s.	FG4	-
2:1	3b	h.s.	FG4	-	4:1	3b	h.s.	grog	-
2:1	3b	K54(i)	FG5	-	4:1	3b	h.s.	grog	1
2:2	3b	h.s.	FG4	-	4:2	3b	h.s.	grog	-
2:2	3b	K36	FG4	-	4:2	3b	h.s.	FG4	-
2:3	3b	h.s.	FG4	-	4:3	3b	h.s.	FG4	-
2:3	3b	h.s.	FG5	-	4:3	3b	h.s.	FG4	7
3:3	3b(ii)	h.s.	FG4	-	4:3	3b	h.s.	grog	-
3:3	3b	h.s.	FG4	-	4:4	3b	h.s.	FG4	-
3:5	3b	h.s.	FG4	-	4:5	3b	h.s.	grog	-
4:0	3b	h.s.	FG4	5, 6, 8	4:5	3k	h.s.	FG5	-
4:0	3b	h.s.	FG4	-					

FINE WARES

Rim form 3

Earlier categories and variants 3a(ii), 3a(iii), 3a(iv), 3b(i), 3c(i), 3c(ii), 3c(iii), 3c(iv), 3f, 3f(i) and 3g are absent from CP4 contexts. Three different forms, 3a(i), 3d and 3j, are present in minor quantities along with 3h and 3i which continue from CP3 (Appendix 2).

- RF3a(i) differs from 3a in that the field above an incised line, which runs parallel to and about 20–25 mm below the rim, is decorated with shell impressions.
- RF3d is restricted to L1. The terminus is rounded and the surfaces are smoothed and decorated with a single incised line on the exterior about 20 mm below the rim.
- RF3j is decorated with diagonal paddle impressions (Fig. 255).

Rim form 3 fabrics

Petrographic analysis on a selection of RF3 sherds shows that at least two different local clays, a relatively micaceous clay similar to the *din niao* sample and silty fishpond material, were exploited. Both were treated with bleb grog. Sherds examined in hand specimen included both rice and grog temper. Those designated the latter were very difficult to discriminate between

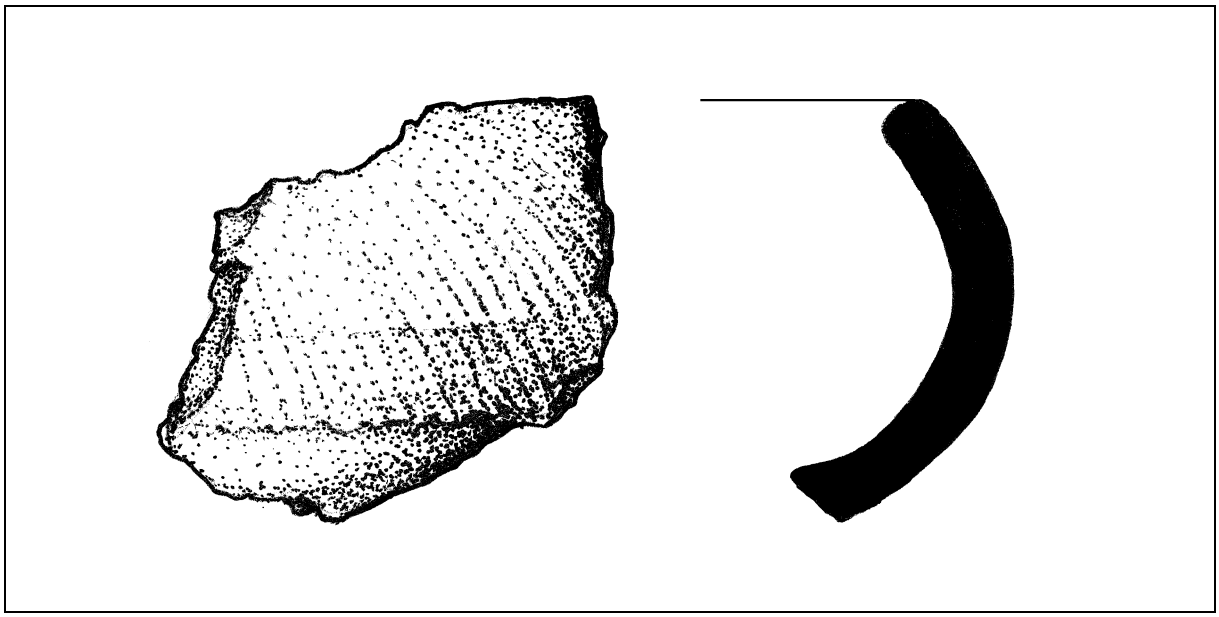


FIG. 255: Rim form 3j. Ceramic Period 4. Scale 1:1

orthodox and bleb grog because, as thin section analysis revealed, the amount of rice combined with the grog particles varied widely. Rice is relatively abundant in some. Determining the varying proportions of plant remains and/or grog through point counting methods is unlikely to subdivide the different fabric treatments given the scarcity of plant remains in some sections.

Rim form 4

The standard of local CP4 fine wares is clearly inferior to that reflected in comparable CP1–3 wares. Local pottery is thicker and less attention is paid to forming and finishing. Burnishing is less meticulous and reduction to produce a dark lustrous colour is no longer emphasized. A marked increase in the range of RF4 categories is evident, however none of these wares approach the very high levels of expertise reflected in any of the earlier local fine ware ceramic spectra. Absent from the CP4 assemblage are RF4f(i), 4i(i), 4am, 4an, 4ao, 4ap, 4aq, 4ar, 4as, 4at, 4au, 4av, 4aw, 4ax, 4ay, 4az, 4aaa and 4aab. Also present in CP3 are RF4f and 4al. Most of the CP4 rims are distinguished by a sharp inverted inflection point about 20–40 mm below the terminus. Some lack an angular inflection point and are tightly curved instead. The zone above and just below the inflection point is variously decorated with geometric and/or curvilinear shapes which have been infilled with a variety of impressions, punctation marks and incised lines. A feature of these rims is the wide variety of design motifs. Several of the rims differ only slightly from one another. All are plain or lightly burnished unless otherwise noted. Compared with earlier traditions, however, burnishing is often inferior with less attention to detail. Although some display high quality burnishing, the effect is diminished by an overall lack of refinement in the

vessel forming. In most, this is coupled with oxidized surfaces which tend to mute the lustrous effect endowed by burnishing. Reduction, in contrast, was a characteristic of the CP2/3 traditions.

TABLE 125: *Rim form 3 fabrics: Ceramic Period 4*
(T.S./h.s.: thin section number/hand specimen, f: fishpond clay)

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
1:1	3	h.s.	grog	-	2:3	3	K6	FG5	-
2:1	3	h.s.	FG5	1	2:3	3	K4	FG5	-
2:1	3	h.s.	FG4	-	2:3	3a	h.s.	FG5	-
2:1	3a	h.s.	FG5	-	3:1	3	K548	FG5	-
2:1	3j	K54(ii)	FG11	-	4:0	3	K595	FG5	5
2:2	3	h.s.	FG5	-	4:0	3h	h.s.	grog	1, 5
2:2	3e	18	FG4	-	4:0	3i	h.s.	FG5	1
2:2	3	K1	FG5	-	4:1	3	h.s.	FG4	-
2:2	3a	K3	FG5	-	4:1	3i	h.s.	FG4	-
2:2	3a	h.s.	FG5	-	4:2	3	h.s.	FG4	2
2:2	3	K536	FG5?	-	4:2	3i	h.s.	FG4	-
2:2	3j	K34	FG11	-	4:2	3j	h.s.	FG5	-
2:2	3	K528	FG5?	-	4:3	3	h.s.	FG4	5
2:2	3	K536	FG5?	-	4:5	3k	h.s.	FG5	-
2:3	3	K9	FG5f	-					

Three decorative aspects are involved in the RF4 assemblage: (i) the mode of decoration. This refers to surface treatment. Paddle, shell or punctate impressions, cord marking and incising were deployed in a variety of forms; (ii) decorative zone utilization. Three zones are involved: the rim terminus, the inverted exterior band between the inflection point and the rim terminus and the exterior wall below the inflection point; (iii) decorative treatment and zone combinations: variations in combining one or more of the different surface treatments provides a wide range of effects. As a corollary to the surface treatment selections, placement of the various modes of decoration in different zones allowed a variety of design expressions to be displayed. This strategy further extended the range of possible designs able to be adopted. The following RF4 categories were restricted to CP4 contexts:

- 4a is burnished and decorated above the inflection point with a trapezoid field infilled with *Anadara* shell impressions. A single incised line runs parallel with and below the inflection point (Fig. 256).
- 4b features part of a trapezoid(?) field contained within the inflection point and rim terminus. In this instance the field is infilled with small punctations made with the point of a round stylus. Small notches, spaced about 7–8 mm apart, are cut into the terminus edge. Vertical paddle impressions decorate the exterior surface below the inflection (Fig. 256). It is burnished.

- 4b(i) contains inverted triangles filled with fine punctations within the upper zone. Diagonal paddle impressions, which cover the exterior wall, are interrupted by a plain 17 mm deep band 12 mm below the inflection point. Fine punctations also decorate the upper of the two paddle-impressed zones (Fig. 263).

- 4c is also decorated with triangular fields between the terminus and inflection point. Each alternate field is infilled with *Anadara* shell impressions to produce a chevron-like pattern. An 8 mm wide band, bordered by the inflection point and an incised line skirts the exterior wall (Fig. 256). *Anadara* shell impressions also decorate the rim edge.

- 4d features a curvilinear field infilled with *Anadara* shell impressions. A single incised line runs about 10 mm below and parallel with the inflection point (Fig. 256).

- 4e lacks an inflection point. It is curved in section and decorated with *Anadara* shell impressions below a single incised line which runs 10 mm below and parallel with the terminus (Fig. 257).

- 4g is decorated with similar geometric fields to RF4k (below). The triangles are infilled with small punctations made with the point of a round stylus. A single incised line runs about 10 mm below and parallel with the inflection point and above this line is also decorated with punctations, as is the rim edge.

- 4h displays a decorative band within the zone between the inflection point and rim terminus. It consists of two parallel incised lines 12-13 mm apart within which are a series of curvilinear incised lines forming a semi-lenticular pattern along each border (Fig. 257).

- 4j again features triangular? fields resting on the rim terminus which are infilled with *Anadara* shell impressions. The rim terminus displays a 5 mm wide band of small punctations made with the point of a round stylus (Fig. 257).

- 4k measures 30 mm from the inflection point to the terminus. Triangular fields, defined by incised lines, point downwards from the terminus. These are infilled with vertical *Anadara* shell impressions. A single incised line skirts 8 mm below the inflection point (Fig. 257). The terminus is decorated with a series of small notches.

- 4l is decorated above the inflection point with a semi-circular field resting on the terminus. It is infilled with small punctations made with the blunt end of a squared stylus to produce triangular impressions. A narrow band filled with vertical cord marks, defined by a single incised line, skirts below the inflection point (Fig. 258).

- 4m is decorated within the upper zone with a lunate incised line which appears to rest on the terminus (Fig. 258). The area above this line is infilled with diagonal *Anadara* shell impressions.

- 4m(i) is a variant with a plain border below the inflection point defined by a single incised line. Diagonal paddle impressions cover the surface below the incised line.

- 4n features a lunate incised line which appears to rest on the inflection point (Fig. 258). The area above this line and within a 6 mm wide band bordering below the inflection point, defined by an incised line, is infilled with diagonal *Anadara* shell impressions.
- 4o displays a curved incised line within the upper zone above which, and including the terminus surface, is infilled with small punctations made with the point of a round stylus (Fig. 258).
- 4p is decorated above the inflection point with triangulated incised lines and below it with two horizontal lines within which are two parallel lines. The latter may represent part of chevron pattern or merely be part of an abstract design (Fig. 258).
- 4q decoration comprises a plain chevron pattern defined by parallel incised lines within a field of small punctations made with the point of a round stylus (Fig. 258). Decoration is confined to the zone above the inflection point.
- 4r also displays triangles which appear to fill the upper zone. Those pointing downwards are probably filled with *Anadara* shell impressions. The incised lines are 2 mm wide, which is broader than usual. A 9 mm wide band below the inflection point is infilled with horizontal *Anadara* shell impressions (Fig. 259).
- 4s again employs triangles within the upper zone, although in this instance those downward pointing are decorated with fine punctations made with the point of a round stylus. Two horizontal incised lines skirt 5 and 8 mm below the inflection point (Fig. 259).
- 4t varies from the samples described above in that the decorative treatment of the triangular(?) field employs what appear to be impressions made with an immature *Anadara* or similar shell. A 10 mm wide band, defined by an incised line filled with a different set of shell impressions, skirts blow the inflection point (Fig. 259). A 2 mm wide incised wavy line circuits the terminus edge (not shown).
- 4u has a rectangular panel within the upper zone, which is infilled with vertical *Anadara* shell impressions, alongside a fragment of a triangular(?) panel similarly treated (Fig. 260).
- 4v curves inwards and lacks an angular inflection point. The entire exterior surface is covered with steeply angled paddle impressions (Fig. 260).
- 4w also curves inwards. Vertical *Anadara* shell impressions decorate the area below a plain border defined by a horizontal incised line 5 mm beneath the terminus (Fig. 260).
- 4x features a lunate field adjacent to part of a rectangular(?) vertical panel contained within the zone between the inflection point and rim terminus. These fields are respectively infilled with diagonal and vertical *Anadara* shell impressions (Fig. 260). The terminus also displays shell impressions.
- 4y follows the triangular field theme within the upper zone. The downwards pointing triangle is filled with horizontal *Anadara* shell impressions. Vertical paddle impressions fill a 7 mm deep band between the inflection point and an incised line (Fig. 260).

- 4z ornamentation consists of running triangles with the upper zone and a series of decorative horizontal bands below the inflection point (Fig. 261). The triangles are filled with paddle impressions angled from left to right upwards. A 16 mm wide horizontal band, defined by incised lines, interrupts paddle impressions which cover the exterior surface below the inflection point. These impressions are angled in the opposite direction to those above it.
- 4aa is embellished with a plain lunate motif set in a field of vertical *Anadara* shell impressions placed within the upper zone (Fig. 261). A 6 mm deep band, bordered by an incised line, of near vertical paddle impressions skirts below the inflection point. The rim terminus also displays *Anadara* shell impressions.
- 4ab is adorned with a 33 mm deep band of diagonal paddle impressions, enclosed by parallel incised lines, which straddle the convex inflection point (Fig. 261).
- 4ac has a shallow 10 mm deep zone above the inflection point which is embellished with inverted triangles filled with *Anadara* shell impressions. An 8 mm deep band, decorated with small punctations made with the point of a round stylus and defined by the first of two horizontal lines spaced 12 mm apart, skirts below the inflection point (Fig. 262).
- 4ad is similar to RF4y, but it differs in detail. *Anadara* shell impressions within the upper zone triangles are disposed diagonally (Fig. 262). The rim terminus also displays these impressions. Diagonal paddle impressions fill a 10 mm deep band which skirts below the inflection point.
- 4ae employs small round stylus punctations to define what are probably a series of downward pointing triangles arranged within the upper zone. The terminus is also decorated with these punctations. An 8 mm deep band embellished with a single row of round stylus punctations above a row of cyma-shaped impressions skirts below the inflection point (Fig. 262).
- 4af (layer 2 only), is adorned with a series of plain lunate motifs set within small punctations made with a round stylus (Fig. 263). A 5 mm deep band defined by an incised line and filled with the same punctations runs below the inflection point.
- 4ag (layer 2 only), measures only 10 mm from the inflection point to the terminus. An oblique triangle defined by an incised line filled with small punctations made with a small round stylus points downwards from the terminus. A single incised line runs parallel and 3 mm below the inflection point (Fig. 263).
- 4ah (layer 2 only), employs three decorative modes. The terminus is adorned with a series of 1 mm wide notches about 2 mm apart made with the side of a round stylus. A shallow lunate motif, filled with small punctations made with the tip of a round stylus, rests on the inflection point. Below this feature is a 9 mm deep band decorated with diagonal paddle impressions (Fig. 263).
- 4ai (layer 2 only), features a series of linked semi-circular lunes, defined by incised lines, which form a continuous motif in the upper zone. The surrounding surfaces are filled with diagonally arranged *Anadara* shell impressions. A 16 mm deep band, defined by an incised line below the inflection point, is filled with diagonal paddle impressions (Fig. 264).

- 4aj (layer 2 only), employs inverted triangles filled with vertical *Anadara* shell impressions which extend from the terminus to the inflection point (Fig. 264). The rim terminus is also decorated with these impressions. Two incised lines skirt 20 and 33 mm below the inflection point. Paddle impressions are also visible on the lowest portion of the sherd.

- 4ak is similar to RF4ai, however the *Anadara* shell impressions are arranged horizontally in the upper zone (Fig. 264). A single line of *Anadara* shell impressions unlined by one incised line skirts below the inflection point, instead of the paddle impressions featured in the former rim.

- 4aac (layer 4 only), has curvilinear semi-lozenge or downwards pointing equilateral-shaped fields filled with diagonally arranged punctation marks made with the tip of a square stylus. The terminus edge and a 12 mm deep band skirting the inflection point are also filled with these punctations. The field are defined by 1.5 mm wide lines incised with a round stylus (Fig. 265).

- 4aad (layer 4 only), is smoothed but not burnished. A rhythmic meandering incised line courses through the centre of the upper zone above the inflection point. The area above this line is infilled with neatly arranged diagonal *Anadara* shell impressions spaced 5 mm apart. About 70 mm of the vessel is present below the inflection point and this is also covered with the impressions running almost in unison with those above it. The shell impressions are about 35 mm long and the row which abuts the inflection point is angled slightly from the perpendicular. A fine straight line runs at 90° to the vessel circumference and this appears to have been used as a guide in aligning the impressions (Fig. 265).

- 4aae (layer 4 only), is lightly burnished. The upper zone is decorated with an oblate hemisphere, defined by 1 mm wide incised lines rendered with a round stylus, filled with diagonally arranged *Anadara* shell impressions. A 15 mm deep band, defined by a straight incised line and filled with diagonal paddle impressions, borders the inflection point (Fig. 265).

- 4aaf (layer 4 only), carries an abstract design rendered in very fine incised lines above the inflection point. Two nearly horizontal lines skirt about 5 and 20 mm below this point. It is lightly burnished and fired in a reducing atmosphere (Fig. 265).

- 4aag (layer 4 only), features low angled paddle impressions above an irregular incised line within the upper half of the panel above the inflection point (Fig. 266). The incised line is carefully applied in an extremely elongated "Z" shape. The paddle impressions are interrupted by a plain band, defined by 2 mm wide horizontal incised lines (about 15 and 30 mm below the inflection point). The fabric is heavily reduced.

- 4aah (layer 4 only), above the inflection point displays of oblate lunate semispheres pointing upwards from the inflection point are infilled with vertical *Anadara* shell impressions. Immediately below the inflection is adorned with a single row of punctation marks made with a blunt end of a half-round stylus (Fig. 266). Two parallel incised lines lie 9 and 20 mm below the inflection. The fabric is fully reduced.

- 4aai (layer 4 only), is probably only smoothed or lightly burnished and also features a curvilinear, probably lunate, field in the upper zone. In this instance the base of the motif rests on the inflection point. It is filled with freehand squiggles made by drawing the sharp point of a stylus backwards and forwards across the field in near vertical zig-zags. This pattern is continued uninterrupted for 10 mm below the inflection point to terminate at a single horizontal 1 mm wide incised line. The terminus is decorated with obscure impressions (Fig. 266).

- 4aaj (layer 4 only), is lightly burnished. Decoration consists of a series of downwards pointing curvilinear semi-lozenge or equilateral-shaped fields defined by 2 mm broad incised lines. The fields are filled with vertical *Anadara* shell impressions to produce a similar motif to that recorded for 4aac, except that the lozenge infill is different (Fig. 266). Two bands, one 13 mm deep which skirts below the inflection point and the other, a 10 mm deep band, which begins 28 mm below this point, are also filled with almost vertical *Anadara* shell impressions.

Rim form 4 fabrics

A selection of RF4 sherds has been examined in thin section and hand specimen (Table 126). Nearly all categories are composed of material consistent with FG5, the CP4 local bleb tempered fabric. One L2:2 RF4a is composed of FG11, an exotic ware. This fabric is correlated with paddle-impressed wares which were recovered from CP2 and CP3 (Chapters VIII and IX). It is important to note that paddle impressing formed a prominent component of local surface treatments during CP4. Two further categories, RF4aad and 4aae, feature orthodox grog and in hand specimen they also appear exotic. Fishpond clay was observed in just one thin-sectioned sherd and although it may also have been present in other sherds, none was detected in the sample examined in hand specimen.

In contrast to the local fine wares which characterize the CP2/3 traditions, the vessels which these rims represent are thicker and often less carefully smoothed and burnished. This has tended to limit the amount of fine colloidal particles which migrate to the surface during smoothing and burnishing. When coupled with a light coloured oxidized fabric, a dull slightly coarser surface results. Few of the CP4 RF4 rims approach the very high standards achieved during CP2/3. This does not appear to be due to the use of inferior clays as, apart from the single fishpond sample, the remaining local sherds examined in thin-section display a similar micaceous matrix to those examined from CP2/3 contexts. As a consequence, differences in the CP4 RF4 fabrics are considered to result from potting skill standards rather than changes in the material sources.

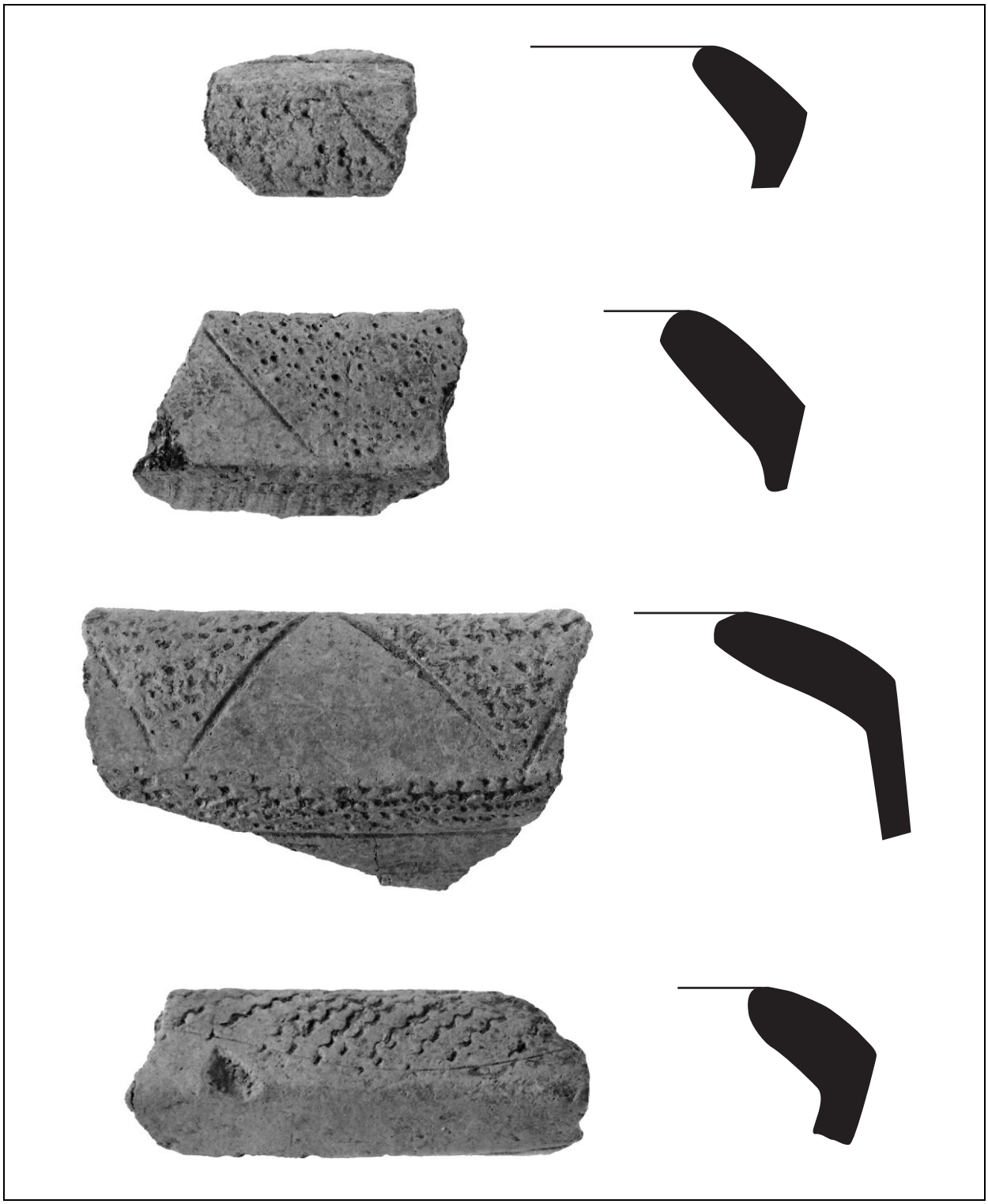


FIG. 256: Rim form 4 categories. Ceramic Period 4. *Top*: 4a, *Centre upper*: 4b, *Centre lower*: 4c, *Bottom*: 4d. Scale 1:1

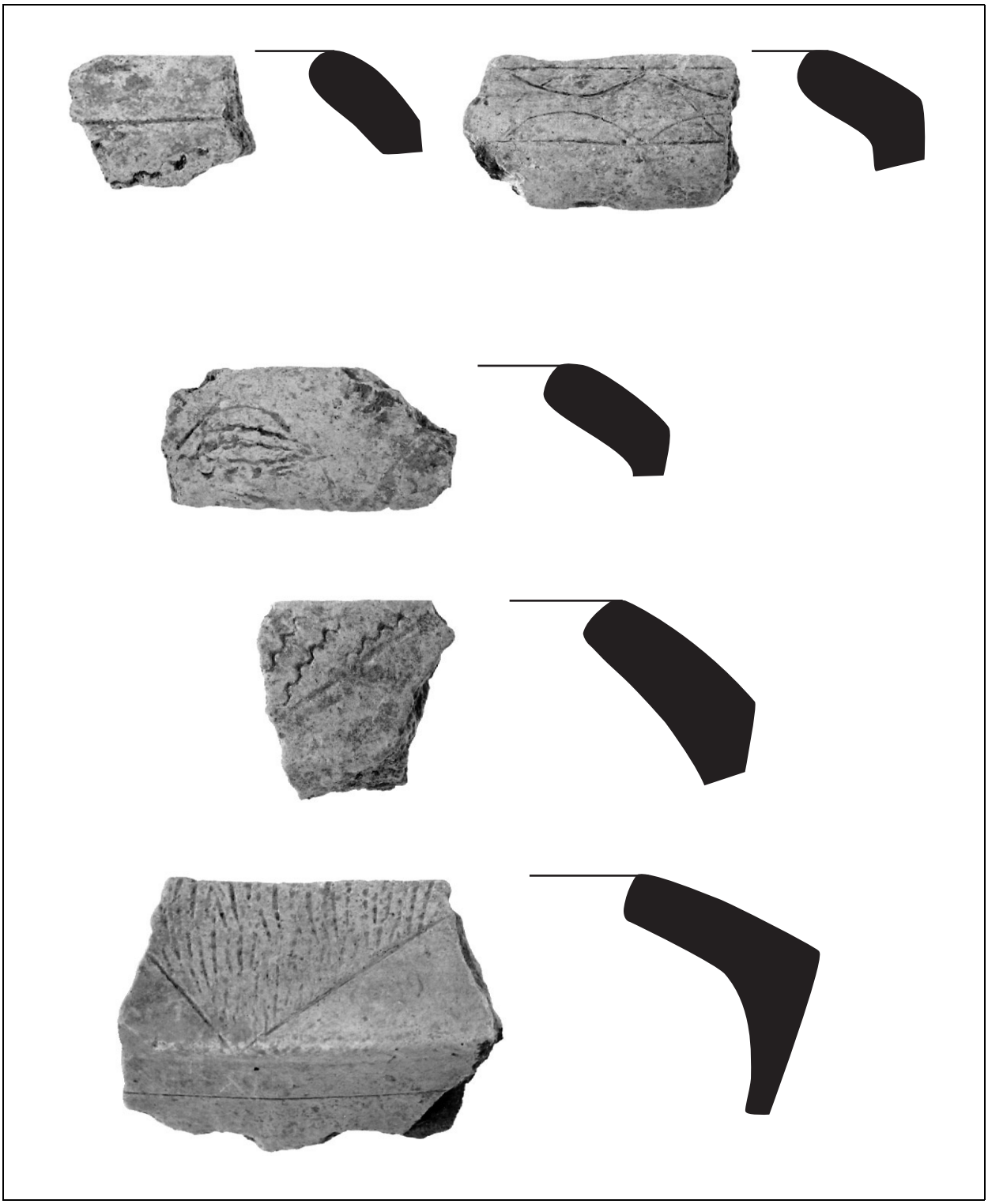


FIG. 257: Rim form 4 categories. Ceramic Period 4. *Top* left: 4e, right: 4h, *Centre upper*: 4i, *Centre lower*: 4j, *Bottom*: 4k. Scale 1:1



FIG. 258: Rim form 4 categories. Ceramic Period 4. *Top* left: 4l, right: 4m, *Centre* left: 4n, right: 4o, *Bottom* left: 4p, right: 4q. Scale 1:1

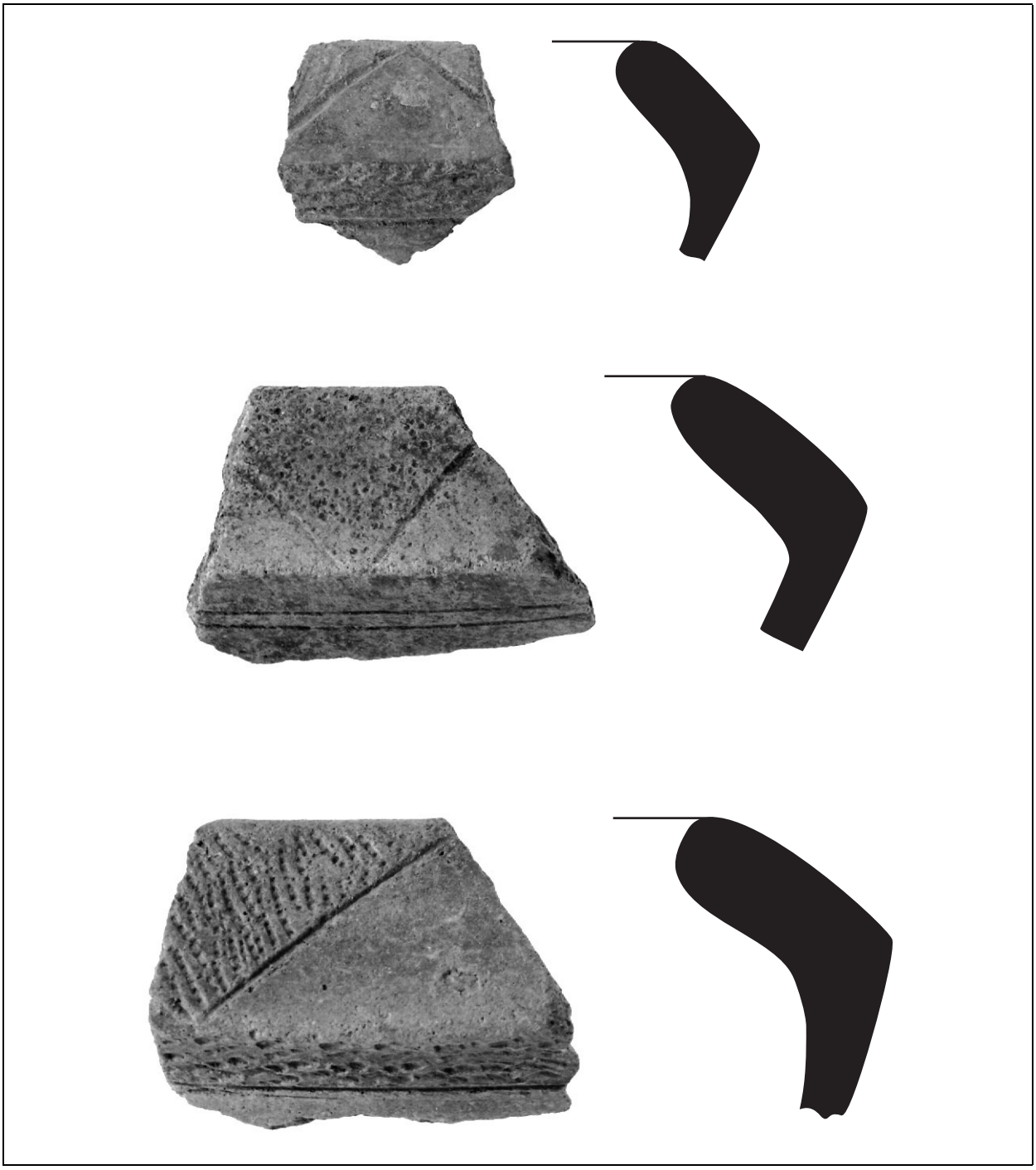


FIG. 259: Rim form 4 categories. Ceramic Period 4. *Top*: 4r, *Centre*: 4s, *Bottom*: 4t. Scale 1:1

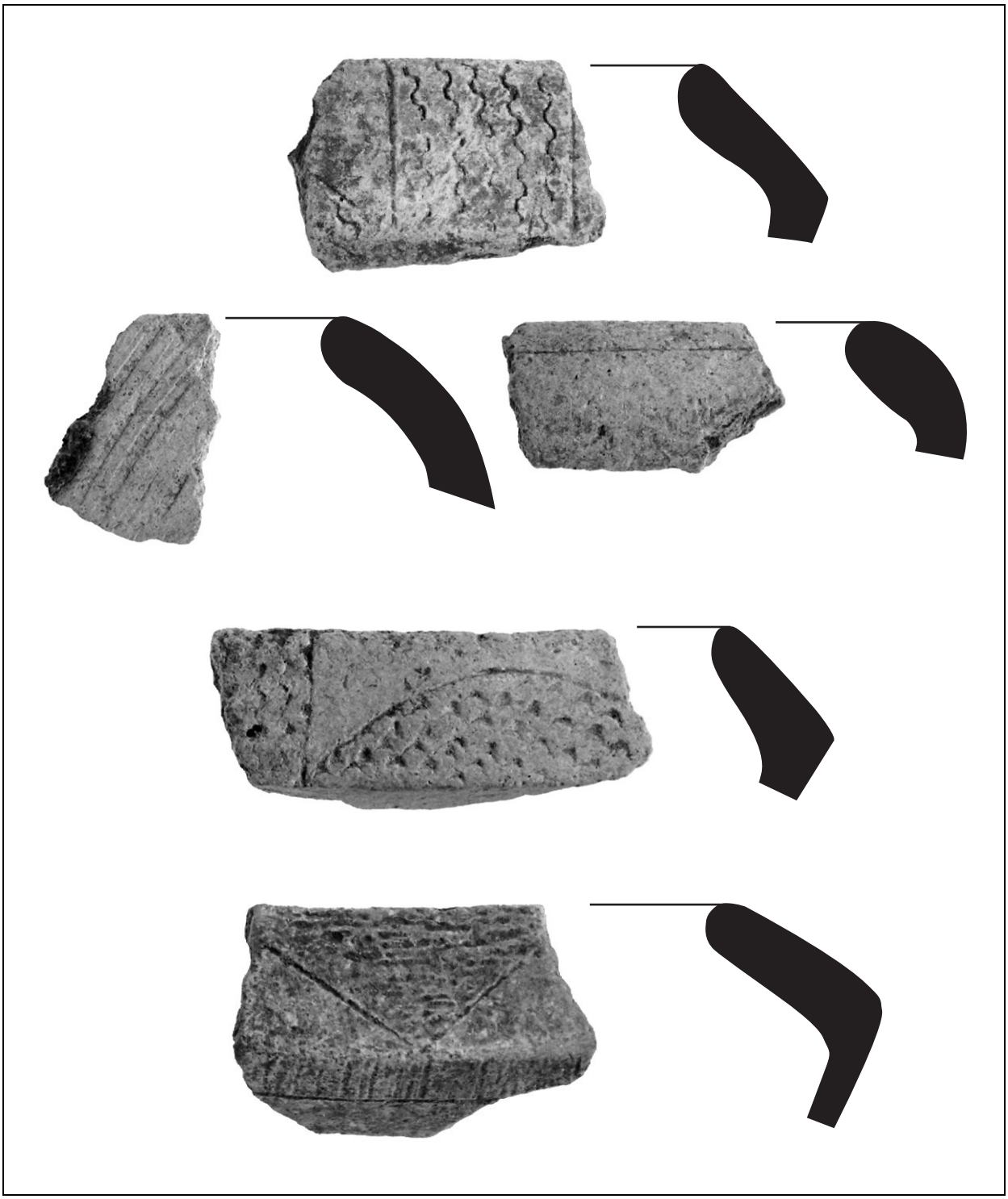


FIG. 260: Rim form 4 categories. Ceramic Period 4. *Top*: 4u, *2nd Top*: left 4v, right 4w, *2nd Bottom*: 4x, *Bottom*: 4y. Scale 1:1

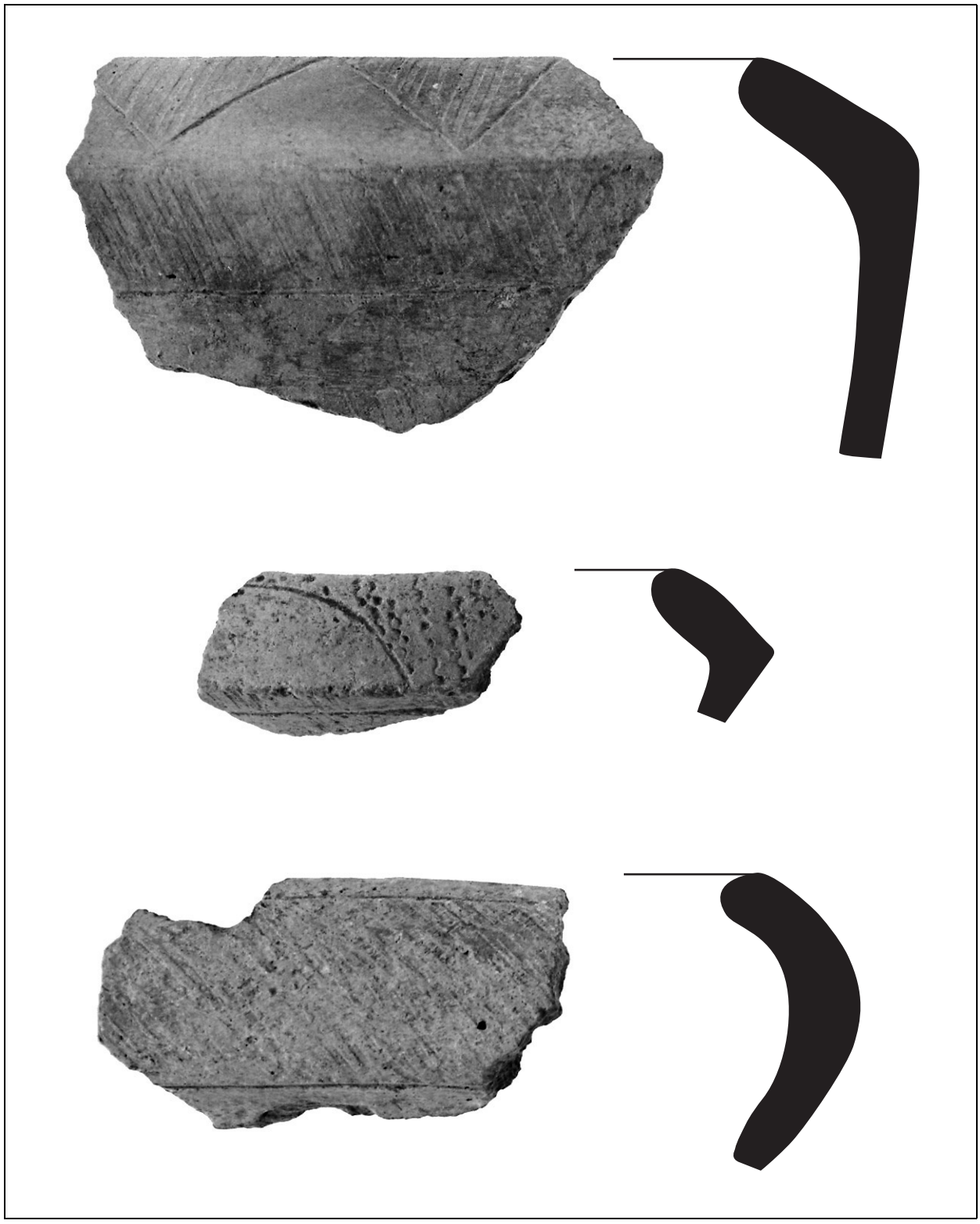


FIG. 261: Rim form 4 categories. Ceramic Period 4. *Top*: 4z, *Centre*: 4aa *Bottom*: 4ab. Scale 1:1

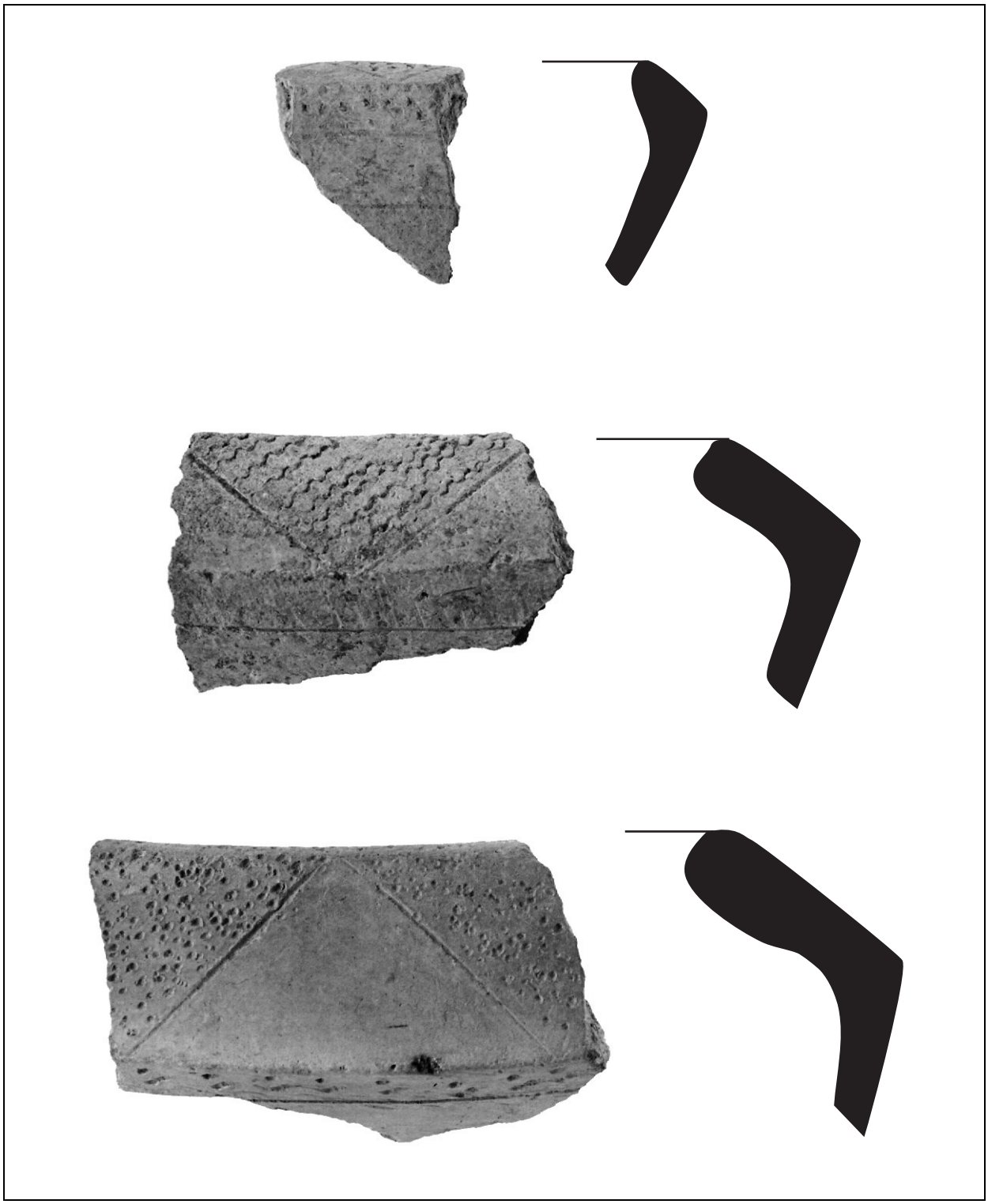


FIG. 262: Rim form 4 categories. Ceramic Period 4. *Top*: 4ac, *Centre*: 4ad, *Bottom*: 4ae. Scale 1:1

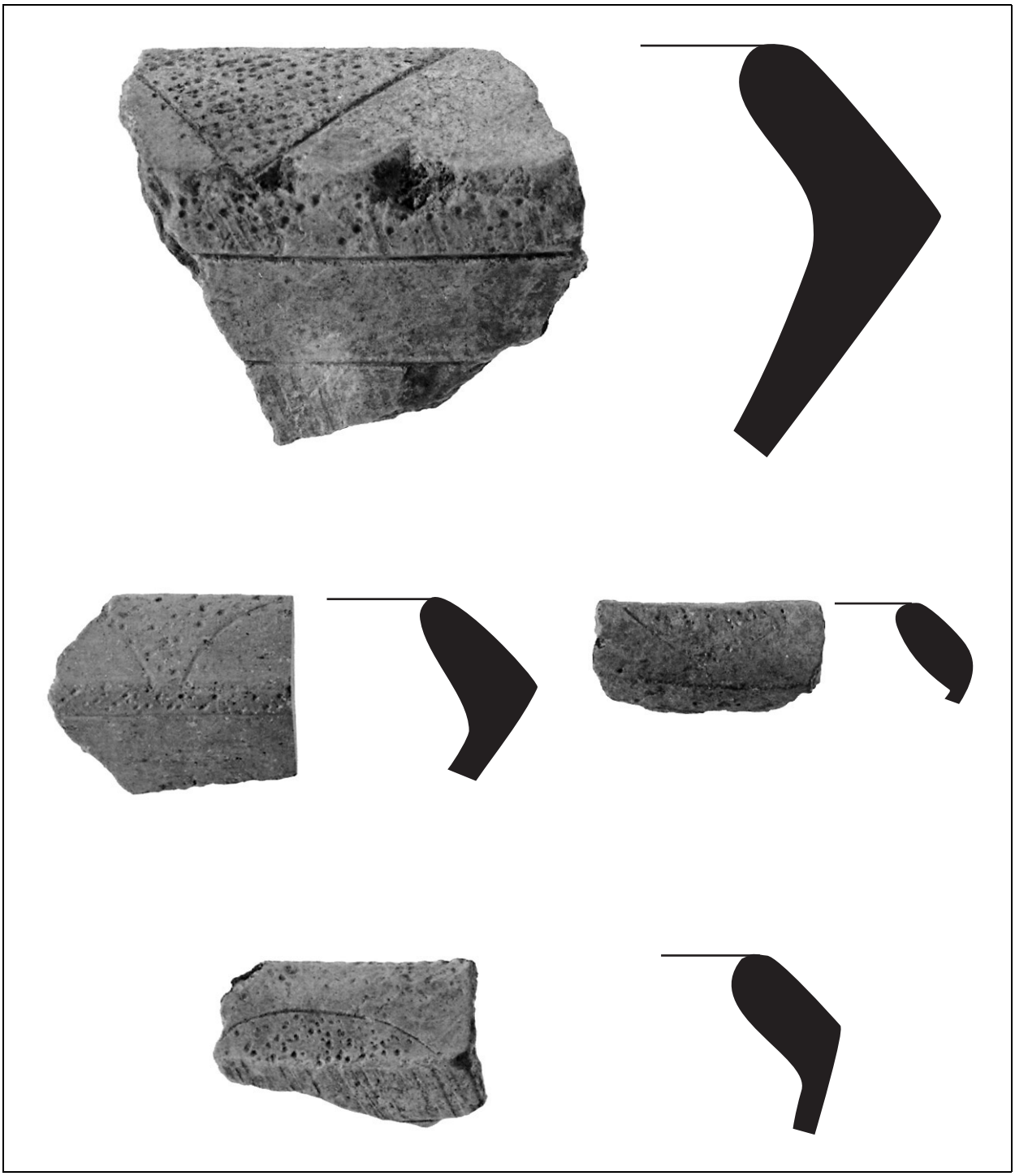


FIG. 263: Rim form 4 categories. Ceramic Period 4. *Top*: 4b(i), *Centre* left: 4af, right: 4ag, *Bottom*: 4ah. Scale 1:1



FIG. 264: Rim form 4 categories. Ceramic Period 4. *Top*: 4ai, *Centre*: 4aj, *Bottom*: 4ak. Scale 1:1

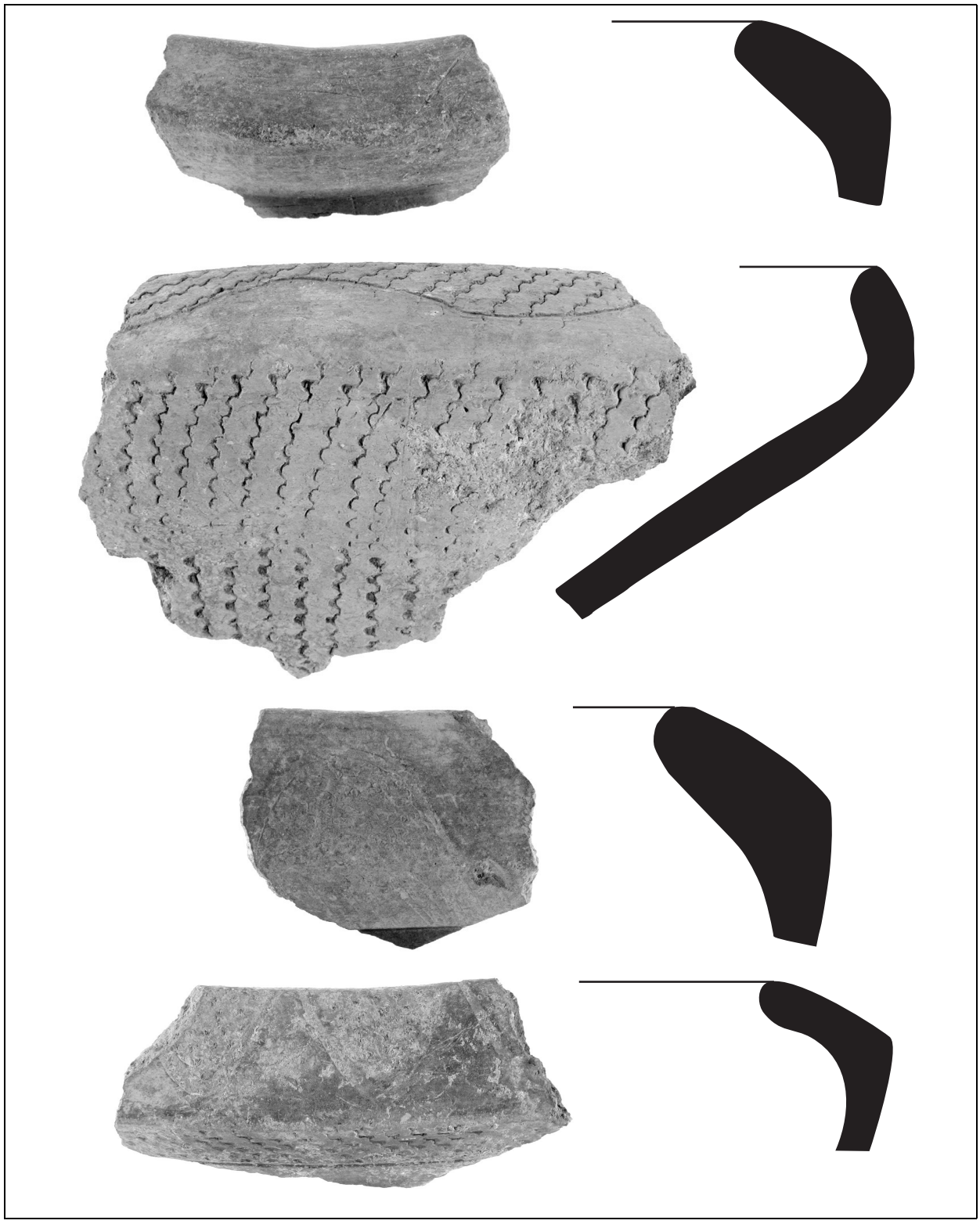


FIG. 265: Rim form 4 categories. Ceramic Period 4. *Top*: 4aaf, *2nd Top*: 4aad, *2nd Bottom*: 4aae, *Bottom*: 4aac. Scale 1:1

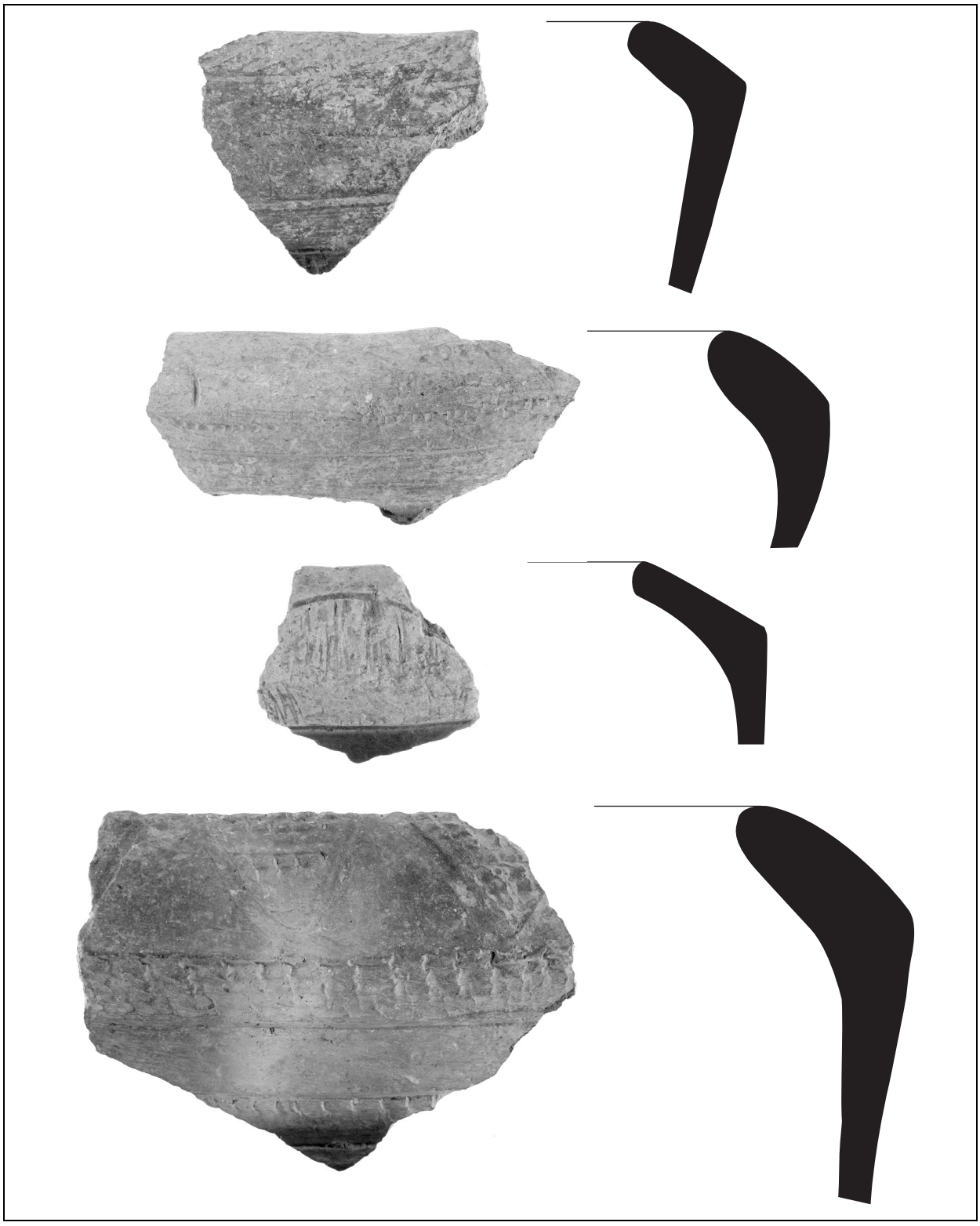


FIG. 266: Rim form 4 categories. Ceramic Period 4. *Top*: 4aag, *2nd Top*: 4aah, *2nd Bottom*: 4aai, *Bottom*: 4aaj. Scale 1:1

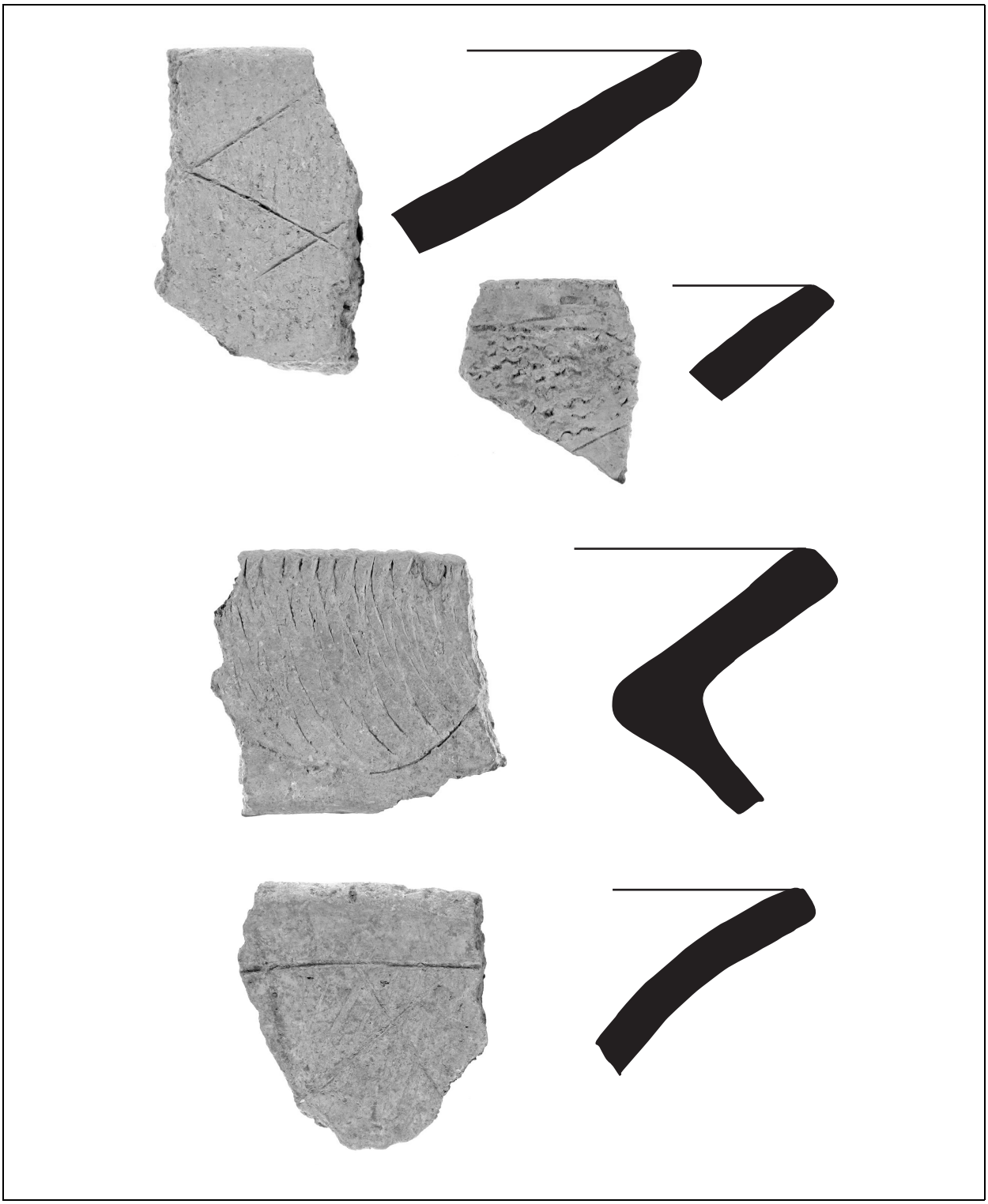


FIG. 267: Rim form 5 categories. Ceramic Period 4. *Top*: 5aai, *2nd Top*: 5aaj, *2nd Bottom*: 5aak, *Bottom*: 5aal. Scale 1:1

Rim form 4 summary

Decorative modes differ in CP4 from those which characterized the CP1–3 assemblage. Of the 45 categories and variants identified 24 (53.33 per cent) display *Anadara* shell impressions, 16 (35.55 per cent) paddle impressions and 15 (33.33 per cent) punctation marks in fields or lines. *Anadara* shell impressions are combined with paddle impressions on six rims, with punctations on two, and paddle impressions are combined with punctations on three examples. Decorative cord marking was noted on only one rim. Freehand decorative elements, applied with a fine-tipped stylus, were incised into three rims unique to L4.

Paddle impressing and the use of punctation marks to decorate local wares is restricted to CP4, as is the use of fingernail marks (see RF5 below), occasional exceptions aside. Exotic FG11 wares entered the site in small amounts during CP2/3 and many were decorated with paddle impressions. Burnishing, incising and *Anadara* shell impressions characterize earlier local wares. RF4 wares during CP4 display burnishing, incising and *Anadara* shell impressions. The latter are consistent with earlier CPs, however, paddle impressions, punctations and the use of freehand motifs are restricted to CP4.

Rim form 5

A tendency towards heavier more coarse RF5 fine wares follows that noted for RF4. It is important to note differences from earlier forms. The rim/body inflection point may be curved, following the earlier versions, or, in extreme instances, sharply everted up to almost 90° (see RF5aap(i), Fig. 269). Rim lengths, measured from the inflection point to the terminus, also vary from 25 to 120 mm. They are either concave or convex in section. Some employ an externally folded terminus which has been carefully smoothed. This technique closely parallels that employed for RF2 coarse wares, however, RF5 versions are usually more gracile and most are extensively decorated. The terminus angle ranges from 45°, or at the vessel's horizontal plane, to 90° with the rim prolongation. Seventy three categories and variants are absent from the CP4 assemblage (Appendix 2). RF5 continues uninterrupted throughout the prehistoric sequence, but quantities vary from 3.82 kg in CP1 to 18.71 kg in CP2; 32.57 kg in CP3 to 13.65 kg in CP4. The following categories and variants were also recovered from earlier contexts: RF5c, 5e, 5f, 5g, 5j(ii), 5k, 5ad, 5ak, 5at, 5aac, 5aad, 5aae, 5aag, 5aat and 5aav. Three decorative zones were variously exploited during CP4: (i) the exterior zone above the everted inflection point, (ii) the opposite interior zone and (iii) the rim terminus. All are plain or lightly burnished unless otherwise noted. Categories and variants which were restricted to CP4 contexts, unless otherwise noted, are:

- 5aag(i) mirrors the 5aag (L5) form, however, the decoration differs. The exterior has vertical cord marks into which a running cross-hatched pattern is incised. A shallow lunate field extends downwards from the terminus. It is filled with punctations made with the end of a pointed stylus.



FIG. 268: Rim form 5 categories. Ceramic Period 4. *Top*: 5aam, *2nd Top*: 5aan, *2nd Bottom*: 5aao, *Bottom*: 5aap(ii). Scale 1:1

TABLE 126: *Rim form 4 fabrics: Ceramic Period 4*
(T.S./h.s.: thin section number/hand specimen, f: fishpond clay, (ar): abundant rice, E: exotic?)

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
1:1	4	h.s.	FG5	1	3:1	4j	h.s.	FG5	-
2:1	4	h.s.	FG5	1	3:1	4k	h.s.	FG5	-
2:1	4c	h.s.	FG5	-	3:1	4l	h.s.	FG5	-
2:1	4d	h.s.	FG5	-	3:1	4m(ar)	h.s.	FG5	-
2:1	4ab	h.s.	FG5	-	3:1	4n	h.s.	FG5	-
2:1	4ad	h.s.	FG5	-	3:1	4o	h.s.	FG5	-
2:1	4af	h.s.	FG5	-	3:1	4x	h.s.	FG5	-
2:1	4ag	h.s.	FG5	-	3:1	4y	h.s.	FG5	-
2:2	4	h.s.	FG5	-	3:2	4p	h.s.	FG5	-
2:2	4a	K27	FG11	-	3:2	4q	h.s.	FG5	-
2:2	4a	K531	FG5	-	3:2	4r	h.s.	FG5	-
2:2	4e	K45	FG5	-	3:2	4s	h.s.	FG5	-
2:2	4f	K46	FG5	-	3:2	4t	h.s.	FG5	-
2:2	4g	h.s.	FG5	-	3:2	4z	h.s.	FG5	-
2:2	4k	h.s.	FG5	-	3:2	4aa	h.s.	FG5	-
2:2	4m	h.s.	FG5	-	3:2	4ab	h.s.	FG5	-
2:2	4n	h.s.	FG5	-	3:2	4al	h.s.	FG5	-
2:2	4y	h.s.	FG5	-	3:3	4ac	h.s.	FG5	-
2:2	4ab	h.s.	FG5	-	3:4	4u	h.s.	FG5	-
2:2	4aj	K8	FG5	-	3:4	4v	h.s.	FG5	-
2:2	4aj	K21	FG5	-	3:4	4w	h.s.	FG5	-
2:2	4ag	h.s.	FG5	-	3:4	4ad	h.s.	FG5	-
2:2	4ah	h.s.	FG5	-	3:5	4ae	h.s.	FG5	-
2:3	4	K5	FG5	-	4:1	4d	h.s.	FG5	-
2:3	4	K25	FG5	-	4:1	4e	h.s.	FG5	-
2:3	4b	K24	FG5	-	4:1	4k	h.s.	FG5	-
2:3	4ai	h.s.	FG5	-	4:1	4p	h.s.	FG5	-
2:3	4ak	h.s.	FG5	-	4:1	4q	h.s.	FG5	-
3:1	4	h.s.	FG5	1	4:1	4r	h.s.	FG5	-
3:1	4a	h.s.	FG5	-	4:1	4s	h.s.	FG5	-
3:1	4b	h.s.	FG5	-	4:1	4t	h.s.	FG5	-
3:1	4c	h.s.	FG5	-	4:1	4v	h.s.	FG5	1
3:1	4d	h.s.	FG5	-	4:1	4x	h.s.	FG5	-
3:1	4e	h.s.	FG5	-	4:1	4aa	h.s.	FG5	-
3:1	4f	h.s.	FG5	-	4:1	4ad	h.s.	FG5	1
3:1	4g	h.s.	FG5	-	4:1	4ae	h.s.	FG5	1
3:1	4h	h.s.	FG5	-	4:1	4aac	h.s.	FG5	-
3:1	4i	h.s.	FG5	-	4:1	4aad	h.s.	orth.grogE	-

TABLE 126: *Rim form 4 fabrics: Ceramic Period 4 (continued)*

Layer	Form	T.S./h.s.	Fabric	Feature	Layer	Form	T.S./h.s.	Fabric	Feature
4:1	4aae	h.s.	orth.grogE	-	4:1	4aaf	h.s.	FG5	-
4:1	4aag	h.s.	FG5	-	4:1	4aaj	h.s.	FG5	-
4:1	4aah	h.s.	FG5	-	4:3	4f	K559	FG5	-
4:1	4aai	h.s.	FG5	-					

- 5aai exterior zone has vertical paddle impressions over which are widely-spaced diagonal fine cross-hatched incised lines. The interior is decorated with horizontal line of finely applied *Anadara* shell impressions. A single diagonal incised lined cut across one corner (Fig. 267).

- 5aaj (layer 4 only), has an exterior field filled with horizontal *Anadara* shell impressions under a plain 7 mm deep band separated by an incised line. The interior features a 13 mm deep band filled with the same impressions located 17 mm below the terminus (Fig. 267).

- 5aak has a plain exterior decorated with incised "X's" running within a 30 mm horizontal panel defined by the terminus and an incised line 35 mm above the inflection point. The interior is adorned with a downwards pointing lunate panel filled with carefully incised arcs which form a series of joined vertical peaks (see also RF5aau). This pattern is repeated to form two distinct slightly overlapping rows. The terminus displays a series of notches impressed every 2 mm at 90° to the circumference. These have been made with a 1.5 mm wide stylus (Fig. 267).

- 5aal is lightly burnished and embellished with an exterior panel bounded by an incised line 12 mm below the terminus. The panel is infilled with near vertical paddle impressions marked over by cross-hatched incised lines. The interior features small panels separated within horizontal bands. The panels are defined by vertical incised lines. Two alternate panels are infilled with punctations made with the tip of a round stylus. A plain, punctate, plain, punctate sequence progresses downward from the terminus. They vary in depth from 10 to 16 mm. The terminus is impressed with irregular notches (Fig. 267).

- 5aal(i) displays a single 20 mm deep internal field bounded by the terminus and a slightly curved incised line. The field is filled with irregular punctations and these also decorate the terminus.

- 5aam exterior is decorated with vertical paddle impressions below a plain 11 mm deep band defined by a horizontal incised line. The interior displays an upward pointing triangle located 5 mm above the inflection point which reaches to 5 mm below the terminus. The triangle is filled with angular punctations made with the blunt end of round stylus. The terminus is impressed with corrugations made with the shaft of the stylus (Fig. 268).

- 5aam(i) (layer 4 only), displays a deeply notched terminus and an additional internal incised line.

- 5aam(ii) features vertical cord marks overlain by diagonal paddle impressions to the exterior zone. The interior field is infilled with *Anadara* shell impressions and the terminus is deeply notched.

- 5aam(iii) has a plain interior and the exterior panel is infilled with near vertical cord marks. The terminus is also cord-marked.

- 5aan exterior is slightly convex and decorated with vertical paddle impressions below a double incised line 9 mm below the rim terminus. A curvilinear field, defined by an incised line, lies beneath a single line which is gauged 10 mm below the terminus (Fig. 268). Remnants of further curvilinear fields are visible at the edge of the sherd.

- 5aao also has a slightly convex exterior and concave interior. The exterior is decorated with a tapering curved field, infilled with diagonal *Anadara* shell impressions, which runs diagonally from the terminus to almost the inflection point. This field is 8 mm wide at the former point and 20 mm at the latter. The exterior displays vertical cord marks below an incised line gauged 12 mm below the terminus. Geometric incised lines are arranged diagonally within the cord-marked field. The terminus is also decorated with *Anadara* shell impressions (Fig. 268).

- 5aap is embellished on the interior surface with part of a triangular field, about 80 mm wide at the terminus and 25 mm at the inflection point, filled with vertical and diagonal *Anadara* shell impressions. The exterior is plain.

- 5aap (i) features a lunate field to the interior defined by an incised line which curves downward from the terminus. It is 70 mm in diameter and filled with punctation marks made with the blunt end of a stylus. The exterior is decorated with diagonal paddle impressions above an incised line cut into the inflection point (Fig. 269). These impressions also decorate the terminus.

- 5aap (ii) (layer 3 only), is decorated on the exterior with near vertical paddle impressions. The interior displays a series of outward-pointing equilateral triangles, defined by incised lines and infilled with randomly distributed punctation marks made with a blunt stylus. Each triangle abuts its neighbour. The terminus is decorated with *Anadara* shell impressions. The body below a convex inflection point is decorated with "Z" twist 1 mm diameter nearly vertical cord marks (Fig. 268).

- 5aaq (layer 3 only), has a plain interior. The exterior is embellished with three incised lines gauged 9, 11 and 16 mm below the terminus. Geometric and curvilinear fields under the latter line are infilled with punctations made with the tip of a round stylus (Fig. 270).

- 5aar (layer 3 only), displays curvilinear fields defined by 2 mm wide incised lines. The fields are infilled with *Anadara* shell impressions (Fig. 270).

- 5aas is adorned on the exterior with diagonal paddle impressions inscribed over with two diagonal 1.5 mm wide lines (Fig. 270). The interior displays a curvilinear field filled with vertical paddle impressions.

- 5aat (also layer 6), has a plain exterior (Fig. 270). The interior is decorated with a plain wedge-shaped geometric field completely surrounded from the terminus downwards by fingernail(?) impressions. Only one sherd was recovered from L3 and three from L6 (CP3).

- 5aau (layer 3 only), also features incised geometric fields, in this case within horizontal bands. The upper is 6 mm deep and positioned 9 mm below the terminus. The top of another field is set below an incised line 22 mm below the terminus (Fig. 270).

- 5aav(i) employs vertical paddle impressions on the exterior over which are incised fine diagonal lines, in a 25 mm deep band 4 mm above the inflection point (Fig. 269). The interior is decorated with what appears to be a series of downwards pointing triangles about 25 mm high. They are filled with vertical *Anadara* shell impressions.

- 5aaw (layer 3 only), displays a 20 mm deep band, 15 mm below the terminus, which is filled with 2 mm wide cross-hatched incised lines, on the exterior (Fig. 269). The interior is adorned with an inverted triangle which extends from the terminus to the inflection point. It is filled with rows of vertical fingernail impressions.

Several of the variants listed have modified versions. To avoid incessant splitting, these have not been assigned to further variant categories. The modifications are listed below:

- RF5 variant modifications noted in layer 3:

- 5aan features either punctations or *Anadara* shell impressions surrounding the interior field.

- 5aan has another version with a horizontal band bordering the terminus on the interior which is filled with punctation marks.

It is important to note that some CP4 RF5 wares differ from the gracile carinated burial jars and other highly burnished and decorated fine wares typical of CP1–3. Several CP4 categories displayed rims everted at sharp angles rather than along a smooth uniform arc. Irregular fracture patterns presented a wide variation in rim sizes. This rendered discrimination between angular or curved everted rims difficult, particularly when the inflection point was absent. This problem mainly relates to the CP4 rims discussed above. Thus unless large sherds or "complete" vessels are available it may not always be possible to designate rims to vessel types with confidence. Caution should be exercised, therefore, when comparing RF5 categories unique to CP4 with earlier examples.

Rim form 5 fabrics

Local fabrics contain fishpond or a more micaceous clay similar to the *din niao* sample. Several of the coarser vessel fabrics are composed of fishpond clay. In a few the fishpond clay grog was added to a more micaceous local clay. Variations in local RF5 fabric compositions are generally minor, although in some blending may have been used to improve workability and/or

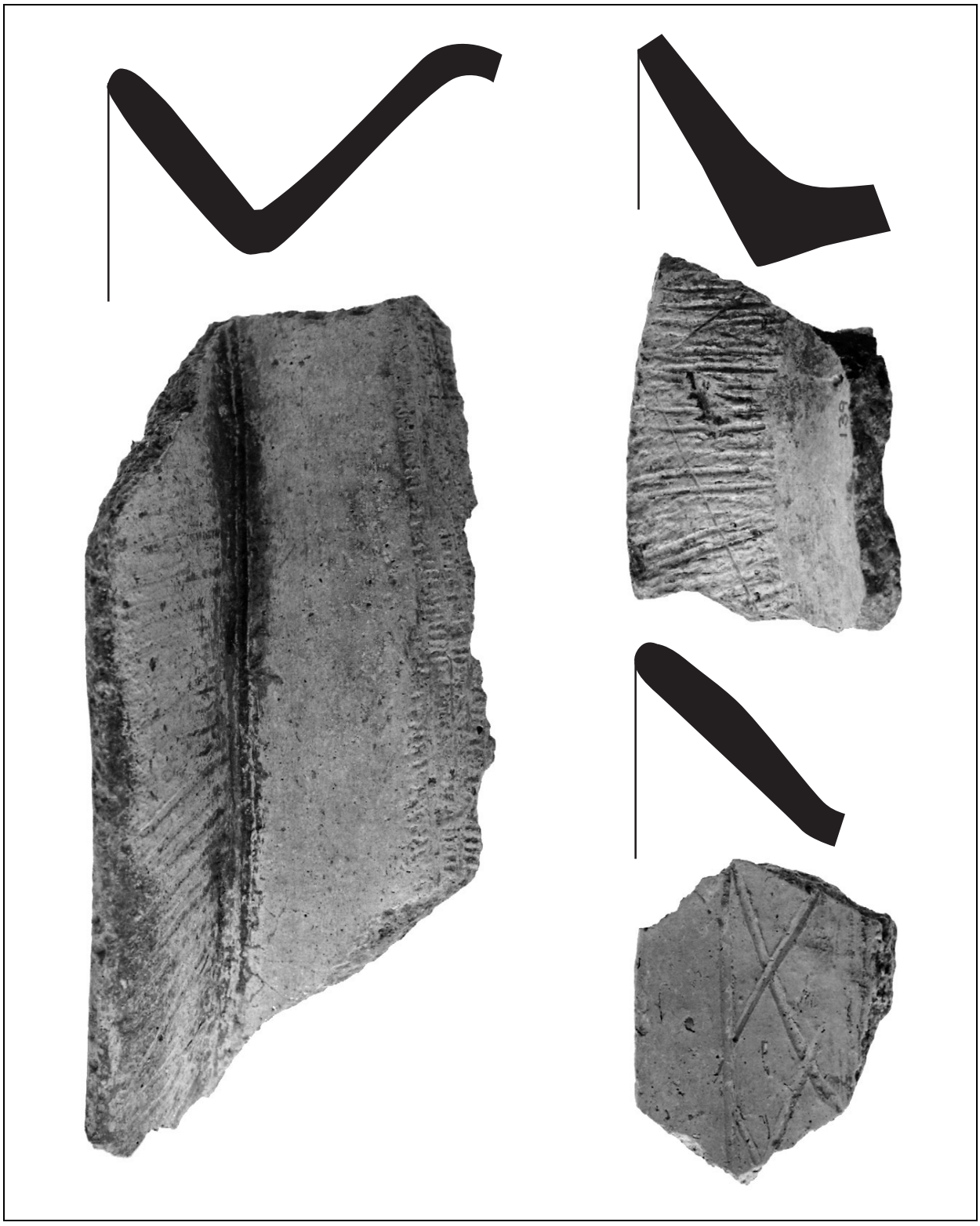


FIG. 269: Rim form 5 cats. Ceramic Period 4. *Left*: 5aap(i), *Top right*: 5aav(i), *Bottom*: 5aaw. Scale 1:1

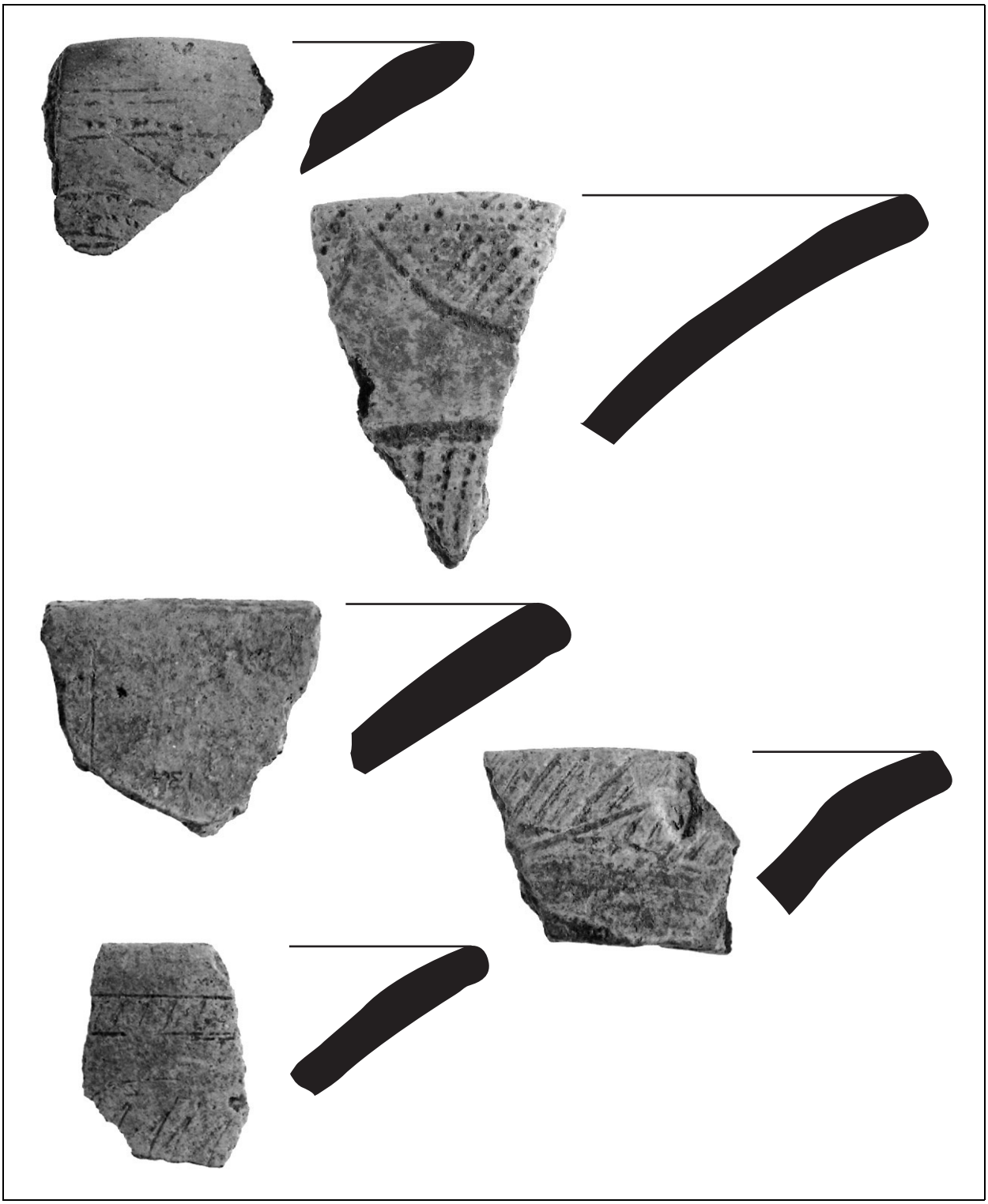


FIG. 270: Rim form 5 categories. Ceramic Period 4. *Top left*: 5aaq, *Top right*: 5aau, *Centre left*: 5aat, *right*: 5aas, *Bottom*: 5aar. Scale 1:1

plasticity or to assist in drying. Determining whether clay blending is present has not been undertaken as such analysis is excessively time-consuming and would add little to the present report as it is clear that abundant supplies of suitable potting clays were locally available. Confidence that these fabrics are composed of local clays is adequate for the present purposes. Given the variations noted in local clay deposits (Chapter V), natural mixing or blending of the clays surrounding the site is likely. Thus both within and between the local prehistoric quarries some natural mixing, or "blending", is predictable. This question aside, however, the resultant ceramic fabrics are clearly composed of local materials.

RF5aan (layer 3) and 5aau have a soapy feel and hand specimen examination determined that they are composed of bleb temper. This suggests that they are exotic, probably FG11 (Tables 127). Exotic RF5 wares, some from igneous sources, continued to enter the site along with the bleb-tempered FG11, associated with limestone in earlier contexts. Exotic sand and orthodox grog-tempered RF5 sherds, probably representing carinated burial jars, or similar such wares, are present throughout CP4.

Rim form 6

Apart from undecorated examples, few earlier RF6 categories were present in CP4 contexts. Exceptions are 6b, 6y, 6y(i), 6aa(i), 6ab, 6ab(i), 6aj, 6au, 6au(i), 6au(ii), 6au(vi), 6aaa and 6aab. The last three were probably relocated down from CP4 in prehistory. Three zones, the exterior, interior and rim terminus were adorned with decorations. All plain surfaces are smooth or burnished. Categories and variants restricted to CP4 contexts, unless otherwise noted, are:

- 6c(iv) is 12 mm thick. The terminus displays diagonal paddle impressions on the exterior half and fine *Anadara* shell impressions(?) to the interior face.
- 6y(ii) features vertical paddle impressions on the exterior which lie below a 10 mm deep plain band gauged 5 mm below the terminus. The interior is decorated with part of both a curvilinear and a geometric design. The former is composed of ladder-like incised lines, the latter a single straight line. The terminus displays *Anadara* shell impressions.
- 6aab(i) has a plain interior. The exterior is completely covered with vertical paddle impressions.
- 6aab(ii) (layer 3 only), decoration employs three zones: (i) the terminus has small notches. (ii) the exterior, beneath a gauged line 8 mm below the terminus, is adorned with near vertical paddle impressions (Fig. 271). (iii) the interior has a narrow horizontal band defined by parallel incised lines infilled with a single line of horizontal fingernail(?) impressions.
- 6aac (layer 4 only), has a distinctive hammer head terminus. The exterior displays part of a convex incised line located 15 mm below and parallel with the terminus. A field below this is filled with fine punctations made with the tip of a round stylus.
- 6aad displays a single 1.5 mm wide incised line gauged 15 mm below the terminus and another below this and connected at 45° to the former, on the exterior wall. The interior is decorated with two geometric fields filled with *Anadara* shell impressions, as is the terminus.

TABLE 127: *Rim form 5 fabrics: Ceramic Period 4*
T.S./h.s.: thin section number/hand specimen, Feat.: feature, min: miniature, fm: fishpond matrix, f: fishpond clay, fg/DNm: fishpond grog in Din Niao matrix, E: exotic

Layer	Form	T.S./h.s.	Fabric	Feat.	Layer	Form	T.S./h.s.	Fabric	Feat.
1:1	5	h.s.	FG5	1	3:1	5aap(i)	h.s.	FG11	-
1:1	5ak	h.s.	FG5	-	3:1	5aaq	h.s.	FG5	-
1:2	5	h.s.	FG5	-	3:2	5min	K106	FG5fm	-
1:3	5	h.s.	FG5	-	3:2	5	K109	FG15	-
1:4	5	h.s.	FG5	-	3:2	5	h.s.	FG5	-
2:1	5	h.s.	FG5	-	3:2	5	h.s.	sand	-
2:1	5	h.s.	grog	-	3:2	5j(ii)	h.s.	sand	-
2:1	5	h.s.	sand	-	3:2	5aao	h.s.	grog	-
2:1	5d	K10	FG5f	-	3:2	5aar	h.s.	FG5	-
2:2	5	h.s.	FG5	-	3:2	5aav	K535	FG5f	-
2:2	5d	K17	FG11	-	3:2	5aav(i)	h.s.	FG5	-
2:2	5	K20	FG11	-	3:2	5	K538	FG11	-
2:2	5	K38	FG5	-	3:2	5aag(i)	h.s.	FG5	-
2:2	5a	K42	FG5f	-	3:2	5aau	h.s.	FG11	-
2:2	5	K47	FG5f	-	3:3	5aap(i)	h.s.	FG5	-
2:2	5	K49	FG5	-	3:3	5aas	h.s.	FG5	-
2:2	5	K53	FG5	-	3:4	5	K82	FG20	-
2:2	5	K58	FG5f	-	3:4	5	K88	FG15	-
2:2	5	K102	FG15	-	3:4	5	K94	FG20	-
2:2	5ak	K101	FG5	-	3:4	5	h.s.	sand	-
2:2	5aad	h.s.	FG5	-	3:4	5aad	h.s.	FG5	-
2:2	5aal	h.s.	FG5	-	3:4	5aan	h.s.	FG5	-
2:2	5aal(i)	K530	FG5fg/DNm	-	3:4	5aat	h.s.	FG5	-
2:2	5aas	K55	FG5	-	3:4	5aaw	h.s.	FG5	-
2:2	5aas	K59	FG5?	-	3:5	5aan	h.s.	FG5	-
2:2	5aat	K533	FG5f	-	4:1	5	h.s.	FG4	-
2:3	5d	K7	FG3?	-	4:1	5at	h.s.	grogE	-
2:3	5	K19	FG11	-	4:1	5aai	h.s.	FG5	-
2:3	5	K28	FG5	-	4:1	5aak	h.s.	grogE	-
2:3	5	K40	FG5	-	4:1	5aal	h.s.	FG5	-
2:3	5	K41	FG5	-	4:2	5aaj	h.s.	grog	-
2:3	5b	K16	FG5f	-	4:2	5aal	h.s.	grog	-
2:3	5aas	K29	FG5	-	4:2	5aam	h.s.	FG5	7
3:1	5j(ii)	K549	FG20	-	4:2	5aam(i)	h.s.	FG5	-
3:1	5aal(i)	h.s.	FG5	-	4:2	5aan	h.s.	or. grogE	-

TABLE 127: *Rim form 5 fabrics: Ceramic Period 4 (continued)*

Layer	Form	T.S./h.s.	Fabric	Feat.	Layer	Form	T.S./h.s.	Fabric	Feat.
4:2	5aap	h.s.	or. grog	7	4:3	5aal(i)	h.s.	FG5	7
4:3	5	K560	FG20	7	4:3	5aam	h.s.	grog	7
4:3	5	K561	FG20	7	4:3	5aam(ii)	h.s.	FG5	-
4:3	5	K563	FG20	7	4:3	5aam(iii)	h.s.	grog	-
4:3	5aae	h.s.	FG4	-	4:3	5aao	h.s.	FG5	7
4:3	5aak	h.s.	or. grogE	7	4:4	5ad	h.s.	FG5	-
4:3	5aal	h.s.	FG5	-	4:5	5k	h.s.	FG5	-

- 6aae (layer 3 only), exterior differs from the previous sample in the placement of the gauged line which is 12 mm below the terminus. Nearly vertical paddle impressions cover the area below the line (Fig. 271). The interior mirrors the interior decorative motif described above for RF5aak, however, in this instance only a single row of incised arcs are visible.
- 6aaf (layer 3 only), is decorated on the exterior, below a roughly gauged line about 6–10 mm beneath the terminus, with a series of downwards pointing irregular incised lines (Fig. 271). The interior is plain.

Rim form 6 fabrics

A selection of RF6 fabrics has been examined in thin-section and hand specimen (Table 128). Local wares contain either rice or bleb grog temper. Both the fishpond and a more micaceous local clay are present. In some examples fishpond clay has been used as a grog to temper another local clay consistent with the *din niao* sample. A variety of mixtures, some with a fishpond matrix others with a *din niao* clay matrix and temper, were recorded. Exotic wares include FG11, the bleb-tempered pottery which is present intermittently for most of the sequence. Other exotic wares, from geologically non-specific sources, contain orthodox grog.

Fabric compositions for the following forms are set out in table 129.

Rim form 7

A single unique RF7c sherd was recovered from layer 4. The exterior is embellished with a lunate downwards pointing field defined by a fine incised line. The field is infilled with neatly arranged horizontal lines of punctations made with the tip of a fine stylus. The vessel was fired in a reducing atmosphere. Hand specimen examination revealed a rice temper. The fabric texture and temper along with the sherd colour suggest that this is a local ware.

Rim form 8

This rim is present in small amounts (Appendix 2). RF8 may be medium coarse and cord-marked. Two new categories, 8c and 8d are restricted to L3.

- 8c is sharply everted and plain except for the interior surface which displays vertical paddle impressions (Fig. 272).
- 8d also features near vertical paddle impressions on the exterior (Fig. 272). The interior is decorated with a series of abutting upwards pointing equilateral triangles which extend from the inflection point to the terminus. They are filled with punctations made with the point of a stylus. The terminus displays *Anadara* shell impressions.

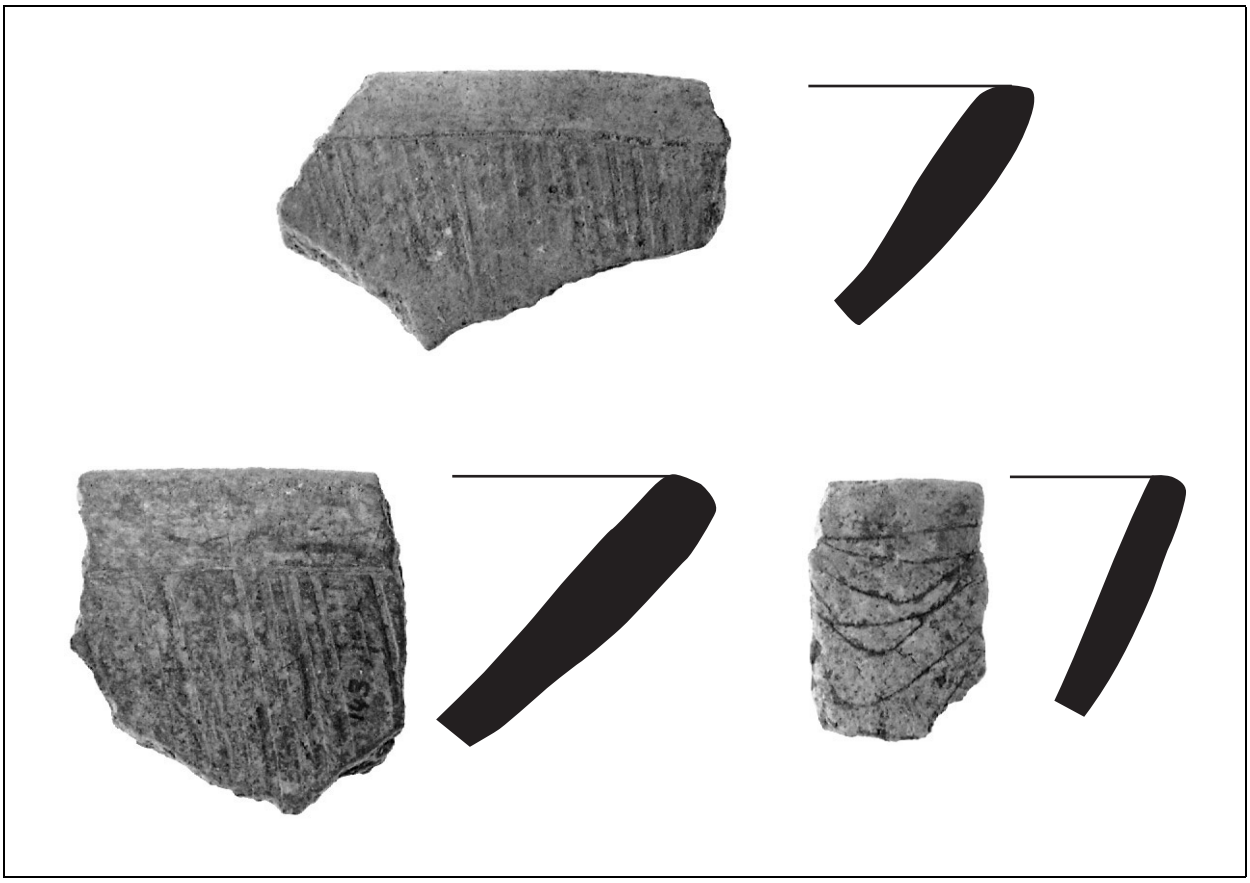


FIG. 271: Rim form 6 categories. Ceramic Period 4. *Top*: 6aab(ii), *Bottom* left: 6aae, right: 6aaf. Scale 1:1

TABLE 128: *Rim form 6 fabrics: Ceramic Period 4*
T.S./h.s.: thin section number/hand specimen, Feat.: feature, f: fishpond clay, E: exotic, NS: geologically non-specific

Layer	Form	T.S./h.s.	Fabric	Feat.	Layer	Form	T.S./h.s.	Fabric	Feat.
1:1	6au	h.s.	FG5	-	3:4	6	h.s.	FG5	-
1:3	6au(ii)	h.s.	FG4	-	3:5	6	h.s.	FG4	-
1:4	6	h.s.	FG4	-	3:5	6	h.s.	or. grogE?	-
2:1	6	K65	FG5	-	3:5	6aab	h.s.	FG5	-
2:1	6au	h.s.	FG4	-	4:1	6	h.s.	FG4	5
2:2	6	h.s.	FG5	-	4:1	6	h.s.	or. grogE?	8
2:2	6	K48	or. grogNS	-	4:1	6	h.s.	FG11	-
2:2	6	K12	FG5f	-	4:1	6c(iv)	h.s.	FG11	-
2:2	6au	K30	FG4	-	4:1	6y(ii)	h.s.	FG11	-
2:2	6b	K11	FG5f	-	4:1	6aa(i)	h.s.	or. grogE?	-
2:3	6aa	K32	FG4f	-	4:1	6ab(i)	h.s.	FG11	-
2:3	6aab	h.s.	FG5	-	4:1	6au	h.s.	or. grog	1
3:1	6aab	h.s.	FG5	-	4:1	6au(i)	h.s.	FG11	-
3:1	6aab(i)	h.s.	FG5	-	4:1	6aaa	h.s.	FG4	-
3:1	6aaf	h.s.	grog	-	4:1	6aaa	h.s.	or. grog	-
3:2	6	h.s.	FG5	1	4:1	6aaa	h.s.	FG11	-
3:2	6aab	h.s.	FG5	-	4:1	6aac	h.s.	or. grogE?	-
3:2	6aab(i)	K534	FG11	-	4:2	6ab	h.s.	or. grogE?	-
3:2	6aab(ii)	h.s.	FG5	-	4:2	6au(i)	h.s.	FG11	-
3:3	6	h.s.	FG5	-	4:2	6aad	h.s.	FG11	-
3:3	6y(ii)	h.s.	FG5	-	4:3	6au(i)	h.s.	FG4	6
3:3	6aab	h.s.	FG5	-	4:5	6aab	h.s.	FG11?	-
3:3	6aae	h.s.	FG5	-					



FIG. 272: Rim form 8 categories. Ceramic Period 4. 8c (left) and 8d. Scale 1:1

Rim form 9

This rare form is represented by a few sherds with plain smoothed surfaces in L3 (Appendix 2).

Rim form 10

Only 4 g were recovered from L2; 14 from L3 and 3 g from L4. The L2 sherd is burnished. Although the form remains, the exterior is decorated with paddle impressions and the interior displays a single horizontal incised line. Some versions have an exaggerated terminal inflection which is inclined near to the vertical and rounded in section with diagonal paddle impressions restricted to a broad band extending downwards 20–25 mm from the terminus. RF10e includes decorative impressions to fields which are described as comb impressions, a term which refers to the tool used to impart the design. It follows such commonly used terms as "paddle-impressed", "cord-marked" and "shell-impressed", because the impressions appear to have been imparted with a small wooden or similar comb. It should be noted that Hall (1993:239-73) includes these "modes of application" as either "stamped" or "impressed" and marks made with "stems or hollow canes produce effects described as punctation" (*op. cit.* 240). Two new categories were restricted to CP4:

- 10d (layer 4 only) has a field of diagonal paddle impressions on the exterior, or upper, surface which extends inwards 12 mm from the terminus. The remainder is plain. This rim is everted 15° from the horizontal.
- 10e (layer 3 only), is everted 40° from the horizontal. An 11 mm wide slightly convex interior platform abutting the terminus is decorated with punctations made either with the

blunt end of a square stylus or impressions imparted by the teeth of a comb. A single incised line is gauged 10 mm further inwards from the platform. The exterior displays a series of vertical paddle impressions(?) beneath an incised line gauged 15 mm below the terminus. A single diagonal incised line runs down from the horizontal one.

Rim form 11

This rim form is represented by 2 g in L4 and 7 g in L3. The rim terminus may either be rounded and the same thickness as the wall, bulbous, or thinner than the vessel wall. Although most have a plain smooth surface, some are cord-marked (see Chapter VII and Appendix 2 for further details).

Rim form 13

This form accounts for 96 g in L4, 1.14 kg in L3, 74 g in L2 and 5 g in L1 (Appendix 2). RF13 is direct inverted and plain or smoothed. Some are decorated with a single horizontal incised line. The following eight categories are restricted to CP4:

- 13g (layer 4 only), features an incised line gauged 12 mm below the terminus on the exterior. The area beneath this line is filled with vertically-arranged lines of *Anadara* shell impressions.
- 13h is decorated with either upward pointing chevrons or curvilinear incised lines beneath a smoothed 20–25 mm deep zone, defined by a horizontal incised line, bordering the terminus (Fig. 273). The region below this point is covered with vertical or cross-hatched cord marks which have been partially smoothed over. The interior is smooth.
- 13i (layer 4 only) also has a plain smoothed interior. The exterior has a fine incised line gauged 10 mm below the terminus. The zone under this area is filled with diagonal *Anadara* shell impressions.
- 13j displays a variety of geometric motifs on the exterior, in each case arranged below an incised line gauged about 10 mm below the terminus. The fields are infilled with punctations or comb impressions (Fig. 274).
- 13k probably has at least three expressions, each involving a different fabric. *Anadara* shell or comb impressions are employed to fill curvilinear decorative fields. Random punctations made with the tip of a stylus decorate some fields (Fig. 274). The exterior only is embellished. Lozenge-shaped plain panels feature as "islands" within larger comb-impressed or punctate-marked fields in some examples; others display simple bands filled with *Anadara* shell impressions.
- 13l (layer 3 only), displays a curvilinear field, defined by incised lines, on the exterior wall. It is filled with vertical *Anadara* shell impressions (Fig. 274).

- 13m (layer 3 only), features a diagonal panel deployed below an incised line gauged 11 mm below the terminus on the exterior wall (Fig. 274). The panel is infilled with horizontal rows of *Anadara* shell impressions.
- 13n (layer 3 only), is decorated on the exterior with incised geometric and curvilinear designs including a lozenge-shaped field filled with vertical comb impressions (Fig. 274). A single incised line is gauged about 9 mm below the terminus and another is oblique to the lozenge.

Rim form 15

Only two sherds of RF15a (Chapter IX) were recovered in layer 2. They are both exotic and tempered with sand. The vessel wall is 5 mm thick and the hammer head rim is 23 mm wide by 10 mm deep. The rim diameter is 320 mm. This form is rare, with only 5 g derived from L5 and 3 g from L2 (Appendix 2). In addition, two rice-tempered RF15 sherds were recovered from CP2 contexts.

Rim form 16

Three categories of this historic wheel-turned ware were recovered from CP4 contexts:

- 16 is an everted rim with two shallow corrugations cut into its upper surface to create an intricate rounded form (Fig. 275). The rim diameter is 300 mm.
- 16a is another wheel-turned vessel. It has a hammer head terminus which points outwards (Fig. 275). The rim diameter is 160 mm.
- 16b (layer 2 only), is only slightly everted. The exterior is embellished with a fine ridge at the concave inflection point below the terminus. A series of very fine grooves decorates the convex zone further below the ridge (Fig. 275).

Rim form 17

Is an inverted bulbous form with an internal rebate cut into the terminus (Fig. 276). The exterior is cord-marked and the interior plain. It is restricted to layer 4.

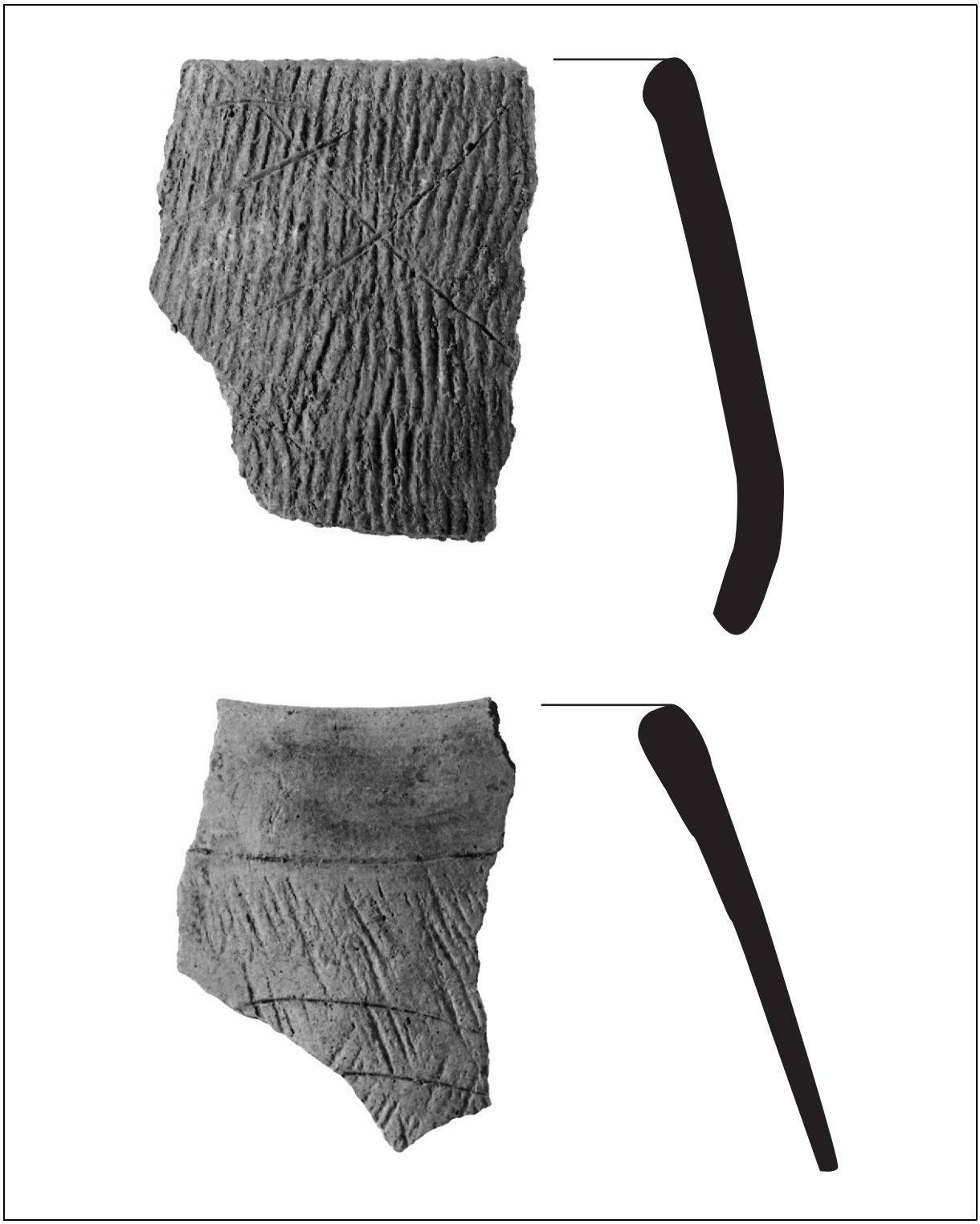


FIG. 273: Rim form 13 categories. Ceramic Period 4. *Top*: 13f, *Bottom*: 13h. Scale 1:1

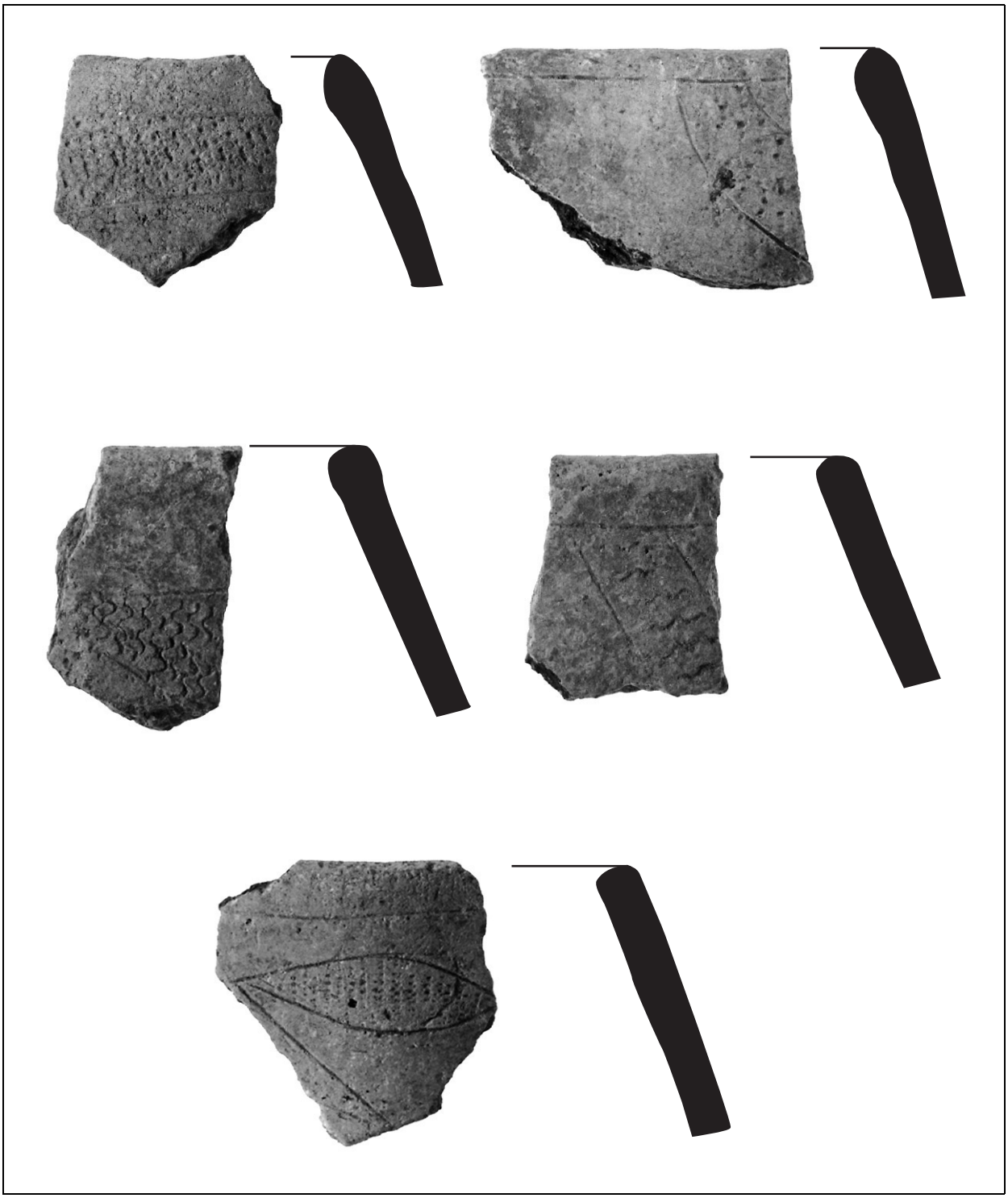


FIG. 274: Rim form 13 categories. Ceramic Period 4. *Top* left: 13j, right: 13k, *Centre* left: 13l, right: 13m, *Bottom*: 13n. Scale 1:1

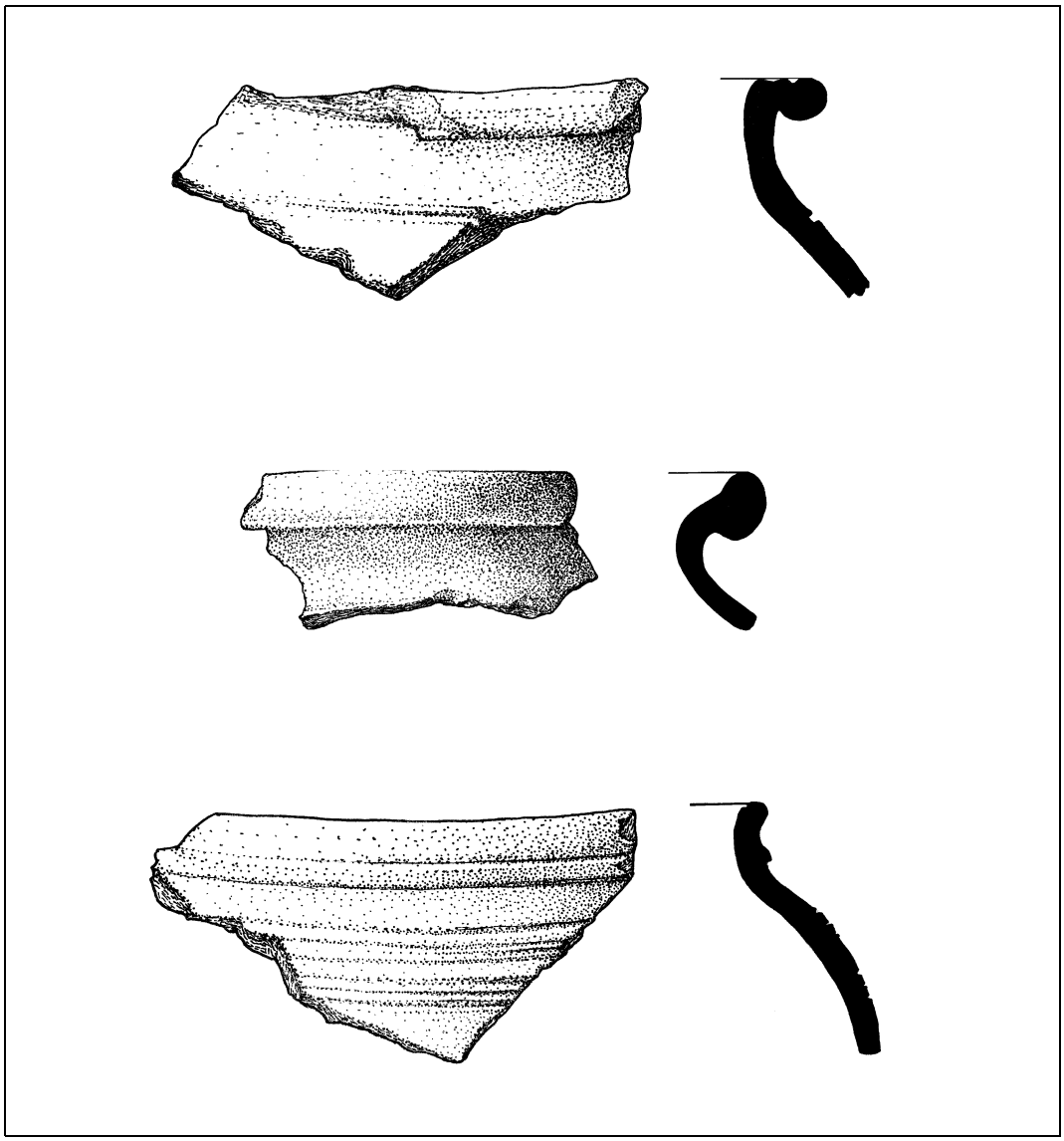


FIG. 275: Rim forms 16 (top), 16a and 16b (bottom). Ceramic Period 4. Scale: 1:2

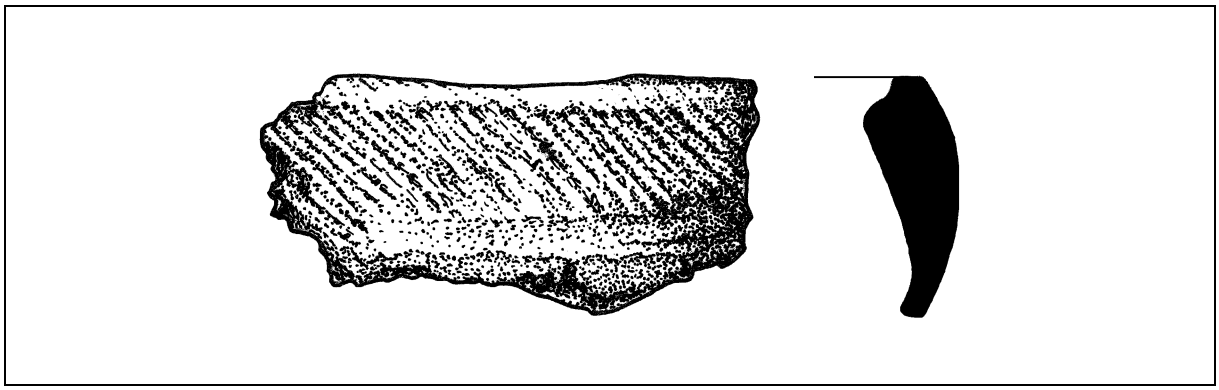


FIG. 276: Rim form 17. Ceramic Period 4. Scale 1:1

Rim forms 7 to 17 fabrics

Local fabrics include rice and bleb tempers. These fabrics were identified in hand specimen only and given that in some thin-sectioned fabrics the grog species is difficult to characterise, the orthodox grog determinations are provisional. The petrology of other local fine wares indicates that RF7–17 are probably composed of bleb grog. Rice remains could not readily be detected in some hand specimen sherds, however, hence the provisional orthodox grog designation.

Exotic FG11 wares are present along with FG13, FG20 and wares tempered with orthodox grog. The latter derive from geologically non-specific sedimentary regions. RF16 categories, which represent historic wheel-turned jars, were present in minor quantities. They are composed of sandy fabrics. The only RF16 examined in thin section (K546 Table 129) contained mono and polycrystalline, mainly angular, coarse quartz sand and coarse subangular to rounded (rare) quartz silt. These are mainly fresh, although some grains are moderately weathered. Fine to coarse silt-sized subrounded dark brown iron-rich(?) opaques, some encasing quartz grains were noted throughout the fabric. Sericite mica is sprinkled throughout the ground mass giving a micaceous sheen to the matrix. Tourmaline and authigenic calcite are rare.

PORCELAIN AND STONEWARE RIMS

Porcelain blue-on-white RF6 sherds were recovered from L1:1 and L1:2. (Fig. 277). They probably represent small bowls with form A(i) bases. Stonewares included dark green glazed RF5 and RF6 sherds (Fig. 277). Cord-marked, plain, stoneware and glazed wares varying in thickness from 2 to 10 mm were recorded. Colours are white, grey, brown, black and green.



FIG. 277: Porcelain rim 5 (top left) and 6 (top right). Stoneware rim form 5 (bottom). Ceramic Period 4. Scale 1:1

SUMMARY

Similarities and differences are evident between CP4 and CP3 local wares as reflected in the rim assemblages. CP3 coarse wares continue into CP4 essentially unchanged. One new RF1 variant is confined to L3, one RF2 variant to L4, one RF3 variant to L3 and another to L4. Some fine ware forms, however, differ markedly. Eleven RF3 categories or variants are discontinued. Two continue from CP3. Minor quantities of three new categories were recorded. They incorporate principally minor decorative variations. This contrasts with a greatly expanded range of RF4 forms with 43 new categories recorded. These are thicker, heavier, and less well prepared or finished compared to earlier versions. Most were fired to produce an oxidized surface with a light colour. Although most are burnished, they lack the deep lustrous sheen which characterises the earlier heavily reduced versions. A combination of heavy walls with a light colour tends to mask the burnished surfaces which further detracts from the overall effect. This falling away of quality extends into RF5 wares, with many displaying less gracile inflection curves. A total of 73 earlier RF5 categories or variants are absent from CP4, while 17 continue from CP3 contexts and 24 new forms were introduced. Only 13 earlier RF6 categories continue into CP4, three of which were probably dislocated from CP4 contexts in prehistory. Seven new RF6 categories, four restricted to single layers, were recorded. One RF7, two RF8, two RF10 and seven RF13 categories or variants made their first appearance in CP4. Four completely novel wares represented by RF16, 16a, 16b and 17 complete the assemblage.

A distinctive range of motifs, featuring either geometric and/or curvilinear fields, sets CP4 apart from the earlier ceramic traditions. Incised chevron, lunate, trapezoid, triangular and lozenge-shaped designs characterise RF4 motifs. They are infilled with *Anadara* shell impressions, round or square punctations and paddle impressions. Other decorative techniques include cord marks and notches. One rim features an incised abstract design and another a lunate field infilled with incised freehand squiggles. Most RF4 rims are decorated with *Anadara* shell impressions (Table 130).

Decorative techniques underwent changes with several new modes introduced during CP4 (Table 130). In total, 43 of the RF4 categories are restricted to CP4. Of these, 31 feature the following multiple modes of decoration:

- *Anadara* shell and paddle impressions decorate seven rims.
- *Anadara* shell impressions and stylus punctation motifs feature on four rims.
- *Anadara* shell impressions and notches occur on one rim.
- Paddle impressions and punctation marks adorn three rims.
- Paddle impressions and cord marks decorate one rim.
- Paddle impressions, punctation marks and notches feature on two rims.

On RF5 categories, the following were recorded:

TABLE 129: *Rim form 7 to 17 fabrics: Ceramic Period 4*
T.S./h.s.: thin section number/hand specimen, Feat.: feature, E: exotic, SE: sandy exotic, g: glassy phases indicate high temperature firing, drl: high-fired, dense with rice (?) leaf temper, NS: non-specific, incidental rice

Layer	Form	T.S./h.s.	Fabric	Feat.	Layer	Form	T.S./h.s.	Fabric	Feat.
1:1	13	K78	or. grogE	-	3:3	8c	h.s.	or. grog?	-
1:1	16	h.s.	historic	-	3:3	8d	h.s.	FG5	-
1:1	16a	h.s.	historic	-	3:3	9	h.s.	or. grogSE	-
2:1	15a	K64	FG20?	-	3:3	13f	h.s.	or. grog?	-
2:1	16a	h.s.	historic	1	3:4	13l	h.s.	or. grog?	-
2:1	16b	h.s.	historic	-	3:5	10	h.s.	FG11	-
2:2	16	K22	FG13?	-	3:5	13k	h.s.	or. grogSE	-
2:3	10	h.s.	FG5	-	4:1	7	h.s.	or. grogE	-
3:1	8	h.s.	FG4	-	4:1	10	h.s.	FG4	5
3:1	8	h.s.	FG5	-	4:1	13	h.s.	or. grog?	-
3:1	10	h.s.	FG5	-	4:1	13	h.s.	FG4	-
3:1	11	h.s.	FG5	-	4:1	13g	h.s.	or. grogE	-
3:1	13	h.s.	FG4	-	4:1	13g	h.s.	FG11	-
3:1	13	h.s.	or. grog?	-	4:1	13j	h.s.	or. grog?	1
3:1	13k	h.s.	or. grog?	-	4:1	17	h.s.	FG5	-
3:1	13l	h.s.	FG11	-	4:1	13k	h.s.	FG5	1
3:1	16	K546	qtz. sand	-	4:2	13	h.s.	rice	-
3:2	10	h.s.	FG11	-	4:2	10d	h.s.	sandE	-
3:2	10e	h.s.	FG5	-	4:2	13	h.s.	FG5	-
3:2	11	h.s.	FG5g	-	4:2	13h	h.s.	or. grog	-
3:2	13h	h.s.	FG4	-	4:2	13h	h.s.	FG11	-
3:2	13h	h.s.	FG11?	-	4:2	10	h.s.	rice leaf?drl	
3:2	13j	h.s.	or. grog?	-	4:3	13	h.s.	rice	-
3:2	13k	K537	or. grog	-	4:3	8	h.s.	or. grogE?	7
3:2	13m	h.s.	FG5	-	4:3	13i	h.s.	or. grog?	7
3:2	13n	h.s.	FG11?	-	4:4	7c	h.s.	FG4	-
3:3	8	h.s.	sandE	-	4:4	13e	h.s.	or. grog?	-
3:3	8	h.s.	or. grog?	-					

- *Anadara* shell and paddle impressions decorate nine rims.
- *Anadara* shell impressions and stylus punctation motifs feature on two rims.
- *Anadara* shell impressions and notches occur on one rim.
- *Anadara* shell impressions and cord marks are paired on three rims.
- Paddle impressions and punctation marks decorate four rims.
- Paddle impressions and cord marks feature on two rims.
- Paddle impressions and notches adorn one rim.
- Punctation and cord marks are paired on two rims.

RF6 categories display the following combinations:

- *Anadara* shell and paddle impressions are paired on two rims.
- Paddle and fingernail impressions are displayed together once.
- Paddle impressions and notches feature on one rim.
- Incised geometric designs occur with paddle impressions on one rim.

Punctation marks decorate RF7. *Anadara* shell, paddle impressions and stylus punctations embellish RF8. RF10 and 13 include comb impressions. The former includes paddle impressions alone or paired with comb marks. Six RF13 categories are adorned with *Anadara* shell impressions and four with punctations, one made with a stylus. One RF13 and RF17 feature cord marks.

Of the 90 decorated fine ware rims restricted to CP4, excluding wheel-turned wares, 47.77 per cent display *Anadara* shell impressions, 33.33 per cent paddle impressions, 34.44 per cent punctation marks, 8.88 per cent cord marks, while notches occur on 6.66 per cent. Abstract, freehand and geometric incised designs also account for 6.66 per cent. Fingernail impressions are employed on 3.33 per cent. Seven modes of decoration attach each to RF4 and 5, six to RF6, one to RF7, three to RF8, two to RF10, three to RF13 and one to RF17. Only RF4 displays abstract and freehand designs, while incised geometric and fingernail impressions are restricted to RF5 and 6.

Compared with CP3, the number of RF4 categories and variants increased from 24 to 46, with only three common to both CPs. This clearly represents a major shift. A similar change is evident in RF5 categories and variants. Thus CP3 revealed 40 of the latter whereas only 25 were recovered from CP4, another 14 were common to both. In addition the RF6 proportions also changed, with 44 categories and variants derived from CP3, 10 confined to CP4 and 11 found in

TABLE 130: *Decorative modes on fine ware rims: Ceramic Period 4*
Punct.: punctate, C.M.: cord marks, Abs.: incised abstract design, Free: incised freehand design, Geom.: incised geometric, c: comb punctations, Finger: fingernail impressions

Form	Impressed: *Anadara* Shell	Paddle	Punct.	C. M.	Notches	Abs.	Free	Geom.	Finger
4	24	14	14	1	3	1	1	-	-
5	9	9	9	5	2	-	-	2	2
6	3	5	1	-	1	-	-	2	1
7	-	-	1	-	-	-	-	-	-
8	1	1	1	-	-	-	-	-	-
10	-	1	1c	-	-	-	-	-	-
13	6	-	4(3 = c)	1	-	-	-	-	-
17	-	-	-	1	-	-	-	-	-
Total	43	30	31	8	6	1	1	4	3

TABLE 131: *Fine ware rim distributions: Ceramic Period 3 and 4*

Form	CP3/4	CP3	CP4	Form	CP3/4	CP3	CP4	Form	CP3/4	CP3	CP4
3	4	10	2	8	-	-	2	14	-	4	-
4	3	24	46	10	-	2	2	15	1	-	-
5	14	40	25	11	-	1	-	17	-	-	1
6	11	44	10	12	-	1	-	-	-	-	-
7	-	1	1	13	3	4	7	-	-	-	-

both contexts (Table 131). Significant differences in site use underlie these changes and should be taken into account when comparing the fine ware distributions.

Fine ware rim category and variant distributions shared by CP3 and CP4 total 36 (13.68 per cent). Those present in CP3 but not in CP4 total 131 (49.80 per cent) with 96 (36.5 per cent) confined to CP4.

TABLE 132: *Exotic rim forms: Ceramic Period 4*

Layer	Form	Thin section	Fabric	Layer	Form	Thin section	Fabric
1:1	13	K78	orth. grog	4:1	6c(iv)	h.s.	FG11
2:1	15a	K64	FG20?	4:1	6y(ii)	h.s.	FG11
2:2	3j	K34	FG11	4:1	6aa(i)	h.s.	orth. grog
2:2	4a	K27	FG11	4:1	6ab(i)	h.s.	FG11
2:2	5d	K17	FG11	4:1	6au(i)	h.s.	FG11
2:2	16	K22	FG13?	4:1	6aaa	h.s.	FG11
3:1	5j(ii)	K549	FG20	4:1	6aac	h.s.	orth. grog
3:1	5aap(i)	h.s.	FG11	4:1	4aad	h.s.	orth. grog
3:1	13l	h.s.	FG11	4:1	4aae	h.s.	orth. grog
3:2	5	K538	FG11	4:1	5at	h.s.	grog
3:2	5	h.s.	sand	4:1	5aak	h.s.	grog
3:2	5aau	h.s.	FG11	4:1	7	h.s.	orth. grog
3:2	6aab(i)	K534	FG11	4:1	13g	h.s.	orth. grog
3:2	13n	h.s.	FG11?	4:1	13g	h.s.	FG11
3:3	8	h.s.	sand	4:2	5aan	h.s.	orth. grog
3:3	9	h.s.	orth. grog	4:2	6ab	h.s.	orth. grog
3:4	5	K82	FG20	4:2	6au(i)	h.s.	FG11
3:4	5	K88	FG15	4:2	6aad	h.s.	FG11
3:5	6	h.s.	orth. grog	4:2	13h	h.s.	FG11
3:5	10	h.s.	FG11	4:2	10d	h.s.	sand
3:5	13k	h.s.	orth. grog	4:3	8	h.s.	orth. grog
4:1	6	h.s.	FG11	4:5	6aab	h.s.	FG11?

FABRIC SUMMARY

Clay preparation techniques employed by local potters during CP4 differ from earlier methods. Rice was added to temper coarse ware clays and bleb grog temper was adopted for most fine wares and ceramic anvils. Only one of the 90 RF1 and 16 of the 40 RF2 sherds examined were tempered with the bleb grog. Apart from RF4, 11 and 17, which are all tempered with bleb

grog, rice temper was present in all local wares, although bleb grog was preferred for fine wares. Exploitation of rice by local potters was confined to CP4, although exotic pottery tempered with rice or bleb grog is present in varying amounts throughout the sequence. Prior to the inception of CP4, local potters tempered their clays with either sand or orthodox grog. At least two and possibly four different local clay deposits were exploited. In some instances two clays were combined, one as a temper. Some blending may have also occurred, although further research is needed to confirm this. A silty, somewhat short, clay, which mineralogically matches the fishpond samples, was preferred by some local potters for utilitarian coarse wares and ceramic anvils.

A single 15 mm thick L1:1 bodysherd contains gypsum pseudomorphs (FG23). In terms of the rim assemblage, exotic wares entered the site from at least four different sources. Of particular interest are the FG11 wares, tempered with bleb grog. Although the CP4 samples are geologically non-specific, earlier samples of this fabric contain limestone, which outcrops in two locations on the eastern flanks of the Ban Pakong Valley. Limestone is also present in FG15, another exotic ware. Other exotic pottery contains sand derived from igneous and metamorphic sources. Of the 17 rim forms identified, 11 are represented by exotic sources. Rim forms 9, 15 and 16 were exclusively exotic (Table 132). Sand, orthodox and bleb grog tempers are represented in the exotic assemblage.

TABLE 133: *Local and exotic rim form fabrics: Ceramic Period 4*

Form	Local fabric groups	Exotic fabric groups	No.	Form	Local fabric groups	Exotic fabric groups	No.
1	4 and 5	-	-	9	-	orth. grog	1
2	4 and 5	-	-	10	4 and 5	11 and sand	2
3	4 and 5	11	1	11	5	-	-
4	5	11 and orth. grog	2	12	-	-	-
5	4 and 5	11, 15 and 20	3	13	4 and 5	11, orth. grog	2
6	4 and 5	11 and orth. grog	2	14	-	-	-
7	4	orth. grog	1	15	-	20	1
8	4 and 5	sand, orth. grog	2	16	-	13?	1
-	-	-	-	17	5	-	-

VESSEL BASES

Base forms B, C, D and E continue from CP1, CP2 and CP3 (Chapters VII, VIII and IX), as do forms F, G, I and J from CP3 (Chapter IX). A single FG5 form K sherd was uncovered in L4:1 (Fig. 278); and form N, a stoneware base, was recovered from L2:1, and two porcelain bases, A and A(i), from L1:1.

- Base form A, (layer 1:1): is a 2–5 mm thick white porcelain base related to RF6.
- Base form A(i), (layer 1:1): another porcelain ware displays blue decorative designs (Fig. 278).
- Base form D(ii), (layer 4:3): features vertical paddle impressions and a plain band gauged by an incised line about 10 mm above the terminus (diam: 220 mm).
- Base form K (layer 2 only): is an extension of a FG4 fine ware vessel wall. It has a plain smooth surface decorated with two incised lines gauged 10 and 15 mm above the terminus. Two rows of fine punctations made with the point of a round stylus circuit about 10 mm above the lines (diam: 220 mm).
- Base form N: is a stoneware with a small round ring added as a simple base (diam: 120 mm).

The following variations were also noted:

- Base form C (layer 3): is plain with a 10 mm extension from the vessel chamber (diam: 60–110 mm). The vessel waist varies from 33–50 mm. Either rice or bleb tempers are present.
- Base form E (layer 2): has a 45 mm extension from the vessel chamber.
- Base form G (layer 3): has a plain or cord-marked simple base (diam: 180–90 mm). In L2 the base thickness varies from 6–9 mm.
- Base form G (layer 2): is a local FG5 painted ware (Table 134).
- Base form G (layer 1): a plain stoneware example was uncovered (diam: 140 mm).

All base form fabrics have been examined in hand specimen (Appendix 3). A selection is set out in table 134. One exotic form C base has been thin sectioned. It is composed of FG21.

TRIPOD POT FEET

Two pot feet cat. 3249 L3:1 and cat. 3284 L1:1, 21 mm long, 10 mm diameter and 22 mm long, 17 mm diameter respectively were recovered. The former is rice-tempered, consistent with CP4 local wares, the latter sand-tempered and probably exotic.

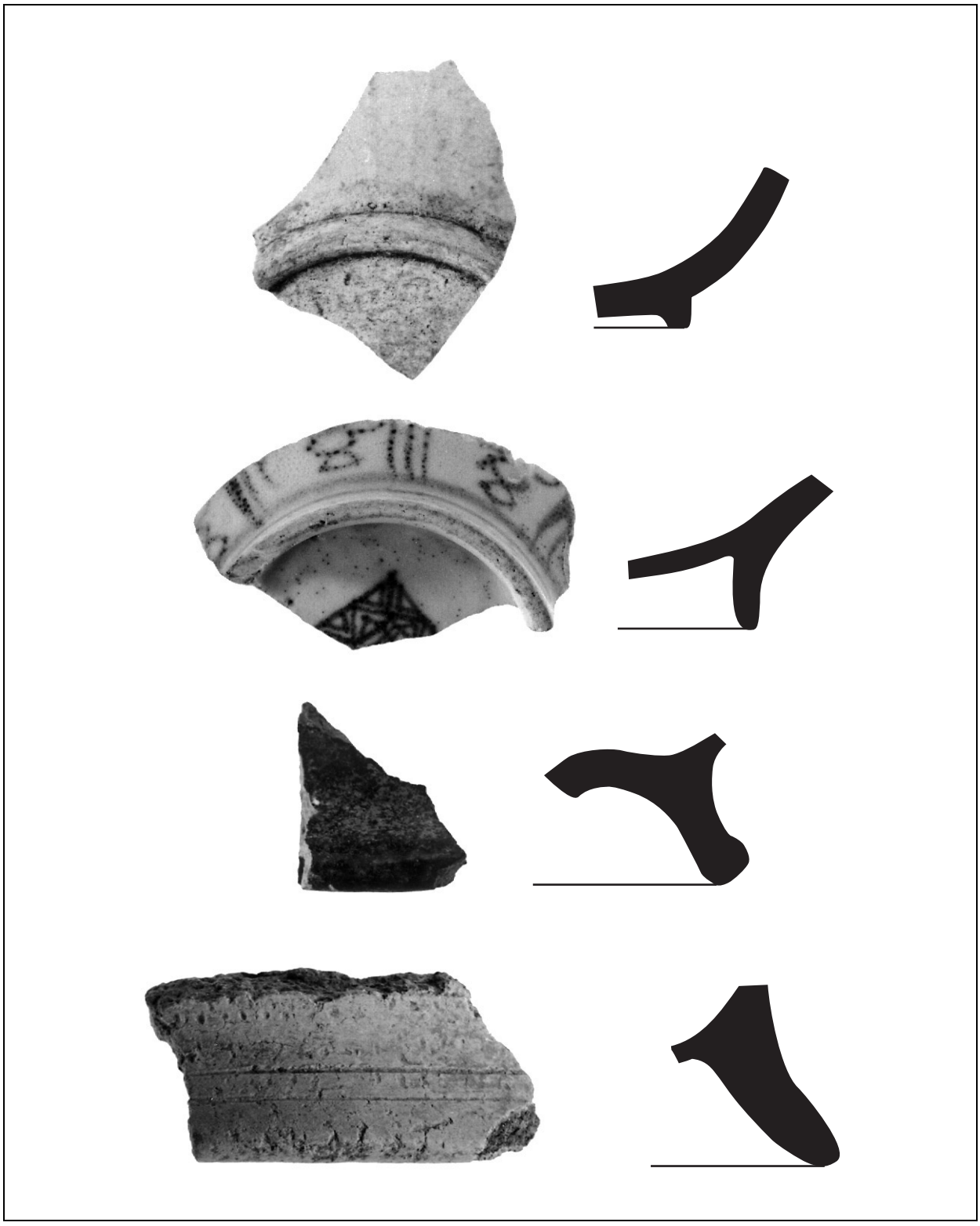


FIG. 278: Ceramic Period 4 base forms *Top*: A, *2nd Top*: A(i), *3rd Top*: E, *Bottom*: K. Scale 1:1



FIG. 278: (continued) Ceramic Period 4 base forms (viewed from below)*Left*: N, *Right*: O. Scale 1:1

TABLE 134: *Vessel base forms: Ceramic Period 4*
T.S./h.s.: thin section/hand specimen, Feat.: feature, E: exotic, LP: local painted ware

Layer	Form	T.S./h.s.	Fabric	Feat.	Layer	Form	T.S./h.s.	Fabric	Feat.
1:1	E	h.s.	4	1	3:2	F	h.s.	5	-
1:1	E	h.s.	5	-	3:3	D	h.s.	5	-
1:1	G	h.s.	stoneware	-	3:4	D	h.s.	11?	-
1:1	G	h.s.	sand	-	3:4	C	K91	21	-
1:1	G	h.s.	5	-	4:1	E	h.s.	5	2
1:2	D(ii)	h.s.	5	-	4:1	E	h.s.	4	5
2:1	C	h.s.	4	-	4:1	C	h.s.	or. grogE?	-
2:1	C	h.s.	5	-	4:1	E	h.s.	11?	-
2:1	D	h.s.	5	1	4:1	K	h.s.	5	-
2:1	E	h.s.	4	-	4:1	G	h.s.	5	-
2:1	E	h.s.	5	-	4:1	J	h.s.	5	-
2:1	G	h.s.	5	-	4:2	B	h.s.	5	-
2:1	I	h.s.	5	-	4:2	C	h.s.	5	2
2:1	N	h.s.	4	-	4:2	D(i)	h.s.	5	-
2:2	E	h.s.	sand	-	4:2	E	h.s.	or. grogE?	-
2:2	G	h.s.	sand	-	4:2	I	h.s.	11?	-
2:2	G	h.s.	5	-	4:3	C	h.s.	or. grogE?	-
2:2	I	h.s.	5	-	4:3	D(ii)	h.s.	11?	-
2:2	J	h.s.	5	-	4:3	E	h.s.	5	9
2:3	G(LP)	h.s.	5	-	4:3	E	h.s.	4	7
3:1	B	h.s.	5	-	4:3	E	h.s.	or. grogE?	7
3:1	C	h.s.	5	1	4:3	G	h.s.	or. grogE?	-
3:1	D(ii)	h.s.	5	-	4:3	J	h.s.	5	9
3:1	E	h.s.	5	1	4:4	E	h.s.	4	-
3:1	G	h.s.	4	-	4:4	E	h.s.	5	-
3:1	I	h.s.	5	-	4:5	C	h.s.	4	1
3:1	J	h.s.	5	-	4:5	E	h.s.	5	1

VESSEL LIDS

Seven lid forms, including two stoneware examples, were recovered from CP4 contexts:

- Lid form 2 (LF2) replicates the earlier version's shape and plain surface finish, however fabrics tempered with either rice, sand or orthodox grog were recorded (Appendix 3). The latter two probably represent exotic wares. Those tempered with grog have cord-marked termini.
- LF4 continues in the same form as the CP3 examples.
- LF4(a) displays an incised line gauged parallel with the terminus (Fig. 279). It is composed of FG5.
- LF6 is plain, 10 mm thick and 160 mm in diameter, with a shallow 10 mm wide channel gauged 9 mm from the terminus (Fig. 279). The fabric is tempered with sand and therefore is exotic. It is confined to L1:3.
- LF6(a) (L2-3) is the same shape as LF6 (diam: 200 mm). The exterior and terminus, however, are cord-marked (Fig. 279).
- LFA (Fig. 279), is a wheel-thrown oxidized stoneware tempered with sand (diam:180 mm).
- LFB (Fig. 279), is a green glazed stoneware with a grooved terminus (diam: 180 mm).

DECORATIVE MODES

Local CP4 decorative modes are characterized by the conservation of earlier techniques combined with the introduction of several new modes. Fine wares continued to be decorated principally with *Anadara* shell impressions, cord marks, incised lines and burnishing. Burnishing probably continued unabated, however, because CP4 firing methods produced pottery with oxidized surfaces, rather than the dark reduced fine ware, which characterizes CP2-3 fine wares. It lacks that pottery's deep lustrous sheen. Punctation marks and a variety of combinations of the traditional modes are also prominent. Cord marks, notches, fingernail impressions and appliqué bands are minor fine ware modes of decoration. Abstract and freehand incised designs feature on some local fine wares.

Major changes are reflected in the introduction of new techniques. Paddle impressing, in particular, represents a crucial shift. Changes in mode combinations, such as incising and punctation, also underline a new focus in decoration. Fine ware rim quantities provide the clearest assessment of mode proportions. Thus *Anadara* shell impressions form 47.77 per cent, punctation

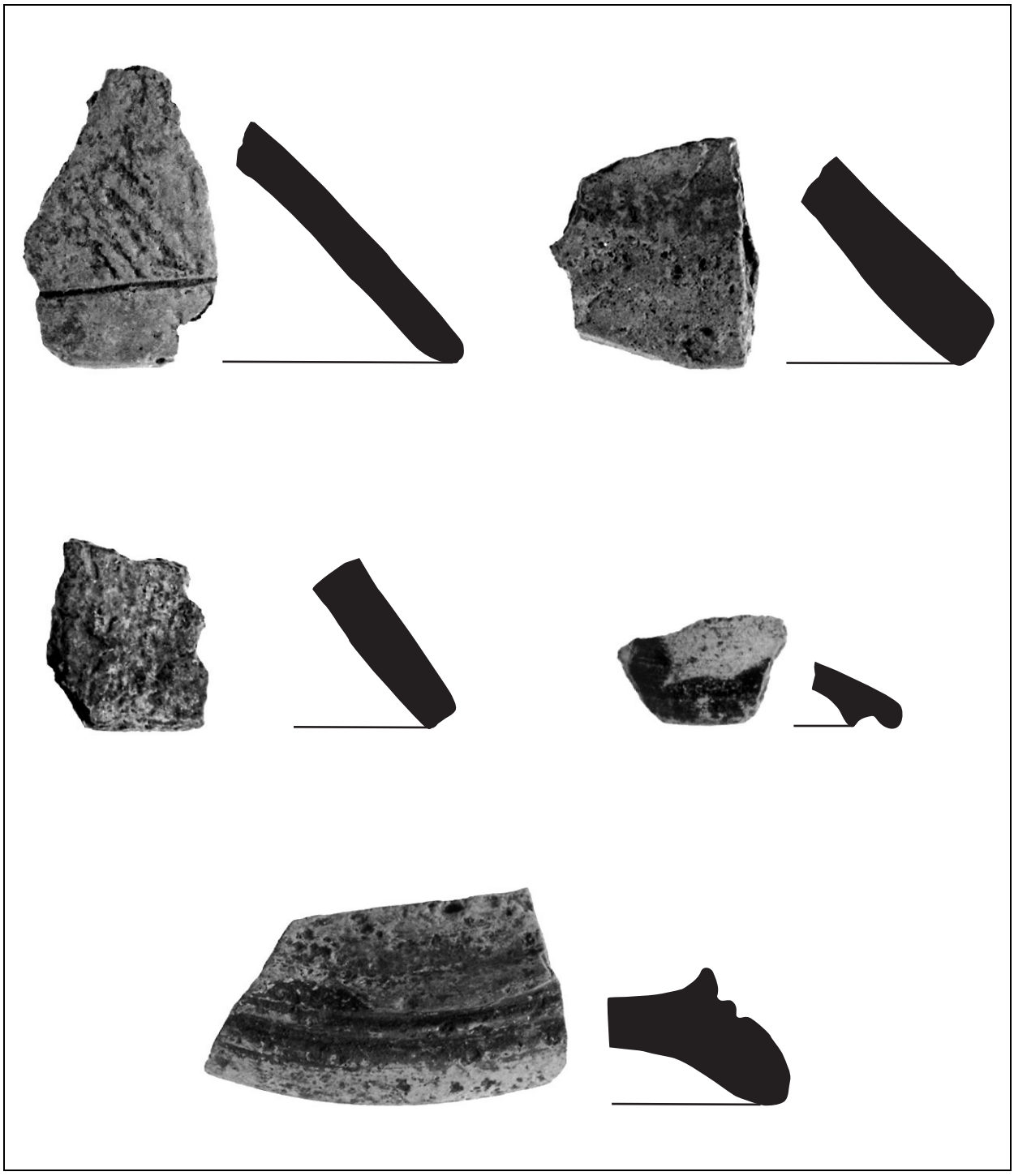


FIG. 279: Lid forms. Ceramic Period 4. *Top* left: 4(a), right: 6, *Centre* left: 6(a), right: B, *Bottom*: A. Scale 1:1

marks 34.34 per cent, paddle impressions 33.33 per cent, cord marks 8.88 per cent, notches 6.66 and fingernail impressions 3.33 per cent of the decorative modes displayed on fine ware rims. Paddle impressions are a major component of local fine ware decoration. They were previously confined to exotic wares.

Mode combinations include *Anadara* shell impressions with paddle impressions, stylus punctations, notches, comb impressions and cord marks. Paddle impressions are also variously combined with stylus punctations marks, cord marks, notches, fingernail impressions and incised geometric designs. Incised lines continue to be extensively employed either as single or multiple horizontal lines. They are also used extensively to define curvilinear and geometric fields. These fields are infilled with *Anadara* shell impressions deployed in a variety of patterns and angles. They may occur either on exterior and interior walls and the rim terminus either singly or in various combinations. A wide range of shell sizes appears to have been employed. Some may have been modified, either deliberately or as the result of use wear. Each of the other modes is also variously combined with incised lines, either alone or in combination.

Coarse ware modes blur these values because surface treatments, such as cord marking, are not necessarily intended as a decoration, whereas in fine wares they usually are. In this respect a notable feature of CP4 local ware surface treatments is the use of a cord-wrapped paddle for coarse wares opposed to carved paddles for fine wares.

''COMPLETE'' VESSELS

Fourteen "complete" vessels and two ladle fragments were recovered from CP4 contexts (Table 135). An historic stoneware vessel apart, all are local CP4 wares and include:

- Cat. 3287 is a fragment of a small L4:1 FG5 test pot. It almost mirrors the shape of a L10:14 version (cat. 3276 Chapter VIII). Roughly formed, the fabric is a medium texture with oxidized surfaces and a black core. The surfaces are coloured 2.5YR/6/6 and the exterior is impressed with "Z" 1 mm wide cord marks. The vessel thickness tapers from 12 mm at the base to 8 mm.

- Cat. 3283 is a 45 mm long by 23 mm wide fragment of a L4:3 FG4 ladle(?) handle and bowl. The fabric is medium texture with oxidized 2.5YR/6/6 surfaces and a black core.

- Cat. 3273 (L3:3) is a 160 mm diameter, 55 mm deep type L1a FG4 utilitarian bowl with a RF6 rim. The fabric is medium textured, 6–7 mm thick and fired in a reducing atmosphere with some oxidized patches and 2.5YR/6/4 to 2.5YR/5/2 colours.

- Cat. 532 is a miniature L4:3 vessel fragment composed of FG5. The fabric is medium textured, 6–8 mm thick with oxidized 2.5YR/6/6 surfaces and a black core. A diagonal incised line decorates the body. A ring foot was probably attached to the base.

NOTES TO THE CERAMIC PERIOD 4 ''COMPLETE'' VESSELS

Although several of the CP4 vessels are represented by fragments which often amount to less than half of the original, they are considered sufficient to be diagnostic. In each instance the vessel type is fully understood from the accumulated corpus of evidence. Confidence in the typology allows vessel forms to be recognised even when only relatively small fragments are available. This is a consequence of sorting a huge assemblage into diagnostic components. Care has been taken to ensure that vessel profiles, or cross sections, are sufficiently representative, given a detailed background knowledge of the taxa.

TABLE 135: *Non-mortuary vessels: Ceramic Period 4*

Layer	Feature	Cat.	Thin section/h.s.	Fabric grp	Type
2:2	-	110	h.s.	4	ladle
2:2	-	3227	K356	3f	L2i
2:2	1	3228	h.s.	-	2j
2:2	-	3269	h.s.	5	L2b
2:2	1	3279	h.s.	stoneware	special
2:3	-	3275	h.s.	5	test pot
3:1	-	3229	h.s.	4	L1f
3:2	-	3234	h.s.	4	L1f
3:2	-	3272	h.s.	5	L2b
3:2	-	3273	h.s.	4	L1a
3:3	-	3268	h.s.	5	L2b
4:1	-	3287	h.s.	5	test pot
4:2	-	3266	h.s.	5	L2b
4:3	7	3265	h.s.	4	L1f
4:3	10	3271	h.s.	4	L1b
4:3	-	3283	h.s.	4	ladle

It is important to note the continuum in local vessel types. Apart from superficial decorative changes, local vessel types remain essentially the same in CP4 as earlier versions. The range of vessel types is reflected in "complete" vessels, rim and base forms. These provide indirect evidence of cultural styles and direct technological data. Our understanding is increased when each is considered in conjunction with the other. While copying styles can disguise a ceramic tradition, and *ipso facto* its parent culture, technological evidence is less likely to be affected. It is important to note in this respect that, although CP4 local vessel forms continue earlier traditions, changes are evident in the modes of decoration employed.



FIG. 280: Non-mortuary vessels. *Top*: cat. 3269 layer 2:2. A burnished and decorated type L2b carinated jar. Rim diameter: 160 mm, carination: 112 mm, overall height: 68 mm (est.), carination 14 mm. Thickness: 5–6 mm. Medium fine texture. Fired upside down, oxidized surfaces apart from fire clouds to interior base. Vertical paddle-edge(?) impressions to field. Notches to carination point made with the shaft of a 1 mm thick round stylus. FG5. colour: 2.5YR/6/6 - 2.5YR/3/2. Quality: very good to excellent. *Bottom*: cat. 3271 layer 5:2 (in f10, L4:3). A smooth, medium fine, deep L1b bowl with stepped rim. Rim diameter: 140 mm, overall height: 83 mm, rim height: 24 mm (15 mm step). Thickness 6.5 mm. Biscuit fired, reduced with barely oxidized surfaces. The perfectly level rim suggests that the vessel was turned on a wheel. FG4. Colour: 2.5YR/6/6. Quality: excellent. Scale: 1:1



FIG. 281: Non-mortuary vessel. Cat. 3266 layer 4:2. A L2b carinated jar. Smoothed and burnished on a fine fabric. Two incised lines circuit below the rim. The carination is decorated with notches made with the shaft of a round stylus. Dimensions: rim diam: 170 mm, carination: 140 mm, rim/carination height: 66 mm, thickness: 5 mm. Slab construction. Biscuit-fired and reduced throughout. FG5. Colour: 2.5YR/4/2. Quality: excellent. About 25% was recovered. Scale: 1:1

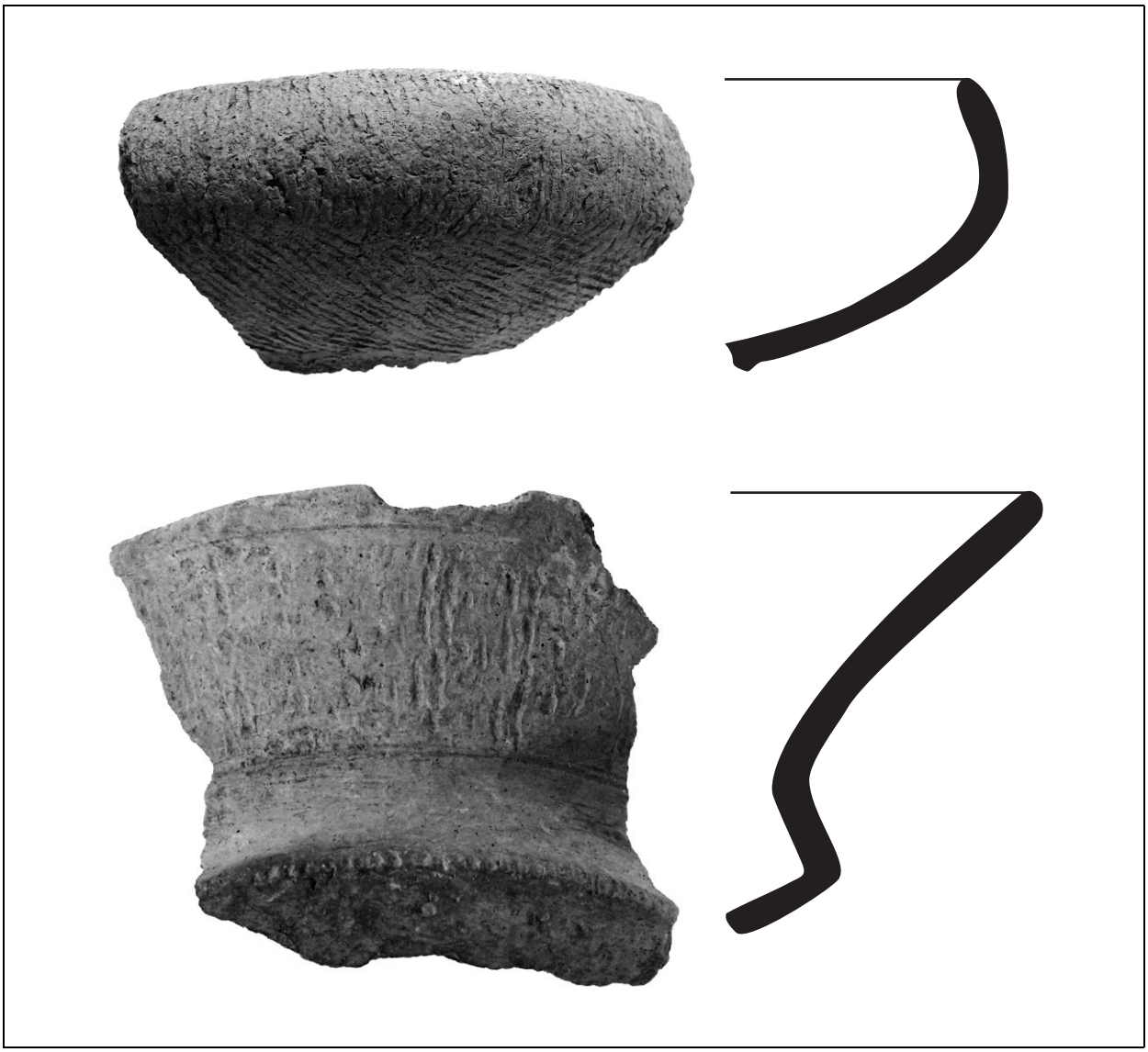


FIG. 282: Non-mortuary vessels. *Top*: cat. 3265 layer 4:3 f7. A coarse ware type L1f footed bowl. The fabric is medium dense. Estimated rim diameter: 160 mm, bowl height 70 mm. Wall thickness: 5–8 mm. Probably constructed from slabs. Biscuit fired and oxidized with some fire clouds. Cord marks: "Z" 1.5/1.5 mm. FG4. Colour: 2.5YR/6/6. Quality: a well made local utilitarian vessel. Scale: 1:2. *Bottom*: cat. 3268 layer 3:3. A small L2b carinated jar. Smoothed and burnished on a medium fine fabric. A *c.* 30 mm deep band with vertical stylus(?) marks circuits below the rim. The carination is decorated with notches. Dimensions: rim diam: 160 mm, carination: 110 mm, rim/carination height: 46 mm, thickness: 5 mm. Slab construction. Low(?) biscuit-fired upside down, oxidized with fire clouds to base. FG5. Colour: 2.5YR/6/4 to 2.5YR/3/2. Quality: very good – excellent, with only a minor rim distortion. Only about 25% was recovered. Scale: 1:1



FIG. 283: Non-mortuary vessel. Cat. 3272 layer 3:2. A type L2b carinated jar, burnished and decorated on a medium fine fabric. A *c.* 30 mm deep band with vertical blunt stylus(?) marks circuits below the rim. The carination is decorated with notches. Dimensions: rim diam: 160 mm, carination: 144 mm, overall height: 70 mm (est.), carination 18 mm. Thickness: 5–6 mm. Slab construction. Biscuit fired. Oxidized surfaces throughout. Notches made with the shaft of a 1.5 mm thick round stylus. FG5. Colour: 2.5YR/6/4. Quality: very good, with some decoration irregularities. About 25% was recovered. Scale: 1:1

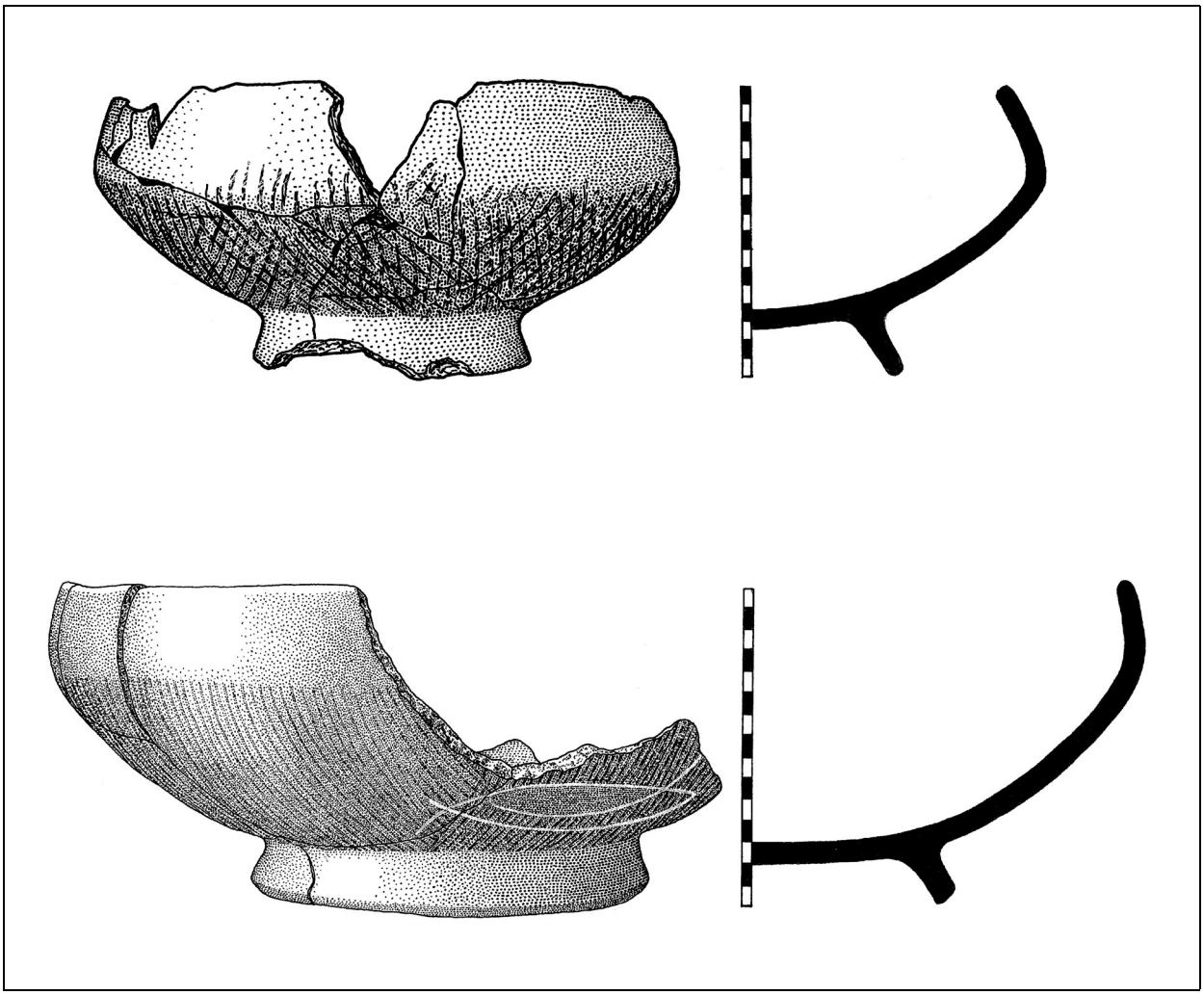


FIG. 284: Non-mortuary vessels. *Top*: cat. 3234 layer 3:2. A L1f footed utilitarian bowl. Interior and exterior above the carination and the base are smooth. The remainder, including the base bottom edge, is cord-marked. The fabric is medium coarse. Dimensions: rim diam: 170 mm, carination: 176 mm, base: 82 mm, height: 75 mm, base: 15 mm, carination: 54 mm. Thickness: 4.5 mm at carination, 3 mm at rim. Slab construction. Low(?) biscuit-fired upside down, oxidized with fire clouds to base. FG4. Cord marks: "Z" 2/2 mm (very coarse). Colour: 2.5YR/6/6. Quality: good – crudely fashioned but regular shape. *Bottom*: cat. 3229 layer 3:1. A L1f footed utilitarian bowl. Interior and exterior above the carination and the base are smooth. The remainder, including the base bottom edge, is cord-marked. A curvilinear (stylized fish?) motif decorates the lower bowl. The fabric is medium coarse. Dimensions: rim diam: 178 mm, carination: 180 mm, base: 92 mm, height: 74 mm, base: 14 mm, carination: 52 mm. Thickness: 4.5 mm at carination, 3 mm at rim. Slab construction. Low(?) biscuit-fired upside down, oxidized with fire clouds to base. FG4. Cord marks: "Z" 1/1 mm. Colour: 2.5YR/6/6. Quality: very good. Scale: 1:1

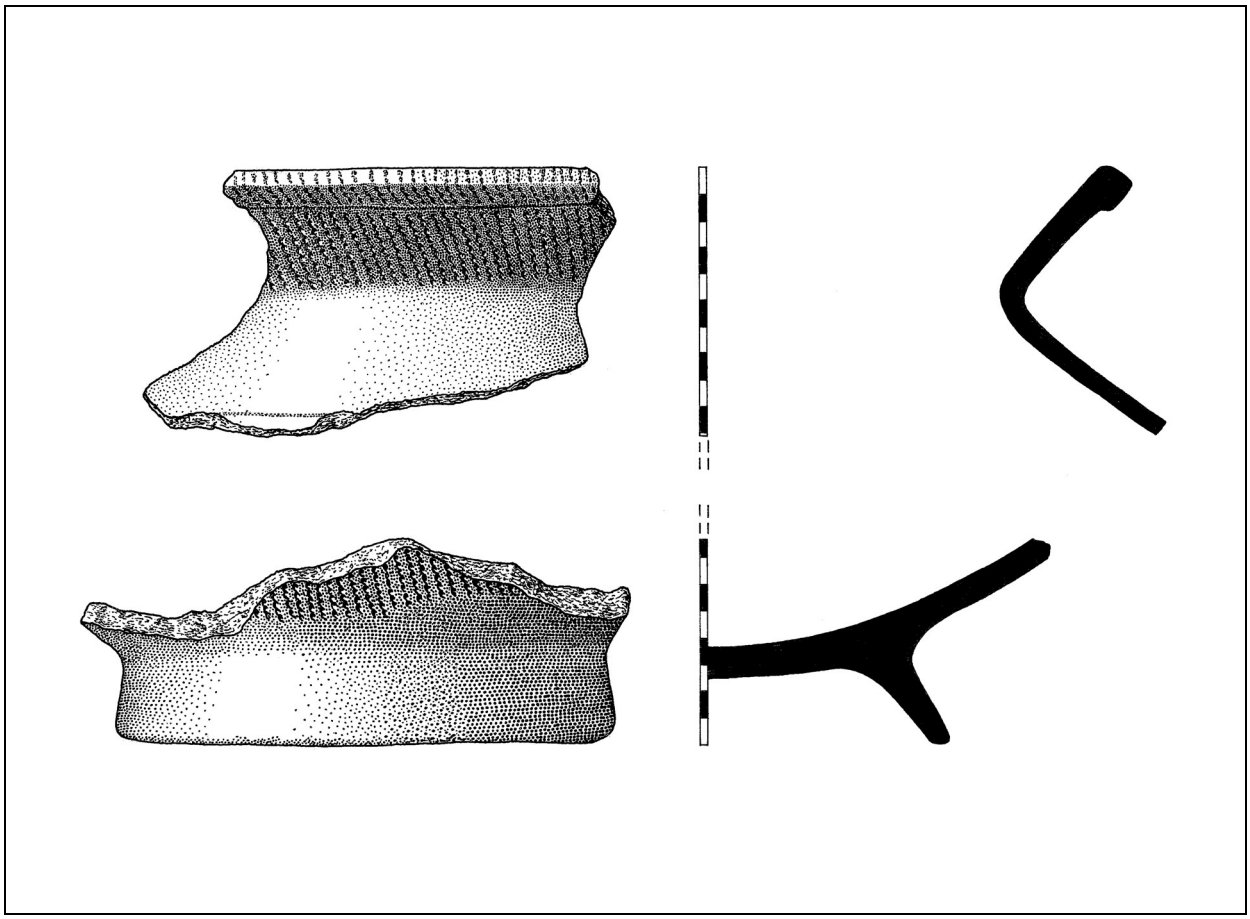


FIG. 285: Non-mortuary vessel. Cat. 3227 layer 2:2. A coarse ware type L2i carinated footed bowl. Vertical cord marks decorate the rim exterior. Below an incised line, the bowl is decorated with diagonal cord marks. The fabric is medium coarse. Dimensions: rim diam: 160 mm (est.), carination: 180 mm (est.), base: 88 mm, height: 120 mm (est.), base: 18 mm, carination: 64 mm (est.). Thickness: 3.5 mm. Slab construction. Biscuit fired and oxidized throughout. Cord marks: "Z" 1.5/1 mm. FG3f. Colour: 7.5YR/8/4. Quality: excellent. Scale segments are 5 mm

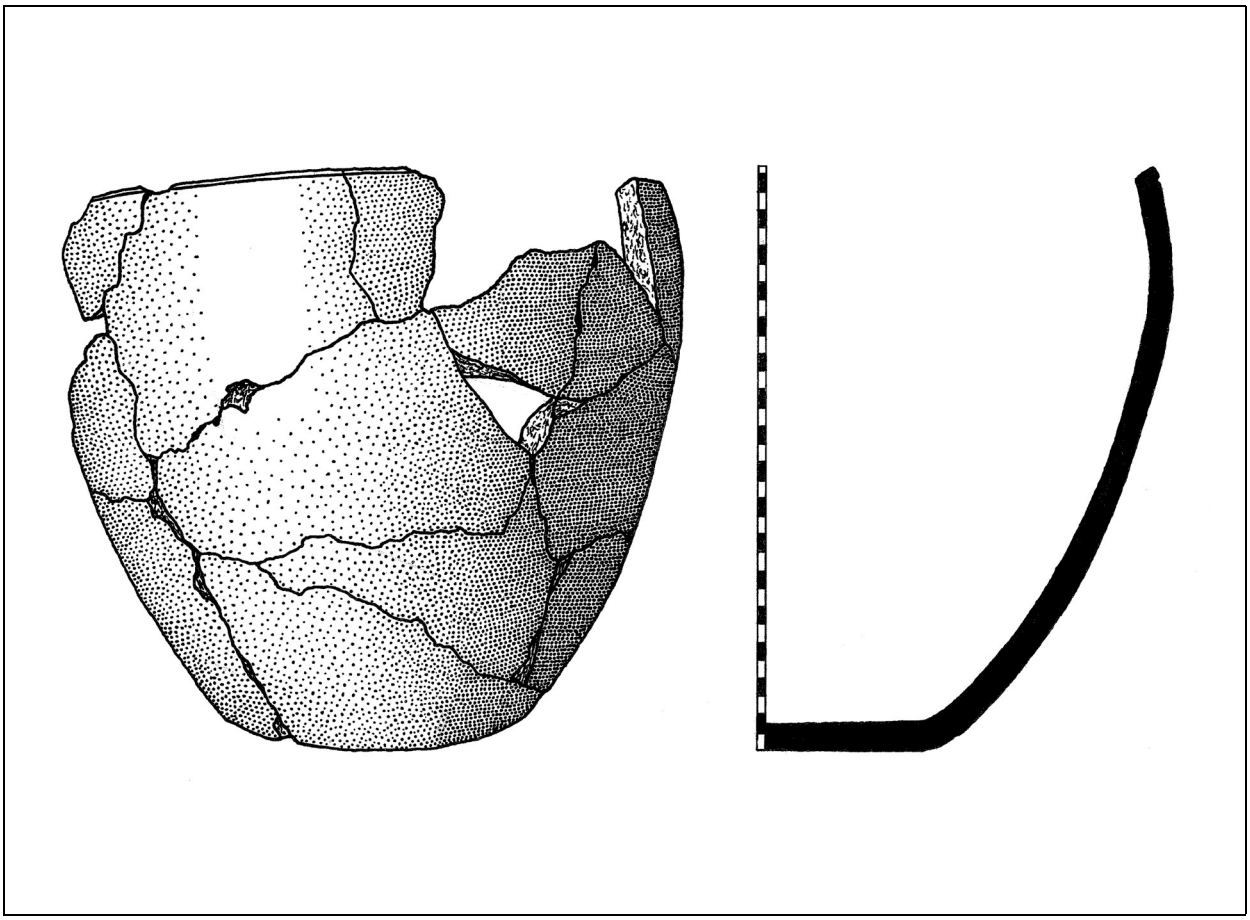


FIG. 286: Non-mortuary vessel. Cat. 3228 layer 2:2 f1. A coarse ware type L2j utilitarian jar. A flat bottom, smooth exterior and slightly rippled interior suggest a wheel-thrown vessel. The fabric is medium coarse. An incised line runs just below the rim. Dimensions: rim diam: 240 mm, base: 102 mm, height: 180 mm. Thickness: 9–11 mm. Biscuit fired and oxidized except for a slightly reduced exterior. FG Colour: 5YR/5/4 (exterior), 5YR/7/6 (interior). Quality: a quickly made wheel-thrown mass-produced historical vessel. Although extensively fragmented about 50% survived for reconstruction. Scale segments are 5 mm



FIG. 287: Non-mortuary vessels. *Top* cat. 3275 layer 2:3. A small test pot. Cup shaped and formed from a roughly moulded and smoothed medium fine lump. Dimensions: rim diam: 62 mm, height: 45 mm (est.). Thickness: 5–8 mm. Biscuit fired and oxidized throughout. FG5. Colour: 2.5YR/6/4. *Centre* cat. 3279 layer 2:1 f1. A small glazed stoneware ware bowl with a flat bottom and a grooved rim. Wheel-thrown or turned. The interior and part of the exterior are unglazed. Vertical flutes on the exterior are over-glazed. Dimensions: rim diam: 90 mm, height: 20 mm. Thickness: 2 mm. Colour: light grey (10YR/7/1) Quality: a historical vessel. *Bottom left* cat. 48 layer 2:1. A small wheel-turned glazed stoneware lid (the bottom is unglazed). Dimensions: diam: 39 mm, height: 11 mm. Thickness: 3–4 mm. Colour: 2.5YR/3/2 (very dark greyish brown). *Bottom right* cat. 13 layer 1:1. A small lid or knob designed to fit into a lid. The texture is medium fine to fine with a smooth surface. Biscuit fired and oxidized. Dimensions: diam: 21 mm (maximum), 19 mm (rebate), overall height: 20 mm, rebate 4 mm. Colour: 5Y/7/1. Scale: 1:1

CERAMIC PERIOD 4: SUMMARY AND CONCLUDING REMARKS

Major changes are evident in the CP4. These reflect the introduction of a new potting tradition. Pottery styles and ceramic technologies changed in tandem. Some aspects of local styles continued with little alteration, others were markedly modified and several unique styles were introduced. Changes in clay preparation methods saw the introduction of rice by-products as a tempering agent, a technique formerly incorporated into exotic wares for much of the sequence. Local and exotic pottery fabrics differ from earlier assemblages. These changes will be outlined to help bring into focus internal technological developments as well as external relationships in terms of the ceramic spectrum.

During CP4 the excavated portion of the site was devoted to clay preparation and pottery making. Such behaviour contrasts with mortuary activities characterising CP2-3. In one respect this limits comparisons with earlier potting traditions, in others it provides information unavailable from the earlier contexts. When information from both is compared and contrasted some aspects may be combined to complement one with the other. Assessments of these data, aimed at illuminating such an approach, are set out in Chapter XI. Evidence recovered from the CP4 workshop is summarized below. This will be briefly compared and contrasted with data from the previous CPs to help characterize any relationships between the two. Pottery styles, production methods and site use will be examined to help determine whether correlations exist between this final expression of the four local ceramic traditions and earlier traditions. Pottery styles and the occurrence of other ceramic artefacts are compared with those documented in earlier CPs. Because pottery production may be critically affected by the physical environment, this issue is also briefly considered. Pottery styles will be considered first.

SUMMARY AND DISCUSSION

Distinct changes in prehistoric activities are signalled in the pottery and related materials uncovered in the uppermost metre or so of the excavation. The material mostly involves local pottery production within a workshop. Such mundane activities provide an excellent opportunity to detail and compare local ceramic production techniques with the evidence provided by the mortuary activities.

A few stone adze heads, whetstones and a hoe, a partially worked ivory cache, some bone, shell and stone jewellery, turtle carapace, a shark tooth and worked antler aside, all of which indicate artefact processing, the upper metre or so was dedicated to clay preparation and pottery manufacture.

Potting tools recovered include 136 complete or fragmented ceramic anvils used to fabricate vessels. They were concentrated in L2-3, about midway through the CP4 sequence. Nearly all are composed of local clay tempered with bleb grog, a few with rice only. Local anvils comprise over 90 per cent of the sample and rice is clearly identifiable in 80 per cent of them which

suggests that they all contained it, either alone or in bleb grog. About 11 per cent of local anvils are composed of a silty clay. The remainder contain a moderately micaceous clay. In some, the micaceous clay was tempered with grog made from the silty clay. This demonstrates that some experimentation was carried out in selecting clays. A few local anvils contain bleb grog and numerous rice husks. Rice temper quantities and compositions also varied widely. Some only contain rice husk. Others appear to include small fragments of straw mixed with husk. The preferential use of grog suggests that it provided a stronger fabric than rice temper alone. Seven anvils are exotic. Three of these contain bleb grog, the same rice-related technology as the local CP4 tradition. Other exotic anvils are tempered with sand or orthodox grog. One bleb-tempered exotic anvil displays a potter's mark.

Potters' marks are present on about 20 per cent of CP4 anvils. At least 24 individual marks are identifiable in the CP4 assemblage. They include incised lines and crosses, patterns of small holes, combined holes and incised lines or deep dome or cone-shaped concavities impressed into handle bases. In others the handle shaft is chamfered or incised with distinctive emblems or the anvil head is either notched or incised. The same or similar marks are probably shared by 12 anvils. At least 17 distinctive potters' marks are apparent. Given the large number of CP4 anvils, these marks emphasize that, at least in this portion of the site, potting was an extremely important activity. Such quantities suggest the presence of a large group of potters. The marks suggest that individual potters recognized a degree of separateness. This aspect of the evidence is considered further in Chapter XI. Several anvils bear cord mark impressions. These featured "S" and "Z" twisted cords, an indication that both left and right handedness was present in the community. Of the 34 cord twists able to be identified with confidence, 29 "Z" and 5 "S" were recorded. The cord diameters range from 1–2 mm.

Twenty seven burnishing stones were recovered from the upper 80 cm of the site. These signal that this mode of decoration continued to be favoured. Bone stylus points and chisel-shaped scribing tools, suited to incising decorations into leather-hard vessels prior to firing, were distributed throughout CP4. They correlate with incised local fine wares. The association of ceramic anvils, burnishing stones and bone incising points emphasizes that potting activities were concentrated in this area. Prepared potting clays provide further evidence.

An abundance of potting clay, concentrated in clay preparation areas and strewn across the square, underscores the presence of potting tools and reinforces the intensive nature of the potting activities. It also helps to characterise the integrated functions of a pottery workshop. Nearly 300 kg, or about 91 per cent of the total prepared potting clays identified at the site, were derived from CP4. Much of the clay was present as cylinders, either for storage purposes or perhaps as vessel pre-forms. Several included grog temper, some contained rice husk. Both the local silty and micaceous prepared clays were present. One large dump of unmixed silty local clay was uncovered in L2. Although no direct evidence for clay blending was detected, this preparation method cannot be ruled out. In some instances, unmodified local clay was used for utilitarian coarse wares. Most of the clay was spread across the workshop floor, except for some contained within pits in the lowest CP4 deposits. Much was mingled amongst potsherds and sandy cultural sediments.

A variety of miscellaneous ceramic artefacts was uncovered. These include "bow" pellets, "counters" or bow missiles, a disc bead or earring, a grinding sherd(?), a domed disc, small

cylinders, a small "tear drop" bead, drilled and perforated rim and body sherds, a sherd used for polishing, ladle handles, square or irregular ground burnishing(?) sherds and a perforated dome-shaped sherd of unknown function.

A restricted range of decorated fine ware body sherds were recorded from CP4 contexts. Cultural activities, mostly midden pit excavations, along with natural disturbances such as bioturbation and erosion, resulted in some mixing of the deposits. As a result some fine burnished and incised wares at the bottom of CP4 were probably dislocated from CP3. Incised wares, however, are distributed throughout CP4, although most are medium fine which contrasts with all other contexts where fine wares dominate the incised spectrum. A single exotic painted sherd was recovered from L4. Paddle-impressed wares, however, increased markedly from a few mainly exotic sherds in CP2–3 to over 17 kg of predominately local pottery in CP4. They are all tempered with bleb grog. Exotic paddle-impressed wares are either tempered with sand, orthodox or bleb grog. The last is associated with paddle-impressed wares throughout the prehistoric sequence. Just 15 g of punctate and over 1.3 kg of local appliqué decorated sherds, including two forms unique to CP4, were represented. Use of the appliqué technique increased markedly during CP4 in contrast to earlier local traditions where it formed a minor decorative mode. Some early exotic examples were composed of a bleb-tempered fabric.

Dense concentrations of coarse ware rim sherds are a feature of CP4. They comprise over 360 kg or 80 per cent of all CP4 rims. The most abundant, RF1, retained the simple internal fold introduced into the spectrum in CP3. Almost all are composed of fishpond clay tempered with rice. A few exceptions contain a more micaceous local clay. One of 90 local RF1 rims examined included bleb grog. RF2 sherds contributed over 105 kg. Minor changes in their forms were noted, but not in their most common shape. In contrast to RF1, most are tempered with bleb grog, although nearly 40 per cent feature rice. The only other local coarse ware, represented by RF3, recorded minor variant changes, and has a similar mix of fabrics to RF2.

Fine wares make up a significant proportion of the CP4 assemblage. Many rim forms continue unaltered from CP3, but marked changes in some shapes and variant decorative details occurred. Although these differences created a distinctive assemblage, its overall structure remained consistent with the traditional vessel typologies. Many traditional regional vessel forms continued on from CP3. Rim form complexity is a particularly sensitive indicator of changes in pottery fabrication within a production centre. Comparison of the CP4 with the CP3 rim form elaboration index gives values of 11.46 for CP3 and 10.63 for CP4. The number of forms remained at 15, categories decreased from 128 in CP3 to 117 in CP4 and variants decreased sharply from 44 to 24. Fine wares represented by RF5 and RF6, the most abundant CP3 forms, provide precise indices of changes in ornamental ware elaboration. During CP3, RF5 is represented by 40 categories and 14 variants. In CP4; 30 categories and nine variants were identified. For RF6 in CP3 35 categories and 19 variants were recorded. In CP4; 11 categories and 10 variants. These give combined values of 75 categories and 33 variants for CP3 and 41 categories and 19 variants for CP4. In terms of RF5 and RF6 combined, this gives elaboration indices of 54 for CP3 and 30 for CP4. These figures include exotic and local forms. In order to establish accurate fine ware elaboration indices, with respect to the RF5 and RF6 figures for CP4, exotic forms need to be deducted. The number of exotic categories and variants in the CP4 RF5/6 sample totals 16. Deducting these from the total 60 categories and variants leaves only 44 local

expressions with an elaboration factor of 22.

To compare CP4 with CP3 local production levels accurately, unique exotic rim forms need to be set side. With exotic specimens excluded there are 12 local forms. Categories reduce from 117 to 104 and variants from 24 to 17. This gives an elaboration index for CP4 of 10, compared with 8.46 for CP3. These values need to be treated with caution, however, due to differences in the kinds of local wares produced. This point aside, local ware variety reduced during CP4 in comparison with CP3. Ornamental fine wares, including local RF5/6 wares, are considered to reflect energy levels expended in pottery production. When exotic wares are excluded, the total number of CP4 rim forms reduce from 15 to 12. Local fine ware forms total 11, categories and variants combined reduce from 141 to 118 to give an elaboration index of 9.83 compared to 8.46 for CP3 local wares.

Comparison of all CP4 and CP3 fine ware rims reveals that of the 142 recognized in the former contexts, only 44 forms, categories or variants match CP3 rims and 98 are restricted to CP4 (Appendix 2). For CP3, 171 were classified, 127 of which were absent from CP4. This means that only about 26 per cent of CP3 and 31 per cent of CP4 fine ware rims are common to both CPs. Rims common to both include RF3, 4, 5 and 6, which comprise the majority of fine wares in the site assemblage. The quality of the CP4 versions, however, is inferior to those of CP2-3. The surface finish tends to be coarse and decorative embellishments are less carefully rendered. CP4 fine wares are thicker and their fabrics slightly coarser than their CP2-3 counterparts. In contrast with these comparisons, CP3 shared 68, or over 40 per cent, of fine ware rims with CP2. Thus, with respect to these data, the CP2/3 ceramic traditions are closer than the CP3/4. Again, caution needs to be exercised because the latter compares pottery from cemetery contexts with that from a workshop.

Pottery fabrication during CP4 is reflected in the association of burnishing stones, bone stylus points (postulated as tools for incising decorations), ceramic anvils, cylinders and dumps of prepared clay on what appears to be a potting workshop floor. No substantial deposits of charcoal or ash were uncovered to suggest pottery firings. While these are unlikely to have been carried out in a fabrication area, patches of burnt reddish clay in L4:5 hint at firings of grog temper, a practice noted in Northeast Thailand close to a clay preparation and vessel construction floor (Vincent 1988). Pottery firings are usually carried out away from habitation areas and abundant evidence for firing was noted at the site's margins.

COMPARISON OF CP3 AND CP4 POTTERY STYLES

Although about 26 per cent of rim taxa are comparable with CP3 fine wares, CP4 pottery is clearly different. CP4 potters placed particular emphasis on RF4 wares, which probably derive from type 3 platters. RF4 sherds comprise 55 per cent of the principal fine wares in the site assemblage, represented by RF4, RF5 and RF6. In CP3 they account for nearly 18 per cent of this group. RF5 sherds make up 32 per cent of them in CP4 and almost 41 per cent in CP3. RF6 sherds derive from everted bowls. These comprise almost 42 per cent of CP3 and nearly 13 per cent of the CP4 RF4–6 fine ware group.

A change of use from cemetery to workshop could influence the composition of the respective

pottery concentrations in each CP. While this could significantly skew type proportions, the style characteristics are likely to have been preserved because members of each regional form are present in the assemblage. The shift in fine ware production noted, therefore, probably accurately reflects local stylistic change within the established regional rubric. While, in general, the vessel shapes which characterise earlier traditions are retained, obvious changes in vessel preference, quality and surface decoration place CP4 pottery in a different, but related, tradition. The extent to which CP4 styles diverge from earlier local traditions is probably best gauged by comparing rim form spectra and changes in modes of decoration. These aspects will be considered further in Chapter XI.

Modes of decoration are sensitive indicators of cultural styles because they mark contemporary fashion preferences. While there is no obvious technical reason for one potter to use a cord-wrapped paddle and another a carved one, and some may use both at various stages in vessel fabrication, they distinguish different pottery styles. Some cultures prefer a cord-marked finish, others paddle impressions. At Khok Phanom Di, although utilitarian wares continued to be cord-marked throughout the prehistoric sequence, several CP4 fine wares feature paddle impressions. *Anadara* shell impressions continue to be the most favoured fine ware decorative treatment and then, in decreasing order, punctation marks, paddle impressions, cord marks, notches, incised geometric designs, fingernail impressions and abstract freehand designs complete the CP4 range. These are deployed in various combinations.

Complete vessels include type L1a shallow and L1b deep bowls, L1f footed bowls, L2b indirect carinated burial and L2i footed jars, all styles consistent with earlier traditions. These were the only complete vessels recovered apart from an historic type L2j jar, glazed stoneware and small potters' test pots. At least ten base forms are featured on local vessels and one type included small solid feet. Historic vessels aside, three different lid forms were associated with local CP4 vessels. Rim and base forms suggest that type L3b platters formed a major component of CP4 local fine ware production. Motifs on these vessels are distinct from earlier examples. Over 40 categories are unique to CP4. Similarly, 25 fine ware jar categories or variants and 10 bowls are restricted to CP4. Whereas 68 of the same rim categories or variants are present in both CP2 and CP3, only 44 of such CP3 rims continue into CP4. In addition to the modes of decoration evidence, this signals that while many earlier potting traditions were retained, major stylistic changes occurred with the advent of the final prehistoric phase of pottery production.

COMPARISON OF CP3 AND CP4 CERAMIC TECHNOLOGIES

One defining criterion of each CP is the composition of ceramic fabrics. During CP4, local pottery comprises two kinds of fabric. For utilitarian wares, a silty local clay tempered with rice by-products was usually preferred. For fine wares a more plastic micaceous clay, tempered with bleb grog, itself containing rice remains, was favoured. As in CP3, clay cylinders continued to be employed for storing clay and perhaps as vessel preforms. Ceramic anvils, burnishing stones and incising tools continued in use. Changes in the forming and firing of vessels, compared to CP2 and CP3, are evident. The use of carved wooden paddles was restricted to CP4. A lack of carbonaceous material on the surface of most vessels indicates that firings were increasingly

oxidizing, although the disposition of carbon within the fabric interstices suggests that firing conditions were partially reducing in most instances. The presence of small test pots suggests a degree of unfamiliarity with local clay properties. Although burnishing, impressing and incising continued to be a favoured decorative technique, artisan skills declined and the finished product diminished in quality. Often the surface finish and fabric texture are coarse, with less attention to detail than that displayed in the outstanding vessels associated with the previous two local traditions.

SYNTHESIS OF CP3/4 DEVELOPMENTS

A clear discontinuity in cultural activities marked the interface between CP3/4. Mortuary ritual ceased and this portion of the site was devoted to industrial pursuits. A few pits containing crab, shellfish, fish, turtle, and relatively rare mammalian remains dot the area. Aside from small quantities of worked materials such as bone stone the area was given over to potting.

TABLE 136: *The distribution of ceramic artefacts: Ceramic Period 4*

Layer:	1	2	3	4		1	2	3	4
rim complexity	6	52	88	93	tripod feet	1	-	1	-
exotic rims	1	5	12	22	burnishing stones	2	8	17	-
exotic sources	1	3	4	3	anvils	7	55	49	25
net weights	-	7	-	-	bone stylus points	-	8	6	3
bow pellets	5	11	-	-	vessels:	-	5	5	4
Totals:						23	154	182	150

Evidence of potting is abundant. Pottery deposits are almost three times greater than any in other CP. Ceramic anvils, burnishing stones and bone incising tools attest to intense potting activity (Table 136). Large dumps of prepared clay, weighing 75.99 kg in L2, 152.22 kg in L3 and 64.88 kg in L4, contained identical materials to those used in the local CP4 pottery. These are dry weights. Hydrated, they represent even greater quantities. Many of the anvils carry identification marks. In addition, the presence of pottery with distinctive incised markings suggests that individual potters acted to secure any production they were responsible for. This, coupled with the distribution of clay cylinders, some with spiral incision marks, suggests that some kind of production system was established. This question is discussed further in Chapter XI. Nearly all local anvils contain rice remains. Exotic anvils derived from three sources, one associated with the paddle impressing technique.

Local wares differ in style and composition from any of the preceding ceramic traditions. The complexity of rims suggests that potting maintained an important role in community activities,

although this sharply declined in the upper half of the CP4 sequence. Exotic sources peaked at four in L3 and then fell away towards the end. One distinctive paddle-impressed ware, containing rice-tempered bleb grog, continued to be imported throughout the sequence. Burnishing stones followed this trend, L3 again containing the majority of artefacts. Anvils are prominent in the lower and middle portions of CP4. The few complete vessels identified suggest that local potting continued to follow long-established regional styles. Traditional modes of decoration continued to be favoured, however new techniques which replicated exotic styles, were also adopted by some local potters. Although two tripod feet were recovered, only one is local. Their small, base-moulded forms bear no resemblance to the earlier attached examples.

While it is difficult to compare the CP4 ceramic spectrum with wares disposed within the underlying cemetery, which included vessels of outstanding quality, the comprehensive sample of rim and other sherds analysed allows a balanced, if somewhat subjective, assessment to be made. Overall, while potting activities matched, or perhaps even increased, during CP4, the standard of local fine wares declined in comparison to earlier production. Against this, however, must be gauged the extremely high standards achieved during the period when this portion of the site was dedicated to funerary ritual.

CP4 POTTERY PRODUCTION AND THE ENVIRONMENT

Floral and faunal evidence is intimately related to environmental conditions. The presence or absence of many species are sensitive indicators of environmental changes. Above the CP3/4 boundary the flora suggests open dry, possibly non-riverine, conditions (Thompson 1996:209). Seeds and charcoal remains indicate that different conditions prevailed during CP4 to those extant throughout the rest of the sequence. Mangrove plant remains common to CP2 and present in the rest of the sequence, are absent in CP4. Temporary and permanent herbaceous swamp flora are most common in CP1-3 and rare in CP4 contexts. A significant environmental change is suggested by a rapid rise in terrestrial micromollusc species, indicating a shift first from a mangal to open coast mudflats, followed by an abrupt increase thought to signal "a major environmental event such as a flood revision of the Ban Pakong River or a seismo-tectonic event that altered local land drainage patterns" (Mason 1996:254). A rapid change in the faunal spectrum from water dominated, prior to CP4, to land-based underscores the dramatic change that took place at the CP3/4 interface (Grant and Higham 1991:147-91; Kijngam 1991:223-9).

Transportation of raw materials and finished pottery is an essential component of any pottery production centre. Interaction between producer and consumer through exchange networks is critical if craft specialization is to survive. Given the volume of pottery produced during CP4, maintenance of some form of water transportation routes would seem critical. The size of the potting population and the scale of output reflects, local consumption aside, a clear need for unrestricted contact with external consumers. Thus while faunal and floral data clearly signal major environmental change, continued access to waterways would have been needed to allow the distribution of pottery.

XI SUMMARY AND DISCUSSION

THE PREVIOUS four chapters and the appendices detail the ceramic evidence for the site. Chapters I–V introduce the report, discuss the purpose of technical studies, outline previous research and the ceramic setting in terms of the local and the regional terrain and the kinds of local clays and fuels which were available for potting. Chapter VI defines the criteria applied in recognizing the four CPs.

This chapter summarizes the evidence presented thus far, in terms of the various ceramic traditions identified. It complements brief explanatory summaries at the end of Chapters VIII-X. Artefact distributions, established in the preceding chapters for each CP, provide insights, often subtle, into chronological developments within and beyond the site. An assessment of the cultural implications of these data, directed towards understanding the diverse, yet related, traditions represented at Khok Phanom Di, follows a discussion of the results. Relationships with other sites are paid particular attention, because these can be closely linked to the development and growth of pottery production centres. Technological innovations in pottery are only accepted when benefits outweigh traditional craft conventions. Specialization has a major impact on the socio-economic structure of a society and can be stimulated by innovations introduced from outside the community or through local invention. Multiple interrelationships between cultures are revealed in the various traditions present in the Khok Phanom Di ceramic spectrum. These are outlined below and their cultural implications are further considered in Chapter XII. Ceramics encapsulate technological, economic and cultural development within individual past societies (Freestone and Gaimster 1997:9).

> "Today ceramics are the single largest category of material culture held in the seven Antiquities Departments of the British Museum. In many instances they have formed the baseline of our understanding of individual societies. In fact, the importance of the medium for the study of human development can be traced as far back as the foundation of the British Museum in 1753." (Freestone and Gaimster *op. cit.*)

CERAMIC PERIOD 1: SUMMARY

The basal deposits of the excavation were composed mainly of ash, consistent with the results of repeated pottery firings, although some may also relate to initial site burning to clear vegetation. Charcoal and shell, clay, pottery, bone and stone artefacts, including adzes, as well as post holes, pits, hearths and patches of burnt clay, representing occupation activities, were dispersed across the lowest levels of the excavated square. They account for an estimated 93 cm of cultural

deposits. Subsequent prehistoric erosion probably deflated these to about 41 cm. Radiocarbon determinations suggest that they were laid down *c.*2,000 BC. Clay dumps and debris, caches of pebbles (for crushing into sand temper), potsherds, ceramic potting anvils and firing stands, ash lenses and charcoal spreads, together, indicate that clay preparation, pottery manufacturing and firing were carried out *in situ*. Potting clays were present in all CPs (Table 9).

CP1 revealed three small dumps of potting clay, one tempered with a very angular sand consistent with freshly-crushed rock. The mineralogy of this sand matches that of the pebbles caches. Clay in the remaining two dumps appears to be unmodified. The mineral composition of the three dumped clays matches samples taken from locations bordering the site. Some of the tempered, but unfired, clay was attached to a typical CP1 cord-marked sherd, composed of fabric group one (FG1). This correlation clearly establishes the presence of potters at Khok Phanom Di and is probably unique in Southeast Asian archaeological contexts. The pebble petrology suggests that they derive from streams carrying weathered pebbly sandstones of the Ratburi Group which outcrops about 87 km inland to the east of Khok Phanom Di, while another source lies about 170 km east along the coast. Perhaps they initially served as canoe ballast. As most CP1 adze stone probably derived from about 100 km east, in the upper reaches of the Ban Pakong River, an inland source for the pebbles is a possibility, but a coastal source is more likely, given a sherd tempered with shell and the prominence of exotic pottery tempered with sand. CP1 local pottery is distinct from later local wares because it contains sand temper and is therefore a major stratigraphic determinant.

Caches of artefacts, including 30 burnishing stones and 13 potters' anvils, were recovered from CP1. Three anvils, probably displaced in prehistory, are composed of FG2 which characterizes the overlying CP2 local pottery. The remaining 10 anvil fabrics are compatible with the local CP1 sand-tempered pottery. Their head sizes range from 36 – 95 mm, indicating that pots of various shapes and sizes were fabricated. The polished burnishing stones, measuring 1-5 cm in diameter, are striated and faceted by use wear. Small bone stylus points, polished from use wear, are correlated with incised local pottery (Appendix 3). Although possibly suited to other uses, their temporal association with incised wares, the matching of their diameters with grooves in sherds, and ethnographic parallels, all suggest that the points were used to incise pottery.

Nine fragments of ceramic stands, suited to supporting the weight-bearing rails under wooden firing rafts, were dispersed within complex lenses of ash, charcoal, extensive areas of fire-hardened clay and potsherds. Firing rafts are common to many modern Southeast Asian potteries. Stands elevate the structure and facilitate air flow, an important consideration in open firings. Mullite, a mineral which forms at temperatures above 1050°C, is present in at least five of the fragments. Such temperatures are rare in open-air firings. Some fragments were thickly coated with dark grey ash which suggests that the stands were repeatedly used in firings until they finally fractured due to thermal stress. Notably, the stand fabrics differ from the sand-tempered local CP1 pottery. They lack any temper or natural non-plastics, which suggests that either they contain a non-local clay or that a local clay was specially prepared to enable it to survive multiple firings. In either case, a clear understanding of the thermal properties of raw clays and the need to prepare them is reflected in the skilful manner with which they were treated.

A lack of non-plastics aside, there is no mineralogical reason to exclude local clays as the raw material used for the firing stands, provided that they were pre-treated to remove inclusions which

were likely to cause thermal shock. Removing minerals prone to abrupt expansion or contraction during firing, such as the quartz in local clays, would reduce the likelihood of catastrophic shattering as temperatures rapidly passed the 573°C quartz inversion point. Glassy mineral phases visible along fragment surfaces indicate that the stands were subjected to temperatures above at least 800°–850°C. The stands are conical, with a broad concave base for stability and a flat top with a protruding side lug, probably designed to lock into a slot cut into a bamboo support beam. Stand fabric oxidization and reduction patterns are consistent with their use in repeated raft firings. Mullite was observed in stands but not pottery. This indicates that temperatures above 1050°C rarely occurred, perhaps only in raft edge embers where air currents were stronger. One stand may be composed of an exotic clay.

Rim sherds have received particular attention because they reflect pottery types. Rims are not equated with vessel numbers, however, as unusual kinds and rates of re-use may disguise actual vessel disposal patterns (Deal 1998). But rims can provide critical information regarding the types, styles and decorative modes which characterise ceramic and related cultural settings. Rims are here separated into form groups, which are subdivided into decorative categories and then into category variants. The sum of categories and variants displayed by any rim form is promoted as a measure of its elaboration. It thus measures the quantum of energy expended and comparative skill levels. Increased elaboration requires higher skill levels than less developed elaboration. By concentrating on rim shapes, a relatively small number of basic form classifications were needed, with just 17 rim forms identified throughout the site, 13 in CP1. This helped to condense such a large sample into manageable proportions, and to readily separate local coarse wares (the most abundant pottery), from the remainder of the sample.

Coarse ware cord-marked rims predominate throughout the sequence. The most common was designated rim form one (RF1), formed by simply folding the pot wall inwards on itself. Significantly, this form changed at the CP2/3 boundary. Coarse ware fabrics are friable and fragmentary, preventing full reconstruction of their parent vessels or their fabrication method. But by matching rim and body sherds their overall shape was approximated. During CP1 they represent 300–350 mm diameter globular vessels, with inverted, indirect rims and medium to coarse fabric textures. Cord marks range up to 2.5 mm in diameter, while twist directions suggest that most cords were made by right-handed individuals. Another, but less abundant, coarse ware rim (RF2), which derives from a more carefully made vessel, is folded outwards. Both vessel forms were probably fabricated using slabs or the lump-and-slab method. Their light grey surfaces are fully oxidized with few fire clouds or smudges, but the fabric core is usually more-or-less reduced. Most contain crushed sand temper (FG1), but some were made from an untempered silty local clay. Coarse utilitarian ware sherds dominate throughout CP1-4. In CP1/2, they probably represent storage jars and in CP3/4 they represent containers. A few are decorated with cursively applied curvilinear incised lines, perhaps to denote ownership.

Bowl and jar rims, augmented by shallow ornamental platters, dominate the CP1 fine ware assemblage. Comparisons with CP2 vessels helped in assigning CP1 rim types. Some plain utilitarian bowls, 160–360 mm in diameter and 45–50 mm high, rest on a small, central circular "ring" base. They were shaped with a cord-wrapped paddle and then finished with a plain one. Their fine finish and precise shapes reflect skilled manufacture. Many were burnished. One exotic bowl includes grog and another shell-temper. The former is geologically non-specific. The latter

probably derives from a beach front or similar environment rather than the numerous sedimentary shell-bearing structures in the region. This extremely rare pottery, represented by a single rim, was probably the product of a maritime community familiar with shell temper.

Local highly-burnished platters feature intricately-incised rims with *Anadara* shell-impressed geometric or curvilinear fields. Reaching 200 mm wide, some platters have circular plates resting on 120-140 mm diameter ring bases. In others, slab-made floors were placed midway up the vessel wall. Most were fired in a reducing atmosphere to a deep dusky red lustrous colour. Oxidized firings are red. Red ochre was probably rubbed into the pot surface during the burnishing process to provide these colours. Red colourings aside, the same characteristics are present in deep, medium-sized, carinated jars, represented by RF5, a direct everted form. These jars, made from a semispherical base and a concave conical upper section, formed from slabs, were joined at the carination point, about two thirds below the rim. They comprise the largest local fine ware assemblage at the site. But exotic sources signal a wide regional distribution. Most were probably fired upside down in a reducing atmosphere to produce a dark burnished finish ranging from light to dark grey.

Only two fragmentary exotic pots were recovered. Both contain grog temper in a coarse sandy fabric, *prima facie* evidence that grog was used at other sites, but CP1 potters preferred sand. Both pots are burnished and decorated with incised lines and *Anadara* sp. shell impressions. One, Cat. 1955, was recovered from a small pit cut into the natural substrate. Unique to CP1, it features a flat base which was probably turned on a slow platform (Chapter VII).

Fourteen different vessel base forms, either attached or integral, were identified in the assemblage, five in CP1. Two mirror local MP2 funerary vessels. One is a high quality platter. This platter and another fine ware have both local and exotic versions. Two belong to CP2. A single coarse ware base is probably exotic. In total, three have both exotic and local expressions, one is uniquely local and another uniquely exotic. Two exotic bases contain FG10, material which is consistent with several outcrops along the CP1 coastline and small islands about 25 km to the south. One exotic fabric contains orthodox and another bleb grog, perhaps the earliest known in Asia, although bleb tempered pottery has recently been detected in early contexts from a South Vietnam site (Vincent *in prep.*).

At least 27 tripod vessel feet, all solid, were scattered throughout the sequence. They have been subdivided into five morphological groups: 1. pointed cones; 2. truncated cones; 3. rounded cones; 4. pointed ovoid cones; 5. dome shaped cones. The five found in CP1 are all local conical 1 solid forms and thus differ, as do the rest of the assemblage, from the much larger hollow Malaysian (Peacock 1959:121-56), and Ban Kao forms (Sørensen and Hatting 1967). Three are sand tempered and one is composed of FG2 from CP2. Two local tripod burial vessels were found in CP2. Some of the CP2 feet are almost certainly exotic.

Miscellaneous ceramic artefacts include pellets assumed to be ammunition for bows used to hunt birds and small game.

The CP1 local fine wares were expertly formed, finished and fired in carefully controlled atmospheres. Ornamental fine wares display incised, impressed, incised and impressed combination, cord-marked and incised on a smoothed band, paddle-impressed, ridged and notched, appliqué and burnished decoration. Burnished local vessels are common throughout the stratigraphic sequence. Most imported fine wares are also burnished and this indicates a regional

decorative style. In some, both the interior and exterior are burnished.

Exotic fine wares were probably imported from both coastal and inland sources. CP1 revealed 11 of 17 rim forms characterised for the entire site. Of nine local fine wares, six had imported counterparts. Six exotic fabric groups were identified in the CP1 pottery assemblage. Three are tempered with sand, one with shell, one with orthodox and one with bleb grog. No suggested source is given for the latter as it has been identified in hand specimen only. The presence of some CP2 grog-tempered sherds in CP1 contexts is probably the result of cemetery activites and posthole cutting during CP2.

Apart from local firing stands, firing temperatures have been assessed in hand specimen only. The stands were fired to at least 1050°C. But local pottery was fired to lower temperatures. The stands and associated ash spreads clearly indicate the remains of open raft firings. Ethnographic evidence and detailed SEM results from Ban Na Di suggest that the Khok Phanom Di pottery was fired to 800–950°C. Crushed pebble temper in the CP1 local pottery would reduce the effects of rapid temperature increases in open bonfires, but better control is possible in raft firings through the gradual addition of light fuels, such as straw. Rice remains were present in CP1 (Thompson 1996:157). Firing stands, ash, crushed pebble temper, friable and black-cored sherds (with unburnt residual carbon due to insufficient firing time), and variable surface colours all typify open firings. These are well known ethnographically and have been tested in experiments by archaeologists (Gibson and Woods 1990, as cited by Varndell and Freestone 1997). Bonfires typically reach about 800°C within 30 minutes. They may last for less than one hour leaving little trace. The depth and extent of the fine CP1 ash lensing suggest repeated firings of greater duration, a characteristic of raft firings which can last for 2 to 3 hours (Vincent 1988).

CERAMIC PERIOD 1: DISCUSSION

We will conclude this examination of the CP1 ceramic spectrum by asking two important questions. First, is it possible to establish unequivocally that CP1 is distinct from later ceramic traditions at Khok Phanom Di? If this is a different tradition does it represent a culturally distinct occupation of Khok Phanom Di and what does this imply? Second, is it possible to place this tradition into a regional context? This latter question will be addressed in detail in the final chapter in terms of the further Asian region. At this point, however, we can attempt to bring into focus relationships with the nearer region through a consideration of exotic pottery and comparison of the local cultural sequence with that of nearby Nong Nor. Neolithic sites in and adjacent to the Central Plain such as Ban Kao (Sørensen 1972) and Tha Kae (Rispoli 1990), have similar pottery styles to some CP1 wares. Similar forms are also present in Malaysian sites (Leong 1990, 1991, Soon 1997).

Pottery was produced from the outset at Khok Phanom Di and was clearly important to the community. Its quality reflects a detailed knowledge of the craft, but a lack of local resources meant that imported pebbles needed to be processed for temper. This extra expenditure of energy would fit well with existing transport systems which accessed exchange networks. It would require planning and knowledge of regional resources. An inability to manufacture grog temper, which would obviate the need to import the pebbles, typifies early potting techniques throughout

Thailand and Southeast Asia. Natural deposits of sand, particularly abundant along coasts and shorelines, are widespread and normally readily obtainable. It is a technically reliable nonplastic, well suited to producing earthenwares of the kind under consideration here. There is no technological reason for sand to be substituted by another temper. It is unlikely that, even if importing pebbles required considerable energy expenditure, the CP1 potters would change to another form of temper as this would put at risk the entire ceramic process. In any case, given that the site was located close to waterways, deposits of sand are likely to have been located nearby. The use of crushed pebbles for temper, therefore, suggests that they could readily be incorporated into existing activities, such as the use of boats for exchange expeditions where ballast was an advantage, for example when traversing open coastal waters. Rough water requiring stable boats is more likely to be encountered on coastal rather than river routes. Crucially, none of the subsequent ceramic traditions at Khok Phanom Di feature sand as temper.

Anvil and firing stand fabrics and forms differ from later local types. Ceramic stands are present in CP1 and 2, but the latter differ from the earlier sample. The former have flat rather than concave bases and are less carefully finished. Vessel forms also differ from the later assemblages. One vessel base and several rim variants only occur in CP1. Although some CP1 forms are unique, the degree of form elaboration is minimal at only 6.08 per cent compared to 22.86 per cent, 33.85 per cent and 36.42 per cent for CP2, 3 and 4 respectively. These figures could be interpreted in different ways. For example, they could suggest that CP1 and CP2 belong to the same tradition and only a limited number of forms were produced initially because the pottery was in its infancy. This seems unlikely, however, because some forms are unique to each CP. Further, the initial CP2 form elaboration was low. This is typical at the inauguration of a new tradition. The technological change from sand to grog temper in CP2, when combined with changes in vessel morphology, is definitive. Alternatively the figures could indicate that the site was occupied briefly and then abandoned to be re-settled by another group with a different ceramic tradition at a later date. The latter interpretation is promoted in this report. We can now examine the non-ceramic evidence at the site and assess whether it is possible to either corroborate or reject this proposal.

According to Mason (1996:253), micromolluscs "strongly suggest" that Khok Phanom Di was surrounded by mangal. High Late Holocene sea levels and gypsum efflorescence on basal sherds indicate that, when founded, the site probably lay just above the high tide mark. Botanical evidence also supports the notion that sea levels had been high prior to settlement. Dense deposits of charcoal in layer 11 from mangal species have been documented by Thompson (1996:66), who speculates that these may derive from dessicated stands "stranded above the high water mark after change in the local hydrology." Two caches with adzes in basal layer 11 point to tree felling for site clearance. During CP1 and CP2 charcoal is present in significantly greater amounts than elsewhere in the site and in layer 10:26 an unusual burning which left large heavy chunks of charcoal has encouraged Thompson (1996:69) to suggest that a second burn-off associated with a re-occupation of the site may have occurred. Three adzes, suited to forest clearance, are again present in layer 10:25 and one is present in 10:24. Correlated with these environmental events is a change from mundane occupation uses to mortuary activities in this part of the site. This new cemetery use continued for about 500 years and dominated the sequence through seven Mortuary Phases.

Burials 153 and 154 (MP1) are cut from ash and shell lenses. According to the excavators the former was interred after "17 cm of cultural material had built up" (Higham and Bannanurag 1990:143). The grave cut and contents of B153, the lowest identified, were encountered at 6.51 m below datum. Thus it was probably cut from about 6.09 m below datum, or 71 cm above the natural ground surface. The excavators note that the basal layers "comprised a complex and variable series of lenses, some of which reflect human activity and others natural deposition, probably by water."

Layer 10 comprised "a complex and at times quite bewildering series of interlocking lenses" principally of ash and shells. The lowest unit contained a series of shell, ash and charcoal lenses and a hearth. Above this were a series of well defined ash and charcoal spreads, burnt clay patches and a hearth. Layer 10:24 also comprised extensive ash and charcoal lenses one of which was cut into by B152. None of these burials contained pottery. Stratigraphically these burials appear to belong to CP1, however, if the site was cleared, briefly occupied and then abandoned, weather induced deflation could account for this apparent anomaly. The 1985 excavation was located over what was probably the highest point in the underlying natural ground surface. Given acceptance of the above interpretation, it implies that Khok Phanom Di was initially occupied on a mound or an island close to a riverine/estuarine environment. Such sites have been reported from within the mangrove swamps of Pulau Kelumpang in Malaysia (Nik Hassan Shumaimi bin Nik Abdul Rahman 1991:141-52). The CP1 settlement appears to have been interrupted by fluctuating sea levels which forced site abandonment. The timing of these events is important because the available radiocarbon dates suggest that Khok Phanom Di was first occupied later than Nong Nor Phase One (Ph. 1).

Stylistically and technically CP1 local wares suggest a close association with nearby Nong Nor during its initial occupation phase. Nong Nor is one of several small estuarine sites occupied during peak Late Holocene shoreline transgression, when Khok Phanom Di is considered to have been either an island (Boyd 1998:82), or first settled later than Nong Nor Ph.1. Given that dividing the sequence into discrete CPs is valid, only three radiocarbon dates apply to CP1. Overall, those radiocarbon determinations considered too early or too late with respect to the rest of the sample have been rejected, a prudent strategy given the method's occasional vagueness (Anderson 1991), while others were too small for valid laboratory analysis (see Chapter IV and Spriggs 1989, Anderson 1991, Spriggs and Anderson 1993).

There are three radiocarbon dates from CP1 and six for Nong Nor Ph. 1. Following Spriggs and Anderson (1993:207-8), protocols for acceptance or rejection of dates note that samples taken from "old wood", that is charcoal from comparatively long-lived species, can be several centuries older than the cultural event they are intended to date (Anderson 1991:780-81). To the writer's knowledge the species from which the charcoal from either site were radiocarbon dated are not available, therefore the dates could be either older or younger than the cultural event. Radiocarbon results are considered questionable where "the oldest date is more than 2 sd adrift of the next date in a sequence otherwise overlapping at 2 sd" (Spriggs and Anderson 1993:208).

At Khok Phanom Di, sample ANU-5490 gives a calibrated date of 2450-1905 BC for charcoal from layer 10:25, ANU-5492 a calibrated date of 2120-1525 BC for hearth 27 from layer 10:25 and ANU-5493 gives a calibrated date of 2130-1700 BC for hearth 1 from layer 11:2 (Higham and Bannanurag 1990:23). These dates overlap at 2 sd and are therefore acceptable. Under the

proposed ceramic sequence only ANU-5493 (L11:2), relates to CP1. The upper layer 10:25 dates, therefore, relate to CP2. Several inversions are apparent in the Khok Phanom Di radiocarbon dates (Higham and Bannanurag 1990:23, Table 1). To these variables we need to add the relative isolation of the Nong Nor and Khok Phanom Di radiocarbon sequences. At present they are the only radiocarbon dates available for the Bang Pakong Valley region derived from archaeological contexts. Whether the radiocarbon dates accurately reflect the region's chronology, or whether they should be regarded as preliminary, is outside the scope of this report.

The CP1 spectrum at Khok Phanom Di is a local expression of a regional tradition. Many of the local ware forms were produced at other Bang Pakong Valley potting sites. Although ceramic research in this region is in its initial stages, preliminary data from Nong Nor Ph. 1 clearly demonstrates that pottery was locally made at this site also. Here the vessel forms are a different expression of the same regional tradition detailed for CP1 at Khok Phanom Di (see Chapter IX and Glossary for a definition of regional traditions). Local expressions of regional ceramic traditions can be identified through variations in pottery forms. Pottery is well suited to establishing contemporaneity compared to other artefacts because it displays highly variable features and is richly developed (Shepard 1971:347). Variations in raw material properties, such as vessel colour, are less likely to provide distinctive variation as are specialized techniques which are restrictive in occurrence. The more specialized, the more weight the technique carries in comparative studies (Shepard 1971:348). We can, therefore, test the composition of the assemblage at the proposed interface between CP1 and CP2 for the presence of distinguishing forms. In terms of the groups established for the previously discussed Khok Phanom Di assemblage these are defined as forms, categories and variants. Table 137 details the distributions of these groups drawn from the rim form database in Appendix 2. Rim forms are diagnostic of the number and kinds of vessels in a ceramic assemblage. In the table, where only a single sherd was recovered from one level, but more were present in the other CP, the form has been assigned to the CP with the greatest representation.

As the rim form distributions show (Appendix 2), many more categories are present in CP1. Further, over 80 per cent of the categories are unique to CP1 and over 94 per cent are unique to CP2. A similar situation pertains to variants with 66.66 per cent and 77.77 per cent being unique in CP1 and CP2 respectively. These data show that, while the number and kinds of vessel forms are the same, their categories and variants differ. This mutual distinctiveness is magnified and further sharpened by the highly specialized decorative treatments involved. Virtually identical vessel forms have been decorated and finished differently. This alone is sufficient to characterise these assemblages as different expressions of the same regional ceramic tradition. One further important point is the degree of elaboration displayed in each tradition. Again adding the number of categories and variants together and dividing the resultant by the number of forms gives CP1 an elaboration factor of 2.67, however, basal CP2 has a factor of only 2.00. Design and decoration complexity can normally be anticipated to increase over time. Such a reversal further reinforces the evidence for cultural change, particularly when it is associated with different decorative techniques.

Temporal increases in pottery style elaboration are predictable, given stable environmental and socio-economic conditions. Decoration will gradually become more complex. At Khok Phanom Di, this trend is confirmed by rim form data for the complete ceramic assemblage. Environmental

TABLE 137: *Pottery form variations for Ceramic Periods 1 and 2*

Period	Form	Category	Variant	Period	Form	Category	Variant
CP1	1	-	-	CP2	1	-	-
CP1	2	-	-	CP2	-	1b	-
CP1	-	2b	-	10:23	-	1c	-
CP1	3	-	-	CP2	2	-	-
CP1	-	3a	-	10:25	-	2a	-
CP1	-	-	3a(iv)	10:25	-	2c	-
CP1	-	-	3c(iii)	CP2	3	-	-
CP1	-	3i	-	CP2	-	-	3a(iii)
CP1	4	-	-	10:25	-	-	3b(ii)
CP1	-	4a	-	10:22	-	-	3c(iii)
CP1	-	4b	-	CP2	-	3f	-
CP1	-	4c	-	10:25	-	-	3f(i)
CP1	5	-	-	CP2	4	-	-
CP1	-	5a	-	10:22	-	4AZ	-
CP1	-	5b	-	CP2	5	-	-
CP1	-	5c	-	10:25	-	5w	-
CP1	-	-	5c(i)	CP2	6	-	-
CP1	-	-	5c(ii)	10:25	-	6a	-
CP1	-	5d	-	CP2	-	6b	-
CP1	-	5e	-	CP2	-	-	6b(i)
CP1	-	5f	-	10:25	-	-	6b(ii)
CP1	-	5h	-	CP2	-	-	6b(iii)
CP1	-	5i	-	CP2	-	6f	-
CP1	-	-	5j(b)	CP2	7	-	-
CP1	-	6a	-	10:25	-	7a	-
CP1	-	6b	-	10:25	-	-	7a(i)
CP1	-	-	6b(ii)	CP2	8	-	-
CP1	-	6c	-	CP2	9	-	-
CP1	-	6d	-	CP2	10	-	-
CP1	-	6e	-	CP2	-	10e	-
CP1	7	-	-	CP2	-	11a	-
CP1	8	-	-	CP2	12	-	-
CP1	-	8a	-	10:25	-	13a	-
CP1	9	-	-	10:25	-	-	13a(i)
CP1	10	10a, b	-				
CP1	11	11a	-				
CP1	12	-	-				
Unique:		21	4			16	7

interruptions apart, local conditions appear to have been conducive to the evolution of pottery production. This relative stability is also reflected in mortuary and physical data (Higham and Bannanurag 1990, 1991, 1993 and Thompson 1996). The combined elaboration factors for CP1 and CP2 give a value of 28.94 per cent, for CP3 33.85 per cent and CP4 36.42 per cent. This confirms that, given stable conditions, regional styles tend to become more complex with time. At the interface between CP1 and CP2, however, elaboration in both assemblages *reduced*. This complexity reduction marks their mutual boundary. Unique vessel styles and different pottery types characterise each CP. Their similarities stem from regional pottery styles. Each is a different expression of the same regional tradition. The CP2 tradition was probably established by a new group whose potters commenced activities after the site appears to have been vacated at the cessation of CP1.

On the basis of the above evidence two different occupations of Khok Phanom Di are proposed, separated by a very brief hiatus, about or just prior to 2000 BC. The first occupation probably took place during or just following the period the Nong Nor Ph. 1 midden was deposited. Thus it is proposed here that Khok Phanom Di and Nong Nor were briefly occupied, in archaeological terms, contemporaneously. Aspects of CP1 and Nong Nor Ph.1 evidence are discussed in the following section. Although it may be possible to interpret the stratigraphic data in more than one way, the ceramic evidence is compelling. Clearly there are similarities and differences between CP1 and CP2 at Khok Phanom Di. The ceramic traditions are similar stylistically because they represent local expressions of what are regional styles. But the differences represent major technological and stylistic variations not easily explained by environmental demands or technical circumstances beyond the control of obviously experienced potters.

CERAMIC PERIOD 1 AND RELATIONSHIPS WITH OTHER SITES

During CP1, Khok Phanom Di was located on or near the coast. Several sherds from the basal deposits are encrusted with gypsum efflorescence which indicates that the sea water was close to the natural ground surface. Marine species dominate the early faunal spectrum (Grant and Higham 1991, Mason 1991) indicating that subsistence was partly dependent on marine activities. The shell fish spectrum is dominated by species from a muddy estuarine habitat, and mangrove sea front species are also abundant Mason (1994).

In CP1 imported pebbles of weathered rock fragments, from a distant metamorphic source, were laboriously crushed for temper. This suggests a traditional method, because alternatives, such as grog tempering, would have proven less arduous. A consistently reliable supply of materials is essential to economic potting (Arnold 1985). Natural deposits of sand from waterways and sedimentary outcrops are the most abundant nonplastic material available. Sedimentary rocks are estimated to cover between 66–80 per cent of the earth's crust (Press and Siever 1974, Folk 1980, Tucker 1981). Throughout Asia sand was likely the preferred temper of most early potters (Vincent 1984, 1985, 1987, 1988, 1991, 1998).

The CP1 potters probably had a long tradition of tempering with sand. Although coastal, riverine and/or estuarine habitats normally contain sand deposits (Tucker 1981:70-1), suitable sand may have been lacking in the local deltaic sediments. Delta sequences usually also include

muds derived from fluctuating shorelines (Tucker 1981:68). Khok Phanom Di is surrounded by a series of clay deposits (Chapter V, this volume). If the CP1 population was accustomed to estuarine habitats they may have reasonably predicted that sand would be available for tempering pottery. We can speculate that pottery making was important enough for them to take considerable effort in securing suitable materials from beyond the site, but that it was not the most important aspect of their choice of this site for habitation. It implies that the community was adapted to an estuarine/coastal subsistence and lifestyle. Pottery making was an important, but not critical, aspect of their economy. A reluctance, or inability, to substitute another material alludes to technological conservatism for which craft potters are noted.

TABLE 138: *Exotic and local rim form fabrics: Ceramic Period 1*

Form	Local fabric groups	Exotic fabric groups	No.	Form	Local fabric groups	Exotic fabric groups	No.
1	1 and fishpond	-	-	8	1 and 2	blebs	1
2	1 and fishpond	-	-	9	1	-	-
3	1 and 2	6, 7	2	10	1	10	2
4	1 and 2	-	-	11	1 and 2	10	1
5	1 and 2	8 and 9	2	12	1	-	-
6	1 and 3	8	1	13	1	-	-
7	1 and 2	-	-				

Sand temper and an emphasis on *Anadara* shell decoration suggest a community with a long standing link with coastal environments. The origins of such traditions may be revealed through an examination of regional type distributions (Table 138). These may reflect simultaneous "ceramic horizons" through the appearance of new types. Comparisons of pottery from sites in similar coastal locations could thus help in understanding the origins of this pottery tradition. Three other sites are known during this period in Central Thailand. All are Neolithic.

Pottery styles from the Bang site at Ban Kao have parallels with forms from peninsular Thailand and Malaysia (Peacock 1959, Leong 1990, 1991). Among these are vessels with large hollow tripod legs and carinated vessels similar in form to the Khok Phanom Di local wares (for example compare Sørensen and Hatting 1967, plate 103: Type 14 (h and i) with KPD CP2/3 carinated vessels). Some carry incised lines and "dentate tool (comb)" impressions (Sørensen and Hatting 1967:138 (footnote 209)). As only 11 of 215 Ban Kao burial vessels are decorated, however, these elements are extremely rare and may simply represent a style copied from exotic wares. Dr. Sørensen kindly provided representative samples of the Bang site sherds for petrographic analysis. Three of four tempered with coarse sand are consistent with the local geology. One is exotic. It contains material which outcrops in several places from 20 km to 75 km from Ban Kao.

According to Bronson and Natapintu (1988:91-106) pottery at Don Noi, 65 km to the north, differs from Ban Kao wares. Their fabrics have not been examined by the writer and no further comment is possible. Phase One pottery at Non Pa Wai, in the Khao Wong Prachan Valley,

has incised and shell-impressed fields similar to Khok Phanom Di wares. Pottery decorated with *Anadara* shell edge impressions is also reported from nearby Tha Kae, Lopburi, during the mid-2nd millennium BC (Rispoli 1990:129-42). Also present is a black incised ware with *Anadara sp.* shell-impressed fields. This has been compared with pottery from a broad range of sites within Thailand, Cambodia and Viet Nam (Rispoli 1992:129-32). Others note similarities with Non Pa Wai, Khok Charoen, Non Nok Tha, Samrong Sen and Ban Chiang wares (e.g. Higham 1996b:274-5). This similarity in decorative techniques and forms is interesting. While some researchers might consider that this reflects the movement of people, there are alternative explanations. For example, the wares could be local copies of exotic styles, regional expressions of fashionable wares, or the pottery could have been imported. The Khok Phanom Di evidence clearly demonstrates that, unless such novel exotic techniques comprise a major portion of the assemblage, they are most likely to be copies of exotic pottery.

Five exotic fabrics have been identified in secure CP1 contexts (Table 138 and Appendix 1). FG8 is excluded because it probably represents sherds displaced in prehistory. One tempered with blebs (which includes rice), is geologically non-specific. Three are associated with coastal (FG6, 7 and 10) and FG9 with an inland source.

NONG NOR PHASE 1

Nong Nor lies 14 km to the southeast of Khok Phanom Di (KPD). Phase One (Ph1) comprises a shell midden interspersed with ash lenses, hearths and burnt soils. Shellfish suggest mangrove and coastal subsistence. Artefacts include anvils, burnishing stones and bone tools suited to incising pottery. The ceramic spectrum closely parallels CP1 at KPD (O'Reilly 1995:122). Nong Nor Ph1 has been radiocarbon dated to about 2450 BC (Higham 1996b:249, 260), although accuracy of the AMS dates has been left open (Higham 1996b:246). In terms of these determinations, therefore, it predates the initial occupation of KPD by approximately 450 years. Higham and Thosarat (1994a:12), consider that "early Nong Nor is the only third millennium BC coastal site known on a former shore of the Gulf of Siam."

According to O'Reilly (1995, 1998b) the site was probably initially occupied by a mobile hunter gatherer group. But Higham (pers. comm.) says the group was "sedentary for at least a season". Mudar (2000:199), questions whether occupation by foragers would support the heavy investment needed for pottery production. The Nong Nor Ph. 1 material culture closely parallels CP1 at KPD (O'Reilly 1995:108-21). Bone one-piece fish-hooks and awls, 2G adzes, grindstones, whetstones, stone flakes, stone pounders and burnishing stones are virtually identical at each site. Both sites occupied similar coastal environments with abundant marine fauna. Their ceramic spectra are identical in many respects. In hand specimen the most abundant Nong Nor Ph.1 and CP1 wares at KPD are identical. The only artefacts not found at both sites, during the period in question, were net weights O'Reilly (1995:142). One seated, flexed posture burial was uncovered, but the domestic dog was absent (Higham 1996b:251).

Excavated Nong Nor Ph1 sherds (over 39,000, weighing 184.3 kg), were separated into rim and base forms as well as plain, cord-marked and surface decorated categories (O'Reilly 1995:19). The latter comprised dentate, painted, slipped, burnished, and shell-impressed wares.

These were compared with the KPD assemblage by O'Reilly (*op. cit.* 1995). The Nong Nor Ph.1 rim forms have also been examined in hand specimen by the present author. The most abundant CP1 rim at KPD (RF1) (Fig. 42), is virtually identical in all respects to rim 1.8A.10 at Nong Nor. At least seven further forms closely parallel RF2, 3, 4, 4a, 5, 6 and 6b at Khok Phanom Di. The matching of rim forms at both sites is crucial evidence, because rims reflect vessel forms, and by extension, cultural styles. Rim forms 1.8A.10 and 1.5.13 at Nong Nor are identical to RF1 and 2 respectively at KPD. The latter is described by O'Reilly (1995:115) as "so similar that it could come from the same vessel," while eight rims "matched without question" and four are similar. This means that coarse and fine wares from both sites match so closely that they could have been made at the same production centre.

Several Nong Nor pot motifs match KPD motifs, for example Hall's (1989) motifs 1:1, 1:6, 3:1. Another motif (3:30) is almost identical. In addition, according to O'Reilly (1995:116-17), "three design motifs which unquestionably link Nong Nor and Khok Phanom Di" are "concentric rings, curvilinear incisions with stamping and dentate pattern bounded by two incised lines." Potting tools, including anvils, burnishing stones and bone stylus points are virtually identical at both sites. Both sites also contained carinated pots, vessels with similar bases and tripod pot feet. Distinctive fine ware platters (represented by rim form 2.6B.10 at Nong Nor and RF4a at KPD), had a short lifespan at both sites (Chapter VIII). Bowls virtually identical to a Nong Nor vessel (cat. 110) are concentrated in CP1 at KPD. Tripod feet are identical at both sites (see conical form 1, restricted to CP1 at KPD) and both are tempered with sand.

A sample of Nong Nor Ph.1 sherds kindly provided by Professor Higham has been examined with a low powered binocular microscope by the author. At least three different fabrics, all sand tempered, were noted. It is important to note that incidental rice husk was present in RF1 and RF5 sherds. Although the exact stratigraphic contexts are unclear, the RF1 sherd (i.e. rim form 1.8A.10) is conclusive because these forms are restricted to Nong Nor Ph. 1. The concordance of anvil and vessel fabrics with a broad range of rim forms clearly signals that the Nong Nor fabrics are readily understood in terms of the KPD CP1 assemblage.

The ceramic assemblages of CP1 at KPD and Nong Nor Ph. 1 are close enough to verify that they belonged to the same contemporary regional potting tradition. Both ceramic spectra have almost identical technologies and styles. Given that variations in hand-formed pottery are due to inherent imprecisions in the method, even when the same potter attempts to produce identical vessels, the matching of Nong Nor Ph. 1 with Khok Phanom Di CP1 pottery is outstanding. The potting methods and tools are the same, the pottery forms, including decoration, are the same, and the ceramic materials match. Clearly we are dealing with the same potting tradition, and possibly, in some cases, the same potters:

> "The closest parallel from NN could come from the hands of the same potter." (O'Reilly 1994:147).

Consistency between the two ceramic spectra is corroborated by other material culture. Stone grinders, whetstones and pounders are a similar shape "and were, in all likelihood, used in the same capacity", while type 2G was the most common adze form at KPD during CP1. Further, the bone awls were "nearly identical" ... "exhibiting similar wear patterns and polish" (O'Reilly

1995: 117-18, 121). Worked bone distributions and an unchanged Ph. 1 ceramic spectrum led O'Reilly (1995:90, 94) to suggest a short occupation period. Potting is technically complex and without stimulus vessel forms, fashionable styles apart, usually endure unchanged. Functional requirements can stimulate changes in utilitarian wares, but, small adjustments aside, these will usually be resisted unless they confer benefits. The continuity of RF1 and 2 at KPD confirms their tendency to endure unaltered (see Chapters VII–X). When changes occur, they are often correlated with significant cultural change. O'Reilly's point, therefore, is well made. The CP1 utilitarian *forms* at KPD remained unchanged for at least 200 years and changed just once in 500 years. But significantly their fabrics changed three times during the 500 year period. This suggests that utilitarian *types* had a lifespan of about 100 years. Forms endured longer. At Nong Nor, Ph. 1 utilitarian ware types would need to have continued unchanged, *in any respect*, for about 500 years to accommodate the variation in radiocarbon dates between the two sites. The presence of utilitarian and highly distinctive fine wares in both assemblages confirms the non-ceramic evidence discussed above.

If both sites were occupied more-or-less simultaneously, four apparent differences need to be reconciled:

1. the absence of human burials in CP1 at KPD
2. the absence of the domestic dog in CP1 at KPD
3. the absence of rice at Nong Nor during Ph. 1
4. variations in the radiocarbon chronologies

The following explanations may warrant consideration:

1. A single "seated flexed posture" burial was uncovered from Nong Nor Ph1 (Higham 1996b:251). None were associated with CP1 contexts at KPD which only yielded occupation remains. This suggests that any CP1 burials would have been located outside the small excavated area. But B150 at KPD, the earliest, was "buried in a crouched position in a shallow grave" (Tayles 1997:338).

2. Although "very unlikely" (Higham pers. comm.), it is possible that domesticated dog was present at KPD during CP1 because a humerus fragment was recovered from L10:16 (Grant and Higham 1991:152, 154, West 1991:204, 334). Given numerous prehistoric disturbances in L10, it could have been dislocated from CP1 contexts.

3. Rice remains were present throughout the KPD sequence except for the uppermost layer (Thompson 1996:157). Rice was not detected at Nong Nor, apart from the incidental husk in the sherd mentioned above. To resolve whether more rice was present requires a detailed petrographic examination of the Nong Nor Ph. 1 local pottery fabrics. Its absence from the midden matrix suggests that either it was not locally exploited, or not present at the site. The latter possibility is extremely unlikely given the areal extent of the excavations (405m^2, Higham and Thosarat 1998a:12) and the use of flotation methods to detect rice (Higham and Lu 1998:873). Its presence in pottery could mean that it was imported.

4. The radiocarbon dates are open to question. Charcoal samples were not speciated, there are few determinations, and the practice of rejecting dates which do not fit an "ideal" sequence needs clarification. Failure to speciate charcoal increases the chances that "old wood" is involved and the dates may relate to events several centuries earlier. If mangrove species are involved datable growth rings are absent, and, although their age is very difficult to determine, they are suspected to live for a long time (Tomlinson 1986:19, 23). The KPD determinations are probably from mangrove species charcoal (Thompson 1996). AMS dates for the Nong Nor estuary have recently been determined, (Higham pers. comm.), but these may also be too early given the difficulties experienced elsewhere (Bellwood, *op. cit.,* Glover 1990:155).

Three of the six Nong Nor Ph. 1 dates are from hearths below midden deposits and two from "charcoal impregnated in the surface of natural immediately underlying the shell midden interpreted by the excavators as the result of burnoff at initial occupation" (Higham and Hogg 1998:23), and one from shell from within the midden. Although "the pooled mean indicated occupation at about 2450 BC." (Higham and Thosarat 1998a:8), there are variations in the results. The calibrated ages vary about 300 years and the pooled mean includes results from two different kinds of deposits, hearths and charcoal impregnated in soil. It also excludes a much younger date from shell, the only sample taken from within the midden.

Of the four differences needing to be resolved, none conflict with the ceramic or other cultural evidence. The first three typify sampling problems common to archaeological excavations. The last is common to many radiocarbon chronologies (Anderson 1991:767-95, Buck *et al.* 1994:252-63, Hall 1997:863-74). Perhaps of most concern with the radiocarbon determinations is the lack of speciation and whether the charcoal is from twigs or large pieces of wood derived from outer or inner rings (Hall *op. cit*), or whether the basal samples include charcoal from mature forest trees of considerable age (Spriggs and Anderson 1993:207). On balance, the evidence strongly supports the hypothesis that both sites were occupied more-or-less contemporaneously by a group or groups of coastal dwellers who lacked agriculture, but had access to rice through exchange networks. Rice was detected in exotic sherds from layers 11:1, 10:26, 10:26 lens 31 and 10:25 at KPD, and became increasingly common in exotic wares during CP2.

CERAMIC PERIOD 2: SUMMARY

CP2 spanned the lower 2 m of a 5 m deep cemetery which overlay the occupation residues of CP1. Of seven MPs identified in the cemetery by the excavators, CP2 includes MPs 1, 2 and most of MP3. MP1 burials lacked vessels. MP2 contained 25 pots and MP3, 20. Some appear to have been ritually "killed" by the removal of their rims or bases in prehistory. There is a noticeable trend to more elaborate local pottery at the beginning of CP2. This is predictable when a new potting group establishes a different tradition. Pottery in the top 11 MP3 burials relates to CP3. This is confirmed by the presence of turtle artefacts among these burials, artefacts which are restricted to the upper half of the cemetery sequence. In addition, 13 vessels were recovered from non-mortuary contexts. The fabrics and styles of at least 10 of these are consistent with the CP2 tradition.

Ash, charcoal spreads, hearths, *Anadara* sp. shell middens and postholes, many in association

with burials, are prominent within CP2. Fire-hardened clay, sherds sealed by ash and shell-filled pits were also encountered. The principal cultural remains are human burials and funerary furniture, which in MP1 comprised unwoven *tapa* or asbestos and red ochre. In MP2 funerary furniture included a wooden coffin or bier, *tapa,* red ochre, a fish vertebra bangle, a *Rhinoceros* tooth, a polished stone adze, burnishing stones, shell ornaments, a bored canine tooth, a bone fish-hook, a pig scapula, ceramic vessels, bow pellets and prepared potting clay. MP3 burials included red ochre, *tapa* or asbestos fabric, shell beads, a fish-vertebra bangle, a turtle carapace ornament, *Nautilus* shell, worked animal tusk, a shark dorsal spine pendant, a polished stone chisel, burnishing stones, a miniature ceramic anvil and pottery vessels. Much pottery, anvils, firing stands and small, mainly isolated dumps of prepared local clays consistent with CP2 local pottery fabrics, were recovered. About 40 ceramic "bow" pellets and net weights were spread evenly throughout CP2. Burnishing stones, a whetstone, stone adze and granite hoes, small bone tools and fish-hooks were recovered from the general matrix. Charcoal from the middle of CP2 was radiocarbon dated to 2270-1740 BC. Very rich deposits of ash and charcoal lay just above this near rice chaff, shellfish, bone and some postholes.

Changes in external relationships are evident just below the CP2/3 boundary. The first slate artefact was found in B72. Immediately above this a leucogranitic hoe signalled another change in stone sources. Changes in site use also occurred. Firing stands reappeared along with whetstones, grinding stones, a pounder and anvils, one anvil probably displaying ownership marks. The final CP2 stratigraphic unit, L10:3, witnessed a marked decrease in cultural activity. Artefacts included three ceramic net weights, fragments of six anvils, three firing stands, burnishing and grinding stones and a stone tool. A hiatus in mortuary activity occurred in L10:2 at the CP2/3 boundary. Only one pit and postholes were evident. Pottery firings, indicating a reversion to mundane occupation activities, replaced burial rituals at this point.

Potters' equipment is prominent throughout CP2, including 197 burnishing stones, 53.5 per cent of the site total (21 in 11 of the 97 MP2 and MP3 burials, the remainder in the general matrix). They were present in female and male graves. Potting anvils (29 probably local, 3 displaced from CP1 in prehistory, 7 exotic) were distributed throughout CP2, one near a disturbed burial. A local CP2 anvil contained incidental rice, and one exotic anvil with a potter's mark features bleb grog, also with rice. Exotic anvils occur unevenly throughout CP2, which indicates an irregular arrival of immigrant potters. Their fabrics suggest at least three donor sources, one probably east of Khok Phanom Di. Three anvils display potters' ownership marks. Each is distinctive in design, method of application and location on the anvil. Marks on ceramic moulds from Non Pa Wai, a *c.* 1500-1000 BC metal working complex about 200 km north in the Khao Wong Prachan Valley, could also indicate ownership. Metal was not found in the 1985 Khok Phanom Di excavations. All anvils, except eight with cord marks, were plain. Bone incising tools closely follow the distribution of incised wares (Table 160, Fig. 296).

Seven ash-coated ceramic firing stand fragments were found in L10:3-5 among high concentrations of very large charcoal fragments. Their shapes and fabrics differ from the CP1 stands. Five are cord-marked, (CP1 stands are plain). Mangrove rhizophoraceae-type charcoals, consistently high throughout L11 to L8, declined rapidly within CP3 which suggests an environmental change.

Pottery firing adjacent to the CP2/3 boundary suggests a cultural dislocation. Local pottery

also changed. In CP3, shell "knives", mainly concentrated in L9, are considered by T. Higham (1993:205-9) to have probably been used *in situ* for reaping rice grass in a cutting motion. These artefacts encouraged C. Higham to argue for ricefields close to the site (Higham and Lu 1998:875). This is a marked departure from the coastal environment reflected in the CP2 botanical and molluscan evidence. The mineralogy and typology of stone tools also changed. Leucogranitic hoes first appeared in L10:3 lens 2 and thereafter are confined to CP3 contexts (Pisnupong 1988:135-8, 1993:88-9). New sources were correlated with the introduction of a new lithic technology. Such changes would be critical for people reliant on stone tools for forest clearance, wood working and perhaps agriculture, although, as Thompson (1996) has argued, local cultivation of rice is extremely unlikely because of saline soils. The lithic changes coincided with environmental changes, reflected in the appearance of different botanical and faunal species. These are compelling correlations. Both botanical and faunal evidence indicate an unstable physical environment, and new lithic sources suggest that cultural changes were correlated with this development.

A hallmark of local CP2 fine wares is their dark, highly burnished, lustrous exterior surfaces, incised with geometric and curvilinear designs. The distributions of burnishing stones, burnished body sherds and burnished and incised sherds for the entire site are set out below (Fig. 295). The last reach a maximum in L10:12 and then gradually decrease to almost disappear in L10:1. Burnishing stones and burnished sherds follow a similar pattern.

Exotic burnished and incised body sherds include either sand, rice, orthodox or bleb grog tempers. Small numbers of exotic paddle-impressed body sherds occurred from L10:21 onwards (Appendix 3). They contain either sand, orthodox or bleb grog. Extremely rare slipped wares, with a distinctive bleb-tempered fabric, were probably imported from the Eastern Highlands. Exotic painted pottery contained either orthodox or bleb grog tempers and slipped wares either sand, orthodox or bleb grog. Such diversity demonstrates a regional distribution. The technical skills required for clay slipping were rare in South-East Asia during this period. Exotic punctate wares tempered with either rice, orthodox or bleb grog were also rare. A single rice-tempered sherd from L10:3 is coated with a red slip or paint. Very rare exotic sherds bearing applied bands and tempered with either sand or bleb grog were recovered from the lower portion of CP2. Local potters also employed punctations and applied clay bands, but they favoured shell-impressed designs for most fine wares.

Rim elaboration increased from 3.54 in CP1 to 10.26 in CP2. Rim forms increased from 13 to 15, categories from 35 to 96 and variants from 11 to 58. Elaboration is most marked in carinated burial jars and fineware bowls. Both forms range from rare cord-marked versions to highly burnished, some with quite intricate, possibly symbolic, decorations.

Coarse cord-marked globular jar rims (RF1), the most abundant, retained the same basic form of CP1 but their fabric changed to the CP2 species. Although often in graves, direct association with burials is uncertain, except to underline their ubiquity and relatively even distribution throughout CP2. Aside from minor form alterations, RF2 also continued in the same manner.

Carinated or waisted ornamental platters with highly-burnished surfaces and complex design fields are a feature of CP2 local wares. Some rim sherds carry similar motifs to two complete burial vessels. Their thin precise walls would be extremely difficult to fashion except for the most skilled potters. Outstanding skills are also apparent in fabric preparation, vessel shaping,

burnishing and decorating with intricate geometric fields of *Anadara* shell impressions.

Carinated burial jars form the majority of CP2 vessels by weight (total CP2 rims: *c.* 76 kg; coarse wares *c.* 38 kg; fine wares 37.78 kg (RF5 *c.* 50 per cent); 20 burials contained RF5 and 23 RF1), and are represented in eight of the nine CP2 exotic sources. They proliferated during CP2, with 65 of 109 variants at the site making their first appearance. Nearly all are burnished and decorated either with bands of two to 11 lines or striations, cord marks, incised chevron or triangular patterns, *Anadara* shell impressions and cross-hatched incised diagonal lines. Geometric, curvilinear and abstract motifs were also present. Exotic carinated jars included fan-shaped *Anadara* shell impressions, paddle impressions and geometric fields of probe marks. Almost 85 per cent were incised and/or shell impressed. Eight categories are common to both CP1 and CP2, five probably derive from CP3.

Several decorative modes represent regional styles. Many cut across different manufacturing methods and technologies. Pottery with similar decorative modes was produced simultaneously at many sites within the region under a variety of potting traditions, demonstrating that these traditions often shared the same styles.

Exotic carinated burial jar sherds were scattered over burials and amongst CP3 graves, which suggests an important role in mortuary rituals. Many were smashed and the sherds allowed to fall into the open grave. They may have been tributes, perhaps in their own right, or containers for food or other offerings. These skilfully made high energy wares required much care and expertise. Many were decorated with *Anadara* shell impressions, a regional style found on both exotic and local jars. At least nine different styles were exclusive to foreign sites. A broad range of exotic sources is represented by igneous, sedimentary or metamorphic minerals in fabrics tempered with either grog, rice or sand. They often contain incidental rice husk (probably included accidentally), which suggests that rice was exploited for subsistence.

Bowl varieties represented by RF6 increased from seven to 31. Three continue from CP1. Most are round, steep-sided, 180–360 mm wide, 4–12 mm thick and burnished. Attached ring bases are rare. Exotic bowls included paddle impressions, fields of deep probe marks or incised lines, *Anadara* shell impressions, pricked or punctate impressions, vertical striations, geometric and curvilinear impressed designs, or cord marks, and are tempered with grog, rice or sand. One is coated with a slip containing limestone.

Some minor rim types continue into CP2 from CP1. CP2 has 15 rim forms (two more than CP1), and eight are represented in exotic wares from nine sources. All exotic types are fine wares. Although selecting for variation will heavily bias in favour of exotic forms (Vincent 1988), only one lacks a local type which underlines the close links between local and regional style traditions. The typological evidence clearly signals that exotic pottery-producing sites were operating within, and influenced by, a regional ceramic stylistic tradition.

Tripod feet, both local and exotic, are most numerous in CP2 (70 per cent of the site total) and five vessel base forms continue from CP1. One local tripod-footed vessel was interred with B76 and another with B86. The exotic types were tempered with either sand, bleb grog or rice.

Vessel lids, all exotic, first appear in the upper levels of CP2.

Most local and exotic decorative modes, such as incising and *Anadara* shell impressing (including an exotic ware with a true ceramic slip), continued into CP2. This suggests that they belonged to a regional or sub-regional tradition. Five new modes were introduced. Two are

exotic, one of which has red paint, the other rice temper.

Intact, or reconstructed, vessels were recovered from mortuary and mundane contexts throughout CP2. Some vessel forms may convey symbolic meaning in themselves and many display what appear to be symbolic motifs. In addition, burial vessel combinations may also have had symbolic meaning. Many were deliberately ritually "killed" by the removal of the rim. None appear to have been completely smashed. Some were covered with red ochre, as was the corpse, perhaps to signify consignment to the "other world". The pristine condition of several local carinated burial jars (type L2b), suggests that they were purposely made for the burial ritual. Some appear to have been made in haste. Numerous fragments of burial jars were also scattered within the burial grounds.

No vessels were found in MP1 graves, but 23 from MP2 and 32 from MP3 burials have been analysed. Local MP2 burnished, incised and/or shell-impressed types, some with motifs, are common. Vessels include carinated burial jars (one exotic), bowls, platters, tall ring-footed carinated jars, a globular jar and miniatures. Miniatures were found with three MP2 infants but were restricted to male adult graves in MP3 (Chapter VIII).

Non-mortuary vessels include crudely-made rudimentary pots probably used to test their drying and firing responses. The quality of local wares clearly demonstrates that these were successful, as shrinkage cracks or firing fractures are generally absent. Full size or miniature bowls and jars were recovered. Most were either cord-marked or plain coarse wares. A few were high quality ornamental wares.

The MP3 local types are different. They include bowls, carinated burial jars, a platter and miniatures (one with tripod feet). Two exotic carinated burial jars (type E2b, one a miniature) from a single source were also recovered. The local wares are tempered with a sandy grog. Based on ceramic, cultural and environmental evidence, the 11 uppermost MP3 burials are here grouped with CP3 which overlies CP2. Local CP3 pottery differs from CP2 wares. Some similarities suggest that a new, but related, potting tradition replaced the CP2 tradition after a very brief interruption in the prehistoric sequence. Because burial jar motifs could signal clan or similar familial associations, changes in the upper CP2 burial jars could reflect the final phase of a familial group or the introduction of new ideas by immigrant potters. But local pottery fabrics and styles changed simultaneously in such a comprehensive manner (Chapter VIII-IX) that it seems more likely that a new population established a different, but related, potting tradition.

CERAMIC PERIOD 2: DISCUSSION

The status and social relationships of individuals are often perceived through a consideration of grave goods. Grave furniture can provide insights into individual wealth, although not necessarily so. Wealth has been defined as "the ownership of desirable transferable goods, is as much a social phenomenon as an economic one" (Renfrew 1972:370). If wealth in life does indeed correlate with grave goods, there was a wide variation between individuals in the CP2 cemetery. Those with potting tools are of particular interest. Of the 10 CP2 burials which clearly included burnishing stones, only four also contained funerary wares (Table 31, 64). The earliest, B110, a female, contained a vessel with triangular motifs and five burnishing stones. An infant, B123, was

interred with three vessels, two also with triangular motifs and one stone. Burial 91 contained two pristine undecorated carinated burial jars (one containing fish remains), a burnished shallow bowl with precisely arranged triple rim coronets, and a highly decorated platter. The fourth, B72, included a small highly-decorated ring base jar and two virtually identical carinated burial jars, both incised with two straight and one wavy line below the rim and an *Anadara* shell-impressed band above the carination point. Ethnographic evidence suggests that such motifs represent clan affiliations (May and Tuckson 1982). The only other vessel with this motif was recovered with B67, which lacked potting accoutrements. This motif, therefore, does not appear to signal a potting affiliation. The B67 grave cut, however, may have been disturbed (Higham and Bannanurag 1990:228, 230).

Skilful potters were active during CP2, yet graves lacked any pottery accoutrements other than burnishing stones and clay, although some possessed apparently precious fine wares. This suggests that while craft skills were not recognized in mortuary ritual, personal status was. Pottery was obviously produced in quantity, with 31 anvils and 197 burnishing stones recovered, yet only stones were clearly associated with burials. Why should this be? High quality local wares, which peaked mid-way through CP2, suggest that Khok Phanom Di was an important pottery production centre. Further, pottery imports reflect extensive external relationships.

Vessels first appear in B130, nearly 1 m above B154, the lowest in the cemetery. Within the next 50 cm 11 burials include 19 vessels $\bar{x}$ 1.72. In the overlying 40 cm, 12 burials included 28 vessels ($\bar{x}$ 2.33). The maximum, in B91, is four. This is relatively few compared to Non Nok Tha with 847 vessels in 217 burials ($\bar{x}$ 3.9), (Bayard 1984), and could suggest that exotic items carried greater value. Only four exotic vessels, one each in B86, B88, B120 and B123, are present. No other data are available for B86. Burial 88, an eight-month infant, is relatively rich with 690 disc and 16 barrel-shaped shell beads, three disc/bangles and two pots. A 21-year-old male (B120), contained 327 disc and 13 barrel-shaped shell beads, a rhinoceros tooth and two pots, one exotic. The local vessel displays a turtle motif. B123, a two-year-old infant, was interred with 120 disc-shaped shell beads, a burnishing stone (Table 139), and three miniature, probably quickly-made, pots. Two are elaborate.

Burials with potting equipment vary widely in richness. All were coated with red ochre. Three, B107, 110 and 132 were wrapped in *tapa* or asbestos cloth. Two, B94 and 109 were probably bound. An infant aged four years (B96), was seriously disturbed in prehistory and B83, a 30-year-old female, contained only two burnishing stones. The latter had suffered growth disruption episodes in infancy and exhibited "no evidence of particular physical activity" (Tayles 1999:332). Burnished and cord-marked sherds, a sambar deer jaw and a macaque femur were recovered with B107, a 40-year-old female who probably suffered chronic ill health (Tayles 1999:335). She was laid on a wooden bier. Remains of a burnished and incised vessel, a cord-marked and a ring foot vessel and one unusual pot were found in the very shallow grave of B110 (Chapter VIII). Rich graves include the outstanding B132, a 34-year-old male and B109, a 31-year-old female. The latter contained potting clay. Burial 94, a 31-year-old female, also revealed exotic carinated burial jar remains and local burnished and cord-marked sherds. Two pristine local, virtually identical, undecorated carinated burial jars (one containing fish bones), and two outstanding ornamental wares were found with B91. Additional local burnished and cord-marked sherds were also found with B91 and B123, a two-year-old infant. Burial 72 included the first

TABLE 139: *Analysis of "potters"' grave wealth in Ceramic Period 2: B: burial, Bu: burnishing stone, DB: shell disc beads, SB: short barrel-shaped shell beads, FB: funnel-shaped beads, PD: perforated shell disc, BS: barrel shell beads, AB: animal bone, CP: clay pellet, NW: net weight, CT: canine tooth, SC: stone chisel, NS: Nautilus shell, ST: shaped tusk, SP: shark pendant, V: ceramic vessels*

B	Sex	Age	Bu	DB	SB	FB	PD	BS	AB	CP	NW	CT	NS	ST	F	SP	V
72	M	32	3	330	-	-	-	-	-	-	-	-	1	1	1	1	3
83	F	30	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
91	M	45	2	1294	-	-	-	93	-	-	-	-	-	-	-	-	4
94	F	31	1	-	55	-	1	-	-	-	-	-	-	-	-	-	-
96	C	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
107	F	40	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-
109	F	31	2	1588	-	-	-	-	-	1	1	-	-	-	-	-	-
110	F	36	5	-	-	-	-	-	-	-	-	-	-	-	-	-	1
123	I	2	1	120	-	-	-	-	-	-	-	-	-	-	-	-	3
132	M	34	3	39000	11	5	-	-	-	-	-	1	-	-	-	-	-

slate artefact, an outstanding footed bowl, and two virtually identical local burial jars, along with cord-marked and burnished/incised sherds.

Mortuary furniture alone, however, may be an insufficient measure of burial ritual wealth. For example, posthole alignments, pits with food remains and burnt areas adjacent to graves all suggest mortuary offerings. Broken pottery was also found in direct association with several corpses. No anvils were found in CP2 graves, but 10 included burnishing stones, which may suggest that some CP2 individuals secured wealth as helpers rather than craft specialists. Present day potting often involves unskilled helpers who may quarry and prepare clay and/or decorate dried pots prior to firing them. In addition, male non-potters often trade wares made by females.

Banannurag (1989:325) ascribed points to grave goods on an arbitrary basis. Following this method, an extra 100 points has been allowed for each vessel found, plus another 100 points for exotic vessels (no allowance has been made for vessel quality or potting clay). This gives values for the "potters"' graves of: B72 (300 extra points) 1047; B83 40; B91 (200 extra points) 992; B94 (400 extra points) 575; B107 220; B109 (500 extra points) 860; B110 (400 extra points) 600 and B123 (200 extra points) 544. The lowest score is 40 (B83) and the highest 7956 (B132). Two, B83 and B107, were probably unhealthy and one is an infant. When these are excluded, only two fall just below the average score for the seven richest "non-potters" group (x = 763, Table 141). There are three males in the group. They are the richest.

Grave furniture was not restricted to individuals with potting accoutrements (Table 140), although 39 of 71 graves (55 per cent), lacked goods. Red ochre was apparent in 56 instances and *tapa* or asbestos in 15. Points for the wealthiest "non-potters" have also been adjusted. Their details are listed below:

- B73, a female in her mid twenties, contained two plain, quickly made, burial jars in pristine condition, the remains of an exotic burial jar as well as local burnished and cord-marked sherds.
- B88, a nine-month infant, included a crude exotic miniature burial jar and a local copy, and additional burnished sherds.
- B90, a 27 year old male, contained two local burial jars, one with two lines, the other with three straight and two wavy lines, and additional burnished, incised and cord-marked sherds.
- B102, a 35 year female, included a high quality platter, one utilitarian jar plus additional burnished and incised sherds.
- A miniature carinated burial jar and an ornamental jar displaying symbolic male and female motifs were found with B103, a 26 year old male. Local burnished and incised, cord-marked and plain sherds were also present.
- Exotic burnished and incised and local cord-marked sherds from two vessels were found with B120, a 21 year male. One of two carinated burial jars is exotic.
- The grave of B133, a three to four month infant, was slightly disturbed.

When disturbed, infant and unhealthy burials are excluded, the "potters"' group is comparatively wealthy. Although the values are arbitrary, a "potter" (B132) with three burnishing stones, but no pots, is the richest. His skeletal evidence suggests a vigorous life consistent with upper body use such as paddling canoes, but he may also have helped potters to burnish pottery.

TABLE 140: *Analysis of "non-potters"' grave wealth in Ceramic Period 2: B: burial, DB: shell disc beads, BS: barrel shell beads, FH: fish-hook, DB: disc bangle, RT: rhinoceros tooth, WS: worked shell, CS: cowrie shell, BB: bone bead, SO: snail ornament, DT: dog teeth, PB: sus scrofa bone, V: ceramic vessels, P: points*

B	Sex	Age	DB	BS	FH	DB	RT	WS	CS	BB	SO	DT	PB	V	P
73	F	25	1260	285	-	-	-	-	-	-	-	-	-	2	1037
88	I	9m	690	16	-	3	-	-	-	-	-	-	-	2	854
90	M	27	1500	37	-	-	-	-	-	-	-	-	-	3	837
102	F	35	-	-	1	-	-	1	-	-	-	16	1	2	500
103	M	26	59	56	-	-	-	1	-	-	-	-	-	2	668
120	M	21	327	13	-	-	1	-	-	-	-	-	-	2	579
133	I	3-4m	-	45	-	1	-	-	17	6	1	-	-	-	868

The range of wares produced, and their artistic and technical quality, all suggest that the CP2 potters were important community members. Setting aside sample skewing due to the limited area excavated and one anvil in doubtful association with B82, burnishing stones may have been included as grave goods because burnished wares were more highly valued. Only four of the ten "potters"' graves contained vessels, although B94, B96, B107 and B109 also included sherds which probably represent vessels dedicated during the mortuary rituals. If so, only B83, the poorest, and B132, the richest, lacked vessels. Yet both included burnishing stones. This could imply that potting *per se* was not highly esteemed but that access to trade networks was a key aspect of individual wealth. Thus while potting was important, access to trade and exchange may have been pre-eminent. Most potters were wealthy compared to others. But the richest individual may have participated in both potting and transporting goods by water.

Pottery and other grave goods imply that, of 71 burials, seven potters and seven non-potters were the most wealthy (Table 141). Allowances have been made for the quality of vessels (utilitarian and average quality wares 100 points, high quality fine wares 200 and exotic wares double these values). The mean score for non-potters is 988; for potters 1967. Infants, B88, B123 and B133, seem to have received endowed wealth, suggesting that some social groups were wealthier than others.

TABLE 141: *Ceramic Period 2 Potters' and Non-potters' grave wealth compared*

Non-potter			Grave				Potter			Grave			
Burial	Sex	Age	Sherds	Pots	Other	Points	Burial	Sex	Age	Sherds	Pots	Other	Points
73	F	25	500	200	537	1237	72	M	32	100	600	447	1147
87	F	24	600	-	174	774	91	M	45	200	800	592	1592
88	I	9m	100	300	454	854	94	F	31	400	-	175	575
90	M	27	300	600	337	1237	109	F	31	500	-	360	860
103	M	26	300	300	268	868	110	F	36	400	200	200	800
120	M	21	500	500	79	1079	123	I	2	100	600	44	744
133	I5m		-	-	868	868	132	M	34	100	-	7956	8056

A "non-potter" male in his mid twenties (B86), reported to have three vessels (one missing), has not been included. The two available pots are high quality; one had tripod feet (detached in prehistory), the other is exotic. Assuming the missing vessel was also of high quality, a score of 700 would apply, the highest "non-potter" score for pots.

Whether the CP2 potters can be defined as craft specialists requires detailed evidence of socio-economic relationships, both internal and external. As Costin (1991) has argued, sufficient demand, inexpensive transportation modes and unequal resource distributions are needed for specialization to develop. This aspect will be given a more detailed evaluation later.

CERAMIC PERIOD 2 AND RELATIONSHIPS WITH OTHER SITES

Exotic pottery is a useful index of trade and/or exchange relationships. It may also mark ties between close social groups such as clans and/or families linked by marriage alliances. At Khok Phanom Di, these may be signalled by carinated burial jars dedicated to mortuary rituals. Some jars were smashed, perhaps symbolically, during the ceremonies. Their origins could indicate the distribution of important socio-economic ties and help trace trade and exchange networks. A long tradition of coastal links is evident in the CP1 ceramic spectrum and faunal remains indicate that the site remained close to the coast during CP2. Sandy coast and marine molluscan species reached their maxima in lower and mid CP2 (Mason 1991:314). Ten distinctive CP2 exotic wares include three sources from secure CP1 contexts (FG6, 9 and 10). Only the former is suggested as a coastal source. Of the seven new sources (FG8, 11–16) two are coastal and five inland.

Four exotic mortuary vessels (cats. 1290, 2020, 1453 and 1620), originated from a single source with limestone, probably located in a sheltered embayment 45 km away on the south coast. Limestone also outcrops about 170 km further along the southern coast. Inland, it outcrops in the southeastern uplands about 55 km away and near the headwaters of the Prachinburi, a tributary of the Bang Pakong, about 80 km to the northeast as the crow flies (Fig. 288). According to Higham (1996b:256-7) shell formed an important exchange item and "men obtained shell locally from clean sandy and offshore coralline habitats. This involved much vigorous canoeing." Three of the four funerary pots are type 2b carinated burial jars. One of these, and a shallow bowl, are miniatures interred with infants. The other two, both full size, were placed in the graves of males in their twenties. B120, one of the seven richest non-potters, led an active life which emphasized his upper limbs. The upper body of B86 also reflects vigorous physical activity.

Carinated burial jar sherds recovered from B73, B94 and B120 included exotic wares tempered with either sand or bleb grog. Eight exotic sources, two considered to be coastal and six inland, are represented in broken carinated burial jar fragments recovered from the general matrix surrounding CP2 graves. Three of these exotic sources also produced ornamental bowls, small thin-walled jars, larger jars and carinated bowls or platters. One further inland exotic source contributed small bowls.

Five anvils are considered to be exotic. One with sand temper is difficult to assign, but an inland source close to metamorphic terrain, perhaps near the FG12 material, is likely. A bleb-tempered anvil with a potter's mark is consistent with FG11, which probably derives from about 100 km upstream in the Prachinburi River catchment (Fig. 288). One anvil contains orthodox grog but is geologically non-specific. Two tempered with sand could not be assigned to a specific source area with confidence. Three additional complete anvils, tempered with orthodox grog, may also be exotic. One anvil was found in the lowest quarter, two in the third and two in the upper quarter of CP2.

Exotic wares during CP2 reflect a broad range of regional technologies and locations. Their styles are relatively homogeneous, with striking similarities in many forms. In several instances only minor changes reveal intra-regional variations. Although the mineralogically distinctive exotic sources lie inland to the east, northeast, or along the south coast, geologically non-specific materials could readily be located within the Central Plains to the west or northwest.

Tripod wares tempered with bleb grog, rice or sand suggest a regional style with widespread distribution. To date, however, Nong Nor is the only contemporary site associated with tripod pot *feet*. A range of carinated vessels characterises Ban Kao pottery. This is the only similarity to CP2 local wares. Carinated vessels also occur at Non Nok Tha, Ban Na Di and Ban Chiang in the Khorat Plateau. They also occurred further afield, for example in Peru, Japan, Palestine, Iran, Switzerland, India and China. But this does not mean that they are related. The Ban Kao tripod vessel *legs* parallel Malaysian forms to the south, but the CP2 tripod feet are quite different. Solid pot feet are also widely spread. Burnishing, incising and shell impressing are common to several exotic potting traditions and this important aspect of comparative archaeology will be further examined in Chapter XII.

CERAMIC PERIOD 3: SUMMARY

The upper half of the cemetery (MP4–7), laid down after a brief hiatus within L5–10:2, represents CP3. It terminated with a major stratigraphic discontinuity marking the commencement of CP4, a potting workshop. Postholes, some cut into CP2, and pits continued throughout CP3. Ash (some mixed with shell), charcoal, areas of burning, burnt clay, small hearths, shellfish lenses and biological remains were interspersed between burials. Ceramic anvils, bow pellets and net weights, burnishing stones, stone adze heads and hoes, whetstones, shell, stone and turtle shell jewellery, shell knives and points, a bone awl, pierced mammal canines, a fish-hook and potting clays were recovered from some burials and/or the general matrix. MP4, in L8, marked a major episode of mortuary activity. Abundant charcoal and a very ashy matrix dotted with burnt red soil distinguished L7. It featured an outstandingly rich adult female, B15, adorned with masses of jewellery, and accompanied by many potting accoutrements, the most vessels in any burial, and a mound of broken potting clay cylinders. Nearby lay B16, an infant, similarly rich with grave furniture. Both graves were much larger than required for the corpse. Extensive, ash and shellfish middens accumulated just prior to the B15 interment and a large ash and charcoal lens partly covered it. Clay, anvils and burnishing stones were found with several burials but turtle artefacts were restricted to male graves, some of which were rich.

The principal artefacts recovered were ceramic anvils (some bearing potters' marks), ladles and net weights, burnishing stones, stone adze heads, ivory as well as turtle shell and stone jewellery, shell knives and bone stylus points, suited to incising pottery. A multi-layered rectangular clay floor, bounded by a low wall and large postholes, spanned L6:4–3. Adjacent burials were precisely aligned with the floor. Associated ash and shell lenses suggest ritual behaviour. Bow pellets, burnishing stones, a stone hoe and adze heads, bone, shell and stone jewellery, bone points and a shark tooth pendant were found in L6–5. CP3 burials were laid out in rows, in contrast to CP2. Nearly all were coated with red ochre. Several included *tapa* or asbestos fabric.

Pottery continued to be prominent funerary furniture, with potting tools and prepared clays, implying craft specialization, common. But vessel shapes and decorations, potting materials and techniques all differ from the CP2 tradition. Decorative motifs on some vessels may represent the insignia of discrete social groups. One could symbolize potters. Some outstandingly rich CP3 burials are associated with potting accoutrements; this, and changes in the the cemetery layout,

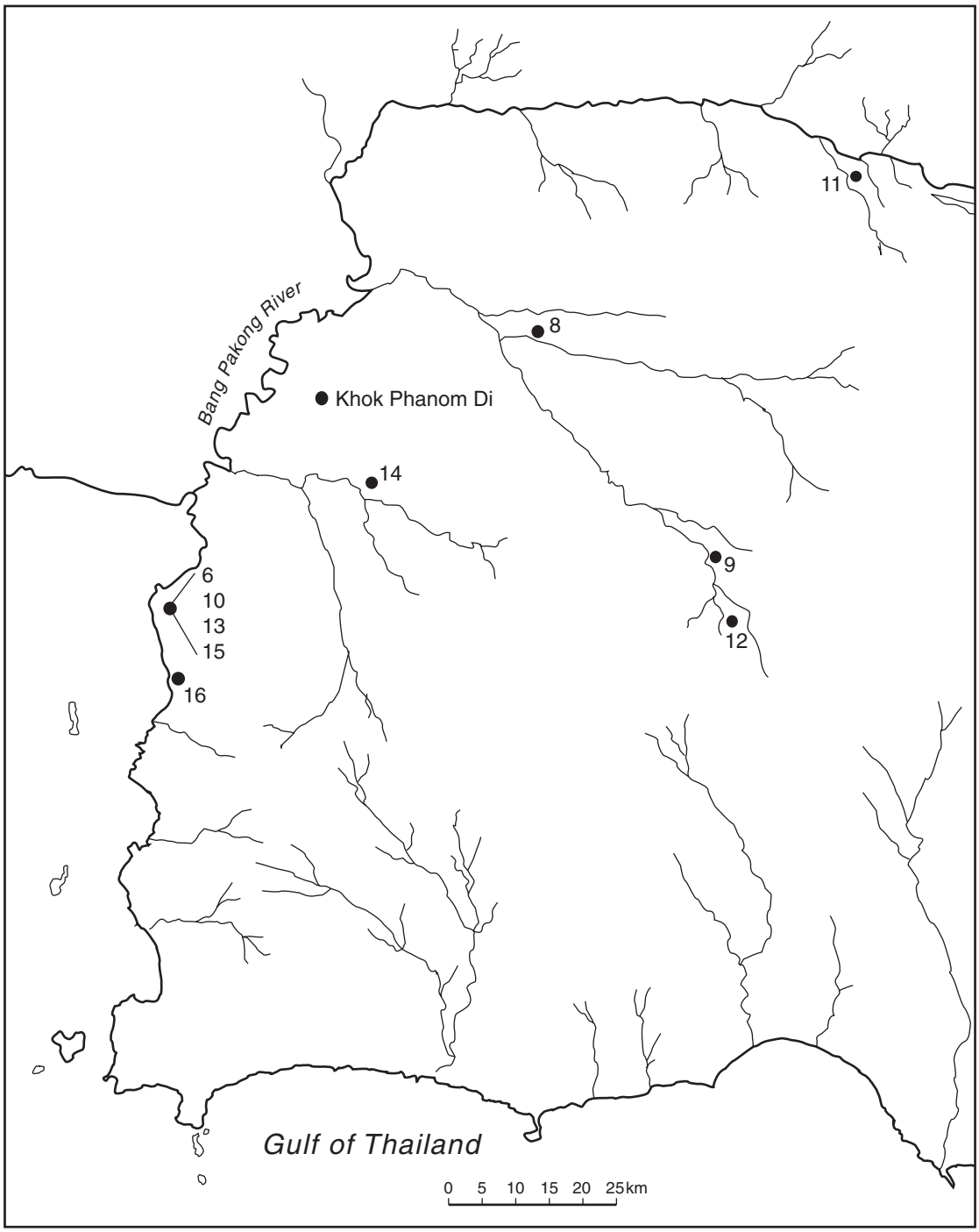


FIG. 288: Suggested exotic pottery sources. Ceramic Period Two. Fabric Groups 6, 8 - 16

suggests that potters achieved high social status along with considerable personal wealth. Some infants, probably potting family members, may have inherited wealth and status because potting was highly valued.

In CP3, 38 of the 62 burials uncovered included grave goods. Sixteen (seven female, four male and five children), featured potting tools. Of these 15 contained burnishing stones and nine contained anvils. Anvils were absent from CP2 burials and restricted to females in CP3. The presence of potting accoutrements, along with items of personal wealth, indicates that potters were valued as craft specialists (Wheatley 1971:64-5, Renfrew 1972:340-5, Arnold 1985:197-8, May and Tuckson 1982:136). A similar, less obvious, association is evident amongst the few CP2 burials which contain potting accoutrements.

Of the 30 CP3 anvils recovered, 10 (three in MP4, two in MP5, three in MP6 and two in MP7) were from burials. Nine of the latter were complete and some display use wear and/or damage. One local anvil was fired to relatively high temperatures and another was smeared with red ochre and possibly gypsum. An unusual, rice-tempered exotic anvil, with a possible potter's mark, has a red-painted handle. Nine display cord marks, the remainder are plain. Local FG3 and fishpond fabrics, some with incidental rice husk, account for 76.6 per cent of the sample. Seven, including the first six in the sequence, are considered exotic (one has rice, one bleb and five orthodox grog temper). Burial 15 contained an important exotic anvil composed of FG8. This fabric made its first secure appearance in CP2 burial jars. The first FG8 rim was found in L10:21. More were dotted throughout CP2 and in B64 (L10:5). Two other FG8 fine wares were in the L10 matrix. Three burial anvils, a L9:6 and a L5:3 fragment each bear a potter's mark. A groove cut through red paint marks the handle of an exotic rice-tempered anvil, two pairs of fine lines mark one local example and five small holes the base of another. The exotic B15 anvil has a single oval hole in the base. A miniature local copy, with the same mark, was found with B16. As with B15, it was placed beside the right ankle. A bivalve shell, containing two burnishing stones, lay to one side of B15.

Over 28 kg of prepared local potting clay was recovered (57 per cent in burials) from CP3. Much was untempered, some was tempered with grog made from silty fishpond clay (probably to conserve better-quality material for fine wares), and some contained incidental rice husk.

Burnishing stones increased to 31 in 15 CP3 burials from 21 in 11 CP2 burials. In total, 116 CP3 and 197 CP2 stones were recovered (31.5 and 53.5 per cent respectively of the site assemblage). Two male burials included burnishing stones and turtle carapace ornaments.

Local burnished fine wares with incised geometric and curvilinear designs were more evenly spread than in CP2. Sparse in L9, they peak in L6 and disappear in L5 (Fig. 294). Burnishing stones have a similar distribution. CP3 contained 31.5 and 20.5 per cent respectively of all burnishing stones and burnished sherds at the site. Incised fine ware sherds increased from 23 in CP2 to 77 per cent in CP3. Burnished only fine ware sherds decreased from 77 to 23 per cent. Exotic examples are tempered with either orthodox or bleb grog, sand or rice temper. They occurred in minor quantities.

Minor exotic paddle-impressed wares occurred intermittently, but gradually increased. Sherds were variously tempered with sand, orthodox or bleb grog. Over half were bleb tempered but in CP2 85 per cent contained sand temper. Exotic painted and slipped fine wares continued to be rare. They variously contained limestone, abundant rice husk and bleb temper and either

rice or orthodox grog. These technique variations illustrate that paddle-impressed and slipped wares were common to several exotic potting centres. Their rarity suggests that they all lay beyond direct contact with CP2 exchange networks. Neither paddle-impressed nor painted and slipped pottery were produced locally. Complex techniques, such as slipping, may be kept secret to preserve favoured access to valuable exchange networks. Although painting was not a local technique, red ochre was rubbed into some burnished vessels as a colourant. Copying of exotic styles is a typical response and local potters may have used ochre as a substitute for unfamiliar slipping and painting techniques. Five exotic punctate sherds, tempered with sand, rice or bleb grog, were also found in CP3.

Minor types include five lid forms, distributed throughout CP3. Two of these continued from CP2. One from basal contexts is probably composed of FG11. Others are tempered with rice or grog. Local sherds with appliqué bands were distributed throughout CP3 in minor amounts. Six new vessel base forms are introduced and four continue from CP1/2. A rare type tempered with shell and another with grog are exotic. Only two, but possibly four, local tripod vessel feet occurred in CP3. One rare local ladle handle fragment was recovered from a L6 shell midden, and two were recovered from the general matrix.

Coarse cylindrical cord-marked containers replaced globular storage jars as the most abundant local ware from the beginning of CP3. These rudimentary vessels were quickly made in large quantities to a standard form, which suggests a new function. These developments co-incide with other ceramic and cultural changes which together suggest the arrival of a new group. This hard, black-cored ware, made from two unblended local clays, often contained incidental rice. It was fired in a partially oxidizing atmosphere to relatively low temperatures. Most of the easily broken containers are composed of a silty clay, but the more robust globular jars, suited to cooking or water storage, contain better quality plastic clay, often tempered with a silty grog. Utilitarian ware forms were more varied than in CP2. But storage jars and bowls, some with ring bases, continued essentially unchanged throughout the site. Some bowls are consistent with a source near the headwaters of the Bang Pakong River (FG11).

Fine wares proliferated in CP3 but only four local CP2 forms survived into the new tradition. A wide range of highly burnished vessels are evident, often further decorated with shell, fingernail and punctate impressions, incising, grooving, burnishing and cord marking. Everted fine ware rim forms, including carinated burial jars, total 164 for the site. Of these 47 are assigned to CP2 and 64 to CP3. At least 28 are unique to CP3. Fine ware bowl forms total 39 for CP2 and 59 (21 unique) for CP3. Some vessels were probably fired upside down. Most display finely textured and deeply lustrous surfaces. They were embellished with a variety of tools, from styli, shells and fingernails to carved and cord-wrapped paddles. Incised geometric and curvilinear designs are common. Some decorative fields are pricked. In contrast to CP2, fingernail marks sometimes replace *Anadara* shell impressions and interior rim surfaces are often decorated. Incidental rice increased markedly in CP3, occurring in nine fine ware rim forms including burial jars.

Carinated burial jars entered the site from 12 exotic sources during CP3. They include fabrics prepared with bleb, orthodox grog or sand temper from igneous, metamorphic and sedimentary zones. One distinctive form was produced at two exotic sites, and several exotic wares have local counterparts, a reflection of the regional distribution of some styles. This may mean local imitation of an exotic design or *vice versa*. Others are exclusively exotic. One form, with incised

lines and *Anadara* shell ("dentate") impressions, is present in CP2 and CP3 local fabrics and four exotic wares. Exotic sources increased markedly during the latter part of CP3. They include wares decorated with *Anadara* shell, paddle and fingernail impressions, cord marking, incising and burnishing. Three exotic groups are represented in bowls, dominated by the bleb-tempered FG11. One exotic bowl is red painted or slipped. Several minor bowl forms first appeared in CP3, some with both exotic and local expressions indicative of regional styles. Exotic fine wares include orthodox grog, sand and rice-temper. But utilitarian wares lack exotic examples.

In terms of rim forms, local pottery proliferated in concert with an acceleration in the importation of exotic wares. During CP3, 101 new forms (51 exotic), were introduced. At least 20 represent both local and exotic wares. This underlines the influence decoration can play in regional pottery styles. Pottery forms, decorative designs, and modes of decoration may be distributed intra- and inter-regionally. Several motifs involve techniques common to local and exotic forms. A typical example displays *Anadara* shell-impressed fields. Other regional modes present throughout CP3 are incising, cord marking and paddle impressing. A red-painted exception aside, each exotic form can be defined as a regional type. Regional ware distributions may differ from those of decorative modes or vessel forms copied by one or more manufacturing centres. Copies of types may be confined to a few sites, or be widespread, much as some exchange items are.

During CP3 local potting underwent a marked florescence. Contact with exotic centres could have provided stylistic and technological stimulation. But although imported pottery featured paddle impressing, red paint, bleb tempering and other novel techniques, these, with one exception, were not adopted. Fingernail impressing, associated with exotic FG11, however, occurs on 10 local forms, but, given its rarity, it was probably copied. Of 15 exotic fabrics identified in CP3, FG11 is of particular interest, because some techniques associated with these wares are absent from local pottery while others appear to have been copied. Slips or paints and novel FG11 motifs are absent. Appliqué bands, fingernail impressions, punctate fields, "nail head" rims, "pricked" and deep probe-marked fields are all extremely rare in local pottery, but feature on FG11 wares. Of about 20 FG11 wares identified, at least 10 have local representations. Although many FG11 decorative modes are distinctive, several include regional techniques.

Local coarse wares continued to be cord marked and fine wares burnished, often with incising and shell impressing as in CP2. Carinated burial jars are burnished and either left plain or incised with 1–4 lines below the rim. Sometimes straight and wavy (shell-impressed) lines are combined. Vertical striations or shell impressions on the body, common in CP2, are rare. Exotic wares are correlated with paddle, *Anadara* shell and fingernail "pricked" or punctate impressions, red paints, slips and cord marks. *Anadara* shell impressions occur on six different exotic wares. Five are paddle-impressed, an exotic marker. An important L5 local exception carries both *Anadara* shell *and* paddle impressions.

Vessels recovered include nine non-mortuary and 79 from mortuary contexts, some damaged, some intact. Some local vessels are without artistic and technical peer for hand-crafted pottery, but different levels of expertise are evident. Utilitarian pots may be elementary or expertly crafted. Ornamental wares tend to reflect higher technical skills. Some are outstanding.

The outset of CP3 witnessed considerable cultural activity. Six mortuary vessels, including four carinated burial jars, one unique ring-foot paddle-impressed bowl and a unique open-ended pot stand, are exotic. Similar stands are known from two Malaysian Neolithic sites, Gua Cha

and Bukit Tengku Lembu (Peacock 1959), and from Po Yue Wan, Cheung Chau in Hong Kong (Crawford 1986). Of course, their mere presence does not mean that they are related. They are, however, distinctive artefacts which increases the possibility of some relationships. Clearly more research is need to determine whether there are any connections. Local mortuary wares include 11 bowls, 45 carinated burial jars, a footed carinated jar, seven globular jars, five open jars, three special vessels and one unique bowl. Two different local clays were used for burial jar fabrics. Some include minor amounts of rice, others bleb-like grog, either accidentally or deliberately added for ritual purposes. The CP3 local burial jars differ markedly from their CP2 counterparts. They have wider rims, narrower carination points and are slightly lower. They comprise over 62 per cent of the 77 vessels classified, and local coarse utilitarian wares comprise 23.3 per cent. Fine wares represent 71.4 per cent of the CP3 mortuary assemblage and nine per cent of these are exotic. They have either shell-impressed or cord marked rims. Overall, vessel decoration is simpler compared to CP2 and both vessel forms and decorative details decrease. Rich burials did not always include many vessels, in spite of an obvious capacity to produce them on site. CP3 graves included six exotic carinated burial jars from five different sources, in contrast to CP2 when three such jars are associated with a single source.

Although complete high quality CP2 platters are absent, outstanding CP3 vessels clearly reflect skills the equal of any in the site. These vessels are very thin, expertly decorated and fired. In shape and artistic expression they are superb. Many otherwise pristine vessels appear to have been ritually smashed or "killed". Others were intact and appear unused. Several were liberally coated with red ochre. One intact jar displays unique stylized human figures arranged in binary pairs. This suggests a special, perhaps ceremonial, function. It was interred with a relatively rich 12-year-old female along with two carinated burial jars, both carrying a double-line motif. This motif is correlated with potting groups.

Carinated burial jars account for about 37 per cent of all CP2 and 63 per cent of all CP3 vessels. Some are almost identical in shape and size, but decorative modes may differ. Exotic burial jars comprise 75 per cent of both CP2 and CP3 exotic vessels, underlining their importance in mortuary ritual. Smashed cylindrical cord-marked containers were also included as grave goods. Due to their brittleness they proved impossible to reconstruct fully, although they clearly had a convex base. Their rudimentary composition suggests that they were intended for discard after a single use.

CERAMIC PERIOD 3: DISCUSSION

A brief review of the CP2 evidence will help to bring into focus CP3 developments. The status of individuals in the lower half of the cemetery clearly demonstrates that potters were valued members of the community. The distribution of potters' equipment and exotic grave goods hints at interactions between potting crafts and the distribution of material wealth amongst participants in trade and exchange networks. The evidence suggests that females potters were the principals in making the wares and that males traded them. Males buried with exotic pottery exhibited skeletal traits consistent with habitual upper body exertion such as paddling canoes. As imported pottery clearly demonstrates that a range of comparable high quality ornamental

wares was produced at several other sites in the region, exchange activities during CP2 are likely to have faced competition from other potteries. Therefore, although CP2 potters probably made a valuable socio-economic contribution, the community was unlikely to have been solely dependent on pottery output for its well being. Those associated with potting, however, were clearly advantaged. This is reflected in the relative mortuary wealth of CP2 potters compared to non-potters.

During CP3 potters achieved increasing wealth, and the disparity between rich and poor widened. Of 38 burials with grave goods, 16 contained potting accoutrements, and potting clay was found in a further five (Table 142). The earliest, a 32 year old male (B42), was mostly located outside the excavation. When completely removed, two burnishing stones, but no other goods, were recovered "in the foot area". Lumps of potting clay were found in association with B7, B8, B27, B28 and B49.

In assessing wealth, in addition to the method used by Banannurag (1989), "potters"' vessels have here been allocated points according their quality and origin. Aspects of individual physical attributes are summarized, along with pottery discovered in their graves as follows:

- B42, the largest male in MP4 (in his early thirties), who shows signs of upper body physical activity. The burial included burnished body sherds.
- B29, a 27-year-old male. Upper and lower limbs indicate vigorous physical activity. The grave contained burnished and incised body sherds.
- B33, a 3-year-old infant. Local burial jar rims, burnished and incised sherds and local platter or bowl sherds were found in the grave.
- B28, probably an unhealthy 21 year old, perhaps male? Exotic and local burial jar and local platter or bowl rims, also burnished and incised sherds were found in the grave.
- B27 a female, 40 years old, with severe degeneration in all joints and evidence of upper limb activity. The grave contained local burial jar rims, coarse ware container rims, exotic burnished body sherds and local platter or bowl rims.
- B36, a 21-year-old female. The hands indicate vigorous activity. Local type 2b jar rims and burnished sherds were found with the burial.
- B23, a 30-year-old male. Vigorous physical activity involved upper and lower limbs. The grave contained local type 2b jar rims.
- B20, a 12-year-old child. Local burial and storage jar and shallow bowl rims, remains of an incised exotic ornamental ware (FG11), and a base were recovered from the grave.
- B35, a 21-year-old female with signs of vigorous upper limb and hand use. An exotic burial jar and bowl (FG11r), local cord-marked container, incised body sherds, bowl and platter rims were found with the burial.

- B16, a 15-month infant. Local incised, burnished sherds, burial and storage jar rims, exotic bowl rim (FG11r) and a vessel base were recovered from the grave.

- B15 has signs of vigorous upper limb, hand and forearm activity. This 35-year-old female is the richest burial uncovered. Exotic type 2b jar (rice), bowl (FG11r), RF10 vessel rims, paddle-impressed and appliqué sherds were recovered. In addition, local type 2b and storage jars, inverted and everted bowls, small ornamental jar, platter and cord-marked bowl rims, as well as vessel base, and burnished and incised sherds were found in the grave.

- B13, the skeletal remains of this 35-year-old female also suggest vigorous upper limb use. Exotic (FG11) and local burial jar remains, local storage jar, cord-marked bowl, platter and local incised sherds were recovered from the grave.

- The grave of B11, a 12-year-old child, included the remains of an exotic lid, local burial and storage jars, a vessel base as well as incised and burnished sherds.

- B9, a 30-year-old male, shows minor signs of upper arm and leg activity. The remains of an exotic sand-tempered and a local burial jar, a local cord-marked bowl, platter, storage jar, a vessel base and incised sherds were recovered.

- B8, a 15-year-old male? Fragments of an exotic and two local carinated burial jars, a platter, incised sherds and a base were in the grave.

- B7, a 21-month-infant. A type L1g vessel was placed in the grave.

- B4, a 25-year-old female, shows signs of moderate use of the hands and upper limbs. Fragments of exotic and local burial jars, a platter, a fine-ware bowl, a cord-marked container, a similar bowl, a vessel base, burnished-and-incised, and burnished only sherds were found with the burial.

- B1, a nine-year-old child included an exotic, rice-tempered burial jar, a local platter, a vessel base, burnished and incised sherds, as well as unburnished incised sherds.

- B19, a 25-year-old female, included remains of a local burial jar, a platter, burnished and incised, as well as incised and punctate sherds.

- B18, a 42-year-old female, included a local cord-marked container, a platter and a vessel base.

- B6, a nine-month infant, included fragments of an exotic bowl, a local burial and a storage jar, a platter and a cord-marked bowl. Exotic and local burnished and incised sherds, exotic painted or slipped sherds were also found.

Disturbed graves or those lying mainly beyond the excavation square provide dubious evidence because the integrity of their surroundings cannot be assured. Four “potters”, B1, B23, B29 and B42 lay mostly within the baulk (Higham and Bannanurag 1990:362, 279, 316 and 311 respectively). B7 and B36 were disturbed, B6 and B18 seriously disturbed in prehistory (Higham

TABLE 142: *Analysis of "potters' " grave wealth in Ceramic Period 3: B: burial, Bu: burnishing stone, CL: clay (weight in kg), A: anvil, SDB: shell disc bead, IB: "I" beads, HB: "H" beads, C: cylinder bead, H: horned disc, SD: small disc, DB: disc bangle, T: turtle bone/ornament, W: worked bone or shell, SA: stone adze, WT: worked tooth, SC: shell container, LB: large disc bead, V: ceramic vessels*

B	Sex	Age	Bu	CL	A	SDB	IB	HB	C	H	SD	DB	T	W	SA	WT	SC	LB	V
6	C	9m	2	0.02	-	17786	-	656	2	1	-	-	-	-	-	-	-	-	-
18	F	42	1	-	1	9969	-	700	-	-	-	-	-	-	-	-	-	-	1
19	F	25	2	0.11	1	1600	-	-	-	-	-	1	-	-	-	-	-	-	4
1	C	9	1	-	2	-	-	-	-	-	-	3	-	-	-	-	-	-	2
4	F	25	4	0.80	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	I	21m	-	0.03	-	9	-	-	-	-	-	4	-	-	-	-	-	-	1
8	M	15	-	0.03	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
9	M	30	1	0.04	-	3	-	-	-	-	-	-	2	1	-	-	-	-	2
11	C	12	-	0.02	-	12	-	57	-	-	-	-	-	-	1	-	-	-	3
13	F	35	8	-	-	3	-	-	-	-	1	1	-	-	-	-	-	-	3
15	F	35	2	10.99	1	120787	950	-	-	2	1	1	-	-	-	5	1	-	8
16	I	15m	1	3.99	1	12247	200	-	-	-	-	1	-	-	-	-	-	-	4
35	F	21	3	-	1	8	-	-	-	-	-	-	-	-	-	-	-	-	2
20	C	12	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
23	M	30	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	3
36	F	21	1	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
27	F	40	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
28	M	21	-	0.02	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
33	C	3	-	-	1	8000≈	107	-	-	-	-	-	-	-	-	-	-	13	4
29	M	27	1	-	-	330	17	-	-	-	-	-	1	-	-	-	-	-	1
42	M	30	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

and Bannanurag 1990:345-6). B42, the poorest, was the lowest in MP4 and the first with potters' tools in CP3.

Three "potters", B4, B6 and B42, lack any "complete" vessels. Burial jars were placed in 13 of the remaining 16 as mortuary furniture. Eight of these jars, including three in B15, carry a double line motif which is likely to signify membership of a social group (Chapter IX).

TABLE 143: *Analysis of "non-potters' " grave wealth in Ceramic Period 3: B: burial, SB: shell disc bead, HB: "H" beads, IB: "I" beads, HD: horn discs, SDB: shell disc/bangle, SBB: short barrel bead, WT: worked tooth, LSD: large shell disc, FH: fish hook, CSB: cylindrical shell bead, CC: ceramic counter, TP: turtle bone pendant, V: vessels, TCO: turtle carapace ornament*

B	Sex	Age	SB	HB	IB	HD	SDB	SBB	WT	LSD	FH	CSB	CC	TP	V	TCO
12	C	12	730	30	-	-	-	-	-	-	-	-	-	-	4	-
3	I	4m	49	12	-	-	4	-	-	-	-	-	-	-	2	-
14	I	15m	269	-	-	-	-	-	-	-	-	-	-	-	4	-
24	M	25	-	-	-	-	-	-	-	-	-	-	-	-	3	1
43	M	30	56200	-	435	-	1	7	1	2	-	1	-	-	1	1
37	C	9	-	-	-	-	-	-	-	-	-	-	-	-	2	-
44	M	18	-	-	-	-	-	-	-	-	-	-	-	-	3	1
30	M	34	-	-	-	-	-	-	-	-	1	-	-	-	1	1
31	F	25	-	-	-	-	-	-	-	-	-	-	1	-	1	-
32	C	11	-	-	-	-	-	-	-	-	-	-	-	1	1	1
22	M	21	-	-	-	-	-	-	-	-	-	-	-	-	2	-
38	M	30	-	-	-	-	-	-	-	-	-	-	-	-	3	-
39	F	25	-	-	-	-	-	-	-	-	-	-	-	-	1	-
41	I	9m	41	-	-	-	-	-	-	-	-	-	-	-	1	-
45	F	45	-	-	-	-	-	-	-	-	-	-	-	-	1	-
47	F	22	-	-	-	-	-	-	-	-	-	-	-	-	1	-
57	M	26	23	-	-	-	-	-	-	-	-	-	-	-	2	1

All the richest "non-potters' " graves contained vessels and six, all male, feature turtle carapace ornaments (Table 143). Burial 14 included four vessels, two of which have been accorded 400 points each because of their outstanding quality. Virtually all of B43 was excavated from the baulk, as were the torso and right arm of B44, and the head and shoulders of B12 which was also cut through by a later posthole (Higham and Bannanurag 1990:28, 327, 267 and 363 respectively). Most of B38 and B39 were also in the baulk and B3 was seriously disturbed in prehistory. Burial 57 included fish bone near his legs and fibrous material at his head. Fish bones were also found near the head of B30.

Three of the 17 non-potters (burials 3, 14 and 41), are infants and three (burials 12, 32 and 37), are children. Burials 31, 32, 39, 45 and 47 are females. The remainder are males whose

skeletons suggest vigorous use of the upper body, particularly shoulders and arms. Burial 30 has signs of vigorous shoulder and lower limb activity. Although males were generally less physically active during CP3 than their CP2 counterparts, all in this group display signs of robustness and vigorous physical activity (Tayles 1999:323-9).

TABLE 144: *Mortuary Phase 4 potters' and non-potters' grave wealth compared*

Non-potter Burial	Sex	Age	Burial Sherds	Pots	Other	Points	Potter Burial	Sex	Age	Burial Sherds	Pots	Other	Points
17	C	12	300	-	-	300	35	F	21	1400	800	82	2282
21	C	8	200	-	-	200	20	C	12	700	400	40	1140
22	M	21	500	300	-	800	23	M	30	200	300	120	620
24	M	25	1400	400	100	1900	36	F	21	200	400	20	620
25	F	19	200	-	-	200	33	C	3	400	700	1909	3009
26	F	35	400	-	-	400	27	F	41	1500	200	-	1700
30	M	28	200	100	120	420	29	M	27	200	200	103	503
31	F	25	700	400	20	1120	28	M	21	800	200	-	1000
32	C	11	200	100	200	500	42	M	29	200	-	40	240
37	C	9	200	200	-	400	-	-	-	-	-	-	-
38	M	29	-	400	-	400	-	-	-	-	-	-	-
39	F	25	400	100	-	500	-	-	-	-	-	-	-
40	F	37	200	-	-	200	-	-	-	-	-	-	-
41	I	9m	-	400	108	508	-	-	-	-	-	-	-
43	M	27	400	200	12165	12765	-	-	-	-	-	-	-
44	M	18	300	500	100	900	-	-	-	-	-	-	-
45	F	45	200	100	-	300	-	-	-	-	-	-	-
47	F	22	-	200	-	200	-	-	-	-	-	-	-

The turtle carapace ornaments in B24, 30, 32 and 57 are large plaques, while B8, 43 and 44 contained ornament fragments (Pilditch 1993:158-60). Turtle artefacts were restricted to wealthy "non-potters" and three male "potters". Of the latter, B9 and B29 contained carapace ornaments and B23 a large carapace plaque. None included anvils but all contained burnishing stones. Burial 23 also included fragments of a double line burial jar. Two of these jars were found with B44, the only "non-potter" to feature them. Burials 13, 31, 35 and 41 contained exotic vessels and B35 may have been an immigrant. It is important to note that the burial sherds were recovered in direct association with the corpse. The lowest score for a MP4 "potter" is 240 (B42) and the highest 3009 (B33) ($\bar{x}$ = 1235, n = 9). For "non-potters" the lowest is 200 (B21, B25, B40 and B47) and the highest (B43) 12,765 ($\bar{x}$ = 1234, n = 18), the same average wealth as "potters" (Appendix 4 and Table 144).

There are clear links between turtle carapace ornaments and the potting group. Of those with turtle ornaments, B30, 32 and 57 all lie together. Burials 20 and 24 lie next to each other; the former has a double line jar, the latter a turtle ornament. Similarly, B20, 24, 27, 39 and 41,

also grouped together, all contain burial jars with cord-marked carination points (Appendix 2). The full significance of such correlations will probably only be revealed through an analysis of mitochondrial DNA in the skeletal remains to determine whether these individuals are genetically related. Of course, other relationships could also be involved, or the burial jar markings be unrelated. But the correlations between potters and the double line motif are striking. They lack only a single exception, B44. Significantly, however, a turtle carapace ornament was placed in the grave with B44. A familial relationship is likely between B15 and the infant B16. The latter contained similar grave goods including a locally made miniature anvil, an exact replica (with the same potter's mark), of the anvil found with B15.

Pots and contents destined for trade and/or exchange may be collected or delivered. Making pots in monsoon climates is seasonally restricted, therefore, unless surpluses are available, transportation schedules require co-ordination. If the cylindrical jars, thought to have been made for trade or exchange (Chapter IX), contained perishable items, expedition timings would need to be impeccable. Potting centres usually deliver their wares along circuits (Arnold 1985, Peacock 1982). Khok Phanom Di occupied a central place (Christaller 1966), favoured locations for the emergence of pottery production centres (Brookfield and Hart 1971:325-7, Hage 1977, Irwin 1977, 1978:39). Estuaries or river mouths are nodal locations ideally placed to exploit coastal and inland systems. While coastal routes are susceptible to adverse conditions, navigable river systems are less risky. Stormy monsoon weather, often involving typhoons, occurs during the wet season (Strahler 1973:189). Because potting is a dry season activity, production and transportation would be best integrated with seasonal climatic and weather conditions. As only females were interred with anvils it seems reasonable to assume that, as in the present-day Papua New Guinea examples (Chapter VIII), females made the pots and males traded or exchanged them. Perhaps in the case of the CP3 cylindrical containers the transactions also included their contents.

Burial 23, a robust, physically active male, included a double line motif burial jar, a burnishing stone, and a turtle ornament. This suggests that he was a member of the potters' group who helped process and then transport pottery. Female or male only, or male/female pottery-making is well known in both Thailand (Solheim 1964) and Papua New Guinea (May and Tuckson 1982:27). If some males restricted their involvement to the transportation of pottery during CP3, those in the rich "non-potters"' group are the most likely candidates because they are the only strong and healthy CP3 individuals displaying signs of vigorous upper body activities consistent with having paddled canoes. Burials 43 and 24, the richest in MP4, were both very active physically and the only individuals with turtle ornaments to include burial jars with cord-marked carinations (Table 143 and Appendix 2).

Turtle ornaments could symbolize high status males who gained recognition through their ability to complete successful trade and/or exchange missions over water. Given the greater wealth attached to potters, links with the potting group would enhance their access to what appears to have been a lucrative enterprise. It should be noted that turtle motifs are present on two ritually "killed" CP2 mortuary vessels (cat. 1678 and 1649, Chapter VIII). These could suggest that clan affiliations with related groups at other sites in the region extended back several generations. Present day Chaw Lay ("Sea Gypsies"), maritime hunter-gatherers, consider turtles to be their mythological ancestors (Engelhardt and Rogers 1996). This underscores the symbolic

connection of turtle motifs and turtle ornaments with maritime lifestyles.

Access to trade and/or exchange networks, for large outputs of CP3 containers, would require precise co-ordination. The integration of seasonal production with transport schedules would naturally engender a close association between potters and those who transported the containers. Links between potters and males with turtle carapace ornaments are evident. Burial 44, a turtle group member, has a double line motif burial jar and B23, a potters' group member, a large turtle carapace plaque. Links are also marked in B9 and B29, males aged 30 and 27 respectively, by the association of turtle carapace ornaments, burnishing stones and burial jars lacking the double line motif. It suggests that some males not only helped with burnishing, but also took part in trade/exchange expeditions centred on the movement of pottery, compelling evidence that males with turtle ornaments belonged to, or were closely associated with, the potters' group. It is therefore proposed that this justifies grouping these burials with potters when assessing wealth, because it seems reasonable to assume that it stemmed from the potting industry. If this is accepted, a markedly different picture of wealth distribution emerges during MP4.

"Non-potters" range in wealth from 200 to 12765 points ($\bar{x}$ = 1067, n = 18). Excluding those with turtle ornaments, they range from 200 to 1120 points ($\bar{x}$ = 425, n = 13). "Potters" range from 240 to 3009 points ($\bar{x}$ = 1235, n = 9). Including those with turtle ornaments, "potters" range from 240 to 12765 ($\bar{x}$ = 1985, n = 14). A clear trend towards increasing wealth over time is apparent in the turtle burial group at the expense of "non-potters" who lacked them (Table 145). The former range from 420 and 500 (L8:5), 1100 (L8:1) to 1900 and 12765 (L7:7). Those without turtle ornaments fell. Potters' wealth was relatively steady, however when the turtle group is included, potters' group values decrease slightly in L8 but increase markedly in L7. These data include disturbed burials and those which lay mainly outside the excavation. In MP4, turtle carapace burials become richer with time (burials 30 and 32 (L8:5) scored 420 and 500 points respectively, B44 (L8:1) 1100 points, while burials 24 and 43 (L7:7) scored 1900 and 12,765 points respectively). If the turtle group is included with non-potters, the values increase slightly in L8, and markedly in L7.

TABLE 145: *Mortuary Phase 4 changes in mean grave wealth distributions*

Layer	Potters	Non-potters	Turtle group	Potters and Turtle group	Non-potters and Turtle group
7	1165 (n = 4)	380 (n = 5)	7332 (n = 2)	3221 (n = 6)	2366 (n = 7)
8	1290 (n = 5)	461 (n = 7)	673 (n = 3)	1059 (n = 8)	565 (n = 10)
9	-	400 (n = 1)	-	-	-

The 11 uppermost MP3 burials with mortuary vessels are in this study grouped with MP4 interments (Chapters VIII and XI). This means that 15 additional burials lacking vessels also lie in CP3. Only B61, a female in her late forties, is adult; the remainder died at birth. None contained grave goods (Appendix 4). A spate of neonate deaths co-incided with upper MP3. Viewed from this perspective, the dramatic shift from the highest neonate mortality rate in MP3 to the very low rate in MP4, (using the excavators' suggested stratigraphically derived MPs),

may be better understood (Tayles 1999:305-6). Exactly how many graves lie within MP3 is difficult to determine precisely given the nature of the deposits. "The layer 10 deposits cover from 4.16 to 6.55 m below datum. It is necessary to visualize it as a complex and at times quite bewildering series of interlocking lenses..." (Higham and Bannanurag 1990:32).

TABLE 146: *Mortuary Phase 3b burial grave wealth*

Burial	Sex	Age	Burial Sherds	Pots	Other	Points	Burial	Sex	Age	Burial Sherds	Pots	Other	Points
56	F	45	-	200	-	200	64	F	21	200	600	-	800
57	M	26	500	600	119	1219	67	M	35	200	400	-	600
58	F	35	-	400	20	420	70	I	0m	-	-	100	100
60	F	19	-	200	-	200	74	M	39	-	400	-	400
62	I	6m	-	200	-	200	77	F	26	200	100	-	300
63	I	20m	-	100	-	100	79	F	47	300	100	-	400

Burial 57 included 23 disc-shaped shell beads, a turtle carapace plaque and two carinated burial jars, one exotic. Significantly, both feature cord-marked carination points, the first in mortuary contexts to be decorated in this manner. The exotic vessel probably derived from the south coast, about 45 km away, thus continuing an association developed during CP2, although other sources can not be ruled out. Burial 57 also contained the first turtle ornament, a carapace plaque. Pilditch (1993:162), in describing the plaques, noted:

> "The example from B57, cat 1287, varied from the other shields in several ways. Like the others it was basically cruciform and had the central hole, but the top and bottom projections were squat and rounded. It was smaller than the others because of this. It also had no apparent method of attaching it though a portion of one end that could have had holes drilled in it is missing."

This 26 year old was muscular and one of the large physically active males in this phase. His is the richest of 12 burials with grave goods in this group (Table 146). The other 10 with pots range from 100 to 800 points ($\bar{x}$ = 362 or including B70 x = 338). These values fit well with the trend towards increasing wealth during the initial stages of MP4.

Layer 10 differed markedly from L9 with more lenses, mainly ash and shellfish (Higham and Bannanurag 1990:31-2). They note "a temporary hiatus in mortuary activity, representing the transition from phase 3 to phase 4" at L10:2 (Higham and Bannanurag 1990:36). If the cemetery, or this portion of it, was unused for a period, it is very likely that some blurring of the original grave cuts could occur through erosion. Such circumstances can create difficulties in the field which may often only be addressed by a precise detailed examination of changes in artefacts.

> "One must remember that even occupation sites may not have been lived in continuously, or that the occupations shifted from part of the site to another. Under such conditions the stratigraphic record will have gaps or temporal discontinuities, and the archaeologist may or may not be aware of these lacunae from a simple visual inspection of stratigraphic profiles. His chief hint of a discontinuity may come from his analysis of artifacts that are known, or assumed on other grounds, to follow a different pattern of change." (Hole and Heizer 1973:136).

Petrographic and stylistic changes in pottery provide "hard" data capable of resolving such difficulties, in addition to routine applications in tracing exchange and other interactions (Weisler 1998:521). Orton (*et al.* 1993:11) note: "In Europe, the main use of seriation seems to have continued to be to order grave-groups or other 'closed' groups (e.g. Doran 1972, Goldmann 1972)". In Southeast Asia cultural stratigraphies vary widely from clear to less visible natural stratification. For example Ban Na Di has been described as clear, but Ban Chiang "fugitive" where changes in soil colours could "reflect a major cultural dislocation" and a "period of abandonment" .. ."analysis of the evidence for ritual in conjunction with the ceramic and human remains might illuminate this possibility" (Higham 1988:77).

Recorded grave cut depths are important gauges of stratigraphic clarity. Content depths below datum are readily recognized but grave bases and cuts less so. Of the 26 burials in MP3b, grave cuts were recognized below the contents in four graves, at the same depth in five, in 11 the contents were encountered 1–5 cm and in six 10–15 cm below the cut (range -4 to +15 cm, ($\bar{x}$ = 4 cm n = 26). This contrasts with the 18 burials in MP5–7 (range 1 cm to 1.24 m, $\bar{x}$ = 54 cm n = 16; Table 147 and Appendix 4). Depths began to increase markedly during MP4 and this trend continued throughout MP5-7. MP3 graves are consistently shallow. They conform to a unique burial pattern established following the laying down of a large shell midden in L10:10-9 which continued upwards to terminate in L10:3, just below the boundary between CP2 and CP3. Mortuary Phase 3b graves were cut from above this point following a short hiatus (Higham and Bannanurag 1990:37 and Figs. 43–48). Their distribution, however, follows a distinctive pattern probably initiated during MP2, with graves arranged to avoid the "T"-shaped shell midden. Another midden (L9: lens 9), follows a similar arrangement during MP4, but soon lapses. This suggests that the locations of earlier graves were known, perhaps marked by structures with posts and that, if the site was temporarily abandoned at the end of CP2, the cemetery layout was understood by the CP3 community.

The shallowness of the MP3b graves denotes a temporary change of use in this portion of the site. A 94 cm deep shell midden, possibly a pathway, suddenly terminated. The midden avoided graves throughout MP3, including MP3b burials. After a brief hiatus spanning 26 cm (L10:3 to L9:7), it was reinstated, only to lapse again shortly before burials 51 and 52 (MP3), 22, 26 and 33 (MP4) and then burial 15 (MP5) were cut. This hiatus in mortuary activity witnessed a huge increase in artefacts, 81 being recovered from L10:3. Such a peak could suggest soil deflation, perhaps due to natural erosion during abandonment, with the relatively heavy artefacts gradually migrating downwards to settle on the re-occupied surface of L10:3. Outstanding concentrations of very large charcoal fragments also accumulated, possibly due to multiple fires and a lack of trampling, at this point (Thompson 1996:69). Interpretation of stratigraphic change, in some detail, has been facilitated by careful excavation techniques. It is fortunate that precise records

TABLE 147: *Mortuary Phase 5, 6 and 7 burial contents and grave cut depths in metres below datum*

Burial	Base	Cont.	Cut	Burial	Base	Cont.	Cut	Burial	Base	Cont.	Cut
1	1.90	1.86	1.20	5	-	1.97	1.96	13	2.78	2.59	2.24
3	2.18	-	1.45	6	2.43	2.30	1.55	18	-	2.50	1.97
10	2.00	-	1.40	7	-	2.15	2.01	19	-	2.79	1.98
12	1.85	1.70	1.30	8	-	2.25	2.01	14	-	2.96	2.35
2	2.43	2.36	1.95	9	2.61	2.48	1.97	15	3.45	3.27	2.50
4	2.57	2.52	1.95	11	-	3.29	2.05	16	3.25	3.15	2.43

of grave dimensions are available (see Vol. 1 this series). Of particular interest are grave depths (Appendix 4), and dispositions (Fig. 289). The data allow several interpretations.

Burials 51 and 52 were the first to interrupt a continuous sequence of placing graves clear of the L10:2 shell lens. These shallow neonate scoops were cut from above the shell lens, at the same level as the lowest of the MP3b group here assigned to CP3. All of the remaining MP3 burials were cut from above this point, although they appear to follow the earlier pattern of avoiding the shell midden. By MP4 this pattern is substantially, but not completely, broken. Earlier burial practices were replaced, partially in MP4 and then completely in MP5, when grave "clusters" gave way to clearly defined burial rows.

Three MP3b graves (B58, 60 and 67), include carinated burial jars rendered in the CP2 style; the balance are in the CP3 style. Burial 57 has two burial jars, one exotic; both have cord-marked carination points. This motif is common to nine MP4 burials, four of these being potters, and to three MP6 potters' graves. The exotic B57 jar follows the CP2 style, as the carination point is wider than the rim, but the local jar conforms to the CP3 style (Appendix 3). This is the only occasion when both styles occur together. Burial 57 not only included the first burial jar with a cord-marked motif but also the first turtle ornament (from which later examples were probably copied), and is the only individual prior to MP4 with a tooth ablation pattern found in the later phases (Tayles 1999:286). These are significant changes which could herald the arrival of a new cultural group. They may represent the fusion of a group of émigrés, perhaps known through external trade or exchange missions, through marriage alliances. Burial 64 is the final MP3b grave with an exotic vessel, a plain jar with a suggested uplands source 40 km to the northeast.

Given that burial jar motifs represent social groups, cord-marked jars accompanied B20, 27, 33 and 35, all members of the MP4 potters' group, while B24 and B43, both non-potters, included turtle ornaments. Burial 31 was interred with B32 which contained a turtle ornament. Finally, B39, a female, included one jar with the cord-marked motif. She lay alongside B38, a male. Clearly there is a close association between the turtle group, potters and those with cord-marked burial jar carination points.

These changes could indicate a brief site abandonment and re-occupation by the earlier occupants along with new immigrants who introduced changes. But the sedimentological data do not support *any* temporary site abandonments (Aitken 1992:176). Alternatively, newcomers

may have introduced a new potting tradition, turtle ornaments, the first slate, and facilitated access to new regional groups. These expanded external relationships may have included access to inland rice producers. Domesticated rice remains were found in two MP3b individuals, B67 and B56 (Thompson 1996:162, 170). The presence of two carinated burial jars rendered in the old style, cat. 1291 (B60) and cat. 1432 (B67), but composed of the new CP3 tradition fabric, alludes to such a mixture and B57 provides a link between both populations. B57 was one of the largest MP3 graves (Fig. 289).

A change in local wares, including the most abundant utilitarian pottery, further underscores the CP2/3 transition, which saw globular vessels give way to cylindrical containers, designed to fulfill a new function. It is proposed that this change heralded the inception of a vibrant new socio-economic infrastructure based on local resources transported in ceramic containers. Evidence for this proposal is set out below. Excluding two neonates, potters' and turtle burials together comprise about 54 per cent of the MP4 sample. There are nine potters' and five turtle graves. Three turtle graves contained L2b burial jars, two of which display cord-marked carination points, one with a triple line rim motif. The other has an *Anadara* shell-impressed carination and a double line rim motif. These motifs connect MP4 with MP5 L2b burial jar motifs. Three MP4 burials contained exotic (E2b) burial jars with cord-marked carinations or bases (B31, 35 and 41). The B31 jar suggested source is inland near the headwaters of the Prachinburi River (Fig. 293, FG11). Burial 35 included two exotic jars both with chert inclusions (FG17). Outcrops of the Kanchanaburi Formation 40 kms inland to the southeast and 50 km east-northeast both include chert beds. The closest suggested source for the B41 jar, which contains metamorphic and granitic or grano-diorite minerals (FG12), lies about 45 km south near the coast, although this fabric could also be derived from about 60 km inland to the east, near the proposed source of rhyolitic tuff used for stone tools (Pisnupong 1988:91, 94).

Apart from B50 and B49 (a neonate scoop cut 4.05 m below datum), MP3b graves appear too shallow to have been cut from the L9:7 surface. The deepest in MP4, an adult (B42), was cut from 3.67 m. The minimum adult grave depth is here estimated at 68 cm. Burial 77, the highest in MP3, was cut about 3.68 m and its contents found at 4.17 m below datum respectively. This suggests either a 12 cm gap between the last MP3 and the first MP4 burial cut, erosion, or sharp differences in mortuary practices between MP3 and MP4. Burials 33 and 22 (MP4), were the first to interrupt the L10:lens 2 feature (Higham and Bannanurag 1990:93-6), while B22 and B43, two of nine MP4 burials with cord-marked burial jar carination points, relate stratigraphically to MP4.

Wealth attached to the artefacts in this study could be misleading. For example, points allocated for pots and turtle artefacts may differ from the values placed on them by the participants. But this aside, there is a clear grouping of those associated with potting and the males who probably carried out trade or exchange along distribution networks. In grave goods terms it appears that only those who contributed to the manufacture and distribution of pottery achieved relative wealth. Overall, potters are wealthier than non-potters.

Rapid accumulation of cultural deposits during CP3 correlates with a doubling of sherd weights from two to four tonnes (Chapter XII). Mean grave cut-to-content depths climb from 2 cm in MP1, 4 in MP2, 5 in MP3 to 19 in MP4, 70 in MP5, 47 in MP6 and 68 cm in MP7 (Appendix 4). Grave wealth escalated in MP5 (Table 148). Burial 14, a 15 month old infant, was

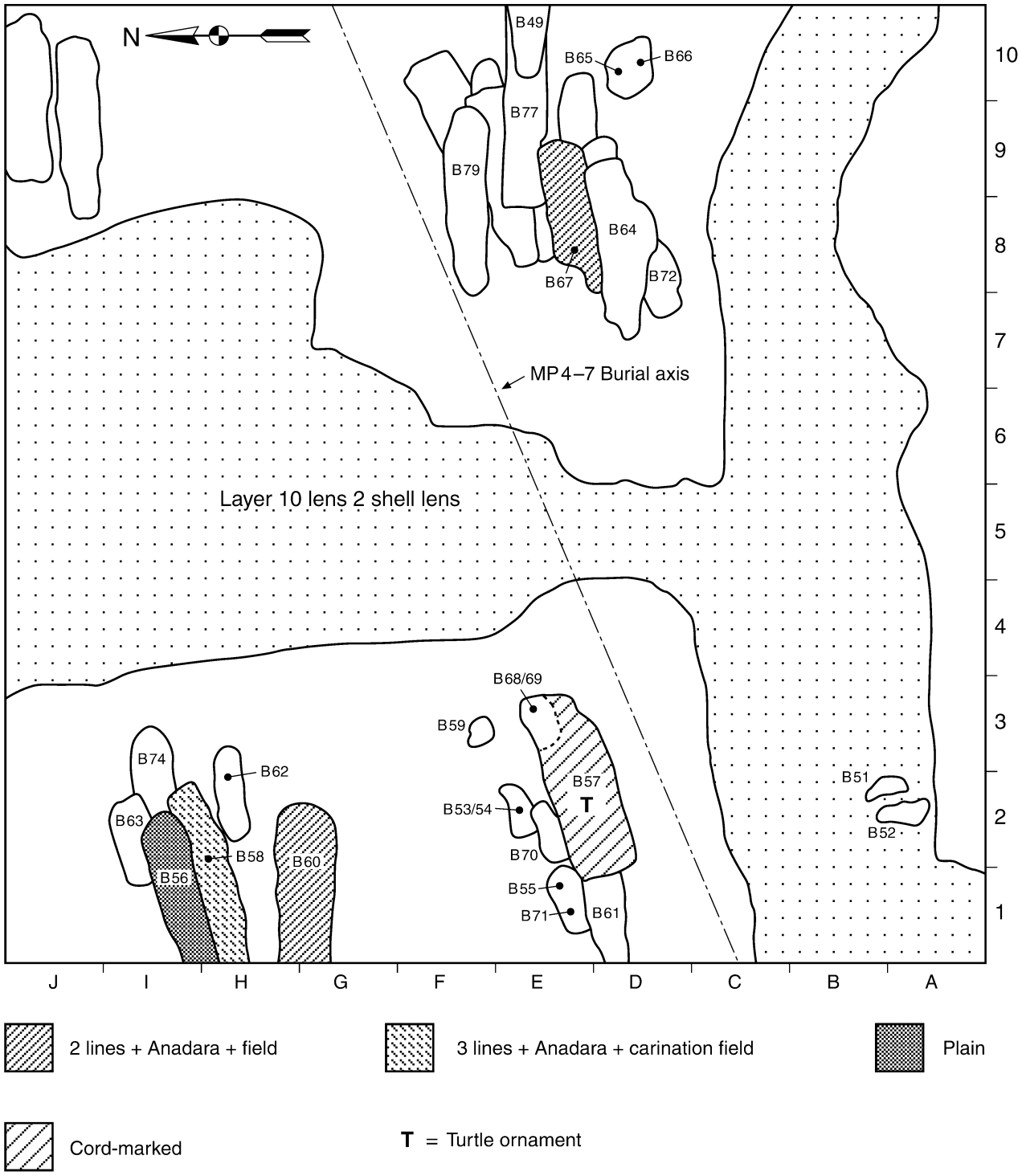


FIG. 289: Mortuary Phase 3b Burials

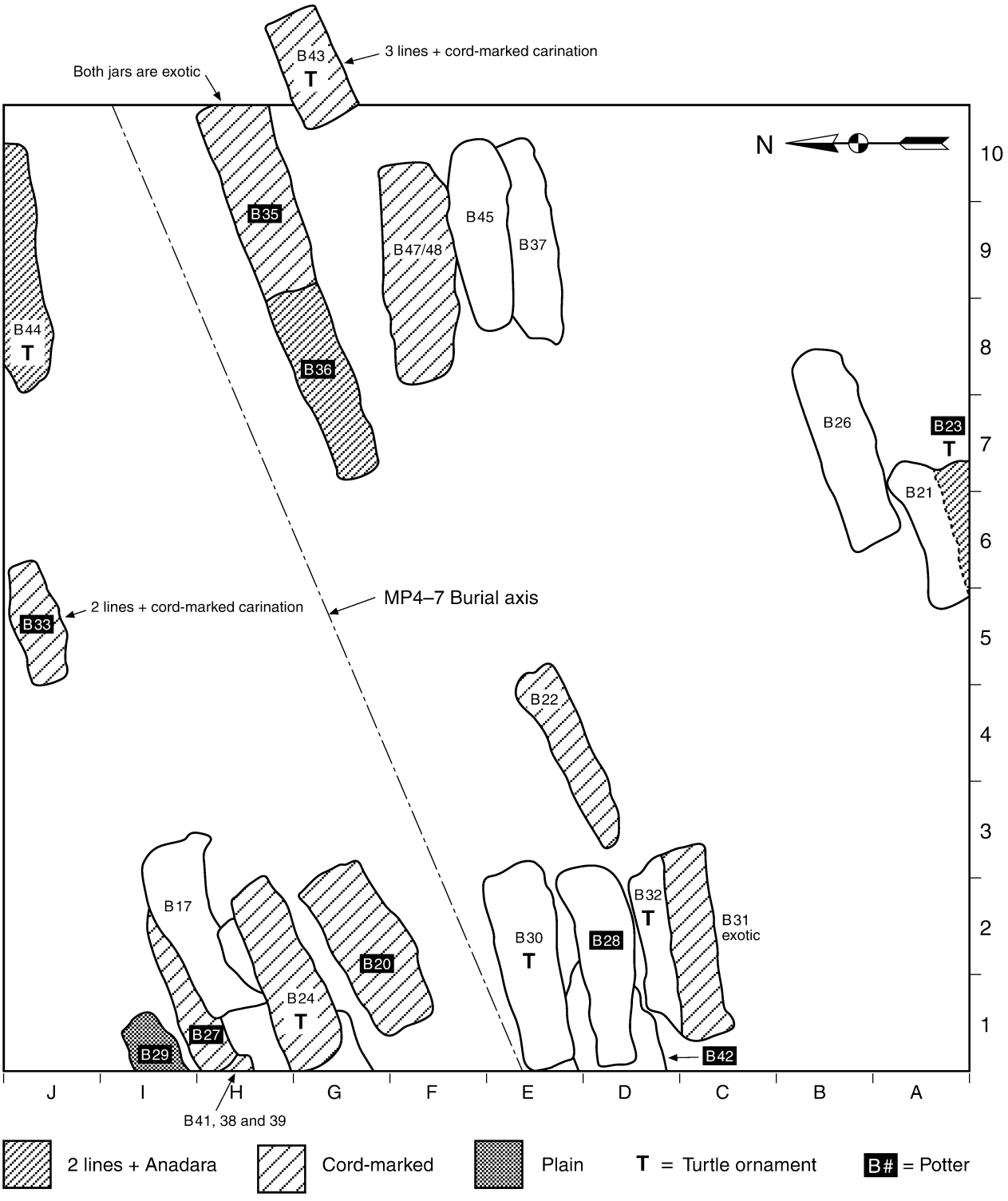


FIG. 290: Mortuary Phase Four Burial Jar Distributions

placed within two vessels arranged horizontally mouth-to-mouth in a circular grave, unique in the cemetery. It lay close to the feet end of the outstandingly large B15 grave (3 m by 1 m and up to 95 cm deep). The unique B14 mortuary urns (cats. 852 and 853, Figs 202 and 203), are of the highest quality for hand-crafted pottery. The maximum values assigned them (400 points each), are clearly inadequate (as is that for cat. 913, Fig. 200, in B15). Even so, including rich turtle burials, B14 scores higher than MP4 "non-potters" ($\bar{x}$ = 1067), and equals the mean for MP4 potters. The infant B16 included four local burial jars with the potters' group double line motif (Chapter IX), a miniature copy of the B15 anvil, (which even carries the same potter's mark on the handle base), and a similar range of jewellery. The three B15 burial jars carry the potters' double line motif.

TABLE 148: *Mortuary Phase 5 burial grave wealth*

Burial	Sex	Age	Burial Sherds	Pots	Other	Points	Burial	Sex	Age	Burial Sherds	Pots	Other	Points
16	I	15m	1000	800	2790	4590	15	F	35	2100	1400	26168	29668
14	I	15m	-	1200	54	1254							

Burial 14 included two local burial jars both inscribed with three lines and one an *Anadara* shell-impressed rim terminus. One has an *Anadara* shell-impressed and the other a cord marked carination point. The only other jar with the latter motif combination was found with B43, the rich MP4 turtle male discussed above. This further confirms the links between potters and the turtle ornament group. Significantly, MP5 was reserved for the richest individual in the cemetery, (a potter), the richest infant, (mimicking the adult in mortuary wealth and ritual), and a unique, also rich, infant burial. Apart from establishing a new distinct burial alignment in rows, MP5 graves were placed in close association to each other along the same axis.

> "When the woman in B15 was interred, there were no other burials in the excavated area. The site of her grave did not overlie any earlier burial, nor did a grave subsequently overlie hers" (Higham and Bannanurag 1990:328).

A rich midden of shellfish, ash, charcoal and food lenses lay nearby, indicative of ritual feasting. Much of the jewellery is unique in the cemetery. A mass of clay cylinders, covered with the smashed remains of two type L2j containers, lay over the corpse of B15. Numerous unopened *Anadara* valves were dispersed throughout the grave fill. Burial 16 was interred in a large grave (2 m long, 82 cm deep), soon after B15, again with clay cylinders placed over the body. Burial 14 was interred slightly later again. If B43 belongs to MP5, the mean MP4 "non-potters"' wealth reduces to 544 (n = 17), with the lowest score 200 and the highest 1900 (B24). The mean for MP4 potters is 1235 (n = 9), for non-potters with turtle ornaments, however, it is 716 (n = 4, range 420 - 1900). Clearly, MP5 graves are outstandingly rich ($\bar{x}$ = 11,837, excluding B43).

Links between the rich "non-potter" and the "potters"' group, through the cord-marked carination motif, can be contrasted with the discontinuation of CP2 type L2b burial jar motifs. Apart from the cord mark motif, introduced with B57, none continue into CP3, which further suggests a population change occurred at the CP2/CP3 interface. Identical burial jar motifs in B14 and B43 suggest the latter belongs in MP5, and increases MP5 burial wealth ($\bar{x}$ = 12,069). This group is, therefore, the richest encountered. It coincides with a potting horizon, when sherd weights increased from 20.42 kgs/m3 in MP4 to 22.40 kgs/m3 in MP5. It is important to note that this surge occurred during a period of marked potting florescence, when production was already double that achieved in CP2. Sherd weights fell to 4.12 kgs/m3 in MP6 and then increased to 17.21 kgs/m3 in MP7, although the migration of sherds from the overlying potting workshop magnified the latter values slightly. Thus pottery production and MP5 grave wealth peaked in unison. Significantly, it was restricted to two adults, B15 and B43, the richest female and male in the cemetery respectively, and two rich infants, B16 and B14 who are closely linked to B15 and B43 respectively. Of 31 CP3 burials, containing 53 type 2b burial jars, B14 and B43 alone carry the same motifs. It would be drawing a very long bow indeed to suggest that these two pairs of adult and infant burials were not in some way connected, both with each other and each with the other pair. Further, their motifs link them with B57. Thus MP5 was reserved exclusively for potters and turtle-related burials, for individuals associated with potting.

Two neonates, three infants, a 15 year old male(?) and six adults make up MP6. A nine month old infant (B2), included a unique type L2i vessel with the potter's two lines and shell impressions motif. The base and most of the rim were removed in prehistory. Remains of a L2b jar, (probably with two incised lines), and incised sherds were found in the grave. Neonates B5a and 5b lacked grave goods and B6, 7 and 18 were disturbed, the latter two seriously, in prehistory. All but B2, 5a and 5b revealed potting items. Potting clay was found with B4 (almost 1 kg), 6, 7, 8, 9, 11 and 19, anvils with B4, 18 and 19, and burnishing stones were found in B4, 6, 9, 13, 18 and 19 (Table 149). Burial 4 contained local and exotic burial jar rims, the former carrying the double line motif, and B6 included local sherds with this motif.

TABLE 149: *Mortuary Phase 6 burial goods: DL: double line rim motif, CM: cord-marked carination point*

Burial	Sex	Age	clay	anvil	stones	Pots	Burial	Sex	Age	clay	anvil	stones	Pots
2	I	9m	-	-	-	DL	9	M	30	x	-	1	CM
4	F	26	x	1	4	-	11	C	12	x	-	-	DL
6	C	9m	x	-	2	-	13	F	35	-	-	8	CM
7	I	21m	x	-	-	-	18	F	42	-	1	1	-
8	C	15	x	-	-	CM	19	F	25	x	1	2	DL

As with MP5 (Fig. 291), complete or fragmented mortuary vessels either carry a double line rim motif or cord-marked carination points. Only disturbed or neonate burials lacked vessels (Fig. 292, B4 included many vessel fragments). Graves and a unique mortuary structure originally built to entomb B19, a female potter, were precisely arranged and aligned with reference to those

established in MP3b and continued throughout MP4 and MP5 (Fig.290). Three local and one exotic burial jars were smashed and placed over the feet of B19. Burial 13, a female, contained three L2b jars with cord-marked carination points and eight burnishing stones. This grave may slightly predate other MP6 interments. Burial 9, a male, and B8 (in addition to a turtle ornament), included two such jars. Thus a tradition established with B57 in MP3b continued through MP4 and MP5 into MP6. Only those interred with potting accoutrements, and/or vessels with a double line motif, or alternatively with burnishing stones or potting clay and burial jars with the turtle group motif, were placed in or next to the mortuary structure. Such exclusiveness suggests that only those who manufactured and/or distributed pottery achieved prominence.

It is important to note that both potters and turtle graves included burnishing stones (Table 142). Burnishing is a precise skill needed to polish pots dried to the leather-hard stage. But it does not require the input of a specialist potter. With a little training, burnishing could readily be undertaken by helpers on a part-time basis. Turtle males could have also helped to collect and/or mix the potting clays.

Reservation of cemetery positions adjacent to a large mortuary structure, for those involved in potting, suggests a marked social heirarchy, a question further explored in Chapter XII. During CP3, graves with type 2b vessels occupied the central cemetery area. Initially, (MP3b), they appear to have shared this area with graves lacking such vessels. By MP4, 16 of 21 burials with vessels contained type 2b jars. All MP5 and most MP6 graves included them. This progressive concentration of vessels which carry motifs correlated with the potters' groups corresponds with the emergence of wealth and hierarchy noted elsewhere:

> ".... certain specific types tend to be *concentrated predominantly in the hands of the rich.* In terms of modern society this is quite unsurprising, but in prehistoric society it implies the emergence of an artefact assemblage associated with a select group of people" (Renfrew 1972:374).

Burial jar motifs are mutually exclusive to CP2 and CP3, with one exception, the double line associated with potters (motif 4 (M4), Appendix 4). Six local motifs were present in CP2. In CP3 there were 17, including two with local and exotic examples. The only motif to continue from MP3 contexts into CP3 is the cord-marked carination point introduced in MP3b with B57. In MP4, 66 per cent of burial jars have this motif, either alone or combined with other motifs. Double line and cord-marked motif burials completely dominate MP4, MP5 and MP6. All graves with type 2b vessels contain these motifs. On this evidence, potters and associated turtle burials were accorded exclusive rights to this portion of the CP3 cemetery.

A unique MP6 feature appears to be a tomb for B19 and perhaps later B18, both potters. The structure was located close to, and aligned in geometric harmony with, adjacent graves. Given the energy invested in the tomb, MP6 potters, as in MP5, were a high status group. This suggests that potters were set apart as craft specialists and that their wealth was derived from potting. Burials 19, 18 and 6 are the wealthiest of a rich group (Table 150), (although B6 and B18 were seriously disturbed in prehistory). No allowance has been made for the structure apparently dedicated to B19.

The mortuary structure floor, over 50 cm thick and comprised of about 28 clay coatings, securely sealed B19. A series of 20 cm diameter perimeter postholes, about 120 cm apart, suggest

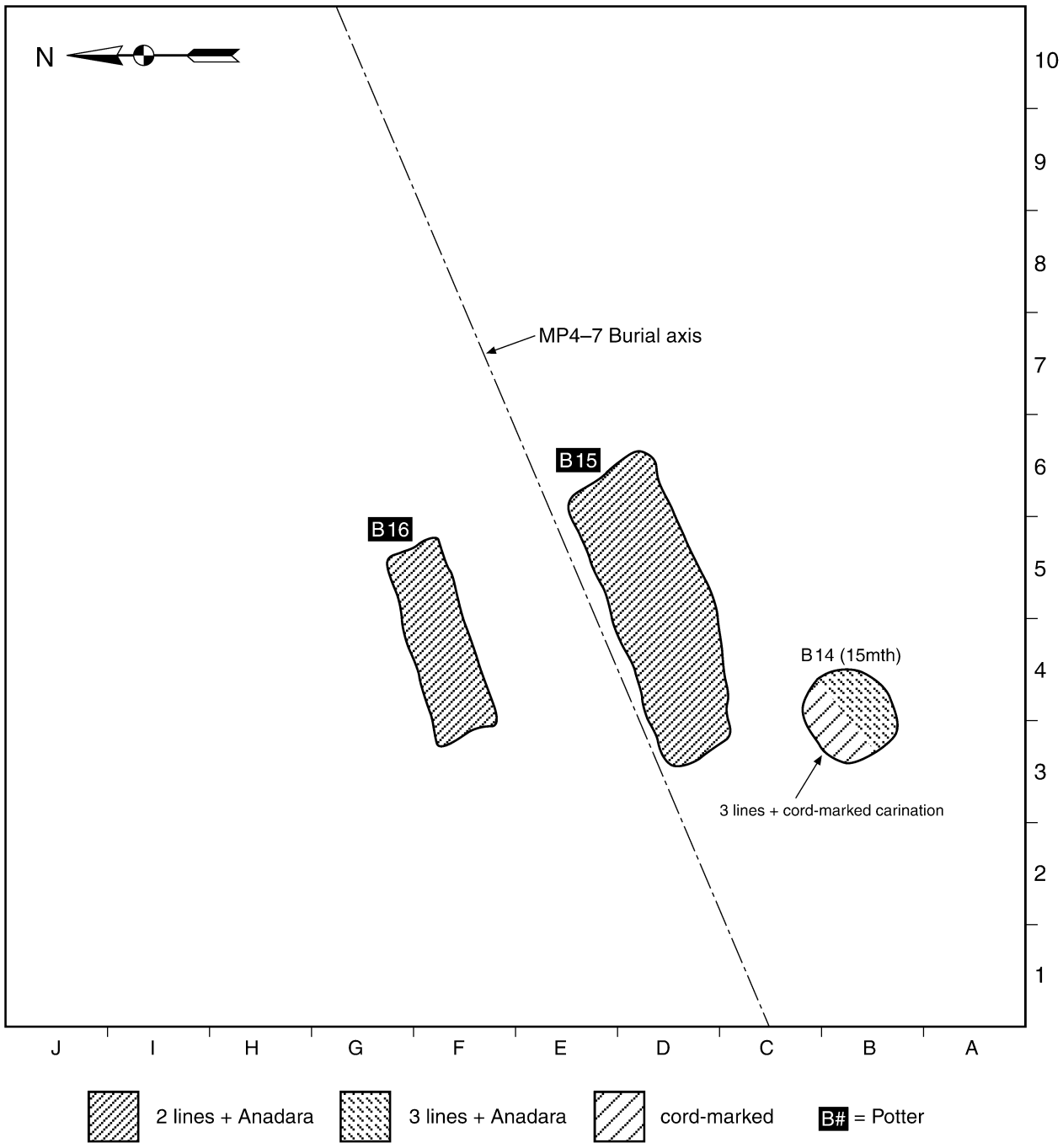


FIG. 291: Mortuary Phase Five Burial Jar Distributions

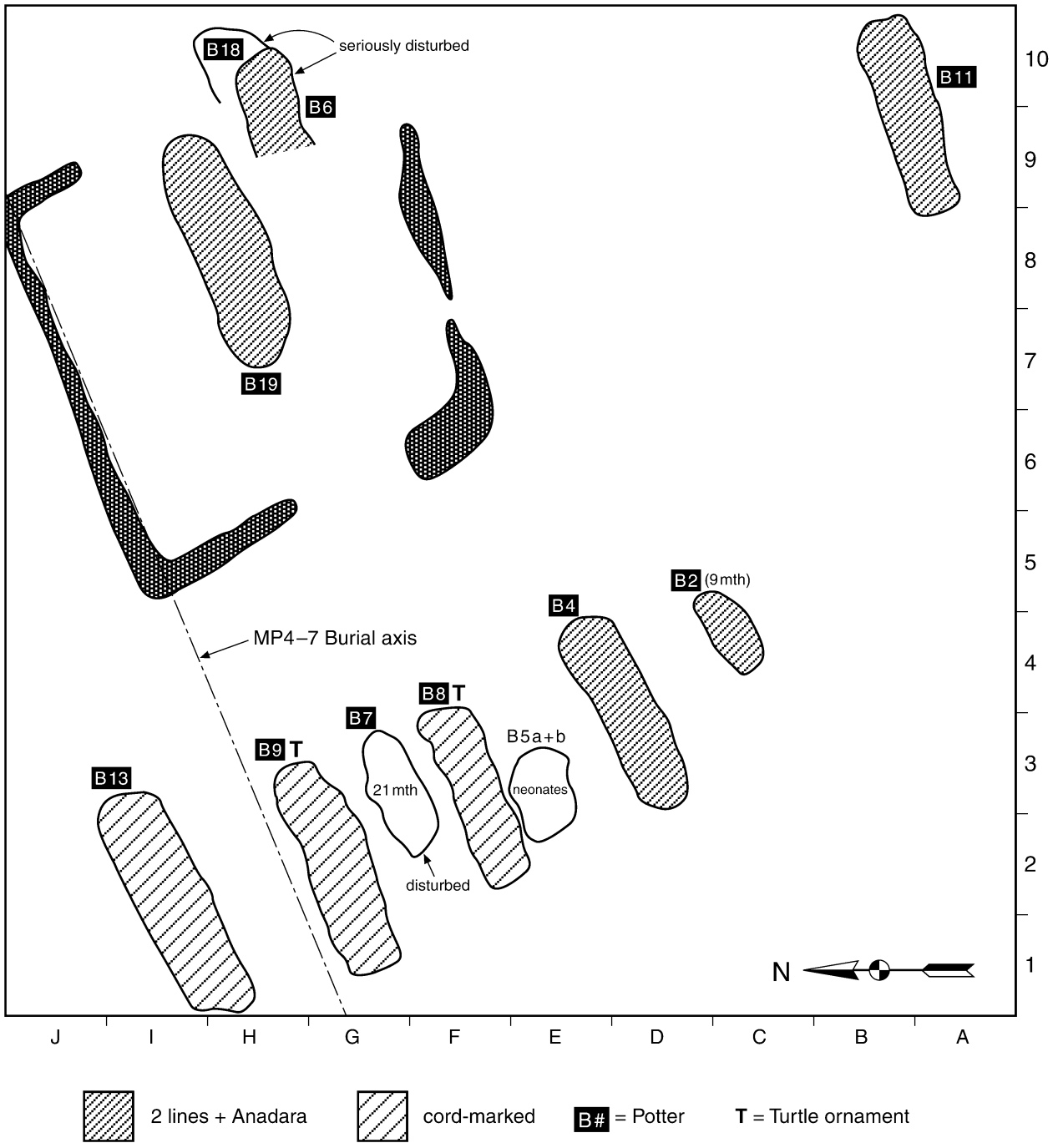


FIG. 292: Mortuary Phase Six Burial Jar Distributions

roof supports. The structure is notably 6° off square, perhaps deliberately so. Pits, ash and shellfish lenses lay in front and between a row of graves, interspersed with postholes to the west. Burials 2, 4, 5a and 5b, 7, 8 and 9 were probably interred following the erection of the B19 tomb. Varying clay compositions suggest repeated additions to the tomb floor, integrated with two major episodes. The lower layers appear related to the initial interment of B19. A perimeter upstand, formed as an extension of the upper floor layers, sealed postholes cut in the first construction period (Higham and Bannanurag 1990:343, Fig. 244; 339). Adding new layers as dedications could have formed part of subsequent mortuary rituals. Alternatively the two major episodes may represent separate important sacred activities. Adjacent grave alignments suggest reference to, and emphasize the significance of, this important symbolic feature. Perhaps following repeated dedications the tomb became a shrine honouring those who contributed to the community's well being, namely the potters' group. This possibility will be given further attention in Chapter XII.

South of the structure's centre line, burials include double line type 2b jars, those to the north cord-marked carination points. None cross the centre line, but B8, with a turtle carapace ornament, lies exactly along the central east/west axis, in perfect alignment with B19 (Fig.292). To the north, B7, although disturbed, revealed potting clay. Burial 9 contained potting clay and two turtle plastron ornaments, and B13, the only female in this group, contained the most burnishing stones in any CP3 grave. This suggests that she specialized in burnishing, not as a potter, but as a member of the associated group whose males traded the pottery. A unique exotic pot stand, tempered with sand, was interred with B13 which suggests links with coastal sites. Two neonates lacked grave goods (B5a and 5b), a common feature of such burials. Burials 4, 2 and 11 each included potting materials and/or double line type 2b burial jars, B6 included clay and two burnishing stones, B18 an anvil and one stone. An outstanding carinated burial jar with B11, a potting group member, carried stylised human figures. This vessel is unique.

Although determination of genetic relationships awaits DNA analysis, cranial features such as bregmatic bones at the coronal and sagittal suture intersections in B8 and B9, the shared retention of the medio-frontal suture (metopism), in B4 and B9, and the lambdoid wormian bones and parietal foramen of B4, B8, B9 and B13 suggest that they are consanguines (Higham and Thosarat 1994b:47). If so, this would reinforce the close relationships suggested here between potters and those associated with finishing and trading the wares.

Grave wealth ranged from 600 to 6336 points in MP6 ($\bar{x}$ = 2561, n = 10, Table 150), but care should be exercised when comparing these values with MP5 because they include disturbed graves. Burial 18 may have originally included vessels placed by the feet (as did B19), which were later removed in prehistory when a large pit was cut.

The energy expended on the B19 tomb and the probable loss of B18 and B6 grave goods in prehistory would add to these scores. Clay lenses in the eastern baulk wall could suggest another "chamber" to the east of the B19 tomb (Higham and Bannanurag 1990:339). But these are fugitive and could merely represent clay mixing and/or dumping residues. Postholes suggest a portal entrance in the eastern wall (Higham and Bannanurag 1990:342, Fig. 243). As construction would normally proceed in an orderly sequence, with floor coatings spread last, clay was probably piled outside the entrance prior to spreading over the floor.

Marks on potters' anvils probably signify ownership (Chapters IX and X). Three anvils were

TABLE 150: *Mortuary Phase 6 burial grave wealth*

Burial	Sex	Age	Burial Sherds	Pots	Other	Points	Burial	Sex	Age	Burial Sherds	Pots	Other	Points
2	I	9m	400	200	-	600	9	M	30	1300	400	301	2001
4	F	26	1600	-	60	1660	11	C	12	1200	800	79	2079
6	C	9	2000	-	4336	6336	13	F	35	1200	1000	161	2361
7	I	21m	-	200	2402	2602	18	F	42	400	400	2714	3514
8	C	15	1100	400	100	1600	19	F	25	1200	1200	461	2861

found in MP6 graves, but, although complete, surface damage on the B18 and B19 anvils may have obliterated any marks. Five small holes, arranged as on a die, mark the B4 anvil base (cat. 738). Chang (1986a:122), notes incised signs on Yangshao pottery "perhaps marking the makers of the pottery, or possibly the owners". Just as early seals probably represented ownership, "not so much the emergence of a concept of ownership but of a *distinction between ownership and immediate possession*" (Renfrew 1972:387), abstract potters' marks, "ideograms" (Harris 1986:32), on what are surely personal craft tools reinforce this notion. They suggest that anvils were not used or kept in the close possession of individuals, such as within the potter's house. Tools in the potter's immediate possession need not carry identification because their location would suffice. But if potters worked in groups, in a common location such as a workshop, then the identification of tools of a similar type would become important. Workshops could create a concept of separateness, perhaps excluding those without the necessary craft skills. Potters' marks, therefore, may have had a different connotation to insignia or "totems" on burial jars. The latter probably represented social groups such as clans, to which all were members of one or another. Generally, only high quality vessels carried insignia. The distribution of burial jars amongst the wealthy implies membership of a distinctive group, perhaps an incipient élite.

The final cemetery phase (MP7), contained four burials. Only the feet of B10 and the legs of B1, a nine year old, protruded into the excavation. An infant partially within the excavation square, (B3), was represented by disarticulated bone fragments. Burial 12, a 12 year old, also lay partially outside the excavation. Burial 1, the only grave to include potting tools, a burnishing stone and two anvils, scored 1240 points, B3, 1033 and B12, 976.

CERAMIC PERIOD 3 AND RELATIONSHIPS WITH OTHER SITES

Exotic wares, represented by 14 different fabrics, entered Khok Phanom Di during CP3. Seven fabrics (FG8, 9, 10, 11, 12, 13 and 14), noted in CP2 rims, continue from CP2, two (FG15 and 16), discontinue and five new exotic fabrics (FG6, 18, 19, 20, 21 and 22), were added (Chapter VIII and IX). Exotic mortuary vessels continued to arrive from two sources (FG11 and 12) and two new fabrics (FG17 and 18), are present. One FG6 vessel, cat. 1290, derived from B57 in MP3b and included with CP2 wares, properly belongs in CP3 (see above), as does cat.

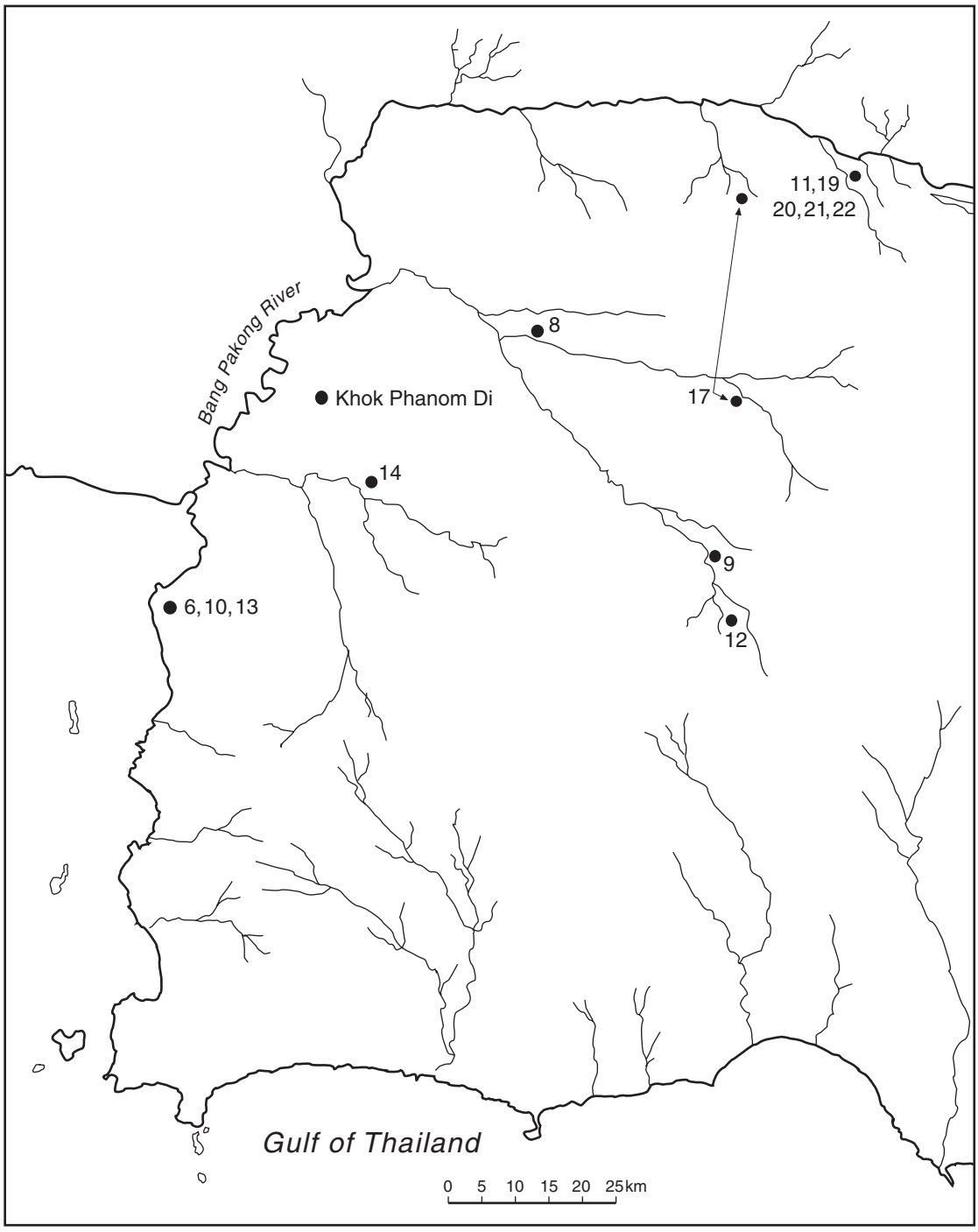


FIG. 293: Suggested exotic pottery sources. Ceramic Period 3

1319 (FG8), from B64. The former has a suggested coastal source about 45 km to the south, the latter inland about 45 km to the northeast. One MP4 carinated burial jar (FG12, cat. 2032, B41), also probably derives from inland about 70 km to the east-southeast, another (FG11, cat. 987, B31), from an inland source 100 km away in the Prachinburi River catchment area. B35 (MP4), included two exotic jars containing chert. Two possible sources, one about 70 km to the east-southeast and the other about 75 km to the northeast, both lie inland. A unique pot stand interred with B13 (MP6), contains shell which suggests a coastal source.

Exotic potting equipment strongly suggests immigrant potters. The B15 anvil fabric is consistent with a suggested source about 45 km to the northeast (FG8, Fig. 293). Exotic anvil fragments found in the general matrix feature either orthodox or bleb grog and in one case rice temper. The latter two suggest a close association with rice agriculture. Exotic burial jar rim sherd fabrics (FG6, 19, 20, 21 and 22), show that external relationships expanded to include further inland sources, probably lying about 75 km in a direct line to the northeast, or upstream in the Prachinburi River catchment area.

Inland sources, particularly near the headwaters of the Bang Pakong River, are increasingly emphasized. Near coastal sources continue, but exotic ceramics suggest stronger connections with inland regions. Khok Phanom Di occupied an ideal location at the interface between coastal and inland river trade or exchange networks. Linkages would confer considerable advantages over separate networks. Tayles (1999:287-9) reports that the CP3 male population tended to be smaller in stature than the CP2 community, which could indicate a different population mix. Perhaps some of these, for example B15, derived from inland communities. Such connections may have stimulated external relationships with previously isolated inland communities. High proportions of MP1-3 males had degeneration of "the shoulders and the knees, ankles and feet in particular. In contrast, in the later phases almost no males suffered from joint degeneration." (Tayles 1999:299).

A marked increase in exotic fine wares, including burial jars, is correlated with a massive increase in the local production of coarse ware cylindrical containers. This suggests that exchange relationships, potters' wealth and container production were correlated, perhaps because the containers were essential for transporting coastal resources inland. But continued coastal connections are evident in the presence of exotic pottery and valuable marine shell, such as *Tridacna sp.*, used in jewellery. Direct access to this shell was probably restricted by environmental change. *Tridacna sp.* shell is "likely to be directly associated with coral" in a shallow off-shore area "somewhere upcurrent from the site" (Mason 1991:304). CP3 witnessed "a dramatic rise in fresh water species" which "suggests a prograding, muddy coastline and increasingly freshwater environment" (Mason 1991:314). Stone sources probably ranged from the Khorat Plateau southern edge to the sea and exotic shell from sheltered coralline locations to the south. Similar H-shaped beads to those recovered from MP6-7 were found at Huai Yai, about 120 km to the northwest (Natapintu 1988). This mix suggests that two networks, coastal and inland, were active during CP3.

CERAMIC PERIOD 4: SUMMARY

An abrupt change from cemetery to artefact manufacturing activities marked the CP3/4 boundary. Floral and faunal changes reflect a major environmental shift, from marine to open dry conditions. Clay preparation and pottery making dominated CP4, the upper metre of the excavation, and a huge increase in potsherds distinguished its upper levels. New clay preparation techniques appeared. Coarse wares were tempered with rice and most fine wares and ceramic anvils with bleb grog. As suitable charcoal deposits were lacking, two local sherds with abundant rice temper were submitted to the University of Oxford Radiocarbon Accelerator Unit for radiocarbon determinations. They provided uncalibrated dates of 4095 $\pm$ 70 for L2:2 and 4285 $\pm$ 55 for L3:4.

Workshop floors were free of postholes, in contrast to earlier contexts, but littered with potsherds, prepared clay cylinders and anvils, many bearing potters' marks. Pottery firing evidence, prominent at the site margins, was absent in CP4 except for several small patches of localised burnt clay, probably from grog firings. Many sherds appear surface-damaged by natural erosion. Ceramic anvils were concentrated in middle and burnishing stones in upper layers. Seven of 135 anvils are exotic, including three composed of FG11, one tempered with sand and one with orthodox grog. At least 78 (about 95 per cent), of local anvils contain rice, mainly associated with bleb grog temper. Over 20 per cent display potters' marks, nearly 45 per cent cord marks and nearly all are composed of local clay.

Numerous prepared cylinders of clay (about 30–40 cm long by 10 cm diameter), were recovered. Some are marked with diagonal parallel or criss-crossed incised lines, either from banana leaf wrappings (to retain moisture), or perhaps as ownership marks. One cylinder end was belled out, suggesting an early stage in vessel forming. Several contain rice husk and grog-like inclusions. About 95 per cent of the total prepared potting clay recovered came from CP4. Although slightly silty, it is sufficiently plastic for coarse earthenwares. Two local clays were variously exploited and sometimes may have been blended, but this is unlikely.

Fine burnished and incised wares were restricted to deposits immediately overlying CP3, which suggests their dislocation during pit digging. But paddle-impressed and incised fine ware sherds, the latter correlated with bone stylus points, increased markedly. Most paddle-impressed wares probably contain local bleb grog, although a few are exotic. Minor amounts of appliqué wares, ceramic pellets and counters were found, but painted and punctate sherds are very rare.

Local coarse ware rims comprise over 80 per cent of the rim assemblage and, minor variations apart, are as for CP3. Local cylindrical jar rims are tempered with rice, but better quality globular jars contain either rice or bleb grog. Fine wares diminished in quality but expanded markedly in variation, with only about 14 per cent common to CP4 and CP3. Most CP4 fine wares are inferior but more elaborate than their CP2-3 counterparts, differences which resulted from lower potting standards rather than material changes. Although the CP2/3 traditions are closer than those of CP3/4, because decorative treatments and some shapes changed, CP4 local wares also readily relate to earlier regional styles. CP4 fine wares contain bleb temper (as do exotic wares throughout CP1–3), used in concert with the introduction of carved wooden paddles. Small amounts of exotic paddle-impressed, bleb-tempered wares occurred throughout CP2/3. Two tripod feet (one probably exotic), and a variety of lids and pot bases reflect regional styles.

Rice or bleb grog tempers were present in exotic wares throughout the sequence. At least

four sources are represented in CP4. Of particular interest are two exotic bleb-tempered wares containing limestone which outcrops in two locations on the eastern flanks of the Ban Pakong Valley. Other exotic wares contain igneous or metamorphic sand. About 65 per cent of the rim forms are represented by exotic sources.

Most CP1–3 decorative modes continued into CP4, but some local pottery displays fingernail impressions, a mode first noted in CP3. The CP3 local wares imitate exotic bleb-tempered wares, some of which contained limestone. Only 14 "complete" vessels were recovered; all are local except one historic stoneware specimen. They include bowls, carinated burial jars, footed jars and small test pots. Historic stonewares and porcelain made their first appearance near the top of CP4.

CERAMIC PERIOD 4: DISCUSSION

Temporal changes afford technical and socio-economic comparisons not often available in single use sites. A relatively short sequence, perhaps spanning little more than 500 years, permits integration of the Khok Phanom Di potting traditions into a broader perspective than would be available if each were viewed as a separate component. Although each technology and style differs, a temporal continuum is clearly evident in aspects of both. Changes in clay preparation techniques are readily defined, however pottery tended to "drift" over time. This meant that only about 26 per cent of rim forms were common to CP3/4. Fine wares generally became coarser as potting standards fell away. This contrasts markedly with CP2/3 when high quality pottery was the norm. Some high-quality fine wares continued, however, which suggests certain local potters were more skilled than others.

Fine wares changed to emphasize coarser plates or platters. Their more varied decorative elaboration suggests changes in consumer requirements. A substantial increase in paddle impressing on both coarse and fine wares, as an alternative to cord marking, suggests the arrival of new potters, if not of a different community. Changes in rim forms, a decreased elaboration index, fewer categories and variants, particularly in the most prominent fine wares, together suggest that less energy was expended compared to CP2/3. Pottery types changed with many previously common fine ware forms, such as jars and bowls, giving way to platters. Paddle impressing and a few minor decorative techniques aside, however, the essential characteristics remained the same. Burnishing, cord marking and incising continued as before. Thus the CP4 tradition can reasonably be conceived as a derivative of the regional potting traditions to which CP1-3 also belonged. Modified in some respects, changed in others, but overall, CP4 can be characterised as a variant of Bang Pakong Valley regional potting traditions during the 2nd millennium BC. Given that this is correct, valid comparisons can be made between CP4 workshop activities and CP2/3 mortuary rituals. Of particular interest is the manner in which potting was undertaken in CP3 when production increased markedly.

Illumination of CP3 potting methods is facilitated through the CP4 workshop evidence. Clay preparation methods, clay cylinders and potters' marks on anvils provide important insights. Grog temper was probably fired in a workshop. Convenient blocks of clay, rolled into cylinders wrapped in banana leaves, were probably carried from quarries about 120 m away, and stored

for later use. Each weighed about 1.5-2 kg, perhaps not too heavy for an older child to carry. Carrying several cylinders bundled together and hung on a pole would be more efficient, but require an adult's strength. Alternatively clay blocks could have been broken down, temper added if necessary, and then rolled into cylinders in, or near, the workshop. Quarrying and transportation requires little skill. Wedging, mixing, forming and finishing, however, were probably undertaken within the workshop as separate stages. Again, the first two steps need not involve skilled potters. From the forming stage onwards a variety of skills, some requiring little training, but others considerable expertise, would be needed. Potters' marks suggest potting in a community workshop, or, in Peacock's (1982) terms, a "manufactory". But whether such a term has relevance in Southeast Asian contexts of this period requires further research.

The level of organisation reflected in the potteries described in this study are important gauges of their sophistication. Modes of production, scale and complexity are apparent in their elements and contexts. It is important to note that the similarities between CP4 and CP3 organisation are considered sufficient to argue for continuity in modes of production. CP3 burials feature potting anvils (many bearing ownership marks), burnishing stones and prepared potting clay, all of which match those found in the CP4 workshop. Such tools and materials are essential elements of potting. Their similarities are so marked that each could belong to the other and mirror the same modes of production. Which kind of production system fits the evidence is considered below.

In grave goods terms CP2 potters achieved less recognition than CP3 potters. CP2 also contained anvils with potters' marks, none securely associated with a burial, and burnishing stones. Clay cylinders and coarse ware cylindrical jars first appeared in association during CP3. Clay found with B109 (Chapter VIII), lacks the distinctive shape and markings of CP3/4 cylinders.

CERAMIC PERIOD 4 AND RELATIONSHIPS WITH OTHER SITES

After allowing for sherd dislocation from CP3, external relationships appear less vibrant than in CP2/3. At least six exotic sources are represented in CP4. Three of these were present in L4, four in L3, and three in L2. Two wares suggest an inland source near the Prachinburi River, a tributary of the Bang Pakong. Two sources lay much closer on the coast and two are geologically non-specific. Because CP4 comprises a workshop rather than a cemetery, exotic pottery volumes are small compared with CP2/3 (Chapter X). Three possible exotic anvils include one with a potter's mark (cat. 490). Each differs in fabric, with sand, orthodox and bleb grog noted. Six exotic rim forms contain FG11, with a suggested source about 100 km away near the Prachinburi River. These wares feature bleb grog which contains rice by-products. Rice in local pottery and links with rice-related production centres, established in CP2 and expanded during CP3, suggest a well-maintained association. Most CP3 paddle-impressed wares feature bleb temper and a Prachinburi source is likely. Paddle impressing, initiated following more-or-less continuous links with the imported ware throughout CP2/3, is a prominent CP4 technique. Perhaps people from the inland source familiar with this tradition settled Khok Phanom Di following an abandonment at the close of CP3. Coastal sources are notably less prominent in CP4, suggesting remoteness or, perhaps more likely, a focal shift in external relationships.

THE CERAMIC SPECTRUM

Firing temperatures

Open air raft firings are clearly indicated by firing stands coated with ash in CP1 and CP2 (Chapters VII and VIII). Mullite in firing stand fabrics indicates that temperatures of at least 1050°C were achieved. Such temperatures produce glassy vitrification structures in clays (Vincent 1988). None was observed in pottery samples examined under a binocular microscope at 40 magnifications. These sherds compare with Khorat Plateau pottery subjected to SEM analysis which determined that they were fired in the range 800–950°C. Hence it is considered appropriate to characterise Khok Phanom Di pottery, both local and exotic, as low temperature biscuit-fired earthenwares fired to about 850°C. Mullite probably formed when the firing stands unintentionally came in contact with "hot spots". Ceramic stands would have been valuable firing raft supports as their fabrics required the careful removal of any non-plastics, likely to expand and shatter the stand under repeated heating and cooling, prior to initial firing. These are conditions not often encountered in open firings. Thermal stress would eventually create fractures and render the stands unusable. Rare potsherds with glassy phases, which suggest similar temperatures, were noted.

Ceramic firing stands

The presence of firing stands dispersed throughout the CP1 occupation lenses of ash, charcoal and pottery wasters is readily understood, but not their presence in cemetery contexts (Table 151). Four changes are correlated with the MP3 stands. First, a hiatus in mortuary rituals occurred near the top of MP3. Second, the local pottery tradition changed. Third, exceptionally high concentrations of very large charcoal fragments were deposited. Finally, environmental changes are heralded by a shift from mangrove to terrestrial flora and fauna. Immediately following the CP2/3 transition, non-Rhizophoraceae species form the majority of the charcoal by weight, and marine species are essentially replaced by freshwater taxa, a trend which continued throughout CP3.

The brief hiatus in mortuary activity is correlated with much pottery, ash, charcoal and the firing stands. Charcoal deposits are consistent with pottery firings or forest clearance, or both. Cleared trees would provide ideal fuel for firing pottery. In form and fabric the cemetery firing stands differ from their CP1 counterparts. Nearly all are composed of a local clay not found in earlier stands. Critically, marked changes in the local environment co-incided with the mortuary hiatus and this could have led to a brief site abandonment, perhaps long enough for a vegetation cover to develop. It seems reasonable to speculate that, when re-occupied and cleared of trees, this portion of the site was initially used for pottery firings and then shortly afterwards re-instated as a cemetery.

TABLE 151: *Firing stands by Ceramic Period and Mortuary Phase*

CP	MP	Stands	% of total	Cord marks	CP	MP	Stands	% of total	Cord marks
2	1	-	-	-	3	3	6	37.50	6
1	-	9	56.25	8	2	2	1	6.25	1

Potting clays

Dumps of unfired local clays, some prepared for potting, were irregularly dispersed throughout the sequence (Table 152). Some L2 potting clays contained incidental rice husk. CP1 dumped clays and local pottery fabrics contain sand temper. In CP2 they contain grog. CP3 pottery is less sandy than that in CP2. Although mineralogically similar, the CP2 nonplastic inclusions are coarser, which suggests that CP3 potters preferred finer clay. Both clays are sufficiently plastic for fine wares. CP1 material is more micaceous, but also consistent with several samples taken from various points around the site.

TABLE 152: *Prepared potting clay weights by layers and Ceramic Period*

CP	Layer	Weight (kg)	Clay	Temper	Period total
4	2	75.39	fishpond	none	
	3	152.22	fishpond & *din niao*	none	
	4	64.88	fishpond	none	292.49
3	5	8.14	fishpond	none	
	6	3.42	fishpond	none	
	7	15.50	fishpond	none	
	8	0.55	fishpond	grog	
	9	0.88	fishpond & *din niao*	none	
	10	0.07	fishpond & *din niao*	grog	28.56
2	10	1.06	micaceous	sand	1.02
1	11	0.05	micaceous	sand	0.09
Total		322.16			322.16

Fourteen burials included potting clays. Two are in MP3b, three in MP4, two in MP5 and seven in MP6 (Table 153). CP3 contained almost 30 kg, about 57 per cent in burials. Most are a silty (fishpond) clay, reserved for coarse utilitarian wares. Of 22 samples examined, three were tempered. The B19 clay included incidental rice, while K429 and K425 include fishpond clay, the latter within a calcitic matrix. The use of one clay as grog to temper another clay

suggests that such mixtures were preferred over clay blending. Cylinders of prepared fishpond clay, introduced during CP3, were interred with B15 and B16. About 11 kg covered the corpse of B15. CP3 type L2j vessels were formed, some probably directly, from cylinders of fishpond clay tempered with grog. These pots are either friable or hard and brittle with fabrics that appear to have been quickly prepared. But a less silty local clay was used for better quality wares, such as type L2e pots.

TABLE 153: *Prepared potting clays in burials and dumps*

CP	MP	Layer	Burial	T.S./h.s.	Clay	Temper	Weight (kg)	Layer %
4		2.2	-	K99	fishpond	none	-	-
		2.2	-	K104	fishpond	none	-	-
3	6	5.2	B19	h.s.	fishpond	none	0.11	1.35
	6	5.3	B6	h.s.	fishpond	none	0.02	0.25
	6	6.1	B4	h.s.	fishpond	none	0.80	23.39
	6	6.3	B7, 8 & 9	h.s.	fishpond	none	0.10	2.92
	6	6.4	B11	h.s.	fishpond	none	0.02	0.58
	5	7.2	B15	h.s.	fishpond	none	10.99	65.56
	5	7.2	B16	h.s.	fishpond	none	3.99	23.84
	4	7.6	B36	h.s.	fishpond	none	0.05	3.31
	4	7.8	B27	h.s.	fishpond	none	0.05	3.31
	-	8.2	-	K428	fishpond	none	-	-
	-	8.3	-	K425	micaceous	grog	-	-
	4	8.4	B28	h.s.	no data		0.02	3.64
	-	9.1	-	K431	fishpond	none	-	-
	-	9.5	-	K426	fishpond	none	-	-
	3?	9.7	B49	h.s.	fishpond	none	0.01	1.14
	-	10.2	-	K427	fishpond	none	-	-
	-	10.2	-	K429	micaceous	grog	-	-
	-	10.2	-	K430	fishpond	none	-	-
	3?	10.3	B58	h.s.	no data		0.03	2.65
2	-	10.21	-	K432	fishpond	none	-	-
1	-	11.2	-	h.s.	unknown	sand	0.07	100.00
Total							16.26	

Another micaceous local clay (*din niao*) was also present in CP2 and CP3. Similar clays were mainly reserved for fine wares and the fishpond clay for utilitarian wares. Fishpond clay exploitation increased markedly during CP3 in concert with a huge increase in coarse ware production. Differential clay use could suggest a shortage of superior quality deposits, or that the silty fishpond clay was suitable for coarse wares more-or-less “as received”. Better quality,

more plastic, clays often need temper to improve their drying and firing responses. While the final product is superior, they require more effort. Variations in quarry deposits probably account for the use of fishpond or *din niao* clays in different local wares, with the best of either deposits being selectively exploited.

If the clay cylinders, found only in CP3 and CP4, contain temper this would illuminate clay preparation and pottery fabrication procedures. Rice remains noted in some cylinders could be deliberate additives or accidental inclusions. The small amounts of rice husk observed in some dumped fishpond clay suggests it needed little modification for coarse wares. CP3 burial cylinders lack temper, but some amorphous CP3 fishpond clay dumps include grog, which implies that the cylinders represent stored material rather than pre-forms. The variable amount of rice in CP4 coarse wares, however, suggests this evidence should be treated with caution as some vessels may have been formed directly from untempered cylinders.

Ceramic anvils

The number of craft specialists in a community is a measure of their socio-economic importance. Pottery densities provide an approximate gauge of production intensity and, by calculating output using pots-per-day values drawn from ethnographic evidence, the number of potters. But climate, technology and raw material variables need consideration. In monsoon regions, production is restricted to dry seasons because during rainy periods clay and unfired pottery becomes too wet. Annual, or longer, climatic fluctuations are variables too complex for output estimates to be quantified with any precision. But overall sherd weights allow inter-site comparisons, and temporal changes in potting accoutrement quantities, given similar technologies, are a guide to local developments.

TABLE 154: *Khok Phanom Di anvils by Ceramic Period*

CP	Anvils	% of total	Complete	%	Fragment	%
4	136	62.96	22	16.17	114	83.82
3	30	13.89	11	36.66	19	63.33
2	37	17.13	20	54.05	17	45.94
1	13	6.02	2	15.38	11	84.61
total	216		55	25.46	161	74.53

Correlating the cemetery potting tool numbers with pottery volumes provides an approximate measure of potting intensity. But more ornamental wares were produced in CP2 and coarse production increased markedly in CP3. Simple utilitarian vessels require much less time than ornamental wares to manufacture. Therefore, if potting tools *and* coarse wares increase in tandem, an increase in pottery production is clearly signalled.

The prestige accorded female potters in CP3 mortuary ritual emphasizes their importance and implies that potting was highly valued. Although many modern craft potters have a low social position, Arnold (1985:198) gives ethnographic examples of high status female potters who have a "relatively high position because they supplement primary subsistence activities–" or "when the demand for pottery involves mythical, religious or social structure symbols." The number of anvils in CP3 burials suggests that potting carried high socio-economic value. CP2 potters produced high quality ornamental wares the equal of their CP3 counterparts. But CP3 coarse ware output increased at the expense of fine wares, thus potters who could quickly and efficiently produce them would be in demand.

Anvils numbers decreased from 37 in CP2 to 30 in CP3 and in terms of site depth, from 17 to 14 per cent (Tables 154 and 155). In burials, however, they increase from one, of equivocal provenance, in CP2 (MP3), to 10 in CP3 (MP4–7, Table 156). Many non-burial anvils are only fragments, thus the proportion in burials is higher than indicated. Anvils in burials increase steadily (about five per cent in MP3 to 100 per cent in MP7), as do anvils with potters' marks (Tables 156 and 157). Some clay cylinders were also marked and both increased dramatically in CP3/4. This suggests that some form of mass production was established for L2j coarse ware containers during CP3.

TABLE 155: *Anvil numbers as a percentage of site depth*

CP	Site depth (m)	% of site depth	Anvils	% of total anvils
4	1.231	18.08	136	63
3	3.110	45.67	30	14
2	2.059	30.23	37	17
1	.409	6.02	13	6
total	6.809	100	216	100

Mass production is often associated with factories or other industrial workshops involving wheel-thrown output and wide distribution networks. Applying Peacock's modes of production criteria, however, encourages a re-assessment of large-scale craft potting. Although the climate probably precluded year-round production, raw material, labour and market availability are key components of "nucleated" workshops (Peacock 1982:9). In the Roman world " a fairly standardised range of high-quality products" characterised these workshops. But at Khok Phanom Di demand for standardised containers to transport resources through established exchange networks may have stimulated mass production. In terms of sherd densities, local production increased by over 30 per cent in CP3 compared with CP2. Rim sherds, a more accurate measure of densities, reveal that local coarse wares increased by over 66 per cent in CP3 and fine wares simultaneously decreased by over 61 per cent. This is a major shift.

It is important to note that exotic bleb and rice-tempered anvils increased from one in CP2, two in CP3 to three in CP4 when local pottery shared the same rice-related technology. Although

present throughout the sequence in exotic fabrics, rice was first used in selected CP3 local fine wares. Bleb temper dominates CP4 local anvils.

TABLE 156: *Anvils by Mortuary Phase*

MP	Anvils	% of total	In burials	%	Complete	Marked	%
seven	2	2.94	2	100	2	-	-
six	6	8.82	3	50	4	1	25.00
five	4	5.88	2	50	2	2	50.00
four	12	17.65	3	25	4	-	-
three	19	27.94	1	5.26	3	2	10.53
two	17	25.00	-	-	11	2	11.76
one	8	11.76	-	-	3	-	-
total	68	100	11	16.17	29	7	10.29

Over 16 per cent of the 216 anvils recovered display potters' marks (Table 157), but as many are represented by small fragments, this proportion is probably much higher. Over seven, 14 and 20 per cent of CP2, CP3 and CP4 anvils respectively are marked, as are seven of 11 found in burials. Marked anvil proportions peaked in MP5 at 50 per cent. Absent in MP4 and MP7, they increased from three of 37 (7.5 per cent) in CP2, to four of 30 (14.29 per cent), in CP3. Three were recovered from CP3, two with identical marks, but none from CP2 graves. At least 24 individual marked anvils (17 are distinctive), were found in the CP4 workshop. Broken anvils were duplicated and 12 display the same marks. This further reinforces the notion that the marks symbolize individual ownership.

Of 136 CP4 anvils, 28 have distinctive marks. Clearly many potters shared the workshop, but each reserved ownership of their equipment and perhaps also their products. Some clay cylinders are also marked and if this also denotes ownership it could imply mass production. Marked cylinders may have been reserved for groups related by socio-economic ties, with part of each team quarrying and transporting clay to the workshop. Several CP3-4 cylindrical containers also carry distinctive marks (Fig. 146). The use of motifs on such low quality, very easily broken, vessels is unusual.

Traditional trade marks, resembling the body tattoos of potters, are reported on wares produced at Boera, Papua New Guinea for trade to the Gulf of Papua (Arifin 1991:373-87). These are "handed down from generation to generation within the female line and no women from other families may copy them" (*op. cit.* 382). On trade expeditions the marks identify pot owners. Females made the pots and males traded them. Traded vessels were thinner, lighter and easier to carry, with a more limited life than those kept for local use. To satisfy demand for everyday cooking vessels, only small pots suited to long distance transportation were traded. The Khok Phanom Di exotic spectrum includes a very broad range of high quality wares which suggests that other production centres could have readily satisfied regional demands for utilitarian pottery.

Competition for consumers often stimulates improved product standards. But notably, the local containers are extremely low quality, probably single-use items, not suited to everyday use.

TABLE 157: *Anvils with potters' marks by Ceramic Period*

CP	Anvils	% of site total	Marked	% of CP marked	% of total marked
4	136	63	28	20.59	80.00
3	30	14	4	14.29	11.43
2	37	17	3	7.50	8.57
1	13	6	-	-	-
total	216	100	35	16.36	100

Anvil and cultural deposit depth proportions provide an approximate guide to potting output, but are considered less reliable than pottery distributions (Table 155, depths are averaged). The distribution of anvils in mortuary contexts is set out in table 156. But only B4 (MP6), B15 and B16 (MP5) included anvils with potters' marks. Potters' marks were present on 13 complete and 22 fragmentary anvils (Table 157). Over 21 per cent of CP2, over 13 per cent of CP3 and 46 per cent of CP4 anvils display cord marks.

Modes of decoration

Decoration modes are important markers of cultural styles, provided the local ceramic spectrum is fully understood and modes are not copied from external sources. Potters often copy fashionable styles. Khok Phanom Di modes included incised, impressed, incised and impressed combination, cord marked and incised on a smoothed band, paddle impressed, appliqué and ridged and notched. Most fine wares were highly burnished, some with further decoration. Some of these styles were copied from elsewhere. Shell-impressed decoration dominates the spectrum. The *Anadara* shell used is a marine species (Mason 1991:249-319, Figures 57–58). Traditional use of marine shell suggests either a long coastal association or the adoption of a novel technique. New fashions are unlikely to be adopted for use across the complete spectrum of traditional forms (Shepard 1956), but are more likely to be used for novel experimental designs or to copy fashionable exotic wares.

Different modes of decoration are often used to characterise cultural styles. But when potters copy exotic styles, the manner with which they form and decorate their wares may also be distinctive. Local copies can be identified through fabric characterization and decorative mode comparisons. Two approaches bear consideration: (i) traditional versus novel designs and methods of decoration; (ii) the introduction of exotic decoration techniques. The former may be restricted to individual production centres or involve regional styles. They include local copies of exotic wares, where both the form and decoration are replicated. The latter, however, may be limited to

TABLE 158: *Suggested exotic burnished and incised wares*

Layer	Feature	Fabric	Kg	Layer %	Layer	Feature	Fabric	Kg	Layer %
5.2	4	sand	0.01	3.13	10.4	B57	rice	0.01	3.13
5.3	B6	sand	0.01	3.13	10.10	57	grog	0.01	0.39
6.2	-	sand	0.06	10.34	10.12	B87	blebs	0.01	0.39
7.8	B27	sand	0.01	2.38	10.12	B87	grog	0.01	0.39
8.3	-	sand	0.04	8.00	10.12	B109	grog	0.04	1.54
8.7	28	grog	0.01	2.00	10.12	B115	grog	0.04	1.54
9.4	36	blebs	0.02	15.38	10.12	-	sand	0.06	2.32
10.1	41	rice	0.01	0.39	10.13	30	blebs	0.02	0.77
10.3	B56	rice	0.01	0.39					

the adoption of novel modes of decoration. Sometimes local and exotic modes are combined and traditional designs modified without an overall style change. The following distributions should be read in conjunction with base, rim and vessel data (Chapters VII, VIII, IX, X and Appendix 2) and Hall's (1993:239-73), motif descriptions.

Incised wares

Incised wares are common to all contexts but rare in L11 (Figs. 294 and 296). They increased markedly in CP4 when their quality declined severely compared to outstanding CP2/3 wares. Their distribution is also affected by differential site use, as CP1 represents occupation activities, CP2 and CP3 mortuary rituals and CP4 a pottery workshop. The distribution of exotic incised wares has been extracted from and supplements the overall values.

Burnished and incised wares

The hallmark of local CP2/3 pottery, burnishing and incising, reflects regional traditions. As with burnished sherds, burnished and incised wares were more prominent during CP2.

Burnishing stones and burnished pottery

According to Moore (1993:108), parallels between modern specimens, the consistent form of the wear patterns, the association with ceramic anvils in burial contexts, ethnographic analogy and the presence of burnished pottery at the site all point to the use of the stones to burnish pottery at Khok Phanom Di. Distributions of burnishing stones compared with burnished only and burnished and incised sherds show a close association (Figs. 295 to 297).

"Whole" vessel weights have been excluded from these tables. It is important to note that burnished wares and burnishing stones both reach their maxima during CP2. The distribution of

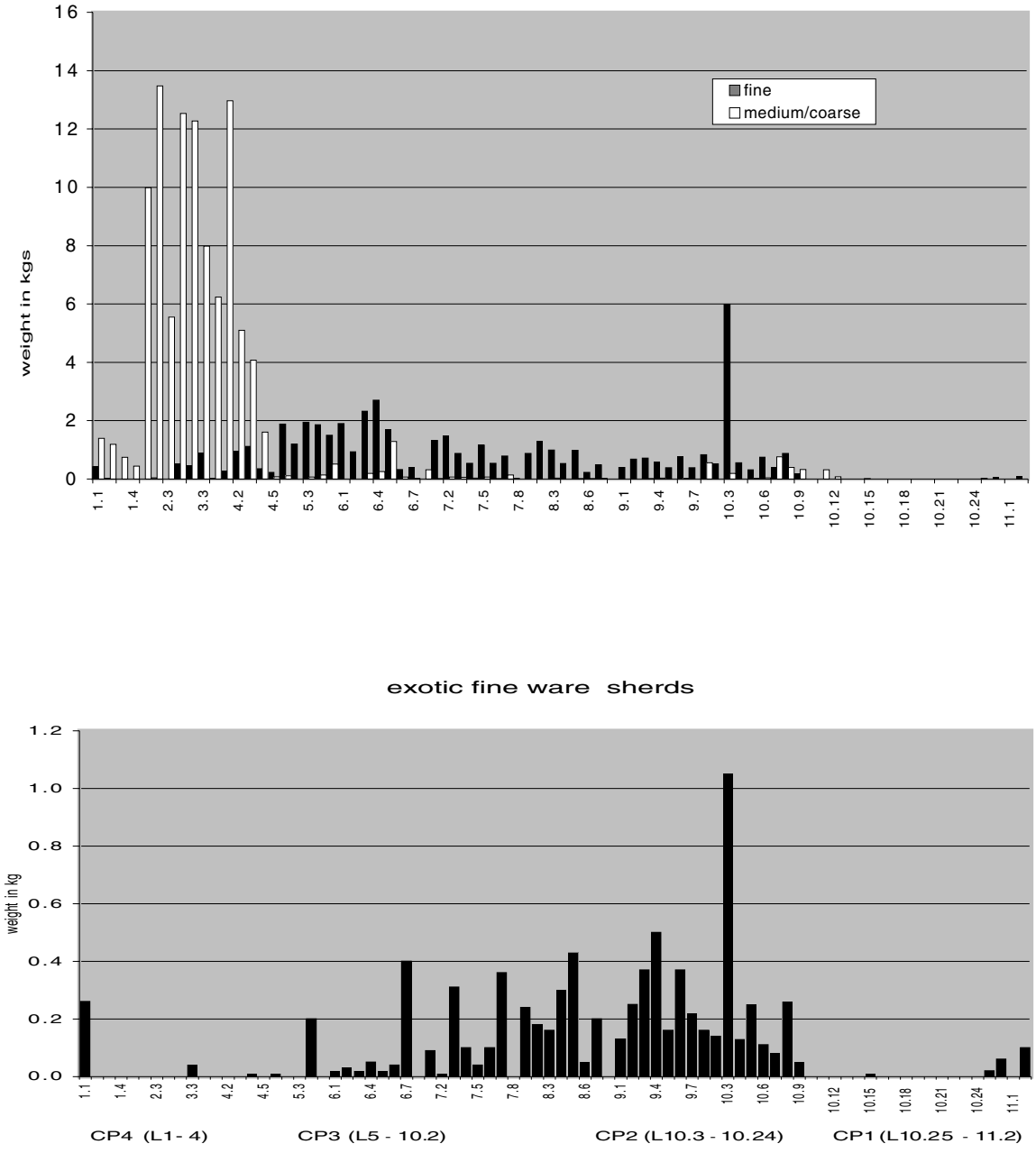


FIG. 294: Exotic and local burnished and incised wares by Ceramic Periods

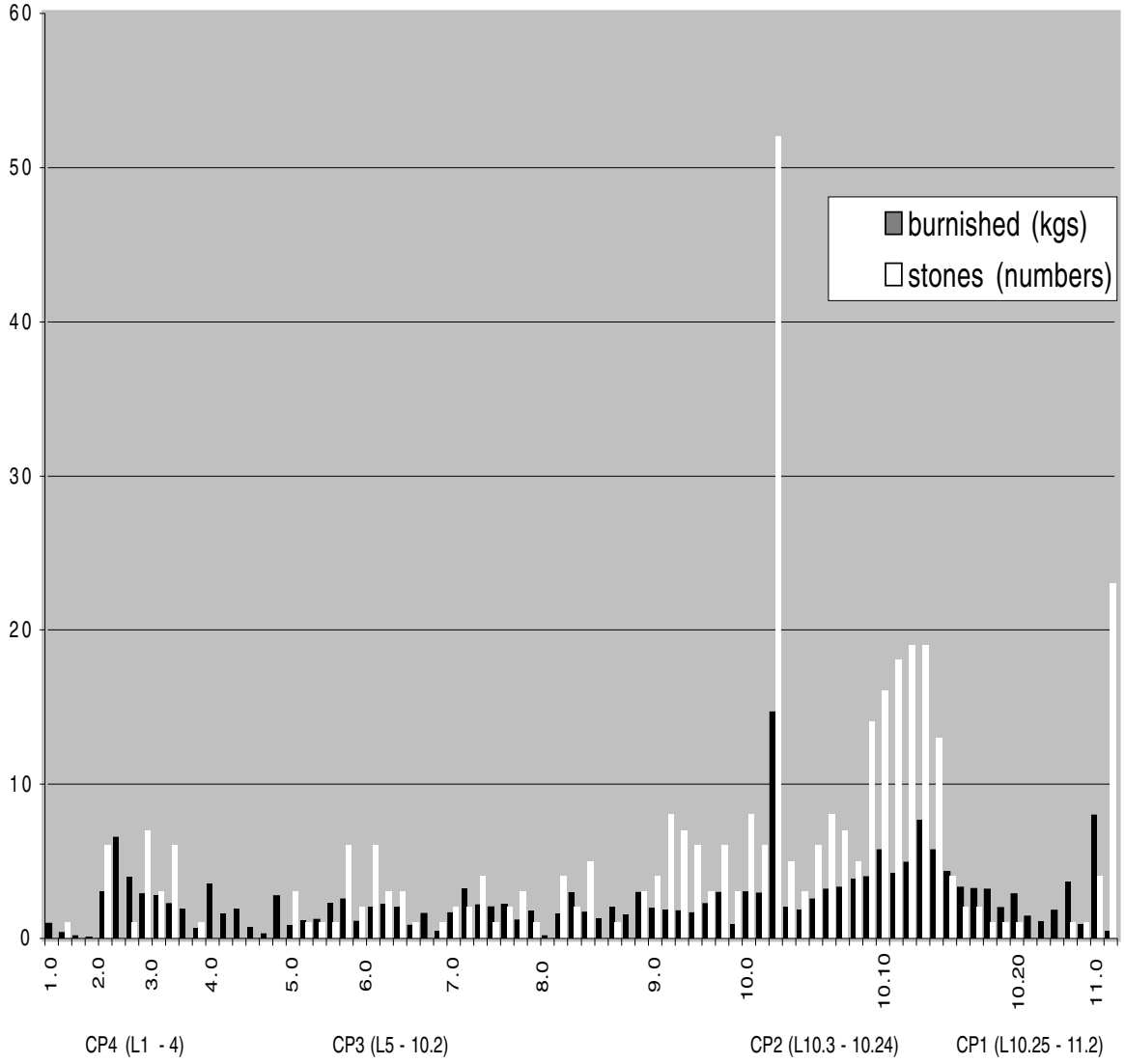


FIG. 295: The distribution of burnished sherds and burnishing stones

TABLE 159: *Burnishing stones by Ceramic Period*

CP	Stones	% of total	In burials	% of total	Depth (mm)	% of depth
4	25	6.79	-	-	1231	18.08
3	116	31.52	31	26.72	2940	43.18
2	197	53.53	21	10.65	2277	33.44
1	30	8.15	-	-	361	5.30
Totals:	368	99.99	52	14.13	6809	100.00

burnishing stones closely follows burnished wares in each CP. Surface erosion, very severe in L3, meant that L3-4 body sherds were difficult to assess, but L3 proportions can be estimated by extrapolating rim data for each CP (Chapters VII–X detail the CP1, 2, 3 and 4 spectra). Burnished body sherd distributions for L4–11 (Fig. 295), for RF4 and RF5 for the entire site (Fig. 297) and exotic fabrics assessed in hand specimen (Table 158), follow a similar pattern. Burnished ware fabrics are detailed in Appendix 3.

Bone incising tools and incised wares

Table 160 sets out the distribution of bone styli by CPs excluding small "micro-awls". It is important to note that styli, points and chisels are present in CP4 when the site was given over to pottery manufacture. Short, pointed bone styli, 14.1 to 28.9 mm long, dominate the CP4 pottery workshop assemblage. This association strengthens the assumption that they were used to incise pottery.

TABLE 160: *Bone stylus points by Ceramic Period*

CP	Stylus	Ridged	Point	Chisel	Total	micro-awls	broken	Total
4	8	-	-	9	17	89	20	126
3	-	-	2	5	7	-	-	7
2	3	3	2	1	9	-	10	19
1	3	-	1	-	4	-	-	4
Totals:	14	3	5	15	37	89	30	156

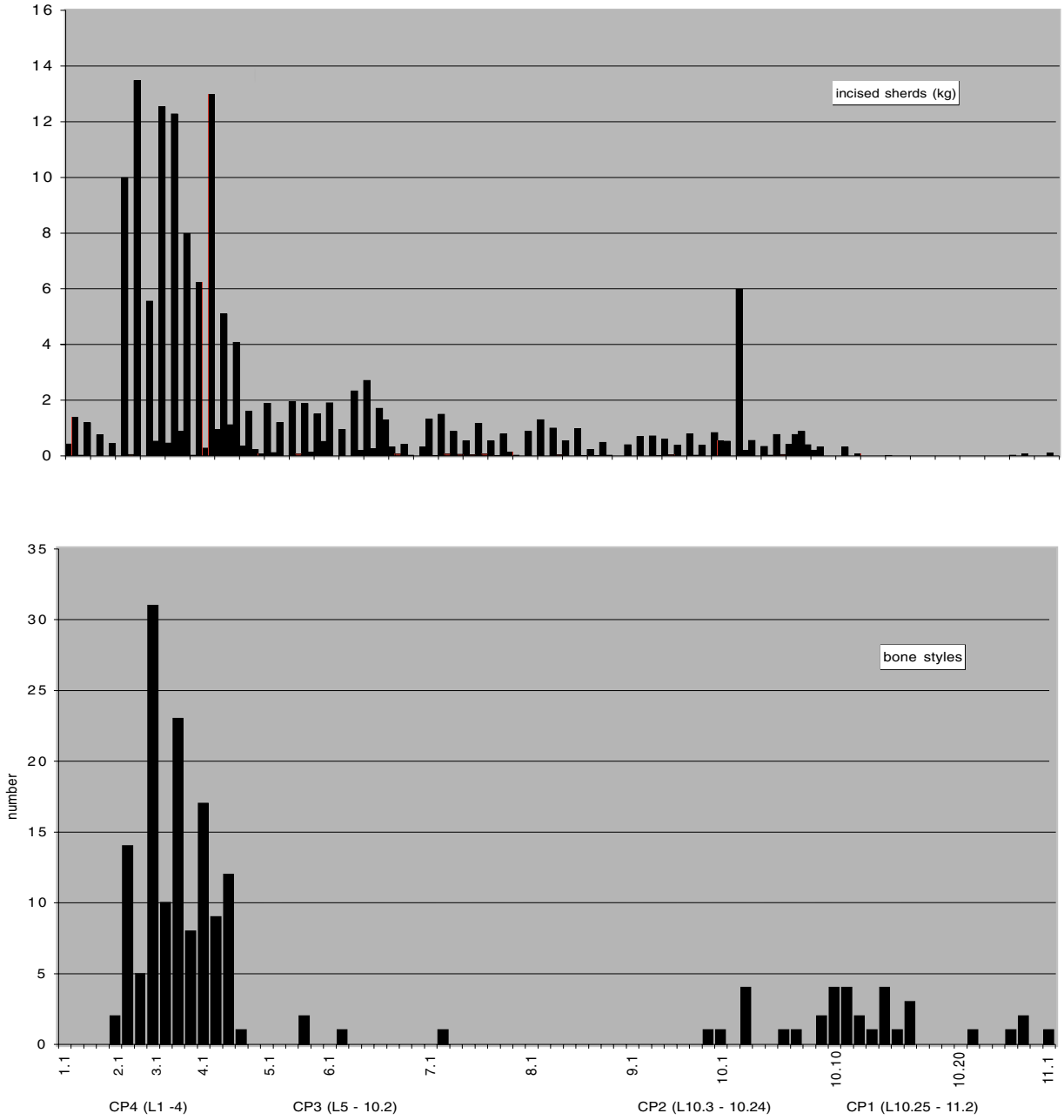


FIG. 296: Incised and burnished/incised wares and bone styles by stratigraphic layers

Their lengths could indicate that some had worn too short to be used and they were therefore discarded. Points as short as 15 mm, however, could still be used if held between the thumb and forefinger as with holding a pen. With this in mind, bone points classified elsewhere as "micro-awls" have been included to allow comparison with the ware distributions. Broken points add another 10 each to CP2 and CP4. There is a heavy emphasis on incising in the CP4 workshop and bone points reach their maxima (Fig. 296). Several CP3 bone points were not included because their function could not be suggested with confidence. Exotic wares have been excluded.

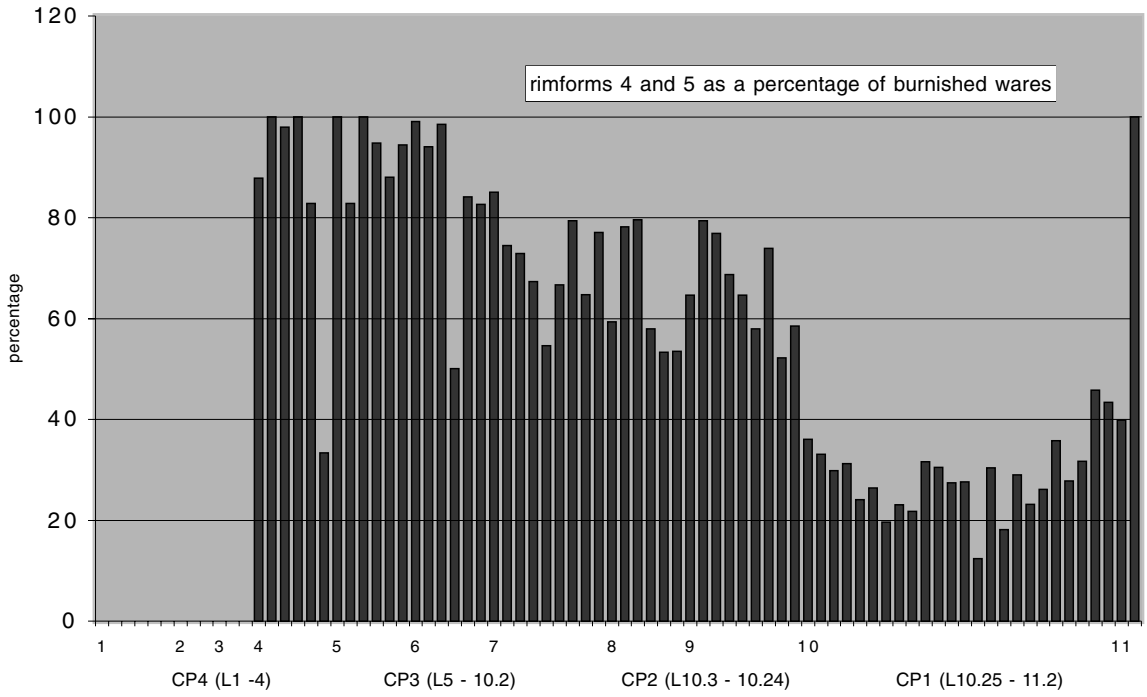


FIG. 297: Rim forms 4 and 5 burnished ware proportions

Appliqué wares

The appliqué technique was a minor focus of local potting traditions throughout CP1–3 (Fig. 298 and Appendix 3). Notable early exotic bleb-tempered examples (L10:12, L10:21 and L11:1) are present alongside local wares. A L3:2 sherd examined in thin section is composed of FG5, which suggests that CP4 potters favoured this distinctive decorative technique in contrast to

earlier traditions. The extent to which CP4 styles diverge from earlier local traditions is probably best gauged by comparing rim form spectra and changes in modes of decoration.

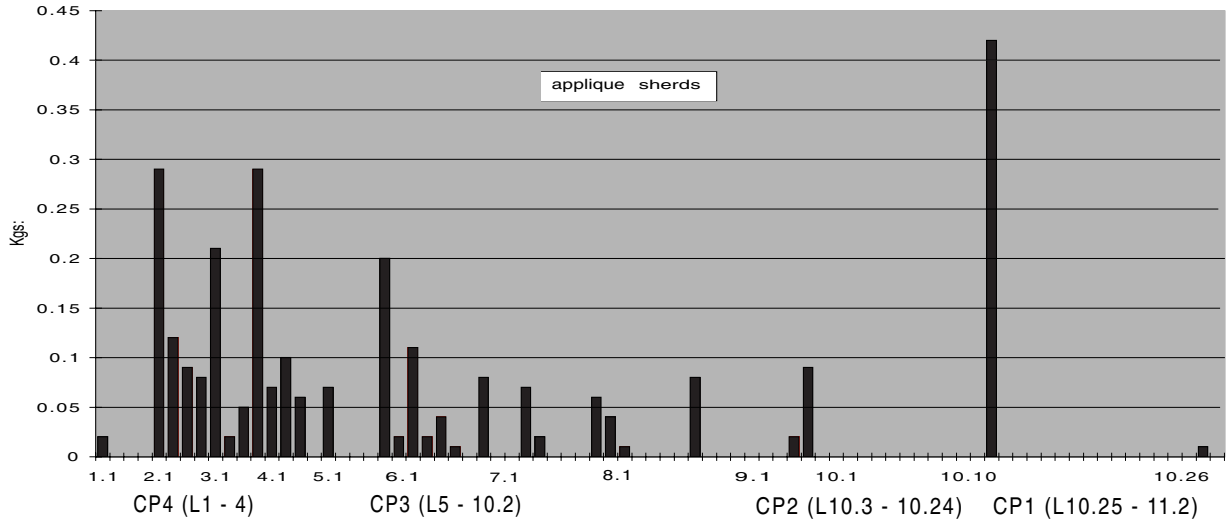


FIG. 298: The distribution of appliqué wares

Painted and slipped fine wares

Painted and slipped fine wares were extremely rare. A combined total of just 1.23 kg was recovered (Fig. 299).

Paddle-impressed and punctate wares

Paddle-impressed wares are absent in CP1 (Fig. 301). Exotic examples, initially spasmodic in CP2, gradually increase to peak near the CP2/3 boundary. Again spasmodic during CP3, they increase near the CP3/4 boundary and continue into lower CP4. Local production was confined to CP4 when it accounted for about a third of fine wares. Punctate sherds were concentrated in CP2 (Fig. 301).

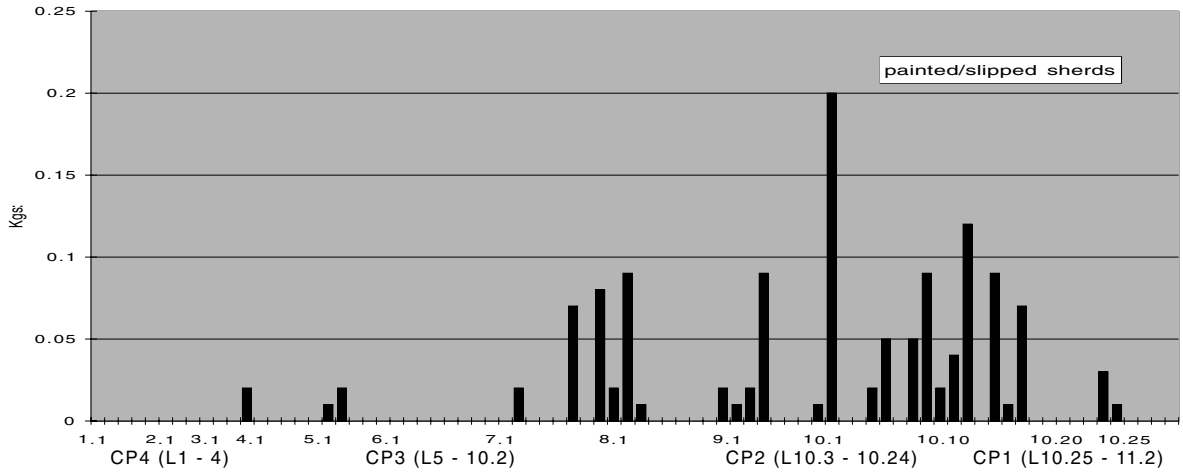


FIG. 299: The distribution of painted and slipped wares

Lids

A few either coarse cord-marked, plain, or burnished vessel lids were recovered from CP2, CP3 and CP4 (Fig. 300). In CP2 all are exotic, half contain sand and half bleb temper. In CP3, they are tempered with orthodox or bleb grog or rice alone. Both exotic and local versions are represented. Most lids are concentrated in CP3 and CP4. Local examples were tempered with blebs or rice, and exotic lids were either tempered with sand or orthodox grog.

Bases

Vessel base sherds were distributed throughout the sequence (Fig. 302 and Appendix 3), only exotic bases being absent from L8. Local production doubled in CP3 from about 6 kg in CP2 in concert with coarse ware production. Almost 70 per cent (tempered with either blebs or rice), were recovered from the CP4 workshop. Of the remainder, 9.32 and 20.59 per cent were found in CP2 and CP3 respectively.

Rims

Vessel rims are described in detail elsewhere (Chapters VII, VIII, IX, X and Appendix 2), and coarse and fine ware proportions in table 109. Exotic fine ware rim sources outnumber exotic mortuary vessels, particularly those from carinated burial jars recovered from the general matrix between the graves. These disproportions would have important cultural implications if the parent vessels played a part in burial rituals. Some may have contained food but were not

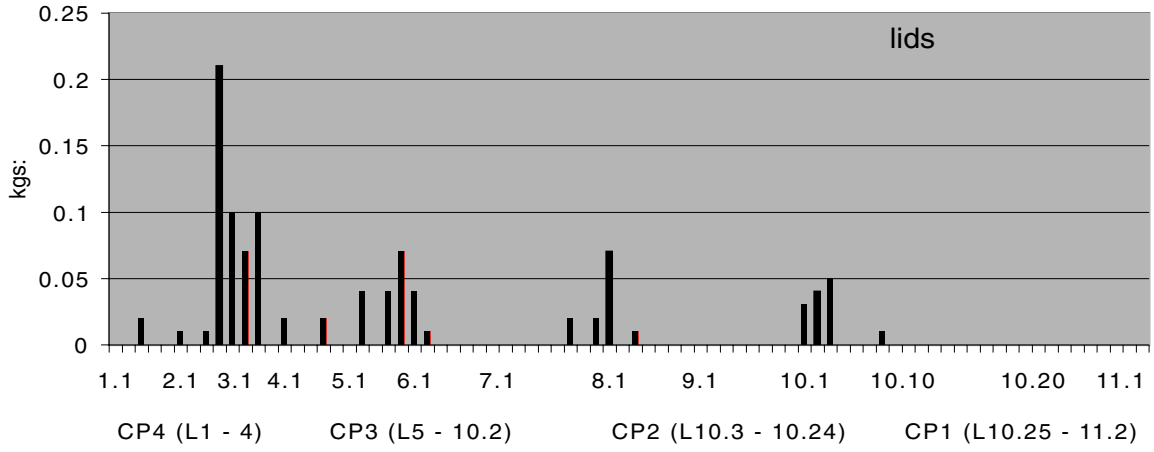


FIG. 300: The distribution of lids

buried alongside the deceased because this was reserved for funerary wares provided by close familial, or clan groups. Ash, charcoal and shell spreads adjacent to some graves suggest the remains of funerary feasting by graveside mourners.

Ceramic pellets and net weights

Seventy pellets were recovered, three from CP1, 39 from CP2, 12 from CP3 and 16 from CP4 contexts. Their use as hunting bow ammunition could suggest that their concentration in CP2 relates to environmental and concomitant faunal changes. Bird species, for example, differ (West 1991:200). The upper half of CP2 contained 34 net weights, eight were scattered through CP3 and seven in L2. As with pellets, their distribution suggests environmental change.

Tripod feet

Two local CP2 vessels, a small platter (B76) and a miniature (B86), featured solid tripod feet. The latter was dislocated and the former detached in prehistory. CP1 revealed five, CP2 19 and CP3 three detached feet (Table 161 and Appendix 3). CP4 included two equivocal examples. Why the feet were isolated in the general matrix, either by normal use or deliberate burial ritual removal, could not be determined. Only one matched detachment marks. Vessel and foot were separated by over a metre of cultural deposits. Nearly 80 per cent are local and over 80 per cent derive from CP1/2. At least 15, possibly 17, excluding burial vessels, are represented. Six are exotic.

CP2 revealed the most tripod vessels, half being exotic. Two types contain bleb, one rice and two different forms, sand temper. The presence of tripods from three, possibly four, exotic sources indicates a regional distribution. It is stressed that the feet are small and solid, unlike the large hollow Malaysian forms or those uncovered at Ban Kao 200 km to the west of Khok

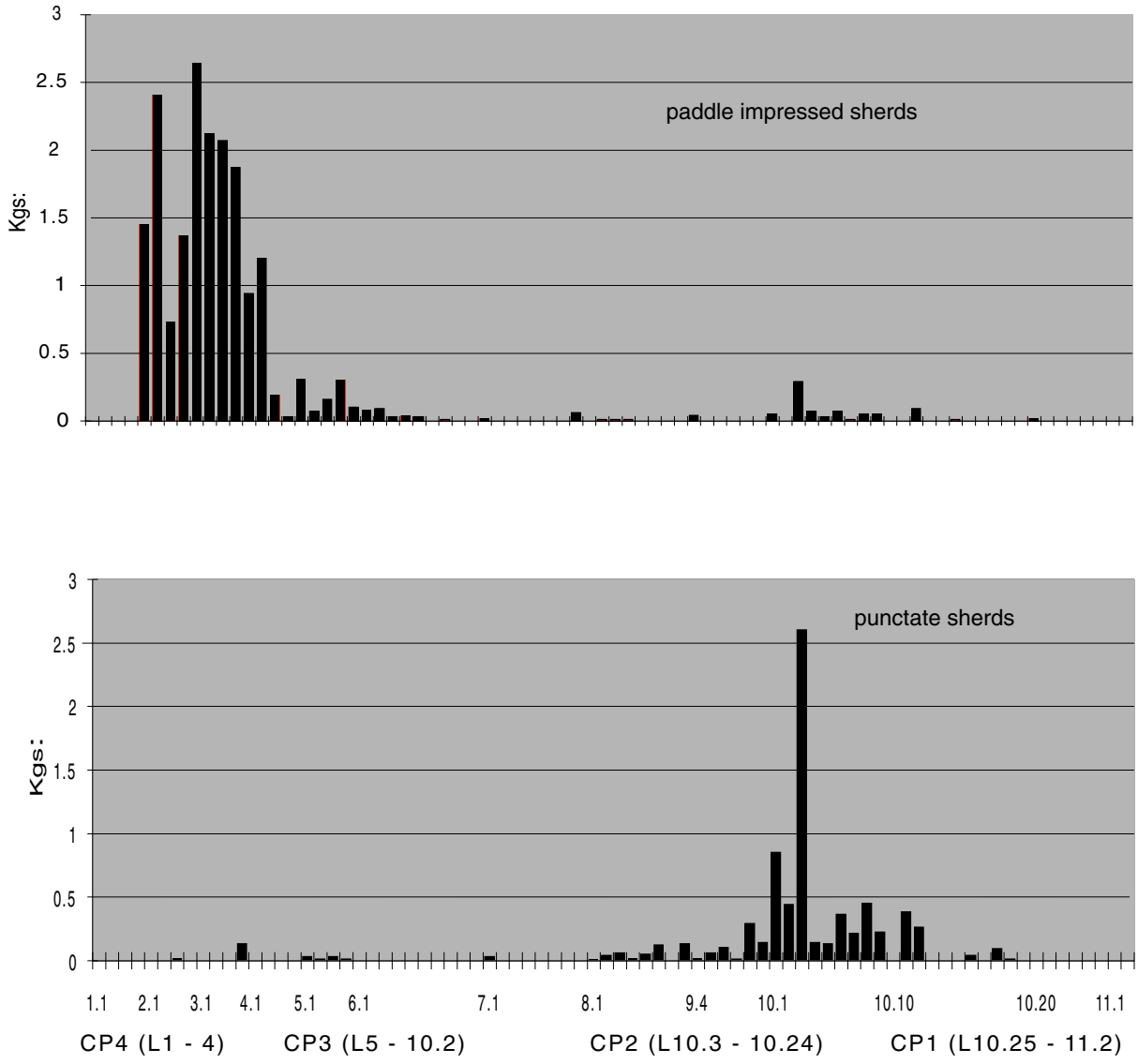


FIG. 301: The distribution of local and exotic paddle-impressed and punctate wares

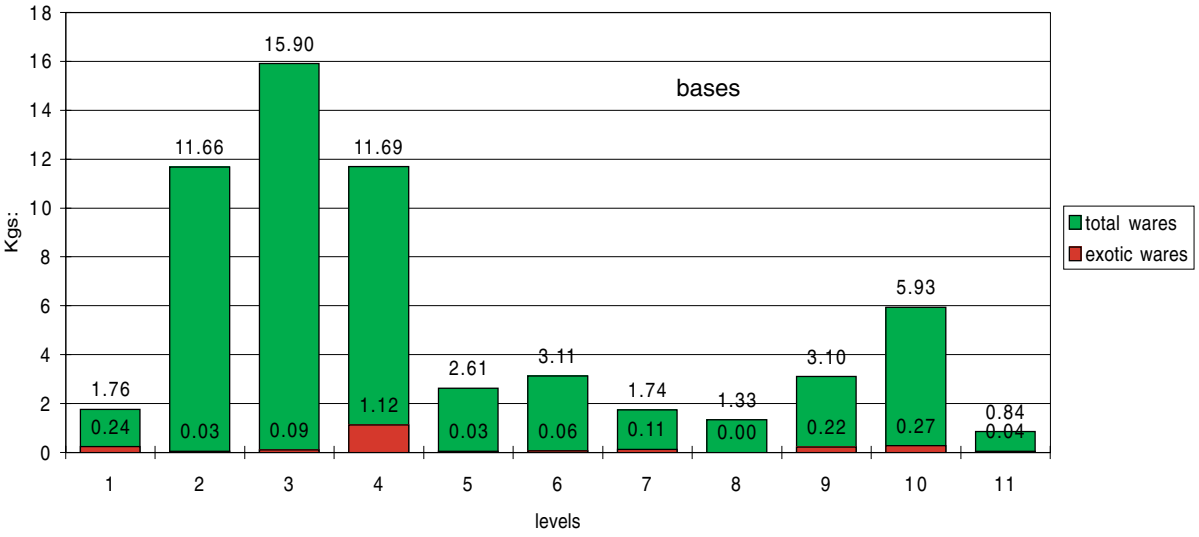


FIG. 302: The distribution of bases

TABLE 161: *Estimated tripod vessel numbers by Ceramic Period*

CP	Feet: Local	Exotic	Vessels: Local	Exotic	Total feet	Total vessels
4	1	1	1	1	2	2
3	3	-	3	-	3	3
2	13	6	5	5	19	10
1	5	-	2		5	2
Totals:	22	7	11	6	29	17

Phanom Di at the foot of the West Continental Highlands. Tripod vessels are known from other South East Asian sites. The implications of these associations are considered in Chapter XII.

Porcelain and stoneware

Historical porcelain and stonewares were restricted to CP4 (Fig. 303). The few sherds recovered from beneath L1 were displaced by post-deposition disturbances.

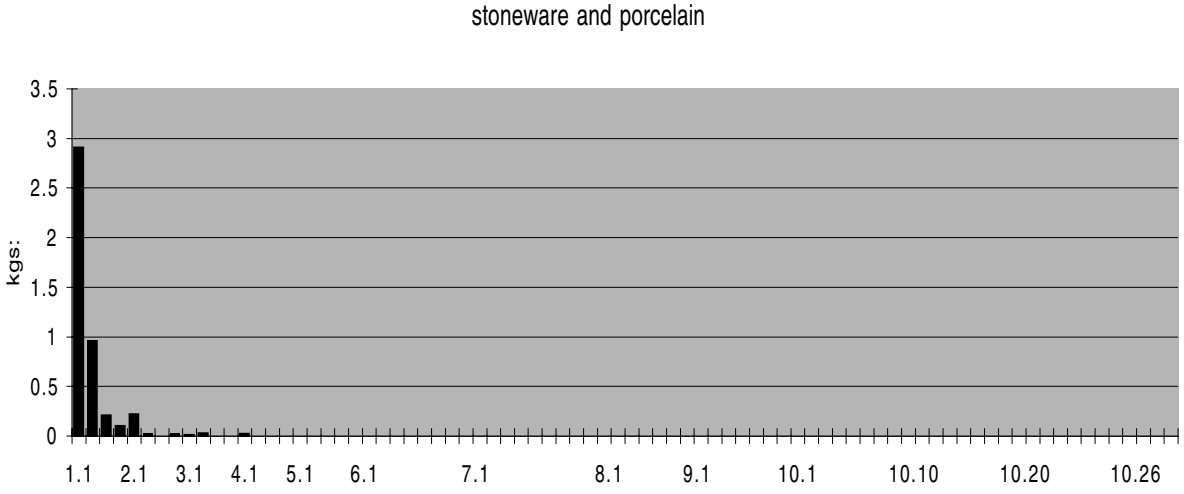


FIG. 303: The distribution of porcelain and stoneware

POTTERY PRODUCTION COMPARED WITH OTHER THAI SITES.

A comparison of burial site sherd densities places Khok Phanom Di well above other Thai pottery producing centres (Table 162 modified after Bayard 1984:89). The Ban Chiang depths are those given by Bayard (*op. cit.*). According to White (1986:77-78, Figs. 4a and 4b), the BCES sequence is over 4m and the BC sequence about 2.8m deep. Ban Chiang, Ban Kao (Vincent 1999) and Ban Na Di (Vincent 1988) provided evidence for local pottery making. The Ban Chiang data relates to the 1974-75 excavations. Non Nok Tha pottery has been examined petrographically (Vincent *in press*). It includes fabrics consistent with the local geology. According to Bayard (*op. cit.*) the Non Nok Tha figures include the "upper 0.5 m of parahistoric occupation deposits; if these are excluded the density is one burial per 1.4 m". The Ban Na Di figures exclude rims and "whole" pots. These are estimated to add another six per cent, or 100 kg to the total. This increases the average weight to 6.89 kg m^3. According to Bayard, the Ban Kao data are based on 690,000 sherds at an estimate of 6 g per sherd.

TABLE 162: *Burial and sherd densities at selected Thai sites*

Site	Average depth (m)	≈Volume m^3	Average weight m^3 (kg)	Burials	m^3per burial
Khok Phanom Di	6.8	680	17.08	154	4.41
KPD cemetery	5.16	516	12.11	154	3.35
Non Nok Tha	1.4	476	0.45	217	2.2
Ban Na Di	4.2	256	6.5	59	4.3
Ban Chiang	4.5	795	7.5	123	6.5
Ban Kao (Bang)	1.5	375	7.0	44	13.1
Non Chai	4.7	360	13.3	10	36.0

When these data are separated into cemetery versus occupation zones, Non Chai should be excluded from burial ground sherd density comparisons because it contained only one burial per 36 m^3 whereas the group average is 11.08 m^3. On this criterion Ban Kao is just above the average. When the cemetery zone at Khok Phanom Di (CP2/3) is considered separately, a value of 12.11 kg m^3 applies. CP4, the potting workshop, however, contained 37.6 kg m^3, which far exceeds the sherd densities of any other Thai site. When comparing sites dedicated to burial grounds with sites given over to occupation activity, or mixed-use areas, some adjustment is needed to account for these factors. The Khok Phanom Di cemetery is probably best compared with Non Nok Tha, the only site clearly reserved for mortuary ritual. Non Chai, a 200 BC-200 AD upper Chi valley site, also stands out as a major production centre (Rutnin 1979, Vincent 1988).

INTERPRETATION OF THE CERAMIC SEQUENCE

Chapter I outlined the objectives of this study, and some interpretations of the evidence presented were offered in the following chapters. Local and exotic ware distributions can now be examined with particular reference to evidence which may reflect underlying influences on local and regional cultural systems. The scale, intensity and implied socio-economic importance of local production will help characterise its role in the community during each CP. We can now apply this evidence to several important questions and seek explanations for them:

1. Was craft specialization present and if so how can it be defined?
2. If present, to what degree had craft specialization evolved?
3. Is social rank reflected in variable grave wealth?
4. Was status achieved solely by an individual's lifetime abilities?

5. With time, did an élite evolve and was rank inherited?

6. For marked internal differentiation to develop, food surpluses are usually a prerequisite. Were such food surpluses available?

7. If the inhabitants of Khok Phanom Di cultivated rice, what evidence, if any, of its role in potting can be anticipated and detected?

We can address these questions through ceramic and corroborative non-ceramic evidence. The latter may be more difficult to specify because of a lack of direct information. By analogy and by examining evidence for change and development, however, conditions underlying craft specialization, food surpluses and social stratification can be revealed, if not always clearly, at least in sufficient outline to provide some understanding of the processes involved. First we will consider craft specialization.

CRAFT SPECIALIZATION

Several researchers have noted inter-relationships between food surpluses and craft specialization (Adams 1966, Childe 1942, 1957, Wheatley 1971, Renfrew 1972, Redman 1978, Chang 1986a), where craft specialists are supported by demands for desirable goods purchased via the exchange of surplus food. In early Mesopotamia, craft specialists were supported by, and for, a central templar administrative structure, their outstanding products being created exclusively for administrative and ritual purposes (Adams 1966:126-7). Regular armies of craftsmen, merchants, transport workers, officials, clerks, soldiers and priests supported by surplus food produced by cultivators, herdsmen and hunters underpin the "urban revolution" concept through which civilisation was created in the Near East (Childe 1936:37, as cited by Renfrew 1972:5). Childe also noted a tendency to secrecy amongst craftspeople, in this case early coppersmiths:

> "Finally, craft lore is liable to be secret. It is passed on from father to son or from master to apprentice. Craftsmen thus tend to form *guilds* or clans which will guard jealously the mysteries of the craft. Among barbarians we find hereditary craft-clans organized on the same 'kinship' basis as savage clans." (Childe 1942:87).

In Shang society, Wheatley (1971:66-7), notes that literary records and archaeological remains "imply that particular handicrafts were probably the perogatives of individual kin groups, and possibly that certain branches of a particular handicraft were wholly in the hands of specific lineages." "All in all, the implications of a close relationship between kin and craft in Shang times are not negligible ..."

Renfrew (1972:340-42), correlated Aegean craft skills with specialization: "Some of the pottery of neolithic (sic) times ... is so accomplished that it cannot have been made by inexperienced hands." Although not employed full-time, one or two people in the village probably "'kept their hand in' by making pottery for other households"... "even the simplest neolithic (sic) village

economy favoured the existence of casual and part-time specialists in this sense." A lack of information as to who made pottery for a village "or even a region", however, reduced the discussion to "simple speculation." Late Bronze Age burials, in contrast, contained a wide variety of goods, many the product of a specialist. Early Bronze Age itinerant potters also plied their craft (*op. cit.* 1972:344).

According to Redman (1978:235), agricultural surpluses were "central to the development of Mesopotamian civilization. It enabled a redistributive economy, crafts, trade and industries." Redistribution, however, can act to equalize wealth. This is particularly true of the shift from a ranked to stratified society. In Fried's (1960, 1967) terminology, in ranked societies, status is maintained through accomplishment and redistribution of wealth. In a stratified society, however, status is formalized and does not require continued reaffirmation through the distribution of wealth.

Childs (1988:5), however, notes that Haas (1982), proposed that rank and status "are attained by achieving and manipulating power." Power is defined by Haas as "the ability of an actor, A, to get another actor(s), B, to do something B would not otherwise do, through the application, threat, or promise of sanctions" (Haas 1982:157 as cited by Childs).

> "Although not discussed in detail, it is apparent that Haas sees the transitions between egalitarian-ranked and ranked-stratified societies as ones of accumulating power bases and the means of enforcing power. Important bases of power lie in the economic (including control over basic resources) and ideological systems of a society." Childs (1988:5)

Chang (1986a:119-22), notes that Neolithic Yangshao villages were organized according to kin or clans and lineages. This was "quite common in Neolithic societies everywhere, but in the case of the Chinese it is noted for its persistence ..." At several Yangshao sites, pots often carried incised signs, perhaps potters' marks, or symbols placed near bowl rims. Some are comparable with clan emblems.

We can note here that recognition of craft artisans varies from one culture to another. For example:

> "The Roman attitude to technology was, indeed, subtly different from that of the Greeks. Like the Greeks, the Romans still believed that actually to work with raw materials, to be an artisan, was degrading; nevertheless they did not hold technology in such disdain that they refrained from writing about it." (Hodges 1970:223).

Attitudes to potters are dependent on the importance of their craft to the community. Arnold (1985:197-8), for example, notes that some potters enjoy high status:

> "The high status of potters can be explained primarily by contextural factors. First, the high status of women potters in Chinautla, for example, generally results from several factors: (1) In the rather precarious agricultural position of Chinautla,

> any source of a steady income (like pottery making) can be an asset to a family with poor quality, little or no agricultural land; (2) since potters are women, the income that they bring into the family is extra and above that of the main breadwinner for the family since generally their time is not as economically valuable as that of the husband (see Tax, 1941:25).
>
> When women are potters ... their position is relatively high because they supplement primary subsistence activities. A second factor involves the demand for pottery. When the demand for pottery involves mythical, religious or social structural symbols, potters that produce this pottery will have a high social position."

Synchronization between agriculture and potting, both regulated by weather patterns, lessens the risk of possible subsistence losses inherent in the diversion of men from agriculture or other subsistence pursuits (Arnold 1985:226).

Distinction needs to be made between the importance of potting for its own sake with less visible economic and social activities, for example the integration of potting with trade using containers for wine, foodstuffs, oil or other valuable items (Riley 1981:123, Fulford 1984:257, Orton *et al.* 1993:26). This may increase the potters' importance due to demand for containers essential in transporting valuable trade or exchange goods.

> "The amphora trade in the Graeco-Roman world is not an exercise in transporting amphoras *per se* but it is the items they contain that are important – wine, olive oil or fish sauces." (Orton *et al.* 1993:199)

Vessel contents may also be of greater value than containers in redistribution systems (Toll 1981:111). Material containers may have the shortest life span, particularly when they are fragile, as is the case with the CP3 cylindrical jars. Standardization and mass production in workshops, by craft specialists, is one response to demands for high volumes of containers. Intensive production requires skilled potters.

Costin (1991), outlines issues in defining production organization or craft specialization. This differs from van der Leeuw (1977) and Peacock (1982). The former has six parts focused mainly on scale and production intensity differences (from household to large-scale industrial), while the latter has eight similar parts with the addition of geographical and élite or governmental participation. Rice (1984), Santley *et al.* (1989) and others drew on these models.

Numerous different terms may often be used to refer to the same basic manner of organisation, or two different kinds of production may be described by the same term. For example, "attached specialization" (Earle 1981, Brumfiel and Earle 1987, Costin 1986, Gero 1983, Hagstrum 1985, 1989, Russell 1988), is defined as production on command for the élite and the institutions they control, where they sponsor and control the distribution of high-value, high-status goods. But Clark and Parry (1990), apply the term to any sponsorship which takes control of the final distribution away from the artisan. Costin has abstracted four general parameters from previous studies which she proposes describe the organization of production:

1. *Context:* the nature of control over production and distribution (independent to attached).

2. *Concentration:* the relative regional concentration of production facilities (dispersed to nucleated).

3. *Scale:* of the production units in terms of their size and constitution (small, kin-based to factory).

4. *Intensity:* or degree production is a part-time opposed to a full-time activity for artisans (part-time to full-time).

Context: Independent specialists tend to make frequently used utilitarian items. Thus, as their development is primarily economic, inexpensive transportation modes are important, and demand especially so. Independent specialization can "evolve under conditions of unequal resource distribution." Attached specialization is primarily promoted by social and political factors, the presence of an élite class being most the important. Egalitarian societies, therefore, lack attached specialists (Costin *op. cit.*: 11-13).
Concentration: Communities, or part communities, that meet "certain demand size criteria will be served by specialists." If specialists are confined to one community this implies that their products will be exchanged on a regional or interregional basis. Production is often nucleated because a community is able to exploit nearby unequally distributed resources. Transportation is a key factor.
Scale (composition), includes small individual or family-based production units. The latter recruit labour through biological or marital ties. Children are taught skills and as production units grow in size new recruits are derived first from "distant, fictive and adoptive kin." Further growth means nonrelated individuals are recruited. The primary scale determinant for independent specialists is efficiency. Dividing tasks among many workers within a workshop, for example, can prove more efficient than other strategies. Easier supervision means that attached specialist workshops tend to be "larger than those of independent producers" (after Goody 1982).
Intensity: Efficiency, risk and scheduling determine whether part or full-time production is established among independent specialists. Establishing "mass" production lines favours full time production. Risk is minimized by combining economic strategies. If independent specialists can combine craft production with agriculture, they will remain part time. Producing overly expensive wares is often the most risky strategy. Scheduling may be dove-tailed with agricultural activities, but production may expand under pressure from economic, social and political factors contingent on household division of labour and the artisan's gender.

Specialists may be recognized in archaeological contexts through raw materials, debris, tools and production facilities. Evidence for production facilities are rare. Production loci items differ from those at consumption sites. As the scale of independent production increases, workshops may develop, but unlike attached specialist workshops, access to them is rarely restricted. Inferences regarding socio-political contexts requires artefacts from primary use-related areas. The size of a facility is insufficient for determining whether production is attached or independent. A regional approach is required to identify the concentration of production centres. Local production and consumption estimates may help identify concentrated production. "If the number of items produced is greater than the number used, this certainly suggests specialization for a market beyond the community at which production takes place (cf. J. Arnold 1987)" (Costin 1991:28). Petrographic information is important in identifying the place of production.

Production facility size infers production scale. It is important to distinguish between where a commodity is produced and a production unit, which implies an element of discrete organization. Workshops staffed by unrelated individuals will be located in nondomestic space. "The more highly structured the organization of production (e.g., into workshops or factories), the more highly organized the space in which those activities took place should be" (Costin 1991:30). Scale can be measured by output, but high output does not indicate a particular scale. Output per production unit is a function of the number of producers, the intensity of production, and the particular technology.

Indirect evidence, such as large numbers of standardized products, has been used to imply specialization (Redman 1978:270). Specialized systems have fewer producers, therefore less individual variability. Standardization may reflect cost-cutting, or, for example, consumer demand for a standard product. Standardized goods are often easier to store, package and transport. High standardization at relatively few production centres is interpreted as mass production, and high variability as small-scale independent workshop production. But it "cannot automatically be assumed that standardization equals independent specialization" Costin (1991:36). Elaboration of even utilitarian objects may reflect social information.

> "Under certain circumstances, the products of specialized production systems will exhibit certain features such as standardization, efficiency, skill, or regional variation. The key to using these data effectively to argue for the presence of specialized production is in demonstrating that they are appropriate *economic* responses to social, political, and environmental conditions." (Costin 1991:44, (emphasis Costin))

Finally, Costin notes that "a "highly specialized" economy" will have "relatively many different specializations and a relatively large percentage of the population pursuing specialized activities while an economy that has a low degree of specialization will have relatively few specialized offices or products and numerically few people pursuing specialized activities."

The Khok Phanom Di evidence comprises processed and raw clay, caches of rock fragments to be crushed for temper, ceramic potters' anvils, polished burnishing stones, bone incising tools, small crude test pots, ceramic firing stands, firing debris (such as ash, charcoals and pottery wasters), standardized coarse and fine wares and a pottery workshop. This evidence is not concurrent but variously spread over four different, but related, CPs. Some is present in all, some restricted to one or another CP. But each is similar enough to view the entire spectrum as representing different expressions of the same, or at least closely-related, regional potting traditions. In determining and characterizing craft specialization, mortuary and non-mortuary evidence combined provides a rare opportunity to infer causal factors. These allow a keyhole glimpse into dynamic developments at a major potting centre which occupied a nodal location for about 500 years. The 1985 excavation exposed a mere 100 m^2 of 5 hectares (or 0.2 per cent). Fortunately, in terms of ceramic evidence this area provided a very rich cross-section of potting and related cultural activities.

Evidence from mortuary and non-mortuary, or mundane, contexts is direct and indirect. Local potting methods can be reconstructed, or inferred, directly or by combining both sets of information. For example, pebble caches in basal deposits match mineralogically freshly fractured

sand temper in local CP1 pottery. Such pebbles are unknown locally. It seems reasonable to infer that imported pebbles were crushed for temper, and as alternative methods are feasible, that tempering with sand was a CP1 tradition. Ethnographic analogy infers that changing a temper, an essential potting component, reflects cultural change, particularly if additional expenditures of energy are involved. But reconstructing the socio-economic behaviour of potters and their associates is more difficult.

Clay preparation using cylinders suggests assembly line mass production. CP3/4 coarse wares are a standard simple form. Large quantities were probably quickly made by accomplished potters, with perhaps non-potters helping in the preform stage. The high quality fine wares required expert potters, but some steps, particularly burnishing, could be undertaken by unskilled helpers. It seems reasonable to distinguish potters from non-potters in mortuary ritual. Potters' graves included anvils. Non-potters' graves included burnishing stones. Only female graves contained anvils; both sexes included burnishing stones. Firing stands suggest repeated raft firings, a method suited to both medium and large-scale firings. Re-using the same equipment is a feature of mass production.

SOCIAL STRATIFICATION

Potters were clearly acknowledged in mortuary ritual, if grave furniture reflects the deceased's lifestyle, with CP3 potters being the richest. Anvils with potters' marks in CP3 graves suggest that workshop mass production of cylindrical containers was instituted by craft specialists following the arrival of immigrants. Local coarse ware production nearly doubled and a new form of ritual fine wares was correlated with these changes. In addition, male helpers probably transported wares along coastal and riverine exchange networks.

In Costin's (1991) terms, these data could indicate the presence of independent specialists operating in a context of high demand for coarse ware containers, and perhaps to a limited degree for fine wares, delivered to external consumers along water transportation routes from a nodal location. They are unlikely to have been attached specialists because of the absence of an élite class. We will return to this aspect below. Nucleated regional production, (not in Peacock's (1982) sense), is favoured when regional resources are unevenly distributed. But quality potting is evident at many other regional sites throughout the sequence. This strongly suggests that potting *per se* was not a critical factor. What advantages would Khok Phanom Di potters have had over other regional production centres? Two factors are obvious: (i) the site's nodal location with direct access to important exchange networks; (ii) access to abundant clay deposits. But, as these seem insufficient to explain the marked change in potters' wealth during CP3, other evidence will be examined.

First, CP3 heralded the arrival of new group(s) of immigrants. This is evidenced in part by skeletal differences, changes in mortuary ritual (from nucleated burial groups ("clusters") to graves arranged in clearly defined alignments), new pottery types, exotic potters' anvils buried with some potters, changes in stone sources, and the appearance of turtle ornaments in male burials. Initially, CP2 style local burial jars, composed of the new CP3 fabric, were placed in a few graves. But this brief echo of the earlier tradition quickly gave way to a new burial jar

type. Such stylistic and technological changes in artefacts central to mortuary ritual, signal a major transition. This process parallels cultural changes at Ban Na Di *c.* 100 BC, in the Khorat Plateau (Vincent 1984, 1988). Three stages are apparent: (i) the arrival of new group(s) and their assimilation into a pre-existing community; (ii) a very brief period of transition when local pottery is manufactured under both old and new traditions; (iii) transformation of pre-existing into new traditions, a cultural metamorphosis evident in, but not restricted to, the potting tradition, mortuary rituals and external relationships.

At Ban Na Di the transition probably involved the northward movement of Khorat Basin inhabitants into the smaller Sakon Nakhon Basin, following intensifying inter-regional exchange relationships. But at Khok Phanom Di the evidence points to immigrants moving from coastal and inland locations, some perhaps through marriage alliances. Coastal donor sites are represented by males associated with turtle carapace ornaments and a cord-marked burial jar motif, (B57). Inland sites are represented by females with a either a cordmarked, (B35), or later a double line burial jar motif and exotic anvils bearing potters' marks (B15). Both burial jars interred with B35 are exotic and both motifs first occur in CP3.

Immigrants appear to have precipitated a marked wealth increase, *in this group*, compared to the earlier population. Wealthy group members are distinguished by carinated burial jars carrying either a double line motif in the case of potters, or a cord-marked carination in those linked to potters, possibly as helpers and/or by marriage. Access to new consumer groups could help explain the increased wealth. Close, perhaps familial, links with other communities would open new exchange opportunities. Exotic pottery, particularly ritual burial jars, suggests intensifying exchange relationships immediately preceded the assimilation of CP3 immigrants (Chapters VIII and IX). These changes were correlated with a huge increase in coarse cord-marked cylindrical containers, in size and shape suited to carriage in canoes. Fitting a slightly larger container over another of smaller diameter would provide a water-tight seal ideal for transporting in water craft. Their fragility suggests that they were disposable after a single trip. But what did they contain?

Uneven resource distribution enhances craft specialization.

Resources needed for subsistence, either food or the means to obtain it can also bring wealth. Access to materials valued for artistic expression, or rarity, such as marine shell in remote inland areas, would also confer advantages. The containers are suited to bulk carriage which seems to rule out rare shell or jewellery. Rice could have been carried, but given its presence in a very wide range of imported wares it seems unlikely that any demand was not otherwise satisfied. We will return to this important point later. Given that these assumptions are correct, what would favour a surge in container production? Two factors: (i) local readily available resource(s) needed elsewhere in the region; (ii) knowledge of this demand, and the ability to satisfy it, would be essential. This could involve delivery and/or entrepot exchange at Khok Phanom Di. Of course this portrayal is entirely speculative, but it fits the available evidence. Several local resources were probably available for exchange, and Thompson (1996:212), has suggested "salt, plant resins, nipa products, dyes and even preserved or smoked fish if there was excess to local needs."

The CP3 potting group achieved significant prominence. This suggests that the containers were either designed for resources previously unavailable and/or that exchange potentials were unknown, or otherwise unrealised, prior to CP3. It seems unlikely that smoked or preserved

fish surpluses increased, as there is no evidence for changes in exploitation patterns (Grant and Higham 1991:188-91, Higham and Bannanurag 1991:333-5), and mollusc numbers declined (Mason 1991:311). Microfauna and bird remains indicate "a definite shift toward greater exploitation of animals from the river and from the forest further inland (unless the forest was advancing with the marine regression)" West (1991:204). Fish-hooks and net weights declined markedly in CP3 compared to CP2. Therefore, fish surpluses are unlikely, but the other items in Thompson's list are possibilities, with perhaps salt the most likely.

Exchange networks can be articulated by central places in nodal locations. Haselgrove (1986:8) lists apparently "crucial" characteristics drawn from Cunliffe's (1976) study of Danebury, a pre-Roman British hill-fort. These are: (i) the existence of a defined territory, (ii) that the site is the most complex form in a hierarchy of settlement types, (iii) manufactured goods were surplus to the resident community's needs, (iv) it was a redistribution and storage focal point. Khok Phanom Di is the largest known site in the Bang Pakong Valley. When occupied it lay at the junction between coastal and inland exchange routes, the only such site in a territory where water transport would have been essential. It is difficult to determine precisely whether surplus goods were manufactured. But Khok Phanom Di clearly contained the most dense sherd deposits, in any context, compared with other Thai sites (Table 162). It seems most unlikely that pottery output was solely for local consumption, given the number of potters, the firing ridge surrounding the site and particularly as even more intensive deposits were uncovered by Pisnupong's earlier excavation (Chapter I).

We have noted that pottery density in CP3 was 13.72 kg/m^3 compared to 37.6 kg/m^3 in CP4 (Table 108). Given that a direct comparison is realistic, this means CP3 weights should be multiplied by 37.6 and divided by 13.72, to give comparable deposition rates. If so, the comparable CP3 coarse ware deposits would be 9,372.6 kg. For CP2, the figures are 1753 kg of coarse ware at a density of 10.51 kg/m^3, to give comparable deposits of 4,804 kg. A large globular coarse ware vessel weighs approximately 1.65 kg. CP3 coarse sherds weigh 3420 kg which amounts to 2,073 vessels at 1.65 kg. These calculations derive from cemetery deposits where everyday activities may have been circumscribed. Therefore, data from the CP4 workshop may more accurately reflect production outputs.

Type L2j cylindrical pots probably weighed about 1.5 kg, to give about 6,248 vessels during MP4–7. Compared with CP2, this would represent 3,202 vessels at 1.5 kg, but as the CP2 vessels are larger globular types weighing 1.65 kg, only 2,911 vessels are estimated to be represented in the CP2 assemblage.

Allowance for breakages and exported shipments needs to be added to the above figures. But data from recipient sites is lacking. Monsoon rains make year round production unlikely. The CP4 workshop anvils represent an estimated 24 potters at least (Chapter X). They could, in a full 26 week production season, produce approximately 1200 pots per week. But these estimates should be treated with caution due to variations in sherd wastage distributions (most wasters being dumped at the site perimeters), and pottery lost to trade and exchange. Thus the estimates may be far too low!

Calder (1972:35-6), noted that at Ban Mọ, all 80 households produced pottery. Of these, 50 were fulltime and 30 only produced pottery in the dry season, but also cultivated rice. Firing was usually undertaken in the dry season. Females made the pots, children occasionally

helped to collect clay, and males fired the pots. Potters worked in groups of two or three, each specializing in a particular skill (for example forming vessel rims), to mass produce wares. Quarried clay was stored in damp sacks until needed. Bleb temper was added to clay shaped into cylinders for forming into vessels. Firing was generally during the late afternoon when the humidity was lowest. Only full-time potters fired in the rainy season. Firing breakages were "high". Earthenware vessels, especially water jars, had a short life span of about two years. Unfortunately the introduction of metal vessels prevents direct comparisons with prehistoric consumption rates.

In the Philippines, Scheans (1977:8, 19-20), recorded Ilongo raft firings of 321 mixed size pots, but their frequency is not documented. Uyogan potters fired about 50 pots on rafts each week using wood and grass fuel, with about 10 per cent breakages (Scheans 1977:121). Again, drying vessels was a key factor in scheduling firings. More recent studies stress clay/fuel ratios (Sheehy 1988:199-226). A ratio of 1.62 units of fuel represented "the average for high firing events" (Sheehy 1988:220). Thus to fire 9,372 kgs of CP3 pottery would require 5,785 kg of fuel. But this does not account for total production. Following Sheans' results, and assuming that all coarse ware sherds are wasters, this means multiplying by 10. But breakage rates vary. For say 1,200 pots per week, 1,800 kg of clay would require 1,111 kg of fuel each week for 26 weeks per annum. But as water can comprise 40 per cent of clay weight (Hamer 1975:312), another 720 kg, for a total of 2,520 kg per week, or 1,555 kg of fuel, would be needed. Clearly, while firing frequencies, clay input at each firing, fuel type, workshop size, breakage rates and pottery quantities leaving the site can only be estimated, the ratio of fuel to clay is compelling. As production increases, local fuel supplies become a critical factor. Gathering fuelwood can be "arduous and time-consuming", a problem often resolved in urban environments "through the development of complex marketing and distribution channels" (Sheehy 1988:221).

Large scale pottery production is complex and requires careful organization. Raw resource input, processing and product distribution channels need careful co-ordination. At Khok Phanom Di, programming cycles of raw resource acquisition, pottery drying and firing schedules would be dictated by seasonal conditions. Such timing would influence raw resource inflows and pottery outflows, leading to clay and fuel stocks being stored when wet seasons restricted other activities. Ownership of valuable stored clay and fuel could stimulate wealth accumulation, much as the systematic storage and control of food surpluses may have stimulated the rise of ranked or stratified societies discussed above. It is important to note the large mass of prepared clay cylinders covering the rich B15 (Chapter IX), that 12 of the 21 CP3 "potters"' graves included clay (Table 142), and that no allowance has been made for potting clay in assessing burial wealth because of difficulties in discriminating between grave fill and potting clay in some instances.

Further logistical planning and implementation would be needed to store, pack and exchange vessels and/or their contents. Unfortunately residues have not been detected in container sherds, but as they represent unused reject pots ("wasters") this is not surprising. Although direct evidence of any used container contents is lacking, production organisation, scale and context provide indirect information. The presence of wealthy potters and associates suggests that both production and distribution were highly successful during CP3, because the containers were an essential component of the operation. Such circumstances encourage social ranking.

FOOD SURPLUSES AND SOCIAL DIFFERENTIATION

Only potters and turtle people secured graves in the MP5-6 burial ground alignments disposed to co-ordinate with a tomb-like mortuary structure built over the grave of a potter. The high quality of local pottery and mass standardized production in community workshops, correlated with the disproportionate wealth of CP3 potters, is also persuasive. It is difficult to characterise these actors as other than a select group. They were separated in death, and possibly also in life. This group may not have been an élite in Childe's, Adam's or Redman's terms, but they were perhaps an incipient élite. Comparisons with developments elsewhere might help to illustrate this point. For example, Renfrew (1972:482), in describing the development of Aegean civilization notes "the nucleus of craft specialization at village level, seen clearly at Myrtos, at Lerna and at Chalandriani, is already a palace economy in microcosm". This transition grew from grape viticulture and especially olive cultivation which enabled a redistributive system to develop. According to Renfrew, this favoured the emergence of local chieftains, and in turn, craft specialists organised by the chief "at village level in what is still basically a subsistence economy."

Renfrew's model rests on the development of a subsistence economy redistributive system. Its essential component is not subsistence crops, but commodities. Control of commodities, whether subsistence surpluses or other items, is pivotal. Renfrew's Aegean model follows earlier models proposed by Childe and others, which envisage that the rise of stratified societies turned on subsistence surpluses controlled by high status individuals who eventually developed into an élite. But at Khok Phanom Di intensive container production suggests a need to transport commodity(ies) in large quantities. Control of this system could have conferred power and status on the central players. The CP3 potters, and turtle group associates, would seem to fit such a profile. While there are no large central buildings, metallurgy, seals or other redistributive system markers, there is a clear difference in wealth between potters and non-potters (Tables 139 to 150). Further, some individuals appear to have not only achieved considerable wealth in their lifetime through their craft and/or entrepreneurial skills, but others (for example 15-month-old infants B14 and 16), appear to have inherited wealth. Higham and Thosarat (1998b:58, Fig. 73), describe B16 as "a mirror image" of B15, the richest uncovered.

Initial conditions in the Aegean model show "little evidence for craft specialisation or for a strong hierarchical social structure. Trade was on a limited scale on the basis of reciprocity" (Renfrew 1972:481). The rise of complex social hierarchies in Southeast Asia is usually assumed to turn on subsistence surpluses, with rice being the key (Higham 1996b:322). Cultivation and control of rice surpluses is conceived of as leading to the rise of complex social structures culminating in the establishment of a socio-political élite. Further, there is an implied "straight line" social evolution in many Southeast Asian models, for example "General Periods" (Bayard 1984:161-8, Bellwood 1988, Higham 1989), although Higham later abandons the notion of indigenous Southeast Asian structural development in favour of diffusion from China (Higham 1996b, Nelson 1997:784-5, Higham and Lu 1998:867-77, Higham 2000:447-8).

Models are important in articulating and explaining archaeological evidence. But their rigour is data dependent. Physical phenomena exhibit properties which, once defined and explained, are predictable (Popper 1963:340). But because societies are continually transforming in a non-

repetitive manner (Renfrew and Cooke 1979, Popper *op. cit.*), many social science explanations lack such rigour. Social science models typically over-simplify, omit much and over-emphasize much (Popper 1967:7), problems not encountered in the natural sciences.

Implanting rice agriculture into regions previously dependent on hunting and gathering might stimulate increased subsistence activities, subsequent population increases and concomitant social stratification, through the organization and control of rice surpluses. This model turns on the diffusion of rice agriculture, a complex activity (Thompson 1996:119-50), either along with those familiar with the processes or through the transmission of the necessary knowledge. If rice agriculture was introduced to Khok Phanom Di during CP3, the transition was rapid. Higham and Lu (1998:875) observe that "only during a brief phase when the sea level fell and freshwater conditions prevailed, however, do we find the shell reaping knives and granite hoes which suggest local cultivation. With a reversion to more marine conditions, the use of agricultural implements lapsed and, we suspect, people returned to hunting, gathering and fishing".

Thompson (1996:215) reported that:

> "The remains of cultivated rice were found in some form in all levels of the site, both before and after the major change from a marine-estuarine situation to a more inland one, and they showed neither an increase in abundance nor a marked change in morphology through the sequence. The general concept of an environmental stimulus prompting cultivation therefore seems inappropriate."

Rice is encapsulated in exotic pottery more-or-less throughout the sequence, as either incidental or deliberate (temper) inclusions. In local pottery it is restricted to CP3 and CP4. As its presence in CP3 local pottery has economic and ritual implications, it is important to establish its likely origin. If rice was introduced following a fall in sea levels, but cultivation later lapsed due to a return to more marine conditions, these changes are not evident in the prehistoric record. Thompson (1996:213-15), noted that rice neither thrives in saline coastal areas nor did its deposition rates and morphology vary significantly throughout the sequence. Demands for pottery firing fuel would have been considerable and local rice crops could provide useful by-products (Thompson 1996:143-4). But rice is absent, except perhaps for husk in clay adhering to L8-10 cord-marked sherds (Thompson 1996:159-60), and in B19 and L9:1 clay samples (Chapter IX). The amounts are so small, however, that they could represent imported rice.

RICE AND ITS ROLE IN KHOK PHANOM DI POTTERY

Potters' conservatism mitigates against using *any* material not consistently available in reliable quantities. During CP3 a few local wares include small amounts of incidental rice or bleb temper, probably added for ritual purposes. But compared to CP2 (Chapter VIII), when incidental rice was extremely rare, a closer association is evident. It is stressed, however, that this does not represent a change in traditional CP3 methods. These special treatments differ from FG5, the CP4 bleb temper. Incidental rice is also present in rare anvil and several rim fabrics, most obviously displaced from CP4 in prehistory (Table 179). In extremely rare cases it was added to CP3

carinated mortuary jar grog. This suggests that, because not locally grown, it was too valuable for general use. Two of the three MP5 graves included mortuary wares with rice in their fabrics (three of four B14 and one of four B16 vessels). In MP6, B9 included two and B19 four such carinated burial jars representing 25 percent of MP6 mortuary wares. No MP4 or MP7 grave wares included rice. Rice was almost certainly added to Ban Na Di mortuary vessels for ritual purposes (Vincent 1988).

Of 78 CP3 vessels examined petrographically, rice was restricted to 15. These inclusions are consistent with ritual rather than technological factors. Stratigraphically, MP5/6 lie within L7:2 to L5:2, above the deposits containing shell knives, when Higham and Lu (*op. cit.*) suspect a reversion to more marine conditions and a return to hunting, gathering and fishing. Access to rice was maintained throughout the cemetery sequence, when sea levels were high, when they fell and when saline conditions would restrict its local cultivation. Only when faunal and floral evidence indicates a clear separation from the sea is rice used as temper, which suggests that successful cultivation was restricted to CP4. CP3 potters modified fabrics with rice and if reliable supplies of rice by-products were available, they could have been used. But such changes are unlikely unless they conferred obvious benefits. Changing from orthodox to bleb grog temper requires additional input, but using rice directly for temper, provided it suited local clays, would be more efficient. But, in spite of possessing the necessary technical skills, the CP3 potters did not change from grog to rice temper. Perhaps because local rice cultivation was unreliable. Although conservative, potters may change their methods when advantages are obvious. Simpler tempering methods and access to rice by-products for fuel would offer clear advantages.

Two sources dominate CP2/3 exotic wares, the broadest range from a potting centre using bleb temper associated with rice husk. These wares steadily increased over time. Several other exotic sources also used rice, thus such techniques were widely known. A generalised temporal sequence of changes in temper "types" has been identified in Thailand (Vincent 2002). The earliest assemblages feature natural, followed by artificial and finally rice tempers (Vincent 1988, 1998b, 2002). These changes suggest that as cultivation was adopted, reliable by-product supplies were exploited for potting. A simple tempering method and reliable fuel supplies would accrue from this change. Thus, if they were available, the highly skilled Khok Phanom Di potters would be unlikely to ignore such benefits.

Beetle remains found in a coprolite associated with B67 and the stomach contents of B56, (*Oryzaphilus surinamensis* and *Formicomus* sp. respectively), are consistent with rice storage (Harris 1991:238), but this does not identify where the rice was grown. There was no change in its morphology, or abundance, to suggest major CP3 developments. Thompson (1996:211), reported that short-lived freshwater ponds and seasonally flooded depressions could have favoured local cultivation. Clearly, domesticated rice was consumed and probably stored on site from at least the outset of CP3. Stone hoes and shell knives suggest that local cultivation was undertaken, but perhaps soon abandoned due to unfavourable growing conditions. Rice in exotic pottery suggests cultivation at several inland locations, from where it could have been acquired by exchange. Its restricted use in ritual burial jars is a measure of its value. Thus while common to many inland sites, only in CP4, post *c.* 1500 BC, was rice exploited by Khok Phanom Di potters.

Access to domesticated rice could reflect a close association with inland cultivators. Exchange relationships with sites producing pottery containing rice intensified during CP2. The outset of

CP3 is marked by exotic anvils, a broad range of exotic pottery and the gradual local adoption of exotic decorative techniques. These changes almost certainly mark the arrival of new groups, perhaps with males of shorter stature (Tayles 1999:287), who, given their use of rice and bleb tempers, were familiar with rice cultivation. At this point sea levels were unstable, a situation which promotes salt accumulation on mudflat surfaces (Strahler 1973:371-3, Tucker 1981:161).

EXCHANGE AND THE CP3 CONTAINERS

Khok Phanom Di is surrounded by "acid sulphate" soil from former tidal flats, acid marine and brackish-water (Maloney 1991:24-5). Gypsum-anhydride forms within high intertidal-supratidal flat sediments, called *sabkhas,* and evaporites precipitate from them. As pore fluids increase in concentration across the *sabkhas*, gypsum crystals are replaced by anhydrite crystals. If the host sediment is cohesive, the gypsum crystal shapes may be retained. Anhydrite formation requires an arid climate with high mean annual temperatures (above 22°) and seasonal temperatures in excess of 35° (Tucker 1981:163-4). "*Layered halite* commonly consists of alteration of halite with anhydrite.." (Tucker 1981:167). Halite is precipitated in coastal salinas or salt marshes. It probably grows displacively analogous to gypsum crystals and anhydrite nodules. Gypsum pseudomorphs are evident in one CP4 pottery fabric (FG23, Appendix 1).

According to Maloney (1991:24), sedimentation in the lower Bang Pakong Valley is unlikely to produce high salinity. But the presence of halophytes indicates a "barren, dry open, saline or hypersaline plain landward of mangrove forest in regions with a seasonally arid climate" (Thompson 1996:209). Halophytes, most common in L10, persisted into L5 at much lower frequencies. In addition, surficial efflorescence on basal sherds attests to the presence of salts (Chapter VII). Prehistoric conditions clearly favoured salt precipitation on or in nearby mudflats.

Inland trade links in Madang Province, Papua New Guinea, involve salt and in some cases include hazardous journeys (May and Tuckson 1982:192, 194):

> "People outside the Tangu region come to the area for pots and social exchange. The Tangu in turn journey to the coast for salt, lime, dogs and manufactured goods" (Burridge 1969).

Ceramic containers were used to transport salt in Western Britain *c.* 450 BC - 50 AD (Morris 1981:68). During the Western Zhou Dynasty in China, *c.* 5th century BC, control of salt production brought success to a male "whose wealth compared with that of a ruler of a kingdom"; salt was produced on the coast (Wheatley 1971:126, 130). Salt monopolies, established in the reign of the Han emperor Wudi in 117 BC, produced half the state's revenue (Gernet 1982:264). It was taken from maritime marshes, salt lakes and mines. Unfortunately, there are still no likely methods for determining prehistoric salt distributions (Reid 1997:492), except where salt containers are identifiable (Morris *op. cit.* Fig. 5:5). Salt-making facilities, including storage tanks to filter salty water and hearths to heat evaporation containers, were uncovered at Nong Tung Pie Pone, in the Upper Mun Basin (Nitta 1997:157-9). Laborious salt-making methods, exploiting saline soils, are still used in Northeast Thailand. First millennium BC salt extraction sites, on, or

near the coast when exploited, but now as much as 30 km inland, are known from west-central France (Scarre 1984:98-107).

The close association with inland potters who had a tradition of rice exploitation is persuasive. Some may have settled at Khok Phanom Di during CP3. But did they introduce rice agriculture? Establishing rice in saline conditions is highly unlikely. Several alternatives can be considered. First, is it possible that this new group brought knowledge of rice techniques but found local soils were unsuitable due to salinity? Perhaps, tradition-bound, they opted for suitable land further inland. A lack of evidence for increased rice suggests that, if this strategy was attempted, it was short-lived. There is no evidence to suggest the CP3 containers were for rice storage or transportation. The outstandingly rich B15, for example, contained several containers but no rice remains. Shell sickles suggest that rice was harvested soon after the arrival of the new group, but by MP5 the reappearance of small amounts of *suaeda maritima* seeds could mean that "rice cultivation became marginal through the invasion of salt water" (Higham and Thosarat 1998b:61). If suitable fresh water locations shifted further inland, cultivating and harvesting rice would become increasingly arduous and may have become uneconomic. Coupled with this stress, readily available rice from inland exchange partners may have ultimately become a better option. Exchange of local commodities, including salt, in the CP3 containers, is one possibility. Of course this is just one of several possible explanations and alternatives also need consideration. For example:

1. The presence of land snails, shell sickles and stone hoes indicate that fresh water conditions prevailed at the outset of CP3 which encouraged local rice cultivation.
2. Rice was cultivated throughout the sequence in spite of saline conditions.
3. Rice was only ever exchanged for local resources, the availability of which changed over time in unison with environmental changes.
4. Some combination of the above.

EXPLANATORY MODELS

Models outlining processes underlying the development of stratified societies often focus on specific cultural components under the rubric of some general theory. Frankfort (1951), for example, focused on cultural style or form, ultimately derived from cosmological forces (Frankfort *et al.* 1946:12). Some conceive social developments as extensions of biological evolution, with cultures tending towards increased complexity. Diffusionists view cultures as developing by accepting new traits from outside, then modifying them to conform with their own. This assumes that most inventions spread from centres of excellence, usually Egypt and Mesopotamia, with the migration of people and/or ideas to secondary centres being the essential process (Childe 1936). The role of ecology, or environmental determinism, in cultural adaptation and change, is central to some models (Clark 1954). Systems theory views cultures as comprised of sub-systems,

the nature of which vary but act to maintain a culture's equilibrium, or homeostasis, with its environment (Clarke 1968, Flannery 1968, Renfrew 1972). Some recent Oceanic studies have applied evolutionary ecology to define cultural evolution, with the origins of complex chiefdoms and their variability being conceived as the result of particular ecological and cultural settings (Aswani and Graves 1998:137).

Brumfiel and Earle (1987) include a commercial development model where increasing complexity results from growing economic activity lacking intentional direction from emerging élites. In contrast with an adaptationist model, where political élites are central players, more complex social organisation (such as "managerial élites"), could result from interaction between specialised activities, new exchange links and more efficient production. Especially where essential resources, such as salt, are dispersed, élite organisation secures the welfare of dependent groups as it simultaneously elevates the élite group's status. By diverting some exchange goods, a central court, including new full-time craft specialists producing prestige symbols, new weaponry and sumptuary goods could be supported. Political leaders must control raw materials and goods. Such models envisage élite control of craft specialists. This further promotes stratification through the control of prestige goods, the subject of restricted exchange between political leaders.

Three activity areas promoted by Brumfiel and Earle could have particular relevance to Southeast Asia. The first involves production and exchange goods (subdivided into subsistence items and goods which signal wealth and prestige). Second, whether independent or attached specialists are involved. Third, the manner in which élites establish and maintain themselves, the extraction and control over status symbols being vital. Two mechanisms, the distribution of status items to followers in return for loyalty, or restricting such items to an upper social group to display their high status (Kristiansen 1987), are possible.

At Khok Phanom Di, the first such activity area could involve jewellery, exquisite pottery, rice and fish (perhaps preserved with salt for dry season consumption). The second probably involved a form of independent specialists, but requires further explanation. In the third, prestige goods could have been restricted to an incipient élite group (elaborate turtle ornaments and burial jars for males, jewellery and exquisite pottery, including burial jars, for females). If rice cultivation was unsustainable during CP3, exchange of salt and preserved fish for rice from inland partners is worth consideration. River communication is relatively quick and simple even with heavily laden boats.

Control by an élite is essential to maintain their position. In this respect Higham (1996b:320) makes a pertinent observation:

> "... in Southeast Asia, this could involve a lowland area where rice can be cultivated in association with uplands rich in stone or ore. Specialisation in each, and the exchange of products, might again be best undertaken through the medium of non-producing managers, whose reward lies in an elevated position in the hierarchy."

The model proposed here to account for the prominence of CP3 potters and their associates includes elements of earlier culture change and social stratification models. A key assumption in these (that craft specialists were commissioned and/or controlled by wealthy patrons with socio-political power), may not fit the present evidence, which suggests that craft specialists

were themselves central actors in the social hierarchy. Whether ranking developed following the arrival of immigrants (female potters and associated turtle group males), or represents a previously established social structure, is unclear. In either case if the exploitation of local resources required pottery containers, those who controlled their production and distribution are likely to have acquired wealth and prestige. Value would be attached not only to the containers and their contents but also to control of clay and fuel supplies. These parameters could explain the sharp rise in socio-economic importance implied in the CP3 burials.

Wheatley (1971:283) notes examples where profit depended on turnover and not "the maximization of return and minimization of cost", and although these involve intercity trade, the same concept could apply to exchange networks. Zhou dynasty entrepreneurs included women and regional specialists who produced and traded salt and other commodities (Wheatley 1971:126, 130, 134). In contrast with temporal élites, potters were valued for their skills but could equally gain status through their ability as entrepreneurs (Wheatley 1971:66-7). While neither Costin's craft specialisation definition nor Peacock's modes of pottery production models precisely fits the data, elements of both are evident. Models of social stratification, cultural adaptation and change often view craft specialists as artisans subject to exploitation by those with socio-economic or political power; pawns in a larger game underlying the development of complex societies. But the role of powerful social orders, formed to secure the secrets and power of craft specialists, should not be overlooked. Childe (*op. cit.*), noted a tendency towards craft guilds or clans, groups probably symbolised in burial jar motifs, as hereditary craft-clans. The power of secret societies, such as Freemasonry, originally craft-based but expanded to include wealthy and powerful individuals from many walks of life (Knight 1983), is an historic example of the amalgam of craft specialists with powerful templar and secular adherents, often with high status industrial, military, political and/or religious associations.

Salt and/or salted fish would be valuable for inland exchange and fit the container evidence. Evidence for continuous local rice cultivation is lacking and compelling. A switch from hunting, gathering and fishing to wet rice cultivation, even simple broadcasting, and a subsequent reversion, can reasonably be anticipated to leave signs in the ceramic record. But incidental rice remains in prepared clay did not increase. Further, Thompson (*op. cit.*), observed no change in rice frequency. Its extremely limited use in ritual vessels suggests that it was too valuable for everyday potting. Shell knives suggest short-lived local rice cultivation, but the over-riding theme is that rice was exotic. Given that it was an exchange item for most of the sequence, where, and for how long, had it been cultivated in the region? Rice temper is present in upper Bang Pakong Valley pottery from at least 4000 BP. Such methods suggest that its cultivation was well established. Control of rice through exchange networks could encourage social ranking.

Exclusive access to mortuary space within and adjacent to a central tomb infers high status (Wheatley 1971:64-5). Such exclusive burial rights and disproportionate wealth are CP3 hallmarks of high status. Rich infant burials suggest inherited status. One adjacent to the richest burial (a female potter), mirrored it down to an identical miniature anvil bearing the same potter's mark. A potters/turtle group alliance is evidenced by exclusive central burial ground access, a joint MP4 burial (B35 with turtle and B36 with potters' group affinities, the only graves laid end to end), and burials with goods and motifs symbolising affinities with both groups (B23, B43 and B44). Soon after the outset of CP3, grave arrangements became more clearly defined.

From MP3b and by MP4 nearly all are aligned along a 70° axis. From MP5 a clear relationship is apparent. Rows of graves are consistently cut along a 68-70° east of north axis, matching the mortuary structure (Figs. 289 to 292). CP2 graves were mainly east-west oriented in tight, sometimes disordered, clusters.

Burial jar distributions and grave goods evidence, while incomplete, outline a pattern of increasing prominence in mortuary contexts of potters and their associates. In some instances the data has been obsured by disturbances. Two MP6 gravess (B2 and B4), lack characteristic burial jars. But the former contained a unique vessel carrying the potters' group insignia and B4 included burial jar sherds and anvil and burnishing stones. Thus when considered in its entirety the information is considered compelling.

Finally, CP3 data suggest frameworks for the rise of social ranking, including orthodox subsistence/redistribution and craft specialisation/wealth models. But information from contemporary regional sites is lacking, rendering them untestable. It seems likely, however, that craft specialists, in some form of alliance with others, articulated and exploited a distribution system thus establishing a kind of "managerial élite". Marriage alliances probably underpinned these developments with clear evidence for sexual differentiation between the two roles, potters being led by females and the distribution system by males. Exotic pottery originated from coastal and inland sites. Exotic potters' tools suggest female marriage alliance immigrants. Exotic burial jars, probably with symbolic motifs, suggest that alliances, even allegiances, played a role in external relationships. In Chapter XII we will explore the implications of this evidence.

XII CONCLUSIONS

KHOK PHANOM DI AS A REGIONAL POTTING CENTRE

IN size and composition Khok Phanom Di is the largest known 2nd millennium BC regional potting centre in Central Thailand, if not Southeast Asia. Ceramic and related cultural evidence suggests that potting varied in socio-economic importance over time (Chapters VII-XI). Clay and potting debris contributed substantially to rapidly accumulated cultural deposits (Aitken 1992, Thompson 1996 and this study). Potting continued throughout the sequence, but in CP1 it was conducted under the stress of technological deficiency, particularly an inability to fully utilize local raw materials. After a brief abandonment, possibly due to intermittent high sea levels, the site was re-occupied. During CP2 a more technically developed tradition exploited locally abundant quality potting clays to produce wares, some outstanding, consistent with imported regional styles. Production doubled in CP3 when large quantities of coarse containers were manufactured. Burial jars from many exotic sources complemented local examples in a cemetery spanning CP2/3. Both exotic and local jars are thought to carry symbolic motifs. Local output peaked and exotic sources reached their maxima in CP3, when some burials have outstanding wealth. Mortuary and related evidence suggests that this florescence witnessed the rise of an incipient élite founded on potting and resource exchange (Chapters IX, XI; Vincent 2000c). At its height, burial in and around a central tomb was reserved for this group (Chapters IX and XI). The site was probably abandoned again *c.* 1500 BC, but re-occupied by a new community who established a pottery workshop (Chapter X). Intensive production of inferior wares probably continued for about 100 years (Higham and Bannanurag 1990:19), when the site was finally abandoned, perhaps because of water course changes.

Potting changes can reflect cultural changes including socio-economic organisation. The manner in which production is organized, and aspects of symbolic expression (particularly in special wares), may signal cultural changes. Interaction between subsistence, social, technological, symbolic and exchange subsystems are central dynamics (Renfrew 1972). Technology and its cultural role, especially its influence on socio-economic organisation, is a central theme in this study. Pottery styles and decorative modes are important but, because readily imitated, provide fragile *cross-cultural* information. But technological evidence is usually robust. Changes to established methods are usually resisted as they risk serious failures in a complex technology heavily reliant on tried and tested traditions. But minor technological adjustments, such as excluding rice from grog temper if supplies are unreliable, are acceptable. Stylistic evidence can provide valuable information when potting traditions are able to be characterised in detail, and increases in significance when supported by ethnographic data. In this study, carinated burial jars, for example, have been identified as carriers of important social symbols. When considered in the overall

context of the detailed data presented, these are most unlikely to have been copied (Chapters VIII, IX and XI).

Potting depends on the availability and quality of clays, tempers, fuel and water. In Southeast Asia seasonal monsoon rains affect potting schedules. Division of labour, subsistence and potting skills affect the type of pottery made, and its disposal. Modes of production are useful in characterising potting traditions. Peacock (1982) recognised a hierarchy of production modes, a concept relevant to Southeast Asia where increasingly complex technologies developed during the 2nd and 1st millennia BC. Pottery from Hong Kong mirrors this sequence which suggests it extends well beyond Southeast Asia. The Khok Phanom Di sequence encapsulates these developments (Chapter XI).

The Bang Pakong Valley lacks a developed chronological framework. But exotic pottery at Khok Phanom Di helps with inter-site relative sequences, and radiocarbon determinations from Nong Nor and Khok Phanom Di provide valuable cross references. CP4 sherds containing abundant rice husk were submitted to the Oxford Radiocarbon Laboratories for determinations, but provided anomalous results (Chapter IV). After similar difficulties with Ban Don Ta Phet AMS dates, Oxford warned Glover (1990:155), not "to put too much faith in the results". Differences and similarities in local and exotic wares at Khok Phanom Di reflect important cultural changes, minor variations such as the adoption of novel exotic decoration modes, which result in 'random drift', aside. Changes in local potting technologies and types helped to characterise three major shifts (Chapters VII-X).

A major socio-economic change is evident in CP3. Pottery production, already high, virtually doubled (Chapter XI). Exotic burial jars and potters' tools suggest that immigrant female potters and males with novel turtle artefacts stimulated this change. Turtle artefacts were subsequently reserved for male burials. The first such male, B57, also displayed a distinctive CP3 tooth ablation pattern. Distinctive carinated burial jars were found in graves throughout CP2/3. They appear to be purpose-made mortuary dedications which carry clan or similiar such motifs. Their shape altered and, with one exception, the motifs differ from CP2 examples. CP3 potters' jars carry a double incised line below the rim. Turtle group jars have a cord-marked carination point, motifs far too subtle to be fashion whims. Some exotic burial jar motifs match local versions, suggesting that similar social groups were present in other communities.

Exotic wares suggest that exchange relationships shifted to emphasize inland rather than coastal connections. This shift probably coincided with a new vibrant socio-economic structure, principally based on the production of large numbers of cylindrical coarse ware containers used to exchange local resource(s) along waterways, under a combined potters'-turtle-group management. This group may have achieved high socio-economic status.

The first notable evidence of assimilation sees both CP2 and CP3 burial jar types present in upper MP3 (MP3b) when burials tended to be aligned along a NE/SW axis (Chapters IX, XI, Vincent 2000c). An area previously reserved for shell midden received the first graves (B51 and B52). Potters' group graves included potters' tools and/or materials, anvils being restricted to females. But some male turtle graves contained burnishing stones. The first local burial jar with a cord-marked carination point appeared in MP3b with B57, a male, along with an exotic jar (which petrographic evidence suggests came from the south coast 45km away), and a turtle carapace plaque. The exotic source was first noted in CP1 (Chapter VII). Burials containing jars

made in the old tradition lay alongside B57. The turtle plaque was probably exotic, but later plaques are considered local copies.

The cord-marked motif is common to nine MP4 burials, including four potters, and three MP6 potters' graves. The exotic B57 jar follows the CP2 style, the carination point being wider than the rim, but the local jar conforms to the CP3 style, the only instance where both styles occur together. The B57 tooth ablation pattern was only found in later phases (Tayles 1999:286). One of the largest MP3 graves, B57 provides a link between CP2 and CP3 populations. The newcomers appear to have introduced a new potting technology, new styles, turtle ornaments and the first slate. They also probably facilitated access to a broader range of regional groups, including rice producers. Domesticated rice remains were found in MP3b with B67 and B56 (Thompson 1996:162, 186). From MP4 onwards burial jars are dominated by the potters' and turtle group motifs, which, if they represent social groups, suggests a population change. The burial jar and male turtle ornament tradition, established with B57 in MP3b, continued into MP4, MP5 and MP6. In contrast to CP2, the CP3 mortuary rituals involved the smashing of burial jars, either local and/or exotic, into graves (Chapters VIII and IX). Burial vessel treatments are listed in Appendix 4 (Tables 195 and 196. Note that MP3b vessels are included with CP2 examples). The condition of mortuary vessels by mortuary phases, as interred in prehistory, is summarized in table 163. Many of these vessels have been substantially reconstructed in the laboratory and typical fracture pattern examples are included in appendix 3 (Figures 316 to 321).

TABLE 163: *The ritual treatment of vessels by Mortuary Phases*

CP2				CP3			
MP	Intact	Smashed	Total	MP	Intact	Smashed	Total
3	19	1	20	7	2	6	8
2	23	-	23	6	2	17	19
				5	4	12	16
				4	-	36	36
				3b	2	16	18
Total	42	1	43		10	87	97

A transition occurred in MP4 when graves began to be aligned in rows along a NE/SW axis, in marked contrast with CP2 burial clusters. Potters' and male turtle group burials dominated this portion of the cemetery and some burial arrangements suggest alliances between the two groups (Chapter XI, Vincent 2000c). Some males may have helped with burnishing and exchange expeditions centred on the movement of pottery. Three burials include goods and motifs symbolising affinities with both groups; for example, a potters' group motif burial jar, a burnishing stone and a turtle ornament were associated with B23, a robust physically active male. Perhaps as a potters' group member he helped process and then transport pottery. B43, the wealthiest male, included grave furniture clearly linking the potters' and turtle groups (Chapters IX and XI).

Commencing with MP5 a transformation is evident, as the cemetery was reserved for just three graves (or four if B43 is included). The largest and richest in the cemetery contained B15, a 35-year-old female interred with many potting accoutrements (including an exotic anvil from a suggested inland source), the most vessels, a mass of broken potting clay cylinders and abundant jewellery. Close by, on the same alignment, lay a 15-month infant (B16), with a miniature local copy of the B15 anvil (including the same potter's mark). As with B15 it was placed beside the infant's right ankle. Clay cylinders were again amassed over B16 who was also adorned with a similar array of jewellery and burial jars to B15. Both graves were much larger than required for the body. A unique circular grave also contained a 15-month infant (B14), placed within two outstanding vessels along with two burial jars, one with a cord-marked carination, the other with identical motifs to those on a B43 jar.

Burial 15 is outstandingly rich, with at least 15 times the average wealth of other potters' graves and nearly 70 times that of non-potters. The only other burial to approach this is B43 with 43 per cent of the B15 wealth. As B14 and B43 contained burial jars with identical motifs (the only two of 50 burial jars in 27 CP3 burials), this suggests that B43 belongs in MP5. It seems clear that these two pairs of adult and infant burials were connected, both with each other and each with the other pair. The motifs provide a link with the B57 burial jar. In this portion of the cemetery, where previously a variety of burial jar motifs are represented and potters' and/or turtle-related burials are absent, MP5 was reserved exclusively for potters' and turtle-related burials, both groups associated with potting. The MP5 burials continued the MP4 NE/SW alignment. As with some MP4 graves, they were again cut into an area avoided throughout CP2.

By MP6 the transformation was complete. Exclusive burial rights now seem reserved for individuals involved in potting. Two neonates and one disturbed infant's burial aside, all MP6 graves either contained potters' motif burial jars and/or potting tools and materials. The graves form a row along a SE/NW axis parallel with a rectangular clay-floored structure constructed to entomb B19, a female potter. It featured substantial roof support posts and a floor made up of almost 30 smoothed clay layers, relaid at least once following the original interment. Two later burials were seriously disturbed in prehistory, possibly by looters (although Higham (pers. comm.) feels the disturbance was simply a circular pit). It seems reasonable to portray the tomb as playing a central role in MP6 mortuary activities. As with previous MPs the remains of localised fires and food remains were scattered about the cemetery, suggesting mortuary feastings. CP3 closed with MP7. Only one of three burials was undisturbed. It contained potting tools.

A developed social hierarchy is evident in the CP3 mortuary evidence discussed above. The relationship between B15 and B16 is compelling as it suggests that wealth and status could be inherited by members of the potters' group (see Bellwood's review of Vol. 1). Tomb burial rites obviously point to preferential treatment for some individuals. But in contrast with temporal élites, status may have been attained through craft and exchange skills combined with an ability to manipulate profits. Large-scale pottery production is complex and requires careful organization. Ready access to raw resources and consumers would confer economic advantages. Under the guidance of a "managerial élite" (Brumfiel and Earle *op. cit.*), more efficient production and distribution of goods would encourage economic growth. This, coupled with interaction between craft specialization and expanded exchange links may have stimulated increased social complexity (Chapters IX and XI). Local pottery production, exotic wares and sources all increased

in unison. Intensive exchange transactions, perhaps involving exotic as well as local resources, are thought to have stimulated the emergence of an *incipient* élite group. Exchange probably involved large numbers of pottery containers produced by independent specialists being transported by their associates along coastal and inland waterways. The site occupied a nodal location with excellent access to these routes. Mortuary evidence suggests that prestige goods were restricted to the incipient élite group. Within this group symbolic burial jars, exquisite pottery, jewellery and other precious artefacts are prominent in female graves, while elaborate turtle ornaments, burial jars and different precious artefacts feature in male graves. Burial 11, for example, contained an adze and B15 a shell container (Chapter XI).

Further assessment of Khok Phanom Di as a regional potting centre awaits information from recipient sites linked to exchange networks. But temporal changes in local output indicates production intensity which can infer external demand. Compared to other sites, Khok Phanom Di was clearly a major pottery production centre (Table 162), probably with a marked influence on regional pottery distributions and ceramic horizons. In terms of excavated material, Khok Phanom Di is only exceeded by Ban Chiang, much of which involved a cemetery. Although according to Higham (pers. comm.), Noen U-Loke (not included here), "by far exceeds both". Non Nok Tha is essentially a shallow cemetery site. Ban Na Di revealed cemetery, occupation and bronze workshop deposits and Non Chai mainly occupation materials, with dense pottery deposits but few graves. Khok Phanom Di produced an outstanding 4657 kg or 39.82 kg/m^3 from the CP4 workshop, the most dense pottery deposits known in Southeast Asia and three times that of Non Chai, the only other Thai site to approach the quantities reported here. In cemetery and occupation volumes combined, Khok Phanom Di exceeds all others, although being second only to Non Nok Tha in burial numbers. The Khok Phanom Di cemetery revealed over 12 kg/m^3 and 26 times that of Non Nok Tha and over 60 per cent more than all Ban Chiang pottery.

TEMPORAL CHANGES IN LOCAL POTTERY PRODUCTION

Understanding cultural and environmental influences underlying a major potting centre's evolution should help in understanding the rise of increasingly more complex Southeast Asian societies during the 3rd to 1st millennium BC. This study has revealed that periodic disruptions punctuated long periods of continuous production. Marked shifts in ceramic technology and pottery styles helped define four Ceramic Periods. These changes could have implications for broader issues. Further, what seem quite subtle trends in local production strategies actually reflected important socio-economic developments. Substantial changes in the ceramic spectrum, at the CP1/2 and CP3/4 interfaces, could indicate site abandonment and re-settlement by different groups. The CP1 tradition relates to brief occupation and pottery firing activities. A completely different potting tradition, and almost continuous cemetery activity for four to five centuries, suggests re-settlement by a new group. The latter potting tradition underwent changes, probably following the assimilation of two new groups (perhaps through marriage or similar social alliances), with the resident community. Pottery firings temporarily interrupted mortuary activity about the CP2/3 boundary. This was soon reinstated but burial rituals changed, which suggests social disruption. The cemetery terminated with CP3, and ceramic evidence again suggests abandonment followed

by a final prehistoric occupation by another group who established a potting workshop (CP4).

Much of the data concerns pottery types, craft specialization, social organisation and regional exchange relationships. The presence of rice remains suggests a close association with the plant but the absence of bronze or copper artefacts, correlated with rice-related pottery at contemporary sites in Thailand (Vincent 2002), requires explanation. Rice was first sparingly used for non-technical reasons in CP3 mortuary vessels, a use noted elsewhere for symbolic expression (Vincent 1988). It was first used for temper in CP4 coarse wares and fine ware bleb grog, which suggests ready access to rice by-products. Restricted use in mortuary wares may indicate that it was imported because saline soils (reflected in the presence of salt-tolerant *suaeda maritima*), frustrated the establishment of reliable crops prior to CP4 (Thompson 1996:209, 215). Exchange of local resources for rice may have been a more viable option in CP3. Exotic wares from several inland sources are tempered with rice, some abundantly (Chapters IV, VII – X). Although found throughout the site, cultivated rice remains neither increased in abundance nor changed markedly in morphology which could suggest that most was exchanged for local resources.

Local production methods followed Southeast Asia trends (Vincent 1988, 1998, 2000a). Clay preparation shows a widespread temporal shift from natural to artificial tempers and rice. Although CP4 local wares feature rice, no metal was recovered. One explanation is that prior to CP4, neolithic hunter-gatherers, who exploited a rich coastal environment but had limited direct exchange connections and limited access to regional socio-economic activities, occupied Khok Phanom Di. It thus lay outside the mainstream of rice agriculture and metallurgy. This hypothesis is nullified by rice in stomach remains and CP3 local fine wares. Rice was available, if not abundant, and its use in CP4 pottery strongly suggests ready and reliable access. The absence of metal, however, may be more persuasive. Copper working was well established at Non Pa Wai during the late 2nd millennium BC, which either suggests a lack of exchange links or that metal did not feature in CP2/3 burial rituals. But metal is unlikely to have been overlooked by those with Bang Pakong Valley exchange links 100 km inland. Thus, either metal was excluded from rich burials (unlikely), or it was absent. An alternative hypothesis is that rice was introduced to this region independently of, and earlier than, metal.

Hand-specimen examination of Nong Nor Phase 1 sherds suggests that rice was present in mid-3rd millennium BC contexts, at least 1,000 years before the introduction of metal production. Rice temper and bronze are present in many mid to late 2nd millennium BC sites, when itinerant craft specialists may have plied their valuable skills from village to village (Vincent 1998, 2002). But local commitments to complex metal technology may have hinged on securing rice agriculture surpluses. The apparent simultaneous appearance of bronze and rice in the archaeological record *c.* 1500 BC may be a co-incidence, a construct of data retrieval.

Pottery production at Khok Phanom Di reflects standardization, mass production and expert technical skills, particularly during CP2/3. All are hallmarks of craft specialization (Peacock 1982, Arnold 1985, Longacre 1996). CP1 differs from later traditions but is virtually identical to that of Nong Nor Phase 1. The CP1 ceramic firing stands, burnishing stones and specialised anvils signal high skill levels, but a dependence on crushing pebbles for temper clearly reflects production difficulties. The Nong Nor potters employed a similar technology. Potting equipment, methods and vessel types at both sites suggest that they not only belonged to the same tradition but actually represent activities of the same potters' group. As O'Reilly (1995, 1998a) observed

some pots could have been made by the same person. Unfortunately there is insufficient evidence to determine whether these potters could be described as craft specialists. But there is little doubt that both belonged to well-developed potting traditions.

At Khok Phanom Di comprehensive evidence is available from the CP2/3 cemetery and the CP4 potting workshop. The quality of CP2/3 ornamental wares reflects a deep understanding of hand-made craft potting. Better quality examples are difficult to imagine. Their hallmarks, precise burnishing, intricate decorating and carefully controlled reduction firings, required considerable skills. Many vessels have thin, evenly smoothed walls which required the close and detailed attention of an expert potter. Ceramic potters' anvils, bearing what appear to be ownership marks, were found in secure stratigraphic contexts in CP3 but not CP2. Although CP2 fine ware is the equal of CP3 examples, the status accorded CP2 potters is unclear. Thus while CP2 potters were craft specialists in technical terms, they may not have achieved the socio-economic status accorded their CP3 counterparts.

Utilitarian vessels were made to two different standard forms, one in CP1/2, another in CP3/4. These were probably regional forms produced at several sites. Production may have been discontinuous and varied as potters moved into and within the region. Function, and cultural style, would be important in dictating forms. Because it may merely reflect cultural style, standardization alone does not identify craft specialization. But analysing evidence from each CP allows local manufacturing strategies to be compared and contrasted. Details from one CP can often help extrapolate an overview of another. For example, CP4 provided information which suggests that potters carried out their craft together in a workshop, but carefully identified their individual tools. Evidence for such group activity is, to the writer's knowledge, unique, at least in Southeast Asia. It strongly suggests that these potters were full time craft specialists who co-ordinated their production methods to increase efficiency. It therefore seems reasonable to assume that potters' marks equate to group activity by craft specialists. Of course such evidence is not a measure of their socio-economic importance or social status. The special recognition accorded CP3 potters and associates in mortuary rituals, most marked in MP5, makes it clear that those potters were held in very high regard.

In terms of context, intensity and scale, at least during CP3, the evidence indicates that craft specialists played an important role in local and possibly regional socio-economic activities. The size and distribution of other production sites in the region are unknown. But Khok Phanom Di occupied a nodal location and provided large pottery outputs. Together, these suggest a central role in regional resource flows.

Both coarse and fine wares are involved. Coarse ware container volumes imply local resource exchange, perhaps preserved fish or salt, to regional partners. High quality exotic funerary vessels, perhaps dedications from familial or clan members, or in recognition of high status individuals, originated from several intra-regional sources, some up to 100 km distant. Motifs on some burial jar rims from general CP3 cemetery contexts differ from the potters' and turtle group motifs, which suggests that several social groups were represented (Chapter IX). Male potters/turtle group members may have operated essential inland and coastal transportation links and assisted with less skilled potting processes. But their primary role may have been to facilitate access to regional exchange partners, thus enhancing the potters/turtle group's status through the promotion of important socio-economic relationships.

Wet season conditions effectively prohibit small scale village potting, but by scheduling various tasks, full time specialists may operate year round. Clay and fuel acquisition and storage, when wet conditions prohibit drying and firing pottery, are important aspects of large scale production. Cutting wood and preparing grog temper on dry days builds up dry season reserves. Covering clay with banana leaves helps prevent drying (May and Tuckson 1982, Scheans 1977:12, 36). Given the restricted data available, only approximate estimates of quantities are possible by comparing clay dump and sherd weights (Chapter XI). Large amounts of suitable fuel, probably several tonnes, would be needed. Shell dumps aside, potting activities were primary in Khok Phanom Di's rapid emergence above the surrounding floodplains, reaching upto 12 m at an estimated 2 m each century.

Huge sherd dumps presently erode from perimeter mounds. The site edge is probably composed entirely of pottery wasters and associated residues. When micro sherds and whole pots in general contexts are included, potting materials clearly form a substantial proportion of the deposits. Because pottery wastes are usually dumped away from work or habitation areas, these concentrations would add substantially to the pottery quantities recorded in this study. Large outputs probably also left the site as exchange items. Cemetery, occupation and potting activity areas therefore bias the volumes downwards. A site transect, which included the waster dumps, would provide a less skewed sample. Data set out in Chapters VII to X and summarised in figures 304 to 306 show that output varied in quantity and type over time. They should be considered in conjunction as the layer subdivisions varied in depth and are somewhat arbitrary.

Potting evidence by Ceramic Period

Comprehensive evidence from occupation, cemetery and workshop contexts has provided detailed insight into local potting traditions. These are summarized in Chapter XI.

During CP1 imported pebbles were crushed for temper, a clear sign that potting was conducted under the stress of unsuitable local materials. This laborious method underlines the importance of pottery to the community. In spite of these restrictions a limited range of good quality wares was produced. In addition, potters' anvils, burnishing stones, firing stands and associated firing evidence, reflect a well-established tradition (Chapter VII). Similar ceramic firing stands are presently used in Northeast Thailand for raft firings. They represent a permanent commitment to potting. Variations using inverted pots or large stones are also known from the Philippines (Scheans 1977). Compared to later developments, external contacts appear limited as only six exotic sources were identified. Exotic shell temper points to coastal, and rice in bleb temper, to inland sources. The relatively brief duration of CP1 suggests a difficult environment, probably affected by high sea levels, which finally became untenable. Some sherds have post-depositional shells attached to them, others gypsum or salt efflorescence, perhaps as the result of periodic site inundation.

Reliance on sand temper is resource dependent. The more technically developed and resource independent grog temper was unavailable to either CP1 potters or their Nong Nor contemporaries. But their knowledge of potting clay thermal responses suggests that they were skilled craft potters. Changes in clay preparation techniques can be sensitive indicators of technical innovation, the adoption of superior methods, and the movement of cultural groups.

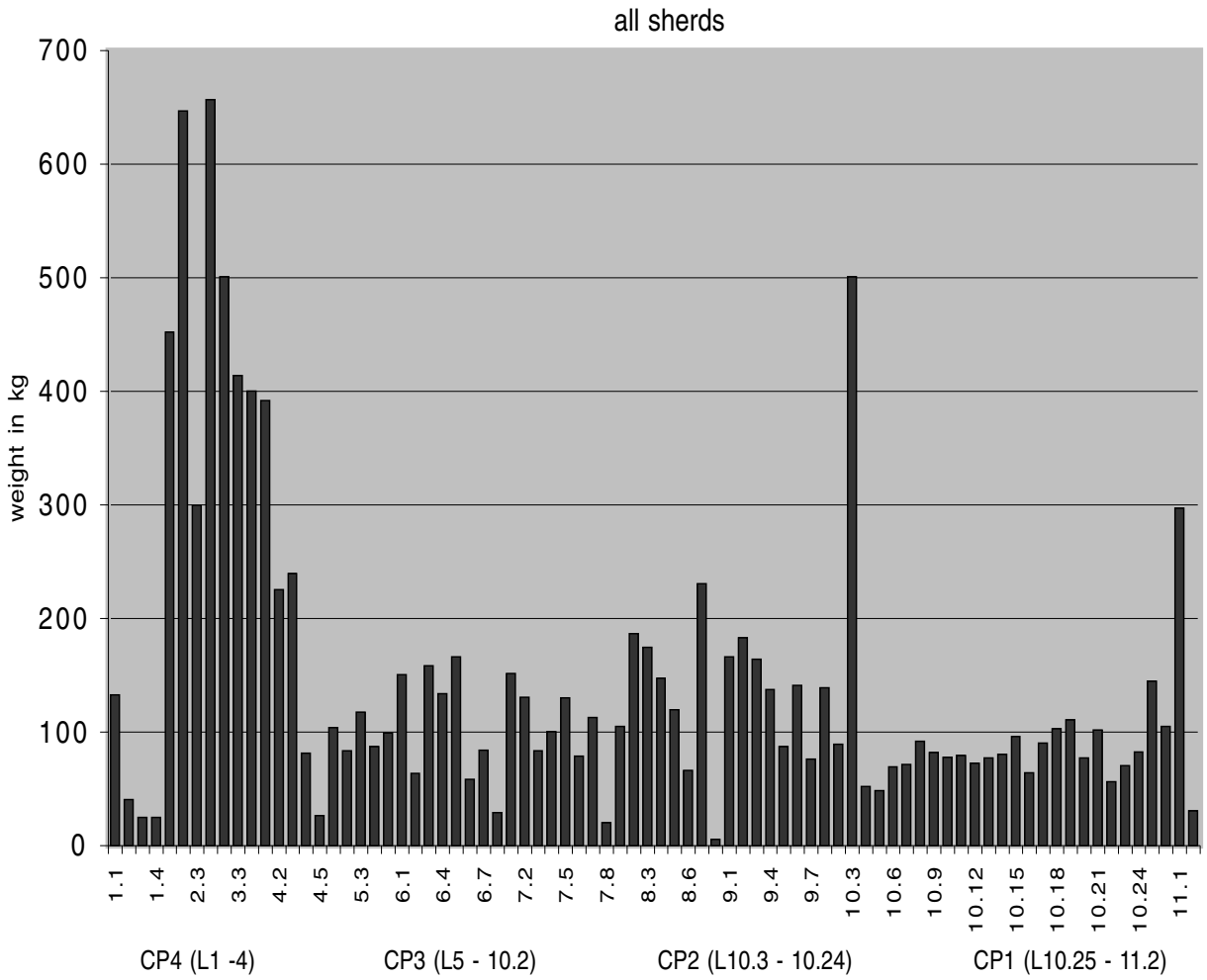


FIG. 304: Temporal changes in local ware production: all sherds

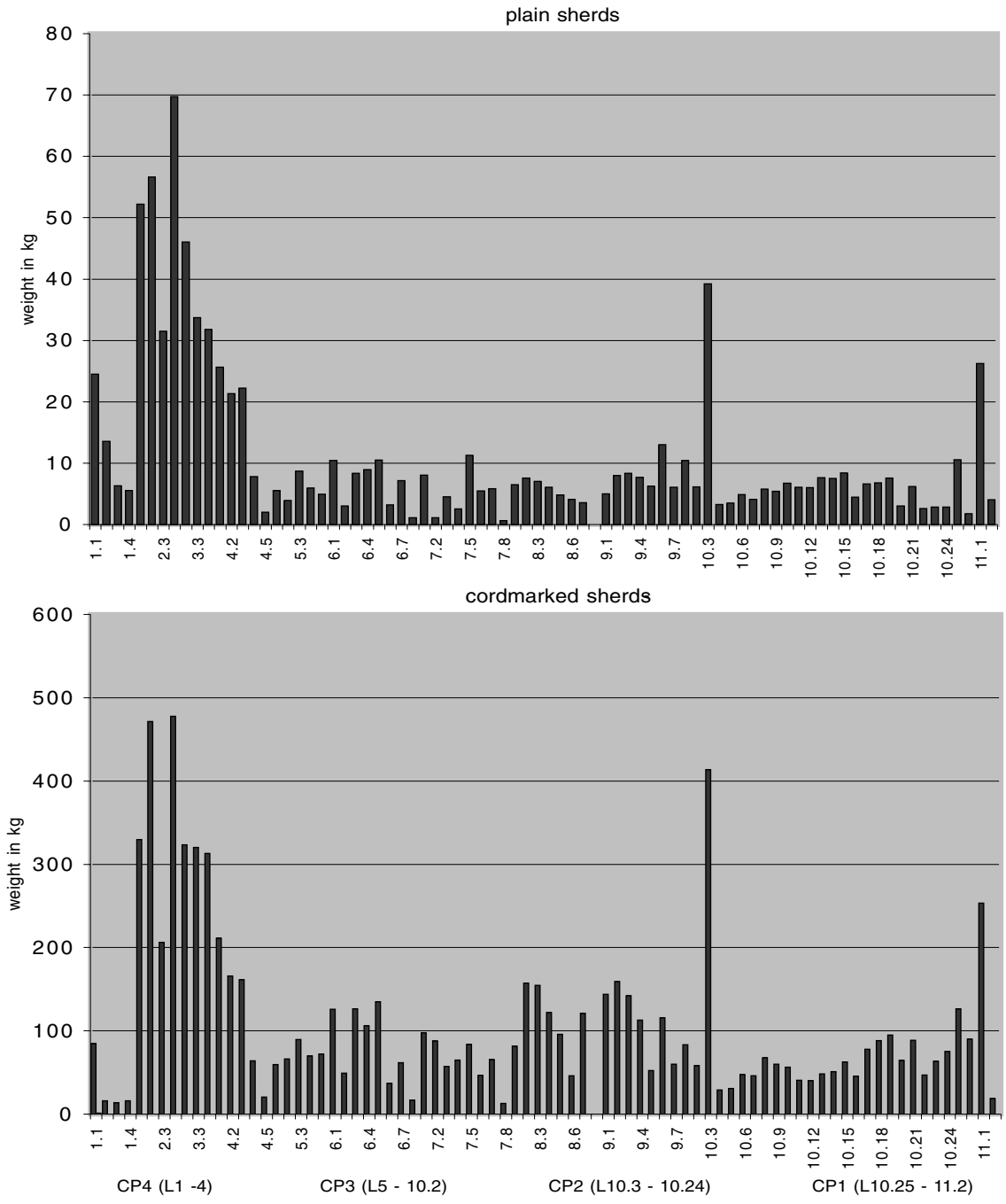


FIG. 305: Temporal changes in local ware production: plain and cordmarked distributions

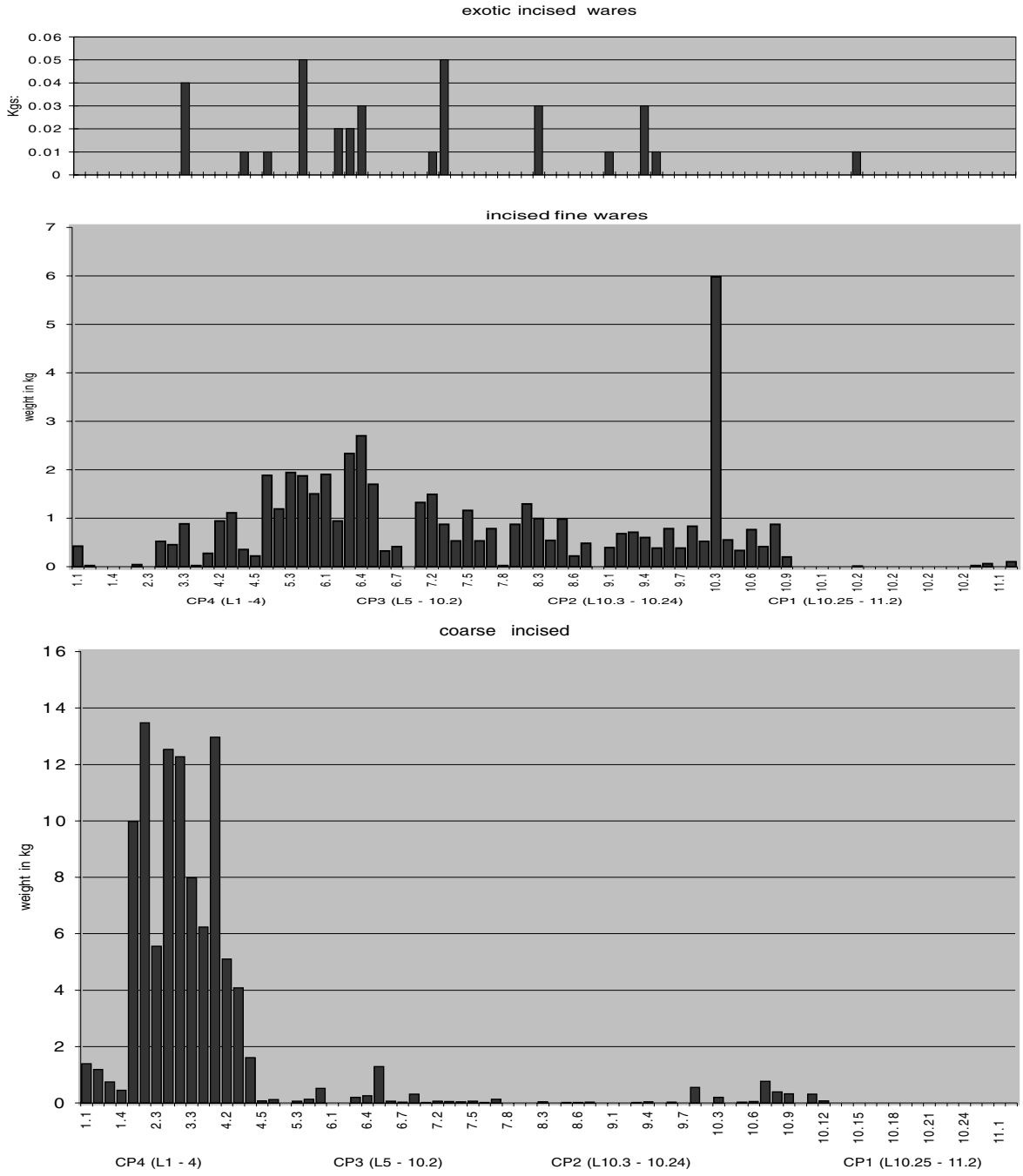


FIG. 306: Temporal changes in the distribution of all incised wares

Manufactured clay temper (grog) was introduced in CP2 when exotic wares and sources increased. Such changes reflect a more developed tradition and wider regional connections. Local forms initially increased in complexity, a measure of the tradition's growing strength, but then reduced towards the end of CP2 (Appendix 2). Adjustments to clay preparation methods were introduced with CP3, probably by immigrants. These potters also mastered using untempered silty clay, a significant innovation allowing mass production of readily disposable containers. High demand for these containers appears to have driven this change. There is no obvious difference in CP2 and CP3 potting skills, but drying and firing the untempered containers would need detailed expertise.

Potting flourished during CP2/3, but potters may have achieved higher status in CP3 (Chapters VIII, IX and XI). Burnishing stones were found in 11 CP2 graves and potting clay in one female burial. Potters' anvils, with perhaps one exception, are absent from CP2 graves, but many anvils and stones were found in the general matrix. Craft specialization is suggested by three anvils with ownership marks and burial jars with the potters' group motif. Three different technologies are represented in exotic anvils, which suggest immigrant potters from several donor groups.

Pottery was fired during a hiatus in mortuary activity between CP2 and CP3 (Chapter XI). The cemetery was re-established as changes in mortuary rituals and the pottery spectrum marked the introduction of a new group. Males with turtle ornaments were at first mixed with graves arranged in the old manner with burial jars carrying CP2 motifs. Potting materials and tools were found in many CP3 graves as a potters/turtle group gained in prominence and eventually dominated the cemetery. This dominance included a central tomb constructed for a female potter, an event usually reserved for individuals of high rank (Adams 1966:98-101, Redman 1978:295-7, Wheatley 1971:64). Exchange operations management involving pottery containers may have precipitated the rise of craft potters to positions of high status in this Neolithic society. The community probably achieved unusual prominence due to a combination of favourable circumstances; these include (i) a nodal exchange location, (ii) abundant potting resources, (iii) expert potters, and (iv) a socio-economic alliance between the potters' and turtle group members. It is proposed that this partnership allowed these two groups to manage and articulate valuable exchange networks in order to fulfil external demands for local resources.

The CP4 potters' workshop revealed almost 300 kg of prepared cylinders (often tempered with rice husk and readied for use) and dumped potting clay (Chapter V). Some pots were probably modelled directly from cylinders stored in leaves to retain moisture. This suggests that a form of the CP3 container assembly-line production continued into CP4. The workshop floors lacked postholes but were littered with potsherds, clay, anvils (many bearing potters' marks), incising tools and burnishing stones. Small localised patches of burnt floor suggest grog temper firings. There are clear correlations between burnishing stones and burnished wares, incised wares and bone incising tools (Chapters VII and X). Bone points were abundant in the CP4 workshop (Fig. 296). Given the wide range of wares produced under intense workshop conditions, potting remained important.

Sherd distributions by Ceramic Period

Sherd weight to volume ratios are disproportionate in CP1 due to added sand, a heavier temper than the grog used in CP2/3 and rice in CP4. The CP2 pottery was composed of a sandy

clay, slightly heavier than that used in CP3. Cord-marked pottery gradually declined in CP2. It initially quickly increased and then decreased slightly in the final phases of CP3. The CP4 workshop material contains rice, the lightest temper. Both plain and cord-marked wares follow similar distribution patterns. Plain wares were not burnished but simply smoothed, probably with a flat paddle. Because the excavation units varied in depth, the histograms tend to stretch CP3 and compress CP2 values. The former contained twice that of CP2 (Table 164). A sharp peak in L10:2 stems from material caught in a very deep shell lens, not a sudden rise in output. Whole pots have not been included (CP2 jars weigh 1.65 kg and CP3 containers 1.5 kg).

Overall sherd density increased from 10.51 kg/m^3 in CP2 to 13.72 kg/m^3 in CP3 but these figures include all sherds: exotic, fine and coarse wares. But when rim sherd weights are assessed (a more accurate method of measurement), actual coarse ware proportions increased by 66.6 per cent and fine wares decreased by 61.16 per cent in CP3 compared to CP2 (Chapter IX). This correlationship between a decrease in fine ware versus an increase in local coarse ware production is critical, because it reflects a major change in local pottery production strategies during CP3.

TABLE 164: *Ceramic Period 2 and Ceramic Period 3 coarse ware weights*

All sherds:	Wt (kg)	Depth (m)	kg/m	Pots	Rims:	Wt (kg)	Depth (m)	kg/m	Pots/m
CP2	1753	2.059	851.38	516	Jars	38.11	2.059	18.50	11
CP3	3420	3.110	1099.67	733	Containers	93.48	3.110	30.05	20

Sherds from Type L2j coarse cord-marked cylindrical containers are most abundant. Increased CP3 production is associated with these vessels and correlated with the potters/turtle group (Chapters IX and XI). The richest, B15, included several L2j containers and the clay cylinders used to fabricate them. These relatively fragile jars were probably designed for a single purpose and suited to stacking in canoes to exchange local resources for rice and lithics from inland sites. In Indonesia, salt-making by coastal inhabitants continues to provide a valuable trade resource (Barnes 1996). Shallow estuarine waters are trapped in ponds, left to evaporate and the resultant salt residues are scraped up into containers (R. Barnes pers. comm.). Salt is often lacking from inland regions. May and Tuckson (1982:194) note that people from the Tangu region (Madang Province) of New Guinea travel considerable distances to the coast for salt. It is still painstakingly extracted from suitable Khorat Plateau soils in the dry season (Nitta 1997:153-60). In 19th century A.D. East Africa, annual tributes of salt were made to the King. Its extraction from soil was the exclusive role of women (Connah 1996). Wheatley (1971:126, 130, 134) notes its importance to late 2nd millennium BC Chou Dynasty leaders and in 119 BC salt became a state monopoly in Han China controlled and taxed by Emperor Wu Ti in 117 BC (Gernet 1982:145, 264).

A restricted range of exquisite burnished wares was the hallmark of Khok Phanom Di potters. Most are beautifully proportioned with a fine, deeply lustrous dark brown to black surface, after firing in a controlled reducing atmosphere. Many are incised with intricate, mainly geometric, fields. Some carry turtle motifs. In CP2 burial jar surface decoration was more refined than in CP3. This suggests that the jars were the most important CP2 funerary items (Chapters VIII

and IX). Apart from special vessels placed in CP3 potters/turtle group graves, CP2 fine ware decoration was more developed. These skills did not decline, but much less attention was paid to CP3 carinated jars, the most common burial vessels. In mortuary contexts, coarse utilitarian vessels, virtually absent from CP2, feature in CP3. This hints at a shift from strictly sacred to more mundane mortuary attributions.

Burnished ware output peaked midway through CP2 but fell away sharply during CP3. Burnishing stone distributions closely follow these trends (Fig. 295). Burnished and incised wares follow the same pattern. Burnishing stones became increasingly prominent in later CP3 burials, some of which were male. Males probably assisted expert female potters in non-technical aspects, such as burnishing. This could mean that some fine wares were for exchange but, as such vessels were made at several centres, competition probably limited transaction opportunities. If this is correct, it tends to reinforce the role containers played in the rise of the potters/turtle group. Male participation in less technically demanding processes would allow female potters to concentrate on vessel forming, a difficult operation for novices. Incised fine wares occurred in limited amounts from mid CP2 to late CP3. They briefly increased during MP5/6 when the potters/turtle group took centre stage in mortuary ritual. Incised coarse wares are a feature of CP4 but rare in CP2/3 (Fig. 306).

Paddle-impressed pottery, imported in small numbers during CP2/3, featured in CP4 local wares (Chapter X). Subtle changes in decoration techniques and a major shift from grog to rice temper suggests that CP4 potters came from inland rice growing regions. Some bowls display paddle and fingernail impressions, first noted in CP3 local copies of exotic wares (Chapter IX). Although coarse wares were cord-marked throughout the sequence, CP4 fine wares feature an amalgam of earlier local decorative modes with new techniques. The latter mirror modes displayed on exotic bleb-tempered wares associated with rice.

Some relatively minor decorative techniques were favoured by local potters in one period but not another. For example, punctate-impressed pottery tended to cluster around the upper portion of CP2. It became extremely rare in CP3. Pottery with raised appliqué bands was very rare but became more prominent in CP4. Some appliqué forms appear to have been copied from exotic examples when four new forms appeared in CP3 (Chapter IX). Fingernail or punctate impressions were occasionally favoured by local potters, but not paints or slips. Local experimentation with novel exotic techniques could explain these aberrations.

Vessel types by Ceramic Period

Relatively few complete vessels were retrieved but much valuable evidence was available from vessel parts such as bases, lids, rims and tripod feet. Coarse ware jars are most common. In CP1 and CP2, these were globular with an inverted rim formed by a simple inwards fold. Although the fabric changed in CP2 the globular form was retained. Early in CP3, cylindrical containers with a simple inwards folded rim and a new fabric replaced globular jars. Containers were produced in CP4 but with rice rather than grog temper. Thus some vessel styles may carry over from one tradition to another.

Most complete vessels, mainly carinated burial jars, were found in CP2/3 graves (Chapters VIII and IX). Many are very high quality, some without peer for hand-made wares. They represent

TABLE 165: *Mortuary vessel furniture distributions by Ceramic Period*

	Burials	With Pots	Percent	With jars	Percentage	Pots	per Burial
CP3	74	46	60.81	29	64.44	97	1.31
CP2	80	23	28.75	11	47.82	45	0.56

a pinnacle of excellence, the work of master craftspeople. Others are inferior and some appear quickly made, perhaps for the mortuary rituals. The CP2 jars carry more decoration than CP3 examples and their shape differs, as the rim diameter is greater than the carination but in CP3 the reverse is true. Incised or striated lines, shell impressions and cord-marks are variously arranged into what appear to be encoded motifs. Significantly, some vessels were smashed and fragments scattered within graves. This custom began with CP3 in MP3b (Chapters IX, XI and Appendix 4). More CP3 pottery was dedicated as mortuary furniture than in CP2 (Table 165), the most in MP5 (Table 166). No fragmented vessels were found in CP2 graves (Table 166).

TABLE 166: *Mortuary vessels by Mortuary Phase*

MP	Burials	Pots	Frag. Pots	Total	Per Burial	Exotic	%	2b	Exotic	%
7	4	8	10	18	4.50	1	5.55	1	-	-
6	11	19	53	72	6.54	10	13.88	15	1	6.66
5	3	16	25	41	13.66	5	12.19	10	-	-
4	30	36	78	114	3.80	13	11.40	22	4	18.18
3b	26	18	13	31	1.19	4	12.90	6	1	16.66
3	17	20	-	20	1.17	1	5.00	13	1	7.69
2	55	25	-	25	0.45	3	12.00	4	2	50.00
1	8	-	-	-	-	-	-	-	-	-
Total:	154	142	179	321	2.08	37	11.52	71	9	12.67

The MP6-7 figures need treating with caution as B6 and B18 were seriously disturbed and B12 was cut by a posthole in prehistory, but even so relatively few vessels were placed in graves. At Non Nok Tha, for example, 217 burials contained 847 vessels (3.9 per burial, Bayard 1984:87-122), but at Khok Phanom Di, the average is much lower. Fragments representing an additional 179 vessels recovered from CP3 graves increase the total to 321 (2.08 per burial). Although less than Non Nok Tha, the value placed on local opposed to exotic artefacts and different mortuary rituals could help explain the difference. An ability to readily produce high quality vessels could diminished their value. Significantly, minor surface decoration experiments apart, exotic vessels were not copied, in contrast with Ban Na Di where inferior copies of high

quality exotic vessels were made (Vincent 1988). Exotic vessels in Khok Phanom Di graves may have had mainly symbolic not material value.

Mortuary rituals changed in concert with pottery types. This is considered to reflect a changed community structure. In CP2 and CP3 some rims were deliberately removed. This suggests that selected vessels were ritually "killed", but only in CP3 were vessels completely smashed during the mortuary proceedings. Only one exotic source was represented in CP2 mortuary wares (Chapter VIII), however six, including the CP2 source, are present in CP3 (Chapter IX), perhaps reflecting established alliances with immigrants. Exotic pottery increased markedly in CP3, particularly the symbolic burial jars, a clear signal that external relationships were flourishing. If the motifs on these funerary tributes represent discrete social groups, they could signal socio-economic allegiances, perhaps with family or clan members or other groups with socio-economic bonds. Although most CP3 burial jars carry little decoration, some large versions and other funerary vessels are masterpieces.

Only two local CP2 vessels with solid tripod feet were identified (Cat. 2019 B86 and cat. 3252 B76 (MP3)). In all, 27 detached and isolated feet were found, five from CP1, 19 from CP2 and three from CP3. In CP2 these almost certainly represent four exotic tripod vessels. The remainder are probably local copies. The feet probably detached because they were placed on relatively thin vessels. The feet from cat. 2019 (B86) were missing. None were in the grave but one, (cat. 1881), was found about a metre away. Thus whether they were lost in normal use or deliberately removed is unknown. When separated into distinctive groups, an estimated minimum four exotic (from CP2) and 15 local tripod vessels (two from CP1, 10 from CP2 and three from CP3, Chapters VII, VIII and IX) were identified. Two moulded dome feet were found in CP4 (Chapter X). The CP1 feet match Nong Nor Phase 1 forms (Chapter XI).

TEMPORAL CHANGES IN EXOTIC POTTERY

Exotic wares were present in almost every stratigraphic context from a wide variety of suggested sources (Chapters VII-XI, Fig. 307). A striking feature is the lack of sources west of the Ban Pakong River. Lithic sources follow a similar distribution pattern (Pisnupong 1993). This could reflect a lack of contact or an inability in this study to identify likely sources in the Central Plain's extensive sedimentary deposits. Several exotic wares contain geologically non-specific fabrics but these await comparative pottery from western sites and further mineralogical and technological evidence. Suggested sources are widely distributed but in earlier contexts they tend to be closer (Table 167).

In CP1 a few exotic burnished and incised wares, probably from an inland source, contain rice remains. One unique sherd contains shell temper, which suggests coastal origins. The rarity of both makes down-the-line exchange more likely than direct contact with their producers. Other exotic wares contain orthodox grog or sand temper. Several jars contain igneous sand, readily identified with deposits within a day's travel and suggesting close ties with nearby sites. Regional forms were made at different sites but most relate directly to early sand-tempered Nong Nor pottery. Exotic coarse wares are very rare, but exactly the same forms are reported at Nong Nor (O'Reilly 1994), as are several Khok Phanom Di fine ware types. Several exotic forms also

have local versions.

TABLE 167: *Exotic fabrics: All Periods*

CP	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	No. -
4						x		x		x					x			x	5
3	x		x	x	x	x	x	x	x			x	x	x	x	x	x		14
2	x		x	x	x	x	x	x	x	x	x								10
1	x	x		x	x														4

Local tripod feet hint at external associations, perhaps with Malaysian sites or with Ban Kao, where tripod vessels with hollow legs are well known. But the local feet are solid and much smaller. Striations on fragments of a unique, high quality, exotic vessel indicate turning on a slow wheel or platform. Myanmar potters still use such a technique, leaving open the question of long distance movement in prehistory along the Andaman Sea coast and then through the Three Pagodas Pass into Thailand. This vessel fragment is the only known to the author from Thai contexts. CP1 potters' anvils differ from later forms but closely match those from Nong Nor. They are almost certainly exotic, but it is unclear whether the anvils or their materials were imported. Overall, most exotic pottery probably came from nearby coastal sites (Chapters VII and Fig. 288). This is consistent with occupation of an elevated site within a rich coastal or mangal habitat.

In CP2, coastal links were maintained and reinforced but three nearer inland sources were added. This suggests that coastal exchange networks continued to dominate, with some extension into slightly inland sites. Just over half of CP2 pottery types have exotic examples, which demonstrates that these were regional styles. Burnishing, incising and shell impressing were common (Chapters VII-X, Appendix 3). Same style pottery characterises homogeneous ceramic regions, particularly when a large production centre is involved. This sets the Bang Pakong Valley apart from other first millennium BC Southeast Asian regions (Vincent 1988, 1998b, 2000a). High quality CP2/3 exotic wares would provide considerable competition for local pottery, making reliance on it for exchange unlikely.

Painted and slipped wares were extremely rare, just 1.23 kg being recovered from the entire site (Fig. 299). Some may have originated from the Eastern Highlands or even beyond the Ban Pakong Valley. Red slipped wares tempered with "vegetal particles" (Rispoli 1992:129-30) have been identified in 2nd millennium contexts at Tha Kae, about 150 km northeast on the Central Plain near the Khao Wong Prachan Valley (Ciarla 1992:111-28). Red painted or slipped wares occurred along with tripod vessels at Ban Kao. The Khok Phanom Di sample has rice or bleb temper and minerals which suggest either a Central Plain or, more likely, a sedimentary source further afield. Red iron oxide paints are known from many northeast Bronze Age sites (for example Ban Na Di, Ban Chiang and Nong Nok Tha). They became widespread following the introduction of iron (Vincent 1980) but are rare in 2nd millennium contexts. True slips are very rare. The Khok Phanom Di sherds include limestone in the *slip*. A suggested source lies in

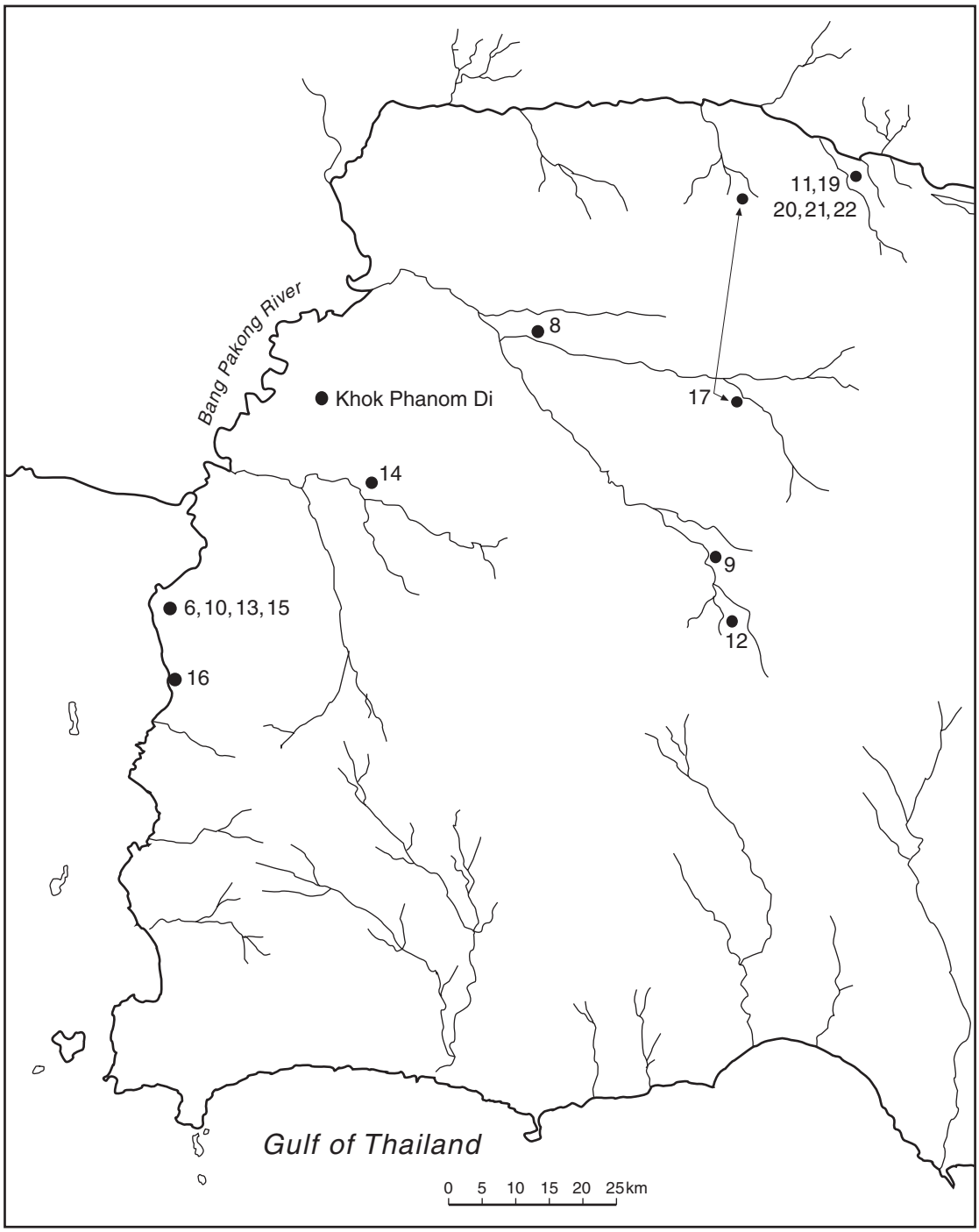


FIG. 307: Suggested exotic pottery sources

the headwaters of the Prachinburi River, an eastern tributary of the upper Bang Pakong River. Pottery from this source increased markedly during CP3.

Exotic burial jar sherds are considered key markers of socio-economic relationships. Some contain sufficiently distinct inclusions to suggest a source or indicate the closest likely mineral zone. For example, limestone outcrops 55 km to the south-east, but lacks waterway access. A perhaps more likely prehistoric source lay 200 km away near the south coast. Exotic burial jars may represent tributes in their own right, or containers of food consumed during the rituals and then symbolically smashed. Numerous sherds were scattered around CP2 graves but, in contrast to CP3, none appear to have been smashed into them. Their predominance suggests that they played an important role in mortuary rituals. Exotic burial jars could signal dedications by foreign individuals or groups. Their fabrics suggest a broad range of sources (Table 60, Appendix 1). The number of exotic vessel types increased from six in CP1 to eight in CP2, nine in CP3 and 11 in CP4. But exotic burial jar sources ranged from two in CP1 to eight in CP2, 12 in CP3 and three in CP4; a clear indication that exotic contacts peaked in CP3.

Five exotic anvils suggest that immigrant potters joined the local CP2 community. A lack of petrographic evidence renders specific sources elusive but technological differences suggest three donor sites. One anvil containing rice inclusions (cat. 1435) was probably displaced from CP3 in prehistory.

External relationships changed in CP3. Inland sources dominated a much expanded ceramic spectrum. Two CP2 exotic mortuary vessel sources were associated with early CP3 burials, one with B57, the other with B64 (a female whose vessel fabric matches the anvil in B15). One B57 vessel has a suggested coastal source. The remaining exotic mortuary vessels are consistent with sources much further inland than any in CP2, but one late grave contained burial jar sherds matching the B64 vessel fabric. This suggests that contact with the CP2 source continued. Exotic burial jars in CP3 graves suggest close inland relationships. One exception, a unique pot stand, perhaps from Gua Cha in Malaysia (Peacock 1959), may have been valued for its rarity. Exotic non-mortuary ware sources also differ. Compared to CP2, they appear to index much stronger and more distant inland connections. The broadest range originated from a potting centre using rice tempered bleb grog (Chapter IX). Seven CP3 anvils, five from the lower levels, are probably exotic. One contains bleb, another rice temper and one is coated with red paint. Two carry potters' marks. All suggest inland sources as do 10 of the 14 CP3 exotic ware fabrics identified.

In CP4, five exotic potteries are suggested, two on the near coast, two deep inland and one new nearby source. Seven of 135 anvils are exotic. Most are consistent with the upper Bang Pakong Valley source which dominated CP3 exotic wares, and contain rice in bleb grog.

Exotic pottery flows indicate a major increase in external relationships during CP3, focused on inland sites.

CERAMIC PRODUCTION AND EXCHANGE RELATIONSHIPS

Comparison of local output with exotic sources over time alludes to exchange relationship influences on local production. Production evidence varies in context and detail. CP1 local pottery has such a strong association with the Nong Nor Ph.1 tradition that it probably represents production

by the same potters or very close exchange relationships. Similarly the exotic sample is likely to mirror exotic pottery at Nong Nor. Either the CP1 potters who settled Khok Phanom Di also produced the Nong Nor Ph.1 wares, or they were active in the same or similar regional exchange networks. The range of pottery types duplicated at both sites is compelling. This evidence includes decorative treatments and ceramic technology in combination. There can be little doubt that these two assemblages either represent the output of the same potters or that of a closely knit regional tradition. High and fluctuating sea levels probably forced the abandonment of Khok Phanom Di, a factor also noted at Nong Nor. Local pottery throughout the Khok Phanom Di sequence contained incidental rice. It was also observed in Nong Nor Ph.1 pottery examined in hand specimen, but the petrographic examination of securely provenanced samples would be desirable to confirm this. Its presence in such coastal sites suggests exchange with inland sources where rice cultivation was not restricted by saline soils.

The CP2/3 cemetery provided a detailed catalogue of local production and exotic pottery flows over time. In CP2, local fine wares peaked about midpoint in the sequence (Chapter VIII). Local types exceeded exotic and their high quality would make them valuable exchange items. Ornate platters, a feature of CP2 but not CP3 grave furniture, are absent from the exotic assemblage. Platters lack the burial jar motifs correlated with social groups, and may have attracted material rather than symbolic value, a further indication that such CP2 wares were exchange items. Local domination changed in CP3 when at least three inland centres also produced platters. Thus, if exchange avenues existed for CP2 local platters, they appear to be absent in CP3.

Coarse utilitarian wares are absent from CP2 graves which indicates that they were not accorded any specific value outside everyday use. In sharp contrast, coarse ware containers were given prominence in rich CP3 (MP4-6), potters' group graves (Chapter IX). Burial 15 included four containers (Figs. 197 and 198); B33 a container base (Fig. 184); B4, 6, 9, 13, 16, 18, 27, 33 and 35 included container fragments (Tables 86 and 89). A MP7 non-potter (B12) also included a container (Fig. 217). It is emphasised that these container or postulated container lid fragments represent vessels smashed into CP3 graves. Only rim sherds diagnostic of whole vessels, and in direct association with each burial, were analysed (see B15, 16 and 33, Figs, 232, 236 and 239, Vol I, for typical sherd spread examples). Significantly, container sherds were not found with either B14 or B43, MP4/5 non-potters.

Prepared container potting clay featured in potters' graves, but has not been not allocated any value (Chapter IX). This material (B15 and 16 contained enough for 10 and four containers respectively), a feature in CP3 burials, was obviously valued along with jewellery and other grave goods. The importance of the most common coarse ware changed with the introduction of containers in CP3. Coarse ware production virtually doubled in CP3 compared to CP2 (see Chapter XI and Appendix 2 rim weights), further emphasizing their value for exchange. Fine ware output declined as CP2 came to a close, perhaps because sea level fluctuations, isostatic and concordant environmental changes began to restrict access to coastal waterways (Chapter IV). Coastline progradation may have made upriver watercraft travel more reliable. But this would change with fluctuating sea levels as direct routes to the sea opened and closed due to sediment migration (Tucker 1981: 68-70).

The CP3 container production correlates with changes in external relationships. Inland sites, some much further distant than earlier exotic wares suggest, dominate regional connections.

Perhaps coastal resources not readily available further inland, such as salt or preserved fish in containers, were exchanged. Fine ware output declined by about 60 percent as coarse wares virtually doubled in CP3 compared to CP2. This sudden critical change is linked to the rise of the potters/turtle group, proposed as central actors in articulating exchange (Chapters IX and XI). These transactions required adjustments to increase production. Some evidence suggests that assembly line mass production methods were adopted to allow non-specialist input. There is no evidence to suggest that CP3 fine wares were intended for exchange. High quality exotic fine wares increased which suggests that demand could have readily been met by other potting centres. Local CP3 production focused on disposable containers in such proportions that local consumption alone seems most unlikely (Chapter IX).

CP3 fine ware decorative treatments declined, which implies that coarse container output was at the expense of fine wares (table 168, Chapter IX). Evidence for local fine ware exchange awaits comparison with other assemblages, but given the range, quantity and complexity of CP2 fine wares these are more likely exchange items than CP3 production. Of course the containers could have been exchange items themselves, or to transport rice, fish preserved in salty brine, unprocessed salty mud or salt scraped from mudflat surfaces (Tucker 1981:161-4). They would not be needed to transport jewellery or similar locally-made items. Khok Phanom Di may have occupied a central place for the exchange of shell ornaments and high quality pottery, but such exchanges are not supported by the CP3 ceramic evidence which differs markedly from that of CP2. If power and prestige were achieved by CP3 potters' group members, the container and mortuary evidence provides support for such development.

If CP3 coarse wares were partly for local consumption, population expansion could help explain the increased production. Although this possibility is difficult to disprove, changed external relationships are also correlated with the rise of the potters/turtle group. Exotic sources and the important burial jar dedications both increased sharply in CP3 compared with CP2. But if coarse ware containers were critical for transporting exchange items, this would explain both the increased production and rich potters. Their shape is not suited to everyday use for, unlike local globular utilitarian jars found throughout the site, they are not self-righting but require support to stay upright. Well suited to stacking in watercraft such as canoes, they did not occur prior to CP3. A new function, associated with new exchange relationships and socio-economic changes instituted in CP3, is implied.

Containers and cylinders of clay used in their construction occupied a central position in the largest, richest grave, that of a female potter. Such prominence is unlikely to have been accorded utilitarian pottery for local consumption because of competition from other local potters. Production promoted by an external demand for local resources, articulated by managerial partners with ability to deliver them, may have been stimulated by asymmetrical access to community leaders who controlled exchange relationships. Valuable tridacna shell, concentrated in L4–7, and other desirable exotic items could readily be obtained through exchange. Local ornament manufacture was mainly restricted to turtle bone and shell ornaments (Pilditch 1993:170). Exchange with coastal sources, although reduced, continued from CP2 into CP3 leaving open the potential for articulating both inland and coastal circuits from a central place (*cf.* Irwin 1977).

In CP4, following a period of probable site abandonment, a group of potters activated a workshop. Their work was clearly inferior to CP2/3 output. Anvil potters' marks and clay preparation

methods suggest intensive group production. But their wares suggest a less vibrant tradition. Vessel styles and forming techniques changed. Paddle impressing, an extensive range of inferior ring-footed and fine ware bowls and platters came into favour. Exotic sources were limited to two coastal, two near the Bang Pakong River headwaters and one nearby, but now probably some distance inland due to coastal progradation. Three were noted in CP3. A workshop with abundant potters' tools, sherds and large clay dumps reflects volume production, much probably for exchange. Containers were again prominent suggesting continued exchange of resources, perhaps now including rice, to coastal areas. Local pottery contained rice temper, a strategy consistent with its cultivation. Soil leaching and desalination following coastal progradation could favour local rice agriculture (Thompson 1996:135-7). Some finer wares, particularly platters, could also have been exchanged.

SOCIAL ORGANISATION

Most prehistoric ceramic assemblages provide some indirect evidence alluding to social organisation. Often encapsulated in pottery technology, it allows insights into potting organisation and scale. Early Ban Na Di potters, for example, made few vessels using crude moulds (Vincent 1988). This suggests small scale household production by low status part-time potters, in contrast to craft specialists producing desirable high quality wares. Social organisation information is usually gleaned from pottery in burial ground sites such as Non Nok Tha, Ban Chiang and Ban Na Di. Very limited evidence concerning the status of prehistoric potters is available. Studies of modern potting groups often reveal a low status, due to the "dirty" nature of the work and limited market value of their produce (Arnold 1985:222-3).

In China *"c.* 957 A.D.", production-line pottery was made by low social status families who specialised in specific steps in the processing of glazed wares (Harrison-Hall 1997:185). Low caste Indian potters produce figurine forms traced back to the middle 6th century BC, but their products are needed by all (Blurton 1997:171). In 3rd millennium BC Mesopotamia, "pottery workshops were sited near the edge of towns, probably owing to a combination of low status, fire risk and easier access to clay and fuel supplies" (Simpson 1997:51). At the other end of the scale, prestige painted pieces afforded highly skilled 15th century A.D. Italian specialists high social status (Thornton 1997:121), as did unique lustreware for 13th century A.D. Islamic potters (Canby 1997:115). In these cases expert artistic and/or technical skills could explain high status, but this is not always so. No doubt many more examples are available, but the central issue is that status is established by cultural determinants and these vary from culture to culture for different reasons. Potters may be valued for artistic, economic or ideological reasons, some independent of craft skills. Demand for pottery may involve socio-political, economic or prestige values. A common concept amongst archaeologists is that:

> "potting was almost always a relatively minor industry .... generally of low status ... its very visibility may give a false impression of its importance" (Orton *et al.* 1993:32).

But Orton also notes that because pottery acts as a marker for less visible economic and social activities "its visibility can be put to good effect". Khok Phanom Di has provided comprehensive evidence not previously available. It allows consideration not only of craft skills but also of implied social determinants. Potting technologies and styles varied in substance and fashion over time. The important social role of certain potters and their associates was acknowledged in some mortuary rituals.

Direct CP1 evidence concerns manufacturing and firing which limits close examination of social organisation. Large raft firings and the transportation of materials and finished pottery require community co-operation. Further, the imported temper pebbles suggest that potting was very important. This evidence gives little insight into social organisation. But rim forms, some with similar motifs to CP2/3 examples, suggest that burial jars were used in mortuary ritual. The CP1 ware types reflect the regional traditions more fully developed in the CP2 spectrum.

Meticulously burnished carinated jars were the most common burial vessel. Their pristine condition suggests that they were purposely made as funerary furniture. Their basic shape, which differs between CP2 and CP3, suggests that they are important carriers of symbolic expression. Many also carry motifs. Although minor changes are evident over time and between different sources, the basic shape remained the same. A marked feature of these vessels is the number of exotic types, which peak at 12 in CP3, a regional aspect which emphasizes their cultural importance. Regional type conformity in ritually significant objects suggests cultural adhesions were recognised and are reflected in the use of these jars in burial ritual. Ritual sharing implies that external relationships beyond exchange or other socio-economic activities were transacted. If these vessels conveyed symbolic messages between social groups, they were understood by several regional communities.

The cemetery's geometric layout suggests that burial rituals were strictly formalised, particularly during CP3 when potting activities appear to have conferred wealth and status on some, implying social rank. Social groups may have been separated, or at least clearly defined, by their familial or clan affinities and/or socio-economic roles. Potters were buried with accoutrements denoting their socio-economic roles. The burial jars carry symbolic insignia, perhaps signalling clan or familial relationships. Some infant burials suggest that status and/or wealth could be inherited. In CP3, social status may have been achieved through managerial entrepreneurship involving craft specialist potters and associates who together developed valuable exchange networks. Network access would be facilitated and enhanced through social relationships. In some instances these links could confer exclusive exchange rights. It is important to view the CP3 mortuary activities as part of a continuum. The disposition of graves, and their relative wealth, is held to reflect, at least in part, the community's social structure. Potters' and non-potters' graves are both represented in MP3b and MP4, but a MP5 infant apart, only potters occupy MP5 and MP6 when potting flourished, a measure of their importance. When viewed as a continuum, not in isolation, the MP3b-6 mortuary and ceramic evidence combined is compelling. This period probably represents no more than nine generations, and the location of ancestral graves would likely be remembered.

> "It is concluded that the occupants of the site were well aware where their predecessors were buried. Only very rarely indeed were earlier graves disturbed by any

> form of excavation, be it pits, postholes or further graves." (Higham and Bannanurag 1991:20-21)

The exclusion of non-potters in MP5, along with the estabishment of a potters tomb in MP6, is considered highly significant.

Tombs and funerary furniture have been related to kinship-based lineages (Yang Hsi-chang 1986:58) or clans (Chang 1986a:297). Ethnographic evidence confirms that pottery is sometimes employed in ritual activities which include the placement of pots owned by the deceased in the burial context (May and Tuckson 1982:136). Some vessels are reserved for mourning rites associated with burial ritual (Wheatley 1971:74, May and Tuckson 1982:104, Arnold 1985:162-3) and other forms of symbolic expression (Orton *et al.* 1993:227-8). Potters in the Kwanga district of the Maprik Area in Papua New Guinea, for example, use leaf-like or animal motifs just under the rim of vessels, or a group of parallel lines or bands of parallel semi-circular lines, to denote clan affiliations (May and Tuckson 1982:292, 322).

Inscribed bronze vessels from *c.* eighteenth to eleventh century BC Shang burials carry clan-sign inscriptions (Barnard 1986:141-206). Some may indicate inter-clan associations, possibly including marriage alliances. Some signs may denote a revered ancestral figure. Paired associations of some clan-signs "seem evident" in cemetery arrangements and this suggests that some Shang burials could be interrelated (Barnard 1986:151). Further, and this has important implications for the CP3 cemetery, some variations in burial arrangements suggest that "certain burial areas tended to be used mainly by interrelated clans while other areas were less restricted." Repetition of clan-signs from one tomb to another seems to indicate close affinities between some tombs. In one tomb seven basic clan-sign combinations were recognised. Barnard grouped the sample partly by vessel types and partly by inscriptions (which he considered a "minimum standard" of data presentation), but without analyses of bronze. Fortunately, in this study, the composition of Khok Phanom Di burial jar fabrics is known.

In Shang society, differences "in wealth and nobility existed between family branches within the same lineage" (Yang Hsi-chang 1986:59). We have noted that CP3 graves were aligned with reference to what is considered to be a tomb structure (Chapter XI). Some graves are wealthier than others and some suggest wealth may have been inherited (see B14, 15 and 16 MP5). All appear to have been inter-connected by clan-signs. It seems reasonable to speculate that some individuals were connected through marriage alliances and possibly economic allegiances. Inferred clan-signs on CP2/3 burial jars suggest that such social groups were present in CP2, but no clear associations between graves or burial clusters are obvious (only clusters C and G, B76 and 90, share M4) (Table 197). But in CP3 (MP4), motif 5, introduced with B57, provides links between clusters A and F. Potters and turtle males share this motif which continued into MP6. The only other inter-cluster link is in MP4 where B36 (cluster C), and B44 (cluster D) have M4 burial jars. Motif four links female potter and male turtle burials (36 and 44 respectively) in MP4, female potter B15 with infant B16 in MP5, and child B11 with female B19 in MP6. All belong to the potters/turtle group. Thus potters' and turtle burials are linked through motifs four and five. Increased CP3 pottery output was correlated with exotic burial jars and potters' tools. The latter suggest immigrant female potters. Their male associates include the first with a turtle carapace plaque. His unique dentition, with a distinctive tooth ablation pattern, subsequently became common in CP3. CP3 jars differ in shape and motifs, M4 aside, to CP2 jars.

Inland connections expanded in CP3 as a new vibrant socio-economic structure developed, perhaps principally based on pottery containers suited to exchange local resource(s), under a combined potters/turtle group management. This group may have eventually achieved high socio-economic status. It is proposed that the changes involved a process of assimilation, followed by a period of transition and finally transformation into a ranked society, perhaps involving an incipient élite composed of craft specialists and their associates. I am unaware of any comparable site. Of course in terms of the site's size, the 1985 excavation is tiny. It thus reveals a commensurate amount of socio-economic evidence. But we wish to explain the phenomena.

Affinity between the CP2/3 communities is suggested by both CP2 and CP3 jar types within MP3b, held to represent the first stage in the assimilation of immigrant groups. Mortuary practices changed as burials tended to be aligned along a NE/SW axis and cut into a new area (Chapter XI). Potters' burials included potting tools and materials. Of these only females contained anvils, but some turtle group males included burnishing stones. The exotic B57 jar suggested source, 45km away on the south coast, follows a link developed in CP2. B57 lay alongside graves containing jars made in the CP2 tradition. The turtle plaque differs from later examples (Pilditch 1993:162), which, given its association with an exotic vessel, could suggest that it was exotic and that the later plaques were local copies, as one piece of excavated carapace "could be an offcut from a body plaque" (Pilditch *op. cit.*).

Motif five (M5, 5a and 5b), is common to nine burials including four potters, two in MP6. In B57, an exotic jar follows the CP2 style and a local example the new CP3 style, the only such coincidence. One of the largest MP3 graves, B57 links the two populations in motifs, tooth ablation, turtle ornaments and probably coastal exchange networks. The newcomers appear to have introduced a new potting tradition and facilitated access to an expanded range of regional groups, including rice producers. Domesticated rice remains were found in two MP3b individuals, B67 and B56 (Thompson 1996:162, 170). CP2 burial jar motifs lapsed after MP3b and CP3 jars are dominated by potters' and turtle group motifs, suggesting a changed social organisation. The burial jar/male turtle ornament tradition, established with B57 in MP3b, continued through MP4 into MP5 and MP6.

Graves in MP4 were aligned along a NE/SW axis and arranged more like rows than the MP1-3 clusters. This transition saw potters' and turtle group burials dominate the cemetery with some arrangements suggesting alliances between the two groups. Two 21-year-old female potters, B35 and 36, were the only graves laid in line. B35 contained an exotic cord-marked burial jar (marks associated with the turtle group) from a suggested inland source; B36 a local M4 jar and potting clay. Both signal membership of the local potters' group. The only grave with a turtle ornament and broken potters' group burial jars was B44. Correlations between potters and the double line motif are otherwise perfect. One potters' group member, B23, was interred with a large turtle carapace plaque. Links are also marked in B9 and B29, males aged 30 and 27 respectively, by the association of turtle carapace ornaments, burnishing stones and burial jars lacking the double line motif. This suggests that males helped with burnishing pottery and with exchange expeditions. Burials 23 and 43 also contained goods and motifs symbolising affinities with both groups. Thus B23, a robust physically active male, included a M4 potters' jar, a burnishing stone and a turtle ornament. In MP4, only B43, the wealthiest male, and B24 contained turtle ornaments and jars with cord-marked carinations. Both were very active physically. Next to B24 lay B20 with an

anvil, a burnishing stone, one M4 potters' and one M5 turtle group jar, both local. Burials 20, 24, 27, 39 and 41 were grouped together. All had M5 jars.

Given that burial jar motifs represent social groups, cord-marked jars accompanied B20, 27, 33 and 35, all MP4 potters' group members, while non-potters B24 and 43 included turtle ornaments. A female (B31), with a M5 jar was interred with a turtle ornament male (B32). Another female with a M5 jar (B39), lay alongside B38, a male. Burial 33, a MP4 infant, included two local jars whose motif (M9), combines the potters' and turtle group motifs. Clearly there are close links between potters and the turtle group. Determining whether these individuals are genetically related may require a technique such as mitochondrial DNA analysis of skeletal remains. But other relationships could also be involved. For example, the burial jar markings could be unrelated to social groups and merely represent artistic expression, however this seems unlikely.

Three graves occupied MP5. The largest and richest in the cemetery contained B15, a female potter. Alongside lay B16, an infant, in a complete but smaller copy. Burial 14 (another 15 month infant), was interred in the only circular grave uncovered. The corpse and two burial jars were placed within two larger outstanding vessels. One jar had a cord-marked carination, the other matched the B43 jar motif (M6). Outstandingly rich, B15 has 15 and nearly 70 times the average potter's and non-potter's wealth respectively. Second richest is B43 with 43% the wealth of B15. Identical jar motifs to those on B14 suggests that B43 belongs in MP5. These are the only two of 50 burial jars in 27 CP3 burials to carry such motifs. It would be drawing a very long bow indeed to suggest that these two pairs of adult and infant burials were not in some way connected, both with each other and each with the other pair. Further, they link with B57, the first to include a burial jar with cord marks. Only potters' and turtle-related burials occupied MP5. Its graves follow the MP4 NE/SW alignment, again cutting into an area avoided throughout CP2.

If cemetery layouts reflect social organisation, the central places allocated to MP6 burials represent a transformation. Potters and their associates were accorded exclusive burial rights, a practice which probably began in MP5. A jar with B2 carried the potters' motif and neonates B5a and B5b lacked grave goods, but all other MP6 graves revealed potting items. Burials 4, 6, 7, 8, 9, 11 and 19 contained potting clay (see Chapter IX for details); B4, 18 and 19 each included an anvil and B4, 6, 9, 13, 18 and 19 contained burnishing stones. Broken exotic and local potters' motif burial jars and about 1 kg of prepared potting clay were found with B4. Burial 6 included portions of local potters' motif jars. A row of SE/NW aligned graves lay parallel to a rectangular clay-floored tomb erected over B19, a female potter. The tomb floor, relaid at least once following the interment of B19, comprised almost 30 layers of smoothed clay. Burials 6 and 18, both seriously disturbed, postdate B19. Burials 8 and 9 included turtle ornaments and jars with cord marks, a motif also associated with B13. Given the increasing potters/turtle group prominence it seems reasonable to portray the tomb as playing a central role in MP6 funerary activities. As with previous MPs the remains of localised fires and food remains were scattered about the cemetery, suggesting mortuary feastings. In MP7, B1 contained two anvils and a burnishing stone but no burial jars. Burials 3 and 12 were disturbed in prehistory.

A social hierarchy is suggested by the mortuary evidence. The relationship between B14 and 15 is compelling. It suggests that wealth and status could be inherited by members of the

potters' group, perhaps invoking aspects of familial or clan lineages. It is obvious that MP6 burials were aligned with reference to the tomb, an orientation which emerged following the arrival of the turtle group. There is clear evidence of a close association between female potters and turtle group males. This, it is proposed, led to the rise of the potters/turtle group. Tomb burial obviously points to preferential treatment for some individuals, but in contrast with temporal élites, status may have been attained through craft and exchange skills combined with an ability to manipulate profits. Large-scale pottery production and distribution is complex, requiring careful organization. Ready access to raw resources and consumers would therefore confer advantages. Increased social complexity may have resulted from growing economic activity under the guidance of what Brumfiel and Earle (1987) describe as "managerial élite" interaction. This interaction probably involved craft specialization coupled with a more efficient production and resource distribution through expanded exchange links. Scale is important in societal process reconstruction. For example, in considering the development of early Chinese metallurgy, large scale activities are equated with production indicating "social stratification, professional specialization and permanent production centers" (Franklin 1983:286).

Local production and exotic wares, particularly from inland sources, increased markedly in CP3. It is proposed that exchange of local resources, and perhaps the redistribution of exotic items, such as marine shell, saw the emergence of a managerial group. The mortuary evidence suggests that prestige goods were restricted to this group. Exquisite pottery, symbolic burial jars and jewellery are prominent in female graves. Elaborate turtle ornaments, burial jars and jewellery feature in male graves. Exchange transactions probably involved large numbers of pottery containers, produced by independent specialists and transported by their associates along coastal and inland waterways. Khok Phanom Di appears to have occupied a nodal location with excellent access to exchange routes.

Social organisation probably changed significantly in CP4 following re-settlement by a new community. New potting techniques (including clay preparation and decoration), such as paddle impressing, suggest major cultural change, but a lack of mortuary evidence limits interpretation. CP4 witnessed concentrated group potting, probably organised co-operatively, in a dedicated workshop. Burial jar rims from just three exotic sources imply that external relationships had declined compared to CP3. Marked ceramic anvils suggest that individual potters felt the need to identify personal tools, perhaps to avoid loss or breakage by others through mis-use, or simply because they made tools suited to their preferred potting methods. Early pottery marks are considered by some as precursors to written language (Cheung 1983:323-91).

KHOK PHANOM DI IN SOUTHEAST ASIA

Khok Phanom Di was a major 2nd millennium BC pottery production centre, possibly the largest yet identified, with mid to late 3rd millennium BC, or earlier, antecedents. Its role in regional socio-economic developments has been alluded to above and in Chapters IX and XI, but its importance in wider Southeast Asian prehistory is best examined in terms of the further Asian region. First, because much recent archaeological research has given primacy to major issues such as rice domestication, metallurgy, the development of stratified societies and their apparent spread

across much of Asia. Second, because some current ideas, involving pottery, stretch hypotheses concerning these issues across the entire region and some even further. Although our present focus concentrates on nearer regions, any attempt to include previous research immediately widens the discussion because materials from other sites have been applied to much broader issues. Thus while the present aim is to interpret the Khok Phanom Di data in its nearer regional context, broader issues become unavoidable.

The Khok Phanom Di ceramic spectrum characterises periods of growth, some rapid, interspersed by a falling away of activity and punctuated by cultural changes. The sequence was probably interrupted by periods of abandonment, between CP1/2 and CP3/4, and possibly very briefly between CP2/3. These four cycles of activity have local and regional cultural geneses, both probably influenced by environmental changes. In part, the cultural changes are thought to represent the movements of groups who occupied a previously abandoned site or re-occupied it after a brief hiatus. Such population movement is the focus of much recent discussion.

Environmental conditions influenced coastal zones in many parts of Asia. In the Shanghai area of China, for example, isostatic and eustatic influences are evident in Neolithic settlement patterns (Pearson 1983:133). The Bang Pakong Valley rests in a tectonically active zone also subject to such forces (Chapter IV). When broader scale sea level changes are superimposed onto such local conditions, dramatic environmental adjustments can result. Groups forced by rising post Pleistocene sea levels to abandon favoured coastal locations would move to suitable alternative sites. Shifting water courses, and other marked environmental changes, probably resulted in relatively rapid site abandonments. Climatic induced changes may have been more gradual, requiring less drastic adjustments. A mosaic of variable regional conditions and differing responses probably resulted in a variety of intra and inter-regional cultural contacts.

Pottery is often useful in tracing the movement of people and ideas between regions but, the copying of styles apart, regional variations mean that some aspects are comparable and others not. Evidence from coastal south China, for example, suggests that by 4000 BC marine transgression had inundated many sites, a disruption which preceded the emergence of several distinctive neolithic coastal cultures extending from south China to Vietnam. This development is clearly in conflict with any diffusionist "nuclear area hypothesis" for Chinese prehistory (Meacham 1983:147-75, 1984-5b). On a larger scale, homogeneous cultural development is not evident in the period before Khok Phanom Di was first settled. Artefact similarities, principally pottery, encouraged the excavators of Ban Kao, which was almost contemporary with Khok Phanom Di, to link neolithic deposits with "Lungshan" and suggest a direct overland migration from China (Sørensen 1972:494-6). Vessel forming and finishing methods at Khok Phanom Di and Ban Kao are similar but fabric treatments are not. Therefore close relationships are unlikely. Similarly, so-called "dentate-stamped" (shell-impressed?) pottery has been connected with Khok Phanom Di, Non Pa Wai, Ban Kao and Khok Charoen, and are held to have "widespread parallels" (Higham 1996b:292). But can such links be substantiated using ceramic evidence?

Setting stylistic parameters aside for the moment, from a ceramic perspective, potters seem most likely to retain their technical skills when migrating to new regions, particularly when their clay preparation methods were not constrained by variable conditions, such as a local paucity of suitable additives. If they were accustomed to manufacturing grog temper they would be free to continue potting independent of resources other than suitable clay (Chapter V). Or,

if they had developed advanced forming methods, for example turning on a fast wheel, such techniques are likely to be maintained, but reversion to hand-formed vessels could occur in some instances (Magrill and Middleton 2001:137-44). Huber (1983:199,202), reports use of a fast wheel in 4th millennium BC Lungshan contexts at Tung-hai-yu and related sites. This is important, but the uneven distribution of Lungshan ware "types" renders direct comparisons hazardous. Black pottery, for example, is rare within the Lungshan tradition and primarily late, although its customary designation is the "black pottery culture" (Huber 1983:186). A better definition of Lungshan is of unpainted vessels mainly "elevated from the ground either by a circular foot or by tripod legs. Understood in this manner, Lungshan remains entirely distinct from Yangshao and will be seen to encompass all the Neolithic pottery traditions of southern and southeastern China, within which local cultures and chronologically successive sub-cultures can be distinguished" (Huber 1983:187).

Given that some Lungshan similarities, particularly tripod-legged vessels, are evident in pottery from Vietnam to Central Thailand to Malaysia, the question must be to what particular aspect of this tradition do they relate? Malaysian examples "are quite different from the Lungshanoid and Lungshan tripods of China" (Leong 1990:65). The Ban Kao and Malaysian tripod legs are hollow with holes, an aspect of Lungshan forms. But, as Leong (1990:73) points out, this form acts to prevent explosions during firing. Without technological evidence, such as forming and clay preparation methods, direct comparisons are weakened by that omission. Because no complete assemblage exists, even in China where aspects of this tradition are unevenly spread geographically and chronologically, we are faced with the strong possibility that, rather than through direct migration, some Lungshan pottery was exchanged along coastal routes where contact with these novel forms inspired local potters to copy them. Sørensen and Hatting (1967:110-11), give a 1770 $\pm$140 BC radiocarbon date for tripods at Ban Kao, and Malaysian sites place tripod wares in the mid-second millennium BC (Bronson and White 1992, Leong 1990:72). Ten Southern Thai sites with tripods have also been reported (Srisuchat 1988).

Similar pottery forms could be parallel developments determined by functional or technical factors. Wrapping potting paddles with cord could in some instances be designed to improve friction when shaping plastic clay. This is a technical adjustment. Such devices, not applied or intended for decoration, may give the illusion of style homogeneity. Major changes result when a potting industry is replaced by another, such as that recorded at Ban Na Di following the proposed movement of southern groups into the Sakon Nakhon Basin (Vincent 1988). Both forms and fabrics changed. But copying exotic forms or decorative treatments usually only involves some typological qualities. For example, an exotic vessel copied with great care by low-skilled potters at Ban Na Di, presumably because it was considered desirable, is virtually impossible to detect without petrographic evidence. Experimentation with novel exotic surface treatments, such as impressing with a shell edge (sometimes termed "dentate stamping"), may be temporary or result in permanent change. Such variations lack diagnostic validity without complete typological data. Deviations from traditional styles may be inspired by exotic artefacts or foreigners who introduce new ideas. Highly distinctive artefacts, such as the double-headed ear ornaments from Phu Hoa, Hang Gon and Sa Huynh in Vietnam, Duyong Cave in the Philippines (Higham 1996b:288) and Ban Don Ta Phet in Central Thailand (Glover 1990:166), leave little doubt that 1st millennium BC coastal contacts occurred.

Technical aspects of potting allow a rigorous comparison of different traditions. For example, rice temper is evident in Ma-chia-pang phase pottery in South China *c.* 5000 BC (Chang 1986a:192-208) and probably earlier in the middle Yangtze (Crawford and Shen 1998:858-66), but does not occur until mid-second millennium BC in Thailand (Vincent 2002). Wheel-made pottery is known from 3rd millennium BC Central Indian sites (Shinde 2000:128), but is unknown in prehistoric Thailand. According to Simpson (1994:674), cultivated rice was identified "at the 5th-7th millennium site of Mahagara (near Allahabad in India) (pp. 40, 150) which rather affects the 'sloping chronology' of rice appearing first in China before spreading to India via Southeast Asia (Potts 1991)", but claims as early as the seventh millennium b.c. (uncalibrated), are considered problematic by specialists (Harris 1996:564). At Khok Phanom Di, distinctive exotic pottery includes tripod pot legs, a unique pot stand, rare painted sherds, very rare slipped rim sherds, and sherds tempered with shell. In contrast, pottery tempered with rice is present throughout the sequence, albeit in small amounts.

Although the small scale of Southeast Asian archaeological research needs to be kept in perspective, especially compared to China where large numbers of sites have been excavated and analysed (Wheatley 1971, Huber 1983, Chang 1986a and 1986b, Barnes 1993), the region is characterised by a marked heterogeneity in distinctive pottery type distributions and regional styles (Bayard 1976, 1977, 1977a, 1980, 1984, Buchan 1973, Bronson 1976, Calder 1972, Chantaratiyakarn 1984, Ciarla 1992, Debreceny 1994, 1995, Glanzman and Fleming 1985, Glover 1990, Glover *et al.* 1996, Hall 1989, 1993, Higham 1977, Higham and Thosarat 1997, Ho 1984, Johnson 1989, 1992, Kijngam *et al.* 1980, Leong Sau Heng 1990, 1991, McGovern *et al.* 1985, McNeill and Welch 1991, Mudar 1993, 1995, O'Reilly 1998a, 1998c, Peacock 1959, Pukajorn 1984, Preecha and Pukajorn 1976, Rispoli 1990, 1992, Rutnin 1979, Solheim 1964, 1967, Solheim and Ayres 1979, Sørensen 1972, Sørensen and Hatting 1967, Vincent 1980, 1984, 1985, 1987, 1988, 1991, 1998b, 2002, Watson *et al.* 1986, Welch 1985, White 1986, White *et al.* 1991, Wichakana 1984a, 1984b, Wilen 1989). Thus we are faced with the strong possibility that pottery was transmitted along coastal and inland exchange routes inspiring local potters to copy fashionable styles. Late first millennium BC Han sea routes extended "towards the South Seas and the Indian Ocean" (Gernet 1982:127). Evidence for a well established "Maritime Silk Route" from at least the early Western Han period (206 BC - AD 8), (Zhang Jiaji 1996:12) and for voyages to Taiwan, Japan in the Spring and Autumn Period (770 - 475 BC), underlines extensive early sea travel. Coastal routes no doubt extended contacts even further, perhaps with much involving "Down-the-line" or "Boundary reciprocal" modes of exchange (Polanyi 1959, Renfrew 1975).

Exotic wares suggest that Khok Phanom Di featured as little more than a "Central-place redistribution" centre (Renfrew 1975), perhaps with local pottery and resources being exchanged for exotic materials such as stone and shell. Most exotic vessels appear to be tributes to deceased individuals, probably related by socio-economic ties. Rice was probably imported through Bang Pakong Valley exchange networks. But rare exotic tripod feet and other pottery also suggest indirect contacts beyond this near region. The feet were copied by local potters, clearly marking their value as rarities. Pot stands are known from Island Southeast Asia and China (Chau Hing-wah 1993:183). Painted sherds are uncommon in Thailand prior to the late first millennium BC, but a feature of some Lungshan phases (Huber 1983). Each example strongly suggests

relative isolation from other mainland Asian regions at a time when some researchers envisage "colonization by growing populations expanding outwards from homeland regions" (Bellwood 1996:467).

Notwithstanding Bellwood's (1996 *op. cit.*) proposal for the colonization of Southeast Asia by rice agriculturalists, even if this is correct, it does not necessarily mean that waves of immigrants swept into Thailand from China. The key issue is that there is no evidence to suggest mass population movements into mainland Southeast Asia, although they have been connected to the spread of rice cultivation (Bellwood 1996:482, Glover and Higham 1996:423). Khok Phanom Di was a major site occupying a nodal location most unlikely to have been overlooked by colonists. Yet ceramic evidence presented here lacks support for any major changes suggestive of the intrusion of populations from further afield than the immediate region (Chapter XI). By the mid third millennium BC "long distance voyaging in double - or single - hulled outrigger canoes and plank built boats was taking place" in Southeast Asia (Glover 1996:63). A large river mouth site such as Khok Phanom Di would have been difficult to miss by those seeking new territories.

Some archaeologists opt for the diffusion of cultural groups and/or ideas across Asia. By *c.* 1500 BC rice and metallurgy became relatively common in Northeast Thailand, the latter probably associated with itinerant craft specialists (Vincent 1988, 2002). The first clear evidence for the movement of people into the Sakon Nakhon from the Khorat Basin occurred *c.* 400-100 BC (Higham 1996b:204), reflected first in increasing inflows of pottery from the south and culminating with local production of new pottery types (Vincent 1984, 1988). Hard evidence of this kind is difficult to find in Southeast Asia, but changes in potting technology, especially when associated with new types, could provide essential broadscale patterning. Patterns of technological sharing are becoming evident when the scale of potting technology distributions is increased. Pottery technology changes at Khok Phanom Di, for example, were a microcosm of second to first millennium BC changes identified across much of Northeast Thailand.

Shifts in pottery technology on a macro scale are gradually being revealed as the results of more detailed research accumulates. A sequential change to bleb temper is also evident moving northwards over time from the Central Plain region into the Khorat Plateau (Vincent 1991). These patterns can be extended to South China where sand temper characterizes pottery from Yung Long, Hong Kong (Vincent 1997:153-6). The excavators consider that the site dates to the Late Neolithic *c.* 2600 - 2400 BC (Rogers and Van Den Bergh 1997:14, following Meacham 1995). A pattern of Neolithic pottery tempered with sand is evident over much of Asia. Without attempting to detail the voluminous data to illustrate this point, it is proposed here that Neolithic pottery is invariably tempered with sand or other natural substances. Conversely, at the other end of the scale, bleb grog and/or rice temper, Khok Phanom Di and Khok Charoen aside, is invariably associated with metallurgy in Thailand (Vincent 2002).

Sedentism correlates with crop cultivation. The adoption of agriculture could account for the invention of new clay preparation methods in response to unfavourable potting conditions. Land suited to rice agriculture would not always favour potting, particularly if suitable tempering materials were unavailable. Rice was probably first cultivated in wet lowlands (Bellwood 1996:479), sedimentary zones where deposits of sand are not always readily available (Tucker 1981:21-37). The invention or adoption of grog temper meant that natural tempers were superceded and potting could be carried out anywhere suitable clay, fuel and water were available.

As agriculture selects for sedimentary strata where suitable clay often abounds, pottery with grog or rice temper is likely to be associated with agriculture in some manner. Exotic wares tempered with rice were present throughout the Khok Phanom Di sequence. Saline soils may have prevented permanent local rice cultivation, but supplies were obtained during CP2/3 when local pottery was tempered with orthodox grog. This suggests access to rice growing areas, perhaps through exchange networks. Coastal sites acquiring rice through exchange would probably lack its by-products, therefore its adoption for temper would be more likely in areas where it was harvested. This could explain why sites such as Nong Nor Ph.1 reveal incidental rice in pottery tempered with sand.

In Thailand, sand temper usually precedes orthodox and then bleb grog and finally rice. Early Neolithic pottery from Pengtoushan in the Central Yangtze Valley contains rice inclusions (Glover and Higham 1996: Fig. 23.22), and rice remains from

> "many sites on the swampy plains of the central and lower Yangzi and adjacent rivers is so widespread and abundant that we can be reasonably confident that rice agriculture became well established in this region between the late sixth and the third millennium bc..." (Glover and Higham 1996:430).

A sedentary lifestyle and abundant crop by-products would encourage potters to use rice temper. Manufactured tempers are also likely to be associated with sedentism, an impression based on analysis of pottery from about 100 Southeast Asian sites and the perusal of numerous site reports. If the hypothesis that *increased clay preparation complexity signals a shift to permanent sedentism* is correct, artificial additives (purposively made grog tempers) are correlated with permanent settlements, and natural additives, such as sand, are more likely, but not necessarily, correlated with mobile groups. Sedentary potters are known to exploit both natural and artificial tempers, but mobile groups, under this proposal, only natural tempers. Of course cultivated crop by-products, such as rice husk, are also most likely to be associated with sedentary communities. If rice temper and complex potting technologies are always linked to sedentism and the spread of permanent agriculture, this relationship will be revealed through analysis of pottery fabrics. Further testing of these proposals is needed, but the evidence to date is compelling.

Khok Phanom Di pottery has provided opportunities to examine connections between potting technology and subsistence. Rice was part of the CP2/3 inhabitants' diet, but potting techniques did not change. This suggests that reliable access to abundant rice by-products is necessary for its everyday use in pottery. Permanent sedentism is correlated with the use of grog temper throughout CP2/3, and rice in CP4. Significantly, during CP1 pebbles imported for sand temper suggest a different, probably seasonal, mode of occupation, as proposed for Nong Nor Ph.1 (O'Reilly 1995, Higham and Thosarat 1998b:43). Given that this correlation holds for early ceramic cultures elsewhere, scale is essential in detecting widespread potting technology distributions and assessing the implications of their changing chronological patterns.

Exotic wares for which sources can be suggested all lie east of the Bang Pakong River. This apparent anomaly suggests either that no sites were present in the sedimentary Central Plain, which extends about 150 km west and 125 km north, or that this region contained mineralogically indistinct clay deposits, a characteristic of large alluvial and colluvial river plains. Where such

plains lie close to rock outcrops, distinctive minerals, including those reworked from sedimentary formations, can usually be identified (Vincent 1988). This greatly assists in suggesting possible sources. The geologically non-specific fabrics, for which sources could not be suggested, could have derived from Central Plain sites. But their rarity suggests that, if they did exist, only a few such sites were involved. Perhaps desirable raw resources, such as stone, and suitable environmental conditions were lacking, hence a preference for locales along and east of the Ban Pakong River.

CONCLUSIONS AND FINAL COMMENTS

> "Pottery tends to arouse strong emotions in archaeologists: they either love it or hate it. For some it has an indefinable fascination, and is potentially full of information, which has to be teased out of it by careful and painstaking study. At the other end of the scale, it is seen as the most common of archaeological materials, whose main functions are to slow down the real business of digging, fill up stores, and behave as an archaeological 'black hole' for post-excavation resources." (Orton *et al.* 1993:3).

Studies of pottery production centres are uncommon and complex. They tend to be excessively detailed and lengthy, involving of necessity intensive analysis of many aspects of potting, a complex craft. In this volume we have examined the local geology and clay mineralogy, local and exotic potting technologies and styles, special wares in mortuary rituals and the role of potters and their associates in socio-economic developments. Changes in potting technologies and styles allowed four CPs to be defined. Within CP2/3, different cultural behaviours are evident in mortuary ritual, the disposal of burial vessels and the treatment of potters as high status craft specialists. Mortuary wealth and ritual suggests that in CP3, potters and their associates stimulated exchange networks to advantage and eventually emerged as an important social group. Changes in the local geophysical environment are considered to have disrupted occupation of the site at three or four points in the sequence, the last forcing its abandonment.

The present research has taken well over a decade to complete, far too long to satisfy the aims of many archaeological projects. Pottery is inherently complex and much is to be learned from it, but its full potential requires a comprehensive analysis of all its interrelated components including an assessment of their cultural implications. Local and regional evidence needs to be compared and contrasted. This study involved local and much wider issues. It has considered cultural, geographic and chronological themes, often calling upon comparative ethnographic evidence. But much broader questions are accessible. A synthesis of worldwide pottery technologies, for example, carries potential for determining the presence of permanent settlements. Another question concerns the relationship between craft specialists and social stratification. Aspects of cultural change and regional cohesiveness involving the movement of potters and pottery have been examined. They reveal potting variously concerned over time with cultural subsystems such as exchange relationships, subsistence, symbolic expression, and social organization. Special ornamental vessels were produced for dedication in mortuary rituals. Coarse ware containers,

a technical innovation, were probably introduced to efficiently carry items along riverine and coastal exchange routes.

Socio-economic relationships involving the movement of potters and pottery, some invoking changed social settings, are of particular interest. Modes of production, including standardization and mass production of coarse wares, technical change and style innovation help us understand prehistoric cultural processes. Community potting workshops, to date unknown in Southeast Asian prehistory, give us a unique glimpse of everyday life in a large pottery production centre. In essence they hint not only at a potter's workday role in village life, but also the community's social structure. The workshop evidence suggested group co-operation but individual potters' marks on tools allude to a social structure where individuals were free to achieve social status through lifetime accomplishments. This did not seem to pertain during the period when potters occupied centre stage in mortuary activities, for there is a suggestion of inherited status amongst the potters' group. But the evidence gives us little more than small glimpses of these roles. It leaves open many more questions than it answers, with further progress awaiting data from related sites, both local and regional.

Until further Ban Pakong Valley sites are excavated, many pressing questions remain unanswered. The influence of Khok Phanom Di can only be gauged with clarity when regional distributions of its pottery are known. Understanding its influence as a nodal exchange centre also hinges on the acquisition of regional data. The chronology of rice agriculture in the region will only be determined if the unequivocal presence of domesticated rice can be established at other sites. As rice remains were found in pottery throughout the sequence, even in basal contexts, it seems likely that it pre-dates the initial settlement of Khok Phanom Di. Further analysis of Nong Nor Ph 1 pottery would clarify whether incidental rice inclusions are present in local and/or exotic wares. Additional radiocarbon determinations will help in assessing regional developments. The harmonizing of absolute and relative chronologies is particularly important if progress on outstanding issues such as the origins of rice agriculture and metallurgy are to be brought into concordance. A secure chronological framework is essential if consensus is to be reached over these questions.

Clay preparation methods varied between each potting tradition. The full range of methods previously identified at sites located across Southeast Asia was represented. These methods span the earliest and most recent techniques for coping with regional variation in clay qualities. We have noted that natural substances are thought to be correlated with mobile groups (notably no postholes were found in CP1 contexts (Higham and Bannanurag 1991:31), to suggest permanent settlement), but manufactured or agricultural by-products added to potting clay indicate sedentism. This proposal could have worldwide implications. For example, similar treatments are associated with the Early Bronze Age Beaker Wares cultures of Europe (Varndell and Freestone 1997:34), and agricultural groups who settled loess lands (Hodges 1965:121).

Standard petrographic analysis has provided essential technological information, without which much of the data would remain obscure, if not inaccessible. Pottery has long been a cornerstone of archaeology due in part to its inherent plasticity, which often results in distinctive characteristics, and to its durability, which explains its abundance. Large pottery assemblages require efficient sorting procedures. Selecting characteristic features is considered appropriate for capturing key information while simultaneously reducing the size of large samples. Judgmen-

tal sampling in this study enabled representative items from each sorted group to be identified relatively quickly. In spite of determined efforts to streamline type identification procedures, no simple fast method of analysing pottery is known which will preserve crucial evidence. Pottery data remains somewhat intractable. Quick solutions are unlikely to provide accurate or complete information. Sorting pottery into groups suited to future analysis by specialists is recommended.

Relationships between craft specialization and social organization are potentially accessible through ceramic analysis. Local and regional modes of production help in assessing regional cohesiveness. Regional traditions, where like types dominate areal distributions, allude to cultural similarities. Many Khok Phanom Di types have regional counterparts (Chapter XI). Forming, finishing and firing details are valuable, but fabric characterization is also needed when comparing potting traditions. Temporal changes in sherd quantities and fine versus coarse wares proportions are useful in assessing modes of production. Changed local types, modes of production and related mortuary evidence provided insight into CP3 socio-economic developments (Chapter XI).

Ceramic and related non-ceramic evidence has illuminated local and broader underlying issues. Integration of potting with subsistence strategies and the role of craft specialization in the development of social stratification have been examined. Mortuary rituals in CP3 centred on rich potters and their socio-economic associates. Highly accomplished potters and their associates probably orchestrated an industry and exchange networks whose success led to an increasingly hierarchical society. Dedicated mortuary vessels bear motifs thought to symbolize familial or similar social groups and hint at regional tribal affiliations. Exotic pottery suggests broadscale coastal and inland exchange networks. This intensive interaction marks the site as occupying a nodal location, a key factor in its rise as a major centre. Interruptions in the ceramic sequence are thought to reflect fluctuating sea levels, coastal progradation and changing riverine conditions, at times forcing site abandonment. Water transportation would be critical for a major potting centre reliant on large material and product flows. The site was finally abandoned (probably following a shift in the river's course), when large volumes of pottery were still being produced. Subsistence aside, pottery production and disposal were probably the most important aspects of prehistoric life at Khok Phanom Di, and they continued to hold centre stage until the last.

XIII APPENDIX ONE

PETROGRAPHIC ANALYSES for all of the excavated wares are detailed in this appendix. Some sherds were not assigned to specific fabric groups because, following comparison with thin-sectioned samples, hand specimen examination was deemed sufficient. General descriptions of these sherds are discussed in the relevant chapters. They cover tempers (such as sand, orthodox and bleb grog or rice), fabric density and in some cases assessments of firing characteristics. Minerals and tempers have been identified in thin section under a petrographic microscope, or in hand specimen where appropriate. Grain sizes follow the Udden-Wentworth grain-size scale chart (Udden 1898; Wentworth 1919). Roundness-Shape categories of roundness follow Pettijohn *et al.* (1973).

It should be noted that some clays "as received" from quarries often contain a mixture of minerals. This may be dependent on the composition of the source structure and the location of the clay deposits with respect to these structures. Clays typically contain quartz and may contain other minerals such as feldspar, iron oxide, mica and calcite. Some sedimentary deposits include siliceous plant or animal remains, such as diatoms, phytoliths and sponge spicules. Weathering of highly varied outcrops within a region are likely to contain a mixture of minerals dependent on their locations with respect to the outcrops. Re-worked sedimentary structures often include diagnostic minerals, such as autochthonous cherts or quartz grains with overgrowths. Mixing of clays due to weathering, transportation and deposition is common. Clay deposits close to primary outcrops are thus likely to be less varied than those at or near the boundary between different facies, or those some distance removed from their source, depending on the composition of the source outcrops. Clays can also be modified and altered by diagenesis following deposition (Tucker 1981:87-95).

Petrographic descriptions of samples from local clay deposits and selected prepared clay from cultural contexts are provided below. Comparison with pottery fabrics shows that a variety of clays were exploited at the site over time, different clays being variously selected for utilitarian or fine wares and/or different tempers applied as required either for technical or, perhaps in some instances, symbolic purposes. At least two different local clay deposits were exploited for utilitarian pottery during CP3/4. Coarse ware containers are composed of either a tempered relatively plastic and moderately micaceous local clay, or alternatively a very silty much shorter clay matching samples retrieved from a nearby modern fishpond. During CP3 many of the container fabrics composed of the fishpond clay are untempered, although some local coarse wares contain orthodox grog. All of the CP4 coarse ware fabrics examined are tempered with rice husk (FG4). In some instances (for example CP4 anvil fabrics), grog composed of fishpond clay has been used to temper more plastic local clay (see Chapter X). Other variations are also discussed in Chapters VII to X.

FABRIC DESCRIPTIONS

The modern clays have been assessed for their potting suitability (Chapter V), and their nonplastic proportions in thin section (TS) have been visually estimated after Pettijohn *et al.* (1973). Nonplastics form 40 per cent of each TS except *din dum* (30) and Pan Thong 3 and 5 (20 per cent each). Annotated photomicrographs of the pottery fabrics are set out below. None of the samples have subjected to point counting.

Modern clays

Quartz either dominates or is the main nonplastic inclusion in each of the following clays. Polycrystalline quartz is rare in Z2 and fishpond B1, a few more are evident in *din dum*, fishpond B5, B9 and Pan Thong (PT) 3 clays and several grains were noted in PT 5. Quartz ranges from very fine silt to medium or coarse sand size in local clays and to very coarse sand size in the PT clays. It ranges from angular to subrounded in all except Z2 and fishpond B9 which are angular to subangular and in *din niao* where they are very angular to angular. Most quartz is fresh with only Z2 and fishpond B5 being moderately weathered. Further petrographic characteristics follow:

Z2. A silty, slightly micaceous clay. Several tourmaline (schorl?), and a few potassium and plagioclase feldspar grains (some of both weathering to kaolinite), rare mozaic chert and muscovite all of up to coarse silt size are present. Sponge spicule fragments and iron oxide opaques of up to very coarse sand size were also noted.

Din niao. Fine to coarse silt in a slightly micaceous matrix characterises this clay. Weathered plagioclase feldspar (coarse sand size), epidote, and tourmaline (both medium silt size), mozaic chert of coarse silt size and fine sand-sized micritic calcite are all rare. Several sponge spicules are also present.

Din dum. A moderately dense silty clay. Medium silt-sized tourmaline and chert along with microcline and plagioclase feldspar of very fine sand size are present as are rare fragments of sponge spicules.

Fishpond B1. The ground mass is opaque and several euhedral coarse sand-sized crystals of gypsum? or replacement aphanitic anhydrite (Tucker 1981:163-6) are present. Some may be gypsum pseudomorphs comprised of micritic calcite or fine grained polyhalite. Medium silt-sized tourmaline, plagioclase feldspar, micritic mosaic chert and epidote are all rare and sponge spicules very rare. Several opaque up to fine sand size iron oxides were also noted.

Fishpond B5. A silty clay with weathered fine sand-sized micritic and mosaic chert and very fine sand-sized plagioclase feldspar. Micritic and platey lathes of calcite occur in amorphous very fine to medium sand-sized groups. The clay ground mass is opaque with rare up to fine sand size iron oxides and numerous gypsum crystals (measuring up to 1.5 mm long and 0.5 mm wide), and particles dispersed through the TS. Minor amounts of fine silt size epidote, very fine sand size tourmaline (schorl?) and muscovite? threads were noted. Several well-preserved sponge spicules and a round siltstone grain of coarse sand size were noted. The latter is composed of quartz in a groundmass of unidentified bioclasts (probably foraminifera and algae).

Fishpond B9. A silty clay dominated by mostly fresh quartz. Several silt-sized sericite threads, potassium feldspar weathering to kaolinite, tourmaline (schorl?) and epidote are present with rare composite calcite,

iron oxide "stains," and very rare mozaic chert grains. Numerous sponge spicule fragments were also noted.

Pan Thong 3. This dense brickworks clay contains silt and sand and a few opaque (iron oxide) inclusions. Some polycrystalline quartz has crenulated sutures and/or inclined extinction. Several sponge spicules were also observed.

Pan Thong 5. Polycrystalline quartz grains display crenulated sutures and sweeping and/or inclined extinction and one encloses an epidote crystal. Tourmaline (schorl?) from silt to medium sand size, very fine sand-sized plagioclase and potassium feldspar (the latter weathering to kaolinite), and rare silt-sized calcite crystals in voids are also present. A few opaque inclusions (iron oxides) of up to medium sand size were also noted.

Potting clays from cultural contexts

Apart from TS 429, each of the following clays and the grog component of TS 429 contain an estimated 40 per cent of nonplastics. Nonplastics comprise about 10 per cent of the TS 429 matrix.

TS 104, L2:2. A dense moderately micaceous clay containing mainly angular mono- and a few polycrystalline, fine silt to fine sand-sized quartz. Medium to coarse silt-sized plagioclase feldspar, tourmaline, sericite and rounded mozaic chert are also present. A few opaque iron oxides up to very coarse sand size were also noted. Several voids contain authigenic calcite. Sponge spicule fragments are very rare.

TS 425, L8:3. Micritic authigenic calcite has almost entirely replaced the clay matrix, but not orthodox grog inclusions of fired fishpond clay (see TS 104, 427). The grog is from medium sand to granule size.

TS 428 L8:2. As for TS 104 with iron oxides to granule size, orthodox grog(?) and extensive authigenic micritic calcite throughout. *TS 431 L9:1.* Fishpond clay as for TS 104 above.

TS 427 L10:2. A typical silty moderately micaceous fishpond clay. In addition to the minerals set out for TS 104 above, these clays sometimes also contain rare silt-sized epidote grains. The micas are probably best described as sericitic threads. Rice husk impressions are visible in TS and hand specimen.

TS 429 L10:2. A micaceous matrix with few nonplastics and a fired orthodox grog (see TS 425 above).

TS 430 L10:2. Another fishpond clay with abundant authigenic micritic calcite and one medium silt-sized microcline grain. Polycrystalline quartz of up to medium sand size is also present.

TS 432 L10:2. Another moderately micaceous fishpond clay with many flakes and strands of muscovite(?) often weathered to sericite. Coarse silt size microcline, subangular plagioclase and potassium feldspars (some completely weathered to kaolinite), were also observed.

Sand cache

A cache of small pebble-sized gravel recovered from basal contexts includes mainly mono- and polycrystalline (sometimes composite) quartz often with well-defined sutures. These subrounded to angular grains range from 10 to 13 mm in maximum diameter. Some grains have sutures with crenulated borders, suggesting that a stretched metamorphic classification would be appropriate (Folk 1980:69). Many grains display strongly undulose extinction, some with elongate lenticular-shaped crystal units. The exterior surfaces of some pebbles are smoothed, which suggests that they were collected from streams. Brown

limonite staining is present within minute surface fissures and interstices along some grain boundaries. A small pebble of ferruginous quartzose sandstone containing angular to subrounded fine silt to coarse sand-sized quartz (mainly mono- but with also some polycrystalline grains of similar composition to the quartz pebbles discussed above) is also present (Fig. 315). Authigenic calcite was noted adhering to pebble surfaces as microlitic crystals.

In hand specimen some grains of what may be quartzite cemented by calcite were noted. Professor D. J. Campbell (pers. comm.) considered that these pebbles probably derive from a high grade metamorphic or a granitic source (not directly from a granite but from a sediment which itself was derived from a granite). Open textured (probably secondary) limonite, such as could be found in modern stream beds, was evident on some pebbles. Fragments of unidentified shells were also included with the pebble cache.

Fabric Group 1

A medium dense fabric tempered with sand. The clay matrix is somewhat micaceous and interspersed with threads of sericite. It also contains argillaceous (some ferruginous) rock fragments (ARFs). These include grains of angular to rounded fine to medium sized silt and fine sand (quartz, plagioclase feldspar, and muscovite), within very coarse sand-sized, rounded to subrounded silty sandstone. A few opaque inclusions (iron oxides) of up to very fine sand size are present in the matrix.

The sand temper consists mainly of granules of angular mono- and polycrystalline quartz phenocrysts. Some quartz grains are heavily strained, some have intergrowths and some crenulated grains display undulating extinction, suggesting that they have been subjected to metamorphism. Many of the quartz grains display very fresh crystal faces. A few grains of coarse to very coarse subrounded sand-sized quartzite are also present. Several grains of angular to subangular alkali plagioclase feldspar (sanidine?), of up to coarse sand size, were noted. Although generally considered a characteristic of volcanic rocks, sanidine may also occur in plutonic rocks (Kerr:1977:304).

Minor amounts of subrounded tourmaline (schorl?), to fine sand size, are also present. Epidote (subrounded to coarse silt size), and flakes of muscovite (coarse silt (one within a polycrystalline quartz grain) to fine sand-sized), are rare. Grains of subrounded to coarse silt-sized epidote are also rare. Authigenic calcite is present in the interstices of the ceramic fabric which suggests post-deposition growth within the artefact (see also Vincent 1988).

Fabric Group 2

This sandy medium dense fabric is tempered with orthodox grog. The parent clay is more sandy than most of the local clays examined (see Chapter V). The sand is poorly sorted and may represent recycled sedimentary deposits. The grog ranges from 1-2 mm in diameter. Mineral inclusions range from angular to rounded in shape, and in size from fine silt to very coarse sand. Generally, the quartz grains appear fresh with little weathering. Most are mono-, but a few polycrystalline examples were noted (some with clear sutured boundaries; others stretched, suggesting a metamorphic source). Some grains display crystal faces. A few medium to coarse silt-sized angular to subangular grains of microcline, one of them in a grog fragment, are also present in some sections. Plagioclase and potassium feldspar, a few of the

latter weathering to kaolinite, were also recorded. The plagioclase feldspar and microcline are larger than usual for local clays. The clay matrix is micaceous, and several flakes of muscovite were noted within it. Authigenic calcite is also present within the interstices of the fabric as microlitic crystals. Opaque minerals are rare, but some apparently iron-rich sand-sized inclusions were noted. Several quartz grains carry limonitic surface staining.

Fabric Group 3

A medium dense fabric tempered with subangular to rounded orthodox grog (0.1-2 mm in diameter), with a silty quartzose composition. Most of the grog particles are reduced. Nonplastics in the parent fabric include very fine silt to fine or rare coarse sand-sized angular to subrounded quartz and fine silt to rare medium sand-sized angular plagioclase feldspar. Several unidentified sponge spicule fragments are present in the moderately micaceous (sericitic?) general matrix. Incidental rice husk is present in a L9:1 RF2 sherd and a RF6 L10:26 lens 31 sherd (sections K517 and K714). Micritic authigenic calcite is visible in many voids and what appear to be shrinkage fissures around grog and other nonplastic particles.

Fabric Group 4

Abundant rice husk temper, in either the silty fishpond clay or a medium dense semi-micaceous clay with few nonplastics, defines this fabric group. The quartzose nonplastics are angular to subrounded and range from very fine to coarse silt size. Authigenic micritic calcite is present in some voids. Several iron-rich sand-sized opaques were noted. Most examples are heavily reduced, but some are almost completely oxidized.

Fabric Group 5

Two different local clays, the relatively plastic clay described for FG4 and a short silty clay mineralogically consistent with the modern fishpond deposits, were tempered with bleb grog during CP4. The majority are composed of the former clay and used for fine wares whereas rice temper (FG4) appears to have been preferred for coarse pottery. The grog particles range from 1-2 mm in diameter and often either enclose rice husk fragments or display diagnostic bleb temper shapes including rice husk impressions (see Chapters II, IV and Fig. 10 for further bleb temper descriptions). Authigenic calcite fills some voids in the fabric.

Fabric Group 6

In thin section this moderately micaceous fabric is characterised by orthodox grog (mainly subrounded to rounded, but some angular). What appear to be argillaceous (occasionally opaque), rock fragments (ARFs) or possibly small fragments of reduced grog, are also present. They range from coarse to very coarse sand size. Some include quartz grains and biotite of medium silt size. Very rare angular quartz grains

of medium sand size, along with very fine sand-sized chert, medium silt-sized plagioclase feldspar and rare threads of very fine sand-sized biotite are also present. Fragments of calcite-cemented, (limestone?), medium to very coarse silt-sized angular chert and quartz were noted. The fragments range from medium to coarse sand size. Some authigenic calcite is also present. Incidental fragments of carbonized rice husk were also noted. Sponge spicules are rare. The sample derives from a L10:26 lens 31 rim sherd considered to be exotic.

Fabric Group 7

A shell (oyster?) temper within a very fine micaceous clay matrix distinguishes this ware (see Adams *et al.* 1984:41, fig 87). The fabric is friable. It contains very few monocrystalline quartz grains (one displaying a sweeping inclined extinction under crossed polars) to coarse sand size. A single polycrystalline grain was noted. Some subrounded very coarse sand-sized ARFs (siltstone?) containing occasional foraminifera (marine?) are present. Sponge spicule fragments are very rare.

Fabric Group 8

Highly micaceous and dense, this fabric is tempered with a granitic sand (up to very coarse sand size). Microcline is abundant. Mono- and polycrystalline angular quartz (to very coarse sand size), angular plagioclase feldspar (fine sand size), muscovite and brown biotite (to coarse silt size), are also present. Quartz and microcline grains are fresh, often displaying crystal faces; the former are often strained. A few rounded opaques (medium sand-sized), were also noted. The granitic sand has derived from rock falls very close to its weathered plutonic source. It typifies the rapid weathering of potassic-rich granitic alkali feldspars, "true granite perthites" (Reay pers. comm.).

Fabric Group 9

Again tempered with a granitic sand (up to very coarse sand size), this fabric is also dense with a highly micaceous matrix. Mono- and polycrystalline quartz (often very angular), is present. Igneous rock fragments containing plagioclase feldspar (some partly weathered to kaolinite) were noted. Many of these grains display crystal faces, some are spherulitic with radiating fibres. Feldspars (oligoclase?), many displaying a perthitic texture, dominate the nonplastics. They are mainly angular to subangular but some subrounded grains were noted. Overall the feldspars are more weathered than those in FG8. Muscovite as well as rare epidote and zircon are also present. These minerals suggest a granitic or schist source (or more grano-dioritic), "a "S" type granite derived from the melting of sediments" (Reay pers. comm.).

Fabric Group 10

Coarse to very coarse quartz and plagioclase feldspar sand temper characterises this dense exotic fabric. The matrix is highly micaceous. A sedimentary, or possibly a metamorphosed sedimentary, source

is suggested. Angular quartzite (very coarse sand-sized), also occurs in small amounts. It is likely that some quartz grains originally derive from a metamorphosed chert heated to 600-700° (Reay pers. comm.). Most grains are angular or sub-angular. Some grains are fresh; others weathered (several feldspars are weathering to kaolinite). A few grains of subangular perthitic microcline (coarse sand-sized), also occur. Plagioclase feldspar perthite textures include stringlets, rods, interlocking and interpenetrating types (Deer *et al.* 1966:313). Several grains are strained. Measured plagioclase feldspar crystal twins (Carlsbad method) suggest labradorite or bytownite. A few rock fragments (RFgs), some composed of quartz, biotite and feldspar, were noted. Plates of light green and dark brown biotite (fine to medium sand-sized), are distributed throughout the matrix. Angular and subangular tourmaline and hornblende (fine silt size), and dark brown (some probably Fe-rich?) opaques occur in varying amounts scattered throughout the parent fabric. Both mono- and polycrystalline quartz (coarse sand-sized), some with fresh surfaces, were recorded. Overall, a mixture of freshly weathered sediments (some grains perhaps originally igneous?) are present, some of which display a degree of metamorphism.

Fabric Group 11

A micaceous fabric tempered with distinctive bleb grog. Abundant fragments of rice husk and characteristic bleb-shaped grog particles, some oxidized but most often heavily reduced, are scattered throughout the fabric. Often associated with a true slip, this fabric is unique at the site.

The parent fabric is of medium density but contains few non-plastics. Mono- and polycrystalline angular to subrounded quartz (up to coarse sand size), and subangular opaque ferruginous minerals (medium to coarse sand size), were noted. The latter are rare. Some polycrystalline quartz grains display undulose extinction. Regrowths are present on some quartz grains, indicating a reworked sediment. Fragments of limestone (LST) with anhedral crystals (a dolomite? or recrystallized calcite), were observed. Authigenic calcite is abundant within the interstices of linear fissures within the parent fabric matrix. These tend to run parallel with the vessel surface.

The slip contains RFgs which include plagioclase feldspar, LST, polycrystalline quartz and mica. Angular dolomitic? LST (coarse to very coarse sand-sized), mono- and polycrystalline quartz (to medium sand size), and micaceous siltstone fragments are also evident. Some quartzitic grains (quartzite) have crenulated boundaries which suggest a metamorphic origin. Both interior and exterior surfaces of the sherd examined in thin section are coated with a true slip, but others only have this slip on the exterior.

Fabric Group 12

Sand temper in a dense, moderately micaceous matrix, characterises this fabric. The sand is mainly angular to subangular (of coarse to very coarse sand size), but some subrounded grains were noted. A mixture of metamorphosed granitic or grano-dioritic altered feldspars is evident. They display stringlet, rod and interlocking perthitic textures. Measured plagioclase feldspar crystal twins (Carlsbad method) suggest oligoclase and/or andesine. The plagioclase feldspar grains are all altered (bent, fractured or otherwise distorted, often with irregular or wavy crystal twins). They range from fresh to heavily eroded, but most are weathered. Both mono- and polycrystalline quartz are present, along with some quartzite with

crenulated sutures. Some feldspar and quartz grains have clearly been stressed. Quartz grains (to coarse and very coarse sand size), often display sweeping extinction. A few Fe-rich opaques (of medium sand-size), were also observed. A few RFgs (from medium to coarse sand size), were noted, one containing plagioclase and potassium feldspar and monocrystalline quartz. A mixed igneous and metamorphic source is suggested.

Fabric Group 13

The matrix of this dense fabric is highly micaceous, and dominated by abundant muscovite mica flakes and threads of sericite. It is tempered with a medium to coarse sand, composed of metamorphic quartz, plagioclase and potassium feldspar and sandstone RFgs. Much of the quartz is strained. Some monocrystalline quartz is fresh but most is weathered. Polycrystalline angular quartz (to coarse sand size) often displays undulose extinction. Grains of angular quartzite (coarse sand-sized), with crenulated sutures and sandstone RFgs composed of quartz, plagioclase feldspar and muscovite were noted. Subangular grains of microcline (medium sand-sized) are also present. Overall, most of the nonplastics are angular to subangular, with a few subrounded grains. Very fine sand-sized apatite and coarse silt-sized epidote are also present. Some of the muscovite is altered to brown chlorite. Perthitic feldspars and the overall mineralogy suggest a mixed metamorphic/granitic source.

Fabric Group 14

Sand temper, comprising a mixture of angular and subrounded grains of metamorphic quartz (coarse to very coarse sand size), characterizes this dense fabric. The parent matrix is micaceous. It contains numerous threads of sericite. Igneous quartz and perthitic alkali feldspars again suggests a mixed metamorphic and granitic source. Plagioclase feldspar is extremely rare (a single medium silt-sized grain was observed). Monocrystalline quartz grains display strongly undulose extinction. Polycrystalline grains are highly strained stretched metamorphic and provide very strong undulose extinction, often with numerous micro-crenulated crystal borders. Some crystal units are elongate and lenticular. Minor medium silt-sized rutile and epidote grains were noted. One fragment of incidental rice husk was also noted.

Fabric Group 15

Metamorphic quartz and quartzite sand temper (coarse to very coarse sand size), characterizes this dense, sometimes highly micaceous, fabric. The quartz is mainly angular to subangular, but a few are subrounded. Most are fresh and show signs of strain (inclined, undulose or wavy extinction). Some highly distorted grains have been intensely stressed. Polycrystalline grains often display crenulated sutures (typical of stretched metamorphic quartz) or inclined unit extinction. Some are schistose (intensely distorted). The quartzite grains sometimes carry mica inclusions along unit borders or display iron? staining. Muscovite mica is abundant as plates and sericitic threads in some sections, in others it is finer and less obvious. The plates are often bent. RFgs of monocrystalline quartz, plagioclase feldspar and muscovite (subrounded to coarse sand size), metamorphic quartz and muscovite (angular of very coarse

sand size), and polycrystalline quartz with crenulated borders (some with muscovite between the units), were recorded. A few grains of weathered subrounded or fresh angular plagioclase feldspar (all fine sand-sized), were noted. Rare perthitic alkali feldspars, some weathering to sericite, were also present. Minor amounts of iron-rich silt-sized opaques, epidote, schorl and hornblende? were also observed. In some sections coarse to very coarse sand-sized fragments of micritic limestone were noted.

Fabric Group 16

Shell and limestone fragments characterize this moderately dense fabric. The parent matrix is composed of a very fine silt. The shell probably derives from a bivalve and the limestone fragments may represent bivalves and/or crinoids (Adams *et al.* 1984).

Fabric Group 17

Orthodox grog (mainly of coarse sand to granule size), and minor amounts of mainly quartz and microcrystalline chert (to medium sand size), distinguish this medium dense fabric. Most of the grog is reduced, but a few oxidized fragments were noted. Some quartz crystal faces are present on overgrowths indicating a reworked sediment. Rare polycrystalline quartz grains display either inclined or undulose extinction. These nonplastics are angular to subrounded and from coarse silt to medium sand size. Minor amounts of Fe-rich opaques (fine to medium sand size), are also present.

Fabric Group 18

A silty orthodox grog, within a silty, slightly micaceous matrix containing fragments of shell (of coarse sand size), and rice husk, characterize this medium dense fabric. Numerous authigenic calcite crystals (micritic and drusy sparites), some filling voids (or representing rounded limestone fragments?), are dispersed throughout the fabric matrix. Minor amounts of angular to subangular mono- and polycrystalline quartz (from fine to coarse sand size), the latter displaying undulose extinction (metamorphosed?), are present. Minor amounts of subangular Fe-rich opaques (from fine to coarse sand size), and extremely rare sponge spicules were also noted.

Fabric Group 19

Sandy orthodox grog temper, in a moderately micaceous and partially silty parent matrix, characterise this medium dense fabric. The fabric interior is partially reduced, but exterior surfaces are fully oxidized. Nonplastics range from silt to very coarse sand size. Angular to rounded monocrystalline quartz grains (to very coarse sand size), are present. They often display undulose extinction and some include regrowth crystal faces indicating a reworked sedimentary source. Angular to subrounded plagioclase and potassium feldspars (fine to medium sand size), as well as RFgs composed of oligoclase (determined using the Carlsbad method) and polycrystalline quartz (to coarse sand size), are quite common. Angular polycrystalline quartz (to medium sand size), displaying undulose extinction, is uncommon. But angular quartzite

(coarse sand size), is rare. Several subangular grains of hornblende (medium sand-sized), were noted. Flakes of muscovite(?), (fine sand-sized), are also present. Authigenic calcite, probably derived from post-deposition ground water, is distributed (mainly as euhedral, but sometimes micritic, crystals), within micro fabric interstices and on exterior surfaces of sherds. Subrounded iron-rich opaques (to medium sand size), are also scattered throughout the matrix.

Fabric Group 20

An almost opaque, dark grey groundmass and a feldspathic sand temper characterise this dense fabric. The temper is composed of angular to subrounded sand and RFgs of medium to coarse sand-size. An abundant mix of fresh or weathered microcline and plagioclase feldspars (often weathering to muscovite or sericite and perhaps in some instances to kaolinite) were recorded. Flakes of muscovite (and also some biotite?) are dispersed through the matrix in minor quantities. Monocrystalline angular (plutonic?) quartz grains (to coarse sand size), and polycrystalline subangular metamorphic quartz displaying undulose extinction and crenulated unit boundaries (from very fine to very coarse sand size), are common. Some grains display microcrystalline overgrowths extending outwards from their rims, others encase mica (biotite?). Many feldspars with perthitic textures are heavily weathered. They are mainly angular (of coarse sand size). The microcline is often fresh and mainly angular (also to very coarse sand size). RFgs are composed of various mixtures of plagioclase feldspar, quartz (some well rounded) and microcline. A few crystals of an amphibole (hornblende?) may also be present. These very coarse sand-sized RFgs have a consertal granular granite texture (see MacKenzie *et al.* 1982:29, Fig. 42).

Rounded arkose sandstone RFgs (to very coarse sand size), composed of medium sand-sized microcline, potassium feldspars and quartz (including a well-rounded grain), are also present. Some are composed mainly of subangular potassium feldspar with undulose extinction and crenulated borders. Feldspathic siltstone RFgs, some displaying altered units and grains, were also noted. Overall the mineralogy suggests an immature sediment. Numerous subrounded dark brown opaque iron oxide particles (to coarse sand size), are dispersed throughout the fabric matrix. Epidote (from fine silt to medium sand size), is rare. Authigenic calcite (probably post-depositional), is present on some sherd surfaces. The mix of fresh and badly weathered feldspars of the same species could suggest a tectonic arkose eroded from a fresh granitic bedrock (Folk 1980:130).

Fabric Group 21

Sand temper in a dense, highly micaceous, matrix characterises this fabric. It is composed of siltstone and a silty sandstone (some arkose?), abundant microcline, mono- and polycrystalline quartz, potassium feldspar (all to very coarse sand size) and plagioclase feldspar (from coarse silt to medium sand size). These grains (except the latter, which is angular to subangular) range from angular to subrounded. Flakes and threads of muscovite (to medium sand size), are common to abundant. The feldspars are often perthitic; some are relatively fresh, but many are weathering (some heavily) to sericite. Some silt and sandstone fragments are micaceous. Quartz grains are often stressed, displaying undulose or inclined extinction. Subrounded iron-rich opaques (coarse silt to very coarse sand size), are scattered throughout the fabric.

Fabric Group 22

Sand temper (mainly of fine sand size), composed of chert and quartz in a dense, moderately micaceous matrix, characterises this fabric. Angular to rounded chert (mainly micritic, from coarse silt to medium sand size) is abundant. Grains composed of various combinations of finely crystalline mosaic micro, mega and chalcedonic quartz (Tucker 1981:211) were observed. Some intergrowths with fine sand-sized single or multiple grains of mono- or polycrystalline quartz (siltstone? fragments), and chert were also noted which suggest replacement and/or pore fillings. Several reddish brown siltstone and sandstone RFgs (to very coarse sand size), composed of mono- and polycrystalline quartz and chert are also present. Numerous angular to rounded (fine to medium sand size), dark brown essentially opaque iron oxide particles are also scattered throughout the matrix. Many quartz grains display overgrowths consistent with a reworked sediment.

Fabric Group 23

This fabric was recovered from the upper portion of layer 1. The sherd is 18-20 mm thick and composed of a medium dense, silty, semi-opaque matrix which is honeycombed with voids. Most of the voids form outlines, or pseudomorphs, of euhedral crystals consistent with porphyroblastic secondary gypsum, which can form following the uplift of anhydrite sequences (Tucker 1981:161-7 and Fig 5.7). The voids are elongate and measure from 0.02-0.5 mm wide and 0.5-3.35 mm long (from fine sand to granule size). Abundant authigenic calcite fills, or partially fills, most small interstices and larger ovoids in the fabric. Numerous brownish iron oxides are dispersed throughout the matrix and are either lenticular, angular to rounded or amorphous, and from medium silt to coarse sand size.

FABRIC PHOTOMICROGRAPHS

Annotated photomicrographs of petrographic thin sections are illustrated below in figures 308 to 315, arranged sequentially beginning with fabric group 1 (FG1) at the top of figure 308 and ending with the sand cache at the bottom of figure 315 immediately below FG23. Each represents images taken with crossed polars and all except the sand cache (100x) are at 40 magnifications.

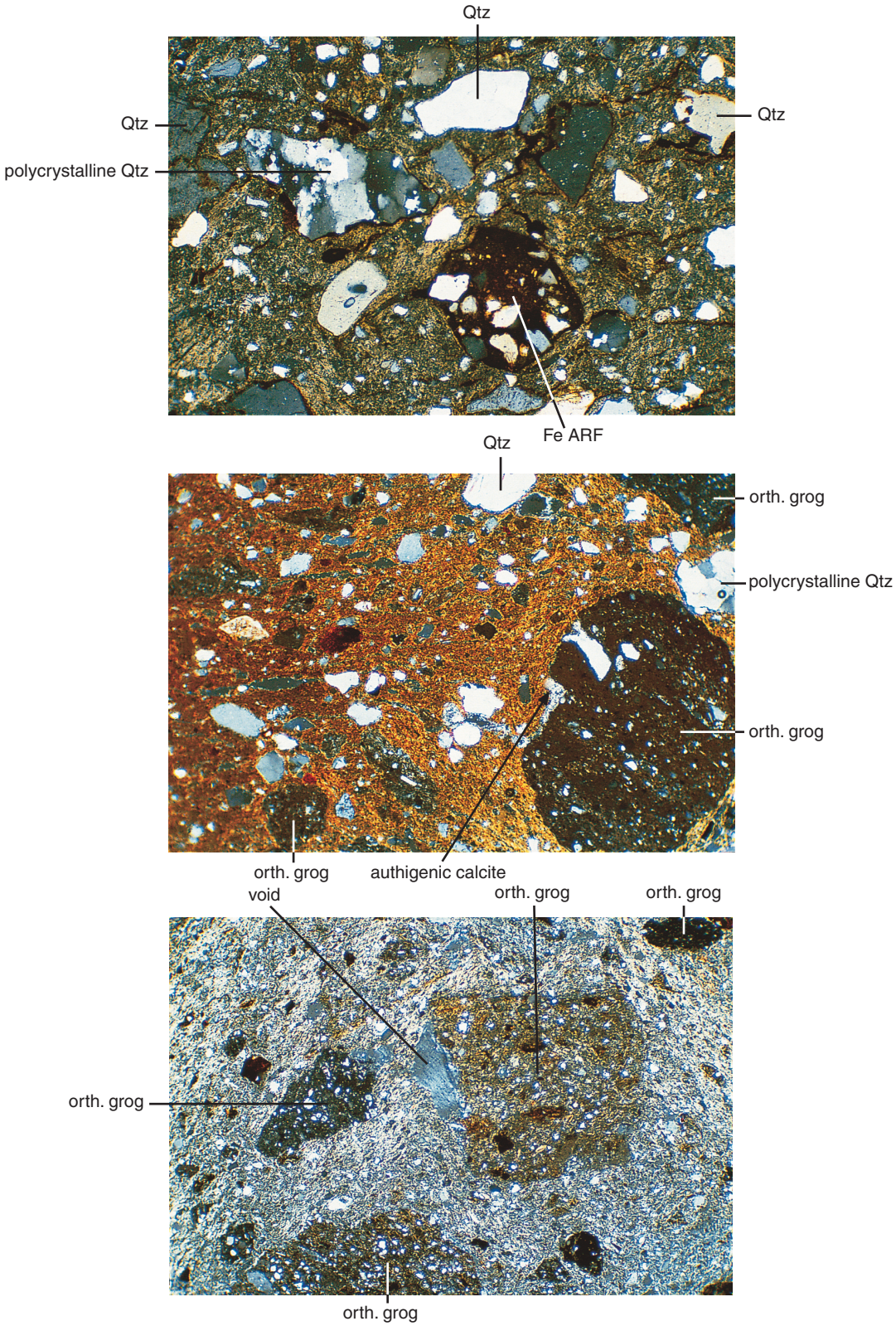


FIG. 308: Photomicrographs of petrographic thin sections. *Top*: FG1, *Centre*: FG2 and FG3 (all 40x)

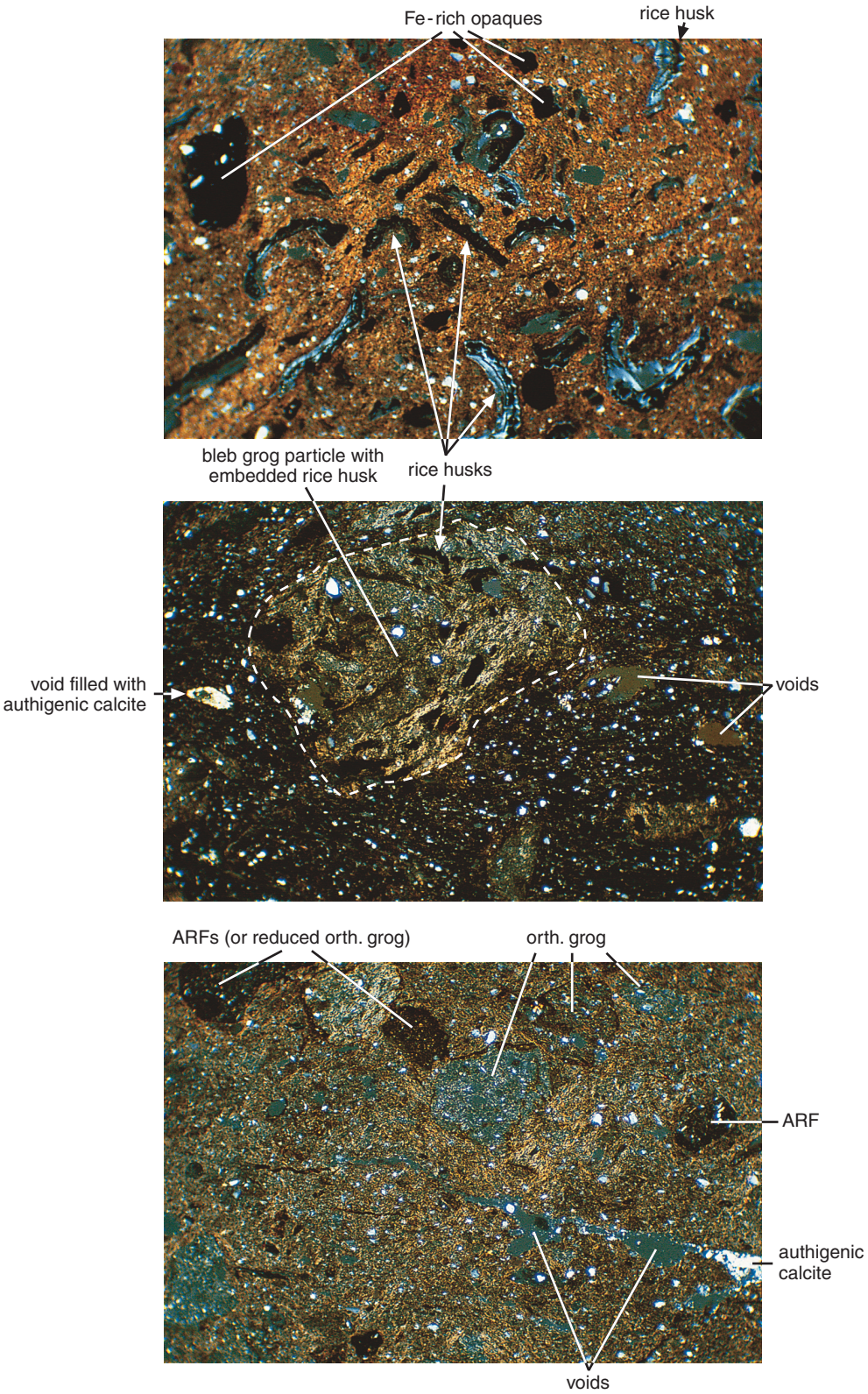


FIG. 309: Photomicrographs of petrographic thin sections. *Top*: FG4, *Centre*: FG5 and FG6 (all 40x)

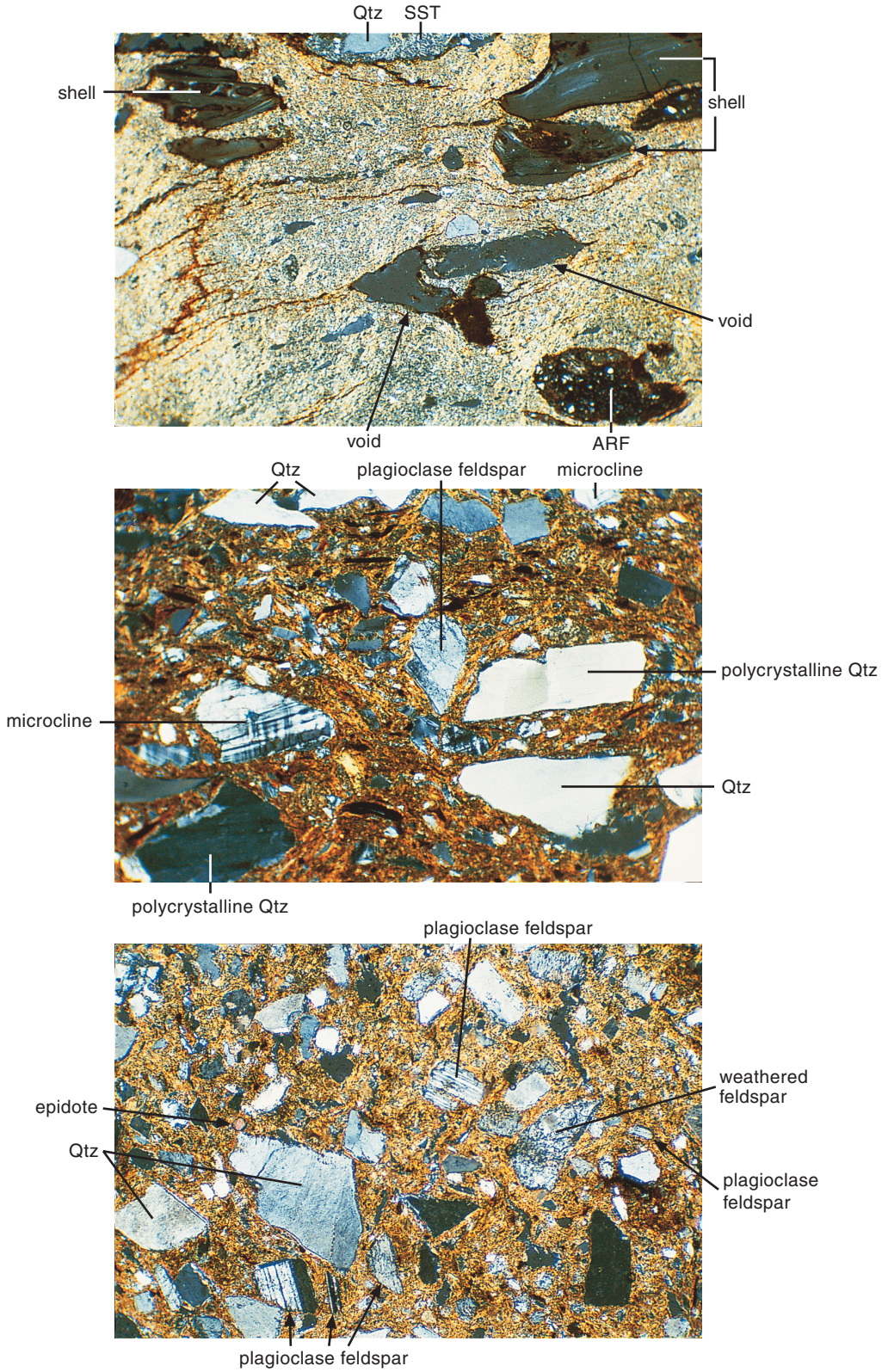


FIG. 310: Photomicrographs of petrographic thin sections. *Top*: FG7, *Centre*: FG8 and FG9 (all 40x)

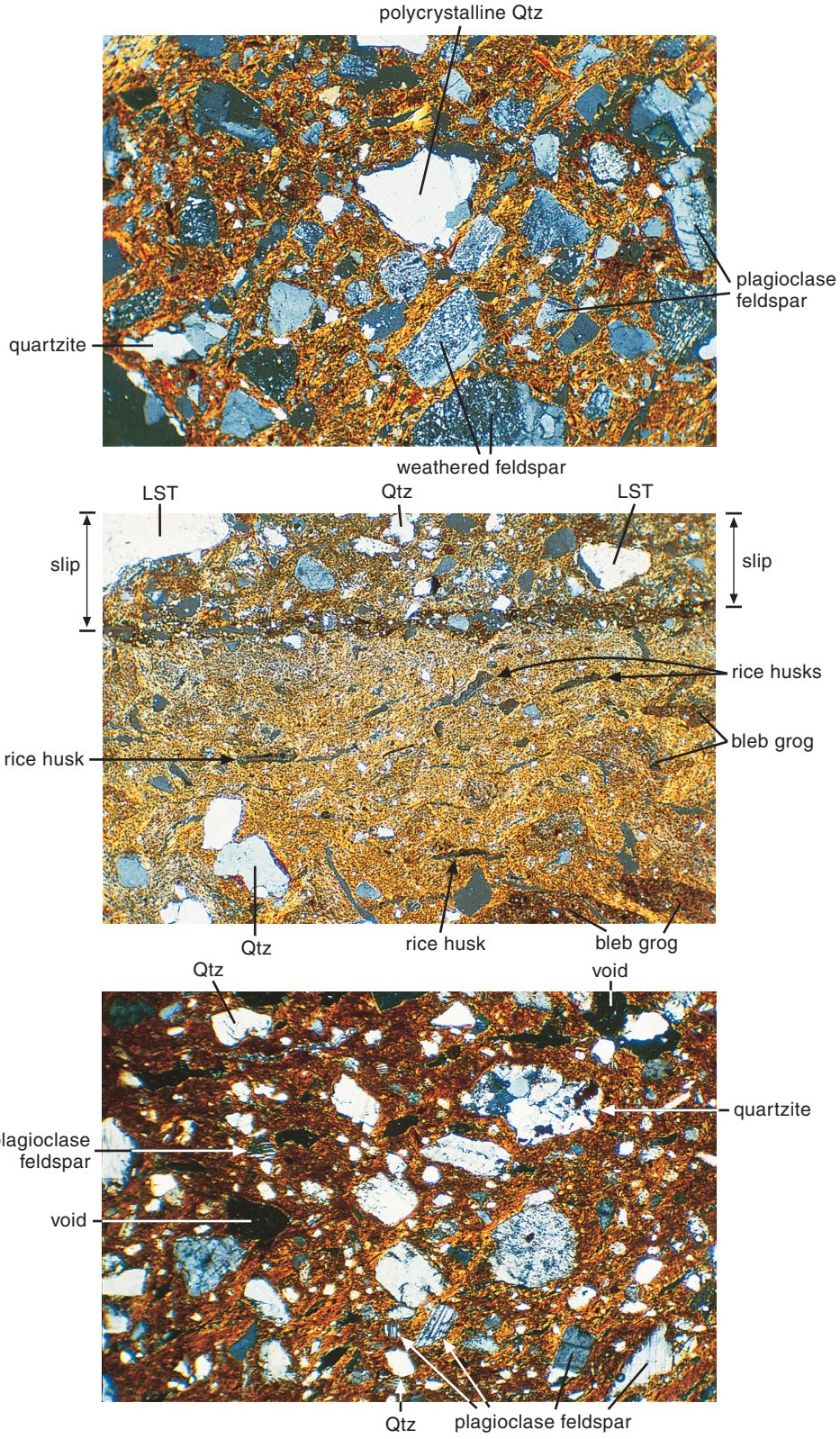


FIG. 311: Photomicrographs of petrographic thin sections. *Top*: FG10, *Centre*: FG11 and FG12 (all 40x)

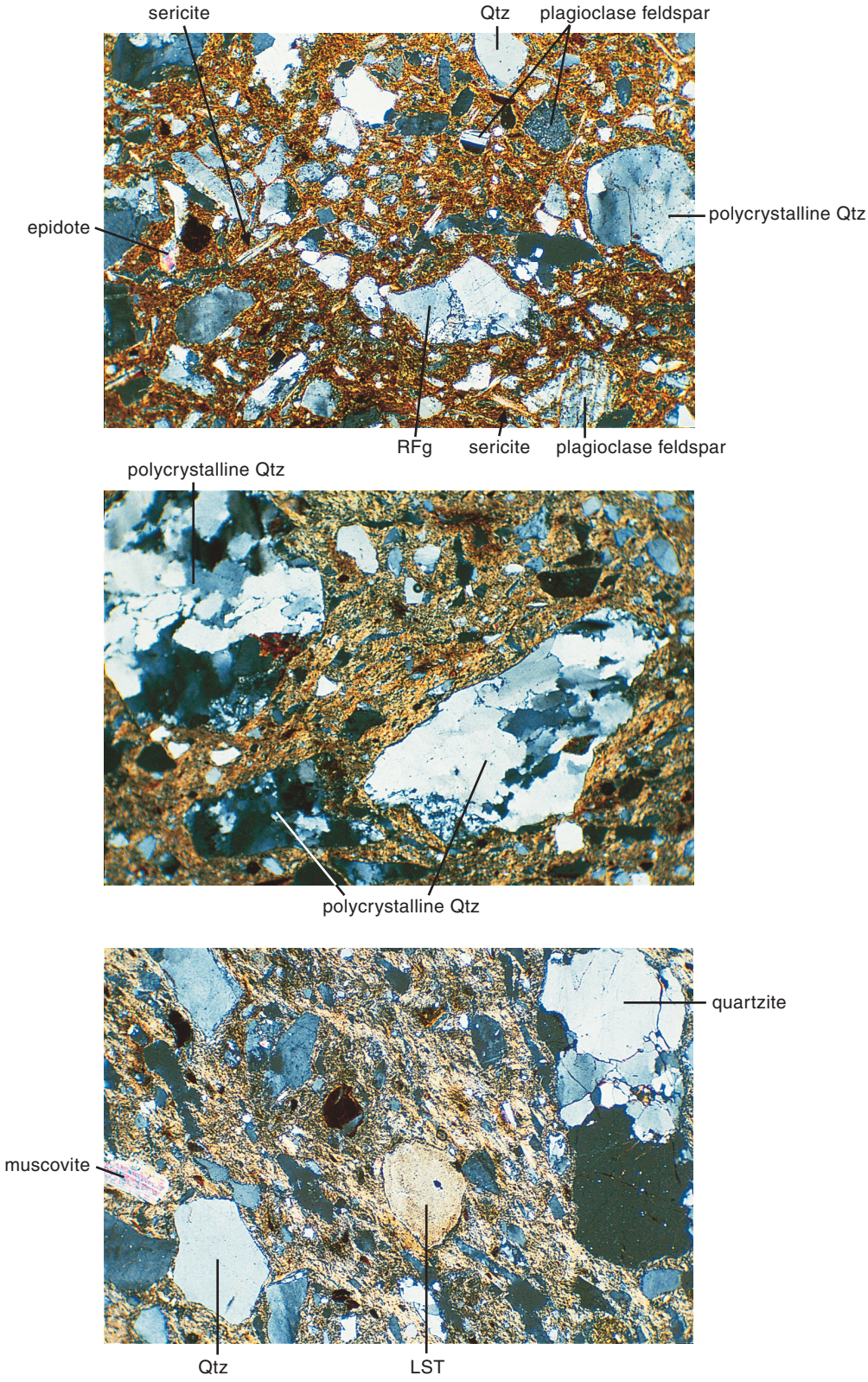


FIG. 312: Photomicrographs of petrographic thin sections. *Top*: FG13, *Centre*: FG14 and FG15 (all 40x)

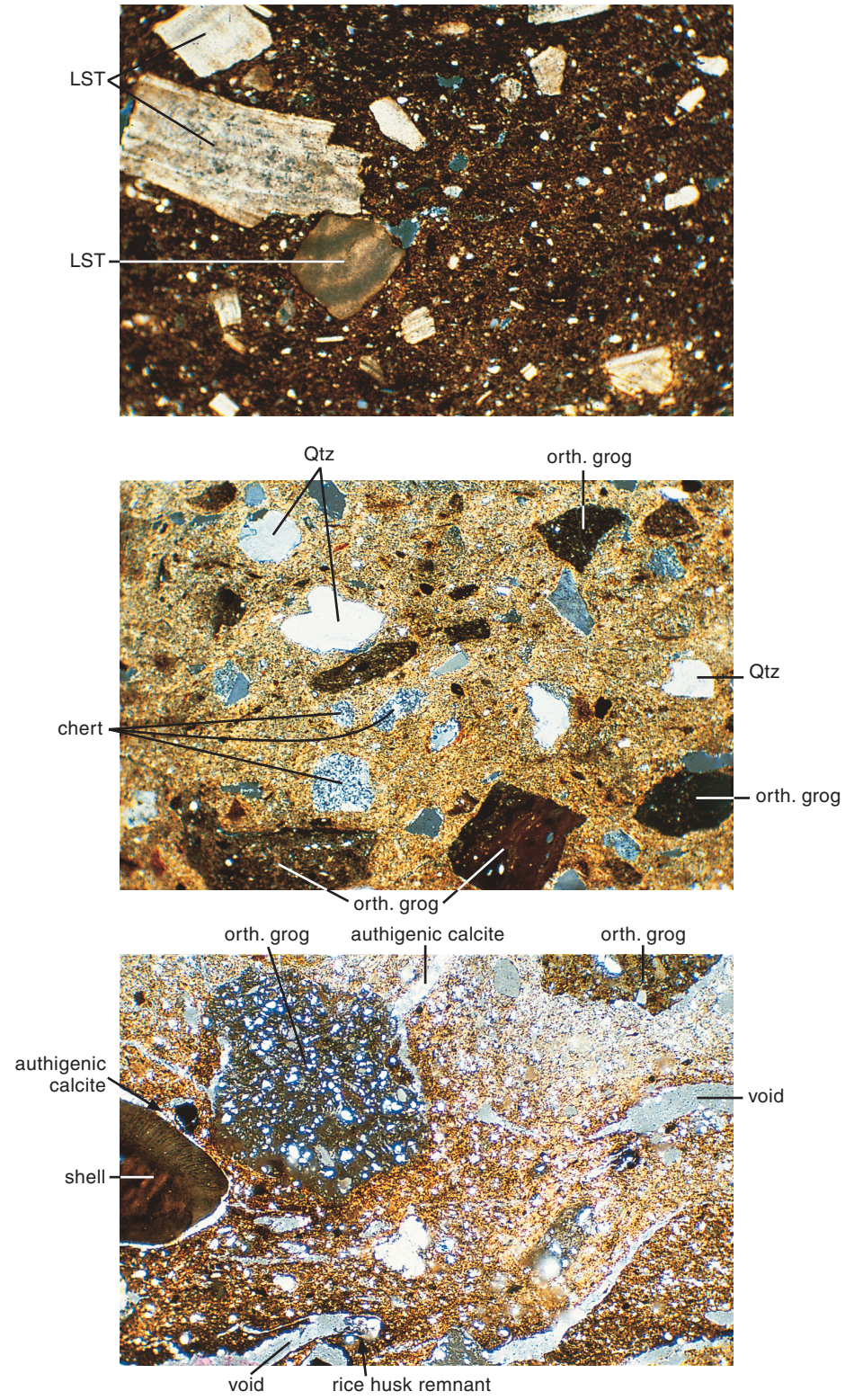


FIG. 313: Photomicrographs of petrographic thin sections. *Top*: FG16, *Centre*: FG17 and FG18 (all 40x)

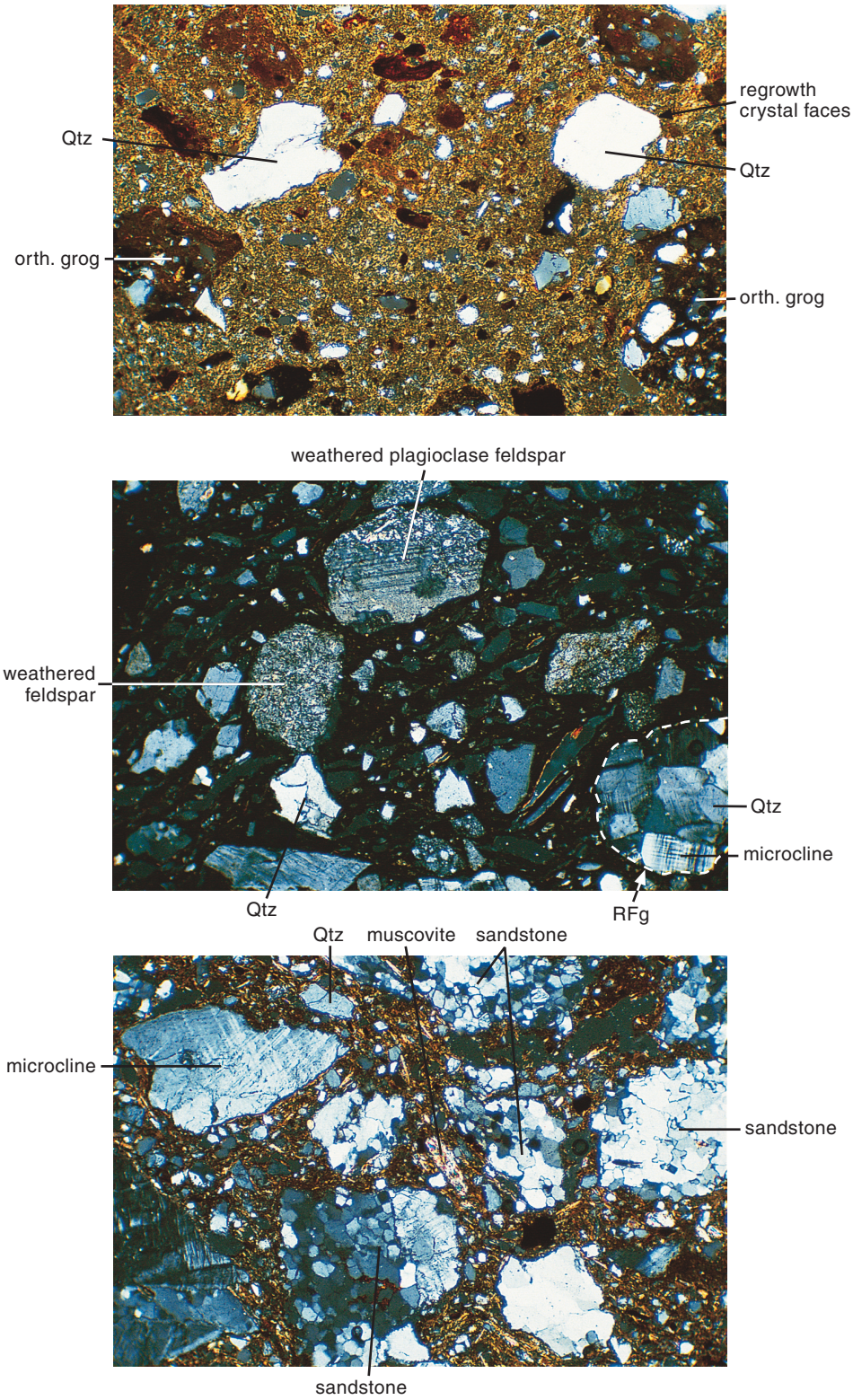


FIG. 314: Photomicrographs of petrographic thin sections. *Top*: FG19, *Centre*: FG20 and FG21 (all 40x)

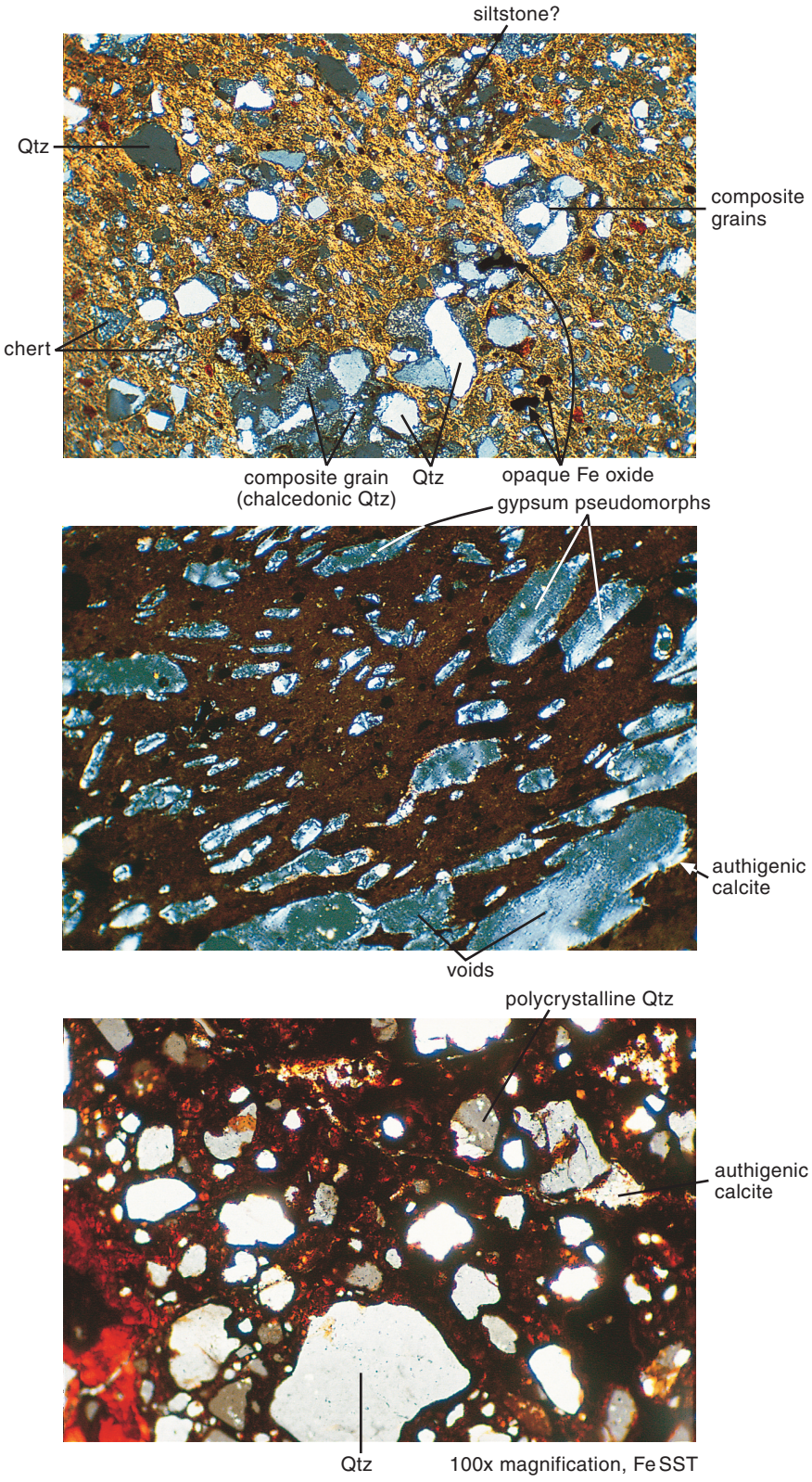


FIG. 315: Photomicrographs of petrographic thin sections. *Top*: FG22, *Centre*: FG23 (40x) and sand cache (100x)

XIV APPENDIX TWO

IN THIS APPENDIX rim forms are detailed for the entire excavation. Where a form is only represented by a form category rather than an unelaborated example, this has been included in the schema (Table 168). Similarly where rim categories are present only as variants in any Ceramic Period, these have been included as representative of the category concerned. It is important to note that the RF1 shape changed at the CP2/3 boundary (see Chapter VIII).

RIM FORMS

TABLE 168: *Rim forms, categories and variants by Ceramic Period (Cats: rim categories; Vars: rim variants)*

Groups																		
CP4																		total
Form	1	2	3	4	5	6	7	8	9	10	11	-	13	-	15a	16	17	15
Cats.	2	3	7	46	30	11	1	2	-	2	-	-	10	-	1	2	-	117
Vars.	1	-	2	2	9	10	-	-	-	-	-	-	-	-	-	-	-	24
CP3																		
Form	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15a	-	-	15
Cats.	3	4	8	21	40	35	2	-	-	2	1	1	6	4	-	-	-	128
Vars.	-	-	6	3	14	19	1	-	-	-	-	-	1	-	-	-	-	44
CP2																		
Form	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	-	-	15
Cats.	4	4	5	1	40	27	-	2	-	3	1	5	-	4	-	-	-	96
Vars.	1	-	10	1	26	16	-	-	-	-	2	-	2	-	-	-	-	58
CP1																		
Form	1	2	3	4	5	6	7	8	9	10	11	12	13a	-	-	-	-	13
Cats.	-	3	3	4	12	6	1	1	-	3	1	-	1	-	-	-	-	35
Vars.	-	-	3	-	3	3	1	-	-	-	-	-	1	-	-	-	-	11

Exotic and local coarse and fine ware rim forms, categories and variants for each CP give an approximate overview of the temporal intensity of potting activity (Table 169). Fine ware elaboration indices for all rims and local rims alone allow overall comparisons of local potting intensities for each CP (Table 170 and 171). These data need to be treated with caution, however,

because allowance for deposition densities and changes in pottery style preferences between CPs need to be evaluated. The latter problem is magnified when changes in specific rim elaborations are considered. For example, RF4 treatments vary little between CP2 and CP3, however they increase markedly with CP4. When assessing the fine ware elaboration indices, therefore, variations in individual ware treatments need to be accounted for. This is because, while particular styles may come into and pass out of favour from one CP to another, the elaboration index is promoted as a measure of local potting intensity during each CP, irrespective of the modes of decorative treatments involved. It is a measure of the amount of energy invested by each potting tradition. Hence the combined local fine ware assemblage for each CP needs to be considered in toto. This means that it is important to exclude exotic wares from the equation. Of course some local wares may represent copies of exotic styles. It is considered that these will have little effect on the overall configuration. In any case they need to be included as contributions to local levels of production. A detailed discussion of the various parameters affecting Khok Phanom Di potting traditions is presented in chapters VII–X.

TABLE 169: *Rim forms, categories, variants and weights by Ceramic Period*

CP	Forms	Categories	Variants	Weight (kg)
4	15	115	24	451.20
3	15	128	44	167.70
2	15	96	58	74.30
1	13	35	16	14.59
Total	17	-	-	707.79

Fine wares are represented by forms 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and category 13a in CP1 (Table 179). In CP2 forms 13, 14 and 15 were added and in CP3 the latter is represented by category 15a. In CP4 this configuration changed. Forms 12 and 14 are absent and RF9 is restricted to an exotic ware. Given the rarity of RF9 throughout the sequence as a local ware, and the likelihood that local examples could easily have been absent from the excavated area, however, it has been included in the elaboration equation. During CP2, rim categories 5b, 5t, 6b, 6x, 6ai, 8b, 12e and 14g were restricted to exotic wares, as were variants 5e(i) and 5y(i). In CP3, 26 categories and five variants are exclusively exotic. The categories are 3a, 3g, 4an, 4aaa, 5x, 5ac, 5ag, 5au, 5aad, 5aaf, 5aag, 5aah, 5aat, 6p, 6q, 6x, 6aa, 6ax, 6az, 6aaa, 6aab, 6aah, 7d, 13c, 13n and 15a, the variants 3a(ii), 3b(i), 3c(i), 5ai(i) and 6b(v) . Variants 3b(i) and 3c(i) are coated with a red oxide paint. Two further CP3 exclusively exotic forms, 5R and 6R, are also painted. These and exotic form 5slip, a slipped ware, have not been assigned to form categories. Including them in the elaboration calculations would reduce the CP3 local fine ware index from 10.53 to 8.61. During CP4, 13 categories, seven variants and three forms are limited to exotic rims. The categories are 3j, 4aad, 4aae, 5at, 5aak, 5aau, 6ab, 6aac, 6aad, 10d, 13g, 13l and 13n, the variants 5j(ii), 5aap(i), 6c(iv), 6y(ii), 6aa(i), 6ab(i) and 6aab(i). Local versions of 5aap(i)

may be present, however without petrographic analysis this could not be determined. Forms 9, 15a and 16 are also exclusively exotic, however, as discussed above, RF9 has been included in the elaboration calculations.

TABLE 170: *Fine ware rim form elaboration by Ceramic Period*

CP	Categories	Variants	Total	Forms	Elaboration
4	108	22	130	13	10.00
3	103	43	146	13	11.23
2	91	56	147	13	11.30
1	32	10	42	11	3.81

TABLE 171: *Exotic and local fine ware rim form elaboration by Ceramic Period*

	Exotic only		Local only				
CP	Categories	Variants	Categories	Variants	Total	Forms	Elaboration
4	13	7	95	15	110	11	10.00
3	26	5	77	38	115	13	8.84
2	8	2	83	54	137	13	10.53
1	-	-	32	10	42	11	3.81

Although, except for CP4 which includes all of layers 1–4, the stratigraphic layers recognized by the excavators do not coincide with the CPs, rim distributions for each layer provide an approximate guide to the disposition of pottery throughout the sequence (Table 172). Layer 10 represents all of CP2, the upper 16 cm of CP1 and the lower 20 cm of CP3. The above tables should be read in conjunction with the summary of rim form, category and variant distributions set out in table 179.

Two ornamental forms, RF5 and RF6, dominate the spectrum during CP2/3. For CP2, RF5 categories and variants combined total 66. If sherds recovered from L10:3, the uppermost CP2 stratigraphic context, are allocated to CP3 this decreases by 19 to 47. CP3 contained a combined category and variant total of 54, which increase by 19 to 73. For RF6 the figures are: CP2 43 minus 5 equals 38; CP3 54 plus 5 equals 59. Exotic wares need to be deducted from these values to obtain local elaboration indices. The combined CP2 RF5/6 total is 90 and for CP3 the total is 127. Seven CP2 RF5/6 rims are exotic leaving 83 local wares. In CP3 20 RF5/6 wares are exotic leaving 107 local. Similarly a single RF5 and four RF6 rims recovered from the top of CP3 could derive from CP4. This leaves 102 RF5/6 rims allocated to CP3. Sherd density variations (see Chapter IX), equate to 7.14 m2 RF5/6 combined categories and variants for CP3 and 7.51 m2 for CP2. Thus, even if all sherds adjacent to the CP2/3 and CP3/4 stratigraphic boundaries are attributed to CP3, the fine ware distributions clearly indicate a reduction in local

fine ware production during CP3 compared to CP2. Given that type L2b burial jars continued to be deployed as funerary furniture throughout CP3, production levels of RF5 are likely to have been maintained. Exotic RF5 wares increased during CP3, however, from four to eleven.

TABLE 172: *Rim forms, categories, variants and weights by stratigraphic layer*

Layer	Forms	Categories	Variants	Weight (kg)
1	8	5	1	22.30
2	10	46	6	159.68
3	12	72	16	179.25
4	13	80	13	89.97
5	11	38	7	36.63
6	10	42	17	43.69
7	12	34	14	27.50
8	13	33	14	25.65
9	15	27	17	24.78
10	15	112	57	88.88
11	12	23	5	9.46
Total	17	-	-	707.79

TABLE 173: *Fine ware rims present in both Ceramic Periods 2 and 3 (n = 68)*

Forms:									
3	3f	5b(iii)	5p(i)	5ac	5ag	6c(i)	6r	7	12
3a	4	5c	5s	5ad	5ai	6c(ii)	6u	8	12b
3a(ii)	4a(i)	5c(i)	5t	5ad(i)	5ai(i)	6g	6v	9	13
3c	5	5g	5u	5ad(iii)	5ak	6i	6x	10	14
3c(i)	5a	5j(ii)	5v	5ad(iv)	5ao	6k	6aa(i)	10c	14c
3c(ii)	5a(i)	5l	5x	5ad(vi)	6	6k(i)	6ac	11	-
3c(iii)	5b	5o	5ab	5af	6b(v)	6p	6ad	11a	-

CARINATED BURIAL JARS

Vessels, including type 2b carinated jars, were present in MP2-7 graves (Table 177). Four zones, the rim terminus, the external margin below the rim, the margin immediately above the carination

TABLE 174: *The distribution of Ceramic Periods 2 and 3 fine ware rims. (x means present)*

Form	CP2	CP3	Form	CP2	CP3	Form	CP2	CP3	Form	CP2	CP3
3a(i)	x	-	5f	x	-	5ar	-	x	6h(i)	-	x
3a(iii)	x	-	5h	-	x	5as	-	x	6j	x	-
3a(iv)	x	-	5g(i)	-	x	5at	-	x	6l	x	-
3c(iv)	x	-	5g(ii)	x	-	5au	-	x	6m	x	-
3c(v)	x	-	5i	x	-	5av	-	x	6n	x	-
3e	x	-	5i(i)	x	-	5aw	-	x	6o	x	-
3g	-	x	5i(ii)	x	-	5aw(i)	-	x	6q	-	x
3h	-	x	5j	x	-	5ay	-	x	6s	x	-
3i	-	x	5k	x	-	5az	-	x	6t	x	-
4f	-	x	5m	x	-	5aaa	-	x	6w	-	x
4f(i)	-	x	5n	x	-	5aab	-	x	6y	-	x
4i	-	x	5p(ii)	x	-	5aac	-	x	6y(i)	-	x
4i(i)	-	x	5p(iii)	x	-	5aad	-	x	6z	-	x
4al	-	x	5p(iv)	x	-	5aae	-	x	6aa	-	x
4am	-	x	5q	x	-	5aaf	-	x	6aa(ii)	-	x
4an	-	x	5r	x	-	5aag	-	x	6ab	x	-
4ao	-	x	5w	x	-	5aah	-	x	6ab(i)	x	-
4ap	-	x	5y	x	-	5aat	-	x	6ad(i)	-	x
4aq	-	x	5y(i)	x	-	5aav	-	x	6ae	-	x
4ar	-	x	5y(ii)	x	-	5aax	-	x	6af	x	-
4as	-	x	5z	x	-	6a	x	-	6ag	x	-
4at	-	x	5aa	x	-	6b	x	-	6ah	x	-
4au	-	x	5ad(ii)	x	-	6b(i)	x	-	6ai	x	-
4av	-	x	5ad(v)	x	-	6b(ii)	x	-	6aj	-	x
4aw	-	x	5ad(vii)	-	x	6b(iii)	x	-	6ak	-	x
4ax	-	x	5ad(viii)	-	x	6b(iv)	x	-	6al	-	x
4ay	-	x	5ae	x	-	6b(vi)	x	-	6am	-	x
4az	x	-	5ah	x	-	6b(vii)	-	x	6am(i)	-	x
4aaa	-	x	5ai(ii)	x	-	6c(iii)	x	-	6am(ii)	-	x
4aab	-	x	5aj	x	-	6f	x	-	6an	-	x
5b(i)	x	-	5aj(i)	x	-	6f(i)	x	-	6ao	-	x
5b(ii)	x	-	5al	x	-	6f(ii)	x	-	6ap	-	x
5c(i)	-	x	5am	x	-	6f(iii)	x	-	6aq	-	x
5d	x	-	5an	x	-	6g(i)	x	-	6au	-	x
5e	x	-	5ap	x	-	6g(ii)	x	-	6au(i)	-	x
5e(i)	x	-	5aq	-	x	6h	x	-	6au(ii)	-	x
total	12	24		31	5		15	21		13	23

TABLE 174: *The distribution of Ceramic Periods 2 and 3 fine ware rims (continued)*

Form	CP2	CP3	Form	CP2	CP3	Form	CP2	CP3	Form	CP2	CP3
6au(iii)	-	x	6aae	-	x	11(ii)	x	-	13f	-	x
6au(iv)	-	x	6aag	x	-	12a	x	-	13n	-	x
6au(v)	-	x	6aah	-	x	12c	x	-	14a	-	x
6au(vi)	-	x	7b	-	x	12d	x	-	14b	x	-
6av	-	x	7b(i)	-	x	13a	x	-	14d	x	-
6aw	-	x	7d	-	x	13a(i)	x	-	14e	-	x
6aw(i)	-	x	8a	x	-	13a(ii)	x	-	14f	-	x
6ax	-	x	8b	x	-	13a(iii)	-	x	14g	x	-
6ay	-	x	10d	x	-	13b	-	x	15	x	-
6az	-	x	10e	x	-	13c	-	x	15a	-	x
6aaa	-	x	10f	-	x	13d	-	x	-	-	-
6aab	-	x	11(i)	x	-	13e	-	x	-	-	-
total	-	12		6	6		7	5		4	6
CP total										88	102

TABLE 175: *Fine ware rims present in both Ceramic Periods 3 and 4 (n = 44)*

Forms:										
3	4	5	5j(ii)	5aac	5aat	6y(i)	6au(i)	6aab	9	13e
3a	4f	5b	5ad	5aad	5aav	6aa(i)	6au(ii)	6aae	10	13f
3h	4i	5c	5ak	5aae	6	6aj	6au(vi)	7	11	13n
3i	4al	5g	5at	5aaf	6y	6au	6aaa	8	13	15a

TABLE 176: *The distribution of Ceramic Periods 3 and 4 fine ware rims. (x means present)*

Form	CP4	CP3	Form	CP4	CP3	Form	CP4	CP3	Form	CP4	CP3
3a(i)	x	-	4v	x	-	4aah	x	-	5as	-	x
3a(ii)	-	x	4w	x	-	4aai	x	-	5au	-	x
3b(i)	-	x	4x	x	-	4aaj	x	-	5av	-	x
3c	-	x	4y	x	-	5a	-	x	5aw	-	x
3c(i)	-	x	4z	x	-	5a(i)	-	x	5aw(i)	-	x
3c(ii)	-	x	4aa	x	-	5b(iii)	-	x	5ay	-	x
3c(iii)	-	x	4ab	x	-	5c(i)	-	x	5az	-	x
3d	x	-	4ac	x	-	5d	x	-	5aaa	-	x
3f	-	x	4ad	x	-	5e	x	-	5aab	-	x
3f(i)	-	x	4ae	x	-	5f	x	-	5aag	-	x
3g	-	x	4af	x	-	5h	-	x	5aag(i)	x	-
3j	x	-	4ag	x	-	5j(i)	-	x	5aah	-	x
3k	x	-	4ah	x	-	5k	x	-	5aai	x	-
4a(i)	-	x	4ai	x	-	5l	-	x	5aaj	x	-
4a	x	-	4aj	x	-	5o	-	x	5aak	x	-
4b	x	-	4am	-	x	5p(i)	-	x	5aal	x	-
4c	x	-	4an	-	x	5s	-	x	5aal(i)	x	-
4d	x	-	4ao	-	x	5t	-	x	5aam	x	-
4e	x	-	4ap	-	x	5u	-	x	5aam(i)	x	-
4f(i)	-	x	4aq	-	x	5v	-	x	5aam(ii)	x	-
4g	x	-	4ar	-	x	5x	-	x	5aam(iii)	x	-
4h	x	-	4as	-	x	5ab	-	x	5aan	x	-
4i(i)	-	x	4at	-	x	5ac	-	x	5aao	x	-
4j	x	-	4au	-	x	5ad(i)	-	x	5aap	x	-
4k	x	-	4av	-	x	5ad(iii)	-	x	5aap(i)	x	-
4l	x	-	4aw	-	x	5ad(iv)	-	x	5aap(ii)	x	-
4m	x	-	4ax	-	x	5ad(vi)	-	x	5aaq	x	-
4m(i)	x	-	4ay	-	x	5ad(vii)	-	x	5aar	x	-
4n	x	-	4az	-	-	5ad(viii)	-	x	5aas	x	-
4o	x	-	4aaa	-	x	5af	-	x	5aau	x	-
4p	x	-	4aab	-	x	5ag	-	x	5aav(i)	x	-
4q	x	-	4aac	x	-	5ai	-	x	5aaw	x	-
4r	x	-	4aad	x	-	5ai(i)	-	x	5aax	-	x
4s	x	-	4aae	x	-	5ao	-	x	6b	x	-
4t	x	-	4aaf	x	-	5aq	-	x	6b(v)	-	x
4u	x	-	4aag	x	-	5ar	-	x	6b(vii)	-	x
total	24	12		20	15		7	29		22	14

TABLE 176: *The distribution of Ceramic Periods 3 and 4 fine ware rims (continued)*

Form	CP4	CP3	Form	CP4	CP3	Form	CP4	CP3	Form	CP4	CP3
6c	-	x	6ab(i)	x	-	6az	-	x	13b	-	x
6c(i)	-	x	6ad(i)	-	x	6aab(i)	x	-	13c	-	x
6c(ii)	-	x	6ac	-	x	6aab(ii)	x	-	13d	-	x
6c(iv)	x	-	6ad	-	x	6aac	x	-	13g	x	-
6g	-	x	6ae	-	x	6aad	x	-	13h	x	-
6h(i)	-	x	6al	-	x	6aaf	x	-	13i	x	-
6i	-	x	6am	-	x	6aah	-	x	13j	x	-
6k	-	x	6am(i)	-	x	7b	-	x	13k	x	-
6k(i)	-	x	6am(ii)	-	x	7b(i)	-	x	13l	x	-
6p	-	x	6an	-	x	7c	x	-	13m	x	-
6q	-	x	6ao	-	x	7d	-	x	14	-	x
6r	-	x	6ap	-	x	8c	x	-	14a	-	x
6u	-	x	6aq	-	x	8d	x	-	14c	-	x
6v	-	x	6au(iii)	-	x	10c	-	x	14e	-	x
6w	-	x	6au(iv)	-	x	10d	x	-	14f	-	x
6x	-	x	6au(v)	-	x	10e	x	-	16	x	-
6y(ii)	x	-	6av	-	x	10f	-	x	16a	x	-
6z	-	x	6aw	-	x	11a	-	x	16b	x	-
6aa	-	x	6aw(i)	-	x	12	-	x	17	x	-
6aa(ii)	-	x	6ax	-	x	12b	-	x			
6ab	x	-	6ay	-	x	13a(iii)	-	x			
total	3	18		1	20		10	11		11	8
CP total										98	127

point and the carination point were decorated. Fields were occasionally added. During CP2, wavy lines, marked with the edge of an *Anadara* shell, were used in combination with straight lines below the rim. MP3b apart, CP2 motifs differ from CP3 motifs. Some CP2 carination points display remnant cord marks left over from smoothing and burnishing. They were not deliberately added.

TABLE 177: *Carinated burial jar distributions (neonates excluded)*

MP	Burials	With Pots	Per cent	With 2b jars	Per cent	L2b's	E2b's	Motifs: Local	Exotic
2	35	14	40	3	21	2	1	-	-
3	22	20	91	13	65	15	2	11	2
L3	10	9	90	7	89	10	1	9	1
3b	12	11	92	5	45	5	1	4	1
4	28	21	75	16	71	18	4	6	1
5	3	3	100	3	100	9	-	3	-
6	10	10	100	5	40	14	1	8	1
7	4	3	75	1	33	1	-	1	-

TABLE 178: *Carinated burial jar motifs (CM: cord marks, Dble: double line)*

MP	CM jar Burials	Per cent	Pots	Dble jar Burials	Per cent	Pots
3b	1	10	3	-	-	5
4	11	39	11	5	18	8
5	1	33	1	2	66	7
6	5	50	7	2	20	6

RIM FORM WEIGHTS BY STRATIGRAPHIC LAYERS

TABLE 179: *The distribution of rims*

Level:	Rim: 1	1a	1b	1b(i)	1c	1c(i)	1d	2	2a	2b	2c	2d	2e	3	3a	3a(i)	3a(ii)
One total:	11.72	0.02	-	-	-	-	-	3.50	-	-	-	-	-	1.53	-	-	-
Two total:	87.33	0.12	-	-	-	-	-	39.36	0.15	-	-	-	-	4.56	1.29	0.07	-
Three 1	25.21	0.14	0.19	0.02	-	-	-	11.74	0.17	-	0.02	-	-	0.77	-	-	-
2	35.66	0.48	0.07	-	-	-	-	13.43	0.06	-	0.02	-	-	0.97	-	-	-
4	17.77	0.38	0.02	-	-	-	-	4.96	0.32	-	-	-	-	0.69	-	-	-
5	4.10	0.04	-	-	-	-	-	1.84	-	-	-	-	-	0.16	0.04	-	-
Total:	109.48	1.53	0.44	0.02	-	-	-	39.40	0.96	-	0.06	-	-	3.29	0.04	-	-
Four 1	24.00	0.44	0.21	-	-	-	-	10.39	0.15	-	0.30	-	-	1.19	-	-	-
2	11.88	0.23	0.13	-	-	-	-	4.33	-	-	-	-	0.05	0.64	-	-	-
3	9.52	0.06	0.06	-	-	-	-	4.28	0.07	-	-	-	-	0.46	-	-	-
4	2.36	0.10	-	-	-	-	-	1.55	-	-	-	-	-	0.16	-	-	-
5	0.78	0.01	0.02	-	-	-	-	0.51	-	-	-	-	-	0.06	-	-	-
Total:	48.54	0.84	0.42	-	-	-	-	21.06	0.22	-	0.30	-	0.05	2.51	-	-	-
Five 1	3.61	0.22	0.12	-	-	-	-	1.08	-	-	-	-	-	0.24	-	-	-
2	3.03	0.21	0.03	-	-	-	-	0.62	-	-	-	-	-	0.06	-	-	-
3	3.32	0.25	0.12	-	-	-	-	1.50	-	-	-	-	-	0.25	-	-	-
4	2.95	0.45	0.12	-	-	-	-	1.14	-	-	-	-	-	0.23	-	-	-
5	4.21	0.37	0.13	-	-	-	-	1.52	-	-	0.01	-	-	0.52	-	-	-
Total:	17.12	1.50	0.52	-	-	-	-	5.86	-	-	0.01	-	-	1.30	-	-	-
Six 1	2.72	0.51	0.22	-	-	-	-	0.69	-	-	-	-	-	0.27	-	-	-
2	2.24	0.05	0.15	-	-	-	-	0.71	-	-	-	-	-	0.22	-	-	-
3	3.74	0.52	0.24	-	-	-	-	1.18	-	-	0.02	-	-	0.17	-	-	-
4	2.37	0.13	0.20	-	-	-	-	0.88	-	-	0.13	-	-	0.12	-	-	-
5	3.19	0.96	0.14	-	-	-	-	0.49	0.03	0.02	0.05	-	-	0.08	-	-	0.01
6	0.45	0.08	0.03	-	-	-	-	0.12	-	-	-	-	-	0.10	-	-	-
7	1.14	0.23	0.05	-	-	-	-	0.12	-	-	0.06	-	-	0.14	-	-	-
8	1.22	0.16	0.01	-	-	-	-	0.06	-	-	-	-	-	0.07	-	-	-
Total:	17.07	2.64	1.04	-	-	-	-	4.25	0.03	0.02	0.26	-	-	1.17	-	-	0.01
Seven 1	2.30	0.20	0.12	-	-	-	-	0.32	-	-	-	-	-	0.20	-	-	0.03
2	1.51	0.17	0.06	-	-	-	-	0.12	-	-	-	-	-	0.20	-	-	-
3	1.11	-	0.15	-	-	-	-	0.10	-	-	-	-	-	0.20	-	-	-
4	1.71	0.02	0.03	-	-	-	-	0.06	-	-	-	-	-	0.21	-	-	-
5	1.69	0.34	0.09	-	-	-	-	0.27	-	-	0.02	-	-	0.36	-	-	0.01
6	0.76	0.13	0.03	-	-	-	-	0.05	-	-	-	-	-	0.20	-	-	-
7	0.71	0.07	-	-	-	-	-	0.17	-	-	0.07	-	-	0.17	-	-	-
8	0.14	-	0.03	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-
Total:	9.93	0.93	0.51	-	-	-	-	1.09	-	-	0.09	-	-	1.57	-	-	0.04
Eight 1	0.98	0.58	0.07	-	-	-	-	0.06	-	-	-	0.05	-	0.36	-	-	-
2	1.67	0.39	0.03	-	-	-	-	0.23	-	-	-	-	-	0.36	0.04	-	-
3	0.89	0.14	0.08	-	-	-	-	0.29	-	-	-	-	-	0.29	0.01	-	-
4	1.29	0.40	0.08	-	-	-	-	0.33	-	-	-	-	-	0.24	-	-	-
5	0.99	0.03	0.06	-	-	-	-	0.22	-	-	-	0.03	-	0.13	-	-	-
6	0.63	0.05	0.09	-	-	-	-	0.14	0.02	-	-	-	-	0.19	-	-	-
7	1.15	0.23	0.08	-	-	-	-	0.48	-	-	-	-	-	0.42	-	-	0.08
Total:	7.60	1.82	0.49	-	-	-	-	1.75	0.02	-	-	0.08	-	1.83	0.05	-	0.08
Nine 1	1.00	0.05	0.07	-	-	-	-	0.29	-	-	-	-	-	0.29	-	-	-
2	0.89	0.10	0.06	-	0.06	-	-	0.48	-	-	-	-	-	0.24	-	-	-
3	1.26	0.06	0.10	-	-	-	-	0.59	-	-	-	-	-	0.36	-	-	-
4	0.72	0.13	0.17	-	-	-	-	0.51	0.02	-	-	-	-	0.15	-	-	-
5	0.58	0.14	0.11	-	-	-	-	0.47	0.02	-	-	-	-	0.19	-	-	-
6	0.68	0.01	0.24	-	-	-	-	0.84	-	-	-	-	-	0.33	-	-	-
7	0.29	0.01	0.04	-	0.08	-	-	0.26	-	-	-	-	-	0.17	-	-	-
Total:	5.42	0.50	0.79	-	0.14	-	-	3.44	0.04	-	-	-	-	1.73	-	-	-
Ten 1	2.08	0.15	0.04	-	0.08	-	-	0.45	0.21	0.05	-	-	-	0.13	0.01	-	-
2	0.84	0.01	0.04	-	0.04	-	-	0.52	0.21	0.07	-	-	-	0.15	-	-	-
3	6.46	0.18	0.20	-	0.06	-	-	1.58	0.26	-	0.94	0.02	-	0.94	0.01	-	0.04
4	0.46	0.03	0.01	-	-	-	-	0.14	0.03	-	0.01	-	-	0.14	-	-	-
5	0.35	-	0.02	-	-	-	-	0.17	0.15	-	0.02	-	-	0.10	-	-	-
6	0.72	0.03	-	-	0.05	-	-	0.15	-	-	-	-	-	0.22	-	-	-
7	1.31	-	0.07	-	0.05	0.03	-	0.29	0.03	-	0.14	-	-	0.10	-	-	-
8	1.70	0.05	0.08	-	0.09	-	-	0.28	-	-	0.03	-	-	0.01	-	-	0.01
9	1.38	0.01	0.04	-	0.03	-	0.03	0.11	-	-	0.07	-	-	0.06	-	-	-
10	1.11	-	-	-	0.05	-	-	0.20	0.02	-	-	-	-	0.04	-	-	-
11	1.19	-	0.03	-	0.05	-	-	0.34	-	-	0.03	-	-	0.13	-	-	-
12	0.71	-	0.05	-	0.06	-	0.04	0.09	-	-	0.07	-	-	0.21	-	-	-
13	1.08	-	0.06	-	0.03	-	-	0.29	-	-	0.07	-	-	0.19	-	-	-
14	1.52	-	-	-	-	-	-	0.10	-	-	0.08	-	-	0.15	-	-	-
15	1.57	-	0.02	-	-	-	-	0.05	0.02	-	0.11	0.01	-	0.18	-	0.01	-
16	1.00	-	-	-	-	-	-	-	-	-	0.01	-	-	0.23	-	-	-
17	1.02	-	0.05	-	-	-	-	0.01	-	-	0.08	-	-	0.19	-	-	-
18	1.03	-	-	-	0.01	-	-	-	-	-	0.06	-	-	0.24	-	-	-
19	1.43	-	-	-	-	-	-	0.07	-	-	0.06	-	-	0.14	-	-	-
20	0.78	-	0.01	-	-	-	-	0.07	0.01	-	0.03	-	-	0.08	-	-	-
21	1.33	0.01	0.10	-	-	-	-	0.08	-	-	0.04	-	-	0.16	-	-	-
22	1.16	-	-	-	-	-	-	-	-	-	0.07	-	-	0.04	-	-	-
23	1.11	-	-	-	0.02	-	-	-	-	-	0.02	-	-	0.03	-	-	-
24	1.02	-	0.05	-	-	-	-	0.03	-	-	0.03	-	-	0.08	-	-	-
25	1.45	-	-	-	-	-	-	0.01	0.01	-	0.07	-	-	0.17	-	-	-
26	0.52	-	-	-	-	-	-	-	-	-	0.06	-	-	0.08	-	-	-
Total:	34.33	0.47	0.87	-	0.62	0.03	0.07	5.03	0.95	0.12	2.10	0.03	-	4.19	0.02	0.01	0.05
eleven 1	2.95	-	-	-	-	-	-	0.15	-	0.06	-	-	-	0.55	0.01	-	-
2	0.74	-	-	-	-	-	-	0.02	-	-	-	-	-	0.06	0.04	-	-
total:	3.69	-	-	-	-	-	-	0.17	-	0.06	-	-	-	0.61	0.05	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	3a(iii)	3a(iv)	3b	3b(i)	3b(ii)	3c	3c(i)	3c(ii)	3c(iii)	3c(iv)	3c(v)	3d	3e	3f	3f(i)	3g	3h
One total:	-	-	0.36	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-
Two total:	-	-	5.66	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06
Three 1	-	-	1.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	1.72	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	1.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	0.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	5.54	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-
Four 1	-	-	1.88	-	-	-	-	-	-	-	-	-	-	-	-	-	0.12
2	-	-	0.86	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
3	-	-	0.58	-	-	-	-	-	-	-	-	-	-	-	-	-	0.11
4	-	-	0.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	3.60	-	-	-	-	-	-	-	-	-	-	-	-	-	0.25
Five 1	-	-	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
3	-	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	0.13
4	-	-	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
5	-	-	0.52	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07
Total:	-	-	1.30	-	-	-	-	-	-	-	-	-	-	-	-	-	0.23
Six 1	-	-	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	0.09	0.01	-	-	-	-	0.01	-	-	-	-	-	-	0.02	-
4	-	-	0.16	-	-	-	-	-	-	-	-	-	-	-	-	0.08	-
5	-	-	0.21	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
6	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	0.10	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-
8	-	-	0.03	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	0.95	0.01	-	0.01	-	-	0.02	-	-	-	-	-	-	0.11	-
Seven 1	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	0.18	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	0.07	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-
6	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	0.34	-	-	-	-	-	0.01	-	-	-	-	-	0.04	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	0.08	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-
3	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	0.05	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-
6	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	0.31	-	-	-	0.02	0.05	-	-	-	-	-	-	-	-	-
Nine 1	-	-	0.26	-	-	0.01	0.01	-	-	-	-	-	-	-	-	-	-
2	-	-	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	0.07	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
4	-	-	0.01	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-
5	-	-	0.05	-	-	-	-	0.01	0.02	-	-	-	-	-	-	-	-
6	-	-	0.01	-	-	-	-	0.16	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	0.56	-	-	0.01	0.01	0.17	0.06	-	-	-	-	-	-	-	-
Ten 1	-	-	0.14	-	-	0.02	0.01	-	-	-	-	-	0.01	-	-	-	-
2	-	-	0.04	0.03	-	0.01	-	-	0.01	-	-	-	-	0.06	-	-	-
3	0.03	-	0.22	-	-	-	-	0.08	0.13	0.05	-	-	-	0.02	-	-	-
4	-	-	0.05	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-
5	0.01	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-
6	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	0.01	-	0.01	-	-	-	-	-	0.17	-	-	-	-	-	-	-	-
8	0.01	-	0.01	-	-	-	-	0.01	0.09	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	0.02	-	0.22	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	0.02	0.12	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	0.12	0.02	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	0.01	0.29	0.05	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	0.22	0.03	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	0.30	0.01	-	-	-	-	-	-	-
15	0.02	-	-	-	-	-	0.02	-	0.29	0.03	-	-	-	-	-	-	-
16	-	-	0.02	-	-	-	-	-	0.09	-	-	-	-	-	-	-	-
17	-	0.02	-	-	-	-	0.05	-	0.11	0.01	-	-	0.01	-	-	-	-
18	0.05	0.01	-	-	-	-	-	-	0.12	0.05	0.02	-	-	-	-	-	-
19	0.03	-	-	-	-	-	-	-	0.11	0.09	0.04	-	-	-	-	-	-
20	-	-	0.01	-	-	-	-	-	0.08	-	0.03	-	-	-	-	-	-
21	0.01	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-
22	0.02	-	-	-	-	-	0.02	-	0.05	-	-	-	-	-	-	-	-
23	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-
25	0.02	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-
26	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.26	0.03	0.55	0.05	-	0.03	0.12	0.15	2.56	0.34	0.09	-	0.03	0.10	-	-	-
eleven 1	-	0.01	-	-	-	-	-	-	0.32	0.01	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-
total:	-	0.01	-	-	-	-	-	-	0.34	0.01	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	3i	3j	3k	4	4aCP1	4a(i)CP2	4bCP1	4a	4b	4b(i)	4c	4d	4e	4f	4f(i)	4g	4h
One total:	-	-	-	0.92	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	0.03	0.03	-	5.06	-	-	-	0.02	0.39	0.15	0.07	0.08	0.01	0.02	-	0.01	-
Three 1	0.20	-	-	0.53	-	-	-	0.01	0.12	-	0.02	0.05	0.01	0.03	-	0.06	0.02
2	0.16	-	-	0.51	-	-	-	-	0.06	-	0.04	0.01	-	-	-	0.01	-
3	0.17	-	-	0.76	-	-	-	-	0.04	-	0.01	-	-	-	-	-	-
4	0.10	-	-	0.67	-	-	-	-	-	-	-	-	-	-	-	-	-
5	0.14	-	-	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.77	-	-	2.56	-	-	-	0.01	0.22	-	0.07	0.06	0.01	0.03	-	0.07	0.02
Four 1	0.08	-	-	1.09	-	-	-	-	-	-	-	0.02	0.02	-	-	-	-
2	0.23	0.06	-	0.32	-	-	-	-	-	-	0.02	-	-	-	-	-	-
3	-	-	-	0.39	-	-	-	0.04	0.05	-	0.02	-	0.02	0.05	-	-	0.04
4	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-
5	-	-	0.03	0.01	-	-	-	-	-	-	-	-	-	-	-	0.01	-
Total:	0.31	0.06	0.03	1.81	-	-	-	0.04	0.10	-	0.04	0.02	0.04	0.05	-	0.01	0.04
Five 1	-	-	-	0.39	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.34	-	-	-	-	-	-	-	-	-	-	-	-	-
3	0.02	-	-	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.41	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	0.78	-	-	-	-	-	-	-	-	-	0.06	-	-	-
Total:	0.02	-	-	2.15	-	-	-	-	-	-	-	-	-	0.06	-	-	-
Six 1	-	-	-	0.51	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.18	-	-	-	-	-	-	-	-	-	0.02	-	-	-
3	-	-	-	0.37	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.41	-	-	-	-	-	-	-	-	-	0.02	0.12	-	-
5	-	-	-	0.42	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	0.03	-	-
7	-	-	-	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	2.20	-	-	-	-	-	-	-	-	-	0.04	0.15	-	-
Seven 1	-	-	-	0.28	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.60	-	-	-	-	-	-	-	-	-	0.01	0.01	-	-
3	-	-	-	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.23	-	-	-	-	-	-	-	-	-	-	0.02	-	-
5	-	-	-	0.32	-	-	-	-	-	-	-	-	-	-	0.01	-	-
6	-	-	-	0.07	-	-	-	-	-	-	-	-	-	-	0.07	-	-
7	-	-	-	0.19	-	-	-	-	-	-	-	-	-	-	0.19	-	-
8	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	1.81	-	-	-	-	-	-	-	-	-	0.01	0.30	-	-
Eight 1	-	-	-	0.44	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.40	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	0.32	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.30	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	0.24	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	0.37	-	-	-	-	-	-	-	-	-	-	0.04	-	-
Total:	-	-	-	2.40	-	-	-	-	-	-	-	-	-	-	0.04	-	-
Nine 1	-	-	-	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.23	-	0.01	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.24	-	-	-	-	-	-	-	-	-	-	0.04	-	-
5	-	-	-	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	0.54	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	0.12	-	-	-	-	-	-	-	-	-	-	0.02	-	-
Total:	-	-	-	1.68	-	0.01	-	-	-	-	-	-	-	-	0.06	-	-
Ten 1	-	-	-	0.53	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.28	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	1.24	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.19	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	0.29	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	0.41	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	0.36	-	0.02	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	0.36	-	0.05	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-
15	0.03	-	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	0.48	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	0.22	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.03	-	-	6.33	-	0.07	-	-	-	-	-	-	-	-	-	-	-
eleven 1	-	-	-	0.05	0.44	-	0.02	-	-	-	0.05	-	-	-	-	-	-
2	0.06	-	-	-	0.08	-	0.03	-	-	-	-	-	-	-	-	-	-
total:	0.06	-	-	0.05	0.52	-	0.05	-	-	-	0.05	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	4i	4i(i)	4j	4k	4l	4m	4m(i)	4n	4o	4p	4q	4r	4s	4t	4u	4v	4w
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	0.08	-	0.07	-	0.07	-	-	-	-	-	-	-	-	-
Three 1	0.04	-	0.01	0.03	-	0.04	-	-	0.03	-	-	-	-	-	-	-	-
2	0.01	-	-	0.03	0.04	0.02	-	0.03	0.03	0.02	0.03	0.02	0.05	0.01	0.01	-	-
3	-	-	-	-	-	0.04	-	-	0.01	-	-	-	0.02	-	-	-	-
4	-	-	-	-	-	0.01	0.01	-	-	-	-	-	-	-	0.02	0.02	0.17
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.05	-	0.01	0.06	0.04	0.11	0.01	0.03	0.07	0.02	0.03	0.02	0.07	0.01	0.03	0.02	0.17
Four 1	-	-	-	-	-	0.03	-	-	-	0.03	0.04	0.05	0.02	0.07	-	0.02	-
2	0.05	-	0.09	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-
3	-	-	-	0.02	-	-	-	-	0.07	-	-	-	-	-	-	-	0.04
4	-	-	-	-	0.02	0.01	-	-	-	-	-	-	0.05	-	-	0.08	-
5	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-
Total:	0.05	-	0.09	0.02	0.02	0.04	-	0.03	0.07	0.03	0.04	0.05	0.07	0.07	0.02	0.10	0.04
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.03	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-
Six 1	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.05	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	4x	4y	4z	4aa	4ab	4ac	4ad	4ae	4af	4ag	4ah	4ai	4aj	4ak	4al	4am	4an
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	0.12	-	-	0.06	-	0.05	-	0.03	0.07	0.05	0.15	0.14	0.08	-	-	-
Three 1	0.02	0.02	-	-	0.02	-	0.11	-	-	-	-	-	-	-	-	-	-
2	0.03	-	0.02	0.02	0.07	-	-	-	-	-	-	-	-	-	0.02	-	-
3	0.02	-	-	-	-	0.06	0.02	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-
Total:	0.07	0.02	0.02	0.02	0.09	0.06	0.14	0.02	-	-	-	-	-	-	0.02	-	-
Four 1	0.04	-	-	0.03	-	-	0.03	0.06	-	-	-	-	-	-	-	-	-
2	-	-	0.03	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	0.03	-	0.04	-	-	-	-	-	-	-	-	-	-
4	-	0.01	-	-	0.05	-	0.03	-	-	-	-	-	-	0.02	0.04	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.04	0.01	0.03	0.03	0.08	0.01	0.10	0.06	-	-	-	-	-	0.02	0.04	-	-
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-
4	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	0.01	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
Total:	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	0.01	0.07	0.04
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.15	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	4ao	4ap	4aq	4ar	4as	4at	4au	4av	4aw	4ax	4ay	4az	4aaa	4aab	4aac	4aad	4aae
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Three 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Four 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.08	0.04
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07	0.08	0.04
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Six 1	-	-	-	-	-	0.04	-	-	-	-	0.04	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	0.02	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-
5	-	0.02	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-
Total:	-	0.04	0.03	0.02	0.03	0.04	-	-	-	-	0.06	-	-	-	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	0.02	-	-	-	0.01	-	-	-	-	-	-
3	-	-	-	-	-	-	-	0.02	-	-	-	-	0.08	-	-	-	-
4	-	-	-	-	-	-	-	-	0.04	0.02	-	-	-	0.01	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	0.02	0.02	0.04	0.02	0.01	-	0.08	0.01	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	0.01	0.02	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	0.01	0.03	-	-	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	0.19	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	0.20	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	0.25	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	4aaf	4aag	4aah	4aai	4aaj	5	5a	5a(i)	5b	5b(i)	5b(ii)	5b(iii)	5c	5c(i)	5c(ii)	5d	5e
One total:	-	-	-	-	-	0.56	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	5.94	0.01	-	0.05	-	-	-	0.01	-	-	0.50	0.14
Three 1	-	-	-	-	-	1.28	-	-	-	-	-	-	0.02	-	-	-	-
2	-	-	-	-	-	1.27	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	0.82	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.80	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	0.27	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	4.44	-	-	-	-	-	-	0.02	-	-	-	-
Four 1	0.02	0.02	-	0.01	-	1.28	-	-	-	-	-	-	-	-	-	-	-
2	-	-	0.03	-	0.08	0.80	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	0.82	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.24	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	-	-
Total:	0.02	0.02	0.03	0.01	0.08	3.28	-	-	-	-	-	-	-	-	-	-	-
Five 1	-	-	-	-	-	0.45	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.43	-	-	-	-	-	-	0.08	-	-	-	-
3	-	-	-	-	-	0.66	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.62	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	1.20	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	3.36	-	-	-	-	-	-	0.08	-	-	-	-
Six 1	-	-	-	-	-	1.61	-	-	-	-	-	-	0.01	-	-	-	-
2	-	-	-	-	-	0.78	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	1.60	-	-	-	-	-	-	0.02	-	-	-	-
4	-	-	-	-	-	1.41	-	-	-	-	-	-	0.02	-	-	-	-
5	-	-	-	-	-	1.51	-	-	-	-	-	0.01	-	-	-	-	-
6	-	-	-	-	-	0.24	-	-	-	-	-	-	0.03	-	-	-	-
7	-	-	-	-	-	1.05	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	0.30	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	8.50	-	-	-	-	-	0.01	0.08	-	-	-	-
Seven 1	-	-	-	-	-	1.06	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	1.68	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	1.28	0.01	-	-	-	-	-	0.04	-	-	-	-
4	-	-	-	-	-	1.01	-	-	-	-	-	-	0.04	-	-	-	-
5	-	-	-	-	-	0.83	-	-	-	-	-	-	0.03	-	-	-	-
6	-	-	-	-	-	0.55	-	0.03	-	-	-	-	0.01	-	-	-	-
7	-	-	-	-	-	0.98	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	7.47	0.01	0.03	-	-	-	-	0.12	-	-	-	-
Eight 1	-	-	-	-	-	0.67	-	0.04	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	1.09	-	0.02	-	-	-	-	0.02	-	-	-	-
3	-	-	-	-	-	0.76	-	0.07	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.47	-	-	-	-	-	-	0.02	-	-	-	-
5	-	-	-	-	-	0.60	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	0.55	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	0.91	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	5.05	-	0.13	-	-	-	-	0.04	-	-	-	-
Nine 1	-	-	-	-	-	0.99	-	-	-	-	-	-	0.01	-	-	-	-
2	-	-	-	-	-	1.02	-	-	-	-	-	-	0.02	-	-	-	-
3	-	-	-	-	-	0.83	0.01	-	-	-	-	0.02	-	-	-	-	-
4	-	-	-	-	-	0.72	-	-	-	-	-	-	0.02	0.01	-	-	-
5	-	-	-	-	-	1.20	-	-	0.03	-	-	-	-	-	-	-	-
6	-	-	-	-	-	1.07	-	0.01	-	-	-	-	0.03	-	-	-	-
7	-	-	-	-	-	0.41	-	-	-	-	-	-	0.02	-	-	-	-
Total:	-	-	-	-	-	6.24	0.01	0.01	0.03	-	-	0.02	0.10	0.01	-	-	-
Ten 1	-	-	-	-	-	0.91	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	1.04	0.03	0.01	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	3.04	0.01	-	0.12	-	0.02	-	0.01	-	-	-	-
4	-	-	-	-	-	0.40	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	0.39	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	0.49	0.02	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	0.47	0.02	-	-	0.02	-	-	-	-	-	-	-
8	-	-	-	-	-	0.57	0.01	-	-	-	-	-	0.01	-	-	-	-
9	-	-	-	-	-	0.58	0.01	-	0.07	-	-	-	-	-	-	-	-
10	-	-	-	-	-	0.51	0.02	-	-	-	-	0.01	-	-	-	-	-
11	-	-	-	-	-	0.60	0.01	-	0.01	-	-	-	0.08	-	-	-	-
12	-	-	-	-	-	0.87	0.04	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	1.03	-	-	-	-	-	-	-	-	-	-	0.03
14	-	-	-	-	-	1.61	-	0.02	-	-	-	-	0.01	-	-	0.01	0.03
15	-	-	-	-	-	1.30	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	0.47	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	0.91	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	0.46	-	-	0.01	-	-	-	-	-	-	-	-
19	-	-	-	-	-	0.77	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	0.35	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	0.44	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	0.33	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	0.20	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	0.53	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	1.18	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	0.17	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	19.65	0.17	0.03	0.21	0.02	0.02	0.01	0.11	-	-	0.01	0.06
eleven 1	-	-	-	-	-	2.17	0.05	-	0.03	-	-	-	0.08	0.03	0.02	0.11	0.07
2	-	-	-	-	-	0.30	-	-	-	-	-	-	0.04	-	-	0.01	-
total:	-	-	-	-	-	2.47	0.05	-	0.03	-	-	-	0.12	0.03	0.02	0.12	0.07

TABLE 179: *The distribution of rims (continued)*

Level:	5e(i)	5f	5g	5g(i)	5g(ii)	5h	5i	5i(i)	5i(ii)	5j	5j(i)	5j(ii)	5k	5l	5m	5n	5o
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	0.34	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Three 1	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-
Four 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	0.01	0.03	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	0.01	0.03	-	-	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	0.01	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	0.01	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	0.02	-	0.01	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
3	-	-	-	0.01	0.01	-	-	-	-	-	0.01	-	-	-	-	-	0.01
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-
12	0.01	-	-	-	-	-	0.01	-	-	0.01	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	0.03	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-
15	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	0.01	0.01	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	0.03	-	0.01	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.01	0.01	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.01	0.01	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.04	0.01	0.01	0.01	0.03	-	0.03	0.01	0.01	0.09	0.01	0.01	0.02	0.02	0.02	0.02	0.03
eleven 1	-	0.01	0.01	-	-	0.01	0.01	-	-	-	-	0.04	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-
total:	-	0.01	0.01	-	-	0.01	0.01	-	-	-	-	0.05	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	5p	5p(i)	5p(ii)	5p(iii)	5p(iv)	5q	5r	5s	5t	5u	5v	5w	5x	5y	5y(i)	5y(ii)	5z
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Three 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Four 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	0.03	-	-	-	0.04	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.02	-	-	-	-	-	-	0.03	-	-	-	0.04	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	0.02	-	-	-	-	-	0.03	-	0.01	-	-	-	-	-	-	-
3	0.02	0.01	-	-	0.01	-	-	0.01	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.01	-	-	0.01	0.01	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-
7	-	-	0.01	-	-	-	-	-	-	-	-	-	-	0.01	0.02	-	-
8	-	-	-	0.01	-	-	0.01	-	-	-	-	-	-	-	-	0.01	0.01
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	0.02	-	-
16	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.02	0.06	0.02	0.01	0.01	0.04	0.03	0.01
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	5aa	5ab	5ac	5ad	5ad(i)	5ad(ii)	5ad(iii)	5ad(iv)	5ad(v)	5ad(vi)	5ad(vii)	5ad(viii)	5ae	5af	5ag	5ah	5ai
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Three 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Four 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-
4	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-
Total:	-	-	-	0.06	-	-	-	0.01	-	-	-	-	-	0.01	-	-	-
Six 1	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.07	-	-	-	-	-	-	-	0.03	-	-	-	-	-
3	-	-	-	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	0.10	0.04	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	0.48	0.04	-	-	-	-	-	-	0.03	-	-	-	-	-
Nine 1	-	-	-	0.06	-	-	0.02	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	0.02	-	-	0.01	-	-	-	-	-	-
3	-	-	-	-	0.02	-	-	-	-	-	-	0.05	-	-	-	-	-
4	-	-	-	0.07	-	-	-	-	-	-	-	0.03	-	-	-	-	-
5	-	-	-	0.03	-	-	0.04	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	0.03	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-
Total:	-	-	0.03	0.16	0.02	-	0.06	0.02	-	0.03	0.01	0.08	-	-	-	-	-
Ten 1	-	-	-	0.09	-	-	-	-	-	-	-	-	-	-	0.01	-	0.02
2	-	-	0.01	0.22	-	-	-	-	-	0.01	-	-	-	-	-	-	0.04
3	-	-	0.01	0.70	0.02	0.05	0.01	0.01	-	0.01	-	-	-	-	0.01	-	-
4	0.01	0.01	-	0.05	-	-	-	-	0.02	-	-	-	-	-	-	-	-
5	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	0.04	-
6	-	-	-	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	0.02	0.06	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	0.09	-	-	-	-	-	-	-	-	-	0.01	-	-	-
11	-	-	-	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-
12	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
15	-	-	-	0.03	-	-	-	-	-	-	-	-	0.06	-	-	-	0.01
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	0.01	-	-	-	-	-	-	-	-	0.01	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.03	0.01	0.02	1.47	0.08	0.05	0.01	0.01	0.02	0.02	-	-	0.10	0.01	0.02	0.04	0.09
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	5ai(i)	5ai(ii)	5aj	5aj(i)	5ak	5al	5am	5an	5ao	5ap	5aq	5ar	5as	5at	5au	5av	5aw
One total:	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	0.13	-	-	-	-	-	-	-	-	-	-	-	-
Three 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Four 1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	0.02	-	-	-	-	-	-	-	-	0.01	-	-	-
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	0.05
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	0.05
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	0.02	-	0.01	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	0.07	-	0.01	-	-	0.07
Seven 1	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-
2	-	-	-	-	-	-	-	-	-	-	-	0.03	0.06	-	-	0.02	0.01
3	-	-	-	-	0.05	-	-	-	-	-	-	0.01	0.01	-	-	-	-
4	-	-	-	-	0.04	-	-	-	-	-	-	-	0.08	-	0.02	-	-
5	-	-	-	-	0.04	-	-	-	-	-	-	-	0.02	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	0.06	0.01	-	-	-
Total:	-	-	-	-	0.13	-	-	-	-	-	-	0.04	0.23	0.01	0.06	0.02	0.01
Nine 1	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	0.02	-	0.03	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	0.03	-	0.06	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	0.02	0.01	-	0.01	0.01	-	-	0.01	0.01	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	0.01	-	-	-	0.01	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.04	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.01	-	-	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	5aw(i)	5ay	5az	5aaa	5aab	5aac	5aad	5aae	5aaf	5aag	5aag(i)	5aah	5aai	5aaj	5aak	5aal	5aal(i)
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	0.02	0.05	-	-	-	-	-	-	-	-	0.01	0.02
Three 1	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	0.03	-	0.01
2	-	-	-	-	-	-	0.04	-	-	-	0.01	-	0.02	-	-	-	-
3	-	-	-	-	-	-	-	0.01	-	-	0.02	-	0.01	-	0.01	-	-
4	-	-	-	-	-	-	0.01	-	0.04	-	-	-	-	-	0.02	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	-
Total:	-	-	-	-	-	-	0.06	0.01	0.04	-	0.03	-	0.03	-	0.06	0.16	0.01
Four 1	-	-	-	-	-	-	-	-	0.01	-	-	-	0.02	-	0.04	0.02	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	0.01	-
3	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	0.02	0.02	0.01
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	0.01	0.01	-	-	-	0.02	0.02	0.06	0.05	0.01
Five 1	-	-	-	-	-	-	0.01	0.01	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	0.03	0.03	-	-	-	-	-	-	-
4	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-
Total:	-	-	-	-	-	0.03	0.01	0.03	0.03	0.03	-	0.02	-	-	-	-	-
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	0.05	-	-	-	0.02	-	-	-	-	-	-	-	-
Seven 1	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.01	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.01	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	5aam	5aam(i)	5aam(ii)	5aam(iii)	5aan	5aao	5aap	5aap(i)	5aap(ii)	5aaq	5aar	5aas	5aat	5aau	5aav	5aav(i)	5aaw
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	0.03	-	0.05	-	-	-	0.02	-	-	-	-	-
Three 1	0.02	-	-	-	0.04	0.01	0.03	0.18	-	0.02	0.02	-	-	-	-	-	-
2	-	-	-	-	0.02	0.11	0.01	0.03	0.02	0.03	0.02	-	-	0.07	0.05	0.01	-
3	-	-	0.02	-	-	0.07	0.03	0.16	-	-	0.05	0.02	-	-	0.02	-	-
4	-	-	-	-	0.02	-	-	0.02	-	-	-	-	0.02	-	-	-	0.03
5	-	-	-	-	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-
Total:	0.02	-	0.02	-	0.12	0.23	0.07	0.39	0.02	0.05	0.09	0.02	0.02	0.07	0.07	-	0.03
Four 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	0.01	0.02	-	-	0.02	-	0.06	-	-	-	-	-	-	-	-	-	-
3	0.04	-	0.02	-	-	0.02	-	0.03	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	0.02	-	-
5	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.05	0.02	0.02	0.02	0.02	0.04	0.06	0.03	-	-	-	-	-	-	0.02	-	-
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	5aax	6	6a	6b	6b(i)	6b(ii)	6b(iii)	6b(iv)	6b(v)	6b(vi)	6b(vii)	6c	6c(i)	6c(ii)	6c(iii)	6c(iv)	6d
One total:	-	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	1.91	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
Three 1	-	0.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	1.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	0.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	0.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	3.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Four 1	-	1.01	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-
2	-	0.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	0.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	1.91	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-
Five 1	-	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	0.12	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-
4	-	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	0.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.90	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-
Six 1	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	0.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	1.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seven 1	-	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	0.11	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
6	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	0.12	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-
8	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.72	-	-	-	-	-	-	-	-	0.01	-	-	0.02	-	-	-
Eight 1	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	0.17	-	-	-	-	-	-	-	-	-	-	0.03	0.02	-	-	-
3	0.21	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0.02	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	0.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.23	0.96	-	-	-	-	-	-	-	-	-	-	0.03	0.02	-	-	-
Nine 1	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ten 1	-	0.04	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-
2	-	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	0.42	-	-	-	-	-	-	-	-	-	0.01	-	-	0.01	-	-
4	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	0.09	-	-	-	-	-	-	-	0.04	-	-	-	-	-	-	-
12	-	0.03	-	-	0.01	-	0.02	0.02	-	-	-	0.01	-	-	-	-	-
13	-	0.18	-	-	-	-	-	-	-	0.01	-	-	0.01	-	-	-	-
14	-	0.03	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
15	-	0.06	-	-	-	-	0.01	-	0.01	-	-	-	0.01	0.01	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	0.02	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
18	-	0.07	-	0.04	-	-	-	0.01	-	-	-	-	-	-	-	-	-
19	-	0.02	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
20	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-
22	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	0.01	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	0.02	0.02	0.15	0.02	0.01	0.01	-	-	-	-	-	-	-	-	-	-
26	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	1.28	0.02	0.20	0.03	0.01	0.04	0.03	0.02	0.07	-	0.04	0.03	0.01	0.02	-	-
eleven 1	-	0.06	0.01	0.02	-	-	-	-	-	-	-	0.03	-	-	-	-	0.01
2	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	0.06	0.01	0.06	-	-	-	-	-	-	-	0.03	-	-	-	-	0.01

TABLE 179: *The distribution of rims (continued)*

Level:	6e	6f	6f(i)	6f(ii)	6f(iii)	6g	6g(i)	6g(ii)	6h	6h(i)	6i	6j	6k	6k(i)	6l	6m	6n
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Three 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Four 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Six 1	-	-	-	-	-	0.01	-	-	-	0.02	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
5	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.03	-	-	-	0.02	-	-	0.04	-	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	0.03	0.01	-	-	-
3	-	-	-	-	-	-	0.01	-	-	-	-	-	-	0.01	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03
10	-	-	-	-	-	0.02	0.04	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	0.01
13	-	-	-	-	-	0.01	0.02	-	-	-	-	0.01	-	-	-	-	-
14	-	-	-	-	-	0.05	0.01	0.02	0.01	-	-	-	-	-	-	0.01	-
15	-	0.01	-	-	-	0.07	-	-	-	-	-	-	-	-	0.01	-	-
16	-	0.04	0.02	0.02	0.02	0.01	0.01	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-
18	-	-	-	-	-	0.01	-	-	0.01	-	0.01	0.01	-	-	-	-	-
19	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.06	0.02	0.02	0.02	0.22	0.11	0.02	0.02	-	0.01	0.02	0.08	0.07	0.01	0.01	0.04
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	6o	6p	6q	6r	6s	6t	6u	6v	6w	6x	6y	6y(i)	6y(ii)	6z	6aa	6aa(i)	6aa(ii)
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-
Three 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	0.02	0.02	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	0.02	0.02	-	-	0.02	-
Four 1	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	0.01	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	0.09	-	-	0.01	-
Five 1	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	0.01
Total:	-	-	-	0.01	-	-	-	-	-	-	-	0.02	-	-	-	-	0.01
Six 1	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	0.03	0.05	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	0.02	-
5	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	0.01	-	-	-	0.07	-	-	-	0.08	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-
Total:	-	-	-	-	-	-	0.01	-	-	-	0.17	0.05	-	-	0.08	0.03	-
Seven 1	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	0.01	-	-
2	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	0.08	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	0.04
4	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	0.03	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04	0.01	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	0.07	0.02	-	-	0.05	0.16	0.04
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	0.02	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	0.03	-
Nine 1	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	0.01	-
2	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	0.02	-
3	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	0.02	-
4	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
5	-	-	-	-	-	-	-	0.04	-	-	-	-	-	-	-	0.02	-
6	-	-	-	-	-	-	-	-	-	-	0.08	-	-	-	-	0.01	-
7	-	0.04	-	-	-	-	-	-	-	-	0.01	-	-	-	-	0.01	-
Total:	-	0.04	-	-	-	-	-	0.04	-	-	0.17	-	-	-	-	0.09	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	0.02	0.01	-	-	-	-	0.02	0.02	-	-	-	0.01	-	0.01	-
3	-	-	-	0.01	0.02	0.02	0.02	0.01	-	-	-	-	-	-	-	-	-
4	-	0.01	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.01	0.01	0.02	0.02	0.07	0.02	0.06	0.01	0.02	0.07	-	-	-	0.01	-	0.03	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	6ab	6ab(i)	6ac	6ad	6ad(i)	6ae	6af	6ag	6ah	6ai	6aj	6ak	6al	6am	6am(i)	6am(ii)	6an
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-
Three 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Four 1	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.02	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06	0.02	-	-
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	0.14	0.01	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	0.14	0.01	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	0.11	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	0.01	-	0.02
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.01	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	0.11	0.02	0.07	0.02
Nine 1	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	0.01	-	-	-	-	-	-	-	0.01	-	-	-	-
Total:	-	-	-	-	0.01	-	-	-	-	-	-	0.01	0.01	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
2	-	-	0.02	0.01	-	0.01	-	-	-	-	-	-	-	-	-	-	-
3	-	-	0.03	0.02	-	-	-	-	0.01	0.06	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	0.02	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-
7	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	0.01	-	-	0.01	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	0.01	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.01	0.01	0.09	0.14	-	0.01	0.01	0.01	0.01	0.06	0.01	-	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	6ao	6ap	6aq	6au	6au(i)	6au(ii)	6au(iii)	6au(iv)	6au(v)	6au(vi)	6av	6aw	6aw(i)	6ax	6ay	6az	6aaa
One total:	-	-	-	0.17	-	0.04	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	2.56	0.02	0.11	-	-	-	-	-	-	-	-	-	-	0.01
Three 1	-	-	-	0.12	0.02	0.17	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	0.24	0.06	0.09	-	-	-	0.02	-	-	-	-	-	-	-
3	-	-	-	0.05	0.01	0.05	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	0.03	0.01	-	-	-	-	0.01	-	-	-	-	-	-	-
Total:	-	-	-	0.54	0.10	0.31	-	-	-	0.03	-	-	-	-	-	-	-
Four 1	-	-	-	0.06	0.12	-	-	-	-	0.01	-	-	-	-	-	-	0.07
2	-	-	-	-	0.08	-	-	-	-	0.02	-	-	-	-	-	-	-
3	-	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	0.12	0.26	-	-	-	-	0.03	-	-	-	-	-	-	0.07
Five 1	-	-	-	0.02	-	-	-	-	-	0.12	-	-	-	-	-	-	0.01
2	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-
3	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.20	-	-	-	-	-	-	-	-	0.09	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-
Total:	-	-	-	0.24	-	-	-	-	-	0.12	-	0.04	0.09	-	0.02	-	0.01
Six 1	-	-	-	0.06	0.09	-	-	-	-	-	-	-	-	-	0.02	-	-
2	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	0.30	0.07	0.04	0.01	-	0.04	-	-	-	-	-	0.05	-	-
4	-	0.01	-	0.26	-	0.05	-	0.01	0.02	-	-	-	0.05	-	-	0.01	-
5	-	-	-	0.13	-	-	-	-	0.01	-	-	-	0.09	-	-	-	-
6	-	-	-	0.06	0.04	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	0.09	-	-	-	-	-	-	-	0.02	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-
Total:	-	0.01	-	0.96	0.20	0.09	0.01	0.01	0.07	-	-	0.04	0.14	-	0.07	0.01	-
Seven 1	-	-	-	0.06	-	-	-	-	-	-	0.02	-	-	0.01	-	-	-
2	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	0.28	-	-	-	-	-	-	-	0.02	-	-	-	-	-
4	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	0.08	-	-	-	-	-	-	-	0.01	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	0.08	0.01	0.02	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	0.66	0.01	0.02	-	-	-	-	0.02	0.03	-	0.01	-	-	-
Eight 1	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	0.01	0.02	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-
3	0.02	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0.05	0.02	0.02	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.07	0.03	0.06	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	6aab	6aab(i)	6aab(ii)	6aac	6aad	6aae	6aaf	6aag	6aah	7	7a	7a(i)	7b	7b(i)	7c	7d	8
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Three 1	0.04	0.02	-	-	0.01	-	0.01	-	-	-	-	-	-	-	-	-	0.04
2	0.02	0.05	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03
3	0.02	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	0.06
4	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
5	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.22	0.07	0.02	-	0.01	0.03	0.01	-	-	-	-	-	-	-	-	-	0.15
Four 1	0.14	0.01	-	0.02	-	-	-	-	-	0.03	-	-	-	-	-	-	0.02
2	-	0.01	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-
3	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
4	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-
5	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.21	0.02	-	0.02	0.02	-	-	-	-	0.03	-	-	-	-	0.01	-	0.06
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06
2	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-
3	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0.02	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.08	-	-	-	-	-	-	-	-	0.03	-	-	0.03	-	-	-	0.06
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	0.01	0.02	-	-	-	-	-	-	-
Seven 1	-	-	-	-	-	-	-	-	-	0.02	-	-	0.03	-	-	-	-
2	-	-	-	-	-	-	-	-	-	0.02	-	-	0.05	-	-	-	-
3	-	-	-	-	-	-	-	-	0.01	0.01	-	-	0.04	-	-	-	-
4	-	-	-	-	-	-	-	-	0.01	0.02	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	0.02	-
8	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	0.04	0.10	-	-	0.12	0.02	-	0.02	-
Eight 1	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-	-	0.04
5	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
7	-	-	-	-	-	0.01	-	-	-	0.07	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.01	-	-	-	0.27	-	-	-	-	-	-	0.05
Nine 1	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	0.03
2	-	-	-	-	-	-	-	-	-	0.09	-	-	-	-	-	-	0.01
3	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
4	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	0.01
5	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	0.20	-	-	0.03	-	-	-	0.05
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	0.07	-	-	-	-	-	-	0.04
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
11	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	0.01
12	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	0.02	0.02	0.02	-	-	-	-	0.07
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	0.02	-	0.13	0.02	0.02	-	-	-	-	0.26
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34
2	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	0.06
total:	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	0.40

TABLE 179: *The distribution of rims (continued)*

Level:	8a	8b	8c	8d	9	10	10a	10b	10c	10d	10e	10f	11	11(i)	11(ii)	11a	12
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-
Three 1	-	-	-	-	-	0.02	-	-	-	-	-	-	0.05	-	-	-	-
2	-	-	-	-	-	0.06	-	-	-	-	0.01	-	0.02	-	-	-	-
3	-	-	0.01	0.04	0.04	0.03	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	0.01	0.04	0.04	0.14	-	-	-	-	0.01	-	0.07	-	-	-	-
Four 1	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.01	-	-	-	0.01	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.03	-	-	-	0.01	-	-	0.02	-	-	-	-
Five 1	-	-	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.07	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.04	-	-	-	-	-	0.02	-	-	-	-	-
5	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.18	-	-	-	-	-	0.02	-	-	-	-	-
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	0.10	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-
Total:	-	-	-	-	-	0.23	-	-	-	-	-	-	0.02	-	-	0.01	-
Seven 1	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	0.01	-
5	-	-	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.15	-	-	-	-	-	-	-	-	-	0.01	-
Eight 1	-	-	-	-	-	0.10	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.15	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.05	-	-	0.01	-	-	-	-	-	-	-	-
5	-	-	-	-	0.02	-	-	-	-	-	-	-	0.03	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	0.02	0.38	-	-	0.01	-	-	-	0.03	-	-	-	-
Nine 1	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	0.03
2	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
4	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	0.03
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	0.01	0.06	-	-	-	-	-	-	0.03	-	-	-	0.06
Ten 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
3	0.01	-	-	-	-	0.09	-	-	0.06	0.01	-	-	0.01	-	-	0.04	-
4	-	0.01	-	-	-	0.01	-	-	-	-	-	-	0.03	0.01	0.01	-	-
5	-	-	-	-	0.01	-	-	-	-	-	-	-	0.01	-	-	-	-
6	-	-	-	-	0.01	-	-	-	0.02	-	-	-	0.01	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-
8	-	-	-	-	-	0.05	-	-	0.03	-	-	-	-	-	-	-	-
9	-	-	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-
11	-	-	-	-	-	0.05	-	-	-	-	-	-	0.01	-	-	-	-
12	-	-	-	-	-	0.01	-	-	-	-	-	-	0.01	-	-	-	-
13	-	-	-	-	-	0.08	-	-	-	-	-	-	0.02	-	-	0.02	-
14	-	-	-	-	-	0.06	-	-	-	-	-	-	0.02	-	-	-	-
15	-	0.01	-	-	-	0.13	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	0.02	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-
20	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	0.01
22	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	0.01	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	0.01	0.04	-	-	-	-	0.04	-	-	-	-	0.02	0.03
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.01	0.02	-	-	0.04	0.62	-	-	0.15	0.01	0.07	-	0.16	0.01	0.01	0.12	0.06
eleven 1	0.01	-	-	-	0.04	0.02	0.01	0.01	-	-	-	-	0.03	-	-	0.03	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06
total:	0.01	-	-	-	0.04	0.02	0.01	0.01	-	-	-	-	0.03	-	-	0.03	0.06

TABLE 179: *The distribution of rims (continued)*

Level:	12a	12b	12c	12d	12e	13	13a	13a(i)	13a(ii)	13a(iii)	13b	13c	13d	13e	13f	13g	13h
One total:	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-
Two total:	-	-	-	-	-	0.74	-	-	-	-	-	-	-	-	-	-	0.02
Three 1	-	-	-	-	-	0.27	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.37	-	-	-	-	-	-	-	-	-	-	0.07
3	-	-	-	-	-	0.17	-	-	-	-	-	-	-	-	0.02	-	-
4	-	-	-	-	-	0.20	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	0.13	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	1.14	-	-	-	-	-	-	-	-	0.02	-	0.07
Four 1	-	-	-	-	-	0.33	-	-	-	-	-	-	-	-	-	0.03	0.04
2	-	-	-	-	-	0.36	-	-	-	-	-	-	-	-	-	0.02	0.09
3	-	-	-	-	-	0.13	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.14	-	-	-	-	-	-	-	0.06	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.96	-	-	-	-	-	-	-	0.06	-	0.05	0.13
Five 1	-	-	-	-	-	0.14	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	0.04	-	-
3	-	-	-	-	-	0.04	-	-	-	-	-	-	-	0.07	-	-	-
4	-	-	-	-	-	0.07	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	0.06	-	-	-	-	-	-	-	-	0.04	-	-
Total:	-	-	-	-	-	0.33	-	-	-	-	-	-	-	0.07	0.08	-	-
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	0.01	-	-	-	-	-	0.03	-	-	-	-	-
4	-	-	-	-	-	0.13	-	-	-	-	-	-	0.04	-	-	-	-
5	-	-	-	-	-	0.02	-	-	-	-	0.03	0.01	-	-	-	-	-
6	-	-	-	-	-	0.02	-	-	-	-	-	0.03	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-
8	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.20	-	-	-	-	0.04	0.07	0.04	-	-	-	-
Seven 1	-	-	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-
8	-	0.01	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.01	-	-	-	0.22	-	-	-	-	-	-	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
Nine 1	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	0.04	-	-	-	0.02	-	-	-	-	-	-	-
4	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.12	-	-	-	0.02	-	-	-	-	-	-	-
Ten 1	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.17	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	0.02	0.01	-	-	-	-	-	-	-	-
7	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-
16	0.02	-	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-
17	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	0.01	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	0.01	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	0.02	0.02	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.05	0.02	0.07	0.01	0.04	0.24	0.02	0.04	0.01	-	-	-	-	-	-	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 179: *The distribution of rims (continued)*

Level:	13i	13j	13k	13l	13m	13n	14	14a	14b	14c	14d	14e	14f	14g	15	15a	16
One total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.20
Two total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	0.78
Three 1	-	-	0.02	0.04	-	-	-	-	-	-	-	-	-	-	-	-	0.04
2	-	0.02	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	0.01
3	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	0.03
4	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01
5	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	0.02	0.03	0.05	0.02	0.02	-	-	-	-	-	-	-	-	-	-	0.09
Four 1	-	0.01	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.02	0.01	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
Five 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-
Six 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seven 1	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-
4	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	0.02	0.06	-	-	0.02	-	-	-	-	-	-	-
Eight 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	0.02	-	0.02	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	0.07	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	-	0.11	-	0.04	-	-	-	-	-	-	-
Nine 1	-	-	-	-	-	-	-	-	-	0.06	-	-	-	-	-	-	-
2	-	-	-	-	-	-	0.04	0.02	-	0.08	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	0.01	-	0.26	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-	0.02	-
5	-	-	-	-	-	-	-	0.02	-	0.15	-	-	-	-	-	-	-
6	-	-	-	-	-	-	0.02	0.18	-	0.26	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	0.06	0.23	-	0.91	-	-	-	-	-	0.02	-
Ten 1	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	0.16	-	-	-	0.02	0.01	-	-	-	-
3	-	-	-	-	-	-	0.02	-	0.01	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	0.01	0.01	-	-	0.02	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-
13	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-
14	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	-	-	-	-	-	-	0.11	0.16	0.02	0.02	0.03	0.02	0.01	0.02	0.02	-	-
eleven 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

XV APPENDIX THREE

MORTUARY AND NON-MORTUARY vessel types are defined in this appendix. The morphological classifications apply equally to local, as well as exotic wares, because many forms clearly have a regional context. The same forms, or in some instances very similar forms, were produced at several production sites. It seems likely that they served the same or similar functions. An effort has been made to keep the taxa as simple as possible; this has resulted in the categorization of just three basic vessel types. Type 1 has nine variants, type 2 has eleven and type 3, five. In addition, there are six special types, one represented by a single potstand, and five by outstanding mortuary vessels. Various vessel parts and decorated sherds are also discussed.

VESSEL TYPES

Whole vessels have been classified according to their fabrics and forms. In Shepard's (1956:225-45) terms, many of the forms can be classed as simple restricted and unrestricted, or independent and dependent composite. In the relevant chapters each type is prefixed with either an E or an L, the former representing an exotic ware, and the latter a local ware. This is considered appropriate because as many of the forms have a regional representation, they apply to both the local and exotic wares. Thus, for example, the local form 1a ware is type L1a. Miniature types are suffixed "(m)". Vessel types have been classified as follows:

Type 1 (bowls):

- 1a is shallow and semispherical. It is a simple unrestricted form with an everted rim (see Cat. 3237, Fig. 103 Chapter VIII).
- 1b is a deeper semispherical and simple unrestricted form with an everted rim (see Cat. 1438, Fig. 101 Chapter VIII).
- 1c is semispherical with an everted rim (as for type 1b), and a ring-foot base. It is a simple unrestricted form.
- 1d is a shallow semispherical dependent restricted form, with an inflection point about the equator, and an inverted rim. The inflection is either gently curved or slightly angular (see Cat. 3240, Fig. 100 Chapter VIII).

- 1e is a simple unrestricted form with contoured walls, an everted rim and a ring-foot base (see Cat. 1359, Fig. 125 Chapter VIII).
- 1f has the same shape as 1d, with the addition of a ring-foot base. The inflection point tends to be angular (see Cat. 3267, Fig. 174 Chapter IX).
- 1g has composite contours with an indirect, relatively broad and sharply everted rim. This unrestricted form has perpendicular walls and a slightly rounded base (see Cat. 3231, Fig. 172 Chapter IX).
- 1h is unrestricted with composite contours. It has a large everted rim. The body walls are perpendicular below a sharply angular inflection point at the rim/wall juncture. The base is rounded (see Cat. 891, Fig. 192 Chapter IX).
- 1i is an unrestricted composite form with an everted rim and a ring-foot base (see Cat. 3264, Fig. 214 Chapter IX).

Type 2 (jars):

- 2a is a dependent restricted form with simple contours and an inverted direct rim (see Cats. 3238, FIg. 102 and 1320 Fig. 128, Chapter VIII).
- 2b is an independent restricted carinated form with composite contours (see Cat. 1469, Fig. 118 Chapter VIII for the CP2 form and Cat. 2784, Fig. 196 Chapter IX for the CP3 form).
- 2c is a shallow version of the CP2 type 2b form with a more complex corner point (see Cat. 1691, Fig. 104 Chapter VIII).
- 2d is an independent restricted form with composite contours, a carination point, an everted rim and a ring-foot base (see Cat. 1678, Fig. 106 Chapter VIII).
- 2e is a simple independent restricted form with an indirect everted rim and a round base (see Cat. 3239, Fig. 102 Chapter VIII).
- 2e(f) is the same form as type 2e but with an everted externally folded rim (see Cat. 988, Fig. 180 Chapter IX).
- 2f is a simple and dependent restricted form with composite contours, a carination point and an inverted rim (see Cat. 1392, Fig. 126 Chapter VIII; a miniature version is Cat. 1599, Fig. 117 Chapter VIII).
- 2g is an independent restricted form with simple contours, and a perpendicular rim (see Cat. 3230, Fig. 172 Chapter IX; a miniature version is Cat. 1648, Fig. 110 Chapter VIII).
- 2h is a restricted independent form with inflected contours and an inverted rim. Complete vessels were unable to be adequately reconstructed.

- 2i has a similar shape to type 2b, but with the addition of a ring-foot base. Note that the rim and carination point are exactly the same diameter (see Cat. 699, Fig. 211 Chapter IX).
- 2j is a simple dependent restricted form with composite contours and a direct, slightly inverted, rim (see Cat. 3228, Fig. 286 Chapter X).

Type 3 (platters):

- 3a is an unrestricted form with composite contours, an everted rim and an internal raised plate floor supported by an outwards sloping base (see Cat. 1465, Fig. 121 Chapter VIII; a miniature version is Cat. 1618, Fig. 115 Chapter VIII).
- 3b is a restricted dependent carinated form with composite contours, an internal raised plate floor, an inverted rim, and a ring-foot base (see Cat. 1518, Fig. 112 Chapter VIII).
- 3c is defined by its extreme diameter in relation to depth and the size of a ring-foot attached base. This unrestricted form has simple contours and an everted rim. The ring-footed base diameter is less than 40 per cent of the rim diameter. The vessel's overall diameter exceeds 20 cm and its overall height is less than 25 per cent of the vessel's diameter (see Cat. 1284, Fig. 133 Chapter VIII).
- 3d is a dependent restricted form with simple contours and a direct inverted rim (see Cat. 3277, Fig. 97 Chapter VIII).
- 3e(t) is a shallow unrestricted platter on tripod feet with composite contours (see Cat. 3252, Fig. 130 Chapter VIII).

Potstand:

- A single potstand was also recovered (Cat. 820, Fig. 205 Chapter IX).

Special Vessels:

- A large intact type 2b carinated burial jar displays a stylised human motif (B11, Cat. 764, Fig. 207 Chapter IX).
- A large egg-shaped vessel used, along with Cat. 853, to entomb B14 (Cat. 852, Fig. 203 Chapter IX).
- Unique in shape and construction, this large unrestricted form with simple contours features a concealed base. It has an inflected and inverted rim. Along with Cat. 852, it entombed B14 (Cat. 853, Fig. 202 Chapter IX).
- The most complex vessel, an independent restricted form with composite contours, featured in B15 (Cat. 913, Fig. 200 Chapter IX).

- A large carinated type L2b burial jar was found with B58 (Cat. 1283, Fig. 134 Chapter VIII).

Distributions of the mortuary types are discussed in Chapters VIII and IX. Non-mortuary vessels are detailed in Chapters VII, VIII, IX and X.

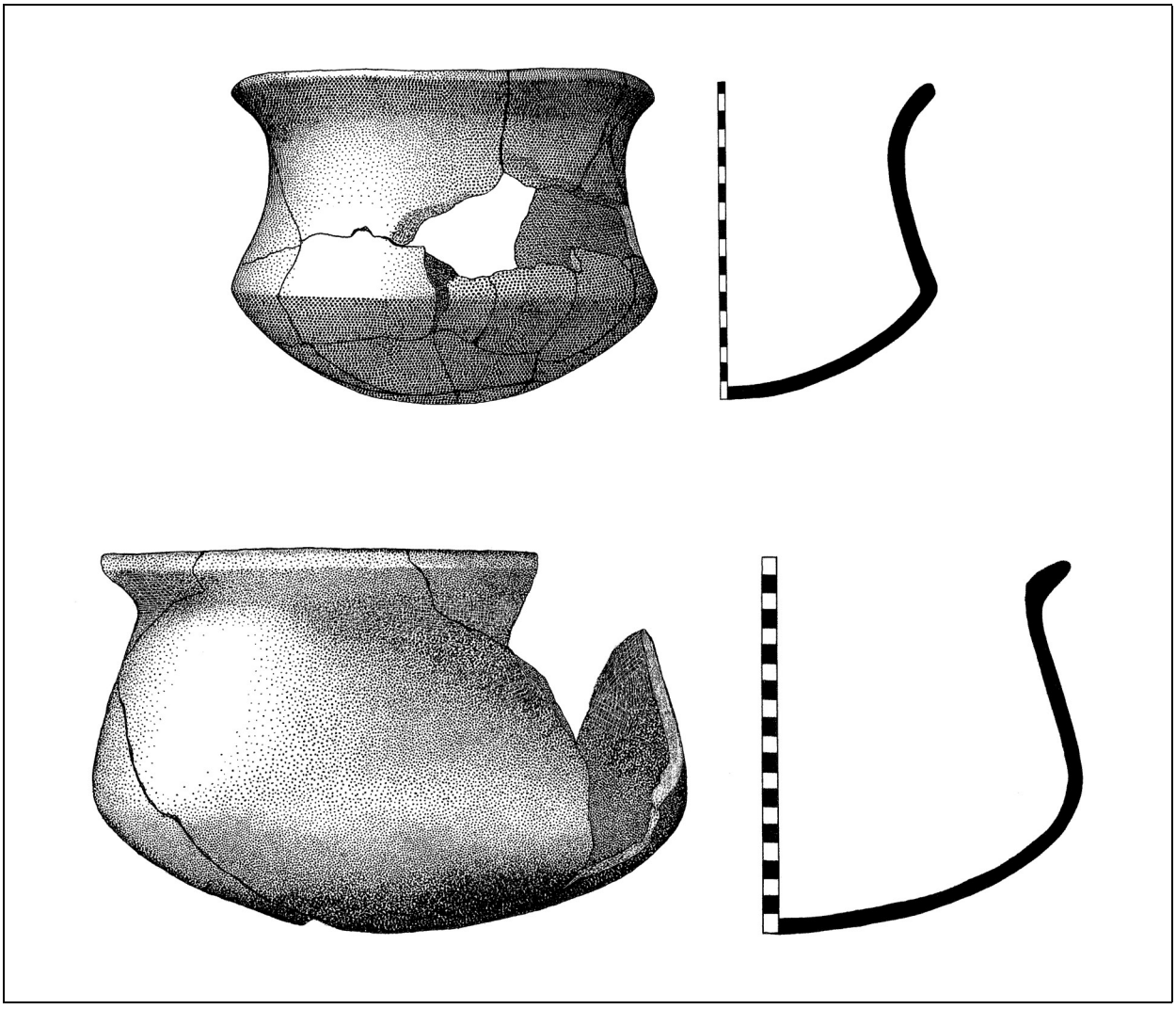


FIG. 316: Vessel fracture patterns. *Top:* cat. 1679, B120. *Bottom:* cat. 1384, B77. Scale segments are 5 mm

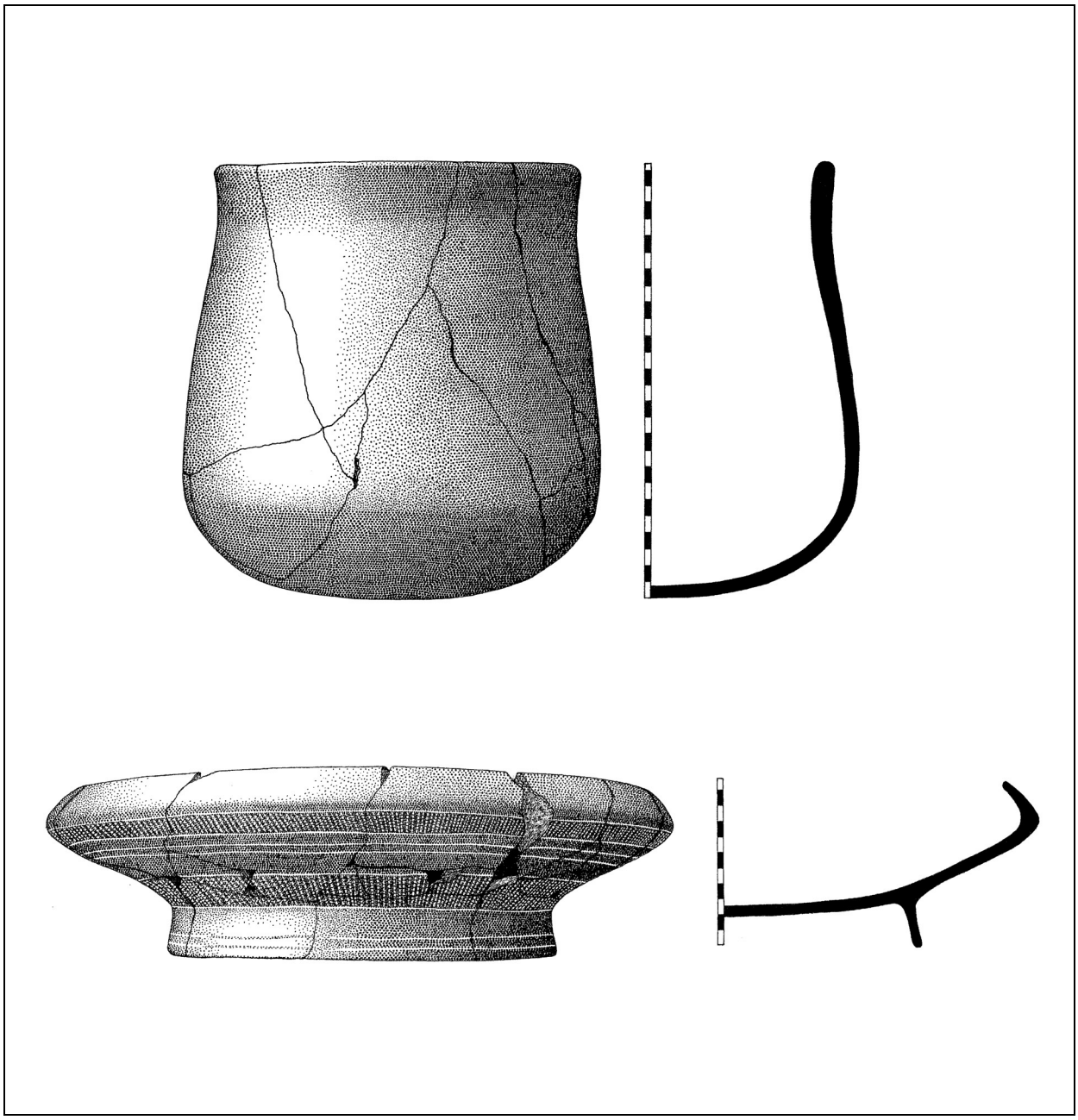


FIG. 317: Vessel fracture patterns. *Top:* cat. 1543, B102. *Bottom:* cat. 1518, B91. Scale segments are 5 mm

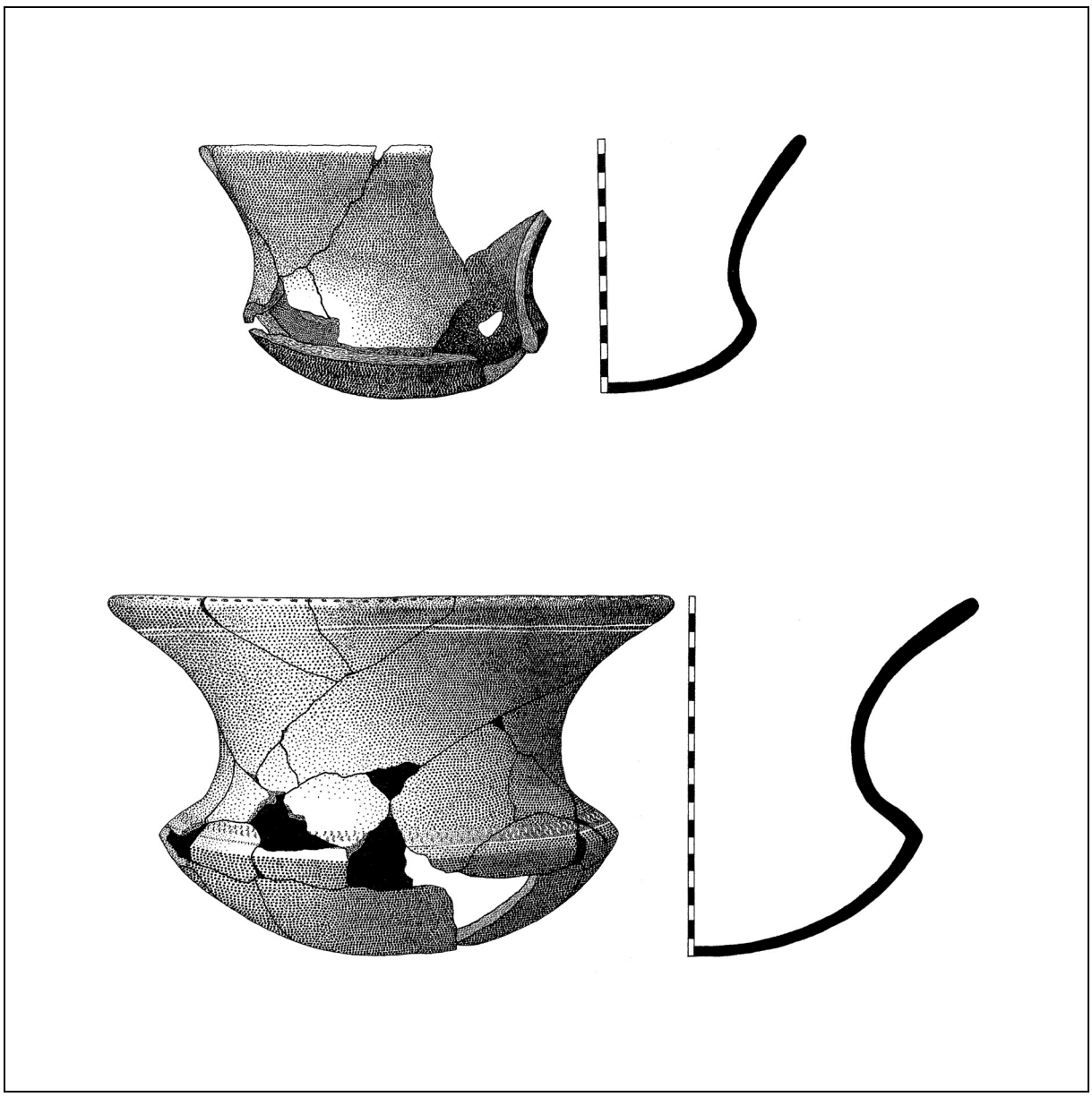


FIG. 318: Vessel fracture patterns. *Top:* cat. 819, B13. *Bottom:* cat. 1101, B33. Scale segments are 5 mm

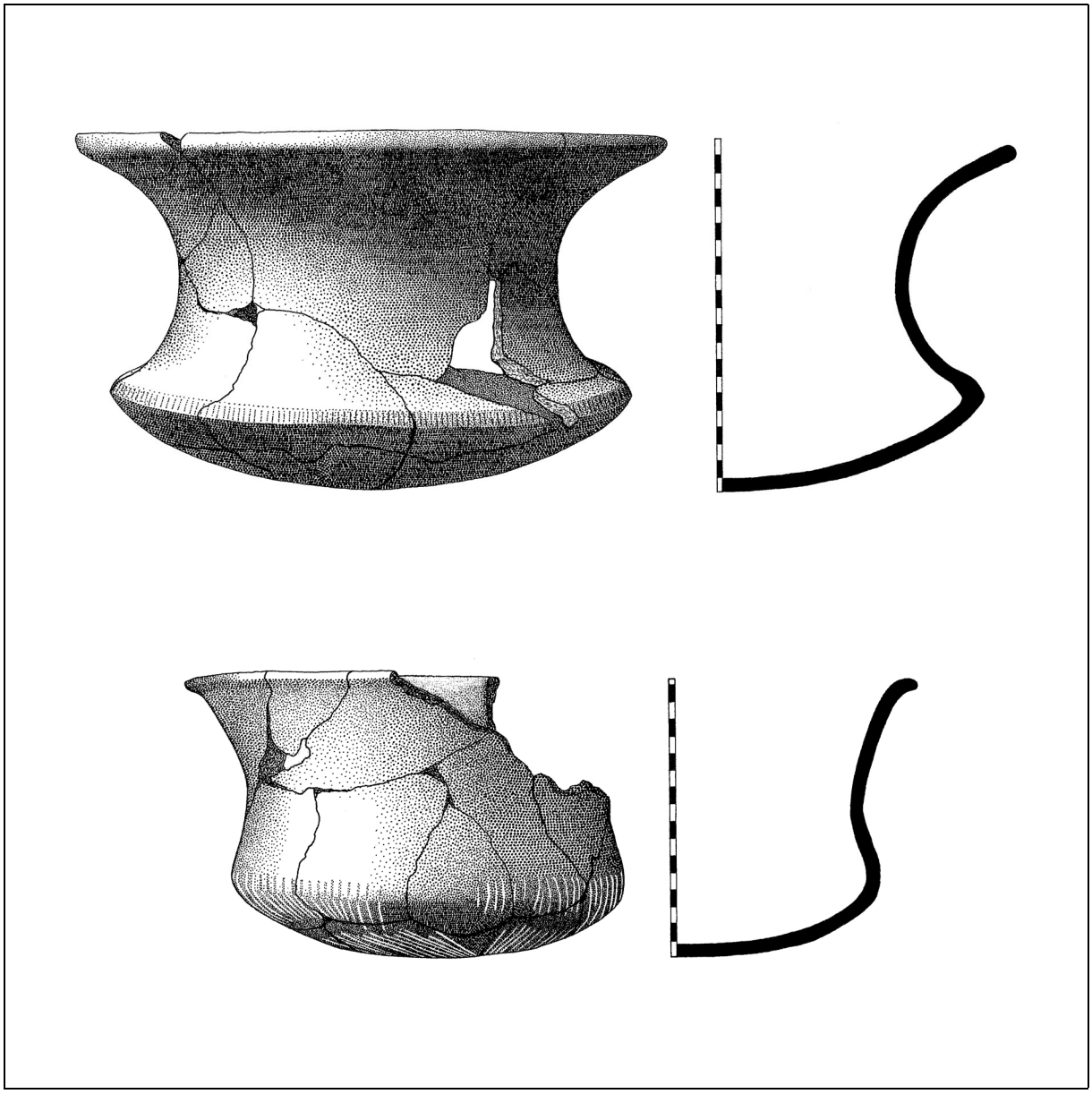


FIG. 319: Vessel fracture patterns. *Top:* cat. 1288, B57. *Bottom:* cat. 1141, B47. Scale segments are 5 mm

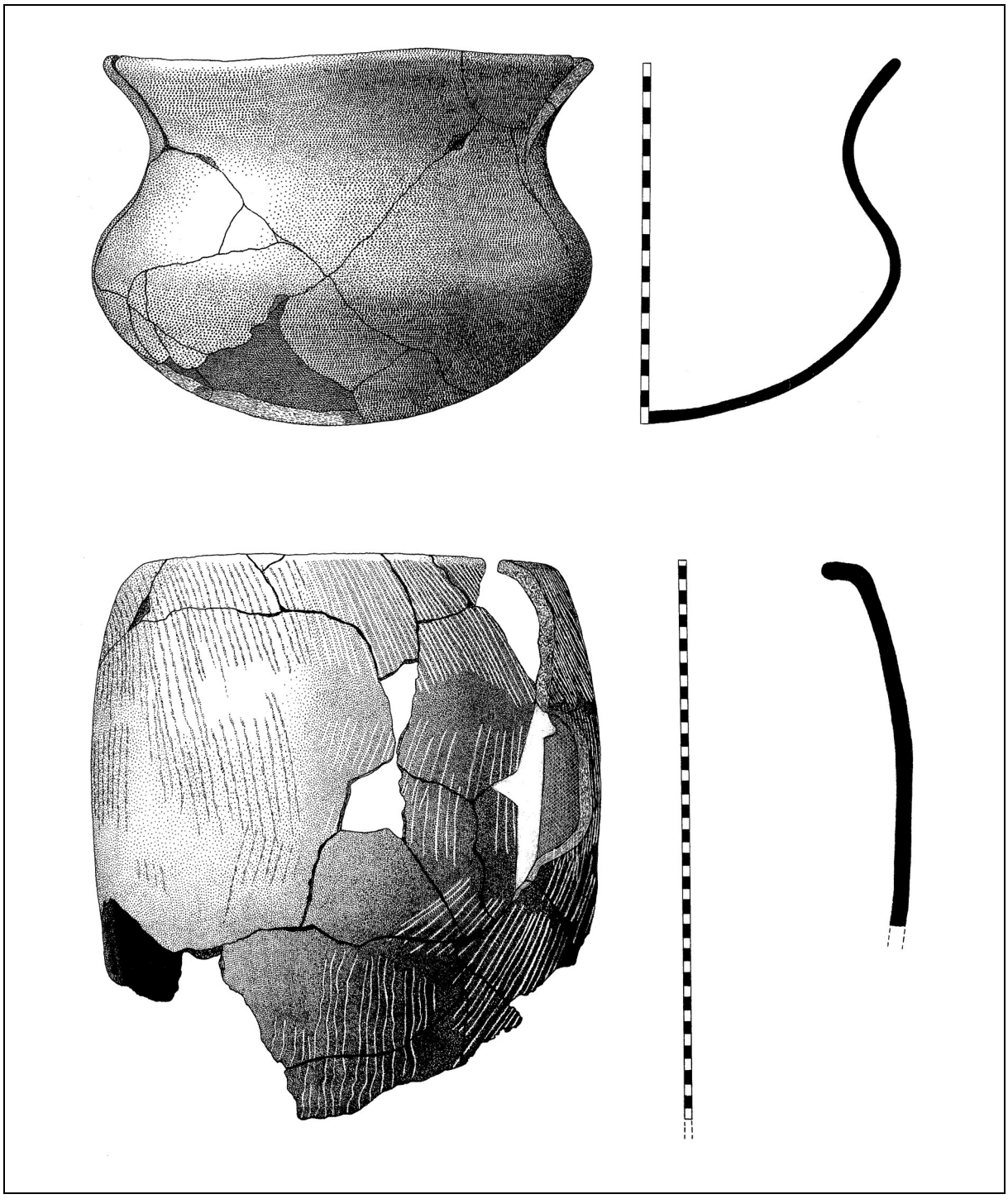


FIG. 320: Vessel fracture patterns. *Top:* cat. 992, B30. *Bottom:* cat. 809, B15. Scale segments are 5 mm

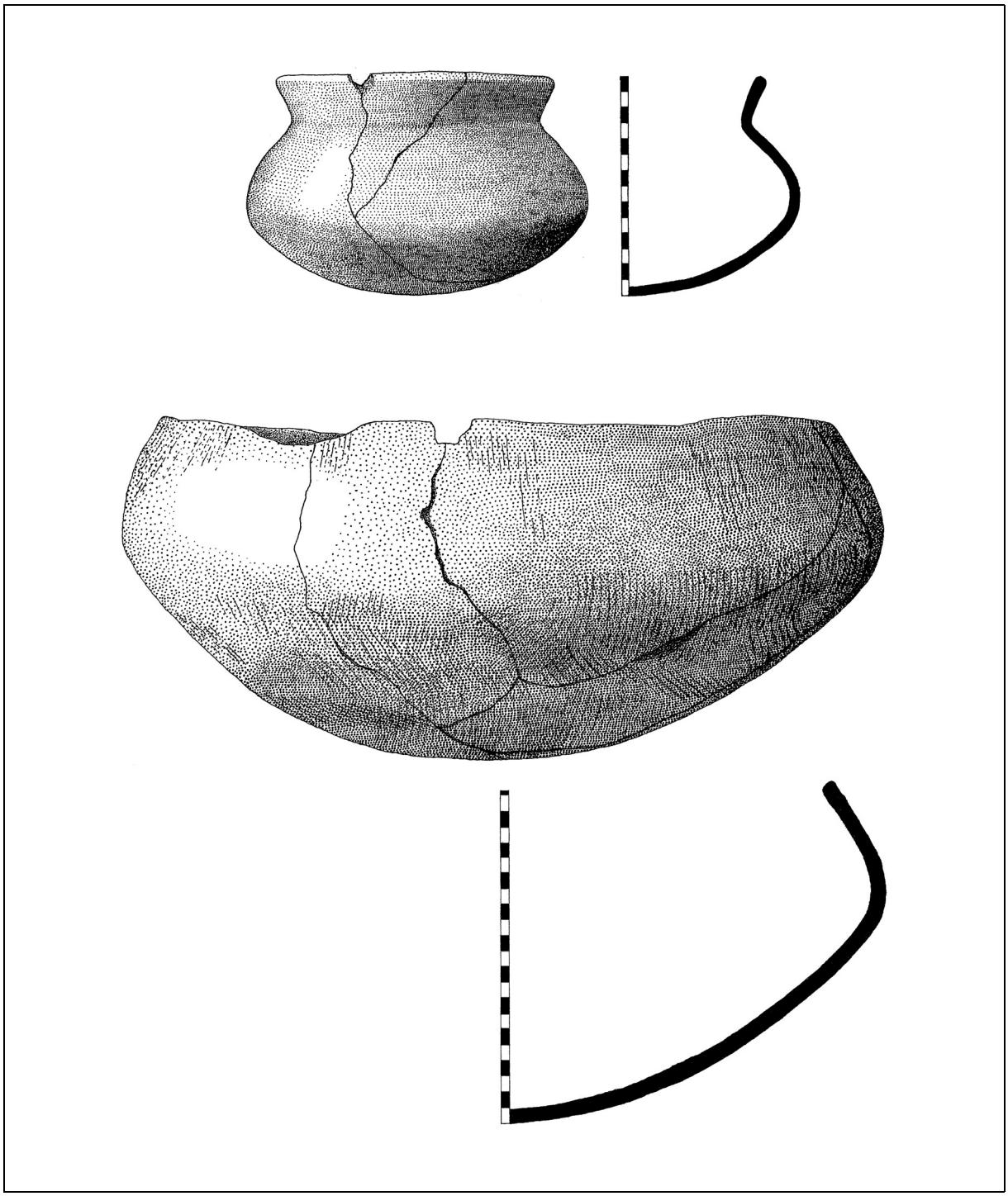


FIG. 321: Vessel fracture patterns. *Top:* cat. 1319, B64. *Bottom:* cat. 1270, B37. Scale segments are 5 mm

TRIPOD POT FEET

Tripod feet were constructed in two ways. They were either formed as an integral part of the vessel base or they were pre-formed and then joined to the completed vessel in the final stage of manufacture prior to drying and firing. These details as well as fabric colours and firing atmospheres are set out in table 180. Note that the function of cat. 3249 and cat. 3250 is uncertain and that they may not be pot feet.

TABLE 180: *Tripod pot feet: additional data*

Cat.	Layer	Colour	Firing	Attachment
3249	3.1	10YR/7/4	oxidized - reduced core	separate
3250	5.1	10YR/6/4	oxidized - reduced core	fragment - no data
3251	6.6	10YR/6/3	oxidized - reduced core	fragment - no data
1256	8.7	-	oxidized	no data
1069	10.1	-	oxidized	no data
1248	10.3 l.2	2.5YR/6/4	oxidized - reduced core	separate?
1262	10.3 l.2	2.5YR/6/4	oxidized - reduced core	integral
1272	10.3 l.2	10YR/5/2	reduced	integral
1311	10.3 l.2	-	oxidized - reduced core	separate
1398	10.3 l.2	10YR/7/3	oxidized - reduced core	separate
1410	10.4	10YR/7/3	oxidized - reduced core	separate
1341	10.5	-	oxidized	no data
1790	10.7	-	oxidized	no data
1408	10.8	10YR/5/1	reduced	integral
1409	10.8	10YR/7/4	oxidized	separate
1795	10.9 f.25	-	oxidized - reduced core	no data
1510	10.10	-	oxidized - reduced core	separate
1553	10.11	-	oxidized	no data
1606	10.13	-	oxidized	separate
1714	10.15	-	reduced	separate
1889	10.20	10YR/3/2	reduced	separate
1870	10.22	10YR/5/2	reduced	separate
1877	10.23	10YR/4/2	reduced	separate
1881	10.24 l.28	10YR/4/2	reduced	separate
1997	10.25 l.29	10YR/5/2	reduced	separate
1933	10.26 l.31	-	-	no data
1914	11.1	-	reduced	separate
1916	11.1	-	reduced	separate
1990	11.1	-	reduced	separate

CARINATED BURIAL JARS, BASES, LIDS AND DECORATED SHERDS

Carinated burial jars

The data set out in table 183 complements details in tables 64 and 65 (Chapter VIII) and discussions in Chapters IX, X and XI. CP2 and CP3 burial jars differ in proportions. Note that rim decorations during CP2 include two or three fine incised lines on the vessel exterior running parallel with the rim terminus, or a combination of such lines and *Anadara* shell impressions. Striations are present on cat. 1478 and a decorative field on cat. 2020. Carination point decorations also vary. Cord marks make their first appearance in MP3b. Decorative fields are present adjacent to some carination points and some rims.

Vessel bases

Fourteen different base forms and two variants have been identified (Table 181). The total weight of all bases for level 11 is 0.84 kg; L10: 5.93 kg; L9: 3.1 kg; L8: 1.33 kg; L7: 1.74 kg; L6: 3.11 kg; L5: 2.61 kg; L4: 11.61 kg; L3: 15.9 kg; L2: 11.66 kg and L1: 1.76 kg.

Vessel lids

Six different lid forms and two variants have been identified. Lid form one (LF1) weight totals 0.06 kg; LF2: 0.39 kg; LF3 0.01 kg; LF4 0.47 kg; LF4(a), LF5, LF6 and LF6(a) 0.02 kg each. The total weight of all lids for level 10 is 0.13 kg; L8: 0.10 kg; L7: 0.02 kg; L6: 0.16 kg; L5: 0.06 kg; L4: 0.12 kg; L3: 0.39 kg; L2: 0.01 kg and L1: 0.02 kg.

In hand specimen, layer 10 lid fabrics include sand and exotic blebs; L8 orthodox grog (probably a local ware) and rice (exotic); L7 orthodox grog (local); L6 orthodox grog (local), bleb grog and rice (both probably exotic); L5 orthodox grog (local) and bleb grog (exotic); L4 rice and bleb grog (both probably local); L3-1 orthodox and bleb grog and sand (the first and last are probably exotic).

Appliqué sherds

Almost all of the appliqué sherds probably derive from local wares. Most were recovered from CP4 contexts. Three exotic fabrics were found, two in CP2, the other in CP1 (Table 184). One in lower CP2 is comprised of FG10, material which is consistent with several outcrops along the CP1 coastline and on several small islands about 25 km to the south (Chapter XI). Two exotic bleb-temper sherds of unknown origin were found about midway through the CP2 sequence. The source of the L11:1 sherd, a sandy clay tempered with bleb grog, is unclear but probably consistent with a coastal source. The total weight of appliqué sherds for level 11 is

TABLE 181: *Vessel base weights by layer*

Forms:	A	B	C	D	D(i)	D(ii)	E	F
level 1						0.03	1.27	
2			0.83	0.13			9.76	
3		0.12	2.45	0.28		0.13	12.04	0.02
4		0.22	0.38	0.01	0.16	0.15	10.30	
5			0.07		0.12		2.21	
6		0.03	0.08	0.14			2.53	
7		0.07	0.22	0.20			1.21	
8			0.07	0.59			0.61	
9		0.12		1.56			0.73	
10	0.18	0.25	0.23	4.04			1.13	0.03
11	0.30	0.09	0.04	0.32			0.09	
Total:	0.48	0.90	4.37	7.27	0.28	0.31	41.88	0.05

Forms:	G	H	I	J	K	L	M	N
level 1	0.28							
2	0.28		0.40	0.22				0.04
3	0.26		0.06	0.48				
4	0.26		0.03	0.14	0.04			
5			0.10	0.11				
6	0.05	0.15	0.11					
7							0.02	
8	0.03						0.03	
9	0.08							
10						0.07		
11								
Total:	1.24	0.15	0.70	0.95	0.04	0.07	0.05	0.04

TABLE 182: *Vessel base sherd weights. SW: stoneware; SF: surface finish; dec: decorated; c/m: cord-marked; ptd: painted; pim: paddle-impressed; inpt: incised punctate; burn: burnished; red: reduced; bcd: black cored; ox.: oxidized*

Level	Form	Texture	SF	Firing	Fabric	Weight	Feature	Level	Form	Texture	SF	Firing	Fabric	Weight	Feature
1:00	E	Med	plain	bcd	FG4	0.01	1	3:03	C	Med	plain	bcd	FG4	0.09	-
1:01	E	Med	plain	bcd	FG4	0.02	-	3:03	C	Med	plain	bcd	FG5	0.03	-
1:01	E	Med	plain	bcd	FG5	0.76	-	3:03	C	Med	plain	bcd	FG3	0.02	-
1:01	E	Med	plain	bcd	FG4	0.06	-	3:03	D	Med	plain	bcd	FG5	0.17	-
1:01	G	Med	plain	ox.	SW	0.18	-	3:03	E	Med	plain	red	FG5	2.25	-
1:01	G	Med	plain	bcd	sand exotic	0.01	-	3:03	E	Med	plain	red	FG4	0.28	-
1:01	G	Med	plain	bcd	FG5	0.01	-	3:03	E	Med	plain	bcd	no data	0.10	-
1:02	D(ii)	Med	dec	bcd	FG5	0.03	-	3:03	J	Med	plain	bcd	FG5	0.08	-
1:02	E	Med	plain	bcd	FG5	0.24	-	3:04	C	Med	plain	bcd	sand exotic	0.01	TS91
1:02	G	Med	plain	bcd	FG5	0.03	-	3:04	C	Med	plain	bcd	FG5	0.15	-
1:03	E	Med	plain	bcd	FG4	0.04	-	3:04	C	Med	plain	bcd	FG3	0.05	-
1:03	G	Med	plain	bcd	sand exotic	0.05	-	3:04	D	Med	plain	bcd	blebs exotic	0.09	-
1:04	E	Med	plain	bcd	FG5	0.14	-	3:04	E	Med	plain	bcd	FG4	0.02	-
2:01	C	Med	plain	bcd	FG4	0.07	-	3:04	E	Med	plain	bcd	FG5	0.24	-
2:01	C	Med	plain	bcd	FG5	0.16	-	3:04	G	Med	c/m	bcd	FG4	0.03	-
2:01	D	Med	plain	bcd	FG5	0.08	1	3:04	G	Med	plain	bcd	FG5	0.06	-
2:01	E	Med	plain	bcd	FG5	3.01	-	3:04	I	Med	plain	red	FG5	0.04	-
2:01	E	Med	plain	bcd	FG4	0.19	-	3:04	J	Med	dec	bcd	FG5	0.14	-
2:01	G	Med	plain	bcd	FG5	0.09	1	3:05	C	Med	plain	bcd	FG4	0.04	-
2:01	G	Med	plain	bcd	FG5	0.12	-	3:05	C	Med	plain	bcd	FG5	0.04	-
2:01	I	Med	plain	bcd	FG5	0.27	-	3:05	E	Med	plain	red	FG4	0.05	-
2:01	N	Fine	plain	bcd	FG4	0.04	-	3:05	E	Med	plain	red	FG5	1.42	-
2:02	C	Med	plain	bcd	FG5	0.45	-	4:00	E	Med	plain	bcd	FG5	0.04	2
2:02	C	Med	plain	bcd	FG4	0.08	-	4:00	E	Med	plain	bcd	FG5	0.14	4
2:02	D	Med	plain	bcd	FG5	0.05	-	4:00	E	Med	plain	bcd	FG5	0.14	1
2:02	E	Med	plain	bcd	FG4	0.26	-	4:00	E	Med	plain	bcd	FG4	0.06	5
2:02	E	Med	plain	bcd	FG5	2.58	-	4:00	E	Med	plain	bcd	FG4	0.04	-
2:02	E	Med	plain	bcd	FG4	0.01	1	4:00	E	Med	plain	bcd	FG3	0.18	5
2:02	E	Med	plain	bcd	FG4	0.20	-	4:00	E	Med	plain	bcd	FG5	0.01	4
2:02	E	Med	plain	bcd	sand exotic	0.02	-	4:00	E	Med	plain	bcd	FG4	0.03	4
2:02	E	Med	plain	bcd	FG5	1.47	-	4:00	E	Med	plain	bcd	FG5	0.13	-
2:02	G	Med	plain	bcd	FG5	0.02	-	4:01	C	Med	plain	bcd	orth g exotic	0.03	-
2:02	G	Med	plain	bcd	sand exotic	0.01	-	4:01	C	Med	plain	red	FG5	0.04	-
2:02	I	Med	plain	bcd	FG5	0.09	-	4:01	D	Med	dec	red	no data	0.01	-
2:02	J	Med	dec	red	FG5	0.14	-	4:01	D(ii)	Med	pim	red	FG5	0.08	-
2:03	C	Med	plain	bcd	FG5	0.07	-	4:01	E	Med	plain	bcd	FG5	0.10	1
2:03	E	Med	plain	bcd	FG5	0.02	TS14	4:01	E	Med	plain	bcd	FG3	0.04	1
2:03	E	Med	plain	bcd	FG4	0.12	-	4:01	E	Med	pim	red	blebs exotic	0.07	-
2:03	E	Med	plain	bcd	FG5	1.90	-	4:01	E	Med	plain	bcd	FG5	2.81	-
2:03	G	Med	ptd	red	FG5	0.04	-	4:01	E	Med	plain	bcd	FG3	0.30	-
2:03	I	Med	plain	bcd	FG5	0.04	-	4:01	E	Med	plain	bcd	FG4	0.65	-
2:03	J	Med	dec	bcd	FG5	0.08	-	4:01	E	Med	c/m	bcd	FG5	0.10	1
3:00	C	Med	plain	bcd	FG5	0.04	-	4:01	G	Med	plcm	bcd	FG5	0.04	-
3:00	E	Med	plain	bcd	FG5	0.05	-	4:01	J	Med	dec	red	FG5	0.04	-
3:00	E	Med	plain	bcd	FG4	0.01	-	4:01	K	Med	inpt	red	FG5	0.04	-
3:01	B	Med	plain	bcd	FG5	0.12	-	4:02	B	Med	plain	bcd	FG5	0.22	-
3:01	C	Med	plain	bcd	FG5	0.06	1	4:02	C	Med	c/m	bcd	FG5	0.09	2
3:01	C	Med	plain	bcd	FG5	0.95	-	4:02	D(i)	Fine	dec	red	FG5	0.10	-
3:01	C	Med	plain	bcd	FG4	0.15	-	4:02	D(i)	Fine	dec	red	FG5	0.06	-
3:01	D(ii)	Med	dec	bcd	FG5	0.13	-	4:02	E	Med	plain	bcd	FG3	0.18	-
3:01	E	Med	plain	bcd	FG5	0.04	1	4:02	E	Med	plain	bcd	FG4	0.05	-
3:01	E	Med	plain	bcd	FG4	0.42	-	4:02	E	Med	plain	bcd	FG3	0.08	-
3:01	E	Med	plain	bcd	FG5	2.79	-	4:02	E	Med	plain	bcd	OSG exotic	0.06	-
3:01	E	Fine	plain	bcd	no data	0.05	1	4:02	E	Med	plain	bcd	FG5	0.26	-
3:01	G	Med	plain	bcd	FG3	0.05	-	4:02	E	Med	plain	bcd	FG5	0.16	2
3:01	G	Med	plain	bcd	FG4	0.03	-	4:02	E	Med	c/m	bcd	FG3	0.08	2
3:01	G	Med	plain	bcd	FG5	0.05	-	4:02	E	Fine	plain	bcd	FG5	0.02	-
3:01	I	Med	plain	bcd	FG5	0.02	-	4:02	E	Fine	plain	bcd	FG5	0.79	-
3:01	J	Med	plain	bcd	FG5	0.02	1	4:02	E	Fine	plain	bcd	orth g exotic	0.08	-
3:01	J	Med	dec	bcd	FG5	0.16	-	4:02	I	Med	plain	bcd	blebs exotic	0.03	2
3:01	J	Med	dec	bcd	FG4	0.02	-	4:02	J	Med	plain	bcd	FG3	0.05	-
3:01	J	Med	plain	bcd	FG5	0.03	-	4:03	C	Med	plain	red	FG4	0.05	-
3:02	C	Med	plain	bcd	FG5	0.83	-	4:03	C	Med	plain	bcd	orth g exotic	0.06	-
3:02	D	Med	plain	bcd	FG5	0.02	-	4:03	D(ii)	Med	pim	red	blebs exotic	0.07	7
3:02	E	Med	plain	bcd	FG4	0.60	-	4:03	E	Med	plain	bcd	FG5	0.01	9
3:02	E	Med	plain	bcd	FG5	3.74	-	4:03	E	Med	plain	bcd	FG3	0.09	8
3:02	E	Med	plain	bcd	FG3	0.04	-	4:03	E	Med	plain	bcd	FG5	0.65	-
3:02	F	Med	plain	bcd	FG5	0.02	-	4:03	E	Med	plain	bcd	FG4	0.17	7
3:02	G	Med	plain	bcd	FG5	0.02	-	4:03	E	Med	plain	bcd	FG3	0.06	7
3:02	G	Med	plain	bcd	FG3	0.02	-	4:03	E	Med	plain	bcd	orth g exotic	0.15	7
3:02	J	Med	plain	bcd	FG5	0.03	-	4:03	E	Med	plain	bcd	FG5	0.34	7

TABLE 182: *Vessel base sherd weights (continued). SP: special; Crs: coarse; SF: surface finish; dec: decorated; c/m: cord-marked; burn: burnished; Em: miniature form E; red: reduced; bcd: black cored; ox.: oxidized*

Level	Form	Texture	SF	Firing	Fabric	Weight	Feature	Level	Form	Texture	SF	Firing	Fabric	Weight	Feature
4:03	E	Med	plain	bcd	FG5	0.03	6	6:03	E	Fine	burn	bcd	FG3	0.01	-
4:03	E	Med	plain	bcd	orth g exotic	0.02	-	6:03	E	Fine	plain	bcd	FG3	0.04	52
4:03	E	Med	plain	bcd	FG5	0.05	3	6:03	E	Fine	burn	bcd	no data	0.01	84
4:03	E	Med	plain	bcd	FG4	0.08	3	6:03	E	Fine	burn	bcd	FG3	0.04	B9
4:03	E	Med	plain	bcd	FG3	0.03	3	6:03	E	Fine	burn	red	grog-blebs	0.02	-
4:03	E	Med	plain	bcd	orth g exotic	0.03	3	6:03	E	Fine	plain	bcd	grog-blebs	0.05	52
4:03	E	Med	plain	bcd	FG5	0.06	1	6:03	E	Fine	plain	bcd	no data	0.01	B3
4:03	E	Med	plain	bcd	orth g exotic	0.50	-	6:03	E	Fine	burn	red	grog-blebs	0.01	36
4:03	E	Med	plain	bcd	FG5	0.54	-	6:03	E	Fine	plain	red	grog-blebs	0.02	8
4:03	E	Fine	plain	bcd	no data	0.06	2	6:03	H	Med	plain	bcd	FG3	0.15	93
4:03	G	Med	plain	bcd	FG3	0.20	7	6:04	C	Med	plain	bcd	blebs exotic	0.01	TS989
4:03	G	Med	plain	bcd	orth g exotic	0.02	-	6:04	C	Med	burn	bcd	no data	0.02	-
4:03	J	Med	plain	bcd	FG5	0.05	9	6:04	E	Fine	burn	bcd	FG5	0.11	-
4:04	E	Med	plain	bcd	FG5	0.40	-	6:04	E	Fine	plain	bcd	FG5	0.01	B11
4:04	E	Med	plain	bcd	FG3	0.03	-	6:04	E	Fine	burn	bcd	FG3	0.03	-
4:04	E	Med	plain	bcd	FG4	0.04	-	6:04	E	Fine	plain	bcd	no data	0.01	14
4:04	E	Med	c/m	bcd	FG5	0.17	-	6:4 L3	E	Fine	burn	bcd	FG5	0.03	-
4:04	E	Med	plain	bcd	FG5	0.02	-	6:05	D	Fine	dec	red	FG3	0.01	-
4:05	C	Crs	plain	bcd	FG4	0.11	1	6:05	E	Med	plain	bcd	FG3	0.18	22
4:05	E	Med	plain	bcd	FG5	0.07	1	6:05	E	Med	plain	red	FG3	0.38	-
5:00	E	Med	plain	red	FG3	0.01	P37-40	6:05	E	Fine	dec	red	grog-blebs	0.03	-
5:00	E	Med	burn	red	FG5	0.01	P	6:05	E	Fine	plain	bcd	no data	0.01	-
5:00	E	Med	plain	red	rice	0.11	P25	6:05	Em	Med	plain	bcd	FG3	0.02	-
5:01	C	Med	plain	bcd	FG5	0.06	-	6:06	D	Med	plain	ox.	FG3	0.02	-
5:01	E	Med	plain	bcd	FG5	0.09	1	6:06	D	Med	plain	bcd	FG3	0.01	20
5:01	E	Med	plain	bcd	FG5	0.60	-	6:06	E	Med	plain	red	FG3	0.04	-
5:01	I	Med	plain	bcd	FG5	0.10	-	6:07	B	Fine	burn	red	grog-blebs	0.01	19
5:02	D(i)	Med	plain	bcd	FG5	0.10	4	6:07	B	Fine	burn	bcd	FG3	0.02	18
5:02	D(i)	Fine	dec	bcd	FG5	0.02	B18	6:07	D	Med	plain	red	FG3	0.01	19
5:02	E	Med	burn	red	orth g exotic	0.02	B19	6:07	D	Med	plain	red	FG3	0.03	18
5:02	E	Med	burn	red	sand exotic	0.01	B19	6:07	D	Fine	dec	red	FG3	0.03	19
5:02	E	Med	plain	bcd	FG5	0.35	-	6:07	E	Med	plain	red	FG3	0.07	-
5:02	E	Med	plain	bcd	FG4	0.02	-	6:07	E	Med	plain	red	FG3	0.13	19
5:02	E	Med	plain	bcd	FG3	0.03	-	6:07	E	Med	plain	red	FG3	0.01	18
5:02	J	Med	burn	bcd	FG5	0.11	-	6:07	E	Med	burn	bcd	FG2	0.02	19
5:03	C	Med	plain	bcd	FG3	0.01	-	6:07	E	Fine	plain	bcd	no data	0.02	-
5:03	E	Med	plain	red	FG5	0.33	-	6:08	E	Med	plain	bcd	FG3	0.01	3
5:03	E	Med	plain	bcd	FG5	0.04	4	6:08	E	Med	plain	bcd	FG3	0.02	-
5:03	E	Med	plain	bcd	FG3	0.15	-	7:01	B	Med	plain	red	FG3	0.04	-
5:03	E	Med	plain	bcd	OSG exotic	0.11	-	7:01	C	Med	plain	bcd	FG3	0.02	3
5:03	E	Med	plain	red	FG4	0.02	-	7:01	D	Fine	dec	red	FG3	0.01	-
5:04	E	Med	plain	bcd	FG3	0.01	-	7:01	D	Fine	dec	red	grog-blebs	0.03	-
5:04	E	Med	plain	bcd	FG3	0.01	2	7:01	E	Med	burn	red	FG3	0.08	-
5:04	E	Med	burn	bcd	FG5	0.01	-	7:01	E	Med	plain	bcd	FG3	0.04	14
5:05	E	Med	plain	bcd	FG3	0.14	-	7:01	E	Med	plain	bcd	FG3	0.01	-
5:05	E	Med	plain	bcd	FG3	0.02	2	7:01	M	fine	dec	bcd	FG2	0.01	TS950
5:05	E	Fine	burn	bcd	FG5	0.07	-	7:02	C	Med	plain	red	rice exotic	0.11	-
5:05	E	Med	plain	bcd	FG4	0.02	6	7:02	C	Med	plain	bcd	rice local?	0.03	B15
5:05	E	Med	plain	bcd	FG5	0.01	2	7:02	D	Fine	dec	red	FG3	0.01	-
6: L1	E	Fine	burn	red	FG5	0.03	-	7:02	E	Med	plain	bcd	FG3	0.07	-
6: L2	E	Med	plain	bcd	FG3	0.02	-	7:02	E	Med	burn	red	FG3	0.06	-
6:00	E	Fine	dec	bcd	FG5	0.03	-	7:02	E	Med	burn	red	FG3	0.03	B15
6: L1	I	Fine	burn	red	FG5	0.11	-	7:02	E	Med	plain	bcd	FG3	0.02	9
6:01	E	Fine	plain	bcd	FG3	0.02	-	7:2 L3	E	Med	plain	bcd	FG3	0.03	-
6:01	E	Fine	burn	red	FG3	0.01	B4	7:02	SP	Med	SP	bcd	FG3	0.02	B15
6:01	E	Med	plain	bcd	FG5	0.24	-	7:03	C	Med	burn	red	FG3	0.04	27
6:1 L2	E	Med	plain	red	FG3	0.01	-	7:03	E	Med	burn	red	FG3	0.06	-
6:01	G	Fine	burn	red	FG5	0.05	-	7:03	E	Med	plain	bcd	FG3	0.07	-
6:02	D	Fine	burn	red	FG5	0.03	-	7:03	E	Med	burn	red	FG3	0.07	B16
6:02	E	Fine	plain	bcd	FG3	0.22	-	7:03	E	Fine	burn	red	FG3	0.02	B16
6:02	E	Med	plain	bcd	FG5	0.37	-	7:03	E	Fine	burn	red	grog-blebs	0.02	2
6:02	E	Fine	plain	bcd	FG5	0.02	-	7:04	D	Med	burn	red	FG3	0.05	-
6:02	E	Fine	burn	bcd	FG5	0.03	-	7:04	D	Fine	dec	red	FG2	0.06	-
6:03	C	Med	c/m	bcd	sand exotic	0.06	44	7:04	E	Med	plain	red	FG3	0.02	-
6:03	E	Med	plain	bcd	FG3	0.01	-	7:04	E	Med	plain	bcd	FG3	0.08	-
6:03	E	Med	plain	bcd	FG3	0.05	41 L6	7:04	E	Med	plain	bcd	FG3	0.07	-
6:03	E	Med	plain	red	FG3	0.10	-	7:05	D	Med	burn	red	FG3	0.01	39
6:03	E	Med	plain	bcd	FG3	0.01	92	7:05	D	Med	burn	red	FG3	0.02	-
6:03	E	Med	plain	bcd	FG3	0.01	73	7:05	E	Med	burn	red	FG3	0.07	-
6:03	E	Fine	burn	bcd	FG3	0.02	B8	7:05	E	Med	plain	red	FG3	0.03	-

TABLE 182: *Vessel base sherd weights (continued). SP: special; CP: carinated; SW: stoneware; SF: surface finish; dec: decorated; c/m: cord-marked; burn: burnished; red: reduced; bcd: black cored; ox.: oxidized*

Level	Form	Texture	SF	Firing	Fabric	Weight	Feature	Level	Form	Texture	SF	Firing	Fabric	Weight	Feature
7:05	E	Med	plain	bcd	FG3	0.04	31	9:04	E	Fine	burn	red	FG2	0.02	-
7:05	E	Fine	burn	red	FG3	0.01	5	9:04	E	Fine	burn	red	FG3	0.02	-
7:06	Cm	Med	burn	red	FG3	0.01	35	9:05	B	Fine	burn	red	FG2	0.06	-
7:06	E	Med	plain	red	FG3	0.01	-	9:05	CP	Fine	burn	red	blebs exotic	0.15	47
7:06	E	Med	burn	red	FG3	0.13	-	9:05	D	Fine	burn	red	FG3	0.03	-
7:06	E	Med	burn	red	FG3	0.02	B20	9:05	D	Fine	burn	red	FG2	0.13	54
7:07	C	Med	plain	bcd	FG3	0.02	44	9:05	D	Fine	burn	red	FG2	0.12	53
7:07	D	Med	burn	red	FG3	0.01	-	9:05	D	Fine	dec	red	no data	0.01	-
7:07	E	Med	plain	bcd	FG3	0.03	56	9:05	E	Fine	burn	red	FG3	0.06	-
7:07	E	Med	burn	red	FG3	0.01	54	9:06	D	Fine	burn	red	FG3	0.14	-
7:07	E	Med	burn	red	FG3	0.07	-	9:06	D	Fine	burn	red	FG2	0.02	32
7:07	E	Med	burn	red	FG3	0.03	1	9:06	D	Fine	burn	red	FG3	0.20	-
7:07	E	Fine	dec	red	no data	0.01	B24	9:6 L9	D	Fine	dec	red	no data	0.04	-
7:07	M	Med	dec	red	FG3	0.02	-	9:06	E	Fine	burn	red	FG2	0.18	-
7:08	B	Med	plain	red	FG2	0.03	26	9:07	D	Fine	burn	red	FG3	0.10	-
8:01	C	Med	plain	red	FG3	0.03	-	9:07	D	Fine	dec	red	no data	0.01	-
8:01	D	Med	dec	bcd	no data	0.02	-	9:07	E	Fine	burn	red	FG3	0.01	-
8:01	E	Med	plain	red	FG3	0.02	-	9:07	E	Med	burn	red	no data	0.02	-
8:02	C	Med	plain	bcd	grog-blebs	0.04	-	9:07	G	Fine	c/m	red	no data	0.05	-
8:02	D	Med	burn	red	FG3	0.06	-	9:07	SP	Fine	SW		no data	0.46	-
8:02	D	Med	dec	red	grog-blebs	0.02	-	10:01	D	Fine	burn	red	FG2	0.03	-
8:02	E	Med	burn	red	FG3	0.02	-	10:01	D	Fine	plain	red	FG3	0.05	-
8:02	E	Med	plain	red	FG3	0.01	-	10:01	E	Fine	burn	red	FG2	0.04	-
8:02	E	Med	plain	red	FG3	0.01	2	10:01	E	Fine	burn	red	FG3	0.10	-
8:02	E	Med	plain	bcd	FG3	0.03	-	10:02	C	Fine	burn	red	FG3	0.01	11
8:02	M	Med	dec	bcd	FG3	0.03	1	10:02	D	Fine	burn	red	FG2	0.10	-
8:03	D	Med	burn	red	FG3	0.04	-	10:02	D	Fine	dec	red	FG3	0.01	-
8:03	D	Med	dec	bcd	FG3	0.02	-	10:02	E	Fine	burn	red	FG2	0.05	-
8:03	E	Med	burn	red	FG3	0.07	-	10:02	E	Fine	plain	bcd	FG3	0.02	-
8:04	D	Med	burn	red	FG3	0.02	L7	10:02	F	Med	plain	red	shell exotic	0.03	-
8:04	D	Med	burn	red	FG3	0.04	-	10:03	B	Fine	burn	red	FG2	0.03	-
8:04	E	Med	plain	red	FG3	0.02	L7	10:03	D	Fine	burn	red	FG2	0.80	-
8:04	E	Med	plain	red	FG3	0.03	-	10:03	D	Fine	dec	red	blebs exotic	0.02	-
8:04	E	Med	burn	red	FG3	0.14	-	10:03	D	Fine	dec	red	FG3	0.10	-
8:05	D	Med	burn	red	FG3	0.02	-	10:03	D	Med	plain	bcd	FG2	0.07	-
8:05	D	Med	dec	bcd	no data	0.01	-	10:03	E	Fine	burn	red	FG2	0.42	-
8:05	E	Med	plain	red	FG3	0.02	-	10:03	E	Fine	plain	bcd	grog-orth	0.05	-
8:05	E	Med	plain	red	FG3	0.03	L8	10:03	E	Fine	plain	bcd	FG2	0.01	-
8:06	D	Med	burn	red	FG3	0.08	-	10:04	D	Fine	burn	red	FG2	0.01	L7
8:06	E	Med	plain	red	FG3	0.02	-	10:04	D	Fine	burn	red	FG2	0.04	-
8:07	D	Med	burn	red	FG2	0.10	-	10:04	D	Fine	burn	red	FG3	0.05	-
8:07	D	Med	burn	red	FG3	0.16	-	10:04	D	Fine	burn	red	FG2	0.01	13
8:07	E	Med	plain	bcd	FG3	0.11	-	10:04	D	Fine	dec	red	FG2	0.07	-
8:07	E	Med	plain	red	FG3	0.01	L12	10:04	E	Fine	burn	red	FG2	0.02	-
8:07	E	Fine	burn	red	grog-blebs	0.02	-	10:05	D	Fine	burn	red	FG2	0.02	-
8:07	E	Med	plain	bcd	no data	0.04	-	10:05	D	Fine	burn	red	FG2	0.02	20
8:07	G	Med	c/m	bcd	no data	0.03	-	10:05	D	Fine	dec	red	FG2	0.01	-
8:08	E	Med	plain	bcd	FG3	0.01	9	10:06	D	Fine	burn	red	FG2	0.19	-
9:01	D	Fine	dec	red	FG3	0.02	-	10:06	D	Fine	burn	ox.	FG2	0.04	-
9:01	E	Med	burn	red	FG3	0.05	-	10:06	E	Fine	burn	red	FG2	0.02	-
9:01	E	Med	plain	bcd	no data	0.02	-	10:06	E	Fine	plain	bcd	FG2	0.01	-
9:02	D	Fine	burn	red	FG2	0.02	-	10:07	D	Fine	burn	red	FG2	0.14	-
9:02	D	Med	plain	bcd	FG3	0.02	-	10:07	D	Fine	burn	red	FG2	0.01	23
9:02	D	Fine	dec	red	no data	0.02	-	10:07	D	Fine	burn	red	FG2	0.01	10
9:02	E	Fine	burn	red	FG3	0.01	-	10:07	E	Fine	burn	red	FG2	0.01	-
9:02	E	Med	plain	bcd	FG3	0.03	-	10:08	D	Fine	burn	red	FG2	0.05	-
9:03	B	Med	plain	red	FG3	0.06	-	10:08	E	Fine	burn	red	FG2	0.03	-
9:03	D	Fine	burn	red	FG2	0.03	-	10:08	E	Fine	burn	red	FG2	0.02	6
9:03	D	Fine	burn	red	FG3	0.19	-	10:09	D	Fine	burn	red	FG2	0.02	-
9:03	D	Med	burn	red	FG3	0.13	-	10:09	D	Fine	dec	red	FG2	0.02	-
9:03	D	Fine	dec	red	FG3	0.10	-	10:09	D	Med	dec	red	FG2	0.01	-
9:03	E	Fine	burn	red	FG2	0.03	-	10:09	E	Fine	burn	red	FG2	0.02	-
9:03	E	Med	plain	bcd	FG3	0.04	-	10:10	B	Fine	burn	red	FG2	0.01	21
9:03	E	Med	plain	red	FG3	0.02	-	10:10	C	Fine	c/m	bcd	FG2	0.02	-
9:03	G	Med	burn	bcd	orth g exotic	0.03	-	10:10	D	Fine	burn	red	blebs exotic	0.03	-
9:04	D	Fine	burn	red	FG3	0.05	-	10:10	D	Fine	burn	red	FG2	0.10	-
9:04	D	Med	burn	red	sand exotic	0.04	-	10:10	D	Fine	burn	red	FG2	0.04	7
9:04	D	Med	burn	red	FG2	0.04	-	10:11	D	Fine	burn	red	FG2	0.07	-
9:04	D	Med	burn	red	FG3	0.09	-	10:11	E	Fine	burn	red	FG2	0.05	16
9:04	D	Fine	dec	red	FG3	0.03	-	10:11	E	Fine	burn	red	FG2	0.09	15

TABLE 182: *Vessel base sherd weights (continued). SP: special; CP: carinated; SW: stoneware; Crs: coarse; SF: surface finish; dec: decorated; c/m: cord-marked; ptd: painted; pim: paddle-impressed; inpt: incised punctate; burn: burnished; ORG: orthodox sandy grog; red: reduced; bcd: black cored; ox.: oxidized*

Level	Form	Texture	SF	Firing	Fabric	Weight	Feature	Level	Form	Texture	SF	Firing	Fabric	Weight	Feature
10:11	E	Fine	burn	red	FG2	0.09	-	10:17	D	Med	dec	ox.	FG2	0.14	-
10:12	B	Fine	burn	red	FG2	0.06	-	10:19	C	Med	c/m	red	orth g exotic	0.04	-
10:12	D	Fine	burn	red	grog-blebs	0.11	-	10:19	D	Fine	dec	red	FG2	0.06	-
10:12	E	Fine	plain	red	FG2	0.02	-	10:19	E	Med	plain	bcd	no data	0.01	-
10:12	E	Fine	burn	red	FG2	0.02	-	10:19	L	Fine	dec	red	FG2	0.03	-
10:12	E	Fine	burn	red	FG2	0.03	9	10:22	A	Med	plain	red	sand	0.07	L27
10:13	D	Fine	burn	bcd	grog-blebs	0.02	13	10:22	B	Fine	dec	red	FG2	0.02	-
10:13	D	Fine	burn	red	FG2	0.04	7	10:22	D	Fine	dec	red	FG2	0.05	-
10:13	D	Fine	dec	red	FG2	0.01	-	10:23	D	Fine	burn	red	FG2	0.02	-
10:13	D	Fine	dec	red	FG2	0.02	-	10:23	D	Fine	dec	red	FG2	0.05	-
10:13	D	Med	dec	red	FG2	0.24	-	10:24	D	Fine	dec	red	FG2	0.06	-
10:14	C	Med	dec	bcd	orth g exotic	0.05	-	10:25	A	Med	burn	red	sand	0.11	-
10:14	D	Fine	dec	red	blebs	0.01	-	10:25	D	Fine	dec	red	FG2	0.23	-
10:14	D	Med	dec	red	FG2	0.28	-	10:26	C	Med	c/m	red	orth g exotic	0.09	-
10:15	C	Med	c/m	red	FG2	0.02	B110	10:26	D	Fine	dec	red	FG2	0.03	-
10:15	D	Fine	dec	red	FG2	0.04	-	11:01	A	Med	burn	red	FG2	0.16	-
10:15	D	Fine	dec	bcd	grog-blebs	0.05	B105	11:01	A	Med	burn	red	sand	0.02	-
10:15	D	Med	dec	red	FG2	0.28	-	11:01	B	Med	burn	red	FG2	0.09	-
10:16	D	Fine	dec	red	FG2	0.03	-	11:01	C	Med	c/m	red	orth g exotic	0.04	-
10:16	D	Med	dec	red	FG2	0.05	-	11:01	D	Med	dec	red	FG2	0.32	-
10:16	L	Med	dec	red	blebs exotic	0.04	-	11:01	E	Med	plain	red	FG2	0.09	-
10:17	B	Med	plain	ox.	FG2	0.10	-	11:02	A	Med	burn	red	sand	0.08	2
10:17	B	Med	dec	red	FG2	0.03	-	11:02	A	Med	dec	red	sand	0.04	-
10:17	D	Fine	dec	red	FG2	0.01	-	-	-	-	-	-	-	-	-

0.01 kg; L10: 0.42 kg; L9: 0.11 kg; L8: 0.09 kg; L7: 0.19 kg; L6: 0.28 kg; L5: 0.27 kg; L4: 0.5 kg; L3: 0.38 kg; L2: 0.5 kg and L1: 0.02 kg (Table 184).

Burnished pottery follows a similar distribution pattern to burnished and incised wares (Table 186). Several local sherds and a sand-tempered exotic ware are coated with red ochre. Many burnished sherds were recovered from burials or other features.

Burnished sherds

Burnished sherds were in 12 CP3 and 19 CP2 burials, but local production was concentrated in CP2. Burnished sherds are rare in CP4. The total weight for level 11 is 4.82 kg; L10: 65.04 kg; L9: 4.09 kg; L8: 4.61 kg; L7: 3.68 kg; L6: 0.70 kg; L5: 1.82 kg and L4: 0.42 kg, giving a site total of 85.18 kg. This equates to 0.42 kg for CP4; CP3: 17.46 kg; CP2: 59.99 kg and CP1: 7.31 kg. Hand specimen examination suggests that most are tempered with orthodox grog mainly representing local wares. The presence of exotic bleb, rice and sand tempers reflects the regional spread of burnished pottery. Local CP1 burnished pottery is tempered with sand. Exotic orthodox or bleb grog and sand-tempered examples were distributed throughout CP2 in varying quantities (Table 186). Most of the burnished sherds carry fragmentary decoration (shell impressions or cord marks for example), but this is insufficient to allow them to be assigned to any other category. Red ochre has been rubbed as a colourant into some local sherds, perhaps to copy novel exotic painted wares.

TABLE 183: *Carinated burial jar details. RD: rim decoration; CD: carination decoration; RW: rim width; CW: carination width; RH: rim height; CH: carination height*

Burial	Cat.	RD	CD	RW	CW	RH	CH	MP	Type	Fabric
57	1290	-	cms	148	160	80	25	3b	E2b	6
57	1288	-	cms	172	149	99	29	3b	L2b	3
56	1243	-	-	148	143	79	15	3b	L2b	3
58	1283	3+1 and.	field+cms?	177	180	138	29	3b	L2b	3
60	1291	2+ and.	field+cms	146	158	98	31	3b	L2b	3
67	1432	2+ and.	field	160	186	118	34	3b	L2b	3
MP3b mean:				158	162	102	27			
CP2 76	2016	2+and.	and.	180	160	82	28	3	L2b	2
72	1361	2+and.	field	141	169	108	49	3	L2b	2
72	1360	2+and.	field	139	166	100	36	3	L2b	2
73	1479	-	-	100	111	65	16	3	L2b	2
73	1478	-	-	112	134	87	27	3	L2b	2
86	2020	and.	fields	96	107	80	29	3	E2b	6
90	1467	3+2 and.	field	112	127	70	26	3	L2b	2
90	1466	2	field	119	139	77	26	3	L2b	2
92	1480	3+2 and.	field	97	108	67	17	3	L2b	2
93	1469	2+1 and.	-	139	162	90	37	3	L2b	2
93	1468	1+2 and.	field	154	194	92	40	3	L2b	2
91	1520	-	-	120	135	73	20	2	L2b	2
91	1519	-	-	119	129	73	24	2	L2b	2
120	1679	-	-	123	122	92	35	2	E2b	6
130	1691	3	2	158	156	60	26	2	L2c	2
MP2/3 mean:				127	141	81	29			
CP3 12	700	field	punctate	232	190	164	74	7	L2b	3
8	740	-	cms	160	96	nd	nd	6	L2b	3
8	741	-	cms?	151	110	76	20	6	L2b	3
9	794	field+cms	-	118	85	58	23	6	L2b	3 + bs
9	795	1+cms	cms?	120	84	58	18	6	L2b	3 + bs
11	764	field+and?	and.	226	160	127	38	6	L2b	3
11	763	2+cms?	cms?	172	115	97	27	6	L2b	3
11	765	2+and?	and?	185	120	105	35	6	L2b	3
13	819	-	and?	130	102	85	26	6	L2b	3
13	823	-	cms	140	100	75	18	6	L2b	3
13	823a	-	cms	140	108	75	15	6	L2b	3
19	977	2	and.	168	130	97	35	6	L2b	3 + bs
19	978	2	and.	180	130	95	30	6	L2b	3 + bs

TABLE 183: *Carinated burial jar details (continued). RD: rim decoration; CD: carination decoration; RW: rim width; CW: carination width; RH: rim height; CH: carination height*

Burial	Cat.	RD	CD	RW	CW	RH	CH	MP	Type	Fabric
CP3 19	3263	2	notch	162	110	88	27	6	E2b	11
19	979	field	cms	165	106	78	23	6	L2b	3 + bs
19	980	2	notch?	167	129	98	36	6	L2b	3
14	854	3+and.	and.	153	107	78	23	5	L2b	3
14	787	3	cms?	143	104	78	28	5	L2b	3 + bs
15	912	2+and.	and.	152	107	75	24	5	L2b	3
15	2781	2+and.	and.	159	118	86	33	5	L2b	3
15	2782	2+and.	and.	160	120	85	30	5	L2b	3
16	933	2+and.	and.	142	107	82	27	5	L2b	3 + bs
16	2784	2+and.	and.	157	117	83	28	5	L2b	3
16	2785	2+and.	and.	152	108	78	24	5	L2b	3
16	2786	2+and.	and.	150	94	70	25	5	L2b	3
20	953	punct?	cms	141	105	80	24	4	L2b	3
20	2787	2	punct?	146	106	82	32	4	L2b	3
22	884	-	cms	140	95	65	18	4	L2b	3
23	2029b	2	and?	120	64	-	-	4	L2b	3
24	899	cms	cms	150	96	76	23	4	L2b	3
27	914	and.	cms	146	93	68	14	4	L2b	3
29	2030	-	-	165	158	121	56	4	L2b	3
31	987	-	cms?	154	111	77	23	4	E2b	11
33	1100	field+cms	cms	204	140	88	26	4	L2b	3
33	1101	2+cms?	1+cms?	160	124	98	33	4	L2b	3
33	1117	2+cms?	1+cms?	172	123	88	30	4	L2b	3
35	1025	-	cmd base	134	88	75	27	4	E2b	17
35	1026	-	cmd base	122	78	57	13	4	E2b	17
36	1024	2+and.	and.	150	109	82	26	4	L2b	3
36	2791	2+and.	and.	150	104	84	24	4	L2b	3
38	2790	-	-	160	120	60	22	4	L2b	3
39	2033	cms	cms	170	147	127	49	4	L2b	3
41	2032	-	cms	160	118	60	15	4	E2b	12
43	2015	3+cms	cms	194	127	96	26	4	L2b	3
44	1049	2+and.	and.	162	118	83	25	4	L2b	3
44	1050	2+and.	and.	154	107	85	24	4	L2b	3
47	1141	-	cmd base	132	107	82	24	4	L2b	3
mean	CP3			156	110	85	27			
	MP3b			158	162	102	27			
	MP2/3			135	147	87	29			

TABLE 184: *Appliqué sherd weights.*
cmd: cord marked; bcd: black cored; ox: oxidized

Level	Feature	Form	Texture	Surface Finish	Firing	Fabric	Weight (kg)
1.1	-	A4	Medium	cmd	bcd	blebs	0.02
2.1	-	A4	Medium	cmd	bcd	blebs	0.01
2.1	-	A6	Medium	cmd	bcd	blebs	0.14
2.1	-	A6	Medium	cmd	bcd	blebs	0.14
2.2	-	A4	Medium	cmd	bcd	blebs	0.01
2.2	-	A6	Medium	cmd	bcd	blebs	0.04
2.2	-	A6	Medium	cmd	bcd	blebs	0.07
2.3	-	A6	Medium	cmd	bcd	blebs	0.09
3.1	-	A6	Medium	cmd	bcd	blebs	0.04
3.1	-	A6	Medium	cmd	bcd	blebs	0.04
3.2	-	A4	Medium	plain	bcd	blebs	0.02
3.2	-	A4	Fine	plain	bcd	grog-orth	0.04
3.2	-	A5	Medium	cmd	bcd	blebs	0.02
3.2	-	A5	Medium	cmd	bcd	blebs	0.03
3.2	-	A6	Medium	plain	bcd	blebs	0.01
3.2	-	A6	Medium	plain	bcd	blebs	0.04
3.2	-	A6	Medium	plain	bcd	blebs	0.01
3.2	-	A6	Medium	cmd	bcd	FG5	0.02
3.2	-	A7	Medium	plain	bcd	blebs	0.02
3.3	-	A6	Medium	plain	bcd	blebs	0.02
3.4	-	A4	Medium	plain	bcd	blebs	0.03
3.4	-	A4	Medium	cmd	bcd	blebs	0.02
3.5	-	A8	Medium	cmd	bcd	blebs	0.02
4.1	-	A4	Medium	cmd	bcd	blebs	0.07
4.1	-	A4	Medium	cmd	bcd	blebs	0.15
4.1	-	A5	Medium	plain	bcd	blebs	0.02
4.1	F2	A7	Medium	cmd	bcd	blebs	0.03
4.2	F2	A6	Medium	cmd	bcd	blebs	0.04
4.2	-	A6	Medium	plain	bcd	blebs	0.03
4.3	-	A5	Medium	plain	bcd	grog-orth	0.04
4.3	-	A6	Medium	cmd	bcd	blebs	0.02
4.3	-	A6	Medium	cmd	bcd	blebs	0.04
4.4	-	A4	Medium	cmd	bcd	blebs	0.03
4.4	-	A4	Medium	cmd	bcd	grog-orth	0.01
4.4	-	A5	Medium	cmd	bcd	blebs	0.02
5.1	-	A4	Medium	cmd	bcd	grog-orth	0.01
5.1	-	A4	Medium	plain	bcd	blebs	0.02
5.1	-	A5	Medium	cmd	bcd	grog-orth	0.02
5.1	-	A6	Fine	plain	bcd	blebs	0.02
5.5	-	A4	Medium	cmd	red	grog-orth	0.17
5	P26-9	A4	Medium	cmd	red	grog-orth	0.03
6.1	F1	A4	Medium	cmd	bcd	grog-orth	0.02
6.2	-	A4	Medium	cmd	bcd	grog-orth	0.11
6.3	-	A4	Medium	cmd	bcd	grog-orth	0.02
6.4	-	A4	Medium	plain	bcd	blebs	0.04
6.5	-	A4	Medium	plain	bcd	grog-orth	0.01
6.7	F19	A4	Medium	plain	bcd	grog-orth	0.03
6.7	F18	A4	Medium	plain	bcd	grog-orth	0.05
7.2	B15	A3	Medium	burnished	bcd	grog-orth	0.07
7.3	-	A4	Medium	plain	bcd	grog-orth	0.02
7.7	-	A5	Medium	plain	bcd	grog-orth	0.06
7.8	-	A4	Medium	cmd	bcd	grog-orth	0.04
8.1	-	A3	Medium	plain	bcd	grog-orth	0.01
8.6	-	A4	Coarse	plain	bcd	grog-orth	0.08
9.5	-	A3	Medium	burnished	bcd	FG2	0.02
9.6	-	A2	Medium	plain	bcd	grog-orth	0.05
9.6	-	A3	Medium	burnished	bcd	FG2	0.04
10.12	-	A1	Fine	other	bcd	blebs	0.01
10.12	-	A2	Medium	other	ox.	blebs	0.41
10.21	-	A2	Fine	other	ox.	FG10	0.02
11.1	-	A1	Fine	other	ox.	sandy blebs?	0.01

TABLE 185: *Burnished and incised sherd weights. red: reduced; bcd: black cored; ox: oxidized*

Level	Texture	Surface Finish	Firing	Fabric	Weight (kg)	Feature
4.1	Medium	decorated	bcd	grog-blebs	0.08	-
4.3	Medium	decorated	bcd	grog-blebs	0.01	F8
4.5	Fine	decorated	red	grog-blebs	0.01	F1
5.2	Fine	decorated	red	sand-exotic	0.01	F4
5.2 P24	Fine	decorated	red	grog-orth	0.03	B19
5.2 P24	Fine	plain	bcd	no data	0.07	B19
5.1 P28	Fine	decorated	red	no data	0.02	F2
5.3	Fine	decorated	red	sand-exotic	0.04	B6
5.3 P1	Fine	decorated	red	grog-orth	0.01	B6
5.2 P12	Fine	decorated	red	grog-orth	0.02	F2
5.5 P31	Fine	decorated	red	no data	0.02	-
5.5 P32	Fine	decorated	red	no data	0.09	-
5.5	Fine	decorated	bcd	grog-blebs	0.01	-
6.1	Fine	decorated	red	grog-blebs	0.02	B4
6.1	Fine	decorated	bcd	grog-orth	0.06	-
6.1	Fine	plain	red	no data	0.13	B4
6.1	Fine	decorated	red	sand-exotic	0.03	-
6.2	Fine	decorated	bcd	grog-blebs	0.03	-
6.2	Fine	decorated	red	sand-exotic	0.03	-
6.3	Fine	decorated	red	grog-blebs	0.02	F8
6.4	Fine	decorated	red	grog-orth	0.01	F68
6.4	Fine	decorated	red	no data	0.05	F8
6.6	Fine	decorated	red	grog-blebs	0.02	F28
6.6	Fine	decorated	red	grog-orth	0.01	F21
6.6	Fine	decorated	red	grog-orth	0.01	F37
6.6	Fine	decorated	red	grog-orth	0.01	-
6.7	Fine	plain	bcd	no data	0.09	-
6.8	Fine	decorated	bcd	grog-orth	0.02	F8
6.8	Fine	plain	bcd	no data	0.04	-
7.2	Fine	decorated	red	grog-orth	0.02	F1
7.2	Fine	decorated	red	grog-orth	0.01	F2
7.2	Fine	decorated	red	grog-orth	0.04	B15
7.2	Fine	decorated	red	grog-orth	0.02	F22
7.2	Fine	decorated	red	grog-orth	0.04	F33
7.2	Fine	plain	red	no data	0.02	F37
7.3	Fine	decorated	red	grog-orth	0.02	B16
7.3	Fine	decorated	red	grog-orth	0.02	F13
7.4	Fine	decorated	red	grog-orth	0.01	-
7.4	Fine	plain	red	no data	0.03	-
7.5	Fine	decorated	red	grog-orth	0.02	F5
7.5	Fine	decorated	red	grog-orth	0.03	F24
7.5	Fine	decorated	red	grog-orth	0.01	F39
7.6	Fine	decorated	red	grog-orth	0.02	F29
7.6	Fine	decorated	red	grog-orth	0.01	F35
7.7	Fine	decorated	red	grog-orth	0.08	-
7.8	Fine	decorated	red	grog-orth	0.01	F31
7.8	Fine	decorated	red	sand-exotic	0.01	B27
8.1	Fine	decorated	bcd	grog-orth	0.01	F36
8.2	Fine	decorated	red	grog-orth	0.01	F41
8.2	Fine	decorated	bcd	grog-orth	0.01	F61
8.3	Fine	decorated	bcd	grog-orth	0.01	B29
8.3	Fine	decorated	red	grog-orth	0.01	F39
8.3	Fine	decorated	red	exotic sand	0.04	-
8.4	Fine	decorated	red	grog-orth	0.02	B28
8.4 L7	Fine	decorated	firecld	sand	0.02	-
8.5	Fine	decorated	bcd	grog-orth	0.01	B30
8.5	Fine	plain	red	no data	0.12	B33
8.5 L8	Fine	decorated	red	grog-orth	0.02	-
8.6	Fine	decorated	red	FG2?	0.01	F17
8.6	Fine	decorated	red	grog-orth	0.01	F38
8.6	Fine	decorated	red	grog-orth	0.01	F78
8.7	Fine	decorated	red	grog-orth	0.01	F3
8.7	Fine	decorated	ox.	exotic grog	0.01	F28
8.7	Fine	decorated	red	grog-orth	0.01	F36
8.7	Fine	decorated	red	no data	0.16	-
9.1	Fine	decorated	ox.	grog-orth	0.02	-
9.1	Fine	decorated	red	no data	0.02	-
9.4	Fine	decorated	red	grog-blebs	0.02	F36
9.5	Fine	decorated	red	FG2	0.01	F40
9.7	Fine	decorated	red	FG2	0.01	F18
9.7	Fine	decorated	red	grog-orth	0.05	F10
10.1	Fine	decorated	red	rice	0.01	F41

TABLE 185: *Burnished and incised sherd weights (continued). red: reduced; bcd: black cored; ox: oxidized*

Level	Texture	Surface Finish	Firing	Fabric	Weight (kg)	Feature
10.2	Fine	decorated	red	grog-orth	0.01	F54
10.2	Fine	decorated	bcd	grog-orth	0.04	-
10.2	Fine	plain	red	no data	0.01	-
10.3	Fine	decorated	red	grog-orth	0.03	B56
10.3	Fine	decorated	red	grog-orth	0.04	B58
10.3	Fine	decorated	bcd	rice	0.01	B56
10.3 L2	Fine	plain	red	no data	0.07	-
10.4	Fine	decorated	red	grog-orth	0.06	B57
10.4	Fine	decorated	bcd	grog-orth	0.01	B60
10.4	Fine	decorated	bcd	rice	0.01	B57
10.4 L7	Fine	plain	red	no data	0.02	-
10.5	Fine	decorated	red	grog-orth	0.01	F12
10.5	Fine	decorated	red	grog-orth	0.01	F34
10.5	Fine	decorated	red	grog-orth	0.02	F39
10.5	Fine	plain	red	no data	0.04	-
10.6	Fine	decorated	red	grog-orth	0.01	F7
10.6	Fine	decorated	red	grog-orth	0.05	B67
10.7	Fine	decorated	red	FG2	0.03	F29
10.7	Fine	decorated	red	grog-orth	0.03	B72
10.7	Fine	decorated	red	grog-orth	0.04	F6
10.7	Fine	plain	red	no data	0.05	-
10.8	Fine	decorated	red	FG2	0.04	B90
10.8	Fine	decorated	bcd	grog-orth	0.02	F15
10.8	Fine	plain	red	no data	0.10	-
10.9	Fine	decorated	ox.	FG2	0.01	B103
10.9	Fine	decorated	red	FG2	0.01	F25
10.9	Fine	decorated	red	FG2	0.01	F28
10.9	Fine	plain	red	no data	0.12	-
10.9	Fine	plain	bcd	no data	0.29	-
10.9	Fine	plain	red	no data	0.03	-
10.10	Fine	decorated	red	FG2	0.02	F28
10.10	Fine	decorated	red	FG2	0.01	B123
10.10	Fine	decorated	red	exotic grog	0.01	F27
10.10	Fine	decorated	red	no data	0.04	B91
10.10	Fine	plain	red	no data	0.05	-
10.10	Fine	plain	red	no data	0.01	-
10.10	Fine	plain	red	no data	0.02	-
10.10	Fine	plain	red	no data	0.02	F26
10.10	Fine	plain	red	no data	0.02	-
10.11	Fine	decorated	red	FG2	0.01	B102
10.11	Fine	plain	red	no data	0.13	-
10.11	Fine	plain	red	no data	0.08	-
10.11	Fine	plain	red	no data	0.02	-
10.11	Fine	plain	red	no data	0.10	-
10.12	Fine	decorated	red	FG2	0.01	F5
10.12	Fine	decorated	red	FG2	0.01	F7
10.12	Fine	decorated	red	FG2	0.04	B87
10.12	Fine	decorated	red	FG2	0.04	B115
10.12	Fine	decorated	bcd	exotic blebs	0.01	B87
10.12	Fine	decorated	red	exotic grog	0.04	B109
10.12	Fine	decorated	bcd	exotic grog	0.01	B87
10.12	Fine	decorated	bcd	exotic grog	0.04	B115
10.12	Fine	plain	red	no data	0.13	-
10.12	Fine	plain	red	no data	0.04	-
10.12	Fine	plain	red	no data	0.04	-
10.12	Fine	plain	red	no data	0.09	-
10.12	Fine	plain	red	sand-exotic	0.06	-
10.13	Fine	decorated	red	FG2	0.01	-
10.13	Fine	decorated	red	exotic blebs	0.02	F30
10.14	Fine	decorated	red	FG2	0.08	B120
10.15	Fine	decorated	red	FG2	0.02	B110
10.15	Fine	plain	red	no data	0.02	B131
10.16	Fine	plain	red	no data	0.01	-
10.16	Fine	plain	red	no data	0.01	-
10.23	Fine	plain	red	no data	0.01	-
10.24 L28	Fine	plain	red	no data	0.07	-

TABLE 186: *Burnished sherd weights. red: reduced; bcd: black cored; ox: oxidized*

Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature
4:00	plain	bcd	grog-orth	0.09	F4	7:04	decorated	bcd	grog-orth	0.03	F1
4:00	plain	bcd	grog-orth	0.22	F5	7:04	decorated	red	grog-orth	0.07	B17
4:03	plain	red	grog-orth	0.01	F6	7:04	decorated	bcd	grog-orth	0.06	F17
4:03	plain	red	sand-exotic	0.02	F2	7:04	decorated	bcd	grog-orth	0.02	F12
4:03	decorated	red	grog-blebs	0.02	-	7:04	decorated	bcd	grog-orth	0.12	-
4:03	decorated	red	sand-exotic	0.02	-	7:04	decorated	red	grog-orth	0.04	-
4:05	plain	bcd	grog-orth	0.04	F1	7:04	decorated	bcd	grog-orth	0.06	F16
5:P8	decorated	bcd	no data	0.01	F1	7:04	decorated	bcd	grog-orth	0.03	F23
5:P9	decorated	red	no data	0.02	-	7:04	decorated	red	grog-orth	0.03	-
5:P15	decorated	red	no data	0.03	-	7:04	decorated	bcd	grog-orth	0.02	F27
5:P24	plain	bcd	grog-orth	0.08	F1	7:04	decorated	bcd	grog-orth	0.05	F30
5:P24	plain	red	grog-orth	0.95	B19	7:04	plain	red	grog-orth	0.02	F36
5:P25	decorated	red	no data	0.02	-	7:04	decorated	red	sand-exotic grog	0.07	B17
5:P26/29	decorated	ox	no data	0.04	-	7:05	decorated	bcd	grog-orth	0.03	F1
5:P26/29	decorated	red	no data	0.07	-	7:05	decorated	red	grog-orth	0.04	F3
5:P28	decorated	red	no data	0.03	F4	7:05	decorated	red	grog-orth	0.07	F5
5:P31	decorated	red	no data	0.04	-	7:05	decorated	red	grog-orth	0.05	F10
5:P32	decorated	red	no data	0.34	-	7:05	decorated	red	grog-orth	0.03	F13
5:P34	decorated	red	no data	0.04	F4	7:05	decorated	red	grog-orth	0.02	F21
5:P35	decorated	bcd	no data	0.01	F4	7:05	decorated	bcd	grog-orth	0.03	F23
5:P37	decorated	bcd	no data	0.05	F2	7:05	decorated	bcd	grog-orth	0.02	F27
5:P37	decorated	bcd	no data	0.03	F3	7:05	decorated	bcd	grog-orth	0.01	F30
5:P37/40	decorated	bcd	no data	0.06	-	7:05	decorated	bcd	grog-orth	0.03	-
6:01	plain	red	grog-orth	0.06	B4	7:05	decorated	red	grog-orth	0.04	F35
6:04	decorated	bcd	grog-orth	0.04	B11	7:05	decorated	red	grog-orth	0.30	F39
6:04	decorated	bcd	grog-orth	0.03	F10	7:05	decorated	red	grog-orth	0.01	F43
6:05	plain	bcd	grog-orth	0.03	F38	7:05	decorated	red	grog-orth	0.04	F44
6:06	decorated	bcd	grog-orth	0.07	F21	7:05	decorated	red	grog-orth	0.17	-
6:06	decorated	red	grog-orth	0.09	F38	7:05	decorated	bcd	sand-exotic	0.04	-
6:06	plain	red	grog-orth	0.03	F37	7:06	decorated	bcd	grog-orth	0.01	F18
6:06	plain	bcd	grog-orth	0.04	F16	7:06	decorated	bcd	grog-orth	0.02	F34
6:06	plain	red	grog-orth	0.01	F19	7:06	decorated	red	grog-orth	0.16	-
6:06	plain	bcd	grog-orth	0.02	F20	7:06	plain	bcd	grog-orth	0.04	B22
6:06	plain	bcd	grog-orth	0.10	F26	7:06	plain	bcd	grog-orth	0.07	B36
6:07	decorated	bcd	grog-orth	0.02	F20	7:06	decorated	red	sand-exotic	0.02	F4
6:07	decorated	bcd	grog-orth	0.08	-	7:06	decorated	red	sand-exotic	0.02	-
6:07	plain	bcd	grog-orth	0.04	F28	7:06	decorated	red	sand-exotic	0.01	B36
6:07	plain	ox	grog-orth	0.01	F17	7:07	decorated	bcd	grog-orth	0.02	F16
6:07	plain	red	grog-orth	0.01	F25	7:07	decorated	bcd	grog-orth	0.02	F29
6:08	plain	red	grog-orth	0.01	F13	7:07	decorated	red	grog-orth	0.02	F32
6:08	plain	red	grog-orth	0.01	F7	7:07	decorated	bcd	grog-orth	0.02	B25
7:01	decorated	bcd	grog-orth	0.02	-	7:07	decorated	bcd	grog-orth	0.04	F37
7:01	decorated	red	grog-orth	0.02	F8	7:07	decorated	red	grog-orth	0.08	-
7:01	decorated	red	grog-orth	0.02	F12	7:07	decorated	red	grog-orth	0.02	F51
7:01	decorated	red	grog-orth	0.04	F18	7:07	decorated	red	grog-orth	0.02	F56
7:01	decorated	red	grog-orth	0.03	F22	7:07	decorated	red	grog-orth	0.02	F57
7:01	decorated	red	grog-orth	0.03	-	7:07	plain	bcd	grog-orth	0.02	F34
7:01	plain	bcd	grog-orth	0.02	F29	7:08	decorated	bcd	grog-orth	0.04	F2
7:01	plain	bcd	grog-orth	0.03	F30	8:01	decorated	red	grog-orth	0.03	-
7:01	decorated	red	sand-exotic	0.02	-	8:01	decorated	red	grog-orth	0.18	-
7:01	decorated	red	sand-exotic	0.01	F26	8:01	decorated	bcd	grog-orth	0.03	B40
7:02	decorated	bcd	grog-orth	0.02	F6	8:01	decorated	red	grog-orth	0.02	-
7:02	decorated	red	grog-orth	0.03	F7	8:01	decorated	red	grog-orth	0.09	-
7:02	decorated	bcd	grog-orth	0.14	B15	8:02	decorated	red	grog-orth	0.08	F1
7:02	decorated	red	grog-orth	0.05	F20	8:02	decorated	red	grog-orth	0.08	-
7:02	decorated	red	grog-orth	0.06	F22	8:02	decorated	red	grog-orth	0.01	-
7:02	decorated	red	grog-orth	0.04	F23	8:02	decorated	red	grog-orth	0.05	F12
7:02	decorated	bcd	grog-orth	0.02	F24	8:02	decorated	red	grog-orth	0.25	-
7:02	decorated	bcd	grog-orth	0.03	F2	8:02	decorated	red	grog-orth	0.43	-
7:02	decorated	bcd	grog-orth	0.02	F29	8:02	decorated	red	grog-orth	0.02	B15
7:02	decorated	bcd	grog-orth	0.17	-	8:02	decorated	bcd	grog-orth	0.02	F42
7:02	plain	bcd	grog-orth	0.04	F34	8:02	decorated	bcd	grog-orth	0.05	F55
7:02	decorated	bcd	rice-exotic	0.01	B15	8:02	decorated	red	grog-orth	0.17	-
7:02	decorated	bcd	sand-exotic	0.04	B15	8:02	plain	bcd	grog-orth	0.02	F24
7:03	decorated	bcd	grog-orth	0.02	B16	8:03	decorated	red	grog-orth	0.07	-
7:03	decorated	bcd	grog-orth	0.17	-	8:03	decorated	red	grog-orth	0.02	F20
7:03	decorated	bcd	grog-orth	0.03	-	8:03	decorated	bcd	grog-orth	0.04	-
7:03	decorated	bcd	grog-orth	0.08	F26	8:03	decorated	bcd	grog-orth	0.04	F29
7:03	decorated	bcd	grog-orth	0.14	F27	8:03	decorated	bcd	grog-orth	0.04	F39
7:03	decorated	bcd	grog-orth	0.08	-	8:03	decorated	red	grog-orth	0.09	-
7:03	plain	bcd	grog-orth	0.02	F28	8:04	decorated	red	grog-orth	0.02	-
7:03	plain	red	grog-orth	0.01	F33	8:04	decorated	red	grog-orth	0.02	-

TABLE 186: *Burnished sherd weights (continued). red: reduced; bcd: black cored; ox: oxidized*

Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature
8:04	decorated	red	grog-orth	0.04	F33	9:03	decorated	red	grog-orth	0.03	F15
8:04	decorated	red	grog-orth	0.10	-	9:03	decorated	red	grog-orth	0.02	F18
8:04	plain	bcd	grog-orth	0.01	-	9:03	decorated	bcd	grog-orth	0.01	F24
8:4 L6	decorated	red	grog-orth	0.01	-	9:03	decorated	red	grog-orth	0.02	F34
8:4 L7	decorated	bcd	grog-orth	0.02	-	9:03	decorated	red	grog-orth	0.01	-
8:5 L8	decorated	bcd	grog-orth	0.06	-	9:03	plain	bcd	grog-orth	0.04	F10
8:05	decorated	bcd	grog-orth	0.19	B30	9:03	plain	bcd	grog-orth	0.01	-
8:05	decorated	bcd	grog-orth	0.03	B31	9:03	decorated	bcd	rice-exotic	0.05	F30
8:05	decorated	bcd	grog-orth	0.02	F18	9:04	plain	bcd	FG2	0.02	ochre
8:05	decorated	bcd	grog-orth	0.06	-	9:04	decorated	red	grog-orth	0.03	-
8:05	decorated	red	grog-orth	0.05	-	9:04	decorated	red	grog-orth	0.09	-
8:05	decorated	bcd	grog-orth	0.09	F61	9:04	decorated	ox	grog-orth	0.03	F16
8:05	decorated	bcd	grog-orth	0.02	F64	9:04	decorated	red	grog-orth	0.04	-
8:05	decorated	red	grog-orth	0.04	-	9:04	decorated	red	grog-orth	0.04	-
8:05	plain	bcd	grog-orth	0.02	F12	9:04	decorated	red	grog-orth	0.02	F39
8:05	plain	bcd	grog-orth	0.02	F19	9:04	decorated	red	grog-orth	0.02	F29
8:05	plain	bcd	grog-orth	0.08	-	9:04	decorated	red	grog-orth	0.06	F32
8:05	decorated	ox	sand-exotic	0.02	F56	9:04	decorated	bcd	grog-orth	0.04	F34
8:06	decorated	red	grog-blebs?	0.02	F50	9:04	decorated	red	grog-orth	0.02	F35
8:06	decorated	red	grog-orth	0.35	-	9:04	decorated	red	grog-orth	0.02	F37
8:06	decorated	red	grog-orth	0.01	F36	9:04	decorated	red	grog-orth	0.02	F39
8:06	decorated	red	grog-orth	0.02	F44	9:04	decorated	red	grog-orth	0.04	-
8:06	decorated	red	grog-orth	0.02	F62	9:05	decorated	bcd	grog-orth	0.08	F6
8:06	decorated	red	grog-orth	0.03	-	9:05	decorated	red	grog-orth	0.03	F9
8:06	decorated	red	grog-orth	0.01	F77	9:05	decorated	red	grog-orth	0.02	F10
8:06	decorated	red	grog-orth	0.13	-	9:05	decorated	red	grog-orth	0.03	-
8:06	decorated	red	sandy grog	0.01	-	9:05	decorated	red	grog-orth	0.08	-
8:06	decorated	bcd	sandy grog	0.04	F17	9:05	decorated	red	grog-orth	0.02	F15
8:06	decorated	red	sandy grog	0.01	F22	9:05	decorated	bcd	grog-orth	0.02	F16
8:06	decorated	bcd	rice-exotic	0.04	F21	9:05	decorated	red	grog-orth	0.02	F21
8:7 L9	decorated	red	grog-orth	0.03	-	9:05	decorated	ox	grog-orth	0.02	F23
8:07	decorated	red	grog-orth	0.03	F1	9:05	decorated	red	grog-orth	0.11	-
8:07	decorated	red	grog-orth	0.02	F7	9:05	decorated	bcd	grog-orth	0.08	F47
8:07	decorated	bcd	grog-orth	0.01	F8	9:05	decorated	bcd	grog-orth	0.07	F53
8:07	decorated	red	grog-orth	0.01	-	9:05	decorated	red	grog-orth	0.04	-
8:07	decorated	red	grog-orth	0.03	F26	9:05	decorated	red	sand-exotic	0.02	F17
8:07	decorated	red	grog-orth	0.02	F27	9:5 L8	decorated	red	grog-orth	0.01	-
8:07	decorated	red	grog-orth	0.23	F28	9:5 L8	plain	bcd	grog-orth	0.13	-
8:07	decorated	red	grog-orth	0.05	F30	9:6 L9	decorated	red	grog-orth	0.18	-
8:07	decorated	red	grog-orth	0.08	-	9:6L9	plain	bcd	grog-orth	0.13	-
8:07	decorated	red	grog-orth	0.02	F36	9:06	decorated	red	grog-orth	0.03	F5
8:07	decorated	bcd	grog-orth	0.02	F33	9:06	decorated	bcd	grog-orth	0.04	F18
8:07	decorated	red	grog-orth	0.09	-	9:06	decorated	red	grog-orth	0.03	-
8:07	plain	bcd	grog-orth	0.13	-	9:06	decorated	red	grog-orth	0.02	F33
8:7 L12	decorated	red	grog-orth	0.38	-	9:06	decorated	red	grog-orth	0.01	-
8:08	decorated	red	grog-orth	0.02	F16	9:06	decorated	red	grog-orth	0.11	-
9:01	decorated	bcd	grog-orth	0.30	-	9:06	decorated	red	grog-orth	0.23	F37
9:01	decorated	red	grog-orth	0.01	-	9:06	decorated	red	grog-orth	0.16	F42
9:01	decorated	bcd	grog-orth	0.01	B42	9:06	decorated	red	grog-orth	0.29	-
9:01	decorated	red	grog-orth	0.02	F27	9:07	decorated	red	grog-orth	0.17	-
9:01	decorated	bcd	grog-orth	0.02	F30	10:01	decorated	red	grog-orth	0.06	F1
9:01	decorated	bcd	grog-orth	0.03	-	10:01	decorated	red	grog-orth	0.54	-
9:01	decorated	red	grog-orth	0.02	-	10:01	decorated	red	grog-orth	0.22	-
9:01	decorated	red	grog-orth	0.02	-	10:01	decorated	red	grog-orth	0.06	F9
9:01	decorated	red	grog-orth	0.03	B37	10:01	decorated	red	grog-orth	0.02	F26
9:01	decorated	red	grog-orth	0.12	-	10:01	decorated	red	grog-orth	0.01	F27
9:01	decorated	bcd	rice-exotic	0.04	F36	10:01	decorated	red	grog-orth	0.02	F29
9:01	decorated	red	rice-exotic	0.02	B37	10:01	decorated	red	grog-orth	0.04	F32
9:02	decorated	red	grog-orth	0.05	F4	10:01	decorated	red	grog-orth	0.14	-
9:02	decorated	red	grog-orth	0.04	F6	10:01	decorated	red	grog-orth	0.03	F39
9:02	decorated	red	grog-orth	0.09	-	10:01	plain	bcd	grog-orth	0.18	-
9:02	decorated	red	grog-orth	0.03	-	10:01	plain	bcd	grog-orth	0.10	-
9:02	decorated	red	grog-orth	0.06	-	10:02	plain	bcd	FG2	0.01	-
9:02	decorated	red	grog-orth	0.03	F26	10:02	decorated	red	grog-orth	0.03	F14
9:02	decorated	red	grog-orth	0.02	-	10:02	decorated	red	grog-orth	0.04	F35
9:02	decorated	red	rice-exotic	0.06	F22	10:02	decorated	red	grog-orth	0.02	F47
9:03	decorated	red	grog-orth	0.04	F5	10:02	decorated	red	grog-orth	0.21	-
9:03	decorated	red	grog-orth	0.05	-	10:02	decorated	red	grog-orth	0.38	-
9:03	decorated	red	grog-orth	0.02	-	10:02	decorated	red	grog-orth	0.11	-
9:03	decorated	red	grog-orth	0.08	-	10:02	decorated	red	grog-orth	0.05	B77
9:03	decorated	red	grog-orth	0.02	F14	10:02	decorated	red	grog-orth	0.02	F65

TABLE 186: *Burnished sherd weights (continued). cmd: cord-marked; red: reduced; bcd: black cored; ox: oxidized*

Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature
10:02	decorated	red	grog-orth	0.23	-	10:07	decorated	red	grog-orth	0.02	F5
10:02	decorated	red	grog-orth	0.02	F64	10:07	decorated	red	grog-orth	0.03	F6
10:02	plain	ox	sand-exotic	0.02	ochre	10:07	decorated	red	grog-orth	0.13	-
10:03	plain	bcd	FG2	0.22	-	10:07	decorated	red	grog-orth	0.12	-
10:03	plain	bcd	grog-blebs	0.04	-	10:07	decorated	red	grog-orth	0.09	B73
10:03	decorated	red	grog-orth	0.03	F1	10:07	decorated	red	grog-orth	0.32	-
10:03	decorated	red	grog-orth	0.05	F5	10:07	decorated	bcd	grog-orth	0.14	F6
10:03	decorated	red	grog-orth	6.42	-	10:07	decorated	bcd	grog-orth	0.02	F19
10:03	decorated	red	grog-orth	0.31	-	10:07	decorated	bcd	grog-orth	0.71	F29
10:03	decorated	red	grog-orth	0.21	-	10:07	decorated	bcd	grog-orth	0.32	-
10:03	decorated	red	grog-orth	0.17	-	10:07	plain	bcd	grog-orth	0.07	-
10:03	decorated	red	grog-orth	0.11	-	10:07	cmd	ox	sand-exotic	0.02	ochre
10:03	decorated	red	grog-orth	0.43	-	10:08	plain	bcd	FG2	0.06	-
10:03	decorated	red	grog-orth	0.02	F26	10:08	plain	bcd	FG2	0.05	-
10:03	plain	bcd	grog-orth	0.06	-	10:08	plain	bcd	grog-blebs	0.05	-
10:03	plain	bcd	grog-orth	0.06	-	10:08	plain	bcd	grog-blebs	0.01	-
10:03	cmd	bcd	grog-orth	0.01	ochre	10:08	decorated	red	grog-orth	0.03	F32
10:03	plain	bcd	grog-orth	0.17	-	10:08	decorated	red	grog-orth	0.04	-
10:03	cmd	bcd	grog-orth	0.39	ochre	10:08	decorated	red	grog-orth	0.02	F6
10:03	plain	bcd	FG2	0.07	-	10:08	decorated	red	grog-orth	0.03	F8
10:03	plain	bcd	sand-exotic	0.04	ochre	10:08	decorated	red	grog-orth	0.02	F10
10:3 Lens2	plain	bcd	FG2	0.02	-	10:08	decorated	red	grog-orth	0.02	F11
10:3 lens2	decorated	red	grog-orth	0.40	-	10:08	decorated	red	grog-orth	0.54	-
10:4 lens7	decorated	red	grog-orth	0.11	-	10:08	decorated	red	grog-orth	0.25	-
10:04	decorated	red	grog-orth	0.01	F25	10:08	decorated	bcd	grog-orth	0.39	-
10:04	decorated	red	grog-orth	0.09	F16 B60	10:08	decorated	bcd	grog-orth	0.16	B90
10:04	decorated	red	grog-orth	0.13	-	10:08	decorated	bcd	grog-orth	0.04	B92
10:04	decorated	red	grog-orth	0.33	-	10:08	decorated	bcd	grog-orth	0.06	B95
10:04	decorated	red	grog-orth	0.18	-	10:08	decorated	red	grog-orth	0.42	-
10:04	decorated	red	grog-orth	0.04	F22	10:08	plain	bcd	grog-orth	0.01	-
10:04	decorated	red	grog-orth	0.03	F18	10:08	cmd	bcd	grog-orth	0.01	ochre
10:04	decorated	red	grog-orth	0.03	B79	10:08	plain	ox	sand-exotic	0.01	ochre
10:04	decorated	red	grog-orth	0.23	-	10:08	cmd	bcd	sand-exotic	0.02	ochre
10:04	plain	bcd	grog-orth	0.04	B79	10:09	decorated	red	grog-orth	0.01	F1
10:04	plain	bcd	grog-orth	0.06	-	10:09	decorated	red	grog-orth	0.07	F4
10:05	decorated	red	grog-orth	0.04	F11	10:09	decorated	red	grog-orth	0.02	F6
10:05	decorated	red	grog-orth	0.04	F3	10:09	decorated	red	grog-orth	0.03	B89
10:05	decorated	red	grog-orth	0.03	F15	10:09	decorated	red	grog-orth	0.07	F11
10:05	decorated	red	grog-orth	0.07	F17	10:09	decorated	red	grog-orth	0.47	-
10:05	decorated	red	grog-orth	0.04	F20	10:09	decorated	bcd	grog-orth	0.45	-
10:05	decorated	red	grog-orth	0.16	-	10:09	decorated	red	grog-orth	0.03	B103
10:05	decorated	red	grog-orth	0.03	F34	10:09	decorated	red	grog-orth	0.08	F25
10:05	decorated	red	grog-orth	0.11	F37	10:09	decorated	red	grog-orth	0.07	F26
10:05	decorated	red	grog-orth	0.22	-	10:09	decorated	red	grog-orth	0.18	F27
10:05	decorated	red	grog-orth	0.03	F44	10:09	decorated	red	grog-orth	0.02	F30
10:05	decorated	red	grog-orth	0.04	F53	10:09	decorated	red	grog-orth	0.47	-
10:05	decorated	red	grog-orth	0.16	-	10:09	decorated	red	sand-exotic	0.63	F27
10:05	decorated	red	grog-orth	0.03	F56	10:09	cmd	bcd	sand-exotic	0.01	ochre
10:05	decorated	bcd	grog-orth	0.02	F17	10:10	plain	bcd	FG2	0.04	-
10:05	plain	bcd	grog-orth	0.15	-	10:10	plain	bcd	grog-blebs	0.02	-
10:05	decorated	red	sand-exotic	0.02	F16	10:10	plain	bcd	grog-blebs	0.01	-
10:06	plain	bcd	FG2	0.01	-	10:10	cmd	bcd	grog-blebs	0.02	ochre
10:06	plain	bcd	FG2	0.01	-	10:10	decorated	bcd	grog-orth	0.05	F1
10:06	decorated	red	grog-orth	0.02	F8	10:10	decorated	bcd	grog-orth	0.64	-
10:06	decorated	red	grog-orth	0.07	F11	10:10	decorated	bcd	grog-orth	0.04	F7
10:06	decorated	red	grog-orth	0.42	-	10:10	decorated	bcd	grog-orth	0.40	-
10:06	decorated	red	grog-orth	0.21	-	10:10	decorated	bcd	grog-orth	0.51	-
10:06	decorated	red	grog-orth	0.16	B67	10:10	decorated	red	grog-orth	0.23	-
10:06	decorated	red	grog-orth	0.40	-	10:10	decorated	red	grog-orth	0.03	F21
10:06	decorated	red	grog-orth	0.03	F38	10:10	decorated	ox	grog-orth	0.04	F23
10:06	decorated	red	grog-orth	0.01	F41	10:10	decorated	red	grog-orth	0.02	F24
10:06	decorated	red	grog-orth	0.04	F43	10:10	decorated	red	grog-orth	0.17	-
10:06	decorated	red	grog-orth	0.04	F46	10:10	decorated	red	grog-orth	0.22	F27
10:06	decorated	red	grog-orth	0.18	-	10:10	decorated	red	grog-orth	0.04	F28
10:06	plain	red	grog-orth	0.02	B65	10:10	decorated	red	grog-orth	0.25	-
10:06	plain	bcd	grog-orth	0.02	-	10:10	plain	red	grog-orth	0.02	B88
10:06	plain	bcd	grog-orth	0.03	-	10:10	plain	bcd	grog-orth	0.02	-
10:06	plain	ox	sand-exotic	0.01	-	10:10	cmd	bcd	grog-orth	0.02	ochre
10:07	plain	bcd	FG2	0.02	-	10:10	plain	bcd	FG2	0.05	-
10:07	plain	bcd	FG2	0.07	-	10:11	plain	bcd	FG2	0.04	-
10:07	decorated	red	grog-orth	0.17	B72	10:11	decorated	bcd	grog-orth	0.10	B94

TABLE 186: *Burnished sherd weights (continued).*
cmd: cord-marked; red: reduced; bcd: black cored; ox: oxidized

Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature
10:11	decorated	red	grog-orth	0.13	F3	10:14	plain	bcd	grog-orth	0.02	-
10:11	decorated	red	grog-orth	0.02	F5	10:14	plain	bcd	grog-orth	0.08	-
10:11	decorated	red	grog-orth	1.10	-	10:14	plain	bcd	grog-orth	0.01	-
10:11	decorated	red	grog-orth	0.14	B103	10:15	decorated	red	grog-orth	0.12	B110
10:11	decorated	red	grog-orth	0.14	F13	10:15	decorated	bcd	grog-orth	0.06	F6
10:11	decorated	red	grog-orth	0.42	-	10:15	decorated	red	grog-orth	0.13	F8
10:11	decorated	red	grog-orth	0.04	F15	10:15	decorated	red	grog-orth	0.06	F11
10:11	decorated	red	grog-orth	0.01	-	10:15	decorated	red	grog-orth	0.02	F15
10:11	decorated	red	grog-orth	0.53	-	10:15	decorated	red	grog-orth	0.08	-
10:11	decorated	ox	grog-orth	0.01	F17	10:15	decorated	red	grog-orth	0.62	-
10:11	decorated	red	grog-orth	0.02	F18	10:15	decorated	red	grog-orth	0.05	F20
10:11	decorated	red	grog-orth	0.02	F21	10:15	decorated	red	grog-orth	0.12	F23
10:11	decorated	red	grog-orth	0.12	F22	10:15	decorated	red	grog-orth	0.49	-
10:11	decorated	red	grog-orth	0.07	F24	10:15	decorated	red	grog-orth	0.64	-
10:11	decorated	red	grog-orth	0.29	-	10:15	decorated	red	grog-orth	1.15	-
10:11	decorated	red	grog-orth	0.74	-	10:15	plain	bcd	grog-orth	0.01	B129
10:11	plain	red	grog-orth	0.05	B101	10:15	plain	bcd	grog-orth	0.17	B131
10:11	plain	bcd	FG2	0.09	-	10:15	plain	red	grog-orth	0.18	B107
10:11	plain	bcd	FG2	0.04	-	10:15	plain	bcd	grog-orth	0.02	-
10:11	plain	ox	sand-exotic	0.02	-	10:15	plain	bcd	FG2	0.02	-
10:12	decorated	red	grog-orth	0.02	F1	10:15	plain	bcd	FG2	0.14	-
10:12	decorated	red	grog-orth	0.07	F7	10:16	decorated	red	grog-orth	0.05	F1
10:12	decorated	red	grog-orth	0.08	F9	10:16	decorated	bcd	grog-orth	0.02	F5
10:12	decorated	red	grog-orth	0.11	F10	10:16	decorated	red	grog-orth	0.02	F7
10:12	decorated	red	grog-orth	0.04	F11	10:16	decorated	red	grog-orth	0.03	F8
10:12	decorated	red	grog-orth	0.02	F13	10:16	decorated	red	grog-orth	0.10	B100
10:12	decorated	red	grog-orth	0.16	B109	10:16	decorated	red	grog-orth	0.04	F14
10:12	decorated	red	grog-orth	0.37	-	10:16	decorated	red	grog-orth	0.40	-
10:12	decorated	red	grog-orth	0.36	-	10:16	decorated	red	grog-orth	1.14	-
10:12	decorated	red	grog-orth	0.06	B87	10:16	decorated	red	grog-orth	0.98	-
10:12	decorated	red	grog-orth	0.75	-	10:16	decorated	red	grog-orth	0.88	-
10:12	decorated	red	grog-orth	0.02	F21	10:16	plain	bcd	grog-orth	0.06	-
10:12	decorated	red	grog-orth	0.06	-	10:16	plain	bcd	FG2	0.01	-
10:12	plain	red	grog-orth	0.04	B115	10:17 L15	plain	bcd	FG2	0.03	-
10:12	plain	bcd	grog-orth	0.01	-	10:17	decorated	red	grog-orth	0.63	-
10:12	plain	bcd	grog-orth	0.14	-	10:17	decorated	red	grog-orth	0.26	-
10:12	plain	ox	sand-exotic	0.02	-	10:17	decorated	red	grog-orth	0.83	-
10:13	plain	bcd	grog-blebs	0.06	-	10:17	decorated	red	grog-orth	0.52	-
10:13	plain	bcd	grog-blebs	0.06	-	10:18	plain bbs	red	FG2	0.07	-
10:13	decorated	bcd	grog-orth	0.03	F7	10:18	decorated	red	grog-orth	0.04	F1 H3
10:13	decorated	red	grog-orth	0.04	F11	10:18	decorated	red	grog-orth	0.18	-
10:13	decorated	red	grog-orth	0.08	F13	10:18	decorated	bcd	grog-orth	0.02	F4
10:13	decorated	red	grog-orth	0.02	F19	10:18	decorated	red	grog-orth	0.94	-
10:13	decorated	red	grog-orth	0.46	-	10:18	decorated	red	grog-orth	0.74	-
10:13	decorated	red	grog-orth	0.05	F30	10:18	decorated	bcd	grog-orth	0.18	-
10:13	decorated	red	grog-orth	0.01	F32	10:18	decorated	red	grog-orth	0.41	-
10:13	decorated	red	grog-orth	0.53	-	10:18	plain	bcd	FG2	0.01	-
10:13	decorated	red	grog-orth	0.74	-	10:18	plain	ox	sand-exotic	0.03	-
10:13	decorated	red	grog-orth	0.83	-	10:19	decorated	red	grog-orth	0.02	-
10:13	plain	red	grog-orth	0.21	B113	10:19	decorated	red	grog-orth	0.05	F2
10:13	plain	bcd	grog-orth	0.06	-	10:19	decorated	red	grog-orth	0.13	F3
10:13	plain	bcd	grog-orth	0.15	-	10:19	decorated	red	grog-orth	0.32	-
10:13	plain	bcd	grog-orth	0.03	-	10:19	decorated	bcd	grog-orth	0.04	F7
10:13	plain	ox	sand-exotic	0.02	-	10:19	decorated	bcd	grog-orth	0.72	-
10:14	plain	bcd	grog-blebs	0.04	-	10:19	decorated	red	grog-orth	0.61	-
10:14	decorated	red	grog-orth	0.22	F2	10:19	decorated	red	grog-orth	0.34	-
10:14	decorated	red	grog-orth	0.01	F6	10:20	decorated	red	grog-orth	0.02	F3
10:14	decorated	red	grog-orth	0.26	F12	10:20	decorated	red	grog-orth	0.44	F7
10:14	decorated	red	grog-orth	0.60	-	10:20	decorated	red	grog-orth	0.08	-
10:14	decorated	ox	grog-orth	0.02	F13	10:20	decorated	red	grog-orth	0.06	-
10:14	decorated	red	grog-orth	0.02	F14	10:20	decorated	red	grog-orth	0.02	F10
10:14	decorated	red	grog-orth	0.02	F15	10:20	decorated	red	grog-orth	0.01	F11
10:14	decorated	red	grog-orth	0.06	F16	10:20	decorated	red	grog-orth	0.35	-
10:14	decorated	red	grog-orth	0.02	F18	10:20	decorated	red	grog-orth	0.48	-
10:14	decorated	bcd	grog-orth	0.05	F19	10:20	plain	bcd	FG2	0.02	-
10:14	decorated	red	grog-orth	1.01	-	10:20	plain	ox	sand-exotic	0.02	-
10:14	decorated	red	grog-orth	0.07	F26	10:21	decorated	red	grog-orth	0.87	-
10:14	decorated	red	grog-orth	0.03	F28	10:21	decorated	red	grog-orth	0.45	-
10:14	decorated	red	grog-orth	1.09	-	10:21	decorated	red	grog-orth	0.17	-
10:14	decorated	red	grog-orth	1.75	-	10:21	decorated	red	grog-orth	0.22	-
10:14	plain	red	grog-orth	0.08	B145	10:21	decorated	red	grog-orth	0.22	-

TABLE 186: *Burnished sherd weights (continued).*
cmd: cord-marked; red: reduced; bcd: black cored; ox: oxidized; H: hearth

Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Surface Fin.	Firing	Fabric	Weight (kg)	Feature
10:21	plain	red	grog-orth	0.03	B150	10:24	decorated	red	FG2	0.22	-
10:21	plain	bcd	FG2	0.03	-	10:24	decorated	red	FG2	0.31	-
10:21	plain	ox	sand-exotic	0.08	-	10:24	decorated	red	sand	0.02	F1
10:21	plain	ox	sand-exotic	0.02	-	10:24	plain	ox	sand	0.05	-
10:21 L 23	plain	red	grog-orth	0.01	-	10:25	plain	bcd	grog-orth	0.03	-
10:22	decorated	red	grog-orth	0.12	-	10:25	decorated	red	FG2	0.40	-
10:22	decorated	red	grog-orth	0.12	-	10:25	decorated	red	FG2	0.22	-
10:22	decorated	red	grog-orth	0.12	-	10:25	decorated	red	FG2	0.08	-
10:22	decorated	bcd	grog-orth	0.04	F6	10:25	decorated	red	FG2	0.11	-
10:22	decorated	red	grog-orth	0.30	-	10:25	decorated	red	sand	0.08	-
10:22	plain	bcd	grog-orth	0.01	H15	10:25	plain	bcd	sand	0.04	-
10:22	decorated	red	FG2	0.14	-	10:25 L29	decorated	red	sand	1.02	-
10:22	plain	ox	FG2	0.03	-	10:26	decorated	red	sand	0.08	-
10:22	decorated	red	sand	0.02	-	10:26	decorated	red	sand	0.16	-
10:23	decorated	ox	grog-orth	0.02	F1	10:26 L31	decorated	red	grog-orth	0.05	-
10:23	decorated	red	grog-orth	0.07	-	10:26 L31	decorated	red	FG2	0.11	-
10:23	decorated	red	grog-orth	0.14	-	10:26 L31	decorated	red	sand	0.11	-
10:23	decorated	red	FG2	0.04	-	11:01	plain	bcd	grog-orth	0.01	-
10:23	decorated	red	FG2	0.10	-	11:01	decorated	red	sand	2.30	-
10:23 L26	plain	bcd	grog-orth	0.09	-	11:01	decorated	red	sand	0.47	-
10:23 L26	decorated	red	FG2	0.27	-	11:01	decorated	red	sand	0.70	-
10:23 L26	plain	ox	sand	0.04	-	11:01	decorated	red	sand	0.62	-
10:24 L28	plain	bcd	grog-orth	0.01	-	11:01	decorated	red	sand	0.57	-
10:24 L28	decorated	red	FG2	0.06	-	11:01	decorated	red	sand	0.12	-
10:24	decorated	red	FG2	0.27	-	11:02	decorated	red	sand	0.03	-
10:24	decorated	red	FG2	0.22	-						

Incised sherds

Incised sherds include all plain ware and cord-marked sherds, of fine, medium or coarse surface texture, but excluding burnished and incised sherds except highly decorated incised sherds which also display some burnishing (Table 187).

Burnished incised sherds and burnished sherds

Burnished and incised sherds occur in CP2-4 (Table 185). Most are probably local, but exotic examples occur in several CP2 burials when burnished and incised wares are at their maxima. Exotic fabrics include sand, bleb and orthodox grog temper. Near the beginning of CP3, the first exotic sherds containing rice temper were recovered. Exotic wares tempered with sand, bleb or orthodox grog were found in very small quantities throughout CP3. The rare sherds recovered from CP4 are probably local. Several CP2/3 burials included burnished and incised fine wares (see also Chapters VIII and IX).

The total weight of incised sherds for level 11 is 0.10 kg; L10: 13.19 kg; L9: 3.98 kg; L8: 5.44 kg; L7: 7.05 kg; L6: 12.41 kg; L5: 9.19 kg; L4: 24.5 kg; L3: 43.06 kg; L2: 29.04 kg and L1: 4.19 kg, giving a site total of 152.15 kg. This equates to 100.79 kg for CP4; CP3: 39.42 kg; CP2: 11.76 kg and CP1: 0.18 kg. The majority of CP4 incised pottery is local medium or coarse textured cord-marked ware. CP2/3 incised wares with cord marks tend to be a finer texture, and ornamental pottery, sometimes highly decorated, comprises much of the assemblage. As with the burnished assemblage, the majority are local, but exotic wares were also noted in hand specimen.

TABLE 187: *Incised sherd weights. HDB: highly decorated and burnished; cmd/pf cord-marked with plain field; PIB: plain/incised/burnished; PHD: plain/highly decorated; CMB: cord-marked/burnished; red: reduced; bcd: black cored*

Level	Texture	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Texture	Surface Fin.	Firing	Fabric	Weight (kg)	Feature
1.1	Coarse	cmd	-	no data	0.12	-	3.3	Medium	plain	-	exotic	0.04	-
1.1	Fine	stoneware	-	stoneware	0.21	-	3.3	Medium	cmd	-	local	0.11	-
1.1	Fine	stoneware	-	stoneware	0.05	-	3.3	Medium	cmd	-	local	0.02	-
1.1	Fine	plain	bcd	no data	0.16	-	3.3	Medium	cmd	-	local	0.04	-
1.1	Medium	cmd	-	no data	1.24	-	3.3	Medium	cmd	-	local	0.08	-
1.1	Medium	cmd	-	no data	0.03	F 1	3.4	Fine	plain	-	no data	0.02	-
1.2	Fine	plain	- bcd	no data	0.02	-	3.4	Medium	cmd/pf	-	no data	2.68	-
1.2	Medium	cmd	-	no data	0.22	-	3.4	Medium	cmd	-	no data	3.27	-
1.2	Medium	cmd	-	no data	0.54	-	3.4	Medium	plain	-	local	0.14	-
1.2	Medium	cmd	-	no data	0.42	-	3.4	Medium	cmd	-	local	0.08	-
1.3	Medium	cmd	-	no data	0.53	-	3.4	Medium	cmd	-	local	0.06	-
1.3	Medium	cmd	-	no data	0.21	-	3.5	Medium	cmd/pf	-	no data	2.10	-
1.4	Medium	cmd	-	no data	0.44	-	3.5	Medium	cmd	-	local	0.06	-
2.1	Medium	cmd	-	no data	0.03	-	3.5	Medium	cmd	-	local	0.02	-
2.1	Medium	cmd	-	no data	0.45	-	4.1	Fine	cmd	-	no data	0.14	F1
2.1	Medium	cmd	-	no data	2.60	-	4.1	Fine	cmd	-	no data	0.11	F8
2.1	Medium	cmd	-	no data	2.93	-	4.1	Fine	plain	-	no data	0.02	F7
2.1	Medium	cmd	-	no data	2.36	-	4.1	Medium	cmd	-	no data	0.95	-
2.1	Medium	cmd	-	no data	1.37	-	4.1	Medium	cmd	-	no data	2.55	-
2.1	Medium	cmd	-	no data	0.14	-	4.1	Medium	cmd	-	no data	1.79	-
2.1	Medium	cmd	-	no data	0.01	-	4.1	Medium	cmd	-	no data	0.75	-
2.1	Medium	cmd	-	no data	0.05	F1	4.1	Medium	cmd/pf	-	no data	0.80	F1
2.1	Medium	cmd	-	no data	0.04	F1-L1	4.1	Medium	cmd	-	no data	0.02	F4
2.2	Fine	cmd	-	no data	0.02	F1	4.1	Medium	cmd	-	no data	0.02	F6
2.2	Fine	cmd	bcd	no data	0.02	-	4.1	Medium	cmd	-	no data	1.47	-
2.2	Medium	cmd	-	no data	3.79	-	4.1	Medium	cmd	-	local	0.01	F6
2.2	Medium	cmd	-	no data	0.99	-	4.1	Medium	cmd	-	local	0.01	F8
2.2	Medium	cmd	-	no data	3.89	-	4.1	Medium	cmd	-	local	0.17	F4
2.2	Medium	cmd	-	no data	2.19	-	4.1	Medium	cmd	-	local	0.94	F5
2.2	Medium	cmd	-	no data	2.55	-	4.1	Medium	cmd	-	local	0.60	F 1
2.2	Medium	plain	-	no data	0.02	-	4.1	Medium	cmd	-	local	0.17	F4
2.2	Medium	cmd	-	local	0.04	F2	4.1	Medium	cmd	-	local	0.06	F2
2.3	Medium	cmd	-	no data	2.45	-	4.1	Medium	cmd	-	local	0.03	-
2.3	Medium	cmd	-	no data	3.10	-	4.1	Medium	cmd	-	local	0.02	-
3.1	Fine	cmd	-	local	0.08	-	4.1	Medium	cmd	-	local	0.07	-
3.1	Fine	cmd	-	local	0.38	-	4.1	Medium	cmd	-	local	0.04	-
3.1	Fine	cmd	-	local	0.06	-	4.1	Medium	cmd	bcd	no data	0.31	F5
3.1	Medium	cmd	-	no data	0.60	-	4.2	Fine	cmd	-	no data	0.87	-
3.1	Medium	cmd	-	no data	4.91	-	4.2	Fine	cmd	bcd	no data	0.07	-
3.1	Medium	cmd	-	no data	2.78	-	4.2	Medium	cmd	-	no data	2.84	-
3.1	Medium	cmd	-	no data	3.49	-	4.2	Medium	cmd	-	no data	1.34	-
3.1	Medium	plain	-	local	0.10	-	4.2	Medium	cmd	-	local	0.09	-
3.1	Medium	plain	-	local	0.08	-	4.2	Medium	cmd	-	local	0.69	F2
3.1	Medium	plain	-	local	0.01	-	4.2	Medium	cmd	-	local	0.12	-
3.1	Medium	cmd	-	local	0.34	F1	4.2	Medium	cmd	-	local	0.01	-
3.1	Medium	cmd	-	local	0.16	-	4.3	Fine	cmd	-	no data	0.42	F7
3.1	Medium	cmd	bcd	no data	0.06	F1-L1.1	4.3	Fine	cmd	-	no data	0.20	-
3.2	Fine	cmd	-	local	0.20	-	4.3	Fine	cmd	-	no data	0.22	F8
3.2	Fine	cmd	-	local	0.04	-	4.3	Fine	cmd	-	no data	0.24	F9
3.2	Fine	cmd	-	local	0.07	-	4.3	Fine	plain	-	local	0.01	-
3.2	Fine	cmd	-	local	0.02	-	4.3	Fine	plain	-	local	0.02	-
3.2	Fine	cmd	-	local	0.12	-	4.3	Medium	cmd	-	no data	0.33	F5
3.2	Medium	cmd	-	no data	2.02	-	4.3	Medium	cmd	-	no data	0.32	-
3.2	Medium	cmd	-	no data	2.36	-	4.3	Medium	cmd	-	no data	0.30	-
3.2	Medium	cmd	-	no data	2.01	-	4.3	Medium	cmd	-	no data	0.35	F8
3.2	Medium	cmd	-	no data	0.67	-	4.3	Medium	cmd	-	no data	1.00	-
3.2	Medium	cmd	-	no data	2.78	-	4.3	Medium	cmd	-	no data	0.60	-
3.2	Medium	cmd	-	no data	1.92	-	4.3	Medium	cmd	-	local	0.18	F1
3.2	Medium	cmd	-	no data	0.25	-	4.3	Medium	cmd	-	local	0.24	F3
3.2	Medium	plain	-	local	0.04	-	4.3	Medium	cmd	-	local	0.29	F6
3.2	Medium	plain	-	local	0.10	-	4.3	Medium	cmd	-	local	0.24	F7
3.2	Medium	cmd	-	local	0.05	-	4.3	Medium	cmd	-	local	0.18	F7
3.2	Medium	cmd	-	local	0.07	F1	4.3	Medium	cmd	bcd	no data	0.04	F2
3.3	Fine	cmd	-	no data	0.52	-	4.4	Fine	cmd	-	no data	0.34	-
3.3	Fine	cmd	-	no data	0.27	-	4.4	Fine	burnished	-	exotic	0.01	-
3.3	Fine	cmd	-	FG5	0.09	-	4.4	Medium	cmd/pf	-	no data	0.83	-
3.3	Medium	cmd	-	no data	0.18	-	4.4	Medium	cmd	-	no data	0.18	-
3.3	Medium	cmd	-	no data	0.87	-	4.4	Medium	cmd	-	no data	0.58	-
3.3	Medium	cmd	-	no data	2.34	-	4.4	Medium	cmd	-	local	0.01	-
3.3	Medium	cmd	-	no data	2.71	-	4.5	Fine	cmd	-	no data	0.22	F1
3.3	Medium	cmd	-	no data	1.59	-	4.5	Medium	cmd	-	local	0.07	-

TABLE 187: *Incised sherd weights (continued). HDB: highly decorated and burnished; cmd/pf cord-marked with plain field; PIB: plain/incised/burnished; PHD: plain/highly decorated; CMB: cord-marked/burnished; red: reduced; bcd: black cored*

Level	Texture	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Texture	Surface Fin.	Firing	Fabric	Weight	Feature
5.1	Fine	cmd/pf	-	no data	0.53	-	6.2	Fine	cmd/pf	-	no data	0.58	-
5.1	Fine	cmd/pf	-	no data	0.19	-	6.2	Fine	cmd	-	no data	0.33	-
5.1	Fine	cmd/pf	-	no data	0.29	-	6.2	Fine	HDB	-	no data	0.01	-
5.1	Fine	plain	-	no data	0.60	-	6.2	Fine	plain	-	exotic	0.02	-
5.1	Fine	plain	-	no data	0.09	-	6.3	Fine	plain	-	no data	0.04	F38
5.1	Fine	cmd	-	no data	0.17	F1	6.3	Fine	plain	-	no data	0.25	F44
5.1	Fine	plain	-	exotic	0.01	F19	6.3	Fine	cmd	-	no data	0.03	F51
5.1	Medium	cmd	-	local	0.05	-	6.3	Fine	cmd/pf	-	no data	0.29	F52
5.1	Medium	plain	-	local	0.02	-	6.3	Fine	cmd	-	no data	0.38	-
5.1 P1	Medium	cmd	-	local	0.04	-	6.3	Fine	cmd/pf	-	no data	0.65	-
5.2	Fine	cmd/pf	-	no data	0.33	-	6.3	Fine	cmd	-	no data	0.01	F 56
5.2	Fine	cmd/pf	-	no data	0.47	-	6.3	Fine	plain	-	no data	0.01	F73
5.2	Fine	plain	-	no data	0.10	F4-10 4.3	6.3	Fine	cmd	-	no data	0.01	F84
5.2	Fine	plain	-	no data	0.29	-	6.3	Fine	cmd	-	no data	0.06	-
5.3 P4	Fine	cmd	-	no data	0.07	-	6.3	Fine	cmd	-	no data	0.05	B9
5.3	Fine	cmd	-	no data	0.41	-	6.3	Fine	plain	-	no data	0.27	-
5.3	Fine	cmd	-	no data	0.76	-	6.3	Fine	cmd	-	no data	0.26	-
5.3	Fine	plain	-	no data	0.15	F4	6.3	Fine	plain	-	exotic	0.02	F59
5.3	Fine	cmd	-	no data	0.02	F7-10 4.3	6.3	Medium	cmd	-	no data	0.02	B2
5.3	Fine	plain	-	no data	0.05	-	6.3	Medium	plain	-	no data	0.05	B3
5.3	Fine	cmd/pf	-	no data	0.26	-	6.3	Medium	cmd	-	local	0.01	-
5.3	Fine	plain	-	no data	0.22	F8	6.3	Medium	plain	-	local	0.03	F42
5.3	Medium	cmd	-	local	0.02	F4	6.3	Coarse	cmd	-	no data	0.08	B8
5.3	Medium	cmd	-	local	0.02	-	6.4	Fine	cmd	-	no data	0.05	F9
5.3	Medium	cmd	-	local	0.01	F5-10 4.3	6.4	Fine	cmd	-	no data	0.04	F11
5. P18	Fine	cmd	-	no data	0.02	-	6.4	Fine	plain	-	no data	0.04	-
5.4	Fine	plain	-	no data	0.07	F2	6.4	Fine	plain	-	no data	0.07	F14
5.4	Fine	cmd/pf	-	no data	0.84	-	6.4	Fine	cmd	-	no data	0.03	F21
5.4	Fine	plain	-	no data	0.30	-	6.4	Fine	cmd	-	no data	0.02	F25
5.4	Fine	cmd	-	no data	0.28	-	6.4	Fine	HDB	-	no data	0.02	-
5.4	Fine	cmd	-	no data	0.02	F5	6.4	Fine	cmd	-	no data	1.10	-
5.4	Fine	cmd	-	no data	0.01	F6	6.4	Fine	cmd	-	no data	0.04	F67
5.4	Fine	plain	-	local	0.04	F3	6.4	Fine	plain	-	no data	0.04	B11
5. P22-3	Fine	plain	-	no data	0.04	-	6.4	Fine	cmd	-	no data	0.56	-
5. P24	Fine	HDB	-	no data	0.05	F2	6.4	Fine	plain	-	no data	0.55	-
5. P24	Fine	HDB	-	no data	0.10	F5	6.4	Fine	plain	-	exotic	0.01	F24
5. P24	Fine	HDB	-	exotic	0.02	F2	6.4	Fine	cmd	-	local	0.03	-
5. P25	Fine	plain	-	no data	0.05	-	6.4	Fine	cmd	-	exotic	0.01	F70
5. P24	Medium	PHD	-	exotic	0.03	F4	6.4 L3	Fine	plain	-	no data	0.09	-
5. PL24	Medium	cmd	bcd	no data	0.01	F3	6.4	Medium	cmd	-	no data	0.25	-
5. P26-9	Medium	plain	bcd	no data	0.08	-	6.5	Fine	cmd	-	no data	0.45	-
5. P15	Medium	plain	bcd	no data	0.04	-	6.5	Fine	cmd	-	no data	0.54	-
5.5	Fine	cmd	-	no data	0.02	F1	6.5	Fine	plain	-	no data	0.16	B13
5.5	Fine	plain	-	no data	0.08	F2	6.5	Fine	burnished	-	no data	0.02	F22
5.5	Fine	cmd	-	no data	0.42	F2	6.5 L5	Fine	cmd	-	no data	0.22	-
5.5	Fine	cmd	-	no data	0.08	F4	6.5 L6	Fine	plain	-	no data	0.04	F41
5.5	Fine	cmd	-	no data	0.60	-	6.5 L6	Fine	cmd	-	no data	0.08	F41
5.5	Fine	cmd/pf	-	no data	0.24	-	6.5 L6	Fine	cmd	-	no data	0.19	F41
5.5	Fine	cmd	-	no data	0.02	-	6.5	Medium	cmd	-	no data	1.04	-
5.5	Fine	cmd	-	no data	0.02	-	6.5	Medium	cmd	-	no data	0.24	-
5.5 P	Fine	cmd	-	local	0.02	-	6.6	Fine	cmd	-	no data	0.10	-
5. P31	Medium	cmd	bcd	no data	0.06	-	6.6	Fine	HDB	-	no data	0.01	F31
5. P32	Medium	cmd	bcd	no data	0.01	-	6.6	Fine	HDB	-	no data	0.03	F39
5. P33-4	Medium	cmd	bcd	no data	0.12	-	6.6	Fine	plain	-	no data	0.09	-
5. P35-6	Medium	cmd	bcd	no data	0.07	-	6.6	Fine	cmd	-	no data	0.08	-
5. P37	Medium	cmd	bcd	no data	0.03	F2	6.6	Fine	plain	-	local	0.01	-
5. P37-40	Medium	cmd	bcd	no data	0.20	-	6.6	Medium	cmd	-	local	0.02	F20
5. P37-40	Medium	cmd	bcd	no data	0.02	-	6.6	Medium	cmd	-	local	0.04	-
5. P8	Medium	plain	bcd	no data	0.01	-	6.7	Fine	HDB	-	no data	0.19	-
6.1	Fine	cmd/pf	-	no data	0.43	-	6.7	Fine	HDB	-	no data	0.02	F7
6.1	Fine	cmd/pf	-	no data	0.44	-	6.7	Fine	cmd	-	no data	0.01	F11
6.1	Fine	plain	-	no data	0.04	-	6.7	Fine	HDB	-	no data	0.03	F18
6.1	Fine	plain	-	no data	0.10	F1	6.7	Fine	HDB	-	no data	0.16	F19
6.1	Fine	cmd	-	no data	0.02	B1	6.7	Medium	cmd	-	local	0.02	F20
6.1	Fine	cmd	-	no data	0.01	-	6.8	Medium	cmd	-	no data	0.30	-
6.1	Fine	plain	-	no data	0.01	-	6.8	Medium	cmd	-	local	0.01	F9
6.1 L1	Fine	cmd/pf	-	no data	0.45	-	7.1	Fine	cmd	-	no data	0.09	-
6.1 L2	Fine	cmd/pf	-	no data	0.20	-	7.1	Fine	plain	-	no data	0.11	-
6.1 L2	Fine	cmd/pf	-	no data	0.10	-	7.1	Fine	plain	-	no data	0.30	-
6.1 L2	Fine	plain	-	no data	0.08	-	7.1	Fine	plain	-	no data	0.04	F14
6.1 L2	Fine	HDB	-	no data	0.02	-	7.1	Fine	cmd/pf	-	no data	0.31	-

TABLE 187: *Incised sherd weights (continued). HDB: highly decorated and burnished; cmd/pf cord-marked with plain field; PIB: plain/incised/burnished; PHD: plain/highly decorated; CMB: cord-marked/burnished; red: reduced; bcd: black cored*

Level	Texture	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Texture	Surface Fin.	Firing	Fabric	Weight	Feature
7.1	Fine	cmd	-	no data	0.02	F26	8.2	Fine	plain	-	no data	0.13	-
7.1	Fine	cmd	-	no data	0.07	-	8.2	Fine	cmd	-	no data	0.17	-
7.1	Fine	HDB	-	no data	0.09	-	8.2	Fine	plain	-	no data	0.03	-
7.1	Fine	cmd	-	no data	0.29	-	8.2	Fine	plain	-	no data	0.14	-
7.1	Medium	plain	-	local	0.01	F3	8.2	Fine	cmd	-	no data	0.14	-
7.2	Fine	cmd	-	no data	0.08	B15	8.2	Fine	cmd	-	no data	0.01	-
7.2	Fine	plain	-	no data	0.12	B15	8.2	Fine	HD/PB	-	no data	0.01	-
7.2	Fine	cmd/pf	-	no data	0.24	-	8.2	Fine	HD/PB	-	no data	0.17	-
7.2	Fine	cmd	-	no data	0.40	-	8.2	Fine	cmd	-	no data	0.36	-
7.2	Fine	cmd	-	no data	0.08	F5	8.3	Fine	cmd	-	no data	0.05	-
7.2	Fine	plain	-	no data	0.20	-	8.3	Fine	plain	-	no data	0.05	-
7.2	Fine	plain	-	no data	0.01	-	8.3	Fine	cmd	-	no data	0.08	-
7.2	Fine	plain	-	no data	0.12	B20	8.3	Fine	plain	-	no data	0.08	-
7.2	Fine	cmd	-	local	0.03	F7	8.3	Fine	cmd	-	no data	0.17	-
7.2	Fine	cmd	-	local	0.04	B15	8.3	Fine	cmd	-	no data	0.01	-
7.2 L3	Fine	cmd	-	no data	0.17	-	8.3	Fine	plain	-	no data	0.01	-
7.2	Medium	cmd	-	local	0.03	F12	8.3	Fine	HD/PB	-	no data	0.13	-
7.2	Medium	plain	-	local	0.02	F12	8.3	Fine	cmd	-	no data	0.38	-
7.2	Medium	plain	-	exotic	0.01	F12	8.3	Fine	burnished	-	exotic	0.03	F9
7.3	Fine	plain	-	no data	0.01	-	8.3	Medium	cmd	-	local	0.01	-
7.3	Fine	plain	-	no data	0.14	-	8.3 L4	Medium	cmd	-	local	0.02	-
7.3	Fine	plain	-	no data	0.28	-	8.4	Fine	cmd	-	no data	0.02	-
7.3	Fine	plain	-	no data	0.15	-	8.4	Fine	HDB	-	no data	0.02	-
7.3	Fine	cmd	-	no data	0.03	-	8.4	Fine	HDB	-	no data	0.06	-
7.3	Fine	burnished	-	no data	0.22	-	8.4	Fine	cmd	-	no data	0.22	-
7.3 L2	Fine	burnished	-	no data	0.04	-	8.4	Fine	burnished	-	no data	0.22	-
7.3	Medium	plain	-	exotic	0.05	B16	8.5	Fine	cmd	-	no data	0.02	-
7.4	Fine	plain	-	no data	0.05	-	8.5	Fine	plain	-	no data	0.02	-
7.4	Fine	plain	-	no data	0.02	F17	8.5	Fine	cmd	-	no data	0.22	-
7.4	Fine	cmd	-	no data	0.12	-	8.5	Fine	HDB	-	no data	0.05	-
7.4	Fine	plain	-	no data	0.05	-	8.5	Fine	HDB	-	no data	0.06	-
7.4	Fine	burnished	-	no data	0.10	-	8.5	Fine	HD/CMB	-	no data	0.06	-
7.4	Fine	plain	-	no data	0.19	-	8.5	Fine	cmd	-	no data	0.21	-
7.4	Medium	cmd	-	local	0.03	B17	8.5 L7	Fine	HD/CMB	-	no data	0.13	-
7.5	Fine	plain	-	no data	0.04	B35	8.5 L7	Fine	HD/CMB	-	no data	0.13	-
7.5	Fine	cmd	-	no data	0.18	-	8.5 L8	Fine	cmd	-	no data	0.04	-
7.5	Fine	cmd	-	no data	0.04	F21	8.5 L8	Fine	plain	-	no data	0.04	-
7.5	Fine	cmd	-	no data	0.31	-	8.5	Medium	plain	-	local	0.01	F17
7.5	Fine	plain	-	no data	0.14	-	8.6	Fine	HD/PB	-	no data	0.01	-
7.5	Fine	cmd/pf	-	no data	0.18	-	8.6	Fine	HD/PB	-	no data	0.02	-
7.5	Fine	cmd	-	no data	0.22	-	8.6	Fine	HD/CMB	-	no data	0.02	-
7.5	Fine	burnished	-	no data	0.03	F35	8.6	Fine	cmd	-	no data	0.07	-
7.5	Fine	burnished	-	no data	0.01	-	8.6	Fine	plain	-	no data	0.07	-
7.5	Fine	plain	-	no data	0.01	-	8.6	Fine	cmd	-	no data	0.02	-
7.5	Medium	cmd	-	local	0.06	F35	8.6	Fine	plain	-	no data	0.01	-
7.6	Fine	cmd	-	no data	0.01	B21	8.6	Medium	cmd	-	local	0.01	F80
7.6	Fine	cmd	-	no data	0.07	B22	8.7	Fine	HD/PB	-	no data	0.15	-
7.6	Fine	cmd	-	no data	0.06	-	8.7	Fine	HD/PB	-	no data	0.04	-
7.6	Fine	plain	-	no data	0.14	-	8.7	Fine	cmd	-	no data	0.13	-
7.6	Fine	cmd	-	no data	0.15	-	8.7	Fine	burnished	-	no data	0.01	-
7.6	Fine	PIB	-	no data	0.01	F35	8.7	Fine	cmd	-	no data	0.08	-
7.6	Fine	HDB	-	no data	0.02	-	8.7	Fine	plain	-	no data	0.07	-
7.6	Fine	HDB	-	no data	0.07	-	8.7	Medium	cmd	-	local	0.02	F16
7.6	Medium	cmd	-	local	0.01	F18	9.1	Fine	cmd	-	no data	0.13	-
7.7	Fine	plain	-	no data	0.03	B25	9.1	Fine	cmd	-	no data	0.01	-
7.7	Fine	plain	-	no data	0.11	F1	9.1	Fine	plain	-	no data	0.01	-
7.7	Fine	PHD	-	no data	0.10	-	9.1	Fine	HDB	-	no data	0.05	-
7.7	Fine	cmd	-	no data	0.15	-	9.1	Fine	HD/CMB	-	no data	0.05	-
7.7	Fine	PHD	-	no data	0.11	-	9.1	Fine	cmd	-	no data	0.02	-
7.7	Fine	plain	-	no data	0.13	-	9.1	Fine	HDB	-	no data	0.02	-
7.7	Fine	burnished	-	no data	0.15	-	9.1	Fine	cmd	-	no data	0.09	-
7.7	Medium	cmd	-	local	0.02	B24	9.1	Fine	plain	-	exotic	0.01	F50
7.7	Medium	cmd	-	local	0.11	-	9.2	Fine	HD/CMB	-	no data	0.05	-
7.8	Fine	plain	-	no data	0.02	F1	9.2	Fine	cmd	-	no data	0.11	-
8.1	Fine	plain	-	no data	0.06	-	9.2	Fine	plain	-	no data	0.07	-
8.1	Fine	plain	-	no data	0.15	-	9.2	Fine	HDB	-	no data	0.12	-
8.1	Fine	cmd	-	no data	0.35	-	9.2	Fine	cmd	-	no data	0.20	-
8.1	Fine	HD/CMB	-	no data	0.12	-	9.2	Fine	cmd	-	no data	0.05	-
8.1	Fine	HD/PB	-	no data	0.12	-	9.2	Fine	HDB	-	no data	0.08	-
8.1	Fine	cmd	-	no data	0.07	F36	9.3	Fine	HDB	-	no data	0.07	-
8.2	Fine	cmd	-	no data	0.13	-	9.3	Fine	cmd	-	no data	0.07	-

TABLE 187: *Incised sherd weights (continued). HDB: highly decorated and burnished; cmd/pf cord-marked with plain field; PIB: plain/incised/burnished; PHD: plain/highly decorated; CMB: cord-marked/burnished; red: reduced; bcd: black cored*

Level	Texture	Surface Fin.	Firing	Fabric	Weight (kg)	Feature	Level	Texture	Surface Fin.	Firing	Fabric	Weight	Feature
9.3	Fine	cmd	-	no data	0.13	-	10.3 L2	Fine	cmd	bcd	no data	0.04	-
9.3	Fine	HDB	-	no data	0.05	-	10.3	Medium	cmd	bcd	no data	0.08	-
9.3	Fine	HDB	-	no data	0.18	-	10.3	Medium	cmd	bcd	no data	0.11	-
9.3	Fine	cmd	-	no data	0.14	-	10.4	Fine	cmd	-	no data	0.16	-
9.3	Fine	HDB	-	no data	0.05	-	10.4	Fine	PHD	-	no data	0.08	-
9.3	Fine	HDB	-	no data	0.02	-	10.4	Fine	cmd	-	no data	0.05	-
9.3	Medium	cmd	-	local	0.01	F24	10.4	Fine	PHD	-	no data	0.05	-
9.4	Fine	cmd	-	no data	0.06	-	10.4	Fine	cmd	-	no data	0.13	-
9.4	Fine	HDB	-	no data	0.10	-	10.4	Fine	cmd	bcd	no data	0.02	B57
9.4	Fine	HDB	-	no data	0.15	-	10.4	Fine	cmd	bcd	no data	0.03	F14
9.4	Fine	cmd	-	no data	0.07	-	10.4	Fine	cmd	bcd	no data	0.03	F18
9.4	Fine	HDB	-	no data	0.22	-	10.5	Fine	cmd	-	no data	0.04	-
9.4	Medium	plain	-	exotic	0.03	F36	10.5	Fine	PHD	-	no data	0.15	-
9.5	Fine	cmd	-	no data	0.08	-	10.5	Fine	PHD	-	no data	0.06	-
9.5	Fine	HDB	-	no data	0.10	-	10.5	Fine	cmd	-	no data	0.04	-
9.5	Fine	HDB	-	no data	0.05	-	10.5	Fine	PHD	-	no data	0.04	-
9.5	Fine	cmd	-	no data	0.01	-	10.5	Medium	cmd	bcd	no data	0.02	-
9.5	Fine	cmd	-	no data	0.08	-	10.6	Fine	cmd	-	no data	0.26	-
9.5	Fine	PHD	-	exotic	0.01	F53	10.6	Fine	PHD	-	no data	0.07	-
9.5	Fine	plain	bcd	no data	0.05	F9	10.6	Fine	PHD	-	no data	0.04	-
9.6	Fine	cmd	-	no data	0.15	-	10.6	Fine	cmd	-	no data	0.04	-
9.6	Fine	HDB	-	no data	0.15	-	10.6	Fine	cmd	-	no data	0.08	-
9.6	Fine	HDB	-	no data	0.07	-	10.6	Fine	cmd	-	no data	0.20	-
9.6	Fine	HDB	-	no data	0.03	-	10.6	Fine	cmd	-	no data	0.07	-
9.6	Fine	cmd	-	no data	0.17	-	10.6	Medium	cmd	bcd	no data	0.04	F38
9.6	Fine	cmd	-	no data	0.09	-	10.7	Fine	cmd	-	no data	0.18	-
9.6	Fine	HDB	-	no data	0.12	-	10.7	Fine	cmd	-	no data	0.05	-
9.6	Medium	cmd	-	local	0.02	F42	10.7	Fine	PHD	-	no data	0.04	-
9.7	Fine	plain	-	no data	0.16	-	10.7	Fine	PHD	-	no data	0.04	-
9.7	Fine	HDB	-	no data	0.06	-	10.7	Fine	cmd	-	no data	0.10	-
9.7	Fine	HDB	-	no data	0.07	-	10.7	Medium	cmd	bcd	no data	0.76	-
9.7	Fine	HDB	-	no data	0.05	-	10.8	Fine	cmd	-	no data	0.10	-
9.7	Fine	HDB	-	no data	0.04	-	10.8	Fine	cmd	-	no data	0.51	-
10.1	Fine	HDB	-	no data	0.04	-	10.8	Fine	PHD	-	no data	0.05	-
10.1	Fine	cmd	-	no data	0.35	-	10.8	Fine	PHD	-	no data	0.21	-
10.1	Fine	cmd	-	no data	0.17	-	10.8	Medium	plain	bcd	no data	0.26	-
10.1	Fine	HDB	-	no data	0.03	-	10.8	Medium	cmd	bcd	no data	0.08	-
10.1	Fine	cmd	-	no data	0.02	-	10.8	Medium	cmd	bcd	no data	0.05	-
10.1	Fine	plain	-	no data	0.01	-	10.9	Fine	cmd	-	no data	0.15	-
10.1	Fine	PHD	-	no data	0.09	-	10.9	Fine	PHD	-	no data	0.05	-
10.1	Fine	plain	bcd	no data	0.06	-	10.9	Medium	cmd	bcd	no data	0.15	-
10.1	Fine	cmd	bcd	no data	0.06	-	10.9	Medium	cmd	bcd	no data	0.17	-
10.2	Fine	plain	-	no data	0.05	-	10.10	Medium	cmd	bcd	no data	0.17	-
10.2	Fine	cmd	-	no data	0.05	-	10.10	Medium	cmd	bcd	no data	0.07	-
10.2	Fine	plain	-	no data	0.10	-	10.10	Medium	cmd	bcd	no data	0.17	-
10.2	Fine	HDB	-	no data	0.09	-	10.10	Medium	plain	bcd	no data	0.06	-
10.2	Fine	cmd	-	no data	0.03	-	10.10	Medium	cmd	bcd	no data	0.08	-
10.2	Fine	cmd	-	no data	0.13	-	10.11	Medium	cmd	-	local	0.09	F27
10.2	Fine	PHD	-	no data	0.05	-	10.11	Medium	cmd	-	local	0.13	F22
10.2	Fine	plain	red	no data	0.02	-	10.11	Medium	plain	bcd	no data	0.01	B96
10.3	Fine	cmd	-	no data	3.57	-	10.11	Medium	cmd	bcd	no data	0.03	-
10.3	Fine	plain	-	no data	0.88	-	10.11	Medium	cmd	bcd	no data	0.05	-
10.3	Fine	HDB	-	no data	0.89	-	10.12	Medium	cmd	bcd	no data	0.03	-
10.3	Fine	cmd	-	no data	0.04	-	10.12	Medium	plain	red	no data	0.03	-
10.3	Fine	plain	-	no data	0.04	-	10.12	Medium	plain	bcd	no data	0.01	B115
10.3	Fine	HDB	-	no data	0.06	-	10.15	Fine	PHD	-	exotic	0.01	-
10.3	Fine	cmd	-	no data	0.25	-	10.25	Fine	PHD	red	no data	0.02	F2
10.3	Fine	cmd	-	no data	0.04	-	10.26	Fine	PHD	red	no data	0.06	-
10.3	Fine	HDB	-	no data	0.04	-	11.2	Fine	PHD	red	no data	0.02	F2
10.3	Fine	PHD	-	no data	0.06	-	11.2	Fine	PHD	red	no data	0.08	-
10.3	Fine	cmd	-	no data	0.07	-							

Painted and slipped sherds

These exotic wares are rare. A few local sherds are coated with red ochre (Table 188).

TABLE 188: *Painted and slipped sherd weights. SF: surface finish; P: painted; S: slipped; BS: burnished and slipped; PB: painted and burnished; EOG: exotic orthodox grog; EB: exotic blebs; ER: exotic rice; bcd: black cored; ox.: oxidized; W: weight; F: feature*

Level	SF	Firing	Fabric	W(kg)	F	Level	SF	Firing	Fabric	W(kg)
4.4	P	bcd	EOG	0.02	-	10.3	S	bcd	EOG	0.02
5.2	P	bcd	EB?	0.01	-	10.6	S	bcd	EOG	0.02
5.3	P	bcd	EB?	0.01	-	10.7	P	bcd	EOG	0.02
5.3	P	ox.	EB	0.01	B6	10.7	P	bcd	EOG	0.03
7.3	P	bcd	EOG	0.02	-	10.9	PB	bcd	EB	0.05
7.7	P	bcd	EB	0.02	B24	10.10	P?	bcd	EB	0.07
7.7	S	bcd	ER	0.02	-	10.10	S?	ox.	sand	0.02
7.7	S	bcd	ER	0.03	-	10.11	ochre	bcd	FG2	0.02
8.1	P	bcd	EB	0.02	-	10.11	P	bcd	EB	0.02
8.1	S	bcd	ER	0.06	-	10.12	ochre	ox.	FG2	0.03
8.2	P	bcd	ER	0.02	-	10.12	P/S?	bcd	EB	0.02
8.3	P	bcd	EOG	0.09	-	10.12	S	ox.	EOG	0.02
8.4	S	bcd	ER	0.01	-	10.13	P	ox.	EOG	0.04
9.2	P	bcd	ER	0.02	F4	10.13	S	bcd	EB	0.07
9.3	S	bcd	EOG	0.01	-	10.13	S	bcd	EOG	0.01
9.4	S	bcd	EOG	0.02	-	10.15	P/S	bcd	EOG	0.03
9.5	P	bcd	ER	0.01	F17	10.15	P	bcd	EB	0.06
9.5 L8	P	bcd	EB	0.08	-	10.16	P/S?	bcd	EOG	0.01
10.2	BS?	bcd	EOG	0.01	-	10.17	P	bcd	EOG	0.07
10.3	P	ox.	EOG	0.07	-	10.23 L26	P/S	bcd	EOG	0.03
10.3	P	bcd	EB	0.01	-	10.24	ochre	bcd	FG2	0.02
10.3	P?	bcd	EB	0.08	-	10.24	S	bcd	EOG	0.01
10.3	P	bcd	EOG	0.02	-					

Painted and/or slipped sherds were absent from L11, L6, L3, L2 and L1. The total weight for level 10 is 0.88 kg; L9: 0.14 kg; L8: 0.2 kg; L7: 0.09 kg; L5: 0.03 kg and L4: 0.02 kg giving a site total of 1.36 kg. This equates to 0.02 kg for CP4; CP3: 0.47 kg and CP2: 0.87 kg.

Paddle-impressed sherds

Paddle impressing was introduced during CP4 (Table 189). Wares tempered with either sand, bleb, orthodox and sandy grog or rice or bleb temper during CP1-3 inclusive are considered to be exotic. CP4 local paddle-impressed wares are generally coarser than exotic examples. Most exotic fabrics are tempered with bleb grog. There were no paddle-impressed sherds in either L1 or L11. The total weight for level 10 is 0.74 kg; L9: 0.04 kg; L8: 0.09 kg; L7: 0.02 kg; L6: 0.28 kg; L5: 0.94 kg; L4: 4.23 kg; L3: 6.13 kg and L2: 4.59, giving a site total of 19.13 kg. This equates to 17.02 kg for CP4; CP3: 1.42 kg and CP2: 0.69 kg.

Punctate sherds

Sherds tempered with either orthodox or bleb grog, sand or rice are considered to be exotic. Punctation appears to have been rarely used by CP2/3 local potters and most of the sample probably represents imported pottery. There were no punctate sherds in L1, L3, L6 or L11. The total weight for level 10 is 6.18 kg; L9: 0.75 kg; L8: 0.3 kg; L7: 0.03 kg; L5: 0.08 kg; L4: 0.13 kg; and L2: 0.02 kg, giving a site total of 7.49 kg. This equates to 0.15 kg for CP4; CP3: 2.08 kg and CP2: 5.26 kg (Table 190).

Miscellaneous shell-impressed sherds

A very small number of sherds with shell impressions were recovered which could not be assigned to any other category. The impressions could not be related to any shell species. These sherds supplement the numerous rim and other vessel portions mentioned in Chapters VII to X inclusive which also carry shell impressions. The site total is 0.81 kg, made up of 0.02 kg in L8:7; 0.76 kg in L10:3; 0.01 kg in L10:6 and L10:8 respectively.

Porcelain and stoneware sherds

These wares were restricted to CP4. The weights for L1:1 are 2.91 kg; 0.96 kg in L1:2; 0.21 kg in L1:3; 0.1 kg in L1:4; 0.22 kg in L2:1; 0.02 kg in L2:2; 0.03 kg in L3:1; 0.01 kg in L3:2; 0.03 kg in L3:3 and 0.02 kg in L4:2, giving a site total of 4.51 kg.

TABLE 189: *Paddle-impressed sherd weights. OG: orthodox grog; ES: exotic sand; bcd: black cored; red: reduced; W: weight; F: feature*

Level	Texture	Firing	Fabric	W(kg)	F	Level	Texture	Firing	Fabric	W(kg)	F
2.1	Medium	bcd	FG5	0.05	-	4.1	Medium	bcd	FG5	0.06	F4
2.1	Medium	bcd	FG5	0.37	-	4.1	Medium	bcd	FG5	0.03	F2
2.1	Medium	bcd	FG5	0.38	-	4.1	Fine	red.	FG5	0.02	F8
2.1	Medium	bcd	no data	0.49	-	4.1	Medium	bcd	FG5	0.17	-
2.1	Medium	bcd	no data	0.16	-	4.1	Medium	bcd	FG5	0.13	-
2.2	Medium	bcd	FG5	0.97	-	4.1	Fine	red.	rice	0.03	F8
2.2	Medium	bcd	FG5	0.41	-	4.1	Fine	bcd	sand	0.02	-
2.2	Medium	bcd	FG5	0.8	-	4.1	Fine	bcd	sand	0.01	F5
2.2	Medium	bcd	FG5	0.23	-	4.1	Fine	red.	sand	0.01	F8
2.3	Medium	bcd	FG5	0.37	-	4.1	Medium	bcd	sand	0.01	-
2.3	Medium	bcd	FG5	0.36	-	4.2	Medium	bcd	FG5	0.34	-
3.1	Medium	bcd	FG5	0.94	-	4.2	Medium	bcd	FG5	0.19	-
3.1	Medium	bcd	FG5	0.03	-	4.2	Medium	bcd	FG5	0.17	-
3.1	Medium	bcd	FG5	0.02	-	4.2	Medium	bcd	FG5	0.1	F2
3.1	Medium	bcd	FG5	0.02	-	4.2	Fine	bcd	no data	0.01	-
3.1	Medium	bcd	no data	0.07	-	4.2	Fine	bcd	sand	0.08	-
3.1	Fine	bcd	no data	0.28	-	4.2	Medium	bcd	sand	0.04	-
3.1	Fine	bcd	sand	0.01	-	4.2	Medium	bcd	sand	0.01	F2
3.2	Medium	bcd	no data	0.5	-	4.3	Medium	bcd	FG5	0.14	-
3.2	Medium	bcd	no data	0.01	-	4.3	Medium	bcd	FG5	0.06	-
3.2	Medium	bcd	no data	0.87	-	4.3	Fine	bcd	FG5	0.06	F5
3.2	Medium	bcd	no data	0.46	-	4.3	Fine	red.	FG5	0.03	F6
3.2	Medium	bcd	no data	0.63	-	4.3	Medium	red.	FG5	0.37	F7
3.2	Medium	bcd	no data	0.17	-	4.3	Medium	bcd	FG5	0.04	-
3.3	Medium	bcd	FG5	0.09	-	4.3	Medium	bcd	FG5	0.02	F7
3.3	Medium	bcd	no data	0.82	-	4.3	Medium	bcd	FG5	0.15	-
3.3	Medium	bcd	no data	0.6	-	4.3	Medium	bcd	FG5	0.09	F8
3.3	Medium	bcd	no data	0.61	-	4.3	Medium	bcd	FG5	0.15	F9
3.4	Medium	bcd	no data	0.87	-	4.3	Fine	bcd	FG5	0.02	F3
3.4	Medium	bcd	no data	0.54	-	4.3	Medium	bcd	OG	0.01	-
3.4	Fine	bcd	sand	0.04	-	4.3	Medium	red.	ES	0.02	F7
3.5	Medium	bcd	FG5	0.62	-	4.3	Medium	bcd	ES	0.04	-
4.1	Fine	bcd	FG5	0.02	-	4.4	Fine	bcd	FG5	0.04	-
4.1	Medium	bcd	FG5	0.58	-	4.4	Fine	red.	FG5	0.03	-
4.1	Medium	bcd	FG5	0.27	-	4.4	Medium	bcd	FG5	0.07	-
4.1	Fine	bcd	FG5	0.09	F5	4.4	Medium	bcd	FG5	0.04	-
4.1	Medium	bcd	FG5	0.09	F1	4.4	Medium	bcd	sand	0.01	-
4.1	Medium	bcd	FG5	0.09	-	4.5	Medium	bcd	FG5	0.03	F1
4.1	Medium	bcd	FG5	0.02	F1	5.1	Fine	bcd	FG5	0.06	-
4.1	Medium	bcd	FG5	0.22	F1	5.1	Fine	red.	FG5	0.02	-

TABLE 189: *Paddle-impressed sherd weights (continued). FBin: Fine burnished and incised; OG: orthodox grog; SG: sandy grog; BG: bleb grog; EXS: exotic sand; Fire: firing; bcd: black cored; red: reduced; ox.: oxidized; W: weight; F: feature*

Level	Texture	Fire	Fabric	W(kg)	F	Level	Texture	Fire	Fabric	W(kg)	F
5.1	Medium	bcd	FG5	0.08	-	6.4	Fine	red	SG	0.01	-
5.1	Fine	red	FG5	0.01	F1	6.4	Medium	bcd	SG	0.02	-
5.1	Fine	bcd	OG	0.05	-	6.5	Fine	red	BG	0.01	-
5.1	Fine	bcd	no data	0.02	-	6.5	Medium	bcd	SG	0.02	F3
5.1	Fine	bcd	sand	0.02	-	6.7	Fine	bcd	SG	0.01	-
5.1	Fine	red	sand	0.01	-	7.2	Medium	red	BG	0.01	B15
5.1	Medium	bcd	SG	0.04	-	7.2	Medium	bcd	OG	0.01	-
5.2	Medium	red	BG	0.04	-	8.1	Medium	bcd	BG	0.06	F5
5.2	Fine	red	BG	0.01	-	8.3	Medium	bcd	OG	0.01	-
5.2	Fine	red	BG	0.02	F4	8.4	Fine	bcd	OG	0.01	-
5.3	Fine	red	BG	0.02	-	8.5	Medium	ox.	BG	0.01	-
5.3	Fine	red	BG	0.03	-	9.2	Coarse	bcd	OG	0.04	-
5.3	Fine	ox.	BG	0.02	-	10.1	Fine	red	BG	0.01	-
5.3	Fine	red	OG	0.02	-	10.1	Fine	red	OG	0.01	-
5.3	Fine	red	sand	0.01	-	10.1	Medium	red	sand	0.01	-
5.3	Fine	red	sand	0.01	-	10.1	Fine	red	sand	0.01	-
5.3	Fine	red	sand	0.01	F4	10.1	Fine	red	sand	0.01	-
5.3 P4	Incised	red	SG	0.04	nth wall	10.3	Fine	red	sand	0.02	-
5.P33-4	Medium	bcd	BG	0.01	-	10.3	Fine	red	sand	0.04	-
5.4	Medium	red	BG	0.14	-	10.3	Fine	red	sand	0.04	-
5.4	Fine	red	BG	0.03	-	10.3 L2	Medium	bcd	BG	0.01	-
5.4	Coarse	red	BG	0.05	F5	10.3 L2	Medium	red	OG	0.04	-
5.4	Fine	red	OG	0.03	F2	10.3 L2	Medium	red	sand	0.14	-
5.4	Medium	bcd	OG	0.04	-	10.4	Fine	red	OG	0.01	-
5.5	Fine	red	BG	0.06	F2	10.4	Fine	red	sand	0.02	-
5.5	Fine	red	BG	0.02	F4	10.4	Fine	red	sand	0.02	-
5.5	FBin	red	EXS	0.02	-	10.4	Fine	red	sand	0.02	-
6.1	Medium	bcd	BG	0.04	-	10.5	Fine	red	sand	0.02	-
6.1	Fine	bcd	BG	0.02	-	10.5	Fine	red	sand	0.01	-
6.1	Medium	bcd	BG	0.01	-	10.6	Fine	red	sand	0.02	-
6.1	Fine	ox.	sand	0.01	-	10.6	Fine	red	sand	0.01	-
6.2	Medium	bcd	BG	0.01	-	10.6	Fine	red	sand	0.04	-
6.2	Medium	bcd	OG	0.02	-	10.7	Fine	red	sand	0.01	-
6.2	Medium	bcd	sand	0.02	-	10.8	Fine	red	sand	0.05	-
6.2	Medium	bcd	sand	0.01	-	10.9	Fine	red	OG	0.02	-
6.2 L7	Medium	bcd	BG	0.02	-	10.9	Fine	red	sand	0.03	-
6.2 L7	Medium	bcd	SG	0.01	-	10.12	Fine	red	BG	0.02	-
6.3	Fine	red	BG	0.02	-	10.12	Fine	bcd	sand	0.07	-
6.3	Fine	red	sand	0.01	-	10.15	Fine	red	OG	0.01	F20
6.4	Medium	bcd	OG	0.01	-	10.21	Fine	ox.	sand	0.02	-

TABLE 190: *Punctate sherd weights. Text: texture; SF: surface finish; Fir: firing; Fab: fabric; Fea: feature; Wt: weight (kg); F: fine; M: medium; B: burnished; IN: incised; P: plain; PS: red paint/slip; n.d.: no data: EOG: exotic orthodox grog; SG: sandy grog; BG: bleb grog; EXS: exotic sand; bcd: black cored; red: reduced; ox.: oxidized*

Level	Text	SF	Fir	Fab	Wt	Fea	Form	Level	Text	SF	Fir	Fab	Wt	Fea	Form
2.3	M	-	bcd	n.d.	0.02	-	P1	10.3	F	B	red	n.d.	2.38	-	P2
4.1	M	-	bcd	n.d.	0.13	F5	P1	10.3	F	P	red	bleb	0.04	-	P3
5:L 24	M	-	bcd	n.d.	0.03	B19	P1	10.3	F	PS	red	rice	0.04	-	P3
5:26-9	M	B	bcd	n.d.	0.01	-	P2	10.4	F	B	red	n.d.	0.14	-	P2
5:L28	M	B	bcd	n.d.	0.03	-	P2	10.5	M	B	red	n.d.	0.03	F41	P2
5:L32	M	-	bcd	n.d.	0.01	-	P1	10.5	F	B	red	n.d.	0.10	-	P2
7.2	M	B	bcd	n.d.	0.03	F34	P2	10.6	M	B	red	n.d.	0.19	-	P2
8.2	M	B	bcd	n.d.	0.01	-	P2	10.6	F	B	red	n.d.	0.17	-	P2
8.3	F	B	red	n.d.	0.04	-	P2	10.7	F	P	ox.	EOG	0.01	-	P1
8.4 L7	M	B	bcd	n.d.	0.06	-	P2	10.7	F	B	red	n.d.	0.06	-	P2
8.5	M	B	bcd	n.d.	0.02	B33	P2	10.7	F	B	red	n.d.	0.14	-	P2
8.6	F	B	red	n.d.	0.05	-	P2	10.8	F	P	red	n.d.	0.01	-	P1
8.7	M	B	bcd	n.d.	0.07	-	P2	10.8	M	B	red	n.d.	0.03	-	P2
8.7	F	B	red	n.d.	0.05	-	P2	10.8	F	B	red	n.d.	0.39	-	P2
9.1	M	B	red	n.d.	0.06	-	P2	10.8	F	B	red	bleb	0.02	-	P3
9.1	F	B	red	n.d.	0.07	-	P2	10.9	F	B	red	n.d.	0.03	-	P2
9.2	F	B	red	n.d.	0.02	-	P2	10.9	F	B	red	FG2	0.09	-	P2
9.3	F	B	red	n.d.	0.06	-	P2	10.9	F	B	red	n.d.	0.10	-	P2
9.4	F	B	red	n.d.	0.10	-	P2	10.10	F	B	red	n.d.	0.06	-	P2
9.5	F	B	red	n.d.	0.01	F21	P2	10.10	F	B	ox.	n.d.	0.01	F3	P2
9.6	F	B	red	n.d.	0.29	-	P2	10.10	F	B	red	n.d.	0.30	-	P2
9.7	F	P	red	n.d.	0.12	-	P2	10.10	F	P	bcd	n.d.	0.02	-	H324
9.7	F	PS	red	rice	0.02	-	P3	10.11	F	P	red	EOG	0.01	-	P1
10.1	F	B	red	n.d.	0.11	-	P2	10.11	F	B	red	n.d.	0.37	-	P2
10.1	F	B	red	n.d.	0.15	-	P2	10.12	F	P	bcd	n.d.	0.03	-	P1
10.1	F	P	red	n.d.	0.17	-	P2	10.12	F	B	bcd	n.d.	0.07	-	P2
10.1	F	P	red	bleb	0.01	-	F	10.12	F	B	red	n.d.	0.06	-	P2
10.1	F	P	red	FG2	0.02	-	H108	10.12	F	B	red	n.d.	0.07	-	P2
10.2	F	B	red	n.d.	0.24	-	P2	10.12	F	IN	bcd	bleb	0.02	-	P3
10.2	F	B	red	n.d.	0.18	-	P2	10.12	F	P	bcd	bleb	0.01	-	H310
10.2	F	B	red	n.d.	0.01	F11	P2	10.16	F	B	red	n.d.	0.04	-	P2
10.2	F	P	red	sand	0.01	-	H330	10.18	M	P	bcd	bleb	0.09	F4	H332
10.3	F	B	red	n.d.	0.14	-	P2	10.19	F	B	bcd	n.d.	0.01	-	P2

XVI APPENDIX FOUR

GRAVE GOODS DISTRIBUTIONS trace the growing importance of potting to the Khok Phanom Di community during CP2 and CP3 (which span MP1–7). After a modest start in MP4, their value accelerated in MP5–7. Of particular interest is the relationship between male burials containing turtle ornaments and potters (Chapters IX and XI).

GRAVE GOODS

Grave goods provide a measure of social behaviour, but different grave contents do not necessarily equate with different social positions in life for the deceased.

> "Differentiation in grave wealth cannot necessarily be linked directly to differences in status, at least in the absence of converging lines of inference from other evidence" (Adams 1966: 95).

Table 191 sets out the distribution of goods found in all burials. It is important to note temporal changes in the presence or absence of some artefacts, and the restriction of jewellery and pottery vessels to what appear to be discrete social groups (see Chapters VIII, IX and XI). There is a notable absence of animal bone in CP3, but it features along with worked shell, teeth and fish bone in several CP2 burials. A rhinoceros tooth was recovered from B120, some *sus scofa* bone with B112 and unidentified animal bone in B107. These are not included in the table. The clay cylinder found with B109 differs from the well-formed CP3 examples as it is somewhat amorphous. Some items are restricted to CP2, others to CP3. These include funnel disc beads, barrel beads, worked shell, a clay pellet, a net weight, cowrie shell, cylindrical bone beads, a snail ornament and dog teeth which were only found in CP2. In contrast, "I" and "H" beads, cylinder beads, horn discs, potters' anvils, worked teeth, turtle bone ornaments and large disc beads were restricted to CP3.

It is important to note the array of unique artefacts interred with B72. It includes a large barrel bead, a nautilus shell, a worked tusk, fish bone, a shark pendant and the first slate tool (a chisel). This burial lay at the interface between CP2/3 (see Chapter VIII).

TABLE 191: *Grave goods, B: Burial; DB: disk bead; IB: I bead; HB: H bead; CB: cylinder bead; HD: horn disc; SD: small disc; FBD: funnel bead; SBB: short barrel bead; LBB: large barrel bead; BB: barrel bead; V: vessel; BS: burnishing stone; CC: clay cylinder; A: anvil; TB: turtle bone; C: counter; TP: turtle pendant; FH: fishhook; WB: worked bone*

B	DB	IB	HB	CB	HD	SD	FBD	SBB	LBB	BB	V	BS	CC	A	TB	C	TP	FH	WB
1	-	-	-	-	-	-	-	-	-	-	2	1	-	2	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
3	49	-	12	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	4	-	1	-	-	-	-	-
6	17786	-	656	2	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-
7	9	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
9	3	-	-	-	-	-	-	-	-	-	2	1	-	-	2	-	-	-	1
11	12	-	57	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
12	730	-	30	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-
13	3	-	-	-	-	-	-	-	-	-	4	8	-	-	-	-	-	-	-
14	269	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-
15	120787	950	-	-	2	1	-	-	-	-	8	2	many	1	-	-	-	-	-
16	12247	200	-	-	-	-	-	-	-	-	4	1	many	1	-	-	-	-	-
18	9969	-	700	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-
19	1600	-	-	-	-	-	-	-	-	-	5	2	-	1	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	2	1	-	1	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	2	1	-	-	1	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	3	-	-	-	1	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
29	330	17	-	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	1	-
31	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-
32	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	1	-	-
33	7845	107	-	-	-	-	-	-	-	-	4	-	-	1	-	-	-	-	-
35	8	-	-	-	-	-	-	-	-	-	2	3	-	1	-	-	-	-	-
36	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
41	41	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
42	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
43	56200	435	-	1	-	-	-	7	-	-	1	-	-	-	1	-	-	-	-
44	-	-	-	-	-	-	-	-	-	-	3	-	-	-	1	-	-	-	-
45	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
57	23	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
58	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
62	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
63	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
64	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-

TABLE 191: *Grave goods (cont.). B: Burial; DB: disk bead; IB: I bead; HB: H bead; CB: cylinder bead; HD: horn disc; SD: small disc; FBD: funnel bead; SBB: short barrel bead; LBB: large barrel bead; BB: barrel bead; V: vessel; BS: burnishing stone; CC: clay cylinder; A: anvil; TB: turtle bone; C: counter; TP: turtle pendant; FH: fishhook; WB: worked bone*

B	DB	IB	HB	CB	HD	SD	FBD	SBB	LBB	BB	V	BS	CC	A	TB	C	TP	FH	WB
70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	330	-	-	-	-	-	-	-	1	-	3	3	-	-	-	-	-	-	-
73	1260	-	-	-	-	-	-	-	-	285	2	-	-	-	-	-	-	-	-
74	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
75	189	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
76	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
77	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
79	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
83	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
86	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
87	866	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	690	-	-	-	-	-	-	-	-	16	2	-	-	-	-	-	-	-	-
89	73	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
90	1500	-	-	-	-	-	-	-	-	37	3	-	-	-	-	-	-	-	-
91	1294	-	-	-	-	-	-	-	-	93	4	2	-	-	-	-	-	-	-
92	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
93	859	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
94	-	-	-	-	-	-	-	55	-	-	-	1	1	-	-	-	-	-	-
96	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
99	250	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
100	220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101	626	-	-	-	-	-	-	2	-	13	1	-	-	-	-	-	-	-	-
102	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	1	-
103	59	-	-	-	-	-	-	-	-	56	2	-	-	-	-	-	-	-	-
105	1043	-	-	-	-	-	-	2	-	88	2	-	-	-	-	-	-	-	-
107	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
109	1588	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-
110	-	-	-	-	-	-	-	-	-	-	1	5	-	-	-	-	-	-	-
112	542	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
113	224	-	-	-	-	-	-	-	-	143	1	-	-	-	-	-	-	-	-
114	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-
120	327	-	-	-	-	-	-	-	-	13	2	-	-	-	-	-	-	-	-
121	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-
122	105	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-
123	120	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-	-	-	-
125	2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
126	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
129	-	-	-	-	-	-	-	-	-	353	-	-	-	-	-	-	-	-	-
130	-	-	-	-	-	-	-	-	-	17	2	-	-	-	-	-	-	-	-
132	39000	-	-	-	-	-	5	11	-	-	-	2	-	-	-	-	-	-	-
133	-	-	-	-	-	-	-	-	-	45	-	-	-	-	-	-	-	-	-
134	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140	610	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
143	50	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
144	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
152	11	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 191: *Grave goods (cont.). B: Burial; D/B: disk bangle; WS: worked shell; WTH: worked tooth; Ad: adze; CH: chisel; P: pellet; NW: net weight; NS: nautilus shell; WT: worked tusk; FB: fish bone; SP: shark pendant; CS: cowrie shell; CBB: cylindrical bone bead; SO: snail ornament; DT: dog tooth; WFB: worked fish bone; PC: Polymesoda container; SHD: shell head dress; LB: large disc bead*

B	D/B	WS	WTH	Ad	CH	P	NW	NS	WT	FB	SP	CS	CBB	SO	DT	WFB	PC	SHD	LB
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	1	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
16	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 191: *Grave goods (cont.). B: Burial; D/B: disk bangle; WS: worked shell; WTH: worked tooth; Ad: adze; CH: chisel; P: pellet; NW: net weight; NS: nautilus shell; WT: worked tusk; FB: fish bone; SP: shark pendant; CS: cowrie shell; CBB: cylindrical bone bead; SO: snail ornament; DT: dog tooth; WFB: worked fish bone; Pc: Polymesoda container; SHD: shell head dress; LB: large disc bead*

B	D/B	WS	WTH	Ad	CH	P	NW	NS	WT	FB	SP	CS	CBB	SO	DT	WFB	PC	SHD	LB
70	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	-	-	-	-	1	-	-	1	1	p	1	-	-	-	-	-	-	-	-
73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
102	-	1	-	-	-	-	-	-	-	-	-	-	-	-	16	3	-	-	-
103	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
107	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
109	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-
110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
113	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
130	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
132	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
133	7	-	-	-	-	-	-	-	-	-	-	17	6	1	-	-	-	-	-
134	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
143	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
144	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
152	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

GRAVE DEPTHS

Depths between grave contents and cuts show a sharp increase from MP4 onwards. The 66 cm gap between MP3 and MP4, at depths of 3.62 and 4.01 m respectively, is the largest between any two MPs (Tables 193, 194 and 195). The lowest grave cut of the 11 MP3 burials with vessels assigned to CP3, is B74 at 4.65 m below datum. The original cut depth is estimated at 4.18 m, which places it clearly within the MP3/4 hiatus. MP1-3 graves are much shallower than those of MP4-7. Because neonate burials are often little more than shallow scoops, they could seriously skew mean depth calculations. Therefore depths both with and without neonates have been considered. When neonates are eliminated, MP2 graves achieve a marginally higher mean score than MP3. CP2 graves are shallow compared to those of CP3. Natural and human activity could erode the soil covering older graves or, perhaps more likely, CP2 burials were simply not cut as deep as their CP3 counterparts. The increased MP4–7 grave depths suggest that mortuary practices changed in CP3.

MP3 burials show little change in grave cut to contents depths through time. They follow the established pattern of being grouped either side of the major L10 lens 2 shell midden, which suggests cultural continuity. There is no apparent inter-cutting between the 11 upper and other MP3 burials, reinforcing the notion that they formed part of the same sequence. It is also possible that following a brief site abandonment, earlier burial practices were re-instituted by returning members of MP3 groups. This could explain the temporary hiatus at L10:2 (Higham and Bannanurag 1990:36).

TABLE 192: *Depths of grave contents by Mortuary Phase*

	All burials		Mean		Neonates excluded		Mean
MP	Number	Range	Depth (cm)	MP	Number	Range	Depth (cm)
7	4	30-140	68	7	4	30-140	68
6	11	1-124	47	6	10	14-124	55
5	3	61-77	70	5	3	61-77	70
4	30	3-55	19	4	28	3-55	19
3b	26	0-15	4	3b	12	1-15	6
L3	14	0-13	5	L3	8	0-13	6
3	40	0-15	5	3	20	0-15	6
2	50	0-25	4	2	32	0-25	7
1	6	0-9	2	1	4	0-9	2

TABLE 193: *Mortuary Phases 7, 6, 5, 4 and Upper 3 burial, contents and grave cut depths in metres below datum (Cont.: contents)*

MP	Burial	Base	Cont.	Cut	Age	Depth	MP	Burial	Base	Cont.	Cut	Age	Depth
7	1	1.90	1.86	1.20	9	0.66	4	38	-	3.54	3.51	33	0.03
7	3	2.18	-	1.45	4m	-	4	39	-	3.58	3.51	25	0.07
7	10	2.00	-	1.40	15m	-	4	40	-	3.67	3.51	37	0.14
7	12	1.85	1.70	1.30	12	1.40	4	41	-	3.67	3.51	9m	0.14
6	2	2.43	2.36	1.95	9m	0.41	4	42	-	3.80	3.62	32	0.13
6	4	2.57	2.52	1.95	26	0.57	4	43	-	2.45	3.00	30	0.55
6	5a/b	-	1.97	1.96	0	0.01	4	44	-	2.98	2.77	18	0.21
6	6	2.43	2.30	1.55	9m	0.75	4	45	-	3.11	2.96	45	0.15
6	7	-	2.15	2.01	21m	0.14	4	46	-	3.67	3.51	4m	0.16
6	8	-	2.25	2.01	15	0.24	4	47	3.40	3.24	3.05	22	0.19
6	9	2.61	2.48	1.97	30	0.51	4	48	3.40	3.24	3.05	0	0.19
6	11	-	3.29	2.05	12	1.24	3b	49	4.12	4.05	4.01	0	0.04
6	13	2.78	2.59	2.24	35	0.35	3b	50	-	4.12	4.12	0	0.00
6	18	-	2.50	1.97	42	0.53	3b	51	-	4.17	4.14	0	0.03
6	19	-	2.79	1.98	25	0.81	3b	52	-	4.17	4.17	0	0.00
5	14	-	2.96	2.35	15m	0.61	3b	53	-	4.37	4.37	0	0.00
5	15	3.45	3.27	2.50	35	0.77	3b	54	-	4.39	4.37	0	0.02
5	16	3.25	3.15	2.43	15m	0.72	3b	55	4.40	4.36	4.36	0	0.00
4	17	-	2.85	2.60	12	0.25	3b	56	-	4.47	4.32	45	0.15
4	20	-	3.32	2.81	12	0.51	3b	57	4.65	4.43	4.41	26	0.02
4	21	-	2.86	2.84	8	0.02	3b	58	-	4.55	4.42	35	0.13
4	22	-	3.00	2.82	21	0.18	3b	59	4.56	4.51	4.48	0	0.05
4	23	-	2.86	2.84	30	0.02	3b	60	4.73	4.56	4.45	19	0.11
4	24	-	3.00	2.80	25	0.20	3b	61	-	4.67	4.57	47	0.10
4	25	-	3.13	3.06	19	0.07	3b	62	4.75	4.49	4.48	6m	0.01
4	26	-	3.16	2.95	35	0.21	3b	63	-	4.46	4.47	21m	0.00
4	27	-	3.24	2.97	27	0.27	3b	64	-	4.54	4.50	20	0.04
4	28	-	3.42	3.27	21	0.15	3b	65	-	4.64	4.60	0	0.04
4	29	-	3.33	3.15	27	0.16	3b	66	-	4.64	4.60	0	0.04
4	30	-	3.37	3.32	34	0.05	3b	67	4.80	4.62	4.50	35	0.12
4	31	-	3.49	3.37	25	0.12	3b	68	4.71	4.65	4.64	0	0.01
4	32	-	3.47	3.37	11	0.10	3b	69	4.71	4.67	4.68	0	0.00
4	33	-	3.46	3.00	4	0.46	3b	70	4.93	4.85	4.73	0	0.12
4	34	-	3.56	3.35	0	0.21	3b	71	-	4.71	4.71	0	0.00
4	35	-	2.87	2.65	21	0.22	3b	74	-	4.64	4.65	40	0.00
4	36	-	2.98	2.65	21	0.33	3b	77	-	4.17	4.21	20	0.00
4	37	-	3.67	3.49	9	0.18	3b	79	-	4.37	4.33	47	0.04

TABLE 194: *Mortuary Phases 3, 2 and 1 burial, contents and grave cut depths in metres below datum (Cont.: contents)*

MP	Burial	Base	Cont.	Cut	Age	Depth	MP	Burial	Base	Cont.	Cut	Age	Depth
3	72	-	4.71	4.72	30	0.01	2	115	-	5.12	5.11	1	0.01
3	73	-	4.88	4.75	20	0.13	2	116	-	5.20	5.20	0	0.00
3	75	-	4.85	4.74	0	0.11	2	117	-	5.38	5.20	16	0.18
3	76	-	-	-	34	-	2	118	-	5.27	5.27	0	0.00
3	78	-	4.76	4.76	0	0.00	2	119	5.47	5.39	5.37	0	0.02
3	80	-	4.87	4.85	0	0.02	2	120	-	5.36	5.36	21	0.00
3	81	-	4.86	4.85	0	0.01	2	121	-	5.31	5.31	15m	0.00
3	82	4.60	4.72	4.54	6m	0.06	2	122	-	5.02	5.00	52	0.02
3	83	4.88	4.66	4.61	30	0.05	2	123	5.13	5.03	5.00	2	0.03
3	84	4.96	4.91	4.80	0	0.11	2	124	-	5.29	5.27	0	0.02
3	85	-	-	4.95	0	-	2	125	-	5.35	5.30	0	0.05
3	86	-	-	-	20	-	2	126	-	5.31	5.29	0	0.02
3	90	5.11	4.90	4.78	27	0.12	2	127	-	5.25	5.25	0	0.00
3	92	4.93	4.67	4.67	18	0.00	2	128	-	5.40	5.40	0	0.00
3	93	5.11	4.90	4.78	42	0.12	2	129	5.28	5.47	5.48	27	0.01
3	95	-	4.72	4.72	0	0.00	2	130	-	5.49	5.48	6m	0.01
3	103	4.98	4.78	4.78	26	0.00	2	131	5.54	5.33	5.33	25	0.00
2	87	-	5.12	5.12	24	0.00	2	132	5.48	5.37	5.37	34	0.00
2	88	-	5.10	5.03	9m	0.07	2	133	-	5.18	5.12	4m	0.06
2	89	5.18	5.13	5.04	6m	0.09	2	134	-	5.12	5.08	6m	0.04
2	91	-	5.13	5.04	45	0.09	2	135	-	-	-	4m	-
2	94	-	5.38	5.13	31	0.25	2	136	-	5.34	5.30	0	0.04
2	96	-	5.20	5.18	4	0.02	2	137	-	5.34	5.30	5	0.04
2	97	-	5.09	5.04	6m	0.05	2	138	5.42	5.41	5.38	0	0.03
2	98	5.12	5.05	5.05	0	0.00	2	139	-	-	5.43	0	-
2	99	-	5.14	5.12	8m	0.02	2	140	-	5.52	5.54	17	0.00
2	100	5.80	5.77	5.55	32	0.22	2	141	5.60	5.59	5.56	0	0.03
2	101	5.30	5.16	5.12	18m	0.04	2	142	-	5.42	5.30	31	0.12
2	102	-	5.16	5.10	35	0.06	2	143	5.67	5.60	5.57	0	0.03
2	104	-	-	5.20	0	-	2	144	-	5.60	5.57	0	0.03
2	105	-	-	-	4m	-	2	145	-	5.60	5.53	8	0.07
2	106	-	-	4.98	6m	-	2	146	-	5.51	5.51	0	0.00
2	107	-	5.37	5.38	40	0.00	1	147	5.98	5.88	5.88	19	0.00
2	108	-	5.20	5.12	0	0.08	1	148	n.d.	n.d.	n.d.	n.d.	n.d.
2	109	-	5.31	5.12	31	0.19	1	149	n.d.	n.d.	n.d.	n.d.	n.d.
2	110	5.62	5.57	5.42	36	0.15	1	150	5.94	6.03	6.03	2	0.00
2	111	-	-	5.12	-	0.00	1	151	6.32	6.33	6.29	0	0.04
2	112	5.34	5.23	5.23	46	0.00	1	152	6.35	6.20	6.20	37	0.00
2	113	-	5.21	5.21	46	0.00	1	153	-	6.51	6.51	0	0.00
2	114	-	5.05	5.00	0	0.05	1	154	6.58	6.54	6.45	25	0.09

TABLE 195: *Ritual Treatment of Ceramic Period 2 Burial Vessels by Mortuary Phases. B: Burial*

B	Cat.	MP	Condition at burial	In situ	Vol.1 Fig.	B	Cat.	MP	Condition at burial	In situ	Vol.1 Fig.
77	1384	3b	smashed	-	Fig. 159	88	1453	2	intact	intact	Fig. 206
56	1243	3b	smashed	sheet	Fig. 215	88	1454	2	intact	intact	Fig. 206
58	1283	3b	smashed	-	Fig. 214	89	1450	2	intact	broken	Fig. 205
58	1284	3b	smashed	-	Fig. 214	123	1618	2	intact	broken	Fig. 179
57	1290	3b	smashed	-	Fig. 108	123	1619	2	intact	broken	Fig. 179
57	1288	3b	smashed	-	Fig. 108	123	1620	2	intact	broken	Fig. 179
60	1291	3b	smashed	-	Fig. 213	91	1517	2	intact	broken	Fig. 204
79	1394	3b	smashed	-	Fig. 158	91	1518	2	intact	broken	Fig. 204
62	1312	3b	smashed	-	Fig. 211	91	1520	2	intact	intact	Fig. 204
62	1314	3b	smashed	-	Fig. 211	91	1519	2	intact	intact	Fig. 204
63	1309	3b	smashed	-	Fig. 212	99	1648	2	intact	no rim	Fig. 198
64	1319	3b	intact	broken	Fig. 156	99	1649	2	intact	intact	Fig. 198
64	1320	3b	smashed	-	Fig. 156	101	1522	2	intact	no rim	Fig. 200
67	1432	3b	smashed	-	Fig. 155	102	1542	2	intact	broken	Fig. 190
67	1431	3b	smashed	-	Fig. 155	102	1543	2	intact	broken	Fig. 190
74	1390	3b	smashed	-	Fig. 209	105	1536	2	intact	intact	Fig. 199
74	1391	3b	smashed	-	Fig. 209	105	1537	2	intact	intact	Fig. 199
74	1392	3b	intact	broken	Fig. 209	112	1654	2	n.d.	missing	Fig. 197
76	2016	3	smashed	-	n.d.	113	1651	2	intact	broken	Fig. 198
76	3252	3	intact	broken	n.d.	120	1678	2	intact	no rim	Fig. 121
72	1361	3	intact	broken	Fig. 150	120	1679	2	intact	intact	Fig. 121
72	1360	3	intact	broken	Fig. 150	125	1638	2	intact	intact	Fig. 132
72	1359	3	intact	broken	Fig. 150	110	1659	2	intact	intact	Fig. 94
73	1479	3	intact	intact	Fig. 148	130	1691	2	intact	broken	Fig. 120
73	1478	3	intact	intact	Fig. 148	130	1641	2	n.d.	missing	Fig. 120
75	1375	3	intact	intact	Fig. 101	-	-	-	-	-	-
86	2020	3	intact	broken	n.d.	-	-	-	-	-	-
86	2019	3	intact	intact	n.d.	-	-	-	-	-	-
86	2021	3	intact	intact*	n.d.	-	-	-	-	-	-
90	1465	3	intact	broken	Fig. 146	-	-	-	-	-	-
90	1467	3	intact	intact	Fig. 146	-	-	-	-	-	-
90	1466	3	intact	intact	Fig. 146	-	-	-	-	-	-
92	1480	3	intact	intact	Fig. 183	-	-	-	-	-	-
92	1481	3	intact	broken	Fig. 183	-	-	-	-	-	-
93	1469	3	intact	broken	Fig. 146	-	-	-	-	-	-
93	1468	3	intact	broken	Fig. 146	-	-	-	-	-	-
103	1599	3	intact	intact	Fig. 182	-	-	-	-	-	-
103	1600	3	intact	broken	Fig. 182	-	-	-	-	-	-

TABLE 196: *Ritual Treatment of Ceramic Period 3 Burial Vessels by Mortuary Phases. B: Burial*

B	Cat.	MP	Condition at burial	In situ	Vol.1 Fig.	B	Cat.	MP	Condition at burial	In situ	Vol.1 Fig.
12	700	7	smashed	-	Fig.262	16	2785	5	smashed	-	Fig.239
12	701	7	smashed	-	Fig.262	16	2786	5	smashed	-	Fig.239
12	702	7	intact	intact	Fig.262	35	1025	4	smashed	-	Fig.168
12	703	7	smashed	-	Fig.262	35	1026	4	smashed	-	Fig.168
1	618	7	smashed	-	Fig.261	20	953	4	smashed	-	Fig.228
1	619	7	smashed	-	Fig.261	20	2787	4	smashed	-	Fig.228
3	654	7	intact	intact	Fig.260	22	884	4	smashed	-	Fig.233
3	655	7	smashed	-	Fig.260	22	891	4	smashed	-	Fig.233
18	3264	6	smashed	-	n.d.	23	2029a	4	smashed	-	n.d.
19	3263	6	smashed	-	n.d.	23	2029b	4	smashed	-	n.d.
19	977	6	smashed	-	Fig.245	36	1024	4	smashed	-	Fig.167
19	978	6	smashed	-	Fig.245	36	2791	4	smashed	-	Fig.167
19	979	6	smashed	-	Fig.245	24	899	4	smashed	-	Fig.229
19	980	6	smashed	-	Fig.245	24	2788	4	smashed	-	Fig.229
7	697	6	smashed	-	Fig.253	24	2789	4	smashed	-	Fig.229
2	699	6	smashed	**	Fig.257	43	2015	4	smashed	-	n.d.
8	740	6	smashed	-	Fig.252	44	1049	4	smashed	-	Fig.185
8	741	6	smashed	-	Fig.252	44	1050	4	smashed	-	Fig.185
9	794	6	smashed	-	Fig.255	44	1051	4	smashed	-	Fig.185
9	795	6	smashed	-	Fig.255	33	1100	4	smashed	-	Fig.232
11	764	6	intact	intact	p.357-8	33	1101	4	smashed	-	Fig.232
11	763	6	intact	intact	p.357-8	33	1117	4	smashed	-	Fig.232
11	765	6	smashed	-	p.357-8	33	1118	4	smashed	-	Fig.232
13	820	6	smashed	-	Fig.251	45	1138	4	smashed	-	Fig.165
13	819	6	smashed	-	Fig.251	27	914	4	smashed	-	Fig.226
13	823	6	smashed	-	Fig.251	29	2030	4	smashed	-	n.d.
13	823a	6	smashed	-	n.d.	47	1141	4	smashed	-	Fig.164
14	854	5	intact	broken	Fig.240	28	990	4	smashed	-	Fig.115
14	787	5	intact	broken	Fig.240	30	992	4	smashed	-	Fig.114
14	852	5	urn	no rim	Fig.240	31	987	4	smashed	-	Fig.113
14	853	5	urn	broken	Fig.240	32	988	4	smashed	-	Fig.113
15	912	5	smashed	-	Fig.237	38	1039	4	smashed	-	Fig.222
15	2781	5	smashed	-	Fig.237	38	2034	4	smashed	-	Fig.222
15	2782	5	smashed	-	Fig.237	38	2790	4	smashed	-	Fig.222
15	913	5	smashed	-	Fig.237	39	2033	4	smashed	-	n.d.
15	809	5	smashed	-	Fig.237	41	2032	4	smashed	-	n.d.
15	2783	5	smashed	-	Fig.236	37	1269	4	smashed	no rim	Fig.162
15	2794	5	smashed	-	Fig.236	37	1270	4	smashed	-	Fig.162
15	2794a	5	smashed	-	n.d.	-	-	-	-	-	-
16	933	5	smashed	-	Fig.239	-	-	-	-	-	-
16	2784	5	smashed	-	Fig.239	-	-	-	-	-	-

TABLE 197: *Burial jar motifs by Mortuary Phases*

Burial	Cat.	MP	Motif	Type	Cluster	Burial	Cat.	MP	Motif	Type	Cluster
24	899	4	M5	local	F	8	740	6	M5	local	H
27	914	4	M5a	local	F	8	741	6	M5	local	H
31	987	4	M5	exotic	A	9	794	6	M15	local	H
33	1101	4	M9	local	-	9	795	6	M14	local	H
33	1117	4	M9	local	-	11	763	6	M16	local	-
35	1025	4	M11	exotic	C	11	765	6	M4	local	-
35	1026	4	M11	exotic	C	13	819	6	M5	local	H
36	1024	4	M4	local	C	13	823	6	M5	local	H
36	2791	4	M4	local	C	13	823a	6	M5	local	H
39	2033	4	M5b	local	F	19	977	6	M4	local	-
41	2032	4	M5	exotic	F	19	978	6	M4a	local	-
44	1049	4	M4	local	D	19	979	6	M13	local	-
44	1050	4	M4	local	D	19	980	6	M10	local	-
47	1141	4	M11	local	C	19	3263	6	M10	local	-
67	1432	3b	M3b	local	C	14	854	5	M12	local	-
60	1291	3b	M7	local	F	14	787	5	M6	local	-
57	1290	3b	M5	exotic	A	15	912	5	M4	local	-
57	1288	3b	M5	local	A	15	2781	5	M4	local	-
58	1283	3b	M8	local	F	15	2782	5	M4	local	-
93	1469	3	M2	local	C	16	933	5	M4	local	-
93	1468	3	M3	local	C	16	2784	5	M4	local	-
92	1480	3	M1	local	D	16	2785	5	M4	local	-
90	1467	3	M1a	local	C	16	2786	5	M4	local	-
90	1466	3	M4	local	C	43	2015	5	M6	local	-
76	2016	3	M4	local	G	20	953	4	M5	local	F
72	1361	3	M3a	local	C	20	2787	4	M10	local	F
72	1360	3	M3b	local	C	22	884	4	M5	local	-
						23	2029b	4	M4	local	E

XVII BIBLIOGRAPHY

Adams, R.M., 1966. *The evolution of Urban Society.* Weidenfield and Nicolson, London.

Adams, A.E., MacKenzie, W.S. and Guilford, C., 1984 *Atlas of sedimentary rocks under the microscope.* Longman Scientific and Technical, Harlow Essex.

Aitken, J.J., 1992. *Archaeological Sediments as Artefacts: The Dirt on Khok Phanom Di, Central Thailand.* Ph.D. thesis, University of Otago, Dunedin.

Anderson, A.J., 1991. The chronology of colonization in New Zealand. *Antiquity.* 65 (249):767-95.

Ardika, I.W. and Bellwood, P., 1991. Sembiran: the beginnings of Indian contact with Bali. *Antiquity.* 65(247):221-32.

Arifin, K., 1991. Social aspects of pottery manufacture in Boera, Papua New Guinea. *Bulletin of the Indo-Pacific Prehistory Association.* 11:373-87.

Arnold, D.E., 1985. *Ceramic Theory and Cultural Process.* Cambridge University Press, Cambridge.

Arnold, D.E., 1993. *Ecology and ceramic production in an Andean Community.* Cambridge University Press, Cambridge.

Arnold, J., 1987. Craft Specialization in the Prehistoric Channel Islands, California. *University of California Publications in Anthropology.* Vol. 18. Berkley: University of California Press.

Asch, D.L. and Brown, J.A., 1990. Stratigraphy and site chronology, in Brown, J.A and O'Brien, P.J. editors, *At the edge of prehistory.* 174-85. Kampsville (IL): Center for American Archaeology. (Cited by Hall 1997).

Aswani, S. and Graves, M.W., 1998. The Tongan Maritime Expansion: A Case in the Evolutionary Ecology of Social Complexity. *Asian Perspectives.* 37 (2):135-64.

Bannanurag, R., 1989. *Khok Phanom Di and its Socio-cultural Implications.* unpublished Ph.D. thesis. University of Otago, Dunedin.

Barnard, N., 1986. A New Approach to the Study of Clan-sign Inscriptions of Shang. In Chang, K.C. editor, *Studies of Shang Archaeology.* Selected Papers from the International conference on Shang Civilization, pages 141-206. Yale University Press, New Haven.

Barnes, G.L., 1993. *China Korea and Japan. The Rise of Civilization in East Asia.* Thames and Hudson, London.

Barnes, R.H., 1996. *Sea Hunters of Indonesia.* Oxford University Press, Oxford.

Battey, M.H., 1972. *Mineralogy for Students.* Longman, London.

Bayard, D.T., 1970. Excavation at Non Nok Tha, Northeastern Thailand, 1968. An Interim Report. *Asian Perspectives,* 13:109-43.

Bayard, D.T., 1971. *Non Nok Tha: The 1968 Excavations: Procedure, Stratigraphy and a summary of the evidence.* University of Otago Studies in Prehistoric Anthropology, 4. Dunedin.

Bayard, D.T., 1976. *A Course Toward What? Evolution development and change at Non Nok Tha, Thailand.* Unpublished Ph.D. thesis, Department of Anthropology, University of Hawaii.

Bayard, D.T., 1977. Phu Wiang Pottery and the Prehistory of Northeastern Thailand. *Modern Quaternary Research in Southeast Asia.* 3:57-102.

Bayard, D.T., 1977a. A Novel Pottery-Manufacturing Technique in Western Loei Provence, Thailand. *Journal of the Siam Society.* 65(1):239-56.

Bayard, D.T., 1980. *The Pa Mong Archaeological Survey Programme 1973-1975.* University of Otago Studies in Prehistoric Anthropology, 13. Dunedin.

Bayard, D.T., 1984. Rank and Wealth at Non Nok Tha: the mortuary evidence. In Bayard, D.T., editor, *Southeast Asian Archaeology at the XV Pacific Science Congress,* pages 87-122. University of Otago Studies in Prehistoric Anthropology, 16. Dunedin.

Bayard, D.T., 1984a. A Tentative Regional Phase Chronology for Northeast Thailand. In Bayard, D.T., editor, *Southeast Asian Archaeology at the XV Pacific Science Congress,* pages 161-8. University of Otago Studies in Prehistoric Anthropology, 16. Dunedin.

Bayard, D.T., 1987. Chronology, evolution and diffusion in the later Southeast Asian cultural sequence:some comments on Higham's recent revision. *Bulletin of the Indo-Pacific Prehistory Association.* 7:118-40.

Bayard, D.T., 1996. Bones of Contention: the Non Nok Tha burials and the chronology and context of early Southeast Asian bronze. In Barnard, N. and Bulbeck, F.D., editors, *Ancient Chinese and Southeast Asian Bronze Age Cultures,* pages 889-940. Vol. 2. Southern Materials Center Inc., Taipei.

Bayard, D.T., Charoenwongsa, P. and Rutnin, S., 1986. Excavations at Non Chai, Northeastern Thailand. *Asian Perspectives,* 25(1):13-62.

Bellwood, P., 1988. Affluence and Ranking, Southeast Asian Style. Review of Charles Higham, The Archaeology of Mainland Southeast Asia. *The Quarterly Review of Archaeology.* Fall 1988:4-5.

Bellwood, P., 1992. Review of Higham, C.F.W. and Bannanurag, R., The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. I: The Excavation, Chronology and Human Burials. Society of Antiquaries of London, Research Report XLVII. 1990. *Journal of Field Archaeology* page 255.

Bellwood, P., 1996. The origins and spread of agriculture in the Indo-Pacific region: gradualism and diffusion or revolution and colonization? In Harris D.R., editor, *The Origins and Spread of Agriculture and Pastoralism in Eurasia,* pages 465-98. UCL Press, London.

Bellwood, P., Gillespie, R., Thompson, G.B., Vogel, J.S., Ardika I.W. and Datan, I., 1992. New Dates for prehistoric Asian rice. *Asian Perspectives.* 31:161-70.

Blatt, H., Middleton, G.V. and Murray, R.C., 1972. *Origin of Sedimentary Rocks.* Prentice-Hall, New Jersey.

Blatt, H., Middleton, G.V. and Murray, R.C., 1980. *Origin of Sedimentary Rocks.* (Second edition). Prentice-Hall, New Jersey.

Blurton, T.R., 1997. Terracotta Figurines of Eastern Gujarat. In Freestone I.C. and Gaimster, D.R.M., editors, *Pottery in the making. World ceramic traditions,* pages 170-75. Trustees of the British Museum, London.

Blust, R., 1996. Beyond the Austronesian homeland: the Austric hypothesis and its implications for archaeology. In Goodenough, W., editor, *Prehistoric settlement of the Pacific.* Transactions of the American Philosophical Society. 86 (5).

Boyd, W.E., 1994. The palaeoenvironment of the archaeological site of Nong Nor, and the implications of a paleoenvironmental model for the regional archaeology. In Higham, C.F.W., Thosarat, R., Boyd. W., Chang. N., Debreceny, J., Higham, T.F.G., Hogg, A., Mason, G.M., O'Reilly, D., Pailles, A. and Tayles, N., *The Excavation of the Prehistoric Site of Nong Nor, Central Thailand. Report to the National Research Council of Thailand.*

Boyd, W.E., 1998. Stratigraphy and Palaeogeography of the Nong Nor area. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Nong Nor, a Prehistoric Site in Central Thailand,* pages 71-85. University of Otago Studies in Prehistoric Anthropology, 18. Dunedin.

Bronitsky, G. and Hamer, R., 1986. Experiments in ceramic technology: the effects of various tempering materials on impact and thermal-shock resistance. *American Antiquity.* 51(1):89-101.

Bronson, B., 1976. *Excavations at Chansen and the cultural chronology of Protohistoric Central Thailand.* Unpublished Ph.D. thesis. University of Pennsylvania.

Bronson, B. and Natapintu, S., 1988. Don Noi: a new flake tool industry of the middle Holocene in Western Thailand. In Charoenwongsa, P. and Bronson, B. editors, *Prehistoric Studies: The Stone and Metal Ages in Thailand,* pages 91–106. Thai Antiquity Working Group, Bangkok.

Bronson, B. and White, J.C., 1992. Radiocarbon and Chronology in Southeast Asia. In Ehrich, R., editor. *Chronologies in Old World Archaeology (3rd edition),* pages 491-503. University of Chicago Press, Chicago.

Brookfield, H.C. and Hart, D. 1971. *Melanesia: a geographical interpretation of an island world.* Methuen, London.

Brumfiel, E. and Earle, T. 1987. Specialization, Exchange, and Complex Societies: An Introduction. In Brumfiel, E. and Earle, T., editors, *Specialization, Exchange, and Complex Societies,* pages 1-9. Cambridge University Press, Cambridge.

Buchan, R.A., 1973. *The Three-dimensional jig-saw puzzle: a ceramic sequence from N.E.Thailand.* Unpublished M.A. thesis. University of Otago, Dunedin.

Buck, C.E., Litton, C.D. and Kus, S.M., 1994. Making the most of radiocarbon dating: some statistical considerations. *Antiquity.* 68 (259):252-63.

Burridge, K.O., 1969. *Tangu Traditions: a study of the way of life, mythology and developing experience of a New Guinea People.* Clarendon Press, Oxford. (Cited by May and Tuckson 1982:194)

Calder, A.M., 1972. *Cracked Pots and Rubbish Pits.* Unpublished M.A. thesis, University of Otago, Dunedin.

Canby, S.R., 1997. Islamic Lustreware. In Freestone I.C. and Gaimster, D.R.M., editors, *Pottery in the making. World ceramic traditions,* pages 110-15. Trustees of the British Museum, London.

Cassaidy, D., 1991. The size frequency distribution of *Scylla serrata* crabs. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part I),* pages 231-36. Society of Antiquaries of London, Research Report XLVIII.

Chang, K.C., 1986a. *The Archaeology of Ancient China.* (4th edition), Yale University Press, New Haven.

Chang, K.C., editor, 1986b. *Studies of Shang Archaeology.* Yale University Press, New Haven and London.

Chantaratiyakarn, P., 1984. The Pottery from Ban Chiang Hian and related sites. In Higham, C.F.W. and Kijngam, A. editors, *Prehistoric Investigations in Northeastern Thailand,* pages 590-621. British Archaeological Reports, International Series 231 (iii). Oxford.

Chau Hing-wah., editor, 1993. *Collected Essays on the Culture of the Ancient Yue People in South China.* Urban Council, Hong Kong.

Cheung Kwong-Yue, 1983. Recent Archaeological Evidence Relating to the Origin of Chinese Characters. In Keightley, D.N., editor, *The Origins of Chinese Civilization.* Translated by Noel Barnard, pages 323-91. Berkeley and Los Angeles. University of California Press.

Childe, V.G., 1936. *Man Makes Himself.* Watts, London.

Childe, V.G., 1942. *What Happened in History.* Book Club Associates, London. (With a new foreword by Graham Clarke, 1964).

Childe, V.G., 1956. *Piecing Together the Past: the interpretation of archaeological data.* Praeger, New York.

Childe, V.G., 1957. *The Dawn of European Civilization.* Paladin, Granada Publishing, St. Albans.

Childs, S.T., 1988. Clay Resource Specialization in Ancient Tanzania: Implications for Cultural Process. In Kolb, C.C., editor, *Ceramic Ecology Revisited 1987. The technology and Socioeconomics of Pottery,* Part i, pages 1-31. British Archaeological Reports, International Series 436(i), Oxford.

Chippendale, C., 1993. Editorial. *Antiquity.* 67 (255):191-99.

Christaller, W., 1966. *Central places in Southern Germany.* Translated by C.W. Baskin. Englewood Cliffs, New Jersey.

Ciarla, R., 1992. The Thai-Italian Regional Archaeological Project: Preliminary results. In Glover, I.C., editor, *Southeast Asian Archaeology 1990. Proceedings of the Third Conference of the European Association of Southeast Asian Archaeologists,* pages 111-28. Centre for South-East Asian Studies, University of Hull.

Clark, J.G.D., 1954. *Star Carr: a case study in bioarchaeology.* Cambridge University Press, Cambridge.

Clarke, D.L., 1968. *Analytical Archaeology.* Methuen.

Clarke, D.L., 1978. *Analytical Archaeology.* (Second revised edition). Methuen.

Clarke, J. and Parry, W.J., 1990. Craft Specialization and Cultural Complexity. *Research in Economic Anthropology.* 12:289-346.

Connah, G., 1996. *Kibiro: the salt of Bunyoro, past and present.* British Institute in Eastern Africa Memoir 13. London. (Reviewed by Andrew Reid *Antiquity.* 71 (272):491-92).

Cooper, J., 1982. The research potential of molluscan shell in shell-tempered pottery. In Freestone, I., Johns, C. and Potter, T., editors, *Current research in ceramics: Thin-section studies,* pages 161-62. British Museum Occasional papers 32.

Cortes, L.L., 1954. La alfarería en Pereruela (Zamora). *Zephyrus,* 9:95-107. (Cited by Arnold 1985:145).

Costin, L.C., 1986. From Mountains to Molehills: A Critical Review of Teotihuacan's Obsidian Industry. In Isaac, B. L., editor *Economic Aspects of Prehispanic Highland Mexico,* pages 23-74. *Research in Economic Anthropology,* supplement 2. Greenwich, Connecticut: JAI Press.

Costin, L.C., 1991. Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production. In Schiffer, M.B., editor *Archaeological Method and Theory,* Vol. 3, pages 1-56. University of Arizona Press, Tucson.

Crawford, G.W. and Shen, C., 1998. The origins of rice agriculture: recent progress in East Asia. *Antiquity,* 72 (278):858-66.

Crawford, J., 1986. Po Yue Wan Pottery. *Journal of the Hong Kong Archaeological Society.* Vol. XI, 1984-1985: 66-79.

Cruijs, M., 1964. *Reconnaissance pour bauxites - rapport de fin de mission United Nations ECAFE,* Committee for Co-ordination of Investigations of the Lower Mekong Basin. Bangkok.

Cunliffe, B.W., 1976. The origins of urbanisation in Britain. In Cunliffe, B.W. and Rowley. T., editors, *Oppida in Barbarian Europe,* pages 135-62. British Archaeological Reports, (Supplementary Series) S11. Oxford.

Curtis, F., 1962. The utility pottery industry of Bailén, Southern Spain. *American Anthropologist,* 64:486-503.

Datan, I. and Bellwood, P., 1991. Recent research at Gua Sireh (Serian) and Lubang Angin (Gunung Mulu National Park), Sarawak. *Bulletin of the Indo-Pacific Prehistory Association,* 10(1):386-405.

Deal, M., 1998. *Pottery ethnoarchaeology in the Central Maya Highlands.* University of Utah Press, Salt Lake City.

Debreceny, J., 1994. The phase 2 ceramics. In Higham, C.F.W., Thosarat, R., Boyd, W., Chang, N., Debreceny, J., Higham, T.F.G., Hogg, A., Hunt, V., Mason, G.M., O'Reilly, D., Pailles, C. and Tayles, N., *The Excavation of the Prehistoric Site of Nong Nor, Central Thailand. Report to the National Research Council of Thailand.*

Debreceny, J., 1995. *The Nong Nor Mortuary Ceramics.* M.A: Thesis, Anthropology Department, University of Otago, Dunedin.

Deer, W.A., Howie, R.A. and Zussman, J., 1966. *An Introduction to Rock Forming Minerals.* Longman, Harlow.

Deraniyagala, S.U., 1973.The citadel of Anuradhapura 1969. A preliminary report. *Ancient Ceylon.* 6:39-47.

Diffloth, G., 1991. Austro-Asiatic Languages. *Encyclopaedia Britannica Macropaedia,* 22:719-21.

Donnan, C.B. and Mackey, C.J., 1978. *Ancient Burial Patterns of the Moche Valley, Peru.* University of Texas Press, Austin and London.

Domett, K.M. and Tayles, N.G., 1999. *Osteoarthritis in Prehistoric Thailand.* Paper presented at the March 1999 New Zealand Archaeological Association Conference, Auckland University.

Earle, T., 1981. Comment on P. Rice, Evolution of Specialized Pottery Production: A Trial Model. *Current Anthropology,* 22 (3):230-31.

Egloff, B.J., 1973. Contemporary Wanigela pottery. In Lauer, P.K., editor, *Occasional Papers in Anthropology, Anthropology Museum, University of Queensland,* pages 61-79. Vol. 2.

Ehrich, R.W., 1950. Some reflections on archaeological interpretation. *American Anthropologist,* 52:468-82.

Engelhardt, R.A. and Rogers, P.P., 1996. *The Puhket Project Revisited: The ethno-archaeology of maritime-adapted communities through time.* Paper Presented at the 6th International Conference of the European Association of Southeast Asian Archaeologists, Leiden, 2-6 September 1996.

Engelhardt, R.A. and Rogers, P.P., 1997. Maritime adaptive strategies in post-Pleistocene Southeast Asia: An ethnoarchaeological model for the nature and distribution of archaeological sites. *Bulletin of the Indo-Pacific Prehistory Association,* 16(3):177-92.

Flannery, K.V., 1968. Archaeological Systems Theory and Mesoamerica. In Meggers, B.J., editor, *Anthropological Archaeology in the Americas,* pages 67-87. Anthropological Society of Washington.

Flint, R.F. and Skinner, B.J., 1977. *Physical Geology,* 2nd edition. Wiley & Sons, New York.

Folk R.L., 1980. *Petrology of sedimentary rocks.* Hempel Publishing Company, Austin, Texas.

Forbes R.J., 1958. *Studies in Ancient Technology.* Vol. VI. E.J.Brill, Leiden.

Foster, G.M., 1965. The sociology of pottery: questions and hypotheses arising from contemporary Mexican work. In Matson, F.R., editor, *Ceramics and Man,* pages 43-63. Aldine, Chicago.

Frankfort, H., 1951. *The birth of civilization in the Near East.* Doubleday, New York.

Frankfort, H. and Frankfort H.A., 1946. Introduction. In Frankfort, H. and Frankfort H.A., editors, *Before Philosophy,* pages 11-36. Penguin Books, Baltimore.

Franklin, U.M., 1983. On Bronze and Other Metals in Early China. In Keightley, D.N., editor, *The Origins of Chinese Civilization,* pages 279-96. Berkeley and Los Angeles. University of California Press.

Freestone I.C. and Gaimster, D.R.M., editors, 1997. *Pottery in the making. World ceramic traditions.* Trustees of the British Museum, London.

Fried M.H., 1960. On the evolution of social stratification and the state. In Diamond, S., editor, *Culture in History.* Columbia University Press, New York.

Fried M.H., 1967. *The evolution of political society: An essay in political anthropology.* Random House, New York.

Fried M.H., 1983. Tribe to State or State to Tribe in Ancient China? In Keightley, D.N., editor, *The Origins of Chinese Civilization,* pages 467-93. Berkeley and Los Angeles. University of California Press.

Fulford, M.G., 1984. Trade and Communication, In Fulford, M.G. and Peacock, D.P.S., editors, *The Avenue Du President Habib Bourguiba, Salammbo: The pottery and other ceramic objects from the site.* Excavations at Carthage: The British Mission Vol. I, 2. University of Sheffield.

Fulford, M.G. and Huddleston, K., 1991. *The current state of Romano-British pottery studies.* English Heritage Occasional Papers 1 (London: English Heritage). (Cited in Orton *et. al.* 1993).

Galipaud, J-C., 1995. A Revision of the Archaeological Sequence of Southern New Caledonia. *New Zealand Journal of Archaeology,* 17:77-109.

Garnsey, W. and Alley, R., 1983. *CHINA. Ancient kilns and modern ceramics. A guide to the potteries.* Australian National University Press, Canberra.

Gardin, J.C., 1980. *Archaeological Constructs: an aspect of theoretical archaeology.* Cambridge University Press, Cambridge.

Gayton, A.H., 1929. Yokuts and Western Mono pottery making. *University of California Publications in American Archaeology and Ethnology,* 24(3):239-55.

Geological Survey Division of the Department of Mineral Resources, 1980. *Geological Map of Thailand 1:250,000, sheet ND 47-8. Changwat Phra Nakhon Si Ayutthaya.* Bangkok.

Geological Survey Division of the Department of Mineral Resources, 1984. *Geological Map of Thailand 1:250,000, sheet ND 47-12: Bangkok Metropolis.* Bangkok.

Geological Survey Division of the Department of Mineral Resources, 1984. *Geological Map of Thailand 1:250,000, sheet ND 47-16: Changwat Rayong.* Bangkok.

Geraghty, P., 1996. Pottery in Fiji: A preliminary survey of locations and terminology. In Davidson, J., Irwin, G., Leach, F., Pawley, A. and Brown, D., editors, *Oceanic Culture History. Essays in Honour of Roger Green,* pages 421-31. New Zealand Journal of Archaeology Special Publication.

Gernet, J., 1982. *A History of Chinese Civilization,* translated by J.R. Foster. Cambridge University Press.

Gero, J., 1983. *Material Culture and the Reproduction of Social Complexity: A Lithic Example from the Peruvian Formative.* Ph.D. dissertation, University of Massachusetts, Ann Arbor: University Microfilms.

Geyh, M.A., Kudrass, H.R. and H. Streif., 1979. Sea-level changes during the late Pleistocene and Holocene in the Strait of Malacca. *Nature,* 278:441-43.

Ghosh, N.C., 1986. *Excavations at Satanikota 1977-80.* New Delhi: Archaeological Survey of India.

Gibbs, R.J., 1971. X-ray Diffraction Mounts. In Carver, R.E., editor, *Procedures in sedimentary petrology,* pages 531-40. John Wiley and Sons, New York.

Gibson, A. and Woods, A., 1990. *Prehistoric Pottery for the Archaeologist.* Leicester University Press, Leicester.

Gifford, J.C., 1960. The type-variety method of ceramic classification as an indicator of cultural phenomena. *American Antiquity,* 25:341-47.

Glanzman, W.D. and Fleming, S.J., 1985. Ceramic technology at prehistoric Ban Chiang, Thailand: Fabrication methods. *MASCA Journal,* 3(4):114-21.

Glover, I.C., 1990. Ban Don Ta Phet: the 1984-5 excavation. In Glover, I.C. and Glover, E., editors, *Southeast Asian Archaeology 1986. Proceedings of the First Conference of the Association of Southeast Asian Archaeologists in Western Europe,* pages 139-83. British Archaeological Reports (International Series) 561, Oxford.

Glover, I.C., 1996. The Southern Silk Road: Archaeological Evidence for Early Trade Between India and Southeast Asia. *Ancient Trades and Cultural Contacts in Southeast Asia.* Proceeding from an international seminar convened by the Office of the National Culture Commission at the Thailand Cultural Centre, pages 57-94. Office of the National Culture Commission, Bangkok.

Glover, I.C. and Higham, C.F.W., 1996. New evidence for early rice cultivation in South, Southeast and East Asia. In Harris D.R., editor , *The Origins and Spread of Agriculture and Pastoralism in Eurasia,* pages 413-41. UCL Press, London.

Glover, I.C., Yamagata, M. and Southworth, W., 1996. The Cham, Sa Huynh and Han in Early Vietnam: Excavations at Buu Chau Hill, Tra Kieu, 1993. *Bulletin of the Indo-Pacific Prehistory Association,* 14(1):166-76.

Goody, E., 1982. Introduction. In Goody, E., editor, *From Craft to Industry. The Ethnography of Proto-Industrial Cloth Production,* pages 1-37. Cambridge University Press, Cambridge. (Cited by Costin 1991:16.)

Gorman, C.F. and Charoenwongsa, P., 1976. Ban Chiang: a Mosaic of Impressions of the First Two Years. *Expedition,* 18(4):14-26.

Grant, A. and Higham, C.F.W., 1991. The large mammalian fauna. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part I),* pages 147-91. Society of Antiquaries of London, Research Report XLVIII.

Green, R.C., 1990. Lapita design analysis: the Mead System and its use; a potted history. In Spriggs, M., editor, *Lapita Design, Form and Composition. Proceedings of the Lapita Design Workshop, Canberra, Australia, December 1988,* pages 33-52. Occasional Papers in Prehistory, 19. Australian National University, Canberra.

Griffin, G.M., 1962. Regional Clay-Mineral Facies - Products of Weathering Intensity and Current Distribution in the Northeastern Gulf of Mexico. *Bulletin of the Geological Society of America,* 73:737-68.

Grim, R.E., 1962. *Applied Clay Mineralogy.* McGraw-Hill, New York.

Grim, R.E., 1968. *Clay Mineralogy,* (2nd edition). McGraw-Hill, New York.

Gupta, S.P., 1969. Sociology of pottery: Chirag Dilli, a case study. In Sinha, B.P., editor, *Potteries in ancient India,* pages 15-26. Department of Ancient Indian History and Archaeology, Patna University, Patna.

Hage, P., 1977. Centrality in the Kula ring. *Journal of the Polynesian Society,* 86:27-36.

Hagstrum, M., 1985. Measuring Prehistoric Ceramic Craft Specialization: A test Case in the American Southwest. *Journal of Field Archaeology,* 12 (1):65-76.

Hagstrum, M., 1989. *Technical Continuity and Change: Ceramic Ethnoarchaeology in the Peruvian Andes.* Ph.D. dissertation, University of California, Los Angeles. Ann Arbor: University Microfilms.

Hall, M.D., 1989. *The Decorated Ceramics of Khok Phanom Di and the Social Implications.* unpublished M.A. Thesis, University of Otago, Dunedin.

Hall, M.D., 1993. Aspects of the Pottery Decoration. In Higham, C.F.W. and Thosarat, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. III: The Material Culture, (Part I),* pages 239-75. Society of Antiquaries of London, Research Report L.

Hall, M.E., 1997. Towards an absolute chronology for the Iron Age of Inner Asia. *Antiquity,* 71 (274):863-74.

Hamer, F., 1975. *The Potters Dictionary of Materials and Techniques.* Pitman, London.

Hamer, F. and Hamer, J., 1977. *Clays.* Pitman, London.

Hardin, M.A., 1984. Models of decoration. In van der Leeuw, S.E. and Pritchard, A.C., editors, *The Many Dimensions of Pottery, Ceramics in archaeology and anthropology,* pages 573-614. Universiteit van Amsterdam.

Harris, A., 1991. The insect remains. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part I),* page 238. Society of Antiquaries of London, Research Report XLVIII.

Harris, D.R., 1996. *The Origins and Spread of Agriculture and Pastoralism in Eurasia.* UCL Press, London.

Harris, R., 1986. *The Origin of Writing.* Duckworth, London.

Harris, V., 1997. Jomon Pottery in Ancient Japan. In Freestone I.C. and Gaimster, D.R.M., editors, *Pottery in the making. World ceramic traditions,* pages 20-25. Trustees of the British Museum, London.

Harrison-Hall, J., 1997. Ding and Other Whitewares of Northern China. In Freestone I.C. and Gaimster, D.R.M., editors, *Pottery in the making. World ceramic traditions,* pages 182-97. Trustees of the British Museum, London.

Haselgrove, C., 1986. Central Places in British Iron Age Studies: a Review and Some Problems. In Grant, E., editor, *Central Places, Archaeology and History.* Department of Archaeology and Prehistory, University of Sheffield.

Hastings, P. and Liengsakul, M., 1983. Chronology of the Late Quaternary Climatic Changes in Thailand. In Thiramongkol, N. and Pisutha-Arnond, V., editors, *Proceedings of the First Symposium on Geomorphology and Quaternary Geology of Thailand,* pages 24-34. Bangkok, Thailand.

Hattori, T., 1972. Some properties of recent sediments in the Bangkok plain of Thailand. *Tonan Ajia Kenkyu (Southeast Asian Studies),* 10(2):321-34.

Heinrich, E.W., 1965. *Microscopic Identification of Minerals.* McGraw-Hill, New York.

Higham, C.F.W., 1977. The Prehistory of the Southern Khorat Plateau, Northeast Thailand, with particular reference to Roi Et Provence. *Modern Quaternary Research in Southeast Asia,* 3:103-43.

Higham, C.F.W., 1984. The social structure of the Ban Na Di prehistoric population. In Bayard, D.T., editor, *Southeast Asian Archaeology at the XV Pacific Science Congress,* pages 16-168. University of Otago Studies in Prehistoric Anthropology, 16. Dunedin.

Higham, C.F.W., 1988. Ban Chiang and charcoal in hypothetical hindsight: a comment. *Bulletin of the Indo-Pacific Prehistory Association, 8:75-78.*

Higham, C.F.W., 1989. *The Archaeology of Mainland Southeast Asia.* Cambridge University Press, Cambridge.

Higham, C.F.W., 1993. The bone, antler and turtle carapace technology. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. III: The Material Culture (Part I),* pages 1-44. Society of Antiquaries of London, Research Report L.

Higham, C.F.W., 1993. Miscellaneous shell artefacts. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. III: The Material Culture (Part I),* pages 213-222. Society of Antiquaries of London, Research Report L.

Higham, C.F.W., 1996a. Archaeology and Linguistics in Southeast Asia: implications of the Austric hypothesis. *Bulletin of the Indo-Pacific Prehistory Association, 14 (1):110-18.*

Higham, C.F.W., 1996b. *The Bronze Age of Southeast Asia.* Cambridge University Press.

Higham, C.F.W., 1996c. The social and chronological contexts of early bronze working in Southeast Asia. In Barnard, N. and Bulbeck, F.D., editors, *Ancient Chinese and Southeast Asian Bronze Age Cultures Vol. 2,* pages 35-102. Southern Materials Center Inc., Taipei.

Higham, C.F.W., 1997. *The Excavation of Noen-U-Loke.* Report read at the at 62nd Meeting of the Society for American Archaeology, Nashville, 2-6 April 1997.

Higham, C.F.W., 2000. Review of Loewe, L. and Shaughnessy, E.L., editors, The Cambridge history of ancient China from the origins of civilization to 221 BC. *Antiquity,* 74 (284):447-48.

Higham, C.F.W. and Bannanurag, R., 1990. *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. I: The Excavation, Chronology and Human Burials.* Society of Antiquaries of London, Research Report XLVII.

Higham, C.F.W. and Bannanurag, R., 1991. *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part I).* Society of Antiquaries of London, Research Report XLVIII.

Higham, C.F.W. and Bannanurag, R., 1992. Prehistoric Traders. *National Geographic Research and Exploration,* 8(2):180-95.

Higham, C.F.W., Bannanurag, R., Maloney, B.K. and Vincent, B.A., 1987. Khok Phanom Di: The results of the 1984-5 excavation. *Bulletin of the Indo-Pacific Prehistory Association, 7:148-78.*

Higham, C.F.W., Bannanurag, R., Boyd, W., Mason, G.M. and Tayles, N., n.d. *Human adaptation to a subtropical coast: excavations at Nong Nor, Central Thailand.* manuscript on file.

Higham, C.F.W. and Kijngam, A., 1984. *Prehistoric Investigations in Northeast Thailand.* British Archaeological Reports, International Series 231 (iii). Oxford.

Higham, C.F.W. and Lu, T.L.-D., 1998. The origins and dispersal of rice cultivation. *Antiquity,* 72 (278):867-77.

Higham, C.F.W. and Thosarat, R., 1993. *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. III: The Material Culture (Part I).* Society of Antiquaries of London, Research Report L.

Higham, C.F.W. and Thosarat, R., 1994a. Introduction: research objectives. In Higham, C.F.W., Thosarat, R., Boyd, W., Chang, N., Debreceny, J., Higham, T.F.G., Hogg, A., Hunt, V., Mason, G.M., O'Reilly, D., Pailles, C. and Tayles, N., *The Excavation of the Prehistoric Site of Nong Nor, Central Thailand. Report to the National Research Council of Thailand.*

Higham, C.F.W. and Thosarat, R., 1994b. *Khok Phanom Di. Prehistoric Adaptation to the World's Richest Habitat.* Harcourt Brace. Fort Worth.

Higham, C.F.W. and Thosarat, R., 1997. *The Excavation of Noen-U-Loke: Implications for developing cultural complexity in Northeast Thailand.* Report read at the 62nd Annual Meeting of Society for American Archaeology, Nashville, 2-6 April 1997.

Higham, C.F.W. and Thosarat, R., editors, 1998a. *The Excavation of Nong Nor a Prehistoric Site in Central Thailand.* University of Otago Studies in Prehistoric Anthropology, 18. Dunedin.

Higham, C.F.W. and Thosarat, R., 1998b. *Prehistoric Thailand. From Early Settlement to Sukhothai.* River books, Bangkok.

Higham, C.F.W., Thosarat, R., Boyd, W., Chang, N., Debreceny, J., Higham, T.F.G., Hogg, A., Hunt, V., Mason, G.M., O'Reilly, D., Pailles, C. and Tayles, N., 1994. *The Excavation of the Prehistoric Site of Nong Nor, Central Thailand. Report to the National Research Council of Thailand.*

Higham, C.F.W., Thosarat, R., Chang, N., Debreceny, J., Higham, T.F.G., Hogg, A., Hunt, V., Mason, G.M., O'Reilly, D., Pailles, C. and Tayles, N., 1994a. *The Excavation of the Prehistoric site of Nong Nor.* Unpublished report to the National Research Council of Thailand.

Higham, T.F.G., 1993. The shell knives. In Higham, C.F.W. and Thosarat, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. III: The Material Culture (Part I),* pages 177-211. Society of Antiquaries of London, Research Report L.

Higham, T.F.G. and Hogg, A., 1994. The Chronology. In Higham, C.F.W., Thosarat, R., Boyd, W., Chang, N., Debreceny, J., Higham, T.F.G., Hogg, A., Hunt, V., Mason, G.M., O'Reilly, D., Pailles, C. and Tayles, N., *The Excavation of the Prehistoric Site of Nong Nor, Central Thailand. Report to the National Research Council of Thailand.*

Higham, T.F.G. and Hogg, A., 1998. The Radiocarbon Chronology. In Higham, C.F.W. and Thosarat, R., editors, *The Excavation of Nong Nor a Prehistoric Site in Central Thailand,* pages 23-25. University of Otago Studies in Prehistoric Anthropology, 18. Dunedin.

Ho, C.-M., 1984. *The Pottery of Kok Charoen and its Farther Context.* Ph.D. thesis, University of London.

Hodges, H.W.M., 1965. Aspects of Pottery in Temperate Europe before the Roman Empire. In Matson, F.R., editor, *Ceramics and Man,* pages 114-23. Aldine, Chicago.

Hodges, H., 1970. *Technology in the ancient world.* Barnes and Noble, New York.

Hole, F. and Heizer, R.F., 1973. *An Introduction to Prehistoric Archaeology.* Third edition, Holy, Rinehart and Winston, Inc., New York.

Hope, J.H. and Hope, G.S., 1976. Palaeoenvironments for Man in New Guinea. In Kirk, R.L. and Thorne, A.G., editors, *The Origins of the Australians,* pages 29-54. Australian Institute of Aboriginal Studies, Canberra.

Howard, H., 1982. Clay and the archaeologist. In Freestone, I., Johns, C. and Potter, T., editors, *Current research in ceramics: Thin-section studies,* pages 145-58. British Museum Occasional Paper, 32.

Howard, H. and Morris, E.L., editors, 1981. *Production and Distribution: a Ceramic Viewpoint.* British Archaeological Reports, International Series 120. Oxford.

Huber, L.G.F., 1983. The Relationship of Painted Pottery and Lung-shan Cultures. In Keightley, D.N., editor, *The Origins of Chinese Civilization,* pages 177-215. University of California Press.

Hurst, H.R. and Roskams, S.P., editors, 1984. *The Avenue Du President Habib Bourguiba, Salammbo: The site finds other than pottery.* Excavations at Carthage: The British Mission Vol. I, 1. University of Sheffield.

Irwin, G.J., 1977. *The Emergence of Mailu as a Central Place in the Prehistory of Coastal Papua.* Ph.D.thesis. Australian National University, Canberra.

Irwin, G.J., 1978. The Development of Mailu as a Specialised Trading and Manufacturing Centre in Papuan Prehistory: The Causes and Implications. *Mankind* 11:406-15.

Johnson, J.M., 1989. *A preliminary petrographic analysis of the ceramic fabrics.* MA report, Institute of Archaeology, London.

Johnson, J.M., 1992. The ceramics at Ban Don Ta Phet; a preliminary report with special reference to the classification of ceramic fabrics. In Glover, I.C., editor, *Southeast Asian Archaeology 1990,* pages 179-86. Centre for South-East Asian Studies, University of Hull.

Kealhofer, L. and Piperno, D.R., 1996. Two phytolith sequences from the Bang Pakong Valley. In Thompson, G.B., *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part 1),* pages 227-38. Society of Antiquaries of London, Research Report XLVIII.

Kerr, P.F., 1977. *Optical Mineralogy* (4th edition). McGraw-Hill, New York.

Key, C.A., 1968. Pottery manufacture in the Wanigela area of Collingwood Bay, Papua. *Mankind* 6:653-57.

Kidder, A.V., 1936. *The Pottery of Pecos, Vol. 2.* Papers of the Phillips Academy Southwestern Expedition, No.7., New Haven.

Kidder, A.V., 1942. Foreword in: Shepard, A.O. *Rio Grande Glaze Paint Ware, A Study Illustrating the Place of Technological Analysis in Archaeological Research.* Contributions to American Anthropology and History, No. 39. Carnegie Institute, Washington.

Kijngam, A., 1984. *The Excavation of Ban Na Di and the Prehistory of the Sakon Nakhon Basin.* unpublished Ph.D. thesis. University of Otago, Dunedin.

Kijngam, A., 1991. The remains of fish, crabs and turtles. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part I),* pages 223-29. Society of Antiquaries of London, Research Report XLVIII.

Kijngam, A., Higham, C.F.W. and Wiriyaromp, W., 1980. *Prehistoric Settlement Patterns in Northeast Thailand.* University of Otago Studies in Prehistoric Anthropology, 15. Dunedin.

Klein, J., Lerman, J.C., Damon, P.E. and Ralph, E.K., 1982. Calibration of radiocarbon dates. *Radiocarbon,* 24(2):103-50.

Knight, S., 1983. *The Brotherhood.* Collins, London.

Kolb, C.C., editor, 1988. *Ceramic Ecology Revisited 1987. The technology and Socioeconomics of Pottery.* Part i. British Archaeological Reports, International Series 436(i). Oxford.

Kristiansen, K., 1987. From stone to bronze: the evolution of social complexity in northern Europe. In Brumfiel, E. and Earle, T., editors, *Specialization, Exchange, and Complex Societies,* pages 30-51. Cambridge University Press, Cambridge.

Kroeber, A.L., 1916. *Zuñi Potsherds.* Anthropological Papers of the American Museum of Natural History 18. New York. (Cited by Orton *et. al.* 1993:11)

Kuhn, T.S., 1961. The Function of Measurement in Modern Physical Science. *Isis,* 52:161-93.

Kuhn, T.S., 1963. The Function of Dogma in Scientific Research (with commentaries by Hall, A.R. and Polany, M.), In Crombie, A.C., editor, pages 347-60. *Scientific Change.* Heinneman, London.

Lauer, P.K., 1971. Preliminary Report on Ethnoarchaeological Research in the Northwestern Massim, T.P.N.G. *Asian Perspectives,* 14:69-75.

Lauer, P.K., 1972. A neglected aspect of New Guinea pottery technology: firing. *Pottery in Australia,* 11(1).

Lauer, P.K., 1973. Miadeba pottery. *Records of the Papua New Guinea Museum,* 3:63-77.

Lauer, P.K., 1974a. The technology of pottery manufacture on Goodenough Island and in the Amphlett group, Southeast Papua. In Lauer, P.K., editor, *Occasional Papers in Anthropology, Anthropology Museum, University of Queensland, Vol. 2,* pages 125-60.

Lauer, P.K., 1974b. *Pottery Traditions in the D'Entrecasteaux Islands of Papua.* Occasional Papers in Anthropology, 3. Australian National University, Canberra.

Leong Sau Heng, 1990. A tripod pottery complex in Peninsular Malaysia. In Glover, I.C. and Glover, E., editors, *Southeast Asian Archaeology 1986. Proceedings of the First Conference of the Association of Southeast Asian Archaeologists in Western Europe,* pages 65-76. British Archaeological Reports (International Series) 561, Oxford.

Leong Sau Heng, 1991. Jenderam Hilir and the Mid-Holocene prehistory of the West Coast Plain of Peninsular Malaysia. *Bulletin of the Indo-Pacific Prehistory Association,* 10(1):150-60.

Lewis, D.W., 1984. *Practical Sedimentology.* Hutchinson, Pennsylvania.

Litto, G., 1976. *South American folk pottery: traditional techniques from Peru, Ecuador, Bolivia, Venezuela, Chile, Colombia.* Watson Guptill, New York.

Longacre, W.A., 1996. *Ceramic Ethnoarchaeology in the Philippines: Implications for Southeast Asian Archaeology,* paper presented at the 6th International Conference of the European Association of Southeast Asian Archaeologists, Leiden. 2-6 September 1996.

McGovern, P.E., Vernon, W.W. and White, J.C., 1985. Ceramic Technology at Prehistoric Ban Chiang, Thailand: Physiochemical Analysis. *MASCA Journal,* 3:104-13.

McKenzie, K.G., 1991. The ostracodes and forams. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part 1),* pages 139-46. Society of Antiquaries of London, Research Report XLVIII.

McKenzie, W.S., Donaldson, C.H. and Guilford, C., 1982. *Atlas of igneous rocks and their textures.* Longman, New York.

McNeill, J.R. and Welch D.J., 1991. Regional and Interregional Interaction on the Khorat Plateau. *Bulletin of the Indo-Pacific Prehistory Association,* 10(1):327-40.

Magrill, P. and Middleton, A.P., 2001. Did the potter's wheel go out of use in Late Bronze Age Palestine? *Antiquity,* 75 (287):137-44.

Maloney, B.K., 1987. The palaeoenvironment. In Higham, C.F.W., Bannanurag, R., Maloney, B.K. and Vincent, B.A., Khok Phanom Di: The results of the 1984-5 excavation. *Bulletin of the Indo-Pacific Prehistory Association,* 7:148-78.

Maloney, B.K., 1988. Khok Phanom Di, Central Thailand: The environmental setting. *Geoarchaeology,* 3:287-91.

Maloney, B.K., 1991. Paleoenvironments of Khok Phanom Di: The pollen, pteridophyte spore and microscopic charcoal record. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. 2: The Biological Remains (Part 1),* pages 7-146. Society of Antiquaries of London, Research Report XLVIII.

Maloney, B.K. and Brown, J.M., 1990. Changing environments and agricultural origins at Khok Phanom Di, Thailand: The pollen evidence. In Glover, I.C. and Glover, E., editors, *Southeast Asian Archaeology 1986, Proceedings of the First Conference of the Association of Southeast Asian Archaeologists in Western Europe,* pages 77-85. British Archaeological Reports, (International Series) 561, Oxford.

Maniatis, Y. and Tite, M.S., 1975. A scanning electron examination of the bloating of fired clays. *Transactions and Journal of the British Ceramic Society,* 4:229-32.

Maniatis, Y. and Tite, M.S., 1978. Examination of Roman and Medieval Pottery using the Scanning Electron Microscope. *Acta praehistorica et archaeologica,* 9/10 (1978/9).

Maniatis, Y. and Tite, M.S., 1981. Technological Examination of Neolithic-Bronze Age Pottery from Central and Southeast Europe and from the Near East. *Journal of Archaeological Science,* 8:59-76.

Mason, B., 1966. *Principles of Geochemistry* (3rd edition). John Wiley and Sons, New York.

Mason, G.M., 1991. The molluscan remains. In Higham, C.F.W. and Bannanurag, R., series editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part 1),* pages 249-319. Society of Antiquaries of London, Research Report XLVIII.

Mason, G.M., 1994. The shellfish remains. In Higham, C.F.W., Thosarat, R., Boyd, W., Chang, N., Debreceny, J., Higham, T.F.G., Hogg, A., Hunt, V., Mason, G.M., O'Reilly, D., Pailles, C. and Tayles, N., *The Excavation of the Prehistoric Site of Nong Nor, Central Thailand. Report to the National Research Council of Thailand.*

Mason, G.M., 1996. The micromolluscs. In Thompson, G.B., (Higham, C.F.W. and Bannanurag, R., series editors), *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. IV: The Biological Remains (Part II),* pages 239-64. Society of Antiquaries of London, Research Report XLVIII.

Matson, F.R., 1972. Ceramic Studies. In MacDonald, W.A. and Rapp, G.R.Jr., editors, *The Minnesota Messenia Expedition,* pages 220-24. The University of Minnesota press, Minneapolis.

May, P. and Tuckson, M., 1982. *The Traditional Pottery of Papua New Guinea.* Bay Books, Sydney.

Mayurie, V., 1982. *Etude archaeologique sur le site de Sab Champa.* M.A. thesis, Universitè de la Sorbonne Nouvelle, Paris (Cited in Mudar 1995:168).

Meacham, W. 1983. Origins and Development of the Yüeh Coastal Neolithic: A Microcosm of Culture Change on the Mainland of East Asia. In Keightley, D.N., editor, *The Origins of Chinese Civilization,* pages 147-75. University of California Press.

Meacham, W. 1984-5b. On the improbability of Austronesian origins in southern China. *Asian Perspectives,* 26:89-106.

Meacham, W. 1995. Middle and Late Neolithic at Yung Long South. In Yeung Chun-Tong and Li Wai-Ling Brenda, editors, *Archaeology in Southeast Asia,* pages 445-66. University of Hong Kong.

Miksic, J.N. and Yap, C.T., 1990. *X-Ray Fluorescence Data on Earthenware Pottery Trade in Sumatra, 12th to 14th centuries.* Paper presented at the 14th Congress of the Indo-Pacific Prehistory Association 25 August - 2nd September 1990, Yogyakarta, Indonesia.

Moore, M.N., 1993. The Burnishing Stones. In Higham, C.F.W. and Thosarat, R., editors,*The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. III: The Material Culture (Part I),* pages 105-18. Society of Antiquaries of London, Research Report L.

Moorman, F.R., Montrakun, S. and Panichapong, S., 1964. *Soils of Northeast Thailand. A reconnaissance survey with map showing the general soil conditions.* Soil Survey Report No. 72, Soil Survey Division, Department of Land Development and Food Agriculture Organization. Bangkok.

Moorman, F.R. and Rojanasoonthon, S., 1968. *Soils of Thailand. A reconnaissance survey with map showing the general soil conditions.* Soil Survey Report No. 72, Soil Survey Division, Department of Land Development and Food and Agriculture Organization. Bangkok.

Morris, E.L., 1981. Ceramic exchange in Western Britain: a preliminary view. In Howard, H. and Morris, E.L., editors, *Production and Distribution: a Ceramic Viewpoint,* pages 67-81. British Archaeological Reports, International Series 120. Oxford.

Mudar, K.M., 1993. *Prehistoric and Early Historic Settlements on the Central Plain: Analysis of Archaeological Survey in Lopburi Province, Thailand.* Ph.D. thesis, University of Michigan.

Mudar, K.M., 1995. Evidence for Prehistoric Dryland Farming in Mainland Southeast Asia: Results of Regional Survey in Lopburi Province, Thailand. *Asian Perspectives,* 34(2):155-94.

Mudar, K.M., 2000. Review of Higham, C.F.W. and R. Thosarat, The Excavation of Nong Nor, a Prehistoric Site in Central Thailand. *Asian Perspectives,* 39(1-2):198-200.

Munsell Soil Color Charts, 1975 edition. Kollmorgen Corporation, Baltimore, Maryland.

Natapintu, S., 1988. Current research on ancient copper-base metallurgy in Thailand. In Charoenwongsa, P. and Bronson, B., editors, *Prehistoric Studies: The Stone and Metal Ages in Thailand,* pages 107-24. Thai Antiquity Working Group. Bangkok.

Nelson, S., 1997. Review of Charles Higham: The Bronze Age of Southeast Asia. *Antiquity,* 71 (273):784-85.

Nik Hassan Shumaimi bin Nik Abdul Rahman., 1991. Recent research at Kuala Selinsing, Perak. *Bulletin of the Indo-Pacific Prehistory Association,* 11(2):141-52.

Nitta, E., 1997. Salt-making industries in Northeast Thailand. *Bulletin of the Indo-Pacific Prehistory Association,* 16:153-60.

Nokaskul, D., 1981. *A study of the culture and the environment of an ancient community at Khok Phanom Di, Changwat Chonburi.* Masters thesis, Silapakon University.

Nutalaya, P. and Rau, J.L., 1981. Bangkok, the sinking metropolis. *Episodes,* 4:3-8.

O'Reilly, D., 1994. The phase 1 ceramics. In Higham, C.F.W., Thosarat, R., Boyd, W., Chang, N., Debreceny, J., Higham, T.F.G., Hogg, A., Hunt, V., Mason, G.M., O'Reilly, D., Pailles, C. and Tayles, N., *The Excavation of the Prehistoric Site of Nong Nor, Central Thailand. Report to the National Research Council of Thailand,* pages 107-60.

O'Reilly, D., 1995. *An Archaeological analysis of the Initial Occupation Phase at Nong Nor, Thailand.* Unpublished M.A. Thesis, University of Otago, Dunedin.

O'Reilly, D., 1998a. The ceramic analysis. In Higham, C.F.W. and Bannanurag, R., editors,*The Excavation of Nong Nor, a Prehistoric Site in Central Thailand,* pages 97-118. University of Otago Studies in Prehistoric Anthropology, 18. Dunedin.

O'Reilly, D., 1998b. Analytical results. In Higham, C.F.W. and Bannanurag, R., editors,*The Excavation of Nong Nor, a Prehistoric Site in Central Thailand,* pages 137-44. University of Otago Studies in Prehistoric Anthropology, 18. Dunedin.

O'Reilly, D., 1998c. Comparative analysis between Nong Nor Phase 1 and Khok Phanom Di. In Higham, C.F.W. and Bannanurag, R., editors,*The Excavation of Nong Nor, a Prehistoric Site in Central Thailand,* pages 161-72. University of Otago Studies in Prehistoric Anthropology, 18. Dunedin.

Orton, C.R., 1980. *Mathematics in Archaeology.* Collins, London.

Orton, C.R., Tyers, P.A. and Vince, A.G., 1993. *Pottery in Archaeology.* Cambridge University Press, Cambridge.

Osborne, D. and Osborne, C., 1954. Twines and Terminology. *American Anthropology,* 56:1093-1100.

Palmer, B. and Shaw, E., 1968. Pottery making in Nasama. *Records of the Fiji Museum,* 1:80-90.

Peacock, B.A.V., 1959. A short description of Malayan Prehistoric Pottery. *Asian Perspectives,* 3 (2):121-56.

Peacock, D.P.S., 1970. The scientific analysis of ancient ceramics: a review. *World Archaeology,* 1:375-89.

Peacock, D.P.S., 1977. Ceramics in Roman and medieval archaeology. In Peacock D.P.S., editor, *Pottery in early commerce.* pages 21-34. Academic Press, London.

Peacock, D.P.S., 1982. *Pottery in the Roman World: an ethnological approach.* Longman, London.

Peacock, D.P.S., 1984. Introduction, In Fulford, M.G. and Peacock, D.P.S., editors, *The Avenue Du President Habib Bourguiba, Salammbo: The pottery and other ceramic objects from the site.* Excavations at Carthage: The British Mission Vol. I, 2. University of Sheffield.

Pearson, R., 1983. The Ch'ing-lien-kang Culture and the Chinese Neolithic. In Keightley, D.N., editor, *The Origins of Chinese Civilization,* pages 119-45. University of California Press.

Pearson, G.W. and Stuiver, M., 1986. High-precision calibration of the radiocarbon time scale, 500-2500 BC. *Radiocarbon,* 28:805-38.

Peebles, C.S. and Kus, S.M., 1977. Some archaeological correlates of ranked societies. *American Antiquity,* 42(3):421-48.

Petrie, W.M.F., 1899. Sequences in prehistoric remains. *Journal of the Royal Anthropological Institute,* 29:295-301. (Cited by Orton *et. al.* 1993:11)

Pettijohn, F.J., Potter, P.E. and Siever, R., 1973. *Sand and sandstone.* Springer, Berlin.

Pigott, V.C., 1992. *The archaeology of copper production at prehistoric Non Pa Wai and Nil Kham Haeng in Central Thailand.* Paper read at the 4th Conference of the Association of Southeast Asian Archaeologists in Western Europe, Rome, 28th September - 4th October 1992.

Pigott, V.C., 1994. *The bronze industry of the Khao Wong Prachan Valley.* Unpublished paper read at the Congress of Indo-Pacific Prehistory Association, Chiang Mai, January 1994.

Pigott, V. and Natapintu, S., 1988. *The Thailand Archaeometallurgy Project 1984-1987.* Paper presented at the Conference on Ancient Chinese and Southeast Asian Bronze Age cultures, Kioloa, New South Wales, Australia.

Pigott, V. and Natapintu S., 1990. *Final Report 1984-1988 to the National Research Council of Thailand.* Manuscript on file with K.Mudar. (Cited in Mudar 1995:168).

Pigott, V. and Natapintu S., 1996. Investigating the origins of metal use in prehistoric Thailand. In Barnard, N. and Bulbeck, F.D., editors *Ancient Chinese and Southeast Asian Bronze Age Cultures Vol. 2,* pages 787-808. Southern Materials Center Inc., Taipei.

Pilditch, J.S., 1984. The jewellery. In Higham, C.F.W. and Kijngam, A., editors, *Prehistoric Investigations in Northeastern Thailand,* page 78. British Archaeological Reports, International Series 231 (i). Oxford.

Pilditch, J.S., 1993. The personal ornaments, In Higham, C.F.W. and Kijngam, A., series editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. III: The Material Culture (Part 1),* pages 119-76. Society of Antiquaries of London, Research Report XLVIII.

Pisnupong, P., 1984. *A Preliminary report on the 1982 Excavation at Khok Phanom Di.* Bangkok.

Pisnupong, P., 1988. *Aspects of Stone Working at Khok Phanom Di.* MA thesis, University of Otago, Dunedin.

Pisnupong, P., 1993. The Industrial Stone Technology. In Higham, C.F.W. and Bannanurag, R., series editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. III: The Material Culture (Part 1),* pages 45-104. Society of Antiquaries of London, Research Report XLVIII.

Plique, A.E., 1887. *Etude de cèramique arverno-romaine* (Caen). (Cited by Orton *et. al.* 1993:17).

Polanyi, K., 1959. Anthropology and Economic Theory. In Fried, M.H., editor, *Readings in Anthropology II,* pages 166-227. Crowell, New York.

Popper, K.R., 1963. *Conjectures and Refutations. The growth of Scientific Knowledge,* 4th revised edition, 1972. Routledge and Keegan Paul, London.

Popper, K.R., 1967. Rationality and the Status of the Rationality Principle. Manuscript. (First published in French in *Les Fondements Philosophiques des Systemès Economiquès.* Text de Jacques Rueff et Essies en son honneur.

Potts, D.T., 1991. A note on rice cultivation. *Nouvelles Assyriologiques Brèves et Utilitaires,* 1:1-3.

Pramojanee, P. and Hastings, P.J., 1983. Geomorphological and palynological investigation of sea level changes in Chanthaburi, S.E. Thailand. In Thiramongkol, N. and Pisutha-Arnond, V., editors, *Proceedings of the First Symposium on the Geomorphology and Quaternary Geology of Thailand,* pages 35-51. Bangkok.

Preecha, K. and Pukajorn, S., 1976. Preliminary report on test excavations at Ban Om Kaeo, Tambon Ban Chiang, Amphoe Nong Han, Changwat Udorn. *Journal of Anthropology,* 17–26. Thamasat University, Bangkok.

Press, F. and Siever, R. 1974. *Earth.* Freeman, San Francisco.

Pukajorn, S., 1984. The chemical analysis of Hoabinhian pottery: new data from the recent Thai excavations in the Ban Kao area. In Bayard, D.T., editor, *Southeast Asian Archaeology at the XV Pacific Science Congress,* pages 14-15. Otago University Studies in Prehistoric Anthropology, 16. Dunedin.

Quaritch-Wales, H.G., 1957. An Early Buddhist Civilization in Eastern Siam. *Journal of the Siam Society,* XLV Part 1.

Rawson, J., 1980. *Ancient China, Art and Archaeology.* Book Club Associates, London.

Redman, C.L., 1978. *The Rize of Civilization: From Early Farmers to Urban Society in the Ancient Near East.* W.H. Freeman, San Francisco.

Reid, A., 1997. Review of Connah, G., Kibiro: the salt of Bunyoro, past and present. *Antiquity,* 71 (272):491-92.

Reith, C., 1997. Comparison of three pottery villages in Shan State, Burma. *The Journal of Burma Studies,* 1:45-82.

Renfrew, C., 1972. *The Emergence of Civilization. The Cyclades and the Aegean in the Third Millennium BC.* Methuen, London.

Renfrew, C., 1973. Problems in the general correlation of archaeological and linguistic strata in prehistoric Greece: the model of autochthonous origin. In R.A. Crossland and Birchall, A., editors, *Bronze Age Migrations in the Aegean.* Duckworth, London.

Renfrew, C., 1975. Trade as Action at a Distance: Questions of Integration and Communication. In Sabloff, J.A. and Lamberg-Karlovsky, C.C., *Ancient Civilization and Trade,* pages 3-60. University of New Mexico Press, Albuquerque.

Renfrew, C., 1987. *Archaeology and Language: the Puzzle of Indo-European Origins.* Johnathan Cape, London.

Renfrew, C., 1994. Towards a cognitive archaeology. In Renfrew, C. and Zubrow, E.B.W. editors, *The Ancient Mind. Elements of cognitive archaeology,* pages 3-12. Cambridge University Press.

Renfrew, C., 1996. Language families and the spread of farming. In Harris D.R., editor, *The Origins and Spread of Agriculture and Pastoralism in Eurasia,* pages 70-92. UCL Press, London.

Renfrew, C. and Cooke, K.L., 1979. *Transformations. Mathematical Approaches to Culture Change.* Academic Press, New York.

Renfrew, C. and Zubrow, E.B.W., editors, 1994. *The ancient mind. Elements of cognitive archaeology.* Cambridge University Press.

Rice, P., 1984. *Pottery Analysis: A Sourcebook.* University of Chicago Press.

Rigby, G.R., 1948. *The thin-section mineralogy of ceramic materials.* British Refractories Research Association, Stoke-on-Trent.

Riley, J.A., 1981. The Late Bronze Age Aegean and the Roman Mediterranean: a case for comparison. In Howard, H. and Morris, E.L., editors, *Production and Distribution: a Ceramic Viewpoint,* pages 133-43. British Archaeological Reports, International Series 120. Oxford.

Rispoli, F., 1990. *La Ceramica di Non Pa Wai (Lopburi, Thailandia centrale).* Ph.D. thesis, Università di Roma.

Rispoli, F., 1992. Preliminary Report on the Pottery from Tha Kae, Lopburi, Central Thailand. In Glover, I.C., editor, *Southeast Asian Archaeology 1990. Proceedings of the Third Conference of the European Association of Southeast Asian Archaeologists,* pages 129-42. Centre for South-East Asian Studies, University of Hull.

Rogers, P.R. and Van Den Bergh, J., 1997. *Yung Long, Plot IV: Data Presentation and Initial Analysis.* Report Submitted to the Antiquities and Monuments Office, Hong Kong, 1997.

Rosenfield, A. and Smith, C., 1997. Recent developments in radiocarbon and stylistic methods of dating rock-art. *Antiquity,* 71 (272):405-11.

Ross, M.D., 1996. Pottery Terms in Proto Oceanic. In In Davidson, J., Irwin, G., Leach, F., Pawley, A. and Brown, D., editors, *Oceanic Culture History. Essays in Honour of Roger Green,* pages 67-82. New Zealand Journal of Archaeology Special Publication.

Rouse, I., 1960. The classification of artefacts in archaeology. *American Antiquity,* 25:213-23.

Russell, G., 1988. *The Impact of Inka Policy on the Domestic Economy of the Wanka, Peru: Stone Tool Production and Use.* Ph.D. dissertation, University of California, Los Angeles. Ann Arbor: University Microfilms.

Rutnin, S., 1979. *A Pottery Sequence from Non Chai, Northeast Thailand.* Unpublished M.A. thesis. University of Otago, Dunedin.

Rye, O.S., 1976. Keeping your temper under control: materials and the manufacture of Papuan pottery. *Archaeology and Physical Anthropology in Oceania,* 11:106-37.

Rye, O.S., 1981. *Pottery Technology, Principles and Reconstruction*. Manuals on Archaeology 4. Taraxacum, Washington.

Rye, O.S. and Evans, C., 1976. *Traditional pottery techniques of Pakistan: field and laboratory studies.* Smithsonian Contributions to Anthropology, No. 21. Washington D.C.

Santley, R., Arnold, P. and Pool, C., 1989. The Ceramic Production System at Matacapan, Veracruz, Mexico. *Journal of Field Archaeology,* 16 (1):107-32.

Scarre, C., 1984. Archaeology and sea-level in west-central France. *World Archaeology,* 16 (1):98-107.

Scheans, D.J., 1977. Filipino Market Potteries. *National Museum of the Philippines.* Monograph 3.

Schlanger, N., 1994. Mindful technology: unleashing the *chaîne opératoire* for an archaeology of mind. In Renfrew, C. and Zubrow, E.B.W., editors, *The ancient mind: Elements of cognitive archaeology,* pages 143-51. New directions in Archaeology, Cambridge University Press.

Sheehy, J.J., 1988. Ceramic ecology and the clay/fuel ratio: Modeling fuel consumption in Tlajinga 33, Teotihuacan, Mexico. In Kolib, C.C., editor, *Ceramic Ecology Revisited 1987: The Technology and Socioeconomics of Pottery,* pages 199-226. British Archaeological Reports, International Series, 436 (i), Oxford.

Shepard, A.O., 1936. The Technology of Pecos Pottery Part 2. In: Kidder, A.V. and Shepard, A.O. *The Pottery of Pecos. Vol. 2.* Papers of the Phillips Academy, No.7. New Haven.

Shepard, A.O., 1942. *Rio Grande Glaze Paint Ware, A Study Illustrating the Place of Ceramic Technological Analysis in Archaeological Research.* Contributions to American Anthropology and History. Publication 528, No.39. Carnegie Institute of Washington, Washington, D.C.

Shepard, A.O., 1956. *Ceramics for the Archaeologist.* Carnegie Institute of Washington, Publication 609. Washington, D.C.

Shepard, A.O., 1971. *Ceramics for the Archaeologist,* 7th printing (with a forward from the 5th printing first included in 1965). Carnegie Institute of Washington, Publication 609. Washington, D.C.

Shinde, V., 2000. The origin and development of the chalcolithic in Central India. *Bulletin of the Indo-Pacific Prehistory Association,* 19(3):125-36. Canberra.

Simpson, St.J., 1994. Review of The History of civilizations of Central Asia. *Antiquity,* 68 (260):672-74.

Simpson, St.J., 1997. Early Urban Ceramic Industries in Mesopotamia. In Freestone I.C, and Gaimster, D.R.M., editors, *Pottery in the making. World ceramic traditions,* pages 50-61. Trustees of the British Museum, London.

Sims-Williams, P., 1998. Genetics, linguistics and prehistory: thinking big and thinking straight. *Antiquity,* 72 (277):502-27.

Sinsakul, S., 1992. Evidence of Quaternary sea level changes in the coastal areas of Thailand: a review. *Journal of Southeast Asian Earth Sciences,* 7:23-37.

Smith, R.E., Willey, G.R. and Gifford, J.C., 1960. The Type-variety Concept as a basis for the Analysis of Maya Pottery. *American Antiquity,* 25(3):330-40.

Solheim, W.G., 1964. Pottery manufacture in Sting Mor and Ban Nong Sua Kin Ma, Thailand. *Journal of the Siam Society,* LII. Part 2.

Solheim, W.G., 1967. Notes on pottery manufacture near Luang Prabang, Laos. *Journal of the Siam Society,* 55(1):85-92.

Solheim, W.G. and Ayres, M., 1979. The Late Prehistoric and Early Historic Pottery of the Khorat Plateau, with special reference to Phimai. In Smith, P.B. and Watson, W. editors, *Early Southeast Asia,* pages 63-77. Oxford University Press, Kuala Lumpur.

Somboon, J., 1988. Paleontological study of the recent marine sediments in the lower central plain, Thailand. *Journal of Southeast Asian Earth Sciences,* 2(3/4):201-10.

Soon, S.C.M., 1997. Prehistoric pottery sources and technology in Peninsular Malaysia based on compositional and morphological properties. *Malaysian Museum Journal,* 33 (new series).

Sørensen, P., 1972. The Neolithic Cultures of Thailand (and Northern Malaysia) and their Lungshanoid Relationship. In Barnard, N., editor, *Early Chinese Art and its possible Influence in the Pacific,* Vol. 2:459-506. Intercultural Arts Press, New York.

Sørensen, P. and Hatting, T., 1967. *Archaeological Excavations in Thailand. Vol. II: Ban Kao, Part 1: The Archaeological Materials from Burials.* Munksgaard, Copenhagen.

Spaulding, A.C., 1960. Statistical Description and Comparison of Artifact Assemblages. In Heyer, R.F. and Cook, S.F., editors, *The Application of Quantitative Methods in Archaeology,* pages 60-92. Viking Fund Publications in Anthropology, No. 28. Chicago.

Spriggs, M., 1989. The dating of the Island Southeast Asian Neolithic: an attempt to at chronometric hygiene and linguistic correlation. *Antiquity,* 63:587-613.

Spriggs, M., 1990. The changing face of Lapita: transformation of a design. In Spriggs, M., editor, *Lapita Design, Form and Composition. Proceedings of the Lapita Design Workshop, Canberra, Australia, December 1988*, pages 83-122. Occasional Papers in Prehistory, 19. Australian National University, Canberra.

Spriggs, M., 1991. Nissan, the island in the middle. Summary report on excavations at the north end of the Solomons and the south end of the Bismarcks. In Allen, J. and Gosden, C., editors, *Report of the Lapita Homeland Project,* pages 222-242. Occasional Papers in Prehistory, 20. Australian National University, Canberra.

Spriggs, M. and Anderson, A.J., 1993. Late colonization of East Polynesia. *Antiquity,* 67 (255):200-17.

Srisuchat, A., 1988. The Prehistoric Cave Sites in Southern Thailand and important Prehistoric Sites in Southern Thailand. *Seminar in Prehistory of Southeast Asia.* Bangkok: SPAFA.

Strahler, A.N., 1973. *Introduction to Physical Geography,* 3rd edition. John Wiley and Sons, New York.

Stuiver, M. and Pearson, G.W., 1986. High-precision calibration of the radiocarbon time scale AD 1950-500 BC. *Radiocarbon,* 28:805-38.

Stuiver, M. and Reimer, P.J., 1993. Extended ^{14}C data base and revised CALIB 3.0 ^{14}C age calibration. *Radiocarbon,* 35(1):215-30.

Subrahmanyam, S., 1964. *Salihundam.* Hyderabad: Government of Andhra Pradesh.

Takaya, Y., 1972. Quaternary outcrops of the southern part of the central plain of Thailand. *Tonan Ajia Kenkyu (Southeast Asian Studies),* 10(2):298-321.

Tax, S., 1941. *Penny capitalism: a Guatemalan indian economy.* Smithsonian Institution, Institute of Social Anthropology Publication No. 16.

Tayles, N.G., 1992. *The People of Khok Phanom Di.* PhD thesis, University of Otago, Dunedin.

Tayles, N.G., 1999. *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol V: The People.* Society of Antiquaries of London, Research Report LXI.

Thiramongkol, N., 1983. Reviews of Geomorphology of Thailand. In Thiramongkol, N. and Pisutha-Arnond, V., editors, *Proceedings of the First Symposium on Geomorphology and Quaternary Geology of Thailand,* pages 6-23. Department of Geology, Chulalongkorn University, Department of Mineral Resources, Geological Society of Thailand, Bangkok.

Thompson, G.B., 1992. *Archaeobotanical Investigations at Khok Phanom Di, Central Thailand.* Ph.D. thesis, Australian National University.

Thompson, G.B., 1996. *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol IV: Subsistence and the Environment: The Botanical Evidence. The Biological Remains (Part II).* Society of Antiquaries of London, Research Report LIII.

Thornton, D., 1997. Maiolica Production in Renaissance Italy. In Freestone I.C, and Gaimster, D.R.M., editors, *Pottery in the making. World ceramic traditions,* pages 116-21. Trustees of the British Museum, London.

Tjia, H.D., Fujii, S. and Kigoshi, K., 1983. Holocene shorelines of Tioman Island in the South China Sea. *Geologie en Mijnbouw,* 62(4):599-604.

Tite, M.S., Freestone. I.C., Meeks, N.D. and Bimson, M., 1982. *Archaeological Ceramics,* 109.

Toll, H.W., 1981. Ceramic comparisons concerning redistribution in Chaco Canyon, New Mexico. In Howard, H. and Morris, E.L., editors, *Production and Distribution: a Ceramic Viewpoint,* pages 83-121. British Archaeological Reports, International Series 120. Oxford.

Tomlinson, P.B., 1986. *The Botany of Mangroves.* Cambridge University Press, Cambridge.

Traschler W., 1965. The Influence of Metalworking on Prehistoric Pottery: Some Observations on Iron Age Pottery of the Alpine Region. In Matson, F.R., *Ceramics and Man,* pages 140-60. Aldine Publishing Company, Chicago.

Tucker, M.E., 1981. *Sedimentary Petrology. An Introduction.* Blackwell Scientific Publications, Oxford.

Udden, J.A., 1898. Chemical Composition of Wind Deposits. *Augustana Library Publication.* No. 1., (Original proposal of grade scale).

van der Kevie, W., 1971. Acid sulphate soils in Central Thailand. *FAO/UNDP Regional seminar on soil survey and soil fertility, New Delhi.*

van der Leeuw, S.E., 1977. Towards a Study of the Economics of Pottery Making. In Beek, B.L., Brant, R.W. and Greunman van Watteringe, W., *Ex Horreo,* pages 68-76. Cingvla, 4. Amderstam: Albert Egges van Gifrfen Institut voor Prae-en Protohistorii, University of Amsterdam.

van der Leeuw, S.E. and Pritchard, A.C., editors, 1984. *The Many Dimensions of Pottery, Ceramics in archaeology and anthropology.* Universiteit van Amsterdam.

Varndell. G. and Freestone I.C., 1997. Early Prehistoric Pottery in Britain. In Freestone I.C, and Gaimster, D.R.M., editors, *Pottery in the making. World ceramic traditions,* pages 32-37. Trustees of the British Museum, London.

Vernon, W., 1996. The crucible in copper-bronze production in prehistoric Phu Lon, Northeastern Thailand: analysis and interpretation. In Barnard, N. and Bulbeck, F.D., editors, *Ancient Chinese and Southeast Asian Bronze Age Cultures,* pages 809-20. Southern Materials Center Inc., Taipei.

Vernon, W., 1997. Chronological variation in crucible technology at Ban Chiang: a preliminary assessment. *Bulletin of the Indo-Pacific Prehistory Association,* 16(3):107-10.

Vincent, B.A., 1980. *An X-Ray Fluorescence analysis of Prehistoric Thai red-slipped ceramics.* Unpublished B.A. (Hons.), Dissertation. University of Otago, Dunedin.

Vincent, B.A., 1984. The petrographic analysis of prehistoric pottery from Ban Na Di and related sites. In Higham, C.F.W. and Kijngam, A., editors, *Prehistoric Investigations in Northeastern Thailand,* pages 644-97. British Archaeological Reports, (International Series) 231 (iii). Oxford.

Vincent, B.A., 1985 (in press). *Exotic Wares at Non Nok Tha.* Manuscript prepared in 1985 for publication in forthcoming Non Nok Tha final report.

Vincent, B.A., 1987. Preliminary report prepared for S. Rutnin on Loei Province wares from Noen Phrik, Phrik Mound and Pha Phim Cave (manuscript on file).

Vincent, B.A., 1988. *Prehistoric Ceramics of Northeastern Thailand, with special reference to Ban Na Di.* British Archaeological Reports, (International Series) 461, Oxford.

Vincent, B.A., 1989. *Early Southeast Asian Coastal Exchange Networks.* Paper presented at the Circum-Pacific Prehistory Conference, Seattle, Washington. August 1989.

Vincent, B.A., 1991. Ceramic Technology in Thailand. *Bulletin of the Indo-Pacific Prehistory Association,* 10(1):341-48.

Vincent, B.A., 1997. Yung Long Ceramic Samples. In Rogers, P.R. and Van Den Bergh, J. *Yung Long, Plot IV: Data Presentation and Initial Analysis,* pages 153-56. Report Submitted to the Antiquities and Monuments Office, Hong Kong, 1997.

Vincent, B.A., 1998a. Khok Phanom Di Pottery Processing Scheme. *Southeast Asian Archaeology 1996. Proceedings of the 6th International Conference of the European Association of Southeast Asian Archaeologists, Leiden. 2-6 September 1996,* pages 1-12. University of Hull.

Vincent, B.A., 1998b. *Earthenware in prehistoric Thailand*. Paper read at the Singapore Symposium on premodern Southeast Asian earthenware, 9-11 July 1998.

Vincent, B.A., 2000a. Pottery technology studies in Southeast Asia: A review. In Lobo, W. and Reimann, S., editors, *Southeast Asian Archaeology 1998. Proceedings of the 7th International Conference of the European Association of Southeast Asian Archaeologists, Berlin, 31 August - 4 September 1998.* Centre for South-East Asian Studies, University of Hull

Vincent, B.A., 2000b (unpublished manuscript). Petrographic analysis of Ban Kao pottery.

Vincent, B.A., 2000c. The Pottery of Khok Phanom Di. *Paper presented at the 8th Conference of the European Association of Southeast Asian Archaeologists, Sarteano 2–6 October 2000.*

Vincent, B.A., 2002. Ceramic Technologies in Bronze Age Thailand. *Bulletin of the Indo-Pacific Prehistory Association,* 22 (6):73-82.

Vincent, B.A., (in prep). Bleb temper in South Vietnam.

Voyatzoglou, M., 1974. The jar makers of Thrapsano in Crete. *Expedition,* 16:18-24.

Watson, W., 1961. *China: before the Han Dynasty.* Thames and Hudson, London.

Watson, W., 1968. The Thai-British Archaeological Expedition. *Antiquity,* 42(168):302-06.

Watson, W., 1979. Khok Charoen and the early metal age of Central Thailand. In Smith, R.B. and Watson, W., editors, *Early South East Asia,* pages 53–62. Oxford University Press, Oxford.

Watson, W., Freestone, I.C. and Ho Chui Mei., 1986, *Thin-section analysis of Pre Iron-Age in Southeast Asia: Scientific and Technical Investigations on Ancient Chinese Pottery and Porcelain.* Shanghai, Institute of Ceramics.

Weinberg, S.S., 1965. Ceramics and the supernatural: cult and burial evidence in the Aegean world. In Mateson, F.R. editor, *Ceramics and Man,* pages 187-201. Viking Fund Publications in Anthropology, Aldine, Chicago.

Weisler, M.I, 1998. Hard Evidence for Prehistoric Interaction in Polynesia. *Current Anthropology,* 39(4):521-32.

Weiss, A.D., 1992. *The social context of copper production in Central Thailand: evidence from mortuary and industrial data.* Paper read at the 4th International Conference of the European Association of Southeast Asian Archaeologists, Rome, 28th September - 4th October, 1992.

Welch, D.J., 1983. Preliminary Report on Archaeological Survey and Excavations in the Phimai Region, Northeast Thailand. *Bulletin of the Indo-Pacific Prehistory Association,* 4:58-70.

Welch, D.J., 1985. *Adaptation to environmental unpredictability: Intensive agriculture and regional exchange at Late Prehistoric centers in the Phimai region, Thailand.* Ph.D. Dissertation, University of Hawaii.

Wentworth, C.K., 1919. A Laboratory and Field Study of Cobble Abrasion. *Journal of Geology,* 27:507-21.

West, B.A., 1991. The microfauna and bird remains. In Higham, C.F.W. and Bannanurag, R., editors, *The Excavation of Khok Phanom Di, a Prehistoric Site in Central Thailand. Vol. II: The Biological Remains (Part I),* pages 193-222. Society of Antiquaries of London, Research Report XLVIII.

Whallon, R., 1972. A new approach to pottery typology. *American Antiquity,* 37:13-33.

Wheatley, P., 1971. *The Pivot of the Four Quarters.* A preliminary enquiry into the origins and character of the ancient Chinese city. Aldine, Chicago
.
White, J.C., 1986. *A Revision of the chronology of Ban Chiang and its Implications for the Prehistory of Northeast Thailand.* Ph.D. dissertation, University of Pennsylvania.

White, J.C., Vernon, W., Fleming, S., Glanzman, W., Hancock, R. and Pelcin, A., 1991. Preliminary cultural implications from initial studies of the ceramic technology of Ban Chiang. *Bulletin of the Indo-Pacific Prehistory Association,* 11(2):188-203.

Whitebread, I.K., 1986. The characterisation of argillaceous inclusions in ceramic thin sections. *Archaeometry,* 28(1):79-88.

Wichakana, M., 1984a. *Ban Na Di, Northeast Thailand. The rim sherds and their implications for the prehistory of the Sakon Nakhon Basin.* M.A. Thesis, University of Otago, Dunedin.

Wichakana, M., 1984b. The Rims from Ban Na Di and Related Sites. In Higham, C.F.W. and Kijngam, A., editors, *Prehistoric Investigations in Northeastern Thailand,* pages 60-64. British Archaeological Reports, International Series 231 (iii). Oxford.

Wilen, R.N., 1989. *Excavations at Non Pa Kluay, Northeast Thailand.* British Archaeological Reports (International Series) 517, Oxford.

Williams, H., Turner. F.J. and Gilbert, C.M., 1982. *Petrography: An Introduction to the Study of Rocks in Thin Sections* (Second edition). Freeman and Co., San Francisco.

Winterhalder, B., Larsen, R. and Thomas, R.B., 1974. Dung as an essential resource in a highland Peruvian community. *Human Ecology,* 2:89-104.

Yang Hsi-chang, 1986. The Shang Dynasty Cemetery System. In Chang, K.C. editor, *Studies of Shang Archaeology.* Selected Papers from the International conference on Shang Civilization, pages 49-63. Yale University Press, New Haven.

Yen, D.E., 1972. Ban Chiang Pottery and Rice: A Discussion of the Inclusions in the Pottery Matrix. *Expedition,* 24(4):51-64.

Zhang Jiaji, 1996. Preface. In Ting, J.S.P. editor, *The Maritime Silk route: 2000 years of trade on the South China Sea,* pages 12-13. Guangzou Museum, the Guangdong Provincial Museum and the Urban Council, Hong Kong.

Zide, A.R.K. and Zide, N.H., 1976. Proto-Munda cultural vocabulary: evidence for early agriculture. In Jenner, P.N., Thompson, L.C. and Starosta, S., editors, *Austro-Asiatic Studies Part II,* pages 1295-1334. Oceanic Linguistics Special Publication 13, Honolulu.

XVIII GLOSSARY OF TECHNICAL TERMS

TECHNICAL and pottery-specific terms used in this volume are discussed below to assist the non-specialist, and where appropriate to clarify variations noted in the growing corpus of Southeast Asian literature concerned with pottery. Much has been written about pottery but few publications contain detailed glossaries (for an excellent example covering World ceramic traditions see Freestone and Gaimster 1997; Garnsey and Alley 1983 provide a brief glossary of terms related to Chinese potteries). A comprehensive dictionary of modern potting terms, many of which are applicable to prehistoric assemblages, has been compiled by Hamer (1975).

Southeast Asian potters often applied unique techniques adapted to local conditions. Some of these methods employ materials which are restricted to Asian potting traditions. Thus, while many ceramic terms have a universal application, some aspects of Southeast Asian prehistoric ceramic traditions may benefit from further clarification. While the underlying concept of creating ceramic artefacts by processing clay into materials suited to everyday use remains the same, the methods used to modify clays and render them suitable for potting may vary from one tradition to another. Hence the need to recognize different techniques and to clarify some of the terms applied to early Southeast Asian ceramics.

The term "ceramic" refers specifically to a material which has purposely prepared and fired to an appropriate temperature by the potter. Descriptions of inclusions, such as "grit" or "sand", are helpful but more detailed technical descriptions add further information which can be useful in discriminating between different wares. It is important to establish whether such inclusions were present in the raw quarried clay, or purposely added by the potter to improve its 'workability' and drying qualities, as well as its reaction to firing.

Of particular interest is the use of additives in preparing quarried clay for use in potting. Prehistoric assemblages derived from archaeological contexts in Thailand, for example, indicate that the kinds of additives changed with time and from region to region. Clays used to fabricate early pottery were treated by adding sand or other natural substances to improve their suitability for potting. In some regions sand was subsequently replaced by an artificial substitute (grog) made by the potter from the raw clay itself. This required an additional step in the preparation process. In the final developmental stage, the by-products of rice cultivation were incorporated into the process. Rice waste was either mixed directly into the clay preparation, or into the grog prior to its incorporation with the prepared clay mixture. The latter method involved even further preparation. Thus, in Southeast Asia at least, increasingly more complex stages are evident in potting clay preparation methods over time. Possible reasons for this progression over time and from region to region are given in the text.

adsorb, adsorption Clay minerals consist of sheets of silica and aluminium or magnesium atoms linked together by common oxygen atoms. Sometimes these may be substituted by Fe or other ions. Clay minerals may take up water through adsorption, a process which involves the attraction of water molecules to the spaces between the sheets. The ability to adsorb water is dependent on the chemical structure of the clay mineral. Some clay minerals, for example smectites, have the ability to expand markedly through adsorption. Potting clays containing such minerals present difficulties for craft potters because they can become excessively plastic unless mixed with clays that adsorb less water. Clays are hydrated by absorbed as well as chemically-bound (adsorbed) water. The former is lost through evaporation during drying and the initial stages of firing (commencing at about 120°C). The latter requires temperatures in excess of 600°C to be removed. Modern potters recognize bound, pore and water of plasticity. The latter is added by the potter as a lubricant to assist mixing and forming. The amount needed is dependent on the kinds and proportions of clay minerals present along with other materials in the potting clay mixture. Water of plasticity evaporates in the atmosphere. Up to 30%, but usually about 20%, of the weight of a plastic clay consists of water. Clays with a high proportion of non-plastic materials, however, may have a water of plasticity content as low as 10%.

appliqué Applied decoration involving the addition of clay strips to the surface of a pot for decorative purposes. In some instances the strips themselves are also decorated, usually after they have been added.

Anadara **shell impressions** Is here used to define a technical mode of decoration where a shell is pressed by the potter against the soft unfired clay of a pot so as to impart a variety of marks. Impressions noted in the Khok Phanom Di assemblage include wavy lines formed with the crenulated edge of the shell, diverse pricking with the rough outer side of the bivalve, and small detailing with the hinge. Some authors use the term "stamping", for example in describing Phung Nguyen and Khok Phanom Di wares (see Higham 1996b:309).

anvil A tool used to form pottery vessels. Anvils are employed in conjunction with a paddle (see below) to beat the clay body into the desired shape. A smooth river pebble may suffice for some shapes, but many Southeast Asian archaeological sites contain purpose-made ceramic anvils of varying shapes and sizes suited to forming a variety of vessel forms. Ceramic anvils are comprised of fired potting clay, either of the same material as the pottery they are associated with (when the clay is suitable), or of a more dense mixture designed to withstand the repeated percussion shocks involved in the paddle-and-anvil method. The presence of anvils comprised of exotic materials amongst local pottery can suggest the movement of potters from one village to another.

authigenic Here used to mean the growth of minerals in the place of occurrence. It includes secondary enlargement. Calcite commonly crystallizes within the voids of buried pottery and is usually introduced as ground water percolates through the pottery fabric. In some instances the calcite may be derived from discarded shell in archaeological deposits.

biscuit-fired Prior to the invention of kilns, earthenwares common to the prehistoric ceramic traditions of Southeast Asia were probably always open-fired (in bonfires or on firing rafts), to relatively low temperatures. These are referred to as biscuit firings, of the kind detailed in this report. Usually the stages of a biscuit firing are described as water smoking, decomposition of vegetable materials, ceramic change, oxidation of carbon and finally, progressive vitrification. Water smoking involves the removal of the chemically bound adsorbed water from within the clay body. This is completed by between 350–450°C in many fired clays. In some this increases to 600°C when ceramic change occurs and the clay particles begin to fuse together. Unbound water is evacuated through evaporation during drying at air temperatures. The rate at which this occurs is dependent on the surrounding air temperature, humidity and the movement of air past the unfired pottery surface.

In modern pottery, biscuit firing temperatures range from about 700–1000°C. Analysis of ceramics derived from archaeological excavations has determined similar temperatures were achieved by prehistoric potters in Southeast Asia. Biscuit-fired pottery is still common to many Asian traditions which produce hand-made open-fired wares. Modern potters may use the term bisc or bisque to denote hard, biscuit-fired, unglazed pottery.

black cored A term used here to describe partially oxidized pottery fabrics where the firing atmosphere has lacked sufficient oxygen to completely burn out carbonaceous material present in the clay mixture. Unprocessed clays often contain plant matter. These initially char, then turn to carbon which is burnt out as firing progresses, provided the atmosphere is oxidizing. Open firings, however, can fluctuate between reducing and oxidizing. Typically in black cored pottery, the outer surfaces display clear, oxidized zones, while the central core remains blackened

by carbon.

blebs, bleb temper Blebs, a geological term, usually used to describe arcuate shards of volcanic glass in typical vitroclastic textures (such as those in vitric tuffs), or small inclusions of one material in another. Because of their distinctive form the term is here used to define bleb grog temper (see under grog and temper below).

burnishing A technique which imparts a smooth, sometimes glossy surface finish, by polishing leather-hard pots with a smooth tool such as a bone or a hard pebble. Burnishing preferentially arranges and compresses the clay minerals to give a dense, unbroken and reflective surface. Pigments such as red ochre (hematite, iron oxide), can also be rubbed into the soft surface. When combined with a reducing firing atmosphere (see below), burnishing can produce a deep lustrous sheen.

burnishing stones Present-day craft potters in some Southeast Asian villages use smooth river pebbles to polish leather-hard pots until a glossy, sometimes lustrous, surface is achieved. This process is termed burnishing. In some instances, red ochre (see below) is rubbed into the surface during burnishing as a colourant. Many river-worn pebbles, displaying striations consistent with having been used for burnishing, were recovered from the 1985 excavations at Khok Phanom Di in association with burnished pottery and other potting tools.

calcareous clay Clays containing about 5% calcite or naturally occurring calcium carbonate ($CaCo_3$). Such clays were rarely exploited by early Southeast Asian potters. Calcium carbonate is the main constituent of limestone (see below).

calcite A mineral found in most clays in varying proportions. Calcite can act as a flux in some firings effectively reducing the temperature needed to vitrify the ceramic body (see below). It also often percolates into the interstices of pottery buried in archaeological contexts. This is authigenic calcite (see above).

carbon An element in most raw clays, often as plant remains, which, unless burnt out during firing, produces a black colour. Some pottery surfaces are deliberately impregnated and blackened by soot (carbon) in a smokey fire.

carinated, carination point An acute keel-like ridge which usually runs around the body of a pot. Because carinations are formed at a sharp angle, carinated pots are usually joined at this point. Carinations are a feature of many ornamental jars placed alongside human burials at Khok Phanom Di, probably for symbolic purposes related to the burial ritual. These jars were reduced, burnished and sometimes highly decorated, particularly the rim and at a carination point in the wall at about a third the distance up from the semispherical bottom.

categories Here used to distinguish different decorative treatments (see below), applied to pot forms and their components. Some categories carry additional decorative motifs. These are termed variants (see below).

ceramic assemblage Refers to a group of pottery or other ceramic artefacts. This may include the entire ceramic material recovered from a site or specific groupings, such as rim sherds.

ceramic materials Potting clay bodies which have been fired to form a hard durable material which will not disintegrate in water are here defined as ceramic materials. Temperatures in the region of 600°C are required to form ceramic materials.

clay Natural deposits of weathered rock, composed of fine-grained materials, characterised by its plasticity (see below). This allows it to be deformed into required shapes without fracturing and to maintain this form when the pressure is removed. Few clays recovered from natural deposits are suited to potting in their "as received" state. Most require the addition of temper (see below) to improve their workability, reduce shrinkage and refine their firing characteristics. As well as clay minerals (see below), clay deposits usually contain quartz and can contain other minerals such as feldspar, iron oxides, micas, calcite and fossils.

clay minerals A group of alumino-silicate minerals, composed of sheets of minute grains, make up the principal constituents of clay (see above). They are composed of microscopic ($\leq 30\,\mu$) platelets which, when hydrated, slide across each other to give clay its plasticity. When increasingly heated above 600°C, these progressively fuse and transform the body into ceramic material.

coarse ware A subjective term used here to define utilitarian pots which display rough surfaces. Most are cord-marked although a few have roughly smoothed surfaces.

combed, comb-impressed A surface decoration treatment effected by either dragging a toothed tool across soft clay to form patterns of parallel lines, or, alternatively, impressing the tooth points into the clay to create a series of small indentations or "punctations" (see below).

complexity Here used as an approximate measure of the amount of time, or energy, invested in forming and decorating pottery in an assemblage. Some pots are more elaborate than others and these variations have been

equated with the complexity of the ornamental wares in a potting tradition. The complexity of the range of pots produced by a pottery is therefore defined in terms of its elaboration, a process requiring craft skills and artistic creativity (see below).

coiling A method of pot construction involving the joining together of rolled strips of clay which are wound on top of each other (see also slabs).

cord-marked Pottery decorated with cord impressions. In Southeast Asia these normally result from paddle-and-anvil shaping of vessels (see below). Wooden paddles, wrapped in a twisted cord, are used to beat and form the vessel walls, imparting cord marks into the soft clay. The cords are normally composed of two strands. Some cords are twisted to the left and leave "S" impressions, but most are usually to the right (leaving "Z" impressions). Cord-marked pottery represents the bulk of many prehistoric assemblages.

decorative mode Here used to define the manner in which decoration is applied to pottery. A particular decorative motif, therefore, could be created using several different modes: punctation marks (either singularly with a stylus or in groups by impressing the teeth of a comb into the soft clay); red colouration (by either applying a paint or alternatively rubbing red ochre into the pot surface during the burnishing process, for example). At Khok Phanom Di, burnishing, cord marking, incising, paddle impressing, smoothing, impressing, punctation marking, appliqué strips, ridges and notches were used at different points in the sequence. These modes were also used in a variety of combinations, for example where fields or motifs defined by incised lines were often infilled with shell impressions, or punctation marks. Modes of decoration, along with styles, help characterise discrete pottery traditions and their associated cultures.

decorative treatments Any embellishment applied by the potter to improve the appearance of pottery. This may range from simple smoothing or cord-marking (see above) of vessel walls, to highly burnished surfaces (see above), carrying beautifully detailed patterns rendered with incising tools.

dentate stamping A term used by some researchers to describe crenulated and similar impressions made into the unfired clay of pottery. It here equates with shell-impressing. (See impressed decoration).

dipping The application of a slip (see below) by immersing a vessel into a slip mixture.

earthenware Pottery which is fired to temperatures below that required for full vitrification (see below), and which is therefore porous. Modern earthenwares can have a porosity (see below) of more than 5%. The porosity of prehistoric earthenwares can vary widely.

engraving Cutting lines into fired pottery by scratching with a hard tool. A single example was recorded at Khok Phanom Di where a fire-damaged portion of an incised design was reinstated after firing. Such repairs are rare, and in this instance, a measure of the value placed on the highly decorated vessel concerned.

elaboration The amount of time and energy expended in forming and decorating fine wares in a pottery assemblage has here been estimated by equating it with the complexity of decorative treatments present. An elaboration factor has been calculated by adding the number of decorative categories and variants together and dividing the total by the number of rim forms (shapes) represented in the assemblage.

fabric Clay and inclusions combined in a ceramic body. In prehistoric wares these are typically mixtures of clay and temper prepared by craft potters. Pottery-making groups at different locations, who exploit different clay deposits, produce pottery with characteristic fabrics. Differences in clay mineralogy and fabric preparation are usually visible under a microscope. Fabrics can be characterised by their visual appearance assisted by microscopy, by chemical composition and physical properties, or any combination of these. Where distinctive minerals are present, the origin of a ware can be suggested, or, when preparation methods involving distinctive tempers are available, the distribution of the technology, region-by-region, can be determined. This data may have important cultural implications. Occasionally potters may use different fabrics for coarse and fine wares.

feldspar A group of silicate minerals including albite (sodium feldspar, $NaAlSi_3O_8$), orthoclase (potassium feldspar, $KALSi_3O_8$), and anorthite (calcium feldspar, $CaAl_2Si_2O_8$). These are common minerals in many clays. Although susceptible to rapid weathering, they can provide valuable sourcing information.

fine ware Generally pottery which has been fashioned with more care and/or composed of a finer fabric than coarse wares. Fine wares are usually thinner, smoother and more carefully formed and finished. Their surfaces vary from plain smoothed fine textures, to highly decorated ornamental vessels invested with considerable time and potting skills. Some ornamental fine wares can incorporate a range of surface treatments and decorative modes, such as burnishing, cord marking, paddle impressing, shell impressing and incising.

firing The conversion of clay into a ceramic body. This requires temperatures of at least 600°C. Unfired clays disintegrate in water, ceramic bodies do not. Other changes, including the burning away of organic matter, colour changes, and at higher temperatures sintering or vitrification, also occur during firing. Depending on the chemical composition of the clay, sintering begins above 600°C when the clay particles begin to coalesce. Vitrification commences above about 800°C, when the body begins to melt or fuse.

fire clouding A term devised by Anna Shepard to denote the uptake, during open firings, of colloid carbons from dense smoke. Open firing atmospheres often fluctuate depending on the prevailing wind direction and strength and/or fuel composition. Such firings may alternate between oxidizing or reducing during the sequence, often when additional fuel is added. Fire clouds can occur when a previously oxidized surface takes up carbon as the firing atmosphere becomes reducing, or where pottery is in contact with unburnt fuel, or when another pot prevents the free flow of oxygenated air. The colour of open-fired pots may often merely reflect atmospheric conditions at the end of the firing sequence.

firing temperature In archaeology, the highest temperature achieved during firing. This can be estimated using different analytical techniques including refiring prehistoric sherds to known temperatures, so that changes can be observed, and by scanning electron microscopy (SEM). SEM allows any sintering and vitrification phases to be identified (see below).

flares Bright oxidized patches on otherwise dark (reduced) pot surfaces. These are caused by flame contact with pottery surfaces when the overall firing sequence is reducing.

form The shape of a pot.

flux The action of any substance which lowers the melting temperature of another substance. The natural presence of calcium in calcareous clays may act to lower the temperature at which initial vitrification (see below) is likely to occur. Deliberately added fluxes are unknown in early Southeast Asian earthenwares. They are important components of glazed wares and porcelain.

granite A coarse-grained igneous rock. Although granites are mainly composed of quartz and feldspar, some leuco-granites include mafic (dark) minerals. These are mostly hornblende or biotite. Muscovite may also be present in some granites.

grog This term has several meanings. In Southeast Asia three different kinds of grog have been identified in prehistoric pottery: (i) crushed pottery, used to temper clay (see below). (ii) prefired balls of clay which are crushed as temper. (iii) prefired balls of clay which themselves have been tempered with rice husk prior to firing. Known as "chua" by Thai potters, this kind of grog is termed "bleb" due to its shape which is similar to particles known to geologists by that name. Grog, therefore, is an artificial non-plastic additive used by potters to improve the quality of raw clays by reducing the proportion of plastic materials in the mixture. It is particularly important in reducing the amount of water needed to render the clay mixture workable. As with other tempers, grog aids drying, reduces shrinkage during the drying phase, and prevents cracking when the vessel is fired, by assisting the escape of steam. Tempers improve the working properties of a prepared clay, in this sense by stiffening the unfired body thus helping it to hold its shape when formed. Some tempers, however, may weaken the overall fired ceramic structure by reducing the proportion of clay minerals present. Clay minerals are the essential ingredient in any ceramic material.

hand-built Usually this term refers to vessel fabrication in the absence of a potter's wheel. In archaeology, this implies construction using coils, slabs or moulding from a clay lump. Some craft potters, however, are known to turn pots on a slab of wood, which is turned rapidly on the potter's thigh with one hand while the other hand shapes the pot.

hematite, (or haematite) Ferric oxide (Fe_2O_3) is formed from iron compound inclusions when the clay body is fired in an oxidizing atmosphere (see below). Natural deposits of haematite ("red ochre") were also exploited to colour pot surfaces during the burnishing processes (see above). This was achieved either by rubbing ground powder into, or directly rubbing a lump of haematite against, the surface being burnished.

impressed decoration Decoration through pressing a firm object such as bone, cord, fingernail, shell, stylus etc., into the soft surface of unfired pottery.

incised decoration Incisions are created by drawing a hard pointed tool over the soft surface of the unfired clay body. Rare instances of lines made after firing are here termed engraving.

inclusions Non-plastics (see below) and coarse components of a clay body. Raw quarried clays may contain natural fossil, non-plastic, organic and vegetal inclusions. In addition, the potter may add such substances as temper (see below).

iron oxide As much as about 15% may be present in

potting clays. Iron oxides determine the colour of many fired bodies.

inflection point The point on any curved surface where the curve changes from concave to convex or *vice versa*. This is determined by measuring the tangental direction of the curves to locate the point at which the curve rotation changes direction.

kaolinite Kaolinite ($Al_2O_3.2SiO_2.H_2O$), is an important clay mineral which forms a major proportion of many potting clay deposits. Some kaolinitic clays are weathered directly from granites and other feldspar-rich acidic rocks, but many are found in re-deposited sediments.

leather-hard A point in drying where the clay can be reshaped by strong pressure without rupturing. Leather-hard marks the boundary between evaporation of the water of plasticity and the removal of pore water. The rate of drying from the plastic to leatherhard state is constant, and marks the point when about half of the water has evaporated. Further drying relies on air humidity. Surface decoration, such as impressing, incising, painting etc., is usually applied at the leather-hard stage while the clay is soft and absorbent.

levigate, levigation Levigation involves removing any coarse particles from a clay slurry. Coarse particles can be separated from the fine clay fraction by adding water until a thin slurry is formed. This mixture is allowed to settle and the fine upper fraction is then decanted. The finer particles can be used as a paint or slip (see below).

limestone A rock formed of carbonate skeletons and non-skeletal grains and fine grained calcite (micrite), all of which is cemented by calcite crystals.

loess Wind-blown deposits of dust or silt containing very fine sand and/or clay. Loess was deposited in vast amounts during the late Pleistocene following the glacial grinding of rocks. Some loess contains minute fossils such as fresh water sponge spicules, the siliceous skeletons of sponges.

mica A sheet silicate mineral, the main constituent of mudrocks, which occurs in granites, metamorphic rocks and clays. Its form acts to increase clay plasticity.

modelling Shaping a clay body by hand or with a tool.

moulding Forming a pot by shaping plastic clay over a ceramic mould. At Ban Na Di, moulds were simply thick-walled pots, placed upside down, over which the lower hemisphere of globular vessels was formed. The upper portion of the vessel being formed was then added using clay coils.

mullite An aluminium silicate mineral that forms in pottery at temperatures of about 1050°C. Mullite forms as alumina-rich kaolinite crystals decompose. It is extremely rare in prehistoric open-fired earthenware pottery of the kind common to Southeast-Asian prehistoric archeological sites, because these firings rarely exceeded 1000°C. Ceramic crucibles used in bronze smelting may contain mullite which has formed when heating the metal by placing the crucible over a furnace.

non-plastic Solid particles, such as sand, which are not readily hydrated, are here termed non-plastics. Non-plastics therefore reduce the amount of water a potting clay can absorb. By decreasing or increasing the proportion of non-plastic to plastic ingredients, a balance can be achieved between the amount of water needed to mobilise the mixture (rendering it suitable for forming), while preventing excessive shrinkage during the drying and firing processes (see also plasticity).

ochre A natural iron oxide-rich earth used as a pigment. Ochres may be yellow, brown or red in colour. Brown and yellow ochres consist of limonite or goethite, and red ochre of haematite (see above).

open firing Firing without a kiln in a bonfire, raft or similar structure. Open firings range in duration from very short (less than one hour) to extended (lasting for several hours), depending on the kind of fuel, the bonfire structure and prevailing atmospheric conditions. Contact with the fuel often produces discolouring on vessel surfaces, although for many potters this may be a pleasing feature. Open firings may be affected by weather conditions. In Southeast Asia the monsoon climate generally restricts firing to the dry season.

oxidation, oxidized Pottery fired in an atmosphere where there is an excess of oxygen, so that carbon is burnt out of the clay body. Iron tends to form red hematite in an oxidizing atmosphere, to produce reddish pottery in low temperature earthenware firings (see also black-cored).

paddle and anvil Pots are shaped with a ceramic anvil (fashioned by the potter), held against the inner wall of the vessel, while a paddle is beaten against the opposite outside surface. But some potters may simply use a suitable smooth stone as an anvil. In Southeast Asia, wooden paddles are either smooth, carved or wrapped in a twisted cord.

paddle-impressed Decoration created when beating the surface of a pot with a carved wooden paddle during the paddle and anvil shaping process. A variety of

wooden paddles, some plain, others carved with a series of parallel grooves, may be used. Although often employed as a decorative treatment (as with cord-wrapped paddles), the grooves allow proportionately more force to be imparted when beating the clay. This assists in gripping and mobilising the clay fabric thus easing the forming process.

petrography, petrographic analysis A geological method for identifying inclusions in rocks, which has been adapted to ceramic analysis. A thin slice is cut from a pot, glued to a glass slide and ground down to 0.03 mm thickness. Many minerals are then translucent and when examined under a petrographic microscope can be identified by their distinctive optical characteristics. Petrography can provide key information regarding the provenience of pottery, from the minerals and rock fragments it contains.

pigment A colourant used by prehistoric potters to decorate pots (see ochre above).

pinching Constructing a pot by expanding a ball of clay between the fingers and thumb.

plain ware Pottery with plain rather than textured surfaces. Plain wares may be matt and dull or smoothed and slightly shiny, depending on the fineness and composition of the clay mixture, but they are not burnished (see above). Burnishing involves an additional step where the vessel is first smoothed, and then polished with a smooth pebble to produce a high gloss.

plastic clay Clay in its plastic state. Practically all clays require some preparation prior to use. The plasticity of potting clays ranges from plastic to short, depending on the clay particle size, the proportions of non-plastics in the raw clay, its moisture content, the uniformity of the clay minerals, and the strength of the clay mineral bonds. Plastic clays generally contain a high proportion of clay minerals. Some clay minerals, however (such as smectites), hydrate excessively through adsorption (see above), and may need to be blended with less plastic clays. Short potting clays are generally deficient in suitably plastic clay minerals.

plasticity A unique property of clays which provides fluidity to a solid body. It allows the solid to be reformed, and new forms can be created without rupturing or returning to the original form. Clays are more-or-less plastic. Clays lacking plasticity are termed "short". Short clays can be improved by blending with more plastic clay. Factors which influence plasticity are the clay mineral content, particle size and uniformity, moisture content and the strength of the particle bond (which refers to both the friction between clay and non-clay particles as well as to the structure of clay minerals in the plastic state). Clay minerals are flat hexagonal crystals which, when hydrated, tend to stick together by suction. Plasticity allows the plates to slide past each other. Strength is provided both by friction and mutual attraction between the crystals through chemical bonding.

porcelain A very highly vitrified (glassy) ware with a low iron content, rendering it colourless. Porcelains, therefore, have a white translucent body.

porosity The ability of a fired body to absorb water. Earthenwares have a porosity of more than 5%. This gradually decreases when vitrification begins at temperatures exceeding 600°C.

pottery production centre Prehistoric potting centres fall on a continuum, with pottery made for local consumption at one end, and production centres which produced surplus pottery for exchange at the other. It is important that prehistoric centres which produced large amounts of pottery for exchange are identified, because their wares may have had extensive intra and interregional distributions. When distinctive minerals or clay preparation techniques are present, petrology can often assist in identifying prehistoric wares which originated from exotic sources. Some sources may be at great distances from the recipient sites. In some instances huge volumes of pottery have been distributed from pottery production centres over large regions to consumer sites through exchange.

potting tradition Here defined as the production of a pottery assemblage in a distinctive style, fabricated using an established technology.

prepared clay A clay mixture which has been prepared for potting. Clays exploited by prehistoric potters needed to be modified to improve their workability, drying and firing characteristics. Most required the addition of non-plastics to reduce their water content. Excessive water can cause slumping when forming a pot, and cracking during its drying and firing stages.

provenience, provenance The place where a pot was made.

punctate, punctations A decorative treatment involving marking pot surfaces with small dots or pits to create curvilinear, geometric and/or abstract patterns, zones or fields. Punctations may be made with such tools as a thorn, pointed shell or a sharpened bone stylus point, or with comb teeth pressed into the soft clay.

quartz An almost ubiquitous mineral of silica (SiO_2). Quartz is an important non-plastic component of many

sands and raw, unprocessed, clays.

quartz inversion Quartz, a mineral of silica (SiO_2) is an important constituent of many clays. When heated to 226°C and again at 573°C, quartz expands rapidly by up to 3% due to an inversion in the crystal lattice. Potting clays which contain a large proportion of quartz can be affected by cracking ("dunting") or surface spalling due to these inversions. Quartz sands are common and most clays contain quartz.

reduced, reduction firing Limiting the amount of oxygen available in the atmosphere by partially enclosing an open firing, usually with an excess of fuel, creates a smokey fire and reducing conditions. In low-temperature firings carbons may remain within the body. At temperatures above 900°C, iron oxides may be converted to black magnetite. Colloidal carbons in the firing atmosphere smoke can also produce "fire clouding" (see above). Many Southeast Asian vessels from archaeological contexts were fired upside down to produce oxidized exteriors and reduced interiors where the atmosphere has been deprived of sufficient oxygen to burn out carbon from the clay body.

regional tradition(s) Here defined as a predominance of potting traditions, within a discrete geographic region, which are similar in most respects. They may not use identical clay preparation methods, although they may produce similar style pottery using the same modes of decoration. Regional traditions can be recognized in both coarse and fine wares. Local copies of exotic pottery can be identified using petrographic analysis to determine fabric mineralogy and clay preparation methods. Comparisons of potting technologies and modes of decoration can also help in identifying copies.

Technological identification of intrusive wares requires recognition of foreign materials or techniques rather than style or general appearance, thus both lines of evidence are used as a check upon each other. The distribution of pottery relative to known sources is important. One region may be characterised by painted pottery while another uses burnishing to polish vessel surfaces. If the majority of potting traditions within a given region produce a particular kind(s) of wares, these help characterize a regional tradition. Pottery styles (that is vessel forms, their surface decoration, colour, textures, and the methods used to create them), all help to determine a regional ceramic tradition. The more a ware is developed, the more difficult it is for a potter of one tradition to copy that of another tradition. Similarly, the more specialized a technique, the more weight it carries in comparative studies. In prehistory, the adoption of one regional tradition by another region is usually considered to be associated with the movement of foreigners into a different region. In some instances there may be a degree of merging as the diffusion of two different traditions takes place. At Ban Na Di, for example, the early orthodox grog tempering tradition was replaced by another using bleb grog in *association* with a different clay, a different style (including new vessel forms), and new decorative techniques (painted curvilinear designs). It would still have been a new regional tradition if the newcomers had used the same clay and temper but had introduced new forms and decorative styles. In assessing regional traditions, account needs to be taken of pottery fabrics and forms, to determine, on balance, whether they can be considered to be the same or that they are different.

Minor variations, such as the development of decorative styles, need to be considered in conjunction with the overall typological variables to determine whether the changes are substantial, experimental or merely the copying of other regional tradition stylistic aspects, such as the use of paint when this has previously not formed part of the local tradition(s). There are many possible influences, such as the marriage of potters into one pottery-making village from another, who either continue to follow their native traditions or adopt those of their new village. But there are probably only two situations when such developments are indistinguishable. The first is when immigrant potters derive all their material from their native pottery-making centre and continue to completely follow their existing techniques and styles. The second is when local potters obtain foreign material and copy perfectly foreign techniques and styles. These problems are rare and did not occur at Khok Phanom Di, because local clays were used throughout the sequence. As Shepard (1956:347) observed "Regional modifications may occur but do not obscure the fundamental traits." (see also potting tradition).

salt Sodium chloride (NaCl). Although it can be mined, it was usually derived from evaporated sea water or from saline soils treated by adding water, draining off the solution into a container and then reclaiming the salt by evaporation over a fire. Salt was a valuable resource for traditional societies.

sand Sediment consisting of particles ranging from 0.06 mm to 2 mm in diameter. Pottery tempered with sand is common throughout Thailand and much of Southeast Asia prior to 1500 BC. It was progressively replaced by

grog and rice tempers thereafter. Although usually conceived of as consisting mainly of quartz, the regional geology determines sand composition. For example, arkose sandstones contain over 25% of feldspars.

shell-impressed Decoration performed by pressing the edge or other part of a shell (such as the ribs on the outer horny surface), into a surface of the soft clay of a pot. A range of techniques was used at Khok Phanom Di, where most designs were achieved using the valve edge of the bivalve *Anadara granosa* (a mollusc found in abundance at the site), although other species may have also been used. The shell edges are crenulated and therefore impart a very distinctive wavy pattern when impressed into the soft clay.

short clay Clay lacking in plasticity (see above).

silica Silicon dioxide (SiO_2). Silica is a major chemical component of rocks and clay (see quartz above).

silt Fine sediments ranging in size from 0.004 mm to 0.06 mm in diameter. Silt is finer than sand but coarser than clay.

sintering All ceramic materials pass through a sintering stage before melting. The clay particles fasten together without fusion. The temperature at which this takes place varies dependent on the kind of clay and the presence of fluxes, such as calcium.

slabs, slabbing A fabrication method often employed by craft potters to construct a pot by joining a series of previously flattened slabs (sometimes in varying shapes), together.

slip, "self-slipping" A preparation of suspended fine clay particles in water which is applied as a surface coating. Slips may be applied by dipping a vessel into the suspension or alternatively brushing or trailing the preparation over the pot surface. Self-slipping (after Shepard 1956), refers to the phenomenon where fine clay particles migrate to the surface during the forming of some pots. This can result in a very fine surface layer of clay particles coating the pot walls. These unintentional formations can mimic separately applied slips. True slips applied by the potter are relatively rare in Southeast Asian archaeological contexts.

smudge Smudges are caused by firing in a smokey carbon-rich atmosphere. Sometimes termed "clamp" firing, where pots are fired in the open with excess fuel used to achieve blackening (see firing, fire clouding, reduced and reduction firing).

spalling The flaking in patches of pot surfaces, usually during or after firing. Spalling is usually caused by the rapid and excessive expansion of potting fabric components such as limestone or shell. Such calcium carbonates decompose to calcium oxide at temperatures greater than about 750°C. After the vessel cools, the calcium oxide absorbs atmospheric moisture and increases in volume, causing the surface flaking. Some craft potters add salt to clays which contain shell fragments to reduce the spalling effects.

stoneware A vitrified, hard body impervious to fluids. Stonewares are generally fired to temperatures in excess of 1100°C, but this varies depending on the mineralogy of the clay body fabric, as some minerals may act as a flux. Because of this, firing temperatures may range from 1100-1400°C.

style Here used to mean pottery forms and decorative treatments which, when considered together, can help to identify cultural traditions. Pottery styles may be restricted to a few potting centres or to larger regions. In some instances, individual or several pottery styles of a cultural group may be copied by another.

stylus A pointed probe used to incise lines into a soft clay body.

temper Non-plastic and any other coarse materials, such as vegetable matter and grog, added to potting clay to improve its working, drying and firing properties. Tempers add strength to the unfired body, acting to stiffen the soft plastic clay during the forming processes. They help drying by assisting water to more readily migrate to the pot surface, and reduce shrinkage by lowering the proportion of water in the prepared clay mixture. In open firings, tempers improve the escape of steam thus preventing catastrophic fracturing of vessels. Temper added by the potter, however, often weakens the overall strength of the fired pottery fabric. This is because temper reduces the proportion of clay minerals in the potting mixture. Clay minerals are the essential strength-providing ingredient of ceramic bodies (see above).

thermal shock Rapid expansion or contraction of minerals in a ceramic body (caused by abrupt changes in temperature), can induce catastrophic cracks, either during or after firing.

thermal stress Some pots when subjected to marked temperature gradients (for example cooking pots placed on an open fire), will develop stresses which will cause them to crack. To prevent such failures a balanced potting clay mixture is needed.

thin section A very thin slice of pottery used to analyse mineral and other constituents of pottery fabrics (see also petrography).

type Pottery types are here defined as their form

(colour, hardness, lustre, shape, surface decoration, texture) in conjunction with their fabric (the material they are composed of). Thus, form plus fabric equals type.

variant Here used to define variations in the decoration of form categories (see above) For example, a group of vessel rims decorated with incised lines on their walls is classified as a category, and a variant of this will carry further minor decoration, such as shell impressions on the rim terminus.

vegetal inclusions Plant and vegetable remains in a fabric which either occur as natural inclusions or were added as temper by the potter. Often these are burnt out during firing making precise identification difficult. Rice husk, straw and grass particles are commonly found in Southeast Asian pottery. Other tempers may include chopped grass, dung and chaff, etc.

vitrification Clays fired to above about 800°C begin to melt or fuse. Tiny amounts fuse at first. Fusing increases as the temperature rises. When subsequently cooled, the melt in the fired pot becomes a glass. This process of converting the clay body to glass is termed vitrification. Low-fired pots often only undergo very minor amounts of vitrification and remain somewhat soft and porous. The glass bonds, however, render the body less porous than it otherwise would be.

wasters Shattered pottery that failed during firing. Often found in dumps at prehistoric potting centres.

xeroradiograph An X-ray image of a pot, used to detect construction joins and cracks.

INDEX

Abbreviations, xxxi

Aegean
craft skills correlated with specialization, 684; initial conditions, 693; social stratification models, 693
Aegean Bronze Age
craft specialist burial goods, 685
agriculture, 17, 49, 184, 623
and craft specialization, 687; and potting, 686; regional chronology, 734; rice, 660, 694
Amphlett Island, Papua New Guinea
fuel, 65
AMS dates, 702
andesine, 743
anvil fabrics, 97
anvil fabrics CP2 (exotic), 171
anvil ownership marks, 657
anvils
and immigrant potters, 171; in burials, 668; in CP3 burials compared with CP2, 475; in CP3 graves, 307, 312; lacking in CP3 male graves, 318; origin of, 116
anvils with potters' marks, 669
apatite, 744
aphanitic anhydrite, 738
appliqué, 159, 160, 193, 329, 331, 396, 399, 466, 532, 677
a local technique, 604; local and exotic examples, 714
appliqué technique
in CP4 contexts, 533
argillaceous rock fragments, 740
Arikamedu, India
fabric analysis, 37; rouletted ware, 37
arkose sandstone, 746
Arnold, Dean, 4
artificial grog
advantages in method, 61
artistic expression
of local potters, 414
ash
on stands from pottery firings, 126
ash spreads associated with burials (L10:5), 167
authigenic calcite, 740, 745

Bali, Indonesia
coastal site pottery studies, 37
Ban Chiang, *see* Fig.2, 28, 33
chronology based on pottery, 94; crucible fabrics, 36; heavy mineral analysis of pottery, 33; modern pottery fabrics, 36; painted ware fabrics, 16; pottery fabrication methods, 34; pottery style comparisons, 620; relative chronology based on pottery, 27; rice temper, 17; sherd densities, 682; size of excavation, 705; stratigraphy, 647
Ban Chiang Hian, *see* Fig. 2
and Non Nok Tha pottery, 30; bleb temper, 26; petrographic analysis, 32; pottery tempers, 21
Ban Don Ta Phet, *see* Fig. 2
ear ornaments, 413, 729; pottery fabrics, 28
Ban Kao, *see* Fig. 2, 21, 41, 93, 96, 613, 619, 717
and Lungshan pottery, 728, 729; carinated vessels, 633; petrographic analysis, 29; petrographic evidence, 619; radiocarbon dates, 729; red painted or slipped vessels, 717; sherd densities, 682–683; similar forms from peninsular Thailand and Malaysia, 619
Ban Kham O, *see* Fig. 3
firing method, 65, 122
Ban Kho Noi, *see* Fig. 2, 32
Ban Khok Raka, Bang Pakong Valley, Central Thailand
brickworks clay samples, 75
Ban Muang Phruk, Sakon Nakhon Basin, Northeast Thailand
pottery analysed, 34; settled by Khorat Basin newcomers, 104
Ban Mọ Northeast Thailand
potting methods, 691
Ban Mọ, Northeast Thailand, 122
modern manufactory, 36
Ban Na Di, Northeast Thailand
bronze casting crucible fabrics, 36; carinated vessels, 633; cemetery and occupation deposits, 705; cultural changes, 24, 26; cul-

tural transition model, 690; early vessels were partly moulded, 34; exotic pottery copied, 16, 20; firing temperatures, 613
compared with Khok Phanom Di, 163; immigrant groups and cultural changes, 104; inferior local clays blended, 501; mortuary ritual, 24; new ceramic tradition introduced, 24–27; pottery fabric groups, 35; pottery imports and major cultural change, 104; potting clay, 26; radiocarbon dates, 24, 101; rice added to pottery for ritual purposes, 20; stratigraphy, 647
Ban Na Kraseng, Northern Thailand
modern pottery fabrics, 36; pottery firings, 65
Ban Nong, Northeast Thailand
potting methods, 65
Ban Om Kaeo, Northeast Thailand
fashionable ware copied, 16
Ban Pakong Valley clays
origin of, 72
Ban Phan Luang, Laos
pottery firings, 65
Ban Phu, Northeast Thailand, 36
Ban Prasat ware, Mun Valley, Northeast Thailand, 35
Ban Suai ware, Mun Valley, Northeast Thailand, 35
Ban Tak Det, Laos, 35
Ban-p'o, China, 20
Bang Pakong Valley
relative dating, 702
Bang Pakong Valley, Central Thailand, 1, 11, 19, 38, 41
clays, 72; climate, 50; CP4 a regional potting tradition, 662; geology, 55; geomorphology, 51; inland sources dominated CP3, 719; nonceramic evidence, 94; radiocarbon dates, 616; rainfall, 50; salinity, 696
Banthat Range, Thailand, 51
basket impression pottery sites, 28
biotite, 741
bleb grog, 743
blended clay
direct evidence lacking, 603; grog temper preferred over blending, 666; in CP4 local pottery, 661; local mixed with superior imported material, 13; method not required, 498; prehistoric example, 501; short and plastic mixtures, 78
Bo Phan Khan, Northeast Thailand, 33
bone incising points, 121
bone incising tools
use by potters, 120
bone stylus bone point distributions, 676
bone stylus points, 96, 99, 120–122, 167, 180, 298, 306, 318, 399, 462, 479, 525–526, 603, 610, 620, 624, 633, 661, 676, 712
at Nong Nor, 621; in CP4 workshop area, 674
bone stylus tools, 120
bow pellets, 123, 159, 166, 170, 304–306, 321, 465, 473, 475, 479, 480, 528, 603, 612, 624, 679
CP2, 186; fabrics, 186
bowl fabrics (rim form 6)
CP2, 223; CP3, 374
bowl types CP3
rim form 6, 374; rim form 8, 384
bronze
absence anomalous, 624; and itinerant craft specialists, 706; and rice agriculture introduction, 706; at Nong Nor, 39; in Northeast Thailand, 731
Bronze Age, *see* burials, paints
Bronze Age craft specialist burials
Aegean, 685
Bronze Age vessel inscriptions
18th-11th century BC Shang, 724
Bukit Cangkul, Malaysia, 36
Bukit Tengku Lembu, Malaysia
pot stands, 413, 638
burial 1, 454, 455
burial 2, 450
burial 3, 305
burial 4, 305, 315, 317
burial 6, 305
burial 7, 305, 449
burial 8, 305, 448
burial 9, 305, 447
burial 11, 305, 445, 446
burial 12, 305, 456, 457
burial 13, 443, 444
burial 14, 440–442
burial 15, 131, 256, 305, 315, 436–440
outstanding wealth, 306; paddle-impressed sherd in, 325; rim form 1 sherds in, 335
burial 16, 305, 434, 435
burial 17, 305
burial 18, 453
burial 19, 310, 451–453
punctate sherd in, 328
burial 20, 432

burial 22, 431, 432
burial 23, 430, 431
burial 24, 428, 429
burial 27, 422
burial 28, 304, 421
burial 29, 422
burial 30, 420
burial 31, 420
burial 32, 419
burial 33, 304, 423–425
burial 35, 317, 433
burial 36, 429, 430
burial 37, 415, 416
burial 38, 418, 419
burial 39, 417
burial 41, 417
burial 43, 427
burial 44, 426, 427
burial 45, 423
burial 47, 421
burial 49, 304
burial 56, 292
burial 57, 189, 291, 292
burial 58, 134, 256, 260, 293, 294
burial 60, 167, 256, 260, 291
burial 62, 256
burial 64, 288, 312
burial 67, 166, 256, 260, 287, 289
burial 72, 166, 184, 256, 284, 285
burial 73, 283
burial 74, 202, 255, 256, 260, 286, 287
burial 75, 282
burial 76, 237, 239, 255, 285, 290
burial 77, 295
burial 79, 167, 289
burial 82, 168, 170
  potting tools in, 168
burial 86, 237, 255, 280, 282
burial 88, 276, 277
burial 89, 276
burial 90, 279–281
burial 91, 202, 223, 272–274
burial 92, 256, 278
burial 93, 278, 279
burial 96, 189, 234
burial 99, 270
burial 100, 232, 236
burial 101, 234, 256, 271
burial 102, 269
burial 103, 234, 256, 277
burial 105, 268
burial 107, 168
burial 109, 168
  clay cylinder in, 168
burial 110, 168, 234, 256, 265
burial 112, 256
burial 113, 267
burial 115, 189
burial 120, 157, 266
burial 123, 274, 275
burial 125, 264
burial 130, 264
burial 147, 108, 166
burial 150, 108, 166
burial 151, 165
burial 153, 108
burial density
  compared with other sites, 683
burial depths
  in CP2, 256
burial jar
  a symbolic mortuary vessel*(see also mortuary vessels)*, 165, 259
burial jar motifs
  and clans, 260; exotic similar to local, 702; in CP2 and CP3, 653, 654; link CP3 potters' and turtle group, 653, 703; turtle group, 654, 690
burial jar styles
  CP2/3 styles in same contexts, 259; CP3 differ from CP2, 260
burial jars, 315, 458, 470, 636, 638, 642, 644, 645, 648, 649, 653, 690, 702, 719
  and external relationships, 719; as a proportion of mortuary vessels, 459; changed with new ceramic industry, 261; coastal and inland sources, 632; coastal donor sites and turtle males, 690; CP2 and CP3 percentages, 638; CP2 motifs lapsed in CP3, 653, 703; CP2 quantities, 626; CP3 exotic increase and containers, 660; CP3 suggest close inland relationships, 719; CP4 types, 564, 567; decoration of, 413; exotic increased in CP3, 716; exotic with first turtle group male, 702; important inland source, 649; in CP3 graves, 648; Mortuary Phase 4-6 distributions, 654; most common mortuary vessels, 714; motif distributions linked, 704; motifs contrasted

with potters' marks, 658; old and new styles link groups, 649; proportion of CP3 vessels, 413; rice added to fabrics, 638; ritually smashed, 654, 703; social symbols, 699, 701; some may have been quickly made, 261; turtle and potters' group dominate CP3, 654; turtle group, 644, 648, 654
burial practices, 725
burial rituals, 245, 703, 723–725
burial urns, 465
burial vessels
absent in MP1, 255; in CP2, 217, 255, 261
burial wealth
in MP5, 649; of MP4 non-potters, 643; potter richest, 640
burials, 11
"clusters", 97; *tapa* wrappings, red ochre, 108; absent in L11, 123; and mortuary rituals, 627; and social organisation, 722; arrangements in CP2 and CP3, 98; aspects of CP2, 623; burial 15 and burial 16 similar, 633; burnishing stones in, 120; CP2 potters and non-potters compared, 630; CP3 characteristics, 633, 639; CP3 potters and non-potters compared, 643; CP3 with anvils, burnishing stones and clay, 663; earliest, 108; earliest lack vessels, 97; hiatus in, 98, 106; high status, 699; incipient élite, 693; infant jar interments
at Ban Na Di, 26
at Nong Nor, 39; MP1 very shallow, 108; MP4 potters' and non-potters' wealth, 644; Nong Nor, 39; platter bases in, 157; pottery used to define, 21; potting clay in, 73; rim form 3 in, 134; shell midden, 97; vessels used to define, 27; wealthy, 701
burnished and incised, 298, 322
in CP3 burials, 465
burnished sherds
in CP2 and CP3 contexts, 325
burnished wares, 120, 135, 139, 159, 161, 188, 202, 205, 346–348, 356–360, 369, 384, 387, 540–559, 670, 671, 712–714
burnishing stones correlated with, 96; colour, 139; CP2, 189, 297, 298; CP2 distribution, 188; CP3, 325–327, 399, 413; CP3 local burial jars, 464; CP4, 531; CP4 differ from earlier, 580
burnishing
and red ochre, 326
burnishing effects, 191
burnishing stones, 3, 11, 94, 166, 306, 322, 475, 629, 635, 654, 714
and burnished sherds, 188, 671; and CP1 fine wares, 117; and shell valves in burials, 168; at Nong Nor, 39; correlations, 96; CP1, 115, 117, 120, 610; CP2, 624; CP2 distribution, 188; CP3 and CP4 compared, 606; CP3 associated with turtle bone, 464; CP3 distribution, 317, 462; CP4 distribution, 486; decorative method, 115; identical at Nong Nor, 620; in burial 15, 315; in burials, 168, 317, 462; in CP2 and CP3 burials, 476; in CP2 burials, 627; in CP3 burials, 635, 644; in male and female graves, 689; site distributions, 625; valued by potters, 120; wear patterns, 120

cache pebbles at Khok Phanom Di
origin of, 114
carbon, 95
and blackened pottery, 123
carbon dioxide, 126
carbonized rice husk, 742
carinated bowl variants (rim form 7)
CP3, 381
carinated burial jars
CP3, 410
carved wooden paddles
use of by local potters during CP4, 661
cemetery
geometric layout, 723
cemetery layout
changes in, 689; CP3 arranged in rows, CP2 in clusters, 633; CP3 burials aligned in rows, 306; MP5 reserved for turtle/potters' group, 653
Central Andean archaeology and pottery styles, 19
central places
Khok Phanom Di, 644; Khok Phanom Di a nodal location, 301, 691
ceramic anvils
origin of, 116
ceramic firing stands
condition of CP1 firing stands, 123; distributions of, 97; fabrics of, 95; indicate a change in CP2 site use, 298; mullite in, 125; recovered from CP1 contexts, 95; recovered from CP2 contexts, 180; use of, 124

ceramic traditions, 165
changes in burial jar motifs, 256
changes in burial jars
CP2 and CP3 differ, 260
changes in local pottery
origin of, 303
changes in MP3 and 4 mortuary evidence, 470
Chansen, Mun Valley, Northeast Thailand
pottery tempers, 21
Chanthaburi Mountains, 50, 51
charcoal
from pottery firings, 183
Chaw Lay, 39
chevron decoration, 354
Chi Valley, Northeast Thailand
and pottery import flows at Ban Na Di, 24; bleb wares at Ban Na Di, 27; exotic pottery at Non Chai, 32; petrographic analysis of pottery, 32; source of exotic fabric at Ban Na Di, 31; wares at Non Nok Tha, 30
chieftains
and craft specialists, 693
China
and Southeast Asian pottery, 729; low status potters, 722; marine transgression, 728; neolithic coastal settlements, 728; pot stands and painted pottery, 730; production-line pottery, 722; regional potting technologies, 731; rice cultivation, 730; rice temper, 730; salt tax, 713; spread of rice agriculture from, 731
chlorite, 69, 71, 72, 75, 80, 81, 87
chronology
relative, 11, 39
clan motifs
Papua New Guinea, 724; Sepik, Papua New Guinea, 458
clan tributes, 716
clan-signs, 724
clans, 260, 263, 299, 458, 463, 627, 644, 684, 685, 702, 723, 724
clay
authigenic calcite in, 319; consumption, 468; in burials, 475; modern, 320; preparing, 629; quality, 79, 474; quarrying, 74, 629; selection, 474; shrinkage, 246; transportation, 474
clay 1-10 (fishpond), 88–92
clay 4 (Nong Wua brickworks), 86
clay 5 (Nong Klang brickworks), 86
clay cylinders
in burial 15 and 16, 305; in burials, 652, 667
clay deposits, 619
clay dumps, 117, 124, 527, 528, 603
CP2 weights, 184; CP3 distribution, 306; CP4 weights, 607
clay floor, 633
clay minerals
chlorite, 71; illite, 70; kaolinite, 69, 70; mica, 70; sericite, 71; smectite, 70
clay P1 (Ban Khok Raka), 84
clay P2 (Wat Phan Thong), 85
clay P3 (Phan Thong brickworks), 85
clay preparation, 663
climate
monsoon, 17, 50–58
coarse ware fabrics
in CP2 and CP3, 473; in CP3, 335, 474
coarse wares, 131, 468, 471, 474, 637
clays used for, 666; colour of, 197; CP1, 133, 197; CP2 weights, 219, 626; CP3, 399; CP3 output, 468, 475, 668, 721; CP4, 533, 580; CP4 clay preparation, 603; CP4 fabrics, 585; regional forms, 716
comb impressions, 592
complex chiefdoms
origin of, 698
cones
tripod feet at Nong Nor, 39; tripod feet cones, 158, 239, 240
container fabrication, 474
container fabrics CP4, 534
containers, 98, 534, 611, 649, 686, 689, 690, 699, 714
and mortuary ritual food, 298; and rice, 690, 697; and salt, 696, 697, 713; and transporting exchange items, 43; as exchange components, 644; as grave goods, 638; burial 15 grave goods, 652; contents more valuable, 686; incised lines on, 262; production levels, 43, 713, 721; survival rate of CP3, 475
copied exotic miniature vessel, 630
copies of imported wares, 716
copper
and rice, 706; at Non Pa Wai, 179, 706
coppersmiths, 684
cord mark twists
CP2, 197
cord marks

and utilitarian pottery, 6; application method, 6; on CP3 burial jars, 471; Z and S cord twists, 126
craft potters
and clays, 71
craft specialists
Aegean, 684; and the development of civilization, 693; CP3 potters valued as, 635; in Shang society, 684; Mesopotamian, 684
craft-clans, 699
crinoids, 745
crucibles, 10, 26, 36
Ban Na Di examples, 104
cultural material, 1
curvilinear decoration, 145, 188, 221, 222, 322, 346, 348

Daneby, a central place compared with KPD, 691
decorating tools, 121
decoration and regional styles, 637
decorative combinations, 592
decorative designs on CP4 assemblage, 582
decorative modes, 243, 399, 465
CP4, 606
decorative treatments
of CP3 burial jars, 469, 471
decorative zones, 361, 371–373, 458, 541, 559
deepest burial (B151), 165
dentate impressions, 28, 619–621, 637, 728, 729
diatoms, 59, 737
Dinh To, Vietnam pottery fabrics, 37
disturbed burials, 299
DNA, 644, 657
Don Taphan, Northeast Thailand, 31
pottery types, 33
double line motif, 465, 644, 645
and potting accoutrements, 464; associated with potting anvil burials, 464; on burial jars, 653, 690; on potters' burial jars, 642
drying
ethnographic evidence, 692; role of temper in, 667; test pots, 627
dunts, 125, 239, 246

earthenware, 21
and fishpond clay, 661; and tempers, 614; clay plasticity, 528; clays, 77; firing temperature, 95, 240, 664; in Vietnam, 37; vessel life span, 692
elaboration indices
of CP2 and CP3 fine wares, 466; of CP3 and CP4 wares, 604
epidote, 740
ethnographic evidence, *see* firing, potters, slips, symbolic expression, Shan State
European Beaker Ware cultures, 734
excavated pottery a skewed sample, 631
exchange, *see* Ban Na Di, containers, exchange network, exotic wares, *hiri*, Khorat Basin, potters, pottery, Prachinburi River, salt, technology, turtle group
in containers of local resources, 698
exchange network, 326, 613, 638, 645, 668, 691, 692, 699, 719–730, 733
hiri, 115; and craft specialization, 608; and production scheduling, 645; coastal and inland, 46; in Sakon Nakhon Basin, 26; Nong Nor, 623
exchange sources, 706
exchange wares, 719
exotic anvil in burial 15, 312, 635
exotic burial jar fabrics, 217
exotic burial jars, 217, 365, 470, 632, 638, 702, 730
exotic burnished wares, 469
exotic decorative techniques, 399
exotic fine wares
CP2 assemblage, 298
exotic forms, 393, 467
exotic painted and slipped wares, 191
exotic production centres, 714
exotic rim form 5
in burials 120, 94 and 73, 297
exotic sherds
in CP3 burials, 374
exotic sources, 470, 585, 716, 725
exotic wares, 2, 11, 16, 93, 128, 160, 223, 236, 322, 374, 413, 569, 605, 626, 632, 658, 701, 702, 717
and bleb temper, 661; and CP3 elaboration indices, 467; and petrology of CP1 rim form 5, 145; and rice, 623, 690, 695; and style analysis, 17; and transportation routes, 477; CP2 burial jars, 298–299; CP2 burnished and incised, 298; CP2 decorative modes, 243; CP2 mortuary assemblage, 297; CP3, 635–637; CP3 bleb wares, 374; CP3 decorative modes, 399, 637; CP3 fabric summary, 390–392; CP3 platters, 354; fabrics, 223; increased in CP3, 392; index exchange

relationships, 632; limestone in, 223, 662; prestige of, 16; regional decorative styles, 476; summary of, 625; value in previous studies, 104; value of, 631

fabric analysis, 11, 16, 27, 41, 96
fabrics, *see* fabric analysis
of containers, 636; of CP4 local pottery, 584
feldspar, 738
feldspars
weathering to kaolinite, 743
female potters, 638
female potters and male associates, 714
female pubes, 277
Fergusson Island, D'Entrecasteaux Group
clay sources, 13, 114
filler, *see* temper
fine ware clays, 319
fine ware distributions
CP2 and CP3, 472
fine ware tempers, 99
fine ware weights
CP2 assemblage, 219
fine wares, 11, 98, 128, 147, 160, 180, 188, 198, 322, 326, 392, 399, 413, 466, 469, 470, 475, 476, 612, 622, 625, 626, 628, 636, 638, 661, 668
and cord marks, 471; and CP2 exchange, 721; and CP3 exchange, 721; CP1 and Nong Nor Ph 1, 621; CP1 vessel bases, 157; CP2 and CP3 proportions compared, 467–468; CP2 and CP3 styles compared, 472–473; CP3 elaboration indices, 466; CP4, 564; CP4 and CP3 compared, 605; CP4 and CP3 styles compared, 605–606; CP4 and CP3 technologies compared, 606; CP4 decorative modes, 590, 604; CP4 elaboration factors, 604; CP4 fabrics, 584; CP4 more coarse, 559; CP4 quality declined, 608; CP4 rim form 4, 540; CP4 rim form 4 fabrics, 546; CP4 surface treatments, 592; exotic increase in CP3, 660; rice in, 669
fingernail impressions, 343, 346, 347, 356, 357, 359, 371–373, 564, 636
as an alternative to shell impressing, 360; CP4, 582, 590; exotic associations, 393; exotic technique, 396; local copies, 637; on exotic mortuary vessels, 469; with paddle impressions, 582
fire clouds, 65, 122
firing, 10, 134
alters clay mineral bonds, 62; archaeological evidence, 14; areas, 107; ash, 475, 610; at site margins, 605; atmosphere, 126; bleb temper, 14, 59; briefly replaced CP2 mortuary activity, 624; clay reactions to, 69; conditions, 612; CP1 evidence, 95, 124, 609, 613; CP2 evidence, 260, 624; CP2 stand forms, 183; CP4 grog temper, 605; CP4 methods, 590, 606; duration of open, 65; ethnographic evidence, 122, 691; failures, 13; frequencies, 692; fuels, 64–65; local ware evidence, 137, 147; no evidence for in CP4, 106; number of vessels fired, 122, 692; on rafts, 65; open firing temperatures, 122; platforms, 13, 122; schedules, 692; shrinkage crack, 296; suitable Khok Phanom Di fuels, 65–68; test pot failures, 246; wasters, 14; water adsorbed, 62
firing activity
during hiatus in burials, 183; evidence for between CP2 and CP3, 182
firing ash remains
in excavation deposits, 97
firing atmosphere, 65
firing blemishes on vessels, 296
firing conditions, 63, 126
firing durations, 63
firing of miniature vessels, 297
firing platforms, 63
Sepik, 63
firing pottery
a seasonal activity, 50
firing remains
CP1 evidence, 108, 117, 122; the CP2 evidence, 98
firing sequence effects, 122
firing sequences, 63
firing shrinkage cracks, 296
firing stand distribution, 664
firing stands, 11, 14
coated with ash, 126; CP2 fabrics, 182; deployment, 126; fabrics, 125; forms, 125
firing techniques
reflect expertise of local potters, 246
firing temperature estimates, 664
firing temperatures, 125, 163, 613, 664
and grog tempers, 60; assessing, 33; Mailu Island, 122; of open firings, 62; SEM determinations, 35

firings
durations vary, 122; open, 126; open-air, 123; recorded in Thailand, 65; scale of, 689
fish bones
in burial jar, 628
fishpond clay, 739
flocculation, 74, 79
reactions, 80
foraminifera, 742
form variation bias favours exotic wares, 223
Freestone, Ian, 28
fuel, *see* Amphlett Island, firing, Papua New Guinea, potters, 43, 62, 63, 75, 613, 664, 692
a critical factor, 692; and clay ratio, 692; and fire clouds, 123; consumption, 64; distribution in firings, 125; dung, 122; grass, 65; importance of, 63; quantity required, 708; ratios, 63; rice by-products as, 17, 694; storage implications, 692; threshold models, 63; types, 63, 65; types available, 68; wet season, 708
fuel/clay ratios
and firing effects, 63
function of pottery, *see* pottery
changes in, 474
funerary vessels, *see* burials
funerary wares
first found in MP2, 166

geometric decoration, 28, 104, 145, 188, 201, 204, 214, 215, 220–223, 232, 322, 346, 348, 354, 359, 370, 371, 386, 542, 563, 564, 567, 573, 582
on rim form 5 sherds, 216
geometric motif, 315
geometric/curvilinear
decoration, 395, 567, 574, 592; design fields, 399; design groups, 580; fields, 359, 360, 540, 563
globular jar fabrics, 537
globular jars
clay used in CP3, 340
glycolation, 71, 81, 87
granite, 740
granite perthite, 742
grano-dioritic, 742
grave depths
MP3b burials, 647–649
grave goods, 306, 462, 464, 627, 631, 638, 657, 714
burial jars, 298, 403; CP3 and CP3 potting, 663; exotic burial jars, 317; in CP3 infant burials, 635; in MP6 burials, 653; lacking in earlier burials, 296; lacking in neonate burials, 645; MP5, 649; potters' anvils, 98; potting clay, 463, 468; potting tools in CP3, 306; suggest status inherited, 699; utilitarian containers, 638
grave shapes
burial 14 a unique circular grave, 652
grave wealth
correlated with pottery production, 653; CP3 potters, 639–646; in MP6 burials, 657; MP3b, 646–647; of CP2 potters, 628; potters and non-potters compared, 628
grave wealth calculations
CP2, 629–631
Greek attitude to technology, 685
grog temper
firing sequence, 60; origin of, 60
Gua Berhula, Malaysia, 36
Gua Cha, Malaysia, 719
pot stand, 413, 637
gypsum, 58, 310, 585, 614, 696, 738
porphyroblastic, 747; pseudomorphs, 747

haematite, 37, 46, 58, 239
halophyte, 49, 696
Suaeda maritima, 48, 49, 67
handmade pottery
coils, 34; lump-and-slab, 34; moulded-base, 34
hiatus between MP3 and MP4 burials, 182
hiatus in burials marked cultural change, 183
hierarchy
settlement, 38; social, 654, 698, 704, 726
high status CP3 potters, 633
high status turtle male burials, 644
hornblende, 743
human figures (stylized), 458

illite, 69, 71, 72
imitations/copies, *see* Ban Na Di, potters, pottery, styles
immigrant potters, 259, 660
and new methods, 93; evidence for, 171
incised, 135, 145, 160, 180, 188, 189, 194, 196, 201, 230, 232, 234, 297, 324, 339, 343, 384, 386, 387, 399
abstract design, 247; and CP2 punctate, 193; chevrons, 298; combinations, 159; CP2 burial jar motif, 260, 262; CP2 motifs, 243; CP2 rim form 5, 205–216; CP2 rim form 6, 220–223; CP3 base forms, 398; CP3 burial jars

differ, 459; CP3 lids, 329; CP3 rim form 13, 386–387; CP3 rim form 1a, 335; CP3 rim form 4, 346–348; CP3 rim form 5, 356–360; CP3 rim form 6, 370–374; field, 145, 152; intricate fields, 136; line diameters, 120; lines bound shell impressions, 137; multiple parallel lines, 129; striated grooves, 120; vessel base, 154
incised and impressed, 160
incised fine ware in CP3 graves, 324
incised wares
bone stylus points correlated with, 96; CP2 distribution, 188–189
incising method
on burial jars, 180
inclusions, *see* clays, fabrics, slips, tempers
independent production
and workshops, 687
independent specialists
and coarseware container production, 705
Indian rouletted ware, 37
Indo-Roman ware, 37
Indonesian studies, 37
infant burial 16 imitated adult burial, 315
inflection points, 130–132, 135, 139, 148, 150, 157, 214, 220, 230, 232, 239, 339, 340, 343, 348, 357, 384, 387, 538, 540, 542–545, 559, 562–564, 570, 572, 574, 580
inherited wealth, 693
insignia, 262, 463
associated with high quality vessels, 658; contrasted with ownership marks, 658; potters' group, 262; rank (see also clans, clan signs), 300; social group, 303, 633; turtle group, 702
inversions
in radiocarbon dates, 616; quartz, 125; silica, 239, 246
iron oxides, *see* pigments, haematite, paints
isolated CP3 infant burials, 304
itinerant potters, 685

jar forms (rim form 9)
CP3, 384
jarosite, 72, 81, 87
Jenderam Hilir, Malaysia, 36
Jomon culture and pottery, 10

kaolinite, 69, 71, 81, 87, 738, 741
abundance, 72; in Bang Pakong clays, 69; potters prefer, 69; workability, 71
Khao Wong Prachan Valley, Thailand
exchange network, 262; marked ceramic moulds, 179, 624; Non Pa Wai decoration and KPD, 619; temper, 717
Khok Charoen, Thailand, 21
pottery fabrics, 20, 29; pottery style comparisons, 27, 620, 728; pottery tempers, 21–29
Khorat Basin, Thailand
population movements, 24, 731; pottery examined, 26, 32–35; spread of bleb wares, 27
Kidder, Alfred V., 4

leather-hard, 78, 120, 121, 134, 160, 180, 191, 192, 205, 319, 331, 603
limestone, 743
limonite, 739
local
scale of industries, 11
local coarse wares changes, 636
local CP3 burial jar types, 463
local potting origins, 2
local wares
and the CP2 burial sequence, 256; CP4 differ from preceding traditions, 607
Loei Region, Northern Thailand
petrographic study of fabrics, 31
Lopburi, Thailand, 21
pottery analysis, 28; surface collected pottery, 27
Lubang Angin, Malaysia
shell temper, 36; XRD pottery analysis, 36
Lungshan
and Malaysian tripod wares, 36; China, 21; migrations, 21; tripod wares, 729
Lungshan pottery, 729

Mailu (Papua New Guinea), firing temperatures, 122
Malaysia, 619
and Ban Kao tripod pot legs, 633; Lungshan style pottery, 729
managerial interaction, 727
managerial partners, 721
managerial élite, 698, 700, 704
mangrove species
Bruguiera, 65; *Ceriops*, 65; *Rhizophora*, 65, 123, 183, 300
mangrove swamp sites, 615
manufacturing methods, 216, 626

skills required, 663
mass production, *see* coarse wares, containers, 734
of containers, 668
Mediterranean
pottery studies, 4
Mesopotamia
craft specialists and food surpluses, 684; diffusion centre, 697; food surpluses, redistributive economies, crafts, trade, industries and wealth, 685
metamorphism, 743
metamorphosed chert, 743
metamorphosed granitic or grano-dioritic altered feldspars, 743
micritic limestone, 745
microcline, 740, 742, 746
microcrystalline chert, 745
microlitic crystals, 741
miniature vessels, 297
Minoan pottery imitations, 154
modern craft potting centre production scale, 122
monsoon
climate, 301, 644, 702; flooding, 58, 108
montmorillonite, 69, 71, 80
mortuary activity in MP4, 304
mortuary offerings, 629
Mortuary Phase 3
burials correlated with ceramic evidence, 255
Mortuary Phase 3 burial aspects, 167
mortuary ritual
associated evidence, 624
mortuary rituals
"killed" vessels, 245, 460, 623, 627, 644, 716; in CP3, 626
mortuary structure, 305, 654–657
mortuary vessel distributions
see also burial jar(s), 165
mortuary vessel numbers
few compared to Non Nok Tha, 628
mortuary vessels, 255–263, 296–297, 410–414, 464
with very thin walls, 297; CP2 and CP3 compared, 473; CP3 decorative modes, 469; crudely made miniature, 297; exotic, 476; high quality, 297; local copy of exotic miniature, 630; miniature, 297; notes to CP3 vessels, 458–461; olive grey to olive, 297; possible fish paste jar, 297; quickly made for ritual, 296, 297; red colour, 297; ritual significance of, 245; triangular motifs on, 627; two almost identical, 296
motif associated with CP2 potters, 712
motifs on burial jars
suggest familial links, 260
moulding/mould-made, *see* Ban Na Di, Non Pa Wai
mullite, 62, 122
Mun Valley, Northeast Thailand, 24
initial petrographic study, 33; Iron Age petrographic study, 37; ware at Non Nok Tha, 30
muscovite, 740, 742, 746
muscovite is altered to brown chlorite, 744
muscovite mica, 744

neonate burials lacked vessels, 653
net weights, 9, 170, 465, 480, 691
CP2, 186, 298; CP2 and CP3, 475; CP3, 321; CP4, 607; site distribution, 679
neutron activation, 36, 37
New Caledonia
AMS dates, 101
Niah, Malaysia
NAA analysis, 36
Noen Phrik, Northern Thailand, 31
Non Chai, Northeast Thailand
1st millennium BC Sakon Nakhon potting origin, 26; and Ban Na Di chronology, 27; burial ground sherd density, 683; mainly occupation materials, 705; major production centre, 683; nodal location, 21; pottery fabrics, 26; pottery tempers, 21, 26
Non Dua, Northeast Thailand, 33
Non Kho Noi, Northeast Thailand
pottery analysis, 27; pottery styles, 27; pottery tempers, 21
Non Na Nong Khong, Northern Thailand, 35
Non Noi, Northeast Thailand, 32
Non Nok Tha, Northeast Thailand, 16, 93
burial vessels, 628; cemetery compared with Khok Phanom Di, 683; petrographic analysis, 30, 682; pottery seriation, 103; pottery temper, 21, 96
Non Nok Tha, Northeast Thailand, 21, 41, 620
burial vessels, 21; chronology, 27; shallow cemetery, 705
Non Pa Wai, Thailand
marked moulds, 624
Non Pa Wai, Thailand
contemporary with Khok Phanom Di, 179; copper working, 706

Non U Mong, Northern Thailand
pottery, 35
non-mortuary vessels
CP2, 245–255; CP3, 403–470
non-mortuary wares, 789
Nong Klang, Bang Pakong Valley
brickwork clay samples, 75
Nong Non Chik, Northeast Thailand
fabric analyses, 31
Nong Nor, Central Thailand, 38–41, 46, 620, 613 – –623
Khok Phanom Di earlier or an island, 47; phase 1 potting technology, 708; potters, 720; pottery fabric analysis, 28; seasonal occupation, 39; sedimentation, 47; tripod vessel feet, 633
Nong Nor, Central Thailand, 615, 618
AMS dates, 101, 620, 623; and Khok Phanom Di, 38; ceramic sequences, 39; phase 1 burials, 620, 622; phase 1 pottery assemblage, 39; phase 1 pottery parallels CP1 wares, 615; phase 1 sherd fabrics, 621; pottery, 236; radiocarbon dates, 39, 56, 615; radiocarbon samples, 623; rice, 706; sedimentation, 55; small Late Holocene coastal site, 615
Nong Wua, Bang Pakong Valley
clay quarry, 75
notch decoration, 370
nubbin decoration, 158, 357, 361

ochres, *see* burnishing, burials, pigments
oligoclase, 743, 745
one-handed vessel turning
Compani, Myanmar (Burma), 162–163
opaque ferruginous minerals, 743
open-air firing methods, 122, 126
outstandingly rich layer 7 burials, 305
ownership marks
on potters' anvils (see also potters' marks), 313
oxidation conditions (in firings), *see* potters
oxidization
and pottery colours, 126

Pa Sak Valley, Central Highlands, Thailand, 29
paddle and anvil
and CP3 utilitarian coarse wares, 333; and slab or lump construction, 132; and wheel turned vessels, 162; carved paddles, 121; compaction, 120; cord marks on firing stands, 126; cord textures and orientation, 131; cord-wrapped paddles, 13; decorative effect not always intended, 131; method, 115, 157; present-day use, 13; primary role of method, 131; two paddle types used, 134, 147; Z and S cord twists, 126
paddle and shell-impressed variant
an important ware, 384
paddle impressing, 559, 580, 606, 820
a major change in CP4, 466, 590, 662; a regional decorative mode, 160, 635, 637; common to local and exotic CP4 wares, 531; CP4 wares, 580–584; exotic anvil and, 607; not adopted by local potters, 393
paddle impressions, 133, 191, 212, 216, 360, 374, 384
and exotic fabrics, 326; as a motif, 159; as decoration, 154; carved paddle impressions on CP3 wares, 325; carved paddle marks correlated with exotic pottery, 212; on exotic pottery, 298
paddle-impressed, 325, 393, 570, 572, 604, 625
carved paddle technique a cultural style, 670; chronological distribution of, 677; CP3 exotic wares, 466; CP4 rim form 4 wares, 541–546; CP4 rim form 5 wares, 562–564; CP4 rim form 6 wares, 567, 569; exotic bleb-tempered wares, 397; exotic CP3 mortuary vessel, 414, 460; first local example found in layer 5, 469; origins of, 663
painted and slipped wares, 717
origin of, 717
painted wares, 326
CP3 exotic bowls, 374
Papua New Guinea
beach sand tempers, 136; female potters and male traders, 644; female/male potters, 644; firing platforms, 122; fuel types, 63; trade marks, 669
paste, *see* fabric
Peacock, David, 4
pebble cache, 11, 95, 96, 114, 115, 739
and mobile lifestyle, 732; technology, 706
perthitic alkali feldspars, 744
Petchabun Piedmont, Thailand, 35
petrographic analysis, 2, 11, 13, 20, 734
Freestone, Ian, 20, 28; of clays, 75, 78; of CP1 vessels, 162; of CP2 and CP3 pottery, 473; of CP2 anvils, 170; of CP2 painted wares, 191; of CP4 clays, 528; of fabrics, 145; of

firing stands, 14, 95; of local clays, 737; previous, 28–37
phallus, 262, 277
Phan Thong, Bang Pakong Valley
brickworks, 75; clay samples, 75–77, 81
Philippines
raft firings, 708; scale of pottery firings, 692
Phimai, Northeast Thailand
petrographic analysis, 32; pottery fabrics, 26; pottery tempers, 21–26
Phu Noi, Thailand, 41
Phu Wiang Region, Thailand
petrographic study, 30
phytoliths, 48, 58, 94, 737
pigments, *see* haematite, iron oxides, paints
plagioclase feldspar, 740
platters, 346, 354, 541, 720, 722
absent in CP3 burials, 414
Po Yue Wan, Hong Kong
pot stands, 413, 638
pollen, 1, 46, 48, 50, 94
pollen spectrum, 99
polycrystalline quartz phenocrysts, 740
porcelain, 467, 578, 585, 662, 682
pot stand, 719
pot stands
Chinese and Malaysian examples, 637; similar to Gua Cha form, 413
potsherds
estimated quantity, 1
potters, 1, 11, 15, 60, 74, 93, 96, 98, 472, 611
and clay, 55, 69, 71, 98; and fashionable styles, 103, 730; and marriage alliances, 97; and metallurgy, 10; as emigrants, 13; clay storage by, 73; CP2 and CP3 techniques, 473–475; CP2 differ from CP1, 618; CP2 highly skilled, 626; ethnographic information, 13; female wealthiest individual, 704; females, 638; fuels used by, 63, 68; importance of, 639; mass production methods, 689; numbers of, 261; present day Fijian, 13; present day Thai, 13; socio-economic role of, 2; status, 11, 15, 629, 638, 639, 654, 685, 692, 707; tempering methods of, 61, 96
potters'
burial jar motif, 463, 465, 644
potters' anvils, 170, 171
origins of CP3, 476, 635
potters' associates, 644
potters' burials
in CP3, 464
potters' equipment
in CP2 contexts, 168; in CP3 burials, 306, 463
potters' marks, 13, 179, 313, 518, 633, 635, 658, 661, 663, 668, 669, 721, 734
CP2 and CP3 compared, 462; CP3 suggest workshops, 689; on burial 15 exotic anvil, 690; on CP2 anvils, 171; on CP3 anvils, 462; on CP4 anvils, 480, 486, 603; unique to Khok Phanom Di, 13; Yangshao, 685
potters' rise to prominence
the CP3 evidence, 689
potters' tomb, 657
potters' tools, 11, 165
anvils with potters' marks, 670
potters' wealth
and container production, 660; in CP3 contexts, 643
potters' wealth and status
evidence suggests some inherited, 704
potters' workshop evidence, 707
potters/turtle group, 645, 654, 703, 721
and burnishing stones, 654; and inland groups, 697
pottery
an exchange item, 10; chronology and origin of, 6; consumers, 9; decoration, 11; durability, 9; form classifications, 611; importance of, 1, 2; importance of rims, 11; medium for artistic and symbolic expression, 159; multiple functions, 9; origin of styles, 10; previous excavations, 3; processing scheme, 1–7; producers, 9; quantity recovered, 4; relative chronologies, 5, 9; style analysis, 10
pottery production centres, 1, 4
potting
and climate, 9; and socio-economic variables, 9; CP1 evidence of, 610; in lowest levels, 109; seasonality, 17
potting accoutrements
absent in CP2 graves, 628; in CP3 burials, 639
potting clay
CP2, 184; CP3, 306, 320, 463; CP3 compared with CP2 burials, 475; CP4, 528; from cultural contexts, 739; in burials, 305, 307; in burials 4, 6, 7, 8, 9 and 11, 305; in CP3 graves, 319; modern and prehistoric samples, 665; prehistoric compared with mod-

ern, 109
potting clay samples, 72
potting community
evidence for in CP4 contexts, 603
potting equipment
in CP2 graves, 624; in CP3 burials, 462–465; in CP3 graves, 306
potting methods
Nong Nor match Khok Phanom Di, 621; preferred by local potters, 326
potting skills
CP3 highly accomplished, 638
potting technology
similar to Nong Nor, 706
potting tools
see also paddles, paddle and anvil, 116; CP2 anvils, 170, 171; CP2 bone incising points, 180; CP2 cord marked anvils, 179; CP3 anvil fabrics, 307; CP4 anvils, 490; first found in CP3 graves, 642; origin of, 116; survival of, 13; used to decorate burial jars, 459
potting traditions
significance of changes in, 260
Prachinburi River, Thailand, 51
and exchange relationships, 632; bleb temper pottery, 326; CP4 exotic wares, 663; exotic potter's marked anvil, 632; external relationships expanded in CP3, 660; geology, 51; slipped pottery with limestone, 192; source of exotic burial jar, 649
prehistoric pottery
origin of, 93
prehistoric potting clays, 73
prepared clay, 109
origin of CP2, 184
processing scheme, 4
production
co-ordination of container output, 645; facility size helps infer scale, 688; modes in Asia, 702; scale and organisation, 663, 692, 722; scale of units, 687; volume, 13; volume indicates large intensive industry, 13; volume of CP3 containers, 660
production system
implied in CP4 data, 607
proton-induced X-ray emission, 33
pseudomorphs, 738
punctate
origin of CP3 wares, 328; sherds CP2, 193
quartz intergrowths, 740
quartz inversion, 240
quartz overgrowths, 745
quartz regrowths, 743
quartzite, 740, 742
quartzite with crenulated sutures, 743
radiocarbon
CP4 samples, 661; New Caledonia determinations, 101; Nong Nor determinations, 101, 620, 623; sample pretreatments, 55; samples, 615, 623; unspeciated charcoal sample, 101
raft, *see* firings
raft firings, 122
raw materials, *see* clay, fuel, temper
red ochre
used to copy exotic pottery, 327
regional pottery styles, 717
and decorative modes, 626; CP2, 216; scale of, 10
regional potting traditions, 473, 671, 735
origins of, 619
regional tradition, 473, 616, 720
different expression, 618
relative dating
pottery used for, 5
repairs
of fired vessel decoration, 296
Rhizophoracae-type charcoal, 48, 49
rice, 730
a regional tempering method, 695; agriculture, origin of, 734; and pottery containers, 690; and pottery tempers, 61; and shell harvesting knives, 625, 694; as a symbolic additive in pottery, 20; as incidental inclusions, 365
in CP4 clay cylinders, 527
in local fabrics, 335, 343, 392, 462; chronology and distribution as temper of, 26, 695; cultivation, origin and role of, 5, 16; does not thrive in saline conditions, 694; domesticated present at Khok Phanom Di, 49; husk in local potting clay, 694; in bleb temper, 59; in coprolite, 695; in CP3 anvils, 310; in CP4 local anvils, 490; in crucible fabrics, 36; in imported pottery, 217, 297, 326, 690
suggests inland cultivation, 660; in local wares, 534, 537, 540, 569, 578, 602, 706; origin of in clay cylinders, 667; origin of in CP3 pottery, 694; prominent in exotic anvil fabrics,

501; ritual application in mortuary vessels, 695; some may have been exchanged from inland, 49; storage beetle
Formicomus, 695
Oryzaphilus surinamensis, 695; straw used for firing pottery, 65, 122; use in modern pottery, 49; use of in Khok Phanom Di pottery, 49
rice temper
at Nong Nor, 39; confined to CP4 local fabrics, 585; in Chinese pottery, 730; in Thai pottery, 21; linked to agriculture and seasonality, 17
rich burials
lack of vessels, 638
ridged and notched, 159, 160
rim classification
of fine wares, 139
rim form 1 sherds
in CP2 burials, 625
rim form categories and variants, 757
Rio Grande
chronology, 19; cultural history reconstruction, 17
ritual sharing, 723
ritual spoiling of vessels, 245, 460
ritual vessels
and rice additives, 699
Roi Et, Northeast Thailand, 33
pottery tempers, 21; rice temper, 33; sgraffito pottery style, 20; white ware, 32
Roman
amphorae, 20; attitude to technology, 685; estate production, 43; pottery workshops, 668
rouletted ware
Anuradhapura, Sri Lanka, 37; Arikamedu, India, 37; Karaikadu, India, 37; origin of, 37; Pacung, Bali (Indonesia), 37; Salihundam, India, 37; Satanikota, India, 37; Sembrian, Bali (Indonesia), 37; Tra Kieu, Central Vietnam, 37
rutile, 744

Sa Huynh, Vietnam, 729
Sab Champa, Thailand, 28
sabkhas, 696
Sakon Nakhon Basin
14 potting clays analysed, 35; 1st millennium BC exotic wares, 24; bleb/rice temper and major cultural changes, 21; bronze industry network, 26; Chi and Mun Valley imports, 24; copied pottery styles, 16; cultural changes, 21, 104; modern craft potters, 35; pottery examined, 26–36; rice temper, 17; surface collected pottery, 35
salt, 67, 696, 713
Suaeda maritima indicates salt in soil, 49; a state monopoly, 696; and pottery containers, 696; and socio-economic organisation, 698; Indonesian exchange item, 713; possible exchange item, 49, 697; possible local resource, 696; Tangu region Papua New Guinea, 696; Western Zhou Dynasty, 696
salt water
and rice, 695
salt-making, 696
salted fish, 698
sample
grave goods, 825; punctate sherds, 820
sampling
"complete" vessels, 402; "minimum standards", 724; brick making clay, 80; clay quarries, 74; fabric groups, 737; identify exotic pottery, 4; local wares are regional expression, 236; pottery assemblage, 6; potting clays, 53; rim forms, 138; thin-sections, 3; to reduce pottery assemblage size, 734; used to seriate pottery assemblages, 103
sandstone, 740
sanidine, 740
scale
and seasonal production, 708; of CP2 potting activity, 259; of pottery production, 4, 668; of regional potting technology, 731; study of workshop production, 479
scanning electron microscope, 33, 35, 36
schistose, 744
schorl, 745
sea levels
and tectonic activity, 301; Post-Pleistocene, 301
seasonal
pottery production, 9, 17, 644; river plain flooding, 50
seasonality, 692
and potting schedules, 645; and salinity, 47
sedentism and pottery production, 620, 731–733
Sepik, Papua New Guinea
bone stylus, 121; pottery motifs, 262–263; tribal

totems, 458
sericite, 740, 744, 746
sgraffito decorative technique, 20
Shan State, Myanmar
ethnographic studies, 162
Shang
clan signs, 724; craft specialists and kin groups, 684; interrelated burials, 724; wealth, status and lineages, 724
shell
Anadara sp., 11, 123, 129, 137, 162, 165, 166, 304, 480, 623, 652, 670
shell impressions, 2, 129, 145, 157, 194, 201, 204, 205, 212, 214–216, 220–222, 230, 234, 239, 243, 255, 260, 297, 329, 343, 346–348, 356–360, 365, 370–374, 382, 384, 386, 387, 393, 395, 396, 398, 399, 539, 541–545, 559, 562–564, 567, 570, 573, 574, 580, 582, 717
Anadara sp., 146, 194, 205; a regional style, 626; as motifs, 715; carelessly applied, 460; CP1 and CP2, 626; favoured by CP2 potters, 625; mirror exotic modes, 476; on burial jars, 626; on CP3 rim form 4 variants, 580; on CP3 rim form 5 variants, 582; on CP3 vessels, 469; on CP3 wares, 590; on exotic wares, 626, 637; prevalence in CP2, 298
shell jewellery, 304–306, 480, 633
shell midden (L10 lens 2), 166
shell temper, 716, 742
Shepard, Anna O., 10
shrinkage problems
during forming, drying and firing, 60
silica inversions, 125
siltstone, 747
silty sandstone, 740
skill levels
of CP4 potters, 662; of local potters, 402
slate
occurred first near CP2/3 boundary, 624
slipped wares, 626, 719
abundant rice inclusions in, 635; at Tha Kae and Ban Kao, 717; common to several potting centres, 636; CP2 rarity suggests remote sources, 636; distribution, 819; exotic fabric, 743; extremely rare, 677; in burials, 640; local imitations, 636; Nong Nor Ph1, 620; rare in Southeast Asia, 625
slips
at Ban Chiang, 33; containing limestone, 223; CP2 distribution, 298; CP2 exotic ware suggested source, 625; CP3 exotic wares, 326–328, 343, 365, 373, 390, 393, 395, 396, 399, 466, 469; CP3 wares, 396; CP4 exotic wares, 531; ethnographic examples, 114; exotic examples, 191–192; Indonesian examples, 37; limestone inclusions, 236; Non Chai pottery, 32; Non Pa Wai wares, 28; not favoured by local potters, 714; on CP2 bowls, 201; on exotic rim form 10, 230; on punctate ware, 193; true versus self-slipping, 243; very rare in 2nd millennium Thailand, 717
smashed mortuary vessels
CP3 ritual differed from CP2, 626
smectite, 69, 75, 80, 87
social conditions
reflected in burial rituals, 296
social groups
and CP2 burial jar motifs, 260
social structure
Khok Phanom Di, 699
social structures, 705
and agriculture, 693; and ceramic analysis, 1; and potting workshop, 734; initial conditions in Aegean model, 693; Southeast Asian models, 693; symbols, 668
socio-economic
adhesions, 16; changes, 15; developments, 705; organisation, 701; potters/turtle group alliance, 712; status, 725; value of potting, 4, 668, 701
socio-economic evidence, 1, 4, 5, 13, 165, 616, 669, 699, 707, 723
CP2 summarized, 632; CP3, 649; CP4, 662; ethnographic, 15; specialization, 303
socio-economic status, 702
CP2 and CP3 potters, 707
Southwest American pottery assemblages, 4
spalling, 237, 239, 246, 296, 459
spherulitic, 742
sponge spicules, 170, 171, 528, 737, 741, 742, 745
standardised production
of containers, 668
standardization, 688, 734
status
of CP2 potters, 628; of CP3 potters, 303; of female potters, 668
status of potters
CP3 compared with CP2, 476

stoneware, 530
bases, 585; lids, 590; rims, 578; vessel, 592
stored clay, 692
stratigraphy
burials above L10:3 assigned to CP3, 298; Upper MP3 burials assigned to CP3, 263
stretched metamorphic, 744
stucco decorative technique, 360
style "drift", 662
styles, 19, 103, 105, 348
and cultural change, 104, 260, 461; and design motifs, 159; and modes of decoration, 670; and pottery types, 16, 714; and radiocarbon determinations, 101; and seriation, 103; Ban Kao, 619; changes in CP2, 256, 301, 627; coincidence of early and late burial jars, 648; CP1 compared with Tha Kae, 613; CP2 and CP3 compared, 462, 470–476; CP2 exotic similarities, 632; CP2 vessels, 623; CP3 regional distribution, 636; CP4, 593, 602, 606, 661; CP4 and CP3 compared, 605; cultural, 9; decorative, 130; exotic, 327, 626; fashionable often copied, 16; favoured by potters, 154; imitations, 154; influences on, 20; motif, 37; Nong Nor Phase 1 and CP1 at KPD, 621; of potters' anvils, 115; pottery and cultural, 96; regional, 10, 11, 104, 128, 216, 392, 608, 701, 730; regional changes in, 618; regional distribution of RF5, 365; traditional, 16
surface decoration categories, 2
surface treatment, *see* burnishing, fine wares, incising, paddle and shell impressions, slips
symbolic
addition of rice, 20; burial jars, 705; decoration, 625; fabric additives, 706; male and female motifs, 262; motifs, 303, 701
on burial jars, 458; potters' marks, 179; significance of tomb, 657; smashing of vessels, 719; turtle motifs, 644; vessel forms, 245
symbolic burial jar motifs
and potting accoutrements, 463
symbolic expression, 165, 627, 723
ethnographic evidence, 15; potting materials and, 15

Tangu, Papua New Guinea, 65
salt, 696
technology, 1, 4, 9–11, 15, 16, 20, 50, 93, 103, 122, 204, 301, 706
and ceramic change, 105; and potters' anvils, 667; and pottery styles, 104; and rice temper, 26, 62; and social organisation, 649, 722; and water adsorbed by clays, 69; broad-scale Southeast Asian changes, 731; changes in, 93, 260; changes in helped define Ceramic Periods, 705; changes in lithic, 184, 625; clay slips, 192, 392; close relationship with subsistence, 59; CP4 differs from earlier, 662; Greek attitude to, 685; metallurgy and potting, 10; new introduced in CP3, 703; regional shifts in, 731; rice-related in CP4 anvils, 603; Roman attitudes to, 685; stone, 94; turtle carapace, 94

temper, 11, 24, 46, 58, 61, 65, 95, 96, 115, 147, 160, 171, 217, 230, 619, 661, 662, 668, 694
adoption of grog, rice, 731; and sherd weight ratios, 712; artificial or natural, 13; artificial provides resource independence, 24; as a non-plastic additive, 13; bleb firing method, 59; chua (bleb grog), 14, 17; CP1, 95; CP1 reflects limited technical knowledge, 618; CP2 changed but not forms, 714; CP2/3, 96; CP3 tradition differs from CP2, 62, 462; crushed bone, 13; cultural correlationships of, 731; distance threshold models, 114; exotic not adopted by CP3 potters, 393; grog, 97; grogs either "hard" or "soft", 60; grogs in thin-section, 62; importance of, 17; in ceramic firing stands, 182; in CP1 anvils, 116; in CP1 appliqué sherd, 160; in CP1 coarse wares, 134; in CP1 prepared clay, 109; in CP2 anvil fabrics, 299; in CP2 exotic paddle impressed wares, 191; in CP2 exotic painted and slipped wares, 191; in CP2 prepared clay, 184; in CP2 punctate wares, 193; in CP2 tripod feet, 240; in CP2/3 potting clays, 473; in CP3 anvil fabrics, 310, 313; in CP3 appliqué sherds, 331; in CP3 clay cylinders, 474; in CP3 exotic punctate ware, 328; in CP3 exotic wares, 322, 466, 635; in CP3 fabrics, 392; in CP3 paddle-impressed wares, 325; in CP3 painted and slipped wares, 326; in CP3 potting clay, 463; in CP3 prepared clay, 320; in CP3 rim fabrics, 354, 365, 374, 384, 385; in CP4 anvil fabrics, 495, 602; in CP4 appliqué sherds, 533; in CP4 exotic anvils, 501; in CP4 paddle impressed wares, 531; in CP4 prepared clay,

603; in CP4 prepared clay cylinders, 527; in CP4 rim fabrics, 534, 537, 539, 564, 578; in exotic appliqué CP2 sherd, 193; in exotic burnished incised wares, 189; in Non Nok Tha pottery, 21; in Nong Nor and KPD tripod feet, 621; lacking in CP2 anvils, 170; leather, 13; less important than clay minerals, 69; limestone, 217; must be readily available, 62; Nong Nor, 39, 216; origin of CP1 cache pebbles, 114, 115; orthodox grog, 14; pebble cache tempering material, 11; petrology of pebble cache temper, 114; pottery wasters as, 14; previously recorded in Thailand, 10, 21, 28–37; reduces shrinkage, 58; rice, 16, 99, 343, 714; rice by-products, 49; rice in CP2 fabrics, 297; rice in palaeobotanical analysis, 16; sand in Southeast Asian pottery, 618; sand is resource dependent, 708; shell, 13, 14, 36, 63, 136, 397, 413, 469, 610, 611, 613, 636, 657, 660, 708; silty fishpond clay grog, 319; traditional use of, 24; transportation threshold, 79; vegetable matter, 13
temper typing, 14
temperature(firings), *see* Ban Na Di, earthenware, firing, Mailu
test clays
firing of, 77
test pots
firing failures, 246; used by local potters, 246
Tha Kae, Central Thailand
pottery styles, 27
Tham Pha Phim, Northern Thailand, 31
thermal stress, 124
Three Pagodas Pass, 717
Tit Nam Hoong, Malaysia, 36
tomb, 654, 704
clay floor, 657; energy expended on, 657
tools, *see* burials, grave goods, potters' tools, pottery, potting tools, workshop
tooth ablation patterns, 724
CP3 pattern introduced with burial 57, 648
totems
Sepik tribal, 458
tourmaline, 740
Tra Kieu, Vietnam
exotic pottery, 37
trade, *see* Mesopotamia, Papua New Guinea
trade marks
Motu of Port Moresby, 262; used by potters, 669
transformation
cultural, 461; in mortuary and pottery traditions, 690; in mortuary ritual, 704; in pottery technology, 14, 303
transport systems, 613
transport workers, 684
transportation
along riverine waterways, 465; maximum ranges for ceramic materials, 79, 114; of clay along waterways, 53, 79; of containers along exchange networks, 668; of fuel, 75; of local pottery output by water, 301; of pottery by CP3 males, 644; of potting clay at KPD, 663; of rice along waterways, 68; on waterways, 43, 46; scheduling of requires coordination, 644
tripod vessel feet, 158, 626
at Nong Nor, 39; copied by local potters, 730; CP2 types, 240; CP4 fabrics, 586; recovered from CP2 and CP3 contexts, 469
tripod vessels, 469, 716, 717
tripod vessels by Ceramic Period, 679
tripod vessels in burials, 612
true slip, 743
turntable, 162
turtle artefacts
in burials, 318, 623
turtle group, 702, 703, 707, 719
and increased pottery production, 713; associated with potters' group, 725–727; burial jars, 702; burial wealth, 645, 652; burnishing stones, 702, 714
turtle motifs, 713
turtle plaque
exotic in burial 57, 703

undulose extinction, 744
upper L10 burials
assigned to CP3, 170
utilitarian ware fabrics
in CP4, 606
utilitarian wares
changed to cylindrical containers in CP3, 649

vessel base and tripod forms
CP3, 397
vessel base forms
in CP3 burials, 469
vessel classifications, 245

vessel condition
burial jars pristine, 261
vessel construction methods, 333
vessel lid types
CP2, 240; CP3, 329
vessel motifs
relate burial 14 and 43, 704
vessel numbers
in burials, 628; in CP2 compared with CP3 burials, 475
vessels
miniatures, 627; platters, 137, 157, 237, 239, 245, 260, 267, 269, 272, 275, 281, 287, 290, 293, 298, 414, 460, 472, 605, 606, 611, 625, 628, 630, 639–640, 791
and Nong Nor, 612, 621
coarse in CP4, 662
exotic, 632
vessels in burials, 715
Vietnam, 729
bleb temper, 612; neolithic coastal sites, 728
vitrification, 62, 123, 125
of clays, 62

ware proportions
CP3 compared to CP2, 467
wasters, 11, 14, 39, 59, 65, 126, 664, 688, 691, 692, 708
Wat Phan Thong, Bang Pakong Valley
clay samples, 78
water transport
suited to large pottery outputs, 46
wealth and status of potters, 303
wheel, 154
slow, 150, 162
wheel turned jar (rim form 10)
CP2, 230
wheel turned pottery, 162
women, *see* potters female
wood, *see* fuel
wooden coffins or biers
lacking in CP3 graves, 306
workshop, 1, 64, 99, 479, 602, 605, 668, 701
and craft specialists, 686; and status of potters, 693; bone points in, 712; clay cylinders in, 669; clay in, 320, 712; location, 688; mass production in, 689; number of potters, 669; output estimate, 691; potters' group, 658; potting clays in, 603; potting evidence, 662; potting floor, 605, 661; potting strategies, 687; potting tools in, 602–603; sherd densities, 683; unique in Southeast Asia, 705
workshop locations, 722
workshops
and independent production, 687

X-ray diffraction, 17, 28, 35–37, 69, 75, 79
determinations, 78; results, 80
X-ray fluorescence, 32
xeroradiography, 34

Yangshao
pottery marks, 658, 685
Yangshao pottery, 729
Yangtze Valley
rice in pottery, 732
Yung Long, Hong Kong
pottery analysis, 731

zircon, 742
zoned incised decoration, 28