

The Bronze Age and Southeast Asia

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Abstract

As the scholarly border between China and Southeast Asia has dissipated, so the vast region from the Yangtze River to Malaysia has been integrated into a whole. There was an inexorable expansion of copper-base expertise southward, reaching Lingnan and Yunnan by 1400–1200 BC, and Southeast Asia one or two centuries later, with ultimate origins in the Asian steppes via the Chinese Central Plains and Sichuan. As prospectors identified and exploited the Southeast Asian copper mines, a limited range of copper-base artefacts moved along established exchange routes, including socketed axes, bangles and spears. At first rare and used to advertise status in communities advantaged by a strategic location, with increased production and in situ casting within consumer settlements, bronzes were no longer associated with social elites. Only with different regional stimuli during the Iron Age, were bronzes again employed by societies characterized by social inequality.

Keywords

Bronze Age – Southeast Asia – technology transfer – social change

Introduction

Absorption of Cambodia into the French colonial empire led, in 1876, to the first inkling that Southeast Asia had an indigenous Bronze Age. Monsieur Rocque, director of the River Transport Company of Cochin China, visited the prehistoric site of Samrong Sen on the Chinit River, and found that the villagers dug into the mound to extract shells to add to their betel nuts (Fig. 1). Three years later Lieutenant Jean Moura went to investigate, finding that villagers

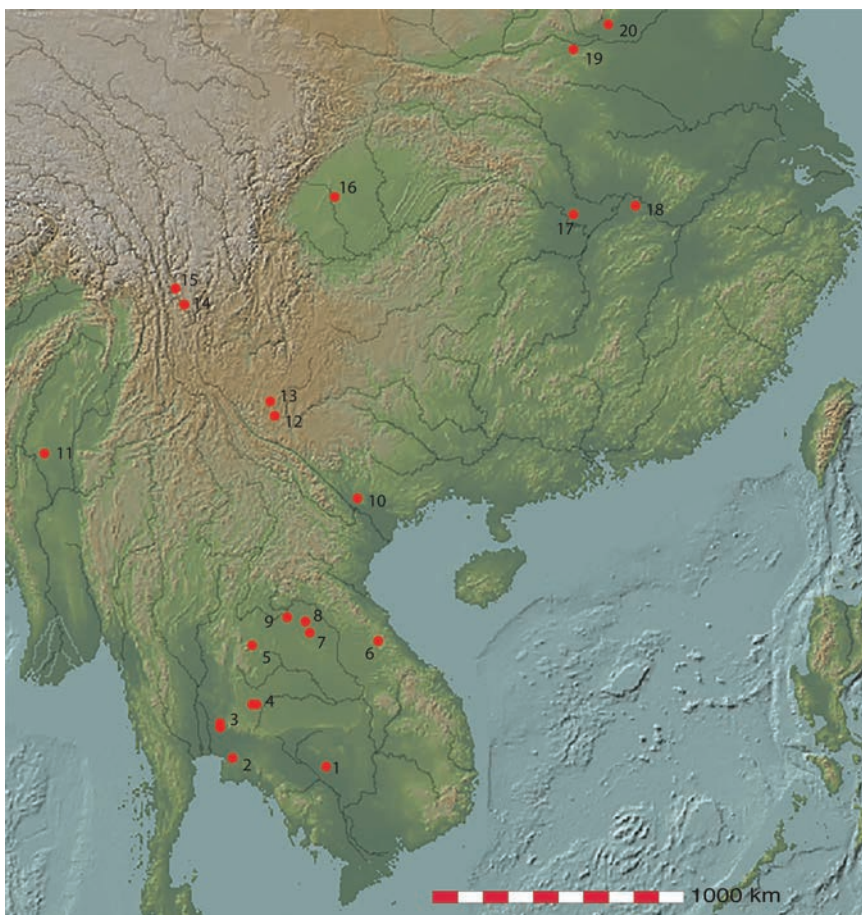


FIGURE 1 Map showing the location of sites mentioned in the text. 1. Samrong Sen, 2. Khok Phanom Di, 3. Non Pa Wai, Nil Kham Haeng, Khao Sai On, 4. Ban Non Wat, Ban Lum Khao, Noen U-Loke, Ban Prasat, 5. Non Nok Tha, 6. Vilabouly, 7. Ban Na Di, 8. Ban Chiang 9. Phu Lon, 10. Dong Dau, 11. Oakaie, 12. Guangfentou, 13. Shangxihe, Hebusuo, 14. Yinsuodao, 15. Haimenkou, 16. Sanxingdui, 17. Panlongcheng, 18. Tonglūshan, 19. Erlitou, 20. Anyang.

had a collection of bronzes. These were sent to Toulouse where they were published by Jean-Baptiste Noulet, the museum director, described as belonging to l'Âge de Bronze (Noulet 1879). The artefacts comprise a socketed axe, bangles, arrowheads and a fish hook, a range little changed from the range known today. There followed a lively debate in French scholarly circles including the first attempts to date the site (Fuchs 1883), and the discovery of other sites (Lefèvre-Pontalis 1894).

The term Bronze Age has been employed by all prehistorians since. Research certainly quickened in 1966–8 when Donn Bayard excavated Non Nok Tha, a

small and low mound in Northeast Thailand. His excavations encountered human graves in a sequence that began in the Neolithic and continued into the Bronze Age (Bayard & Solheim 2010). One founder was interred with a bivalve mold for casting a socketed axe, another grave contained a female wearing bronze bangles. The academic world was startled when the radiocarbon determinations were said to place these graves in the fourth millennium BC (Solheim 1968). By 1974, attention was focused on Ban Chiang, where rampant looting had revealed further prehistoric graves. Excavations then and the following year traced a sequence that again, began in the Neolithic and then progressed through burials containing bronzes, before entering the Iron Age. The excavators confirmed the early chronology based, again, on radiocarbon determinations, by placing the first bronze in ca. 3600 BC and iron between 1600–1200 BC (Gorman & Charoenwongsa 1976). These claims placed Southeast Asia center stage in any general consideration of the origins of copper base metallurgy, and the following half century has seen concerted efforts to assess their validity in the light of further research. The objective of this paper is to explore when and how knowledge of copper base metallurgy reached Southeast Asia, and then assess its social impact in the light of new excavations at key sites.

Origins

Bivalve molds for casting socketed copper base axes link sites from Yunnan, Lingnan and Southeast Asia. There is a general consensus that the ultimate origin for this technology is to be found in the Asian Steppes, whence the technological knowledge spread into the Central Plains. Ciarla (2013) has traced the further expansion southward in detail, finding that knowledge of mining, smelting and casting followed the riverine routes from the Yangtze south into Guangdong and northern Vietnam. Copper base technology was not the only innovation – domestic wheat followed a similar route through Sichuan into Yunnan by 1400–1000 BC (Stevens et al. 2016). This second route linking Gansu, Sichuan and Yunnan is evidenced, quite independently of any archaeological enquiry, in cores taken from Lake Erhai that reveal a sharp rise in copper from ca. 1500 BC, but not in tin or lead, suggesting that early metallurgists were not casting bronzes (Hillman et al. 2015).

In terms of archaeology, Haimenkou is a site of central importance. Located in northern Yunnan in the Lake Jian basin, excavations have uncovered a long sequence that began with Neolithic occupation before the first copper-base artefacts appeared from ca. 1500 BC (Chiou-Peng 2018). These include hollow core axes, bells, awls, chisels and bangles, many cast in copper and others

with an admixture of tin. The pottery vessels and metal objects, together with the wheat grains, all point to origins in the Qijia culture of Gansu (2200–1600 BC) and beyond further into the Asian Steppes. Yinsuodao is located on an island of Lake Er, about 100 km south of Haimenkou. Excavations there have uncovered a Neolithic settlement followed by a hiatus before re-occupation from ca. 1500 BC by a community familiar with the casting of bronzes. From 1200 BC, copper base artefacts included awls, fish hooks, bangles and arrow-heads. Further south still, Shangxihe and Hebusuo, two occupation sites on the shore of Lake Dian, have been investigated (Yao et al. 2020). Here, the Neolithic occupation has been dated between 1300–1100 BC, followed immediately by the first occurrence of copper-base artefacts that include a socketed axe, awl, fish hook and projectile point, in addition to casting residue and a sandstone mold fragment. The lead isotopes from fourteen of these have been analyzed to evaluate the copper sources and their wider relationships (Pryce et al. 2022). The lead isotope data suggest that the copper came from the smelting site of Guangfentou, 50 km south east of the Lake Dian sites. Moreover, this source also sent copper north to Haimenkou. In a result of profound potential significance, Pryce et al. have noted consistent similarities between the Guangfentou copper and artefacts from Oakaie in Myanmar and Ban Chiang in Northeast Thailand. By ca. 1200 BC, copper production had penetrated down the course of the Red River to impact the late Neolithic Phung Nguyen communities and see the transition into the early Bronze Age there with the many Dong Dau culture sites.

This new evidence documents beyond reasonable doubt the transmission of copper-base metallurgical skills south from Gansu through Yunnan into Southeast Asia. As Ciarla (2013, 2022) has also shown, there are persuasive grounds for advocating other transmission routes from the mid Yangtze into Lingnan, a region encompassing southern China, where again we encounter later second millennium sites containing hollow core axes.

Into Southeast Asia

Rice and millet farming communities had occupied lowland Southeast Asia for at least 1300 years before the first copper prospectors arrived, and copper-base artefacts joined long-established exchange routes. Assessing the impact of both requires an appreciation of the recipient farmer communities. Riverine and coastal routes eased the passage of early farmers as they expanded south ultimately from the Yangtze and probably too, the Central Plains of China. They brought with them a full repertoire of technological expertise, from the

manufacture of fine ceramic vessels to weaving, bone and stone technology. In addition to the rice and millet, they brought domestic pigs and dogs, and probably cattle. The first results from ancient DNA reveals introgression with the Australo-Papuan indigenous hunter gatherers (McColl et al. 2018). The village settlements comprised houses with plastered floors and painted wattle and daub walls. Stone was often obtained through exchange and fashioned into adzes and hoes. Bone fish hooks were used. The dead were interred within the confines of their settlements, in an extended supine position together with a variable range of mortuary offerings. These included pottery vessels, shell bangles, discs and beads, stone adzes and food remains. In some late Neolithic sites in the strategic Red River Delta region, jade *yazhang* blades matching those from Erlitou and Sanxingdui were imported. It is highly likely that the cowries interred with Fu Hao at Anyang came from Southeast Asia.

Khok Phanom Di on the Gulf of Siam was a pottery manufacturing and trading hub, where about 17 generations are represented in superimposed burial groups (Higham & Thosarat 2004a). On occasion, some individuals were interred with outstanding wealth and accompanying rituals. Thus, a woman potter wore over 121,000 shell beads when she was interred under a heap of clay preforms for making pots. Alongside lay an infant covered in red ocher and wearing 12,447 shell beads. If, as seems highly likely, copper prospectors travelled into Southeast Asia, they would have encountered people well attuned to long distance exchange, stable settlement, and acquisitive interest in exotic ornaments as vehicles to advertise status. The Neolithic sites that are of particular interest are those that continued to be occupied into the Bronze Age, for these provide the best insight into the resulting changes, if any, that might have been stimulated by the new medium, copper. Copper mines and associated smelting and casting sites are clearly also significant.

The Copper Mines

By ca. 1200–1000 BC, copper miners had reached at least three copper sources in Southeast Asia. The Khao Wong Prachan region of Central Thailand incorporates a series of inselbergs rich in copper veins. At least four mining and ore processing sites have been investigated there, and the results are crucial in any attempt to date the arrival of the first metal prospectors and assess their activities. Non Pa Wai is the most relevant, since five hectares of the accumulated residue from copper ore smelting and casting two meters thick overlie a Neolithic occupation site that includes human burials (Pigott et al. 1997). A

new initiative has dated charcoal, millet, rice and *Spilanthes* seeds from this stratified sequence (Higham et al. 2020). The Neolithic occupation fell within the period 2200–1800 BC, corresponding to the dates obtained from other sites in Central Thailand. The burials contained stone adzes and marine shell jewelry, indicative already of exchange relationships over some distance. After centuries of abandonment, Non Pa Wai was re-occupied by a community that exploited the local copper ore. By means of Kernel Density Estimates, copper mining and smelting began from ca. 1200–1000 BC, as one would expect from the growing chronological data for corresponding activity in Yunnan and Lingnan.

These first metal workers would have encountered copper oxide ores on the surface. Easily assembled, the ore was smelted in crucibles in what has been described as a rudimentary procedure (Pigott 2019; Pigott et al. 1997). The remains of copper processing include much ash, ore crushing tools, crucible and mold fragments, lumps of ore and slag. An intact smelting crucible had a diameter of 17 cm. Many fragments of ceramic “furnace chimneys” were also found. Though their function is not clearly identified, they must have played a part in smelting or casting. Molten copper was cast into axes, points, arrowheads and ingots, the last presumably for exchange.

Several graves date to this initial period of copper working. One of these contained a copper axe as a mortuary offering, with just .75% tin, insufficient to label it bronze (Fig. 2). Remarkably, lead isotope analysis shows that this was not cast from local copper and must have been imported. Another individual was interred with an unidentifiable copper item, but two more stand out for the presence of ceramic bivalve molds. In one of these an adult man was associated with molds for casting an axe, a second had a complete bivalve axe mold placed between the knees, and a copper-base fish hook under the skeleton. An interesting aspect of these burials is the lack of any indication that the founders were distinguished by wealthy grave goods, there being few pottery vessels, bone points and marble and stone bangles along with red ocher. Much of their output appears to have gone into casting ingots.

Nil Kham Haeng lies three km south of Non Pa Wai. Covering at least five ha and with a total depth of up to six metres, this copper processing site dates between ca. 900–400 BC, thus overlapping production at Non Pa Wai. This was both an occupation, mortuary and industrial site in which the layers were redeposited, probably by monsoon rains, into thin lenses, the matrices of which largely comprised crushed host rock and ore. Fourteen graves were uncovered, four of which contained copper-base offerings including a tin bronze spear point and small and thin cordiform artefacts of unknown purpose. Five graves also included furnace chimneys. Pigott (2019) has concluded that the copper



FIGURE 2 The founder's burial from Non Pa Wai, Central Thailand. A bivalve axe mold was found between the knees. Circa 1100-1000 BC.

COURTESY DR VINCENT PIGOTT

production was undertaken as a dry season activity by kin-based groups acting independently. About 30 km to the south, copper was mined and smelted at sites round the hill of Khao Sai On in a manner closely similar to Nil Kham Haeng (Ciarla 2007). A clay lined bowl was cut into the substrate within which the smelting crucible was located under a furnace chimney. The burials associated with this complex date to the Iron Age (ca. 200 BC–AD 200).

To any copper prospector travelling from Yunnan down the Mekong River, two hills at the confluence of a small stream and the main course would have stood out. Known as Phu Lon, malachite ore is abundant. From at least 1000 BC, the hills were progressively riddled with mine shafts such that one of them eventually collapsed. River stones were on hand to convert into mauls to extract and begin to process the ore. As at Nil Kham Haeng, this involved

crushing the host rock into small fragments to extract the malachite with hammer stones and anvils. Fragments of crucible containing slag suggest local crucible smelting, while casting also took place to judge from the presence of sandstone mold fragments. At Phu Lon, this involved tin-bronzes. A bronze axe was cast from local ore and dates to the first half of the first millennium BC.

The Vilabouly complex is located in upland Laos. The exploitation of the abundant deposits of malachite, azurite and cuprite is best known on the basis of deep mine shafts, some of which reached up to 23 m in depth, and were lined with wooden revetting. Even the baskets for transporting ore have survived. The output includes three forms of ingot, axes, ge-halberds of distinctive Han type and drums. Indeed the mines saw intensive activity during the Iron Age. The deep shafts recall the mines of Tonglūshan to the north. Crucially, a radiocarbon determination from the rattan lining of a mine shaft 10 m deep from the Thengkham South C locus has returned a date of 2843 ± 20 BP; cal. 1071–922 BC (Cadet et al. 2019). According to LIA results, copper comprising the bronze spear with burial 76 at Ban Chiang was sourced at Vilabouly (Pryce 2019). The human bone collagen from this individual has been dated to 1056–919 cal. BC (Higham et al. 2015).

The Consumer Sites

The impact of copper-base metal on prehistoric Southeast Asian communities, if any, is best evaluated on the basis of settlements where there was a seamless continuity between Neolithic and Bronze Age phases of occupation. Three sites on the Khorat Plateau of Northeast Thailand satisfy this condition: Non Nok Tha, Ban Lum Khao and Ban Non Wat. We can also involve sites where there is a viably large sample of evidence for the Bronze Age occupation. These include Ban Na Di, Ban Prasat, and Ban Chiang.

Non Nok Tha is a small and low mound located on the eastern rim of a Phu Wiang, a monadnock on the eastern rim of the plateau (Bayard & Solheim 2010). Excavated in 1966 and 1968, it has been employed as a vehicle for assessing the social organization of a Bronze Age community multiple times. The cultural sequence is based on successive mortuary phases beginning with Neolithic Early Period (EP) 1 and 2. EP3 saw the first evidence for bronze grave goods (Fig. 3), proceeding into eight Middle Period (MP) phases.

Bayard has argued that two affiliative groups distinguished by a particular form of pot placed with the dead evidence an inequality since those with one of the forms contained more mortuary offerings. Bacus (2006) concluded that females were distinguished by a greater wealth. MacDonald (1980) had



FIGURE 3

Non Nok Tha was once said to be one of the earliest sites to reveal bronze technology in the world. This axe was then described as “the World’s oldest socketed tool”. It has now been dated to ca. 1000–800 BC.

Non Nok Tha as a component settlement of an emerging chiefdom. All three interpretations had these social forms within an extraordinarily long period of occupation: Bayard’s two affiliative groups for example, would have placed their dead in this cemetery for at least 100 generations.

We now have established the crucial chronology for this site (Higham et al. 2014). The initial Neolithic settlement began in the 14th century BC, with the transition onto the Bronze Age in ca. 1000 BC, just as the mines at Phu Lon were opening up 130 km to the north. The Bronze Age cemetery accumulated over a handful of centuries with the graves laid out in rows. Pottery vessels and stone adzes were placed in the 11 complete Neolithic graves an average of 3.5 for the former and 1 for the latter. Four graves contained pig and cattle bones; there were three grinding stones and two shell beads. What happened when copper-base artefacts entered exchange networks? There are 53 relevant and relatively complete burials. An average of 6.5 pots were found in each. Shell disc beads that might have an exotic origin averaged 22 per person. There were four shell bangles and 22 whetstones. Casting of bronzes occurred, seen in the presence of two burials with crucibles and one with a bivalve axe mold. When one includes every burial whether complete or not, we find that in 217 graves there were 28 bronze bangles shared between five individuals, and five socketed axes. Those interred with bronzes, crucibles or molds did not stand out as being wealthy in any other sense, other grave goods being confined to pig

and cattle bones, grinding stones, shell beads and bangles, stone adze heads, bone tools, bivalve shells and red ocher. Bayard set a benchmark of 15 mortuary offerings to distinguish between wealthy and poor burials. There is a steady gradation to the richest, with 32 items, on the basis of which Bayard has suggested some social ranking. But locally made pots are the dominant offering, set against just four possibly exotic shell bracelets and a few beads.

The Bronze Age cemetery at Non Nok Tha was of relatively brief duration. The graves were set out in rows and there was little change in the form of the pots placed with the dead. The graves were poorly endowed with offerings and demonstrably exotic ornaments were very rare. There was thus no great social change with the advent of copper base metallurgy.

Ban Lum Khao

Ban Lum Khao is a late Neolithic and Bronze Age settlement located in the upper reaches of the Mun River catchment (Fig. 1). Due to looting, the excavated area lay on the site margins (Higham & Thosarat 2004b). The Neolithic occupation has been dated between ca. 1400–1100 BC with the highest probability density region being 1275 BC (Higham 2004). The Bronze Age graves have been dated on the basis of freshwater bivalve shells and shell beads, since no bone collagen has survived. One cannot rule out the possibility that both shell sources had inbuilt age, perhaps as heirlooms, but the resulting chronology places the burials in the period 1200–700 BC. There are eight intact Neolithic burials, and, as at Non Nok Tha, mortuary offerings are dominated by pottery vessels with an average of 3.25 in each grave. One man wore 786 shell beads and a woman had one. There were pig bones in two graves and overall one bivalve shell, one antler and an exotic marble bangle.

The early Bronze Age graves, again as at Non Nok Tha, were laid out in rows. Although fragments of crucibles and molds have been recovered (Fig. 4), just one undoubtedly in situ bronze grave good has been found in the sample of 95 burials. The offerings accompanying the dead comprise pottery vessels, shell beads, bangles of shell and marble, pig and dog bones, red ocher, anvils for shaping pots, spindle whorls and bivalve shells. A series of statistical tests have been applied to this sample. The raw data do not suggest that any individual or row stood out on the basis of elaborate rituals or particularly prestigious burial goods. The average number of grave goods for each row varied from 2.8 to 8.8. On the basis of age at death, those dying between 30–39 had a moderate increase in grave goods compared to their contemporaries. Men and women were given similar treatment and no group stood out for more than the norm for exotic ornaments (O'Reilly 2004).

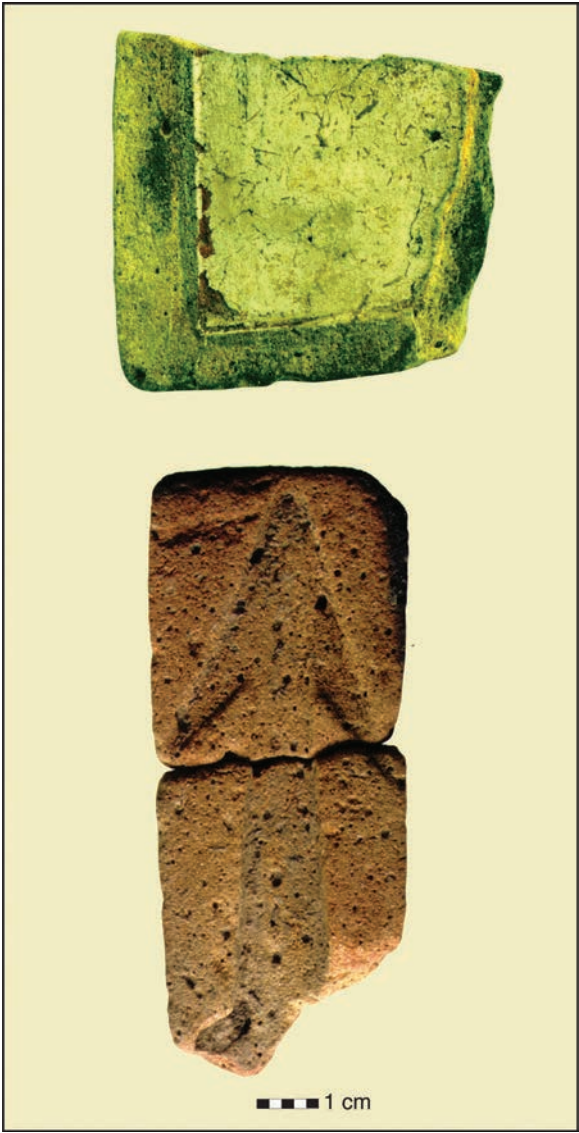


FIGURE 4 Although no bronzes were placed with the dead at Ban Lum Khao, casting took place there.

Ban Na Di

This site is located in the Sakhon Nakhon Basin in the northeastern part of the Khorat Plateau. Excavations in 1981–2 revealed Bronze and Iron Age

occupations, that included clay-lined hearths for melting tin bronze prior to casting. These working stations included crucibles and stone mold fragments for casting a socketed axe, arrowheads and bangles.

The human bone collagen dates place the Bronze Age burials in two phases between 800–500 BC followed by a transition into the first graves with iron mortuary offerings (Higham et al 2015). Of the 36 burials, just three contained 23 bronze bangles. Otherwise, pottery vessels dominated the list of grave goods. Two areas ca. 30 m apart were excavated and it was interesting that those in one of these had a greater range of offerings than in the other. For example, the clay animal and human figurines, slate, trochus shell and marble bangles predominated in one of these areas. When broken, these exotic bangles were repaired with bronze ties. I concluded that the Bronze Age inhabitants had “a system of flexible lineage ranking of which the unequal distribution of valuables in cemetery contexts are the archaeological embodiment” (Higham 1984:538).

Ban Chiang is located ca. 20 km north of Ban Na Di. Excavations in 1974–5 revealed a sequence that began in the Neolithic and proceeded through Bronze Age occupation into the Iron Age. For long contentious on the basis of its chronology, this impasse has been settled with the dating of human bone collagen (Higham et al. 2015). The 54 new radiocarbon determinations place the initial settlement in ca. 1500 BC with the transition into the Bronze Age, based on the association of bronzes with human burials, in ca. 1000 BC. Graves at this site were very poorly endowed with mortuary offerings. Burial 76, dated 1025–935 BC, contained a socketed spear and one pottery vessel. The child in burial 38 was buried with one pot and wore five anklets. Later graves present the same pattern. Burial 23, dated to the mid first millennium BC, contained an older male wearing four bangles with a socketed axe by the head as well as a pot and a cache of clay pellets. Little can be said of the fragments of bronze from non-mortuary contexts because of the likelihood that larger items would have been recycled.

The Upper Mun Valley

The Mun River rises in the Petchabun Upland and flows eastward to its confluence with the Mekong. Its upper reaches are strategic in their proximity to a pass over the Petchabun Range that links the Khorat Plateau with the Central Plains of Thailand and importantly, the copper mines of the Khao Wong Prachan Valley. To the east, the Mun River is a natural conduit for the transit of

ingots from Vilabouly. During the Bronze Age, marine shell and marble ornaments were valued, as seen in the care given to repairing broken bangles at Ban Na Di. In the 1980s, a distinctive form of ceramic vessel was turning up in the Bangkok weekend market. They were traced back to a village called Ban Prasat, where villagers were systematically looting for saleable antiquities. The Fine Arts Department sent a team to excavate in the center of this large moated settlement and a square measuring 8x8 meters was opened. After a layer containing Iron Age burials was examined, the excavators encountered a tightly grouped assemblage of Bronze Age graves containing the same pots that were seen in Bangkok. When compared with other known Bronze Age sites in Thailand, the burials were very richly endowed with mortuary offerings, one in particular standing out for the tens of pottery vessels, shell ornaments and socketed copper-base axe associated with an adult male (Fig. 5; Monkhonkamnuanket 1992).

Ban Non Wat is another moated settlement located 10 km west of Ban Prasat. Ten seasons of excavations from 2002 have opened a large area in the center of this site, as well as smaller squares at intervals across the entire settlement (Higham & Kijngam 2009, 2012a,b). The occupation of this remarkable site began in ca. 20,000 years BP seen in an infant grave and shell midden representing early hunter gatherers. A community of fully-fledged rice farmers



FIGURE 5 The Bronze Age burials at Ban Prasat were the first hint of social elites in the Mun River region. Note the partially covered male burial bottom right, with many pottery vessels and a copper-base axe.

reoccupied Ban Non Wat in ca. 1650 BC (Higham and Higham 2009). Their burials contained a range of mortuary offerings. There are 16 adult and 14 infant graves in which pottery vessels of considerable quality dominate. The adults have an average of 2.5 pots per burial, the infants an average of 2. Four adults were interred with a stone adze and several with pig bones. There was just one shell bangle, but interestingly, seven cowrie shells were found with two adults. These had to come from a remote marine source, showing that long distance exchange was in place. A second Neolithic phase has been dated to 1250–1050 BC. There are 28 adult graves, and these contain just 29 pots of a quite different, simple form when compared with Neolithic 1. There were hardly any other grave goods: ten shell beads, two bivalve shells, two pig bones and 10 fish bones.

The transition into the next phase assumes significance by the fact that the pottery vessels continued virtually unchanged, but the mortuary offerings greatly increased. Dated to 1050–1000 BC, there are just seven burials, ascribed to this first phase of the Bronze Age. Three of these contain young adults, the rest comprise a ten-year old, an infant aged about two at death, a neonate and a pre-term fetal infant. The number of pottery vessels rose to as many as 17 with a two-year old and 14 with a young female who also wore 2382 shell beads. Another young probable female had 1009 beads. The mortuary rituals involved deeply-cut graves, wooden coffins and in two cases, a shell shroud over the corpse. And most significantly, there were eight exotic trochus or tridacna bangles, and five of the seven graves contained a socketed copper-base axe, even that of an infant (Figs. 6, 7).

An important point about the transition into Bronze Age 2, is that the graves of the latter slot in against those of the former (Fig. 8).

This suggests a seamless transition from one to the other, that took place in about 1000 BC. With this second phase of the Bronze Age, we encounter rows of burials, all of which whether of men, women or infants, were uniquely wealthy. Much has been said of this cemetery (Higham 2011, Higham and Cawte 2021). The data speak for themselves. There are 19 adult and 14 infant graves. Pottery vessel forms proliferated, many were embellished with complex red on buff painted designs and 737 were recovered from the 33 burials. 80,864 shell disc beads, 411 trochus or tridacna marine shell bangles, and 24 marble bangles were worn by the dead. There were also 52 copper base artefacts, including socketed axes, chisels, awls, anklets and bells (Figs. 9, 10, 11). This wealth continued into phase 3A, where 12 adults and an infant were associated with 262 pots, 78,271 shell disc beads, 361 marine shell bangles and 19 bangles of marble. Most of the 36 copper base artefacts were bells on the ankle of an infant, the others comprised axes.



FIGURE 6 Burial 569, Bronze Age 1 at Ban Non Wat, dated 1050–1000 BC. The woman was interred in a boat shaped coffin, with multiple exotic shell beads and a copper axe seen at the right shoulder. The bivalve shells are thought to symbolize rebirth.

Exchange Links

We have seen that copper from Guangfentou in Yunnan is the likely source for the earliest copper-base artefacts from Oakaie in Myanmar. The lead isotope signature (LIS) for the axe from the grave of an infant at Ban Non Wat does not match any of the Southeast Asian copper mines, and there is the possibility that it, too, was a trade item from an as yet undocumented source in southern China. The LIS for two other Bronze Age 1 axes at Ban Non Wat trend towards the Khao Wong Prachan Valley. With Bronze Age 2 at Ban Non Wat, two axes and a chisel have a close match with the Central Thai mines. There is also a close match between the chronology of each site, and the shape of the axes in question. Two further Bronze Age 2 axes trend towards the Vilabouly source,



FIGURE 7 The copper axes from Bronze Age 1 burials at Ban Non Wat (1050–1000 BC). Note that at the far left is very similar in form to that from the Non Pa Wai founder's burial (figure 2).

as do the axes and arrowheads from Bronze Age phases 2 and 3. Copper from Khao Wong Prachan and Vilabouly also reached Oakaie, distances of 1000 and 1200 km. The bronze spear and some relatively early bangles are also made of copper with a LIS of Vilabouly about 250 km to the east (Pryce 2012, 2019).

The Later Bronze Age

The most revealing evidence for the later Bronze Age comes from Ban Non Wat. Bronze Age phases 3B, 4 and 5 saw a sharp decline in all exotic grave goods, albeit still far greater than at any site in the remoter regions of the Khorat Plateau discussed above. In a combined total of 202 graves, there were two bronze bangles and two arrowheads, 798 pots, 8751 shell beads, 19 marble and 286 marine shell bangles. Set against the extreme rarity of bronzes during these later phases, a young to mid-aged man during Bronze Age 4 (800–700 BC) was interred with 29 clay molds. Four of these were bivalves for casting socketed axes, the rest were unique sets of clay molds that were arrayed in a row, bookended by molds with casting surfaces only on the interior. The molds within were for casting one or on occasion two bangles on each surface (Fig. 12, 13). This innovation was a method for mass production (Higham 2008).

Following an initial period of copper imports, we thus find the establishment of casting of bronzes within the community. This was undertaken by raising the alloy above melting point on small clay-lined furnaces ringed by casting spillage and crucibles, some still complete, others fractured. All crucibles analyzed were for casting tin bronze (Cawte 2008). The furnaces were cut down from the later Bronze Age layers, and the number of crucibles and molds



FIGURE 9 The copper-base hollow core axes from the burials of Ban Non Wat Bronze Age 2 (1000–900 BC).

Bronze in the Iron Age

At Ban Non Wat, the Bronze Age 5 graves merged seamlessly with those of the initial Iron Age during the 5th century BC. This is unique both in itself, and in the size of the sample of burials. There are 15 adult and 6 infant or child BA5 burials. The adults were interred with an average of 5 pottery vessels. They also shared just 300 shell beads, 295 of which were with an adult female, and just two shell bangles. The overriding impression of the mortuary offerings as



FIGURE 10
Burial 455 from Ban Non
Wat; note the anklet with
bells and the copper-base
axe.

a whole was the number of spindle whorls and lumps of grey clay, the latter known to be a mordant in the dying of cloth. Two spindle whorls were found with infants. The community was clearly involved in weaving fabric. There was also the burial of another bronze founder, seen in the clay bivalve mold with a mid-adult man who was also the only individual to be accompanied by copper-base offerings, in this case two arrowheads.

As one moves eastward, we encounter the first graves containing iron. There are two groups, one with the head orientated to the north, the other to the south. They were interred in circular tree-trunk coffins, to judge from the configuration of the broken pottery vessels, cheek by jowl that comprise rows probably proceeding in time towards the east. The northern group comprises 22 complete male and 18 female graves. Even with men, spindle whorls and clay continued to be placed with the dead. There was an average of six pots in each grave. Iron was forged into spears, hoes, a bangle, knife blades and points. An exotic agate bead was found with one man. The range and number of bronzes did increase over the preceding late Bronze Age: four men wore bangles to a total of 32, one young man wearing 27 of them. There was one



FIGURE 11

Burial 197 from Ban Non Wat. This man was buried with several copper base axes, chisels and an awl.

bronze arrowhead and two of the enigmatic socketed implements seen in profusion at Nil Kham Haeng. The women of the northern group were accompanied by an average of four pots. Spindle whorls and clay were found frequently. There were three iron bangles and two knife blades and an old adult wore an agate, a carnelian and a glass bead, all indicating ultimate contact with South Asia. One bronze ring was worn by an older female. There are 24 infant or child burials. A seven-year-old wore a bronze bangle.

There are 16 females, 35 males, 18 adults of uncertain gender and nine infants or children in the southern group. The mortuary offerings are virtually identical to the northern set. Women were interred with an average of four pots. There were some with spindle whorls and clay. Iron was rare, with four chisels,



FIGURE 12
With Bronze Age 4 at Ban Non Wat (800–700 BC), we find that there were resident bronze founders. This man was interred with 29 molds for casting bangles and axes.

four knives and an unidentified object. One mid-aged female wore two glass ornaments, another young person three carnelian beads, and two others one agate bead each. Just eight bronzes were recovered, four bangles on the arms of two individuals. Men were buried with an average of 4.5 pots that often contained fish skeletons. Three had an iron hoe, one had five knives and another three an iron knife each. There were seven iron spears, three points and two billhooks. One man wore 10 bronze bangles, two others had one apiece. Other bronzes comprised a ring, an anklet, and three spears with a bronze haft and iron blade. One mid to old man was interred with a complete crucible. Bronzes with adults of unknown sex comprised two rings, five bangles, eleven anklets and an arrowhead. A remarkable pair of bronze anklets with a nine-month-old



FIGURE 13 One of the bivalve clay axe molds found with a bronze founder at Ban Non Wat.

infant were cast by lost wax and were filled with clay balls to sound like a bell or rattle (Fig. 16). A second infant of the same age wore two very broad decorated bronze bangles.

As with the Late Bronze Age, ceramic vessels from the Iron Age 1 graves remained similar in form, and continued to be packed with fish. Some people were interred with spindle whorls and grey clay. But there were also changes, seen in the increase in bronze ornaments, bimetalllic spears, iron spears and tool kits, lead castings, exotic stone ornaments and domestic water buffalo bones. The relatively intact burials have been analyzed on the basis of principal component analysis (Higham & Manly 2012). The results reveal that the majority of individuals were grouped closely together in one nucleated group irrespective of their age, group affiliation or sex. However, a handful of graves are separated from the rest on the basis of a larger and more varied set of mortuary offerings. There is no indication, however, that these people were distinguished by their location in the cemetery, age, sex or their group. Despite the possible presence of two nuclei of relatively wealthy burials, we have not found any evidence for hierarchic social distinctions at Ban Non Wat in the early Iron Age. At least two of the men interred were probably bronze founders, given the mold with one and crucible with another. This matches the recovery of clay



FIGURE 14 Many hundreds of molds were found in later Bronze Age contexts at Ban Non Wat, for casting spears, axes and bangles. Bottom left, a casting furnace and bottom right, a complete casting crucible.

lined furnaces in Iron Age occupation layers, along with molds and caches of the plugs to create the deep sockets of bronze axes.

Noen U-Loke

Continuing the deployment of bronze during the Iron Age takes us two km west of Ban Non Wat, to Noen U-Loke, another large, moated settlement. Here there are four phases of burials, and it is the third that will be reviewed. Dating to ca. AD 250–400, burials were configured as tight groups comprising about 15–18 men, women and infants with a space between each group. In some cases, clay-lined coffins have survived, and graves were filled with rice. The



FIGURE 15 Casting took place at Ban Na Di during the later Bronze Age, seen in crucibles and molds.

wealth of these burials has been described in detail expressed in exotic agate, gold, silver, glass and bronze ornaments (Higham et al. 2007). A mid-aged woman for example, wore a necklace of 68 gold and many agate beads, and two agate pendants. Bronze coils had been inserted into her ear lobes. Other bronzes included at least 38 bangles, 64 finger and nine toe rings, while one of her rings was silver, as was a toe ring. In a second of these clusters, a man wore three bronze belts, 75 bangles on each arm, 67 finger rings, four toe rings, two weighty bronze rings at the neck while his ears were ornamented with silver and gold coils (Fig. 17). Many glass beads and at least nine pottery vessels and an iron knife were also placed in his grave. A third cluster contained another man, aged 25–30 at death. He wore four bronze belts, and bronze discs in his ears. Other bronzes included 20 bangles, 124 finger rings and 33 toe rings. Any one of these three wore more bronze than in the entire mortuary assemblages of Ban Chiang, Ban Na Di and Non Nok Tha combined. Nor are they by any means the only wealthy individuals during this phase at Noen U-Loke. Within a century or two, early states were forming in the Mun River region and the lowlands of Cambodia to the south.



FIGURE 16 This infant of Iron Age 1 at Ban Non Wat was interred wearing an innovative pair of anklets containing clay balls to act as a rattle or bell.

Synopsis and Conclusions. The Initial Stages of the Southeast Asian Bronze Age

There was a progressive southward movement of individuals with knowledge of mining, smelting copper ore and casting a limited range of artefacts that owes its ultimate origins in the Asian steppes, thence into the Yellow River catchment. From there, several likely routes can be traced, through Sichuan into Yunnan and the central Yangtze River region into Lingnan. The deployment of copper alloys varied markedly with the requirements and aspirations of the communities that were exposed to this novel technology. In the Central Plains, new casting methods involving piece molds produced ritual vessels, alongside bivalve mold casting of smaller implements. A distinctive tradition of casting massive human masks, figures and trees arose at Sanxingdui in Sichuan. Further south, when from ca. 1100 BC copper technology penetrated Southeast Asia, artifacts long since fashioned in stone and bone, such as axes,



FIGURE 17
Burial 14 from Noen U-Loke, a man wearing
150 bronze bangles, three belts and 65 finger
rings. ca. 250–400 AD.

chisels, awls, fish hooks, bangles, and projectile points were now replicated in copper or bronze.

It is highly likely that prospectors with prior knowledge of the properties of copper ore travelled into Southeast Asia. At least four mine complexes have been located with dates ranging in southern Yunnan at 1400 BC to an inception of mining by 1100–1000 BC at the other three. At the best-documented sites of Nil Kham Haeng and Non Pa Wai in Central Thailand, smelting was undertaken in what has been described as rudimentary methods in crucibles covered by a furnace chimney. The output included deep socketed copper axes, fish hooks and ingots.

At Ban Non Wat the first copper artefacts were, in all likelihood, imported. There is no compelling evidence for local casting. It is impossible to identify a precise causative link between this passage of copper base artefacts along the exchange networks of Southeast Asia with social change in the recipient communities. Nevertheless, it is possible to document changes in social structure, or indeed a lack thereof, based on mortuary sequences that span the late Neolithic and the initial Bronze Age. This requires an acceptance of

a relationship between how individuals were interred, and what they were accompanied by during that consistent rite of passage, burial at death.

The late Neolithic burials at Ban Non Wat were modestly endowed with pottery vessels and little else. When the first copper axes appeared in graves, while the pottery forms continued, their number greatly increased. One grave containing a woman was cut deeply and the coffin had a pointed prow as in a boat. Many more exotic shell beads were worn and some of the dead lay under a shellfish shroud. What particularly intrigues is the presence of copper axes, one imported from an unknown source and two from Central Thai mines, that would have been of little technical value due to the inherent softness of unalloyed copper. One such axe was placed in the grave of a two-year-old. It is hard to avoid the conclusion that these were regarded more as new symbols of ownership and perhaps status, rather than as useful implements.

This period was short lived, perhaps no more than a generation or two, before it was succeeded by a burial ground of remarkable and unanticipated wealth. There are several relevant issues. Without exception, all the dead were wealthy: men, women and infants. Laid out in rows, some were partially disinterred and then the bones were carefully replaced in the grave. Infants lay in graves large enough for an adult to make room for the many associated ceramic vessels. The vessel forms were now immensely varied and often bore painted designs. No grave was disturbed, their locations were, it seems, known. Apart from the copper axes, chisels and awls, there were virtually no manufacturing tools such as clay anvils for shaping pots, or spindle whorls for making twine, suggesting that the elite dead were not involved in spinning or potting. However, the weight of exotic shell and marble ornaments is far beyond any contemporary site in Southeast Asia other than nearby Ban Prasat, as is the number interred with copper-base offerings. This new medium for ownership and display reflects the existence of what has been described as a lineage of social aggrandizers, wealthy in the extreme, but ephemeral. The burst of wealth did not last for more than perhaps four to six generations (Higham 2011).

A parallel phenomenon occurred at Ban Prasat where, as at Ban Non Wat, the graves were located centrally within the settlement. In contrast, the excavation at Ban Lum Khao took place on the site's periphery. Here, we find another burial ground comprising rows of graves that was contemporary with Bronze Age 2 at Ban Non Wat, to judge from the more limited range of pottery forms involved. However, those interred were markedly and consistently poorer than the Ban Non Wat aggrandizers. None were partially exhumed, none had a copper-base mortuary offering.

When the area excavated is such a small fraction of the extent of each site, the resulting conclusions must be treated with caution. There might for

example, have been a wealthy group interred at Ban Lum Khao, and there is solid evidence for relatively poor Bronze Age 2 burials at Ban Non Wat in different parts of the settlement. What one can say, however, is that there was a distinctly wealthy cemetery in the center of Ban Non Wat and a markedly poorer contemporary group on the periphery of Ban Lum Khao.

From BA 3B at Ban Non Wat, the mortuary rituals persisted but there was a drastic reduction in the number of pots and exotic bronzes, marine shell and marble ornaments. However, the period from ca. 800–700 BC witnessed the establishment of on-site bronze casting. We find the clay-lined furnaces with associated casting spillage, crucibles and molds. The near 400 molds are the key to knowing what was being cast, by now in tin bronze. One form was for large tools and weapons, such as axes and spears. Another cast bangles. These two appear in roughly equal numbers (Cawte 2012). A bronze founder was interred with molds for casting axes and bangles. Contemporary contexts at Ban Lum Khao and Ban Na Di to the north also contain virtually identical furnaces, crucible and molds, while at Non Nok Tha, founders at this period were interred with bivalve molds. However, very few bronzes were now placed with the dead. This might, of course, be the result of small sampling of these large sites, and any explanation has to be speculation. One possibility is that copper had lost its cachet, and was seen as too commonplace to be used to advertise social status by conspicuous immolation.

The adoption of iron technology in the fifth century BC saw at Ban Non Wat a palpable but not major increase in mortuary bronzes. There were certainly more bangles worn, but no large tools or weapons other than bimetallic bronze and iron spears. No enclave of elite individuals was found. However, with the third phase of the Iron Age at Noen U-Loke, dated to ca. 250–400 CE, there was a quite remarkable surge in the complexity of mortuary rituals that involved clay coffins, exotic gold, silver, agate and glass ornaments, and bronzes. This phenomenon, matched at nearby moated sites of Non Ban Jak and Non Muang Kao, has been ascribed to the reaction to a sharp deterioration in the climate involving less rainfall. In a complex interacting model, we find a nexus of related changes: as aridity set in, so moats were constructed to store water that was reticulated into permanent bunded rice fields. Fields were now cultivated with iron ploughshares hauled by domestic water buffaloes. Rice harvests, now brought in with iron sickles, were abundant and predictable, generating wealth for those owning the best land (Wohlfarth et al. 2016, Castillo et al. 2018). The rich local salt deposits were exploited and exchanged. The wet environment, however, was deleterious to human health. Wading through the rice fields to

plough, plant, weed and harvest brought people into contact with a range of potentially lethal pathogens, not to mention the suitable habitat for malarial mosquitoes. The upshot was a remarkably high incidence of infant mortality (Higham & Kijngam 2020).

Bronze, it is argued, had no seminal role in this rise of social inequality; it was a human choice to use the output of the Vilabouly copper mines as visible emblems of wealth, achievement and status. Any man wearing 150 bangles, three belts and 60 finger rings, not to mention gold and silver ear discs, would have radiated sunlight. These large moated sites litter the floodplain of the Mun River and spill over into northern Cambodia. But they cut out in the northern Khorat Plateau. There at Ban Chiang, we find as yet no matching weight of bronze mortuary offerings, just a profusion of elegantly painted pottery vessels. The deployment of bronzes at this late stage of the prehistoric sequence was regional. In the Upper Mun region, sites straddled a natural exchange route, a choke point for trade from Central Thailand. It is exactly the same to this day, Nakhon Ratchasima, 'Royal Frontier City', being the biggest and richest city on the Khorat Plateau. In the more remote and provincial northern reaches of the plateau, social change moved at a slower pace.

The majority of prehistorians with experience of excavating and interpreting Southeast Asia's past employ the term 'Bronze Age' as a useful descriptor for a period of about six centuries when copper with admixture of tin was the being mined, smelted and cast. I for one have never seen bronze as a stimulant or prime mover in the rise of social inequality. Rather, our still limited information must be employed to identify and assess what different communities across the extensive and varied terrain of Southeast Asia chose to do when confronted with the sight and the properties of copper metal. As we have seen, this varied regionally and over time, and certainly differed from the way in which bronzes were cast and used in the states of Sichuan, the Shang, Zhou, and aristocrats of Panlongcheng (Liu et al. 2019).

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