

Ban Chiang: The Metal Remains in Regional Context. A Review Essay

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ABSTRACT—This article reviews the third volume in a trilogy that assesses the metal remains from Ban Chiang in their regional context (White and Hamilton 2019). Having reviewed its contents, it addresses two scenarios. The first, advocated by White, favours a long chronology for both bronze and iron within a social context of small-scale communities with little social differentiation. The second supports a short chronology, that the strategically favoured upper reaches of the Mun River witnessed a rise in social elites, which coincided with the first evidence for bronze metallurgy, and a second in the early 1st millennium CE as a reaction to climatic aridity.

Ban Chiang, Northeast Thailand, Volume 2C: The Metal Remains in Regional Context edited by Joyce C. White and Elizabeth G. Hamilton (Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology, 2019). ISBN: 9781931707930 (hard cover). US\$69.95.

Introduction

This volume is the first synthesis of the Bronze and Iron Ages of Thailand since my book, *The Bronze Age of Southeast Asia*, was published (Higham 1996). There are four contributors: Vincent Pigott and Oliver Pryce are archaeometallurgists, who have directed excavations at key sites, the former in Central Thailand, the latter in Myanmar; Elizabeth Hamilton is also an archaeometallurgist; and Joyce White is a prehistorian. Having previously described the metal remains from Ban Chiang and small test squares in three nearby sites (White and Hamilton 2018a and b, reviewed by Higham 2020), the editors now summarise their findings in the broader context of prehistoric Thailand.

Ban Chiang, located in the northern reaches of the Khorat Plateau, is best known in Thailand for highly decorated late Iron Age pottery vessels. There have been several excavations there, the metal remains presented in these publications coming from two seasons of fieldwork in 1974-5, directed by Chester Gorman and Pisit Charoenwongsa (University of Pennsylvania Museum and the Thai Fine Arts Department). I was a member of the research team and participated in the excavations at Ban Chiang. Chester Gorman died in 1981, and the University Museum appointed Joyce White to publish

the results of the two seasons of excavation. Her acceptance of this responsibility was a courageous move by an inexperienced graduate student, but she did have the advantage of immediate access to all artefacts for analysis in the University Museum's MASCA laboratory. During the course of the last thirty-eight years, one volume has reported on the human remains (Pietrusewsky and Douglas 2000), and three volumes on the metal, published in 2018-9. The unparalleled luxury of having all artefacts available in the University Museum since 1976 has allowed Elizabeth Hamilton, as the principal specialist contributor, to co-ordinate the analyses undertaken by others during the past forty-four years. Under current Thai government regulations, this would be impossible.

The 1974-5 excavations covered a comparatively small area, and the cultural material available for analysis is modest. In terms of the data available to document copper-base metallurgy during what I, and others, term the Bronze Age, there is only a spear, an axe and a handful of bangles from graves. In addition there are four moulds of unknown purpose in terms of what they might have cast, about seventy-four fragments of crucible and several hundred fragments of copper-base metal, most probably bronze from occupation contexts. Unlike most comparable sites, no casting furnaces to bring bronze to melting point were recovered, and there were no burials of founders, those who cast bronzes, containing their moulds or crucibles. Iron artefacts were also relatively sparse. This is most probably due to the very small areas excavated.

Having provided a detailed analysis of the metal remains from Ban Chiang in the preceding volumes, White and Hamilton turn for comparative data to all other Thai sites, that have yielded evidence for copper-base and iron metallurgy and that are published in English. The basic data comprise how the dead were interred, how copper mining and smelting, and iron forging, were organized, what implements were made, and how metal was deployed in the communities that engaged in exchange, not only of bronze or iron, but other identifiable exotic substances. Any changes are necessarily weighed against a chronological framework. In synthesizing information from different sites and regions, the authors have had to confront a number of problems. There are few sites available, full and final excavation reports are rare, and White and Hamilton find serious deficiencies in the depth to which metal remains have been analysed. When considering the social contexts of metallurgy, Joyce White presents results in her preferred paradigm, that she compares with other approaches and interpretations.

The preceding two volumes have explored four key issues. As Hallam Movius long ago stressed of all prehistoric endeavours: "Time alone is the lens that can throw it into focus" (Movius 1960: 355). Any assessment of socio-technical change in Thailand necessitates a robust chronological framework. White's dating of Ban Chiang is based on half a dozen internally contradictory radiocarbon determinations from the organic fraction of the temper of pottery vessels, a technique renowned for its unreliability (Higham et al. 2019; White 2008; White and Hamilton 2018a). On this basis, she places the earliest evidence for copper-base metal in the range of circa 2000–1750 BC. However, a new series of more than 400 radiocarbon dates from Ban Chiang itself and other regional mining and consumer sites, rigorously and necessarily analysed within a Bayesian framework, unanimously place this transition in the range circa 1200–1000 BC (Higham et al. 2015; T. Higham et al. 2020). White does not accept their validity

(White and Hamilton 2018a). This is important. The longer the duration of the Bronze Age in Thailand, the slower the rate of perceived cultural changes.

Timing is also vital in identifying origins. How and when did the knowledge of the means to convert a coloured rock into a metal axe or bangle reach Thailand? White's preferred long chronology rules out an origin in the complex states that were establishing themselves in the Yellow and Yangtze riverine plains. She, therefore, has leapfrogged these to pinpoint origins in a direct movement from the enigmatic Seima-Turbino horizon of the Siberian Altai (White and Hamilton 2009, 2014). The short chronology, however, follows a precise archaeological trail of the southward expansion of the necessary mining, smelting and casting expertise from the north; White dismisses this transmission as "Sinocentric" (White and Hamilton 2009; Higham et al. 2011).

A consistent theme, that runs through all three volumes, is White's insistence that her paradigm is new and that it provides new insights into the relationship between societies and metals in prehistoric Thailand. A paradigm is a theoretical framework within which to interpret and understand what happened in the deep past, a past with no written records. Even a superficial glance at the tenets of her "new" paradigm reveal that it is virtually standard procedure. What did people desire to be cast from bronze, or later, forged from iron? How did new and complex technological processes reach Thailand? How were they organized, and by whom? For example, was mining and smelting a seasonal dry season activity undertaken by villagers, or did an organizing elite take charge, profiting from the ownership of the metal produced by workers under their direction? If rare bronzes entered exchange networks to reach consumer communities far from the ore sources, were they cornered by social aggrandizers, or did everyone have an equal opportunity to wear a bangle, or wield an axe? Did those with the skill to make crucibles and moulds for melting and casting ingots live in consumer villages, and if so, when? These issues lie at the heart of understanding the social impact of metals and the sociotechnical systems that eventuated. Few if any would disagree with these issues.

However, in order to accentuate the novelty of their new approach, White and Hamilton set out to "debunk the conventional paradigm" (White and Hamilton 2018c: 49). This paradigm they associate with colleagues, who use what is known as the "Three Age System". Most specialists, including White and Hamilton themselves, use this as a convenient means of dividing the sequence into "Neolithic" food-producing society with no knowledge of metal, a "Bronze Age" with copper-base metallurgy, and finally the "Iron Age". White and Hamilton, however, have now rejected the terms Bronze and Iron Age in favour of bronze and iron periods, a change of stunning vacuity. They further, characterize those who have used, and still use, the Three Age System as essentialists, who in their apparent slavery to the so-called old paradigm, insist that the adoption of bronze casting inevitably led to the rapid rise of controlling elites in society, along with warfare, entrenched social inequality and the rise of states, in essence, the top-down command of the many by the few. This article will consider these issues further.

Prehistoric copper mining and smelting in Southeast Asia: evidence from Thailand and Laos

Following a brief introduction by Joyce White, “Providing a Regional Socioeconomic Context for Prehistoric Metallurgy in Thailand”, the second chapter of the book begins on a high note. Vincent Pigott is the first to consider Southeast Asia metallurgy in the round, and here in “Prehistoric Copper Mining and Smelting in Southeast Asia: Evidence from Thailand and Laos” he has written a masterly synthesis of the three documented copper mining and smelting locales, two of which—the Khao Wong Prachan Valley (KWPV) and Phu Lon in northern Northeast Thailand—were excavated by the Thailand Archaeometallurgy Project co-directed by himself and Surapol Natapintu. Non Pa Wai, in the former area, is a particularly important site, counted among the largest prehistoric copper production sites known in Eurasia (Pigott et al. 1997; T. Higham et al. 2020). Pigott (Pigott 2019: 29) describes how the basal deposit comprises Neolithic occupation and burials, that date from the late 3rd into the early 2nd millennium BC. There was then a hiatus before we encounter the first evidence for copper smelting in the form of founder’s burials, crucible fragments and slag. Dating this sequence is clearly of the first importance, but the task is complicated by the “intrusive metallurgical remains from the Industrial Deposit immediately above the basal deposit. Pitting and other anthropogenic disturbance from this deposit penetrated ... into the underlying basal deposit creating a potential for mixing industrial deposit materials with those in the underlying basal deposit.” (Pigott 2019: 29; Pigott et al. 2010).

Pigott’s opening paragraph emphasizes this vital issue when he stresses that “There is little at or in archaeological sites that remains static over time. Bioturbation, leaching, organic decay, and erosion are among the various natural agencies at work at sites and on the artefacts contained within over the *longue durée*.... thus entropic change is inevitable; nothing remains the same” (Pigott 2019: 5). This wise dictum we will meet again when reviewing the later chapters of this volume.

However, with the application of a Kernel Density Estimate approach, based on a new set of radiocarbon determinations from charcoal and, in particular, short-lived seeds from the KWPV sites, T. Higham et al. (2020) have now massively reinforced the dating of the advent of copper smelting within the span circa 1200–800 BC. This has important implications when we turn to dating the sites to which KWPV copper was being exchanged. The industrial deposit at the 5 ha. KWPV site of Non Pa Wai, we learn, also contained potsherds and animal bones, but no further burials or evidence for domestic occupation, hence it is not known if the exploitation of copper was undertaken by full time specialists or by seasonal workers who lived elsewhere, whether access was under some form of social control, and if so, how it might have changed over time. Where did the copper miners live? If we are to match the social information gained, for example, from Shennan’s analysis of copper mining in the Mitterberg during the European early Bronze Age, we need to open a very large excavation at Non Mak La. This is a settlement site close to the KPWP smelting sites (Shennan 1999).

The Vilabouly complex, in the uplands of Laos 300 kilometres to the east, has been intensively examined by Thongsasay Sayavongkhamdy, Viengkeo Souksavatdy and

Nigel Chang, and is furnishing remarkable new information on copper production (Pryce et al. 2011; Cadet et al. 2019; Tucci et al. 2014). Timber-lined shafts over twenty metres deep gave access to copper ore, a mining technique that Pigott compares with that practiced at Tonglūshan far to the north in China's Hubei Province. It is, again, too early to be definitive on the social organization involved or how it changed over time. Tucci et al. (2014) advance alternatives, one of which was heterarchic exploitation with no elite dominance, a second being an outpost of the 1st millennium BC Zhou Dynasty with its heavy demands for copper. One important point is that we now have radiocarbon determinations that place the initiation of mining by about 1000 BC.

Lead isotope characterization and provenance of base artefacts from Ban Chiang and Don Klang

In the third chapter, "Lead Isotope Characterization and Provenance of Copper-base artifacts from Ban Chiang and Don Klang", Oliver Pryce, who directs the pioneering Southeast Asian Lead Isotope Project (SEALIP), presents a succinct review of his Lead Isotope analyses (LIA) of seventeen copper-base artefacts from Ban Chiang, ranging from the earliest mortuary bronze, a spearhead, to late period fragments. This has redefined the source of the Ban Chiang copper. White and Pigott (1996) initially speculated quite reasonably that the Phu Lon mines on the right bank of the Mekong River to the north-west might have been exploited seasonally by the inhabitants of Ban Chiang. However, the LIA data link a spearhead from burial 76 at Ban Chiang with the Vilabouly mines 300 kilometres to the east. Joyce White insists that this spearhead dates to circa 2000 BC, a full millennium before the earliest evidence for mining at Vilabouly. Two radiocarbon dates from burial 76 bone collagen have been determined: 1056-919 cal. BC (Higham et al. 2015). Joyce White finds these inconveniently late (White 2018: 36-40).

Pryce's research is opening new vistas on the remarkable distances, that were involved in early contacts between mining and consumer sites, and the different linkages. Thus, current evidence now suggests that the Upper Mun Valley sites were receiving some copper from Central Thailand before Vilabouly became the dominant source, while this latest LIA evidence links Ban Chiang with upland Laos (Pryce 2012).

The archaeometallurgy of prehistoric northern northeast Thailand in regional context

In the fourth chapter, "The Archaeometallurgy of Prehistoric Northern Northeast Thailand in Regional Context", White and Hamilton spread their wings beyond the four sites, that have been the basis of their exploration into metallurgy hitherto, to summarise what we know of other sites in Thailand. Being restricted to publications in English, their survey omits any reference to Ban Suai, an important Iron Age settlement that lies beneath the Angkorian city of Phimai. The excavation there in 2001 identified significant Iron Age burials with bronze mortuary offerings (Thosarat and Kijngam 2004). Reference to the excavation of Ban Prasat, a key site in the upper Mun River

area, is also missing (Phommanodch 1991; Monkhonkamnuanket 1992). Non Praw is a Bronze Age settlement incorporating twenty-five burials, five of which included bronze axes and bangles (Buranrak 1994). It is briefly mentioned only in the form of a reference to my summary description (Higham 1996).

Sites are treated on a regional basis incorporating the northern reaches of the Korat Plateau, the piedmont of the Phetchabun Range, the upper Mun Valley and the Central Plain. Their review correlates eleven periods with the phases identified at Ban Chiang and the authors' latest iteration of White's chronological framework. They place the transition from the late Neolithic to the Bronze Age at Ban Chiang within the span 2000–1750 BC, and transition into the Iron Age over 900–700 BC (Table 1). Neither is supported by any other site in Southeast Asia. This chronology flies in the face of all recent and reliable radiocarbon determinations. In terms of the sites with which I am personally familiar, there are many inconsistencies and omissions. On page 100, it is stated that no iron was found at the site of Ban Lum Khao. This is true. However, in Table 4. 4, the third mortuary phase at this site is placed in the Iron Age. When referring to the evidence for metallurgy at Ban Non Wat, they overlook the vital information in Hayden Cawte's (2008) doctoral dissertation despite its being referred to in the published excavation reports for the site.

A regional synthesis of early metal technological systems in prehistoric northeast and central Thailand

The fifth chapter, by White and Hamilton on "A Regional Synthesis of Early Metal Technological Systems in Prehistoric Northeast and Central Thailand" consists of a regional synthesis based on their reviews of the data available from the comparative sites. This begins by identifying where they find the earliest evidence for metal production. Pottery vessels, decorated with incised and impressed patterns, are almost universally associated throughout Southeast Asia with the initial ingress of Neolithic farmer communities (Rispoli 2008). There are sites where basal Neolithic occupation was succeeded by layers clearly ascribed to the Bronze Age. These sites include: Ban Chiang, Non Nok Tha, Ban Non Wat and Non Pa Wai. A few fragments of bronze and crucibles are occasionally found in disturbed Neolithic layers. No burial anywhere in Southeast Asia with incised and impressed pottery vessels has contained a copper-base artefact. White, however, interprets these fragments as firm evidence for the inception of copper-base metallurgy in Southeast Asia. This chapter then proceeds with summaries of how copper was mined, smelted and cast at production sites before considering how and what was cast in consumer sites. Regional preferences are identified: axes in the upper Mun sites, bangles further north. Founders' burials are a sure signal that casting was being undertaken in consumer villages.

Conclusions: placing metals in social contexts in prehistoric Thailand

The denouement to the three volumes, that focus on the evidence for metallurgy at the site of Ban Chiang, and its regional social context, comes in the final chapter by Joyce

White on “Conclusions: Placing Metals in Social Contexts in Prehistoric Thailand”. The essence of this chapter is her claim that she has generated a new paradigm predicated on the “Basic description of full artifact assemblages that includes technical analyses of representative samples provides the foundation for defining production sequences, technological styles, and consumer demand.” This contrasts with the old paradigm, that she states is concerned with “intact artifacts and assertions of prestige roles and technological levels” (White 2019: 156).

When claiming that a new and dynamic paradigm changes how we understand what happened in prehistory, there is no better way to burnish its value than to compare it unfavourably with an alternative, even that of a fictitious straw man. Since I have excavated and published a significant number of the sites she relies upon in this volume as vehicles for her paradigm, it is only to be expected that she turns to what I have written. Dr. White has conceded that she becomes peevish when she does not agree with colleagues (White 2017: 67), and this is self-evident in her “Critique of the Higham metal age model”, which comes with a strong whiff of sulphur. I am to her an “essentialist”. By employing the “Three Age System”, I have overlooked regional diversity, misinterpreted social phenomena, reified boundaries and profoundly oversimplified the actual situation by attempting to fit the data into an outmoded model, which claims that bronze necessarily involves the rise of the state. I remain in a time warp of the 1970s and 1980s, an “Anglophone processualist”, ignoring advances in archaeological theory by constantly seeking to identify who controlled the source and deployment of metal. I ignore metal found in non-mortuary contexts, finding the elite and the, so far unique, wealthy early Bronze Age cemetery at Ban Non Wat as “normative”, and ignoring or dismissing data from ordinary burials at other Thai sites. I am, she claims, discomfited that a few fragments of bronze found their way into “Neolithic” layers at Ban Non Wat, as an essentialist arguing that since bronze cannot be found in Neolithic layers, they must be intrusive. By setting aside these fragments as intrusive from a higher and later context, I have firstly coerced this sequence into my preferred “short” chronology, and then championed the rapid impact for the uptake of copper-base metallurgy. I am a technological determinist, distorting the data by requiring that metal be the single factor in the rise of the Ban Non Wat social elites and early Southeast Asian states. I erroneously cite the location of Ban Non Wat as significant, by wrongly stressing that it lies near an exchange bottleneck for goods travelling from Central Thailand onto the Korat Plateau. I stand accused of blindly seeking the origins of Southeast Asian states in the adoption of bronze technology. Her prose drips with peevishness.

In sum, the “stubbornly entrenched paradigm”, which White manufactures before taking issue with it, apparently champions “narratives of elite consumption, warfare, and a normative progressive trajectory for socio-technological change” (White 2019: 156). The latter course, she suggests, might have occurred in the Central Plains of China and Mesopotamia, where copper and tin had to be obtained from remote sources, but in Southeast Asia, both ores were available close to the consumer sites and there was little, if any, stimulus to the development of a dominant social elite. Neither bronze nor iron stimulated conflict and a warrior class. The best definition, she finds, is that metallurgy was adopted in “heterarchic middle range societies” characterized by “variant forms of

social, economic and political differentiation and inequality". Mining was undertaken by independent households or communities, smelting was probably a dry season part-time activity, and much casting was undertaken in consumer villages by resident or itinerant founders. Founders themselves, when interred, were not marked by distinctively wealthy grave goods. The village demand for metal objects was limited to axes, spears, awls, chisels, bangles, anklets, fishhooks and bells, with regional community preferences. There is little, if any, evidence for change in the sociotechnical system over the long duration of her bronze period.

Nor did the uptake of iron smelting and forging have any discernible impact on society. According to White's chronology, iron was being deployed in prehistoric Thailand for up to a millennium before the third phase of the Iron Age at the site of Noen U-Loke, when bronze ornaments proliferated in some wealthy graves. The real social change, she argues, came with the establishment of the Dvaravati states in the mid-first millennium CE.

Commentary

This volume addresses prehistoric metallurgy in Northeast and Central Thailand: when bronze and iron were first deployed, what articles were made, and the social impact. Thirty-eight prehistoric sites are reviewed in an area of 600 by 800 kilometres. They are concentrated on the Korat Plateau and Lopburi, regions linked by a pass that severs the Phetchabun range at the headwaters of the Mun River. Copper and tin ores are widely distributed in the upland areas, and laterite iron oxides are found on the plateau itself.

Archaeometallurgical research in this region has developed in a sporadic manner as prehistoric sites have been excavated. Evidence for copper/bronze metallurgy comes from the production sites in the form of the mines and smelting and casting debris. The deployment of copper/bronze in the consumer sites can be assessed on the basis of casting furnaces, crucibles, moulds, complete artefacts in human graves and the fragments of metal that accumulated as casting spillage and discards. Iron is likewise documented by examining how it was smelted and forged, what was made, and how its social impact may be gauged from mortuary, residential and settlement data.

There are multiple avenues for assessing the social impact of metallurgy in prehistoric Thailand. Community preferences in what was actually cast, where and by whom is one key. In identifying prehistoric social inequality, Fochesato et al. (2019) have applied the Gini Coefficient to information from burials, with particular reference to the intensity of ritual behaviour and what was interred with the dead. There are, however, very few prehistoric sites in Thailand where excavation has covered a sufficient area to enable the evidence of metal usage and social change to be analysed and assessed. The 1975 excavation of Ban Chiang covered about 0.1% of the site. Can one realistically rely upon such a fragment to be representative?

In just over half a century, only six Bronze Age consumer settlements in Thailand have been excavated and published in sufficient detail for some consideration. With each new report, therefore, the data available to weigh the impact of metal on prehistoric Thai

society has been greatly magnified. Before reviewing the evidence and interpretations, what do we know of the communities that first encountered bronze in any shape or form? As with the Bronze Age, published Neolithic sites are vanishingly rare, but we do know some important facts, that some might feel should have been incorporated in the volume under review.

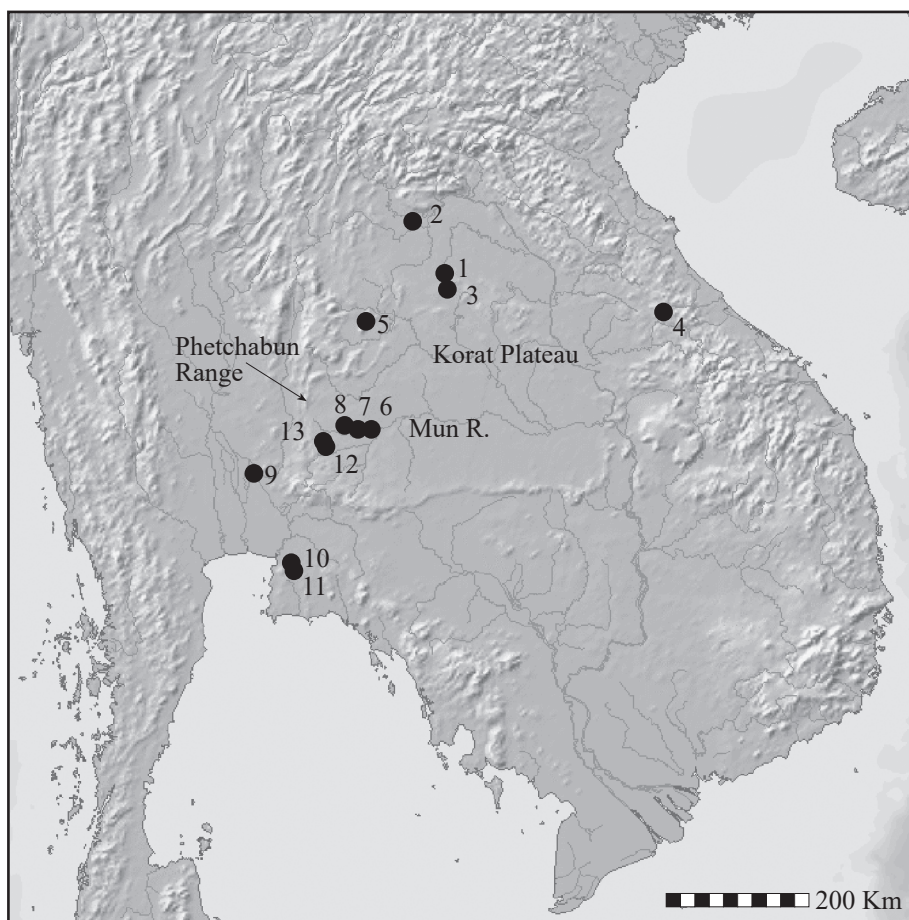


Figure 1. The location of sites mentioned in the text. 1. Ban Chiang, 2. Phu Lon, 3. Ban Na Di, 4. Vilabouly, 5. Non Nok Tha, Non Praw, 6. Ban Prasat, 7. Ban Lum Khao, 8. Ban Non Wat, 9. KWPV, Non Pa Wai, 10. Khok Phanom Di, 11. Nong Nor, 12. Nakhon Ratchasima, 13. Muang Sema

From the late 3rd millennium, rice and millet farmers infiltrated into mainland Southeast Asia, probably by multiple riverine or coastal routes. They encountered indigenous hunter-gatherer groups, giving rise to what is known as the “two layer hypothesis” (Oxenham and Matsumura 2011; Matsumura and Oxenham 2014; Higham 2017). They lived in permanent, sizeable communities. Khok Phanom Di is a key site (Higham and Bannanurag 1990, 1991; Higham and Thosarat 1993, 1994, 2004a). This vibrant Neolithic community, located on the Bang Pakong River estuary, commanded a bottleneck for the passage of desirable goods (Figure 1). Stone for adzes was imported, exotic trochus and tridacna shells were brought into the site for personal ornaments, red

ochre was needed for mortuary rites and granite for hoes. The point is that the pre-metal communities of Thailand engaged in long distance exchange in exotic valuables, and some men and women went to their graves with such wealth, that they can reasonably be described as socially elite. Metallurgy came to farming and trading communities, whose inhabitants already experienced wealth differentials. One woman at Khok Phanom Di went to her grave wearing over 120,000 shell beads.

The six key Bronze Age sites

Non Nok Tha lies in the upper Nam Phong watershed (Bayard and Solheim 2010). This first major excavation of a Neolithic and Bronze Age site in Thailand became the focus of a long-running controversy over both its chronology and its social organization. It is a small site with a shallow stratigraphy of little over a metre. Initial attempts at dating, based on charcoal fragments accumulated from disparate contexts, led to many sensational claims for the earliest bronzes in the world (e.g. Solheim 1968). More than 200 burials were uncovered, and these have gone through a labyrinthine series of social interpretations (Bayard 1972; MacDonald 1980; Bacus 2006). White and Hamilton (2019b: 89) find that “The investigation of the metals at Non Nok Tha has for the most part been unsystematic, fragmented and poorly reported.” Key points are the association of axe moulds and four mostly intact crucibles in a small number of burials. This compares with just twelve crucible fragments in non-mortuary contexts. Bangles and axes were found in a handful of graves. White and Hamilton place the initial Neolithic settlement of Non Nok Tha prior to circa 2000 BC, and the transition into the Bronze Age between circa 2000 and 1750 BC. The site remained a Bronze Age cemetery, they claim, until circa 900 BC, when in the later part of Bayard’s Middle Period, it entered the Iron Age.

As is always the case, it is vital to establish the chronology of a site before assessing its cultural status. We have dated human bone collagen from a sample of human bones from Non Nok Tha, and shown that the Neolithic use of the cemetery dates within the period circa 1500–1000 BC, and the subsequent Bronze Age burials were interred within the span circa 1000–500 BC (Higham et al. 2014). These dates White blithely disregards. The mortuary offerings at Non Nok Tha were modest during all phases. We have incorporated these in a statistical analysis of all complete Bronze Age burials of sufficient sample size in Thailand (Higham et al. 2014) and argue that there is little evidence for a wealthy elite segment in society following the uptake of metallurgy, a fact that was virtually self-evident.

Ban Chiang was the next Bronze Age site to be excavated in 1974-5. It is impossible to assess the social impact of metal using data from human burials because the data have not been published and, therefore, cannot feature in our overall statistical analyses. We do know that bronze grave goods were very rare, comprising a socketed spear, an axe and some bangles. Nevertheless, White and Hamilton have turned to the fragments of bronze from non-mortuary contexts to conclude that Ban Chiang was but one example of variable community-determined choice of what metal items were desirable. Ergo the prehistoric inhabitants were very interested in bangles. Having excavated several Ban

Chiang Bronze Age graves myself, including the one with the bronze axe, I was able to conclude in 1996 that the burials were decidedly poor in terms of grave goods (Higham 1996: 198).

In 1981, two modestly-sized areas of the site of Ban Na Di were opened, and for the first time in Thailand, there was a full suite of published evidence for bronze casting, metal composition and the preferred artefacts in association with human burials dating from about 800–500 BC (Higham et al., 2015; Higham and Kijngam 1984). To make bronze, copper and tin were heated in crucibles in clay-lined furnaces before being cast into stone moulds. Over time, clay moulds were used for lost-wax casting of bangles. The dead in one part of the site were consistently rather richer in terms of grave goods than those in another. After our excavations I concluded that: “Settlement and mortuary data are consistent with a system of flexible lineage ranking of which the unequal and restricted distribution of valuables in cemetery contexts are the archaeological embodiment.” (Higham 1984: 250).

At Nong Nor, located near the eastern shore of the Gulf of Siam, excavations in 1991–3 revealed a cemetery cut into a site of much earlier occupation by coastal hunter-gatherers. There are two groups of graves. The earlier we ascribe to the later Bronze Age, the later extends into the early Iron Age. On the basis of the mortuary data we concluded that “the Bronze Age communities of Southeast Asia were small, autonomous and expressed individual status through the ownership of exotic valuables. Nong Nor fits this pattern.” (Higham and Thosarat 1998: 538).

Ban Lum Khao is a prehistoric site in the upper Mun River catchment. Excavations there in 1996–7 traced initial late Neolithic occupation and burials dating circa 1400–1100 BC, followed by two phases of Bronze Age burials (Higham and Thosarat 2004b). Having undertaken a detailed analysis of the Bronze Age 2 cemetery there, we concluded that:

there was very little difference in mortuary wealth between contemporaneous inhabitants at Ban Lum Khao. This is not to say that the evidence is indicative of an egalitarian society, but it does seem to indicate that there was no entrenched hierarchy. Such a result is not, in the case of Thailand, unusual, for few Bronze Age sites provide definitive evidence for the preeminence of one group over another. (Higham and Thosarat 2004b: 328).

Analysing the Ban Lum Khao cemetery, Dougald O’Reilly (2004: 330) also wrote:

Higham (1989) recognized as early as 1989 that Bronze Age settlements were most likely autonomous units comprising no more than 500 individuals. He also noted that ‘the attainment of status was flexible rather than fixed and that the relative position of each autonomous community was given to fluctuation and, therefore, instability’ (Higham 1989: 187). This is, in fact, what more recent proponents of the heterarchical model are proposing for Southeast Asia (White 1995, White and Pigott 1996).

Thus, by the late 20th century, there was a consensus that no entrenched elites, no warfare and no dominance of one community over another eventuated as a result of the adoption of bronze metallurgy. When writing my book, *The Bronze Age of Southeast Asia*, in 1992, I concluded that:

In mortuary contexts, bronze joined other exotic items – marble, slate, serpentine, trochus and conus shells – as items of personal finery. It was never abundant and only a small percentage of individuals were buried with bronzes... there is no evidence that those associated with bronze were distinguished from others through their location, mortuary wealth or energy expended in their interment. (Higham 1996: 339)

The fair-minded reader might find it difficult to recognize in these conclusions the writings of an “Anglophone processualist” bent on requiring that, in White’s words (2017: 68), Southeast Asia “has a ‘Bronze Age’ comparable to that of Mesopotamia or central plains China (e.g., Higham 1996: 320)”.

Indeed, Joyce White (1995: 110) agreed with me, writing: “Grave differentiation at Ban Chiang, Ban Kao, Ban Na Di, and Non Nok Tha has not been identified in terms of overtly exclusive placement combined with a degree of wealth outstanding from the continuum (i.e., an outstandingly rich grave in a special location suggestive of a chief or chiefly lineage).” This was reiterated the following year by White and Pigott (1996: 168):

While significant exposures of cemeteries associated with these large moated sites dating to the late first millennium B.C. have yet to be undertaken, Ban Chiang Late Period burials (300 B.C. – A.D. 200) reveal increased variety of grave furnishings with numerous elaborately painted pots and continued prominence of jewelry. While graves vary in their relative richness, so far no set of unusually wealthy graves has been found isolated from a large, obviously poorer set of graves, hence here is no evidence so far for the formation of a rigidly defined hereditary elite.

A new dimension: the site of Ban Non Wat

Rachanie Thosarat and I excavated at Ban Chiang in 1975, and have since co-directed excavations at eight prehistoric sites in Central and Northeast Thailand and two in Cambodia. By 2002, we were increasingly aware that the size of our excavations, relative to the total area of each site, provided only a brief and possibly inaccurate snapshot of what might have been. We, therefore, decided to concentrate our resources on one site and excavate as large an area as possible, combined with smaller, strategically placed squares. We chose a village called Ban Non Wat in the upper reaches of the Mun River, specifically because it occupies, with a dense cluster of similar, moated prehistoric settlements, a highly strategic region on the eastern side of a pass that links the Korat Plateau with the broad plains of the Chao Phraya River. We spent a total of two years in the field over seven seasons, followed by a further three

under the direction of Dr Nigel Chang. The area of our main square is compared with that of the 1975 excavation of Ban Chiang in Figure 2. Our conviction, that chronology was absolutely essential, has involved radiocarbon dating multiple samples of charcoal and rice grains from assuredly undisturbed contexts and freshwater shellfish placed with the dead as mortuary offerings. All three materials present the same chronological framework (Higham and Higham 2009, Castillo et al. 2019). Initial Neolithic settlement dates to the 18th century BC, with the earliest evidence for copper-base artefacts in the 11th century BC.

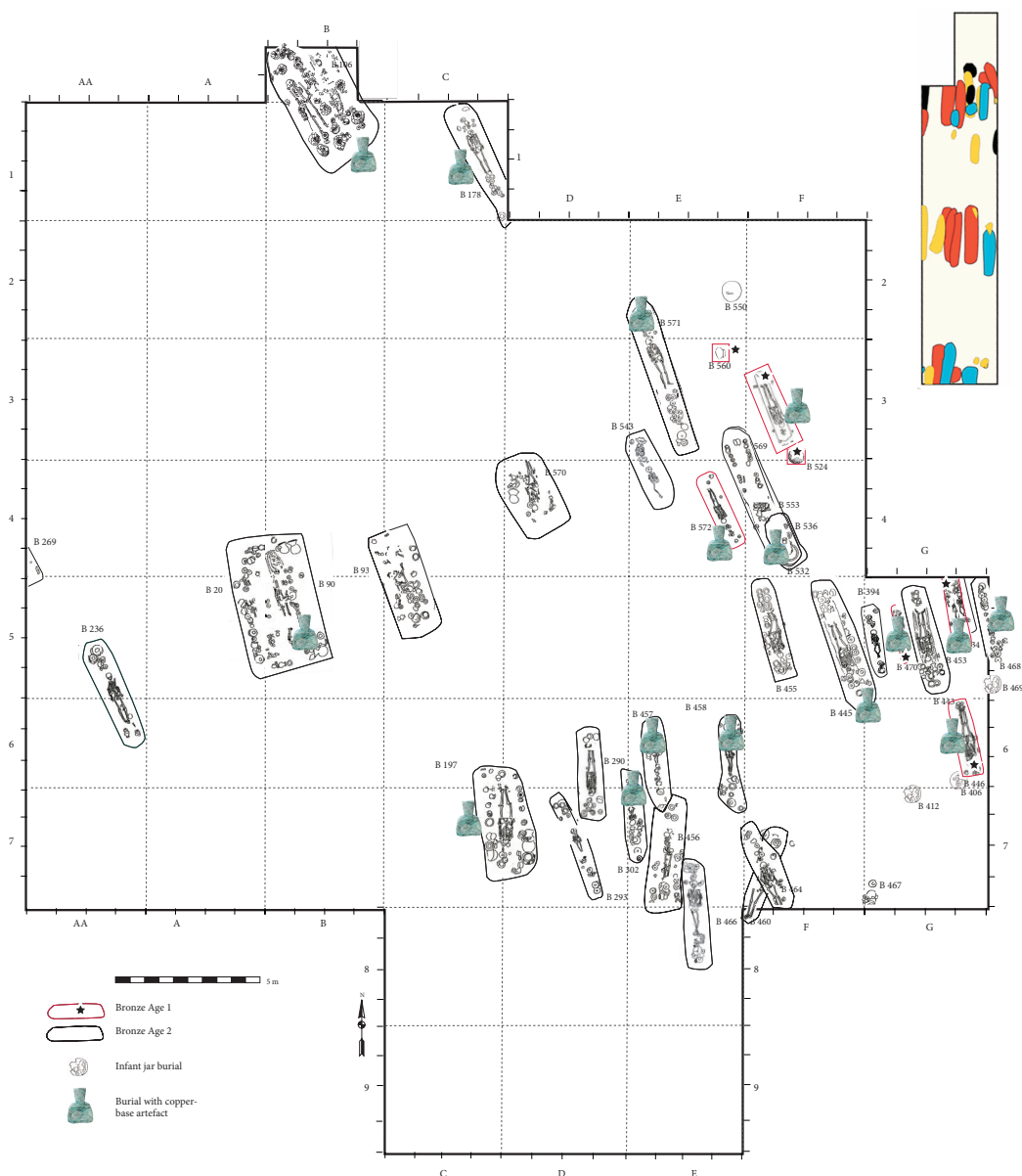


Figure 2. The Bronze Age phase 1 and 2 cemetery at Ban Non Wat. Inset, the earlier Bronze Age burials in the area excavated at Ban Chiang in 1975

The earlier part of the cultural sequence at Ban Non Wat involved Neolithic occupation and two phases of burials. The Neolithic occupation layers were heavily disturbed by later Bronze Age burials. There was then a notable change in the sequence: the first burials to contain socketed copper-base axes, assigned to Bronze Age phase 1 (BA1), were manifested in seven graves of a young male, two young to mid-young females, a child aged about ten years, an infant of two years, a neonate and a pre-term infant. All except the neonate and foetal infant were accompanied by a copper-base socketed axe in graves far more elaborate than during the preceding late Neolithic. A young to mid-adult female was found in a deep, boat shaped wooden coffin wearing a belt and a necklace of shell beads, and surrounded by fourteen pots similar in form to those of late Neolithic, but of much finer quality. We have dated this phase on the basis of charcoal and shell radiocarbon dates to about 1050–1000 BC (Higham and Higham 2009). Emerging evidence now suggests that the Khao Wong Prachan and Vilabouly copper ores were first being exploited at this same time. However the LIA of at least one of the burial socketed axes indicates an as yet unknown source for the copper which, given the prevailing model for Chinese-derived metallurgy, possibly lies far to the north.

These few BA1 burials slot in perfectly between the graves of the earliest set of BA2 burials, that we date circa 1000–900 BC (Figure 2). Having been accustomed to the extremely modest burials at Ban Chiang, Ban Na Di, Ban Lum Khao and Nong Nor, we could barely credit the wealth of the men, women and infants of BA2, and the number, range of forms and quality of the ceramic vessels. We uncovered not just one or two wealthy graves, but row upon row of them. The weight of exotic marine shell and marble bangles, earrings and beads is unmatched in Southeast Asia (Figures 3–4). Where just one socketed axe was found with all Bronze Age burials at Ban Chiang, fourteen were recovered from thirty-two BA2 graves at Ban Non Wat, three with one male and at least two from copper sourced in the Khao Wong Prachan valley. Importantly, infants as well adults were interred with considerable ritual and opulence, that included shell ornaments and ceramic vessels. Two infants were also accompanied by a copper-base axe, and a third with five bells (Figure 5). Neither infant could possibly have found a use for such an axe. It is surely more likely that these items project the status of those responsible for the burial rites.

This degree of wealth continued into BA3A (900–800 BC), but then fell sharply with BA3B, 4 and 5 (circa 800–500 BC). It was during BA4–5 that we find founder's burials with moulds and crucibles, but hardly any bronzes in any grave. In order to identify and quantify the differences in wealth between the BA2 and 3A burials from Ban Non Wat, we have subjected them to a statistical analysis, that compares them to all other available Bronze Age burials from Thailand (Figure 6). This analysis excludes Ban Chiang because the data for that site have still not been published. There is clearly a major separation: the Ban Non Wat dead were interred with highly significant wealth, measured in ceramic vessels, exotic shell and marble ornaments and bronzes. I have provided a detailed review of this phase in the occupation of Ban Non Wat, concluding that:

Social organization from the eleventh to the fifth centuries BC in the upper Mun Valley was, it is held, transegalitarian. The eruption of social display and ostentation



Figure 3. Ban Non Wat Bronze Age 2 Burial 197, showing associated axes and the radiocarbon determination



Figure 4. Ban Non Wat Bronze Age 2 Burial 290, showing associated axes and the radiocarbon determination



Figure 5. Infant burials from Bronze Age 2, Ban Non Wat. Top row left to right: burial 457 aged 9 months to 1.5 years, burial 68 aged 3-9 months, burial 293 aged 2-4 years, burial 302 aged 1-2 years. Bottom row, left to right: mortuary vessel for burial 469 aged 9-13 months, pottery vessel from burial 302, copper-base bells from burial 468 and axes from burials 457 and 458

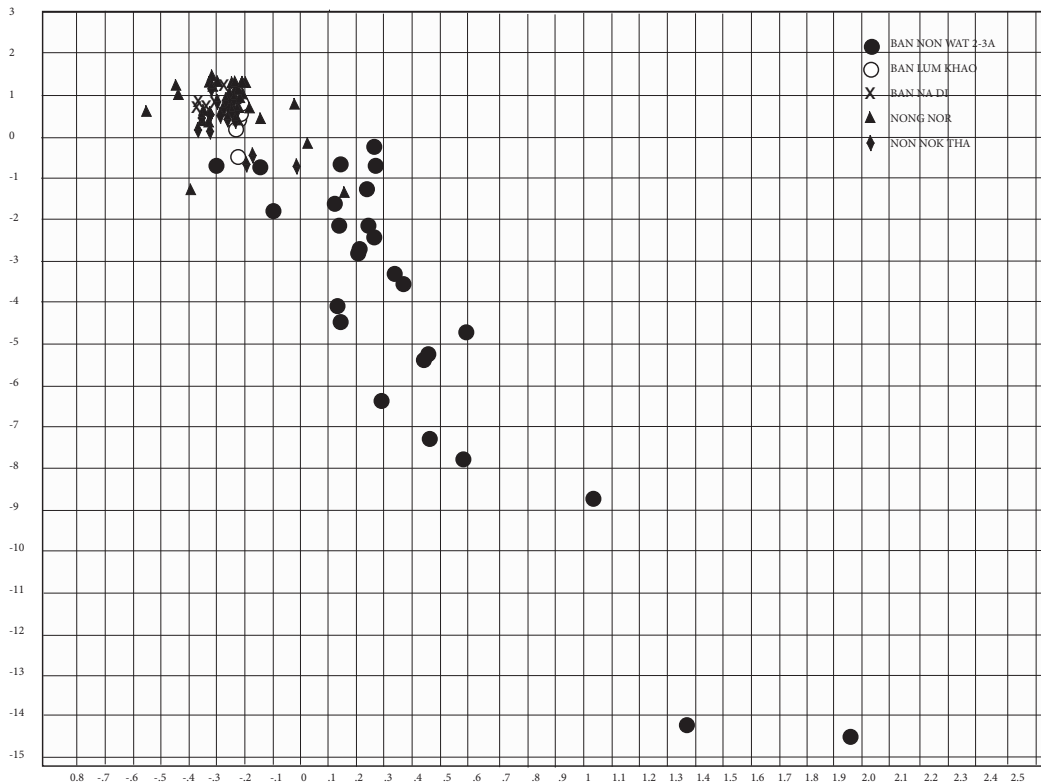


Figure 6. The distribution of Bronze Age burials on the basis of principal components 1 and 2 derived from all mortuary offerings from the key sites in Thailand. Note that those from Ban Non Wat Bronze Age 2-3A stand out from all others on account of their wealth

that took place with the initial Bronze Age reflects social inequalities that gave differential access to the ownership of resources and access to prestige goods. In the nature of transegalitarian societies, social success achieved by aggrandizers was impermanent, and there was no embedded political control from one centre over its contemporaries. (Higham 2011: 387)

Within a securely anchored chronological framework based on over 400 new radiocarbon determinations, one can measure the pace and tempo of social change in its proper context. Snapshots taken in the more remote reaches of the northern Korat Plateau have revealed bronze casting undertaken in small and autonomous consumer communities, displaying at best weak internal social ranking. In the upper Mun River catchment, a bottleneck location for exchange, social aggrandizers secured ownership of exotic valuables, including copper-base axes and ornaments, but this ownership was fragile and did not endure for more than eight to ten generations.

A continuing debate

It seems remarkable that interpreting no more than a dozen prehistoric sites can generate such different results when what they portray seems so obvious. However, it is in the nature of archaeological scholarship that divergent views are best resolved

through debate. The first and foremost issue is the acceptability of evidence for the initial uptake of copper-base metallurgy. Joyce White adopts a sanguine stance: she accepts the presence of fragments of crucible or copper-base metal in Neolithic layers at Ban Chiang and Ban Non Wat as firm evidence for metallurgical knowledge. Others are cautious, preferring as evidence in situ casting furnaces and metal grave goods. This needs elaboration with facts.

The volume here under review, and the two preceding volumes, have the site of Ban Chiang as the central focus. Neither Elizabeth Hamilton nor Joyce White has excavated at Ban Chiang or any comparable site in Southeast Asia. Assessing and interpreting someone else's excavation is fraught with difficulties, precisely expressed by White herself when she wrote of her near forty-year involvement with Ban Chiang that:

One could certainly wish for much clearer and more accurate records of the excavation of the square but 'human error' or at least 'human variability' is in evidence throughout the records. Higham's xeroxed plans demonstrate an example of the maddening inconsistency of placement of features which continue from layer to layer in some instances. Sorting out degrees of reliability must take into consideration many factors including who was excavating and who was recording the notes and plans. . . . I have noticed that in general the quality of the excavation records is much higher when Chet (Chester Gorman) was present. (White 1994: 11)

I empathize with Joyce White's taking on the impossible mission to understand and properly interpret the cultural sequence at Ban Chiang. It brings to mind Armit's view that "Writing up someone else's excavation is always difficult. Missing sections, duplicated context numbers and misinterpreted stratigraphic relationships are all par for the course" (Armit 2015: 755). Of all the sites I have excavated, Ban Chiang had the most intractable stratigraphy due particularly to bioturbation and prehistoric digging and delving into earlier cultural deposits. Chester Gorman and I spent hours in the excavation squares trying to make sense of the stratigraphy. Since no sections or level plans have ever been published, the interested reader confronts an information vacuum. My experience there, and at other sites, underwrites my extreme caution in ascribing fragments of metal, or of crucibles, to a context that cannot be proven to be accurate.

If it is difficult for Dr White to make sense of Ban Chiang, then reinterpreting the far bigger and more complex excavations at sites she has never encountered, other than in a library, is an even steeper climb and dangerously prone to gaffes. Thus, a constant theme in Dr White's exegesis of my seven seasons excavating Ban Non Wat is my scepticism over the legitimate presence of copper-base fragments and crucibles in the basal disturbed layers, that she insists are in situ. Let me elucidate. Figure 7 shows a typical section from this site. It is riddled with disturbances cut down into the initial Neolithic occupation layer. Professor William Boyd, a professional geomorphologist, who recorded this section, noted for example that layer 4 is "subject to extensive bioturbation, matrix is largely homogenized, and many sensitive distinctions have been obliterated. Pit and post-hole boundaries are very difficult to trace."

We excavate by meticulously identifying these disturbances, ascribing them



Figure 8. The surface of one of the intact Neolithic middens from basal Ban Non Wat. No bronze was found in any of them

record the item(s) and henceforth publish a revised date for the presence of bronze at this site in the 18th century BC.

Interpreting these sites from an armchair is quite different from working at the coalface. This might explain why Dr White is so liberal in her interpretations of stratigraphy that I regard with extreme caution.

Chronology

This caution decrees that evidence for the initial appearance of bronze or iron be unimpeachable. Acceptance of a legitimate presence of bronze or of iron later in the sequence, in disturbed or potentially disturbed contexts, is tantamount to accepting alternative facts. This approach underwrites Table 4.3 in the book under review, “Regional temporal units in relation to Ban Chiang periodization” (reproduced here as Table 1). Most archaeologists build their chronologies on the basis of radiocarbon determinations from securely provenanced samples. Over the past decade, we have applied Bayesian analyses to over 400 new radiocarbon determinations from key sites, from Myanmar to Vietnam, to China. We have dated charcoal, human bone collagen, shells, rice grains, millet grains and *Spilanthes* seeds (Higham and Higham 2009; Higham et al. 2015, 2019; T. Higham 2020). This includes fifty-one determinations from human bones and four from pig bones at Ban Chiang itself, that date the initial Neolithic burials to about 1500 BC and the earliest graves with bronze mortuary offerings to about 1000 BC. The new chronological scaffolding in all newly dated sites places the initial Neolithic farmer settlement in the late 3rd millennium BC, the first bronze metallurgy in the late

2nd millennium BC and early iron in the mid-1st millennium BC. This is now accepted by regional specialists, who regard the debate over a long or a short chronology for the Southeast Asian Bronze Age as over and done with.

Table 1. Based on White and Hamilton table 4.3 “Regional Temporal Units in Relation to Ban Chiang Periodization”. Column 4 is Added, and Sets out the Radiocarbon Chronology for Ban Chiang based on 55 Determinations from Human and Pig bone (Higham et al. 2015)

Period	Ban Chiang phasing	Working time range	Radiocarbon Chronology
dating range			
Recent	recent	Last 250 years	
Historic	historic	900–1768 CE	
Protohistoric (Dvaravati)	protohistoric	500–900 CE	
Late iron period	Hiatus or late period-protolithic transition	200–500 CE	From 200 CE
Middle iron period	Late period phases IX and X	300 BC – 200 CE	300 BC – 200CE
Early iron period	Middle Period Phases VIIb-VIII	700–300 BC	500-300 BC
Late bronze period transition to iron period	Middle Period Phases VI-VIIa	900–700 BC	
Middle bronze period	Upper Early Period Phases Va-c	1500–900 BC	800–700 BC
Early bronze period	Lower Early Period Phases III-IV	1750–1500 BC	1050–800 BC
Pre-metal to bronze period	Lower Early Period Phases IIa-c	2000–1750 BC	1400–1050 BC
Pre-metal period	Lower Early Period Phase 1	>2000 BC	Start 1500 BC

Joyce White is the exception. Impervious to, and dismissive of, the remarkable advances made in third generation radiocarbon dating (Bayliss et al. 2007), she adheres to the notion that “the degree of resolution possible for many problems in regional prehistory is coarse for now. Often, ‘within the correct half millennium’ and when lucky, the correct third of a millennium, are adequate for many issues” (White 2008: 101). This, she notes, leads to Southeast Asian archaeologists tolerating “some degree of chronological fuzziness”. Her chronology for the site of Ban Chiang, set out in the accompanying Table 1, is so at odds with all other site chronologies, that it would

necessitate root and branch revision of virtually every site sequence in later prehistoric Thailand. Indeed, she has taken a meat cleaver to these scrupulously generated site sequences and chronologies on the most specious of grounds. Thus, a few fragments of bronze, found in the highly disturbed lower layers at Ban Non Wat, mean that they must be Bronze Age. Therefore, the initial Neolithic occupation of Ban Non Wat is reinterpreted as early Bronze Age with a date of circa 1750–1500 BC.

This has set in train a domino effect for other key sites. She has, of necessity, placed the later Neolithic phases at Ban Lum Khao and Ban Non Wat in her middle bronze period. The later Bronze Age cemetery at Ban Lum Khao is relocated to her early iron period despite the absence of any iron being recorded there. Bronze Ages 4 and 5 at Ban Non Wat are likewise early Iron Age. This means that the initial Iron Age at this site has to be shunted into her middle iron period. At Non Pa Wai, the initial Neolithic occupation, recently dated by charcoal and millet grains at about 2000 BC, intrudes into the early bronze period. Even later occupation at Khok Phanom Di, the best documented Neolithic settlement in Southeast Asia, must perforce be early Bronze Age because it has been dated within the span 2100–1500 BC despite the complete lack of bronze there. It will be interesting to see if any reputable Southeast Asian specialist accepts her working time range in Table 1.

Top-down, bottom-up or topsy-turvy?

Our excavations at Ban Chiang were too small for a realistic assessment of the social role of metals there. In 1975, we opened an area of just 58.5 square metres in a narrow village lane after being restricted to 72.3 square metres in an unlooted yard the previous year. No casting furnaces were identified, and four fractured moulds of no known purpose were found. Copper-base mortuary offerings were vanishingly rare. So White and Hamilton have, perforce, focused their analyses on the bits and pieces of metal recovered from non-mortuary contexts on the assumption that these will illuminate community preferences. A moment's reflection will reveal the flaw in this approach. At Ban Non Wat, we have a sample of nearly 400 moulds or mould fragments, as well as some casting furnaces and the graves of those who cast bronze. It is these that properly tell us what was being cast and when. There are two mould forms, one with a curved, the other with a rectangular cross section (Cawte 2008, 2009, 2012; Higham and Kijngnam 2012). The former were heavy-duty moulds for casting weighty axes, spears and other tools or weapons, while the latter cast ornaments. White and Hamilton have excoriated our publications to date on the metal remains from Ban Non Wat for ignoring the fragments. Figure 9 complements White and Hamilton's depiction of the composition of the bronze fragments from Ban Chiang, and her other three sites, by incorporating the equivalent data computed for Ban Non Wat. It is evident that at Ban Non Wat, compared to the other sites, far more bronzes come from burials and that of the identifiable fragments, bangles predominate and there is not one single axe or spear, presumably because the metal in these was more likely to have been recycled. This finding is matched at Non Nok Tha, where virtually all moulds were for casting axes, whereas in the 1966 season, twenty-two bangle fragments and only one axe were

found (Bayard and Solheim 2020: 249). Thus, I would argue that White and Hamilton's assessment of the central social role of bronze bangles at Ban Chiang, based on fragments rather than moulds, is in need of rethinking.

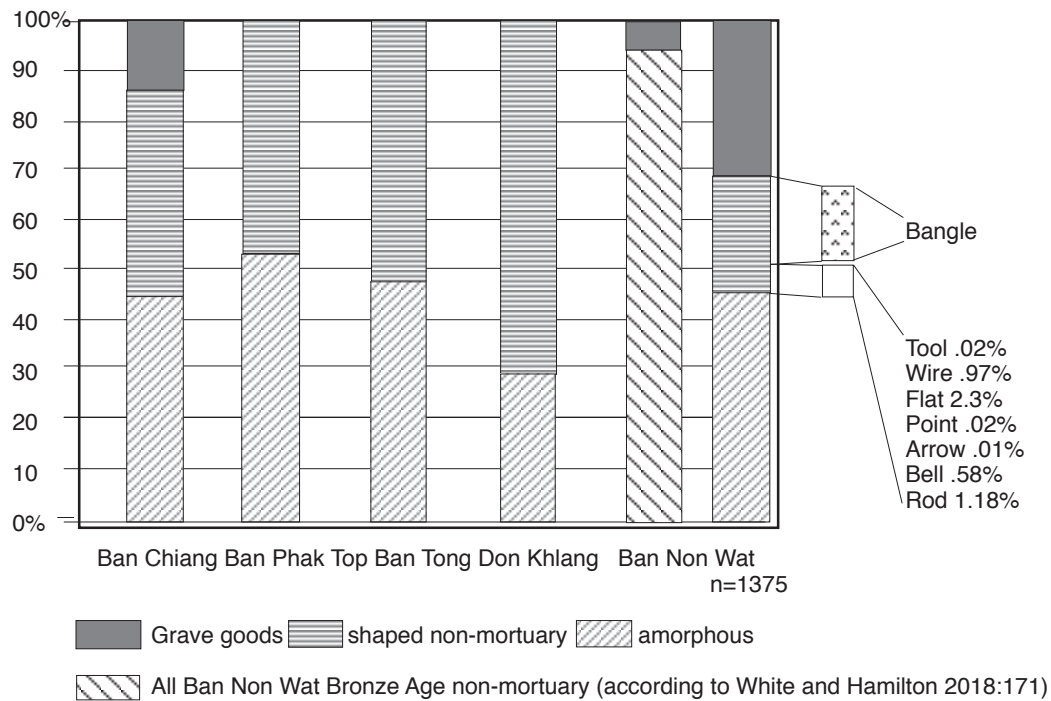


Figure 9. The percentages of grave goods, shaped non-mortuary and amorphous fragments of bronze from Ban Chiang, Ban Non Wat and three test squares from minor sites according to White and Hamilton, together with the actual figures for Ban Non Wat (column at far right)

A new paradigm, or the old one in new clothes?

In her concluding chapter, Dr White flatteringly turns to my writings as a foil to advance her own. In doing so, she does not seem to appreciate that models change with new data. Apparently, my metal age model is based on “essentialist lines of reasoning... whereby ‘types’ such as ‘Ages’ and technological ‘Stages’ subsume diversity and are given priority over actual data” (White 2019: 172). The reality, as I wrote nearly a quarter of a century ago, is that:

There is no agreed system of nomenclature for the prehistory of mainland Southeast Asia. In the following pages... the period from the first use of copper-base artefacts will be called the Bronze Age... it is, however, stressed that the Three Age System is used only as a convenient shorthand and with no implications for similarities with other regions where it is employed. (Higham 1996: 7)

I am not alone in using the term Bronze Age. It seems that Joyce White travelled on an archaeological Road to Damascus some time between 2014 and 2017. Her

publications from 1982 until 2014 freely employed the Three Age System (White 1995: 111; White and Hamilton 2009: 357, 360; 2014: 807-808, 821, 828, 832; etc). She set a trend with her publication, *Ban Chiang: the Discovery of a Lost Bronze Age* (1982). Virtually all her specialist colleagues working in Southeast Asia, old and young, employ the terms Neolithic, Bronze and Iron Age (Bellwood et al. 2013; Pigott and Ciarla 2007; Pryce et al. 2014; Oxenham et al. 2015; Rispoli et al. 2013; Killick 2014; Martín-Torres and Rehren 2014). Were expert archaeometallurgists Doonan et al. (2014: 757) also following essentialist lines of reasoning when they wrote: “The Eurasian Bronze Age has traditionally been viewed as somewhat peripheral to core developments in Mesopotamia, the Near East, and the Aegean”? Or Linduff and Mei (2014: 785), who conceded that “Until fairly recently, however, little evidence could be gathered to argue convincingly that the Chinese Bronze Age was an indigenous affair”? As far as I am concerned, the Bronze Age and bronze period are synonymous.

White proceeds to reference my “appeal over the decades” to this famous quotation by James Muhly (1988: 16):

What we lack ... is any sense of the underlying cultural and political contexts associated with the emergence of bronze technology in Southeast Asia... in all other corners of the Bronze Age world – China, Mesopotamia, Anatolia, the Aegean and central Europe – we find the introduction of bronze metallurgy associated with a complex of social, political, and economic developments that mark the ‘rise of the state.’ Only in Southeast Asia ... do these developments seem to be missing, and explaining, (or eliminating) this anomalous situation is one of the major challenges of archaeological and archaeometallurgical research during the next decade.

White seems convinced that my sole purpose in evaluating Bronze Age social structures has been to coerce the evidence in favour of a rapid rise of state societies in Southeast Asia. But the crucial words in the Muhly quotation are “*or eliminating*”. My excavations at Bronze Age sites between 1974 and 2002, including Ban Chiang, Ban Na Di, Nong Nor and Ban Lum Khao as well as involvement in the analysis of Non Nok Tha, have indeed eliminated any notion that the advent of metal technology inevitably led to a rapid rise of social inequality. My various publications clearly reflect this.

Where then do we stand? By insisting on the acceptance of the presence of fragments of bronze and crucibles in disturbed basal layers at Ban Non Wat, that we have dated to about 1700 BC, Joyce White has added at least seven centuries to the duration of the Thai Bronze Age. This negates any possibility of deriving the knowledge of copper smelting and casting from China south of the Yellow River. White and Hamilton therefore seek the transmission of the necessary expertise directly from the Seima-Turbino metallurgical horizon of the Altai (White and Hamilton 2009, 2014). This requires a bizarre scenario in which there were bronze specialists present in Thailand for about thirty human generations before a single bronze was placed in a burial, before any evidence for mining and smelting took place, and before any evidence for the casting of bronze in a single consumer site. White’s essentialist stance that, throughout the Bronze Age, there was a bottom-up community determination of how bronze or iron were deployed, sets

aside as insignificant the presence of an aggrandizer elite of Ban Non Wat between circa 1000–800 BC.

Alternative models

“Two major paradigms are competing in Bronze Age research: one that stresses elite-controlled long-distance trade networks (e. g. Kristiansen and Larsson, 2005; Kristiansen and Earle, 2014), another that stresses local processes and smaller-scale tribal or segmentary interaction (e. g. Harding, 2000, 2013; Kienlin, 2015).” (Earle et al. 2015: 633).

Until the excavation of Ban Non Wat, there was a broad measure of agreement that the advent of copper-base metallurgy in Thailand did not stimulate a rise of entrenched social hierarchies, let alone early states. It would be absurd, given the results of the excavation of Ban Non Wat, Non Nok Tha, Ban Lum Khao or Ban Chiang, to suggest otherwise. This debate over the potential of bronze, or iron, to be a prime mover has deep roots that remain important to this day. I suggest that, in absorbing lessons from elsewhere, it is first necessary to incorporate a vital variable that White and Hamilton barely consider, namely the geography. This factor is elegantly adopted by Earle et al. (2015) in their analysis of the political economy and metal trade in Bronze Age Europe, further explored by Earle (2017) in his review of Bronze Age tell communities. They stress the importance of bottlenecks through which desirable commodities necessarily flowed. We have already seen this operating even during the Thai Neolithic, when the site of Khok Phanom Di was perfectly situated to control the passage of desirable marine shell from the sources of tridacna and trochus into the interior.

What variables need to be grafted into the generation of a model that might provide a deeper understanding of later prehistoric Thailand? Earle et al. (2015) have identified an integrated trading system in Bronze Age Europe, that conferred advantages on certain regions over others. Their list of traded products included copper, tin, textiles, salt and shells. This list matches that for Southeast Asia. In Europe, there were bottlenecks, or constriction points, that provided an opportunity to control access to traded valuables. Earle and colleagues proceed to draw attention to issues that might well resonate in Southeast Asia as more sites are excavated and more data become available. They suggest that in areas of Europe, remote from long distance trade routes, life during the Bronze Age could be expected to continue little changed from the preceding Neolithic. By the same logic, in Thailand, rice farming, stock raising, fishing and hunting would have continued in scattered and small communities, such as Ban Chiang, with limited exposure to the rare and exotic. However, “in areas articulated with prestige goods flows, ownership of metal goods defined elite statuses, marked by displays seen in burials and hoards” (Earle et al. 2015: 634). The elaboration or otherwise of mortuary rituals reflected the structure of the corporate group. In Europe, “Critically important, however, ownership came to be extended over key resources linked to metal trade, especially the river routes. Although burials were fairly uniform in content, a small percentage of burials (about 5 per cent) was associated with metal wealth (Vicze, 2011), probably indicative of emergent stratification” (Earle et al. 2015: 635). This paradigm has been

explored in detail in a region with intriguing parallels with Thailand. As Quinn et al. (2020) have emphasized, Transylvania had many sources of copper, tin and salt, which played a role in the rise of social complexity in the Carpathian macroregion. With the exploitation and trade of metal resources, bottlenecks, which restricted access to valuables, stimulated the rise of political hierarchies.

Not even the most ingrained Anglophone processualist would impose this model on Thailand, but there are certain facts that it would be unwise to ignore. Ban Non Wat is one of many prehistoric settlements clustering in the upper reaches of the Mun River catchment. I have suggested that this location was advantageous in accessing exotic goods, including marine shell, marble and copper, being exchanged from Central Thailand onto the broad expanse of the Korat Plateau. Joyce White does not agree. However, as anyone who has driven east from Lopburi over the pass to the plateau knows, this is a hugely important trade route. It is the location of Nakhon Ratchasima (in Thai, royal sacred frontier city), the largest city on the Korat Plateau, and of Muang Sema, an Iron Age moated site that was greatly expanded in the early historic period and probably the centre of an early state known as Sri Canasa (Higham 2016). Ban Non Wat, Ban Prasat and Noen U-Loke are all similarly situated athwart the ingress of traded goods from Central Thailand.

This geography must be considered in any attempt to model and understand what happened in the 11th and 10th centuries BC in Thailand. Sociocultural changes unfolded rapidly. Late Neolithic graves at Ban Non Wat and Ban Lum Khao were very modestly endowed with just a handful of ceramic vessels (Higham and Kijngam 2010). An expanding exchange system then brought marine shell and marble ornaments to this strategic region. Exchange also brought socketed copper base axes. At Ban Non Wat and Ban Prasat, these were interred with the dead in a demarcated central part of the site, but not in modest graves in another part of this site, or in the contemporary cemetery at Ban Lum Khao. The analysis of the Ban Non Wat bronzes is far from finished, but as we know so far from lead isotope analyses, at least one of the copper-base socketed axes found in the BA1 cemetery was cast from copper brought from a remote, but unidentified, source (Pryce et al. 2014). The slightly later BA2 axes so far analysed came over the Phetchabun pass onto the Korat Plateau and to Ban Non Wat (Higham and Rispoli 2014). I do not assert that this imported copper or cast artefacts in themselves stimulated social change, but do suggest that they were rare and exotic items which, along with the stone and shell ornaments, were employed to project elite status by a social group over several generations.

The elite mortuary rituals at Ban Non Wat are not confined to the weight of exotic ornaments, the number of ceramic vessels or the presence of bronzes. Graves were far bigger than was necessary to contain the coffin, and some of the dead were exhumed before being painstakingly reinterred, as if they retained status as revered ancestors. We have seen that infants were interred in graves far bigger than the human remains in order to contain the weight of offerings, two of them with a copper-base axe (Figure 5). Neonates were buried in lidded pottery vessels with complex painted designs, one resembling birth, another a remarkable human face. A pottery vessel in an adult grave was painted with a scene of dancers, and food remains in the graves surely reflect mortuary feasting

and the provision of food for the afterlife. It is for future archaeologists to ascertain if this remarkable cemetery is unique, or a regular occurrence in this strategic region.

The maintenance of this elite status, however, was unstable and impermanent. White is dismissive of any social implications of the fact that all adults during BA1 and half the male adults in BA2 were buried with copper-base axes, saying that: “The assertion that the copper market was ‘cornered’ by aggrandizers or elites during the bronze period can be questioned based on the sheer number of copper-base objects recovered outside of grave good contexts at Ban Non Wat.” (White 2019: 175). Reinterpreting a prehistoric site from a position of ignorance is fraught with pitfalls. Dr White seems unaware that it was only after the period of elite graves that the number of bronze fragments tripled, the number of moulds increased by 500 percent and the number of crucibles by 600 percent.

After BA3A, the mortuary rituals at Ban Non Wat continued, but there were no more elite graves. During this later part of the Bronze Age, local casting of bronzes took place, seen in the founder’s burials. The quantity of bronze fragments, crucibles and moulds surged. Locally-cast bronzes were readily available, at a time when the Central Thai mines, according to the new radiocarbon dates, were abandoned or in steep decline (T. Higham 2020). The lead isotope analyses now identify the Vilabouly mines, far to the east, as a major copper source (Cadet et al. 2019; Pryce et al. 2011). It is possible that as new data come to hand, we will find supportive evidence that, after an initial rise in aggrandizer elites (but with no essentialist requirement of accelerating durable social complexity), changing exchange patterns and increasing availability of metal for the population at large reduced its social value as a prestige commodity.

At Ban Non Wat, the late Bronze Age BA5 cemetery contained hardly any bronze. However, as the cemetery expanded in an easterly direction, there was a transition into the initial Iron Age, documented by the first bimetallic bronze and iron spears, iron ornaments and tools, carnelian glass and agate ornaments. Bronze ornaments now markedly increased, but there is no evidence in this cemetery for a social elite (Higham and Manly 2012). The later Iron Age contexts at this site were very poorly documented, but at the nearby site of Noen U-Loke, there was a marked increase in the opulence and intensity of mortuary rituals during the third Iron Age phase, seen in graves filled with rice and a massive increase in the weight of bronzes worn by the dead (Higham et al. 2007). More than one of the dead wore more ornaments on a single arm than the entire number of bronzes from every burial recorded at Ban Chiang. Again, we must consider the environment. The upper Mun valley is much drier than the northern part of the Korat Plateau, and this change came from about 200 CE with the onset of climatic aridity, the construction of moat reservoirs round settlements, the reticulation of water into irrigated rice fields, the forging of iron ploughshares and sickles and increased evidence for conflict (Wohlfarth et al. 2016). We have modelled this seminal sociopolitical change, without any hint that either bronze or iron technology was a prime mover. Rather, they were deployed to signify elite status on the one hand, and to cut, plough, harvest and fight on the other (Castillo et al. 2019; Higham et al. 2019). We find that the major social change in the upper Mun Valley took place during the later Iron Age from about 200 CE and not, as White has suggested, with the establishment of Dvaravati states in Central Thailand and the upper Mun Valley.

Summary

This volume under review, and its two predecessors, will be valued for the contributions made by specialist archaeometallurgists. However, their research is hamstrung by a synthesis of the later prehistory of Thailand that is riven by fault lines. The most deeply embedded is Dr White's unshakeable conviction that bronze and iron metallurgy came to Ban Chiang, in particular, and Southeast Asia, in general, at a remarkably early date. This notion has deep roots. It began with the claims from Non Nok Tha and Ban Chiang for the earliest bronze in the world (e.g. Solheim 1968; Gorman and Charoenwongsa 1976). The University of Pennsylvania Museum grandees adopted this credo, convincing themselves that they had found a new Ur of the Chaldees. In the hands of Dr White, this has taken on all the trappings of an academic flywheel that routinely dismisses all evidence to the contrary. The chronology for Ban Chiang adhered to in this volume comes from six internally contradictory radiocarbon determinations from the organic fraction of crushed potsherds, a technique known to be unreliable (White 2008; Higham et al. 2019), and rejects many hundreds of dates on multiple materials from multiple sites across the whole Southeast Asian mainland.

When H.M. King Bhumibol visited Ban Chiang in 1972, he asked if the human bones had been radiocarbon dated. When advised that this was possible but expensive, he replied: "It should not be considered too costly since this is of international interest and Ban Chiang has attracted attention worldwide. Everyone would like to participate and cooperate in dating procedures, and they would be more reliable." We have followed this wise royal advice, with the enthusiastic support of the Thai Fine Arts Department, by analysing the fifty-five new AMS determinations within a Bayesian framework (Higham et al. 2015). The transition from the late Neolithic into the early Bronze Age took place circa 1000 BC, and the Iron Age burials at Ban Chiang date from the 5th century BC. This is a virtual carbon copy of the radiocarbon chronology for other Thai consumer sites (Higham et al. 2015). We have dated charcoal and millet grains from the Neolithic and copper smelting sites in Central Thailand that again show the uptake of copper smelting in the late 2nd millennium BC (T. Higham et al. 2020).

Dr White has rejected all these. In order to bolster her own dating dogma, she has reinterpreted the cultural sequence of Ban Non Wat. This turns on the presence of a handful of bronze and crucible fragments found in heavily disturbed basal contexts (she fails to mention that there are also fragments of iron and glass, which do not appear in regional contexts before the mid-1st millennium BC). As explained above, there are some undisturbed Neolithic midden deposits in the deep layers at this site, and they do not contain any evidence for bronze metallurgy. We have five calibrated 95.4 per cent confidence charcoal radiocarbon determinations from these middens. They are 1734-1531 BC, 1735-1531 BC, 1608-1418 BC, 1682-1521 BC and 1505-1409 BC (Higham and Higham 2009). In a proposal that will surely stun reputable archaeologists with excavation experience, she adopts these five determinations as proof of early bronze casting in Thailand. This then generates a cascading series of chronological contortions in other sites across Thailand summarised in her table 4.4, leading to a prehistory of

cloud cuckoo land where Neolithic sites with no metal are Bronze Age, and Bronze Age sites with no iron are Iron Age.

A second fault line stems from her reliance on the bits and pieces of bronze to generate a model for the social significance of metal. The excavations at Ban Chiang were far too small for any hope of generating a meaningful assessment of a sociotechnical system. We cannot determine what prehistoric people used bronze for by relying on fragments, because many artefacts will have gone through the sieve of recycling. As I think Dr White would agree, what is needed is an excavation large enough to yield evidence for the *chaîne opératoire* and deep enough to identify change over time. This evidence includes casting furnaces and moulds, notable for their presence at Ban Non Wat and Ban Na Di, but their absence at Ban Chiang. We know that the later Bronze Age founders at Ban Non Wat cast axes, spears, arrowheads and bangles. What their contemporaries at Ban Chiang cast, other than bangles, is hardly known. But reliance on the fragments has led to what must almost certainly be a blind alley, for White concludes that “the most common copper-base artifact class identifiable to function is bangles ... this finding suggests that in that part of Thailand, the primary demand for copper-base products was for personal adornment during both life and death”. (White 2019: 161).

Dr White’s essentialist credo requires that the advent of bronze metallurgy caused scarcely a social ripple, and any evidence hinting at the contrary must be dismissed. Those working in the upper Mun Valley familiar with the excavation at Ban Prasat have suspected for years that this was not the case because the site contains the graves of astonishingly wealthy Bronze Age men and woman, still to be seen in an open square. When we opened an excavation at Ban Lum Khao, just ten kilometres to the west, we encountered a cemetery of similar date, but relatively impoverished. Then, at Ban Non Wat, a second set of remarkably wealthy early Bronze Age individuals was revealed, that followed hard on the heels of their late Neolithic predecessors. Lead isotope analyses undertaken so far indicate that some axes and chisels were cast from Central Thai metal and these, together with awls, bells and anklets, joined multiple exotic shell bangles and marble ornaments, not to mention up to twenty times as many ceramic vessels as are found in a typical Bronze Age grave at this and other sites. This represents, in most archaeologists’ vocabulary, a social elite.

But not for Dr White. Stressing that “the occasional copper implements (even if unused) were interred with some well-do-do individuals”, she finds that “The assertion that the copper market was ‘cornered’ by aggrandizers or elites during the bronze period can be questioned based on the sheer numbers of copper-base objects recovered outside of (*sic*) grave good contexts.” (White 2019: 175). Once again, Dr White has missed the bus. There was a surge in bronze, crucibles and moulds only after this early Bronze Age phase.

Active faults are also evident in the lack of any input from location and environment. Thailand, then and now, was not a *tabula rasa*. Central Thailand was a focus for the massive smelting and casting of copper axes and ingots as well as the manufacture of marine shell ornaments (Pryce et al. 2010; Ciarla et al. 2017). The passage of these along exchange routes encountered choke points. These gave advantages to some communities, but not others. It is not enough simply to dismiss the Ban Non Wat elites

as happening to have some rich grave goods without a deeper exploration into the anthropology of their technology.

In 1994, Dr White wrote of the site of Ban Chiang, that “publication of the first volume on chronology and stratigraphy is scheduled for January 1997” (White 1994: 20). I find the surviving archaeologists, who excavated at Ban Chiang forty-six years ago, are unanimous in urging Dr White to work on, and publish, a factual site report before launching into any further regional syntheses. One hopes that, should this report appear, it will have the grace to acknowledge the contribution of Thai authorities in allowing foreigners to undertake research, and perhaps provide a dedication to Dr Pisit Charoenwongsa, doyen of Thai prehistorians, who co-directed the Ban Chiang excavation.

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