Ban Chiang, Northeast Thailand , Volumes 2A and 2B: A Review Essay

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INTRODUCTION: THE SITE OF BAN CHIANG

Joyce C. White and Elizabeth G. Hamilton's *Ban Chiang, Northeast Thailand* volumes 2A (2018) and 2B (2019) are the first two of four projected volumes reporting on the origins, timing, and social impact of metallurgy in Southeast Asia with particular reference to the site of Ban Chiang in Northeast Thailand. Ban Chiang is a village located in the northern reaches of the Khorat Plateau in Thailand. In the late 1960s, lavishly painted prehistoric pottery vessels came to the attention of the villagers at the same time as a nearby base was occupied by the American military during the war in Vietnam and Laos. This unfortunate conjunction led to intense looting by villagers and countless pots being returned to the United States as souvenirs. News of the scale of destruction spread widely. In response, the Thai Fine Arts Department of the Ministry of Culture organized two excavations, one in the temple grounds in 1972, the other in an unlooted lane a year later. The latter revealed a lengthy prehistoric cultural sequence, but no burials or associated offerings were removed for analysis. Early attempts to date the pottery vessels by thermoluminescence provided incredibly early dates. One sample, sent to the University Museum, Philadelphia, returned a date of ca. 7000 B.P. (Loofs-Wissowa 1983). This was found in association with bronze, giving credence to an indigenous origin for metallurgy in Northeast Thailand (Solheim 1968). Ban Chiang was becoming a site of world significance.

Reports of these early dates came to the attention of Froelich Rainey, Director of the University Museum in Philadelphia. In cooperation with the Thai Fine Arts Department, he sponsored two further excavations in 1974 and 1975, directed by Chester Gorman from the University Museum, Philadelphia, and Pisit Charoenwongsa of the Thai Fine Arts Department. The first took place in an intact garden and covered an area of 72.3 m^2; the second was adjacent to the previous excavation in the lane and involved 58.5 m^2. The Ban Tong, Ban Phak Top, and Don Klang sites located in the same region were also investigated in 1974 and 1975 with test squares of between 9 and 12 m^2.

This fieldwork followed the 1966–1968 excavations at Non Nok Tha, 115 km to the southwest, which had already fuelled claims for the world's earliest copper-base metallurgy (Bayard 1971; Solheim 1968). Following the two seasons in the field,

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Gorman and Charoenwongsa (1976) claimed confirmation of this startling discovery on the basis of charcoal radiocarbon determinations from Ban Chiang, placing the earliest evidence for bronze at ca. 3600 B.C. and for iron at ca. 1600 B.C. An article soon appeared in *Time* magazine in 1976 with the headline "Turning the Clock Back," repeating these dates (Time 1976). White's (1982) illustrated guide to the site that accompanied a travelling exhibition was then entitled "Ban Chiang: Discovery of a Lost Bronze Age," despite extensive literature in French published over a century earlier that already described Bronze Age sites in Southeast Asia (Noulet 1879). All this publicity divided the interested academic community into those prepared to accept the early dates from those who were not. After Chester Gorman died in 1981, Joyce White, then a young graduate student, was placed in charge of the analysis and publication of the 1974–1975 excavations the following year by the Directorate of the University Museum, Philadelphia. Two of the four volumes reporting on the metal remains have now been published. I comment on them below as a member of the excavation team who spent a month during both seasons at Ban Chiang.

BAN CHIANG, NORTHEAST THAILAND, VOL. 2A

In the first two chapters of volume 2A, White reiterates the contents of my summary on the nineteenth century identification of prehistoric copper-base metallurgy in Southeast Asia following the establishment of French colonial government over Vietnam, Cambodia, and Laos (Higham 1996:17–28). This is the background to the pioneer fieldwork in Northeast Thailand that led to the excavation of Nok Tha and Ban Chiang. The fieldwork generated ongoing debates over chronology, nomenclature, and the social impact of metallurgy that are summarized in the first chapter. In the second chapter, White outlines the nature of the cultural contexts, including occupation and mortuary remains, difficulties in understanding site formation processes, and offers a relative chronological framework linking all four sites. Twenty-two distinct levels are identified at Ban Chiang encompassing 19 mortuary phases. She then summarises her views on the disagreements that have bedeviled progress in addressing the timing, origin, adoption, and social impact of metallurgy in Southeast Asia. This is an important introductory chapter, but the interested reader might well ask when during her sequence, which involves initial, lower Early, upper Early, Middle, and Late Periods and their 19 mortuary phases, does one first encounter bronze, then iron? There is no answer to either question. In fact, the earliest mortuary bronze, a spearhead, comes from burial 76 in lower Early Period III. White's chronology places this bronze spear within the span ca. 2100–1500 B.C. Middle Period VII contains the first undoubted presence of iron, which she dates between ca. 900 and 300 B.C.

Chapter 3 is co-authored with Elizabeth G. Hamilton, the project archaeo-metallurgist. White and Hamilton review how to approach the issue of metal working and society by seeking to elucidate the mechanisms for its spread and adoption. They criticize previous claims made for the relevance and impact of metallurgy, the relationship between casting bronze and evidence for increasing conflict, and the proposition that metal technologies stimulated a rise in social inequality. Under the heading "Ontological Conundrums to Evolutionary Paradigms," the authors heavily criticize the employment of the Three Age System as a convenient framework for weighing evidence for chronology and associated cultural changes (vol. 2A:79). They do not recoil from accusing colleagues of manipulating evidence that does not fit a

preconceived model, writing that: "Dates are discounted, not mentioned or 'adjusted' (Rispoli et al. 2013:136); associations are downplayed or ignored" (vol. 2A:87). This is one of many instances of cherry-picking and then misinterpreting sentences that the attentive reader will find were no more than components of a far more complex argument, a pettiness that mars an otherwise interesting text. The chapter ends with a truly ground-breaking decision: to replace "Bronze Age" with "bronze period" and "Iron Age" with "iron period" (vol. 2A:89).

They then review how to define and date the inception of metallurgy. There are two alternatives. One is to confine the evidence to *in situ* metal working installations and graves with metal mortuary offerings. However, they assert that this cautious approach "excludes the initial period of metal evidence including its earliest transmission and adoption" (vol. 2A:89–90). They prefer that "all metal-related evidence is considered valuable and worthy of evaluation, not just that from grave assemblages and metalworking installations" (vol. 2A:90). In this they are not alone; it is standard procedure.

In chapter 4, White and Hamilton argue in favor of a new paradigm that does not see technological change as a "straightforward or necessarily simple affair" (vol. 2A:113). With reference to copper-based technology, virtually all Southeast Asian specialists look north for origins, and all would agree when the authors state that "the details of how it was transmitted, from where, and why it was adopted become paramount archaeological questions" (vol. 2A:113).

The fifth chapter considers three key variables: how metal was produced, consumed, and exchanged. Evidence for production is necessarily based on Sepon, Phu Lon, and the Khao Wong Prachan Valley mining and smelting sites. Ban Chiang and its satellites were importers of copper-base metal artefacts and probably harbored iron smiths. Three of the sites under review are known only from tiny test squares and the two openings at Ban Chiang are also of a very limited area, so obtaining a realistic picture of how copper-base items were deployed will not be easy. The authors estimate that 0.16 percent of Ban Chiang has been excavated.

Chapter 6 is a straightforward literature summary of the geological formation processes for the various metal ores found in prehistoric contexts. The final chapter by Hamilton provides a most useful summary of the techniques used in producing metal, from mining to smelting, annealing, and casting.

BAN CHIANG, NORTHEAST THAILAND, VOL. 2B

After an introduction by Joyce White, Elizabeth Hamilton describes the various methods employed in examining the 639 prehistoric copper-base and iron artifacts derived from the four sites. She stresses the importance of analyzing as great a variety as possible from all contexts and periods of occupation because "a technological system cannot be reconstructed, even tentatively, from limited and unrepresentative samples of materials" (vol. 2B:16).

In chapter 3, Hamilton progresses to a classification system that identifies nine artifact classes with types and subtypes. She begins by recalling that White had already noted that the dominant copper-base artifact at Ban Chiang was the bangle, of which 16 types have been described. Bronze tools were very rare indeed, and weapons almost nonexistent. Indeed, there is only one socketed bronze axe in the entire assemblage, which I had the pleasure of finding in 1974. Iron was initially used for bangles, but tools came to predominate the iron assemblage. There follow illustrations of each class:

bangles, axes/adzes, blades, points, wires/rods, flat pieces, spears, and amorphous fragments. These classes are described with bronze and iron artifacts with all four sites combined and each illustrated artifact is given a unique catalogue number. This is confusing. It would have been much clearer had bronzes and iron been treated separately. The catalogue numbers provide no relevant information to the reader. Thus, in Figure 3.12(c) a blade is described as BCES 480/1367. But how does this ascription place the artifact in the site sequence? The same figure contains a drawing of an "unclassified iron blade catalogue DK 255B/400" (vol. 2B:29). This is identical to the many iron sickles interred with the dead during the latest phase of the Iron Age in upper Mun Valley sites ca. 300 km to the southwest, an innovation of considerable cultural significance (Higham, Manly et al. 2019).

In chapter 4, Elizabeth Hamilton is joined by Samuel Nash to outline the results of the various technical analyses. The majority of the bronzes included tin and were left as cast; there is little evidence for annealing or hardening. Temporal change was slight. Iron was introduced in the Middle Period and the Late Period saw some high-tin bronzes, particularly a child's necklace. A rare feature of the early use of iron was the presence of spears with an iron point and bronze haft. The authors conclude from the first appearance of bronzes that the technology came to Ban Chiang fully developed. A binary tin alloy dominated throughout. There is no evidence for leaded alloys. No interest seems to have been given by the prehistoric smiths to hardening either cast bronzes or forged iron, even in the case of the early socketed bronze spear found with burial 76. No increase in the range of bronzes over time is in evidence. It was a very conservative tradition, we read, in which bangles predominated.

What evidence is there for the presence of founders at Ban Chiang? The answers come in chapter 5, authored by Hamilton, White, and William Vernon. As they describe, artifacts used in the production of bronzes can illuminate what was being locally cast. Small-lipped crucibles together with adhering dross, slag, and copper prills comprise the principal evidence. The 90 crucible fragments and two nearly complete specimens span all three periods of occupation. Their form and size and the presence of thin layers of lagging are all matched by crucibles from other sites in Northeast Thailand and beyond, into Southeast Asia as a whole. Casting moulds at Ban Chiang are very rare; just four in sandstone are described, none of which clearly display what was being cast. No definite clay moulds were encountered. No hearths used to melt copper prior to casting were present. Again the tradition was conservative: there is no discernable change in crucible technology throughout the occupation span of Ban Chiang. The founders, they conclude, reflect a small-scale intra village activity, of short duration, with little labor input. Whether or not there were indeed local founders, or only visiting itinerant specialists, is left open.

The authors advocate what they call a "life history" approach to metallurgy at Ban Chiang. Where an artifact is found, they write, begins an additional chapter in its life history. There are four different contexts: in burials as mortuary offerings, possibly associated with burials through proximity, in features such as pits or postholes, and simple recovery in the cultural matrix of the site. Very few of the dead at Ban Chiang were interred wearing bronze ornaments or accompanied by bronze tools or weapons. In the entire mortuary assemblage of ca. 148 graves, there are 35 bronze bangles/anklets, an axe/adze, a point, and three pieces of wire/rod. Broken down into successive phases, four of 79 Bronze Age burials contained 14 bangles, one axe/adze, and a spear. The ca. 54 Iron Age graves contained 21 bronze bangles and three wire

necklaces. There were also an iron blade, a bimetallic spear, a bimetallic point, seven iron bangles, six iron blades, and five iron points. No crucibles or moulds were found as grave goods. The vast majority of the metal finds come from non-mortuary contexts; these are dominated by amorphous lumps of bronze that might be by-products of on-site casting. Bangle fragments are the most frequently identified bronze artifacts from general soil matrices. Very few tools were found and these take the form of blade fragments that cannot be assigned to a particular type. The authors conclude that metal, though rarely placed with the dead, was relatively abundant in daily life.

White and Hamilton turn to some important results of their previous analyses in chapter 7. Again, stressing the importance of evaluating domestic and other non-mortuary contexts, they comment on the severe problem of possible relocation of fragments of metal through disturbance, such as the digging of graves, postholes, pits, bioturbation, and the impact of monsoon rains. The key question is: can you be sure that a small fragment of metal or crucible found in a potentially disturbed layer belongs where it was found or could it have been relocated in prehistory? Answering this question where such fragments are found in a context judged earlier than the first burial with a bronze grave good or a casting hearth will obviously date the initial use of metal at any given site. The authors devote detailed descriptions to the presence of amorphous fragments of bronze in the lower levels at Ban Chiang. The lowest was found in a feature described as a "hearth" by Gorman, although evidently no charcoal was ever identified in excavated remains. This "hearth" is at a lower level than burials 42 and 43. My colleagues and I have dated the latter on the basis of bone collagen to 1285–1119 cal. B.C. (Higham, Douka et al. 2015). Having described a handful of other scraps of bronze in early soil matrix deposits, they turn to burial 72 and the issue of a flat piece of bronze found under the skeleton. If this was not a deliberate placement, they suggest that it might have been relocated from an earlier deposit when the grave was cut. The bone collagen date for this burial is 1025–921 cal. B.C. On the basis of seven fragments of metal, a piece of crucible, and one piece of slag, the authors conclude that metal processing was in place contemporaneously with their lower EP II burials.

By the same reasoning, the first iron should have been smelted and forged simultaneously with the first bronze, for iron was recovered from an equally early level. It came from an area below burial 31 of their lower EP III–IV. There was another piece of iron in the overlying level 8. Apparently, I excavated a piece of iron on 11 May 1974 associated with an otherwise late Bronze Age burial 9. These finds underline the very exacting issue of identifying an accurate provenance for fragments of metal in any of the soil matrix deposits at a site riddled with burials, pits, postholes, and myriad other sources of disturbance. Quite rightly, they conclude that these tentative findings need confirmation from other sites in the region.

Nevertheless, one of their conclusions is that copper-base metals were indeed in use at Ban Chiang before the first evidence from burials; similarly, iron was also present prior to its appearance as a grave good. Furthermore, copper was not so rare that it was recycled, since fragments survived in occupation contexts.

DISCUSSION

As Armit (2015:755) has stressed, "Writing up someone else's excavation is always difficult. Missing sections, duplicated context numbers and misinterpreted stratigraphic relationships are all par for the course." In the light of this fact, one

must admire Joyce White's courageous decision in 1982 to accept responsibility for analyzing and publishing the excavations at Ban Chiang and three related sites. She has now grappled with this challenging mission for 37 years, writing in 1994 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)

Indeed, who was excavating and recording the notes and plans? This is clearly an important issue. The excavation was directed by Chester Gorman and Pisit Charoenwongsa. Digging was undertaken by Thai villagers and trainee students from Silpakon University. Human burials were uncovered by Chester Gorman, Deborah Kramer, Michael Pietrusewky, Jean Kennedy, the students, and by me. The excavation proceeded in 10 cm spits within layers. After each spit was removed, the newly exposed surface was scraped clean and any features recorded on a plan. The features such as pits, postholes, and areas of disturbance were then excavated, each with its own number, and drawn on a plan. All burials were photographed and drawn on graph paper with mortuary offerings given a unique number. Gorman was not always present, particularly towards the end of the 1975 season, and recording was then in the care of the graduate students. This was Gorman's and my first experience excavating such a site. We were confronted with deposits that were difficult to interpret. There were numerous insect nests, each the size of a cricket ball, constituted of relocated cultural material. Torrential monsoon rains would have affected the integrity of accumulated cultural remains. As White (1994:7) noted, there was also the impact of prehistoric human disturbances: "This was not a specimen in isolation from intensive cultural activity. The plan shows an extremely complex surface with numerous postholes, features, and burials originating and cutting into lower layers. There is very little 'undisturbed surface'."

These two volumes are a most welcome addition to the literature on prehistoric metallurgy in Southeast Asia, and Elizabeth Hamilton is to be congratulated on the comprehensive analyses they contain. However, some serious issues must be addressed. Foremost is the lack of a full and final report on the excavations. The scholarly community has no access to site plans, sections, or data on other categories of material culture as referents within which to weigh the data on metals despite the modest size of excavations. Thus, we opened an area of just 4 × 17 m to a depth of 3.4 m in 1975. In 1994, White (1994:20) wrote that "publication of the first volume on chronology and stratigraphy is scheduled for January 1997." This promised report has never appeared, and any archaeometallurgist interested in what was happening in Southeast Asia will not find it easy to gain necessary insight. For example, White has adopted a system of nomenclature unique to Ban Chiang. For the 1975 area opened, there is a lower Early Period containing five levels and mortuary phases IIc, IIIa, IIIb, IVa, IVb, and IVc. This is followed by an upper Early Period with four levels and mortuary phases Va, Vb, Vc, and VI. The Middle Period has five levels and burial phases VI, VIIa, VIIb, and VIII, while the Late Period has a further three levels and mortuary phases IX and X. How can one relate this sequence to any other site or region? Which levels or burial phases belong to the Neolithic, Bronze Age, or Iron Age?

Table 1. Cultural Sequence from Ban Chiang 1974–1975 Excavation Seasons

Period per White and Hamilton	Mortuary Phase per White and Hamilton	Technological Age per C. Higham	Ban Chiang 1974 Burial Nos.[a]	Ban Chiang 1975 Burial Nos.[a]
Late-Middle	LP X	Late Iron	1, 3, **14**, 51, **55**	1, 2, 3, 7, 8, 13
	LP IX			4, 5, 6, 9
	MP VIII	Early Iron		**12**
	MP VIIb		22	11, 19, 20, 22, **23**, **24**, **26**, **80**
	MP VIIa		11	10, **14**, 15, **16**, 17, **40**, 41, 71, 73, 75, 78
	MP VI	Late Bronze	4, 9, 15, 17, 18, 20	21 25
Upper Early	EP Vc		5, 6, 7, 8, 10, 12, 13, 16, 19, 28, 35, **49**, 53	28, 29, 30, 32, 53
	EP Vb			27, 36, 56,
	EP Va		21, **23**, 29, 30, 36, 37, 39, 50	33, 42, 59
Lower Early	EP IVc	Early Bronze		31, 34, 35, 37, **38**, 48, 64, 82
	EP IVb			46, 61, 63, 66, 77
	EP IVa		26	43, 50, 51, 54, 55, 69
	EP III–IV		31, 54	45, 65
	EP IIIb			44, 47, 49, 70
	EP II–IV?			67, 68
	EP II–III			58, 72, 79, 81
	EP IIIa			49, 52, 62, **76**
	EP IIc	Late Neolithic	24, 33, 34, 38, 40, 42, 43, 45, 46	57, 60, 74
	EP IIb		32, 41, 47, 52	
	EP IIa		25, 48	
	EP I	Early Neolithic	44	

[a] Numbers in bold are for burials with bronze offerings.

To assist the reader, I provide an aide memoire (Table 1, Fig. 1). Because of the lack of published information I cannot trace a mortuary plan for the 1974 excavation season, but I find that the 1975 burial phases EP IIIa–EP IVc are comprised of three rows of early Bronze Age graves (Fig. 2). Burial phases EP V–MP VIII form rows of late Bronze Age graves, followed by two clusters of graves dating to the Early Iron Age. A thin scatter of LP IX–X burials belong to the Late Iron Age.

I do not wish further to flog the dead horse of Ban Chiang's chronology. The facts are available for all interested readers to make their own judgement (Higham, Douka et al. 2015; Higham, Higham et al. 2019). However, the interested reader from beyond Southeast Asia needs to know that White and Hamilton (2009) have dated early bronze at Ban Chiang from 2000 to 1800 B.C. This span derives from six Accelerator Mass Spectrometry (AMS) dates on rice chaff temper mixed with crushed potsherd, and one

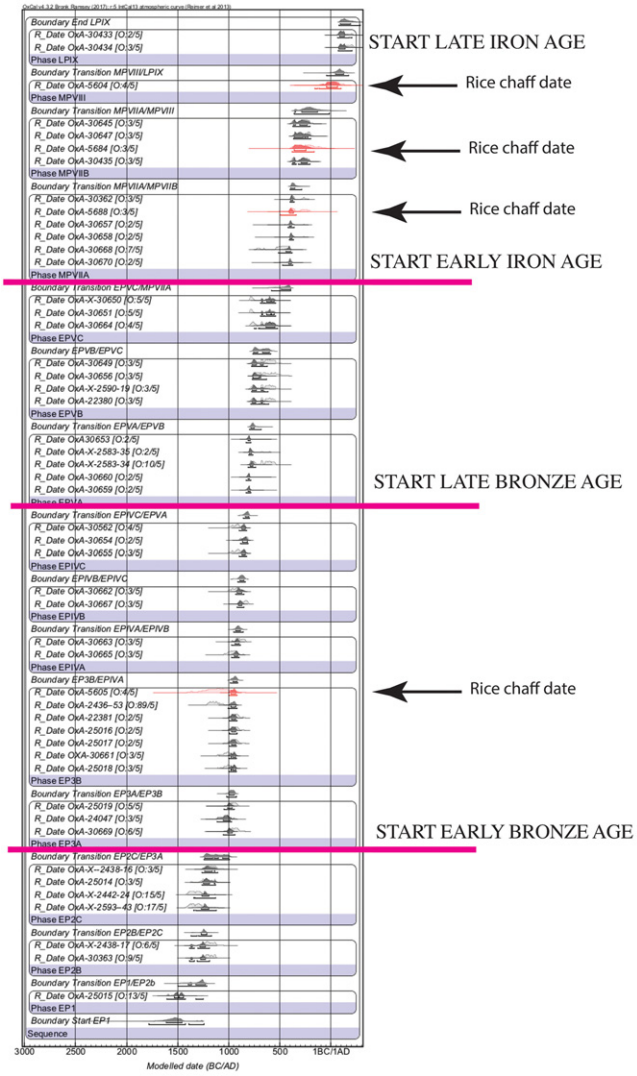

Fig. 1. Bayesian plot of bone collagen dates for human and pig bone from Ban Chiang, showing Higham's division into major cultural phases; arrows point to four dates derived from organic temper from mortuary vessels, but rejected by Glusker and White (1997) as unacceptably late despite matching dates obtained from bone collagen (image by C. Higham).

from rice phytoliths, winnowed out from a total of 21 determinations (Fig. 3). The 14 rejected results include four derived from organic temper extracted from its clay matrix that have been rejected because they were seen as too late despite their matching precisely the sequence derived from bone collagen (Fig. 1). Other results on crushed potsherds have been manipulated away as being too early (Glusker and White 1997).

We have seen White criticize three of her colleagues because "Dates are discounted, not mentioned or 'adjusted' (Rispoli et al. 2013:136)," a remarkable statement given her own track record.

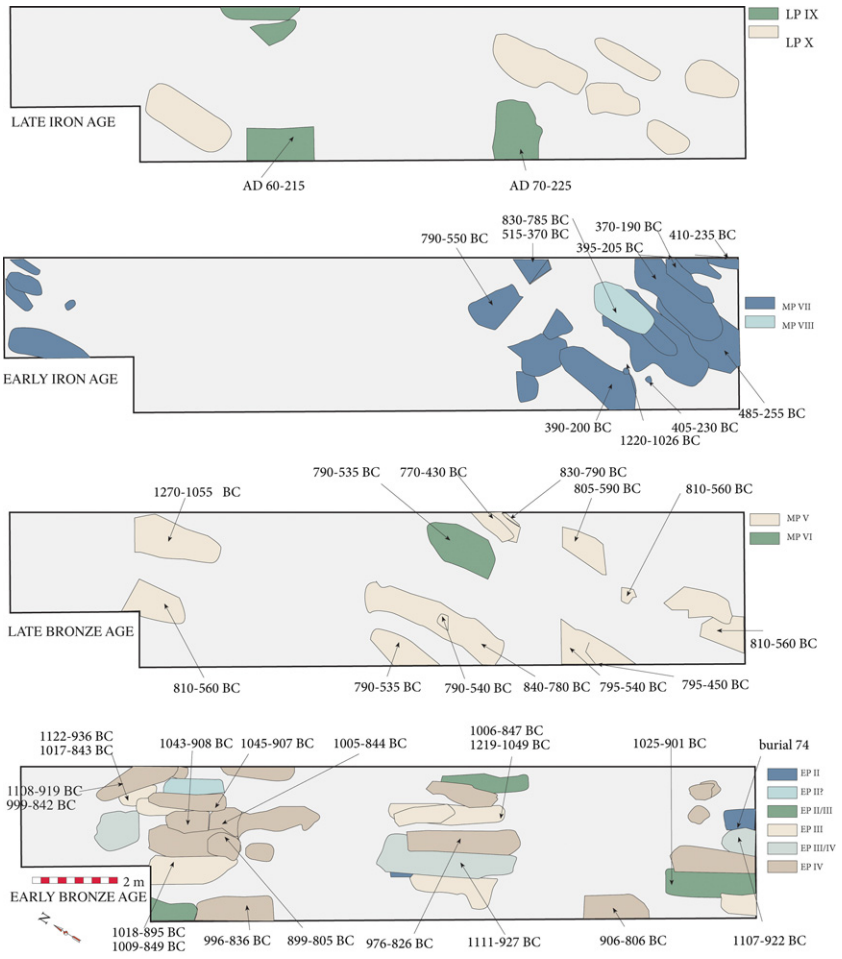

Fig. 2. The cemetery plans for Ban Chiang 1975, showing bone radiocarbon determinations for each burial dated (image by C. Higham).

These seven determinations are the foundation for White's long chronology. They must be set against a major dating initiative that has generated 320 new radiocarbon dates derived from charcoal, rice and millet grains, freshwater bivalve shells, and human bone collagen from nine key Southeast Asian sites, including Ban Chiang itself. The new dates provide a chronological anchor for the Neolithic, Bronze, and Iron ages on mainland Southeast Asia. They place the arrival of the first millet and rice farmers in the late third millennium, the establishment of copper-base metallurgy in the late second millennium, and the first iron forging at ca. 400–500 B.C. (Higham, Douka et al. 2015; Higham, Higham et al. 2014; Pryce et al. 2018).

Many specialists have warned against AMS radiocarbon dating of crushed potsherds. For example, Berstan and colleagues (2008:702) note that "direct radiocarbon dating of pottery is relatively uncommon due to the presence of carbon sources with differing ages, for example geological carbon remaining in the clay after firing, added organic temper, carbon from fuel in the kiln and exogenous contaminants absorbed from the

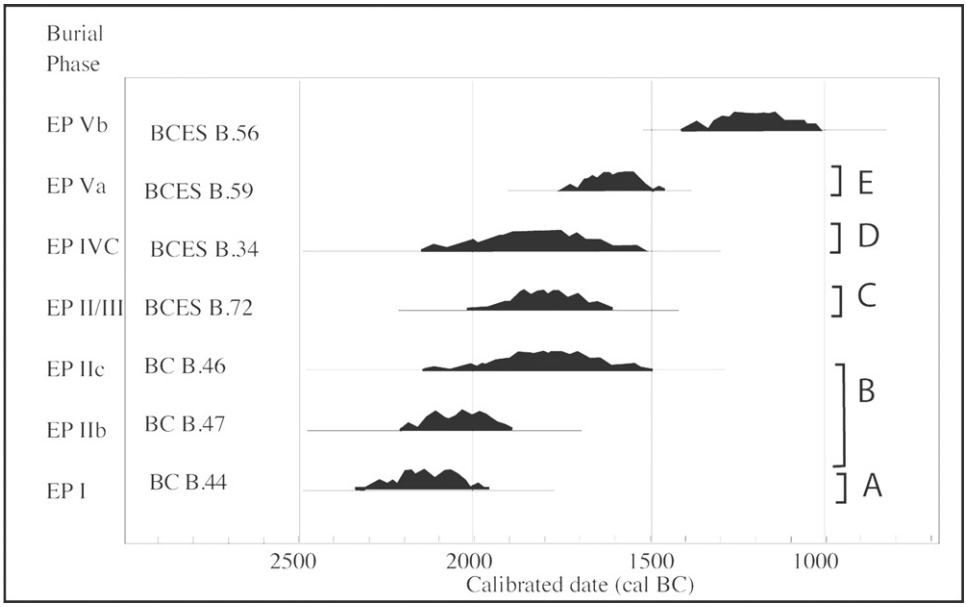

Fig. 3. Plot of the seven radiocarbon determinations from crushed potsherds and phytoliths from Ban Chiang that provide evidence for White's long chronology (image by C. Higham, based on White 2008:97, fig. 3).

burial environment." Nevertheless, White's chronology turns on these seven hand-picked internally contradictory determinations that were derived from samples widely seen as highly unreliable (Fig. 3). Her interpretation begins with BC burial 44, a Neolithic, pre-metal, grave dated on the basis of rice phytoliths to 2289–1978 cal. B.C. (Fig. 3A). The same burial has been dated on the basis of human bone collagen to 1565–1444 cal. B.C. There are two crushed potsherd determinations for EP IIb–c. No burial of this phase contained bronze, but there are a few scraps of bronze in occupation contexts said to be contemporary with this phase. The two dates barely overlap at 2198–1891 and 2032–1526 cal. B.C. (Fig. 3B). A flat piece of bronze was found at the base of burial 72, which was one of the earliest uncovered in 1975. The crushed sherd date for this burial is 1973–1616 cal. B.C. (Fig. 3C). However, the bone collagen date for the individual interred is 1025–901 cal. B.C. A crushed sherd date from burial 34 of EP IVc is 2132–1533 cal. B.C. (Fig. 3D). This burial, White alleges, is later than burial 76, which is associated with a bronze spear. The bone collagen date for this individual is 897–806 cal. B.C. Finally, there are two crushed potsherd results for burials 59 and 56 that postdate the burial with the bronze spear: 1739–1496 and 1385–1016 cal. B.C., respectively. Burial 59, which has a bone collagen date of 808-748 cal. B.C., is thus said to support bronze earlier than 1500 B.C. (Fig. 3E).

In all, my colleagues and I have dated human bone collagen from 49 human and five pig bones from Ban Chiang (Higham, Douka et al. 2015:8, fig. 3). The Bayesian analysis of these bones place initial Neolithic occupation in the late sixteenth century B.C., the first undoubted presence of bronze at about 1000 B.C., and the transition into the Iron Age in the fifth century B.C. (Fig. 1). In arguing against the validity of these determinations and their Bayesian analysis, White presents an interesting argument

under the heading "Red Flag Bone Dates," which introduces the site of Ban Non Wat for comparative purposes (vol. 2A:36). This site commands a natural trade route in the upper reaches of the Mun River where extensive excavations over ten seasons have revealed a twelve-phase sequence spanning the early Neolithic to the end of the Iron Age. She takes one Neolithic pottery vessel from my excavations at Ban Non Wat dated to 3170 ± 27 B.P. from shell and finds it so similar to two pots from Ban Chiang dated 2984 ± 26 and 2958 ± 29 B.P from bone collagen that they should be contemporary. That they are not, she asserts, undermines the reliability of both dating methods. She also illustrates this pot as if it were the same size as those from Ban Chiang, but in fact it is twice as large (Fig. 4).

White is the leading proponent for cultural diversity in Southeast Asia, writing:

> Surprising differences in nearby sites first became evident when the pottery sequence of the prehistoric site of Ban Chiang was compared in detail with that of Ban Na Di located

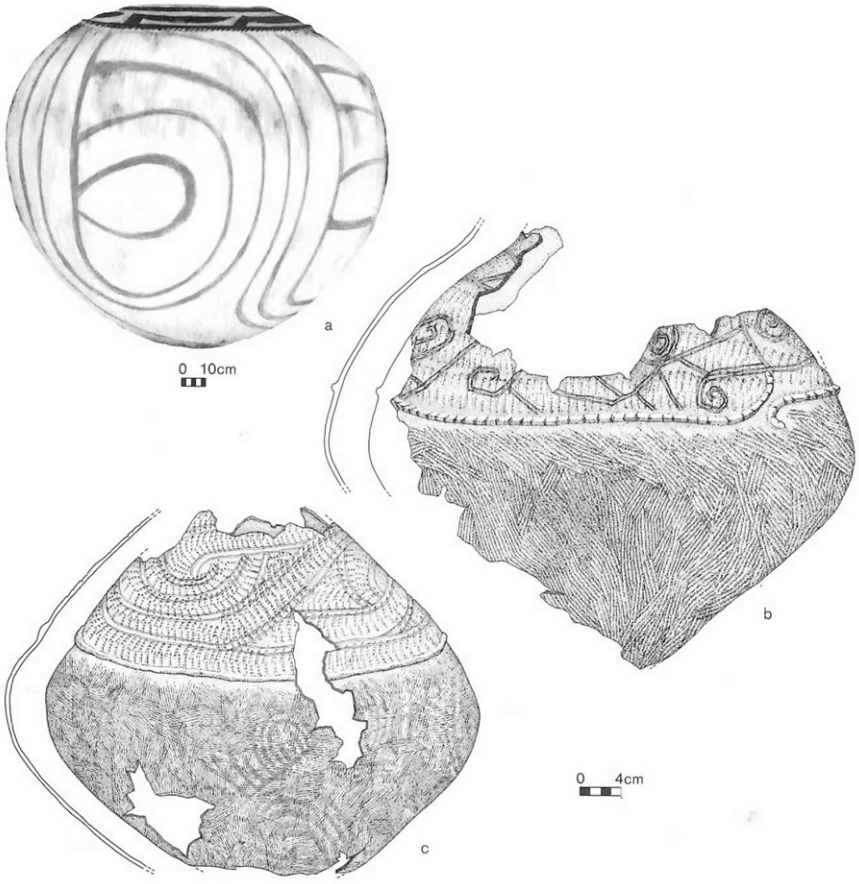

Fig. 4. White and Hamilton's illustration of three vessels shown at similar size, although the Ban Non Wat vessel (a) is actually twice as large as the other two; original caption: "Possible comparanda from early phases at Ban Chiang and Ban Non Wat. (a) Example of a BNW Neolithic 1 burial jar that contained an adult. Burial 28 cat. 1039. (b) the i&i burial jar for BC Burial 43 Pot A 1374. (c) Example of a lower Early Period Phase IIc i&i burial jar" (after White and Hamilton 2018:37, fig. 2.8, courtesy of Penn Museum).

> only 20 kilometers away (White 1986:234). Based on radiocarbon dates, the main cemetery deposit at Ban Na Di primarily overlaps the Ban Chiang Middle Period cemetery dating from the early to the middle of the first millennium BC. The usual archeological assumption that two such close sites would share the same cultural tradition (Higham and Kijngam 1984) proved hard to specify ceramically, contemporaneous deposits at the two sites had so few stylistically similar ceramics that it was difficult to crossdate the two sites. (White 1995:105)

You cannot have your cake and eat it.

White has written that "Southeast Asian archaeologists . . . know they must tolerate some degree of chronological fuzziness" (White 2008:101). Her chronology presented in volume 2A:47 table 2.3 is a masterpiece of the genre. The first bronze we learn, comes from contexts attributable to burial phase II. This lies nebulously within a span from ca. 2100 to 1500 B.C.The first evidence for iron reposes between ca. 900 and 300 B.C. I leave dating to the professionals. In advocating the application of Bayesian analysis to multiple well-provenanced samples, Bayliss and colleagues (2007:24) wrote that:

> The less formal approaches to interpreting radiocarbon dates which are very widely used by prehistorians are very frequently importantly wrong and misleading. Not only does it appear that human activities which may in fact have been separated by centuries were contemporary, but it also appears, erroneously, that activities lasted much longer than they did in reality.

I follow their lead, and leave it to readers to draw their own conclusions.

A strong thread running throughout the volumes is that the life history of each metal object is of central importance and that determining an object's life history is best achieved by identifying its *châine opératoire*. There are also numerous aspersions at colleagues who concentrate their attention on metal from mortuary contexts at the expense of those found in occupation deposits that are assumed to represent the daily use of bronze or iron. My own excavations, particularly at Ban Non Wat, are treated as prime targets for such negligence.

Facts speak for themselves. There are 40 bronzes comprising 35 bangles, one axe/adze, one spear, and three pieces of wire/rod in the total of ca. 147 burials at Ban Chiang. Just one Iron Age man from my excavations at Noen U-Loke had more than twice that number of bronzes on one arm (Higham et al. 2007:214). Hence, these two volumes devote much analytic and interpretative attention to the fragments of bangle assumed to have been discarded during the daily round, to bits of blade, flat pieces, rods, and points, as well as to the numerous amorphous pieces that cannot be ascribed a form. These, the concluding sentence in volume 2B asserts, stress "the importance of assessing typological, temporal and distributional evidence of even fragmentary non-grave good remains for understanding production and daily life usage of metal technologies" (vol. 2B:201).

This is perfectly true. It is why my colleague Hayden Cawte (2008) devoted his doctoral dissertation to reconstructing the complete *châine opératoire* of bronze production at Ban Non Wat, a study seemingly unfamiliar to White or Hamilton. He pinpointed an absolutely crucial point that must be considered in conjunction with the relative areas excavated at the two sites. The combined exposure at Ban Chiang during 1974–1975 is 15 percent of the main square at Ban Non Wat. No bronze casting areas

were identified at Ban Chiang, but several were encountered at Ban Non Wat. Just four fragmentary moulds were recovered at Ban Chiang, none of which revealed what was being cast. At Ban Non Wat, between 350 to 400 moulds were found, including 25 bangle moulds and four clay axe moulds, in the grave of one founder. Herein lies a simple fact: you only know what was being cast on the basis of moulds. Cawte found that there are two forms at Ban Non Wat, one with rounded and the other with rectangular cross-sections (Cawte 2012: fig. 18:27). The former were used to cast predominantly axes and also spears, while the latter were used for bangles. There were more axe moulds than bangle moulds. As at Ban Chiang, the non-mortuary bronzes at Ban Non Wat are dominated by bangles. There are no complete axes or spears, other than in graves, surely because the metal was recycled.

The inescapable conclusion is that the non-mortuary bronzes that are so central to the study under review are but a pale reflection of reality; only a much larger excavation and the recovery of bronze foundries with moulds will illuminate the actual situation. In a wooded habitat with houses and other items made of wood, it is inconceivable that axes were not a daily need. This only reinforces the fact that full site reports must come before specialist volumes. At Ban Non Wat, for example, we find that the number of stone adzes plummeted as the first bronzes became available (Higham 2009: fig. 10:1). How many stone adzes were found at Ban Chiang, one asks, and what was their provenance?

What constitutes evidence for the initial presence of bronze and iron? White has concluded that copper-based metal was present in non-burial contexts in levels with "I and I" (Impressed and Incised) pottery, a widespread decorative technique that defines the early Neolithic settlement in Southeast Asia. I urge that the greatest caution be applied to giving credence to the presence of fragments of bronze in Neolithic contexts that underlie Bronze Age settlements. I base this on experience, not only of excavating at Ban Chiang, but also directing fieldwork at several other sites in Southeast Asia. Two of these, like Ban Chiang, had a sequence of Neolithic to Bronze Age occupation and burials. If I had an agenda to extend backward the date of initial metallurgy at either, I could easily have done do so by pinpointing a piece of bronze or a scrap of crucible in a Neolithic layer. I could even have claimed the earliest forged iron in the world, or placed the foundation of the Coca Cola company in the late Iron Age. I recommend caution, particularly when attempting to interpret a site without the experience of having excavated there or any similar settlement.

CONCLUSIONS

So where does all this lead? We have been promised that the synthesis in volume 2C will place Ban Chiang in a wider perspective. This is keenly anticipated and it is again hoped that a set of inescapable facts will be addressed in that volume. The first of these is location. Ban Chiang lies in the remote north of the Khorat Plateau, far from any natural exchange routes. Viewed from the perspective of the highly strategic sites in the upper reaches of the Mun River, it was a prehistoric settlement of marked poverty. The two volumes reviewed here have shown that there were few advances in technical expertise in the range of cast bronzes throughout the sequence or any hint of social change. By contrast, Cawte's (2008) life history approach to analyzing the bronzes from Ban Non Wat has identified nuanced aspects to the sequence there that do not seem to be matched at Ban Chiang. The analyzed axes from the early burials there are near pure

copper, whereas analyzed crucibles were used to cast tin-bronze. We have suggested that the first copper mortuary offerings came to the site as exotic imports, which together with multiple exotic shell and marble ornaments, signaled the rapid rise of a social elite that continued for several generations (Cawte 2008; Higham 2011).

The strategic location of the Mun Valley, with its command of a natural trade route and vital salt deposits, is also evident during a later phase of occupation there. The 76 Iron Age burials at Noen U-Loke contained 1508 bronzes, 50 times as many as the ca. 30 from Iron Age Ban Chiang (Higham et al. 2007). Moreover, the burials incorporated innovative casting methods and a far wider range of objects, including belts, finger and toe rings, and ear discs. One man wore 150 bangles. This highlights a fault line that runs through both *Ban Chiang, Northeast Thailand* volumes. On the one hand, Elizabeth Hamilton has contributed a superb and comprehensive analysis of the evidence for bronze and iron consumption at Ban Chiang. I hope she will now extend her expertise to other sites. On the other hand, in the 46 years since we excavated there, the structure of Southeast Asian prehistory has been transformed, and Ban Chiang has become a footnote. The excavated areas were small and the sample of metal insufficient for meaningful conclusions. The almost complete lack of moulds rules out any knowledge of what was actually being cast there or the possibility of exploring significant temporal change. The continuing lack of even a summary excavation report means that the study of the metal is isolated, with no possibility of being integrated with other aspects of society. Findings are set within a fuzzy timescale at a time when a rapidly growing corpus of Bayesian site chronologies across Southeast Asia and southern China unanimously date the initial farmer settlement of mainland Southeast Asia to the late third millennium B.C. and the first evidence for copper-based technology, including copper mines and production sites, a millennium later. If White continues to favor an initial date of 2000–1800 B.C. for Bronze Age Ban Chiang, then she will need to explain how bronze technology reached Ban Chiang just as the first Neolithic farmers were just establishing themselves elsewhere in Southeast Asia, and why knowledge of bronze technology never expanded beyond Ban Chiang to any other site for nearly 1000 years. One hopes that volume 2C will present a carefully revised approach to the chronology, shorn of stinging assaults on colleagues' credibility, and not set a pigeon among the cats.

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