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A new paradigm for the future of archaeometallurgy in Anatolia: review of Thai archaeology monograph series (TAM)

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Short Note

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ABSTRACT

This article reviews the Ban Chiang, Northeast Thailand, Volumes 2A, 2B, and 2C edited by Joyce C. White and Elizabeth G. Hamilton with the aim of bringing a new perspective to the understanding of archaeometallurgy in Anatolia. Regardless of specific subject focus such as geology, geomorphology, archaeology, or anthropology, any scholar interested in the field of archaeometallurgy will find a comparanda of their research in the Thai archaeology monograph volumes. White and Hamilton suggest a new paradigm favoring diversity and an anthropological technology-driven model for archaeometallurgical research, which I believe presents an excellent case to change and revise the presumptions of scholars studying metals' role in ancient Anatolia.

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1. Introduction

This article reviews the following three volumes:

White, J. C., Hamilton, E. G. 2018. (Ed.). Ban Chiang, northeast Thailand, 2A: Background to the study of the metal remains. University of Pennsylvania Press, Philadelphia.

White, J. C., Hamilton, E. G. 2018. (Ed.). Ban Chiang, northeast Thailand, 2B: Metals and related evidence from Ban Chiang, Ban Tong, Ban Phak Top, and Don Klang. University of Pennsylvania Press, Philadelphia.

White, J. C., Hamilton, E. G. 2019. (Ed.). Ban Chiang, northeast Thailand, 2C: The metal remains in a regional context. University of Pennsylvania Press, Philadelphia.

The Penn Museum's Thai Archaeology Monograph Series (TAM) is the product of decades of research by Joyce C. White and Elizabeth G. Hamilton at Ban Chiang and three other contemporary sites, Ban Tong, Ban Phak Top, and Don Klang. Published in four volumes (TAM 2A-2D), the first book, Ban Chiang, Northeast Thailand, Volume 2A: Background to the Study of the Metal Remains, introduces the archeology, chronology, and theoretical background of metallurgy in seven excellently constructed chapters. The second volume, Ban Chiang, Northeast Thailand, Volume 2B: Metals and Related Evidence from Ban Chiang, Ban Tong, Ban Phak Top, and Don Klang, documents metallurgical remains and their contexts. The discussion of data in a broader regional framework is presented in the third volume, Ban Chiang, Northeast Thailand, Volume 2C: The Metal Remains in Regional Context. The last book, Ban Chiang, Northeast Thailand, Volume 2D: Catalogs for Metals and Related Remains from Ban Chiang,

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Ban Tong, Ban Phak Top, and Don Klang, covers the metal-related evidence from the sites and will be published in 2021.

The significance of reviewing the TAM series for the Bulletin of the Mineral Research and Exploration (MTA) of Turkey is two-fold: First, the volumes put Southeast Asian metallurgy in a regional context, which should convince scholars in Turkey—and abroad—to concentrate on micro regional research while also keeping the global context in mind. Regardless of specific subject focus such as geology, geomorphology, archeology, or anthropology, any scholar interested in the field of archaeometallurgy will find a comparanda of their research in the TAM volumes. Second, the volumes, particularly TAM 2A, urge a shift from the linear cultural evolutionary model to the anthropological technology-driven model in the evaluation and interpretation of metallurgical data. This new model, which the editors of the volumes name the *New Paradigm*, is vital in obtaining a broader understanding and global vision of ancient Anatolian metallurgy. Research related to archaeometallurgy in Anatolia has long been (and still is) under the influence of Childe's technologically deterministic model. Archeologists, archaeometallurgists, and geologists accept the linear sequence of usage of copper, arsenical copper, and copper-tin alloy (i.e. tin bronze) as de facto without putting in enough effort to observe spatial and temporal variations. With the ever-growing archeological and geological evidence, Childe's cultural evolutionary model followers' arguments are insufficient to explain the diversity and different social complexity lines, especially in the bronze age of Anatolia. The New Paradigm opens a venue for scholars to change and revise their presumptions regarding metals' role in ancient Anatolia. I will illustrate this with specifics at the end of the review.

2. Review

TAM 2A deals significantly with the theoretical frame of social processes and the anthropology of technology. As the starting point, White acknowledges chronological problems while discussing stratigraphy along with absolute and relative chronologies in the first two chapters.

Chapter 3 severely criticizes universalist, linear progressive, normative, essentialist, and

technologically deterministic perspectives of archaeometallurgical research by referring to them under the umbrella term the Conventional Paradigm. White and Hamilton discuss why archeological ages cannot be equated with technological stages and how this misconception has caused scholars to interpret metals as the prime motivator for social complexity and inequality. Research in different parts of the world now shows that different paths and metallurgical sequences for metallurgy depend on people's idiosyncratic cultural context. Metals did not always significantly contribute to the rise of elites or act as a social catalyst for the emergence of social classes. As the authors wisely put in the chapter's title (*Debunking the Conventional Paradigm*), such evaluations and generalizations stemming from scholars with Marxist backgrounds (e.g., Childe) should be debunked. This chapter casts a dramatic shadow on the oversimplified models drawing an arrow from simple to complex metallurgy and relating it to social complexity.

Chapter 4 is devoted to presenting White and Hamilton's new model for archaeometallurgy, which they call the New Paradigm. The anthropology of technology stands at the core of this model. The authors clarify a series of relevant concepts such as technological systems, choices, styles, traditions, changes, and life history frameworks to highlight the importance of studying metallurgy as a socio-technical system. Human agency in its social contexts is emphasized (not only for metallurgy but for other technological systems) through a distilled discussion on the adoption of technology. This chapter nicely builds upon the previous one to confirm why archaeometallurgy should not be explained with linear progressive and deterministic approaches in Thailand or globally, and is better defined as less linear and more complex.

Chapter 5 shows how the New Paradigm can assess production, consumption, and exchange patterns of prehistoric economies and their associated societies. The chapter starts with a thorough review of Costin's craft production model (1991) by briefly discussing dependent-independent crafts, part-time and full-time specialization, and the organization of craft production. For consumption and demand aspects of economies, the authors discuss the differentiation between the definitions of prestige goods (Earle, 1991) and valuables (Dalton, 1977) to question: how metals fit into the economies of the middle-range metal-

age societies of Thailand (page 126). Regarding this query, middle-range societies economics (introduced in Chapter 3) are discussed via wealth accumulation and regional exchange systems. For the economic foundation of the bronze period of Thailand, regional exchange systems are suggested to favor regional heterarchical sociopolitical systems with varying degrees of hierarchies (White, 1995).

Any research related to prehistoric metallurgy needs to address the raw material potential of the region, i.e., whether required resources were readily available for exploitation in nearby areas or not. The accessibility of resources in the landscape directly relates to the region's geology and geomorphology, which is the subject of co-authored Chapter 6 of TAM 2A. Hamilton and White's brief review demonstrates that Ban Chiang and its environs lack mineral resources due to its geology; even though tin, copper, and lead ores are abundant in Southeast Asia. The Ban Chiang culture area sites' metal assemblage reveals that these communities had access to metal from distant sources, which is confirmed with the lead isotope analysis presented in TAM 2C (Chapters 2 and 3). While TAM 2C provides detailed investigations of particular areas in Thailand for prehistoric metallurgy, the authors cautiously remind readers that resources identified in modern surveys might be different than the ones used in prehistory. This particular problem resonates well with prehistoric metallurgy research in Anatolia, where current zones of raw materials and documented resources might not be of metallurgical interest to ancient societies.

In the final chapter (Chapter 7) of TAM 2A, Hamilton presents technical details on the study of archaeological metal (copper, bronze, arsenical copper, antimonial copper, and iron) by expanding the discussion on chaînes opératoires (introduced in Chapter 5). This chapter helps the reader understand the analytical data presented in the following volumes. The dictionary of technical terms appended at the end of the book is useful for anyone interested in archaeometallurgy. TAM 2B includes a similar glossary with related terminology.

TAM 2B dives into the details of the metallurgical remains from Ban Chiang, Ban Tong, Ban Phak Top, and Don Klang. The volume focuses on the archaeometallurgical studies conducted on their assemblages.

In chapter 2, Hamilton introduces the collections, which comprise 639+ provenanced pre- and protohistoric metal items. The conservation procedures applied to the artifacts after 1976 (when the material was shipped from Thailand to the Penn Museum in Philadelphia, USA) along with years-long documentation and the database process are explained. The metallographic research relies on microstructural and compositional analysis. Optical microscopy was applied to understand the microstructure (i.e., marks of hammering, annealing, casting, etc.) of metal samples. PIXE (proton-induced X-ray emission spectroscopy), SEM-EDS (scanning electron microscope/ energy-dispersive X-ray spectroscopy), optical emission spectroscopy, and XRF (X-ray fluorescence) illuminate the compositions. Not all analytical techniques were applied to every sample. Nonetheless, the sample sets from each site cover all the artifact types and periods.

The typological categorization of the metals as personal ornaments, implements, and others, along with sub-groupings and terminologies, are presented in the following chapter (Chapter 3). Morphologies and possible functions of the artifacts lead the way to a broader understanding of the metals' role in pre- and protohistoric communities' lives.

The importance of archaeometallurgical analysis emphasized throughout the TAM volumes is embodied in chapter 4. Hamilton and Samuel K. Nash present the results of laboratory work. The physical and chemical properties of the metals examined via various analytical techniques noted in chapter 2 describe the basic information on the material characteristics of the artifacts. Understanding material properties is described as an essential step to reconstruct not only chaînes opératoires of past technological systems, but also socio-technical systems of metal working (page 61). Various combinations of metal working (e.g., casting, annealing, hammering) and alloy choices are identified (e.g., copper, bronze, tin bronze with lead, bronze high with tin, leaded high-tin bronze, arsenical alloys, impure copper, leaded antimonial copper, iron). The data suggests that the copper-based technology arrived in the Ban Chiang area in an already developed stage. The variety in alloying practices is intriguing; there is no correlation between alloy and artifact types. An enormous analytical data load presents an excellent framework to evaluate changes and diversity for non-state, middle-range societies through time.

William W. Vernon and the editors' co-authored chapter 5 presents evidence related to on-site manufacturing. A total of 102 artifacts, mainly consisting of crucibles and crucible fragments and a small sample-set of molds and slag, were analyzed with a combination of analytical techniques, including thin section petrography, SEM-EDS, and PIXE. The laboratory work conducted on the manufacturing process' remains offers direct and indirect evidence of metal processing, suggesting that the metal production was dispersed, non-specialized, and decentralized. These results add another step towards the New Paradigm.

Chapters 6 and 7 apply the life history framework introduced in TAM 2A chapter 4 to the metal corpus of Ban Chiang, Ban Tong, Ban Phak Top, and Don Klang, all of which are mixed cemetery and occupation sites. Temporally assessed depositional contexts (e.g., burial, non-burial) alongside typological data provide numerous lines of information to examine the study sites' discard and domestic behaviors. The contextual details described in these final chapters of TAM 2B express that metals were part of daily and mortuary life. Whether scholars seek to establish a comprehensive realization of the social role of metals in Southeast Asia or elsewhere (e.g., Anatolia, the Near East), a thorough, non-selective contextual evaluation appears mandatory.

TAM 2C sets the larger regional scene for Southeast Asia's prehistoric metallurgy by deriving evidence from several excavations conducted at primary production zones located in northeastern and central Thailand. In Chapter 2, Vincent Pigott introduces the mining and smelting evidence collected from six sites located in the Khao Wong Prachan Valley in central Thailand, Phu Lon in the northeast, and Sepon in Laos. These sites reveal the most extensive archaeological confirmation for prehistoric mining and metallurgy in the middle Mekong and Chao Phraya Basins. Considering the geological backdrop of Thailand with nucleated metallic resource areas reviewed in TAM 2A Chapter 6, mining and smelting evidence at the sites discussed by Pigott are potential candidates for supplying metals (copper) to the greater region. The similarities in artifact typologies and technologies, such as distinctive ways of ore processing, crucible smelting, or the use of bivalve molds suggest connections between the production regions, all of

which produced copper to meet the significant demand of consumer sites like Ban Chiang.

The next step in accumulating regional evidence is introducing the results of lead isotope analysis (LIA) by T. Oliver Pryce in Chapter 3. Even though LIA has a drawback in assigning ultimate provenance to metal artifacts, it provides valuable data sets to illuminate the supply chains. Only a small number of artifacts from Ban Chiang (17 samples) and Don Klang (3 samples) were isotopically analyzed as part of the Southeast Asian Lead Isotope Project (SEALIP). Considering the high volume of artifacts presented in TAM 2B from the four sites, the isotopic research conducted on 20 samples appears somewhat limited. The LIA results could not assign provenance(s) to the sample set, which might relate to several pitfalls of the methodology. Thus, the results should not be taken as conclusive. Further regional surveys and excavations not only focusing on modern mining zones, but also on small, local resources, could pinpoint mining locales exploited for non-state, middle-range societies.

Chapter 4 focuses on regional consumer patterns and the relation between production and consumer sites from northeastern and central Thailand. The growing number of excavations at the consumer sites in the region allows Hamilton and White to establish a regional perspective to analyze various behavioral and socio-technical dynamics between producer and consumer communities. This chapter reviews the archaeometallurgical data unearthed at 34 sites in northern northeastern, southern northeastern, and central Thailand. The Tables 4.1 and 4.2 provided are especially useful to understand the data (i.e., chronology, context, artifact type, analytical work) collected from hard-to-find publications and theses (page 65). However, this review chapter compiles only sources written in English. Regarding the fact that the Three Age system was discussed and determined to be insufficient for Southeast Asia (TAM 2A, Chapter 3; White, 2017), the working regional chronology provided in Table 4.4 as a color plate appears well-prepared and extremely useful. Overall, this relatively long chapter offers the reader an in-depth review of consumption patterns at prehistoric sites located in different subregions of Thailand.

Chapter 5 incorporates the data collected from the four case sites (TAM 2B) into the copper production and regional consumer sites (TAM 2C). This regional

perspective allows the editors to assess the variations and changes in metal in producer and consumer communities. This chapter's significance is the emphasis on the local variations in non-state societies, which indicate choices that have not been under the political or social control of elite groups. Copper-base metals have different social roles in the Thai subregions, and bronze was not a marker of wealth in the bronze age. While the authors admit some methodological and sampling differences between the four cases and the regional data when evaluated within the New Paradigm theoretical frame, the overall assessment related to diversity, decentralized production, and significance of community choices stand.

White presents the conclusive remarks in the very last chapter (Chapter 6) of these comprehensive monographs. The holistic approach established in the TAM volumes facilitates archeological and analytical data collection embedded in anthropological theories. The evidence-driven New Paradigm leads to a shift from the previous arguments, which highlighted copper-base metals as triggers of social complexity and inequality. White provides the reader with a short and sharp critique of Charles Higham's model of metal ages while also integrating Chernykh's (1980) Circumponitic Metallurgical Province framework into southeast Asia to propose a Southeast Asian metallurgical province (SEAMP) (White, 1982, 1988; Pigott, 1999). White notes at the preface of TAM 2A that the ultimate aim of their work is to build a foundation for present and future scholars of prehistoric technology. The last chapter of TAM 2C substantiates the objective of the decades of research.

3. Discussion

Ban Chiang and Southeast Asian metallurgy overall created fault lines among scholars. The TAM volumes will not put a full stop to disagreements among scholars on the chronology and Ban Chiang's significance in Southeast Asian prehistory, and they will not establish agreement among scholars' approaches to evaluate archaeological data. Nevertheless, White and Hamilton make an excellent case to change evolutionary perspectives molded around Southeast Asian metallurgy. The authors demand a shift from the conventional model (i.e., linear, normative, essentialist, and technologically deterministic) to a paradigm centered on technological systems, choices,

styles, traditions, changes, and life history frameworks. Whether the chronology of the region changes or not, the anthropology of technology approach of the new model will stay effective, meaning that the epoch of working with selected data with a top-down approach is now over.

While the New Paradigm focuses on the extensive evidence collected from four sites located in northeast Thailand, this well-grounded model appears significant for regions beyond Southeast Asia. For example, the New Paradigm assessments resonate significantly with third millennium BC north-central Anatolian metallurgy. Decades of research focusing only on the so-called prestige goods, weapons, and elite objects in sites like Alaca Höyük do not reflect the complete picture of the social role of metals in these non-state societies. Arguments overstating the function of the majority of grave goods (e.g., prestige, luxury weapons), and heavily typology-based analyses of production and consumption patterns in the region spread the Childean narrative of metals as primary motivators of elite dominance and founders of social classes. A significant number of scholars choose to compress social inequality into metals. They do not want to integrate all available data and think out of their comfort zone, namely the Conventional Paradigm.

Hamilton and White noted that ... evaluating whole assemblages has not been the norm at recent excavations at metal age sites in Thailand (TAM 2B, page 126). Evaluation of selected assemblages is precisely the case for the Anatolian bronze age. While continuous efforts have been put into examining collections from cemetery areas, non-mortuary contexts receive less attention. Such a perspective with an arbitrary selection of evidence will continue to overstate the role of metals in Anatolia. A recent study assessing the typological, contextual, and technical data as a whole indicates that the screenshots taken from the selected finds and alloys (i.e., bronze) are only tailoring roles for ancient Anatolian metallurgy (Dardeniz, 2020).

There is no evidence of top-down economic control in the third millennium BC north-central Anatolian sites. Accordingly, scholars should examine inter-societal relations in detail before suggesting hierarchical models. Accumulating evidence displaying high levels of variety in local

production and consumption indicates that metals' social, political, and economic role could be different even for contemporaneous settlements. The New Paradigm presents a unique opportunity to start testing the Conventional Paradigm molded around Anatolian archaeometallurgy. White states that much more research is needed worldwide to tease out relationships-cause, correlation, or consequence-of copper, tin, and bronze to the establishment of political hierarchies (TAM 2C, page 157). I believe the third millennium BC metallurgy of north-central Anatolia and the Black Sea coast would provide excellent case studies to reevaluate predetermined production and consumption modes.

4. Results

To conclude, the ultimate aim of the TAM volumes is to add to the current global discussion of the development of early metallurgy (preface in TAM 2A). Correspondingly, the volumes are a great success. Both the editors and contributors challenged and succeeded to debunk the conventional paradigm of prehistoric metallurgy. The evidence is crystal clear that the impact of metal technology was not equal in all prehistoric societies; thus, they should not be considered uniform. The cases based on the Ban Chiang cultural zone sites of Southeast Asia validate the New Paradigm. Now, it is time for scholars in the field to test the new model to understand technologies (e.g., metal, ceramic, stone, textile) in social contexts to lead the paradigm shift.

Note for the readers: This review does not capitalize the term bronze age on purpose. To see the critiques on the capitalization of the Three Age system, the reader is encouraged to look into the relevant chapters in TAM 2A.

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