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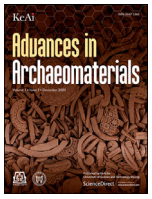

The anthropology of technology and a new paradigm for archaeometallurgical research?
Review of Joyce C. White and Elizabeth G. Hamilton, *Ban Chiang, Northeast Thailand*, Volume 2A: *Background to the Study of the Metal Remains*, Volume 2B: *Metals and Related Evidence from Ban Chiang, Ban Tong, Ban Phak Top, and Don Klang*, Volume 2C: *The Metal Remains in Regional Context*

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The publication of Joyce White and Elizabeth Hamilton's *Ban Chiang, Northeast Thailand*, Volumes 2A–2C (Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology, 2018–2019), is a major milestone in the global archaeological study of copper alloys, as rightfully acknowledged by James Muhly, the author of the work's foreword (2A:xviii). Reflecting the results of a commendably interdisciplinary and well-organized project, the multivolume work speaks directly to a puzzling interpretive issue. The development of metallurgy has long been seen as integral to the formation of states and their associated phenomena, including warfare (facilitated by metal implements), social stratification, agricultural implements, and complex economic systems. Yet despite the early adoption and development of copper-, bronze-, and ironworking in northeast Thailand, there is no evidence that metallurgy contributed significantly to state formation (as has been argued for the Near East). The authors succinctly describe the issue:

> With a date in the early 2nd millennium, bronze product manufacturing in Southeast Asian villages placed the technology at a surprisingly early age and in an unexpected social context. Remote from early urban societies, with no associated evidence of warfare or class society, in an area that in recent times has been impoverished, it was difficult for scholars . . . to explain . . . how and why these societies had such mastery over a complicated technology such as bronze metallurgy (2A:2–3).

To tackle this issue, the authors reject the "conventional paradigm" in archaeometallurgy, which assumes "universal stages of progressive technological and social development—from small simple groups to states, and from stone-tool-using societies to bronze and then iron-using societies" (2A:51). They note that the "petri dish" for early metallurgy was not the state but heterarchical "middle-range societies," formerly called tribes or chiefdoms (2A:85). Central to their view is a rejection of the technological determinist notion that the development of bronze and iron ipso facto spurs the emergence of full-time craft specialization, economic controls, and additional signs of the formation of states, including violence and warfare (2A:87). In place of the conventional paradigm, the authors argue for a "new archaeometallurgy paradigm," founded squarely on the scholarly framework known as the anthropology of technology (2A:92). Employing this paradigm, the authors find that the metallurgy practiced at Ban Chiang, and in prehistoric Thailand generally, was likely of exogenous origin, benefited from abundant natural resources that did not require central control to exploit, responded to the needs and preferences of a "relatively egalitarian and mostly peaceful community" (2B:102), and provides no decisive evidence of state formation processes.

The authors' conclusions are certain to provoke controversy, contrasting as they do with the views of the distinguished archaeologist Charles Higham, who is depicted as the exemplar par excellence of the conventional paradigm in the archaeology of Northeast Thailand. Some of the disagreement concerns matters that are best evaluated by professional archaeologists, such as dating and metallurgical analysis, and lie outside this sociocultural anthropologist's expertise. Here I focus on the authors' interpretation and use of the anthropology of technology (Pfaffenberger, 1988, 1992; Schiffer, 2001), a field to which I have contributed.

Fundamental to the anthropology of technology is an explicit rejection of a conventional narrative, the "standard view of technology" (Pfaffenberger, 1992), and in particular its deeply encoded cultural evolutionism such that the development of bronze or iron metallurgy signifies the onset of state formation processes. As the authors observe, the standard view's "three age" system, which envisions an inevitable progress from copper to bronze to iron and the resultant rise of the state, obscures a contingent factor: culture (2A:55). For example, in the New World, metals were largely developed for nonutilitarian purposes, reflecting a widespread emphasis on the sound and color of the resulting artifacts (2A:54).

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From the point of view of the anthropology of technology, critique of Higham's cultural evolutionist interpretation is justified. Based on work at a different Northeast Thailand site, Higham notes that the graves of presumed "founders" included metal production artifacts and lavish personal decorations. Graves from earlier phases had large quantities of grave goods, implying the presence of well-to-do individuals. From his perspective, this evidence suggests the rise of "aggrandizement," as an emerging class employed mortuary ritual to raise its status and wealth (Higham, 2014), presaging the development of economic controls and social stratification. Still, the authors of the present work are not claiming that the metal-forging cultures of Northeast Thailand were egalitarian. Like the numerous middle-range societies that anthropologists have studied around the globe, they were likely heterarchical. Status differentials, including hereditary ones, are the norm in such societies, not the exception, and arise from a multitude of causative factors (Rousseau, 2001). If the rise of status differentials ipso facto attests to early state formation processes, then the state was about to emerge in heterarchical societies famously studied by anthropologists in the Trobriand Islands, Highland New Guinea, and the western coast of Canada.

Equally characteristic of the anthropology of technology is a rejection of technological determinism, the doctrine that a technology's social impact arises directly from its innate, inflexible characteristics and potential. If bronze spear points are produced, war will follow. Anthropologists of technology reject technological determinist scenarios due to their tendency to obscure cultural factors that might tell a different story. It is exceptionally easy to frame technological determinist scenarios—after all, they appear to be commonsensical—but teasing out the possibly countervailing cultural factors is costly. Cultural factors are capable of nullifying the presumed and inescapable "inner logic" of adopted technologies. This point has been repeatedly affirmed by a large literature in the anthropology, sociology, and history of technology.

An example should serve to demonstrate the risk inherent in technological determinist interpretations. In a gravity-flow irrigation system, plots at the top end of the system receive much more water than those at the tail end, leading some to suggest that they are intrinsically productive of socioeconomic differentiation (Price, 1995). However, in his meticulous ethnography of Pul Eliya, a remote Sri Lankan village, the eminent and indefatigable British social anthropologist Edmund Leach (1961) discovered, by means of constructing a kinship chart embracing the entire village, that deeply embedded community choices served to allocate water equitably among villagers of sufficient caste (Leach, 1960). Every holding in the well-watered Upper Field was matched by a corresponding plot in the less advantageously situated Lower Field. During times of water scarcity, the scope of cultivation was communally contracted to ensure equal access to water. In short, water rights in Pul Eliya, and indeed villages throughout pre-twentieth-century Sri Lanka, were akin to "an equal share in a corporation"; such water rights were "floating" rather than irrevocably attached to a particular unit of land (Obeyesekere, 1967). These customs were deeply embedded in communities' complex kinship systems, with concomitant inheritance rules that prohibited the sale of plots. By means of policy and legal changes focusing directly on multiple claims to a given plot of land, British colonial authorities attacked this system out of conviction that it stymied investment. The result was the widespread abandonment of village irrigation systems and growing landlessness as land came on the market. A new class of rural moneylenders developed, and landholders often became serfs working on what was formerly their own land. In sum, the traditional irrigation system common to villages in the dry zone of Sri Lanka illustrates how culture and community agency produced a technology that privileged social objectives. To assume that mere presence of gravity-flow irrigation produced socioeconomic differentiation in premodern Sri Lankan villages is to mistake the past for the present (Pfaffenberger 1990).

From the anthropology of technology perspective, the technological determinism reflected in some of Higham's assertions raises critical questions. In noting the appearance of banks and moats in the latter stage of the site he studied, Higham (2015) finds evidence that plowing with iron implements—"a quantum improvement in efficiency compared with hoeing"—"unlocked the potential for social change based on the ownership of improved land." In support of this contention, Higham quotes Jean Jacques Rousseau's famous nostrum on property rights: "The true founder of civil society was the first man who, having enclosed a piece of land, thought of saying 'this is mine' and came across people simple enough to believe him." Noting a rise in the manufacture of iron spear points and a burial in which one such point was embedded in the victim's spine, Higham suggests that it would be "naive" to suggest that banks and moats played no role in defense. From the anthropology of technology perspective, there is evidence of banks, moats, and perhaps murder, not necessarily the beginnings of private property and warfare. To be sure, warfare is not unknown in middle-range societies (Arkish and Allen 2006, noting archaeological evidence not only from Europe but also from South America, China, and Micronesia). The point is simply that the presence of private property and warfare should not be presumed in the absence of definitive evidence.

Providing an alternative interpretive framework, the anthropology of technology argues for a focus on socio-technical systems: the entire complex, culturally embedded structures within which artifact production, consumption, and disposal are situated (Pfaffenberger 1992). To call such formations "systems" is to imply that the constituent components are mutually adapted to each other. A reasonable working premise, in avoidance of technological determinism, is that culture shapes technology rather than the other way around. It logically follows from this model that analysts should leave scope for agency, the capacity of actors to shape a system in accordance with their culturally shaped objectives (Dobres 2000). Additionally, and importantly, the anthropology of technology argues for a comprehensive study of an artifact's entire life cycle (Schiffer 1972), in contrast to what White and Hamilton call "art history" interpretations that focus only on finished mortuary artifacts. Accordingly, throughout the volumes, they consider the full range of recovered metal, including discarded and fragmentary artifacts found outside the mortuary context. This approach raises site interpretation issues related to the non-grave depositional context that I am unqualified to assess. Still, from an anthropology of technology point of view, their approach is justified. The system cannot be fully understood unless it is grasped as a whole. Excluding non-mortuary artifacts, however problematic, raises the risk of misunderstanding the social and cultural forces that shaped the technology (White and Hamilton 2021; cf. Higham et al. 2011:235).

To identify the cultural forces underlying the archaeological evidence, the authors skillfully employ a set of related concepts developed in the anthropology of technology. They focus on technological activities, again ranging from resource extraction to disposal, with the hypothesis that these are likely shaped by culture in addition to the irreducible requirements the technology imposes. These activities include the *chaînes opératoire* (sequences of technical action) carried out by smiths. The authors employ the *chaîne opératoire* concept creatively and logically in order to identify the social and cultural factors that shaped the system. In one of the book's most useful chapters (2A, chapter 7), the authors cogently state the irrevocable requirements of copper and iron smelting and melting—that is, what must be done to successfully fabricate copper, bronze, and iron artifacts. These actions are required and are beyond the reach of cultural modification (Lemonnier 1992:20). But in any technology, there are alternative ways to proceed. The term *technological choices* refers to the practitioners' selection from the range of possible alternatives. In the anthropology of technology, the *chaînes opératoire* actually put into practice are interpreted to reflect the shaping influence of the surrounding culture, as researchers in this field have repeatedly and consistently found. To the extent that a pattern of technological choices emerges and becomes characteristic of a given technological tradition, anthropologists of technology identify a *technological style* (Lechtman 1977). Again, these concepts have been repeatedly af-

firmed by a large and growing literature in anthropology, sociology, and the history of technology. This literature affirms that the study of technological choice shows where the cultural rubber hits the technological road.

Having identified what *must* be done to smelt copper, bronze, and iron, the authors devote the entire second volume of the work to identifying what actually *was* done—that is, the community choices that shaped this tradition's technological style. What were the shaping cultural forces in this tradition? Among the social and cultural forces at work, consumer demand appears to be the most prominent—specifically, demand for relatively small, unadorned artifacts for daily use and mortuary ritual (2B:58). Smiths produced small, simple, and unadorned artifacts for personal adornment (such as bangles) and some for presumably practical applications (adzes and small points). Still, the smiths made little effort to harden their artifacts to render them more useful for practical purposes, although they were capable of doing so. This pattern holds true even for some artifacts, such as adzes, with a presumed practical use (2C:132). Although points and spear points were produced, they were likely used for hunting or ritual purposes (2B:60); there is no evidence of fortifications or battle injuries. A soft, socketed spear point, left in its annealed (weak) state, suggests a ritual use (2B:101), as does the employment of adornment artifacts in burials, particularly and touchingly those of children. In apparent accord with consumer demand, smiths employed small crucibles equipped with spouts and designed for use with ceramic molds.

Above all else, what is characteristic of this technological tradition is its astonishing conservatism: the same artifact classes continued to be produced, and in roughly the same proportions, for nearly 2,000 years, if one accepts the authors' chronology. What is more, this occurred even as new metals came into use (2B:101), suggesting that the same shaping cultural forces remained at work during the entire period. Presumably, the smiths were capable of innovation; many of the crucibles show evidence of lagging, the addition of a layer of quartz to the crucible's interior, suggesting that smiths "had a sophisticated understanding of refractory principles and deliberately enhanced the performance of their crucibles" (2B:113). Still, as the authors suggest, it seems that once smiths worked out the problems of smelting and casting various materials, they were content to leave matters where they were.

From my perspective as an anthropologist of technology, and again leaving aside the archaeological issues that I am not competent to evaluate, I believe this work insightfully and creatively employs the concepts and approaches of the anthropology of technology, affirms the authors' thesis, and charts the way forward in the archaeometallurgy of Southeast Asia. It should be widely read. The work's tone is combative, to be sure, but for reasons that, as I have endeavored to explain and with apologies to Higham, strike me as crucially important and eminently justified from an anthropology of technology perspective. Furthermore, I believe this work should be required reading for students of archaeometallurgy generally. It is exceptionally well written and accessible to those new to the field, as evidenced by the lengthy and useful glossary. The chapters on geomorphology and the required steps of metalworking, dating, metallurgical analysis, technical analysis, and regional analysis strike this nonspecialist reader as exemplary and well worthy of study. This work should prove of great value for instruction.

I do offer a minor suggestion in the hope that it is helpful. Like most English speakers, the authors correctly translate the phrase *chaîne opératoire* as "sequence of technical actions" or "operational sequence" and leave it at that. Still, as Dobres has rightfully emphasized (Dobres, 2000, 2001), the concept has a long pedigree in French anthropology that is often overlooked. The originator of the *chaîne opératoire* concept, André Leroi-Gourhan (1993 [1943]), was influenced by Marcel Mauss (1967 [1925]). Mauss regarded technical activities in what are now called middle-range societies as "total social phenomena," integrating technical behaviors and cultural meanings to the point that they rival religious ritual in their culture-generating prowess. Viewed from a Maussian perspective, the *chaîne opératoire* of metalworking as practiced in Ban Chiang would amount to a *performance*, one that was not only influenced by the surrounding cultural setting but was deeply and powerfully capable of shaping it (see, e.g., Schmidt 2013). If this perspective bears merit, and I believe it does (Pfaffenberger, 1998); see Pfaffenberger 2001 for several ethnographic examples), the prominence of founders' tools in burial rites likely derives not from their "aggrandizement" and a desire for control but rather from the community's respect and esteem.

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