

Comment on ‘Debating a great site: Ban Non Wat and the wider prehistory of Southeast Asia’

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Many of the components of this argument can be seen as a matter of debate; for example, the occurrence at sites in north-east Thailand of indisputably Bronze Age flexed burials contradicts Higham’s contention that flexed graves represent earlier indigenous hunter-gatherer populations. The occurrence of tin-bronze artefacts in ordinary graves at other sites in north-east Thailand belies the proposed scenario that bronze was necessarily a ‘prestige valuable’ that generated a competitive milieu, particularly as the early metal artefacts at Ban Non Wat are unalloyed copper. It is my view that although the argument may initially appear convincing, it is based on selected, simplified and flawed data chosen to fit pre-determined social and chronological models.

There are many aspects of the methodology and theory of the Higham interpretation of Southeast Asian archeology and specific sites that I find problematic, but I will focus here on the chronological issues. Higham has stressed repeatedly the importance of chronological accuracy as central to correct archaeological interpretation, but the dating framework employed in this article (Higham & Higham 2009; Higham *et al.* 2015) is highly likely to be inaccurate and unreliable. It is based on shell and bone dates that, for the technical reasons reviewed below, are probably too late to be accurate representations. Choices in stratigraphic interpretation further affect the accuracy of the chronology and bias the chronological framework towards an inaccurately late interpretation.

Absolute dating of Ban Non Wat relies primarily on shell dates, but there is no suggestion that the shell was vetted for contamination by young carbon. Webb *et al.* (2007) and Busschers *et al.* (2014) have shown that routine assessments for shell recrystallisation (during which intracrystalline precipitation can introduce exogenous carbon) will not detect changes that can introduce young carbon into the shell under certain geochemical conditions, specifically high magnesium:calcium ratios and salinity. This soil chemistry is associated with sediments from old seabeds, and as much of north-east Thailand overlies old seabeds of such richness that salt extraction is an important industry region-wide, it seems highly likely that shell from sites in north-east Thailand would have diagenetic changes that could introduce young carbon and contraindicate their reliability for ^{14}C dating. Higham’s team has not mentioned incorporating soil chemistry studies as part of their assessments, but King *et al.* (2011) report on soil chemistry studies at Ban Non Wat that found high soil concentrations of magnesium and sodium, specifically the elements that can lead to

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contamination of shell by young carbon (Webb *et al.* 2007). Taylor and Bar-Yosef (2014: 74) conclude that the "use of non-marine shells for dating should probably be restricted to situations where [. . .] detailed studies of the geochemistry of the freshwater environment have been done". Given that the groundwater chemistry was apparently not taken into consideration in the interpretation of the Ban Non Wat shell dates, and that the shell was not vetted with techniques such as Raman spectroscopy, which can detect the problematic recrystallisation, the shell dates should be best considered minimum dates or *termini ante quem*, following the examples of Webb *et al.* (2007), Busschers *et al.* (2014) and Lai *et al.* (2014).

The dates for Ban Chiang used by Higham rest on bone 'collagen', which can also produce unreliable results depending on soil chemistry, pretreatment protocols and other factors. A recent inter-laboratory assessment of bone dating compared protocols and results from four radiocarbon labs—Oxford, Groningen, Kiel and the University of California, Irvine—for a bone sample of well-established age (Fiedel *et al.* 2013). The study found that 'collagen' samples, including some that underwent ultrafiltration at Oxford, were significantly younger than expected for a sample dated in the four different laboratories. Gillespie *et al.* (2014) also report erroneously young ages from the application of Oxford's ultrafiltration method. A probable reason is that contaminants remain in the ultrafiltered samples, as Boudin *et al.* (2013: 2039) recently noted:

Ultrafiltration of bone collagen [. . .] is an effective method for the removal of low molecular weight contaminants from bone collagen but it does not remove high molecular weight contaminants, such as cross-linked humic-collagen complexes [emphasis added].

Furthermore, on the subject of collagen dating, Marom *et al.* (2012: 6878) state:

the extracted bulk gelatin can be heterogeneous and include, or be cross-linked to, potential contaminants from the depositional environment, such as humic and fulvic acids, rootlets, cellulose, sediments, and other plant and animal remains including amino acids from bacteria and micro-organisms.

No amino acid profile has been presented to support the claim that only collagen was being dated, contra the recommendation of Taylor and Bar-Yosef (2014: 77).

Additional problems with the absolute dating framework in this article are that the bone and shell dates do not cross-date well with each other, and a particular pottery style, known as I&I pottery, dates roughly 200 years younger when dated by associated bone from Ban Chiang in comparison with shell dates associated with the most similar pottery at Ban Non Wat, a discrepancy that raises a red flag for regional specialists.

Given the reliability issues noted above with both the shell and bone dates, they should be considered *termini ante quem* or minimum dates at best. On this basis, Higham's proposed chronology is not a reliable or accurate framework for defining the Ban Non Wat or Ban Chiang site sequences, never mind the wider prehistory of Southeast Asia.

I disagree with many other aspects of the methodology, theory and details of the Higham interpretation of Southeast Asian archeology and specific sites, too many to present in this brief comment. In general terms, this interpretation tries to make Southeast Asian evidence fit a European model. As one example of biasing selectivity, Higham simply ignores the

evidence that metal production in prehistoric Thailand was decentralised and community-based with no evidence of elite control (White & Pigott 1996; Pigott 1998; Tucci *et al.* 2014). Instead, Higham proposes a ‘top-down’, elite-centric ‘vision’ without supporting data.

Interpreting Ban Non Wat from a Eurocentric frame of reference is, in my view, a missed opportunity for Southeast Asian archaeology. When the totality of the regional archaeological evidence is examined, and once regional specialists shake off allegiance to essentialised frameworks such as the Three Age System and address the data in more nuanced ways with updated paradigms, the site and the region will have much to offer global archaeology (White n.d.).

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