



Burial containers – A hidden aspect of mortuary practices: Archaeothanatology at Ban Non Wat, Thailand

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ABSTRACT

Research on mortuary practices has attracted a wide following for the role it can play in determination of individual social identity and population social structure. One aspect of mortuary practices that is rarely addressed, except where physical remnants are recovered, is the form of burial containers. Archaeothanatology is a taphonomically based methodology applied to infer the form of such containers when no material evidence remains. This paper shows how the archaeothanatomical approach can be applied *post hoc*, with 133 adult burials from the prehistoric site of Ban Non Wat analyzed. Temporal changes in container form were expected as subsistence, technology, and social organization transformed over 1850 years. The deceased were predominantly loosely wrapped in non-durable material or placed in wide coffins, although individuals were buried in other contexts, with a peak in variety towards the end of the Bronze Age and early Iron Age. In combination with evidence from other sites in the area, our results identify a reduction in the variety of container forms used within sites in the mid to late Iron Age. We have shown the value of archaeothanatology as a contributor to research on mortuary practices, in particular having shown that it may be usefully applied *post-excavation*.

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Introduction

Archaeothanatology, also known as *anthropologie de terrain* or field anthropology, is a taphonomically based methodology that can be applied to infer the form of burial containers (referred to here as 'burial context') when no material evidence remains. While mortuary archaeology in general has enjoyed a wide following from scholars who acknowledge its role in the determination of social identity and population structure, archaeothanatology has failed to capture the same attention in the English literature. Pioneered by Henri Duday (2006, 2009; Duday et al., 1990; Duday and Guillon, 2006) and widely applied in Francophone research, archaeothanatology relies on interpretation of the spatial positioning of skeletal elements within a grave, as these reflect the burial context. Ideal application of the method demands detailed recording during excavation, as it requires the identification of each skeletal element *in situ*, recording of its exact position, anatomical orientation, and spatial relationship to other elements (Duday, 2006; Duday and Guillon, 2006). Such an approach necessitates a significant investment of time, one of the reasons Knudson and Stojanowski (2008) cite for its slow uptake. However, recent research published in the English literature has shown that a viable

alternative is to use photographs and field drawings as the primary recording tools (Nilsson Stutz, 2003a, 2003b, 2006; Willis and Tayles, 2009). Such an approach has obvious limitations, most originating from the differing objectives of the original excavators and later archaeothanatomical investigators, resulting in insufficient recording from an archaeothanatomical viewpoint. Despite this, if an archaeological excavation is sufficiently well recorded such an approach can yield valuable information.

A number of investigators have discussed the fundamental concepts behind the archaeothanatology approach (Duday, 2006, 2009; Duday and Guillon, 2006; Nilsson Stutz, 2003a, 2003b, 2006; Roksandic, 2002). However, a detailed methodology for its systematic application to a large number of burials has yet to be published, although Willis and Tayles (2009) provided an overview of a method they applied to two small skeletal samples. Our paper presents such an archaeothanatomical methodology based on the use of photographs and field drawings and applies it *post hoc* to a large sample of burials from a prehistoric site, Ban Non Wat, in the upper Mun River Valley of Northeast Thailand (Fig. 1). Excavations at the site have recovered burials spanning from early agriculturalists to Iron Age inhabitants and present an opportunity to investigate many facets of the lives of its prehistoric populace. In this article we identify the burial containers used during a series of mortuary phases at Ban Non Wat before considering how their use changed over some 1850 years; a period that saw a revolution in subsistence strategies as agriculture became widely employed, technological advancements including the introduction of bronze

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Fig. 1. Location of Ban Non Wat and other prehistoric Thai sites mentioned in the text (adapted from Higham, 2002).

and iron, and changes in social organization towards an inherited hierarchical structure. By amalgamating these data with previous research in Northern Thailand we are able to synthesize a model of dynamic change in one aspect of mortuary practice and link this to socio-political transformations in the region. Perhaps more relevant to an international audience, our research illustrates an archaeothanatological methodology that can be applied post excavation to any site.

Burial containers in prehistoric Thailand

Archaeothanatological research has been published for a small number of prehistoric sites within present day Thailand (Pautreau and Mornais, 2003; Willis and Tayles, 2009). This section describes these findings as well as other research relating to funerary containers.

The burial context of the predominantly Bronze Age site of Ban Lum Khao (1400–500 BC) in the upper Mun River Valley of North-east Thailand was investigated by Willis and Tayles (2009). Fourteen of the 26 burials included in their sample were interpreted as having been wrapped, and 12 interred in narrow coffins. This

variation was viewed as related to sex, as all coffin burials except one were female, although the authors caution that confidence in this suggestion is tempered by an imbalanced sex ratio in the sample. The age structure of the sample was also imbalanced, with the males being mostly old, which meant that it was not possible to determine whether the variation was influenced by age. The authors recognized that chronology of the interment could play a factor as the burials belonging to earlier mortuary phases showed a combination of both wrapping and coffin burials while the (admittedly smaller) later phase had only wrapped individuals.

Willis and Tayles (2009) investigated burial context at a second, later site in the upper Mun River Valley, the Iron Age site of Noen U-Loke (300 BC–300 AD). All 34 individuals included in their study were interred in wrappings. When the authors considered this in relation to their findings at Ban Lum Khao, they concluded that burial context became more uniform over time within the area.

At Ban Wang Hai, an Iron Age site dated to between c. 400 AD and 700 AD in the Chiang Mai-Lamphun basin, northern Thailand, 29 graves were analyzed using archaeothanatology (Pautreau and Mornais, 2003). They suggested the interments were in closed coffins made of hollowed out tree trunks. In one grave the imprint of a

container was well preserved showing the internal profile of the container to have had a flat bottom that curved sharply to form walls gradually widening towards the top (Pautreau and Mornais, 2003).

Such coffins are found in large numbers in the rocky hollows of the Mae Hong Son area, located approximately 150 km west of Ban Wang Hai. Based on radiocarbon analysis coffins of the type attributed to Ban Wang Hai were used at Mae Hong Son between 200 AD and 700 AD (Pautreau and Mornais, 2003). Treerayapiwat (2005) has noted similar coffins made from carved tree trunks but without lids at the Ban Rai rock shelter, in Pang Mapha district of Mae Hong Son province. Based on the research of Grave (1995) who examined burial customs in the Pang Mapha district, the coffins at Ban Rai were dated to between 100 BC and 800 AD, and came in two sizes. Treerayapiwat interpreted the larger coffins as belonging to individuals interred earlier, in more prominent locations, and smaller coffins as later burials, placed in less desirable locations. In contrast, Sørensen (1988) has argued that distinctions in burial context of similar Iron Age burials in the cave of Tam Ongbah in Kanchanaburi province, western Thailand, were influenced by social status, with individuals interred in coffins accompanied by a higher number and more diverse grave goods than their contemporaries buried without coffins. However, confidence in this assertion is tempered by significant looting at Tam Ongbah prior to study.

Clearly burial context was variable in prehistoric Thailand both geographically and temporally. While chronology appears to have played a part at some sites (Ban Lum Khao and Noen U-Loke, Ban Rai), there is also evidence for the influence of social factors within contemporary groups (Ban Lum Khao, Tam Ongbah). As such, Ban Non Wat sits as an ideal case study, with its long chronology and the large number of burials excavated at the site (over 600) allowing burial context to be examined both temporally and within contemporary groups.

Ban Non Wat

Ban Non Wat is a mortuary and occupation site first identified through the use of Thai military aerial photographs, and described by Boyd et al. (1999) as a mound approximately 300 m in diameter with numerous ditches. Excavations at the site began in January 2002 as part of *The Origins of the Civilization of Angkor* research project, continuing under its auspices until December 2007 (Cawte et al., 2009). *The Origins of Angkor* project was concerned with investigating the prehistoric foundation on which the civilization of Angkor was built. Of the five sites excavated as part of the project (Ban Non Wat, Ban Lum Khao, Noen U-Loke, Non Muang Khao, and Phimai Prasat) Ban Non Wat was likely the most important, prompting Boyd and Chang (2010, p. 227) to label it “...an unparalleled opportunity to understand social change over time”. The high number of burials recovered, large area unearthed (32 m by 35 m in the main square with two additional four meter by four meter pits; Fig. 2), and meticulous excavation methods employed by researchers provide this opportunity.

Recent radiocarbon analysis has provided date ranges for the mortuary record at Ban Non Wat, starting with early agriculturalist groups around 1750 BC and ending in the early historic period c. 500 AD (Higham and Higham, 2009a, 2009b). The excavation of burials followed methods used by the *Origins of Angkor* research team at earlier excavations at Ban Lum Khao (Domett, 2004) and Noen U-Loke (Tayles et al., 2007). Each burial excavated was exposed *in situ*, photographed and drawn before being lifted from the soil.

The burials from Ban Non Wat can be broadly grouped into the Neolithic, Bronze Age, and Iron Age. An additional group of individuals were buried in a flexed position (Higham, 2011a). Citing this position and a small number of artifacts distinct from Neolithic equivalents, Higham (2011a) suggests they may represent indigenous hunter-gatherers, although an alternative explanation is that

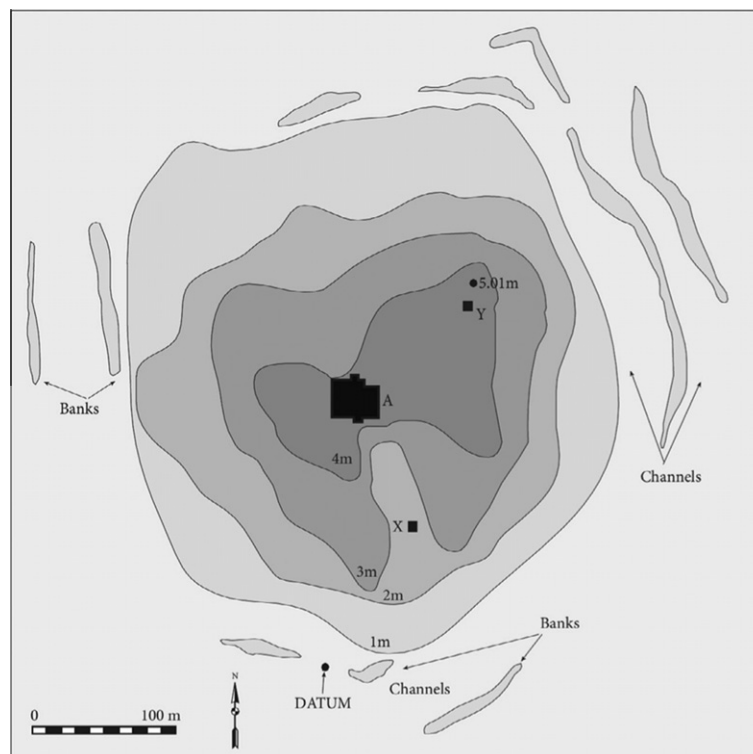


Fig. 2. Map of Ban Non Wat showing location of excavation squares with the main square labeled 'A' and the two smaller pits 'X' and 'Y' (Higham and Higham, 2009b).

Table 1
Ban Non Wat mortuary phases (Higham and Higham, 2009a; Higham, 2009).

Mortuary phase	Date range	Number of individuals	Most common characteristics
Flexed burials	1750–1050 BC	14	Burial in either supine position or on side, with knees flexed. Dispersed distribution of burials with no common orientation, few grave goods
Neolithic 1	1650–1250 BC	29	Burial in supine extended position, burials largely dispersed distribution with some groupings, oriented on either north–south or east–west axis, ceramics decorated with complex incised designs, increased number of grave goods cf. flexed burials
Neolithic 2	1250–1050 BC	40	Burial in supine extended position, burials largely dispersed though with some groupings, often oriented on east–west axis, globular cord marked ceramics, decreased number of grave goods
Bronze Age 1	1050–1000 BC	5	Burial in supine extended position, inclusion of copper based artifacts, burials located on eastern side of main square, oriented on northeast–southwest axis, increase in number of grave goods
Bronze Age 2	1000–900 BC	36	Burial in supine extended position, inclusion of copper based artifacts in most burials, burials possibly interred in three rows, head orientated to the north or northwest, large graves with exceptionally large number of grave goods
Bronze Age 3A	900–800 BC	14	Burial in supine extended position, inclusion of copper based artifacts in some burials, burials located in center of square, clustered together, head oriented to the northeast, continued high number of grave goods, possibly contemporary with phase 3B, although individuals in this group had a higher number of grave goods
Bronze Age 3B	900–800 BC	22	Burial in supine extended position, inclusion of copper based artifacts in some burials, burials located south of those from phase 3A, clustered together, head oriented to the northeast, possibly contemporary with phase 3A although individuals in this group had fewer grave goods
Bronze Age 4	800–700 BC	176	Burial in supine extended position, rare inclusion of copper based artifacts, burials distributed across square, possibly in groups, buried on northeast–southwest axis, continued decrease in the number of grave goods
Bronze Age 5	700–420 BC	37	Burial in supine extended position, inclusion of copper based artifacts in some burials, burials clustered in center of main square, buried predominantly on northeast to southwest axis, distinguished from phase 4 by form of ceramics
Iron Age 1	420–100 BC	125	Burial in supine extended position, inclusion of copper based or iron artifacts in some burials, clustered to east of main square, buried predominantly on northeast–southwest axis, indistinguishable from Bronze Age 5 except by the inclusion of iron artifacts
Iron Age 2	100 BC–200 AD	24	Burial in supine extended position, inclusion of copper based artifacts in some burials, inclusion of iron based artifacts in some burials, burials to the west of Iron Age 1 burials in no clear clusters, buried predominantly on a northeast–southwest axis, ceramic vessels in the Phimai black tradition, recognized elsewhere in the region as Iron Age (Welch and McNeill, 1991)

the flexed burials were a subsection of the Neolithic population treated differently for some, as yet, unknown reason. The Neolithic was characterized by mortuary or occupational remains that included domestic animals or plants but no evidence for metallurgy (Higham and Higham, 2009b). In the Bronze Age copper based artifacts, crucibles, or molds were included in burial goods (Higham and Higham, 2009a) and Iron Age burials were accompanied by iron implements, or evidence for iron forging (Higham and Higham, 2009b).

Each of the Neolithic, Bronze and Iron Ages were further split into mortuary phases, of which there are 11 (Higham, 2009) (Table 1). The phases were constructed based on a number of factors including the superposition of burials, grave form, grave location, grave orientation, and mortuary offerings (Higham and Higham, 2009a, 2009b; Higham, 2009). The most important of these was seen to be superposition of burials supported by ceramic vessels and radiocarbon dating, with mortuary phases showing relative chronology (Higham and Higham, 2009a; Higham, 2009).

With the exception of the flexed burials, most adults and older children were interred in an extended supine position, while younger children and infants were usually placed in mortuary vessels. Five adults were interred in different positions, two from the Neolithic 1 phase were seated in large mortuary vessels (Higham, 2011a), two from Bronze Age 4 were placed on their sides, and one individual from Bronze Age 5 was interred prone. Regardless of burial position, individuals were usually interred with grave goods, and although these changed over time pottery was included throughout each mortuary phase (Boyd and Chang, 2010). Boyd and Chang (2010) note three trends in grave goods over time: (1) a general increase in both number and variety; (2) more exotic goods were included in later phases; (3) there was a move from wild materials to more domestic grave goods. These changes largely reflect the increase in trade from outside the Mun River Valley

as well as the enhanced importance attached to agriculture as environmental conditions declined in the Iron Age (Boyd and Chang, 2010; Talbot, 2002).

Along with changes in grave goods, chronological alterations in other burial practices can be charted. Based on personal observations during excavation seasons at Ban Non Wat, Boyd and Chang (2010) have noted that practices in the Neolithic were more diverse than later periods. In support of their argument they reference the use of mortuary vessels in adult interments, varying orientation and dispersed distribution of the Neolithic burials. In comparison, the Bronze and Iron Ages are seen as more conforming, the spatial positioning of graves seeming to be chosen in relationship to other burials, with those from the later Bronze Age mortuary phases in neat rows while Iron Age burials were grouped in clusters.

As yet, temporal changes in burial context have not been charted at Ban Non Wat. One reason for this is the poor preservation of organic materials in the tropical environment. Although a number of unpublished burial photographs show small fragments of wood, the majority of such materials can be assumed to have long since decomposed. The wooden fragments may suggest the use of coffins, although they could also represent wooden grave goods. Consequently, the correct inference of burial context at Ban Non Wat is contingent on an archaeothanatological approach.

The value and applicability of such an approach was demonstrated by Willis (2005) who included a subsample of 47 Ban Non Wat burials in her Masters thesis. At the time of her research only burials from the first two seasons of excavations at Ban Non Wat were available for analysis. Many showed evidence of constriction that she attributed to a tight durable wrapping. In this article we build on Willis's work, reinterpreting a number of burials from her sample as well as investigating those from later seasons, allowing for a more comprehensive investigation. Also, at

Table 2

Types of spaces in graves, descriptions, and skeletal responses (after Duday, 2006; Duday and Guillon, 2006; Nilsson Stutz, 2003a; Roksandic, 2002).

Space	Description	Skeletal response
None	Reflects progressive infilling where the soil filled spaces as they appeared. This required the soil to be porous and in direct contact with the body, indicating no container was used	Identified by the articulation of the hyoid bone, or of skeletal elements in potentially unstable positions (such as hands on the abdomen or pelvis), and no flattening of the thoracic cage or pelvis. In general only very small movements occur
Internal	Indicates delayed infilling where the soil did not immediately fill spaces as they appeared within the original confines of the body. This could be either because the body was interred in a container or the soil was non-porous	Fall of elements into pelvic cavity, fall of thoracic cage and hyoid bone. No evidence of external space, with articulation of the pelvis (or only slight disarticulation at the pubic symphysis), articulation of the patellae
External	Indicates delayed infilling where the soil did not immediately fill spaces outside the body as they appeared. This indicates the body was interred in a container	In addition to evidence of internal space; lateral disarticulation of the pelvis, lateral rotation of the femora causing fall of the patellae, any movements of elements outside the original confines of the body
Secondary external	Indicates delayed infilling where organic material within the grave decomposed, causing external space to form	Movement of skeletal elements outside the original confines of the body when there is no other evidence of skeletal response to external space. Often difficult to differentiate from taphonomic processes

the time of Willis's research the burials had not been placed in a chronological sequence. This has now been done, allowing the form of burial containers to be compared over time.

Materials and methods

Fundamental principles of archaeoethanatology

Duday and Guillon (2006) describe the appearance of an excavated grave as the result of interaction between two processes. The first of these are the original characteristics of the funerary deposit, the intentional and unintentional acts of individuals at the time of burial, including burial context. The second are taphonomic processes, chance modifications that change the characteristics of the deposit. An example of a human taphonomic factor is the digging of a posthole through a burial. Non-human taphonomic factors include bioturbation, movement of skeletal elements by scavenging animals or ground water, and gravity. Archaeoethanatology aims to identify and account for the second, taphonomic, processes, allowing interpretation of the effects of the burial processes on the skeleton, to determine the burial context.

The most important taphonomic processes for archaeoethanatology are actions of gravity on decomposition of the cadaver. Different burial contexts create different spaces in the grave (Duday, 2006). As the soft tissues of the cadaver decompose, gravity causes movements that are either allowed by space in the grave or restricted by a lack of space. By determining what spaces were present it is possible to infer the container in which an individual was interred (Duday and Guillon, 2006).

As a basic knowledge of decomposition is essential to understanding how spaces form in the grave, this will be briefly described. Decomposition includes all the processes that occur in a human body from the time of death to the disintegration of its body parts (Pinheiro, 2006). The soft tissues are the first to decompose, although the fibrous ligaments are relatively durable, keeping skeletal elements in articulation, while a liquefied mass from the soft tissues surrounding them is absorbed into the soil (Janaway, 1996). Skeletonization is the last stage of soft tissue decomposition, leaving only skeletal elements (Pinheiro, 2006). The dynamic relationship between decomposition, which can cause spaces to form in the grave into which skeletal elements can move, and the texture of the surrounding sediment, which fills those spaces, is fundamental to the application of archaeoethanological principles.

Space is a prerequisite for movement, with the location and extent of space within a grave playing a major role in the resulting position of skeletal elements. There are three types of space; internal within the body formed by the decomposition of the soft

tissues, external within the grave cut but outside the body, and secondary external formed when organic objects in the grave decompose (Duday, 2006). It is also possible that there was no space within a grave, a result of soil having progressively replaced soft tissues as they decomposed. This is dependent upon the body being in direct contact with fine-grained, porous soil (Nilsson Stutz, 2003b). Table 2 gives a description of each type of space and criteria for their identification, primarily applicable to supine burials.

If a body was interred in any position other than supine there may be different movements to those noted under 'skeletal response' in Table 2, however, the general description for each type of space does not change. For instance, identifying the presence of internal space requires visualization of movements that occurred



Fig. 3. Burial showing constriction in the shoulders, evidenced by the verticalization of the clavicles and rotation of both the scapulae, and the humeri.

within the original confines of the body, while external space is recognized by the movement of skeletal elements outside of those original confines.

In addition to the type of space present, the grave cut or a container may have limited movement of skeletal elements through *effet de parois* or 'wall effects'. These result when skeletal elements rest against the limits of a grave, durable burial container or architectural structure (Roksandic, 2002). Lateral constriction in the skeleton is an example of a bilateral wall effect and shows that burial occurred in a tight container or narrow grave. Constriction is evident primarily in the shoulders, where there is 'verticalization' of

the clavicles (rotation from their normal horizontal orientation), movement of the scapulae so the shoulder joint is facing superiorly, and inward rotation of the humeri (Nilsson Stutz, 2003a) (Fig. 3). However, it is important when identifying constriction that the position of the hands is taken into account. The placement of the hands on the upper half of the body can cause the humeri to move proximally, giving the appearance of constriction in the shoulders. Therefore, whenever possible, the finding of constriction in the shoulders should be supported throughout the rest of the skeleton.

Ideally, the edges of the grave cut are identified in order to determine whether constriction was caused by a narrow grave or

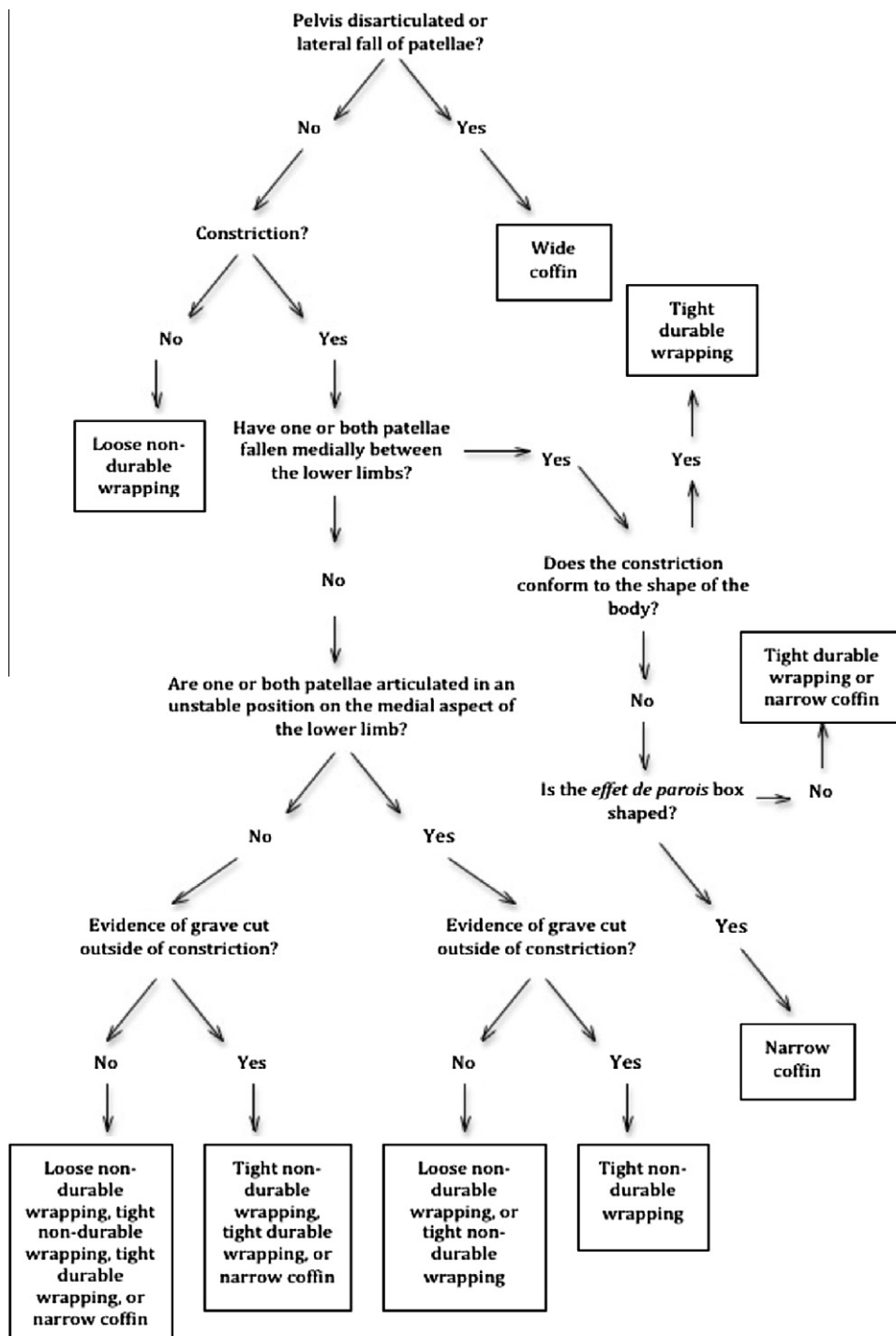


Fig. 4. Flow chart showing method used to assign burial context at Ban Non Wat.

Table 3

Burial context descriptions and criteria for their identification.

Burial context	Description	Criteria
Loose non-durable wrapping/no wrapping	Body buried without a container or loosely wrapped in a material that decomposed quickly	Internal or no space. No constriction, or constriction with no evidence that the grave cut was wider than the constriction (i.e. constriction possibly caused by narrow grave cut)
Tight non-durable wrapping	Body tightly wrapped in a material that decomposed quickly	Internal space only, constriction. Only identifiable with evidence that grave cut was wider than constriction
Tight durable wrapping	Body tightly wrapped in a material that decomposed slowly, such as fibrous matting	Limited external space present, or the possibility that container so tight that no external space present. Most commonly identified by constriction and the disarticulation of patellae medial to the knees combined with a wall effect that conforms to the shape of the body
Narrow coffin	Body placed in a hard narrow container that decomposed slowly	Limited external space present, possibility that container so tight that no external space present. Uses the same criteria as tight durable wrapping combined with a 'box' shaped wall effect
Wide coffin	Body placed in a hard wide container that decomposed slowly.	Internal and external space, no constriction. Most commonly identified by disarticulation of the pelvis, lateral rotation of the femora, and lateral fall of the patellae (Duday and Guillon, 2006)

a tight container (Nilsson Stutz, 2006). If grave cuts are not shown in photographs or field drawings, or could not be identified at the time of excavation, the only alternative is to identify their approximate position by the location of grave goods. Skeletons that were constricted when there is evidence that the grave cut was wider than the constriction can be identified as having been buried in a tight container.

Our archaeothanatological approach

This research applied an archaeothanatological approach to 133 human burials, based on photographs and field drawings from Ban Non Wat. This is from a total of 427 adult burials excavated. The high proportion of burials excluded from the sample were unable to have the archaeothanatological approach successfully applied largely due to disturbance of the skeletons by later activities at the site. As the flexed burials have not been accurately placed within the chronological sequence they have been excluded from this investigation, and infant and child burials are not included as most were interred in mortuary jars.

Because of the large number of burials analyzed it was necessary to develop a heuristic to assist in the assignation of burial context (Fig. 4). This allowed for the large sample size, however, it is important to note that the flow chart was a guide more than strictly followed rule. It is important when applying archaeothanatological principles that the researchers are aware that multiple explanations may exist for a single burial and to consider the ways in which space can form in the grave and be filled, before making judgments. The figure shows that using the method described here it was not always possible to assign burials to a single context, reducing sample sizes.

The method applied to burials from Ban Non Wat allowed the identification of five types of burial contexts. Three of these have been labeled as wrappings, a term we have adopted throughout this paper, however 'shroud' would be an appropriate alternative. All burial contexts are described and the criteria for the identification of each summarized in Table 3.

The combination of a lack of external space and no constriction allowed the identification of burials in loose non-durable wrappings (Fig. 5). These would have been made of a soft flexible material that did not constrain the original position of the body and decomposed quickly enough to allow soil to fill space between the lower limbs before the persistent patellar ligaments decomposed. This means that if any space was present it was internal, so minimal movement of skeletal elements would occur and the skeletal elements would remain in the position in which they were interred. It was not possible to differentiate burials without any wrapping, whether or not they were wearing non-durable clothing,

from those in loose non-durable wrappings, as all would have most likely decomposed at the same rate. This means that those burials



Fig. 5. Burial interred in a loose non-durable wrapping (or no wrapping), shown by a lack of constriction throughout the body and no external space.



Fig. 6. Burial interred in a tight non-durable wrapping shown by constriction with evidence that the grave cut was wider (pot sherds lateral to left knee) and lack of external space.

assigned to the 'loose non-durable wrapping' group may, in fact, not have had any wrappings at all.

Tight non-durable wrappings were made of a flexible material that was tightly wrapped around the body, causing constriction. As with loose non-durable wrappings, the wrapping would decompose before the patellar ligaments, suggesting there were no external spaces. Identification of tight non-durable wrappings therefore used the same criteria as loose non-durable wrappings, with additional evidence for constriction (Fig. 6). As already discussed, if there is no evidence that the grave cut was wider than the constriction then burial in a tight non-durable wrapping could not be differentiated from one in a loose non-durable wrapping in a narrow grave.

Tight durable wrappings and narrow coffins share many of the same patterns in the spatial positioning of the skeletal elements. Both are identified by constriction and the presence of a limited amount of external space between the knees. This space is indicated by the medial disarticulation of the patellae, as the durable nature of the containers prevents soil from infiltrating the grave and holding the patellae in place. This does, however, mean that



Fig. 7. Burial showing wall effect that conforms to the shape of the body, caused by a tight durable wrapping.

if the patellae are not in unstable positions on the medial aspect of the knees or disarticulated between the knees, the ability to assign a single burial context is markedly reduced.

Characteristic wall effects differentiate tight durable wrappings and narrow coffins from one another. In tight durable wrappings this conforms to the shape of the body. Such a phenomenon can be seen in Fig. 7 where the container was tight around the lower and upper limbs but allowed the left forearm to be placed lateral to the pelvis. This wall effect seems to taper down the body ending in the constriction shown in the feet, with the left foot placed on top of the right. The second type of durable rigid container, a narrow coffin, can be seen in Fig. 8, in which the wall effect in the upper limbs retain a box shape, or 'parallel sided' appearance (Rodwell, 1981), with the left hand placed on top of the pelvis rather than beside it. In both cases it is necessary to show that the *effet de parois* were not caused by narrow grave cuts, shown in the figures by the presence of grave goods outside of the constriction.



Fig. 8. Burial showing 'box shaped' wall effect caused by a narrow coffin.

A wide coffin was identified by evidence of external space and no constriction. Disarticulation of the pelvis, lateral rotation of the femora, and the fall of the patellae lateral to the lower limbs most commonly characterized this context (Duday and Guillon, 2006) (Fig. 9).

Results

The result of analysis of burials within each mortuary phase is listed in Table 4. Clearly the number of individuals assigned burial context are not equally distributed across the mortuary phases, which may have distorted the results in the smaller samples (particularly the Neolithic and Bronze Age 1 phases).

Because of the small numbers of individual's assigned burial context in the first Neolithic phase it appears that being interred in a jar was commonplace for adults. This was unlikely to be the case as these were the only two adults from Ban Non Wat recovered in mortuary vessels. Because of such issues with sample size comparison between the phases of the Neolithic is of limited value. Despite this it can be clearly seen that the Neolithic 1 phase used loose non-durable wrappings and mortuary jars, whereas the Neolithic 2 individuals were buried in loose non-durable wrappings, tight durable wrappings, or narrow coffins.

Throughout each phase of the Bronze Age wide coffins were in use, with an apparent peak in Bronze Age 1. Loose non-durable wrappings were the most represented burial context after the first



Fig. 9. Burial showing flattened pelvis and lateral fall of left patella, indicative of a wide coffin.

Bronze Age phase, and may have been represented in Bronze Age 1 if not for the small sample size. Bronze Age 2 saw only loose non-durable wrappings and wide coffins used, while Bronze Age 3A included tight durable wrappings. Bronze Age phase 3B had a higher percentage of individuals interred in wide coffins and lower percentage in loose non-durable wrappings than in later phases. Comparisons between Bronze Ages 4 and 5 highlight the fact that although the numbers of individuals in each burial context changed markedly, the frequency of individuals in each context remained similar. In general, loose non-durable wrappings appear to have been the favored burial context during the late Bronze Age, with low frequencies of individuals interred in the alternative contexts.

Of the Iron Age burials from Ban Non Wat, only individuals from phase 1 could be assigned burial context. This phase continued the pattern from the late Bronze Age, with a wide variety in burial contexts being used. Loose non-durable wrappings were the most common burial container, followed by wide coffins, narrow coffins, and then the tight wrappings.

Table 4

Numbers of individuals in each mortuary phase assigned a burial context, with percentages in brackets.

	Loose non-durable wrapping	Tight non-durable wrapping	Tight durable wrapping	Narrow coffin	Wide coffin	Jar	Total
Neo 1	0 (0)	1 (33.3)	0 (0)	0 (0)	0 (0)	2 (66.7)	3 (100)
Neo 2	1 (33.3)	0 (0)	1 (33.3)	1 (33.3)	0 (0)	0 (0)	3 (100)
BA 1	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	1 (100)
BA 2	7 (58.3)	0 (0)	0 (0)	0 (0)	5 (41.7)	0 (0)	12 (100)
BA 3A	9 (69.2)	0 (0)	2 (15.4)	0 (0)	2 (15.4)	0 (0)	13 (100)
BA 3B	4 (44.5)	1 (11.1)	0 (0)	1 (11.1)	3 (33.3)	0 (0)	9 (100)
BA 4	29 (63.0)	2 (4.3)	5 (11.0)	4 (8.7)	6 (13.0)	0 (0)	46 (100)
BA 5	7 (58.3)	0 (0)	2 (16.7)	2 (16.7)	1 (8.3)	0 (0)	12 (100)
IA 1	18 (53.0)	1 (2.9)	1 (2.9)	5 (14.7)	9 (26.5)	0 (0)	34 (100)
Total	75 (56.4)	5 (3.8)	11 (8.2)	13 (9.8)	27 (20.3)	2 (1.5)	133 (100)

Key: Neo = Neolithic; BA = Bronze Age; IA = Iron Age.

Discussion

Our application of archaeoethnatology to a sample of burials from the prehistoric site of Ban Non Wat has illustrated that the method can be applied post-excavation and make a considerable contribution to understanding mortuary practices at a site. As noted earlier, [Boyd and Chang \(2010\)](#) have suggested that burial practices in the Mun Valley changed from diverse in the Neolithic to conforming in the Bronze and Iron Ages. With the addition of this research into burial context we are able to dispute the universal validity of their assertion as related to the various burial practices. We have shown that there was conformity in the most preferred burial context throughout, although some individuals were buried in other contexts, with a peak in variety of contexts towards the end of the Bronze Age and early Iron Age. [Willis and Tayles \(2009, pp. 552–553\)](#) have previously stated that while there was “...increasing variation in other aspects of mortuary practices and social organisation in the upper Mun River Valley during late prehistory, the aspects of burial mode identified...became more uniform over time”. This is a statement in which we have more confidence, and by combining the Ban Non Wat data presented here with that from Noen U-Loke can now pinpoint the onset of that conformity to the mid to late Iron Age. This period is, however, preceded by wide variety in the late Bronze and early Iron Age. Here we review the burial contexts used during the mortuary phases at Ban Non Wat as well as incorporating other research in the area, allowing a regional overview of how burial containers changed over time in the Mun Valley and further afield.

In the very small first Neolithic mortuary phase, the most significant point is that two of three adults at Ban Non Wat were interred in mortuary jars. This is unusual as the remaining jar burials at the site contained infants. There was no obvious reason for such an unusual mortuary practice. Both were primary interments

accompanied by a similar number of mortuary goods as their contemporaries. They were found in different parts of the site, but it is not known how close temporally they were interred. An explanation offered by [Cox \(2009\)](#), for burial 28 ([Fig. 10](#)) is that he was an immigrant to the site, suggested by isotope analysis, an investigation of non-metric traits, as well as the atypical burial context. Burial 292, the second adult interred in a vessel, has not yet been subjected to isotopic analysis, so we cannot say whether these two individuals were treated differently in death because they were immigrants, but it remains a possibility.

The third individual in the first Neolithic phase, the three in the second phase and the single individual in Bronze Age 1 were each buried in a different context, covering the full range of wrappings and coffins, so there was no discernible pattern and no obvious link between burial context and sex or age. The findings from the Neolithic and Bronze Age 1 at Ban Non Wat can be directly compared with those of [Willis and Tayles \(2009\)](#) from Mortuary Phase 1 at Ban Lum Khao. Although definitive dates are not available for Ban Lum Khao Mortuary Phase 1, the burials are likely to have been interred sometime between 1280 BC and 1000 BC ([Higham and Thosarat, 2004](#)), as Bronze Age 1 burials at Ban Non Wat were dated to 1050–1000 BC, the dates overlap. The findings from each site appear to correlate with a similar range of burial contexts plus the addition of two adult jar burials and the single loose non-durable wrapping at Ban Non Wat.

In the second Bronze Age mortuary phase the range of contexts reduced to two, with interments in either loose non-durable wrappings or wide coffins. The coffins used were most likely made of wood, based on the presence of fragments in a number of the graves. Two burials with wood fragments remaining in their

**Fig. 10.** Burial 28 a possible immigrant to the site, interred in a mortuary jar.**Fig. 11.** Burial 443 showing the remains of a curved wooden coffin, possibly made of a hollowed out tree trunk. Arrows indicate the wooden remains.

graves, burials 290 and 443 (Fig. 11), were interpreted using archaeothanatology methods as interred in loose non-durable wrappings. This, combined with the curved profile of the wooden base shown by the angles of the bangles seen in the figure, suggests that open coffins made of hollowed tree trunks, similar to those identified by Pautreau and Mornais (2003) at Ban Wang Hai, may have been used at Ban Non Wat. Because open coffins allow soil to be in direct contact with the body they are not distinguishable using archaeothanatology methods, highlighting the need to include archaeological findings when assigning burial context.

In Bronze Age 3A and 3B, the predominant burial context continued to be the same as the previous phase but with individuals buried in the range of other contexts. Bronze Age 3 was divided into two subphases by Higham (2009) primarily on the basis of differences in wealth, with 3A wealthier than 3B. The minimal variation in context between the two periods suggests the difference in wealth was not matched by a difference in burial mode.

Based on comparative analysis of ceramic vessels, Hauman (2009) has shown Bronze Ages 2, 3A, and 3B from Ban Non Wat to be contemporary with Mortuary Phase 2 at Ban Lum Khao. This means that the findings of Willis and Tayles (2009) at Ban Lum Khao can be directly related to burials from Ban Non Wat. Mortuary Phase 2 burials at Ban Lum Khao were interred either in narrow coffins or tight wrappings, with burial context possibly dependent upon sex (all coffin burials except one were female). In contrast, contemporary burials at Ban Non Wat were interred most frequently in loose non-durable wrappings or wide coffins. There were no links identified in the Bronze Age between burial context and either sex or age.

The late Bronze Age phase 4 at Ban Non Wat had the largest sample and also the most variety in burial contexts. Although more than half were buried in the same two contexts as Bronze Age 3, all other contexts were represented. In Bronze Age 5, loose wrapping remained the most favored context, a smaller proportion were buried in wide coffins and two other contexts were represented. It is possible that the apparent increase in diversity of burial contexts in Bronze Age 4 is purely a reflection of the larger sample.

Higham and Thosarat (2004) have previously placed Mortuary Phase 3 at Ban Lum Khao in the late Bronze Age. As Hauman (2009) has shown Bronze Ages 2, 3A, and 3B at Ban Non Wat to be contemporary with Mortuary Phase 2 at Ban Lum Khao, it appears that Mortuary Phase 3 was contemporaneous with Bronze Ages 4 and 5 at Ban Non Wat. In Mortuary Phase 3 at Ban Lum Khao, burials were interred only in tight wrappings, there was no evidence that coffins were used (Willis and Tayles, 2009). This differs from the predominant context being loose non-durable wrapping in the late Bronze Age burials at Ban Non Wat, although the second most common context is coffin burial and there is a higher proportion of tight wrapping than in earlier phases. There may have been a sampling effect at Ban Lum Khao, which could be explained by the smaller area excavated, located off the center of the mound, or the smaller sample available to Willis and Tayles. Alternatively, it may show actual differences in the way individuals were being interred between the two sites, with Ban Non Wat being a larger site and therefore possibly more influential in the Mun Valley, attracting immigrants from elsewhere in the valley who brought the diversity of customary burial practices.

In the first Iron Age phase at Ban Non Wat the earlier pattern continued with loose wrappings and wide coffins favored, although all other contexts were represented and narrow coffins more frequently used than in earlier phases. Again no links were identified between burial context and sex or age. On first appearance the Iron Age burials at Ban Non Wat contrast with the tight wrappings identified by Willis and Tayles (2009) at Noen U-Loke. However, burials included in their research came predominantly from the later mortuary phases at Noen U-Loke, equating to the mid to late

Iron Age. The earliest burial included in their investigation was from the second Iron Age phase at Noen U-Loke, which they tentatively identified as in a loose wrapping, possibly showing the last of the variation before the conformity of the later Iron Age. The conformity in burial context shown in the mid to late Iron Age is however offset by the increased variation in other mortuary practices, including the addition of clay lined graves and rice within burials (Talbot, 2002). The Iron Age site of Ban Wang Hai mirrored the findings at Noen U-Loke, with all individuals interred in a single context, although they were interred in coffins (Pautreau and Mornais, 2003).

We must be cautious when combining the results from Ban Non Wat with those of Noen U-Loke to form an overview of burial context in the upper Mun Valley. As we have shown with the comparison between Ban Non Wat and Ban Lum Khao, some variation did exist between geographically close settlements. It is possible that while some populations in the upper Mun River Valley were reducing burial context variability throughout the Iron Age, others continued to favor the Bronze Age pattern. However, based on current evidence, it can be hypothesized that burial context in sites within the upper Mun River Valley, and perhaps Northern Thailand as a whole, became less variable during the Iron Age. The uniformity within Noen U-Loke and Ban Wang Hai is tempered by variation between them, suggesting that by the mid to late Iron Age geographical regions had entrenched and, in comparison to earlier phases, enforced burial practices. We will now consider such a progression in light of socio-political, technological, and subsistence advances in the region.

Archaeological evidence has shown that within the upper Mun Valley intensification of rice agriculture did not occur until the Iron Age, when drier conditions led to the purposeful manipulation of waterways (Boyd and Chang, 2010; Boyd and Habberfield-Short, 2007). This was accompanied by changes in social complexity, with inhabitants adopting a hierarchical socio-political system by the late Iron Age, possibly spurred by Indianised concepts introduced through trade (Boyd and Chang, 2010; Higham, 2002, 2011b; Higham and Higham, 2009b). Associated with this increasing socio-political complexity was a changing view of social identity, moving towards "...an identity subsumed within an emerging centralised state landscape" (Boyd and Chang, 2010, p. 291). We propose that such a change was partially expressed through the homogenization of burial context, regardless of differences in emerging social classes, in order to foster this community identity, with social inequalities displayed by alternate mortuary practices such as grave goods. Such a consolidation appears to have been accompanied by a reduction in immigration from outside the upper Mun River Valley (Bentley et al., 2009; Cox et al., 2011). Burial context heterogeneity seen in the earlier stages of occupation in the Mun Valley could have been a reflection of immigrants bringing their own burial customs to the region, with these being allowed to propagate within the early constructs of individual social identity. At this period of early colonization social identity was largely transported from originating settlements, as shown by the preservation of classic Southeast Asian pottery styles and previously established farming techniques (Boyd and Chang, 2010). Later reduction in migration and transformation in both social identity and socio-political structure had the potential to promote regional uniformity in burial context and variation in other mortuary practices, such as the increasingly high number and diversity of grave goods.

It must be noted that this theory of change based on migration and social identity is one possible explanation. An equally compelling case could be made for a stronger relationship between social status and burial context, as was made at Tam Ongbah. Higham (2011b, p. 133) has recently made the argument for a lack of "...evidence for hierarchical social distinction at Ban Non Wat in the early

Iron Age". This suggests that the diversity seen in the Neolithic, Bronze, and early Iron Ages at Ban Non Wat was not prompted by hierarchical social inequalities but does not preclude the possibility of individuals being distinguished in death based on personal accomplishments, as in heterarchical social systems. For discussions on the applicability of heterarchy to pre-Iron Age Thailand see O'Reilly (1999, 2000, 2003) and White (1995). Although it would be interesting and potentially illuminating to investigate burial context in relation to the type of goods placed in graves, such research falls outside the scope of this paper and is left to others.

Conclusion

The application of an archaeothanatological methodology to burials from Ban Non Wat has illustrated a suggested method for the assignation of burial context after excavation. Although a variety of burial contexts were being used at Ban Non Wat, loose wrapping and wide coffins were favored. Apart from this preference, variety in other burial contexts peaked in the late Bronze Age and early Iron Age, a finding that differs from that of Willis and Tayles (2009) at nearby Ban Lum Khao but aligns with that from Noen U-Loke. When our findings are taken into account with the results of Willis and Tayles (2009), it appears that the Neolithic, Bronze, and early Iron Ages in the Upper Mun Valley were characterized by high diversity in the form of burial containers both within and between sites. This may have been the result of migration combined with a concept of social identity promoting the diversification of communities (Boyd and Chang, 2010). During the mid to late Iron Age, burial context became uniform within sites but geographically variable, reflecting changes in social identity fitting within the regional socio-political framework.

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