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Death on the frontier: military cremation practices in the north of Roman Britain

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Abstract:

The study of cremated human remains from archaeological contexts has traditionally been viewed as less valuable than the study of inhumed bodies. However, recent methodological and theoretical developments regarding the taphonomic processes that transform the human body during cremation have highlighted their potential for understanding past cultural and funerary practices. This study combines the first application of spectroscopic with more traditional methods of studying cremated bone to examine Romano-British contexts, with the aim of better understanding funerary practices along the military frontier. Five Romano-British military sites from northern England (Beckfoot, Carlisle, Herd Hill, Lincoln and Malton) were studied, with remains excavated from a range of cinerary urn contexts. Despite the known heterogeneity of the ethnic composition of the Roman army, analyses revealed a surprising consistency with respect to the cremation practice, implying shared knowledge of pyre procedure and, possibly, a prescribed funerary practice amongst military communities in the Roman North. The consistency within these five northern provincial sites in Britain stands in contrast to cremation contexts from Roman sites elsewhere in Europe, as well as other periods of the British past. The associated material culture recovered from these cremation deposits, however, does provide evidence for differences in dress and bodily display. This contrasts with the homogeneity of the cremation technology and highlights the importance of these individualizing features for signalling identity amongst Roman military communities in Britain.

Keywords: FTIR-ATR, funerary identity, cremation, pyre, burning intensity, taphonomy, Roman Britain, Roman army

Introduction

Cremated human remains from archaeological sites have, for many years, languished unstudied within museum repositories. Despite attempts to highlight their interpretive value, the challenging nature of this material has led to its continuing neglect. Nonetheless, cremated human remains are a prominent and long-standing feature of the archaeological funerary record and have the potential to yield important insights into past human societies. In recent years there has been a sharp increase in the number of publications that have focussed on cremation studies within the disciplines of archaeology and forensic anthropology (e.g., Ellingham et al., 2015; Gonçalves, 2012; Kuijt et al., 2014; Schmidt and Symes, 2015; Thompson, 2015a; Ubelaker, 2009). Much of this research explores new methodological approaches in forensic research, although the adoption of theoretical approaches to archaeological cremated remains has also been attempted (see, for example, Kuijt et al., 2014).

The analysis presented here combines new methodological developments for exploring the taphonomic transformation of burned human remains, with macroscopic skeletal and funerary analyses. This approach is applied to the cremated skeletal remains from five Romano-British military sites in the North of England. Cremated human remains have, to date, played a limited role in interpretations of these sites (with the exception of Brougham; Cool, 2004). The aim is to examine whether this new approach can help to address questions regarding military identities and funerary practices on the Roman frontier.

Evidence of cremation and its interpretation

There is still much that is not fully understood concerning the nature of heat-induced changes to the hard tissues of the body. However, during burning bone progresses through four stages of change - dehydration, decomposition, inversion and then fusion (Thompson, 2004). Continued heating will cause a restructuring of the inorganic component of bone, and eventual coalescing of the inorganic crystals. These changes (referred to as primary-level changes; Thompson, 2004) then produce macroscopic alterations of the bones (referred to as secondary-level changes), such as colour change, fracture propagation, fragmentation, warping and shrinkage.

Archaeologists have recorded these macroscopic changes in order to better understand past cremation practice. Colour is the heat-induced change which has been most frequently associated with conditions of burning. As temperature increases, the colour of bone alters from buff-coloured to dark grey and black, and then light grey and white (Munro et al., 2007). The trend is consistent across all contexts, but a straightforward correlation between colour and temperature should be viewed with caution since there are many variables that influence the colour of burned bone (Gejvall, 1969; Buikstra and Swegle, 1989; Ellingham et al., 2015). Archaeologists have also used fracture patterns to comment on whether bodies were fleshed or defleshed (decomposed) prior to burning (Baby, 1954; Binford, 1963), but caution has been advised to avoid over-interpretation (Gonçalves et al., 2011). Over recent years, the refinement of microscopic methods has enabled the examination of changes to the crystal structure of bone under a variety of burning conditions. Generally, there is an

increase in the crystallinity of bone as the intensity of heating increases. This occurs due to the reordering and coalescing of the crystals within the bone and has been shown to be a useful means of analysing burning intensity within different cremation contexts (Thompson, 2015c).

The theme of the transformation of the human body by fire is common in funerary studies. Oestigaard (1999) describes three forms of cremation transformation - technological, social and ritual. Technological transformations focus on the physical processes involved in cremation; social transformation focuses on commemoration, while ritual transformation emphasises the link between the living and the dead (Davies, 2002; Nilsson Stutz, 2008; Williams, 2003). Other interpretations of cremations often concentrate on the importance of the spectacle of cremation itself (Thompson, 2015b). Despite the visibility of the act of burning, evidence for the actual site (even with repeatedly used *ustrina* [funeral pyre sites]) is rare, partly because the heat of the pyre only penetrates approximately 10 cm into the soil (McKinley, 2015) - although recent experimental work suggests that heat-induced change could occur more deeply (Aldeias et al., 2016). There is also a practical element to the cremation practice, particularly within a military context, including the logistical advantages of rendering the body transportable and biologically inert, or even unrecognisable in order to prevent desecration of a corpse by the enemy (Kutterer et al., 2012; Noy 2005; Lucan 8.764-67; Suetonius *Nero* 49).

The effect of taphonomic factors on the interpretation of cremation evidence

Taphonomic factors influence the interpretation of cremation contexts in two ways. First, burning is itself a taphonomic process and therefore archaeologists must determine whether the burning event was part of an intentional funerary process, rather than accidental/incidental burning, or whether it occurred some time after deposition of the remains (e.g.: Cataroche and Gowland, 2015). Usually, additional contextual information (such as the presence of funerary goods) is used to determine this (e.g. Scott et al., 2010), although evidence from the skeletal remains themselves, such as fracture patterns, can also be indicative of the timing of burning relative to death (Garrido-Varas and Intriago, 2015; Gonçalves et al., 2011).

Second, a range of additional taphonomic factors will affect the cremated remains after the body has burnt, and these have implications for the integrity of the material. Generally, cremated material is inert due to the lack of organic content and the restructuring of the crystal component, but collapse of the pyre, raking or dousing of the pyre, bioturbation, collection of bone for secondary deposition, trampling of the ground above, deposition within an urn, or directly in the ground, and excavation and storage factors can all affect the degree of fragmentation, alter the position of the bones in relation to each other or associated artefacts, and result in partial analysis (Aplin et al., 2015; Thompson, 2015b). These factors may be considered problematic if archaeologists are attempting to use solely fragment size or the weight of remains recovered to comment on minimum number of individuals. However, the integrity and appearance of the cremated remains (fragment size, fracture patterns and colour) can yield important information concerning the specific funerary rites associated with Roman cremation practice.

Cremation in the Roman world

Ancient Roman authors provide a detailed picture of the physical processes, rituals and beliefs surrounding death and burial and this has strongly influenced understanding of practices across the Roman world. Cremation pyres were constructed from layers of wooden logs placed at right angles to each other, possibly nailed together for stability; gaps were filled with sweet-smelling brush and other floral offerings (Noy 2000; Vitruvius *On Architecture* 2.9.15). The corpse was washed and prepared either by the family, or increasingly over time, by hired professionals (Erker 2011). The deceased was transported on a funeral couch or bier to the pyre for burning and was positioned supine atop the pyre structure. This location not only provided a good view of the body for spectators but also was the optimum for the purposes of combustion (Noy 2000; McKinley 1994). Funerary offerings would be placed around the corpse on the pyre, which could include items such as jewellery, incense and even full or partial animal carcasses given as sacrifices (Toynbee, 1971). A funeral meal (the *silicernium*) was eaten beside the pyre with food for the deceased, and other remnants, thrown into the flames. Once the pyre collapsed and burned down, the bones were sprinkled with wine and collected into an urn for burial. The procession, the scale (and cost) of the pyre, and the sight and smell of the burning corpse underlined the fact that the Roman funeral was a public, not private affair. This also ensured that the appropriate rituals were conducted to avoid death pollution; the deceased had to make a proper transition to avoid a restless spirit and the living needed to be reintegrated into the community (Toynbee, 1971).

These descriptions from textual sources, however, are heavily biased toward the practices of a small elite group and are largely focused on funerals at the City of Rome. It should therefore not be assumed that practices described by authors such as Cicero were adopted universally across the provinces of the Roman Empire. Further, Pearce (2013) notes that these sources can have limited potential for reconstructing pyre form and associated ceremonies. Funerary rites may have been a means through which distinct cultural and social identities were asserted in the face of Roman imperial expansion. To understand funerary practices across the Empire more generally, it is necessary to turn to the archaeological evidence. Many cemeteries had dedicated areas, *ustrina*, set aside for pyres that may have been used multiple times for many different individuals. Archaeologically, this arrangement has potential implications for interpretation; bones had to be taken from the *ustrinum* for burial elsewhere and some skeletal elements may have been missed during collection and hence absent from the final deposit. Inadvertent mixing of skeletal material from multiple individuals might also be misinterpreted as evidence for the presence of two or more individuals within a cremation deposit intended for a single individual (Wahl, 2015).

In contrast to the *ustrinum* is the *bustum*-type burial, where the site of the pyre and the site of the final deposition of the burned bone are the same. The pyre structure was built above a shallow, rectangular pit into which the structure fell as it burned down. Bone was then collected into an urn which was deposited in the pit along with pyre debris and then the pit backfilled with earth. From an archaeological perspective, skeletal material should be more complete (if not always entirely contained within the urn or vessel) and less likely to be mixed with material from other individuals.

Archaeological evidence suggests that the deceased was placed on the pyre dressed as in life (see Carroll and Wild, 2012); clothing, footwear and the posture of the body all influenced the speed and degree to which the body was burned. Bones were collected into a variety of containers, including glass or ceramic vessels, baskets and bags; some collections of bone were placed 'un-urned' directly in the ground. The proportion of the bones collected and skeletal elements selected for deposition were highly variable. In addition to the bones of the deceased, animal bones, especially pig, have been observed in many Roman cremation deposits, either as sacrifices, food for the deceased, or the remains of feasting (Wahl, 2015). In sum, archaeological evidence from the western provinces (as with other regions of the Empire) provides support for many aspects of the funerary rites described in the ancient textual sources, including pyre technology and feasting, but also demonstrates significant variations in practice both within and between cemeteries.

Following the Roman conquest of Britain, starting in AD 43, funerary rites become increasingly visible. Across the province as a whole, cremation was predominant during the early Roman period, with inhumation more common from the mid-second century, and predominant from the mid-third century to the end of the Roman period in the early fifth century (Pearce 2013). There was, however, significant chronological and geographical variation and cremation persisted in Britain long after it had ceased to be the dominant funerary rite on the continent (Mattingly 2006; Philpott, 1991). This persistence has been noted for the northern frontier regions in particular (McKinley, 2015; Petts, 2009). The most common type of cremation deposit identified during the excavation of these sites in Roman Britain is an urn or container of burned bone collected from, but deposited away from the site of the pyre; in contrast *bustum*-type burials are less common.

Cemeteries are known from at least 31 military sites in the north of Roman Britain, with published osteological data available for around half of these. The most extensively excavated and best-known of these cemeteries is at the fort of Brougham, Cumbria. Here, some 350 funerary-related deposits, including 322 containing cremated bone, were excavated; almost all date to the third century AD (Cool, 2004). Within northern Roman Britain, *bustum*-type cremations are particularly well represented in the vicinity of Hadrian's Wall. For example, the Petty Knowes cemetery associated with the fort at High Rochester, Northumberland, has produced evidence for *bustum*-burials beneath low earthen mounds or barrows; cremations at this site date from the early second to the early fourth century AD (Charlton and Mitcheson, 1984). Other sites with *bustum* burials in the vicinity of Hadrian's Wall include Beckfoot, Herd Hill and Birdoswald (Petts, 2009). A key characteristic across this region, however, is the diversity of funerary practices documented, even within individual cemeteries, in relation to bone selection and deposition, the use of burial containers, the spatial organisation of burials, and the inclusions of grave goods (e.g. for comments on diversity at Birdoswald, see Haynes, 2013).

Apart from the permanent legionary fortresses at York and Chester, the forts of northern Britain were garrisoned by auxiliary units, which were originally raised in other provinces of the Roman Empire and posted to Britain. Most of the auxiliary units documented on Hadrian's Wall were first recruited from other frontier provinces along the Rhine and Danube. There has been much interest in whether these units may have maintained cultural or ethnic traits, expressing these, for example, in traditional pottery forms. In this context, the inclusion of horses in some of the burials at Brougham, unusual in a Romano-British context, has

been suggested to indicate possible links between the military unit garrisoned at the site and the province of Pannonia on the Danube frontier (Cool, 2004). Though doubts have been raised about this specific interpretation (Bidwell and Hodgson, 2009), it usefully flags the fact that the Roman army was not a single, unified entity, but comprised culturally and ethnically diverse groups of soldiers from across the Empire; it was also part of a larger community of non-military personnel, including women and children, and located amongst a much larger indigenous British population.

Materials

The samples for this study come from the cemeteries of five different Roman military sites in the North of England: Beckfoot, Herd Hill, Carlisle (all Cumbria), Malton (North Yorkshire) and Lincoln (Lincolnshire) (Figure 1). The precise periods of occupation for each site vary, but collectively they span from the late 1st century AD to the early 5th century AD (i.e., the entire span of Roman occupation). Three of the sites are associated with Hadrian's Wall and its western extension down the coast of Cumbria. The fort of **Beckfoot** was located on a low cliff overlooking the Irish Sea; it appears to have been founded in the early second century AD as part of the Hadrianic frontier works (Caruana 2004). Between Beckfoot and the western terminus of Hadrian's Wall, **Herd Hill** was a small fort or 'milefortlet', one of a sequence built along the Cumbrian coast at the same time as Hadrian's Wall; a small number of early second-century cremations have been discovered at the site (Bellhouse, 1954; Breeze 2006). At **Carlisle**, a fort was founded in the winter of c. AD72/3, which remained in occupation, with a few short phases of abandonment, until the end of the fourth century. There is evidence for the presence of a range of auxiliary, cavalry and legionary garrisons. A large civilian settlement rapidly grew up, vastly exceeding the fort in size. Three substantial cemeteries are known, with both cremations and inhumations, in use from the late first to the early fifth century AD (Breeze 2006).

The final two sample sites lie some distance to the south of Hadrian's Wall (Figure 1). The first fort at **Malton**, c. 30km north-east of the legionary fortress at York, was founded in the late first century AD, with a sequence of abandonment and reconstruction extending, probably, into the fifth century AD. There was a small civilian settlement (*vicus*) outside the fort and a substantial industrial settlement producing pottery (Wenham, 1974). The cemeteries of this site are not well known, despite the recording of both cremation and inhumation burials outside the fort, and evidence suggesting three additional cemeteries on the other side of the river (Wilson, 2006). Finally, a legionary fortress was established at **Lincoln** in c. AD 60. With the departure of the legion (*legio II Adiutrix*), the site was converted into a colony (*colonia*) for military veterans before the end of the first century AD. Henceforward, there was no permanent military garrison at the site which developed into one of the major urban centres of Roman Britain. Substantial cemetery areas have been identified on all sides of the urban centre, extending from the mid-first to the early fifth century AD; most burials were of cremated bone, though inhumations are well represented (Jones, 2002). Together, the five sample sites represent a diverse range in terms of location, date, size and the military and social composition of their inhabitants.

Methods

The human remains were excavated by one of the authors (JS) from the containers which had been recovered previously and the data presented here is a sub-set of a larger study of cremation and identity in Roman Britain (Szigeti, 2016). Anthropological analysis of the human remains was performed using standard methods (e.g.: Scheuer and Black 2000; White 2000). The measure of cremation efficiency and pyre technology was assessed through macroscopic observation using the standardised methods outlined by McKinley (2004) and Fourier Transform Infrared - Attenuated Total Reflectance (FTIR-ATR) analysis. The cremated bone had been deposited in a variety of vessel types (Figure 2). Following recovery from the ground, the exterior of each vessel was tightly wrapped with cling film to ensure stability. The vessels were then excavated in roughly 10mm spits.

Fragmentation

Each deposit was sieved using 10mm, 5mm, and 2mm geological sieves. After the removal of any large fragments of non-osseous material, the total weight of the contents of each sieve, including the base (which held the smallest bone fragments, unidentifiable bone dust and inclusions), were recorded. The fragments from each sieve were sorted according to skeletal area (cranium, axial or appendicular skeleton) and then, where possible, identified to skeletal element, or assigned to an 'unidentified' category.

Fracture Patterns

Fracture patterns were recorded using the following accepted standardised terms: transverse, curved transverse, bull's eye, patina, longitudinal, step, delamination/splintering, and warp/shrinkage.

Colour

Colour-change was recorded on a gradient from: normal/buff/cream (indicative of bone that has burned only until the flesh has been removed), brown and black (indicative of charring), through taupe, grey, blue and white (white indicating complete oxidation and removal of any organic material). Colour change was recorded using the Munsell colour system according to the criteria of Munro et al. (2007).

Microscopic Analysis

Bone samples for FTIR-ATR analysis were taken from material removed from the 5mm sieve. Forty-nine individuals were sampled, and each sample comprised of a 1g fragment of unidentified long bone. Sampling followed the recommendations of Thompson et al. (2013). FTIR-ATR scans were undertaken, using a Nicolet 5700 FTIR Spectrometer controlled by OMNIC 7.3 software. For each sample, background spectra were collected and the diamond stage was cleaned with propanol before use. Six replicate measurements were taken for each sample and mean averages were used in subsequent analysis. The spectra were then recorded between 2000 cm^{-1} and 400 cm^{-1} , at a resolution of 4 cm^{-1} using previously published methods (Squires et al 2011; Thompson et al., 2013). The following crystallinity measures proposed by Thompson et al (2013) were used in this study:

$$\text{CI} = (565 \text{ cm}^{-1} + 605 \text{ cm}^{-1}) / 595 \text{ cm}^{-1}$$

$$\text{C/P} = 1415 \text{ cm}^{-1} / 1035 \text{ cm}^{-1}$$

$$\text{CO/P} = 1650 \text{ cm}^{-1} / 1035 \text{ cm}^{-1}$$

$$\text{CO/CO}_3 = 1650 \text{ cm}^{-1} / 1415 \text{ cm}^{-1}$$

$$\text{CO}_3/\text{P} = 900 \text{ cm}^{-1} / 1035 \text{ cm}^{-1}$$

Phosphate High Temperature (PHT) = $625\text{ cm}^{-1}/610\text{ cm}^{-1}$

Line width = the full width at half maximum of the phosphate peak at 1035 cm^{-1}

Note that the numbers relate to positions on the FTIR spectra and the ratios themselves examine different aspects of burning intensity. Therefore use of all seven indices allows one to analyse a range of possible burning intensities. With this in mind, C/P, CO/CO₃, CO₃/P, CO/P and line width best describe low temperature burning; CI and line width middle intensity, and; PHT and C/P high intensity burning events (Thompson et al., 2013).

Results

Macroscopic Analysis

Minimum Number of Individuals

A minimum number of 72 cremated individuals were recovered from the five sites, with Beckfoot being the largest assemblage, comprising 40% of the total sample (Figure 3). Twelve of the individuals came from urned contexts, including a glass bottle (Carlisle CALMG 1997.352/86), and a Samian bowl (*terra sigillata*) (Beckfoot EF 213) (Figure 2). There were three instances of double-burials, two from Lincoln (one contained two adults of undetermined biological sex and the second an adult male and a perinate) and one from Beckfoot (an adult and an immature individual, both of undetermined biological sex). The latter were recovered from within the Samian bowl (Figure 2). Ten males and five females were identified in the sample, with the remaining individuals of undetermined sex.

Fragmentation

Fragmentation at each of the sites was generally consistent, with the vast majority of the bone weight from each site consisting of fragments exceeding 10mm in size (Figure 4). The fragment size greatly aided the skeletal element identification from the sites, and these included whole vertebrae and long bone fragments as long as 21cm.

Skeletal Element Representation

The bones of the cranium were well represented (Figure 5), in line with other cremation studies. This is partly due to the fact that they are more readily identifiable in burned skeletal assemblages due to the distinctive morphology of the cranium and mandible. It is often difficult to distinguish between different limb bones due to the degree of fragmentation and warping of burned skeletal remains and hence these represent a large, but undifferentiated, proportion of the total skeletal elements recovered. There were no notable trends in terms of skeletal element recovery from the pyre. It was noted at Beckfoot, however, that foot and lower limb bones were particularly well represented in nine individuals.

Colour Change

Detailed recording of the colour of the bone fragments from each site demonstrates inconsistent and incomplete oxidation, with the whole colour spectrum represented (Figure 6). At all of the sites, the bones of the cranium tended to be incompletely oxidised, exhibiting blue/black charring rather than full calcination when compared to other skeletal elements from the same individuals. The very distal portions of the long bones also displayed incomplete calcination. As is common in cremation contexts, trabecular bone displayed less

severe heat-induced colour change than the superficial compact bone. Figure 6 shows the colour range of the fragments observed from each of the sites, from normal (unburned) to white (completely oxidised). Note that individuals may register a range of colour changes within their skeletal elements. Thus it was not uncommon for a single skeletal element to exhibit marked differences in colour change across the element. Furthermore, paired elements from the same individual may exhibit striking differences in burning intensity (Figure 6).

Fracture Patterns

Fracture patterns from each of the sites were varied, but the presence of curved transverse fractures suggested that the corpses were burned fully fleshed. Current research has confirmed that the presence of curved transverse or thumbnail fractures occur on fleshed and green bones, as opposed to dry bones (Gonçalves et al., 2011).

Other inclusions

In addition to the burned human remains, other elements were found amongst the deposits, including animal bones, fragments of decoration from funerary biers, nails and other unidentified ferrous material, melted glass beads, and charcoal.

Microscopic Analysis

The results of all of the crystallinity measures produced from the FTIR-ATR analysis are consistent with trends provided by other published studies (for examples, see Thompson, 2015c; Thompson et al., 2013), which suggests that the data are therefore reliable. Note that despite all seven indices being used, only CI and C/P are presented here to allow comparison with other sites, some of which do not report all of the indices used in this study.

The values for CI and C/P shows a clear consistency both within each of the sites and between all of the sites studied here (Figure 8). Thus, it can be said that the manner of cremation is similar at all five sites, at least from a pyre-perspective. When the results are compared to cremations from the Continent and elsewhere in England, a distinct difference in burning intensity can be seen. The Romano-British study sample clusters at medium burning intensity. By way of comparison, samples analysed in previous studies from Lisbon (Iron Age and Roman, Portugal) and Elsham (Anglo-Saxon, Norfolk, UK) were burned at a much higher intensities. This is further confirmed when the results from funerary cremations are compared to the results from a range of previous experimental, controlled burnings (Figure 8; see Thompson et al., 2013 for details of this experimental set-up). This is consistent with the findings of the macroscopic analysis in which the colour change and degree of fragmentation were similar between each of the sites and indicated incomplete oxidation.

Discussion

The results of the macro- and microscopic analysis demonstrate that across all sites there is an underlying uniformity of incomplete oxidation, as suggested by the variable colour-change across the skeleton (Figure 7) and confirmed by the results of the FTIR-ATR analysis. When compared to previous studies (Thompson, 2015c), the cremations fall into the 'medium intensity' category.

The large size of the bone fragments (Figures 4 and 5) indicates that the pyres were allowed to burn down with little interference. This observation is supported by the considerable variation in the heat-induced colour changes observed between skeletal elements of individuals (Figures 6 and 7), indicating that the remains were not repeatedly stirred or mixed within the pyre. Tending of a pyre results in a greater uniformity of colour change since it allows heat to reach all elements of the body equally; by contrast the peripheries remain cooler when no tending occurs (McKinley, 2015). The proposed relative lack of pyre-tending has resulted in large and recognizable bone fragments that would have been easy to identify within the pyre debris during collection. In terms of the collection process, it is unlikely that the bones were raked from the pyre as this would have resulted in a greater degree of fragmentation (Figure 4). The containers have also protected the cremated bone from the effects of a range of taphonomic factors which also increase fragmentation levels. There is also some evidence for ordered deposition from collection to placement within the urns. For example, from the Beckfoot site, the foot bones seem to have been deposited in the urns first, suggesting a systematic collection and placement from the feet upwards. However, this is based on the excavation of only a handful of urns and so can only be tentatively inferred.

The consistent medium intensity burning observed at each of the Roman sites studied here, together with the incomplete calcination, heat-induced colour changes and degree of fragmentation, can be argued to suggest similarities in pyre construction, including types of fuelwood, construction, and tending of the pyre. Such homogeneity may indicate a shared cultural model of appropriate funerary practice, with limited local variation, perhaps indicating a prescribed Roman military practice, following standardized procedures and/or involving funerary professionals. It should be noted that there are other possible causes for this consistent occurrence of incomplete cremation. For example, charcoal evidence from Beckfoot shows a combination of taxa, each of which burn at different rates and temperatures. At Beckfoot the primary fuelwood was alder and hazel, which would have burned quickly (especially alder), probably leaving the corpse incompletely calcined.

Despite the proposed uniformity of the cremation practice at each of the sites, associated artefacts provide evidence for differences in the presentation of the corpse on the pyre, which may have signified status as well as possibly cultural or ethnic differences. For instance, at Beckfoot, fragments of bone veneer that would have decorated funeral biers were recovered from some, but not all, urns. These biers may have been upholstered (at Beckfoot, small nails were recovered that would have been suitable for nailing the fabric to the frame of the bier) (Bellhouse 1954), and the veneer painted. At the site of Roman fort site of Birdoswald, traces of blue, black and red paint were found on bone veneer fragments (Cool 2004).

At the large Roman cremation cemetery at Brougham, Cool (2004) observed that individuals were cremated in dress, rather than shrouded or naked, due to the presence of jewellery items, brooches and charred textile. The evidence for jewellery within the sites studied here was limited, but melted fragments of a green glass bead were found with an adult at Beckfoot (C10) and numerous unidentifiable ferrous items were also recovered, some of which may have been jewellery items. A carved bone hairpin was found in the burial of a young child aged less than 8 years at Carlisle (CALMG 1896.44.4, museum catalogue records). This has similar parallels with Romano-British inhumation cemeteries such as Butt Road, Colchester, in which children of this age are also buried wearing hairpins (Gowland 2001).

Other items of dress can be inferred from both the skeletal and artefactual evidence. For example, in some instances a high proportion of foot bones were found, especially from the Beckfoot assemblage. While their position on the periphery of the body means that these bones are often among the last to burn (Symes et al., 2008), the presence of hobnails indicates that the deceased was wearing footwear on the pyre, which would have offered

some additional protection to the bones of the feet from the flames. However, care should be taken not to over-interpret. For example, Sulosky (2006: 22) suggests that the charring of cranial fragments from burial 217.76 in Lincolnshire could have been caused by the wearing of some form of hat or headgear, which inhibited complete oxidation. Conversely, the parietal and occipital bones of the cranium are also among the last to burn on the human skeleton, and in a medium intensity burning event it is unlikely for these bones to become completely calcined (Symes et al. 2008)

The containers used for the cremated remains also suggested social differentiation; for example, some individuals at Beckfoot were buried within plain or Black Burnished (BB1) cooking pots, while the bones of an adult and an immature individual were deposited within a decorated Samian bowl (also containing a decorated bone comb). The square glass bottle from Carlisle (Figure 2), seems also to be a higher status item and contained the skeletal remains of an adult male, aged between 35 and 39 years. In future analyses, greater attention should be paid to the possibility of structured deposition of skeletal elements within such containers. An archaeothanatological approach could be applied to cremated deposits in the way it has been to inhumed remains (Duday 2006). However, the processes which affect the final position of cremated bone are substantial and include such factors as intensity of burning, degree of fragmentation, timing of burning relative to death and decomposition, selective recovery of the burned remains, and movement of the storage vessel from the pyre to the burial site. Although recent work is helping with the interpretation of the relationship between taphonomic change and human activity (see for example, Waterhouse's 2013 work on fragmentation), more work is required.

Conclusions

This study has highlighted the benefit of a detailed macroscopic and microscopic analysis of cremated human remains for understanding past cremation practices. This is the first study of its kind to undertake large-scale FTIR-ATR analysis of bones from Romano-British cremations. It has established that the majority of individuals were burned at an intensity that would not completely oxidize the bones. These findings are supported by the colour of the burned bones retrieved, which also indicate incomplete oxidation. Of particular interest for this study is the consistency in FTIR-ATR results across the five study sites with values clustering close together. It is proposed that cremation practice on the Romano-British frontier may have followed a prescriptive process, with pyres likely to have been constructed in similar ways, using similar species of wood as fuel, and were tended following common practices. It is also notable that the FTIR-ATR values from these sites differ from those obtained from cremation deposits from other sites and periods (Figure 8; but also unpublished studies including funerary sites from British Anglo-Saxon and British modern periods). It is proposed that these data imply that cremation amongst these military communities was both standardized and distinct from that of other (later) cultural groups. Similar analysis of cremation burials from the civilian regions of southern Roman Britain would allow comparison with the military communities sampled in the current study. Such work could address the question of whether the consistency of cremation practice identified here was a specifically military (or northern British) phenomenon, or whether it was more widely shared across the Roman province between both military and civilian communities, north and south; it would also clarify connections with pre-Roman Iron Age practices both in Britain and Continental Europe. Since cremation was incomplete (for example, as evidenced from the colour and crystallinity changes) this may suggest that in this military context the aim of cremation was not, as with the practice of cremation today, complete oxidation (see McKinley, 2015), but simply sufficient combustion to ensure that the corpse was transformed. Finally, amongst these sites, while widely shared aspects of funerary practice (e.g. pyre construction and tending/bone collection) are in evidence, these similarities existed alongside variations regarding the display of the corpse, expressed through the use

of biers and items of dress, as well as the choice of vessel for final interment. The tension between unity in diversity, or expressing difference in similar ways, is a defining characteristic of Roman provincial cultures (e.g. Woolf 1998; also Mattingly 2010 on 'discrepant identities') and is further supported by the evidence presented here.

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References

- Aldeias, V., Dibble, H.L., Sandgathe, D., Goldberg, P. and McPherron, S.J.P. 2016. How heat alters underlying deposits and implications for archaeological fire features: a controlled experiment. *Journal of Archaeological Science* 67: 64-79.
- Aplin, K., Manne, T., and Attenbrow, V. 2015. Using a 3-stage burning categorization to assess post-depositional degradation of archaeofaunal assemblages: Some observations based on multiple prehistoric sites in Australasia. *Journal of Archaeological Science: Reports* doi: 10.1016/j.jasrep.2015.11.029.
- Baby, R.S. 1954. Hopewell Cremation Practices. *The Ohio Historical Society Papers in Archaeology* 1: 1-7.
- Bellhouse, R.L. 1954. Roman Sites on the Cumberland Coast, 1954. Appendix II: Roman cremation-sites at Herd Hill. *CW²* 54: 54-55.
- Biddulph, E. 2015. Residual or ritual? Pottery from the backfills of graves and other features in Roman cemeteries. In Brindle, T., Martyn, A., Durham, E. and Smith, A. (eds.) *TRAC 2014. Proceedings of the Twenty-fourth Annual Theoretical Roman Archaeology Conference*. Oxford: Oxbow, pp. 41-53.
- Bidwell, P., and Hodgson, N. 2009. *The Roman Army in Northern England*. Newcastle upon Tyne: The Arbeia Society.
- Binford, L.R. 1963. Analysis of cremations from three Michigan sites. *Wisconsin Archaeologist* 44(2): 98-110.
- Breeze, D.J. 2006. *J. Collingwood Bruce's Handbook to the Roman Wall*. 14th ed. Newcastle -upon-Tyne: Society of Antiquaries of Newcastle-upon-Tyne.
- Buikstra, J.E., and Swegle, M. 1989. Bone modification due to burning: Experimental evidence, in R. Bonnichsen & M.H. Sorg (eds.) *Peopling of the Americas*. Orono: Center for the Studies of the First Americans. pp. 247-258.

- Carroll, M., and Wild, J.P. 2012. *Dressing the Dead in Classical Antiquity*. Gloucestershire: Amberley.
- Caruana, I. 2004. The Cemetery at Beckfoot Roman Fort. In Wilson, R.J.A., and Caruana, I.D. (eds) *Romans on the Solway: Essays in Honour of Richard Bellhouse*. Great Britain: Cumberland and Westmorland Antiquarian and Archaeological Society, pp. 134-173.
- Cataroche, J. and Gowland, R. L. 2015. Fire, Flesh and Funerary Remains from the Neolithic site of La Varde, Guernsey: investigations past and present. In T. Thompson (ed). *The Archaeology of Cremation*. Oxford: Oxbow Books. pp. 19-42.
- Charlton, B., and Mitcheson, M. 1984. The Roman Cemetery at Petty Knowes, Rochester, Northumberland. *Archaeologia Aeliana* 5 (12): 1-31.
- Cool, H.E.M. 2004. *The Roman Cemetery at Brougham, Cumbria: Excavations 1966-7*. Britannia Monograph Series 21, Society for the Promotion of Roman Studies.
- Davies, D.J. 2002. *Death, Ritual and Belief: The Rhetoric of Funerary Rites*. 2nd ed. London: Continuum.
- Duday, H. 2006. L'archéothanatologie ou l'archéologie de la mort (archaeoethanatology or the archaeology of death). In: Gowland, R.L. and Knusel, C. (eds.) *Social Archaeology of Funerary Remains*. Oxford: Oxbow Books. pp . 30-56.
- Ellingham, S.T.D, Thompson, T.J.U., Islam, M. and Taylor, G. 2015. Estimating temperature exposure on burnt bone – a methodological review. *Science & Justice* 55: 181-188.
- Erker, D. 2011. Gender and Roman funeral ritual. In: Hope, V.M. and Huskinson, J. *Memory and mourning: Studies on Roman death*. Oxford: Oxbow Books. pp 40-60.
- Garrido-Varas, C. and Intriago, M. 2015. 2015. The interpretation and reconstruction of the post-mortem events in a case of scattered burned remains in Chile. In: Thompson, T.J.U. (ed) *The archaeology of cremation: burned human remains in funerary studies*. Oxbow Books: Oxford. pp. 227-242.
- Gejvall, N.G. 1969. Cremations. In: Brothwell, D. and Higgs, E. (eds.) *Science in Archaeology, 2nd Edition*. Praeger: New York. pp 468-479.
- Gonçavles, D. 2012. The micro-analysis of human burned bones: some remarks. *Cadernos do GEEvH* 1: 32-40.
- Gonçalves, D., Thompson, T.J.U. and Cunha, E. 2011. Implications of heat-induced changes in bone on the interpretation of funerary behaviour and practice. *Journal of Archaeological Science* 38: 1308-1313.
- Gowland, R. L. (2001). 'Playing Dead: Implications of Mortuary Evidence for the Social Construction of Childhood in Roman Britain', in D. Davies, A. Gardner, and K. Lockyear (eds), *TRAC 2000: Proceedings of the Tenth Annual Theoretical Roman Archaeology Conference, London 2000*. Oxford: Oxbow Books, 152–168.

Haynes, I. 2013. *Blood of the Provinces: The Roman Auxilia and the Making of Provincial Society from Augustus to the Severans*. Oxford: Oxford University Press.

Jones, M.J. 2002. *Roman Lincoln: conquest, colony and capital*. Stroud: Tempus.

Kuijt, I., Quinn, C.P., and Cooney, G. (eds). 2014. *Transformation by Fire. The Archaeology of Cremation in Cultural Context*. Arizona: University of Arizona Press.

Kutterer, A.U., Doppler, S., Uerpmann, M. and Uerpmann, H-P. 2012. Neolithic cremation in south-east Arabia: archaeological and anthropological observations at FAY-NE10 in the Emirate of Sharjah (UAE). *Arabian Archaeology and Epigraphy* 23: 125-144.

Lucan. *The Civil War (Pharsalia)*. Trans. by J.D. Duff. London: William Heinemann Ltd., 1969.

Mattingly, D.J. 2006. *An Imperial Possession: Britain in the Roman Empire*. London: Penguin Books.

Mattingly, D.J. 2010. *Imperialism, Power and Identity*. Princeton University Press.

McKinley, J.I. 1994. *The Anglo-Saxon cemetery at Spong Hill, North Elmham. Part VIII: The cremations*. *East Anglian Archaeology* 69.

McKinley, J.I. 2015. In the heat of the fire. In: Schmidt, C. and Symes, S. (eds.) *The analysis of burned human remains* (2nd ed). pp181-202.

Munro, L.E., Longstaffe, F.J., White, C.D. 2007. Burning and boiling of modern deer bone: Effects on crystallinity and oxygen isotope composition of bioapatite phosphate. *Palaeogeography, Palaeoclimatology, Palaeoecology* 249: 90-102.

Nilsson-Stutz, L. 2008. More than Metaphor: Approaching the Human Cadaver in Archaeology. In Fahlander, F., and Oestigaard, T. (eds) *The Materiality of Death: Bodies, burials, beliefs*. BAR International Series 1768, pp. 19-28.

Noy, D. 2000. Building a Roman Funerary Pyre. *Antichthon* 34: 30-45.

Noy, D. 2005. Romans. In Davies, D.J., and Mates, L.H. 2005. *Encyclopedia of Cremation*. England: Ashgate, pp. 366-368.

Oestigaard, T. 1999. Cremations and transformations: when the dual cultural hypothesis was cremated and carried away in urns. *European Journal of Archaeology* 2: 345-364

Pearce, J. 2013. Contextual Archaeology of Burial Practice: Case Studies from Roman Britain. BAR British Series 588. Oxford: Archaeopress.

Petts, D. 2009. Burial on Hadrian's Wall. In: Symonds, M. and Mason, D. (eds) *Frontiers of knowledge: a research framework for Hadrian's Wall. Volume 1 Resource assessment*. Durham: Durham County Council. pp.160-163.

- Philpott, R. 1991. *Burial Practices in Roman Britain: a survey of grave treatment and furnishing AD 43-410*. BAR British Series 219.
- Scott, R.M., Buckley, H.R., Spriggs, M., Valentin, F. and Bedford, S. 2010. Identification of the first reported Lapita cremation in the Pacific Islands using archaeological, forensic and contemporary burning evidence. *Journal of Archaeological Science* 37: 901-909.
- Schmidt, C.W and Symes, S.A. 2015. (eds.) *The analysis of burned human remains (2nd ed)*. Academic Press: London.
- Scheuer, L and Black, S.M. 2000. *Developmental juvenile osteology*. Elsevier Ltd: Amsterdam.
- Squires, K.E., Thompson, T.J.U., Islam, M. and Chamberlain, A. 2011. The application of histomorphometry and Fourier Transform Infrared Spectroscopy to the analysis of early Anglo-Saxon burned bone. *Journal of Archaeological Science* 38: 2399-2409.
- Suetonius. 1970. *The Lives of the Caesars. Trans. by J.C. Rolfe*. William Heinemann Ltd: London.
- Sulosky, C.L. 2006. *A Report on Romano-British Cremated Remains from Lincolnshire*. Unpublished report for The Collection, Lincoln.
- Szigeti, J. 2016. Burned Human Skeletal Remains and Cremation Practice in Roman Britain. Unpublished PhD thesis: Durham University.
- Thompson, T.J.U. 2004. Recent advances in the study of burned bone and their implications for forensic anthropology. *Forensic Science International* 146S: S203–S205.
- Thompson, T.J.U. 2015a (ed) *The archaeology of cremation: burned human remains in funerary studies*. Oxbow Books: Oxford.
- Thompson, T.J.U. 2015b Fire and the body; fire and the people. In: Thompson, T.J.U. (ed.) *The archaeology of cremation: burned human remains in funerary studies*. Oxbow Books: Oxford. pp. 1-17.
- Thompson, T.J.U. 2015c. The analysis of heat-induced crystallinity change in bone. In: Schmidt, C. and Symes, S. (eds.) *The analysis of burned human remains (2nd ed)*. Academic Press: London.
- Thompson, T.J.U., Islam, M. and Bonniere, M. 2013. A new statistical approach for determining the crystallinity of heat-altered bone mineral from FTIR spectra. *Journal of Archaeological Science* 40: 416-422.
- Toynbee, J.M.C. 1971. *Death and Burial in the Roman World*. New York: Cornell University Press.
- Ubelaker, D. H. 2009. The forensic evaluation of burned human remains: a synthesis. *Forensic Science International* 183: 1-5.

Vitruvius. *On Architecture*. Ed by T.E. Page. London: William Heinemann Ltd., 1931.

Wahl, J. 2015. Investigations on Pre-Roman and Roman Cremation Remains. In: Schmidt, C. and Symes, S. (eds.) *The analysis of burned human remains (2nd ed)*. Academic Press: London. pp. 163-179.

Waterhouse, K. 2013. Post-burning fragmentation of calcined bone: Implications for remains recovery from fatal fire scenes. *Journal of Forensic and Legal Medicine* 20: 1112-1117.

Wenham, L.P. 1974. *Derwentio (Malton) Roman Fort and Civilian Settlement*. Huddersfield: Cameo Books.

White, T.D., Black, M.T. and Folkens, P.A. 2000. *Human osteology*. Academic Press: GB.

Williams, H. 2003. Introduction: The Archaeology of Death, Memory and Material Culture. In Williams, H. (ed) *Archaeologies of Remembrance: Death and Memory in Past Societies*. London: Kluwer Academic/Plenum Publishers, pp. 1-24.

Wilson, P. 2006. A Yorkshire Fort and 'Small Town': Roman Malton and Norton Reviewed. *Yorkshire Archaeological Journal* 78: 35-60.

Woolf, G. 1998. *Becoming Roman*. Cambridge: Cambridge University Press.