Osteological Analysis of the Cremated Bone from Cae'r Odyn, Pen y Garn, Rhydypennau, Ceredigion

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Abstract

Osteological analysis of the cremated bone recovered during an archaeological investigation undertaken by Archaeology Wales Ltd. from the site of *land north of Caer Odyn, Rhydypennau*, *was carried out in order to identify and quantify the material excavated. The cremated bone formed part of fill [1006] and was discovered in a shallow pit, cut [1007].*

Analysis revealed that only a very small quantity of bone was present. At least some of the fragments were likely to be human and the majority were fully oxidised, suggesting that there were the product of a deliberate cremation. Some fragments could be re-associated, indicating some post-deposition breakage of bone. The morphology of some of the larger fragments suggested that they originated from the extremities of the body, most likely the foot. It was not possible to make any inference about the age and sex of the individual present.

Charcoal was found in situ along with the bone, perhaps indicating that this was a token deposit of pyre debris. The very small quantity of bone present in the pit suggests that the vast majority of bone that would be expected from a cremation event had been carefully collected and deposited elsewhere.

The site represents an important prehistoric burial complex and the proposed radiocarbon dating of the bone sample analysed here will provide important independently established contextual information as to the nature of the funerary activity at the site.

1. Introduction

This report contains the results of the osteological analysis of the cremated bone recovered during an archaeological strip, map and sample of land north of Cae'r Odyn, Rhydypennau, which was undertaken by Archaeology Wales Ltd. between 2nd and 20th June 2014, for which a full archaeological report is in preparation (Jones 2014).

A small quantity of cremated bone [1006] was excavated fill of a small shallow pit, cut [1007]. Dating of the bone has yet to be undertaken but it is understood that the deposit is likely to be prehistoric as its associated fill contained some possible prehistoric pottery fragments. Archaeological investigations at the site revealed several features that appear to collectively represent a mortuary complex including seven probable inhumation graves, one of which was partially circumscribed by a penannular style or 'horse-shoe' shape gully (cuts [1032] and [1024] respectively). Unfortunately, no bone had survived in these graves, most likely due to a combination of soil acidity and the post-deposition truncation of these seemingly shallow features.

The osteological analysis aims to provide a detailed description of the nature of the cremated bone present, to quantify and differentiate, where possible, between animal and human cremated bone, to assess the age, sex and presence of pathological changes and to identify any evidence of pyre technology used during the cremation process.

2. Methods and Process

The cremated material was analysed according to the standards laid out in the guidelines recommended by the British Association of Biological Anthropologists and Osteologists in conjunction with the IFA (Guidelines to the Standards for Recording Human Remains, Brickley and McKinley (eds) 2004) as well as by English Heritage (Human Bones from Archaeological Sites: Guidelines for producing assessment documents and analytical reports, Centre for Archaeology Guidelines, 2002).

- The material was analysed macroscopically and where necessary with the aid of a magnifying glass for identification purposes.
- The material was sorted into three fractions of 10mm, 5mm and 2mm using UKAS accredited calibrated sieves.
- The material was weighed using calibrated digital scales to an accuracy of 0.1g.
- The material was analysed without prior knowledge of associated artefacts
- The material was recorded on sheets provided in Appendix A.

2.1 *Reasons for the Analysis*

Osteological analysis was carried out to ascertain:

- The type of deposit
- Total weight of the bone
- Identification and quantification of human bone
- Demographic data
- Pathology data
- Degree of fragmentation
- Efficiency of the cremation
- Presence and type of pyre goods
- Presence and type of pyre debris

3. Type of Deposit and Disturbance

3.1 *Introduction*

Recording of the type of deposit of cremated bone is necessary to make fair comparisons between different deposits from across a site, between one site and another and between cremated bone deposits from different historical contexts. Recording the type of deposit allows inferences to be made about the state of preservation of the material interred and how this may have affected bone content and fragmentation. This information is essential for accurate analysis of cremation processes due to diagnostic analytical techniques being based upon the weight and size of bone fragments present.

3.2 *Observations*

The nature of the deposit of the cremated bone was assessed during field excavation and recorded on the relevant context sheets. This information was subsequently classified according to the categories suggested by Brickley and McKinley (2004) and recorded on the Access database provided.

3.3 *Results*

The bone fragments under analysis were recovered from the fill of a small shallow pit, cut [1007]. The associated fill contained charcoal. Also found associated with the cremated bone were possible

prehistoric pottery sherds, although the bone did not appear to be contained within a vessel. The deposit has, therefore, been recorded as a 'cremation related deposit'.

4. Identification and Quantification of Cremated Bone

4.1 Introduction

Cremated bone deposits have been found on frequent occasions to contain both human and animal bone remains. Often, particularly if the bone fragments are very small, it is not possible to identify whether bone is categorically human or animal. However, it is clear from the analysis of cremated bone deposits that the deposition of both types of bone together is intentional and, therefore, it is imperative to approach the assessment of the cremated bone present holistically, as well as to attempt to identify human and animal elements.

An assessment of the quantity of bone recovered may give an indication of the state of preservation of the associated feature in which the bone was interred or, if recovered from relatively undisturbed context, may provide valuable information regarding cremation processes. This may relate not only to the actual pyre technology itself but also to the collection and ritual deposition of bone after the process was complete. McKinley (1993) found that modern cremation processes resulted in the production of between 1227.4g and 3001.3g of bone. From this she inferred that the cremation of a whole body and deposition of the remains in an archaeological context would realistically produce between 1001.5g and 2422g of cremated human bone.

Identification of particular elements of the human body serves to confirm the presence of human material and also may give an insight into any particular areas of the body which may have been purposefully collected following cremation. The absence of elements, especially those that are smaller, may be due to the lack of their survival as a result of fragmentation during the cremation, post-depositional preservation conditions or may be due to their loss during the cremation itself.

4.2 Observations

The total amount of bone present in this context was weighed and subsequently analysed for identifiable fragments. These fragments were then weighed and recorded separately according the area of the body they originated from. Full quantification of bone is given in the database.

4.3 Results

The results of the quantification analysis are summarised in Table 1 below:

Context	*1006*
Total Weight of Cremated Materials (g)	3.9
Total Weight of Identifiable ?Human Fragments (g)	1.8
Minimum Number of Individuals	1

Table 1: *Results of the quantification of bone present*

The quantity of cremated bone present is very small in comparison to the 1000g or thereabouts generally recovered from cremated bone burials containing complete adult individuals. Four fragments could be re-associated and together formed a concave articular surface, closely resembling that of the proximal end of a 1st metatarsal. It should be noted, however, that several skeletal elements, at least in part, consist of concave articular surfaces, especially those within the foot. Another fragment consisted of the end of a narrow diaphysis terminating in a convex articular surface. This fragment most closely resembled the distal portion of a proximal small toe phalanx; though there is a possibility of the phalanx belonging to the hand, the articular surface was angulated and was most similar to that of the toe.

Human bone can, on some occasions, be differentiated from animal bone on account of the density of the cortex (the outer wall) of long bone fragments. However, this method tends to discriminate positively for the identification of animal bone rather than conclusively identifying human individuals since there is invariably some overlap between the two given the potential number of skeletal elements and the variation between human individuals. Some long bone fragments found here appeared to be of a similar density observed in human bone. However, no diagnostic landmarks were present and based upon cortical density alone, this should be treated as a tentative identification.

Overall, the identification from morphological features suggested that at least some of the bone was likely to be human. However, many of the fragments of bone were non-diagnostic and no conclusive evidence was present to differentiate the fragments from animal species. The very small quantity of bone suggests that this cremation-related deposit may have consisted primarily of pyre debris with the inclusion of some very small fragments of bone originating from the extremities of the body that had become intermingled with debris during the cremation process.

There were no repeated elements present, so the fragments represent a minimum of one individual.

5. Demographic Data

5.1 Introduction

Demographic data recorded from human cremated bone gives an indication as to the age and sex of the individual. This information is derived from the macroscopic examination and metric assessment sexually dimorphic elements (e.g. Gejvall 1981, Van Vark (1975) and Whal (1982) as well as analysis of dental and bone development recommended by Buikstra and Ubelaker (1994). A large sample of well-preserved cremated bone deposits can provide a valuable insight into the demographic structure of the archaeological population and also into any ethnocentric funerary practices associated with the age and sex of the individual cremated.

5.2 Observations

Observations of material present and any indicators of age and sex were noted on the recording forms contained on the database.

No fragments present were large enough to allow metric assessments to be undertaken so any observations were based upon morphological features.

5.3 Results

Age: Due to the very small size of the cremated bone sample, the age of the individual present could not be assessed for a specific age at death.

Sex: Sex could not be assessed from any of the fragments present.

6. Pathology Data

6.1 Introduction

Palaeopathology is the study of diseases of past peoples and can be used to infer the health status of groups of individuals within a population as well as indicate the overall success of the adaptation of a population to its surrounding environment. Pathologies are categorised according to their aetiologies; e.g. congenital, metabolic, infectious, traumatic, neoplastic etc. Any pathological modifications to the bone are described. The size and location of any lesion is also noted. Pathology data is usually restricted, however, by intrinsic nature of cremated bone, although if fragment size is large enough, pathological changes may be observed.

6.2 Observations

Observations were recorded on the sheets provided in Appendix A.

6.3 Results

No pathology was observed among the fragments of cremated bone present.

7. Bone Fragmentation

7.1 Introduction

The observation and quantification of bone fragmentation is essential in assessing its impact on the quality of the overall data retrieved from the analysis of cremated bone. It may also be an indicator of practices carried out during the cremation process and give and insight into pyre technology. Fragmentation of bone is assessed by sorting all bone fragments into three sieve fractions (10mm, 5mm and 2mm) and comparing the proportion of bone in each fraction (Brickley and McKinley 2004). Measurement of the maximum bone fragment length is also recorded.

The fragmentation of bone can occur for several reasons, i.e. from the raking of the remains during the cremation process, the collection and the subsequent interment of the remains, making it difficult to assess whether bone was deliberately fragmented as part of the cremation ritual (McKinley 1994b, 2001). It is, however, generally believed that both the excavation and post-excavation processes can lead to the largest amount of damage caused to the remains (Lange *et al.* 1997, McKinley 1994b).

7.2 Observations

Observations of the weight of bone present in each sieve fraction and the percentage of each fraction of the total weight of bone were recorded on the sheets provided in Appendix A.

7.3 Results

Table 2 below summarises the results of the quantification of cremated bone present by sieve fraction weight and percentage of total weight:

Context	*1006*
>10mm Weight (g)	1.3
>10mm Percentage of Total	*33.3%*
>5mm Weight (g)	1.1
>5mm Percentage of Total	*28.2%*
>2mm Weight (g)	1.5
>2mm Percentage of Total	*38.5%*
Assessment of Bone Content Percentage <2mm residue	99%

Table 2: *Weight by fraction of cremated bone*

These results indicate that the majority of the fragments were between less than 5mm in length, with a proportion of larger fragments present. Maximum bone size for the sample was 14.8mm and estimated average was 3mm. Interestingly, four fragments could be re-associated to make one composite fragment. This indicates that it is highly likely that part of the fragmentation process occurred post-deposition and that some fragments could have been considerably larger when they were originally deposited.

8. Efficiency of the Cremation

8.1 Introduction

Effective cremation of a human body requires basically two elements: burning at high temperatures and a sufficient length of time of the application of this heat. Differences in temperature and length of time of exposure will result in variation in how the bone is burned. Complete burning will result in complete oxidation of the organic element of bone, leaving the mineral portion remaining (McKinley 1994a, Lange *et al.* 1987).

Holden *et al.* (1995) reports that generally, the range of colours seen in burnt bone relates to the temperature to which the bone was exposed:

Brown/Orange = Unburnt

Black = Charred (*c.*300°)

Blue/Grey = Incompletey Oxidised (*c.*600°)

White = Completely Oxidised (>600°)

The colour may vary from bone to bone as different elements of the body may be exposed to different temperatures for different lengths of time. It is, therefore, essential to record any differences in colouration according to skeletal elements affected and to the aspect of the element (i.e. interior, exterior) affected. The extent of the burning or oxidation of the bone represents the relative success of the cremation processed applied and contemporary knowledge of pyre technology.

Observations of dehydration of the bone should also be recorded. Shrinkage of bone due to dehydration can amount to a 25-30% decrease in cross-section width and accordingly approximately a 5% decrease in length (Lange *et al.* 1987). Evidence of dehydration presents itself on the bone fragments in the form of fissuring, transverse, concentric and parabolic cracking, especially on articular surfaces of long bones and cranial vault fragments (Lange *et al.* 1987, McKinley 1994a). These are generally interpreted as occurring due to the result of cremating the bone when soft tissue was still present on the bone.

8.2 Observations

Observations were noted on the recording forms contained in the database. Generally, the bone was observed to be white in colour but some variation was noted. One unidentifiable fragment of long bone cortex was largely white in colour but with some blue-grey colouration in the mid cortex observable in cross-section. This has occurred as a result of the element being incompletely oxidised during the cremation process and is often noted in the denser cortical bone in cremated deposits. Observations regarding dehydration of the bone were also noted.

8.3 Results

The results of the analysis of colour variation in the fragments of bone suggest that the vast majority of bone present was completely calcined or oxidised (Murray *et al.* 1993). This suggests that the bone had been exposed to a temperature of at least 600° for a substantial period of time. It is noteworthy that the fragment exhibiting the blue-grey variation in colour was of higher bone density.

Fissuring, transverse and longitudinal cracking was present on the vast majority of the elements contained in this context. Concentric cracking was also noted on the articular surfaces of fragments. This indicates that soft tissue was present on the bone when it was cremated. The presence of both transverse and longitudinal fissuring confirms that the bone has been cremated long enough for substantial amount of dehydration of the bone to occur, in concordance with the coloration of the bone.

9. Presence and Type of Pyre Goods

9.1 Introduction

Pyre goods are those items that were placed on the pyre and have been deliberately included for interment along with the cremated human bone. These can consist of objects manufactured from glass, ivory or metal, for example, which may have formed items of personal adornment. Metal items may only leave a trace of their presence in the form of staining on the bone, especially those manufactured from copper alloys.

It is most common for animal bone to be included with deposits of human bone (e.g. Wells, C 1960). It is generally perceived that these represent animal sacrifice or food offerings to the dead (McKinley 1994b, Bond 1994,). Williams (2005) has suggested, furthermore, that the deliberate admixture of animal and human cremated remains is deeply significant and may be associated with shamanistic rituals often observed ethnographically whereby not only can animals symbolically represent totemic ancestor lineages and but also both human and animal beings are seen to dynamically and mutually co-exist: “Animals were more than symbols of identity but agents of transformation, enabling the dead to be reconstituted into a new social status in death." (Williams 2005).

9.2 Observations

Observations regarding the identification, quantification and percentage of identifiable animal bone present were recorded on sheets contained in the database. Most of the bone present was non-diagnostic and no fragments could be conclusively identified as animal.

9.3 Results

The deliberate inclusion of animal remains in deposits of cremated human remains has been recorded in Wales at Carneddau cairn 2, where the remains of two children were found with the cremated carcass of a pig while beaver bone was discovered in the cremated bone burial of an adult (Brittain 2006). Animal remains appear to have been equally important in the role they played in cremation rituals during the Bronze Age throughout the UK; approximately 16% of burials of cremated bone contain faunal remains and typically include sheep or pigs and birds (McKinley 2001). The lack of grave goods found during the Bronze Age compared with the presence of pyre goods indicates that their presence is strongly linked to the funerary rituals carried out through the cremation (McKinley 2001).

The small size of the vast majority of the fragments in this deposit precludes making a positive identification of any animal bone in this deposit. Nonetheless, the lack of the inclusion of any substantial animal bone fragments or other pyre goods perhaps corroborates the interpretation that

this deposit of bone may represent a token deposit of pyre debris, with the majority of human bone, and possibly any other pyre items, having been collected and deposited elsewhere.

10. Presence and Type of Pyre Debris

10.1 Introduction

The presence and type of pyre debris is analysed in order to ascertain the nature of pyre technology and can be used to provide an insight into the type of deposit. Recent experimental reconstructions of pyre sites have determined that distinct features and types of debris can be left by former pyre sites and in particular that the use of different materials alters the type and form of deposit (Marshall 2005).

10.2 Observations

Observations regarding presence, quantity and type of pyre debris were made and recorded on the forms contained in the database.

10.3 Results

Only very small charcoal fragments weighing less than 0.1g was present in the sample analysed here; a small quantity of charcoal was observed to be present, however, in the associated fill [1006] which was not included in this sample. The restricted size of the sample of bone and charcoal make it difficult to make any inferences regarding the pyre technology employed at this site. However, the the presence of fissuring and the completeness of the oxidation process of the associated bone suggests that the charcoal deposited in the pit is the product of a deliberate cremation process.

11. Conclusion

Table 3 below summarises the findings of the osteological analysis of cremated bone deposit [1006].

The osteoarchaeological analysis of the cremated bone recovered from context [1006] revealed that the deposit was likely to contain the remains of at least one human individual. Only a very small amount of cremated bone was present in comparison to what would be expected from the remains of a complete individual and thus the sample was recorded as a ‘cremation related deposit’. The

	1006
Type of deposit	Cremation related deposit
Total weight of cremated materials	3.9g
Quantification of bone: Possibly Human	1.8g
Minimum Number of Individuals	1
Demographic data: Age	Unobservable
Demographic data: Sex	Unobservable
Pathology data	None
Maximum Fragment Size	14.7mm
Degree of fragmentation – average fragment size	3mm
Efficiency of the cremation	Overall colour: White Blue/Grey (c.5%)
Presence and type of pyre goods	None
Presence and type of pyre debris	<0.1g Charcoal

Table 3: *Summary of Osteoarchaeological Observations*

majority bone present had been fully oxidised through the cremation process and the bone was highly fragmented in preservation. Some breakage is thought to have occurred through post-depositional processes. Many of the fragments were non-diagnostic and none could be positively identified as animal remains. All the cremated bone present demonstrated evidence of cracking and fissuring, indicating that the bone was surrounded by soft tissue when it was burnt. Interestingly, the bone fragments that could be tentatively identified appeared to belong to the foot. This may suggest that this deposit represents a very small portion of cremated remains belonging to the extremities of

the body that may have become intermingled within some pyre debris during the cremation process and the management of the cremain. This indicates that the vast majority of the cremated bone that would have been produced by the cremation was carefully separated or extracted and was treated separately to the deposit contained within pit cut [1007].

Several prehistoric funerary sites of significance are already known in close proximity to the site at Cae'r Odyn, such as the Rhydypennau Barrow cemetery dating to the Bronze age and the cemetery at Plas Gogerddan (Jones 2014), dating from the Iron age to the early Medieval period. Recent excavations at Trefael near Nevern in South-west Wales have demonstrated the importance of cremation as a funerary ritual during the early prehistoric periods and its significance in the establishment of monuments, the use of which as foci for mortuary complexes can span many subsequent periods of time (http://www.bristol.ac.uk/news/2014/february/outputurl-36448-en.html). The presence of this 'token' cremation-related deposit in the context of several other inhumation burials suggests that this site was an important location in the landscape for funerary activity.

The earliest dates for cremation practice in Wales range between 3200-3100 cal. BC, around the late Neolithic period, with cremation and inhumation practices being noted as contemporary in many cases and some funerary monuments likely to have been re-used at later dates (Brittain 2006). Indeed, non-local soils were found adhering to the surfaces of cremated bone at Moel Goedog ring cairn 1 and Great Carn ring cairn 1, suggesting the exhumation and reburial of cremated remains (Brittain 2006). There was no clear dating evidence for the excavated features from stratified artefacts from Cae'r Odyn and therefore, the proposed future dating of the bone analysed here will provide important information regarding the time-frame of the funerary activity at the site and the context in which it was undertaken.

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THE ARCHIVE

Type	No	Type	No
Basic Context & Weights Recording Form	1	CD-Rom Database	1
Bone Fragment Analysis Recording Form	1		
Pyre Technology Recording Form	1		

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Appendix A

Recording Sheets for Context [1006]