**The cremated bone from Thornton Abbey, Lincolnshire**

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**Introduction**

In 2013 a disturbed cremation burial was identified and recovered during archaeological excavations at Thornton Abbey, Lincolnshire (TA 118 188). The archaeological excavation of this site was carried out by the University of Sheffield as part of an ongoing programme of excavation and research. The cremated bone that was recovered during the 2013 field season was subjected to osteological analysis on the 8th October 2014. The following report contains the results of this analysis.

One deposit of cremated bone, referred to as small find (s.f.) 4070, was recovered from an early Anglo-Saxon pottery urn. The fill of this cremation vessel was numbered as (**4001**). Post-depositional activity resulted in the disturbance of both the cremated bone and funerary receptacle. Consequently, the urn was found on its side and some of the bone had spilled out into the surrounding burial environment.

**Aims**

The primary aims of this analysis was two-fold. Firstly, to construct a biological profile of the individual(s) interred in this vessel and secondly, to gain an understanding of pyre conditions and associated funerary rites.

**Methods**

Dr Diana Swales (University of Sheffield) excavated the funerary vessel in 20mm spits. In total eight spits were excavated; the uppermost spit was labelled ‘spit one’ and the bottom spit was categorised as ‘spit seven’. The cremated remains that had spilled out of the cinerary urn, and were found adjacent to the funerary vessel, were labelled as ‘spit eight’. Loose cremated bone was also recovered from the fill of s.f. 4070. Following the excavation of the urn, Dr Kirsty Squires (Staffordshire University) conducted detailed osteological analysis of the cremated bone. In the first instance, the preservation and completeness of the skeletal remains were assessed to gain an insight into the cremation process and subsequent mortuary rite. The total weight of burned bone from each spit was recorded before the skeletal material was sieved through mesh sizes of 2mm, 5mm and 10mm. The weight of each sieve compartment was recorded in turn. Consequently, the maximum fragment size of bone from each sieve compartment was measured (in mm) using digital callipers. All identifiable bone fragments were recorded from each sieve compartment. A Munsell Soil Colour Chart (2000) was used to document the colour of cremated bone from each sieve compartment. Shrinkage, warping, and fracture patterns were also noted. Since there is no standardised procedure for recording these characteristics, a three point scale was adopted for the purpose of this task. This involved assessing the degree of warping, shrinkage and fracturing based on macroscopic observations. The degree of thermal alteration was then classified for each characteristic using the following categories: ‘none’ (no modification), ‘moderate’ (a small amount of modification) and ‘severe’ (significant amounts of modification). Brief descriptions were also provided to justify the categories ascribed to each heat induced characteristic.

Following an assessment of the completeness and preservation of the skeletal remains, the minimum number of individuals was established. The age and sex of each skeleton was determined through traditional osteological methods (i.e. Buikstra and Ubelaker 1994). Non-metric traits and pathological conditions were also recorded during this analysis.

**Results**

A detailed breakdown of the preservation and completeness of cremated bone from each spit can be seen in appendix I. A summary of these data is presented in Table 1. The following results section will highlight some of the key observations made during the analysis of the cremated bone from Thornton Abbey.

*Weight*

The total amount of cremated bone recovered from the Anglo-Saxon cinerary urn weighed 110.5g. Jacqueline McKinley (1994, 75) has identified that a complete adult skeleton produces 1600-3600g of cremated bone, with an average weight of 2500g. The quantity of skeletal material excavated and subsequently analysed comprises a fraction of what would be expected from a complete skeleton. It may be assumed that cremated bone in the lower spits (towards the base of the pottery vessel) were offered greater protection than those positioned towards the mouth of the cinerary urn. However, as illustrated in Table 1, skeletal remains located at the bottom of the urn were just as (if not more) susceptible to damage and disturbance than cremated bone in the uppermost spits.

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| **Spit** | **Weight (g)** | **Max fragment size (mm)** | **Colour** |
| 1 | 7.3 | 27.1 x 5.9 | White (2.5Y 8/1)Light greyish blue (GLEY 2 5B 7/1) |
| 2 | 15.6 | 30.4 x 7.5 | White (2.5Y 8/1)Very dark bluish grey (GLEY 2 10B 3/1) |
| 3 | 27.8 | 24.8 x 14.9 | White (2.5Y 8/1)Dark bluish grey (GLEY 2 5PB 4/1) |
| 4 | 15.3 | 25.3 x 10.4 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Very dark bluish grey (GLEY 2 10B 3/1) |
| 5 | 2.5 | 32.3 x 6.1 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Light bluish grey (GLEY 2 10B 7/1) |
| 6 | 3.0 | 20.5 x 4.1 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Very dark bluish grey (GLEY 2 10B 3/1) |
| 7 | 0.6 | 17.9 x 7.7 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Bluish grey (GLEY 2 10B 5/1) |
| 8 | 17.3 | 38.5 x 10.5 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Very dark bluish grey (GLEY 2 10B 3/1)Bluish black (GLEY 2 5B 2.5/1) |
| ‘Loose’ bone recovered from the fill of s.f. 4070 | 21.1 | 33.6 x 11.1 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Very dark bluish grey (GLEY 2 10B 3/1)Bluish black (GLEY 2 5B 2.5/1) |

**Table 1: Total weight, maximum fragment size and colour of cremated bone from each spit**

*Maximum fragment size*

The largest cremated bone fragment identified during analysis derived from spit 8 and measured 38.5mm in length. This bone was identified as a scapular spine. The degree of fragmentation of bone from each spit was extensive (Table 1). McKinley (1994) has noted that the maximum fragment size of burned bone retrieved from modern crematoria before raking lies at around 250mm. An examination of the maximum fragment sizes of cremated bone from each spit is extremely small and corresponds to the extensive post-depositional disturbance identified during the excavation of this deposit. Accordingly, this influenced the identification of individual bones. A full list of identified remains can be found in appendix I. Based on the identified remains, cranial, axial and limb bones were observed throughout this deposit indicating that the collection and interment of cremated remains was not influenced by skeletal element type.

*Colour of bone*

The colour of bone from each spit were similar in nature and ranged from white (5Y 8/1), which was the most common colour identified, through to bluish black (GLEY 2 5B 2.5/1). No artefact-related discolouration was identified during osteological analysis. The overall colour of the burned skeletal remains suggests that the cremation pyre reached high temperatures and a steady flow of oxygen was available. However, some bones show evidence of incomplete cremation caused by reducing conditions. A number of bones also exhibited unusual burning patterns, specifically the ‘sandwich effect’ (McKinley 2008, 176). This type of burning can be caused by intentional and natural disturbance to the pyre. For example, a bone normally shielded from intense burning conditions would have been directly exposed to high temperatures and an oxidising environment.

*Shrinkage, warping and fracture patterns*

The overall shrinkage of cremated bone was minimal and ranged from ‘none’ to ‘moderate’ on the three point scale employed to assess this characteristic. Some bones exhibited greater cremation intensity resulting in greater degrees of shrinkage compared to other remains, though this variation was limited. Similarly, the degree of warping identified ranged from ‘none’ to ‘moderate’ and was variable throughout the spits examined. Warping primarily affected long bone diaphyses, specifically the cortical bone of these remains. Fracturing was identified on numerous bones and ranged in intensity from ‘none’ to ‘moderate’ fracturing. A variety of fracture types were identified during analysis of the skeletal remains and included: longitudinal, step, transverse, patina and splintering and delamination fractures. The presence of heat-induced fractures indicates that the body was fleshed at the time of cremation, the latter point is further supported by the presence of warping.

*Demography*

One individual was identified from this burial. However, it was not possible to provide an accurate age estimate due to the lack of surviving diagnostic skeletal remains. A maxillary permanent central incisor root (half of which survived) was identified along with a fused distal hand phalanx (Figure 1). A faint line of fusion was identified around the base of the distal hand phalanx, which possibly suggests the individual was an adolescent or young adult at the time of death. However, due to the lack of evidence it is only possible to speculate about the biological age of this individual.

Similarly, there was a dearth of sexually diagnostic skeletal remains from this burial. A right supraorbital margin was examined and was assigned to the ‘probable female’ category but, again, due to the lack of skeletal evidence it was not possible to establish the biological sex of this individual. No non-metric traits or pathological conditions were identified during osteological analysis.



**Figure 1:** Distal hand phalanx from the fill of s.f. 4070

*Animal bone*

Animal bone was not identified in this deposit.

*Pyre- and grave goods*

Pyre- and grave goods were not observed or recovered from this burial.

*Pyre debris*

No pyre debris (i.e. charcoal) was identified from the spits examined. However, all spits did contain stone inclusions from the burial environment.

**Conclusion**

Only a small amount of burned human bone was identified from the Thornton Abbey Anglo-Saxon cremation burial. Consequently, the amount of information obtained from these remains was minimal. The low weight of cremated bone and extensive fragmentation hindered the identification of many fragments and can be attributable, in part, to disturbance caused to the burial due to post-depositional processes. Yet it is worth mentioning that the recovery of ‘complete’ skeletons from Anglo-Saxon cremation burials is extremely rare. The small deposits of cremated bone frequently identified from the early Anglo-Saxon period may also be the result of post-cremation rites (Squires 2015). On the whole, the cremation process was efficient though this was not uniform. Signs of reducing conditions and variability in terms of the shrinkage, warping and fracturing of skeletal remains was also noted during the analysis of this deposit. Only one individual was identified from this interment. The age and sex of this individual is not known due to the lack of surviving diagnostic skeletal remains. Non-metric traits and pathological conditions were not identified on the bones examined. Animal offerings and grave- and pyre goods are commonly found in early Anglo-Saxon cremation burials. However, there is no surviving evidence for these remains from the burial recovered from Thornton Abbey. The lack of pyre debris from this burial is likely to represent the disturbance caused in the burial environment but may also indicate that the skeletal remains were carefully sorted and collected after the cremation process, in that only skeletal material was recovered from the pyre site and subsequently interred in a ceramic urn.

**Future recommendations**

Given the small quantity of bone recovered from this burial, further work is not recommended.

**Bibliography**

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**Appendix I: Preservation and completeness of burned bone from the Thornton Abbey cremation burial**

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| **Spit 1 (0-20mm)** |
|  | **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| **10mm** | 0.5 | 17.8 x 14.3 | White (2.5Y 8/1)Light greyish blue (GLEY 2 5B 7/1) | Cranial fragment | Patina fracturing |
| **5mm** | 4.4 | 27.1 x 5.9 | Brown (10YR 4/3)Light greyish blue (GLEY 2 10B 7/1) | Three cranial fragments, two maxilla fragments (two dental alveoli visible on one fragment) and humerus/femur fragment  | Patina and transverse fractures identified on long bone fragments. Signs of reducing conditions noted. |
| **2mm** | 2.4 | 10.8 x 5.1 | White (2.5Y 8/1)Bluish grey (GLEY 2 10B 5/1) | Four upper limb bone fragments (possibly distal ulna) | Patina fractures noted on two unidentifiable epiphysis fragments |
| **Total** | **7.3** |  |  |  |  |

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| **Spit 2 (20-40mm)** |
|  | **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| **10mm** | 0.9 | 26.1 x 12.8 | White (2.5Y 8/1) | Occipital bone | No fracturing identified |
| **5mm** | 10.0 | 30.4 x 7.5 | White (2.5Y 8/1)Very dark bluish grey (GLEY 2 10B 3/1) | Five cranial fragments (including one right orbit – supraorbital margin), one vertebra and one rib | Moderate warping and transverse fractures noted on unidentifiable long bone diaphyses |
| **2mm** | 4.7 | 19.7 x 2.7 | White (2.5Y 8/1)Dark bluish grey (GLEY 2 10B 4/1) | Three ribs, numerous cranial fragments | Patina fracturing identified on rib fragments |
| **Total** | **15.6** |  |  |  |  |

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| **Spit 3 (40-60mm)** |
|  | **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| **10mm** | 9.3 | 24.8 x 14.9 | White (2.5Y 8/1)Dark bluish grey (GLEY 2 5PB 4/1) | Humerus, tibia, vertebra and four cranial fragments | Longitudinal and step fractures identified on three unidentifiable diaphysis fragments and patina fractures noted on a humerus fragment |
| **5mm** | 10.8 | 23.7 x 6.2 | White (2.5Y 8/1)Bluish grey (GLEY 2 10B 5/1) | Three ribs, numerous cranial fragments, maxillary fragment (one dental alveolus visible), vertebrae and rib fragments | Moderate warping noted |
| **2mm** | 7.7 | 21.7 x 6.0 | White (2.5Y 8/1)Bluish grey (GLEY 2 10B 5/1) | Rib fragment | Primarily unidentifiable diaphysis and cancellous bone fragments. Moderate warping noted. |
| **Total** | **27.8** |  |  |  |  |

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| **Spit 4 (60-80mm)** |
|  | **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| **10mm** | 4.7 | 24.8 x 14.9 | White (2.5Y 8/1) | Head of first metatarsal, humerus and radius | Patina fracturing on head of metatarsal 1 and humerus fragment. Longitudinal fractures notes on radius fragment. Moderate warping and no shrinkage of the aforementioned remains. |
| **5mm** | 5.8 | 22.9 x 10.5 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Very dark bluish grey (GLEY 2 10B 3/1) | All unidentifiable epiphysis and diaphysis fragments |  |
| **2mm** | 4.8 | 14.4 x 3.8 | White (2.5Y 8/1)Light bluish grey (GLEY 2 10B 8/1)Very dark bluish grey (GLEY 2 5PB 3/1) | All unidentifiable epiphysis and diaphysis fragments and many fragments of cancellous bone |  |
| **Total** | **15.3** |  |  |  |  |

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| **Spit 5 (80-100mm)** |
|  | **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| **10mm** | - |  |  |  | No bones from this sieve compartment |
| **5mm** | 1.7 | 32.3 x 6.1 | White (2.5Y 8/1)Light bluish grey (GLEY 2 10B 7/1) | All unidentifiable diaphysis fragments | Moderate warping of a unidentifiable long bone diaphysis fragment |
| **2mm** | 0.8 | 12.9 x 3.8 | White (2.5Y 8/1)Light bluish grey (GLEY 2 10B 7/1) | Unidentifiable fragments of cancellous and cortical bone only |  |
| **Total** | **2.5** |  |  |  |  |

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| **Spit 6 (100-120mm)** |
|  | **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| **10mm** | - |  |  |  | No bones from this sieve compartment |
| **5mm** | 2.2 | 20.5 x 4.1 | White (2.5Y 8/1)Very pale brown (10YR 8/4) | Four cranial fragments | Only nine fragments collected in this sieve compartment |
| **2mm** | 0.8 | 8.7 x 4.4 | White (2.5Y 8/1)Dark bluish grey (GLEY 2 10B 3/1) | Upper limb (radius or ulna) fragment | Bones are primarily unidentifiable fragments of cancellous and cortical bone  |
| **Total** | **3.0** |  |  |  |  |

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| **Spit 7 (120-140mm)** |
|  | **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| **10mm** | - |  |  |  | No bones from this sieve compartment |
| **5mm** | 0.2 | 17.9 x 7.7 | Very pale brown (10YR 8/4) |  | Only one cortical bone fragment identified in this sieve compartment. Longitudinal fracturing and moderate warping noted. |
| **2mm** | 0.4 | 13.1 x 4.8 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Bluish grey (GLEY 2 10B 5/1) | Unidentifiable fragments of cancellous and cortical bone only |  |
| **Total** | **0.6** |  |  |  |  |

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| **Spit 8 (deposit of cremated bone found adjacent to the cinerary urn)** |
|  | **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| **10mm** | 7.4 | 38.5 x 10.5 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Bluish grey (GLEY 2 10B 6/1) | Thoracic vertebra, scapula fragment (scapular spine) | Moderate patina fracturing identified on thoracic vertebra fragment and moderate delamination fractures visible on the scapula fragment |
| **5mm** | 6.7 | 13.8 x 8.4 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Very dark bluish grey (GLEY 2 10B 3/1) | Maxillary permanent central incisor (only half of the root survives), fourth metatarsal base and diaphysis | Moderate warping of unidentifiable cortical bone fragment |
| **2mm** | 3.2 | 15.6 x 3.5 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Bluish black (GLEY 2 5B 2.5/1) | Unidentifiable fragments of cancellous and cortical bone only |  |
| **Total** | **17.3** |  |  |  |  |

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| **Fill from s.f. 4070 (this material was not sieved)** |
| **Weight (g)** | **Max fragment size (mm)** | **Colour** | **Identifiable elements** | **Other notes** |
| 21.1 | 33.6 x 11.1 | White (2.5Y 8/1)Very pale brown (10YR 8/4)Bluish black (GLEY 2 5B 2.5/1) | Distal hand phalanx and head of a metatarsal | Some pitting noted on the head of the metatarsal – this is not pathological in nature |