**Holding On To The Past: Curation, Imitation and Veneration of the Dead in a British Prehistoric Landscape.**

Martin J. SMITH1, Michael J. ALLEN2, Gabrielle DELBARRE1, Thomas BOOTH3, Paul CHEETHAM1, Lauren BAILEY1, Francine O’MALLEY1, Mike PARKER PEARSON4 and Martin GREEN5.

1Bournemouth University, Christchurch House C134, Talbot Campus, Fern Barrow, Poole, BH12 5BB;

2Allen Environmental Archaeology, Redroof, Green Road, Codford, Wiltshire, BA12 0NW, UK;

3NaturalHistory Museum, Cromwell Road, London, SW7 5BD, UK;

4 UCL Institute of Archaeology, 31-34 Gordon Square, London WC1H 0PY, UK;

5Cranborne Chase Archaeology, Down Farm, Sixpenny Handley, Dorset, UK.

**Abstract**

For long periods in prehistory the burial record of many regions often appears decidedly homogeneous with protracted periods where a particular ‘standard’ mode of burial is followed, only to be replaced with another equally basic and simple means of disposing of the dead. Such a view has previously characterised the situation in Britain where the disarticulated burials of the Earlier Neolithic supposedly gave way to the simple, flexed inhumations of the Later Neolithic and Bronze Age. However, such views may, in fact, be grossly oversimplified due to a disproportionate focus on grave goods and monuments and an overly reductionist approach to burial interpretation. This paper presents observations of a range of prehistoric burials from Cranborne Chase, Dorset, UK, in which a more holistic approach is followed, giving equal weight to taphonomy, microscopic and histological analysis, micro-CT scanning, archaeothanatology and contextual dating to reveal a more nuanced picture where the dead were dealt with in ways that were both more varied and considerably more protracted than was previously assumed. In particular several lines of evidence point to practices involving the protracted curation of the dead as articulated bodies with some soft tissue persisting. Such ‘ancestors’ appear to have been retained for periods spanning generations and this observation is of particular importance in light of previously published claims for ‘mummification’ in Bronze Age Britain suggesting such practices may have been both widespread and persistent over time.

***1.0 Introduction***

*1.1 Traces of a Monument*

Cranborne Chase is an area of open chalk downland situated in central southern England with a rich and varied selection of well-preserved prehistoric remains and a long history of archaeological study. An area encapsulated by two modern farms, Down farm and adjacent Canada Farm (Fig. 1b) is among the most comprehensively investigated parts of the landscape, containing a broad range of monuments, burials and occupation evidence stretching from the Mesolithic to the Romano-British period and beyond (Barret *et al.* 1991; Green and Allen, 1997; Green 2000; French *et al*., 2007). During the early part of one of the author’s (MG) fieldwalking survey of the upper Allen valley in Cranborne Chase in 1972 the soil mark of a plough flattened barrow was recorded on Canada Farm (Fig. 1). This feature lay approximately 20 metres north of the Dorset Cursus (the longest prehistoric monument in Britain at approximately 10km). Much later in 2007, the feature was identified again from aerial photography followed by geophysical survey (by PC) which revealed weak indications of the ditch but also located a large central feature (Fig. 1c). Due to the continuing plough induced erosion of the area a decision was made to excavate with the resultant work taking place in 2009 with an interim report following in 2012 (Green, in Jones *et al.* 2012). The excavations uncovered two phases of ditch which partly impinged on one another. The first phase ditch consisted of a penannular ring with a diameter of 13 metres with a 4 metre wide gap to the west, partly filled by an elongated pit (F7). The ditch was about 1 metre wide with an average depth of 0.4 m. The inner ditch was also penannular with a metre wide gap to the south west and of a similar width with an overall diameter of 11.5 metres. The surviving depth was only 0.1 m revealing plough truncation, which accounted for the poor geophysics resolution. A structure consisting of nine postholes lay just outside the ditches to the northwest but remains to be dated.

*1.2 The Burials*

Enclosed within the ditches were two cut features, F1 a large primary grave associated with the phase 1 ditch and F2 an elongated pit which contained a small beaker but no surviving human remains, probably due to the acidic nature of the clay fill. Five further interments were found cut into the ditches with a sixth outside to the southeast (F3). Two contracted burials (F4, F5) were cut into the south eastern terminal of the phase 2 ditch with a further cutting the southern terminal of the phase 1 ditch (F8). This latter burial was found at the base of the ploughsoil and clearly would soon have been ploughed away if the excavations had not intervened. The remaining burials comprised a flexed infant (F6) and a cremation (C1) both cutting the impinging ditches on the southeast side.

The primary grave incorporated a 5 cm deep recess, which may originally have held a rectangular, wooden coffin. The recess had been dug into the bed-rock floor of a larger burial pit (2.6 x 2 x 0.45 m deep), which had then been in-filled with rubble. The grave contained an adult male, accompanied by a Carinated Beaker, a weathered antler toggle and slivers from a boar’s tusk. This burial produced two AMS dates calibrated to 2620-2470 cal BC and 2470-2290 cal BC (see Table 1). These differing date ranges were both obtained from samples of the same bone (L. femur). Two of the secondary burials were also dated; F3 and F4 calibrated to 1620-1500 cal BC and 1500-1390 cal BC respectively. These are clearly in the Middle Bronze Age and contracted burials of this date were found within a contemporary cemetery placed in the ditch and just outside of the present barrow’s nearest known neighbour some 130m to the north on Down Farm (Fig. 1b). This barrow, which also only survived as a ring ditch, had a remarkably similar biography to Canada Farm and has been discussed in detail elsewhere (Barrett *et al*. 1991a, 1991b, Green 2000 and Green in Jones *et al*. 2012).

Taken at face value the Canada Farm burials seemed relatively straightforward and unremarkable in themselves as essentially ‘standard’ examples of the funerary practices of their respective dates. However, on further investigation anomalous features became apparent with regard to three of the burials which could not easily be explained. The radiocarbon dates obtained from F1 were inconsistent with the accepted date range of the accompanying beaker (see below). Two of the satellite burials, F3 and F5 exhibited anthropogenic modifications to several bones which could only have been produced some time after death and implied that these apparently simple articulated inhumations had undergone some degree of disarticulation followed by re-assembly. Taken together these burials implied mortuary practices that are both more complex and more protracted than is generally assumed at these dates and which hold further significance in relation to claims made for similarly drawn out and multi-faceted funerary treatments elsewhere in Bronze Age Britain. The current article presents the results of additional analysis using a range of different techniques applied in order to resolve and further investigate these anomalies.

***2.0 The Human Remains*** *(MS, GD, FO and LB)*

*2.1 The Primary Burial*

The remains were of an adult male aged 25-30 years old, interred in a semi-flexed position, on his left side facing East (Fig. 2a). While the body had been predominantly articulated when buried, the mandible was no longer in articulation and was located in the northwest corner of the presumed coffin. The right upper limb was also slightly displaced at both the shoulder and elbow joints whilst the bones of the left were disarticulated but resting in positions consistent with having been originally articulated in a flexed position. These dislocations may suggest the individual either to have been dead for some time at the time of burial with at least some soft tissues having decayed or to have been subject to disturbance some time later. Signs of mammalian scavenging at the articular ends of long bones suggest the body may have undergone some period of exposure prior to burial. With regard to the disjuncture between the human remains and the accompanying beaker, this style of pottery is normally expected to date from within a century either side of 2200 BC (Ros Cleal: pers. comm; also Needham, 2005). The median point of the later radiocarbon date range obtained falls at 2380 BC, predating the appearance of such ceramics in Britain by the best part of a century. The median point of the earlier date range (2545 BC) predates the respective pot style by nearly two and a half centuries. The latest possible point of the later range (at 95% C.I.) could just overlap with the appearance of Carinated Beakers, although this appears highly unlikely given the other date range obtained and on balance the two radiocarbon results together are most plausibly interpreted as showing the burial to predate the pot by between one and three (and possibly as much as four) centuries.

2.2 *The Secondary Burials*

The individuals were all young, with the exception of F8 who was at most a young adult (Table 1). Aside from this last inhumation, which had been severely damaged by ploughing, these skeletons were relatively complete. Levels of preservation vary across each skeleton but are good overall, although fragmentation, poor preservation of several important diagnostic areas and the immature nature of the skeletal remains hindered osteological assessment. Radiocarbon dates were not obtained for F5, F6 and F8 although parallels between burial styles suggest them to be roughly contemporary. All five secondary burials were interred in a tightly flexed, or foetal, position, with all recovered bones in their correct anatomical position. None were accompanied by any grave goods, conforming to the usual tradition at that time.

Where there was damage to these skeletons this took the form of root etching and post-mortem breaks indicated to have occurred in the burial environment by their irregular course and patinated margins. A series of linear defects with v-shaped profiles were apparent on the right scapular neck of F4 which would appear to be cutmarks although their roughened interiors precluded resolving this by microscopy as any internal surface features had been lost. Of further interest however, was the repeated presence of regular, circular holes located in the epiphyseal and diaphyseal ends of the long bones of skeleton F3 (see Fig. 3). These features measure approximately 9mm in diameter and could be seen to penetrate the respective bones to differing depths. There were no signs of bony reaction or remodelling and the margins and interiors of the defects were patinated identically to the rest of the bone. These features are not consistent with any pathological process or recognised form of natural taphonomic change. In light of this point and also the regular shape of each defect it was concluded that these features could only have been produced by human agency, apparently having been manually drilled using a rotary motion which would explain their circular form. An apparently similar, but smaller hole (approximately 3mm diameter) was present passing through the first metacarpal of F5 (Fig. 4a). The hand and foot bones were well preserved for all skeletons, however this was the only example of such a hole in this area.

It was of particular interest that while all the ‘drill cavities’ in the long bones were associated with the ends of the bones, not all of the holes located in the shafts had holes in the corresponding epiphyses. For example, there are holes in both ends of the right femur of F3 which only occur on the unfused diaphyseal shaft; the epiphyses have not been similarly modified. In contrast, the distal end of the left femur exhibits a drill hole through the epiphysis, with a slight continuation into the shaft. In order to create these holes the body must have been in a sufficiently advanced state of decomposition to permit access both to the ends of longbones and for the displacement of unfused epiphyses. An aspect of further note in this regard is the fact that all the bones of this individual were in normal anatomical articulation when uncovered at excavation. In this position the points at which the bones had been drilled were not accessible. This latter point necessitates that not only must parts of this individual’s skeleton have been selectively abstracted and modified, but that the skeleton must then have been manually re-assembled in order to achieve the position and state of articulation in which the remains were finally buried. These observations therefore further necessitate that the body must have been retained in an accessible location for some time after death, rather than simply being buried shortly after the individual had deceased.

*2.3 Summary*

In summary, both the primary burial and one of the secondary burials show strong indications that the respective individuals were not deposited in their graves immediately after death but were curated for an extended period. The inconsistency between the pottery type interred with the primary burial and the radiocarbon dates obtained from the skeleton show that this individual is likely to have died between one and four centuries years prior to being finally buried. If these remains had been found in a disarticulated state this would simply imply the retention of the bones of a long dead ‘ancestor’. However the degree of articulation in which the burial was encountered can only be explained by the presence of at least some soft tissues (ligaments etc.) meaning that this individual was buried as an ‘intact’ body rather than a bundle of curated bones. In the case of the secondary burial F3 again this individual was neither deposited in the ground shortly after death, nor transferred to the grave as a collection of bones after the soft tissues had decomposed, but rather something in between. The absence of grave goods precludes the kind of comparison of differential dating evidence possible for F1, however the apparent treatment of the body implies something more than short term retention of the remains. In order to clarify and further explore this apparent evidence for protracted and possibly quite complex mortuary practices which occur at a single site, but with notable separation in time, a range of further investigative strategies were applied. The bones of F1 were subject to histological analysis in order to obtain further information on the circumstances of decomposition, whilst the creation of the apparent drill holes in F3 and F5 was tested by experimental replication with both the actual and experimental defects then examined using scanning electron microscopy and micro CT scanning.

***3.0 Analytical Methods***

*3.1 Histological Analysis (TB)*

Lower long bone shaft fragments from six individuals were submitted for histological analysis of diagenesis using thin section light microscopy. Transverse thin sections 50-120 microns thick were cut from each sample using a Leica 1600 diamond-saw microtome. Undecalcified and unstained thin sections were mounted onto a glass slide using Entellan (Merck Chemicals). Thin sections were analysed under normal and polarised light using transmitted light binocular microscopes fitted with polarising filters at 25, 40 and 100 times magnification. Histological preservation was assessed using the Oxford Histological Index (OHI) which translates the percentage intact bone microstructure into an ordinal grade ranging from 0 (worst preserved) to 5 (best preserved) (Hedges *et al.* 1995; Millard 2001). The variable orientation of concentric microscopic bone lamellae produces birefringence under polarised light. Diagenetic loss of bone collagen reduces and eventually obliterates birefringence. Birefringence was assessed here using the Birefringence Index (BI), which records unaffected (1), reduced (0.5) and obliterated (0) birefringence (Jans *et al*. 2004).

*3.2 Experimentation (GD and MG)*

To help resolve the question of whether the circular holes observed on F3 and F5 were the result of deliberate anthropogenic modification attempts were made to replicate them experimentally using contemporaneous flint tool types. The holes observed on the proximal and distal unfused diaphyses of individual F3’s right femur and on the distal end of left first metacarpal of F5 (Figs. 3 and 4) were replicated on the unfused diaphyses of a pig femur (*Sus scrofa*) and on a pig rib respectively. Two types of flint tools were selected, a borer and an awl, similar to those found during excavations at the nearby Bronze Age site of Monkton-up-Wimborne, Dorset (French *et al.* 2007 –also see supplementary material). This allowed determination of which type of tool was more appropriate for drilling holes in different experimental bone elements. Using replicas of the awl and the borer, the experimental holes in the pig’s rib were drilled from both sides until the holes joined, piercing the full thickness of the bone. To assess whether the direction of rotation was important, two different rotating movements were used to drill the holes at the proximal and distal unfused diaphyses of the experimental femur. Using the borer, the experimental hole in the pig’s proximal femur was drilled using a 360° unidirectional rotating movement. The hole in the pig’s distal femur was drilled using a 180° bidirectional (backward and forward) rotating movement imitating that of a bow drill. Although both the experimental tools used were suitable for drilling holes, the point of the awl was more prone to breaking and it was felt that, by comparison, the borer is steadier in the hand and could be more adapted to drilling holes in bone. Initial results confirmed this hypothesis and determined the borer as the more appropriate choice to drill the holes in the experimental pig femur. The experimentally drilled holes were then investigated and recorded using the same modalities as the archaeological material.

*3.3 Electron Microscopy (GD)*

Details of the edges and interior of the archaeological and experimentally-drilled holes were examined using a JEOL (JSM-6010 PLUS/LV), scanning electron microscope (SEM). Images were captured at high resolution and at a magnification ranging from 14x to 27x. The SEM was operated in a variable pressure mode (chamber pressure 15 Pa). This allowed for the acquisition of back scattered electron (BSE) images without applying a conducting layer on the specimen. The parameters for the specimens were set as: accelerating voltage of between 1kV and 3kV; spot sizes between 55 and 69; pole-piece to specimen working distance of between 13mm and 32 mm. Energy-dispersive x-ray (EDX) microanalysis was carried out using INCA software.

2.2.4 *Micro CT Scanning (GD)*

Micro-computed tomography (micro-CT) was carried out to measure and record the internal dimensions and angles of the holes in the archaeological (human) and experimental (pig) femora and the volume of the holes in the human metacarpal and the pig rib. The specimens were scanned using a HMX ST 225 CT (Nikon Metrology). The instrument uses a cone beam projection system with a four megapixel detector panel. Different settings were used to optimize contrast and minimize the effects of beam hardening. All bones were orientated with their long axis set vertically with respect to the beam to ensure maximum resolution while minimizing streak artefacts (Yu *et al.* 2004). The human femur was reconstructed by combining two CT-scans (proximal-mid shaft and mid shaft-distal). For the human bones, the final scan parameters were: Tungsten target; 180 kV; 160μA; 3142 projections with 500 milliseconds exposure. The voxel size was of 112μm for the femur and of 16μm for the metacarpal. A 0.1mm copper plate was used. The final scan parameters for the pig femur were as follow: Tungsten target; 200 kV; 180μA; 3142 projections with 708 milliseconds exposure and a voxel size of 89μm. A 1 mm copper plate was used. For the pig rib, these were: Tungsten target; 180 kV; 160μA; 3142 projections with 500 milliseconds exposure and a voxel size of 22μm. A 0.25mm copper plate was used. The micro-CT data were reconstructed using CT-Pro software 2.0 (Nikon Metrology) and rendered using Drishti v.2.4 visualisation software.

***4.0 Results***

*4.1 Histological Analysis*

All of the Canada Farm specimens were poorly preserved histologically apart from the sample from F1 (Table 2). Histological degradation was consistent with Hackett’s (1981: 250) non-Wedl MFD (bacterial bioerosion) in all cases (Jans *et al*. 2004). Variation in bacterial bioerosion has been linked to early taphonomic processes which affect the level of putrefactive decomposition experienced by a skeleton (Jans *et al.* 2004; Nielsen-Marsh *et al.* 2007; White & Booth 2014; Booth *et al*. 2015). Bones retrieved as part of articulated complete skeletons are usually extensively bioeroded, as the immediate burial of an intact corpse protects it from rapid defleshing by scavengers, thereby exposing the skeleton to extensive bacterial soft tissue decomposition. Bacterial bioerosion is more often reduced or absent in disarticulated archaeological bones, as processes which involve the rapid removal of flesh (e.g. excarnation, dismemberment) will limit the level of soft tissue decomposition experienced by the bone.

The poor histological preservation of the majority of specimens from Canada Farm suggests that they were exposed to high levels of putrefactive bacterial activity, which is usually indicative of primary burial. Deposition within a sealed structure would also protect the body from scavengers and reduce the speed of invertebrate-mediated soft tissue loss (Goff 1991; Anderson 2011), however the lack of experimental histological data means that it is difficult to assess whether this represents a valid alternative scenario. The microstructure of the F1 sample was anomalously well-preserved and comparable to fresh bone. This specimen appeared to have experienced little if any putrefactive decomposition, which is unusual for a bone from a complete articulated adult skeleton (Booth, 2015). Anoxic or waterlogged environments can inhibit decomposition and reduce bioerosion (Turner-Walker & Jans 2008; Hollund *et* al. 2012; Booth 2015), but these conditions were unlikely to have been prevalent in the local free-draining sediments. Staining and inclusions, which can be indicative of variable depositional conditions, were absent from the Canada Farm thin sections. F1 was coffined, but permeable wooden coffins rarely impede bodily decomposition or bioerosion in well-drained environments (Booth 2015). The articulation of the F1 skeleton precluded the possibility that it had been rapidly defleshed. Mummified bodies are the only ancient articulated human remains whose bones consistently demonstrate low levels of bacterial bioerosion (Booth *et al*. 2015). Therefore the best explanation for the anomalous diagenetic signature of the F1 individual is that it was mummified before being buried, in common with skeletons recovered from several British Bronze Age sites (Parker Pearson *et al*. 2005; Booth *et al*. 2015).

*4.2 Electron Microscopy*

Scanning electron microscopy (SEM) of portions of the experimentally-drilled holes on the proximal and distal unfused (pig) femoral diaphyses, show a regular, slightly serrated edge profile (Fig. 6b, d). A similar profile is observed on the proximal and distal ends of the human right femur (Fig. 6a.) The serrated edges are similar to those reported in SEM studies of perforations made by stone tools (e.g. Olsen 1988) and are consistent with anthropogenic agency in the drilling of the two holes observed in the human femur. On the experimental pig rib, whether drilled with an awl (Fig. 6c) or a borer (Fig 6d), the SEM results show a regular-edged hole (4 mm and 3.88 mm in diameter) and internal striae transverse to the longitudinal axis of the defect. Such features diagnostic of lithic technology as reported e.g. by Giacobini and Patou-Mathis (2002) and Olsen (1988). The areas around the lateral and medial holes of the proximal end of the human left first metacarpal are eroded and the bone is root marked. The results from SEM show an irregularly-shaped surface (4.07mm long and 3.47 mm wide) with serrated edges on the medial side of the human left first metacarpal (Fig. e., g.). A round-shaped hole (3.21 mm in diameter), with sections of a regular edges, is observed inside a larger irregularly-shaped surface on the lateral side of the human left first metacarpal. There is no evidence for striae, but the sections of regular edges on the surface of the hole in the lateral side of the metacarpal are similar to those observed on the experimentally-drilled holes. The more regular appearance of the lateral entrance as opposed to the more irregular form of the opening on the opposite side is consistent with the pattern of disruption usually seen in rotary drilling of brittle materials. In such instances the entrance point tends to be more neat and regular whilst the exit point of the drill tends to exhibit ‘exit burring’ where material is forced outwards from the edges of the drill channel to leave irregular projections in more plastic materials or to cause irregular sections of material to delaminate and break away as the drill bit emerges on the other side in more brittle materials (Chambers and Bishop, 1995, 571).

*3.4 Micro CT Scanning*

The micro-CT scan data show a U-shape hole in the proximal femur of the pig (Fig.7a-c) with regular contours. At the distal end the data reveal a V-shape holed with irregular contours (Fig. 7d-f). The micro-CT scan of the human proximal femur shows a U-shaped hole with regular contours (Fig. 7g-i). The cross-section of the human distal femur shows a V-shaped hole. The U-shape and wide angle of the pig femur proximal hole was created by a 360° unidirectional movement being applied. By contrast, using a 180° bidirectional movement resulted in the V-shape and narrower angle of the pig femur distal hole. Coinciding with two different drilling movements, virtual transverse sections show that the edges of the experimental holes are rough in the distal end, but neat and regular in the proximal end (Fig. 8a,b). The same is true for the human femur, where virtual transverse sections show that the holes are rough at the proximal end, but neat and regular at the distal end (Fig. 8c,d). These comparative results from micro-CT data show the holes in the bones of F3 firstly to be consistent with having been produced using a single tool and secondly to be highly consistent with drilling using a flint borer. The experiences of attempting to reproduce such holes led the individual involved (MG) to also suggest that the choice of drilling method could result from being adapted to the ontogenic shape of the human bone. The conscious choices reported by MG when drilling the experimental holes in the pig femur support this hypothesis.

The experimental drill holes were created for qualitative comparison rather than producing a large sample for comparing repeated measurements. However, metric comparison with the dimensions of the holes in the femur of F3 was not without interest (Table 3). The experimental holes were very close in diameter to those in F3 (<5% percentage difference). In terms of depth and angle the proximal holes exhibited greater differences but the holes drilled in the distal ends were again extremely similar. This difference may stem from variations in the form of human and pig femora where the two differ more from each other at the proximal end than at the distal end. The porous structure of the human metacarpal bone prevented a micro-CT analysis as the air-filled cavities from the bone structure are indistinguishable from those resulting from the hollow left by the “drill”.

**4.0 Discussion**

The application of a varied suite of techniques to the human remains from Canada Farm has provided multiple lines of complementary data that go beyond the standard range of analyses generally applied to archaeological burials. Taken together these additional data allow the unusual aspects of these burials to be considered in greater detail than would otherwise have been possible and also for competing hypotheses to be evaluated in terms that are less speculative than they might otherwise be. The two radiocarbon dates obtained from the primary burial F1 appear to show the body to be older than the beaker pot this individual was buried with. In determining what this means there are three possible interpretations which we argue to be particularly plausible. Firstly, if taken at face value the discordant dating ranges of the ceramic and radiocarbon assessments, in conjunction with the articulated nature of the skeleton could be taken to indicate that a degree of soft tissue remained in place at the time the body was interred and that this event took place between one and four centuries after the individual’s death. Perhaps most plausibly such soft tissues might consist of skin and connective tissues (ligaments and tendons particularly) in a dessicated state. For this to occur the body must have been retained and curated after death either in circumstances that permitted it to dry out slowly, or with the application of some deliberate means of preserving soft tissues. A second possibility is more mundane, the coffin the body appears to have been placed in was re-opened some considerable time after the individual’s death and the beaker pot was placed inside. The third possibility is that the individual’s death occurred at the very far end of the second radiocarbon date range obtained which overlaps the earliest point at which the respective style of beaker is first known to appear in Britain.

Of these three possibilities, the suggestion most easily discounted is the second on the basis that had the individual simply been buried around the time of his death, it would not be possible to then open the coffin generations later as it would have been sealed beneath the barrow, rendering it inaccessible. It is of course possible that the barrow could have been dug into to uncover the coffin and permit it to be opened. However this seems rather implausible, not least as it is reliant on the coffin having resisted decay in the ground over an extended period and further we know of no archaeological parallels for such from this period. Alternatively if the coffin was not placed in the grave and covered by the barrow until a time contemporaneous with the beaker then this returns the picture to one of retention of a dead ‘ancestor’ for a protracted period. We would argue that given the overall evidence apparent this seems more plausible than the barrow undergoing excavation in the beaker period. The fact that the dates provided by ceramic typology and radiocarbon could overlap at their extreme ranges remains a possible solution. However, this latter hypothesis fails to explain the initial radiocarbon result (2620-2470 cal BC). Whilst one of the AMS results obtained must be closer to the real age of the bone tested than the other, it is ultimately more likely that the answer lies somewhere in between the two rather than completely outside one range and at the extreme latter end of the other.

Turning to an alternative line of evidence, the histological analysis was conducted with a view to establishing whether the respective bones displayed patterns of degradation of the kind normally produced in putrefactive decay or whether they exhibited signatures that differed from this. As outlined above the bone from F1 was remarkably well preserved to the extent that it retained its normal microstructure in similar proportions to fresh bone. The only way this can have been achieved is if the normal processes of putrefaction were prevented from occurring. The principal source of putrefactive bacteria in a corpse are an individual’s own gut flora which cause the abdominal contents to putrefy first, with decomposition then spreading outwards to affect progressively more peripheral parts of the body. Bronze Age people would have been familiar with methods of butchering animals and would undoubtedly have known that the flesh lasts much longer when the abdominal contents are removed. If this principle was applied to a deceased person, with the body then bound or wrapped and kept in a warm, dry environment such as within a house, it is plausible that the remaining soft tissues could dessicate, whilst the bones would remain well preserved as is the case for F1. Other suggestions for means of deliberate preservation available to Bronze Age people include smoking or deposition in a peat bog (Booth *et al*., 2015). The latter option would have been unavailable in the Cranborne Chase environs, whilst none of the bones or teeth of F1 display discolouration which would be consistent with prolonged exposure to smoke and so the suggestion above currently seems the most plausible option.

Turning to the anthropogenic modifications in the bones of two of the Middle Bronze Age burials (F3 and F5) apparent as circular channels produced by drilling, these are by definition indicative of the retention of these bodies, (F3 in particular), for some time after death. The sites at which the drill holes in F3 are located would not be accessible whilst the soft tissues were present. Even once soft tissue decomposition had largely run its course it would not be possible to access several of the drilled points without disarticulating the respective joints. Given that F3 was buried in full articulation in a tightly flexed position it must therefore be concluded that after the respective joints had been drilled the remains of this individual were manually re-assembled before the body was finally interred in the barrow ditch. This observation raises the question of what practical purpose (if any) such modification of these bones might serve? Archaeological parallels for such are limited. Whilst trepanation is widely known from throughout later prehistory, the drilling of human bones from other parts of the skeleton has rarely been observed. An apparent example from Britain is that of an articulated Bronze Age burial excavated near Oxford in which the right ulna had a circular full thickness defect similar in appearance to the Canada Farm ‘drill holes’ (Chris Evans pers. comm.). Other examples are widely separated in space and time from Bronze Age Wessex and also differ in social context such as drilled human forearms removed as war trophies in prehistoric California (Andrushko *et al*., 2005). The drilling of human crania for suspension and display is known from prehispanic Peru (Andrushko, 2011), but again relates to trophy taking rather than funerary practice.

A possible explanation which occurred to the present authors is that the holes might have originally held some sort of manufactured object with a circular profile such as a peg or dowel. Toggles made of worked bone or antler with a circular profile and similar diameter to the F3 drill holes are certainly known from Bronze Age Britain (Piggott, 1958, Gardiner *et al.,* 2007, Hunter and Woodward, 2014, 121, Fitzpatrick, 2013, pl.18) not to mention that one was found among the grave goods of F1. If such objects had originally been present in the drill holes but were made of other organic material (most likely wood) these would have decayed relatively quickly once buried. If the holes were indeed made to hold pegs or dowels, these might in turn be attached to each other, perhaps using cord or leather which would have the effect of artificially keeping the respective limbs /joints in attachment to the rest of the body. Such an arrangement implies a desire to maintain the remains of an individual in normal articulation as an ‘intact’ body for some time after death. If the body of F3 was retained and curated as would appear to be the case for F1, the continued existence of the body in an articulated state would require a degree of soft tissue preservation, without which the limbs would naturally disarticulate over time. The results of histological analysis for F3 were consistent with the pattern that would be expected from the normal course of decomposition. It would seem therefore that whatever circumstances the remains of F3 were retained in, these were not sufficient to prevent the normal processes of decay. If this was the case then the use of pegs/ dowels to fix the limbs to the rest of the body would make sense as a practical solution to keep the body together as it began to naturally fall apart, effectively imitating a better preserved body such as that of F1. At the point when both F3 and F5 were interred they would appear to have been bound in the tightly flexed position observed at excavation, perhaps having been deposited as wrapped bundles.

Ethnographic examples of the retention of the dead following some form of anthropogenic mummification are known from various parts of south east Asia and the Pacific. Such practices include smoking, wrapping and also the evisceration of the dead to effect soft-tissue preservation. In particular the Sa’dan Toraja of South Sulawesi (Indonesia) retain the bodies of high status individuals for extended periods (Weiss-Krecji, 2012), in which bodies are repeatedly exhumed from coffins and given new clothes. If the retained bodies of F3 and F5 were kept as wrapped bundles with the body tightly flexed within, these might have been similarly unwrapped periodically. Such unwrapping could have permitted the realization that F3 had decayed to the point where the limbs were coming apart, prompting the decision to fix this individual’s failing joints back together using wooden dowels. The primary burial (F1) and the surrounding satellite burials are separated by several centuries and other than for the fact that the later inhumations were placed in the ditch of the same burial monument there would be no strong reason for discussing them here in the same article. However, when the different anomalous features of these burials, particularly F1 and F3 are considered together they are of interest for similar reasons in that both imply the retention of human remains in an articulated state for an extended period before their final inhumation. In this respect the separation in time of these burials is of particular interest in that it implies such a tradition have lasted for several centuries from at least the final Neolithic/earliest Beaker phase to the Middle Bronze Age. Such a suggestion would then be of interest in itself as a phenomenon local to the Cranborne Chase region of central southern Britain, but can be argued to have much greater significance in light of previous claims for evidence of such practices in other regions during the Bronze Age.

Parker Pearson and colleagues (2005) observations of articulated burials from the Western Isles (Scotland) that were centuries older than the grave contexts they were buried in led to the conclusion that the respective bodies must have been curated with preserved soft tissues holding them together over multiple generations before they were finally buried. Booth’s (2015) subsequent study (also Booth *et al.* 2015) of histological preservation in 301 individuals from a wide range of archaeological burials, mostly from Britain demonstrated the majority, particularly those from historic contexts to exhibit levels of bioerosion consistent with burial soon after death. However, just under half of the Bronze Age burials analysed (16/34) displayed high levels of bone preservation consistent with that seen in mummified remains. It would seem therefore that one or more forms of mortuary practice were apparently widespread during the British Bronze Age in which the preservation of the dead with soft tissue retained was the desired aim. Attempts at such preservation may in fact have met with variable success as illustrated by the poor preservation and implied natural disarticulation of Canada Farm F3, with subsequent attempts to maintain the body in articulation by artificial means. The current analyses of the Canada Farm remains are of further significance in this respect, firstly in extending the temporal spread of such treatments back to the final Neolithic or at least the earliest Beaker period, whilst also extending the geographical range of this practice. If mummification was practised at the far North of Britain as indicated at Cladh Hallan (Parker Pearson *et al*., 2005) and the far South as apparent at Canada Farm then it is reasonable to suggest that such traditions are likely to have existed in other parts of the British Isles spanning the distance in between.

**Acknowledgements**

We are grateful to Peter Andrews and Sylvia Hixson-Andrews (for sharing their insights on the taphonomy of the assemblage), Dan Sykes and Rebecca Summerfield (for providing training and assistance with Micro CT Scanning), Paola Barbuto (SEM training), Rob Read (Illustration), Mike Henderson (pottery reconstruction/ conservation). We also thank Ros Cleal for sharing her insights on the date of the beakers. The thin section histological analysis of bone was carried out at the University of Sheffield Department of Archaeology.

**References**

Anderson GS. 2011. Comparison of decomposition rates and faunal colonisation of carrion in indoor and outdoor environments. *Journal of Forensic Sciences* 56,136-142.

Andrushko, V.A. (2011) “How the Wari fashioned trophy heads for display: a distinctive modified cranium from Cuzco, Peru, and comparison to trophies from the capital region” in Bonogofsky, M. (ed.) *The Bioarchaeology of the Human Head: Decapitation, Decoration, and Deformation* Gainesville (FL), Florida University Press, 262-285.

Andrushko, V.A., Latham, K., Grady, D.L., Pastron, A.G., Walker, P.L. (2005) “Bioarchaeological Evidence for Trophy-Taking in Prehistoric Central California” *American Journal of Physical Anthropology* 127, 375–384.

Barrett, J., Bradley, R. and Green, M. (1991a) *Landscape Monuments and Society: the Prehistory of Cranborne Chase*. Cambridge University Press.

Barrett, J.C., Bradley, R. & Hall, (eds.) (1991b) *Papers on the Prehistoric Archaeology of Cranborne Chase*. Oxford: Oxbow 11.

Booth, T.J. (2015) “An investigation into the relationship between funerary treatment and bacterial bioerosion in European archaeological bone” *Archaeometry* (early view online: DOI: 10.1111/arcm.12190).

Booth, T.J. Chamberlain, AT. Parker Pearson, M. (in press) *“*Mummification in Bronze Age Britain” *Antiquity*.

Chambers, A. and Bishop, G. (1995) “The drilling of carbon fibre polymer matrix composites” in: Poursartip, A. and Street, K. (eds.) *Proceedings of the Tenth International Conference on Composite Materials, Volume III: Processing and Manufacturing* Cambridge: Woodhead Publishing, 565-572.

Drishti (version 2.4) Volume Exploration and Presentation Tool. Available from: http://anusf.anu.edu.au/Vizlab/drishti /(accessed May 2014).

Fitzpatrick, A. (2013*) The Amesbury Archer and the Boscombe Bowmen - Bell Beaker burials at Boscombe Down, Amesbury­* Salisbury: Wessex Archaeology, Report No. 27.

French, C., Lewis, H., Allen, M.J., Green, M., Scaife, *upper* R. and Gardiner, J., 2007. *Prehistoric landscape development and human impact in the Allen valley, Cranborne Chase, Dorset*. Cambridge: Macdonald Institute for Archaeological Research.

Gardiner, J., Allen, M.J., Powell, A.B., Harding, P., Lawson, A.J., Loader, E., McKinley, J.I., Sheridan, A. and Stevens, C.J. (2007) “A Matter of Life and Death: Late Neolithic, Beaker and Early Bronze Age Settlement and Cemeteries at Thomas Hardye School, Dorchester” *Proceedings of the Dorset Natural History and Archaeological Society* 128, 17-52.

Giacobini, G. and Patou-Mathis, M., 2002. Fiche rappels taphonomiques. In: Patou-Mathis, M., ed. Industrie de l’os préhistorique, Cahiers X. Compresseurs, percuteurs, retouchoirs. Paris: Editions Société Préhistorique Française, 21-28.

Goff ML. 1991. Comparison of insect species associated with decomposing remains recovered from inside dwellings and out-doors on the Island of Oahu, Hawaii. *J Forensic Sci* 36:748-753.

Green, M. (2000) A Landscape Revealed: 10,000 Years on a Chalkland Farm Stroud: Tempus.

Green, M. (2012) “Cursus continuum: further discoveries in the Dorset Cursus environs, Cranborne Chase, Dorset” In: Jones, A.M., Pollard J., Allen M.J. and Gardiner J. (eds.) *Image, Memory and Monumentality, Archaeological Engagements with the Material World*. Prehistoric Society Research Paper 5.

Hackett CJ. 1981. Microscopical focal destruction (tunnels) in exhumed human bones. *Med Science and Law* 21, 243-266.

Hedges REM, Millard AR, Pike AWG. 1995. Measurements and relationships of diagenetic alteration of bone from three archaeological sites*. J Archaeol Sci* 22:201-209.

Hollund HI, Jans MME, Collins MJ, Kars H, Joosten I, Kars SM. 2012. What happened here? Bone histology as a tool in decoding the postmortem histories of archaeological bone from Castricum, The Netherlands. *International Journal of Osteoarchaeology* 22,537-548.

Hunter, J. and Woodward, A. (2014) *Ritual in Early Bronze Age Grave Goods* Oxford: Oxbow.

Jans MME, Nielsen-Marsh CM, Smith CI, Collins MJ. & Kars H. 2004. Characterisation of microbial attack on archaeological bone. *J Archaeol Sci* 31:87-95.

Millard A. 2001. The Deterioration of Bone. In: Brothwell D, Pollard AM. editors. *Handbook of Archaeological Sciences.* Chichester: John Wiley & Sons. p 637-647.

Needham, I.S. (2005) “Transforming Beaker culture in North-West Europe; processes of fusion and fission” *­Proceedings of the Prehistoric Society* 71, 171-217.

Nielsen-Marsh, C.M, Smith, C.I, Jans, M.M.E., Nord, A., Kars, H., Collins, M.J. (2007) “Bone diagenesis in the European Holocene II: Taphonomic and environmental considerations” *Journal of Archaeological Science* 34, 1523-1531.

Olsen, S.L. (1988) “The identification of stone and metal tool marks on bone artifacts” in: Olsen, S.L. (ed.) *Scanning Electron Microscopy in Archaeology*. BAR International Series 452, 337-363.

Parker Pearson, M.; Chamberlain, A., Craig, O., Marshall, P., Mulville, J., Smith, H., Chenery, C., Collins, M., Cook, G., Craig, G., Evans, J., Hiller, J., Montgomery, J., Schwenninger, J., Taylor, G., Wess, T. (2005) “Evidence for mummification in Bronze

Age Britain” *Antiquity* 79, 529-546.

Piggott, S. (1958) “Segmented bone beads and toggles in the British Early and Middle Bronze Age” *Proceedings of the Prehistoric Society*24, 227–9.

Turner-Walker G, Jans, M. (2008) “Reconstructing taphonomic histories using histological analysis” *Palaeogeography, Palaeoclimatology, Palaeoecology,* 266, 227-235.

Wayland Barber, E. (2004) *The Mummies of Urumchi* London: Macmillan.

Weiss-Krecji, E. (2012) “Shedding light on dark places: deposition of the dead in caves and cave-like features in Neolithic and Copper Age Iberia” in: Bergsvik, K.A., Andreas, K., Bergsvik, S. and Skeates, R. (eds.) *Caves in Context: The Cultural Significance of Caves and Rockshelters in Europe­ Oxford: Oxbow, 118-137.*

White, L., Booth, T.J. (2014) “The origin of bacteria responsible for bioerosion to the internal bone microstructure: Results from experimentally-deposited pig carcasses” *Forensic Science International* 239, 92-102.

Yu, Z., Sidky, E.Y. and Pan, X. (2004) “Partial volume and aliasing artefacts in helical cone-beam CT” *Physics in Medicine and Biology*, 49, 2365-2375.