Proceedings of the Prehistoric Society 88, 2022, pp. 193–220
doi:10.1017/ppr.2022.8 First published online 08 November 2022

The Ambivalent Dead: Curation, Excarnation and Complex Post-mortem Trajectories in Middle and Late Bronze Age Britain

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This paper sets out the results of radiocarbon, histological, and contextual analysis of human remains from non-mortuary contexts in Middle and Late Bronze Age Britain. In the latter period in particular, human bone (much of it fragmentary and disarticulated) has frequently been recovered from settlement contexts and from other locations, such as waterholes, across the wider landscape. However, the source and post-mortem trajectories of such finds are poorly understood. The results of our analyses indicate that some of these finds come from primary burials while others were the result of post-mortem processes such as excarnation. Certain fragments appear to have been curated for lengthy periods of time but there is much less evidence for deliberate curation of bone than there is in Early Bronze Age graves, although other forms of manipulation, such as cutting and shaping of bone fragments, have been recorded. In contrast to the Early Bronze Age, where it has been argued that curated bones may have belonged to venerated ancestors, some of the individuals from the sites discussed in this paper had suffered violent deaths, suggesting that bones selected for manipulation, curation, and deposition may have belonged to a variety of different categories of person.

Keywords: Human remains, depositional practices, excarnation, curation, Bronze Age, radiocarbon dating, histology

The curation of artefacts in Chalcolithic and Early Bronze Age Britain is a well-documented phenomenon (eg, Sheridan & Davis 2002; Woodward 2002; Woodward & Hunter 2015). Detailed studies of grave goods have shown that some were heirlooms, deliberately retained for many years before final deposition in the grave, probably because of their connections with significant ancestors. Only recently, however, has the curation of objects from Middle and Late Bronze Age contexts become a focus of attention, with recent discussion of 'out of time' artefacts in hoards and other contexts suggesting that some bronzes may have been curated over periods of several centuries (Knight 2019). Chemical analysis of a shield from Milsom's Corner (Somerset), for example, indicates that it was manufactured in the Penard period, but radiocarbon dating of animal bone with which it was associated suggests that it was deposited sometime after the mid-11th century, 100 years or more later (Needham *et al*. 2012; Knight forthcoming). Placed face-down in a ditch, it was pierced from behind three or four times, possibly by a wooden stake, an act suggestive of ritual decommissioning of a powerful object.

As yet, however, no study has sought to investigate whether human remains of Middle or Late Bronze Age date were subject to similar practices. During this period, fragments of unburnt bone and small deposits of cremated remains are frequently recovered from non-mortuary contexts. Human bone is a common find on settlements, particularly during the Late Bronze Age (Brück 1995), where it was deposited in post-holes, pits, and ditches, including in and around round-houses. Late Bronze Age middens, widely interpreted as places where large numbers of people gathered for feasting and

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exchange, have yielded human remains. Human bone is also found in the wider landscape in field boundaries and waterholes, as well as in locations from which 'votive' deposits of metalwork have been recovered, such as rivers, lakes, bogs, and caves. It has long been accepted that such finds do not represent the remains of formal burials. The majority comprise fragmentary and disarticulated bone. The preponderance of skull and long bone fragments, and their frequent location at significant points in space such as boundaries and entrances, suggests that these were deliberately selected for deposition to mark significant places and events for Bronze Age communities (Brück 1995).

The source and post-mortem trajectories of such non-mortuary deposits are poorly understood, however. Cremation burial was the dominant form of mortuary rite in Middle Bronze Age Britain (Ellison 1980; Caswell & Roberts 2018), but relatively few formal burials of Late Bronze Age date are known (Brück 1995, though current PhD research by Beverley Still is identifying previously unrecognised examples). The paucity of formal burials and the frequent occurrence of unburnt, disarticulated fragments of human bone in settlement contexts of Late Bronze Age date suggests that excarnation may have been a common form of mortuary treatment (Brück 1995; cf. Carr & Knüsel 1997; Redfern 2008). However, conclusive evidence for this practice is rare and studies of similar deposits in Iron Age Britain suggest that disarticulated bones from those later contexts may have been disinterred from existing primary burials as they lack signs of weathering or animal gnawing (Madgwick 2008; Sharples 2010, 272). Tantalising evidence for curation of human remains from Late Bronze Age domestic contexts has already been identified at Cladh Hallan on South Uist (Western Isles), where histological analysis and radiocarbon dating of two bodies buried beneath the floor of a round-house suggested that they had been formerly mummified (Parker Pearson *et al*. 2005; 2007; Hanna *et al*. 2012). However, similar analysis has not been undertaken on other human remains from non-mortuary contexts of this date.

In this paper, we will explore what radiocarbon and histo-taphonomic analysis of bone from non-mortuary contexts can tell us about the treatment of the body after death, including the processes and practices that facilitated the fragmentation, circulation, and curation of human bone. Deposits of partial and fragmentary human remains are well-documented in later prehistoric settlement and non-mortuary contexts elsewhere in Europe too (eg, Stapel 1999). Both within and beyond European prehistory, the complex, variable, and often protracted nature of mortuary practice has been a particular focus of recent archaeological discussion (eg, Rebay-Salisbury *et al*. 2010; Weiss-Krejci 2010; Gramsch 2013; Bradbury & Scarre 2017), and archaeologists have drawn on the extensive ethnographic evidence to understand the use and deposition of human remains in non-mortuary settings (eg, Weiss-Krejci 2011; Armit 2017). These studies amply illustrate the variety of funerary, post-funerary, and taphonomic processes that can result in the fragmentation and curation of the human body as well as variability in the meanings ascribed to those bodily elements. Fragmentation may result from accidental or deliberate disinterment of primary burials, excarnation, defleshing, or dismemberment, *inter alia*, while curation may be facilitated by a range of processes including excarnation, defleshing, dismemberment, mummification, smoking, deposition in an anoxic environment, or indeed by re-opening of graves to retrieve dry bones for re-use. This paper adds to these ongoing discussions by employing radiocarbon dating and histological analysis together with macroscopic taphonomy and contextual information to examine evidence for extended post-mortuary interaction with human bone outside of the mortuary context in Middle and Late Bronze Age Britain.

Here, we will consider what such post-mortem trajectories might tell us about concepts of personhood, about the social and political significance of the dead in the world of the living, and about the range of ritual practices in which human remains played a role. Evidence for the curation of human bone, as well as for the timeframes over which human remains might have been retained, may help cast light on the significance and complexities of such practices. For example, the identities of the recent dead are likely to have been known and may have been an important factor in determining patterns of use and deposition of their remains. In contrast, where bones were retained over longer periods, the original identities of those to whom they had once belonged may have been forgotten or might have been considered unimportant. Such bones might have been curated for their symbolic or magical properties, rather than for their links to particular individuals, or they may have been associated with a more generalised ancestry.

SAMPLING AND METHODOLOGY

In order to investigate the curation of human remains in non-mortuary contexts during the Middle and Late

https://doi.org/10.1017/ppr.2022.8 Published online by Cambridge University Press

Bronze Age, we employed radiocarbon dating to examine whether deposits of bone, whose composition or condition suggested curation, were significantly older than their depositional context. We generated 56 new radiocarbon dates from human bone and associated short-life material from 22 different contexts on 12 sites of Middle and Late Bronze Age date (Table 1). We chose samples from recently excavated, well-documented contexts for which osteoarchaeological assessments or analyses were available, and where there was minimal evidence for later disturbance and little to suggest that the dated finds were residual. The large number of recent developer-funded excavations in southern Britain coupled with the excellent preservation of bone in soils overlying the Jurassic geologies that dominate parts of eastern and southern England meant that the majority of samples were derived from sites in these areas (Fig. 1). There were 13 additional dates available for four of these sites generated in the context of the original post-excavation analyses. The majority of samples derived from settlements and related contexts such as post-holes, pits, enclosure ditches, waterholes, and field boundaries, although dates were also obtained for human bone associated with a timber platform and with a hoard. Dating was focused on unburnt human remains to avoid the potential impact of the old wood effect, and we included only one fragment of cremated bone, from Striplands Farm, Cambridgeshire, the date of which we compared with a sample of burnt animal bone from the same context. We cannot rule out that the old wood effect had some bearing on the results from Striplands Farm. However, we found little evidence for a substantial and pervasive old wood effect in the cremated human bones we dated as part of our broader project (which included samples of Chalcolithic and Early Bronze Age date as well as from mortuary contexts: Booth & Brück 2020) where results on cremated remains were in line with those obtained from unburnt human bones. We also re-analysed the published dates available for two sites, Cladh Hallan, Western Isles, and Cliffs End Farm, Kent, for which we did not ourselves generate new dates (for a full list of all sites from which the data in this paper derive, see Table 2).

We tested whether human bones were anomalously old by comparing their radiocarbon dates against the dates of other short-life material from the same contexts. The methodology employed to assess whether individual samples were anomalously old has already been set out in a previous paper where full statistical analysis of the dataset is reported (Booth & Brück 2020) but we summarise it here as we will discuss the results for key sites below. In brief, we used the Combine function and chronological modelling in OxCal 4.4 using the IntCal20 curve to test whether bone was significantly older than its depositional context (Bronk Ramsey 2009; Reimer *et al.* 2020). Bones that are older than their depositional context may, of course, have become accidentally incorporated into a later context. However, we found that human bones from Bronze Age contexts came back as anomalously older, as defined by X^2 tests and agreement indices in chronological models, statistically significantly more often than would be expected by chance (Booth & Brück 2020). In cases where human remains were shown by these methods to be anomalously old, we put the dates into new chronological models which assumed that the human bone was older than the material it was associated with. We compared both modelled and unmodelled dates using the Difference function in OxCal to determine the period over which the bone was likely to have been curated. When dates which were entered into chronological models or Combine functions in OxCal produced good agreement indices and/or passed the X^2 test, the bone could not be shown to be anomalously old.

Moreover, when we combined unmodelled Difference probability distributions into a single distribution using BChron in RStudio (Haslett & Parnell 2008; R Core Team 2013), this combined distribution was skewed statistically significantly lower than a simulated normal probability distribution which assumed no significant difference between associated dates (Booth & Brück 2020). The difference between these distributions remained statistically significant even when we removed single distributions generated from samples that had been shown to be anomalously old by X^2 tests and chronological models in OxCal. This suggested that human bones which were already old when they were deposited were also present amongst the samples that were not identified as old by X^2 tests and chronological models, because the period over which those human remains had been curated was too short to be detected by these methods. However, we could not distinguish which specific bones amongst this sample were more or less likely to have been curated. Our chronological modelling indicated that even where individual samples could have been curated for considerable periods of time,

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Table 1. Contexts from which human bone and other associated materials dated for this project were derived

Ref. Fig. 1	*Site*	*Context no.*	*Period*	*Feature/ deposit type*	*Elements present*	*Other dated material from same or related context*	*Age*	*Sex*	*Curation*	*Taphonomy/ modification*
1	Bradley Fen	853	MBA	Waterhole	Complete articulated skeleton	Animal bone	Older middle adult	Female	No	None
1	Bradley Fen	948	LBA	Fen edge near hoard	Cranium	Peat, wooden spear shaft	Adult	Unknown	No	None
2	Brigg's Farm	575	MBA	Ditch	Femur	Animal bone	Adult	Unknown	Yes	None
3	Clay Farm	2910	MBA	Ditch	Cranium	Animal bone, charred seed	Adult	Possible male	No	None
4	E. Chisenbury	128	LBA–EtIA	Ditch	Ulna	Animal bone	Child 8–12 yrs	Unknown	Yes	Bleaching, longitudinal cracks
4	E. Chisenbury	140	LBA–EtIA	Post-hole	Radius	Animal bone	Adult	Unknown	No	Canid gnawing
4	E. Chisenbury	152	LBA	Old ground surface	3 skull frags (same indiv.)	Animal bone	Adult 18–30 yrs	Female?	No	Anti- & peri-mortem trauma, slight erosion
4	E. Chisenbury	201	LBA	Occupation deposit	3 skull frags, 1 tibia frag. (same indiv.)	Animal bone	Adult 18–30 yrs	Female	No	Slight erosion
4	E. Chisenbury	600	LBA–EtIA	Occupation deposit/ badger spoil	Skull frag.	Animal bone	Adult 18–30 yrs	Unknown	Yes	Shiny, possible tool marks
5	Eye Quarry	2222	EtIA–EIA	Pit	Skull fragment	Animal bone	Adult	Male	No	None
5	Eye Quarry	2623	EtIA	Pit	Mandible	Animal bone	Older subadult or young adult 17–25 yrs	Unknown	No	None
6	Greylake	2	LBA	Timber platform	Humerus (+ other disartic. bone)	Animal bone, timber platform	Adult	Unknown	No	Carnivore gnawing
7	Latton Lands	1751	MBA	Waterhole	Partial skeleton (with cranium)	Animal bone	Adult	Female	No	Fresh break
8	Needingworth Quarry	3284a	LBA	Buried soil	Femur	Femur frag.	Disartic. human skeleton	Adult	No	Carnivore gnawing
9	Potterne	Phase 11	LBA	Midden	Skull frag.	Animal bone	Adult	Unknown	No	Fresh cutmark
9	Potterne	Phase 10	LBA	Midden	2 skull frags	Human bone	Adult	Unknown	No	Weathering to 1 frag.
9	Potterne	Phase 4	LBA	Midden	Mandible frag.	Charcoal	Adult	Unknown	Yes	Fresh cutmark
10	Stanton St Bernard	100004	EtIA	Midden	Skull frag.	Pottery typology	Adult	Unknown	No	Weathering & cutmarks
10	Stanton St Bernard	200004	EtIA	Midden	Skull frag.	Pottery typology	Adult	Unknown	No	Weathering & cutmarks
10	Stanton St Bernard	3	EtIA	Midden	Skull frag.	Pottery typology	Adult	Unknown	No	Weathering & cutmarks
11	Striplands Farm	F2	LBA	Pit	Cremation deposit	Burnt animal bone	Unknown	Unknown	Yes	None
12	Wicken (Dimmock's Quote Quarry)	1254	LBA	Natural hollow	Skull frag.	Animal bone	Unknown	Unknown	No	None

For a full list of all radiocarbon dates, see Booth & Brück 2020

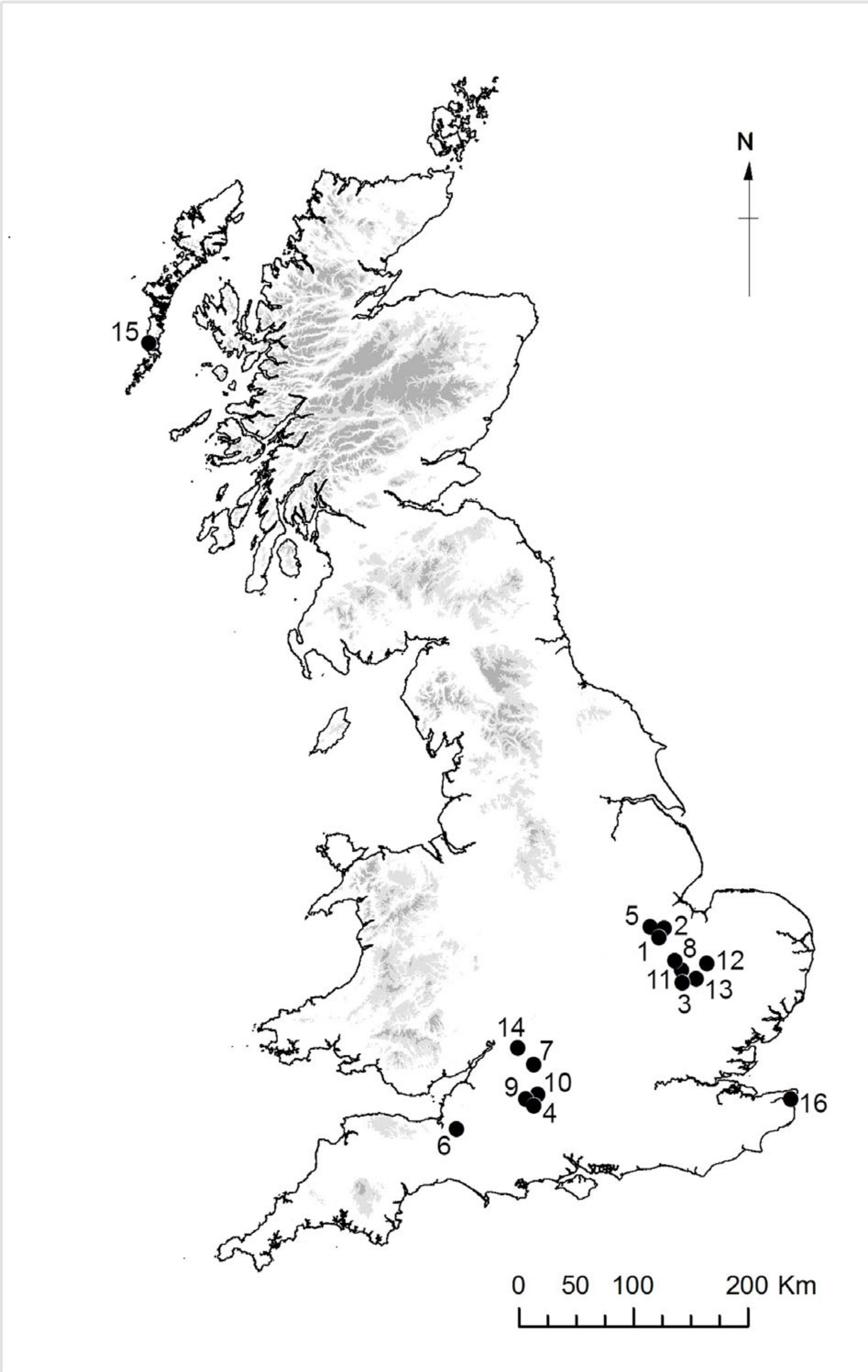

Fig. 1.
Map showing the location of sites discussed in this paper

Table 2. List of sites from which data in this paper derive

Ref. Fig. 1	*Site*	*New C^{14}dates generated*	*Existing dates from same contexts*	*Histological analysis*
1	Bradley Fen	Y		Y
2	Brigg's Farm	Y	Y	Y
3	Clay Farm	Y	Y	Y
4	E. Chisenbury	Y		Y
5	Eye Quarry	Y		
6	Greylake	Y		Y
7	Latton Lands	Y		Y
8	Needingworth Quarry	Y	Y	Y
9	Potterne	Y	Y	
10	Stanton St Bernard	Y		
11	Striplands Farm	Y		
12	Wicken (Dimmock's Quote Quarry)	Y		
13	NW Cambridge Sites IV & V			Y
14	Shorncote Quarry			Y
15	Cladh Hallan		Y	Y
16	Cliffs End Farm		Y	Y

the probability was that they have been curated for decades rather than centuries. We argued that the marine reservoir effect is unlikely to have affected the dates we collated as stable isotope analysis of human remains from Bronze Age Britain indicates very low levels of consumption of marine or freshwater resources (Parker Pearson *et al.* 2016).

In order to investigate variability in post-mortem treatment, we carried out histological analysis using micro-computed tomography (micro-CT) to investigate patterns of bone bioerosion in eight of our dated bone samples as well as in four other samples on which dating unfortunately failed due to poor collagen (Table 3; Dal Sasso *et al.* 2014; Booth *et al.* 2016). Scans were performed on long bone and cranial vault fragments that had been sampled for radiocarbon dating. Bone samples weighing 0.5–1 g were cut from larger bone fragments using a small circular saw. Samples were then embedded in Oasis floral foam (Oasis Floral products) within a plastic beaker. X-ray micro-CT scans were performed at the Image Analysis Centre (IAC) at the Natural History Museum, London, using a Nikon Metrology HMX ST 255 (Nikon Metrology, Tring, UK) micro-CT scanner fitted with a 0.1 mm Cu filter. All scans were carried out at 150 mA with a molybdenum target and 3142 projections were taken over a 360 rotation with no frame averaging. Samples were CT scanned at exposures of 708 ms with accelerating voltages of 180–200 Kv. Three-dimensional volumes were reconstructed from the micro-CT scans with CT Pro (Nikon metrology, Tring, UK) using a modified Feldkamp back-projection algorithm (Feldkamp *et al.* 1984). The 3D data were rendered using VG Studio Max (Volume Graphics, Heidelberg, Germany) to analyse the quality of the scans and produce three-dimensional visualisations. We also used VG Studio Max and ImageJ to produce stacks of two-dimensional transverse cross-sections, equivalent to transverse bone thin sections. Levels of bacterial bioerosion were assessed by the analysis of virtual transverse slices using the Oxford Histological Index (OHI; Hedges *et al.* 1995; Millard 2001).

Previous studies indicate that bodies buried intact and soon after death in generally dry, aerobic environments will suffer high levels of bacterial bioerosion (Jans *et al.* 2004; Booth 2016; Booth *et al.* 2016). In contrast, low levels of bacterial bioerosion in bones from the same sort of burial environments correlate with early taphonomy, particularly forms of post-mortem treatment that inhibit bodily decomposition, such as mummification, or that rapidly remove soft tissue such as excarnation or dismemberment (Jans *et al.* 2004; Nielsen-Marsh *et al.* 2007; Booth *et al.* 2015; Booth 2016; Brönnimann *et al.* 2018; Papakonstantinou *et al.* 2020). There is an ongoing discussion over the origin of bacteria responsible for bioerosion to bone, specifically the relative roles of bacteria from the soil and putrefactive bacteria that originate from the decomposing organism itself (Kendall *et al.* 2018; Turner-Walker 2019; Eriksen *et al.* 2020). Certainly, it has been demonstrated that soil bacteria can produce at least minor bioerosion in buried bone under certain conditions, but variability in bacterial bioerosion across large numbers of archaeological bones from the same sites, soils, and sometimes even the same burial contexts challenge simple environmental explanations for variability in bacterial bioerosion, with early post-mortem treatment showing a higher correlation with bioerosion in archaeological bone (Jans *et al.* 2004; Nielsen-

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Table 3. Results of the histological analyses (all bone disarticulated)

Ref. Fig. 1	*Site*	*Context no.*	*Period*	*Feature/ deposit type*	*Element*	*Completeness (DE = discrete element)*	*Taphonomy/ modification*	*OHI*	*Waterlogged*	*Interpretation*	*Curation*
1	Bradley Fen	948	LBA	Fen edge near hoard	Cranium	DE	None	5	No/ episodic	Excarnation	No
2	Brigg's Farm	575	MBA	Ditch	Femur	DE	None	0	No	Primary burial	Yes
3	Clay Farm	2910	MBA	Ditch	Cranium	DE	None	0	No	Primary burial	No
4	E. Chisenbury	140	LBA–EIA	Posthole	R. radius	DE	Canid gnawing	0	No	Primary burial	No
4	E. Chisenbury	201	LBA	Occupation deposit	R. tibia	DE	Slight erosion	0	No	Primary burial	No
6	Greylake	2	LBA	Timber platform	Humerus	DE	Carnivore gnawing	5	Yes	Excarnation	No
7	Latton Lands	481	MBA	Waterhole	Cranium	DE	None	4	Yes	Excarnation	No C^{14} date – poor collagen preservation
7	Latton Lands	1751	MBA	Waterhole	Femur	Partial skele (with cranium)	Fresh break	5	No/ episodic	Excarnation	No
8	Needingworth Quarry	3284a	LBA	Buried soil	Femur	DE	Carnivore gnawing	1	No	Primary burial	No
13	NW Cambridge Site IV	250	LBA/ EIA?	Waterhole	Cranium	DE	None	5	Yes	Excarnation	No C^{14} date – poor collagen preservation
13	NW Cambridge Site V	3674	LBA/ EIA	Waterhole	Humerus	DE	None	5	No	Excarnation	No C^{14} date – poor collagen preservation
14	Shorncote Quarry	276	LBA	Waterhole	Cranium	DE	None	5	Yes	Excarnation	No C^{14} date – poor collagen preservation

Marsh *et al.* 2007; White and Booth 2014; Booth 2016; Brönnimann *et al.* 2018; Papakonstantinou *et al.* 2020). A prominent role for soil bacteria in bone bioerosion does not necessarily contradict correlations with early post-mortem treatment: it is possible for instance that the amount of soft tissue associated with a bone when it is buried in the ground may affect the extent to which soil bacterial are able to attack.

However, anoxic or waterlogged environments do confound the relationship between bioerosion and early taphonomy. Bones from these burial environments tend to show lower levels of bacterial attack, presumably because these environments inhibit osteolytic bacterial activity. As with all taphonomic evidence, histo-taphonomic analysis suffers from problems of equifinality, where several possible scenarios could explain the same result. Therefore, this analysis works best when considered alongside other taphonomic and contextual analyses to develop a likely scenario that could explain all observations and it comes with some uncertainties which might be clarified or refined with further research. Here, we therefore discuss the histo-taphonomic and radiocarbon dating results alongside macroscopic analyses to assess evidence for weathering, gnawing or post-mortem modifications such as cutmarks. Macroscopic taphonomic information was collected from osteological assessments provided in reports and publications on each site.

OVERALL OBSERVATIONS

Before proceeding with more in-depth analysis of individual sites, some general observations can be made for the dataset as a whole. Of the 22 Middle and Late Bronze Age non-mortuary deposits for which we generated dates for this project, four could be assigned to the Middle Bronze Age and the other 18 to the Late Bronze Age or Earliest Iron Age (Table 1); this is in line with other evidence for the increasing occurrence of human bone from non-mortuary contexts in the Late Bronze Age (Brück 2019). Combination of dates on samples from five out of 22 deposits (23%) produced poor agreement indices and failed the X^2 test, indicating that the human remains from these contexts were anomalously old; all these bones had been curated for a significant period of time. The remaining 17 deposits (77%) yielded bones which were not demonstrably older than their depositional context, although it is possible

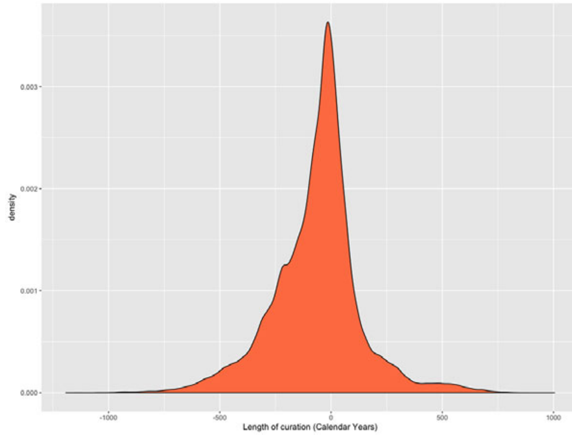

Fig. 2.
Density plot showing kernel distribution estimates for combined Middle and Late Bronze Age Intervals generated in BChron, representing estimates of human bone ages on deposition. Kernel distributions were generated using the geom_density function in the ggplot package in R Studio with default parameters: kernel = 'gaussian'; bw = 'nrd0'; scale = 'area' (R Core Team 2013)

that these had been curated for short periods of time which would not show up as anomalously old in our X^2 tests or chronological models. Calculation of the differences for all sites between date of death and date of deposition by combining Interval probability distributions generated in the BChron software in R for all mortuary deposits indicates a median period of curation of 43 years, with an interquartile range of 198 (Fig. 2; 1st quartile = –166, 3rd quartile = 32; Haslett & Parnell 2008; R Core Team 2013; see Booth & Brück 2020 for full methods). This is statistically significantly shorter than the median period of 95 years calculated for Chalcolithic and Early Bronze Age burials (Wilcoxon rank sum, $W = 4.2317^{10}$, $p < 0.01$; Brück & Booth 2022). We have argued elsewhere (*ibid.*) that the evidence from the Chalcolithic and Early Bronze Age for the re-opening of graves, the manipulation of the bodies they contained, and the deposition of curated human bone alongside the bodies of the more recently deceased, suggests that curated remains of this date were often figured as ancestors. The shorter median period of curation for the Middle and Late Bronze Age samples suggests that the meanings ascribed to human bone may have changed over the course of the Bronze Age, or that different categories of person are represented amongst the curated remains of the later period.

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With the exception of one articulated skeleton, all of our dataset comprised fragmentary disarticulated bone; in many cases deposits yielded just a single bone or bone fragment. Apart from one unidentifiable bone from the cremation deposit at Striplands Farm, all curated remains were skull and long bone fragments. These are, however, the most common skeletal elements recovered from sites of this period, whether or not they were curated (Brück 1995). The dataset included bones belonging to 19 adults and one child; out of these, the bones of three adults and one child were identified as curated. The preponderance of adults is notable; more children were curated in Chalcolithic and Early Bronze Age burials (Brück & Booth 2022). The sex of the human remains could be determined in just four of the 22 deposits we dated for this study. These included bones belonging to one male and three females (with one additional possible male and one additional possible female). This sample is very small, but the presence of both sexes is worth noting. None of the sexed bones had been curated.

Histological analysis indicated that five of the 12 samples displayed extensive bacterial bioerosion (OHI<2) while the remaining seven showed little or no bacterial attack (OHI>3). These results suggest at least two taphonomic trajectories are represented amongst the disarticulated remains we sampled (Fig. 3). This bimodal distribution of OHI scores is the same as has been recorded previously for bones from Bronze Age Britain and differs substantially from what has been observed in human burials from historic cemeteries where bodies were buried intact soon after death and where levels of bacterial attack were almost universally extensive (Booth *et al.* 2015; Booth 2016; Booth & Brück 2020).

All bones showing little or no bacterial bioerosion originate from contexts that were either waterlogged at the point of excavation or were recovered from contexts, such as waterholes, that could have been waterlogged over the period of deposition, at least intermittently (Table 3). Waterlogged and anoxic environments can interfere with levels of bacterial bone bioerosion through the inhibition of osteolytic bacteria, regardless of whether they primarily originate from within the organism or the soil (Booth 2016; Kendall *et al.* 2018). We cannot rule out that the burial conditions in these contexts had interfered with low levels of bacterial attack in these bones. However, some of the contexts from which these bones were recovered showed no signs of waterlogging at the time of excavation, suggesting that if they were waterlogged at all, this is likely to have been episodic and that there would have been long periods where the bones had lain in dry, aerobic soils. While bones from waterlogged contexts tend to show lower levels of bacterial attack, this can be variable, particularly in bones from episodically waterlogged contexts where levels of bacterial bioerosion can often be intermediate to high (Turner-Walker & Jans 2008; Hollund *et al.* 2012; Booth *et al.* 2016). Defleshed and excarnated bones show little or no bacterial bioerosion more often than bones recovered from episodically waterlogged environments (Booth *et al.* 2016), and therefore early taphonomy, rather than waterlogging provides a better explanation for the limited bacterial tunnelling we see in our samples.

The bimodal distribution of OHI scores among our samples are consistent with what has been observed previously in human bones from Bronze Age Britain, including material from aerobic burial environments, and so funerary practices specific to the Bronze Age represent a better explanation for the high OHI scores in our samples than the burial environment. All the deposits we examined histologically comprised discrete disarticulated bones, suggesting that they were not recovered from their primary depositional environment and that the bodies had originally decomposed elsewhere. Therefore, waterlogging of the contexts from which they were recovered would not have affected bodily decomposition, and the low levels of bacterial bioerosion observed in these bones would suggest that they were skeletonised by processes such as excarnation which did not involve soil burial. One caveat is that if bones had been retrieved from nearby burials from the same wet landscapes with high water tables, it is possible that these burials had decomposed within waterlogged graves which affected bacterial attack to the bone.

The extensive bacterial tunnelling observed in five of the samples (Table 3) is found commonly in bones from bodies that were buried intact soon after death and exposed to extensive soft tissue decomposition. Therefore, the simplest explanation for these patterns of attack is that these bones derived from primary burials. Deposition of bodies in sheltered or covered environments, for instance caves or covered pits, can produce similarly high levels of bacterial bioerosion to bone, as these contexts provide some protection from invertebrates which would otherwise rapidly skeletonise exposed bodies (Booth 2016; Booth &

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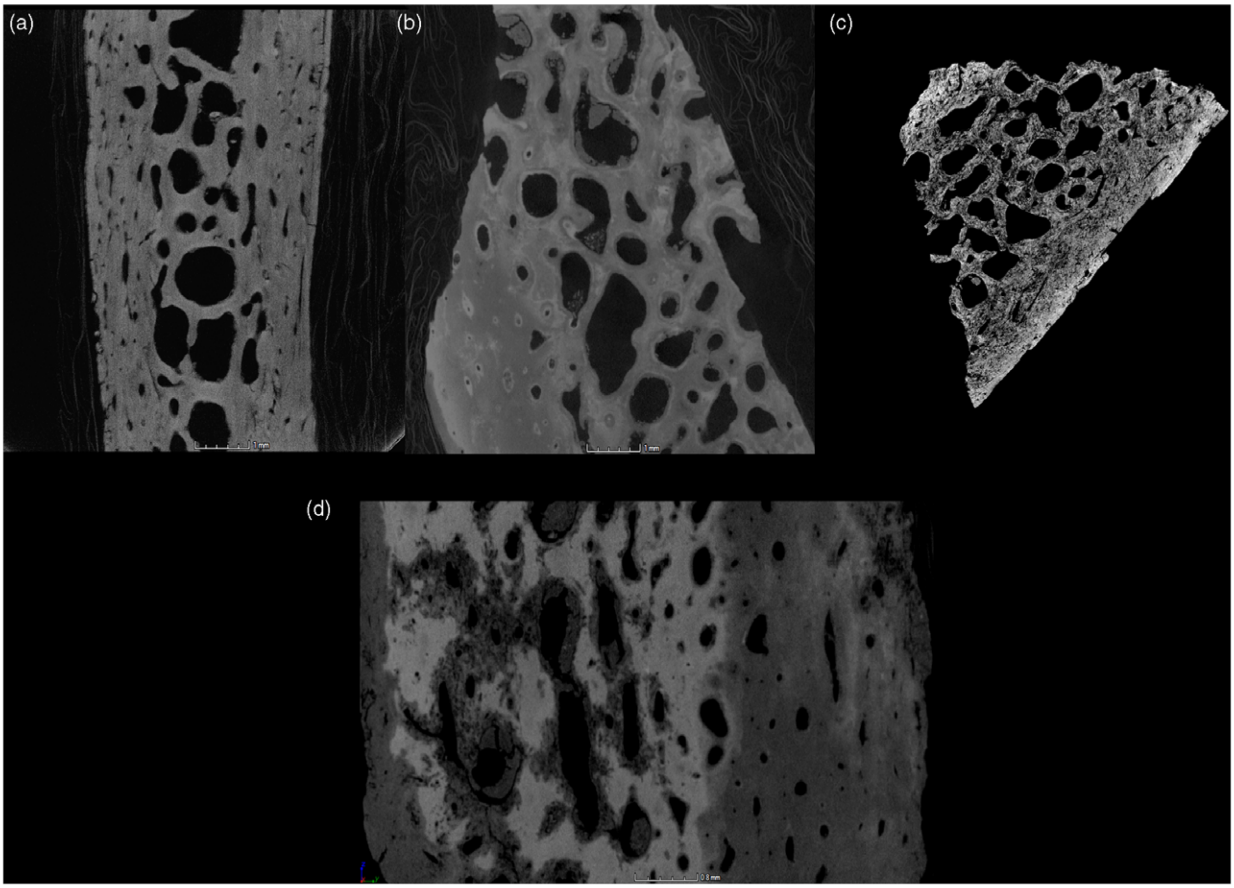

Fig. 3.
'Virtual' transverse thin sections of four archaeological human bone samples showing variable levels of bacterial bioerosion generated by micro-CT; a. cranial fragment F.948 from Bradley Fen, showing excellent histological preservation with no signs of bioerosion (OHI=5); b. cranial fragment F.250 from NW Cambridge Site IV also showing excellent histological preservation with no signs of bioerosion (OHI=5); c. cranial fragment from East Chisenbury context 201 showing extensive bacterial bioerosion of the internal bone microstructures (OHI=0); d. cranial fragment from Latton Lands context 481 showing minor bacterial bioerosion concentrated around the diploë (OHI=4)

Madgwick 2016). In contrast, the excellent preservation of the bone microstructure in the remaining seven samples suggests that these had been subject to a form of post-mortem treatment that inhibited their exposure to bodily decomposition. Practices which could be responsible include dismemberment, defleshing, excarnation, or mummification (Jans *et al*. 2004; Fernandez-Jalvo *et al*. 2010; White & Booth 2014; Booth 2016). Problems of equifinality means distinguishing between these different treatments is difficult using the histo-taphonomic evidence alone. Determining which kind of treatment was responsible is only possible through appraisal of the histo-taphonomic evidence alongside contextual information and other taphonomic factors such as state of articulation, presence of cutmarks or carnivore gnawing.

DEPOSITIONAL PROCESS AND THE TREATMENT OF THE DEAD IN THE MIDDLE AND LATE BRONZE AGE

In order to assess the post-mortem trajectories of human remains, let us turn now to examine what the data from individual sites reveals, starting first with those of Middle Bronze Age date. Just one of the four samples of Middle Bronze Age date had been curated. This was a disarticulated human femur recovered from one of a series of ditches that defined a

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settlement at Brigg's Farm, Thorney, Cambridgeshire (Pickstone & Mortimer 2011). It was between 325 and 209 years old (at 68% confidence) when it was deposited in the ditch (Fig. 4; note that throughout this paper, 68% confidence intervals are quoted in the text to provide a better sense of probable 'true' values, but 95% confidence intervals are also provided in the figures). Histological analysis was carried out on this bone and it showed high levels of bacterial bioerosion. We can therefore suggest that it was originally part of a complete inhumation burial that was subsequently disturbed or disinterred. In contrast, histological analysis of a femur from Latton Lands, Wiltshire (Stansbie & Laws 2004), indicated very low levels of bacterial attack, consistent with mummification or excarnation. This formed part of the partial disarticulated remains of an adult female found in a Middle Bronze Age waterhole. An unusual loomweight decorated with four impressed lines of round-toothed comb impressions was recovered from the same feature. Combination of a date on her femur and a date on animal bone from the same context produced good agreement indices and passed the X^2 test, indicating that the date of death and date of deposition were not significantly different. The disarticulated state of the remains, and the lack of a significant offset between date of death and date of deposition suggests that the body was excarnated prior to deposition; there are no cutmarks on the bones to suggest other modes of defleshing or dismemberment.

At Clay Farm, Trumpington, Cambridgeshire, we dated one of a series of fragments of human bone from a Middle Bronze Age settlement and field system (Fig. 5; Mortimer & Phillips 2012). This was a skull fragment, possibly belonging to an adult male, found in the terminal of a Middle Bronze Age field boundary. It had been deposited in the upper fill of the ditch above the articulated burial of a dog. Histological analysis of this bone indicated that it was originally from a primary burial. We placed the date in a phase model with radiocarbon dates that had previously been obtained from an animal bone and a charred seed from earlier stratigraphic units in the same ditch. The phase model produced good agreement indices, indicating that the skull fragment was not very old when it was buried. It is therefore possible that the bones of this individual were deliberately disinterred for re-use and/or redeposition. Other finds of human remains from the same site include an articulated skeleton found near the base of a pit and it is possible that the skull fragment we dated was recovered from a deposit of this sort.

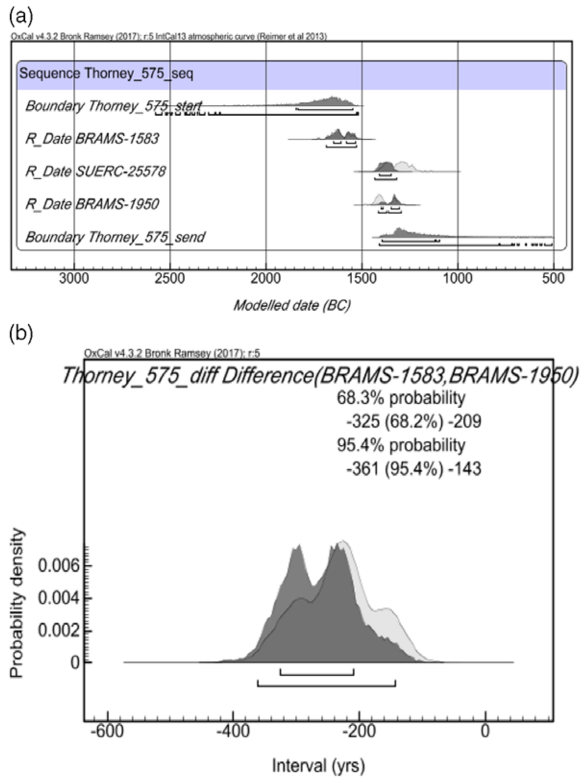

Fig. 4.
a) Chronological model of the radiocarbon dates from Brigg's Farm; b) probability distribution of the difference between the radiocarbon dates from the disarticulated femur (BRAMS 1583) and a fragment of animal bone from the same context (BRAMS 1950). SUERC 25578 is a disarticulated animal bone from a stratigraphically earlier context. Note that in this figure and other probability distributions presented in this paper, the light grey distribution represents the unmodelled difference, comparing the dates directly with no assumptions. The dark grey distribution represents the modelled difference (posterior density estimate), comparing the dates within the constraints applied by assumed or observed relationships with other dated materials included in the model. Quoted differences reflect modelled differences

The settlement at Clay Farm also yielded an undated skull fragment with a deep cut- or chop-mark from the terminal of an enclosure ditch. Other sites of Middle Bronze Age date have also yielded possible evidence for inter-personal violence. For example, the articulated body of an adult female had been deposited head-first into a Middle Bronze Age waterhole at Bradley Fen, Cambridgeshire (Fig. 6; Knight &

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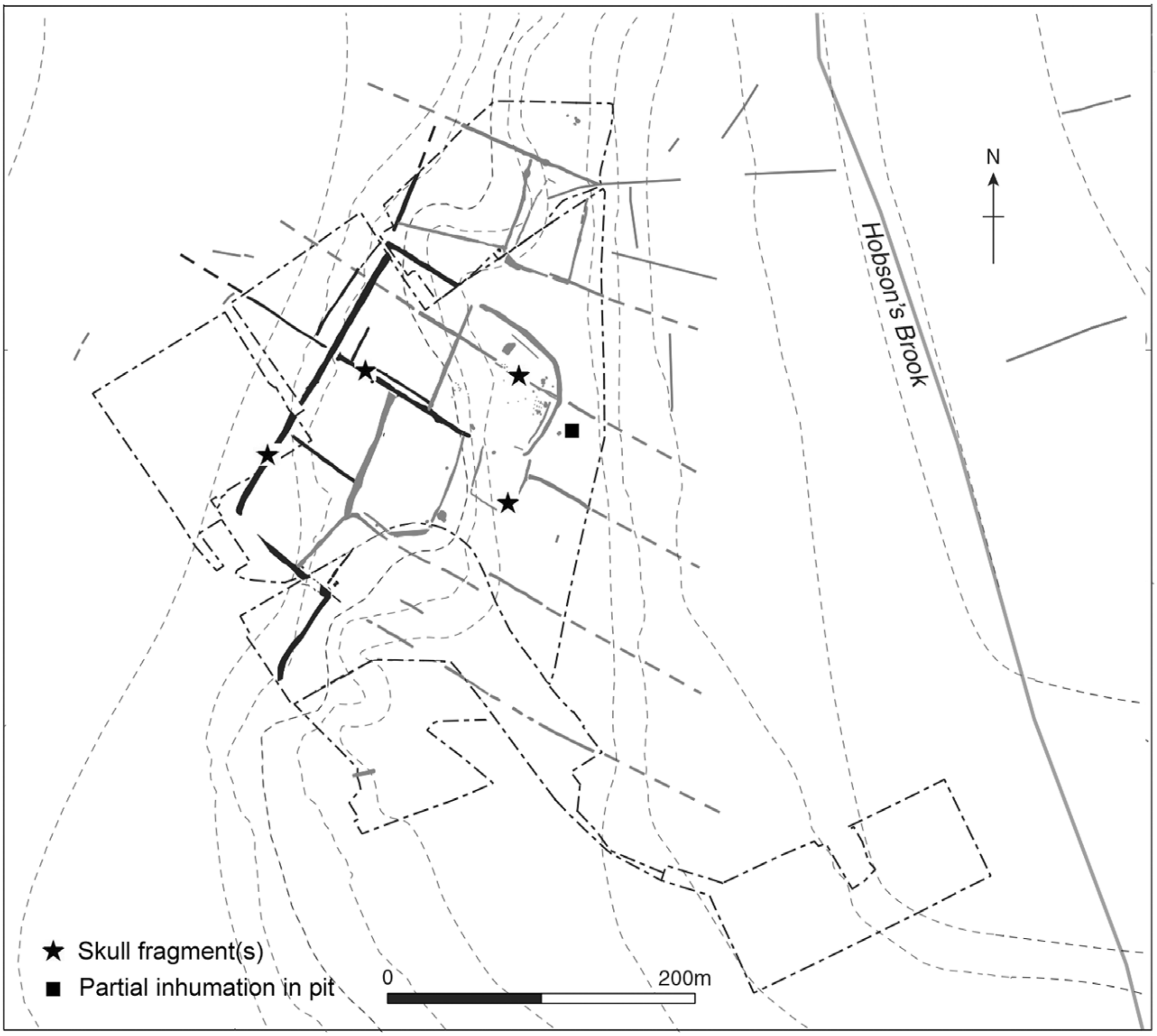

Fig. 5.
Location of the human remains from the settlement and field system in Area E, Clay Farm, Cambridgeshire (© Oxford Archaeology)

Brudenell 2020, 170–1; skeleton 853 in Table 1); the position of her hands and feet suggest that they may have been bound. A radiocarbon date from her left metacarpal indicated that this burial was not significantly older than the articulated skeleton of a dog from a spread of organic material immediately above her.

The rest of the human bone that we radiocarbon dated was Late Bronze Age in date, reflecting the more common occurrence of bone from non-mortuary contexts on sites of this period. Some of this appears to have been curated over a considerable period. At Striplands Farm, Cambridgeshire, *c.* 225 g of cremated human bone (representing just a small proportion of a complete body) was deposited in a pit that formed part of a scatter of Late Bronze Age pits, wells, waterholes, and buildings including a round-house and four-post structure (Evans *et al.* 2011); this was between 41 years and 1 year older (at 68% confidence) than burnt animal bone from

Fig. 6.
The body of a woman deposited in waterhole 853 at Bradley Fen, Cambridgeshire (© Cambridge Archaeological Unit)

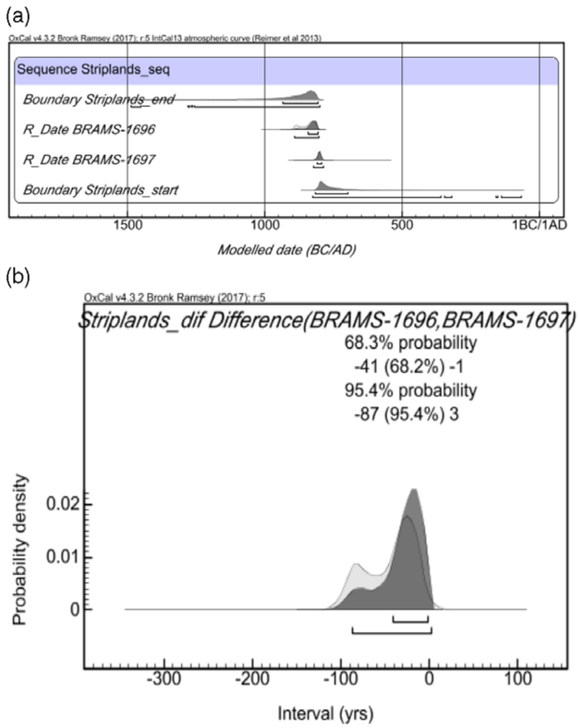

Fig. 7.
a) Chronological model of the radiocarbon dates from Striplands Farm; b) probability distribution of the difference between the radiocarbon dates from burnt human bone (BRAMS 1696) and burnt animal bone from the same context (BRAMS 1697)

Fig. 8.
Burial 2638 from Cladh Hallan, South Uist (reproduced with permission of Mike Parker Pearson)

the same context (Fig. 7). Human bone that had been curated over a long period of time, particularly if this belonged to deceased members of the household, may have had particularly potency when incorporated into deposits relating to the identity and lifecycle of the household group, such as foundation or abandonment deposits (Brück 1999; 2006). In this case, the period of time for which the bone had been curated suggests that it belonged to a known individual.

It has been suggested that the well-known mummy (burial 2638) from Cladh Hallan on South Uist in the Western Isles was several centuries older than the house itself (Fig. 8; Parker Pearson *et al.* 2005). This ‘body’ comprised elements from three different individuals combined to look like a single person, suggesting lengthy and complex post-mortem manipulation of the remains. It was buried along with a second body (burial 2613) that combined skeletal elements from a man and a woman beneath the floor of house 1370 (Hanna *et al.* 2012). Analysis performed for this project of previously obtained radiocarbon and OSL dates indicates that only the tibia from burial 2638 showed poor overall agreement with the other dates because it was too old. This bone was between 401 and 282 years older (at 68% confidence) than charred barley from the floor of the house (Fig. 9c). Dates from the mandible and cranium of burial 2638 and a femur belonging to burial 2613 were older than contextual dates, but not statistically significantly so. This does not contradict suggestions that these bones and bodies had been curated, as it is possible they had been retained for shorter lengths of time, within radiocarbon dating error. In all cases, there was extensive osteological and taphonomic evidence that these remains were already old before they were deposited (Parker Pearson *et al.* 2005; 2007). When placed in a chronological model which assumes these bones were already old when they were deposited, the cranium and mandible from burial 2638 were 294–158 and 284–137 years old (at 68% confidence) when they were deposited while the femur from burial 2613 was 153–39 years old (at 68% confidence) (Fig. 9).

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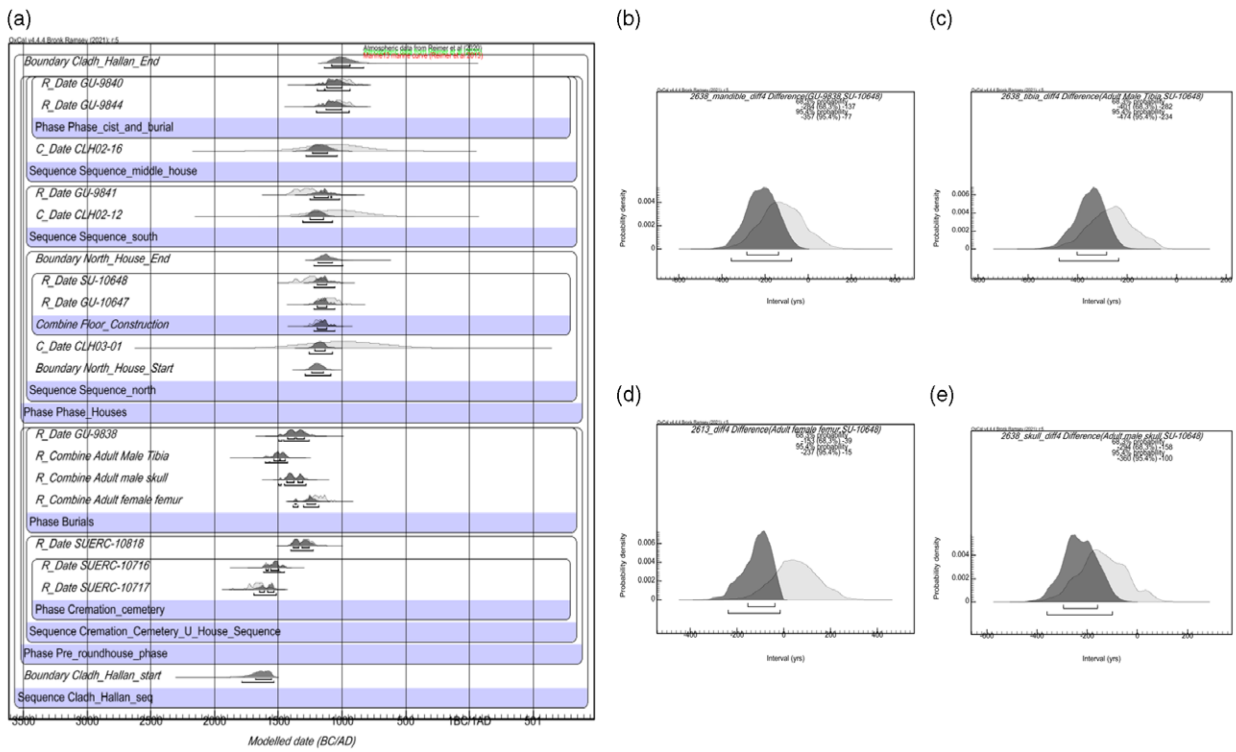

Fig. 9.
a) Chronological model of the radiocarbon dates from Cladh Hallan; b–d) probability distribution of the difference between the radiocarbon dates from human bone from burials 2638 and 2613 and burnt barley (GU 10648) dating the construction of the house in which these 'bodies' were deposited

In contrast to the bodies from Cladh Hallan, which were clearly intentionally deposited, the majority of human remains from non-mortuary contexts of Late Bronze Age date comprise stray fragments of disarticulated bone. Although some of this fragmentary material may have entered the archaeological record through accidental processes of incorporation, disturbance, or redeposition, it has been argued elsewhere that evidence for the selection of particular bodily elements and for deposition in certain types of contexts suggests that disarticulated fragments of human bone were often deliberately deposited (Brück 1995; for similar practices elsewhere in Europe, see eg Rittershofer 1997; Menotti *et al.* 2015). It should nonetheless be borne in mind that a variety of different taphonomic processes may have resulted in the deposits discussed below.

Dating of disarticulated bone from Late Bronze Age settlement contexts indicates potential variability in the trajectories followed by human bone prior to deposition. A fragment of frontal bone belonging to an adult male from Eye Quarry near Peterborough, Cambridgeshire, was found in the basal deposits of a pit (Patten 2004). This feature was cut into the top of an earlier ditch defining a Middle Bronze Age droveway. There was a possible blade injury adjacent to the metopic suture. A mandible belonging to an older subadult or young adult was found in another pit that formed part of a pit cluster on the western edge of the settlement. Dating of animal bone from the same two contexts indicated that neither fragment of human bone had been curated for a long period prior to deposition.

At East Chisenbury, Wiltshire, recent excavations of the enclosure ditch surrounding the well-known midden, as well as post-holes and other features immediately adjacent to it, produced several fragments of human bone (Andrews 2021; for discussion of the overall date range of the midden itself, see Waddington *et al.* 2019). The disarticulated ulna of a child aged 8–12 was deposited in the enclosure ditch (middle fill 128). This had been curated and

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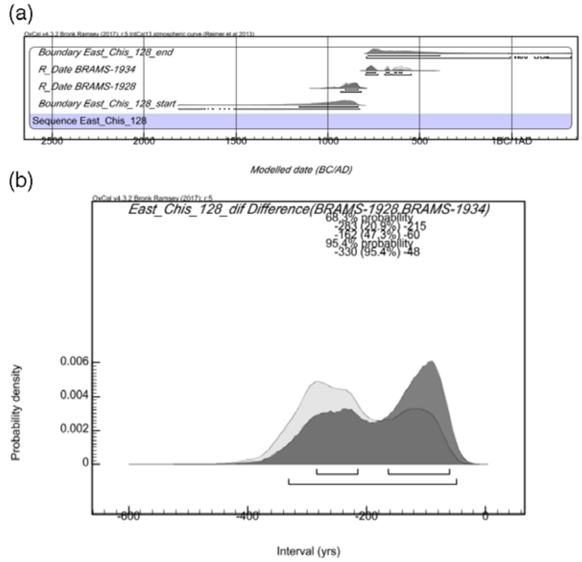

Fig. 10.
a) Chronological model of the radiocarbon dates from East Chisenbury context 128; b) Probability distribution of the difference between the radiocarbon dates from the disarticulated ulna (BRAMS 1928) and a cattle mandible from the same context (BRAMS 1934)

was 283–60 years older than its depositional context (at 68% confidence) (Fig. 10). Elsewhere on the site, a discrete deposit (deposit 152) of animal bone that appeared to have been placed directly on the old ground surface yielded three skull fragments belonging to a young adult, possibly female. In contrast to the juvenile ulna, a date on one of the skull fragments suggests that it was not significantly older than the animal bone from the same context. Evidence that this individual may have suffered a violent death is indicated by injuries to the skull inflicted by a pointed implement or weapon around the time of death (but possibly shortly thereafter). Three skull fragments and a fragment of tibia, probably all belonging to the same individual, another young adult female, were recovered from an occupation deposit (layer 201). The date of one of the skull fragments was also consistent with that of its depositional context. Histological analysis of this sample indicates that the internal bone microstructures had been subject to the high levels of bioerosion usually characteristic of primary inhumation burials. The skull fragment may therefore have been disinterred from a complete burial. An adult radius from a post-hole also showed extensive bacterial tunnelling; in this case, the animal bone we dated from the same context was significantly older than the human bone. The radius showed signs of carnivore gnawing, which has previously been identified as a possible indication of exposure and excarnation (Carr & Knüsel 1997), contrasting with the histological evidence for possible primary burial. However, it is possible that this bone had a complex taphonomic history involving primary burial or burial in a sheltered environment, followed by exposure before it was redeposited (Booth & Madgwick 2016).

Further evidence for varied practices involving manipulation of human remains can be identified at other midden sites. At Potterne in Wiltshire, for example, 139 disarticulated fragments of human bone were recovered from the midden (McKinley 2000, 99). These included a significant proportion of skull fragments, while among the axial bones there was a clear preponderance of elements from the right-hand side. We sampled three skull fragments and one mandible fragment from three different phases of the site at Potterne for dating, adding these to a chronological model built from pre-existing radiocarbon dates on charcoal and animal bone. Only the mandible fragment was anomalously old (Fig. 11); this had been curated for between 210 and 96 years prior to deposition (at 68% confidence). Both the curated mandible and one of the skull fragments from Potterne had been deliberately cut or shaped into roughly rectangular shapes that would fit in the palm of a hand (Waddington 2009, 328, 333). The edges to these 'artefacts' were fresh, suggesting that the curated mandible was kept in a protected environment prior to deposition; it might have been wrapped, for example, or kept in a container. In contrast, the skull fragment was probably buried soon after death.

Cutmarks were also identified on the three skull fragments we dated from Stanton St Bernard, Wiltshire; in this instance, modification of the bone appears to have been carried out on already disarticulated fragments (D. McOmish, pers. comm.). All three skull fragments were weathered, suggesting that they were exposed to the elements, either during excarnation or display. No other datable material was available from this site, but a phase model produced good agreement indices between the radiocarbon dates on the human bone and the calendrical date range for the midden inferred from associated pottery typologies (800–700 BC; D. McOmish, pers. comm.). This suggests a relatively short interval between death and deposition, although this could have been

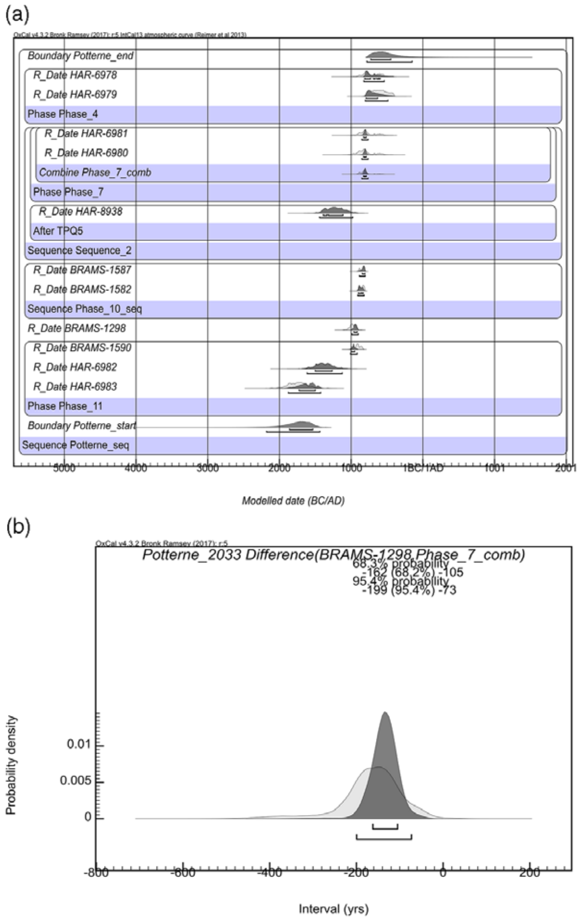

Fig. 11.
a) Chronological model of the radiocarbon dates from Potterne; b) probability distribution of the difference between the radiocarbon dates from the mandible fragment (BRAMS 1298) and the combined dates on charcoal from phase 7 (HAR 6980 and 6981). The model shown here assumes that the mandible was curated and so is older than phase 4, the context from which it was recovered. The other three skull fragments were from lower levels of the midden: BRAMS 1582 and 1587 were on two skull fragments from phase 10 and BRAMS 1590 was on a skull fragment from phase 11. The remaining Harwell dates are on charcoal from phases 4 and 11

anything from a few years to several decades. The complex taphonomies of the human bone from middens may reflect the episodic nature of activities at many of these sites (Madgwick & Mulville 2015b; Madgwick 2016), with periods of intensive occupation interspersed with much lower levels of activity resulting in repeated acts of handling and manipulation prior to final deposition. The disarticulated character of the bone from Stanton St Bernard and other middens, the evidence for deliberate modification of some pieces and the selection of specific components of the body for display and deposition suggests that such finds are not a direct reflection of mortuary practices but derive from a variety of other social and ritual activities.

Looking beyond core zones of settlement activity, disarticulated human bone, particularly skull fragments, has been found in many Late Bronze Age waterholes. We sampled three disarticulated bones from Late Bronze Age–Earliest Iron Age waterholes for radiocarbon dating. These included a single fragment found in a waterhole at Site IV, Northwest Cambridge, Cambridgeshire (Evans & Newman 2010), and one of nine skull fragments from a waterhole close to a Late Bronze Age round-house at Shorncote Quarry, Gloucestershire (Brossler *et al.* 2002). The fragments from the latter site probably all belonged to the same individual, identified as an adult, possibly male, suggesting that a large portion of the complete skull was originally deposited in this feature. At Site V, Northwest Cambridge, a single unburnt adult humerus was recovered from a waterhole in a field system of Late Bronze Age/Early Iron Age date (Brittain 2014). Unfortunately, all three samples failed due to poor collagen preservation but histological analysis indicated that all were very well preserved. In these instances, the presence of just a single fragment or a few pieces of bone suggests that the bodies to which they originally belonged had decomposed elsewhere and that the preservation of the bone can be accounted for by a process such as excarnation rather than being due to deposition in waterlogged sediments.

Given the significance of wet places in prehistory, as well as the preponderance of skull fragments from waterholes, it is likely that human remains were deliberately selected for deposition in such contexts. We sampled two pieces of human bone from other wet contexts. At Bradley Fen, Cambridgeshire, three fragments of adult human skull were found in peat at the fen edge 4 m north of a hoard of spears, swords, ferrules, and chapes (Fig. 12; Appleby 2005; Knight & Brudenell 2020, 182; context 948 in Table 1). A radiocarbon date on one of the skull fragments is consistent with dates previously obtained on a wooden spear shaft and on peat from within and around the hoard, indicating that it was not curated over a long period of time. Again, histological analysis

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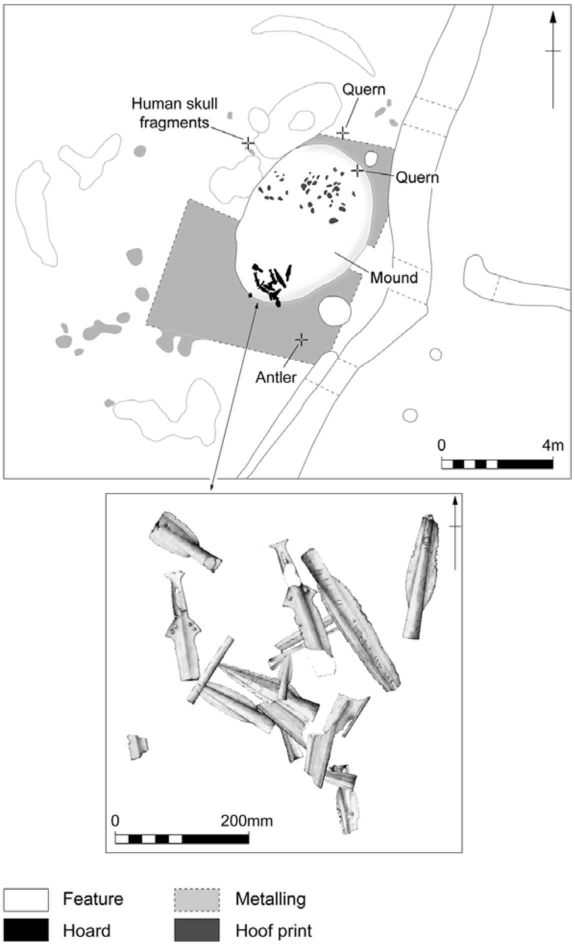

Fig. 12.
Location of the skull fragments, hoard, and other finds in the fen edge at Bradley Fen, Cambridgeshire (© Cambridge Archaeological Unit)

of the skull fragment indicates excellent preservation of the bone microstructure suggestive of post-mortem treatment such as excarnation. At Greylake, Somerset, several disarticulated human bones were recovered from a deposit associated with the construction of a timber alignment or platform that stood in what was an area of shallow freshwater during the Bronze Age (Brunning 1997). A number of white quartz pebbles, two sheep mandibles, and some broken pottery were found in the same layer. We sampled a human left humerus and the two sheep mandibles for radiocarbon dating. The phase model sequence, which included previously obtained dendrochronological dates for the wooden structure, showed good overall agreement, indicating that the human bone was not curated for a lengthy period, although its disarticulated condition suggests that some years elapsed between death and deposition. Histological analysis demonstrated that this was very well-preserved. As noted above, bacterial bioerosion of bone can be arrested through the deposition of a fleshed body in a waterlogged environment and, at first glance, this might be viewed as the most parsimonious explanation of the excellent condition of this humerus given the presence of several other human bones in the same context. However, carnivore gnawing to the humerus indicates that the bones were more likely retrieved from a body that had been excarnated elsewhere. Interestingly, the date from one of the sheep mandibles was anomalously old, suggesting that this may have been curated; it is widely accepted that many of the objects found in association with timber platforms and alignments, such as the well-known site at Flag Fen, Cambridgeshire (Pryor 2005), were deliberately selected for deposition in the water.

It is not clear whether the human remains found in a large pit at Cliff's End Farm (Kent; McKinley *et al.* 2014) should be viewed as the residues of mortuary activities or other ritual practices. The excavators favour the former interpretation, although similar deposits of articulated, partially articulated and disarticulated human bone are widely known from settlement contexts, albeit rarely representing so many different individuals. The pit yielded five complete and partial articulated burials (Fig. 13). One of the articulated burials, an elderly female, had suffered a number of sword blows to the back of the head (burial 3675); another was missing its right hand and most of its skull (burial 3674); and the skull of a third had been twisted round, probably after the body had partially decomposed (burial 3676). More extreme forms of post-mortem manipulation are indicated by the articulated but incomplete body of an adult male (burial 3673). This comprised the skull, spine, left half of the ribcage, and upper left arm arranged as a bundle; the awkward relative positioning of the different elements suggested that the body must have been partially decomposed when it was deposited in the pit. Substantial numbers of disarticulated bones representing multiple people were also found; the presence of clearly definable groups, particularly skulls and long bones, suggests deliberate deposition rather than accidental inclusion.

The published chronological phase model (McKinley *et al.* 2014) suggests that the complete

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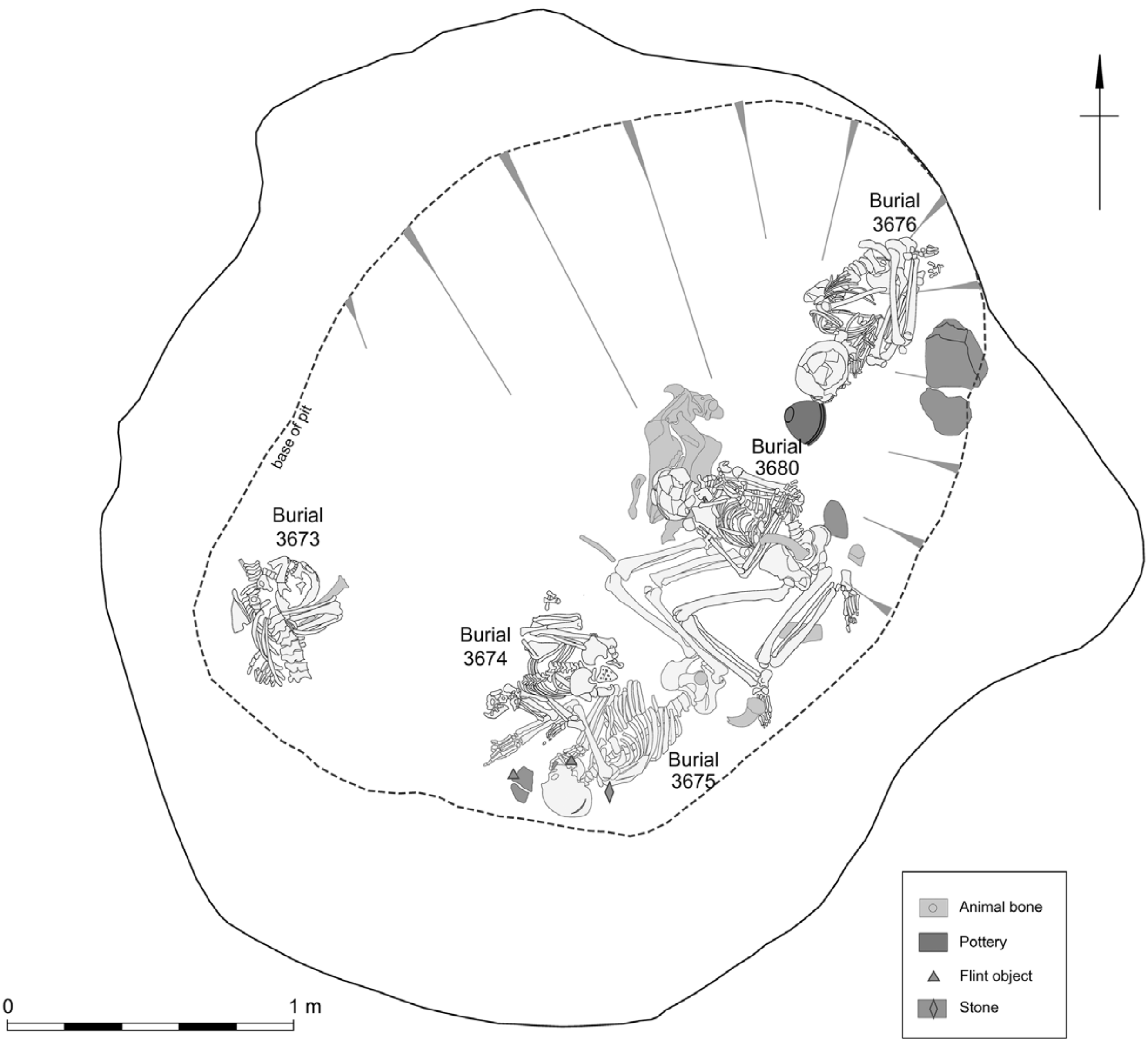

Fig. 13.
The burial pit at Cliffs End Farm, Kent (© Wessex Archaeology)

and partial skeletons may have been deposited within ten years of each other. We did not obtain any new radiocarbon dates for Cliff's End Farm, but interrogated radiocarbon dates that had already been obtained within the chronological model developed by McKinley and colleagues. Only one of the human bones was anomalously old (ON110); this was a disarticulated adult left femur which was between 110 and 40 years older (at 68% probability) than the articulated burials from the feature (Fig. 14). It is possible either that this bone was curated or that it was disinterred and redeposited. Canid gnawing, longitudinal fissures, bleaching, and loss of trabecular bone suggests that some of the other disarticulated remains from the pit were exposed (McKinley *et al.* 2014), consonant with the results of some of our histological analyses from other sites. Isotopic analysis indicates that some of the bones deposited in the pit belonged to non-locals, perhaps from as far away as Scandinavia or the Mediterranean. Non-locals were

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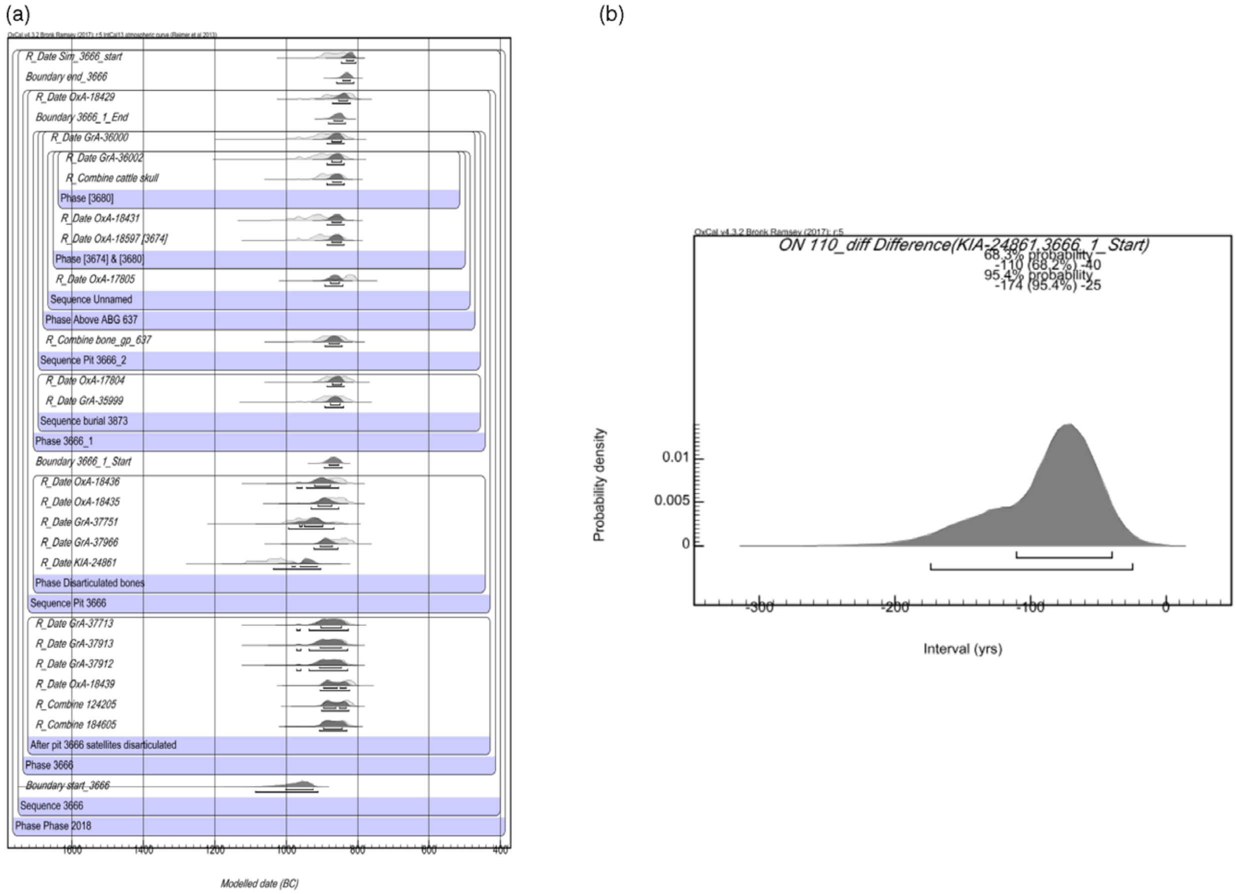

Fig 14.
a) Chronological model of the radiocarbon dates from Cliffs End Farm; b) probability distribution of the difference between the radiocarbon dates from the disarticulated femur (ON110: KIA 24861) and the modelled start date for deposition in the mortuary pit based on the dates of articulated human remains and disarticulated animal bone from the base of this feature

identified both among the complete/near-complete bodies and the disarticulated skeletal elements, and Needham (2014, 221) suggests that, in some cases, it may have been curated bones rather than living individuals who travelled.

Unusual and complex deposits such as that from Cliffs End Farm cannot be compared directly with the more common occurrence of single fragments of bone or small groups of disarticulated elements at the other sites discussed above. However, the detailed contextual, taphonomic, and osteological analyses of the human remains from the site (McKinley *et al.* 2014) provide clear evidence for prolonged periods of interaction with the dead as well as for varied forms of post-mortem manipulation, removal of bones from otherwise complete burials, and deliberate redeposition of disarticulated remains, all of which we have suggested may explain some of the other deposits already described in this paper.

DISCUSSION

Although there is clear evidence for the curation of human bone in non-mortuary contexts dating to the Middle and Late Bronze Age, the majority of human remains included in this analysis had not been curated for a significant length of time. The median period of 43 years between date of death and date of deposition is significantly less than the period of 95 years calculated for possible curated bone from Chalcolithic and

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Early Bronze Age mortuary contexts (Brück & Booth 2022). Some bone was curated for long periods of time, for example the femur from Brigg's Farm, Thorney, Cambridgeshire (Pickstone & Mortimer 2011), which was between 325 and 209 years older than the ditch deposits from which it was recovered. However, most bone was retained for much shorter periods prior to deposition. Of course, human remains that had been curated for a few months or years would not show up as anomalously old in our X^2 tests, so curation may in fact have been more common than our analysis here suggests.

The histological and macro-taphonomic evidence suggests a variety of possible trajectories for bone from non-mortuary contexts of Middle and Late Bronze Age date. Seven out of 12 bones subjected to histological analysis as part of this project displayed excellent preservation of the internal bone microstructures: the fragmentary and disarticulated state of these remains is suggestive of excarnation, and this is supported by the presence of carnivore gnawing to the humerus fragment from Greylake in Somerset. However, the other five bones showing extensive bacterial bioerosion were most likely retrieved from primary burials. This was an unexpected result, as relatively few primary inhumations are known from Middle or Late Bronze Age contexts. All five of these bones were disarticulated, and in only one case was there more than one element belonging to the same individual present. In several cases, evidence for weathering or carnivore gnawing suggests protracted periods between exhumation and final deposition. Although accidental disturbance of earlier burials cannot be ruled out, the evidence for modification of bone from other sites discussed in this paper as well as the selection of particular skeletal elements for deposition (Brück 1995) suggests that bone was deliberately sourced for a variety of non-mortuary ritual practices.

The large pit at Cliffs End Farm, with its evidence for protracted interaction with human remains in a variety of states of decomposition (McKinley *et al.* 2014), provides valuable insights into the kinds of contexts from which bones might have been retrieved for redeposition elsewhere. There is no evidence for re-excavation of the pit between episodes of deposition, and this suggests that the feature may have been left open with perhaps a temporary cover in place to protect the bodies from the elements (*ibid.*). This kind of sheltered deposition in covered pits or perhaps mortuary structures is likely to have prevented bodies from being rapidly skeletonised by scavengers and invertebrates, meaning the bones would have been exposed to extensive bacterial soft tissue decomposition (Booth & Madgwick 2016). Thus, although it is possible that some of the histological results reported here can be explained by the burial of complete bodies followed by the reopening of the grave, they could also indicate the deposition of bodies in covered pits or mortuary houses; after a period of time, defleshed bone may have been removed from these contexts for subsequent manipulation and redeposition elsewhere. Although the sample is small, most disarticulated bones displaying high levels of bioerosion were found in and around settlements. These may have derived from mortuary houses or other sheltered contexts where the bodies of deceased kin were temporarily stored. In contrast, bones that showed histo-taphonomic indicators of having been excarnated were deposited across the wider landscape in contexts such as waterholes and wet places.

The curation of bone over relatively short timeframes suggests that the original identities of the people to whom the bones once belonged would have been known. What those identities might have been is an interesting question. We have suggested elsewhere that curated bones from Early Bronze Age graves belonged to individuals identified as ancestors and were retained as ancestral relics (Brück & Booth 2022). The shorter periods of curation during the Middle and Late Bronze Age suggest that bone may now have been curated for other reasons and that it might have derived from other categories of person. The evidence of peri-mortem violence, for example the skull fragment with the cutmark from Clay Farm, Cambridgeshire (Mortimer & Phillips 2012) and the possible blade injury to the frontal bone from Eye Quarry, Cambridgeshire (Patten 2004), suggests that human remains from settlement contexts may sometimes have belonged to enemies or to people identified as socially deviant. The display and deposition of heads may have been an effective method of intimidation and humiliation; so too the act of disarticulation perhaps functioned as a means of desecrating the memories of the dead. Neither of those bones from Clay Farm or Eye Quarry could be sexed, but it was not just men who were victims of violence, as the elderly woman with sword blows to her skull at Cliffs End Farm, Kent, demonstrates (McKinley *et al.* 2014). In contrast, no similar marks were identified on any of the bones of Chalcolithic and Early

Bronze Age date we examined previously (Brück & Booth 2022).

The suggestion that some of the bones selected for manipulation and deposition may have belonged to enemies or outcasts is perhaps supported by their frequent retrieval from contexts such as settlement boundaries and entrances, as well as locations such as bogs and caves – liminal spaces between social categories and between the world of the living and the otherworld of spirits, gods, and ancestors. The human bone deposited in such contexts may have been regarded as an ambivalent substance, belonging to dangerous others and redolent of processes of transformation and transgression (Brück 1995). Indeed, the deposition of skull fragments at entrances is reminiscent of Iron Age skull cults which involved the decapitation and display of heads that may have belonged to vanquished enemies (Armit 2012). The lack of evidence for genetic kin in a recent analysis of ancient DNA from British Late Bronze Age human remains (Patterson *et al*. 2022) perhaps supports the suggestion that kinship was relatively unimportant in determining which bones were selected for deposition during this period. This contrasts with evidence from Chalcolithic and Early Bronze Age burials where genetic kin have been identified and it can be argued that kinship was a significant factor in shaping mortuary practices including curation of human bone (Booth *et al*. 2021; Brück & Booth 2022).

However, the variety of post-mortem trajectories described in this paper indicates that human remains from non-mortuary contexts of Middle and Late Bronze Age date are unlikely to have derived from a single category of people. Late Bronze–Earliest Iron Age midden sites nicely exemplify the challenges of interpreting such finds. These sites were gathering places where large numbers of people came together for a variety of activities including feasting, exchange, and lifecycle rites (McOmish 1996; Lawson 2000; Waddington 2010; Madgwick & Mulville 2015a; Brück & Davies 2018). In such a context, the display and manipulation of bones belonging to enemies might have played an important role in the expression of regional identities and affiliations. Alternatively, bones belonging to people who had been the victims of violence may have been employed in practices designed to ameliorate inter-community conflict.

However, most of the cutmarks on bones from midden sites were not evidence for violence but for forms of post-mortem processing and manipulation. It is important to bear in mind that our own abhorrence of bodily dissolution is rooted in post-Enlightenment ideologies of the individual (Morris 1991). In Middle and Late Bronze Age Britain, the fragmentation of the body may not have been viewed in a negative way. In other words, we should not assume that processes of bodily disaggregation indicate attitudes of disrespect or were applied only to enemies or outcasts. Instead, the ubiquity of disarticulated human bone both in middens and in other settlement contexts suggests that communities were used to encountering and handling human remains and may not have viewed them with fear or disgust. Indeed, the presence of human bone within and around household space suggests that at least some of these were the 'familiar' dead – ancestral remains that helped to generate a sense of belonging, identity, and continuity among the living (Brück 1995).

Prolonged handling of the body over many years may also suggest intimate links between the living and the dead. The remains of both men and women were deposited in the middens, settlements, and other contexts described in this paper, suggesting that gendered identity was articulated in a variety of different ways in relation to ideas of kinship, descent, and belonging; it was not the case, for example, that only the bones of male 'ancestors' were deposited in such locations. The relative lack of children is notable, however, and contrasts with the evidence from the Chalcolithic and Early Bronze Age when the bones of children were among those whose remains were curated (Brück & Booth 2022). At midden sites, where communities came together for feasting and ritual, we can suggest that bones belonging to known and esteemed kin might have been selected as a means of foregrounding the identities of the living. Alternatively, the identity of the deceased person may have been unimportant: bone may have been curated for its ability to speak of the symbolism of death and rebirth central to the creation of monumental middens (Brück 2006) rather than for its association with a known individual.

The deposition of human bone in waterholes raises similar questions and can be interpreted in various ways. In some cases, such fragments were deposited alongside with other interesting finds such as complete wooden and ceramic vessels, portions of shale armlets, casting mould fragments, and complete and partial animal burials (eg Jackson & Napthan 2015). Similar finds are most commonly recovered from

https://doi.org/10.1017/ppr.2022.8 Published online by Cambridge University Press

settlements and might be interpreted as domestic refuse. If so, then human bone from the same contexts may have signified the abject and the other: as material that no longer fulfils a social role, refuse can be viewed as dirty and dangerous (Douglas 1966; Okely 1983). It is possible that the skull fragments from these contexts originally belonged to trophy heads displayed fully fleshed; decapitation would separate the head from the gut bacteria that are widely considered to cause erosion of internal bone microstructures. Final deposition in a refuse deposit might have acted as a means of humiliating an enemy.

Yet, the kinds of objects deposited in waterholes often appear to have been deliberately selected rather than form part of a generalised dump of refuse and they speak of significant social identities formed in the context of domestic, agricultural, and craftworking activities. It has been argued that the recycling of broken objects in Bronze Age technologies such as potting and metalworking and the use of domestic refuse as manure for the fields indicates that what we would view as rubbish may have been seen as a source of fertility and new life in the Bronze Age (Brück 2006). As a component of such assemblages, human bone may have been regarded as a powerful material with positive attributes – retrieved perhaps from the bodies of relatives or other known and respected members of the community after excarnation.

Of course, the power of human bone may have derived from its ambiguous qualities – as a material that spoke of personal bonds and their dissolution, and of the danger and promise of crossing social boundaries. This shift in the possible significance of fragmented, curated, and redeposited human bone compared to the Chalcolithic and Early Bronze Age (Brück & Booth 2022) can perhaps be contextualised relative to other socio-economic changes such as the appearance of land divisions and more permanent forms of settlement during this period (Thomas 1989; Barrett 1994; Yates 2007). The deposition of ancestral bone in contexts such as settlements, field boundaries, and waterholes may have legitimated access to land, while the display of bones belonging to enemies may indicate increasing intercommunity competition.

Yet, we must be careful to avoid imposing contemporary forms of economic organisation (such as concern over the control and ownership of resources) onto the past. Similarities in the treatment of human and animal bodies suggest that the categorical distinction between people and animals that characterises modern, Western relations with the natural world may not always have been recognised during this period. Disarticulated human bone from features such as ditches and waterholes is frequently associated with the disarticulated remains of animals. Human bone is also associated with complete animal burials, for example the articulated skeleton of the dog found above the body of the adult female in the waterhole at Bradley Fen (Knight & Brudenell 2020, 182). Similarities between the treatment of people and objects are also evident: just as fragments of human bone might be curated or deposited swiftly after death, so too bronze artefacts found together in hoards often had quite varied life histories, with some deposited in a relatively fresh condition while others display significant wear (eg Webley & Adams 2016, 335–6). In other words, the modern Western distinctions between self and other, subject and object, and nature and culture that underpin our visions of economic intensification and competition over land in the Middle and Late Bronze Age may be problematic.

Indeed, the fragmentation of the human body on death suggests that concepts of personhood were very different to those we are familiar with from a Euro-American cultural context. The modern, Western, ideology of the individual is predicated on the maintenance of bodily integrity (Abrahams 1990; Morris 1991); the dissolution of the boundaries between self and other is viewed as morally and ontologically problematic (although this is changing dramatically today with technological advances in electronic implants and prosthetics). In the Middle and Late Bronze Age, despite the often short timeframe between death and deposition, it is not clear how (or whether) personal identity was vested in fragmented skeletal elements, although the prevalence of skull fragments should be noted, for the head may have been viewed as an important locus of personhood. The fragmentation of the body was a normal part of the human lifecycle, facilitating fluid and relational concepts of the self that do not neatly fit with normative models of the Bronze Age person as a defined, enduring locus of power (Brück 2019). The spatial dislocation between the place of burial and the final place of deposition indicates that human remains could move across space as well as time, giving material form to inter-personal links. Relational concepts of the self suggest distributed and contextual forms of power that call static models of chiefly hierarchies based on competitive individualism into question (Brück & Fontijn 2013).

This is not to suggest, however, that differences in power were not experienced as real, as the evidence for violence discussed above demonstrates so effectively, and there is no doubt that the humans remains discussed in this paper were caught up in narratives of identity, belonging, and exclusion that shaped the political and social landscape.

Historically, the scrappy fragments of human bone that have been recovered from non-mortuary contexts in Middle and Late Bronze Age Britain have not been viewed as productive targets for sustained scientific research. Here, we have focused on post-mortem trajectories, but an integrated bioarchaeological approach bringing together the kinds of research detailed in this paper with aDNA, isotope, and more traditional osteoarchaeological methods has the potential to illuminate the life histories and biological relationships of the people whose bones were selected for deposition. A sensitivity to context will continue to be crucial to future research in this area, however, for this has much to say about the varied and potentially contradictory ways in which identities may have been constructed in this period.

Acknowledgements: This research was funded by a grant from the Gerda Henkel Foundation (AZ 04/F/15). We are extremely grateful to Tim Knowles and Paul Monaghan (Bristol Radiocarbon Accelerator Mass Spectrometry Facility) for their training, help, and generosity. We would like to thank all of the people responsible for providing access to samples and crucial contextual information on deposits, including Natasha Dodwell (Oxford Archaeology East); Chris Evans, Marcus Brittain, Mark Knight & David Gibson (Cambridge Archaeology Unit); Phil Norman & Kirsten Egging-Dinwiddy (Wessex Archaeology); James Harris & Alison Brookes (Corinium Museum); Dave McOmish & Simon Mays (Historic England); John Barrett (University of Sheffield); Richard Brunning (Somerset Heritage Centre); Stefanie Vincent (Swindon Museum); & Sharon Clough (Cotswold Archaeology). Particular thanks are due to Peter Marshall for providing the method for calculating radiocarbon date offsets and to all those who kindly gave permission to reproduce the figures included in the paper. We are grateful also to our two anonymous reviewers for their useful and constructive comments.

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RÉSUMÉ

Le mort ambivalent: la conservation et l'excarnation des os humains à l'âge du Bronze moyen et final en Grande-Bretagne, par Joanna Brück et Thomas J. Booth

Cet article présente les résultats de l'analyse radiocarbone, histologique et contextuelle de restes humains provenant de contextes non-funéraires en Grande-Bretagne à l'âge du Bronze moyen et final. Au cours de cette dernière période, en particulier, des os humains (dont la plupart sont fragmentaires et désarticulés) ont été fréquemment récupérés dans des contextes d'habitat et dans d'autres endroits, tels que des points d'eau, dans le paysage plus large. Cependant, l'origine et les trajectoires post-mortem de ces découvertes sont mal comprises. Les résultats de nos analyses indiquent que certaines de ces découvertes proviennent de sépultures primaires tandis que d'autres sont le résultat de processus post-mortem tels que l'excarnation. Certains fragments semblent avoir été conservés pendant de longues périodes mais il y a en fait beaucoup moins de preuves de conservation délibérée des os que dans les tombes de l'âge du Bronze ancien. La présence de marques de découpe et d'autres marques de violence sur certains de nos échantillons ou sur d'autres restes humains provenant des mêmes sites indique que, contrairement à l'âge du Bronze ancien, où l'on peut affirmer que les os sélectionnés pour être conservés et redéposés peuvent avoir appartenu à des ancêtres vénérés, les os des contextes mortuaires de l'âge du Bronze moyen et final peuvent provenir de différentes catégories de personnes, y compris des ancêtres et des ennemis.

https://doi.org/10.1017/ppr.2022.8 Published online by Cambridge University Press

ZUSAMMENFASSUNG

Die ambivalenten Toten: die Aufbewahrung und Entfleischung menschlicher Knochen in Großbritannien in der Mittel- und Spätbronzezeit, von Joanna Brück und Thomas J. Booth

Dieser Beitrag legt die Ergebnisse von C14-, histologischen und kontextuellen Untersuchungen menschlicher Überreste aus Nicht-Grabkontexten der Mittleren und Späten Bronzezeit aus Großbritannien vor. Insbesondere in der späteren Periode wurden menschliche Knochen – viele davon fragmentiert und disartikuliert – häufig aus Siedlungs- und anderen Fundkontexten, z.B. aus Wasserstellen, in der weiteren Landschaft geborgen. Jedoch wissen wir wenig über die Herkunft und die postmortale Geschichte solcher Funde. Die Ergebnisse unserer Untersuchungen zeigen, dass einige dieser Funde aus Primärbestattungen stammen, während andere das Resultat postmortaler Praktiken wie z.B. Entfleischung sind. Bestimmte Fragmente scheinen für längere Zeitabschnitte benutzt worden zu sein, aber es gibt deutlich weniger Hinweise auf beabsichtigte Aufbewahrung von Knochen als bei solchen aus Gräbern der Frühbronzezeit. Das Vorhandensein von Schnittspuren und anderen Hinweisen auf Gewalt bei einigen der von uns untersuchten Funde und bei weiteren menschlichen Überresten von denselben Fundorten deutet darauf hin, dass, im Gegensatz zur Frühbronzezeit, wo wir davon ausgehen können, dass Knochen, die für Aufbewahrung und erneute Niederlegung ausgewählt worden waren, möglicherweise verehrten Ahnen gehörten, die Knochen aus Bestattungskontexten der Mittel- und Spätbronzezeit von einer Vielzahl unterschiedlicher Kategorien von Personen stammen, darunter sowohl Ahnen als auch Feinde.

RESUMEN

Los muertos ambivalentes: la curación y el descarnado de los huesos humanos en el Bronce Medio y Final en Gran Bretaña, por Joanna Brück y Thomas J. Booth

En este artículo se exponen los resultados del análisis radiocarbónico, histológico y contextual de los restos humanos en contextos no-mortuorios del Bronce Medio y Final en Gran Bretaña. En el último de estos períodos, en particular, los huesos humanos (muchos de ellos fragmentados y desarticulados) se han recuperado frecuentemente en contextos de asentamiento y otras localizaciones, como pozos de agua, a lo largo de un territorio amplio. Sin embargo, las causas y trayectorias post-mortem de estos hallazgos son poco conocidas. Los resultados de nuestros análisis indican que algunos de estas evidencias proceden de enterramientos primarios mientras que otras fueron el resultado de procesos post-mortem como el descarnado. Algunos restos parecen haber sido preservados durante largos períodos de tiempo, aunque existe mucha menor evidencia para la conservación intencional de muertos que en las tumbas adscritas al Bronce Inicial. En contraste con el Bronce Inicial durante el cual se puede sostener claramente que los huesos seleccionados para ser preservados podrían haber pertenecido a ancestros venerados, la presencia de marcas de corte y otras evidencias de violencia en algunas de nuestras muestras sugiere que esta selección en los contextos funerarios del Bronce Medio y Final podría haber derivado de una gran variedad de categorías de personas, incluyendo ancestros y enemigos.

https://doi.org/10.1017/ppr.2022.8 Published online by Cambridge University Press