Journal of Archaeological Method and Theory (2025) 32:18
https://doi.org/10.1007/s10816-024-09674-5

RESEARCH

# Death and Dichotomy: Exploring Varied Human and Animal Depositional Practices in the Iron Age at Battlesbury Bowl, UK, through Histotaphonomy

A. Bricking[1] · B. Revell[2] · R. Madgwick[2]

Accepted: 11 October 2024


**Abstract**
Taphonomic analysis of bone microstructure, commonly known as histotaphonomy, has been used as a proxy for interpreting early post-mortem treatments in archaeological contexts with increasing frequency. This method is especially useful when evidence for varied pre-depositional practices such as disarticulation and taphonomic markers (*e.g.* fracturing, gnawing, cut marks, weathering) is present in the assemblage, but is rarely used on faunal remains. Iron Age Britain provides the ideal context for comparative study due to the wide range of depositional practices employed for both humans and animals. While human and faunal remains from single sites in Britain have been studied before, such as at Cladh Hallan and Danebury hillfort, they were usually examined separately without substantial synthesis of the data. Thus, this study represents the first single-site comparative histotaphonomic analysis of archaeological human and animal remains from Britain. To this end, this research assesses archaeological human and faunal bone from Battlesbury Bowl, an Iron Age site in Wiltshire England, with 70 samples (46 faunal and 24 human) taken from a range of contexts, and from both articulated and disarticulated deposits. It explores evidence for the mortuary practices afforded to human remains and how they compare to the treatment of fauna from the site. Macroscopic analysis was undertaken prior to thin section microscopy using the Oxford Histological Index (OHI) and the Birefringence Index (BI). Results showed that the faunal samples from Battlesbury Bowl have more varied microstructural preservation with some species treated similarly to humans post-mortem, while others (especially caprines) are generally better preserved. This suggests that humans and animals at Battlesbury Bowl were subject to different early post-mortem processes, thus shedding light on mortuary practices and the complexity of human-animal relations in life and death.

**Keywords** Histology · Britain · Mortuary practices · Hillfort · Bioerosion

Extended author information available on the last page of the article

Published online: 02 January 2025

## Introduction

The Iron Age in Britain (c. 800 BC to AD 43) is noteworthy for a scarcity of human remains in the archaeological record despite evidence for a substantial population with widespread settlement (Cunnington, 1923; Hodson, 1964; Sharples, 2010; Whimster, 1981). Archaeological evidence of ‘formal’ burial practices, such as inhumation and cremation cemeteries, is predominantly restricted to relatively small, regional, or local traditions, such as the Arras tradition in East Yorkshire (Stead, 1979) and the Welwyn-type cremation cemeteries in Southeast England (Smith, 1912). This paucity of burial evidence is often suggested to represent majority funerary processes that leave no trace, such as sub-aerial exposure or ‘excarnation’ (Carr & Knüsel, 1997; Harding, 2016; Wait, 1985).

Interestingly, taphonomic signs that typically accompany exposure—such as weathering, trampling and animal gnawing—are relatively uncommon in disarticulated bone remains, suggesting the possibility of alternative methods of skeletal disarticulation (Madgwick, 2008, 2010). Faunal remains are often deposited in the same features as human remains, though generally not in close association and in a range of articulation levels, from disarticulated fragments to whole carcasses. To explore potential mortuary practices leading to the disarticulation of human remains and how this relates to faunal deposition, this study focuses on human and animal bones from Battlesbury Bowl, an extensively excavated and well-documented Iron Age settlement site in Wiltshire England. Through detailed examination of surface taphonomy and the histological preservation of skeletal elements, this study aims to discern differences and similarities between the treatment of human and animal remains, thereby shedding light on human-animal interactions in both life and death.

After death, the bones of an organism are subject to an array of taphonomic processes: physical, chemical and biological, resulting in their destruction or fossilization (Booth et al., 2016, 2022; Jans, 2022). Bacterial bioerosion to microstructure is considered one of the first taphonomic processes to impact bone post-depositionally (Smith et al., 2008). Transmitted light microscopic analysis of thin sections can be used to assess the preservation of bone microstructure. The extent and character of bacterial bioerosion are used to infer details about the treatment of individuals during the early post-mortem period. This is most commonly used on human remains, but has also proved of value in examining atypical depositional practices in animals (Mulville et al., 2012).

The main focus of this study is to determine the extent and character of bioerosion in a range of archaeological bone from Battlesbury Bowl to infer pre-depositional practices relating to both humans and animals. This forms the largest single-site histotaphonomic study using contemporaneous archaeological human and animal bone from different states of articulation to the authors’ knowledge, where samples were taken from bone assemblages, rather than micromorphological slides. Though other forms of microtaphonomy such as fungal and cyanobacterial tunnelling were noted when present, they are not discussed in detail in this study. The following research questions are explored:

1. What post-mortem treatments were afforded to human remains at Battlesbury Bowl?
2. Were the pre-depositional practices for humans at Battlesbury Bowl similar to those of the animals?
3. Is there any relationship between skeletal articulation and histological preservation in humans and fauna?

## Site Context and Background

Battlesbury Bowl is an Iron Age site consisting of a multivallate hillfort and associated settlement, located just outside Warminster in Wiltshire (Fig. 1). It was founded in the Late Bronze Age and was occupied through the Iron Age to the Roman Period (approximately 800 BC to AD 43) (Ellis & Powell, 2008). Excavations from 1998 to 1999 recovered a total of 27,813 fragments of animal bone from 663 contexts, with 32 deposits of human remains deriving from 29 contexts across the site (Hambleton & Maltby, 2004, 2008; McKinley, 2008). The macroscopic preservation of the faunal remains and disarticulated human remains appears broadly similar, though the extent and severity of the taphonomic changes were greater on the animal remains (McKinley, 2008: 76). By analysing both human and faunal remains from the site, this study will determine whether macroscopic similarities are reflected in the preservation of bone microstructure. The site has a homogenous lithological and sedimentological background, being upper chalk with some overlying superficial colluvium and greyish-brown compacted silty clay topsoil (Ellis & Powell, 2008: 9). There remains little evidence that differences in soil matrix have substantial effects on variable histological preservation, but any such effects can be confidently discounted at a site with homogenous matrices such as this.

## Iron Age Mortuary Practices

The scarcity of human remains from Iron Age Britain, with only an estimated 6% receiving an 'archaeologically visible' burial (Wait, 1985), suggests that those recovered represent the remains of a minority rite. This rarity is further emphasized by the frequent discovery of disarticulated human remains within various archaeological features in and around settlement sites, particularly in disused grain storage pits and boundary ditches. Occasionally, partially articulated deposits, such as isolated body parts are also found (*e.g.* a foot from Battlesbury Bowl, Ellis & Powell, 2008: 35 and pl.3.6c; a leg from Cadbury Castle, Barrett et al., 2000: 110, Fig. 58; two arms from North Perrott, Hollinrake & Hollinrake, 1997; crania with mandibles from Glastonbury Lake Village, Coles & Minnitt, 1995: 170–174). These deposits suggest that remains were still connected by soft tissue when deposited, though dismembered, or that elements were removed from a fully articulated skeleton after soft tissue had decayed. The general lack of burial evidence, combined with the prevalence of disarticulated bones, has led researchers to propose that excarnation, or subaerial exposure, was the majority rite for much of Iron Age Britain (Carr & Knüsel, 1997). In theory, this practice would result in scavenging animals removing most

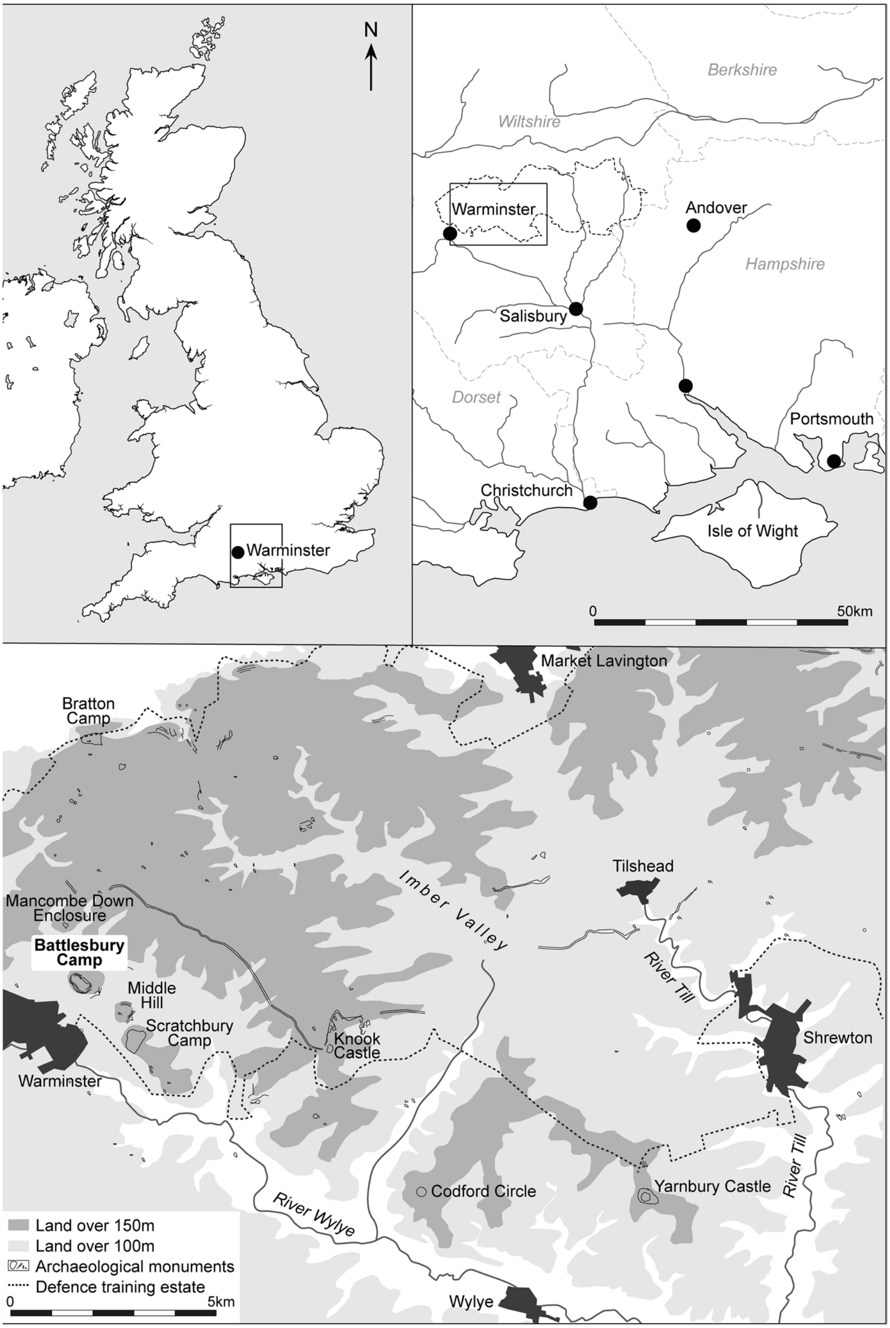


**Fig. 1** The Battlesbury Bowl site location (adapted by Kirsty Harding, from Ellis & Powell, 2008: Fig. 1.1)

body parts, with the remnants ending up in various features around settlement sites, either accidentally or as intentional disposal. However, there are numerous processes that could result in the separation of skeletal elements and explain the variability in articulation often observed at Iron Age sites. Deposits at Battlesbury Bowl, for example, included fully articulated skeletons, partially articulated body parts, and disarticulated bone and bone fragments, recovered from features (McKinley, 2008). Interestingly, animal remains are recovered in similar configurations, such as the articulated cattle foreleg and articulated cattle vertebrae from Ditch 4293, suggesting they may have undergone similar post-mortem processes as the human remains, either as separate 'ritual' deposits or as part of a complex mortuary process.

Much of this evidence comes from disused or repurposed storage pits. The use of storage pits for apparently formalized, intentionally structured deposits of human and animal bone has been widely discussed, and while they remain enigmatic, it is clear that they had significant, likely symbolic purposes beyond their use as repositories for food or refuse (*e.g.* Bersu, 1940; Whittle, 1984; Cunliffe & Poole, 1991: 153–162; Cunliffe, 1992, 1995: 80–85; Hill, 1995). Understanding early post-mortem treatment is challenging, and therefore, histotaphonomic analysis may provide new insights into the treatment of humans and animals in storage pits, and thus shed light on the characteristically enigmatic mortuary practices of Iron Age Britain.

## Animal Deposition in the Iron Age

There has been a substantial amount published on ritual and animals in Iron Age Britain (Cunliffe, 1984, 1992; Green, 1992; Harding, 2016; Hill, 1995; Morris, 2011; Russell, 2012; Wait, 1985). Animal remains are deposited for a range of reasons and reflect a wide variety of domestic, agricultural and ritual practices in Iron Age Britain (Harding, 2016). Cattle and sheep were the dominant food animals, with smaller numbers of pigs and also small numbers of horses exhibiting butchery evidence (Cross, 2011).

Across Iron Age Britain, faunal remains have been found within human burial contexts, whether articulated or partially articulated (*e.g.* Millett & Russell, 1982; Grant, 1989; Madgwick, 2008, 2010; Russell et al., 2014, 2016; Harding, 2016). These are often pigs or sheep; however, some cattle and horses have also been found both butchered and unbutchered (Grant, 1984; Millett & Russell, 1982) and some sites show an over-representation of dogs and horses in these contexts (Grant, 1984). These faunal remains have been interpreted as ritual offerings, remains from funerary banquets, or supplies for the journey to the otherworld (Harding, 2016: 254). The faunal samples from Battlesbury Bowl represent articulated, partially articulated and disarticulated remains, but none of the articulated faunal remains sampled from Battlesbury Bowl are associated with human deposits.

Associated bone groups (ABGs) are typically formed of cattle, sheep, pigs, horses and dogs. However, wild animals have also been found as ABGs (Morris, 2008; Pluskowski, 2012). In the southwest of the site, most ABGs have been discovered in pits (Morris, 2008). No complete animal burials were identified at Battlesbury Bowl, but a minimum of four bones belonging to the same skeleton were classified as an ABG (Hambleton & Maltby, 2008). Though an articulated caprine was sampled (BB(F)36), this was not a complete skeleton but consisted of six vertebrae, the left astragalus, left metatarsal and left humerus, right femur, and some skull fragments, along with a horn core and some teeth. There was a single articulated dog skeleton consisting of around 50 well-preserved bones, which has been sampled for this study.

### Histotaphonomic Analysis of Archaeological Human and Faunal Remains

Taphonomic analysis of bone microstructure, or histotaphonomy, can offer insights into post-mortem histories by assessing diagenetic change in bone. The most prevalent type of diagenetic change in archaeological bone is bioerosion, which manifests as microfocal destruction (MFD) (Hackett, 1981). This is further differentiated by identification of the types of microbial tunnelling visible in the microstructure. Three MFD forms (budded, linear longitudinal and lamellate) are typically linked to osteolytic bacterial activity and are the most common bioerosion types (Hackett, 1981; Balzer et al., 1997; Jackes et al., 2001; Turner-Walker, 2012). Additionally, fungal action can impact bone microstructure, frequently termed Wedl tunnelling (Fernández-Jalvo et al., 2010; Hackett, 1981; Marchiafava et al., 1974), though there is debate over the aetiology of Wedl tunnelling (see Kendall et al., 2018).

The preservation of bone microstructure frequently contrasts with external macroscopic preservation, thus offering distinct taphonomic insights (Hedges, 2002; Hedges et al., 1995; Jans et al., 2004). A bone with an excellent surface condition may have poor histological preservation, and a poorly preserved bone may have pristine microstructure. Experimental research on bacterial bioerosion of bone microstructure indicates that it typically occurs during the early post-mortem phase, generally within the first decade (Bell et al., 1996; Boaks et al., 2014; White & Booth, 2014). The degree of bacterial tunnelling is not directly correlated with the chronological age of the specimen, as the signature of microstructural bioerosion, or preservation, persists through deep time (Hedges, 2002; Hedges et al., 1995; Jans et al., 2004; Turner-Walker, 2012).

Since bacterial bioerosion is the primary driver of histological diagenesis, it is important to understand the origin of osteolytic bacteria. Some authors believe soil microorganisms are largely responsible for bacterial bioerosion in bone, and exogenous factors dictate bioerosion (Turner-Walker & Jans, 2008; Turner-Walker, 2012, 2019, 2023; Kendall et al., 2018). However, strong arguments have been made for an endogenous origin for the bacteria (Booth, 2016; Booth & Brück, 2020; Booth & Madgwick, 2016; Booth et al., 2016, 2022; Brönnimann et al., 2018; Damann & Jans, 2017; Jans et al., 2004; White & Booth, 2014). An endogenous origin implies that different funerary treatments impact the type and extent of bacterial bioerosion, and therefore, assessing bioerosion could help differentiate between individuals buried immediately post-mortem and those that underwent different mortuary treatments (Lemmers et al., 2020). However, it is important to note that recent studies using modern human remains demonstrate the severity of bioerosion can be influenced by various factors. A study by Emmons et al. (2022) found that microbial populations in bones from deep burials were similar to those from human viscera compared to bones from shallow or surface deposits, which were more similar to those from the soil environment. An experimental study by Mavroudas et al. (2023) showed no variation in histological preservation between five buried and partially exposed cadavers within the first two years. Another study analysed the histological preservation of bone from whole cadavers, and determined that there was a lack of significant differences in bioerosion between the coffin and direct burials, and that bioerosion is directly related to the early post-mortem period (Reid et al., 2024).

It is clear that histological preservation can be influenced by a number of variables, including body articulation and burial conditions. The potential for intra-skeletal variation, and inter-species variation, must also be considered as this may impact the results and comparison between different species (Jans et al., 2004; Kontopoulos et al., 2022). Thus, results of histological analysis in this study are interpreted alongside archaeological and taphonomic evidence to suggest the most likely taphonomic pathways.

Histotaphonomic analysis on archaeological human remains has a well-established body of research (*e.g.* Garland, 1987; Bell, 1990; Turner-Walker & Jans, 2008; Hollund et al., 2012; White & Booth, 2014; Booth, 2016; Booth et al., 2016; Booth & Madgwick, 2016; Mollerup et al., 2016; Booth & Brück, 2020; Goren et al., 2021; Bricking et al., 2022; Bricking, 2023; Madgwick & Bricking, 2023; Reid et al., 2024). Similar studies on animal remains in archaeology are less frequent (Booth et al., 2022; Brönnimann et al., 2018; Mulville et al., 2012; Pesquero et al., 2018), though most experimental research has used modern animals (Eriksen et al., 2020; Kontopoulos et al., 2016; Turner-Walker, 2012; White & Booth, 2014). The few studies that have histologically examined both human and animal remains generally do not observe the differences in early taphonomy and draw on material from multiple sites (Brönnimann et al., 2018; Jans et al., 2002, 2004).

Using a sample size of 261 specimens from 41 sites across five countries, Jans et al. (2004) determined that bacterial attack was more common in human bone than in animal, at 75% compared to 34% for animals. However, all articulated animal skeletons analysed displayed evidence of bacterial attack, supporting an endogenous origin for bacteria, as these samples are highly likely to have enteric bacteria present at the point of deposition. Microstructural degradation therefore correlates with the early stages of putrefaction (Jans et al., 2004: 92). Brönnimann et al. (2018), using 25 human bone samples and 184 samples of animal bone fragments, also determined that bacterial attack in human remains was more frequent in comparison to the faunal remains from the same site (96% vs. 23%). Thus, it was hypothesized for this study that the faunal remains would be better preserved than the human remains on average, providing a comparative baseline as well as exploring structured treatment of animals. However, articulated faunal remains should display similarly extensive bacterial attack, as enteric bacteria would be present and soft tissue decomposition would attract any exogenous bacteria (Booth et al., 2022).

The research described above indicates that an endogenous origin for bacterial attack is most common, in Northern European contexts at least, and therefore, histotaphonomic analysis is useful for exploring early post-mortem treatment. However, exogenous bacterial activity can potentially affect the results, and further research is needed to clarify the interpretative potential of this histotaphonomic approach. New experimental research, as well as further comparisons between archaeological humans and animals from Britain, may lead to a revision of interpretations in histotaphonomic studies.

## Materials and Methods

### Samples

A total of 70 specimens, comprising 24 human and 46 faunal samples (23 cattle, 10 caprine, 4 pig, 9 horse, 1 dog), were selected for analysis from a range of Iron Age contexts at Battlesbury Bowl. Specimens were selected to address questions surrounding the relationship between skeletal articulation and histological preservation, differences between species preservation and the point at which post-mortem manipulation occurred. The specimens represent a range of skeletal articulation levels (disarticulated, partially articulated and articulated) and are from a variety of features including storage pits, boundary ditches and post-holes (Table 1). Skeletal elements deposited within the same features and contexts were selected for sampling to investigate potential variation in early post-mortem treatments afforded to disarticulated humans and animals represented in the same burial context.

Long bone mid-shafts, especially femora, were preferentially selected for humans and animals. These are frequently used for histotaphonomic studies due to their dense cortical bone (providing a wider section for analysis), close proximity to the gut and therefore conceivably greater likelihood of being affected by enteric bacteria, and to control for potential inter-element differences (Hollund et al., 2012; Jans et al., 2004; Nielsen-Marsh & Hedges, 2000). Other long bones were selected in the absence of a viable femur. Crania and cranial fragments were also sampled to investigate whether the head was treated differently to the rest of the body, as has been widely speculated in Iron Age scholarship (*e.g.* Bulleid & Gray, 1917; Cunnington, 1923; Hencken, 1938: 57; Wheeler, 1954; Gardner & Savory, 1964: 221; Whimster, 1981; Wait, 1985; Harding, 2016; Armit, 2012). It must be borne in mind that intra-individual variability can occur in histological preservation (see Kontopoulos et al., 2022) and therefore comparisons of cranial and post-cranial remains must be made cautiously. However, there is no clear evidence that these classes of remains are inherently more or less susceptible to bioerosion.

Samples of approximately 1cm$^2$ were cut from each specimen using a Saeshin Strong 209A precision drill with diamond wheel attachment. The samples were embedded in Struers Epofix epoxy resin and sealed in a Nalgene vacuum desiccator for a minimum of 24 h to minimize air bubbles and protect the structural integrity of the samples (Turner-Walker & Mays, 2008).

Transverse thin sections of each sample were then prepared using a Reha-Tech RMS-16G3 annular diamond-saw microtome. These sections were between 50 and 120 thick µm, depending on the fragility of the bone samples. The thin sections were mounted on a VWR ground-edge microscope slide. Entellan New rapid mounting

**Table 1** Details of the human and animal remains from Battlesbury Bowl sampled for histotaphonomic analysis The taphonomic characteristics of the human remains incorporate findings documented by McKinley (2008:Table 5.1) and additional observations made by A. Bricking. Taphonomy on faunal remains was recorded by B. Revell

| Sample no | Species | Cut/feature no | Context | SK/ON no | Associated with human remains? | Deposit type | Element | Taphonomy | OHI | BI |
|---|---|---|---|---|---|---|---|---|---|---|
| BB01 | Human | Ditch 4043 | 5142 | – | – | Disarticulated | Femur | Gnawing, fractures | 0 | Low |
| BB02 | Human | Ditch 4293 | 4292 | – | – | Disarticulated | Tibia? | Heavily eroded, dry fractures | 0 | None |
| BB03 | Human | Pit 5216 | 5218 | – | – | Disarticulated | Humerus? | Possible gnawing, fracture | 0 | None |
| BB04 | Human | Pit 4865 | 4863 | – | – | Disarticulated | Femur | – | 0 | None |
| BB05 | Human | Pit 5358 | 5735 | – | – | Disarticulated | Humerus? | – | 0 | None |
| BB06 | Human | Pit 4320 | 4321 | SK 4322 | – | Articulated | Femur | Dry | 3 | High |
| BB07 | Human | Pit 4223 | Lower | SK 4345 | – | Articulated | Femur | Root etched | 1 | Low |
| BB08 | Human | Pit 4223 | Upper | SK 4251 | – | Articulated | Femur? | – | 0 | None |
| BB09 | Human | Ditch 4043 | 4112 | – | – | Disarticulated | Femur | Canid gnawing, root etched, abrasion | 0 | None |
| BB10 | Human | Pit 4320 | 4321 | ON 3116 | – | Disarticulated | Femur | Gnawing, root etched | 0 | None |
| BB11 | Human | Pit 4272 | Lower | SK 4346 | – | Articulated | Femur | – | 1 | Low |
| BB12 | Human | Pit 4272 | Upper | SK 4347 | – | Articulated | Femur | – | 0 | None |
| BB13 | Human | Pit 4272 | 4273 | – | – | Disarticulated | – | White patch | 0 | Low |
| BB14 | Human | Ditch 4293 | 4249 | ON 3050 | – | Disarticulated | Humerus | Canid gnawing, trampled, root etched, abraded, black discolouration | 0 | None |
| BB15 | Human | Ditch 4043 | 4111 | – | – | Disarticulated | Femur | Fractures | 1 | None |
| BB16 | Human | Ditch 4043 | 4124 | – | – | Disarticulated | Femur | Fresh fractures, gnawing, slightly polished | 1 | None/low |
| BB17 | Human | Ditch 4012 | 4016 | – | – | Disarticulated | Tibia | Canid gnawing, fractures, root etched | 1 | Low |
| BB18 | Human | Post-hole 4199 | 4159 | – | – | Disarticulated | Cranium | – | 0 | Low |
| BB19 | Human | Pit 5358 | 5769 | – | – | Disarticulated | Skull | – | 0 | Low |
| BB20 | Human | Pit 5358 | 5359 | – | – | Disarticulated | Skull | – | 0 | Low |
| BB21 | Human | Post-hole 5584 | 5585 | ON 3371 | – | Disarticulated | Cranium | Worked | 0 | None/low |

**Table 1** (continued)

| Sample no | Species | Cut/feature no | Context | SK/ON no | Associated with human remains? | Deposit type | Element | Taphonomy | OHI | BI |
|---|---|---|---|---|---|---|---|---|---|---|
| BB22 | Human | Pit 4332 | 4385 | ON 3107 | – | Disarticulated | Frontal | Root etched, black discolouration, possibly worked | 0 | Low |
| BB23 | Human | Pit 5043 | 5044 | ON 3340 | – | Disarticulated | Cranium | Fractured, root etched, black discolouration, possibly worked | 0 | None |
| BB24 | Human | Pit 4993 | 4994 | ON 3876 | – | Disarticulated | Cranium | Canid puncture, fresh fracture, polished | 1 | Low |
| BB(F)01 | Pig | Pit 5043 | 5137 | – | Yes | Disarticulated | Humerus | Root etched | 0 | None |
| BB(F)02 | Cattle | Pit 5358 | 5359 | – | Yes | Disarticulated | Humerus | Root etched, weathered, trampled, cut marks | 0 | None |
| BB(F)03 | Cattle | Pit 4332 | 4385 | – | Yes | Disarticulated | Humerus | Root etched | 0 | None |
| BB(F)04 | Horse | Pit 5358 | 5359 | – | Yes | Disarticulated | Femur | Root etched, weathered, cut marks | 0 | None |
| BB(F)05 | Cattle | Pit 4113 | 4127 | – | – | Disarticulated | Humerus | Burnt, root etched | 1 | None |
| BB(F)06 | Caprine | Pit 4332 | 4333 | – | Yes | Disarticulated | Humerus | – | 2 | None |
| BB(F)07 | Horse | Pit 4423 | 4424 | – | – | Disarticulated | Cranium | Root etched | 1 | Low |
| BB(F)08 | Cattle | Pit 4497 | 4592 | – | – | Disarticulated | Humerus | Root etched, cut marks | 1 | None |
| BB(F)09 | Cattle | Pit 5670 | 5713 | – | – | Partially | Pelvis | Root etched | 1 | None |
| BB(F)10 | Horse | Ditch 4043 | 4104 | – | Yes | Disarticulated | Pelvis | Root etched, cut marks | 1 | None |
| BB(F)11 | Cattle | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Root etched, abraded | 3 | Low |
| BB(F)12 | Caprine | Pit 4486 | 4507 | – | – | Partially | Tibia | Root etched | 3 | Low |
| BB(F)13 | Cattle | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Root etched, gnawing | 3 | Low |
| BB(F)14 | Dog | Pit 4423 | 4482 | – | – | Articulated | Femur | Root etched | 1 | None |
| BB(F)15 | Pig | Pit 4423 | 4424 | – | – | Disarticulated | Scapula | – | 1 | None |
| BB(F)16 | Caprine | Pit 4612 | 4697 | – | – | Disarticulated | Mandible | Root etched | 4 | High |
| BB(F)17 | Cattle | Pit 5848 | 5358 | – | Yes | Partially | Rib | – | 0 | None |
| BB(F)18 | Cattle | Pit 4470 | 4483 | – | – | Disarticulated | Cranium | Small cut marks | 1 | None |

**Table 1** (continued)

| Sample no | Species | Cut/feature no | Context | SK/ON no | Associated with human remains? | Deposit type | Element | Taphonomy | OHI | BI |
|---|---|---|---|---|---|---|---|---|---|---|
| BB(F)19 | Horse | Pit 4751 | 4317 | – | – | Disarticulated | Cranium | Weathered, root etched | 2 | Low |
| BB(F)20 | Cattle | Pit 4470 | 4483 | – | – | Partially | Metatarsal | Root etched, weathered | 0 | None |
| BB(F)21 | Cattle | Pit 4497 | 4592 | – | – | Disarticulated | Femur | – | 1 | None |
| BB(F)22 | Cattle | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Lightly root etched, cut marks | 0 | None |
| BB(F)23 | Caprine | Pit 4486 | 4507 | – | – | Partially | Tibia | – | 0 | None |
| BB(F)24 | Horse | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Gnawing | 0 | None |
| BB(F)25 | Caprine | Pit 5348 | 5858 | – | Yes | Disarticulated | Metatarsal | – | 3 | Low |
| BB(F)26 | Caprine | Pit 5670 | 5671 | – | – | Disarticulated | Metatarsal | Root etched, weathered | 4 | High |
| BB(F)27 | Pig | Pit 5670 | 5671 | – | – | Disarticulated | Mandible | – | 2 | None |
| BB(F)28 | Horse | Post-hole 4524 | 4521 | – | – | Disarticulated | Mandible | Root etched, weathered | 3 | High |
| BB(F)29 | Cattle | Pit 5645 | 5814 | – | – | Disarticulated | Skull | Root etched | 1 | None |
| BB(F)30 | Cattle | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Root etched | 1 | None |
| BB(F)31 | Cattle | Ditch 4043 | 4123 | – | Yes | Disarticulated | Skull | Root etched | 1 | None |
| BB(F)32 | Cattle | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Soil staining, gnawing | 0 | None |
| BB(F)33 | Cattle | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Lightly root etched, cut marks | 2 | Low |
| BB(F)34 | Horse | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Soil staining, gnawing | 1 | None |
| BB(F)35 | Pig | Pit 4332 | 4336 | – | Yes | Disarticulated | Mandible | Root etched | 1 | None |
| BB(F)36 | Caprine | Pit 4486 | 4507 | – | – | Articulated | Femur | – | 3 | Low |
| BB(F)37 | Cattle | Ditch 4043 | 4101 | – | Yes | Disarticulated | Skull | Lightly root etched, cut marks, gnawing | 1 | Low |
| BB(F)38 | Caprine | Pit 4796 | 4797 | – | – | Disarticulated | Tibia | Root etched | 1 | Low |
| BB(F)39 | Cattle | Pit 5670 | 5671 | – | – | Disarticulated | Tibia | Root etched | 2 | Low |
| BB(F)40 | Cattle | Ditch 4043 | 4101 | – | Yes | Disarticulated | Humerus | Root etched, cut marks | 1 | None |
| BB(F)41 | Horse | Pit 4796 | 4797 | – | Yes | Disarticulated | Tibia | Weathered, root etched | 0 | None |

**Table 1** (continued)

| Sample no | Species | Cut/feature no | Context | SK/ON no | Associated with human remains? | Deposit type | Element | Taphonomy | OHI | BI |
|---|---|---|---|---|---|---|---|---|---|---|
| BB(F)42 | Horse | Pit 4332 | 4334 | – | Yes | Disarticulated | Radius | Root etched | 1 | Low |
| BB(F)43 | Cattle | Pit 4796 | 4797 | – | – | Disarticulated | Radius | Weathered | 3 | Low |
| BB(F)44 | Cattle | Pit 4470 | 4483 | – | – | Disarticulated | Tibia | Root etched, cut marks | 0 | None |
| BB(F)45 | Caprine | Ditch 4043 | 5256 | – | – | Disarticulated | Humerus | Stained | 5 | High |
| BB(F)46 | Cattle | Pit 5004 | 5003 | – | Yes | Disarticulated | Humerus | Root etched, grey staining, chopped | 1 | Low |

medium was used to secure the sample between the slide and the VWR borosilicate cover glass and left overnight to dry. All thin sections were analysed under normal and plane polarized transmitted light on a Nikon Eclipse ME600 optical microscope, with a Nikon LHS-H100C-1 lightbox, at magnifications of 50x, 100x and 200x.

## Analysis

The extent of bioerosion was assessed by the authors (AB and BR) using the Oxford Histological Index (OHI), which ranges from 0 (extensively bioeroded) to 5 (no signs of bioerosion) (Millard, 2001). Typically, bone samples exhibit either very poor (OHI 0–1) or very good (OHI 4–5) preservation, with a small proportion scoring in the middle of the scale, suggesting histological alteration generally either occurs to completion or not at all (Millard, 2001). The cause of microfocal destruction can either be fungal (identified by Wedl-type tunnels) or bacterial (identified by non-Wedl tunnels). The various tunnel types are defined elsewhere (Hackett, 1981), but are simplified for the purposes of this study as either Wedl/fungal or non-Wedl/bacterial.

Each sample was examined using circularly polarized light (CPL) to determine the extent of birefringence. High birefringence generally corresponds with good microstructural preservation and good collagen preservation. However, some external factors can cause loss of birefringence, even when the microstructure is well preserved, through processes of chemical hydrolysis. Some processes potentially relating to mortuary practice and depositional history can cause hydrolysis such as low-heat burning or intense cycles of wetting and drying (Collins et al., 1995; Nielsen-Marsh et al., 2007; Smith et al., 2007). The level of birefringence is measured using the Birefringence Index (BI), and scored as low, medium or high to compare with histological preservation. For example, an element with OHI 0–1 would likely have low birefringence, while 2–3 would be medium, and 4–5 high (Booth et al., 2016; Jans, 2022; Jans et al., 2004).

The surface taphonomy of each sampled element was also assessed for evidence of post-mortem manipulation (fracturing, butchering, working) or exposure (weathering, gnawing, trampling, abrasion). Though macroscopic analysis of remains is beneficial for determining some of their taphonomic history, undertaking microscopic analysis alongside this can reveal further taphonomic impacts which are not visible to the naked eye (Booth & Madgwick, 2016). Comparison of macrotaphonomy and histotaphonomy has the potential to provide more detailed insights on pre-depositional practices afforded to these remains.

## Results

The details for each sampled specimen, OHI score and level of birefringence are presented in Table 1.

The histological preservation of the human remains at Battlesbury is generally poor, with only one notable exception exhibiting a mid-range OHI score (BB06). This trend of poor preservation is consistent across all types of deposits, whether articulated or disarticulated. Additionally, there was no difference in histological preservation between cranial and post-cranial elements. The prevalence of poor microstructural preservation in articulated deposits is expected following either the endogenous or exogenous model of osteolytic bacterial origin: the level of articulation suggests burial occurred before decomposition of soft tissue, thus allowing putrefactive gut bacteria to migrate through the skeleton as well as attracting bacteria from the depositional environment. However, the extent of bioerosion observed in disarticulated bones is unexpected, especially in cases where there is evidence of post-mortem manipulation, such as fresh fracturing and bone working, or signs of exposure, such as canid gnawing (Figs. 2, 3, and 4). The exception to this is a femur from an articulated burial in a storage pit, which demonstrated mid-ranging preservation with an arrested pattern of microfocal destruction (Fig. 5). This preservation level may be attributed to the body decomposing more rapidly, while not being fully exposed—for


**Fig. 2** Human remains with taphonomic evidence for post-mortem manipulation and poor histological preservation: **a**) punctures from canid gnawing on a human parietal fragment (BB24/SF 3876) from a storage pit (Pit 4993); **b**) micrograph of sample BB24 (OHI 1), 50x magnification


**Fig. 3** Human remains with taphonomic evidence for post-mortem manipulation and poor histological preservation: **a**) a worked (intentionally shaped) fragment of human cranium (BB21/SF 3371) from a post-hole (Post-hole 5584); **b**) micrograph of sample BB21 (OHI 0), 50x magnification

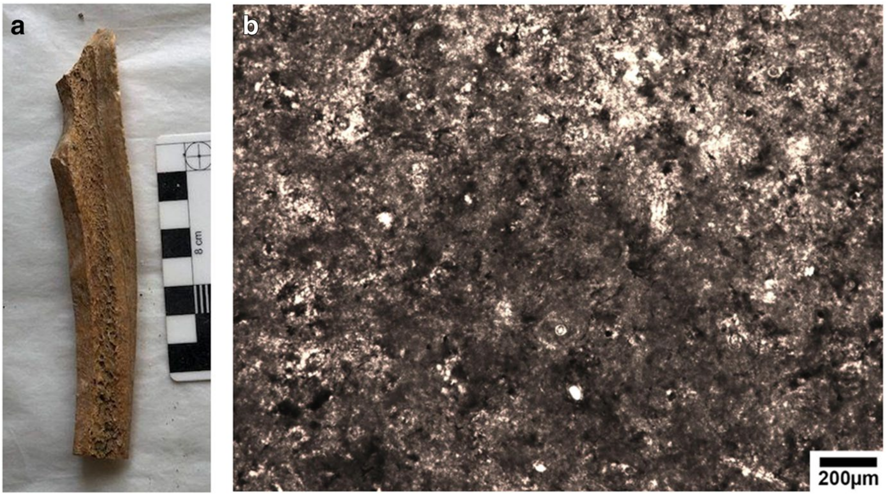


**Fig. 4** Human remains with taphonomic evidence for post-mortem manipulation and poor histological preservation: **a**) fresh split fracture on human femur (BB15/SF 4111) from a boundary ditch (Ditch 4043); **b**) micrograph of sample BB15 (OHI 1), 50x magnification

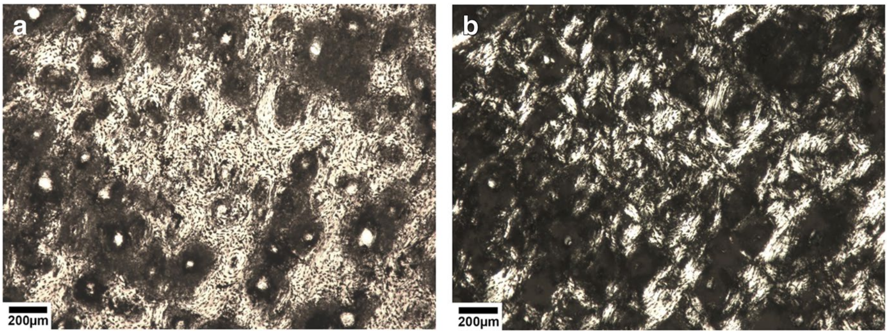


**Fig. 5** Human sample BB06 showing mid-ranging histological preservation and bacterial attack radiating from Haversian canals (OHI 3): **a**) normal transmitted light, 50x magnification; **b**) polarized light, 50x magnification

instance, being placed at the bottom of a pit and covered (Booth & Madgwick, 2016). Such a scenario would prevent access by scavenging animals but allow invertebrates to contribute to the decomposition process, albeit more slowly than in an exposed environment, as suggested in previous studies (Booth & Madgwick, 2016). This is a hypothetical scenario, and experimental research is required to clarify the drivers of such mid-ranging patterns, but it is supported by the fact that mid-ranging scores have commonly been found in caves, which represent a semi-sheltered, but exposed setting (Booth, 2014). It is interesting to note that a disarticulated femur fragment from the same context (BB10) showed the most advanced levels of bacterial bioerosion, scoring OHI 0, despite evidence for canid gnawing on the epiphyses that would otherwise suggest exposure.

In contrast to the human remains, the faunal remains have more varied OHI scores, ranging from 0 to 5, with caprines being better preserved on average (Fig. 6). Concerning both horse and cattle, 78% of the remains have OHI scores of 0 or 1. Pigs were also poorly preserved, with 75% having OHI scores of 1 or 0. In contrast, only 22% of the caprines sampled displayed evidence of severe bioerosion. Though there is one mid-ranging human score (BB06), overall animals were marginally better preserved.

The caprine samples display better preservation than all other species sampled in this study. Only one of the caprine samples (BB(F)45) has an OHI score of 5 (Fig. 7), and two have OHI scores of 4, a similar pattern to that observed at the hillfort of Danebury (Booth et al., 2022). These results suggest that the well-preserved caprine remains were removed of soft tissue relatively quickly after death, thus likely representing food waste, though there was no macroscopic evidence of butchery or heat treatment on the sampled elements. However, sample BB(F)12 is from a neonatal caprine that was partially articulated, and scored OHI 3. The mid-ranging level of histological preservation implies this individual may have been subjected to a different post-mortem process, or was deposited in a different environment, than the adult caprines. For example, the carcass may have been deposited in a sheltered but exposed environment thus facilitating accelerated decomposition (but

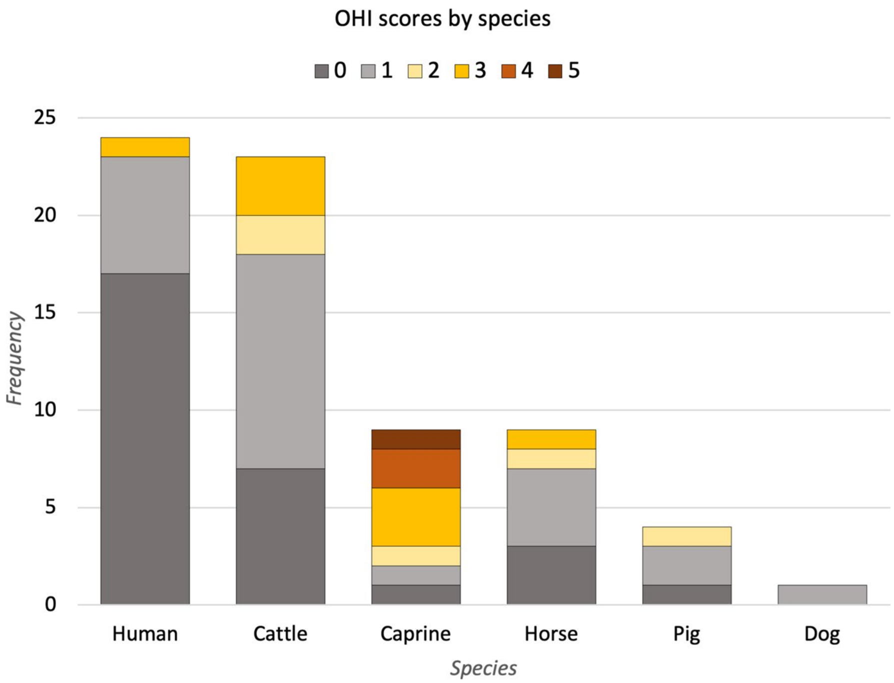


**Fig. 6** Frequency of OHI scores by species

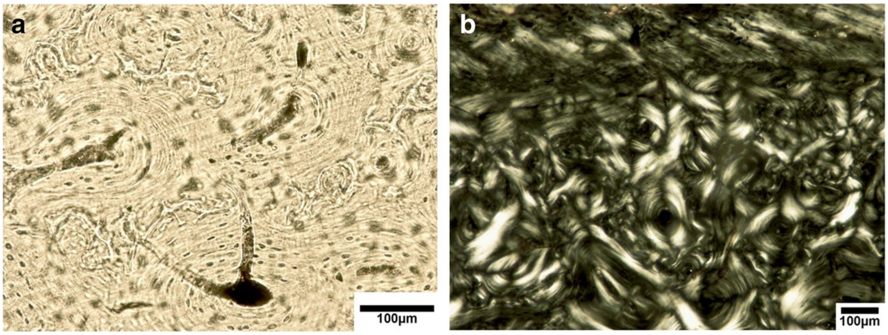


**Fig. 7** Caprine sample BB(F)45 showing good histological preservation (OHI 5): **a**) normal transmitted light, 200x magnification; **b**) polarized light, 100x magnification

not as quickly as exposure on the surface), or buried after decomposition had begun but while the elements were still connected by soft tissue, maintaining articulation.

It is necessary to consider that the difference in histological preservation may be caused by the difference in bone structure between neonatal and adult skeletons. Previous studies by Turner-Walker and Jans (2008), Turner-Walker and Mays (2008) and Turner-Walker (2012) have suggested that bone porosity may play a key role in microstructural preservation of bone: specifically, bones from older individuals will be more porous, and therefore more susceptible to exogenous bacterial attack, than those of younger individuals. However, if this were the case, then an opposite result would be expected in the Battlesbury Bowl caprines.

A study by White and Booth (2014) experimentally buried and exposed piglets and found the individuals buried in the soil were more affected by bacterial bioerosion, therefore directly comparable samples in terms of age and species showed marked variation dictated by depositional practice. In addition, a study by Booth et al. (2016) on archaeological neonatal human skeletons showed many sampled neonates were virtually free of bacterial bioerosion compared to adult skeletons buried in the same cemetery. This result led the authors to conclude the difference was likely due to the undeveloped gut microbiomes of the neonates. Therefore, evidence suggests that different histomorphology between different classes of remains (*e.g.* species, age category) are unlikely to have a substantial role in the extent of bioerosion, though further studies are needed to examine variation across histomorphologically variable samples.

The sampled dog was represented by a relatively complete, articulated skeleton. The bone microstructure was badly preserved, with an OHI score of 1, and there is no evidence of butchery or post-mortem manipulation observed on the skeleton. This suggests that this dog was buried whole with soft tissue intact and was not exploited for meat or hide. High numbers of dogs have been recovered from ABGs in Iron Age pits across Britain, suggesting that the species was considered symbolically significant (Smith, 2006).

The poor preservation of the horse, cattle and pig samples was unexpected, especially as the remains are largely disarticulated. Disarticulated remains would be expected to show less extensive bacterial attack if separated from the carcass shortly after death (*e.g.* through butchery) since they would not be accessible to putrefactive gut bacteria, nor exogenous bacteria drawn to the decomposing carcass. This might suggest that animals were deposited articulated, then became disarticulated through intentional exhumation or accidental disturbance. It appears these animals were afforded different post-mortem treatments in comparison to the caprines from the same site. It is important to note that ten of the samples were taken from horse and cattle skulls deposited in Ditch 4043, which were labelled a 'special deposit' (Ellis & Powell, 2008: 135–136), of which seven samples scored OHI 0 or 1, and three samples scored OHI 2 and 3. The term special deposit was attributed to certain deposits of animal bone at Battlesbury Bowl, including articulated remains, and any deposits deemed 'unusual' by excavators. These animals may have been left to decompose articulated, before the skulls were exhumed and reburied in this special deposit. Fully articulated faunal remains, including typical food animals, are known from other Iron Age sites in Britain (*e.g.* Millett & Russell, 1982; Cunliffe & Poole, 1991; Russell et al., 2016, 2017), and this type of post-mortem treatment may have occurred at Battlesbury Bowl. However, it cannot be ruled out that remains from the same special deposit were afforded different pre-depositional treatments. Additionally, faunal remains from other parts of Iron Age Britain demonstrate a propensity for the consumption of one particular body part, such as the feasting midden site in Llanmaes, Vale of Glamorgan (Madgwick & Mulville, 2015). Therefore, it is possible that the disarticulated animal bone at Battlesbury Bowl represents animals who had certain parts removed to be processed for food, and the rest inhumed intact, until later disturbance.

Similar to the human samples, there is some discrepancy between surface taphonomy and histological preservation in the fauna. Of the samples that display evidence of butchery and burning, only one (BB(F)33) has an OHI score higher than 1. Again, the special deposit of horse and cattle skulls in Ditch 4043 is particularly interesting as only some of the skulls display evidence for butchery, suggesting the pre-depositional treatment of the skulls may have varied (Hambleton, 2013). It is likely that, due to the unusual nature of this deposit, in addition to the lack of butchery evidence and low OHI scores, these skulls represent a more 'ritualized' depositional treatment as opposed to standard butchery waste. Two of the seven samples taken for this study displayed evidence of butchery, one of which had an OHI score of 2, while the other scored 0. Two of the samples which scored OHI 3 displayed no evidence of butchery. This directly contrasts with expectations, as butchered remains imply dismemberment and consumption which would limit bacterial bioerosion. Brönnimann et al. (2018: 55) emphasize that some butchered animal bones display signs of bacterial bioerosion which may be due to the timing and efficiency of butchery, stating that endogenous bacteria are occasionally recovered from modern meat (Chaillou et al., 2015). However, this seems an unlikely explanation due to the extent of the bioerosion in the majority of these samples. Alternatively, it is possible that offal was deposited with bones after butchery, meaning enteric bacteria would be present at the point of deposition. It cannot be discounted that exogenous bacteria from the wider burial environment is responsible for these higher levels of bioerosion, though a greater degree of homogeneity might be expected across the samples from broadly comparable pits and ditches.

The difference between the type of features is important when considering the macro- and micro-preservation of bone, as closed pits would afford greater protection to deposits, thus reducing the speed of soft tissue degradation, whereas open ditches would allow bone to be impacted by a greater range of taphonomic processes (Hill, 1995: 26). However, the results appear to be broadly similar across the different feature types, suggesting similar treatment of both human and animal remains post-mortem irrespective of feature (Fig. 8).

Interestingly, there are variations in histological preservation between humans and animals in the same feature. Ditch 4043 contained both human and faunal remains, including the special deposit of cattle and horse skulls. All four of the human remains from this feature showed poor histological preservation. However, three cattle had mid-ranging scores (OHI 2 and 3) and the sampled caprines showed perfect histological preservation, suggesting some of the faunal remains may have been treated differently to the human remains (Fig. 9). This mixed pattern of preservation in the same feature supports an endogenous model of bioerosion (if they were deposited at the same stage of decay), as soil bacteria would be expected to generate a more even pattern of degradation.

The post-holes at Battlesbury Bowl were not always associated with an identifiable structure, but were often associated with pits, and human remains were recovered from structured depositions in three cases (Ellis & Powell, 2008). Three samples (BB18, BB21, BB(F)28) were taken from post-holes for this study: two human and one horse, though the preservation differs between them. While the humans have poor histological preservation, the horse has mid-ranging preservation and an arrested pattern of bacterial attack (Fig. 10). Due to the small sample size, no definitive conclusions can be made about differing practices. However, it is worth noting that despite the low OHI score, the remains were disarticulated.

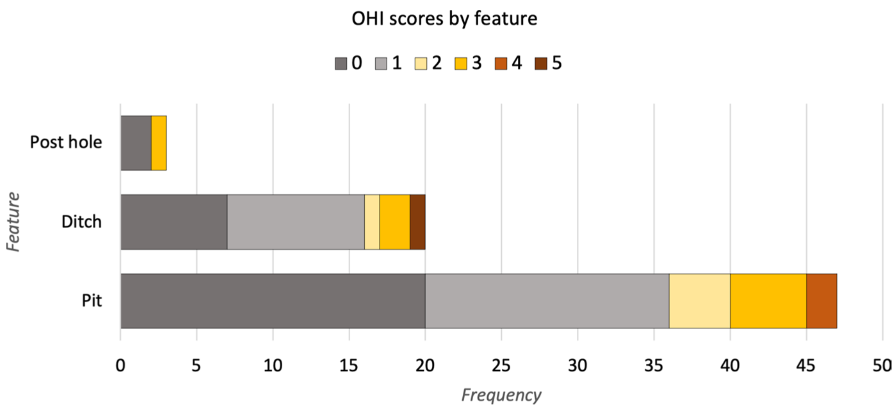


**Fig. 8** Frequency of OHI scores by feature

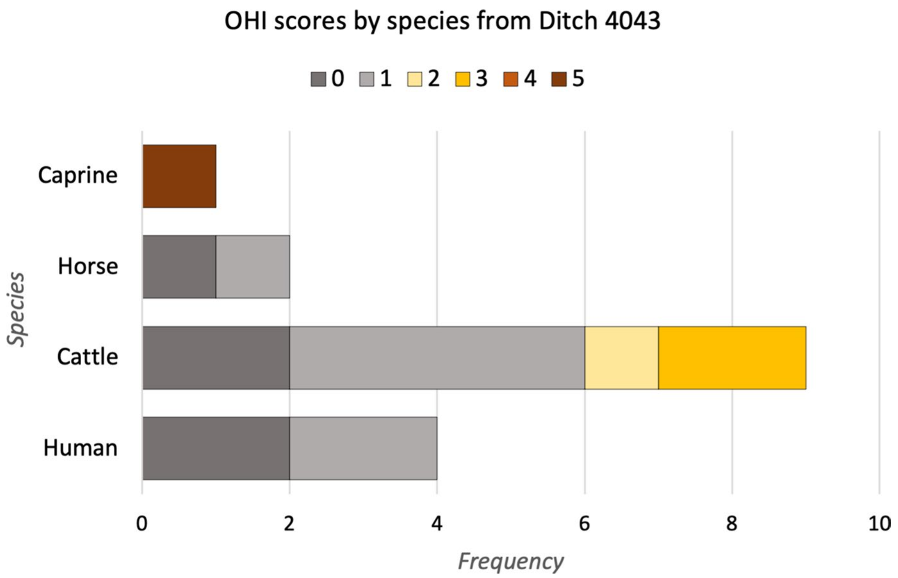


**Fig. 9** Frequency of OHI scores by species within Ditch 4043

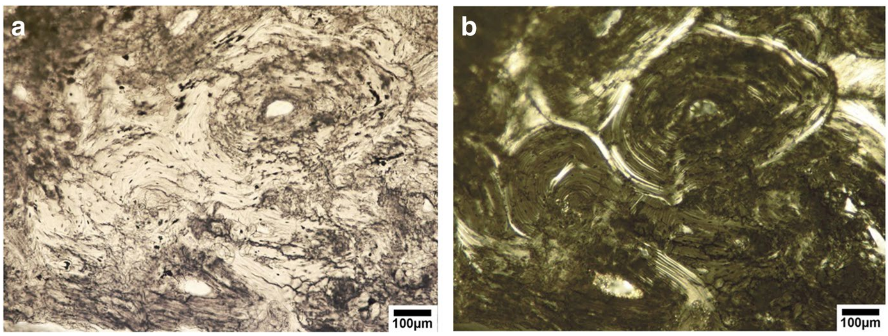


**Fig. 10** Horse sample BB(F)28 from a post-hole showing mid-ranging histological preservation (OHI 3): **a**) normal transmitted light, 100x magnification; **b**) polarized light, 100x magnfication

It is also worth considering the potential impact of repeated deposition of corpses and carcasses on the microbial composition of the burial environment. The decomposition of flesh in these contexts could either attract osteolytic bacteria from the surrounding soil or lead to the release of enteric bacterial populations into it (Booth et al., 2022; Cobaugh et al., 2015; Singh et al., 2017). However, while this factor may influence the soil microbiome, it cannot account for the observed histological differences between human and animal bones extracted from the same archaeological feature.

## Discussion

### Mortuary Practices at Battlesbury Bowl

The analysis of human remains from the site revealed a high level of microfocal destruction, with the majority scoring OHI 0 and 1, compared to the animal remains which exhibited more varied levels of histological preservation. It is important to consider the histomorphological differences between human and animal bone when interpreting these results: it is possible, for example, that human bone microstructure better facilitates the movement of bacteria and thus bioerosion would be expected to be more extensive. However, with the exception of caprines, the majority of samples from each species were as poorly preserved as the majority of the sampled human bone, suggesting inter-species histomorphological variation is not a significant factor. Concerning the caprines, the near-perfect histological preservation in the sampled adults compared to the mid-ranging preservation of the neonate suggests that bone porosity is unlikely to be responsible for the intra-species variation. Considering the homogeneity of the geology and soil matrix, it is unlikely that exogenous bacteria in the deposition environment are responsible for the variation in histological preservation.

These results suggest humans at Battlesbury Bowl were generally buried soon after death, allowing bacteria to access bone during the slow process of subterranean soft tissue degradation and then exhumed following skeletonization, with certain skeletal elements being redeposited in various locations. This practice is supported by the presence of partially articulated remains, such as a dismembered foot in Pit 4332 likely left behind during the removal of other elements. Additionally, the site report noted many pits had been recut multiple times at Battlesbury Bowl (Ellis & Powell, 2008: 39), possibly as one skeleton was exhumed and a new corpse interred, although a lack of radiocarbon evidence makes it difficult to determine the duration between recuts. Nevertheless, over time, these features have clearly seen a cycle of use: burial, exhumation, clearance and new deposition. This pattern is noted in burials from other Iron Age sites in southern Britain, for example Cockey Down, Wiltshire (Lovell, 1999) and Suddern Farm, Hampshire (Cunliffe & Poole, 2000: 168).

Considering there is no difference in histological preservation between the samples from disarticulated and articulated deposits at Battlesbury Bowl, it is possible that the articulated skeletons represent an incomplete mortuary practice whereby the elements had not been exhumed and redeposited. Alternatively, the presence of contemporaneous articulated and disarticulated deposits may signify multiple mortuary practices, or variations of a mortuary practice, occurred simultaneously at the site. The one human femur from an articulated burial in a storage pit (BB06, SK 4322) displayed an unusual case of mid-range histological preservation that may provide further evidence for variation in mortuary practice. These patterns of histological preservation are more difficult to explain. One possibility is that a change in the treatment or burial environment of the individual occurred after bacteria were initially able to access bone microstructure. This could be caused by, for example, movement to an anoxic burial context (such as a waterlogged area) unsuitable for bacterial attack, prior to final deposition (Parker Pearson et al., 2005). Such a complex multi-stage rite seems unlikely, especially given the level of articulation. Therefore, a scenario of semi-exposure may be more likely, with soft tissue decaying more slowly (and therefore allowing some bacterial attack) in a deep silting or perhaps covered pit, as has been suggested in a histological study of archaeological human remains from Danebury (Booth & Madgwick, 2016).

Signs of gnawing and fracturing on some bones suggest a lapse of time between exhumation and redeposition. Canid gnawing was observed on eight human bones sampled in this study and five of the faunal bones with all but one faunal sample scoring OHI 0–1. The predominance of poor histological preservation suggests both humans and faunal remains were buried whole (or at least with some soft tissue) shortly after death, then exhumed post-skeletonization either deliberately or accidentally, and then made accessible to dogs. This pattern of fracturing, canid gnawing and poor histological preservation of human bone has been identified in other Iron Age sites in southwest Britain (Bricking, 2023; Bricking et al., 2022), suggesting a potentially widespread practice.

Additionally, there appears to be a deliberate aspect of curation of human remains at Battlesbury Bowl, particularly in the manipulation of crania, possibly shaping them into amulets, indicative of a complex process encompassing inhumation, exhumation, curation, manipulation and redeposition. Crucially, the poor histological preservation in all but one sample suggests the mechanism by which human remains became disarticulated was not through sub-aerial exposure, as has often been hypothesized, but rather through exhumation and selective retrieval of skeletal elements.

## Animal Deposition at Battlesbury Bowl

Overall results suggest that animals were treated similarly to humans in the early post-mortem period at Battlesbury Bowl, with the exception of caprines. This result is expected for dogs and horses which have been known to be buried whole (Cross, 2011). However, it is less expected for disarticulated cattle and pigs in storage pits, although macroscopic taphonomic work has highlighted the comparable treatment of humans and animals at some sites (Madgwick, 2010). Cattle may have been viewed as special and more rarely used for meat because of their secondary products (dairy), and their value as a symbol of wealth/status (Green, 1992: 92), although prevalent butchery evidence indicates meat was exploited. There are instances of cattle buried whole elsewhere in Britain, as for example at Pocklington (Stephens, 2023: 93) and Garton Slack in Yorkshire where they were buried 'in human-style graves…[suggesting] treatment as metaphorical humans' (Parker Pearson, 1999: 53). The poor histological preservation of the samples from Battlesbury Bowl suggests the cattle were buried whole and became disarticulated through exhumation and redeposition, similar to human burials, with some variation. By contrast, sheep may represent food waste at Battlesbury Bowl, as they have greater histological preservation than the other species, with BB(F)45 scoring OHI 5. The pristine preservation of this sample also suggests the depositional environment had little impact on histological preservation, as other samples from the same feature displayed higher levels of bioerosion. When compared to the other domesticates, this is an unusual result and it is important to consider alternative explanations. As previously discussed, neonatal skeletons are often unaffected histotaphonomically (Booth et al., 2016), and animals killed for meat at a younger age have lower bone porosity and are less susceptible to bioerosion (Turner-Walker 2012). However, these explanations seem unlikely as the majority of the caprine samples were fully grown, and displayed no evidence of butchery.

Large quantities of faunal remains have been found in pits across Iron Age Britain and are often thought to be part of rubbish repositories as opposed to burial features. However, their association with human remains in some pits provides an alternative view on their pre-depositional treatment and intended purposes. Animal deposits within human burial pits are often disarticulated, but occasionally complete and with no traces of butchery (Grant, 1989). These animals are most commonly cattle, caprines, horses, pigs and dogs. However, there are rare instances of cats, badgers, deer and foxes being buried in this way too (Grant, 1989). The lack of butchery evidence and the complete articulation of many of these deposits, even on animals typically thought to be food sources, indicates these were subject to prescribed depositional practices. At Battlesbury Bowl, 23 of the 46 faunal samples were found in the same feature as human remains, yet the humans and animals were disarticulated. Seven of these 23 samples also displayed signs of butchery, in contrast to those analysed by Grant (1989) and suggesting a different pre-depositional treatment. Future work including isotope analysis on contemporaneous human and animal remains may shed light on the treatments afforded to them, and whether they originated from the same location or were subject to prescribed management regimes.

## Conclusions

In conclusion, this research suggests mortuary practices at Battlesbury Bowl predominantly involve primary burial soon after death, followed by processes of exhumation, manipulation, curation and redeposition. There is no evidence that human remains became disarticulated through a process of sub-aerial exposure (often termed excarnation) but rather through exhumation and selective retrieval of skeletal elements. The deposits were of varied character and show different articulation levels, indicating that this was not a uniform rite. It may be that histologically poorly preserved remains recovered in different articulation levels may represent different phases of the same multi-stage mortuary practice. One noteworthy exception appears to have been subject to a different practice, perhaps semi-exposed in a silting or covered pit. Further experimental work has the potential to clarify the taphonomic pathways that can lead to these patterns of varied preservation.

This study observed considerable variability in the treatment of animals. Many appear to have been deposited whole shortly after death, paralleling human burial practices.

Others, especially caprines, appear to represent different burial practices, with largely histologically well-preserved samples. The unexpected poor histological preservation of cattle and pigs, species typically considered food animals, provides new insights into the pre-depositional practices afforded to animals at Battlesbury Bowl.

There remains considerable disagreement on the interpretative potential of histotaphonomic data (*e.g.* see Turner-Walker et al., 2023). However, there is growing evidence, as presented in previous research throughout this paper, that the extent of bioerosion can vary according to pre-depositional treatment and does not correlate with a class of remains or soil matrix (see Booth et al., 2024, for review). If soil matrix and element class were dictating factors in this study, we would not expect to observe intra-taxonomic variation in preservation (as the soil matrix is overwhelmingly homogenous). Further experimental research is required to examine the impact of a comprehensive range of variables (*e.g.* taxon, element, soil matrix, age, diet, seasonality, health status) on histological preservation of bone.

Methodologically, this research stands out as among the first to integrate analyses of the histological preservation of archaeological human and animal bones from the same site in Britain. Notably, the results pertaining to animals lean more towards interpretations of 'special' or structured deposition, challenging the notion of these remains being entirely food waste and providing insight into human-animal relationships in a mortuary context. For future research, an expanded sample size with a broader representation of species would enhance inter-species and feature comparisons. Lastly, it is noteworthy that no significant difference was found in the early post-mortem treatment of skulls compared to long bones, with both exhibiting evidence for post-skeletal manipulation, suggesting a uniform approach to burial practices across different skeletal elements.

**Acknowledgements** We would like to thank the Wiltshire Museum, and specifically Lisa Brown, for allowing us access to the human and faunal remains from Battlesbury Bowl, and for agreeing to destructive sampling for this research. We would also like to thank Ellen Hambleton and Jackie McKinley for their detailed specialist reports and Ellen for providing the original zooarchaeological recording for Battlesbury Bowl. We are also grateful to Tom Booth for insightful discussions surrounding the interpretation of histotaphonomic data and to Kirsty Harding for assistance in the production of Figure 1.

**Author contributions** All authors contributed to the study conception and design. Material acquisition and preparation, data collection, and analysis for the human remains were performed by Adelle Bricking. Material acquisition and preparation, data collection, and analysis for the faunal remains were performed by Bethany Revell. Material acquisition and supervision was undertaken by Richard Madgwick. The first draft of the manuscript was written by Adelle Bricking and Bethany Revell, and all authors commented on and edited the manuscript. All authors read and approved the final manuscript.

**Data Availability** No datasets were generated or analysed during the current study.

**Declarations**

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

**Compliance with Ethical Standards** Research on the human remains was conducted in accordance with the BABAO Code of Ethics and Practice. Destructive sampling was approved by the Cardiff University School of History, Archaeology and Religion Ethics Committee and the trustees of The Wiltshire Museum.

**Competing Interests** The authors declare no competing interests.

## References

Armit, I. (2012). *Headhunting and the body in Iron Age Europe*. Cambridge University Press.

Balzer, A., Gleixner, G., Grupe, G., Schmidt, H. L., Schramm, S., & Turban-Just, S. (1997). In vitro decomposition of bone collagen by soil bacteria: The implications for stable isotope analysis in archaeometry. *Archaeometry, 39*(2), 415–429. https://doi.org/10.1111/j.1475-4754.1997.tb00817.x

Barrett, J., Woodward, A., & Freeman, P. (2000). Cadbury Castle Somerset: The later prehistoric and early historic archaeology. *English Heritage Archaeological Monographs* [data-set]. York: Archaeology Data Service [distributor] https://doi.org/10.5284/1028203

Bell, L. S. (1990). Palaeopathology and diagenesis: An SEM evaluation of structural changes using backscattered electron imaging. *Journal of Archaeological Science, 17*, 85–102. https://doi.org/10.1016/0305-4403(90)90016-X

Bell, L. S., Skinner, M. F., & Jones, S. J. (1996). The speed of post-mortem change to the human skeleton and its taphonomic significance. *Forensic Science International, 82*, 129–140. https://doi.org/10.1016/0379-0738(96)01984-6

Bersu, G. (1940). Excavations at Little Woodbury, Wiltshire, part 1: The settlement as revealed by excavation. *Proceedings of the Prehistoric Society, 6*, 30–111. https://doi.org/10.1017/S0079497X00020429

Boaks, A., Siwek, D., & Mortazavi, F. (2014). The temporal degradation of bone collagen: A histochemical approach. *Forensic Science International, 240*, 104–110. https://doi.org/10.1016/j.forsciint.2014.04.008

Booth, T. J. (2014) *An investigation into the relationship between bone diagenesis and funerary treatment*. Unpublished PhD thesis, University of Sheffield.

Booth, T. J. (2016). An investigation into the relationship between funerary treatment and bacterial bioerosion in European archaeological human bone. *Archaeometry, 58*(3), 484–499. https://doi.org/10.1111/arcm.12190

Booth, T. J., Bricking, A., & Madgwick, R. (2024). Comment on "Bacterial bioerosion of bones is a post-skeletonisation phenomenon and appears contingent on soil burial" [Quat. Int. 660 (2023) 75–83]. *Quaternary International, 702*, 61–64. https://doi.org/10.1016/j.quaint.2024.02.005

Booth, T. J., Brönnimann, D., Madgwick, R., & Portmann, C. (2022). The taphonomic and archaeothanatological potentials of diagenetic alterations of archaeological bone. In C. J. Knusel, and E. M. Schotsmans (Eds.), *The Routledge handbook of archaeothanatology* (1st ed., pp. 580–599). Routledge.

Booth, T. J., & Brück, J. (2020). Death is not the end: Radiocarbon and histo-taphonomic evidence for the curation and excarnation of human remains in Bronze Age Britain. *Antiquity*, *94*(377), 1186–1203. https://doi.org/10.15184/aqy.2020.152

Booth, T. J., & Madgwick, R. (2016). New evidence for diverse secondary burial practices in Iron Age Britain: A histological case study. *Journal of Archaeology Science, 67*, 14–24. https://doi.org/10.1016/j.jas.2016.01.010

Booth, T. J., Redfern, R. C., & Gowland, R. L. (2016). Immaculate conceptions: Micro-CT analysis of diagenesis in Romano-British infant skeletons. *Journal of Archaeological Science, 74*, 124–134. https://doi.org/10.1016/j.jas.2016.08.007

Bricking, A. (2023). Mortuary practices in the Iron Age of southwest Britain. Unpublished PhD thesis, Cardiff University.

Bricking, A., Hayes, A., & Madgwick, R. (2022). An interim report on histological analysis of human bones from Fishmonger's Swallet, Gloucestershire. *Proceedings of the University of Bristol Speleological Society, 29*(1), 67–86.

Brönnimann, D., Portmann, C., Pichler, S. L., Booth, T. J., Roder, B., Vach, W., Schibler, J., & Rentzel, P. (2018). Contextualising the dead - Combining geoarchaeology and osteoanthropology in a new multi-focus approach in bone histotaphonomy. *Journal of Archaeological Science, 98*, 45–58. https://doi.org/10.1016/j.jas.2018.08.005

Bulleid, A. & Gray, H. St. G. (1917). The Glastonbury Lake Village (vol. 2). The Glastonbury Antiquarian Society.

Carr, G., & Knüsel, C. (1997). The ritual framework of excarnation by exposure as the mortuary practice of the early and middle Iron Ages of central southern Britain. *Oxbow Monograph*, 167–173.

Chaillou, S., Chaulot-Talmon, A., Caekebeke, H., Cardinal, M., Christieans, S., Denis, C., Desmonts, M. H., Dousset, X., Feurer, C., Hamon, E., Joffraud, J.-J., La Carbona, S., Leroi, F., Leroy, S., Lorre, S., Macé, S., Pilet, M.-F., Prévost, H., Rivollier, M., … Champomier-Vergès, M.-C. (2015). Origin and ecological selection of core and food-specific bacterial communities associated with meat and seafood spoilage. *ISME Journal, 9*(5), 1105–1118. https://doi.org/10.1038/ismej.2014.202

Cobaugh, K. L., Schaeffer, S. M., & DeBruyn, J. M. (2015). Functional and structural succession of soil microbial communities below decomposing human cadavers. *PLoS ONE, 10*(6), e0130201. https://doi.org/10.1371/journal.pone.0130201

Coles, J., & Minnitt, S. (1995). *Industrious and fairly civilized: The Glastonbury Lake Village*. Somerset Levels Project and Somerset County Museums Service.

Collins, M. J., Riley, M. S., Child, A. M., & Turner-Walker, G. (1995). A basic mathematical simulation of chemical degradation of ancient collagen. *Journal of Archaeological Science, 22*, 175–183. https://doi.org/10.1006/jasc.1995.0019

Cross, P. J. (2011). Horse burial in First Millennium AD Britain: Issues of interpretation. *European Journal of Archaeology, 14*(1–2), 190–209. https://doi.org/10.1179/146195711798369409

Cunliffe, B. (1984). *Danebury: An Iron Age Hillfort in Hampshire* (Vol. 2). Council for British Archaeology.

Cunliffe, B. (1992). Pits, preconceptions and propitiation in the British Iron Age. *Oxford Journal of Archaeology, 11*(1), 69–83. https://doi.org/10.1111/j.1468-0092.1992.tb00257

Cunliffe, B. (1995). *Danebury: An Iron Age Hillfort in Hampshire* (Vol 6. No. 102). Council for British Archaeology.

Cunliffe, B., & Poole, C. (1991). *Danebury: An Iron Age Hillfort in Hampshire: The excavations 1979–1988: The finds* (Vol. 5, No. 73). Council for British Archaeology.

Cunliffe, B., & Poole, C. (2000). Suddern Farm, Middle Wallop, Hants., 1991 and 1996. English Heritage and Oxford University Committee for Archaeology Monograph No. 49.

Cunnington, M. E. (1923). *The Early Iron Age inhabited site at all Cannings Cross Farm, Wiltshire*. Simpson.

Damann, F. E., & Jans, M. M. (2017). Microbes, anthropology, and bones. In D. O. Carter et al. (Eds). *Forensic microbiology* (pp. 312–327). John Wiley and Sons. https://doi.org/10.1002/9781119062585.ch12

Ellis, C., & Powell, A. B. (2008). *An Iron Age settlement outside Battlesbury Hillfort, Warminster and sites along the Southern Range Road*. Wessex Archaeology Ltd.

Emmons, A. L., Mundorff, A. Z., Hoeland, K. M., Davoren, J., Keenan, S. W., Carter, D. O., Campagna, S. R., DeBruyn, J. M., & Kent, A. D. (2022). Postmortem skeletal microbial community composition and function in buried human remains. *mSystems*, *7*(2), e00041–22. https://doi.org/10.1128/msystems.00041-22

Eriksen, A. M., Nielsen, T. K., Matthiesen, H., Caroe, C., Hansen, L. H., Gregory, D. J., Turner-Walker, G., Collins, M. J., & Gilbert, T. P. (2020). Bone biodeterioration - The effect of marine and terrestrial depositional environments on early diagenesis and bone bacterial community. *PLoS ONE, 15*(10), e0240512. https://doi.org/10.1371/journal.pone.0240512

Fernández-Jalvo, Y., Andrews, P., Pesquero, M. D., Smith, C., Marin-Monfort, D., Sánchez, B., Geigl, E.-M., & Alonso, A. (2010). Early bone diagenesis in temperate environments: Part I: Surface features and histology. *Palaeogeography, Palaeoclimatology, Palaeoecology, 288*(1–4), 62–81. https://doi.org/10.1016/j.palaeo.2009.12.016

Gardner, W., & Savory, H. N. (1964). *Dinorben: A Hill-Fort occupied in Early Iron Age and Roman times*. National Museum of Wales.

Garland, A. N. (1987). A histological study of archaeological bone decomposition. In A. Boddington, A. N. Garland, & R. C. Janaway (Eds.), *Death, decay and reconstruction: Approaches to archaeology and forensic science* (pp. 109–126). Manchester University Press.

Goren, H. P., Agarwal, S. C., & Beauchesne, P. (2021). Interpreting mortuary treatment from histological bone diagenesis: A case study from Neolithic Çatalhöyük. *International Journal of Osteoarchaeology, 31*, 121–134. https://doi.org/10.1002/oa.2930

Grant, A. (1984). Survival or sacrifice? A critical appraisal of animal burials in Britain in the Iron Age. In C. Grigson and J. Clutton-Brock (Eds), *Animals and archaeology 4: Husbandry in Europe* (pp. 221–228). British Archaeological Report (International Series 227).

Grant, A. (1989). Animals and ritual in Early Britain: The visible and the invisible. L'Animal dans les pratiques religieuses: Les manifestations matérielles. *Anthropozoologica, 3*, 79–86.

Green, M. (1992). *Animals in Celtic life and myth*. Routledge.

Hackett, C. J. (1981). Microscopical focal destruction (tunnels) in exhumed human bones. *Medicine, Science and the Law, 21*(4), 243–266. https://doi.org/10.1177/002580248102100403

Hambleton, E. (2013). The life of things long dead: A biography of Iron Age animal skulls from Battlesbury Bowl. *Wiltshire. Cambridge Archaeological Journal, 23*(3), 477–494. https://doi.org/10.1017/S0959774313000486

Hambleton, E., & Maltby, M. (2004). *The animal bones from Battlesbury Bowl*. Bournemouth University.

Hambleton, E., & Maltby, M. (2008). Faunal remains. In C. Ellis & A. B. Powell (Eds.), *An Iron Age settlement outside Battlesbury Hillfort, Warminster and sites along the Southern Range Road* (pp. 84–93). Wessex Archaeology Ltd.

Harding, D. (2016). *Death and burial in Iron Age Britain* (1st ed.). Oxford University Press.

Hedges, R. E. (2002). Bone diagenesis: An overview of processes. *Archaeometry, 44*(3), 319–328. https://doi.org/10.1111/1475-4754.00064

Hedges, R. E., Millard, A. R., & Pike, A. W. (1995). Measurements and relationships of diagenetic alteration of bone from three archaeological sites. *Journal of Archaeological Science, 22*(2), 201–209. https://doi.org/10.1006/jasc.1995.0022

Hencken, T. C. (1938). The excavation of the Iron Age camp on Bredon Hill, Gloucestershire, 1935–1937. *Archaeological Journal, 95*(1), 1–111. https://doi.org/10.1080/00665983.1938.10853692

Hill, J. D. (1995). *Ritual and rubbish in the Iron Age of Wessex* (Vol. 242). BAR: Tempus Reparatum.

Hodson, F. R. (1964). Cultural grouping within the British Pre-Roman Iron Age. *Proceedings of the Prehistoric Society, 30*, 99–110. https://doi.org/10.1017/S0079497X00015085

Hollinrake, N., & Hollinrake, C. (1997). *An archaeological evaluation at Perrott Hill School*. Fieldwork report. C. and N. Hollinrake Ltd. https://doi.org/10.5284/1029077

Hollund, H. I., Jans, M. M. E., Collins, M. J., Kars, H., Joosten, I., & Kars, S. M. (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*(5), 537–548. https://doi.org/10.1002/oa.1273

Jackes, M., Sherburne, R., Lubell, D., Barker, C., & Waymann, M. (2001). Destruction of microstructure in archaeological bone: A case study from Portugal. *International Journal of Osteoarchaeology, 11*, 415–432.

Jans, M. M. (2022). Microscopic destruction of bone. In J. T. Pokines, S. A. Symes, & E. N. L'Abbe (Eds.), *Manual of forensic taphonomy* (pp. 23–39). CRC Press.

Jans, M. M., Kars, H., Nielsen-Marsh, C. M., Smith, C. I., Nord, A. G., Arthur, P., & Earl, N. (2002). In-situ preservation of archaeological bone: A histological study within a multidisciplinary approach. *Archaeometry, 44*(3), 343–352. https://doi.org/10.1111/1475-4754.t01-1-00067

Jans, M. M., Nielsen-Marsh, C. M., Smith, C. I., Collins, M. J., & Kars, H. (2004). Characterisation of microbial attack on archaeological bone. *Journal of Archaeological Science, 31*(1), 87–95. https://doi.org/10.1016/j.jas.2003.07.007

Kendall, C., Eriksen, A. M., Kontopoulos, I., Collins, M. J., & Turner-Walker, G. (2018). Diagenesis of archaeological bone and tooth. *Palaeogeography, Palaeoclimatology, Palaeoecology, 491*(1), 21–37. https://doi.org/10.1016/j.palaeo.2017.11.041

Kontopoulos, I., Nystrom, P., & White, L. (2016). Experimental taphonomy: Post-mortem microstructural modifications in *Sus scrofa domesticus* bone. *Forensic Science International, 266*, 320–328. https://doi.org/10.1016/j.forsciint.2016.06.024

Kontopoulos, I., Van De Vijver, K., Robberechts, B., Von Tersch, M., Turner-Walker, G., Penkman, K., & Collins, M. J. (2022). Histological and stable isotope analysis of archeological bones from St. Rombout's cemetery (Mechelen, Belgium): Intrasite, intraindividual, and intrabone variability. *International Journal of Osteoarchaeology*, 32(5), 1142–1156. https://doi.org/10.1002/oa.3145

Lemmers, S. A., Goncalves, D., Cunha, E., Vassalo, A. R., & Appleby, J. (2020). Burned fleshed or dry? The potential of bioerosion to determine the pre-burning condition of human remains. *Journal of Archaeological Method and Theory, 27*, 972–991. https://doi.org/10.1007/s10816-020-09446-x

Lovell, J. (1999). Further investigation of an Iron Age and Romano-British farmstead on Cockey Down, near Salisbury. *Wiltshire Archaeological and Natural History Magazine, 92*, 33–38.

Madgwick, R. (2008). Patterns in the modification of animal and human bones in Iron Age Wessex: Revisiting the excarnation debate. In O. Davis, N. Sharples, & K. Waddington (Eds.), *Changing perspectives on the First Millennium BC* (pp. 99–118). Oxbow.

Madgwick, R. (2010). Bone modification and the conceptual relationship between humans and animals in Iron Age Wessex. In J. Morris and M. Maltby (Eds.) *Integrating social and environmental archaeologies: Reconsidering deposition* (pp. 66–82). B.A.R. International Series 2077. Archaeopress.

Madgwick, R., & Bricking, A. (2023). Exploring mortuary practices: Histotaphonomic analysis of the human remains and associated fauna. In P. Guarino & A. Barclay (Eds.), *In the Shadow of Segsbury: The archaeology of the H380 Childrey Warren Water Pipeline, Oxfordshire, 2018–20*, *Cotswold Archaeology monograph* (pp. 96–102). Cotswold Archaeology.

Madgwick, R., & Mulville, J. (2015). Feasting on fore-limbs: Conspicuous consumption and identity in later prehistoric Britain. *Antiquity*, *89*, 629–644. https://doi.org/10.15184/aqy.2015.24

Marchiafava, V., Bonucci, E., & Ascenzi, A. (1974). Fungal osteoclasia: A model of dead bone resorption. *Calcified Tissue Research, 14*, 195–210.

Mavroudas, S. R., Alfsdotter, C., Bricking, A., & Madgwick, R. (2023). Experimental investigation of histotaphonomic changes in human bone from whole-body donors demonstrates limited effects of early post-mortem change in bone. *Journal of Archaeological Science, 154*, 1–10. https://doi.org/10.1016/j.jas.2023.105789

McKinley, J. I. (2008). Human Remains. In C. Ellis & A. B. Powell (Eds.), *An Iron Age settlement outside Battlesbury Hillfort, Warminster and sites along the Southern Range Road* (pp. 71–83). Wessex Archaeology Ltd.

Millard, A. R. (2001). Deterioration of bone. In A. M. Pollard & D. R. Brothwell (Eds.), *Handbook of archaeological sciences* (pp. 637–647). Wiley.

Millett, M., & Russell, D. (1982). An Iron Age burial from Viables Farm. *Basingstoke. Archaeological Journal, 139*(1), 69–90. https://doi.org/10.1080/00665983.1982.11078533

Mollerup, L., Tjellden, A. K., Hertz, E., & Holst, M. K. (2016). The postmortem exposure interval of an Iron Age human bone assemblage from Alken Enge, Denmark. *Journal of Archaeological Science: Reports, 10*, 819–827. https://doi.org/10.1016/j.jasrep.2016.06.021

Morris, J. (2008). Associated bone groups; one archaeologist's rubbish is another's ritual deposition. In O. Davis, N. Sharples, & K. Waddington (Eds.), *Changing perspectives on the First Millennium BC* (pp. 83–98). Oxbow Books.

Morris, J. (2011). *Investigating animal burials: Ritual, mundane and beyond* (Vol. BAR 535). Archaeopress.

Mulville, J., Madgwick, R., Powell, A., & Parker Pearson, M. (2012). Flesh on the bones: Animal bodies in Atlantic roundhouses. In A. Pluskowski (Ed.), *The ritual killing and burial of animals: European perspectives* (pp. 208–221). Oxbow Books.

Nielsen-Marsh, C. M., & Hedges, R. E. M. (2000). Patterns of diagenesis in bone I: The effects of site environments. *Journal of Archaeological Science, 27*(12), 1139–1150. https://doi.org/10.1006/jasc.1999.0537

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*(9), 1523–1531. https://doi.org/10.1016/j.jas.2006.11.012

Parker Pearson, M. (1999). Food, sex, and death: Cosmologies in the British Iron Age with particular reference to East Yorkshire. *Cambridge Archaeological Journal, 9*(1), 43–69.

Parker Pearson, M., Chamberlain, A., Craig, O., Marshall, P., Mulville, J., Smith, C., Chenery, C., Collins, M., Cook, G., Craig, G., Evans, J., Hiller, J., Montgomery, J., Schwenninger, J.-L., Taylor, G., & Wess, T. (2005). Evidence for mummification in Bronze Age Britain. *Antiquity, 79*, 529–546.

Pesquero, M. D., Lynne, B. S., & Fernandez-Jalvo, Y. (2018). Skeletal modification by microorganisms and their environments. *Historical Biology, 30*(6), 882–893. https://doi.org/10.1080/08912963.2017.1371713

Pluskowski, A. (2012). Introduction: The ritual killing and burial of animals in the past. In A. Pluskowski (Ed.), *The ritual killing and burial of animals: European perspectives* (pp. 10–15). Oxbow Books.

Reid, R. A. G., Jans, M. E., Chesson, L. A., Taylor, R. J., & Berg, G. E. (2024). The influence of taphonomy on histological and isotopic analyses of treated and untreated buried modern human bone. *Journal of Archaeological Science, 161*, 1–14. https://doi.org/10.1016/j.jas.2023.105901

Russell, M., Cheetham, P., Evans, D., Gale, J., Hambleton, E., Hewitt, I., Manley, H., Pitman, D., & Stewart, D. (2016). The Durotriges Project, Phase Three: An interim statement. *Proceedings of the Dorset Natural History and Archaeological Society, 137*, 157–161.

Russell, M., Cheetham, P., Evans, D., Hambleton, E., Hewitt, I., Manley, H., & Smith, M. (2014). The Durotriges Project, Phase One: An interim statement. *Proceedings of the Dorset Natural History and Archaeological Society, 135*, 217–221.

Russell, N. (2012). *Social zooarchaeology: Humans and animals in prehistory*. Cambridge University Press.

Russell, R., Cheetham, P., Barrass, K., Evans, D., Hambleton, E., Manley, H., Pitman, D., & Steward, D. (2017). The Durotriges Project 2017: An interim statement. *Proceedings of the Dorset Natural History and Archaeological Society, 139*, 127–133.

Sharples, N. (2010). *Social relations in later prehistory: Wessex in the First Millennium BC*. Oxford University Press.

Singh, B., Minick, K. J., Strickland, M. S., Wickings, K. G., Crippen, T. L., Tarone, A. M., Benbow, M. E., Sufrin, N., Tomberlin, J. K., & Pechal, J. L. (2017). Temporal and spatial impact of human cadaver decomposition on soil bacterial and arthropod community structure and function. *Frontiers in Microbiology, 8*(2616), 1–12. https://doi.org/10.3389/fmicb.2017.02616

Smith, C. I., Faraldos, M., & Fernandez-Jalvo, Y. (2008). The precision of porosity measurements: Effects of sample pre-treatment on porosity measurements of modern and archaeological bone. *Palaeogeography, Palaeoclimatology, Palaeoecology, 266*(3–4), 175–182. https://doi.org/10.1016/j.palaeo.2008.03.028

Smith, C. I., Nielsen-Marsh, C. M., Jans, M. M. E., & Collins, M. J. (2007). Bone diagenesis in the European Holocene I: Patterns and mechanisms. *Journal of Archaeological Science, 34*(9), 1485–1493. https://doi.org/10.1016/j.jas.2006.11.006

Smith, K. (2006). *Guides, guards and gifts to the gods: Domesticated dogs in the art and archaeology of Iron Age and Roman Britain* (Vol. 422). Archaeopress.

Smith, R. A. (1912). On late Celtic Antiquities discovered at Welwyn, Herts. *Archaeologia, 63*, 1–30. https://doi.org/10.1017/S0261340900011553

Stead, I. M., (1979). *The Arras culture*. Yorkshire Philosophical Society.

Stephens, M. (2023). *Chariots, swords and spears: Iron Age burials at the foot of the East Yorkshire Wolds*. Oxbow Books.

Turner-Walker, G. (2012). Early bioerosion in skeletal tissues: Persistence through deep time. *Neues Jahrbuch fur Geologie und Palaontologie-Abhandlungen*, 165–183.

Turner-Walker, G. (2019). Light at the end of the tunnels? The origins of microbial bioerosion in mineralised collagen. *Palaeogeography, Palaeoclimatology, Palaeoecology, 529*, 24–38. https://doi.org/10.1016/j.palaeo.2019.05.020

Turner-Walker, G., Galiacho, A. G., Armentano, N., & Hsu, C.-Q. (2023). Bacterial bioerosion of bones is a post-skeletonisation phenomenon and appears contingent on soil burial. *Quaternary International, 660*, 75–83.

Turner-Walker, G., & Jans, M. M. (2008). Reconstructing taphonomic histories using histological analysis. *Palaeogeography, Palaeoclimatology, Palaeoecology, 266*(3–4), 227–235. https://doi.org/10.1016/j.palaeo.2008.03.024

Turner-Walker, G., & Mays, S. (2008). Histological studies on ancient bone. In R. Pinhasi & S. Mays (Eds.), *Advances in human palaeopathology* (pp. 121–146). John Wiley and Sons Ltd.

Wait, G. A. (1985). *Ritual and religion in Iron Age Britain* (Vol. 149). Oxford.

Wheeler, R. E.M. (1954). *The Stanwick fortifications: North Riding of Yorkshire*. Research Committee of The Society of Antiquaries.

Whimster, R. (1981). *Burial practices in Iron Age Britain: A gazetteer of the evidence c. 700 BC-AD 43*.

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. https://doi.org/10.1016/j.forsciint.2014.03.024

Whittle, A. (1984). The pits. In B. Cunliffe (Ed.) *Danebury: An Iron Age Hillfort in Hampshire, Volume 1, the excavations, 1969–1978: The site (Vol 2); the excavations 1969–1978: The finds* (pp. 128–145). Council for British Archaeological Research Report 52.



## Authors and Affiliations

**A. Bricking[1] · B. Revell[2] · R. Madgwick[2]**

✉ R. Madgwick
MadgwickRD3@cardiff.ac.uk

A. Bricking
adelle.bricking@museumwales.ac.uk

B. Revell
revellbs@cardiff.ac.uk

[1] Department of Archaeology and Numismatics, Museum Wales - Amgueddfa Cymru, Cardiff, UK

[2] School of History, Archaeology and Religion, Cardiff University, Cardiff, UK