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Research Article

'The darker angels of our nature': Early Bronze Age butchered human remains from Charterhouse Warren, Somerset, UK

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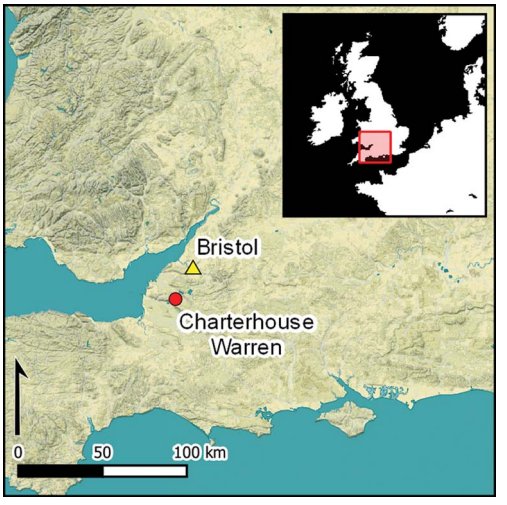

Direct physical evidence for violent interpersonal conflict is seen only sporadically in the archaeological record for prehistoric Britain. Human remains from Charterhouse Warren, south-west England, therefore present a unique opportunity for the study of mass violence in the Early Bronze Age. At least 37 men, women and children were killed and butchered, their disarticulated remains thrown into a 15m-deep natural shaft in what is, most plausibly, interpreted as a single event. The authors examine the physical remains and debate the societal tensions that could motivate a level and scale of violence that is unprecedented in British prehistory.

Keywords: South-west England, Beaker, violence, cutmarks, cranial trauma, cannibalism

Introduction

While Steven Pinker's 2011 book *The better angels of our nature* reflects on a decline in violence over the course of human history (though not uncontroversially, e.g. Ferguson 2013),

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the Early Bronze Age site of Charterhouse Warren, Somerset, reveals the darker side of human prehistory. Excavated in the 1970s, the site contains the remains of at least 37 men, women and children who were thrown down a 15m-deep natural shaft. This little-known assemblage is notable for the sheer number of cutmarks on the bones indicating dismemberment and defleshing, alongside perimortem fracturing of long bones and percussive injuries to crania. While evidence for interpersonal violence is not unknown in British prehistory, nothing else on this scale has been found, and the site joins a small number of Neolithic, Chalcolithic and Bronze Age sites in continental Europe showing extreme violence and postmortem processing of human remains. This article presents an overview of research undertaken at Charterhouse Warren, focusing on the evidence for skeletal trauma and body processing and the radiocarbon dating and isotopic analyses of the individuals.

Despite the hundreds of well-preserved, largely complete skeletons excavated, there is limited direct physical evidence for violent conflict in the British Chalcolithic (*c.* 2450–2200 cal BC) and Early Bronze Age (*c.* 2200–1600/1500 cal BC). The skeleton of a young adult male found in the ditch at Stonehenge, shot multiple times with flint-tipped arrows, provides one prominent example (Evans 1984). At Racton, West Sussex, the skeleton of an adult male exhibits sharp-force trauma consistent with a metal-edged weapon, probably a bronze dagger like the one that accompanies the burial (Needham *et al.* 2017). Such cases are difficult to interpret: was this violence occurring within the community, as homicide, revenge or socially sanctioned punishment for some transgression? Or was violence occurring between communities or polities, thereby meeting a standard anthropological definition of warfare (Otterbein 2004)?

While disarticulated skeletal remains from the Chalcolithic and Early Bronze Age do occur (Brück 2006; Bloxam & Parker Pearson 2022), there are many more complete, articulated skeletons, particularly in south-west England prior to *c.* 1900 BC, when cremation began to dominate funerary rites (Lewis & Mullin 2012). There is also limited evidence for multiple burial at this time (e.g. Fitzpatrick 2011). The large assemblage of disarticulated remains at Charterhouse Warren therefore stands in contrast to normative funerary rites for the period, even before the evidence for trauma and extensive postmortem processing of the body is considered.

Charterhouse Warren Farm Shaft

Charterhouse Warren Farm Shaft (CWFS, originally but mistakenly termed a swallet) is a 20m-deep natural shaft in the Carboniferous limestone plateau of the Mendip Hills, Somerset, south-west England. Two excavation campaigns were undertaken at the site, initially in 1972–1976 and again in 1983–1986, aimed at finding the entrance to an underlying cave system (Figure 1 and online supplementary material (OSM) S1–S5; for a full account of the excavations see Levitan *et al.* 1988).

Excavations in the entrance shaft are designated Horizons 1–4. Horizon 1 comprises the upper 9m of the shored shaft starting at 6m below the surface, and contained comparatively few faunal and human remains, concerning which little information is available (as is also the case for the side passage designated Horizon b; see OSM S1). Horizon 2, first reached in July 1975, is distinguished by its high density of disarticulated, fragmented human and faunal remains, overwhelmingly cattle (Table S1, see also OSM S2). Sherds of a nearly complete

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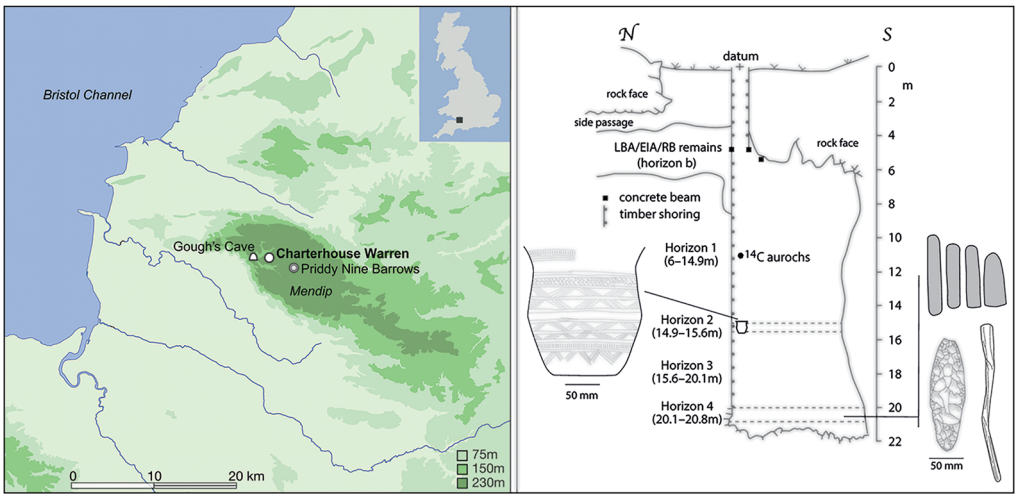

Figure 1. Left) Location of Charterhouse Warren, Mendip, Somerset; right) schematic north-south section through the entrance shaft showing locations of selected artefacts (Beaker vessel, sponge finger stones, flint dagger, antler spatula) (after Levitan et al. *1988: figs. 6, 21, 23 & 25) (figure by authors).*

Bell Beaker were also found at this level (Figure 1). Beneath this, Horizon 3 contained only some cattle remains and coarse black potsherds. Horizon 4 extended for 0.74m to a depth of 20.79m, containing neonatal human remains, animal bones and a small assemblage of artefacts including a flint dagger, an antler spatula and a collection of 'sponge finger stones' (Figure 1), all typical of a Beaker (*c.* 2450–1800 BC) funerary assemblage (see Woodward & Hunter 2015). Single radiocarbon dates obtained on human bone from Horizons 2 and 4 are statistically indistinguishable at 2343–2036 cal BC (χ^2, df=1, T=0.1(5%, 3.8)) (Table S3), despite the intervening 4.45m near-sterile fill of Horizon 3 (Levitan & Smart 1989).

The human bone assemblage

Analysis of the disarticulated and highly fragmented human bone assemblage from Horizon 2 at Charterhouse Warren is challenging. The material was recovered under difficult conditions, working at a depth of 15m in a cramped space and from sticky, silty clay sediment interspersed with numerous stones. Stratigraphic details are available for some bones, but in other cases it is not clear whether they are from Horizon b or from Horizon 2. This attribution is crucial, as Horizon b appears to span the Late Bronze Age (*c.* 1150–800/700 BC) to the Romano-British period (AD 43–410), while Horizons 2 and 4 date to the Early Bronze Age. Approximately one-third of the bones show some degree of dark mineral staining (see OSM S3, Figure S6).

More than 3000 individual human bones and bone fragments at least tentatively identified to element have been recovered (compared to only 229 reported in Levitan *et al.* 1988; Table S1), the vast majority of which derive from Horizon 2 (the human remains from Horizon 4 are restricted to a small number of elements from one or possibly two neonates). The

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shaft was sectioned during excavation so that only approximately half of the remains were recovered. The fragmentary and incomplete state of the material hinders construction of a demographic profile but it is possible to broadly characterise the assemblage. Based on a combination of non-repeating fragments of mandibles and long bones (cf. Knüsel & Outram 2004), at least 37 individuals are conservatively estimated to be represented, though the real total is probably higher. Age-at-death ranges from neonate to older adult (Figure S7). Both males and females are represented, but relative proportions cannot be estimated at this stage. Older children and adolescents together comprise nearly 50 per cent of the assemblage, more characteristic of a catastrophic mortality profile (OSM S4; Figure S8) as these age groups usually experience low mortality in stable populations (Weiss 1975). Apparent underrepresentation of infants and younger children may reflect taphonomic and/or recovery biases. Ongoing ancient DNA analysis of ancestry and familial relationships should provide additional insights into the nature of the assemblage, and whether it represents a snapshot of a 'living community'.

Several cranial elements display clear evidence of blunt force trauma (Figure 2), identified by curvilinear fracture lines with smooth edges and oblique fracture margins with patinated internal bevelling (Kranioti 2015). The number of individuals affected is difficult to determine, given the highly fragmented condition of the assemblage. But of 20 cranial elements that include at least part of the right orbit (and so represent distinct individuals), nine (45.0%) show evidence of perimortem fracturing. Considering all cranial elements, 30.4 per cent (170/559) show perimortem fracturing (OSM S5; Table S2). This implies that many, if not all, of the individuals in Horizon 2 at CWFS suffered a violent death.

The only previously published account of the human remains noted a "large number of [human] bones, many of which bear cut-marks and other evidence of 'butchery'" (Levitan *et al.* 1988: 174), but neither the size of the assemblage nor the full extent of postmortem processing has been appreciated. Cutmarks, often multiple, are found on 20 per cent of the human elements, and one-third exhibit perimortem fracturing. The faunal assemblage has yet to be studied, but it can be noted that only about six per cent of a subset of approximately 160 non-human mammal bones exhibit cutmarks. The majority of the cutmarks appear to have been made with stone rather than metal tools (Figure 3; OSM S5), though further examination is required before the latter can be excluded. The locations of the cutmarks on the post-cranial skeletal remains are consistent with both disarticulation and defleshing (Galán & Domínguez-Rodrigo 2013).

Of the cranial elements, 25.2 per cent (141/559) exhibit cutmarks, with frontal bones and mandibles being the most frequently affected (Table S2). One of the more complete crania presents multiple cutmarks along the length of the frontal bone, suggesting removal of the scalp (Figure 2g–h). At least five mandibles show multiple deep cutmarks on the anterior surface of the ascending ramus, in a position that indicates the powerful masseter muscle was severed, facilitating the removal of the lower jaw (Figure 4). In at least one case, there are long slicing cutmarks on the interior surface of the body of the mandible, suggesting removal of the tongue.

Five of 12 largely complete (hence belonging to different individuals) atlas vertebrae exhibit cutmarks, as do six of 10 axis vertebrae (Figure 5). These range from shallow slices to short, deep cuts, but all occur on the anterior surfaces and would have served to remove

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Figure 2. Examples of cranial trauma. Top) perimortem injury to the left posterior of the frontal bone (a), cutmarks can also be seen on the frontal bone (b) and patinated bevel of the internal cranial surface is apparent around the injury (c); middle) cranium with a perforating injury to mid-frontal bone (d), a closer view shows radiating fracture lines (e) and the internal view shows patinated bevel (f); bottom) adult cranium (g), close inspection shows cutmarks running along the mid-frontal (h) and a perimortem blunt force fracture to the conjoining right frontal bone fragment (i) (figure by authors).

the head from the torso. Cutmarks are also seen on scapulae and on the posterior surfaces of several distal humeri, relating to disarticulation at the shoulder and elbow joints (Figure 6). Similarly, cutmarks on the ilium and the proximal femur mark the removal of the lower limb from the torso. Detachment of the foot from the leg is indicated by cutmarks on calcanei and

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Figure 3. Cutmarks on the posterior supraspinous fossa of an adult left scapula. Multiple parallel striations are visible within the cuts marked 'b' (figure by authors).

Figure 4. Right hemi-mandible of child aged about 10 years (a) with detail of cutmarks on the ascending ramus (b) (figure by authors).

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Figure 5. Axis (second cervical) vertebrae showing multiple cutmarks (figure by authors).

Figure 6. Cutmarks on distal left humerus (figure by authors).

tali. Cutmarks along the shafts of long bones and on both the external and internal (visceral) surfaces of ribs indicate defleshing and evisceration, respectively.

Approximately one-third of the Horizon 2 assemblage shows fractures characteristic of breaks to fresh bone, with many long bone fragments exhibiting curving margins and smooth, patinated surfaces (Figure 7; Table S2). Some long bones also display percussion pits and conchoidal fractures. An unusual damage pattern is observed on several distal femora, in which both the lateral and medial condyles have been removed. Similar damage is noted on some distal humeri. That this was the result of intentional action is clear, firstly because this kind of symmetrical breakage would be highly unusual for post-depositional taphonomic damage, and secondly because of the presence of a series of distinctive C- and D-shaped percussion pits on the condyles, adjacent to the removals (Figure 8). These were caused by indirect percussion, perhaps employing a bone awl or chisel. The fracturing and percussion patterns are consistent with

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Figure 7. Conjoining sections of left humerus showing perimortem spiral fracture of the midshaft, with detail of fracture margins below (figure by authors).

removal of yellow marrow from the long bone diaphyses and red marrow from the femoral condyles.

Several ribs exhibit bending fractures that may have been caused by the forceful opening of the chest cavity from a cut made along the midline (cf. Novak & Kollmann 2000). Cutmarks on the visceral surfaces of ribs demonstrate that the cavity was exposed. In addition, a small number of small bones of the hands and feet exhibit fresh bone crushing fractures that are consistent with the flat molars of omnivores, including humans, rather than the sharper punctures caused by carnivores (Figure 9) (Fernández-Jalvo & Andrews 2011; Saladié *et al.* 2013). There is little evidence for either carnivore or rodent gnawing in the assemblage, in keeping with the rapid infilling of the shaft inferred by the excavators (Levitan *et al.* 1988).

Interpretation of the assemblage

Duration of deposition

Nine new radiocarbon dates were obtained on human bone from Horizons 2 and 4, adding to the two previously published results (Levitan & Smart 1989) (OSM S6; Table S3). A further

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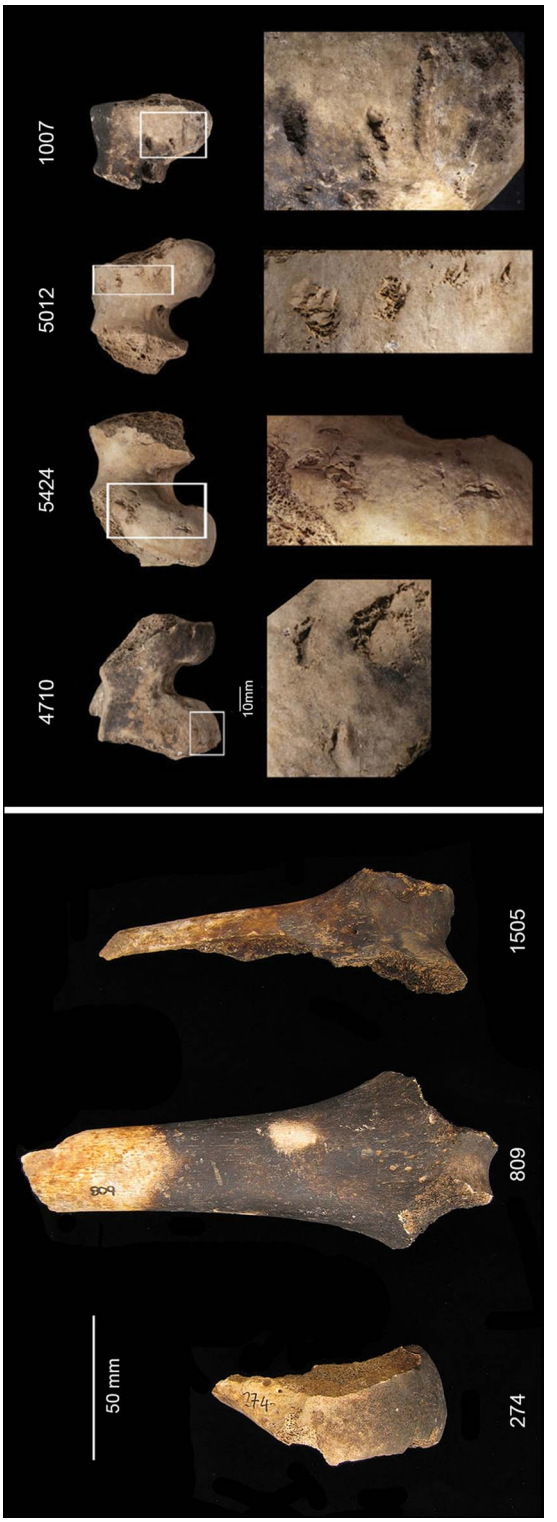

Figure 8. Left) distal femora with unusual breakage patterns involving symmetrical damage of the condyles; right) detail of percussion damage to the inferior surface of distal femora (figure by authors).

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Figure 9. Bones showing damage attributed to possible human chewing—from left to right: metatarsal 1, metatarsal, clavicle, metatarsal (figure by authors).

two dates were obtained on individuals from the uppermost deposits of Horizon b. All samples from Horizons 2 and 4 gave dates in the Early Bronze Age, while those from Horizon b returned Late Bronze Age/Early Iron Age and Middle Iron Age dates, confirming that the upper levels post-date the Early Bronze Age.

Given the intervening 4.45m of largely sterile Horizon 3, Horizons 2 and 4 can be treated as sequential. A Bayesian model (Bronk Ramsey 2009) therefore treats the Early Bronze Age remains as belonging to two consecutive phases (Figure 10), although Horizon 4 is poorly constrained (containing only two dates that possibly derive from the same individual), with start and end dates modelled as *2425–2140 BC* and *2280–2100 BC* (95.4% probability) respectively (modelled dates are presented in italics, rounded to nearest five years). Horizon 2 is modelled as starting *2210–2055 BC* and ending *2190–2010 BC* (95.4%) (Table S4). The modelled duration over which the deposition of human remains occurred in Horizon 2 is *0–125 years* (95.4%) or *0–60 years* (68.3%), with the highest single probability being that of a single event (Figure S9), although deposition over decades and up to a century or so is possible.

All the dates from Horizon 2 can be combined statistically to 2197–2038 cal BC (3721 ±10 BP, χ^2: df=8, T=14.2(5% 15.5)), and so are consistent with a single event. The dates from Horizons 2 and 4 cannot be successfully combined (χ^2: df=10, T=21.7(5% 18.3)), leaving open the possibility that two events are represented, separated by up to a century. Chronological precision is, however, constrained by late third-millennium fluctuations in the calibration curve, resulting in multiple intercepts.

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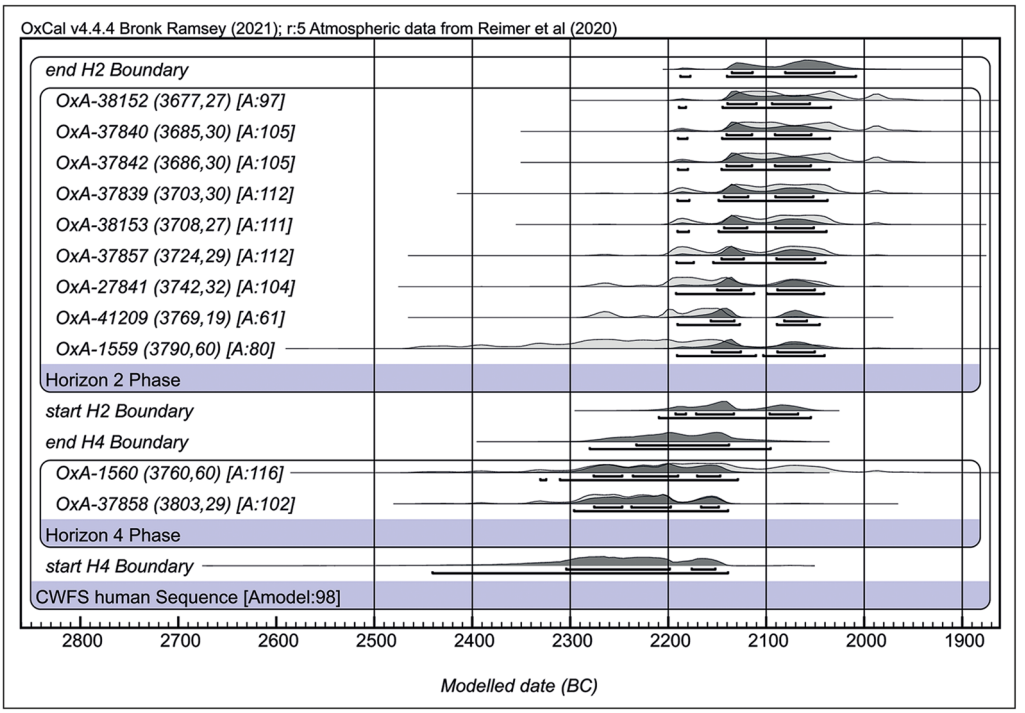

Figure 10. Bayesian model for radiocarbon-dated humans from CWFS, treated as two consecutive phases (figure by authors).

Geographic origins of individuals

Application of strontium ($^{87}Sr/^{86}Sr$) and oxygen ($\delta^{18}O$) isotopic analyses can indicate the geographic origin of dietary resources and water that were consumed while dental enamel was forming and, by extension, the area in which an individual grew up (see OSM S8 for methods and references). The results for 25 humans from Horizon 2 are largely consistent with a 'local' origin, with the exception of two outliers with higher $^{87}Sr/^{86}Sr$ values, which could reflect origins at least tens of kilometres to the west or south (Figure S10; Tables S6–S8).

A Bronze Age massacre?

The human bone assemblage from Horizon 2 at Charterhouse Warren is clearly exceptional, both in terms of the number of violent deaths—evidence for which is otherwise rare in the British Early Bronze Age—and in the extensive and systematic processing of the bodies, previously unknown for this period. Some 37 men, women and children—and possibly many more—were killed at close quarters with blunt instruments and then systematically dismembered and defleshed, their long bones fractured in a way that can only be described as butchery. Body parts were deposited in what was probably a single event between 2210 and 2010 cal BC, in a partly infilled shaft that was still 15m deep, together with a faunal assemblage also

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showing evidence of butchery (though perhaps less intensive than that seen on the human remains). Whether there is any connection between what appears to have been a more formal burial deposit in Horizon 4 and the jumbled remains of Horizon 2 is unclear. The shaft then infilled more slowly, with elements of an aurochs deposited some five centuries later in what was still a sizeable depression about 11m deep. The later deposits of Horizon b are of a completely different character, probably unrelated to what lay beneath. The location itself may be the common denominator; the natural shaft and large underlying cave system inviting comparisons with a portal to the underworld.

The presence of perimortem injuries in the human bone assemblage is not consistent with any known mortuary rites. The cranial injuries and the absence of projectile points at CWFS, despite evidence for the use of the bow and arrow in Early Bronze Age conflicts (e.g. the male from the ditch at Stonehenge, 2338–1899 cal BC, BM-1582: 3715±70 BP; Evans 1984), suggests that the violence was face-to-face from the outset, and not the result of an armed confrontation between two groups. That the victims were either already captives or were taken by surprise—a common tactic in warfare among small-scale societies (Keeley 1996; Gat 1999)—may be further implied. Assuming that a single event is represented, the presence of at least 37 individuals suggests the massacre of a substantial segment of a community. A massacre can be defined as the indiscriminate killing of multiple individuals, often with excessive violence. In this case, the violence may have continued postmortem. Such occurrences do not happen in isolation, nor do they emerge from 'meaningless violence'; rather, they are intensely political (Sémelin 2009). The level of violence expressed in the CWFS assemblage could indicate that the actions were retaliatory, in response to a previous violent event or the perceived breach of a serious social taboo. The identification of genomes from the plague bacterium *Yersinia pestis* in teeth from two subadults could also be relevant (Swali *et al.* 2023), especially if more individuals were infected. Yet, if and how this finding relates to the massacre is unclear, particularly given the subsequent treatment of the bodies.

It is difficult to understand the human remains from Horizon 2 in anything other than a context of extreme violence and systematic corporeal insult seemingly including anthropophagy. While there are occasional examples of cutmarks on British and Irish Neolithic human remains, these are usually rationalised as the result of actions to hasten the transition to a fully skeletonised state and thus 'ancestral' status (Baxter 2001; Geber *et al.* 2017). There is no tradition of ritual dismemberment of the deceased for the British Early Bronze Age, nor would this explain the prevalence of cranial blunt-force injuries indicating that these individuals were killed beforehand. Differential mortuary treatment within the community, perhaps for those dying violent deaths, is also difficult to reconcile with estimates for the relatively short duration of deposition for Horizon 2. This does raise a question concerning the scale of the event, given the number of humans and animals represented. Consumption of all individuals represented in the human and faunal assemblages from Horizon 2 in a single episode implies a substantial gathering and the complicity of potentially many hundreds of people. Whether some element of selection was involved, and its basis if so, is unknown. It is possible that the act of butchery was more important than the actual consumption, which may have been token. This requires further research and integration of faunal analyses.

Gough's Cave (*c.* 14 700 cal BP), though distant in time, is located just 3km to the west (Figure 1) and provides a regional comparison. The remains of a minimum of six individuals

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exhibiting evidence for dismemberment and butchery were found in the cave and interpreted as the remains of anthropophagy (Andrews & Fernández-Jalvo 2003; Bello *et al.* 2015). Many of the modifications to the bones are strikingly similar to those at CWFS, including probable human chew marks on foot and hand bones and ribs. But while the crania at Gough's Cave exhibit cutmarks indicative of defleshing and modification through multiple circumferential blows into 'skull cups' (Bello *et al.* 2011; though see Fernández-Jalvo & Andrews 2021), there is no clear evidence for the killing of these individuals. In this sense, and in scale, Gough's Cave differs markedly from CWFS.

Cases of anthropophagy have been proposed (and debated) at other prehistoric European sites (see OSM S9). Though often controversial, the evidence that cannibalism did occur on occasion seems incontrovertible (Saladié & Rodríguez-Hidalgo 2017). The reasons behind it, however, are both more interesting and less clear. Neither culinary nor starvation cannibalism seem likely; evidence for the former is rare and sporadic, while the commingling of large-bodied fauna, and the size and demography of the Horizon 2 human bone assemblage, are not consistent with a response to starvation (but see Mays *et al.* 2017 for a possible medieval case). An Early Bronze Age mortuary rite involving ritual dismemberment has already been dismissed, as we would expect evidence for this to be more widespread, and while the circulation of ancestral 'relics' has been proposed for Bronze Age Britain, this involves little if any evidence of active dismemberment (Booth & Brück 2020). Nor do any of these explanations take the manner of death into account. This leaves cannibalism within a context of violent conflict, in which individuals are dehumanised and treated as animals. This does not belie the act as a highly ritualised event—indeed the enactment of rituals may have been essential for isolating such behaviour from quotidian experience.

CWFS may be best interpreted as an extreme form of 'violence as performance', in which the aim was to not only eradicate another group, but to thoroughly 'other' them in the process. While the remains themselves seem to have been removed from view soon afterwards (to judge from the paucity of carnivore scavenging), an event of this scale could not be hidden, and no doubt resonated across the wider region and over time. In this sense it was a political statement. It is also highly unlikely that this was an isolated incident without precursors or consequences. That no specific evidence has been found for either is hardly surprising given the nature of the archaeological record. The purely accidental discovery of CWFS is salutary in this respect. Had the remains been left on the ground in the aftermath or consigned to a shallow pit, their chances of survival for millennia would have been negligible.

The intricacies of why such an occurrence happened at this specific time and place may never be fully understood. Neither climate change, ethnic conflict nor competition over material resources seem to offer convincing explanations. Climate change has often been implicated in the escalation of conflict elsewhere (e.g. Gronenborn 2006; Barnett & Adger 2007; McCool *et al.* 2022) and indeed CWFS does fall within the temporal span of the 4.2ka climate event, which led to widespread and prolonged cooling and drying across the mid-latitudes of the northern hemisphere (Bond *et al.* 1997; Mayewski *et al.* 2004). Yet evidence for its impact in Britain and Ireland specifically has proven elusive (Roland *et al.* 2014), and, if anything, seems to have involved increased precipitation rather than aridification (Jordan *et al.* 2017). Nor is there any evidence for a widespread increase in conflict at this time, as might be expected if climate change were a factor.

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The history of the twentieth century shows only too well that inter-ethnic violence can be episodic, explosive and extreme. Yet, while there is compelling genetic evidence for large-scale population replacement in Britain beginning in the Chalcolithic, *c.* 2500 cal BC (Olalde *et al.* 2018; Armit & Reich 2021), this pre-dates the assemblage from CWFS by some three centuries. The movement of individuals with steppe ancestry from the continent was likely considerable from the outset, and there is currently no genetic evidence to suggest the co-existence of communities with markedly different ancestries that might have given rise to tension and conflict (cf. Schröder & Schmidt 2001). Furthermore, the isotopic evidence is consistent with the individuals from CWFS being local to the region rather than outsiders, though investigation of additional isotope systems (such as lead and sulphur) would be worthwhile. Whether the perpetrators were also local, or incomers to the region, is not possible to determine. Abundant historical evidence demonstrates that violence can occur between neighbours as well as between strangers (Stewart & Strathern 2002), and indeed that it may take more extreme forms in the former case, a phenomenon that Freud termed 'the narcissism of minor differences' (Blok 1998).

Competition for resources also seems an unlikely explanation. While well-known for its Romano-British lead mines, the Mendip Hills hold no tin or copper deposits that could have been exploited and contested by Early Bronze Age communities. Its karst landscape is not particularly fertile, and while its good drainage properties have made it attractive pastureland historically, any advantage this might offer seems out of proportion with the violence seen at CWFS.

This leaves, albeit by default, conflicts that arise from social and political inter-personal and inter-community interactions, which, left unchecked, can lead to outbreaks of extreme violence. Common proximate causes of lethal violence can include theft—especially of cattle in societies in which they are highly valued, which certainly applies to the British Neolithic and Early Bronze Age—perceived slights and insults, and charges of sorcery (Keeley 1996; Gat 1999). Though not typically traceable in the archaeological record, cycles of tit-for-tat revenge can escalate dramatically, and may be out of all proportion to the original offence (cf. Hinton 1998). That two individuals at CWFS—and by inference others—carried the plague bacterium at the time of their death raises the possibility that illness exacerbated a sense of fear in the region. And, while not a direct cause, it is possible that climate perturbations of the 4.2ka event increased the frequency and severity of what would otherwise have been more manageable confrontations and so in that sense may have contributed to what unfolded at CWFS.

Conclusions

The Early Bronze Age human skeletal assemblage from Charterhouse Warren is unique in Britain. At least 37 men, women and children were killed and dismembered, and probably partly consumed, before their remains were cast into a 15m-deep shaft in the limestone plateau of the Mendip Hills together with a faunal assemblage dominated by domestic cattle. This was probably a single event occurring sometime between 2210 and 2010 cal BC. The victims appear to have been predominantly local. The factors contributing to such violence remain unclear but the event may have been part of a spiralling cycle of revenge arising from social and political pressures within or between Early Bronze Age communities, and

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hence may have had both antecedents and consequences. At this stage, our investigation has raised as many questions as it has answered. Work is ongoing to shed more light on this decidedly dark episode in British prehistory.

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Online supplementary material (OSM)

To view supplementary material for this article, please visit https://doi.org/10.15184/aqy.2024.180 and select the supplementary materials tab.

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