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AMS ^{14}C DATING AND STABLE ISOTOPE (CARBON, NITROGEN) ANALYSIS OF AN EARLIER NEOLITHIC HUMAN SKELETAL ASSEMBLAGE FROM HAY WOOD CAVE, MENDIP, SOMERSET

by

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ABSTRACT

The results of an AMS dating programme presented here confirm the attribution of much (and quite likely all) of a large assemblage of human remains from Hay Wood Cave to the earlier Neolithic period. The use of the cave for burial is modelled as commencing in the period *3930-3715 BC* and ending *3580-3350 BC* (95.4% confidence). While the majority of the 10 dated individuals centre on 3600–3500 cal BC, two are significantly earlier, and indeed represent the earliest directly dated Neolithic individuals from Mendip. Stable carbon and nitrogen isotope data indicate a predominantly terrestrial diet, despite the proximity of the coast, less than 3 km distant. This is consistent with other results from Mendip, and from Britain overall, and provides further support for a rapid and relatively complete dietary transition between the Mesolithic and Neolithic. An intriguing question is what lay behind the decision to place human remains in either a cave or a monument.

INTRODUCTION

Hay Wood is a limestone cave located on the western edge of the Mendip Hills, Somerset (Figure 1). Excavations by the Axbridge Caving Group and Archaeological Society beginning in 1957 and running until 1971 yielded a large assemblage of human remains (Everton and Everton, 1972). The dating of this assemblage was uncertain, since the artefactual material recovered from the cave deposits included Mesolithic microliths, and Iron Age and Roman-British pottery. Nor, in any case, was there any clear association between the artefacts and the human remains. This problem is typical of cave deposits, which are often heavily disturbed, by animals, rock falls, and repeated episodes of human activity. That at least some of the human remains were of Neolithic age was demonstrated when a single AMS radiocarbon date on a human vertebra provided an estimate of 3794–3385 BC (OxA-5844: 4860 ± 65 BP) (Hedges *et al.* 1997). However, there is little justification for extending this result to the remainder of the human bone assemblage. The present project was intended to gain a better understanding of the chronology of the human remains at Hay Wood Cave through additional AMS ^{14}C dating.

The excavations

Hay Wood Cave is located on the western edge of the Mendip Hills (ST 3398 5824), within a wood on a steep, north-facing slope in the parish of Hutton. The main excavations took place in a mound located under an overhanging cliff face forming a rock shelter (Figures 2 and 3). Towards the back of the shelter a tunnel led deeper into the hillside, with only a few inches of soil along its length; it was this that was first explored, but was found to become too constricted for further progress. Documentation regarding the early years of work is limited due to the unfortunate loss of Professor Palmer's notes following his death in 1962, he having been brought in to run the excavations after the initial discoveries. This section provides a brief summary of the excavations and finds. Further details can be found in Everton and Everton (1972) and the specialist reports therein.

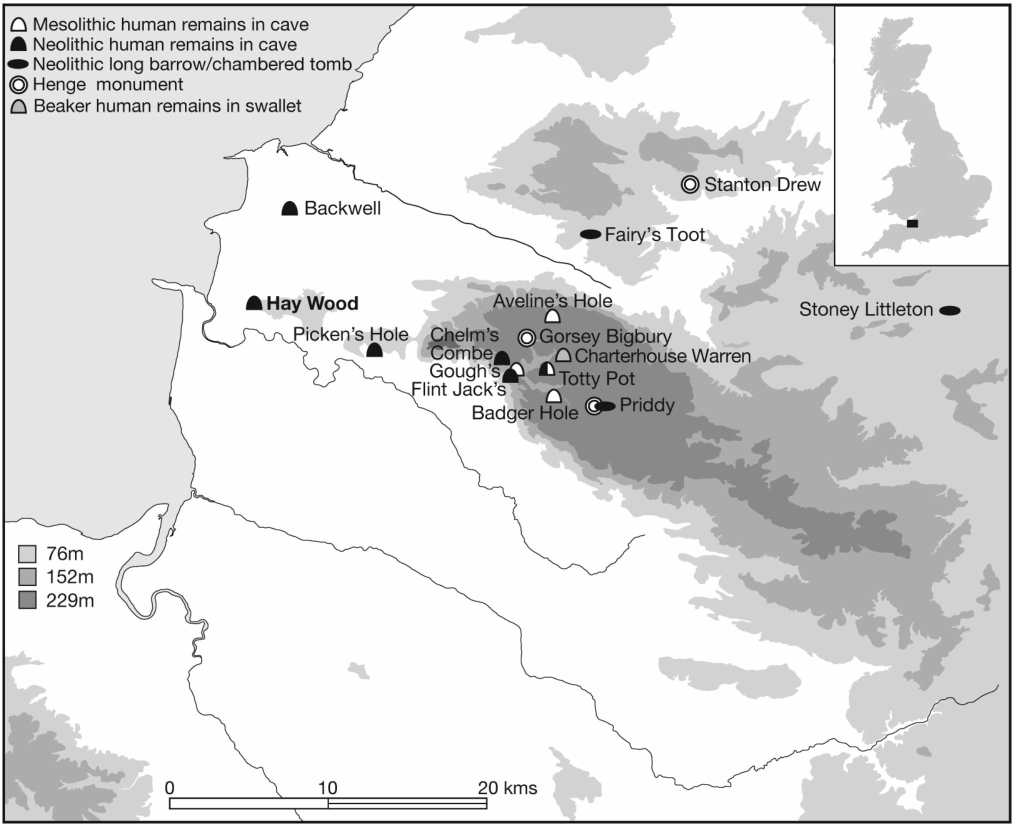

Figure 1. *Map showing location of Hay Wood Cave and selected other sites in the area.*

Everton and Everton (1972: 9–11) divide the site's stratigraphy into four layers. The topmost Layer 1 consisted of a dark brown clayey loam with small angular stones, 10-12" (25.4–30.5 cm) thick. Layer 2 is described as a lighter brown clayey loam with stones, of varying thickness stretching away from the mound in the mouth of the cave/rockshelter, reaching a maximum of 3.5 ft (1.07 m) over bedrock at the cave entrance. This layer contained some worked flints, the majority of the Romano-British pottery, and some of the Iron Age pottery. The above mentioned mound constitutes Layer 3, and comprises 'a pile of large angular and rounded stones, intermixed with a lighter brown, clayey loam.' This was interpreted by Palmer as a built feature, though this is questionable, given the amount of rockfall that might be expected to accumulate naturally at a cliff face, and the presence of a clayey loam described as filling the interstices between the stones. Layer 3 contained most of the human bones, flints, animal bone and some pottery. The latter included some Iron Age sherds from the base of the

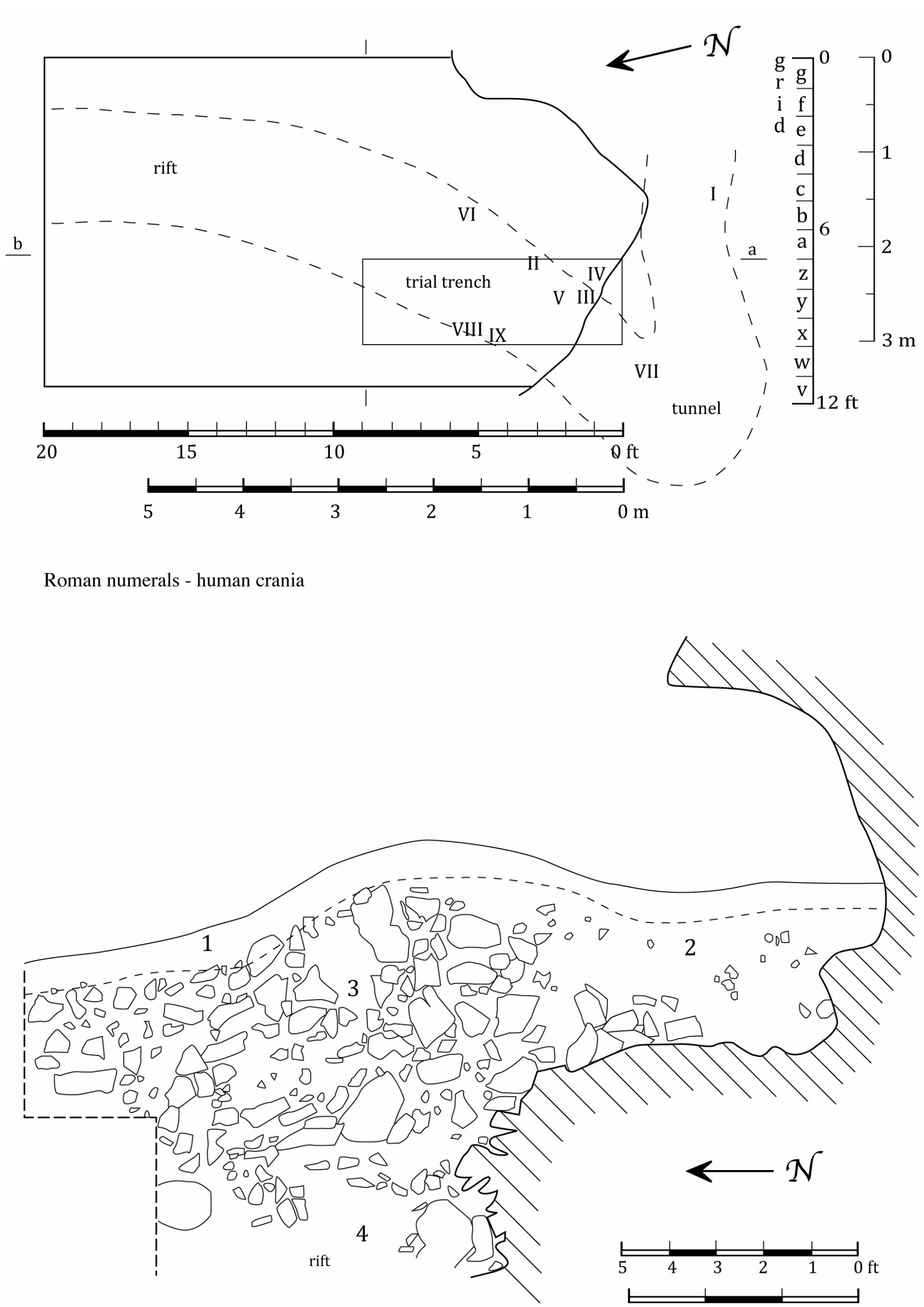

Figure 2. *a) Plan and b) section (a-b) of Hay Wood Cave, after E.J. Chapman, in Everton and Everton 1972: figures 2 and 3 (note that figs. 3 and 6 should read section a-b as here, not c-d).*

mound, and thus suggested that date or later for the human remains. Finally, Layer 4 is described as 'a reddish sandy cave earth containing a few angular stones', disturbed by a badger run (Everton and Everton 1972:11).

The first human remains (including 'Skull I') were encountered some six feet (1.8 m) along the tunnel at the back of the cave, lying unburied on the surface and only 18 inches (0.46 m) below the roof. 'Skull VII' was subsequently found back towards the tunnel entrance, at the beginning of a sharp turn leading from the rock shelter. The main group of crania and other human bones were found in the mound within the rock shelter, at varying depths from five to eight or nine feet (1.5 to 3 m) below the surface (Figure 3). Palmer noted that 'Skull V' was found inverted between two parallel stone slabs, 'as if in a crude cist' (Everton and Everton, 1972: 14), though the fact that this was within a very rocky deposit sounds a note of caution. 'Skull VI' was reportedly found lying on its left side on a sloping rock shelf on the eastern wall of what was described as the rift. The suggestion that one cranium had a lump of yellow ochre intentionally placed in its mouth (Palmer and Chapman, n.d.), while intriguing, is difficult to sustain given that the floor of the cave is rich in this mineral (Everton and Everton, 1972: 11). Two groups of what are described as fragments of bleached human bone, though the preliminary reexamination indicates little evidence for subaerial exposure, were found in areas of disturbance towards the front of the mound. These were designated Burials 1 and 2 and were thought to postdate the other human bone, due both to their putative association with sherds of Iron Age and Romano-British pottery (*ibid*.). However, a badger set in this area must call any such associations into question, and indeed the radiocarbon dating results, discussed below, place Burial 1 in the Neolithic.

The most diagnostic elements of the small flint assemblage of 58 pieces are a group of 20 geometric microliths, which can be placed in the Late Mesolithic (Everton and Everton, 1972: Fig. 7; cf. Gardiner, 2001; Jacobi, 1979). The remaining worked flints include seven scrapers, a borer and five retouched blades. While the microliths are all, with one exception, patinated, the other flints are more variable, with some patinated and others not, and this likely provides some indication of age. The pottery assemblage comprises what are identified as 58 Early Iron Age sherds and 98 late third/fourth century Romano-British sherds. Interestingly, in the light of the radiocarbon results presented below, neither pottery nor flint tools diagnostic of the Neolithic period were identified. The several hundred identifiable large mammal bones are overwhelmingly of domestic species, mainly sheep/goat, with cattle, domestic pig and dog also represented. Four wolf metapodials and three fragments of beaver teeth were the only identified large wild mammal remains, with badger remains being common amongst the small animal bones. The apparent absence of red deer is noteworthy. There is, then, a discrepancy between the Mesolithic date that would be expected from the lithic assemblage, and all the other finds categories. The human bones, flints, Iron Age pottery and animal bones all share reasonably similar horizontal and vertical distribution in the cave, while the Romano-British pottery is concentrated in the upper part of the stratigraphy (Everton and Everton, 1972: Figs. 4 and 5). The high degree of mixing of the finds may be largely a result of disturbance, particularly by badgers (*ibid*.: 16–17). Some of the microliths were found in Layer 4, which contained no pottery or domestic animal bone, and may reflect a less disturbed Mesolithic context. This would be worth further investigation in the future.

The human bone assemblage

The human bone assemblage from Hay Wood Cave has yet to be fully reanalysed, the main focus for the purpose of the present paper being the identification of distinct individuals for AMS ^{14}C dating. According to the original report, a total of some 560 identifiable human bones was found in a fragmentary and scattered state, with no recorded articulations, although the close proximity of some elements suggests that they may belong to the same individual. A number exhibit rodent gnawing, noted previously for the faunal remains but not mentioned for the human bone.

Figure 3. *Photograph of the beginning of excavations at Hay Wood Cave, 1958. From left to right are Jack Lane, Bill West, Tom Davies (face) and Jack Weare.*

Photo: E.J. Chapman.

A preliminary assessment of the assemblage indicates the presence of at least 10 individuals, including eight adults, an adolescent of ca. age 15, and a child of ca. age 6. This is substantially lower than the estimated 28 individuals reported in Everton (1972: 28); while it is likely that a more thorough analysis of the assemblage would confirm the presence of additional individuals, whether it would reach this total is debatable. Of the eight most complete adult crania, three can be identified as female/probable female and three as male/probable male (Appendix, Figure 4). As it happens this is closely matched amongst the postcrania by the presence of seven adult left femora, of which five are relatively robust and two are more gracile. The adolescent is represented most clearly by a number of long bones with unfused epiphyses and by a mandible, while the child is represented by cranial fragments and loose teeth, including a worn deciduous molar with resorbing roots. A large number of the small bones of the hands and feet are present, indicating that the cave likely held complete, articulated bodies when first deposited, *contra* Everton and Everton (1972:17), who suggest that the bones had been gathered up after burial or exposure elsewhere and brought to the site (though of course this is still a possibility for some elements, but confirmation would require more detailed analysis). Their final fragmented and scattered state is probably a combination of disturbance during repeated visits to the cave, during which remains may have been intentionally rearranged, followed by post-Neolithic use of the cave in the Iron Age and Romano-British periods, as well as natural processes, including rock fall and badger activity.

Pathological conditions have not yet been systematically studied, but the preliminary reassessment suggests that, as Everton (1972) noted, this population experienced the usual wear and tear of individuals living an active lifestyle. One adult mandible fragment exhibits ante-mortem tooth loss, while a fragment belonging to a different individual has an abscess on the buccal side of the left first molar. Neither condition is uncommon in the Neolithic (Brothwell and Blake, 1966; Roberts and Cox, 2003). Some teeth exhibit extensive calculus deposits (Figure 5), leading Tratman (1972) to remark on the population's poor hygiene. However, what

Figure 4. *Hay Wood Cave, adult ?female cranium IV, left lateral view.*
Axbridge Museum; photo: R.J. Schulting.

he took as evidence for 'ritual mutilation' of the teeth (1972: 27) is simply advanced anterior tooth wear, again not unusual in prehistoric populations and usually attributed to some non-dietary use of the anterior dentition, such as hide-working (Molnar, 1972). The interesting suggestion of Paget's disease on Skull II (Everton, 1972:25) warrants further investigation, certainly the surviving vault fragments appear notably thickened (Figure 6), which is one of the criteria of the condition, though insufficient on its own. What was identified by Everton (*ibid.*) as a possible peri-mortem fracture to the right parietal of Skull VII is more probably post-mortem damage, possibly by rock fall.

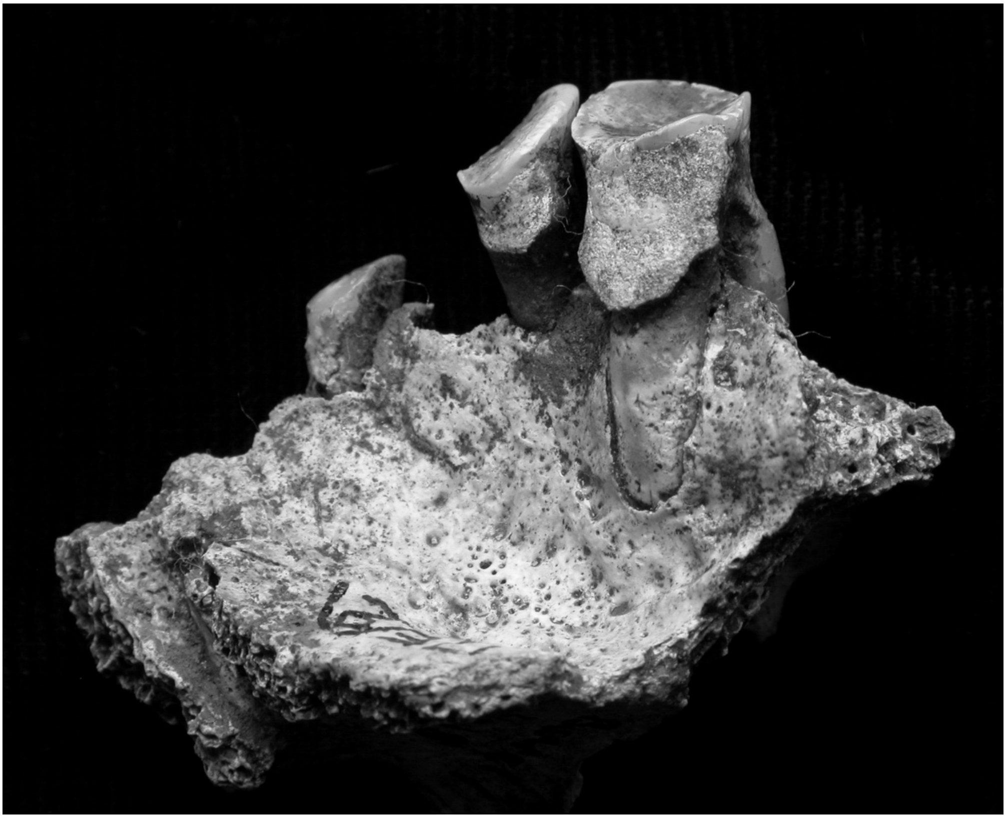

Figure 5. *Hay Wood Cave, left maxilla fragment with large calculus deposits on first molar and fourth premolar*.
Axbridge Museum; photo: R.J. Schulting.

The dating programme

A total of 17 AMS ^{14}C determinations were obtained on human bone and dentine from Hay Wood Cave. Samples were taken from eight adult crania, ranging from nearly complete to very partial, one subadult cranium (a child of ca. 6 years), and an unfused tibia shaft and a mandibular tooth belonging to an adolescent. Crania were preferentially selected for the additional information they can provide in terms of ageing, sex determination, craniometrics, dental palaeopathology, and any future provenancing studies using oxygen and strontium isotopes on dental enamel. Also sampled was an indeterminate long bone fragment from the group of fragments designated 'Burial 1'. Three measurements represent duplicate determinations undertaken as part of the quality control measures at the Oxford Laboratory for Archaeology and the History of Art. A further two measurements were selected as paired samples of bone and tooth from the same individual (definite in the case of Cranium V, and suspected in the case of the adolescent tibia/canine tooth). This was intended as a further quality check of laboratory procedures for the removal of contaminants, in this case probably PVA applied to the bone. Teeth (i.e., the roots sampled for dating) are to some extent physically protected from applied consolidants by their sockets (cf. Schulting, *et al.* 2012). The relationship of one sample

('Burial 1') to the others is uncertain (i.e., it could potentially be from one of the same individuals represented by the other determinations). Thus, a total of at least 10 distinct individuals are represented in the series.

Sample	*Age*	*Sex*	*Element*	*Lab no.*	*^{14}C*	±	*Date BC*		*$\delta^{13}C$*	*$\delta^{15}N$*
Cranium I	adult	F	cranium	OxA-19905	4740	34	3637	3378	-20.0	10.4
Cranium I	adult	F	cranium	OxA-19904	4742	31	3636	3380	-20.1	10.3
Cranium I	adult	F	cranium	combined	4741	23	3635	3381	-20.1	10.4
Cranium II	adult	M	cranium	OxA-19768	4968	30	3891	3661	-20.7	-
Cranium III	adult	M?	cranium	OxA-19906	4786	32	3646	3518	-20.4	10.1
Cranium IV	mid-old adult	F?	cranium	OxA-19907	4762	31	3640	3384	-19.7	9.7
Cranium V	young adult	F	cranium	OxA-19908	4770	45	3646	3379	-20.2	9.9
CV tooth	young adult	F	max M3	OxA-19916	4781	32	3645	3386	-20.1	9.8
CV tooth	young adult	F	max M3	OxA-19882	4748	31	3636	3381	-20.3	9.9
CV, cranium and tooth	adult	F	max M3	combined	4765	20	3636	3521	-20.2	9.9
Cranium VI	adult	M	cranium	OxA-19909	4723	32	3634	3376	-20.3	10.1
Cranium VII	adult	M	cranium	OxA-19917	4773	30	3641	3385	-20.2	9.9
Cranium VII	adult	M	cranium	OxA-19910	4776	33	3644	3384	-20.2	10.1
Cranium VII	adult	M	cranium	combined	4774	23	3639	3521	-20.2	10.0
Cranium VIII	subadult	I	cranium	OxA-19911	4674	32	3622	3368	-20.8	11.1
Cranium IX	adult	I	cranium	OxA-19912	4758	33	3639	3382	-20.5	9.9
Cranium IX	adult	I	cranium	OxA-19881	4730	33	3635	3377	-20.4	9.9
Cranium IX	adult	I	cranium	combined	4744	24	3636	3382	-20.5	9.9
'Burial 1'			bone	OxA-19913	4851	31	3704	3536	-20.7	9.2
adolescent	adol., <15 yrs	I	tibia	OxA-19914	5052	32	3955	3775	-20.8	9.9
adolescent	adol., <15 yrs	I	mand C	OxA-19915	5036	32	3950	3714	-20.5	9.7
adolescent	adol., <15 yrs	I	bone, tooth	combined	5044	23	3946	3781	-20.7	9.8
Cranium IV?	adult	I	vertebra	OxA-5844	4860	65	3794	3385	-20.8	-

Table 1. *AMS and stable isotope results from Hay Wood Cave ('Date BC' 95.4% probability, calibrated in OxCal 4.1 using IntCal 2009).*

All the results fall within the earlier Neolithic, ranging from 3946–3781 to 3622–3368 cal BC. The three duplicate measurements on the same samples all show excellent agreement, as do the paired bone and dentine samples from Cranium V. The similarity of the results for the adolescent tibia and canine strongly support the notion that these derive from the same individual, as no other determinations were this early. These five paired measurements are therefore combined in Table 1, and it is the resulting estimates that feature in Figure 7 and in the Bayesian model discussed below. While the previously available determination on a vertebrae (OxA-5844) ostensibly associated with Cranium IV is sufficiently similar in date to the cranial sample from this individual reported here to enable the two to be combined, this has not been done as their association is not seen as entirely secure.

A simple Bayesian model is presented in Figure 8, treating all the dates as belonging to a single phase of activity, of unknown start and end, and unknown duration (Buck, *et al.* 1994). The combined measurements for the subadult show marginally poor agreement (A = 51.9%, versus the recommended 60%) for inclusion within this putative phase. However, the overall model still shows satisfactory agreement at 81.8% (Bayliss, *et al.* 2007; Bronk Ramsey, 2009). Removing the subadult determination actually has the effect of making the overall model worse, and leading to an even poorer individual agreement index for OxA-19768 (49.3%) and a similar one for OxA-19911 (53.9%). This is because the remaining eight determinations cluster so tightly around 3600–3500 BC; indeed, they could conceivably represent a single burial event. The model should be seen as a heuristic device in any case, and so for present purposes all results are retained, and considered as a 'phase' of activity involving the deposition of human remains at the site, occurring within the earlier Neolithic.

Figure 6. Hay Wood Cave, adult male 'Skull II' in situ'; note thickened vault.
Photo: E.J. Chapman.

The model places the start of burial activity at between *3930-3715 BC* and its end at *3580-3350 BC* (95.4% confidence). Clearly the adolescent and Cranium II (OxA-17968) are responsible for the early start date. While the calibrated probability distributions of two individual results – OxA-19909 and more particularly OxA-19911 – are shifted considerably to the earlier part of their ranges, the modelled end date of *3580–3330 BC* in effect reinstates the likelihood of continued burial activity in the cave into the 34th century BC. The overall span of use of the cave for burial is modelled as lasting between *150 and 530 years* (95.4%), though again this is heavily influenced by the two earliest individuals, with the major focus of burial activity centring on 3600–3500 cal BC.

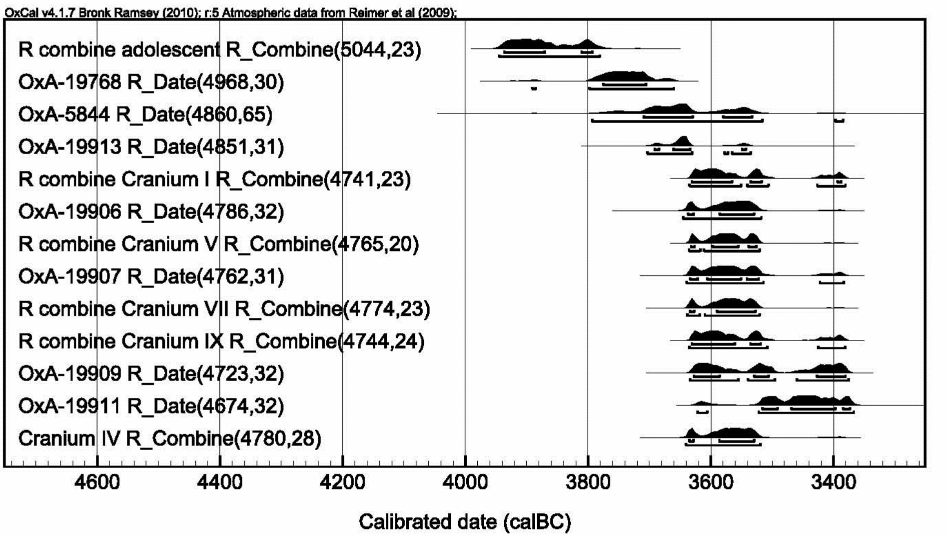

Figure 7. *Plot showing calibrated AMS determinations from Hay Wood Cave (OxCal 4.1.5).*

Stable isotopes and Neolithic diet

Stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) measurements on bone collagen are now routinely used to characterise aspects of human (and animal) diets. In the present context, the most relevant aspect is their ability to detect the consumption of marine protein. Humans obtaining 100% of their protein from the sea will have the same values as seen in fish or seal bone, ca. -12 ± 1‰, while humans obtaining all of their protein from terrestrial plants and/or animals will have values of ca. -21 ± 1‰ (Schulting and Richards, 2002). Stable nitrogen measurements reflect trophic level to a large extent, and so can inform on the relative proportions of plant and animal protein in the diet, and can also detect the consumption of freshwater fish that is usually not apparent in $\delta^{13}C$ values. C:N ratios and collagen yields provide a means of assessing the quality of collagen preservation, which in the present study was found to be acceptable for all samples, with C:N values ranging between 3.2 and 3.4, and collagen yields of 2.4 to 11.0% (DeNiro, 1985; van Klinken, 1999).

Hay Wood Cave is located some 3 km inland from the Bristol Channel. Thus, while not directly on the coast, the site is within a reasonable distance of the sea in terms of potential access to marine resources. The $\delta^{13}C$ measurements cluster very tightly at the terrestrial end of the range, with an average of -20.4 ± 0.3‰, indicating little or no detectable contribution of marine protein. The $\delta^{15}N$ data also cluster, with an average value of 10.0 ± 0.5‰. The absence of a convincing positive correlation (r^2 = 0.14) between the two isotopes further supports the lack of any significant marine contribution to the diets of these individuals (Figure 9). While

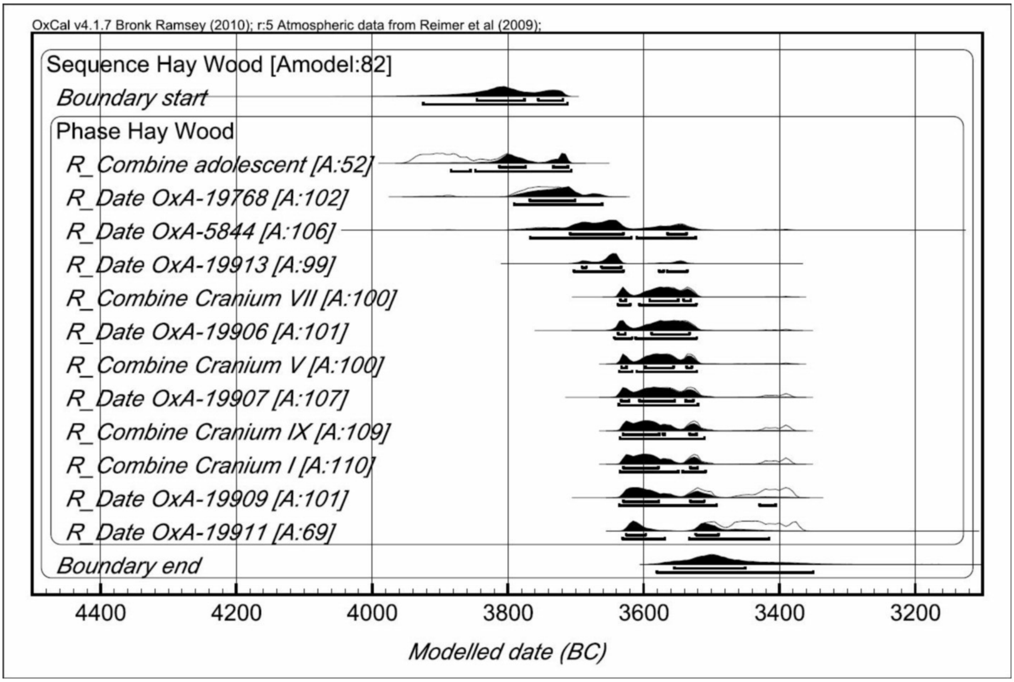

Figure 8. *Modelled dates on human bone from Hay Wood Cave (OxCal 4.1.5).*

Cranium IV's $\delta^{13}C$ value of -19.7‰ could be seen as sufficiently elevated to suggest a (very) small input of marine protein, this is not supported by its lower-than-average $\delta^{15}N$ value of 9.7‰. Conversely, the individual with the lowest $\delta^{13}C$ value (-20.8‰) actually has the highest $\delta^{15}N$ value (11.1‰); this is subadult Cranium VIII, clearly an outlier, and possibly subject to a residual nursing effect (Schurr 1998). The precise age of this individual, represented only by thin parietals, is uncertain, but a child as old as six might still be expected to retain traces of an elevated $\delta^{15}N$ nursing signal due to the time-lag in bone turnover (Waters-Rist and Katzenberg 2009).

	All individuals		*male/male?*		*female/female?*	
	$\delta^{13}C$	$\delta^{15}N$	$\delta^{13}C$	$\delta^{15}N$	$\delta^{13}C$	$\delta^{15}N$
average =	-20.4	10.0	-20.0	10.0	-20.5	10.1
± 1SD =	0.3	0.5	0.2	0	0.2	0.3
n =	12	10	3	3	3	3

Table 2. *Summary of stable carbon and nitrogen results from Hay Wood Cave.*

It has been possible to estimate the sex of only six individuals (three male, three female), and, not surprisingly given the low overall variability, there is no discernible difference in either $\delta^{13}C$ or $\delta^{15}N$ (Table 2). The $\delta^{15}N$ average of 10‰ is relatively high, though not unusually so for the British Neolithic (Hedges, *et al.* 2008; Richards, 2000; Schulting, 2011). There remain some points of contention and uncertainty over the interpretation of high nitrogen values (Bogaard, *et al.* 2007; Hedges and Reynard, 2007), but taken at face value a relatively high contribution of animal protein to the diet, whether meat and/or milk, can be suggested for the individuals at Hay Wood Cave. While contemporaneous faunal data would be extremely helpful in fine-tuning our interpretation of the human isotopic results, the mixed nature of cave deposits (and hence unknown age) and the paucity of faunal material from monuments presents difficulties in this regard.

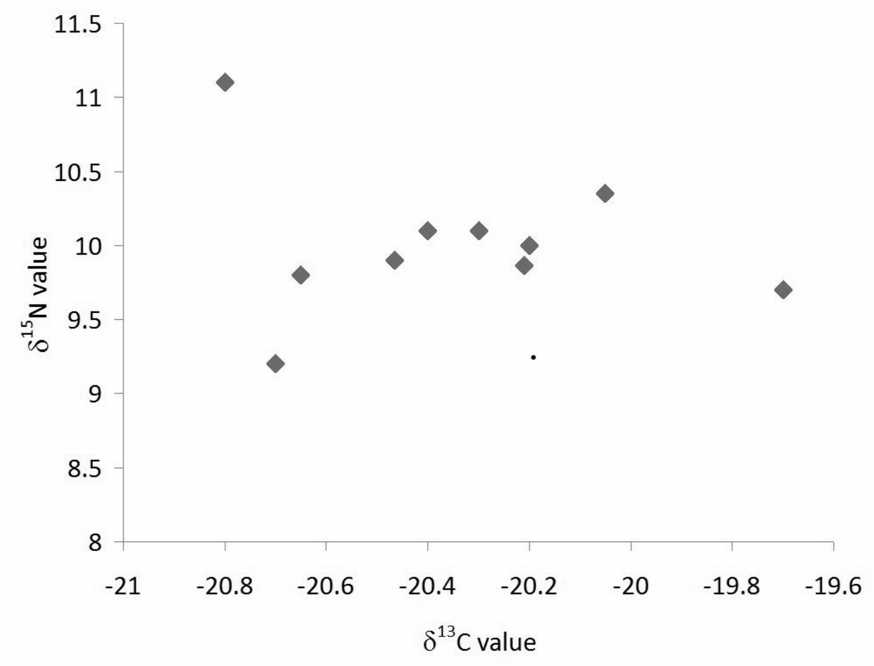

Figure 9. *Plot of $\delta^{13}C$ and $\delta^{15}N$ values on human bone collagen from Hay Wood Cave. The elevated value of 11.1‰ on the $\delta^{15}N$ scale is a subadult of unknown age.*

DISCUSSION

The main phase of burial activity at Hay Wood lies between ca. 3700 and 3500 cal BC, though the Bayesian model admits of the probability of use of the cave some two centuries either side of this. The possibility of burial activity as early as ca. 3900 cal BC is particularly interesting, as it is becoming clear with recent dating programmes that this represents a very early stage in the British Neolithic (Sheridan, *et al.* 2008; Whittle, *et al.* 2007; 2011). While this is very much dependent on two determinations on what is almost certainly a single individual, the fact that the two results agree so closely does provide some confidence. Their combined calibrated date is 3946–3781 cal BC, which, while early, is not necessarily strikingly so.

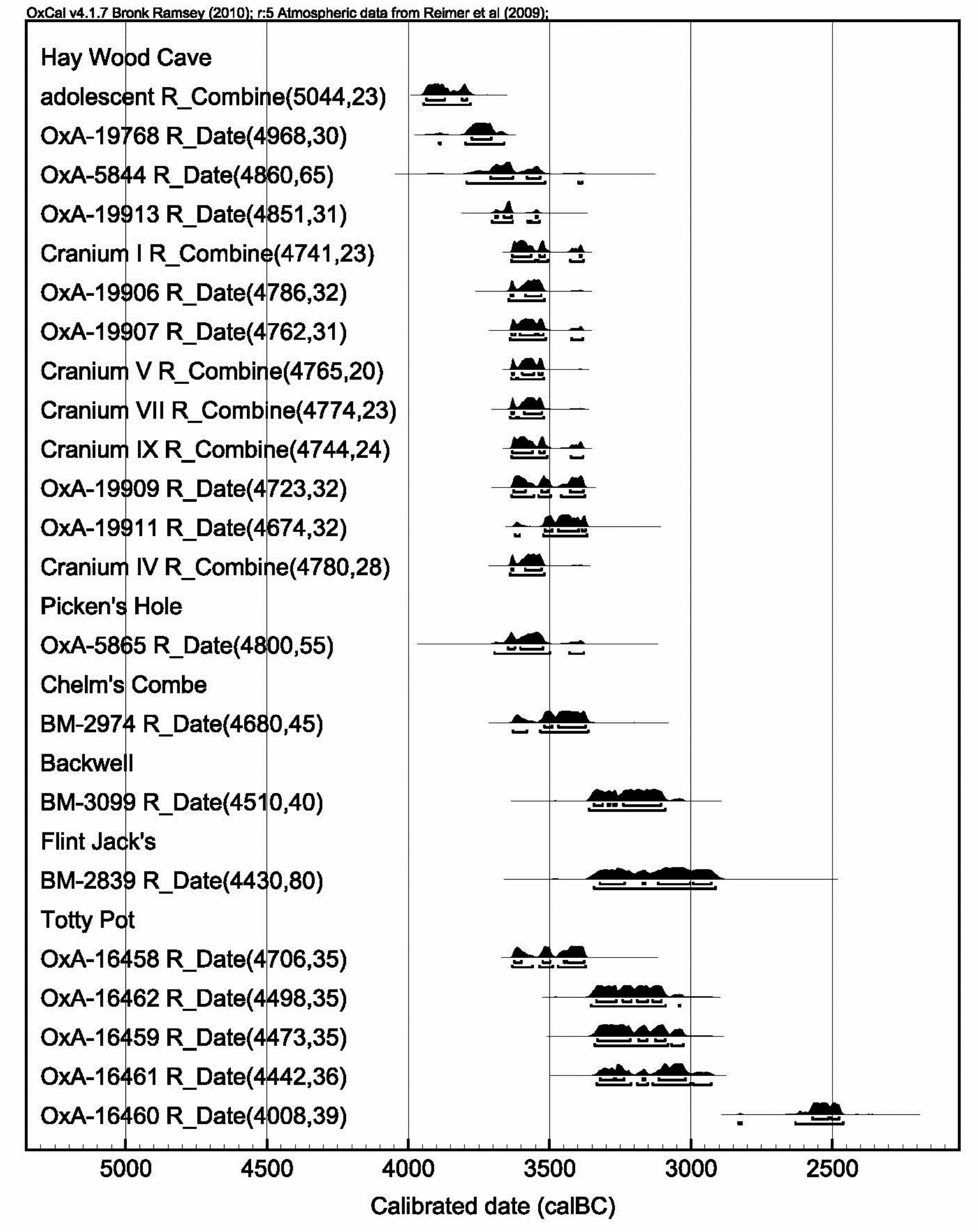

Figure 10. *Plot showing calibrated AMS determinations on Neolithic human bone from caves in Mendip (OxCal 4.1.5). Sources: Hay Wood, this paper; all others, Schulting et al. 2010 and references therein.*

Similarly, the Bayesian model places the start of activity in the range *3950-3715 BC*; in both cases, then, the bulk of the probability distribution lies well after 3900 cal BC. Given this date, and the homogeneity of the stable isotope data, it is very unlikely that this represents an individual attributable to the Mesolithic.

Despite the lack of associated material culture of the period, the dating programme places the sampled human remains securely within a Neolithic context. Thus, it seems clear that the presence of Late Mesolithic microliths at Hay Wood is entirely coincidental. While there is abundant evidence for the use of caves in the Mendips for burial in the Mesolithic, this appears to be largely restricted to the earlier part of the period (Schulting, 2005; Schulting, *et al*. 2010). At 7445–7080 cal BC (the combined result of BM-2073 and OxA-16457), the latest directly dated Mesolithic individual comes from Totty Pot (Schulting, *et al*. 2010, Table 1), preceding the use of Hay Wood Cave by at least three millennia. Thus, there is no evidence for meaningful continuity here in the use of caves for burial between the Mesolithic and Neolithic (cf. Chamberlain, 1996; 1997; Schulting, *et al*. 2010; Schulting and Richards, 2002). Rather, cave burial seems to have been independently rediscovered in the Neolithic, *contra* Hellewelle and Milner (2011), who propose a degree of continuity in the use of caves for burial between the Mesolithic and Neolithic, on the basis of a single site with two suspect dates (see Meiklejohn *et al*. 2011). In addition to the oft-discussed otherworldly, liminal qualities of caves, perhaps their appearance prompted comparisons as well as contrasts with the chambers of chambered tombs in the minds of Neolithic people (Schulting, 2007).

What is perhaps most intriguing about Hay Wood and other contemporaneous cave sites (Figure 10), is the window that they present on alternative burial practices in the Neolithic, at the same time when the construction and use of mortuary monuments becomes such a major and highly visible feature of the archaeological record. This immediately raises questions over who was buried in the monuments, and who in the caves. In many ways the practices encountered are similar at both, presenting communal, commingled remains, generally with few grave offerings. In some cases the intentional rearrangement and/or removal of selected elements can be seen (*ibid*.): at Hay Wood specifically, we can recall the possibility (albeit one questioned above) that Cranium V had been placed in a crude stone cist, and that Cranium VI lay (i.e., was placed) on a ledge of the rift. The remains of domestic animals are sometimes found accompanying the deceased in chambered tombs – those at Hay Wood would need to be directly dated before their potential association with the human remains can be accepted. Similarly, while a number of known and suspected earlier Neolithic long barrows and chambered tombs are present on Mendip (Beddoe, 1866; Lewis, 2002; 2005; Scarth, 1858; Thomas 2002), no direct radiocarbon dates are yet available for these sites. Nevertheless, it is clear that they must have overlapped in use, at least in general terms (cf. Lewis, 2011).

The absence of any isotopic evidence for the significant use of marine resources is consistent with the pattern already well known for Britain (Richards, *et al*. 2003; Schulting and Richards, 2002; Schulting, 2011). Nevertheless, the new Hay Wood data are important additions to this accumulating database, as few results were previously available for an area of Mendip so close to the coast. They thus contribute to the debate over the nature and speed of the Mesolithic-Neolithic transition (Milner, *et al*. 2004; Richards and Schulting, 2006), coming down firmly in support of a relatively rapid and complete change in economic emphasis, from marine (wild) to terrestrial (presumably largely domesticated) resources. They also further emphasise the lack of any clear isotopic differences between those buried in caves and those buried in monuments in general, though isotopic results on human remains from Mendip monuments would be useful to examine this position in more detail and at a more local level (cf. Schulting, 2007).

CONCLUSIONS

Hay Wood Cave provides the largest known surviving Neolithic assemblage of human bone from Mendip, regardless of context. It is certainly the largest collection from a cave dating to this period known from Southwest England. Its use for burial (and apparently nothing else) spans some four centuries in the earlier fourth millennium BC, including the earliest Neolithic evidence for cave burial in the region, from the thirty-ninth or thirty-eighth century. No definite Neolithic artefacts were recovered from the cave, though finds of both earlier and later periods were not lacking, highlighting the difficulty of assuming any kind of association between human remains and artefacts in the majority of cave deposits (cf. Schulting, *et al.* 2010; Schulting, *et al.* submitted).

Stable carbon and nitrogen isotope measurements provide additional confirmation of the lack of any significant use of marine food resources, despite the proximity of the coast some 3 km from the site. Future work on the human and faunal bone assemblage will refine this picture through comparisons with nearby sites, and including both cave and monumental contexts. There are additional isotopic analyses to be undertaken on the human remains, including oxygen and strontium analysis to help identify any possible non-local individuals. Aside from this, a thorough osteological analysis of a cave assemblage of human remains confirmed to be entirely of Neolithic age will provide a very useful baseline for comparison with contemporary assemblages from caves and monuments, and may provide insights regarding the decision of where to place the dead.

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APPENDIX

Summary information on the most complete crania from Hay Wood Cave.

Cranium I. Adult female. Calotte. Fragment of L maxilla may belong with this individual. Fourth premolar worn to stub, first molar worn to enamel ring. Large amount of calculus.

Cranium II. Adult male. Fragmentary calotte with notably thick vault. Everton (1972) suggests this individual may have suffered from Paget's disease.

Cranium III. Adult ?male. Partial calotte.

Cranium IV. Middle adult ?female. Partial maxillary dentition present. First molar and premolars worn to enamel rings. Third molars are congenitally absent. Hole in right parietal is probably post-mortem.

Cranium V. Young adult female. Calotte and incomplete maxilla with complete tooth row. First molars are worn to half dentine, and beginning to show oblique wear. Third molar cusps are lightly worn, with root tips still open.

Cranium VI. Adult male. Calotte.

Cranium VII. Adult male. Partial calvarium, lacking much of the basicranium.

Cranium VIII. Child, sex indeterminate. Most of L parietal and approximately half of R.

Cranium IX. Adult, sex indeterminate.

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