

A Mid-Upper Palaeolithic human humerus from Eel Point, South Wales, UK

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Abstract

We report here on a human humerus directly dated to $24,470 \pm 110$ BP, placing it within the Gravettian, or Mid-Upper Palaeolithic. The partial humerus is an isolated find and can be attributed (with some caution) to the Pleistocene 'bone cave' of Eel Point on Caldey Island, Wales (UK). The humerus is probably male, similar in robusticity to other Gravettian right humeri. The apparent absence of stone tools and presence of hyaena bone and coprolites suggest that the element may not derive from an intentional burial. After a maxilla from Kent's Cavern and the Gravettian Paviland 1, Eel Point represents the third oldest anatomically modern human known from Britain. Stable carbon and nitrogen isotope measurements do not support certain use of marine foods but highlight the need for more research on contemporary faunal remains in order to better interpret human values from this period.

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Introduction

As part of an ongoing investigation into coastal Mesolithic and Early Neolithic subsistence and settlement in Britain, human bones from a number

of cave sites in South Wales have been selected for AMS dating and stable isotope analysis. Previous results from a group of sites on Caldey Island revealed an important series of human remains dating to the earlier Mesolithic, as well as to the earlier Neolithic and Romano-British periods (Schulting and Richards, 2002). Here, we report on the distal half of an adult right humerus,

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attributed to Eel Point on Caldey Island, from the Swansea Museum (SWASM 1840.2.1). This specimen has been dated by direct ^{14}C AMS dating to ca. 24,500 BP (see below), placing it within the Gravettian, or Mid-Upper Palaeolithic. It therefore adds to the small Gravettian human sample from northwestern Europe.

Discovery and context

Caldey Island is located towards the western edge of Carmarthen Bay in Pembrokeshire, Wales (Fig. 1). A number of excavations have been undertaken on the island over the years, including those by Lacaille and Grimes (1955), Brother James van Nederveelde (formerly one of the resident monks on the island) (van Nederveelde et al., 1973), and local amateur archaeologist Mel Davies (Davies, 1989). Eel Point itself is located on the northwest of Caldey Island (51:38:35N; 4:42:13W), and it was well known in the nineteenth

century as a ‘bone cave’ yielding large quantities of Pleistocene fauna (Leach, 1945; Smith, 1860).

A series of poorly or unrecorded explorations of Eel Point took place from the late 1830s onwards, and it is from one of these that the humerus appears to derive. The specimen was identified amongst a small collection of Pleistocene and later faunal remains donated to Swansea Museum in 1840 by L.L. Dillwyn, owner of the Cambrian Pottery in Swansea. Dillwyn had visited Eel Point on a fossil-hunting excursion with the Rev. G.N. Smith in August of 1839 and picked up a collection of bones at that time (Dillwyn, n.d.). Human remains were also found by Smith, but these, along with domestic fauna, fish bones, marine shells and a few potsherds, were in the uppermost deposits and were thought to be much later in date. It was the site’s Pleistocene fauna that generated the most interest, with papers being presented at learned societies by Smith and by W. Buckland, and correspondence being exchanged between Smith and Charles Darwin (Smith, n.d.). Further digging in the limestone cave by quarrymen occurred

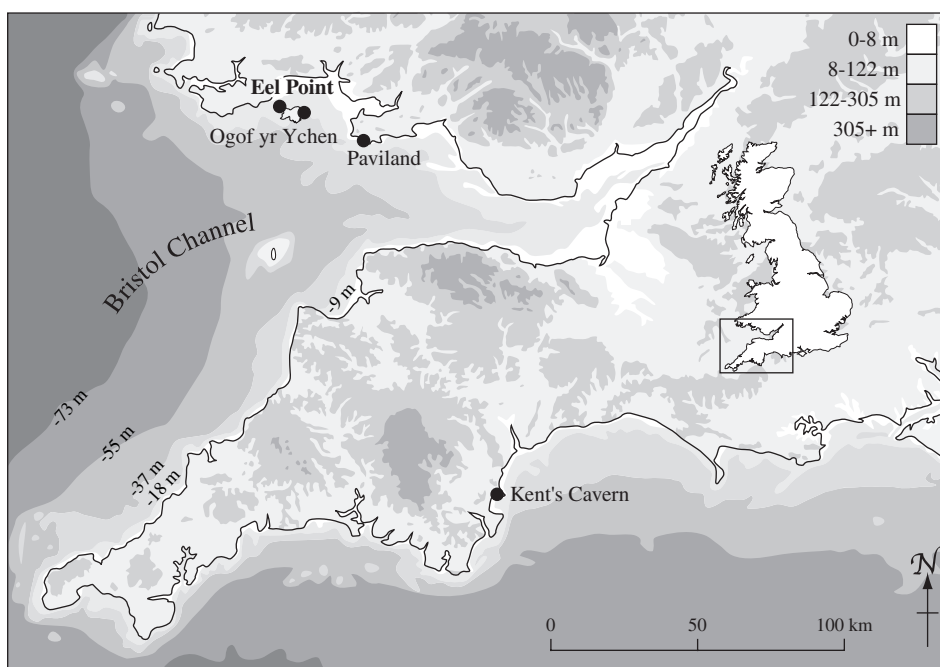


Fig. 1. Map showing location of Eel Point and other sites mentioned in the text. The contemporary coastline at ca. 24 Kya ^{14}C BP would have been just beyond the -73 m contour shown here (sea-level contours corrected from Schulting and Richards, 2002: Fig. 5).

intermittently over the next few decades, and Smith and Edward Laws conducted a series of small excavations and obtained further bone collections. But the majority of the abundant bone from the site was sold by the quarrymen for manure, or simply dumped into the sea (Smith, 1860). Species noted as present by Smith, Laws and W. Boyd Dawkins include woolly rhinoceros, cave hyaena, cave bear, horse, lion or tiger, mammoth, hippopotamus, brown bear, giant Irish deer, bison, wolf and possibly reindeer. Investigations were renewed in 1950 by van Nederveelde and W. F. Grimes, but by then it seemed that quarrying had largely destroyed the cave (Lacaille and Grimes, 1955). However, persistent investigations by van Nederveelde led to the discovery in 1986 of sealed fissures containing more Pleistocene fauna (Davies, 1989; Davies and Smith, 1989).

Pleistocene faunal remains and stone tools are well known from most of the Caldey Island sites, although the association between the two is far from certain. A deep, infilled swallet at Ogof-yr-Ychen was found to contain the bones of rhinoceros and hyaena together with many red deer antlers, as well as two struck adinole flakes and one chert flake (David, 1990: 22). Adinole is a raw material usually associated with Upper Palaeolithic tool assemblages in Wales. A radiocarbon determination of $22,340 \pm 620$ BP (Birm-340) was obtained on one of the rhinoceros bones (van Nederveelde et al., 1973). The more recent investigations within a series of fissures at Eel Point have produced a small number of flints including three microliths and a retouched blade (David, 1990: 120); these relate to the well-attested

Mesolithic use of what is now Caldey Island. Cutmarks on faunal remains (provisionally identified as *Bos taurus* and ?*Bos primigenius*) have been noted on the small assemblage at the Swansea Museum during a brief examination by RJS (obviously the *Bos taurus* must belong to the Neolithic period or later). Carnivore gnawing was present on faunal remains from Eel Point in the National Museum and Gallery of Wales, Cardiff. Both collections require further investigation. The Tenby Museum and Art Gallery also hold collections from Eel Point that include a small group of human remains from G.N. Smith's investigations of ca. 1840. This material does not appear to show the same degree of mineralisation as the humerus under discussion, and an ulna from this group has previously yielded a Romano-British date of AD 134–379 (OxA-10968: 1771 ± 34 BP) (Schulting and Richards, 2002: Table 1).

AMS dating

To determine the age of the Eel Point humerus, a sample was taken from the broken proximal end, which is slightly distal of midshaft. During sampling, it was apparent that the humerus was far more heavily mineralised than other human remains previously examined and sampled from the Caldey Island sites, hinting that it might be older than this material. An initial ^{14}C AMS result of $24,000 \pm 140$ BP (OxA-11015) confirmed this impression. A second determination run on the same collagen preparation was sought for

Table 1

AMS dates and stable isotope data on the Eel Point humerus. The AMS determinations are of ultrafiltered gelatin extracted using the methods outlined in Bronk Ramsey et al. (2004). $\delta^{13}\text{C}$ is expressed in ‰ wrt. vPDB and $\delta^{15}\text{N}$ in ‰ wrt. to AIR. A suite of 'quality' indicators undertaken at ORAU supports the acceptability of the quality of the collagen extracted for dating. Collagen yields in wt.% ought to be >1% to be acceptable at ORAU. C:N atomic ratios are accepted if they range between 2.9–3.5. Both ‰C and ‰N are well above the minimum threshold for acceptance (*c.* > 13‰ for C and *c.* > 5‰ for N)

Lab no.	Radiocarbon age BP	±	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	C:N	‰C	‰N	Collagen yield (wt.%)
OxA-11015	24000	140	−19.1	10.8	3.3	42.7	15.2	5.3
OxA-11543	23370	110	−18.8	11.0	3.1	39.2	14.6	4.0
OxA-14164	24470	110	−19.1	11.4	3.2	41.9	15.2	7.2
Bradford			−19.7	11.4	3.3	39.6	13.9	2.0
Eel-1 average			−19.2	11.2				

confirmation, and provided an estimate of $23,370 \pm 110$ BP (OxA-11543). Although the two determinations do not quite overlap at two sigma, the results are in reasonably good agreement given their age.

Recent redating of other British Middle to Late Upper Palaeolithic bones in a related project, however, has emphasized once more the importance of carefully sampling old bones in museum collections so as to avoid exterior bone. Victorian collectors often used 'isinglass', a collagen paste derived from the swim bladders of fish (Hickman et al., 2000), to conserve collected specimens. This was used as a warm aqueous solution, and bones were immersed or even simmered in it. William Beard refers to the use of isinglass at the Banwell Bone Cave in documents held at the Somerset Archaeological and Natural History Society. It appears to have been used widely in the early 19th century and until the 1960s (A. Currant, pers. comm.). Sampling of bone for AMS dating from specimens such as these, then, is clearly a critical consideration within the dating process. The fact that thermal denaturation of isinglass occurs at lower temperatures than mammalian collagen might enable effective pretreatments to be implemented in future cases (Hickman et al., 2000).

The first dates were from a bone sample cut in half section from the midshaft of the humerus, and therefore included some exterior bone. This bone was removed using an aluminium oxide shotblaster in Oxford. To evaluate the possibility that the lack of agreement between the two initial AMS results was caused by the incorporation of some conservation material, we resampled the bone in the Swansea Museum, this time by drilling only material from the very centre of the bone. The result was $24,470 \pm 110$ BP (OxA-14164) (Table 1). The result was the oldest of the three determinations, and therefore we believe it is the most reliable.

The calibration of radiocarbon results this early is not possible since the INTCAL98 calibration dataset (Stuiver et al., 1998) extends only to 20 Kya ^{14}C BP (24 Kya cal BP), and this invites speculation regarding the precise calendrical difference between the three measurements. In addition, all three estimates clearly do refer to the same 'event', the death of this individual. The

conversion of dates this early is difficult, but essential if full use is to be made of increasingly high resolution climatic data coming from ice cores. The period c. 24.5 Kya ^{14}C BP can be provisionally corrected to c. 29.5–28.5 Kya cal BP based on a comparison of marine radiocarbon ages and the high resolution Greenland ice cores (Voelker et al., 1998; see also Bowen, 2000: Table 4.1). The recent Cariaco Basin dataset similarly invites comparison with our AMS result (Hughen et al., 2004). Using this dataset with the OxCal software (Bronk Ramsey, 2001), we obtained a range at 68.2% probability of 26751–26451 BC (59.4%) and 26198–26119 BC (8.8%). At 95.4% probability, there were multiple ranges at 27164–26960 BC (9.8% prob.), 26766–26410 BC (62.3%), 26308–25975 BC (21.9%) and 25619–25512 BC (1.4%) (Fig. 2). To facilitate comparison with the ice core calibration, the two sigma confidence interval may be summarised as 29.1–27.5 Kya cal BP. This timespan encompasses and extends outside of a brief, warmer interstadial phase (i3) lodged between two longer cold events (c2 and c3), following the GRIP/GISP2 ice core sequences. But even within the cold events, there is no reason to expect the total abandonment of human settlement in Britain, although recent analysis by Bowen (2000) has suggested that humans favoured the milder pulses in the climate sequence.

The date makes the Eel Point humerus the third oldest modern human presently known from Britain. The oldest directly dated specimen derives from Kent's Cavern, where a small isolated maxilla fragment has yielded an AMS estimate of $30,900 \pm 900$ BP (OxA-1621) (Hedges et al., 1989).¹ Next is the partial skeleton from the Goat's Hole, Paviland, on the Gower peninsula, situated some 30 km east of Caldey Island. Paviland 1 in fact presents the closest point of comparison with the Eel Point humerus, both spatially and temporally. While at ca. 26 Kya ^{14}C BP (OxA-1815 and OxA-8025), Paviland 1 slightly

¹ Ongoing dating of material from above and below the Kent's Cavern maxilla suggests that it may be significantly older than thought, and may not even be modern human, making Eel Point 1 the second oldest anatomically modern human in Britain after Paviland 1 (Higham, T., Jacobi, R., Bronk Ramsey, C., in preparation, *Journal of the Quaternary Society*).

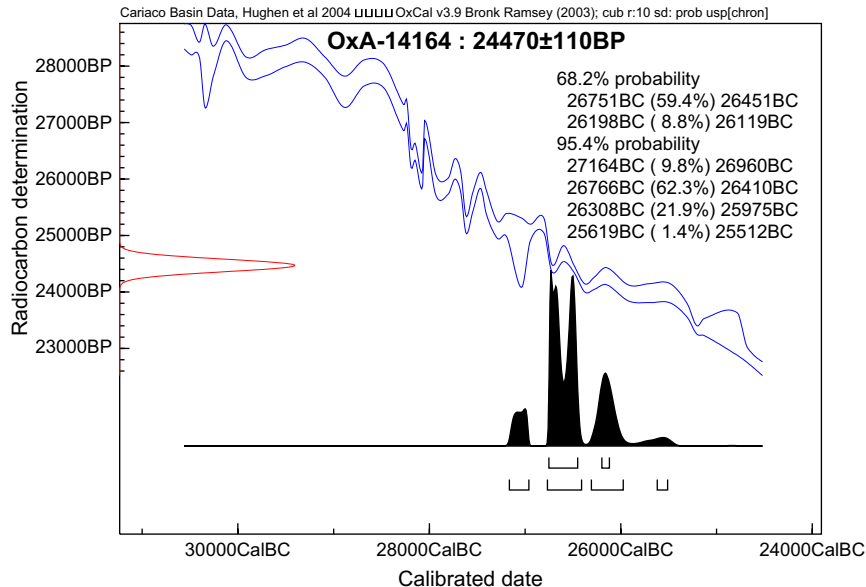


Fig. 2. Calibration of the Eel Point date OxA-14164 using Oxcal v. 3.9.

pre-dates the Eel Point humerus, there are a number of more closely comparable dates from the site, including a series of five ranging between 24,760 and 22,780 ^{14}C years BP on a mammoth ivory pendant, two bone spatulae, and three unmodified animal teeth (Pettitt, 2000: Table 4.1).

Description and morphology

The Eel Point humerus represents the distal half (154 mm surviving length) of an adult right humerus (Fig. 3a–c). The bone is broken diagonally just below the midshaft, preserving the nutrient foramen. The bone surfaces are reasonably well preserved. Overall colouration is very pale brown (Munsell 10YR 8/2), with small areas of slight reddish brown staining (5YR 6/4)—e.g., within the olecranon fossa—likely deriving from the ‘reddish cave earth’ typical of many Pleistocene cave sediments in southwest Britain (Macphail and Goldberg, 2003).

The element is robust in its surface markings. A slight but definite bony ridge runs along the medial midline of the element’s full surviving length. This serves as part of the attachment site for

M. brachialis, involved in the flexion of the forearm. Both the medial and lateral epicondylar ridges are quite well developed; the lateral ridge, though slightly damaged post-mortem, appears particularly pronounced, and serves as the attachment site for *M. extensor carpi radialis longus* (Fig. 3a). The medial and lateral epicondyles are also well developed. The muscles attaching to these regions of the distal humerus, via the common flexor and extensor tendons, respectively, and also *M. pronator teres*, are related to powerful movements of the forearm, wrist and hand. A slight bony crest separates the trochlea and capitulum. The rugous appearance and slight lipping of the coronoid and radial fossae suggest the onset of arthritic changes relating to the mechanical stresses placed on the elbow-joint (Fig. 3a). The dorsal side of the specimen’s distal end is less well preserved, exhibiting some post-depositional erosion. There is no indication of a septal aperture in the olecranon fossa (Fig. 3b).

In addition to the slight osteoarthritic degenerations, the anteroposterior radiograph shows complete obliteration of the distal epiphyseal line. This confirms the fully adult status of the bone. Sex is not directly indicated by the preserved



Fig. 3. (a) The Eel Point 1 humerus, ventral view. (b) The Eel Point 1 humerus, dorsal view. (c) The Eel Point 1 humerus, medial view. (d) Radiograph of the Eel Point 1 humerus (the medullary cavity retains matrix).

element, and its assessment depends upon its size relative to other, pelvically sexable, Gravettian specimens.

For descriptive and comparative purposes, a series of standard osteometrics of the distal humerus are presented in Table 2, along with comparable measurements from the slightly older Paviland 1 left humerus. However, given the frequent presence of humeral bilateral asymmetry, especially among some European Gravettian specimens (Trinkaus et al., 1994; Churchill and Formicola, 1997), comparisons are made principally to the available data from Gravettian right humeri (Table 3).

The length of the Eel Point humerus is not known, although the morphology of the diaphysis near the proximal break suggests that it was slightly distal of midshaft. To provide a length estimate for comparative purposes, maximum humeral length was regressed on distal epicondylar breadth for a sample ($N = 16$) of European Gravettian right humeri. The resultant least

squares formula [$HM \times L = (6.18 \times EpBr) - 41.3$; $r^2 = 0.751$], provides an estimated length of 340.0 ± 3.7 mm for Eel Point 1, or a two sigma confidence range of 332.6–347.4 mm. This length estimate places it in the overlap zone between the male and female Gravettian sample means, much as its epicondylar breadth (not surprisingly) is between the means of slightly smaller Gravettian sex-specific samples. The length estimate is nonetheless above the highest Gravettian female value (335.0 mm for Caviglione 1) and above the values for five of the male Gravettian specimens (including for the Paviland 1 left humerus). Moreover, its distal articular breadth, which does not correlate well with humeral length ($r^2 = 0.574$, $N = 15$), is close to the male mean and 2.7 standard deviations from the mean of the small female sample. It is therefore probable that the Eel Point 1 humerus represents a Gravettian male.

To assess the robusticity of the distal diaphysis, two measures were plotted against estimated

Table 2

Osteometric measurements of the Eel Point 1 and Paviland 1 right and left humeri respectively. M-# designates the Martin measurement definition in Bräuer (1988). Paviland 1 measurements from Trinkaus and Holliday (2000)

Measurement (mm)	Eel Point 1	Paviland 1
maximum length (M-1)	—	337.0
epicondylar breadth (M-4)	61.7	57.1
distal articular breadth (M-12a)	44.5	47.2
humeral epicondyle size (M-4-M12a)	17.2	9.9
trochlear breadth (M-11)	24.2	25.0
capitular breadth (M-12)	20.5	22.5
trochlear max. AP diameter (M-13)	25.5	24.4
olecranon fossa breadth (M-14)	24.0	22.9
olecranon fossa depth (M-15)	12.0	8.0
distal shaft AP diameter	22.1	18.9
distal shaft ML diameter	21.4	16.4
distal minimum circumference (M-7)	69.5	56.2
AP diameter at nutrient foramen	23.6	—
ML diameter at nutrient foramen	20.8	—
AP diameter at ca. 35% length	23.0	19.5
ML diameter at ca. 35% length	20.6	16.7
35% total area (mm ²)	329.5	237.9
35% cortical area (mm ²)	232.1	179.4
35% polar moment of area (mm ⁴)	16040.4	8666.2

humeral length, distal circumference and 35% polar moment of area. The latter was computed from subperiosteal diaphyseal diameters and cortical thicknesses at approximately 35% of estimated length (measured from the distal end), using standard ellipse formulae (O'Neill and Ruff, 2004) (Table 2); the polar moment area (J) was determined as the sum of the anteroposterior (I_x)

and mediolateral (I_y) second moments of area. Since the subperiosteal and endosteal borders are close to parallel between 30% and 40% of bone length (Fig. 3d), any imprecision in section location should have minimal effects on the values. However, since cross-sectional parameters computed using ellipse formulae can exceed those generated from digitizing reconstructed cross sections (O'Neill and Ruff, 2004), least squares regressions were computed to convert ellipse generated values to digitized values for total area (TA), cortical area (CA) and polar moment of area (J), using a pooled sample of Late Pleistocene Eurasian humeral 35% cross sections (N = 55). The resultant formulae are: $TA_d = 0.778 \times TA_e + 40.0$, $r^2 = 0.909$; $CA_d = 0.780 \times CA_e + 27.8$, $r^2 = 0.913$; $J_d = 0.712 \times J_e + 1693.9$, $r^2 = 0.911$. The resultant predicted digitized values have SE_{est} s between 1.0% and 1.9%.

The bivariate plots of the Eel Point 1 humerus middistal diaphyseal measures against humeral length (Fig. 4) show it to be moderately robust with respect to its subperiosteal dimensions (the circumference comparison), but very similar to other Gravettian specimens in the cross-sectional measure of diaphyseal rigidity. The Eel Point humerus therefore appears to reinforce the pattern of modest strength of Gravettian humeral shafts relative to both preceding late archaic Europeans and succeeding Late Upper Paleolithic humans (Churchill et al., 2000; Trinkaus, 2005). The slight contrast between these two measures of humeral

Table 3

Select osteometric measurements of the Eel Point 1 humerus and Gravettian right humeri [mean \pm standard deviation (N)]. The comparative samples includes specimens from Arene Candide, Barma Grande, Baouso da Torre, Caviglione, Cro-Magnon, Dolní Věstonice I & II, Grotte des Enfants (Fanciulli), Paglicci, Pataud, Paviland, Pavlov I, Předmostí, La Rochette and Sunghir (data from Matiegka, 1938; Churchill, 1994; Churchill and Formicola, 1997; Mallegni et al., 1999; Kozlovskaya and Mednikova, 2000; Sládek et al., 2000; Trinkaus, pers. observ.). The Gravettian total sample includes specimens that cannot be reliably assigned sex. The P-value is from a t-test between male and female samples; * = $P < 0.05$, with a sequentially reductive Bonferroni multiple comparison correction

Measurement (mm)	Eel Point	Gravettian Males	Gravettian Females	Gravettian Total	Male-Female P-value
maximum length	—	352.2 \pm 23.2 (12)	316.0 \pm 19.3 (7)	337.3 \pm 28.0 (20)	*0.002
epicondylar breadth	61.7	62.9 \pm 3.8 (10)	59.0 \pm 2.9 (5)	61.2 \pm 4.0 (16)	0.050
distal articular breadth	44.5	45.6 \pm 2.9 (9)	41.8 \pm 1.0 (5)	44.1 \pm 3.0 (15)	*0.003
trochlear max. AP diameter	25.5	29.1 \pm 1.8 (7)	25.2 \pm 2.2 (5)	27.5 \pm 2.7 (12)	*0.009
olecranon fossa breadth	24.0	28.8 \pm 1.2 (5)	29.0 \pm 1.7 (3)	28.5 \pm 1.6 (9)	0.869
distal shaft AP diameter	22.1	—	—	18.1 \pm 1.3 (7)	—
distal min. circumference	69.5	67.7 \pm 5.0 (9)	59.7 \pm 4.7 (6)	64.1 \pm 6.1 (18)	*0.007

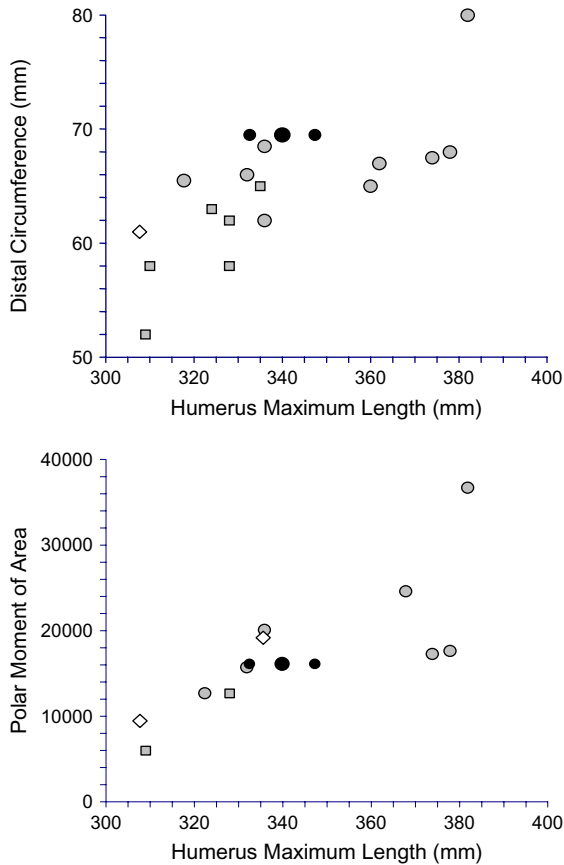


Fig. 4. Bivariate plots of distal circumference (above) and 35% polar moment of area (below) versus humeral maximum length, for right humeri. Eel Point 1: black circle; Gravettian males: gray circles; Gravettian females: gray squares; Indeterminate sex: open diamonds. The two small circles for Eel Point 1 indicate the 2σ range for its length estimate.

diaphyseal strength is accounted for by the below average relative cortical area of the humerus (Fig. 5).

The proportions of the distal epiphysis are notable only for the exceptionally narrow olecranon fossa. At 24.0 mm, the olecranon fossa is the smallest of the Gravettian right humeri, approached only by the measure of 25.7 mm for the much smaller Pataud 5 humerus (maximum length: 308 mm). An index of olecranon to distal articular breadths is 53.9 for Eel Point 1, which is 3.3 standard deviations from a Gravettian mean (66.7 ± 3.9 , $N = 9$).

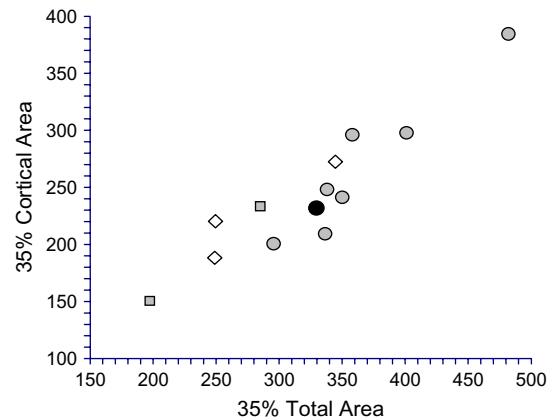


Fig. 5. Bivariate plots of 35% cortical area versus total subperiosteal area for right humeri. Eel Point 1: black circle; Gravettian males: gray circles; Gravettian females: gray squares; Indeterminate sex: open diamonds.

Palaeodietary reconstruction

Stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope values reflect some aspects of an organism's position in the foodweb, and thus can be used to reconstruct past diet. Following the logic discussed above in relation to the dating of the specimen, the stable isotope values associated with OxA-14164 are preferred, although as seen in Table 2 the differences between the isotope values associated with the three AMS determinations are minimal. The values associated with OxA-14164 are -19.1‰ for $\delta^{13}\text{C}$, and 11.4‰ for $\delta^{15}\text{N}$, while a separate bone sample prepared specifically for palaeodietary analysis at the Department of Archaeological Sciences, Bradford University, yielded values of -19.7‰ for $\delta^{13}\text{C}$, and 11.4‰ for $\delta^{15}\text{N}$ (Table 2). Slightly different values from Paviland 1 ($\delta^{13}\text{C} = -18.4\text{‰}$; $\delta^{15}\text{N} = 9.4\text{‰}$) have been interpreted by Richards (2000: 75) as indicating the consumption of around 10 percent marine-derived protein. While this is possible, it remains a tentative conclusion, as stable isotope values vary through time, reflecting climatic and associated vegetation changes (Iacumin et al., 1997; Drucker et al., 2003; Richards and Hedges, 2003; Drucker and Bocherens, 2004). Some hint of this can be seen in the faunal $\delta^{13}\text{C}$ values available for the period 30 to 20 Kya BP (Richards, 2000: Table 4.5), which tend

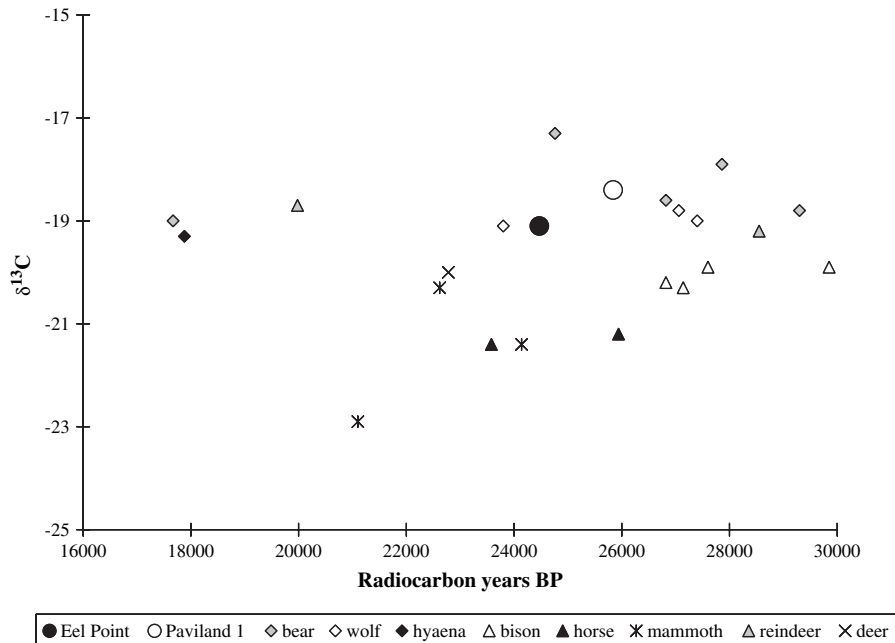


Fig. 6. Bivariate plot showing AMS dates and $\delta^{13}\text{C}$ values for Eel Point and Paviland humans, together with fauna from South Wales over the period 20,000–30,000 ^{14}C years BP (data from Richards, 2000). Note the elevated $\delta^{13}\text{C}$ values for the fauna, particularly affecting hyaena, wolf, bear and reindeer.

to be more variable and slightly elevated in many species relative to Holocene values (Fig. 6) (see also data in Hedges et al., 1996). The possibility of a marine dietary inference is even less secure for the Eel Point humerus, which exhibits a more negative $\delta^{13}\text{C}$ value (*i.e.*, more 'terrestrial'). Better evidence for a marine dietary component at this time comes from a Gravettian burial in Italy ($\delta^{13}\text{C} = -17.6\text{‰}$; $\delta^{15}\text{N} = 12.4\text{‰}$) (Pettitt et al., 2003).

Nitrogen isotopes measure trophic level, and so should be able to inform on the extent to which humans are acting as carnivores or omnivores. Anything approaching vegetarianism is unlikely to have been a viable option in the north-temperate Palaeolithic; while many modern hunter-gatherers rely heavily on plant foods, these tend to live in tropical and subtropical environments (Lee, 1968; Eaton and Konner, 1985). Only limited plant foods are available to human consumers in higher latitudes, and with a very few exceptions, those that do not provide the combination of high protein and high energy offered by animal meat and fat (Speth and Spielmann, 1983). The $\delta^{15}\text{N}$

values for the Eel Point humerus average to ca. 11.2‰, while that for Paviland is 9.4‰, though there may be some question over this latter value being too low (Table 2). The Eel Point value is at the lower end of the range published for Mid-Upper Palaeolithic humans in central and eastern Europe (11.2 to 15.3‰) that have been used to support the importance of hunting and perhaps also freshwater fishing (Richards et al., 2001a).

A comparison with stable carbon and nitrogen isotope values from a number of Pleistocene species from Paviland (c. 17,000–35,000 BP) and Kent's Cavern (c. 28,000–38,000 BP) illustrates the complexity of interpreting the human values (Fig. 7). The humans fall within the range of both brown bears (*Ursus arctos*) and hyaenas (*Crocota crocuta*), and so could be said to be acting as predators. However, brown bears are omnivorous, and a large part of their diet comprises plant foods, and this seems to apply to the Pleistocene as much as to modern animals (Bocherens et al., 1997, 2004). But then low-protein plant foods would be underrepresented in stable isotope

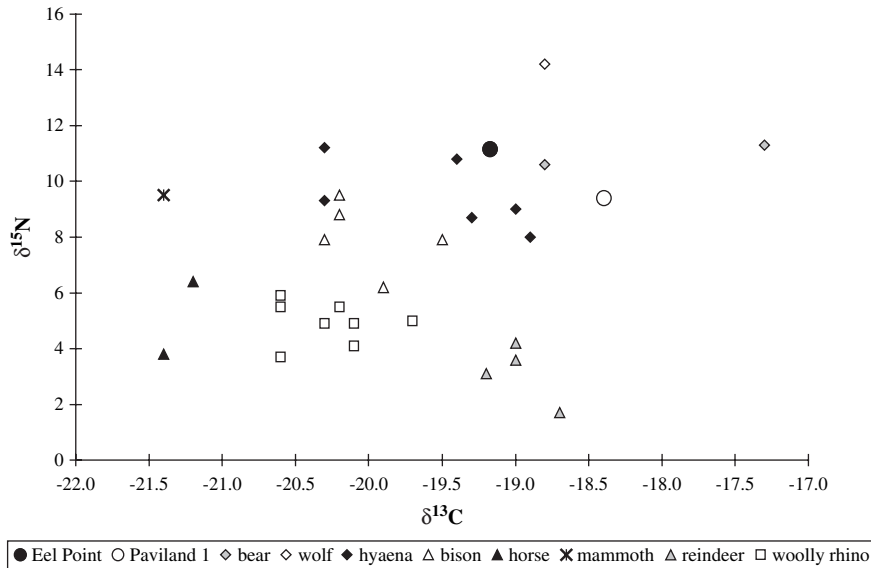


Fig. 7. Bivariate plot showing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for Eel Point and Paviland humans, and series of Pleistocene fauna (17–38 Kya ^{14}C BP) from South Wales (Richards, 2000) and Kent's Cavern, Devon (Bocherens et al., 1995). The averaged values for 4 measurements are used for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ (Table 2). Note that horse, mammoth and wolf values are on teeth and so are expected to be elevated in $\delta^{15}\text{N}$ relative to bone due to the 'nursing effect' (Bocherens et al., 1994; Richards et al., 2002). Predator bone collagen values can be expected to be enriched by ca. 0.8–1.3‰ for $\delta^{13}\text{C}$, and ca. 3–5‰ for $\delta^{15}\text{N}$, relative to prey bone collagen (Bocherens and Drucker, 2003; DeNiro and Epstein, 1981; Schoeninger et al., 1983).

measurements on bone collagen, so that the brown bear values may be reflecting primarily the meat component of their diet, which would then make them a reasonable analogue for human hunters. At the same time, the similarity of some of the hyaena $\delta^{15}\text{N}$ values to the Eel Point human suggests that freshwater fish need not necessarily be invoked to account for the high human value. Complicating matters even further, the difference in $\delta^{15}\text{N}$ values between two herbivores—reindeer (*Rangifer tarandus*) and bison (*Bison sp.*)—is on the order of a full trophic level shift. The result of this is that it is possible to posit a range of combinations of animal and, to a lesser extent, plant foods that could result in the observed human values. The variety of potential prey species present in the Pleistocene, their considerable between- and within-species variation (see also Richards et al., 2000), and the presence of variation within species over time, combine to make the interpretation of human values from this period a difficult task.

The issue of dietary reconstruction has importance beyond subsistence concerns, since the use of

marine foods would imply a considerable scale of mobility, whether seasonal or otherwise. Reconstructed sea-levels in the Bristol Channel area at this time are estimated to have been at –80 m OD or greater (Bowen, 2000: 63), and so both Caldey Island and Paviland would have been 80 km or more from the sea. That people at this time were in contact with the coast is evident from the perforated marine shells at Paviland. But whether they would make significant use of coastal resources depends on the nature of those resources, the timing of their availability and the available technology, and on the available terrestrial options. Stable sulphur isotope analysis (in progress) will bring additional information to bear on this issue, since it can detect whether an individual was consuming terrestrial foods originating near the coast (Richards et al., 2001b).

Taphonomy: burial or scavenged?

While Paviland 1 forms part of an emerging pan-European pattern of burials with elaborate

associated rituals dating to the Gravettian (Aldhouse-Green, 2000; Pettitt, 2002; Zilhão and Trinkaus 2002; Pettitt et al., 2003), it is impossible to say whether the Eel Point humerus was part of an intentional burial, or whether it was washed into the cave or introduced by non-human scavengers. And, in fact, there are possible carnivore tooth puncture marks on the humerus (see Fig. 3a), and punctures and gnawing—presumably by hyaena—were noted on some of the surviving faunal material at the National Museum of Wales, Cardiff. The puncture marks on the humerus are not entirely convincing, however. But the presence of gnaw marks on fauna was also noted during early investigations at the site, as was the presence of hyaena coprolites (although none have survived), suggesting a den (Smith, 1860). Even formal burials could be subject to subsequent disturbance by persistent scavengers. Nevertheless, the apparent absence of any contemporary flint implements at Eel Point strongly suggests that, unlike Paviland, the cave was not used for human occupation in the Pleistocene. This in turn could argue against the presence of a formal burial at the site.

In this sense the burial environment and depositional context for Eel Point is reminiscent to that recently reported for two Upper Palaeolithic sites in the Czech Republic. Svoboda (2000) argues that those human remains in the karstic cave systems may well derive from material falling in through chimneys reaching the surface, rather than through intentional burial.

Conclusion

The Eel Point 1 humerus adds to the corpus of directly dated early modern humans in western Europe. It supports the pattern of modest robusticity seen in other Gravettian humeri and has an unusually narrow olecranon fossa. The stable isotope results confirm a pattern emerging at this time, for slightly elevated $\delta^{13}\text{C}$ values that may not, however, indicate use of marine foods. This is an important issue for further research relating to subsistence practices and the scale of human movement over the landscape. The elevated $\delta^{15}\text{N}$ result suggests a high reliance on meat, although

interpretation is complicated by the variability seen in Pleistocene faunal values. Finally, the Eel Point humerus re-affirms the importance of re-visiting older museum collections.

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