**Supplementary text 1: ZooMS Methodology:**

A recording error resulted in the failure to record the element used to identify select specimens to species. Due to Covid-19 restrictions preventing access to collections, the elements used to identify species could not be re-checked. To confirm initial species identifications collagen peptide fingerprints were obtained for these specimens. This was undertaken following methods adapted from Buckley et al. (2009) and Welker et al. (2015) using the acid-insoluble collagen. For each sample, around 100 ng of already extracted collagen were transferred to Eppendorf micro-tubes and gelatinised in 50 µl 50 mM Ammonium Bicarbonate for 1h at 65°C. Samples were then incubated overnight at 37°C with 0.4 μg of sequencing grade modified trypsin (Promega). Following trypsin digestion, samples were acidified with 0.5% trifluoroacetic acid (TFA) and purified using PierceTM 100 µl C18 resin Tips (Thermo Scientific) using conditioning and eluting solutions composed of 50% acetonitrile and 0.1% TFA. Collagen was eluted in 50 μL.

For MALDI-TOF-MS, 0.5 μL of the trypsin-digested extract was spotted with 0.5 μL of α-cyano-hydroxycinnamic acid matrix solution (0.1% TFA in ACN/H2O 1:1 v/v) onto a 48 spot MALDI target plate, and air dried. MALDI-MS analyses were carried out in triplicate on a Shimadzu MALDI 8020 instrument, operating at up to 2000 laser shots per plate spot, over a m/z range of 900-4000. The mass spectra were calibrated against an adjacent MS standard spot containing eight calibrant peptides (TOFMixTM) of 0.8 to 3.7 kiloDalton (kDa) range (Bradykinin 1-7, angiotensin II, angiotensin I, Glu1-fibrinopeptide B, N-acetyl Renin substrate, ACTH 1–17 clip, ACTH 18–39 clip and ACTH 7–38 clip) – of which seven were used (1.0 – 3.7 kDa range).

The obtained collagen fingerprints were manually inspected for the presence of relevant peptide markers (A-G) in mMass v. 5.5.0 (Strohalm et al., 2010), after filtering peaks with a signal-to-noise ratio (S/N) threshold of 3.0 (Kirby et al., 2013), and using previously published collagen peptide markers from reference spectra (Buckley et al. 2009, 2017; Welker et al., 2016).

All initial species identifications were confirmed by ZooMs analysis (See table S1.1 and S1.2)

|  |
| --- |
| Table S1.1 ZooMS results. Columns P1 to G1 indicate identified peaks in the mass spectra. ZooMS identification is based on these peaks |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Sample ID** | **P1** | **A** | **A'** | **B** | **C** | **P2** | **D** | **E** | **F** | **F'** | **G** | **G'** | **ZooMS ID** |
| BW1 | 1105.2 |   | 1209.3 | 1427.4 | 1580.4 | 1648.5 | 2130.9 |   | 2853.1 |   |   |   | *Bison / Bos sp* |
| BW8 | 1105.4 | 1192.5 | 1208.5 | 1427.7 | 1580.7 | 1648.8 | 2131.2 | 2792.8 | 2853.8 |   |   | *3035.1 - shifted by 1 amu* | *Bison / Bos sp* |
| BW11 | 1105.3 |   |   | 1427.5 | 1580.5 | 1648.6 | 2130.9 |   |   | 2899.4 |   | *3094.7 - shifted by 1 amu* | *Capra sp / Rangifer* |
| BW12 | 1105.6 | 1150.6 | 1196.4 | 1427.7 | 1580.8 | 1648.8 | 2131.1 |   |   |   |   | *3094.9 - shifted by 1 amu* | *Rangifer* |
| BW13 | 1105.6 |   | 1166.6 | 1427.9 | 1581.0 | 1649.0 | 2131.4 |   | 2883.0 |   |   |   | *Rangifer* |
| BW17 | 1105.5 |   |   | 1427.6 | 1580.6 | 1648.7 | 2130.9 |   | 2883.1 |   |   | 3093.0 | *Capra sp / Rangifer* |
| BW19 | 1105.6 |   | 1166.6 | 1427.7 | 1580.8 | 1648.8 | 2131.0 |   | 2883.5 |   |   | 3093.7 | *Rangifer* |
| BW20 | 1105.6 | 1150.6 |   | 1427.7 | 1580.7 | 1648.8 | 2131.0 |   | 2883.3 |   |   | 3093.9 | *Rangifer* |

|  |
| --- |
| Table S1.2 Most probable identification based on macroscopic zooarchaeological, ZooMS and stratigraphic context. |
|  |  |  |  |
| **Sample ID** | **Macroscopic zooarchaeological identification** | **ZooMS identification** | **Most probable identification1** |
| BW1 | *Bison* | *Bison / Bos sp* | *Bison* |
| BW8 | *Bison* | *Bison / Bos sp* | *Bison* |
| BW11 | *Rangifer tarandus* | *Capra sp / Rangifer* | *Rangifer tarandus* |
| BW12 | *Rangifer tarandus* | *Rangifer* | *Rangifer tarandus* |
| BW13 | *Rangifer tarandus* | *Rangifer* | *Rangifer tarandus* |
| BW17 | *Rangifer tarandus* | *Capra sp / Rangifer* | *Rangifer tarandus* |
| BW19 | *Rangifer tarandus* | *Rangifer* | *Rangifer tarandus* |
| BW20 | *Rangifer tarandus* | *Rangifer* | *Rangifer tarandus* |

**Supplementary text 1 bibliography:**

Buckley, M., Collins, M., Thomas-Oates, J., Wilson, J.C., 2009. Species identification by analysis of bone collagen using matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry. Rapid Commun Mass Spectrom 23 (23), 3843–3854.

Buckley, M., Harvey, V.L., Chamberlain, A.T., 2017. Species identification and decay assessment of Late Pleistocene fragmentary vertebrate remains from Pin Hole Cave (Creswell Crags, UK) using collagen fingerprinting. Boreas 46, 402–411.

Kirby, D.P., Buckley, M., Promise, E., Trauger, S., Holdcraft, T.R., 2013. Identification of collagen-based materials in cultural heritage. Analyst 138 (17), 4849-4858.

Strohalm, M., Kavan, D., Novak, P., Volny, M., Havlicek, V., 2010. mMass 3: a crossplatform software environment for precise analysis of mass spectrometric data. Anal. Chem. 82 (11), 4648-4651.

Welker, F., Soressi, M., Rendu, W., Hublin, J.-J., Collins, M.J., 2015. Using ZooMS to identify fragmentary bone from the Late Middle/Early Upper Palaeolithic sequence of Les Cottés, France. J Archaeol Sci, 54, 279–286.

Welker, F., Hajdinjak, M., Talamo, S., Jaouen, K., Dannemann, M., David, F., Julien M., Meyer, M., Kelso, J., Barnes, I., Brace, S., Kamminga, P., Fischer, R., Kessler, B.M., Stewart, J.R., Pääbo, S., Collins, M.J., Hublin, J.-J., 2016. Palaeoproteomic evidence identifies archaic hominins associated with the Châtelperronian at the Grotte du Renne. PNAS, 113 (40): 11162-11167.

**Supplementary Table 1: Sample details and bone collagen carbon and nitrogen stable isotope results.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample code** | **Sample no** | **Find no** | **Species** | **Element** | **%C** | **%N** | **d13C** | **d15N** | **C:N** | **source** |
| BW1 | 39 | 43 | Bison | \* | 33.6 | 12.3 | -20.6 | 9.6 | 3.2 | 1 |
| BW2 | 10 | 11 (a) | Bison | Phalange | 38.6 | 14.2 | -20.8 | 9.1 | 3.2 | 1 |
| BW3 | 21 | 23 | Bison | Astragalus | 42.6 | 15.6 | -21.4 | 10.1 | 3.2 | 1 |
| BW4 | 26 | 25 | Bison | Vertebrae | 41.8 | 15.3 | -20.7 | 9.7 | 3.2 | 1 |
| BW5 | 10 | 16 | Bison | Phalange | 40.4 | 14.8 | -20.6 | 9.8 | 3.2 | 1 |
| BW6 | 39 | 40 | Bison | Scapula | 43.5 | 15.9 | -20.3 | 9.7 | 3.2 | 1 |
| BW7 | 1 | 8 | Bison | Phalange | 43.3 | 15.8 | -20.6 | 9.9 | 3.2 | 1 |
| BW8 | 10 | 11 | Bison | \* | 47.3 | 17.4 | -20.7 | 9.1 | 3.2 | 1 |
| BW9 | 45 | 47 | Bison | Vertebrae | 43.8 | 16 | -20.5 | 9.6 | 3.2 | 1 |
| BW10 | 8 | 1 | Bison | Vertebrae | 44.6 | 16.3 | -20.8 | 9.4 | 3.2 | 1 |
| OxA-14136 |   |   | Bison | calcaneum | 41.2 |   | -20.3 | 10.8 | 3.2 | 2 |
| OxA-14138 |   |   | Bison | calcaneum | 41.1 |   | -20.7 | 10.6 | 3.1 | 2 |
| BW11 | 10 | 12 | Reindeer | \* | 43.5 | 15.8 | -19.9 | 9.2 | 3.2 | 1 |
| BW12 | 18 | 19 | Reindeer | \* | 41.6 | 15.2 | -19.8 | 6.4 | 3.2 | 1 |
| BW13 |   | 7 | Reindeer | \* | 40.3 | 14.7 | -19.8 | 6.1 | 3.2 | 1 |
| BW14 | 33 | 38 | Reindeer | Vertebrae | 41.9 | 15.3 | -19.7 | 7.1 | 3.2 | 1 |
| BW15 |   | 5 | Reindeer | Mandible | 40.9 | 14.9 | -19.6 | 8.3 | 3.2 | 1 |
| BW16 | 45 | 46 | Reindeer | Maxilla | 42.3 | 15.4 | -19.7 | 7.5 | 3.2 | 1 |
| BW17 | 18 | 17 | Reindeer | \* | 42.8 | 15.7 | -19.7 | 6 | 3.2 | 1 |
| BW18 |   | 14 | Reindeer | Astragalus | 46.3 | 17 | -19.9 | 7.9 | 3.2 | 1 |
| BW19 | 21 | 24 | Reindeer | \* | 52.5 | 19.2 | -19.9 | 8.3 | 3.2 | 1 |
| BW20 | 60 | 61 | Reindeer | \* | 49.5 | 18.1 | -19.6 | 9.2 | 3.2 | 1 |
| BW21 | 33 | 36 | Reindeer | Scapula | 43.3 | 15.8 | -19.8 | 5.8 | 3.2 | 1 |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 1: This study |  |  |  |  |  |  |  |  |  |  |
| 2: Higham, T. G., Jacobi, R. M. & Bronk Ramsey, C. AMS radiocarbon dating of ancient bone using ultrafiltration. Radiocarbon 48, 179–195 (2006) |
| \* Element not recorded so species identification was confirmed by ZooMs. See supplementary text 1 |  |  |  |

**Supplementary Table 2: Sample details, tooth enamel oxygen and carbon isotope results, and results of conversion equations**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample code | Species | Notes | Tooth | Animal age during formation (months) | Measured enamel carbonate d13C | Measured enamel carbonate d18O vpdb | Calculated carbonate d18O vsmow (equation 1) | Calculated phosphate d18O vsmow (equation 2) | Calculated drinking water d18O vsmow (bison equation 3, reindeer equation 4) |
| ED1 | Bison |   | Upper left P3/P4 | 9 months to c.30months | -10.9 | -7.0 | 23.7 | 14.9 | -9.1 ± 2.6 |
| ED2 | Bison |   | Upper left M1/M2 | en utero to c.13 months | -12.6 | -6.6 | 24.1 | 15.3 | -8.5 ± 2.7 |
| ED3 | Bison |   | Lower right P3/P4 | 9 months to c.30months | -11.7 | -6.7 | 24.0 | 15.3 | -8.6 ± 2.6 |
| ED4 | Bison |   | Upper left M1/M2 | en utero to c.13 months | -12.4 | -5.7 | 25.0 | 16.2 | -7.1 ± 2.7 |
| ED5 | Bison |   | Upper left M1/M2 | en utero to c.13 months | -11.3 | -6.5 | 24.2 | 15.5 | -8.3 ± 2.7 |
| ED11 | Bison |   | Lower M1 | en utero to c.4months | -12.5 | -6.4 | 24.3 | 15.5 | -8.2 ± 2.7 |
| ED12 | Bison |   | Upper left M3 | 9 months to c.24months | -10.2 | -6.8 | 23.9 | 15.2 | -8.7 ± 2.6 |
| ED13 | Bison |   | Upper Left M2 | Birth to c.13 months | -10.1 | -6.0 | 24.7 | 15.9 | -7.6 ± 2.7 |
| ED14 | Reindeer |   | Lower Left M1/M2 | 3 to 9 months | -11 | -5.1 | 25.6 | 16.8 | -4.8 ± 2.8 |
| ED15 | Reindeer |   | Lower Left M1/M2 | 3 to 9 months | -10.1 | -8.2 | 22.5 | 13.8 | -9.3 ± 2.4 |
| ED16 | Reindeer | ED16, ED23 from same mandible | Left lower P2 | 13 to 18 months | -10.5 | -5.0 | 25.8 | 17.0 | -4.6 ± 2.8 |
| ED17 | Reindeer |   | Upper Left P2/dp2? | 13 to 18 months | -13.3 | -8.0 | 22.6 | 13.9 | -9.1 ± 2.4 |
| ED18 | Reindeer |   | Upper right M3 | 9 to 26 months | -10.7 | -5.6 | 25.1 | 16.3 | -5.5 ± 2.7 |
| ED19 | Reindeer | ED19, ED20 from same mandible | Upper Left M3 | 9 to 26 months | -10.2 | -5.6 | 25.1 | 16.3 | -5.6 ± 2.7 |
| ED20 | Reindeer | ED19, ED20 from same mandible | Upper Left M2 | 13 to 18 months | -10.3 | -8.1 | 22.5 | 13.8 | -9.2 ± 2.4 |
| ED21 | Reindeer | ED21, ED22from same mandible | Lower left P3 | 13 to 18 months | -11 | -7.4 | 23.3 | 14.6 | -8.1 ± 2.5 |
| ED22 | Reindeer | ED21, ED22from same mandible | Lower Left P2 | 13 to 18 months | -10.9 | -7.7 | 23.0 | 14.2 | -8.6 ± 2.4 |
| ED23 | Reindeer | ED16, ED23 from same mandible | Left lower P3 | 13 to 18 months | -10.1 | -5.7 | 25.1 | 16.3 | -5.6 ± 2.7 |
|  |  |  |  |  |  |  |  |  |  |
| Bison-based palaeo-δ18Oprecip estimate |   |   |   |   |   |   |   |   | ‑8.3 ± 1.3  |
| Reindeer-based palaeo-δ18Oprecip estimate |   |   |   |   |   |   |   |   | -7.0 ± 1.6  |
| Bison-based temperature estimate (ºC) (equation 5) |   |   |   |   |   |   |   |   | 10.3 ± 2.5  |
| Reindeer-based temperature estimate (ºC) (equation 5) |   |   |   |   |   |   |   |   | 12.8 ± 3.1 |
|  |  |  |  |  |  |  |  |  |  |
| Equation 1: | δ18OVSMOW = 1.03091\*δ18OVPDB+30.91 (Coplen 2011) |  |  |  |  |  |  |
| Equation 2: | δ18Ophos = 0.973\*δ18Ocarb - 8.12 (Zazzo et al. 2004) |  |  |  |  |  |  |
| Equation 3: | δ18Oenvi = (δ18Ocarb -30.057 (±0.58))/0.703 (±0.12) (based on Hoppe 2006) |  |  |  |  |  |
| Equation 4: | δ18Oenvi = (δ18Ophos – 20.117(± 0.34)) / 0.683 (±0.11) (based on Longinelli et al., 2003) |  |  |  |  |  |
| Equation 5: | temperature (ºC) = (δ18Oprecip – 13.74 (±0.16)) / 0.53 (±0.08) (Pryor et al., 2014) |  |  |  |  |  |

|  |
| --- |
| Timing of crown formation or enamel mineralization in Rangifer is estimated here based on known information for other deer species as this information is yet to be established for reindeer (Brown and Chapman, 1991a, b).  |
| For Bison, these estimates are based on Gadbury et al. 2000. |
|  |
| **Supplementary table 2 bibliography**Coplen, T. B., 2011. Guidelines and recommended terms for expression of stable-isotope-ratio and gas-ratio measurement results. Rapid Communications in Mass Spectrometry 25(17), 2538–2560. |
| Zazzo, A., Lécuyer, C., Sheppard, S.M., Grandjean, P., Mariotti, A., 2004. Diagenesis and the reconstruction of paleoenvironments: a method to restore original δ18O values of carbonate and phosphate from fossil tooth enamel. Geochimica et Cosmochimica Acta 68(10), 2245-2258. |
| Hoppe, K.A. 2006. Correlation between the oxygen isotope ratio of North American bison teeth and local waters: implication for paleoclimatic reconstructions. Earth Planetary Science Letters 244 (1-2), 408-417. |
| Longinelli, A., Iacumin, P., Davanzo, S., Nikolaev, V., 2003. Modern reindeer and mice: revised phosphate–water isotope equations. Earth and Planetary Science Letters 214(3-4), 491-498. |
| Pryor, A.J., Stevens, R.E., O'Connell, T.C., Lister, J.R., 2014. Quantification and propagation of errors when converting vertebrate biomineral oxygen isotope data to temperature for palaeoclimate reconstruction. Palaeogeography, Palaeoclimatology, Palaeoecology 412, 99-107. |
| Brown, W.A.B., Chapman, N.G., 1991a. Age assessment of fallow deer (Dama dama) from a scoring scheme based on radiographs of developing permanent molariform teeth. Journal of Zoology 224(3), 367-379.  |
| Brown, W.A.B., Chapman, N.G., 1991b. The dentition of red deer (Cervus elaphus): a scoring scheme to assess age from wear of the permanent molariform teeth. Journal of Zoology 224(4), 519-536. |
| Gadbury, C., Todd, L., Jahren, A.H., Amundson, R., 2000. Spatial and temporal variations in the isotopic composition of bison tooth enamel from the Early Holocene Hudson-Meng Bone Bed, Nebraska. Palaeogeography, Palaeoclimatology, Palaeoecology 157 (1-2), 79-93. |

**Supplementary Table 3: Results of conversion of collagen and carbonate d13C data to estimated d13C diet.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sample code** | **Species** | **d13C** | **Material** | **Calculated d13C diet** |
| BW1 | Bison | -20.6 | Collagen | -25.6 |
| BW2 | Bison | -20.8 | Collagen | -25.8 |
| BW3 | Bison | -21.4 | Collagen | -26.4 |
| BW4 | Bison | -20.7 | Collagen | -25.7 |
| BW5 | Bison | -20.6 | Collagen | -25.6 |
| BW6 | Bison | -20.3 | Collagen | -25.3 |
| BW7 | Bison | -20.6 | Collagen | -25.6 |
| BW8 | Bison | -20.7 | Collagen | -25.7 |
| BW9 | Bison | -20.5 | Collagen | -25.5 |
| BW10 | Bison | -20.8 | Collagen | -25.8 |
| OxA-14136 | Bison | -20.3 | Collagen | -25.3 |
| OxA-14138 | Bison | -20.7 | Collagen | -25.7 |
| BW11 | Reindeer | -19.9 | Collagen | -24.9 |
| BW12 | Reindeer | -19.8 | Collagen | -24.8 |
| BW13 | Reindeer | -19.8 | Collagen | -24.8 |
| BW14 | Reindeer | -19.7 | Collagen | -24.7 |
| BW15 | Reindeer | -19.6 | Collagen | -24.6 |
| BW16 | Reindeer | -19.7 | Collagen | -24.7 |
| BW17 | Reindeer | -19.7 | Collagen | -24.7 |
| BW18 | Reindeer | -19.9 | Collagen | -24.9 |
| BW19 | Reindeer | -19.9 | Collagen | -24.9 |
| BW20 | Reindeer | -19.6 | Collagen | -24.6 |
| BW21 | Reindeer | -19.8 | Collagen | -24.8 |
| ED1 | Bison | -10.9 | Enamel | -24.9 |
| ED2 | Bison | -12.6 | Enamel | -26.6 |
| ED3 | Bison | -11.7 | Enamel | -25.7 |
| ED4 | Bison | -12.4 | Enamel | -26.4 |
| ED5 | Bison | -11.3 | Enamel | -25.3 |
| ED11 | Bison | -12.5 | Enamel | -26.5 |
| ED12 | Bison | -10.2 | Enamel | -24.2 |
| ED13 | Bison | -10.1 | Enamel | -24.1 |
| ED14 | Reindeer | -11 | Enamel | -25 |
| ED15 | Reindeer | -10.1 | Enamel | -24.1 |
| ED16 | Reindeer | -10.5 | Enamel | -24.5 |
| ED17 | Reindeer | -13.3 | Enamel | -27.3 |
| ED18 | Reindeer | -10.7 | Enamel | -24.7 |
| ED19 | Reindeer | -10.2 | Enamel | -24.2 |
| ED20 | Reindeer | -10.3 | Enamel | -24.3 |
| ED21 | Reindeer | -11 | Enamel | -25 |
| ED22 | Reindeer | -10.9 | Enamel | -24.9 |
| ED23 | Reindeer | -10.1 | Enamel | -24.1 |
|  |  |  |  |  |
| δ13Ccoll and δ13Cenamel were converted to δ13Cdiet by assuming a diet to collagen offset of +5‰, and diet to carbonate offset of +14‰ following Lee Thorpe *et al.* 1989 and Cerling and Harris 1999  |
|  |  |  |  |  |
| Lee-Thorp, J. A., Sealy, J. C., van der Merwe, N. J., 1989. Stable carbon isotope ratio differences between bone collagen and bone apatite and their relationship to diet. Journal of Archaeological Science 16(6), 585-599. |
| Cerling, T. E., Harris, J. M., 1999. Carbon isotope fractionation between diet and bioapatite in ungulate mammals and implications for ecological and paleoecological studies. Oecologia 120(3), 347-363. |

**Supplementary Table 4: Bone collagen δ13C and δ 15N of late Pleistocene reindeer from the UK and southwest France collated from published literature.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Site Name | Country | Element | Lab code | Direct 14C date lab Code | Direct 14C date | uncertainty on 14C date | Age category | Collagen d13C | Collagen d15N | Collagen C:N ratio | Date reference | Carbon (coll) reference | Nitrogen (coll) reference |
| Sun Hole Cave  | UK | 1st phalange | OxA-14827 | OxA-14827 | 10145 | 55 | GS-1 (Younger Dryas) | -18.3 | 4.6 | 3.2 | 11 | 11 | 11 |
| Kent’s Cavern | UK | 1st phalange | OxA-14825 | OxA-14825 | 10255 | 45 | GS-1 (Younger Dryas) | -19.5 | 5.1 | 3.2 | 11 | 11 | 11 |
| Chelm's Combe | UK | left dentary | A/CC/B/6 | OxA-17831 | 10480 | 45 | GS-1 (Younger Dryas) | -18.4 | 4 | 3.2 | 11 | 11 | 11 |
| Foxhole Cave | UK | astragalus | OxA-8312 | OxA-8312 | 10685 | 65 | GS-1 (Younger Dryas) | -18.7 | 3.4 | 3.3 | 15 | 15 | 15 |
| Foxhole Cave | UK | astragalus | OxA-25145 | OxA-25145 | 10780 | 50 | GS-1 (Younger Dryas) | -19 | 3.5 | 3.2 | 16 | 16 | 16 |
| Foxhole Cave | UK | tibia | OxA-8311 | OxA-8311 | 10785 | 65 | GS-1 (Younger Dryas) | -18.7 | 4 | 3.4 | 15 | 15 | 15 |
| Gough's Cave | UK | antler | OxA-18064 | OxA-18064 | 12535 | 55 | GS-2.1a | -19.2 | 1.8 | 3.2 | 11 | 11 | 11 |
| Foxhole Cave | UK | astragalus | OxA-25146 | OxA-25146 | 12555 | 55 | GS-2.1a | -19.7 | 2.7 | 3.2 | 16 | 16 | 16 |
| Kent’s Cavern | UK | astralagus, left | OxA-14826 | OxA-14826 | 14395 | 60 | GS-2.1a | -18.4 | 4.7 | 3.2 | 11 | 11 | 11 |
| Reindeer Rift, Cattedown | UK | calcaneum, sin. | OxA-17160 | OxA-17160 | 14550 | 55 | GS-2.1a | -18.4 | 3.7 | 3.2 | 11 | 11 | 11 |
| Goat's Hole (Paviland) | UK | bone | OxA-17560 | OxA-17560 | 24240 | 110 | OIS3 | -17.7 | 3.4 | 3.3 | 12 | 12 | 12 |
| Pontnewydd Cave | UK | 1st phalange | OxA-13984 | OxA-13984 | 25210 | 120 | OIS3 | -18.4 | 3.1 | 3.2 | 3 | 3 | 3 |
| Goat's Hole (Paviland) | UK | antler | OxA- 7084 | OxA-7084 | 28550 | 650 | OIS3 | -19.2 | 3.1 | 3.1 | 15 | 15 | 15 |
| Pontnewydd Cave | UK | metacarpal | OxA-13993 | OxA-13993 | 30240 | 230 | OIS3 | -18.5 | 3.2 | 3.2 | 3 | 3 | 3 |
| Pontnewydd Cave | UK | tibia | OxA-11672 | OxA-11672 | 31800 | 1000 | OIS3 | -17.7 | 3 | 3.3 | 3 | 3 | 3 |
| Goat's Hole (Paviland) | UK | antler | OxA-13438 | OxA-13438 | 31990 | 180 | OIS3 | -19 | 3.7 | 3.2 | 12 | 12 | 12 |
| Kent’s Cavern | UK | antler | OxA-30162 | OxA-30162 | 34850 | 600 | OIS3 | -18.8 | 3.2 | 3.4 | 14 | 14 | 14 |
| Kent’s Cavern | UK | antler | OxA-30272 | OxA-30272 | 35100 | 650 | OIS3 | -19.1 | -0.7 | 3.3 | 14 | 14 | 14 |
| Pontnewydd Cave | UK | tibia | OxA-11671 | OxA-11671 | 35400 | > | OIS3 | -19.7 | 3 | 3.4 | 3 | 3 | 3 |
| Pontnewydd Cave | UK | humerus (left) | OxA-11669 | OxA-11669 | 36700 | > | OIS3 | -20 | 5.2 | 3.5 | 3 | 3 | 3 |
| Goat's Hole (Paviland) | UK | antler | OxA-13658 | OxA-13658 | 37350 | 320 | OIS3 | -18.6 | 5.8 | 3.2 | 12 | 12 | 12 |
| Pin Hole  | UK | antler | OxA-11980 | OxA-11980 | 37760 | 340 | OIS3 | -19.5 | 4.8 | 3.3 | 13 | 13 | 13 |
| Pontnewydd Cave | UK | right mandible | OxA-14052 | OxA-14052 | 39600 | 900 | OIS3 | -18.6 | 3.1 | 3.4 | 3 | 3 | 3 |
| Kent’s Cavern | UK | left dentary | OxA-13888 | OxA-13888 | 40000 | 700 | OIS3 | -18.5 | 2.8 | 3.3 | 8 | 8 | 8 |
| Pontnewydd Cave | UK | humerus (right) | OxA-11670 | OxA-11670 | 40200 | > | OIS3 | -18.4 | 2.5 | 3.3 | 3 | 3 | 3 |
| Goat's Hole (Paviland) | UK | antler | OxA-13439 | OxA-13439 | 40570 | 370 | OIS3 | -18.8 | 2.2 | 3.2 | 12 | 12 | 12 |
| Site Name | Country | Element | Lab code | Direct 14C date lab Code | Direct 14C date | uncertainty on 14C date | Age category | Collagen d13C | Collagen d15N | Collagen C:N ratio | Date reference | Carbon (coll) reference | Nitrogen (coll) reference |
| Pin Hole  | UK | antler | OxA-11797 | OxA-11797 | 40650 | 500 | OIS3 | -18.5 | 0.8 | 3.4 | 8 | 8 | 8 |
| Pontnewydd Cave | UK | astragalus | OxA-14055 | OxA-14055 | 41400 | 1400 | OIS3 | -18.4 | 3 | 3.3 | 3 | 3 | 3 |
| Pin Hole  | UK | antler | OxA- 11796 | OxA-11796 | 44200 | 800 | OIS3 | -17.5 | 1.6 | 3.3 | 8 | 8 | 8 |
| Robin Hood's Cave | UK | bone | OxA-12772 | OxA-12772 | 47300 | 1200 | OIS3 | -18.1 | 3.7 | 3.2 | 13 | 13 | 13 |
| Kent’s Cavern | UK | proximal radius | OxA-14714 | OxA-14714 | 49600 | 2200 | OIS3 | -18.6 | 3.1 | 3.3 | 8 | 8 | 8 |
| Abri Castanet | France | tibia | CST400 | GifA 97312 | 32460 | 420 | OIS 3 | -19.5 | 7.6 | 3 | 2 | 2 | 2 |
| Abri Castanet | France | metatarsus | CST600 | GifA 97313 | 32750 | 460 | OIS 3 | -19.8 | 9.7 | 3.1 | 2 | 2 | 2 |
| Abri Castanet | France | humerus | CST500 | GifA 99165 | 31430 | 390 | OIS 3 | -19.2 | 9.2 | 3.1 | 2 | 2 | 2 |
| Abri Castanet | France | tibia | CST300 | GifA 99166 | 34320 | 520 | OIS 3 | -19.1 | 10.3 | 3.2 | 2 | 2 | 2 |
| Abri Castanet | France | femur | CST200 | GifA 99180 | 32950 | 520 | OIS 3 | -18.7 | 10.3 | 3 | 2 | 2 | 2 |
| Abri Castanet | France | metatarsus | CST100 |   |   |   | OIS 3 | -18.8 | 8.6 | 3 | 2 | 2 | 2 |
| Abri Castanet | France | humerus | CST-A1 |   |   |   | OIS 3 | -19.3 | 7.8 | 3.5 | 2 | 2 | 2 |
| Abri Lartet | France | astragalus | LRT-2 |   |   |   | OIS 3 | -19.2 | 8.4 | 3.3 | 2 | 2 | 2 |
| Abri Lartet | France | astragalus | LRT-3 |   |   |   | OIS 3 | -19.3 | 7.5 | 3.3 | 2 | 2 | 2 |
| Abri Pasquet | France | calcaneum | PSQ-1 |   |   |   | OIS 3 | -19.4 | 8.9 | 3.5 | 2 | 2 | 2 |
| Abri Pataud | France | Tibia | P-19918 | OxA-21581 | 33550 | 550 | OIS 3 | -19.3 | 7.5 | 3.3 | 9 | 6 | 6 |
| Abri Pataud | France | Metacarpal III-I | P-19931 | OxA-21587 | 28150 | 290 | OIS 3 | -19.2 | 6 | 3.3 | 9 | 6 | 6 |
| Abri Pataud | France | Central + fourth t | P-19932 | OxA-21588 | 28250 | 280 | OIS 3 | -19.2 | 6 | 3.3 | 9 | 6 | 6 |
| Abri Pataud | France | Tibia | P-19912 | OxA-21599 | 34850 | 600 | OIS 3 | -18.6 | 6.6 | 3.3 | 9 | 6 | 6 |
| Abri Pataud | France | Metatarsal III-I | P-19913 | OxA-21600 | 34200 | 550 | OIS 3 | -19.2 | 7.4 | 3.3 | 9 | 6 | 6 |
| Abri Pataud | France | Bone | P-21953 | OxA-21670 | 33450 | 500 | OIS 3 | -19.2 | 7.2 | 3.4 | 9 | 6 | 6 |
| Abri Pataud | France | Bone | P-21954 | OxA-21671 | 34300 | 600 | OIS 3 | -19.1 | 7.5 | 3.3 | 9 | 6 | 6 |
| Grotte XVI | France | metatarsus | G16-47 |   |   |   | OIS 3 | -19.1 | 7.7 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | metatarsus | G16-50 |   |   |   | OIS 3 | -19.3 | 7 | 3.2 | 2 | 2 | 2 |
| Grotte XVI | France | tibia | G16-100 |   |   |   | OIS 3 | -19.3 | 6.6 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | mandible | G16-19 |   |   |   | OIS 3 | -19.5 | 6.1 | 3.4 | 2 | 2 | 2 |
| Grotte XVI | France | radioulna | G16-20 |   |   |   | OIS 3 | -18.9 | 6 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | metatarsus | G16-23 |   |   |   | OIS 3 | -19 | 7.2 | 3.2 | 2 | 2 | 2 |
| Grotte XVI | France | metatarsus | G16-24 |   |   |   | OIS 3 | -19.5 | 6.6 | 3.3 | 2 | 2 | 2 |
| Site Name | Country | Element | Lab code | Direct 14C date lab Code | Direct 14C date | uncertainty on 14C date | Age category | Collagen d13C | Collagen d15N | Collagen C:N ratio | Date reference | Carbon (coll) reference | Nitrogen (coll) reference |
| Grotte XVI | France | metacarpum | G16-25 |   |   |   | OIS 3 | -19.1 | 7.4 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | metatarsus | G16-26 |   |   |   | OIS 3 | -19.1 | 6.5 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | mandible | G16-37 |   |   |   | OIS 3 | -18.9 | 6.4 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | phalanx I | G16-70 |   |   |   | OIS 3 | -19 | 5.8 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | astragalus | G16-76 |   |   |   | OIS 3 | -19.8 | 8 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | metapodial | G16-93 |   |   |   | OIS 3 | -19.2 | 7.1 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | metacarpum | G16-94 |   |   |   | OIS 3 | -19.3 | 7.8 | 3.3 | 2 | 2 | 2 |
| Grotte XVI | France | metacarpum | G16-95 |   |   |   | OIS 3 | -19.4 | 7.4 | 3.3 | 2 | 2 | 2 |
| La Berbie | France | jawbone | LBR1100 |   |   |   | OIS 3 | -19.1 | 7.6 | 3.2 | 1 | 1 | 1 |
| La Berbie | France | femur | LBR3400 |   |   |   | OIS 3 | -19.4 | 5.8 | 3.3 | 1 | 1 | 1 |
| La Moustier | France | metacarpal | OxA-25170 | OxA-25170 | 50000 | 3900 | OIS 3 | -19.4 | 6.2 | 3.5 | 10 | 10 | 10 |
| La Quina | France | bone | OxA-21807 | OxA-21807 | 45200 | 2200 | OIS 3 | -18.678 | 7.6 | 3.3 | 10 | 10 | 10 |
| Le Moustier | France | calcaneum | G16-77 |   |   |   | OIS 3 | -19.3 | 6.3 | 3.3 | 2 | 2 | 2 |
| Le Moustier | France | scapula | MST-12 |   |   |   | OIS 3 | -19.3 | 6.3 | 3.3 | 2 | 2 | 2 |
| Les Peyrugues  | France | humerus | PRG3900 |   |   |   | OIS 3 | -19.2 | 6.3 | 3.3 | 5 | 5 | 5 |
| Les Peyrugues  | France | radius | PRG5400 |   |   |   | OIS 3 | -19.4 | 6 | 3.1 | 5 | 5 | 5 |
| Les Peyrugues  | France | long bone | PRG5500 |   |   |   | OIS 3 | -19 | 6.1 | 3.3 | 5 | 5 | 5 |
| Les Peyrugues  | France | metatarsal | PRG5600 |   |   |   | OIS 3 | -19.7 | 6 | 3.2 | 5 | 5 | 5 |
| Les Peyrugues  | France | radius | PRG5800 |   |   |   | OIS 3 | -19.2 | 6.1 | 3.2 | 5 | 5 | 5 |
| Les Pradelles / Marillac | France | bone | not given |   |   |   | OIS 3 | -20.3 | 6.5 | not given | 7 | 7 | 7 |
| Les Pradelles / Marillac | France | bone | not given |   |   |   | OIS 3 | -19.6 | 6.9 | not given | 7 | 7 | 7 |
| Les Pradelles / Marillac | France | bone | not given |   |   |   | OIS 3 | -19.5 | 6.2 | not given | 7 | 7 | 7 |
| Les Pradelles / Marillac | France | bone | not given |   |   |   | OIS 3 | -19.4 | 6.5 | not given | 7 | 7 | 7 |
| Les Pradelles / Marillac | France | bone | not given |   |   |   | OIS 3 | -19.4 | 6.3 | not given | 7 | 7 | 7 |
| Les Pradelles / Marillac | France | bone | not given |   |   |   | OIS 3 | -19.2 | 5.9 | not given | 7 | 7 | 7 |
| Les Pradelles / Marillac | France | bone | not given |   |   |   | OIS 3 | -19.2 | 6.6 | not given | 7 | 7 | 7 |
| Mandrin | France | femur | OxA-21694 | OxA-21694 | 47100 | 0 | OIS 3 | -19.5 | 6.6 | 3.4 | 10 | 10 | 10 |
| Roc-de-Combe | France | metatarsus | RCM-22 |   |   |   | OIS 3 | -18.4 | 7.6 | 3.3 | 2 | 2 | 2 |
| Site Name | Country | Element | Lab code | Direct 14C date lab Code | Direct 14C date | uncertainty on 14C date | Age category | Collagen d13C | Collagen d15N | Collagen C:N ratio | Date reference | Carbon (coll) reference | Nitrogen (coll) reference |
| Roc-de-Combe | France | metatarsus | RCM-23 |   |   |   | OIS 3 | -19.4 | 8.6 | 3.3 | 2 | 2 | 2 |
| Roc-de-Combe | France | metatarsus | RCM-24 |   |   |   | OIS 3 | -19.1 | 6.5 | 3.2 | 2 | 2 | 2 |
| Roc-de-Combe | France | phalanx | RCM-25 |   |   |   | OIS 3 | -19.8 | 8 | 3.3 | 2 | 2 | 2 |
| Roc-de-Combe | France | maxillary | RCM-26 |   |   |   | OIS 3 | -19.4 | 7.2 | 3.3 | 2 | 2 | 2 |
| Saint-Césaire | France | metapodium | RPB7200 |   |   |   | OIS 3 | -18.3 | 7.3 | 3.2 | 1 | 1 | 1 |
| Saint-Césaire | France | not given | RPB3100 |   |   |   | OIS 3 | -19.4 | 6.7 | 3.2 | 4 | 4 | 4 |
| Saint-Césaire | France | not given | RPB3700 |   |   |   | OIS 3 | -19.4 | 6.5 | 3.2 | 4 | 4 | 4 |
| Vergisson II | France | bone | OxA-7758 | OxA-7758 | 35700 | 2400 | OIS 3 | -19.604 | 6 | 3 | 17 | 18 | 17 |

**Supplementary table 4 bibliography**

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| 1: Bocherens, H., Drucker, D.G., Billiou, D., Patou-Mathis, M., Vandermeersch, B. 2005. Isotopic evidence for diet and subsistence pattern of the Saint-Césaire I Neanderthal: Review and use of a multi-source mixing model. Journal of Human Evolution 49: 71–87. |
| 2: Bocherens, H., Drucker, D.G., Madelaine, S., 2014. Evidence for a 15N positive excursion in terrestrial foodwebs at the Middle to Upper Palaeolithic transition in south-western France: implications for early modern humans. Journal of Human Evolution 69, 31-43. |
| 3: Debenham, N.C., Pettitt, P.B., Housley, R.A., Higham, T.F.G., Rowe, N.P., Atkinson, T., Hebden, N. 2012. Neanderthals in Wales: Pontnewydd and the Elwy Valley. ed. / S.H.R. Aldhouse-Green; Rick Peterson; K.E. Walker. Cardiff : Oxbow Books in association with The National Museum of Wales, 302-320. |
| 4: Drucker, D., Bocherens, H., Mariotti, A., Lévêque, F., Vandermeersch, B., Guadelli. J.-L., 1999. Conservation des signatures isotopiques du collagène d'os et de dents du Pléistocène supérieur (Saint-Césaire, France) : implications pour les reconstitutions des régimes alimentaires des néandertaliens. Bulletins et Mémoires de la Société d'Anthropologie de Paris, Nouvelle Série, tome 11 fascicule 3-4, pp. 289-305. |
| 5: Drucker, D., Bocherens, H., Biliou, D. 2003. Evidence for shifting environmental conditions in Southwestern France from 33 000 to 15 000 years ago derived from carbon-13 and nitrogen-15 abundances in collagen of large herbivores. *Earth Planetary Science Letter* 216, 163–173. |
| 6: Drucker, D.G., Vercoutere, C., Chiotti, L., Nespole, R., Crepin, L., Condard, N.J., Munzel, S.C., Higham, T., Plicht, J., Laznickova-Galetova, M. and Bochrens, H. 2015 Tracking possible decline of woolly mammoth during the Gravettian in Dordogne (France) and the Ach Valley (Germany) using multi-isotope tracking (13C, 14C, 15N, 34S, 18O). Quaternary International, 359, 304-317. |
| 7: Fizet, M., Mariotti, A., Bocherens, H., 1995. Effect of Diet, Physiology and Climate on Carbon and Nitrogen Stable Isotopes of Collagen in a Late Pleistocene anthropic palaeoecosystem: Marillac, Charente, France. Journal of Archaeological Science 22(1), 67-79. |
| 8: Higham, T.G., Jacobi, R.M., Bronk Ramsey, C., 2006. AMS radiocarbon dating of ancient bone using ultrafiltration. Radiocarbon 48(2), 179–195. |
| 9: Higham, T., Jacobi, R., Basell, L., Bronk Ramsey, C., Chiotti, L., Nespoulet, R. 2011. Precision dating of the Palaeolithic: A new radiocarbon chronology for the Abri Pataud (France), a key Aurignacian sequence. Journal of human evolution, 61(5) 549-563. |
| 10: Higham T, Douka K, Wood R, Ramsey CB, Brock F, Basell L, et al. The timing and spatiotemporal patterning of Neanderthal disappearance. Nature. 2014; 512: 306–309. |
| 11: Jacobi, RM, Higham T. 2009. The early Late glacial re-colonization of Britain: new radiocarbon evidence from Gough’s Cave, southwest England. Quaternary Science Reviews, 28 : 1895-1913 |
| 12: Jacobi, R.M., Higham, T.F.G. 2008. The 'Red Lady' ages gracefully: new ultrafiltration AMS determinations from Paviland. Journal of Human Evolution, 55: 898-907. |
| 13: Jacobi, R.M., Higham, T.F.G., Bronk Ramsey, C. 2006. AMS radiocarbon dating of Middle and Upper Palaeolithic bone in the British Isles: improved reliability using ultrafiltration. *Journal of Quaternary Science*. 21 (5): 557–573. |
| 14: Proctor, C., Douka, K., Proctor, J.W. and Higham, T. 2017. The Age and Context of the KC4 Maxilla, Kent’s Cavern, UK. European Journal of Archaeology 20 (1) 2017, 74–97. |
| 15: Richards, M. P. 2000. Human and faunal stable isotope analyses from Goat's Hole and Foxhole caves, Gower. Pp. 71-75 in S. Aldhouse-Green (ed.), Paviland Cave and the "Red Lady": a definitive report. Western Academic and Specialist Press, Ltd.: Bristol. |
| 16: Schulting, R.J., Fibiger, L., Macphail, R.I., McLaughlin, R., Murray, E.V., Price, C., Walker, E.A. 2013a. Mesolithic and Neolithic humans remains from Foxhole Cave (Gower, South Wales). Antiquaries Journal 93: 1-23. |
| 17: Stevens, R.E. Jacobi, R., Street, M., Germonpré, M., Conard, N.J., Münzel, S.C. Hedges, R.E.M. 2008 Nitrogen isotope analyses of reindeer (Rangifer tarandus), 45,000 BP to 9,000 BP: Palaeoenvironmental reconstructions.Palaeogeography, Palaeoclimatology, Palaeoecology , 262 (1-2) pp. 32-45. |
| 18: ORAU database: https://c14.arch.ox.ac.uk/database/db.php?page=checkDate&oxa=7758&auto=true |

**Supplementary Table 5: Bone collagen δ13C and δ 15N of late Pleistocene Bovids from the UK and southwest France collated from published literature.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Site Name | Country | Species | Element | Lab code | Direct 14C date Lab Code | Direct 14C date | Age category | Collagen d13C | Collagen d15N | Collagen C:N ratio | Date reference | Carbon (coll) reference | Nitrogen (coll) reference |
| Ash Tree Cave  | UK | Bison priscus | cervical vertabra | OxA-15003 | 57700 | > | Banwell MAZ site | -20.6 | 5.6 | 3.2 | 1 | 1 | 1 |
| Windy Knoll | UK | Bison priscus | radius | OxA-15001 | 51700 | > | Banwell MAZ site | -20.7 | 4.6 | 3.2 | 1 | 1 | 1 |
| Steetley Quarry | UK | Bison priscus | metacarpal | OxA-15000 | 53200 | > | Banwell MAZ site | -20.6 | 9.4 | 3.2 | 1 | 1 | 1 |
| Ash Tree Cave  | UK | Bison priscus | metatarsal | OxA-13800 | 54100 | > | Banwell MAZ site | -20.4 | 9 | 3.3 | 1 | 1 | 1 |
| Banwell Bone Cave | UK | Bison priscus  | calcaneum | OxA-14136 | 59500 | > | Banwell MAZ site | -20.3 | 10.8 | 3.2 | 1 | 1 | 1 |
| Banwell Bone Cave | UK | Bison priscus  | calcaneum | OxA-14138 | 53900 | > | Banwell MAZ site | -20.7 | 10.6 | 3.1 | 1 | 1 | 1 |
| Hunter’s Lodge Inn Sink | UK | Bison priscus  | scapula | OxA-13566 | 54800 | > | Banwell MAZ site | -20.6 | 8.8 | 3.2 | 1 | 1 | 1 |
| Goat's Hole (Paviland) | UK | Bison | not given | OxA-6932 | 32600 | 950 | OIS3 | -20.2 | 9.5 | 2.9 | 2 | 2 | 2 |
| Kendrick’s Cave  | UK | Bovine | humerus | OxA-11726 | 12310 | 50 | GI-1ed | -20 | 2.8 | 3.2 | 3 | 3 | 3 |
| Goat's Hole (Paviland) | UK | Bison | not given | OxA-13435 | 30320 | 170 | OIS3 | -19.4 | 10.2 | 3.2 | 4 | 4 | 4 |
| Goat's Hole (Paviland) | UK | Bison | not given | OxA-13418 | 31250 | 230 | OIS3 | -20.2 | 8.4 | 3.3 | 4 | 4 | 4 |
| Goat's Hole (Paviland) | UK | Bison | not given | OxA-6924 | 31600 | 850 | OIS3 | -19.5 | 7.9 | 2.9 | 2 | 2 | 2 |
| Goat's Hole (Paviland) | UK | Bos/Bison | not given | OxA-6926 | 26820 | 460 | OIS3 | -20.2 | 8.8 | 3 | 2 | 2 | 2 |
| Goat's Hole (Paviland) | UK | Bos/Bison | not given | OxA-6925 | 29850 | 700 | OIS3 | -19.9 | 6.2 | 3 | 2 | 2 | 2 |
| Foxhole Cave | UK | Bos/Bison | sacrum | OxA-25158 | 28310 | 290 | OIS3 | -22.1 | 3.5 | 3.2 | 5 | 5 | 5 |
| Foxhole Cave | UK | Bos/Bison | scapula | OxA-25157 | 30750 | 390 | OIS3 | -19.5 | 5.5 | 3.2 | 5 | 5 | 5 |
| Pin hole Cave | UK | Bovini | partial right tibia | OxA-11976 | 40720 | 390 | OIS3 | -20.4 | 2.5 | 3.3 | 1 | 1 | 1 |
| Pin hole Cave | UK | Bovini | left radius/ulna | OxA-13591 | 48000 | 1000 | OIS3 | -19.8 | 6.6 | 3.1 | 1 | 1 | 1 |

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| **Supplementary table 5 bibliography**1: Higham, T.G., Jacobi, R.M., Bronk Ramsey, C., 2006. AMS radiocarbon dating of ancient bone using ultrafiltration. Radiocarbon 48(2), 179–195. |
| 2: Richards, M. P. 2000. Human and faunal stable isotope analyses from Goat's Hole and Foxhole caves, Gower. Pp. 71-75 in S. Aldhouse-Green (ed.), Paviland Cave and the "Red Lady": a definitive report. Western Academic and Specialist Press, Ltd.: Bristol. |
| 3: Jacobi, R.M., and Higham, T.F.G., 2011. The British Earlier Upper Palaeolithic: Settlement and Chronology. AHOB. Developments in Quaternary Science: 14 ISSN 1571-0866 |
| 4: Jacobi, R.M. and Higham, T.F.G. 2008. The 'Red Lady' ages gracefully: new ultrafiltration AMS determinations from Paviland. Journal of Human Evolution, 55: 898-907. |
| 5: Schulting, R.J., Fibiger, L., Macphail, R.I., McLaughlin, R., Murray, E.V., Price, C. and Walker, E.A. 2013. Mesolithic and Neolithic humans remains from Foxhole Cave (Gower, South Wales). Antiquaries Journal 93: 1-23. |