**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* |

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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.

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**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. |
|  |
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**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 | | | | |
|  |  |  |  |  |
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**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 |

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**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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