

# **A New Radiometric Date and Assessment of the Last Glacial Megafauna of Dream Cave, Derbyshire.**

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## **Abstract**

The extinct fauna of Dream Cave, Derbyshire, has played a significant role in the history of British cave paleontology, a near-complete woolly rhinoceros from the cave having been famously illustrated in 1823. The fauna was not subsequently re-studied until 2000, with the publication of an indirect radiometric date by uranium-series disequilibrium dating of a presumed-overlying flowstone. Here we present a direct radiocarbon date of  $43,330 \pm 1800$  yBP on the fauna, with additional comments on the fauna and the taphonomy of the site.

## **Keywords**

*Ceolodonta*, *Bos*, *Rangifer*, Marine isotope stage 3, Pleistocene, Britain.

## **Introduction**

In December 1822, lead miners sinking a shaft in the hamlet of Callow, near Wirksworth, Derbyshire, serendipitously intersected a natural cavity that was found to be filled with “a confused mass of argillaceous earth and fragments of stone” (Buckland, 1823, p62), within which lay the essentially complete and well preserved skeletal remains of a woolly rhinoceros *Coelodonta antiquitatis*. The subsequent excavation also revealed the

original natural open fissure into which the animal had apparently fallen or been washed. The owner of the property, Phillip Gell, communicated the discovery to the Rev. D. Stacy, who in turn notified William Buckland, the first Reader in Geology at Oxford. Buckland had just achieved some fame following his publication of an excavation at Kirkdale Cave, Yorkshire (Buckland, 1822), and the Dream Cave discovery came as he was working on his major treatise on cave paleontology. The discovery of the rhinoceros was remarkable enough that the cave and specimen were illustrated in profile in Buckland's influential *Reliquiae Deluvianae* (1823), and the reproduced copper plate has become well known (e.g. Rudwick, 1995). Following Buckland's death in 1856 and the formal opening of the Oxford University Museum in 1860, the Dream Cave collection was absorbed into the museum's collections but was not formally curated until recently (Howlett, *pers. comm*). No formal listing of the Dream Cave fauna has been attempted since 1874, and no direct radiometric dating or re-survey of the site has previously been undertaken.

### **Study Site**

Dream Cave (also known as Dream Mine; 53.07° N, 1.59° W; 244 m; Figure 1) is a natural karst cavity developed along a mineralized vein in the Lower Carboniferous Monsal Dale Limestone Formation (British Geological Survey, 2016). In its current form, the site consists of a broad open fissure some 14 m deep, with an artificially enlarged cavity and solution tubes extending in a WNW - ESE direction. The original fill has been largely removed, but a small deposit of material remains (Figure 2). All known fossils from the site are preserved in the Oxford University Museum of Natural History (OUMNH) collections.

### **Faunal remains**

Following the near-complete excavation of the cave, the faunal remains entered William Buckland's personal collection at Christchurch College, Oxford, and were transferred to the Oxford University Museum sometime after the founding of that institution in 1860 (Gordon, 1894). Archival research in the OUMNH reveals that the larger bones were on display in the museum by 1861, and at some point between 1872 and 1874 the smaller ones were moved into drawers nearby (Howlett, *pers. comm.*, 2016).

The current faunal list comprises only megafaunal species, presumably due to a lack of interest in the microfauna in the mid-19<sup>th</sup> century, rather than their true absence from the cave. In fact, a letter from Phillip Gell to Sir Everard Home, dated 21 May 1823, noted

*"The Rhinoceros appears to have occupied the centre of the Cave, the Ox and Deer one end, and the smaller animals the other end."* (Gell, 1823).

The identity and disposition of these "smaller animal" remains is unfortunately unknown.

Specimens in the Dream Cave collection include the woolly mammoth (*Coelodonta antiquitatis*, 1 individual; OUMNH Q.1511, 92 elements; Fig. 3), auroch (*Bos primigenius*, 1 juvenile individual; OUMNH Q.7755, 18 elements; and at least one adult; OUMNH Q.7756–Q.7759, 4 elements), reindeer (*Rangifer tarandus*; OUMNH Q.7769–Q.7780, 12 elements), and horse (*Equus*; OUMNH Q.7781, 1 element). It should be noted however that the *Equus* specimen, a partial radius with the diaphysis of the ulna adherent (Fig 4A) has a lighter coloured patina than the other Dream Cave material, and jagged breaks suggesting that it was not water-rolled. It is possible that this specimen originated elsewhere and was mis-associated with the Dream Cave collection by an earlier investigator. Boyd-Dawkins examined the Dream Cave collection and included *Equus* in his short description of the material (Boyd-Dawkins, 1874), but the provenance of the specimen remains uncertain.

The complete osteological list appears in Appendix 1.

Lithological material:

The Dream Cave collection also includes two lithological samples: a block of flowstone (OUMNH Q.7782) and a piece of limestone from the fissure wall (OUMNH Q.7783). The latter is marked “A” and “B” in ink at the two ends, and the accompanying label reads:

“Projecting side of the fissure at the Dream Cave near Wirksworth just under the Plumb line. see Plate 20 of Buckland’s Cavern Papers. the Scratches from A. to Base are from the diluvial fragments that fell in by this fissure to the cave below”.

## Methods

Dream Cave was surveyed using standard magnetic cave surveying techniques (Dasher, 1997) in January 2016. Data was processed in COMPASS software (Fish, 2015) and the final product drawn in profile to replicate the original Buckland illustration as closely as possible. Aerial imagery was obtained using a custom-built photogrammetric unmanned autonomous quadcopter.

A left tibia, OUMNH Q.7755/14, of *Bos primigenius* in the Oxford University Museum of Natural History collections was selected for this study. A 10 mm core was drilled from the specimen (Fig. 5) using a sterile diamond-tipped core bit and transferred to a DNA-free centrifuge tube. Radiocarbon dating was performed at the Oxford Radiocarbon Unit using the collagen ultrafiltration method of preparation (Higham *et al.*, 2006).

## Results

Macromolecular collagen yield was 9.2 %, indicative of excellent preservation. The specimen provided a finite radiocarbon date of 43,300 +/- 1800 ( $\delta^{13}\text{C}$  -21.12; OxA-33959), 42,544 calBP calibrated against Oxcal v4.2.4 (Ramsey 2013) and the InterCal13 dataset (Reimer *et al.*, 2013; Figure 6).

## Discussion

A previous study of the age of the Dream Cave fauna was attempted by McFarlane *et al.* (2000), based on the discovery of a block of flowstone, OUMNH Q.7782, in the Buckland collection at Oxford. Although Buckland does not mention flowstone in his 1822 account, the specimen is clearly labelled “The Dream Cave Wirksworth” in his handwriting and consists of flowstone ~ 2 cm thick with residual argillaceous sediment on the underside, and was obviously considered significant by Buckland at the time of collection. McFarlane *et al.* (2000) considered this specimen to have been a flowstone cap over the original fossiliferous sediment, and obtained a uranium-thorium disequilibrium date of 36,451 – 1262, +1277 yr on the lowermost layer as a minimum age for the underlying fauna. The direct radiocarbon age of 43,300 ± 1800 rcyBP on auroch bone reported in this study is fully consistent with this interpretation.

The radiocarbon dated *Bos* material was emplaced in the cave during marine isotope stage (MIS) 3, substage 3B (Fig. 7), during a cooling phase that preceded the rapid warming and flowstone deposition at the MIS 3A optimum. Examination of the remnant deposit of allochthonous sediment in Dream Cave reveals a heterogeneous mixture of sub-rounded metamorphic gravels and finer matrix (Fig 2). This material cannot have originated in the immediate vicinity, as Dream Cave lies near the summit of a small limestone hill. The nearest source of metamorphics is an outcrop of the Hopton Agglomerate, some 1.5 km due west of the cave.

Buckland (1823) noted that the bones of the rhinoceros lay “nearly in the center of this subsiding mass, and at a height of many feet above the floor of the actual cave” (Buckland, 1823, p.62), and were in close proximity to one another. On this basis, he concluded that the cave had not acted as a pitfall (as mis-stated by Boyd-Dawkins in 1874), since this would have resulted in the skeletal elements being scattered on the sediment floor through normal taphonomic processes of displacement, but rather that the animal represented “*a carcass that was drifted in entire at the same time with the diluvial detritus*” (Buckland, 1823, p.64). Although Buckland was writing in the context of a Noachian Universal Deluge (Rudwick, 1995), his explanation was taphonomically correct in its essential elements. MIS 3 was characterized by “large amplitude, millennial scale cycles of abrupt temperature rise followed by gradual cooling” which correlate with Dansgaard-Oeschger cycles (Moseley *et al.*, 2014). The Dream Cave fauna is almost coeval with an

intensively studied *Coelodonta* site in Staffordshire (~ 40 km SSW of Dream Cave) where Shreve *et al.* (2013) have reconstructed mean monthly July and January temperatures of 8 to 11 °C and -16 to -22 °C respectively, noting that annual spring thaws would be associated with high-energy flood regimes. The Dream Cave megafauna was likely emplaced by a single debris flow during one of these flood events, and we consider the *Bos* radiocarbon date as likely to be coeval with the more famous woolly rhinoceros specimen, the deer specimens; we remain ambivalent with respect to the *Equus* specimen.

The woolly rhinoceros, *Coelodonta antiquitatis*, is a relatively uncommon component of the British glacial fauna, known from less than 20 locations and a comparable number of individuals (Jacobi *et al.*, 2009; Schreve *et al.* 2013). A set of 17 ultrafiltration-based radiocarbon dates presented by Jacobi *et al.* (2009) range from 55,900 ± 4000 to 31,140 ± 170 rcyBP in age. *Coelodonta* has also been reported from Ogof-yr-Ychen (Caldey Island, Wales) at 22,350 ± 620 rcyBP but this date was rejected by Jacobi *et al.* (2009) since it is based on an earlier, less reliable radiocarbon methodology. A number of probabilistic methods for the estimation of extinction ages are available (McFarlane, 1999); application of the median gap method to the Jacobi *et al.* (2009) dataset, with the addition of one date from Schreve *et al.*, (2013), gives the lower 95% confidence limit on the extinction age as 28,460 rcyBP, adding support to Jacobi's view that the Ogof-Yr-Ychen date should be regarded with caution. The age of the Dream Cave fauna, based on the co-excavated *Bos* skeleton, falls almost mid-way through the demonstrated tenure of *C. antiquitatis* in Britain.

The Dream Cave deer remains comprise 12 antler fragments, described by Buckland as “some portions of deer's horns, of the size but not the shape of those of a large fallow deer, and some of them having the upper extremities palmated.” (Buckland, 1823, p.63). All show at least some sign of smoothing by fluvial movement. While two specimens from the collection, OUMNH Q.7769 and Q.7770 were figured in Buckland (1823) in Plate 22 as numbers 3 and 4 respectively, little further work appears to have been done on these specimens. All examined antler fragments appear to be attributable to *Rangifer tarandus*.

OUMNH Q.7769 (Fig. 4B), an unshed basal antler fragment from the left side, is described as follows: “Lower extremity of a horn, still adhering to the skull, found with the rhinoceros in the cave near Wirksworth, 1822. Near it were several cylindrical portions of the shafts of similar horns, nearly of the same diameter as this, having their surface very smooth.” (Buckland, 1823, 276). It consists of a remnant of the frontal bone and pedicle, with a portion of the fronto-parietal suture preserved at the posterior side. Although the specimen is eroded, the interface between the base of the beam, burr and the pedicle is clear. At first glance, the eroded remnant of a brow tine lying on the burr seems to curve to the broken base of a bez tine, orientated laterally and located c. 20 mm above, recalling *Cervus elaphus*. The pedicle is short and robust, however, and the burr – although eroded – does not seem

to have been as developed or had the rough surface and pearly typically associated with *C. elaphus*. While pedicle length is known to decrease with age (e.g. Lister, 1990), measurements (Table 1) also indicate that pedicle length would be anomalously short for its diameter when compared with data from Pleistocene-age and extant *Cervus* specimens (cf. Lister, 1990). Examination of the remnants of the brow and bez tines suggest that while the former is severely eroded it was unlikely to have been substantial. Conversely, the cross section of the base of the bez tine indicates that this tine would have been elongate in proximal-distal direction and flattened medio-laterally: more akin to *Rangifer* than *Cervus*. Taken together, OUMNH Q.7769 is parsimoniously attributed to *Rangifer tarandus*. An estimate of the surface area of the pedicle (Table 1) compared with data from extant North American specimens (Miller *et al.*, 2013) is equivalent to data from large male antlers.

OUMNH Q.7770 (Fig. 4C) is described in Buckland as follows: “*Portion of a flat and palmated horn found with No. 3,*” and is a fragment of palmated and flattened tines of *Rangifer tarandus*.

Among the “*several cylindrical portions*”, four specimens clearly refit to form a shed antler of *Rangifer tarandus* (Fig. 8A): OUMNH Q.7771/1, a brow tine that preserves a portion of anterior beam and anterior pedicle; OUMNH Q.7771/2, a preserved posterior portion of pedicle and basal beam with proximal shaft of bez tine; OUMNH Q.7771/3, a fragment of palmated distal bez tine and; OUMNH Q.7771/4, beam with remnant base of posterior tine. Comparison of the estimated surface area of the refitted pedicle (Table 1) with data in Miller *et al.* (2013) suggests a male individual.

OUMNH Q.7772/1 and Q.7772/2 (Fig. 8B) comprise a robust unshed antler beam including a broken portion of the antler base with pedicle and fragment of fronto-parietal suture (OUMNH Q.7771/1). The presumed basal location of brow and bez tines is broken away. Pedicle length (16.01 mm) is very short and indicates *Rangifer tarandus*. OUMNH Q.7772/2 is a fragment of the beam. A further beam fragment (OUMNH Q.7773) may also be associated with these specimens. OUMNH Q.7774 is a more gracile unshed antler of *Rangifer tarandus*. Remnants of the pedicle, brow and bez tines are preserved. Comparison of measurements of the pedicle (Table 1), with data in Miller *et al.* (2013), however, suggest this specimen also derived from a male.

Buckland’s account of the cave also mentions “the radius and some other bones of a stag” (Buckland, 1822, p.63) but these have not as yet been located in the OUMNH collections (Howlett, *pers. comm.*, 2016).

## Future of the Dream Cave site

The Dream Cave site lacks the protective status of a Site of Special Scientific Interest, and has suffered from agricultural debris dumping and partial in-filling. Although the cave is unlikely to produce additional palaeontological specimens, the historical significance of the site is sufficient to warrant basic conservation measures and the provision of appropriate interpretive materials.

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## References

Boyd-Dawkins, W., 1874. Cave Hunting. Researches on the evidence of caves respecting the early inhabitants of Europe. MacMillan and Co. London. 455p.

British Geological Survey. 2016. Geology of Britain digital geological map.  
<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

Buckland, W. 1822. Account of an assemblage of fossil teeth and bones of elephant, rhinoceros, hippopotamus, bear, tiger, and hyaena, and sixteen other animals; discovered in a cave at Kirkdale, Yorkshire, in the year 1821: with a comparative view of five similar caverns in various parts of England, and others on the Continent. *Philosophical Transactions of the Royal Society of London* 112: 171-236 .

Buckland, W. 1823. Reliquiae Diluvianae; or observations on organic remains attesting to the action of an Universal Deluge. John Murray. London. 303p.

Dasher, G. R. 1997. On Station. A complete handbook for surveying and mapping caves. National Speleological Society. Huntsville. 242p.

Gell, P. 1823. Unpublished correspondence to Sir Everard Home. William Buckland Archive, Letters, G/3. OUMNH.

- Gordon, E.O. 1894. The life and correspondence of William Buckland, D.D., FRS.: sometime Dean of Westminster, twice President of the Geological Society, and first President of the British Association. John Murray. London. 288p.
- Guthrie, R.D. 1990. Frozen fauna of the Mammoth Steppe: the story of Blue Babe. University of Chicago Press. Chicago. 338p.
- Higham, T.F.G., Jacobi, R.M., and Ramsey, C.B. 2006. AMS radiocarbon dating of ancient bone using ultrafiltration. *Radiocarbon*, 48(2): 179-195.
- Jacobi, R.M., Rose, J., MacLeod, A., and Higham, T.F.G. 2009. Revised radiocarbon ages on woolly rhinoceros (*Coelodonta antiquitatis*) from western central Scotland: significance for timing the extinction of woolly rhinoceros in Britain and the onset of the LGM in Scotland. *Quaternary Science Reviews* 28: 2551-2556.
- Kuzmin, Y. 2010. Extinction of the woolly mammoth (*Mammuthus primigenius*) and woolly rhinoceros (*Coelodonta antiquitatis*) in Eurasia: review of chronological and environmental issues. *Boreas* 39(2): 247-261.
- Lister, A.M. 1984. Evolutionary and ecological origins of British deer. *Proceedings of the Royal Society of Edinburgh* 82B: 205-229.
- Lister, A. 1990. Critical reappraisal of the Middle Pleistocene deer species "Cervus" elaphoides Kahlke. *Quaternaire* 3-4: 175-192.
- McFarlane, D.A. 1999. A comparison of methods for the probabilistic determination of vertebrate extinction chronologies. P.95- 103. In MacPhee, R.D.E. (Ed.) *Extinctions in near time: causes, contexts, and consequences*. Kluwer Academic /Plenum Publishers. New York. 394p.
- McFarlane, D.A., Lundberg, J., and Ford, D.C. 2000. The age of the woolly rhino from Dream Cave, Derbyshire, UK. *Cave and Karst Science* 27(1): 25-28.
- Miller, J.M., Druckenmiller, P., Bahn, V. 2013. Antlers on the Arctic Refuge: capturing multi-generational patterns of calving ground use from bones on the landscape. *Proceedings of the Royal Society B* 280.
- Moseley G.E., Spötl, C., Svensson, A., Cheng, H., Brandstater S., and Edwards, R.L. 2014. Multi-speleothem record reveals tightly coupled climate between central Europe and Greenland during Marine Isotope Stage 3. *Geology* 42(12): 1043-1046.
- Railsback, L.B., Gibbard, P.L., Head, M.J., Voarintsoa, N.R.G., Toucanne, S. 2015. An optimized scheme of lettered marine isotope substages for the last 1.0 million years, and

the climatostratigraphic nature of isotope stages and substages. *Quaternary Science Reviews* 11: 94-106.

Rudwick, M.J.S. 1995. *Scenes from deep time*. University Chicago Press. Chicago. 294p.

Schreve, D., Howard, A., Carrant, A., Brooks, S., Buteux, S., Coope, R., Crocker, B., Field, M., Greenwood, M., Greig, J., and Toms, P. 2013. A middle Devensian woolly rhinoceros (*Coelodonta antiquitatis*) from Whitemoor Haye Quarry, Staffordshire (UK): palaeoenvironmental context and significance. *Journal of Quaternary Science* 28(2): 118-130.

Shirley, J. 1958. The Carboniferous limestone of the Monyash-Wirksworth area, Derbyshire. *Quarterly Journal of the Geological Society* 114: 411-429.

**Table 1. Pedicle measurements of antler specimens from Dream Cave, Derbyshire**

| <b>Specimen(s)</b> | <b>Pedicle</b>                                   | <b>mm</b> |
|--------------------|--|-----------|
| OUMNH Q.7769       | Pedicle diameter (medial-lateral/min. axis)      | 42.50     |
|                    | Pedicle diameter (anterior-posterior/ maj. axis) | 45.52     |
|                    | Basal (pedicle) circumference                    | 144       |
|                    | Log basal (pedicle) surface area                 | 3.18      |
|                    | Pedicle length (measured posterior face):        | 17.20     |
| OUMNH Q. 7771/1-4  | Pedicle diameter (medial-lateral/min. axis)      | 33.22     |
|                    | Pedicle diameter (anterior-posterior/ maj. axis) | 34.04     |
|                    | Log basal (pedicle) surface area                 | 2.948     |
| OUMNH Q.7774       | Pedicle diameter (medial-lateral/min. axis)      | 24.46     |
|                    | Pedicle diameter (anterior-posterior/ maj. axis) | 25.48     |
|                    | Log basal (pedicle) surface area                 | 2.6897    |

## Figure Captions

Figure 1. Dream Cave, Wirksworth, Derbyshire. The upper illustration is Plate 20 from Buckland (1823), “drawn by T. Webster from a sketch by Prof. Buckland”. The original sketch is lost. The lower illustration is a plan and section of Dream Cave drawn from a 2016 survey by the present authors. The profile is drawn on the same bearing as the Buckland original. Buckland’s shaft “A” is the capped shaft in the modern profile.

Figure 2. Remnant of the original cave fill from which the Dream Cave megafauna was recovered.

Figure 3. Woolly rhinoceros (*Coelodonta antiquitatis*) right mandible, OUMNH Q.1511/7.

Figure 4. A) Horse (*Equus* sp.) radius from the Dream Cave collection. B-C) Reindeer (*Rangifer tarandus*) antler fragments from Dream Cave; B) OUMNH Q.7769 and C) OUMNH Q.7770. Scale bars are 50 mm.

Figure 5. Auroch (*Bos primigenius*) left tibia, OUMNH Q.7755/14, showing location of the core extracted for radiocarbon dating.

Figure 6. Radiocarbon calibration curve, for the Dream Cave *Bos primigenius* tibia, OUMNH Q.7755/14

Figure 7. Marine oxygen isotope curve (adapted from Railsback *et al.*, 2015), showing the age of the Dream Cave *Bos primigenius* (circled) and the bounding dates on isotope substage 3b. Warm episodes are depicted as peaks; cold episodes as troughs.

Figure 8. Refitted reindeer (*Rangifer tarandus*) specimens, A) OUMNH Q.7771/1-4, and B) OUMNH Q.772/1-2.

Figure 1

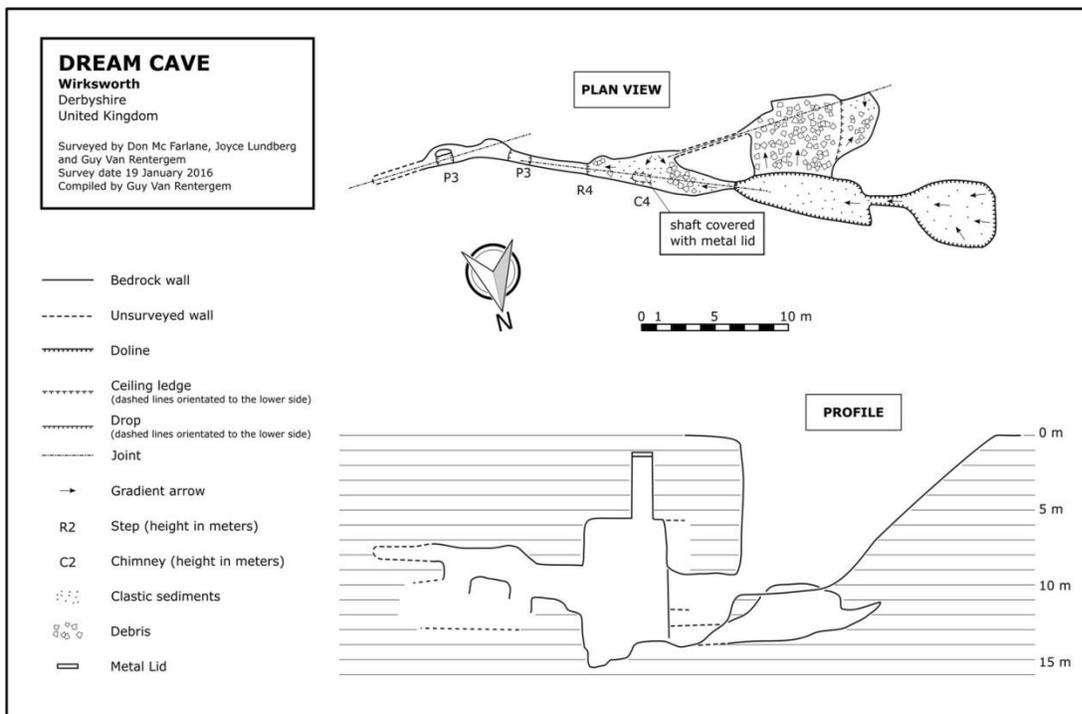


Figure 2



Figure 3



Figure 4



Figure 5



Figure 6

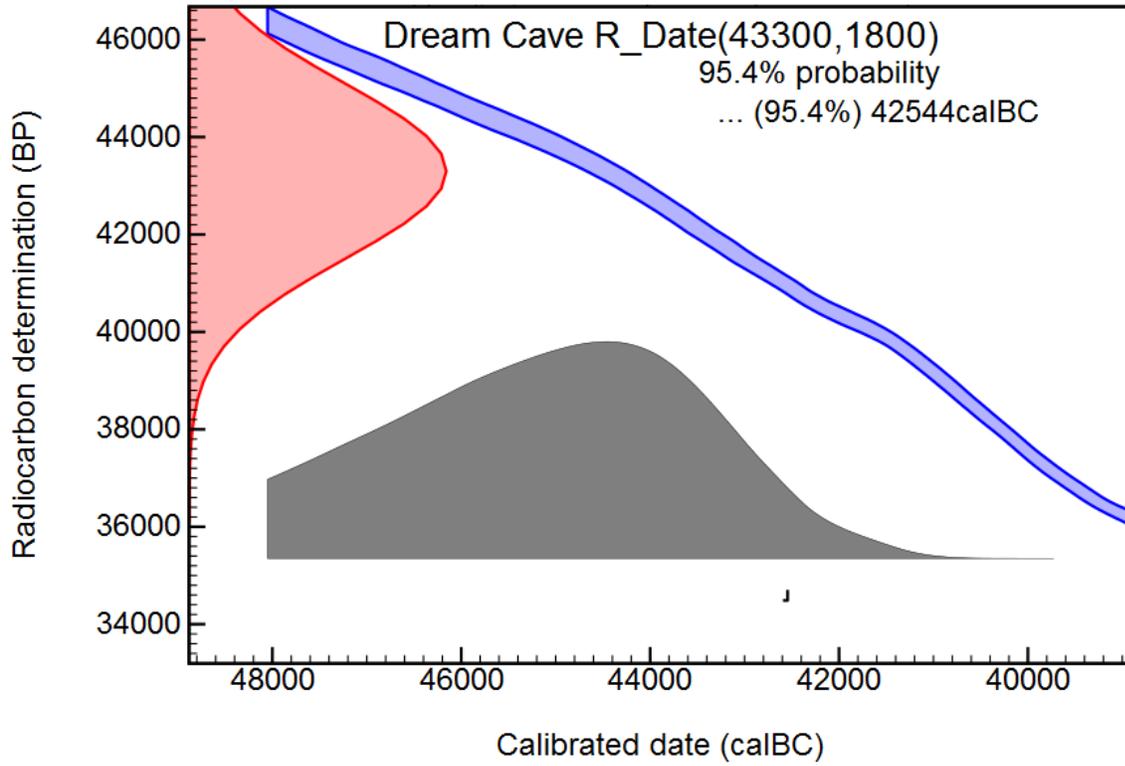


Figure 7

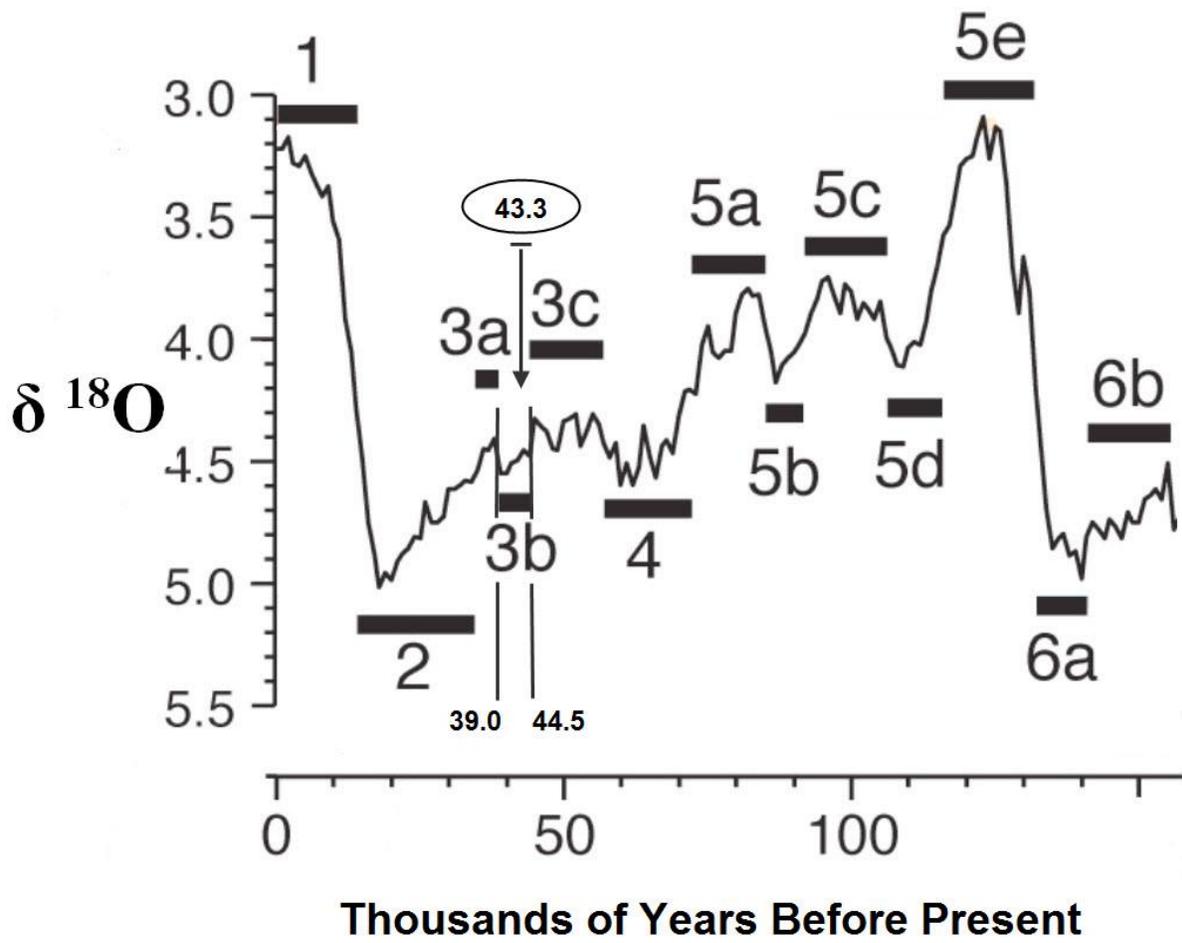


Figure 8



Appendix 1. Dream Cave osteological material in the Oxford University Museum of Natural History collections.

| Registration_Number | Species_Name            | Nature_of_Specimen                      |
|---------------------|-------------------------|---|
| Q.1511              | Coelodonta antiquitatis | Near complete skeleton                  |
| Q.1511/1a           | Coelodonta antiquitatis | Anterior part of skull and nasal septum |
| Q.1511/1b           | Coelodonta antiquitatis | Posterior part of skull                 |
| Q.1511/1c           | Coelodonta antiquitatis | Skull fragment                          |
| Q.1511/1d           | Coelodonta antiquitatis | Skull fragment                          |
| Q.1511/1e           | Coelodonta antiquitatis | Skull fragment                          |
| Q.1511/1f           | Coelodonta antiquitatis | Skull fragment                          |
| Q.1511/1g           | Coelodonta antiquitatis | Skull fragment                          |
| Q.1511/1h           | Coelodonta antiquitatis | Skull fragment                          |
| Q.1511/1i           | Coelodonta antiquitatis | Skull fragment                          |
| Q.1511/1j           | Coelodonta antiquitatis | Skull fragment                          |
| Q.1511/1k           | Coelodonta antiquitatis | Skull fragment (maxilla)                |
| Q.1511/1l           | Coelodonta antiquitatis | Skull fragment (maxilla)                |
| Q.1511/1m           | Coelodonta antiquitatis | Skull fragment (maxilla)                |
| Q.1511/2            | Coelodonta antiquitatis | Right upper premolar IV                 |

|           |                         |                                       |
|-----------|-------------------------|---------------------------------------|
| Q.1511/3  | Coelodonta antiquitatis | Right upper molar II                  |
| Q.1511/4  | Coelodonta antiquitatis | Left upper molar I                    |
| Q.1511/5  | Coelodonta antiquitatis | Left upper molar II                   |
| Q.1511/6  | Coelodonta antiquitatis | Left upper molar III                  |
| Q.1511/7  | Coelodonta antiquitatis | Right mandible with molars I, II, III |
| Q.1511/8  | Coelodonta antiquitatis | Left mandible with molars I, II       |
| Q.1511/9  | Coelodonta antiquitatis | Left lower molar III                  |
| Q.1511/10 | Coelodonta antiquitatis | Atlas                                 |
| Q.1511/11 | Coelodonta antiquitatis | Axis                                  |
| Q.1511/12 | Coelodonta antiquitatis | 3rd cervical vertebra                 |
| Q.1511/13 | Coelodonta antiquitatis | 4th cervical vertebra                 |
| Q.1511/14 | Coelodonta antiquitatis | Cervical vertebra                     |
| Q.1511/15 | Coelodonta antiquitatis | Thoracic vertebra                     |
| Q.1511/16 | Coelodonta antiquitatis | Thoracic vertebra                     |
| Q.1511/17 | Coelodonta antiquitatis | Thoracic vertebra                     |
| Q.1511/18 | Coelodonta antiquitatis | Thoracic vertebra                     |
| Q.1511/19 | Coelodonta antiquitatis | Last thoracic vertebra                |
| Q.1511/20 | Coelodonta antiquitatis | 1st lumbar vertebra                   |
| Q.1511/21 | Coelodonta antiquitatis | 2nd lumbar vertebra                   |
| Q.1511/22 | Coelodonta antiquitatis | 3rd lumbar vertebra                   |
| Q.1511/23 | Coelodonta antiquitatis | 4th lumbar vertebra                   |

|           |                         |                             |
|-----------|-------------------------|-----------------------------|
| Q.1511/24 | Coelodonta antiquitatis | 5th lumbar vertebra         |
| Q.1511/25 | Coelodonta antiquitatis | Sacrum                      |
| Q.1511/26 | Coelodonta antiquitatis | Rib                         |
| Q.1511/27 | Coelodonta antiquitatis | Left scapula - proximal end |
| Q.1511/28 | Coelodonta antiquitatis | Right humerus               |
| Q.1511/29 | Coelodonta antiquitatis | Left humerus                |
| Q.1511/30 | Coelodonta antiquitatis | Right radius - distal end   |
| Q.1511/31 | Coelodonta antiquitatis | Left radius                 |
| Q.1511/32 | Coelodonta antiquitatis | Right ulna                  |
| Q.1511/33 | Coelodonta antiquitatis | Left ulna                   |
| Q.1511/34 | Coelodonta antiquitatis | Right scaphoid              |
| Q.1511/35 | Coelodonta antiquitatis | Left scaphoid               |
| Q.1511/36 | Coelodonta antiquitatis | Right lunar                 |
| Q.1511/37 | Coelodonta antiquitatis | Left lunar                  |
| Q.1511/38 | Coelodonta antiquitatis | Left cuneiform              |
| Q.1511/39 | Coelodonta antiquitatis | Left magnum                 |
| Q.1511/40 | Coelodonta antiquitatis | Right unciform              |
| Q.1511/41 | Coelodonta antiquitatis | Left unciform               |
| Q.1511/42 | Coelodonta antiquitatis | Right metacarpal II         |
| Q.1511/43 | Coelodonta antiquitatis | Left metacarpal II          |
| Q.1511/44 | Coelodonta antiquitatis | Left phalanx II             |

|            |                         |                          |
|------------|-------------------------|--------------------------|
| Q.1511/45  | Coelodonta antiquitatis | Right metacarpal III     |
| Q.1511/46  | Coelodonta antiquitatis | Left metacarpal III      |
| Q.1511/47  | Coelodonta antiquitatis | Right phalanx III        |
| Q.1511/48  | Coelodonta antiquitatis | Right phalanx III        |
| Q.1511/49  | Coelodonta antiquitatis | Right metacarpal IV      |
| Q.1511/50  | Coelodonta antiquitatis | Left metacarpal IV       |
| Q.1511/51a | Coelodonta antiquitatis | Right ilium - main piece |
| Q.1511/51b | Coelodonta antiquitatis | Right ilium - fragment   |
| Q.1511/51c | Coelodonta antiquitatis | Right ilium - fragment   |
| Q.1511/52  | Coelodonta antiquitatis | Left ilium - part        |
| Q.1511/53a | Coelodonta antiquitatis | Right femur - head       |
| Q.1511/53b | Coelodonta antiquitatis | Right femur - fragment   |
| Q.1511/53c | Coelodonta antiquitatis | Right femur -distal end  |
| Q.1511/54  | Coelodonta antiquitatis | Left femur - head        |
| Q.1511/55  | Coelodonta antiquitatis | Right patella            |
| Q.1511/56  | Coelodonta antiquitatis | Left patella             |
| Q.1511/57  | Coelodonta antiquitatis | Right tibia              |
| Q.1511/58  | Coelodonta antiquitatis | Left tibia               |
| Q.1511/59  | Coelodonta antiquitatis | Right astragalus         |
| Q.1511/60  | Coelodonta antiquitatis | Left astragalus          |
| Q.1511/61  | Coelodonta antiquitatis | Right calcaneum          |

|           |                         |                              |
|-----------|-------------------------|------------------------------|
| Q.1511/62 | Coelodonta antiquitatis | Left calcaneum               |
| Q.1511/63 | Coelodonta antiquitatis | Right navicular              |
| Q.1511/64 | Coelodonta antiquitatis | Right cuboid                 |
| Q.1511/65 | Coelodonta antiquitatis | Left cuboid                  |
| Q.1511/66 | Coelodonta antiquitatis | Right metatarsal II          |
| Q.1511/67 | Coelodonta antiquitatis | Right astragalus             |
| Q.1511/68 | Coelodonta antiquitatis | Right metatarsal III         |
| Q.1511/69 | Coelodonta antiquitatis | Left metatarsal III          |
| Q.1511/70 | Coelodonta antiquitatis | Right phalanx III            |
| Q.1511/71 | Coelodonta antiquitatis | Left phalanx II              |
| Q.1511/72 | Coelodonta antiquitatis | Left phalanx III             |
| Q.1511/73 | Coelodonta antiquitatis | Right metatarsal IV          |
| Q.1511/74 | Coelodonta antiquitatis | Left metatarsal IV           |
| Q.7755    | Bos primigenius         | Partial skeleton of juvenile |
| Q.7755/1  | Bos primigenius         | Atlas                        |
| Q.7755/2  | Bos primigenius         | Lumbar vertebra              |
| Q.7755/3  | Bos primigenius         | Neural spine                 |
| Q.7755/4  | Bos primigenius         | Right humerus                |
| Q.7755/5  | Bos primigenius         | Right ulna                   |
| Q.7755/6  | Bos primigenius         | Right radius                 |
| Q.7755/7  | Bos primigenius         | Partial left radius          |
| Q.7755/8  | Bos primigenius         | Right metacarpal             |
| Q.7755/9  | Bos primigenius         | Left metacarpal              |
| Q.7755/10 | Bos primigenius         | Right pubis                  |
| Q.7755/11 | Bos primigenius         | Head of right femur          |
| Q.7755/12 | Bos primigenius         | Left femur                   |
| Q.7755/13 | Bos primigenius         | Right tibia                  |
| Q.7755/14 | Bos primigenius         | Left tibia                   |
| Q.7755/15 | Bos primigenius         | Right metatarsal             |

|           |                     |                                 |
|-----------|---------------------|---------------------------------|
| Q.7755/16 | Bos primigenius     | Right calcaneum                 |
| Q.7755/17 | Bos primigenius     | Phalanx                         |
| Q.7755/18 | Bos primigenius     | Partial head of left humerus    |
| Q.7756/1  | Bos primigenius     | Left calcaneum                  |
| Q.7756/2  | Bos primigenius     | Left scaphocuboid               |
| Q.7757    | Bos primigenius     | Right magnum                    |
| Q.7758    | Bos primigenius     | Partial ?scaphocuboid           |
| Q.7759    | cf. Bos             | Rib - 1st left                  |
| Q.7760    | cf. Bos             | Rib - probably 4th left         |
| Q.7761    | Large mammal indet. | Rib                             |
| Q.7762    | Large mammal indet. | Rib                             |
| Q.7763    | Large mammal indet. | Rib                             |
| Q.7764    | Large mammal indet. | Rib                             |
| Q.7765    | Large mammal indet. | Rib                             |
| Q.7766    | Large mammal indet. | Rib                             |
| Q.7767    | Large mammal indet. | Rib                             |
| Q.7768    | Large mammal indet. | Rib                             |
| Q.7769    | Rangifer tarandus   | Basal antler fragment - left    |
| Q.7770    | Rangifer tarandus   | Antler fragment                 |
| Q.7771/1  | Rangifer tarandus   | Basal antler fragment - ? right |
| Q.7771/2  | Rangifer tarandus   | Basal antler fragment - ? right |
| Q.7771/3  | Rangifer tarandus   | Antler fragment - ? right       |
| Q.7771/4  | Rangifer tarandus   | Antler fragment - ? right       |
| Q.7772/1  | Rangifer tarandus   | Basal antler fragment ? right   |
| Q.7772/2  | Rangifer tarandus   | Antler fragment - ? right       |
| Q.7773    | Rangifer tarandus   | Antler fragment                 |
| Q.7774    | Rangifer tarandus   | Basal antler fragment           |
| Q.7775    | Rangifer tarandus   | Antler fragment                 |
| Q.7776    | Rangifer tarandus   | Antler fragment                 |
| Q.7777    | Rangifer tarandus   | Antler fragment                 |
| Q.7778    | Rangifer tarandus   | Antler fragment                 |
| Q.7779    | Rangifer tarandus   | Antler fragment                 |
| Q.7780    | Rangifer tarandus   | Antler fragment                 |
| Q.7781    | Equus sp.           | Radius                          |