Proc. Univ. Bristol Spelaeol. Soc., 2018, 27 (3), 261-265

RADIOMETRIC DATING OF SAMPLES FROM PICKEN'S HOLE

by

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ABSTRACT

The various radiometric dates obtained from specimens from Picken's Hole are listed. The later, AMS, ^{14}C dates and the two U-series dates and their utility in delimiting the ages of the faunal assemblages, including the Human teeth are discussed further.

INTRODUCTION

Radiocarbon dating has been carried out on material from this site on a number of occasions between the 1970s and 2010s. The first set were obtained on bulk samples of mammalian bone from units three and five. These dates were obtained by beta counting and the work was carried out at the, now closed, British Museum laboratory. The results were published by Burleigh and Hewson (1979). As a check, the material from Unit 5 was dated twice. As these dates were not in the expected stratigraphical sequence, the deeper Unit 5 being seemingly younger than the stratigraphically higher Unit 3, further samples from these two units were submitted to the same laboratory and were subsequently published by Burleigh, Amber and Matthews (1984). A single human tooth was later submitted to the Oxford Radiocarbon Accelerator Unit (ORAU) and the result published by Hedges (1997). This was the first date for the site obtained from Oxford and the first determined using AMS. All subsequent dates have been obtained from Oxford, using the most up to date equipment and techniques (Higham, *et al* 2006). In 2009, two dates were obtained on Woolly Rhinoceros from Unit 3 by Jacobi *et al* and in 2010 seven further dates were obtained by Lee-Thorp and Wright as part of a wider study. Finally, on checking the catalogue and the collection during the production of this report, two further dates were found. These had been on material submitted by the late R.M. Jacobi and do not appear to have been previously published. The results of all these analyses are summarised in Table 1.

DISCUSSION

Of the seventeen dates listed in Table 1, only those most recently obtained (OxA-10804 to OxA-24997) have used modern preparation and recording techniques, including ultrafiltration (Higham, *et al* 2006). The earlier analyses, obtained by beta counting often on bulk samples are not considered further This in line with the approach taken by Currant and Jacobi (2011).

Table 1 lists the uncalibrated dates obtained. All the dates used in this discussion have been calibrated by the program OxCal v4.3.2 using the calibration curve IntCal 13 (Reimer, *et al,* 2013). The earliest obtained AMS date, OxA-5865, is considered as it is the only date obtained on human material, despite not having been prepared using ultrafiltration. The calibration curve is shown in Figure 1. The calibrated date places this human premolar squarely in the in the Early to Middle Neolithic period. This contrasts significantly with the Late Middle Palaeolithic age to which the lithic artefacts have been attributed.

Table 1. *Radiocarbon dates obtained on material from Picken's Hole References A: Burleigh and Hewson 1979; B, Burleigh Ambers and Matthews, 1984; C: Hedges* et al *1997; D: Lee-Thorp and Wright (pers. comm.); E: Jacobi et al 2009. F: Jacobi ?unpub.. The descriptions given in column 1 are taken directly from the original publications, or, for unpublished dates, from the catalogue. The earlier bulk specimens were not allocated catalogue numbers.*

Material and Association	Cat. No.	Radiocarbon date uncalibrated	Lab No.	Ref.
Unidentified mammalian bone fragments (collagen) from Unit 3.		34,265 + 2600bp - 1950	BM-654	A
Unidentified mammalian bone fragments (collagen) from Unit 5		26,650 + 1850 bp -1400	BM-655 A	A
Unidentified mammalian bone fragments (collagen) from Unit 5		27000 + 1850 bp -1500	BM-655 B	A
Limb bone of large mammal (collagen) from Unit 3	M30.2/605	27,540 ± 2440 bp	BM-2117	B
Metacarpal of Reindeer (collagen) from Unit 5 **(Note 1.)**	M30.2/57	12,400 ± 1500 bp	BM-2118	B
Human premolar from (apparent) stratified context in unit 3	M30.12/1	4800 ± 55 bp	OxA-5865	C
Woolly Rhinoceros tooth (unit 3B)	M30.22/444	37200 ± 800 bp	OxA-22219	D
Woolly Rhinoceros tooth (unit 3B)	M30.22/310	43000 ± 1700 bp	OxA-22220	D
Woolly Rhinoceros tooth (unit 3?)	M30.22/19	40300 ± 1200 bp	OxA-22221	D
Horse tooth (Unit 3)	M30.22/187	45900 ± 2400 bp	OxA-22222	D
Horse tooth (Unit 3)	M30.22/114	43100 ± 1700 bp	OxA-22223	D
Woolly Rhinoceros tooth (unit 3)	M30.22/1012	40700 ± 1300 bp	OxA-22277	D
Horse tooth (Unit 3A)	M30.22/74	46000 ± 2400 bp	OxA-24997	D
Woolly Rhinoceros left femur (unit 3)	M30.2/374	40200 ± 700 bp	OxA-10804	E
Woolly Rhinoceros mandibular symphysis (unit 3)	M30.2/159	>44,000 bp	OxA-10805	E
Giant Deer left cubonavicular (**Note 2.**)	M30.2/614	>48,200 bp	OxA-19091	F
Horse *(Equus ferus*) tooth (Unit 3?) (**Note 3.**)	M30.22/218	12,460 ± 60 bp	OxA-19346	F

Notes:

1. A.J. Stuart (in Burleigh *et al* 1984) notes "Bone labelled as from Layer 5, but obtained from trial trench where stratification indistinct; presumably comes from overlying deposit of late Glacial age. Date is acceptable for reindeer."

2. The catalogue does not record the context or layer from which this specimen came.

3. This specimen is recorded as having come from an area disturbed by badger burrows. Thus, although it is recorded as *appearing* to be Unit 3, this cannot be assured. Tom Higham (*pers. comm.*) writes: "This sample comes with a health warning, owing to the low yield of collagen obtained. We treated 530 mg of bone and obtained 7.8 mg of gelatin. This is less than our 10 mg threshold. The C/N atomic ratio of 3.2 was within the accepted range."

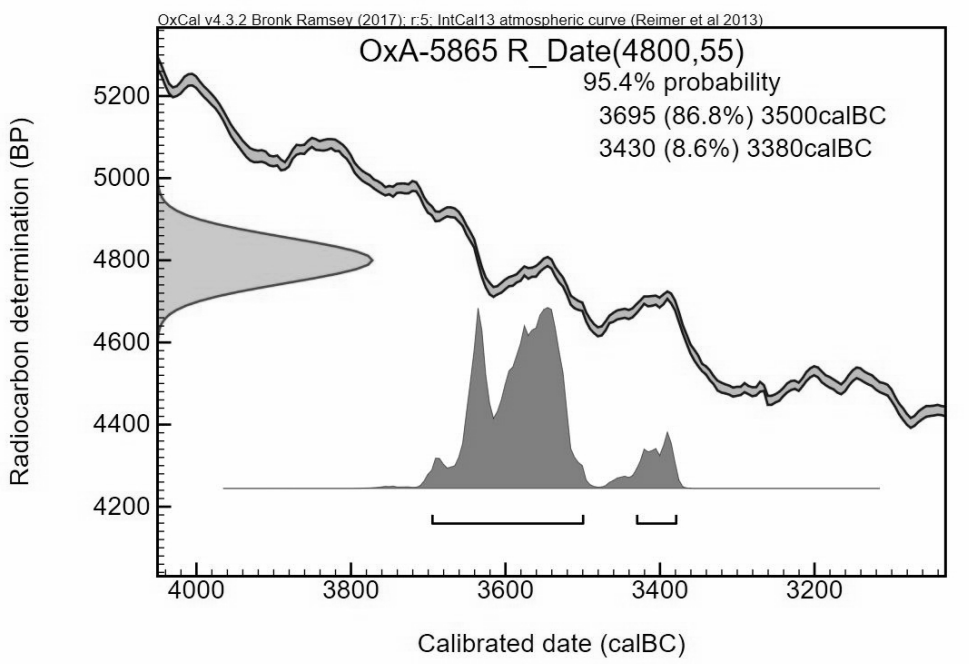

Figure 1. *Calibration curve for specimen OxA-5865.*

The remaining eleven determinations have been made on samples attributed to Unit 3, with the exception of OxA-19091 whose context has not been recorded in the catalogue and OxA-19346 whose association with unit 3 is doubtful and whose possible reliability was questioned owing to a low collagen yield (see Table 1 note 3). In passing, it is worth noting that the latter specimen has a similar late-glacial date to that previously determined for BM-2118 which also has a doubtful context (see Table 1 note 1).

This leaves nine dates which are probably all from Unit 3. Unfortunately, most of these specimens were recovered prior to the use of 3D position recording; thus, their relative stratigraphic positions were not recorded. The samples were selected by workers who were not strictly interested in the detailed stratigraphy of the site. The calibration curves for the earliest and latest dates from these determinations are shown below in Figures 2 and 3. These show that the age of Unit 3 can be taken to extend from around 38,000 cal BC to beyond the range of calibration at 48,000 cal BC (Reimer, *et al* 2013).

In 2016, Hodge, *et al,* published two U-series dates obtained from PH1-82, a sub-sample of flowstone that underlies the main fossiliferous sequence in the Picken's Hole cave, 240 ± 13 and 200 ± 11 ka. No younger phases of speleothem have been recorded at the site. These dates can be taken to indicate an upper limit on the age of Unit 6 in the sedimentary sequence, which it caps.

The author is grateful to Deborah Wright for supplying her results and to Tom Higham of ORAU for supplying additional information. Several of the dates were funded as part of the AHOB project funded by the Leverhulme Trust. I am also grateful to the staff of ORAU for their work in preparing and analysing them.

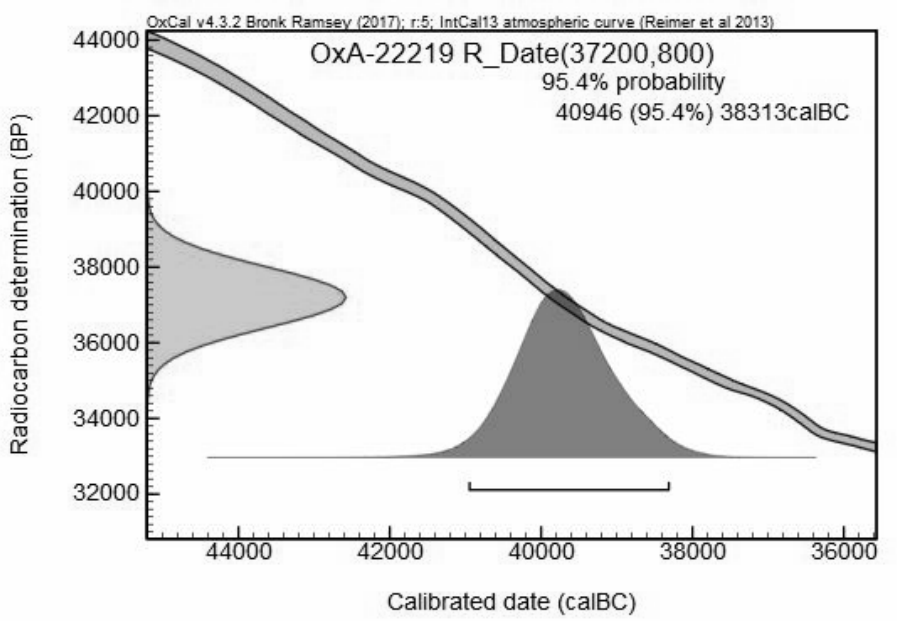

Figure 2 *Calibration curve for specimen OxA-22219.*

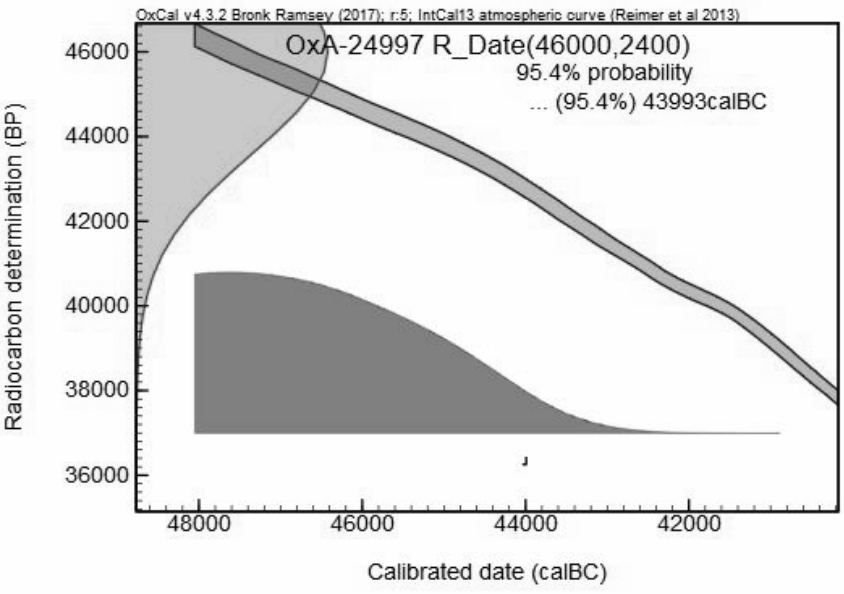

Figure 3. *Calibration curve for specimen OxA-24997.*

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