

RADIOCARBON DATING OF VERTEBRATE REMAINS FROM BULL PIT, PERRYFOOT, DERBYSHIRE

by

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ABSTRACT

Bull Pit is a large doline located close to the northern margin of the Peak District carboniferous limestone outcrop. Excavation of the sedimentary fill of a rift in the base of Bull Pit by the Technical Speleological Group has revealed an assemblage of more than 350 identified bones and teeth. These remains include specimens from a range of wild and domesticated animal species as well as disarticulated human remains. Radiocarbon dating of five bones from the middle and lower levels of the sediments show that these deposits were accumulating between 1900 and 600 years ago. The dating evidence provides information about the rate of sediment accumulation in the rift, and the composition of the faunal assemblage reflects the high density of deer in the royal hunting grounds of the Peak Forest in medieval times.

INTRODUCTION

Bull Pit is a large doline or sink-hole formed over a rift in the Bee Low Limestone at NGR SK 10650 81432. The site is situated about 300 m to the south of the boundary between the limestone and the outcrop of the overlying Bowland Shale Formation, which is marked by a line of active swallets along the shale margin (Figure 1). The underground streamway from the P8 swallet runs southwards approximately 200m to the east of Bull Pit (Beck, 2006), though at a considerably greater depth than the current known lower limit of the rift in Bull Pit.

The rift, which has formed through breakdown alongside a vertical mineral vein, was filled with large limestone boulders mixed with unconsolidated silts and clays. Since 2011 a shaft has been excavated through the sedimentary fill of the rift by members of the Technical Speleological Group (TSG) (Williams and Mason, 2017). This excavated shaft is located in the northwest corner of the doline, with the lip of the top of the shaft at approximately 335 m above Ordnance Datum (Figure 2). The excavation has reached a depth of 35 m below the lip of the shaft without reaching the lower limit of the deposits. The purpose of this report is to highlight some aspects of the extensive collection of faunal remains recovered from the excavation and to present the results of radiocarbon dating and their implications for understanding the history of deposition of the cave sediments.

VERTEBRATE REMAINS

Faunal and human remains including bones, teeth and antlers were recovered from the TSG dig from 2017 to 2020 at depths of between 10 m and 35 m below the lip of the shaft. No bones were reported from the uppermost 10 m of the excavation. Due to the restricted digging conditions the recording of the exact locations of individual finds was not possible, but the stratigraphic levels from which most of the groups of bones were recovered were noted and

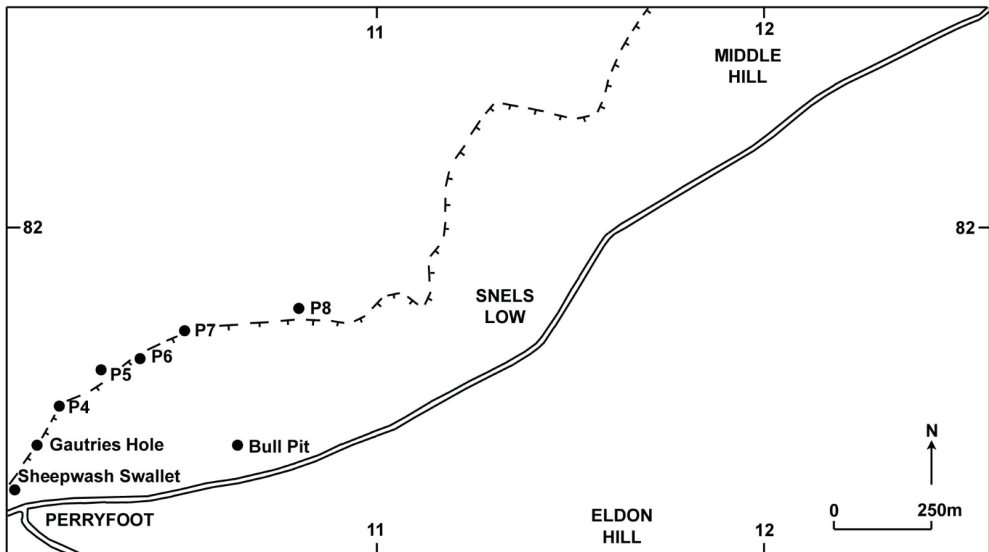


Figure 1. Location of Bull Pit in relation to the margin of the Bowland Shale Formation (dashed line) and the nearby swallet caves distributed along the shale/limestone boundary.

their depths calculated from a reference datum at the top of the excavated shaft. A proportion of the assemblage was recovered from the spoil dumps outside the cave and for those remains the level within the deposit was not recorded.

Specimens were identified using a reference skeletal collection at the University of Manchester. All cranial remains (including teeth as well as the 1st and 2nd cervical vertebrae) and the bones of the appendicular skeleton were identified to species, but non-diagnostic specimens such as other vertebrae, ribs and small bone fragments were left unidentified. The numbers of identified specimens (NISP) of the principal species recovered are listed in Table 1.

Table 1. Number of identified specimens (NISP) of the principal species recorded from the Bull Pit assemblage (*totals for *Cervus* exclude naturally shed antlers).

Depth (metres)	<i>Cervus</i> * (Red deer)	<i>Capreolus</i> (Roe deer)	<i>Canis lupus</i> (Wolf)	<i>Vulpes</i> (Red Fox)	<i>Bos</i> (Domestic Cattle)	<i>Equus</i> (Horse)	<i>Canis</i> (Dog)	<i>Sus</i> (Pig)	<i>Ovicaprid</i> (sheep or goat)	<i>Homo</i> (Human)
10.0 – 19.9	11	5	1	0	9	14	0	0	0	0
20.0 – 29.9	38	6	8	0	3	3	1	1	0	0
30.0 – 39.9	7	11	0	6	1	6	71	13	3	37
Not recorded	13	10	2	1	22	7	19	1	3	21
Total NISP	69	32	11	7	35	30	91	15	6	58

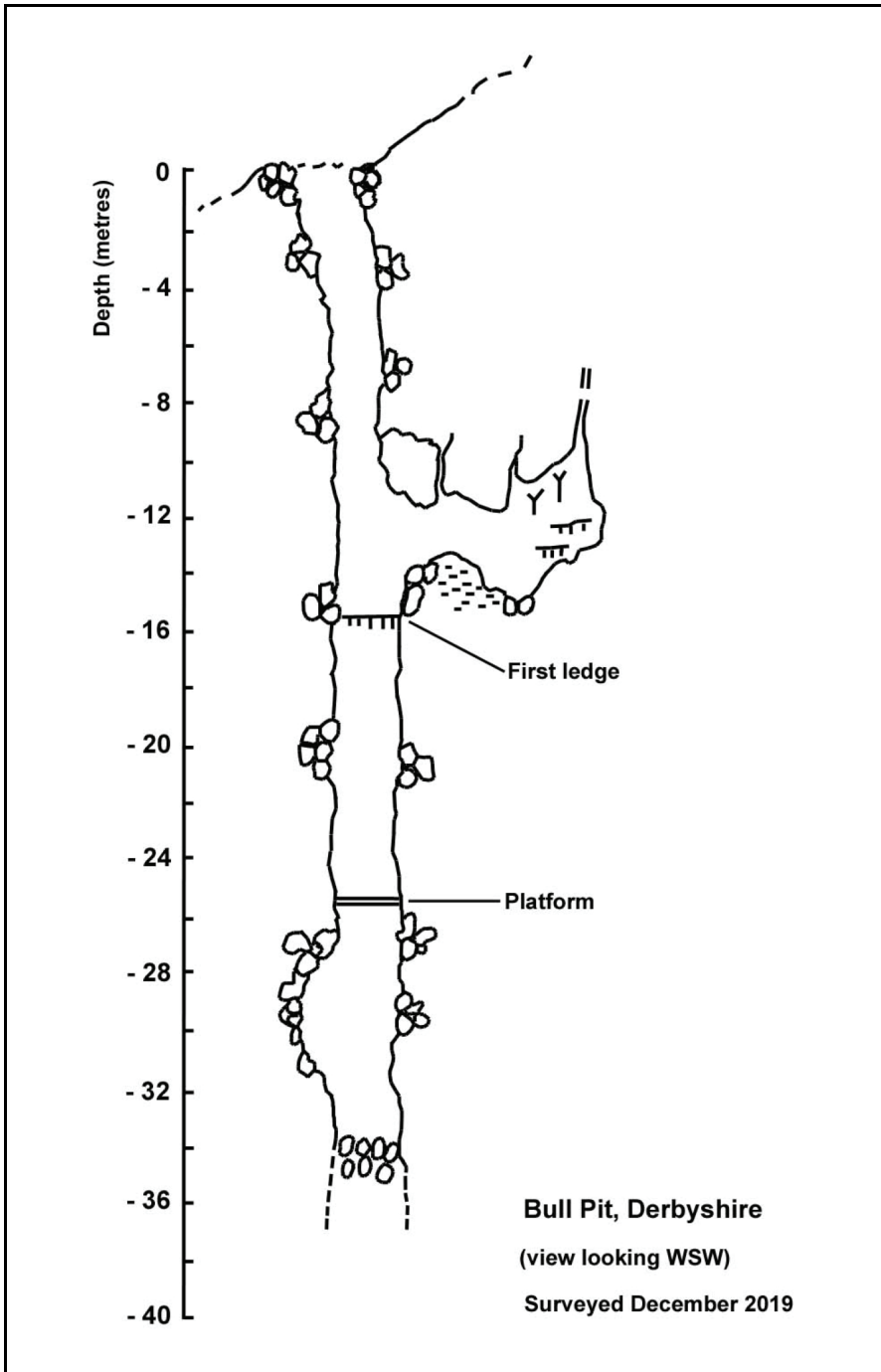


Figure 2. Elevation of the excavated shaft at Bull Pit.
 Survey courtesy of Simon Brooks.

Red Deer:

This species is represented by 69 identified bones and teeth from a minimum of five individuals as well as numerous fragments of naturally shed antlers, making it the most common wild species represented in the Bull Pit assemblage. The remains were found throughout the deposit but were more frequent in the upper and middle levels (Table 1). There is very little evidence for post-mortem modification such as cutmarks, burning or gnawing visible on the red deer remains. One cranial fragment with the pedicle (base) of an antler exhibited chopping and sawing marks from removing the antler, and one fragment of pelvis showed evidence of carnivore gnawing.

Domestic Cattle, Horse, Roe Deer, Pig and Ovicaprids:

Remains of both adult and juvenile animals of these species were found. Two bones showed evidence of post-mortem modification, consisting of carnivore damage to a cattle bone and rodent gnawing of an ovicaprid bone. Cattle and horse were more frequent in the upper levels, and several of the bones from these species can be re-articulated as belonging to the same individual animal, so they may represent the remains of animals that had fallen by accident into the rift.

Carnivores:

The majority of the canid remains are attributed to domestic dog (*Canis familiaris*). A few of the canid remains are of a sufficiently large size to be attributed to the wolf (*Canis lupus*) which is represented in this assemblage by a minimum of two individuals. The different canid species were also stratigraphically distinct, with the wolf remains being found in the middle levels whereas the dog remains were recovered from the lower levels (at the same levels as the remains of humans, pigs and ovicaprids). A small number of bones of the red fox (*Vulpes vulpes*) were also recovered from the lower levels of the deposit.

Human remains:

Fragmentary disarticulated remains of a minimum of two adult male skeletons were recovered from the lowest five metres of the excavated deposits.

RADIOCARBON DATES AND STABLE ISOTOPE ANALYSIS

Radiocarbon dates on four animal bones and one human bone were obtained (Table 2). The radiocarbon dates were run in separate laboratories at the Centre for Isotope Research, University of Groningen, at ETH Zürich in Switzerland and at the Scottish Universities Environmental Research Centre, Glasgow, U.K.

The radiocarbon dating laboratories also provided the levels of the stable isotopes of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) in the bone collagen, which can be used to interpret the diet and trophic level of the species. The specimens of *Canis lupus* and *Homo sapiens* have $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ levels that are considerably higher than the corresponding values for the red deer and roe deer specimens. These data are consistent with the expected trophic enrichment in wolves and

humans due to the contributions of animal-sourced proteins in their diets (Bocherens and Drucker, 2003).

Table 2. Radiocarbon dates and stable isotope determinations on bones from Bull Pit. Calibrated dates are given as the 95% confidence interval (2σ range).

Laboratory Number	Sample and depth	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	C:N ratio	Radiocarbon Age (BP)	Calibrated Date (95% probability)
GrM-17239	BP18-016. Right femur of <i>Capreolus</i> , 20 m depth.	-21.1	+4.6	3.2	515 ± 20	AD 1405–1440
ETH-94748	BP18-039. Right metacarpal of <i>Cervus</i> , 23 m depth	-21.8	+3.5	3.3	743 ± 22	AD 1255–1285
GrM-17240	BP18-056. Right femur of <i>Capreolus</i> , 23 m depth	-22.2	+4.0	3.2	820 ± 20	AD 1170–1265
ETH-94749	BP18-058. Left radius of <i>Canis lupus</i> , 27 m depth	-20.2	+8.9	3.3	1145 ± 22	AD 775–950
SUERC-90243	BP19-150. Left femur of <i>Homo sapiens</i> , 32 m depth.	-20.0	+11.7	3.3	1868 ± 21	AD 80–218

DEPOSITION HISTORY

The dates were obtained on bones from different depths in the fill of the Bull Pit shaft and they demonstrate a consistent pattern, with older dates occurring on bones from deeper levels within the shaft fill (Figure 3). The human bone from the deepest level that was sampled (32 m depth) dates to the 1st or 2nd centuries AD. The sample of wolf (*Canis lupus*) from a level 5 m higher in the deposit dates to the 8th or 9th centuries AD, whereas the deer bones from higher levels in the stratigraphic sequence date to the 12th through to the 15th centuries AD. Assuming continuous accumulation of the deposit the relationship between date and depth implies that the sedimentary fill in Bull Pit accumulated at an average rate of 9 mm per year during the estimated 1200 years during which the deposits between 30 m and 20 m depth were accumulating (see Figure 3). The rate of fill in the lower part of the Bull Pit deposit is estimated to be 7 mm per year, a rate that is comparable with natural fill rates determined for some other dated vertical shaft fills, including Charterhouse Warren Farm Swallet where the upper fill of the entrance shaft accumulated at 5 mm per year (Levitan and Smart, 1990) and at Tynning's Great Swallet where the sediments also had an estimated average deposition rate of 5 mm per year (Mullan and Boycott, 2004; Mullan, 2006). It is likely that fill rates of karstic depressions

are influenced by a range of factors including local topography, rates of sediment flux, alluvial reworking and compaction of deeper deposits amongst others.

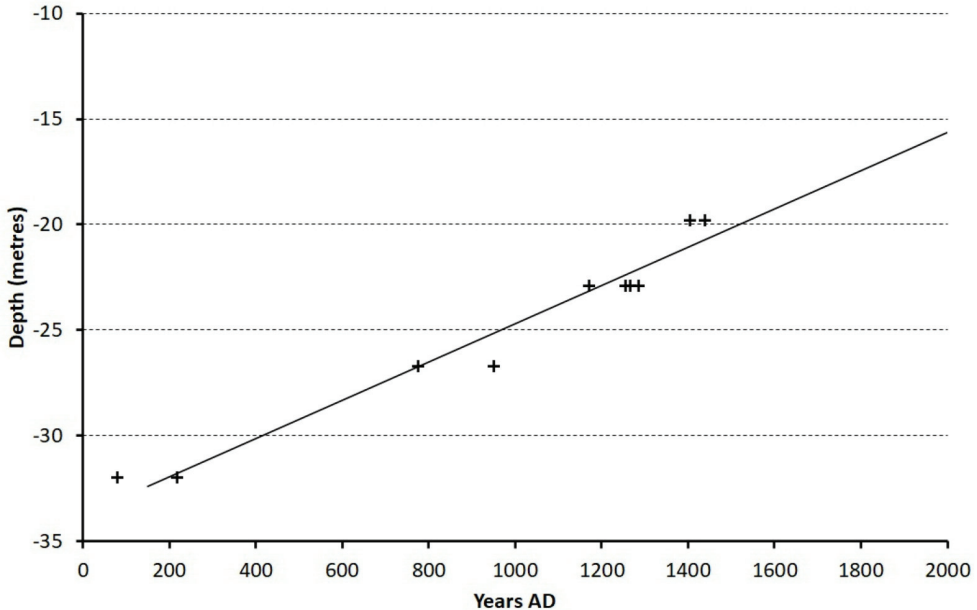


Figure 3. Distribution of calibrated radiocarbon dates related to depth measured from the top of the shaft. Markers indicate the 95% confidence limits on the dates (see Table 2). The linear trend line fitted to the data has an R^2 value of 0.97, with the equation: $\text{Depth (metres)} = 0.009 (\text{years}) - 33.8$.

DISCUSSION

Skeletal remains of both red deer and roe deer have been found in many Peak District caves and although these species are not frequently observed in that region in the present-day deer were common and widespread in the Peak District during the prehistoric and early historic periods. One of the specimens of red deer from Bull Pit showed signs of having been cut with a saw, therefore it was conjectured that some of the Bull Pit material might date to the historical time period. The medieval date of the deer bones was confirmed by the radiocarbon dating which indicates that the bones of these animals were being deposited in the rift over an extended period of time between about AD 1150 and AD 1450. Bull Pit is located near the centre of the former King's Forest of the High Peak: this Forest was administered in medieval times from Peveril Castle in Castleton, 4 km to the east of the site, and from a hall at Chamber Farm, located just 2 km south of Bull Pit. The population of deer was substantial in this area up to the middle of the 17th century, when High Peak's status as a royal forest was abolished (Kirke, 1867; Cox, 1905).

The specimen of wolf dates to the Anglo-Saxon period and thus before the formal recognition of the High Peak as a Royal Forest. Wolves were common in Derbyshire in the Middle Ages, as shown by records of payments to wolf trappers as well as from copious place name evidence (Cameron, 1959; Aybes and Yalden, 1995). This predator, whose remains have been found in at least fourteen caves in the Peak District, probably continued to be present in the region up to about AD 1500.

The almost complete absence of butchery marks or other post-mortem modifications such as carnivore gnawing on the bones from Bull Pit, together with evidence that multiple bones belonging to the same animals are present in the assemblage, indicates that complete carcasses either accidentally fell or were deliberately deposited into the rift during the periods when the sediments were accumulating. The large number of shed antlers may indicate that there was deliberate collection and deposition of antlers at the site. Deer stags shed their antlers throughout their territories, so it would be relatively unusual for many antlers to accumulate naturally at a single location.

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