

HOYLE'S MOUTH, TENBY, WALES: STEPHEN ALDHOUSE-GREEN'S EXCAVATIONS 1986–1996

by

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ABSTRACT

Stephen Aldhouse-Green's excavations at Hoyle's Mouth obtained new sedimentological, faunal and lithic artefact assemblages. The historic record of an Aurignacian *burin busquée* remains the only cultural evidence for a pre-Last Glacial Maximum use of the cave. The research dated faunal remains through MIS 3 and added little to the faunal record from south Wales for this earlier time.

The Late Glacial artefact assemblage was enhanced by new finds which can be connected to an early Late Glacial faunal assemblage of mammals, microfauna and avian remains from the new excavations. Artefacts were discovered stratified deep within the cave leading to a consideration of the use of the cave during this period. All the lithic artefacts were studied and similarities between those from Hoyle's Mouth and Gough's Cave, Cheddar, Somerset were noted. The faunal assemblage provides evidence for the local contemporary environment and climate.

Later use of Hoyle's Mouth, with a Mesolithic knapping floor above the cave entrance, and the use of the Recess within the cave as a burial place for Neolithic people are described.

INTRODUCTION

An incised graffito on the wall of Hoyle's Mouth in the Reindeer Chamber reads "1817" demonstrating that the cave was fully open before the earliest recorded archaeological work took place. The cave was first excavated in 1840 by Colonel Jervis. No account survives of this work, but a plan drawn by E.L. Jones references it (Figure 1). Further work took place in 1862 by the Rev. G.N. Smith (Smith, 1863); W.A. Sanford and Rev. H.H. Winwood in 1865 (Winwood, 1865); W. Boyd Dawkins in 1872 (Dawkins, 1874); Edward Laws in the 1870s (Laws, 1888) and in the late 1870s by E.L. Jones (Jones, 1882). Jones' plan is a key record of the location of the various excavators' work. In 1968 Hubert Savory conducted rescue excavations within, and just outside, the Entrance Chamber in response to a threat to develop the site as a show cave, which did not materialise (Savory, 1973).

Stephen Aldhouse-Green excavated Hoyle's Mouth in 1986, 1990 and 1996 as part of Amgueddfa Cymru's *Palaeolithic Settlement of Wales Research Project*. The excavations sought to provide context for the historic finds and to place them in their wider regional framework. Stephen prepared the structure for this paper and noted his interpretation of the evidence as it stood at that time. This report has been edited and amended as new research from specialists has developed the thinking about this cave. Consequently, this paper brings the manuscript Stephen was working on at the time of his death together with newly commissioned work. His contemporary work at Little Hoyle Cave is published separately (see Peterson, *et al.* 2026 this volume).

The Hoyle's Mouth research incorporated and used the techniques of its time. Many of these relate to dating techniques which have, in the years since commencement of the project,

progressed greatly. All dates available are shown in Tables 1–3. Thermoluminescence dating of sediments was undertaken by Nick Debenham; uranium series dating on stalagmite was undertaken at the Atomic Energy Research Establishment by Miro Ivanovich and Angela Rae and later at the University of East Anglia by Tim Atkinson and Peter Rowe. Radiocarbon dating was undertaken at the Oxford University Radiocarbon Dating Laboratory both pre- and post-the routine use of ultrafiltration, a more successful method used to remove contaminants from bone (Bronk Ramsey, *et al.* 2004; Higham, *et al.* 2006).



Figure 1. E.L. Jones' plan of Hoyle's Mouth showing where finds were discovered in the Jervis, Smith, Laws and Jones work.

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The chronology described has been used to create the framework for the discussion that follows and some of this may now have been superseded as new techniques have emerged. As this framework was used it is kept here. The fauna, specifically the mammalian and avian reports, were commissioned prior to the receipt of the detailed sedimentological report. This work was therefore written using an interpretation of the stratigraphy by Aldhouse-Green's 'Units' which have been superseded by the analysis of the deposits. Where possible these reports have been unpicked and are shown in relevant tables. Table 4 shows inter-relationships, where it has been possible to create these, but some more complexity has emerged that may not be fully reflected in this paper. All original reports are lodged in the Hoyle's Mouth archive at Amgueddfa Cymru – Museum Wales and see appendices 1-4.

Circumstances as they are, this report aims to present the key findings of the excavation and to connect these, the geology and surviving stratigraphy, to the reports of the fauna and

Table 1. Results of all radiocarbon dates on specimens from Hoyle's Mouth Cave. *Indicates results since the introduction of ultrafiltration. Highlighted results indicate two dates on the same specimen. Calibrations using OxCal v 4.4.4 Bronk Ramsey, 2021 r.5; Atmospheric data from Reimer, et al. 2020

<i>Find No.</i>	<i>Lab. Ref.</i>	<i>Trench and Context</i>	<i>Specimen</i>	<i>Determination BP</i>	<i>Calibration Cal. BP</i>	$\delta^{13}C$
HM1972	OxA-34738*	T4 (2a)	<i>Rangifer tarandus</i> Reindeer Cranial fragment	29,930 ± 350	35,211 – 33,793	-18.83
HM362	OxA-1024	T1 (3a)	Indeterminate bone	27,900 ± 600	33,732 – 31,070	-----
HM1065	OxA-6227	T3 (5)	<i>Rangifer tarandus</i> Reindeer antler tine fragment	26,500 ± 550	31,763 – 29,752	-19.2
HM1244	OxA-6226	T4 (2)	<i>Rangifer tarandus</i> Reindeer Phalanx I	26,200 ± 600	31,438 – 29,213	-18.5
HM1244	OxA-33905*	T4 (2)	<i>Rangifer tarandus</i> Reindeer Phalanx I	25,700 ± 230	30,419 – 29,246	-19.25
HM2023	OxA-6230	T6 (5)	<i>Ursus arctos</i> Brown bear pisiform	12,220 ± 130	14,637 – 13,800	-20.6
HM1120	OxA-6225	T4 (2)	<i>Equus</i> Horse upper deciduous molar	12,110 ± 150	14,547 – 13,604	-20.1
HM1751	OxA-33908*	T5 (5)	<i>Ursus arctos</i> Brown Bear Cut-marked phalanx I	12,070 ± 60	14,067 – 13,801	-19.2
HM2336	OxA-6229	T5 (7)	<i>Ursus</i> Bear phalanx II	12,010 ± 110	14,114 – 13,602	-19.6
HM2422	OxA-6228	T3 (5)	<i>Dicrostonyx torquatus</i> Collared lemming mandible	11,860 ± 110	13,893 – 13,501	-21.0
HM2023	OxA-33904*	T6 (5)	<i>Ursus arctos</i> Brown Bear Pisiform	11,600 ± 60	13,522 – 13,328	-19.48
HM1877	OxA-9303	T5 (5d)	<i>Bufo bufo</i> common toad bone	8190 ± 90	9,449 – 8,983	-24.1
HM877	OxA-33909*	T3 (2)	Cervid sp. Cut-marked phalanx I	4,625 ± 37	5,466 – 5,297	-23.29
HM3(a) 2002.27H/12.1	OxA-6231	Unknown	<i>Homo</i> human R. metacarpal I (adult male)	4,265 ± 65	4,978 – 4,611	-23.1
HM4(b) 2002.27H/26	OxA-6232	Unknown	<i>Homo</i> human L. metacarpal I (adult female)	4,225 ± 60	4,875 – 4,571	-22.0
HM1595	OxA-9368	T5 (4)	<i>Rana temporaria</i> common frog bone	1,210 ± 65	1,280 – 1,046	-18.7

lithic artefact assemblages. This all in the context of a dating framework elements of which, due to technical advances, can only be regarded as indicative. This report was written over an extended period of time, and it is published now as a way of ensuring that all the available evidence is brought together to provide a foundation, however flawed, to enable further future research and reinterpretation. It is in this framework that the conclusions presented here are made.

Table 2. *Hoyle's Mouth. Uranium series dates on stalagmite. {AEA/MI = Atomic Energy Research Establishment, Prof. M. Ivanovich; AEA/AR = Atomic Energy Research Establishment, Dr A. Rae; UEA = University of East Anglia, Dr T. Atkinson and Dr P. Rowe. (*Note: an Oxychilus sp. shell was embedded in the stal.).}*

<i>Find No.</i>	<i>Trench and context</i>	<i>Determination</i>	<i>Lab.</i>
HM2291	T4 (4)	12.4 ± 4 ka	AEA/MI
HM2255	T6 (4)	$115 \pm 29/-24$ ka	AEA/MI
HM2257	T5 (on 3)	8.9 ± 3 ka	AEAMI
HM127*	T1 (2)	$58.5 \pm 12/-11$ ka	AEA/AR
HM2256	T5 (flowstone below 4)	$117.4 \pm 10.6/-9.7$ ka	UEA

Table 3. *Hoyle's Mouth. TL dates on sediment – Dr N. Debenham.*

<i>Find No.</i>	<i>Trench and context</i>	<i>Determination</i>	<i>Lab. Ref.</i>
HM412	T1 (3)	18.4 ± 2.7 ka	HO3
HM414	T1 (3)	24.7 ± 4.6 ka	HO5
HM415	T2 (5)	10.5 ± 1.4 ka	HO6
HM411	T2 (5)	18.3 ± 6.2 ka	HO2

Table 4. Chronostratigraphy of the Hoyle's Mouth cave entrance and cave interior trench exposures, correlated through ^{14}C , U-series and TL dating (Tables 1–3) with the INTIMATE event stratigraphy (Rasmussen, et al. 2014). * = Based upon Pettitt and White (2012) and references within. ** = NGRIP, GRIP and GISP2 INTIMATE event stratigraphy. From Rasmussen, et al. 2014.

Cave Entrance			Cave Interior			Stratigraphic sub-divisions (formal stage / age BP*)	Chronology**	
Recess Trench 1	Trench 2	Trench 3	East Fissure Trench 4	Bear Chamber Trench 5	Reindeer Chamber Trench 6			
Trample & disturbance						Holocene 11,700 to date		
Orange pink silt with grit, angular limestone clasts and breccia fragments Context 3	Yellow silt, with sand and some limestone clasts Context 5	Orange and yellow silt with local concentration of angular limestone Contexts 3 and 5	Uncemented breccia with buff/brown/pink medium-fine sand matrix, passing laterally into clay silt matrix Context 2, 2a, 6 and 7	Red clay layers intercalated with cemented and uncemented breccia Contexts 3, 5 and 6 Loose orange breccia with clay silt matrix, locally fine sand included Context 7	Uncemented breccia in buff silty matrix with grey silt lenses Contexts 13 and 14 Loose breccia in yellow fine sand matrix Contexts 15 and 16 Roof, wall and stalagmite collapse – incorporated into overlying breccia Context 18 Uncompacted red clay Context 19 Brown clay Context 20	Younger Dryas 12,900-11,700	GS-1	11,703-12,896
						Allerød 14,010-12,890	GI-1a	12,896-13,099
							GI-1b	13,099-13,311
							GI-1c	13,311-13,954
						Older Dryas 14,090-14,010	GI-1d	13,984-14,075
						Misendorf/Bolling Oscillation 14,670-14,090	GI-1e	14,075-14,692
						Oldest Dryas 18,000-14,670	GS2-1a	14,692-17,480
						Late LGM 22,700-18,000	GS2.1b-c	17,480-22,900
						Early LGM 28,000-22,700	GS2.1c to GS4 to GI-17	22,900-28,600
						Middle Devensian 59,000-28,000		28,600-59,440
Buff yellow silt Context 3a						Early Devensian 116,000-59,000	c. GI-17 to GI-25	59,440-115,370
Derived stalagmite from disturbed layer						Last Interglacial 128,000-116,000		
			Decayed Stalagmite	Stalagmite	Stalagmite			

SETTING, GEOLOGY AND GEOMORPHOLOGY

Hoyle's Mouth (SN112003) (also known as The Hoyle (Savory, 1973)) is a north-west facing horizontal fissure cave overlooking the Ritec valley near Tenby at c. 16.5 m O.D. (Figures 2 and 3). The overall regional geology is of Variscan aligned folds, locally complicated by faulting, bringing to crop out the Ridgeway Conglomerate Formation (Devonian sandstones and conglomerates) forming The Ridgeway, the southern interfluvium of the Ritec valley (~90 to 100 m O.D.); the Carboniferous limestones (Pembroke and Avon Groups) within which the cave and the valley floor are contained; and the Bishopston Mudstone Formation (Carboniferous mudstones, siltstones and sandstone) forming the northern valley interfluvium (~80 to 100 m O.D.). The parent rock of Hoyle's Mouth (and Little Hoyle Cave) is tentatively assigned to the Gully Oolite Formation (Pembroke Group; Chadian age: c. 345 Ma (Waters and Davies, 2006)). The valley is cut into the lower coastal plateaux of Brown (1960), more specifically the 45 m to 100 m denudation surface of Rowberry (2012). Denuded or exhumed during the Palaeogene, Neogene (Pliocene) or early Pleistocene (Crowther, 1989; Owen, 2015), the coastal plateaux provided the regional geological and topographic foundation to erosion and deposition during the Quaternary. Within this context, however, the respective ages of the cave and valley are indeterminate, the valley is probably the product of multiple episodes of glacial (sub-glacial), periglacial and interglacial channel flow.

The evidence for glaciation of the Hoyle's Mouth area is in the form of relict glacial sediment outcrops on local interfluviums from ice sheets overrunning the region. The earliest glaciation deposited gravels with local clasts and erratics from north Pembrokeshire (Penfro Formation (Bowen, 1999)). Relict outcrops of till/diamicton are mapped within the Ritec valley to the south and west of St Florence {British Geological Survey, 1977 (referenced Boulder Clay on earlier map editions)}. The deposits are possibly as old as 620 ka BP (Marine Isotope Stage (MIS) 16+) (Bowen, 1999), though there is some uncertainty attached to this. Another early glacial episode can be inferred from the 'Paviland Moraine', west Gower. Comprised of sediments deposited by Welsh ice from the north (Llanddewi Formation (*ibid*)) it is, with acknowledged uncertainty, considered by Bowen (*ibid*) to be the product of a MIS 12 (~470 ka to 420 ka BP) ice advance across the region. Shakesby, *et al.* (2018) however, consider this moraine to be Devensian (MIS 2, Last Glacial Maximum).

Devensian Ice (MIS 2) did not overrun the Ritec valley as Mynydd Preseli provided sufficient barrier to deflect the coalesced Irish Sea and Welsh ice sheets to the west and east respectively, the Welsh ice ultimately advancing to within 16 km of the Ritec valley (Figure 4). The Devensian ice reached its maximum extent between ~27,000 BP and ~23,000 BP. A ^{36}Cl age from the giant erratic boulder of Arthur's Stone dates the Last Glacial Maximum on Gower (Welsh ice cap) at 23,272 BP (Bowen, *et al.* 2002). Luminescence ages on ice-contact sand and gravel deposits near Cardigan (Irish Sea ice stream) indicate a maximum advance before 26,700 BP after which evidence suggests a rapid deglaciation with much of the Cambrian Mountains ice free by about 15,000 BP (Glasser, *et al.* 2018). Although not glaciated at this time the Ritec valley would have been subject to a periglacial environment with freeze thaw, fluvial, hillslope and aeolian processes depositing breccia, alluvium, colluvium, coversand and loess.

Warm interglacial and Post-glacial (Holocene) environments would have enabled water percolation and speleothem deposition within the cave, the cementing of cave sediments, water flow with the potential to erode cave sediments, and water ponding which would facilitate the deposition of fine sediments.



Figure 2. *Hoyle's Mouth cave entrance.*
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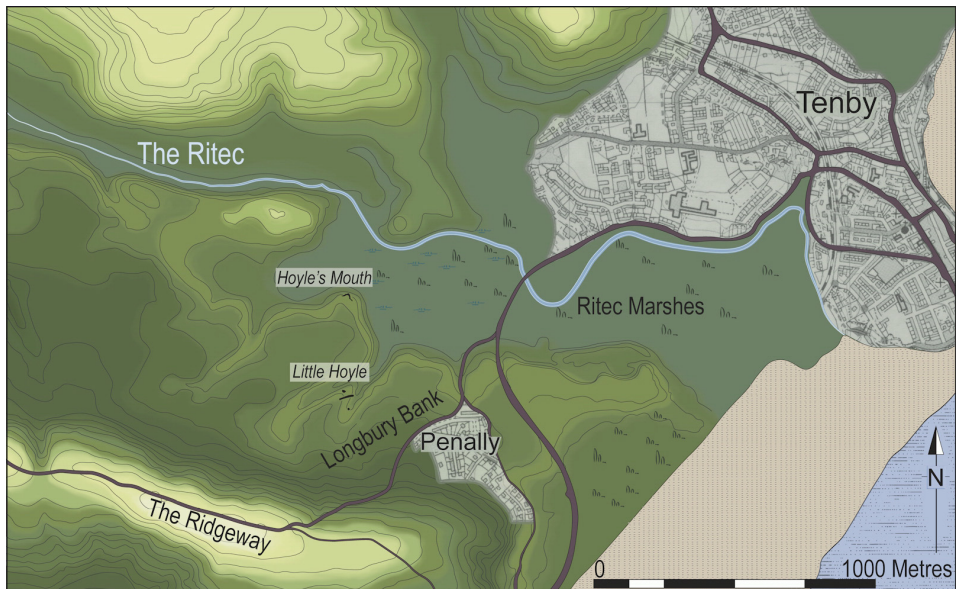


Figure 3. *Plan showing the location of Hoyle's Mouth in relation to Little Hoyle and present-day Tenby.*
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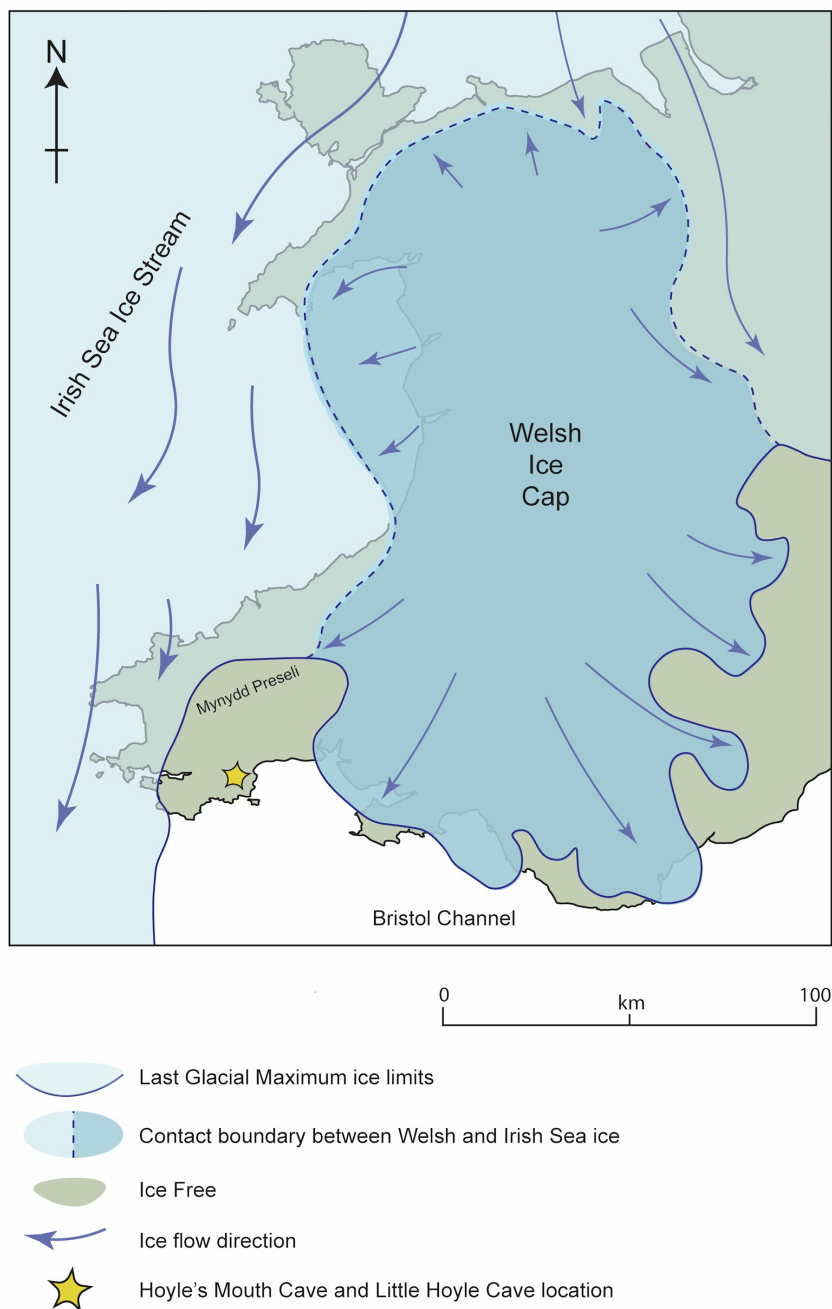


Figure 4. The location of Hoyle's Mouth and Little Hoyle Caves relative to the Last Glacial Maximum ice limit in Wales (based on Bowen, 1984, 5; Glasser, et al. 2018, 805; Jenkins, et al. 2018, 264). Mynydd Preseli proved a barrier to the full advance of the Welsh ice. The 'Bristol Channel' would have been an open flat terrestrial landscape due to low sea level.

CAVE MORPHOLOGY

Hoyle's Mouth is about 48 m in overall length. It is essentially a concatenation of fissures dissolved along joints. A joint may be seen in the cliff face above the cave entrance and for most of the length of the cave joints can be traced in the roof, most clearly seen in the Recess where there is a slot in the ceiling several metres high. There is also a clearly defined joint governing the shape of the Deep Chamber. The control by jointing results in the cave being generally taller than it is wide.

The cave is generally about 1 to 1.5 m wide, exceptions being the Entrance Chamber which is up to 5.5 m wide at the Recess narrowing to 0.8 m immediately beyond the East Fissure, the Bear Chamber, (2 m wide), and the Reindeer Chamber (4 m wide). The cave roof stays consistently within the limits of 18 to 20 m O.D. while excavation has shown the limestone bedrock floor at the cave entrance to be at 15.95 m O.D., lowering to <14.27 m at the East Fissure, with indeterminate rock floors at the Bear Chamber (<16.61 m) and Reindeer Chamber (<16.83 m). Within the Deep Chamber sediment fill almost reaches the cave roof preventing further access. It is not clear to what extent sediments have been removed from the cave, but in 1863 Smith stated that the passages between the entrance and the inner chambers had bare rock floors (Smith, 1863). Within the entrance and the inner chambers, the cave floor marks the top of sedimentary fill, from which archaeological material has been recovered.

THE ENTRANCE CHAMBER AND RECESS

G.N. Smith recorded finding a concentration of artefacts at the mouth of the Recess (Smith, 1863, 48). Both artefacts and fauna (modern and ancient – the latter including bear, horse, deer and hyaena) were dispersed through an 'almost black' soil (ibid). W. Boyd Dawkins records finding 'many flint flakes and bones broken by man from the breccia' (Dawkins, 1874, 289) and E.L. Jones found flint flakes, almost all from the Recess, plus reindeer, wild boar, bovid, modern animals and human bones. Savory recorded two artefacts from stratified contexts: a Cheddar point fragment (TENBM 1988:17) from the lower sandy layers at the southern end of Trench B (Savory, 1973, 24) and a later prehistoric convex scraper from powdery brown earth 33 cm down, near the southern end of Trench B (TENBM 1983:2601:01; Savory, 1973, 26).

Stratigraphy and Sedimentology

The Aldhouse-Green excavations enabled stratigraphic recording and sampling of sediments for description and characterisation. Selected contexts were sampled and physical properties of particle size, roundness, shape, and fines/matrix particle size were determined through processing calliper, sieve and sedimentation/Accusizer (2003) measurements through GRADISTAT and Tri-plot software (Graham and Midgley, 2000). The mean size (mean of a, b, c axes), and descriptive statistics are presented below. Clast lithology, Powers (1953) roundness and fines/matrix colour (Munsell Chart) were also recorded.

Recess (Trench 1) and Entrance (Trench 2)

Trenches 1 and 2 were excavated during the 1986 season, both positioned to incorporate a part of Savory's 1968 trenches. The 1990 Trench 3 excavation incorporated all of Trench 2 and the northern half of Trench 1 (Figure 6) and all is reported here under Trench 3. Much of the Trench 1 sediment was identified as 'trample', but where the southern part of the trench

extends into the Recess (beyond Trench 3 limits) the basal context (context 3) is an orange sandy silt with clasts. The clasts comprise rolled limestone and water rounded pebbles of exotic lithologies.

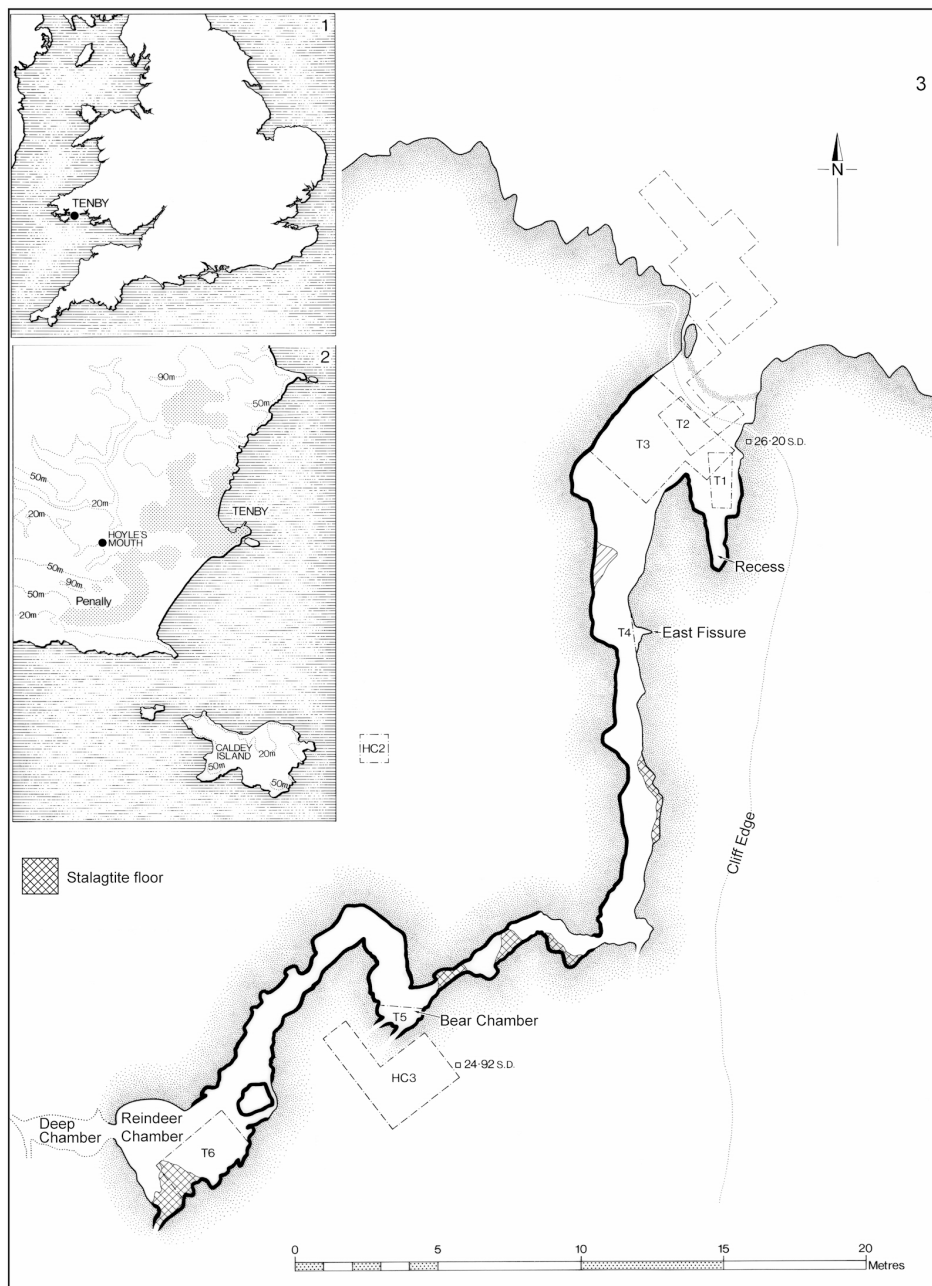


Figure 5. Plan of Hoyle's Mouth showing the location of all excavation trenches.
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Figure 6. *Trench 3 during excavation.*
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Entrance Chamber (Trench 3)

The sequence and brief description of contexts in the Entrance Chamber Trench 3 are as follows (Figure 7):

- Contexts 1, 2 and 4 are either trample or disturbance – a derived clast from this area yielded an age of 58,500 +12,000/-11,000 BP (Table 2, HM127, dated at the Atomic Energy Research Establishment by Dr A. Rae). This demonstrates an Early/Middle Devensian development of stalagmite in the cave.
- Wall stalagmite overlying wall breccia – no context number – this stalagmite is undated.
- Contexts 3 and 5 (interpreted as equivalent layers). An orange silt and yellow silt up to 15 cm thick, containing a few well-sorted, angular (mean roundness 0.23) coarse gravel clasts (mean size 21.6 mm), predominantly bladed in shape. 100% limestone. The fine fraction is a poorly sorted very fine sand (mean size 0.1 mm) dominated by very fine sand (33%) and silt and clay (42%). Context 3/5 sits directly on bedrock having an irregular top boundary with disturbed layers.

Chronology

The correlation of sediment, stratigraphy and chronology is shown in Table 4. The Aldhouse-Green excavations enabled stratigraphic recording and sampling of sediments for description and characterisation.

The basal deposits revealed by the excavations show a sequence of buff, yellow and orange silt with some grit and scattered angular limestone clasts, with variable total thickness

up to 1 m. There is no evidence of clear bedding, or of any hiatuses/breaks in sediment accumulation. Last Interglacial stalagmite is not exposed at the cave entrance but derived Early/Middle Devensian stalagmite (58,500 $\pm$ 12,000/-11,000 BP; see above and Table 2) occurred in the disturbed upper layers of Trench 1, this providing a *terminus post quem* for the Entrance Chamber silts. Although the context is unknown, it would be sensible to assume a within-cave provenance. The occurrence indicates a Middle Devensian episode of stalagmite formation with subsequent fragmentation possibly resulting from the erosion of older supporting material. Deposition of the silts commenced at the end of the Middle Devensian based on a radiocarbon date of 33,732 – 31,070 cal BP (95.4%; OxA-1024; HM362; Table 1) on an undetermined bone fragment from context 3a recovered from the base of Trench 1. The deposition progressed through to the end of the Late Glacial as evidence by a TL date of 10,500 BP from silts near the top of Trench 2 (HM415 from context 5; Table 3). The deposit is predominantly silt/clay (42%) and fine sand (43%) which suggests periodic loess and coversand deposition in the valley, including the Entrance Chamber. Loess and coversand were deposited across south Wales during the Last Glacial Maximum; reworked by cryoturbation during post-depositional cold episodes (Last Glacial Maximum, Oldest and Younger Dryas), and pedogenesis and colluviation during warm episodes (Meiendorf/Bølling-Oscillation, Allerød, Holocene) diluting the original sediment signatures (Case, 1983; 1984).

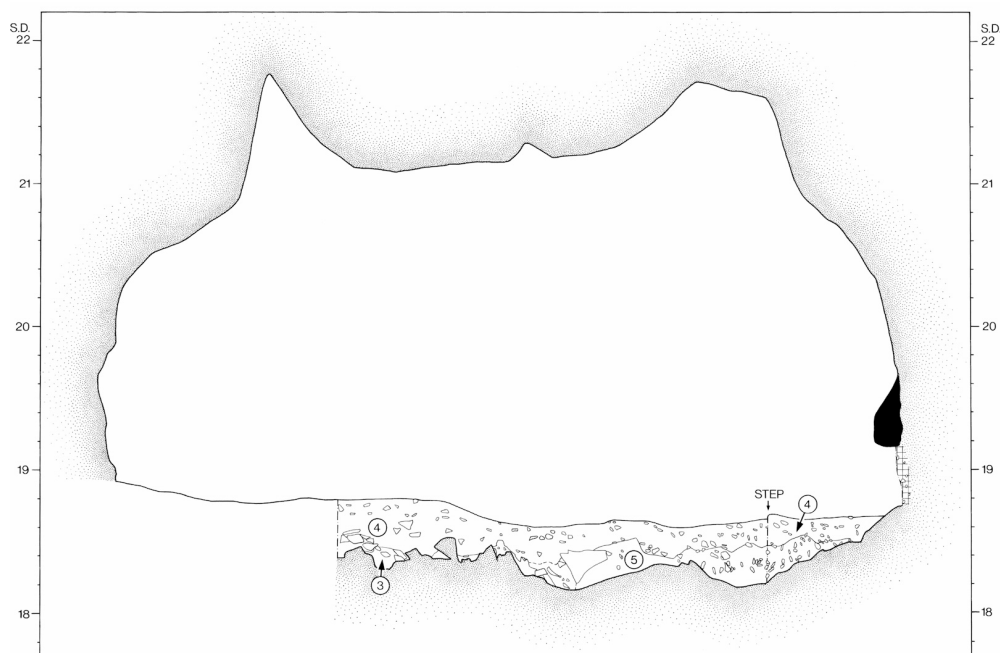


Figure 7. Section through Trench 3 showing the stratigraphy.

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The angular clasts within the silts/fine sand indicate that breccia was forming within the Entrance Chamber throughout the Last Glacial Maximum and Late Glacial. Outside the cave a 2 m+ thick outcrop of limestone breccia in the form of talus with a downslope fabric

crops out just below the cave and is characteristic of the Late Devensian periglacial screes cropping out across south and south-west Wales (Campbell and Bowen, 1989; Bowen, 1999). The talus is interpreted as the product of slope retreat and/or cave entrance roof collapse. Given the proximity of the outcrop to the cave, the breccia would almost certainly have accumulated around the entrance to the cave, the absence of such talus today suggesting removal during early excavation, although there is no documented record of such. However, the presence of fauna such as *Ursus arctos* (bear) and *Equus sp.* (horse) bones of Late Glacial age within the cave indicates that the cave entrance was not sealed at this time.

Cemented breccia occurs as a wall deposit in Trench 3. Separate to the other cave fill sediments it is difficult to position stratigraphically, other than it is overlapped by, and therefore older than, an undated wall stalagmite deposit. This stalagmite could be equivalent to dated Late Glacial/Early Holocene stalagmites that occur in the East Fissure and Bear Chamber.

Lithic artefacts and fauna

The Entrance Chamber is the source of most of the lithic artefacts recovered from the cave, including 107 of the total 130 artefacts recovered by Stephen Aldhouse-Green. It is assumed that most of the other 280 artefacts from earlier excavations also came from the Entrance Chamber. This assemblage was accrued mainly from the nineteenth century excavations and as such we are reliant on the scanty records of the work and the finds that survive in museum collections for their interpretation. All three of the excavators who worked in the Entrance Chamber mention quantities of artefacts. Smith records a concentration at the mouth of the Recess (Smith, 1863, 48). One Aurignacian artefact, a *burin busquée* (Figure 8), from Smith's work, provides evidence for an Early Upper Palaeolithic human presence at the site at a time around 33–31,000 BP based on associated dating at Kent's Cavern, Devon (Dinnis, 2015, 71). Of possible association with this artefact is the record of a small assemblage of Middle Devensian fauna including an unstratified *Coelodonta antiquitatis* (woolly rhinoceros) tooth from Trench 3. Identifiable specimens of *Vulpes* (fox), *Ursus* (bear), *Meles meles* (badger) and *Rangifer tarandus* (reindeer) were recovered from the basal silts (contexts 3 and 5) in the Entrance Chamber (Table 6). A piece of reindeer antler produced a radiocarbon date of 31,763 – 29,752 cal BP (95.4%; OxA-6227; HM1065; Table 1) but all the other remains are loose teeth. The microfauna suggests some mixing, with colder evidence of lemmings from the more securely stratified context 3 in Trench 3, although the presence of toad, frog and bat in Trench 3 context 5 is also suggestive of disturbance. The microfaunal assemblage from the Entrance Chamber is dominated by *Microtus agrestis* (field vole) which was recovered from all the three trenches. *Rana temporaria* (common frog) was also widespread in the trenches in association with the key cold climate indicator species of *Dicrostonyx torquatus* (Arctic lemming), *Microtus oeconomus* (tundra vole) and *Lemmus lemmus* (Norway lemming) recovered from context 3 in Trench 3.

The faunal assemblage recovered by Savory in 1968 from the Entrance Chamber is comprised predominantly of unstratified modern domestic taxa because of disturbance and the re-deposition of material in the higher stratigraphic levels (Savory, 1973, 20). However, according to Savory (ibid), the disturbed deposits in Section B gave way to a layer of 'powdery yellow earth containing partly fossilised bones belonging to hyaena, cave bear and possibly bison'. Aldhouse-Green (1996) noted that information given in the catalogue entries (Savory, 1973, 32) differ from this, with the two fragments of *Crocota crocuta* (hyaena) pelvis listed as being derived from an undisturbed sandy silt bottom layer, a bear canine from clean sand equating to the same context, whilst no provenance is given for a bear premolar (other than from the north end) and the possible bovid bone. This layer of undisturbed sandy silt is thought to equate

with the *in situ* silt deposits (contexts 3 and 5) excavated by Aldhouse-Green (Aldhouse-Green *pers. comm.* 2014). The Entrance Chamber breccia only survives as wall deposits and there are no faunal remains from this context.

Late Glacial artefacts are found in abundance at Hoyle's Mouth. Most of these date to the earliest part of the Late Glacial and parallels can be drawn between this assemblage and with that published from Gough's Cave, Cheddar, Somerset (Jacobi, 2004). The Entrance Chamber was the focus of the nineteenth century excavations, and it is thought that most of the artefacts in Tenby, Manchester and Bristol Museums (280 pieces) came from this area of the cave. Although, it must be noted that there is no means now of knowing which, or how many, of these tools were recovered from deeper within the cave as flints are noted on Figure 1 in

both the Bear and Reindeer Chambers.

The quantity of abruptly-backed points and tools of Late Upper Palaeolithic date originating from the Entrance Chamber indicates the use of this sheltered area for everyday activities. Table 5 shows that most knapping took place in the Entrance Chamber.

Also associated with assemblages of this time are the avian bones which represent the remains of wildfowl, a pattern consistent with the Late Glacial bird fauna at Little Hoyle, with two passerine bones, indicating a wintering *Turdidae* (thrush) and a *Sturnus vulgaris* (starling). The three bird bones from Trench 3 may be more equivocal, *Erithacus rubecula* (robin), might be accepted as a Late Glacial specimen but may equally have been deposited during the Holocene or in very recent times.

Four avian bones were recovered from the Recess but are of limited

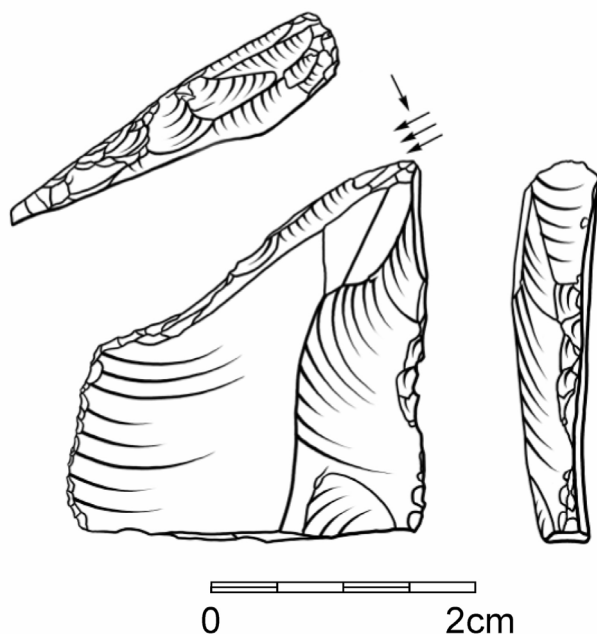


Figure 8. The burin busquée discovered by Smith (drawn by Jackie Chadwick).

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significance despite supplying a few clues as to the seasonality of their deposition. The presence of wildfowl reflects the proximity of a wetland habitat. If a Late Glacial dating is assumed, these species would most likely be present during the winter months. No bird remains are recorded from Trench 2 and only three from Trench 3; *Turdus iliacus* (redwing), robin and *Anthus cf. petrosus/spinoletta*, possibly either a rock or water pipit. All three species are present on a variety of sites in differing ecological zones of western Europe throughout the Pleistocene and Holocene and so cannot be used to date the contexts.

Contexts 1 and 2, the youngest material, is disturbed, as indicated by chiropteran remains, a *Talpa europea* (mole) specimen along with common frog, *Bufo bufo* (common toad), and large amounts of field voles. One *Vipera* sp. (viper) vertebra was also recovered from

context 2. The mammal faunas from these same contexts are also of Holocene date and comprise sixteen specimens most of which belong to sheep (n=7) although canid (dog), *Vulpes vulpes* (red fox), horse, *Sus scrofa* (pig), and lagomorph (hare/rabbit) are all represented too. Three cut-marked bones were found, including a probable deer phalanx with at least one cut-mark on the distal end, most likely inflicted during skinning. An *Oryctolagus cuniculus* (rabbit) tibia in two pieces (also probably modern) displays oblique cut-marks on their anterior and medial faces.

Human remains are recorded as coming from the Recess in the Entrance area. Two bones from the Savory excavations have been dated and have generated Neolithic dates (Table 1). Analysis of the Tenby Museum and Amgueddfa Cymru collections indicate a minimum of two individuals, one adult who had reached maturity, and one older teenager (17–19), although there is every chance that more people are represented. The Aldhouse-Green excavations recovered a range of artefacts of later prehistoric age. These came from the Entrance Chamber and are described later in this report.

Table 5. *Hoyle's Mouth lithic artefacts by trench.*

Context	Unstratified	Trenches					
		1	2	3	4	5	6
<i>Burin busquée</i>	1						
<i>Abruptly backed points</i>	20	3	1	5		1	
<i>Piercers</i>	3	1					
<i>Burins</i>	9	1	1				
<i>Burin spalls</i>	4	2		2	2		1
<i>Scrapers</i>	18	1	1	5			
<i>Composite tools</i>	6	1	1				
<i>Truncated blades</i>	2			1			
<i>Microliths</i>	4			2			
<i>Denticulated scraper</i>	1						
<i>Chisel arrowhead</i>	1						
<i>B&T arrowhead</i>				1			
<i>Flake from polished axehead</i>	1	1					
<i>Knives</i>	1						
<i>Miscellaneous retouched</i>	10	2		4	1		
<i>Utilised pieces</i>	13			3			
<i>Flakes & fragments</i>	72	11	3	11	5		1
<i>Blades & fragments</i>	106	17	7	23	2		3
<i>Cores</i>	7						
<i>Core rejuvenation pieces</i>	7	1	1				
<i>Spalls</i>	8	15	1	6	3		
<i>General knapping debitage</i>	17	6	1	4	1		

In summary the remnants of the deposits that survive in the Entrance Chamber are poorly stratified and heavily disturbed. Given the presence of so many faunal species with

ranges that span long chronological periods it has been difficult to create a secure sequence for these deposits from the fauna and distinct periods can only be recognised from the identifications of individual artefacts and specimens.

Table 6. Entrance Chamber stratified species by number of individual specimens.

	<i>Trench 1</i>	<i>Trench 2</i>	<i>Trench 3</i>		
	3	5	3	4	5
<i>Ursus</i> (bear)	3				1
<i>Rangifer tarandus</i> (reindeer)	1				1
<i>Equus</i> (horse)				1	
<i>Alopex lagopus</i> (Arctic fox)	2				
<i>Vulpes vulpes</i> (red fox)	2			1	1
Fox	4			2	1
<i>Lepus europaeus</i> (European hare)	1				
<i>Lepus</i> spp. (hare)	1			1	
Cervidae spp. (deer)	1				
<i>Meles meles</i> (badger)			1		
<i>Ovis</i> (sheep)				1	
Sheep/goat				7	
Pig				2	
Carnivore			2		
Large mammal	1			1	
Medium mammal	1			1	
<i>Turdus iliacus</i> (redwing)	1				
<i>Anas Penelope</i> (wigeon)	1				
<i>Sturnus vulgaris</i> (starling)	1				
<i>Anthus spinoletta</i> (water pipit)			1		
<i>Microtus agrestis</i> (field vole)	62	12	25	3	
<i>Arvicola terrestris</i> (water vole)	3	2	2		
<i>Myodes glareolus</i> (bank vole)			5		
<i>Dicrostonyx torquatus</i> (Arctic lemming)	1		14		
<i>Microtus oeconomus</i> (tundra vole)			3		
<i>Microtus</i> sp. (vole)			1		
<i>Rana temporaria</i> (common frog)	14	1	2		4
<i>Bufo bufo</i> (common toad)	4		1		6
<i>Bufo</i> sp. (toad)					7
<i>Rana</i> sp. (frog)			1		2
<i>Chiroptera</i> (bat)	1				1

CAVE INTERIOR: EAST FISSURE, BEAR CHAMBER AND REINDEER CHAMBER

Stephen Aldhouse-Green opened three trenches inside the cave; the East Fissure (Trench 4), Bear Chamber (Trench 5), and Reindeer Chamber (Trench 6). These have exposed a sequence of limestone breccias which are uncemented except for some very local cementation where breccia has contact with the cave wall. The deposits are variable up to 1 m in thickness with no evidence of clear bedding, or of any hiatuses/breaks in sediment accumulation.

The local clast lithology indicates an autochthonous origin. The breccia most likely formed through endokarstic processes as described by Gutiérrez and Cooper (2013) angular clasts being released from the cave roof and walls through interstratal dissolution enabling gravity brecciation. However, the cave roof is within 5 m of the ground surface and so it is also possible that some breccia could have been released through frost penetration during the Last Glacial Maximum. The matrices, derived from loess, coversand and hillslope deposits, most probably washed in from the cave entrance or through the limestone joints of the cave roof, these fines also contributing to local lenses of silt and clay, the product of ponding. The breccias do not exceed 1 m in thickness indicating that clast release and accumulation was slow, suggesting an essentially dry cave which would further explain the lack of breccia cementation, the exception being an age indeterminate breccia cemented to the wall of the East Fissure (Trench 4).

*Stratigraphy and Sedimentology**East Fissure (Trench 4)*

The sequence of deposits recovered in Trench 4 is summarised in Table 4 and Figures 9 and 10. It is as follows:

- Contexts 1 and 3 are both disturbed and mixed deposits. These overlie:
- Context 4 a layer of *in situ* stalagmite which has been Uranium Series dated to the Late Glacial/Early Holocene, $12,400 \pm 4,000$ BP (HM2291; Table 2).
- Context 2 is a brown matrix-supported breccia with very well-sorted angular (mean roundness 0.23) coarse gravel clasts (mean size 22.3 mm), predominantly bladed in shape. 100% limestone. The fine fraction is between 90% to 98% sand which is poorly sorted with a mean in the medium to fine sand class (mean size 0.4 mm to 0.25 mm). There is a clear irregular top boundary with overlying disturbed layers and a very indistinct lower boundary with context 2a.
- Context 2a is a brown matrix-supported breccia with well-sorted angular (mean roundness 0.21) coarse gravel clasts (mean size 26.7 mm), predominantly bladed/elongate in shape. 100% limestone. The fine fraction is 71% sand which is poorly sorted with a mean in the fine sand class (mean size 0.21 mm) There is a very indistinct upper boundary with contexts 2 and 7, the lower boundary lies on bedrock.
- Context 5a is a cemented breccia occurring as a wall deposit.
- Context 5b is an uncemented breccia with a buff matrix.
- Context 6 is a buff fine deposit with small sub-angular clasts. Its geometry suggests a short west to east channel possibly indicating local reworking of the uncemented breccias. It has a distinct boundary with contexts 1 and 5b above and context 7 below.
- Context 7 is reddish-brown matrix-supported breccia with well-sorted sub-angular (mean roundness 0.25) coarse gravel clasts (mean size 27.7 mm), predominantly

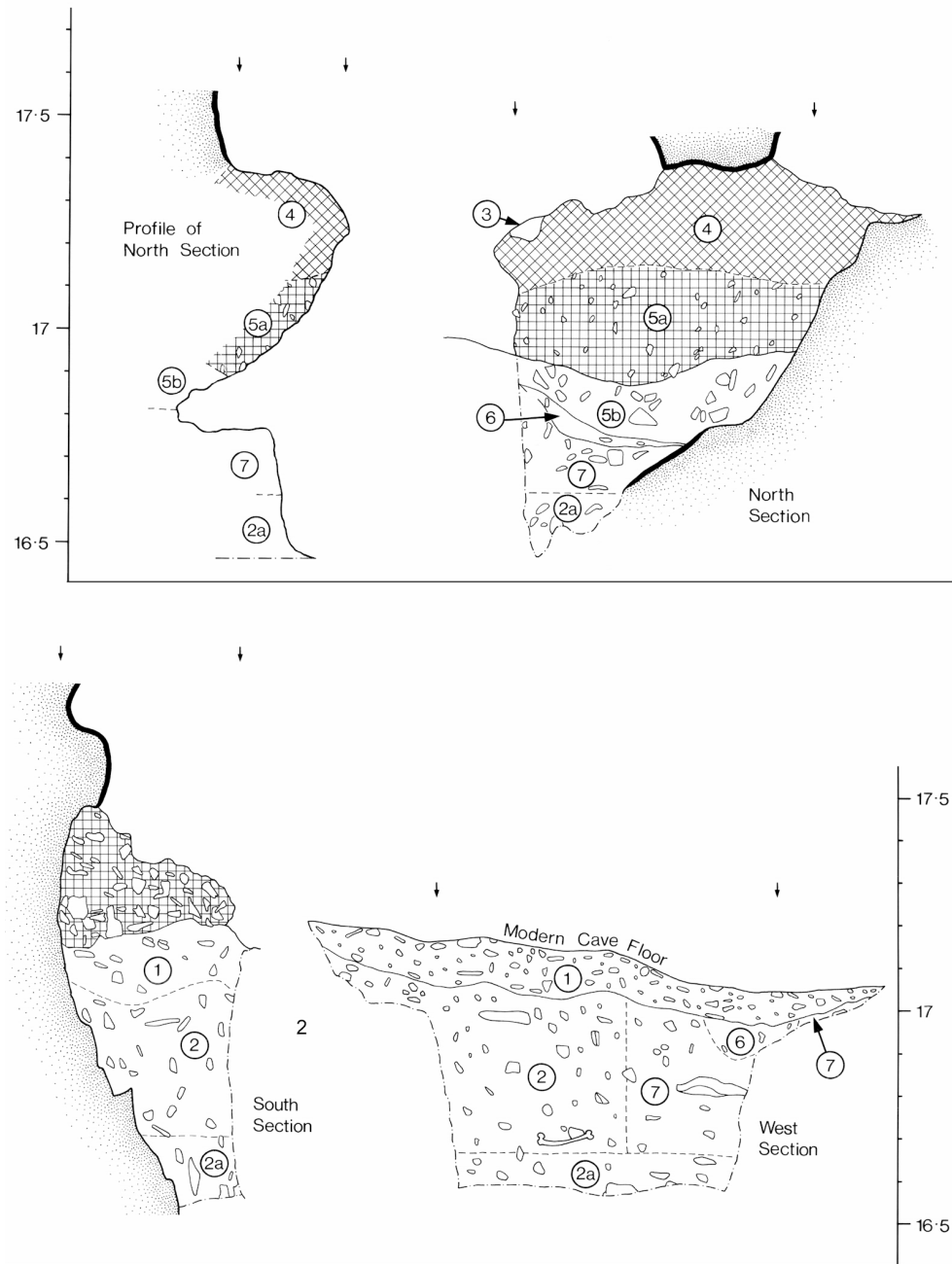


Figure 9. *Trench 4, the East Fissure sections.*
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Figure 10. *Trench 4, the East Fissure west section.*

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bladed/elongate in shape. 100% limestone. The fine fraction is between 96 to 97% sand which is poorly sorted with a mean in the medium sand class (mean size 0.3 mm to 0.4 mm).

- Context 8 is decayed flowstone on the cave wall of the east side of Trench 4, overlain by all other contexts.

Contexts 2, 2a, 5b, and 7 are all uncemented matrix supported breccias. Context 5a is a similar breccia but cemented, the precipitation responsible for the overlying context 4 (stalagmite) almost certainly being responsible for the cementing of 5a. Sediment analysis on contexts 2, 2a and 7 shows comparable values for clast size, shape, roundness, sorting and lithology; the matrices in each case are poorly sorted sand. These contexts are interpreted as the same sedimentary unit. Field description, stratigraphic position, and indistinct boundaries with no evidence of hiatus also includes contexts 5a, 5b and 6 in the unit. Faunal analysis (below) suggests that contexts 2, 2a and the top of 7 may be slightly disturbed.

The summary of the sedimentological sequence for Trench 4 is shown in Table 4.

Bear Chamber (Trench 5)

The sequence of deposits in Trench 5 is as follows (Figures 11 and 12):

- Contexts 1 and 2 are both disturbed.
- Stalagmite (no context number). This has yielded an early Holocene Uranium Series date of $8,900 \pm 3,000$ BP (HM2257; Table 2; dated at the Atomic Energy Research Establishment by Prof. M. Ivanovich). Site notes indicate a possible association with the stalagmitic matrix of context 5.



Figure 11. *Trench 5, the Bear Chamber photograph of the south wall.*

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- Context 3 is a very red clay with few clasts up to 3 cm long. It occupies a shallow basin in the top of the underlying context 5 cemented breccia, this facilitating ponding into which clay can settle.
- Context 4 has a matrix-supported loose breccia comprising angular limestone clasts and fractured lumps of stalagmite.
- Context 5 is a cemented limestone breccia with intercalated lenses of red clay (labelled sub-contexts 5a–5g) suggesting periodic ponding episodes as per context 3.
- Context 6 is an uncemented loose breccia. There is a possibility that contexts 3, 4, 5 and 6 are all the same sedimentary unit representing episodes of breccia accumulation interspersed with ponding and red clay accumulation.
- Context 7 is an orange matrix-supported breccia with moderately sorted angular (mean roundness 0.21 to 0.24) coarse gravel clasts (mean size 28.1 mm to 31.6 mm), predominantly very platy in shape. 100% limestone. The fine fraction is poorly sorted with between 46 to 67% silt and clay and a mean in the very fine sand class (mean size 0.1 mm). There is a distinct top boundary with context 5, the base of the context was not exposed.
- Flowstone on bedrock (no context number). This has yielded a Last Interglacial Uranium Series date of 117,400 ± 10,600/-9,700 BP (HM2256; Table 2; dated at the University of East Anglia by Dr T. Atkinson and Dr P. Rowe).

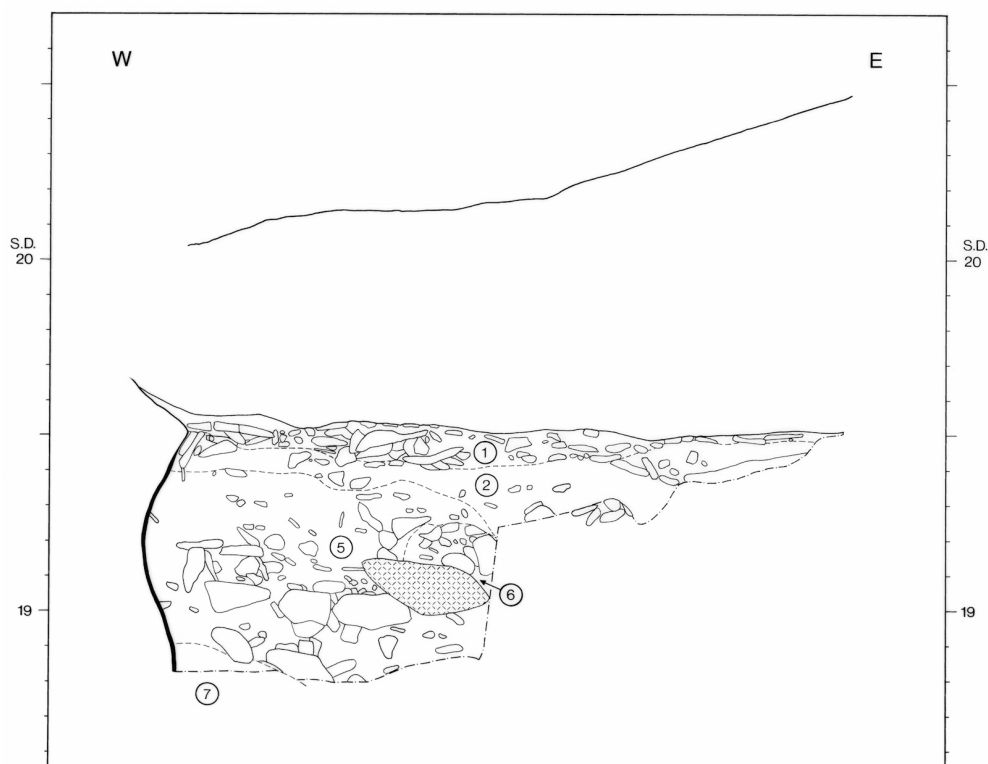


Figure 12. *Trench 5, the Bear Chamber north section.*

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Reindeer Chamber (Trench 6)

The contexts in Trench 6 were re-evaluated between each season of excavation. The numbering given here relates to the final sequence as determined in the field by Stephen Aldhouse-Green (Figures 13, 14 and 15).

- Contexts 10, 11, 12 and 17 are all disturbed. They contained modern material, clay pipe stems, but also Pleistocene bone and context 12 contained abundant anuran bones, so frogs and toads may have colonised air-hole screens and therefore become incorporated within them.
- Context 13 is an uncemented breccia with moderately to well-sorted angular (mean roundness 0.21 to 0.23) medium to coarse gravel (mean size 19.0 mm to 33.4 mm), with an equal mixture of platy, bladed and elongate shapes. 100% limestone. The matrix is a poorly-sorted yellow sand/silty sand yielding varying size distributions, five separate samples giving a range from 98% to 51% sand, with means ranging from very fine sand to medium sand (0.1 mm to 0.4 mm). The context has a clear upper boundary with the overlying disturbed sediments, but locally the disturbance has made the boundary diffuse. The context has a clear boundary with the underlying contexts 15 and 16. This context contained a flint burin spall (HM2578; Figure 16) and a hyaena gnawed bone (HM2565).

- Context 14 is a localised lens of grey silt stratigraphically at the boundary between contexts 13 and 15.
- Context 15 is a loose yellow breccia with moderately- to well-sorted angular (mean roundness 0.21 to 0.23) medium to coarse gravel (mean size 27.0 mm to 35.8 mm), predominantly of bladed and elongate shapes. 100% limestone. The matrix is a poorly-sorted yellow silty sand/sandy silt. Four separate samples gave a range from 92% to 32% sand, with means ranging from very fine sand to fine sand (0.1 mm to 0.2 mm). This context contains a large quantity of microfauna.



Figure 13. *Trench 6, the Reindeer Chamber west section.*

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- Context 16 is a loose angular breccia, with no matrix, which occurs locally along the rock margins of the cave. It is coextensive with context 15 and sits under context 13 with a diffuse boundary. Stratigraphic position and clast similarity suggests it is a cave margin variant of 13 and 15.
 - Context 18 is incorporated into the breccia deposits of contexts 13, 15, 16 and 19. It comprises collapsed roof, wall and flowstone (former stalagmite floor). The subsided stalagmite floor gave a Last Interglacial Uranium Series date of 115,000 $\pm$ 29,000/-24,000 BP (HM2255; Table 2; dated at the Atomic Energy Research Establishment by Prof. M. Ivanovich).
 - Context 19 is a red clay found, with a clear boundary, below context 16 although fallen clasts have penetrated into the clay.
 - Context 20 is brown clay found, with a clear boundary, below contexts 13 and 15.
- See Table 4 for the sequence.

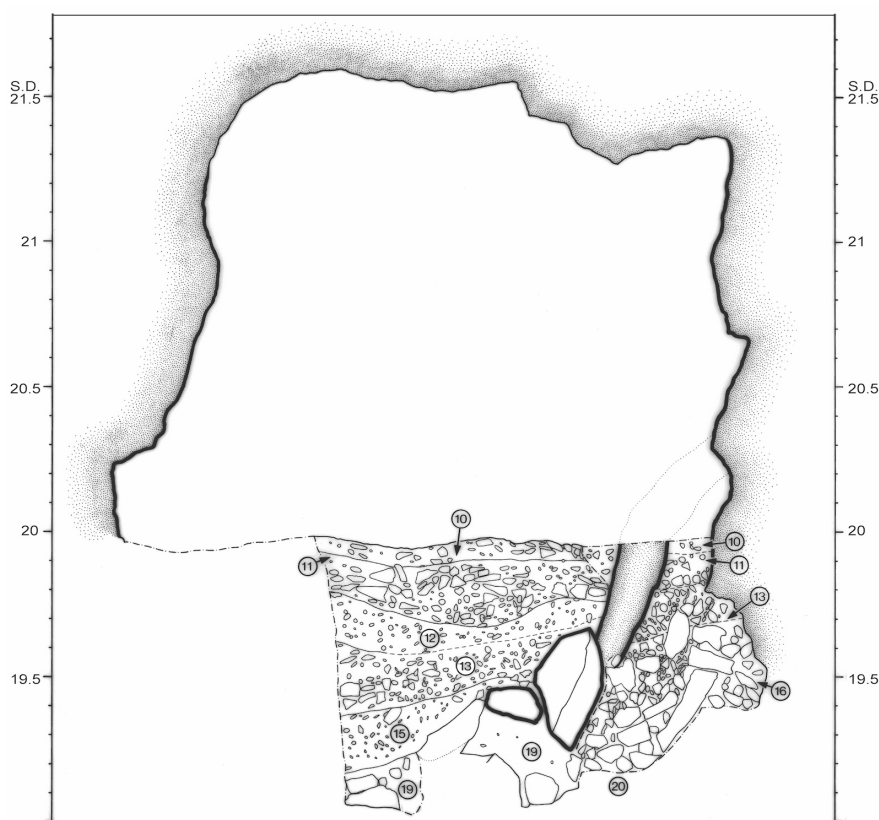


Figure 14. *Trench 6, the Reindeer Chamber north section.*
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Chronology

Stratigraphic control inside the cave is afforded by dated stalagmite which provides a *terminus post quem* for the cave sediments. Last Interglacial stalagmite (117,000 BP; Tables 2 and 4) crops out on the Carboniferous limestone cave floor at the base of Trench 5. The overlying cave sediments are therefore Devensian or Holocene in age. The Trench 6 Last Interglacial fractured stalagmite floor (115,000 BP; Tables 2 and 4; and see above) is not *in situ*, it has collapsed onto and been buried by Devensian breccias, possibly the result of an erosion event. A date of 35,211 – 33,793 cal BP (see below) from the base of the breccias in Trench 4 indicates the collapse took place in the Middle Devensian. For collapse to occur the stalagmite floor must have been undermined indicating that there were deposits older than Last Interglacial in the cave on which the stalagmite floor developed. The occurrence of waterworn pebbles, some exotic, at the base of the cave entrance Recess sequence (Trench 1) provides evidence of at least one past episode of water flow/erosion within the cave. The red and brown clays at the base of Trench 6 suggest the presence of water ponds, but their age is indeterminate.

The uncemented/loose limestone breccias with fine sand and silty matrices started to accumulate in the Middle Devensian, based on a radiocarbon date of 35,211 – 33,793 cal BP (95.4%; OxA-34738; HM1972; Table 1) from a reindeer bone near the base of Trench 4, context 2a). Breccia continued to slowly accumulate through to the end of the Late Glacial

based on a radiocarbon date of 13,522 – 13,328 cal BP (81.7%; OxA-33904; HM2023; Table 1) from a brown bear bone below the top of the breccia deposit in Trench 6, context 5.

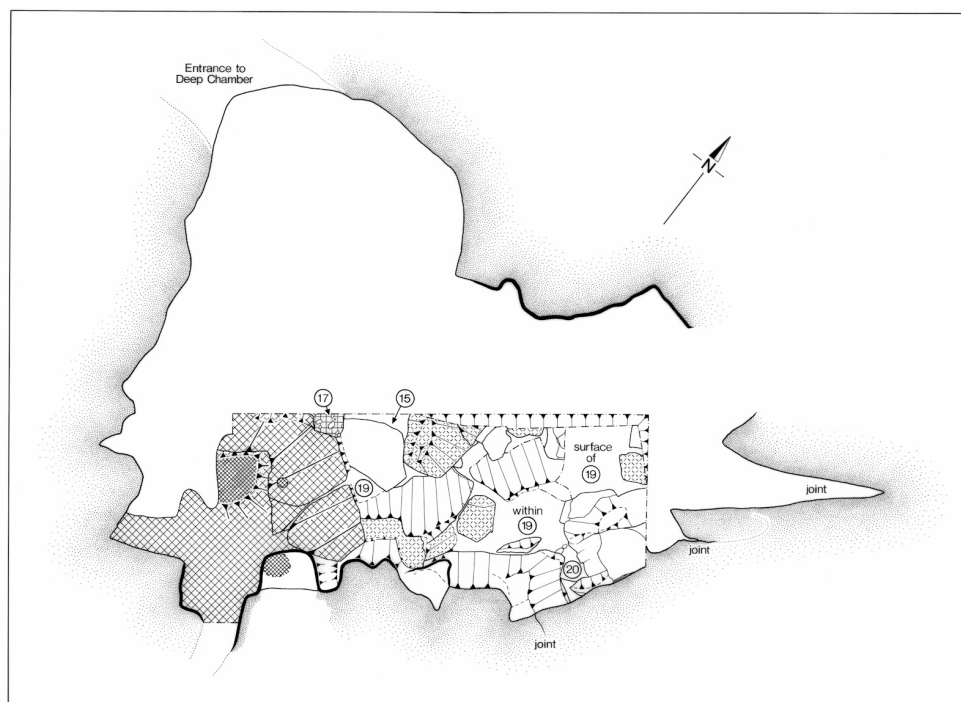


Figure 15. Trench 6, the Reindeer Chamber plan in 1996.
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Fauna and lithic artefacts

East Fissure (Trench 4)

The upper uncemented breccia deposits in this trench (contexts 2, 7, 2a) contained sheep, pig, and rabbit, comprising almost half the total number of remains from this trench, with sheep the most numerous taxa ($n=18$) (Table 7). Red fox is well represented. *Lepus timidus* (Arctic hare), horse, reindeer and *Bos*/bison are also present. Most specimens are from the extremities (head and feet). The presence of modern domestic mammals from these contexts indicates that the deposit has suffered some disturbance and mixing.

The bird remains from Little Hoyle show a preponderance of *Branta leucopsis* (barnacle geese) amongst a range of *Anserinae* (swans and geese) dating to the late Last Glacial Maximum, but a single bone (HM2513) is only one of two barnacle goose bones recovered from Hoyle's Mouth, and both are very dark in colour. (The second, HM2474, was found in the Bear Chamber context 5).

Overall, Trench 4 was rich in avian bone with a diversity of species, but most of the bone came from topsoil context 1 and so are mostly Holocene or recent, with most having a fresh appearance. There is uncertainty about their origin, whether derived through natural processes or predation. The presence of bones of waterfowl is consistent with the patterns of

bird life in the Ritec valley at any time from the Late Glacial and early Holocene up until early modern times. In contrast to the avian fauna, identifiable microfaunal remains are scarce from this trench. The main species identified are field vole, common frog and common toad. The majority of these come from context 7 which, as also observed by the mammalian fauna, suggests some mixing of deposits, possibly in the upper levels, as this context has a long chronological duration.

Thirteen lithic artefacts were recovered from this trench. As noted above there are close similarities between contexts 2, 2a and 7. Context 2a being limited to a specific area of this trench (Figure 9). It is this context from which eight artefacts have originated; comprising a fragment of a miscellaneous retouched blade with marginal retouch (HM2350), a rhyolite flake (HM2351; Bevins, *et al.* 2025), a flint spall, a flint burin spall, flakes of flint and chert, a flint blade fragment and an irregular piece of general flint knapping debitage. These finds are not easily dated and work published so far has relied upon the dating of a reindeer phalanx of 30,419 – 29,246 cal BP (95.4%; OxA-33905; HM1244; Table 1) as a possible association. This date comes from a bone in context 2 which the faunal reports have demonstrated may have experienced some disturbance since Holocene species are also represented within it. Two flint spalls have been recovered from context 2. More securely stratified is context 7 lying at the base of this trench which has generated a thick rhyolite burin spall (HM1281) which may be Late Upper Palaeolithic in date (*ibid*). Context 3 has produced a thick, heavily prepared flint flake with a hinge fracture, whilst the unstratified context 1 has produced a flint flake, blade fragment and two spalls.

Bear Chamber (Trench 5)

Context 5 in the Bear Chamber (and contexts 13 and 15 in the Reindeer Chamber) have a Late Glacial origin and together produced 86 identifiable mammal specimens (Table 7). The majority of the material is from Trench 5 context 5 and more than half belongs to fox with both *Alopex lagopus* (Arctic fox) and red fox represented. Most of the fox remains are derived from the head or feet although three pieces of radius and two fragments of ulna are present. *Ovis aries* (sheep) (n=17) is the second most numerous taxon and again major limb bones are scarce with just two pieces of radius present. Pig is represented by a humerus and ulna. The recovery of sheep and pig bones from context 5 deposits (5, 5c, 5d and 5e) indicates that some mixing has taken place. Several other taxa are present in this context, including badger which is represented by an atlas vertebra. A 1st phalanx belongs to reindeer and a few bone fragments belong to deer including a tibia, a calcaneus and a navicular cuboid. Two lower molars, a femur and calcaneus belong to hare whilst a lower molar and ulna are rabbit.

Context 7, the basal deposits of the Bear Chamber produced just three identifiable specimens: a red fox metacarpal, a fox premolar and a bear 2nd phalanx. This context generated bones of only one avian species, *Anas platyrhynchos* (mallard), which is also found throughout the deposits in this trench.

The majority of the bird bones were recovered from the Bear Chamber. Forty-six were recovered from a single metre square (M2) with 37 of these coming from the north-western quadrant. Analysis of the vertical distribution within this area appears to show patterning as seen in Table 8.

Context 5 has generated one of the only two bones of barnacle goose recovered from this site, despite the fact that at Little Hoyle it is the most frequently recorded species. In Hoyle's Mouth contexts 7 and 5 the most numerous bones were mallard, with single bones only of *Anas crecca* (teal) and a large raptor. The latter, a 1st phalanx, digit 1 has been defined on

Table 7. *Cave Interior stratified species by number of individual specimens.*

[illegible]

	Trench 4				Trench 5										Trench 6			
	2a	3	6	7	3	4	5	7	4a	5c	5d	5e	5f	5g	13	15	16	19
<i>Linaria cannabina</i> (linnet)											3							
<i>Branta leucopsis</i> (barnacle goose)	1						1											
<i>Ardea cinerea</i> (grey heron)														1				
<i>Lagopus lagopus</i> (willow grouse)																1		
<i>Scolopax rusticola</i> (woodcock)											1							
<i>Sterna hirundo</i> (tern)											1							
Large raptor							1											
Small raptor										1								
<i>Anas</i> (duck)											2							
Bird							1			1								
<i>Microtus agrestis</i> (field vole)	1	3		6		20	2	1		1	1	3	1		20	71	38	134
<i>Arvicola terrestris</i> (water vole)						22	3				1	1		1	2	11	5	3
<i>Myodes glareolus</i> (bank vole)						3	2											9
<i>Microtus gregalis</i> (narrow headed vole)						1					1				1	1	4	11
<i>Dicrostonyx torquatus</i> (Arctic lemming)						8			1		1		1		2	8	9	64
<i>Microtus oeconomus</i> (tundra vole)						3									2	4	3	11
<i>Lemmus lemmus</i> (Norway lemming)						1							1					3
<i>Mus</i> sp. (mouse)																		1
<i>Microtus</i> sp. (vole)						2		1										
<i>Rana temporaria</i> (common frog)				12	4	15	5	2		5	6	7			1			
<i>Bufo calamitis</i> (natterjack toad)					2													
<i>Bufo bufo</i> (common toad)				5	6	16	7		1	23	6	1		1	1			
<i>Bufo</i> sp. (toad)					7					4								
<i>Rana</i> sp. (frog)					2	4				9								
<i>Chiroptera</i> (bat)					1	1								1				

the basis of the ambient ecology as possibly of *Haliaeetus albicilla* (white tailed eagle). It occurs on Late Glacial and Holocene sites in Britain from Church Hole in Derbyshire to Walthamstow in Essex (Northcote, 1980; Jenkinson, *et al.* 1984) and was quite well recorded in caves in the south-west of Britain, at Clevedon Cave and Soldier's Hole in Somerset and at Cathole, Gower (Bell, 1915; Bramwell, 1959; 1960; Harrison, 1980; 1987). A claw from Little Hoyle would also appear to belong to this eagle. In France it is a species most usually recovered from sites of Magdalenian date situated from the Dordogne region to the Pyrenees (Eastham, 1995) but in Britain they are found in quantity on sites of Neolithic age in north-west Scotland (Udal, North Uist; Crawford, 1970). In the present context, they may have been scavenging on the food remains of other animals or their bones or plumage used to make equipment or clothing.

Table 8. Analysis of bird specimens recovered from Bear Chamber (Trench 5) grid square M2.

	US	2	3	5c	5d	5e	5g	5	7
Mallard	2	2	2	1	4		1	4	1
Shelduck		1	1		1				
Redwing		1							
Pipit		1							
Pintail			1						
Small Raptor				1					
Redshank				1	1				
Woodcock					1				
Linnet					3				
Black Tern					1				
Teal						1		1	
Large Raptor								1	
Barnacle Goose								1	
Grey Heron							1		
Little Ringed Plover	1								
Starling	2								
Wigeon	1								
Bird undetermined	1			1					
Duck undetermined					2			1	

The middle layers (contexts 3, 5c, 5d, 5e and 5g) are also dominated by mallard, but with some wading birds present including *Tringa totanus* (redshank) and possibly *Ardea cinerea* (heron). The latter would be an unusual find, identified at only a few Late Glacial sites, one of which was Pin Hole, Creswell Crags, Derbyshire (Jenkinson, *et al.* 1984) and another in the Magdalenian levels of the Abri Dufaure, one of the sites along the Pastou cliffs, beside the Gave d'Oleron at Sordes L'Abbaye in the Landes Department of France (Eastham, 1995). In general, it is a species rarely recovered in Western Europe in Late Glacial/early Holocene contexts. The avian fauna also shows a mix of inland aquatic species including *Tadorna tadorna* (shelduck), teal, redshank and *Scolopax rusticola* (woodcock). Oddities here are *Anas acuta* (pintail duck) and the possible pes phalanx of a member of the tern family, *Sternidae*. Normally these are regarded as belonging to a marine environment, though they are known to come to inland lakes and rivers. However, the determination of this specimen contains some

element of uncertainty.

The upper contexts are more mixed with mallard, shelduck, redwing and pipit as well as a *Charadrius dubius* (little ringed plover) and *Anas penelope* (wigeon). Besides the aquatic species, passerine remains are few from the Bear Chamber. Thrushes are totally absent, but there was an unstratified mandible of starling and three bones of a species of *Carduelis* sp. (finch), probably linnet or a twite. The latter is currently a scarce winter visitor to Pembrokeshire, whilst the former is a resident breeder at the present day (Donovan and Rees, 1994).

The range of avian species recovered from the Bear Chamber demonstrates the rich diversity of habitat niches available in the Ritec valley during the Late Glacial. It indicates the presence of quite a complex avifauna that equates quite closely with other assemblages of similar date from south-west Britain and Aquitaine (Eastham, 1995). Such species reflect a concentrated exploitation of the game resources of the Ritec valley and has implications for the types of habitat it may have offered to both resident and migratory wetland species at the time.

The possible presence of heron and the numbers of *Anatidae* (dabbling ducks), suggest that there were pools or larger expanses of water containing fish and plants. Herons preferentially nest and roost in trees so may indicate some level of arboreal cover although they are known to use reed beds and tussocks of grass. The geese tend to forage on grassland and marshy grounds.

The largest number of individual microfaunal specimens (32% of total NISP), was recovered from the Bear Chamber, indicating microfauna were present in higher densities towards the back of the cave. Contexts 4 (disturbed) and 5 (the Late Glacial) have yielded good climatic indicators with an abundance of field vole, common frog, common toad, Arctic lemming and Norway lemming. Some tundra vole is present in context 4 giving some good material indicators of a colder climate. The ponding episodes recorded by centimetres of clay indicate periods of very slow sedimentary activity in the cave which may explain the concentration of bones from context 5.

There is just one lithic artefact recorded from this trench, a fragment of a burnt abruptly-backed blade of unclassifiable form of Late Upper Palaeolithic age (HM2258). This tool comes from the disturbed Context 2 (Figure 16).

Reindeer Chamber Trench 6

Six bird bones were recovered from the Reindeer Chamber and all those recorded came from disturbed contexts (1 and 12). Two bones were not determinable, and of the others, three were mallard and the fourth was probably teal (Table 7).

Two mammal specimens came from context 14 in the Reindeer Chamber: a fox canine and a bear pisiform. The latter produced a date of 13,522 – 13,328 cal BP (81.7%; OxA-33904; HM2023; Table 1). Context 13 produced four specimens: a fox canine and 1st phalanx and two hare 1st phalanges. There is no reason to think these layers are mixed given the absence of bones belonging to modern domestic mammals.

Context 15 produced 44 specimens, predominantly of fox, *Lepus europaeus* (brown hare) and Arctic hare bones. A tibia and humerus belong to hare but the other hare remains are from the head and feet. One of the fox remains is a major limb, a humerus, the other specimens are from the head or feet. A hyaena molar and a bear canine also came from this context. The hyaena molar (HM2607) may be derived from earlier deposits. Other than this, the range of taxa present is generally comparable with those found at contemporary sites including Gough's Cave (Currant and Jacobi, 2001) and so it appears that these deposits have remained largely intact.

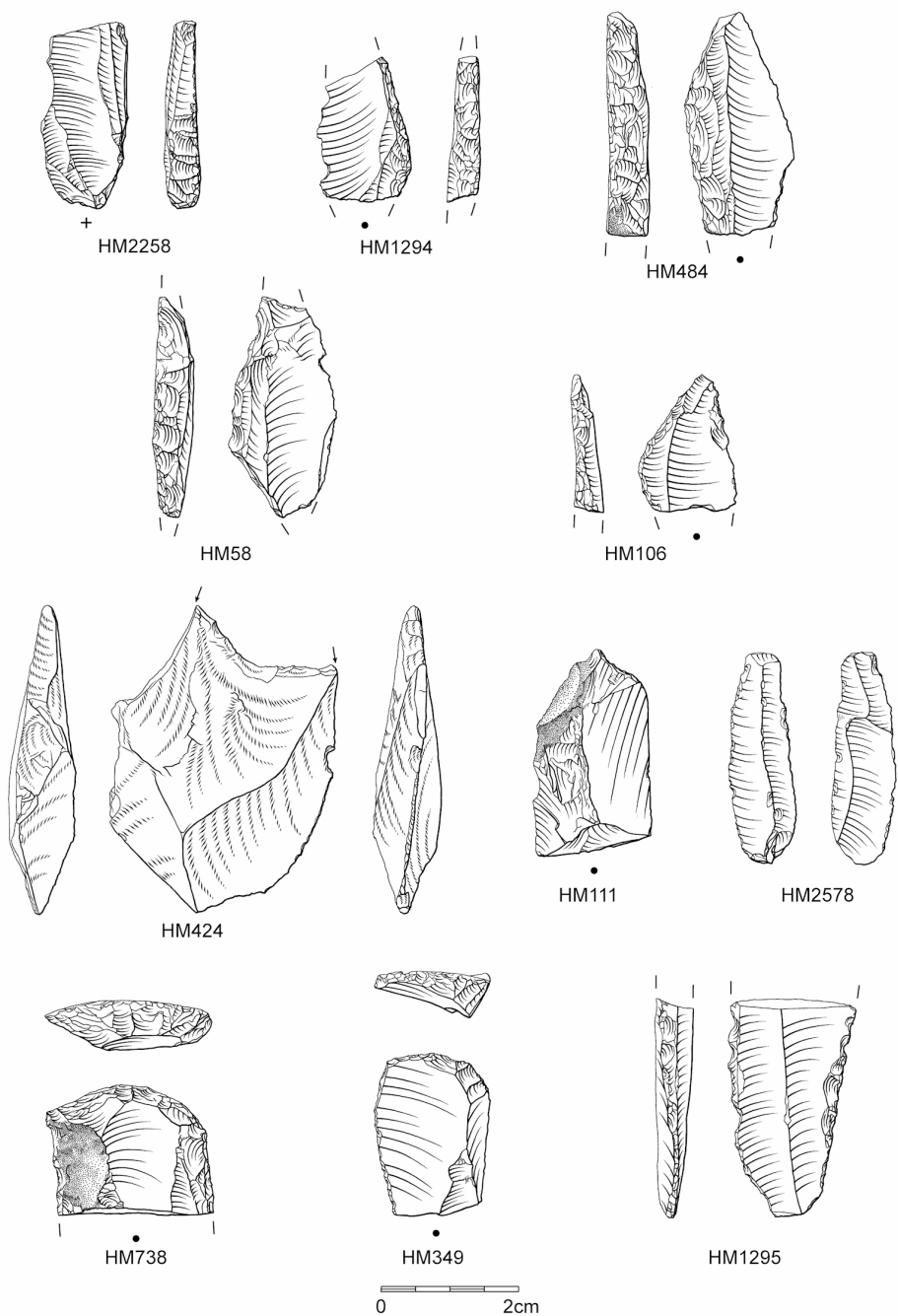


Figure 16. *Hoyle's Mouth* artefacts from Stephen Aldhouse-Green's excavations.
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The small sample from context 16 contains red fox, bear and hare. Except for a fox and rabbit/hare vertebrae, all the remains are loose teeth or podial bones.

Context 19 also only generated a few specimens and there is nothing to suggest that the deposit is pre-Last Glacial Maximum with fox, bear, *Bos*/bison and hare all present. Bear is represented by eight specimens including a mandible, major limb (humerus, radius and tibia), and foot bones. Apart from a hare humerus, other taxa are represented solely by elements from the head and feet.

The Reindeer Chamber has generated the second largest assemblage of microfauna from the cave. The lower contexts are dominated by field vole. Arctic lemming is also very strongly represented especially within contexts 16 and 19. In this lowest sequence of contexts 15, 16 and 19 there is an absence of common toad and common frog. In context 19 Norway lemming is present in small quantities in addition to *Myodes glareolus* (bank vole). Common toad and common frog initially appear in low quantities within context 13 whilst tundra vole and *Microtus gregalis* (narrow-headed vole) are all also present in higher numbers with more narrow-headed vole within contexts 16 and 19.

Just one of the lithic artefacts, a burin spall of Late Upper Palaeolithic age, is securely stratified within context 13 (HM2578; Figure 16) and is Late Glacial in age. Four further lithic artefacts were recovered from the uppermost, or from disturbed contexts. These comprise three blade fragments from contexts 1 and 2 and a honey-coloured flint flake, which is equally undiagnostic, from context 12.

DISCUSSION

Stephen Aldhouse-Green's excavations brought new information to light on what was already considered to be a prehistoric cave of some significance. The inevitable complexities of the stratigraphy have begun to be unpicked and examined trench by trench. The discussion will now focus on the human cultural evidence recovered from the cave which will be fitted into the broader environmental framework drawing upon the evidence derived from the faunal analysis, stratigraphy and dating and placed in the wider Welsh context.

Pre-Last Glacial Maximum

The Middle Devensian sees the demise of the final late Neanderthals in Europe and the arrival of the first anatomically modern humans. No evidence for a Neanderthal presence has been recovered from Hoyle's Mouth and in Wales the evidence for the presence of anatomically modern humans is, as in the rest of the British Isles, slim. This largely comes from lithic artefacts recovered from various caves the description and chronology of which has been synthesised elsewhere (Walker, 2016; 2023).

Aurignacian humans were present at Hoyle's Mouth. The one tool that evidences this, a *burin busquée* (TENBM 1988:22; Figure 8) is significant as there is otherwise nothing that may be dateable with certainty to this time. This tool was recovered by the Rev. G.N. Smith and was first recognised by Andrew David amongst the historic collection at Tenby Museum when undertaking his review of the evidence for a Welsh Early Upper Palaeolithic (David, 2007, 15). It has been studied in detail in the context of the rest of the Hoyle's Mouth assemblage both by David and for this paper. No further Aurignacian tools have been identified amongst the Hoyle's Mouth lithic assemblage. This single tool therefore apparently appears to be an outlier, but one of some importance nonetheless. *Burin busquées* are recorded from just four Welsh

caves, Ffynnon Beuno, Denbighshire (Garrod, 1926, 109); Paviland Cave, Swansea (ibid, 56), Long Hole, Swansea (Dinnis, 2015, 68) and Hoyle's Mouth. Analysis of these was undertaken as part of a wider study of Aurignacian technologies by Rob Dinnis who suggests that these are tools distinctive of late Evolved Aurignacian form (ibid). He interprets them as bladelet cores for the striking of narrow, regular-sized bladelets for possible use in hunting armatures (Dinnis, 2008). They have generally been recovered from across Belgium and elsewhere in Britain where they are frequently associated with a tool with a carinated end from which blades have been struck from the dorsal surface towards the ventral where they terminate (ibid, 28).

Stephen Aldhouse-Green's excavations at Hoyle's Mouth sought to obtain more data about the Aurignacian use of the cave, the dating of which might reasonably lie between 36,000 and 35,000 cal BP based on associated dates of tools from Kent's Cavern, Devon (Pettitt and White, 2012; Dinnis, 2015, 71). However, the work demonstrated that at Hoyle's Mouth undisturbed sediment only survived in fissures and within pockets of deposit at the rear of the cave. Despite a full wet-sieving programme undertaken throughout the excavations no further certain Aurignacian tools, or the small bladelets struck from such cores, were found.

The dating of Trench 4, contexts 2, 2a and 7 containing eight artefacts may hint at further evidence for an Aurignacian age given the dates obtained for reindeer from specimens from these same contexts (Table 1). However, none of these tools are diagnostic and the fauna from the upper levels suggests that there may be some disturbance of the upper part of this deposit.

The Aurignacian has been recognised elsewhere in south Wales with Paviland Cave, Gower, Swansea, generating the largest assemblage of tools (51); including scrapers, burins and blades (Dinnis, 2015, 68). Long Hole, Gower, has also produced a carinated burin from Colonel Wood's historic work at the cave in 1861 (Dinnis, *et al.* 2019, 44). As at Hoyle's Mouth, stratigraphic positions for these finds are unknown, however, Paviland Cave is a site of some significance at this time and it seems that neither Long Hole, nor Hoyle's Mouth, were more than transitory camps or shelter for very short periods. This may support Paul Pettitt's observation that cumulatively across the UK the Aurignacian presence was little more than one season's visit by hunters from mainland Europe (Pettitt, 2008, 29). There are no radiocarbon dates on fauna that directly connect the single Hoyle's Mouth *burin busquée* to the wider environment.

At Hoyle's Mouth a reindeer antler recovered from basal silts in the Entrance Chamber (Trench 3, context 5) produced a radiocarbon date of 31,763 – 29,752 cal BP (95.4%; OxA-6227; HM1065; Table 1) suggests that some other animal remains at Hoyle's Mouth pre-date the Last Glacial Maximum. The dating of two further specimens, the reindeer cranial bone (HM1972; Trench 4 context 2a; OxA-34738; 35,211 – 33,793 cal BP; 95.4%; Table 1) and the reindeer 1st phalanx (HM1244; Trench 4 context 2; OxA-33905; 30,419 – 29,246 cal BP; 95.4%; Table 1) both indicate species present in the cave during MIS 3. These dates have therefore provided confirmation of the survival of deposits of Middle Devensian age within the cave with the result on the reindeer providing a closer age to a possible Aurignacian human presence at the site than has previously been recorded.

The pattern of a human presence during the Early Upper Palaeolithic is therefore complex when we look at the data from south Welsh caves (Walker, 2016; 2023). The new research into the faunal assemblages from the excavations at Hoyle's Mouth can provide glimpses of information about the landscape and environment during this time. However, the evidence available for Hoyle's Mouth's use by Early Upper Palaeolithic people is very slim. An absence of dated humanly-modified bone to support the timing and extent of human activity at the cave is also unhelpful in attempting to unpick the Aurignacian use of Hoyle's Mouth. The

lack of faunal remains is interesting, given the richness of deposits from elsewhere in Wales that date to this period. Caves such as Paviland Cave (Aldhouse-Green, 2000), the Upper Breccias within Pontnewydd Cave, Denbighshire (Aldhouse-Green, *et al.* 2012), the deposits at Ffynnon Beuno (Aldhouse-Green, *et al.* 2015) have all generated a rich suite of fauna dating to this time, yet fewer specimens were recovered from Hoyle's Mouth. This may simply be a consequence of the extent of the nineteenth century excavations at the cave and of what is assumed to be the selective preservation of faunal remains from this early work.

The microfaunal evidence from Hoyle's Mouth indicates that contexts 16 and 19 in Trench 6, date to the Middle Devensian, yet contained no amphibian remains suggesting that the environment may have been drier at this time relative to the later periods where both common frog and common toad made up the dominant proportion of the identifiable assemblages. The presence of *Arvicola terrestris* (water vole) indicates that there must have been some water nearby, but not enough to sustain populations of amphibians. The presence of Arctic lemming within these deposits indicates that the environment was cool and dry. This is supported by the presence of narrow-headed vole, which preferentially occupies tundra and forest steppe environments and suggests cooler conditions at this time. Tundra voles typically occupy humid and marshy areas, but when they are not competing with other species such as *Microtus arvalis* (common vole), they spread into drier regions, living in grassland and scrub (Ligtvoet and Van Wijngaarden, 1994). The presence of bank vole, found in Trench 6 context 19, which preferentially inhabits drier habitats also suggests an environment that was drier at this time. Field voles were commonly represented within the assemblage. Their environmental niche is relatively broad, but they preferentially reside in rough scrub and grassland regions, which is consistent with the drier, rough vegetation indicated by the other microfauna represented at the site. The presence of such a suite of microfauna of Middle Devensian age provides some detail to the local environment in the vicinity of Hoyle's Mouth.

Little Hoyle is located in close proximity to Hoyle's Mouth, just 350 metres to the south. It has produced deposits spanning at least 50,000 years (Aldhouse-Green, n.d; and see Peterson, *et al.* 2026 this volume). No lithic artefacts of Early Upper Palaeolithic age have been recovered from this cave. As with Hoyle's Mouth, deposits excavated in the nineteenth century (Rolleston, *et al.* 1878) and in 1959–60 by Charles McBurney (1959) produced evidence for an earlier fauna that included woolly rhinoceros, some with gnaw-marks indicative of spotted hyaena. The more recent excavations by Aldhouse-Green (n.d.) in 1984 produced Early to Middle and Later Devensian material that included red fox, brown bear, reindeer and hare (Currant, n.d.). Currant (*ibid*) noted the absence of woolly rhinoceros from the later phase other than as derived fossils. In this respect, it is interesting that only a few kilometres to the south-east, the site of Ogof-yr-Ychen on what is now Caldey Island, produced the latest dated (Birm-340, 22,350 ± 620 BP; 27,849 – 25,554 cal BP) record of woolly rhinoceros, albeit now a very early, and therefore potentially unreliable, date (Bateman, 1973; Nédervelde, *et al.* 1973, 454).

Last Glacial Maximum

A gap in the record for a human presence across Wales, and indeed the UK, coincides with the colder, drier climatic conditions associated with the onset and duration of the Last Glacial Maximum. This break took place from a point in the late Gravettian until the end of the Dimlington stadial, which is most probably a consequence of an absence of big game resources. It is generally thought that spotted hyaena, woolly rhinoceros and bison did not return to Britain when the ice sheets started to recede after the Last Glacial Maximum (Currant and Jacobi, 2001, 1713; Yalden, 2010) at about 21,000 BP (Stringer, 2006, 134). It was not until close to

the start of the Late Glacial Interstadial when Magdalenian resettlement took place (Currant and Jacobi, 2011, 174).

Late Glacial

Hoyle's Mouth has long been known as a Late Upper Palaeolithic site of some significance as the evidence presented here demonstrates. The very end of the Oldest Dryas (Dimlington stadial) saw the start of the recolonisation of Britain as climatic amelioration took place. The first evidence for this comes from the dating of humanly-modified wild horse bones found in Gough's Cave and Sun Hole, Cheddar Gorge, Somerset, and at King Arthur's Cave, Wye valley, Herefordshire (Parkin, *et al.* 1986; Jacobi and Higham, 2011). The dating demonstrates people returned to Britain immediately before, or at the onset of, the last Late Glacial Interstadial (Jacobi and Higham, 2011, 229). A human left ulna shaft fragment, also from Sun Hole, is dated to 15,234 – 14,833 cal BP (OxA-19557, $12,620 \pm 50$ BP, *ibid*).

At Hoyle's Mouth a cut-marked brown bear phalanx demonstrates a direct connection between a person using a stone tool and this bear (HM1751; OxA-33908; 14,067 – 13,801 cal BP; 95.4%; Table 1). This specimen therefore provides our first date for the human use of Hoyle's Mouth during the Late Glacial Interstadial. However, there is limited direct evidence for human interaction with Late Glacial animals at Hoyle's Mouth due to the scarcity of cut-marked or otherwise humanly-modified bones. It is possible that humanly-modified bone failed to survive subsequent destruction by carnivores and other taphonomic processes that destroy bone. Abundant humanly-modified bone has been recovered from Gough's Cave where *Cervus elaphus* (red deer) bones display cut-marks and other forms of human modification associated with skinning, dismemberment, filleting and tendon removal (Parkin, *et al.* 1986; Ingrem, 2015). At Robin Hood's Cave, Creswell Crags, Derbyshire, cut-marks on hare bones suggest defleshing and dismemberment, possibly for eating raw (Charles and Jacobi, 1994). Cut hare bones have been recovered from other Late Glacial cave deposits at Creswell Crags including those in Pin Hole and Church Hole (Jacobi and Higham, 2011, 239). Consequently, there is little doubt that during the Late Glacial period, small mammals were routinely exploited by people and it is quite feasible that humans practiced a similar subsistence strategy in the vicinity of Hoyle's Mouth.

There is also no certain evidence for butchery from marks on the bird bone found in Hoyle's Mouth. Only one bone carries any mark that might be attributed to anthropogenic activity, a mallard bone from the Bear Chamber (HM1617). It is a proximal fragment of a left humerus with a clear transverse scrape on the ventral fossa. The absence of any marks on even quite large birds is not unusual in a Late Upper Palaeolithic context, apart from circumstances where the resultant element was required for another, further use as a tool or other artefact.

The sample of undisturbed Late Glacial faunal remains at Hoyle's Mouth, although relatively small, is clearly dominated by the remains of foxes (both Arctic and red) with small amounts of bear present suggesting that at some time during its history, the cave functioned as a carnivore den. The presence of fox, bear and hare is unsurprising in Late Glacial deposits but the recovery of a probable hyaena tooth from Trench 6 context 5 in the Reindeer Chamber indicates this particular specimen was derived from earlier deposits.

The mammalian remains from Hoyle's Mouth suggest that fox, bear and other carnivores (including humans) most probably occupied the cave intermittently and at different times to each other. However, bears do not generally bring food back to their dens (Haynes, 1983), so it is likely that foxes were responsible for bringing most of the bones into the cave. The dominance of wildfowl observed amongst the bird fauna recovered from the excavations could

be a factor supporting this. The few bird bones recovered from the Reindeer Chamber offer little in the way of further conclusions of either an environmental nature or in any interpretation of human or animal resources and exploitation except that the species identified are not inconsistent with those from the Bear Chamber and emphasise the significance of having an adjacent expanse of wetland for the exploitation of predatory animals occupying the cave, whether carnivorous mammal or human. Foxes both hunt and scavenge; their prey generally comprises small vertebrates such as hares, rodents and birds (Burton, 1979) although very young reindeer fawns may be taken (Ingold, 1980, 51). Adult large herbivore remains, such as deer, are unlikely to represent the kill of foxes although parts of animals killed by larger carnivores may have been scavenged. Equally, some of the bones may have been brought to the cave by wolves and humans.

Twenty-one gnawed bones were recovered from within the cave. Most of the damage was inflicted by large carnivores such as wolf or dog although a fox is probably responsible for marks visible on a hare calcaneus recovered from the Bear Chamber. The gnawed bones belong to Arctic fox, red fox, hare and deer. The assemblage is dominated by loose teeth and podial bones, a pattern generally associated with carnivore activity, rather than human accumulation. According to Marean and Kim (1998, 89), the abundance of teeth and metapodia in an assemblage ravaged by carnivores is due to high bone density and lack of grease retaining cancellous bone that, in combination renders them unattractive to carnivores. A teal coracoid (HM1450) from the Bear Chamber was found to have two 1 mm diameter holes pierced through it, matching tooth marks of a small/medium sized carnivore indicating that there was some animal activity involved even if it was not a factor in the initial predation. Nevertheless, there was no sign on other bird bones of incisions made by animal teeth or gnawing.

As mentioned above the pattern of skeletal element representation at Hoyle's Mouth is therefore unsurprising for a carnivore accumulated assemblage. The relatively poor representation of limb bones belonging to fox and bear suggests it was not only herbivore limb bones that were destroyed in this manner. Brown bears and their cubs are particularly vulnerable during the winter when they den in underground holes or caves and may die of starvation if they have not built up sufficient reserves (Haynes, 1983). This suggests that some bones belonging to brown bear may be present because of natural fatality.

Microfauna can enter caves independently, attracted by the niches provided by cave environments including increased food sources, or a need for shelter (Andrews, 1990; Price, 2003). The presence of species that occupy such different distinctive environmental niches have been identified within the same deposits (e.g. water vole, field vole, common frog, Norway lemming, narrow-headed vole), this scenario indicates that this is not the case at Hoyle's Mouth and another form of agency must be responsible. It is likely that these remains represent the remains of ancient owl pellets, deposited by owls frequenting the cave in prehistory. Owls are predators that scour local fields, hedgerows, riverbanks and woodland for prey which they consume whole, before regurgitating the indigestible bone and feather remains. Owls have commonly been identified as a common agent for the transportation of microfaunal remains within archaeological cave deposits (Andrews, 1990; Price, 2003; Walker, *et al.* 2014). The fact that cranial elements and long bones are present in the Hoyle's Mouth assemblage also suggests they are the product of owl pellets as they are consumed whole, meaning that most parts of the skeleton are found in the archaeological deposits. The species of owl is unknown, and no owl specimens have been identified at Hoyle's Mouth. Typically barn owls and short-eared owls have diets dominated by field vole (Andrews, 1990; Yalden and Morris, 1990) and could be a potential agent for the remains identified at Hoyle's Mouth.

The *Chiroptera* (bat) remains would not have been present within the owl pellets. Bats inhabit caves and naturally accumulate within the cave deposits on death (Andrews, 1990). The fresh-looking specimens within the upper layers are potentially modern individuals that became incorporated into mixed deposits.

The suite of microfaunal species is typical of the Late Upper Palaeolithic, with field vole, Norway lemming, Arctic lemming and narrow-headed vole which are characteristic of this period, all being well-represented within the deposits (Yalden, 2010). Norway lemming and Arctic lemming are thought to have been present in the UK into the Windermere Interstadial dating to 14,700 – 12,890 cal BP (Yalden, 1982). tundra vole and bank vole. Narrow-headed voles are also typical of the Late Devensian and are believed to have become extinct prior to 9,000 BP (Coard and Chamberlain, 1999), indicating these deposits predate this event.

The presence of *Bufo calamita* (natterjack toad) within Trench 5, context 4 indicates that these deposits may date to around the Late Glacial Interstadial, which is when this species is thought to have appeared in the UK (Gleed-Owen, 1998). Typical dates of natterjack toad specimens within British archaeological sites range from around 12,000 – 9,000 BP (*ibid*). This provides a rough indication of the dating of this deposit and suggests that the overlying layers post-date this time.

Palaeoenvironmental evidence from south Wales suggests the Late Glacial warming may have started before 14,500, possibly up to 15,000 cal BP (Walker, *et al.* 2003, 511). The continued presence of the lemming species, in combination with low frequencies of species associated with slightly warmer temperatures (e.g. natterjack toad) indicates that these layers date to around the time of the Late Glacial interstadial.

Trench 6 context 13 has very small numbers of specimens but contains a similar faunal suite to contexts 16 and 19. Context 13 exhibits the first evidence of amphibian remains, indicating that the environment may have been moister at this time, with areas of marshy land or water suitable for both common frog and common toad. The continued presence of Arctic lemming and narrow-headed vole indicates that the environment was still cool, with areas of drier land providing habitats appropriate for bank vole to survive.

Trench 4 context 7 contained very few identifiable fragments, preventing a detailed reconstruction of the environment at this time. Common frog and common toad within the assemblage indicates that there must have been pools of water or marshy land present for breeding of both species, in addition to areas of grassland, hedgerows or forests suitable for the survival of field vole.

The large assemblages of identifiable microfaunal remains within Trench 5 context 5 indicate a cool environment, as demonstrated by the presence of Arctic lemming, Norway lemming and the small numbers of narrow-headed vole specimens, which preferentially inhabit cooler tundra environments. The environment was potentially wetter and more humid at this time with more of common frog and common toad within the microfaunal assemblage. Similarly, water voles are well-represented within the deposit, indicative of an area of water near the cave providing a habitat for this species. Within context 4 tundra vole, is present, although accounting for a smaller proportion of the assemblage than seen earlier in the sequence. Context 4 in Trench 5 contains natterjack toad specimens and may indicate a more saline, brackish or dune-based environment that this pioneer species is now able to occupy.

Almost all the wildfowl are fully or partially migratory at the present day, some species more markedly so than others. The barnacle goose and *Anser erythropus* (lesser white fronted goose) that are discussed in more detail in the paper on Little Hoyle (Peterson, *et al.* 2026 this volume), is known to arrive in western Europe only during the winter months. Shelduck, are only partially migratory in western Europe, moving to moulting grounds from

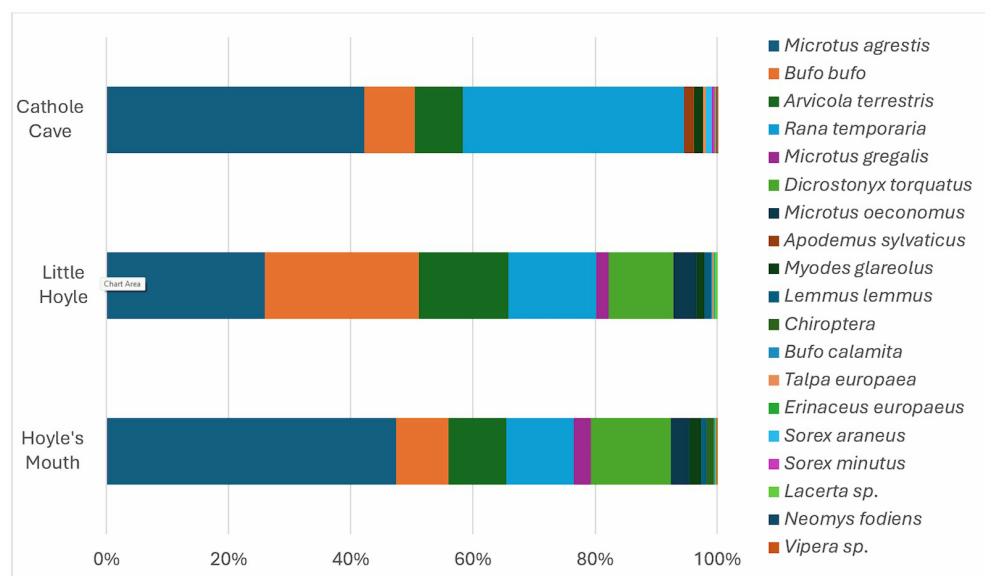


Figure 17. Comparison of microfauna NISP values between Upper Palaeolithic assemblages from south Wales caves.

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June onwards and returning any time from September onwards, with more northerly populations remaining in more southerly latitudes through the winter months. However, except for the mallard, the ducks, wigeon, pintail, teal and *Anas strepera* (gadwall), migrate north to breed in Iceland, Fennoscandia, the Baltic or Siberia and arrive in wintering sites during the autumn, having moved to moult areas during the latter part of the summer. The redshank is another winter visitor. The small number of passerine bird bones at Hoyle's Mouth provides little positive evidence of seasonal factors. Nevertheless, considerable numbers of thrushes, especially redwing, *Turdus pilaris* (fieldfare) and starling are found in many of the Late Glacial sites in south-west Britain. This is matched at the present day by the movements of these species often in very large flocks to milder areas during the winter months. Furthermore, there is a southerly drift of the regions of winter habitat for wildfowl and aquatic species during times of glacial advance that continues for a long time into its retreat. This has been found to be a drift of up to 500 kilometres or so and, for example, *Cygnus cygnus* (whooper swan), *Cygnus columbianus bewickii* (Bewick's swan) and other wildfowl that winter in north and north-west Europe at the present day have been identified on sites in southern and south-west France, dated to around 12,000 BP.

Present day bird migration patterns amongst these species suggest that seasonality is an important factor in their behaviour and hence exploitation. Of the geese, the lesser white fronted goose is currently found in northern Fennoscandia during the breeding season, moving to wintering sites mainly in continental Europe with increasing numbers coming to western Europe during the Autumn. Herons are largely resident in Britain at the present day, but more northern and continental populations disperse in a south-westerly drift in winter. The ducks have different patterns of migration in winter.

The other wetland species would have foraged along the edges and margins of open

water, like redshank and little ringed plover or among the grassy marshland beyond, like woodcock. The event of a possible tern species arriving in the valley would have been unusual but not unlikely as they are seen occasionally flying over inland waters.

Microfaunal records from two other Upper Palaeolithic south Wales cave sites were available for comparison: Little Hoyle Cave (Jones, 2015), and Cathole Cave, Gower (Walker, *et al.* 2014). The proportions of species identifiable to species at each of these sites is shown in Figure 17. The suite of microfaunal specimens identified at Hoyle's Mouth and Little Hoyle is consistent between these two caves and is typical of Late Upper Palaeolithic British deposits (Yalden, 2010). Both sites contain large quantities of field vole, common toad, water vole, common frog and Arctic lemming) which combine to account for 90% of both sites' total assemblage (Figure 17). Other key species include Norway lemming, narrow-headed vole and tundra vole. Limited numbers of natterjack toad and *Erinaceus europaeus* (European hedgehog) were identified, which are typically associated with climatic warming towards the end of the Late Glacial period. No shrews were identified at Hoyle's Mouth, whilst two *Sorex araneus* (common shrew) specimens were identified in the Little Hoyle assemblage. Given the proximity of these caves to each other, the similarity within the microfaunal deposits is expected, and both sites indicate a relatively cool, tundra environment, with bodies of water nearby to support large populations of common toad, water vole and common frog in the Late Glacial period.

In contrast Cathole Cave, Gower, exhibited a different suite of fauna to those observed at Hoyle's Mouth and Little Hoyle, with neither lemming species identified at the site, and without narrow-headed vole and tundra vole being present. Similarly, a greater variety of shrew specimens were identified at Cathole Cave including *Sorex minutus* (pygmy shrew), *Neomys fodiens* (water shrew) and *Apodemus sylvaticus* (wood mouse) more indicative of grassland environments, and shrub-based environments (Walker, *et al.* 2014), whereas Little Hoyle and Hoyle's Mouth have species indicative of cooler tundra environments. This suggests that there were localised environmental differences or temporal variations or oscillations in climate between these two regions during the Late Upper Palaeolithic in south Wales which enabled differences in local habitats.

The microfaunal assemblage appears to originate from around the time of the Late Glacial interstadial based on the presence of Late Glacial species including Norway lemming, Arctic lemming, narrow-headed vole and tundra vole. The presence of these species suggests a relatively cool, and potentially moist tundra environment in the vicinity of Hoyle's Mouth, as indicated by the lemming species, and narrow-headed vole, with a body of water, the Ritec, nearby supporting large populations of water vole and common toad. The microfaunal assemblage is typical of the suite of species expected in Upper Palaeolithic Britain, and mirrors the assemblage identified at nearby Little Hoyle.

The Hoyle's Mouth lithic assemblage comprises 477 artefacts. Of these, 166 have a stratigraphical record. The finds are distributed between Amgueddfa Cymru (157), Tenby Museum (247), Manchester Museum (51) and Bristol Museum (22) see Table 5 for the overall composition of this assemblage. The raw materials used would mostly have been available locally with flint either carried in as finished tools, or available from local glacial deposits. Other materials used are chert and a rhyolite which is frequently mentioned in the historic literature named as adinole. This material recently underwent detailed chemical analyses with most of the artefacts in the study recovered from Hoyle's Mouth, with examples from other south Wales sites selected for comparison. This work determined that it is in fact rhyolite of local Preseli origin and that the term adinole should not now be used in such an archaeological context (Bevins, *et al.* 2025).

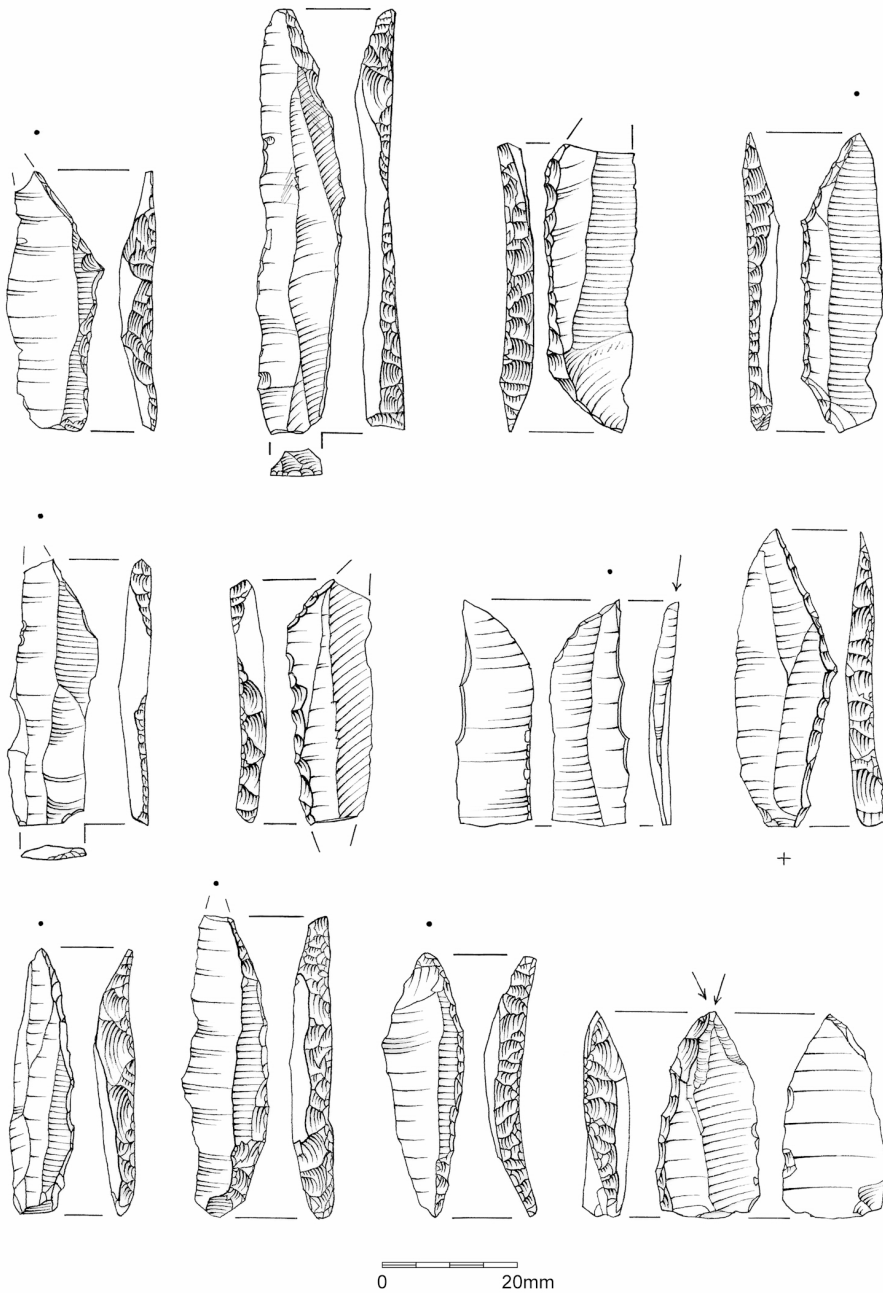


Figure 18. *Abruptly-backed blades from Hoyle's Mouth.*

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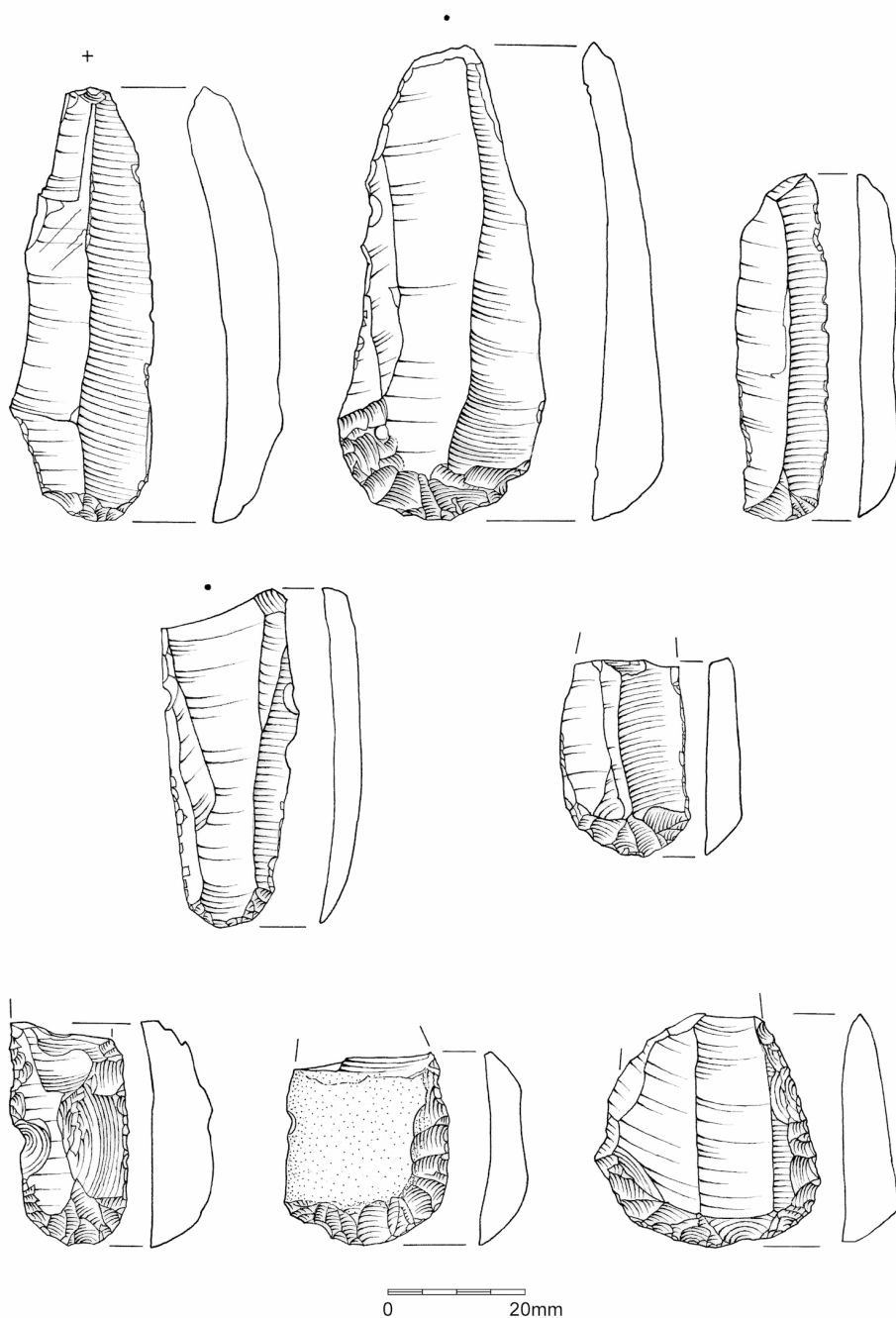


Figure 19. *Scrapers from Hoyle's Mouth.*
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The assemblage contains 32 abruptly-backed blades; seven Cheddar points of trapezoidal form with bi-truncation (Figure 18). There are six angle-backed points all of which have a single oblique truncation with backing of all or some of the lateral edge (Creswell points). Six of the tools have been classified here as convex-backed. These have continuous retouch running along one of the lateral lengths that takes a convex form. There is one straight-backed point, although it is possible because it is broken that it was a Creswell point. There are also several unclassifiable fragments that have abruptly-backed retouch, but which are too short in length and without defining features that would make them attributable to type.

There are 25 scrapers (Figure 19) amongst the Hoyle's Mouth assemblage and a further three tools that form an element of some composite tools. Eight of these scrapers are deemed to be of later prehistoric date due to their forms, the remaining 16 and three composites are all Upper Palaeolithic. Most of the Upper Palaeolithic pieces are made on blades, rather than on flakes. However, there are a few cortical flakes that have been used and which are considered to be of Upper Palaeolithic date. Sixteen of the scrapers are of Late Glacial date. Such scraper forms are typically longer than those of later age. In Wales, where the raw materials to make long blades are not available locally, the tools are generally far shorter and consequently stumper scrapers are commonplace. This makes them different from those recovered from sites in southern England where flint is more plentiful, resulting in longer blades with scrapers on the end.

Twelve burins have been recorded from Hoyle's Mouth (Figure 20). These are made on a broader range of raw materials than other tools in the assemblage. Two are made of rhyolite with one of a possible chert (David, 2007, 47) and the remaining ten are of flint. These comprise a range of forms, two are made on older backed blades. One burin has been reworked into a piercer of a form described by Roger Jacobi as a 'twist-drill' (Jacobi archive in the British Museum; David, 2007, 48). Other burins are of forms including burins on truncations and there is one composite tool of burin, piercer and scraper (HM424) made of rhyolite. One complex faceted burin is also present in the assemblage. Eleven burin spalls have been identified amongst the assemblage.

Three 'twist-drills' or borers are recorded, with a further three piercers, including the one described above (Figure 21). The three piercers all come from the nineteenth century work at the cave. Close parallels can be drawn between the Hoyle's Mouth assemblage and that from Gough's Cave, Cheddar, a point noted by Roger Jacobi (2004) and Andrew David (2007, 47). The tools at Hoyle's Mouth include four blades that demonstrate the *en éperon* butt form typical to such dated assemblages. The same suite of tools has been recorded at Gough's Cave and also at King Arthur's Cave (Parkin, *et al.* 1986; Jacobi and Higham, 2011). The toolkit is purposed towards the hunting of wild horses, which could have been the principal food resource for the Hoyle's Mouth people, in a landscape that was open and conducive for such species. Glimpses of the same tools are recorded elsewhere across south Wales. Cheddar points were recovered from Paviland Cave, Swansea (Swainston, 2000, 108–109); and from Nanna's Cave, Caldey Island (Walker, 2016, 13–14). The piercers from Hoyle's Mouth are identical in form to a surface find from Cophill Farm, Howick, Chepstow, which was associated with Late Glacial tools including long end-scrapers and a composite burin/scrapper (Walker, 2015, 115). Parallels have also been drawn between a piercer found at Carden Park, Cheshire (Morgan and Morgan, 2004; Walker, 2015, 115). The three 'twist-drills' were also all recovered during the historic work at the site (David, 2007, 22, fig. 2.22). At Little Hoyle the assemblage is also of interest and includes an abruptly-backed blade of a convex-backed bi-point form discovered in 1958 in Charles McBurney's excavations (McBurney, 1959, 269). Also recovered by McBurney was one long blade (19.3 mm) which is very similar to another blade (105.4 mm)

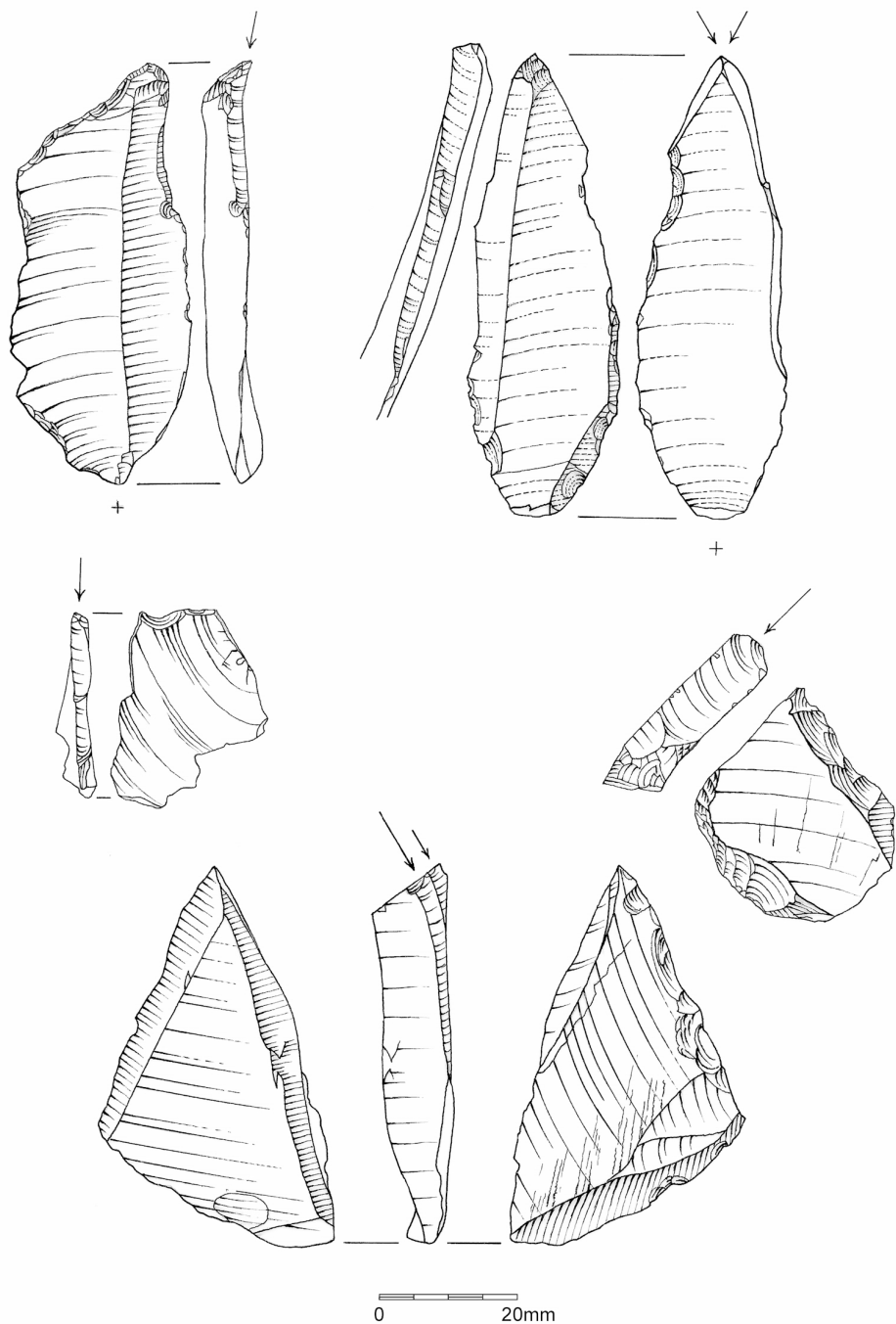


Figure 20. *Burins from Hoyle's Mouth.*
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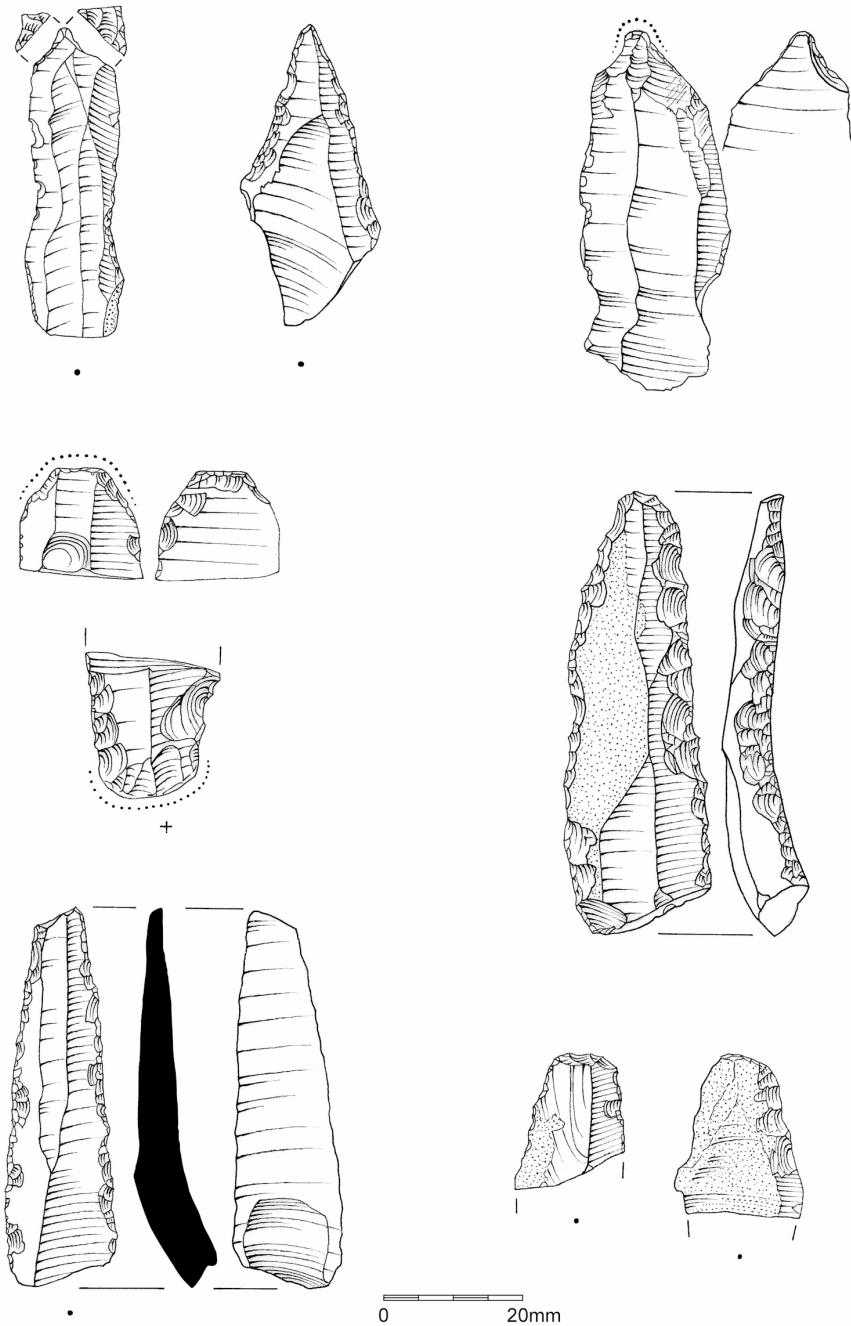


Figure 21. *Twist-drills and retouched pieces from Hoyle's Mouth.*

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originating from the 1877 excavations of Power and Laws, now in Tenby Museum. If Late Upper Palaeolithic, these blades may have formed part of a small cache, as there is no evidence that they were manufactured at Little Hoyle (David, 1991, 152; Walker, 2016, 12; and see Peterson *et al.* 2026 this volume). The Little Hoyle abruptly-backed blade is likely to be contemporary with the Hoyle's Mouth assemblage.

Some of the fauna recovered from Hoyle's Mouth dates to a slightly later period, a time when there appears to be a break in the record for wild horse and a major expansion of birch woodland (Jacobi and Higham, 2011). The red deer became the main prey species, this being common in dense woodland. Other caves in the vicinity of Hoyle's Mouth have produced penknife points, the tool typically associated with the *federmessergruppen*, including Priory Farm Cave (Grimes and Cowley, 1933; Walker, 2016, 16) and Potter's Cave, Caldey Island (Green and Walker, 1991, 67; Walker, 2016, 15). Such penknife points have not been recorded amongst the Hoyle's Mouth lithic assemblage.

Lynx Cave, Denbighshire, has evidence for Late Glacial butchery, including marrow extraction from bones of reindeer and *Bos primigenius* (aurochs). The dating of these and a Magdalenian style bone point have provided results of both the Allerød period and Late Allerød/early Younger Dryas (Currant and Jacobi, 2011; Blore, 2012; Stevens, *et al.* 2021). The associated tools include abruptly-backed points of predominantly Creswellian or an early variant of *federmesser* industries (Stevens, *et al.* 2021, 591). These are therefore of a later date than the majority of the Hoyle's Mouth Cave assemblage. However, the detailed isotopic analysis of faunal remains from this site indicates clusters of species in both the Allerød (red deer, elk and aurochs) and the Late Allerød/early Younger Dryas of reindeer. Whilst the Hoyle's Mouth assemblage does not contain any of these distinctive penknife points, a bear pisiform from Trench 6, context 5 is dated (OxA-6230; HM2023; 13,522 – 13,328 cal BP; 81.7%; Table 1) which may indicate the presence of brown bear in the vicinity of the cave at this time. This specimen is, however, unmodified, and therefore cannot be related directly to human activity in the cave. The date instead provides a useful indicator of the possible age of the deposits and may provide an indication of a Final Palaeolithic faunal use of the cave.

Holocene

A very cold stadial, the Younger Dryas, took place right at the end of the last Glacial. This lasted approximately 12,890 to 11,700 cal BP and it is a time for which there is no evidence to suggest that people were present in the British Isles. It was so cold with glaciers forming in upland areas that people followed the food south into adjoining continental regions (Dinnis and Stringer, 2013, 137).

The early Holocene, known archaeologically as the Early Mesolithic period, is dominated by a very different technology with blades struck from small cores modified into tools such as microliths and scrapers. The Hoyle's Mouth excavations show that such finds have been recovered from the Entrance Chamber from which two Early Mesolithic microliths of obliquely-blunted form were found in Trench 3. Early Mesolithic tools are also recorded amongst the historic collection in Tenby Museum. An Early Mesolithic microlith of scalene triangle form, a Mesolithic truncated blade, burin and convex scraper are all marked Hoyle Field. In 1996 it was decided to explore the ridge directly above Hoyle's Mouth. The main research question was to establish if there could be a Palaeolithic knapping floor on the ridge above the cave. What was discovered was not Palaeolithic, but a Mesolithic knapping floor (see Figure 5 trenches marked as HC2 and HC3). These ridge excavations, known as Hoyle's Cottage site, generated 1,133 worked lithic artefacts from the excavation of test-pits (Table 9).

This assemblage, Mesolithic in age, is a mix of both early and later Mesolithic finds. The early Mesolithic finds include two microliths; one a large obliquely-blunted point and a straight-backed point, also present is a tranchet flake from sharpening a Mesolithic adze or axe, a tool which is generally thought to be of early Mesolithic age in Wales (David and Walker, 2004, 309). Two later Mesolithic microliths one a large obliquely-blunted point and a straight-backed point are present. This presence is matched by finds from within the cave Entrance Chamber below where one later Mesolithic microlith fragment was recovered along with a quantity of later Mesolithic bladelet and scalar cores.

Table 9. *Hoyle's Cottage Mesolithic site. Composition of the lithic artefact assemblage.*

<i>Object Name</i>	<i>Number</i>
Microliths	13
Microdenticulates	2
Microburins	3
Scrapers	11
Knife	1
Burin	1
Tranchet sharpening flake	1
Retouched pieces	4
Utilised piece	1
Cores	15
Core rejuvenation pieces	11
Flakes and flake fragments	319
Blades and blade fragments	420
Spalls	192
General knapping debitage	139
	1133

Such assemblages, particularly of microliths are generally associated with the hunting of game. As the woodland spread and developed over Wales during the later Mesolithic these people, often associated with hunting, gathering and fishing, would have used such tools as armatures in their spears or harpoons. As the Mesolithic gave way to the start of the Neolithic we see a change in human habitation practices.

The remains of domestic cattle, domestic pig and sheep recovered from Hoyle's Mouth clearly have a post-glacial origin as these domesticated species are unknown in Britain before the Neolithic period. It is also quite possible that the cave continued to be used as a den by foxes which might account for the remains of foetal/neonatal sheep and pig deep inside the cave in the Bear Chamber. However, as the assemblage of post-glacial origin is mainly from

Table 10. *Human remains from Hoyle's Mouth.*

<i>Accession No.</i>	<i>Trench & Context</i>	<i>Element</i>	<i>Side</i>	<i>P fusion</i>	<i>D fusion</i>	<i>Taphonomy</i>	<i>Comments</i>
2002.27H/18.2	Section B surface	Lower incisor 2	Left			Acid erosion	Hypoplasia 3.2mm from CEJ
86.91H/2.HM99	T1 (2)	Foot phalanx 1		Fused			
86.91H/2.HM104	T1 (2)	Foot phalanx 1		Fused			
2002.27H/6	N. extension	Hand phalanx		Fused			
2002.27H/18.3	Section B surface	Thoracic		Fused			
88.190H	Unstrat.	Upper 1 st incisor	Right				
90.64H/2.HM1083	T3 (2)	Hand phalanx 1		Unfused			
90.64H/2.HM878	T3 (2)	Foot phalanx 1				Canid gnawing	
90.64H/2.HM932	T3 (2)	Metatarsal				Canid gnawing	MT 2 or 3
90.64H/2.HM501	T3 (4)	Rib	Right				
90.64H/2.HM1117	T3 (2)	Hand phalanx 1		Fused		Weathering	
90.64H/2.HM767	T3 (1)	Lower incisor 1	Right				
90.64H/2.HM573	T3 (2)	Lower canine	Right				Calculus
2002.27H/1.2		Patella	Right				
2002.27H/1.3		Radius	Left		Fusing	Fresh fracture	Likely same as below
2002.27H/1.4		Radius	Left	Fused		Fresh fracture	Likely same as above
2002.27H/1.1		Humerus	Right			Gnawing, weathering, dry fracture	
2002.27H/26	Section B	Metacarpal 1	Left				Dated OxA-6232
2002.27H/7.1	Section A unstrat	Upper 2 nd incisor	?				
2002.27H/15.1	Section A (E. end)	Metacarpal					
2002.27H/15.2	Section A (E. end)	Rib	Left				
2002.27H/15.3	Section A (E. end)	Rib	Right			Mould staining	
2002.27H/12.6	Section A (E. end)	Hand phalanx 1				Concretions	
2002.27H/12.4	Section A (E. end) unstrat.	Clavicle	Right		Unfused		
2002.27H/12.1	Section A	Metatacarpal 1	Right				Dated OxA-6231
2002.27H/12.2	Section B	Metatarsal 2	Left				

<i>Accession No.</i>	<i>Trench & Context</i>	<i>Element</i>	<i>Side</i>	<i>P fusion</i>	<i>D fusion</i>	<i>Taphonomy</i>	<i>Comments</i>
2002.27H/12.3	Section A (E. end)	Metatarsal 2	Left	Fused			
2002.27H/12.5	Section A (E. end)	Humerus	Right			Canid gnawing, mould staining, dry fracture	Straight dry chop through distal end (post-depositional)
TENBM:1983:2616:01		Clavicle	Right			Gnawing - rodent	
TENBM:1983:2616:02		Fibula	Left				
TENBM:1983:2616:03		Radius	Left				
TENBM:1983:2616:04		Clavicle	Left				
TENBM:1983:2616:06		Metacarpal 3	Right				
TENBM:1983:2616:07		Trapezium	Left				
TENBM:1983:2616:09		Metatarsal 1	Right				

undated or disturbed contexts consequently it is not possible to elucidate depositional history or the nature of subsistence practices in more recent chronological periods.

The dating of a cut-marked deer phalanx (HM877, 5,466 – 5,297 cal BP; 95.4%; OxA-33909; Table 1) may indicate a slightly earlier use of the cave in the Holocene, as this comes from a cut-marked deer bone which is older than either of the two dates obtained on human bones.

Cut-marks on a few of the sheep bones provide a clear indication that some of the material is the result of human interaction. However, it is also possible that much of the material was brought to the cave by scavenging carnivores, particularly foxes. It is only possible to say with certainty, that cattle, sheep, pig and rabbit are all present and judging by the recovery of bones belonging to foetal and/or neonatal animals, that sheep and pigs were raised in the vicinity of Hoyle's Mouth. That said, the ageing data available for sheep is interesting in that almost all the specimens derive from animals culled are between 6–12 months or over 3 years. Given the consistency in the data, it would not be surprising if the assemblage originated from a single period of prehistory or history with young animals slaughtered for meat to avoid over-wintering and older animals slaughtered at an age when they would have already provided a few clips of wool and other secondary products such as manure and possibly milk. However, in the absence of dated, stratified material this must remain purely speculative.

The burrowing habits of foxes, badgers and rabbits may have been responsible for some of the mixing that is evident in the deposits within the cave. It follows that some of the bones belonging to these animals may be present as the result of natural casualty.

The human remains recovered from the cave comprised 35 elements for which radio-carbon dates have been obtained on two bones, both with Neolithic results (Table 1). For the purpose of estimating how many individuals are present the site is treated whole, and it is assumed that remains of an individual could derive from multiple contexts. No articulations were observed. Taphonomy was not considered in assessing the minimum number of individuals, as different parts of the same skeleton could have been subject to very different taphonomic

trajectories and instead element representation and fusion information were used to calculate the minimum number of individuals. This small, commingled assemblage comprises a minimum of two individuals (evidenced by two distal right humeri and two left 2nd metatarsals). One individual is an older teenager aged 17–19 at death. Fusion evidence indicates that this individual was yet to reach full skeletal maturity and an unfused lateral clavicle, unfused proximal hand phalanx and fusing distal radius may all derive from this individual. The second individual was an adult who had reached skeletal maturity (on the basis of available evidence) and was at least 18 years of age (based on fully fused phalanges and metapodia). None of the teeth present patterns of attrition that are inconsistent with these age categories. It must be stressed that this represents the minimum number of individuals, for it is, however, certainly plausible that several more individuals are represented, though none can be confidently identified osteologically. Nor can most of the remains be assigned to one or other individual, as most have no fusion information. The teeth, humeri, ribs, patella, and vertebra could belong to either individual (or indeed to different individuals altogether). No useful evidence for sex estimation was present in the assemblage (Table 10).

The element representation is unusual, with bones of the extremities dominating. This hints at selective retrieval and/or deposition of certain elements as part of a secondary burial rite (Peterson, 2019, 57–58). Taphonomic analysis indicates a complex depositional trajectory of the remains including being affected by scavengers, weathering and post-depositional disturbance, potentially including intentional sharp force post-depositional damage. The interpretative potential of the material is limited though it makes a valuable contribution to the substantial corpus of human remains from caves in Wales, particularly as later Neolithic dates are relatively uncommon for these deposits. The deposition of human remains in caves forms a significant part of funerary practice in the earlier 4th millennium BC in Britain and more widely in north-west Europe (Peterson, 2019). However, there are currently only three sites with 3rd millennium dates from south Wales. It has been suggested that later Neolithic cave burial usually took place deep within cave systems and was likely to involve the successive inhumation of bodies over a long period of time (*ibid.*, 182). However, the location and taphonomy of human remains from caves in south Wales suggests that practices at this date were more varied.

At Ifton Quarry in Monmouthshire (Schulting, 2020, 26) there is a single Late Neolithic date on a cranium. This bone is part of an assemblage of at least six individuals all of which seem to have been placed in the daylight zone of the cave in a successive inhumation rite (Knowles, 1911, 9). However, the majority of the human remains from this site appear to date much earlier, to the Middle Neolithic. At Spurge Hole, Gower an apparent single extended inhumation was shown by osteological analysis to be a curated composite individual. Radiocarbon dating of the different elements of this burial show that the most recent element dated to the Late Neolithic, which is presumably when the human remains were deposited for their final burial (Konstantinidi, 2023, 130). At Ogof Brân Goesgoch, in Pembrokeshire (*ibid.*, 125), three skeletal elements from two different individuals were recovered under salvage conditions, one of which has been radiocarbon dated to this period. In summary, the caves of south Wales, including Hoyle's Mouth, show a more varied range of burial practice in the Late Neolithic than is usual in other regions at this date. Rather than being dominated by evidence for successive inhumation deep within caves, most of the evidence points to different kinds of secondary burial practice having taken place in the daylight zone.

Associated with the Neolithic people are a quantity of stone tools. A typical mixed surface assemblage was recorded from the ridge above the cave including Neolithic and Early Bronze Age tools as well as general undiagnostic material allocated a prehistoric date. These artefacts were found across a wide area and so unsurprisingly represent a wide range of dates.

None of these finds have good provenances and none have archaeological contexts. Other finds, from the ridge originate from McBurney's investigation and include a thumbnail scraper of possible Neolithic or Early Bronze Age date. Recovered from the cave Entrance Chamber were a Neolithic scraper from Savory's excavations (Savory, 1973, 26), a flake from a Neolithic polished stone axehead, a mid-Neolithic chisel arrowhead and a barbed and tanged arrowhead, none of which were securely stratified. All of the lithics from the cave entrance could be broadly contemporary with the dates for the human remains.

CONCLUSIONS

Hoyle's Mouth, like so many Welsh caves, experienced a long history of excavation before an understanding of cave stratigraphy and the application of scientific techniques in archaeology were commonplace. This paper has sought to place Hoyle's Mouth into the wider context of a current understanding of changing environment and climate as well as the human presence throughout Welsh prehistory. Part of the study, along with the excavations at Little Hoyle, set out to correlate the sequences documented at both caves and to provide a context for finds at Hoyle's Mouth (Aldhouse-Green, 1996).

This work demonstrates that Hoyle's Mouth is a cave of some significance, given the quantity of artefacts and faunal remains recovered. The cave lay just beyond the extent of the ice sheets of the Last Glacial Maximum and so survived many of the ravages of this extreme climate. The archive available enables a picture to be drawn of the prehistoric faunal and human uses of this cave.

The oldest deposits recorded in Hoyle's Mouth were stalagmites. These form under mild climatic conditions, and at Hoyle's Mouth date back to the Last Interglacial as early as 115,000 BP (HM2255). No evidence for an associated fauna has been found, which typically might include *Hippopotamus amphibius* (hippopotamus) and *Palaeoloxodon antiquus* (straight-tusked elephant). Humans are not thought to have been present in Britain at this time (Dinnis and Stringer, 2013, 87). There is later evidence for a growth of stalagmite in both Hoyle's Mouth and Little Hoyle between c. 60 to 50,000 years ago (HM127; NC212). This period would have seen very late Neanderthals in south Wales evidenced by the distinct *bout coupé* handaxes found at Coygan Cave, Laugharne, Carmarthenshire (Aldhouse-Green, *et al.* 1995).

The oldest sediments in both Hoyle's Mouth and Little Hoyle contain animal bones. At Hoyle's Mouth these include woolly rhinoceros and spotted hyaena and we see a hint that people were present. This Aurignacian presence, based on the *burin busquée* at Hoyle's Mouth, is slim, but fits with the thinking that the Aurignacian presence was little more than a very brief visit by such hunters to the country (Pettitt, 2008, 29). Perhaps they took a brief period of shelter whilst on a hunting expedition from Paviland Cave or another site in south Wales. This glimpse, when linked with similar hints from single, or small groups of tools from other south Welsh caves cumulatively adds to a picture of a very sparse population in Wales at this time.

A deposit of wind-blown silts and fine sand (loess and coversand; HM414; HM411; HM412) dated by thermoluminescence at Hoyle's Mouth 25,000 – 18,000 BP (Last Glacial Maximum; Table 3) a period for which there is little faunal evidence. At Little Hoyle dates on barnacle goose suggest a faunal presence in the vicinity of the cave, perhaps reliant on local conditions in the Ritec valley. The presence of such geese indicate intensely cold conditions locally at this time.

Overlying these dated silts are areas of frost-shattered rock, the breccias of Hoyle's Mouth. Most of the finds from Hoyle's Mouth come from these deposits. They are Late Upper

Palaeolithic in age, when it is reasonable to suggest that this was a cave of some importance. The smaller numbers of contemporary stone tools recovered from other caves such as Paviland Cave, Little Hoyle and Nanna's Cave, mark Hoyle's Mouth out as being a primary campsite. The quantity of tools recovered suggest that multiple activities were carried out here and tools were manufactured. The abruptly-backed points are perhaps hunting armatures, knives or blades. The scrapers, burins and piercers all served functions alongside tools of other materials made of bone, wood, leather, plant or other organic remains which have not survived. The similarities that can be drawn between the finds at Hoyle's Mouth and those across what was, at the time, a drier land Bristol Channel coastal plain to Gough's Cave, Cheddar, Somerset have already been noted (Jacobi, 2004).

Of interest is the discovery of artefacts found well beyond the daylight zone in the Bear and Reindeer Chambers. These hint at the possibility of ritual activity or of shelter for security deep in the cave (Aldhouse-Green, 1996). Circumstantial evidence would perhaps tend to favour the latter interpretation. But the presence of a stratified burin spall deep within the Reindeer Chamber may be indicative of the use of the cave for spiritual purposes. Burins may have been used for engraving, and if any cave in Wales may have been used in such a way, then Hoyle's Mouth, like Cathole Cave would be the place (Nash, *et al.* 2012; Nash, 2015). However, so far as has been established to date, no rock art (if ever present) would survive in the Reindeer Chamber due to Late Glacial exfoliation of the rock. The absence of any worked bones, or any other portable art, also limits how we may interpret this area of the cave. The mystic concept of exploring deep into the cave is as valid today as it was in prehistory. Heading along the sometimes narrow, low passage leads into the unknown. But once at the rear of the cave lies a chamber which opens into a space where people can stand and revel in the journey into this area of darkness. So, if Late Upper Palaeolithic people wanted a place of sacred significance it is not unreasonable that this is exactly where they would have gone, perhaps taking with them some stone tools, or possibly even pigments to make marks on the limestone walls and along the way, perhaps to resharpen their burin by removing a spall from their tool. The significance of a dark mystical space at the rear of the cave therefore might offer some insight into what people may have been thinking here but leaves a certain interpretation for these tools deep within the darkness zone of the cave enigmatic.

This one stratified tool found deep in the cave, along with other tools now unknown (but marked on Jones' plan) contrasts with the fact that most of the artefactual finds came from a breccia deposit in the Recess area of the Entrance Chamber. This prompted comment by the Rev. Gilbert Smith that "the fabricator might be supposed to have seated himself [here] to take advantage of the light" (Smith, 1863, 48). The recovery of a concentration of finds from this limited area of the cave entrance may be explained by one or more knapping events of the kind envisaged by Smith.

The fact that later Upper Palaeolithic hunters chose not to utilise this cave later in the Allerød is also interesting, given that penknife points have been recovered locally from Potter's Cave, Caldey Island and at Priory Farm Cave, Monkton, Pembroke (Walker, 2016, 15–16). Interest moved elsewhere, or as has been suggested by the fauna, possibly carnivores had established their dens in the cave to the exclusion of any humans (Ingrem, 2015). Housley (1991, 27) has also observed a possible dichotomy during the Late Glacial Interstadial (14,010 – 12,890 BP) between settlement patterns in the first open-landscape phase when most finds seemed to come from caves, and the later forested phase when people had open-air settlements. Given the apparent correlation between cave sites/open-landscape and open sites/forest it may be plausible to interpret the selection of caves by Palaeolithic hunters as indicative of a desire both for a secure and secluded habitation, or vantage point, in preference to an exposed

campsite on the open plains. The location of Hoyle's Mouth overlooking the Ritec valley makes it an ideal lookout place to observe herds of game as they wander along this plain for water and food. One radiocarbon date on Arctic lemming (13,893 – 13,501 cal BP; 82.4%; HM 2422; OxA-6228; Table 1) might hint at the brief climatic deterioration of the Younger Dryas when we see no evidence for people in Britain.

In the early post-glacial period people continued to utilise caves. An extensive knapping floor has been identified on the ridge above Hoyle's Mouth at the Hoyle's Cottage site. Here, the implement types recovered reflect a range of activities and, probably also, span across several thousand years of the Mesolithic. Of note was a resharpening flake from the blade of a tranchet axe or adze (of fine silicic tuff), microliths of both early and later forms were used as arrow barbs or tips, and scrapers for preparing hides for possible use in clothing.

The brief uses of the cave by Mesolithic people represents one of a network of sites dating to such times and we see similarities with this settlement and the more extensive Mesolithic settlement at Daylight Rock, Caldey Island (David, 2007, 69). Together, with the same absence of humanly-modified bone and indeed organic preservation of such age we again only gain a glimpse of past activity here from the stone tools.

Finally in the Neolithic period both Little Hoyle and Hoyle's Mouth caves were used as ossuaries by early farming communities. No fewer than 11 people were buried at Little Hoyle with dates centring on 4,750 BP. Here, the burials may relate to a contemporary Neolithic settlement on the hill above and are part of a wider European tradition of burial in caves at this date. The presence of at least two burials at Hoyle's Mouth 500 years later in the Late Neolithic, around 4,250 BP, is important because of the relative scarcity of cave burials at this date. Within south Wales, and more generally across the UK, Late Neolithic cave burials are not well recognised, and Hoyle's Mouth provides important evidence for the variety of practices which may have existed at this date.

The depth of time use represented at Hoyle's Mouth, like Little Hoyle has added to our knowledge and understanding of these places in prehistory. Whilst the current research is now complete, this report demonstrates that there is potential for further future study of the fauna using modern isotopic and other scientific techniques, as well as new dating techniques to tidy up some of the unanswered questions about the dating and human use of Hoyle's Mouth presented here.

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APPENDICIES

Appendices 1-4 are available online from the links given below:

Appendix 1: Sediment data from the Hoyle Caves.

https://ubss.org.uk/resources/procsupplement/30_2_73-131_appendix_1.xlsx

Appendix 2: The Large Mammal Remains.

https://ubss.org.uk/resources/procsupplement/30_2_73-131_appendix_2.pdf

Appendix 3: The Large Mammal Remains: Tables.

https://ubss.org.uk/resources/procsupplement/30_2_73-131_appendix_3.xlsx

Appendix 4: The Evidence of the Bird Remains.

https://ubss.org.uk/resources/procsupplement/30_2_73-131_appendix_4.pdf

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