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

APPENDIX 2: THE LARGE MAMMAL REMAINS

by

CLAIRE INGREM

A significant assemblage of animal bone was recovered from Hoyle's Mouth cave during excavations carried out in the 20th century, principally by Professor Stephen Aldhouse-Green in 1986, 1990 and 1996 on behalf of the National Museum of Wales. A smaller assemblage of bone was previously recovered by Savory (Savory, 1973) during work just outside and in the entrance area during 1968 and this material is also considered in this report. Of the more recent excavations, that carried out in 1986 consisted of two trenches (1 and 2) located in the Entrance Chamber and Recess which confirmed Savory's (1973) conclusion that surviving deposits in this area were scarce. Work in 1990 and 1996 provided an opportunity to further investigate the Entrance Chamber and Recess (Trench 3) as well as the East Fissure (Trench 4), the Bear Chamber (Trench 5) and the Reindeer Chamber (Trench 6). The recovery of flint artefacts combined with stratigraphic evidence and dates obtained from radiocarbon, uranium series and thermoluminescence dating indicates that the deposits span the Late Devensian through to the Post-glacial period.

Hoyle's Mouth was also the subject of earlier investigations during the 19th Century commencing in 1840 with work by Col. Jervis, followed by Rev. Smith (1863), Rev. Winwood (1865), Dawkins (1874) and Jones (1992). There is no surviving account of the earliest work by Jervis although reference is made to it on a site plan made by Jones and preserved in the Tenby Museum. The various accounts relating to the other excavations mention the recovery of animal remains but other than a few unstratified specimens displayed in Tenby Museum, their whereabouts is unknown.

1. Methodology

Anatomical elements were identified to species or family level where possible using the authors personal reference collection, comparative material in the collection at Taunton Museum and various identification atlases (Lavocat, 1966; Pales and Lambert, 1971; Schmit, 1972). In addition, comments and advice regarding the identification of hyaena pelvis fragments was given by Professor Danielle Shreve. As a result of the small size of much of the material many specimens could not be identified with total certainty. This is particularly the case with bones belonging to closely related species such as members of the deer, fox and lagomorph families as their morphological similarities renders identification to species level extremely difficult. Unidentifiable specimens were assigned to animal size categories where possible. Mandibles and limb bones were recorded using the zonal method developed by Ingrem (2009) to allow the calculation of the minimum number of elements (MNE) and individuals (MNI); this is based on the most numerous zone of a single element taking into account side. In addition, all bone fragments over 10 mm in the hand recorded material and over 2 mm in the sieved samples were recorded to species or size category to produce a basic fragment count of the Number of Identified Specimens (NISP).

Evidence of burning, gnawing and butchery were recorded along with the agents considered responsible. Other surface modifications such as root damage and colour were also recorded. In respect of limb bones, the proportion of the circumference and length of the bone present was noted as well as the characteristics necessary to allow the calculation of the fracture freshness index devised by Outram (2001).

Measurements were taken according to the conventions of von den Driesch (1976) for mammals and are listed in Appendix 3 Table 11. The wear stages of the lower cheek teeth of cattle, sheep and pig were recorded using the method proposed by Grant (1982) and age attributed according to the method devised by Legge (1982), Payne (1973) and O'Connor (1988). The fusion stage of post-cranial bones was recorded and age ranges estimated according to Getty (1975) for domestic animals. The wear on teeth belonging to fox, brown bear (*Ursus arctos*) and hyaena (*Crocuta crocuta*) was recorded and age estimated following the criteria of Stiner (1994). The method of Lowe (1967) was used to estimate the age of red/giant (*Cervus elaphus/Megaloceros giganteus*) deer teeth and also to provide some indication of relative wear on specimens tentatively identified as reindeer (see below).

A selected suite of elements was used to differentiate between sheep and goat (Boessneck, 1969, Payne 1985): the distal humerus, proximal radius, distal metapodials, astragalus, calcaneus and deciduous fourth premolar. No elements were positively identified to goat so for the purposes of this report the caprine remains are generally referred to as sheep. Lagomorphs were assigned to taxa/species following the criteria of Callou (1997) and Lavocat (1966). Cat and fox were assigned to species according to size and by comparison with modern reference specimens. In respect of foxes, measurements taken on teeth were also compared with those published for arctic fox (*Alopex lagopus*) and red fox (*Vulpes vulpes*) by Compagnoni, *et al*. (1997).

A reliable method that allows the teeth of reindeer (*Rangifer tarandus*), red deer (*Cervus elaphus*) and giant deer (*Megaloceros giganteus*) to be differentiated according to morphology does not exist; however it was possible to tentatively assign some specimens to reindeer on the basis of overall size and buccolingual width (Hillson,1986). Where this was not possible, deer remains are categorised simple as *Cervidae spp*.

The data includes several specimens currently on loan to the museum at Tenby and for these it was only possible to record information regarding species and element.

2. Data

The assemblage of animal bone examined for this report consists of a total of 1,046 specimens of which 830 (79%) are identifiable (Table 1a). A wide range of taxa is represented but most of the identifiable remains belong to either sheep (39%) or fox (24%) with both arctic fox and red fox present. In addition to the remains of arctic fox, several other animals that are no longer present in southern Britain are represented and these include:- wolf (*Canis lupus*), brown bear, spotted hyaena, woolly rhinoceros (*Coelodonta antiquitatis*), reindeer and arctic hare (*Lepus timidus*).

The sample of identifiable remains recovered from deposits assigned to the Late Glacial consists of 208 specimens with a further 19 pieces recovered from probable Late Glacial contexts.

The presence of bones belonging to modern domestic animals such as cattle, sheep and pig in some dated (and in some cases presumed stratified) contexts indicates the disturbed/mixed nature of these deposits.

Table 1a includes a small number of specimens that were recovered by sieving and for comparative purposes these are shown in Table 1b. For all tables, see Appendix 3.

2.1. Late Glacial deposits

11-10 ka BP

The deposits from Unit EIII in the Entrance Chamber, Unit BIV in the Bear Chamber and Units RII and RIII in the Reindeer Chamber have been dated to 11-10 ka BP and consist of 114 identifiable specimens (Tables 1a and 2i).

Unit EIII produced the largest sample but sheep, pig, and rabbit (*Oryctolagus cuniculus*) comprise almost half the remains with sheep the most numerous taxa (n=18). Red fox is also well represented and arctic hare is present. Horse, reindeer, bos/bison and hare are also present. Most specimens are from the extremities (head and feet) but a humerus and ulna belongs to red fox and a pelvis to deer. A few limb bones also belong to sheep and rabbit (Table 3ai).

The deposits from Units BIV in the Bear Chamber produced just three identifiable specimens: a red fox metacarpal, a fox premolar and a bear 2nd phalanx (Table 3aii).

Units RII and RIII in the Reindeer Chamber produced 55 identifiable specimens. The sample includes bones belonging to red fox, spotted hyaena, brown bear, brown hare (*Lepus europaeus*) and arctic hare. Unit RII produced the larger of the two samples (n=44) (Table 2i) and this is comprised predominantly of fox and hare bones. One of the fox remains is a major limb - a humerus, the other specimens are from the head or feet (Table 3iii). A hyaena molar and a bear canine also came from this unit. A tibia and humerus belong to hare but the other hare remains are from the head and feet. The small sample from Unit RIII contains red fox, bear and hare. With the exception of a fox and lagomorph vertebrae, all the remains are loose teeth or podial bones (Table 3iv).

The presence of modern domestic mammals in Unit EIII in the Entrance area indicates that the deposit has suffered disturbance and mixing. The only anomalous specimen in the layers recovered from the Bear and Reindeer Chambers discussed above, is a hyaena tooth (SF 2607) which came from Unit RII (Layer 15) which may be derived from earlier deposits. Other than this, the range of taxa present in the latter 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.

25-15 ka BP

Seven identifiable specimens were recovered from the basal silts (Unit EIV) in the Entrance area believed to date to 25-15 ka BP (Table 1a, 2ii). Single specimens belong to fox, bear, badger (*Meles meles*) and reindeer. A piece of reindeer antler produced a radiocarbon date of 26,500+/-550 BP but other than this all the remains are loose teeth (Table 3b).

The assemblage recovered by Savory in 1968 from the Entrance Chamber is comprised predominantly of unstratified modern domestic taxa as a result of disturbance and the re-deposition of material in the higher levels (Savory, 1973; 20). However, according to the 1973 publication (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 (n.d.) noted that information given in the catalogue entries (Savory, 1973:32) differ somewhat, with the two fragments of hyaena pelvis listed as being derived from an undisturbed sandy silt bottom layer (assigned as 'g' by Aldhouse-Green, n.d.), a bear canine from clean sand (also 'g') 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 (Unit EIV) excavated by Aldhouse-Green (Aldhouse-Green *pers. comm*.) and discussed above.

Late Glacial

Layer 5 in the Bear Chamber and Layers 3 and 5 in the Reindeer Chamber also have a Late Glacial origin and together produced 86 identifiable specimens.

The majority of the material (n=80) is from Layer 5 in the Bear Chamber and more than half belongs to fox with both arctic and red fox represented. Most of the fox remains are once again derived from the head or feet although three pieces of radius and two fragments of ulna are present (Table 3bii). 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 Layer 5 deposits (5, 5c, 5d and 5e) indicates that some mixing has taken place.

Several other taxa are present including badger which is represented by an atlas. 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 belong to rabbit.

Two specimens came from Layer 5 in the Reindeer Chamber: a fox canine and a bear pisiform. The latter produced a date of 12,220+/-130 ka BP. Layer 3 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.

Unit IV in the Reindeer Chamber is also probably of Late Glacial date. The sample of mammal bone is small but there is nothing to suggest that the deposit is anything other than late glacial 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 (Table 3c iv).

Minimum number of individuals

The material from all the late glacial deposits has been combined for the purposes of calculating the minimum number of individuals. This method of quantification is not generally appropriate for use on small samples due to its propensity to exaggerate the relative frequency of the least common taxa (Lyman, 1994). However, it has been included here for comparative purposes.

Due to the small size of the samples it has been necessary to combine the data for all fox and all hare remains in order to include those specimens not identifiable to one species (Table 1c). This suggests that a minimum of four foxes and one hare are represented by the bones. A consideration of element representation including loose teeth confirms this and also indicates that horse, bear, badger, hyaena, and reindeer are all represented by a minimum of just one individual.

Ageing data

A few teeth from the contexts discussed above provide ageing data (Table 4i) but unfortunately most is from deposits that have suffered mixing. In the Entrance Chamber, Unit EIII produced two juvenile and one adult red fox molar(s), an immature horse tooth and an adult reindeer tooth. In the Bear Chamber, Late Glacial deposits produced a molar belonging to a prime aged fox whilst loose teeth found in the Reindeer Chamber provide evidence for prime age/old hyaena and an adult bear.

A few bones with unfused epiphyses provide additional evidence for juvenile animals (Table 4bi). Late Glacial deposits in the Bear Chamber produced an unfused reindeer 1st phalanx, a distally unfused deer tibia and an unfused deer calcaneus. The material from Unit II in the Reindeer Chamber included an unfused fox/hare distal metapodial and Unit IV an unfused bear proximal 2nd phalanx.

2.2 Post glacial

The samples from Units EI and EII are of post-glacial date and comprise sixteen specimens most of which belong to sheep (n=7) although canid, red fox, horse, pig, and lagomorph are all represented by just one or two specimens each. All the specimens are from either the head or foot.

2.3 Unstratified/disturbed material

Unstratified

In addition to the stratified material and the material of probable Late Glacial date, 583 identifiable specimens came from unstratified deposits including several pieces recovered from the earlier excavations and currently on loan to the Tenby Museum. Layers that contain the remains of modern domestic animals have clearly suffered disturbance. However, Trench 3 - Layer 3, Trench 5 - Layer 4 (and 4a), Trench 6 - Layers 2,14, 13/15, 14/13, 16/19, 1a Basal did not produce the remains of domestic animals so may be intact.

The majority of the unstratified material belongs to sheep (n=279) although fox and bear are quite numerous (Table 1a). In addition, the wide range of taxa includes wolf (*Canis lupus*), dog, cat, badger, reindeer, woolly rhinoceros, horse, cattle, pig, rabbit and mole (*Talpa europaea*).

Anatomical representation of the major taxa is given in Appendix 3 Table 11. Major limb bones are once again relatively scarce, although a good number belong to sheep and several to fox. To facilitate the comparison of body part representation between the stratified and unstratified material as well as different taxa, the elements have been grouped into cranial, major limb and podial bones and this data is displayed graphically in Figure 1. Although this does not take into account the number of elements in each category, it does provide a simple method for comparing the types of elements present when the samples vary in size (Figure 1). The samples from stratified and unstratified deposits show a similar pattern in respect of fox, bear and hare. However, major limb bones belonging to deer are more numerous in the stratified deposits whilst the opposite is apparent in respect of sheep.

Six specimens belong to humans, including an incisor, tibia, astragalus, metacarpal and vertebrae fragments. The condition of the bone suggests they are of relatively recent origin.

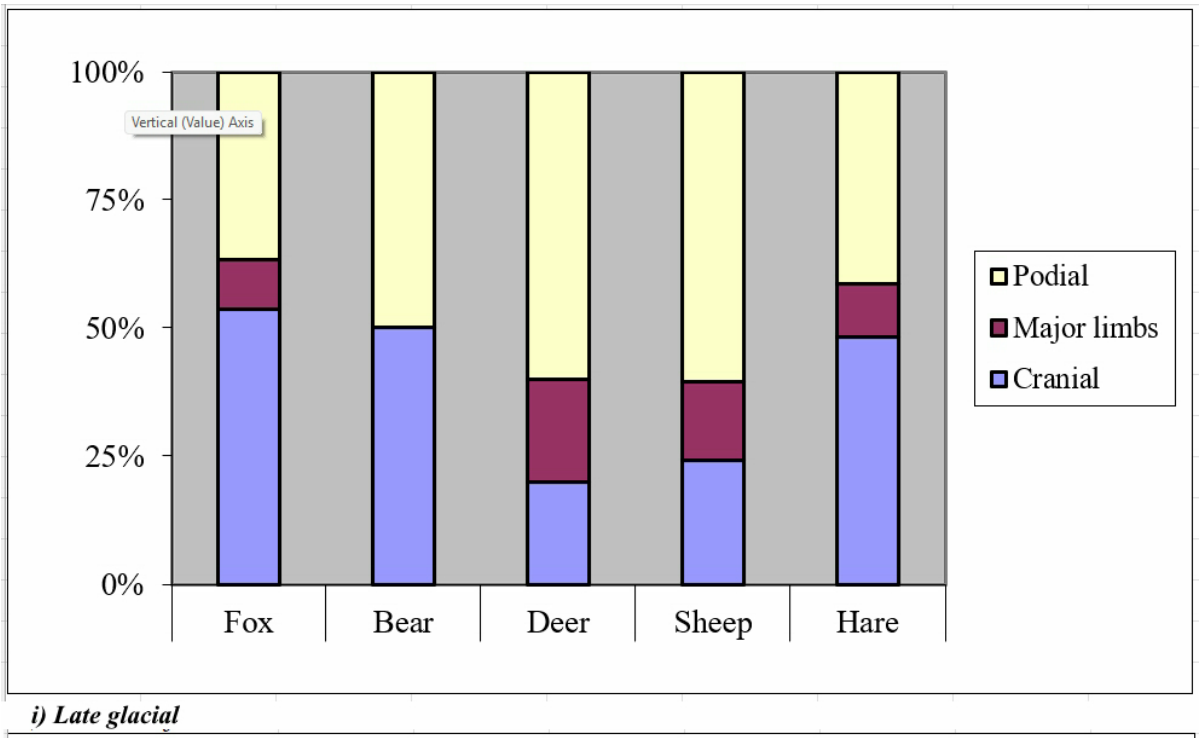
The assemblage also contains three fragments which may not be from the site of Hoyle's Mouth and these are listed separately in Table 1a.

Ageing data

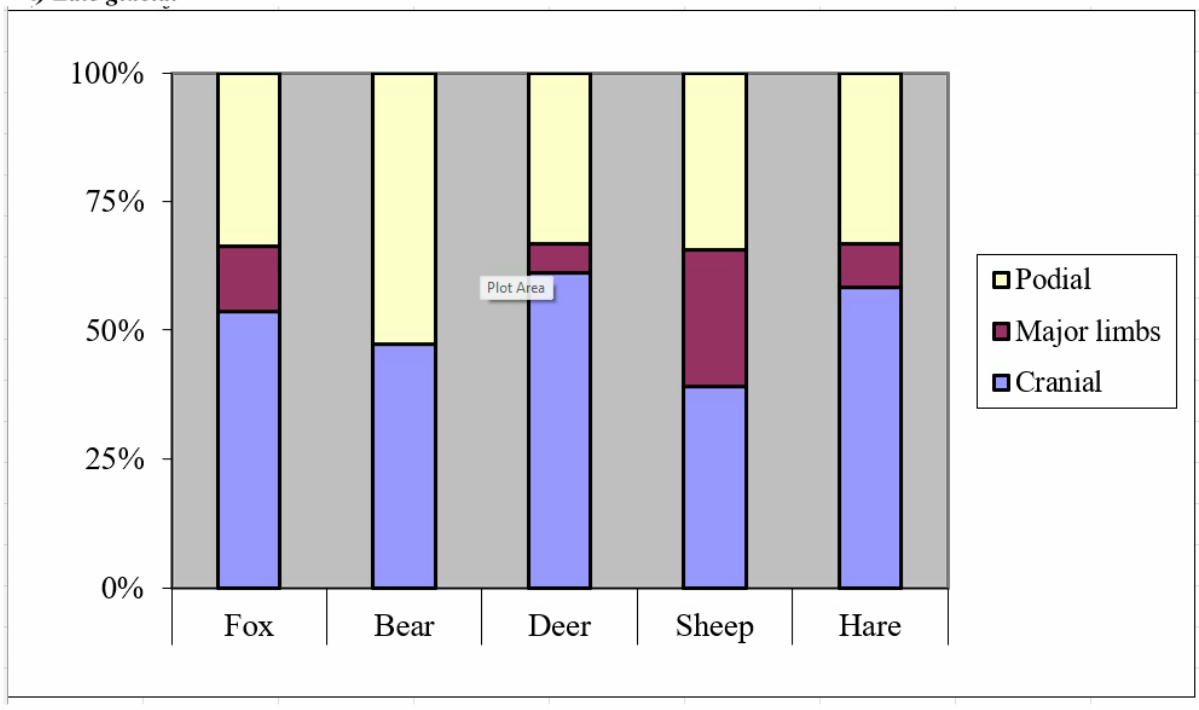
Dental ageing data from unstratified contexts is given in Table 4aii & 4bii. There is evidence for juvenile and prime adult foxes, juvenile and adult bear and subadult/adult reindeer - all of which may have a Late Glacial origin. A few bones with unfused epiphyses also provide evidence for the presence of immature fox and bear.

Ageing data for modern domestic animals recovered from deposits previously thought to be of late glacial origin are considered in this section as they clearly result from disturbance/mixing. In the Entrance Area, Unit EII produced a sheep lower fourth premolar belonging to an animal aged between 6-12 months and an unfused calcaneus from a sheep less than 36 months (Table 4a & b). Several other bones recovered from Unit EIII in the Entrance Chamber also attest to the presence of immature sheep and rabbit. Late glacial deposits in the Bear Chamber produced bones belonging to foetal or neonatal lamb and piglet (Table 4bi).

Dental data from the unstratified deposits provides evidence for immature cattle and suggests that sheep commonly died between 6-12 months or survived past 3 years (Table 4aii). A good number of the unstratified bones belong to immature sheep including a scapula, humerus, pelvis and metatarsal belonging to foetal or neonatal animal (s) (Table 4bii). A few belong to pig and rabbit.



i) Late glacial



ii) Unstratified

Figure 1. Representation of major body parts (% NISP).

2.4 Taphonomy

Butchery

A few specimens preserve evidence for butchery and these have been reported on previously by Ruth Charles (n.d). All derive from unstratified deposits (Table 4i) or deposits containing a mixture of modern and Late Glacial fauna.

Unit EIII in the Entrance Chamber produced three cut bones including a probable deer phalanx with at least one cut mark on the distal end (Figure 2), most likely inflicted during skinning. The appearance of this specimen suggests it may be of modern origin although it is within the size range of reindeer so would benefit from being radiocarbon dated. The other two specimens are conjoining pieces of a tibia belonging to a rabbit (probably also modern) which display oblique cut marks on their anterior and medial faces.

The unstratified material includes a bear phalanx (Figure 3) which has oblique cuts on the middle part of the anterior face. However as noted by Charles (ibid), this specimen is still greasy so is unlikely to be of Late Glacial origin. A sheep humerus displays oblique cuts on its distal medial epiphyses which probably result from disarticulation. A rabbit vertebra also has cuts on the transverse processes. A few other unstratified specimens display cut marks but these are not identifiable to species level (Table 4ii).

Figure 2. *Location of cut mark on a probable deer phalanx*.

Gnawing

Twenty-three bones display evidence for gnawing (Table 4iii). Apart from the two pieces of hyaena pelvis recovered by Savory from layer 'g' in the Entrance area, all are from either the Bear or Reindeer Chambers. Most of the damage was inflicted by large carnivores such as hyaena, wolf or dog although a fox is probably responsible for marks visible on a hare calcaneus recovered from the Bear Chamber. This area also produced gnawed specimens belonging to arctic fox, red fox and deer, all of which are assigned to the Late Glacial period because of their provenance. Gnawed specimens belonging to fox and hare were similarly recovered from deposits dated to 11-10 ka BP in the Reindeer Chamber.

Figure 3. *Cut marks on bear phalanx.*

Burning

The only evidence for burning came from an unidentifiable specimen that is charred and was recovered from an unstratified deposit in the Entrance area by Savory.

Fracture and fragmentation analysis

The fracture characteristics of limb bones according to stratigraphic unit are given in Table 5. This indicates that a large proportion of the material has less than 10% of the fracture surface perpendicular to the cortical bone, a characteristic often associated with the breakage of fresh bone. However, in respect of the texture and outline of the fractures very few specimens display the characteristic most associated with the breakage of fresh bone; apart from two unstratified specimens, all came from the Reindeer Chamber.

Fragmentation analysis indicates that the shaft circumference is intact for most limb bones (Table 6i). In contrast, few limb bones retain their complete length with most specimens less than 25% or between 25 and 50% complete (Table 6ii).

Weathering

The majority of the specimens, including the majority of stratified specimens from the Bear and Reindeer Chambers, are in the early stages of weathering and show little sign of cracking although they are not generally greasy (Table 7). In light of this, it is likely that that the cut bear phalanx recovered by Savory from 'g' was deposited in more recent times but it may be worthwhile investigating this further by subjecting this specimen to radiocarbon dating.

Root damage

Very few specimens preserve marks suggestive of root damage and most of these are from unstratified deposits (Table 8).

Colour

A wide variety of colour was observed on the bones (Table 9). The majority of the unstratified material retains its natural colour which is not unsurprising given that much of the material has a recent origin. In contrast, only a small proportion of the bones recovered from Late Glacial deposits in the Bear and Reindeer Chamber appears natural with most specimens stained a mixture of brown and other colours.

Abrasion

None of the specimens are significantly abraded.

2.5 Pathology

A metacarpal II & III belonging to red fox and recovered from an unstratified deposit in the Reindeer Chamber (R1) are fused together, probably due to remodelling of the bone following fracture (Figure 4).

Figure 4. *Fused metacarpals belonging to red fox. Recovered from an unstratified deposit (R1).*

2.6 Metrical data

A small number of specimens were sufficiently complete to provide metrical data and this is given in Appendix 3. Measurements taken on the teeth of foxes were also used to support visual size differentiation between arctic and red fox using the criteria of Compagnoni, *et al.* (1997).

3.Discussion and Interpretation

3.1 Late Glacial

The samples retrieved from individual stratified layers are generally small and consequently, unable to withstand detailed analysis and provide reliable information concerning their depositional history. As a result, for the purposes of this discussion the Late Glacial material is generally considered as a whole.

The limitations on the data imposed by sample size are compounded by the complex nature of the stratigraphy with taxa representation indicating that some of the layers previously thought to be stratified have in fact, suffered disturbance and/or mixing, possibly as a result of burrowing by modern day foxes, badgers and lagomorphs. However, if the modern domestic taxa (cattle, sheep, pig) and rabbit are discounted, the species list remains fairly consistent with the late glacial samples which are dominated by fox and hare with smaller numbers of bear and reindeer present.

Only deposits recovered from the Bear and Reindeer Chambers and dated to 11-10 ka BP, a small sample from the Entrance area dated to 25-15 ka BP and a small sample of late glacial date from the Reindeer Chamber appear to have retained their stratigraphic integrity. The sample of undisturbed late glacial material, although relatively small, is clearly dominated by the remains of foxes (both arctic and red) with small amounts of bear also 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 deposits dated to 11-10 ka BP (Unit RII) in the Reindeer Chamber suggests this particular specimen may be derived from earlier deposits. 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 (LGM) (Currant and Jacobi, 2001: 1713; Yalden, 1996:4) at about 21 ka BP (Stringer, 2006:134).

A reindeer antler recovered from basal silts in the Entrance Chamber (Trench 3, Layer 5) produced a radiocarbon date of 26,500 +/- 550 suggests that some other animal remains at Hoyle's Mouth pre-date the LGM. Hare is noticeably absent from the small sample of animal bone from this deposit (assigned to the broad date range 25-15 ka BP) and apart from the reindeer antler all the specimens belong to carnivores with fox, bear and badger present. The sample is small and so this pattern may simply reflect sample size, although it is equally possible that carnivore use of the cave and/or carnivore prey species changed over time. A tooth belonging to woolly rhinoceros and currently on loan to Tenby Museum was recovered from unstratified deposits during earlier excavations and this provides additional evidence for animal remains deposited in the cave prior to the LGM.

There is no certain evidence for human intervention with the late glacial animal remains in the form of cut marks which is curious given that Hoyle's Mouth is one of the richest Upper Palaeolithic sites in Britain, and in Wales it is second only to Paviland (Aldhouse-Green, n.d.a). Approximately 300 artefacts have been recovered including a range characteristic of the Late Upper Palaeolithic as well as an Aurignacian busked burin associated with the Early Upper Palaeolithic. The cave was clearly used by humans on at least two occasions with the similarity between the Late Glacial industries of Hoyle's Mouth and Gough's Cave suggesting one of the occupations was between 12,500-12,000 BP.

It is possible that humanly modified bones failed to survive subsequent destruction by carnivores and other taphonomic processes that destroy bone. In this respect, it is interesting that an investigation of human presence in Britain during the Middle Palaeolithic suggests that the scarcity of cut marked bone during a period when many of the archaeological sites also functioned as

hyaena dens, represents the relatively low density and sporadic nature of the human presence at that time (Ingrem, 2009). A similar explanation may well account for the scarcity of cut marked bone in the Late Glacial deposits at Hoyle's Mouth.

The assemblage is dominated by loose teeth and podial bones, a pattern generally associated with carnivore activity. 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. 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.

Fox, bear and other carnivores (including humans) most probably occupied Hoyle's Mouth 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. Foxes both hunt and scavenge; their prey generally comprises small vertebrates such as lagomorphs, 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, hyaenas and humans.

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, ibid). This suggests that some bones belonging to brown bear may be present as a result of natural fatality.

4. Regional Context

Located in close proximity to Hoyle's Mouth, just 350 m to the south is the cave known as Little Hoyle which has produced deposits spanning at least 50,000 years (Aldhouse-Green, n.d b). Here, Late Glacial animal remains are associated with the final phase of infilling and include species such as reindeer and arctic hare. As with Hoyle's Mouth, deposits excavated in the 19th century (Rolleston, *et al*. 1878) and in 1959–60 by McBurney produced evidence for an earlier fauna that included woolly rhinoceros, some with gnaw marks indicative of spotted hyaena. More recent excavations by Aldhouse-Green (n.d) in 1984 produced Early to Middle and Later Devensian material that included 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 a only a few kilometres to the south-east, the site of Ogof-yr-Ychen on what is now Caldey Island produced the latest dated (22,350 +620 BP) record of woolly rhinoceros (Bateman, 1973; Nedervelde, *et al*. 1973).

Several other caves in the vicinity of Hoyle's Mouth have produced Upper Palaeolithic artefacts and assemblages of late glacial animal bone including Priory Farm Cave and Potters Cave (Ford, 1989). Clearly, although the ice margin was only about 30 km from Hoyle's Mouth, this area of south-west Wales continued to support a fairly diverse range of large mammals even at a time of climatic severity. Further along the coast to the east, caves such as Cathole (Walker,*et al* 2014) and Longhole (Campbell, 1977) have produced similar deposits indicating that humans were present throughout South Wales during the Late Pleistocene.

Gough's Cave located to the east in what is now Somerset has been used as the type site for this period in respect of its mammal assemblage (Currant and Jacobi, 2001). With the exception of the modern domestic species and rabbit indicative of mixing and spotted hyaena and woolly rhinoceros which are probably derived, the remaining species recovered from Hoyle's Mouth are also present in the Late Glacial assemblage from Gough's Cave. A major difference between the two sites lies in the recovery of cut marked bones which provide clear evidence for the re-colonisation of Britain by humans following the Last Glacial Maximum (Parkin, *et al.* 1986). Most occur on bones belonging to horse and red deer and are associated with skinning,

dismemberment, filleting and tendon removal thus indicating that large mammal carcasses were intensively exploited for meat and marrow, and probably skins and sinews. Small animals were also exploited during this period as evidenced by marks associated with dismemberment that are visible on two hare bones and cuts present on several bird bones.

A second Upper Palaeolithic site that has produced abundant cut marked bone is Robin Hood Cave at Creswell Crags in Derbyshire. In this instance, humanly modified bones belonging to a minimum of ten arctic hares were recovered from deposits located outside of the West Entrance by Campbell (1977). Radiocarbon dates obtained from five specimens have a pooled mean of 12,423 ± 69BP and it is thought, could represent a single event (Charles and Jacobi, 1994). A range of activities are represented by the position of the cuts but most are associated with defleshing and dismemberment. This latter process is considered unusual in respect of hare given their suitability for being cooked whole and the ease with which they can be jointed once cooked. As a result, it was suggested that hare meat may have been eaten raw, either due to preference, extreme hunger and/or a lack of kindling to light a fire (ibid). As well as cut and scrape marks, the hare and hare-sized bones are broken in a similar manner to those associated with marrow extraction. Only very small quantities of marrow would have been available from hare bones but it may have been a vital addition to the diet given the very low fat content of hare meat and the importance of fat for survival in extreme conditions (ibid, 1994). Cut hare bones have been recovered from other Late Glacial cave deposits at Creswell Crags including those in Pin Hole and Church Hole. Consequently, there is little doubt that during the Late Glacial period, small mammals were routinely exploited by humans and it is quite feasible that humans practiced a similar subsistence strategy in the vicinity of Hoyle's Mouth.

5. Holocene

The remains of cattle, sheep and pig recovered from Hoyle's Mouth clearly have a post-glacial origin since it is only with the advent of the Neolithic period that human populations started to lead a more sedentary lifestyle based on animal husbandry and crop cultivation. 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, the assemblage of post-glacial origin is mainly from undated or disturbed contexts and consequently is unable to provided detailed information concerning depositional history or the nature of subsistence practices in more recent chronological periods. 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. The ageing data available for sheep is interesting in that almost all the specimens derive from animals culled 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. It follows that some of the bones belonging to these animals may be present as the result of natural casualty.

6. Conclusion

The faunal evidence from Hoyle's Mouth suggests that the cave functioned as a carnivore den intermittently throughout its Late Glacial and post-glacial history. It is clear from the recovery of flint artefacts that Upper Palaeolithic humans also occupied the cave on at least two occasions but the Late Glacial assemblage has few of the characteristics generally associated with human exploitation. This might reflect the low density and sporadic nature of the human presence in South Wales or alternatively, the subsequent destruction of humanly modified material by later carnivore occupation.

BIBLIOGRAPHY

Aldhouse-Green, S. (n.d.a) *Excavations at Little Hoyle*. Unpublished interim report for the National Museum and Galleries of Wales.

Aldhouse-Green, S. (n.d.b) *Excavations at Hoyle's Mouth 1986 -1996: An interim analysis*. Unpublished interim report for the National Museum and Galleries of Wales.

Bateman, J. 1973. Faunal remains from Ogof-yr-Ychen, Caldey Island. **Nature.** 245. 454–5.

Boessneck, J. 1969. Osteological Differences between Sheep (*Ovis aries* Linné) and Goat (*Capra hircus* Linné). In Brothwell, D., Higgs, E and Clark, G (eds) *Science in Archaeology*, 2nd Edition. London. Thames and Hudson. 331–358.

Burton, R. 1979. *Carnivores of Europe*. London. Batsford

Callou, C. 1997. Diagnose differentielle des principaux elements squelettiques du lapin (Genre *Orctolagus*) et du Lièvre (Genre *Lepus*) en Europe occidentale. *Fiches d'ostéologie animale pour l'archéologie, Série B: Mammifères* No.8. Centre de Recherches Archéologiques du CNRS.

Campbell, J.B. 1977. *The Upper Palaeolithic in Britian: a study of Man and Nature in the Late Ice Age.* Volume 1. Oxford. Clarendon Press.

Compagnoni, B., Curci, A. and Tagliacozzo, A. 1997. Exploitation of the fox in the Epigravettian levels of Grotta Romanelli (Apulia, Italy). *Anthropozoologica*. **25,26**. 319–327.

Currant, A. and Jacobi, R. 1997. Vertebrate Faunas of the British Late Pleistocene and the Chronology of Human Settlement. *Quaternary Newsletter*. **82.** 1–8.

Currant, A. and Jacobi, R. 2001. A formal mammalian stratigraphy for the Late Pleistocene of Britain. *Quaternary Science Reviews.* **20.** 1707–1716.

Davies, W. and Gollop, P. 2003. The Human Presence in Europe during the Last Glacial Period II: Climate Tolerance and Climate Preferences of Mid- and Late glacial Hominid. In T.H. van Andel and W. Davies. *Neanderthals and modern humans in the European landscape during the last glaciation.* . Cambridge. McDonald Institute Monographs. 131–146.

von den Driesch, A. 1976. *A guide to the measurement of animal bones from archaeological sites*. Peabody Museum Bulletin 1.

Davies, M. 1989. Recent advances in cave archaeology in southwest Wales. In T. D. Ford (ed) *Limestones and caves of Wales.* Cambridge. University Press. 79–91.

Getty, R. 1975. *Sisson and Grossman's The Anatomy of the Domesticated Animals*. Philadelphia. W.B. Saunders Co.

Grant, A. 1982. The use of toothwear as a guide to the age of domestic ungulates. In R. Wilson, C. Grigson and S. Payne (eds.) *Ageing and Sexing Animal Bones from Archaeological Sites* BAR British Series **109.** 91–108.

Haynes, G. 1983. A guide for differentiating mammalian carnivore taxa responsible for gnaw damage to herbivore limb bones. *Paleobiology*. **9.** 164–172.

Hillson, S. 1986. *Teeth*. Cambridge. Cambridge University Press.

Huntley, B. and Allen, J.R.M. 2003. Glacial Environments III: Palaeo-vegetation Patterns in last Glacial Europe. In T. H. v. Andel and W. Davies. *Neanderthals and Modern Humans in the European Landscape during the Last Glaciation*. Cambridge, McDonald Institute for Archaeological Research: 79 –102.

Ingrem, C. 2009. *An investigation of the nature of human presence in Britain during oxygen isotope stage 3 (c.60 – 25 kyr BP): a zooarchaeological approach*. PhD thesis, School of Humanities, University of Southampton.

Ingrem, C. (forthcoming) The large mammal remains. In S. Aldhouse-Green & E. Walker (eds) Excavations at Hoyle's Mouth 1986 -1996. National Museum and Galleries of Wales.

Lavocat, R. 1966. *Atlas de Préhistoire Tome III: Faunes et Flores Préhistoriques de L'Europe Occidentale*. Paris. Centre National de Recherche Scientifique.

Legge, A.J. 1982. The Agricultural Economy. In R.J. Mercer (ed) *Excavations at Grimes Graves*. London. HMSO. 79–103.

Lowe, V.P.W. 1967. Teeth as indicators of age with special reference to red deer (*Cervus elaphus* L.) on Rhum. *Journal of Zoology.* **152.**

MacDonald, D. and Barrett, P. 1993. *Mammals of Britain and Europe*. London. HarperCollins.

McBurney, C.B.M. 1959 Report on the First Season's Fieldwork on British Upper Palaeolithic Cave Deposits. *Proceedings of the Prehistoric Society.* **XXV**. 260–269.

Marean, C.W. and Kim, S.Y. 1998. Mousterian Large-Mammal Remains from Kobeh Cave: Behavioral Implications for Neanderthals and Early Modern Humans. *Current Anthropology.* **39.** (2, Supplement), 79 –113.

Mayhew, D.F. 1975. *The Quaternary History of Some British Rodents and Lagomorphs*. PhD Thesis. University of Cambridge.

Nedervelde, Br. J. van., Davies, M. and John, B. S. 1973. Radiocarbon dating from Ogof-yr-Ychen, a new Pleisotcene site in west Wales. *Nature.* **245**. 453–4.

O'Connor, T. 1988. *Bones from the General Accident Site, Tanner Row*. London. Council for British Archaeology.

Outram, A. 2001. A new approach to identifying bone marrow and grease exploitation: Why the "indeterminate" fragments should not be ignored. *Journal of Archaeological Science.* **28.** 401–410.

Pales, L. and C. Lambert. 1971. *Atlas Osteologique pour servir a l'identification des Mammiferes du Quaternaire*. Centre National de la Recherche Scientifique.

Payne, S. 1973. Kill-off patterns in sheep and goats: the mandibles from Asvan Kale. *Anatolian Studies* **XXII.** 281–303.

Payne, S. 1985. Morphological Distinctions between the Mandibular Teeth of Young Sheep, *Ovis*, and Goats, *Capra*. *Journal of Archaeological Science*. **12.** 139–147.

Schmid, E. 1972. *Atlas of Animal Bones: For Prehistorians, Archaeologists and Quaternary Geologists.* London. Elsevier

Stiner, M. 1994. *Honor Among Thieves*. Princetown. University Press.

Sutcliffe, A. J. 1970. Spotted hyaena: crusher, gnawer, digester, collector of bones. *Nature.* **227.** 1110–1113.

Walker, E., Case, D., Ingrem, C., Jones, J.R. and Mourne, R. 2014. Excavations at Cathole Cave, Gower, Swansea. *Proceedings of the University of Bristol Spelaeological Society*, **26.** 2. 131–169.