Assessment of animal bones recovered from a Mesolithic and Bronze Age site at Low Hauxley, Northumberland

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Introduction

The site of Low Hauxley is situated on a low spur of glacial deposits that is being eroded by the sea at its eastern side, and which is bounded by peat deposits to the north and a derelict coal mine to the west. The coal mine has removed all surface deposits to a considerable (but unknown to this author) depth, and is currently flooded as part of a nature reserve. To the south, the land-surface dips down again and eventually reaches another area of peat deposits. Sand dunes cover both the spur and the adjacent peats. Marine erosion has revealed a burial cairn, presumed to be Bronze Age that lies on top of the spur beneath the sand dunes. An investigative excavation behind the cliff face in 1983, by Clive Bonsall of Edinburgh University in collaboration with English Heritage, revealed a smaller cairn, separate from the one in the cliff face, and also salvaged material from the eroding cliff face. This cliff face material included a burial cist containing a human skeleton from within the main cairn, and a small amount of shell midden material from pockets beneath the main cairn. Further erosion led to further salvage work at the cliff face by Steve Speak of Tyne & Wear Museums Service in 1993. Two more cists containing human burials were recovered, together with samples of material from the cliff face. In October 1994, Denise Drury of the Lancaster University Archaeological Unit, in collaboration with English Heritage, undertook further investigations behind the cliff face. These consisted of two trenches machine-cut through the sand dunes down to the top of the underlying strata. These two trenches extended the line of Bonsall's 1980 area excavation westwards towards the flooded coal pit and northwards into the edge of the peaty deposits. In addition, a few bones that had become exposed in the cliff-face within the area of the main cairn were removed for safe keeping, in the fear that they would either erode out of the face completely, or be removed by members of the public.

The material

This assessment does not include details of the small amount of material that was recovered by Bonsall in 1982/3 (since the material has not been seen by this author) although it does take it into consideration. The bulk of the material assessed consists of animal bones recovered from Drury's machine-cut trenches in 1994, together with the few bones salvaged from the cliff face in 1994 during Drury's excavations. In addition, one group of material was chosen for scanning from Speak's 1993 investigations. None of this 1993 material has been processed, and so further specialist work was considered to be not cost-effective. However, all of the 1993 material should be processed and assessed.

The aims of this assessment

This assessment aims to do two things:

(1) to consider the nature of the recovered material, and its potential for further analysis,
(2) to consider the potential of the site to provide further animal bone material of relevance to archaeological investigations.

Methodology

The animal bones recovered in 1994 have been identified in comparison with modern reference material held in the Biological Laboratory of the Department of Archaeology, University of Durham. Ageing criteria are those given by Silver (1969) for modem domestic livestock, and measurements have been taken in accordance with Driesch (1976).

Details of the material

1. The material from Bonsall's 1983 investigations

This material has not been seen by the author, and the following notes are based on information provided verbally by Bonsall in 1994 and on the brief excavation note in PPS (Bonsall 1984). Very little animal bone was recovered (only a few grams) from the 1983 excavation of the smaller cairn behind the cliff. These were looked at by Lyn Bametson and include some small bones, possibly toe bones, possibly of deer and of pig (Bonsall, pers. comm. Records and material not checked). The preservation of the human skeleton lying beneath the smaller cairn was poor, which probably indicates that conditions were unsuitable for the preservation of any isolated bone fragments that might have been discarded on the old ground surface. There were no sub-surface features such as pits or ditches associated with this cairn, nor with the western edge of the main cairn (which was the only portion of that cairn that was revealed in the excavated area).

Pockets of marine shells, mainly winkles, were recovered from the cliff face (?in 1982 rather than 1983) beneath the main cairn. Included amongst these shells, which produced a radiocarbon date of approximately 5000bc (Bonsall 1984), was a fish otolith. Bonsall believes that the survival of the animal bones at the site may be related to locally altered soil conditions. The main cairn may have been sufficient to protect bones from leaching. Alternatively, it may have been calcium carbonate from shellfish remains that permitted the survival of adjacent bones.

2. The material from Speak's 1993 investigations

The only material that has been looked at for faunal remains from Speak's 1993 investigations is that from Cist 1, which contained a human cremation (contexts 17, 18 and 19). At the time of recovery, it was thought that this material might include a bird skull. Scanning of all of the (unprocessed) samples from Cist 1 failed to reveal any animal bones other than a few unbumt bones of frog or toad. These bones (at least one of which is from toad rather than frog) could be intrusive. A cist would have made an ideal winter shelter for a hibernating animal. Notes on the results of the scan are given in Appendix 1.

No cremated animal bones were noted during the scan (the bone tentatively identified as a bird skull is probably one of the warped fragments of human skull bone that includes part of the eye socket).

Cremated marine shellfish remains, however, are present in small numbers throughout the samples. These mainly derive from winkles, but other species are also represented including probable cockle and at least one other species of bivalve. This material is important and presumably indicates some form of burial rite. The human remains have not been studied, but clearly derive from at least one adult. Small bones such as terminal digits (finger tip bones) are commonly present, which suggests that the body was cremated entire (*ie* not after excarnation).

There are several samples associated with Cist 2 and a few bags of material from deposits below the cairn that have not been processed nor scanned. The reason that this material has not been included in this assessment is one of cost. No financial provision was made for the processing of these samples, but it is very time consuming (and expensive) for a specialist to attempt to scan unprocessed material. The Cist 1 material was scanned as a trial 'experiment', the material being chosen since it included the sample that was thought to contain a possible bird skull. It proved to have very informative results, but further investment of specialist time was not considered appropriate at this assessment stage.

3. The material from Drury's 1994 investigations
Most of the assessed material comes from these investigations.

3.1 The material from the trenches
Almost all of the animal bones recovered from trenches D1 and D2 are extremely well preserved. They have a rufus-red colour and many of them still have sand grains and plant rootlets adhering to their surfaces. None of them derive from the old ground surface or from deposits cut into it. Only one find (Object record number 5017 from context 145 in Trench D2) appears to be stratified in an archaeological deposit. It has a different preservation state to that of the dune bones, being a dull mid-brown colour and having some surface etching caused by acids. The fragments derive from one cattle pelvis and the size of the bone indicates that it was a domestic animal, smaller than Neolithic domestic cattle or modern domestic cattle. A date anywhere between the Bronze Age and the Victorian era is possible for this bone on morphological grounds.

All of the other bones derive from domestic cattle or sheep or from (probably domestic) horse. The size and morphology of the sheep and cattle bones indicate that they are of relatively modern 'improved' stock. They are extremely unlikely to predate the post-medieval period, and may date to the Twentieth Century AD. It should be noted that other animal remains were located during the excavation of the dunes, but that these still retained undecomposed soft tissues or hair, and were assumed to be of very recent origin. These remains were not kept for further analysis and have not been seen by the author. None of the collected bones have any signs of either cutmarks or chewmarks, and none appear to have been broken or damaged in any way prior to excavation. Although no complete skeletons were recovered, the fact that some of the bones appear to derive from the same individuals as others, together with this lack of post-death alteration, suggests that the bones are the remains of entire carcases, buried with the flesh still on the bones shortly after the animals died.

One mature horse is represented by lumbar vertebrae and tibiae, all of which have bony alterations that may be associated with strenuous work and/or with increasing age. One neonatal calf is represented by a scapula, an ulna and a pelvis, whilst a second, slightly older calf (possibly a few months old) is represented by a pair of tibiae. Two adult sheep are represented by skulls, both of them naturally polled (which is a trait that is particularly common in modem sheep but was unusual in sheep prior to the medieval or post-medieval periods). The teeth in both of these skulls, together with those in the pair of mandibles that articulates with one of them indicate that both individuals were fully mature. Two femurs may come from these same two individuals. Both femora are large and robust, one of them particularly so, and neither is likely to predate the late 18th to 20th Centuries on morphological grounds.

The ages represented do not include any 'prime' age animals: all of them were either extremely young or fully mature individuals when they died. It is most likely that all of the remains, excepting the cattle pelvis from context 145, represent comparatively recent farmers' losses. The animals probably died of natural causes that precluded their commercial exploitation and necessitated their swift burial. There are not even any cutmarks indicating the removal of skins from any of the bones.

The good preservation of the bones is interesting and may indicate that the dunes themselves provide a benign environment for bony tissues. This environment may have been affected temporarily by the initial presence of surrounding soft tissues, but the bones appear to be stable and there are no outward signs that the bones are being eroded since the soft tissues disappeared. The poorer preservation state of the cattle pelvis fragments from context 145 may indicate that they were exposed to weathering for a time prior to their burial, since when they may have been in a stable equilibrium with their enclosing sediment.

Some bulk samples were processed by flotation at the Durham Laboratory and the >1.7mm mesh residues were sorted, but no animal bone remains were recovered.

3.2 The material from the cliff-face
All of this material derives from sheep. Two individuals are represented. One was a fully mature individual represented by ribs, costal cartilages, a thoracic vertebra and an articulating group of ankle bones (tibia, astragalus, calcaneum and naviculo-cuboid). The other individual was a

neonatal lamb represented by elements from all over the skeleton (a scapula, a humerus, an ulna, vertebrae, a pelvis, a femur, a tibia, a calcaneum and a pair of metatarsals). These two individuals may have been a ewe and its lamb that died together. The size and morphology of the adult bones are compatible with a comparatively modem date (late 18th - 20th Centuries).

The preservation state of the bones is indistinguishable from that of the bones recovered from the sand dunes in the trench cuts, and the remains are probably of a similar date and type (*ie* relatively recent farmers' losses). They may have slumped into the cliff-face from the dunes overlying the main cairn. It is very, very unlikely that they date to any prehistoric deposits associated with the cairn or the underlying strata. The presence of the animal bones from the sand dunes in trenches D1 and D2 proved extremely useful in the identification and interpretation of this cliff-face material.

Recommendations for further work on the animal bone material recovered so far

1. The material from Bonsall's 1983 excavation and investigations

This should be identified and the records added to the site archive. They should also be included in the published report of the 1983 excavations (Bonsall, in prep).

2. The material from Speak's 1993 investigations

It is strongly recommended that all of the material from Speak's investigations is processed and is assessed by a faunal specialist. In particular, all of the samples taken from and around Cist 2 should be scanned for faunal remains. If some are present, they may warrant further analysis. In addition, the material from below the cairn should also be checked for faunal remains since these deposits are believed to predate the cairn and may relate to Mesolithic activities in the area. Preferably, the samples should be floated in order to search for botanical remains. At the very least the material should be sieved and sorted. All of the material, of course, should be assessed by a human bone specialist and, if appropriate, analysed further.

3. The material from Drury's 1994 excavation and investigations

The material from the excavated trenches and from the cliff-face has all been identified and recorded for this assessment (see Appendix 2), on the grounds that it was unlikely to be looked at again. No further work is recommended on this material, unless it can be of use for radiocarbon dates relating to the formation of the dunes, or to the development of modem breeds and types of domestic livestock.

The implications of the material recovered so far

This section is ordered stratigraphically.

It is clear that the sand dunes provide a benign environment for the preservation of animal bones but, as yet, the dates of these deposits are almost unknown. Innes and Frank's (1988) work on pollen data further up the coast suggest that the dunes may have been forming at least since the Iron Age. Only one bone (a fragmentary pelvis from domestic cattle) has been recovered that may derive from a deposit dating to the prehistoric, Romano-British or medieval periods. All of the other bones recovered from the dunes appear, on morphological grounds, to derive from post-medieval or recent stock. The bones recovered from the cliff-face as it eroded in October 1994 appear to be of a similar date to those in the dunes, and they shed no light on the prehistoric periods for which the site has been publicised.

The main cairn may well contain animal bones, both unburnt and burnt, but very little material has actually been removed from this feature, and so it is difficult to assess the possible significance of any animal bone remains. Some other cairns in northern England have produced large quantities of animal bones, relating both to funerary activities and to background ecology (*eg* Manor Farm and Hardendale Nab: see faunal reports by Jones *et al* 1987 and Stallibrass 1991, respectively) and it may be reasonable to expect Low Hauxley to contain similar material.

The presence of grave goods in the form of cremated shellfish remains accompanying the cremated adult human in Cist 1 is extremely interesting. It indicates not only an unusual (or, at least, rarely discovered) funerary rite but also shows that people were exploiting faunal resources from the upper and middle seashore during the Beaker period.

The faunal material from deposits beneath the cairns indicate that some early prehistoric people exploited both terrestrial and marine resources, presumably for food. It is particularly interesting that winkles and other shellfish were exploited in both the early prehistoric period (about 7000 years ago) and the Beaker period.

The scale of faunal exploitation in the early prehistoric period is difficult to assess. The material eroding out of the cliff face beneath the main cairn indicates small-scale, possibly intermittent, deposition of faunal remains, but it is possible that greater quantities of material lie outside the investigated area (most likely in the peat deposits, close to the former shoreline on the spur).

The potential of the site to provide animal bone material of relevance to archaeological investigations

Ironically, the policy of damage limitation followed at the site has restricted the amounts of material examined from the deposits most relevant to the preservation and recovery of animal remains. Assessing the site's potential for faunal studies, therefore, has been a little difficult at this stage, and has had to rely partly on circumstantial evidence such as comparisons with similar sites. In the long term, this damage limitation should have ensured that maximum information may be obtained from the faunal material, if and when it is investigated under area excavation.

The site can be regarded as a composite of various types of deposit and each may have very different potentials for animal bone presence and preservation. The investigations have demonstrated that there is artefactual and faunal evidence for human activities during the Mesolithic and the Beaker periods on the low spur of land that is currently eroding into the foreshore. In addition, it is probable that faunal remains relating to the site are also distributed in the various peat deposits adjacent to the spur. Certainly, the vegetational and hydrological histories of these peats are extremely relevant to any considerations of past habitats and environments, and relate directly to the faunal resources that are likely to have been available in the past.

The Mesolithic period

The site of Low Hauxley has unusually good potential for investigations of faunal resources and their exploitation during the Mesolithic period because of the juxtaposition of sealed deposits on dry land and waterlogged peat deposits. It is also of particular interest because of its proximity to the sea.

The site's situation during the Mesolithic period was on a slight elevation adjacent to at least one body of freshwater. People could have exploited three types of habitat within a very short distance from the site: inland terrestrial habitats, adjacent freshwater habitats, and coastal/marine habitats to the east. Extremely few Mesolithic sites in Britain (or Europe) are known from such rich catchment areas. Investigating how, when and if Mesolithic people exploited which of these potential sources of biological resources requires studies of (a) precisely what resources would have been available and (b) the remains of the exploited resources themselves.

(a) What resources might have been available?

This aspect requires studies of the peat deposits in the area, including the peat deposits immediately north and south of the spur, the submerged peat beds on the seaward side, and the submerged peat beds to the south of Druridge Bay. These are known to have produced Mesolithic faunal remains including artefacts made out of bone and antler (Trechmann, 1936). We need to discover where there were bodies of fresh and/or brackish water and when they began to infill with vegetable or mineral matter, as well as the nature of the vegetation growing in and around the area. Work that may be able to contribute to this study has already been undertaken for the peat

beds to the north of the site (Tipping, in prep. [in conjunction with Bonsall's 1983 investigations]; Innes and Frank, 1988), but the other peat deposits have not yet been studied. We also need to find out just where the coastline lay, and how rapidly it changed.

N.B. These studies are all equally relevant to the later prehistoric period, when the cairns were built and utilised.

(b) The remains of exploited animal resources

This aspect requires good preservation conditions for faunal remains. Investigations at the site to date suggest that, on the slight spur of the boulder clay, only the area beneath the cairn may have well preserved Mesolithic faunal material. However, other Mesolithic sites (*eg* Star Carr and Seamer Carrs) in Britain and north-west Europe that lie at the edge of peat deposits all tend to suggest that biological material was thrown into the water, landing in a 'toss-zone' where it preserves extremely well. The investigations at Low Hauxley have not yet investigated the peat deposits adjacent to the spur for archaeological materials, although samples from Drury's 1994 trenches do show that the distribution of Mesolithic flintwork does extend towards them.

Any Mesolithic faunal material on the spur is likely to be sparse and spatially intermittent, based on the pockets of shell 'midden' material identified by Bonsall in the cliff face in 1992/3. However, it is possible that this type of distribution is typical of Mesolithic sites exploiting coastal resources, and that large midden sites such as those of the Obanian culture are exceptional. The site should not be dismissed, therefore, on the possibly spurious grounds that the absolute quantities of data may be small.

Summary for the Mesolithic period

The site of Low Hauxley has an extremely high degree of interest regarding faunal exploitation during the Mesolithic period, and two types of deposit may have good potential for the preservation of faunal remains. Localised pockets of faunal material are known to survive on the spur beneath the later cairn(s). In addition, the peat deposits adjacent to the spur may contain general debris in which animal bones should have survived well.

***The later prehistoric periods (Beaker, and possibly Bronze* Age)**

The main cairn has good potential for the recovery of faunal material related to the human burials. Excavations at Bronze Age cairns in north-west England (*eg* Manor Farm, Hardendale Nab) have shown that large quantities of animal bone can be associated with Bronze Age burial monuments at inland locations. The site of Low Hauxley is unusual for its near-coastal position, and it is clear from the grave goods in at least one of the cists that marine resources (shellfish) were exploited by people utilising the cairn as a funerary monument.

A study of the contemporaneous vegetation and landscape is required to place the faunal remains into their environmental context (see Mesolithic section, above).

Other periods

It is quite possible that activities took place at the site between the Mesolithic and Beaker periods but, as yet, no faunal remains have been identified that might relate to this time.

The sand dunes appear to preserve animal bones well, but it is unlikely that any major deposits of animal bones are located in the dunes other than recent burials of domestic livestock losses.

<u>Recommendations for further work at the site</u>

The Mesolithic material from the site is of national importance. The Beaker/Bronze Age material is possibly also of national importance (this author is unaware of other burial cairns with coastal settings that have been investigated for faunal remains). **At the least, it is of high regional significance.**

* Whether or not any further material is removed from the site, it is important that the material recovered by Bonsall in 1982/3 is fully reported and published, and that the material recovered by Speak in 1993 is properly treated, assessed, analysed and published.

* Since the site is currently being destroyed by marine erosion, it is recommended that it should be excavated under controlled conditions as soon as is feasible, in order to maximise the amounts of stratified deposits available for investigation. The precise choice of timing for excavation should be made regarding safety aspects and seasonal weather conditions.

* All stratified deposits should be sieved in order to maximise the opportunity to recover faunal remains. Apart from samples required for other specialist studies (such as those of botanical remains, sediments *etc*) all of these deposits should be sieved through mesh not greater than 4mm in diameter.

* In order to search for small bones such as those from fish, amphibians, small birds and small mammals, samples (sometimes 100%) of relevant deposits should be sieved through mesh not greater than 1mm. These samples should be selected in a manner agreed by the excavator and a faunal specialist.

* The sieved material should be sorted as soon as possible to facilitate quick assessment of its significance.

* Remains of marine molluscs should be recovered in the same way as vertebrate remains, and the two groups of material should be considered together in terms of their ecological, economic and cultural significance.

* It is recommended that investigations are made of the peat deposits adjacent to the spur in order to search for material, particularly Mesolithic material, that may have been discarded in that area concurrent with the activities taking place on the spur. Although the peat deposits are less threatened than the unconsolidated cairn material, investigations of other Mesolithic sites suggest that any investigation of 'dry land' deposits without associated 'toss-zone' material would give an incomplete and biased view of past behaviour.

* It is recommended that palaeoecological investigations are made in the area, in order to place the site into its contemporaneous landscape contexts for the Mesolithic and Beaker/Bronze Age periods. The most relevant deposits are the peat beds north and south of the site, and the submerged peat beds on the foreshore to the east and to the south of the site.

* The palaeoecological studies need to be complemented by studies of the nature and position of the past coastline.

* The results of these investigations should be synthesised so that the evidence from archaeological deposits for faunal presence and exploitation can be placed into context regarding the site's environment and landscape.

* A full archive report should be prepared and made available on request, and all of the information regarding the site should be published in a suitable journal or monograph.

Summary

Investigations at Low Hauxley in 1982/3, 1993 and 1994 have demonstrated that animal bones and shells of marine shellfish are preserved in stratified deposits dating to both the Mesolithic and the Beaker/Bronze Age periods on top of a low spur of glacial deposits.

The preservation of faunal materials on British Mesolithic sites is very unusual, giving Low Hauxley 'rarity value'. Quantities of material may be small, but may be more typical of Mesolithic activities than those represented at some more famous sites. In addition, comparison with other sites suggests that further Mesolithic material may survive in the peat deposits adjacent to the site. If this is the case, then Low Hauxley is again unusual, in possessing both *in situ* and related primary deposits. The site is also of particularly high interest for the Mesolithic period because of its situation in a very rich catchment area for faunal resources. The immediate surrounding area included terrestrial, freshwater and coastal habitats. The presence of several extensive deposits of peat in the area allows for the study of the contemporaneous vegetation around the site, which would help to put the site into environmental context.

For the Beaker period, it is clear that people continued to exploit coastal resources, and it is of note that grave goods in at least one of the cists included cremated shellfish. Further work is required on the material recovered from the cliff-face during salvage work in 1993.

If excavation goes ahead at the site in order to pre-empt further erosion by the sea, then care must be taken to recover faunal remains (by sieving) from all stratified deposits.

Although the quantities of faunal remains may be small, they are extremely important for both archaeological periods.

If possible, the edge of the adjacent peat deposits should be investigated for the presence of debris in a 'toss-zone' relating to the Mesolithic activities.

In addition, it is recommended that further work is undertaken on the palaeoecology of the site and its surroundings, and on the past nature and position of the coastline, in order to place the site in its environmental context during both the Mesolithic and the Beaker/Bronze Age periods.

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Appendix 1: Notes on the unprocessed samples from Cist 1, from Speak's 1993 investigations

DB93. Context 17 (six bags of material)
The contents of the six bags are similar, but differ in relative amounts of soil, cremated bone and small stones. Some bags contain almost exclusively fragments of cremated bone. In all cases where a fragment could be identified it was human not animal. Many of the fragments show fused epiphyses (including vertebrae) and this evidence together with the sizes of the bones suggest that only adult bones are present. Small bones (particularly phalanges) are common, suggesting that the body was not excarnated prior to cremation.

Mixed in with the cremated bone in four of the six bags are occasional shells from marine shellfish. Some are identifiable as winkles. Occasional other shells can be identified as being comparable to cockle, or to a smoother shelled form of bivalve. All of these shells appear to have been heated to a similar temperature as the human bones and were presumably cremated with the body/ies. Occasional unburnt bones of toad or frog are present in five of the bags. At least one toad is represented amongst the bones, many of which are rather fragile. Other finds include occasional shells of snails, which are thought to be unburnt in all cases.

DB93. Context 18 (two bags of material)
Both bags contain material that is similar to that recovered from context 17. One bag contains several small fragments of charcoal and several small stones (unburnt) as well as cremated shells of at least three types of marine mollusc. It also contains one small cremated bone fragment that might be the remains of the shaft of a long bone of a small bird or small mammal. This 'identification' is extremely tentative, and this is the only fragment that might be thought to be non-human in origin.

DB93. Context 19. Cremation 1 (one bag).
This contains similar material to that recovered from contexts 17 and 18, with the addition of several small pieces of pottery and the absence of cremated shellfish remains. Occasional unburnt shells of landsnails are present, but no bones of toad or frog were noted.

Appendix 2: Identifications of the animal bones recovered by Drury in 1994

Material from Trench D1 (which runs northwards from Bonsall's 1983 area towards the peat deposit)

All of the animal bones from this trench derive from the sand dune material, and have been regarded by the excavator as being unstratified. All of the bones are well preserved and have rufus-brown colour. Sand grains and small rootlets adhere to their surfaces.

Context 1011 UIS. Object record No. 5042.
(i). A young cattle scapula, with the bicipital tuberosity unfused (less than 7-10 months of age at death). The SLC measures 39.7mm. Rootlets and sand adhere to the surface of the bone.

(ii). Lumbar vertebrae numbers 5 and 6 of a mature horse (more than five years old at death). These vertebrae are fully fused together along the lengths of their lateral spines, as well as at the body surfaces. There is a small degree of osteophytic lipping around the proximal and distal articular surfaces of both vertebrae, probably related to work and/or to ageing. The sizes of the bones are slightly smaller than those of a modern reference Dales pony (that stood at about 14 hands). The proximal articulation of lumbar vertebra 5 is about 54.3mm diameter, whilst the distal articulation of lumbar vertebra 6 is approximately 49.1mm in diameter.

(iii). An adult sheep skull, complete. This skull is naturally polled (hornless) and has marked 'thumbprint' depressions in the frontal bones where the horncores would be if they were present. All adult teeth are erupted and in full wear. Measurements:
No. 2=225mm; PB (=No. 3)=212mm; PPd (=No. 18)=127mm; No. 21=67.3mm
No. 27=51.0mm; No.29=19.9mm; OB (=No. 30)=17.9mm; No. 34=123.9mm;
No. 36=80.7mm.

(iv). A pair of sheep mandibles that articulate with the skull above ((iii)). All adult teeth are fully erupted and in full wear. Grant's (1982) mandibular wear stages are: P4 g; M1 k; M2 g; M3 g (Mandibular Wear Score = 39). This is compatible with a mature (but not senile) adult. There is no dental pathology on either of the mandibles.

(v). A second, similar sheep skull, also naturally polled although lacking the 'thumbprints'. The nasal bones and premaxillae are missing (disarticulated or crushed). All adult teeth are erupted and in full wear. Measurements:
No. 21=70.4mm; No. 27=46.7mm; No. 29=20.6mm; OB(=No. 30)=16.1mm;
No. 34 = 120.0mm; No. 36=66.2mm

(vi). A pair of sheep hyoid bones.

(vii). One right sheep femur. Fully fused at proximal and distal epiphyses (more than 3 - 3.5 years of age at death). Large and robust, probably from a modern 'improved' breed of sheep.
Measurements: DC=26.7mm; Bp=52.6mm; SD=20.9mm; Bd=42.0mm; GL=181mm; GLC=181mm
Withers height (using Teichert's figures for prehistoric and early historic sheep, in Driesch & Boessneck, 1974) = 181 x 3.53 = 639mm. (N.B. Haak's figures for merino sheep, also in Driesch & Boessneck, 1974, give an even greater height at 181 x 3.62 = 655mm).

(viii). One left sheep femur. Fully fused at proximal and distal epiphyses (more than 3 - 3.5 years of age at death). Extremely large and very robust. Almost certainly from a modem breed of sheep, possibly from a ram, possibly from a longwool sheep. This animal was both large and heavily built, with strong muscle attachments on its bones.
Measurements: DC=26.7mm; Bp=62.4mm; SD=23.5mm; Bd=50.6mm; GL=199mm; GLC=186mm

Withers height (using Teichert's figures for prehistoric and early historic sheep, in Driesch & Boessneck, 1974) = 199 x 3.53 = 702mm. (N.B. Haak's figures for merino sheep, also in Driesch & Boessneck, 1974, give an even greater height at 199 x 3.62 = 720mm).

(ix). Fragment of rib from a cow-sized mammal.

(x). Costal cartilage from ribcage of a cow-sized mammal.

(xi). Skull fragment from a cow-sized mammal.

(xii). Unidentified bone fragment form a large mammal.

(xiii). Complete, very young, cattle ulna. Proximal and distal epiphyses completely unfused (less than 3.5 – 4 years of age at death). Size (GL=158mm) and developmental stage indicate that the animal was extremely young when it died: at most a few weeks old, possibly neonatal. Prummel's (1989) conversion factors taken from Bünger-Marek (1972) for the German Black and White Lowland breed give an age at death of 310 days since conception (*ie* 30 days since birth). However, that breed stands at 1.31m shoulder height (cows) and 1.42m shoulder height (bulls). The developmental stage of the Low Hauxley ulna suggests that it might be a younger bone from a larger breed.

Context 130. Object record No. 5040
(i). Very young cattle ilium (pelvis). Acetabulum completely unfused (less than 7 – 10 months of age at death). Shaft morphology and depth of median acetabular border (32.3mm) indicate a male animal.

(ii). Pair of young cattle tibiae, both completely unfused at proximal and distal epiphyses (less than 2 – 2.5 years of age at death). Right tibia very slightly damaged during excavation. Left tibia: GL diaphysis = 247mm, SD= 32.2mm.

Material from Trench D2 (which runs northwestwards from Bonsall's area, towards the edge of the coal pit)

Context 145. Object record No. 5017
This bone was recovered from a deposit of coarse sand within the sand-dunes, lying at the same height as a shell-rich horizon with some stones (context 143) that may reflect a break in the dune formation and some (human?) activity. It is the right innominate of a cattle pelvis, broken into several pieces. The acetabulum is fused, indicating an animal of more than ten months old at death, but no further estimate can be made regarding the age of the animal. The bone is too fragmentary to assess the sex of the individual. The bone is from an animal of (pre 20th Century AD) domestic size. The fragmentary state of the bone is probably due to the pressure of the machine during the stripping of the overburden, in conjunction with the bone's brittle preservation state (which indicates a loss of some of the organic content of the bone). The bone's surface is partially eroded by soil acids (it is beginning to have the 'fossil sponge' look of badly leached bones). No cut or chew marks were noted, although deep marks should have been clearly visible had they been present. The bone fragments are a dull mid-brown colour.

The rest of the animal bones recovered from Trench D2 derive from the sand dune material, and have been regarded by the excavator as been unstratified. The bones are well preserved and have rufus-brown colour. Sand grains and small rootlets adhere to their surfaces.

Context 1012 U/S. Object record No. 5041
A pair of horse tibiae, both fully fused at proximal and distal ends, come from an adult animal (over 3 – 3.5 years old) of about 13.1 hands in height. Both tibiae have spicules of extra bony growth at the proximal ends of the shafts, where the fibula is in juxtaposition and where the muscles attach

to the bone. These minor alterations may be work and/or age-related. The right tibia is damaged. The measurements of the left tibia are:
SD=39.6mm; Bd-74.5mm; Dd=45.3mm; GL=333mm; GLl=305mm.
Using Kiesewalter's factor of 4.36 X GLl, this gives a withers height of 1.330m (source taken from Driesch & Boessneck, 1974).

Material from the cliff-face
All of these bones (excepting Finds numbers 5012 and 5013) are very well preserved. All of them have rufus-brown colour. Sand grains and small rootlets adhere to their surfaces.

Context 8. Object record No. 5001
Two complete left ribs of a mature sheep or goat. Each rib has an area of slightly swollen bone located on the outer side of the bone, approximately one third of the length of the bone from the sternal articular end (*ie* at the animal's side). These may be healed fractures but, if so, the breaks were not serious since the bones are not misaligned in any way. Alternatively, there may have been some infection in this area to which the bones reacted.

Context 120. Object record No. 5002
Neonatal right calcaneum of sheep or goat. Slightly larger than that of a reference skeleton from a perinatal Scottish Blackface sheep.

Context 120. Object record No. 5003
Neonatal left ulna of sheep or goat. Slightly larger than that of a reference skeleton from a perinatal Scottish Blackface sheep.

Context 120. Object record No. 5004
Costal cartilage rib from a sheep-sized animal. There are spicules of extra bony growth where the cartilage would have articulated with the sternal end of the rib, indicating some reaction to strenuous movement of the bones.

Context 120. Object record No. 5005
Neonatal left metatarsal of a sheep. Slightly damaged at proximal end. Metatarsals III and IV are fused together. SD=8.4mm; GL=approximately 71.6mm. Could be a pair with (5010).

Context 120. Object record No. 5006
Sheep right naviculo-cuboid. Bd=28.1mm. Articulates with astragalus (5014), calcaneum (5016i) and tibia (5008).

Context 120. Object record No. 5007
Neonatal right humerus of sheep/goat. GL diaphysis 64.7mm. Slightly larger than that of a reference skeleton from a perinatal Scottish Blackface sheep.

Context 120. Object record No. 5008
Sheep right tibia. Proximal and distal epiphyses fully fused (more than 3 – 3.5 years of age at death). SD=18.1mm; Bd=33.4mm; Dd=23.9mm; GL=205mm.
Withers height using Teichert's factor for prehistoric and early historic sheep (in Driesch & Boessneck, 1974) is 205 x 3.01 = 617mm.
Tibia articulates with astragalus (5014), naviculo-cuboid (5006) and calcaneum (5016i).

Context 120. Object record No. 5009
One fragment of a right rib from an adult sheep or goat.

Context 120. Object record No. 5010
Neonatal sheep right metatarsal. Metatarsals III and IV are fused together. SD=8.1mm; GL=73.8mm. Could be a pair with (5005).

Context 120. Object record No. 5011
Four fragments deriving from two neonatal lumbar vertebrae, almost certainly of sheep/goat. All parts of the vertebrae are completely unfused (less than 3-6 months of age at death).

Context 120. Object record No. 5012
Right femur fragment of neonatal sheep or goat. Proximal end of diaphysis broken off and all of remaining bone very fragile and lightweight, with pock-marked surface pitted by erosion caused by acids.

Context 120. Object record No. 5013
Right ilium (pelvis) from neonatal sheep or goat. Acetabulum unfused (less than 6 – 10 months of age at death). Bone very fragile, and damaged around acetabulum and edge of ilial blade. Some pock-marking of surface by acid etching.

Context 120. Object record No. 5014
Right astragalus of adult sheep. Bd=22.4mm; GLl=31.4mm.
Articulates with naviculo-cuboid (5006), calcaneum (5016i) and tibia (5008).

Context 120. Object record No. 5015
Costal cartilage from a large sheep-sized animal.

Context 120. Object record No. 5016
(i). Right calcaneum of adult sheep. Tuberosity fully fused (more than 2.5 – 3 years of age at death). Articulates with astragalus (5014), naviculo-cuboid (5006) and tibia (5008).

(ii). Costal cartilage from a sheep-sized animal.

(iii). Thoracic vertebra from an adult sheep or goat. Proximal and distal epiphyseal plates fully fused.

(iv). Neonatal right tibia of sheep or goat. Proximal and distal epiphyses completely unfused (less than 2 – 2.5 years at age of death). SD=9.0mm; GL diaphysis= 91.4mm. Slightly larger than that of a reference skeleton from a perinatal Scottish Blackface sheep.

(v). Unfused distal epiphysis of a humerus from a neonatal sheep or goat. Slightly larger than that of a reference skeleton from a perinatal Scottish Blackface sheep.

(vi). Neonatal left scapula of a sheep or goat. Bicipital tuberosity completely unfused (less than 6 – 8 months of age at death). Blade of scapula slightly damaged by crushing. SLC=10.3mm. Slightly larger than that of a reference skeleton from a perinatal Scottish Blackface sheep.

(vii). Body fragment from a neonatal vertebra of a sheep-sized animal. Completely unfused (less than 3 - 6 months old at death).

Appendix 3: bulk samples processed by flotation and sorted for remains > 1.7mm diameter

Context	Sample Numbers		
22	2157		
24	2050	2054	2155
27	2156		
54	2045		
143	2056		
144	2096		
147	2097		
155	2059	2112	
161	2092		
167	2067		
168	2068		
169	2069		
172	2076		
173	2075	2077	
178	2111		
180	2081		
186	2086		
199	2150		
201	2152		