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Ancient Monuments Laboratory
Report 116/90

THE MAMMAL AND BIRD BONE FROM THE 1986 EXCAVATIONS AT HARTLEPOOL, MIDDLEGATE, CLEVELAND

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Summary

Excavations on the sea front revealed a sequence of occupation from the 12th century to the present day. The major structural phase is phase 4 when two buildings with an associated yard were in use from the 13th to 15th centuries. A large part of the animal bone was recovered from this phase. The bones from all phases are the product of urban domestic household consumption with no evidence for any commercial waste products. In all phases sheep/goat remains outnumber those of cattle with lesser numbers of pig bones also present. Polled and horned sheep are represented in phases 4-6. It seems probable that two types of sheep rather than two sexes are indicated. Horse bones are scarce. Several cats had been interred on the site in phases 4 and 6. Dogs were kept as many bones were gnawed but dog bones were much less frequent than those of cat. Hare, rabbit and rat are represented but uncommon. Fowl and goose bones are present in all phases and phase 4 also produced bones of duck, pigeon, cormorant and gannet. Manx shearwater was found in phase 2, 13th century backfill, and guillemot was found in modern material. Preservation in general is good with clear butchery marks observable. Sawing as a method of butchery is only frequent from phase 6, 18th century onwards. Bones of very young cattle and sheep/goat survive with a trend for a higher proportion of younger animals in the more recent phases.

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The mammal and bird bone from the 1986 excavations at Hartlepool Middlegate, Cleveland.

By L. J. Gidney

Introduction

The animal bones studied in this report were recovered from a sequence of occupation on the sea front at Hartlepool. Six phases of activity have been identified. A full synopsis of the phasing may be found in Appendix 1. In brief, phase 1 is twelfth to thirteenth century in date with a stake built structure and a boulder wall. Phase 2 is earlier thirteenth century backfill raising the level of the shoreline. Phase 3 is mid/late thirteenth century features cut into the top of the phase 2 backfill. Phase 4 is more complex with part of two buildings and an associated backyard occupied from the late thirteenth to fifteenth centuries. Phase 5 is a period of abandonment and accumulation of humic soil spanning 1500-1700. Phase 6 comprises two eighteenth century stone buildings utilised into the early twentieth century.

The species present in each phase are listed in Table 1. However since phase 4 has a long time span and can be divided not only into buildings but also into rooms a more detailed breakdown of the species and numbers of fragments present in phase 4 is given in Tables 1a and 1b. The individual subdivisions of phase 4 are too small for detailed analysis and for most of this report all the bones from phase 4 are considered together.

This report is based on the mammal and bird bones recovered by hand during excavation. Forty samples were taken from a variety of contexts. A full list of the

contexts sampled is available in Appendix 2. The mammal and bird bones recovered from the samples will be considered separately from those recovered by hand excavation.

The animal bones and site archive will be stored in the Gray Museum and Art Gallery, Hartlepool, Cleveland.

Identification

Bone fragments were identified to species as far as possible using the reference collection of the Biological Laboratory, Department of Archaeology, University of Durham.

Fragments of mammal bone not readily identifiable to species, such as ribs and vertebrae, were assigned to the size categories of large ungulate and small ungulate. The large ungulates identified on this site are cattle and horse. However horse bones are very infrequent so large ungulate is incuded with cattle in some analyses. The category large mammal was applied to long bone fragments, amorphous pieces probably of scapula or pelvis and some skull fragments. These fragments probably also derive in the main from cattle but are not generally included in the analyses.

The small ungulates found on this site are sheep/goat and pig. Pig bones are less frequent and more readily identifiable so the category of small ungulate has been included with sheep/goat in some analyses. It is probable though that pig ribs have been masked by this approach. The alternative of sheep or goat is given except in the case of skull fragments which were indubitably sheep. However none of the other bones suggested the characters of goat and it is the author's opinion that all the

sheep/goat fragments are from sheep and that goat is not represented on this site.

Preservation

This collection comprises 2101 fragments of mammal bone and 191 fragments of bird bone.

The bones are generally in good condition. Only a small proportion of fragments in any phase appear to have been rolled and weathered prior to burial. Table 2 shows that phases 4 and 5 have the lowest proportions of weathered fragments. This may be expected in phase 4 where much of the bone was recovered from within buildings but more weathering might have been expected from the soil accumulation of phase 5. This may suggest that phase 5 was a fairly rapid accumulation so bones were not lying on the surface exposed to the elements for any great period of time. The waterlain deposits of phase 1, not surprisingly, have the highest proportion of rolled fragments but this is still less than 10% of this group.

At least half the fragments in each phase could be identified to species and approximately a third could be assigned to a size category. The maximum proportion of unidentifiable fragments were found in phases 2 and 6 where about 11% could not be identified.

As will be discussed later the good condition of the bone means that many fragments have clearly visible butchery and gnawing marks and juvenile animals are well represented.

Dogs certainly had access to many bones prior to burial but in general most bones appear to have been deposited when reasonably fresh.

Fragmentation

As noted above preservation on this site is good. There are few loose teeth in any phase which suggests that few jaws have decayed sufficiently for only the teeth to survive even in the periods of open accumulation, phases 1 and 5.

Further fragmentation is considered in Table 3 giving the number of zones represented. This uses a method developed by Rackham (1986 & unpubl.) whereby each bone is allocated up to 10 diagnostic zones. Each zone is recognisable on a bone fragment, though many fragments do not incorporate zones. A zone is only counted if at least half the relevant feature is present. The **Fragmentation Index** reflects the **total number of zones** to the **total number of identified bones** per species. A high number of zones to identified bones gives a higher fragmentation index indicating a lower level of fragmentation.

It can be seen that sheep/goat bones are consistently less fragmented than those of cattle and pig. This is consistent with joints of lamb or mutton being consumed on the bone whereas more of the bones of cattle and pig were removed or cut into smaller sections than the equivalent sheep/goat bones before the meat was consumed. Beef and ham bones could also have been broken up to extract the marrow or to make stock.

In phases 1-3 the admittedly small numbers of cattle bones appear to be marginally less broken up than those of pig whereas in phases 5 and 6 the converse is true. In phase 4 the degree of breakage for cattle and pig bones seems similar.

Table 4 indicates that dogs have had a significant impact on the bones from phases 4-6 in particular. Table 5 details the incidence of canid gnawing marks on sheep/goat bones in particular. The gnaw marks indicate that the dogs were not particularly large and/or hungry as generally only the ends of the bones have been chewed without splintering the shafts. A large dog could totally consume most sheep/goat and poultry bones. Many of the epiphysial ends of the bones chewed will not have been fused so canid gnawing will have reduced the number of surviving unfused epiphyses. This will affect the interpretation of the age structure of the sheep/goat in particular. An unknown proportion of small and juvenile bones originally present on the site could have been totally consumed by dogs. Skulls and jaws do not appear to have been given to dogs to eat as no gnaw marks were seen even on mandibles from young sheep. The apparent absence of canid destruction of jaws may partly explain the relatively low number of loose teeth recovered.

Fragments with rodent gnaw marks were only seen in phases 4 and 6 associated with human habitation and finds of rat type bones.

Butchery

An examination of cut marks on identified sheep/goat and cattle bones only was made by Nicholas Drey for an undergraduate dissertation in the University of Durham, Department of Archaeology (Drey 1988, acc. no. 4669). It is not proposed in this report to duplicate Drey's work which catalogues in detail the number and type of butchery marks he identified.

An indication of the prevalence of butchery marks is given in Table 6 where it can be seen that the proportion of clearly butchered bones is highest in phases 4 and 6. Single examples of sawn bones occur in phases 4 and 5 but sawing as a method of carcase dismemberment is only prevalent in phase 6.

The good condition of the bone has preserved fine knife marks in all phases. Some of these would appear to be defleshing marks made by the butcher while some may be attributed to manipulation during cookery or carving. The distal end of the dog tibia in phase 6 has two fine knife marks which may indicate skinning. No evidence for skinning marks was seen on any of the cat skull fragments.

The most common method of dismembering beef and mutton/lamb carcases in all phases appears to have been with a cleaver or similar tool. The presence in all phases of split vertebrae suggests that the carcases of sheep and cattle were routinely split into sides. Ribs were also severed at some point along their length. In a beef carcase this would separate the roasting rib cuts from the brisket and in a mutton carcase the best end of neck from the breast. In phases 1 and 2 the few sheep skulls represented do not appear to have been split, in phases 4 and 5 skulls appear whole and split in equal proportions while in phase 6 only a split shull fragment was recovered. This implies that heads could have been left on the carcase from phases 4 to 6 and split when the carcase was halved. One skull fragment from phase 5 has a knife mark probably from skinning.

Horn cores appear to have been routinely removed from the skull by the butcher, no skull fragment with the horn cores attached was found in any phase. There is one example of a skull with horn cores removed in phase 2, three in phase 4 and two in phase 5.

There are three loose horn cores in phase 4, three in phase 5 and three in phase 6. These are insufficient to imply commercial horn working.

While it is appreciated that phase 4 spans some 200 years there are only sufficient fragments from this phase to suggest preferred methods of dismembering the shoulder and leg of mutton. It can be seen from Table 7 that in the shoulder whole humeri and radii are uncommon and that this joint was regularly divided midshaft in both the humerus and radius giving quite small joints of meat. In the leg it can be seen that the pelvis was regularly divided through the acetabulum with the femur and tibia both divided midshaft providing small joints too.

Species

The most numerous bones in all phases are those of sheep/goat and cattle with pig remains also present in all phases but far less numerous. These domestic animals were exploited for food and their remains represent culinary waste.

Since the greater part of this report is concerned with these three species they will not be discussed in detail here, though a few comments will be made on the sheep.

As noted above there are skull fragments of horned sheep in phases 2 and 4. Also from phase 4 is part of a polled skull with knobs of bone on the site of the horn

cores. The author has seen this in a polled Manx Loghtan ewe skull, an otherwise horned breed. It is possible that this skull is also a hummel of an otherwise horned breed. The three loose horn cores from phase 4 are from ewes or wethers.

In phase 5 there are two loose horn cores from rams, one very small horn core from a ewe or wether and two skull fragments of horned sheep. There is an almost complete skull of a polled sheep with small scurs on the site of the horns.

In phase 6 there is one ram horn core, two of ewes or wethers and another largely complete skull of a polled sheep with small scurs. The polled sheep of phases 5 and 6 are of a different type to the polled sheep of phase 4 and may represent the introduction of a new type of sheep from the sixteenth century. Polled sheep also appear in Newcastle from this period at Black Gate (Rackham 1981, 237) and Crown Court (Gidney, unpubl.).

Horse remains are very infrequent and none were recovered from phases 2 and 3. The bones represented are a jaw fragment from phase 1, an astragalus from phase 4, a loose mandibular tooth and a second phalanx from phase 5, a first phalanx from phase 6, a loose incisor from the modern deposits and an unstratified skull fragment. None of these fragments suggests human utilisation of horse carcases or the disposal of dead animals in the waste ground phases. These extremities could have been procured for, or scavenged by, dogs.

Cat bones were recovered from all phases and deceased animals appear to have been buried on site by the inhabitants of the structures in phases 4 and 6.

Forty four of the cat bones from phase 4 are from one animal recovered from contexts 235 and 240, adjacent fills in one pit. Many of the epiphyses of this animal were still unfused. Parts of two front legs of a skeletally mature cat were found in context 129, clay debris in Room 1E of Building IV. The other cat bones could possibly belong to this individual but were scattered through five contexts in Buildings III and IV.

In phase 6 seventeen bones from one animal were found in context 53, an ash layer in the alley. The anterior portion of a cat skull was found in context 07, a wall in Building II. This skull is large and stocky and the left canine had been broken in life which suggests this may have been a tom cat. At least two cats are represented in phase 6, one immature and one skeletally mature.

There were no indications of skinning marks on any of the cat bones.

In contrast to the cats, dog bones were only found in phases 4 and 6 though dogs were obviously present in all phases from the occurence of gnawed bones.

All the dog bones from phase 4 were recovered from context 114, a rubble layer in room 1E of Building IV. Only one animal appears to be represented, which was straight legged and skeletally mature. Only an ulna is intact to be measured and this gives an estimated shoulder height of 40cm for the animal using Harcourt's (1974, 154) method of calculation.

In phase 6 four dog bones were recovered from context 110, a cobbled floor in Building II. At least two and probably three animals are represented. A complete radius from a straight legged animal gives an estimated shoulder

height of 40 cm using Harcourt's method. This could be a residual piece of the phase 4 dog, the radius and ulna look as though they belong together although they are from different sides of the body.

There are two left mandibles of very similar size which could derive from one type of dog. They are of similar length to a fox jaw but much more robust. Dogs of this stature would create the pattern of gnawing seen in this collection.

Finally from this context is a tibia from a fairly short, bow legged animal. The proximal end is unfused and the distal end has a clear fusion line. This suggests that the animal was in its second year from Silver's age estimates (1969, 286). The animal represented by this tibia was of a different type to the phase 4 animal and was shorter, perhaps about 30cm shoulder height. The two mandibles could derive from this type of animal.

Hare and rabbit are represented but with only one hare bone from phase 3 and single rabbit bones from phases 2, 4 and 5 plus one modern rabbit bone neither animal can have been of great economic significance.

Bones comparable with rat were found in phases 4 and 6 when human habitations occupied the site. Bone fragments with rodent gnawmarks were only recovered from these phases too, suggesting that the rodents were attracted by the detritus of human occupation. Cat and dog bones are also concentrated in phases 4 and 6 and these animals could have helped to control the depredations of the rat/rodent population.

Two human bones were found amongst the animal bone. A radius from phase 2 context 754, backfill, and a cervical

vertebra from phase 4 context 895, rubble. Both these bones would appear to be redeposited and do not suggest disturbed human internments on this site but elsewhere in Hartlepool.

Domestic fowl and goose bones occur in all phases. Goose bones are overall slightly more numerous than fowl bones but this may merely reflect the greater size and hence better recovery by hand excavation of goose bones. Many of the goose bones were noticeably larger than the grey lag goose used for reference so they could well be domestic birds.

Three fowl bones from phase 5 context 107 were comparable in size to a modern bantam. One tarso-metatarsus with a pronounced spur was found in phase 6 and another two in phase 4. One tarso-metatarus from phase 6, without a spur, appears to have a healed break in the shaft. One might expect a lame bird to be culled immediately. A fowl scapula from phase 4 has exostosis around the proximal articulation.

Both goose and fowl appear to have been consumed regularly through time though not in great numbers.

Phase 4 has the greatest variety of birds represented with duck, pigeon, cormorant and gannet. It is quite likely that all these species were eaten but only on rare occasions.

The gannet bones were all recovered from the backyard and comprise coracoid, carpo-metacarpus and ulna. All are likely to be from the same bird. The ulna had been fractured mid shaft producing a loose splinter of bone which was healing over with new bone growth when the bird

died. Gannet was also recovered from the medieval phases at Church Close, Hartlepool (Allison, 1988).

A manx shearwater humerus was found in phase 2, context 681, backfill. Manx shearwater has also been found in Newcastle (Allison 1987).

The sea gull from phase 6 and the guillemot bones from modern and unstratified contexts are perhaps more likely to be natural mortalities. The gull is herring or lesser black-backed size.

Quantification of the Common Domestic Species

Three methods of quantification are presented in Table 8. These are the relative percentage of identified fragments for each species, the relative percentage of the total number of zones for each species and the ratio of the most frequent zones in each species. The inherent biases of these methods have previously been discussed by Rackham (1988).

All three methods in all phases produce figures giving a predominance of sheep/goat, considerably lesser numbers of cattle and a small proportion of pig. There are minor fluctuations between the phases with phases 4 and 6 having the highest proportions of cattle to sheep/goat fragments and phase 2 having the lowest. The highest proportions of pig bones occur in phases 1 and 6 and the lowest in phase 2 and 5. This slight variation is probably not significant and may only be due to the differing quantity of bone from each phase.

Sheep/goat were probably of greater significance than even these figures suggest. As previously noted dogs have destroyed bones of juveniles and the smaller elements have a poorer recovery rate.

It is interesting that there is no major change through time in the proportion of sheep/goat to cattle bones on this site. O'Connor (1989) has noted an increase in the proportion of sheep/goat to cattle bones through time at York and Lincoln and the author has noted this trend in Newcastle. On this site in Hartlepool sheep/goat aapear to have been the most regularly consumed animal from the twelfth century. Alternatively beef and pork or bacon may have been procured off the bone so are under represented in this faunal assemblage. If this were true for the occupation phases more stray beef bones might perhaps have been expected from the open ground phases when more 'background' faunal material could have found its way onto site.

Relative Frequency of Skeletal Elements

This information is provided in Tables 9a-c. The few loose teeth have been included in the skull or jaw counts. The term 'front leg' includes the scapula, humerus, radius and ulna while the term 'hindleg' includes the pelvis and sacrum, femur and patella and tibia. While carpals and tarsals are usually included on the extremity of these carcase portions they have not been counted as tarsals, being larger, have a better recovery rate than carpals.

Cattle

Since there are very few cattle bones from phases 1-3 these will be considered together. There is a thin scattering of bones from all parts of the body with only rib fragments being particularly numerous. The foreleg seems better represented than the hind leg despite the total absence of humerus fragments.

In phase 4 there are notable numbers of rib fragments and thoracic vertebrae. The rib cage forms a large part of a carcase. Lumbar vertebrae are uncommon but there are fewer of these in a carcase. The head is well represented and phalanges are noticeably more common than metapodials. While there are six phalanges to each metapodial phalanges are much smaller and easily missed during excavation. Bones of the fore and hind limb appear in roughly equal quantities though in the hindlimb the pelvis, sacrum and femur are more frequent than the tibia and tarsals. The latter carry less meat than the former.

Phase 5 appears to have another thin scattering of most parts of the body. The head and ribs are the most frequent items. The forequarter seems slightly better represented than the hindquarter which has an absence of tibia.

In phase 6 ribs and thoracic vertebrae are the most common. Lumbar vertebrae are better represented than in the other phases. The head is well represented. The upper hindlimb is more frequent than the lower hindlimb and the same appears true of the forelimb. Phalanges are less numerous than metapodials, unlike phase 4. The inhabitants of phase 6 appear to have had more choicer joints, as represented by lumbar vertebrae, pelvis and sacrum, than the denizens of phase 4.

Sheep/goat

In phase 1 there is a thin scattering of bones with most parts of the body represented. Rib fragments are the most common but thoracic vertebrae are absent. Fragments of the extremities, head and feet, are proportionally higher than the rest of the body. On such a small group

it is difficult to decide whether this is a pattern of survival or disposal. If the latter then this group could incorporate an element of butchers or tanners waste or reflect a preference for cheaper food.

There are rather more fragments from phase 2 with ribs being the most numerous element. The head is well represented but feet are scarce compared to phase 1. The forequarter is evenly represented but in comparison the bones of the hindlimb are very sparse. The scarcity of tibia is unlikely to be a factor of preservation or recovery as the distal end is very compact, survives well and is easily recognised. This may suggest that the people disposing of refuse in phase 2 did not include tanners waste or were under no necessity of consuming sheep trotters. These people do not seem to have had leg of lamb as frequently as shoulder.

There are fewer bones from phase 3. Ribs are the single most common fragment but, like the phase 1 group, there are no thoracic vertebrae. Unlike the two preceding phases bones of the hindlimb are more numerous than those of the forelimb, humerus, carpals and metacarpals being absent.

Phase 4 is the largest group but also has a long time span. All parts of the body are present but there are low numbers of carpals and metacarpals to tarsals and metatarsals as in the two previous phases. The high number of phalanges suggests this is not entirely due to differential recovery. Ribs are the single most common element. The vertebrae are fairly evenly represented. There are rather more fragments from the forelimb than

the hindlimb which may suggest a small preference for the shoulder.

In phase 5 there appears to be a fairly even distribution of fragments with only carpals totally absent and tarsals rare. Ribs are marginally the single most common fragment but skull, radius and ulna, tibia and metatarsal fragments are almost as common in direct contrast to phase 4. Head and feet fragments are also proportionally more common than in phase 4. Forelimb and hindlimb fragments are present in similar numbers. However tibiae are relatively more abundant than in any of the earlier phases.

All parts of the carcase are represented in phase 6. As in all the earlier phases ribs are the most common fragments though thoracic vertebrae fragments are low in comparison. Cervical vertebrae are the most abundant, a pattern not clearly seen in earlier phases which may suggest increased popularity of scrag end. Unlike all the previous phases carpals and metacarpals outnumber tarsals and metatarsals. The other bones of the foreleg slightly outnumber those of the hindlimb too.

The impression gained from all phases is that all parts of the body were considered edible including the head and feet. The latter were esteemed in the nineteenth century by Mrs Beeton (1861 facsimile, recipes 741-2) though trotters in particular are not commonly met with today. Neither head nor feet are present in sufficient numbers to suggest any significant disposal of butchers or tanners waste. There appears a slight but not marked preference for the forequarter in all phases. The number of ribs may be slightly exaggerated in all phases by the

inclusion of some pig ribs under the category of small ungulate.

Pig

Pig remains are rather scarce in all phases to interpret the pattern of body part representation. Only some brief comments are possible. Remains of the hindlimb are most numerous in the earlier phases, head and trotter fragments occur in similar numbers while the forelimb is slightly more sparse. In phases 4 and 5-6 there are similar numbers of fragments from the head, fore and hindlimbs and lesser numbers of trotters. The absence of ribs is artificial, the few likely to be present are probably included as small ungulate in the sheep/goat section.

Analysis of age structure

The age at which animals were slaughtered is estimated from the stages of epiphysial fusion and tooth eruption and wear. The ages of fusion and eruption given in Tables 10 and 11 are taken from Silver (1969, 285-6, 296-8).

Loose epiphysial ends and unfused diaphyses have both been counted for Table 10 unless a shaft and epiphysis were found which fitted together. Since damage by dog gnawing has reduced the number of unfused diaphysial ends, counting both unfused parts will help to redress this loss. It is still thought that juvenile animals will be somewhat under represented in this table.

Cattle

There are insufficient surviving epiphysial ends of cattle to examine the age structure in each phase. For Table 10 phases 1-4 and phases 5-6 have been amalgamated.

In the earlier group it seems that some 30% of the cattle were killed before about 2 years of age.

Nine of the total unfused epiphysial ends come from animals newborn or at most a few weeks old. There are a further 31 fragments without the epiphysial ends surviving which also derive from young calves. These could derive from natural mortalities implying the presence of breeding cattle nearby or veal calves which also postulate milch cows.

Altogether about threequarters of the animals present were probably killed by about three years of age with only one quarter having attained full skeletal maturity.

In the later phases about a third of the cattle would appear to have been killed before about 2 years of age. Young calves are represented by one fragment with epiphysial end and a further 24 without. The next cull seems to be at the 3-4 year old stage, a step later than in phases 1-4. There also seems a smaller cull at the time the vertebral epiphyses fuse with fewer animals surviving to full skeletal maturity than in the earlier phases.

Sheep/goat

Epiphysial ends of sheep/goat are scarce in phases 1-3 so have been amalgamated for Table 10b. The proportion of first year animals killed appears to double in phases 5 and 6 compared to the earlier phases. However bones of neonatal or very young lambs are infrequent compared to those of calves. In phase 1 there are two radii of very young lambs, in phase 4 there are four bones with epiphysial ends and three without and in phase 6 one fragment without an epiphysial end. This may partly

reflect recovery as calf bones are much larger than lamb bones.

The pattern of cull for sheep/goat is otherwise broadly similar in all phases with about 20% in the 1-2 year age group and 35-40% in the 2-4 year group. Phase 5 has a smaller cull in the 1-2 year group but this appears to be compensated by a higher cull in the next stage. The earlier phases with the smaller culls of young animals have a higher proportion surviving to full skeletal maturity. Conversely the later phases with a higher juvenile cull have fewer animals reaching full skeletal maturity.

Pig

There are comparatively few epiphysial ends surviving from the individual phases so these have been amalgamated into two groups, phases 1-4 and phases 5-6. Both groups show a high cull of animals in their first year with no fused epiphyses present which fuse after 2-3 years of age. None of the pigs appear to have attained skeletal maturity.

Teeth

The evidence for ageing from the teeth is presented in Table 11. The deciduous teeth present have been counted as unerupted permanent teeth. Slight wear corresponds roughly to Grant stages A-E (Grant 1982, 92-4).

Cheek teeth from cattle were only found in phases 4, 5 and 6. In phases 4 and 5 there are more permanent teeth in full wear than deciduous teeth or permanent teeth with little wear. In contrast there are more deciduous than permanent teeth in phase 6.

More cheek teeth are present in all phases for sheep/goat. In phases 1 and 2 there is an absence of deciduous teeth. In phase 2 the majority of the permanent teeth only have slight wear. In phase 3 there is a lack of later erupting permanent teeth with full wear. In phase 4 there is a clear majority of deciduous or unerupted permanent teeth with very few of the permanent teeth showing heavy wear. This pattern can also be seen in phases 5 and 6. In sum the teeth suggest in phases 1 and 2 that the greater part of the sheep attained their permanent dentition but in phase 2 did not survive long enough to accrue much attrition. In phases 3-6 the greater part of the sheep were killed with deciduous dentition and very few survived to attain the full adult dentition.

In total ten jaws had intact tooth rows to calculate Mandibular Wear Stages after Grant (1982, 96). In phase 1 one jaw has MWS 52, in phase 2 one jaw has MWS 35 and two jaws have MWS 43. In phase 3 one jaw has MWS 24, in phase 4 one jaw has MWS 24 and another MWS 9. In phase 5 there is a jaw with MWS 9 and another with MWS 9 in phase 6. Also in phase 6 is a neonatal lamb's jaw with MWS 0. This clearly illustrates the absence of intact mandibles from mature sheep in the later phases.

There are very few pig teeth and jaws present. It can clearly be seen from Table 11 that there are no permanent pig teeth present from any phase showing heavy wear.

The evidence from the epiphyses and the teeth both suggest that skeletally mature sheep were culled in the earlier phases but in the later phases a greater proportion of younger animals were consumed. Both lines

of evidence suggest that all the pigs were immature. The cattle teeth are sparse but complement the epiphysial evidence for the presence of calves and immature beasts with fewer skeletally mature animals.

Pathology

Very few diseased bones were seen in this collection. The bird bones have previously been mentioned. Otherwise in phase 4, context 149, a rib and thoracic vertebra, both probably from the same animal, were found with arthritic type bony growth. A bovine first phalanx from context 862 has an enlarged proximal articulation with bony growth.

In phase 6 a bovine first phalanx from context 44 has slight lipping round the proximal articulation. The most serious injury seen in this collection is a bovine rib from context 841 which has a large abscess type condition on the neck involving a proliferation of fine bony growth with lots of cavities. This bone has clearly been sawn further down the shaft so the injury was presumably not still putrid when the carcase was butchered.

Samples

The residues from the bulk samples were sorted for faunal remains. Most of the bones recovered from the samples were tiny unidentifiable fragments which have not been counted. The fragments identifiable to species or size of animal are listed in Table 1C. Not surprisingly there is better recovery of the bones of the smaller species than is possible by hand excavation. For instance blackbird and small mammal (not rat sized) were only recovered from samples.

The skeletal elements of sheep/goat recovered from the samples are listed in Table 9D. It can be seen that loose teeth, carpals, tarsals and other small elements have been recovered which were scarce or absent in the hand excavated collection. The scarcity of these elements in Table 9 is thus a reflection of recovery bias.

Measurements

All bones that could be measured from phases 1-5, whether complete or one articular end were measured. The recent bones from phase 6 were not measured to economise on the time taken to produce this report . All measurements were taken in millimetres folowing the order given in Jones et al (AML Report 3342), based on von den Driesch (1976).

The measurements taken are listed in Appendix 3. Abbreviations of the measurements are given for the first occurence of each bone in the appendices. Insufficient measurable bones were recovered for any analyses within this site so the metrical data are presented solely for the use of other researchers.

Complete bones with greatest length measurement were used to estimate the stature of the sheep/goat following the multiplication factors given by Teichert for prehistoric and early historic sheep (von den Driesch and Boessneck 1974, 339). Two metacarpals from phase 2 both give shoulder heights of 56cm. One radius and four metacarpals from phase 4 give shoulder heights of 53-59cm. Three metacarpals and five metatarsals from phase 5 give shoulder heights of 52-65cm. The larger animals from the later phase may perhaps reflect either the entire

males represented by the horn core fragments or a difference in size between the horned and polled sheep.

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Bibliography

Allison, E. P. 1987. Bird Bones from the Quayside, Queen Street, Newcastle upon Tyne. AML report 96/87.

Allison, E. P. 1988. The Bird Bones from excavations in Church Close, Hartlepool 1984 and 1985. AML report 52/88.

Beeton, I. 1861 facsimile. The Book of Household Management.

Drey, N. 1988 unpubl. An examination of the cut marks from bones from Hartlepool Middlegate: with specific reference to sheep and cattle. University of Durham acc. no. 4669.

Gidney, L. J. Unpubl. Newcastle Crown Court. The Mammal and Bird Bone.

Grant, A. 1982. The use of tooth wear as a guide to the age of domestic ungulates. In Wilson, B., Grigson, C. and Payne, S. (Eds) Ageing and Sexing Animal Bones from Archaeological Sites. B. A. R. British Series 109.

Harcourt, R. A. 1974. The Dog in Prehistoric and Early Historic Britain. Journal of Arch. Science 1974 vol. 1.

Jones, R. T., Wall, A. M., Locker, A. M., Coy, J. & Maltby, M. Computer Based Osteometry. Data Capture User Manual (1). Ancient Monuments Laboratory Report 3342.

O'Connor, T. 1989. What Shall We Have for Dinner? Food Remains from Urban Sites. In Serjeantson, D. and Waldron, T.(Eds) Diet and Crafts in Towns. B. A. R. British Series 199.

Rackham, D. J. 1981. The Animal Remains. In Harbottle, B. and Ellison, E. An Excavation in the Castle Ditch, Newcastle upon Tyne, 1974-6. Arch. Aeliana 5th series 9.

Rackham, D. J. 1986. Assessing the relative frequencies of species by the application of a stochastic model to a zooarchaeological database. In Wijngaarden-Bakker, L. van (ed) Database Management and Zooarchaeology.

Rackham, D. J. 1988. The Mammal Bones from Medieval and post-Medieval Levels at Queen Street. In O'Brien, C. et al The Origins of the Newcastle Quayside. Soc of Antiq. Newcastle upon Tyne Monograph No. 3.

von den Driesch, A. and Boessneck, J. A. 1974. Kritische Anmerkungen zur Widerristhoherbereichnung aus Langenmassen vor- und fruhgeschichtlicher Tierknochen. Saugtierkundliche Mitteilungen 22.

Von den Driesch, A. 1976. A Guide to the Measurement of Animal Bones from Archaeological Sites. Peabody Museum Bulletin 1.

Hartlepool Middlegate
Table 1. Fragment counts for the species present.

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Modern
Cattle	12	14	10	139	41	83	7
Sheep/Goat	29	78	25	199	86	112	15
Sheep	1	2		10	6	4	
Pig	11	10	4	44	5	33	4
Horse	1			1	2	1	1
Cat	2	4	1	67	2	30	1
Dog				9		5	
Hare			1				
Rabbit		1		1	1		1
cf Rat				2		2	
Human		1		1			
L. Mam.	3	9	7	78	19	41	4
L. Ung.	2	21	10	86	19	72	6
S. Ung.	21	38	21	180	37	126	18
Indet.	4	18	3	46	13	47	22
Fowl	1	7	2	24	8	13	1
Goose	3	8	6	30	5	20	1
Duck				3	2		
Pigeon				3			
Guillemot							1
Cormorant				1			
Gannet				3			
Gull							1
Manx Shearwater		1					
Indet Bird		6	1	9	2	18	9

Hartlepool Middlegate
Table 1A
Fragment counts for the species present from Phase 4.

	Building IV									Building III					Back Yard
	1A	1C	1D	1E	2A	2B	2C	3A	Gen	4A	4B	4C	4D	Gen	
Cattle	4	16	4	26	2	6	1		2	12	2	6	31	1	26
Sheep	2		1		2	2							1		
Sheep/Goat	13	16	6	28	11	23	1		9	10	7	1	40	1	33
Pig	3	2	6	4	1	6			1	6	2	1	5		6
Horse															
Dog				9											
Cat			1	16								3	45		
Rabbit				1											
Rat										1					1
Human															1
L. Ung.	2	7	3	14	4	2	2		3	16	2		13	1	17
S. Ung.	21	14	20	14	10	5		1	7	19	3	3	38		23
L. Mam.	7	8	5	6	3	5		1	2	11	4	3	16		7
Indet. Mam.	1	5	4	2		3	3				2	1	12		13
Goose	2	3	2	2					3	3		1	4		10
Fowl	1	1	1		2	4	1		2	2	2	1	6		1
Duck			2												
Pigeon		3													
Cormorant				1											
Gannet															3
Indet Bird				1		1			1	1			3		2

Hartlepool Middlegate
Table 1B
Phase 4 Buildings III and IV
Fragment counts for the species present

	Building IV	Building III
Cattle	61	52
Sheep	7	1
Sheep/Goat	107	49
Pig	23	14
Dog	9	
Cat	17	48
Rabbit	1	
Rat		1
L. Ung.	37	32
S. Ung.	92	63
L. Mam.	32	44
Indet.	18	15
Goose	12	8
Fowl	12	11
Duck	2	
Pigeon	3	
Cormorant	1	
Indet. Bird	3	4
	437	343

Hartlepool Middlegate
Fragment counts for the species present in the samples
Table 1C

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 6
Cattle			1	3	
Sheep/Goat	4	12	7	10	2
Pig	1	2	2	3	
L. Ung.		1	2	2	
S. Ung.	2	4		10	2
L. Mam		1			
S. Mam.		1		1	
Fowl	1	2	1	2	
Goose		1		1	
Blackbird		1			
Indet. Bird		5	1	8	

Hartlepool Middlegate
Table 2
Proportions of identified and decayed mammal and bird bone

	Phase 1		Phase 2		Phase 3		Phase 4		Phase 5		Phase 6	
Id to sp	60	66.6%	126	57.7%	49	53.8%	537	57.3%	158	63.7%	304	50%
Id to size	26	28.8%	68	31.1%	38	41.7%	344	36.7%	75	30.2%	239	39.3%
Indet	4	4.4%	24	11%	4	4.3%	55	5.8%	15	6%	65	10.6%
Decayed	8	8.8%	10	4.5%	5	5.4%	20	2.1%	1	0.4%	18	2.9%
Loose teeth	2	2.2%	5	2.2%	2	2.1%	8	0.8%	9	3.6%	9	1.4%
Total frags	90		218		91		936		248		608	

Hartlepool Middlegate
Table 3. Fragmentation indices

Cattle	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
No. of zones	9	16	10	135	24	87
No. of bones with zones	6	9	6	89	18	43
No. of bones id.	12	14	10	139	41	83
Frag. Index	0.75	1.1	1	0.9	0.5	1.04
Sheep/goat						
No. of zones	41	145	36	437	173	176
No. of bones with zones	21	56	18	188	69	90
No. of bones id.	30	80	25	209	92	116
Frag. Index	1.3	1.8	1.4	2.09	1.8	1.5
Pig						
No. of zones	7	7	2	40	8	41
No. of bones with zones	4	6	1	26	3	22
No. of bones id.	11	10	4	44	5	33
Frag. Index	0.6	0.7	0.5	0.9	1.6	1.2

Hartlepool Middlegate
Table 4. Frequency of gnawing marks
C = Canid R = Rodent

	Phase 1	Phase 2	Phase 3	Phase 4		Phase 5	Phase 6	
	C	C	C	C	R	C	C	R
Cattle			1	25		6	11	
Sheep/goat	1	9	3	64		23	18	1
Pig				9	1	1	4	
L. Mam.				3		5	5	1
L. Ung.				8			7	
S. Ung.			2	12		1	9	2
Indet Mam.				1		1	2	
Fowl				1	2			
Goose			1	3			4	
Indet. Bird				1		1	2	
% gnawed	1.1%	4.1%	7.6%	13.6%	0.4%	14.9%	9.8%	0.6%

Hartlepool Middlegate
Table 5
Incidence of canid gnawmarks on sheep/goat bones

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Prox. Scapula				1		1
Dist. Scapula				4	3	2
Prox. Humerus		1		3	1	2
Dist. Humerus				7	1	1
Prox. Radius				3	3	3
Dist. Radius				10	3	3
Prox. Ulna				3	3	
Prox. Mc		1		1		1
Dist. Mc		1		3		3
Prox. Ilium		1		10		1
Dist. Ilium		1		1		
Prox. Ischium				2		1
Dist. Ischium				4	1	1
Prox. Femur				1		
Dist. Femur		1	1	7		
Prox. Tibia			1	2	2	2
Dist. Tibia		2		3	1	2
Calcaneum				2		
Astragalus			1			
Prox. Mt						
Dist. Mt	1			2	4	
Occipital				1		
Atlas				1		
Axis					1	

Hartlepool Middlegate
Table 6
Incidence of Butchery marks
C = Chop K = Knife S = Saw R = Repeated

	C	CR	K	KR	S	SR	% with butchery marks
Phase 1							
Cattle etc	2	1					
Sheep/Goat etc	5		1				
Pig	1						
Indet		1					
							12.2%
Phase 2							
Cattle etc	5	1					
Sheep/Goat etc	13	1		2			
Goose				1			
							10.5%
Phase 3							
Cattle etc	2	1	1	1			
Shep/goat etc	5		1	1			
							13.1%
Phase 4							
Cattle etc	80	22	2	5			
Sheep/Goat etc	83	8	12	8	1		
Pig	5	1	1				
Bird				1			
Indet	2						
							24.6%
Phase 5							
Cattle etc	9	3	2	1			
Sheep/Goat etc	31	3	3	4	1		
							22.9%
Phase 6							
Cattle etc	37	13	2	2	15	1	
Sheep/Goat etc	42	15	1	9	16		
Pig	3	4			1	2	
Dog				1			
							26.9%

Hartlepool Middlegate
Table 7
Phase 4 Sheep/goat fragments

Shoulder		Leg	
Dist. Scap.	8	Pelvis	1
Prox. Hum.	5	Ilium	7
Dist. Hum.	17	Ilium/Acet.	4
Humerus	2	Ischium/Acet.	2
Prox. Rad.	8	Pubis/Acet.	2
Dist. Rad.	11	Prox. Fem.	3
Radius	2	Dist. Fem.	11
Prox. Ulna	5	Femur	2
		Prox. Tibia	5
		Dist. Tibia	13

Hartlepool Middlegate
Table 8
Three methods of Quantification

Phase 1	Cattle		Sheep/Goat		Pig	
No. of frags	12	22.6%	30	56.6%	11	20.7
Total no. of zones	9	15.7%	41	71.9%	7	12.2
Most frequent zone	1	20%	3	60%	1	20%
Phase 2						
No. of frags	14	12.2%	80	70.1%	10	8.7
Total no. of zones	16	9.5%	145	86.3%	7	4.1
Most frequent zone	1	14.2%	5	71.4%	1	14.2
Phase 3						
No. of frags	10	25.6%	25	64.1%	4	10.2
Total no. of zones	10	20.8%	36	75%	2	4.1
Most frequent zone	1	25%	2	50%	1	25%
Phase 4						
No. of frags	139	35.4%	209	53.3%	44	11.2
Total no. of zones	135	22%	437	71.4%	40	6.5
Most frequent zone	8	24.2%	20	60.6%	5	15.1
Phase 5						
No. of frags	41	29.7%	92	66.6%	5	3.6
Total no. of zones	24	11.7%	173	84.3%	8	3.9
Most frequent zone	2	15.3%	9	69.2%	2	15.3
Phase 6						
No. of frags	83	35.7%	116	50%	33	14.2
Total no. of zones	87	28.6%	176	57.8%	41	13.4
Most frequent zone	6	40%	6	40%	3	20%

Hartlepool Middlegate
Table 9a
Skeletal elements present for cattle and large ungulate

	Phases 1-3	Phase 4	Phase 5	Phase 6
Skull	4	20	13	16
Jaw	4	16	8	7
Scapula	5	8	2	9
Humerus		6	2	3
Rad. & Uln.	7	10	4	2
Cervical Vt.	6	9	5	4
Thoracic Vt.	2	14	3	17
Lumbar Vt.	5	4	2	13
Ribs	22	50	9	32
Pelvis & Sac.	1	15	3	16
Femur & Pat.	1	9	1	8
Tibia & Mal.	2	6		3
Carpals		1		1
Tarsals	2	7	2	5
Sesamoids		2		
Metacarpal		3	2	6
Metatarsal	3	7	2	6
Phalanges	5	23	1	5

Hartlepool Middlegate
Table 9b
Skeletal elements present for sheep/goat and small ungulate

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Skull	5	10	3	30	13	14
Jaw	5	9	3	16	7	8
Scapula		6	1	15	8	12
Humerus	1	5		25	5	10
Rad. & Ulna	3	4	3	33	12	12
Cervical Vt.	3	5	1	20	6	21
Thoracic Vt.		2		21	4	10
Lumbar Vt.	1	3	5	15	9	14
Rib	14	25	10	99	15	62
Pelvis & Sac.	2	8	2	18	7	12
Femur & Pat.	1		3	20	2	8
Tibia		1	5	20	11	8
Carpals				1		7
Tarsals	1	2	2	5	1	4
Metacarpal	4	1		9	7	6
Metatarsal	5		2	15	11	3
Phalanges	2	4	1	16	5	7

Hartlepool Middlegate
Table 9c
Skeletal elements present for pig

	Phases 1-3	Phase 4	Phases 5-6
Skull	4	2	5
Jaw	5	6	5
Scapula	1		3
Humerus	1	1	4
Rad. & Ulna	4	7	3
Cervical Vt.	3	2	
Thoracic Vt.	1	2	1
Lumbar Vt.	1	1	1
Rib			
Pelvis & Sac.	5		2
Femur	5	4	6
Tib. & Fib.	5	4	2
Carpals			
Tarsals	2	1	1
Metacarpal	3	2	1
Metatarsal	5	1	
Phalanges	1	5	2

Hartlepool Middlegate
Elements of Sheep/goat recovered from samples
Table 9D

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 6
Mand. Tooth		1			
DUP4		1			
UPM4		1			
LPM2			1		
DLI				2	
Zygomatic		1	1		
Premaxilla		1		1	
Scapula				1	1
Radius		1			
Ulna	1				1
Acet				1	
Pubis		1			
Femur		1			
Patella			1		
Centroquartal	1				
Astragalus			1		
Tar 2+3				1	
Carpal 4		1	1		
Metatarsus		1	1		
Metapodial				1	
Phalanx 1	2				
Phalanx 2				1	
Phalanx 3				1	
Dist. Ses.				1	

Hartlepool Middlegate
Table 10 Epiphysial fusion data

F = Fused J = Just Fused K = Killed U = Unfused

Cattle	Phases 1-4				Phases 5-6			
	F	U/J	%U	%K	F	U/J	%U	%K
0-2yr	27	12	30.7%	30.7%	7	4	36.3%	36.3
2-3yr	2	7	77.7%	47%	5	1	16.6%	0
3-4yr	4	9	69.2%	0	3	7	70%	33.7
5yr	9	11	55%	0	5	33	86.8%	16.8
>5yr				22.3%				13.2
Pig								
0-1yr	4	4	50%	50%	2	3	60%	60%
2-3yr	3	17	85%	35%	2	2	50%	0
3-4yr		8	100%	15%		7	100%	40%
5yr		18	100%	0		2	100%	0
>5yr				0				0

Hartlepool Middlegate
Table 10b Epiphysial fusion data

Sheep/goat	Phases 1-3				Phase 4			
	F	U/J	%U	%K	F	U/J	%U	%K
0-1yr	11	1	9%	9%	29	4	12.1%	12.1%
1-2yr	21	6	28.5%	28.5%	29	16	35.5%	23.4%
2.5-3.5yr	5	11	68.7%	40.2%	10	24	70.5%	35%
5yr	9	14	60.8%	0	17	43	71.6%	1.1%
>5yr				31.3%				28.4%
	Phase 5				Phase 6			
0-1yr	9	3	25%	25%	11	3	21.4%	21.4%
1-2yr	13	7	35%	10%	9	7	43.7%	22.3%
2.5-3.5yr	2	7	77.7%	42.7%	4	15	78.9%	35.2%
5yr	9	15	62.5%	0	15	40	72.7%	0
>5yr				22.3%				21.1%

Hartlepool Middlegate
Table 11 Tooth eruption and wear

U = Unerupted S/W = Slight Wear H/W = Heavy Wear

		Phase 4			Phase 5			Phase 6		
Cattle		U	S/W	H/W	U	S/W	H/W	U	S/W	H/W
5-6m	M1	1		2			2			1
15-18m	M2			2			3			
24-30m	P2	1		2	1	1		1		1
18-30m	P3	1		3		1	2	2		1
24-30m	M3						2			1
28-36m	P4	2		2	2			3		

		Phases 1-4			Phases 5-6		
Pig		U	S/W	H/W	U	S/W	H/W
4-6m	M1					1	
7-13m	M2		2			1	
12-16m	P2				1		
12-16m	P3				1	2	
12-16m	P4				1	2	
17-22m	M3	2			1		

Hartlepool Middlegate
Table 11b Sheep/Goat

		Phase 1			Phase 2			Phase 3		
		U	S/W	H/W	U	S/W	H/W	U	S/W	H/W
3-5m	M1			3			3			2
9-12m	M2			1			5		2	
21-24m	P2		1			5		1		
21-24m	P3		1	1		7		1		
18-24m	M3		1	1		5	3			
21-24m	P4			2		4	2	2		

		Phase 4			Phase 5			Phase 6		
		U	S/W	H/W	U	S/W	H/W	U	S/W	H/W
3-5m	M1	1	2	2		2		1	2	1
9-12m	M2	3	2	1	1	1	2	2	1	
21-24m	P2	4			1			3		
21-24m	P3	4		1	1			3		
18-24m	M3	4		3	1		1	2	1	1
21-24m	P4	5		2	1			2	1	1

Appendix 1

HARTLEPOOL MIDDLEGATE 1986

Synopsis of Phases

Phase 1 12th to 13th Century

Waterborne sands which contained the much decayed remains of stakes. A number of stakes formed a square c2 m across (Structure VI).

A mass of boulders (not the usual limestone building material) acted as a wall, behind which layers of dirty, silty material accumulated. These layers were interspersed with lenses of cleaner sand.

Phase 2 First half of 13th Century

Backfilled material used to raise the level of the shoreline in order to reclaim the land. This consisted of layers of clean sand, dirty silty sand and clay layers.

Phase 3 Mid to Late 13th Century

Early medieval features cut into the top of the backfilled material. These were mostly random stake holes but there were also two gulleys set c4 m apart (Structure V). A few stake holes appeared to run perpendicular to these gullies.

Phase 4 Late 13th Century to 1500

Part of two medieval buildings (BIII and BIV) were seen aligned east-west and an associated back yard.

BIII (South of 18th Century cellar)

In the medieval period this part of the site could be divided into four sub phases.

4a - Two large pits.

4b - The first stone walls of BIII with associated drains.

4c - Re-build of BIII with occupation debris.

4d - Decay and robbing.

BIV

A thick sequence of occupation debris with much industrial activity. The contexts have been divided into sub phases within each room. The stratigraphic sequence is as follows.

1a, 1b, 2a and 4a, 2b, 3a and 2c, 2d, 1d, 1e. The positioning of 1c within this is uncertain but it was probably contemporary with 2a, 4a, 2b, 3a and 2c accumulating.

Back yard

Mostly layers of back yard material with a square, stone cess pit between the two medieval buildings.

Phase 5 1500 to 1700

Abandonment and accumulation of humic soil across the site.

Phase 6 1700 to Early 20th Century

Two 18th Century stone buildings aligned north-south, each with cellars with modern backfill (BII and BVII). A lane made from the build up of rubble, soil and concrete ran between them. Victorian brick buildings were built on top (BI). A dome shaped cess pit and brick rubbish pit also belong to this phase.

Appendix 2

Hartlepool Middlegate
Sample details

Sample no.	Context no.	Phase	Volume floated (l)	Feature
01	158	4	12.00	layer within building
02	186	4	12.00	layer within building
03	210	4c	0.40	layer within oven
04	219	4c	0.40	layer within oven
05	229	4c	2.00	layer within building
06	240	4d	0.80	layer within pit
07	249	4c	9.00	layer within building
08	293	4	6.00	layer within building asbestos
09	327	4b	11.00	layer within building
10	407	4a	3.00	?hide from bottom of feature
11	479	4a	3.00	layer within cess pit, may have sunk from 4b above
12	506	4	6.00	ash layer within building
13	538	3	24.00	fill of feature
14	527	3	22.00	fill of rectangular pit
16	554	4	1.50	fill of post hole
17	563	3	12.00	fill of feature
18	572	2	28.00	backfilled material
19	590	4	4.80	ash layer within building
20	619	4	19.50	ash layer within building
21	651	4	3.00	layer within building
22	622	4	3.00	back yard cess pit layer
23	647	4	18.80	layer within building
24	681	2	11.50	backfilled material
25	691	4	1.20	backyard layer
26	707	2	19.00	backfilled material
27	706	3	9.00	fill of feature
29	731	2	14.00	backfilled material
30	753	2	12.00	backfilled material
31	771	1	5.00	layer/feature
32	772	1	14.00	waterlain sand
33	750	4a	8.00	layer in bottom of cess pit
34	790	1/4	24.00	leakage from Med.cess pit into waterlain sand(750)
35	826	6	3.00	fill of rubbish pit
36	841	6	8.00	fill of rubbish pit
37	932	4	1.00	layer within building
38	968	1	6.00	waterlain material
39	985	3	2.00	fill of rectangular pit
40	969	1	25.00	waterlain matrix of beach boulders

Hartlepool Middlegate
Appendix 3A
Sheep/Goat Distal Tibia

Breadth	Depth	Phase
27.01	20.17	2
25.75	19.08	2
24.61	19.2	2
25.75	20.7	2
25.91	20.25	3
25.45	19.52	3
29.62	22.31	4
25.59	19.77	4
25.07	18.89	4
26.33	20.25	4
24.83	19.24	4
36.34	34.31	4
27.58	20.61	4
24.13	17.99	4
24.62	19.22	4
24.37	18.93	5

Hartlepool Middlegate
Appendix 3B
Measurements for sheep/goat bones
Phase 1

	GL	BP	DP	SD	MD	BD
Phalanx 1	35.3	12.82	13.96	10.77	10.26	12.05
	GLI	GLC	BP	PD	BT	
Humerus	0	0	0	0	26.78	
	DD	BD	SD	GL	LT	
	20.58	28.43	0	0	18.46	

Phase 2

	LA	BA	LAL	LAR	D			
Acetabulum	21.9	23.29	27.73	23	4.43			
	GLL	GLC	GLM	PB	BD	DL	DMD	
Astragalus	26.98	21.91	26.45	18.57	17.66	16.18	14.16	
	GL	BP	PB	MB	MD	BD		
Radius	0	0	0	0	0	26.31		
	DD	BFP	BFD	LP	SD	GL1		
	16.55	0	23.93	0	13.59	0		
Radius	0	0	0	0	0	25		
	14.95	0	23.11	0	0	0		
	Gl	BP	DP	SD	MD	BD	MDD1	MDD2
Metacarpus	115.87	21.16	15.51	12.69	10.42	24.55	10.62	15.33
	LDD1	LDD2	WMC	WLC	DD	DFB	DFD	L1
	10.12	14.79	10.14	9.41	9.17	24.2	13.5	0
Metacarpus	0	0	0	0	0	25.45	11.01	15.62
	10.4	15.15	9.96	9.59	0	25.54	13.71	0
Metacarpus	0	0	0	0	0	25.01	10.81	15.88
	10.23	15.52	10.04	10.05	9.59	24.45	13.78	0
Metatarsus	0	0	0	0	0	22.26	9.34	14.89
	8.88	13.79	9.83	8.72	9.76	22.77	12.04	0
Metatarsus	0	0	0	0	0	21.86	9.76	15.09
	9.13	14.1	9.64	8.93	8.85	21.94	11.8	0
Phalanx 1	36.9	10.66	13.48	7.79	9.12	9.6		
Phalanx 1	35.88	12.18	14.27	10.34	9.85	11.84		
Phase 3								
Phalanx 2	21.46	13.64	13.32	9.89	9.64	10.21		
Astragalus	27.53	22.38	27.45	19.75	18.75	16.89	15.26	
Radius	0	29.48	14.56	16.1	7.94	0		
	0	27.11	0	0	15.79	0		
Metatarsus	0	0	0	0	0	24.04	9.52	15.34
	8.77	14.08	11.13	9.63	9.77	24.01	14	0

Hartlepool Middlegate
Appendix 3C
Measurements of sheep/goat bones
Phase 4

	Ld	SLC	TN	GLP	BG	
Scapula	0	19.06	10.99	31.28	20.83	
	LG	HS	DHA	SG		
	24.22	0	0	19.89	0	
Scapula	0	0	0	28.4	19.31	
	23.22	0	0	0	0	
Scapula	0	20.06	11.18	33.84	21.59	
	26.37	0	0	20.62	0	
Humerus	0	0	0	0	27.33	
	20.4	29.57	0	0	17.2	
Humerus	0	0	0	0	26.89	
	19.42	28.52	0	0	17.32	
Humerus	0	0	0	0	29.13	
	21.47	30.89	0	0	18.59	
Humerus	0	0	0	0	30.91	
	23.73	34.59	0	0	22.05	
Humerus	0	0	0	0	27.84	
	21.1	29.2	0	0	18.49	
Humerus	0	0	0	0	31.92	
	24.81	36.3	0	0	21.43	
Humerus	0	0	0	0	30.35	
	23.08	31.73	0	0	19.45	
Humerus	0	0	0	0	27.63	
	20.74	29.58	0	0	18.62	
Humerus	0	0	0	0	27.47	
	18.59	29.35	0	0	18.11	
Humerus	0	0	0	0	28.59	
	22.28	30.42	0	0	18.7	
Radius	0	0	0	0	0	31.05
	18.25	0	26.42	0	19.67	0
Radius	0	29.7	14.62	18.03	8.62	0
	0	27.33	0	0	0	0
Radius	0	31.01	15.29	16.64	8.24	0
	0	27.49	0	0	0	0
Radius	137.88	0	0	17.2	8.35	28.96
	17.76	0	25.78	0	15.76	0
Radius	0	0	0	0	0	27.18
	17.74	0	25.45	0	13.53	0
Radius	0	30.95	15.22	17.22	8.46	0
	0	28.07	0	0	0	0
Radius	0	33.32	16.74	19.62	9.07	0
	0	30.21	0	0	18.44	0
	GL	GLC	BD	LCW	MCW	
Femur	0	0	36.9	15.55	14.06	
	DD	SD	MD	DC	BP	
	43.14	0	0	0	0	
	L1	L2	GL	PB	PD	GB
Calcaneum	42.65	51.97	63.96	14.76	16.19	21.94
	AB2	ADI	AD2	AD3	AD4	LDF
	0	19.25	23.31	0	0	17.92
Calcaneum	34.6	42.16	52.52	12.97	13.21	0
	0	15.66	20.39	0	0	15.15

Appendix 3c (cont.)

Calcaneum	35.41	45.25	55.85	13.5	14.6	18.63		
	0	15.87	22.29	0	0	16.45		
Astragalus	27.41	21.85	25.71	18.7	18.83	15.99	14.57	
Metacarpus	110.12	22.09	15.87	12.43	10.17	23.59	10.36	
	9.53	14.55	9.79	9.28	8.75	23.38	12.51	
Metacarpus	112.1	21.61	15.8	11.77	10.24	23.89	10.16	
	9.71	15.33	10.09	9.18	8.22	23.65	12.75	
Metacarpus	121.22	21.52	15.63	11.73	10.93	23.02	10.95	
	10.46	15.54	8.54	8.43	8.72	23.13	12.35	
Metacarpus	118.44	21.99	16.81	13.55	11.64	23.56	10.65	
	10.09	14.76	9.3	8.96	9.07	24.33	12.18	
Metacarpus	0	0	0	0	0	23.48	9.75	
	9.32	13.88	8.77	8.5	7.97	0	0	
Metatarsus	0	0	0	0	0	24.68	10.23	
	9.72	15.59	11.07	9.89	9.24	24.28	12.96	
Metatarsus	0	0	0	0	0	23.46	10.11	
	9.64	15.09	10.27	9.41	8.55	23.32	12.41	
Metatarsus	0	0	0	0	0	25.59	10.1	
	9.52	14.73	11.23	9.86	10.43	24.71	13.27	
Phalanx 1	34.98	12.42	14.64	9.87	9.85	11.06		
Phalanx 1	32.09	11.28	13.16	8.64	8.4	10.15		
Phalanx 1	32.75	11.85	13.29	9.41	9.42	10.55		
Phalanx 1	34.82	12.28	14.4	9.81	9.91	11.17		
Phalanx 1	32.36	11.1	13.87	8.57	9.18	10.16		
Phalanx 1	33.25	12.98	13.61	9.68	9.8	11.55		
Phalanx 1	32.33	10.91	13.15	8.25	8.14	10.64		
Phalanx 1	35.46	12.24	14.81	10	10.43	11		
Phalanx 2	23.5	11.87	12.25	9.02	10.01			
Phalanx 2	20.25	9.16	10.83	7.08	7.21	7.93		
Phalanx 2	22.43	10.55	11.49	7.91	7.75	8.75		
	DLS	LD	PB	PD	MBS			
Phalanx 3	26.52	20.05	9.16	14.54	5.64			

Hartlepool Middlegate
Appendix 3D
Measurements of sheep/goat bones
Phase 5

Scapula	0	0	0	33.86	19.33			
	26.76	0	0	0	0			
Scapula	0	20.68	10.4	31.89	20.31			
	25.36	0	0	21.81	0			
Humerus	0	0	0	0	26.09			
	20.22	28.3	0	0	16.46			
Radius	0	38.89	19.3	0	0	0		
	0	35.25	0	0	0	0		
Metacarpus	123.05	23.49	17.03	14.39	11.86	25.35	10.64	16.09
	10.56	15.87	10.8	10.14	10.63	26.4	14.23	0
Metacarpus	134.26	0	0	14.44	11.74	26.74	11.98	0
	11.26	17.09	10.39	10.01	10.29	27.43	16.31	0
Metacarpus	0	0	0	0	0	24.05	10.05	14.91
	9.38	14.39	10.1	9.53	8.84	24.02	12.38	0
Metacarpus	120.9	22.03	17.3	13.43	11.1	25.23	10.33	15.79
	9.88	15.47	0	0	9.76	25.24	13.32	0
Metatarsus	134.38	22.1	20.05	11.57	12.41	24.46	9.98	0
	9.52	0	0	0	10.38	24.98	12.93	0
Metatarsus	116.47	19.2	19.04	10.95	12.25	22.24	9.26	14.48
	8.53	13.31	9.79	9.22	9.25	22.03	12.47	0
Metatarsus	136.59	20.91	20.97	11.47	12.26	23.71	10.59	0
	10.34	15.53	10.15	9.49	10.25	23.71	14.33	0
Metatarsus	127.79	20.88	20.34	13.19	12.89	26.44	9.58	15.56
	9.22	15.11	11.6	10.36	10.64	25.88	14.02	0
Metatarsus	124.67	20.95	21.24	12.86	13.14	25.38	9.87	15.91
	9.2	15.07	11.02	10.12	11.06	24.68	13.57	0

Hartlepool Middlegate
Appendix 3E
Measurements of Cattle Bones

Phase 1						
Phal 1	52.64	25.73	26.47	22.23	20.51	25.02
Radius	0	0	0	0	0	62.55
	38.7	0	57.01	0	0	0
Phase 2						
Phal 1	59.11	31.69	32.35	27.43	24.29	27.75
Calcaneum	83.82	106.02	122.6	31.61	35.03	46.45
	0	39.09	49.48	0	0	36.95
Phase 3						
Phal 1	56.96	25.15	28.84	20.49	22.35	23.81
Phase 4						
Phal 1	60.8	25.55	29.93	22.95	22.57	24.23
Phal 1	67.51	33.87	36.35	28.83	28.16	29.6
Phal 1	63.76	29.13	32.12	24.1	25.81	29.2
Phal 1	52.57	24.46	25.73	20.57	20.84	24.3
Phal 1	64.91	30.48	32.84	26.25	25.83	27.6
Phal 1	53.38	26.98	27.79	22.12	21.54	24.93
Phal 2	38.6	24.66	26.33	19.5	18.19	19.62
Phal 2	39.37	26.6	27.81	21.94	19.88	26.68
Phal 2	36.25	25.13	25.61	19.6	21.07	20.61
Phal 2	38.5	27.05	26.76	21.27	21.58	21.7
Phal 2	43.41	30.17	30.38	22.94	24.51	25.91
Phal 2	37.02	24.57	23.76	18.79	20.17	20.2
Phal 2	40.29	29.57	29.35	23.05	23.7	24.91
Phal 3	54.85	44.9	20.48	31.1	17.74	
Phal 3	62.53	49.49	20.91	34.89	18.86	
Phal 3	73.89	54.29	26.95	43.19	24.41	
Phal 3	62.68	49.84	21.46	35.98	19.16	

Hartlepool Middlegate
Appendix 3F
Pig Measurements (in mm)

Phase 1	Acet	26.42	25.63	34.66	29.37		
Phase 4	Humerus	0	0	0	0	34.37	
		35.04	45.59	0	0	34.18	
	Radius	0	32.98	23.11	0	0	0
		0	0	0	0	0	0
	Phalanx 1	32.15	14.88	15	11.95	11.05	
	Phalanx 1	29.92	18.6	18.74	16.1	12.11	16.34
	Phalanx 3	28.39	26.66	13.26	17.67	11.49	
Phase 5	Radius	0	29.46	22.15	0	0	0
		0	0	0	0	0	0
	Radius	0	30.49	21.7	0	0	0
		0	0	0	0	0	0

Hartlepool Middlegate
Sheep/goat Humerus
Gt Bdth Troclea x Length Trochlea

26.78	18.46	Phase 1
27.33	17.2	Phase 4
26.89	17.32	
29.13	18.59	
30.91	22.05	
27.84	18.49	
31.92	21.43	
30.35	19.45	
27.63	18.62	
27.47	18.11	
28.59	18.7	
26.09	16.46	Phase 5