Part 2 The animal bone report 2

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Report 2: Piercebridge outer ditch: a report on the animal bones from the lower fills in the outer ditch, Piercebridge Roman Fort

Introduction D12.111
Method D12.112
Fragmentation and skeletal distribution D12.113
Species proportions in the outer ditch D12.114
Demographic characteristics of the major species D12.116
Other species D12.119

Illustrations

12D.67. Frequency of cattle, sheep/goat and pig fragments from lower fills in the outer ditch D12.130
12D.68. Frequency of cattle, sheep/goat and pig zones from the lower fills in the outer ditch D12.131
12D.69. Bar diagram of the percentage of fused cattle, sheep/goat and pig bone epiphyses from the lower fills in the outer ditch D12.132
12D.70. Percentage of cattle, sheep/goat and pig mandibular teeth unerupted, in slight, medium and heavy wear from the lower fills in the outer ditch D12.133
12D.71. 3D plot of the frequency of wear patterns on the Molar 1+Molar 3 against Molar 2 of cattle mandibles from the lower fills in the outer ditch and layer 505 D12.134
12D.72. 3D plot of the frequency of wear patterns on the deciduous or Premolar 4 (dp4/P4)+Molar 1 against Molar 2 of Sheep/goat mandibles and dp4/P4+M2 against M1 of pig mandibles the lower fills in the outer ditch D12.135
12D.73. Scattergram of proximal breadth against greatest length of cattle 1st phalanges from the lower fills from the outer ditch D12.136
12D.74. Scattergram of proximal depth against proximal breadth of cattle 1st phalanges from the lower fills from the outer ditch D12..136
12D.75. Scattergram of distal depth against distal breadth of cattle tibiae from the lower fills from the outer ditch D12.137
12D.76. Scattergram of distal medial depth against distal breadth of cattle astragali from the lower fills from the outer ditch D12.137
12D.77. Scattergram of distal diaphysial depth against distal breadth of cattle metatarsi from the lower fills from the outer ditch D12.141
12D.78. Scattergram of distal depth against distal breadth of sheep/goat tibiae from the lower fills from the outer ditch D12.141

Tables

12D.27 Weight of uncatalogued and number of catalogued bone fragments from all the outer ditch deposits studied. D12.123
12D.28 Fragment counts for each species from all the studied outer ditch deposits D12.124
12D.29 Minimum percentage loss in layer 505 and late third and early fourth century deposits in the outer ditch D12.125
12D.30 Percentage representation of the major species in the outer ditch deposits using different quantification methods D12.125
12D.31 Proportions of the species from each major feature group D12.125
12D.32 Maximum number of bone fragments per individual from the different areas and feature groups D12.125
12D.33 Relationship of the modern ageing information to the cattle material from the outer ditch D12.126
12D.34 Relationship of the modern ageing information to the sheep material from the outer ditch D12.127
12D.35 The number of bones from juvenile animals in which the epiphyseal junction did not survive D12.128
12D.36 Estimate of the proportion of the slaughtered cattle in particular age categories in the outer ditch D12.128
12D.37 Proportion of sheep slaughtered in different age categories in the outer ditch D12.128
12D.38 The number of fused and unfused epiphyses of horses from the lower fills of the outer ditch D12.129

REPORT 2

Piercebridge Outer Ditch: A report on the animal bones from the lower fills in the Outer Ditch. Piercebridge Roman Fort.

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1985 (with minor editing and revisions in 2006)

[*Editorial note. As with Report 1, this report was written various of the areas of the Housing Scheme site were known by different names. This report has been edited in a similar way*].

Introduction

Beneath and to the south of the Large Vicus building [*Vicus building 2*] lies a depression possibly of natural origin described as the Outer Ditch. This depression had been filled with deposits (Fig 12D.1) rich in archaeological material and produced an extremely large collection of animal bones. The feature was excavated in three parts. The northernmost section has already been discussed under the heading of Large Vicus Building (Rackham and Gidney, 1984 - this report will henceforward be referenced as Report 1). The quantity of material from the southern 50 metres was such that sampling was essential within the scale of the programme. The main sample chosen was the middle section of the ditch, largely because the archaeological information available for this area was more comprehensive. The surface layers of this feature (Fig. 12D.4 layer 500) were not studied, being composed of mixed Roman and post-Roman material. The layers analysed were 505, a very large sample, which was analysed in 1984, and the lower deposits, layers 535, 538, 539, 550, 551, 554, 557, 558, and 559 of which two, 551 & 554, were processed in 1984. Two lower layers, 1054 and 1055, from the southern section of the Outer Ditch were also studied but were too small for separate study so the results from these two layers are incorporated with the lower levels of the middle section.

The bulk of the archaeological material in layer 505 dates to the fourth century and this is assumed to be the case for the animal bone. The coin evidence suggests that the lower layers are late third century. They do not contain any earlier coinage nor the mixed third and fourth century coinage which is found in some of the Inner Ditch deposits and 505 and is taken to suggest disturbed or mixed deposits. These lower layers of the Outer Ditch therefore represent the earliest well dated deposits that can be associated with the first period of activity at the fort.

[The recent re-appraisal of the pottery from these deposits has assigned contexts 538 and 551 to the early 4th century and 537, 539 and 557 to the late 4th. However no ceramic data was available for the other contexts so it may be an assumption to treat the remainder as still of late 3rd century date. The original phasing in the lower ditch was based upon the absence of 4th century coinage - see above. On stratigraphic grounds (see Fig. 12D.4) the deposits might break down in the following manner:

	Middle section	*Southern section*
late 4th century	*505*	
	537, 539	
early 4th century	*538, 551*	
late 3rd century	*554, 550*	*1054, 1055*

"   557, 558, 559
"   535

The main text and figures of the original report have not been revised along the lines of this phasing because all the studied contexts are stratigraphically earlier than late 4th century deposit 505 above, but Table 12D.28 has been revised to show the proportions that fall within these revised date groupings. The lower fills discussed in this report are referred to in the Tables as 'LF', on the figures as 'L.Fills' and in the text as 'Lower fills']

It was therefore felt to be important to study these deposits as providing the only group of uncontaminated late third and early fourth century material (*see note above*) from the area of the site under study. Resources did not permit this in 1984 but at that time the value of the group was unrecognised since the coin material had not been studied.

It was hoped that the late third and early fourth century group when compared with material studied earlier (Report 1) would provide important evidence, whether of similarity or difference, in the exploitation of domestic livestock in two separate periods of time in the late military occupation at Piercebridge. The hiatus in military occupation in the earlier fourth century interpreted from the relative absence of pre-348 House of Constantine coinage is important as showing the late 3rd and early 4th century and late 4th century groups of animal bone to be of separate origin.

The small size of each individual layer (Table 12D.27) has necessitated considering all eleven separate layers as one unit for viable comparison both with 505 and the Inner Ditch deposits. This group is referred to in the tables as Lower fills (LF). No obvious differences were noted between the individual layers, which would invalidate this approach.

Method

The approach to cataloguing this group was the same as that initiated for the material previously studied whereby only identifiable bones were catalogued, the remainder being weighed and an estimate made of the number of uncatalogued fragments (Table 12D.27) (see Report 1). The frequency of identified fragments are listed in Table 12D.28. No goat bones were identified and in the text the ovicaprid bones are referred to as sheep.

A further refinement was added to the cataloguing procedure on this group whereby the skull, girdles and limb bones are divided into zones (Rackham, 1986a), with the 2nd and 3rd phalanges, tarsals and carpals counted as a zone each. The zones chosen occur on the bones of all three major domestic species and thus allow direct comparisons between the species. These data are used in comparisons of fragmentation (Fig. 12D.68) and species abundance (Table 12D.30).

Regrettably this means that the results of the previous work are not directly comparable at this level. Also the two late 3rd and early 4th century layers, 551 & 554, catalogued last year but included in the analysis of this group do not have this information and so are not included in Fig. 12D.68 which is based on zone counts.

The teeth have been used to assess comparative species abundance by calculating the mean percentage of each tooth for the three major species (Table 12D.30). The age structure of the sample is compared with layer 505 using the tooth wear characters devised by Grant (1982) and plotted in a three dimensional frequency plot not dissimilar to West's (1984) 3D column diagrams (see Figs. 12D.71-2).

Fragmentation and Skeletal distribution

The material from the third century deposits is compared with that from layer 505 and the Inner Ditch (Report 1). The fragments of each species in the Lower fills are illustrated in Fig. 12D.67(a-c) where they are arranged in the rank order established for the whole collection from the Inner Ditch. This assists in the comparison of the two ditches and makes differences in skeletal distribution more obvious visually. The cattle and sheep/goat (Figs. 12D.67 a & b) show some slight differences from layer 505 and the Inner Ditch while the pigs (Fig. 12D.67c) are not dissimilar in rank order except for an abundance of maxillary fragments. Relatively speaking there are very few post-cranial bones of pig by comparison with the mandibles and maxillae. The minimum percentage loss (min%loss) from the collection is considerably greater for the pigs in these layers (Table 12D.29) than in any previously studied except perhaps layer 19 of the Inner Ditch and is comparable with that of sheep (see Tables 12D.3 and 12D.9 in Report 1).

The min%loss for the three major species, based on the methods used by Rackham and Gidney (Report 1) are given in Table 12D.29. The results for cattle and sheep are again broadly similar to layer 505 but using the fragment counts the pigs appear to have suffered greater loss and destruction than in layer 505, although there are more pig bones present in the Lower fills. This pattern is not reflected in the loss rates calculated using the epiphyses so it is more probably an anomaly caused by the high number of jaws present (see below) in the Lower fills depressing the percentages of other bones in comparison. Apart from this anomaly the sheep have suffered greater loss using all three methods and the cattle have suffered the least. This is probably a reflection of the greater robustness and easier recognition of cattle bone fragments. The cattle data for the Lower fills group (Table 12D.29) does however reinforce the opinion previously given of layer 505 that the destruction of the epiphyseal ends of cattle in the Outer Ditch is significantly lower than in the Inner Ditch. This reinforces the opinion that the Outer Ditch deposits are primary fills or relatively less disturbed unlike the Inner Ditch fills which are believed to be largely redeposited.

The distribution of the skeletal fragments of cattle (Fig. 12D.67a) is slightly different from that obtained from the total collection from the Inner Ditch (Report 1 Fig 12D.6a). The plateau effect in the fall off of frequency and peak of phalanges seen in 505 (Report 1 Fig. 12D.13b) are not so apparent in the Lower fills group. Elements of the lower limbs (metapodials and tarsals/carpals) are slightly under-represented in the Lower fills cattle but the min%loss is similar between the Lower fills and 505.

The distribution of the elements of sheep (Fig. 12D.67a) differs in the Lower fills. The sheep fragments from the Inner Ditch and layer 505 are closely similar (Report 1, Figs 12D.8a and 12D.16a) but in the Lower fills although tibial fragments are still the most common, jaws are considerably under-represented and in contrast maxillae are more common. Other elements such as metacarpals and scapulae are more frequent. This does not seem to be a problem of sample size since both groups have similar numbers of sheep bones. The fragment frequency would appear to reflect a combination of preservational qualities, hence abundant distal tibiae (see Fig. 12D.67b) and taphonomic factors relating to behaviour, perhaps reflecting a higher proportion of front limbs relative to layer 505 and the Inner Ditch. The difference in pattern is not easily interpreted but may relate to relatively less fragmentation and destruction in the Lower fills.

The frequency of occurrence of the bones of pig in the Lower fills group is different to the Inner Ditch. Jaws and maxillae are most frequent in the Lower fills group (Fig. 12D.67c), a pattern similar to 505 (Report 1, Fig. 12D.18a), but less marked although there are relatively fewer limb bones by comparison with the maxillae. This pattern reflects one that might be expected from preservation, those fragments with teeth surviving best, but it could indicate disposal of an abundance of skulls and jaws.

Using the zone data (Fig. 12D.68a-c) the frequency of each zone is plotted in rank order as a percentage of the most frequent zone of each species. The pattern is different for all three species. The phalanges have been divided by two to compensate for the frequency of these bones. The cattle show the lowest removal or loss (Fig. 12D.68a) of bones and apart from high frequencies of the more robust elements or element parts many of the first 40 zones occur with similar frequency.

The sheep show a high initial loss (Fig. 12D.68b), the distal tibia shaft surviving most frequently. This is quite apparently a survival factor rather than selection since other parts of the distal tibia are considerably less frequent. The remaining part of the bar diagram shows a slow but steady reduction in frequency similar to cattle but overall illustrating a more substantial relative loss.

The pig zones (Fig. 12D.68c) show a continual and fairly sharp decrease in frequency of zones with only the more robust elements, mainly jaw fragments, occurring most frequently, but overall indicating a relatively less substantial loss than sheep.

Both the pig and the sheep figures show one bone, the jaw and the tibia respectively, being responsible for most of the most frequently occurring zones. This is a pattern that could be expected from collections subjected to substantial erosion/destruction or specific skeletal selection. For the sheep the former probably applies but the high occurrence of jaws and maxillae of pigs (Figs. 12D.66c & 12D.68c) while potentially a preservation factor also suggests a selectivity for the head although the other bones or zones of the skull are not particularly frequent.

As these diagrams use the zone records initiated for this project it is not possible to produce comparable tables for the other groups of bone already studied from Piercebridge.

Species proportions in the Outer Ditch.

The data from which the relative abundance of species is determined are presented in Table 12D.304. For the same reasons as those used previously (Report 1) the fragment percentages are unlikely to reflect the proportions in which the animals were slaughtered. To recapitulate it is very probable that the fragment counts considerably under-represent both sheep and pigs, for example virtually no carpals or tarsals of these species were found. Even using zones (Figs. 12D.68a-c) the uneven number of fragments from the different limbs, particularly pigs many of whose zones occur infrequently or are absent, suggests that straight zone ratios will also under-represent pig and to a lesser extent sheep. The loss factors discussed above illustrate that both selection and destruction or loss have affected the frequency of fragments and zones and therefore negate these variables as valid indicators of relative abundance.

The jaws and teeth suggest a much more equal relative frequency of the three species in the Lower fills than 505 or the Inner Ditch or vicus buildings. This is supported by MNI's which suggest that equivalent numbers of each species were slaughtered. However it has been noted that sheep jaws are relatively infrequent and pig jaws more frequent by comparison to the collections from 505 and the Inner Ditch. This must reflect a cultural taphonomic factor and therefore may represent disposal practices that introduce a bias away from the true slaughter proportions.

The figures obtained from using the frequency of epiphyseal ends (excluding the bones of the feet) or the major bones (Table 12D.30) are slightly different between 505 and the Lower fills but the relative order of importance of the species is the same. A greater difference occurs between 505 and the Lower fills when using the frequency of teeth (Table 12D.30). This indicates an order of importance of cattle, pig and sheep in contrast to the results for the other methods.

The reduction in the frequency of cattle using the frequencies of major bones or the teeth is to be expected as this species has the lowest min%loss and is thus over-represented by the fragment counts. The sheep in the Lower fills do not exhibit such a striking increase using teeth as 505 considering the high min%loss of sheep in both groups. This is probably a reflection of the lower proportion of jaws in the Lower fills. Using all major bones the frequency of sheep in both groups is virtually identical. The distal tibial shaft of sheep has a considerably greater frequency (see Fig. 12D.68b) than any other zone of sheep. In contrast the fall off in frequency for cattle and pig is considerably less suggesting that this element may over-represent the relative proportion of sheep. The relative abundance of the most frequently occurring zone of each species independent of side is 65 cattle (39.6%), 65 sheep (39.6%), and 54 pigs (20.7%) (Fig. 12D.68), but on the most frequent bone represented by its fragments 242 cattle (51%), 96 sheep (20.2%) and 156 pigs (28.7%) (Fig. 12D.67). This contrast serves to illustrate both the scale of fragmentation and the degree of loss of other zones of these elements and reinforces the remarks made above concerning destruction of sheep material.

The pigs are interesting. It is to be expected that their frequency will exceed that indicated by the fragments for two reasons. Using the fragment count (Fig. 2) the pigs have the highest min%loss of all the three species in the Lower fills and secondly they are generally younger (see below) which may be a contributory factor to high min%loss. The frequency given by the teeth is thus perhaps a truer representation of the frequency of pigs in Lower fills, but this figure may be distorted by the high number of jaws present. This selection and differential loss between species suggests that relative abundance is not easily or usefully obtained here.

However given the level of fragmentation, the preservation conditions, scavenging and the relative frequency of different elements, the jaws and teeth are probably the best measure of relative abundance of carcasses. If some allowance is made for loss of sheep relative to cattle, and pig relative to cattle the proportions might approximate to 1 sheep: 1.26 cattle: 1.34 pigs. It is likely that the cattle have survived better and that the proportion of sheep and pigs may be a little higher. The minimum number of animals represented by this sample is 34 sheep (true MNI), 43 cattle (estimated MNI from above ratio) and 46 pigs (estimated MNI). This is the highest proportion of pigs and the lowest for cattle of all the groups studied (Table 12D.31).

More individuals are represented by fewer bones in the Lower fills than 505, which is thought to contain 30 cows, 21 or 22 sheep and 21 or 22 pigs, as shown in Table 12D.32 by the maximum number of bones per individual.

Demographic characteristics of the major species
This section deals with the age at death or slaughter of the animals represented in the samples. The age structure has been analysed by a consideration of the state of fusion of the post-cranial epiphyses and the eruption and wear of the teeth (see Report 1).

Cattle
The data on the epiphyseal fusion of the cattle bones is presented in Fig. 12D.69a. The epiphyseal data from the Lower fills is not appreciably different in overall pattern to layer 505 (Report 1 Fig. 12D.25b) although, a slightly higher proportion of animals have survived to skeletal maturity (40%). The pattern is very similar up to the fusion of the later fusing appendicular epiphyses (Table 12D.33) but in 505 it appears that a few percent more have been killed at this stage of development and before the fusion of the vertebral epiphyses. Possibly 4 or 5 percent more may have been slaughtered or died while quite young before the fusion of the distal humerus and proximal phalanges.

The teeth (Fig. 12D.70) show a similar picture with rather more unerupted teeth in the Lower fills than 505 which ties in with the slightly higher number of juveniles seen from the epiphyses. The tooth pattern is very similar to LVBCob (Report 1, Fig. 12D.29). Fewer jaws had the P4 erupted in the Lower fills (Table 12D.33), but a larger number of animals (50%) had a full dentition in medium to heavy wear (Grant (1982) stage e and beyond on M3) than in layer 505 (40%) indicating a smaller cull between the eruption and wear of this tooth but a larger cull before its eruption.

The Lower fills group has been compared with 505 using Grant's (1982) tooth wear categories. These are plotted 3 dimensionally (see West 1984) to illustrate the frequency of occurrence of similar wear patterns (Fig. 12D.71a & b). The samples are not large but the patterns are slightly dissimilar. Animals are being slaughtered at many of the possible wear patterns from the eruption of the M2 onwards, but show concentrations at one or two wear stages. The later wear stages are likely to be exposed for longer than the earlier patterns therefore concentrations are to be expected relative to these earlier patterns. The

Lower fills (Fig. 12D.71a) show a concentration of wear pattern occurrences at stages k and l on the M2 (see Grant 1982). A comparison with the data from 1st and 2^{nd} century cattle from Carlisle (Rackham, 1986b) would suggest these two peaks represent animals in the age groups 8.5 +/- 3 years and 11 +/-2 years. The small peak at wear stage g on M2 would appear to correspond to an age of about 4.5 years in the Carlisle specimens. Layer 505 reflects a similar pattern but the peak at M2 wear stage k may indicate a tendency to slaughter those in the later age groupings slightly earlier, although differences in 'breed' or pasture type could produce greater changes than this slight variation.

Sheep

The samples from 505 and the Lower fills (Fig. 12D.69b and Report 1, Fig. 12D.31a) are complicated by the extreme smallness of some of the epiphyseal samples. The proportion of unfused and just fusing distal tibial epiphyses is practically identical but the remaining epiphyses occur in such small numbers that interpretation would be unrealistic. The vertebral epiphyses suggest a higher proportion, some 24%, surviving to full skeletal maturity in the Lower fills in contrast to only 13% in 505 (Table 12D.34).

The pattern from the teeth (Fig. 12D.70 and Table 12D.34) illustrates an even higher slaughter of juveniles in the Lower fills than 505 with some 25% dying before the eruption of the M2 in contrast to only 7% in 505. However the figure (Fig. 12D.70b) shows no overlap between the slightly worn Ml and M2's. This is unlikely since it would suggest the M2 was not erupting until after wear stage d (see Grant 1982) on the Ml, a feature shown by the intact jaws not to be true and must be attributed to sample discrepancies introduced by looking at loose teeth as well as jaws. The evidence for juveniles may tie in with the unfused distal humeri and scapula tuberosities seen in the epiphyseal figure (Fig. 12D.69b) and give a truer reflection of the rate of slaughter of juveniles than the epiphyses which may have suffered more loss through destruction. A possible alternative is suggested by the fact that sheep jaws are considerably under-represented in this sample and it is possible that they represent a different slaughter group to that of many of the epiphyses. A further 52% were killed before the eruption of the M3 in the Lower fills compared to 30% in 505 with only 25% surviving to dental maturity in the Lower fills compared to 30% in 505. The sheep mandibles from the Lower fills group have been analysed in a similar manner to the cattle (Fig. 12D.72a) but the M2 is plotted against the deciduous and permanent P4+M1. The break in occurrences in this figure occurs at the point of loss of the deciduous premolar 4 and it can be seen that slaughter is concentrated in two groups before the loss of this tooth and one group after its loss. It has been suggested elsewhere (Rackham, 1987a) that the deciduous p4 may remain in the jaw until up to five years of age in Iron Age sheep. Stock changes may have affected this but it seems probable that the two earlier peaks represent animals of perhaps 3 and 4 years of age. Those with a complete adult dentition with the M2 at wear stage g (see Grant 1982) being perhaps 5 or 6 years old. The middle peak has the appearance of a group killed at the same age (see Rackham 1987b) representing a cull of 4 year olds. A small group of animals were killed just after the eruption of the M2 and before any visible wear. These represent animals of perhaps 18 months (Silver 1969).

Pig

It has already been noted above that of the three major species pigs are the most likely to have lost a proportion of the bones in a juvenile stage of development although the pattern for sheep above suggests that this may be true for this species too. Both of the figures illustrating the state of epiphyseal fusion have a serious deficit of bones for all the later fusing epiphyses (Fig. 12D.69 & Report 1, Fig 12D.35b). The kill off appears to be continuous from a very early stage of skeletal development and is largely complete before appendicular maturity.

The teeth show many more juveniles in the Lower fills (Fig. 12D.70c) than in 505 (Report 1 Fig. 12D.37), with 40% dying before the eruption of the M2 compared to 15% in 505 and no animals in the Lower fills survive to an age at which the M3 is in full wear (ie Grant stage e and beyond) compared to 5% in layer 505. An analysis of the tooth wear suggests that the slaughter is not continuous but rather concentrated in three or four classes of wear and therefore age. The peak of oldest animals has the appearance of a cull of animals of the same age. The figure (Fig. 12D.72b) illustrates the Ml plotted against the dp4+M2. The gap in the distribution again reflects the point where the dp4 is lost and the P4 erupted.

Interpretation of age structure

Cattle. In the Lower fills some 5% were killed in their first year borne out by a comparatively high number of juveniles without epiphyses (Table 12D.35). Fewer second year animals were killed in the Lower fills than 505. A slightly higher number of 2-5 year olds and a lower number of 3-4 year olds were slaughtered in Lower fills than 505, and a very much higher number of fully adult animals more than five years of age were killed in the Lower fills group than in layer 505 (Table 12D.36).

Sheep. From the epiphyseal data some 12% seem to have been slaughtered in their first year in 505 but none in the Lower fills (Table 12D.34). The evidence from the teeth indicates a substantial cull of animals probably in their second and third years in 505 - 35% but a devastating 77% in the Lower fills (Table 12D.37). This is the highest level of cull at this age group from all areas of the site and contrasts with the Inner Ditch where 80-90% of the stock was slaughtered after three years.

Pig. The epiphyseal sample size for both 505 and the Lower fills is very small so only data for teeth are used. In the Lower fills 40% were killed in their first year compared to 16% in 505. The rest in the Lower fills were slaughtered before 3 years, 5% in 505 survive beyond three.

Sex representation in the major species

The fragmentation of the collection is such that little has survived that allows the morphological determination of the sex of an animal from which individual bones derive. Any attempt to discover the proportion of the sexes among the animals whose remains this collection represents is therefore limited to that deriving from measurements that are dimorphic for sex. This is further complicated by the expectation that castrated animals are present whose measurements are likely to fall between those of males and females.

Cattle
Few of the cattle bones occur with sufficient frequency for their measurement to be useful. Ninety one 1st phalanges were measured (Fig. 12D.73) which include one extremely large specimen which must be presumed to be a bull or even possibly an aurochs although there is no evidence to suggest that the latter still survived at this period. The remainder of these phalanges (Fig. 12D.74) show a spread of size with a concentration in the smaller part of the range. The single specimen in this figure with a large proximal breadth measurement may have been a draught animal in which the stresses on the bone have expanded the articulation in a medial/lateral direction but not significantly in the anterior/posterior direction. All these bones are fused, however the smaller specimens may well include sub-adult animals of both sexes complicating a possible interpretation of the lower concentration as cows and the more diverse upper group as castrates. Also the fore and hind phalanges were not separated during recording and some variation occurs between the fore and hind limbs.

The measurements on other cattle bones, tibia (Fig. 12D.75), astragalus (Fig. 12D.76) and metatarsus (Fig.12D.77) are inconclusive although bivariate scatters of some of these measures suggest some slight groupings that may tentatively be attributed to cows and castrates, with the latter figure (Fig.12D.77) including a bull. Such conclusions are very tentative and further complicated by some animals probably having been used for draught which will have resulted in morphological changes producing measurements beyond the normal range as suggested by Fig. 12D.74.

If these tentative interpretations were to be accepted the sex ratio would appear to show a dominance of females over castrates with very few bulls- the proportions being approximately 69% females, 30% castrates and 1% intact males. It should be remembered that apart from the astragalus only bones with their epiphyses fused (the adult condition) have been measured and therefore these ratios reflect the sub-adult and adult sex ratios not necessarily the ratio in the total cull.

Sheep
Very few sheep bones occurred in enough numbers for analysis of their measurements. The most frequent measureable fragment, the distal tibia, produced 29 bones upon which the distal depth and distal breadth could be measured. A bivariate scatterplot of these measures shows a relatively strong correlation with two, perhaps three size groupings (Fig.12D.78). The standard interpretation is probably a group of ewes, one of wethers and two rams. If this is so, ewes would appear to predominate in the sub-adult and adult sample but without further corrobative evidence from other data such a conclusion has little support.

Pig
There was too little material of this species for any attempt to establish the sex ratio of the slaughtered animals.

Other species

We have discussed in some detail the finds of the major domestic species. The other finds in this collection are by comparison infrequent (Table 12D.28) but are discussed individually below.

Horse

Most parts of the carcass are represented among the 85 recorded bones but only a minimum of three animals can be identified. The bones derive from most of the Lower fills, the largest group from the layer with the most bone fragments. None of the material was found articulated or associated in contrast to some finds from the other parts of the site but neither is there any evidence of butchery in terms of cut or chop marks.

The sample is generally less fragmented than the cattle material but even so few whole bones except those of the foot have survived. As has been found elsewhere on the site the animals were largely adult (Table 12D.38) when they were slaughtered or died but at least one animal in layer 555 (possibly represented by a number of bones) was a sub-adult of probably less than 3.5 years.

Only one specimen in this collection allowed the determination of a withers height. This using the Kiesewalter factor (Ambros & Muller, 1974) gave a figure of 140.6 cms and is within the range found for other specimens from the site.

Dog

The third century sample yielded 70 bones of dog. Apart from those in layer 1055 these were found in small numbers in most of the layers and the presence of at least two individuals in most of the layers, in collections between 6 and 15 identified bones, indicates that the material is thoroughly disarticulated.

The material from 1055, 24 bones, indicates the presence of at least two animals and the presence of a few ribs and vertebrae probably from the same individual suggests that this deposit includes part of the skeleton of a buried carcass.

There is no evidence that the dogs were eaten and it is normally assumed that such animals are buried whole. The whole collection contains a minimum of four animals and the disarticulation and distribution of the bones suggests that, if the bones derive from buried carcasses, the deposits are considerably disturbed or possibly redeposited. The latter would seem to be the most acceptable possibility and would suggest that the material deposited in the base of the Outer Ditch rather than representing primary dumping has been removed from elsewhere after primary deposition. This interpretation would, explain the pattern of remains of horse described above.

The collection included a small stocky animal but the remains generally indicate animals of border collie size. All the individuals represented are adult with two 'old' animals. No measurements were taken on the dog material.

Cat

Two fragments of cat were identified. Cats are extremely uncommon in this whole collection and other Roman deposits in the north.

Red deer

Four fragments of red deer were recognised in the Lower fills sample. This included two left mandibles, a femur fragment and the tip of an antler tine. This small collection contrasts with the material from the Inner Ditch where antler waste and off cuts were relatively common. There is no similar evidence of any type of bone working in the Lower fills of the Outer Ditch.

Hare

Only three bones of hare were found. The proportion of wild animal remains in this group is extremely small (Table 12D.28).

In addition to the animal remains five fragments of disarticulated human material were found. There were no burials nearby and this material presumably derives from elsewhere possibly being brought in with redeposited rubbish.

Birds

Several birds were recovered from the late third and early fourth century deposits (Table 12D.28). Bones of domestic fowl predominate with greylag or domestic goose also in some numbers. It is probable that all these goose bones derive from domestic birds rather than wild. These two species represent animals killed for food, but the crane, duck, golden plover and stock dove bones probably also derived from food waste. The starling is likely to have been a casual death but the buzzard may have been killed, or perhaps trapped, while scavenging and parts of the carcass could have been used as amulets (see Report 1).

Layer	No. catalogued fragments	Weight uncat. fragments (kg.)	Relationship No. cat/weight uncat.	Est. no. of uncat. frags.
505	4090	40.075	102.0	5300-6000
535	480	3.975	120.7	460
538	1909	17.675	108.0	2101
539	248	2.500	99.2	440
550	304	2.050	148.0	230*
551	76	1.500	50.6	228
554	148	0.675	211.0	103
557	195	1.600	121.8	245*
558	32	0.090	320.0	13
559	198	1.375	144.0	215*
1054	324	2.600	124.6	458
1055	765	7.400	103.3	1276
Total	8769	83.690		11,109 -11,809

Table 12D.27: Weight of uncatalogued and number of catalogued bone fragments from all the Outer Ditch deposits studied. (* actual number)

Species	505	537, 539, 557	538, 551	535, 550, 554, 558-9, 1054, 1055
Phasing	late 4th	late 4th	early 4th	late 3rd?
Cattle	2272	222	1080	1076
Sheep or goat	583	69	228	313
Sheep	8		8	13
Pig	590	83	287	340
Horse	65	11	44	30
Dog	40	3	14	53
Cat	3	-	-	2
Human	4	1	1	3
Fox	2	-	-	-
Red deer *Cervus elephas*	5	-	3	1
Brown hare *Lepus capensis*	3	-	2	1
Water vole *Arvicola terestris*	1	-	-	-
Domestic fowl	37	5	12	44
Greylag/dom. goose *Anser anser*	3	2	5	12
Duck sp. *Anas* sp.	-	-	3	-
Black grouse *Lyrurus tetrix*	1	-	-	-
Crane *Grus grus*	-	-	-	1
Stock/domestic dove *Columba oenas*	-	1	-	-
Golden plover *Pluvialis apricaria*	-	-	-	1
Rook *Corvus frugilegus*	1	-	-	-
Barn owl *Tyto alba*	1	-	-	-
Starling *Sturnus vulgaris*	-	-	-	1
Buzzard *Buteo buteo*	6	-	11	-
Large bird, indeterminate	-	-	-	1
indeterminate bird	5	-	2	-
Large ungulate	404	54	257	338
Small ungulate	97	12	57	68
Indeterminate	2			2
Total	4133	463	2014	2300

Table 12D.28 Fragment counts for each species from all the studied Outer Ditch Deposits

	Fragments		Epiphyses		Epiphyses (without feet)	
	505	*LF*	*505*	*LF*	*505*	*LF*
Cattle	61.0	61.7	58.9	48.7	60.9	58.1
Sheep	76.8	71.1	81.0	79.0	76.0	75.4
Pig	67.1	80.1	64.1	65.1	62.5	62.2

Table 12D.29**:** Minimum percentage loss (min%loss) in layer 505 and late third and early fourth century deposits in the Outer Ditch (see Report 1 for methods)

	Fragments		All bones		Epiphyses		Teeth	
			Limbs & jaws	*Skull & pelvis too*				
	%		*mean %*		*mean %*		*mean %*	
	505	*LF*	*505*	*LF*	*505*	*LF*	*505*	*LF*
Cattle	65.8	63.9	51.0	53.05	62.3	61.3	53.4	38.5
Sheep	17.1	16.9	26.4	27.4	18.3	23.8	33.3	23.1
Pig	17.1	19.0	22.6	19.3	19.4	14.7	13.3	38.1
N	3455	3719						

Table 12D.30**:** Percentage representation of the major species in the Outer Ditch deposits using different quantification methods

		Cattle	Sheep	Pig
Inner Ditch	11, 12 & 14	2.20	1.40	1.00
	19	1.40	1.00	1.00
Outer Ditch	505	1.40	1.00	1.00
	LF	1.26	1.00	1.34
Vicus building 2		1.60	1.40	1.00
Vicus building 1		1.50	1.00	1.30

Table 12D.31: Proportions of the species from each major feature group

	Outer Ditch		Inner Ditch		Vicus Building 2	
	505	*LF*	*11, 12 & 14*	*19*	*LVBPre*	*LVBCob*
Cattle	75.7	55.3	54.6	33.0	49.2	62.8
Sheep	27.6	18.5	27.4	13.0	20.3	31.7
Pig	27.6	15.4	20.5	9.6	18.6	32.9

Table 12D.32: Maximum number of bone fragments per individual from the different areas and feature groups

Post Cranial development			
Age Estimate (Silver 1969)	Epiphyseal fusion stage	505 (% of sample)	LF (% of sample)
< 7-10 months	App epis. unfused	1	5
12-18 months	2nd phal. fused		
	1st phal. unfused	8	1
18-24/30 mths	Dist. tibia unfused	29	27
30/36 – 36/42 mths	Metapodials fused	12	19*
	P. Calc & P. fem. unf.		
> 42-48 mths	All append epis fused	-	-
< 7-9 years	Vert. epis. unfused	20	5
> 7 years	Vert. epis. unfused	30	43
Mandibular tooth development			
Age Estimate (Silver 1969)	Mandibular tooth eruption. Tooth eruption stage	505 (% of sample)	LF (% of sample)
< 6 mths	M1 unerupted	1	5
6 – 18 mths	M2 unerupted	13	9
18 – 27 mths	M3 unerupted	3	8
24 – 30 mths	P4 unerupted	8	18
27 – 42 mths	P4 slight wear	36	8
> 42 mths	P4 med-extensive wear	39	52

Table 12D.33: Relationship of the modern ageing information to the cattle material from the Outer Ditch (* P. calc. f.)

Post Cranial development				
Age Estimate (Silver 1969)	Age Estimate (Bullock & Rackham 1982)	Epiphyseal fusion stage	505 (% of sample)	LF (% of sample)
<10 months		Prox. rad unf.	12	0
<6 – 10 months	<12 – 15	Acet. sym unf.	0	0
18-24 mths	< 36	Dist. tibia unf.	2	13
>18 <20-28 mths	>30 < 48	Dist. mps unf.}		
> 20-28 < 36 mths	>3 – 5 years	Dist. rad. unf.}	29	29
> 3 <4-5 years	>4 < 6	Vert. epis. unf.	44	34
> 4 – 5 years	>5 - 6	Vert. epis. unf.	13	24
Mandibular tooth development				
Age Estimate (Silver 1969)	Age Estimate (Bullock & Rackham 1982)	Mandibular tooth eruption. Tooth eruption stage	505 (% of sample)	LF (% of sample)
< 3 mths		M1 unerupted	0	0
< 9 – 12 mths	<14 – 24	M2 unerupted	7	25
<9/12 <18/24 mths	>24 <40	M3 unerupted	35	52
> 18 <21-24 mths	<36	P4 unerupted	28	0
>24 – 42 mths	< 4 years	P4 slight wear	4	2
	>4	P4 med-extensive wear	26	21

Table 12D.34: Relationship of the modern ageing information to the sheep material from the Outer Ditch

	19	14	11	12	LVBCob	505	LF
Cattle	2	3	24	9	18	6	24
Sheep	-	-	5	2	3	-	7
Pig	2	-	4	-	7	1	3

Table 12D.35: The number of bones from juvenile animals in which the epiphyseal junction did not survive (most of these specimens are very small juveniles) and are therefore not included on the figures for fused and unfused epiphyses

		505		*LF*	
Epiphyseal Age	*Tooth Age*	*Epis %*	*Teeth %*	*Epis %*	*Teeth %*
0 – 10 months	0 – 6 months	1	1	5	5
10 – 18	6 – 18	9	12	1	9
18 – 30		27	4	27	8
	27 – 36	-	6	-	18
24 – 42		13	-	19	-
	36 – 48	-	38	-	8
42 – 60		20	-	5	
> 5 yrs	> 4 yrs	30	39	43	52

Table 12D.36: Estimate of the proportion of the slaughtered cattle in particular age categories in the Outer Ditch based on ages given by Silver (1969).

			505		*LF*	
Silver Epi. Age	*B & R Epi. Age*	*Silver Tooth Age*	*Epis %*	*Teeth %*	*Epis %*	*Teeth %*
0 – 10 mths	0 – 12	0 – 3	12	0	0	0
6 – 10	12 – 15	3 – 9/12	0	7	0	25
10 – 18/24	15 – 36	-	2	0	13	0
		18 - 24	-	35	-	52
18/24 – 36	36 – 40	-	29	-	29	-
		21 – 24	-	29	-	0
		24 – 36	-	3	-	2
36 – 48/60	48 – 72	-	45	-	34	-
		> 36	-	26	-	21
> 48/60	> 72	-	12	-	24	-

Table 12D.37**:** Proportion of sheep slaughtered in different age categories in the Outer Ditch based on ages determined from Silver (1969) and Bullock and Rackham (1982)

	unfused	just fused	fused
Proximal radius	-	-	4
Distal humerus	-	-	5
Proximal 2nd phalanx	-	-	1
Proximal 1st phalanx	-	-	3
Distal metacarpus	-	-	2
Proximal calcaneum	-	-	1
Distal radius	-	-	2
Proximal humerus	2	-	-
Distal femur	-	-	1
Proximal ulna	1	-	-
Cranial vert. epi.	4	1	15
Caudal vert. epi.	17	-	7

Table 12D.38: The number of fused and unfused epiphyses of horses from the Lower fills of the Outer Ditch arranged in approximate order of fusion, top to bottom.