

# Digital Chapter 12

## Part 1: The animal bone report 1

**D.J. Rackham and L.J. Gidney**

*(file names: AB report1 AB report1fig)*

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## REPORT 1

### **Piercebridge Roman Fort and Environs: An analysis of a sample of animal bones from the collections excavated at Piercebridge Roman Fort and *vicus***

D.J. Rackham and L.J. Gidney

1984 (minor revisions 2006)

*[Editorial Note - When this report was written various of the areas of the Housing Scheme site were known by different names (see Chapter 1 of the letterpress volume). The most notable of these changes concern the ditches. The Inner Ditch was then known as the Main Ditch and the Outer Ditch was known as the Secondary Ditch. Vicus building 1 was called the Strip Building and in this report was sometimes abbreviated to VSB. Vicus building 2 was called the Large Building, here frequently abbreviated to VLB. In what follows the ditches have been renamed to their current usage and the current building names are attached as italic entries. Otherwise the discussions of the stratigraphy have not been altered and the reader should consult the letterpress volume for an updated account of the various features].*

Excavations at Piercebridge were carried out between 1969 and 1982. These included a number of excavations at different sites (Fig. 12D.1) of military, civilian and agricultural aspect.

It was considered upon the completion of excavation that the quantity of animal bones from these excavations could be expected to occupy one analyst for some three years and a conservative estimate of over a quarter of a million bones and bone fragments was made for the total collection. The utility of parts of this varied appreciably and the quantity of material available from the individual excavation areas also varied. Therefore in part due to these factors and financial restrictions a 12 month programme of analysis was proposed and funded by the Department of the Environment and subsequently by HBMC.

This programme has of necessity resulted in the exclusion of some areas from the analysis and selected sampling of other areas, with two or three areas of the site being analysed in their entirety because the analysis had been carried out prior to the formulation of the programme or the collection was felt to justify or need total analysis. This collection has at the present been retained in its entirety and will be stored at the Bowes Museum, Barnard Castle, Durham County. The sample that is reported here is exclusively from the last phase of excavations (HS76-81). The un-analysed portion of the collection (as well as that analysed) will therefore be available for any future analysis or research study.

#### **Part 1: Excavated areas**

The early excavations at Piercebridge were carried out on sites outside the fort walls. The first of these in 1969 was the excavation by Dr D. Harding at Holme House Farm a Roman villa (Site 6. Figure 12D.1). This site approximately one kilometre south-east of the village of Piercebridge is thought to have been constructed in about 100 A.D. and dismantled about 200 A.D. The archaeological analysis indicates a minimum of later contamination but the sample of bones

recovered during the dig has not been analysed in its entirety (Gidney nd) although it is taken to represent a well stratified collection of second century date. This is the only well stratified material of this date within the environs of the site and covers a period of occupation prior to the existence of the known fort.

### *Toft Field*

Between 1973 and 1975 excavations were carried out on three sites in Tofts Field where aerial photography had revealed an extensive extra-mural settlement (*vicus*) and settlement along both sides of the early course of Dere Street (Fig. 12D.2). The first of these in 1973 uncovered a single vicus building (Site 2 - Fig 12D2). This appears to have been built at the end of the first century and rebuilt in 125 AD and again in 250 AD. This last phase of occupation was probably contemporary with the occupation of the known fort. This site produced a potentially useful collection of stratified second and third century bone material from the vicus the quantity of which is estimated to fill approximately 24 boxes (ministry size). This collection was however bagged in well labelled polythene bags and reburied in a trench excavated at the riverside edge of the field. Although it has been indicated that this collection is potentially recoverable for analysis, time did not permit its re-excavation and the sample at present remains buried.

In 1974 an excavation was carried out over Dere Street (Site 3, Fig 12D.2) and an adjacent area. Once again owing to the lack of an analyst and the necessary funds at the time the animal bones from this site were also re-buried in well-labelled polythene bags. The archaeologist reports that the collection from this site produced a large number of scapulae that are estimated to be of cattle size. As a readily recognisable bone this may indicate an activity such as butchering on the site the disposal of other waste bones from such an activity being less readily recognisable to an inexperienced person. The size of this collection is unknown and it has not been re-excavated for analysis. A very small amount from this excavation has been found in store but although catalogued is not discussed in this report.

In 1975 a site on the edge of Tofts Field (Site 4, Fig 12D.2) was excavated and has subsequently been identified as a small temple constructed in the third century A.D. which went out of use before the end of the century. A second part of this site was excavated in 1976 and in this area was cut by a ditch (Fig 12D.3). The ditch (offset ditch) has produced approximately 14 boxes of animal bone but this feature was excavated by machine and it has not been considered suitable for analysis. The small collection from the contemporary and later third and fourth century deposits in the temple has been catalogued but no further analyses undertaken.

It is unfortunate that circumstances have not permitted the re-excavation of the material from the two vicus excavations since these deposits obviously offer the best groups of well-stratified material for comparison with the extensive collections discussed below presumed to derive from the fort.

### *The Bath House*

Between 1976 and 1980 three sites were excavated in the south-eastern corner of the fort (Sites 5, 6 and 7. Fig. 12D.3). Glen View (5) contained five and Tees View (6) four structural phases which have been identified as a bath-house. The dating of these phases is problematic but the Bath House was first constructed in the early third century with the main period of activity being

Severan. The bath house continued in use with modifications after the construction of the fort (260-300 AD) and the later levels all contain fourth century material. At Bridge End (7) the excavations uncovered a complex of drains originally built at the end of the second century and associated with the bath house but subsequently with the internal drainage of this part of the fort. By the end of the third century at least part of this drainage system had become disused. The fillings of these features at Bridge End contained largely fourth century material, and the majority of bone from this site must date to this period.

All the material from Roman levels in Tees View and Glen View has been identified, although a relatively small collection, but a larger group of fourth century material from Bridge End is still unstudied. This collection forms the only significant sample of bones from the internal structures of the fort and derives largely from infilling or make up as features went out of use or were re-designed. Unfortunately the archaeological relationships of the deposits are not clear and the catalogued material is not discussed.

#### *Northern Nurseries*

In 1975 the opportunity arose to excavate on a site adjacent to Dere Street (site 8, Fig. 1) about one third of a kilometre north of Piercebridge. Three trenches NNA, NNB and NNC were excavated. NNA located a late fourth century roadside building constructed at about 370 AD and the other two areas to the south uncovered part of Dere Street, a ditch and a drain. Only a small collection of material was produced from these excavations (NNA-3 boxes, NNC-4 boxes, NNB-material not kept) and has not been analysed and therefore will not be considered in this report.

#### *Housing Scheme*

In 1976 excavations began in an area of gardens behind the village street (HS76, HS78, HS80, Fig. 12D.2) and was designated the Housing Scheme in association with a proposed development. The excavations in this area were conducted up until 1982 and have produced the bulk of the animal bone sample from the Piercebridge excavations.

The excavations in this area (Fig 12D.2) can be conveniently divided up into areas and these are introduced individually.

#### *Courtyard Building (9A - Fig.12D.3)*

This was originally termed a Barrack Block but is now recognised as part of a courtyard building constructed in the early third century and incorporated into the fort when this was constructed. Excavation of this fairly extensive structure produced very little material and the archaeologist remarked that it appeared to have been "swept clean" before the abandonment of the fort. The area produced only 6 boxes of bone and in the light of the archaeologist's remark and its small size it was not felt that its analysis would be informative. This collection was not therefore catalogued.

#### *Intervallum Road (9B - Fig. 12D.3)*

This area of the Housing Scheme site produced about 16 boxes of animal bones. The majority of this collection was not associated with any archaeological features and much of it may have derived from post-Roman activities on the site. The fact that this was a garden area and a number

of skeletons of domestic animals were unearthed during the excavation testifies to the degree of disturbance and it was therefore decided not to analyse the material recovered from this area.

#### *East Road and East Gate (9C- Fig. 12D.3)*

The area to the north in the Housing Scheme site included the excavation of the East gate of the fort and a length of the road running east-west through this gate. Three road surfaces were identified the earliest of which lay on a slightly different alignment and therefore predated the Gate. The second presumably dated to the construction of the fort and its east gate and the third to about 350 AD. The Gate itself built at the time of the construction of the fort (260-300 AD) contained little bone material and the pottery found dates mainly to the fourth century.

The road, both inside and outside the gate produced about 15 boxes of bone from each area. Much of the later levels over the roads are likely to contain substantial quantities of post-Roman material and cut into the road just to the east of the gate was an eleventh century corn drying kiln. Although it must be presumed that a substantial amount of material is Roman the lack of good Roman contexts for much of it and the current impossibility of distinguishing bone from different periods has justified the decision to exclude this material from the study.

The remaining four areas of the housing scheme site constitute the most important from the point of view of the animal bones. These include three structures (9D) described as vicus buildings, the Inner Ditch (9F), an Outer Ditch (9E) and the berm (9G - Fig. 12D.3). These are all extramural, although with an obvious relationship to the fort, and contain the majority of the animal bone sample from the Piercebridge excavations.

#### *Vicus Buildings (9D - Fig. 12D.3)*

The Strip Building, [*Vicus building 1*] (VSB), lies to the north of the road in the north-east corner of the site. A number of structural phases have been recognised on this site, the earliest made of timber, and the buildings are interpreted as being of civilian character throughout their history. The earliest phases predate the construction of the fort, but it is the later phases that have produced the majority of the animal bones. All the material from this area has been studied.

Just to the south of the road was situated the small vicus building. The material from this area has been analysed but subsequent archaeological analysis has thrown doubt on the date of this structure and the deposits contain much medieval material. The collection is small and is only briefly discussed in this report.

The Large Vicus Building, [*Vicus Building 2*] (LVB), lay just to the south of the small vicus building but only its west end was excavated. The dimensions of the whole building are not known. The corner of the building is built over the north eastern corner of the depression described as the Outer Ditch. This depression was partially filled before the construction of the building which is dated to the fourth century. The building is aligned with others in Tofts Field and is thought to be associated with the vicus. The majority of the animal remains from this area have been recovered from the paved area to the west of the building, the cobbles (LVBCob). Although these deposits contain a small amount of medieval pottery this is thought to be intrusive and it is unlikely that the sample is anything other than very slightly contaminated by post-Roman material.

Other material from deposits beneath the structure and material possibly of post-Roman date in the collapse layers of the building have also been studied and all the material from this area has been catalogued.

#### *Outer Ditch (9E- Fig. 12D.3)*

Beneath and to the south of the large vicus building lies a depression possibly of natural origin described as the Outer Ditch. This depression had been filled with deposits (Fig. 12D.4) 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 [*Vicus building 2*]. The quantity of material from the southern 30 metres was such that sampling was essential within the scale of the programme. The sample chosen was the middle section of the ditch. This was chosen largely because the archaeological information available for this area was more comprehensive and the section drawings permitted some consideration of whether the layers were dumped from the east or west side of the ditch (Fig 12D.4). The surface layers of this feature were not studied, being composed of mixed Roman and post-Roman material. The layers analysed were 505, a very large sample, and layers 551 and 554 which were quite obviously deposited from the vicus side of the ditch. Re-assessment of the pottery from 551 dates this to the early fourth century with some late fourth century contamination. These layers were completely analysed and are discussed below. The lower layers of this ditch fill have been dated to the late third century AD and have been analysed as a separate group from the fills above (see Gidney and Rackham 1985 – described as Report 2 in all further references).

#### *Inner Ditch (9F - Fig. 12D. 3)*

The Inner Ditch was cut at the time the fort was constructed and subsequently became filled with deposits that have produced large quantities of animal bones. About 60 metres of the ditch were excavated in four sections and the Inner Ditch was sub-sampled in the same manner as the Outer Ditch. The southern quarter of the excavated portion, about 15 metres of ditch (Fig. 12D.5), was chosen and all the material excavated from this portion was analysed. The ditch is largely filled by tumble from the fort wall and it is apparent that many of the upper layers may have been formed at the end of or during the immediate post-Roman period when the walls were decaying and being robbed. However despite this hypothesis, the stratified layers within the ditch contain only Roman material although the top and subsoil are contaminated by medieval material. Evidence of Anglian activity is indicated by a find of 6th century pottery in wall tumble on the Berm but it seems unlikely that much post-Roman contamination of the animal bones in the ditch will have occurred. The pottery in this ditch shows a high proportion of late fourth century wares and indicates a starting date later than that in the Outer Ditch. It is dominated by material from the latest phases of occupation on the site. As a whole the coarse pottery indicates a date in the last quarter of the fourth century. The coins however suggest a hiatus in occupation with a group of late third century material and a second group of late fourth century coins. It is probable therefore that the material derives from both these phases of activity on the site. Recent re-assessment of the pottery suggests that Layer 11 in the upper fills includes lots of residual material brought in from elsewhere so this is presumed to be a mixed assemblage, while layer 12 has a lot of redeposited third century material, but the pot in deposits 19 and 14 are securely late fourth century.

### *Berm (9G - Fig. 12D. 3)*

The area between the fort wall and the Inner Ditch, the Berm, contained many pits, about half a metre deep, presumed to be of a defensive character. These and the surface of the Berm became filled and covered with late fourth century material and tumble from the fort wall during its decay, some of which extended into the Inner Ditch. Although this area produced a fairly large collection of material time has not permitted its analysis. It may be argued that the sample from the Inner Ditch may be as effective an indication of the material without the further analysis of this group.

A number of other minor features and post-Roman features were uncovered during these excavations but the small size of the samples from these and the problem of inevitable and extensive contamination of post-Roman deposits by Roman material has suggested that the analysis of these would have little utility.

In summary the analysis has concentrated on three areas only, with as large a sample as possible being studied from these.

1. Roman Vicus Buildings. Second to Fourth centuries.
2. Outer Ditch. Late fourth century.
3. Inner Ditch. Late fourth century with some residual material.

The most significant absence from this list being the collections from the *vicus* excavations in 1973 and 1974, which were reburied and the unreported group from the Bath House. The villa assemblage has been studied by Gidney [*see now chapter 7*]. The Outer Ditch material contains the only well stratified late third century material on the site, so this has been studied as two groups, a later fourth century group (reported below) and a late third century collection reported in Report 2 (Gidney and Rackham 1985).

## **Part 2: Sampling and Methods**

### *Objectives and sampling*

The selection of those areas of the site that were analysed has been discussed as has the sampling by section of the Inner and Outer Ditch fills. The collection was still however of substantial proportions and after an initial two months of analysis on layers 12 and 14 of the Inner Ditch, from which all material was catalogued it was considered necessary to introduce a further level of sampling if a sufficient body of data was to be recorded for analysis. The nature of this further selection was in part determined by the character of the deposits that have been excavated and in part by the questions being asked of the material.

The following questions were originally proposed (Rackham 1983, unpublished).

1. What differences or similarities are determinable between the different 'social' units e.g. villa, vicus, roadside settlement, mansion, bath house, and fort?
2. How does the debris in the Inner Ditch, presumed to be debris from the fort and therefore military in origin, compare with the collections that can be attributed to the vicus?

3. What chronological variation can be recognised and is this associated with the establishment of a military post?
4. Can the villa collection be recognised as indicative of a producing settlement in contrast to the consumption character of the fort and vicus?
5. Can the large quantity of fourth century deposits in the Inner Ditch and Outer Ditch allow us to carry out a detailed analysis of the stock, slaughter pattern and husbandry practices of this period and region?
6. Are there significant differences between the late third and late fourth century collections in the Inner and Outer Ditches (see Gidney and Rackham 1985)

These questions encapsulate the two main analytical objectives. The first, a descriptive account of the fragmentation, skeletal element distribution, preservation etc. This type of analysis has two functions. It is used in the interpretation of activity areas, variability in the sample, disposal behaviour, etc. It is necessary for determining the taphonomic origin of the sample and its subsequent interpretation in terms of contemporary behaviour and functional characteristics. It has however little bearing upon an analysis of the original stock and slaughter pattern except to establish the validity of this type of approach. The second objective is the description of the structure of the stock - the species, sex and ages of the animals that generated the sample.

Both objectives must be fulfilled in order to answer the questions noted above but whereas the first, that largely taphonomic in purpose, requires an analysis of the whole sample including the component of the sample that cannot be identified to species, the second, stock structure, utilises only material identified to species. Furthermore many of the questions posed in the taphonomic analysis can be answered by an analysis of the identifiable fraction of the sample only.

At this site in the interests of establishing a large sample of identified and measured material it was decided that the largely unidentifiable component of the sample would not be studied or catalogued. Two large layers, and two smaller collections from the Inner Ditch were analysed in their entirety (see below) and offer an illustration of the nature of that component left out of subsequent studies. It is evident from the discussion of the excavated areas and the potential of the animal bone in each that some of the questions above cannot be answered because the animal bones assemblages did not warrant study.

A brief consideration of the results of the analysis of layers 12, 14, 41 and 44 (Table 12D.2) illustrates that a very high proportion of the sample (68%) is unidentifiable to species and about 45% of the sample could only be identified to large animal. A further 8% could not even be assigned to any particular size of animal. These fragments do give some indication of the nature of the deposits perhaps implying a high level of redeposition suggested by the level of fragmentation. However the large mammal and indeterminate mammal fragments give a fairly limited amount of information about skeletal distribution and variability. In the context of the ditch, activity areas are of little importance and certainly all the information relating to stock is

obtained from the identified fraction which is also that fraction from which measurements and comparative studies can be made.

The indeterminate fragments contribute only a little information and the excavation of much of these ditch deposits was such that objectives such as the origin of specific small dumps or layers was likely to be an unrewarding approach.

The following procedure was therefore adopted for the material subsequently catalogued from the excavations. All identifiable material was catalogued although a proportion of fragmented shafts of the sort classified for the layers already studied were not taken to species where perhaps with more time this would have been possible. Of the unidentifiable material all the vertebrae with the exception of small fragments were catalogued even if not identifiable to species, also all rib fragments with the capitulum were catalogued. Fragments where the bone was identifiable although the species was not were also catalogued - this applied to a number of skull fragments.

Area	Number catalogued fragments	Weight uncatalogued fragments (kg.)	Relationship of Number catalogued/weight uncatalogued	Estimated number of uncatalogued fragments.*	Estimate of weight of catalogued fragments (kg)
Vicus building 1	1446	18.20	79.5	2423-2724	37.3
Vicus building 2	4601	42.10	109.3	5619-6319	118.8
Outer Ditch	4302	42.25	101.8	5633-6334	110.0
Inner Ditch 11	5939	56.70	104.7	7555-8496	**153.3
Inner Ditch 19	1713	19.00	90.2	2533-2849	44.2
Inner Ditch 14	463	5.70	81.2	858	11.6
Inner Ditch ass.	300	2.10	142.9	283-318	7.7
<i>Sub-total</i>	<i>18764</i>	<i>186.10</i>		<i>27898</i>	<i>482.9</i>
Inner Ditch 12	6771				
Inner Ditch 14	7853				
Inner Ditch 44+41	381				
<i>Sub-total</i>	<i>15005</i>				
Grand Total	33769		Estimated total of all fragments	61667	Estimated weight of all bone 895 kg

**Table 12D. 1:** Weight of uncatalogued and number of catalogued bone fragments from the areas studied

\*catalogued on the basis of sample taken from layer 11 (minimum and maximum range)

\*\* (not estimated)

The result is that no indeterminate mammal fragments were catalogued and considerably fewer large mammal fragments. In the categories of large and small ungulate the main difference is the failure to catalogue rib shaft fragments therefore producing far fewer numbers in these sections. The uncatalogued material was subjected to two checks. The preliminary sort during cataloguing and a subsequent check of a large collection of indeterminate material before bagging separately and weighing.

All of the uncatalogued portions of the studied areas were weighed. The weight of the uncatalogued component of layer 11 in the Inner Ditch was used as a measure of the number of unidentifiable fragments from the analysed parts of the site. This fraction constituted approximately 25% of the total weight of bone recovered from layer 11 and an estimated 7800 fragments or approximately 57% of the total number of fragments from the layer. This makes a total of 61% unidentified from layer 11, a little less than the 66% from layers 12, 14, 41 and 44, indicating some variation. This variation, for the rest of the site, has only been documented qualitatively and not quantitatively and is one of the items lost through this procedure.

An estimated (Table 12D.1) 900 kilograms of bones have been studied, representing approximately 61,000 individual mammal bone fragments of which 33,769 were catalogued and 21,330 were identified to species.

While this procedure has been considered useful on this site where the analysis is directed towards gross differences and stock selection it may well be inappropriate for many site analyses and is very much dependant upon the questions asked of the bone sample. In the study of the late third and early fourth century material from the Outer Ditch a new recording procedure, 'zones', was used (see Report 2).

#### *Recovery and Identification*

The only recovery procedure used on site was hand collection during excavation. Areas which were machine dug have been excluded from the analysis. A small number of soil samples were taken for analysis and these have produced the only fish remains from the whole site and although this component of the buried bone population is likely to have been completely missed during hand excavation it would seem unlikely to be a major economic component of the diet.

The fragments were identified by comparison with the reference collection of the Biological Laboratory, Department of Archaeology, University of Durham, and catalogued using the system devised by Jones (Jones *et al* n.d.). Measurements were taken on all whole skeletal elements and many bone fragments. These followed those described by Von den Driesch (1976) and Jones *et al* (n.d.). A complete catalogue of these measurements is to be found on the CD.

### **Part 3: Analysis**

#### **Inner Ditch**

The deposits analysed from this area are illustrated in Fig 12D.5. The upper layer of this part of the ditch fill, 15, was not catalogued since much of the deposit had been contaminated and disturbed by medieval and later activity. The section illustrates that some of these layers were extensive and it is possible that some aspects of the stratigraphy were not recorded. The deposits date to the late fourth century AD and the larger layers are analysed separately and within stratigraphic phases. Layers 11 and 12 in the upper fills are contaminated by residual material, layer 12 including a lot of third century sherds. A summary of the animal bones is given in Table 12D.2.

#### *Fragmentation and Skeletal Distribution*

Initially the material in these deposits is analysed in terms of the degree to which it has been broken up and the distribution of the different skeletal elements of the most common species.

This is accomplished in two ways. The frequency of the fragments of each skeletal element of each species are arranged in their rank order and the minimum percentage loss (Grant 1984) is determined for each layer. Variation in this loss factor for the same species in each layer is a measure of the destruction of the collection and its degree of fragmentation or removal of material before deposition. Furthermore changes in the rank order of the bones of one species from layer to layer illustrates a differential distribution of the bones of the skeleton. In order to do comparisons across species the procedure outlined above is unsatisfactory because it makes no allowance for differential fragmentation between species. Therefore the comparison is effected by arranging the frequency of identified epiphysial junctions (as used in the tables on ageing) in rank order for each species and comparing the minimum percentage loss for each species in a single layer. This gives a measure of the degree to which one species has more or less suffered from the destructive agencies associated with the accumulation of the deposits and further confirms any skeletal selectivity associated with particular layers.

The rank order of frequency of bones of cattle (Fig. 12D.6a) from the whole ditch is characteristic of this species (see Grant 1984) and is largely a factor of the robustness of the skeletal element and to a degree also its ease of recognition when fragmented. A comparison of the percentage loss from the four large layers of the Inner Ditch fill indicates differential fragmentation and survival (Table 12D.3, and Figs. 12D.6 and 7). The lower layers of the fill (19 and 14) generally have a higher percentage loss than layers 11 and 12. 11 having the lowest (48.4%). This is a pattern that is duplicated by pig (Figs. 12D. 10 and 11) but to a much lesser extent by sheep bones (Figs 12D.8 and 9) and is suggestive of a greater degree of fragmentation and bone loss in layers 14 and 19 than in 11 and 12. [Sheep is used throughout the text although the bones were recorded as sheep or goat. No goats were identified in the Inner Ditch and the assemblage is presumed to be entirely sheep.] The loss based upon the frequency of epiphysial junctions of cattle varies in a slightly different pattern.

Species	1 <sup>st</sup> fill		2 <sup>nd</sup> fill		Tertiary fills			Quaternary fills		
			33,54,72	19	14	44	55+41	11	12	
Cattle	59	40	893	1677	65	42	3401	1590		
Sheep or goat	18	7	304	482	22	6	779	397		
Sheep	1	-	4	4	2	-	6	2		
Pig	14	4	227	439	17	7	553	257		
Horse	-	2	46	88	2	3	278	116		
Dog	1	17	38	82	2	7	140	48		
Cat	-	-	-	-	-	-	3	5		
Human	-	-	-	4	-	-	3	8		
Dog or fox	-	-	3	-	-	-	3	-		
Fox <i>Vulpes vulpes</i>	-	-	1	-	-	-	15	8		
Badger <i>Meles meles</i>	-	-	-	1	-	-	4	2		
Red deer <i>Cervus elaphus</i>	1	4	20	22	2	3	133	33		
Brown hare <i>Lepus capensis</i>	1	-	-	4	-	-	1	3		
Water vole <i>Arvicola terrestris</i>	-	-	-	-	-	-	4	1		
Domestic fowl										
Greylag/domestic goose, <i>Anser anser</i>		1	15	16		1	44	40		
Small goose sp.			5				9			
Mallard, <i>Anas platyrhynchos</i>				5			2	1		
Stock dove? <i>Columba oenas</i>			1							
Golden plover <i>Pluvialis apricaria</i>			1							
Raven <i>Corvus corax</i>			1							
Small corvid, magpie? <i>Pica pica</i>							6			
Crow/rook <i>Corvus corone/frugilegus</i>								4		
Buzzard? <i>Buteo buteo</i>			5				3	1		
Indeterminate bird										
Large animal	-	-	-	3853	149	14	50	2772		
Large ungulate	12	8	149	934	11	7	507	533		
Small ungulate	5	2	23	341	5	1	63	232		
Indeterminate	-	14	-	384	61	-	-	768		
Total	112	99	1736	8336	338	91	6007	6821		

**Table 12D.2:** Fragment counts for each species from the Inner Ditch deposits

Layer 19 is the most fragmented (Table 12D.3) but in contrast to the information derived from the fragments, layers 11 and 14 are similar, with layer 12 showing the smallest destructive influence. This latter result is almost certainly partially due to the differential skeletal distribution noted for layer 12 below. The frequency of epiphysal junctions of sheep and pig was not sufficient to do this analysis by layer. The differential survival of the three major species is therefore considered for the whole of the deposits from this section.

In the consideration of the epiphyses the frequency has been corrected for the number of bones in the skeleton. This is obviously important for foot bones where pigs would become more frequent. It is immediately apparent from the figures (Table 12D.3 and Figs 12D.6a, 8a and 10a) that sheep appear to have suffered the greatest loss and destruction. This is most apparent if the frequency of the distal tibia is compared to the other epiphyses particularly those of the proximal epiphysis of the same bone (Fig 12D.30a). The loss for the pig bones appears only a little less marked (Table 12D.3, and Fig 12D.10a) but the fact that many of the pigs were juveniles suggests that the overall loss, rather than minimum percentage loss, may well have been higher than that of sheep. The significance of this differential destruction is discussed below when considering the relative abundance of the species.

The skeletal distribution of the sheep and pigs in these layers appears to have been primarily affected by preservational conditions. The rank order of frequency varies little between layers (Figs 12D.8 and 9, & 10 and 11), each layer being arranged in the rank order for the whole ditch, and what variations, if any, may have originally been present have been obscured by these preservational factors. The more robust bones are the most frequent, the distal tibia, proximal radius, mandible, distal humerus and metapodials of sheep and for the pigs the jaws, tibiae, humeri and scapulae are characteristically the most frequent. The epiphyses of the later fusing bones are particularly infrequent due to their fragility and age factors.

In contrast to the pattern for the smaller domestic animals the element frequency of cattle while being one that can be associated with robustness and preservational qualities in the majority of the ditch deposits, in layer 12 shows a very significant departure in rank order of frequency (Fig. 12D.7c). An analysis of the bones in this layer which show a higher than expected frequency with respect to the other layers in the ditch (Figs 12D.6 and 7) reveals that they are largely restricted to the lower limbs, e.g. phalanges, carpals, tarsals and metapodials. It is apparent that the predominance of the lower limb bones, which are often if not generally found intact, is one of the reasons for this layer having the lowest percentage loss as described above.

If we are to interpret the results of these analyses a number of explanations may be presented. Layer 19 has suffered the most serious erosional and destructive forces and we might therefore suggest that this layer of the ditch fill (Fig 12D.5) accumulated over a period of time in the base of the ditch while it was still functional. A similar hypothesis may be advanced for layer 14 although the destruction is less. An alternative is that these layers are redeposited from a fairly severe erosional environment. The condition of the

bones was average but not generally poor and the burial environment and nature of the deposit is unlikely to have been a factor in the destruction of material.

	Tertiary fills		all	Quaternary fills		Method
	19	14		11	12	
Cattle	70.1	61.9		63.4	56.4	All appendicular epiphyses
	70.9	64.4		66.4	69.3	Appendicular epiphyses, except phalanges & metapodials
	59.9	64.9		48.4	54.1	Fragments (first 20 bones in rank order)
Sheep		78.2			78.8	All appendicular epiphyses
		73.0			74.2	Appendicular epis. except phalanges and metapodials
	78.2	80.1		82.5	71.3	Fragments (first 20 bones in rank order)
Pig	78.3		72.8		66.7	All appendicular epiphyses
			67.3			Appendicular epis. except phalanges and metapodials
			71.9			Fragments (first 20 bones in rank order)

**Table 12D.3:** Estimate of the minimum percentage loss (Min%loss) using three methods for cattle, sheep and pig in the layers from the Inner Ditch

The most numerous bones are those with high density and good survival properties. The deposits contained a number of unassociated human bones and none of the bones of horse - a species often found as whole or partial skeletons - were recorded as associated. These facts may point to a high level of disturbance and given the conditions already alluded to it seems probable that much of the material must have undergone erosion and destruction elsewhere. It is probable that most of this collection is redeposited, deriving from deposits and dumps where it had already undergone substantial disintegration before becoming incorporated in the ditch where it was presumably sealed fairly quickly. The re-assessment of the pottery has identified layers 19 and 14 as good late fourth century deposits, but layers 11 and 12 with lots of re-deposited third century material in an otherwise late fourth century context. Layer 11 appears to be associated with tumble or dumping from the fort side of the ditch. The section (Fig. 12D.5) suggests that this may have been a specific tipping and the lesser degree of fragmentation may indicate less exposure to erosional or destructive agencies although these have still been sufficiently severe to suggest that this material is redeposited rather than primary refuse/rubbish, supported by the quantities of residual pottery. The interpretation of layer 12 which represents the infilling of the ditch is complicated by the fact that it is dominated by the bones of the lower limb, some of the bones most resistant to destruction. This layer has therefore probably been subjected to more destruction than the initial analysis above suggests and if the loss is based upon a sample excluding the feet bones the remainder of the skeleton can be seen to have suffered more than expected in layer 12 (Table 12D.3), suggesting that this layer may have been subjected to more attack than layers 11 and 14. This might suggest that the infilling of the ditch, layer 12, was not a rapid event but such an interpretation is complicated by the obvious secondary nature of the deposits and the erosion may have taken place in the primary depositional environment. It would appear probable that layer 12 is secondarily redeposited from an environment in which considerable erosion had already occurred and in which different bones of cattle were selectively deposited. A lot of third century material in this layer supports the interpretation of this re-deposition. The concentration of feet suggests that this original deposit was likely to be refuse from butchering or skinning activities - the latter for preference since the pigs and sheep bones do not show a similar pattern. Whether this deposit derived from the vicus or can be associated with the infilling of the ditch by clearance of refuse deposits from within the fort is unanswerable.

### *Species Abundance*

It is only legitimate to approach the question of the relative frequency of the different species in a collection after first analysing the fragmentation of each species, the differential fragmentation between species and the degree of destruction or loss that can be associated with the collection. It may well already have been noted by the reader that aspects of the foregoing discussion will have some importance in respect of the relative frequency of the three major domestic species. The percentages of the fragments of each of the major food species are presented in Table 12D.4 for each of the deposits from the Inner Ditch. It would appear from these figures that there are significant changes between the lower deposits (primary, secondary and tertiary fills) and the infill deposits (quaternary fills) of the ditch. While this is true it may rather be a reflection of the taphonomic

processes and fragmentation pattern than any economic change or change in species slaughter frequency.

	Primary fills %	Primary+ secondary	Secondary fills	Tertiary fills			Quaternary fills		
				19	14	44	55+41	11	12
context				19	14	44	55+41	11	12
Cattle	64	(69)	78	63	64	61	76	72	71
Sheep	21	(18)	14	22	19	23	11	17	18
Pig	15	(13)	8	16	17	16	13	12	11
N =	92	(143)	51	1428	2602	106	55	4739	2246

Table 12D.4: Percentage of fragments of each of the major food species in the Inner Ditch deposits

	Tertiary		Quaternary	
	19 (%)	14 (%)	11 (%)	12 (%)
Cattle	47.2	62.3	60.2	60.4
Sheep	29.4	21.2	22.4	22.0
Pig	23.4	16.5	17.3	17.6

Table 12D.5: Percentage of each of the major food species based upon particular skeletal zones on each major bone element

	12+14 (%)		11 (%)		19 (%)	
	54.7	51.6	51.6	47.0	47.0	31.3
Cattle	54.7	51.6	51.6	47.0	47.0	31.3
Sheep	27.5	28.6	28.6	21.6	21.6	31.3
Pig	17.8	19.8	19.8	31.3	31.3	31.3

Table 12D.6: Percentages of cattle, sheep and pig based upon the frequency of mandibular premolar 4, Molars 1, 2 and 3 (see text for method of inclusion of juveniles)

It is therefore necessary to use an approach that although not completely independent of these preservational factors can overcome some of the problems. The method used here is the comparison of the frequency of particular zones of skeletal elements for each species. The mean percentage frequency is taken as being the best measure of the relative abundance of a species in a layer. The method is fully discussed in Rackham (1986a). Utilising only the major limb bones (scapula, humerus, radius, ulna, femur and tibia) the proportion of the major species in each of the four main layers is shown in Table 12D.5. The technique is illustrated in Fig. 12D.12 for layer 19.

It is apparent that, by whatever method of study, layers 11 and 12 indicate almost identical proportions and would suggest that the bones in these layers either come from the same overall population or that there were no changes in proportional exploitation between the periods when the material from these deposits was being generated, although we have already seen that the skeletal distribution in 12 is biased for cattle. Layer 14 in slight contrast to the fragment figures is not significantly different from the proportions in 11 and 12, but layer 19 when analysed in this manner has produced a significantly different pattern. By excluding the foot bones from the analysis to produce these figures we have largely removed two biases, that of differential recovery of small bones such as phalanges and tarsals, and secondly the possibility of bias introduced by the skeletal selection already noted in layer 12.

A further bias must be considered before interpreting these figures. We have shown that fragmentation is differential between these layers (Table 12D.3) and it is possible that the generally greater fragmentation present in layer 19 (Table 12D.3 and Figs. 12D.6a, 8a and 10a) may have influenced the figures. It is certainly the case that the loss of epiphysal ends of cattle is greater in this layer than the others (Table 12D.3), a pattern not observable in the pig and sheep bones although these samples are small. The fact that the loss based upon fragments is not so consistent might be attributed to the increased number of identified shaft fragments of cattle which counter balances the destructive loss of the epiphyses. This would certainly produce a depression of the relative proportion of cattle in layer 19 when using the technique used to produce Table 12D.5. It is perhaps unlikely that it would have produced quite such a substantial (13%) fluctuation (although even with these relatively large samples a variation of this size might occur by chance) given the consistency of the figures from the upper layers.

An independent check on these figures can be made by the analysis of the teeth which are more resilient and less subject to destruction. These are subject to recovery efficiency if loose. The figures presented in Table 12D.6 are the relative proportions of each species based upon the occurrence of the P4, M1, 2 and 3. Juvenile jaws with the later erupting teeth absent are counted once for each un-erupted tooth. Layer 19 once again appears anomalous and we must conclude that the proportions of animals slaughtered to produce this latter collection was different from that for the later deposits in the ditch.

We now have a number of figures (Tables 12D.4-6) that purport to represent the proportion of the major species in the collections. While each is internally consistent with the interpretation above they each represent the species in different proportions. Having

established layers 11, 12 and 14 as similar these will be treated as a single unit for establishing the proportions of the species in the upper fills of the ditch.

	Fragments %		Epiphyseal Mean %		Teeth Mean %	
	Upper fills	19	Upper fills	19	Upper fills	19
Cattle	69.6	63.0	61.0	47.2	53.1	47.0
Sheep	17.4	22.0	21.9	29.4	28.1	21.6
Pig	13.0	16.0	17.1	23.4	18.8	31.3
N =	9587	1428				

Table 12D.7: Species proportions as a percentage of cattle+sheep+pig in the upper fills of the Inner Ditch and layer 19

The upper fills show the same rank order of importance of species whichever method is used with the importance of cattle being progressively reduced as elements less subject to destruction are used in the assessment (Table 12D.7). We have seen in Table 12D.3 that the destruction is differential between species, most particularly between cattle and the small domesticates (sheep and pig), and this result accords with the reduction of cattle as more resistant skeletal units are used. Furthermore we have established that sheep are the most seriously effected by this destruction and the results from the teeth have favoured sheep by comparison with the other figures. One may therefore reason that in these deposits the relative frequency of the teeth best represents the proportions of the major species. One final aspect that must be taken into account is the age structure of each species. It is shown later that the majority of the pigs are juvenile a pattern not reflected by cattle and sheep. It may therefore be assumed that although the minimum percentage loss of pigs is apparently less than sheep there is likely to have been a greater loss of all pig bones than for sheep where the distal tibia and proximal radius are particularly resilient. This loss may be through destruction of the more fragile juvenile bones or active scavenging by dogs whose destruction of softer juvenile bones can be complete. At this time there is no analytical method available for quantifying this loss, other than that discussed (see Grant, 1984) but an approximate correction based largely on the results of this analysis and experience can be suggested. The ratio of animals slaughtered some of whose remains found their way into the upper layers of the Inner Ditch was approximately 1 pig: 1.3 sheep: 2.2 cows. From these figures some estimate can be made of how many animals may be represented in this sample. This is not the Minimum Number of Individuals as defined by Chaplin (1972) or Grayson (1984) but a calculated/reasoned estimate of the smallest number of animals that were killed to produce this sample. The MNI of cattle, based upon the right proximal radial epiphyses is 122. This section of the ditch therefore contains the remains of a definite minimum of 122 cattle and a probable minimum of 55 pigs and 72 sheep. This would suggest that the excavated 60 metres of the upper ditch fills may have contained the remains of nearly 500 cattle, 220 pigs and 288 sheep. This gives some idea of the scale of the rubbish that must have been generated by the fort.

We will now assess the species proportions in layer 19. In this layer the proportions based upon teeth have produced a different rank order from that indicated by the epiphyses and

fragments (Table 12D.7). This discrepancy serves to support the suggestion already made that pig bones have been 'generally' lost through destruction more than the sheep although they have a smaller minimum percentage loss. On the other hand it may be a generally lower proportion of sheep jaws in this layer, a character supported by the unexpectedly low incidence of jaw fragments in Fig 8b (7 in the rank order) by comparison with the other layers. There is therefore a skeletal selectivity bias affecting the figures obtained from the mandibular teeth. If we return to those based upon the limb bones (Table 7) the minimum percentage loss for sheep and pigs is very similar in the layer (Table 3), but we have suggested that this under represents pigs because of the high proportion of juveniles in the sample and the greater tendency to destruction. The loss of cattle bones (Min%loss) is less than sheep or pig and the figures in Table 7 must therefore be adjusted to compensate for this differential loss. We have not yet developed a quantitative method for assessing the compensation factor and it must at present be an estimate resulting from the analysis of Min%loss and experience. In this case the ratio of animals slaughtered to produce this collection probably approximates to 1 pig: 1 sheep: 1.4 cattle. The difference between these lower and the upper fills may reflect a chronological change, an economic change or a different origin or source for the material in layer 19 from the later deposits. Comparison with other parts of the site may help to elucidate this question which will be discussed later with reference to the relative economic importance of each species as a meat contributor.

The remaining aspects of the major domestic species from the Inner Ditch will be dealt with in detail under the discussion of each species.

## **Outer Ditch**

A section from that part of the Outer Ditch analysed is illustrated in Fig. 12D.4. The surface levels have been ignored and the analysis has concentrated on the very large deposit, layer 505. The lower fills have been catalogued but are reported elsewhere (Report 2). Two small deposits, XX and XD (contexts 554 and 551), considered to represent dumping from the vicus side of the ditch have been analysed but are not of sufficient size for detailed comparison with the large groups from the site and these are included in the second report (Report 2). All the deposits that have so far been analysed are dated on the basis of the included pottery fabrics and coins to the fourth century and are broadly contemporaneous with the material analysed from the Inner Ditch. The number of identified fragments of each taxa are noted in Table 12D.8.

### *Fragmentation and Skeletal distribution*

The material from this feature is compared with that from the Inner Ditch. The fragments of each species in layer 505 are figured in Figs. 12D.13, 16 and 18 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 minimum percentage loss for the three major species, based on the three methods used above is given in Table 12D.9. Although the rank order is the same as the deposits from

the Inner Ditch, with sheep showing the greatest minimum percentage loss, the pattern is slightly different. Sample size is a significant problem for sheep and pigs in this layer.

Species	551+554	505
Cattle	129	2272
Sheep or goat	13	583
Sheep	-	8
Pig	23	590
Horse	5	65
Dog	1	40
Cat	1	3
Human	-	4
Dog or Fox	-	-
Fox	-	2
Red deer <i>Cervus elaphus</i>	-	5
Brown hare <i>Lepus capensis</i>	-	3
Water vole <i>Arvicola terestris</i>	-	1
Domestic fowl		37
Greylag/domestic goose <i>Anser anser</i>		3
Black grouse <i>Lyrurus tetrix</i>		1
Rook <i>Corvus frugilegus</i>		1
Barn owl <i>Tyto alba</i>		1
Buzzard <i>Buteo buteo</i>		6
Indeterminate		5
Large ungulate	50	404
Small ungulate	2	97
Indeterminate	-	2
Total	224	4133

Table 12D.8: Fragment counts for each species from the Outer Ditch deposits

Pig have been subject to less destruction and loss than in any of the layers in the Inner Ditch (Table 12D.3) and this appears also to be the case for cattle although fragmentation is such that if all identifiable fragments are used (col. 1 Table 12D.9) it falls within the range found in the Inner Ditch layers (Table 3). This data would suggest a lower loss and destruction of epiphyseal ends of cattle bones and although the appendicular skeletal fragmentation by comparison with the Inner Ditch deposits is greater, there being almost a 10% drop in the proportion of epiphyseal ends in the total fragments for the limb bones, the differential loss of skeletal fragments is not so great. This may indicate that while fragmentation is just as great or greater the collection has been less subject to post-depositional, erosional and destructive forces and may be in a primary context or secondarily redeposited from a less disturbed primary deposit than the layers from the Inner Ditch. The sheep remains contradict this picture somewhat by having a relatively greater loss of epiphyseal ends than the Inner Ditch deposits. While this variation is small it does contrast with the pig and cattle remains and reinforces the significance of factors that act differentially on each species.

	Fragments	Epiphyses	Epiphyses (without foot bones)
Cattle	61.0	58.9	60.9
Sheep	76.8	81.0	76.0
Pig	67.1	64.1	62.5

Table 12D.9: Minimum percentage loss in layer 505

The distribution of the skeletal fragments of cattle (Fig. 13b) is slightly different from that obtained for the total collection from the Inner Ditch. Certain elements are proportionally more frequent, although there is a general drop in those generally more common in the Inner Ditch. These include the phalanges which are uncharacteristically high but not to the degree found in layer 12. There is a plateau in the fall off of frequency with 6 skeletal elements occurring between 36% and 38% of the jaw fragments and 9 between 36% and 46%. Such a plateau does not occur in any of the layers from the Inner Ditch. This pattern supports the hypothesis of less destructive loss, despite the abundance of jaw fragments, and suggests that many parts of the skeleton are fairly equally represented indicating disposal of all parts with little selectivity, heads and feet included.

The distribution of elements of sheep (Fig. 12D.16a) varies little in rank order from the sample from the Inner Ditch deposits and may be presumed to have suffered similarly, the occurrence being largely one of survival and recovery rather than due to any contemporary human selectivity.

The frequency of occurrence of the bones of pig in layer 505 (Fig. 12D.18a) is different from the layers in the Inner Ditch (Fig. 12D.11a). Although the rank order in this layer is different the significant feature is the consistently higher frequency of skull fragments, maxilla, temporal, frontal, occipital, premaxilla and zygomatic. At first glance this would suggest a higher proportion of skulls being disposed of in this layer. A second explanation might be that lower fragmentation and destruction in this layer (see above) has resulted in the survival of a greater proportion of recognisable fragments of these relatively more fragile skulls than those in the Inner Ditch. We would therefore suggest that this difference is due to taphonomic not cultural selectivity.

#### *Species proportions in layer 505*

The data from which the relative abundance of species is determined are presented in Table 10. For the same arguments as those used above the fragment percentages are unlikely to reflect the proportions in which the animals were slaughtered. The figures obtained from using the frequency of epiphyseal ends (excluding the bones of the feet) is not appreciably different, but these are both substantially different from the frequency of teeth and that from the main limb bones and jaws when all parts of the bones are counted. The reduction in the frequency of cattle is to be expected since this species has the lowest minimum percentage loss. A substantial increase in sheep is also to be expected since this species has the highest Min%loss. The pig remains are more problematic. It is to be expected that their frequency will exceed that indicated by the fragments for two reasons. They have a

higher Min%loss than cattle and secondly they are generally younger (see below) and must have suffered a generally greater loss than the Min%loss suggests. The proportions from the teeth therefore stand out as unexpected and should perhaps be explained by suggesting that mandible fragments of pig are relatively less frequent in this layer although still the most abundant fragment (see Fig. 12D.18a for confirmation). The figure taken from all the bones is probably least affected by bias and if we remove the jaw fragments from this calculation the figures are 47.7% cattle: 27% sheep: 24.4% pig. Preservation will have effected even these figures to a degree and they probably under-represent both pig and sheep.

	Fragments %	All bones Limbs & Jaws Mean %	Epiphyses (without feet) Mean %	Teeth Mean %
Cattle	65.8	51.0	62.3	53.4
Sheep	17.1	26.4	18.3	33.3
Pig	17.1	22.6	19.4	13.3
N =	3453			

Table 12D.10: Representation of the major species in layer 505 using different quantification methods

These figures suggest proportions very similar to those from layer 19 in the Inner Ditch (Table 12D.7) and since at least 30 cattle are present (MNI ) the deposits are likely to contain the remains of a further 21 or 22 carcasses of sheep and an equal number of pigs. The much less dispersed character of this deposit is illustrated by the maximum number of bones per individual (Table 12D.11).

	Inner Ditch		Outer Ditch	Vicus	
	11, 12 & 14	19	Layer 505	LVBPre	LVBCob
Cattle	54.6	33.0	75.7	49.2	62.8
Sheep	27.4	13.0	27.6	20.3	31.7
Pig	20.5	9.6	27.6	18.6	32.9

Table 12D.11: Maximum number of bones per estimated individual from the different areas and feature groups.

The figures for sheep and pig are based upon the estimated relative frequency in comparison with cattle and not their own MN1. The latter has been established for cattle only.

### Large Vicus Building [*Vicus building 2*]

The large vicus building [*Vicus building 2*] overlay the terminal of the so called Outer Ditch on the south side of the east-west road. The whole collection from this area was analysed and can be divided into three broad groups of material. The primary filling of this part of the depression (Pre LVB) which underlies the Vicus building but is probably attributable to the fourth century. A large collection of bones from the cobbled and paved

area to the west of the structure (LVBCob. *see Chapter 5 p. 000*). The finds from these features indicate a later fourth and early fifth century date although a small amount of 'intrusive' medieval pottery was present. The third collection comes from the later deposits inside the 'structure' and the collapse levels of the site. The date of these deposits is uncertain but the majority of the dateable finds are late Roman and it may be largely fifth century in date.

These groups are analysed separately although of smaller proportions than the layers from the ditches (Table 12D.12).

Species	Pre-struct	A	B	C	Cob. area	D	E	F
Cattle	394	89	96	20	1257	83	44	92
Sheep or goat	132	36	62	5	546	39	16	35
Sheep	10	-	1	-	8	-	-	-
Pig	93	19	17	8	411	37	16	21
Horse	34	4	2	2	81	3	3	3
Dog	2	-	-	-	33	2	-	1
Cat	1	-	-	-	-	-	-	-
Human	2	-	-	-	-	-	-	2
Dog or Fox	-	2	-	-	-	-	-	-
Fox <i>Vulpes vulpes</i>	-	-	-	-	1	-	-	-
Badger <i>Meles meles</i>	-	-	-	-	1	-	-	-
Red deer <i>Cervus elaphus</i>	-	1	1	-	7	-	1	1
Roe deer <i>Capreolus capreolus</i>	-	-	-	-	1	-	-	-
Brown hare <i>Lepus capensis</i>	-	-	-	-	7	2	-	61*
Domestic fowl	21	7	34	5	39	8	-	-
Greylag/domestic goose <i>Anser anser</i>	9	3	44	4	9	-	-	-
Goose, sp.	-	-	1	-	-	-	-	-
Mallard <i>Anas platyrhynchos</i>	-	1	1	-	2	1	-	-
Whooper swan? <i>Cygnus cygnus</i>	-	-	-	-	1	-	-	-
Black grouse <i>Lyrurus tetrix</i>	1	-	-	-	-	-	-	-
Dove <i>Columba</i> sp.	-	-	-	-	1	-	-	-
Jackdaw <i>Corvus monedula</i>	1	-	-	-	-	-	-	-
Rook <i>Corvus frugilegus</i>	1	-	-	-	-	-	-	-
Indeterminate bird	-	-	23	-	1	-	-	-
Large animal	-	-	-	-	5	-	-	-
Large ungulate	100	17	31	14	338	28	13	13
Small ungulate	26	9	16	4	119	7	4	-
Total	827	188	329	62	2873	210	97	229

Table 12D.12: Fragment counts for each species from the Large Vicus building (Vicus building 2) deposits

\* - includes bones from a partial skeleton

A - lowest deposits inside building; B – deposits to the north of the building; C – higher deposits inside the building; D – collapse deposits; E – fill of gully 824; F – fill 828 of boundary ditch 826  
*Fragmentation and Skeletal distribution*

The PreLVB material and that from the cobbles are the only large groups from this area (Table 12D.12). The others are slightly dispersed from each other and of insufficient size for this type of analysis. The Min%loss for the major domesticates is given in Table 13.

As samples decrease in size the problems of identifying taphonomic and cultural anomalies in the collection become progressively more difficult. It can be seen in Table 13 that apart from the fragments the sample is too small for assessing the Min%loss for each of the major species. It is again apparent that cattle have lost the least and that the loss is slightly greater in the Pre LVB deposits. This appears to be true also for the sheep and pig although the latter species occurs in numbers too small for confident analysis.

	PreLVB			LVBCob		
	Fragments	Epiphyses	Epiphyses (without foot bones)	Fragments	Epiphyses	Epiphyses (without foot bones)
Cattle	55.4	64.1	68.8	55.2	57.7	61.0
Sheep	72.9	77.7*	73.7	73.0	69.0	63.8
Pig	80.5*	*	*	72.1	59.9*	*

\* sample too small

Table 12D.13: Minimum percentage loss for cattle, sheep and pig from phases of the Large Vicus Building (Vicus Building 2)

The sheep appear to have been subject to less loss in the deposits over the cobbles than any others analysed so far and it may be that much of the material is primary in character. Owing to small sample size it is not possible to determine whether pigs have suffered a greater or lesser loss than sheep which affects the reliability of the estimate of species abundance discussed below.

The skeletal distribution in the deposits over the cobbles (Fig. 12D.14a) is not substantially different from that in the Inner Ditch, although with a somewhat higher incidence of phalanges and a generally depressed relationship of most other bones relative to jaws. The PreLVB levels do show a different pattern (Fig. 12D.13c). The sample is comparatively small but fragments of certain elements have an unexpectedly high frequency by comparison with the Inner Ditch material. Phalanx 1 is the most abundant bone and yet the metapodials and calcaneum are under-represented. Unlike some of the other layers this difference in pattern appears to have no consistency and sample size may be the most significant factor.

The distribution of sheep bone fragments (Figs. 12D.16b & 17a) is not greatly different from those in the Inner Ditch, although the radii are unexpectedly low. Likewise the pig bones in the cobbled area (Fig. 12D.18b) are similar in distribution to those in the Inner Ditch although the tibiae and ulnae are slightly under-represented. This latter characteristic probably merely reflects the lower degree of fragmentation, since the tibiae and ulnae are often common in eroded material with heavy loss.

There is no apparent selectivity in these layers other than that caused by taphonomic factors and recovery procedures. The collections are characteristic of food refuse with no evidence of other cultural activities.

#### *Species Proportions*

The figures in Table 12D.14 for both the PreLVB and the LVBCob deposits vary in a similar manner as the method of estimation of the proportion changes. The high count for sheep based upon the teeth is certainly due to the fact that both these feature groups contain a higher proportion of sheep mandibles than any of the other areas. This selectivity is not associated with any other skeletal elements and it is apparent that the proportion of mandibles is different from that of the other skeletal elements. In this group the second column is used because this is the category with the largest sample size, apart from fragments.

The frequency of each species is the same in both feature groups although the PreLVB group is more fragmented and has been subject to greater loss. Sheep are obviously more significant in these deposits than those analysed above and are certainly more abundant than pig in these layers. The loss for cattle and sheep in both groups is proportionally similar and therefore the relationship between the two species need not change between the PreLVB and LVBCob deposits. The combination of bone loss and the species proportions in Table 12D.13 column 2 would suggest the species in proportions approximately 40% cattle, 35% sheep and 25% pig, or a ratio of 1 pig : 1.4 sheep : 1.6 cattle in both feature groups.

The MNI of cattle for these two groups is 8 from PreLVB and 20 from the LVBCob based upon the distal humerus and proximal radius respectively. The maximum number of bones per individual based upon the MNI for cattle and the relative frequency estimates above are given in Table 12D.11. The cobbles have a larger number of bones per individual but this may be purely a sample size factor. In the PreLVB deposits a minimum (MNI) of 6 pigs are present indicating at least 8.4 sheep and 9.6 cattle on the basis of the proportions from column 2 Table 14. The minimum number of animals represented in these deposits is 24 and in the LVBCob area the remains of at least 50 animals are present (20 cattle : 17.5 sheep : 1 2.5 pigs).

#### **Vicus Strip Building** [*Vicus building 1*]

The Vicus Strip building [*Vicus building 1*] has five recognised stone structural phases overlying an earlier timber structure from which no material survives. The first phase (B) of the stone structure is third century in date and produced a small collection of material

(Table 12D.15). No bone was recovered from layers associated with the structural alterations in Phases C and D but phases E and F produced a sufficiently large sample for analysis. These phases of the structures certainly date to the later fourth century. A number of other deposits probably of post-Roman date were also analysed and the finds are noted in Table 12D.15.

	Pre Large Vicus Building				Large Vicus Building Cobbles			
	Fragments %	Bones Mean %	Epiphyses (no feet) *	Teeth Mean %	Fragments %	Bones Mean %	Epiphyses (no feet) Mean %	Teeth Mean %
Cattle	62.6	42.7	*	29.9	56.6	41.8	49.0	29.8
Sheep	22.6	32.9	*	40.6	24.9	34.7	33.0	48.9
Pig	14.8	23.5	*	29.5	18.5	22.5	18.0	21.2
N	629				2222			

Table 12D.14: Species proportions from the Large Vicus building [*Vicus building 2*) using different methods (\* sample too small)

Unfortunately although Phases E and F appear to be different in the proportions of the major species (Table 12D.15) neither has a sufficiently large sample for analysis at the detail hitherto used and the material from these phases has therefore been amalgamated with a concomitant decrease in resolution.

In these layers the samples of sheep and pig are too small for the analysis of Min%loss of the epiphyses and estimates of loss must be based upon the fragments and those trends indicated by the other deposits at the site. The loss for cattle bones varies little whichever method is used (Table 12D.16). That for pig and sheep might be expected to be somewhat less than the fragment figures suggest particularly for the column with no foot bone epiphyses where recovery has not been an important bias.

The data in Table 12D.16 suggests that although the Min%loss in these layers is no greater than many other layers on the site, this collection is the most highly fragmented in terms of the relationship between the number of bones identified and the weight of unidentified bone. It was apparent during the cataloguing of the larger layers from phase F that the unidentified fraction of the material was composed largely of heavily fragmented shaft fragments of humeri, tibiae, femori and radii of cattle sized animals.

Species	Phase B	E	F	Mod	1100, etc
Cattle	24	407	207	44	145
Sheep or goat	5	57	48	22	45
Sheep	-	1	2	-	1
Pig	2	56	76	13	47
Horse	-	5	3	2	14
Dog	-	4	-	1	3
Cat	-	-	1	-	1
Human	-	-	-	2	-
Red deer <i>Cervus elaphus</i>	-	1	4	-	2
Brown hare <i>Lepus capensis</i>	-	1	2	-	1
Domestic fowl	2	16	-	-	83*
Greylag/domestic goose <i>Anser Anser</i>	-	2	-	-	-
Goose sp.	-	-	-	-	1
Rook <i>Corvus frugilegus</i>	-	-	-	-	1
Pheasant <i>Phasianus phasianus</i>	-	-	-	-	1
Large ungulate	1	62	66	8	26
Small ungulate	-	11	7	3	13
Total	35	623	416	95	384

Table 12D.15 : Fragment counts for each species from the Vicus Strip Building [*Vicus building 1*] deposits

This last remark is reinforced by the skeletal distribution of identified cattle bones in the later phases (Figs. 12D.15 a and b). The femori, humeri, scapulae and to a lesser extent the tibiae and radii are more frequently represented than in any of the other areas. This pattern is present in both phase E and F but particularly in E where the four upper limb

bones are the most frequently represented fragments. This must be viewed as a substantial selectivity even though sample sizes are not large. This associated with the severe fragmentation of these bones may indicate selective exploitation of marrow bones rather than due to their relatively high meat yield (see below).

	Fragments	Epiphyses	Epiphyses (without feet)
Cattle	68.8	69.2	68.1
Sheep	72.9*	*	*
Pig	75.7	*	*

Table 12D.16: Minimum percentage loss from phases B, E and F in the Vicus Strip building [*Vicus Building 1*]  
(\* sample too small)

The pig fragments (Fig. 12D.18c) vary little in relative frequency from those in the other feature groups and whatever variation is present may well be due to small sample bias. The apparent dissimilarity of frequency of fragments of sheep bones (Fig. 12D.17b) from those in other groups is probably due also to small sample bias. There is no evidence for element selectivity in these two species by comparison with the cattle.

#### *Species Proportions*

Estimation of species proportions is again complicated by small sample size particularly for the last three columns of Table 12D.17. The proportions fluctuate wildly depending on the method being used.

	Fragments	Bones	Epiphyses (without feet)	Teeth
	%	Mean %	Mean %	Mean %
Cattle	71.9	46.4	62.0	28.4
Sheep	12.6	24.6	20.2	25.8
Pig	15.5	28.0	17.8	45.8
N =	854			

Table 12D.17: Species proportions for Phases E+F from the Vicus Strip Building [*Vicus Building 1*]

Cattle are seriously under-represented if teeth are used because jaw fragments are uncharacteristically infrequent in these deposits (Fig. 12D.15). In the fragment and epiphyses columns cattle are over-represented because of the bias in favour of cattle long bones in the sample. The second column using a combination of mandible, scapula, humerus, radius, ulna, femur and tibia average some of these differences. It will be this average that our estimates are based upon but it may be inappropriate given the variations in this sample to give this estimate any great confidence.

The loss estimates given above (Table 12D.16) suggest that pig had the greatest and cattle the least. Therefore using column 2 of Table 12D.17 allowing for the destruction and loss

the species proportions probably approximate to 38.9% cattle, 34.6% pig and 26.5% sheep or a ratio of 1.3 pigs: 1 sheep: 1.5 cattle.

These figures endeavour to overcome the obvious bias in favour of cattle by their skeletal selectivity and suggest the proportion in which the species were slaughtered. Phases E and F contain a MNI of 17 cattle (based on the proximal radius) which would indicate that the deposits from these phases contain at least 17 cattle, 15 pigs and 11 sheep.

Most of the analyses above have been concerned with establishing the most significant biases in the collection in order that a 'realistic' estimate could be made of the proportions of animals of each species that were slaughtered. It would have been inadequate to use fragment counts or minimum numbers of individuals. It would also not be possible to ask some of the questions posed in Part 1 if the analysis had not been done by area but merely on the total from the whole of the fourth century collection. The conclusions, which have been based upon the largest groups at the site (Table 12D.18), show substantial differences in the proportion of species slaughtered. While it is conceivable that all this material comes from the same fourth century 'population' of slaughtered animals the differences nevertheless indicate differential exploitation which must be put down to personal or economic choice. That single or short lived cultural events may have produced some of the variation is quite possible and the skeletal selectivity in layer 12 and phase E of the VSB are suggestive of specific activities.

	Cattle	Sheep	Pig
Inner Ditch 11, 12 & 14	2.0	1.0	1.0
Inner Ditch 19	1.4	1.0	1.0
Outer Ditch, 505	1.4	1.0	1.0
Vicus building 2	1.6	1.4	1.0
Vicus building 1	1.5	1.0	1.3

Table 12D.18 : Estimated ratios of the species from each major feature group

It is impossible with this type of analysis to extend it to the less frequent species and no estimate is made of the relative significance of those which are discussed below individually.

### Wild Mammals

Only six species of wild mammals were identified from the collection. The absence of small mammals, apart from a few finds of water vole, is certainly a recovery factor and due to the absence of any sieving at the site. The species are dealt with individually.

#### Fox *Vulpes vulpes*

Twenty-seven bones of fox have been identified from these collections. These are most numerous in the quaternary fills of the Inner Ditch with incidental finds in the other areas (Tables 12D.2, 8 and 12). The 15 bones from layer 11 in the Inner Ditch represent a minimum of two animals and although only two bones were found together, a radius and ulna, most of these bones are probably from a single adult individual. The dispersal of this

through the layer probably being a result of the redeposition of these deposits (see above). The bones in layer 12 (main ditch) were also found unassociated although possibly from a single individual. A number of bones were classified as dog or fox. These were fragments where a confident decision could not be made and certainly one or two of these bones were rather robust by comparison with the male fox specimens in our reference collection. Comparison with dog material in the British Museum (Nat.Hist.) later confirmed these as being of similar proportions to small dog breeds.

#### Badger *Meles meles*

Badger is represented by eight bones, seven of these occurring in the fills of the Inner Ditch. The four bones in layer 11 derive from at least two individuals, one of which was a juvenile. It was recorded during excavation that the Outer Ditch contained a badger sett. The bones of this species and those of the fox noted above may have resulted from the intrusion of these animals at sometime since the deposition of the deposits. Dispersal and loss possibly being caused by continued use of the sett and subsequent collapse. Whether these species were contemporarily deposited with the other material or were later in date is not significant. They are of little or no economic importance and may represent no more than three or four individuals in total.

#### Red deer *Cervus elaphus*

Bones of red deer were the most common of the wild mammals. A total of 241 fragments were identified to this species of which over 90%, came from the deposits in the Inner Ditch. However most of these latter, 151 pieces, are fragments of antler. Many of these are broken fragments of tine and be am with no evidence of working (78 pieces). Fifty two pieces have been sawn or cut and appear to represent offcuts or waste from the utilisation of the antler. A few pieces were worked and a number of finished artefacts are made from antler. That this material is evidence of antler crafting at the site is further supported by the occurrence of a few shed antler bases (6 pieces) indicating that the raw material had been collected. The remaining bones from these layers derive from animals that must have been killed and are dominated by fragments of metapodials, carpal, tarsal and phalanges (61%) with a few identified fragments of humerus, radius and tibia. The remains of post-cranial elements are largely restricted to layers 11 and 12 the rest of the site producing only 10 fragments of appendicular skeleton. It is probable that this concentration of both antler and post-cranial remains in the Inner Ditch reflects a distinction between the source for these deposits and those from elsewhere on the site. The remains of deer carcasses in layer 11 and 12 may represent a social distinction in the origin of this material, but whether these are the result of recreational hunting by officers or the social status of a vicus resident may be problematic. At least three animals are represented in layer 11 and 4 in layer 12, with both adult and juveniles present. Animals of various sizes are present and one specimen exceeded in size a prehistoric male stag (see Tooley *et al.* 1982) in the reference collection.

#### Roe deer, *Capreolus capreolus*

The only specimen of roe deer is an almost complete unshed antler with part of the pedicle from layer 816, LVBCob.

Brown hare *Lepus capensis*

86 bones of this species have been identified. These include a partial skeleton of 61 bones from the fill of the boundary ditch, layer 826, in the area of the large vicus building. This is a late feature and although containing much Roman material this skeleton may be much later in date. The other 25 bones may represent the remains of meals or chance inclusion of carrion or possibly in the manner suggested for the fox and badger. They appear to be of little significance and none of the specimens carried any evidence of butchery.

Water Vole. *Arvicola terrestris*

Two mandibles of water vole were recovered individually during excavation from layers 12 and 505 and a find of four bones probably from a single individual from layer 11. These specimens probably represent natural intrusions into the deposits.

The absence of small mammals in the collection can be attributed exclusively to the lack of sampling or on site sieving. This applies also to fish remains, the only finds of which have been recovered from a soil sample.

Frog. *Rana temporaria*

A single skeleton of frog was recovered from layer 551 in the Outer Ditch and presumably represents a natural death.

**Wild and domestic birds**

E.P.Allison

A total of 757 bird bones were examined and a summary list of the species recorded and the numbers of fragments is given in Table 12D.19.

Some of the domestic fowl bones from the site are very large. One virtually complete skeleton of a large fowl, consisting of 77 bones from the Vicus Strip Building [*Vicus building* 1] area, is from a post-Roman context and is medieval or post-medieval in date. Other particularly large bones from the Inner Ditch area are of uncertain date, as the contexts from which they were recovered contained Roman, medieval and post-medieval pottery. In particular, a number of bones from one of these contexts are of a different appearance to the rest of the bones from the site, and from the others in the same context, in that they are yellow rather than darkened. These consist of the remains of several large fowl (minimum number of individuals represented = 4). The ulnae, femora and tibiotarsi of these fowls contain spicules of medullary bone in the marrow cavity, showing that all are females. These bones were thought to have been intrusive and may be of relatively recent date. The remainder of the domestic fowl material is of the size and range which has been encountered in other assemblages of Roman date in Britain. Histograms of measurements of the distal tibiotarsus and proximal tarso-metatarsus from the site are shown in Fig. 12D.19 (a & b), and illustrate the range of variation in the size of fowls. The measurements are those of von den Driesch (1976). Only the proximal end of some tarso-metatarsi were present so it could not be determined whether these bones had been spurred or not. The presence of a spur can usually be taken to indicate a male, but absence does not necessarily imply that the bone is from a female, it could simply be a young male killed before the

spur core had become fused to the shaft of the tarso-metatarsus (West 1985). The smallest tarso-metatarsi are unspurred, as are the largest bones. The large unspurred bones are all of either medieval or post-medieval date, or from layers containing Roman, medieval and post-medieval pottery. Several spurred tarso-metatarsi and a single bone possessing a 'spur scar' were present.

Pathological features were present on several domestic fowl bones. A humerus and a tibiotarsus from the Inner Ditch show the excessive thickening of the diaphysis which is characteristic of avian osteopetrosis.

A number of small rounded lumps of bone with diameters of approximately 2mm, were present on the distal halves of both left and right tibiotarsi of the large medieval or post-medieval fowl skeleton from the Vicus Strip Building area. No other bones of the skeleton were affected. These appear to be osteomata. An osteoma is a benign bone tumour. One about the size of a small pea has been recorded on a fowl ulna from Wicken Bonhunt (Baker and Brothwell 1980, 102).

	late 3rd C	mainly 4th C £	post- Roman
Whooper Swan, <i>Cygnus cygnus</i> (L.)		?1	
Greylag/domestic goose, <i>Anser anser</i> (L.)	19	106	
small goose sp.(p.)		8	
indeterminate goose bone		1	
Mallard, <i>Anas platyrhynchos</i> L.		16	
Duck sp.	3		
Buzzard, <i>Buteo buteo</i> (L.)	11+	7	
Black grouse, <i>Lyrurus tetrrix</i> (L.)		2	
Pheasant, <i>Phasianus colchicus</i> L.			1
Domestic fowl, <i>Gallus gallus</i> L.	59 (3)	361 (14)	82
Crane, <i>Grus grus</i> (L.)	?1	1	
Golden Plover, <i>Pluvialis apricaria</i> (L.)	1	2	
Dove sp., <i>Columba</i> sp.	1	1	
Stock dove, <i>Columba oenas</i> L.		?1	
Barn Owl, <i>Tyto alba</i> (Scopoli)		1	
Starling, <i>Sturnus vulgaris</i> L.	1		
Jackdaw, <i>Corvus monedula</i> L.		1	
Rook, <i>Corvus frugilegus</i> L.		2	1
Carrion crow/rook, <i>C. corone</i> L./ <i>frugilegus</i> L.		25 (1)\$	
Raven, <i>Corvus corax</i> L.		1 (1)	
small corvid, magpie? <i>Pica pica</i> L.		1	
large bird	1		
indeterminate	2	39	

Table 12D.19. List of bird species recorded and numbers of fragments of each by date

£ some of the contexts in this group contain some medieval and post-medieval pottery

+ remains of a minimum of two individuals

\* 77 bones from one skeleton

\$ 21 bones apparently from one individual  
numbers in parentheses indicate the numbers of incompletely ossified bones included in the total for that  
species - ie juvenile birds.

The distal part of the diaphysis of a spurred tarso-metatarsus is distorted below the level of the spur. One ulna showed a healed fracture.

A domestic fowl cranium from the Inner Ditch area was unusual. Firstly the frontal bone above the right orbit was thickened into a flattened knob. The bone in this area had a very wrinkled appearance. The corresponding area on the left side of the cranium was missing. Secondly, the basi-occipital region of this specimen was somewhat flatter than those of the modern and archaeological domestic fowls which were available for comparison. Thirdly, the laminae basi-parasphenoidales, two ridges at the back of the cranium below the occipital condyle which serve for attachment of the ventral neck muscles to the cranium (Baumel 1979, 89) were much more pronounced than in reference specimens. Crania of guinea fowls possess knobs on the skull roof but they are positioned medially and are elongated in shape. It is possible that the observed peculiarities may be connected with an unusual comb configuration. The cranium of a modern reference specimen of a Black Leghorn cock which had a large single comb, has a roughly triangular raised area on the frontal bones. This extends from the junction of the frontal and nasal bones, to the midline of the frontal bones, at the level of the most posterior point of the lachrymal bones. The skull of a Horned Fowl, a breed of domestic fowl in which the comb is developed into two large horn-like projections, is figured by Darwin (1875) and shows two round knobs of bone on the frontal bones on either side of the skull, positioned above the level of the lachrymal bones. These knobs are apparently for the purpose of supporting the comb. It is possible that the Piercebridge specimen may have had another knob further forward but the anterior part of the cranium is absent. The knobs in the Horned Fowl are more pronounced and more clearly defined than that in the Piercebridge bone. If the knob on this cranium is due to the presence of an unusual comb, the well-developed laminae basiparasphenoidales might also be associated with this if the comb was heavier than a normal one. This cranium is of uncertain date, as it was derived from a context in the Inner Ditch area which contained Roman, medieval and post-medieval pottery.

The majority of the goose bones were of the size of domestic or greylay geese, with a few bones of one or more of the smaller species present among the fourth century material.

Eighteen buzzard bones from a minimum of two individuals were recorded. One tibiotarsus has knife marks on the distal articulations. It is often thought unlikely that raptors would have been eaten although a number of possible examples where this may have occurred has been discussed by Allison (1985, 188-9). It is also possible that the tarso-metatarsus and the feet may have been removed for some other purpose, perhaps for use as amulets or talismans. Claws of eagles and other Falconiformes have been used in this way since prehistoric times, examples are given by Clark (1948) and Meaney (1981). An apparent pair of tarso-metatarsi were present among other bones of buzzard in the same context, but since it appears that two individuals are represented, these may have belonged to another bird.

Both bones of black grouse which were recovered are of males, as indicated by the size of the bones. A pheasant cranium was recovered from a post-Roman context. To date no bones of this species have been recorded from unquestionably dated Roman deposits in Britain. There may be documentary evidence for the presence of pheasants in England immediately prior to the Norman conquest (Lever 1977, 335), but this has been questioned by Yapp (1983).

A dove ulna was tentatively identified as being of stock dove. The ulna is one of the bones which can permit the separation of the closely related similar stock dove and rock or domestic doves (Fick 1974).

### **Domestic Mammals**

The domestic mammal species make up over 97% of the identified fragments from all these deposits. The majority of these remains are cattle, sheep and pigs but bones of horse, dog and cat are also present.

#### *Cat*

Cat has been identified from 23 bones and occurs in small numbers in all areas. The eight bones in layer 803 of the collapse deposits in the LVB [*Vicus building 2*] are all from a single adult. The other finds are single bones. None of the specimens were of a size suggestive of wild cats although no measurements have been recorded.

#### *Dog*

A fairly large number (422) of dog bones were recovered most of which derive from the main and Outer Ditch deposits with a number from the cobbled area of the LVB [*Vicus building 2*] and occasional finds in the other deposits. Individual animals are generally represented by more than one bone although no actual partial skeletons were excavated. This is one of the supporting lines of evidence suggesting that much of the material, in the ditches at least, is redeposited. The original intact skeletons being broken up during removal and re-deposition of the deposits. The sample of measured bones is small and length measurements were only possible on three bones, most being more or less fragmented. Most of the animals were adult, but some unfused distal tibiae and metapodials indicate one or two juvenile animals. There is little pathology associated with these animals. One abscess occurred on a mandible.

Despite the lack of measurements there appear to be two groups of animals present. A fairly large straight limbed animal with one or two specimens indicating sizes larger than the alsation reference skeleton, and a second small bow-legged type of dog. The few bones noted above as dog or fox possibly represent a third type of animal, a straight-limbed animal similar in size to a fox but more robust. All these specimens fall in the size range of Romano-British dogs given by Harcourt (1974).

There is a possibility that the smaller animals could be relatively modern terriers stuck in the badger sett when put down after foxes and badgers, whose bones in the ditch fills could

also be of recent origin. The larger dogs may be hunting dogs supposedly an Iron Age export of Britain (Strabo) but also implied by shrines of Vinotonius at Scargill.

### *Horse*

Bones of horse occur throughout the deposits. The layers in the Inner Ditch contain 535 bones and those from the other areas a further 226. In the Inner Ditch no skeletal elements occur with any frequency (Fig 12D.19) but at least seven individuals are represented in the collection from layer 11. No bones were found associated however the recovered material bears no evidence of butchery and apart from recent and *in situ* fragmentation of some jaw bones most of the fragments were less fragmented than the cattle bones. The more fragile epiphyseal ends have survived better than those of cattle. This suggests that the disposal of this material was different from the bones of the other species and it seems plausible that this is further evidence for the redeposition of material. The skeletons of horse, as has been suggested for dogs, being removed from their original burial places and becoming disarticulated before deposition. They have certainly not been eroded or attacked by dogs in the same manner as the other refuse and are probably therefore not dietary in origin. This is true also for the material in the Outer Ditch where the MNI is only 3 individuals.

In contrast the deposits in and beneath the LVB contain partial horse skeletons. Part of a horse vertebral column was found in a feature beneath the building. This exhibited lipping of the centra epiphyses often associated with elderly animals and in one case the fusion of two adjacent thoracic vertebrae and may indicate a beast of burden rather than a riding animal. Rather more of a partial skeleton, comprising most of the vertebral column with part of the rib cage and pelvis came from the cobbled area outside the building (see archaeological report). From the vicinity was also recovered an astragalus with the tarsal 3+4 and the central tarsal fused on with some exostosis around the fusion.

While these three specimens do exhibit pathologies suggestive of old age and work the other horse specimens while mostly from old animals show no pathological features. A mandibular premolar shows serious deformation of the cementum layer. The only other arthropathy in this species was a first phalanx with a pitted proximal articular facet and a lipped and expanded proximal end. A number of cheek teeth show very heavy wear suggesting that some of the animals reached a fairly advanced age but the epiphyseal data (Fig. 12D.21a) indicates that one or two animals were not fully mature and over 28% of the posterior vertebral central epiphyses were still unfused indicating that a number of the older animals were dying before the complete fusion of the skeleton.

Although the sample of measured bones is very small a scattergram (Fig. 12D.22) of the breadth and depth of the distal tibia appears to cover a sufficient range to suggest three size groups are present. Calculation of the withers height from the metapodials and other bones using Keiswaters factors (von den Driesch and Boessneck, 1974) indicates the majority of animals were between 1.2 and 1.36 metres (13-13.5 hands) but with some larger animals from 1.38 up to 1.36 metres (13.75 - 15 hands). These are larger than the majority of the individuals recorded from the Iron Age site at Thorpe Thewles (1.12-1.29m, n = 7 and

1.38-1.39m, n = 2 - Rackham 1987a) although one or two individuals at Piercebridge may be this small.

### **Cattle, sheep and pig**

The remains of these species, the most frequent at the site are discussed below in detail. The study is directed towards the analysis of the age and sex structure of each species in the samples.

There is no evidence whatsoever of any goat bones in the collection and the sample discussed below is treated as entirely sheep.

#### *Demographic characteristics of the major species*

This section deals with the age at death or slaughter of the animals represented in the samples and the sex of the animals from which the bones derive.

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. Obviously the fragmentation and destruction discussed above will have affected the sample available for establishing the age structure of the population. The more fragile and the later fusing epiphyses being more susceptible to destruction. This has exhibited itself in two ways. In the figures illustrating the proportions of each epiphyses fused and unfused (Figs. 12D. 23-27, 30-31 and 35-36) those epiphyses that fuse later in life occur much less frequently than those fusing early. This is primarily due to their greater fragility and is to be expected even when all the epiphyses are fused. Secondly because a larger proportion of later fusing epiphyses in a population are unfused by comparison with those that fuse early in life the effect of destructive agencies on these epiphysal ends is likely to be biased against the unfused condition which is by nature more fragile than the fused condition. It may therefore be taken that the juvenile condition of the later fusing epiphyses and probably but to a lesser extent in the early fusing epiphyses, is under-represented in samples where destructive agencies have been significant. Although discrepancies indicated by these figures could be interpreted in terms of differential selection of age groups for some bones it is much more credibly explained by a greater fragmentation and loss of the more fragile juvenile bones compared with those with the adult condition. The greater robustness and earlier fusion time being responsible for the survival of the epiphyses to the left of these figures. In layers such as 14 where the loss has been shown to be less, than in other layers, when based upon the epiphyses without feet (Table 12D.3). This may be due to less destruction being responsible for a slightly greater incidence of the juvenile condition of most bones (Fig. 12D.24b).

The manner in which the teeth are used is also subject to a variety of biases that must be considered. Loss of the premolars from jaws is common but loss of the deciduous premolars is less frequent. It is therefore to be expected that the P2 and 3, particularly, are under-represented in numbers and will generally indicate a higher proportion of juveniles than the other teeth. Juvenile jaws in which the M3 is unformed or unerupted must be scored for this tooth, i.e. unerupted M3, even though it does not exist. Fragments of a

young jaw broken off behind a deciduous premolar 3 (dpm3) should be scored for the unformed M3 if this tooth is not to be under-represented. It cannot however be scored for a tooth that may have erupted and could occur loose in the sample. High fragmentation can obscure the recognition of jaws in this condition and the M3's may therefore under-represent the true proportion of juveniles. In most cases the other teeth can be used as an independent check against this bias (see Figs. 12D.28-9).

### *Cattle*

The data on the epiphyseal fusion of the cattle bones is presented in Figs. 12D.23-7. It has already been noted that this information probably underrepresents juveniles to varying degrees but this is not easy to quantify. The analysis below therefore uses the figures directly and the degree to which this information mis-represents the possible true picture is discussed later.

The data from the four large layers of the Inner Ditch (19,11, 14 and 12) (Figs. 12D.24-5) show a similar pattern, fluctuations being due to small sample bias or preservation factors. Layer 14 differs slightly from the other layers in that there is a higher percentage of unfused epiphyses among those that fuse late in life. The general picture indicated for layers 19, 11 and 12 is as follows. There is little slaughter of young stock. Very few epiphyses of those that fuse before the proximal epiphysis of the 1st phalanx are unfused. Less than 5% of the stock was slaughtered before this stage of development. It is immediately apparent that a significant proportion of the sample population were slaughtered soon after the fusion of the proximal 1<sup>st</sup> phalanx but before that of the distal tibial epiphysis. This varies in the layers from about 18 to 25% slaughtered before this epiphysis fuses or between 13 and 20% slaughtered at this stage of development. The occurrence of a small percentage in which this epiphysis is just fused indicates that the slaughter was still taking place at this stage of skeletal development. The slaughter continues to occur up until the fusion of the femur head, at which stage some 50% of the sample population has been slaughtered. At this stage there appears to be little further slaughter until full skeletal maturity has been reached. The slight rise in some of the bars for layer 11 is probably due to a greater selective destruction of the unfused epiphyses of these bones by comparison with the more robust proximal femur. Since the remaining 40-50% of the bones show the completely fused condition it must be assumed that these were all adult animals. While layer 14 shows a similar pattern there is a slightly greater proportion of juveniles for most bones and it would appear that only 20% of the animals represented in this layer were fully mature skeletally. It has been suggested that this may be due to a slightly better degree of preservation in this layer and the consistency with which the bars fall to the right of the figure unlike the pattern for layer 11 would support this. The greater difference between the two layers in the later fusing epiphyses by comparison with those from the earlier is the expected for the argument used above. The figure on the other hand may represent a real increase in the proportion of sub-adult and young adult animals slaughtered.

We can again use the results from the Inner Ditch as a basis for comparison with the other groups from the site. The epiphyseal data from the Outer Ditch (Fig. 12D.25b) is not appreciably different in overall pattern although the distal tibia has a much larger

proportion of unfused specimens. There is a flattening of the bars at 50% as in layers 11 and 12 but it may be that a further 20% of the animals were slaughtered between the development of appendicular skeletal maturity and axial (i.e. the vertebrae) since only 30-34% of the vertebral epiphyses show the fused condition, a pattern midway between layers 14 and the other Inner Ditch layers.

Although the sample from the PreLVB (Fig. 12D.26a) is small it is consistent with that from the LVBCob area (Fig. 26b) and both while varying by degree in a similar way to the sample from the Outer Ditch show a similar pattern to the large sample from the Inner Ditch.

The results from the Vicus Strip building [*Vicus building 1*] (VSB Fig.12D.27) are complicated by small sample size. This group does however differ from those discussed above. There is no evidence whatsoever of animals that have not reached the stage at which the phalangeal epiphyses fuse. The proportion of unfused distal tibial and metapodial epiphyses is considerably smaller than the other feature groups and for those late fusing epiphyses with the larger sample sizes less than 20% are unfused although up to a further 30% are in the process of fusing. Relatively few of the vertebral epiphyses are unfused although a similar proportion to the Inner Ditch material are completely fused. This evidence would suggest little more than 20% of the animals in the sample being slaughtered before appendicular maturity and all of these after the fusion of the phalangeal epiphyses. Then perhaps 40% were killed before complete skeletal maturity. We have already noted above that the cattle material from this area is selective and it may be that the collection represents a specific component of the slaughtered population being used for a particular purpose, (see below).

The teeth are used as a second line of evidence to verify this picture. It is traditional for mandibles to be used in this analysis, but by the exclusion of loose teeth a large component of the sample is being ignored. In this analysis both loose teeth and those still in the jaw have been used. The analytical level has been restricted to un-erupted, slight wear (Grant stage a-d) and medium-heavy (Grant stages e-n) wear although for all the material from the Outer Ditch and vicus buildings Grant's (1982) method of recording tooth wear has also been used.

The pattern of slaughter (Fig. 12D.28) indicated by the teeth from the Inner Ditch varies very little. The data suggests that less than 10% of the animals were killed before the eruption of the M3 and none before the eruption of the M1. A further 20% were slaughtered between the eruption of the M3 and that of the P4, and between 20-30% while the P4 was only slightly worn. The remaining 40-50% was from animals with a fully mature dentition in complete wear. There is a small percentage, about 10%, of M3's with heavy wear. The upper levels show an increase in the number of animals killed just before and after the eruption of the P4.

The material from the Outer Ditch, PreLVB and LVBCob [*Vicus building 2*], areas (Fig. 29) are compared with the results from the Inner Ditch. The other areas produced too little material.

A slightly higher proportion of juveniles occur in these collections, between 14 and 16%, of the M2's in the Outer Ditch and the cobbled area being un-erupted. This is greater than the collection from the Inner Ditch as a whole although only slightly greater than that from layer 11. Between 17 and 21% of the M3s are unerupted, also slightly greater than the proportion in the Inner Ditch. The proportion of P4s un-erupted is only slightly greater than in the Inner Ditch but all the teeth have a generally higher proportion un-erupted or in slight wear than those in the Inner Ditch. While it is difficult to quantify the scale of these differences, they appear consistent enough for each tooth that despite some small sample sizes they are likely to reflect true differences in slaughter pattern.

This pattern follows to some degree the slight changes observed from the epiphyseal data and this evidence is considered together in the interpretive section below.

### *Sheep*

It is unfortunate that the bones of this species are not sufficiently numerous for each layer to be analysed individually. The data is therefore presented in Figs. 12D.30 and 31 where associated layers have been amalgamated in an effort to increase the sample size. It must be appreciated that this procedure can potentially mis-represent the true picture if two layers are amalgamated where differences were originally present.

In the Inner Ditch the lower (layers 30-76, 19 and 14) fill and the upper fill (layers 11 and 12) are considered individually (Figs. 30b and c) in the lower fill (Fig. 30b) there is very little evidence for very young animals and fusion of the epiphyseal junctions had occurred on almost all of the bones that fuse before the distal tibia. Approximately 15% of these latter epiphyses were unfused indicating death before the fusion of this bone. A further 15-20% of the sample is from animals killed before the fusion of the later fusing epiphyses (p calc., d.fem., d.rad, etc) suggesting that over 60% of the whole sample may have lived to appendicular maturity. There is a wide variation at this point probably due to sample size and as much as 60% may have been killed before the complete fusion of the appendicular epiphyses. 26% of the vertebral epiphyses are fused, indicating skeletal maturity. This suggests that between 14 and 30% of the animals were slaughtered between these two stages of skeletal development.

The material in the upper fill looks a little different (Fig. 12D.30b). A small proportion of the animals had been slaughtered or died young with only the distal humerus fused. The proportion with the distal tibia fused is similar to the lower layers although the metapodials have a smaller proportion of unfused specimens. The remaining appendicular epiphyses show a larger proportion of juveniles than the lower fills although the vertebrae indicate a larger proportion of animals at full skeletal maturity. This contrast probably indicates that no animals were killed between appendicular and axial skeletal maturity, whereas in the lower fills this appears to have taken place.

The material from the Outer Ditch (layer 505, Fig. 12D.31a) is complicated by the extreme smallness of some of the epiphyseal samples. The proportion of unfused and just fusing tibial epiphyses is the same as both levels of the Inner Ditch, but the remaining epiphyses

occur in such small numbers that interpretation would be unrealistic. The vertebral epiphyses suggest a very small proportion, 12%, only surviving to full skeletal maturity.

The sheep bones from the LVBCob [*Vicus building 2*] (Fig. 31b) do appear to exhibit a different pattern although once again sample size is very small. Barely 4% of the distal tibiae are unfused suggesting fewer animals slaughtered by this stage, but between 30 and 60% have been killed between the time of fusion of this epiphysis and that of the distal metapodials. No more animals were killed until after appendicular maturity when a further 20% were killed. Only 10% survive to full skeletal maturity. The sample from the VSB [*Vicus building 2*] is too small for interpretation.

The analysis of the teeth from the Inner Ditch (Fig. 12D.32-3) suggests that the age structure of the animals in layers 19 and 11 is similar, although the sample from 19 is very small. A small fraction, approximately 8%, died with the M2 un-erupted and about 20% before the M3 erupted. Approximately 60% of the sample had a fully mature dentition with perhaps 8% of these carrying slight wear only on the P4. The material from layers 14 and 12 differ from this picture. Very few animals, perhaps 1-2%, were killed or died before the eruption of the M2 and only 6% before the eruption of the M3. However the slaughter between this stage of development and the eruption of the P4 appears to be high, representing perhaps 60% of the sample. Only 30%, appear to have survived to dental maturity, and half of these have only slight wear on the P4.

The pattern indicated by the teeth again changes substantially in the material from the Outer Ditch and the large vicus building [*Vicus building 2*] (Fig. 12D.34). These areas are characterised by a substantial slaughter of juvenile animals. A small proportion, 10%, died before the eruption of the M2. A further 30% in the Outer Ditch were killed before the eruption of the M3, but in the LVBCob the slaughter between these stages was 60% of the sample. In layer 505 only 30% survived to dental maturity and even fewer in the LVBCob area, where only 12% of the sample comes from animals with a complete dentition and substantial wear. The sample from PreLVB is small but appears to have a few specimens indicating the death of very young animals with only their deciduous dentition, and a proportion with only slight wear on the M1 and M2.

The relationship between the tooth eruption data and that from the epiphyses is discussed below in conjunction with the interpretation of the sample.

### *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. Each of the figures illustrating the state of epiphyseal fusion has a serious deficit of bones for all the later fusing epiphyses (Figs. 12D.35 and 36). The figure with the greatest clarity is that from the Inner Ditch where all the layers have been amalgamated to produce as big a sample size as possible (Fig. 12D.35a).

There is no discernible difference between any of the areas. Each has one or two bones indicating the presence of animals with a mature appendicular skeleton, but the sample size

is too small for a sensible assessment of what contribution these made to the total. The kill off appears to be continuous from a very early stage of skeletal development and is largely complete before appendicular maturity. Assuming little change in the exploitation pattern all the epiphyses from the whole site have been placed together in Fig. 12D.36b in order that a general slaughter pattern can be established for this period. There is one point of note before discussing this general picture. It is only in the LVBCob that the proportion of specimens of unfused acetabular symphysis and scapula tuberosity is marked. These epiphyses fuse first and the unfused condition indicates very young animals. This difference is responsible for the anomaly in the bar diagram for all areas where the proportion of these two epiphyses unfused is higher than that for the succeeding two epiphyses. The remainder of the diagram indicates that 50% of the sample had been killed before the fusion of the distal tibia and over 80% by the time the tuber calcus fused. As already noted a few specimens have survived from adult animals, but these almost certainly over-represent the true proportion of these mature animals.

This evidence appears to be supported by that from the teeth (Fig. 12D.37). The data on the Inner Ditch, Outer Ditch and LVBCob [*Vicus building 2*] is not identical and there may be some minor differences in slaughter practice occurring. However these are of such a scale that quantification would be unreliable. A small percentage (2-4%) died before the eruption of the M1 in the main and Outer Ditches with a slightly greater proportion in the LVBCob, agreeing with the epiphyseal data. Approximately 20% of the sample had died before the eruption of the M2. The figures based upon the P4 indicate about 25% slaughtered before the eruption of this tooth in the Inner Ditch, about 34% in the Outer Ditch and perhaps 52% in the LVBCob although this last is too small a sample. The percentage of un-erupted M3s is consistent in all areas, almost 40+/- 3% with a similar proportion of these erupted teeth with medium wear, 5-10%.

While we have discussed the data relating to the skeletal and dental maturity of the animals represented in these samples no effort has yet been made to equate maturity with absolute age. While many contend that absolute age is not important for the interpretative analysis of animal bone collections, this is we believe naive. Substantial discrepancies in the actual ages of animals at the same stage of skeletal maturity is to be expected between modern and ancient stock. If as Rackham (1986b) has suggested this may result in underestimates of as much as 40-50% in the estimate of actual age then it is immediately apparent that for the younger age groups and sub-adult animals this will be of great significance. The basis of an economy slaughtering sheep at three rather than five years, a possible suggestion for the scale of error, must be different. To use the data from modern animals is therefore to misinterpret the ancient economy.

The next section by comparing the skeletal and dental development indicated by the above analysis will endeavour to estimate the actual ages of the animals in the samples.

### *Cattle*

In Table 12D.20 the percentage of the samples from layers 11 and 505, which died at different stages of skeletal and dental maturity are given with the approximate modern age equivalent (from Silver 1969; Bullock and Rackham 1982; Grigson 1982). It may be

postulated that the loss of juveniles suggested above may under-represent the juvenile epiphyses by comparison with the teeth. While this would explain the slight discrepancy between teeth and epiphyses in layer 11, the discrepancy in layer 505 is slight. The loss of epiphyses appears to be a little greater in 11 than 505 (Tables 12D.3 & 9).



Epiphyseal Fusion		Mandibular tooth eruption		
Layer 11, Inner Ditch	#	% of sample	age in yrs	
Age estimate (Silver 1969)				Age estimate (Silver 1969)
<7-10 mths		3		< 6 mths
>18<24-30 mths		24	>4.5	6 – 18mths
>27-36		10	<5.5	18 – 27 mths
<36 - 42		17	>6-7	24 – 30 mths
>42 – 48 mths		46	<7-8	27 – 42 mths
< 7 – 9 years			>7.5	
> 7 years				
<b>Layer 505</b>				
<7-10 mths		1		< 6 mths
12 – 18 mths		8		6 – 18 mths
18 – 24/30 mths.		29	<4.5	18 – 30 mths
30/36 – 36/42 mths.		12	>4.5	27 -
>42 - 48		20	<5.5	27 – 42 mths
<7 – 9 yrs		30	>7-8	
> 7 yrs				

Table 12D.20 : Relationship of the modern ageing information to the cattle material from layers 11 and 505

(# - age estimates derived from analysis of Roman cattle cementum annuli from Carlisle and a partial skeleton from Thorpe Thewles -Rackham 1986b; 1987a)

Using these two sets of data we can suggest relationships between skeletal and dental development in these fourth century Romano-British cattle. By the time the distal epiphyses of the metapodials have fused, the mandibular P4 is erupting or erupted. This is consistent with modern data which indicates that these two events both occur between 28 and 36 months in modern stock (Silver, 1969) although a little later in 19th century French stock, 42 months. If we extend Silver's data by using the wear described by Higham (1967) then the P4 in slight wear, corresponding to Higham's primary wear would indicate an age of 40-50 months in modern stock. This stage of dental development in this fourth century sample corresponds approximately to the fusion of all the appendicular epiphyses, but not those of the vertebrae. This skeletal stage is reached at about 42-48 months (Silver, *op.cit.*) in modern stock confirming the correspondence of dental and skeletal development in this stock by comparison with modern stock. It is possible to suggest from this evidence that there has been little or no change in the comparative developmental rates of the dentition and the skeleton. This does not however mean that the age estimates if based upon modern stock would be correct. It is possible that these beasts reached the developmental stage of that of a 48 month old modern animal at five years or even older. A number of cattle incisors were sectioned in an effort to use cementum lines as a method of determining age (Stallibrass 1982; Rackham 1986b). Unfortunately soil conditions had resulted in the deterioration of the cementum and all the internal microscopic structure of this tissue had been lost. The following discussion of the age at which these cattle died or were killed therefore utilises data from modern stock, but by exploiting data obtained from tooth sections on first and second century cattle from Carlisle (Rackham 1986b) we can extend this information. The development rate is similar and the eruption of the P4 coincides with some 9 incremental lines in the cementum of M1, suggesting an age between 4.5 and 5.5 years. By extension the appendicular epiphyses would fuse at 7-8 years and the vertebral epiphyses by 7.5-8.5 years. Application of these absolute age estimates to Table 12D.20 are given in a central column.

There is very little evidence for the slaughter of very young stock. The few percent from each area could be natural deaths or slaughtered animals. The first significant slaughter appears to be in the second year and again in the third year. Between 31 and 40% of the sample were slaughtered in this period, the proportion being higher in the Outer Ditch where the larger portion was second year animals. Between 3 and 5 years slaughter of stock continued with between 20 and 48% killed, this last figure indicating a substantially higher slaughter of 3 year olds for the Outer Ditch, due to the few 2 year olds killed. The remaining animals were over 5 years, between 30-40% of the sample, the Outer Ditch again appearing to have a slightly higher slaughter of 4 year olds and fewer fully adult animals in the sample. It is apparent from the degree of wear on the teeth that some of these latter animals, perhaps as much as 10% of the total sample, survived beyond 10 years (Rackham 1986b).

The cattle remains from the Large Vicus building cobbles [*Vicus building 2*] show a very similar age profile to those from layer 505, although there is a greater slaughter of beasts under three years (Table 12D.21) with a consequent drop in the number of adults on the basis of the dental data. The epiphyseal data is somewhat at odds with this suggesting a larger proportion of adults than layer 505.

Epiphyseal Age	Tooth Age	Inner Ditch		Outer Ditch		LVBCob		VSB	
		Epis%	Teeth%	Epis%	Teeth%	Epis%	Teeth%	Epis%	Teeth%
0 – 10 mth	0 – 6 mth	4	3	1	1	0	2	0	nd
10 – 18 mth	6 – 18 mth	0	-	9	12	8	14	0	nd
18 – 30 mth		19	5	27	4	16	5	-	nd
24 – 42 mth	27 – 36 mth	-	20	-	6	-	16	-	nd
		15	-	13	-	15	-	10	
42 – 60 mth	36 – 48 mth	-	29	-	48	-	36	-	nd
> 5 yrs	> 4 yrs	22	-	20	-	24	-	-	
		40	43	30	39	37	27	90	nd

Table 12D.21: Estimate of the proportions of the slaughtered cattle in particular age categories using epiphyseal and dental data (age data based upon Silver 1959; Grigson 1982)

nd - no data (the data was missing off the printout and was not recoverable from the digital archive)

No mention has been made of the sample from phases E and F of the VSB [*Vicus building 1*] (Table 12D.21). The collection from this area is complicated by small sample size but even so has less than 10% in the younger than two and a half year category. Although as much as 66% of the small numbers of later fusing epiphyses are unfused between 82 and 98% of all vertebral epiphyses are fused. These latter figures could be biased by bones from one adult carcass but there is no evidence of this. Few of the small sample of teeth indicate juveniles and it appears likely that this collection is largely from adult animals, although because it has been heavily fragmented (see above) and is biased towards long bones the surviving sample may be seriously biased against juveniles.

### *Sheep*

An attempt is made to deduce the relationship between skeletal and dental development from the information in Table 12D.22.

The data from the upper fills of the Inner Ditch suggests that the fusion of the distal tibia coincides with the eruption of the M3. It would appear that the P4 does not erupt until most if not all of the appendicular epiphyses have fused. In the lower fills it appears that this tooth is not erupting until after this stage in some animals. If loss of juvenile bones has been severe and there has been no similar loss of juvenile jaws then the P4 will have erupted earlier than indicated. Complete fusion of the vertebral epiphyses correlates with medium or greater wear on the P4.

In the Outer Ditch and LVB [*Vicus building 2*] deposits un-erupted P4 may be associated with animals with complete appendicular epiphyseal fusion. The earlier stages are not readily analysable because of small sample size.

Unlike the cattle data the relationship between epiphyseal fusion and tooth eruption in the sheep sample does not correspond to modern data. It could be argued that substantial loss of juvenile bones is suggesting the eruption of the P4 much later than in reality it did. On the other hand Rackham (1987a) has recently shown that a jaw with a dp4 still present corresponds precisely in wear pattern to a fragmented mandible associated with a partial skeleton with complete appendicular and partial axial fusion from the first century levels at the Iron Age site of Thorpe Thewles. The data above is consistent with this specimen and it must be suggested that these sheep may well still retain the dp4 even after complete appendicular fusion. If this is accepted then the modern figures cannot be used as they have for cattle. It is assumed here that the rate of skeletal maturation was not faster in this Roman stock than in modern animals, but was probably slower. Therefore the tooth development is not a good basis for estimating absolute age since it may have changed substantially. The figures presented below for the age of the animals at this site are therefore based upon Bullock and Rackham's (1982) figures for epiphyseal fusion which show for goats a longer maturation period than the figures given by Silver (1969) and other workers for sheep.

Few animals appear to have been slaughtered or died in their first year of life (Table 12D.23). This proportion being slightly higher, 11-12%, in the Outer Ditch and LVB.



Silver Epi. Age	B & R Epi. Age	Silver Tooth Age	Inner Ditch lower fills Epi.%	Inner Ditch lower fills Teeth%	Inner Ditch upper fills Epi.%	Inner Ditch upper fills Teeth%	Outer Ditch layer 505 Epi.%	Outer Ditch layer 505 Teeth%	Vicus Building 2 Epi.%*	Vicus Building 2 Teeth%
0-10	0-12	0-3	0	0	2	0	12	0	-	2
6-10	12-15	3-9/12	0	4	7	3	0	7	-	9
10-18/24	15-36		14	-	3	-	2	-	4	-
		18-24	-	2	-	10	-	35	-	59
18/24-36	36-60		23	-	33	-	29	-	51	-
		21-24	-	55	-	34	-	29	-	6
36-48/60	48-72	24-36	-	4	-	8	-	3	-	12
		> 36	38	-	3	-	45	-	33	-
> 48/60	> 72		-	35	-	45	-	26	-	12
			25	-	52	-	12	-	12	-

Table 12D.23: Proportion of sheep slaughtered in different age categories (\* small samples), age in months

The evidence from the teeth indicates a substantial cull of animals probably in their second and third years in the Outer Ditch (35%) and the LVB [*Vicus building 2*](59%). This is substantially higher than the figures from the Inner Ditch and is reflected, though less obviously in layer 505, by the data on appendicular fusion. It is possible that the M3 is not actually erupting until after 3 years of age. The first major slaughter in the Inner Ditch occurs after the eruption of the M3 and before that of the P4. This corresponds with the fusion of the later fusing epiphyses but before the fusion of the vertebral epiphyses falling in an age category of 3-5/6 years. The slaughter in this age group in layer 505 is smaller than that in the Inner Ditch and that in the LVB smaller still, being concentrated at the very beginning of this period. The percentage of specimens indicating animals over 6 is much higher in the Inner Ditch than in 505 or the LVB. The upper deposits of the Inner Ditch having the largest proportion with the P4 in wear and the vertebral epiphyses fused.

It is clear from this analysis that the data from each of the deposits in Table 12D.23 results from different slaughter patterns. The general trend being 80-90% of the stock in the Inner Ditch being slaughtered after 3 years of age, the lower layers having the greatest proportion killed at 3 and 4 years. Between 20-50% of the animals were not killed until after 5 years of age. In the Outer Ditch and LVB [*Vicus building 2*], in contrast, between 40-70%, of the animals had been killed by 3 years and over 80%, by about 5 years with only 10-15% surviving to full skeletal maturity. This appears, on a very small sample, to also be the case in the VSB [*Vicus building 1*].

With a larger sample and better preservation a much more accurate picture of the slaughter would be possible but the obvious differences coupled with the fact that all these deposits are of similar period is of particular interest.

#### *Pigs*

The epiphyses (Table 12D.25), except in the sample from the LVBCob. [*Vicus building 2*] indicate no animals slaughtered in their first year. The teeth contradict this in each area analysed and it can be argued that this difference is due to the loss of the very fragile juvenile bones although possibly the deciduous teeth may have survived longer in these animals. A few bones from each area were described during cataloguing as very small piglet?, but had lost their epiphyseal junctions and are therefore not scored in the figures (Table 12D.25). This is illustrative of the preservational problems and reinforces the remarks made earlier that all these figures will under-represent the juvenile component.

layer/deposit	19	14	11	12	LVBCob
Cattle	2	3	24	9	18
Sheep	-	-	5	2	3
Pig	2	-	4	-	7

Table 12D.24: The number of bones from juvenile animals in which the epiphyseal junction did not survive

Epiphyseal fusion		Tooth eruption		
Age estimate (Silver 1969)	Fusion stage	% of sample	Tooth eruption	Age estimate (Silver 1969) (Payne 1982)
<12 mths	Acetabular sym.unfused	0	M1 unerupted	<4-6 mths
12-24 mths	Distal tibia unfused	43	M2 unerupted	6-13 mths
24-36/42 mths	Prox & dist ulna unf.	39	P4 unerupted	12-16 mths
36-42 mths	Prox & dist femur unf.	10	M3 unerupted	16-22 mths
42 mths -4/7 yrs	Vertebral epis. unfused	10	M3 erupted slight wear	22-36mths
> 4/7 yrs	Vertebral epis. fused	0	M3 >/=medium wear	> 36 mths

Table 12D.25 : Relationship of modern ageing information to the pig material from the Inner Ditch

Silver Epiphy. age	Silver Tooth age	Inner Ditch		Outer Ditch layer 505		Vicus Building 2	
		Epis%	Teeth%	Epis%*	Teeth%*	Epis%*	Teeth%*
0-12 mths	0-6	0	3	0	4	-	11
	7-13	-	19	-	12	-	14
12-24	12-16	43	4	88	17	57	28
	17-22	-	31	-	27	-	9
24-36/42	22-36	39	39	12	35	-	27
36-42	> 36	10	-	*	-	34	-
42-48/84		10	4	-	5	9	11
> 48/84		0	-	-	-	0	-

Table 12D.26: Proportion of pigs slaughtered in different age categories in all feature groups (ageing after Silver 1969) (\* small sample size)

The correspondence between epiphyseal fusion and tooth eruption in these data (Table 12D.25) suggest that the relative developmental rate is not significantly different from that recorded for modern wild and domestic pigs (see Bull & Payne, 1982). Whether actual maturation rate was different is not known so the figures given by Silver (1969) will be used.

Between 16-20% of the animals were killed in all areas before the age of about 1 year. Most of the slaughter occurred between 1 and 3 years of age and was concentrated in the second part of this period in the Inner Ditch sample but slightly earlier in the Outer Ditch and probably also in the second year in the LVB [*Vicus building 2*]. Between 4-11%, survived beyond 3 - 3½ years and an incalculable proportion may have survived to complete appendicular maturity but this was almost certainly a small component. There may be slight differences between these areas although sample size is small. This is most clearly indicated in the LVB (pig teeth Fig. 12D.37c) in which a larger component of younger animals is definitely present.

#### *Sex discrimination*

The morphological distinction of sex in these collections has not been possible. The material is fragmented to such an extent that those skeletal elements upon which this distinction characteristically relies the skull, pelvis and horn cores are too fragmented. Sexual distinction in this collection for all but the older pig mandibles and maxillae, has therefore had to rely upon the size distribution of certain measurements and indices exhibiting polymodalism. While an interpretation of such polymorphisms as sexual in origin may be acceptable it should be remembered that few of these measures have been shown in modern known sex material to be polymorphic. The occurrence of different types ('breeds') of stock may produce similar differences, or stock being kept on different pasture, or nutritional regimes, such as the contrast between hill grazing sheep and those on lowland pasture may produce similar polymorphisms.

#### *Cattle*

A number of authors have used different measurements and indices, particularly on the metapodials, for distinguishing the sexes. These have recently been reviewed by Grigson (1982). Rackham (1982) in the fossil bovid *Bison priscus* found most bones exhibited a size dimorphism. In wild bovidae today such a dimorphism between the sexes is readily recognisable. In domestic varieties whose castration of the male animal occurs often at different ages, and conscious and unconscious breeding has also taken place many of the biological controls responsible for maintaining the dimorphism have ceased to be effective. The dimorphism has often decreased in scale and been thoroughly obscured by the effects on the growth of males caused by castration.

Few of the measurements analysed here allow a confident distinction of sex groups and even those indices and measurements commonly employed (Figs 12D.42-44, 49-51) are unconvincing when applied to the fairly large samples at this site.

Measurements were taken on all whole bones and where it could be established that a specimen was adult (i.e. the distal end of a metapodial or radius) fragments were also

measured. The measurements are available in the database. For some of the more common bones, such as metapodials, juveniles were also measured. In layers 12, 41 and 44 of the Inner Ditch only whole bones were measured.

The measurements have been analysed using histograms and bivariate scatterplots. These few illustrated for a number of bones (Figs. 12D.49-54) show a similar pattern. They are all skewed to the left the smaller end, with concentrations of occurrences in the lower half of the distribution. Except for one or two occurrences (Figs. 12D.39 and 43) there is little evidence for a distinct separation in the distributions plotted. Since the samples are large enough for the expectation that all sexual groups are represented it follows that any polymorphism present is not sufficiently large for confident recognition and the degree of overlap is unpredictable. That the smaller of the potential morphs is the most abundant is apparent from all the figures. Whether these represent cows or castrates or both is problematic. The larger specimens one can safely assign to bulls particularly those two or three that lie at the extreme range of the distributions. The problems arise when interpreting that group lying above the bulk of the specimens but below those assigned to bulls. These may also be intact males or the larger specimens of a group of castrated animals that overlaps with the smaller females.

For those bones that give a clear large group, between 6.5 and 17.6% can be assigned to bulls. If the measures used by O'Connor (1979) and Higham and Message (1969) on the metacarpal for which the former claimed a clear separation of oxen and cows, are applied (Fig. 12D.43) it is apparent that no division similar to O'Connor's interpretation occurs, and if oxen are present then the variation between cow and oxen is allometric unlike that presented by O'Connor (1982, Fig. 20). The smaller group might certainly be cows with the more dispersed larger animals being oxen and bulls. A scatterplot of the two indices used by Wilson (1978) at Ashville (Howard, 1963; Higham and Message, 1969) that apparently show sexual morphs produces no obvious distinction (Fig. 12D.51), although the histograms for the maximum distal breadth (Fig. 12D.52) does suggest a bimodal distribution with a large mode at 53mm that could be assigned to cows and a smaller mode at 59mm that may be oxen. This latter figure could be used to postulate a group of 49 females with two groups of larger specimens of 15 and 6 which could be castrated and intact males with one 'certain' bull. The possibility of mixed 'breeds' would however confound such an interpretation.

A small number of acetabuli were measured on the medial edge (Grigson, 1982) ( Fig. 53). The sample of 11 split into two groups. Six specimens were small for this measure and are interpreted as cows. Two larger specimens may also be cows or oxen and the three large specimens could be oxen or bulls. The smaller bones again the most frequent.

For the sake of argument the samples are presumed to contain two overlapping size morphs, cows and castrates, with a few intact male specimens. If these two morphs are assumed to be normally distributed with the oxen larger in size then it is possible to estimate the relative contribution of each morph to the total sample. Using the results from all the measured limb bones and taking the mean percentage the figures might suggest that

the ratio of cows: castrates: males may be 75.1: 21.84: 3.05, but it must be remembered that this is only in the sub-adult and adult component of the slaughtered animals.

Whether one agrees with this procedure or not it is apparent that until more work is done on sexual dimorphism in domestic cattle and the effects of castration on growth this aspect of zoo-archaeological analysis will remain subject to such untested analysis and the interpretation of its results. What is perhaps even more important is that both the results of such analyses and their interpretation must be used by other workers with due discretion and suspicion, and should not be unthinkingly cited as comparative studies. Furthermore this discussion has taken no account of the possibility that more than one cattle stock type may be present.

### *Sheep*

Many fewer bones of sheep were measured than those of cattle and the samples for this species must be viewed as minimal. There is evidence for different size groupings in the data. The measurements on the astragali appear to split into 3 groups (Figs. 12D.60 and 61), but since these bones may not be adult whether the groupings are age or sex related or due to other factors is problematic. The radii (Fig. 12D.57) suggest possibly three groupings which if attributable to sex would indicate 59% ewes, 33.3% wethers and 7.7% rams. A sample of 11 acetabuli measured on their medial side (Armitage 1976) produced three groups which if sexual in origin would indicate 3 females, 6 wethers and 2 males. The distal tibia (Fig. 12D.59), the most frequently measured fragment produces a left skewed distribution which might suggest an abundance of female animals. The metapodial measures are inconclusive (Figs. 12D.58 & 62), producing no strong evidence for sexual morphs although the variation is sufficiently wide for a larger sample to be more conclusive, and one or two specimens are probably from rams. Similarly, the scapula (Fig. 12D.54) is suggestive of size groups but has insufficient sample size.

The inconclusive nature of this evidence is apparent. Superficially the collection appears to be dominated by ewes, with wethers also present in some numbers, but considerably fewer intact males. However the accuracy of this assessment must remain doubtful. As with cattle much more work is required and large samples of well dated archaeological material needed.

### *Pig*

If determination of sex from the measurements of sheep bones was problematic, that from the bones of pig is impossible at this site. The samples are extremely small, the most abundant measureable unit being the astragalus (16) a group which must contain largely juveniles. A scatterplot of the lateral length against medial length shows a wide variation with a group of small specimens (Fig. 12D.66). This must reflect an age distribution, the two large specimens representing adults, rather than one relating to sexual differences although both are obviously superimposed. This pattern is reflected in a number of bones such as the fused distal tibia, and the distal scapula and humerus (Figs. 12D.63-65). In these bones the sexual differences may be more significant but age cannot be ruled out as a contributing factor.

### *Stock Type*

Very little work has been done on stock types and this has largely relied upon size as a basis for comparing material. It is only with the work of Noddle (1978, 1983) that characters that are presumed to be genetic in origin are being recorded and compared between collections. This type of analysis has not been conducted at this site but the major domestic species are compared with the measurements of those from a later Iron Age site at Thorpe Thewles in the lower Tees valley some 30-40 kilometres downstream of Piercebridge. There are other local sites of the Roman period with which this sample could be compared but it is not the purpose of this study to do a detailed analysis of this type.

Figures 12D.40, 42, 46-48 and 52 plot some measures on the cattle bones from both Piercebridge and Thorpe Thewles. While the ranges of these two samples overlap extensively it is apparent that the Iron Age sample is generally smaller. A regression of the data on the tibia for each site produces a slightly different slope suggesting that as well as a general increase in size there may be a slight change in the relationship between these two measures of the distal tibia.

Unfortunately the failure to adequately sex these specimens throws doubt on an analysis of this sort where sex should first be determined before making the comparison in case the differences may be sexual in origin. The horn cores found at this site are diminutive and flattened, the typical celtic shorthorn. They are generally strongly keeled and similar to specimens of Iron Age date from this region. They have little or no torsion, tending to arise horizontally from the skull and curve forwards.

The sheep samples are much smaller (Figs. 12D.55, 59 & 63) but there is again a suggestion that the Roman material is on the whole larger. The range of variation in this period is also greater though this is to be expected from a larger sample size, and could also reflect differences in age and sex.

The pig sample is even smaller but interestingly the Iron Age specimens are concentrated in the upper range of the Roman specimens (Figs. 12D.63 & 65) in contrast to the bones of cattle and sheep. Age and sex is even more important as a size determinant in this species and it should be pointed out that until sexed groups of bones from similar aged animals are used these comparisons need not reflect true changes in stock size or type.

### **Interpretation**

In the discussion above of the ageing characters of the cattle bones from the Inner Ditch it has been shown that they divide into four main groups which shall now be considered. Before venturing on this topic, to recapitulate this collection comes from the Inner Ditch of a Roman fort, adjacent to a large courtyard building which may be interpreted as a commandant's house. On the other side is the Outer Ditch and beyond that the vicus. This section of the ditch would not appear to be easily accessible to straying domestic livestock, nor to a farmer wishing to dispose of a putrescent carcass. A major assumption of the following discussion is that the animal bone is in a primary or secondary context, which is

debatable as discussed above, and probably derives from the fort as waste. It should therefore reflect the husbandry practices of a wide area around Piercebridge and the particular selection processes of the Roman fort.

### *The cattle*

The first group is of juvenile cattle up to 12 months which comprise less than 10% of the sample. This small number of juvenile cattle could be taken to represent natural infant mortality. This could be possible if some milch cows were kept either in or near the fort to provide fresh milk. Otherwise they would suggest a limited consumption of veal, probably of grass fed rather than milk fed veal, which is older and has reputedly more flavour. As demonstrated above there may be a +/- 10% distortion factor, due to selective preservation, in the numbers of juvenile bones. Veal production is normally taken to be a side product of a dairy industry (see Legge 1981). It should perhaps also be considered that some of these calves are the result of sacrifices (Levitan 1993).

The second group is of immature/young adult beasts of 1-3.5 years, which comprise *circa* 20% of the sample. This is the age range at which modern beef production aims for slaughter of bullocks and surplus heifers. The lower end of the range encompasses baby beef in modern parlance, which is intensively housed and fed, and is not a probable model for the late Roman period. It does however overlap with the concept of grass fed veal mentioned above. In the more recent past when prize long and short horns were being developed animals were slaughtered between 2 and 4 years at excessive weights. Even today Longhorn crosses will reach 1000kg on a predominantly grass diet at 2-3 years. By the end of this age range it is possible to have heifers that have calved once. According to modern butchers in Teesdale (W.Peat and W. Kidd pers comm.) these produce the best beef.

The third group comprises adult cattle up to 5-7 years, which comprise between 20 and 30% of the assemblage. By this stage we would expect that castrate males surplus to draught requirements would have been slaughtered. This group may in fact be viewed as casualties. Cows unsuitable for further breeding because of mastitis, etc.; draught oxen in work for some years may be retired; stock bulls being replaced by new blood - these would all still be useful for beef.

The last group comprises adult cattle 7+ years, and comprises *circa* 40% of the sample. These would appear to be geld cows and bulls and worn out draught oxen. These have a market value and would be suited to outlets producing pies and stews and could have supplied 'fast food' outlets.

At this point it may be as well to remember that cattle may not have been brought into Piercebridge solely for their meat. The hides are a valuable commodity in their own right and so to a lesser extent are the horns and bones. While leather and horn has not survived from Piercebridge, plentiful examples of leather sandals are known from local sites such as Vindolanda and Binchester, while Piercebridge itself is rich in artefacts of worked bone.

The heavily worn teeth of animals in this aged category suggests cows surviving into their teens which is easily comparable with the surviving more primitive cattle (eg Chillingham and British White) either as sucklers or dairy animals. This raises the question, sadly unanswerable, of the importance of dairy produce to Piercebridge, and whether we are seeing the surplus production of a dairy based industry used for meat and other secondary products or rather a ranch style beef industry with more emphasis on hide production.

The concept of possibly slightly tough old beef and the presence of dog bones in the ditch may suggest that some cattle were brought in solely for kennel meat.

### *Sheep*

As noted above no goats have been positively identified while some skull fragments are definitely from sheep and the generally gracile nature of the material would seem to be indicative of sheep. The age structure of the sheep sample divides into five groups, the first being juveniles up to 10 months, less than 10% of the assemblage. As with the calves the first suggestion would seem to be natural infant mortality and this may be possible if some milch ewes were kept near the fort. Until early last century it was a widespread practice to mix sheep and goat milk in with cows to raise the fat and solids level for butter and cheese making. The alternative is that young spring lamb is a delicacy, the first fresh meat of the year, when salted and smoked meat is running low and may be a little off. This is a luxury, but possibly an affordable one by the higher echelons within the fort, unless ewes are being milked so some surplus male lambs may be disposed of.

The second group of lambs, *circa* 8-15 months old, are 5-7% of the assemblage. This is the stage, after weaning, that lamb is killed nowadays.

The third group is of young adults 1.5 to 2 years of age and comprises *circa* 35% of the sample. This group suggests wethers and possibly surplus gimmer hogs after the first (and best) wool crop. It used to be normal practice in Teesdale to run wethers on the hills with the ewes over winter. Being bigger animals they can break through snow and clear food for the smaller ewes and they also ate the coarser vegetation thus improving the grazing. A lot of so-called modern lamb is still in fact young mutton like this.

The fourth group are adult sheep of 2-4 years, which represent up to 38% of the assemblage. This again suggests wethers with possibly some ewes with reproductive problems.

The fifth group is adults over 4-5 years at death. These comprise between 25 and 50% of the sample and probably represent cast ewes and aged tups. In primitive sheep ewes can lamb into their teens. Meat from animals of this age can be quite palatable being more like venison, especially from surviving primitive breeds. As with cattle the meat may not have been the most important product. Until early last century large wether flocks were kept because the wool crop from wethers was heavier than that from ewes, and the taste then was for larger and more strongly flavoured joints of meat than at present.

### *Pigs*

Unlike cattle and sheep, pigs have no important by products apart from unusual uses such as truffle hounds. Judging by the recipes in Apicius the Romans were partial to ham, sucking pigs and the offal (wombs from sterile sows for example!). The pigs from Piercebridge seem to fall into three groups, the first being juveniles up to a year old. The high reproductive rate of the pig necessitates a heavy cull giving a more constant supply of fresh meat than beef or mutton. This group includes sucking pig and slightly older piglets both weaned and unweaned.

The second group are pigs slaughtered between 12 and 24 months, which comprise between 31 and 43% of the sample from the Inner Ditch. This group suggests bacon, hams and sausages. Older than modern baconers but older breeds in general mature later than modern intensively housed commercial hybrids.

The third group are adults of two to four years old. These comprise nearly 40% of the sample and represent heavy hogs and possibly sows having farrowed more than twice. Today these would typically be used for sausage meat.

Finally there is a very small group of animals over three and a half years at slaughter. These seem likely to include aged boars and sows kept no longer for breeding. Boars meat is nowadays considered inedible from boar taint but perhaps the Romans had stronger palates.

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