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Hand-collected bones from Roman to medieval deposits at the General Accident Extension site, York (1983-4.32)

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CONTENTS

This report has been prepared synchronously with other post-excavation studies of the stratigraphy and artefacts from this site, and is based on such archaeological information as was available in October 1985. It is evident that when all artefactual and absolute dating evidence is to hand the dating of context groups from this site will be further refined, and their apparent stratigraphical relationship may be modified. However, project deadlines have necessitated the preparation of this report in advance of the final archaeological analysis, and the report thus deals in rather broad periods of time. Colleagues wishing to use the results presented here in any published work are advised to contact the author in advance.

As a possible source of confusion, it should be noted that this site is sometimes, wrongly, named 'Tanner Row' in unpublished documents.

1. Introduction

1.1 The site

The site was located on the South-West side of the River Ouse between the present Ouse and Lendal Bridges (grid reference TA600518). The area has produced a variety of structural and artefactual finds of Roman date, and comprises the colonia or civilian part of the city, as distinct from the legionary fortress which underlies the centre of modern York. The site became available for excavation when the General Accident Insurance company announced their intention to build upon what had previously been a car-parking area adjacent to their offices at the junction of Tanner Row and Rougier Street. This location was thought to be close to or immediately upon the course of a major Roman road leading through the colonia eastwards to the river. A previous trial excavation nearby (site 1981.12) had proved the presence of deep waterlogged stratigraphy in the area.

An initial trench (Area 1) near the Tanner Row frontage demonstrated the presence of a substantial robbed-out stone building (assigned to the late 2nd century A.D.) with associated floors. Subsequent development in this area of the site included a timber building of uncertain date and a sequence of intercutting medieval pits. Further excavation was made possible by a grant from the site owners, General Accident, which in turn provoked further funding from the Historic Buildings and Monuments Commission for England. Areas 2 to 5, the excavation of which was supported by these new funds, showed the robbed stone building to be underlain by a sequence of timber buildings of post-and-plank construction. These buildings appeared to front onto the alignment of modern Tanner Row and were demarcated at this end by a rampart, possibly a flood defence. Behind the buildings, to the North, was a sequence of possible floor surfaces with flimsy sill-beams of other buildings. At the time of writing, the date of robbing of the stone building is uncertain, though the event was clearly post-3rd century, and predates the early medieval pits and layers which covered much of the site.

For the present purposes, excavated contexts have been dated to six broad periods, only five of which yielded identifiable bones.

Period F - modern. 19th-20th century overburden.

Period E - medieval. All definitely pre-modern deposits which clearly postdate.....

Period D - robbing. Robbing of late Roman stone building (Anglo-Scandinavian or Norman??)

Period C - pre-robbing. Deposits immediately pre-dating the robbing of the stone building. Could be late Roman or post-Roman. Unproductive of bone.

Period B - Roman. Deposits securely within the Roman period (basically 2nd-early 3rd century).

Period A - pre-Roman. Includes 'natural' and possible pre-Roman ground surface.

1.2 Materials and methods

Although bits of bone were recovered from most excavated contexts, the majority of the material considered in this report came from two periods of the site's history: Period B, representing the use of the timber and stone buildings through the 2nd and 3rd centuries, and Period E, medieval pits and accumulations. This report describes only the bones recovered by hand-collection. A substantial number of soil samples was sieved for small bones, and the content of these samples will be described in a separate report.

Specimens were identified to species level as far as possible, although caution was exercised with bird bones in particular. Direct comparisons were made with specimens in the reference collections of the Environmental Archaeology Unit, University of York, supplemented where necessary by published taxonomic works. Chief amongst these were Erbersdobler (1968) and Kraft (1972) for the galliforms, Bacher (1967) for swans and geese, Woelfle (1967) for ducks and Fick (1974) for Columbidae.

Details of identification, skeletal part, fragmentation, any evidence of age or sex, butchery, abnormal pathology, or post-mortem modification were made on A4-sized listing sheets, with biometrical data, records of non-metrical traits, and incidental notes being collected in a separate file. Measurements used in this work follow von den Driesch (1976), and records of dental attrition employ the wear stages defined by Grant (1982), although analysis of these data does not follow Grant's work.

1.3 The archive

All finds and records relating to this site will be archived at the Yorkshire Museum, under York Archaeological Trust and Yorkshire Museum accession number 1983-4.32. These records will include copies of all listing sheets and data tables used in this report.

Acknowledgements

The study of the bones from this site was funded by the Ancient Monuments Laboratory of the Historic Buildings and Monuments Commission for England. I would like to thank Nick Pearson and Jane Lilley for their exemplary co-operation and intelligent concern with this project.

2. Results

2.1 Preservation and recovery

The state of preservation of bones recovered from this site varied considerably. The worst preserved bones were generally the most recent in date: bones from the medieval deposits were mainly of ochreous colour and brittle. Medieval bone samples were characterised by the presence of numerous very small fragments, many of them apparently originating during storage. At the other extreme, bones from the waterlogged Roman levels were dark-brown to black in colour and very hard, with much less apparent breakage during and after excavation. This was reflected in the unusually high proportion of cattle horncores which were complete to the tip when submitted for examination.

Although recovery of bone fragments by hand during excavation can only ever be partially effective, consideration of the incidence of small bones in the samples thus recovered together with direct comparison of assemblages recovered by sieving and hand-collection from the same context indicates that recovery on this site was acceptably efficient. By this it is meant that the recovered sample is thought to be an adequate representation of the bones present in the deposits; biased certainly, but to no greater extent than is typical for such samples, and falling within the typically encountered range of such biases.

2.2 Species distribution and quantification

Tables 4.1 and 4.2 give respectively the abundance and frequency of taxa. The three large domestic mammals, in particular cattle, dominate all the assemblages. In terms of both abundance and frequency, the picture is the familiar one of 'mostly cattle, some sheep, fewer pigs'. The relative abundance of pig bones is higher in Roman deposits than at any other period at this site, and the proportion of domestic fowl bones is conspicuously higher in pre-Roman and Roman groups than in medieval samples. Looking at the fowl bones in more detail, both abundance and frequency are much higher in Area 4 (9.2% and .60) than in Roman levels elsewhere on the site (4.2% and .43). This pattern is also seen with bones of domestic pig (17.7% and .91 in Area 4: 12.0% and .65 elsewhere). Most bones from Area 4 were obtained from a sequence of irregular layers immediately to the North of the main buildings.

Of the minor domestic mammals, horse bones were present in small amounts in all layers, as were goat bones. The higher abundance of goat in medieval levels can largely be accounted for by the presence in some pits of concentrations of goat horncores. Several concentrations of cattle horncores were also noted in medieval levels, reminiscent of the bones recovered from early medieval pits in Skeldergate (O'Connor, 1984a), several hundred metres to the South-East. Small numbers of cat and dog bones were scattered throughout the deposits at the General Accident site, with cat being generally more abundant in post-Roman than in Roman levels.

Wild mammal species formed an insignificant part of the assemblages from all periods. Nine pig bones were confidently assigned to wild boar (Sus scrofa), all of them specimens of great size. Red and roe deer (Cervus elaphus and Capreolus capreolus) were present in small numbers, with a few specimens of fallow deer (Dama dama) in medieval levels. Hare (Lepus capensis) was only found in Roman deposits, and then in very small numbers. Other wild mammals represented were hedgehog (Erinaceus europaeus - 1 record), fox (Vulpes vulpes - 1 record) and grey seal (Halichoerus grypus - a single canine tooth from a medieval pit).

Overall, the meat supply in all periods would seem to have been derived from a mixed livestock agronomy, with a particular concentration on cattle rearing.

2.3 Element distribution and butchery

The abundance of cattle, sheep and pig skeletal elements in various carcass divisions is summarised in Table 4.3 for nine contexts which yielded particularly large amounts of bones. Contexts 1049 and 2006 serve as examples of the two different types of element distribution seen in medieval levels. In 1049, most of the 24 carcass components are represented, with some under-representation of cattle and sheep horncores. This is a pattern familiar from Anglo-Scandinavian and medieval samples from elsewhere in York. Context 2006, on the other hand, is marked by an over-abundance of cattle horncores, with a fairly random scatter of other carcass components. In other words, the assemblage from 2006 resembles 'non-specific rubbish' with a number of cattle horncores added to it. This context also yielded six goat horncores from at least five individuals. The resemblance to samples from Skeldergate has already been commented on. In York, concentrations of goat, or cattle+goat, horncores are now known from Skeldergate (O'Connor, 1984a), Petergate (Ryder, 1970) and Ebor Brewery (D.J. Rackham, in prep.), and at these other sites they have been interpreted as indicating the collection of horn for artefact manufacture. Recent developments in conservation and artefact technology have underscored the importance of horn as a raw material in the past (S. O'Connor, in prep.), and regular finds of horn-collection debris must come as little surprise.

Table 4.4 includes a single sample from the robbing phase of the site. If the raw values given in the table are standardised to allow for the number of times a given element occurs in one individual, the bones in context 1119 are seen to be dominated by cattle limb bones, including the limb girdles and metapodials. Sheep and pig bones are less abundant than cattle, but they too are mainly limb elements. In sum, then, the bones in 1119 appear to represent the waste from carcass butchery and perhaps consumption rather than from slaughter and primary dressing-out of carcasses.

It is the samples of Roman date which show the greatest variation in element content. Assemblages from contexts 2208 and 2210 are dominated by cattle limb bone elements almost to the exclusion of everything else. The element counts in Table 4.4 exclude midshaft fragments, which were present in enormous numbers in both of these layers and in others associated with them. Basically these deposits were composed of heavily butchered cattle femora, tibiae, humeri and radii. The epiphyses of these bones were chopped away from the diaphysis and often cut into smaller pieces. The diaphyses were then split axially and usually cut or smashed into still smaller fragments. In 2208, of 443 fragments attributed to cattle, 336 (76%) were bits of humerus, radius, ulna, femur and tibia. From the lower limbs, there were no fragments of metapodium, three astragali and one phalanx secundus. The limb girdles were also under-represented, totalling only 18 fragments of scapula and pelvis. Similar concentrations of smashed cattle diaphyses have been noted at Little Chesters (Askew, 1961), Ulpia Traiana (Waldmann, 1967) and Zwammerdam (van Mensch, 1974).

To illustrate this concentration of diaphysis fragments, Fig. 1 shows the distribution of different zones of stylopodium and xygopodium in cattle bones from 2208. The method used is described more fully in O'Connor (1984b). In brief, the number of occurrences of each of six zones in each major limb bone is totalled. These numbers are then standardised (because different zones score in different numbers of fragment descriptions - thus there are more 'chances' of scoring zone 3 than zone P), and the standardised counts from, in this instance, zone P of the stylopodium through to zone D of the xygopodium are converted to cumulative percentage values. The technique is reasonably objective, and produces numbers which are readily susceptible to statistical analysis. The one underlying assumption which could be questioned is that each zone should be equally recognisable, even in such fragmentary material. Probably this is not always the case, so the results must be approached with the potential for observer error of this kind borne firmly in mind.

Having thus explained the underlying procedures, it is clear from Fig. 1 that epiphysis zones are markedly under-represented compared with diaphyses. Within each of the four bones considered, the representation of the four shaft zones seems roughly equal, with the exception of tibia zones 3 and 4. There is a marked flattening of the graph at tibia zone 3, suggesting that the distal quarter of the tibia was under-represented in comparison with the rest of the back leg. Given the dearth of autopodium bones in this sample, the results suggest that the first main butchery division of the hind limb was made through the distal part of the shaft of the tibia, not through the tarsus, whereas the forelimb was divided through the carpus. The under-representation in this deposit of epiphysis fragments implies that these were processed and disposed of separately from diaphyses, indicating a very specialised, highly selective, technique of butchery and food processing.

Moving on from these 'cattle legs' samples, other assemblages from Roman levels give further evidence of a decidedly systematic butchery and disposal procedure. Many of the smaller samples from Roman deposits contained a large proportion of cattle scapulae, almost to the exclusion of everything else. The majority of these scapulae were unusually complete: in most cases at least half of the scapular blade remained intact. Typically, the scapulae had been butchered so as to remove the spinus and the coracoid process. In some of the more complete specimens, it was also noted that a hole had been cut through the blade.

The size and shape of these holes varied considerably, but most were roughly rectilinear and 20-30mm across, having been produced by making a series of straight cuts from the lateral aspect of the scapula. The holes were positioned within 50mm of the suprascapular margin, roughly midway between the anterior and posterior margins.

Chopping of the spinus and coracoid could respectively be explained as occurring during defleshing of the shoulder area and detaching the forelimb. What of the rectilinear holes, however? Their variable size, shape and position, the rough way in which they were cut, and the fact that only one hole was found per scapula tends to preclude the possibility that 'blanks' were being cut out for artefact manufacture or for some decorative purpose. An alternative interpretation (though by no means the only one) would be that the holes were cut in order to suspend all or part of the limb, and ethnographic records from around the world indicate that a common reason for hanging up lumps of meat is in order to smoke or cure them. Similarly butchered scapulae were noted at Augusta Raurica (Schmid, 1967) and at Valkenburg (van Mensch and Ijzereef, 1977), where smoking of joints was offered as the most probable interpretation. The subject is discussed further by Luff (1982, 252).

If we accept this hypothesis for the moment, it can further be argued that the joint being smoked comprised the 'stewing steak' around the scapula, and not the rest of the forelimb. If the whole fore-quarter were being hung, it seems more likely that scapula and humerus fragments would have been deposited together in rubbish heaps, rather than the shoulder blades being concentrated separately. The large numbers of scapulae recovered from the relatively small area of this site require further explanation, however, because if the households of Roman York occasionally bought a smoked ox shoulder with the bone in situ, then the scapulae would have been dispersed around the city and one would not expect to find such a concentration in one place. Perhaps our hypothetical joint of smoked beef was sold off the bone, therefore, in which case the scapulae would accumulate at the place at which de-boning occurred.

Stretching these accumulations of butchered scapulae to the limits of reasonable credibility, they suggest that a 'blade bone' joint of beef was butchered from the carcass, occasioning removal of the coracoid. A rough hole was cut near the 'top' of the scapula and this was used to hang the shoulder for smoking or some similar process, and when curing was complete, the meat was cut away from the bone, perhaps at this point removing the spinus. Finally the scapulae were thrown away, by now well divorced from the rest of the carcass. Concentrations of cattle scapulae were also noted in 3rd century deposits at Caerleon, Gwent (O'Connor, 1983; also in press), although the butchery marks noted on the General Accident specimens were not apparent on those from Caerleon.

Whatever the correct interpretation of these highly specialised deposits of cattle bones, the dumps and accumulations in which most of these groups occur are associated with the second timber building located in the sequence in Area 2. Although there is no confirmatory evidence, it is tempting to suggest that this structure, or one very near to it, was used or lived in by a butcher who did not merely sell lumps of raw meat, but who smoked or cured meat and utilised bone-marrow products.

2.4 Age at death

Table 4.4 shows the number of cattle, sheep and pig mandibles attributed to each of six age classes in each period. The results obtained for cattle mandibles show a marked difference between the medieval and Roman periods in the proportion of old individuals in the Roman deposits (16 out of 37 mandibles: 7 out of 27 mandibles in medieval levels). Age class 0 is open-ended, and its beginning is not well-defined in terms of calendar years of age. Determining the age at which the accessory pillar on the lower third molar begins to exhibit dentine exposure requires knowledge of the age of eruption and rate of attrition of this tooth in ancient populations. Both of these factors can only be the subject of an educated guess (or stochastic reconstruction), but taking modern data into account, it could reasonably be argued that cattle in age class 0 were 7-8 years old, or older, at the time of death. For over 40% of the cattle in a sample to be of such an age, it seems most likely that the killed sample derived from herds kept predominantly for dairying.

The age distribution of the medieval cattle is typical of that seen in Anglo-Scandinavian and medieval samples from elsewhere in York and beyond. The majority of individuals (51.8%) are attributed to an age group the widest limits of which are about 3 and 8 years, a pattern which accords with the multi-purpose use of the beasts. If the Roman cattle are taken as largely derived from dairy herds, however, one question arises. Dairy production is based on mature female cattle, and generates surplus young males. At several sites in York, cattle mandibles from 16th and 17th century levels have shown a concentration of markedly old and quite young individuals (that is, in age classes 0 and I or J). This is quite what would be expected from a balanced dairy/veal industry, and fits with the historical evidence for this period (see, for example, Maltby, 1979, 32). However, this Roman sample lacks the young specimens, the presumed surplus male calves. What can have become of them?

Veal was important to the Roman army (Walker, in Toynbee, 1973, 325: Davies, 1971), and a supply of calves may have been maintained to the garrison. If the garrison had first claim on the veal calves, then that would explain the absence of their bones from the colonia. Alternatively, it is plausible that the draught and hide value of oxen was such that it was considered worthwhile to keep them to adulthood, and the importance of a supply of adult cattle for sacrifice should also be borne in mind. On balance, the age distribution seen in this sample would be consistent with cattle being slaughtered at no particular 'preferred' age. Probably surplus calves were disposed of as veal, and probably most of the older cattle were milking cows. However, given the variety of roles which cattle filled in Roman society, it would be unwise to place too simplistic an interpretation on these data.

The sample of sheep mandibles from Roman levels shows a wide range of ages, with concentrations of individuals roughly attributable to 2-6 months and 2-6 years of age. In other words, the sheep were mostly prime adults at death, apart from lambs in their first summer. The slaughtering of 2-6 year-olds is consistent with culling stock from flocks which were mainly kept for wool and milk. At least one year's fleece could have been taken from each sheep, and this is the pattern seen in medieval levels at this site. The lambs are surprisingly young. Even in modern breeds, a lamb is only just coming to marketable size at 6 months, and these Roman sheep would have matured more slowly. Looking at the distribution of these lamb mandibles in more detail, they were concentrated, though not exclusively, in a series of organic accumulations overlying the metalled surface which is the earliest Roman structure in Area 1. It is difficult to exmplain the slaughter of these lambs in rational economic terms, and recourse must be had either to the traditional explanation of ritual activity, or a Latin predilection for suckling lambs, for which their is no supporting evidence. Columella (in De Re Rustica VII, 3, 13) recommends that some young lambs should be taken from their dams whilst suckling and despatched forthwith so as to maintain a supply of ewes' milk for cheese manufacture. Admittedly, Columella was describing procedures in the Roman homelands, not in Britannia Inferior, but it is plausible that these lambs represent kill-off from a flock kept mainly for dairying, and their concentration in deposits datable to the earlier decades of the development of the colonia may not be fortuitous.

The age distribution of pigs is much the same in Roman as in medieval levels. Most were killed between the eruption time of the lower 2nd and 3rd molars: perhaps between 1.5 and 2.5 years old. By this age, the pigs were probably reaching adult size and would have made a good carcass for pork or bacon. Apart from breeding stock, there would be little need for older pigs to be kept. The sample from Roman deposits includes a small number of pigs aged between 3 and 18 months, presumably slaughtered to fill a demand for suckling pig and young pork.

The results presented so far have been based on dental evidence alone. Sufficient examination was made of the much less satisfactory epiphysial evidence to determine whether these data would contradict or amend the dental evidence. This was not the case, the results serving only to confirm the conclusions reached above.

2.5 Non-metrical traits

Table 4.5 gives the frequency of occurrence of several non-metrical traits in cattle and sheep bones. The purpose of generating these data is mainly to contribute to a growing corpus of results from archaeological sites, the significance and interpretation of which is far from clear to date, but which can only be clarified by reference to a larger corpus of results.

Congenital absence of the lower 2nd premolar (LP2) in ruminant mandibles has been brought to the attention of archaeologists by Andrews and Noddle (1975). Figures quoted by them show an incidence of about 1% in a large sample of modern cattle. A range of samples from York, Beverley and Lincoln variously studied by the present author and S.A. Scott gave a fairly consistent frequency of 5-6 %. Seen in this context, the results from the General Accident site are remarkably high: 16% in Roman levels, 18.2% in medieval levels, although based on relatively small samples. To take the 25 jaws recorded from Roman levels, at the usual frequency of 5%, we would expect 1.25 mandibles to lack LP2. Comparing this with the observed frequency of 4 out of 25, chi-squared is 6.37 at 1 degree of freedom; $p<.05$ and there is a significant departure from the expected distribution. Thus the frequency of congenitally absent LP2 is higher in both Roman and medieval levels than is typically seen in archaeological samples from Eastern England. The implications are not staggering, however. If cattle were kept in fairly small, mainly endogamous, herds, a single bull carrying the gene or genes for this trait could have a substantial and lasting impact on the genepool of that herd, and considerable variation from herd to herd in the frequency of this trait would thus be expected.

The expected frequency of absent LP2 in sheep mandibles, to judge from other archaeological samples, is around 3%. The results in Table 4.5 are unsurprising, therefore. Five cattle mandibles from medieval levels exhibited total or virtual absence of the distal column of the 3rd molar (LM3). Again, this is a trait which could be much more common in one small herd than in another, and is apparently more common in cattle than in sheep. None the less, finding 5 specimens in an assemblage of modest size would seem to imply that herds were small and endogamous enough to allow uncommon recessive genes occasionally to be expressed.

The position of the major nutrient foramen on the sheep femur varies betwen three loci (Noddle, 1978). Much the commonest in modern sheep is the proximal anterior position, less common is a position posteriorly at the distal end of the shaft, and rarest of all is a posterior position at midshaft. At the General Accident site, only Roman deposits produced enough femora to quantify the frequency of this trait, and the results in Table 4.5 correspond quite closely to the frequencies seen in most other archaeological samples and to modern sheep as a whole.

Single occurrences of two other non-metrical traits were noted among the cattle bones, both of them known from other archaeological assemblages. A cattle mandible from context 1125 bore an irregular pit in the articular surface of the condyle. This pit showed no indications of being caused by infection or trauma and was probably of developmental origin. A cattle humerus from context 4002 exhibited a small foramen in the olecranon fossa, not an uncommon trait.

2.6 Disease and injury

Deposits dated to the medieval period (period E) produced six specimens with symptoms of disease or trauma, four being of cattle, one of sheep, and one of horse. Three of the cattle specimens appear to exhibit a form of osteoarthritis. On one metatarsal, the distal articular surfaces show marked eburnation and the abrasion of deep grooves, clearly indicating that the articular cartilages were largely destroyed, leaving bone bearing on bone. A naviculocuboid showed milder arthritis, with minor eburnation of the distal facies, and eburnation was also noted on the cranial aspect of the centrum of a thoracic vertebra. The fourth cattle specimen from period E was a patella which exhibited periarticular exostoses riven by what appeared to be sinuses for the draining of pus. The beast appears to have suffered an arthropathy through bacterial infection of the synovial cavity, possibly as a consequence of a severe trauma to the knee.

One sheep radius exhibited the familiar exostoses indicative of a severe sprain to the elbow joint, in this case arising from the lateral tuberosity of the proximal epiphysis, adjacent to the articular surface.

The remaining medieval specimen was the mandible, both left and right rami, of an elderly horse. A pit was noted on both sides in the alveolar bone between P4 and M1, apparently formed as a response to severe periodontal disease. As if this were not enough, a large void at the base of the left canine alveolus was evidence of periapical abcessing in this area.

Roman deposits (period B) produced 15 specimens with evidence of disease or injury, mostly of cattle. Osteoarthritic damage to cattle bones was noted at the proximal femur (2 cases), proximal metatarsal, first and second phalanges, and on a thoracic vertebra. Exostoses on the distal part of a cattle metatarsal shaft seemed more likely to have resulted from a severe sprain or from stress-induced ligament damage, as the articular surfaces were not affected. One case of slight alveolar bone damage as a consequence of periodontal disease was noted, in the usual position involving P4 and M1 alveoli.

Periodontal disease was also noted in one Roman sheep, taking the form of a smooth-sided pit labial to M1 and M2. This individual also displayed heavy accumulations of dental calculus. As a general observation, dental calculus development was more marked in Roman cattle and sheep than in medieval specimens. Evidence of a lower back injury to a horse was noted. The 1st to 4th lumbar vertebrae were ankylosed by ossification of the longitudinal ligaments, with no involvement of the centra. A similar condition was noted on three neural spines of pig thoracic vertebrae, which showed extensive synostosis near their bases. The centra were missing and so could not be examined.

Perhaps the most severely malformed specimen was a roe deer metatarsal which exhibited great expansion and remodelling of the proximal half of the bone. The medullary cavity was greatly enlarged, with sinuses draining to the exterior. The cause appears to have been serious osteomyelitis following trauma or generalised septicaemia.

Three abnormal fowl bones were recorded from Roman deposits, all of them showing some thickening of the cortex in longbone shafts. In one case, a tibiotarsus, the specimen showed symptoms of avian osteopetrosis, a specific viral disorder, but in the other two cases, a radius and a humerus, the cause of the cortical thickening was not apparent.

Deposits of uncertain date produced two more specimens of note. A fowl humerus from post-Roman deposits in Area 4 showed a small callus development at midshaft which did not appear to be related to any fracture of the bone. The other specimen was a cat ulna from post-Roman levels in Area 3 with severe trauma to the olecranon process. The process appears to have been fractured and displaced anteriorly before the formation of a healing callus. A large cavity lateral to the olecranon process seems to indicate that the fracture was associated with bacterial infection and inflammation.

Overall, the incidence of disease and injury was not high, with the usual concentration on stress-related arthropathies in cattle. The fact that these symptoms were noted in Roman, as well as medieval, specimens indicates that cattle were in use for traction during the Roman period. The specimens which were most difficult of diagnosis were fowl bones exhibiting some degree of cortical thickening in wing and leg bones. Although avian osteopetrosis may be diagnosed in dry bone specimens, and is a well-studied disorder (Baker and Brothwell, 1980), many cases have to be written off as hyperostosis of unknown aetiology. The incidence of dental disease was low in all samples, despite substantial calculus accretions on Roman cattle and sheep mandibles. Presumably this reflects some difference in feeding between Roman and medieval cattle, but at this early stage of our understanding of bovid oral biology it would be unwise to draw too specific conclusions.

2.7 Biometry

Table 4.6 gives selected biometrical data collected from the samples. This listing is selective, and concentrates on those elements which gave adequate samples for analysis and comparison. Further measurements were taken on less frequent elements, and the data from these are included in the full data archive held at the Yorkshire Museum. The purpose of this section of the paper is to review the results and to investigate specific themes.

The first of these is variation in the morphology of cattle horncores. This perennial topic has been reviewed by Armitage and Clutton-Brock (1976), who drew attention to the possible use of horncore morhpology to distinguish between bulls, cows and oxen, and suggested divisions into horn-length categories which would define, for example, 'short-horned' or 'medium-horned' cattle. Even in samples where such categorisation is impracticable, the degree of variation in horncore morphology may, assuming some degree of pleiotropy, provide a measure of the breadth and diversity of the cattle genepool in the sampled population.

Fig. 3 is a scattergram of the length and basal circumference of medieval and Roman cattle horncores from the General Accident site. The distribution of cases shows that medieval specimens were, on the whole, longer than Roman ones, and that the Roman horncores were very diverse in size. There is a concentration of small specimens, both short and slender, with a substantial minority of larger cores similar in size and proportions to medieval specimens. In fact, this difference was very apparent while the specimens were being measured. Horncores from Roman deposits included many which were short, markedly oval in basal cross-section, and which curved in a tight circle from the frontal bone with little or no torsion. This form of horncore has regularly been described from Iron Age and Roman samples, and has been given the somewhat fanciful appellation 'Celtic shorthorn'.

In an attempt to quantify the frequency of this type of horncore in some objective manner, the measured Roman and medieval specimens were subdivided on the basis of length and cross-sectional shape. Cross-section was defined by an index obtained by dividing the maximum basal diameter by the minimum basal diameter. Thus this basal shape index (henceforth BSI) tends to 1.0 for horncores of circular section and is higher in more oval specimens. From inspection of the data, divisions were made at postero-dorsal curve length greater than or equal to 120mm and BSI greater than or equal to 1.40. This gives four categories of horncore shape, of which length less than 120mm and BSI greater than 1.40 corresponds to the so-called Celtic shorthorn morphology. Of the 22 measured medieval horncores, none fell into this category, compared with 20 out of 58 in the Roman deposits. A further 14 Roman specimens showed the oval cross-section, but were 120mm or more in length.

A closer examination of the distribution of these 'Celtic shorthorn' cores showed them to be concentrated in one particular group of deposits. Of the 20 shorthorn cores from Roman deposits as a whole, 12 were from organic accumulations underlying the timber buildings in Area 1 (context group 7), out of a total of 20 measured cattle horncores from these organic layers. Other Roman deposits produced only 8 shorthorn cores out of 38 measured. Applying Yates' correction to chi-squared, this is a highly significant discontinuity of distribution (chi-squared = 7.16; 1 D of F; p less than .01). These organic accumulations also contained a high proportion of young lambs, and were evidently receiving bone input from a distinctive source different to the sources of bones in other, mainly later, Roman deposits.

Enough metrical data were collected from cattle metacarpals to permit some examination of size variation in the post-cranial skeleton. Fig. 4 is a scattergram of two breadth measurements on the distal end of the metacarpal. The distribution of points shows Roman and medieval cattle to have been of much the same size, with a similar concentration of cases at the 'small' end of the range. The coincidence of size range suggests that whatever genetic changes in cattle there may have been between the Roman and medieval periods, there was little change in average body size. The concentration of smaller specimens in both periods suggests that the majority of individuals in both samples were cows.

The size range represented in Fig. 4 gives no indication of body weight, i.e. what the widths of distal metacarpals really represent in terms of kilograms of beef. Much work has been undertaken to investigate the relationship between bone size and body weight in various beasts, ranging from Noddle's (1973) down-to-earth use of modern bones from beasts of known body weight through to sophisticated (sensu stricto) procedures utilising generalised allometric relationships. Results from two of these allometric studies were applied to data from

Roman and medieval cattle, and they gave wildly varying results.

Astragalus measurements were used to reconstruct body weight using an equation published by Reitz and Cordier (1983). This equation gave results which showed the Roman cattle (mean weight 318.8kg; s.d.=19.4; n=8) to be heavier on average than medieval cattle (mean 280.7kg; s.d.=41.9; n=21). The figures obtained suggested that both Roman and medieval cattle were surprisingly heavy. For comparison, metatarsal shaft widths were entered into an equation given by Alexander et al. (1979) specifically for bovids. Although the difference between Roman and medieval cattle was apparently confirmed, the mean reconstructed weights of 145.3kg (s.d.=53.2; n=13) for Roman cattle and 132.5kg (s.d.=29.7; n=10) are perplexingly at variance with the first set of results. In short, Reitz and Cordier's equation for the astragalus would suggest the cattle to be over twice as heavy on average as would Alexander et al.'s work. A further estimate of the average weight of the Roman cattle was obtained by applying Alexander et al.'s equation for the bovid metacarpus. This produced a result of 384.1kg (s.d.=78.4; n=15), somewhat in excess of the Reitz and Cordier result, but over 2.6 times the estimate obtained on the basis of the metatarsal. The moral of this story would seem to be that whilst allometric studies offer a way of investigating the relationship between, in this case, skeletal size and body mass, the factors and exponents obtained by such studies are not sufficiently accurate to provide a useful method for reconstructing body weights from a sample of ancient bones.

An alternative means of obtaining a rough estimate of body weight is to essay a reconstruction of withers height and to make comparison with adult body weight in extant cattle of comparable size. Using conversion factors recommended by von den Driesch and Boessneck (1974: Foch's factors for metapodia), mean reconstructed withers height for Roman cattle is 1126mm (s.d.=44.6; n=8), and for medieval cattle 1092mm (s.d.=7.6; n=3). Rounding both of these results to 1.1m, and assuming a light body conformation, adult weights in the range of the smallest modern breeds would be indicated; about 200-250kg. This result bears little resemblance to any of those obtained by allometric scaling. Luff (1982, 156-7) summarises reconstructed cattle withers heights from variety of Roman sites around England. A mean of 1.1m falls around the middle of the range represented in this survey, well below the means obtained from some heavily Romanised towns in the South of England, such as Great Chesterford (1.28m) and Colchester (1.25m). Luff speculates (ibid., 132-4) that the Roman period saw the emergence of larger cattle, which intermingled with the 'Celtic shorthorn' cattle of the natives. The evidence from the cattle horncores at the General Accident site is that there was a mixture of Celtic shorthorn-like cattle and a more heavily horned morphotype, a result which is consistent with Luff's suggestion.

Moving on to the sheep, Fig. 5 illustrates size variation in sheep metacarpals, and shows remarkably little difference between the Roman and medieval samples for this parameter. The Roman sample appears to show a slightly biphasic distribution of points, the sample dividing at about (22,16) into six large specimens and 20 smaller ones. Variation in size and morphology in ancient and modern sheep metacarpals was investigated at length by O'Connor (1982), who used a comparison of Iron

Age and Roman samples from around England to suggest that some Roman samples conprised a mixture of small (i.e. Iron Age-sized) sheep and larger, perhaps introduced, sheep (ibid., 124-143). The proportion of large sheep was usually higher in samples from the South of Romanised England, such as Silchester, Hacheston and Uley, than in samples from less-civilised outlying regions such as Exeter and Garton Slack. The size distribution seen in Fig. 5 is consistent with this hypothesis, and the results suggest that the sheep, like the cattle, comprised a mixture of stock, mostly native but with a larger introduced element. It should be noted that the results in O'Connor's survey indicate that these larger sheep were of primitive, probably slow-maturing, body conformation, i.e. that they would not necessarily have been more efficient as meat-producing stock even though they would each have produced a heavier fleece, and may have had improved lactation or lambing properties.

How large were these large sheep? Application of Teichert's conversion factors (Teichert, 1975) to a sample of six metacarpals and 18 metatarsals from Roman deposits produced a mean reconstructed withers height of 589.8mm (s.d.=34.54; n=24), with a considerable range (528.5mm to 651.5mm). Luff (1982, 163-4) found a wide size range in sheep from Roman sites, with mean withers height estimates typically falling between 0.55m and 0.63m, about the same as modern hill breeds. Measurements of the smallest specimens from the General Accident site are similar to those of the modern Soay sheep, so the weight of an adult Soay ewe (around 25kg) could be taken as the bottom end of the weight range represented by these Roman sheep. The biggest specimens stood about 1.23 times as tall as the smallest, so if body weight is taken to be proportional to the cube of a linear body dimension, these biggest sheep should have been 1.86 times as heavy as the smallest: about 46.5kg. This is rather above the average for a modern Welsh Mountain ewe, and a little below weights attained by Swaledale or Herdwick sheep, and assumes quite a primitive body conformation. These 'large' Roman sheep should not be judged as large in modern terms, therefore. Mixed into a flock of small 'native' sheep, they probably stood out as being conspicuously taller and longer in the leg, but may otherwise have borne little resemblance to the plump, deep-chested, wide-bodied commercial sheep of today.

Pig bones, as usual, were too few, too fragmented, and too immature to permit the collection of a useful corpus of biometrical data. What can be said from the few specimens available is that no size difference could be discerned between Roman and medieval samples, and that pigs in both were of the small stature familiar from most pre-18th century bone groups.

Roman deposits produced a modest sample of measurable domestic fowl tarsometatarsi, which permit an examination of size variation and male/female ratios in this species. In Fig. 6 the length of the tarsometatarsus is plotted against the shaft breadth, with the intention of representing shaft robustness as well as gross size. The scatter of points divides into a cluster of 14 specimens with three outliers of much greater size, in particular on shaft breadth. Of these three large specimens, two were spurred and the third bore a socket primordium, the beginnings of spur formation. Eleven of the remaining 14 cases were unspurred, two bore socket primordia and one had the broken base of a spur. The simplest interpretation of Fig. 6 is that the 14 smaller cases are hens, and the three very big specimens are cockerels. This interpretation requires that three of the hens had developed or were developing ossified spurs at the time of death. Much has been written on the subject of spur development in the domestic fowl (West, 1982; West, 1985; Allison, forthcoming), and one of the few firm conclusions which has been reached on the subject is that old hens may develop substantial, fully ossified spurs. Within the 'hen' group in Fig. 6 there is little variation in length/breadth ratios, and the most rational conclusion would seem to be that the sample comprises 14 hens and three cockerels, with no evidence for the presence of capons or for any breed differentiation.

The remaining biometrical theme worthy of investigation is that of size variation and sexual dimorphism in the goat horncores. The medieval pits at the General Accident site yielded a sample of 25 measurable goat horncores. As the specimens were being measured, it became apparent that there was an obvious difference between presumed male and female cores. The distribution of points in Fig. 7 illustrates this difference, plotting the General Accident specimens against the size ranges shown by three other 9th-12th century groups from York. The horncores from Skeldergate differ from those from Coppergate and Ebor Brewery in showing less sexual dimorphism; i.e. the 'male' group are smaller in size. Two specimens from Coppergate and one from General Accident fall into this size range, with the remaining General Accident 'males' falling into the size range of Coppergate and Ebor Brewery males. At the time of writing, it is doubtful whether enough is known of medieval goats to permit a categorical interpretation of Fig. 7. A feasible working hypothesis would be to suggest that two distinct morphotypes of goat were current in the York area during the Anglo-Scandinavian-medieval period, differentiated skeletally by the degree of sexual dimorphism in horncore size. The 'small' morphotype was exclusively represented at Skeldergate, and the 'large' morphotype exclusively at Ebor Brewery, whilst Coppergate and General Accident samples contain both types, with 'large' type males in the majority. This is only a hypothesis at this stage, and a greater corpus of data from in and around the city needed. However, goat horn was a useful raw material in pre-plastic days, and it is likely that other caches of measurable goat horncores will come to light.

2.8 Birds and fish

Birds: Table 4.7 lists by phase and Area the bird bones other than domestic fowl and domestic/greylag goose. Excluding some of the more tenuous attributions, 23 taxa are represented, of which 17 were recorded from Roman deposits, compared with only six from medieval levels. Ducks and geese make up the largest group (eight taxa), and these, with the two swan species, crane and lapwing, reflect the predominance of wetland habitats in the York area. Given the substantial involvement of human engineering and ingenuity which is required to minimise winter flooding around York today, substantial areas of land must have been intermittently flooded in the Roman period, and species such as mallard, teal, wigeon and tufted duck would have been readily available. The specimen attributed to Bewick's swan is of interest. This is a humerus shaft which is morphologically quite clearly a Cygnus species, and of such small size as to be consistent only with C. columbianus. This is an Arctic bird which winters in several places around Britain today, including the York area.

Of the other birds represented in Roman deposits, woodcock, black grouse, wood pigeon and perhaps stock dove were probably taken for food. All except stock dove are familiar from Anglo-Scandinavian and medieval deposits in the city (Allison, forthcoming). Rook and crow might have been taken for the pot, although crows are scavengers by habit, and the depth of organic accumulation on the General Accident site would suggest that enough rubbish was generally available to keep whole flocks of crows well fed.

Of the species represented in medieval levels, only guillemot and razorbill are worthy of note. These two auks are pelagic for most of the year, only coming ashore in spring and early summer to nest in colonies on cliffs. There is today a substantial nesting ground of these species on cliffs to the North of Flamborough Head, some 70km East of York. Guillemot and razorbill bones have been found in early medieval levels elsewhere in York (at Coppergate, Allison, forthcoming; and at The Bedern, Scott, 1984) and in Beverley (Scott, forthcoming). It would appear that substantial colonies of both species were available in the 11th-13th centuries, at least, and were exploited as a source of dietary variety. The most suitable cliff habitats would have been in the same area as that in which the species nest today, around Flamborough Head.

Fish: Of the 131 fish bones recovered from the site by hand-collection, 104 were from medieval deposits, and only 4 could firmly be dated to Roman deposits. In brief, the medieval specimens were mostly of cod, with smaller numbers of bones of ling and haddock. The species identified amongst the few Roman bones were salmon and possibly pike.

Much larger, and more representative, assemblages of fish bones have been recovered from the General Accident site by a programme of wet-sieving. These assemblages are currently being studied, and will be the subject of a separate report.

Fig. 1. Graphs of cumulative percentage abundance of fore and hind limb zones in cattle bones from context 2208. Note the marked flattening of the graphs at epiphysial zones and the change in slope at tibia zone 3.

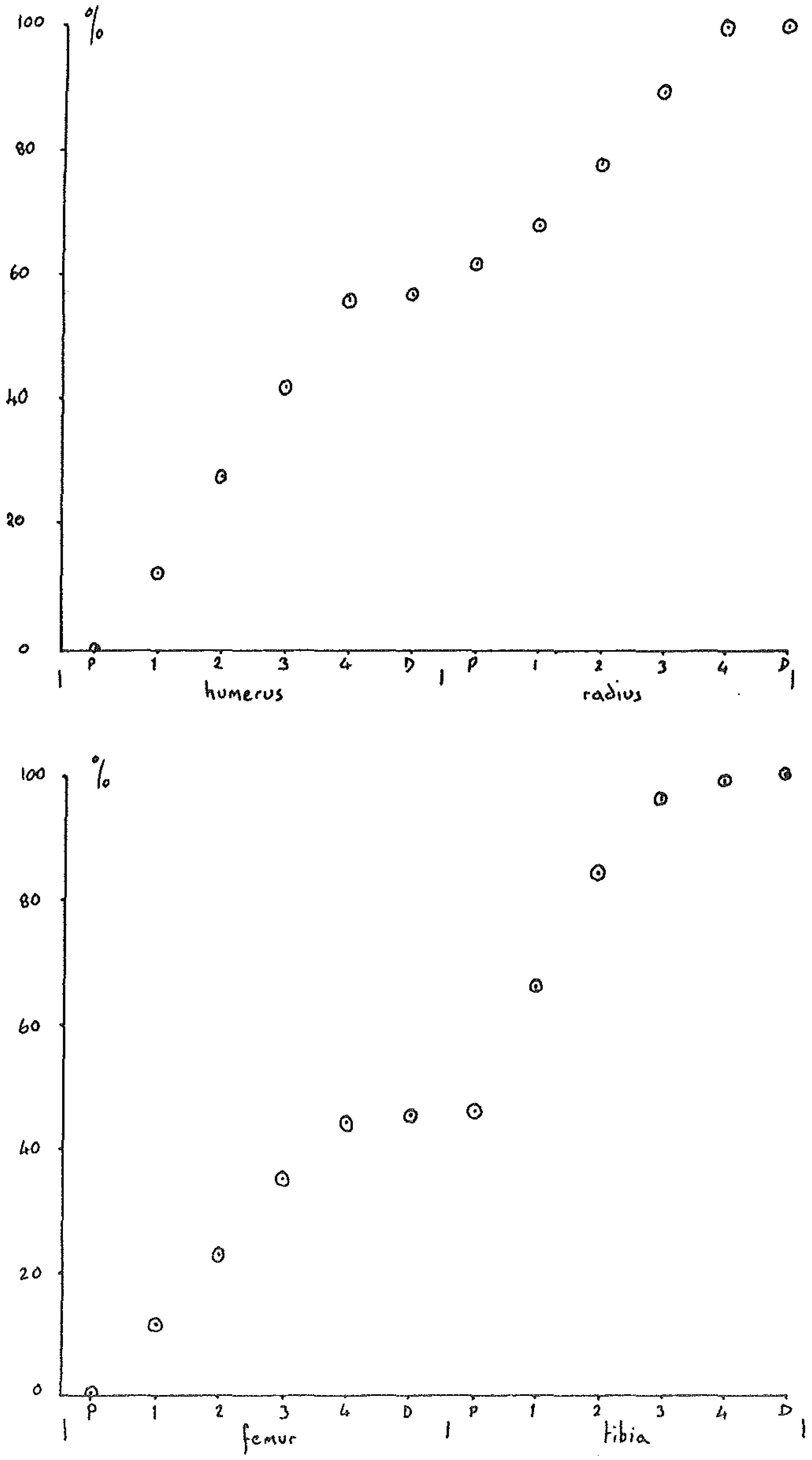
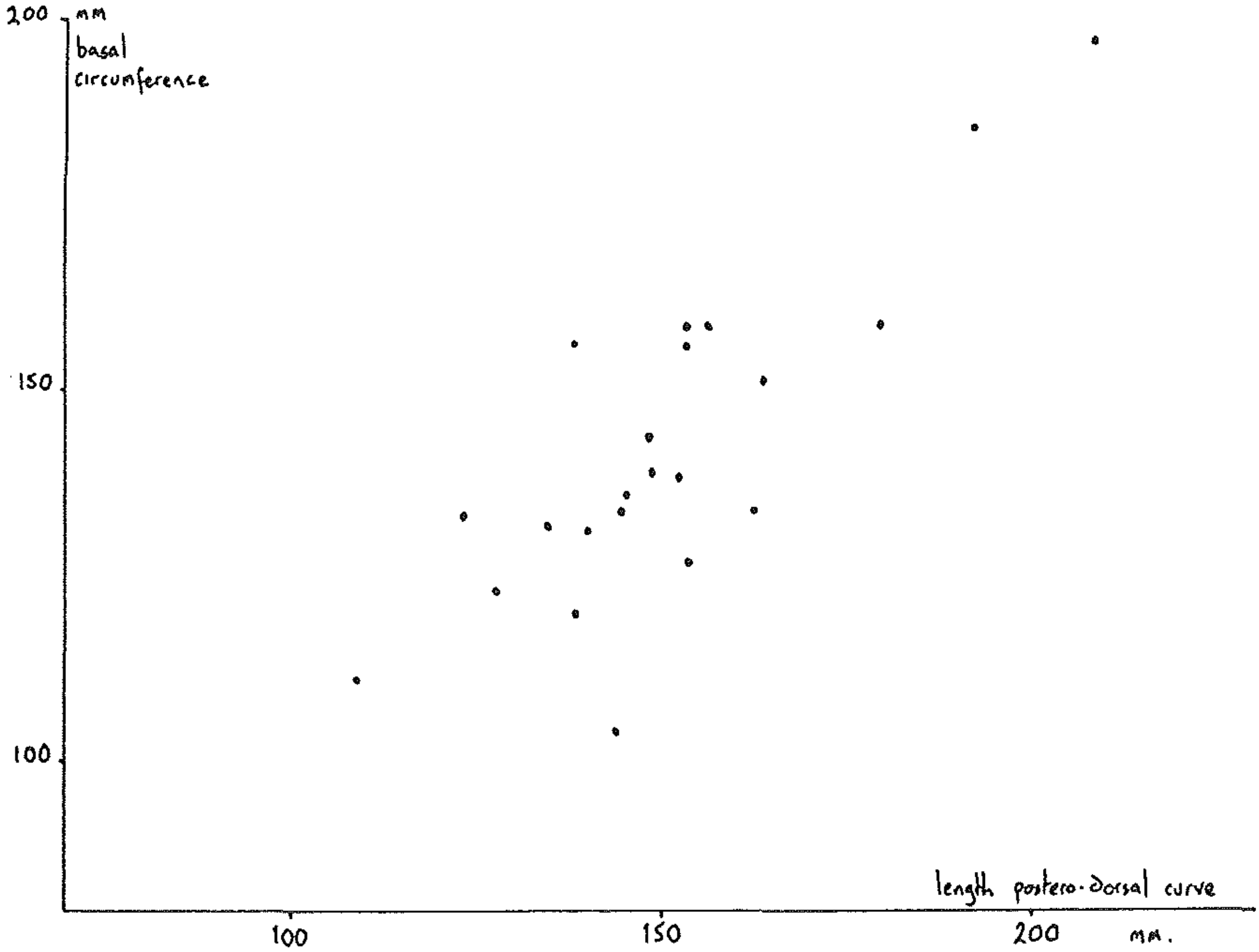


Fig. 2. Butchery of cattle scapulae in Roman deposits. Note that chopping of the spinus overlies chopping of the coracoid. Half natural size.

Fig. 3. Size and shape variation in cattle horncores. Medieval above: Roman below.



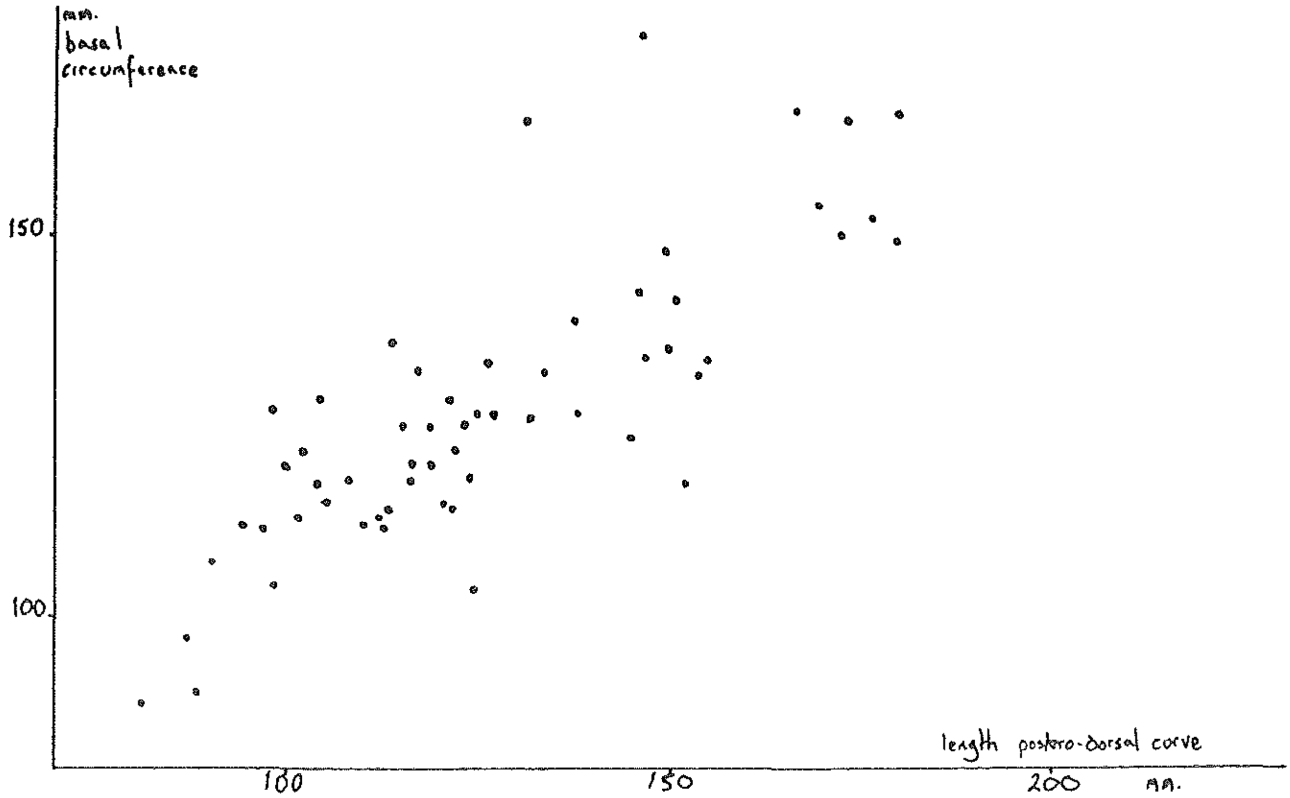


Fig. 4. Size variation in cattle metacarpals.

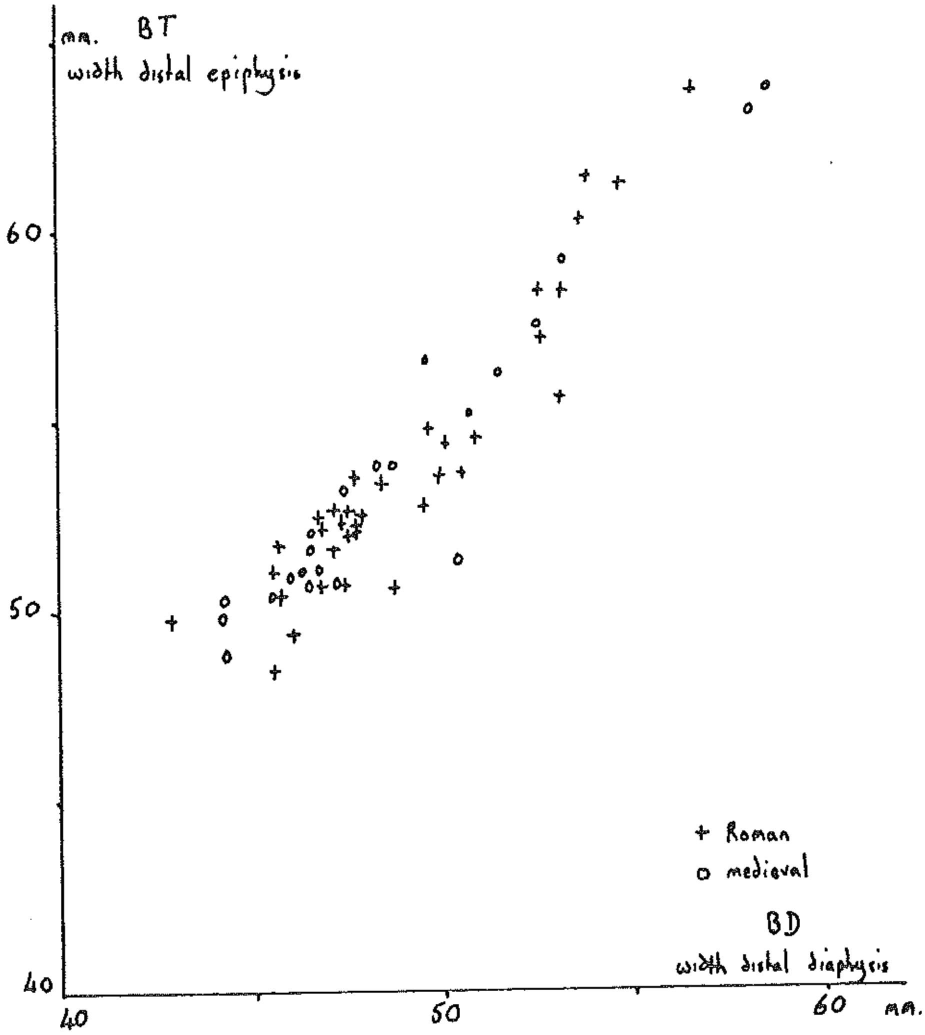
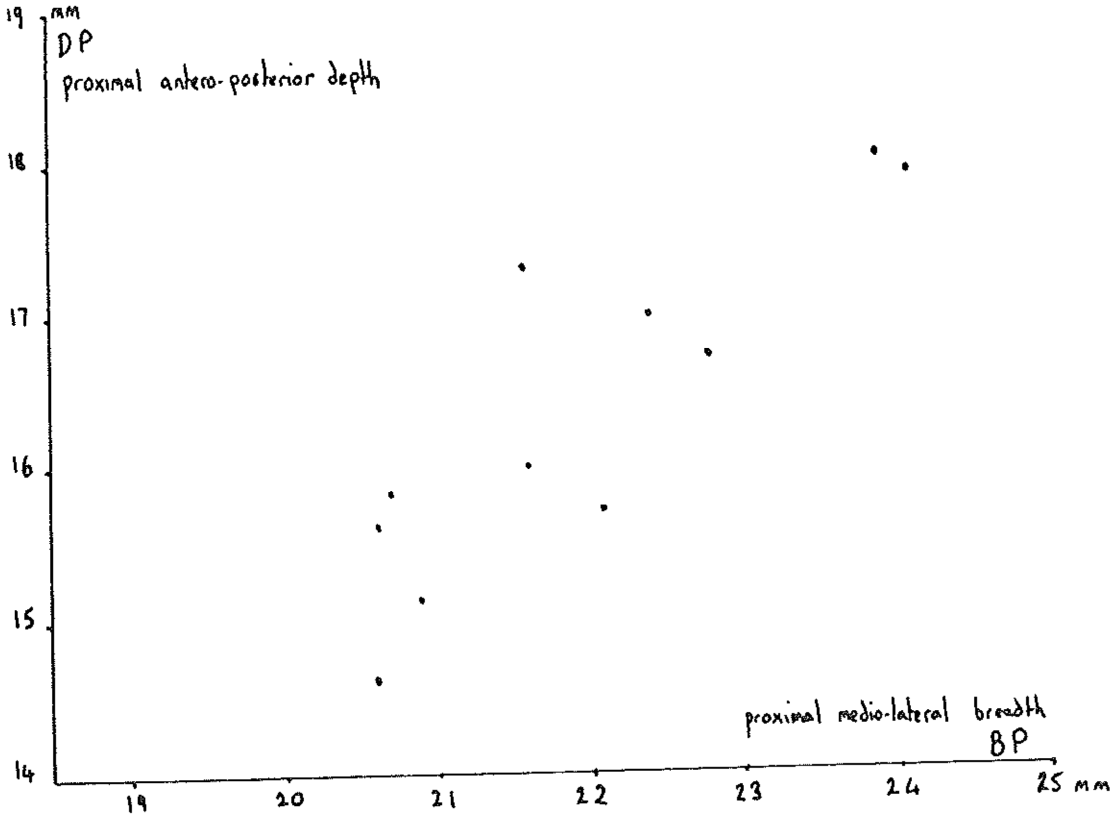
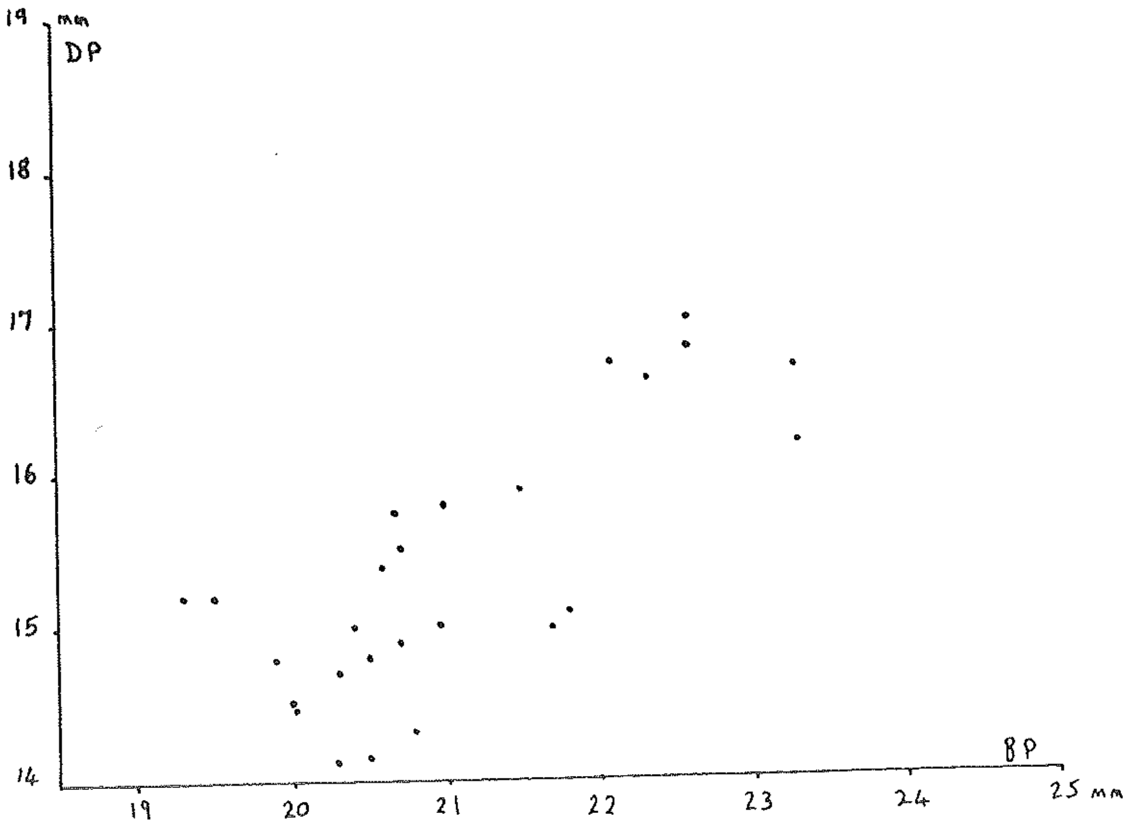


Fig. 5. Size variation in sheep metacarpals. Medieval above: Roman below.





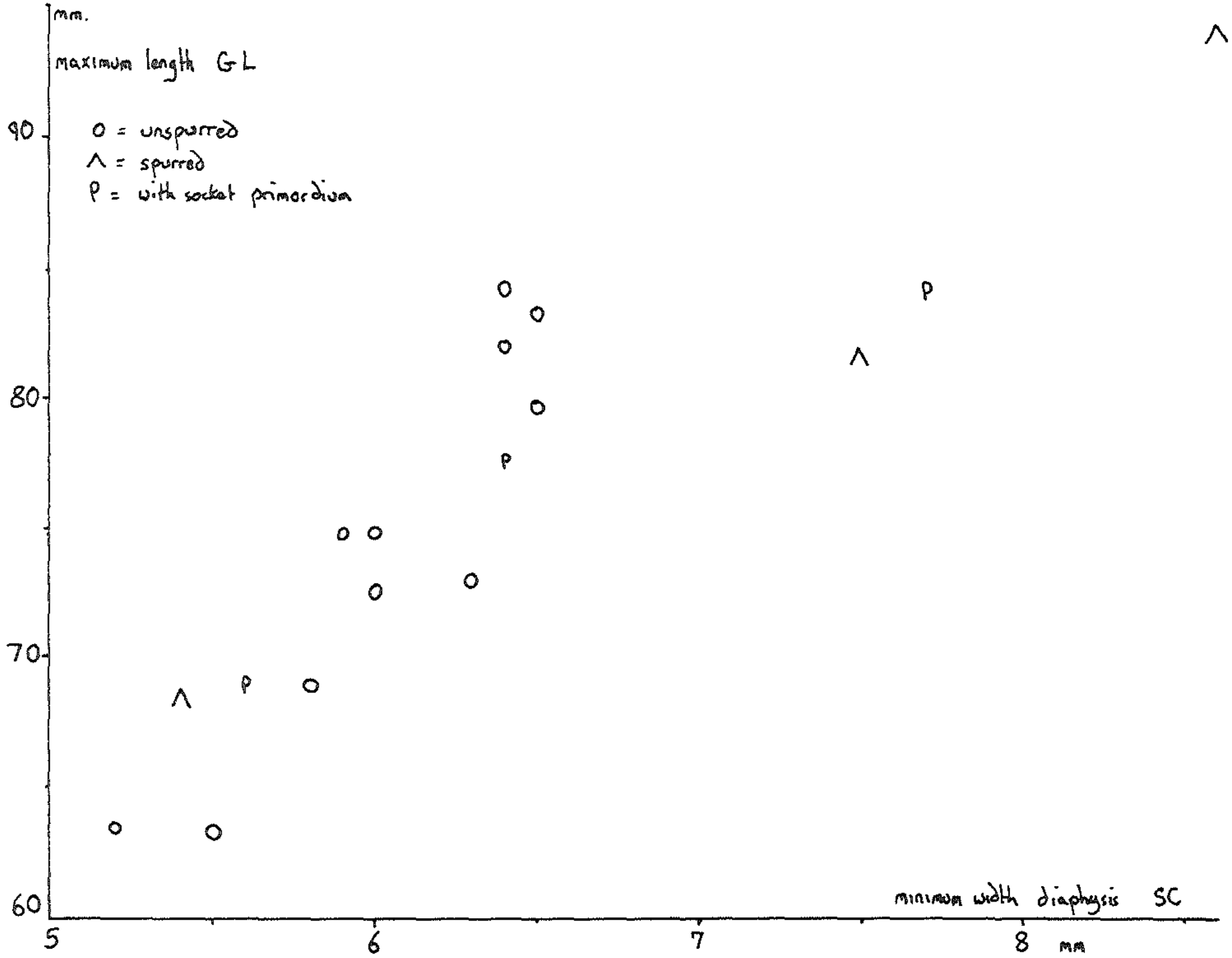


Fig. 6. Size variation in Roman fowl tarsometatarsi.

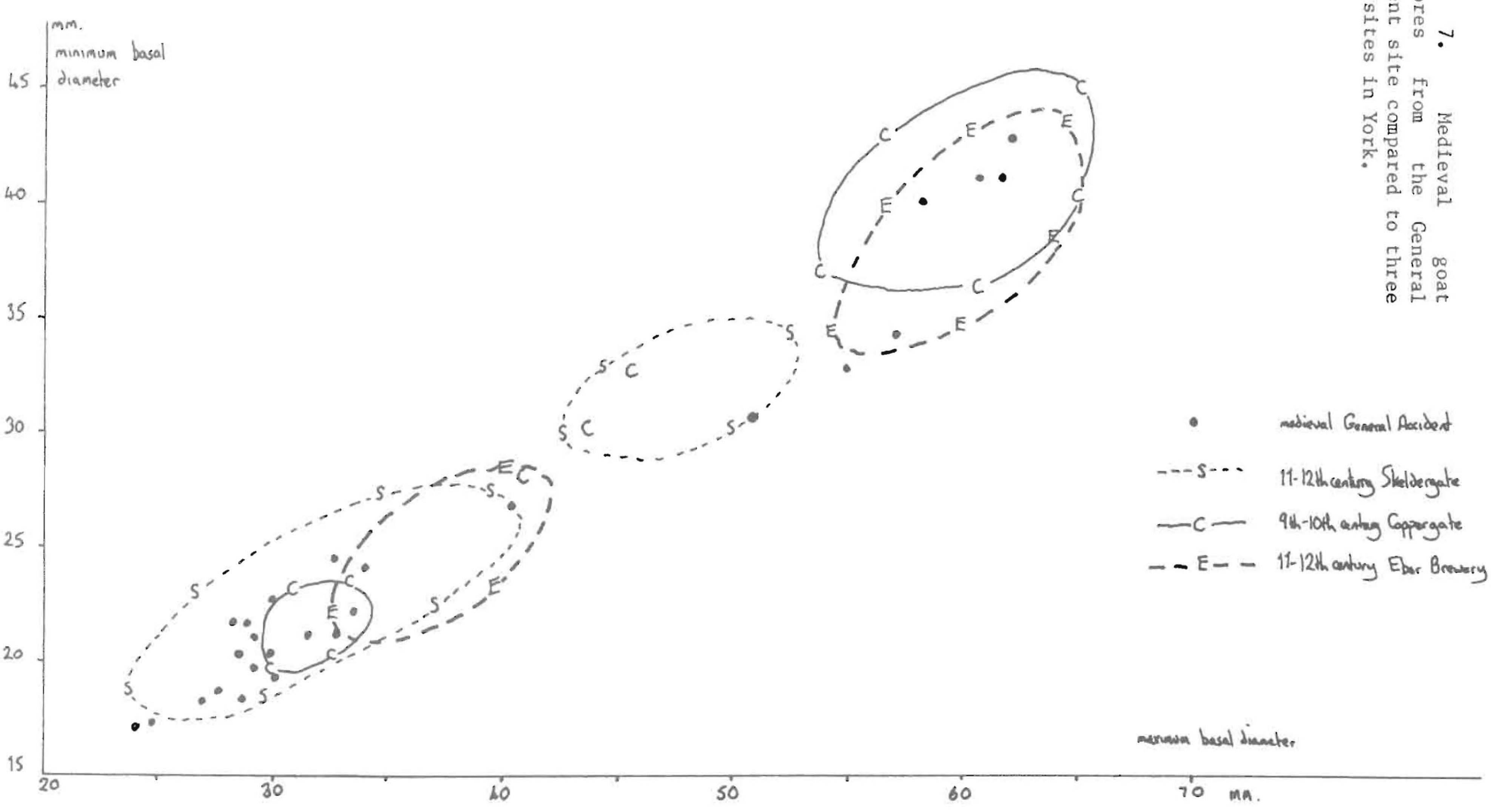


Fig. 7. Medieval goat horncores from the General Accident site compared to three other sites in York.

Discussion and conclusions

3.1 Implications within the site

Most of the bones from the General Accident site can be attributed to three main groups of deposits. The earliest are the organic accumulations of the early phases of Roman settlement,post-dating the metalled surface which is the first real structure on the site and cut by the piles and sill-beams of the timber buildings. Dumps and accumulations associated with these timber buildings comprise the second group, terminated by the construction trench of the stone building, apparently early in the 3rd century. The third substantial group of bone samples came from the medieval pits and accumulations which formed the latest deposits excavated on this site.

Bones from the early organic accumulations (mostly from context groups 1.7.1 to 1.7.9) were distinctive in several ways. It was in these deposits that the greatest concentrations of 'Celtic shorthorn' cattle and immature sheep were found. The cattle horncores could be taken to indicate that the beasts in these deposits were mostly obtained from native, rather than Romanised, farms. This is a rather hazardous reading of the data, as it makes the apparently simplistic assumption that the 'shorthorn' cores represent the Iron Age stock of the area, while the larger, more circular-sectioned, cores represent the introduction of new stock under Roman influence. Simple assumptions are not necessarily wrong, however, and if we were to make an educated guess as to the horn morphology of pre-Roman cattle in the York area, the 'Celtic shorthorn' form would seem to be the most likely. Furthermore, it would be unsurprising to see the strongest native influence in the livestock during the earlier years of Roman settlement. As Davies (1971, 123) points out, when the army was not actually engaged in warfare, it was provisioned at least in part by purchase or requisition from civilians in the immediate area. As York grew from a legionary fortress to Romanised colonia, livestock and husbandry practices in the hinterland may have changed. In the early days, however, the native influence would have persisted, and the city would have been supplied with 'native' livestock.

What, then, of the young sheep? Was this the usual kill-off from native held flocks in the area, or a response to some influence from the city? To some degree this question cannot be answered until Iron Age and Romano-British settlements are excavated in the immediate surroundings of the city, providing material for direct comparison. However, given the role of adult sheep as providers of both wool and milk, it seems unlikely that small, settled farming communities would regularly slaughter large numbers of lambs. If this culling of young animals does indicate that milking flocks were being maintained (see references to Columella, section 2.4 above), then perhaps this was more in response to demand from the new market in the city than a reflection of traditional habits.

Given the lack of comparable Iron Age material from near York, these earliest Roman deposits are a little enigmatic. A few groups of bones from the General Accident site were identified as pre-dating Roman activity, but these groups were too small to make useful comparisons.

The dumps and accumulations associated with the Roman timber buildings are much more straightforward in their interpretation. Large dumps of smashed cattle marrow-bone diaphysis appear to indicate large-scale boiling-down of waste bone for stock and, perhaps, fat, and the distinctive butchery observed on unusually large numbers of intact cattle scapulae suggest that joints of beef were being smoked or cured, again on a large scale. The implication is that meat processing, probably all stages from slaughtering through to retail sale of meat and other animal products, was going on in or near the buildings. Although the bones from soil samples from this site will be the subject of a separate report, it should be noted passim that deposits associated with these buildings have produced specimens of a dormouse Eliomys querçinus (L.) which is not indigenous to Britain, and which may have been imported as a delicacy.

The medieval pits and accumulations yielded debris which hints more of industry than of domestic refuse. The concentrations of cattle and goat horncores are paralleled nearby at Skeldergate, presumably representing horn collection, and the rest of the bones from these pits include elements which would be primary butchery debris, as well as a minor component of possible domestic waste (i.e. bird and fish bones). The impression which is gained is that the area was waste ground used for rubbish disposal, this rubbish coming from a variety of sources. Some of the pits may have been used for the disposal of excrement: examination of other biological remains will elucidate this point.

3.2 Comparison with other sites

Roman sites have been a favourite target of archaeologists for many years, and some of them have yielded useful bone assemblages. King (1978) listed 116 examples in his comparative study of bone assemblages from Roman Britain, and Luff (1982) has added a few more, together with a comparison with sites in the North-West part of mainland Europe. In this section it is proposed to examine the results from the General Accident site mainly in the context of the surveys presented by King and Luff.

To start with a simple analysis of the relative abundance of cattle, sheep and pig, King (1978, 211-215) points out the predominance of cattle bones on most Roman sites, in particular in towns and post-1st century military sites. For the purposes of direct comparison, the data given for Period B in Table 4.1 can be condensed to give proportions of 69.3% cattle, 16.6% sheep and 14.2% pig, a result which is well in accord with the pattern seen from other Roman sites. On the whole, sites which have produced substantial proportions of sheep bones (i.e. over 30% of fragments) are native sites or early military sites. The area around York cannot have been conducive to sheep husbandry, being damp underhoof for most of the year and subject to occasional flooding from several rivers. King (ibid., 216-7) also points out that sites which have yielded pig bones as more than 10% of identified fragments are mainly Romanised sites in river valleys or on heavy soils, an observation with which the results from this site accord.

Horse and deer bones seem generally to be uncommon on Roman sites. The dietary status of horse is unclear, either from osteological or documentary evidence, and deer seem mainly to have been exploited for their antler. This is not just an attribute of sites in Britain: Luff (1982, 267) found little evidence of hunting for food on Roman sites elsewhere in Europe. In terms of the species represented and their relative abundance, therefore, the General Accident site has produced results which are consistent with other sites of comparable date and type.

The cattle and sheep from this site (apart from the lambs in early Roman deposits) were mainly rather old. Comparisons with published data from elsewhere are complicated by the use of different analytical procedures by different workers. Grant (1975, 437-450; also 1982) has described a procedure which attributes wear stages to the four main teeth of the lower jaw (LP4 to LM3), then calculates a total wear score for the whole mandible. This is all well and good if all four teeth are present to be examined. Of the 101 cattle mandibles from General Accident for which at least one tooth could be scored, only 36 bore three molars and either the permanent or deciduous 4th premolar. For absent teeth, wear scores have to be estimated on the basis of the teeth which are present. Thus for the General Accident cattle, results for 65 specimens (64.4%) would have involved some element of guesswork. In 24 jaws only two teeth were recorded, and in another 24 jaws only one tooth could be scored. Thus in nearly one-quarter of the specimens (23.8%), the majority of the mandible wear score would have been estimated. This is one reason why Grant's method of analysis has not been followed through. However, results from Roman deposits at Portchester Castle (Grant, 1975, 395) show the majority of the cattle at this site to have been mature, with about 60% of individuals have been aged 'three and a half years or more'. The assumptions which have been made about the timing of eruption of LM3 are not stated, but evidently the cattle mandible samples showed a similar age structure to those seen at General Accident.

Maltby (1979, 30-31) described age structure in cattle from a variety of sites in Exeter, and attempted to correlate his own relatively straightforward age classification system with Grant's. Maltby concluded that the majority of cattle in 2nd-3rd century deposits were mature, and attributed most of them to a mandible wear score of 45 to 48, which Grant took for the Portchester sample to indicate an age approaching 5 years. Of the few Roman cattle mandibles from General Accident for which mandible wear scores can be calculated without estimation, there is a concentration of cases between 43 and 46, i.e. much the same age as the majority of Roman cattle from Exeter. Maltby (ibid., 31) casts doubt upon equating this stage of wear with an age as young as 5 years, which age Grant appears to have derived from the increasingly questioned work of Silver (1969, 295-6). In General Accident specimens, mandibles equivalent to wear scores of 43 plus had dentine exposed on all three columns of the third molar. This seems to be an advanced state of wear for a beast of only five years, and the present writer is inclined to agree with Maltby's reservations. Luff (1982, 50-51) noted a majority of adult cattle at Sheepen although cattle from Colchester were generally a little younger (ibid., 108-9). The overall impression which is gained is that the majority of cattle slaughtered for Roman communities in England were mature beasts, perhaps mostly between five and seven years old. The evidence from York agrees with that from other sites.

To consider the sheep rather more briefly, the results from the General Accident site concur fairly well with the age distributions seen at Portchester (Grant, 1975, 397), and at Sheepen (Luff, 1982, 60) with a mixture of young and mature sheep. At Exeter (Maltby, 1979, 42) and Colchester (Luff, 1982, 127), however, the emphasis was more on the slaughter of young animals (2nd year sheep at Exeter; 1st and 2nd years at Colchester), with few adults. Evidently the exploitation of sheep was more flexible, presumably depending on the relative market values of lamb on the one hand, and ewes' milk and wool on the other. 2nd century deposits at Exeter were notable for showing a high proportion of sheep fragments, whereas at Colchester sheep were decidedly poorly represented (9.4% of fragments in early 2nd-3rd century), so we cannot draw a simple correlation between a high proportion of sheep and a tendency to slaughter young. General Accident, like Sheepen, has concentrations of adults and 1st years at a site where sheep were only a minority element in the slaughtered livestock.

It could be argued, of course, that husbandry, butchery and livestock marketing are likely to have been hedged about by tradition and a degree of environmental determinism, thus increasing the differences from site to site, even under the standardising iron fist of Rome. However, certain features of the bone debris from Roman deposits at General Accident have parallels elsewhere in the occupied provinces. The fact that the distinctive patterns of butchery of the cattle bones can be matched at such diasporate places as Augusta Raurica, Zwammerdam, Valkenburg, Ulpia Traiana and Derby suggests a remarkable degree of consistency either in the behaviour of Roman butchers or, more probably, in the demands of their customers. Presumably if there is free competition between butchers in a town and the customer demands smoked shoulder of ox, then it is bad business to be selling mince. Just how strong the non-British element was in York's population during the 2nd century is highly debatable, but evidently Latin tastes were sufficiently well ingrained to generate a significant consumer demand.

The implications of the biometrical data from this site have been discussed above in section 2.7. To summarise, data from cattle and sheep bones seem to confirm evidence from other sites to the effect that larger stock was introduced during the Roman period, and that this larger stock co-existed with, rather than immediately replaced, the 'native' cattle and sheep. This is a theme which could usefully be further explored when bone assemblages from Romano-British sites in less intensively Romanised parts of Britain become available for study.

To sum up, these hand-collected bones have provided some impression of the type of livestock kept around York in the 1st to 3rd centuries, and have provided specific information about the use of this part of the city in the Roman and medieval periods. Further resolution may be obtained when all the bones from soil samples have been identified, and as information from other lines of enquiry becomes available. This is the first substantial Roman assemblage from York to be examined. It is to be hoped that further excavation in the city will produce well-stratified samples which may be directly compared with this General Accident assemblage in order to examine variations within the fortress and the colonia, and so as to provide a check on some of the conclusions which have been reached in this report.

4. Data tables

Table 4.1. Fragment numbers

Totals by period and trench

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Per. F	1	–	304	133	18	–	–	55	–	2	–	–	–	–	8	49	10	4	138
	%	–	52.1	22.8	3.1	–	–	9.4	–	0.3	–	–	–	–	1.4	8.4	1.7	0.7	
Per. E	1	20	2686	754	35	4	4	485	1	10	8	–	17	1	103	96	34	11	1482
	2	4	305	69	10	1	–	26	1	4	2	–	–	–	1	7	2	1	73
	3	–	42	9	–	–	–	4	–	–	–	–	1	–	–	2	–	–	10
	%	0.5	63.7	17.5	0.9	0.1	0.1	10.6	0.0	0.3	0.2	–	0.4	0.0	2.2	2.2	0.8	0.3	
Per. D	1	2	239	40	2	–	–	31	–	–	2	–	–	–	–	4	1	5	68
	2	2	348	58	3	13	1	43	–	2	–	–	3	–	–	8	–	1	117
	5	1	69	21	–	–	–	10	–	8	–	–	–	–	–	5	1	–	32
	%	0.5	71.1	12.9	0.5	1.4	0.1	9.1	–	1.1	0.2	–	0.3	–	–	1.8	0.2	0.7	
Per. B	1	2	1556	479	5	3	4	346	–	–	1	8	2	–	1	144	25	27	419
	2	10	2250	317	5	3	1	312	3	–	45	3	1	2	3	92	19	22	489
	3	15	198	84	–	–	–	70	–	1	–	2	–	–	–	19	10	3	65
	4	1	591	220	4	1	2	211	2	1	2	2	7	–	–	109	21	15	214
	%	0.4	63.1	15.1	0.2	0.1	0.1	12.9	0.1	0.0	0.7	0.2	0.1	0.1	0.1	5.0	1.0	0.9	
Per. A	1	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	3	1	169	39	–	1	6	44	–	–	1	1	–	–	–	24	4	–	46
	%	0.3	57.5	13.3	–	0.3	2.0	15.0	–	–	0.3	0.3	–	–	–	8.2	1.4	–	
B–E	1	–	4	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	5
	3	6	506	131	11	2	2	79	–	5	7	–	2	–	–	12	5	2	226
	4	1	339	90	12	–	–	56	–	1	1	–	–	–	15	27	6	1	141
B–C	1	1	313	89	4	2	–	55	1	–	1	–	1	–	–	22	4	10	113
	2	2	107	38	–	2	–	20	1	–	3	–	–	–	–	9	5	2	35
	5	–	15	10	–	–	–	5	–	–	–	–	–	–	–	–	–	1	8
A–B	1	2	16	5	–	–	–	6	–	–	–	–	1	–	–	–	1	–	7

The table gives fragment counts arranged by period (F to A) and within periods by trench (1 to 5). For each period, the relative abundance (%) of each taxon is given as a percentage of the total number of identified fragments for that period.

Key: 1 – horse 2 – cattle 3 – sheep 4 – goat 5 – red deer 6 – other deer (fallow in period E, roe elsewhere) 7 – pig 8 – wild boar 9 – cat 10 – dog 11 – hare 12 – human 13 – other mammal (fox, hedgehog, grey seal) 14 – fish 15 – domestic fowl 16 – domestic goose 17 – other bird 18 – unidentified

Table 4.2 Frequency of taxa

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Per. E	1	14	71	64	19	4	4	62	1	10	6	-	8	1	31	42	23	9	72	4269	59.3
		.19	.99	.89	.26	.06	.06	.86	.01	.14	.08	-	.11	.01	.43	.58	.32	.13			
Per. B	1	2	82	69	4	3	5	59	-	-	1	7	1	-	1	45	17	18	90	2603	28.9
		.02	.91	.77	.04	.03	.05	.66	-	-	.01	.08	.01	-	.01	.50	.19	.20			
Per. B	2	5	81	64	5	4	1	55	3	-	5	4	1	2	1	33	19	13	87	3086	35.5
		.06	.93	.74	.06	.05	.01	.63	.03	-	.06	.05	.01	.02	.01	.38	.22	.15			
Per. B	3	3	34	22	-	-	-	26	-	1	-	2	-	-	-	14	5	1	37	402	10.9
		.08	.92	.59	-	-	-	.70	-	.03	-	.05	-	-	-	.38	.14	.03			
Per. B	4	1	45	38	3	1	2	41	2	1	2	2	3	0	0	27	13	9	45	1189	26.4
		.02	1.0	.84	.07	.02	.04	.91	.04	.02	.04	.04	.07	-	-	.60	.29	.20			

This table gives the frequency of occurrence of taxa by period and by trench within the Roman period, and for medieval deposits in Area 1. For each Area is given the total number of contexts in which the taxon was recorded, and the relative frequency, this being calculated by dividing the number of context records for the taxon by the total number of contexts examined for that trench.

Key: 1 - horse 2 - cattle 3 - sheep 4 - goat 5 - red deer 6 - other deer 7 - pig 8 - wild boar 9 - cat 10 - dog 11 - hare 12 - human 13 - other mammal 14 - fish 15 - domestic fowl 16 - domestic goose 17 - other bird 18 - number of contexts yielding identifiable bone 19 - total of identified fragments 20 - avge.frags per context (=19/18)

Table 4.3. Carcass component abundance in the largest context-groups.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1049	E	1	7	11	5	13	14	7	15	21	0	1	4	3	7	4	5	1	12	5	2	2	3	4	2
1119	D	0	5	15	14	14	25	28	25	12	1	1	2	3	11	6	11	0	3	2	0	5	3	9	0
1308	B	1	2	1	5	0	3	1	2	18	1	3	2	1	6	6	14	1	6	1	0	2	0	1	0
1406	B	1	5	3	6	2	2	3	1	30	0	1	0	0	3	2	2	0	18	8	2	2	4	13	7
2006	E	24	4	8	2	3	6	8	5	11	1	3	1	1	2	0	3	0	3	0	0	1	0	1	1
2148	B	0	2	12	6	0	7	6	6	16	0	1	0	0	2	1	4	0	6	3	0	3	6	3	1
2210	B	2	3	1	5	52	71	0	0	5	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0
2208	B	1	10	3	8	127	140	0	1	6	0	1	0	1	0	3	0	0	0	1	0	0	1	1	0
2361	B	15	23	40	23	27	31	4	1	46	0	2	1	2	6	4	8	0	5	6	1	4	0	2	1

Table 4.3. Key

1-9 Cattle: 1-horncores, 2-skull, 3-vertebrae, 4-scapula+pelvis, 5-forelimb 6-hindlimb, 7-hocks, 8-phalanges, 9-ribs.

10-18 Sheep: 10-horncores, 11-skull, 12-vertebrae, 13-scapula+pelvis, 14-forelimb, 15-hindlimb, 16-metapodials, 17-phalanges, 18-ribs.

19-24 Pig: 19-skull, 20-vertebrae, 21-scapula+pelvis, 22-forelimb, 23-hindlimb, 24-metapodials III+IV.

Note that these are not counts of fragments, but of non-reproducible elements, such as limb-bone epiphyses, acetabulae, vertebral centra.

Table 4.4a. Age-grouping of mandibles on basis of dental attrition and eruption.

	Cattle						Sheep						Pig					
	N	J	I	SA	S	O	N	J	I	SA	A	O	N	J	I	SA	A	O
Period F	0	0	0	2	1	3	0	0	0	1	2	1	0	1	0	2	0	0
Period E	0	1	1	4	14	7	0	1	1	4	9	1	0	0	0	11	5	0
Period D	0	0	0	0	5	1	0	0	0	2	4	1	0	0	0	3	1	0
Period B	0	0	0	2	19	16	1	17	5	14	24	0	0	6	9	24	17	0
Period A	0	0	0	0	2	1	0	0	0	0	0	0	0	0	4	2	3	0

Table 4.4b. Pig mandibles in Periods B + E broken down by age and sex.

	sex	N	J	I	SA	S	O
Period E	M	0	0	0	1	2	0
	F	0	0	0	1	1	0
	?	0	0	0	9	2	0
Period B	M	0	0	2	1	4	0
	F	0	1	1	4	2	0
	?	0	5	6	19	11	0

Table 4.4. Key.
N - neonatal.
J - M1 not erupted into wear
I - M1 in wear, but M2 not erupted into wear
SA - M2 in wear, but M3 not erupted into wear
A - M3 in wear on at least one column but not heavily in wear
O - M3 showing heavy wear (dentine exposed on accessory pillar)
(For pigs, this stage is defined as TWS j as given by Grant, 1982)
M - male
F - female
? - sex unknown

Table 4.5. Incidence of selected non-metrical traits in cattle and sheep

	Cattle jaws			Sheep jaws			Sheep femora					
	PM2+	PM2-	LM3<	PM2+	PM2-	LM3<	prox+	prox-	mid+	mid-	dist+	dist-
Period F	2	-	-	2	-	-	1	-	-	-	1	-
Period E	18	4 18.2%	5	17	- 0%	-	4	-	1	2	1	2
Period D	5	-	-	1	-	-	2	1	-	1	1	-
Period B	21	4 16%	-	24	1 4%	-	13 93%	1	1 5.9%	16	5 31.3%	11

Table 4.5 Key

PM2+ - mandible with second permanent premolar or its alveolus present
PM2- - mandible in which second permanent premolar was congenitally absent
LM3< - lower third molar with reduced or absent distal column

prox+ - nutrient foramen present at proximal locus
prox- - nutrient foramen absent at proximal locus
mid+ and mid- - foramen present/absent at midshaft locus
dist+ and dist- - foramen present/absent at distal locus

Cattle horncores

context	side	max basal diameter	min basal diameter	basal circumference	length postero-dorsal curve
a) Period E					
1081	R	67.3	46.5	185	193
1088	R	45.9	36.1	134	163
1090	R	45.1	36.3	134	145
1102	R	43.3	37.1	139	149
1125	R	52.5	38.1	146	-
2002	L	49.1	34.7	138	153
2002	R	45.4	33.1	133	124
2006	L	41.0	31.1	123	128
2006	L	55.3	40.7	159	157
2006	L	54.6	40.5	156	154
2006	R	41.4	33.9	127	154
2006	R	43.5	35.5	132	135
2006	R	69.6	53.3	197	209
2006	R	53.3	39.8	151	164
2006	R	41.1	31.0	120	139
2006	R	54.8	41.1	156	139
2006	R	54.9	42.3	159	154
2006	R	48.9	38.8	144	149
2023	R	53.9	41.0	159	180
1036	R	36.3	31.8	111	109
1047	R	35.5	27.6	104	144
1123	R	46.8	31.3	131	140
1065	L	45.8	36.2	135	145
b) Period B					
1065	L	60.0	40.2	166	167
2260	L	49.5	33.9	135	150
2260	R	50.9	40.0	150	173
2210	L	48.7	37.4	149	180
2275	R	53.0	35.7	148	150
1348	L	49.6	35.0	141	151
1348	R	48.2	27.2	125	119
2261	L	31.1	24.3	97	87
2261	L	31.2	22.7	90	88
2261	L	44.6	31.5	122	102
2261	R	28.6	22.5	89	81
2261	R	47.3	35.2	136	114
2261	R	42.9	31.7	127	98
2261	R	46.0	33.6	131	153
2261	R	57.5	39.3	154	170
2352	L	47.7	34.0	139	138
2352	L	58.7	38.6	165	174
2361	R	50.0	32.5	134	147
2352	L	42.4	30.8	125	123
2352	R	42.2	31.7	118	116
2357	L	42.1	29.7	120	119
2357	R	40.7	28.6	114	113
2361	L	39.2	27.5	113	111
2208	L	50.3	40.3	152	177
1365	L	43.0	26.8	120	100
1365	R	47.7	28.9	129	104
1365	R	45.8	32.1	133	126
1376	L	44.4	24.4	117	104
1376	R	43.5	24.2	113	101
1376	R	42.5	26.6	118	108
1376	R	40.0	29.9	117	152
1376	R	43.0	30.2	125	115
1362	R	42.1	31.1	120	116
1376	L	45.0	26.5	115	105
1376	L	37.7	26.2	104	98
1376	R	36.3	26.1	106	90
1376	R	42.3	23.5	112	94
1376	R	42.6	30.8	121	122
1383	L	34.6	26.6	103	124
1388	R	58.5	41.4	165	131
1388	R	42.3	28.2	112	112
1398	L	40.5	26.5	111	97
2188	L	59.3	44.5	177	147
2260	R	44.4	30.2	126	125
2361	L	40.0	33.2	123	145
2361	L	47.7	31.9	129	121
2361	L	49.9	31.4	136	120
2361	L	40.0	26.3	111	110
2361	R	48.6	30.7	132	117
2361	R	43.6	32.4	126	138
2361	L	62.5	38.0	166	180
2361	L	43.5	31.9	126	132
2361	L	47.8	31.5	133	155
2361	L	46.8	31.9	132	134
2361	R	41.0	30.1	118	124
2381	L	44.4	31.1	126	127
2455	L	40.6	29.3	114	121
4254	R	48.4	37.7	142	146

Cattle metacarpals

context:	side:	GL:	BP:	DP:	SD:	BD:	BT
period E							
1049	L	-	63.3	40.7	-	-	-
1053	R	-	-	-	-	49.9	-
1036	L	-	55.5	-	-	-	-
1036	R	-	-	-	-	50.8	55.1
1037	R	-	48.9	31.3	-	-	-
1086	R	-	63.2	38.5	-	-	-
1087	R	-	-	-	-	44.3	48.9
1090	R	-	-	-	26.2	45.6	50.3
1092	L	-	60.2	37.8	-	-	-
1092	L	-	48.1	28.2	25.9	-	-
1102	L	-	-	-	-	46.6	52.0
1104	L	-	-	-	-	49.7	56.5
1108	R	-	-	-	-	58.6	63.7
2001	L	-	-	-	-	46.4	51.0
2002	R	-	-	-	-	48.2	53.8
2006	R	-	48.0	28.3	-	-	-
2006	R	-	58.1	36.1	-	-	-
2006	R	-	-	-	-	46.4	51.7
2028	L	-	50.8	31.6	-	-	-
2028	R	-	-	-	28.8	48.8	53.9
1020	R	-	-	-	50.5	51.2	
1036	R	-	48.6	30.7	-	-	-
1036	L	-	-	-	-	46.4	50.6
1036	R	-	-	-	-	52.6	57.6
1046	R	-	52.2	32.1	28.0	-	-
1043	L	-	-	-	-	58.2	63.0
1052	L	-	47.0	29.7	25.2	-	-
1071	R	-	-	-	30.0	47.5	53.2
1073	L	-	-	-	-	47.2	50.7
1123	L	-	58.0	36.8	32.1	-	-
1123	L	-	-	-	-	44.2	50.1
1123	R	-	-	-	-	44.1	49.8
2017	R	179.7	58.7	34.5	34.3	53.1	59.1
2020	R	178.0	50.9	31.0	28.1	46.8	51.0
2026	R	-	55.0	32.7	28.2	-	-
1040	R	177.3	52.2	31.6	28.0	44.0	-
1048	L	-	-	-	-	46.0	50.9
1097	R	-	48.2	31.0	-	-	-
1099	R	-	48.6	29.2	-	-	-
Period B							
1399	L	-	59.1	38.0	-	-	-
1406	R	-	53.8	32.2	-	-	-
3335	R	-	-	-	-	45.9	51.7
3335	R	-	51.9	30.5	-	-	-
3361	L	191.3	51.8	33.3	29.8	47.3	51.5
1308	R	-	-	-	-	47.7	53.4
1309	B	-	-	-	-	47.6	50.5
1310	R	-	52.2	31.9	-	-	-
1310	R	-	52.0	32.5	-	-	-
1265	L	-	51.9	30.5	-	-	-
1365	R	-	49.5	30.9	-	-	-
1376	L	-	-	-	-	49.6	52.9
1383	L	-	62.0	39.6	-	-	-
1383	L	-	-	-	-	48.8	50.5
1383	L	-	-	-	-	47.6	52.5
1388	R	-	50.4	34.0	-	-	-
2148	R	190.5	52.8	32.5	29.3	50.0	53.4
2148	R	-	-	-	-	54.8	61.1

3114	R	-	-	-	-	49.6	54.8
3127	L	177.4	53.0	34.6	29.4	51.0	54.7
3131	L	-	-	-	-	56.4	63.7
3132	L	-	-	-	-	52.7	58.4
3132	R	-	-	-	25.8	43.0	49.8
3172	L	177.8	50.3	32.4	26.5	47.1	52.5
3224	L	187.7	48.3	32.3	27.1	46.9	50.8
2318	L	-	51.0	31.0	-	-	-
2321	L	192.4	53.7	32.0	30.8	50.2	54.3
2321	L	-	51.0	32.3	-	-	-
2327	L	175.8	47.2	31.7	25.5	44.3	-
2357	L	-	-	-	-	48.0	52.3
3282	R	-	50.9	30.0	-	-	-
3286	L	-	-	-	-	46.5	50.8
2361	L	-	-	-	-	45.6	48.3
2351	L	-	-	-	-	45.9	50.3
2401	R	-	-	-	-	47.3	52.4
2405	R	-	-	-	-	46.2	49.2
2420	R	-	-	-	-	54.0	61.3
2428	R	177.5	51.0	33.1	26.8	47.9	52.3
2457	L	-	50.7	32.5	-	-	-
2168	R	-	-	-	-	45.5	51.1
2184	L	-	-	-	29.6	50.5	53.7
4146	L	-	-	-	-	48.4	53.4
4151	L	-	-	-	32.7	53.3	58.1
4161	L	-	-	-	-	47.7	52.0
4167	L	-	-	-	-	53.2	55.6
4169	L	-	62.7	37.3	-	-	-
4169	R	53.0	30.9	-	-	-	
4169	R	-	-	-	-	52.6	57.1
4202	L	-	50.4	31.6	-	-	-
4205	R	-	-	-	-	46.8	52.1
4219	L	-	52.5	32.6	-	-	-
4219	R	-	52.3	33.0	-	-	-
4240	R	-	-	-	-	53.8	60.2

Cattle astragalus

context:	side:	GLL:	GLM:	BD
Period E				
1053	R	54.1	49.0	35.3
1081	R	58.3	53.0	38.6
1083	R	55.8	50.6	35.8
1090	R	50.5	45.3	30.5
1092	L	61.6	55.1	38.8
1092	R	61.9	56.7	38.4
1104	R	59.5	54.5	37.2
1104	L	57.9	51.7	37.8
1125	L	64.3	57.5	43.1
2006	L	61.1	56.5	37.4
2028	R	58.0	54.1	38.6
1040	L	60.7	54.9	37.4
1040	R	62.3	57.0	40.1
1041	L	61.1	56.5	38.4
1047	L	59.8	53.6	40.1
1123	L	58.6	54.4	37.3
1123	R	55.5	50.0	36.0
1123	R	62.9	57.1	43.3
1096	L	59.0	-	37.2
1060	R	62.7	57.2	41.6
2026	R	57.1	52.8	39.2
Period B				
2236	R	62.4	56.9	40.9
1201	L	62.7	56.7	37.5
1379	R	61.5	56.3	38.6
2148	L	61.5	57.1	37.1
2148	R	61.6	57.3	37.2
2351	L	61.1	57.1	37.1
2485	R	65.0	60.6	41.4
2443	R	60.9	56.1	37.3

Sheep metacarpals

context:	side:	GL:	BP:	DP:	SD:	BD:	BT
Period E							
1050	L	-	22.8	16.7	13.7	-	-
1036	R	-	22.1	15.7	13.4	-	-
1104	R	-	21.6	17.3	-	-	-
1106	R	-	-	-	14.2	26.0	25.2
1017	R	-	-	-	-	24.0	24.5
1018	L	-	22.4	17.0	13.3	-	-
1035	L	116.9	20.9	15.1	12.1	23.6	23.3
1041	R	116.4	23.9	18.0	15.3	28.6	27.9
1046	R	-	-	-	-	25.9	24.8
1047	L	-	21.6	16.0	14.1	-	-
1120	L	-	20.6	15.6	13.4	-	-
1124	L	-	24.1	17.9	15.5	-	-
1094	L	-	20.6	14.6	12.5	-	-
1074	R	-	20.6	14.6	12.5	-	-
Period B							
1396	R	-	23.3	16.2	14.5	-	-
2210	R	-	22.6	16.8	13.6	-	-
2275	R	-	22.1	16.7	14.0	-	-
3343	L	-	21.0	15.8	12.3	-	-
1308	L	-	20.0	14.5	11.1	-	-
1289	L	-	22.3	16.6	14.2	-	-
2361	R	126.3	19.9	14.8	11.9	22.6	22.9
1370	-	-	-	13.6	10.9	24.5	23.1
1371	R	-	20.7	15.7	-	-	-
1363	L	120.5	20.8	14.3	11.4	22.0	22.5
1364	R	-	20.7	15.5	12.9	-	-
1383	L	-	21.7	15.0	12.7	-	-
1383	L	-	20.5	14.8	12.6	-	-
1383	L	-	-	-	10.8	20.9	21.0
1383	L	-	-	-	-	24.1	24.7
1383	L	-	-	-	12.7	22.7	23.2
1392		116.2	19.3	15.2	12.3	21.8	22.3
3203	R	-	20.0	14.5	12.7	-	-
3220	L	-	21.0	15.0	13.1	-	-
3220	L	116.0	19.5	15.2	12.2	21.8	-
3269	L	-	20.3	14.1	12.0	-	-
2405	R	119.4	20.7	14.9	11.1	22.0	22.5
2443	L	-	20.4	15.0	11.8	-	-
2487	L	-	22.6	17.0	13.6	-	-
2148	R	-	23.3	16.7	12.2	-	-
4169	R	-	20.5	14.1	12.0	-	-
4198	L	-	21.5	15.9	13.1	-	-
4202	L	-	20.6	15.4	12.1	-	-
4205	R	-	20.3	14.7	11.7	-	-
4260	L	-	21.8	15.1	13.3	-	-
4261	L	-	-	-	11.2	22.1	22.4

Domestic fowl tarsometatarsus

context: side: GL: BP: SC: BD: spur (p=primordium present)

Period E						
1052	L	-	-	5.6	12.6	-
2002	R	71.5	12.8	5.8	-	-
Period B						
1399	R	-	12.3	6.1	-	?
1406	L	72.7	11.9	6.0	12.4	-
1406	L	93.9	15.5	8.7	15.4	+
1406	R	63.2	12.5	5.5	12.0	-
2275	L	68.8	12.7	5.8	12.3	-
1308	L	-	-	7.0	14.7	P
1309	R	79.5	13.8	6.5	13.5	-
2321	L	83.9	15.5	7.7	15.0	P
1377	L	73.0	12.6	6.3	13.1	-
2260	R	74.8	12.6	6.0	-	-
2420	L	84.3	13.2	6.4	13.3	-
2420	R	82.0	13.3	6.4	13.9	-
2148	R	67.0	11.7	5.4	11.1	+
4148	L	83.2	13.3	6.5	14.2	-
4196	L	-	14.1	7.0	-	P
4200	L	63.2	12.2	5.2	11.2	-
4202	L	77.2	12.8	6.4	13.4	P
4222	R	68.8	11.7	5.6	12.0	P
4245	R	81.5	14.4	7.5	-	+
4255	R	74.9	12.9	5.9	12.5	-

Goat horncores

context; side; max basal diam: min basal diam; basal circumf: length

Period E					
1092	L	62.0	41.7	167	-
1092	R	62.3	41.8	170	-
2002	L	52.1	31.4	134	-
2006	L	28.8	20.2	84	146
2006	L	24.0	16.8	72	-
2006	R	28.9	20.7	85	143
2006	R	33.3	24.1	94	130
2006	R	24.2	17.1	72	-
2035	L	57.0	34.1	147	245
3015	L	28.9	19.5	82	-
3015	R	27.4	19.8	82	-
3017	L	28.5	18.2	81	130
3017	L	27.0	18.0	78	142
3017	R	32.8	21.3	93	135
3017	R	27.6	18.3	78	141
1009	L	31.5	20.7	88	150
1001	L	28.7	22.2	89	191
1001	R	33.5	24.1	98	205
1006	L	33.5	22.2	93	-
4002	L	40.5	26.4	112	135
4008	R	29.7	22.1	88.0	173
4008	R	55.0	32.7	141	230
4025	L	62.0	42.3	170	-
4071	R	58.4	39.6	158	245
4094	L	28.7	21.2	84	-

Table 4.7 Non-domestic birds by Area and Period

Period	Area	Species and fragment numbers
F	1	dom. duck 2 mallard 1 crane 1
E	1	dom. duck 4 cf barnacle goose 1 crane 1 lapwing 1 guillemot 1 razorbill 1
E	2	cf barnacle goose 1
D	1	mallard 1 cf barnacle goose 1 raven 2 capercaillie 1
D	2	raven 1
B	1	dom. duck 3 mallard/dom. duck 4 mallard 6 cf barnacle goose 2 wild goose sp. 1 cf wigeon 1 cf tufted duck 2 teal 1 cf Bewick's swan 1 mute swan 1 woodcock 1 black grouse 1 crow 3
B	2	dom. duck 5 mallard 2 cf barnacle goose 5 cf shoveller 1 golden plover 4 black grouse 1 wood pigeon 2
B	3	mallard 1 cf tufted duck 1 wood pigeon 1
B	4	dom. duck 2 mallard/dom. duck 1 gadwall 1 cf barnacle goose 7 wild goose sp. 1 stock dove 2 rook 1
A	3	cf barnacle goose 2
B–E	3	dom. duck/mallard 2
B–E	4	dom. duck 1
B–C	1	dom. duck 2 dom. duck/mallard 1 mallard 2 cf barnacle goose 4 wild goose sp. 1
B–C	2	mallard 1 crane 1
B–C	5	dom. duck 1

Systematic list of bird species

mute swan	Cygnus olor
Bewick's swan	Cygnus columbianus
c.f. barnacle goose	Branta leucopsis - sized goose
wild goose sp.	Anser/Branta sp.
mallard	Anas platyrhynchos
mallard/dom. duck	Anas platyrhynchos ?domestic form
dom. duck	Anas platyrhynchos domestic form
gadwall	Anas strepera
wigeon	Anas penelope
teal	Anas crecca
shoveller	Anas clypeata
tufted duck	Aythya fuligula
black grouse	Lyrurus tetrix
capercaillie	Tetrao urogallus
crane	Grus grus
golden plover	Pluvialis apricaria
lapwing	Vanellus vanellus
woodcock	Scolopax rusticola
razorbill	Alca torda
guillemot	Uria aalge
stock dove	Columba oenas
wood pigeon	Columba palumbus
raven	Corvus corax
rook	Corvus frugilegus
crow	Corvus corone

Table 4.8. Fish bones grouped by Area and period

Period	Area	species
F	1	cod 5, ling 1, Gadidae 1, unidentified fish 1
E	1	cod 52, ling 6, haddock 6, Gadidae 29, unidentified fish 10
	2	cod 1, ling 1
B	1	?pike 1
	2	salmon 1, unidentified fish 2
B-E	4	cod 9, ling 1, Gadidae 5

cod	Gadus morhua
ling	Molva sp.
haddock	Melanogrammus aeglefinus
pike	Esox lucius
salmon	Salmo salar

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