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The Vertebrate Remains from Six Saxon Sites in the Lincolnshire and Norfolk Fenlands (Saxon Fenland Management Project)

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(with a contribution on the fish bones by Rebecca Nicholson)

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Summary

The hand-collated and sieved animal bone assemblages from six of the Saxon Fenlands site yielded a total of 1522 identified mammal, bird and fish bones. Most of the hand-collected remains are from cattle and sheep, while pig, equid and other domestic mammals are less common. Domestic fowl, geese, duck, coot, wader and buzzard are present. A wide variety of marine, estuarine and freshwater fish were taken, most if not all of which may have been found inshore and/or inland. The age distributions in sheep suggest that these served a variety of purposes, in particular meat. There is no convincing evidence for seasonal site use or seasonal slaughter of livestock and the presence of very juvenile-adult animals suggests that the sites were occupied year round. The sheep metric data, albeit limited, show a possible variation in shape, with smaller jaws but larger bodies, compared to other Saxon and early Medieval sites, suggesting a possible change in sheep management and husbandry from the Roman period. The evidence for tooth overcrowding in many of the sheep jaws suggests that the animals may have been subject to nutritional or other environmental stress, but which does not seem to manifest itself in adult size. A number of cattle metapodials, including at least one of a subadult show evidence of asymmetrical development of the condyles, an abnormality generally attributed to the use of cattle for traction. The evidence for this development in young animals may indicate a different cause, or that animals were used for labour, at a younger age than expected.

Keywords

Animal Bone
Fish Bone
Early Medieval
Saxon

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Introduction

The animal bone assemblages described in this report are from rural Saxon sites in Lincolnshire and Norfolk, excavated as part of the Fenlands Management Project (Crowson et al. 2000). The project objectives were to locate sites and assess preservation of remains, in order to inform future management of the Fenland archaeological resource. Excavation was undertaken under the direction of Tom Lane, Lincolnshire Heritage Trust and Andy Crowson, Norfolk Archaeological Unit.

The investigations consisted of evaluations rather than large-scale excavations (Crowson et al. 2000: 75). Consequently, most of the animal bone assemblages are small, and individually they provide limited information about site economy. However, taken together, recurrent patterns are evident in taxonomic and age distributions and in pathological modifications. These aspects inform on diet, animal use and husbandry, which in turn may assist in the interpretation of site occupation and function.

Six sites were selected for analysis (Tables 1-2). These include three sites in the parish of Gosberton, Lincolnshire (Third Drove, Chopdike Drove and Mornington House), and three in the parishes of Terrington St. Clement, West Walton and Walpole St. Andrew, Norfolk (Fig. 1). An additional three assemblages were excluded on the basis of their very small size. The information recorded by Simon Davis for the sites of Leaves Lake Drove, Pinchbeck (PIN5/PLL94) and Hoe Hills, Dowsby (DOW8) in Lincolnshire is included in the assessment report (Davis in Trimble n.d.). The assemblage from Banklands, Clenchwarton (CLE 11), Norfolk, weighs 376 g and is listed in the project design (Norfolk Archaeological Unit 1999). The remains of herpetofauna (amphibians and reptiles) extracted from the sieved samples were studied by Chris Gleed-Owen (2000; no date). Dr. Rebecca Nicholson, University of Bradford, provided the fish bone identifications.

The results of the analysis are described below for each site individually. This is followed by a general consideration of economy and husbandry in the Fenlands during the Saxon Period.

The sites

The Lincolnshire sites are small rural sites located on the roddons or levees of ancient creeks, on the landward edge of the marine silts of the Wash (Fig. 1). They were separated from the upland by freshwater fen, and may have been periodically flooded by both fresh and marine water. Pollen analysis from the three sites indicates an open landscape, with proximity to saltmarsh. Occupation is dated to the early-middle Saxon period (Crowson et al. 2000).

The Norfolk sites are located approximately 1.5-2km apart on a series of roddons, in the siltlands to the south of Kings Lynn, also known as Marshlands. Occupation is dated to the middle and late Saxon/early Medieval periods. The discovery of many Saxon sites provided new and unexpected evidence for continuous occupation from the Roman period. In addition, the regularity of the settlement pattern suggested that the sites may have been established as part of an organised settlement strategy (Silvester 1988 in Crowson et al. 2000: 213). One of the main points of interest is whether the sites were settled permanently, or occupied seasonally in order to graze stock on the saltmarshes.

The sites included in this report are listed below and are described in detail in Crowson et al. (2000).

Lincolnshire
Third Drove, Gosberton, GOS 16 (GBT93), NGR TF 17722888: Roman-Postmedieval (mainly early Saxon)
Chopdike Drove, Gosberton, GOS 22 (GOS 92), NGR TF 19882900: mid-late Saxon
Mornington House, Gosberton, GOS 37 (GOS 93), NGR TF 17473170: mid Saxon

Norfolk
Hay Green, Terrington St. Clement, TSC 17 (TSC 22275) and TSC 23 (TSC 22576), NGR TF 537182 and 541176): mid Saxon-late Saxon/early Medieval
Ingleborough, West Walton, WNW 18943 (WNW 42), NGR TF 4721481: Iron Age-Saxo-Norman (mainly late Saxon)
Rose Hall Farm, Walpole St. Andrew, WPA 22145 (WNW 23), NGR TF 48741600: mid Saxon

Methods

Recovery and provenance

Animal remains were primarily hand-collected but bulk samples, ranging in size from 7-40 L, were taken for fine sieving/flotation. Heavy residues were collected on a 0.5mm mesh (Crowson et al. 2000: 14), and the fraction >1mm was sorted (Peter Murphy, pers. comm. 2001). Additional samples were coarse dry-sieved in the field using a mesh size of 5mm. Hand-collection generally results in a loss of the smaller bones and teeth of the domestic mammals and of the smaller taxa, including birds and fish. This is indicated by the scarcity of isolated incisors of cattle, pig, and in particular sheep, in most assemblages (Fig. 2), and echoed in the taxonomic distributions. Cattle tend to predominate in the hand-collected assemblages (Table 1; Fig. 3), whereas, most of the fish bones and almost all the small mammal remains were recovered by sieving (Table 2).

Recovery may also be influenced by context type. Taxonomic distribution shows that cattle tend to predominate in gullies and ditches, whereas the smaller livestock are as, if not more common than cattle in pits (Table 3; Fig. 4). While this may represent different disposal strategies (following upon original use of the features), the fine-sieved and dry-sieved assemblages show that sheep (and less commonly pig) remains are more frequent in most context types. This suggests that less care was taken in the excavation and recovery of remains from ditch fills.

Recording and analysis

For mammals, the following bones and bone parts were recorded: all identifiable fragments of the main limbbones, where over half of the medial or lateral side of the distal or proximal articular or epiphysial surface was present; the innominate and scapula, where at least half of the acetabulum and glenoid respectively were present. The carpals c23 and radiale, and centrotarsale, astragalus and calcaneum were recorded regardless of fragmentation. Except for the calcaneum, most of these were complete. All phalanges were recorded where at least half of the proximal articulation was present. For the mandible and skull, the following parts were recorded: upper and lower teeth (where more than half of the crown was present); diagnostic and durable parts of the cranium (zygomaticus and occipital) where at least half complete; horncores and frontal bones with at least half of the base of the horncore or where evidence of polling was available. Although there is some risk of recording more than one fragment per original element, the results compare closely to counts based on Davis' (1992a) method, which is restricted to a suite of non-repeatable zones. Given the small assemblage sizes, other quantification units, such as Minimum Number of Individuals or Elements (MNI and MNE) were not used. For birds, all of the main limbbones were identified to taxon where possible. Fish identifications were made on cranial bones, vertebrae and a few diagnostic spines, and size range was determined by comparison with modern reference specimens (Appendix 5).

Distinction between bones of closely related species may be difficult. Sheep and goat bones were separated following Boessneck (1969); Payne (1969, 1985); Prummel and Frisch (1977). As only sheep remains were identified in the assemblages, it is assumed that most if not all caprine remains are in fact from sheep. Equid teeth were differentiated following Davis (1987). Rodent teeth and shrew mandibles were identified following criteria in Chaline (1974). The medium size Galliformes were distinguished following MacDonald (1992).

Tooth wear and mandible wear stages were recorded following Payne (1973, 1987) for sheep, and Grant (1982) and O'Connor (1988) for cattle and pigs (Appendix 1). Measurements follow von den Driesch (1976), Davis (1987,1992a), Payne (1969) and Payne and Bull (1988) and are presented in Appendix 2. The more common measurements were compared to data from other sites, using the Kolmogorov-Smirnov test. This test is recommended where sample sizes are small, as is the case for these sites (Downie and Heath 1965). Pathologies and non-metric traits were noted and described; in particular evidence of tooth crowding in mandibles is recorded in detail in Appendix 3. Modifications including butchery and burning as well as state of preservation (weathering, carnivore gnawing) were recorded.

Results

Preservation

The assemblages from all sites were recovered mainly from ditch and pit fills. The remains are well preserved in general; weathering and erosion of surfaces were rarely observed and few specimens show evidence of gnawing by carnivores or rodents (Table 4). The assemblages include a low proportion of battered or rounded specimens, which might be suggestive of reworking (<10%). Only the Mid Saxon assemblages from Terrington St. Clement, TSC 23, and the very small assemblage from Late Saxon deposits at Chopdike Drove, Gosberton (Gos 22), include a higher proportion of battered or rounded specimens (15% and c. 30% respectively), which may indicate greater disturbance of these deposits. It is tempting to suggest that the relatively high proportion of cattle at TSC 23 reflects preservation bias against the smaller taxa, however the sieved assemblages include no cattle remains while fish bones are relatively common.

Cultural modifications include burning and butchery. Charring and/or calcination were observed on less than 10% of remains in each assemblage. Evidence of butchery, including cut and chopmarks, is present on c. 22-33% of bones (Fig. 5).

Lincolnshire sites

Third Drove, Gosberton, GOS 16 (GBT93): Roman-Postmedieval

The small animal bone assemblage was recovered mainly from Roman and early Saxon ditch fills and undefined feature fills, excavated in two trenches. Middle Saxon pottery is absent at this site and occupation is thought to have ceased or shifted at this time, due to "expansion of the freshwater fen" (Crowson et al. 2000: 107-109).

The animal bones are mainly from cattle, pig and sheep/goat (Tables 1-2). An incomplete pig skeleton (111) was recovered from a Saxon ditch fill (106 and 114); all epiphyses were unfused and the M^1s were erupting, indicating that the animal was less than c. 4-6 months at death. The dP_4s are only lightly worn, stage c-d after Grant (1982), and an unworn M_1 was probably not fully erupted (Table 5; Appendix 1). The significance of the deposit is unclear, although a ritual explanation has been suggested. It may simply represent disposal of an unwanted, perhaps sick animal (e.g Wilson 1992). The few Saxon cattle remains include a small and incompletely ossified astragalus of a very juvenile animal. A cattle calcaneum in the Roman assemblage is unfused, but shows possible arthritic bone growth on the lateral and posterior sides of the articulation (Plates 1a-1b). This suggests that the joint was subjected to stress of some sort, but whether this was due to injury, traction or other factors, is uncertain. The Roman assemblage also includes a mandible of an equid in which the M_1 was not yet erupted (under one year at death, after Silver 1969) and an unworn and possibly unerupted equid cheek tooth.

The presence of very young cattle and pigs suggests that some animals were raised locally, although they may have brought from a distance also. Hunting, fishing and gathering of resources may have been undertaken. A fragment of red deer antler was recovered from a disturbed Saxon ditchfill, but is considered unstratified. It is not possible to tell if it is from a shed antler or hunted animal. Birds are rare or absent, but many fish remains were recovered in the fine-sieved Roman deposits. Most of these are from haddock and flatfish (including plaice and/or flounder). Water vole and shrew are present in the fine-sieved assemblages.

Chopdike Drove, Gosberton, GOS 22 (GOS 92): Mid-Late Saxon

The animal bone assemblage was recovered mainly from middle and late Saxon pit and ditch fills. The remains are primarily from cattle and sheep, and include a partial sheep skeleton from a mid Saxon pit fill (Tables 1-2). Other domestic taxa include cat and horse. The few bird bones are from domestic fowl, domestic or wild goose (*Anser sp.*), coot and wader (Scolopacidae, similar to dunlin, jack snipe or common sandpiper). The goose bones are similar in size or slightly smaller than greylag goose (*Anser anser*). A wild duck, teal (*Anas crecca*)/garganey (*Anas querquedula*) size, is present in the late Saxon assemblage. Only a few fish bones, including eel, were recovered from fine-sieved late Saxon ditch fills. A human deciduous upper second molar was recorded from a mid Saxon pit fill (019).

All bodyparts of the main domestic mammals are represented. Of note is the presence of a first phalanx of an equid, which is cut at the distal end on the anterior side. An equid radius from an unstratified context is chopped through the mid and distal shaft.

Tooth wear and epiphysial fusion in cattle and sheep indicate the presence of subadult and adult animals (Table 5; Appendix 1). Although the assemblage is small, the relatively high frequency of subadults is notable. The incomplete sheep/goat skeleton is from a very juvenile, possibly neonatal animal. The bones are very small, all epiphyses are unfused and the third and fourth metapodials are not fused together (see Prummel 1987). The equid remains include an unworn second incisor, from a subadult animal, as well as a heavily worn third incisor of an adult (over 12 years after Brown 1913). Heavily worn deciduous cheek teeth also attest to the presence of subadult equids. Few pathologies were observed. One sheep/goat horncore shows a "thumbprint" type depression on the cranial-posterior side. The possible causes for this malformation are uncertain, but Albarella (1995) suggests that it is probably due to resorption of calcium, which may be caused by nutritional deficiencies, late breeding, or intensive milking. Two cattle metatarsals (one of which is unstratified) show asymmetrical development of the condyles (Plate 2; Table 8).

The fine-sieved samples include a variety of small mammals, the most abundant species being the field and water voles. Although the frequency of field and water vole varies between periods, the remains may be from a few individuals only. The mid Saxon assemblage also includes the wood/yellow-necked mouse, and harvest and house mouse, while bank vole is present in the late Saxon assemblage. The presence of house mouse is of interest, as this animal tends to seek out human habitation and work buildings for shelter and food, in particular in late autumn and winter (Corbet and Southern 1977). This may provide additional evidence, albeit limited, for permanent occupation at the site.

Mornington House, Gosberton, GOS 37 (GOS 93): Mid Saxon

The presence of an unusually high frequency of imported lava querns suggests that this settlement was of "higher than average status" (Crowson et al. 2000: 116). Unfortunately, the assemblage is too small to allow inter- or intrasite spatial analysis of possible status variation, and to all intents and purposes it resembles the data from the other Gosberton sites.

Cattle remains predominate, followed by sheep (Tables 1-2). Most cattle were juvenile or subadult at death (Table 5; Appendix 1); the remains include an incompletely ossified first phalanx and very small and splayed metapodials of juvenile animals. Sheep were killed when subadult and adult (Table 5; Appendix 1). Two sheep mandibles are pathological. A subadult mandible shows crowding of the premolars and a mandible of an adult, in which the alveolus of P_2 is resorbed, also shows interdental wear and severe malocclusion (Table 9; Appendix 3). As at Gos22, the presence of subadult and adult equids is indicated by the presence of deciduous teeth and a heavily worn incisor, in which the infundibulum is no longer visible (over 12 years, after Brown 1913). An equid scapula is chopped through the glenoid on the lateral-anterior side.

The few bird remains are from domestic or wild goose (*Anser* sp.) and medium sized raptors. While many of the raptor bones are probably from buzzard (*Buteo buteo*), in some cases it was not possible to distinguish between buzzard, rough-legged buzzard (*Buteo lagopus*) and red kite (*Milvus milvus*), or between buzzard and harrier species (*Circus* sp.). The buzzard is commonly recorded in Medieval urban assemblages and was probably attracted to refuse in human settlements (O'Connor 1993). Harriers are rare in Medieval urban sites and their status is less clear (Mulkeen and O'Connor 1997). However, they would not be out of place in the rural environment. The measurements of a tibiotarsus and tarsometatarsus (ditch fill 018) compare to those of marsh harrier (*Circus aeruginosus*) (data in Schmidt-Burger 1982; see Table 10). This species frequents fens, swamps, marshes and areas with dense reeds (Peterson et al. 1983: 72), environments characteristic of the Lincolnshire Fenlands.

A few bones of haddock were recovered by hand and sieving. Hand-collected shell includes mainly mussel, and fewer cockle and oyster shells (Crowson et al. 2000: 119). Small mammals, including shrew, field vole, and mole are infrequent.

Norfolk sites

Ingleborough, West Walton, WNW 18943 (WNW 42): Iron Age-Saxo-Norman (mainly late Saxon)

This site is located on the highest point of a roddon and may have been associated with salt-making as suggested by its form, a raised mound, and location "up against the [..] sea bank" (Crowson et al. 2000: 215). Although the finds are from trenches cut across the roddon at intervals (through the densest scatters, Crowson et al. 2000), the animal bone assemblages are too small to allow assessment of change across the site.

The assemblage is mainly from late Saxon (Saxo-Norman) deposits. Sheep and cattle predominate, while pig and equid (including horse) are much less frequent (Tables 1-2). Cat and hare are present in the mid-Saxon assemblage. The presence of cat may suggest sedentary occupation, although these animals may also become feral. All bodyparts of the main mammals are present in low frequency. The few age data available for the late Saxon period indicate that cattle and sheep died at a range of ages from juvenile to adult (Table 5; Appendix 1). There is no evidence for neonatal animals, but the sheep remains include juveniles less than 6-8 months old. Three sheep mandibles, including a subadult, show crowding of the teeth and malocclusion

(Table 9; Appendix 3). A cattle metatarsal from an Iron Age silt layer shows asymmetrical development of the condyles (Plate 3).

Birds, including goose, *Anser* sp., are rare. A few bones of large cod and haddock bones were recovered by hand, and many smaller bones of eel and flatfish (including flounder) and one of smelt are present in the sieved assemblage. Some of the eel and Pleuronectid bones appear chewed, and some may be charred. Small mammals include field vole and wood/yellow necked mouse.

Hay Green, Terrington St. Clement, TSC 23 (22576) and TSC 17 (22275): Mid Saxon-Late Saxon/Early Medieval

Occupation at these sites is dated almost exclusively to the mid Saxon period. The presence of spinning and weaving equipment suggests that domestic activities were undertaken (Crowson et al. 2000: 220-223). Over half of the animal bone assemblage is from a "pond-like" feature" 16m in diameter, which was filled with alternating layers of silt and charcoal-rich material. Although the nature and original use of the feature are uncertain, its contents resemble those from other features in the Marshland sites, and appears to have been used at least in part, for waste disposal (see Crowson et al. 2000: 220).

Sheep and cattle dominate the assemblage. A few pig and equid remains are present but other domestic mammals and game are absent (Tables 1-2). Birds include domestic fowl and wild or domestic goose (*Anser* sp.) and many fish bones were recovered in the fine-sieved assemblages, including eel, herring and/or sprat, and flatfish (including flounder and/or plaice). Other food remains include mussel and cockle (Crowson et al. 2000: 223).

All bodyparts of cattle and sheep are present. There is a predominance of sheep mandibles and metatarsals in the assemblage from TSC 23 but these are from a range of contexts, and concentrations that might suggest differential disposal of waste are not apparent. Only one deposit stands out. Context 078, a layer in the pond-like feature includes the metapodials and phalanges of a very juvenile calf, which are probably associated.

The tooth wear and fusion data from both sites show the presence of juvenile, subadult and adult animals (Tables 5-6; Appendix 1). In two cattle mandibles from TSC 23, M_2 was not erupted at time of death. An unfused metatarsal is small and splayed and may be from a very young malnourished animal (Plate 4). Asymmetrical condyles were observed in a second fused metatarsal (Plate 5). For caprines, the following mandible stages were determined (after Payne 1973): C (6-12 months) 2; D (1-2 years) 4.5; E (2-3 years) 6.5; G (4-6 years) 3; H (6-8 years) 1 (Fig. 7). This indicates that sheep were killed mainly by 4 years, suggesting a dual purpose for meat and wool. In addition, a few very small and incompletely ossified bones may be from perinatal or very juvenile animals. Seventeen sheep/goat mandibles (out of 22) show overcrowding of teeth (Table 9; Appendix 3). Interdental attrition is apparent mainly on the aboral facet of the deciduous and permanent premolars, and on the oral and aboral facets of M_1. As for the larger sample from Walpole St. Andrew, these patterns show that erupting teeth impacted on the teeth in place, and suggest that mandible growth was delayed or inhibited with respect to tooth development. In one of the adult mandibles, the P_2 is missing (Plate 6, top). This trait may be a genetic marker but it occurs only rarely in the Saxon Fenland sites. A pig mandible shows recession of bone on the medial and posterior side of the third molar.

Eight equid remains were identified, including two horse teeth. Two bones, a first phalanx and a distal metapodial, may be from foetal or perinatal animals, suggesting that horse breeding may have been undertaken locally. The first phalanx is small, unfused and incompletely ossified and is probably from a very juvenile equid, much younger than 13-15 months. The distal metapodial is unfused and the cortical surface is porous, again suggestive of a young animal (under 15-20 months, after Silver 1969). A complete radius gives a withers height of 1246mm (after Kieswalter 1888 in Driesch and Boessneck 1974).

The juvenile specimens provide some, albeit limited evidence for local breeding, including possibly horse breeding. Pathologies and anomalies observed on the sheep mandibles compare to data from Walpole St. Andrew and suggest that stock at these sites were subject to similar developmental stresses (see below).

Rose Hall Farm, Walpole St. Andrew, WPA 22145: Mid Saxon

Occupation at this site is exclusively mid Saxon. Only 1% of the site was sampled and the main feature types consist of linear features and circular and sub-rectangular pits. The linear features were filled with water-borne silts and may have been drains or boundaries, associated with water or stock control. The pits show alternating layers of silt and organic waste, so they were used at least partly for waste disposal (Crowson et al. 2000: 218-219). Some of the linear features and pits may have been used in the salt-making process also. Although no structural remains were evidenced, finds include worked bone objects, a spindle whorl and a loom weight, indicating that activities other than salt making and stock management were undertaken (Crowson et al. 2000: 219).

The animal bones from contexts 1-100 are missing except for the sheep and cattle mandibles. The missing material was housed in two boxes and makes up approximately one third of the assemblage (see Luff 1992). As such the results of the analysis must be considered incomplete. Nonetheless, the study was warranted given the presence of a large number of sheep mandibles, which show abnormal development, as well as evidence for a consistent pattern of butchery of metapodials and longbones. As such the assemblage may provide valuable information about stock management, environmental conditions, and domestic activities. Walpole St. Andrew provides by far the largest record of sheep mandibles and as such acts as a comparative base for data from the smaller assemblages

The assemblage includes mainly remains of cattle and sheep and the fine-sieved samples show that sheep were the more common livestock (Tables 1-2). Pig and equid are rare and wild mammals are absent, apart from microfauna (field vole, water vole and mole). Only a few bones of domestic fowl, and wild or domestic duck and goose were recovered. A femur of domestic fowl is almost completely filled with medullary bone, indicating that hens in lay were present (see Lentacker and Van Neer 1996). A spurred tarsometatarsus shows that males were raised also. Many fish bones were recovered in the fine-sieved samples. These are mainly from eel but also flatfish, gadids, herring/sprat, as well as from cyprinids (roach/dace) and pike, indicating fishing in freshwater and marine environments.

Bodyparts and butchery

All bodyparts of cattle and sheep are present in approximately even frequency. Longitudinal splitting was observed on half of the cattle metapodials and radii and on one fifth of tibiae and femora. It was observed on approximately 15% of sheep metapodials. It has been suggested that this represents a consumer activity (Luff n.d.), and certainly it suggests that marrow was a valued food source. Evidence of bone working in the form of cast-offs or unfinished items, which might also require splitting of bone, have not been found, so this may a less plausible explanation.

Ageing

The most informative aspect of this assemblage lies in the age data. A total of 40 sheep mandibles with at least two teeth in the dP_4/P_4-M_3 tooth row, six with one tooth present and one with the deciduous second and third premolars provide information about age at death and dental development (Tables 6-7: Appendix 1). The data show that c. 60% of sheep died before the age of two years and that most sheep did not survive beyond four-five years (Table 7; Fig. 7). Some animals died at a very young age, as indicated by a mandible with a very lightly worn dP_3 (pitfill

102), a third/fourth metapodial which was not fused to the opposite element, and additional small and incompletely ossified bones (e.g. pit fill 241, neonatal caprine). Cattle teeth include one unworn dP_4 and one just barely in wear, as well as mandibles with unerupted M_3s (Appendix 1), indicating the presence of very juvenile and subadult animals. Bone fusion and development also indicate the presence of calves, under 7-10 months and probably much younger, including a possible neonatal animal from pitfill 241. The fusion data although limited, suggest that few cattle survived beyond 3-4 years (Table 5).

The presence of neonatal and very juvenile animals suggests that some sheep and cattle were raised locally. The age data are not substantial enough to indicate possible seasonal variation in site use, and the presence of all age groups up to c. four years may be indicative of a domestic economy based on meat production, and in the case of sheep, of wool also. The concentration of wear stages in dP_4 (c. 14L), M1 and M2 in sheep assists little in understanding slaughter patterns, as these stages are long-lived (Table 6). The data may simply reflect this lack of variation over a period of time.

The equid remains include a third phalanx possibly of a very young animal. The morphological and cortical development is similar to that of a very juvenile modern pony. The distal fusion line in a metatarsal is visible, and the cortical surface is incompletely ossified at proximal and distal ends, indicating that the animal was subadult at death. A second metatarsal is unfused (under 16-20 months, after Silver 1969). In contrast, a series of heavily worn incisors may be from one or more animals aged over 10 years (after Brown 1913). The length (Ll) measurements of a metacarpal and metatarsal both give withers heights of c. 137 cm (after Kieswalter 1888 in Driesch and Boessneck 1974) (Appendix 2).

Pathologies

Tooth crowding was observed in 33 sheep/goat mandibles (out of 47), and in one maxilla (Table 9; Appendix 3) (see examples in Plates 7-10). In particular, 26 mandibles show consistent patterns of interdental attrition. In 13 mandibles in which the deciduous premolars are present, attrition occurs on the aboral end of the teeth, that is dP_2 is worn by dP_3, dP_3 by dP_4, and dP_4 by M_1. In those mandibles (12) where P_4 and M_1 are present, attrition occurs mainly in the reverse direction, that is on the oral facet of M_1. This suggests that as teeth erupted they impacted on the teeth in place, so M_1 crowds the deciduous premolars, and P_4 (and possibly P_2 and P_3) crowds the molars. Some molars also show attrition on their aboral cusps. These patterns indicate that the mandibles did not grow large or perhaps quickly enough to accommodate the erupting teeth.

Almost all the mandibles, in which the teeth are crowded, also show evidence of uneven wear on individual teeth and/or along the tooth row, which may be due to malocclusion of upper and lower jaws. This is evident in 26 mandibles (Appendix 3). The abnormal wear varies from slight to very pronounced unevenness on a single tooth or adjoining teeth. Another unusual aspect of tooth wear in 24 mandibles is the very steep and sharp cusps of some teeth (see Plates 7, 9). This may occur in tandem with malocclusion and interdental wear, and occurs in subadult as well as adult animals, up to mandible wear stage H (after Payne 1973).

A few postcranial elements of the main livestock are pathological. Four cattle metatarsals show asymmetrical development of the condyles or distal shaft. In one specimen the epiphysis was unfused and in a second fusion was not yet complete (Plate 11). In the unfused specimen and in a second metatarsal of a very juvenile animal, the distal shaft is markedly splayed, which may be a sign of malnutrition. One sheep/goat horncore shows a thumbprint type depression, an abnormality, which has been attributed to resorption of calcium (see above and Albarella 1995). In a cattle scapula, the cortex on part of the glenoid cavity is very irregular but the reason for this is unknown. A cattle radius and ulna and a few sheep bones show extra, possibly arthritic, bony growth near the articulations.

Summary and discussion

Frequency and diversity of domestic and wild animals

Common features may be observed in the Saxon Fenland assemblages. The taxonomic distribution in all cases shows the predominance of cattle and sheep and very low occurrence of pig. The latter is not due to recovery bias given the relatively high frequency of sheep, and so must represent a real discrepancy. While there is some variability in cattle and sheep counts, the sieved data suggest that sheep were much more common than cattle at these sites, although the latter would have provided the bulk of meat. Equids, including horse, were present at most of the sites albeit in low frequency. Of interest is the presence of two bones of a very young, possibly foetal equid from Walpole St. Andrew, which would suggest local horse breeding. The remains of cat and dog are scarce, however the presence of carnivore gnawed (probable dog) bones suggest their presence at four sites where their remains have not been identified. The presence of cat and house mouse, although limited, may indicate sedentary occupation at least in some settlements.

Game animals are equally rare. Red deer antler was recovered in two sites, but may have been collected rather than obtained from hunted animals. The absence of beaver should be noted. Beaver has been identified in prehistoric assemblages from the Fenlands, most notably at Haddenham (Evans and Serjeantson 1988; see also Albarella 1997). An increasing number of finds suggest that beaver was present up to the Saxon period, although it may have become extinct by the late Saxon period (Yalden 1999; Albarella 1997a). It's absence in the mid-late Saxon Fenland sites may be due to a general lack of involvement in hunting, or alternatively to the lack of appropriate habitat and reduction in availability. It may simply reflect the small assemblage sizes from these sites. The small mammal remains, mainly from voles and occasional shrew, provide limited information about local conditions of the settlements, but no doubt reflect the wider environments, including grasslands and waterways. They may be from animals, which became entrapped in ditches or pits or were prey of larger scavengers.

Birds include mainly domestic fowl and domestic or wild goose. Duck, coot, small wader and raptors are present but rare, and no doubt include scavengers or natural casualties as well as birds that were consumed.

A variety of fish were caught, including haddock, cod, flatfish (including plaice and flounder), herring, smelt, eel, as well as cyprinids and pike, suggesting that marine, estuarine and freshwater environments were fished. Although eel bones make up approximately half of the larger assemblages, they may be overrepresented due to the greater number of vertebrae in the eel skeleton. The flat fish (Pleuronectidae) are the second most common family. Most of the bones are from fairly small fish, suggesting an estuarine/inshore fishery; this predominance of small flatfish is typical of fenland sites in the Saxon period (R. Nicholson pers. comm. 2002). Both plaice and flounder may be found in the tidal/intertidal zones, and flounder is found in freshwater rivers and lakes "in communication with the sea" (Wheeler 1978: 356). Smelt is an inshore migratory fish and is common in estuaries and at river mouths, and spawns in freshwater (Wheeler 1978: 90). Even large haddock and cod may frequent inshore or coastal waters at various times of the year (Wheeler 1978). The size range of the species is provided in Appendix 5. The presence of oyster, mussel and cockle also indicates that estuarine and inshore environments were exploited (Crowson et al. 2000).

The predominance of sheep (and to a lesser extent cattle) in the Fenlands follows a trend documented for the Iron-Age to Postmedieval periods. Assemblages from Haddenham (Evans and Serjeantson 1988), Market Deeping, Lincs. (Iron Age) (Albarella 1997a) and from a number of Iron-Age-Roman saltern sites (Albarella in press) reveal the importance of cattle and sheep over pig in these areas. The importance of the Lincolnshire and Norfolk fens for cattle and sheep grazing in the Medieval and Postmedieval periods is documented historically also (Dobney et al. 1996). Livestock may suffer from various diseases in wet pasture, including footrot and liver fluke. However, wet ground conditions would not pose a great threat to cattle, sheep or pigs, while the severity of fluke infestation may be limited by the presence of salt (Dobney et al. 1996: 58; Wijngaarden-Bakker 1998: 177).

The low frequency of pig may be partly explained by the scarcity of woodland; for the most part, pollen analyses from the Fenland sites indicate a grassy and open environment, rather than a heavily wooded one (Murphy forthcoming). There may be other "cultural" explanations for the low pig frequencies. Analyses of Saxon animal bone assemblages from rural and urban sites in East Anglia suggest that high pig ratios may characterise elite sites, although this appears to be based to some extent on extrapolation from the Medieval period (Crabtree 1994; see also Grant 1988). Data from urban Saxon London would, however tend to support the suggestion (Rackham in prep.). Their scarcity in the Fenland sites may reflect a more lowly status for these settlements.

Kill-off patterns, animal use and seasonality

One of the questions of interest regarding occupation in the Fenlands is whether settlements were occupied seasonally or year round. This question has been broached for Iron Age Market Deeping and a series of Iron Age-Roman saltern sites (Albarella 1997a; Albarella and Mulville in press). Despite the small assemblage sizes and limited age data, in all of these sites the presence of very young, including foetal animals, as well as older livestock suggested occupation in the spring and possibly throughout the year. The age data for the Saxon Fenland sites add to the general picture of site occupation, stock management and use through time. At all the Saxon sites cattle and sheep were killed at a range of ages, from foetal/neonatal or very juvenile to adult. The presence of neonatal animals, animals under 6 months, between 6-12 months and older, suggests that livestock were present year round, rather than brought to the areas in particular seasons. The spread of wear stages in M_3 also suggests more permanent occupation. The identification of seasonal activities is tenuous for the small samples. The wear stages in the larger group from Walpole St. Andrew, and indeed in the smaller assemblages, show that young animals in which the deciduous dentition was still present, were killed mainly when the dP_4 had reached wear stage 14L. Summarising Deniz and Payne's (1982) observations for goats, Albarella (1997a) notes that this stage may occur anywhere between 2-13 months, but is generally found in animals aged 4-6 months old. As at Market Deeping (Albarella 1997a), the data may indicate a focus on late summer-autumn killing (assuming lambs were born in the spring), but the presence of more heavily worn deciduous dP_4s, at least at Walpole St. Andrew, may indicate slaughter through the winter as well. Given that lambing may have occurred over a period of months, in this area possibly from late winter to early summer, and that the recorded tooth wear stages of both deciduous and permanent dentition are long-lived, the data do not provide good evidence for seasonal slaughter.

The wide age range at which both cattle and sheep died suggests that their role was multi-purpose. The presence of a relatively high proportion of subadult cattle at some sites is notable, and suggests that animals were raised for meat in addition to other uses. Very young animals may have been killed if winter fodder was scarce, while some may be natural casualties. Young cattle may also be slaughtered in order to free up milk supply in a dairying economy, however, in these sites the data do not suggest an intensive regime of calf slaughter. The presence of older animals is consistent with the evidence for arable farming and their possible use for traction. The sheep mandibles show that animals were slaughtered at a range of ages, and in most cases before they reached an advanced age. The two largest mandible groups, from Walpole St. Andrew and Terrington St. Clement show that approximately 50-60% of animals died before they reached two years of age, and that most died by four-five years. This suggests an emphasis on meat production, and indeed the pattern resembles such a regime as suggested by Payne (1973), in particular for male animals. Unfortunately, it is not possible to define sex ratios in the small samples. Animals killed at an older age however, would have supplied wool as well as milk, and it is probable that the Fenland data reflect this multipurpose use of sheep. Similar patterns may be seen in the assemblages from Iron Age Market Deeping (Albarella 1997a), Saxon Burystead (Davis 1992b in Albarella and Davis 1994), Late Saxon Thetford (Albarella 1999) and Early Medieval West Cotton (Albarella and Davis 1994) (Fig.1).

Bodyparts and butchery

The assemblages are unremarkable in the broad distribution of elements and butchery marks. Bodypart distribution indicates that whole animals were present at the sites. Unusual deposits or concentrations of particular elements were not evident, apart from two partial skeletons and the possible associated bones of juvenile cattle. The recurrent splitting of cattle and sheep metapodials and other longbones at Walpole St. Andrew and similar finds from other sites suggests that marrow was a valued food source. The presence of butchery marks on equid remains indicates that horse hides, bones and possibly meat were used. Butchered horse bones have been found in other sites and it may have served as dog food, although consumption by humans cannot be ruled out. While Christian rules forbade the eating of horseflesh from the 8th century, perhaps these were transgressed in times of need (see Albarella and Davis 1994: 20). Butchered horse bones are known from late Saxon Thetford (Albarella 1999) and are relatively common at early Medieval West Cotton (Albarella and Davis 1994).

Livestock size and health

Few measurements were available and for the purpose of comparison, the data from the mid-late Saxon periods were pooled. The measurements are summarised in Tables 11 and 12 for cattle and sheep respectively, and a full list appears in Appendix 2. Cattle and sheep measurements clearly exceed the Iron Age data from Market Deeping and West Stow, in line with what we know of size increase in Britain from the Iron Age. The cattle measurements are broadly similar to or exceed data from Roman sites, including Scole (Norfolk-Suffolk border) and Lincoln (Table 11; Figs. 8a-8b). The data also suggest that the Fenland cattle were larger than Saxon and early Medieval animals from other sites, the means of the more common measurements exceeding comparative data. Statistical comparison of cattle measurements to other sites reveals few significant differences however. The Fenland cattle astragali are significantly larger than data from West Cotton, Thetford, Castle Mall, Lincoln (at the 5% confidence level) and Burystead (at the 1% confidence level) (Table 13).

More interesting is the variation in the sheep tooth and bone measurements. The postcranial measurements appear larger than data from Roman and Saxon sites, while tooth breadth (M_3) is smaller. Few significant differences were observed (Table 13). M_3 breadth in the Fenland sheep is significantly smaller than at West Cotton, Castle Mall (at the 5% confidence level) and Thetford (1% confidence level), while tibia Bd is significantly larger than at West Cotton (5% confidence level). For the postcranial measurements, it is unlikely that the variation is due to observer differences, as the same methods were followed (e.g. von den Driesch 1976) and most of the measurements are easily taken. In contrast, the lack of clearly defined points for measuring length or breadth in bovid teeth means that consistency is difficult. However, in this case the breadth of dP_4 is very similar to measurements from other sites, so observer error may not be the cause.

The apparent difference in size between the Fenland sheep and other Saxon/early Medieval sites is surprising given the evidence for abnormal development in sheep jaws. These data suggest that the animals may have been subject to nutritional or other environmental stress (see below), but this does not seem to manifest itself in adult livestock size. The reasons for this are not clear, but may reflect stress early in life or recurrent, perhaps seasonal stress, which may have been followed by a "catch-up" in growth.

A few equid remains provide withers heights of c. 1.2-1.4m. These would have been rather small animals, comparing in size and possibly shape to Exmoor ponies.

Congenital traits were rarely observed. The absence of P_2 in sheep was recorded for one mandible out of eleven at Terrington St. Clement, and the absence of the hypoconulid in the third molar of cattle was not observed. The most common anomalies are crowding of teeth and malocclusion, which were observed in 70-75% of sheep mandibles in the larger assemblages. The cause of tooth crowding is uncertain. It may reflect genetic characteristics and/or susceptibility to environmental stress, including malnutrition or type of nutrition (Levitan 1984; Calcagno and Gibson 1991 for human dentition). Teeth are "genetically much more stable" (Clutton-Brock 1981: 24) than bone, and so react more slowly to external influences (see also Payne and Bull 1988: 37). Thus, they may reach normal size even where mandible growth is affected. Crowding of teeth may result in their rotation and/or in interdental attrition, which in turn may result in malocclusion of upper and lower jaws. Although not uncommon, interdental attrition has rarely been recorded systematically in archaeological assemblages. Levitan's (1984) study of sheep mandibles from the Roman-Postmedieval period at Middleton Stony, Oxfordshire, is the exception, and provides the protocol for recording the Fenland mandibles.

Levitan noted the incidence and location of interdental attrition on individual teeth in 26 mandibles. A high proportion of mandibles was affected (23 mandibles or 88%), and the results showed that as teeth erupt, they are worn by the teeth in place. Levitan noted that this is variable in the deciduous and permanent premolars, which erupt at about the same time, the P_4 and molars are worn mainly on the posterior and anterior sides respectively, reflecting the eruption sequence (1984: 116). The data from the Fenlands, in particular Terrence St. Clemington and Walpole St. Andrew, suggest that attrition is caused not only by the teeth in place but also by the reverse process, that is by the erupting teeth. For example, where dP_4 and M_1 are present, wear occurs almost exclusively on the aboral surface of dP_4 and much less commonly on the anterior cusp of M_1, suggesting that attrition is caused by M_1 (see Plates 8d, 10a). The prevailing attrition on the posterior facet of dP_3 also suggests that pressure is mainly from the aboral dentition. Where P_4 and M_1 are present, interdental attrition occurs predominantly on the oral facet of M_1. Part of this may be due to earlier attrition by dP_4 but the "fit" between P_4 and M_1 suggests that eruption of P_4 impacts on M_1 also (e.g. Plates 8a, 10b). Similarly, eruption of M_2 causes attrition of the posterior facet of M_1 (e.g. Plate 10b, c) and so on with the M_3 (Plate 8b). There is some variation to the pattern however. At Terrence St. Clemington, attrition on the posterior facet of P_4 is relatively common, showing attrition by M_1 (Appendix 3). And in the Walpole St. Andrew mandibles, where tooth wear is advanced, attrition on both P_4 and M_1 may be observed (e.g. Plate 10c).

The data suggest that interdental attrition did not occur on the deciduous premolars before M_1 had erupted but was advanced before M_2 was heavily worn, suggesting that crowding began with molar eruption in the first year. The acute angle at which the permanent premolars erupted was observed in some cases (but not recorded systematically), suggesting that crowding was pronounced before the end of the second year. It is possible that the deciduous premolars were similarly crowded from birth, as indicated by the slight displacement of dP_2-dP_4 in one of the mandibles from Walpole St. Andrew (wear stage B, after Payne 1973).

While it has been possible to identify the pattern of crowding and malocclusion in the Fenland mandibles, the causes of this are not clear. It may be due to nutritional stress, including perhaps poor quality or insufficient grazing or fodder. There is other, albeit limited evidence from Walpole and Terrington St. Clement to suggest that young cattle and sheep may have suffered from malnutrition or other external stress (very slender and splayed metapodials).

A number of postcranial pathologies were observed, including the growth of exostoses on phalanges and some metapodials, pronounced splaying of juvenile bones, and the asymmetrical development of condyles in cattle metapodials. This asymmetry has been attributed to advanced age or to the use of cattle for heavy labour, although the link to traction has not been proven. Generally it has been observed more frequently in the metacarpals, which carry the greatest weight (Bartosiewicz et al. 1997). In the Fenland assemblages, asymmetrical condyles were observed most frequently in the metatarsals, but this does not simply reflect their greater numbers in the assemblages (Table 8). For the mid-late Saxon period, seven out of 15 metatarsals show this anomaly compared to only one out of seven metacarpals. The occurrence of asymmetry in the bones of subadult animals in the Walpole assemblage also suggests that factors other than age or traction may be involved. Stress caused by uneven terrain may play a role in metapodial development (Bartosiewicz et al. 1997). It would be of interest to know if the terrain of siltlands and water meadows places undue stress on the development and movement of the limbones in large livestock.

Conclusions

The animal bone assemblages from the Saxon Fenland sites, albeit limited in size, add to a growing understanding of site occupation and economy in these marshy environments. Sheep, and less commonly cattle, were the preferred livestock and were raised for a range of purposes, in particular meat production. A wide variety of fish was consumed, but neither fish nor fowl would have rivalled the importance of meat from livestock.

There is no evidence for specialised economies, and the data resemble strategies adopted on Iron Age and rural Saxon-early Medieval sites in the Fenlands and further afield. In contrast with traditional theories, the sites do not appear to have been occupied in particular seasons, but rather the age data suggest year round occupation. This does not exclude seasonal activities, but the tooth wear stages in mandibles and individual teeth do not provide secure evidence for seasonal slaughter. The presence of very juvenile equids as well as adults at two sites may indicate that horse breeding was undertaken locally, although only two specimens may be from foetal animals.

The size and health of livestock provide surprising and possibly conflicting data. Both cattle and sheep rivalled the size of Roman animals, and indeed appear to have exceeded that of Saxon and early Medieval livestock from other sites, although few significant differences were observed. The data also show, for sheep, a possible variation in shape, with smaller teeth, hence jaws, but larger bodies. These results suggest at least for sheep, that a change may have occurred in livestock management and husbandry from the Roman period, and also that during the Saxon period, variation existed in the types of animals raised. The samples are small and it is difficult to draw secure conclusions about variation in size and/or shape on this basis. The above pattern is surprising given the evidence for abnormal development in sheep jaws. These data suggest that the animals may have been subject to nutritional or other environmental stress, but this does not seem to manifest itself in adult livestock size. The reasons for this are not clear, but may reflect stress early in life or recurrent, perhaps seasonal stress, which may have been followed by a catch-up in growth.

Asymmetrical condyles were observed in a number of cattle metapodials, including two bones of subadults, suggesting that this type of development may be due to causes other than age or use for traction.

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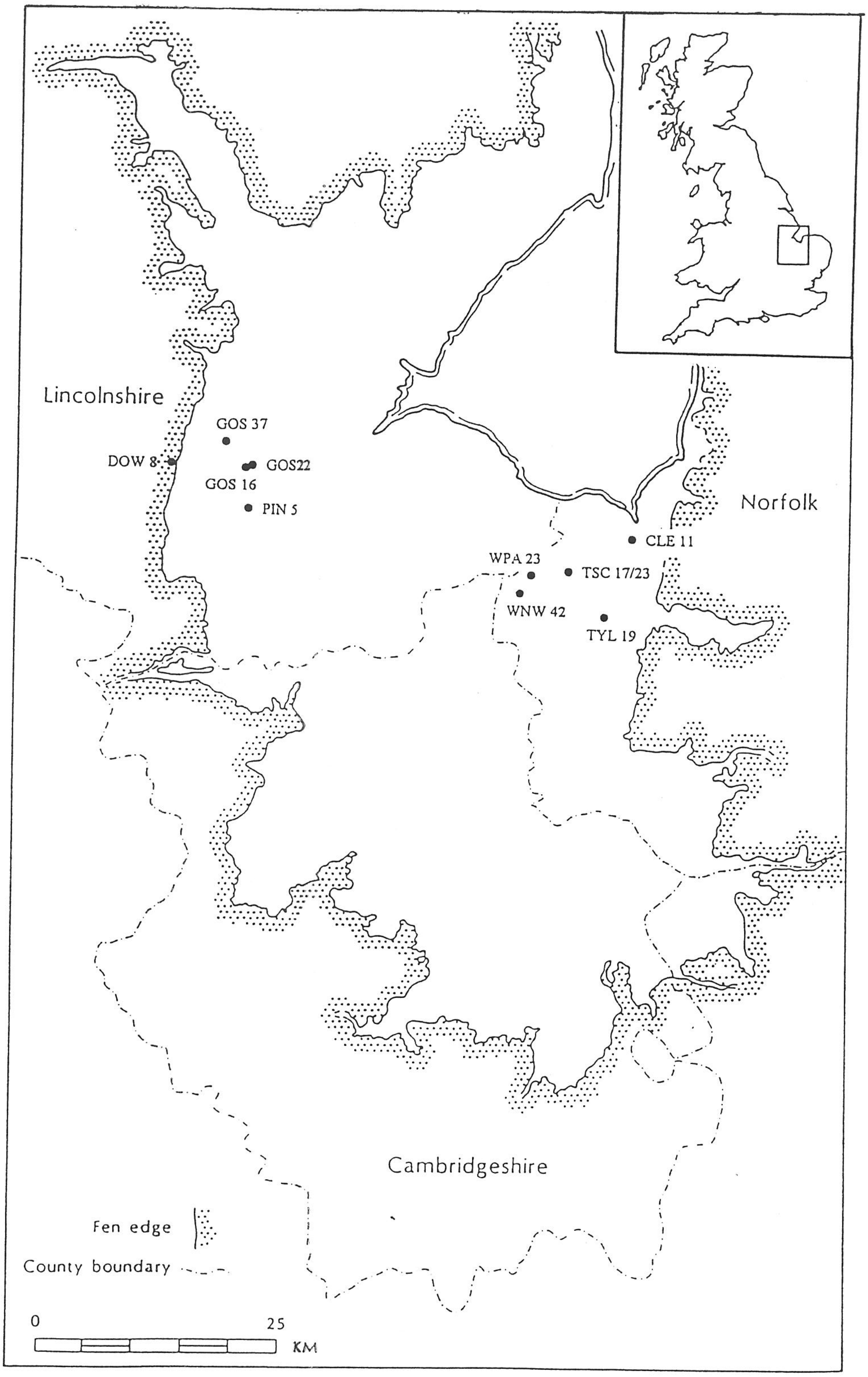

Fig. 1: Location of Saxon Fenland sites in Lincolnshire and Norfolk (from Norfolk Archaeological Unit, 1999)

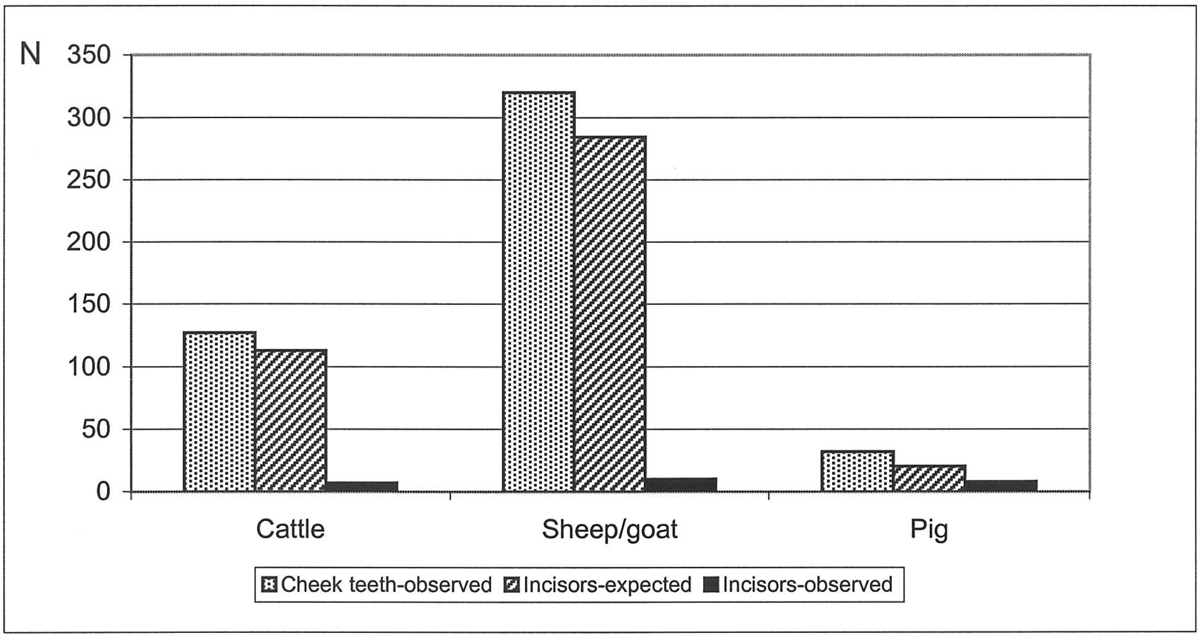

Fig. 2: Expected frequency of incisors compared to observed cheek teeth and incisors ; calculation based on the expected cheek teeth and incisor counts in one mandible of each of the main taxa: **cattle and sheep/goat:** adult cheek teeth: 6; adult incisors 4, juvenile cheek teeth 3, juvenile incisors 4; **pig:** adult cheek teeth: 7, adult incisors 3; juvenile cheek teeth 4, juvenile incisors 4.

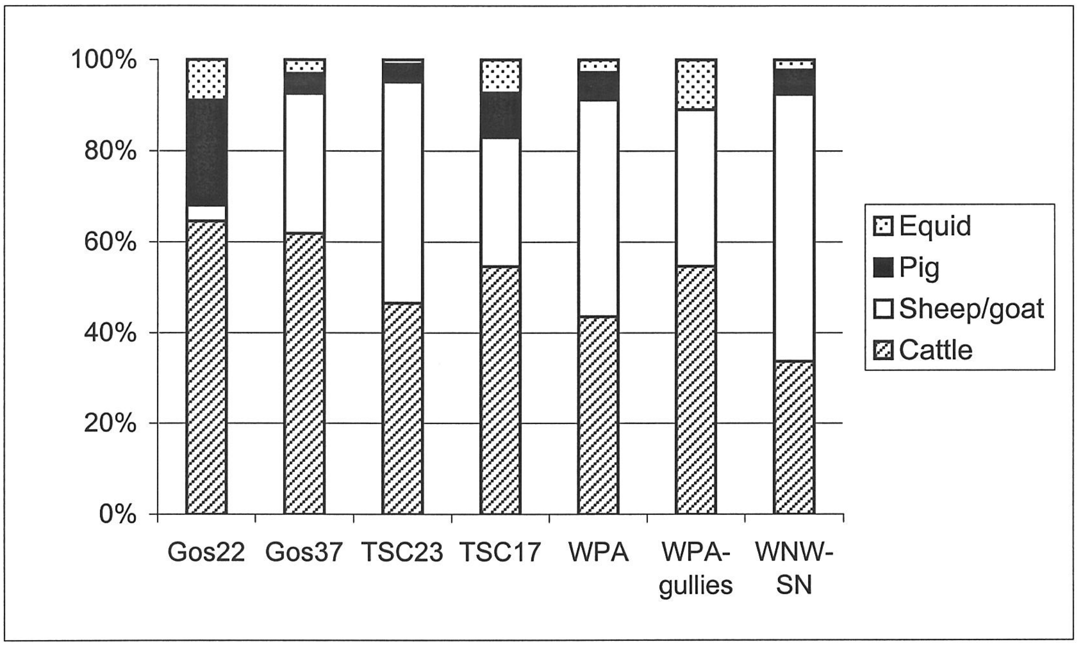

Fig. 3: Relative frequency of cattle, sheep/goat, pig and equid in the hand-collected assemblages (based on NISP, data in Table 1)

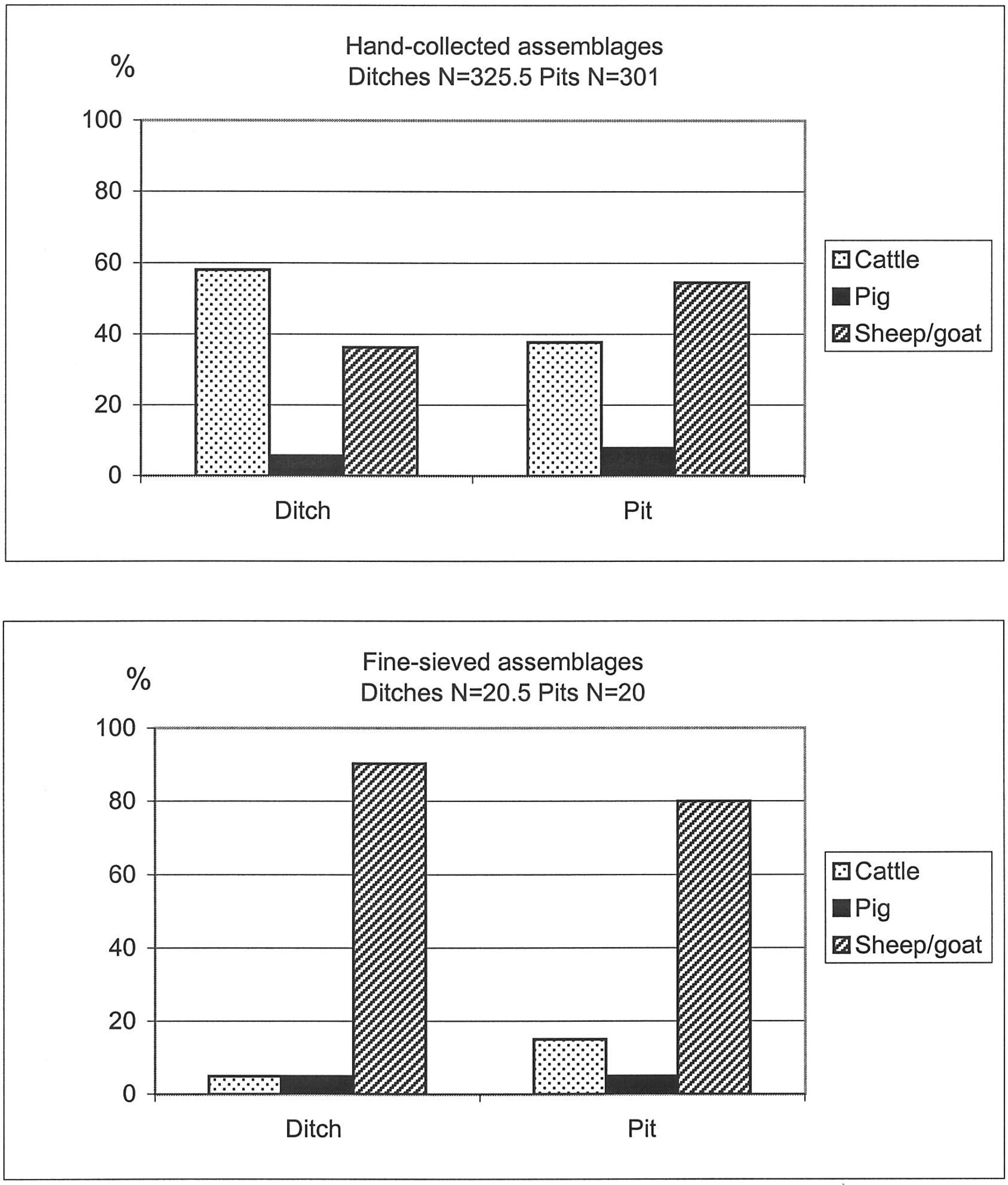

Fig. 4: Relative frequency of cattle, sheep/goat and pig in ditches and pits (based on NISP)

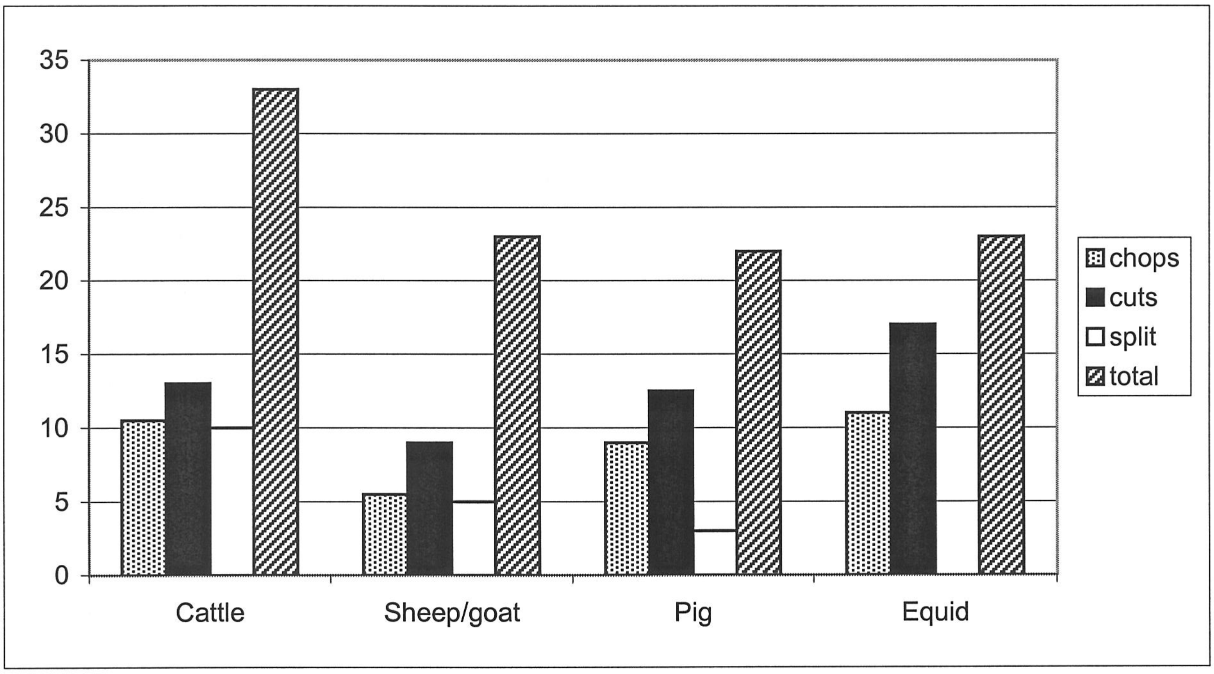

Fig. 5: Relative frequency of butchery marks and total butchered bones of cattle, sheep/goat, pig and equid in all sites (excluding Iron Age phase; based on NISP); cattle 295; sheep/goat 253; pig 32; equid 18

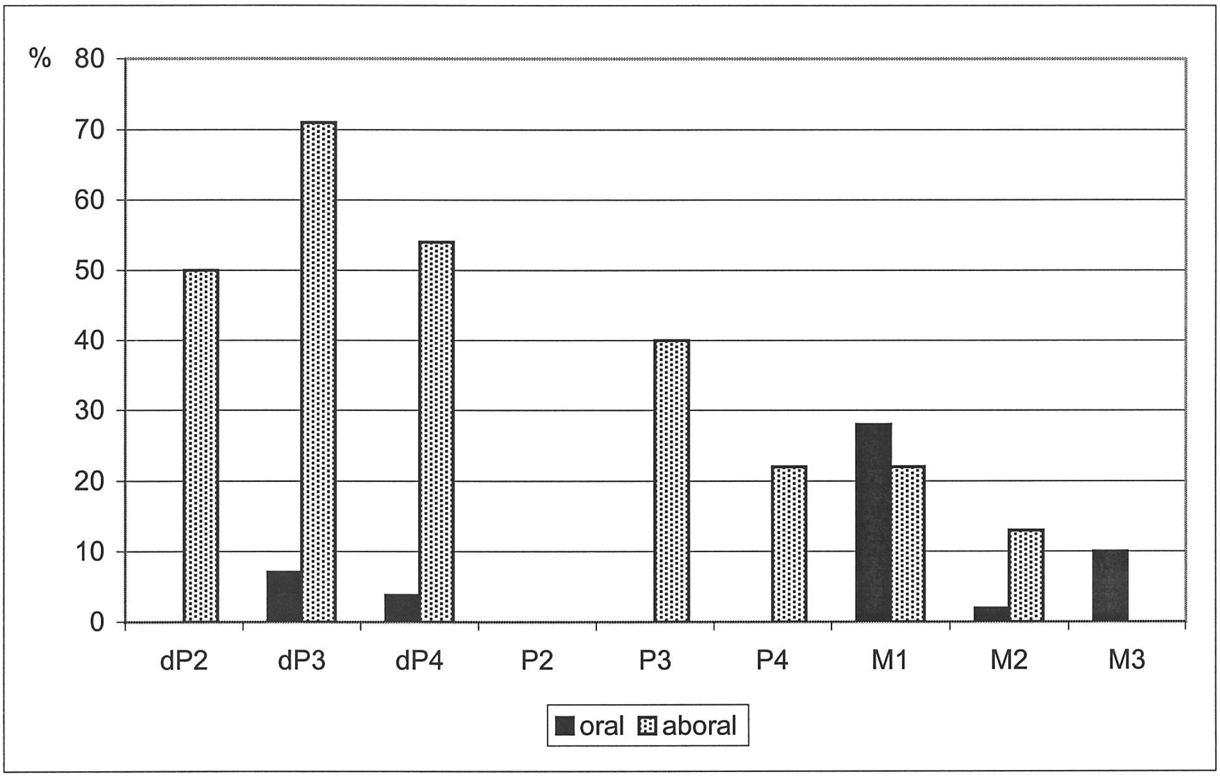

Fig. 6: Relative frequency of interdental attrition on oral and aboral aspects of deciduous and permanent premolars and molars (data in Table 9 and Appendix 3); M1s worn on oral facet occur exclusively in mandibles with permanent dentition (ie. with P4); M2s and M3s with interdental wear occur only in mandibles with permanent dention (ie. where permanent premolars present).

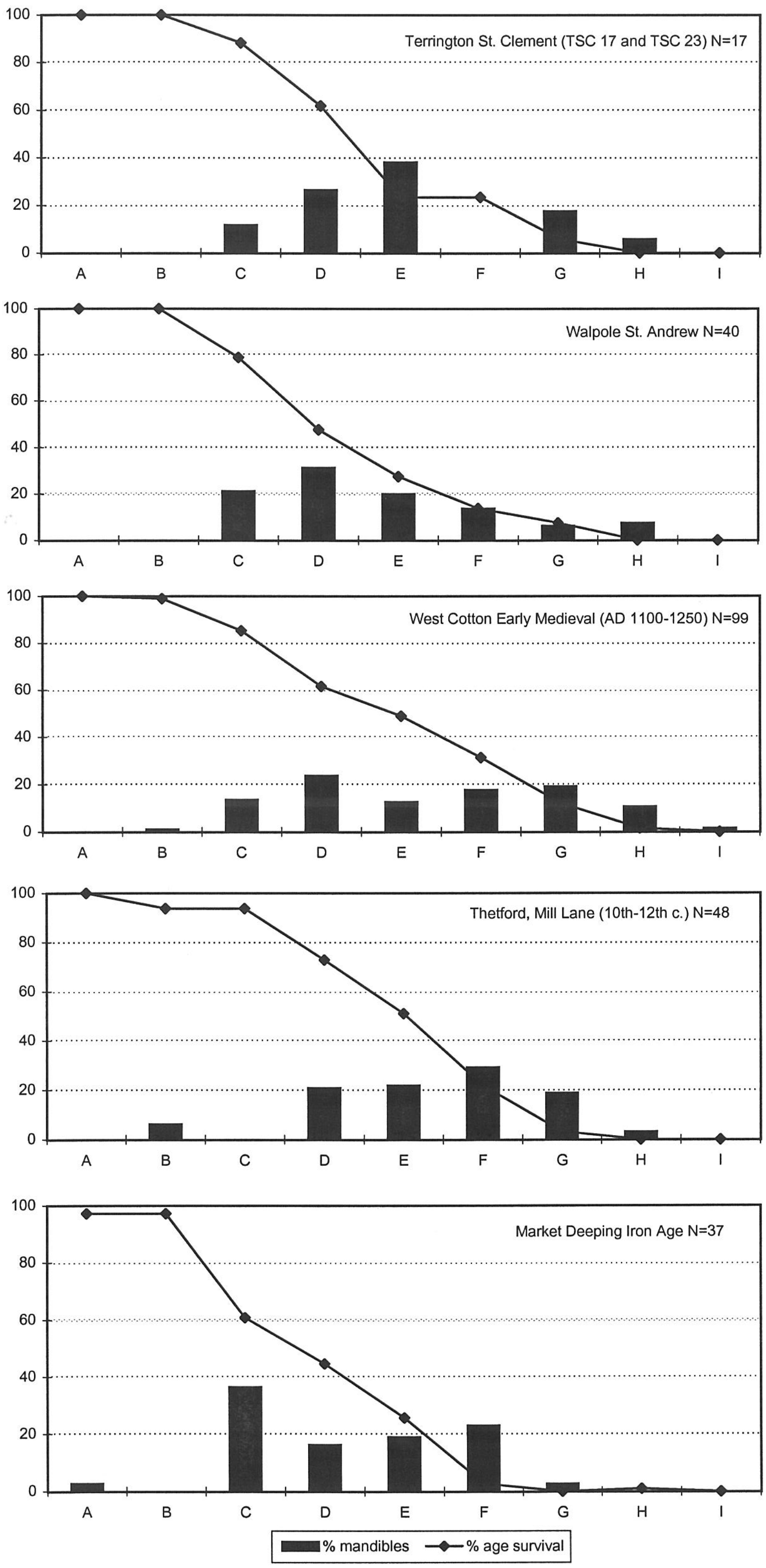

Fig. 7: Age profiles for sheep/goat mandibles from Terrence St. Clemington and Walpole St. Andrew compared to Iron Age and Early Medieval sites (Fenland data in Table 6 and Appendix 1; comparative data from Albarella 1997, 1999; Albarella and Davis 1994). Age groups after Payne 1973: A: 0-2 months; B: 2-6 months; C: 6-12 months; D: 1-2 years; E: 2-3 years; F: 3-4 years; G: 4-6 years; H: 6-8 years; I: 8-10 years

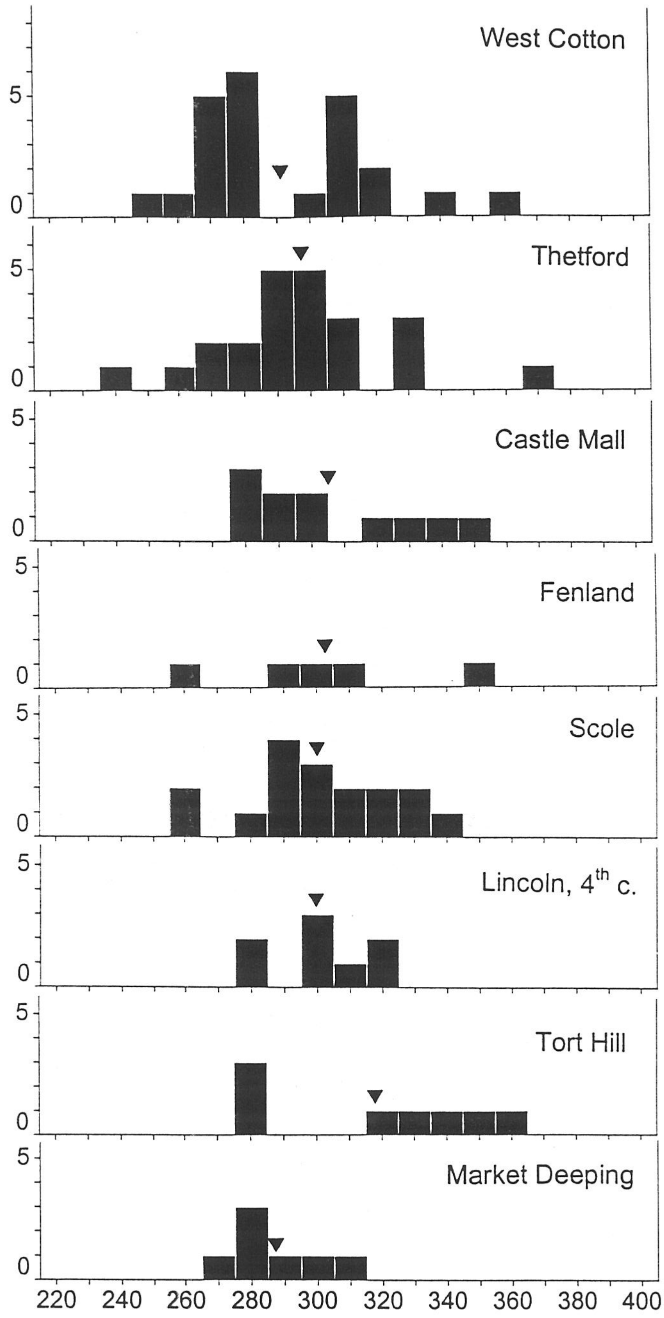

Fig. 8a: Distribution of humerus HTC in cattle. Comparison between Iron Age-early Medieval sites. References: Market Deeping, Iron Age (Albarella 1997a); Tort Hill (and Norman Cross), 1st-4th c. (Albarella 1997b); Lincoln, 4th c. and late Saxon (Dobney et al. 1996); Scole, 4th c. (Baker 1998); Castle Mall, late 9th-11th c. (Albarella et al. 1997); Thetford, 10th-12th c. (Albarella 1999);West Cotton, AD 1100-1250 (Albarella and Davis 1996).

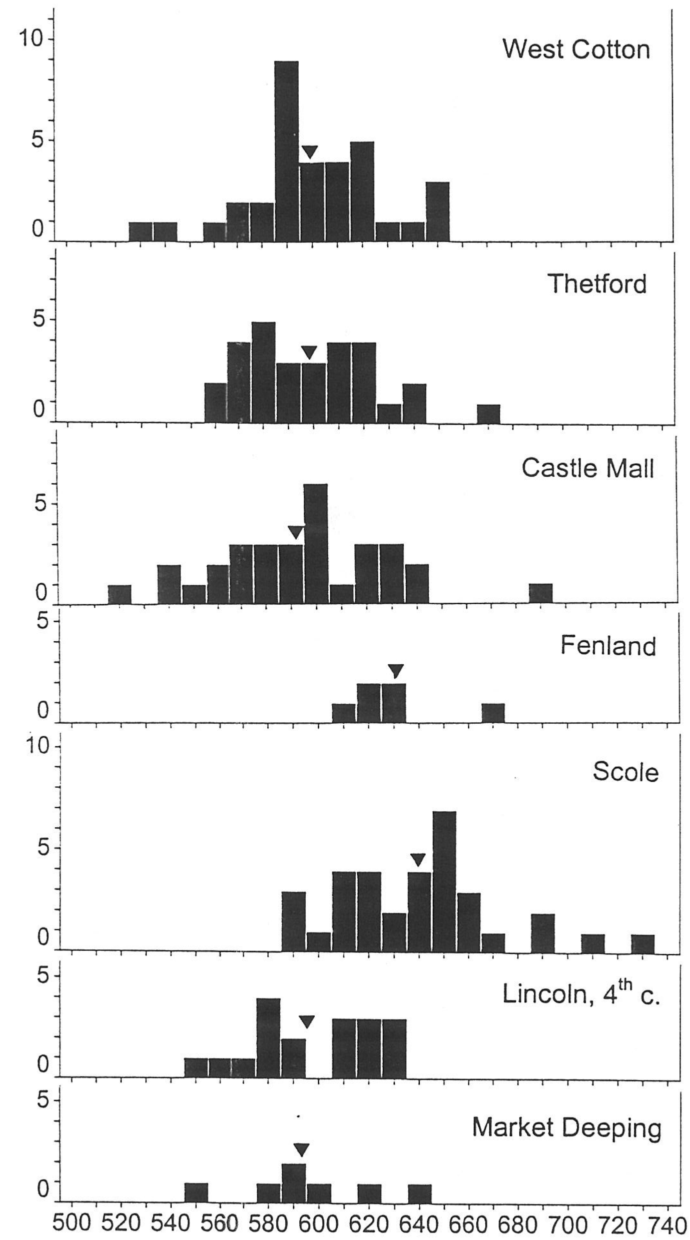

Fig. 8b: Distribution of astragalus GLl in cattle. Comparison between Iron Age-early Medieval sites. References: Market Deeping, Iron Age (Albarella 1997a); Tort Hill (and Norman Cross), 1st-4th c. (Albarella 1997b); Lincoln, 4th c. and late Saxon (Dobney et al. 1996); Scole, 4th c. (Baker 1998); Castle Mall, late 9th-11th c. (Albarella et al. 1997); Thetford, 10th-12th c. (Albarella 1999);West Cotton, AD 1100-1250 (Albarella and Davis 1996).

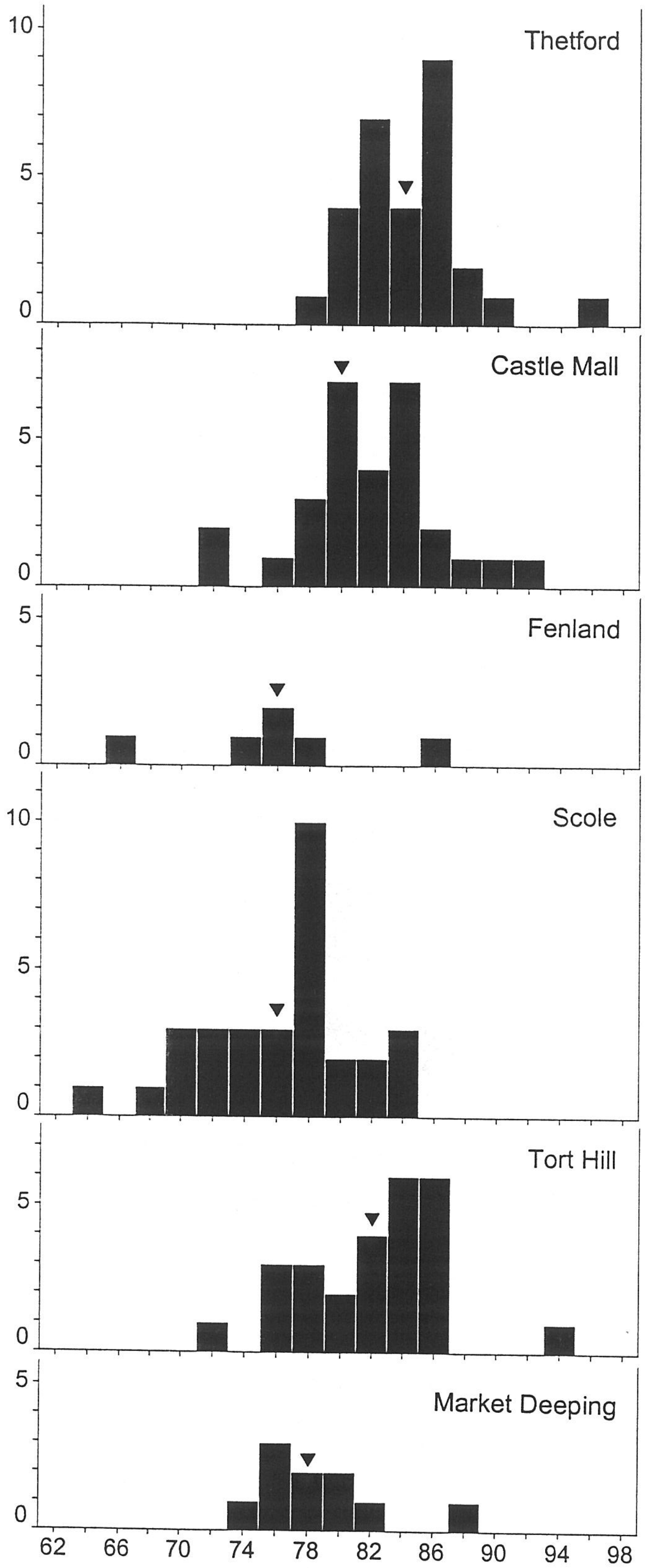

Fig. 9a: Distribution of M3 breadth in sheep/goat (data include sheep and sheep/goat measurements). Comparison between Iron Age-early Medieval sites. References: Market Deeping, Iron Age (Albarella 1997a); Tort Hill (and Norman Cross), 1st-4th c. (Albarella 1997b); Scole, 4th c. (Baker 1998); Castle Mall, late 9th-11th c. (Albarella et al. 1997); Thetford, 10th-12th c. (Albarella 1999.

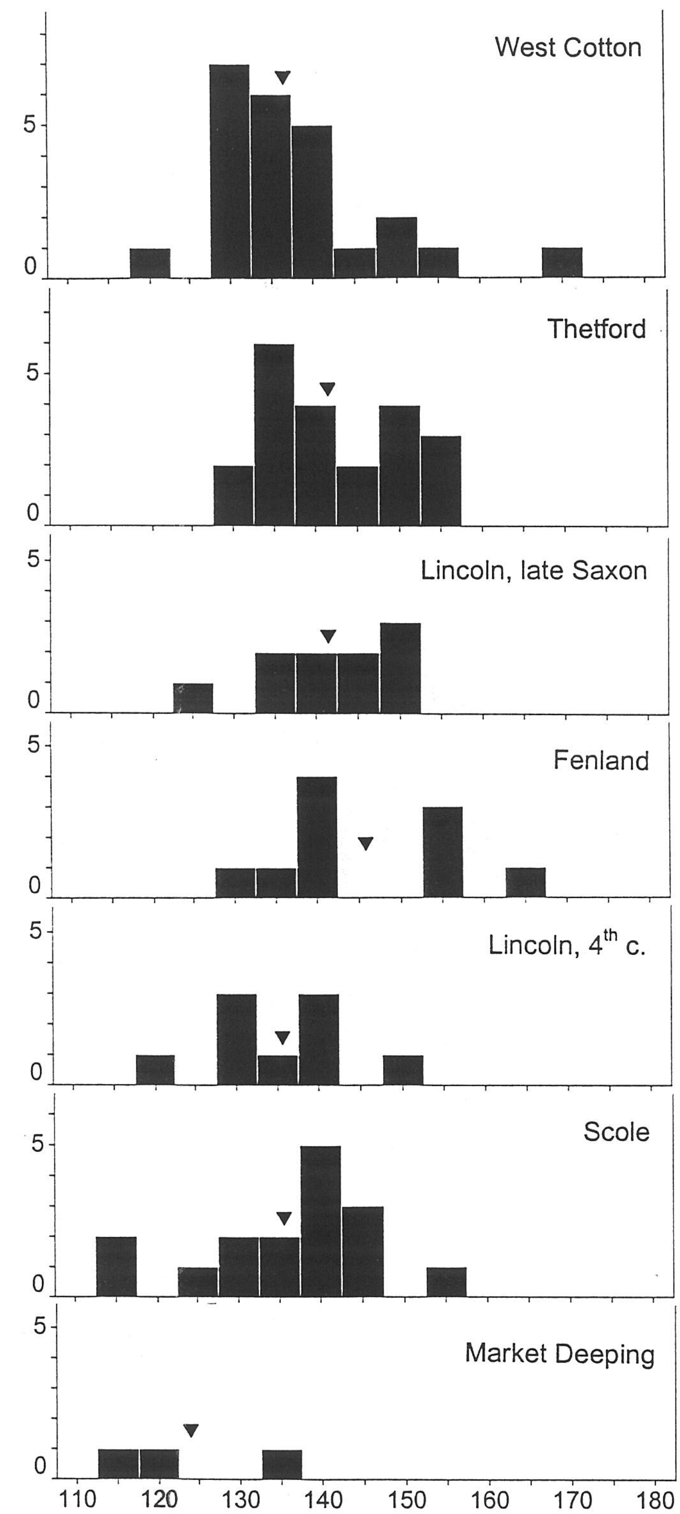

Fig. 9b: Distribution of humerus HTC in sheep/goat (data include sheep and sheep/goat measurements). Comparison between Iron Age-early Medieval sites. References: Market Deeping, Iron Age (Albarella 1997a); Lincoln, 4th c. and late Saxon (Dobney et al. 1996); Scole, 4th c. (Baker 1998); Castle Mall, late 9th-11th c. (Albarella et al. 1997); Thetford, 10th-12th c. (Albarella 1999);West Cotton, AD 1100-1250 (Albarella and Davis 1996).

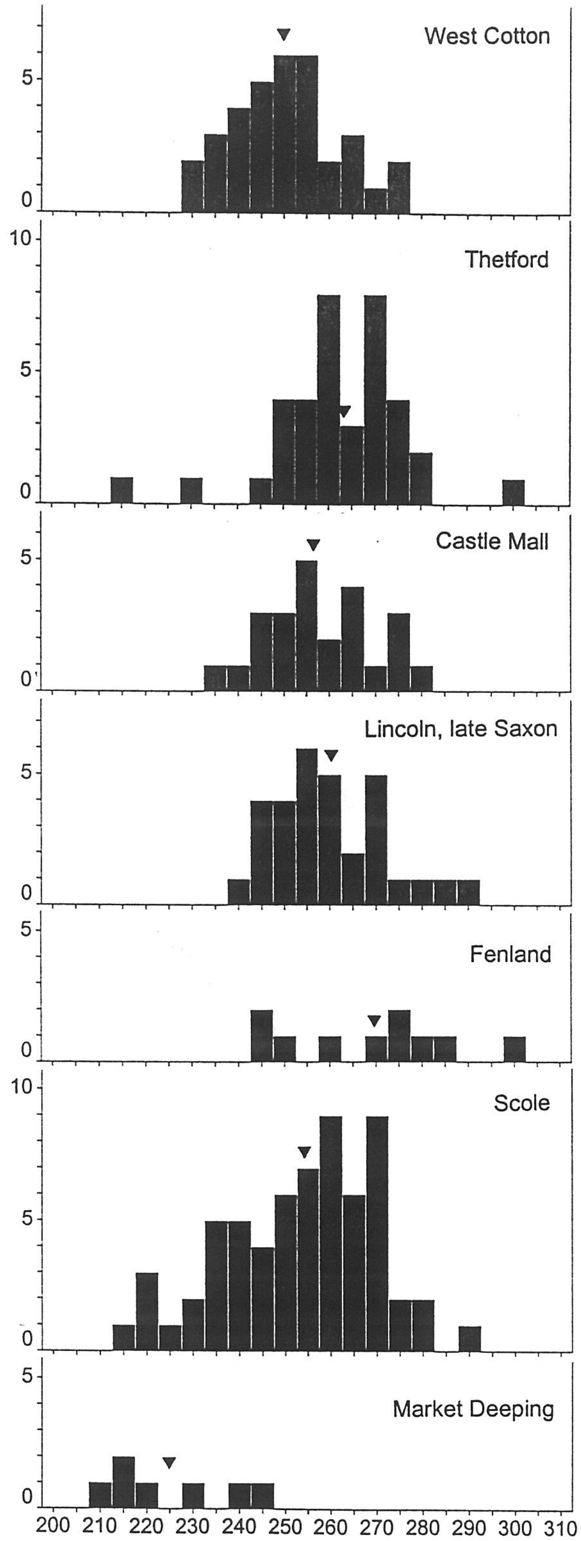

Fig. 9c: Distribution of tibia Bd in sheep/goat (data include sheep and sheep/goat measurements). Comparison between Iron Age-early Medieval sites. References: Market Deeping, Iron Age (Albarella 1997a); Tort Hill (and Norman Cross), 1st-4th c. (Albarella 1997b); Lincoln, 4th c. and late Saxon (Dobney et al. 1996); Scole, 4th c. (Baker 1998); Castle Mall, late 9th-11th c. (Albarella et al. 1997); Thetford, 10th-12th c. (Albarella 1999);West Cotton, AD 1100-1250 (Albarella and Davis 1996).

Table 1: Taxonomic distribution in hand-collected assemblages (NISP); IA Iron Age; R Roman; S Saxon; MS Mid Saxon; LS Late Saxon; EM Early Medieval; SN Saxo-Norman; for WPA, MS-main includes contexts 1-99 and MS-main+ includes contexts over 100. Cattle and sheep distal half metapodials and isolated epiphyses counted as 0.5; pig third and fourth metapodials; and isolated epiphyses counted as 0.5; equid phalanges multiplied by 2; cat and hare metapodials counted as 0.2; partial skeletons in ( ) included as 1 in taxon count; counts in [ ] not included in totals; * Medium Galliformes includes Domestic fowl (Gallus gallus)/Pheasant (Phasianus colchicus)/Guinea fowl (Numida meleagris).

Taxon	WNW IA	Gos 16 R	Gos 16 S	Gos 22 MS	Gos37 MS	TSC23 MS	TSC17 MS	WNW MS	WPA MS-gullies	WPA MS-main	WPA MS-main+	Gos 22 LS	TSC23 LS/EM	TSC17 LS/EM	WNW SN
Mammal															
Cattle (*Bos taurus*)	3	11	4	36.5	41.5	104	53	8	35	1	144	6.5	12	2	15.5
[cf. Cattle					2	3			2		8				0.5]
Pig (*Sus scrofa*)	1		9(39)	2	3	9	9.5				20	1	2		2.5
[cf. Pig											1				]
Sheep (*Ovis aries*)/goat (*Capra hircus*)	4	4	1	13	20.5	111.5	27.5	7	22	13	156.5	11.5	2	1	27
[Sheep (*Ovis aries*)	2	1		3	4	27	10		8	3	45.5	1	1		7]
[cf. Sheep/goat				1	2	3		1			5				]
Equid (*Equus* sp.)		5	2	5	2	2	7		7		9	1			1
[cf. Horse (*Equus caballus*)				1											]
Cat (*Felis domesticus*)				1.2				0.2							
Dog (*Canis familiaris*)/fox (*Vulpes vulpes*)	1														
Hare (*Lepus* sp.)								1							
Mole (*Talpa europaea*)					1										
Mammal total	9	19	16	56.7	68	229.5	96	15.2	64	22	343.5	20	16	3	46
Bird															
Domestic fowl (*Gallus gallus*)											4				
Medium Galliformes*				3		1					2	1			
[cf. Medium Galliformes				1											]
Duck (*Anas* sp.)		2									1	1			
Goose (*Anser* sp.)				1	2	5	1	1			6		6		1
[cf. Goose (*Anser* sp.)						1					2				]
Coot (*Fulica atra*)				1											
Buzzard/cf. Buzzard (*Buteo* sp.)					8										
Buzzard (*Buteo* sp.)/Harrier (*Circus* sp.)					3										
Buzzard (*Buteo* sp.)/Kite (*Milvus* sp.)					1										
Bird total		2		5	14	6	1	1			11	2	6		1
Fish															
Cod (*Gadus morhua*)															1
Haddock (*Melanogrammus aeglefinus*)					2			1							
Gadidae															3
Total	9	21	16	61.7	84	235.5	97	17.2	64	22	354.5	22	22	3	51

Table 2: Taxonomic distribution in sieved assemblages (NISP); IA Iron Age; R Roman; S Saxon; MS Mid Saxon; LS Late Saxon; EM Early Medieval; SN Saxo-Norman; for WPA, MS-main includes contexts 1-99 and MS-main+ includes contexts over 100. Cattle and sheep distal half metapodials and isolated epiphyses counted as 0.5; pig third and fourth metapodials; and isolated epiphyses counted as 0.5; equid phalanges multiplied by 2; partial skeletons in ( ) included as 1 in taxon count; counts in [ ] not included in totals; + present; * Medium Galliformes includes Domestic fowl (Gallus gallus)/Pheasant (Phasianus colchicus)/Guinea fowl (Numida meleagris).

	Fine-sieved assemblages														Dry-sieved assemblages					
	WNW	Gos16	Gos16	Gos22	Gos37	TSC23	TSC17	WNW	WPA	WPA	Gos22	TSC23	TSC17	WNW	Gos22	Gos37	TSC23	TSC17	WPA	WNW
Taxon	IA	R	S	MS	MS	MS	MS	MS	MS-mai	Ms-main	LS	LS/EM	LS/EM	SN	MS	MS	MS	MS	MS-mai	SN
Mammal																				
Cattle (*Bos taurus*)				2						2						1		1	2	
[cf. Cattle																1			1	]
Pig (*Sus scrofa*)			1(9)	1	0															
Sheep (*Ovis aries*)/goat (*Capra hircus*)				6(4)		2	9		4	5.5	4			6	1(16)		2		1	2
[Sheep (*Ovis aries*)							1			0.5									1	2]
[cf. Sheep/goat									1					1						]
Equid (*Equus* sp.)		1		2															1	
Mole (*Talpa europaea*)										1	1									
Common shrew (*Sorex araneus*)			1	1	3						2									
Northern water vole (*Arvicola terrestris*)			3	2						2	20									
Bank vole (*Clethrionomys glareolus*)											1									
Field vole (*Microtus agrestis*)	3	1		19	1			17		4	13			3						
[cf. Field vole (*Microtus agrestis*)										1	4									]
Harvest mouse (*Micromys minutus*)				1																
House mouse (*Mus musculus*)				1																
Wood mouse (*Apodemus sylvaticus*)/Yellow-necked mouse (*A. flavicollis*)				1										3						
[cf. Wood/Yellow-necked mouse														3						]
Human (*Homo sapiens*)															1					
Mammal total	3	2	5	36	4	2	9	17	4	18.5	41			12	4	1	2	1	4	2
Bird																				
Medium Galliformes*													1		5					
[cf. Medium Galliformes															1					]
Duck (*Anas* sp.)																			1	
Goose (*Anser* sp.)															1					
cf. Scolopacidae				1																
cf. Buzzard (*Buteo* sp.)/Kite (*Milvus* sp.)					1															
Bird total				1	1										6				1	
Amphibia			1		1															
Fish																				
Eel (*Anguilla anguilla*)			1				1		17	27	1			83						
[cf. Eel									1	1										]
Herring (*Clupea harengus*)													1							
Herring/sprat (*Sprattus sprattus*)										1			3							
cf. Clupeidae										1										
Smelt (*Osmerus eperlanus*)														1						
Pike (*Esox lucius*)										1										
Cyprinidae										2										
Haddock (*Melanogrammus aeglefinus*)		14			3				6	5				1						
Gadidae										1										
Stickleback (*Gasterosteus aculeatus*)										1										
Flounder (*Platichthys platessa*)		1												1						
cf. Flounder						1														
Plaice (*Pleuronectes platessa*)/flounder		1				1				1				1						
Pleuronectidae		6				6	3		10	11			5	25						
[cf. Pleuronectidae										1										]
Flatfish (Pleuronectiformes)		4				5			8				2							
Fish total	0	26	1	0	3	13	4	0	41	51	1	0	11	112	0	0	0	0	0	0
cf. Crustacea											+									
Total	3	28	7	37	9	15	13	17	45	69.5	42	0	11	124	10	1	2	1	5	2

Table 3: Distribution of cattle, pig and sheep remains in select context types (based on NISP)

	Fine sieved			Dry-sieved			Hand-collected		
	Cattle	Pig	Sheep	Cattle	Pig	Sheep	Cattle	Pig	Sheep
Gos16 Roman									
Cut fill							7		3
Linear feature fill							3		1
Gos16 Saxon									
Ditch fill		10			1		3	7.5	
Linear feature fill							1		
Gos92 Mid Saxon									
Ditch fill	1		1				3		2
Pit fill	1	1	4				31	2	10
Gos22 Late Saxon									
Ditch fill			3				6	1	11.5
Pit fill			1				0.5		
Gos37 Mid Saxon									
Ditch fill							33	2	14.5
Pit fill							6.5	1	5
TSC 17 Mid Saxon									
Ditch							16.5	2	4
Ditch fill			8	1			31.5	4.5	20
Pit fill			1				2	1	2.5
TSC 23 Mid Saxon									
Ditch fill							12		7
Gully fill							2		2
Pit fill							9	3	15
Pond segment fill	1				1		62	5	63.5
WNW Saxo-Norman									
Ditch fill			1				8.5	0	13
Pit fill			5			2		2.5	13
WPA Mid Saxon gullies									
Gully fill							35		22
WPA Mid Saxon main									
Ditch fill	0	0	5.5	1			75.5	4	46
Gully fill							5	2	4
Pit fill	2		4	1		1	64.5	14	117.5

Table 4: Preservation of mammal and bird bones in the Saxon Fenland hand-collected assemblages based on postcranial remains (NISP excluding isolated teeth); ? Possible modification.

site	total	battering	rounding	weathering	carnivore gnawing	burning	modern breakage
Gos16							
Roman	16						1
Saxon	20	1		1			1
Gos22							
Late Saxon	20	6				2	
Mid Saxon	79	9	1	2	2?	1	
Gos 37							
Mid Saxon	75	6		2		1	2
TSC 17							
Late Saxon/Early Medieval						2	1
Mid Saxon	83	4		1?	1	3+1?	22
TSC 23							
Late Saxon/Early Medieval	16	1		2	1		3
Mid Saxon	194	31	2	8		6	40
WNW							
Saxo-Norman	45	5					
Mid Saxon	15	1					1
WPA							
Mid Saxon gullies	54	2		1			9
Mid Saxon-main*	296	18	1	3		20+1?	61

* includes one semi-digested bone

Table 5: Epiphysial fusion in cattle-main phases in all sites (excludes unfused epiphyses except where indicated); WNW main phase is Saxo-Norman; [MS]: Mid Saxon hand-collected and sieved remains combined; specimens in ( ) included in total; Complete or partial skeletons are included separately; Gos 22 sheep/goat skeleton is foetal/neonate; n-neonate; f-foetal; vj-very juvenile; j-juvenile; s-subadult; e-unfused epiphysis. Fused specimens include bones in which fusion is not complete.

Cattle		Gos16		Gos22		Gos37		TSC17		TSC23		WNW		WPA	
Elemen	Age	U	F	U	F	U	F	U	F	U	F	U	F	U	F
sca d	7-10m						1		4		3		1[MS]	1	1
hum d	12-18m					1	1		1	1	1			1	5
rad p	12-18m								2	2j	7		1[MS]	3(1j)	6
p1 p	18m	2j		1e (j)	2	1j		1		5j	3			5	3
p2 p	18m				1				1	4(3j)	2			1	2
mtc d	24-30m		1			2			1	1.5(j)				4	0.5
tib d	24-30m			1e			1		1		1	1		4(1n/j)	3
mtt d	27-36m				0.5	1j	0.5		0.5	3(2j)	2			1.5	6
mtp d	24-36m									1		0.5			0.5
uln p	36-42m			1						1		1[MS]		4	1
cal p	36-42m	1				1	1	1		1		1		3	
fem p	42m		1	1e		1		2		2(1j)	1	1		4(1j)	3
fem d	42-48m					1			1	1j	1			1j	
tib p	42-48m													2(1j)	
rad d	42-48m		1		1							1[MS]		3(1j)	1
hum p	42-48m					1								1	1

Sheep/goat		Gos22		Gos22-skelet	Gos37		TSC17		TSC23		WNW		WPA	
Elemen	Age	U	F	U	U	F	U	F	U	F	U	F	U	F
sca d	6-8m			1	1	1				6	1j		1	1
hum d	10m					1		2	1	3	1		1	5
rad p	10m		1	1		1		4		6	1j	2	3(1j)	6
p1 p	13-16m						1			2		2	5	3
p2 p	13-16m									1			1	2
mtc d	18-24m			4			2		2	1		0.5	4	0.5
tib d	18-24m		1	2	1	1		1	3(1j)	2		4	4(1j/s)	3
mtt d	20-28m						3(1j/s)	2	2	1.5	1		1.5	6
mtp d	18-28m				0.5		0.5							0.5
cal p	24-30m					1			3	1	1		3	
uln p	30m			2					2	3			4	1
rad d	36m			1		1	2	1	1e	2			3(2j)	
fem p	30-36m	1		2		1	1j		1	1			4(1j)	3
fem d	30-36m	1		2						1		1	1	
tib p	36-42m			2				1	1j	1			2(1j/s)	
hum p	36-42m						1			1	2(1j)	1	1	1

Pig		Gos16	Gos16 skelet	Gos 37	TSC17		TSC23		WNW	WPA	
Elemen	Age	U	U	U	U	F	U	F	U	U	F
sca d	12m	1j	1			2		1			1
hum d	12m		2					1			
rad p	12m	1	2								1
p1 p	24m	3j	2								
p2 p	12m	1j	1								1
mtc d	24m		2								
tib d	24m		2	1	1		1			1	
mtt d	27m		2			0.5			0.5		
mtp d	24-27m	0.5j									
cal p	24-30m	1j(e)	1		1j					1	
uln p	36-42m	1j	2					1		1j	1
rad d	42m	1j	2								
fem p	42m		1				1			1	
fem d	42m		1								
tib p	42m		2		1						
hum p	42m	1j	1								

Table 6: Tooth wear in sheep/goat (after Payne 1973) and cattle (Grant 1982) at Walpole St. Andrew and Terrington St. Clement; data pooled for TSC 17 and TSC 23 and for WPA gully and main phase; Cr-visible in crypt; Er-erupting through bone; Half-half erupted; ind-indeterminate.

Sheep/goat wear stage	Cr	Er	Half	0	1	1_2	2	3	4	5	6	6_7	7	8	8_9	9	10	11	12	13	14	15	16	17	19	20	ind	Total
Terrington St. Clement (TSC 23 and TSC 17)																												
dP4																		1			3					2		6
LP4													1	2	1	1			1		3							9
LM1										1				2		8			2		1	1						15
LM2	1								1	1		1	3	1		8		1										17
LM1/2				1									1														1	3
LM3		1	1	1					1	2	1		2					3									1	13
Walpole St. Andrew (WPA 22145) Middle Saxon main phase and gully phase																												
dP4										1										2	8		2	2	4		3	22
LP4				2							2		2	1	1	2		2	4		1							17
LM1							2			2	1			2		23	1	1	3			1						36
LM2	1								1	2	5		6	3		12	3											33
LM1/2		1		4		1	1				2			2		2											1	14
LM3	4	3		2					1	3	2		2	3		1	2	8										31

Cattle wear stage	Cr	Er	Half	a	a_b	b	c	d	e	e_f	f	g	h	h/j	i	j	k	l	m	ind	Total
Terrington St. Clement (TSC 23 and TSC 17)																					
LdP4																3	1				4
LP4									1		2										3
LM1											1	1					2				4
LM2	2										1						3				6
LM1/2					2	1	1	2			2	1	1	1			1			1	13
LM3				1							1	2	2								6
Walpole St. Andrew (WPA 22145) Middle Saxon main phase and gully phase																					
dP4				1		1				1			2			3			1		9
LP4							1														1
LM1				1													1				2
LM2			1					1									1				3
LM1/2						1							1				1				3
LM3	1	1				1		2													5

Table 7: Walpole St. Andrew (WPA 22145): Sheep/goat kill-off pattern (after Payne 1988); Middle Saxon - main phase (data include 2 dP4s and 2 M3s

	N		% killed	Cumulative %	Age
0-2 years	21 dP4		58.3	58.3	by c. 2 years
>2 years	15 LP4 (excluding unworn teeth)		41.7		
%>2 years subdivided based on LM3 wear					
2-3 years	1 LM3	2A-4A	60.2	1.9	c. 3 years
3-5 years	13 LM3	5_10	84.8	24.6	c. 5 years
6-10 years	8 LM3	11G	100	15.2	c. 10 years
>10 years	0 LM3	>11G			
Total	22 LM3 at wear stage 2A/+				

Table 8: Incidence of asymmetry in cattle metapodials (distal end with condyles or epiphysial surface present); * includes epiphysis in the process of fusing; ** includes one specimen in which fusion is almost complete (fusion line visible)

Site	Period	Metacarpal-fused		Metacarpal-unfused		Metatarsal-fused		Metatarsal-unfused	
		Total	Assymetry	Total	Assymetry	Total	Assymetry	Total	Assymetry
Gos22	Mid-Saxon					1	1		
Gos22	Unstratified					1	1		
Gos37	Mid-Saxon			2				1	
Gos16	Roman	1*							
TSC 17	Mid-Saxon	1				1			
TSC 23	Mid-Saxon			1		1		3	
TSC 23	Late Saxon					1	1		
WNW	Iron Age					1	1		
WPA	Mid-Saxon			3	1	6	3**	1	1

Table 9: Occurrence and pattern of overcrowding in sheep/goat mandibles (after Levitan 1984); * total number of mandibles in which relevant teeth are present; ** total count is total number of mandibles with or without P2 or P2 alveolus; dP-deciduous premolar; P-permanent premolar; M molar

	Gos37 Mid Saxon		WNW Saxo-Norman			TSC 17 Mid Saxon		TSC17 Late Saxon/ Early Medieval		TSC 23 Mid Saxon			WPA Mid Saxon			Grand total		
	N	Total*	N	Total*	%	N	Total*	N	Total*	N	Total*	%	N	Total*	%	N	Total	%
Overcrowding																		
Interdental attrition	2	3	3	6	50	2	2	1	1	14	20	70	26	47	55	48	79	61
Uneven crown height	2	3	3	6	50	1	2	1	1	13	20	65	26	47	55	46	79	58
Tooth displacement										1	20	5	1	47	2.1	2	67	3
Congenital traits																		
Absence of P2**		2		3			2	1	1		13			15		1	36	3
Pattern of interdental attrition																		
dP2 aboral		1				1	1			1	1		1	3		3	6	50
dP3 oral		1					2				3		1	8		1	14	7
dP3 aboral		1				2	2			2	3		6	8		10	14	71
dP4 oral		1					2				4		1	19		1	26	4
dP4 aboral		1					2			3	4		11	19		14	26	54
P2 aboral		0		3			2		0		1			4		0	6	0
P3 oral		2							1		5			12		0	20	0
P3 aboral	1	2						1	1	4	5		2	12		8	20	40
P4 oral		2							1		9			15		0	27	0
P4 aboral		2						1	1	4	9		1	15		6	27	22
M1 oral		3				1	1			7	15		7	35		15	54	28
M1 aboral		3						1	1	8	15		3	35		12	54	22
M2 oral		2						0	1	1	16			33		1	52	2
M2 aboral	1	2						1	1	3	16		2	33		7	52	13
M3 oral	1	2							1	1	11		1	15		3	29	10

Table 10: Comparison of measurements of medium-size raptors (data from Otto 1981, Schmidt-Burger 1982)

Taxon	Meas.	Sex	n	Min	Max	Mean
Tarsometatarsus						
Gos37 (018)	Bd		1	11.4		
Gos37 (013)	Bd		1	13		
Milvus milvus	Bd	m	4	12.8	13.7	13.18
Milvus milvus	Bd	?	5	13	14.2	13.62
Buteo buteo	Bd	m	33	12.6	14.5	13.1
Buteo buteo	Bd	f	27	13	14.5	13.93
Buteo lagopus	Bd	m	3	12.6	13.1	12.83
Buteo lagopus	Bd	f	2	14.2	15	14.6
Circus aeruginosus	**Bd**	**m**	**7**	**10.9**	**11.7**	**11.36**
Circus aeruginosus	Bd	f	5	12.3	13	12.76
Circus cyaneus	Bd	m	3	8.6	8.8	8.7
Circus cyaneus	Bd	f	11	10	10.6	10.24
Tibiotarsus						
Gos37 (018	Bd		1	10		
Gos37 (013)	Bd		1	12.1		
Milvus milvus	Bd	m	4	11.2	11.7	11.45
Milvus milvus	Bd	f	5	11.3	12.3	11.78
Milvis migrans	Bd	f	2	10.9	11.3	
Milvus migrans	Bd	?	2	11	11.5	
Buteo buteo	**Bd**	**m**	**31**	**11**	**13.2**	**11.85**
Buteo buteo	Bd	f	23	12.2	13.1	12.63
Buteo lagopus	Bd	m	3	11.8	12.3	12.13
Buteo lagopus	Bd	f	2	13.2	13.9	13.55
Circus aeruginosus	**Bd**	**m**	**9**	**9.3**	**10.1**	**9.72**
Circus aeruginosus	Bd	f	7	10.2	11	10.71
Circus cyaneus	Bd	m	5	8	8.4	8.08
Circus cyaneus	Bd	f	18	9	9.6	9.29
Ulna						
Gos37 (020)	Bp		1	11.1		
Milvus milvus	Bp		2	13.4	13.6	
Milvus milvus	Bp		2	13.4	14.5	
Milvis migrans	Bp	m	2	12.3	12.9	
Milvus migrans	Bp	f	4	12.7	13.5	13.15
Buteo buteo	**Bp**	**m**	**19**	**11**	**12.5**	**11.63**
Buteo buteo	Bp	f	23	11.3	12.5	11.97
Buteo lagopus	Bp	m	3	11.7	12.5	12.2
Buteo lagopus	Bp	f	4	12.8	13.2	13.03
Circus aeruginosus	**Bp**	**m**	**6**	**10.3**	**11.1**	**10.77**
Circus aeruginosus	Bp	f	8	11.2	11.8	11.53
Circus cyaneus	Bp	m	10	9.3	9.6	9.42
Circus cyaneus	Bp	f	18	10	10.9	10.45

Table 11: Cattle measurements from the Mid and Late Saxon Fenland sites (FMP) compared with Iron Age-early Medieval data; measurements in tenths of a millimetre; n.p. Coefficient of variation (CV) or standard deviation (SD) not published; Data from Albarella 1997, 1999; Albarella and Davis 1994; Baker 1998; Crabtree 1989; Davis 1992, 1997a, 1997b; Castle Mall (1)-Saxon; LS-late Saxon; LR-late Roman; FMP data in Appendix 2.

Site		meas.	n	mean	min	max	CV
West Cotton	1100-1250	M3 W (Wa)	22	155	138	175	6.4
Thetford	10th-12th c.	M3 W	38	150	133	172	6.1
Burystead and Langham Rd	late Saxon	M3 W	35	151	135	162	5.122
FMP	**mid Saxon**	**M3 W**	**3**	**158**	**155**	**162**	
Scole	4th c.	M3 W	56	152	132	174	6.6
Redlands Farm	Roman	M3 W (Wa)	7	163	151	183	6.9
Tort Hill and Norman Cross	1st-4th c.	M3 W	19	158	144	168	4.141
Market Deeping	Iron Age	M3 W	6	152	142	161	5.5
West Cotton	1100-1250	hum HTC	23	291	247	364	9.6
Thetford	10th-12th c.	hum HTC	22	297	239	371	9.5
Castle Mall	late Saxon	hum HTC	11	305	278	350	10.62
Lincoln	late Saxon	hum HTC	5	291	274	321	6.475
FMP	**mid Saxon**	**hum HTC**	**5**	**302**	**263**	**349**	**10.4**
Lincoln	4th c.	hum HTC	7	298	278	316	5.323
Scole	4th c.	hum HTC	17	300	262	338	8.345
Torthill and Norman Cross	1st-4th c.	hum HTC	8	317	279	364	12.66
Cowbit Wash	pre Roman Iron Age	hum HTC	3	275	268	288	
Market Deeping	Iron Age	hum HTC	7	286	274	311	5.3
West Cotton	1100-1250	tib Bd	35	563	465	655	8.2
Thetford	10th-12th c.	tib Bd	19	543	494	606	6.5
Castle Mall	late Saxon	tib Bd	35	559	458	645	10.41
Lincoln	late Saxon	tib Bd	7	545	495	633	10.7
FMP	**mid Saxon**	**tib Bd**	**3**	**597**	**559**	**662**	
West Stow	7th c.	tib Bd	6	573	520	685	10.5
West Stow	6th c.	tib Bd	37	560	505	655	7.7
West Stow	5th c.	tib Bd	23	559	508	674	7.2
Lincoln	4th c.	tib Bd	105	561	408	677	7.283
Scole	4th c.	tib Bd	11	585	511	657	7.4
West Stow	Iron Age	tib Bd	9	573	508	654	9.5
Market Deeping	Iron Age	tib Bd	5	537	517	556	2.8
West Cotton	1100-1250	ast GLl	34	599	530	654	4.8
Thetford	10th-12th c.	ast GLl	29	599	562	666	4.4
Castle Mall	late Saxon	ast GLl	31	594	522	685	6.074
Lincoln	late Saxon	ast GLl	18	595	549	631	4.981
Burystead and Langham Rd.	early-late Saxon	ast GLl	15	599	549	680	5.786
FMP	**mid-late Saxon**	**ast GLl**	**6**	**631**	**612**	**672**	**3.3**
Hamwic	Saxon	ast GLl	167	609	492	715	n.p.
West Stow	7th c.	ast GLl	8	607	561	703	7.2
West Stow	6th c.	ast GLl	61	601	536	672	4.5
West Stow	5th c.	ast GLl	27	611	542	658	5.2
Lincoln	4th c.	ast GLl	154	615	530	708	5.215
Scole	4th c.	ast GLl	33	640	585	726	5.2
Redlands Farm	Roman	ast GLl	4	686	619	723	6.7
Torthill and Norman Cross	1st-4th c.	ast GLl	8	603	550	644	4.241
West Stow	Iron Age	ast GLl	8	580	539	613	5.2
Market Deeping	Iron Age	ast GLl	7	594	550	635	4.5
West Cotton	1100-1250	mtt B at F	16	452	381	522	8.4
Thetford	10th-12th c.	mtt B at F	28	471	396	565	9.3
FMP	**mid Saxon**	**mtt B at F**	**4**	**487**	**465**	**534**	**6.6**
Scole	4th c.	mtt B at F	42	525	468	612	8

Table 12: Sheep measurements from the Saxon Fenland sites (FMP) compared with Iron Age-early Medieval data; Sheep and sheep/goat measurements included; measurements in tenths of a millimetre; n.p. Coefficient of variation (CV) or standard deviation (SD) not published; Data from Albarella 1997, 1999; Albarella and Davis 1994; Baker 1998; Crabtree 1989; Davis 1997a, 1997b; LS-late Saxon; LR-late Roman; FMP data in Appendix 2; Castle Mall (1)-Saxon;

site		meas.	n	mean	min	max	CV
West Cotton	1100-1250	dp4 W	30	64	59	69	3.5
Thetford	10th-12th c.	dp4 W	8	64	60	68	4
FMP	**mid-late Saxon**	**dp4 W**	**24**	**64**	**51**	**70**	**6.6**
Scole	late Roman	dp4 W	24	64	56	72	5.9
Market Deeping	Iron Age	dp4 W	24	60	55	69	6.3
West Cotton	1100-1250	M3 W	72	77	65	87	6
Thetford	10th-12th c.	M3 W	29	84	77	95	4.3
Castle Mall	Saxon	M3W	29	81	72	92	5.3
FMP	**mid Saxon**	**M3 W**	**6**	**75.5**	**64**	**86**	**9**
Scole	late Roman	M3 W	31	76	64	84	6.3
Tort Hill and Norman Cross	1st-4th c.	M3 W	26	82	71	94	5.8
Market Deeping	Iron Age	M3 W	10	78	74	88	5.2
West Cotton	1100-1250	hum BT	15	273	255	307	5.6
Lincoln	late Saxon	hum BT	10	285	261	304	6
Thetford	10th-12th c.	hum BT	22	281	225	310	6.8
FMP	**mid-late Saxon**	**hum BT**	**9**	**283**	**261**	**319**	**6.7**
Lincoln	4th c.	hum BT	10	271	252	300	5.5
Scole	late Roman	hum BT	14	271	231	311	7.4
Tort Hill and Norman Cross	2nd-4th c.	hum BT	6	252.5	225	271	6.4
West Cotton	1100-1250	hum HTC	21	136	122	153	5.4
Thetford	10th-12th c.	hum HTC	24	141	130	155	5.5
Lincoln	late Saxon		10	142	125	151	6
FMP	**mid-late Saxon**	**hum HTC**	**10**	**146**	**132**	**166**	**7.6**
Scole	late Roman	hum HTC	16	136	115	155	7.8
Lincoln	4th c.	hum HTC	9	136	122	151	6.6
Tort Hill and Norman Cross	2nd-4th c.	hum HTC	6	125	114	131	4.9
Market Deeping	Iron Age	hum HTC	3	124	117	136	
FMP	**mid Saxon**	**rad Bd**	**5**	**302**	**270**	**313**	**6**
West Stow	Saxon	rad Bd	44	280	239	323	6.4
Scole	late Roman	rad Bd	10	275	244	301	7.3
West Cotton	1100-1250	tib Bd	34	249	229	273	4.4
Thetford	10th-12th c.	tib Bd	34	262	217	300	5.7
Lincoln	late saxon	tib Bd	31	260	238	289	4.8
FMP	**mid-late Saxon**	**tib Bd**	**10**	**269**	**246**	**302**	**6.7**
Castle Mall	Saxon	tib Bd	24	257	234	279	4.7
West Stow	Saxon	tib Bd	5	249	238	270	6
Scole	late Roman	tib Bd	63	254	215	289	6.7
Lincoln	4th c.	tib Bd	54	256	200	288	7
Redlands Farm	2nd-5th c.	tib Bd	4	258	242	273	5.1
Tort Hill and Norman Cross	1st-4th c.	tib Bd	11	254	223	284	9.5
West Stow	Iron Age	tib Bd	13	256	179	279	10
Market Deeping	Iron Age	tib Bd	7	225	212	243	5.5
West Cotton	1250-1400	ast GL	8	268	253	280	3.8
West Cotton	1100-1250	ast GL	3	269	257	276	
Thetford	10th-12th c.	ast GL	3	277	269	290	
FMP	**mid-late Saxon**	**ast GL**	**3**	**281**	**269**	**291**	
Hamwic	Saxon	ast GL	267	259	218	300	n.p.
West Stow	late 6th-7th c.	ast GL	5	279	266	298	4.3
West Stow	6th c.	ast GL	70	281	248	316	5.7
West Stow	5th c.	ast GL	25	280	260	299	5
Scole	late Roman	ast GL	19	281	237	336	8.5
Tort Hill and Norman Cross	1st-4th c.	ast GL	3	277	237	329	
West Stow	Iron Age	ast GL	3	269	238	319	

Table 13: Results of statistical tests on measurements from the Saxon Fenland sites (Kolmogorov-Smirnov test); Measurements in tenths of a millimetre; * significant at the 95% confidence interval; ** significant at the 99% confidence interval; Sheep and sheep/goat values included; goat bones were not identified in the comparative sites; FMP data in Appendix 2; Castle Mall (1)-Saxon; LS-late Saxon; LR-late Roman; Data from Albarella 1997, 1999; Albarella and Davis 1994; Baker 1998; Davis 1992; Dobney et al. 1996.

Measurement	Site 1	Mean1	N1	Site 2	Mean2	N2	Kolmogorov-Smirnov Probability	Z-value	Significance
Cattle									
Astragalus GLl	FMP	631	6	West Cotton	599	34	0.019	1.528	*
	FMP	631	6	Thetford	599	29	0.018	1.538	*
	FMP	631	6	Castle Mall (1)	594	31	0.02	1.519	*
	FMP	631	6	Burystead LS	591	11	0.003	1.656	**
	FMP	631	6	Lincoln LS	595	18	0.037	1.414	*
	FMP	631	6	Lincoln 4th c.	615	154	0.129	1.17	N
	FMP	631	6	Scole LR	640	33	0.363	0.922	N
	FMP	631	6	Market Deeping	594	7	0.074	1.284	N
Sheep									
LM3 W	FMP	75.5	6	West Cotton	82	64	0.015	1.561	*
	FMP	75.5	6	Thetford	84	29	1.781	0.004	**
	FMP	75.5	6	Castle Mall	81	29	0.04	1.397	*
	FMP	75.5	6	Scole LR	76	31	0.918	0.554	N
	FMP	75.5	6	Market Deeping	78	10	0.694	0.71	N
Tibia Bd	FMP	269	10	West Cotton	250	34	0.035	1.423	*
	FMP	269	10	Thetford	263	37	0.197	1.077	N
	FMP	269	10	Castle Mall	257	24	0.141	1.151	N
	FMP	269	10	Lincoln LS	260	31	0.109	1.206	N
	FMP	269	10	Lincoln 4th c.	253	54	0.18	1.097	N
	FMP	269	10	Scole LR	254	63	0.088	1.25	N
	FMP	269	10	Market Deeping	225	7	0.001	2.029	**

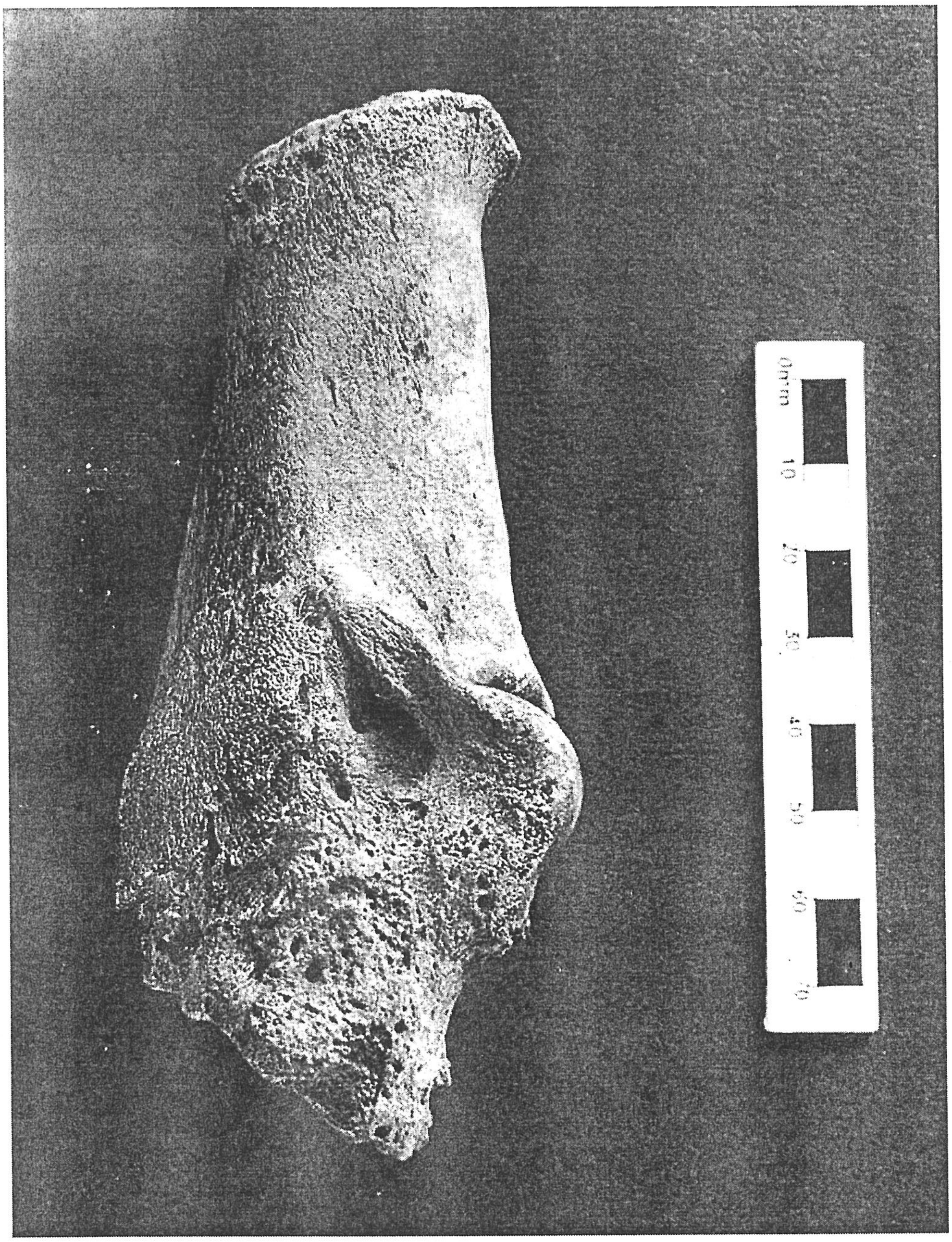

Plate 1a: Subadult cattle calcaneum with extra bone growth on lateral and posterior sides of articulation, from Third Drove, Gosberton (Gos16), Context 249. Lateral view.

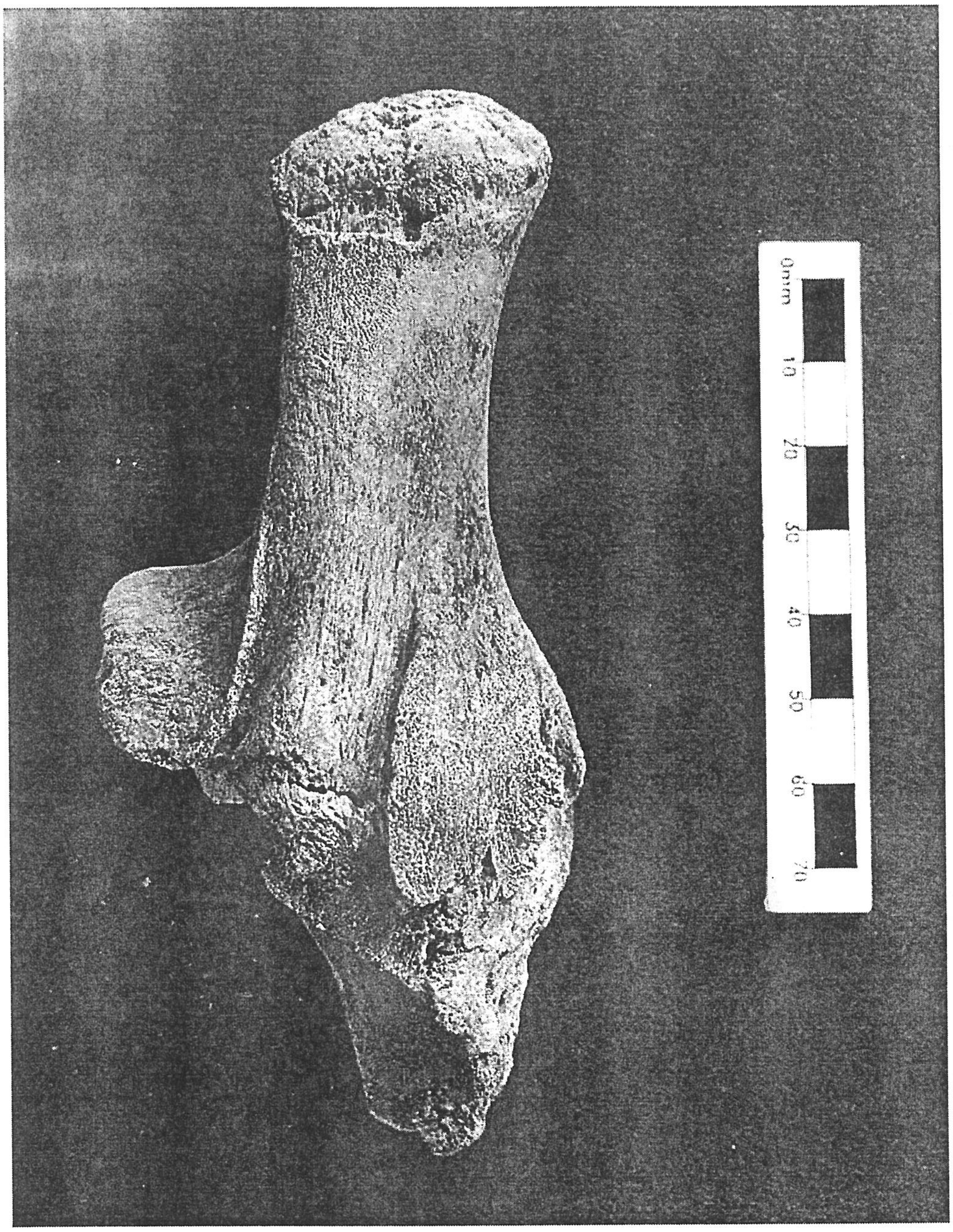

Plate 1b: Subadult cattle calcaneum with extra bone growth on lateral and posterior sides of articulation, from Third Drove, Gosberton (Gos16), Context 249. Posterior view.

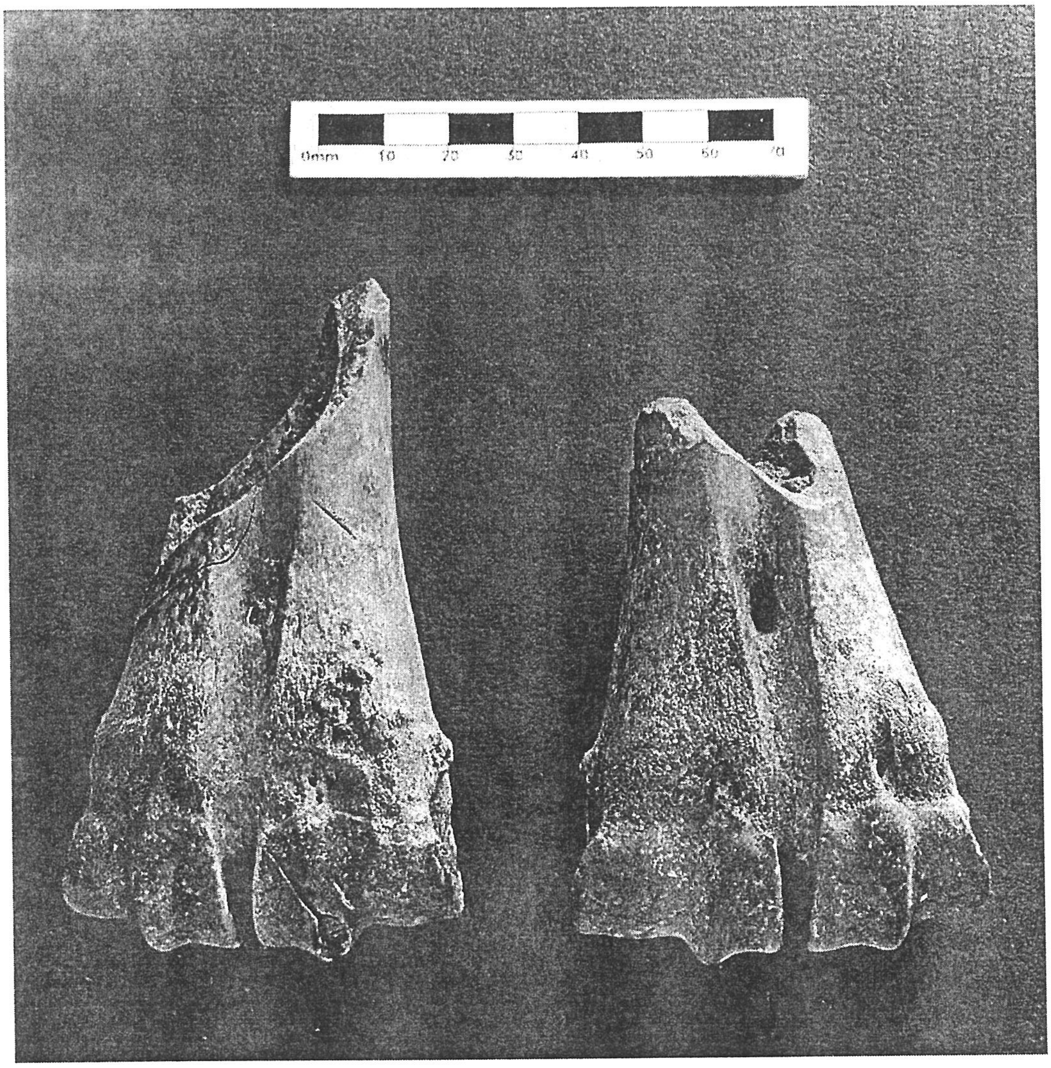

Plate 2: Cattle metatarsals with asymetrical condyles from Chopdike Drove (Gos 22): Right: Context 496, Sample 53; Left: Context 92 (unstratified)

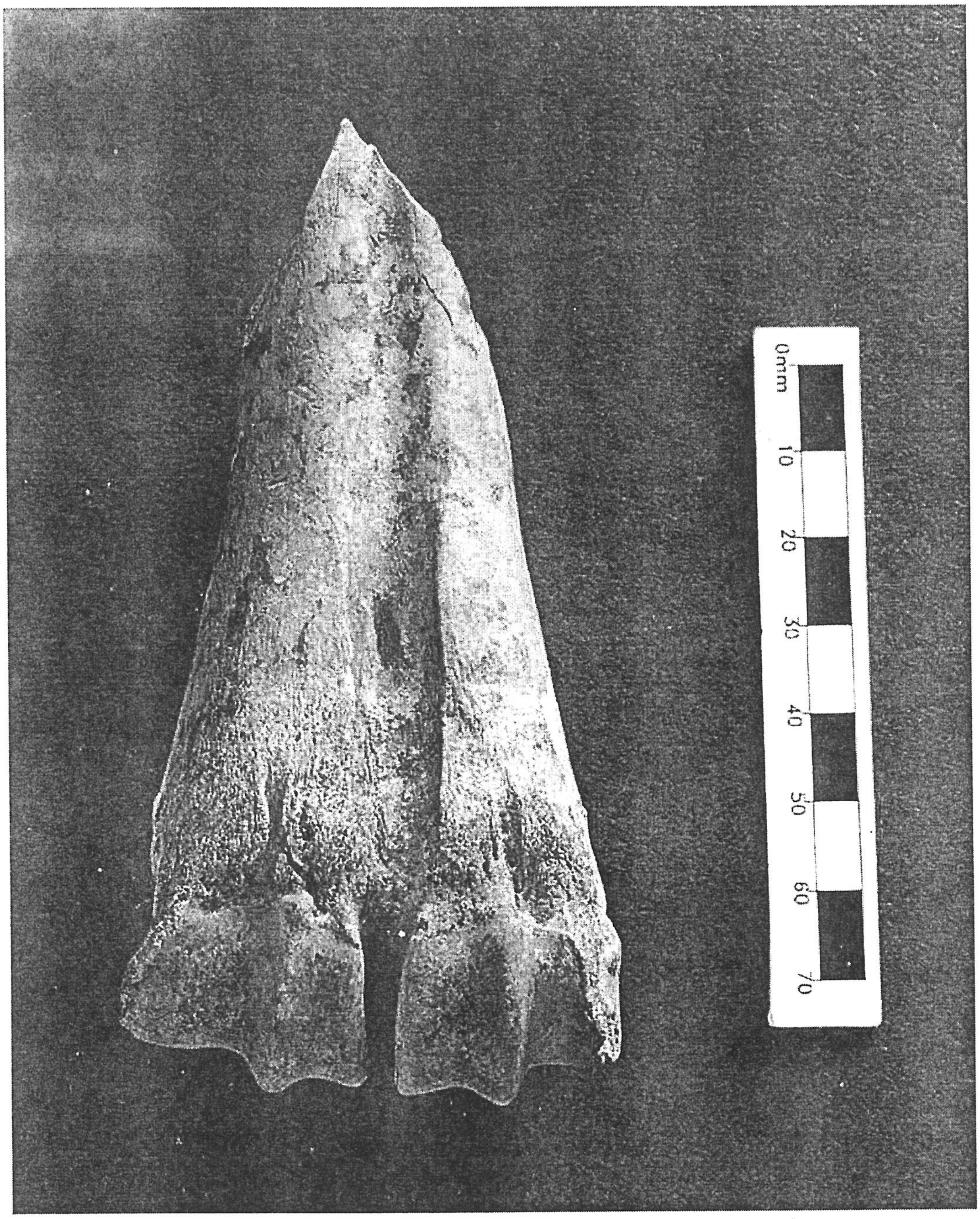

Plate 3: Cattle metatarsal with asymetrical condyles from Ingleborough, West Walton (WNW 18943), Context 39.

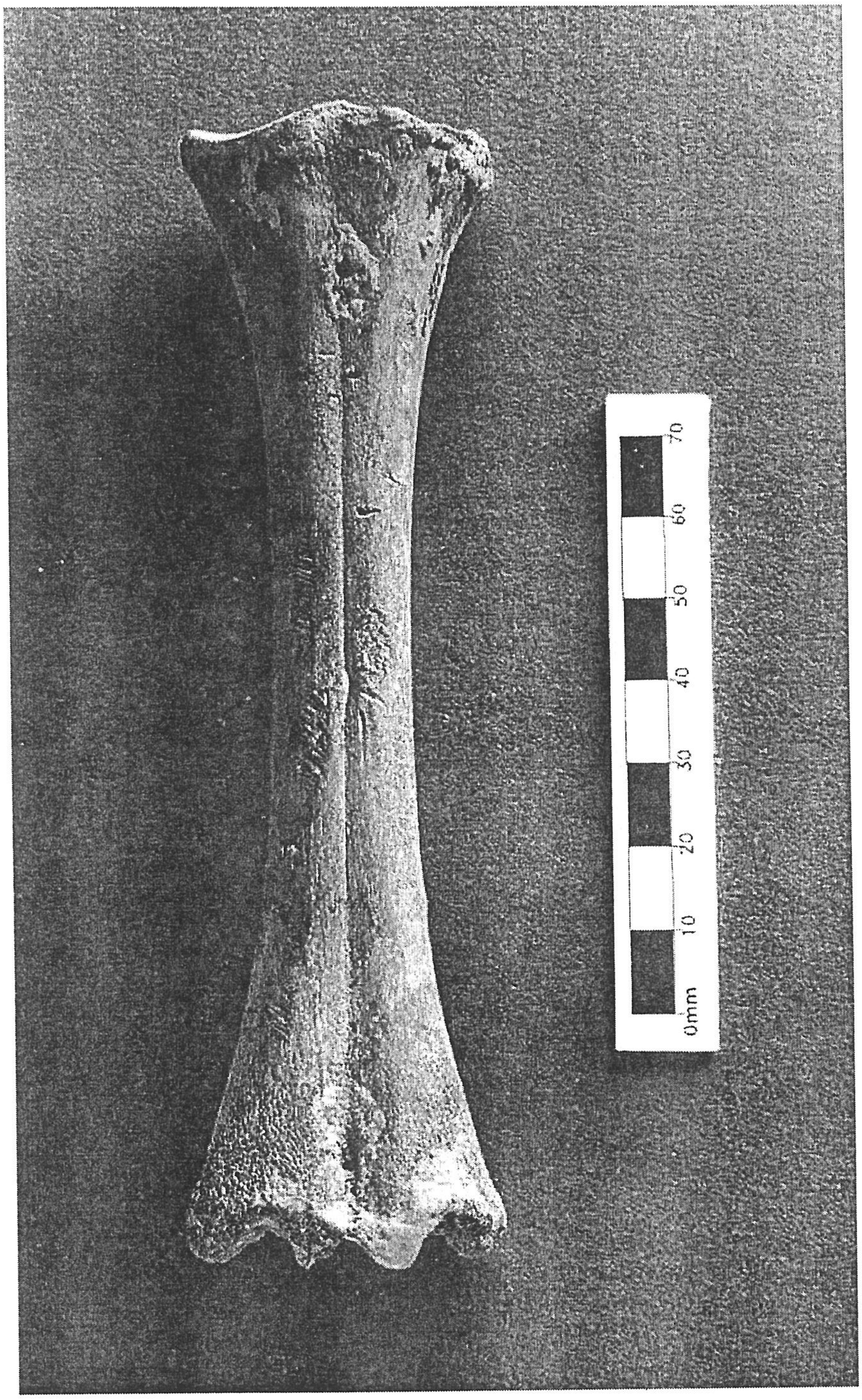

Plate 4: Juvenile cattle metatarsal with splayed shaft, from Hay Green, Terrington St. Clement (TSC 23), Context 103.

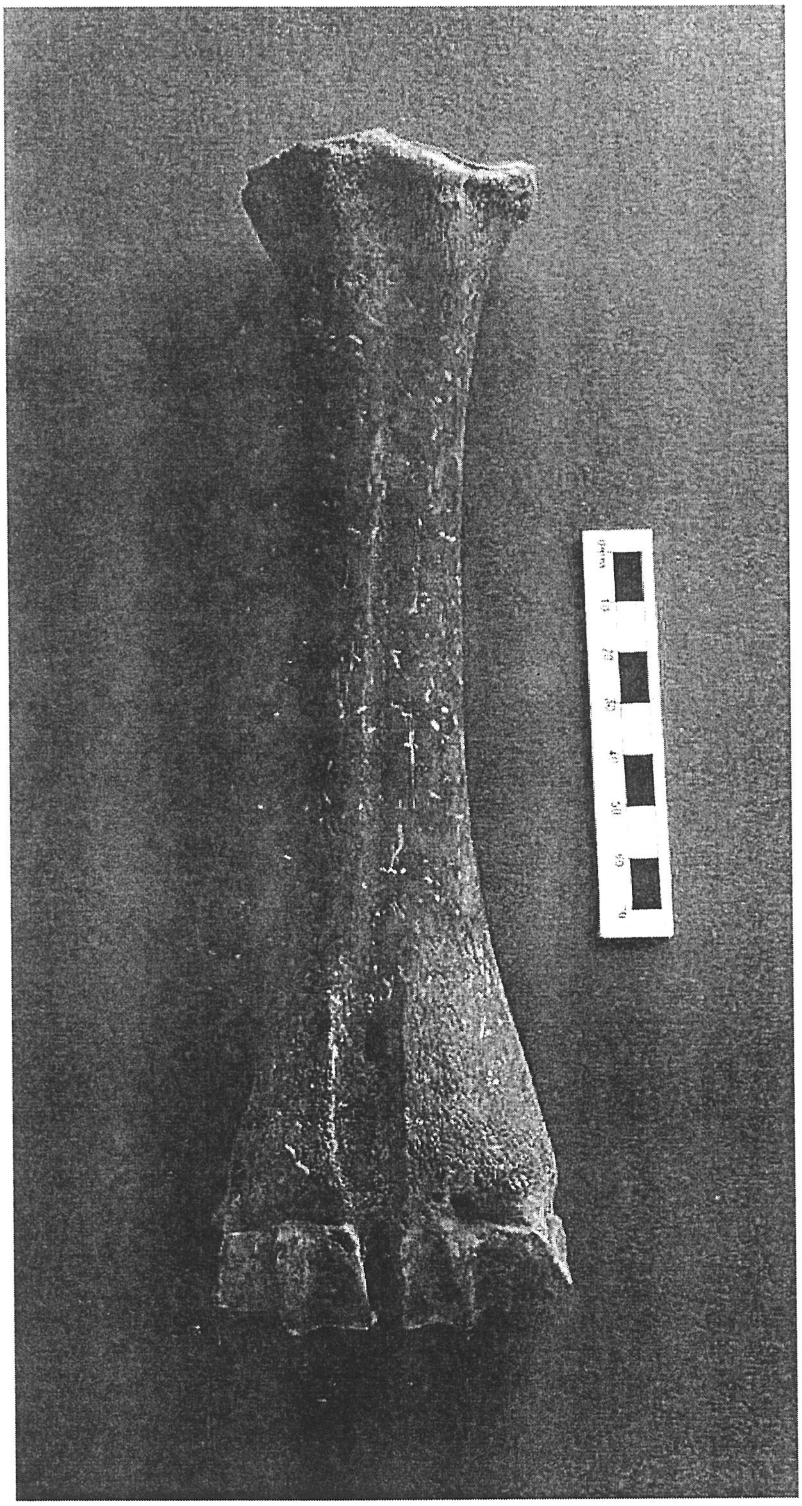

Plate 5: Cattle metatarsal with asymetrical condyles from Hay Green, Terrington St. Clement (TSC 23), Context 40.

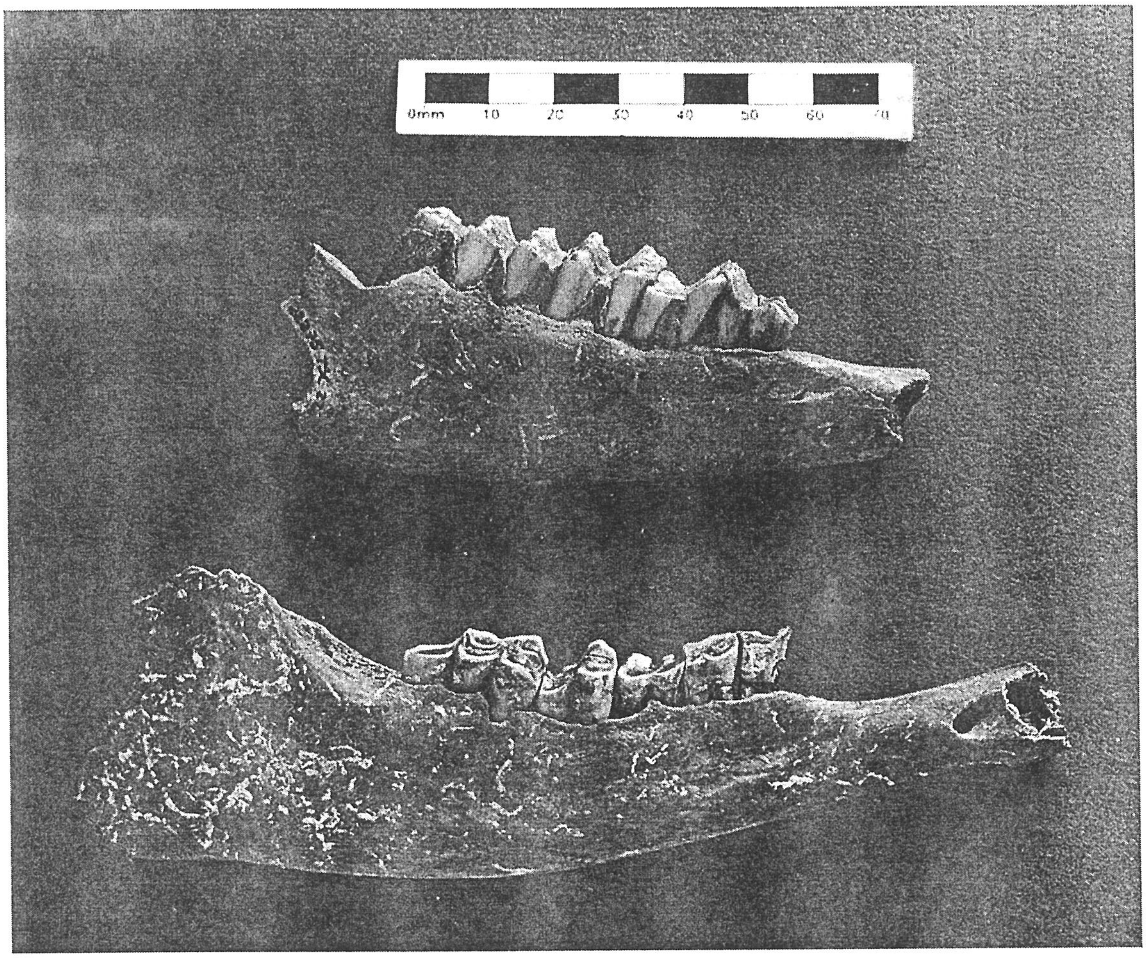

Plate 6: Sheep/goat mandible with interdental attrition and malocclusion, from Hay Green, Terrington St. Clement (TSC 23). Top: Context 22. Bottom: Context 037.

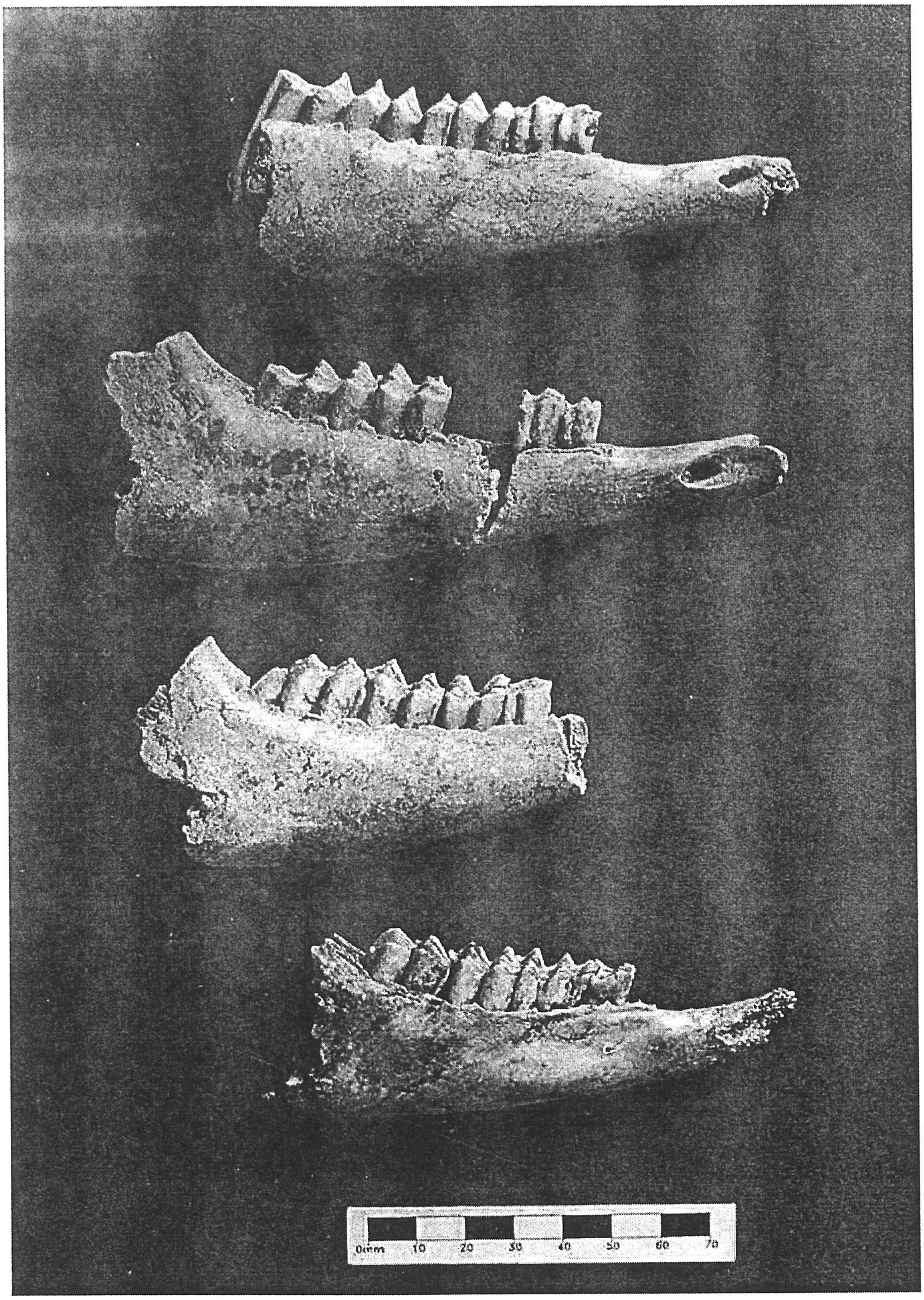

Plate 7 (a-d from top to bottom): Sheep/goat mandibles with interdental attrition and malocclusion from Walpole St. Andrew (buccal view): a- Context 11; b-Context 32; c-Context 15; d-Context 6.

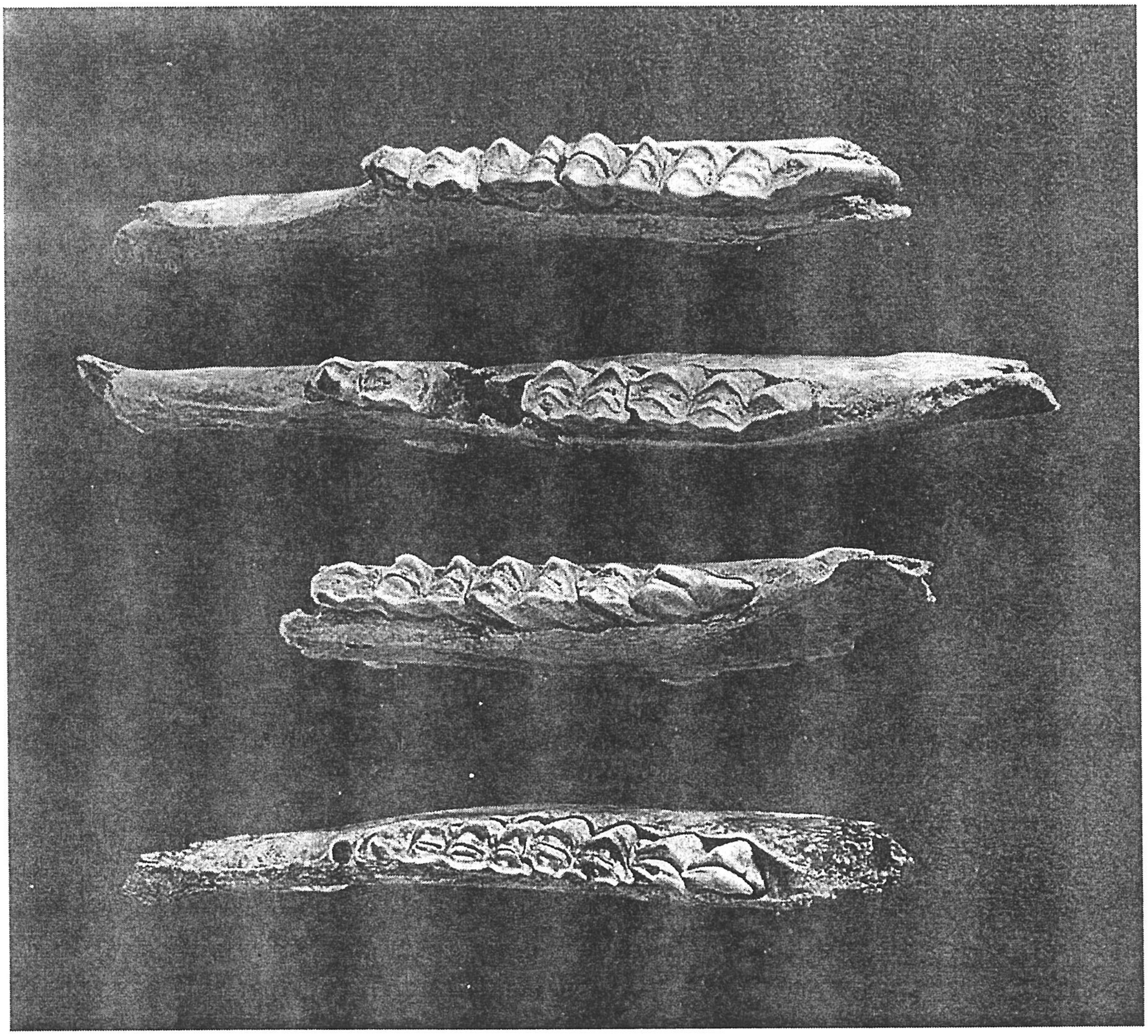

Plate 8: (a-d from top to bottom): Sheep/goat mandibles with interdental attrition and malocclusion from Walpole St. Andrew (occlusal view): a- Context 11; b-Context 32; c-Context 15; d-Context 6.

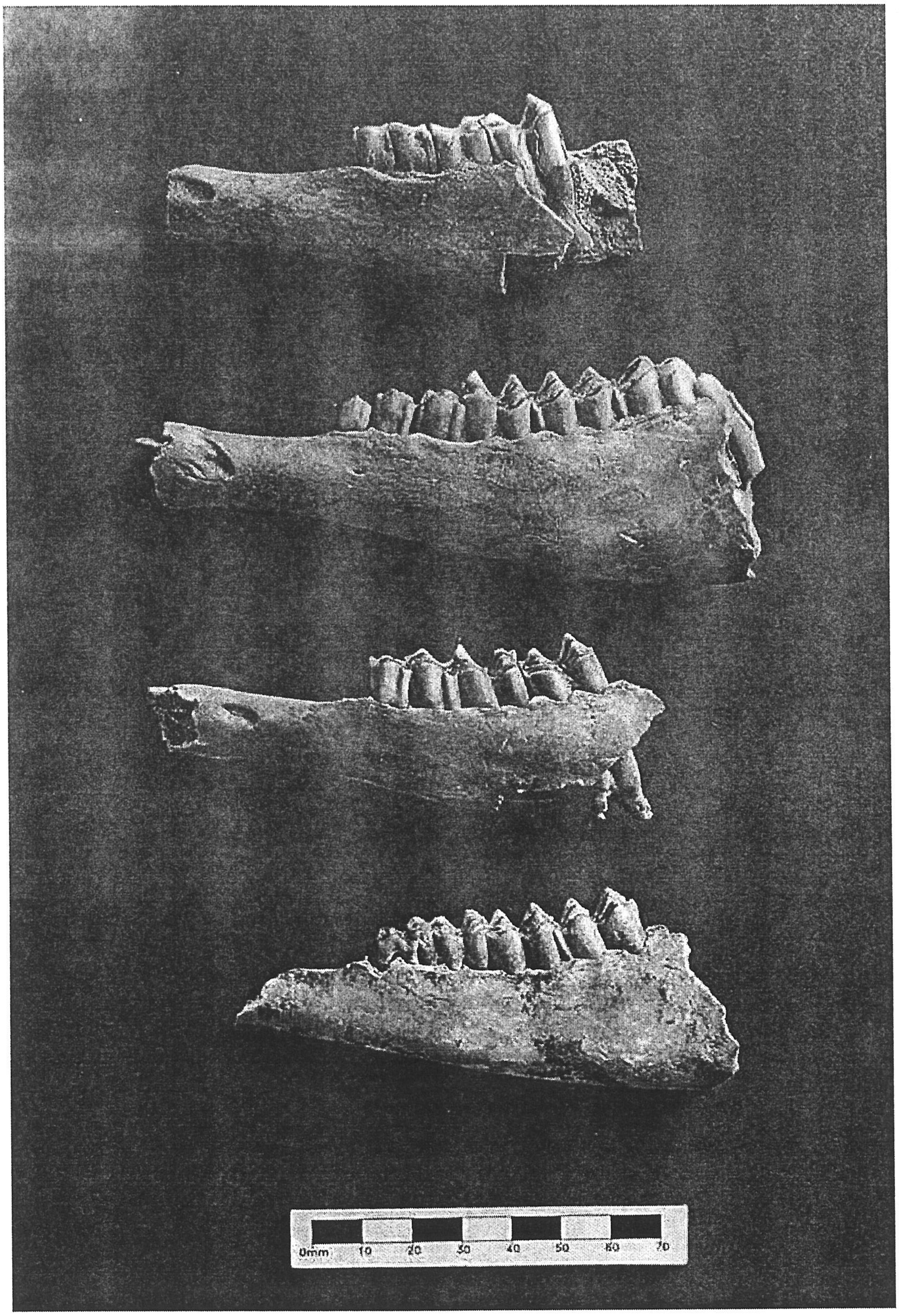

Plate 9: (a-d from top to bottom): Sheep/goat mandibles with interdental attrition and malocclusion from Walpole St. Andrew (buccal view): a- Context 5; b-Context 2 ; c-Context 17 ; d-Context 7.

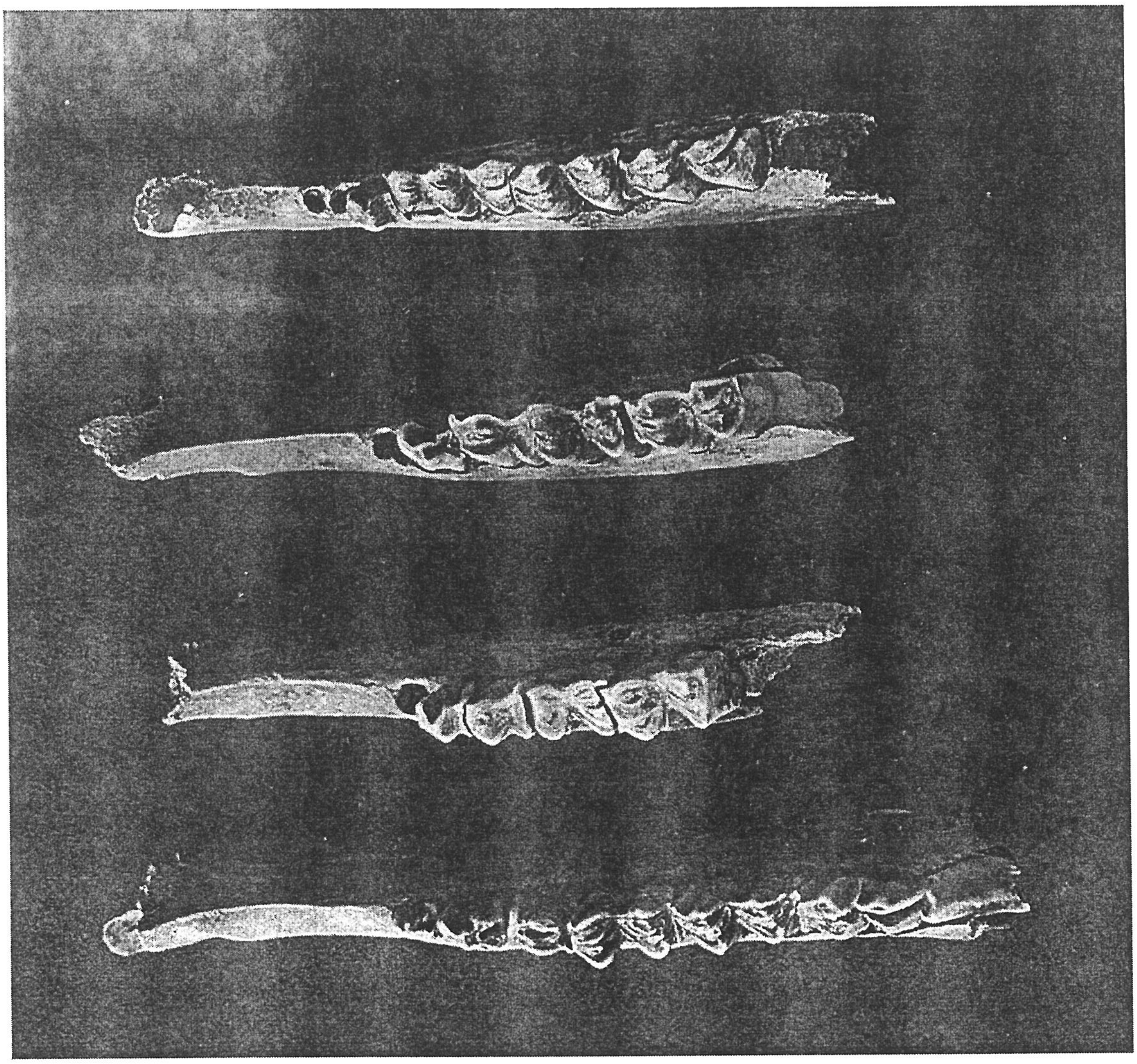

Plate 10: (a-d from top to bottom): Sheep/goat mandibles with interdental attrition and malocclusion from Walpole St. Andrew (occlusal view): a- Context 17; b-Context 7; c-Context 5; d-Context 2.

Plate 11: Subadult and adult cattle metatarsals with assymetrical condyles and/or epiphysial surface from Walpole St. Andrew (Context 127)

Appendix abbreviations

Period
IA-ns: Iron Age, natural silts
R: Roman
MS: mid Saxon
Ms-m: mid Saxon- main phase
Ms-g: mid Saxon-gullies
LS: Late Saxon
SN: Saxo-Norman
LS/EM: Late Saxon/Early Medieval

Cxt: Context

#: catalogue number of cattle and sheep mandibles

Rec: recovery method. hc: hand-collected; s: sieved; fs: fine-sieved

Taxa
bos: cattle
ovc: sheep/goat
ova: sheep
oa?: cf. sheep
oa??: cf. cf.. sheep
sus: pig
equ: equid
eqc?: cf. horse
fel: cat
anser: goose (*Anser* sp.)
anas: duck (*Anas* sp.)
but?: cf. Buzzard (*Buteo buteo*)/ Rough legged buzzard, *Buteo lagopus*)
but/mil?: cf. buzzard/red kite (*Milvus milvus*)
but/cir?: cf. buzzard/harrier (Marsh harrier, *Circus aeruginosus*/ Hen harrier,*Circus cyaneus*)
gag: Domestic fowl (*Gallus gallus*)
g/m: Domestic fowl/Guinea fowl (*Numida meleagris*)
gpm: Domestic fowl/Pheasant (*Phasianus colchicus*)/Guinea fowl (*Numida meleagris*)
fulica: Coot (*Fulica atra*)

Sd: side

Sx: sex

Age: j: juvenile; s: subadult; ? age uncertain

Pf: proximal fusion; **Df**: distal fusion: f: fused; v: fusion line visible; g: fusing (incompletely fused)

Pa: pathology. p: present (* asymmetrical condyles)

Attr: interdental attrition. p-present

Elements
ast: astragalus
atls: atlas
cal: calcaneum
can: canine
centr: centrotarsale
cpm: carpometacarpus
fem: femur
fro: frontal
hrn: horncore
hum: humerus
hrn: horncore
inn: innominate
Ldi1, Udi1: lower/upper deciduous first incisor
Ldi2, Udi2: lower/upper deciduous second incisor
Ldi3, Udi3: lower/upper deciduous third incisor
Ldi4: lower deciduous fourth incisor
Ldic: lower deciduous incisor
LI1, UI1: lower/upper first incisor
LI2, UI2: lower/upper second incisor
LI3, UI3: lower/upper third incisor
LdP2, UdP2: lower/upper deciduous second premolar
LdP3, UdP3: lower/upper deciduous third premolar
LdP4, UdP4lower fourth deciduous premolar
LP2, UP2: lower/upper second premolar
LP3, UP3: lower/upper third premolar
LP4, UP4: lower/upper fourth premolar
LM1, UM1: lower first molar
LM2, UM2: lower/upper second molar
LM12, UM12: lower/upper first or second molar
LM3, UM3: lower/upper third molar
man: mandible
mt2: second metacarpal
mt4: fourth metacarpal
mtc: metacarpal
mtt: metatarsal
occ: occipital
p1: first phalanx
p3: third phalanx
pub: pubis
rad: radius
sca: scapula
tbt: tibiotarsus
tib: tibia
tst: tarsometatarsus
uln: ulna
UP2: upper second molar
UP/M: upper premolar or molar
zyg: zygomaticus

Appendix 1: Mandible and mandibular tooth wear stages in cattle, sheep/goat and pig (after Ewbank et al. 1964; Grant 1982; Payne 1973, 1987), in order by taxon, site and element. Pathologies listed in Appendix 4. IA Iron Age; R Roman; S Saxon; MS Mid Saxon; LS Late Saxon; EM Early Medieval; SN Saxo-Norman; for WPA, MS-m main phase and MS-g gully phase.

ID#	Site	Period	Cxt	#	Rec	Tax	Elem	Sd	Sx	Burn	Pa	dP4	P4	M1	M2	M1/2	M3	Stage
Cattle																		
476	gos16	R	217		hc	bos	LdP4	r				m						
465	gos16	R	012		hc	bos	LM12	l								f		
475	gos16	R	217		hc	bos	LM12	l								a		
82	gos22	MS	111		hc	bos	LdP4	r				k						
94	gos22	MS	203		hc	bos	LM12	l								b		
112	gos22	MS	392		hc	bos	LM12	r								g		
113	gos22	MS	392		hc	bos	LM12	r								f		
190	gos22	MS	057		fs	bos	LM12	l								k		
22	gos22	MS	123		hc	bos	LM12	r								k		
114	gos22	MS	517		hc	bos	man	l				c						
107	gos22	MS	234		hc	bos	man	r				f						
21	gos22	MS	111		hc	bos	man	r				j						
75	gos22	MS	094		hc	bos	man	r							d		Cr	S
93	gos22	MS	203		hc	bos	man	r										
108	gos22	MS	234		hc	bos	man	r								Er		
413	gos37	MS	212		hc	bos	man	r				d-f						
411	gos37	MS	212		hc	bos	man	r				j		b				I?
412	gos37	MS	212		hc	bos	man	l				j		b				I?
315	gos37	MS	025		hc	bos	man	r									g	
350	gos37	MS	074		hc	bos	man	l									Cr	
991	TSC 17	MS	036		hc	bos	LM12	l								g		
916	TSC 17	MS	105		hc	bos	LM12	l							Cr			
917	TSC 17	MS	105		hc	bos	LM12	l								d		
925	TSC 17	MS	105		hc	bos	LM12	l								d		
1002	TSC 17	MS	026		hc	bos	LM12	r								k		
918	TSC 17	MS	105		hc	bos	man	l				j						
926	TSC 17	MS	105		hc	bos	man	l				j						
891	TSC 17	MS	073		hc	bos	man	l				j		f				I+
924	TSC 17	MS	105		hc	bos	man	l							Cr			
996	TSC 17	MS	026		hc	bos	man	r							k		g	A
997	TSC 17	MS	026		hc	bos	man	r					f					
998	TSC 17	MS	026		hc	bos	man	r										
999	TSC 17	MS	026		hc	bos	man	?								ind		
972	TSC 17	MS	023		hc	bos	man	l					f	k	k			S+
637	TSC 23	LS/EM	011		hc	bos	LM12	l								a		
765	TSC 23	MS	081		hc	bos	LM12	r		pt ch						h/j?		
786	TSC 23	MS	083		hc	bos	LM12	r								f		
697	TSC 23	MS	060		hc	bos	LM12	r								f		
696	TSC 23	MS	060		hc	bos	LM12	r								h		
847	TSC 23	MS	103		hc	bos	LM12	r								a-b		
846	TSC 23	MS	103		hc	bos	LM12	r								a-b		
845	TSC 23	MS	103		hc	bos	LM12	r								c		
844	TSC 23	MS	103		hc	bos	LM12	r								b		
764	TSC 23	MS	081		hc	bos	LM3	l									h	
601	TSC 23	MS	005		hc	bos	LM3	r									a	
853	TSC 23	MS	104		hc	bos	LM3	l									g	
811	TSC 23	MS	085		hc	bos	man	l				k		g				I+
753	TSC 23	MS	079		hc	bos	man	l									f	A
687	TSC 23	MS	039		hc	bos	man	l							f			
852	TSC 23	MS	104		hc	bos	man	l					e	k	k		h	A
800	TSC 23	MS	084		hc	bos	man	r										
1120	WNW	SN	110		hc	bos	LM12	l								k		
1644	WPA	MS-g	323		hc	bos	LdP4	l				b						
1657	WPA	MS-g	323		hc	bos	LdP4	l				a						
1405	WPA	MS-m	190		hc	bos	LdP4	r				e-f						
1658	WPA	MS-m	227		hc	bos	LdP4	l				j						
1643	WPA	MS-g	323		hc	bos	LM12	r								h		
1331	WPA	MS-m	131		hc	bos	LM12	r								b		
1428	WPA	MS-m	193		hc	bos	LM12	l								k		
1432	WPA	MS-m	195		hc	bos	LM3	l									d	
1433	WPA	MS-m	195		hc	bos	LM3	r									d	
1654	WPA	MS-m	050		hc	bos	LM3	l									b	
1648	WPA	MS-g	323		hc	bos	man	l										
1520	WPA	MS-m	127		hc	bos	man	r				h						
1659	WPA	MS-m	135		hc	bos	man	l				h						
1521	WPA	MS-m	127		hc	bos	man	r				j						

ID#	Sitecode	Period	Cxt	#	Rec	Tax	Elem	Sd	Sx	Burn	Path	dp4	P4	M1	M2	M1/2	M3	Stage
1660	WPA	MS-m	240		hc	bos	man	r				j						
1522	WPA	MS-m	129		hc	bos	man	l				m						
1364	WPA	MS-m	135		hc	bos	man	l						a	1/2			J
1434	WPA	MS-m	195		hc	bos	man	l					c					
1523	WPA	MS-m	129		hc	bos	man	r										
1652	WPA	MS-m	238		hc	bos	man	l							d		Cr	S
1653	WPA	MS-m	133		hc	bos	man	l									Er	
1655	WPA	MS-m	216		hc	bos	man	r						k	k			S+
Sheep/goat																		
79	gos22	MS	097		hc	ovc	LdP4	r					0					
104	gos22	MS	216		hc	ova	man	r				14L		7A	Cr			C
191	gos22	MS	057		fs	ovc	man	l						indt	6A			D
57	gos22	LS	005		hc	ovc	LM12	r								6A		
8	gos22	LS	007		hc	ovc	LM12									5A		
9	gos22	LS	013		hc	ovc	man	r					14S	15A				F-I
371	gos37	MS	148		hc	ovc	LM12	l								5A		
355	gos37	MS	085		hc	ovc	LM12	l								9A		
386	gos37	MS	181		hc	ovc	LM12	l								9A		
385	gos37	MS	181		hc	ovc	LM3	l									10G	
339	gos37	MS	041		hc	ovc	man	l					11S	9A				C-F
334	gos37	MS	042		hc	ova	man	r			p	14L		8A	2A			D
331	gos37	MS	037		hc	ovc	man	r			p		14S	15A	9A		11G	G
1023	TSC 17	MS	026		fs	ovc	LM12	r								0		
1022	TSC 17	MS	026		fs	ovc	LM12	r								7A		
935	TSC 17	MS	008		hc	oa?	man	l			p	14L						
1021	TSC 17	MS	026		fs	ova	man	r			p	14L						
959	TSC 17	LS/EM	022		hc	ovc	man	r			p		9A	15A	9A		11G	G
743	TSC 23	MS	079		hc	oa?	man	r			p	14L		5A	Cr			C
778	TSC 23	MS	082		hc	ovc	man	l						8A	4A			C
830	TSC 23	MS	102		hc	ovc	man	l			p			8A	5A		0	D
689	TSC 23	MS	039		hc	oa?	man	r			p	20M		9A	6A/7A			D
759	TSC 23	MS	079		hc	ovc	man	l						9A	7A		Er	D
815	TSC 23	MS	085		hc	ovc	man	r			p		8A	9A	7A		1/2	D
690	TSC 23	MS	039		hc	ova	man	r			p	20M		9A	7A			D/E
803	TSC 23	MS	085		hc	ovc	man	l			p		8A	9A	8A		4A	E
766	TSC 23	MS	081		hc	ovc	man	l			p				9A		5A	E
779	TSC 23	MS	082		hc	ovc	man	r			p		9A	9A	9A		7A	E
876	TSC 23	MS	106		hc	ovc	man	l			p		7S	9A	9A		6A	E
793	TSC 23	MS	084		hc	ovc	man	r			p		8A9A	9A	9A		5A	E
777	TSC 23	MS	082		hc	ovc	man	r							9A		7A	E
839	TSC 23	MS	103		hc	ovc	man	l			p		12S	12A	9A		7A+	G?
825	TSC 23	MS	086		hc	ovc	man	r			p		14S	12A	9A		11G	G
820	TSC 23	MS	085		hc	ovc	man	l			p		14S	14A	9A		11G	G
760	TSC 23	MS	079		hc	ovc	man	r			p		14S	15A	11A		11G	H
652	TSC 23	MS	013		hc	ova	man	r				11L						
594	TSC 23	MS	004		hc	ovc	man	r										
862	TSC 23	MS	104		hc	ovc	man	r								ind		
1066	WNW	SN	077		hc	ovc	LM12	l								9A		
1070	WNW	SN	080		hc	ovc	LM12	l								9A		
1091	WNW	SN	098		hc	ovc	LM12	r								8A		
1062	WNW	SN	063		hc	ovc	LM3	r									0	
1098	WNW	SN	100		hc	ova	man	l			p	14L						
1056	WNW	SN	063		s	ova	man	r				10N		Er				B
1061	WNW	SN	063		hc	ova	man	r				14L		4A	Cr			C
1092	WNW	SN	098		hc	ovc	man	r			p		12S	15A	9A			F
1114	WNW	SN	104		hc	ovc	man	l			p		9A	10A	10A		11G	H
1055	WNW	SN	062		hc	ovc	man	r					Cr	9A				C-F
1557	WPA	MS-m	245		hc	ovc	LdP4	l				10N-14L						
1186	WPA	MS-m	203	040	hc	ova	man	r			p	14L						
1182	WPA	MS-m	209	010	hc	ova	LdP4	r				17L						
1181	WPA	MS-m	106	013	hc	ova	LdP4	r				19L						
1194	WPA	MS-m	039		hc	ovc	LM12	r								6A		
1195	WPA	MS-m	209		hc	ovc	LM12	l								0		
1196	WPA	MS-m	152		hc	ovc	LM12	l								2A		
1197	WPA	MS-m	240	012	hc	ovc	LM12	l								6A		
1198	WPA	MS-m	007		hc	ovc	LM12	l								8A		
1199	WPA	MS-m	127		hc	ovc	LM12	l								9A		
1200	WPA	MS-m	029		hc	ovc	LM12	l								6A/7A/8B		
1201	WPA	MS-m	240	011	hc	ovc	LM12	r								9A		
1202	WPA	MS-m	209		hc	ovc	LM12	r								8A		
1203	WPA	MS-m	209		hc	ovc	LM12	r								0		
1651	WPA	MS-g	323		s	ovc	LM12	l								0		
1670	WPA	MS-m	129		fs	ovc	LM12	r								0		
1680	WPA	MS-m	216		fs	ovc	LM12	l								1B/2A		
1205	WPA	MS-m	297	004	hc	ovc	LM3	l									0	

ID#	Sitecode	Period	Cxt	#	Rec	Tax	Elem	Sd	Sx	Burn	Path	dp4	P4	M1	M2	M1/2	M3	Stage
1206	WPA	MS-m	127	007	hc	ovc	LM3	l									7A	
1207	WPA	MS-m	216	001	hc	ovc	LM3	l									8G	
1208	WPA	MS-m	127	006	hc	ovc	LM3	l									11G	
1209	WPA	MS-m	245	009	hc	ovc	LM3	l									11G	
1210	WPA	MS-m	152	005	hc	ovc	LM3	r									0	
1211	WPA	MS-m	240	005	hc	ovc	LM3	r									9G	
1212	WPA	MS-m	214	002	hc	ovc	LM3	r									10G	
1235	WPA	MS-m	216	037	hc	ovc	LM3	l			p						11G	
1189	WPA	MS-g	323		hc	ovc	man	r								Er		
1236	WPA	MS-m	102	021	hc	oa?	man	r				5A						
1187	WPA	MS-g	323	043	hc	ova	man	r			p	13L						
1190	WPA	MS-m	048		hc	ovc	man	l						0				
1191	WPA	MS-m	214		hc	ovc	man	l						0				
1204	WPA	MS-g	192		hc	ovc	man	l									Cr	
1214	WPA	MS-m	197	023	hc	ova	man	l				13L		2A				C
1237	WPA	MS-g	323	027	hc	ova	man	r				14L		2A				C
1188	WPA	MS-m	245	042	hc	ovc	man	l			p	14L		5A				C
1184	WPA	MS-m	045	045	hc	ova	man	r			p	14L		5A				C
1185	WPA	MS-m	209	011	hc	ova	man	l				14L		8A				C
1215	WPA	MS-m	204	020	hc	ova	man	l			p	14L		9A	5A			C
1193	WPA	MS-m	193	044	hc	ovc	man	r						6A	Cr			C
1192	WPA	MS-m	046	128	hc	ovc	man	r							6A		Cr	D
1239	WPA	MS-m	188	006	hc	ova	man	r			p	14L		8A	4B		Cr	D
1216	WPA	MS-m	106	012	hc	ovc	man	l						9A	5B			D
1219	WPA	MS-m	134	033	hc	ovc	man	l			p			9A	6A		Er	D
1220	WPA	MS-m	214	031	hc	ova	man	l			p	16L		9A	6A			D
1240	WPA	MS-m	131	022	hc	ova	man	r			p	19L		9A	6A			D
1241	WPA	MS-m	240	025	hc	ova	man	r			p	19M		9A	6A			D
1243	WPA	MS-m	129	014	hc	ovc	man	r			p			9A	6A		Cr	D
1217	WPA	MS-m	206	019	hc	ovc	man	l						9A	7A		Er	D
1218	WPA	MS-m	216	001	hc	ova	man	l			p	14L		9A	7A		Er	D
1222	WPA	MS-m	197	007	hc	ova	man	l			p	16L		9A	7A			D
1238	WPA	MS-m	240	026	hc	oa?	man	r			p	14L+		9A	7A			D
1183	WPA	MS-m	134	038	hc	ova	man	r			p	19M						D
1226	WPA	MS-m	013	006	hc	ovc	man	l			p		7S	9A	7A			E
1228	WPA	MS-m	238	024	hc	ovc	man	l			p		7S	9A	7A		5A	E
1221	WPA	MS-m	046	018	hc	ova	man	l			p	17M		9A	8A			E
1244	WPA	MS-m	009	009	hc	ovc	man				p		6S	9A	8A		5A	E
1227	WPA	MS-m	009	002	hc	ovc	man	l			p		6U?	9A	9A		5A	E
1245	WPA	MS-m	297	030	hc	ovc	man	r			p			9A	9A		7A	E
1246	WPA	MS-m	131	015	hc	ovc	man	r			p		8A	9A	9A		4A	E
1224	WPA	MS-m	215	017	hc	ovc	man	l			p		11S	9A	9A			E/F
1242	WPA	MS-m	240	034	hc	ovc	man	r			p		9A	9A				E/F
1247	WPA	MS-m	214	028	hc	ovc	man	r			p			10B	9A		8G	F
1231	WPA	MS-m	097	003	hc	ovc	man	l			p		12S	11B	9A		10G	F
1223	WPA	MS-g	323	029	hc	ovc	man	l			p			9A	8A		6G	F
1225	WPA	MS-m	153	004	hc	ovc	man	l			p		9A	9A	9A		6A	F
1229	WPA	MS-m	214	008	hc	ovc	man	l			p		8A/9A	9A	9A		8G	F
1232	WPA	MS-m	136	005	hc	ovc	man	l			p		12S	12A	9A			F/G
1248	WPA	MS-m	134	011	hc	ovc	man	r			p		12S	12A	9A		11G	G
1249	WPA	MS-g	323	032	hc	ovc	man	r			p		11S		9A		11G	G
1213	WPA	MS-m	135	039	hc	ovc	man	r							9A		11G	G
1230	WPA	MS-m	128	016	hc	ovc	man	l			p		12S	12A	10A		11G	H
1233	WPA	MS-m	243	035	hc	ovc	man	l					14S	15A	10A			H
1234	WPA	MS-m	029	010	hc	ovc	man	l			p				10A		11G	H
1471	WPA	MS-m	215		hc	ovc	man	l		ch		ind						
1179	WPA	MS-m	045		hc	oa?	man	r			p							
Pig																		
536	gos16	R	012		fs	sus	LdP4	?				a						
490	gos16	S	111		hc	sus	LM1	r						a				
457	gos16	S	019		hc	sus	LM12	l								d		
546	gos16	S	106		fs	sus	LM12	l								a		
458	gos16	S	019		hc	sus	LP4	l					a					
488	gos16	S	111		hc	sus	man	r	?			c-d						
489	gos16	S	111		hc	sus	man	r	?			c-d						
97	gos22	MS	203		hc	sus	man	r	?				indt	g				J+
981	TSC 17	MS	024		hc	sus	man	r	?		?						d	
841	TSC 23	MS	103		hc	sus	LM12	l								c		
1586	WPA	MS-m	297		hc	sus	man	r			p		b	g	d		1/2	S
1531	WPA	MS-m	239		hc	sus	man	l	f		p		e	h	g			S+
1585	WPA	MS-m	297		hc	sus	man	l	f				b					

Appendix 2a: Cattle and sheep/goat mandible and tooth measurements (after Driesch 1976): tooth width measured across both cusps. IA Iron Age; R Roman; S Saxon; MS Mid Saxon; LS Late Saxon; EM Early Medieval; SN Saxo-Norman; for WPA, MS-m mid Saxon main phase, MS-g mid Saxon gully phase

ID#	Site	Period	Cxt	#	Rec	Tax	Elem	Sd	Sx	Pa	Attr	Measurements dP4L	dP4Wp	M1W	M2W	M12W	M3W
Cattle																	
476	Gos16	R	217		hc	bos	LdP4	r				285	145				
114	Gos22	MS	517		hc	bos	man	l				265	130				
411	Gos37	MS	212		hc	bos	man	r				277	130				
412	Gos37	MS	212		hc	bos	man	l					132				
413	Gos37	MS	212		hc	bos	man	r				289	124				
891	TSC 17	MS	073		hc	bos	man	l				272	127				
918	TSC 17	MS	105		hc	bos	man	l				269	127				
926	TSC 17	MS	105		hc	bos	man	l				269	127				
1658	WPA	MS-m	227		hc	bos	LdP4	l				277	131				
1659	WPA	MS-m	135		hc	bos	man	l				249	123				
1660	WPA	MS-m	240		hc	bos	man	r				257	131				
1655	WPA	MS-m	216		hc	bos	man	r						132			
1655	WPA	MS-m	216		hc	bos	man	r							157		
996	TSC 17	MS	026		hc	bos	man	r							148		
465	Gos16	R	012		hc	bos	LM12	l								155	
190	Gos22	MS	057		fs	bos	LM12	l								164	
113	Gos22	MS	392		hc	bos	LM12	r								152	
22	Gos22	MS	123		hc	bos	LM12	r								135	
991	TSC 17	MS	036		hc	bos	LM12	l								155	
1002	TSC 17	MS	026		hc	bos	LM12	r								157	
637	TSC 23	LS/EM	011		hc	bos	LM12	l								148	
696	TSC 23	MS	060		hc	bos	LM12	r								146	
844	TSC 23	MS	103		hc	bos	LM12	r								151	
845	TSC 23	MS	103		hc	bos	LM12	r								143	
1120	WNW	SN	110		hc	bos	LM12	l								151	
1428	WPA	MS-m	193		hc	bos	LM12	l								131	
753	TSC 23	MS	079		hc	bos	man	l									154
764	TSC 23	MS	081		hc	bos	LM3	l									162
853	TSC 23	MS	104		hc	bos	LM3	l									172
1432	WPA	MS-m	195		hc	bos	LM3	l									156
1433	WPA	MS-m	195		hc	bos	LM3	r									155
Sheep/goat																	
104	Gos22	MS	216		hc	ova	man	r				155	62				
334	Gos37	MS	042		hc	ova	man	r		p	p	151	65				
935	TSC 17	MS	008		hc	oa?	man	l		p	p		66				
1021	TSC 17	MS	026		fs	ova	man	r		p	p	138					
652	TSC 23	MS	013		hc	ova	man	r					58				
689	TSC 23	MS	039		hc	oa?	man	r		p	p		58				
690	TSC 23	MS	039		hc	ova	man	r		p	p	150	63				
1056	WNW	SN	063		s	ova	man	r				144	62				
1061	WNW	SN	063		hc	ova	man	r				137	51				
1098	WNW	SN	100		hc	ova	man	l		p	p	167	67				
1181	WPA	MS-m	106	013	hc	ova	LdP4	r				141	67				
1182	WPA	MS-m	209	010	hc	ova	LdP4	r				139	65				
1183	WPA	MS-m	134	038	hc	ova	man	r		p	p	142	64				
1184	WPA	MS-m	045	045	hc	ova	man	r		p	p	157	64				
1185	WPA	MS-m	209	011	hc	ova	man	l				152	64				
1186	WPA	MS-m	203	040	hc	ova	man	r		p	p	137	66				
1187	WPA	MS-g	323	043	hc	ova	man	r		p	p	152	65				
1214	WPA	MS-m	197	023	hc	ova	man	l				136	68				
1215	WPA	MS-m	204	020	hc	ova	man	l		p	p	140	61				
1218	WPA	MS-m	216	001	hc	ova	man	l		p	p	144	64				
1220	WPA	MS-m	214	031	hc	ova	man	l		p	p	131					
1221	WPA	MS-m	046	018	hc	ova	man	l		p	p	139	61				
1222	WPA	MS-m	197	007	hc	ova	man	l		p	p	136	63				
1239	WPA	MS-m	188	006	hc	ova	man	r		p	p	138	69				
1240	WPA	MS-m	131	022	hc	ova	man	r		p	p	138	70				
1241	WPA	MS-m	240	025	hc	ova	man	r		p	p	138	70				
9	Gos22	LS	013		hc	ovc	man	r						68			
830	TSC 23	MS	102		hc	ovc	man	l		p	p			75			
830	TSC 23	MS	102		hc	ovc	man	l		p	p				84		
766	TSC 23	MS	081		hc	ovc	man	l		p	p				78		
777	TSC 23	MS	082		hc	ovc	man	r							80		
1226	WPA	MS-m	013	006	hc	ovc	man	l		p					85		

ID#	Site	Period	Cxt	#	Rec	Tax	Elem	Sd	Sx	Pa	Attr	dP4L	dP4Wp	M1W	M2W	M12W	M3W
1215	WPA	MS-m	204	020	hc	ova	man	l		p	p				83		
690	TSC 23	MS	039		hc	ova	man	r		p	p				76		
8	Gos22	LS	007		hc	ovc	LM12									82	
57	Gos22	LS	005		hc	ovc	LM12	r								76	
355	Gos37	MS	085		hc	ovc	LM12	l								68	
386	Gos37	MS	181		hc	ovc	LM12	l								76	
1022	TSC 17	MS	026		fs	ovc	LM12	r								60	
862	TSC 23	MS	104		hc	ovc	man	r								74	
1070	WNW	SN	080		hc	ovc	LM12	l								68	
1091	WNW	SN	098		hc	ovc	LM12	r								75	
1194	WPA	MS-m	039		hc	ovc	LM12	r								66	
1197	WPA	MS-m	240	012	hc	ovc	LM12	l								77	
1198	WPA	MS-m	007		hc	ovc	LM12	l								66	
1199	WPA	MS-m	127		hc	ovc	LM12	l								84	
1201	WPA	MS-m	240	011	hc	ovc	LM12	r								68	
1202	WPA	MS-m	209		hc	ovc	LM12	r								66	
1680	WPA	MS-m	216		fs	ovc	LM12	l								71	
385	Gos37	MS	181		hc	ovc	LM3	l									74
766	TSC 23	MS	081		hc	ovc	man	l		p	p						79
777	TSC 23	MS	082		hc	ovc	man	r									85
1207	WPA	MS-m	216	001	hc	ovc	LM3	l									86
1208	WPA	MS-m	127	006	hc	ovc	LM3	l									75
1209	WPA	MS-m	245	009	hc	ovc	LM3	l									75
1211	WPA	MS-m	240	005	hc	ovc	LM3	r									65
1212	WPA	MS-m	214	002	hc	ovc	LM3	r									78

ID#	Site	Period	Cxt	Rec	Tax	Elem	Sd	Sx	Pa	Measurements		
Pig										**L**	**Wa**	**Wp**
457	Gos16	S	019	hc	sus	LM12	l			163	104	110
841	TSC 23	MS	103	hc	sus	LM12	l			152	107	113

ID#	Site	Period	Cxt	Rec	Tax	Elem	Sd	Sx	Pa	dP4 L	dP4 Wa	dP4 Wp	M1L	M1 Wa	M1 Wp	M2L	M2 Wa	M2 Wp	M3 Wa	M3 Wc
488	Gos16	S	111	hc	sus	man	r	?		180	64	84								
489	Gos16	S	111	hc	sus	man	r	?		180	65	87								
97	Gos22	MS	203	hc	sus	man	r						144	98	103					
981	TSC 17	MS	024	hc	sus	man	r		?										167	150
1531	WPA	MS-m	239	hc	sus	man	l	f	p				154	102	116	198	137	145		
1586	WPA	MS-m	297	hc	sus	man	r		p				151	106	113	195	137	138		
1585	WPA	MS-m	297	hc	sus	man	l	f												

ID#	Site	Period	Cxt	Rec	Tax	Elem	Sd	Sx	Pa	L	B	L1	L2	L3	Wa	Wb	Wc	Wd
Equid (L1-3 and Wa-d after Davis 1987)																		
461	Gos16	R	042	hc	equ	LdP4	l					352	152	113	124	115	101	14
474	Gos16	LS	52		eqc?	LP/M						240	139	e 78	c 138	142	126	c 31
603	TSC 23	LS	8		equ	UP2				315	238							

Appendix 2b: Postcranial measurements-mammals and birds (in alphabetical order by element) (after von den Driesch 1976; Payne and Bull 1988; Davis 1992). IA Iron Age; R Roman; S Saxon; MS Mid Saxon; LS Late Saxon; EM Early Medieval; SN Saxo-Norman; for WPA, MS-m mid Saxon main phase, MS-g mid Saxon gully phase. p-pathological; *assymetrical condyles. Pf-proximal fusion; Df-distal fusion; f-fused; v-fusion visible; g-fusing; ? uncertain. e-estimate

Site	Period	Cxt	Taxon	Elem	Sx	Pf	Df	Path	Measurements			
Mammals									GLl	Bd	Dl	
TSC 23	MS	060	bos	ast					628	389	344	
TSC 23	MS	078	bos	ast						423		
TSC 23	MS	079	bos	ast					612	386		
WPA	MS-g	323	bos	ast					e644	406	362	
WPA	MS-m	190	bos	ast					622	402	352	
WPA	MS-m	127	bos	ast					672		358	
WPA	MS-m	297	bos	ast					630	393	356	
WNW	SN	095	bos	ast					623	390	334	
Gos22	LS	005	ova	ast					269	185	152	
TSC 23	MS	016	ova	ast					291	185		
WPA	MS-g	323	ova	ast					283	187	160	
Gos37	MS	148	bos	cal		f			1250			
TSC 23	MS	009	ova	cal		u			572			
WPA	MS-g	323	ova	cal		f			540			
WPA	MS-m	238	ova	cal		f		p	603			
									Bp	DC		
WPA	MS-g	323	bos	fem		f				449		
WPA	MS-m	190	bos	fem		f				396		
WPA	MS-m	221	ovc	fem		f			444	204		
									Dmax	Dmin	Outer length	
Gos37	MS	020	bos	hrn					510	482		
TSC 17	MS	023	bos	hrn					429	355	e162	
WPA	MS-m	130	bos	hrn					e365	296		
WPA	MS-m	127	bos	hrn					412	323		
									Bd	BT	HTC	
TSC 17	MS	008	bos	hum			f				295	
WPA	MS-g	323	bos	hum			f			e758	349	
WPA	MS-m	137	bos	hum			f		738	689	311	
WPA	MS-m	152	bos	hum			f				263	
WPA	MS-m	131	bos	hum			f		700	648	293	
TSC 17	MS	023	oa?	hum			f			e265		
WNW	SN	095	oa?	hum			f			264	132	
TSC 23	LS/EM	011	oa??	hum			f				149	
Gos37	MS	027	ova	hum			f		317	282	141	
TSC 23	MS	016	ova	hum			f		306	277	139	
TSC 23	MS	079	ova	hum			f			284	154	
WPA	MS-m	201	ova	hum			f		285	e277	141	
WPA	MS-m	127	ova	hum			f		316	297	154	
WPA	MS-m	127	ova	hum			f		279	261	139	
WPA	MS-m	239	ova	hum			f		326	298	156	
WPA	MS-m	297	ova	hum			f		353	319	166	
WNW	IR-ns	031	ova	hum			f				121	
WPA	MS-m	225	ovc	hum			f			267	134	
TSC 23	MS	103	sus	hum			g		367	e303	185	
									LA	LAR	Pmin	Pmax
TSC 23	LS/EM	040	bos	inn					683		146	281
Gos22	MS	077	bos	inn					695	e615		
Gos37	MS	029	bos	inn					651	e536		
Gos37	MS	101	bos	inn					666	e557	149	261
TSC 17	MS	026	bos	inn					627	e542		
TSC 23	MS	082	bos	inn					585	e516		
WPA	MS-g	323	bos	inn					715	624		
WPA	MS	131	bos	inn	f?				652	522		
WPA	MS-m	131	bos	inn					689	577		
WPA	MS-m	223	bos	inn					615	520		
Gos22	MS	106	bos	pub							113	226
WPA	MS-m	134	bos	pub							162	179
Gos37	MS	088	ovc	pub	m?						74	81
WPA	MS-m	152	ovc	pub	m?						89	105
Gos22	LS	282	ovc	inn	f						55	74

Site	Period	Cxt	Tax	Elem	Sx	Pf	Df	Pa	Measurements										
TSC 23	MS	009	ovc	inn	f?						45	98							
TSC 23	MS	013	ovc	inn						242									
TSC 23	MS	079	ovc	inn	f?				e278	236	51	80							
TSC 23	MS	084	ovc	inn	m?						88	103							
TSC 23	MS	085	ovc	inn	f				284	245	45	84							
TSC 23	MS	005	sus	inn					400	335									
WPA	MS-m	136	sus	inn						301									
									GL	**Bd**									
TSC 17	MS	032	sus	mt4			f		166	126									
									GL	**Bd at f**	**BFd**	**DEM**	**DEL**	**DVM**	**DVL**	**WCM**	**WCL**	**Bp**	**SD**
Gos22	MS	069	bos	mtc			?											516	255
TSC 17	MS	023	bos	mtc			f		1794	486	530	217	196			252	243	502	292
TSC 23	LS/EM	011	ovc	mtc			?											234	
TSC 23	MS	102	oa?	mtc			u											234	129
TSC 23	MS	033	ovc	mtc			?											222	
TSC 23	MS	079	ovc	mtc			?											248	
WPA	MS-m	152	oa?	mtc			f						104		152		114		135
WPA	MS-m	216	oa??	mtc			?											242	
WPA	MS-m	127	ovc	mtc			?											224	134
WPA	MS-m	240	ovc	mtc			?	p										222	
WPA	MS-m	127	ovc	mtc			?												133
Gos22	MS	069	bos	mtt			?	?										428	
Gos22	MS	496	bos	mtt*			f	p		534	597	236	224			303	265		
Gos37	MS	037	bos	mtt			?											518	
TSC 17	MS	099	bos	mtt			?											423	227
TSC 17	MS	023	bos	mtt			v						210				238		
TSC 23	LS/EM	011	bos	mtt			?												217
TSC 23	LS/EM	040	bos	mtt*			f	p	2277	545	594	234	217			293	267	496	260
TSC 23	MS	013	bos	mtt			?											441	228
WNW	IR-ns	040	bos	mtt*			f	p		490	547	233	216			273	247		
WPA	MS-g	323	bos	mtt*			v	p		470	468	200	185			222	210		
WPA	MS-m	152	bos	mtt			?											429	
WPA	MS-m	127	bos	mtt			?											437	
WPA	MS-m	219	bos	mtt			?	p										453	224
WPA	MS-m	127	bos	mtt*			f	p		465	493	201	187			234	229		
WPA	MS-m	134	bos	mtt*			f	p		478	498	211	193			241	220		
Gos16	R	233	oa?	mtt			?											225	137
TSC 17	MS	105	oa?	mtt			u											201	113
TSC 17	MS	105	oa?	mtt			v		e1263	248			96				102	200	113
TSC 17	MS	105	oa??	mtt			u											201	113
TSC 23	MS	079	oa?	mtt			?											209	119
TSC 23	MS	081	oa?	mtt			?											191	111
TSC 23	MS	104	oa?	mtt			?											213	111
TSC 23	MS	032	ovc	mtt			u		262									223	126
WPA	MS-m	132	oa?	mtt			?											217	
WPA	MS-m	127	oa?	mtt			?											198	116
WPA	MS-m	127	ovc	mtt			?											222	128
									GL	**Bd**	**Bp**	**SD**							
Gos22	MS	203	bos	rad			f			654									
TSC 23	MS	032	bos	rad		f					764								
TSC 23	MS	103	bos	rad		f					723								
WPA	MS-g	323	bos	rad		f					707								
WPA	MS-g	323	bos	rad			f			764									
Gos37	MS	148	ova	rad			f					160							
TSC 17	MS	023	ova	rad		f					e293	166							
TSC 17	MS	032	ova	rad		f	?				304	160							
TSC 23	MS	008	ova	rad			f			302									
TSC 23	MS	016	ovc	rad		f					283								
TSC 23	MS	106	ovc	rad		f	f		1347	270	276	148							
TSC 23	MS	060	oa?	rad		f					318								
WPA	MS-g	323	ova	rad		f					297								
WPA	MS-g	323	ova	rad		f					341	171							
WPA	MS-m	134	ova	rad		f					263								
WPA	MS-m	188	ova	rad		?	f			310		163							
WPA	MS-m	195	ova	rad		f	f		1631	313	343	177							
WPA	MS-m	239	ova	rad		f	v		1714	313	335	175							
WPA	MS-m	240	ova	rad		f					278								
WPA	MS-m	133	ovc	rad		f						150							
WPA	MS-m	201	ovc	rad		f						155							
WPA	MS-m	216	sus	rad		f					302								

Site	Period	Cxt	Tax	Elem	Sx	Pf	Df	Pa	Measurements								
									SLC								
Gos37	MS	029	bos	sca			f		434								
Gos37	MS	143	bos	sca			?		484								
TSC 17	MS	023	bos	sca			f		440								
TSC 23	MS	004	bos	sca			f		514								
WNW	MS	103	bos	sca			f		388								
Gos16	R	012	ovc	sca			f		216								
Gos37	MS	088	ovc	sca			f		177								
TSC 23	MS	009	ovc	sca			f		186								
TSC 23	MS	009	ovc	sca			f		178								
TSC 23	MS	013	ovc	sca			?		205								
TSC 23	MS	082	ovc	sca			f		203								
TSC 23	MS	085	ovc	sca			f		181								
WPA	MS-m	211	ovc	sca			f		363								
WPA	MS-m	225	ovc	sca			f		214								
WPA	MS-m	240	ovc	sca			f		194								
Gos37	MS	141	sus	sca			?		201								
TSC 17	MS	071	sus	sca			f		229								
TSC 23	MS	102	sus	sca			f		210								
WPA	MS-m	240	sus	sca			f		227								
									Bd								
TSC 17	MS	071	bos	tib			f		662								
TSC 23	MS	079	bos	tib			f		569								
WPA	MS-g	323	bos	tib			v		559								
WPA	MS-g	323	oa?	tib			f		259								
WNW	SN	132	oa?	tib			f		251								
Gos22	MS	016	ova	tib			f		273								
WPA	MS-m	190	ova	tib			f		279								
WPA	MS-m	127	ova	tib			f		272								
WPA	MS-m	216	ova	tib			f	p	283								
WPA	MS-m	238	ova	tib			f	p	276								
WPA	MS-m	297	ova	tib			f		302								
WNW	SN	062	ova	tib			f		246								
WNW	SN	100	ovc	tib			f		247								
									GH	**GB**	**LhT**	**BFd**					
WPA	MS-m	190	equ	ast					553	619	556	511					
									GLC	**Bp**	**HTC**	**SD**					
WNW	SN	105	equ	hum		f	f		e2737	e899	366	346					
									LA	**LAR**							
TSC 23	MS	009	equ	inn					703	616							
									GL	**GLl**	**Ll**	**Bp**	**Dp**	**Bd at f**	**BFd**	**DD**	**SD**
WPA	MS-m	152	equ	mtc			f		2228	2188	2135	488	e336	453	465	215	309
WPA	MS-g	323	equ	mtt			vf		2650	2617	2565	475	421	435			257
									GL	**Bp**	**BFp**	**Dp**	**Bd at f**	**SD**	**BFd**	**DD**	
Gos22	MS	578	equ	p1		f			859	574	521		490	377	469		
WPA	MS-g	323	equ	p1		f			736	506	479	353	422	310	400		
WPA	MS-m	132	equ	p1		f		p	805	513	459	327	460	331	425		
Gos16	R	052	equ	p1		f			868	512	475	354	449	321	425		
									GL	**GB**	**BF**						
WPA	MS-m	297	equ	p3		f			490	579	440						
									GL	**Ll**	**Bp**	**BFp**	**Bd at f**	**BFd**	**SD**		
TSC 17	MS	012	equ	rad		f	f		2985	2870	799	731	715	590	360		
									GL	**Bd**	**SD**						
Gos22	MS	108	fel	mt2			f		457	52	38						
Birds									**GL**	**Bp**	**Did**						
TSC 23	LS/EM	029	anser	cpm						223							
TSC 23	LS/EM	029	anser	cpm						229							
Gos22	MS	048	anser	cpm					911	217	107						
Gos22	MS	095	fulica	cpm						80							
									Bp	**SC**	**Bd**	**Dd**					
Gos37	MS	013	but?	fem					144								
Gos22	MS	203	g/m	fem					132	56							
TSC 23	MS	009	gpm	fem							137	116					

Site	Period	Cxt	Tax	Elem	Sx	Pf	Df	Pa	Measurements					
									GL	Bp	SC	Bd		
Gos22	MS	203	gpm	hum								132		
Gos22	LS	185	anas	hum								95		
WPA	MS-m	216	anas	hum								146		
WPA	MS-m	216	anas	hum						207				
TSC 17	MS	072	anser	hum					1629	339	113	237		
Gos37	MS	013	but/mil?	hum					1185	215	86	190		
Gos37	MS	018	but/mil?	hum						201				
									DiA					
Gos37	MS	013	but?	inn					68					
									GL	SC	Bd			
TSC 23	LS/EM	029	anser	rad					1473	49	109			
TSC 23	LS/EM	029	anser	rad					1485	48	105			
Gos37	MS	029	anser	rad					1461	66	110			
Gos22	LS	282	g/p	rad					572	28	61			
									GL	Dip	La	SC	Bd	Dd
Gos22	MS	225	gpm	tbt					924	181	889	53	103	10
WPA	MS-m	207	gpm	tbt						174		49		
Gos22	MS	578	anser	tbt									186	
Gos37	MS	018	but/cir?	tbt									98	81
Gos37	MS	013	but?	tbt									121	88
									GL	Bp	SC	Bd		
WPA	MS-m	135	gag	tst	m				781	144	73	143		
WPA	MS-m	163	gag	tst						145				
Gos16	R	217	anas	tst					482	194	45	194		
TSC 23	MS	106	anser	tst					896	201	91			
WPA	MS-m	132	anser	tst					842	188	85	201		
Gos37	MS	013	but/cir?	tst								130		
Gos37	MS	018	but/cir?	tst								114		
									GL	Bp	Dip	SC	Did	
Gos22	MS	203	gpm	uln					590	77	113	36	89	
TSC 23	LS/EM	029	anser	uln					1573	166				
TSC 23	LS/EM	029	anser	uln					1561	164	198	83	168	
TSC 23	MS	102	anser	uln						167		79		
WPA	MS-m	245	anser	uln						157	214			
Gos16	PM	023	anser	uln						161	192			
Gos37	MS	020	but?	uln						111				
Gos37	MS	013	but?	uln								61	100	

Appendix 3: Dental attrition and pathologies in cattle, pig and sheep/goat mandibles. IA Iron Age; R Roman; S Saxon; MS Mid Saxon; LS Late Saxon; EM Early Medieval; SN Saxo-Norman; for WPA, MS-m mid Saxon main phase, MS-g mid Saxon gully phase: anterior cusp; p-posterior cusp; attrition/modification: - slight; + heavy; ++ extreme; ? Uncertain; pr present; St-wear stage after Payne 1973; Ml malocclusion; Cs sharp cusps.

ID#	Site	Per	Cxt	#	Rc	Tax	Sd	Sx	St	Interdental attrition dP2	dP3		dP4		P2		P3		P4		M1		M2		M3		Ml	Cs
										p	a	p	a	p	a	p	a	p	a	p	a	p	a	p	a	p		
Cattle																												
852	TSC23	MS	104		hc	bos	l																					
Pig																												
981	TSC17	MS	024		hc	sus	r																					
1531	WPA	MS-m	239		hc	sus	l	f													x							
1586	WPA	MS-m	297		hc	sus	r																					
Sheep/goat																												
334	Gos37	MS	042		hc	ova	r		D			x																pr
331	Gos37	MS	037		hc	ovc	r		G									x	x					x	x		pr	
935	TSC17	MS	008		hc	oa?	l		C	x		x																
1021	TSC17	MS	026		fs	ova	r		C			x																
959	TSC17	MS	22		hc	ovc			G									x		x	x	x		x-				
743	TSC23	MS	79		hc				C	x-		x		x-														
689	TSC23	MS	039		hc	oa?	r		D			x++		x														
830	TSC23	MS	102		hc	ovc	l		D													x-	x-					
815	TSC23	MS	85		hc				D												x							
690	TSC23	MS	039		hc	ova	r		D/E					x														
766	TSC23	MS	081		hc	ovc	l		E															x-	x-			
803	TSC23	MS	085		hc	ovc	l		E									x			x							
876	TSC23	MS	106		hc	ovc	l		E									x-			x	x						
779	TSC23	MS	82		hc				E									x		x	x	x						pr
793	TSC23	MS	84		hc				E											x++		x						pr
825	TSC23	MS	86		hc				G												x	x		x				
820	TSC23	MS	85		hc				G											x-		x++						
839	TSC23	MS	103		hc				G?												x	x						
760	TSC23	MS	79		hc				H									x		x	x	x-		x++				
1187	WPA	MS-g	323	043	hc	ova	r		B/C				x-															
1184	WPA	MS-m	045	045	hc	ova	r		C					x-													pr	
1215	WPA	MS-m	204	020	hc	ova	l		C			x		x													pr	pr
1188	WPA	MS-m	245	42		ovc			C					x														
1186	WPA	MS-m	203	040	hc	ova	r		C/D			x															pr	pr
1183	WPA	MS-m	134	038	hc	ova	r		D		x	x															pr	
1218	WPA	MS-m	216	001	hc	ova	l		D			x		x													pr	pr
1220	WPA	MS-m	214	031	hc	ova	l		D					x														pr
1222	WPA	MS-m	197	007	hc	ova	l		D					x														pr
1239	WPA	MS-m	188	006	hc	ova	r		D			x		x													pr	pr
1240	WPA	MS-m	131	022	hc	ova	r		D					x													pr	
1241	WPA	MS-m	240	025	hc	ova	r		D			x		x													pr	
1243	WPA	MS-m	129	14		ovc			D																		pr	pr
1219	WPA	MS-m	134	33		ovc			D																			pr
1238	WPA	MS-m	240	26		ova			D					x													pr	pr
1221	WPA	MS-m	046	018	hc	ova	l		E					x														pr
1226	WPA	MS-m	013	006	hc	ovc	l		E																		pr	pr
1227	WPA	MS-m	009	002	hc	ovc	l		E											x-							pr	pr
1228	WPA	MS-m	238	024	hc	ovc	l		E												x						pr	pr
1244	WPA	MS-m	009	009	hc	ovc	r		E																		pr	
1245	WPA	MS-m	297	030	hc	ovc	r		E																		pr	pr
1246	WPA	MS-m	131	015	hc	ovc	r		E												x						pr	
1224	WPA	MS-m	215	017	hc	ovc	l		E/F																		pr	pr
1242	WPA	MS-m	240	34		ovc			E/F												x						pr	
1223	WPA	MS-g	323	029	hc	ovc	l		F																		pr	pr
1225	WPA	MS-m	153	004	hc	ovc	l		F												x						pr	pr
1229	WPA	MS-m	214	008	hc	ovc	l		F												x						pr	pr
1231	WPA	MS-m	097	003	hc	ovc	l		F									x-			x-	x		x	x		pr	pr
1247	WPA	MS-m	214	028	hc	ovc	r		F																			pr
1232	WPA	MS-m	136	005	hc	ovc	l		F/G																		pr	pr
1248	WPA	MS-m	134	011	hc	ovc	r		G												x	x					pr	pr
1249	WPA	MS-g	323	32	hc	ovc			G																		pr	pr
1230	WPA	MS-m	128	016	hc	ovc	l		H									x				x					pr	pr
1234	WPA	MS-m	29	10	hc	ovc			H															x			pr	pr
1179	WPA	MS-m	45		hc	ova				x																	pr	
1098	WNW	SN	100		hc	ova	l		C	x		x		x-													pr	
1092	WNW	SN	098		hc	ovc	r		F							x-		x			x	x					pr	
1114	WNW	SN	104		hc	ovc			H										x	x	x							

Appendix 4a: Skeletal element representation in cattle, sheep/goat and pig (NISP). R Roman; MS Mid Saxon; LS Late Saxon; EM Early medieval; MS-g gully phase; MS-m main phase skel skeleton; SN Saxo-Norman; for WPA, MS-main+ includes contexts over 100; hc hand-collected; s dry-sieved; fs fine sieved. For Gos22, * represents specimens from Mid-Saxon sheep/goat skeleton; for Gos16, numbers in [ ] represent specimens not from hand-collected Saxon pig skeleton.

Gos22	Cattle			Pig			Sheep/goat				
	MS	MS	LS	MS	MS	LS	MS	MS (skel)	MS	LS	LS
Elem	fs	hc	hc	fs	hc	hc	fs	s	hc	fs	hc
hrn									1		
occ			3					1			
zyg											
man		6			1		1		1		1
max		1			1				2		1
UdP3		1									
UdP4							1				1
UM12			1			1				1	2
UM3									2		
Ldi1							1*				
Ldi2	1						1+1*			1	
Ldi3?							1*			1	
Ldi4							1*				
Ldic		1									
LdP3			1								
LdP4		1							1		
LI1		1		1							
LI1?			1								
LI2									1		
LM12	1	4									2
LP3										1	
axis		2									
sca d		1						1			
sca n		1						1			
hum p+d									1		
rad p+d								1			
rad p									1		
rad d		1									
uln p		1						1			
uln m								1			
mtc p+d		1						2			
mtc p+m		1									
mtc p		1									
inn		1									
inn p								2			1
inn d											1
fem p+d								2			
fem p		1							1		
fem d									1		
pat		1					2				
tib p+d								2			
tib p											
tib d		1							1		
mt3											
mtt p+d		1						2			
mtt p		2									
mtt d		0.5									
mtp d			0.5								0.5
ast											2
centr		1									
p1		3									
p2		1									
	2	36.5	6.5	1	2	1	9	16	13	4	11.5

Gos16	Cattle		Pig		Sheep/goat	
	R	S	S (skel)	S (skel)	R	S
Elem	hc	hc	fs	hc	hc	hc
occ				2		
zyg	1			1		
mnt				2		
mxt		1		2[+1]		
pxt				2		
UM12	2	1				
UM3						1
Ldi/c			1			
LdP2			1			
LdP4	1					
LI12				[2]		
LM1				1		
LM12	2		1	[1]		
LP4				[1]		
Can				[1]		
atls		1				
sca d				2	1	
hum p+d				1		
hum p			1			
hum d				2		
rad p+d				2[+1]		
rad d				1		
uln p+d				2		
uln m				[1]		
mc3				1		
mc4				1		
mtc d	1					
inn	1					
inn p				1		
fem p+d				1		
fem d					1	
tib p+d				2		
tib p				2		
tib d				1		
mt3				1		
mt4				1		
mtt p+d					1	
mtp d				1		
ast	1			1		
cal	1			1		
centr			1			
p1	1	1	3	3		
p2				2	1	
p3			1			
	11	4	9	47	4	1

Appendix 4a: Skeletal element representation in cattle, sheep/goat and pig (NISP) – cont.

WNW	Cattle		Pig	Sheep/goat			
	MS	SN	SN	MS	SN	SN	SN
Elements	hc	hc	hc	hc	fs	s	hc
hrn							1
man						1	5
max		2	1				2
UM12		3		2			
UM2		1					
UP34					1		
Ldi2					1		
Ldic					1		
LI2?		1					
LM12		1					3
LM3							1
sca d	1	1					1
hum p+d					1		
hum p					1		1
hum d							1
rad p	1						3
rad d	2						1
uln p	2						
carpal	1						
mtc p+d				1			1
mtc p							1
mtc d				0.5			
inn d			1				
fem p		2					
fem d				1			
tib p+d							1
tib p							
tib d		2				1	2
mt3			0.5				
mtt p+d							
mtt p				1			
mtt d							1
mtp d		0.5		0.5			
ast		1			1		
cal		1					1
centr	1						
p1				1			1
	8	15.5	2.5	7	6	2	27

Gos37	Cattle		Pig		Sheep/goat
	MS	MS	MS	MS	MS
Elem	ds	hc	fs	hc	hc
hrn	1	1			0
man		5			3
max		1			
UdP3		1			
UM1		1			
UM12					2
UM3					1
Ldi2?				1	
LdP3		1			
LP2		1			
LM12					3
LM3					1
axis		1			
sca d		2			2
sca n		2		1	
hum p		2			
hum d		2			1
rad p+d					1
rad p		2			1
mtc p+d		2			
mtc d		1			
inn-acet		2			
inn p		1			
fem p		2			1
fem d		1			
tib p+d		1			
tib d				1	2
mtt p+d		1			
mtt p		1			1
mtt d		0.5			
mtp d					0.5
cal		2			1
centrotars		1			
p1		3			
p3		1			
	1	41.5	0	3	20.5

Appendix 4a: Skeletal element representation in cattle, sheep/goat and pig (NISP) – cont.

TSC23	Cattle		Pig		Sheep/goat			
	MS	LS/EM	MS	LS/EM	MS	MS	MS	LS/EM
Element	hc	hc	hc	hc	fs	s	hc	hc
hrn							1	
occ	2						3	
zyg	2	1					2	
man	5						20	
max	6	1	1		1		4	
UdP3	1							
UdP4	2	1						
UP2	2							
UP3?						1		
UP34	1	1						
UP4	1							
UM1	1							
UM12	6	1					9	
UM2	1							
UM3	1						3	
LP3							1	
LM12	8	1	1					
LM3	3							
Can				1				
atls	2						1	
axis							1	
sca d	3		2				7	
hum p							1	
hum d	1		1				4	1
rad p+d							1	
rad p	9						5	
rad d							2	
uln p	1		1			1	4	
mtc p+d	1	1					3	
mtc p	1.5						2	1
mtc d							1.5	
inn	2	1	1				3	
inn p	1							
inn d				1			1	
fem p+d	1							
fem p	4		1				2	
fem d	2						1	
tib p+d							2	
tib p							1	
tib d	1		1				3	
mtt p+d	3	2					7.5	
mtt p	3						5	
mtt d	1							
mtp d	1.5						0.5	
ast	4						2	
cal	1						5	
centr	1	1					1	
p1	8	1					2	
p2	6				1			
p3	4							
	104	12	9	2	2	2	111.5	2

TSC17	Cattle			Pig	Sheep/goat		
	MS	MS	LS/EM	MS	MS	MS	LS/EM
Element	s	hc	hc	hc	fs	hc	hc
hrn		1					
occ		1					
zyg		1					
man		10		1	1	1	1
max		1		2	1	1	
UdP2					2		
UdP3		2			1		
UdP4		2					
UM12		4			1	2	
UP34					1		
LI2				1			
LP34		1					
LM12		5			1		
atls		1					
sca d	1	3		2			
hum p						2	
hum d		1				2	
rad p+d						3	
rad p		2				1	
rad d						1	
uln p		2					
mtc p+d		1					
mtc d						2	
inn		1					
inn p		1					
inn d		3					
fem p		1	1			1	
fem d		0					
pat		1					
tib p				1		1	
tib d		1	1	1		1	
mt4				0.5			
mtt p+d		1.5				4	
mtt p		1				2	
mtt d						1	
mtp d		0.5				1.5	
cal		2		1	1		
p1		1				1	
p2		1					
	1	53	2	9.5	9	27.5	1

Appendix 4a: Skeletal element representation in cattle, sheep/goat and pig (NISP) – cont.

WPA	Cattle				Pig	Sheep/goat			
	MS-g	MS-m	MS-m	MS-m	MS-m	MS-g	MS-m	MS-m	MS-m
Element	hc	fs	s	hc	hc	hc	fs	s	hc
hrn				2		1			2
fro									
occ						1			
zyg	1		1	4	1				
man	1			13	3	6			44
max	1	1		5	1				7
UdP2				1					
UdP3				1					3
UdP4				2					
UM12				6			1		4
UM3				3		1			3
UP2			1						
UP4				1					
LdP2									1
LdP3						1			1
LdP4	2			2					3
LI1					1				
LI2		1			1				
LI12				1					
LI2?				1					
LM12	1			2			1		10
LM3				3					9
Can					1				
atls				2					2
axis				1					
sca d				3	1				4
sca n				1					2
hum p+d									
hum p				4					5
hum d	1			5			1		8
hum m									
rad p+d				1	1	1			7
rad p	5			2		1			4
rad d	2			3					
uln p+d					1				
uln p	3	0		3	1				2
mtc p+d				4.5					4.5
mtc p	1			1			1		2
mtc d				2.5				1	2.5
inn	1			3	2				1
inn p	1			2	1				
inn d				2					2
fem p+d	1			1					1
fem p	2			8	2	2			3
fem d				3					1
tib p+d				1	1				
tib p	1			1					3
tib d	3			5	0	1			9
mtt p+d				6		1			2
mtt p	1			1		2			6
mtt d	1			6					1
mtp d				1			0.5		2.5
ast	1			4		1			1
cal	2			4	1	1			4
centr	1			2					1
tarsal				1					
p1				9		2	2		2
p2				3	1		2		
p3	2			2			1		
	35	2	2	145	20	22	9.5	1	169.5

Appendix 4a: Skeletal element representation in equids, dog, cat and wild mammals (NISP). IA Iron Age; R Roman; S Saxon; MS Mid Saxon; LS Late Saxon; EM Early Medieval; SN Saxo-Norman; for WPA, MS-main includes contexts 1-99 and MS-main+ includes contexts over 100; equid phalanx counts multiplied by 2; numbers in [ ] are from fine-sieved assemblage for Gos 22 and dry-sieved assemblage for WPA.

	WNW IA	Gos 16 R	Gos 22 MS	Gos37 MS	TSC23 MS	TSC17 MS	WNW MS	WPA MS-gullies	WPA MS-main+	Gos 22 LS	WNW SN
Equid											
occ									2		
zyg									[1]		
UP2					1						
UP/M						1					
LdP2			1								
LdP3			1								
LI2				1							
LP/M			1 ec?								
I12								2			
I2?			[1]					1			
I3/I3?			[1]					1			
atlas									1		
sca d				1							
hum p+d											1
hum d						1					
rad p+d						1					
uln p						1					
mtc p+d									1		
inn-acet					1						
mtt p+d								1	1		
mtp d						1					
ast									1	1	
p1			2			2		2	2		
p3									2		
Dog											
hum	1										
Cat											
mandible			1								
mtt			0.2				0.2				
Hare											
inn	1										
Mole											
tibia				1							

Appendix 4b: Skeletal element representation in birds (NISP). IA Iron Age; R Roman; S Saxon; MS Mid Saxon; LS Late Saxon; EM Early Medieval; SN Saxo-Norman; for WPA, MS-main+ includes contexts over 100; Gos 22 MS (sv): dry-sieved assemblage; numbers in [[ ]] are from fine-sieved assemblage; WPA and TSC 17: numbers in [ ] are from dry-sieved assemblage

	Gos 16 R	Gos 16 S	Gos 22 MS	Gos 22 MS (sv)	Gos37 MS	TSC23 MS	TSC17 MS	WNW MS	WPA MS-gullies	WPA MS-main+	Gos22 LS	TSC23 LS/EM
Domestic fowl												
scapula												
humerus				1								
radius				1							1	
ulna				1								
carpometacarpus												
innominate												
femur				1		1				1		
tibiotarsus			2				[1]			1		
fibula				1								
tarsometatarsus										2		
Goose												
coracoid						1						
scapula						1		1				
humerus							1					
radius								1		1		2
ulna					1	1			1	1		2
carpometacarpus			1									2
femur										1		
tibiotarsus					1					1		
tarsometatarsus				1		2				1		
Duck												
humerus	1									1+[1]	1	
tarsometatarsus	1											
Wader (Scolopacidae)												
humerus				[[1]]								
Coot												
carpometacarpus			1									
Buzzard (*Buteo buteo*/cf. *Buteo* sp.)												
radius					1							
ulna					1							
innominate					2							
synsacrum					1							
femur					1							
tibiotarsus					1							
tarsometatarsus					1							
Buzzard/harrier (*Circus* sp.)												
tibiotarsus					2							
tarsometatarsus					1							
Buzzard/Kite (*Milvus* sp.)												
humerus					1+[1]							
Eggshell		[1]										

Appendix 5: Distribution of fish bones by site, phase, taxon and size. em early Medieval; r Roman; ms mid Saxon; ls late Saxon; ni no information; sn Saxo-norman; s Saxon; us unstratified; msm main Saxon period (contexts 1-99); msm+ main Saxon period (contexts 100+); fs fine-sieved; h/c hand-collected (identifications provided by Dr. Rebecca Nicholson, University of Bradford).

Site	Period	Cxt	S.	Rec	#	Element	Taxon	Size	Notes
Gos16	ni	16	4	fs	1	post-temporal	haddock	65-70cm	
Gos16	r	233	55	fs	1	caudal vertebra	flatfish	20cm	
Gos16	r	253	58	fs	1	hypural	flatfish	small	
Gos16	r	255	60	fs	1	caudal vertebra	flatfish	20cm	crushed
Gos16	r	255	60	fs	1	caudal vertebra	flatfish	15cm	
Gos16	r	234	56	fs	1	articular	flounder	20cm	left side
Gos16	r	232	54	fs	1	caudal vertebra	haddock	40-50cm	
Gos16	r	233	55	fs	1	precaudal vertebra	haddock	40-50cm	
Gos16	r	233	55	fs	1	atlas vertebra	haddock	40-50cm	
Gos16	r	233	55	fs	1	caudal vertebra	haddock	40-50cm	
Gos16	r	234	56	fs	1	caudal vertebra	haddock	50cm	
Gos16	r	234	56	fs	1	parasphenoid	haddock	50-60cm	fragment
Gos16	r	253	58	fs	1	cleithrum	haddock	70-75cm	
Gos16	r	253	58	fs	1	dentary	haddock	70-75cm	right side
Gos16	r	253	58	fs	1	hyomandibular	haddock	70-75cm	
Gos16	r	255	60	fs	1	precaudal vertebra	haddock	large	
Gos16	r	255	60	fs	2	caudal vertebra	haddock	large	
Gos16	r	256	61	fs	1	precaudal vertebra	haddock	70-75cm	
Gos16	r	256	61	fs	1	post-cleithrum	haddock	70-75cm	fragment
Gos16	r	233	55	fs	1	precaudal vertebra	plaice/flounder	45cm	
Gos16	r	234	56	fs	1	cleithrum	Pleuronectidae	20-25cm	
Gos16	r	255	60	fs	1	caudal vertebra	Pleuronectidae	25cm	
Gos16	r	233	55	fs	2	caudal vertebra	Pleuronectidae	35-40cm	
Gos16	r	233	55	fs	1	caudal vertebra	Pleuronectidae	40-45cm	
Gos16	r	232	54	fs	1	brancheostegal	unidentified		
Gos16	r	12	4	fs	1	brancheostegal	indeterminate		
Gos16	r	212	48	fs	1	supraoccipital	indeterminate		
Gos16	s	258	65	fs	1	vertebra	eel	30-40cm	
Gos16	s	142	36	fs					indet fragments only
Gos16	s	149	30	fs					indet fragments only
Gos22	ls	24	2	fs	1	hyomandibular	eel		
Gos22	ls	133	49	fs					indet. fragment only
Gos22	ls	279	50	fs					indet. fragments only
Gos22	ni	Bx 4	h/c	h/c	1	caudal vertebra	cod	large	
Gos22	us	469	h/c	h/c	1	cleithrum	haddock	>80cm	
Gos37	ms	29	18	fs	1	precaudal vertebra	haddock	35-40cm	
Gos37	ms	19	h/c	h/c	1	cleithrum	haddock	40-45cm	
Gos37	ms	53	h/c	h/c	1	cleithrum	haddock	40-45cm	
Gos37	ms	017/019	10	fs	2	precaudal vertebra	haddock	40-50cm	
Gos37	ms	017/019	5	fs					indet fragments only
Gos37	ms	32	17	fs					indet fragments only
TSC 17	ls/em	22	3	fs	1	precaudal vertebra	flatfish	small	burnt
TSC 17	ls/em	22	3	fs	1	caudal vertebra	flatfish	25-30cm	
TSC 17	ls/em	22	3	fs	1	articular	herring		
TSC 17	ls/em	22	3	fs	1	maxilla	herring/sprat		
TSC 17	ls/em	22	3	fs	1	opercular	herring/sprat		
TSC 17	ls/em	22	3	fs	1	preopercular	herring/sprat		fragment
TSC 17	ls/em	22	3	fs	1	precaudal vertebra	Pleuronectidae	25-30cm	
TSC 17	ls/em	22	3	fs	1	anal pterygiophore	Pleuronectidae	25-35cm	fragment
TSC 17	ls/em	22	3	fs	1	precaudal vertebra	Pleuronectidae	25-30cm	
TSC 17	ls/em	22	3	fs	2	caudal vertebra	Pleuronectidae	30cm	
TSC 17	ms	26	5	fs	1	articular	eel	40-50cm	
TSC 17	ms	26	5	fs	2	caudal vertebra	Pleuronectidae	25cm	
TSC 17	ms	26	5	fs	1	atlas vertebra	Pleuronectidae	15cm	

Site	Period	Cxt	S.	Rec	#	Element	Taxon	Size	Notes
TSC 17	ms	26	5	fs	1	vertebra	indeterminate		charred
TSC 17	ms	8	2	fs					indet. fragments only
TSC 23	ls/em	30	1	fs					indet. fragments only
TSC 23	ms	106	3	fs	1	precaudal vertebra	cf. flounder	30-35cm	
TSC 23	ms	106	3	fs	1	caudal vertebra	flatfish	small	burnt
TSC 23	ms	106	3	fs	2	precaudal vertebra	flatfish	<15cm	
TSC 23	ms	106	3	fs	1	precaudal vertebra	flatfish	15-20cm	
TSC 23	ms	106	3	fs	1	cleithrum	flatfish		fragment
TSC 23	ms	106	3	fs	1	urohyal	plaice/flounder	<15cm	
TSC 23	ms	106	3	fs	4	precaudal vertebra	Pleuronectidae	30-35cm	
TSC 23	ms	100	4	fs	1	caudal vertebra	Pleuronectidae	large	cf. plaice
TSC 23	ms	106	3	fs	1	pharyngeal	Pleuronectidae		
TSC 23	ms	106	3	fs	2	vertebra	indeterminate		burnt
TSC 23	ms	77	2	fs					indet. fragments only
WNW	ia	36	7	fs					indet. fragments only
WNW	md	83	8	fs	1	atlas vertebra	flatfish	<15cm	
WNW	md	83	8	fs	1	vertebra	indeterminate		
WNW	ms	186	19	fs					indet. fragment only
WNW	sn	110	15	fs	1	parasphenoid	eel		
WNW	sn	104	13	fs	24	vertebra	eel	small	
WNW	sn	107	14	fs	1	vertebra	eel		
WNW	sn	110	15	fs	57	vertebra	eel	small/med	some chewed bones
WNW	sn	62	3	fs	1	tubercle	flounder		
WNW	sn	95	11	fs	1	cleithrum	haddock	60-70cm	
WNW	sn	104	13	fs	1	vertebra	plaice/flounder	30-35cm	
WNW	sn	63	2	fs	1	caudal vertebra	Pleuronectidae	15cm	
WNW	sn	104	13	fs	1	atlas vertebra	Pleuronectidae	20cm	
WNW	sn	62	3	fs	1	caudal vertebra	Pleuronectidae	20cm	
WNW	sn	107	14	fs	21	vertebra	Pleuronectidae	small	?occasionally chewed/charred
WNW	sn	107	14	fs	1	maxilla	Pleuronectidae		
WNW	sn	62	3	fs	1	vertebra	smelt		
WNW	sn	63	2	fs	1	vertebra	indeterminate		
WNW	sn	80	9	fs					indet. fragments only
WNW	sn	98	12	fs					indet. fragment only
WNW	sn	107	16	fs					indet. fragments only
WNW	ms	130	h/c	h/c	1	cleithrum	haddock	>60cm	
WNW	sn	107	h/c	h/c	1	precaudal vertebra	cod	90-100cm	
WNW	sn	107	h/c	h/c	2	exoccipital	gadid	large	fragments
WNW	sn	107	h/c	h/c	1	supraoccipital	gadid	large	
WPA	msm	17	12	fs	1	vertebra	cf. eel		
WPA	msm	17	12	fs	3	vertebra	eel		
WPA	msm	17	12	fs	1	precaudal vertebra	eel	<20cm	
WPA	msm	17	12	fs	1	precaudal vertebra	eel	<20cm	
WPA	msm	17	12	fs	3	vertebra	eel	30-40cm	
WPA	msm	29	1	fs	1	vertebra	eel		
WPA	msm	40	11	fs	4	vertebra	eel		
WPA	msm	40	11	fs	3	vertebra	eel		fragments
WPA	msm	40	11	fs	3	caudal vertebra	flatfish	<20cm	
WPA	msm	40	11	fs	2	precaudal vertebra	flatfish	<20	
WPA	msm	40	11	fs	2	caudal vertebra	flatfish	small	
WPA	msm	40	11	fs	1	preopercular	flatfish	small	
WPA	msm	40	11	fs	2	caudal vertebra	haddock	45-55cm	
WPA	msm	40	11	fs	1	cleithrum	haddock	55-60cm	
WPA	msm	40	11	fs	2	precaudal vertebra	haddock	55-60cm	
WPA	msm	40	11	fs	1	caudal vertebra	haddock	65-70cm	
WPA	msm	17	12	fs	1	caudal vertebra	Pleuronectidae	small	
WPA	msm	40	11	fs	1	precaudal vertebra	Pleuronectidae	15cm	
WPA	msm	40	11	fs	2	precaudal vertebra	Pleuronectidae	20-25cm	
WPA	msm	40	11	fs	1	quadrate	Pleuronectidae	20-25cm	
WPA	msm	40	11	fs	3	caudal vertebra	Pleuronectidae	25-30cm	
WPA	msm	40	11	fs	2	caudal vertebra	Pleuronectidae	30-35cm	
WPA	msm+	207	6	fs	1	spine	3-spined stickleback		
WPA	msm+	197	4	fs	1	scale	cf. clupeid		fragments
WPA	msm+	197	4	fs	1	precaudal vertebra	cyprinid	15cm	cf. roach/dace

Site	Period	Cxt	S.	Rec	#	Element	Taxon	Size	Notes
WPA	msm+	199	9	fs	1	pharyngeal	cyprinid		fragment. No teeth/tooth sockets
WPA	msm+	231	10	fs	1	vertebra	cf. eel		fragment
WPA	msm+	106	13	fs	7	vertebra	eel		
WPA	msm+	106	13	fs	7	vertebra	eel	30-40cm	
WPA	msm+	188	3	fs	3	vertebra	eel		
WPA	msm+	188	3	fs	1	precaudal vertebra	eel		burnt
WPA	msm+	197	4	fs	6	vertebra	eel		
WPA	msm+	207	6	fs	1	vertebra	eel		
WPA	msm+	231	10	fs	1	vertebra	eel		charred
WPA	msm+	231	10	fs	1	vertebra	gadid		eroded
WPA	msm+	197	4	fs	1	cleithrum	haddock	60-65cm	
WPA	msm+	231	10	fs	4	precaudal vertebra	haddock	50-60cm	
WPA	msm+	197	4	fs	1	vertebra	herring/sprat		
WPA	msm+	129	2	fs	1	articular	pike	35cm	right side
WPA	msm+	239	8	fs	1	atlas vertebra	plaice/flounder	45-50cm	
WPA	msm+	239	8	fs	1	anal pterygiophore	Pleuronectidae	15cm	
WPA	msm+	239	8	fs	1	caudal vertebra	Pleuronectidae	15cm	
WPA	msm+	188	3	fs	3	precaudal vertebra	Pleuronectidae	15-25cm	
WPA	msm+	188	3	fs	2	caudal vertebra	Pleuronectidae	15-25cm	
WPA	msm+	197	4	fs	1	caudal vertebra	Pleuronectidae	10-15cm	
WPA	msm+	197	4	fs	1	caudal vertebra	Pleuronectidae	25-30cm	
WPA	msm+	197	4	fs	1	urohyal	Pleuronectidae	20-25cm	cf. flounder
WPA	msm+	207	6	fs	1	precaudal vertebra	cf. Pleuronectidae		
WPA	msm+	106	13	fs	1	hypohyal	indeterminate		
WPA	msm+	106	13	fs	1	vertebra	indeterminate		fragment
WPA	msm+	106	13	fs	3	vertebra	indeterminate		fragments
WPA	msm+	207	6	fs	1	scale	indeterminate		
WPA	msm+	129	2	fs					indet. fragments only
WPA	msm+	300	7	fs					indet. fragments only