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THE SAXON, MEDIEVAL AND POST-MEDIEVAL MAMMAL AND BIRD BONES EXCAVATED 1989-91 FROM CASTLE MALL, NORWICH, NORFOLK

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Summary

A large assemblage of mammal and bird bone from Castle Mall (Norwich) derives from six periods that range from the 9th to 18th century AD. Most belong to cattle, sheep, pig and domestic fowl. Beef was the main meat consumed in all periods, with pork an important second in the early periods and mutton later. Meat supply to the town derived from three main sources: animals bred on site, animals brought in on the hoof, and dressed carcasses purchased at market. The local breeding of cattle and sheep may have died out in post-medieval times, whereas pigs continued to be reared within the town. The practise of stock rearing within the town suggests that, at least in Saxon and medieval times, open areas were available and that the town was a mixture of rural and urban environments. Most bones derive from butchery and kitchen refuse, but many are from crafts and industries such as bone-, horn-, antler-, and leather-working. The bones indicate a variability in the quality of diet which is typical of towns. No evidence of high status activity such as royal banquets could be found in periods 2 and 3 when the castle was most active. The presence of two 17th century parrot bones indicates trade with distant countries. An increase in animal size and morphological changes are found in post-medieval and, in some cases, late medieval levels. These changes are related to the Agricultural Revolution and indicate stock improvement. A difference in kill-off patterns in later periods attests to a change in use. Cattle, which had mainly been used for traction throughout the Middle Ages, became more important for meat. Sheep remained extremely important for wool production, but their size increase after the 16th century suggests increased importance of mutton. An early increase in domestic fowl size represents an original contribution that the Castle Mall assemblage provides to the debate on the beginning of the Agricultural Revolution.

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The Saxon, medieval and post-medieval mammal and bird bones excavated 1989-1991 from Castle Mall, Norwich (Norfolk)

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CONTENTS

Summary

A large assemblage of mammal and bird bone was recovered from the site of Castle Mall (Norwich). This assemblage can be divided into six main periods that range from the 9th to 18th century AD (late Saxon to post-medieval). The majority of bones recovered belong to the main domestic animals, such as cattle, sheep, pig and domestic fowl. Beef was the main meat consumed in all periods, with pork making an important contribution to the diet in the early periods and mutton in the later periods. The meat supply to the town derived from three main sources: some animals were bred on site, others were brought to the site on the hoof in addition to pieces of dressed carcasses purchased from the market. The local breeding of cattle and sheep may have died out in post-medieval times, whereas pigs continued to be reared within the town. The practise of stock rearing within the town suggests that, at least in Saxon and medieval times, open areas were available and that the town was a mixture of rural and urban environments.

The majority of remains represent butchery and kitchen refuse, but many are also associated with craft and industrial activities such as bone-, horn-, antler- and leather-working. Altogether the bones indicate a variability in the quality of diet which is typical of towns. No evidence of high status could be found in periods 2 and 3 when the castle was most active. We must therefore assume that the bones do not represent the remains of royal banquets. The presence of two parrot bones in a 17th century context points to the existence of trade with distant countries.

An increase in animal size and morphological changes are found in the post-medieval and, in some cases, the late medieval levels. These changes are related to the agricultural revolution and indicate the presence of improved breeds. A difference in the kill-off patterns in later periods attests to a change in use. Cattle, which had mainly been used for traction throughout the Middle Ages, became more important for meat production. Sheep remained extremely important for wool production, but their size increase after the 16th century suggests also an emphasis on mutton production. There is a particularly early increase in the size of domestic fowl which represents an original contribution that the Castle Mall assemblage can provide to the debate on the beginning of the agricultural revolution.

Introduction

Norwich is the main town in Norfolk, the most northern of the East Anglian counties, and is one of the most important centres in eastern England (fig.1). The city was particularly important in medieval times and the castle is one of Norwich's most prominent features (fig.2).

The town is located in the valley of the river Wensum which is characterised by accumulations of sand and gravel glacial deposits (Ayers 1994). Hillslopes and gravel terraces found on the banks of the river make the town rather hilly, in contrast to the generally flat morphology of the surrounding Norfolk landscape.

The site of "Castle Mall" occupied the south bailey of Norwich Castle and a large area of adjacent urban settlement (fig.3). It was excavated by the Norfolk Archaeological Unit (NAU) under the direction of Jez Reeve between April 1989 and May 1991 (NAU 1994). It was the largest archaeological excavation ever undertaken in Norwich and one of the largest urban excavations in Europe (Reeve 1992). The post-excavation stage of the project started in 1991 again carried out by the Norfolk Archaeological Unit, this time under Liz Shepherd's direction.

A large assemblage of animal bone was recovered from all areas and phases of the site. Assessment of potential for analysis of the assemblage was undertaken by the Cambridge Faunal Remains Unit for mammals and birds (Luff 1992) and by Alison Locker for fishes (Locker 1992). Subsequent to funding and approval of the post-excavation project by English Heritage, the study of the mammal and bird bones from one particular feature, the barbican well (flint shaft), was undertaken by Marta Moreno Garcia (forthcoming). The study of the mammal and bird bones from the rest of the site started in January 1995 and represents the subject of this report. The fish bones from the whole site (including the barbican well) have been studied by Alison Locker (forthcoming).

The site was divided into eighteen areas and six main periods. Site plans by period can be found in figs.4-13. The periods are defined as follows:

	Site period	Chronology	General period
Period 1	pre/early post-conquest	late 9th to 11th centuries	late Saxon / early Norman
Period 2	conquest / timber castle	late 11th to early 12th centuries	Norman ("early medieval")
Period 3	stone castle	late 11th to 12th centuries	Norman ("early medieval")
Period 4	medieval developments	late 12th to mid 14th centuries	medieval ("mid medieval")
Period 5	late medieval / transitional	mid/late 14th to mid 16th centuries	late medieval
Period 6	post-medieval	late 16th to 18th centuries	post-medieval

Period 1 is mainly late Saxon, though some contexts from the upper levels (sub-period 4) could belong to the post-conquest phase. There is a considerable overlap in the dating of periods 2 and 3 thus they were often combined in our analysis. Although further divisions of the first three periods[1] into sub-periods was possible it was generally not adopted in this report, as the resulting bone assemblages would have been too small for meaningful analysis. The only exception is in period 1 where a comparison between sub-periods 1-3 (late 9th to 11th centuries: pre-conquest) and 4 (late 11th century: pre/post-conquest) was attempted. In addition a few specific bone deposits or individual finds could be more precisely dated than to period level (see below).

Animal bones were found throughout all areas and periods of the site, but were more abundant in periods 1 and 6. The distribution of bones across the site was very uneven and changed in different periods. Only stratified contexts which could be reliably phased have been considered. Contexts seriously affected by contamination or residuality have also been excluded.

The main aims of this report are:

- to contribute to our understanding of human activities in the area of Norwich Castle in different periods. In more general terms to see how animals contributed to the economy of Norwich, how they influenced (or were influenced by) the environment of the site, and how these relationships developed through time.
- to contribute to our understanding of more general issues, such as husbandry practices, economic development and use of the environment at a regional and national level.

A secondary, but still important, aim was to see how our methodological approaches and problems could contribute to address and improve future zooarchaeological research.

[1] By the time this report was finished sub-periods for periods 4 to 6 also became available. Unfortunately it was too late to take these more refined dates into account for the analysis. However, sub-periods for periods 4 to 6 are included in the two appendices (ageing and metric data); see the key to appendix 1 for the chronology of sub-periods.

Archaeological and Historical Summary (from Ayers 1994, Reeve 1992 and Tillyard 1992-93)

Saxon (period 1)

There is no historical or archaeological evidence of pre - late Saxon occupation in Norwich. However, street names with Danish formations possibly reflect an Anglo-Scandinavian heritage. Evidence for the existence of late Saxon settlement in this area comes from the Domesday book. Written in 1068 it retrospectively records the presence of 98 properties which were vacated to allow the building of the castle.

Although in this period eastern Norfolk was densely populated compared to the rest of England, only a few towns had developed. Norwich as one of the largest had already acquired its status of dominant town.

Trade in this period was mainly local and regional, but occasional contacts with overseas countries (Scandinavia, Low Countries and Rhineland) have been identified by archaeological evidence. Craftsmen such as shoemakers and comb-makers were already active in Saxon times in the town.

Archaeological evidence of late Saxon structures was found underneath the rampart of the south bailey. The remains of domestic buildings, pits and a graveyard were revealed (fig.4). Almost all pits were eventually used for refuse disposal, although some may have originally functioned as cess or storage pits, with a few perhaps serving an industrial function (Liz Shepherd, pers. comm.). Several different styles of house buildings were identified, amongst these are wooden post structures, post-in-slot type buildings and sunken-feature buildings.

Norman/medieval (periods 2, 3 and 4)

The castle - Around 1068, just after the arrival of the Normans, a *royal* castle was erected. At the same time, or possibly sometime later, defensive structures in the form of ditches and a mound were also built. The castle keep was initially constructed in timber, but was replaced with a stone structure by the beginning of the 12th century. The area of land used for the royal estate was defined by a surrounding ditch. In the 13th century a massive new ditch, the "barbican ditch", was dug across the southern entrance to the castle.

The castle was used by early kings only as an occasional residence. They visited no more frequently than once every five or ten years and even more rarely by the 13th century. On these occasions, or when a disturbance or an invasion threatened the town, the sheriff had to provision the castle. The purchase of such goods as wheat, salt pork, sausages and cherries for this purpose is well documented.

By the end of the 13th century the importance of the castle as a royal residence and military stronghold began to decline. However, the area remained under royal jurisdiction until 1345. Once no longer used for defence, its irregular terrain, due to the presence of earthworks, led to the Castle Mall area being used as an open space for refuse disposal and animal grazing. Due to later landscaping

there is little archaeological evidence for this period. By the beginning of the 14th century the Castle was mainly used as the County Gaol.

The town - The city grew in importance after the Norman conquest, becoming a well known centre for cloth-finishing, probably for cloth produced in the surrounding countryside. Archaeological remains of such activity include an early medieval wool comb made of bone found in the Whitefriars excavation (Ayers and Murphy 1983) (fig.2). Documentary evidence indicates that tanning, skinning, fulling, dying and horn-working industries and trades were also well established, and were mainly situated along the banks of the river. The presence of further activities connected with the clothing trade (shoemakers, tailors, woolmen) and other trades such as poulterers is also recorded.

The main market place, originally laid out in the 11th century, was used for the sale of poultry, sheep, cattle, wheat, wood and cheese. The trade in fish also seems to have been important with the presence of two fish houses mentioned in the second half of the 13th century.

By the early 14th century Norwich was the largest walled town in England (larger than London and Southwark combined). Through gradual growth the city's population may have become as large as 30,000 inhabitants by this time. This increase in population size began to create problems with rubbish disposal. This was partly resolved by dumping material along the river bank, but it is also likely that smaller scale waste disposal in rear tenement yards was being practised.

In 1349 Norwich was hit hard by the Black Death, which affected the city into the later part of the century. Unfortunately this period of the city's history is not yet well represented in the archaeological record.

Late medieval (period 5)

In the 15th century the corporate body of the city became a major element of Norwich society, buying up shops and market stalls and controlling the sale of meat, poultry and fish. The city was wealthy, but the social contrasts between the upper and poor classes are evident by this period. Industrial activities were still flourishing, although the textile trade seems to have suffered some decline. The main craftsmen, fullers, tanners and skinners, continued mostly to use the river frontage as in earlier periods.

By this time the castle had lost its importance and the towers were in a state of decay. The banks and ditches were beginning to fill up with all sorts of rubbish, from sewage to building rubble. In the 14th century a long-standing battle started between the authorities and people who used the castle ditches as rubbish dumps. Documentary evidence attests to the prosecution of several individuals for illegal dumping of waste in the ditches. Cases of the illegal disposal of horse carcasses in a lane near the Shire House and in the castle ditches are recorded for 1391 and 1549. Evidence for sheep and horse pasturing in the castle ditches and meadows is suggested by a 1535 decree which prohibited these sort of activities.

A great fire broke out in 1507 burning 718 houses in 16 parishes. This disaster added to the economic problems that the city was already facing. Although some indications of wealth are still recognisable, a general economic

malaise of the city characterises this period. Weeds were growing in the market place and at the beginning of the 16th century a herd of cows interrupted a service in the church of St.Peter Mancroft. However, despite economic and political problems, Norwich maintained its importance as a major urban centre in the region.

The archaeological excavations at Castle Mall highlighted an intense period of activity testified by evidence of industrial working and dumping of rubbish, but the only excavated structures of this date were boundary walls across the southern part of the site.

Post-medieval (period 6)

The population of Norwich continued to grow, by the 17th century it was the second largest city in England. Its importance as a regional centre and as a market also increased. The castle surroundings were built up with the exception of the area in front of the castle gate where the terrain was probably still considered to be too irregular for housing. By the end of the 18th century the city was densely populated but most of the population was still housed within the city walls. Evidence for the wealth of the city in this period is found in the richness of the artifacts, such as high class imported pottery, found within the fills of the barbican ditches.

Deliberate dumping led to the filling up of the castle ditches whilst the illegal disposal of animal corpses continued into this late period. In 1666 a man was accused of throwing several horse carcasses into the barbican ditch.

Cattle, sheep and pigs were sold in the south-western part of the bailey in the 17th century. In 1738 landscaping of the castle area was undertaken to provide a cattle market and a horse fair, where sheep and pigs were sold.

Methods

Excavation, sampling and recovery

Most of the site was hand-excavated by trowel. However, part of some large earthwork features, such as the post-medieval barbican ditch (figs.11-13) were largely dug by machine. This latter technique did not allow the recovery of many animal bones. The great majority of the bones from the barbican ditch derive from a "trial hole" (fig.13), which was excavated by hand.

Most animal bones were hand-collected, but many others derive from the large-scale sampling programme which was carried out on the site. Samples for sieving and flotation were taken from all pre-modern "sealed" and "primary" deposits and from all features that could not be fully excavated due to time constraints (NAU 1994).

Two types of samples were taken: "soil riddled samples" (SRS) and "bulk samples" (BS). Soil riddled samples were wet sieved through an 8mm mesh (Irena Lentowicz pers. comm.) and provided supplementary finds to the hand retrieved material. Bulk samples were taken for flotation (0.5mm mesh) to recover smaller material, such as plant remains and snails. The sorting of the flotation residues allowed the recovery of a substantial amount of animal bones. The size of the samples was variable but normally 15-30 litres were taken for bulk samples and 150 litres for soil riddled samples (Murphy forthcoming). More specific information is available in archive and can be requested from the Birmingham Zooarchaeology Laboratory or the Norfolk Archaeological Unit.

Both types of samples were "whole earth" samples (Julia Huddle pers. comm.), that is no material was collected from the samples prior to sieving or flotation. This provided a true representation of all the species present and therefore could be confidently used for quantification purposes, and not only to supplement the list of species from the hand-collected assemblage (see Payne 1992 for a more detailed discussion of this problem).

The method of recovery of the mammal and bird bones from Castle Mall is of particular relevance to the interpretation of results such as the frequency of different taxa and the representation of body parts. For the remainder of this report we will use the following abbreviations to differentiate the methods of recovery used for animal bones at Castle Mall:

HC = hand-collected bones
SRS = bones deriving from 8mm sieving of "soil riddled samples"
BS = bones deriving from the 0.5mm flotation residues of "bulk samples"

Identification

Some closely related taxa were difficult to distinguish. In such cases, separation was only attempted for parts of the skeleton for which it was thought that reliable criteria were available. It was considered that this method would preserve all the quantitative aspects of analysis, be more reliable and less time consuming.

Caprines - It was generally possible to identify the following parts of the skeleton as either sheep or goat: dP_3, dP_4, distal humerus, distal metapodia (both fused and unfused epiphyses), distal tibia, astragalus, and calcaneus using the criteria described in Boessneck (1969), Kratochvil (1969) and Payne (1969 and 1985b). Since horncores are not necessarily present in both sexes and can be subject to different patterns of preservation, they were distinguished but not used to calculate the sheep:goat ratio.

Equids - The shape of the enamel folds (Davis 1980; Eisenmann 1981) was used for identifying equid teeth to species. Only complete or sub-complete molar rows were considered. All post-cranial bones were identified simply as "equid".

Galliforms - The closely related galliforms - domestic fowl, guinea fowl (*Numida meleagris*) and pheasant (*Phasianus colchicus*) - are difficult to distinguish. The presence of a spur on tarsometatarsi was considered a diagnostic character of male domestic fowl/pheasant (being absent from guinea-fowl), whereas the lack of a continuous posterior keel on the tarsometatarsus was considered a diagnostic character for distinguishing between pheasant and domestic fowl/guinea fowl. Therefore a spurred tarsometatarsus lacking the posterior continuous keel was securely identified as "domestic fowl". The presence or absence of an air-sac foramen on the proximal end of the femur was used to distinguish between pheasant and domestic fowl/guinea fowl. MacDonald's (1992) criteria for the scapula and carpometacarpus were used to distinguish domestic fowl/pheasant from guinea fowl.

Amphibians - All amphibian bones were identified to class level; differences in the shape of the pelvis were used to distinguish frog from toad.

Counting and quantification

For a full description of the methods used for mammal bones see Davis (1992a). In brief, all mandibular teeth and a restricted suite of "parts of the skeleton always recorded" (i.e., a predetermined set of articular ends/epiphyses and diaphyses of girdle, limb and foot bones) were recorded and used in counts. These are: scapula (glenoid articulation), distal humerus, distal radius, carpal 2-3 (or 2 or 3 according to the taxon), distal metacarpus, ischial part of the acetabulum (pelvic girdle), distal femur, distal tibia, calcaneus, astragalus, distal metatarsus, proximal end of the first phalanx, and third phalanx. In order to avoid multiple counting of very fragmented bones, at least 50% of a given part had to be present for it to be counted. Single metapodial condyles of cattle, caprines and cervids were counted as halves, as were each of the two central pig metapodia. Metapodia of carnivores and lagomorphs were counted as quarters. One skull element (the zygomatic arch) was added to the list of countable elements suggested by Davis (1992a). The radiale was not recorded.

Horncores and antlers with a complete transverse section and "non-countable" elements of particular interest (e.g. belonging to rarer species, of anomalous size or with interesting butchery marks or abnormalities) were recorded, but not included in the counts. Worked bones were recorded, but included in the counts only if they included a "countable" zone (see above). Countable worked bones were few and are thus unlikely to affect the distribution

of species and body parts.

For birds the following elements were always recorded: articular end of scapula, proximal coracoid, distal humerus, proximal carpometacarpus, distal femur, distal tibiotarsus and distal tarsometatarsus.

For amphibians, the following were always recorded: humerus, radius, pelvis, femur and tibia. Long bones were recorded when at least one half was present, whereas pelvis was recorded when the acetabulum was present.

Total number of fragments (NISP) and minimum number of individuals (MNI) were both calculated for the most common taxa. As the side of each element was not recorded, the MNI was simply calculated by dividing each element by its number in the body. The MNI was calculated at the "higher level of aggregation" (Grayson 1984), i.e. it was calculated considering each period as a single group, rather than calculating the MNI for smaller groups, such as units, and summing them to get the total for the period.

The weight of bird bones for each context was also recorded. This was then compared to the total weight of bones by context as provided by the Norfolk Archaeological Unit (these data were originally collected by Rosemary Luff). Unfortunately this comparison was only possible for the hand-collected material, as the total animal bone weight of the sieved samples was not recorded either by Rosemary Luff or by us. It was not intended to use the "weight method" to assess precisely the relative importance of different taxa, but rather to compare broad taxonomic groups in a similar way as done by Davis (1991a) for the site of Closegate and as recommended by Barrett (1993).

Ageing and sexing

The wear stage was recorded for all P_4s, dP_4s and molars of cattle, caprines and pig, both isolated teeth and those in mandibles. Tooth wear stages follow Grant (1982) for cattle and pig and Payne (1973 and 1987) for sheep/goat. Mandibles with at least two teeth in the dP_4/P_4 - M_3 row, whose wear stage was recordable, were also assigned to the mandibular wear stages of O'Connor (1988) for cattle and pig and of Payne (1973) for caprines. A complete list of the mandibular wear stages of the three main domesticates is presented in appendix 1.

The fusion stage of post-cranial bones was recorded for all species. An epiphysis was described as "fusing" once spicules of bone had formed across the epiphysial plate joining the diaphysis to the epiphysis but open areas were still visible between epiphysis and diaphysis. An epiphysis was described as "fused" when this line of fusion was closed.

Bird bones with "spongy" (i.e., incompletely ossified or growing) ends were recorded as "juvenile".

It was only possible to separate the sexes using morphological characters in pig and domestic fowl. The size and shape of pig canines (and their alveoli) were used to distinguish boars from sows, whereas the presence or absence of a spur on the tarsometatarsus was the criterion used to distinguish cocks (and capons) from hens (exceptions can occur, so this method may not separate all male from female domestic fowl). For other taxa any attempt to detect the sexual composition of the population had to rely on metrical analysis.

Measurements

A complete list of the individual measurements taken at Castle Mall is given in appendix 2, whereas a summary of the most common measurements of the main species can be found in tables 18, 27, 36 and 41. Measurements in general follow von den Driesch (1976), but some specifications are necessary for a few cases.

Cattle M_3 length and width (M_3L and M_3W) are the maximum length and width of the crown. In order to take the maximum measurement some mandibles had to be carefully prised apart in order to extract the tooth. This was also the case when taking the maximum crown widths of caprine teeth. Measurements taken on equid cheek teeth follow Davis (1987a). Pig tooth measurements follow Payne and Bull (1988) but in addition, the width of the central (i.e., second) pillar of M_3 was measured.

Humerus HTC and BT and Tibia Bd are, for all species, taken in the way described by Payne and Bull (1988) for pigs. Measurements on cattle and caprine metapodia follow Davis (1992a).

W_{max} and W_{min} are the largest and smallest diameters at the base of horncores and antlers. L is the dorsal distance between the base and the top of the horn-core.

Gnawing, butchery and burning

For all "countable" post-cranial bones gnawing and butchery marks were recorded. They were also recorded when present on mandibles, but not used for quantitative purposes.

Butchery marks were described crudely as "chop", "cut" and "saw" marks. Their position was recorded only if considered particularly meaningful (e.g., cuts on the proximal or distal part of the metapodia), but this was not used for quantitative purposes.

Gnawing marks made by carnivores and rodents were differentiated. Signs of partial digestion (see Payne and Munson 1985) were also recorded.

Burnt bones were recorded as "singed" (only a relatively small area of the bone had been in contact with fire), " burnt" (a substantial part of the bone was burnt and had acquired a brown/black colour), or "calcined" (the bone had been subject to high temperature stress and had acquired a whitish colour and a "chalky" consistency). Since we were aware of the reduction in size which is generally consequent to contact with fire, "burnt" and "calcined" bones were not measured.

Storage

The mammal and bird bones from Castle Mall are presently and temporarily held in the English Heritage store in Nottingham. The bones will finally be stored in the Norfolk Landscape Archaeology Section at Gressenhall (Norwich).

Preservation

The majority of the Castle Mall bones were fragmented as a consequence of human activity, animal gnawing, trampling and combined mechanical/chemical action in the soil. However, a few complete or sub-complete articulated skeletons were found, as well as a substantial quantity of complete bones which were either untouched by fragmentation mechanisms or derived from redeposited skeletons.

The level of fragmentation varied between different periods, areas and contexts, but was difficult to assess. The level of fragmentation of a bone assemblage is generally assessed using the ratio between the number of teeth and bones or between the number of isolated teeth and mandibles. Unfortunately these ratios are particularly affected by problems such as recovery biases and disposal practices, and, especially in the case of urban excavations, can be of little use as an index of fragmentation. For instance, a very low number of isolated teeth was observed in all periods at Castle Mall. Although this is possibly connected with a relatively low rate of fragmentation, it is almost certainly a consequence of recovery bias which led to the preferential collection of larger and more visible mandible fragments.

The few articulated bones, indicating the presence of primary deposits, were found across the site in various periods (see table 5 for a list of articulated skeletons). It is probable that most bones derive from contexts representing secondary deposits, i.e. they were not found at the original site of discard. This is typical of most archaeological sites and does not necessarily affect the quality of zooarchaeological information that can be obtained from the faunal assemblage.

The presence of gnawing marks generally attests to the redeposition of the animal bones as a result of scavenger activity. A substantial amount of bone - ranging between 6% and 15% of the total in different periods - bore gnawing marks (table 20). These were mainly caused by dogs, but in a few cases also by smaller carnivores (plate 1). This total is somewhat lower than that generally found on most rural sites - see for instance Burystead and Langham Road (Davis 1992b) and West Cotton (Albarella and Davis 1994). The lower incidence of scavenger marks on bones from urban sites may suggest more organised disposal practices in towns than in villages. In this respect it is interesting to notice that the percentage of gnawing marks at Castle Mall decreases by period 4, possibly indicating a change of strategy in the organisation of disposal practices.

Only slight variations in the incidence of gnawing marks on different species were noted. This is somewhat surprising as it is expected that dogs would more commonly chew bones of a relatively small size, such as sheep or pig bones. However, smaller bones could also be more easily destroyed and therefore become "invisible" in the archaeological assemblage (the recording system used only takes into account bones which still bear an articular end).

Very few bones were burnt: no more than 4% in any period. It is interesting to note that the lowest percentage of burnt bones (1%) was found in the post-medieval period, perhaps suggesting that a larger proportion of the material deriving form this phase was of non-domestic origin.

Occurrence and relative importance of different animals

The Castle Mall animal bone assemblage, like most other medieval sites in Britain, is dominated in all periods by the main domestic livestock - cattle, sheep, pig and domestic fowl. However, a variety of other mammals and birds was also found at the site (tables 1-4). Some of these taxa may not have an anthropogenic origin, and certainly not all of them represent food animals. Nevertheless, it is obvious that most of the animals were associated with people and certainly the bulk of the bones originate from animals which were eaten.

Mammals versus birds

The relative percentage and importance of mammals and birds is strongly affected by differential recovery and taphonomic biases and is therefore difficult to assess. This comparison becomes easier to tackle when it is seen in relative terms by comparing different periods. Thus rather than trying to establish the exact proportion of mammals and birds in each period we will investigate how it varied over time.

In fig.14 the relative weight and number of bird fragments are compared. Due to their small size and low weight bird bones represent only a very small percentage of the total bone weight. The percentage of bird fragments (NISP) is much higher, especially for the material recovered from sieving where there was a better recovery rate of smaller material. Little difference was noted in the bird and mammal ratios between the SRS and BS sieving: for bird bones the sorting of the flotation residues ("BS") did not result in a more efficient recovery than the coarse sieving ("SRS").

All quantification systems indicate that there is no dramatic variation in the frequency of birds in different periods. The highest number of birds is found in period 4 (medieval) and after this period the frequency of birds started to decline again. In general there are more birds present in the mid to post-medieval periods than in the Saxo-Norman period.

This difference is not a result of better recovery as it is also observed in the sieved material. There is no evidence that taphonomic factors lead to a better preservation in period 4 or that the bird bones came from one or two specific deposits which could be the consequence of specialised activities. Thus it appears that a slight, but genuine, increase in the economic importance of birds occurred in period 4.

Comparison between quantification and recovery systems

When the frequency of the main mammal taxa was compared, different quantification methods gave different results (tables 6 and 7; fig.15). Cattle were consistently better represented in the NISP count of hand collected specimens, whereas sheep/goat and pig were more frequent when the NISP for sieved material or the MNI counts were applied. The only minor exception is represented

by period 3 and this is almost certainly a consequence of small sample bias. Among the birds, goose was slightly over-represented in the hand-collected material (table 8).

MNI is less affected by taphonomic and recovery biases than NISP and therefore provides results which are similar to those obtained from the sieved assemblage. A good way to quantify the frequency of different taxa would be to calculate the MNI for the sieved material. Unfortunately MNI can be reliably applied only to large samples, and this is generally not the case for the sieved assemblages from Castle Mall.

The different biases that affect the three different quantification systems at Castle Mall are here summarised:
NISP hand collected: severely affected by recovery and taphonomic biases
NISP sieved: still partly affected by taphonomic biases and less reliable due to smaller and selective samples
MNI: not applicable to small assemblages; it may count body portions rather than individuals.

One possible solution to these problems is to calculate correction factors from the NISP sieved material to apply to the NISP hand collected material, successfully accomplished by some authors (e.g. Watson 1983). However, to carry out such a correction it is important that there are no substantial lateral variations in the distribution of the main taxa. Due to differential sampling at Castle Mall, the sieved material does not have the same spatial distribution as the hand-collected material. Therefore, lateral variation in the distribution of the bones would imply that the hand-collected and the sieved assemblages are not entirely comparable. To check this, the distribution of the main taxa in period 1 was investigated and statistically significant differences between areas were identified. Thus a correction factor from sieved material could not be applied (see below for a more detailed discussion of lateral variation). We can therefore only conclude that, as is the case for almost all bone assemblages, none of these systems provide a precise estimate of the relative frequency of the three main taxa. However, a comparison between the different quantification systems suggests that by assuming the NISP hand collected count furnishes a figure for cattle which is about 10-20% too high (this should be equally distributed between sheep/goat and pig) a realistic estimate of abundance can be reached. For birds an over-representation of goose of about 5% is probable.

The Castle Mall excavation produced a sieved bone assemblage that is much larger than that recovered from most other archaeological sites in Britain. This has been invaluable for the recovery of smaller species and in highlighting problems of recovery bias. Nevertheless, this is still insufficient to produce the best possible result from such a time-consuming recovery process. A substantial percentage of the content of *all* contexts or group of contexts should be coarse sieved to allow for the calculation of correction factors to apply to the hand-collected material. Selective sampling necessarily leads to the creation of two, non-comparable, assemblages of hand collected and sieved animal bones.

Comparison between different periods

Although there are problems in combining information from different areas and types of context an attempt to compare the frequency of the main mammals and birds between different periods was undertaken. Only a few contexts clearly contained bone deposits which were different from the normal mixture of butchery, food and work refuse found in most urban medieval sites. Only one of these "special" assemblages - a pit full of sheep horncores, metapodia and phalanges from period 5 - was large enough to severely bias the analysis of taxon frequency, and it was excluded from this comparison.

Another consideration was the possibility that variation in the recovery rate of hand collected bones had occurred between different periods. This could affect the relative frequency of species and thus create artificial differences between periods. The problem was tackled by calculating the relative number of small elements (incisors and astragali) within each period (table 9). Although the small elements were heavily underrepresented no major changes could be noted between different periods. Thus it can be assumed that roughly the same recovery bias affects the hand collected assemblage in all periods and that no large differences in the frequency of the species due to differential recovery occur as a result.

Although not the most numerically frequent species (tables 6 and 7; fig.15), cattle, due to their large size, must have provided the bulk of meat in most periods at Castle Mall. Whilst the frequency of cattle remained stable throughout the Castle Mall chronological sequence, in the later periods sheep became more common at the expense of pig.

Although many varied factors are affecting these percentages, they still demonstrate an interesting trend. Despite possible differences in preservation, in the use of the archaeological features and in disposal practices between different periods, the change in the frequency of the main domestic mammals reflects the results of previous research. Several authors have noted a countrywide trend (e.g. Grant 1988, Albarella and Davis 1996) for a high frequency of pigs in early medieval periods and an increase in the importance of sheep, probably connected to the rise of the wool industry, in the late Middle Ages. A decline in the number of pigs in late medieval times has been identified in another area of Norwich, Fishergate (G.Jones 1994).

The presence of a large number of pig bones has been linked to high status sites (Grant 1988, Albarella and Davis 1996). Pigs are typically "meat animals" and are thus expected to be more common on sites with a higher meat consumption. Periods 2 and 3 at Castle Mall are those associated with the most active period of the castle life, and thus it is possible to speculate that the higher frequency of pigs in these periods is an indication of status. However, as will be discussed below, no other evidence of high status, either from the animal or the plant assemblages (Murphy forthcoming), could be found for these periods. We are thus more inclined to think that the decrease in the number of pig bones in later periods is a consequence of a genuine change in the animal economy noted at a countrywide level. This question is further discussed in the section "comparison with other sites".

A substantial increase in the number of pigs was noted in the later part of period 1 (table 10), namely in the immediately pre-conquest or early post-conquest

period. This again could be interpreted as a consequence of the high status that the site acquired with the erection of the castle, but it is more probably due to some change in animal exploitation or in the use of the site which was brought about by the arrival of the Normans.

Another expected trend is a decrease in cattle, relative to horse, in late medieval and post-medieval times (Albarella and Davis 1994). In Norfolk in particular horses increased in importance very early, already during the Middle Ages (Langdon 1986). Equids are rare in any period at Castle Mall with the remarkable exception of the latest, post-medieval period 6 (table 2). However, it is doubtful that this is connected with changes in the economic system. The high number of horse bones in the late fills of the castle ditches (mainly the barbican ditch) is probably the consequence of the different disposal practises carried out in post-medieval times. Historical evidence of the illegal disposal of horse skeletons in the castle ditches is abundant (see above). Horses are typical farm animals and are generally not common in urban sites: they were used in towns, but they were generally bred or slaughtered elsewhere. Very low frequencies of horse bones have also been noted for the other Norwich sites of Alms Lane (Cartledge 1985), St.Martin-at-Palace Plain (Cartledge 1987) and Fishergate (G.Jones 1994).

Among the main domestic birds, domestic fowl represents by far the most common species, with goose relatively common and duck only occasionally present. A slight increase in the importance of goose was noted after Saxon times: a possible consequence of minor cultural and economic changes. Slightly higher percentages of goose bones have been found in the 10th-12th century levels at Fishergate (Norwich) (G.Jones 1994) and Thetford (G.Jones 1993), however, this may only reflect differences in the efficiency of recovery.

Spatial analysis

We have so far considered the bone assemblages within each period as single units. However, the possibility that variation between different areas of the site and types of context occurs must be considered. This analysis is aimed at the identification of possible differences and similarities in use of the site in different areas and to assess to what extent these affect the frequency of the species in different periods.

Due to the nature of the archaeological evidence the analysis of lateral variation in animal bone distribution in terms of a comparison between different "activity areas" could only be undertaken for period 1 (Liz Shepherd pers. comm.). For other periods the comparison was limited to the study of the contrast between the contents of pit and ditch fills.

Period 1 covers the late Saxon occupation of the site and possibly the very early post-conquest phase (sub-period 4). The castle was not yet built and the Castle Mall area was occupied by different "properties" which probably had both domestic and industrial functions. It was not possible to compare bone assemblages from each individual "property" as this would have resulted in a division of the assemblage into very small samples. Thus, after discussion with the excavators, it was decided to group the "properties" into four different areas:

centre, north, east and west (figs.4 -6). The frequency of the main domestic taxa was calculated for each of these areas (fig.16).

This comparison identified substantial differences between the areas. "Properties" on the east part of the settlement produced a much larger number of domestic fowl bones, whereas the "properties" in the north had a larger number of pig bones. We also investigated the distribution of craft activities, such as horn-working, in different areas. Horncore and antler finds were scattered throughout the site, but were less common in the northern area (fig.17). Antler fragments were mainly concentrated in the eastern part which produced only very few horncores.

The interpretation of these differences is far from easy and should be attempted in the light of all other archaeological evidence. One possibility is that they reflect differences in food taste between different families, another is that they indicate variation in the disposal of food refuse. Wilson (1994) has pointed out that greater amounts of large bone fragments are generally present in the periphery of a settlement. In view of this observation it is possible that the eastern area, with its high number of small chicken bones, might be closer to the real centre of the site. It seems reasonable to suggest that the central part of a settlement was kept clear of the largest food and butchery refuse.

In considering the distribution of horncores and antlers it must be emphasised that we are dealing with small samples (fig.17). However, it appears that horn and antler working was practised all over the site. The latter was mainly concentrated in the "properties" in the east, whereas horn-working was primarily practised in the centre and northern "properties". It is also possible that this distribution reflects patterns of disposal rather than activity, but we think that this is a less likely explanation. In the area under analysis there is a rather high density of buildings and workers would probably dispose of their refuse either in the vicinity of their own workshop or much further afield.

Although bones were recovered from floors, external layers and other contexts, the majority of the Castle Mall animal bones derive from pit and ditch fills. The assemblages from periods 2,3,4 and 6 are more or less evenly distributed between these two types of context, whereas bones from period 1 and 5 derive almost entirely from pits (table 11). Differences between the distribution of bone in ditches and pits have been noted by several authors (Maltby 1981, Coy 1987, Wilson 1994). Wilson (1994) also suggested that ditches have a tendency to contain higher frequencies of the bones of larger animals (cattle and horses). If the small, and possibly misleading, assemblages are ignored this tendency is confirmed at Castle Mall (table 11). Although the difference is not striking, cattle bones are regularly relatively scarcer in pit fills. The figure for period 6 must be carefully considered as the percentages are affected by the high number of equid and carnivore bones presumably derived from complete bodies discarded in the barbican ditch.

The main difference between ditch and pit fills is the larger number of domestic fowl bones in the latter contexts. This is particularly evident for period 6. The large number of chicken bones in pit fills can be associated with the possibly more "domestic" nature of these features and with the fact that their small bones are more easily tolerated in the vicinity of domestic activities. No major differences in the recovery rate could be noted between ditch and pit fills

(see table 9).

Variation in the frequency of taxa between different type of contexts thus occurs but is not particularly striking and does not severely affect the interpretation of differences between periods. However a slight under-representation of cattle in periods 1 and 5, which are found mainly in pit contexts, must be taken into account. The hypothesis that the higher number of bird bones in period 4 is due to a genuine change in diet/economy rather than the nature of the excavated deposits (see table 11) is confirmed.

A high concentration of partial skeletons was found in a series of pits (group 9/109) in the eastern part of the settlement in period 1 (table 5) and suggests that in late Saxon times these pits were used to dispose of dead bodies. The contexts then remained undisturbed, as indicated by the presence of bones in articulation. More bones than indicated in table 5 presumably derive from complete, rather than butchered and dismembered skeletons. This is probably the case for many of the bones found in the barbican ditch fills (Period 6) (fig.13). A substantial number of complete horse, dog and cat bones was found in these contexts. Whilst not found in articulation it is probable that these bones derive from complete skeletons discarded in the ditch and subsequently reworked. Thus the archaeological evidence suggests that the illegal disposal of animal corpses (mainly horses) continued to be practised in spite of all prohibitions.

A few contexts provided abundant evidence of craft activities. These are highlighted in figs.7, 12 and 13.

Comparison with the barbican well assemblage

Although this report does not deal directly with the material from the barbican well a comparison with the material from the rest of the site is worth investigating. The barbican well is located within the castle precinct (figs.11 and 12) and was probably built in the 13th century. Animal bones were recovered from the upper fills of the well dating to the mid-late15th - early 16th century and are contemporary with period 5 of the Castle Mall sequence.

The % total weight of bird bones in the barbican well is substantially higher (4.3%: sieved *and* hand-collected) than the period 5 assemblage (1.3%: hand collected) (fig.14). However, when the NISP count is considered the difference is not that evident. Bird bones represent 21% of the total number of mammal and bird fragments from the barbican well (this count includes both material hand-collected and from sieving) and between 15% and 30% (depending on which type of recovery is considered) (fig.14) from the rest of the site in period 5. The relatively higher weight of bird bones from the barbican well is partly the result of the inclusion of material from sieving (where a larger number of bird bones are expected) and partly due to the higher number of bones from the larger goose. The abundance of goose bones in the barbican well deposit can be attributed to the high numbers of carpometacarpi, which are probably the by-product of some industrial activity (Moreno Garcia forthcoming).

The MNI percentage of the main domestic mammals from the barbican well was compared to the rest of the site for period 5. A larger proportion of pig bones (30% versus 16%) and a smaller proportion of cattle bones (20% versus

39%) were found in the barbican well. However, the counts were very similar when the frequency of taxa calculated through a "diagnostic zone" system (hand collected + sieved material) adopted by Moreno Garcia was compared to our NISP (which is also a "diagnostic zone" system). In general more similarities than differences emerge from the comparison between the barbican well and the rest of the site. The minor differences can be attributed to factors such as variation in preservation, recovery or quantification methods which are of little archaeological interest. Wild species are poorly represented both in the barbican well and in the rest of the Castle Mall assemblage, however a moderate number of hare and rabbit bones were recorded from the barbican well. It is interesting to note that for the rest of the site the largest number of lagomorph bones were also found in period 5 (see tables 2-4).

Comparison with other sites

The comparison of the frequency of species between different sites is one of the most difficult tasks in zooarchaeology (King 1978; Payne 1985a; Albarella 1995b). Differences in butchery patterns, waste disposal, preservation, excavation strategies (especially recovery) and quantification methods can severely affect the frequency of taxa and therefore the interpretation of variation between sites.

Two possible approaches can be adopted. One possibility is to compare two assemblages, trying to take into consideration all possible biases which may have affected the frequency of species at the two sites. Once this "background noise" has been eliminated differences and similarities are interpreted on the basis of environmental and economic factors. This is the approach we have adopted in the comparison of the barbican well with the rest of the site (see above).

The other approach is to examine a large number of assemblages, without exploring in detail all the variables which can affect the frequency of species in each assemblage. It is then possible to observe whether, despite all biases, general trends can still be detected. This approach has successfully been undertaken by King (1978 and 1984) who analysed a large number of Roman sites and succeeded in identifying patterns of regional variation within Europe. More recently Albarella and Davis (1994 and 1996) have applied a similar method to medieval and post-medieval England. By considering a large number of sites from across the country some of the trends initially suggested by Grant (1988), such as the higher number of pig bones in early medieval and high status sites, were confirmed. Naturally many exceptions to these general trends occur, and thus this method cannot be used to determine the status or the cultural context of an individual site.

The latter approach has been used to compare Castle Mall with other contemporary sites in England. The list of sites taken into account can be found in table 12 and includes a larger number of sites than originally used by Albarella and Davis (1996). In particular Saxon sites and important sites in the same geographic area as Norwich and within the town itself have been added (see also fig.2). The list is far from being complete, but the majority of the main Saxon to post-medieval sites have been incorporated. The sites have been divided on the basis of their type of settlement (fig.18): towns, villages and castle. This division

is very approximate, as the status of a site is not always clear, urban castles occur (Castle Mall is an example), monastic sites and manor houses are not easily assigned to one of these categories, etc. However, the aim, as stated above, is only the identifications of broad trends. Castle Mall has been considered as a "town" in periods 1, 3, 4, 5, and 6 and a "castle" in period 2, when the excavated features are more closely associated with the castle.

The Castle Mall assemblage is located within the main cluster of urban sites, which tend to be characterised by a high frequency of cattle (in most cases above 40%) and a relatively small number of pig bones. An exception is period 1 - subperiod 4, which stands out as having a higher percentage of pig (fig.18). In general there is a higher variability in castle sites, but even though many exceptions occur they tend to have a larger number of pigs. This is not evident at first sight, but if a line is drawn separating sites with more than 20% pig from the others, this group would contain 49% of the castles, 32% of the villages and only 16% of the towns. With its 25% pigs, Castle Mall period 2 is within the >20% pig category. It is not until period 4 that the pig frequency at Castle Mall drops below 20%. This suggests that the relatively high percentage of pigs in the early phases is not a consequence of status, but is a feature of the early medieval economy.

This can better be illustrated by dividing the assemblages by chronological period (fig.19). The frequencies of sites with more than 20% pigs are distributed as follows: Saxon 38%, early Medieval 38%, middle Medieval 33%, late Medieval 26% and post-medieval 8%. For sheep the frequency of sites with more than 40% of this species is: Saxon 29%, early Medieval 28%, middle Medieval 38%, late Medieval 43%, post-medieval 62%. The steady decrease of pig and increase of sheep are countrywide phenomena and the Castle Mall assemblage - apart from the unusual period 1 superiod 4 - lies well within the main distribution of sites for each period.

Cattle

Body parts

One of the main problems in the study of the distribution of body parts is the variation that may occur between different contexts or groups of contexts. Ideally the distribution of the anatomical elements should thus be analysed context by context or, at least, group by group. However, for Castle Mall this approach would reduce the size of each assemblage to such a degree that any variation between contexts - except for a few very large ones - would be of no statistical meaning. Therefore the whole assemblage for each period has to be studied, whilst bearing in mind the possibility of lateral variation affecting any interpretation.

The frequency of cattle body parts by period is shown in table 13 and fig.20. This only includes hand-collected material. As expected, the distribution of the anatomical elements is uneven. A general feature of all periods is the under-representation of some elements due to either differential recovery (incisors, carpals, phalanges) or preservation (cranium, femur). Further differences in distribution may be due to other factors and will be considered period by period.

In periods 1 and 2, apart from the biases due to preservation and recovery, there is no significant variation in the frequency of different elements. Hind limb bones such as tibia, astragalus and calcaneus are particularly common perhaps because they preserved slightly better than the humerus. This was not the case in the well known experiment undertaken by Brain (1967) in Africa where the distal humerus was the best preserved post-cranial bone. However, this experiment was carried out on a different species (goat) and in very different environmental and climatic conditions. In fact, archaeological cattle bone assemblages where hind-limb bones occur more frequently than fore-limb bones are very common. The roughly equal numbers of metacarpi and metatarsi (which tend to have similar patterns of preservation) in periods 1 and 2 at Castle Mall support the hypothesis that the number of cattle fore and hind limbs on the site was originally the same.

The assemblages from periods 3 and 4 are unfortunately rather small (table 13 and fig.20) and thus are not discussed. Period 5 is characterised by a surprisingly high number of metatarsi. Due to the comparatively small number of metacarpi present in this period we can assume that this is not due to a preservation bias. The metatarsi are scattered across the site more or less like the other elements and do not appear to derive from one specific event. It is likely that some of the industrial activities, such as tanning and bone working, that were being practised in this period would have affected the distribution of the bones. It is possible that the extremities of hind limbs represent the by-products of such activities. Phalanges are under-represented relative to metatarsi but, when compared to other elements, are more common than in other periods. Once we have excluded the metatarsi the distribution of body parts is rather similar to that for periods 1 and 2, but with a slightly higher number of cranial elements. Heads are the body parts most likely to be excluded from dressed carcasses thus their abundance further emphasises the presence of whole carcasses on site in period 5.

The distribution of elements in period 6 is similar to period 5, once the metatarsi have been excluded, but this time the fore limb elements slightly outnumber the hind-limb. As with other periods the teeth are still well represented.

We can thus conclude that in each Castle Mall period all cattle body parts are present, although in different percentages. The majority of beef derived from complete carcasses present on site which suggests that a high percentage of the animals had been either locally reared or brought on the hoof to the town. This pattern is also known for other Saxon and medieval sites in England, such as Southampton (Bourdillon 1994) and York (O'Connor 1994).

In early periods hind limbs are better represented than fore limbs and heads. In later periods, if we exclude the period 5 metatarsi, the opposite is seen to be true. Thus it is possible that some dressed carcasses were also imported to the town. In the post-medieval periods in particular it seems that some of the best cuts of meat are missing. They may have been consumed in specific areas of the towns and their refuse disposed of away from the Castle Mall area.

Age

The ageing evidence for cattle suggests that the kill-off strategies for this species remained stable throughout late Saxon and medieval times, whereas a major change occurred between the 15th and the 16th century.

Most cattle are adult or elderly in periods 1 to 4, whereas a large number of milk premolars in early stages of wear have been found in periods 5 and 6 (table 14). Erupting first molars are also abundant during these periods but are totally absent in earlier periods. This finding is confirmed by the analysis of mandibular wear stages where juvenile mandibles become common only by period 5 (table 15; fig.21). The difference in the mortality curve is highly statistically significant when periods 2+3 and 5 are compared, whereas no changes is seen to occur between periods 1 and 2+3 and between periods 5 and 6 (table 16).

The ratio between deciduous and permanent premolars also indicates a lower frequency of juveniles in period 1, though the proportion of milk teeth in period 2+3 is almost as high as in later periods (fig.22). However, most of the milk premolars from period 2+3, unlike those from periods 5 and 6, are heavily worn (table 14).

Due to the differential preservation of unfused and fused bones the analysis of the epiphyseal fusion in the study of kill-off patterns is not as reliable as tooth eruption and wear. However, some broad trends can still be detected. The higher number of unfused bones in periods 5 and particularly 6, confirm the presence of younger animals in late periods. It is interesting to note that quite a few early fusing epiphyses, such as scapula, distal humerus, pelvis, are unfused in periods 5 and 6. Indeed a remarkable 50% of scapulae are unfused in period 6 (table 17). Thus the presence of young calves in post-medieval times is confirmed. No consistent differences could be detected between periods 1 and 2+3.

To summarise, in late Saxon and early medieval times most cattle were killed when adult or elderly, when older than approximately 3-5 years. A small number of animals were also killed when sub-adult, this is most noticeable in

periods 2+3. In late medieval, and to a greater extent in post-medieval times, a new culling strategy can be detected. Two mortality peaks can now be identified: cattle are mostly killed when juvenile (younger than 6 months) or adult (about 3-5 years old). However, the relatively low number of elderly cattle in these later times may simply be because they were not brought to the town market for sale.

The culling of a high number of calves in post-medieval times appears to be a countrywide phenomenon, well demonstrated from both archaeological and historical evidence. This same trend has been found in several other archaeological sites across the country, such as Exeter (Maltby 1979), Sandal Castle (Griffith *et al.* 1983), Leicester St.Peter's Lane (Gidney 1991b and 1991c), St.Andrew's Priory (O'Connor 1993a), Launceston Castle (Albarella and Davis 1996) and Lincoln (Dobney *et al.* 1996). This increase in the percentage of young animals at some sites is also highlighted by Grant (1988) in her summary of the animal economy in the British medieval countryside.

A large number of juvenile mandibles has also been found by Moreno Garcia (forthcoming) in her study of the bones from the Castle Mall barbican well (late 15th-early 16th century). Together with the evidence from period 5, this seems to suggest that the shift towards culling of juvenile cattle may have occurred earlier in Norwich than in other parts of the country. Other evidence to support this hypothesis comes from the site of St.Martin-at-Palace Plain, Norwich (Cartledge 1987). Here a large number of calf mandibles were found in the 14th-15th century levels, which is a remarkably early date for this occurrence. The site of Fishergate, Norwich, which is pre-15th century in date, has produced almost only bones of mature cattle (Cartledge 1994), and is consistent with our findings from the medieval levels at Castle Mall.

Historic documents tell us that throughout the Middle Ages cattle had mainly been used for traction power, and particularly for ploughing. This must have been emphasised in areas such as Norfolk which were primarily oriented towards arable farming (Dyer 1988). However, by the end of the Middle Ages many changes occurred in the agricultural economy of Britain (Kerridge 1967, Beckett 1990). These included a general shift from arable to pasture farming and the gradual replacement of oxen with horses for ploughing (Trow-Smith 1957). In fact horses had started replacing oxen as early as the 12th century (Langdon 1986, Overton and Campbell 1992), but in Norfolk it was only by the 17th century that oxen had virtually been eliminated as draught animals (Overton and Campbell 1992). By this time there was no need to keep large numbers of fully grown cattle, as the emphasis in their husbandry had shifted towards meat or dairy production. Norfolk in particular specialised in fattening young animals for meat production. The juvenile bones found at Castle Mall in period 5 and 6 can thus be interpreted as the result of a demand for veal from the town. Meat husbandry can be complemented with the production of milk. The removal of the calf allows exploitation of the mothers milk for human consumption. However, in Norfolk there was a general move away from dairying (Overton and Campbell 1992) and therefore although milk could have been a useful by-product, the emphasis probably lay upon meat production.

A few neonatal bones were found in all periods, except period 4. This suggests that at least some animals were bred on site. This evidence is particularly sparse in period 6, where only one neonatal bone has been identified. Since in this

period there is an emphasis on juvenile calves it is possible that one animal was killed for sale when particularly young.

Size, shape and sex

Cattle from late Saxon and medieval times at Castle Mall were of similar size. A noticeable, but not striking, size increase occurred in early post-medieval times, possibly as early as period 5. Large differences in the size and shape of horncores attest to the presence of a new and different breed in period 6.

The stable size of the cattle body in Saxon and medieval times can be appreciated in fig.23, where the width of the lower third molar is plotted for all periods. Some apparent size increase may be seen in period 6, but this is not statistically significant (table 19), due to the small sample sizes in periods 4 and 5. When medieval and post-medieval periods are combined to increase the sample size, the difference between these two groups becomes highly significant (table 19). Teeth are less susceptible to differences due to the age or sex of individuals (Degerbøl 1963) and are less affected by environmental factors such as different planes of nutrition. Therefore the increase in tooth size, although slight, attests to the genuine presence of larger cattle in post-medieval Norwich.

Size increase in later times is also attested by the post-cranial bones (tables 18 and 19; fig.24). However, the small sample for period 5 does not allow us to answer the interesting question, of when this size increase first occurred. A greater width of distal metatarsi from period 5 (table 18) suggests that larger animals were already present by at least the 16th century, but this measurement is very sex-dependent and thus this result must be interpreted with caution - it might merely reflect a shift towards a larger number of steers.

The larger size of cattle from period 6 can also be seen from the analysis of the metapodia (figs.25 and 26). Both dimensions of these elements increase in size in the 16th-18th century. Length is a less sex-dependent measurement as is demonstrated by its generally lower coefficient of variation (table 18), thus the increase in metapodia length may indicate a genuine shift towards a different cattle type. The variation in cattle metapodia size also increases in post-medieval times (figs.25 and 26). This phenomenon has been noted elsewhere (Albarella and Davis 1996) and is either due to a greater variation in cattle types in later times or by the presence of residual specimens in the upper layers of the site.

The metapodium shape is sexually dimorphic, with bulls having more robust bones than cows. Nevertheless, the analysis of the metapodia shape failed to reveal any identifiable clusters (figs.25 and 26). This is hardly surprising as very few bulls were kept in medieval villages and towns (Grand and Delatouche 1950, Thornton 1992) and cows and steers are difficult to distinguish morphologically. Differences in the shape of metapodia in medieval sites are likely to reflect the presence of different cattle types rather than different sexes (Albarella in press). However, an extremely robust metatarsus from period 1 (fig.26) may actually represent a bull or an achondroplastic animal (many thanks to Sebastian Payne for the latter suggestion). The slightly more robust shafts of the cattle from period 6 (fig.25) may be a typical feature of the larger post-medieval animals.

The difference between medieval and post-medieval cattle becomes striking when the horncores are considered. Horncores from period 6 are much larger than those from any other periods, whereas no change seems to occur between Saxon, early and mid medieval specimens (fig.27A and 27B). Interestingly, the post-medieval horncores also have a very different shape, with a relatively much smaller base (fig.27C). This is obviously the "structural" consequence of having much longer horns, but it still seems that these horncores were more "long" than "massive".

We thus have short horned cattle in late Saxon and medieval times and longer horned cattle in the late 16th-18th century (period 6). This is consistent with the historical evidence that short horned cattle were widely distributed in the 12th and 13th century and could still be found until the 16th century (Armitage 1980). Long horned cattle first appeared in the late 14th-early 15th century (Armitage 1980) but became common only by the 16th century (Markham 1614, Trow-Smith 1957). On the basis of historical and archaeological evidence Armitage (1980) defines three main types of long horned cattle:

- *long-horned*: late medieval-early Tudor; animals of large size; "massive" horncores with large base.
- *longhorn*: 17th-early 18th century; animals of small size; unimproved form of the modern "Longhorn"
- *Longhorn*: established in late 18th-early 19th century; improved breed; relatively small base.

On the basis of its rather large size, the shape of its horncores and its chronology it seems that the period 6 cattle represent a form roughly intermediate between the *long-horned* and the *longhorn* types.

Late Saxon and medieval cattle from Castle Mall are similar in size to animals from other medieval sites in central England, but are larger than cattle from Cornwall (fig.24). It has been suggested that the latter animals may be smaller due to their location in a marginal area (Albarella and Davis 1994). The size of the post-medieval animals is also comparable to that found in other roughly contemporary sites in Britain, such as Exeter (Maltby 1978), Launceston Castle (Albarella and Davis 1996) and Lincoln (Dobney *et al.* 1996). These animals represent the product of the improvements in husbandry techniques which had been brought about by the "agricultural revolution" which started before the beginning of Castle Mall period 6 (Kerridge 1967, Davis in press).

Non-metric traits, abnormalities and pathologies

Two non-metric dental traits were regularly recorded for cattle: the absence of the lower second premolar (Andrews and Noddle 1975) and the absence of the third cusp, or hypoconulid, of the lower third molar.

The absence of the second premolar was a relatively common character, but unfortunately could only occasionally be recorded as the anterior part of the mandible was generally broken. In about 50% of the specimens the second premolar was absent (14 out of 30), but no variation in the occurrence of this trait could be noted between different periods.

In all periods the absence of the M_3 hypoconulid was rare. In only 4 out

of 137 teeth (c.3%) the third cusp was missing or reduced. This condition is rather common in some Roman sites, such as Exeter (21% of cases; Maltby 1979), but remarkably unusual in late Roman Lincoln (Dobney *et al.* 1996). In late Saxon Burystead and Langham Road (Davis 1992b) and in medieval West Cotton (Albarella and Davis 1994) its occurrence was slightly greater than at Castle Mall. More than 10% of the late medieval cattle at Launceston Castle had a reduced or missing hypoconulid, but this condition almost completely disappeared in post-medieval times (Albarella and Davis 1996). The picture thus looks rather complicated: this trait can regularly be found in cattle populations from Roman to post-medieval times, but its frequency of occurrence was rather variable. If regularly recorded from other sites this character could represent a useful tool for identifying populations or perhaps regional types.

One of the most common abnormalities in cattle bones from archaeological sites is the asymmetry of distal metapodia caused by the abnormal development of the medial condyle. This condition, which has been claimed by many authors (e.g. Jewell 1963) as due to traction stress, was virtually absent from Castle Mall. Only one metacarpus from period 2 - the condition is generally more common in metatarsi - and one metatarsus from period 5 had these arthropathic condyles. We think that more than questioning the medieval use of cattle as draught animals this finding should cast some doubt upon the still undemonstrated association between metapodium asymmetry and traction stress.

Pathological bones were not particularly common, especially in later periods. Arthropathic conditions on metapodia and phalanges have been noted for periods 1 and 2, whereas no evidence of spavin - namely the fusion of proximal metapodia to some of the carpal or tarsal bones - was found from any period. All these identified pathologies are traditionally associated with traction stress, but they may have alternative causes, for example they can be found in non-draught animals such as sheep. Two metatarsi from periods 2 and 3 presented a swelling on the mid-shaft which looks like a haematoma caused by injury (see Baker and Brothwell 1980) (plate 2). However, this does not seem to be associated with a fracture. Oral pathologies are mainly represented by the occasional occurrence of periodontal disease.

Butchery and bone working

Butchery marks were recorded on about 20% of the cattle postcranial bones. Chopping marks, in particular, were more common in period 6 (table 20). In all periods butchery marks were more common in cattle than in sheep and pig. This is presumably a consequence of the larger size of the cattle body which needs to be divided into a greater number of portions for processing.

Most of the chopping marks were produced by a cleaver or an axe. They are generally associated with the dismembering of the carcass - chops on articulations - or with the extraction of marrow - chops on long bone shafts. Cut marks were produced by a knife, and in most cases were to sever the tendons. However, when found on mandibles, metapodia and particularly phalanges, cut marks are more likely to be associated with skinning. In medieval times cattle hides were a secondary, but important, product of the cattle carcass (Grand and

Delatouche 1950). Evidence for the use of cattle skins has been found in all periods at Castle Mall and this is consistent with the historical evidence for a flourishing leather industry and market in Norwich (see above).

One third phalanx with a chop mark on the plantar side may indicate an interest in the hoof as working material. However, the keratinous material the Norwich people were mainly after was horn. 185 cattle horncores, 69 of which bear chop or cut marks, have been found at Caste Mall. They are distributed throughout all periods although major concentrations were found in periods 2 and 6. Most chop and cut marks are located at the base of the horncore (plate 3) and were presumably made to separate the horncores from the skull and to remove the horn sheath from its bony core. This was generally done after soaking the horncore in water for some weeks (MacGregor 1985), but it could also be done through desiccation (Keith Dobney pers. comm.). Strangely two of the period 6 horncores had been sawn rather close to their tips (plates 4 and 5), perhaps to help the separation of the horn sheath or because there was some specific interest in the horn tip or, more likely, in producing a flat sheet of horn (many thanks to Keith Dobney for this suggestion).

Evidence of bone working was also abundant. This is discussed in more detail by Huddle (forthcoming), and so is only briefly mentioned here. Sawn bones, mainly metapodia (plate 6), were found in periods 1 and 6 and illustrates the use of the robust metapodium shaft to make tools. Other chopping marks were also probably aimed at bone working. A group of cattle and sheep metapodia from period 6 had been subject to some faceting (plate 7) as a possible preliminary stage in bone tool production and this work was then abandoned. Similar evidence has been found on another metatarsus and a series of metacarpi from period 6. Femur heads were regularly used in periods 1 and 2 to make spindle whorls, and testify to two of the common activities in Saxo-Norman Norwich: bone handicraft and weaving of wool.

Sheep/Goat

Sheep or goat?

The large majority of caprine specimens belong to sheep (tables 2- 4). The two species were separated on the basis of morphological criteria (see "methods" section for details). Metrical analysis was undertaken as a check on identifications (fig.28). It must be noted that all unidentified specimens ("sheep/goat") plot together with the sheep clusters and thus almost certainly belong to this species. This suggests that the actual sheep/goat ratio is higher than that expressed in table 2.

The scarcity of goats is not surprising as they are similarly scarce at most other British archaeological sites. Goats are, much more than sheep, adapted to a warmer climate and a rockier environment. Although regularly used in small numbers, they have never been very successful in northern Europe.

Although goats are uncommon in all periods at Castle Mall, this is particularly so in late medieval and post-medieval times. Even excluding the five "identifiable" bones which belong to a partial skeleton from period 1 (tables 2 and 5), goats represent 7% of the sheep *and* goat total in period 1+2, and less than 1% in period 5+6. The decline of goats in Britain is historically attested and may be linked to the enclosure of land, as goats were considered destroyers of hedgerows. Burke (1834, vol.2 p.505) wrote that for goats : "the enclosure of land has...banished them from the soil, as they nip the hedges, and bound over the highest common fences".

Goats at Castle Mall are much better represented by their horncores (plate 8), which, in earlier periods, are almost as common as sheep horncores (table 21). These elements are not useful in calculating the frequencies of species, as they can be missing from the females of some breeds and are subject to a different pattern of preservation. As a result they are of no use in establishing sex ratios, because even in breeds where both sexes are horned, male horncores tend to be more robust and therefore to preserve better. The relatively high frequency of goat horncores compared to teeth and postcranial bones has been noted elsewhere in Norwich (Cartledge 1987; G.Jones 1994) and also on other urban sites (e.g. King's Lynn: Noddle 1977; York: O'Connor 1988 and Keith Dobney pers. comm.). This suggests that horncores alone or hides with horncores still attached were imported to the town for handicraft purposes without the rest of the carcass. Goats were probably bred in the countryside mainly for milk production. Goat meat has never been highly regarded in England (Markham 1614, Burke 1834), and thus was probably consumed by goat breeders themselves and only occasionally sold in the market, where its value would have been low.

Due to the overwhelming majority of sheep remains, the discussion in the rest of this chapter will almost entirely concern this animal.

Body parts

The recovery bias, discussed earlier with regard to cattle, is even more important

in the interpretation of the body part distribution of the smaller species, such as sheep. Small elements are regularly under-represented in all periods (tables 9 and 22; fig.29). If the presence of whole carcasses on site is assumed, there is a loss of about 90% of incisors, astragali, calcanei and first phalanges, and almost 100% of carpals and third phalanges. Unfortunately, as discussed above, the sieved assemblage is too small and not sufficiently comparable to the hand-collected material to allow the calculation of correction factors for the distribution of the anatomical elements. However, it is of some interest to note that 8% of sheep post-cranial elements from sieving are astragali and 27% are phalanges. These figures drop respectively to 1.5% and 10% when calculated from the hand-collected assemblage. Other elements such as cranium and femur are also rather uncommon, but this is more probably due to a preservation bias (see Brain 1967).

The distribution of body parts in periods 1 and 2 can probably be explained entirely on the basis of differential recovery and preservation. The most common elements, such as tibia and mandibles, are those which preserve well and are large enough not to be overlooked on site. The remains from these early periods probably derive from the dismembering and butchery of complete carcasses. In period 4 a higher number of cranial elements is found and this is interesting when considered in relation to the hind-limb bones which carry the best meat cuts. It is possible that by this period the castle ditches and pits were more commonly used for discarding primary butchery and industrial refuse - however, the sample from this period is not very large and the results must thus be treated with caution.

In period 5 teeth remain very common but the number of metapodia increases. Although the bones in this period clearly represent the consequence of a mixture of different activities, the contribution of industrial (bone-, horn- and leather working) and possibly primary butchery refuse may increase. Even excluding a large group from a possible "tanning pit", metatarsi remain the most common elements for this period (table 22).

In period 6 we have a very different picture: scapula becomes by far the most common body part. This is unusual as the scapula is not one of the elements which preserve well (see Brain 1967). In the "dog gnawing" experiment carried out by Payne and Munson (1985) the scapula was the element least likely to survive. This high number of scapulae must therefore be due to the manner in which the carcass was dressed and imported to the site. Sheep scapulae are particularly common in the barbican ditch fills (37% of the total number of bones, as opposite to the 15% from the rest of the site) and this may suggest that they represent the consequence of a specific pattern of distribution and disposal of meat cuts of sheep. However, they do not represent a single episode of accumulation, as they are dispersed through many different contexts of this very large ditch. Butchery evidence supports the suggestion that the barbican ditch scapulae derive from a different process and that the situation on the rest of the site reflects a more common, standard distribution. Only 1 scapula out of 62 (< 1%) from the barbican ditch bore butchery marks as opposite to 16 out of 40 (40%) from the rest of the site. The percentage of sheep scapulae with butchery marks from other periods is about 30%. We can thus hypothesise that some houses or tenements regularly received or produced specific cuts of meat which included the scapula and the proximal humerus (here not recorded, and generally poorly preserved on

archaeological sites); food refuse from these meat cuts were subsequently discarded in the barbican ditch. On the rest of the site it is possible that the scapula were generally separated from the humerus which would explain the higher frequency of cut marks.

It is interesting to note that in early periods the best represented long bone is the tibia, whereas the humerus becomes more common by late medieval times. This has been observed on other sites such as Exeter (Maltby 1979) and Launceston Castle (Albarella and Davis 1996). It would be interesting to check whether the same pattern is found elsewhere as it might be connected to a general change in procurement and butchery practices.

Age

Throughout the Castle Mall sequence most sheep were killed between the second and the sixth year (mandibular wear stages D-G). This suggests a mixed economy aimed at the production of meat and wool. However, in periods 1 to 3 the slaughter is concentrated on the lower part of the range (meat emphasis), whereas in periods 5 and 6 more animals were slaughtered between the fourth and fifth year (wool emphasis). Unfortunately, only a small number of mandibles was available from period 4 (mid and late medieval) when the wool industry was at its height.

Eruption and wear stages of individual teeth (tables 23 and 25; fig.22) and tooth rows (table 24; fig.30) have both been considered in the interpretation of the sheep kill-off pattern. The reconstruction of the mortality curve through mandibular wear stages has been carried out in two different ways (table 24). In one system all mandibles with at least two teeth with recordable wear, in the dP_4/P_4 - M_3 row, were taken into account, whereas in the other system, following Payne's (1973) recommendations, only mandibles with a dP_4/P_4 in place have been considered. The two methods gave similar results (table 24) and, since it produced a larger number of mandibles, the first one was chosen.

Data both from individual teeth and mandibles suggest a gradual increase in the age at which sheep were culled. Minor changes can be noted between different stages, but these may be due to chance, and probably the only significant trend is towards a higher number of mature animals in later periods. When periods 1-4 and 5-6 are combined the difference in the mortality curve, as reconstructed through mandibular wear stages, is statistically significant (table 16). Only a few data from period 4 could be collected, but they suggest that a high number of mature animals were killed in this period.

Data from post-cranial bones (table 26) also indicate an older age for late and post-medieval animals. This evidence is not as convincing as the tooth wear data, particularly when metatarsi and phalanges are considered. It may be that industrial and craft activities have affected the distribution of the fusion data.

In early periods the age of slaughter suggests that most sheep had been bred for meat production. In later medieval times, probably already by the late 13th - early 14th century (Chris Dyer pers. comm.), the emphasis seems to shift towards wool production. This trend is further increased in post-medieval times. The presence of a considerable number of animals older than four years in later

periods suggests either local breeding for wool or that poor quality meat was purchased by the Norwich inhabitants. Indeed Muffet (1655) suggests that the best mutton is not above four years old.

The mortality curve for the late Saxon period resembles that found at the urban site of Hamwic, Southampton (Bourdillon and Coy 1980), but differs from the rural site of West Stow (Crabtree 1990). In the latter site a much higher number of animals were killed in their first year. However, West Stow, although geographically closer than Southampton, is much earlier than Castle Mall in date and its sheep husbandry strategies may have continued the Roman tradition.

The trend towards culling of older animals in late medieval and post-medieval periods has been consistently found on many sites in different areas of England, such as Leicester St.Peter's Lane (Gidney 1991b and 1991c), Leicester, Little Lane (Gidney 1991a and 1992), Colchester (Luff 1993), West Cotton (Albarella and Davis 1994), Launceston Castle (Albarella and Davis 1996) and Lincoln (Dobney *et al.* 1996). Although a few exceptions can be found - for instance at Exeter a large number of lambs were found in the post-medieval levels (Maltby 1979) - these findings suggest that wool production continued to increase in importance as late as the 16th and 17th century.

The zooarchaeological evidence from Castle Mall and other sites confirms the historically well documented importance of the wool industry in medieval England. From the beginning of the 13th century British wool was considered the best in Europe (Grand and Delatouche 1950), and the wool trade reached its peak at the end of the 15th century (Trow-Smith 1957). In early modern times although the importance of mutton increased the importance of wool did not decrease (Trow-Smith 1957).

A few neonatal sheep/goat bones were found in all periods, although there is only one specimen from period 6 recorded as "neonatal/very juvenile". Thus there is evidence that some sheep, from late Saxon up to at least late medieval times, were bred on site. This agrees with the, somewhat tenuous, suggestions from the study of the skeletal parts and the kill-off pattern (see above).

Size and shape

Until at least the 15th century the Castle Mall sheep were of the same, rather small type, found in many other British medieval sites. In period 6 a substantial size increase occurred. The shape of the animals also varied over time and this suggests the presence of distinct types of sheep in different periods.

The increase in sheep size between medieval and post-medieval periods is attested to by both tooth and bone measurements (table 19; figs.31-33). However, the increase is larger in bones than teeth. This is not surprising due to the more conservative nature of teeth (Degerbøl 1963). As in bovines, the combined increase in tooth and bone size suggests that a genuinely new type of sheep was present in Norwich in period 6.

Davis (1996) has demonstrated that measurements taken on the same axis tend to be highly correlated. Thus all *lengths*, *widths* and *depths* have been combined, to allow the comparison of larger samples between different periods. Using the log ratio method (Simpson *et al.* 1960), these measurements have then

been compared with "standard" values calculated from a group of modern *female* unimproved Shetland sheep (Davis 1996). Lengths and depths confirm the previous findings: size stability between periods 1 and 5 and an increase in period 6 (table 28; figs.34 and 36). The depth increase is actually only very slight, but it is highly statistically significant due to the large sample obtained from the combination of different measurements. Somewhat surprisingly a different pattern was suggested by the variation of widths: a steady size decrease from periods 1 to 4, and an increase from periods 4 to 6 (table 28; fig.35). The different results obtained from measurements on different axes suggest some variation in the shape of sheep from different periods.

In table 29 the significance of the difference for measurements on the three axes is shown. Sheep from periods 1, 2+3 and 6, have more or less similar proportions as the female Shetland - although we know that those from period 6 are larger. In period 4 and 5 *depth* measurements are relatively larger, this suggests some anatomical difference between these sheep and those from earlier and later periods.

When the Castle Mall sheep are compared to sheep from other sites, the situation is similar to that for cattle. The Norwich late Saxon and medieval sheep are similar in size to animals from other areas of the country, apart from the Cornish sheep (from Launceston Castle), which are definitely smaller. A large group of sheep metapodia from an early-mid 15th century context (period 5) at Castle Mall has been compared with metapodia from another discrete group from early 16th century Lincoln (Dobney *et al.* 1996) (table 30; figs.37 and 38). The Castle Mall sheep are far smaller than the Lincoln ones which suggests that they belong to a still unimproved type. A relatively larger width of the Castle Mall metapodia is noted in figs.37 and 38, but the difference is not statistically significant (table 30). Finally, it is important to point out that the data from the barbican well (Moreno Garcia forthcoming) support the hypothesis that the sheep in period 5 are relatively small.

How can we interpret this rather puzzling collection of data? The lack of any substantial size variation between the 10th and the 15th century is not surprising in view of the rather homogeneous size of medieval sheep attested by historical (Trow-Smith 1957) and archaeological sources (Grant 1988). The sheep in medieval times was essentially a wool animal and the importance of a larger body mass was emphasised only in post-medieval times, when mutton production also became important. Although period 5 is rather broadly dated to the mid/late 14th-mid 16th century, most of the bones come from pre-16th century contexts, thus the lack of any size increase in this period is probably still an entirely medieval phenomenon. Unfortunately there is no tightly dated information on the size of the 16th century Castle Mall sheep. It can be seen that in period 6 sheep were still mainly bred for wool although by this time mutton production had become of countrywide importance which may explain the larger size of the animals from this period. Very few period 6 contexts date as late as the mid 18th century and we can thus suggest that sheep improvement was well under way by the beginning of the 18th century. Even earlier evidence of sheep size increase has been found on other sites - e.g. Exeter (Maltby 1979) and Lincoln (Dobney *et al.* 1996) - this indicates that in some areas sheep improvement began earlier than was suggested by O'Connor (1995).

It is more difficult to interpret the differences in shape. First of all it is interesting to note that when the relatively new approach suggested by Davis (1996) is adopted the assumed general homogeneity of the English medieval sheep is no longer confirmed. This is hardly surprising, if the main driving force in sheep husbandry was the production of wool, some variation occurred and this would have had an effect on the type of animal required. Moreover, although the general small size of the medieval sheep is attested by historical documents, sheep throughout the country would not have been identical. Indeed Trow-Smith (1957) mentions the presence of several regional types. Differences between sheep from different periods at Castle Mall are therefore not surprising. It is possible that in periods 4 and 5 a different, rather sturdy, type of sheep was present. This is the period in which the wool industry was probably most important and this sheep type might be associated with wool production. An alternative explanation is that this difference in shape reflects a change in the sex distribution. By period 4 it is possible that more wethers, the typical wool animals, were used. We know that, compared to other sexes, wethers limb bones tend to mainly increase in length (Hatting 1983, Davis in prep.) but this is dependant on the age of castration. It is possible that in mid and late medieval times rams were castrated at a later age than in post-medieval times, acquiring in this manner a different, more male-like shape. At present we can only suggest hypotheses, but hopefully future experimental and archaeological work will allow us to reveal more about the only apparently monotonous shape of the medieval sheep.

Insufficient horncores were found to allow comparison between periods. In period 5 (table 27) a group of 21 horncores from a possible tanning pit are remarkable for their general small, female-like, size (although they may represent early castrated wethers). The presence of a hornless sheep type is attested by a skull from period 5. Another specimen from period 6 has a nubbin, possibly indicating the presence of a lateral horncore; this would not be improbable as there is historical evidence for four-horned sheep (Trow-Smith 1957).

Abnormalities and pathologies

The most common abnormalities were periodontal disease and unusual tooth wear. More interesting is the relatively common occurrence of depressions on sheep horncores. These are more like "thumb prints" than indentations (see Albarella 1995a). These depressions were found in specimens from periods 1, 2 and 5. In particular 9 out of 21 horncores found in the possible tanning pit from period 5 have clear thumb prints. This condition is commonly found in archaeological sites and has been associated with environmental stresses such as malnutrition or breeding in elderly animals, which may cause calcium resorption (Hatting 1983, Albarella 1995a). Its occurrence in about 25% of the horncores from period 5 suggests that the condition of these sheep may have been poor. Their rather small size may also be associated with a low plane of nutrition (see Davis 1996). A similar occurrence of depressions (23%) was found by Moreno Garcia (forthcoming) in her study of the late 15th - early 16th century fills of the barbican well.

Of particular interest amongst the post-cranial pathologies are the so called "penning elbow" and "spavin". The former condition is characterised by exostoses around the elbow joint possibly due to trauma when the animals are put through pens (Baker and Brothwell 1980). This condition has been found on two humeri from periods 1 (plate 9) and 6. Evidence of "spavin" comes from one metatarsus from period 1 (plate 10). This condition has been considered typical of draught animals such as horse, cattle and camel (Baker and Brothwell 1980) and its presence in sheep is therefore of some interest. This proves that other factors, apart from traction stress, can be involved.

Butchery and bone working

Butchery marks were found on about 15% of the sheep post-cranial bones. Unlike cattle, cut marks are more frequent than chopping marks (table 20). This is due to the smaller size of the sheep carcass which does not require the extensive use of heavy tools. Moreover only a small quantity of marrow can be extracted from sheep bones, therefore chops aimed at breaking long bones are less common in this species.

Most butchery marks are associated with division of the carcass, but evidence of skinning - in the form of cut marks on metapodia and phalanges - has also been found in periods 1, 2, 3 and 5. A sawn pelvis from period 6 (group 9/41: mid 17th - early 18th century) suggests that saws were being used as butchery tools by this period, and not just for bone working.

Of particular interest is the contents of a period 5 pit (context 11030) (fig.12) which produced a collection of 21 horncores, 109 metapodia and 60 phalanges (all belonging to sheep) (plate 11). This context was dated to the early-mid 15th century. *All* horncores had been chopped off the skull, 22% of the metapodia bore cut marks, presumably from skinning, whereas no butchery marks could be found on any phalanges. Cut marks on both metacarpi and metatarsi were all located very close to the proximal end. This deposit can be interpreted as the result of a primary butchery activity, that is when body parts which carry little or no meat are discarded. However, due to the total absence of any other sheep anatomical elements, the contemporary presence of foot bones *and* horncores and the historically well attested importance of leather working in the town, we are more inclined to think that it represents tanning or tawing waste. Indeed we know that in the past foot bones and horncores were left on the skin when this was brought to the tanner or the tawyer (Serjeantson 1989). The lower number of horncores compared to metapodia can be explained either by the fact that some skins were brought to the tannery with feet but no horncores, or that some skins derived from polled sheep. A better preservation of metapodia would also account for this discrepancy.

Deposits with a high concentration of foot bones or horncores have been found in several other sites, and have generally also been interpreted as tanning waste. For instance, sheep metapodia and phalanges interpreted as refuse of leather working have been found at Walmgate, York (O'Connor 1984), Hungate, Lincoln (Dobney *et al.* 1996) and St.Peters Street, Northampton (Harman 1979). The last case had originally been interpreted as slaughtering waste, but

Serjeantson (1989) suggests that it could be another case of tanning or tawing refuse. Association between horncore deposits and leather working activities have also been suggested by Prummel (1978; quoted by Serjeantson 1989)) for the site of Hertogenbosch, Netherlands. Castle Mall provides the only case we know of the close association of foot bones and horncores. This is interesting because it represents the first archaeological confirmation of the historically known phenomenon of leaving the cranial and foot bones attached to the skin, and also because it suggests that different practices may have been carried out in different towns.

Sheep and goat horncores are fairly common, but not as common as cattle horncores. Many horncores - from all periods - bear chop marks at their base, aimed at separating them from the skull. In addition several skulls had their horncores chopped off (plate 12). A remarkable group of four such skulls was found in period 2 within the same context (plate 13) and suggests that this activity may have been concentrated in specific areas. Cut marks - also related to the removal of the horn sheath from the horncore - are rarer, but they have been noted on a few horncores (plate 14).

Evidence of bone working was less common than for cattle. This is hardly surprising due to the smaller size of this animal and the less robust nature of its bones. However, a few cases were noted; the faceting of sheep metapodia from period 6 has already been mentioned in the "cattle" section. The presence of a hole in the proximal end of another metatarsus from period 6 (plate 15) is also worth mentioning. It is possible that this bone had been used as a handle.

Pig

Body parts

The pattern of representation of pig body parts can almost entirely be explained by differences in recovery and preservation. As for sheep the smaller elements, such as incisors, tarsals and phalanges are poorly represented as well as the most fragile elements such as skull and femur (tables 9 and 31; fig.39). On average about 90% of phalanges and 80% of astragali have been lost, with some fluctuations in different periods. This loss is mainly due to recovery bias, as is demonstrated by the phalanges representing 36% of the sieved assemblage and only 11% of the hand-collected material.

The proportion of teeth is higher than in cattle and sheep and is probably due to the destruction by scavengers of the more porous and greasy pig epiphyses (Albarella 1995b) and other taphonomic factors. It is improbable that the high frequency of teeth is due to a genuine over-representation of heads, as skull fragments are not very numerous. This pattern of body part distribution has been found in most archaeological sites and can be even more emphasised, especially in rural sites (see Albarella and Davis 1994).

No major differences in the representation of pig body parts between periods have been noted. However, the further under-representation of post-cranial bones in period 6 is of some interest (fig.39). This is probably due to the younger age of pigs in this period (see below) which has made the taphonomic bias between teeth and bones even more pronounced.

Age and sex

Pigs were generally killed at a younger age than cattle and sheep. This is typical of animals which are exploited almost entirely for meat, and indeed this pattern is found on almost all archaeological sites. However, a change in the kill-off pattern occurred by period 6 when pigs were killed even earlier.

Data on tooth eruption and wear are summarised in tables 32 and 33 and figs.22 and 40. Fusion data can be found in table 34. Unfortunately insufficient ageable specimens were available for periods 4 and 5, thus our analysis is limited to a comparison between late Saxon, early medieval and post-medieval times. No significant changes could be noted between periods 1 and 2+3. In period 6 a much higher number of deciduous premolars were present (fig.22). Furthermore a different mortality curve can be detected for this period when mandibular wear stages are considered. The culling peak in the early periods is at the "subadult" stage, whereas in post-medieval times it shifts towards the younger "immature" stage (fig.40). In approximate terms this means a shift from about two year old to one year old animals. The analysis of wear on individual teeth is also of some interest, as it can be noted that a higher percentage of first and second molars are in early stages of wear in period 6. Although not many postcranial bones were available, they confirm the trend suggested by the tooth analysis, with a higher number of unfused epiphyses in the latest period (table 34). A high frequency of

less than one year old pigs has been found in the barbican well (Moreno Garcia forthcoming), which can compensate for the scarcity of data from period 5. This suggests that the change in culling strategies may have begun before the 17th century.

Due to the relatively small number of mandibles, the difference in the kill-off pattern is not statistically significant, although it is only marginally beyond significance levels (table 16). However, due to the consistency of our data from individual teeth, mandibles and bones we are confident in suggesting that a real change in the culling strategies occurred by post-medieval times.

The trend towards the slaughter of younger animals is not as well documented for pigs as it is for cattle. A similar trend has been found in other towns such as Exeter (Maltby 1979) and Lincoln (Dobney *et al.* 1996), although in both cases the post-medieval samples are rather small. No such change was detected at Launceston Castle (Albarella and Davis 1996). The very young age of the post-medieval pigs is consistent with what the authorities of the period suggested. Markham (1614) for instance recommended the slaughter of pigs of 9-12 months, whereas Mortimer (1707) claimed that pigs of 12-18 months are good for bacon. However, some regional variation occurred, Marshall (1796; quoted by Maltby 1979) observed that in some parts of Devon pigs were not slaughtered until they were two or three years old. This might explain the variation in the archaeological evidence - the location of Launceston Castle near the Devon border is interesting in this respect.

Unlike cattle the decrease in pig slaughter age does not indicate a change in their use. Pigs have been reared for meat since they were first domesticated and this kind of exploitation has never changed. The culling of very young animals, which is also typical of modern husbandry, can rather be associated with the selection of improved, faster growing breeds. The presence of a different type of animal in period 6 is also attested by the biometric analysis and will be discussed in the next section.

Neonatal bones are present in periods 1, 2, 3, 5 and 6, but they are more common in late periods (13 neonatal bones from period 5 and 11 from period 6). Their presence suggests that, even more convincingly than for cattle and sheep, some animals were bred on site. This practice may have become more common in late medieval and post-medieval times. The presence of pigs within the walls of the town is also implied by the documentary evidence, and in particular by the Records of the City of Norwich (Hudson and Tingey 1910; quoted by Moreno Garcia forthcoming) in the 14th century: "It is ordained and established that each man or woman...who has boar, sow or other pig within the said city, that they keep them within their enclosure...".

Due to the presence of the sexually diagnostic canines it is possible to ascertain the sex distribution of the pig population (table 35). Both females and males are present at Castle Mall. When all canines are considered the male:female ratio is about 2.5:1. However, it is possible that females canines might have been more commonly overlooked than the larger male tusks. The ratio was therefore recalculated excluding isolated teeth. Males were still predominant, but this time in a ratio of about 1.7:1, which is probably closer to reality. Unfortunately, only 14 canines were collected from the sieved samples, and they were equally distributed between the two sexes. The relative number of females and males

appears to have remained constant in all periods.

The higher number of males is not surprising as males (possibly castrated) were more frequently killed at a younger age for meat consumption. More females than males were kept for breeding. It is probable that many of the very young animals, which could not be sexed due to the non diagnostic shape of the milk canine, were also males. However, we still have a remarkably high number of females which could be consistent with the assumption that some on-site breeding was carried out. In other words, our evidence suggests that Castle Mall was not only a "consumer" site but also a "producer" site.

Size and shape

Biometrical analysis shows that, like cattle and to some extent sheep, no major changes in the size of pigs occurred between Saxon and medieval times. Larger and dimensionally different animals were present in period 6.

A size increase in the width of the first molar can be definitely detected in period 6 and possibly in period 5 (table 19; fig.41). To increase the sample size all teeth measurements were combined. Using the "log ratio technique" (Simpson *et al.* 1960) they were then compared with "standard" measurements obtained from a population of English neolithic pigs from Durrington Walls, Wiltshire (Albarella and Payne in prep.) (table 28; fig.42). The small, but statistically significant, size increase in period 6 is confirmed. Due to the smaller number of bone measurements, it was necessary to combine measurements to carry out a comparison between different periods. Unfortunately, even after combining all bone measurements, samples from period 4 and 5 are still rather small. Nevertheless, the larger size of the post-medieval animals is clearer for bones than it is for teeth (fig.43). The statistical significance of the difference is not as striking as for teeth (table 28), but this is a result of the smaller sample size, as the bone increase is actually larger than the tooth one. This is confirmed by the comparison between tooth and bone measurements. Whereas in periods 1 to 5 the relative proportion of teeth and bones is not significantly different from the Durrington Walls pigs, in period 6 bones become relatively larger than teeth (table 29).

Unlike cattle and sheep, the wild ancestor of the domestic pig, namely the wild boar, was still present in Britain until the 17th century (Corbet and Harris 1991) and its presence at Castle Mall cannot therefore be excluded. However, in all periods the distribution of measurements tend to plot out as a rather unimodal curve, suggesting the presence of a single population. Due to the general historical and archaeological context and to the rather small size of these animals we have little doubt that the *status* of this population is *domestic*. One very large outlier from period 2 (fig.43) may represent an odd wild specimen in an assemblage mainly composed of domestic animals.

The comparison between Castle Mall and other sites is somewhat handicapped by the fact that only a few zooarchaeologists measure pig teeth. Thus we could only compare our data with measurements from West Cotton (Albarella and Davis 1994) and Launceston Castle (Albarella and Davis 1996). The Norwich medieval pigs are similar in size to the roughly contemporary animals from West

Cotton, whereas the late medieval pigs from Launceston are probably smaller. The post-medieval pigs from Castle Mall (period 6: late 16th-18th century) are much larger than the early post-medieval (16th century) animals from Launceston Castle, which, once again, emphasises the small size of the Cornish animals.

As discussed above, the increase in tooth size can be taken as good evidence for the presence of a larger and different type (breed?) of pig in post-medieval Norwich. The relatively larger dimension of the bones from period 6 confirms the presence of rather different animals in these later times. This has been observed in other sites, such as Launceston Castle (Albarella and Davis 1996) and Lincoln (Dobney *et al.* 1996) where, in post-medieval times, pigs could be described as having small teeth and large bones. This has also been noted on some modern breeds (Payne pers. comm.) and it is probably characteristic of improved, fast maturing breeds, possibly subject to a high plane of nutrition. The ratio between tooth and bone measurements is the best criterion that we can see at the moment to detect the first arrival or selection of modern pig breeds.

Abnormalities and pathologies

Periodontal disease, tooth rotation, irregular tooth wear, exostoses and fractures have all been occasionally noted on the Castle Mall pig bones. These conditions do not have any particular archaeological interest and are thus not described here in detail.

Butchery and bone working

Around 10% of the pig post-cranial bones bear butchery marks (table 20). Unlike cattle and sheep this percentage does not increase in the late periods. Cut marks and chop marks are more or less equally represented, representing a situation intermediate between cattle, which has more chops, and sheep, which has more cuts. This is probably determined by the size of the pig body, which is smaller than a cattle but larger than a sheep. Chop and cut marks were also observed on several mandibles.

Cut marks on metapodia and phalanges, which may be associated with skinning, have been found in periods 1, 5 and 6. These are less common than for cattle, sheep and horse, and may indicate the minor value of the pigskin. Pig bones were not commonly used for making tools, this is not surprising due to their rather fragile and porous consistency. However, two metatarsi from period 1 (small find n.6586 and 6669) and two from period 2 have holes in their shafts, which suggests their use as toggles (see MacGregor 1985).

Other mammals

Equids

Equid bones have been found in all periods, but are very common only in period 6. Whilst in period 1 they are partly represented by sub-complete skeletons (table 5) in the later post-medieval contexts they were only found as disarticulated bones. As discussed above this may partly be due to the reworking of specimens originally discarded as complete skeletons. All the mandible tooth rows recovered had horse-like teeth, and there was no evidence for the presence of donkeys (*Equus asinus*). Hence all equid bones are considered to be horse, although the presence of the odd donkey bone cannot entirely be excluded.

Two partial skeletons were found in period 1 (table 5; plates 16 and 17). Both belong to very young animals, possibly neonatal, with all epiphyses, including the scapula, unfused. This suggests that not only the main food animals, but also horses were, at least occasionally, reared on site.

A possible increase in the horse withers height occurred in period 6 (fig.44), but this is only slight and the comparison is made difficult by the small samples from late Saxon and medieval contexts. All horses from Saxon and medieval periods are shorter than 140cm (i.e. 14 hands), and can thus be defined as "ponies". The majority of post-medieval animals are also within this category, but some larger animals ("horses") are also present. The Castle Mall medieval horses have a similar size to the contemporary specimens from West Cotton (Albarella and Davis 1994) and the earlier specimens from West Stow (Crabtree 1990), whereas the larger period 6 animals are comparable to the post-medieval horses from Lincoln (Dobney *et al.* 1996). It is possible that the use of horses for ploughing, which gradually increased in importance, encouraged the selection of larger and stronger animals.

Apart from occasional exostoses, the only horse pathology of some interest was a "spavin" in a metatarsus from period 6. Most interesting was the presence of a peculiar pattern of wear on the anterior part of a second premolar in a post-medieval mandible from the barbican ditch (plates 18-20). This condition has been noted in other specimens from Buhen, Egypt (Clutton-Brock 1974) and Towcester, England (Payne 1983). Anthony and Brown (1991) have investigated this condition in detail and suggest that it can confidently be associated with *bit wear*, when the following three characters are present:

- bevelling of the anterior part of the tooth of at least 2mm at the front
- diagnostic pattern of breakage on the occlusal enamel
- localisation of the wear over the entire paraconid cusp (i.e. the anterior cusp), so that enamel and dentine are worn to the same level.

The amount of bevel (measured as suggested by Anthony and Brown 1991) was about 5mm. The tooth was not analysed by SEM (scanning electronic microscope), but observation under an optical microscope was enough to detect the presence of a peculiar breakage pattern restricted to the enamel of the bevelled area of the tooth. No such pattern was present on the other enamel ridges either on the posterior part of the P_2 or on the other teeth. Finally the wear was definitely extended across the whole paraconid area and indeed also on the

anterior part of the metaconid. On the basis of Anthony and Brown's (1991) suggestions, we assume that this wear pattern was caused by a bit and that this horse had thus been used for riding or, more probably, as a draught animal. The animal was used in this way until its death - which occurred at an advanced age, as is demonstrated by its heavily worn teeth. Indeed the bit wear is obliterated by subsequent wear if a bit is not used anymore. Cut marks on the posterior part of the mandible (plate 21) indicate that, after its death, the animal was skinned.

Butchery marks on horse bones were less frequent than for cattle (table 20), but not uncommon. Chop and cut marks were both noted. Some of the cut marks are concentrated on metapodia and phalanges (table 37) and were probably caused by skinning. The use of horse hides is well attested in medieval times (Grand and Delatouche 1960; Langdon 1989). However, butchery marks were also found on typical meat bearing bones such as scapula, humerus, pelvis and femur (table 37). This indicates that horse flesh was also used, possibly for feeding dogs, as Markham (1633) suggests that horse meat is "...the strongest and the lustiest meat you can give" to hunting hounds. However, there is evidence that, despite the proscription by Pope Gregory III (AD 732), in periods of poor harvests and livestock diseases, horse meat was also consumed by people (Hollis 1946). Evidence for the dismembering of horse carcasses is also provided by the extremity of a hind limb found in articulation (plate 22). The calcaneus of this specimen is gnawed and the absence of the rest of the skeleton suggests that this limb was separated and given to the dogs.

Butchered horse bones are regularly found in medieval and post-medieval sites, both urban and rural (see Albarella and Davis 1996 for a summary). Even in Norwich a horse pelvis with a similar pattern of butchery to the Castle Mall specimens had already been found at Fishergate (G.Jones 1994). There is a remarkably large aggregation of butchered horse bones at Witney Palace, Oxfordshire (Wilson and Edwards 1993). These remains are concentrated in an 18th century occupation phase and have been interpreted as the waste from dog food. Thus whether for people or dogs, there is evidence that throughout the country horse flesh was, if not regularly, commonly used.

A few horse bones from period 6 had been worked or sawn (plate 23). Horse bones are very robust and, like cattle bones, make very good tools. Amongst the worked specimens were two quite remarkable right mandibles found together in one of the barbican ditch contexts (period 6, small find n.421). Both mandibles are polished at the bottom (plates 24 and 25) as a consequence of severe and continuous wear. Their probable use as sledges or skates was first pointed out by Julia Huddle (forthcoming) of the Norfolk Archaeological Unit. There is substantial pictorial evidence from the 16th and 17th century for the use of cattle and horse mandibles as skates or sledges for children (fig.45). Many paintings by P.Brueghel the younger (16th century) illustrate small bone sledges, but also later paintings (17th century) by other Dutch artists such as E. Van de Velde and A. Van der Neer report the same subject.

Dog

Dog bones were represented in the form of partial skeletons as well as isolated

bones (tables 2 and 5). Two of the partial skeletons from period 1 and a few loose bones from period 6 belong to neonatal specimens. The other animals were of variable age and included some old dogs with very worn teeth.

Calculation of the shoulder heights reveals a wide range of sizes (fig.46). Almost the full size range of British Saxon and Roman dogs (Harcourt 1974) is present at Castle Mall. The dogs from period 2+3 are more or less equally distributed between the small-medium and a medium-large size groups. In period 6 the situation is quite different and most dog bones belong to very small animals, although there are a few medium, large and very large specimens also present (fig.46). The shape of the complete skulls found in period 6 also confirms the wide variety of dog types. Comparison of these skulls with those in the reference collection of the Ancient Monuments Laboratory (London) indicates that one small rounded skull (plate 26) was very similar to a poodle, whereas another small skull was similar to a beagle. A small-medium size skull was remarkably similar to a terrier (plate 27) whilst a larger specimen resembled a robust version of a Labrador.

Butchery marks (table 20) were not particularly common, but are nonetheless noteworthy. Unlike those found on other non food species, such as horse and cat, they do not appear to be associated with skinning activities. A couple of bones were chopped (plate 28) whilst cut marks were not located in areas normally associated with skinning, such as the acetabulum (plate 29) and the distal femur (table 38; plate 30). Butchery marks on dog bones are found more rarely than on horse bones, but they have been noted on several Roman, medieval and post-medieval sites such as medieval West Cotton (Albarella and Davis 1994), Roman Eastbourne (Serjeantson 1989), medieval Lincoln (Dobney *et al.* 1996), Roman Lincoln (Dobney *et al.* 1996), post-medieval Witney Palace (Wilson and Edwards 1993) and post-medieval Newcastle upon Tyne (Gidney 1996). In the first three sites cut marks on dog bones were probably associated with skinning. At medieval Lincoln and Witney Palace the bones were chopped rather than cut and this has been interpreted either as dismembering of the carcass for human consumption (Dobney *et al.* 1996) or as use of the dog flesh for feeding other dogs (Wilson and Edwards 1993). An alternative explanation has been provided for the chopped dog bone from Newcastle. Gidney (1996) suggests that dogs may have been butchered for their fat rather than their flesh and supports this hypothesis with historical evidence for the use of dog fat for cosmetic and medical reasons. It is unclear which of these is the correct explanation for the Castle Mall specimens, however, we are more inclined to think that occasionally dog meat was eaten, either by other dogs or by people in periods of famine.

Cat

Cat bones were as common as those of dog, and occurred in all periods (table 2). Most of them came from complete or sub-complete skeletons (table 5), but isolated bones were also recovered, especially from period 6. Periods 1, 5 and 6 all have evidence for the presence of neonatal or very juvenile animals.

The most remarkable feature of the cat bones was the presence of cut marks on skulls, mandibles, metapodia and phalanges (table 39; plates 31-33).

These marks were almost exclusively found on late Saxon and early medieval bones, although a single radius with deep cut marks was found in period 6 (plate 34). These cut marks are probably linked to skinning activities as they are located at the body extremities. There was no interest in cat flesh, this is clearly demonstrated on the complete skeletons where although skinning marks testify to the removal of the pelt (plate 35) there is no evidence of any further dismemberment of the skeleton. Cut marks on a cat sacrum were reported from the barbican well (Moreno Garcia forthcoming).

The interpretation of knife cuts as skinning marks is supported by the age distribution of the cat assemblage (fig.47). A high percentage of cat bones from late Saxon and medieval times (periods 1-5) were unfused. However, the percentage of immature animals decreases in period 6, when the number of cut marks becomes lower. The association between the young age of cats and exploitation of their pelts has been suggested by McCormick (1988) and Serjeantson (1989). In particular McCormick found a difference in the age of the Irish cat populations between Early Christian and medieval levels. In the latter period McCormick considers the higher numbers of younger cats to reflect the use of their pelts. A relationship between the young age of cat populations and pelt production has also been suggested for the sites of West Cotton (Albarella and Davis 1994) and Cambridge (Luff and Moreno Garcia 1995). On both these sites abundant cut marks were recorded on cat bones. In particular, the Cambridge assemblage consists of 79 cat skeletons all of which were skinned and then dumped in a well (Luff and Moreno Garcia 1995). This assemblage is even younger than that at Castle Mall (fig.47) where the assemblage had a more mixed origin. The percentage of unfused epiphyses at medieval Castle Mall is more like that found at medieval West Cotton (fig.47). Unlike the Cambridge well, at both these sites the cat populations were not entirely selected for their skins. Although young cats were preferred, adult cats were occasionally also skinned, there is a cat skeleton from Castle Mall with cut marks and all epiphyses fused.

An anatomical curiosity is represented by a cat mandible from period 1 with an extra premolar. This phenomenon of tooth duplication has occasionally been found in other archaeological sites (Albarella 1993) and is described in Miles and Grigson (1990).

Deer

Deer bones are rare at Castle Mall and in particular no post-cranial bones of red deer were found in any period (table 2). This is typical of medieval and post-medieval towns and rural sites, and contrasts with the high percentage of deer bones found in many castles (Grant 1988; Albarella and Davis 1996). Venison consumption was associated with high status, and deer hunting was a well known privilege of the aristocracy. The presence of deer bones on low status sites can be explained either as occasional poaching or a gift from an aristocrat. The donation of high status goods such as venison was common practice in medieval times (Dyer 1988).

Even in periods 2 and 3, which contain contexts most closely associated with the life of the castle, deer bones are scarce. This is not surprising as the

castle refuse was not necessarily derived from high status meals, visits by royalty were only very occasional (see above), and the castle was mostly inhabited by tenants of lower status. No other evidence of high status was found in the period 2+3 assemblage.

Deer are much better represented by their antlers. The majority of identifiable antler is red deer, although in many cases it was not possible to separate red and fallow deer fragments. No positive evidence of fallow deer antler was found although this species is represented by a few post-cranial bones. A roe deer trophy - including antlers and the frontal part of the skull - was found in the Saxo-Norman period (plate 36); this probably represented a status object, rather that a specimen of any practical use. Antler was regarded as a good working material and many pieces are chopped or sawn (plate 37). It was probably imported to the site as part of a general antler trade. In many cases the antlers were shed (plate 38) which suggests they may have been collected in the woods around the town or further afield, hence no correlation is necessary between the number of antlers and cervid post-cranial bones.

One fallow deer metatarsus (plate 39) was found in a context attributed to period 1, sub-period 4, and dated to the late 11th century. This rather early occurrence is noteworthy. Fallow deer disappeared from England after the last glaciation and were reintroduced possibly by the Romans. Rather than a full reintroduction to the wild the Romans probably brought with them some animals to be kept in semi-captivity. In fact, fallow deer bones are rare if not absent from Saxon sites, and become common only with the Norman conquest (see Lister 1984 for a review). Castle Mall is one of the earliest sites to provide evidence for the reintroduction of the fallow deer by the Normans, and the early occurrence of this species in Norwich is confirmed by another find from an 11th-early 12th century context at St.Martin-at-Palace Plain (Cartledge 1987). Fallow deer bones from Norman contexts have also been found at Castle Acre (Norfolk) (Lawrance 1982).

The Castle Mall specimen has been identified as a fallow deer on the basis of its size and of the morphological characteristics suggested by Lister (1996). This bone also displays knife cuts on the mid shaft (plate 39) which attests to the skinning of the animal.

Minor species

A few other wild mammals were found at Castle Mall. One badger mandible from period 3 (plate 40) testifies to the occasional hunting of this animal, probably for its fur. Rabbit and hare bones are more common. In particular quite a few rabbit bones were recovered from the late periods. These species were certainly exploited for their meat, as is also proved by the presence of clear chop marks on a hare tibia from period 5 (plate 41).

There is surprising evidence for the presence of rabbit bones in period 1 (table 2). This species, like the fallow deer, was introduced to England by the Normans (Corbet and Harris 1991), but probably not before the 12th century (Veale 1957). It is thus possible that the Castle Mall bones attest to an earlier introduction of the rabbit in this country. However, due to the burrowing habits of this species, the possibility that the bones are contaminants from an upper level

must be considered as a more likely explanation.

Other small mammals such as rats and mice are commensal species which are commonly found in medieval and post-medieval urban environments. Voles are typical inhabitants of grassland habitats (Corbet and Harris 1991) and their presence is probably connected to some open, not completely urbanised, areas of the town.

Birds

Domestic fowl

No evidence of any other medium sized galliforms, such as pheasant (*Phasianus colchicus*) or guinea fowl (*Numida meleagris*), has been found at Castle Mall. Hence, although only a few specimens could be identified to species (*Gallus gallus*), it is assumed that the overwhelming majority of the bones belong to the domestic fowl, and will be considered as such in the rest of this report.

Domestic fowl bones were common throughout all periods (table 2), with their relative frequency even higher in the sieved assemblage (tables 3 and 4). Most bones were isolated finds, although a few burials were present (table 5). One of these skeletons from period 1 belongs to a neonatal individual and indicates the local breeding of this species. The possibility that chickens were bred in towns has also been raised by Grant (1988), who suggests that they could easily have been fed with household scraps.

The majority of the domestic fowl bones have non-porous, adult-like, bone ends. This is typical of many archaeological sites and it is probably mainly due to preservation, recovery and identification problems which cause an underestimation of the number of young birds. However, about 15-20% of specimens had porous extremities, typical of juvenile animals. This percentage increases to c.35% in period 6 (fig.48). This change may be associated with a shift in importance away from egg production in the Middle Ages to meat production in the later periods. The same trend has been noted on other British sites (Grant 1988). The use of chicken meat and eggs is well documented for medieval times (Grand and Delatouche 1950). However, considering the relatively small body mass of a domestic fowl, chicken meat would have been a welcome, but not substantial, contribution to the diet.

There is a difference in the sex ratio between periods 1-4 and 5-6 (table 40; fig.49). In the Middle Ages a mixed economy aimed at the production of meat and eggs would have an expected sex ratio of about five hens for one cock (Grand and Delatouche 1950). In Roman times Columella (VIII.2.13) suggested an identical ratio. The lower number of males is a result of the killing of males (generally caponized) at a young age, before they develop a tarsometatarsal spur (Sadler 1990a). This ratio is approximately the same as that found in the medieval levels at Castle Mall. However, in later periods a roughly equal number of hens and cocks is found. This variation in the proportion of sexes probably has a similar cause to the age decrease in the population. In an economy mainly aimed at meat production many females as well as males would have been killed at early stages of growth. The data from the Barbican well (late 15th - early 16th cent.) confirms what is stated above with similar numbers of unspurred and spurred tarsometatarsi found (Moreno Garcia forthcoming).

The analysis of the metric variation of this species has produced some very interesting results. A substantial size increase occurs in periods 5 and 6 (table 19; figs.49 and 50). This is highly statistically significant when periods 1 to 4 are combined for comparison (table 19). This can partly be explained by the higher number of males in later periods. However, when fowl of the same sex are

compared the size increase is still evident. For instance, note in fig.50C the larger size of the females from periods 5 and 6. This size increase is again probably a consequence of the different use of the animals, as larger birds would have been selected for meat production. What is particularly interesting is the early occurrence of this improvement, which seems to have been initiated in the 15th century. Due to the general scarcity of metric data available for domestic fowl from post-medieval sites, we know little about size variation in chicken populations. The Castle Mall data suggest that the agricultural revolution brought about improvements and changes not only in the mammalian stock but also in poultry. Moreover, Castle Mall provides evidence that these changes began at a remarkably early date, as historians and archaeologists have more recently been suggesting (Kerridge 1967; Davis in press).

No significant size differences were noted between the medieval birds at Castle Mall, West Cotton (Albarella and Davis 1994) and Launceston Castle (Albarella and Davis 1996). This might suggest that during the Middle Ages these birds were bred for similar purposes throughout England.

Pathologies such as exostoses and abnormal bone growth (plate 42) were noted on some domestic fowl bones, but none were abundant and therefore are of little archaeological interest.

Butchery marks were present on about 6% of the bones, and were evenly distributed between the different periods. They are direct evidence for the consumption of chicken flesh. The majority of butchery marks are knife cuts, and they confirm the direct relationship between body size and the chops/cuts ratio suggested above. One tarsometatarsus from period 1 had a series of parallel cuts on the spur which eventually led to the removal of the spur tip (plate 43). We cannot find a sensible explanation for this operation and would be grateful for any suggestions. If the reason was the removal of the spur why were so many cuts produced and why was the whole spur not removed?

Other domestic birds

Goose was the second most common bird at Castle Mall, although it was much rarer than domestic fowl. On the basis of the large size of the bones it is assumed that most belong to domestic animals, although two smaller specimens from period 6 might derive from a wild species.

Geese were popular birds in medieval times when they were kept for their meat, eggs and particularly for their valuable feathers (Grand and Delatouche 1950). Fewer juvenile geese than juvenile domestic fowl were found at Castle Mall (fig.48). This same pattern has been noted at other sites such as Exeter (Maltby 1979), Launceston Castle (Albarella and Davis 1996), West Cotton (Albarella and Davis 1994) and also in the fills of the barbican well (Moreno Garcia forthcoming). Bones from periods 1 to 4 all belong to adult animals, but in periods 5 and particularly 6 there are also a number of juvenile bones. Like for domestic fowl, it appears that a change in the use of geese occurred by post-medieval and possibly late medieval times. The importance of eggs and feathers may have declined at the expense of more intensive breeding for meat production. Indeed during the Middle Ages geese were not killed for their feathers, but they

were regularly plucked live twice a year, in spring and autumn (Grand and Delatouche 1950).

More goose than chicken bones bore visible cut marks (c.23%). This is not surprising in view of the larger size of this bird. Almost all marks were cuts rather than chops. The large number of carpometacarpi and of worked radii and ulnae which characterises the barbican well fills (Moreno Garcia forthcoming; Huddle, forthcoming) have only occasionally been found in the rest of the site (Julia Huddle pers. comm.). Only two goose ulnae (from periods 1 and 4) were worked to make bone cylinders, of unknown use (Huddle forthcoming).

Ducks were rarer than geese and this is consistent with the situation on most medieval sites in Britain (Grant 1988). Unlike geese, ducks were not valued in the Middle Ages, and their meat was considered unhealthy due to their "dirty" feeding habits (Grand and Delatouche 1950). It is therefore possible that duck meat was mainly eaten by lower class people. Cut marks are present on 9% of the bones, a similar percentage to that found on domestic fowl, which is of similar size. This suggests that ducks, along with the other domestic species, were kept for their meat.

Two turkey bones were found from periods 5 and 6. The former specimen derives from a late 14th-15th century group (82, area 9), which, even considering the latest date, seems a surprisingly early occurrence for this American bird. The first record of the presence of turkey in England is from 1541 (Crawford 1984). However, a small quantity of late 16th - early 17th century pottery was found in this group (context 90716) (Irena Lentowicz pers. comm.), suggesting that the turkey is also of a later date.

A bone of a peacock - a bird normally associated with high status - was also identified, but unfortunately it belongs to a context of uncertain date

Wild birds

Only a few bones of wild birds were found at Castle Mall, but some were of great interest. They are distributed in all periods (tables 1-4), without any particular concentration in a specific phase or area.

Some of the duck bones were very small and could be confidently attributed to either of the two tiny wild species - the common and widespread teal or, less likely, the rarer garganey. Another duck bone from period 5 was, on morphological grounds, identified as a diving duck (*Aythya* sp.). Other water birds include the swan, cormorant, coot and moorhen. A grebe humerus from period 5 was identified as a little grebe (*Tachybaptus ruficollis*) on the basis of its size and proportions (see Bochènski 1994). This specimen displays clear cut marks (plate 44) which suggests its use for meat.

Waders include curlew, snipe and an unidentified small wader of the size of a dunlin. However, there is evidence that more waders were occasionally hunted, as plover and godwit bones were found in contexts which were subsequently considered of uncertain date.

Among the terrestrial birds woodcock and grey partridge bones were found. A partridge coracoid from period 4 bore cut marks (plate 45). Both these species were highly prized in medieval times (Simon 1944) and their bones are

found in great abundance in some high status sites (Maltby 1982; Albarella and Davis 1996).

Birds of prey were only found in period 1. They are represented by four buzzard bones possibly belonging to the same individual and by the partial skeleton of a goshawk (group 9/109) (plate 46). The goshawk derives from a sub-period 3 context (11th century), and it is hard to say whether this pre-dates or post-dates the Norman conquest.

If the buzzard was just a scavenger (see O'Connor 1993b) then the presence of the goshawk is of more interest. This bird is one of the four species most commonly used in falconry (the others being the peregrine, the merlin and the sparrowhawk). This type of hunting was particularly common in the Middle Ages and the occurrence of falconry at Castle Mall seems the most plausible explanation for the presence of the goshawk. A few birds of prey have been found buried in human graves in European sites, but generally when a trained hawk died it was just thrown on the waste tip (Prummel in press). Whereas falcons were strictly associated with the highest aristocracy, sparrowhawks and goshawks were also used by the lower nobility and rich commoners (Prummel in press). In particular the goshawk was the typical bird of the yeoman (Grant 1988). Although it is tempting to connect the hawking practice with the arrival of the Norman nobility, we cannot exclude a Saxon origin of the goshawk, or that it belonged to a royal servant.

The most unusual finds from the Castle Mall assemblage were two parrot bones (plate 47), which probably belong to the same individual. They derive from the fills of a pit dated to the mid-late 17th century (period 6). No other exotic finds were found in this pit, although seeds of pumpkin, a fruit of American origin, were found in a nearby pit of the same date (Murphy forthcoming). It is unfortunate that, despite careful analysis of the bird bone collection of the Natural History Museum in Tring, it was not possible to identify these bones to species or even genus level. These bones belong to a middle-large sized parrot, of about the same dimensions as an African grey parrot (*Psittacus*). Parrots are tropical and sub-tropical birds with some 200 species found on four continents. They are a very homogenous order (*Psittaciformes*), all grouped in the same family (*Psittacidae*) and subdivided in three subfamilies: Cacatuinae, Lorinae and Psittacinae (Forshaw 1990). On metric and morphological basis we could exclude the first two subfamilies, but this was not of much help as the *Psittacinae* are as widely distributed as the whole order. Work on the identification of these bones is still in progress (Albarella and Stewart in prep.), but meanwhile we must assume that this animal could have come from virtually any place in the southern hemisphere.

Parrot bones have never been found before on an archaeological site in England, and we would be interested to hear of any such remains from the European continent. However, parrot illustrations are well known in medieval manuscripts. The earliest use of parrot pictures as decoration known in England is from the mid-13th century books associated with William of Devon. Another parrot, probably a ring-necked parakeet (*Psittacula* sp.), also appears in the Luttrell Psalter (13th century) (Yapp 1981). However, our bones belong to a larger parrot than the parakeet.

Although we do not know the place of its origin, the parrot is interesting

because it demonstrates a connection between Norwich and exotic countries. The 17th century was certainly a period of intense travelling and trade and the fact that valuable exotic goods arrived in Norwich suggests that the city had not lost its importance as a centre of exchange and market.

Environment and economy at Castle Mall: the evidence of the animal bones

Food provision

One of the most interesting findings from the Castle Mall animal bones was the evidence of on-site breeding. The main evidence for this is the presence of neonatal bones of the main domestic animals: cattle, sheep, pig, horse and domestic fowl. These bones are not very abundant, but this is likely to be a result of their small size and fragility which cause poor preservation and recovery. Neonatal cattle and sheep bones are more common in early periods, whereas newborn pig bones were more commonly found in periods 5 and 6.

Stock breeding within the town may be unexpected, as towns are primarily considered to be consumer sites. In fact animals were reared in the area of Castle Mall which suggests that the town was not fully urbanised until at least post-medieval times. These rural areas within the walls were probably used as pasture rather than cultivated land, as the evidence from the plant remains suggests that "most grains were imported to the site as semi-cleaned prime product at all periods" (Murphy forthcoming). The absence of local agriculture is also suggested by the presence of large numbers of latrine pit assemblages, these indicate that there was no need to use human sewage as manure ("night soil") (Murphy forthcoming).

The scarcity of cattle and sheep neonatal bones in post-medieval times implies that breeding of these animals in the town gradually died out, or became much reduced. This is consistent with the growth of the Norwich population and the increasing urbanisation of the castle surroundings. However, pig breeding continued. This is not surprising as pigs need much less space and could be raised in house courtyards and fed with household food scraps (see also Hudson and Tingey 1910 and Moreno Garcia forthcoming).

The evidence from Castle Mall contrasts with that found in other late Saxon and early medieval towns, such as Southampton (Bourdillon 1994) and York (O'Connor 1994). In these sites the presence of all skeletal parts of the livestock body, combined with the absence of neonatal bones, was taken as evidence that animals were imported to the site on the hoof. In other words, the breeding of the animals was practised elsewhere but the slaughtering and the primary butchery occurred in town. Can we therefore suggest that Norwich had more open areas and was less urbanised than Southampton and York? This does not seem probable. It is more likely that these differences are due to assemblages coming from different areas of the town. It is probable that there were areas in Southampton and York where stock-rearing was carried out. It is also possible that Norwich in late Saxon times still had a rather rural aspect. In the subsequent medieval period the presence of the castle and its ditches may have contributed to the area not becoming built up and maintained its "open land" characteristics suitable for animal pasturing.

The town and the castle were probably only partly supplied with products derived from local breeding. Norwich had an important market and the arrival of livestock on the hoof is historically well attested. Moreover the evidence from the

distribution of body parts indicates that, although complete carcasses were present, selected cuts of meats were also sometimes imported or just distributed. For example, the presence of a high number of sheep scapulae in the post-medieval fills of the barbican ditch can be interpreted as the acquisition of selected parts of the carcass, not necessarily from the countryside but perhaps from butchers present in other areas of the town.

Diet

Unfortunately archaeologists have not yet found a way to assess the relative contribution of plant and animal products to the diet. Therefore we must rely on historical sources which suggest that urban populations ate more meat than people living in villages (Dyer 1989). Our ability to detect the contribution of dairy products is also unsatisfactory. The kill-off patterns of cattle and sheep do not suggest any particular emphasis on milk production, but the situation might have been different in the countryside, and milk and dairy products could regularly have been sold in urban markets. It is known that dairy products were consumed, although not in great abundance (Dyer 1989), however, "cheese is believed to have been more important for the peasant than for the rich" (Serjeantson forthcoming).

Even taking into account the obvious over-representation of cattle bones, it is quite clear that beef was the most consumed meat during all periods. Pork was particularly important in late Saxon and early medieval times. Mutton was also consumed but was of secondary importance to the main use of the sheep, which was the production of wool. Horse and dog meat may occasionally have been eaten, perhaps in periods of crisis, but the flesh of these animals was more likely to have been used to feed dogs.

Chicken and goose meat provided a secondary but constant contribution to the diet. This probably increased in post-medieval times when these birds began to be bred specifically for their meat, rather than for eggs or feathers.

The contribution of wild game to the diet was negligible. Venison and wildfowl meat were only very occasionally eaten, perhaps in special circumstances and only by the more wealthy townsfolk.

Craft

The known intensity of craft and industrial activities in Norwich and the Castle Mall area (Tillyard 1992-93) finds wide confirmation in the zooarchaeological evidence. Although only one large group of bones - from period 5 - could be associated with a specific area of craft activity (fig.12; plate 11) there was scattered but plentiful evidence of bone-, horn- , antler- and leather-working found throughout the site in all periods. A few small groups of bones associated with craft activities were found (figs.7,12 and 13; plates 7, 11 and 13), but in most cases they were mixed with common food refuse.

Bone tools were generally made from cattle and horse bones, although

bones of other animals were occasionally utilised. Due to their robust shaft, cattle and horse metapodia were the bones most commonly used; evidence of sawing and faceting has been found on these bones. However, many other objects, such as spindle whorls, handles, skates and possibly child sledges were also found (see Huddle for a comprehensive list and description of the bone objects). Spectacular evidence for the use of goose feathers for making quills and goose bones for making tools has been found in the barbican well (Moreno Garcia forthcoming; Huddle forthcoming).

Antler and horn were also used for making tools. Horn generally does not preserve on archaeological sites, but its bony core - the horncore - is commonly recovered. Abundant evidence for the use of cattle, sheep and goat horns has been found in all periods, although this is more common in periods 2 and 6 for cattle and period 5 for sheep. The presence of a number of goat horncores, in contrast to the rare occurrence of post-cranial bones, attests to the existence of an independent horn-trade and thus to a specific interest in this material. The same was true for antlers, which are found in large numbers, despite the rare occurrence of deer bones.

It is possible that the horn-worker was closely associated with the tanner - or tawer - as horncores and foot bones were generally still on the skin when this arrived at the tannery (Serjeantson 1989). A large group of sheep horncores, metapodia and phalanges from the 15th century can indeed be explained as the dump of a tannery workshop. Evidence of skinning has also been found for cattle, pig, horse, fallow deer and cat. The use of cat pelts is almost entirely limited to the early phases of the site.

Status

The presence of a royal castle in periods 2 and 3 might lead to the expectation that evidence of high status would be found in these periods. In fact this was not the case and the typical high status animals, such as deer and wild birds, are as rare during the castle phases as they are in earlier and later times. Continuity, rather than change, could be observed in the transition from period 1 to 2. Thus it appears that the excavated features, even if belonging to the castle, did not contain refuse of royal banquets. This is not surprising as visits of the king were only very occasional and may have left traces in other areas of the castle, untouched by this excavation. The findings from the plant remains are consistent with the animal bone results: no exotic species or any other indication of high status was observed (Murphy forthcoming).

Some findings, such as the evidence for falconry in the 11th century, or a rather high proportion of pig bones in late Saxon to early medieval periods - roast pork was "the most consistent source of more delicate meat" (Dyer 1989 quoted by Serjeantson forthcoming) -, or even the presence of exotic species, such a parrot in a 17th century pit fill, may hint that some evidence of high status is indeed present. However, this is not necessarily related to the status of the castle, but is more probably a consequence of the variation and inequality of the distribution of the wealth within towns (Dyer 1989). For instance, the parrot might have belonged to a rich merchant and, as discussed above, the goshawk was

not necessarily a bird associated with the highest aristocracy.

Use of space and disposal practices

The topography of the site changed enormously in different periods, and when we compare periods we are also comparing different types of sites. Whatever the type of building present or the organisation of the space, in all periods the animal bones mainly derived from pits and ditches that were filled with a mixture of food and industrial refuse.

In period 1 the site was organised as a settlement with several "properties" (figs.4-6). Although no obvious division between domestic and industrial areas could be detected, lateral variation occurred in the distribution of the animal bones. Not only did the frequency of different species vary in different areas, but also the type of handicraft - in particular for horn- and antler-working. The significance of this variation is not completely understood, but it might be related to the disposal of food refuse on site and to the spatial distribution of different workshops.

From period 2 onwards the features excavated are mainly represented by the outer and inner ditches of the castle, and by a series of minor structures also located within the perimeter of the castle area (figs.7-13). Some differences in the contents of ditches and pits have been noted, and this is probably due to the different use of these two types of features. Ditches may have mainly been used for large scale dumping of the town refuse, whereas pits were associated with small scale domestic activities. In particular, the disposal of the carcasses of dead animals in the barbican ditch (fig.11-13) seems to have been common practice during late medieval and post-medieval times. Many complete horse bones were found in the ditch, but they were not in articulation, which suggests that these are not primary deposits and that reworking of the barbican ditch fills occurred at some stage.

A lower frequency of gnawing marks in later periods probably indicates a prompter burial of bone refuse and thus a more organised system of waste disposal. This would have become necessary as the density of population increased and is consistent with the increasing urbanisation of the town in late and post-medieval times as suggested above.

Animal economy and the agricultural revolution: the Castle Mall contribution

The type of animals and the husbandry techniques found in the late Saxon and medieval periods at Castle Mall are both consistent with other archaeological sites in England and with information from historical sources. It has also become apparent that the age, sex and size of the animals are inter-related factors which must all be considered in any study of the evolution of husbandry techniques.

From the 9th century (period 1) to at least the 14th century (period 4) the principal uses of the main domestic stock at Castle Mall and throughout the country were probably as follows: cattle were mainly exploited for their traction power, sheep were a precious source of wool, pigs provided almost exclusively meat (and fat) and domestic birds produced eggs and feathers. All animals were at some point eaten, but in some cases their flesh may have represented only a secondary product. This is obviously an over-simplification, because variation across the country occurred and in some periods other products may have become predominant, but in very broad terms these were the main uses of the animals.

In medieval times, partly due to the primitive techniques then available and partly due to the type of animal use, the livestock was of a relatively small size. This is well attested by historical sources and has been confirmed by the study of the Castle Mall animal bones. However, this does not mean that the animals were all identical across the country. Variation occurred and even if we cannot yet talk of genetic breeds in the modern sense, regional types were present (Trow-Smith 1957). The high homogeneity of the medieval sheep, in particular, has hitherto been emphasised in the zooarchaeological literature. However, using a technique which allows the comparison of different measurements on the same axis (Davis 1996), we have found that the medieval sheep at Castle Mall, even being of roughly the same size, show some shape variation between periods. This suggests that the homogeneity of the medieval sheep might have been overemphasised due to the way the measurements have been examined to date.

After a period of relative stability which lasted for several centuries, some major changes in the type of use and in the size and shape of the animals occurred towards the end of the Middle Ages and the beginning of the modern age. When exactly did these changes occur? The evidence that we have from other sites suggests that many of these changes had already begun during the 16th century (Davis in press). This is consistent with the view of some historians who suggest that the "agricultural revolution" was an earlier and more gradual phenomenon than often claimed (see for instance Kerridge 1967). Unfortunately the 16th century at Castle Mall is either poorly represented or not securely dated. Therefore this animal bone assemblage cannot provide a major contribution to the question of when livestock improvement began. However, interesting data concerning the changes in the husbandry techniques and the consequent modifications of the size and shape of the animals that the agricultural revolution brought about have been found.

Prior to entering into a detailed discussion of the exploitation of the main species at Castle Mall it is useful to summarise the data for age, sex, size and morphology:

		Period 1 - 2+3	Period 2+3 - 4	Period 4 - 5	Period 5- 6
Cattle	Age	stable	stable	*decrease*	stable
	Size	stable	stable	increase??	*increase*
	Shape	stable	stable	?	*change*
Sheep	Age	stable	stable?	*increase*	stable
	Size	stable	stable	stable	*increase*
	Shape	stable	*change*	stable	*change*
Pig	Age	stable	?	?	*decrease*
	Sex	stable	stable	stable	stable
	Size	stable	stable	stable?	*increase*
	Shape	stable	stable	stable	*change*
Domestic fowl	Age	stable	stable	stable	*decrease*
	Sex	stable	stable	*change*	stable
	Size	stable	stable	*increase*	stable
Goose	Age	stable	stable	stable?	*decrease*

Details of how these results were obtained and their interpretation are presented in the relevant sections and will not be repeated here. In this concluding section it is our aim to make some very general comments. In both cattle and sheep, variation in the kill-off patterns precede size and morphological changes. In the case of cattle it is plausible to assume that a new type of animal use, more specifically aimed at the production of meat, was associated with a different kill-off pattern and led to the selection of larger beasts. The situation for the sheep is more complex, as changes in size and mortality do not go in the same direction. The shift towards older animals is evidence that wool production was further increasing in importance, whilst the size increase suggests that large animals capable of producing more mutton were also being selected. In fact the two changes do not go together, but they are perfectly compatible, because large sheep can also produce good quality wool. Many of the best "wool" breeds, such as the Lincoln Longwool, are actually very large (Keith Dobney, pers. comm.).

The situation is different for pig where both the main changes are concentrated in the latest period. The use of pig for meat and lard production continued and the only reason for these changes was to increase productivity. It is probable that this increase in productivity was realised with the importation of new stock, which was larger, faster growing and thus could be killed at an earlier age.

The role of the domestic fowl has been neglected in the study of changes connected to the agricultural revolution. However, the Castle Mall evidence suggests that already in period 5 (i.e. almost certainly during the course of 15th century) this bird had been subject to a size increase: possibly the consequence of selective pressure towards higher meat production. This improvement was successfully completed in the later period, where an age decrease implies the increasing importance of meat. The evidence from Castle Mall alone is not

enough to suggest that this increase in size of domestic fowl represents one of the first results of the agricultural revolution, but it certainly provides a stimulus for further investigation of this question on other sites.

Now that we have seen how the Castle Mall animals changed, let us summarise the innovations in their type of use. The following table illustrates this by taking into account both the Castle Mall data, and what is known from the rest of the country, from both historical and archaeological sources. The animal products or uses of greater importance have been indicated in capital letters:

	medieval	late medieval - post-medieval
Cattle	TRACTION, meat, milk	MEAT, milk (traction in limited areas)
Sheep	WOOL, meat, milk	WOOL, MEAT, milk
Pig	MEAT, fat	MEAT, fat
Goat	milk, meat	-
Horse	traction	TRACTION
Domestic fowl	EGGS, meat	MEAT, eggs
Goose	FEATHERS, meat	MEAT, feathers

We are certainly aware that these changes did not all occur contemporaneously and that in some areas they did not happen at all. In addition some of the data presented above are still under debate. Nevertheless, we believe that only by trying to generalise can the Castle Mall data be put in a wider context and contribute to the history of animal husbandry in Britain. One general consequence, which is clear from the above table and concerns most animals, is that the agricultural revolution gave rise to a much greater emphasis on meat production. This was probably caused by the growth of the urban population which required an increasingly larger meat supply.

Norwich was one of the largest medieval towns in Britain and a very important market place. Any study of the economic history of England must consider this town which had the advantage of being situated in a convenient position for contacts with the continent. The Low Countries, from where so many technological and economic innovations originated, have always had close contacts with the Norfolk area. If improvements in either the animals or husbandry techniques occurred, it is to be expected that they began earlier in Norfolk than in many other parts of the country. We hope that the Castle Mall data can contribute to our understanding of the economic development of the town and of the country as a whole. At the same time we hope there will be more animal bones recovered from secure 15th to 17th century contexts in the city. Information from such contexts may provide answers to the important question of when improvement started which could not be concluded in this report.

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TAXA	PERIOD					
	1	2	3	4	5	6
Cattle (*Bos taurus*)	HSB	HSB	HSB	HSB	HSB	HSB
Sheep/Goat (*Ovis/Capra*)	HSB	HSB	HSB	HSB	HSB	HSB
Sheep (*Ovis aries*)	HSB	HSB	HSB	HSB	HSB	HS
Goat (*Capra hircus*)	H	HSB	H		H	H
Pig (*Sus domesticus*)	HSB	HSB	HSB	HSB	HSB	HSB
Equid (*Equus sp.*)	HS	HSB	HS	H	H	HS
Dog (*Canis familiaris*)	H B	HSB	HS	HS	HS	HS
Dog/Fox (*Canis/Vulpes*)	B					
Cat (*Felis catus*)	HSB	HSB	HSB	HSB	HSB	HS
Red deer (*Cervus elaphus*)	H	H	H	HS	H	H
Fallow deer (*Dama dama*)	H			H		H
Roe deer (*Capreolus capreolus*)	H	H				
Badger (*Meles meles*)			B			
Hare (*Lepus sp.*)	SB	H		HS	HS	HS
Rabbit (*Oryctolagus cuniculus*)	H			H	HSB	HSB
Lagomorph				H		
Rat (*Rattus sp.*)		B	S	HS	S	
Rat/Water vole (*Rattus/Arvicola*)	H					
House mouse (*Mus musculus*)			B			
House/Wood mouse (*Apodemus/Mus*)	B	B		B	B	
Field vole (*Microtus arvalis*)	B					
Domestic fowl (*Gallus gallus*)	HSB	HSB	HSB	HSB	HSB	HSB
Goose (*Anser anser*)	HSB	H B	H	HSB	HSB	HSB
Duck (*Anas sp.*)	H B	HS	H	HSB	HSB	HS
Turkey (*Meleagris gallopavo*)					H	H
Little grebe (*Tachybaptus ruficollis*)					H	
Cormorant (*Phalacrocorax carbo*)						H
?Grey Heron (*Ardea ?cinerea*)		H				
Swan (*Cygnus sp.*)		H			H	
Teal/Garganey (*Anas crecca/querquedula*)		S	B	H		
Pochard/Tufted duck (*Aythya ferina/fuligula*)					H	
Buzzard (*Buteo buteo*)	B					
Goshawk (*Accipiter gentilis*)	H					
Grey partridge (*Perdix perdix*)				H	B	H
Coot (*Fulica atra*)					HS	
Moorhen (*Gallinula chloropus*)						H
Woodcock (*Scolopax rusticola*)						S
Curlew (*Numenius arquata*)				S		
Snipe (*Gallinago gallinago*)						S
?Crane (*?Grus grus*)					H	
Small wader		B				
?Black headed gull (*Larus ?ridibundus*)						H
Pigeon (*Columba sp.*)	H	HS			S	H
Parrot (*Psitaccinae*)						H
Rook/Crow (*Corvus frugilegus/corone*)					H	H
Small corvid	H		S	H		H
Turdid		SB				
Passeriform			H			S
Bird	B				H	HS
Amphibian	HSB	H B			SB	HSB
Toad (*Bufo bufo*)	B					

Table 1

Presence of mammal, bird and amphibian taxa in all levels at Castle Mall.
Taxa present in hand collected material are denoted as "H", that in SRS sieved material as "S" and that in BS sieved material as "B".

TAXA	PERIOD 1	2	3	4	5	6	TOTAL
Cattle	540.5	374	71.5	170.5	312.5	676.5	2145.5
Sheep/Goat	236	165	42.5	133	477**	530.5	1584
(Sheep	*(51)*	*(44)*	*(12)*	*(11)*	*(193)*	*(135)*	*446)*
(Sheep?	-	-	-	-	-	*(2)*	*2)*
(Goat	*(9)*	*(2)*	*(+)*	-	*(1)*	*(1)*	*13)*
(Goat?	-	*(1)*	-	-	-	*(2)*	*3)*
Pig	*276.5	181	34.5	61.5	*121.5	*148.5	823.5
Equid	*43.5	27.5	6	5.5	1.5	161.5	245.5
Dog	*51.5	*67	7.5	10.5	*10	*82.5	229
Cat	*73	*40.5	3	*25.5	*35	84	261
Red deer	+	+	+	+	+	+	+
Fallow deer	1	-	-	1	-	1	3
Roe deer	1.5	3	-	-	-	-	4.5
Hare	-	1.5	-	1.5	3	1	7
Rabbit	4.5	-	-	4.5	22.5	*16.5	48
Lagomorph?	-	-	-	1	-	-	1
Rat	-	-	-	1	-	-	1
Rat/Water vole	1	-	-	-	-	-	1
Domestic fowl	*191	93	6	*83	*119	*82	574
Goose	22	26	4	18	48	25	143
Duck	9	8	1	3	9	9	39
Turkey	-	-	-	-	1	1	2
Little grebe	-	-	-	-	1	-	1
Cormorant	-	-	-	-	-	1	1
Grey Heron?	-	1	-	-	-	-	1
Swan	-	1	-	-	1	-	2
Teal/Garganey	-	-	-	1	-	-	1
Pochard/Tufted duck	-	-	-	-	+	-	+
Goshawk	4	-	-	-	-	-	4
Grey partridge	-	-	-	1	-	+	1
Coot	-	-	-	-	1	-	1
Moorhen	-	-	-	-	-	1	1
Crane?	-	-	-	-	+	-	+
Black headed gull?	-	-	-	-	-	+	+
Parrot	-	-	-	-	-	2	2
Pigeon	2	1	-	-	-	1	4
Rook/Crow	-	-	-	-	1	1	2
Small corvid	1	-	-	*12	-	1	14
Passeriform	-	-	1	-	-	-	1
Bird	-	-	-	-	1	3	4
Amphibian	3	1	-	-	-	+	4
TOTAL	1461	990.5	177	533.5	1165	1829	6156

Table 2

Numbers of hand collected mammal, bird and amphibian bones and teeth (NISP) in all levels at Castle Mall. Sheep/Goat also includes the specimens identified to species. Cases where only "non-countable" bones were present are denoted by a "+". Pig metapodia and ruminant half distal metapodia have been divided by two, while carnivore and lagomorph metapodia have been divided by four. Due to the difficulty in distinguishing between upper and lower incisors in equids and upper and lower canines in carnivores, all have been recorded and then divided by two. All totals which include material from partial skeletons are denoted by "*". This material is described in further detail in table 5.

** = This figure includes a "special" group of 169 sheep metapodia and phalanges.

TAXA	PERIOD						TOTAL
	1	2	3	4	5	6	
Cattle	37	28.5	4	20.5	41	36	167
Sheep/Goat	29.5	21.5	6	45.5	41.5	25.5	169.5
(Sheep	*(6)*	*(5)*	*(1)*	*(13)*	*(4)*	*(1)*	*30)*
(Goat	-	+	-	-	-	-	+)
Pig	48	42.5	7	21	18	18.5	155
Equid	2	2	1	-	-	2	7
Dog	-	3	1	7.5	4	2.5	18
Cat	*6	2.5	0.5	*14	0.5	4.5	28
Red deer	-	-	-	+	-	-	+
Hare	1	-	-	0.5	4.5	0.5	6.5
Rabbit	-	-	-	-	7	*11	18
Rat	-	-	1	1	1	-	3
Domestic fowl	20	19	1	44	38	21	143
Goose	1	-	-	10	11	1	23
Duck	-	1	-	1	2	7	11
Teal/Garganey	-	1	-	-	-	-	1
Coot	-	-	-	-	1	-	1
Woodcock	-	-	-	-	-	1	1
Curlew	-	-	-	1	-	-	1
Snipe	-	-	-	-	-	1	1
Pigeon	-	1	-	-	1	-	2
Small corvid	-	-	1	-	-	-	1
Turdid	-	1	-	-	-	-	1
Passeriform	-	-	-	-	-	1	1
Bird	-	-	-	-	-	2	2
Amphibian	1	-	-	-	1	1	3
TOTAL	145.5	123	22.5	166	171.5	135.5	764

Table 3

Numbers of SRS (soil riddled samples) sieved mammal, bird and amphibian bones and teeth (NISP) in all levels at Castle Mall. All samples are "whole earth" (see text for an explanation). Sheep/Goat also includes the specimens identified to species. Cases where only "non-countable" bones were present are denoted by a "+". Pig metapodia and ruminant half distal metapodia have been divided by two, while carnivore and lagomorph metapodia have been divided by four. Due to the difficulty in distinguishing between upper and lower incisors in equids and upper and lower canines in carnivores, all have been recorded and then divided by two. All totals which include material from partial skeletons are denoted by "*". This material is described in further detail in table 5.

TAXA	PERIOD						TOTAL
	1	2	3	4	5	6	
Cattle	41.5	11	6	8	11.5	6	84
Sheep/Goat	35.5	22	13.5	15	43	5.5	134.5
(Sheep	*(4)*	*(5)*	*(4)*	*(3)*	*(5)*	-	*21)*
(Goat?	-	*(1)*	-	-	-	-	*1)*
Pig	49.5	27.5	4.5	5	15	5.5	107
Equid	-	1	-	-	-	-	1
Dog	3.5	6	-	-	-	-	9.5
Dog/Fox	4	-	-	-	-	-	4
Cat	*23	2.5	1	1.5	*10.5	-	38.5
Badger	-	-	1	-	-	-	1
Hare	0.5	-	-	-	-	-	0.5
Rabbit	-	-	-	-	12	3	15
Rat	-	5	-	-	-	-	5
House mouse	-	-	1	-	-	-	1
House/Wood mouse	2	1	-	1	1	-	5
Field vole	2	-	-	-	-	-	2
Domestic Fowl	*34	25	7	19	19	8	112
Goose	2	2	-	1	1	1	7
Duck	1	-	-	1	1	-	3
Teal/Garganey	-	-	1	-	-	-	1
Buzzard	4	-	-	-	-	-	4
Grey partridge	-	-	-	-	1	-	1
Small wader	-	1	-	-	-	-	1
Turdid	-	1	-	-	-	-	1
Bird	2	-	-	-	-	-	2
Amphibian	15	4	-	-	1	1	21
(Toad	*(1)*	-	-	-	-	-	*1)*
TOTAL	219.5	109	35	51.5	116	30	561

Table 4

Numbers of BS (bulk samples) sieved mammal, bird and amphibian bones and teeth (NISP) in all levels at Castle Mall. All samples are "whole earth" (see text for an explanation). Sheep/Goat and Amphibian also include the specimens identified to species. Cases where only "non-countable" bones were present are denoted by a "+". Pig metapodia and ruminant half distal metapodia have been divided by two, while carnivore and lagomorph metapodia have been divided by four. Due to the difficulty in distinguishing between upper and lower incisors in equids and upper and lower canines in carnivores, all have been recorded and then divided by two. All totals which include material from partial skeletons are denoted by "*". This material is described in further detail in table 5.

Period	Sub-period	Area	Group	Context	Collection method	Species	Notes
1	2	4	7	40319	Hand	Dog	16.5 bones + teeth
	2	9	109	90469	BS sieve	Cat	16.5 bones
	2	9	109	90366	Hand	Pig	3 bones
	2	9	109	90398	Hand	Dom.Fowl	12 bones
	2	22	138	22023	Hand	Goat	10 bones + teeth
	2	22	145	22110	Hand	Cat	13 bones + teeth
	3	9	63	90227	Hand	Dog	5 bones
	3	9	109	90354	Hand	Horse	10 bones
	3	9	109	90354	SRS sieve	Cat	4.5 bones
	3	9	109	90491	Hand	Goshawk	4 bones
	3	9	109	90501	Hand	Dog	13.5 bones
	3	9	109	90506	Hand	Horse	6 bones
	3	9	109	90506	Hand	Cat	18 bones + teeth
	4	4	11	40002	BS sieve	Dom.Fowl	5 bones
	4	4	11	40047	Hand	Pig	13 bones
	4	49	47	49192	Hand	Cat	25 bones
2	1	2	5	20168	Hand	Cat	15 bones
	3	2	2	20152	Hand	Dog	14 bones
	3	2	2	20163	Hand	Dog	17.5 bones
	3	4	2	40185	Hand	Cat	5 bones
4	-	4	28	40416	SRS sieve	Cat	8 bones
	-	8	16	80268	Hand	Cat	4.5 bones
	-	8	28	80112	Hand	Dom.Fowl	7 bones
	-	45	1	45183	Hand	Dom.Fowl	13 bones
	-	45	1	45183	Hand	Small corvid	11 bones
5	-	1	97	10976	Hand	Cat	20 bones
	-	1	97	10976	BS sieve	Cat	4.5 bones
	-	9	61	90765	Hand	Dom.Fowl	10 bones
	-	9	73	90171	Hand	Pig	6 bones
	-	9	94	92716	Hand	Dog	5 bones
6	-	1	87	10023	Hand	Dog	10.5 bones + teeth
	-	1	98	10521	Hand	Dog	3 bones
	-	1	98	10850	Hand	Dom.Fowl	4 bones
	-	1	103	10095	SRS sieve	Rabbit	6 bones
	-	9	41	91387	Hand	Pig	3 bones

Table 5

Catalogue of partial skeletons found within all periods at Castle Mall. The number of bones and teeth given in the notes are the number of countable specimens from each skeleton (see also tables 2 - 4).

Hand collected bones and teeth:

Period	1		2		3		4		5		5*		6	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Cattle	540.5	51	374	52	71.5	48	170.5	47	312.5	34	312.5	42	676.5	50
Sheep/Goat	236	22	165	23	42.5	29	133	36	477	52	308	41	530.5	39
Pig	276.5	26	181	25	34.5	23	61.5	17	121.5	13	121.5	16	148.5	11
Total	1053		720		148.5		365		911		742		1355.5	

SRS sieved bones and teeth:

Period	1		2	3	4	5		6
	n	%	n	n	n	n	%	n
Cattle	37	32	28.5	4	20.5	41	41	36
Sheep/Goat	29.5	26	21.5	6	45.5	41.5	41	25.5
Pig	48	42	42.5	7	21	18	18	18.5
Total	114.5		92.5	17	87	100.5		80

BS sieved bones and teeth:

Period	1		2	3	4	5	6
	n	%	n	n	n	n	n
Cattle	41.5	33	11	6	8	11.5	6
Sheep/Goat	35.5	28	22	13.5	15	43	5.5
Pig	49.5	39	27.5	4.5	5	15	5.5
Total	126.5		60.5	24	28	69.5	17

SRS + BS sieved bones and teeth:

Period	1		2		3	4		5		6
	n	%	n	%	n	n	%	n	%	n
Cattle	78.5	33	39.5	26	10	28.5	25	52.5	31	42
Sheep/Goat	65	27	43.5	28	19.5	60.5	53	84.5	50	31
Pig	97.5	40	70	46	11.5	26	23	33	19	24
Total	241		153		41	115		170		97

Table 6

Numbers and percentages (NISP) of cattle, sheep/goat and pig within all periods at Castle Mall. Percentages are only calculated where the total number of fragments is greater than 100 within a particular period.
* = in this count a "special" group of sheep metapodia and phalanges (context 11030) has been excluded.

Period	1		2		3		4		5		5*		6	
	MNI	%	MNI	%	MNI		MNI		MNI	%	MNI	%	MNI	%
Cattle	28 (TI)	39	21 (CA)	41	6 (M3)		6 (PM,M3,CR,MC)		17 (MT)	24	17 (MT)	39	35 (M1/2,HU)	34
Sheep/Goat	21 (M1/2)	30	14 (TI)	27	4 (TI)		13 (M1/2)		47 (MT)	66	20 (MT)	45	51 (SC)	49
Pig	22 (MC)	31	16 (C)	31	4 (C,MC)		4 (M1/2,SC,MC)		7 (M1/2)	10	7 (M1/2)	16	18 (M1/2)	17
Total	71		51		14		23		71		44		104	

Table 7

Minimum numbers of individuals (MNI) of cattle, sheep/goat and pig within all periods at Castle Mall (hand collected only).
Percentages are only calculated where the total MNI is greater than 30 within a particular period.
Those parts of the skeleton which indicated the highest MNI are given in parentheses:
C=canine, PM=deciduous and permanent premolars, $M_{1/2}$=1st/2nd permanent molars, M_3=3rd permanent molar,
CR=cranium (zygomaticus), SC=scapula, HU=humerus, MC=metacarpus, TI=tibia, CA=calcaneus, MT=metatarsus.
* = in this count a "special" group of sheep metapodia and phalanges (context 11030) has been excluded.

Hand collected bones and teeth:												
Period	1		2		3	4		5		6		
	n	%	n	%	n	n	%	n	%	n	%	
Domestic Fowl	191	**86**	93	**73**	6	83	**80**	19	**68**	82	**71**	
Goose	22	**10**	26	**20**	4	18	**17**	48	**27**	25	**22**	
Duck	9	**4**	8	**7**	1	3	**3**	9	**5**	9	**8**	
	222		127		11	104		176		116		
SRS + BS sieved bones and teeth:												
Period	1		2		3	4		5		6		
	n	%	n		n	n	%	n	%	n		
Domestic Fowl	54	**93**	44		8	63	**83**	57	**79**	29		
Goose	3	**5**	2			11	**15**	12	**17**	2		
Duck	1	**2**	1			2	**3**	3	**4**	7		
	58		47		8	76		72		38		

Table 8

Number and percentages (NISP) of the **main bird** taxa within all periods at Castle Mall. Percentages are only calculated where the total number of fragments is greater than 50 within a particular period.

PERIOD	element	Cattle % MNI	Sheep/Goat % MNI	Pig % MNI
Period 1	incisors	4%	4%	8%
	astragalus	*20%*	*9%*	*8%*
Period 2+3	incisors	4%	7%	7%
	astragalus	*24%*	*3%*	*7%*
Period 4	incisors	6%	3%	15%
	astragalus	*25%*	*10%*	-*
Period 5	incisors	5%	2%	14%
	astragalus	*9%*	*7%***	*5%*
Period 6	incisors	3%	1%	5%
	astragalus	*14%*	*6%*	*6%*
Pits (all periods)	incisors	5%	2%	11%
	astragalus	*17%*	*6%***	*10%*
Ditches (all periods)	incisors	4%	1%	7%
	astragalus	*17%*	*11%*	-***

Table 9

Percentages of **small elements** in different periods at Castle Mall.
% MNI is calculated as follows:
incisors: [MNI of incisors/ (MNI incisors + MNI premolars + MNI 1st and 2nd molars + MNI 3rd molar)] x 100
astragalus: [MNI astragalus/ (MNI femur + MNI tibia + MNI astragalus + MNI calcaneus + MNI metatarsi)] x 100.
* = not calculated due to small sample size
** = a "special" group with many sheep metatarsi has been excluded from this count
*** = no pig astragali out of 37 hind-limb bones

Hand collected bones and teeth:

	Period 1 Subperiod 1-3		Period 1 Subperiod 4		Total	
	n	%	n	%	n	%
Cattle	421	**57**	119.5	**37**	540.5	**51**
Sheep/Goat	150	**20**	86	**27**	236	**22**
Pig	162	**22**	114.5	**36**	276.5	**26**
Total	733		320		1053	

SRS + BS bones and teeth:

	Period 1 Subperiod 1-3		Period 1 Subperiod 4	Total	
	n	%	n	n	%
Cattle	70.5	**35**	8	78.5	**33**
Sheep/Goat	48	**24**	17	65	**27**
Pig	83	**41**	14.5	97.5	**40**
Total	201.5		39.5	241	

Table 10

Period 1: numbers and percentages (NISP) of the **main taxa** in **pre-conquest** (period 1 subperiods 1-3) and possible **post-conquest** contexts (period 1 subperiod 4) at Castle Mall.

	Period 1				Period 2				Period 3				Period 4				Period 5				Period 6			
	Ditch		Pit		Ditch		Pit		Ditch		Pit		Ditch		Pit		Ditch		Pit		Ditch		Pit	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Cattle	14	45	448	37	124	38	144	35	33	39	16	53	116	37	32	27	17	49	277	28	254	36	234	37
Sheep/Goat	10	32	185*	15	59	18	62	15	18	21	9	30	96	31	21	18	6	17	439	45	184	26	226	35
Pig	4	13	258*	21	35	11	88	22	21	25	3	10	29	9	19	16	4	11	105*	11	65*	9	66	10
Equid	2	7	35*	3	10	3	14	3	3	4	-	0	2	1	4	3	-	0	2	<1	111	16	13	2
Dog + Cat	1	3	129*	11	75*	23	52*	13	9	11	2	7	27*	9	8	7	3	9	53*	5	100	14	34*	5
Domestic fowl	-	0	166*	14	21	7	47	12	1	1	-	0	44	14	33*	28	5	14	98*	10	1	<1	64	10
Total	31		1221		324		407		85		30		314		117		35		974		715		637	

Table 11

Frequencies of main taxa (NISP) in ditch and pit fills at Castle Mall.
Corrections for the number of metapodia (see table 2) have not been carried out for this table. Only hand collected material is included.
* These figures include bones from partial skeletons (see table 5 for details).

Table 12

List of Saxon, medieval and post-medieval sites whose faunal assemblages are plotted in the tripolar diagrams (figs. 18 and 19). Assemblages with less than 150 identified specimens have been excluded from the diagrams.

Key:

AV = Avon, BU = Buckinghamshire, CH = Cheshire, CO = Cornwall, DO = Dorset, DU = Durham, DV = Devon, EX = Essex, GC = Gloucestershire, HA = Hampshire, HT = Hertfordshire, HU = Humberside, HW = Hereford and Worcester, LI = Lincolnshire, NF = Norfolk, NN = Northamptonshire, ND = Northumberland, NY = North Yorkshire, OX = Oxfordshire, SF = Suffolk, SO = Somerset, TW = Tyne and Wear, WS = West Sussex, WY = West Yorkshire.

C = castle, M = monastic, N = manor house, P = palace, U = urban, V = village.

S = saxon, M = medieval, EM = early medieval (late XI-XII), MM = middle medieval (XIII-XIV), LM = late medieval (XV-early XVI), PM = post-medieval.

PUBPER is the code and date of each period in the original publication. In order to avoid confusion between period codes and dates, the periods are given in Arabic numbers, even if in the original publication they were numbered with Roman numbers.

The number of fragments (NISP) is calculated in different ways by different authors; when a "diagnostic zones" method was used this has been preferred to the crude number of identified fragments. In most of the sites the figure for *Ovis* includes *Capra*.

SITE	COUNTY	TYPE	PERIOD	PUBPER	N.BOS	N.OVIS	N.SUS	%BOS	%OVIS	%SUS	REFERENCE
ABINGDON, STERT STREET	OX	U	MM	XIII-XIV	229	453	127	28	56	16	Wilson R. 1979
ABINGDON, STERT STREET	OX	U	LM	XV-XVI	21	48	14	25	58	16	Wilson R. 1979
ABINGDON, WEST ST.HELEN STREET	OX	U	EMMM	XII-XIII	38	41	7	44	48	8	Wilson R. 1975
ABINGDON, WEST ST.HELEN STREET	OX	U	MM	LATEXIII-EARLYXV	62	79	12	41	52	8	Wilson R. 1975
AYLESBURY	BU	U	MM	2-3 (XIII-XIV)	488	396	170	46	38	16	Jones G. 1983
BANBURY CASTLE	OX	C	EMMM	XIII-XIV	48	67	42	31	43	27	Wilson R. 1976
BANBURY CASTLE	OX	C	PM	XVII-XVIII	47	22	3	65	31	4	Wilson R. 1976
BARNARD CASTLE	DU	C	MM	5 (XIII)	959	302	2108	28	9	63	Jones R. *et al.* 1985a
BARNARD CASTLE	DU	C	LM	8 (XV-XVI)	130	150	93	35	40	25	Jones R. *et al.* 1985a
BARNARD CASTLE	DU	C	PM	10 (XVII+)	521	430	279	42	35	23	Jones R. *et al.* 1985a
BATH	AV	U	M	X-XIII	581	767	219	37	49	14	Grant 1979
BEVERLEY, 33-35 EASTGATE	HU	U	EM	3-5 (XI-XII)	2706	3499	622	40	51	9	Scott 1992
BEVERLEY, 33-35 EASTGATE	HU	U	MM	6-12 (XIII-XIV)	3029	4558	808	36	54	10	Scott 1992
BEVERLEY, LURK LANE	HU	U	MM	7 (XIII-XIV)	1068	1339	500	37	46	17	Scott 1991
BEVERLEY, LURK LANE	HU	U	LM	8 (XV)	384	337	137	45	39	16	Scott 1991
BEVERLEY, LURK LANE	HU	U	PM	9 (XVI)	202	230	54	42	47	11	Scott 1991
BRAMBER CASTLE	WS	C	M		274	182	254	39	26	36	Westley 1977
BRISTOL, MARY-LE-PORT	AV	U	M		660	571	113	49	42	8	Noddle 1985
BURYSTEAD & LANGHAM ROAD	NN	V	M	XII-XV	181	199	79	39	43	17	Davis 1992
CAISTER-ON-SEA	NF	U	S	MID-SAXON	305	108	77	62	22	16	Harman 1993
CARLISLE, BLACKFRIARS STREET	CU	U	M	XII-XVI	179	40	27	73	16	11	Rackham 1990
CARLISLE, BLACKFRIARS STREET	CU	U	PM	POSTMED.	142	86	45	52	32	16	Rackham 1990
CASTLE ACRE CASTLE	NF	C	EM	1 (LATE XI)	0	0	0	24	34	42	Lawrance 1982
CASTLE ACRE CASTLE	NF	C	EM	1cc (XI-XII)	0	0	0	49	29	22	Lawrance 1987
CASTLE ACRE CASTLE	NF	C	EM	2 (EARLY XII)	0	0	0	26	34	40	Lawrance 1982
CASTLE ACRE CASTLE	NF	C	EM	2/3 (MID XII)	0	0	0	27	34	39	Lawrance 1982
CASTLE ACRE CASTLE	NF	C	EM	3 (LATE XII)	0	0	0	27	32	41	Lawrance 1982
CASTLE LANE	NN	V	MM	XIII	455	904	123	31	61	8	Jones R. *et al.* 1985b
CHEDDAR PALACE	SO	P	EMMM	4-5 (XI-XII)	274	95	57	64	22	13	Higgs *et al.* 1979
CHEDDAR PALACE	SO	P	MMLM	6 (XIII- XVI)	110	141	134	30	36	34	Higgs *et al.* 1979
CHESTER, DOMINICAN FRIARY	CH	M	MM	XIII	331	217	182	45	30	25	Morris 1990
CHESTER, DOMINICAN FRIARY	CH	M	MMLM	XIV-XVI	210	67	184	46	15	40	Morris 1990
CHRISTCHURCH	DO	U	M	MEDIEV.	88	85	21	45	44	11	Coy 1983
CHRISTCHURCH	DO	U	PM	POSTMED.	73	75	25	42	43	14	Coy 1983
COLCHESTER, CULVER STREET 7	EX	U	EM	EARLY MEDIEV.	125	53	68	51	21	28	Luff 1993
COLCHESTER, CULVER STREET 8	EX	U	M	MEDIEV.	313	309	219	37	37	26	Luff 1993
COLCHESTER, LONG WYRE STREET	EX	U	EMMM	XI-XIV	62	38	20	52	32	16	Luff 1993
COLCHESTER, LONG WYRE STREET	EX	U	PM	XVI-XVII	34	45	13	37	49	14	Luff 1993
COLCHESTER, MIDDLEBOROUGH	EX	U	M		180	121	34	54	36	10	Luff 1993
COLCHESTER, MIDDLEBOROUGH	EX	U	PM		249	428	87	33	56	11	Luff 1993

SITE	COUNTY	TYPE	PERIOD	PUBPER	N.BOS	N.OVIS	N.SUS	%BOS	%OVIS	%SUS	REFERENCE
COPT HAY	OX	V	EM	1-2	39	23	13	52	31	17	Pernetta 1974
COPT HAY	OX	V	EMMM	3-5	98	105	124	30	32	38	Pernetta 1974
DROITWICH, FRIAR STREET	HW	U	S	4ii (LATER SAXO-NORMAN)	140	103	93	42	31	27	Locker 1992
DROITWICH, FRIAR STREET	HW	U	EM	5i (XII)	257	159	110	49	30	21	Locker 1992
DROITWICH, FRIAR STREET	HW	U	MM	5ii (EARLY XIII)	90	64	48	44	32	24	Locker 1992
DROITWICH, FRIAR STREET	HW	U	MM	6 (XIII-XIV)	554	367	292	46	30	24	Locker 1992
DROITWICH, FRIAR STREET	HW	U	LM	7 (XV-XVI)	58	60	38	37	39	24	Locker 1992
DROITWICH, THE OLD BOWLING GREEN	HW	U	EMMM	XII-XIV	303	160	43	60	32	8	Locker 1992
DROITWICH, THE OLD BOWLING GREEN	HW	U	LMPM	XV-XVIII	55	53	88	28	27	45	Locker 1992
ECKWEEK	AV	V	MM	XIII-XIV	113	333	54	23	67	11	Davis 1991b
EXETER	DV	U	MM	Md5-Md9 (XIII-XIV)	2454	2871	913	39	46	15	Maltby 1979
EXETER	DV	U	LM	Md10 (XIV-XV)	112	133	37	40	47	13	Maltby 1979
EXETER	DV	U	PM	Pm1-Pm4 (XVI-XVIII)	2156	2900	608	38	51	11	Maltby 1979
FACCOMBE NETHERTON	HA	N	MM	XIII-XIV	105	127	114	30	37	33	Sadler 1990
FACCOMBE NETHERTON	HA	N	LM	XV AND LATER	616	682	754	30	33	37	Sadler 1990
GLOUCESTER, EAST GATE	GC	U	M		1219	942	283	50	39	12	Maltby 1983
GLOUCESTER, WEST GATE	GC	U	M	5-7	0	0	0	27	48	25	Maltby 1983
GORHAMBURY	HT	V	M		81	110	76	30	41	28	Locker 1990
GRENSTEIN	NF	V	M	XI-XV	130	214	78	31	51	18	Ambros 1980
ILCHESTER	SO	U	M		1483	1614	250	44	48	7	Levitan 1982
KING'S LYNN	NF	U	EM	1 (LATE XI-XII)	603	715	350	36	43	21	Noddle 1977
KING'S LYNN	NF	U	MM	2 (XIII-XIV)	2493	1861	764	49	36	15	Noddle 1977
KING'S LYNN	NF	U	LM	3 (XIV-XV)	674	411	209	52	32	16	Noddle 1977
KING'S LYNN	NF	U	PM	POSTMED. (XIV-XVIII)	895	513	195	56	32	12	Noddle 1977
KIRKSTALL ABBEY	WY	M	LM	XV-XVI	0	0	0	92	5	3	Ryder 1959
LAUNCESTON CASTLE	CO	C	MM	6 (LATE XIII)	397	427	463	31	33	36	Albarella and Davis 1996
LAUNCESTON CASTLE	CO	C	LM	8 (MID-LATE XV)	1185	854	764	42	30	27	Albarella and Davis 1996
LAUNCESTON CASTLE	CO	C	PM	9 (XVI-XVII)	577	409	156	51	36	14	Albarella and Davis 1996
LAUNCESTON CASTLE	CO	C	PM	10+11 (LATE XVII-EARLY XIX)	690.5	569	138	49	41	10	Albarella and Davis 1996
LINCOLN	LI	U	S	LATE XI	1037	449	203	61	27	12	Dobney *et al.* 1996
LINCOLN	LI	U	EM	XII-XIII	306	253	68	49	40	11	Dobney *et al.* 1996
LINCOLN	LI	U	MMLM	XIV-XV	206	133	36	55	35	10	Dobney *et al.* 1996
LINCOLN	LI	U	PM	MID XVII	1175	758	195	55	36	9	Dobney *et al.* 1996
LINCOLN, BISHOPS PALACE	LI	P	LM	XV	65	186	7	25	72	3	Ellison 1975
LINCOLN, FLAXENGATE	LI	U	S	PreT-T6 (IX-LATE XI)	11301	6106	2174	58	31	11	O'Connor 1982
LINCOLN, FLAXENGATE	LI	U	EM	T7-T13 (LATE XI-XII)	9543	8406	2268	47	42	11	O'Connor 1982
LINCOLN, FLAXENGATE	LI	U	MM	S1-S5 (XIII-XIV)	919	856	177	47	44	9	O'Connor 1982
LINCOLN, FLAXENGATE	LI	U	LM	S6-S10 (XV-XVI)	959	970	208	45	45	10	O'Connor 1982
LYVEDEN	GC	V	MMLM		253	254	126	40	40	20	Grant 1975
MIDDLETON STONEY	OX	C	MM	5	0	0	0	21	47	32	Levitan 1984a
MIDDLETON STONEY	OX	C	LM	6	0	0	0	26	38	37	Levitan 1984a
MIDDLETON STONEY	OX	C	PM	7	0	0	0	31	43	27	Levitan 1984a
NEWCASTLE, CLOSEGATE I & II	TW	U	MM	XIII-XIV	39	71	13	32	58	11	Davis 1991a
NEWCASTLE, CLOSEGATE I & II	TW	U	LM	XV-XVI	299	585	66	31	62	7	Davis 1991a
NEWCASTLE, CLOSEGATE I & II	TW	U	PM	XVII-XVIII	44	121	8	26	70	5	Davis 1991a
NEWCASTLE, QUEEN STREET	TW	U	MM	1-4ii (XIII)	475	227	111	58	28	14	Allison 1988
NEWCASTLE, QUEEN STREET	TW	U	MMLM	5-5i (MID XIV-XV)	920	557	217	54	33	13	Allison 1988
NEWCASTLE, QUEEN STREET	TW	U	PM	6-6i (LATEXVI-EARLYXVII)	144	121	31	49	41	10	Allison 1988
NORTH ELMHAM PARK	NF	V	S	1 (MIDDLE SAXON)	2424	2808	2182	33	38	29	Noddle 1980
NORTH ELMHAM PARK	NF	V	S	2 (LATE SAXON, X)	1046	1503	827	31	45	24	Noddle 1980
NORTH ELMHAM PARK	NF	V	EM	3-4 (LATE SAXON/EARLY MED.)	290	291	321	32	32	36	Noddle 1980
NORTH ELMHAM PARK	NF	V	M	5 (XIV-XV)	1025	1063	1225	31	32	37	Noddle 1980
NORTH ELMHAM PARK	NF	V	PM	6 (XVI-XVII)	1169	623	419	53	28	19	Noddle 1980
NORTH PETHERTON	SO	V	LM	3	46	34	10	51	38	11	Adcock 1976/77
NORTHAMPTON, ST PETER'S STREET	NN	U	EMMM	3 (XII-XIV)	1042	2006	377	30	59	11	Harman 1979
NORTHAMPTON, ST PETER'S STREET	NN	U	LM	4 (XV)	391	784	107	30	61	8	Harman 1979
NORTHAMPTON, ST PETER'S STREET	NN	U	PM	5 (XVI-XVII)	58	100	12	34	59	7	Harman 1979
NORWICH, ALMS LANE	NF	U	S	1 (EARLY XI)	30	17	12	51	29	20	Cartledge 1985
NORWICH, ALMS LANE	NF	U	EM	2 (LATE XI - EARLY XII)	33	20	11	52	31	17	Cartledge 1985
NORWICH, ALMS LANE	NF	U	EM	3 (EARLY XII - LATE XIII)	80	77	25	44	42	14	Cartledge 1985
NORWICH, ALMS LANE	NF	U	MM	4 (LATE XIII - XIV)	452	482	159	41	44	15	Cartledge 1985
NORWICH, ALMS LANE	NF	U	LM	5 (EARLY XV)	542	355	125	53	35	12	Cartledge 1985
NORWICH, ALMS LANE	NF	U	LM	6 (MID XV - LATE XV)	420	376	113	46	41	13	Cartledge 1985
NORWICH, ALMS LANE	NF	U	LM	7 (EARLY - MID XVI)	477	482	182	42	42	16	Cartledge 1985
NORWICH, ALMS LANE	NF	U	PM	8 (LATE XVI)	136	146	52	41	44	15	Cartledge 1985
NORWICH, ALMS LANE	NF	U	PM	9 (EARLY - MID XVII)	657	468	142	52	37	11	Cartledge 1985

SITE	COUNTY	TYPE	PERIOD	PUBPER	N.BOS	N.OVIS	N.SUS	%BOS	%OVIS	%SUS	REFERENCE
NORWICH, ALMS LANE	NF	U	FM	10 (LATE VII - EARLY XVIII)	100	109	25	43	47	10	Cartledge 1985
NORWICH, ALMS LANE	NF	U	FM	11 (EARLY-MID XVIII)	350	409	108	40	47	13	Cartledge 1985
NORWICH, ALMS LANE	NF	U	FM	12 (MID-LATE XVIII)	222	166	58	50	37	13	Cartledge 1985
NORWICH, CASTLE MALL	NF	U	S	1.i-iii (LATE IX-XI)	421	150	162	57	20	22	
NORWICH, CASTLE MALL	NF	U	EM	1.iv (LATE XI)	119.5	86	114.5	37	27	36	
NORWICH, CASTLE MALL	NF	C	EM	2 (LATE XI-EARLY XII)	374	165	181	52	23	25	
NORWICH, CASTLE MALL	NF	U	EM	3 (LATE XI-XII)	72	43	35	48	29	23	
NORWICH, CASTLE MALL	NF	U	EMMM	4 (LATE XII-MID XIV)	171	133	62	47	36	17	
NORWICH, CASTLE MALL	NF	U	MMLM	5 (MID XIV-MID XVI)	313	308	122	42	42	16	
NORWICH, CASTLE MALL	NF	U	FM	6 (LATE XVI-XVIII)	677	531	149	50	39	11	
NORWICH, CASTLE MALL (BARBICAN WELL)	NF	U	LM	LATE XV - EARLY XVI	152	579	89	18	71	11	Moreno García forth.
NORWICH, FISHERGATE	NF	U	S	1 (X)	118	28	51	65	12	22	Jones G. 1994
NORWICH, FISHERGATE	NF	U	S	3i (EARLY XI)	117	70	61	47	28	25	Jones G. 1994
NORWICH, FISHERGATE	NF	U	SEM	3ii (XI)	244	114	118	52	24	25	Jones G. 1994
NORWICH, FISHERGATE	NF	U	EM	4 (XII)	67	52	33	44	34	22	Jones G. 1994
NORWICH, FISHERGATE	NF	U	MMLM	6 (XIV+)	35	22	3	58	37	5	Jones G. 1994
NORWICH, ST.MARTIN-AT-PALACE PLAIN	NF	U	EM	1 (XI - EARLY XII)	1524	1102	1140	41	29	30	Cartledge 1987
NORWICH, ST.MARTIN-AT-PALACE PLAIN	NF	U	EMMM	1/2 (XI-XIII)	953	702	660	41	30	29	Cartledge 1987
NORWICH, ST.MARTIN-AT-PALACE PLAIN	NF	U	EMMM	2 (XII-XIII)	2040	1801	1433	39	34	27	Cartledge 1987
NORWICH, ST.MARTIN-AT-PALACE PLAIN	NF	U	MMLM	3 (XIV-XV)	686	310	312	52	24	24	Cartledge 1987
NORWICH, ST.MARTIN-AT-PALACE PLAIN	NF	U	FM	4 (XVI-IX)	14	15	10	36	38	26	Cartledge 1987
NORWICH, WHITEFRIARS	NF	U	EM	2-3 (lateX-XII)	504	374	294	43	32	25	Cartledge 1983
OKEHAMPTON CASTLE	DV	C	MM	XIV	264	271	214	35	36	29	Maltby 1982
OKEHAMPTON CASTLE	DV	C	LM	LATE MED.	489	674	185	36	50	14	Maltby 1982
OKEHAMPTON CASTLE	DV	C	FM	POSTMED.	631	467	54	55	41	5	Maltby 1982
OXFORD CASTLE	OX	C	MMLM	XIII-MIDXV	68	30	28	54	24	22	Marples 1976
OXFORD, QUEEN STREET	OX	U	MM	4a-4b (XIII)	63	69	26	40	44	16	Wilson R. *et al.* 1983
OXFORD, QUEEN STREET	OX	U	LM	5b (XV-XVI)	19	1136	32	10	73	17	Wilson R. *et al.* 1983
OXFORD, THE HAMEL	OX	U	EM	2-3 (XII)	257	435	141	31	52	17	Wilson R. and Bramwell 1980
OXFORD, THE HAMEL	OX	U	MM	4-5 (XIII-XIV)	370	577	232	31	49	20	Wilson R. and Bramwell 1980
OXFORD, THE HAMEL	OX	U	MMLM	7-8 (LATEXIII-XVI)	415	531	194	36	47	17	Wilson R. and Bramwell 1980
OXFORD, THE HAMEL	OX	U	FM	9-10 (XVI)	376	435	73	43	49	8	Wilson R. and Bramwell 1980
PORTCHESTER CASTLE	HA	C	S	EARLY-MIDDLE (V-VIII)	287	74	64	68	17	15	Grant 1986
PORTCHESTER CASTLE	HA	C	S	MIDDLE-LATE (VIII-X)	1935	1303	817	48	32	20	Grant 1986
PORTCHESTER CASTLE	HA	C	S	LATE (X-XI)	439	267	185	49	30	21	Grant 1986
PORTCHESTER CASTLE (INN.BAIL.)	HA	C	MM	A-B (XIII-XIV)	182	202	220	30	33	36	Grant 1985
PORTCHESTER CASTLE (INN.BAIL.)	HA	C	FM	C (XVI-XVII)	89	88	27	44	43	13	Grant 1985
PORTCHESTER CASTLE (OUT.BAIL.)	HA	C	MM	3-4 (XIII-XIV)	390	155	107	60	24	16	Grant 1977
PORTCHESTER CASTLE (OUT.BAIL.)	HA	C	LM	6 (XV-XVI)	70	99	13	38	54	7	Grant 1977
PRUDHOE CASTLE	ND	C	MM	4-5 (XIII-XIV)	249	129	141	48	25	27	Davis 1987b
PRUDHOE CASTLE	ND	C	LM	6-8 (XV-MIDXVI)	177	85	34	60	29	11	Davis 1987b
PRUDHOE CASTLE	ND	C	FM	9-11 (MIDXVI-XVIII)	351	352	45	47	47	6	Davis 1987b
SANDAL CASTLE	WY	C	MM	5-6 (XII-XIV)	99	49	33	55	27	18	Griffith *et al.* 1983
SANDAL CASTLE	WY	C	LM	2-4 (XV)	526	314	149	53	32	15	Griffith *et al.* 1983
SANDAL CASTLE	WY	C	FM	"+"-1 (XVI-XVIII)	684	521	154	50	38	11	Griffith *et al.* 1983
SOUTHAMPTON	HA	U	EMMM	A (XI-XIII)	145	73	104	45	23	32	Noddle 1975
SOUTHAMPTON	HA	U	MM	B (XIII-XIV)	73	62	88	33	28	39	Noddle 1975
SOUTHAMPTON	HA	U	FM	C (XVI-XVIII)	47	49	12	44	45	11	Noddle 1975
SOUTHAMPTON, MELBOURNE STREET	HA	U	S	MIDDLE SAXON	23896	14606	6953	53	32	15	Bourdillon and Coy 1980
SOUTHAMPTON, QUILTER'S VAULT	HA	U	EM	A	412	442	118	42	45	12	Bourdillon 1979
SOUTHAMPTON, QUILTER'S VAULT	HA	U	MM	B	88	55	32	50	31	18	Bourdillon 1979
SOUTHAMPTON, QUILTER'S VAULT	HA	U	FM	C	29	67	15	26	60	14	Bourdillon 1979
TAUNTON, BENHAM'S GARAGE	SO	U	EMMM	3 (XII-XIII)	374	242	20	59	38	3	Levitan 1984b
TAUNTON, BENHAM'S GARAGE	SO	U	MM	4 (XIII-XIV)	1346	1316	125	48	47	4	Levitan 1984b
TAUNTON, BENHAM'S GARAGE	SO	U	FM	POSTMED.	154	120	6	55	43	2	Levitan 1984b
TAUNTON, PRIORY BARN	SO	U	EMMM	1 (XII-XIII)	199	367	35	33	61	6	Levitan 1984b
THETFORD, BRANDON ROAD	NF	U	EM	XI-XII	1757	1577	687	44	39	17	Jones G. 1993
THETFORD, BRANDON ROAD	NF	U	EMMM	XII-XIV	229	382	104	32	53	15	Jones G. 1993
THETFORD, BRANDON ROAD	NF	U	MMLM	XIV-XV	117	151	56	36	47	17	Jones G. 1993
THETFORD, BRANDON ROAD	NF	U	S	SAXON (X)	1427	1050	483	48	35	17	Jones G. 1993
THETFORD, BRANDON ROAD	NF	U	LM	XV-XVI	243	298	66	40	49	11	Jones G. 1993
THETFORD, REDCASTLE FURZE	NF	U	S	2 -EARLY SAXON (VI-VII)	203	159	67	47	37	16	Wilson T. 1995
THETFORD, REDCASTLE FURZE	NF	U	S	4ii -LATE SAXON (EARLY-MID XI)	92	97	29	42	45	13	Wilson T. 1995
THETFORD, REDCASTLE FURZE	NF	U	S	4iii -LATE SAXON/EM (LATE XI)	240	338	77	37	51	12	Wilson T. 1995
THETFORD, REDCASTLE FURZE	NF	U	MM	7 (XIII-XIV)	198	422	50	30	63	7	Wilson T. 1995
THETFORD, SITE 1092	NF	U	S	LATE SAXON	919	650	394	36	38	26	Jones G. 1984

SITE	COUNTY	TYPE	PERIOD	PUBPER	N.BOS	N.OVIS	N.SUS	%BOS	%OVIS	%SUS	REFERENCE
THRISLINGTON	DU	V	MM	XIII-XIV	252	249	67	44	44	12	Rackham 1989
THUXTON	NF	V	M	XII-XV	140	188	224	25	34	41	Cartledge 1989
TOTNES	DV	U	PM		79	169	21	29	63	8	Bovey 1984
UPTON	GC	V	EMMM	XII-XIII	106	452	23	18	78	4	Noddle *et al.* 1969
WALTON	BU	V	EM	SAXO-NORMAN	726	871	396	36	44	20	Noddle 1976
WALTON	BU	V	M	MEDIEV.	645	827	292	37	47	17	Noddle 1976
WEST COTTON	NN	V	EM	EARLY MED. (XII-XIII)	760	531	318	47	33	20	Albarella and Davis 1994
WEST COTTON	NN	V	MMLM	MID-LATE MED. (XIII-XV)	406	825	230	28	56	16	Albarella and Davis 1994
WEST STOW	SF	V	S	1 (V)	2539	3469	1683	33	45	22	Crabtree 1989
WEST STOW	SF	V	S	2 (VI)	4811	6944	1912	35	51	14	Crabtree 1989
WEST STOW	SF	V	S	3 (LATE VI-VII)	523	725	308	34	46	20	Crabtree 1989
WHARRAM PERCY	NY	V	MM	XIII-XIV	328	851	132	25	65	10	Ryder 1974
WHARRAM PERCY	NY	V	LM	XV-EARLY XVI	438	886	126	30	61	9	Ryder 1974
WINCHCOMBE	GC	U	M	XII ONWARDS	280	259	23	50	46	4	Levitan 1985
WINCHCOMBE	GC	U	PM	XVI-XVII	31	24	4	53	41	7	Levitan 1985
YORK, FISHERGATE	NY	U	EM	4 (XI-XII)	1025	660	237	53	34	12	O'Connor 1991
YORK, GENERAL ACCIDENT SITE	NY	U	EM	9 (XI-XII)	139	38	33	66	18	16	O'Connor 1988
YORK, GENERAL ACCIDENT SITE	NY	U	EMMM	10-11 (XII-XIV)	4059	1054	656	70	18	11	O'Connor 1988
YORK, GENERAL ACCIDENT SITE	NY	U	MM	12 (XIV)	581	200	76	68	23	9	O'Connor 1988
YORK, PETERGATE	NY	U	MM	XI-XIV	207	117	141	45	25	30	Ryder 1971
YORK, SKELDERGATE	NY	U	EM	SkK+SkN+SkZ (XI-XII)	1223	410	159	68	23	9	O'Connor 1984
YORK, SKELDERGATE	NY	U	LM	SkD-SkE (EARLY XV)	438	674	80	37	57	7	O'Connor 1984

ELEMENT	PERIOD 1 NISP	MNI	%	2 NISP	MNI	%	3 NISP	MNI	%	4 NISP	MNI	%	5 NISP	MNI	%	6 NISP	MNI	%
DECIDUOUS+ PERMANENT INCISORS	13	2	7	10	2	10	-	-	-	3	1	17	14	2	12	21	3	9
DECIDUOUS+ PERMANENT PREMOLARS	71	12	43	49	9	43	7	2	33	32	6	100	78	13	76	200	34	97
M1/2	64	16	57	54	14	67	17	5	83	20	5	83	46	12	71	139	35	100
M3	33	17	61	29	15	71	12	6	100	12	6	100	21	11	65	30	15	43
CRANIUM	11	6	21	6	3	14	5	3	50	11	6	100	13	7	41	18	9	26
SCAPULA	28	14	50	30	15	71	7	4	67	4	2	33	16	8	47	46	23	66
HUMERUS	37	19	68	23	12	57	1	1	17	4	2	33	14	7	41	69	35	100
RADIUS	23	12	43	16	8	38	2	1	17	6	3	50	10	5	29	32	16	46
CARPAL	2	1	4	1	1	5	1	1	17	2	1	17	-	-	-	-	-	-
METACARPUS	35	18	64	26.5	14	67	3	2	33	12	6	100	5.5	3	18	51	26	74
PELVIS	27	14	50	22	11	52	4	2	33	9	5	83	4	2	12	18	9	26
FEMUR	10	5	18	7	4	19	1	1	17	4	2	33	7	4	24	24	12	34
TIBIA	56	28	100	26	13	62	3	2	33	4	2	33	14	7	41	43	22	63
ASTRAGALUS	39	20	71	31	16	76	8	4	67	7	4	67	8	4	24	23	12	34
CALCANEUS	51	26	93	42	21	100	7	4	67	8	4	67	21	11	65	35	18	51
METATARSUS	36.5	19	68	31.5	16	76	5	3	50	8	4	67	33.5	17	100	41	21	60
PHALANX 1	65	9	32	45	6	29	8	1	17	23	3	50	44	6	35	68	9	26
PHALANX 3	26	4	14	12	2	10	1	1	17	10	2	33	23	3	18	17	3	9
TOTAL	627.5			461			92			179			372			875		

Table 13

Parts of the cattle skeleton by number of fragments (NISP) and minimum number of individuals (MNI) at Castle Mall. Unfused epiphyses are not counted. Only hand-collected material is included.
Each individual tooth within mandibles has been counted, hence the total is greater than the total NISP in table 2.
The MNI has been calculated as follows:
Incisors and phalanges have been divided by 8, deciduous + permanent premolars by 6, $M_{1/2}$ by 4, all other elements, except metapodii, by 2.
Metacarpus = (MC1 + MC2/2 + MP1/2 + MP2/4) / 2
Metatarsus = (MT1 + MT2/2 + MP1/2 + MP2/4) / 2
Where:
MC1 = complete distal metacarpus.
MC2 = half distal metacarpus.
MT1 = complete distal metatarsus.
MT2 = half distal metatarsus.
MP1 = complete distal metapodium.
MP2 = half distal metapodium.
% = frequency of an element expressed in relation to the most common one (by MNI).

			C	V	E	H	a	b	c	d	e	f	g	h	j	k	l	m	n	o	p
dP4	Period	1								1		1			1	3	2				
		2													5	2	1				
		3		1												1					
		4						1								2					
		5						6	6	1						2	1				
		6						11	11	5					4	2	3				
P4	Period	1			3		1		3	1	3	7	4	3							
		2			1		1	1	1			1	8	4	1						
		3			1							1		2							
		4											1	2							
		5	1	1	2				3	1	2		3		1						
		6	1	2	2	5		5	6	5	5	10	3	6	1						
M1	Period	1				1	1					1	7	2		11	5	2	1	2	
		2											8		1	4	6	2	1	2	
		3											1		1	2	3		1		
		4											1			1	2			1	
		5		7	2								1	3	2	6	3				
		6		4	15							1	3	1	10	28	8	3	1		1
M2	Period	1	1			1	1					5	5		4	4	6	1			
		2						1	1	1		2	3		1	8	4	2			
		3										2	3			3				1	
		4											1		1	1		1			
		5						1					6		4	4	2				
		6		1								2	15	5	8	8	6	4			
M1/2	Period	1					1	1		1			1			1	2				
		2									1	1	3		1	1		2			
		3										1					3				
		4								1		1	3		2		2				
		5	1				2				1		1		1	3	1	1			
		6					3					.5	2		2	6	1	1			
M3	Period	1		1	1	1	1	3	3			3	7		3	6	4	1			
		2	2	1	1					2	1	2	7		2	6	2	3			
		3			1		1	3					2			4		1			
		4									1		6		1	2	1	2			
		5	1					3	2	2	1		7		2	2					
		6					2	1		2	1	8	9	1		2	3	1			

Table 14

Cattle wear stages of individual teeth (following Grant 1982) at Castle Mall. Both teeth in mandibles and isolated teeth are included. Grant's stage "U" is considered equivalent to stage "a". Unworn isolated teeth which could have been in one of the eruption stages (C, V, E, H) are coded as "a".

Cattle	Mandibular wear stage										
Period	Juvenile		Immature		Subadult		Adult		Elderly		Total
	n	%	n	%	n	%	n	%	n	%	
1	2	**6**	2	**6**	4	**12**	14	**41**	12	**35**	34
2 + 3	-	**0**	-	**0**	7	**19**	16.5	**45**	13.5	**36**	37
4	-		-		0.5		3		4.5		8
5	8	**29**	-	**0**	2	**7**	13.5	**48**	4.5	**16**	28
6	15	**21**	0.5	**1**	2.5	**3**	40.5	**55**	14.5	**20**	73

Table 15

Cattle mandibular wear stages (following O'Connor 1988) at Castle Mall. See appendix 1 for complete list of individual mandibles. Only mandibles with two or more teeth (with recordable wear stage) in the dP_4/P_4 - M_3 row are considered. Percentages are only calculated where the sample is greater than 20 within a particular period.

Taxon	Periods compared	Value	Degrees of freedom	Probability
Cattle	1 versus 2+3	5.06	4	25% < x < 50%
Cattle	2+3 versus 5	14.38	4	0.5% < x < 1% **
Cattle	5 versus 6	1.62	4	75% < x < 90%
Sheep/Goat	1 versus 2+3	3.85	8	75% < x < 90%
Sheep/Goat	2+3 versus 5	7.72	8	25% < x < 50%
Sheep/Goat	5 versus 6	5.62	8	50% < x < 75%
Sheep/Goat	1-4 versus 5-6	18.08	8	1% < x < 2.5% *
Pig	1 versus 2+3	2.83	4	50% < x < 75%
Pig	2+3 versus 6	9.32	4	5% < x < 10%

Table 16

Castle Mall. **Significance of the differences between cattle, sheep/goat and pig kill-off patterns in different periods.** The chi square (χ^2) test (Spiegel 1961) compares the age profiles as calculated by the mandibular wear stage distribution (figs.21, 30 and 40).

** = the difference is highly significant (with less than a 1% probability that it is due to chance)
* = the difference is significant (less than 5% probability that the difference is due to chance)
no asterisk = no significant difference (more than a 5% probability that it is due to chance)

	Period 1		Period 2+3		Period 4		Period 5		Period 6	
Element	n	%	n	%	n	%	n	%	n	%
Scapula d	32	**97**	39	**98**	5	**100**	16	**89**	22	**50**
Humerus d	39	**95**	25	**93**			12	**80**	51	**73**
Radius d	16	**67**	17	**89**			7	**50**	14	**42**
Metacarpus d	28	**78**	20	**67**	9	**64**	7	**64**	37	**71**
Pelvis a	30	**100**	29	**100**			5	**100**	16	**84**
Femur d	5	**50**	6	**60**					10	**42**
Tibia d	46	**77**	27	**84**			7	**47**	34	**77**
Calcaneus	15	**47**	20	**71**			4	**21**	10	**29**
Metatarsus d	20	**53**	33	**80**			17	**47**	24	**57**
Phalanx 1	66	**90**	54	**96**	29	**88**	45	**90**	68	**93**

Table 17.

Cattle, number and percentage of fused epiphyses at Castle Mall. Fused and fusing epiphyses are amalgamated. Only unfused diaphyses, not epiphyses, are counted.
n = total number of fused/ing epiphyses; % = percentage of fused/ing epiphyses out of the total number of fused/ing epiphyses and unfused diaphyses.
d = distal, a = acetabulum.
Figures for total number of epiphyses smaller than 10 have been omitted.

	Measurement	Mean	V	Min	Max	N
Period 1	Horncore L	1185	22.9	812	1700	13
	Horncore W_{max}	466	18.1	370	655	29
	Horncore W_{min}	357	17.3	260	563	25
	M_3L	342	7.2	263	377	22
	M_3WA	143	7.5	120	165	24
	Humerus BT	688	9.2	615	811	11
	Metacarpus GL	1811	4.4	1690	1940	15
	Metacarpus SD	292	11.3	241	347	16
	Metacarpus Bd	521	9.3	466	618	24
	Metacarpus 3	252	7.7	215	286	20
	Metacarpus BatF	471	8.6	411	578	22
	Metacarpus a	247	9.5	200	290	22
	Metacarpus b	237	9.7	191	284	23
	Tibia Bd	560	9.2	458	645	34
	Astragalus GLl	594	5.7	522	685	31
	Astragalus Bd	377	6.8	311	436	32
	Astragalus Dl	326	8.2	215	355	29
	Metatarsus Bd	478	5.6	441	557	19
	Metatarsus 3	248	4.1	227	264	19
	Metatarsus BatF	450	5.9	397	504	20
	Metatarsus a	228	7.2	206	279	18
	Metatarsus b	216	6.5	199	252	19
Period 2+3	Horncore L	1025	22.4	582	1446	21
	Horncore W_{max}	460	20.6	265	675	42
	Horncore W_{min}	346	17.7	212	496	41
	M_3L	339	5.7	309	388	33
	M_3WA	141	10.3	117	169	33
	Metacarpus GL	1803	6.9	1600	1960	15
	Metacarpus SD	275	11.7	223	321	13
	Metacarpus Bd	521	9.2	467	613	14
	Metacarpus 3	253	9.3	228	296	15
	Metacarpus BatF	478	9.7	428	586	14
	Metacarpus a	267	9.2	219	302	13
	Metacarpus b	244	10.1	215	288	13
	Pelvis LAR	616	6.6	561	695	10
	Tibia Bd	557	5.9	509	616	18
	Astragalus GLl	584	6.3	508	655	29
	Astragalus Bd	369	6.9	327	434	31
	Astragalus Dl	326	6.0	292	371	29
	Metatarsus GL	2026	6.9	1700	2270	15

	Metatarsus Bd	497	8.8	412	575	27
	Metatarsus 3	251	9.4	192	286	23
	Metatarsus BatF	461	8.2	394	529	26
	Metatarsus a	238	10.0	192	283	28
	Metatarsus b	225	9.5	181	262	24
Period 4	M_3WA	142	5.0	132	156	11
Period 5	M_3WA	145	7.0	129	161	10
	Metatarsus Bd	509	10.1	451	620	10
	Metatarsus 3	264	6.5	240	292	13
	Metatarsus BatF	454	11.2	377	548	12
	Metatarsus a	238	7.3	215	269	11
	Metatarsus b	230	10.1	202	275	11
Period 6	Horncore L	2339	25.7	1168	3190	15
	Horncore W_{max}	635	18.0	298	826	73
	Horncore W_{min}	540	19.6	237	747	70
	M_3L	359	6.7	314	407	18
	M_3WA	154	9.2	129	176	24
	Humerus BT	714	8.8	631	890	34
	Humerus HTC	323	9.8	247	393	42
	Metacarpus GL	1895	8.5	1550	2176	25
	Metacarpus SD	319	13.3	228	408	25
	Metacarpus Bd	555	10.9	426	701	28
	Metacarpus 3	270	8.8	229	324	30
	Metacarpus BatF	519	11.9	404	681	28
	Metacarpus a	268	11.6	222	348	26
	Metacarpus b	261	10.3	222	330	26
	Tibia Bd	609	9.5	519	725	27
	Metatarsus GL	2192	7.8	1912	2500	12
	Metatarsus SD	257	11.1	229	318	13
	Metatarsus Bd	525	9.2	460	638	17
	Metatarsus 3	271	7.6	238	318	17
	Metatarsus BatF	484	8.6	429	603	14
	Metatarsus a	255	10.3	225	313	13
	Metatarsus b	244	9.0	214	290	13

Table 18

Means, coefficients of variation (V), ranges and sample sizes for cattle measurements at Castle Mall. Fusing bones are included, unfused ones are not. A few measurements are approximated. All measurements are in tenths of millimetres. Only samples of at least 10 measurements are given.

Taxon	Element	Measurement	Periods compared	T-value	Probability
Cattle	M3	WA	1 and 2+3	0.57	0.571
			2+3 and 4	-0.16	0.874
			4 and 5	-0.84	0.414
			5 and 6	-1.80	0.081
			1 and 2-4	0.58	0.561
			2-4 and 5-6	-3.32	0.001 **
	Tibia	Bd	1 and 2-4	0.52	0.604
			2-4 and 5-6	-3.79	0.000 **
Sheep/Goat	M3	WA	1 and 2+3	0.20	0.845
			2+3 and 4	-0.04	0.969
			4 and 5	0.43	0.671
			5 and 6	-3.22	0.002 **
	Humerus	HTC	1 and 2+3	-1.04	0.306
			2+3 and 4	2.33	0.026 *
			4 and 5	-1.06	0.296
			5 and 6	-3.59	0.001 **
Pig	M1	WP	1 and 2+3	0.75	0.458
			2+3 and 4	0.79	0.437
			4 and 5	-1.29	0.215
			5 and 6	-0.75	0.459
			1 and 2-4	0.97	0.338
			2-4 and 5-6	-3.08	0.003 **
Domestic Fowl	Tibiotarsus	Bd	1 and 2+3	1.50	0.141
			2+3 and 4	-0.87	0.390
			4 and 5	-1.63	0.113
			5 and 6	-0.53	0.598
			1-4 and 5-6	-3.55	0.001**
			1-4 and 5	-2.42	0.018*
			1-4 and 6	-3.07	0.003**
			1-5 and 6	-2.65	0.009**

Table 19

Significance of the size differences for cattle, sheep/goat and domestic fowl between different periods at Castle Mall as indicated by a **t-test.**
** = the difference is highly significant (with less than a 1% probability that it is due to chance)
* = the difference is significant (with less than a 5% probability that it is due to chance)
no asterisk = no significant difference (more than a 5% probability that it is due to chance)

Period 1								
	Chopping		Cuts		Total Butchery		Gnawing	
	n	%	n	%	n	%	n	%
Cattle	79	15	30	6	102	19	84	16
Sheep/Goat	14	7	15	7	27	13	30	14
Pig	16	5	22	7	33	11	31	10
Equid	1	3	1	3	2	5	1	3
Dog	-	0	1	2	1	2	-	0
Cat	-	0	8	6	8	6	-	0
Total	110	9	77	6	173	14	146	11

Period 2								
	Chopping		Cuts		Total Butchery		Gnawing	
	n	%	n	%	n	%	n	%
Cattle	49	13	36	10	79	22	67	18
Sheep/Goat	11	7	20	13	28	18	23	14
Pig	3	2	6	3	9	5	29	16
Equid	1	4	1	4	2	8	8	32
Dog	1	1	2	2	2	2	-	0
Cat	1	1	3	5	4	7	-	0
Total	66	8	68	8	124	14	127	15

Period 3								
	Chopping		Cuts		Total Butchery		Gnawing	
	n	%	n	%	n	%	n	%
Cattle	5	8	11	17	16	25	8	13
Sheep/Goat	2	4	1	2	3	6	5	10
Pig	-	0	2	6	2	6	5	14
Equid	-	0	-	0	-	0	1	25
Dog	-	0	-	0	-	0	-	0
Cat	-	0	-	0	-	0	-	0
Total	7	4	14	9	21	13	19	12

(continues)

	Period 4							
	Chopping		Cuts		Total Butchery		Gnawing	
	n	%	n	%	n	%	n	%
Cattle	21	15	12	9	23	16	9	6
Sheep/Goat	9	7	11	8	30	23	14	11
Pig	3	5	5	8	7	11	7	11
Equid	0	-	1	20	1	20	-	0
Dog	0	-	-	0	-	0	-	0
Cat	0	-	-	0	-	0	-	0
Total	33	8	29	7	61	16	30	8

	Period 5							
	Chopping		Cuts		Total Butchery		Gnawing	
	n	%	n	%	n	%	n	%
Cattle	53	19	13	5	61	22	18	6
Sheep/Goat	17	4	61	13	73	15	27	6
Pig	5	5	8	7	13	12	9	8
Equid	-	0	-	0	-	0	-	0
Dog	-	0	-	0	-	0	-	0
Cat	-	0	-	0	-	0	-	0
Total	75	8	82	9	147	15	54	6

	Period 6							
	Chopping		Cuts		Total Butchery		Gnawing	
	n	%	n	%	n	%	n	%
Cattle	164	30	36	7	189	35	40	7
Sheep/Goat	43	9	60	13	106	23	42	9
Pig	8	7	5	5	11	10	7	6
Equid	6	5	13	10	17	13	2	2
Dog	1	1	1	1	2	3	-	0
Cat	-	0	1	1	1	1	-	0
Total	222	16	116	8	326	23	91	6

Table 20

Percentages of **butchered and gnawed postcranial bones** at Castle Mall. Total butchery includes chop and cut marks (its value is lower than the total of chopping and cuts because some bones were chopped *and* cut). Gnawing includes digested bones and bones gnawed by carnivores or rodents. The percentage is calculated from the total number of postcranial bones in that period.

Period	Sheep	Goat	Total
1	14	13	27
2	12	6	18
3	4	3	7
4	9	-	9
5	54 (33*)	3	57 (36*)
6	7	4	11
Total	100	29	129 (108*)

Table 21

Number of **sheep and goat horncores** by period at Castle Mall.
* in these figures a "special" context (11030) containing an accumulation of sheep horncores, metapodii and phalanges has been excluded.

ELEMENT	PERIOD 1 NISP	MNI	%	2 NISP	MNI	%	3 NISP	MNI	%	4 NISP	MNI	%	5 NISP	MNI	%	5* NISP	MNI	%	6 NISP	MNI	%
DECIDUOUS+ PERMANENT INCISORS	12	2	10	3	1	7	1	1	25	6	1	8	8	1	2	8	1	5	6	1	2
DECIDUOUS+ PERMANENT PREMOLARS	63	11	52	41	7	50	12	2	50	37	7	54	70	12	26	70	12	60	108	18	35
M1/2	82	21	100	33	9	64	10	3	75	50	13	100	69	18	38	69	18	90	132	33	65
M3	31	16	76	7	4	29	6	3	75	22	11	85	34	17	36	34	17	85	75	38	75
CRANIUM	6	3	14	3	2	14	-	-	-	5	3	23	14	7	15	14	7	35	9	5	10
SCAPULA	14	7	33	16	8	57	3	2	50	10	5	38	19	10	21	19	10	50	102	51	100
HUMERUS	18	9	43	17	9	64	5	3	75	10	5	38	33	17	36	33	17	85	56	28	55
RADIUS	16	8	38	12	6	43	4	2	50	7	4	31	22	11	23	22	11	55	37	19	37
CARPAL	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	1	1	5	1	1	2
METACARPUS	16	8	38	10.5	6	43	3	2	50	10	5	38	84.5	43	91	30.5	16	80	38.5	20	39
PELVIS	18	9	43	14	7	50	2	1	25	5	3	23	20	10	21	20	10	50	50	25	49
FEMUR	6	3	14	4	2	14	1	1	25	2	1	8	16	8	17	16	8	40	24	12	23
TIBIA	33	17	81	27	14	100	8	4	100	8	4	31	15	8	17	15	8	40	42	21	41
ASTRAGALUS	6	3	14	2	1	7	-	-	-	1	1	8	5	3	6	5	3	15	7	4	8
CALCANEUS	4	2	10	3	2	14	2	1	25	2	1	8	12	6	13	12	6	30	11	6	12
METATARSUS	15.5	8	38	12.5	7	50	1	1	25	6	3	23	94	47	100	39	20	100	42	21	41
PHALANX 1	10	2	10	7	1	7	2	1	25	12	2	15	64	8	17	20	3	15	6	1	2
PHALANX 3	2	1	5	-	-	-	-	-	-	2	1	8	16	2	4	-	-	-	2	1	2
TOTAL	352.5			212			60			195			596.5			427.5			748.5		

Table 22

Parts of the sheep/goat skeleton by number of fragments (NISP) and minimum number of individuals (MNI) at Castle Mall. Unfused epiphyses are not counted. Only hand-collected material is included.
Each individual tooth within mandibles has been counted, hence the total is greater than the total NISP in table 2.
The MNI has been calculated as follows:
Incisors and phalanges have been divided by 8, deciduous + permanent premolars and incisors by 6, $M_{1/2}$ by 4, all other elements, except metapodia, by 2.
Metacarpus = (MC1 + MC2/2 + MP1/2 + MP2/4) / 2
Metatarsus = (MT1 + MT2/2 + MP1/2 + MP2/4) / 2
Where:
MC1 = complete distal metacarpus.
MC2 = half distal metacarpus.
MT1 = complete distal metatarsus.
MT2 = half distal metatarsus.
MP1 = complete distal metapodium.
MP2 = half distal metapodium.
% = frequency of an element expressed in relation to the most common one (by MNI).
* = in this count a "special" group of sheep metapodia and phalanges (context 11030) has been excluded.

			C	V	E	H	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
dP4	Period	1							1			1							1	5			2						2	2
		2									1					2				1	2					1				
		3																												1
		4					1				1												1					1		1
		5														1				3							1			2
		6																		3	2			1						1
P4	Period	1				1		1			2		2	2	6	10			4		1									
		2							1					1	3	3			2						1					
		3								1					2				1											
		4			1	1					1	1		1	2	5		3	3		1									
		5					1							4	8	8		1	6			1								
		6					1	2	1			2		6	4	17		4	11		2	1								
M1	Period	1		3	1	1						1		1	1	26	6	1	3			2								
		2		2					2						1	6	4	1				2								
		3														4	1				2									
		4		1												10	2	1	4			3								
		5		1	1				1							15	2	4	2	1	3	4								
		6			2	1			3							29	10	6	9	1	4	4	1							
M2	Period	1							1		3		1	7	5	19		2												
		2	1									1		3	2	10														
		3												1		4														
		4									1		2	3		10			1		1									
		5	2											1	1	28	1	1	1		1	1								
		6	1								1		2	7	4	50				1		1								
M1/2	Period	1												3	2	2														
		2								1			1	1		1			1			1								
		3					1																							
		4											1	1	1	8		1				1								
		5											1	1	2	4														
		6											1		1	4			1		1									
M3	Period	1	3	2					3		6			1	5	2	1	11	1											
		2		2							1		1	2			1	3												
		3		1								1		1		1	1	1						1						
		4	1	3		1		1	1		2				1	1		10			1									
		5	1				1		1		2	2	3		4	5	5	12		1										
		6	3	1			1	3	3	1	4	3	3	1	6	11	5	33					1							

Table 23

Sheep/goat wear stages of individual teeth (following Payne 1973 and 1987) at Castle Mall. Both teeth in mandibles and isolated teeth are included.
Unworn isolated teeth which could have been in one of the eruption stages (C, V, E, H) are coded as "0".

Sheep/ Goat 1	Mandibular wear stage																
Period	A		B		C		D		E		F		G		H		I		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
1	-	0	5	10	2	4	9	18	16.5	34	6.5	13	8	16	2	4	-	0	49
2 + 3	-	0	2	7	2	7	5	19	7.8	29	3.3	12	5.8	22	-	0	1	4	26.9
4	1	5	-	0	-	0	5	24	3.5	17	1.5	7	6.3	30	2.3	11	1.3	6	20.9
5	-	0	2	5	1	3	1.5	4	11.3	29	8.8	23	10.3	26	3	8	1	3	38.9
6	-	0	2	3	3	4	4.5	6	19.5	26	14.8	20	28.8	38	0.8	1	1.5	2	74.9

Sheep/ Goat 2	Mandibular wear stage																
Period	A		B		C		D		E		F		G		H		I		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
1	-	0	5	12	1	2	6	14	15.5	37	6.5	15	7	17	1	2	-	0	42
2 + 3	-		2		2		1		4.8		1.8		4.3		-		1		16.9
4	1		-		-		4		2.5		1.5		6.3		2.3		1.3		18.9
5	-	0	2	6	1	3	1.5	5	9.8	32	6.3	20	8.3	27	2	6	-	0	30.9
6	-	0	2	3	3	5	1.5	2	19	30	13.8	22	22.8	36	0.3	<1	1	2	63.4

Table 24

Sheep/Goat mandibular wear stages (following Payne 1973) at Castle Mall. See appendix 1 for complete list of individual mandibles.
Sheep/Goat 1 = Only mandibles with two or more teeth (with recordable wear stage) in the dP_4/P_4 - M_3 row are considered.
Sheep/Goat 2 = Only mandibles with two or more teeth (with recordable wear stage) in the dP_4/P_4 - M_3 row, one of the which is dP_4/P_4, are considered.
Percentages are only calculated where the sample is greater than 20 within a particular period.

Period	Age ranges	Tooth	Wear stage	% killed within age range	cumulative % killed	Age
1	0-2 years	9 dP_4 (+5)		25% (33%)	25% (33%)	c.2 years
	> 2 years	27 P_4 (+2)		75% (67%)		
	2-3 years	8 M_3 (+1)	2-4	22% (20%)	47% (53%)	c.3 years
	3-5 years	8 M_3 (+1)	5-10	22% (20%)	69% (73%)	c.5 years
	6-10 years	11 M_3 (+0)	11G	29% (25%)	97% (98%)	c.10 years
	> 10 years	1 M_3 (+0)	>11G	3% (2%)	100% (100%)	
Period	Age ranges	Tooth	Wear stage	% killed within age range	cumulative % killed	Age
2+3	0-2 years	8 dP_4 (+3)		38% (42%)	38% (44%)	c.2 years
	> 2 years	13 P_4 (+2)		62% (58%)		
	2-3 years	- M_3 (+1)	2-4	0% (4%)	38% (46%)	c.3 years
	3-5 years	6 M_3 (+2)	5-10	37% (33%)	75% (79%)	c.5 years
	6-10 years	3 M_3 (+1)	11G	19% (17%)	94% (96%)	c.10 years
	> 10 years	1 M_3 (+0)	>11G	6% (4%)	100% (100%)	
Period	Age ranges	Tooth	Wear stage	% killed within age range	cumulative % killed	Age
4	0-2 years	3 dP_4 (+3)		14% (24%)	14% (24%)	c.2 years
	> 2 years	18 P_4 (+1)		86% (76%)		
	2-3 years	3 M_3 (+0)	2-4	16% (14%)	30% (38%)	c.3 years
	3-5 years	2 M_3 (+0)	5-10	11% (10%)	41% (48%)	c.5 years
	6-10 years	10 M_3 (+0)	11G	54% (48%)	95% (96%)	c.10 years
	> 10 years	1 M_3 (+0)	>11G	5% (5%)	100% (100%)	
Period	Age ranges	Tooth	Wear stage	% killed within age range	cumulative % killed	Age
5	0-2 years	5 dP_4 (+1)		16% (17%)	16% (17%)	c.2 years
	> 2 years	27 P_4 (+2)		84% (83%)		
	2-3 years	2 M_3 (+1)	2-4	5% (7%)	21% (24%)	c.3 years
	3-5 years	18 M_3 (+1)	5-10	49% (45%)	70% (69%)	c.5 years
	6-10 years	10 M_3 (+2)	11G	27% (28%)	97% (97%)	c.10 years
	> 10 years	1 M_3 (+0)	>11G	3% (2%)	100% (100%)	
Period	Age ranges	Tooth	Wear stage	% killed within age range	cumulative % killed	Age
6	0-2 years	7 dP_4 (+0)		13% (12%)	13% (12%)	c.2 years
	> 2 years	47 P_4 (+6)		87% (88%)		
	2-3 years	8 M_3 (+0)	2-4	11% (10%)	24% (22%)	c.3 years
	3-5 years	26 M_3 (+3)	5-10	35% (36%)	59% (58%)	c.5 years
	6-10 years	30 M_3 (+3)	11G	40% (41%)	99% (99%)	c.10 years
	> 10 years	1 M_3 (+0)	>11G	1% (1%)	100% (100%)	

Table 25

Sheep/goat, kill-off pattern at Castle Mall based upon single teeth (dP_4/P_4 and M_3) and teeth (dP_4/P_4 and M_3) in mandibles, using the system suggested by Payne (1988). Unworn P_4s are included and wear stages are as in Payne (1973). Teeth recovered from sieved samples are added in parenthesis. Calculations including teeth recovered from sieved samples are also in parenthesis.

	Period 1		Period 2+3		Period 4		Period 5		Period 6	
Element	n	%	n	%	n	%	n	%	n	%
Scapula d	16	**100**	18	**90**	8	**73**	19	**83**	97	**93**
Humerus d	19	**95**	28	**97**	15	**94**	33	**94**	56	**100**
Radius d	8	**47**	5	**26**			14	**64**	22	**56**
Metacarpus d	10	**63**	7	**47**	7	**58**	77	**86**	28	**70**
Pelvis a	20	**91**	16	**100**	8	**80**	21	**95**	50	**100**
Femur d							13	**76**	17	**68**
Tibia d	28	**76**	32	**86**	6	**60**	18	**100**	35	**81**
Calcaneus							12	**92**	9	**75**
Metatarsus d	15	**83**	6	**46**			92	**93**	27	**61**
Phalanx 1	11	**85**			13	**76**	80	**98**		

Table 26

Sheep/Goat, number and percentage of fused epiphyses at Castle Mall. Fused and fusing epiphyses are amalgamated. Only unfused diaphyses, not epiphyses, are counted.
n = total number of fused/ing epiphyses; % = percentage of fused/ing epiphyses out of the total number of fused/ing epiphyses and unfused diaphyses.
d = distal, a = acetabulum.
Figures for total number of epiphyses smaller than 10 have been omitted.

	Measurement	Mean	V	Min	Max	N
Period 1	M_1W	72	6.7	59	83	39
	M_2W	79	5.7	70	91	37
	M_3W	81	5.3	72	92	29
	Humerus BT	275	7.1	247	318	12
	Humerus HTC	136	4.4	125	146	16
	Tibia Bd	257	4.7	234	279	24
	Metatarsus Bd	239	5.0	213	255	14
	Metatarsus 3	134	4.3	124	143	12
Period 2+3	M_1W	71	5.5	63	79	20
	M_2W	79	4.8	72	86	18
	M_3W	81	5.1	69	86	14
	Humerus BT	281	6.1	257	313	16
	Humerus HTC	139	7.3	127	162	20
	Tibia Bd	251	6.6	222	284	27
Period 4	M_1W	73	7.1	62	84	18
	M_2W	81	5.1	74	86	16
	M_3W	81	5.2	73	88	15
	Humerus BT	263	5.5	243	285	11
	Humerus HTC	132	6.6	118	146	14
Period 5	Horncore W_{max}	320	11.0	237	378	37
	Horncore W_{min}	225	12.5	180	295	31
	M_1W	68	7.3	59	80	26
	M_2W	78	5.8	67	85	32
	M_3W	81	5.3	71	89	32
	Humerus BT	270	6.1	217	292	26
	Humerus HTC	134	5.9	121	151	29
	Metacarpus GL	1158	5.3	940	1298	56
	Metacarpus SD	134	5.6	110	149	53
	Metacarpus Bd	244	3.6	220	265	63
	Metacarpus 3	131	5.1	110	144	67
	Metacarpus a	114	4.1	102	130	68
	Metacarpus b	111	4.9	96	123	67
	Metacarpus 1	105	5.2	89	115	68
	Metacarpus 4	99	6.1	83	112	65
	Pelvis LAR	268	5.9	251	305	10
	Tibia Bd	248	5.3	219	267	13
	Metatarsus GL	1236	5.4	1105	1360	69
	Metatarsus SD	116	6.3	95	133	67
	Metatarsus Bd	230	5.0	206	257	85
	Metatarsus 3	127	5.2	113	142	83

Period 6	M_1W	72	6.3	63	84	63
	M_2W	81	5.9	68	94	61
	M_3W	83	4.7	72	93	72
	Humerus BT	284	5.9	252	322	47
	Humerus HTC	142	6.9	122	163	50
	Radius GL	1404	4.8	1290	1510	10
	Radius Bd	150	8.1	124	168	10
	Metacarpus GL	1281	8.1	1080	1507	19
	Metacarpus SD	143	10.1	116	172	18
	Metacarpus Bd	256	7.3	224	305	24
	Metacarpus 3	135	7.5	118	166	23
	Metacarpus a	120	8.0	106	142	23
	Metacarpus b	116	8.0	104	139	23
	Metacarpus 1	107	8.3	95	134	22
	Metacarpus 4	102	8.8	89	131	23
	Pelvis LAR	282	11.2	216	379	30
	Tibia Bd	257	7.4	223	303	31
	Metatarsus GL	1350	5.4	1141	1425	14
	Metatarsus SD	115	9.6	97	135	13
	Metatarsus Bd	234	5.4	214	266	22
	Metatarsus 3	129	3.9	120	140	21

Table 27

Means, coefficients of variation (V), ranges and sample sizes for **sheep/goat measurements** at Castle Máll. Fusing bones are included, unfused ones are not. A few measurements are approximated. All measurements are in tenths of millimetres. Only samples of at least 10 measurements are given.

Taxon	Measurement	Periods compared	t-value	Probability
Sheep/Goat	Length	1 and 2+3	1.07	0.294
		2+3 and 4	0.12	0.907
		4 and 5	-1.4	0.164
		5 and 6	-3.99	0.000 **
	Width	1 and 2+3	2.65	0.009 **
		2+3 and 4	2.04	0.044 *
		4 and 5	-3.5	0.001 **
		5 and 6	-6.97	0.000 **
	Depth	1 and 2+3	1.29	0.201
		2+3 and 4	0.17	0.868
		4 and 5	-1.63	0.104
		5 and 6	-3.00	0.003 **
Pig	All bone measurements	1 and 2+3	-1.94	0.057
		2+3 and 4	1.05	0.304
		4 and 5	-0.35	0.730
		5 and 6	-1.59	0.124
		1 and 2-5	-1.31	0.196
		1-5 and 6	-2.87	0.005 **
		2-5 and 6	-1.84	0.071
	All teeth measurements	1 and 2+3	0.45	0.650
		2+3 and 4	-0.36	0.722
		4 and 5	-0.86	0.390
		5 and 6	-1.32	0.187
		1 and 2-5	-0.32	0.749
		1-5 and 6	-3.99	0.000 **
		2-5 and 6	-3.43	0.001 **

Table 28

Significance of the size differences for sheep/goat and pig between different periods at Castle Mall as indicated by a **t-test**. The test is carried out on the log values of the ratio between the actual measurements and the standard values proposed by Davis (in press a) for sheep/goat and by Albarella and Payne (in prep.) for pig.
** = the difference is highly significant (with less than a 1% probability that it is due to chance)
* = the difference is significant (with less than a 5% probability that it is due to chance).
no asterisk = no significant difference (more than a 5% probability that it is due to chance).

The sheep/goat measurements are distributed as follows:
Length: humerus (GLC), radius (GL), metacarpus (GL), tibia (GL), astragalus (GLl), calcaneus (GL), metatarsus (GL)
Width: humerus (BT), metacarpus (Bd,a,b), tibia (Bd), astragalus (Bd), metatarsus (Bd)
Depth: humerus (HTC), metacarpus (1,3,4), astragalus (Dl), metatarsus (3)

Taxon	Period	Measurements compared	t-value	Probability	
Sheep/ Goat	1	Length / Width	0.45	0.652	
		Length / Depth	0.17	0.867	
		Width / Depth	-0.42	0.674	
	2+3	Length / Width	-0.44	0.662	
		Length / Depth	-1.00	0.322	
		Width / Depth	-1.25	0.214	
	4	Length / Width	0.56	0.579	
		Length / Depth	-1.17	0.246	
		Width / Depth	-2.59	0.012	*
	5	Length / Width	0.84	0.400	
		Length / Depth	-4.18	0.000	**
		Width / Depth	-6.80	0.000	**
	6	Length / Width	1.35	0.179	
		Length / Depth	0.81	0.420	
		Width / Depth	-0.88	0.379	
Pig	1	Teeth / Bones	1.82	0.070	
	2+3	Teeth / Bones	-1.60	0.111	
	4	Teeth / Bones	1.13	0.267	
	5	Teeth / Bones	0.64	0.527	
	6	Teeth / Bones	-2.45	0.016	*

Table 29

Significance of the difference between measurements on different axes (sheep/goat) and between **teeth and bone measurements (pig)** at Castle Mall as indicated by a **t-test.**
** = the difference is highly significant (with less than a 1% probability that it is due to chance)
* = the difference is significant (with less than a 5% probability that it is due to chance)
no asterisk = no significant difference (more than a 5% probability that it is due to chance).

The following measurements have been used:
Sheep/Goat lengths: humerus GLC; radius GL; metacarpus GL; pelvis LA; femur GL; tibia GL; astragalus GLl; calcaneus GL; matatarsus GL.
Sheep/Goat widths: humerus BT; metacarpus Bd,a,b; tibia Bd; astragalus Bd; metatarsus Bd.
Sheep/Goat depths: humerus HTC; metacarpus 1,3,4; astragalus Dl; metatarsus 3.
Pig teeth: dP4 L,WA; M1 WA,WB; M2 WA,WB; M3 L,WA,WC.
Pig bones: humerus BT,HTC; pelvis LAR; tibia Bd; astragalus GLl; calcaneus GL.

Groups compared	Bones compared	Measurements compared	t-value	Probability
Castle Mall early mid 15th cent./ Lincoln early 16th cent.	Sheep metacarpus	GL	-6.04	0.000**
		Bd	-6.11	0.000**
		SD	-6.39	0.000**
		Bd/GL	1.94	0.057
		SD/GL	-0.90	0.372
	Sheep metatarsus	GL	-9.39	0.000**
		Bd	-8.68	0.000**
		SD	-10.23	0.000**
		Bd/GL	1.59	0.116
		SD/GL	-0.29	0.772

Table 30

Significance of size and shape measurements between two groups of **sheep metapodia** from **Castle Mall and Lincoln** as indicated by a **t-test**. Note the much larger size of the Lincoln specimens.
** = the difference is highly significant (with less than 1% probability that it is due to chance)
no asterisk = no significant difference (more than 5% probability that it is due to chance).

ELEMENT	PERIOD																	
	1			2			3			4			5			6		
	NISP	MNI	%	NISP	MNI	%	NISP	MNI	%	NISP	MNI	%	NISP	MNI	%	NISP	MNI	%
DECIDUOUS+ PERMANENT INCISORS	31	5	29	24	4	25	6	1	25	7	2	50	11	2	29	18	3	17
CANINE	25	13	76	31	16	100	7	4	100	4	2	50	9	5	71	20	10	56
DECIDUOUS+ PERMANENT PREMOLARS	62	11	65	77	13	81	13	3	75	13	3	75	23	4	57	73	13	72
M1/2	51	13	76	56	14	88	10	3	75	13	4	100	26	7	100	71	18	100
M3	34	17	100	19	10	63	3	2	50	4	2	50	10	5	71	23	12	67
CRANIUM	6	3	18	3	2	13	-	-	-	2	1	25	4	2	29	3	2	11
SCAPULA	15	8	47	6	3	19	1	1	25	7	4	100	9	5	71	12	6	33
HUMERUS	18	9	53	11	6	38	-	-	-	5	3	75	10	5	71	9	5	28
RADIUS	11	6	35	8	4	25	1	1	25	2	1	25	6	3	43	7	4	22
METACARPUS	44	11	65	20	6	38	8	3	75	8	2	50	13	4	57	11	3	17
PELVIS	13	7	41	9	5	31	4	2	50	-	-	-	8	4	57	7	4	22
FEMUR	6	3	18	4	2	13	2	1	25	2	1	25	6	3	43	8	4	22
TIBIA	31	16	94	16	8	50	6	3	75	3	2	50	6	3	43	9	5	28
ASTRAGALUS	7	4	24	3	2	13	-	-	-	1	1	25	1	1	14	1	1	6
CALCANEUS	14	7	41	8	4	25	3	2	50	2	1	25	4	2	29	6	3	17
METATARSUS	37	10	59	12	4	25	-	-	-	1	1	25	3	1	14	8	2	11
PHALANX 1	16	2	12	10	2	13	-	-	-	9	2	50	14	2	29	7	1	6
PHALANX 3	3	1	6	-	-	-	-	-	-	1	1	25	2	1	14	1	1	6
TOTAL	424			317			64			84			165			294		

Table 31

Parts of the pig skeleton by number of fragments (NISP) and minimum number of individuals (MNI). Unfused epiphyses are not counted. Only hand-collected material is included.
Each individual tooth within mandibles has been counted, hence the total is greater than the total NISP in table 2.
The MNI has been calculated as follows:
Phalanges have been divided by 8, deciduous + permanent premolars and incisors by 6, M1/2 by 4, all other elements, except metapodia, by 2.
Metacarpus = (MC/2 + MP/4) / 2
Metatarsus = (MT/2 + MP/4) / 2
Where:
MC = metacarpus.
MT = metatarsus.
MP = metapodium.
% = frequency of an element expressed in relation to the most common one (by MNI).

			C	V	E	H	a	b	c	d	e	f	g	h	j	k	l	m
dP4	Period	1									1	1				1	2	1
		2									2		1	2	1		2	3
		3																1
		4					1			1	1		1		1			
		5					3					2				1	1	
		6					3			1	2	2		1	1	2	3	3
P4	Period	1			1		5	10	1	2	2	1						1
		2		1			6	8	1	2	2	1	1					
		3				1	2	2				1						
		4						1				1						
		5			1		1		1	1								1
		6			2	1	7	5	1	1								
M1	Period	1					2	1		3	8	3	5	2	1			1
		2					3	1	2	2	8	2	5	5	1		1	2
		3	1								3			1		1		
		4	1			1	1		1	1	1	1			1			1
		5		1				1	2	1	4	1		2			1	
		6	1				4	3	3	4	13	3	2		1	1		
M2	Period	1	1	1		2	7	4	4	3	8		1		1			1
		2	1	2	1	1	4	2	5	1	6	2			1			
		3					2			1		2						
		4	1		1		1		1		2							
		5	1	1			5	1	2			2	1		1			
		6	4	2	4		15	4	1	3	2		1					
M3	Period	1	7	9	1		11	3	2	3		1		2				
		2	4	5	1	2	4	1	1	1								
		3		1		1		1	1									
		4	1	1			2											
		5	1	5	1		3	3										
		6	7	6	5	1	2				2	1	1					

Table 32

Pig wear stages of individual teeth (following Grant 1982) at Castle Mall. Both teeth in mandibles and isolated teeth are included. Grant's stage "U" is considered equivalent to stage "a". Unworn isolated teeth which could have been in one of the eruption stages (C, V, E, H) are coded as "a".

	Period 1		Period 2+3		Period 4		Period 5		Period 6	
Element	n	%	n	%	n	%	n	%	n	%
Scapula d	12	60					5	50	6	43
Humerus d	12	48	9	60			5	42		
Radius d										
Metacarpus d	2	4	4	13			3	21	1	8
Pelvis a	16	100	12	86			4	40		
Femur d									1	13
Tibia d	12	32	9	33					2	18
Calcaneus	2	14	2	13						
Metatarsus d	1	2	1	7						
Phalanx 1	8	32	9	43			8	40		

Table 34.

Pig, number and percentage of fused epiphyses at Castle Mall. Fused and fusing epiphyses are amalgamated. Only unfused diaphyses, not epiphyses, are counted.
n = total number of fused/ing epiphyses; % = percentage of fused/ing epiphyses out of the total number of fused/ing epiphyses and unfused diaphyses.
d = distal; a = acetabulum.
Figures for total number of epiphyses smaller than 10 have been omitted.

Pig	Mandibular wear stage										
Period	Juvenile		Immature		Subadult		Adult		Elderly		Total
	n	%	n	%	n	%	n	%	n	%	
1	3	8	9.8	27	16.3	44	5.8	16	2	5	36.9
2 + 3	4	9	13.3	31	20.8	48	4.8	11	-	0	42.9
4	2		2		4		0.5		0.5		9
5	1		7.5		4.5		2		-		15
6	6	15	22.5	58	9.5	24	1	3	-	0	39

Table 33

Pig mandibular wear stages (following O'Connor 1988) at Castle Mall. See appendix 1 for a complete list of individual mandibles. Only mandibles with two or more teeth (with recordable wear stage) in the dP_4/P_4 - M_3 row are considered.
Percentages are only calculated where the sample is greater than 20 within a particular period.

Period	Females	Males
1	8 (5)	17 (11)
2+3	12 (9)	26 (12)
4	-	4 (1)
5	2 (2)	6 (2)
6	5 (3)	13 (7)
Total	27 (19)	66 (33)

Table 35

Pig sex ratio at Castle Mall. Both isolated canines and mandibles with canines are included. The numbers of canines in mandibles are given in parenthesis. Only hand-collected specimens are included.

	Measurement	Mean	V	Min	Max	N
Period 1	M_1WA	101	4.4	93	108	20
	M_1WP	107	3.7	101	114	22
	M_2WA	128	6.1	113	140	23
	M_3WP	130	6.2	119	144	22
	M_3L	313	8.1	271	362	14
	M_3WA	151	7.6	138	180	14
	M_3WC	144	5.3	132	161	13
Period 2+3	M_1WA	100	4.3	91	109	28
	M_1WP	106	4.1	99	113	25
	M_2WA	126	6.6	111	143	18
	M_2WP	128	4.6	117	139	15
Period 5	M_1WA	103	3.7	96	108	11
	M_1WP	109	5.4	99	117	11
Period 6	M_1WA	103	4.9	95	115	28
	M_1WP	111	5.0	99	123	28
	M_2WA	133	5.6	122	152	23
	M_2WP	136	5.5	119	149	21

Table 36

Means, coefficients of variation (V), ranges and sample sizes for pig measurements at Castle Mall. A few measurements are approximated. All measurements are in tenths of millimetres. Only samples of at least 10 measurements are given.

	Period 1			Period 2+3			Period 4			Period 6		
	Tot	Chop	Cut	Tot	Chop	Cut	Tot	Chop	Cut	Tot	Chop	Cut
Cranium	-	-	-	-	-	-	-	-	-	10	-	-
Mandible	7	-	-	9	-	-	1	-	-	42	-	1
Scapula	3	-	-	1	1	-	1	-	-	13	-	1
Humerus	3	-	-	7	-	1	-	-	-	15	-	-
Radius	6	-	-	-	-	-	-	-	-	17	-	2
Pelvis	2	-	-	-	-	-	-	-	-	20	4	4
Femur	2	-	-	2	-	-	-	-	-	18	1	1
Tibia	4	-	-	2	-	-	-	-	-	12	-	1
Astragalus	1	-	-	1	-	-	-	-	-	1	-	-
Calcaneus	2	-	-	2	-	-	-	-	-	-	-	-
Metapodia	8	1	-	6	1	-	2	-	1	17	1	4
1st Phalanx	6	-	1	6	-	-	1	-	-	3	-	-
Total	44	1	1	36	2	1	5	-	1	168	6	14

Table 37

Number of **butchery marks on equid bones** at Castle Mall. "Tot" is the total number of each element within a particular period.

	Period 1			Period 2+3			Period 4			Period 5			Period 6		
	Tot	Chop	Cut	Tot	Chop	Cut	Tot	Chop	Cut	Tot	Chop	Cut	Tot	Chop	Cut
Cranium	2	-	-	3	-	-	-	-	-	-	-	-	6	-	-
Mandible	7	-	-	15	-	-	7	-	-	3	-	-	14	-	-
Scapula	7	-	1	4	-	-	1	-	-	2	-	-	7	-	-
Humerus	6	-	-	8	-	-	1	-	-	2	-	-	16	-	-
Radius	3	-	-	6	-	-	-	-	-	1	-	-	12	-	-
Pelvis	6	-	-	4	-	1	2	-	-	1	-	-	5	-	1
Femur	7	-	-	14	1	1	2	-	-	4	-	-	13	-	-
Tibia	6	-	-	12	-	-	3	-	-	-	-	-	12	1	-
Astragalus	1	-	-	1	-	-	1	-	-	-	-	-	-	-	-
Calcaneus	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
Metapodii	18	-	-	27	-	-	4	-	-	5	-	-	6	-	-
1st Phalanx	2	-	-	7	-	-	1	-	-	-	-	-	-	-	-
Total	65	-	1	105	1	2	22	-	-	18	-	-	91	1	1

Table 38

Number of **butchery marks on dog bones** at Castle Mall. "Tot" is the total number of each element within a particular period.

	Period 1			Period 2+3			Period 4			Period 5			Period 6		
	Tot	Chop	Cut	Tot	Chop	Cut	Tot	Chop	Cut	Tot	Chop	Cut	Tot	Chop	Cut
Cranium	4	-	2	3	-	1	-	-	-	2	-	-	-	-	-
Mandible	10	-	-	4	-	-	6	-	1	5	-	-	4	-	-
Scapula	8	-	-	3	-	-	2	-	-	3	-	-	2	-	-
Humerus	11	-	-	11	-	1	4	-	-	6	-	-	21	-	-
Radius	9	-	-	5	-	-	2	-	-	4	-	-	14	-	1
Pelvis	6	-	-	3	-	-	3	-	-	3	-	-	4	-	-
Femur	13	-	-	6	-	-	8	-	-	6	-	-	16	-	-
Tibia	10	-	-	8	-	-	8	-	-	4	-	-	22	-	-
Astragalus	2	-	-	-	-	-	1	-	-	1	-	-	1	-	-
Calcaneus	3	-	-	1	-	-	4	-	-	2	-	-	-	-	-
Metapodii	45	-	3	18	-	2	6	-	-	29	-	-	12	-	-
1st Phalanx	12	-	3	1	-	-	1	-	-	3	-	-	-	-	-
Total	133	-	8	63	-	4	45	-	1	68	-	-	96	-	1

Table 39

Number of **butchery marks on cat bones** at Castle Mall. "Tot" is the total number of each element within a particular period.

Period	Unspurred tarsometatarsi	Spurred tarsometatarsi	% females
1	22	6	79
2+3	13	4	76
4	9	0	100
5	8	7	53
6	4	3	57
Tot	56	20	74

Table 40

Number of **unspurred (females) and spurred (males) tarsometatarsi of domestic fowl** at Castle Mall. "Spurred" also includes specimens which only have a "spur scar" or a "reduced spur".

	Measurement	Mean	V	Min	Max	N
Period 1	Humerus GL	665	7.8	611	815	16
	Humerus SC	67	9.5	58	83	16
	Humerus Bd	143	9.0	129	175	18
	Femur GL	732	9.4	638	854	21
	Femur Lm	690	9.2	590	799	20
	Femur SC	66	11.8	55	83	22
	Femur Bd	145	10.4	125	179	27
	Femur Dd	124	9.8	108	148	25
	Tibiotarsus GL	986	6.3	901	1155	16
	Tibiotarsus La	954	6.6	867	1120	17
	Tibiotarsus SC	57	9.3	49	69	19
	Tibiotarsus Bd	110	9.4	100	140	30
	Tibiotarsus Dd	114	9.3	98	146	28
	Tarsometatarsus GL	670	10.7	575	849	30
	Tarsometatarsus SC	59	8.8	52	72	33
	Tarsometatarsus Bd	122	9.1	108	148	32
Period 2+3	Humerus Bd	146	7.9	121	164	14
	Femur Lm	675	13.1	507	805	10
	Femur SC	63	11.3	55	77	12
	Femur Bd	142	10.4	122	163	14
	Femur Dd	123	7.7	109	141	13
	Tibiotarsus GL	1025	8.2	931	1175	10
	Tibiotarsus La	986	8.1	893	1134	10
	Tibiotarsus SC	59	9.1	51	68	11
	Tibiotarsus Bd	106	6.6	94	121	18
	Tibiotarsus Dd	111	8.6	95	127	16
	Tarsometatarsus GL	687	7.5	605	798	18
	Tarsometatarsus SC	59	8.1	53	68	18
	Tarsometatarsus Bd	122	6.9	113	142	20
Period 4	Humerus Bd	145	6.1	136	163	13
	Femur GL	670	3.9	656	747	10
	Femur Lm	647	4.0	603	692	12
	Femur SC	62	5.0	59	69	10
	Femur Bd	137	5.2	121	149	17
	Femur Dd	117	5.7	100	128	17
	Tibiotarsus Bd	109	12.3	90	138	18
	Tibiotarsus Dd	111	8.6	98	131	18
	Tarsometatarsus GL	660	7.1	581	757	12
	Tarsometatarsus SC	56	5.1	52	62	11
	Tarsometatarsus Bd	120	6.4	113	142	13

Period 5	Humerus SC	68	11.5	57	81	12
	Humerus Bd	149	8.6	129	172	20
	Femur GL	785	8.2	681	881	17
	Femur Lm	728	8.0	635	824	17
	Femur SC	71	11.4	60	84	16
	Femur Bd	186	11.7	124	204	20
	Femur Dd	133	10.6	109	156	20
	Tibiotarsus Bd	117	9.2	107	145	14
	Tibiotarsus Dd	119	11.5	102	147	13
	Tarsometatarsus GL	789	13.1	640	973	11
	Tarsometatarsus SC	70	17.9	52	94	12
	Tarsometatarsus Bd	135	12.4	115	166	10
Period 6	Humerus GL	747	10.8	629	871	10
	Humerus SC	73	11.1	58	86	10
	Humerus Bd	158	11.3	131	191	10
	Femur SC	72	10.9	63	86	10
	Femur Bd	158	10.2	139	186	11
	Femur Dd	135	11.4	115	163	10
	Tibiotarsus Bd	119	11.1	104	148	14
	Tibiotarsus Dd	121	9.9	103	141	14

Table 41

Means, coefficients of variation (V), ranges and sample sizes for **domestic fowl measurements** at Castle Mall. Juvenile ("J") bones are not included. A few measurements are approximated. All measurements are in tenths of millimetres. Only samples of at least 10 measurements are given.

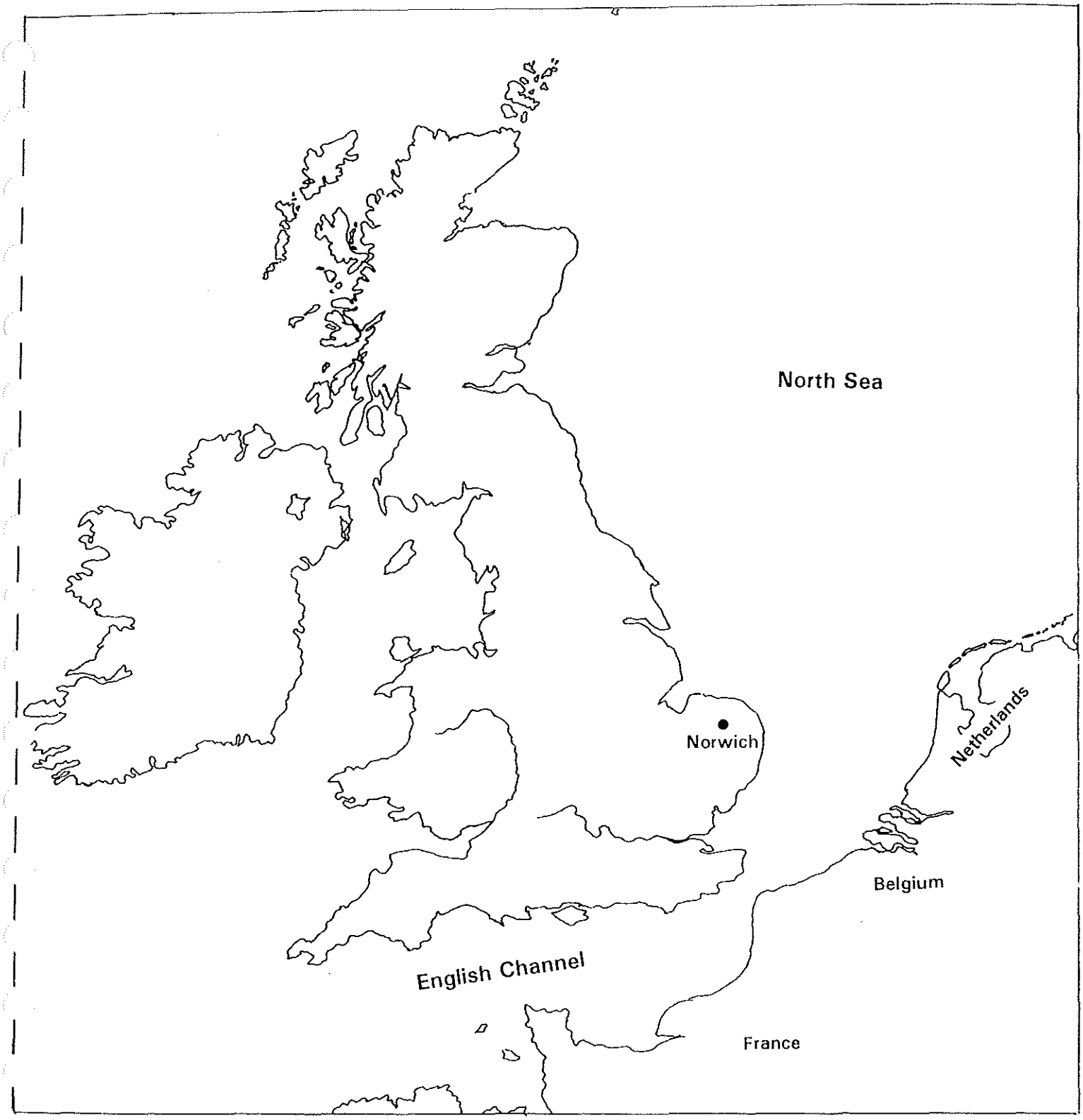


Figure 1. Map to show the location of Norwich.

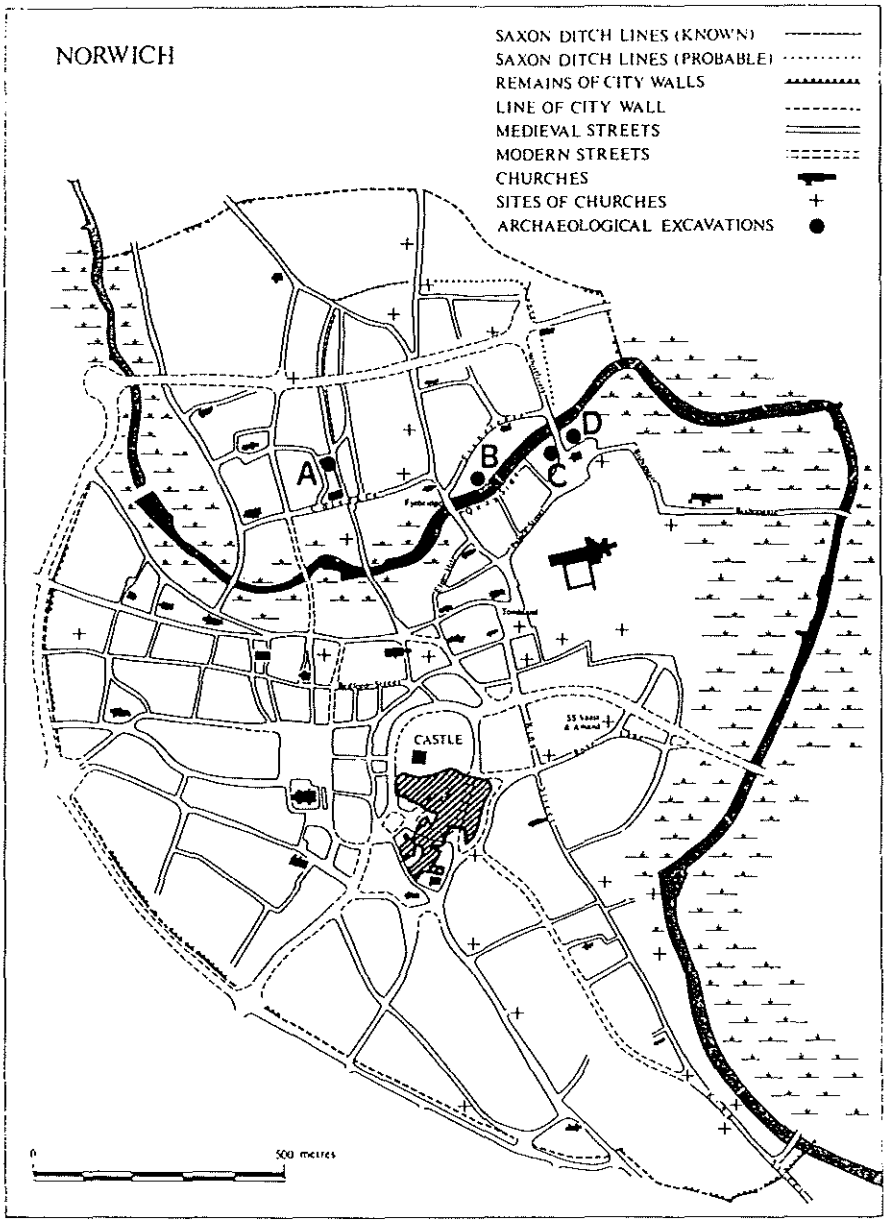


Figure 2. Map of saxon and medieval Norwich, showing the location of the medieval walled city (adapted from Ayers 1987, fig. 1).

Hatched area indicates location of the Castle Mall excavations.
Previous archaeological excavations with published animal bone reports (see also table 12) are marked as follows:
A = Alms Lane (site 302), B = Fishergate (site 732)
C = Whitefriars (site 421), D = St.Martin-at-Palace Plain (County site 450).

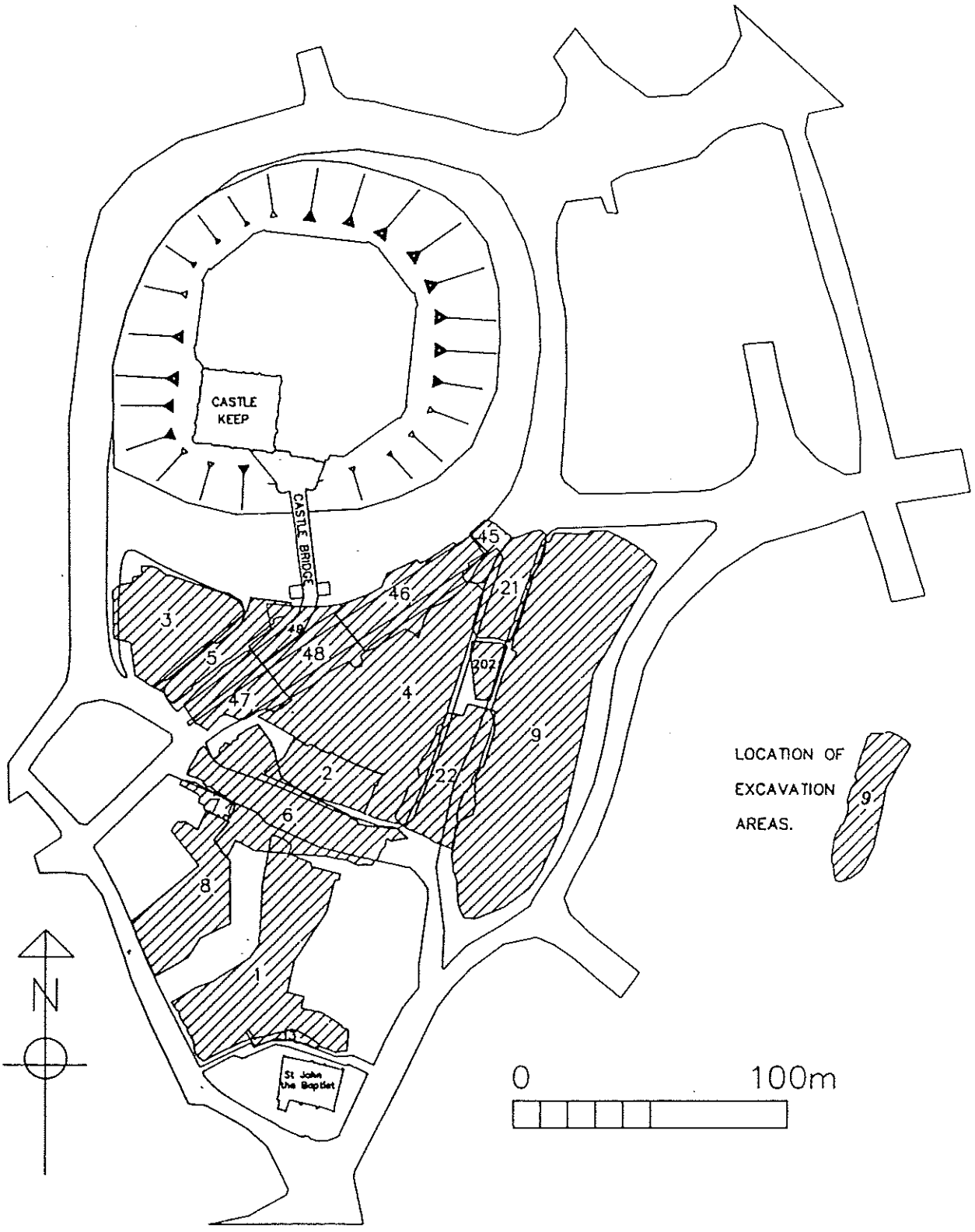


Figure 3. Map of the Castle Mall excavations showing the location of the different excavation areas.

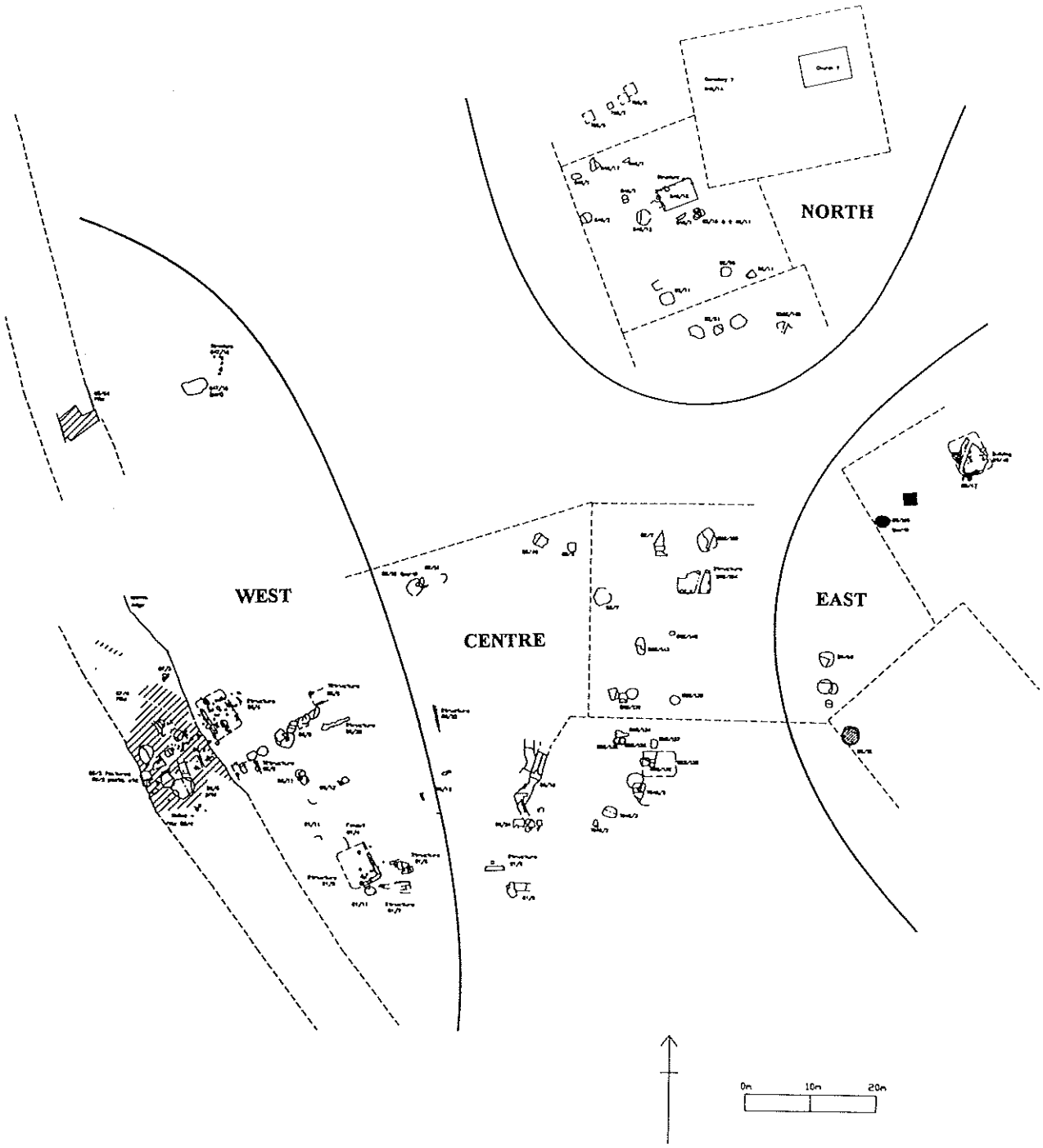


Figure 4 Castle Mall: Period 1, Subperiod 2 - late 9th to early 11th century.
(Early pre-Conquest)

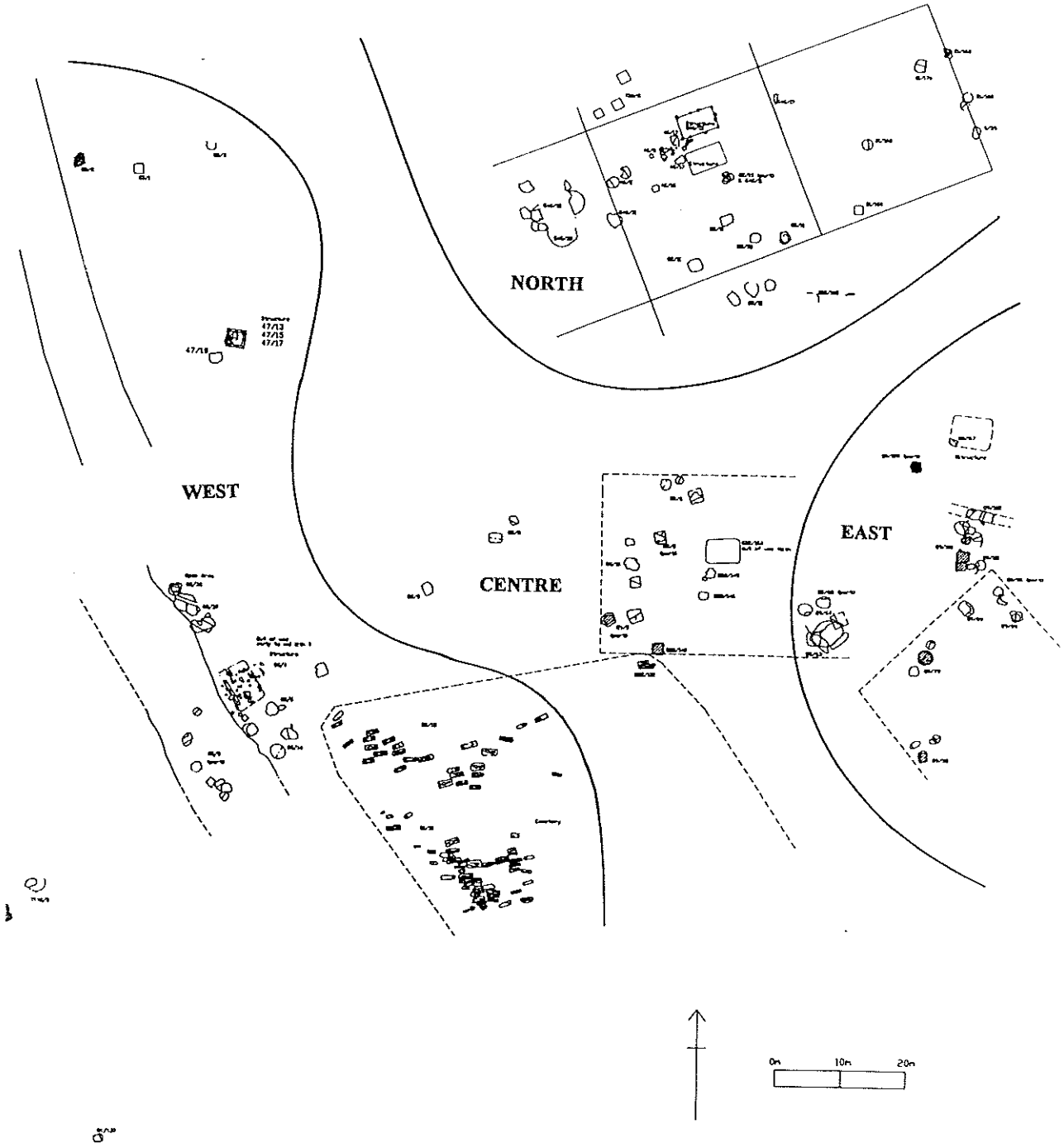


Figure 5 Castle Mall: Period 1, Subperiod 3 - 11th century.
(Pre-Conquest)

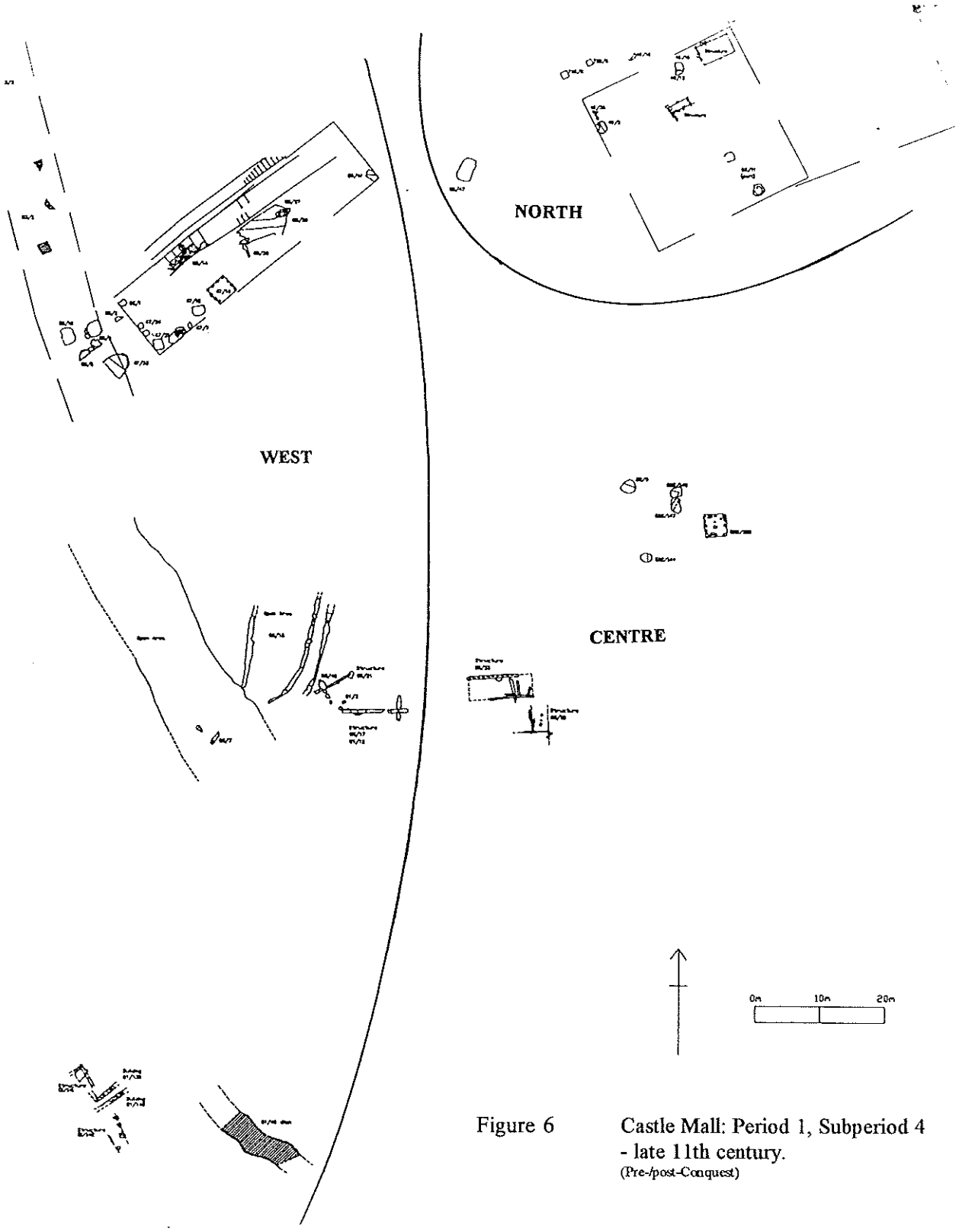


Figure 6 Castle Mall: Period 1, Subperiod 4 - late 11th century.
(Pre-/post-Conquest)

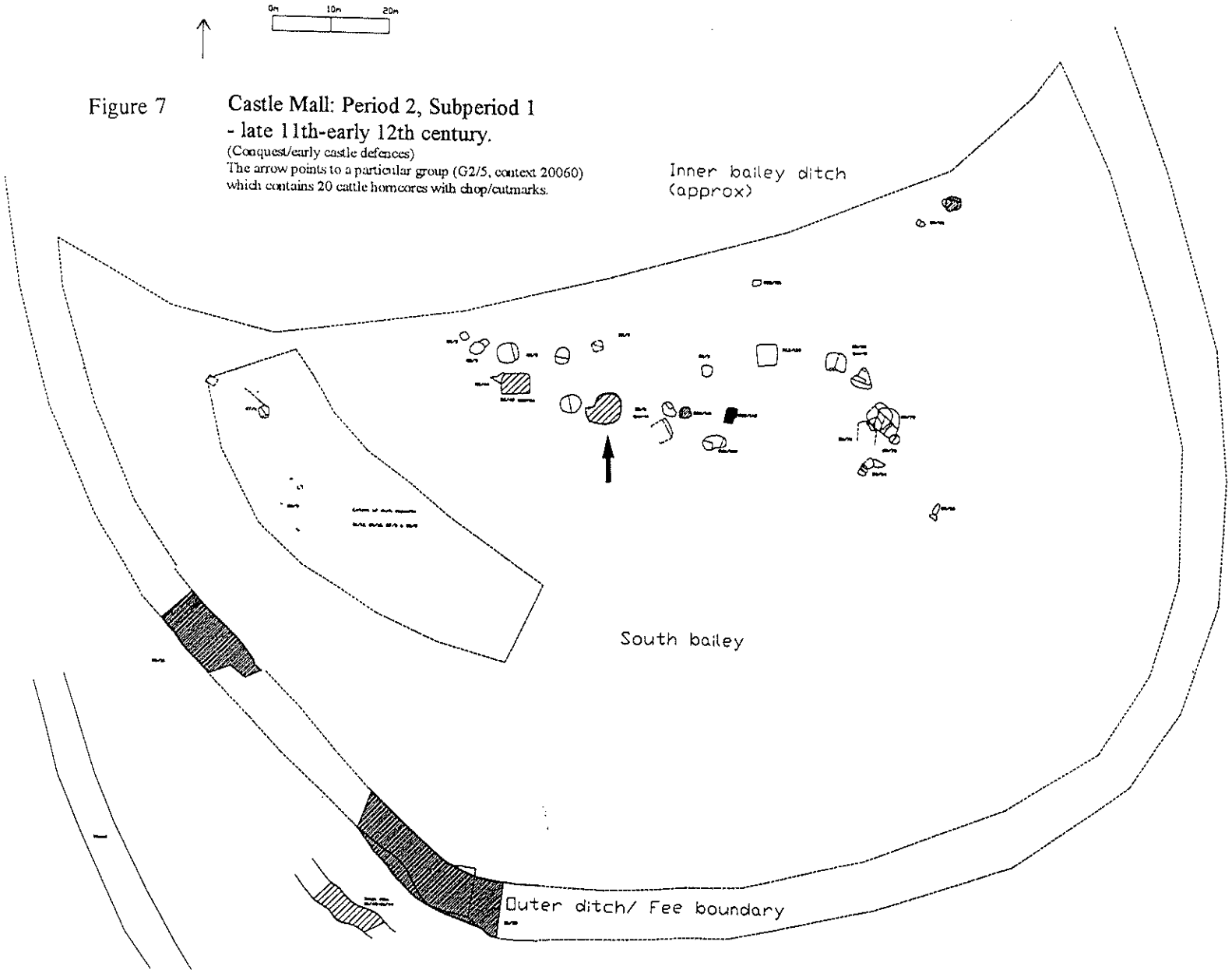


Figure 7 **Castle Mall: Period 2, Subperiod 1**
- late 11th-early 12th century.
(Conquest/early castle defences)
The arrow points to a particular group (G2/5, context 20060) which contains 20 cattle horncores with chop/cutmarks.

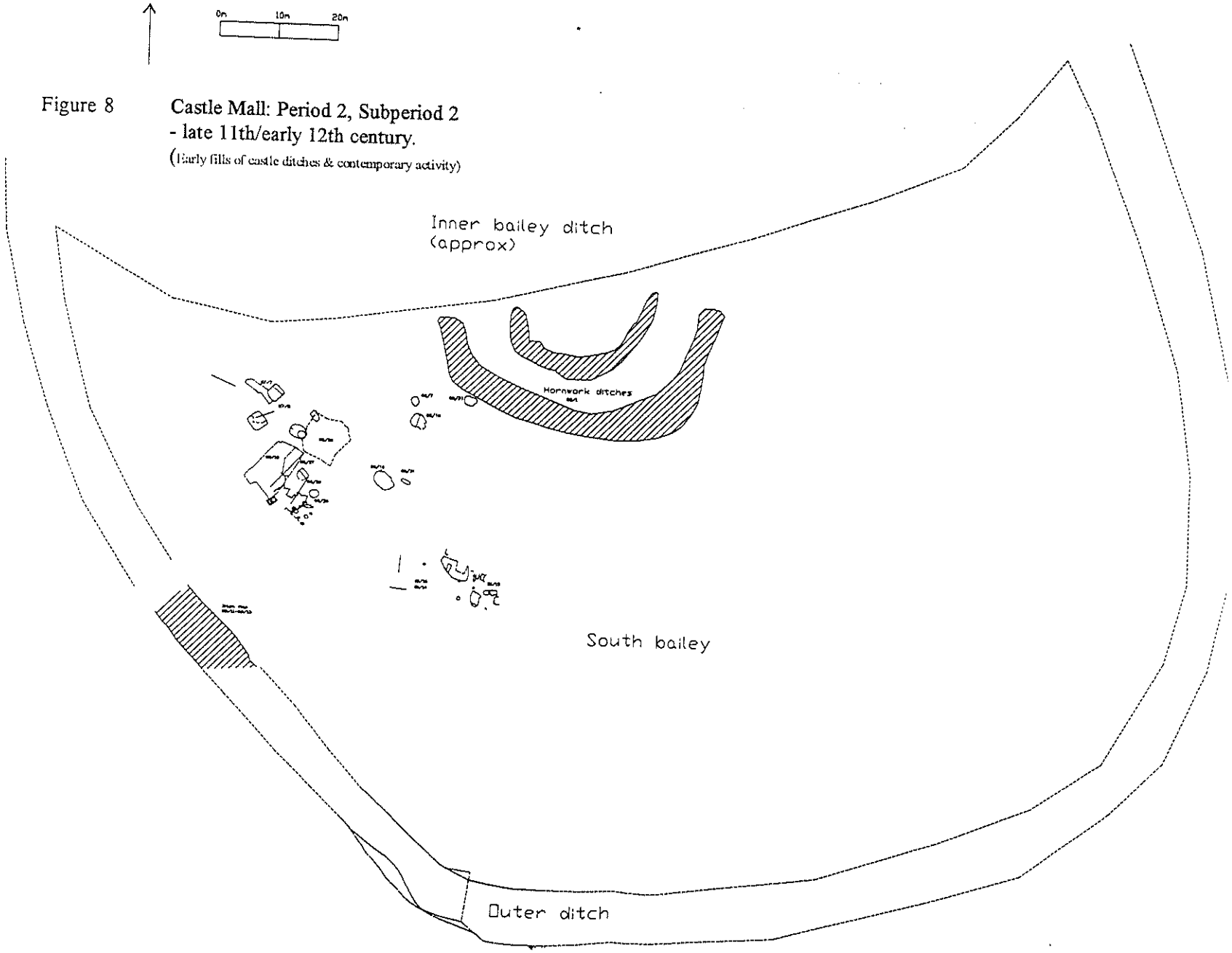


Figure 8 **Castle Mall: Period 2, Subperiod 2 - late 11th/early 12th century.**
(Early fills of castle ditches & contemporary activity)

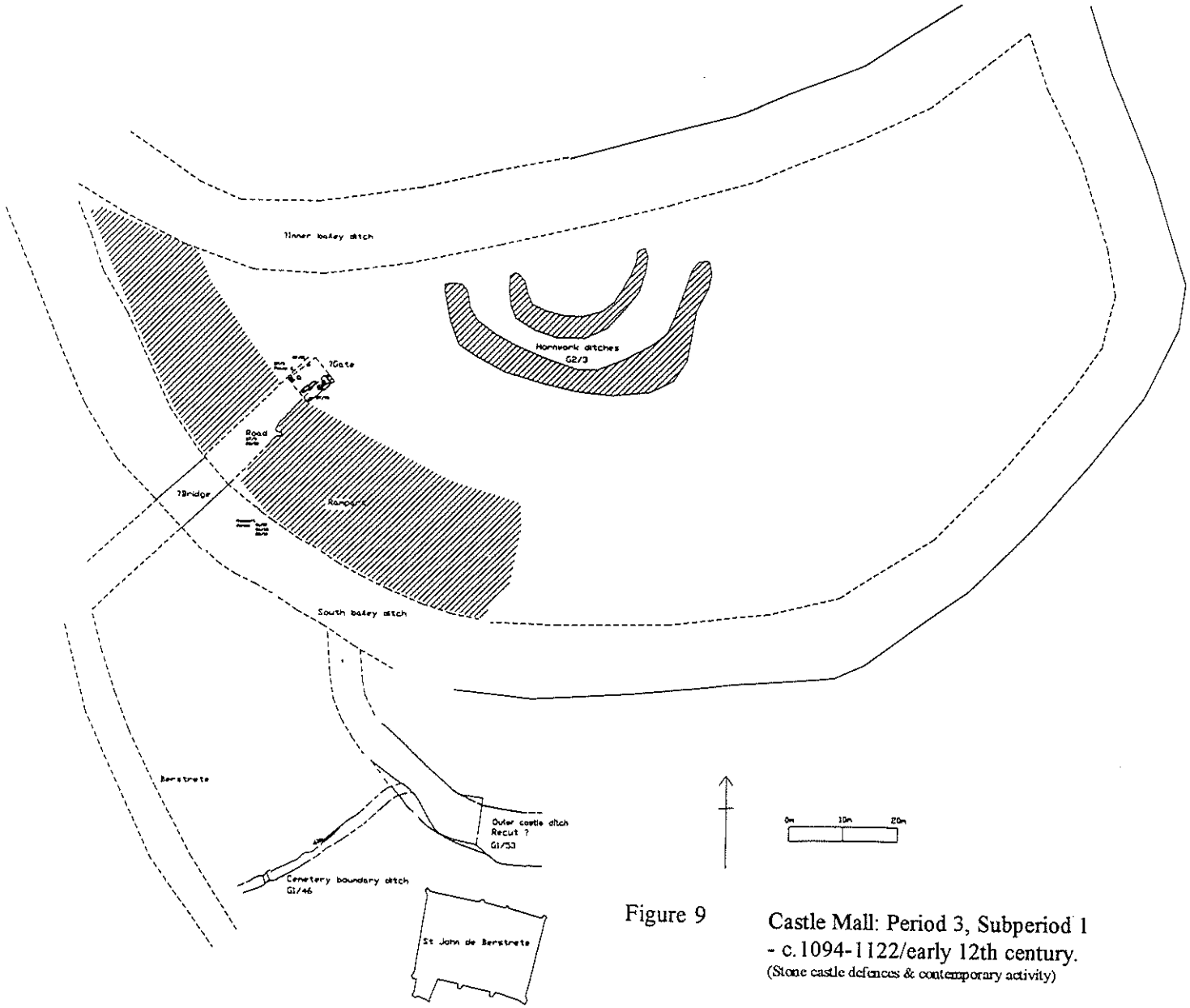


Figure 9

Castle Mall: Period 3, Subperiod 1 - c.1094-1122/early 12th century.
(Stone castle defences & contemporary activity)

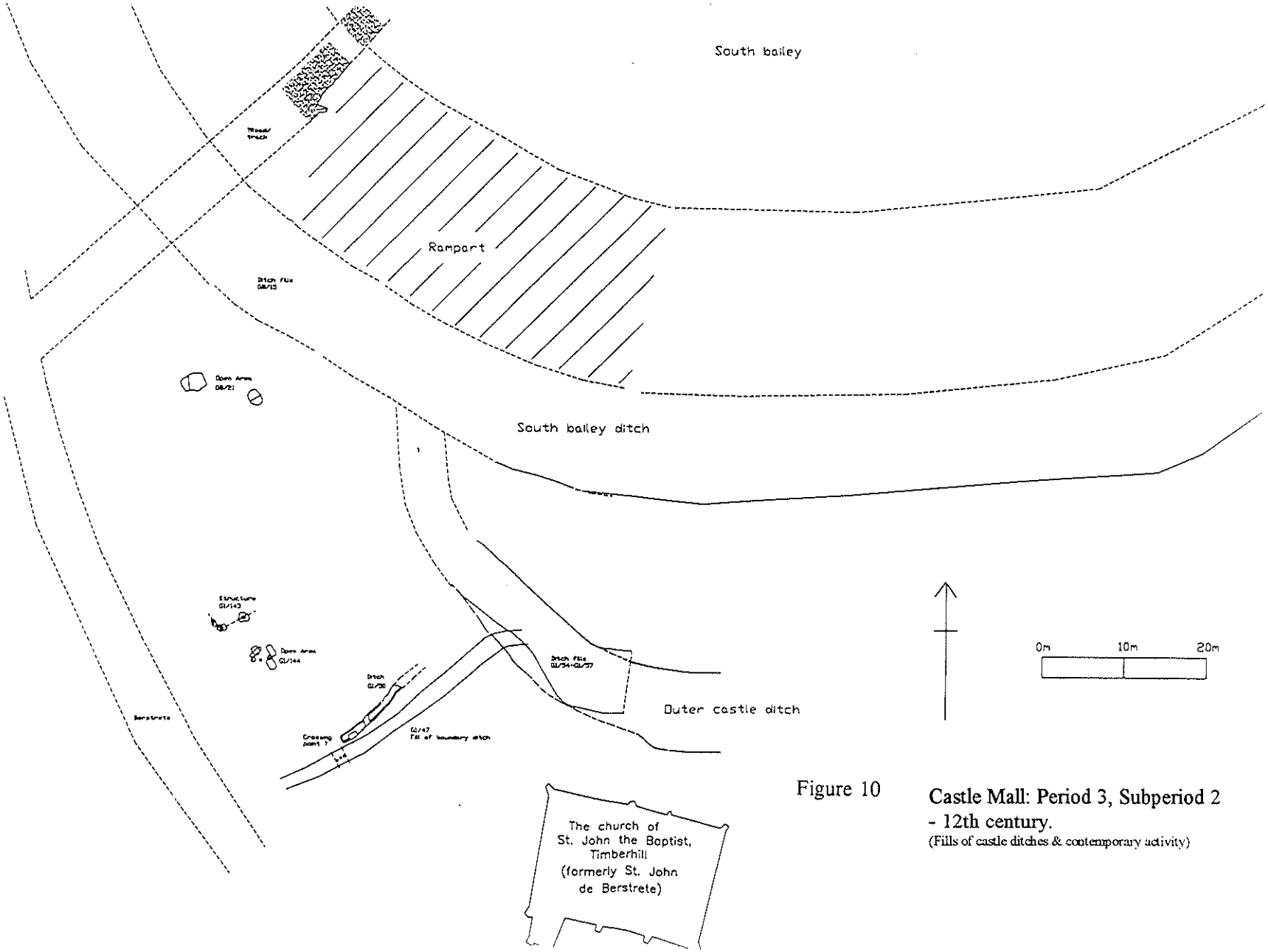


Figure 10

Castle Mall: Period 3, Subperiod 2 - 12th century.
(Fills of castle ditches & contemporary activity)

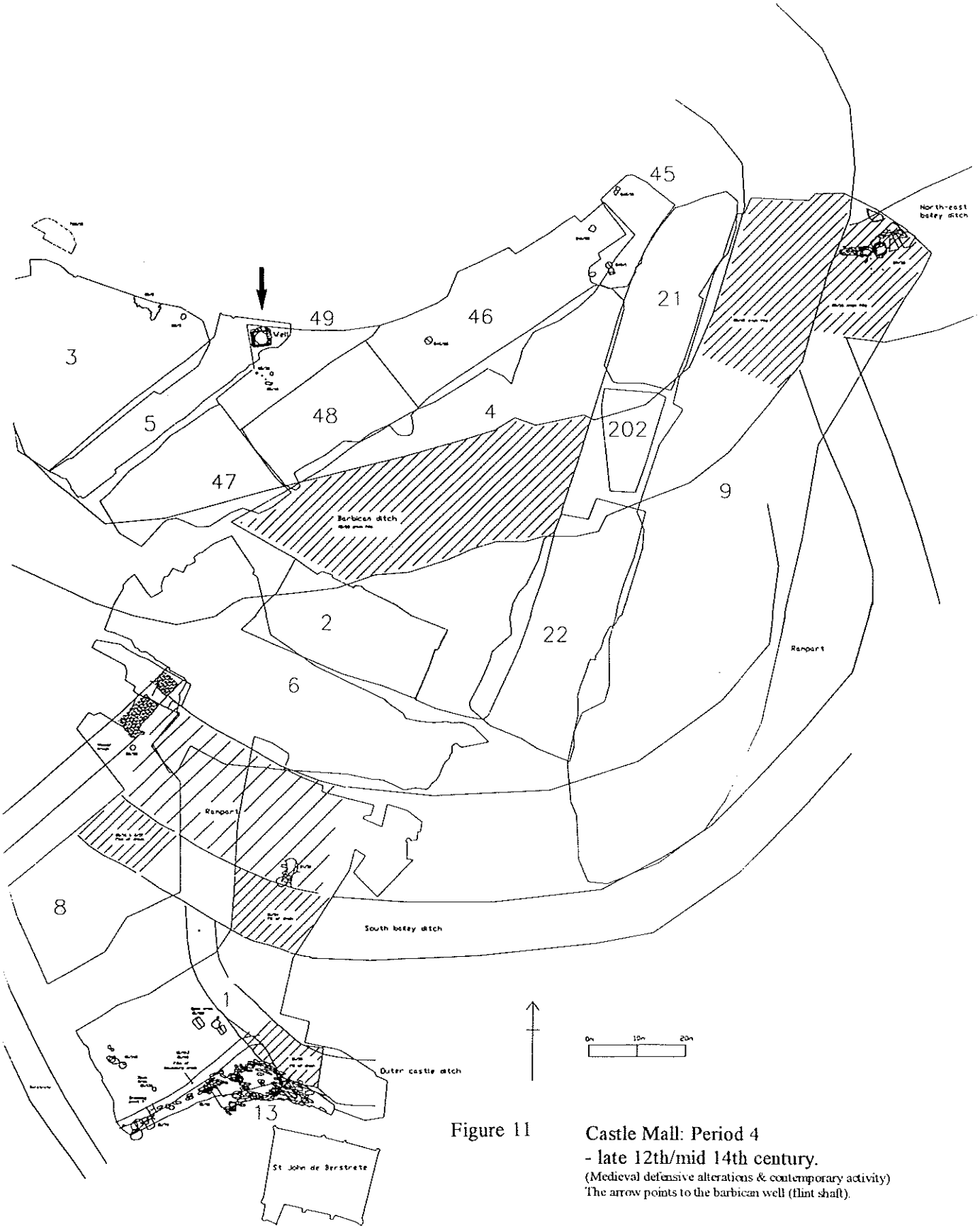


Figure 11

Castle Mall: Period 4
- late 12th/mid 14th century.
(Medieval defensive alterations & contemporary activity)
The arrow points to the barbican well (flint shaft).

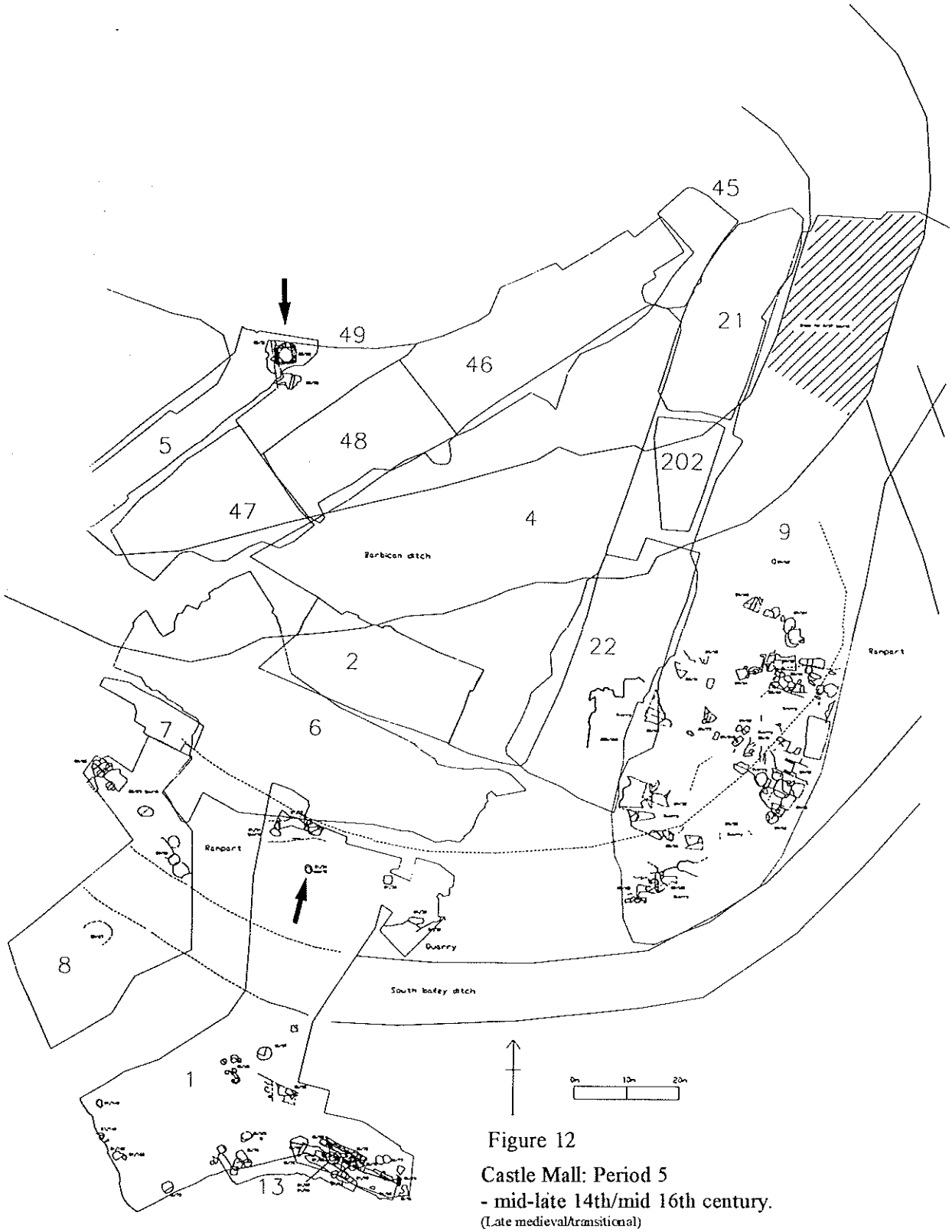


Figure 12

Castle Mall: Period 5
- mid-late 14th/mid 16th century.
(Late medieval/transitional)
The top arrow points to the barbican well (flint shaft).
The lower arrow points to a particular group (G1/24, context 11030) which contained an interesting collection of sheep bones (21 horncores, 109 metapodials and 60 phalanges).

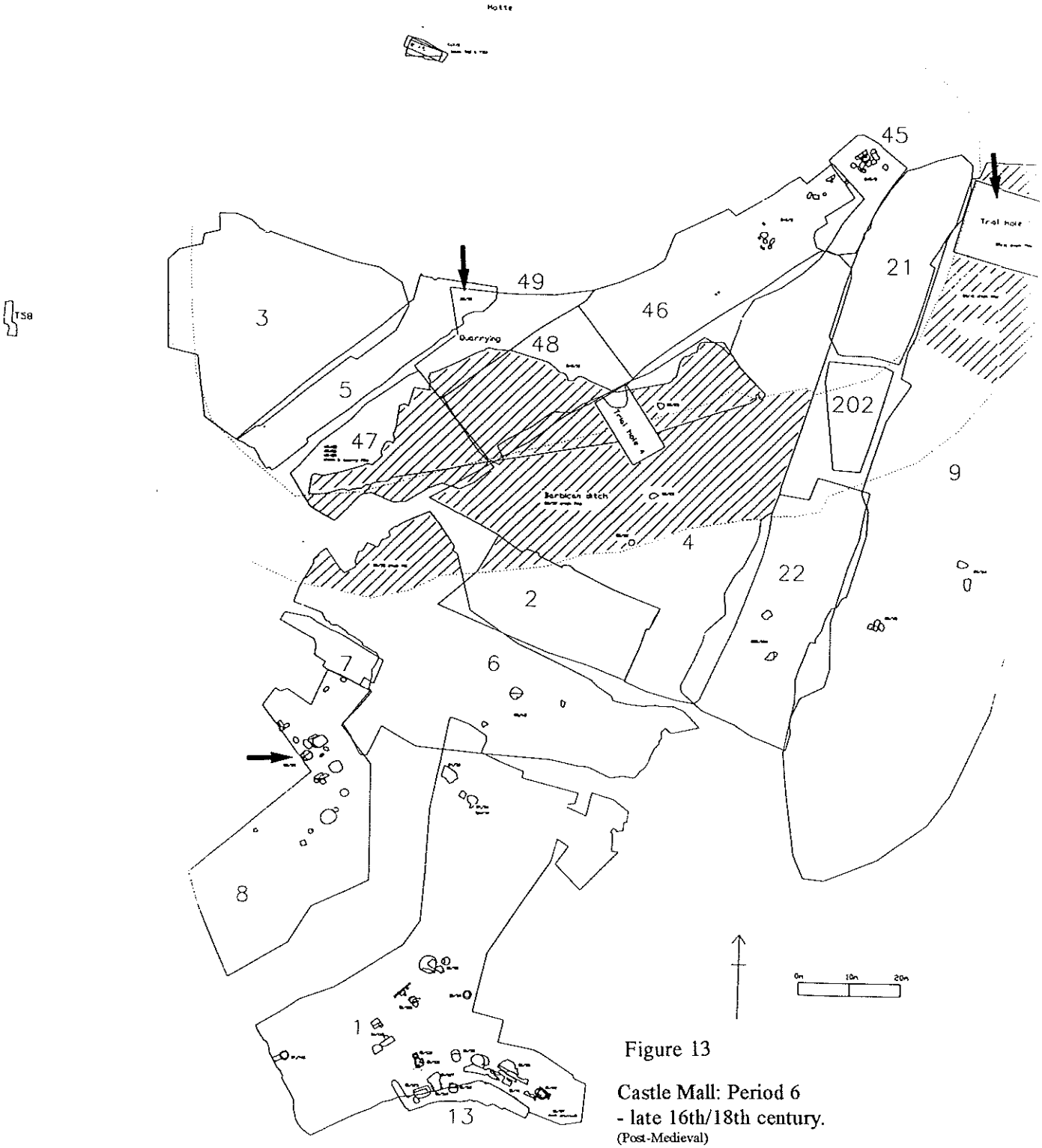
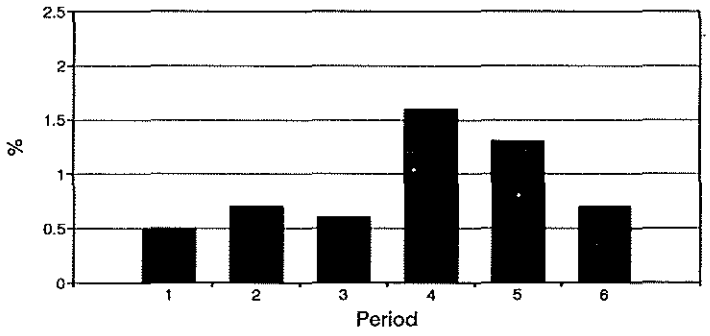


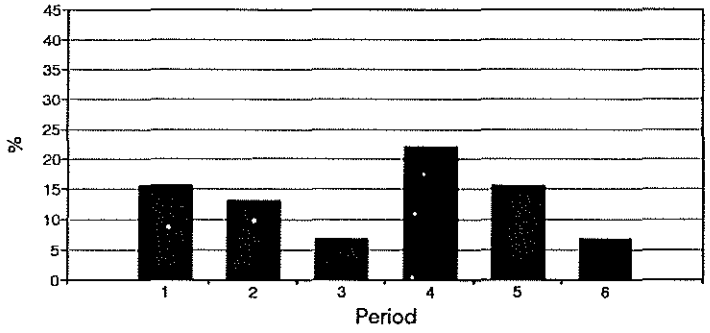
Figure 13

Castle Mall: Period 6
- late 16th/18th century.
(Post-Medieval)
The top left arrow points to a particular group (G5/52, context 50077) which contained 17 worked antler fragments. The top right arrow points to an area (trial hole 1, G9/41, barbican ditch fills) containing a large amount of bones incl. 87 cattle homcores. The bottom left arrow points to a particular group (G8/29, context 80186) containing 8 worked cattle metapodials.

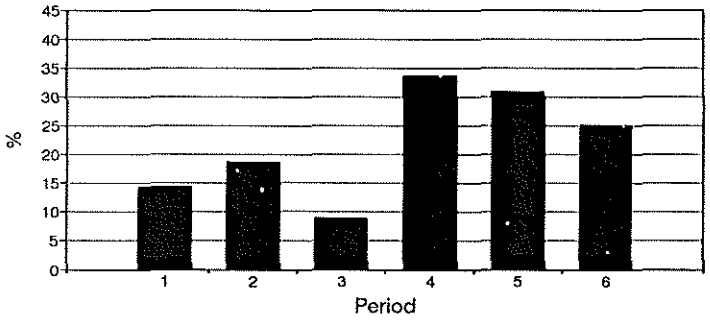


% HC BIRD WEIGHT

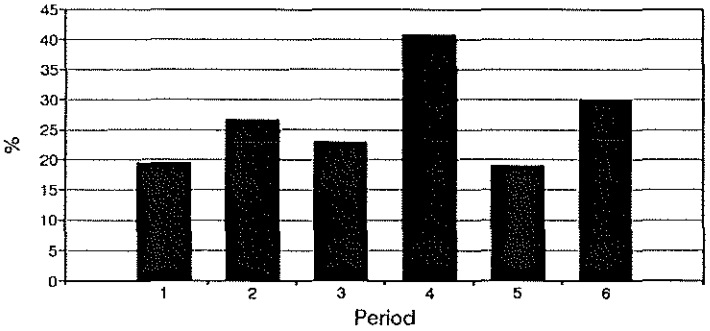
Note the different scale of the Y-axis



% HC BIRD NISP



% SRS BIRD NISP



% BS BIRD NISP

Figure 14. Comparison of the relative percentages of BIRD WEIGHT and BIRD NISP for hand-collected (HC) and sieved (SRS+BS) bone by period at Castle Mall. Percentages are calculated out the total weight and NISP of all bones.

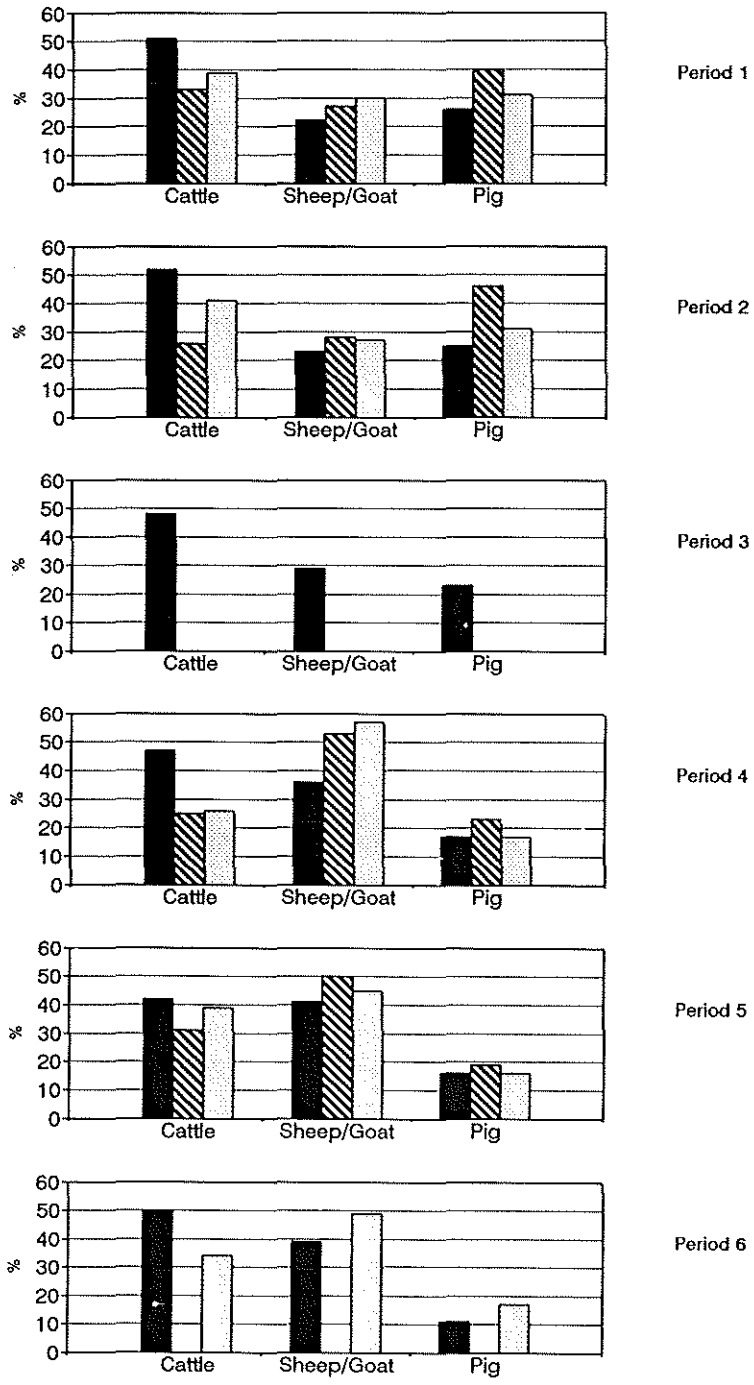


Figure 15 Comparison of hand collected (HC), sieved (SRS+BS) NISP and MNI figures for the major species at Castle Mall.

Percentages were only calculated if the combined total of the three main species exceeded 100 for NISP and 20 for MNI.

Solid bars = *NISP (HC)*
Striped bars = *NISP (SRS+BS)*
Dotted bars = *MNI*

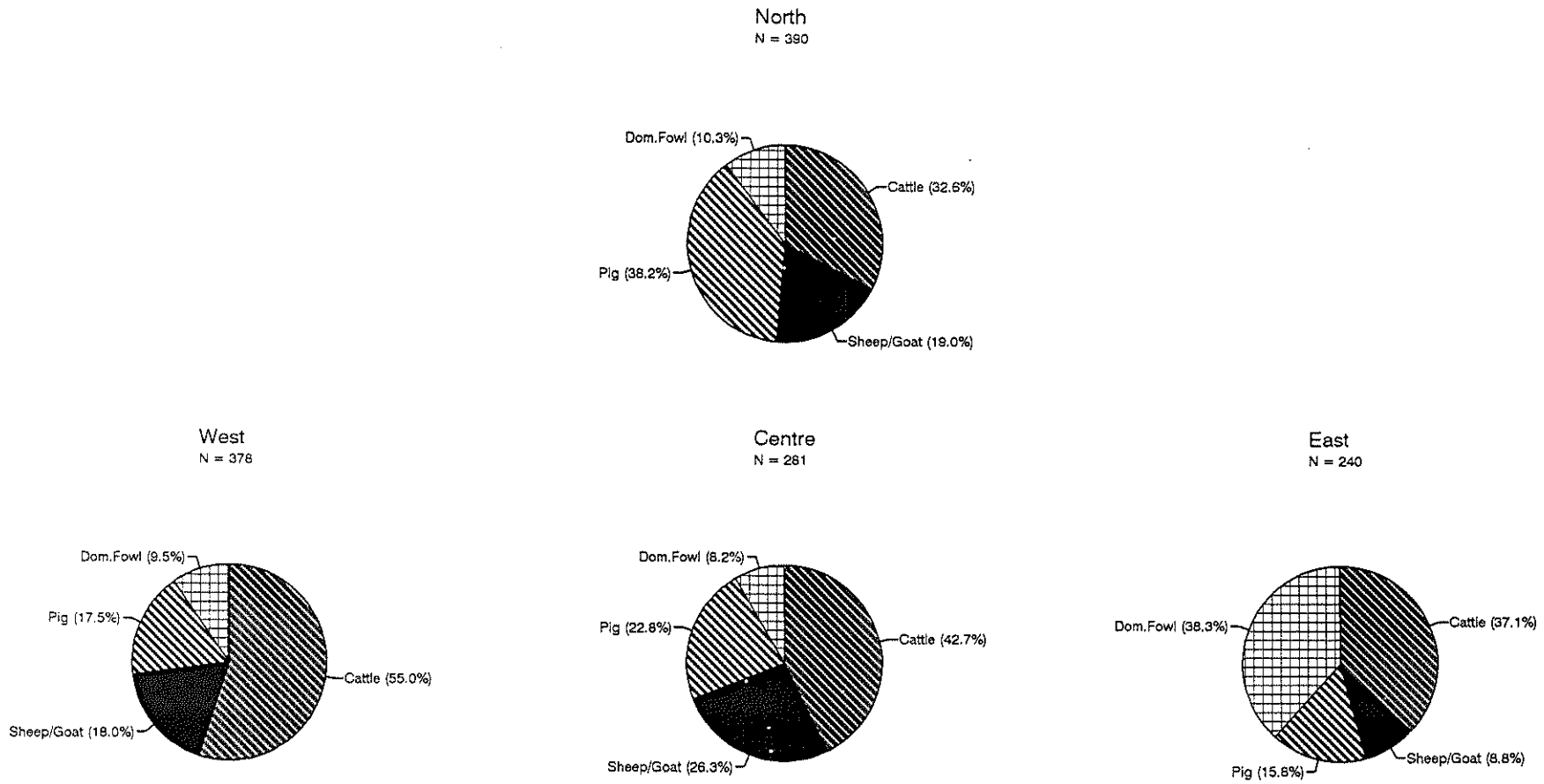


Figure 16. Relative proportion of the main species within different areas in period 1 at Castle Mali

These areas are defined as follows:

North:	area 2 (group 19), area 4 (groups 11,19 & 50-51), area 21 (groups 168 & 170), area 45 (group 12), area 46 (groups 1,7,11 & 14-17), area 49 (groups 27-29,35 & 47), area 202 (group 165), T20 (group 8), T95 (group 6)
Centre:	area 2 (groups 5 & 8), area 4 (groups 5-10), area 22 (130-132,134-135,137-138,140,145-148 & 154-155)
East:	area 9 (groups 39,48,51,52,63,64,69,79,88,89,100 & 117)
West:	area 1 (groups 3,7,10,41 & 141), area 5 (groups 1,3,10 & 64), area 6 (groups 3-4,13-15,17,20 & 37), area 7 (group 4), area 8 (groups 3-6), area 47 (groups 7,18,21,24 & 33)

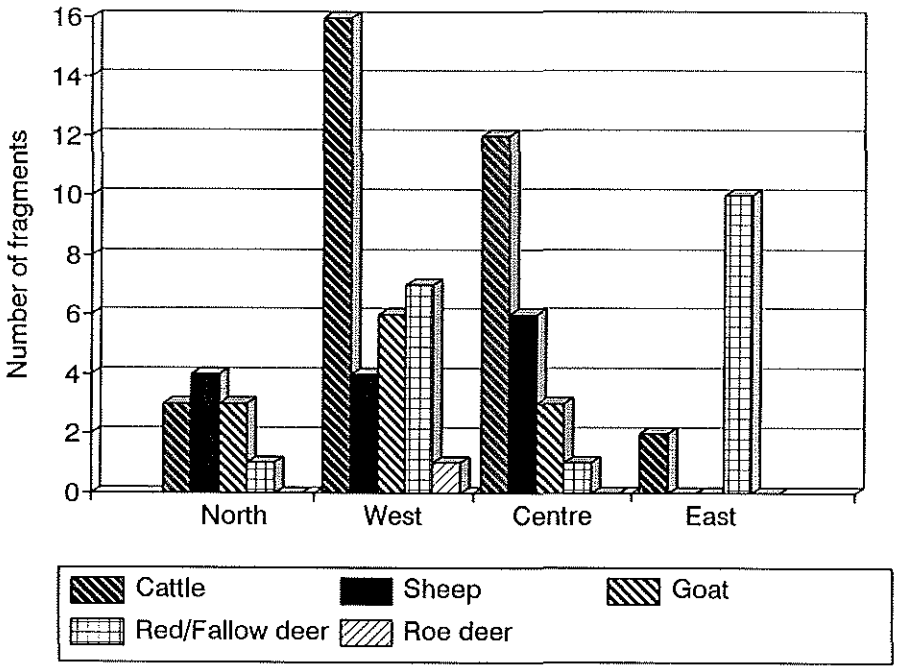


Figure 17 Distribution of horncores and antlers in period 1 by area

See fig.16 for definition of these areas

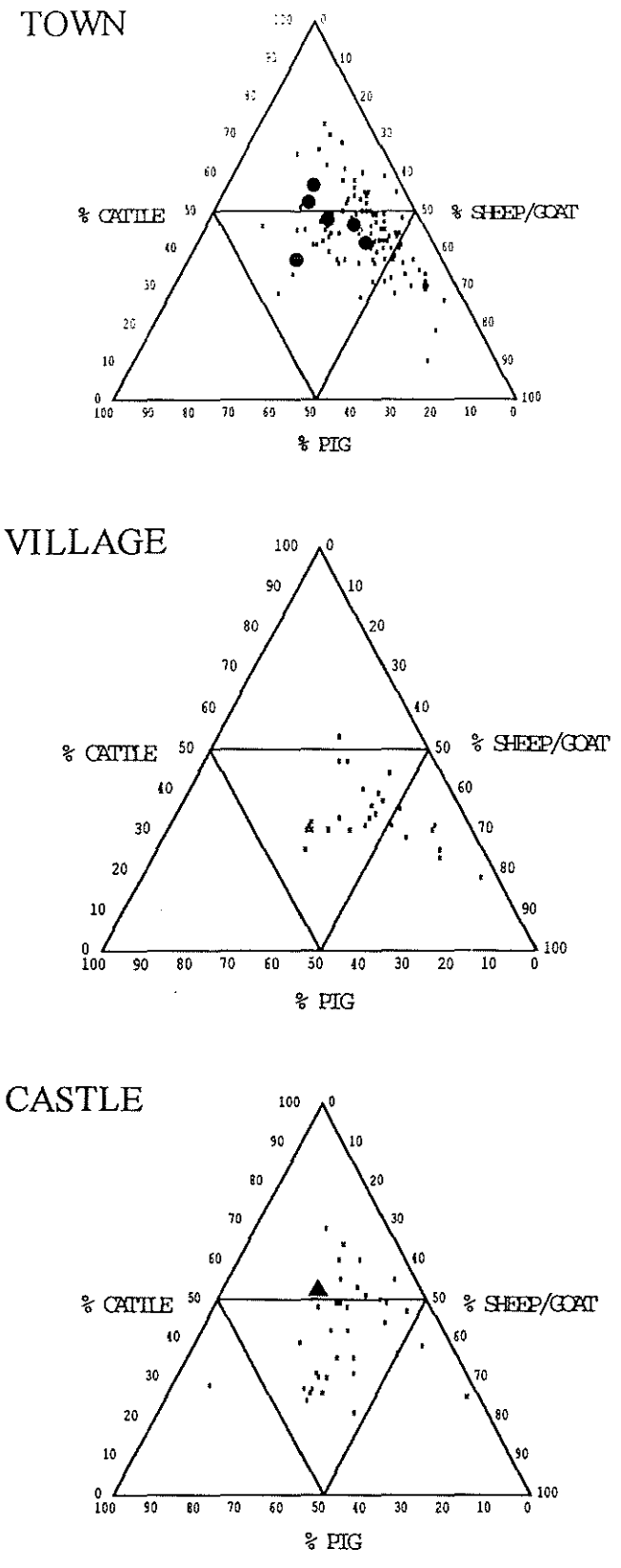


Figure 18 Comparison of Town, Village and Castle zoo-archaeological assemblages in England.

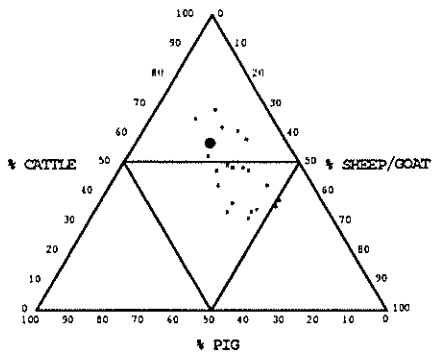
The inner triangle assists the reading of percentages in the appropriate direction, e.g. the left outer triangle on the pig axis represents greater than 50% (as does the top triangle on the cattle axis, and the bottom right triangle on the sheep/goat axis). Points located within the innermost triangle indicate sites where none of the three major species form more than 50% of the total.

Key to symbols:

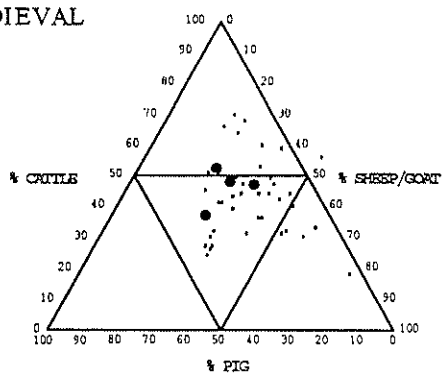
Town ● = Castle Mall, periods 1.iv, 1.i-iii, 3, 4, 5 and 6 (left to right)
Castle ▲ = Castle Mall, period 2

Points marked by small crosses indicate monastic sites based in towns and rural manor houses.

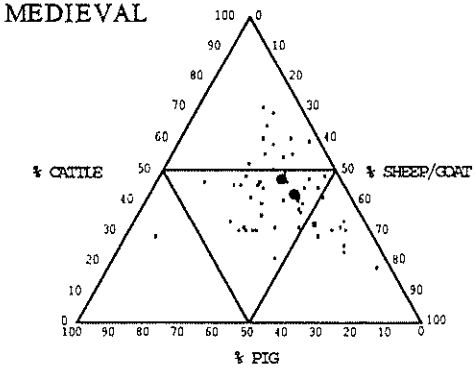
SAXON



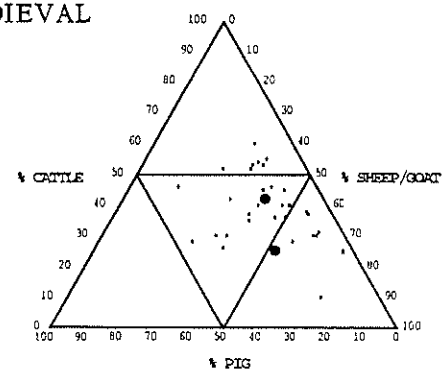
EARLY MEDIEVAL



MIDDLE MEDIEVAL



LATE MEDIEVAL



POST MEDIEVAL

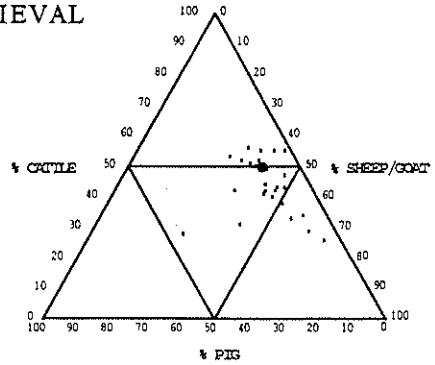


Figure 19

Comparison of Saxon, Early -, Middle, Late- and Post-Medieval zooarchaeological assemblages in England.

The inner triangle assists the reading of percentages in the appropriate direction, e.g. the left outer triangle on the pig axis represents greater than 50% (as does the top triangle on the cattle axis, and the bottom right triangle on the sheep/goat axis). Points located within the innermost triangle indicate sites where none of the three major species form more than 50 % of the species total.

Points marked by large circles indicate various phases belonging to Castle Mall: Saxon - period 1.i-iii; Early Medieval - periods 1.iv, 2, 3 and 4 (from left to right); Middle Medieval - periods 4 and 5 (from left to right); Late Medieval - period 5 and Barbican Well ("flint shaft") (from top to bottom); Post-Medieval - period 6.

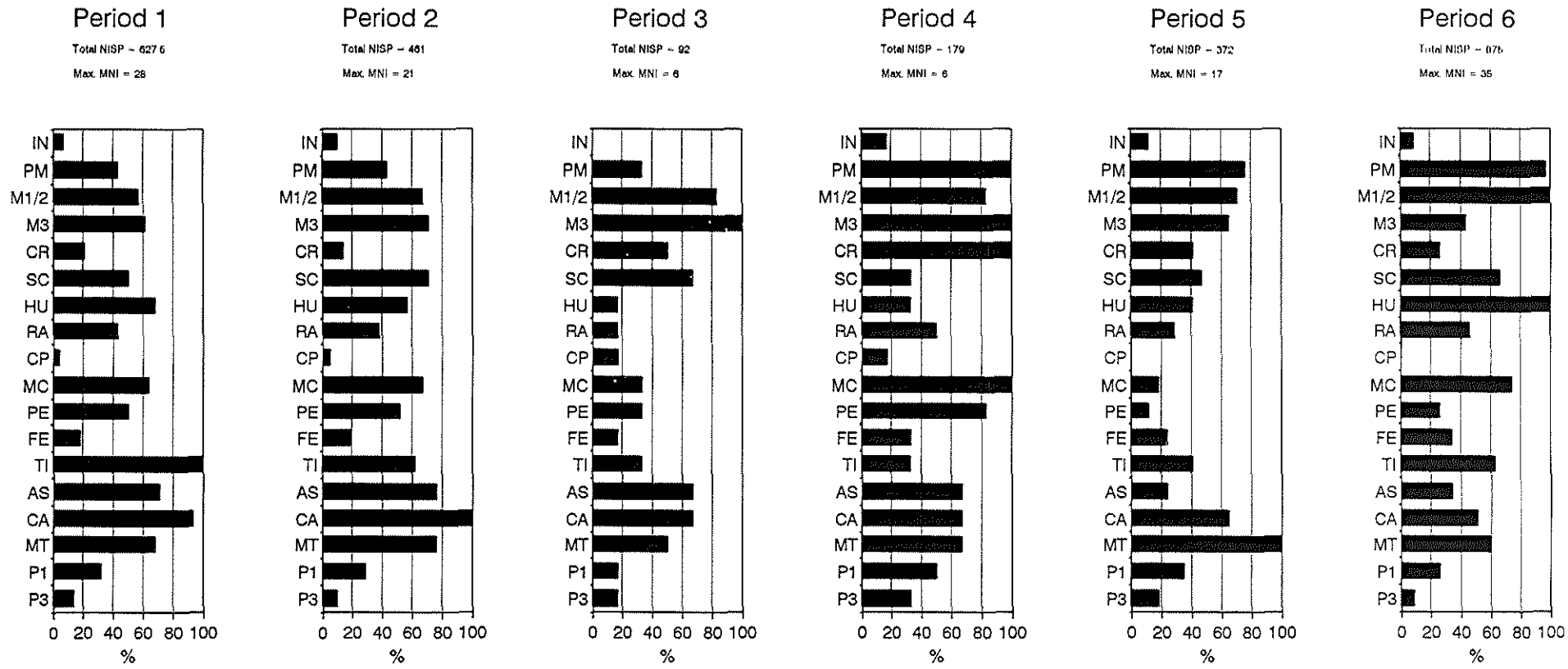


Figure 20. Cattle body parts at Castle Mall.

Percentages are calculated on the basis of the frequency of an element in relation to the most common one (by MNI).

IN = deciduous and permanent incisors, PM = deciduous and permanent premolars, M1/2 = 1st & 2nd molars, M3 = 3rd molars, CR = cranium (zygomaticus), SC = scapula, HU = humerus, RA = radius, CP = carpal, MC = metacarpus, PE = pelvis, FE = femur, TI = tibia, AS = astragalus, CA = calcaneus, MT = metatarsus P1 = 1st phalanx, P3 = 3rd phalanx.

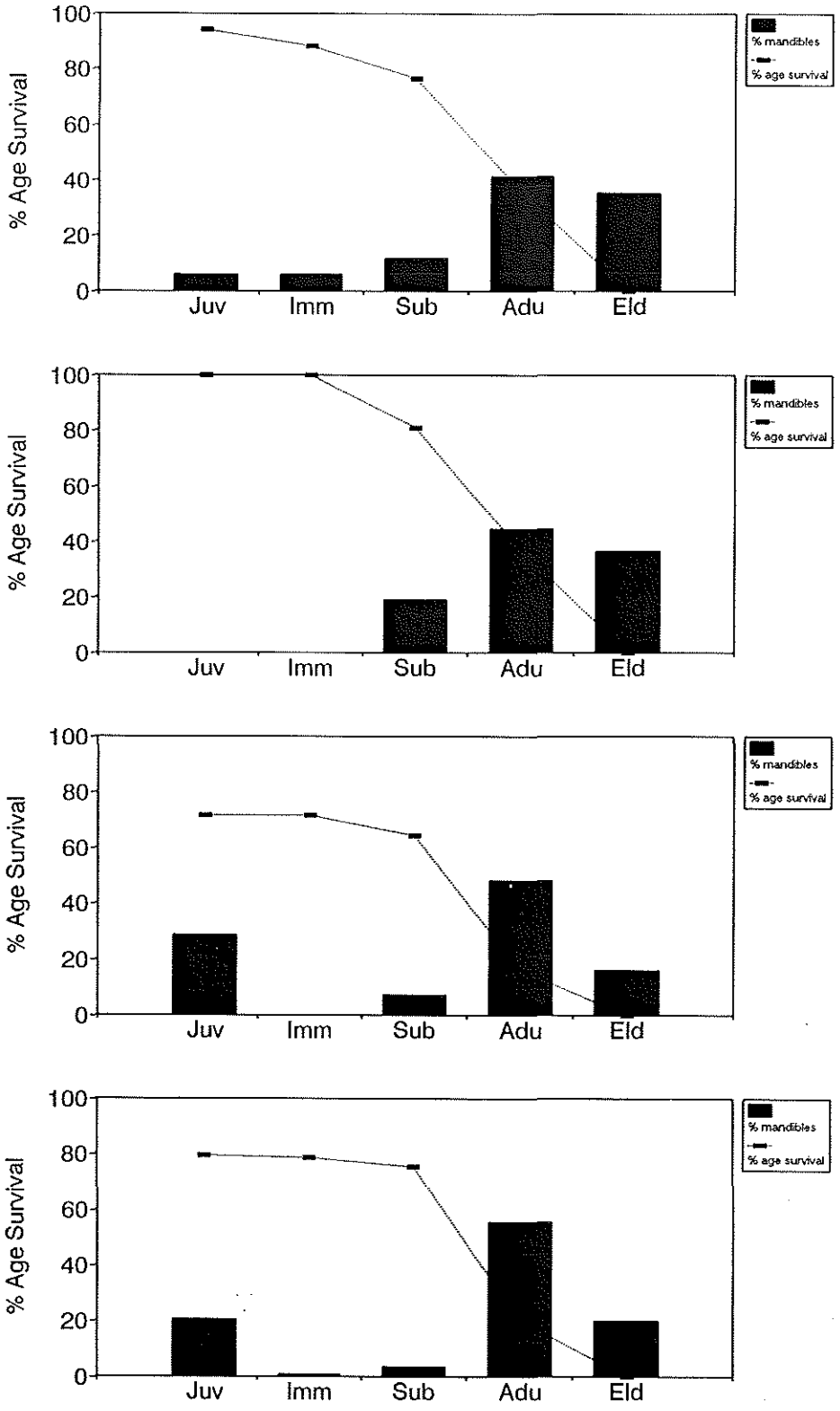
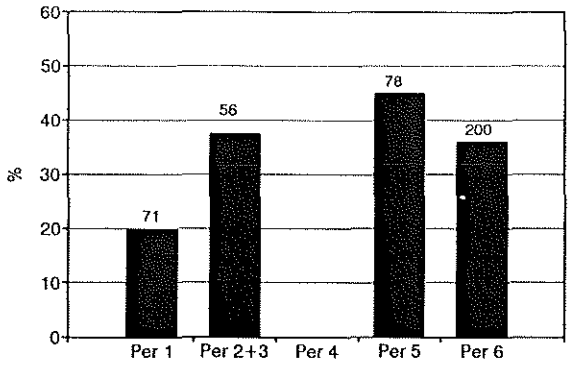
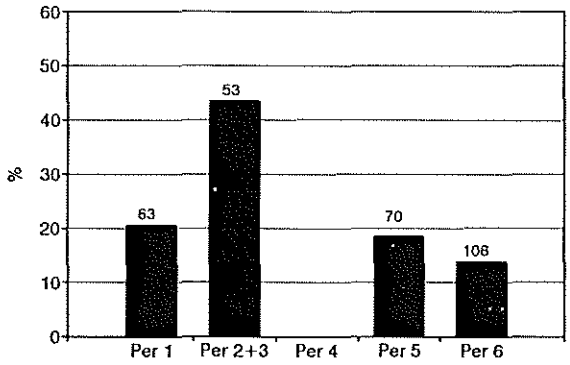


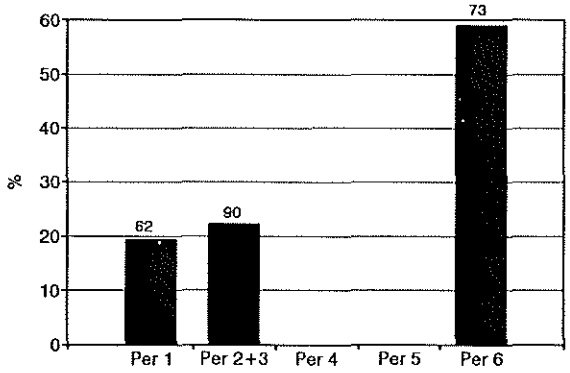
Figure 21 The relative percentages of CATTLE mandibles by age stage in different periods at Castle Mall. Age stages are from O'Connor (1988). All mandibles with two or more teeth with recordable wear in the dP4/P4-M3 row were considered.



% Cattle deciduous premolars



% Sheep/Goat deciduous premolars



% Pig deciduous premolars

Figure 22 Percentages of deciduous premolars of the three main taxa at Castle Mall

Calculations are made by [dP / (dP + P)] x 100.
Numbers of (dP + P) for cattle, sheep and pig are given above the bars.
Percentages were only calculated if the total (dP + P) > 50.
Only hand-collected material.

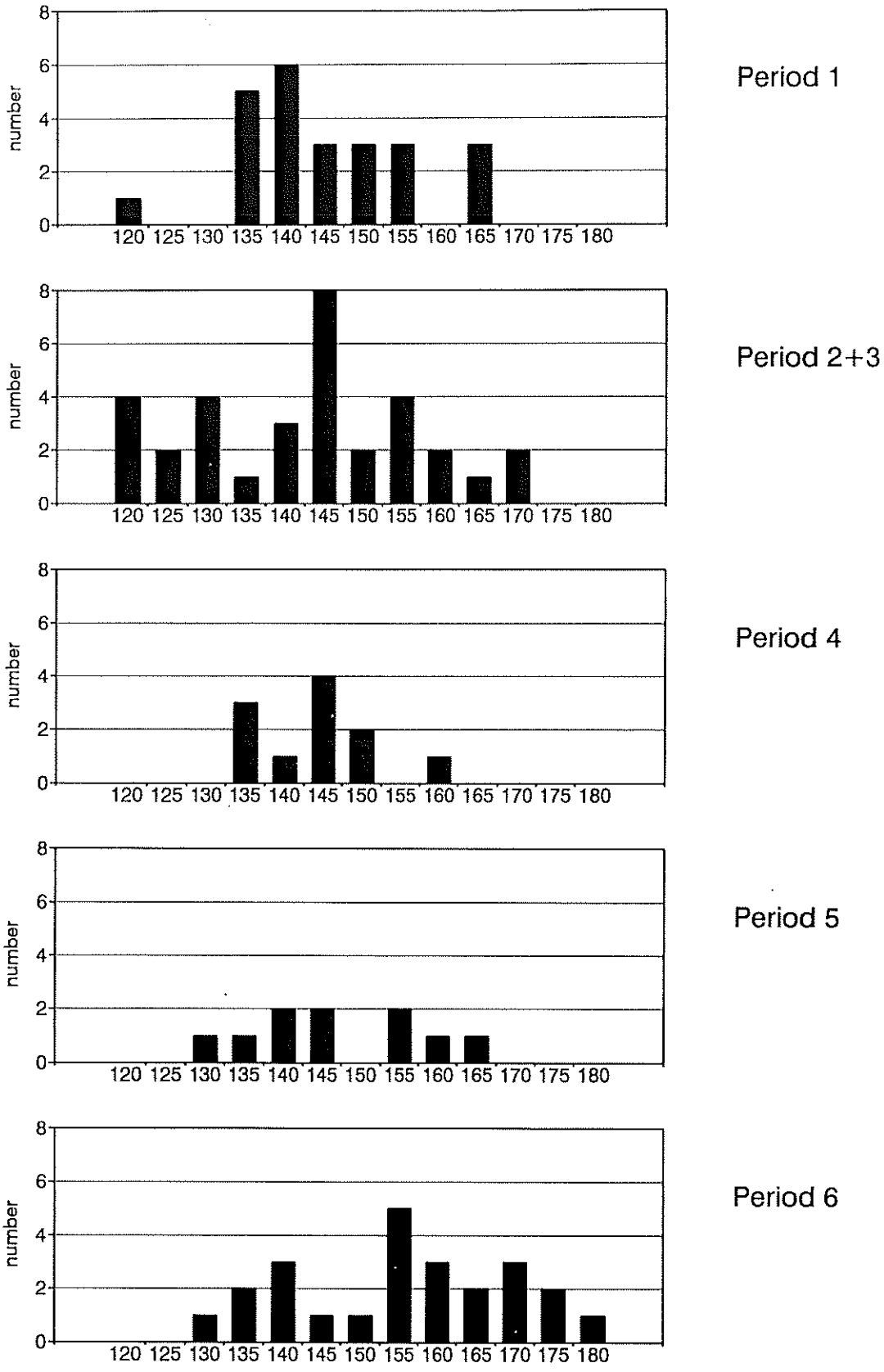


Figure 23. Variation of CATTLE M3 width at Castle Mall. Measurements are in tenths of mm.

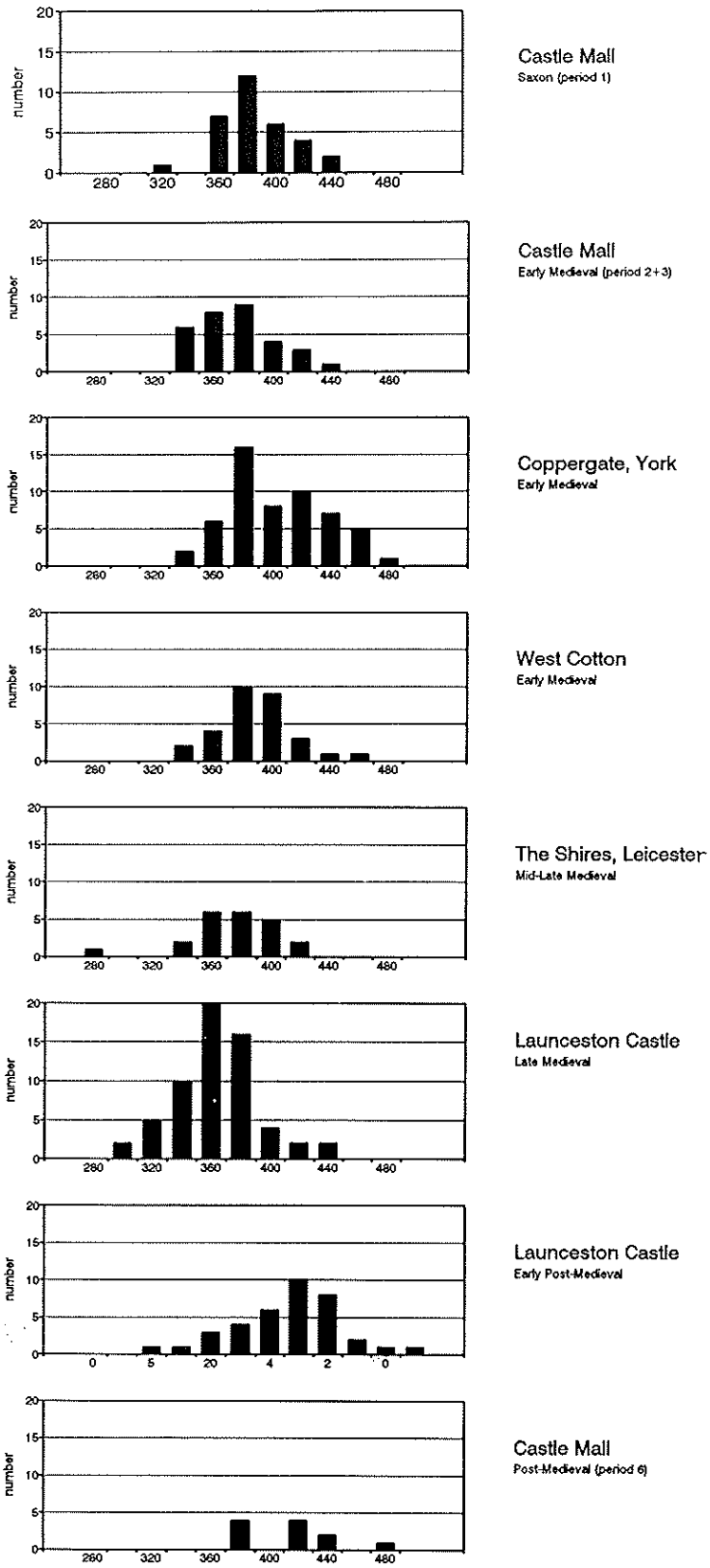


Figure 24. CATTLE astragalus distal breadth (Bd).
Measurements are in tenths of mm.

A comparison between specimens from York (O'Connor 1986), Launceston Castle (Albarella and Davis 1996), West Cotton (Albarella and Davis 1994), Leicester (Gidney 1991a,1991b) and Castle Mall.

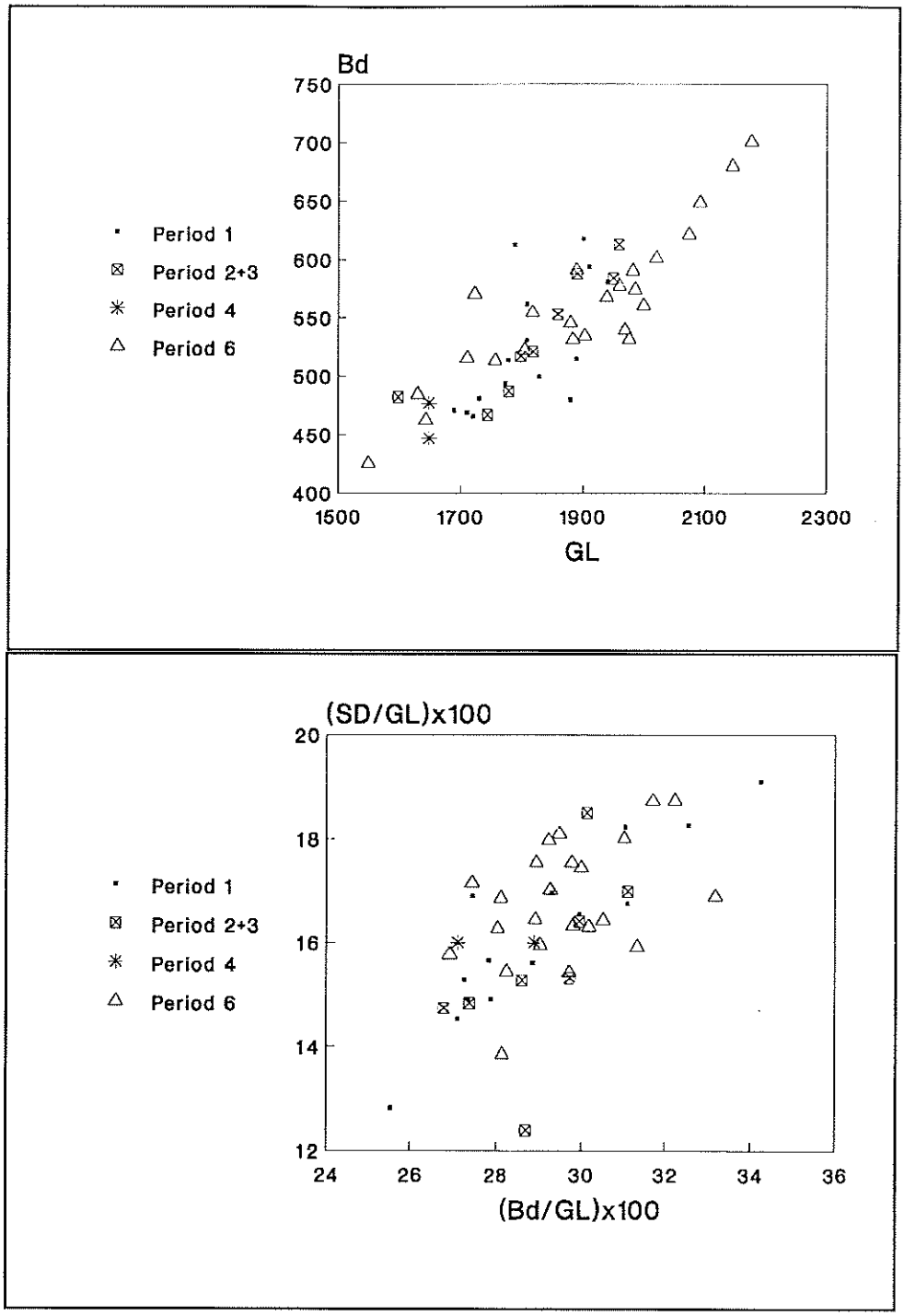


Figure 25

Size (top) and shape (bottom) variation of **cattle metacarpus** at Castle Mall.

The bottom diagram is size independent: the higher the value the more robust is the specimen.

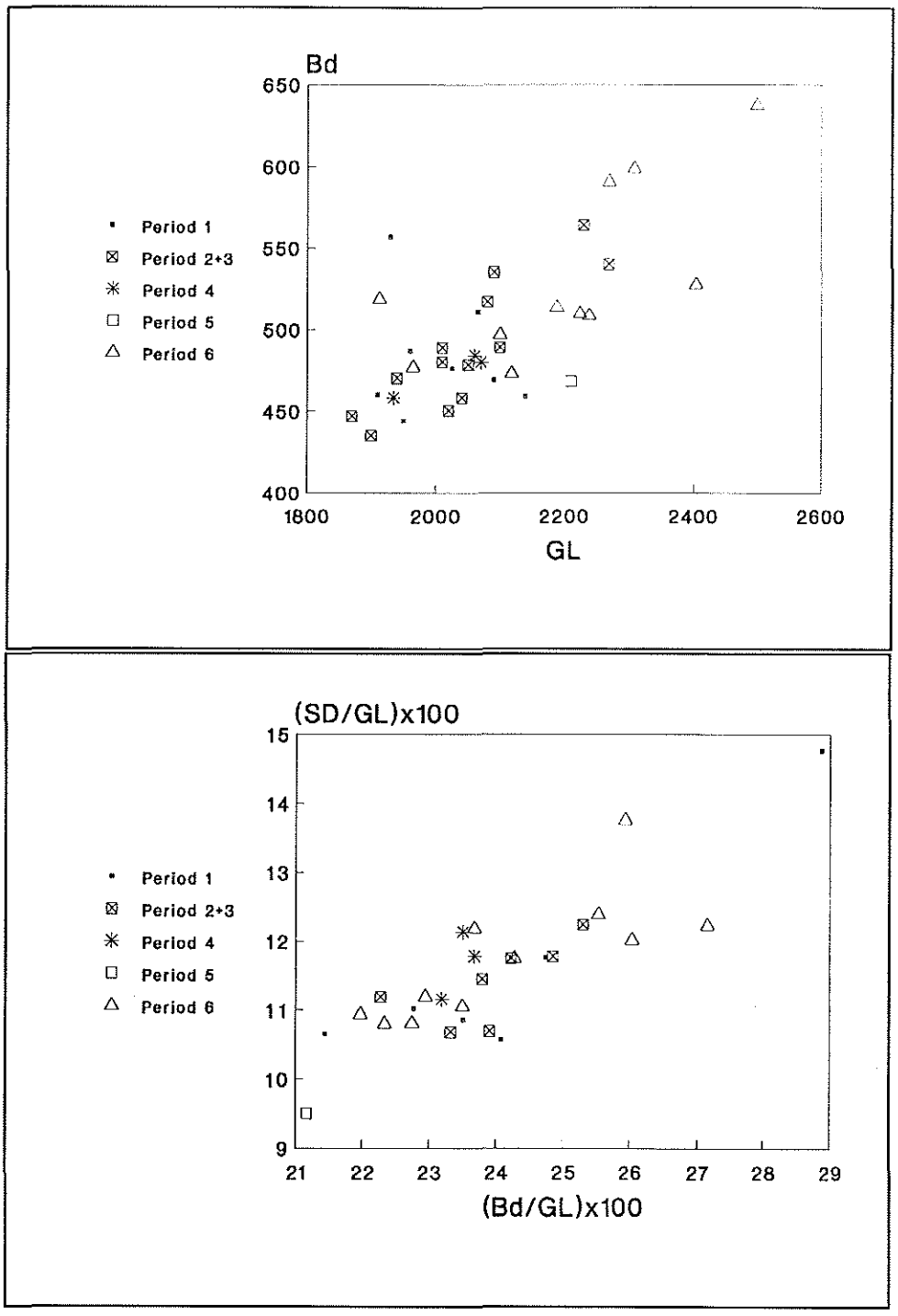
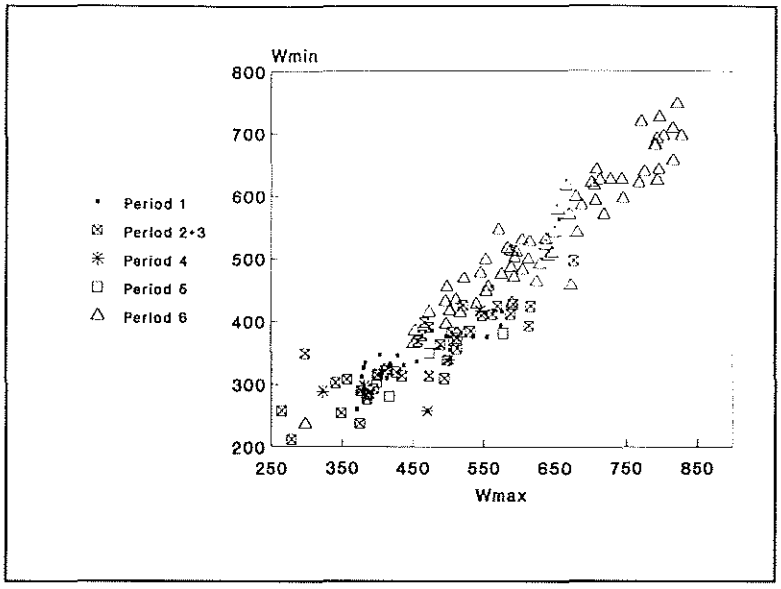


Figure 26

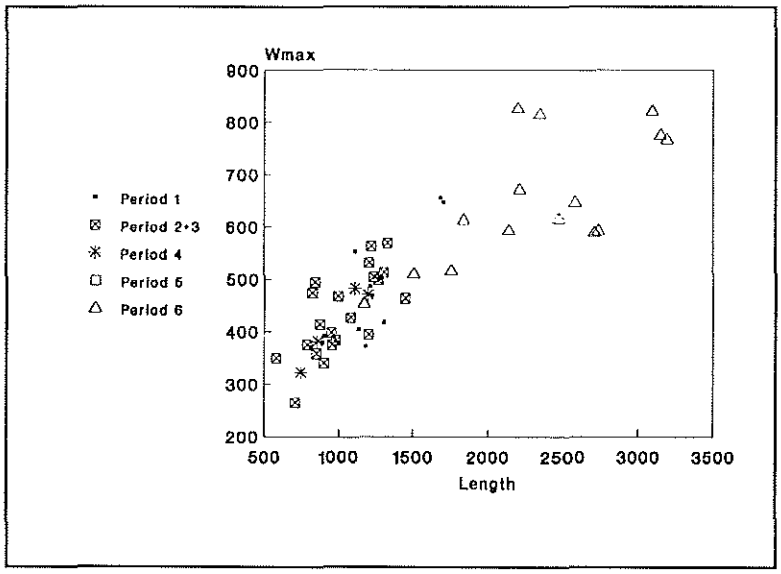
Size (top) and shape (bottom) variation of **cattle metatarsus** at Castle Mall.

The bottom diagram is size independent: the higher the value the more robust is the specimen.

A



B



C

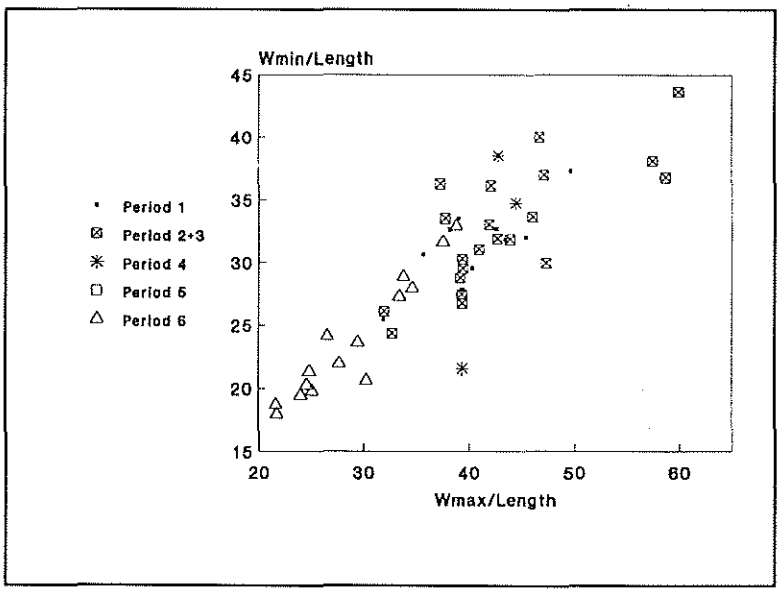


Figure 27

Size (A and B) and shape (C) variation of **cattle horncores** at Castle Mall.

The bottom diagram is size independent.

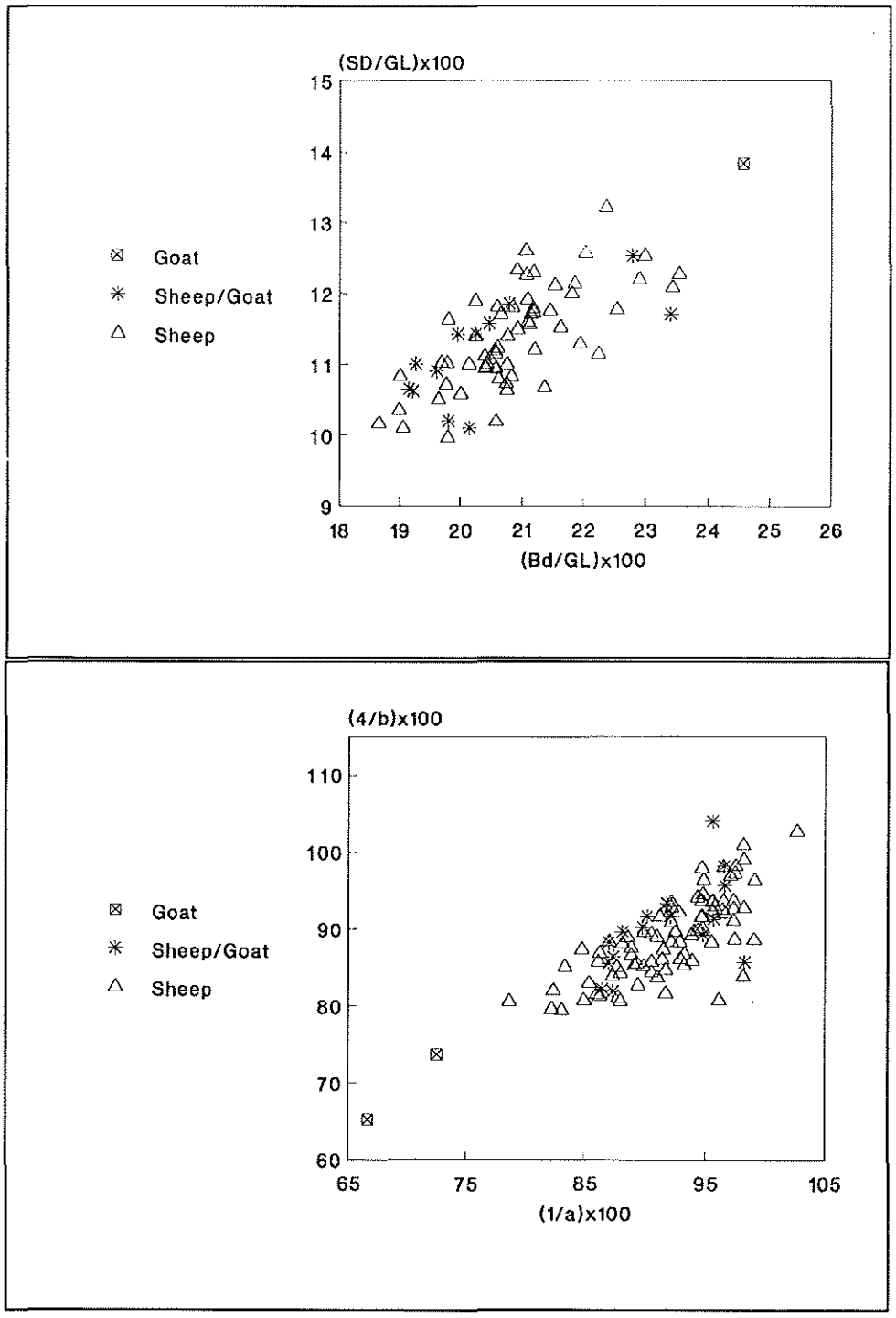


Figure 28

Shape of **sheep and goat metacarpus** at Castle Mall.

This is expressed by the general robustness of the bone (top) and by the ratio between the trochlea depths and condyle widths (see Payne 1969) (bottom).

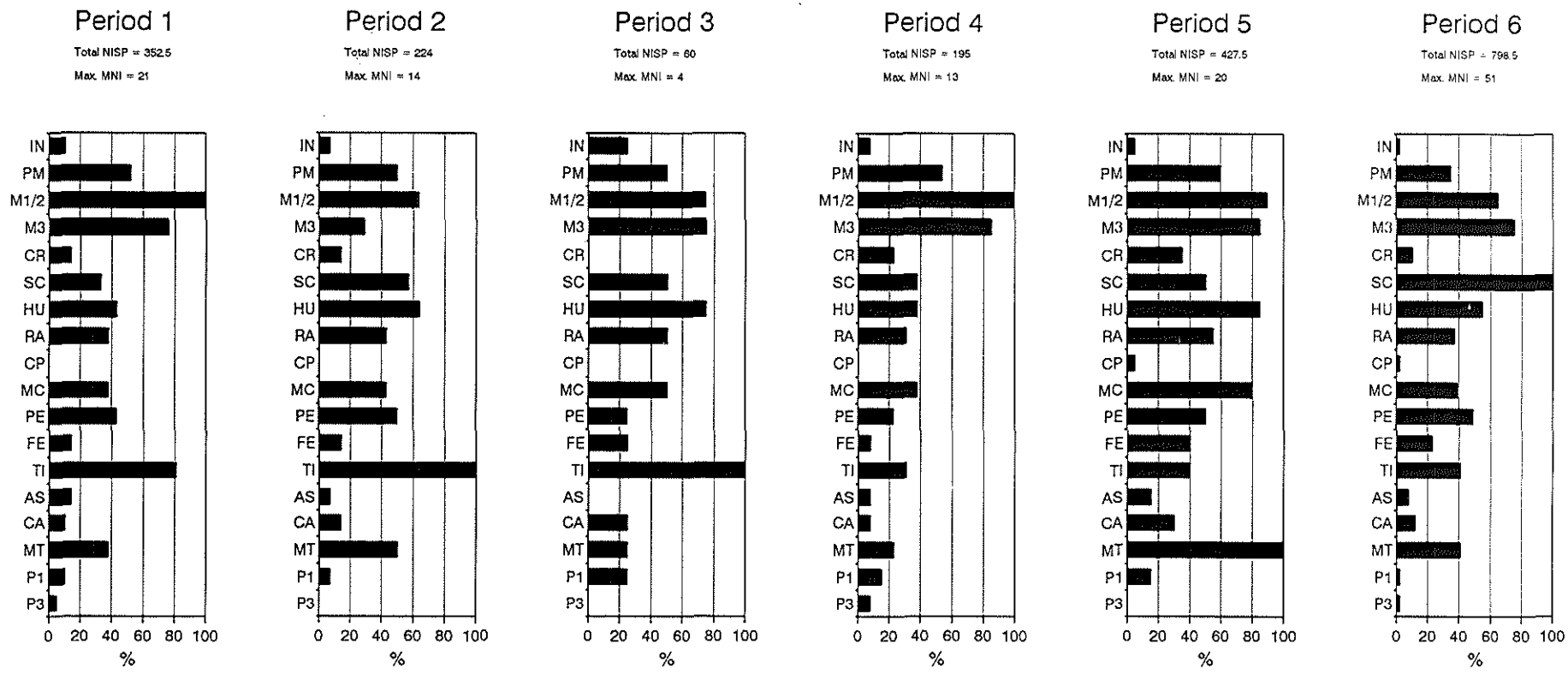


Figure 29 Sheep/Goat body parts at Castle Mall

Percentages are calculated on the basis of the frequency of an element in relation to the most common one (by MNI).

IN = deciduous and permanent incisors, PM = deciduous and permanent premolars, M1/2 = 1st & 2nd molars, M3 = 3rd molars, CR = cranium (zygomaticus), SC = scapula, HU = humerus, RA = radius, CP = carpal, MC = metacarpus, PE = pelvis, FE = femur, TI = tibia, AS = astragalus, CA = calcaneus, MT = metatarsus P1 = 1st phalanx, P3 = 3rd phalanx.

N.B. the special group of sheep bones from context 11030 has been excluded.

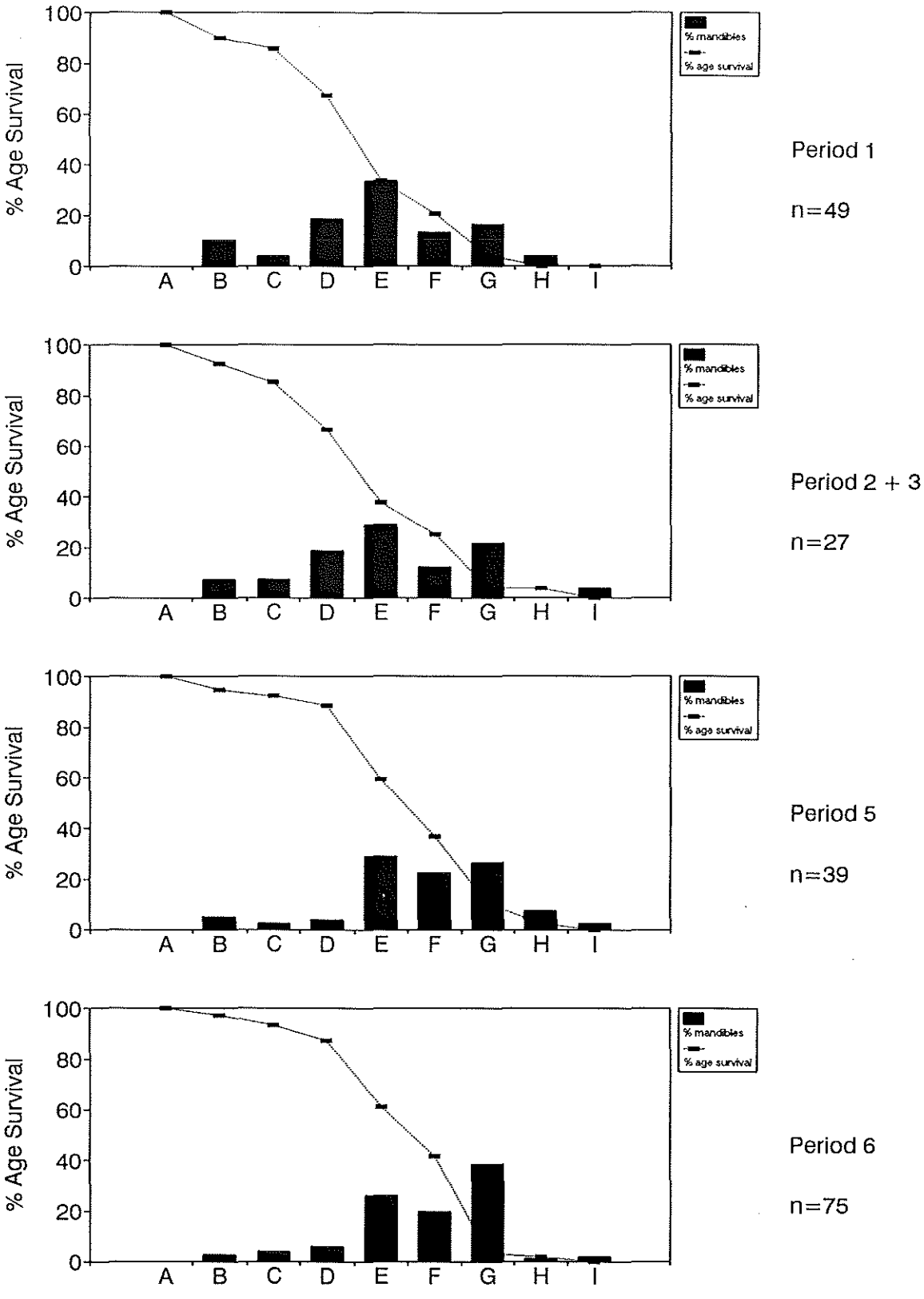


Figure 30 Relative percentages of SHEEP/GOAT mandibles by age stage in different periods at Castle Mall
Age stages are from Payne (1973). All mandibles with two or more teeth with recordable wear
in the dP4/P4-M3 row were considered.

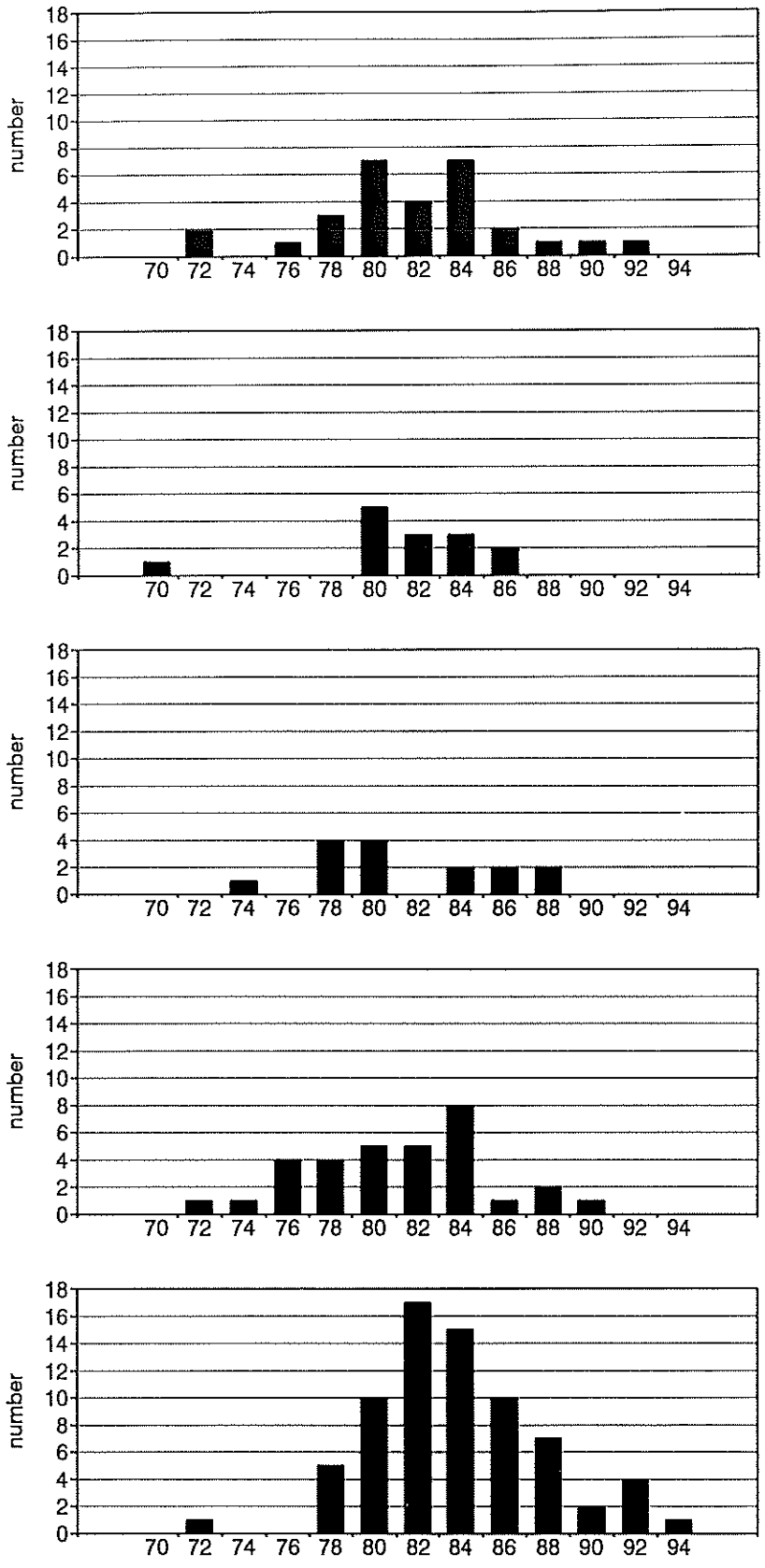


Figure 31 Variation of SHEEP/GOAT M3 width at Castle Mall
Measurements are in tenths of mm.

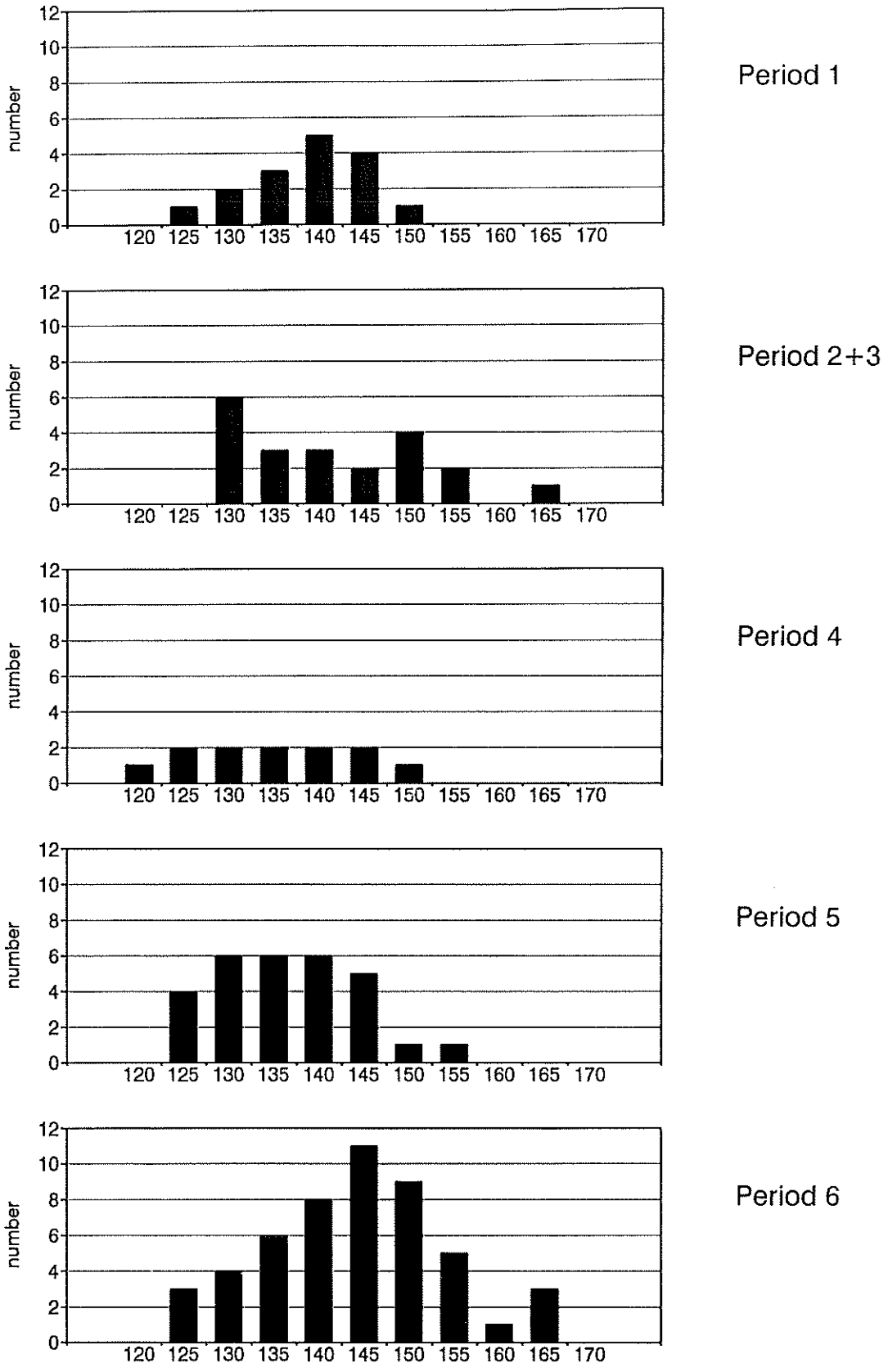


Figure 32. Variation of SHEEP/GOAT height of the humerus trochlea constriction (HTC) at Castle Mall. Measurements are in tenths of mm.

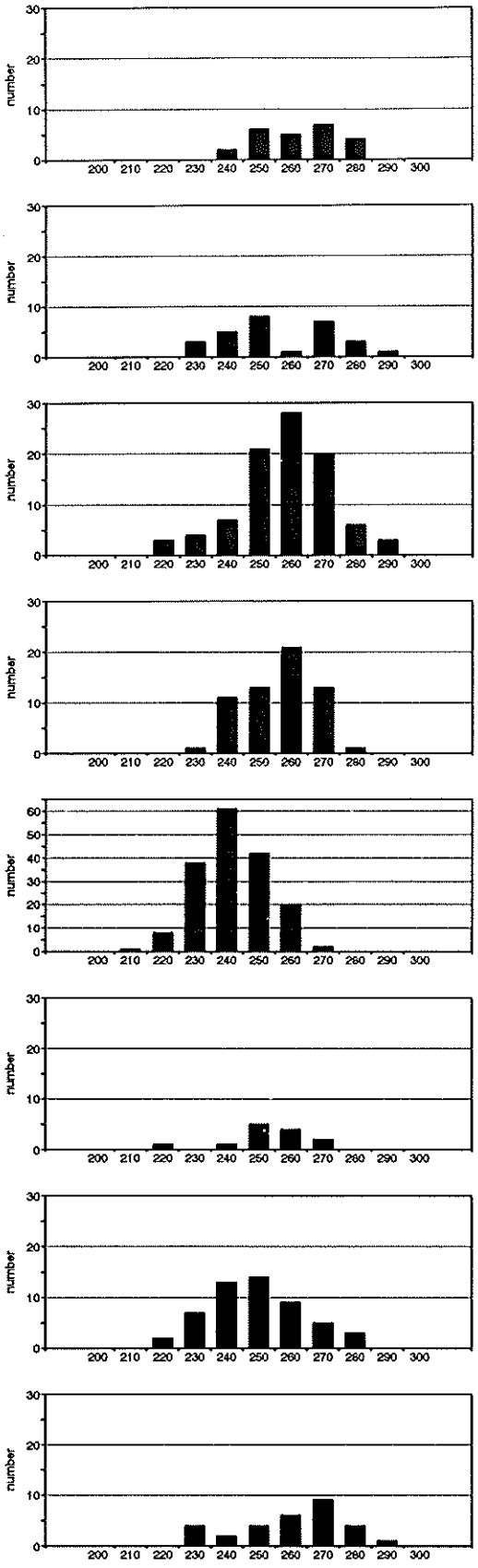


Figure 33 Sheep/Goat tibia distal breadth (Bd)
Measurements are in tenths of mm.

A comparison between specimens from York (O'Connor 1986), Launceston Castle (Albarella and Davis 1996), Leicester (Gidney 1991a,1991b) and Castle Mall.

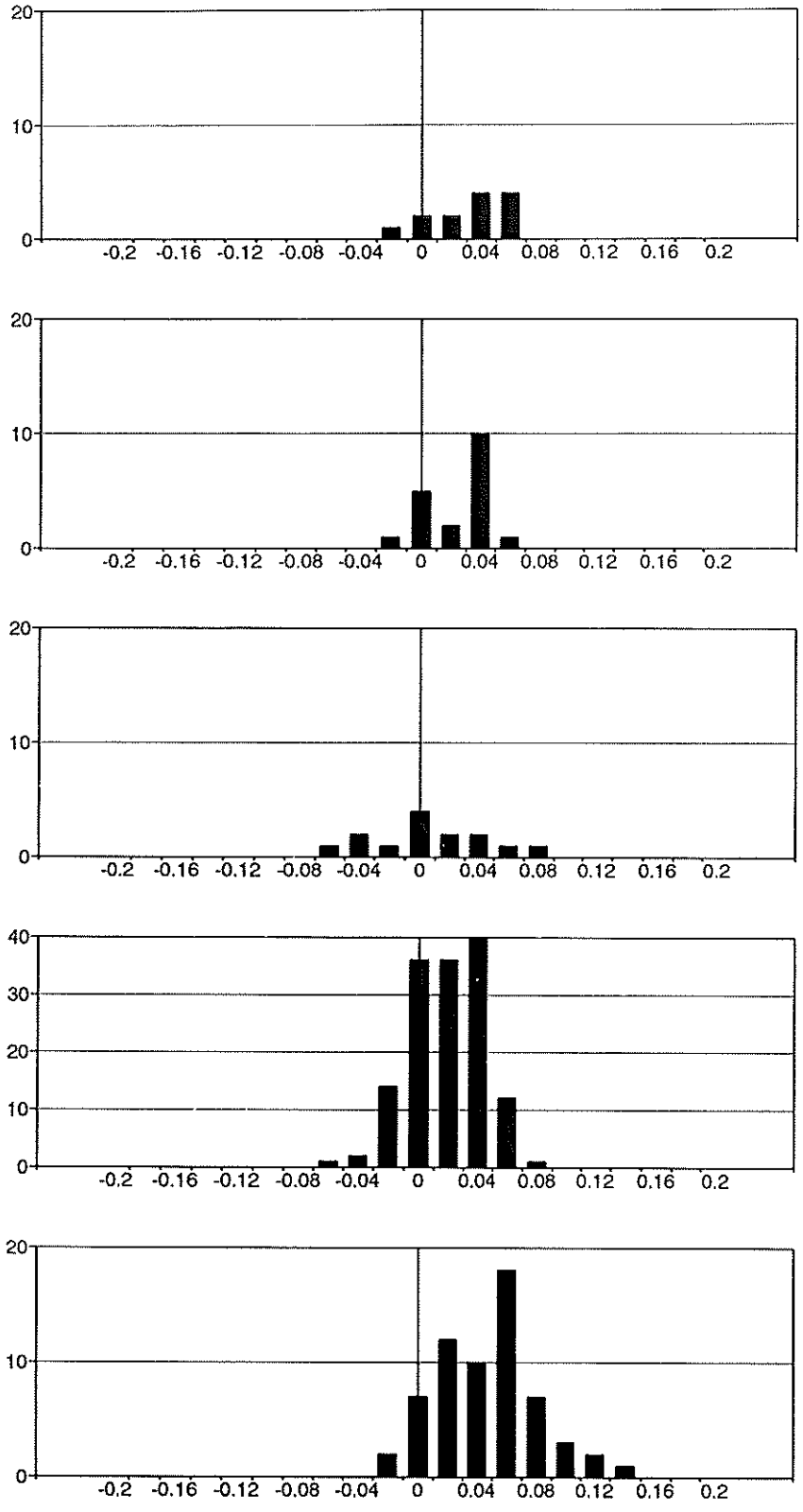
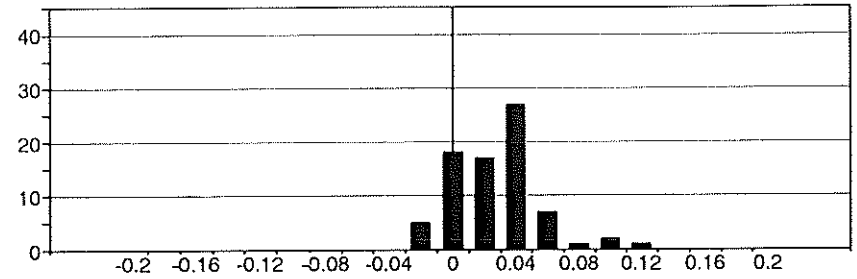
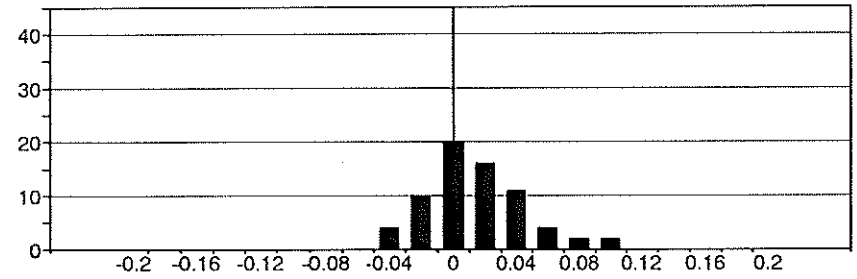


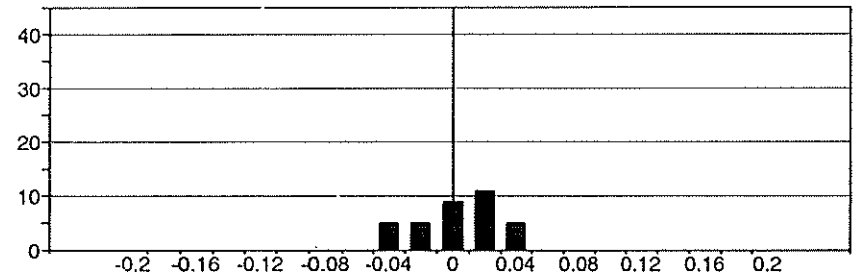
Figure 34 Variation in SHEEP/GOAT measurements at Castle Mall. A comparison of the LENGTH of sheep/goat bones with a standard sample of unimproved Shetland ewes (Davis 1996), using the log ratio technique (Payne and Bull 1988).



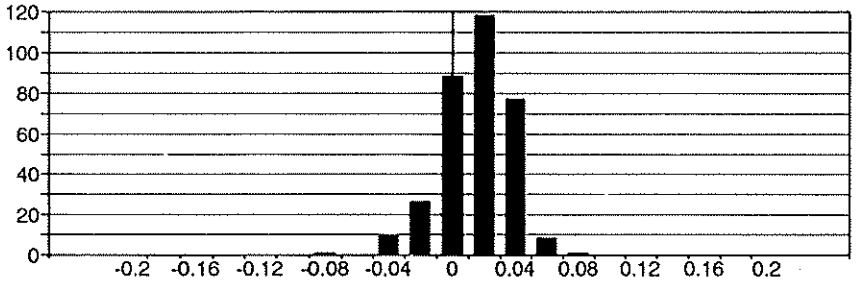
Period 1



Period 2+3

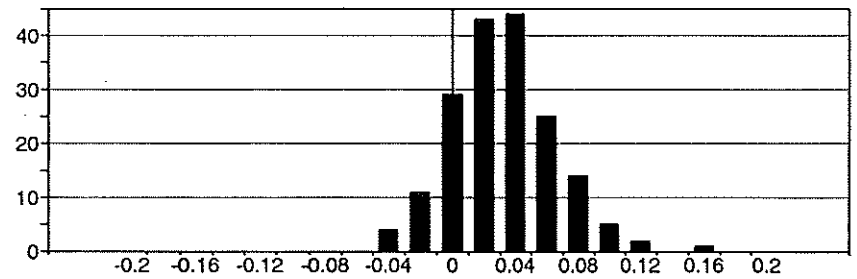


Period 4



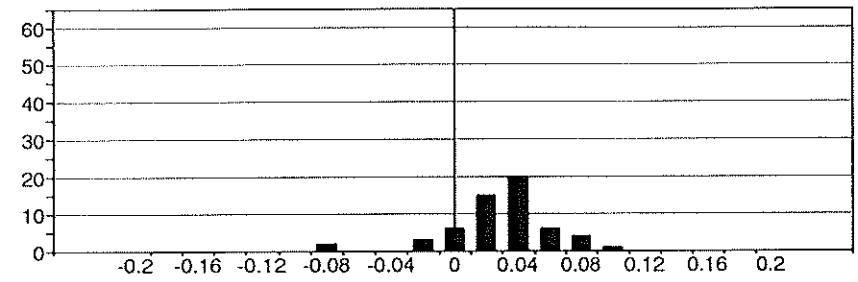
Period 5

Note the smaller y-axis used for this histogram

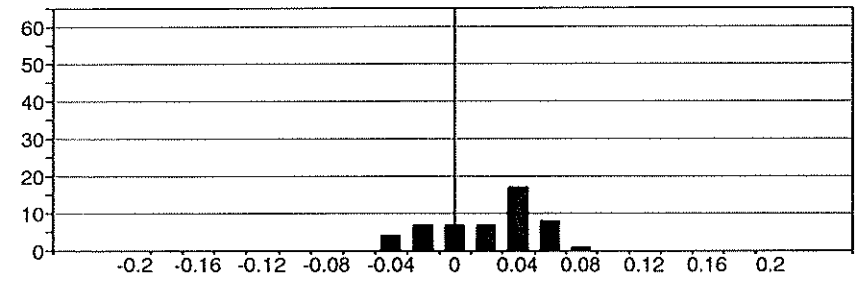


Period 6

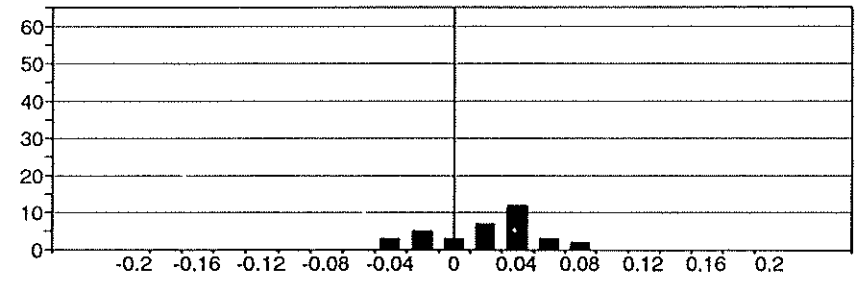
Figure 35 Variation in SHEEP/GOAT measurements at Castle Mall. A comparison of the WIDTH of sheep/goat bones with a standard sample of unimproved Shetland ewes (Davis 1996), using the log ratio technique (Payne and Bull 1988).



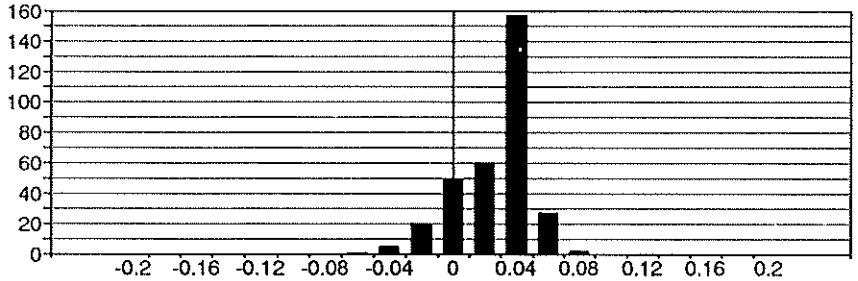
Period 1



Period 2+3

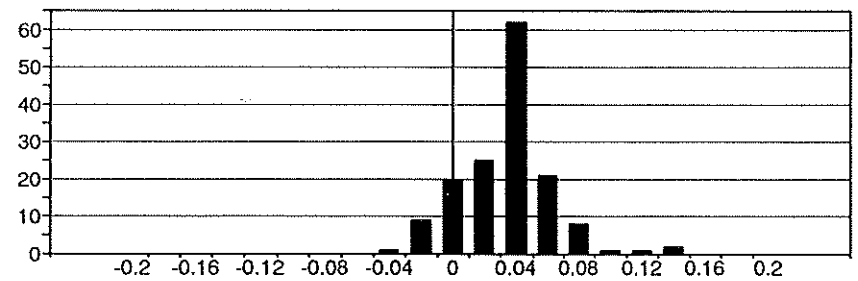


Period 4



Period 5

Note the smaller y-axis used for this histogram



Period 6

Figure 36 Variation in SHEEP/GOAT measurements at Castle Mall. A comparison of the DEPTH of sheep/goat bones with a standard sample of unimproved Shetland ewes (Davis 1996), using the log ratio technique (Payne and Bull 1988).

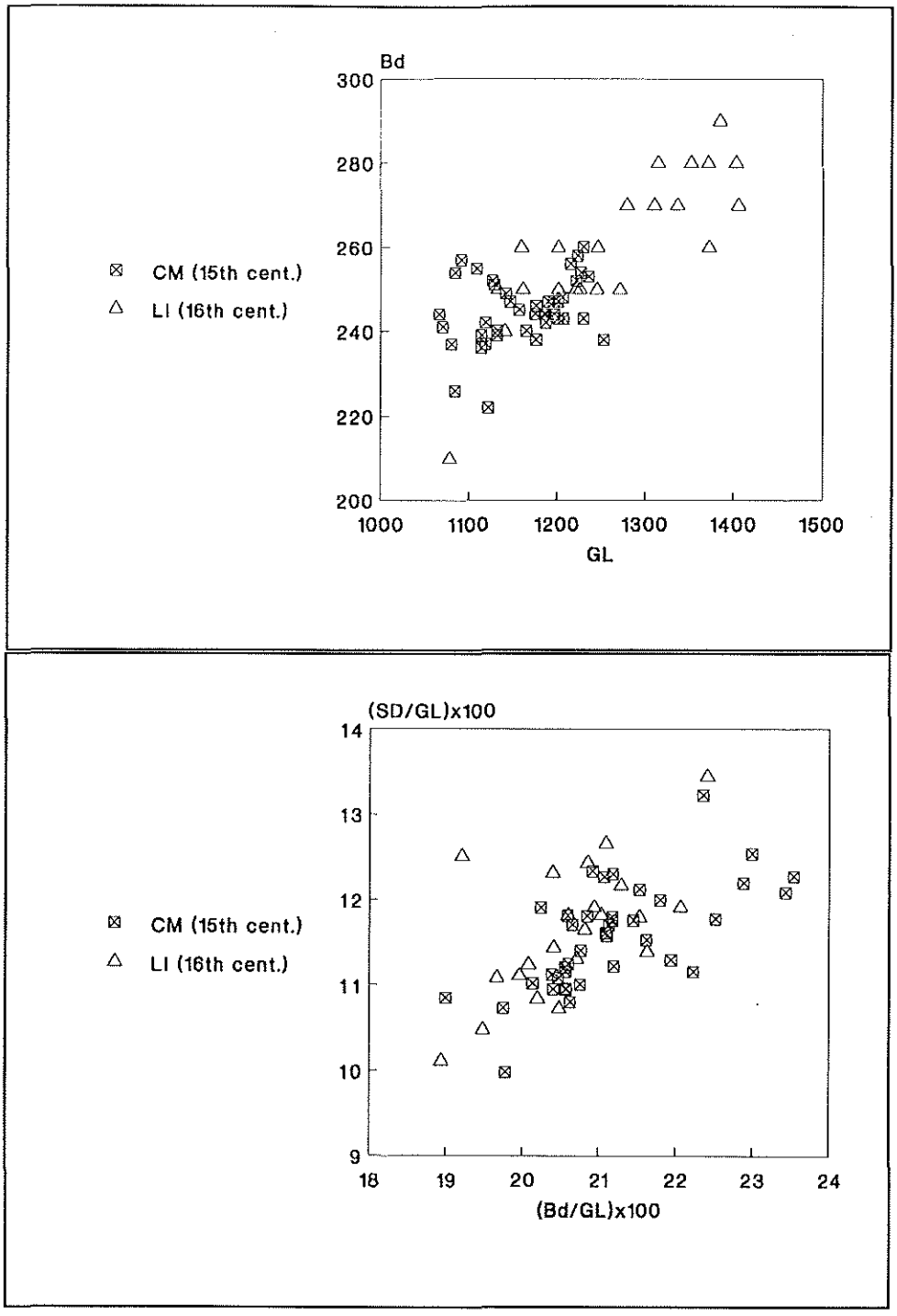


Figure 37

Size (top) and shape (bottom) variation of **sheep metacarpus** from an early-mid 15th century group at Castle Mall (context 11030) and an early 16th century group at Lincoln (Dobney et al. 1996).

The bottom diagram is size independent: the higher the value the more robust is the specimen.

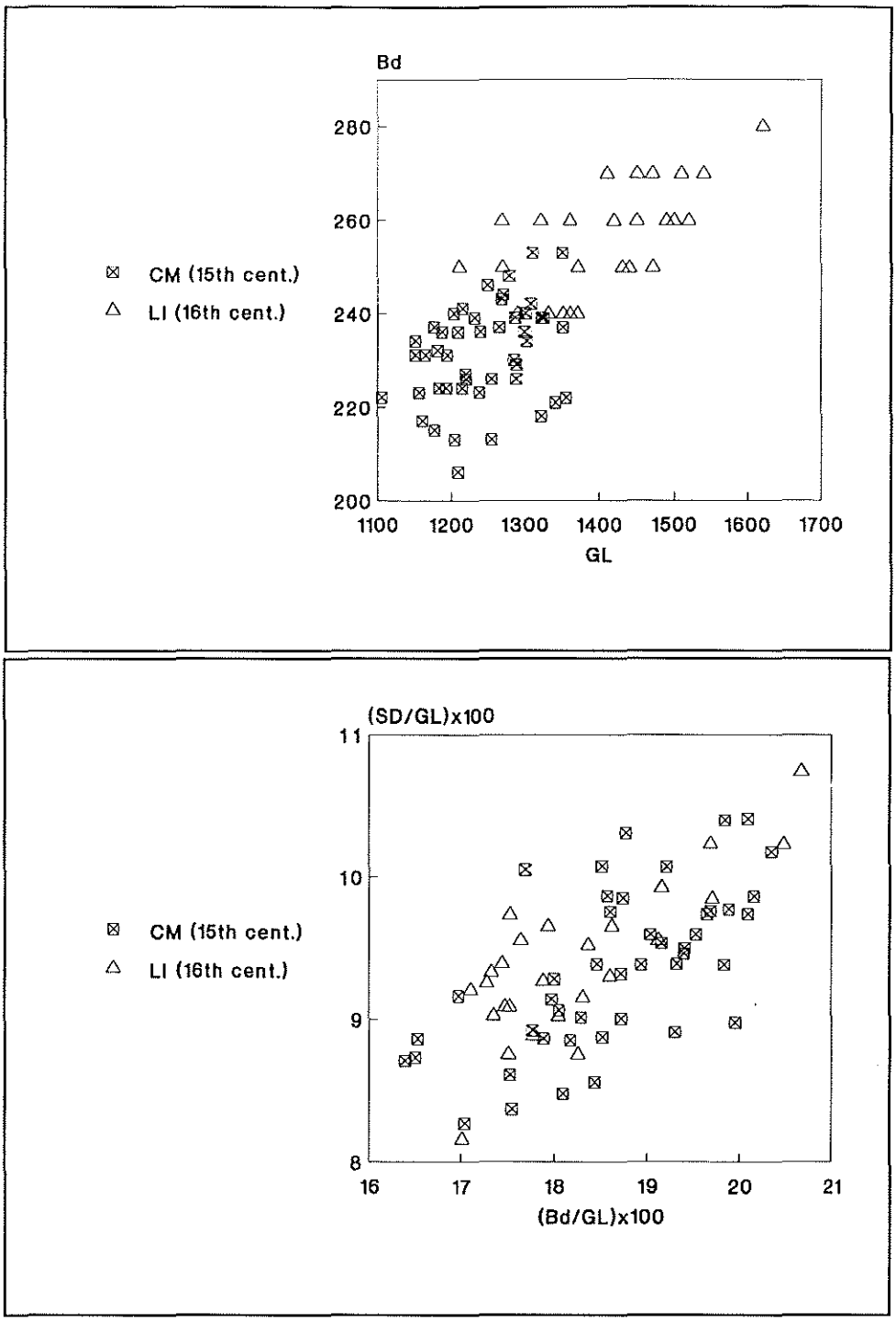


Figure 38

Size (top) and shape (bottom) variation of **sheep metatarsus** from an early-mid 15th century group at Castle Mall (context 11030) and an early 16th century group at Lincoln (Dobney et al. 1996).

The bottom diagram is size independent: the higher the value the more robust is the specimen.

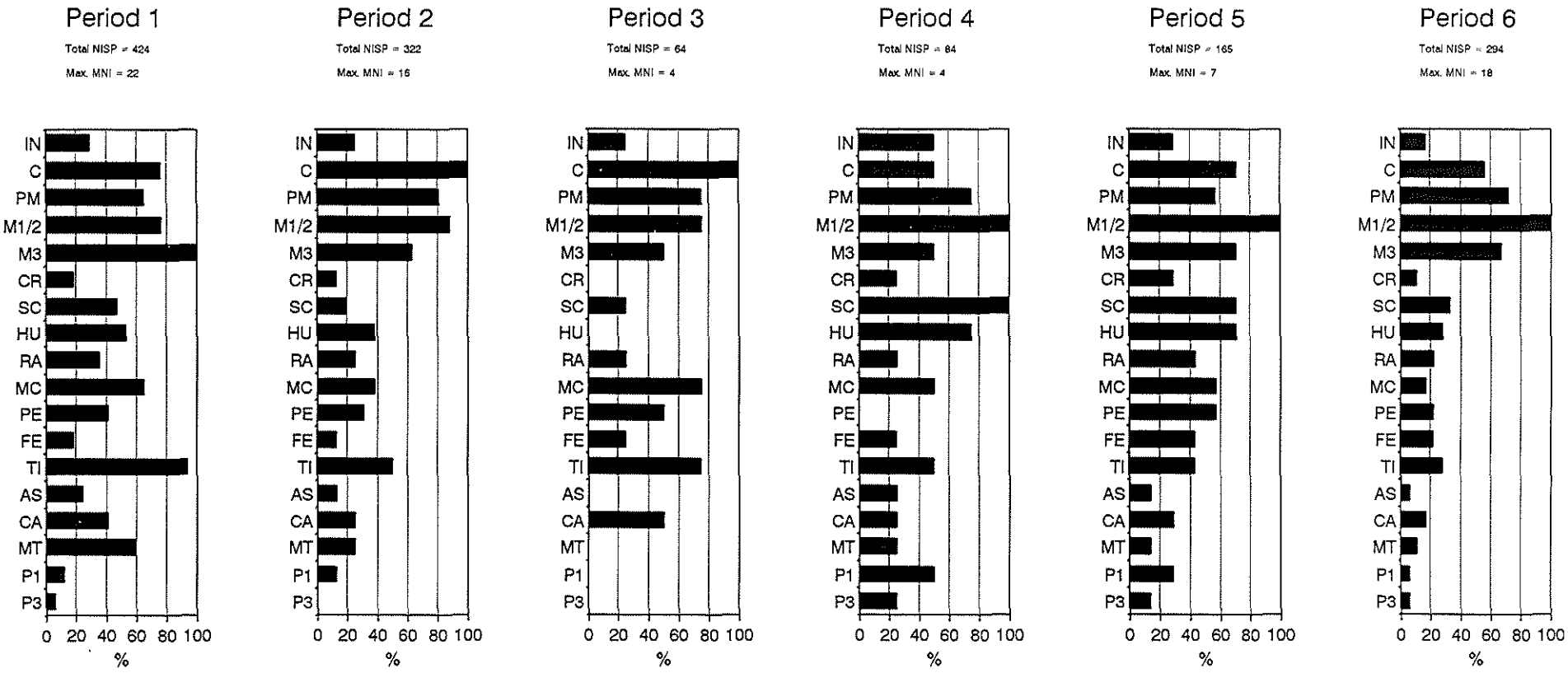


Figure 39 Pig body parts at Castle Mall

Percentages are calculated on the basis of the frequency of an element in relation to the most common one (by MNI).

IN = deciduous and permanent incisors, C = canine, PM = deciduous and permanent premolars, M1/2 = 1st & 2nd molars,
M3 = 3rd molar, CR = cranium (zygomaticus), SC = scapula, HU = humerus, RA = radius, MC = metacarpus
PE = pelvis, FE = femur, TI = tibia, AS = astragalus, CA = calcaneus, MT = metatarsus, P1 = 1st phalanx, P3 = 3rd phalanx

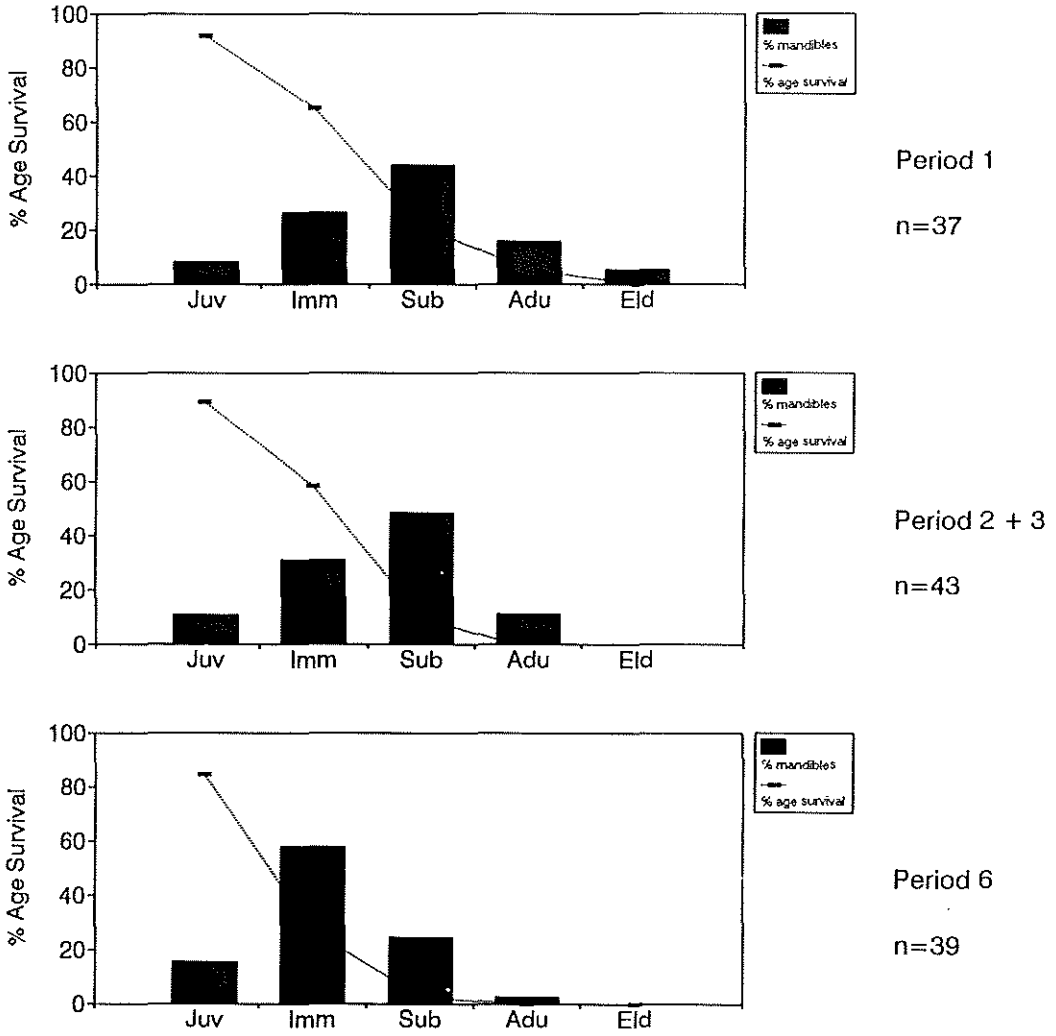


Figure 40 Relative percentages of PIG mandibles by age stage in different periods at Castle Mall Age stages are from O'Connor (1988). All mandibles with two or more teeth with recordable wear in the dP4/P4-M3 row were considered.

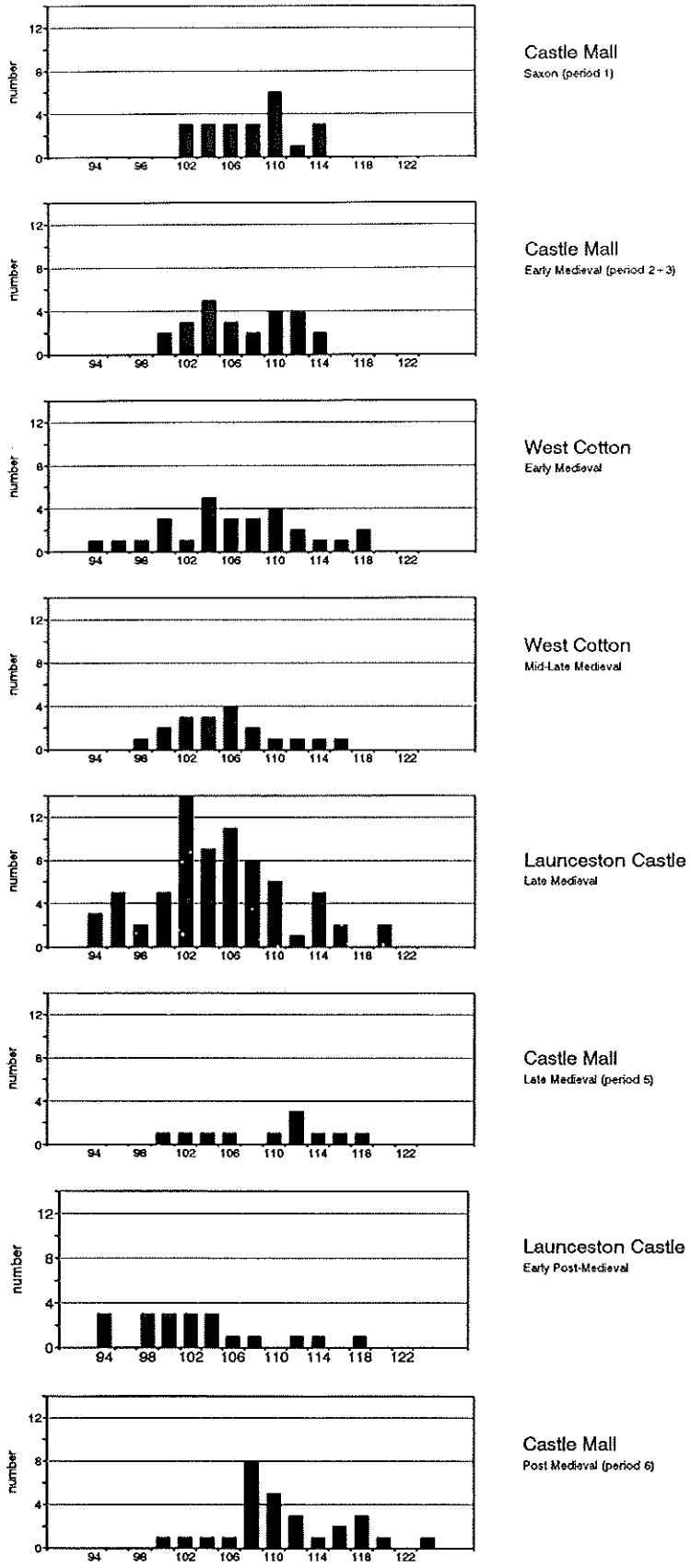


Figure 41 PIG first molar: posterior width

Measurements are in tenths of mm.

A comparison between specimens from Launceston Castle (Albarella and Davis 1996), West Cotton (Albarella and Davis 1994) and Castle Mall.

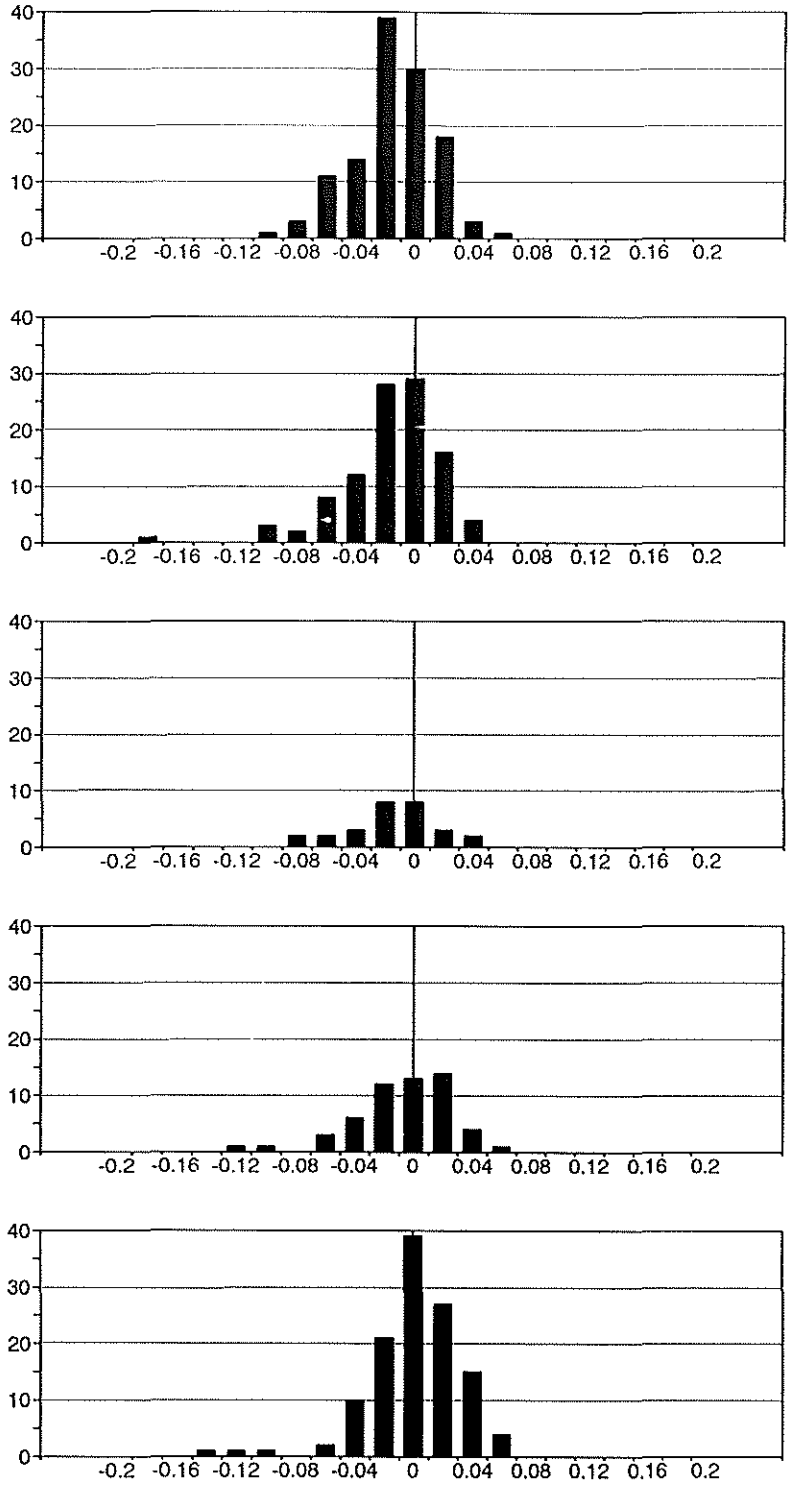


Figure 42 Variation in PIG TOOTH measurements at Castle Mall. A comparison of pig teeth with a standard Neolithic pig sample from Durrington Walls (Albarella and Payne, in prep), using the log ratio technique (Payne and Bull, 1988).

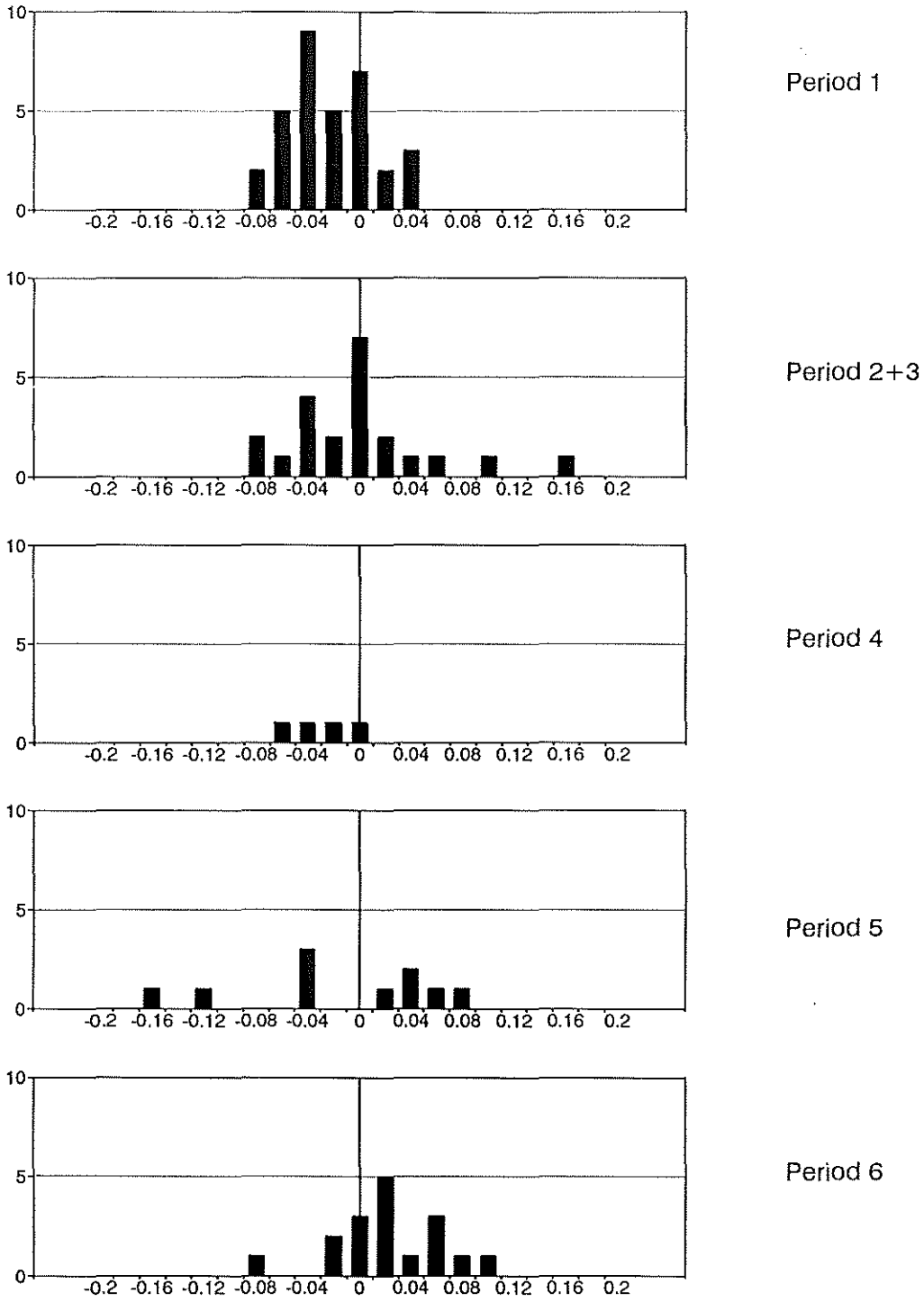
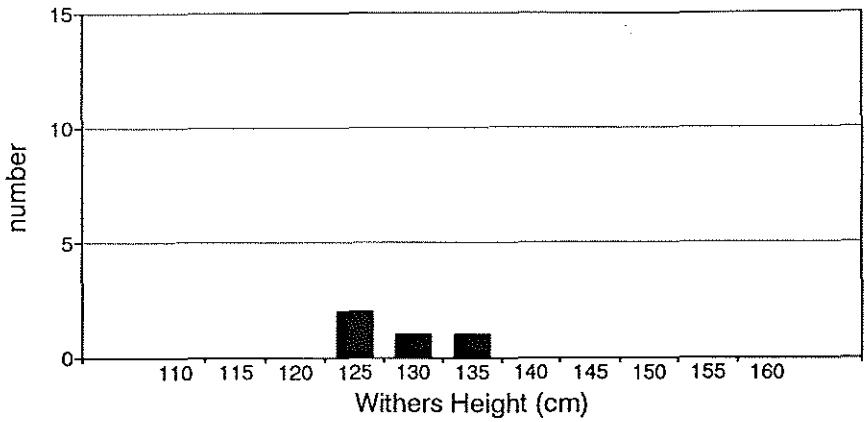
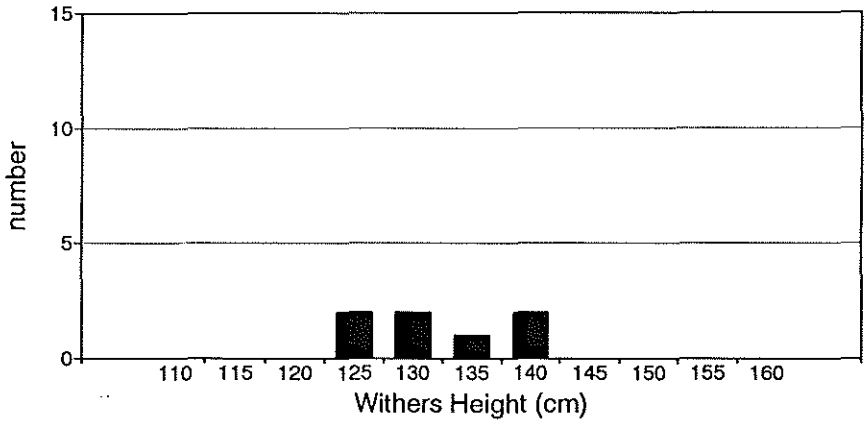


Figure 43 Variation in PIG BONE measurements at Castle Mall. A comparison of pig bones with a standard Neolithic pig sample from Durrington Walls (Albarella and Payne, in prep), using the log ratio technique (Payne and Bull, 1988).



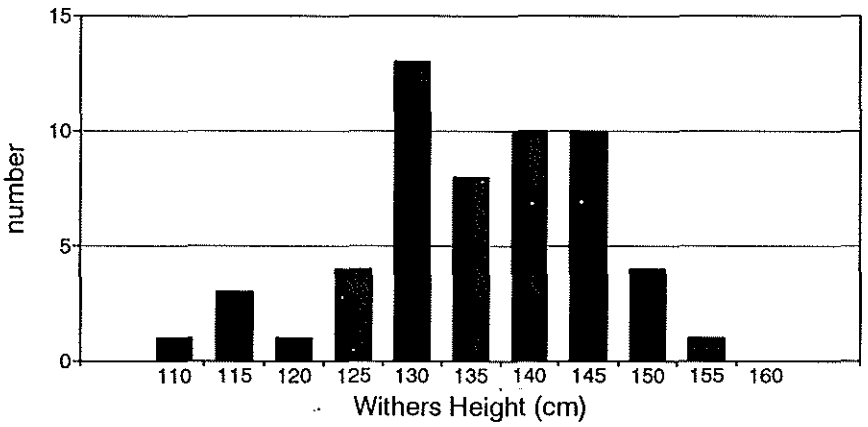
Period 1

Late Saxon



Period 2-4

Early/Mid-Medieval



Period 6

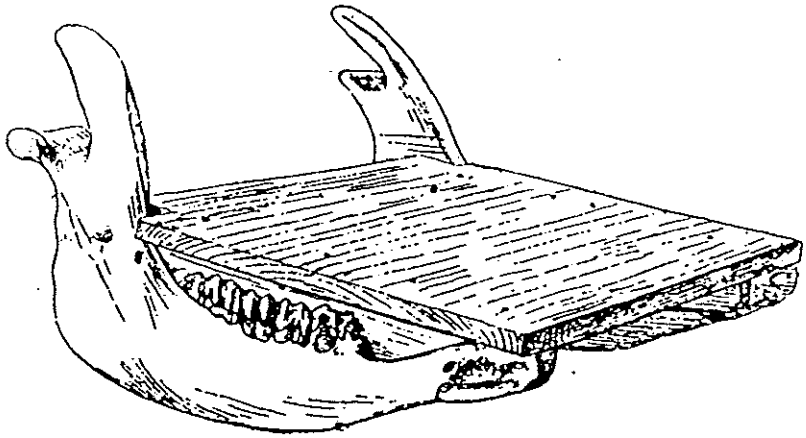
Post-Medieval

Figure 44 Equid withers heights in centimetres at Castle Mall.

All withers heights calculations are based on the formulae provided by Vitt (1952), using the greatest length (GL) measurements of the following elements: humerus, radius, metacarpus, femur, tibia and metatarsus.

(a)

(b)



(c)

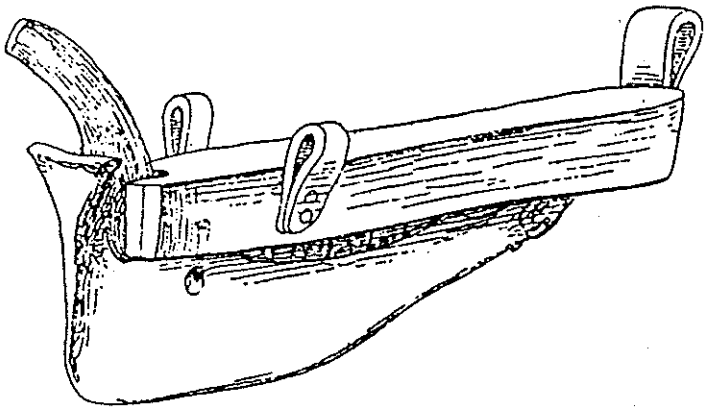


Figure 45

Jaw-bone sledges and skates
(reproduced from Balfour 1898, fig.8-10).

(a) Child on a jaw-bone sledge, taken from a Dutch engraving representing sports on the ice in the town ditch at Antwerp, 1594 (Chambers, Book of Days 1869, vol.ii, p.787).

(b) Jaw-bone sledge from Pomerania
(Virchow, Zeit. f. Ethnol., xix, 1887, p.362).

(c) Jaw-bone skate from Pomerania
(Virchow, Zeit. f. Ethnol., xix, 1887, p.362).

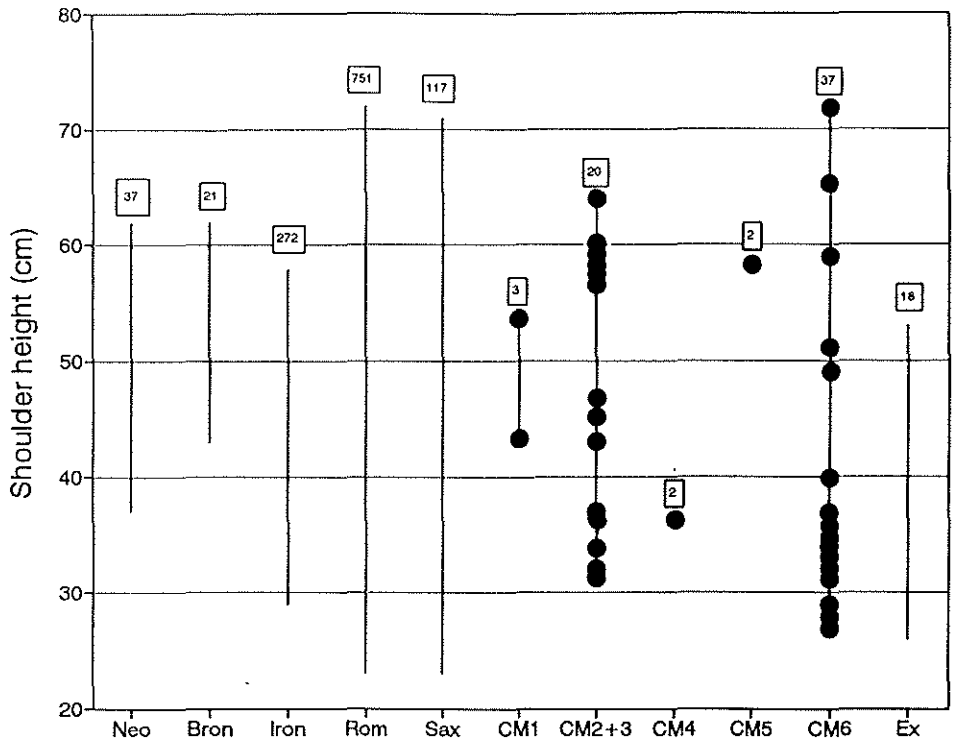


Figure 46

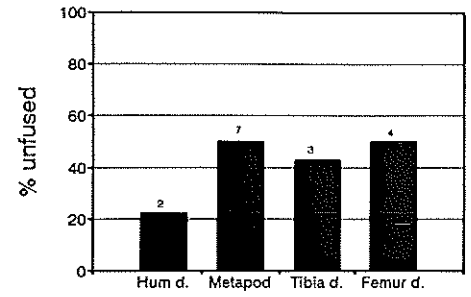
Dog shoulder heights from Castle Mall.

The lines represent the range of measurements for each of the periods.
Points on the Castle Mall lines represent the actual position of calculated shoulder height measurements.
The numbers enclosed in boxes above the lines represent the sample size.

All shoulder heights are calculated using the formulas given in Harcourt (1974).

Neo = Neolithic, Bron = Bronze age, Iron = Iron age, Rom = Roman, Sax = Saxon,
CM1 = Castle Mall period 1, CM2+3 = Castle Mall periods 2+3, CM4 = Castle Mall period 4,
CM5 = Castle Mall period 5, CM6 = Castle Mall period 6, Ex = Exeter (post-medieval)

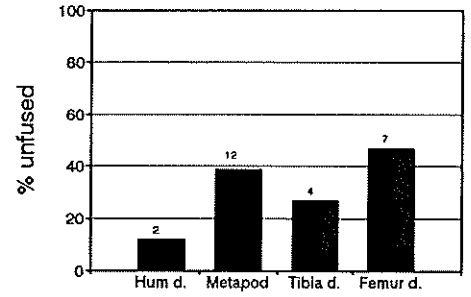
Neolithic-Saxon data from Harcourt (1974). Exeter post-medieval data from Maltby (1979).



Castle Mall - Period 1

Late Saxon (late 9th-11th century)

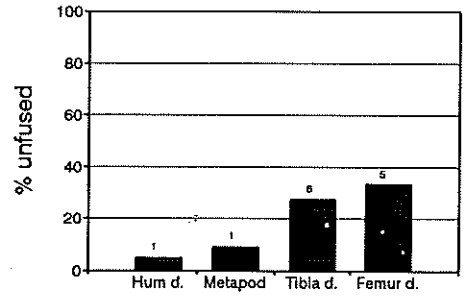
Total (unfused + fused) = 38



Castle Mall - Periods 2-5

Early-Late Medieval (late 11th-mid 16th century)

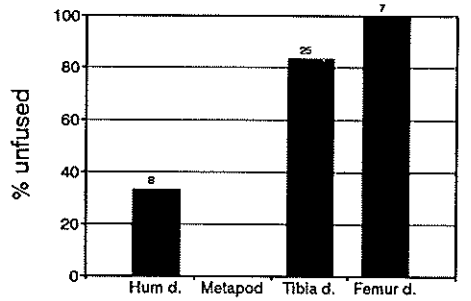
Total (unfused + fused) = 78



Castle Mall - Period 6

Post-Medieval (late 16th-18th century)

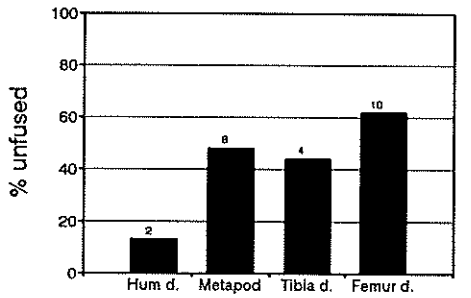
Total (unfused + fused) = 69



Cambridge, Bene't Court

Medieval (13th century)

Total (unfused + fused) = 61



West Cotton

Early-Late Medieval (early 12th/mid-15th century)

Total (unfused + fused) = 59

Figure 47 Relative percentages of unfused cat bones at Castle Mall, Cambridge - Bene't Court (Luff and Moreno Garcia 1995) and West Cotton (Albarella and Davis 1994).

The numbers of unfused bones are indicated above each bar.
Hum = humerus. Metapod = metacarpus + metatarsus. d = distal.
Where skeletons occurred at Castle Mall only a single metacarpus + metatarsus was counted from each individual.
No metapodial data were available from Cambridge-Bene't Court

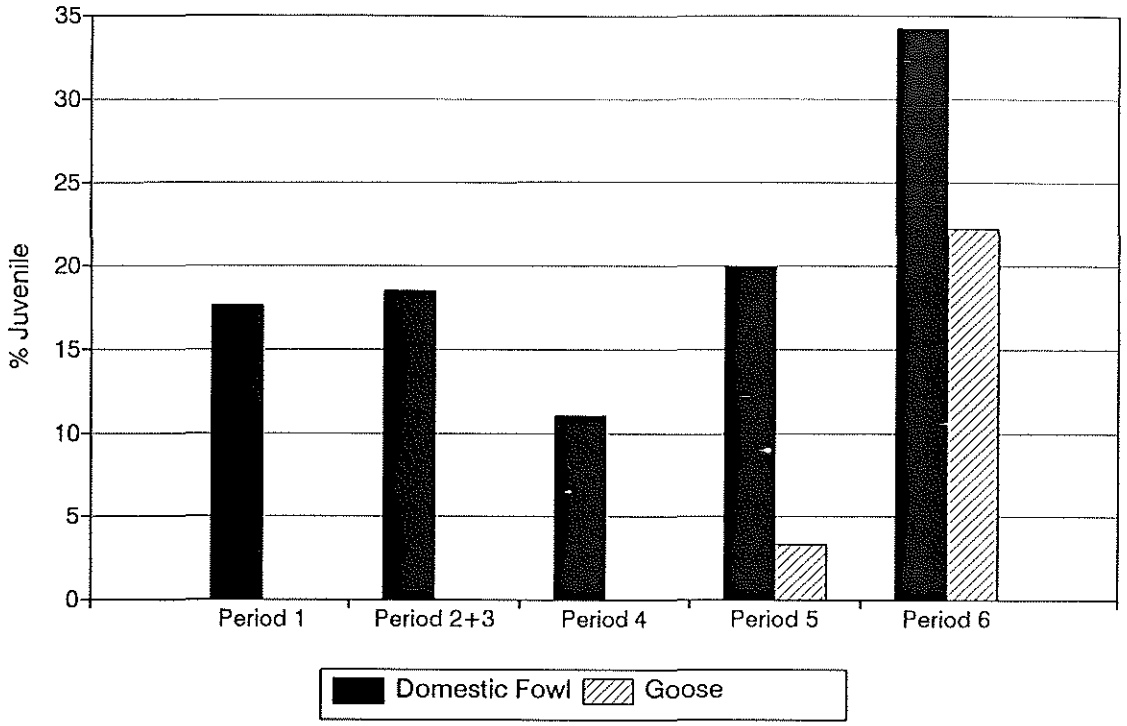


Figure 48

Relative percentages of juvenile domestic fowl and goose by period at Castle Mall.

		Period 1	Period 2+3	Period 4	Period 5	Period 6
Sample sizes (Total NISP)	Domestic Fowl	245	151	146	176	111
	Goose	25	32	29	60	27

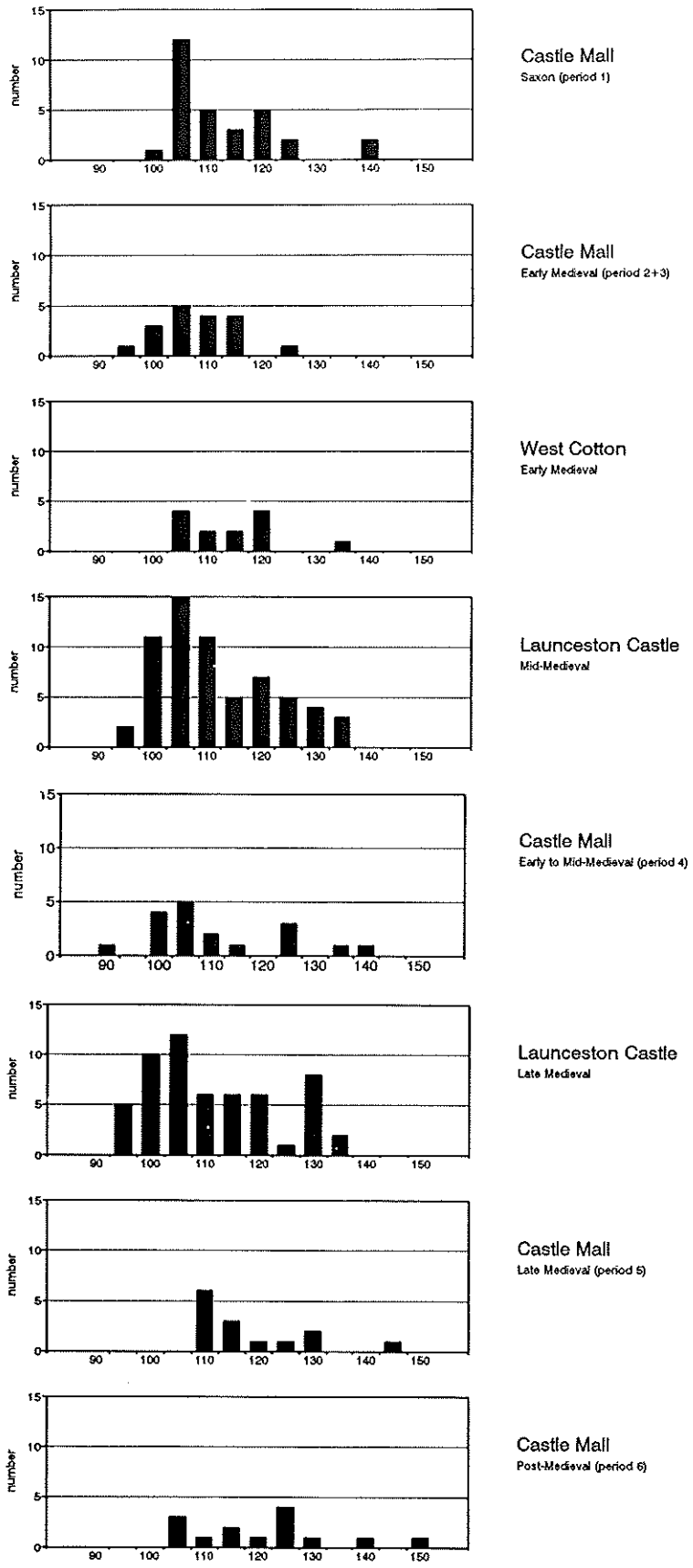
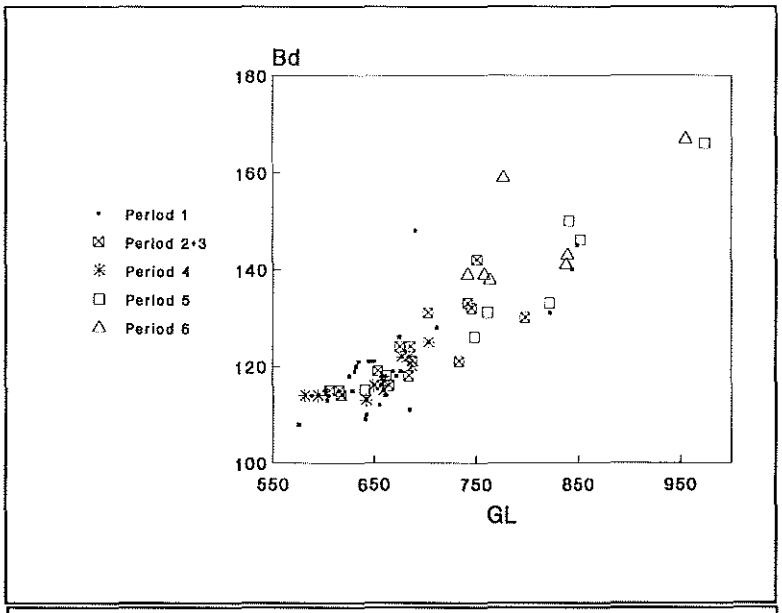


Figure 49 DOMESTIC FOWL tibiotarsus distal breadth (Bd)

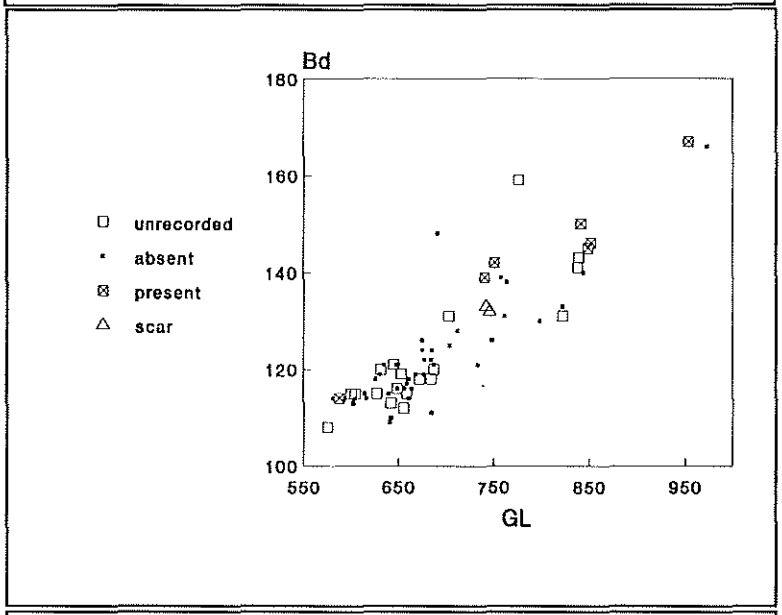
Measurements are in tenths of mm.

A comparison between Launceston Castle (Albarella and Davis 1996), West Cotton (Albarella and Davis 1994) and Castle Mall.

A



B



C

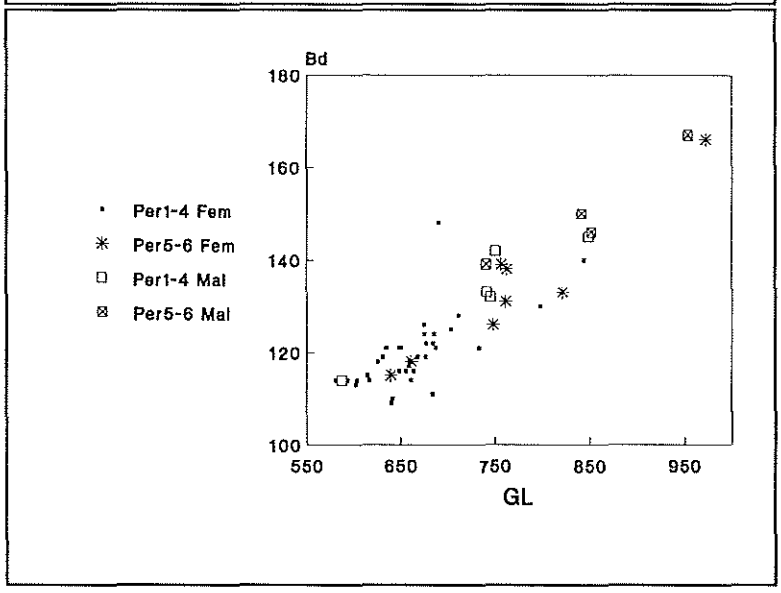


Figure 50

Size variation of **domestic fowl tarsometatarsus** at Castle Mall by period (A), according to the presence/absence of a spur (B), and the two variables together with periods 1-4 and 5-6 combined (C). In the diagram C specimens without spur are considered females and specimens with a reduced or complete spur are considered males.

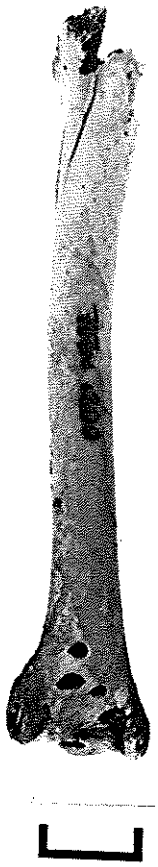


Plate 1. Period 5. Duck humerus.
Punctures probably caused by cat gnawing.

Plate 2. Period 2. Cattle metatarsus.
Ossified haematoma?

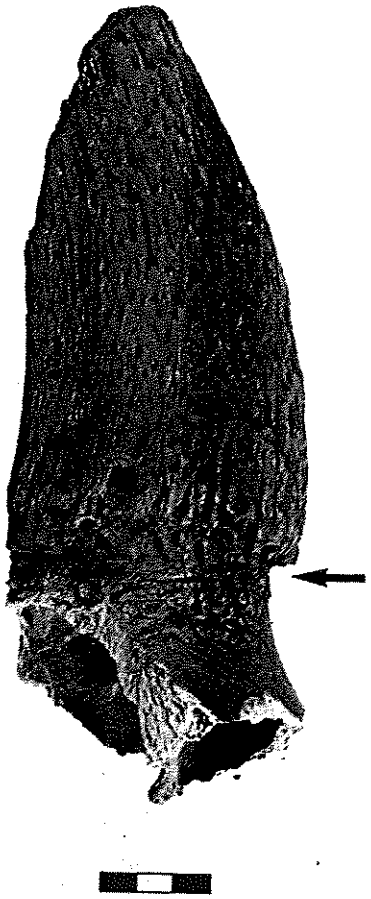


Plate 3. Period 6. Cattle horncore.
Cut marks at the base.

Plate 4. Period 6. Cattle horncore.
Sawn near the tip.

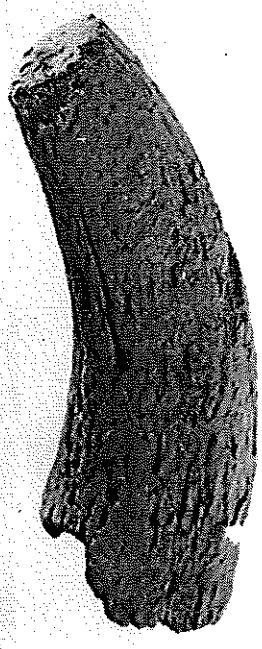


Plate 5. Period 6. Cattle horncore.
Sawn near the tip.

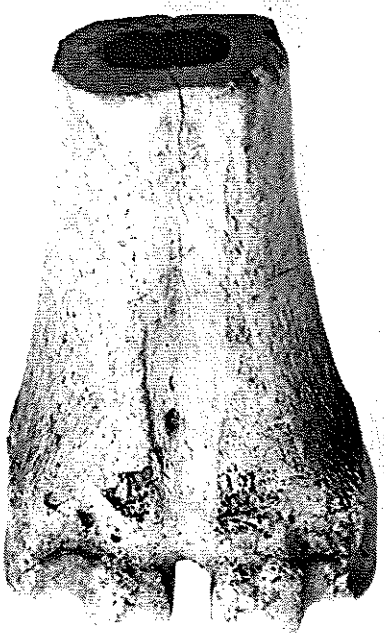


Plate 6. Period 6. Cattle metatarsus.
Sawn.

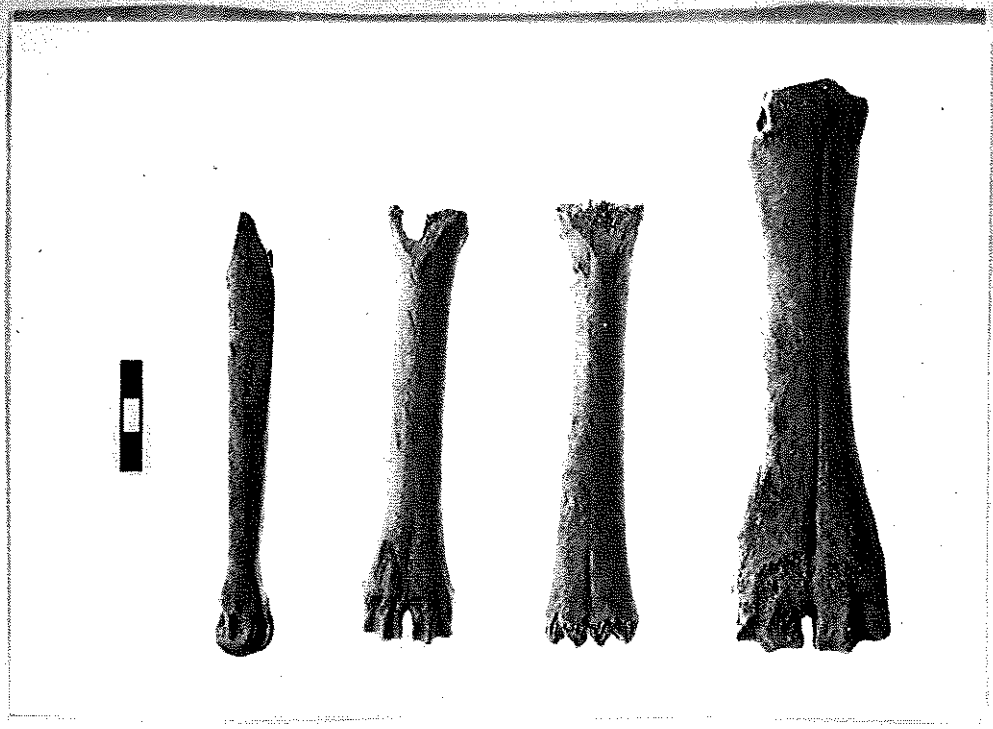


Plate 7. Period 6. Cattle and sheep metapodia.
Bone working.

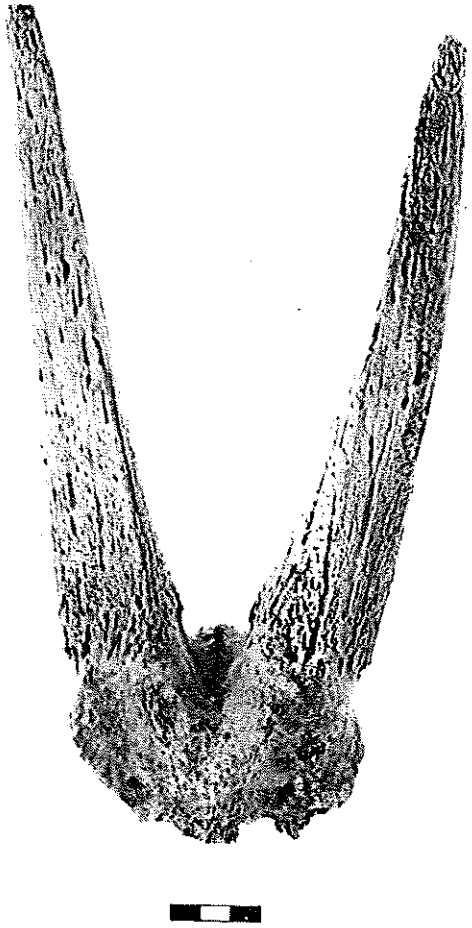


Plate 8. Period 1. Goat horncores.

Plate 9. Period 1. Sheep humerus.
"Penning elbow".

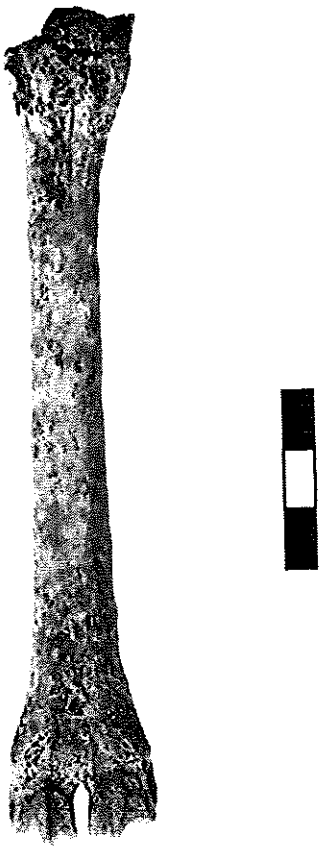


Plate 10. Period 1. Sheep metatarsus.
"Spavin".

Plate 11. Period 5. Sheep horncores, metapodia and phalanges.
Collection from a possible tanning pit.

Plate 12. Period 1. Sheep skull.
Chopped horncores.

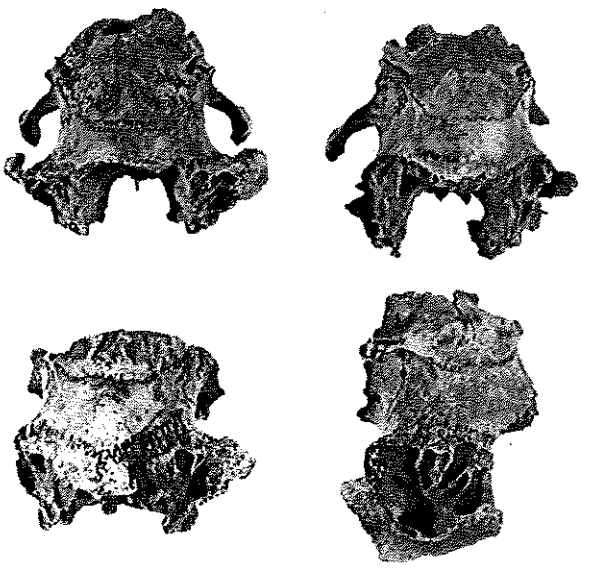


Plate 13. Period 2. Sheep skulls.
Chopped horncores.

Plate 14. Period 2. Goat horncore.
Cut marks.

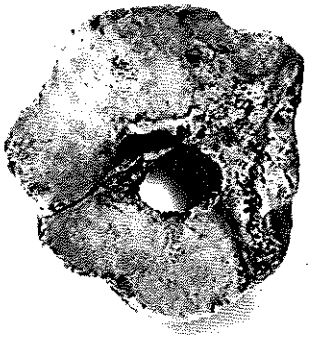


Plate 15. Period 6. Sheep metatarsus.
Hole in the proximal end. Used as a handle?

Plate 16. Period 1. Horse partial skeleton (juvenile).

Plate 17. Period 1. Horse partial skeleton (juvenile).

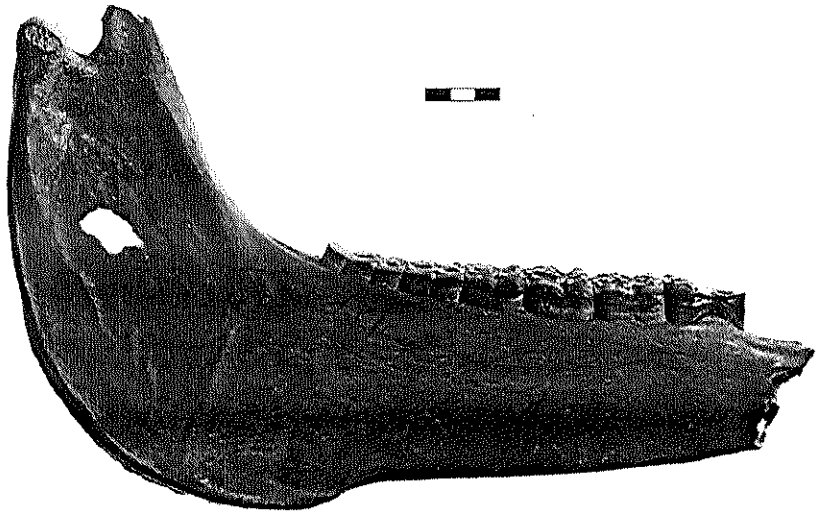


Plate 18. Period 6. Horse mandible.
Bit wear.

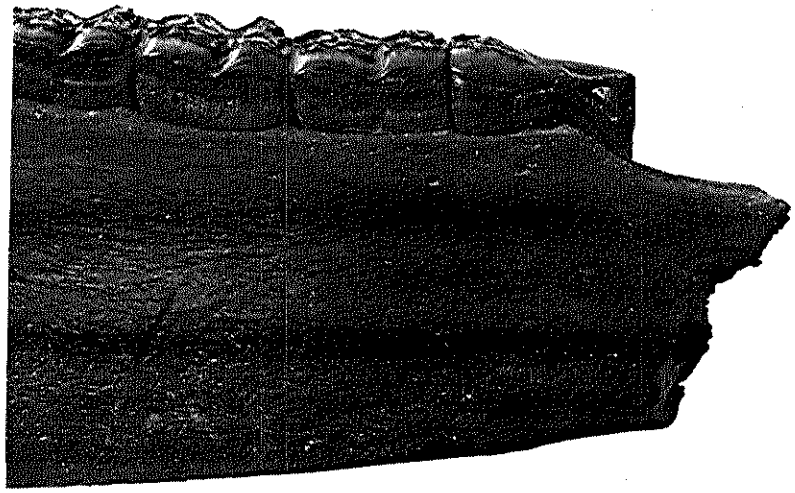


Plate 19. Period 6. Horse mandible.
Bit wear.

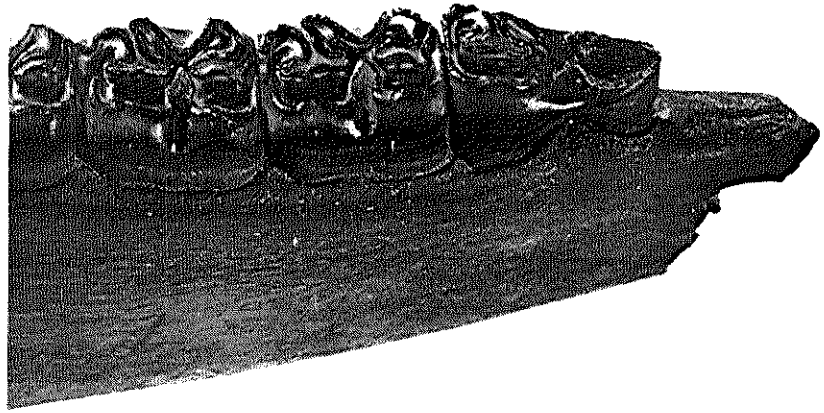


Plate 20. Period 6. Horse mandible.
Bit wear.

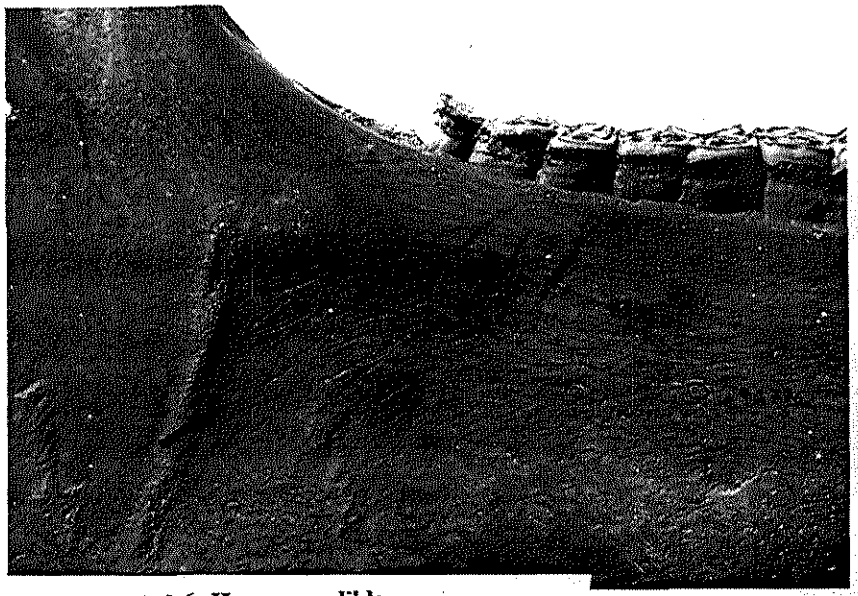


Plate 21. Period 6. Horse mandible.
Cut marks (same specimen as in plates 18-20)

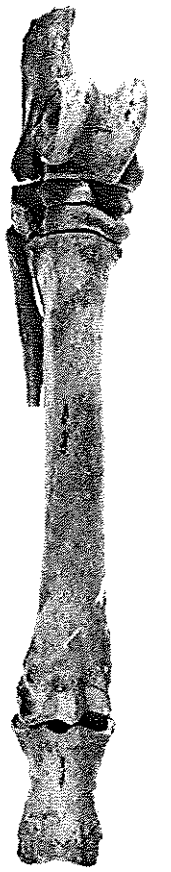


Plate 22. Period 2. Horse limb.
Extremity of hind limb in anatomical connection.

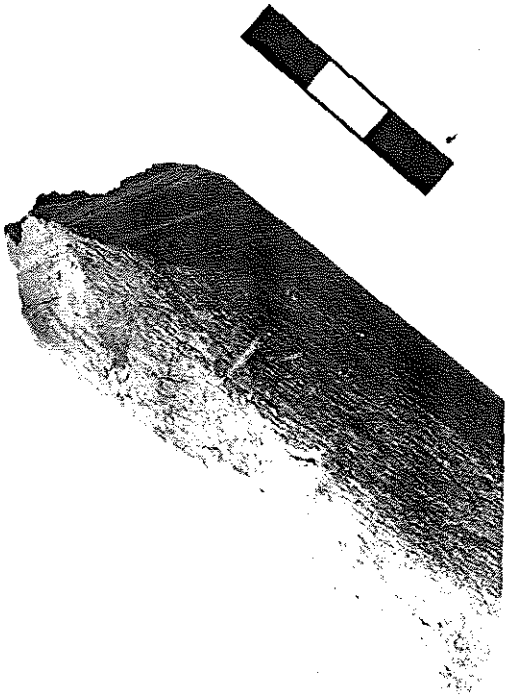


Plate 23. Period 6. Horse metatarsus.
Sawn.

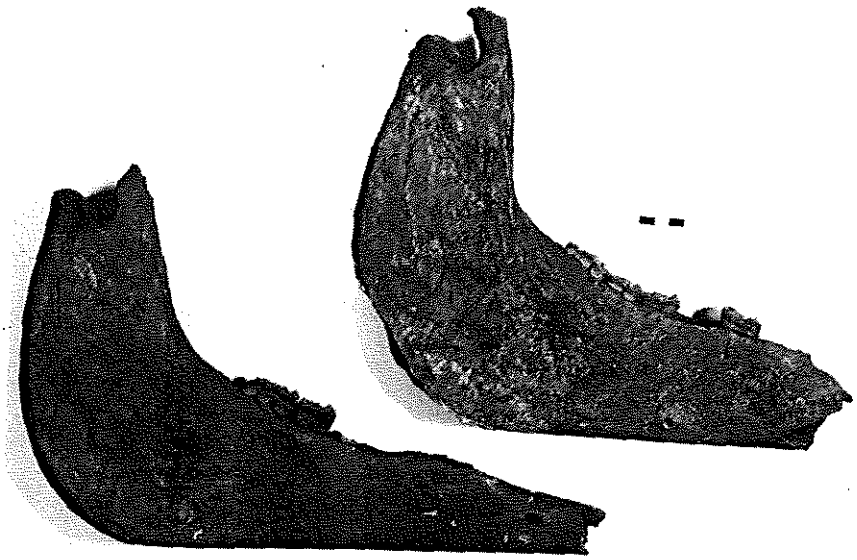


Plate 24. Period 6. Horse mandibles.
Skates or sledges. Small find n.421.

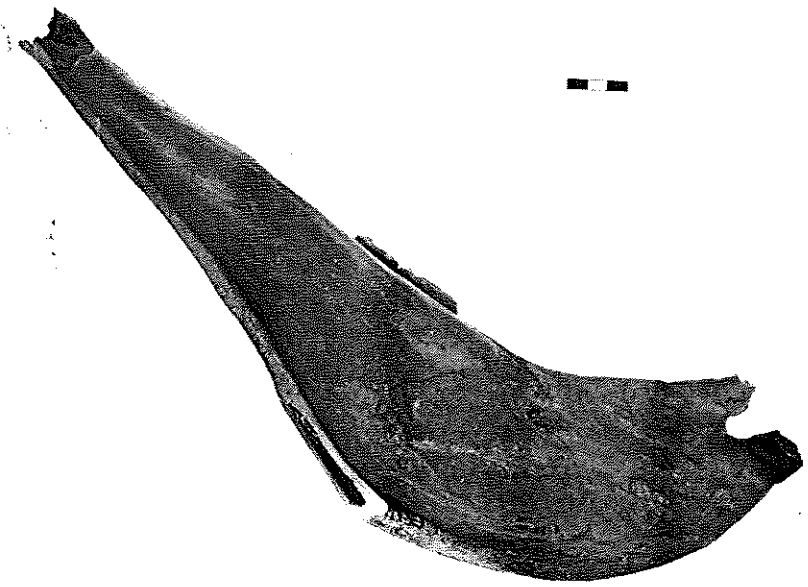


Plate 25. Period 6. Horse mandible.
Skate or sledge. Small find n.421.

Plate 26. Period 6. Dog skull.
Poodle-like.

Plate 27. Period 6. Dog skull.
Terrier-like.

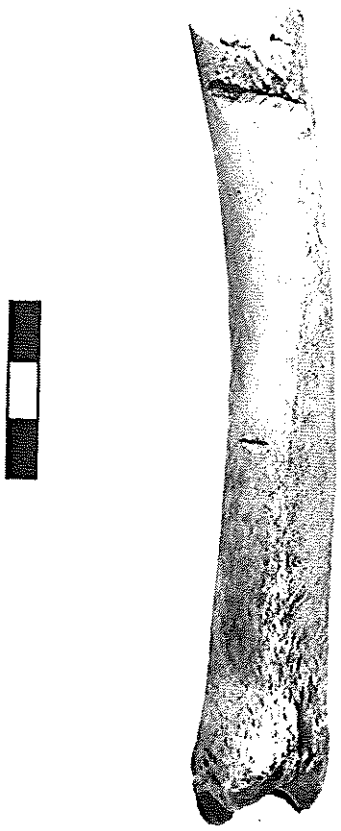


Plate 28. Period 6. Dog tibia.
Chopping marks.

Plate 29. Period 1. Dog pelvis.
Cut mark.

Plate 30. Period 2. Dog femur.
Cut mark.

Plate 31. Period 1. Cat skull.
Cut marks.

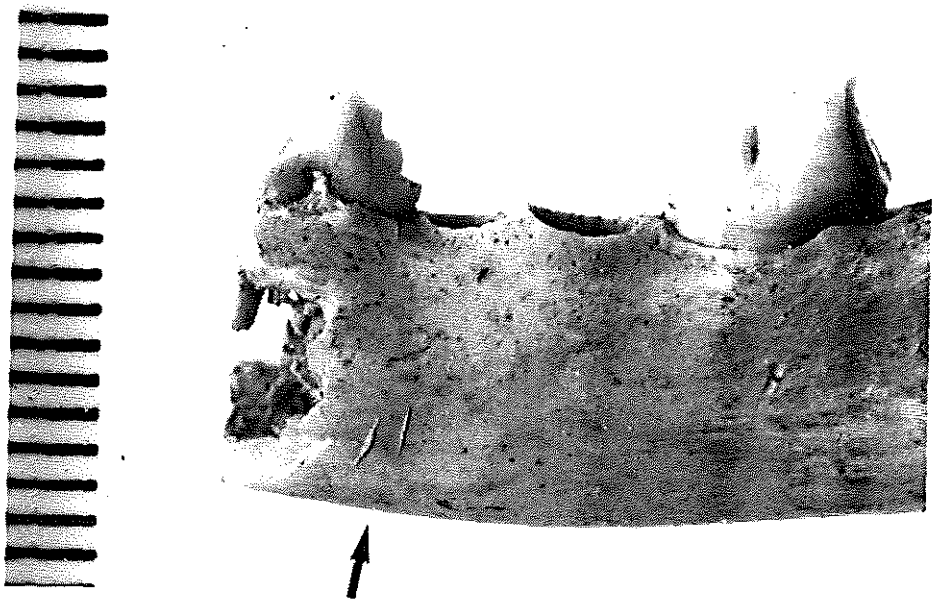


Plate 32. Period 4. Cat mandible.
Cut marks.

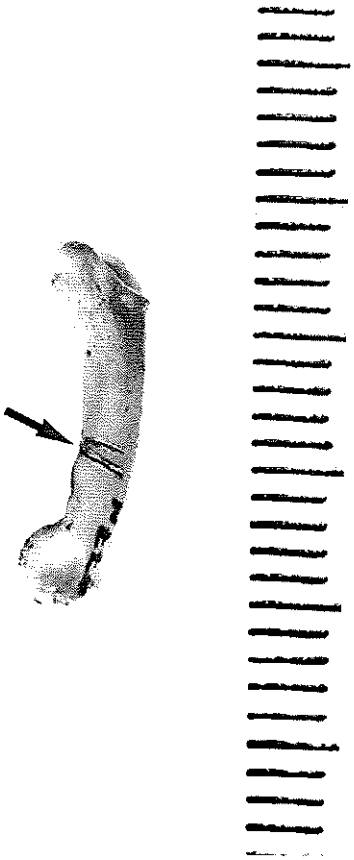


Plate 33. Period 1. Cat 1st phalanx.
Cut marks.

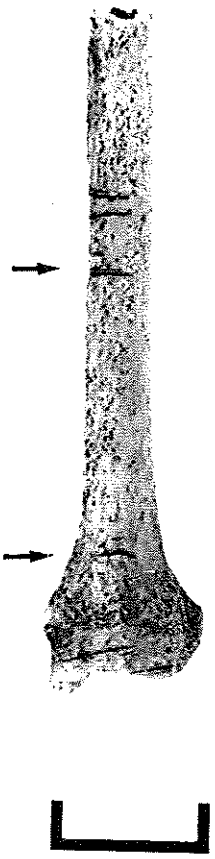


Plate 34. Period 6. Cat radius.
Cut marks.

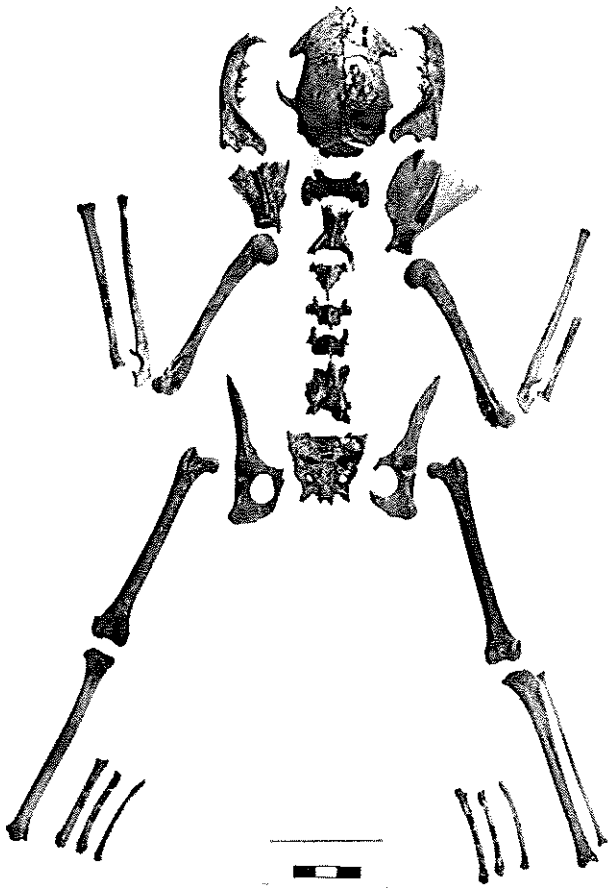


Plate 35. Period 2. Cat skeleton.
This specimen has cut marks on the skull.

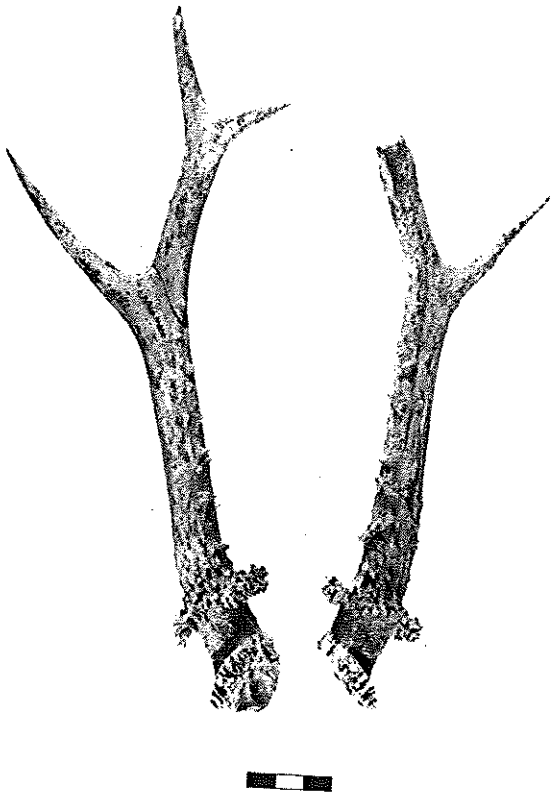


Plate 36. Period 1. Roe deer antlers.

Plate 37. Period 6. Red/fallow deer antler.
Sawn tine.

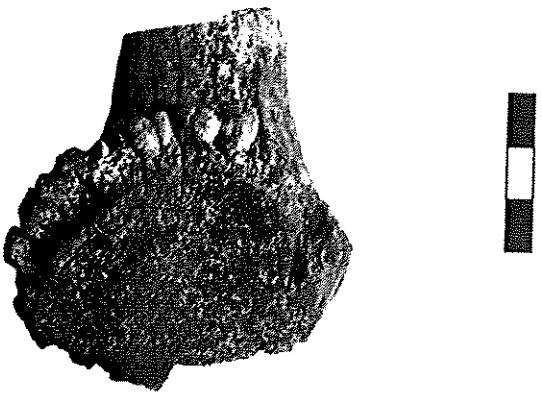


Plate 38. Period 4. Red deer antler.
Shed antler. Sawn. Small find n.964.

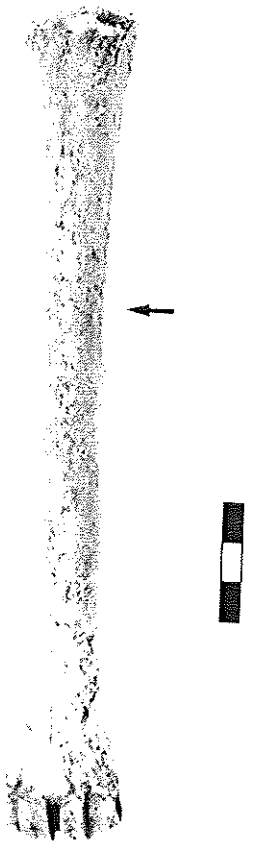


Plate 39. Period 1. Fallow deer metatarsus.
Cut marks on shaft.

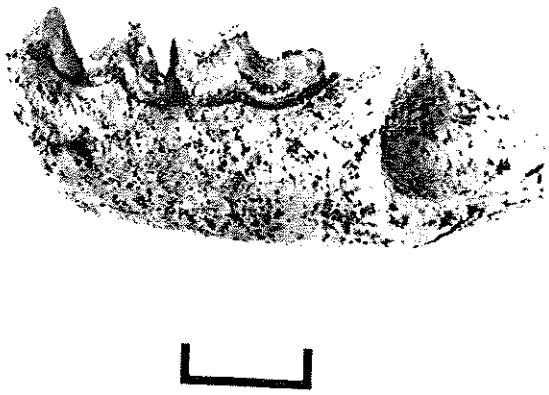


Plate 40. Period 3. Badger mandible.

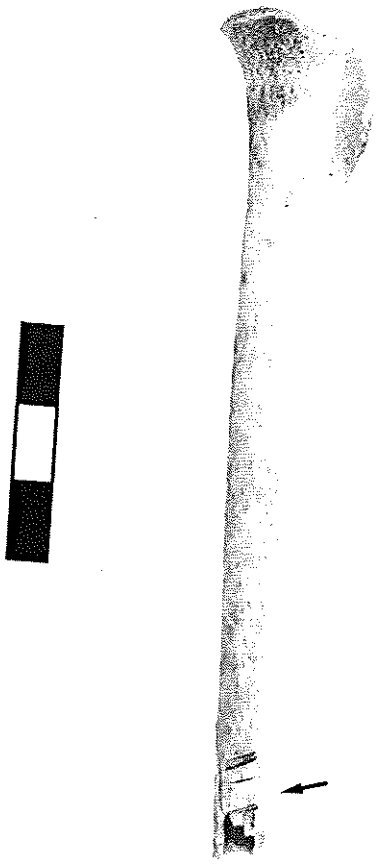


Plate 41. Period 5. Hare tibia.
Chopping marks.

Plate 42. Period 4. Domestic fowl tibiotarsus.
Large exostoses.

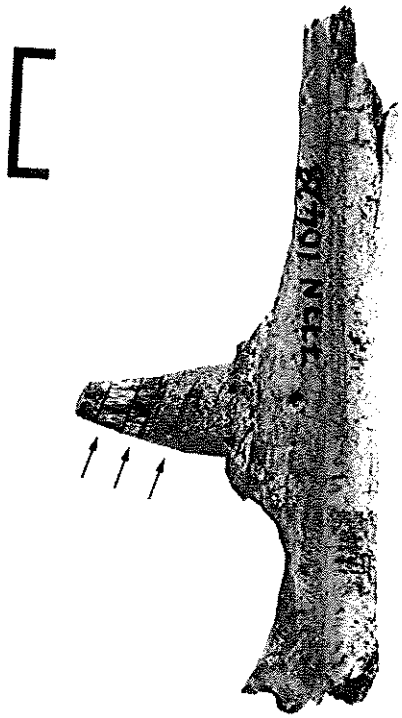


Plate 43. Period 1. Domestic fowl tarsometatarsus.
Cut marks on spur.

Plate 44. Period 5. Little grebe humerus.
Cut marks.

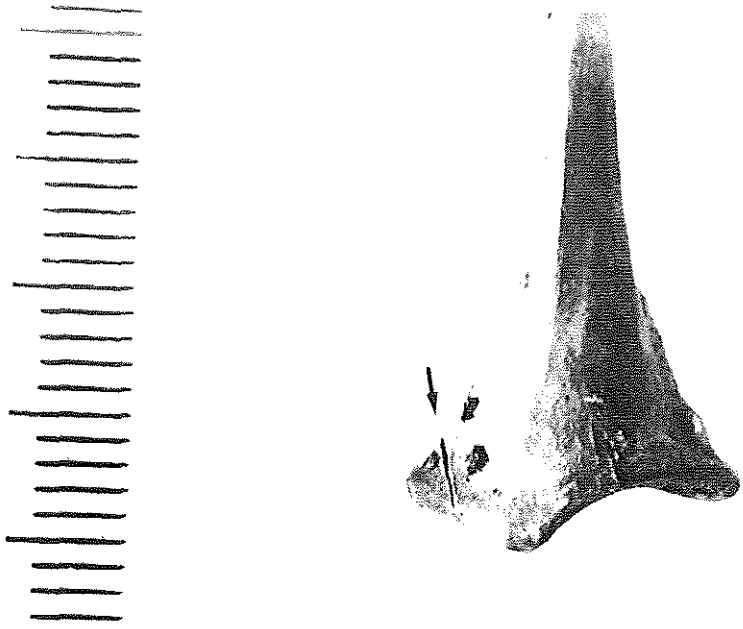


Plate 45. Period 4. Grey partridge coracoid. Cut marks.

. Period 1. Goshawk partial skeleton.

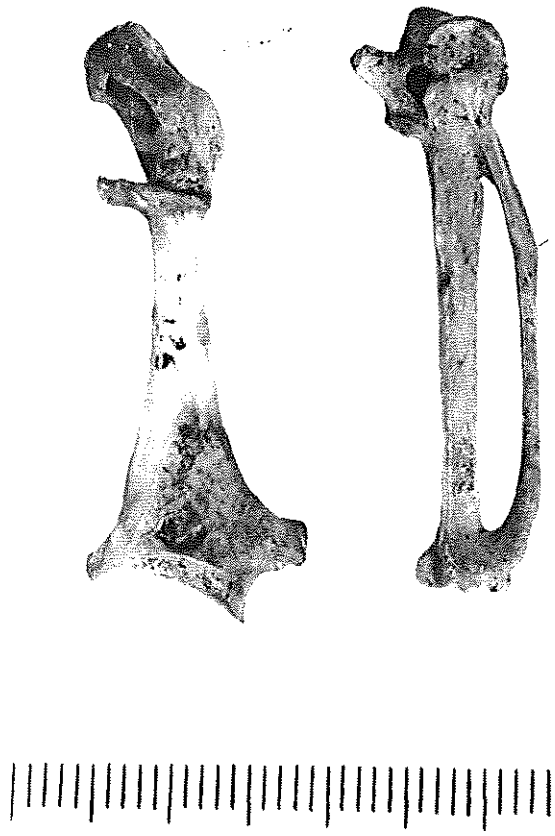


Plate 47. Period 6. Parrot coracoid and carpometacarpus.

Appendix 1.

Castle Mall. **Mandibular wear stages** for the main species.

Tooth wear stages for cattle and pig follow Grant (1982) and for sheep/goat follow Payne (1973 & 1987). Mandibular wear stages for cattle and pig follow O'Connor (1988), for sheep/goat follow Payne (1973). Only mandibles with two or more teeth (with recordable wear stage) in the dP_4/P_4 - M_3 row are given. "P" = tooth present, but wear stage not recordable.

TAX	= TAXA:	Mandibular wear stage:		
B	= cattle	Cattle & Pig:	J	= Juvenile
OVA	= sheep		I	= Immature
CAH	= goat		SA	= Subadult
O	= sheep/goat		A	= Adult
S	= pig		E	= Elderly
PER	= period	Sheep/Goat:	B	=c. 2-6 months
			C	=c. 6-12 months
SUBP	= sub-period		D	=c.1-2 years
			E	=c. 2-3 years
CO	= context		F	=c. 3-4 years
			G	=c. 4-6 years
SIE	= method of collection		H	=c. 6-8 years
			I	=c. 8-10 years
HC	= hand collected			
SRS	= "SRS" sieved			
BS	= "BS" sieved			

Periods (PER) and subperiods (SUBP) are coded as follows:

PER 1 late 9th - 11th centuries
- SUBP 2 late 9th - early 11th centuries
- SUBP 3 11th century
- SUBP 4 late 11th century

PER 2 late 11th - early 12th centuries
- SUBP 1 late 11th - early 12th centuries
- SUBP 2 late 11th - early 12th centuries
- SUBP 3 late 11th - early 12th centuries

PER 3 late 11th - 12th centuries
- SUBP 1 late 11th - early 12th centuries
- SUBP 2 12th century

PER 4 late 12th - mid 14th centuries
- SUBP 1 late 12th - 13th century
- SUBP 2 13th - mid 14th century

PER 5 mid/late 14th - mid 16th centuries
- SUBP 1 mid/late 14th - 15th centuries
- SUBP 2 15th - mid 16th century

PER 6 late 16th - 18th centuries
- SUBP 1 late 16th - mid 17th century
- SUBP 2 mid 17th - early 18th century
- SUBP 3 18th century

TAX	PER	SUB	CO	SIE	P4	DP4	M1	M2	M3	Mandibular stage
B	1	2	47871	HC		d	a			J
B	1	2	80579	BS		f	H	C		J
B	1	3	22133	HC		k	g	a		I
B	1	3	60091	HC		j	g	H		I
B	1	3	20219	HC		l	h	f	E H	S
B	1	3	80527	HC		k	g	f	E H	S
B	1	4	40354	HC			f	f		S
B	1	3	21003	HC		k	g			S/A
B	1	4	47751	HC		l	g	f		S/A
B	1	2	22067	HC	c		k	k	f	A
B	1	2	47871	HC	e		k	g		A
B	1	2	80547	HC	e		k	j	g	A
B	1	2	80604	HC	E		g	f	g	A
B	1	3	20219	HC	d		k	g	f	A
B	1	3	22155	HC	E		h	g	f	A
B	1	3	60005	HC			k	g	f	A
B	1	3	90353	HC	f		k	j	g	A
B	1	3	90638	HC	e		k	g		A
B	1	4	22106	HC	f		k	j	g	A
B	1	2	22211	HC	f		k	k		A/E
B	1	2	90321	HC	g		l			A/E
B	1	3	40184	SRS	f		k			A/E
B	1	3	90354	SRS	f		k			A/E
B	1	4	47090	HC	g		l			A/E
B	1	4	49192	HC	f		m	l		A/E
B	1	2	46285	HC	h		l	k	k	E
B	1	2	50089	HC	f		l		k	E
B	1	2	80604	HC	g		m	l		E
B	1	3	60003	HC			o	m	E	E
B	1	3	60091	HC			l	k	E	E
B	1	3	60416	HC				l	k	E
B	1	3	90041	HC				l	l	E
B	1	4	40354	HC			o	l	l	E
B	1	4	47751	HC			n	l	l	E
B	2		22309	HC		j	g	b	C	S
B	2		91042	HC		k	g	c	C	S
B	2	1	70088	HC		j	g	d	C	S
B	2	1	80471	HC		k	g	f	E	S
B	2	1	20060	HC		j	g			S/A
B	2	1	80518	HC		j	g			S/A
B	2	1	80672	HC		j	g			S/A
B	2	2	60342	HC		l	g	f		S/A
B	2	1	20060	HC			k		g	A
B	2	1	20060	HC			l	k	g	A
B	2	1	20168	HC	c		k	j	g	A
B	2	1	70088	HC	E		k	g	d	A
B	2	1	80078	HC	g		l	k	g	A
B	2	1	80471	HC	f		k	g	g	A
B	2	1	80471	HC	g		o	m	g	A
B	2	2	47992	HC	b		j	g	f	A
B	2	2	70019	HC	g		l	k	g	A
B	2	1	20081	HC	h		m	l		A/E
B	2	1	40182	HC	h			k		A/E
B	2	3	20151	HC	g			l		A/E
B	2	1	20016	HC	g		m	l	E	E
B	2	1	20064	HC	h		l	k	E	E
B	2	1	20081	HC	g		l	k	E	E
B	2	1	20168	HC	h		o		E	E
B	2	1	40206	HC	g			k	E	E
B	2	1	80471	HC	g		n	m	E	E
B	2	1	80471	HC	j				E	E
B	2	1	80518	HC			l	l	E	E
B	2	1	90376	HC				k	E	E
B	3	1	70074	HC		V	g	f	E	S
B	3	1	80151	HC			j	f	E	A
B	3	1	80503	HC		k	k	g	E	A
B	3	1	80503	HC	E		k	g	E	A
B	3	2	10671	HC			l	g	E	A
B	3	1	80203	BS	f		n	k	E	E
B	3	1	80503	HC	h		l	k	E	E
B	3	1	80503	HC	h		l	k	E	E
B	4	2	10468	HC	P		P			
B	4	2	10468	HC			g	g		S/A
B	4	2	10121	HC				j	E	A
B	4	2	10468	HC		k	k			A/E
B	4	2	11451	HC	h		l			A/E
B	4	1	80268	HC	g		l	k		A/E
B	4	2	10468	HC				o	E	E
B	4	2	10468	HC	h		o			E
B	4	2	45177	HC				m	l	E
B	5	1	13565	HC		c	V			J
B	5	1	13211	HC		d	V			J
B	5	2	81211	HC		c	V			J
B	5	1	91434	HC		c	V			J
B	5	1	91585	HC		b	E			J
B	5	2	91683	HC		b	V			J
B	5	2	91683	HC		b	V			J
B	5	2	91683	HC		c	V			J
B	5	2	91119	HC				m	l	S
B	5	1	91847	HC	E		h			S/A

TAX	PER	SUB	CO	SIE	P4	DP4	M1	M2	M3	Mandibular stage
B	5	1	90585	HC		k	g			S/A
B	5	2	10050	HC				g	d	A
B	5	2	10085	HC				j	g	A
B	5	1	10524	HC	c		k	g		A
B	5	1	11089	HC	d		k	j	g	A
B	5	2	90171	HC			j	g		A
B	5	1	90471	BS		l	j	g		A
B	5	2	90510	HC	c		k	j		A
B	5	2	90655	HC			l	k	g	A
B	5	2	92716	HC			h	g	b	A
B	5	2	92716	HC			h	g	d	A
B	5	2	92716	HC	C		k	j		A
B	5	2	11058	HC			l	k		A/E
B	5	2	90319	HC	c		k			A/E
B	5	1	90585	HC	e		k			A/E
B	5	2	80044	HC	g			k	k	E
B	5	2	80445	HC	j		l	l	k	E
B	5	2	92716	HC				l	j	E
B	6	1	91527	SR	f		P			
B	6	3	10003	HC		c	V			J
B	6	3	10100	HC		b	V			J
B	6	1	10850	HC		d	E			J
B	6	1	80137	HC		b	E			J
B	6	2	80196	HC		b	V			J
B	6	1	91527	SR		d	V			J
B	6	2	92750	HC		d	E			J
B	6	1	92758	HC		c	E			J
B	6	1	92761	HC		b	E			J
B	6	1	92761	HC		c	E			J
B	6	2	92762	HC		c	E			J
B	6	1	92764	HC		c	E			J
B	6	1	92766	HC		b	E			J
B	6	1	92766	HC		b	E			J
B	6	1	92776	HC		c	E			J
B	6	2	92750	HC		j	f			I/S
B	6	1	40476	HC		j	j	f		S/A
B	6	2	92750	HC		j	g			S/A
B	6	2	92750	HC	E	j	g			S/A
B	6	1	92758	HC		k	g	f		S/A
B	6	3	10002	HC		l	j			A
B	6	1	13013	HC	e		k	j		A
B	6	3	40912	HC				g	g	A
B	6	3	48001	HC				g	d	A
B	6	3	48001	HC	f		k	j		A
B	6	1	50077	HC				g	d	A
B	6	1	50077	HC	h		l	l	g	A
B	6	1	50077	HC	h		m	m	g	A
B	6	2	91325	SR	b		k	j		A
B	6	1	92741	HC	b		j	g		A
B	6	2	92750	HC	b		k	g		A
B	6	2	92750	HC	H		j	g		A
B	6	1	92758	HC	b		h	g	f	A
B	6	1	92758	HC	d		j	g		A
B	6	1	92758	HC	f		k	j		A
B	6	1	92761	HC	c		j	g		A
B	6	1	92761	HC	c		k	j	f	A
B	6	1	92761	HC	d		k		f	A
B	6	1	92761	HC	H			g	b	A
B	6	1	92764	HC	d		k	h	g	A
B	6	1	92765	HC			j	g		A
B	6	1	92766	HC	c		k	g	f	A
B	6	1	92766	HC	c		k	j		A
B	6	1	92766	HC	e		k	k	g	A
B	6	1	92766	HC	H		j	g		A
B	6	1	92767	HC	H		k	h		A
B	6	1	92768	HC			k	g	f	A
B	6	1	92768	HC	b		k			A
B	6	1	92768	HC	e			h	g	A
B	6	1	92769	HC	H		k	g		A
B	6	1	92770	HC	d		k	h	f	A
B	6	1	10951	HC	f		k			A/E
B	6	1	60499	HC	h		k			A/E
B	6	2	80186	HC	f		m	l		A/E
B	6	2	92739	HC		k	k			A/E
B	6	2	92739	HC	g		l			A/E
B	6	1	92741	HC	d		k			A/E
B	6	1	92758	HC	c		j	j		A/E
B	6	1	92761	HC			k	k		A/E
B	6	1	92761	HC	e		k			A/E
B	6	1	92761	HC	g		l	k		A/E
B	6	1	92761	HC	j		m			A/E
B	6	1	92765	HC			k	k		A/E
B	6	1	92766	HC	f		k			A/E
B	6	1	92766	HC	f		k	k		A/E
B	6	1	92770	HC	f		k	k		A/E
B	6	1	13013	HC	h		l	l	l	E
B	6	3	48001	HC				m	m	E
B	6	3	48001	HC	h		l	l	k	E
B	6	1	92740	HC	h		n			E
B	6	2	92750	HC				m	l	E
B	6	2	92750	HC			p	m	l	E
B	6	1	92766	HC			l	l	k	E

TAX	PER	SUBP	CO	SIE	P4	DP4	M1	M2	M3	Mandibular stage
CAH	1	2	22023	HC		13L	V			B
CAH	1	2	22023	HC		13L	V			B
O	1	2	90349	BS		13L	H			B
OVA	1	2	91980	BS		12L	E			B
O	1	4	49192	HC		13L	V			B
O	1	3	40178	HC			8A	4A		C
O	1	3	40184	HC		13L	5A			C
OVA	1	2	80604	HC		22L	9A	7A	C	D
OVA	1	3	46624	SRS		16L	9A	2A		D
O	1	3	47805	HC		23L	9A	7A	V	D
O	1	3	60041	HC		23L	9A	6A		D
O	1	3	60068	HC				8A	V	D
O	1	3	80539	BS			7A	4A	C	D
O	1	4	40354	HC		22L	9A	7A		D
OVA	1	4	49192	SRS		16L	9A	4A	C	D
O	1	2	90349	HC			9A	7A		D/E
O	1	3	20219	HC			9A	7A		D/E
O	1	2	22334	HC	4B		9A	8A	2A	E
O	1	2	47871	HC	1B		9A	9A	2A	E
O	1	2	80547	HC	8A		9A	8A	4A	E
O	1	2	80676	HC	6S		9A	9A	4A	E
O	1	2	80733	HC	6S		9A	9A	4A	E
O	1	3	20139	HC	8A		9A	7A		E
O	1	3	20219	HC	9A		9A	9A	7A	E
O	1	3	90354	SRS	4A		9A	8A	4A	E
O	1	4	21105	BS				9A	8G	E
O	1	4	22106	HC	7S		9A	8B	4A	E
O	1	4	22106	HC	9A		10A	9A	8G	E
O	1	4	22106	HC	H		9A	7A	4A	E
O	1	4	40047	HC	7S		9A	9A	2A	E
O	1	4	49192	HC	9A		9A	9A	8A	E
O	1	2	80613	HC	8A		9A			E/F
O	1	3	80539	HC	8A		9A			E/F
O	1	3	91828	HC	9A		9A	9A		E/F
O	1	2	50089	HC	8A		10A			F
O	1	4	22106	HC			9A	9A	9G	F
O	1	4	22106	HC	9A		9A	9A	10G	F
O	1	4	47751	HC	9A		9A	9A	9H	F
O	1	3	90540	HC	9A		10A			F/G
O	1	4	21105	BS	12S		12A	P		F/G
O	1	2	40116	HC				9A	11G	G
O	1	2	47871	HC	12S		11A	9A	11G	G
O	1	2	90321	HC	12S		10A	9A	11G	G
O	1	3	40023	HC	9A		12A	9A	11G	G
O	1	4	22106	HC	8B		10A	9A	11G	G
O	1	4	22106	HC	9A		10A	9A	11G	G
O	1	4	47751	HC	9A		12A	9A	11G	G
O	1	2	90349	HC			15A	11A	11G	H
O	1	4	50007	HC	14S		15A	11B	11G	H
OVA	2	1	11105	HC		9L	V			B
O	2	1	20060	HC		4A	V			B
OVA	2	2	60342	HC		13L	2A			C
OVA	2	3	49245	SRS		14L	2A	C		C
O	2	1	70088	HC			9A	7A	V	D
O	2	1	80471	HC			9A	5A		D
O	2	1	20056	HC			9A	7A		D/E
O	2	1	20081	HC			9A	7A		D/E
O	2	1	70088	HC				9A	7G	E
O	2	1	90385	SRS	8A		8A	9A	7A	E
O	2	2	80310	SRS			9A	8A	4A	E
O	2	3	20163	HC	9A		9A	9A	6A	E
O	2	1	20011	HC	2C		10A	8A		E/F/G
O	2	2	20044	HC	8B		11B	9A		F
O	2	2	20164	HC				9A	10G	F
O	2	3	20136	HC			10A	9A		F/G
O	2	1	20060	HC	8B		10A	9A	11G	G
O	2	2	80310	SRS			15A	9A	11G	G
O	2	3	49141	HC	12S		15A	9A		G
O	2	3	49245	HC	7S		10A	9A		G
O	3	1	70115	HC			9A	7A	V	D
O	3	2	80333	SRS		23L	9A			D
O	3	1	80063	BS	8A		9A	9A	5A	E
O	3	2	11125	HC	3C		10A	9A	7A	E
O	3	1	20135	HC	8A		9A			E/F
O	3	1	11649	HC	12S		14A	9A	11G	G
O	3	2	10930	HC		P	14A	9A	17L	I
O	4	1	80244	BS		0	V			A
O	4	2	10296	HC			10A	4A	C	D
O	4	2	10468	HC		16A	9A	7A	H	D
O	4	2	10468	HC		23L	9A	6A		D
OVA	4	2	11360	HC		21M	9A	6A		D
O	4	1	92445	HC	H		9A	7A	V	D
O	4	2	10468	HC			9A	7A	6A	E
O	4	1	92478	HC	8A		9A	9A	8G	E
O	4	2	10118	HC	9A		9A	9A		E/F
O	4	2	10296	HC	7S		9A	9A		E/F
O	4	2	10468	HC	9A		9A			E/F
O	4	2	10468	HC	4A		9A	9A	9G	F
O	4	2	10468	HC	11S		12A	9A	11G	G
O	4	2	10468	HC	12S		12A	9A	11G	G
O	4	2	10468	HC	9A		12A	9A	11G	G

TAX	PER	SUBP	CO	SIE	P4	DP4	M1	M2	M3	Mandibular stage
O	4	2	10468	HC	9A		12A	9A	11G	G
O	4	1	13059	HC	9A		10A	9A	11G	G
O	4	1	92449	HC	11S		11A	9A	11G	G
O	4	2	10534	HC	12S		15A			G/H/I
O	4	2	10468	HC	11S		15A	12A	11G	H
O	4	1	11410	HC	12S				11G	H
O	4	1	11140	HC	14S		15A	14A	14G	I
OVA	5	2	11030	HC		13L	E	C		B
O	5	2	11030	HC		13L	V			B
OVA	5	2	92679	HC		13L	2A	C		C
O	5	2	10085	HC		23L	9A	7A	C	D
OVA	5	1	10874	HC		23L	9A	8A		D/E
O	5	1	10094	SRS	8A		12A	9A	4A	E
O	5	1	10893	HC				9A	6A	E
O	5	2	80016	HC	7S		9A	9A	8G	E
O	5	1	90434	HC	8A		9A	9A	6A	E
O	5	1	90434	HC	8A		9A	9A	6A	E
O	5	1	90471	SRS	8A		9A	9A	5A	E
O	5	1	90567	HC	7T		9A	9A	8G	E
O	5	1	90567	HC	8B		9A	9A	8G	E
O	5	1	90585	HC	8A		9A.	9A	5A	E
O	5	2	90683	HC	7T		9A	9A	2A	E
O	5	1	90434	HC			9A	9A	P	E/F
O	5	2	92716	HC	12S		9A	9A		E/F/G
O	5	2	80195	HC	9A		9A	9A	10G	F
O	5	2	90390	HC	9A		9A	9A	10G	F
O	5	1	90533	HC	9A		10A	9A	9G	F
O	5	1	90567	HC	12S		11B	9A	10G	F
O	5	2	90683	HC			11A		10H	F
O	5	2	90702	HC	8A		9A	9A	9G	F
O	5	2	92716	HC				9A	9J	F
O	5	2	11058	HC	9A		11B	9A		F/G
O	5	2	90319	HC	9A		12A			F/G
O	5	2	10050	HC				9A	11G	G
O	5	1	10524	HC	11S		14A	9A	11G	G
O	5	2	11597	HC	9A		15A	9A	11G	G
O	5	2	90031	HC	12S		14A	9A	11G	G
O	5	2	90123	BS		9A	11A	9A	11G	G
O	5	2	90320	HC	9A		10A	9A	11G	G
O	5	2	90474	SRS				9A	11A	G
O	5	2	90702	HC	12S		14A	9A	11G	G
O	5	2	92716	HC	12S		13A	9A	11G	G
O	5	2	80195	HC			15A	10A	11G	H
O	5	1	90567	HC	12S		15A	11B	11A	H
O	5	2	90702	HC	15A			12A	11G	H
O	5	2	10050	HC			15A	15A	13H	I
OVA	6	1	50077	HC		13L	E			B
OVA	6	1	92758	HC		13L	H			B
OVA	6	3	10100	HC		14L	2A			C
OVA	6	2	92750	HC		13L	2A			C
OVA	6	1	92766	HC		14L	2A	C		C
O	6	1	10123	HC			9A	7A	V	D
O	6	1	60611	HC			9A	6A		D
O	6	2	92739	HC			9A	6A	C	D
OVA	6	1	92768	HC		17L	9A	4A	C	D
O	6	1	92766	HC	0		9A	7A		D/E
O	6	1	10521	HC				8A	3B	E
O	6	1	13014	HC	1B			7A	5G	E
O	6	1	13014	HC	1B		9A	7A	5A	E
O	6	1	13014	HC	5U		9A	8A	6G	E
O	6	1	45217	HC				9A	1A	E
O	6	2	91325	HC	7A		9A	7A	4A	E
O	6	1	91608	SRS	2C		9A	9A	7A	E
O	6	1	91732	HC	9A		9A	9A	8G	E
O	6	2	92739	HC	9A		9A	9A	8G	E
O	6	1	92741	HC				9A	8G	E
O	6	1	92741	HC			9A	7A	1A	E
O	6	1	92768	HC			9A	7A	4A	E
O	6	1	92768	HC	7A		9A	8A	8G	E
O	6	1	92768	HC	7A		9A	9A	5G	E
O	6	1	92774	HC	12S		10A	9A	8G	E
O	6	1	92776	HC	7A		9A	8A	4A	E
O	6	1	10850	HC	8A		9A			E/F
O	6	1	91451	SRS	5A		9A	9A		E/F
O	6	2	92739	HC	9A		9A			E/F
O	6	2	92739	HC	9A		9A	9A		E/F
O	6	1	92758	HC	9A		9A	9A		E/F
O	6	1	92761	HC	9A		9A	9A	P	E/F
O	6	1	10521	HC			14A	9A	10G	F
O	6	1	91438	SRS	11S		9A	9A	9G	F
O	6	1	91438	SRS	9A		9A	9A	9H	F
O	6	2	92750	HC	7A		9A	9A	9G	F
O	6	1	92758	HC	8A		9A	9A	9G	F
O	6	1	92761	HC	8A		9A	9A	9G	F
O	6	1	92761	HC	9A		9A	9A	9G	F
O	6	1	92766	HC	9A		10A	9A	9G	F
O	6	1	92768	HC	7A		10A	9A	10G	F
O	6	1	92776	HC	P		P	9A	10G	P
O	6	1	10149	HC	9A		10A			F/G
O	6	1	10149	HC	9A		10A	9A		F/G
O	6	2	92750	HC	12S		10A	9A		F/G
O	6	1	92741	HC	14S		14A			F/G/H
O	6	3	10002	HC	8B		10A	9A	11G	G
O	6	3	10002	HC			11B	9A	11G	G

TAX	PER	SUBP	CO	SIE	P4	DP4	M1	M2	M3	Mandibular stage
O	6	3	10003	HC	9A		11B	9A	11G	G
O	6	3	10058	HC			15A	9A	11G	G
O	6	3	40345	HC			14A	9A	11G	G
O	6	3	48001	HC	11S		12A	9A	11G	G
O	6	1	50082	HC	12S		12A	9A	11G	G
O	6	1	60499	HC	12S		15A	9A	11G	G
O	6	1	8013	HC	P		10A	9A	11G	G
O	6	1	91438	SRS			13H	9A	11G	G
O	6	1	91438	SRS	9A		10A	9A	11G	G
O	6	1	9152	SRS	12S		11B	9A	11G	G
O	6	2	92739	HC	12S		12A	9A	11G	G
O	6	2	92739	HC	14S		12A	9A	11G	G
O	6	2	92750	HC	9A		12A	9A	11G	G
O	6	2	92750	HC	9A		12A	9A	11G	G
O	6	1	92753	HC	12S		10A	9A	10G	G
O	6	1	92758	HC	11S		10A	9A	11G	G
O	6	1	92758	HC	12S		14A	9A	10G	G
O	6	1	92758	HC	9A			9A	11G	G
O	6	1	92761	HC	9A		11A	9A	11G	G
O	6	1	92764	HC			9A	9A	11G	G
O	6	1	92765	HC	12S		15A	9A	11G	G
O	6	1	92766	HC			10A	9A	11G	G
O	6	1	92770	HC	11S		11A	9A	11G	G
O	6	1	92774	HC	12S		11A	9A	11G	G
O	6	1	92775	HC	12S		12A	9A	11G	G
O	6	1	91732	HC			15A	13A		H/I
O	6	1	10521	HC	15A		16A	15A	16H	I

TAX	PER	SUB	CO	SIE	P4	DP4	M1	M2	M3	Mandibular stage
S	1	2	80604	HC			f	a		J
S	1	4	47661	HC		f	a	C		J
S	1	4	50007	HC		e	a			J
S	1	3	20146	HC	E		e	a	C	I
S	1	3	60091	HC			d	a		I
S	1	3	90041	HC			e	H	V	I
S	1	3	90041	HC		l	b	H	C	I
S	1	4	40047	HC		k	e	a	C	I
S	1	4	40047	HC		m		a	C	I
S	1	4	40354	HC			d	V	C	I
S	1	4	47751	HC				a	V	I
S	1	4	50027	HC		l	e	a		I
S	1	2	80604	BS	m		d			I/S
S	1	4	46176	HC	b		g			I/S/A
S	1	2	40079	HC	b			e	a	S
S	1	2	40319	HC	b			c	V	S
S	1	2	80545	BS	a		e	b		S
S	1	2	80613	HC				e	a	S
S	1	2	91073	HC			h	e	a	S
S	1	3	20172	HC	b		e	c		S
S	1	3	46416	HC	b		g	d	a	S
S	1	3	46624	SRS	b		e	d	V	S
S	1	3	80527	HC				e	a	S
S	1	4	21105	BS	c		j	e	a	S
S	1	4	40002	HC	a		e	b	C	S
S	1	4	47090	HC				c	a	S
S	1	4	49292	HC				b	C	S
S	1	4	49292	HC	a		f	b		S
S	1	4	49292	HC	b		g	d	V	S
S	1	4	50093	HC	e		g	c		S/A
S	1	2	46285	HC	d		g	e	b	A
S	1	3	12602	SRS				g	c	A
S	1	3	22133	HC	e		h	e	b	A
S	1	3	90176	HC	d				d	A
S	1	4	40002	HC				e	c	A
S	1	2	80609	HC				j	h	E
S	1	3	21052	HC	f		m	m	h	E
S	2		91076	HC		h	a			J
S	2	1	20081	HC		h	c	V		J
S	2	3	20136	HC		e	a	C		J
S	2	1	22040	HC			d	V	C	I
S	2	1	22040	SRS			d	a		I
S	2	1	22151	HC		l	e	a		I
S	2	1	40250	HC		j	a			I
S	2	1	40262	HC		l	e	H		I
S	2	2	70019	SRS		e	b			I
S	2	2	80470	HC	P		e	a		I
S	2	3	20156	HC		m	e	E		I
S	2	3	49141	HC				a	V	I
S	2	1	40210	HC	V		c			I/S
S	2	1	80672	HC		m	e			I/S
S	2	1	80672	HC		m	e			I/S
S	2	3	49245	HC	a		e			I/S
S	2	3	49245	HC	b		g			I/S/A
S	2	1	20011	HC	b		g	d	H	S
S	2	1	20060	HC				e	H	S
S	2	1	22012	HC				c	C	S
S	2	1	22012	HC	b		g	b	C	S
S	2	1	22066	HC	a		g	c	C	S
S	2	1	80672	HC	a		h	c	V	S
S	2	1	90376	HC	e		h	e	a	S
S	2	2	70026	HC	a		e	c	V	S
S	2	3	40192	HC	b			e	a	S
S	2	3	40192	HC	b		l	f	a	S
S	2	3	49141	HC	a		f	c	V	S
S	2	3	49141	HC	b		h	e	a	S
S	2	3	49245	HC	b		g	b	V	S
S	2	3	49245	HC	c		h	e		S
S	2	3	49245	HC	d		m	f	E	S
S	2	1	20060	HC	P		f			S/A
S	2	3	49141	HC	b		j			S/A
S	2	1	20060	HC				e	b	A
S	2	1	20060	HC	f		m	j	d	A
S	3	2	11198	HC	a		C			J
S	3	1	20116	hc	H		e	a	C	I
S	3	1	80065	HC		m	e	a		I
S	3	1	70008	HC	a		e	d		S
S	3	2	49216	HC	b		h		V	S
S	3	1	20135	HC	b		k	f		S/A
S	3	2	11125	BS				f	b	A
S	4	2	10296	HC		d	H			J
S	4	2	10751	HC		e	a	C		J
S	4	1	49231	SRS			e	a		I
S	4	1	91812	HC		g	c	E	C	I
S	4	2	10118	HC		j	d			S
S	4	2	10468	HC			j	e	V	S
S	4	1	13165	HC				e	a	S
S	4	1	92111	HC			f	c		S
S	4	2	10468	HC	f		m			A/E
S	5	2	92716	HC		a	V			J
S	5	1	10469	HC			d	a	V	I
S	5	1	49197	HC		f	b	C		I

TAX	PER	SUB	CO	SIE	P4	DP4	M1	M2	M3	Mandibular stage
S	5	2	90123	SRS		l	e	a	C	I
S	5	2	90216	HC		k	c	V		I
S	5	1	90567	HC				a	E	I
S	5	2	90655	HC	a		e	a	V	I
S	5	2	92716	HC	E		e	a		I
S	5	2	90384	HC	m		e			I/S
S	5	2	10085	HC			f	c	V	S
S	5	2	10628	HC				b	V	S
S	5	2	90171	HC	d		l	f	a	S
S	5	1	90765	SRS			h	c	V	S
S	5	2	80210	HC	c		h	f	b	A
S	5	2	92716	HC				g	b	A
S	6	3	10002	HC		e	a	C		J
S	6	1	10521	HC		k	a	V		J
S	6	2	11072	HC		a	C			J
S	6	2	80196	HC		f	a	C		J
S	6	1	92761	HC			f	a	C	J
S	6	1	92764	HC		d	a			J
S	6	1	10522	HC	H		e	a		I
S	6	1	10747	HC				a	C	I
S	6	1	13014	HC		l	e	a		I
S	6	3	40891	HC		f	c	C		I
S	6	3	40898	HC		j	b	C		I
S	6	1	80110	HC		m	e	a		I
S	6	2	80196	HC		m	e	a	C	I
S	6	1	91438	SRS			b	a	E	I
S	6	1	92741	HC				a	C	I
S	6	2	92750	HC				a	V	I
S	6	1	92758	HC	a			a		I
S	6	1	92758	HC	a		e	a	V	I
S	6	1	92758	HC	a		e	a	V	I
S	6	1	92765	HC	E		d			I
S	6	1	92766	HC			d	E		I
S	6	1	92768	HC	b		e	a	C	I
S	6	1	92776	HC			d	a	V	I
S	6	1	92776	HC		e	c	V	C	I
S	6	1	92776	HC		k	c	E		I
S	6	1	92776	HC		l	b	E		I
S	6	1	92776	HC		m	d	E		I
S	6	1	92778	HC		l	e	a		I
S	6	2	80186	HC	E		e			I/S
S	6	2	11363	HC	b		g	d	V	S
S	6	2	13003	HC	a		e	b	C	S
S	6	3	40911	HC			e	b	V	S
S	6	2	80186	HC	b		e	b	E	S
S	6	1	91608	SRS	d		k	e	a	S
S	6	1	92761	HC	b		f	c	E	S
S	6	1	92766	HC	b		f	d	H	S
S	6	1	92776	HC	a		e	b	E	S
S	6	1	92776	HC	a		g	d	E	S
S	6	1	12758	HC	c		j	g	g	A

Appendix 2.

Castle Mall. Measurements of animal bones and teeth, arranged by taxon, part of skeleton and period. All measurements are in tenths of a millimetre. See text for an explanation of how measurements are taken. Measurements are given in the following order: horncores, teeth, postcranial bones.

Key:

Taxa (TAX) are coded as follows:

B	*Bos* (cattle)
OVA	*Ovis* (sheep)
CAH	*Capra* (goat)
O	*Ovis/Capra* (sheep/goat)
S	*Sus* (pig)
EQ	*Equidae* (equid)
CAF	*Canis familiaris* (dog)
FEC	*Felis catus* (cat)
CEE	*Cervus elaphus* (red deer)
DAD	*Dama dama* (fallow deer)
CAC	*Capreolus capreolus* (roe deer)
MEM	*Meles meles* (badger)
LE	*Lepus* (hare)
ORC	*Oryctolagus cuniculus* (rabbit)
GAG	*Gallus gallus* (domestic fowl)
GNP	*Gallus/Numida/Phasianus* (domestic fowl/guinea fowl/pheasant)
GN	*Gallus/Numida*
GP	*Gallus/Phasianus*
ANS	*Anser* (goose)
ANA	*Anas* (duck)
MEG	*Meleagris gallapavo* (turkey)
TAR	*Tachybaptus ruficollis* (little grebe)
PHC	*Phalacrocorax carbo* (cormorant)
CYG	*Cygnus* (swan)
ACQ	*Anas crecca/querquedula* (teal/garganey)
BUB	*Buteo buteo* (buzzard)
ACG	*Accipter gentilis* (goshawk)
PEP	*Perdix perdix* (grey partridge)
FUA	*Fulica atra* (coot)
GAC	*Gallinula chloropus* (moorhen)
NUA	*Numenius arquata* (curlew)
GAN	*Gallinago gallinago* (snipe)
COL	*Columba* (pigeon/dove)
COF	*Corvus frugilegus/corone* (rook/crow)
COS	small corvid
TU	*Turdus* (turdid)

Parts of skeleton (ELEM) are coded as follows:

HC	horncore (antler in deer)
CO	coracoid
SC	scapula
HU	humerus
RA	radius
MC	metacarpal (carpometacarpus in birds)
PE	pelvis
FE	femur
TI	tibia (tibiotarsus in birds)
AS	astragalus
CA	calcaneum
MT	metatarsal (tarsometatarsus in birds)
MP	metapodial
P1	1st phalanx

PER period

SUBP subperiod

For the chronology of periods and subperiods see appendix 1

CO context

SIE method of collection:

HC	hand collected
SRS	"SRS" sieved
BS	"BS" sieved

Epiphysial fusion/age (FUS) is coded as follows:

F	fused
H	fused/fusing
G	fusing
UM	unfused diaphysis
UE	unfused epiphysis

Pig canines (SEX) are coded as follows:

AF	female alveolus
AM	male alveolus
F	female canine
M	male canine

The presence/absence of a spur on a bird tarsometatarsus is coded as follows:

A	absent
P	present
S	scar

Approximate measurements are designated:

c - within 0.2
e - within 0.5 mm

ELEM	TAX	PER	SUBP	CO	GL	W_{max}	$W_{1/2}$
HC	B	1	2	40265		576	415
HC	B	1	2	40305	e 1110	552	414
HC	B	1	2	50089		383	334
HC	B	1	2	80579	1700	647	
HC	B	1	2	80604	1132	404	347
HC	B	1	2	80604	1678	655	563
HC	B	1	2	80613		575	394
HC	B	1	2	80613	1308	c 418	c 333
HC	B	1	2	90349		379	312
HC	B	1	3	11143	c 1180	372	
HC	B	1	3	20172	1220	468	
HC	B	1	3	22286	998	381	326
HC	B	1	3	40024		417	329
HC	B	1	3	40178		555	376
HC	B	1	3	46416		391	
HC	B	1	3	46416		496	376
HC	B	1	3	90226	e 812	370	260
HC	B	1	3	90227		404	314
HC	B	1	3	90353		535	376
HC	B	1	3	90353		562	456
HC	B	1	4	11020	899	392	286
HC	B	1	4	11171	e 890	380	291
HC	B	1	4	22187		413	310
HC	B	1	4	40354	1208	487	357
HC	B	1	4	47008		430	346
HC	B	1	4	47090		476	385
HC	B	1	4	47751	1275	502	355
HC	B	1	4	50066		456	336
HC	B	2		91042	850	358	307
HC	B	2	1	20060		279	212
HC	B	2	1	20060		473	390
HC	B	2	1	20060		507	369
HC	B	2	1	20060		512	373
HC	B	2	1	20060	994	466	398
HC	B	2	1	20060	e 1206	531	384
HC	B	2	1	20060	e 1301	512	357
HC	B	2	1	20060	e 1446	463	377
HC	B	2	1	20081	c 1220	563	411
HC	B	2	1	20168		385	276
HC	B	2	1	20168	e 950	399	314
HC	B	2	1	22012		588	412
HC	B	2	1	22012		617	424
HC	B	2	1	22012	790	375	237
HC	B	2	1	22066		388	284
HC	B?	2	1	22314	845	e 292	279
HC	B	2	1	22314	e 1200	394	292
HC	B	2	1	40206	875	414	324
HC	B	2	1	80471		434	313
HC	B	2	1	80518	954	376	289
HC	B	2	3	20149	840	494	309
HC	B	2	3	20149	1264	498	338
HC	B	2	3	20151		488	363
HC	B	2	3	20151		592	427
HC	B	2	3	20151	822	473	313
HC	B	3	1	11644		298	349
HC	B	3	1	20003		675	496
HC	B	3	1	70008	e 1230	504	382
HC	B	3	1	80503		457	368
HC	B	3	2	10427		401	316
HC	B	3	2	11209		410	321
HC	B	3	2	80010	c 711	265	258
HC	B	4	1	11028	750	322	289
HC	B	4	1	11028	c 1105	481	
HC	B	4	1	13194	e 685		
HC	B	4	1	13208	1060		
HC	B	4	1	30036		545	417
HC	B	4	2	10118	855	381	297
HC	B	4	2	10591		501	339
HC	B	5	1	10565		473	349
HC	B	5	1	11781		399	303
HC	B	5	1	90808		578	c 381
HC	B	6	1	10521		298	237
HC	B	6	1	50077		c 590	430
HC	B	6	1	60477		378	292
HC	B	6	1	91731		664	617
HC	B	6	1	92741		451	365
HC	B	6	1	92741		472	415
HC	B	6	1	92741		495	432
HC	B	6	1	92741		539	428
HC	B	6	1	92741		541	
HC	B	6	1	92741		625	464
HC	B	6	1	92741		630	492
HC	B	6	1	92741		711	625
HC	B	6	1	92741		717	570
HC	B	6	1	92741		795	642
HC	B	6	1	92741		797	726
HC	B	6	1	92741	1751	516	414
HC	B	6	1	92741	2215	671	457
HC	B	6	1	92741	e 2572	646	510
HC	B	6	1	92758		484	
HC	B	6	1	92758		588	513
HC	B	6	1	92758		596	511
HC	B	6	1	92758		638	532
HC	B	6	1	92758		654	
HC	B	6	1	92758		666	571
HC	B	6	1	92758		679	542
HC	B	6	1	92758	1832	623	500
HC	B	6	1	92758		748	626
HC	B	6	1	92758	2143	593	471
HC	B	6	1	92758	2474	615	526
HC	B	6	1	92758	2705	569	487
HC	B	6	1	92758	2731	599	510
HC	B	6	1	92761		521	465
HC	B	6	1	92761		647	517
HC	B	6	1	92761		664	503
HC	B	6	1	92761		615	483
HC	B	6	1	92761		637	522
HC	B	6	1	92761		682	576
HC	B	6	1	92761		677	593
HC	B	6	1	92761		745	586
HC	B	6	1	92761		705	593
HC	B	7	1	92761		776	642
HC	B	7	1	92761		713	577
HC	B	7	1	92761		713	611

ELEM	TAX	PER	SUBP	CO	GL	W_{max}	W_{min}
HC	B	6	1	92761		801	696
HC	B	6	1	92761		814	708
HC	B	6	1	92761		c 789	681
HC	B	6	1	92761		c 790	681
HC	B	6	1	92761	1168	c 453	385
HC	B	6	1	92761	3094	821	747
HC	B	6	1	92764		703	617
HC	B	6	1	92764	1506	510	435
HC	B	6	1	92765		552	499
HC	B	6	1	92765		553	448
HC	B	6	1	92765	3150	775	639
HC	B	6	1	92775		726	626
HC	B	6	1	92775	e 3190	767	621
HC	B	6	2	80195	e 2200	826	697
HC	B	6	2	92739		501	417
HC	B	6	2	92748		675	
HC	B	6	2	92750			651
HC	B	6	2	92750		496	396
HC	B	6	2	92750		497	455
HC	B	6	2	92750		545	478
HC	B	6	2	92750		571	547
HC	B	6	2	92750		604	531
HC	B	6	2	92750		637	532
HC	B	6	2	92750		641	505
HC	B	6	2	92750		649	543
HC	B	6	2	92750		792	691
HC	B	6	2	92750	e 2350	815	657
HC	B	6	2	92754		771	719
HC	B	6	3	40912		575	476
HC	B	6	3	48001		556	456
HC	B	6	3	48001		699	621

TAX	PER	SUBP	CO	SIE	M3L	M3WA	
B	1	2	22067	HC	360	148	
B	1	2	40052	HC	343	134	
B	1	2	46285	HC	377	165	
B	1	2	50089	HC	359	140	
B	1	2	80547	HC	364	137	
B	1	2	80565	HC	339	133	
B	1	2	80602	HC	367	161	
B	1	2	80604	HC		120	
B	1	2	80604	HC	263	152	
B	1	2	80617	HC	341	140	
B	1	3	20219	HC	341	131	
B	1	3	22155	HC	332	134	
B	1	3	40074	HC	354	137	
B	1	3	60003	HC	361	162	
B	1	3	60091	HC		145	
B	1	3	60416	HC	363	142	
B	1	3	60478	HC	319	140	
B	1	3	90226	HC	303	136	
B	1	3	90227	HC	341	152	
B	1	3	90353	HC	334	135	
B	1	4	22106	HC	341	146	
B	1	4	40354	HC	350	152	
B	1	4	47751	HC	342	150	
B	1	4	47804	HC	323	142	
B	2	1	11391	HC	377	152	
B	2	1	20011	HC	321	142	
B	2	1	20016	HC	320	136	
B	2	1	20060	HC	310	163	
B	2	1	20060	HC	336	146	
B	2	1	20064	HC	319	142	
B	2	1	20081	HC	345	143	
B	2	1	20168	HC	313	123	
B	2	1	20168	HC	343	156	
B	2	1	40206	HC	324	140	
B	2	1	70080	HC	331	145	
B	2	1	70089	HC	323		
B	2	1	80078	HC	330	142	
B	2	1	80471	HC	346	120	(M3 abnormal wear)
B	2	1	80471	HC	348	117	
B	2	1	80471	HC	353	159	
B	2	1	80471	HC	388	154	
B	2	1	90376	HC	352	154	
B	2	2	47992	HC	309	118	
B	2	2	70019	HC	352	153	
B	2	3	20029	HC	355	150	
B	2	3	20148	HC	321	130	
B	2	3	20149	HC	336	128	
B	3	1	11643	HC	333	139	
B	3	1	40199	HC	334	129	
B	3	1	70110	HC		123	
B	3	1	80151	HC	352	135	
B	3	1	80203	BS	342	144	
B	3	1	80503	HC	317	130	
B	3	1	80503	HC	326	118	
B	3	1	80503	HC	349	145	
B	3	1	80503	HC	368	169	
B	3	1	80503	HC	368	169	
B	3	2	10671	HC	345	142	
B	4	1	13196	HC	344	140	
B	4	1	80265	SBS		132	
B	4	2	10121	HC	322	142	
B	4	2	10468	HC		143	
B	4	2	10468	HC	314	135	
B	4	2	10468	HC	340	146	
B	4	2	10468	HC	341	148	
B	4	2	10751	HC	323	132	
B	4	2	45170	HC	320	143	
B	4	2	80112	HC	328	156	
B	4	2	81496	BS	340	143	
B	5	1	10137	HC	342	152	
B	5	1	11089	HC	315	140	
B	5	1	80279	HC		138	(M3 3rd pillar absent)
B	5	2	10050	HC	350	157	
B	5	2	80044	HC	361	151	
B	5	2	80195	HC	322	145	
B	5	2	80445	HC	351	161	
B	5	2	90655	HC	335	134	
B		1	92716	HC	331	151	
B		2	92716	HC	339	144	

TAX	PKR	SUBP	CO	SIE	M3L	M3WA	
B	6	1	10502	HC	314	138	
B	6	1	13013	HC	382	169	
B	6	1	45092	HC	342	145	
B	6	1	50077	HC	347		
B	6	1	50077	HC	349	152	
B	6	1	50077	HC	355		
B	6	1	92741	HC		164	
B	6	1	92756	HC	371	176	
B	6	1	92758	HC		152	(M3 3rd pillar reduced)
B	6	1	92761	HC		132	
B	6	1	92761	HC	373	152	
B	6	1	92764	HC	332	149	
B	6	1	92766	HC		c 155	
B	6	1	92766	HC	397	175	
B	6	1	92766	HC	407	c 160	
B	6	1	92768	HC		165	
B	6	1	92768	HC	371	150	
B	6	1	92770	HC	368	168	
B	6	2	92750	HC		138	
B	6	2	92750	HC		158	
B	6	3	10002	HC	327	131	
B	6	3	40912	HC		129	
B	6	3	47347	HC	357	156	
B	6	3	48001	HC	337	152	
B	6	3	48001	HC	363	173	
B	6	3	48001	HC	366	140	

ELEM	TAX	PKR	SUBP	CO	SIE	FUS		BT	BTC
HU	B	1	2	80604	HC	F		759	331
HU	B	1	2	80609	HC	H			298
HU	B	1	2	90330	HC	F		739	
HU	B	1	3	12807	HC	F	e	748	340
HU	B	1	3	20077	HC	F		615	278
HU	B	1	3	22133	HC	F		624	283
HU	B	1	3	40190	HC	F		640	295
HU	B	1	3	80542	HC	H		712	320
HU	B	1	4	46172	HC	F		699	
HU	B	1	4	47008	HC	F		646	293
HU	B	1	4	47090	HC	F		643	282
HU	B	1	4	47090	HC	F		670	289
HU	B	1	4	47751	HC	F		811	350
HU	B	2	1	20016	HC	H	e	717	319
HU	B	2	1	20050	HC	F		640	291
HU	B	2	1	20060	SRS	F			313
HU	B	2	1	40210	HC	F		639	289
HU	B	2	1	70080	HC	F		703	313
HU	B	2	1	70080	HC	F	c	637	
HU	B	2	1	80471	HC	F		649	260
HU	B	2	2	60298	HC	G		562	272
HU	B	2	2	70029	HC	F		733	310
HU	B	3	1	80503	HC	F			267
HU	B	4	2	10118	HC	F			321
HU	B	5	1	10094	HC	F		582	255
HU	B	5	1	10565	HC	F			298
HU	B	5	2	10050	HC	F		685	
HU	B	5	2	10085	HC	G		819	351
HU	B	5	2	10085	SRS	H			271
HU	B	5	2	90016	HC	F		747	377
HU	B	5	2	90031	HC	H		737	338
HU	B	5	2	92716	HC	F		641	296
HU	B	6	1	10149	HC	F		663	313
HU	B	6	1	13014	HC	F		786	384
HU	B	6	1	45133	HC	F	c	679	299
HU	B	6	1	50077	HC	H		645	
HU	B	6	1	50082	HC	F			345
HU	B	6	1	92741	HC	F		706	307
HU	B	6	1	92741	HC	F		715	305
HU	B	6	1	92741	HC	F		721	307
HU	B	6	1	92741	HC	F		729	316
HU	B	6	1	92741	HC	F		789	355
HU	B	6	1	92753	HC	F		631	275
HU	B	6	1	92758	HC	F		663	304
HU	B	6	1	92758	HC	F		690	325
HU	B	6	1	92758	HC	F	c	797	375
HU	B	6	1	92761	HC	F		695	312
HU	B	6	1	92761	HC	F		769	358
HU	B	6	1	92761	HC	H		770	350
HU	B	6	1	92764	HC	F			324
HU	B	6	1	92765	HC	F		685	300
HU	B	6	1	92768	HC	F	c	635	294
HU	B	6	1	92776	HC	F		890	387
HU	B	6	2	10678	HC	F			348
HU	B	6	2	60058	HC	F		665	300
HU	B	6	2	80186	HC	F			328
HU	B	6	2	80186	HC	F		709	292
HU	B	6	2	90165	HC	F			280
HU	B	6	2	91325	HC	F		706	318
HU	B	6	2	92739	HC	F		768	358
HU	B	6	2	92739	HC	G		861	354
HU	B	6	2	92745	HC	G			327
HU	B	6	2	92758	HC	F			346
HU	B	6	2	92758	HC	F			349
HU	B	6	2	92758	HC	F		655	317
HU	B	6	2	92758	HC	F		694	393
HU	B	6	2	92758	HC	F		713	299
HU	B	6	2	92758	HC	F		760	346
HU	B	6	3	10002	HC	F		657	285
HU	B	6	3	10003	HC	F	c	681	316
HU	B	6	3	40891	HC	H		735	311
HU	B	6	3	48001	HC	F			247
HU	B	6	3	48001	HC	F			325
HU	B	6	3	48001	HC	F	e	642	303
HU	B	6	3	48001	HC	H	e	723	300
HU	B	6	3	92672	HC	H		633	

ELEM	TAX	PKR	SUBP	CO	SIE	FUS	GL	SD
RA	B	2	1	22055	HC	F	1310	454

ELEM	TAX	PER	SUBP	CO	SIX	FUS	GL	Bd	3	SD	BatF	a	b	l	4
MC	B	1	2	12150	HC	F	1790	613	278	342	532	290	284		
MC	B	1	2	22112	HC	F		501			461	245	228		
MC	B	1	2	40265	HC	F		514	243	279	470	247	241		
MC	B	1	2	40305	HC	F	1940	581	286	321	497	e 284	e 274		
MC	B	1	2	47871	HC	F		516	252		467	254	239		
MC	B	1	2	50089	HC	F	1890	515	255	289	481	252	241		
MC	B	1	2	50097	HC	F	1810	562	273	330		268	265	235	216
MC	B	1	2	60206	BS	F		549	265		514	264	256	221	206
MC	B	1	2	80604	HC	F	1730	481		271	453		235		
MC	B	1	2	90366	HC	F	1775	494	224	278	452	242	228		
MC	B	1	2	91073	HC	F	c 1830	500	252	273	461	239	229	215	204
MC	B	1	3	20139	HC	F	1780	514	251	278	467	257	239		
MC	B	1	3	22286	HC	F		601							
MC	B	1	3	40074	HC	F	1720	466	232	250	411	221	213	195	184
MC	B	1	3	40184	HC	F		475	255		422	206	198	219	227
MC	B	1	3	40184	HC	F	1900	618	279	347	578	249	230	281	280
MC	B	1	3	60091	HC	F	1710	469	c 215	289	447	c 236	c 219		
MC	B	1	3	90226	HC	F		520	253		490	256	234		
MC	B	1	3	90227	HC	UE		533	270		530	254	242		
MC	B	1	4	11171	HC	F	1910	594	273	320	530	286	282		
MC	B	1	4	40047	HC	F		466	237		425	200	191	223	215
MC	B	1	4	40354	HC	G		517	248		513	245	240		
MC	B	1	4	47003	HC	F	1810	531	257	307	471	265	248		
MC	B	1	4	47090	HC	F		502	244		463	241	235		
MC	B	1	4	47751	HC	F	1880	480		241	445	224	227		166
MC	B	1	4	49292	HC	F	1690	471	227	252	423	225	223		
MC	B	2	1	10001	SRS	F		504	245		444	242	229	205	201
MC	B	2	1	11365	HC	F	1830			269	464				
MC	B	2	1	20050	HC	F		486	241		443	229	223		
MC	B	2	1	20084	HC	F		478	246		455	c 219	228		
MC	B	2	1	22086	HC	F	1890	588	287	321	547		283		
MC	B	2	1	80078	HC	F	1820	521	242	278	497	249	243		
MC	B	2	1	80471	HC	F	1600	482	237	296	471	c 225	c 223		
MC	B	2	1	80471	HC	F	1800	517	244	223	482	250			
MC	B	2	1	80471	HC	F	1860	553		285	510	270	256		
MC	B	2	1	80471	HC	F	1940			315					
MC	B	2	1	80471	HC	F	1950	584	289	320	543	280	271		
MC	B	2	1	80471	HC	F	1960	613	296		586	302	288		
MC	B	2	1	80471	HC	G	1660			226					
MC	B	2	1	90411	HC	F			287						
MC	B	2	2	70046	HC	F	1600		228	249				196	
MC	B	2	2	80470	HC	F	c 1680								
MC	B	2	3	20151	HC	G		470	237			229	215		
MC	B	2	3	40228	HC	F	1744	467	233	257	428	224	222		
MC	B	3	1	11804	HC	F		537	253		485	c 235	252	209	198
MC	B	3	1	70008	HC	F	1780	487	235	264	445	240	227	206	183
MC	B	3	2	10141	HC		1930			c 278					
MC	B	4	1	11400	HC	F		511				248	238		
MC	B	4	2	10296	HC	F		547	268		489	277	249		
MC	B	4	2	10468	HC	F		427	213		384	201	198		
MC	B	4	2	10535	HC	F		597	283		525	289	270		
MC	B	4	2	10751	HC	F	1650	447	219	264	437	230		196	184
MC	B	4	2	10751	HC	F	1650	477	219	264	437	230		196	184
MC	B	4	2	11268	HC	F		460	222		409	225	214		
MC	B	4	2	40459	SRS	F					466				
MC	B	4	2	80241	BS	F	1230	466	238	237	406	220	213	197	186
MC	B	5	1	11148	HC	F		c 507			476	239	233		
MC	B	5	1	90471	BS	F		479	242		454	236	219	206	198
MC	B	5	1	90567	HC	F		514	261		470	218	200		
MC	B	5	2	90031	HC	F		543	258		496	258	261		
MC	B	5	2	90716	HC	UE		579	283		505	286	261		
MC	B	5	2	90716	HC	UE		628	288		640	310	290		
MC	B	6	1	10561	HC	F	1970	540	276	338	528	256	250		
MC	B	6	1	11012	HC	F	c 1550	c 426							
MC	B	6	1	80127	HC	F		537	271		497	c 250			
MC	B	6	1	90219	HC	UE		607	291			296	282		
MC	B	6	1	92741	HC	F		488	244		445	234	225		
MC	B	6	1	92741	HC	F	1806	523	243	317	464	234	238		
MC	B	6	1	92741	HC	F	2022	602	291	355	564	292	283		
MC	B	6	1	92756	HC	F	1722	571	256	291	492	273	271		
MC	B	6	1	92758	HC	F		551	262		505	263	263		
MC	B	6	1	92758	HC	F	1903	535	251	321	497	255	251		
MC	B	6	1	92758	HC	F	1977	c 532	281	312	507	c 246	c 248		
MC	B	6	1	92758	HC	F	1987	575	278	327	544	275	270		
MC	B	6	1	92758	HC	F	2145	680	324	402	681	332	c 321		
MC	B	6	1	92761	HC	F	2176	701	324	408	620	348	330		
MC	B	6	1	92761	HC	G	1889	592		301	582	287	281		
MC	B	6	1	92765	HC	F	2074	622	300	362	596	302	286		
MC	B	6	1	92766	HC	F				272	480				
MC	B	6	1	92766	HC	F	1879	546	272	300	505	257	256		
MC	B	6	1	92766	HC	UM							375		
MC	B	6	2	10664	HC	F	1710	516	268	279	486	247	240		
MC	B	6	2	80186	HC	F			247						
MC	B	6	2	80186	HC	F			264						
MC	B	6	2	80186	HC	F		513	258		470	250	241		
MC	B	6	2	80186	HC	G			243						
MC	B	6	2	91529	HC	UM				270					
MC	B	6	2	92739	HC	F	1819	c 555		299					
MC	B	6	2	92739	HC	F	1939	568	291	330	529	271	265		
MC	B	6	2	92739	HC	F	1983	591	267	324	553	275	271		
MC	B	6	2	92739	HC	F	2001	561	280	326	543	275	263		
MC	B	6	2	92739	HC	F	2092	649	308	377	628	315	294		
MC	B	6	2	92739	HC	UM				378					
MC	B	6	2	92746	HC	UM				295					
MC	B	6	2	92750	HC	F	1632	485	238	252	436	231	225		
MC	B	6	2	92750	HC	F	1645	463	229	228	404	222	222		
MC	B	6	2	92750	HC	F	1757	514	258	316	480	234	239		
MC	B	6	2	92750	HC	F	1883	532	267	291	497	254	243		
MC	B	6	2	92750	HC	G	1854		273	291					
MC	B	6	2	92750	HC	UM				342					
MC	B	6	2	92750	HC	UM				360					
MC	B	6	3	10305	HC	G	1960	578	292	355	534	278	265		
MC	B	6	3	10305	HC	UE		623	299		642	296	289		
MC	B	6	3	40341	HC	F			256		465		248		

ELEM	TAX	PER	SUBP	CO	SIE	FUS		LA
PE	B	1	2	47871	HC	F		554
PE	B	1	2	90366	HC	F		588
PE	B	1	3	22133	HC	F		656
PE	B	1	3	22133	HC	F		680
PE	B	1	3	90227	HC	F		624
PE	B	1	3	90227	HC	F		633
PE	B	1	3	90227	HC	F		678
PE	B	1	4	40002	HC	F		582
PE	B	1	4	60200	BS	F		542
PE	B	2	1	10978	HC	F	e	633
PE	B	2	1	20050	HC	F		597
PE	B	2	1	20081	HC	F		617
PE	B	2	1	22151	SRS	G		561
PE	B	2	1	22321	HC	F		695
PE	B	2	1	40206	HC	F		585
PE	B	2	1	40250	HC	F		660
PE	B	2	2	40437	HC	H		523
PE	B	2	3	49143	HC	F	e	590
PE	B	3	1	70110	HC	F		584
PE	B	3	2	49216	BS	F		636
PE	B	4	1	11043	HC	F		614
PE	B	4	1	11159	HC	F		589
PE	B	4	2	10468	HC	F		635
PE	B	4	2	10534	HC	F		528
PE	B	5	2	10085	HC	F		623
PE	B	6	1	80134	HC	F		696
PE	B	6	1	80134	HC	F		792
PE	B	6	1	80187	HC	F		710
PE	B	6	2	92750	HC	F		676
PE	B	6	2	92750	HC	F	c	813
PE	B	6	3	10051	HC	F		696
PE	B	6	3	40884	HC	F		653

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL		Bd	SD
TI	B	1	2	12182	HC	F			544	
TI	B	1	2	40006	HC	F			519	
TI	B	1	2	40079	HC	F	2935		535	229
TI	B	1	2	40265	HC	F			532	
TI	B	1	2	40305	HC	F			499	
TI	B	1	2	47871	HC	F			622	
TI	B	1	2	50089	HC	F			551	
TI	B	1	2	50089	HC	F			634	
TI	B	1	2	50089	HC	F		c	586	
TI	B	1	2	60311	HC	F		c	499	
TI	B	1	2	80545	BS	F			516	
TI	B	1	2	80545	HC	G			497	
TI	B	1	2	80547	HC	F			549	
TI	B	1	2	80619	HC	F			645	
TI	B	1	2	80646	BS	UE			521	
TI	B	1	2	90366	HC	F			633	
TI	B	1	2	90381	HC	F			552	
TI	B	1	3	12807	HC	F			550	
TI	B	1	3	20146	HC	G			571	
TI	B	1	3	22286	HC	F			640	
TI	B	1	3	40023	HC	F			610	
TI	B	1	3	40074	HC	F			519	
TI	B	1	3	40074	HC	F			629	
TI	B	1	3	40187	HC	F			530	
TI	B	1	3	40289	HC	F			597	
TI	B	1	3	60091	HC	G			492	
TI	B	1	3	90227	HC	F			458	
TI	B	1	3	90227	HC	F			507	
TI	B	1	3	90227	HC	H			550	
TI	B	1	3	90836	HC	F			617	
TI	B	1	4	10966	SRS	F			533	
TI	B	1	4	40047	HC	F			596	
TI	B	1	4	47090	HC	F			636	
TI	B	1	4	47661	HC	F			517	
TI	B	1	4	47804	HC	F			577	
TI	B	2	1	20016	HC	F			509	
TI	B	2	1	20016	HC	F		e	516	
TI	B	2	1	20060	HC	F			553	
TI	B	2	1	20060	HC	F			561	
TI	B	2	1	20060	HC	F			585	
TI	B	2	1	20060	HC	F			602	
TI	B	2	1	22151	SRS	G			598	
TI	B	2	1	40206	HC	G			536	
TI	B	2	1	40210	HC	F		c	616	
TI	B	2	1	70080	HC	F			598	
TI	B	2	1	70080	HC	G			529	
TI	B	2	1	70088	BS	F			520	
TI	B	2	1	70143	HC	F			549	
TI	B	2	2	20169	HC	G			568	
TI	B	2	2	70046	HC	F			560	
TI	B	2	3	20146	HC	F			550	
TI	B	2	3	20146	HC	H		e	500	
TI	B	2	3	49245	HC	F			564	
TI	B	3	1	80503	HC	F			516	
TI	B	4	2	45183	HC	F		c	514	
TI	B	5	2	90045	HC	F			545	
TI	B	5	2	90702	HC	F			566	
TI	B	5	2	90716	HC	F			576	
TI	B	6	1	10012	HC	F			725	
TI	B	6	1	13014	HC	F			597	
TI	B	6	1	13014	HC	F			598	
TI	B	6	1	45133	HC	F			628	
TI	B	6	1	50077	HC	F			519	
TI	B	6	1	60477	HC	F			553	
TI	B	6	2	80166	HC	G			653	
TI	B	6	3	10039	HC	F			557	
TI	B	6	3	40912	HC	F			522	
TI	B	6	3	40912	HC	F			609	
TI	B	6	3	40922	HC	F			643	
TI	B	6	3	48002	HC	G			678	

RLEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	SD
TI	B	6	1	92741	HC	F		537	
TI	B	6	1	92741	HC	F		597	
TI	B	6	1	92741	HC	F		615	
TI	B	6	1	92741	HC	F		556	
TI	B	6	1	92753	HC	F		665	
TI	B	6	1	92761	HC	F		560	
TI	B	6	1	92761	HC	TE		631	
TI	B	6	1	92765	HC	F		530	
TI	B	6	1	92766	HC	F		638	
TI	B	6	1	92776	HC	F		688	
TI	B	6	2	80196	HC	F		583	
TI	B	6	2	80196	HC	F		640	
TI	B	6	2	80196	HC	F		716	
TI	B	6	2	92739	HC	F		583	
TI	B	6	2	92739	HC	F		597	
TI	B	6	2	92750	HC	F		651	

RLEM	TAX	PER	SUBP	CO	SIE	GLl	Bd	Dl
AS	B	1	2	22075	HC		369	
AS	B	1	2	22075	HC		376	
AS	B	1	2	22211	HC	575	366	327
AS	B	1	2	40021	HC	522		294
AS	B	1	2	40319	HC	544	355	311
AS	B	1	2	40319	HC	617	377	334
AS	B	1	2	47871	HC	626	380	339
AS	B	1	2	50089	HC	639	412	350
AS	B	1	2	60295	HC	580	358	332
AS	B	1	2	60387	HC	593	377	311
AS	B	1	2	80545	HC	550	347	315
AS	B	1	2	80545	HC	598	401	344
AS	B	1	2	80547	HC	559	355	327
AS	B	1	2	80579	BS	628	424	355
AS	B	1	2	80613	HC	584	311	312
AS	B	1	2	90349	HC	592	379	330
AS	B	1	3	12807	HC	603	365	324
AS	B	1	3	20079	HC	614	398	355
AS	B	1	3	22052	HC	626	436	354
AS	B	1	3	22133	HC	622	389	
AS	B	1	3	40024	HC	572	371	215
AS	B	1	3	40024	HC	599	411	342
AS	B	1	3	40184	HC	601	370	324
AS	B	1	3	40358	BS	574	365	
AS	B	1	3	60091	HC	620	396	343
AS	B	1	3	90175	HC	571	341	323
AS	B	1	3	90227	HC		383	328
AS	B	1	3	90353	HC	595	403	332
AS	B	1	4	22417	BS	585		312
AS	B	1	4	40002	HC	558	359	323
AS	B	1	4	47751	HC	541	347	302
AS	B	1	4	47804	HC	635	388	354
AS	B	1	4	47806	HC	604	389	339
AS	B	1	4	47806	HC	685	378	
AS	B	2		22298	HC	561	368	c 316
AS	B	2	1	11365	HC		358	345
AS	B	2	1	20011	HC	609	386	342
AS	B	2	1	20084	HC	508	327	292
AS	B	2	1	40182	HC	652	410	371
AS	B	2	1	40206	HC	574	359	322
AS	B	2	1	40206	HC	590	380	320
AS	B	2	1	40206	HC	595	375	327
AS	B	2	1	40216	HC	576	359	318
AS	B	2	1	40217	HC	626	434	
AS	B	2	1	40262	HC	559	371	318
AS	B	2	1	70080	HC	547	340	304
AS	B	2	1	70141	HC	592	375	331
AS	B	2	1	80471	HC	559	329	315
AS	B	2	1	80471	HC	584	360	317
AS	B	2	1	80471	HC	641	401	357
AS	B	2	2	40356	HC	655	416	368
AS	B	2	2	60432	HC	629	389	345
AS	B	2	2	80489	HC		339	
AS	B	2	2	80489	HC	563	367	322
AS	B	2	3	40195	HC	559	351	317
AS	B	2	3	49243	HC	546	340	298
AS	B	2	3	49245	HC	574	379	325
AS	B	3	1	11620	HC	570	353	319
AS	B	3	1	40177	HC	623	380	343
AS	B	3	1	60395	HC	639	387	343
AS	B	3	1	70008	HC	539	355	305
AS	B	3	1	80365	HC	564	364	313
AS	B	3	2	10217	HC	598	392	339
AS	B	3	2	11113	HC	549	336	305
AS	B	3	2	11177	HC	557	357	314
AS	B	4	1	11404	HC	514		297
AS	B	4	2	10107	HC	597	387	322
AS	B	4	2	11468	HC	613	375	
AS	B	4	2	11751	HC	660	c 394	361
AS	B	5	1	11089	HC	571	399	312
AS	B	5	2	90228	HC	613		346
AS	B	5	2	90702	HC	628		353
AS	B	5	2	92716	HC	597	409	337
AS	B	6	1	11650	HC			354
AS	B	6	1	11112	HC		365	
AS	B	6	1	45192	HC	587	432	
AS	B	6	1	80177	HC	631	401	
AS	B	6	1	81163	HC		367	
AS	B	6	1	92741	HC		417	358
AS	B	6	1	92758	HC			c 344
AS	B	6	1	92764	HC	612	364	338
AS	B	6	1	92768	HC	687	436	375
AS	B	6	2	40159	HC	676	466	
AS	B	6	2	80196	HC	619	418	343
AS	B	6	2	91748	HC		403	
AS	B	6	3	41912	HC	606	377	308

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL
CA	B	1	2	46464	HC	F	1188
CA	B	1	2	80295	HC	F	1150
CA	B	1	2	80599	SRS	G	1125
CA	B	1	2	80348	HC	UX	1069
CA	B	1	4	40956	HC	F	1077
CA	B	1	4	47661	HC	F	1180
CA	B	2	1	11108	HC	F	1108
CA	B	2	1	20017	HC	G	1113
CA	B	2	1	20155	HC	F	1230
CA	B	2	1	70083	HC	F	1230
CA	B	2	1	70095	HC	F	1100
CA	B	2	1	80285	HC	F	1210
CA	B	2	3	49141	HC	G	1134
CA	B	4	1	80331	SRS	F	1046
CA	B	6	1	13014	HC	F	1453
CA	B	6	1	80124	HC	G	142
CA	B	6	1	82755	HC	F	1326
CA	B	6	1	82764	HC	F	1429
CA	B	6	1	82765	HC	F	1462
CA	B	6	3	40691	HC	F	1193

UX = unfused

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	Dd	SD	BaF	a	b
MT	B	1	2	40071	HC	UX~	2010		245	201	466	225	220
MT	B	1	2	50085	HC	F		448	239		424	215	206
MT	B	1	2	50083	HC	F		471	239	231	443	221	219
MT	B	1	2	50089	HC	F	1910	460	239	202	425	224	209
MT	B	1	2	80565	HC	F				259	504		
MT	B	1	2	80604	HC	F		480	250		439	229	210
MT	B	1	2	80604	HC	F		498	264		476	241	229
MT	B	1	2	80604	HC	G	2090	469	258		466	227	206
MT	B	1	2	80760	HC	F	1960	487	251		447		232
MT	B	1	3	20172	HC	F		465	231		430	226	206
MT	B	1	3	20172	HC	UX~		476	245		463	226	222
MT	B	1	3	22135	HC	F	1950	444	227	215	419	212	199
MT	B	1	3	22467	SRS	F		486	246		464	234	221
MT	B	1	3	40074	HC	F		468	243		447	223	214
MT	B	1	3	40187	HC	F		502	252		459	214	200
MT	B	1	3	60017	HC	F		482	259		458	228	223
MT	B	1	3	80175	HC	F	2140	459	249	228	431	218	205
MT	B	1	3	80353	HC	F	2025	476	249	220	442	226	222
MT	B	1	4	11241	HC	F		441	263		397	c 206	206
MT	B	1	4	22125	HC	F	1930	557	255	285	496	279	252
MT	B	1	4	47061	HC	F		478	257	228	445	227	214
MT	B	1	4	47152	HC	F	2065	511	244	243	483	250	240
MT	B	2		81076	HC	F	2270	540		260	499	266	233
MT	B	2	1	11105	HC	F					412	219	
MT	B	2	1	11105	HC	F	2080	517	260	245	480	249	233
MT	B	2	1	20086	HC	F		494	274		453	224	210
MT	B	2	1	22012	HC	F		447	236		405	215	202
MT	B	2	1	22012	HC	F	1940	470	243	228	427	223	216
MT	B	2	1	22043	SRS	F		575	286		514	273	262
MT	B	2	1	40206	HC	F		510	256		478	250	231
MT	B	2	1	40210	HC	F	2020	c 450		226	438	214	
MT	B	2	1	40210	HC	F	c 2090	535	271		496	c 262	c 233
MT	B	2	1	49145	HC	F		469	234		430	221	217
MT	B	2	1	70061	HC	F	2010	480	257		444	235	218
MT	B	2	1	70061	HC	F	2010	489	240		458	232	223
MT	B	2	1	70061	HC	F	2040	458	254		430	223	207
MT	B	2	1	70061	HC	F		504	258		475	242	227
MT	B	2	1	80471	HC	F	2080			257			
MT	B	2	1	80411	HC	F		498			489	248	225
MT	B	2	2	40356	HC	F		552			488	283	247
MT	B	2	2	80411	HC	F		562			529	272	261
MT	B	2	2	80431	HC	F	2050	478	251	219	427	229	210
MT	B	2	2	70046	HC	F	1870	447	220	200	427	215	192
MT	B	2	3	11151	HC	F		555	285		502	266	251
MT	B	2	3	20159	HC	F		412	217		394	192	181
MT	B	3	1	11114	HC	F	2100	489	252		465	c 224	230
MT	B	3	1	11135	HC	F	1700		192	260		219	
MT	B	3	1	70076	HC	F		456	237		415	221	201
MT	B	3	1	81513	HC	F		512	266				
MT	B	3	2	10671	BS	F		529	276		503	257	236
MT	B	4	1	11198	HC	F		468			424	224	204
MT	B	4	1	11284	HC	F	1935	458	235	228	424	222	212
MT	B	4	1	13014	HC	G	2060	484	238	250	493	228	219
MT	B	4	1	13216	HC	F		472	255		451		
MT	B	4	2	80241	BS	F	2070	480	249	231	450	230	218
MT	B	5	1	11568	HC	F		519	276		464	250	244
MT	B	5	1	11752	HC	F					404		
MT	B	5	1	11822	HC	F			265		455		217
MT	B	5	1	11822	HC	F		451	241		417	215	202
MT	B	5	1	11855	HC	F					377		
MT	B	5	1	11951	HC	F			240		403	220	
MT	B	5	1	11961	HC	F		c 620	292		548		275
MT	B	5	1	13166	HC	G		464	254		473	217	208
MT	B	5	1	13436	HC	UX		530	279		550	262	239
MT	B	5	1	81467	HC	F	2210	468	250	210	433	227	209
MT	B	5	1	11567	HC	F		569	292		531	269	265
MT	B	5	2	80111	HC	F		496	261		470	239	227
MT	B	5	2	81028	HC	UX					547	256	
MT	B	5	2	81551	HC	F		490	278			232	223
MT	B	5	2	81711	HC	UX		549	272		557	256	245
MT	B	5	2	81711	HC	UX		559	270		570	270	252
MT	B	5	2	81711	HC	F		506	258			247	232
MT	B	5	2	81961	SRS	F		505	253		469	249	230
MT	B	5	2	81711	HC	F			268			254	
MT	B	5	2	11161	HC	F		498			490	237	232
MT	B	5	2	11811	HC	UX				299	568		
MT	B	5	2	81551	HC	F		480	238		460	227	214
MT	B	5	2	81777	HC	F		536	283	254	509	259	249
MT	B	5	2	11461	HC	F		460			429		
MT	B	5	2	11751	HC	F	2413	528	293	263	498		
MT	B	5	2	11754	HC	F	2188	514	261	242	496	247	240
MT	B	5	2	11754	HC	F	2123	510	261	249	479	244	233
MT	B	5	2	11754	HC	F	2280		261	235			
MT	B	5	2	11754	HC	F	1118	473	251	229	448		
MT	B	5	2	11754	HC	F	1811	494	116	310	503	313	231
MT	B	5	2	11754	HC	F			266				

ELEM	TAX	PER	SUBP	CO	SIX	FUS	GL		Bd		Dd	SD	BaF	a	b
MT	B	6	2	80186	HC	G			561		274			259	251
MT	B	6	2	80196	HC	F	2310		599		296	318		282	272
MT	B	6	2	92750	HC	F	2238		509		274	242	485	237	235
MT	B	6	2	92750	HC	F	c 1912	c	519		258	234	461		
MT	B	6	2	92750	HC	F	c 1965		477		245	231	439	225	221
MT	B	6	2	92750	HC	F	e 2100		497		262	256	480	243	229
MT	B	6	2	92750	HC	UM						270			
MT	B	6	2	92750	HC	UM						315			
MT	B	6	3	40895	HC	F	2270		591		286	273		294	271
MT	B	6	3	40898	HC	F			536		288		492	251	239

ELEM	TAX	PER	SUBP	CO	GL	M_{max}	M_{min}
HC	OVA	1	3	40074	e 1300		387
HC	OVA	1	3	85004	820		279
HC	OVA	1	4	22106		431	272
HC	OVA	1	4	45002		600	
HC	OVA	1	4	45176	c 1425	e 492	
HC	OVA	1	4	47751		440	538
HC	OVA	1	4	47751		514	376
HC	OVA	1	4	55066		419	397
HC	OVA	2		91042	c 100		291
HC	OVA	2	1	76080	e 1250		306
HC	OVA	2	1	70088	e 1150		229
HC	OVA	2	1	80471		539	342
HC	OVA	2	1	80471	1250	435	
HC	OVA	3	1	76025	c 1446	436	
HC	OVA	4	1	11028	c 762	343	212
HC	OVA	4	1	11028	c 979	402	257
HC	OVA	4	2	10466		369	211
HC	OVA	5	2	11030		283	210
HC	OVA	5	2	11030		285	205
HC	OVA	5	2	11030		292	206
HC	OVA	5	2	11030		293	180
HC	OVA	5	2	11030		293	197
HC	OVA	5	2	11030		297	
HC	OVA	5	2	11030		299	197
HC	OVA	5	2	11030		306	
HC	OVA	5	2	11030		341	201
HC	OVA	5	2	11030		346	
HC	OVA	5	2	11030		357	253
HC	OVA	5	2	11030	1158		273
HC	OVA	5	2	11030	e 810	237	181
HC	OVA	5	2	11057		289	218
HC	OVA	5	2	11057		321	
HC	OVA	5	2	11057		331	224
HC	OVA	5	2	11057		375	226
HC	OVA	5	2	11057	c 660	263	
HC	OVA	5	2	11058		308	209
HC	OVA	5	2	11058		357	244
HC	OVA	5	2	11058		360	259
HC	OVA	5	2	11058		373	222
HC	OVA	5	2	11058		c 299	239
HC	OVA	5	2	11058		c 360	271
HC	OVA	5	2	11058	270		
HC	OVA	5	2	11058	c 855	319	225
HC	OVA	5	2	11058	e 750	320	199
HC	OVA	5	2	11058	e 789	359	229
HC	OVA	5	2	11058	e 860	315	258
HC	OVA	5	2	11063		263	
HC	OVA	5	2	11063		299	202
HC	OVA	5	2	11063		313	195
HC	OVA	5	2	11063		316	216
HC	OVA	5	2	11063		319	236
HC	OVA	5	2	11063		369	220
HC	OVA	5	2	11063		c 296	c 218
HC	OVA	5	2	11063		c 345	c 254
HC	OVA	5	2	11063		c 378	
HC	OVA	5	2	90393	e 950	361	295
HC	OVA	6	1	92758			406
HC	OVA	6	1	92761		377	250
HC	OVA	6	1	92761		503	
HC	OVA	6	1	92766		335	
HC	OVA	6	1	92766		c 425	
HC	OVA	6	1	92766	c 1473	483	326

ELEM	TAX	PER	SUBP	CO	GL	M_{max}	M_{min}
HC	CAH	1	2	80587	e 1900	586	386
HC	CAH	1	2	80587	e 1900	620	368
HC	CAH	1	3	22155	e 1720	591	368
HC	CAH	1	3	40156	e 1500	303	200
HC	CAH	1	3	80539	e 1900	503	297
HC	CAH	1	4	40002		534	345
HC	CAH	1	4	40302		535	346
HC	CAH	1	4	47008	2085	597	438
HC	CAH	1	4	80601	e 1300	460	327
HC	CAH	2		22303	e 1500	314	206
HC	CAH	2	1	11105		617	387
HC	CAH	2	1	20050	1643	318	230
HC	CAH	2	3	20027		269	163
HC	CAH	3	1	80503	e 2550	506	373
HC	CAH	3	2	10427		518	355
HC	CAH	5	1	11356	c 1220	308	200
HC	CAH	5	2	11356	c 970	359	218
HC	CAH	6	2	90179	e 1600	625	294
HC	CAH	6	3	40912	c 1140	299	

TAX	PER	SUBP	CO	SIE	DP4W	M1W	M2W	M3W
OVA	1	2	20104	BS	64			
OVA	1	2	80504	MT	65			
OVA	1	2	91961	BS	60			
OVA	1	3	46624	SBS		72	69	
OVA	1	4	49192	SBS	66	73	72	
CAH	1	2	22123	MT	67			
CAH	1	2	22123	MT	67			

TAX	PER	SUBP	CO	SIR	DP4W	M1W	M2W	M3W
O	1	2	10040	HC				79
O	1	2	22014	HC				81
O	1	2	22334	HC		73	80	80
O	1	2	40116	HC			78	80
O	1	2	47871	HC		68	80	78
O	1	2	47871	HC		69	81	82
O	1	2	50089	HC		77		
O	1	2	80547	HC		68	73	72
O	1	2	80613	HC		71	80	
O	1	2	80676	HC		69	74	78
O	1	2	80733	HC		76	81	83
O	1	2	90321	HC		72	84	84
O	1	2	90349	HC		59	73	72
O	1	2	90349	HC		71		
O	1	2	90349	BS	60			
O	1	3	11143	HC		83	83	
O	1	3	20139	HC		77	84	
O	1	3	20219	HC		70	78	80
O	1	3	20219	HC		73	79	
O	1	3	21046	HC				76
O	1	3	40023	HC		79	81	82
O	1	3	40178	HC		73	76	
O	1	3	40184	HC	61	63		
O	1	3	47805	HC		73	73	
O	1	3	60041	HC	69			
O	1	3	60068	HC			78	
O	1	3	80539	BS		73	81	
O	1	3	90354	HC				85
O	1	3	90354	SRS		76	74	
O	1	3	90540	HC		63		
O	1	3	91828	HC		72	80	
O	1	4	11171	HC				81
O	1	4	21105	BS			91	92
O	1	4	21105	BS		73		
O	1	4	22106	HC		66	75	79
O	1	4	22106	HC		67	77	80
O	1	4	22106	HC		70	77	79
O	1	4	22106	HC		72	77	83
O	1	4	22106	HC		72	79	85
O	1	4	22106	HC		72	85	83
O	1	4	22106	HC		72	86	83
O	1	4	40047	HC		77	81	84
O	1	4	40354	HC		71	79	
O	1	4	47751	HC		71	83	78
O	1	4	47751	HC		81	88	89
O	1	4	49192	HC		79	84	87
O	1	4	50007	HC		69	75	84
OVA	2	2	60342	HC	69			
OVA	2	3	49245	SRS	56			
O	2	1	20056	HC		73	78	
O	2	1	20060	HC		70	86	86
O	2	1	20081	HC		78	78	
O	2	1	70080	HC				86
O	2	1	70088	HC				80
O	2	1	70088	HC		79	80	
O	2	1	80471	HC		73	77	
O	2	1	90385	SRS		71	78	82
O	2	2	20044	HC		66	72	
O	2	2	20164	HC			76	80
O	2	2	80310	SRS		70	73	79
O	2	2	80310	SRS		74	82	83
O	2	3	20136	HC		63	86	
O	2	3	20163	HC		73	80	82
O	2	3	49141	HC		66	78	
O	2	3	49245	HC		70	74	
O	3	1	11649	HC		69	76	83
O	3	1	20135	HC		75		
O	3	1	70115	HC		68	80	
O	3	1	80063	BS		71	78	82
O	3	1	80067	HC				69
O	3	2	10671	HC				79
O	3	2	10930	HC		68		80
O	3	2	11125	HC		72	81	84
O	3	2	80333	SRS	67	70		
OVA	4	2	11360	HC	56	69	77	
O	4	1	11140	HC		72	85	88
O	4	1	11410	HC				80
O	4	1	13059	HC		74	82	84
O	4	1	92445	HC		71	76	
O	4	1	92449	HC		72	84	83
O	4	1	92478	HC		73	86	87
O	4	2	10118	HC		84	77	
O	4	2	10296	HC		71	81	
O	4	2	10296	HC		76	85	
O	4	2	10468	HC				78
O	4	2	10468	HC				78
O	4	2	10468	HC		66	74	78
O	4	2	10468	HC		69		
O	4	2	10468	HC		69	76	80
O	4	2	10468	HC		72	77	80
O	4	2	10468	HC		77	86	86
O	4	2	10468	HC		78	80	85
O	4	2	10468	HC	64	71	80	80
O	4	2	10468	HC	70	80	85	
O	4	2	10534	HC				77
O	4	2	10534	HC		62		
O	4	2	11268	HC				73
OVA	5	1	10874	HC		73	79	
OVA	5	2	92679	HC	63			
O	5	1	10094	SRS		67	76	
O	5	1	10524	HC		73	81	80
O	5	1	10893	HC			74	79
O	5	1	90471	SRS		71	74	76
O	5	1	90533	HC		66	75	82
O	5	1	90567	HC		64	71	75
O	5	1	90567	HC		70	83	87
O	5	1	90567	HC		72	78	82
O	5	1	90567	HC		74	82	83
O	5	1	90585	HC		69	82	83
O	5	1	90765	HC				84
O	5	2	10050	HC			78	80
O	5	2	10050	HC			80	82
O	5	2	10085	HC				77
O	5	2	10085	HC		68	75	
O	5	2	11058	HC		67	74	

TAI	PER	SUBP	CO	SIE	DP4W	M1W	M2W	M3W
C	5	2	11597	HC		67	80	82
C	5	2	80195	HC		63	76	82
C	5	2	80195	HC		65	67	71
C	5	2	90031	HC		66	80	83
C	5	2	90123	BS		80	85	89
C	5	2	90319	HC		66		
C	5	2	90320	HC		75	84	88
C	5	2	90390	HC		68	79	77
C	5	2	90474	SRS			81	77
C	5	2	90683	HC		72	82	83
C	5	2	90702	HC			74	77
C	5	2	90702	HC		59	71	74
C	5	2	90702	HC		68	78	80
C	5	2	90709	HC				79
C	5	2	92716	HC				83
C	5	2	92716	HC				84
C	5	2	92716	HC			79	84
C	5	2	92716	HC			85	
C	5	2	92716	HC		69	83	85
OVA	6	1	80173	HC	58			
OVA	6	1	92758	HC	62			
OVA	6	1	92766	HC	65			
OVA	6	1	92768	HC	63	71	80	
OVA	6	2	92750	HC	69	76		
OVA	6	3	10100	HC	63	72		
O	6	1	10123	HC				82
O	6	1	10123	HC		76	88	
O	6	1	10149	HC		63		
O	6	1	10149	HC		68	75	
C	6	1	10521	HC			80	79
C	6	1	10850	HC		71		
C	6	1	11012	HC				78
C	6	1	13014	HC			79	
C	6	1	13014	HC		74	78	77
C	6	1	13014	HC		75	82	80
O	6	1	45217	HC			80	80
O	6	1	50082	HC		72	79	84
O	6	1	60499	HC		65	73	83
O	6	1	60611	HC				87
O	6	1	60611	HC		70	78	
O	6	1	80137	HC				92
C	6	1	80137	HC		68	75	78
O	6	1	91438	SRS		72		81
O	6	1	91438	SRS		73	79	78
O	6	1	91438	SRS		74	84	83
O	6	1	91438	SRS		78	e 82	85
O	6	1	91451	SRS		65	68	
O	6	1	91527	SRS		67	75	83
O	6	1	91608	SRS		78	86	83
O	6	1	91616	HC				85
O	6	1	91732	HC		72	78	79
O	6	1	92741	HC				80
O	6	1	92741	HC			82	84
O	6	1	92741	HC		69		
O	6	1	92741	HC		74	82	84
O	6	1	92753	HC		70	80	86
O	6	1	92758	HC			78	84
O	6	1	92758	HC		64	75	79
O	6	1	92758	HC		72	81	
O	6	1	92758	HC		74	82	85
O	6	1	92758	HC		75	83	87
O	6	1	92761	HC		73	82	86
O	6	1	92761	HC		74	84	86
O	6	1	92761	HC		75	85	87
O	6	1	92761	HC		77	87	91
O	6	1	92764	HC				84
O	6	1	92764	HC		74	95	87
O	6	1	92765	HC		65	79	82
O	6	1	92766	HC		71		92
O	6	1	92766	HC		81	92	
O	6	1	92766	HC		84	88	90
O	6	1	92768	HC				82
O	6	1	92768	HC		73	83	83
O	6	1	92768	HC		75	78	82
O	6	1	92768	HC		81	90	93
O	6	1	92768	HC		e 76	85	91
O	6	1	92770	HC		71	80	82
O	6	1	92774	HC				84
O	6	1	92774	HC		72	76	82
O	6	1	92774	HC		75	80	85
O	6	1	92775	HC		72	81	
O	6	1	92776	HC				85
O	6	1	92776	HC			81	84
O	6	1	92776	HC		72	78	81
O	6	2	11003	HC				72
O	6	2	10086	HC				82
O	6	2	91325	HC		75	83	85
O	6	2	92739	HC				81
O	6	2	92739	HC				87
O	6	2	92739	HC		66	75	79
O	6	2	92739	HC		68		
O	6	2	92739	HC		70	78	81
O	6	2	92739	HC		71	77	82
O	6	2	92739	HC		75	81	
O	6	2	92739	HC		84	94	
O	6	2	92745	HC				88
O	6	2	92750	HC				81
O	6	2	92750	HC				81
O	6	2	92750	HC				85
O	6	2	92750	HC		67	75	
O	6	2	92750	HC		71	78	81
O	6	2	92750	HC		72	77	82
O	6	2	92750	HC		74	83	84
O	6	2	92751	HC				81
O	6	3	10002	HC				84
O	6	3	10002	HC		70	81	84
O	6	3	10003	HC		68	89	89
O	6	3	10005	HC		71	82	88
O	6	3	10050	HC		67	77	80
O	6	3	10100	HC				79
O	6	3	40345	HC		64	76	78
O	6	3	48001	HC		67	75	80

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GLC	SD	BT	HTC
HU	OVA	6	2	92750	HC	F			313	161
HU	OVA	6	2	92750	HC	F			315	155
HU	OVA	6	2	92751	HC	F			288	148
HU	OVA	6	3	10002	HC	F			295	141
HU	OVA	6	3	10005	HC	F			286	153
HU	OVA	6	3	10100	HC	F			284	145
HU	OVA	6	3	40898	HC	F			274	139
HU	OVA	6	3	40912	HC	F			280	142
HU	OVA	6	3	48001	HC	F			252	122
HU	OVA	6	3	48001	HC	F			295	141
HU	OVA	6	3	48001	HC	F			e 282	131
HU	OVA	6	3	48001	HC	F	1202	135	262	125
HU	OVA	6	3	48001	HC	G			282	139
HU	OVA	6	3	48001	HC	H			e 303	135
HU	O	6	1	11070	HC	F			276	
HU	O	6	1	13014	HC	F				139
HU	O	6	1	45187	HC	F			256	
HU	O	6	2	10664	HC	F			274	137
HU	O	6	3	40911	HC	F			291	145

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD
RA	O	1	2	10040	HC	G	1440	158
RA	O	1	3	20146	HC	F	1296	148
RA	O	4	1	10397	HC	F	1440	159
RA	O	4	1	13172	HC		1530	168
RA	O	4	2	10468	HC	F	1480	152
RA	O	5	1	49241	HC	F	1271	144
RA	O	5	1	90533	HC	F	1365	154
RA	O	5	2	11058	HC	F	1310	134
RA	O	5	2	90031	HC	F	1460	169
RA	O	5	2	90508	HC	F	1325	157
RA	O	6	1	10408	HC		1420	161
RA	O	6	1	10408	HC		e 1370	
RA	O	6	1	10522	HC	F	1463	168
RA	O	6	1	11012	HC	F	1400	145
RA	O	6	1	11070	HC	F	1290	147
RA	O	6	1	80114	HC	F	1314	e 124
RA	O	6	1	80137	HC	F	1404	150
RA	O	6	1	92741	HC	F	1510	150
RA	O	6	2	80186	HC	F	1405	163
RA	O	6	3	10005	HC	F	1460	145
RA	O	6	3	10388	HC	F	1335	151
RA	O	6	3	47370	HC	UM	653	

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	3	SD	A	B	1	4
MC	OVA	1	2	40006	HC	F		241	133		112	110	110	
MC	OVA	1	4	22106	HC	F		255	137		118	115	113	107
MC	OVA	1	4	22106	HC	F		257	135		119	114	115	105
MC	OVA	1	4	22106	HC	F		262	146		121	117	118	115
MC	OVA	1	4	50027	HC	F	1147	236	130	117	107	107	99	96
MC	CAH	1	3	40184	HC	F	1070	263	122	148	82	79	123	121
MC	CAH	1	3	60041	HC	F	1237	308	151		142	c 137	103	101
MC	O	1	4	40002	HC	UM				114				
MC	O	1	4	40002	HC	UM				137				
MC	O	1	4	47751	HC	F	1213	233	129	129	111	105	102	97
MC	O	1	4	47806	HC	F	1241	258	145	147	171	119	116	109
MC	OVA	2	1	20050	HC	F	1240	253	130	136	123	115	106	100
MC	OVA	2	1	40206	HC	F	1190	243	131	131	111	108	107	100
MC	OVA	2	3	20148	HC	F	1181	246	132	128	116	113	110	109
MC	OVA	2	3	20148	HC	UE		252	136		117	116	114	103
MC	CAH?	2	1	22401	BS	UM	579							
MC	O	2	1	20050	HC	F					120		107	
MC	O	2	1	20050	HC	UM								
MC	O	2	1	70080	HC	UM								
MC	O	2	1	80471	HC	F	1127	227	110	114	107	104	93	89
MC	O	2	3	40185	HC	UM								
MC	O	2	3	49141	HC	G	1209	237	123	132	110	105	101	98
MC	OVA	3	1	20005	HC	F	1095	234	113	117	105	101	92	86
MC	OVA	4	1	91713	HC	F	1170	234	132	124	112	107	107	99
MC	OVA	4	2	10768	SRS	G		213	119		101	96	95	88
MC	O	4	2	10468	HC	F		239	139		113	111	108	105
MC	O	4	2	10468	HC	F		242	149		115	112	111	110
MC	O	4	2	10468	HC	UM								
MC	O	4	2	80112	HC	F	1285	246	139	137	c 115	115	110	105
MC	OVA	5	1	10893	HC	F		231	126		109	101	96	89
MC	OVA	5	1	90585	HC	F		245	127		114	109	98	89
MC	OVA	5	1	90585	HC	G		252	143		119	116	107	104
MC	OVA	5	1	90585	SRS	F		240	128		115	111	106	101
MC	OVA	5	1	90585	SRS	F		246	144		115	114	100	92
MC	O	5	1	10173	HC	UM								
MC	O	5	1	13210	HC	F	1298	250	144	143	118	116	114	111
MC	O	5	1	90811	HC	F		233	122		109	106	96	95
MC	OVA	5	2	11030	HC	F								
MC	OVA	5	2	11030	HC	F					114	109	108	100
MC	OVA	5	2	11030	HC	F		248			113	114	105	100
MC	OVA	5	2	11030	HC	F		265	142		123	119	112	103
MC	OVA	5	2	11030	HC	F	1066	244	118	130	116	114	102	e 92
MC	OVA	5	2	11030	HC	F	1070	241	125	126	e 109	115	100	94
MC	OVA	5	2	11030	HC	F	1080	237	130	122	109	112	107	94
MC	OVA	5	2	11030	HC	F	1084	226	129	128	108	e 111	106	102
MC	OVA	5	2	11030	HC	F	1084	254	128	131	e 113	114	101	96
MC	OVA	5	2	11030	HC	F	1092	257	124	134	114	117	100	95
MC	OVA	5	2	11030	HC	F	1109	255	129	139	116	115	102	97
MC	OVA	5	2	11030	HC	F	1111		125	128	107		92	
MC	OVA	5	2	11030	HC	F	1114	236	130	137	113	113	107	98
MC	OVA	5	2	11030	HC	F	1114	239	133	131	111	112	106	99
MC	OVA	5	2	11030	HC	F	1119	237	126	132	106	109	96	92
MC	OVA	5	2	11030	HC	F	1119	242	127	129	111	116	105	97

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	3	SD	A	B	1	4
MC	OVA	5	2	11030	HC	F	1122	222	125	112	103	102	100	99
MC	OVA	5	2	11030	HC	F	1124			128		111		100
MC	OVA	5	2	11030	HC	F	1127	252	135	149	119	116	111	99
MC	OVA	5	2	11030	HC	F	1128		135	135	113		109	
MC	OVA	5	2	11030	HC	F	1129	251	131	126	113	113	110	103
MC	OVA	5	2	11030	HC	F	1132	239	125	131	e 103	115	99	93
MC	OVA	5	2	11030	HC	F	1132	240	131	127	e 106	109	100	98
MC	OVA	5	2	11030	HC	F	1142	249	132	137	116	113	103	99
MC	OVA	5	2	11030	HC	F	1157	245	132	136	113	112	107	105
MC	OVA	5	2	11030	HC	F	1165	240	127	131	112	112	104	99
MC	OVA	5	2	11030	HC	F	1168		135	140		113	108	96
MC	OVA	5	2	11030	HC	F	1175	244	133	134	114	112	107	100
MC	OVA	5	2	11030	HC	F	1185	244	133	140	114	112	108	101
MC	OVA	5	2	11030	HC	F	1186	244	129	130	112	108	106	99
MC	OVA	5	2	11030	HC	F	1187	242	134	132	113	112	111	104
MC	OVA	5	2	11030	HC	F	1187	244	136	133	115	111	109	105
MC	OVA	5	2	11030	HC	F	1190	247	142	131	112	113	111	109
MC	OVA	5	2	11030	HC	F	1196	244	142	131	112	110	110	109
MC	OVA	5	2	11030	HC	F	1196	247	132	140	115	114	108	98
MC	OVA	5	2	11030	HC	F	1201	247	130	134	112	109	107	102
MC	OVA	5	2	11030	HC	F	1201	e 243	132		117	e 99	110	
MC	OVA	5	2	11030	HC	F	1206	248	131	132	114	115	109	106
MC	OVA	5	2	11030	HC	F	1207	243	139	133	113	113	110	106
MC	OVA	5	2	11030	HC	F	1215	256	139	149	122	118	108	105
MC	OVA	5	2	11030	HC	F	1222	252	131	132	119	117	98	96
MC	OVA	5	2	11030	HC	F	1223	258	138	142	119	121	111	105
MC	OVA	5	2	11030	HC	F	1227	254	136		118	119	108	104
MC	OVA	5	2	11030	HC	F	1230	243	129	132	118	118	97	94
MC	OVA	5	2	11030	HC	F	1230	260	137	144	119	119		108
MC	OVA	5	2	11030	HC	F	1233		136	139	114		106	
MC	OVA	5	2	11030	HC	F	1252			137		111		108
MC	OVA	5	2	11030	HC	F	1253	238	139	136	112	109	115	112
MC	OVA	5	2	11030	HC	F	e 1114							
MC	OVA	5	2	11030	HC	F	e 1147	247	130	139	116	113	100	92
MC	OVA	5	2	11030	HC	F	e 1165		131	131	116		104	
MC	OVA	5	2	11030	HC	F	e 1176	238	130	140	e 118	e 103	100	e 90
MC	OVA	5	2	11030	HC	F	e 1176	246	132	145	109	115	108	102
MC	OVA	5	2	11030	HC	F	e 1236	253	134	137	117	115	107	99
MC	OVA	5	2	11597	BS	F		235	117		109	105	100	89
MC	OVA	5	2	11597	HC	F		241	132		115	109	106	102
MC	OVA	5	2	11597	HC	F		242	126		114	109	104	100
MC	OVA	5	2	80016	BS	F	1112	243	128	135	112	111	100	95
MC	OVA	5	2	80016	HC	F		248	127		117	111	98	
MC	OVA	5	2	80016	HC	F	1200	253	133	143	119	116	106	99
MC	OVA	5	2	90031	HC	F		243	138		114	110	110	108
MC	OVA	5	2	90474	SRS	F		241	139		113	111	109	104
MC	O	5	2	90537	HC	F		253	131		117	112	115	96
MC	O	5	2	92716	HC	F		244	136		115	112	109	100
MC	O	5	2	92716	HC	F	940	220	110	110	103	101	89	93
MC	O	5	2	92716	HC	F	1080	221	115	125	102	96	94	88
MC	O	5	2	92716	HC	F	1110	253	129	139	118	116	103	95
MC	OVA	6	1	10149	HC	F		235	118		110	106	96	89
MC	OVA	6	1	10149	HC	F		235	126		106	104	96	93
MC	OVA	6	1	11012	HC	F	1130	249	126	142	116	112	99	93
MC	OVA	6	1	11012	HC	F	1250	246	133	138	116	112	107	104
MC	OVA	6	1	11012	HC	F	1269	252	134		113	111	108	104
MC	OVA	6	1	11012	HC	F	c 1210	255	140		119	114	116	111
MC	OVA	6	1	80184	HC	F		252	134		115	112		97
MC	OVA	6	1	91731	HC	F	1286	271	140	162	127	127	115	109
MC	OVA	6	1	91732	HC	F	1374	272		160				
MC	OVA	6	1	92741	HC	F	1441	285	144	159	138	128	115	109
MC	OVA	6	1	92764	HC	F	1228	229	125	125	111	104	103	96
MC	OVA	6	1	92767	HC	F	1277	265	134	136	124	122	103	97
MC	OVA	6	1	92769	HC	F	1279	271	136	150	136	124	107	100
MC	OVA	6	2	80186	HC	F	1255	239	145	127	113	111	110	103
MC	OVA	6	2	92739	HC	F		253	132	134	118	115	106	98
MC	OVA	6	2	92739	HC	F	1417	269	145	147	128	129	118	114
MC	OVA	6	2	92746	HC	F	1507	305	166	172	142	139	134	131
MC	OVA	6	2	92748	HC	F	1295	271	135	149	126	125	107	101
MC	OVA	6	3	40912	HC	F								
MC	OVA	6	3	40912	HC	F		256	134		122	120	105	103
MC	OVA	6	3	48001	HC	F	1080	224	119	116	107	105	95	91
MC	OVA	6	3	48001	HC	G	1350	265	134	142	122	119	111	106
MC	CAH	6	1	11012	HC	UM								
MC	O	6	1	60499	HC	F		276	143		126	125	110	108
MC	O	6	1	13013	HC	UM								
MC	O	6	1	13014	HC	F	1198	239	126	137	112	108	101	99
MC	O	6	2	13003	HC	F	1283	254	138	131	117	113	105	102
MC	O	6	2	80196	HC	F	1215	246	132	139	115	111	100	98
MC	O	6	3	48001	HC	UM								

ELEM	TAX	PER	SUBP	CO	SIE	FUS	LA
PE	O	1	2	40021	HC	F	239
PE	O	1	2	40116	HC	F	266
PE	O	1	2	40116	HC	F	269
PE	O	1	2	47871	HC	F	250
PE	O	1	2	47871	HC	F	274
PE	O	1	3	21003	HC	H	257
PE	O	1	3	40102	HC	F	257
PE	O	1	3	40178	HC	F	266
PE	O	1	4	40121	HC	H	296
PE	O	2	1	20050	HC	F	257
PE	O	2	1	22012	HC	F	257
PE	O	2	2	49144	HC	F	282
PE	O	2	2	49252	HC	F	275
PE	O	2	2	70026	HC	F	250
PE	O	2	3	22149	HC	H	279
PE	O	2	3	49245	HC	F	252
PE	O	3	1	49235	HC	F	266
PE	O	4	1	13118	HC	F	269
PE	O	4	2	10468	HC	F	269
PE	O	4	2	10591	HC	F	238
PE	O	4	2	80241	BS	F	267
PE	O	5	1	10565	HC	F	305
PE	O	5	1	10822	HC	F	251
PE	O	5	1	11038	HC		258
PE	O	5	1	49241	HC	F	256
PE	O	5	1	50443	SRS	F	273
PE	O	5	2	11057	HC	F	255
PE	O	5	2	41195	HC	F	263
PE	O	5	2	80716	HC	F	268

ELEM	TAX	PER	SUBP	CO	SIE	FUS	LA
PE	O	5	2	90716	HC	F	272
PE	O	5	2	90716	HC	F	279
PE	O	6	1	10149	HC	F	263
PE	O	6	1	10149	HC	F	275
PE	O	6	1	10149	HC	F	280
PE	O	6	1	10149	HC	F	357
PE	O	6	1	10561	HC	F	293
PE	O	6	1	11070	HC	F	224
PE	O	6	1	11070	HC	F	291
PE	O	6	1	13013	HC	F	261
PE	O	6	1	13013	HC	F	276
PE	O	6	1	13014	HC	F	c 241
PE	O	6	1	45133	HC	F	305
PE	O	6	1	80134	HC	F	322
PE	O	6	1	91616	HC	F	280
PE	O	6	1	92741	HC	F	284
PE	O	6	1	92753	HC	F	295
PE	O	6	1	92758	HC	F	263
PE	O	6	1	92758	HC	F	287
PE	O	6	1	92761	HC	F	276
PE	O	6	1	92764	HC	F	279
PE	O	6	1	92764	HC	F	282
PE	O	6	1	92766	HC	F	261
PE	O	6	1	92768	HC	F	250
PE	O	6	2	80186	HC	F	289
PE	O	6	2	92739	HC	F	284
PE	O	6	2	92739	HC	F	379
PE	O	6	2	92750	HC	F	287
PE	O	6	2	92750	HC	F	290
PE	O	6	2	92750	HC	F	290
PE	O	6	3	10003	HC	F	236
PE	O	6	3	10005	HC	F	216
PE	O	6	3	10039	HC	F	270

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD
FE	O	2	3	49245	HC	F	1580	105
FE	O	4	1	11043	HC	UM	c 671 (n)	
FE	O	6	1	92758	HC	G	1833	187

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD	Bd
TI	OVA	1	2	22211	HC		2120	111	250
TI	OVA	1	2	90330	SRS	F			275
TI	OVA	1	3	21003	HC	F			262
TI	OVA	1	3	40023	HC	F			249
TI	OVA	1	3	40024	HC	F			243
TI	OVA	1	3	40114	HC	G			256
TI	OVA	1	3	40196	HC	F			243
TI	OVA	1	3	40229	HC	F			248
TI	OVA	1	3	46416	HC	F			254
TI	OVA	1	3	46624	SRS	F			275
TI	OVA	1	3	60091	HC	F			253
TI	OVA	1	3	90041	HC	F			275
TI	OVA	1	3	90176	HC	F			264
TI	OVA	1	3	90353	HC	F			265
TI	OVA	1	4	40002	HC	F			268
TI	OVA	1	4	40121	SRS	F			279
TI	OVA	1	4	40354	HC	F			246
TI	OVA	1	4	47003	HC	F			263
TI	O	1	2	20105	HC	F			240
TI	O	1	3	40187	HC	F			261
TI	O	1	3	80542	HC	F			253
TI	O	1	4	47751	HC	G			256
TI	O	1	4	47751	HC	G			263
TI	O	1	4	49192	HC	F			234
TI	OVA	2		91042	HC	F			270
TI	OVA	2	1	11365	HC	F			244
TI	OVA	2	1	20011	HC	F			235
TI	OVA	2	1	20011	HC	F			261
TI	OVA	2	1	20011	HC	F			262
TI	OVA	2	1	20050	HC	F			267
TI	OVA	2	1	22012	HC	F			250
TI	OVA	2	1	40216	BS	UE			271
TI	OVA	2	1	40250	HC	F			236
TI	OVA	2	1	40262	HC	F			265
TI	OVA	2	1	70080	HC	F			276
TI	OVA	2	3	20136	HC	F			284
TI	OVA	2	3	20149	HC	F			271
TI	OVA	2	3	20162	HC	F			233
TI	OVA	2	3	20163	HC	G			228
TI	OVA	2	3	49245	HC	F			231
TI	OVA	2	3	49245	HC	F			239
TI	O	2		22298	HC	F			268
TI	O	2	1	20060	SRS	F			250
TI	O	2	1	20084	HC	G			247
TI	O	2	2	70026	HC	F			262
TI	O	2	2	80082	HC	F			247
TI	OVA	3	1	49225	HC	G			242
TI	OVA	3	1	80065	HC	F			222
TI	OVA	3	1	80065	HC	G			258
TI	OVA	3	2	80010	HC	F			228
TI	OVA	3	2	80011	BS	F			246
TI	O	3	1	80503	HC	F			245
TI	OVA	4	1	80374	SRS	F			253
TI	OVA	4	2	10468	HC	F			267
TI	OVA	4	2	11326	SRS	F			239
TI	O	4	2	10468	HC	F			225
TI	O	4	2	10468	HC	G			243
TI	OVA	5	1	10125	HC	F			c 251
TI	OVA	5	1	10565	HC	F			248
TI	OVA	5	1	10565	HC	F			259
TI	OVA	5	1	90434	HC	F			256
TI	OVA	5	1	91547	BS	F			242
TI	OVA	5	2	10767	HC	F			231
TI	OVA	5	2	80016	HC	F			233
TI	OVA	5	2	90702	HC	F			243
TI	OVA	5	2	90716	HC	F			255

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD	Bd
TI	OVA	5	2	90922	HC	F			241
TI	O	5	1	10822	HC	F			267
TI	O	5	2	90655	HC	F			219
TI	O	5	2	92716	HC	F			246
TI	O	5	2	92716	HC	F			263
TI	OVA	6	1	10561	HC	F			264
TI	OVA	6	1	10715	HC	F			227
TI	OVA	6	1	13014	HC	F			303
TI	OVA	6	1	40476	HC	F			255
TI	OVA	6	1	45021	HC	F			243
TI	OVA	6	1	50077	HC	F			253
TI	OVA	6	1	80184	HC	F			239
TI	OVA	6	1	80187	HC	F	2040	108	264
TI	OVA	6	1	92741	HC	F			242
TI	OVA	6	1	92741	HC	F			251
TI	OVA	6	1	92761	HC	F			225
TI	OVA	6	1	92764	HC	F	1777	102	223
TI	OVA	6	1	92765	HC	F			286
TI	OVA	6	2	10678	HC	F			264
TI	OVA	6	2	80186	HC	F			261
TI	OVA	6	2	80186	HC	F			270
TI	OVA	6	2	92739	HC	F			275
TI	OVA	6	2	92739	HC	G			269
TI	OVA	6	2	92748	HC	F	1910	112	259
TI	OVA	6	2	92750	HC	F			270
TI	OVA?	6	3	10005	HC	F			269
TI	OVA	6	3	10039	HC	F			259
TI	OVA	6	3	10051	HC	F			271
TI	OVA	6	3	10334	HC	F			223
TI	OVA	6	3	40325	HC	F			272
TI	OVA	6	3	40891	HC	F			227
TI	OVA	6	3	40898	HC	F			235
TI	O	6	1	45133	HC	F			277
TI	O	6	2	80196	HC	F			249
TI	O	6	2	80196	HC	F			253
TI	O	6	3	10100	HC	F			241

ELEM	TAX	PER	SUBP	CO	SIE	GL1	Bd	D1
AS	OVA	1	3	22033	HC		193	
AS	OVA	1	3	22340	HC	286	193	160
AS	O	1	2	80613	HC	255	179	143
AS	O	1	4	11171	HC	276	181	152
AS	OVA	2	1	20064	BS	280	182	160
AS	OVA	2	1	40210	BS	290	187	166
AS	OVA	2	3	20151	HC	254	174	134
AS	OVA	2	3	49245	SRS	280	187	160
AS	O	2	1	70143	BS	290	182	168
AS	O	3	1	70047	BS	283	183	157
AS	OVA	4	1	80264	BS	230	149	129
AS	OVA	4	1	80264	BS	265	183	148
AS	OVA	4	2	91424	SRS	264	166	148
AS	OVA	5	1	10469	HC	274	179	149
AS	OVA	5	1	90278	HC	289	175	155
AS	OVA	5	1	90413	HC	250	160	142
AS	OVA	5	2	90655	HC	248	160	139
AS	O	5	2	90107	HC	245	169	139
AS	OVA	6	1	10521	HC	281	183	155
AS	OVA	6	3	10100	HC	258	168	139
AS	OVA	6	3	47364	HC	317	217	176
AS	O	6	1	10149	HC	260	171	158
AS	O	6	1	45133	HC	264	172	151
AS	O	6	3	10002	HC	276	175	150

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL
CA	O	1	3	21003	SRS	F	586
CA	OVA	2	1	20047	HC	F	516
CA	OVA	2	2	80470	HC	F	574
CA	OVA	2	3	40248	HC	F	510
CA	OVA	4	1	80331	SRS	F	508
CA	OVA	4	2	10118	BS	F	485
CA	O	4	2	91202	SRS	F	469
CA	OVA	5	1	10171	HC	F	520
CA	OVA	5	1	10448	HC	F	474
CA	OVA	5	1	10565	HC	G	529
CA	OVA	5	1	49241	HC	F	505
CA	OVA	5	1	90765	HC	F	551
CA	O	5	2	92716	HC	F	517
CA	OVA	6	1	10149	HC	F	530
CA	OVA	6	1	91387	SRS	F	599
CA	OVA	6	3	10100	HC	F	535
CA	OVA	6	3	47357	HC	F	577
CA	O	6	1	80114	HC	F	565
CA	O	6	2	13004	HC	F	588

ELEM	TAX	PER	SUBP	CO	SIR	FUS	GL	Bd	3	SD	BaF
MT	OVA	1	2	40116	HC	F	1317	250	143	117	
MT	OVA	1	3	40184	SRS	F		225			
MT	OVA	1	3	90227	HC	F		232	131		
MT	OVA	1	4	22106	HC	F		242	133		
MT	OVA	1	4	22106	HC	F		243	130		
MT	OVA	1	4	22106	HC	F		245	130		
MT	OVA	1	4	22106	HC	F		247	134		
MT	OVA	1	4	22106	HC	F		249	138		
MT	OVA	1	4	22106	HC	F		255	140		
MT	OVA	1	4	49292	HC	F		228	124		
MT	O	1	2	22291	HC	F		247	141		239
MT	O	1	2	91924	SRS	F		236	137		227
MT	O	1	3	11688	HC	F		213			201
MT	O	1	3	40184	HC	F		225			222
MT	O	1	4	49192	HC	G		229	128		225
MT	OVA	2	1	22012	HC	F		222			
MT	OVA	2	1	80561	BS	F	c 1204			107	
MT	CAH	2	1	20011	HC	F		213	129		
MT	CAH	2	1	80625	HC	F	1310	275	150	155	
MT	O	2	3	20136	HC	F	1234	231	126	119	
MT	OVA	3	1	80503	HC	F	1210	200	123	99	
MT	OVA	4	1	13162	HC	F		229	124		
MT	OVA	4	2	10118	BS	F	1241	221		111	
MT	OVA	4	2	80366	SRS	F	1198	208	122	95	197
MT	O	4	1	11532	HC	F		238	130		
MT	O	4	2	10468	HC	F		215	127		
MT	O	4	2	10468	HC	F		227	124		
MT	OVA	5	1	10125	HC	F	1130	216	114	95	
MT	OVA	5	2	10050	HC	F		240	128		
MT	OVA	5	2	10473	HC	F	1109	225	116	116	
MT	OVA	5	2	11030	HC	F		238	125	117	
MT	OVA	5	2	11030	HC	F		245			
MT	OVA	5	2	11030	HC	F		252	141	127	
MT	OVA	5	2	11030	HC	F	1105	222	122	115	
MT	OVA	5	2	11030	HC	F	1150	231	125	112	
MT	OVA	5	2	11030	HC	F	1150	234	122	117	
MT	OVA	5	2	11030	HC	F	1159	217	123	108	
MT	OVA	5	2	11030	HC	F	1164	231	127	121	
MT	OVA	5	2	11030	HC	F	1176	215	123	106	
MT	OVA	5	2	11030	HC	F	1176	237	125	116	
MT	OVA	5	2	11030	HC	F	1183	224	140	111	
MT	OVA	5	2	11030	HC	F	1187	236		116	
MT	OVA	5	2	11030	HC	F	1193	e 224		123	
MT	OVA	5	2	11030	HC	F	1194	231	127		
MT	OVA	5	2	11030	HC	F	1203	240	130	108	
MT	OVA	5	2	11030	HC	F	1204	213	122	121	
MT	OVA	5	2	11030	HC	F	1209	206	120	100	
MT	OVA	5	2	11030	HC	F	1209	236	131	116	
MT	OVA	5	2	11030	HC	F	1215	224	117	104	
MT	OVA	5	2	11030	HC	F	1215	241	128	114	
MT	OVA	5	2	11030	HC	F	1220	227	126	119	
MT	OVA	5	2	11030	HC	F	1221	226	129	123	
MT	OVA	5	2	11030	HC	F	1232	239	123	117	
MT	OVA	5	2	11030	HC	F	1239	223	125	115	
MT	OVA	5	2	11030	HC	F	1250	246	140	122	
MT	OVA	5	2	11030	HC	F	1255	e 213		115	
MT	OVA	5	2	11030	HC	F	1257			118	
MT	OVA	5	2	11030	HC	F	1269	243	127	121	
MT	OVA	5	2	11030	HC	F	1271	244	130	128	
MT	OVA	5	2	11030	HC	F	1272				
MT	OVA	5	2	11030	HC	F	1279	248	136	121	
MT	OVA	5	2	11030	HC	F	1286	230	128	114	
MT	OVA	5	2	11030	HC	F	1287	239	127	127	
MT	OVA	5	2	11030	HC	F	1288		126	121	
MT	OVA	5	2	11030	HC	F	1289	226	124	111	
MT	OVA	5	2	11030	HC	F	1289	229	124	115	
MT	OVA	5	2	11030	HC	F	1299	236	131	115	
MT	OVA	5	2	11030	HC	F	1300	240	131	122	
MT	OVA	5	2	11030	HC	F	1302	234	129	119	
MT	OVA	5	2	11030	HC	F	1306		130	115	
MT	OVA	5	2	11030	HC	F	1307	242	120	116	
MT	OVA	5	2	11030	HC	F	1310	253	142	123	
MT	OVA	5	2	11030	HC	F	1320	218	132	117	
MT	OVA	5	2	11030	HC	F	1321	239	128	112	
MT	OVA	5	2	11030	HC	F	1324	239	134	120	
MT	OVA	5	2	11030	HC	F	1340	221	133	117	
MT	OVA	5	2	11030	HC	F	1350	237	130	113	
MT	OVA	5	2	11030	HC	F	1350	253	141	133	
MT	OVA	5	2	11030	HC	F	1355	222	137	118	
MT	OVA	5	2	11030	HC	F	1360		130		
MT	OVA	5	2	11030	HC	F	e 1156	223	121	103	
MT	OVA	5	2	11030	HC	F	e 1181	232	123	e 115	
MT	OVA	5	2	11030	HC	F	e 1240	236	126	119	
MT	OVA	5	2	11030	HC	F	e 1256	226	124		
MT	OVA	5	2	11030	HC	F	e 1266	237	134	114	
MT	OVA	5	2	11597	HC	F		216	118		207
MT	OVA	5	2	11597	HC	F		223	116		222
MT	OVA	5	2	11597	HC	F		227	126		219
MT	OVA	5	2	11597	HC	F		241	129		234
MT	OVA	5	2	11597	HC	F		242	139		235
MT	OVA	5	2	11597	HC	F	1226	227	129	118	229
MT	OVA	5	2	80016	BS	F		221	127		220
MT	OVA	5	2	80016	BS	F	1234	229	127	113	224
MT	OVA	5	2	80016	HC	F		223	125		
MT	OVA	5	2	80016	HC	F	1285	245	135	125	
MT	OVA	5	2	90216	HC	F		213	113		
MT	OVA	5	2	90218	HC	F	1197	227	126	110	
MT	OVA	5	2	90218	HC	F	1216	220	120	111	
MT	OVA	5	2	90218	HC	F	1274	257	132	133	
MT	OVA	5	2	90390	HC	F	1120	207	118	101	
MT	OVA	5	2	90422	HC	F	1290	226	123	111	
MT	OVA	5	2	90585	HC	F		228	126		
MT	OVA	5	2	90585	HC	F	1140	211	122	111	
MT	OVA	5	2	90585	HC	F	1190	226	121	121	
MT	OVA	5	2	90585	HC	F	1220	226	122	107	
MT	OVA	5	2	90585	HC	F	c 1270	226	133	116	
MT	O	5	1	90580	SRS	F		233	125		232
MT	O	5	1	90585	BS	F		239	131		227
MT	O	5	2	11343	HC	F		224	132		229
MT	O	5	2	11343	HC	F	e 1160	227	121	111	223
MT	O	5	2	90228	HC	F		218	123		
MT	O	5	2	90228	HC	F		238	134		
MT	O	5	2	92716	HC	F		224	132		206
MT	O	5	2	92716	HC	F		221	130		205
MT	O	5	2	92716	HC	F		228	127		221

ELEM	TAX	PER	SUBP	CO	SIR	FUS	GL	Bd	3	SD	BaP
MT	O	5	2	92716	HC	F		243	138		231
MT	O	5	2	92716	HC	F	1110	208	116	109	202
MT	O	5	2	92716	HC	F	1180	210		104	203
MT	OVA	6	1	10149	HC	F		223	120		218
MT	OVA	6	1	10149	HC	F		224	130		223
MT	OVA	6	1	10149	HC	F		229	130		230
MT	OVA	6	1	10149	HC	F		231	136		237
MT	OVA	6	1	11012	HC	F		214	123		
MT	OVA	6	1	11012	HC	F	1425	266	140		
MT	OVA	6	1	45092	HC	F	1141	217	121	109	213
MT	OVA	6	1	60611	HC	F		226	130		
MT	OVA	6	1	92741	HC	F	1350	243	131	135	
MT	OVA	6	1	92741	HC	F	c 1324	243	130	114	
MT	OVA	6	1	92753	HC	F		221	125	97	
MT	OVA	6	1	92756	HC	F	1388	232		124	
MT	OVA	6	1	92758	HC	F	1344	226	132	117	
MT	OVA	6	1	92758	HC	G	1398	252	134	117	
MT	OVA	6	1	92764	HC	F	1314	237	126	100	
MT	OVA	6	1	92766	HC	F	1305	246	134	132	
MT	OVA	6	2	92750	HC	F		244	130		
MT	OVA	6	2	92750	HC	F	1355	233	125	114	
MT	OVA	6	2	92750	HC	F	1420	245	132	112	
MT	OVA	6	3	10002	HC	F	c 1180	219	113	109	
MT	OVA	6	3	10002	HC	F	c 1340			105	
MT	CAH?	6	1	13014	HC	F	1264	261	131	131	258
MT	CAH?	6	3	10002	HC	F	1480	254		142	
MT	O	6	1	13014	HC	F	1338	220	132	106	219
MT	O	6	1	13014	HC	G	1423	237	124	117	239
MT	O	6	1	80137	HC	F	c 1377	237	129		228

TAX	PER	SUBP	CO	SIE	SEX	DP4L	DP4WA	M1WA	M1WB	M2WA	M2WB	M3L	M3WA	M3WC	M12WA	M12WB
S	1	2	40079	HC	M					140	136	362	163	161		
S	1	2	40116	HC								298	180	149		
S	1	2	40319	HC						139	140					
S	1	2	46285	HC	F				108	133	134	287	145	137		
S	1	2	80545	BS	M			93	102	119	121					
S	1	2	80604	HC				102	109							
S	1	2	80604	HC	M			98	104	129	121					
S	1	2	80604	BS	F			103	105							
S	1	2	80669	HC								341	148	148		
S	1	2	91073	HC					109	129	144					
S	1	3	12602	SRS						126	129	305	138	132		
S	1	3	21052	HC				108	114	135	139	318	159	140		
S	1	3	22133	HC	M			107	112	135	142	320	158	147		
S	1	3	22133	SRS								325	144	147		
S	1	3	40023	HC								340	149			
S	1	3	40289	HC								324				
S	1	3	46416	HC				102	103	121	124					
S	1	3	46624	SRS	F			97	103	124	130					
S	1	3	80091	HC				96	108	127						
S	1	3	80527	HC						117	119					
S	1	3	90041	HC				105	114							
S	1	3	90041	HC	M			97	105							
S	1	3	90176	HC	F							304	144	145		
S	1	4	21105	BS				100		128	132	277	153	146		
S	1	4	22126	HC	M							271	138	134		
S	1	4	40002	HC						140	142		147	139		
S	1	4	40002	HC	F			101	109	122	132					
S	1	4	40047	HC		176	75			113	123					
S	1	4	40047	HC			82	95	101	113	119					
S	1	4	46176	HC	M				113							
S	1	4	47090	HC						130	134	304	142	143		
S	1	4	47661	HC		196	91	107	110							
S	1	4	49292	HC						126	129					
S	1	4	49292	HC				104	107	131	133					
S	1	4	49292	HC				106	109	131	122					
S	1	4	50007	HC				99	109							
S	1	4	50027	HC				96	102							
S	1	4	50093	HC	F			98	105	127	123					
S	2	1	11105	HC		180	68									
S	2	1	20011	HC				102	111	126	131					
S	2	1	20060	HC						138	139	334	165	146		
S	2	1	20060	HC	M					114	120	227	135	135		
S	2	1	20081	HC		181		105	107							
S	2	1	22012	HC				102	105	131	132					
S	2	1	22040	SRS				102								
S	2	1	22151	HC				109	110							
S	2	1	40210	HC				99	105							
S	2	1	40250	HC		188	92	105	110							
S	2	1	40262	HC				101	109							
S	2	1	40273	HC								268	158	138		
S	2	1	80672	HC				100	105							
S	2	1	80672	HC				100	113							
S	2	1	80672	HC	F			97	101	125	129					
S	2	1	90376	HC				105	108	128	132					
S	2	2	70019	SRS		172	85	108	112							
S	2	2	70026	HC	M			94	103	126						
S	2	2	80470	HC	M					111	117					
S	2	3	20027	BS											125	126
S	2	3	20136	HC		160	87	102	111							
S	2	3	20156	HC				96	102							
S	2	3	49141	HC						124	130					
S	2	3	49141	HC				91	104	114	123					
S	2	3	49141	HC				99	103							
S	2	3	49141	HC				102		123	128					
S	2	3	49245	HC				99		123	129					
S	2	3	49245	HC				100	102	129	130					
S	2	3	49245	HC				105	112							
S	2	3	49245	HC	M			97	103							
S	2	3	49245	HC	M			102	104	129	133					
S	2	3	91076	HC				100	109							
S	3	1	20116	HC	M			101	113	143						
S	3	1	20135	HC						136						
S	3	1	70008	HC	M			95	99	118	120					
S	3	1	80065	HC				93	99							
S	3	2	11125	BS						129	131	269	141	136		

TAX	PER	SUBP	CO	SIE	SEX	DP4L	DP4WA	M1WA	M1WB	M2WA	M2WB	M3L	M3WA	M3WC	M12WA	M12WB
S	4	1	13165	HC						142	143	329	163	155		
S	4	1	49231	SRS				88	94	113	117					
S	4	1	91812	HC		177	85	102	107							
S	4	1	92111	HC				110	118	132	140					
S	4	2	10118	HC		175	84	93	100							
S	4	2	10468	HC				101	108	122	129					
S	4	2	10751	HC		175	79	97	100							
S	5	1	10171	HC			66									
S	5	1	10565	HC											116	117
S	5	1	13184	BS			76									
S	5	1	49197	HC		192	89	107	114							
S	5	1	90567	HC									149	144		
S	5	1	90567	SRS											103	109
S	5	1	90765	SRS				104	112	130	139					
S	5	1	90767	SRS									137			
S	5	1	90808	HC									133	134		
S	5	2	10085	HC				108	117	129	132	307	141	140		
S	5	2	10767	HC				104	99							
S	5	2	80210	HC	AF			105	110	133	139					
S	5	2	90031	HC	M	187										
S	5	2	90123	SRS		181	89	101	111	131	133					
S	5	2	90171	HC	F			96	106	127	136	341	156	151		
S	5	2	90216	HC		178	63	104	115							
S	5	2	90384	HC				101	101							
S	5	2	90655	HC				98	103	123	122					
S	5	2	92716	HC								387	167	155		
S	5	2	92716	HC				98	104							
S	5	2	92716	HC				107	111	137	142					
S	5	2	92716	HC	P	161	80									
S	6	1	10522	HC				99	107	134	136					
S	6	1	10732	HC								363	152	146		
S	6	1	10747	HC							119					
S	6	1	13014	HC		170	80	100	107	127	136					
S	6	1	45187	HC	M					123	136					
S	6	1	80110	HC				103	107	132	129					
S	6	1	91430	SRS				98	108	129	134					
S	6	1	91608	SRS	AM					141						
S	6	1	92741	HC						132	138					
S	6	1	92758	HC	AF					143	145					
S	6	1	92758	HC	AF			110	120	152						
S	6	1	92758	HC	M			104	112	138	147					
S	6	1	92761	HC				105	114	139	149					
S	6	1	92761	HC	F			108	109	136	137					
S	6	1	92764	HC				115	123							
S	6	1	92765	HC											141	141
S	6	1	92765	HC	M			105	110							
S	6	1	92766	HC	F			100	107	128	143					
S	6	1	92768	HC				100	102	125	127					
S	6	1	92776	HC				101	108	135						
S	6	1	92776	HC				102	111							
S	6	1	92776	HC				105	110	128	137					
S	6	1	92776	HC			82	101	105							
S	6	1	92776	HC		168	78	95	99							
S	6	1	92776	HC		193	92	102	117							
S	6	1	92776	HC	c	187	83									
S	6	1	92776	HC				98	108	129	130					
S	6	1	92778	HC	F		87	102	110	127	132					
S	6	2	11363	HC				112	115	136	145	365	162	157		
S	6	2	12758	HC								338	133			
S	6	2	13003	HC				96	108	122	129					
S	6	2	80186	HC				106	111							
S	6	2	80186	HC	M			109	118	138	143					
S	6	2	80196	HC	M			105	110							
S	6	2	92750	HC						133	139					
S	6	3	10002	HC	P			110	118							
S	6	3	10334	HC									111	115		
S	6	3	40884	HC											127	132
S	6	3	40891	HC		176	66	108	116							
S	6	3	40898	HC		184	64	97	104							
S	6	3	40911	HC						122	131					

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GLC	BT	HTC
HU	S	1	2	22049	BS	F		276	160
HU	S	1	2	40116	HC	F		299	192
HU	S	1	2	40319	HC	G		332	198
HU	S	1	2	80604	HC	F			
HU	S	1	3	40023	HC	G		298	188
HU	S	1	3	90277	SRS	G		267	182
HU	S	1	4	40002	HC	UM	591 (n)		
HU	S	1	4	40002	HC	UX			164
HU	S	1	4	40047	HC	G			191
HU	S	1	4	49292	HC	G		300	173
HU	S	2	1	20011	HC	G		e 275	178
HU	S	2	1	80560	HC	G			
HU	S	2	2	20044	HC	F			
HU	S	2	3	20136	HC	F		288	182
HU	S	2	3	40228	HC	G			193
HU	S	3	2	10671	SRS	F		351	213
HU	S	4	1	13038	HC	F			184
HU	S	4	2	45157	HC	G			
HU	S	5	1	13210	BS	UM	570 (n)		
HU	S	5	1	90280	HC	F			179
HU	S	5	2	90228	HC	UM	440 (n)		
HU	S	6	1	10521	HC	F		372	237
HU	S	6	1	92753	HC	F		319	201
HU	S	6	1	92753	HC	G		258	185
HU	S	6	3	40084	HC	UM	e 633 (n)		
HU	S	6	3	48001	HC	G		328	197

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL
RA	S	1	4	40002	HC	UM	530 (n)
RA	S	1	4	40002	HC	UM	531 (n)
RA	S	6	1	47190	BS	UM	218 (n)

ELEM	TAX	PER	SUBP	CO	SIE	FUS	LAR
PE	S	1	2	40006	HC	F	321
PE	S	1	2	80604	HC	F	294
PE	S	1	3	40023	HC	F	297
PE	S	1	3	40074	HC	F	337
PE	S	1	3	40308	HC	F	361
PE	S	1	3	91815	SRS	F	322
PE	S	1	4	11241	HC	F	293
PE	S	1	4	50007	BS	F	349
PE	S	2	1	80560	HC	F	329
PE	S	2	3	49245	HC	F	319
PE	S	3	1	11649	HC	F	405
PE	S	3	2	11113	HC	F	322
PE	S	5	1	10940	HC	F	364
PE	S	5	1	90808	HC	F	301
PE	S	5	2	10085	HC	F	383
PE	S	6	1	92741	HC	F	308
PE	S	6	1	92776	HC	F	322
PE	S	6	2	92750	HC	F	367
PE	S	6	2	92750	HC	F	371

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL
FE	S	5	2	90228	HC	UM	453 (n)

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd
TI	S	1	2	22060	BS	UM		277
TI	S	1	2	47871	HC	F		289
TI	S	1	2	80545	HC	F		c 271
TI	S	1	2	80619	HC	G		303
TI	S	1	2	91073	HC	F		c 272
TI	S	1	3	20139	HC	G		c 267
TI	S	1	3	20172	HC	UX		315
TI	S	1	3	40074	HC	G		292
TI	S	1	3	46416	BS	F		276
TI	S	1	3	90638	HC	G		247
TI	S	2	1	80471	HC	F		321
TI	S	2	1	80560	BS	F		306
TI	S	2	2	60430	BS	G		310
TI	S	2	2	80470	HC	G		251
TI	S	2	3	20163	HC	F		c 430
TI	S	3	2	10427	HC	G		297
TI	S	5	1	11257	HC	G		346
TI	S	5	2	90031	HC	F		224
TI	S	5	2	90228	HC	UM	456 (n)	
TI	S	5	2	90657	HC	F		269
TI	S	6	1	10746	SRS	F		343
TI	S	6	1	92753	HC	G		313
TI	S	6	2	60196	HC	UM	622 (n)	

ELEM	TAX	PER	SUBP	CO	SIE		GL1
AS	S	1	2	90349	HC		342
AS	S	1	4	40047	HC		342
AS	S	1	4	40047	HC		346
AS	S	1	4	40047	HC		367
AS	S	2	1	20060	BS		394
AS	S	2	1	20060	SRS	c	330
AS	S	2	1	40210	HC		369
AS	S	2	2	20044	SRS		363
AS	S	4	1	80331	BS		396
AS	S	4	2	45183	HC		357
AS	S	5	1	10448	SRS		447
AS	S	5	1	49241	HC		412
AS	S	6	1	10464	BS		391
AS	S	6	1	10738	HC		423
AS	S	6	1	91387	SRS		419

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL
CA	S	2	3	49245	SRS	F	674
CA	S	4	2	49149	HC	F	682
CA	S	5	2	90031	HC	F	524

TAX	PKR	SUBP	CO	SIK	P2Ll	P2Wa	P2Wd	P3Ll	P3Wa	P3Wd	P4Ll	P4Wa	P4Wd	MlLl	MlWa	MlWd	M2Ll	M2Wa	M2Wd	M3Ll	M3Wa	M3Wd	
EQ	1	3	90227	HC													328	141					
EQ	1	4	21020	HC	308	106	53																
EQ	1	4	60026	HC	309	104	86	278	144	64	268	144	64	244	137	46	250	137	42	281	116	43	
EQ	2	1	49145	HC	c 315	109	80	257	157	79	257	156	72	231	147	32				324	129	38	
EQ	2	2	70046	HC							257	150	50				244	139	25	292	124	32	
EQ	6	1	92758	HC	305	107	63	254	144	53	252	155	48	240	143	37	242	136	32	315	128	31	
EQ	6	1	92761	HC																321	113	48	
EQ	6	1	92761	HC				272		72	263	154	72	237		40	237		40	313	131	36	
EQ	6	1	92764	HC	323	111	66	267	154	57	270	152	54	255	155	33	260	148	33	341	142	34	
EQ	6	1	92776	HC	331			280	156	48	267	154	50	244	142	36	241	134	34	315	131	33	(bit wear on P2)
EQ	6	2	92739	HC	295	113	81	247	152	70	263	159	66	255	141	41	261	152	44	307	138	46	
EQ	6	2	92750	HC													252	139	44	329	132	42	(horse sledge, SF-421)
EQ	6	2	92750	HC				279	150	50				241	156	30	269	156	27	325	148	20	(horse sledge, SF-421)
EQ	6	2	92750	HC																283	124	19	
EQ	6	2	92750	HC	339	131		281	163	71	272	164	65	257	152	37	260	151	33	302	123		

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GLC	BT	HTC	SD
HU	EQ	1	4	47751	HC	F		715		
HU	EQ	2	1	20050	HC	F		743	374	
HU	EQ	2	1	80471	HC	F		667	334	
HU	EQ	2	1	80471	HC	F		673	358	
HU	EQ	2	2	60298	HC	H	c 2650			330
HU	EQ	2	2	80470	HC	F		758		
HU	EQ	2	3	49245	SRS	F		758	379	
HU	EQ	3	1	70008	HC	F		c 661	347	
HU	EQ	6	1	80150	HC	F		684	366	
HU	EQ	6	1	92758	HC	F	2692	710	357	357
HU	EQ	6	1	92758	HC	F	2945	760	387	349
HU	EQ	6	1	92761	HC	F		713	367	
HU	EQ	6	1	92761	HC	F	2759	705	351	323
HU	EQ	6	1	92761	HC	F	2815	c 714	377	321
HU	EQ	6	1	92765	HC	F		791	392	
HU	EQ	6	1	92765	HC	F	2754	757	390	306
HU	EQ	6	1	92765	HC	F	2768	743	378	327
HU	EQ	6	1	92766	HC	F		685	354	
HU	EQ	6	1	92771	HC	F	2949	807	392	
HU	EQ	6	1	92775	HC	F		771	388	
HU	EQ	6	2	80196	HC	F		670	348	
HU	EQ	6	2	92739	HC	F		729	381	
HU	EQ	6	3	48001	HC	F		807	437	

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD
RA	EQ	1	2	80587	HC	F	3110	467
RA	EQ	1	3	80540	SRS	F	3290	
RA	EQ	1	3	80542	HC	F	3150	350
RA	EQ	6	1	80150	HC	F	3150	359
RA	EQ	6	1	92758	HC	F	3378	397
RA	EQ	6	1	92761	HC	F	e 3590	407
RA	EQ	6	1	92761	HC	F	3358	379
RA	EQ	6	1	92761	HC	F	3648	400
RA	EQ	6	1	92764	HC	F	3056	345
RA	EQ	6	1	92764	HC	F	3439	357
RA	EQ	6	1	92765	HC	F	3539	385
RA	EQ	6	1	92765	HC	F	3568	370
RA	EQ	6	1	92766	HC	F	c 3247	334
RA	EQ	6	1	92767	HC	F	3583	391
RA	EQ	6	2	11363	HC	F	3250	402
RA	EQ	6	2	92750	HC	F	3546	410
RA	EQ	6	2	92750	HC	F	c 3380	369
RA	EQ	6	2	92750	HC	F	e 3550	383
RA	EQ	6	3	48001	HC	F	3520	397

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	L1	SD	Bd
MC	EQ	1	3	40016	SRS	F			310	
MC	EQ	1	3	90354	HC	UM	1406 (n)			
MC	EQ	1	3	90354	HC	UM	1409 (n)			
MC	EQ	1	4	47804	HC	F	2020	2185	321	484
MC	EQ	2	1	70141	HC	F	2080	1985	317	c 440
MC	EQ	3	1	40177	HC	F	2050		286	
MC	EQ	4	1	13208	HC	F	2240		359	282
MC	EQ	4	1	13208	HC	F	2240	2122	371	505
MC	EQ	4	2	10157	HC	F	1970	1896	308	432
MC	EQ	6	1	92758	HC	F	2249		337	477
MC	EQ	6	1	92761	HC	F	2224		322	490
MC	EQ	6	1	92764	HC	F	2153		322	464
MC	EQ	6	1	92766	HC	F	2054		302	453

ELEM	TAX	PER	SUBP	CO	SIE	FUS	LAR
PE	EQ	6	1	92758	HC	F	729
PE	EQ	6	1	92758	HC	F	666
PE	EQ	6	1	92758	HC	F	568
PE	EQ	6	1	92758	HC	F	578
PE	EQ	6	1	92758	HC	F	652
PE	EQ	6	1	92758	HC	F	655
PE	EQ	6	1	92758	HC	F	658
PE	EQ	6	1	92758	HC	F	635
PE	EQ	6	1	92758	HC	F	c 614
PE	EQ	6	1	92758	HC	F	680
PE	EQ	6	1	92761	HC	F	599
PE	EQ	6	1	92761	HC	F	660
PE	EQ	6	1	92764	HC	F	644
PE	EQ	6	1	92764	HC	F	687
PE	EQ	6	1	92765	HC	F	611
PE	EQ	6	1	92775	HC	F	642
PE	EQ	6	2	92739	HC	F	643
PE	EQ	6	2	92739	HC	F	611
PE	EQ	6	2	92750	HC	F	562
PE	EQ	6	2	92750	HC	F	641

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD
FE	EQ	1	3	90354	HC	UX	1328	
FE	EQ	1	3	90354	HC	UX	1328	
FE	EQ	6	1	92741	HC	F	3489	390
FE	EQ	6	1	92758	HC	F	3953	415
FE	EQ	6	1	92758	HC	F	3839	482
FE	EQ	6	1	92761	HC	F	3426	377
FE	EQ	6	1	92761	HC	F	3459	391
FE	EQ	6	1	92761	HC	F	3747	416
FE	EQ	6	1	92765	HC	F	3903	434
FE	EQ	6	2	92750	HC	F	3320	367

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD	Bd
TI	EQ	1	3	11629	HC	F			685
TI	EQ	1	3	90354	HC	UM	1549		
TI	EQ	1	4	47751	HC	F			687
TI	EQ	2	1	20060	HC	F			687
TI	EQ	2	1	80560	SRS	F			e 694
TI	EQ	6	1	92758	HC	F	e 3740	328	831
TI	EQ	6	1	92758	HC	F	3826	304	803
TI	EQ	6	1	92758	HC	F	4023	355	914
TI	EQ	6	1	92761	HC	F	3630	285	721
TI	EQ	6	1	92761	HC	F	3918	335	804
TI	EQ	6	1	92761	HC	F	3854	336	874
TI	EQ	6	1	92765	HC	F	3565	291	745
TI	EQ	6	1	92766	HC	F	3448	284	717
TI	EQ	6	1	92774	HC	F	3582	301	774
TI	EQ	6	2	11363	HC	F	3460	300	770
TI	EQ	6	2	92750	HC	F	3741	314	753
TI	EQ	6	3	48001	HC	F	3440	297	774

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GH	GB	BFd	LmT
AS	EQ	1	4	47751	HC		537	578	484	551
AS	EQ	2	1	91953	HC		605	567	527	640
AS	EQ	6	1	92761	HC		551	629	553	573

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL
CA	EQ	1	2	40116	HC	F	1013

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Ll	Bd	Dd	SD
MT	EQ	1	3	90354	HC	UM	1723				
MT	EQ	2	1	91953	HC	F	2605	2585	e 472		323
MT	EQ	2	2	70038	HC	F	2490	2395	433		
MT	EQ	6	1	10521	HC	F	2750	2730	488		329
MT	EQ	6	1	80152	HC	F	c 2530	2429			307
MT	EQ	6	1	92741	HC	F				440	336
MT	EQ	6	1	92758	HC	F			568		
MT	EQ	6	1	92758	HC	F	2347		439	335	279
MT	EQ	6	1	92761	HC	F			495	392	
MT	EQ	6	1	92761	HC	F	2531		475	366	324
MT	EQ	6	2	11363	HC	F	2590	2515			326
MT	EQ	6	2	92753	HC	F	2690			384	321
MT	EQ	6	2	92750	HC	F	2692		507	397	344
MT	EQ	6	2	92752	HC	F	2854		521	420	350

ELEM	TAX	PER	SUBP	CO	SIE	FUS	Bd
MP	EQ	1	3	20083	HC	F	468

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bp	Dp	SD	Bd	Dd
P1	EQ	1	2	90343	HC	F	822	587	385	393	545	271
P1	EQ	1	3	11636	HC	F	755	527	358	316	442	
P1	EQ	1	3	80527	HC	F	790			330	468	251
P1	EQ	1	4	11241	HC	F	c 762	429	301	315	380	
P1	EQ	1	4	50067	HC	F						
P1	EQ	2	1	11241	HC	F	770	511	339	314	428	229
P1	EQ	2	1	20062	HC	F	810	543	341	363	453	241
P1	EQ	2	1	70141	HC	F	930	544	351	326	430	242
P1	EQ	2	1	91953	HC	F	806	563	398	357	466	257
P1	EQ	2	2	70026	HC	F	780	488	333	321	412	227
P1	EQ	6	1	92758	HC	F	836	521	355	337	419	244
P1	EQ	6	1	92761	HC	F	816	547	396	340	431	255
P1	EQ	6	2	92753	HC	F	855	628	348	299	383	222

TAX	PER	SUBP	CO	SIE	P4L	P4W	M1L	M1WA	P1-M3 L	P2-M3 L	P1-P4 L	P2-P4 L	M1-M3 L	H
CAF	1	2	40319	HC			218	83	699	650	369	325	341	202
CAF	1	2	40319	HC			219	86	697	654	367	324	343	202
CAF	1	4	11220	HC			199	76		701		358	349	
CAF	2	1	10001	SRS	115		209	81	762	708	401	355		
CAF	2	1	80471	HC			218	82		727		363	535	
CAF	2	1	90376	HC	117	65	232	93	773	713	404	344	379	
CAF	2	3	20156	HC					628					
CAF	2	3	20156	HC	123	69	203	80	668	625	360	310	326	211
CAF	2	3	20156	HC	97	50	184	68	631	582	340	295	292	206
CAF	2	3	20163	HC	124	60	221	85	755	712	382	334	388	210
CAF	3	2	11209	HC	117	61	211	80	782	735	426	375	355	241
CAF	5	1	91545	SRS			172	68						
CAF	6	1	10023	HC	98	47	166	65	537	505	292	258	263	163
CAF	6	1	10023	HC	99	48	164	67	536	497	291	256	262	147
CAF	6	1	92741	HC	101	51	179	72						146
CAF	6	1	92741	HC	86	43	154	61	498	454	279	232	246	142
CAF	6	1	92753	HC	93	48	165	65	577	539	318		271	157
CAF	6	1	92761	HC	101	50								152
CAF	6	1	92761	HC	109	60	202	86						183
CAF	6	2	92762	HC	89	45	168	63			285	241		138
CAF	6	2	92762	HC	95	49	167	67			310	274		159

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GLC	Bd	HTC	SD
HU	CAF	1	3	90227	HC	F		248		
HU	CAF	2	1	70080	HC	F		318		
HU	CAF	2	1	90376	HC	F	1660	336	132	138
HU	CAF	2	1	90376	HC	F	1710	339	129	118
HU	CAF	2	3	20152	HC	F	985	249	87	100
HU	CAF	2	3	20163	HC	F			112	
HU	CAF	3	1	80503	HC	F	1765	363	143	167
HU	CAF	4	2	40432	HC	F		309	120	
HU	CAF	5	2	92716	HC	F	1710	326	139	
HU	CAF	6	1	10023	HC	F	961	197	75	82
HU	CAF	6	1	10023	HC	F	965	199	77	82
HU	CAF	6	1	92741	HC	F	861	185	70	69
HU	CAF	6	1	92741	HC	F	970	191	69	68
HU	CAF	6	1	92741	HC	F	1035	205	81	71
HU	CAF	6	1	92741	HC	F	1072	226	92	76
HU	CAF	6	1	92753	HC	F	915	234	85	95
HU	CAF	6	1	92758	HC	F	1163	231	88	
HU	CAF	6	1	92766	HC	F	1094	221	95	85
HU	CAF	6	1	92768	HC	F	1444	310	114	111
HU	CAF	6	2	60058	HC	F	829	170		59
HU	CAF	6	2	92750	HC	F	1016	215	80	74
HU	CAF	6	3	48001	HC	F		383	150	

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD
RA	CAF	2	3	20152	HC	F	980	107
RA	CAF	2	3	20152	HC	F	980	150
RA	CAF	2	3	20163	HC	F	1485	111
RA	CAF	3	2	11209	HC	F	1770	136
RA	CAF	6	1	10023	HC	F	1003	81
RA	CAF	6	1	10023	HC	F	1008	80
RA	CAF	6	1	92741	HC	F	840	71
RA	CAF	6	1	92741	HC	F	1084	75
RA	CAF	6	1	92741	HC	F	1839	134
RA	CAF	6	1	92753	HC	F	859	100
RA	CAF	6	1	92776	HC	F	868	62
RA	CAF	6	2	60058	HC	F	855	61
RA	CAF	6	2	80186	HC	UM	465 (n)	
RA	CAF	6	2	92750	HC	F	1043	71

ELEM	TAX	PER	SUBP	CO	SIE	FUS	LAR
PE	CAF	1	2	40319	HC	F	205
PE	CAF	1	2	80604	HC	F	228
PE	CAF	1	3	90227	HC	F	158
PE	CAF	1	3	90227	HC	F	159
PE	CAF	2	1	40244	HC	F	241
PE	CAF	2	3	20148	HC	F	221
PE	CAF	2	3	20152	HC	F	193
PE	CAF	6	1	92741	HC	F	157
PE	CAF	6	1	92741	HC	F	157
PE	CAF	6	1	92741	HC	F	180
PE	CAF	6	2	92750	HC	F	248
PE	CAF	6	2	92750	HC	F	250

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD
FE	CAF	1	3	90227	HC	F	1360	101
FE	CAF	1	3	90227	HC	F	1362	100
FE	CAF	2	1	20060	HC	F	1880	128
FE	CAF	2	1	20168	HC	F	1098	91
FE	CAF	2	1	90385	HC	F	1910	144
FE	CAF	2	3	20152	HC	F	1170	109
FE	CAF	2	3	20152	HC	F	1453	99
FE	CAF	2	3	20153	HC	F	1172	
FE	CAF	3	2	11198	HC	F	1880	136
FE	CAF	4	2	10126	HC	F	1145	79
FE	CAF	5	2	92716	HC	F	1860	135
FE	CAF	6		10681	HC	UM	427 (n)	
FE	CAF	6	1	10951	HC		2290	208
FE	CAF	6	1	92740	HC	F	1114	76
FE	CAF	6	1	92741	HC	F	1188	82
FE	CAF	6	1	92761	HC	F	1035	76
FE	CAF	6	1	92761	HC	F	1619	129
FE	CAF	6	2	92750	HC	F	1115	79
FE	CAF	6	2	92750	HC	F	1123	76

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	SD
TI	CAF	1	2	80613	HC	F		247	
TI	CAF	1	3	80542	BS	F	1850	206	99
TI	CAF	2	1	90376	HC	F		244	
TI	CAF	2	1	90376	HC	F		249	
TI	CAF	2	2	80470	HC	F	2180	255	148
TI	CAF	2	3	20149	HC	F	1920	221	129
TI	CAF	2	3	20152	HC	F	1097	195	89
TI	CAF	2	3	20152	HC	F	1098	190	88
TI	CAF	2	3	20152	HC	F	1482	163	96
TI	CAF	2	3	20163	HC	F		169	
TI	CAF	4	1	13172	HC	F		172	
TI	CAF	4	2	10126	HC	F	1245	147	77
TI	CAF	6	1	11012	HC	F	c 2230	279	169
TI	CAF	6	1	92741	HC	F	913		62
TI	CAF	6	1	92741	HC	F	1171	154	72
TI	CAF	6	1	92741	HC	F	c 1161		74
TI	CAF	6	1	92758	HC	F	938	163	79
TI	CAF	6	2	80186	HC	UM	522		
TI	CAF	6	2	92750	HC	F		258	
TI	CAF	6	2	92750	HC	F	1137	152	80
TI	CAF	6	2	92750	HC	F	1175	152	73
TI	CAF	6	2	92750	HC	F	1195	145	69
TI	CAF	6	2	92750	HC	F	1207	141	66

ELEM	TAX	PER	SUBP	CO	SIE		GL
AS	CAF	2	3	20163	HC		229

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL
CA	CAF	2	3	20152	HC	F	390
CA	CAF	2	3	20156	HC	F	400
CA	CAF	2	3	20163	HC	F	365

TAX	PER	SUBP	CO	SIE	P4L	P4W	M1L	M1WA	P3-M1L	H
FEC	1	2	22110	HC					189	
FEC	1	2	22110	HC					192	
FEC	1	2	40305	HC	50	26	73	30	176	99
FEC	1	2	90469	BS					157	
FEC	1	2	90469	BS					171	
FEC	1	3	90041	HC			76	33		
FEC	1	3	90506	HC					175	102
FEC	1	3	90506	HC					175	106
FEC	1	4	49192	HC	71	28	81	32	193	
FEC	1	4	49192	HC	72	29	89	33	193	
FEC	2	1	20024	HC	52		68			
FEC	2	1	20168	HC	66	33	79	31		
FEC	3	2	10178	HC					187	
FEC	4	2	10751	HC			61			
FEC	4	2	10751	HC			66		172	
FEC	4	2	10751	HC			68	31	176	
FEC	4	2	11268	HC					178	
FEC	5	2	90290	HC					190	109
FEC	6	1	47190	HC			77	31	185	
FEC	6	1	92741	HC			73	32	172	96
FEC	6	1	92761	HC	66	27	75	29	184	90
FEC	6	1	92766	HC			72	29	178	108

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GLC	Bd	HTC	SD
HU	FEC	1	2	22110	HC	F	886	174	59	57
HU	FEC	1	2	22110	HC	F	888	172	59	57
HU	FEC	1	3	90354	HC	F		140	50	
HU	FEC	1	3	90506	HC	F	919	181	60	62
HU	FEC	1	3	90506	HC	F	925	182	61	63
HU	FEC	2	1	20166	HC	F		143	49	
HU	FEC	2	1	20168	HC	F	859	156	53	55
HU	FEC	2	1	20168	HC	F	859	167	51	55
HU	FEC	2	2	11558	HC	F		150	52	
HU	FEC	2	3	20154	HC	G		140	48	
HU	FEC	2	3	20156	HC	G		139		
HU	FEC	2	3	40228	SRS	F		142	52	
HU	FEC	3	2	10457	HC	F		160		
HU	FEC	4	2	10468	HC	F	822			48
HU	FEC	4	2	10751	HC	F	779	141	48	
HU	FEC	5	1	10565	HC	G		167	62	
HU	FEC	5	2	90290	HC	F	912	179	61	66
HU	FEC	5	2	90290	HC	F	913	179	61	67
HU	FEC	6	1	45217	HC	F	759	139		48
HU	FEC	6	1	60611	HC	F		158	54	
HU	FEC	6	1	92741	HC	F		151	50	51
HU	FEC	6	1	92741	HC	F		169	59	
HU	FEC	6	1	92741	HC	F	856	177	57	60
HU	FEC	6	1	92741	HC	F	967	185	59	62
HU	FEC	6	1	92761	HC	F		162	52	
HU	FEC	6	1	92761	HC	F	815	156	50	57
HU	FEC	6	1	92764	HC	G		172	57	
HU	FEC	6	1	92766	HC	F	871	152	51	48
HU	FEC	6	1	92774	HC	F			55	
HU	FEC	6	1	92775	HC	F		159	54	
HU	FEC	6	2	80196	HC	F	893	161		64
HU	FEC	6	2	92750	HC	F		154	52	
HU	FEC	6	2	92750	HC	F		177	58	
HU	FEC	6	2	92750	HC	F	822	160	55	58
HU	FEC	6	3	10003	HC	F	872	164	56	54
HU	FEC	6	3	10003	HC	F	867	163	53	64

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD
RA	FEC	1	2	22110	HC	F	888	53
RA	FEC	1	2	22110	HC	F	892	54
RA	FEC	1	3	90506	HC	F	858	58
RA	FEC	1	3	90506	HC	F	860	59
RA	FEC	6	1	92740	HC	F	912	57
RA	FEC	6	1	92741	HC	F	915	51
RA	FEC	6	1	92761	HC	F	771	47
RA	FEC	6	1	92766	HC	F	886	56
RA	FEC	6	2	11363	HC	F	908	59
RA	FEC	6	2	92750	HC	F	879	49
RA	FEC	6	3	10002	HC	F	780	47
RA	FEC	6	3	48003	HC	F	888	54

ELEM	TAX	PER	SUBP	CO	SIE	FUS	LAR
PE	FEC	1	3	90354	SRS	F	96
PE	FEC	1	3	90354	SRS	F	96
PE	FEC	1	3	90506	HC	F	106
PE	FEC	1	3	90506	HC	F	106
PE	FEC	2	1	20166	HC	F	106
PE	FEC	2	1	20166	HC	F	106
PE	FEC	4	2	40419	SRS	F	110
PE	FEC	5	1	11069	HC	F	109
PE	FEC	6	1	92741	HC	F	103
PE	FEC	6	1	92761	HC	F	105

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	SD
FE	FEC	1	2	22110	HC	F	991	69
FE	FEC	1	2	22110	HC	F	991	71
FE	FEC	1	3	90506	HC	F	999	81
FE	FEC	1	3	90506	HC	F	1003	79
FE	FEC	2	1	20168	HC	F	934	71
FE	FEC	2	1	20168	HC	F	940	
FE	FEC	5	1	11252	HC	G	995	78
FE	FEC	6	1	80134	HC	F	996	83
FE	FEC	6	1	92740	HC	F	954	75
FE	FEC	6	1	92741	HC	F	1027	70
FE	FEC	6	1	92741	HC	F	1029	69
FE	FEC	6	1	92758	HC	F	1008	
FE	FEC	6	1	92761	HC	F	887	62
FE	FEC	6	1	92765	HC	F	975	75
FE	FEC	6	2	92739	HC	F	990	75

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	SD
TI	FEC	1	2	22110	HC	F	1034	146	62
TI	FEC	1	2	22110	HC	F	1039	143	61
TI	FEC	1	3	40024	HC	F		129	
TI	FEC	1	3	40094	HC	F		132	
TI	FEC	1	3	90506	HC	F	1086	148	70
TI	FEC	2	3	20156	HC	F		132	
TI	FEC	2	3	20163	HC	F		115	
TI	FEC	4	1	80268	HC	F		142	
TI	FEC	4	2	40416	SRS	F		130	
TI	FEC	4	2	40432	HC	F		124	
TI	FEC	4	2	40432	HC	F		125	
TI	FEC	5	2	90290	BS	F	1060	155	63
TI	FEC	6	1	10738	HC	F	904	118	
TI	FEC	6	1	47190	HC	F	1003	128	62
TI	FEC	6	1	92740	HC	F		154	
TI	FEC	6	1	92741	HC	F		140	
TI	FEC	6	1	92741	HC	F	1091	146	63
TI	FEC	6	1	92741	HC	F	1107	162	63
TI	FEC	6	1	92741	HC	F	1108	158	62
TI	FEC	6	1	92758	HC	F	943	133	53
TI	FEC	6	1	92761	HC	F	960	129	58
TI	FEC	6	1	92765	HC	F	1068	144	65
TI	FEC	6	2	92750	HC	F		136	
TI	FEC	6	2	92750	HC	F	963	128	55
TI	FEC	6	2	92750	HC	F	968	132	55
TI	FEC	6	2	92750	HC	F	1007	138	57

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL
CA	FEC	4	1	80268	HC	F	240
CA	FEC	4	2	40413	SRS	F	255
CA	FEC	4	2	40413	SRS	F	261
CA	FEC	4	2	40416	SRS	F	283

ELEM	TAX	PER	SUBP	CO	GL	W_{max}	W_{min}
HC	CEE	1	2	22211		520	415
HC	CEE	1	3	91029		661	480
HC	CEE	1	4	46172		656	477

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	3	BT	HTC	SD
HU	DAD	6	1	92776	HC	F				382	214	
MC	DAD	1	3	90227	HC	F	2090	309	180			187
MT	DAD	4	2	40432	HC	F		309				

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	3	BT	HTC	SD
HU	CAC	2	1	49145	HC	F				222	144	
HU	CAC	2	2	70026	HC	H				230	137	
MC1	CAC	1	4	49192	HC	F	1590	209	115			117
MC1	CAC	2	2	70019	HC	F	1570	205	115			110

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	GLC	Bd	LAR	SD
HU	LE	4	2	10468	HC	F		897			54
PE	LE	1	3	46624	SRS	F				124	
PE	LE	2	3	49245	HC	F				120	
PE	LE	5	1	90471	SRS	F				89	
FE	LE	5	1	90471	SRS	F	829				72
TI	LE	5	1	90443	SRS	F			111		

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	GLC	Bd	HTC	LAR	SD
HU	ORC	1	2	10040	HC	F			81	39		
HU	ORC	1	2	10040	HC	F			87	42		
HU	ORC	5	1	10448	HC	F		596	91	44		45
HU	ORC	5	1	49241	HC	F			89	46		
HU	ORC	5	1	90434	HC	F		631	95	44		43
HU	ORC	6	1	10522	HC	F			91	44		
HU	ORC	6	1	10561	HC	F			89	43		
HU	ORC	6	1	45021	HC	F		586	89	42		48
HU	ORC	6	1	60499	HC	F		594	88	45		38
HU	ORC	6	1	91638	SRS	F			89	44		
HU	ORC	5	2	80044	BS	F			83			
HU	ORC	5	2	90655	HC	F		604				39
HU	ORC	5	2	90713	HC	F			86	42		
HU	ORC	5	2	90716	SRS	F		638	90	46		30
HU	ORC	6	3	48001	HC	F		556	83	42		39
HU	ORC	6	3	92671	HC			582	85	41		39
HU	ORC	6	3	92672	HC	F		604	88	42		42
PE	ORC	4	1	30014	HC	F					90	
PE	ORC	5	1	10293	HC	F					84	
PE	ORC	5	1	49201	HC	F					84	
PE	ORC	5	1	90580	SRS	F					87	
PE	ORC	5	2	90657	HC	F					79	
PE	ORC	6	2	10678	SRS	F					80	
PE	ORC	6		92764	HC	F					81	
FE	ORC	5	2	10050	HC		802					69
FE	ORC	5	2	90405	HC	F	837					72
FE	ORC	6	1	13013	HC	F	776					66
FE	ORC	6	1	45123	HC	F	831					66
FE	ORC	6	1	80187	HC	F	800					67
CA	ORC	4	1	30014	HC	F	204					
CA	ORC	5	2	10085	BS	F	231					

TAX	CO	PER	SUBP	SIE	P4L	P4W	M1L	M1W
MEM	70047	3	1	BS	80	47	135	66

ELEM	TAX	PER	SUBP	CO	SIE	FUS	GL	Bd	SC
HU	GAG	1	2	90398	HC		628	139	66
HU	GAG	1	2	90398	HC		629	138	65
HU	GNP	1	2	22060	HC		646	138	67
HU	GNP	1	2	80613	HC		662	139	66
HU	GNP	1	2	90299	HC		736	163	75
HU	GNP	1	2	90349	HC			133	
HU	GNP	1	2	90349	SRS		669	132	62
HU	GNP	1	2	90469	BS		629	137	66
HU	GNP	1	3	20077	HC			157	
HU	GNP	1	3	60091	HC		718	152	73
HU	GNP	1	3	90353	BS			160	
HU	GNP	1	3	90354	HC		649	138	63
HU	GNP	1	3	90354	HC		650	137	63
HU	GNP	1	3	90354	HC		664	135	59
HU	GNP	1	3	90506	HC		611	129	58
HU	GNP	1	3	90506	HC		654		
HU	GNP	1	3	90506	HC		661	139	67
HU	GNP	1	4	47751	HC		815	175	83
HU	GNP	1	4	50093	HC		616	131	64
HU	GNP	2	1	20056	HC		707	159	71
HU	GNP	2	1	20060	BS			154	76
HU	GNP	2	1	20084	HC			150	
HU	GNP	2	1	40206	HC			157	79
HU	GNP	2	1	60359	SRS		749	164	78
HU	GNP	2	1	80471	HC			135	
HU	GNP	2	1	80560	HC			146	
HU	GNP	2	1	90392	SRS			153	
HU	GNP	2	3	20163	HC			149	
HU	GNP	2	3	49143	HC		661	135	65
HU	GNP	2	3	49245	HC		652	139	62
HU	GNP	2	3	49245	HC		680	141	65
HU	GNP	3	2	11209	HC			142	
HU	GAG	4	2	45183	HC		621	141	68
HU	GAG	4	2	45183	HC		624	140	68
HU	GNP	4	1	10506	HC			147	
HU	GNP	4	1	80268	HC			159	
HU	GNP	4	2	10121	HC			148	70
HU	GNP	4	2	10391	HC			163	
HU	GNP	4	2	10468	HC			136	68
HU	GNP	4	2	10468	HC			137	
HU	GNP	4	2	10468	HC			152	
HU	GNP	4	2	10468	HC		746		77
HU	GNP	4	2	10768	SRS		640	139	63
HU	GNP	4	2	11376	SRS			141	
HU	GNP	4	2	80218	SRS			136	
HU	GNP	4	2	80302	HC		653	140	73
HU	GNP	5	1	10940	HC		699	148	75
HU	GNP	5	1	11090	HC			132	
HU	GNP	5	1	13210	HC		760	165	73
HU	GNP	5	1	49201	BS			158	
HU	GNP	5	1	49201	BS			172	
HU	GNP	5	1	50100	HC		619	156	70
HU	GNP	5	1	90443	SRS		612	131	59
HU	GNP	5	1	90471	SRS			159	
HU	GNP	5	1	90567	SRS			129	
HU	GNP	5	1	90585	HC		778	168	81
HU	GNP	5	1	90585	SRS			134	57
HU	GNP	5	2	10050	HC			157	81
HU	GNP	5	2	11597	HC		667	142	67
HU	GNP	5	2	80044	BS	J	724	166	72
HU	GNP	5	2	90031	HC		647	137	59
HU	GNP	5	2	90216	HC			147	72
HU	GNP	5	2	90290	HC			161	
HU	GNP	5	2	90320	HC		699	147	66
HU	GNP	5	2	90655	HC		629	139	59
HU	GNP	5	2	90702	HC			152	
HU	GNP	5	2	90923	HC			148	
HU	GN	6	2	80186	HC		671	145	69
HU	GN	6	2	80186	HC		672	148	70
HU	GN	6	2	80186	HC		709	146	65
HU	GNP	6	1	40076	HC		787		80
HU	GNP	6	1	45092	SRS			161	
HU	GNP	6	1	45217	HC		807	169	80
HU	GNP	6	1	50082	HC		841	191	86
HU	GNP	6	1	60611	HC		629	131	58
HU	GNP	6	1	80187	HC		708	148	72
HU	GNP	6	2	10658	HC		772	170	75
HU	GNP	6	2	60057	BS	J	714	149	73
HU	GNP	6	3	10002	HC		871	175	76

ELEM	TAX	PER	SUBP	CO	SIE	GL	La	Bd	Dd	SC
FE	GAG	1	2	90398	HC			143	125	
FE	GAG	1	2	90398	HC	686	656	132	119	62
FE	GAG	1	2	90398	HC	700	659	141	109	61
FE	GN	1	2	40079	HC	784	732	159	134	72
FE	GN	1	2	40169	HC	646	599	125	108	
FE	GN	1	2	80613	HC	698	651	132	111	60
FE	GN	1	2	80617	HC			160	129	70
FE	GN	1	2	80762	HC	790	740	152	125	69
FE	GN	1	2	90349	HC	650	611	132	110	58
FE	GN	1	2	90349	HC	805	752	163	139	77
FE	GN	1	2	90388	HC	772	719	152	128	73
FE	GN	1	2	90469	BS	670	636	137	118	58
FE	GN	1	3	40074	HC	638	590	126		55
FE	GN	1	3	60091	HC	661	620	129	110	63
FE	GN	1	3	90354	HC	718	672	140	125	63
FE	GN	1	3	90380	HC	837	787	179	148	83
FE	GN	1	3	90540	HC	812	765	152	134	71
FE	GN	1	3	91815	SRS	854	799	167	141	75
FE	GN	1	4	49192	HC	800	756	159	139	72
FE	GN	1	4	50007	HC	641	597	134	113	58
FE	GNP	1	2	22060	HC			142	119	
FE	GNP	1	2	40021	SRS			140	113	
FE	GNP	1	3	11561	HC			132		
FE	GNP	1	3	40023	HC			132	113	
FE	GNP	1	3	90506	HC	731	679	141	120	59
FE	GNP	1	3	90506	HC	760	680	142	122	59
FE	GNP	1	4	50027	HC	727	695	178	146	73

ELEM	TAX	PER	SUBP	CO	SIE	GL	La	Bd	Dd	SC
FE	GN	2	1	20060	HC	697	646	133	121	56
FE	GN	2	1	20081	HC	777	729	157	129	77
FE	GN	2	1	22401	BS	675	636	129	116	58
FE	GN	2	1	22401	BS	c 680	635	133	120	59
FE	GN	2	1	40182	HC	805	757	161	132	68
FE	GN	2	1	40217	HC	845	805	163	141	74
FE	GN	2	1	70080	HC	750				69
FE	GN	2	1	90426	HC		507	122		55
FE	GN	2	2	70019	BS	660	625	129	109	59
FE	GN	2	3	20151	HC			137	117	60
FE	GN	2	3	49245	HC	694	644	133	117	61
FE	GN	2	3	49245	SRS		768	163	132	65
FE	GNP	2	1	20060	SRS			160	134	
FE	GNP	2	2	49144	HC			137	115	
FE	GNP	2	3	20151	HC			136	117	
FE	GAG	4	2	45183	HC	690	643	130	119	61
FE	GAG	4	2	45183	HC	690	641	133	118	59
FE	GN	4	1	30036	HC	702	652	143	116	62
FE	GN	4	1	80264	SRS		603	121	100	
FE	GN	4	1	90268	HC	656	611	131	113	63
FE	GN	4	1	80275	SRS	689	640	133	110	
FE	GN	4	2	10468	HC	687	644	134	116	59
FE	GN	4	2	10468	HC	747	692	142	122	69
FE	GN	4	2	11268	HC	720	673	143	118	60
FE	GN	4	2	80241	BS	737	685	136	119	59
FE	GN	4	2	80302	HC		644	140	118	60
FE	GN	4	2	80302	HC	680	641	135	118	63
FE	GNP	4	1	80253	BS			132	108	
FE	GNP	4	2	10468	HC			135	114	
FE	GNP	4	2	10468	HC			149	124	
FE	GNP	4	2	80218	SRS			143	124	
FE	GNP	4	2	90430	SRS			147	128	
FE	GAG	5	2	80016	HC	781	742	204	154	84
FE	GN	5	1	10096	HC	879	818	173	151	77
FE	GN	5	1	10565	HC	736	694	143	128	64
FE	GN	5	1	10565	HC	845	787	166	133	70
FE	GN	5	1	10792	HC	761	709	195	156	84
FE	GN	5	1	10940	HC	849				
FE	GN	5	1	49241	HC		724	155	135	67
FE	GN	5	1	90434	HC	701	651	134	119	61
FE	GN	5	1	90443	SRS	816	759	158	133	76
FE	GN	5	1	90471	SRS	705	654	135	113	60
FE	GN	5	1	90546	HC	881	824	174	147	72
FE	GN	5	1	90567	HC	c 848	804	124	151	79
FE	GN	5	2	11058	HC	778	727	150	129	69
FE	GN	5	2	90107	HC	744	698	c 191	c 133	
FE	GN	5	2	90655	HC	681	635	139	109	61
FE	GN	5	2	90683	HC	735	698	145	124	64
FE	GN	5	2	90683	HC	818	764	169	140	76
FE	GNP	5	1	10169	HC	731	686		146	64
FE	GNP	5	1	10469	HC			138	112	
FE	GNP	5	1	10940	HC			159	133	
FE	GNP	5	2	11597	HC			146	123	
FE	GN	6	1	10123	HC	c 793	c 750	158		71
FE	GN	6	1	45133	HC	713	665	139	115	63
FE	GN	6	1	50077	HC	812	755	158	134	74
FE	GN	6	2	80186	HC	778	731	154	133	65
FE	GN	6	2	80186	HC	804	765	153	121	73
FE	GN	6	2	80186	HC	843	814	163	140	79
FE	GN	6	2	80186	HC	910	856	182	154	86
FE	GN	6	3	10005	HC	975	906	186	163	82
FE	GN	6	3	10100	HC	695	648	139	123	65
FE	GN	6	3	10100	HC			139	123	66
FE	GNP	6	1	10023	HC			166	144	

ELEM	TAX	PER	SUBP	CO	SIE	GL	La	Bd	Dd	SC
TI	GAG	1	2	90398	HC	943	904	101	107	56
TI	GAG	1	2	90398	HC	949	908	101	104	54
TI	GN	1	2	40079	HC			125		
TI	GNP	1		45192	HC			140	137	
TI	GNP	1	2	40054	HC	962	915	110	127	58
TI	GNP	1	2	60349	BS			106	112	
TI	GNP	1	2	80604	BS			107	109	
TI	GNP	1	2	90349	HC	901	867	100	101	55
TI	GNP	1	2	90349	HC	901	869	101	98	54
TI	GNP	1	2	90349	HC	1020	998	110	110	59
TI	GNP	1	2	90366	HC			116	120	67
TI	GNP	1	2	90469	BS	920	881	101	104	53
TI	GNP	1	3	10549	HC			138	146	
TI	GNP	1	3	21003	HC		1000	110	104	57
TI	GNP	1	3	40010	BS			116		
TI	GNP	1	3	90354	HC	970	955	111	110	55
TI	GNP	1	3	90354	HC	997	961	104	112	58
TI	GNP	1	3	90354	HC	999	960	103	114	57
TI	GNP	1	3	90354	HC	1025	992	101	108	52
TI	GNP	1	3	90354	HC	1155	1120	116	123	64
TI	GNP	1	3	90506	HC	1019	989	104	116	50
TI	GNP	1	3	90506	HC	1021	978	103	115	49
TI	GNP	1	3	90506	HC	1022	987	102	108	52
TI	GNP	1	3	90540	HC			114	118	
TI	GNP	1	4	21105	BS			111	114	
TI	GNP	1	4	47090	HC			117	125	69
TI	GNP	1	4	47090	HC	971	936	104	107	56
TI	GNP	1	4	47751	HC			117	117	
TI	GNP	1	4	49292	HC			122	110	
TI	GNP	1	4	60470	HC			102	106	
TI	GNP	2		22309	HC	944	907	94	106	55
TI	GNP	2	1	20016	HC	988		112	106	56
TI	GNP	2	1	20060	HC	957	921	105	107	62
TI	GNP	2	1	20081	HC	1048	1022	114	127	61
TI	GNP	2	1	22401	BS	931	893	102	104	51
TI	GNP	2	1	22401	BS	1106	1050	109	122	62
TI	GNP	2	1	40262	HC			121	127	
TI	GNP	2	1	70088	HC			98	101	
TI	GNP	2	1	70088	HC	1175	1134	113	125	68
TI	GNP	2	1	80471	HC			96		57
TI	GNP	2	1	80471	HC	1045	1001	109	115	65
TI	GNP	2	1	80560	BS			108	103	
TI	GNP	2	1	80560	HC	1102	1060	110	116	
TI	GNP	2	1	70122	HC		951	104	104	57
TI	GNP	2	2	70122	HC	951	918	103	110	52

ELEM	TAX	PER	SUBP	CO	SIE	GL	La	Bd	Dd	SC
TI	GNP	2	3	20149	HC			99		
TI	GNP	3	1	49225	HC			112	111	
TI	GNP	3	1	70047	BS			104	95	
TI	GAG	4	2	45183	HC	939	904	101	104	57
TI	GAG	4	2	45183	HC	940	904	102	102	57
TI	GAG	4	2	80112	HC	964	929	100	106	53
TI	GAG	4	2	80112	HC	970	939	103	107	53
TI	GNP	4	1	10871	HC	976	933	103	106	55
TI	GNP	4	1	80264	BS			134	114	
TI	GNP	4	1	80275	SRS		825	90	98	49
TI	GNP	4	2	10468	HC			110	122	
TI	GNP	4	2	10468	HC			121	126	
TI	GNP	4	2	10468	HC			123	115	
TI	GNP	4	2	10468	HC	1117	1067	138	123	69
TI	GNP	4	2	40435	SRS			106	108	
TI	GNP	4	2	45183	HC			100	108	
TI	GNP	4	2	80302	SRS			97	99	
TI	GNP	4	2	80338	SRS			104	115	
TI	GNP	4	2	80366	BS			124	131	
TI	GNP	4	2	80366	BS	958	928	98	103	56
TI	GNP	4	2	91423	SRS			115	c 107	
TI	GNP	5	1	10096	HC			113	121	
TI	GNP	5	1	10195	HC		1034	110	111	58
TI	GNP	5	1	10524	HC		1138	119		72
TI	GNP	5	1	10940	HC	1248	1182	145	147	70
TI	GNP	5	1	49241	HC			112	114	
TI	GNP	5	1	90434	HC			127	131	
TI	GNP	5	1	90434	HC	961	931	108	108	57
TI	GNP	5	1	90434	HC	998	959	107	110	57
TI	GNP	5	1	90443	SRS			108	102	
TI	GNP	5	1	90585	HC			127	129	
TI	GNP	5	2	11597	BS			109	107	
TI	GNP	5	2	90007	HC			109	112	56
TI	GNP	5	2	90683	HC			123	139	
TI	GNP	5	2	90923	HC	1005	963	115	112	59
TI	GNP	6		90265	SRS			124	121	
TI	GNP	6	1	10522	HC			148	130	
TI	GNP	6	1	50082	HC			125	134	
TI	GNP	6	1	80137	HC			113	120	
TI	GNP	6	1	80187	HC	1010	982	104	112	57
TI	GNP	6	1	80187	HC	1189	1156	127	130	70
TI	GNP	6	1	91387	SRS			121	133	
TI	GNP	6	1	91452	SRS			111	115	
TI	GNP	6	2	80186	HC	1363	1318	139	141	80
TI	GNP	6	2	80186	HC	1090	1052	117	117	58
TI	GNP	6	2	80186	HC	1209	1165	121	130	72
TI	GNP	6	3	10058	HC			106	108	
TI	GNP	6	3	40428	SRS			105	103	
TI	GNP	6	3	48001	HC		1009	105	104	58

ELEM	TAX	PER	SUBP	CO	SIE	SPUR	GL	Bd	SC
MT	GAG	1	2	22059	HC		822	131	65
MT	GAG	1	2	40021	HC	P	655	142	65
MT	GAG	1	2	80579	BS	P			64
MT	GAG	1	2	90398	HC	A	631	119	56
MT	GAG	1	2	90398	HC	A	635	121	56
MT	GAG	1	3	60017	HC	P	588	114	63
MT	GAG	1	4	47751	HC	P	818		68
MT	GNP	1	2	90349	BS	P	849	145	72
MT	GN	1	2	22022	HC	A	641	109	54
MT	GN	1	2	22023	HC	A	650	121	58
MT	GN	1	2	22059	HC		655	112	56
MT	GN	1	2	22075	HC	A		139	
MT	GN	1	2	40006	HC		575	108	53
MT	GN	1	2	40319	HC	A	660	119	59
MT	GN	1	2	80577	HC	A	604	114	57
MT	GN	1	2	90326	HC	A	844	140	66
MT	GN	1	2	90339	HC	A	603	113	53
MT	GN	1	2	90381	HC		645	121	57
MT	GN	1	3	40229	HC	A	674	126	58
MT	GN	1	3	40229	HC	A	675	126	60
MT	GN	1	3	90353	HC			138	65
MT	GN	1	3	90353	HC		601	115	54
MT	GN	1	3	90354	HC		628	115	58
MT	GN	1	3	90354	HC		632	120	65
MT	GN	1	3	90354	HC		672	118	53
MT	GN	1	3	90506	HC	A	642	110	53
MT	GN	1	3	90506	HC	A	660	118	52
MT	GN	1	3	90506	HC	A	661	114	53
MT	GN	1	3	90506	HC	A	676	119	52
MT	GN	1	3	90506	HC	A	626	118	57
MT	GN	1	3	90667	BS	A	648	121	59
MT	GN	1	4	49192	HC	A	684	111	57
MT	GN	1	4	49192	HC	A	711	128	59
MT	GN	1	4	50027	HC	A	690	148	57
MT	GAG	2	1	20056	HC	S	741	133	66
MT	GAG	2	1	20056	HC	S	745	132	
MT	GAG	2	1	22151	HC	P	751	142	68
MT	GAG	2	1	22321	HC		702	131	63
MT	GNP	2	1	10978	SRS			134	
MT	GNP	2	3	49245	HC	A		113	
MT	GN	2	1	11105	HC	A	685	124	67
MT	GN	2	1	20016	HC		605	115	57
MT	GN	2	1	20019	HC	A	656	116	55
MT	GN	2	1	20019	HC	A	659	117	55
MT	GN	2	1	20081	HC		653	119	59
MT	GN	2	1	22151	HC	A		113	55
MT	GN	2	1	22151	HC	A	615	115	53
MT	GN	2	1	22151	HC	A	664	116	53
MT	GN	2	1	80471	HC	A	617	114	56
MT	GN	2	3	49245	HC	A	687	121	55
MT	GN	2	3	49245	HC	A	733	121	63
MT	GN	2	3	49245	HC	A	798	130	60
MT	GN	2	3	49245	SRS		684	118	61
MT	GN	2	3	49245	SRS		700		58
MT	GN	3	1	80151	SRS	A	675	124	62
MT	GAG	4	1	10691	SRS			142	
MT	GAG	4	1	45183	HC		642	113	55
MT	GAG	4	1	45183	HC		643		57

ELEM	TAX	PER	SUBP	CO	SIE	SPUR	GL	Bd	SC
MT	GAG	4	2	80112	HC		649	116	53
MT	GN	4	1	80247	BS	A	757		
MT	GN	4	2	10468	HC	A		120	
MT	GN	4	2	10468	HC	A	677	122	62
MT	GN	4	2	11268	HC	A	703	125	58
MT	GN	4	2	40435	SRS	A	684	122	56
MT	GN	4	2	80218	SRS	A	581	114	53
MT	GN	4	2	80218	SRS	A	594	114	52
MT	GN	4	2	80302	HC		659	115	58
MT	GN	4	2	80302	HC		687	120	55
MT	GN	4	2	80366	SRS	A	649	116	57
MT	GNP	4	1	80374	SRS			122	
MT	GAG	5	1	90434	HC	S	789		68
MT	GAG	5	1	90443	HC	P		146	70
MT	GAG	5	1	90567	HC	P	841	150	87
MT	GAG	5	2	11597	BS		907		94
MT	GAG	5	2	90216	HC	P	852	146	75
MT	GN	5	1	10469	HC	A	640	115	52
MT	GN	5	1	90434	HC	A	748	126	62
MT	GN	5	1	90462	HC	A	688		57
MT	GN	5	1	90825	HC	A	973	166	84
MT	GN	5	2	10050	HC	A	761	131	70
MT	GN	5	2	10050	HC	A	821	133	63
MT	GN	5	2	90290	HC	A	661	118	63
MT	GNP	5	2	90123	SRS			118	
MT	GAG	6	1	80187	HC		838	141	71
MT	GAG	6	1	80187	HC		839	143	72
MT	GAG	6	1	90067	HC	P	741	139	68
MT	GAG	6	1	92761	HC		776	159	61
MT	GAG	6	2	13003	HC	P	954	167	80
MT	GAG	6	2	92750	HC	R		160	83
MT	GN	6	1	80187	BS	A	757	139	63
MT	GN	6	1	80187	HC			62	72
MT	GN	6	2	80186	HC	A	763	138	63
MT	GNP	6	2	10648	HC	A	754		

ELEM	TAX	PER	SUBP	CO	SIE	GL	Bd	SC
HU	ANS	1	2	40319	HC		260	
HU	ANS	1	4	40002	HC		232	
HU	ANS	1	4	50053	HC		199	90
HU	ANS	1	4	50053	HC		241	116
HU	ANS	2	1	22401	BS	1680	235	115
HU	ANS	2	1	90396	HC		250	
HU	ANS	2	2	60021	HC		240	
HU	ANS	2	3	49245	HC		236	
HU	ANS	4	2	10590	BS		217	
HU	ANS	5	2	10050	HC	1679	243	116
HU	ANS	5	2	11057	HC		238	
HU	ANS	5	2	90290	HC		253	
HU	ANS	5	2	90702	HC		236	
HU	ANS	6	1	60611	HC		176	

ELEM	TAX	PER	SUBP	CO	SIE	GL	La	Bd	Dd	SC
FE	ANS	1	2	40116	HC					86
FE	ANS	1	3	46416	HC			183	159	
FE	ANS	2	1	10978	HC		767	206	162	82
FE	ANS	2	1	10978	HC	757	710	194	164	81
FE	ANS	2	1	22321	HC	771		199		85
FE	ANS	2	3	49245	HC			192	154	
FE	ANS	4	2	10751	HC	833	791	221	170	87
FE	ANS	5	1	10169	HC	786	721	205	167	87
FE	ANS	5	2	11030	HC	822	767	210	184	89
FE	ANS	5	2	90702	HC	800	739	201	168	77
FE	ANS	5	2	90922	HC	840	794	216	176	87
FE	ANS	6	1	13014	HC			191	147	
FE	ANS	6	1	45098	HC	c 772	721	204	168	88
FE	ANS	6	2	80186	HC					91

ELEM	TAX	PER	SUBP	CO	SIE	GL	La	Bd	Dd	SC
TI	ANS	1	4	49192	HC		1264	166	166	85
TI	ANS	1	4	60470	HC			160	164	
TI	ANS	2	1	70143	HC	836		180		75
TI	ANS	2	3	20149	HC			162	164	
TI	ANS	2	3	20150	HC			159	163	
TI	ANS	2	3	20163	HC			180	183	
TI	ANS	3	1	80151	HC			169	176	88
TI	ANS	3	1	80151	HC	1357	1295	167	175	87
TI	ANS	4	1	10397	HC		1328	168	147	89
TI	ANS	4	1	30014	HC			133	145	
TI	ANS	4	2	10468	HC			176	177	
TI	ANS	4	2	10468	HC			c 171		
TI	ANS	5	1	10137	HC			162	159	
TI	ANS	5	1	49241	HC			172	173	
TI	ANS	5	1	90533	HC			183	177	
TI	ANS	5	2	11030	HC			175	181	
TI	ANS	5	2	80039	BS	1482	1466	180	181	87
TI	ANS	5	2	80195	HC			178	193	
TI	ANS	5	2	80211	HC	1464	1389	182	179	89
TI	ANS	5	2	90657	HC			169		
TI	ANS	6	1	10850	HC			161	160	
TI	ANS	6	1	40082	HC			174	187	
TI	ANS	6	1	80187	HC			177	172	
TI	ANS	6	2	10493	HC		1332	166	169	85

ELEM	TAX	PER	SUBP	CO	SIE	GL	Bd	SD
MT	ANS	1	3	20172	HC	871		85
MT	ANS	1	4	49192	HC	819	198	82
MT	ANS	2	1	22320	HC	831	179	
MT	ANS	2	1	22328	HC	805	162	80
MT	ANS	5	1	10094	HC		204	
MT	ANS	5	2	10050	HC	833	191	77
MT	ANS	5	2	92716	HC		194	75

ELEM	TAX	PER	SUBP	CO	SIE	GL	Bd	SD
HU	ANA	5	1	90471	SRS	918	148	73
HU	ANA	5	2	90007	HC	943	149	81
HU	ANA	5	2	92718	HC		149	73
HU	ANA	6	1	45123	SRS	957	154	75
HU	ANA	6	1	50077	HC	957	154	74
HU	ANA	6	3	52705	HC	918	150	70

ELEM	TAX	PER	SUBP	CO	SIE	GL	La	Bd	Dd	SC
FE	ANA	1	4	50053	HC	515	495	108		39
FE	ANA	5	2	90683	HC	525	501	127	95	52
FE	ANA	6	1	10850	SRS			123	91	
FE	ANA	6	2	80186	HC	528	505	115	95	42

ELEM	TAX	PER	SUBP	CO	SIE	GL	La	Bd	Dd	SC
TI	ANA	1	2	46286	BS			91	95	
TI	ANA	1	3	40024	HC			92	98	
TI	ANA	2	3	49245	HC			136	140	
TI	ANA	4	1	80247	BS			87	101	
TI	ANA	6	1	45217	HC			103	108	
TI	ANA	6	1	90219	HC	875	827	102	117	49

ELEM	TAX	PER	SUBP	CO	SIE	GL	Bd	SD
MT	ANA	1	3	90353	HC	484	101	46
MT	ANA	1	3	90354	HC	451	93	48
MT	ANA	3	1	11649	HC	430		57
MT	ANA	5	1	90443	HC	475	109	50

ELEM	TAX	PER	SUBP	CO	SIE	Bd
HU	MEG	6	2	80186	HC	223

ELEM	TAX	PER	SUBP	CO	SIE	GL	Dd	Dd	SC	La	La
HU	TAR	5	1	90434	HC	550	57		29		
MT	PHC	6	1	92741	HC		e 170				
MC	CYG	2	3	49245	HC	1203					
HU	ACQ	4	1	13175	HC	585	95		49		
HU	BUB	1	3	90491	BS	897	170		75		
TI	BUB	1	3	90491	BS	1042	119	82	62		
TI	BUB	1	3	90491	BS	1046	116	82	63		1022
MT	BUB	1	3	90491	BS	763			57		
MC	ACG	1	3	90491	HC	570					
MT	PEP	5	1	90585	BS	427	86		36		
MT	FUA	5	1	90567	SRS	655	108		39		
MT	FUA	5	1	90585	HC	589	97		41		
FE	GAC	6	1	45217	HC	560	93	80	41	535	
TI	SCR	6	1	45092	SRS		63	59			
MT	NUA	4	1	80265	SRS	866	106		40		
MC	GAN	6	1	45092	SRS	255					
HU	COL	1	3	90354	HC	460	112		56		
HU	COL	2	1	22151	HC	534	128		62		
MT	COL	2	1	22151	SRS	315	85		40		
TI	COL	6	1	10951	HC	576	69	66	33		568
FE	COF	6	3	10388	HC	504	103	88	45	476	
FE	COS	1	3	20219	HC	500	105	87	45	470	
FE	COS	3	2	11113	SRS	410	80	68	35	389	
HU	COS	4	2	45183	HC		112				
HU	COS	4	2	45183	HC	441	114		42		
FE	COS	4	2	45183	HC	413	83		34	395	
FE	COS	4	2	45183	HC	415	82		34	395	
TI	COS	4	2	45183	HC	690	66	63	31		675
TI	COS	4	2	45183	HC	690	67	61	30		675
MT	COS	4	2	45183	HC	488	50		28		
MT	COS	4	2	45183	HC	489	51		28		
HU	COS	6	1	50077	HC	630	104		46		
HU	TU	2	2	70120	BS		66				