AML Report 4543 SITE 1367

MAGIOVINIUM: The Animal Bones

Excavations at Magiovinium in 1978-9 produced 11,306 animal bones, these were recovered from a series of Roman gullies and ditches, one timber building and a single pit mainly dated to the second and third centuries, with a small amount of first century material. There were also a small number of bones (1,370) from the topsoil which may have received some admixture of later material but seems essentially the same as the well stratified and sealed deposits.

The following species were identified; ox (Bos sp.) 11.8%, goat (Capra sp.) 0.008%, ovicaprid (Ovis sp/Capra sp.) 8.2%, pig (Sus sp.) 1.8%, horse (Equus sp.) 5.5%, red deer (Cervus elaphus) 0.04%, roe deer (Capreolus capreolus) 0.01%, ox sized fragments 32.1%, ovicaprid sized fragments 11.4%, dog (Canis sp.) 0.8%, fox (Vulpes vulpes) 0.008%, cat (Felis sp.) 0.008%, hare (Lepus sp.) 0.04%, unidentified mammal fragments 27.2%, domestic fowl (Gallus sp.) 0.4%, domestic duck/mallard (Anas sp.) 0.008%, raven (Corvus corax) 0.08%, barn owl (Tyto alba) 0.08%, swan (Cygnus sp.) 0.008%.

Tables 1-4 show the proportions of different anatomies recovered for each species.

The ditches and gullies are later than the occupation of the assumed fort and are probably associated with roadside settlement along Watling Street from the second to the fourth centuries AD. The single pit and timber building produced negligable amounts of bone.

## Recording Methods

Each bone was encoded onto punchtape using the method outlined in Jones et al 1981. The information was then transferred onto floppy discs and, using a Research Machines 380Z microprocessor, paper archives were produced of both the descriptive and metrical data.

For the purposes of analysis ox and ox sized fragments have been combined - since ox is the most frequently occuring large mammal it is most likely that these bones do indeed belong to ox. Further support for this is that the ox sized fragments are heavily fragmented through butchery (hence their tentative identification), while horse bones tend to be fairly complete and easily identifiable. Similarly ovicaprid and ovicaprid sized fragments have been amalgamated, as goat, pig and roe deer whose size range they might also belong to occur less frequently. The term ovicaprid has been used to cover any misidentification of goats, but the vast majority of ovicaprids would in fact be sheep.

Spacial Distribution

Although the bones were not phased through time three groups were distinguished spacially on site, each being composed of gullies and ditches, and each group being examined in comparison with the others and against the distribution of the site as a whole. It was hoped to observe differences in carcass disposal in the three groups although there was no evidence archaeologically for functional difference between them. Little success was met using chi squared tests (used to indicate whether the differences in the recorded data could be reasonably attributed to chance variation) comparing the distribution of the most common species (divided into different anatomy groups) between areas and against the distribution of the whole site. The level of chi (or $x^2$) was extremely high in all cases, so high as to suggest that the data was unsuitable for this sort of analysis, perhaps the group divisions were too crude and were bound to suggest great variability. Very high values were obtained both comparing species between areas and for pairing species in different levels of fragmentation which was successfully carried out on the Brancaster material (Wall et al in prep).

Cluster analysis using the weighted pair group average for certain anatomies did not reveal any significant differences between species and observation of the distribution between different groups did not suggest any variance in carcase disposal.

The inconclusive results of some of the tests may be the result of certain problems with the data such as the bias against the recovery of small bones since no sieving was carried out, for example the phalanges of sheep will stand less chance of recovery than those of ox purely from the size difference. Some bones survive better than others, eg jaws and metapodials are very robust; and Grant (1975. 384) cites the proximal ends of humeri, tibiae, skull and vertebrae fragments as having a low specific gravity and therefore unlikely to survive well. Similarly early fusing bones should be more dense and survive better than the late fusing bones, the latter include the proximal ends of humeri and tibiae and also the distal end of the femur, so there are two sources of bias operating against these particular bones survival. At a more basic level the reduction in size of bones by fragmentation must effectively reduce the chances of recovery, especially if no sieving is carried out. If one accepts the above points as valid then the bones which stand the best chance of survival and recovery are those from animals which are not eaten, hence not butchered and are fully mature at death so that the bones are at their maximum size and density. At Magiovinium horse seems to satisfy most of these requirements and is probably the largest animal recovered.

In this report the assumption has been made that the distribution of species and anatomies across the site is random, and that no deliberate disposal of bone waste related to specific activities was exclusive to any area of the site.

Fragmentation

Consideration of the fragmentation of the major food species cannot really be separated from butchery and thus the least fragmented commonly occuring species appear to be horse and dog. Diagrams have been made which give some indication of the level of fragmentation of ox and sheep (see figs 1 and 2) using the method of Wall (1980. 235-236). Sheep being a smaller animal than ox requires less chopping than ox to render the limbs into manageable joint sizes, the extremities of both animals tend to be complete since these areas produce little meat. The major limb bones are well fragmented both for their meat and for their marrow. In cattle some of the heaviest fragmentation occurs in the mandibles,maxillae, skull and os coxae. The hind limbs are more fragmented than the fore except for the scapulae which as well as being subject to extensive butchery easily fragments in the blade area. By comparison in sheep most bones have a higher proportion in the 50% range except for os coxae and scapulae which are heavily fragmented.

The numbers of pig bones were really too low for any interpretation of their fragmentation, but a high level of fragmentation was suggested for mandibles and maxillae, scapulae tended to be more complete than for ox and sheep, 46% fall in the 50% size range, possibly indicating a different butchery technique, radii are greatly fragmented with 50% lying in the 25% size range and 53% of humeri in the 25% size range, but the total numbers are rather too small for these figures to be reliably used.

None of the fragmentation of horse was due to butchery, it seems to be now generally accepted that horses were not normally eaten in the Roman period. There is both supporting and conflicting evidence for this. Toynbee (1973. 185) states that horses were only eaten in the Roman Empire when starvation was the alternative this information is found in Tacitas' Histories. However some butchered horse bones were found at Shakenoak (Cram. 1973. 148), perhaps this is a result of native British influence, Ann Wilson (1973. 72) also suggests that the coming of the Romans further influenced opinion away from the eating of horse meat which was not the usual practice elsewhere in the Empire. Stewart (1975. 37) comments that the Romans did not eat horsemeat but that wild asses were bred for food (the source for this information is not clear). Anne Wilson (1973. 309) quotes a unique interpretation of five aged horses found during the 1936 excavations at Verulamium under the floor of a late third century building. The bones of these animals were interlocking and had been stripped of their meat before burial. It was suggested that they were relics of a sausage factory. Anne Wilson considers that if the eating of horsemeat was not approved in the Roman Empire it could have been disguised in highly seasoned sausages. However the evidence does seem to suggest that horses were not normally eaten during the Roman period and did not form a significant part of the diet. Similarly no butchery marks were found on dog bones although the numbers were rather low.

Butchery

The presence of different parts of the anatomy of food animals suggests that the animals were slaughtered in the immediate vicinity, rather than being brought to the site as dismembered carcasses. All parts of the body were reasonably well represented bearing in mind the reduced recovery of certain bones due to the biases previously mentioned.

Ox; Skulls were heavily fragmented, there was no evidence of poleaxing, horncores were removed from the skull often including part of the frontals. Maxillae were very fragmented and mandibles often chopped through around the area of the diastema, apparently this is unncessary for the removal of the tongue. Rixson (pers comm) has suggested that 'chopping through the vertical ramus and through the diastema which are often found together, may have been practised to remove the ox cheek (massetor muscles) with the main part of the mandible, being the only significant amount of meat on the head'. Also the chopping of the diastema might be practised for the removal of the marrow from the mandible.

Scapulae were often found to be chopped obliquely across the neck, or at the glenoid cavity, the blade was normally shattered, there is no evidence for the complementary chopping of the proximal end of the humerus as was noted at Brancaster (Wall et al unpub). The proximal humerus is one of those areas previously mentioned as not surviving well due to its low density and late fusion. The distal end of the humerus was chopped about the shaft and also in the midshaft area, metacarpals (one of which showed evidence of canid gnawing) were sometimes chopped across the shaft, phalanges were mainly whole, knifecuts were noted at some proximal ends, possibly as a result of skinning.

Os coxae were heavily butchered, femora were chopped across the midshaft as were tibiae, and also across the distal end. Astragalii were sometimes chopped obliquely, and metatarsals were chopped in a similar manner to metacarpals, and in one case the distal end of a metatarsal was chopped and also covered in knifecuts.

Sheep; the butchery of sheep differed essentially from that of ox in that many of the bones were chopped across the midshaft area and not at the proximal or distal end, which might be explained by the smaller size of sheep carcasses not requiring such extensive butchery. The mandibles were also chopped around the area of diastema and alveoli, presumably also for marrow extraction.

For ox, sheep, and pig vertebrae were chopped both axially and transversely.

There is little to comment on the butchery of pig since there were so few pig bones, one skull was cleaved axially in half, scapulae were chopped across the blade showing a slight difference in butchery technique to that used on ox and sheep, and a humerus was chopped across the midshaft.

Few knifecuts were recorded from any species, some have already been mentioned, and generally speaking they most frequently occurred on the first phalanges of ox (probably associated with skinning although knifemarks need not penetrate the bone if this done expertly). Other knifemarks were noted on some rib fragments of ox and sheep, an ox scapula and a hyoid, these are more likely to be associated with the boning out of meat during butchery.

No butchery marks were observed on any other species.

Heavy fragmentation of many long bone splinters in the ox sized and ovicaprid sized categories could well be evidence of marrow extraction as suggested by Cram (1973 151), involving chopping a bone into fragments and then boiling these fragments in water so that the fat could be skimmed off the surface. Cram also states that metapodials tend to be less broken up than some of the main limb bones because they contain less marrow.

There were only a few examples of gnawing all of them canid and included a fragment of tibia, probably sheep, and the midshaft of an ox metacarpal. This might suggest that bone refuse was disposed of fairly quickly and not left lying on the ground surface where it would be found by dogs.

Burnt bone was also sparse, and included the following; first and second phalanges of ox, two unidentified fragments, part of a sheep acetabulum and a fragment of sheep vertebrae.

## Ageing

The ageing was studied from areas 1, 2 and 3, and was based on the eruption of the teeth and to a lesser extent epiphyseal fusion.

Although the ageing method devised by Grant (1975. Appendix B. 437-450) was used whenever possible many of the mandibles were so fragmented that it was frequently not possible to record enough of the mandible to achieve a value. So in addition the tooth eruption was also recorded using field 9 of the recording system (Jones et al 1980) in which the state of eruption is described. The information was then transposed into age groups (better regarded as eruption stages) using Silver's data (1969). The author's impression is that had it been possible to use the Grant system (1975) throughout broadly similar results would have been achieved, but with rather finer divisions.

Considering ox mandibles, over 50% (the total number was 42) have the third molar in wear (see fig 3) implying a high proportion of mature individuals, perhaps reflecting that the primary purpose of these animals was not beef, which was a secondary function after they had provided ploughing, traction breeding and manure. It is difficult to assess the importance of cattle for dairy products in Britain during the Roman period as White (1970. 277-278) shows evidence for Italy where cows milk was not often used for human consumption but was somewhat of a rarity, sheep and goats milk was much more common. In any event the animals last contribution would be its meat and hide so it would seem sensible to get the maximum use out of it before slaughter. There are some immature individuals and one is tempted to regard these as castrates since their other functions would be reduced. Whether they were in fact sickly animals that were unsuitable for sale or work and so were slaughtered and eaten as was practised in the Middle Ages in Britain (Locker in prep) is difficult to judge. Varro mentions guarantees of soundness in slaughter regulations (White 1970. 277), although butchers that bought for sacrifice normally required no guarantee. The adherence to these regulations may not have been so strict in this outpost of the Empire.

The sheep mandibles show a greater variety of eruption stages, with a lower proportion of individuals reaching full dentition, only 19% (see fig 4) out of a total number of 62, had all teeth in wear. This is perhaps surprising since sheep also provide a wide range of products, wool was the most important product followed by milk and cheese (White 1970. 301). Cato in discussing cheese is only concerned with that made from sheep's milk (White 1970. 277), their manure would also be useful as fertiliser. Perhaps the more variable age groupings are a reflection of the capability of sheep to breed twice a year against the single offspring of cattle, although White (1970. 308) seems to suggest that in Italy in the Roman period sheep only lambed once a year, Varro and Pliny prefere mid May to the end of July as the mating season. But sheep still reproduce more frequently than cattle if one heeds the advice of Columella (White 1970. 278) that where fodder is scarce cows should only calve every second year, especially if the cows are also used for farm work.

Few pig mandibles were present (see fig 5) but they do indicate as is usual, pigs being slaughtered at a relatively young age, often between the eruption of the second and third molar. The only uses of pig are for breeding and meat, however as they have a high fecundity level only a relatively small proportion need be kept for breeding. Scrofa thought that sows should not be allowed to breed until they were twenty months old and then should be considered too old for breeding after seven years (White 1970. 317).

All the mandibles of horse indicated full dentition and were all adult animals (using Silver's data (1969. 291) regarding the eruption of the molars since the incisors were sometimes missing due to fragmentation this would give an age of at least three and a half to four and half years.

Evidence from epiphyseal fusion was also examined, though alone it is not a very reliable ageing method since it only supplies a minimum age once a bone is fused, but in general the achievement of full epiphyseal fusion in ox (except for vertebrae which fuse late anyway) reflects much the same stage as the teeth, ie fully mature animals. For sheep fusion suggested a wider age range than the ox, supported by evidence for the teeth. Pig showed a higher proportion of unfused and porous bones than the other two species. All the horse bones were fused except for a pair of pelves that were unfused which, using Silver's data suggested an age of one and a half to two years (1969. 286) or under one year using Getty (1975. 298).

Metrical analysis

Measurements were taken whenever possible using those outlined in Jones et al 1981, and the complete metrical archive is available from the Ancient Monuments Laboratory, comparisons have been made with a number of other Roman sites.

Ox; the range of total lengths of metatarsals compared with other Roman sites can be seen in fig 6, those from Magiovinium span 32 mm, and seem to fall within a mid range compared with other sites (n equals the number of specimens). The greatest diversity is from Corstopitum and Godmanchester whose ranges span 63 and 65 mm respectively. The distal width of metatarsals (fig 7) and the distal width of tibiae (fig 8) were similarly compared, and both cases Magiovinium fell close to the maximum size, this may be because the tibia does not reflect sexual dimorphism to the same extent as the metatarsals.

The total length ranges for other bones from Magiovinium are as follows:

| | | |
|---|---|---|
| Metacarpal | 175 - 230 mm | n = 17 |
| Humerus | 294 | n = 1 |
| Radius | 268 - 285 | n = 5 |
| Femur | 326 - 350 | n = 3 |

Forty five withers heights were calculated giving the following:

| | | | |
|---|---|---|---|
| Metacarpal | 107.1 - 140.7 cm | n = 17 | using Fock 1966 (no sex factor) |
| Metatarsal | 110.0 - 127.3 cm | n = 20 | |
| Femur | 113.1 - 121.4 cm | n = 3 | Matolsci 1970 |
| Radius | 115.2 - 122.5 cm | n = 5 | |
| Humerus | 121.5 or 126.8 cm | n = 1 | (using two factors) |

The differing withers heights on the humerus result from using two different factors on different length measurements, so perhaps it is more accurate to compare only absolute lengths. This difficulty also occurs with the calculation of horse withers heights as there seems to be a large discrepency between the methods of Kieswalter and Vitt, so the author has decided only to use absolute measurements to avoid this discrepancy.

The plotting of the distal width index of metacarpals against their length and the midshaft diameter against length did not reveal any distinct sex groupings, although one outlier occurred in each case. Figs 9 and 10.

Examination of twelve horncores from Ditch 209 by Dr P Armitage suggested that both short horned and medium horned animals were present in subadult and adult classes, some castrates were also identified.

Sheep; the range of both metacarpal and metatarsal lengths were plotted with those from four other sites, the metacarpals were well within the ranges for the other sites but the metatarsals were rather larger, see figs 11 and 12.

Comparisons with other Roman sites concerning the humerus distal breadth and the metatarsal distal breadth show the Magiovinium range to be rather larger than those from other sites:

| | | | |
|---|---|---|---|
| Humerus distal breadth: | Magiovinium | 25.5 - 32.6 mm | n = 17 |
| | Ashville | 23.0 - 28.0 | n = 2 |
| | Farmoor | 30.0 - 31.0 | n = 3 |
| | Gadebridge | 25.0 - 28.0 | n = 5 |
| | Frocester | 23.0 - 28.0 | n = 21 |

| | | | |
|---|---|---|---|
| Metatarsal distal breadth: | Magiovinum | 19.7 - 27.6 mm | n = 7 |
| | Gadebridge | 21.0 - 23.0 | n = 4 |
| | Tripontium | 20.0 - 24.0 | n = 6 |
| | Frocester | 18.0 - 24.0 | n = 5 |

Modern sheep data suggested that the maximum distal tibia width of castrates is 104% that of ewes (Noddle 1975. 253) based on data from eighty animals. The distal tibial width was plotted against the distal tibial depth of the sheep from Magiovinium, the resultant graph suggested that there might be two possible groups with approximately equal numbers in each and one outlier. This might be regarded as an equal number of ewes and wethers with one ram although they are not necessarily contemporary to one another.

Pig; measurements were limited because of the low numbers of pig bones, and their immaturity, but the following ranges have been included:

| | | |
|---|---|---|
| Humerus distal breadth | 34.5 - 43.3 mm | n = 5 |
| Tibia distal breadth | 30.0 - 37.0 | n = 4 |

Horse; there were relatively high numbers of horse bones, many of which were so complete that many measurements could be taken. The greatest number of comparisons could be made between the length ranges of metacarpals and metatarsals as seen in Figs 13 and 14. In both cases the Magiovinium horses seem to have quite a narrow range compared to the number of specimens, the site with the largest range for metatarsals is Corstopitum and for metacarpals is Godmanchester, (although the latter only has two specimens). Considering the number of specimens the range from Tripontium is also very narrow.

Other length ranges comparing Magiovinium with other sites are as follows:

| | | | |
|---|---|---|---|
| Tibia | Magiovinium | 309.0 - 364.0 mm | n = 10 |
| | Godmanchester | 342.0 - 345.0 | n = 2 |
| | Gadebridge | 320.0 | n = 1 |
| | Penrith | 308.0 | n = 1 |
| | Corstopitum | 293.0 - 379.0 | n = 4 |
| Humerus | Magiovinium | 282.0 | n = 1 |
| | Godmanchester | 259.0 | n = 1 |
| | Penrith | 310.0 | n = 1 |
| | Corstopitum | 217.0 - 285.0 | n = 8 |
| Radius | Magiovinium | 321.0 - 345.0 | n = 9 |
| | Brancaster | 286.0 | n = 1 |
| | Parnell and Appian Road | 320.0 - 323.0 | n = 2 |
| | Corstopitum | 292.0 - 336.0 | n = 8 |

Although the tibiae are well within the range for Corstopitum the radius range is rather greater.

Dog; a number of long bones were measured including a femur whose total length was 90 mm and using Harcourts formula (1974. 154) the shoulder height was estimated at 27 cm, a tibia length of 114 mm gave a shoulder height of 34.2 cm (this specimen was from the topsoil). The range of the lengths of the lower first molar is 20.0 - 24.9 mm (n = 7), Harcourt's Roman range is 15.0 - 24.5 mm. It is possible that these were working animals, there was no evidence of butchery on any of these bones.

## Pathology

Instances of pathology are relatively infrequent on animal bones on archaeological sites and Magiovinium was no exception. There may be pathological conditions common archaeologically which can only be traced through documentary evidence if they do not manifest themselves in gross bony changes.

Ox; the proximal surface of a metatarsal was affected by a lesion, pitting was most marked on the medial side. This must have affected the conformation of the joint, which could have been inflammed. This appears to be similar to an infection known as tarsitis, and if it was of the aseptic variety could have affected the animals mobility. Alternatively it may simply be a case of osteoarthritis as this specimen exhibits three of the four changes characterising this condition as outlined by Baker and Brothwell (1980. 115). (See Plate 1).

A metatarsal exhibits evidence of exostoses over the distal anterior surface of the bone, but it does not extend to cover the joint surface. Exostosis is also evident on a fore lateral first phalanx, extending over the proximal medial area and over the later al side of the proximal articulation with slight eburnation. It is possible that this is a case of ring bone as described in Baker and Brothwell (1980. 120). (See Plate 2).

A rib fragment showed evidence of exostosis near its sternal end.

Sheep; a humerus shaft had become infilled with bone, in dogs the shaft of the femur can become infilled when there is a Vitamin A deficiency, perhaps this is a related condition (Bourne 1972. 201). (See Plate 3).

A fragment of femur shaft was invoried and may have part of an ossified tendon attached.

Horse; a first and second phalanx had become fused together (see Plate 4), severe exostoses occur around the distal area of the first phalanx and the proximal area of the second. This probably resulted in some immobility of the foot.

A lumber vertebra with a collapsed centrum was found, in cattle a collapsed centrum can be an indication of tuberculosis (Greenough et al 1972. 392). Perhaps this may also apply to horse.

Pig. the first premolar of a right mandible had rotated and now points towards the canine, this type of condition is not uncommon in pigs.

Dog; the antemortem loss of the third molar in a right mandible was observed, the alveoli had completely healed over and its shadow could be seen in X ray. The other teeth were all normal in eruption and wear.

Bone Working

A large pig tusk from F 501 had a hole penetrating the medial side (see Plate 5), but which did not run right through to the lateral side. The purpose for this is unclear, perhaps it was part of some decoration.

A fragment of long bone, possibly sheep radius had been sharpened and polished to a point, (See Plate 6), from F 1655.

Other species

Goat was only positively identified by a single horncore, though it is quite possible that there are goats in the ovicaprid category which could not be reliably separated from sheep.

A fox was identified from a single fused radius and ulna, this identification was made on the basis of size so it is also possible that it is a fox sized dog.

Cat was represented by a single metapodial.

Hare was identified from five bones from a variety of contexts and together with the few bones of red and roe deer form the small contribution of game to the economy that is represented in the animal bone. Even the evidence of red deer is not conclusive since this species is represented by fragments of antler that could be cast, plus one upper premolar. The evidence for roe deer is more convincing in the form of fragments of maxilla and mandible.

Birds

A number of domestic fowl bones were identified from a variety of contexts see Table 5, the ranges of their total lengths are as follows:

| | | |
|---|---|---|
| coracoid | 47.0 - 57.0 mm | n = 2 |
| scapula | 63.2. | n = 1 |
| humerus | 62.0 - 76.0 | n = 3 |
| radius | 63.4 - 68.2 | n = 2 |
| ulna | 57.5 - 75.0 | n = 3 |
| carpometacarpus | 34.9 | n = 1 |
| femur | 69.6 - 69.9 | n = 2 |
| tibiotarsus | 110.0 | n = 1 |

Domestic fowl would have been kept both for their eggs and meat, the size range of the bones seems to be within the range for Roman sites examined by Macready (1976). Poultry keeping was quite a sophisticated form of husbandry in Italy during the Roman period according to White (1970. 322) and there is much written on the keeping of these birds which would probably have been put to good use during the occupation of Britain.

A few bones were also found of crow and raven who may well have been scavengers around the site, also the coracoid of a swan, this species was eaten in Roman times and has been recorded from the military sites of Chester and Ribchester (Davies 1971. 130). The topsoil also produced evidence of barn owl and duck domestic/mallard though these could be intrusive.

General Discussion

A variety of types of site have been compared with Magiovinium in this report, mainly from the aspect of comparing the measurements. The site itself is difficult to classify. It is close to an earlier fort and lies beside Watling Street, perhaps it might best be described as a roadside settlement with military influence.

Because of the nature of the site and the type of deposits that the bone was found in, it seems justifiable to view this material as rather cosmopolitan in origin, some of it might possibly be earlier fort debris, some possibly the debris of travellers along Watling Street and town clearance, but the bulk of the material must originate from the indigenous settlement, and as earlier mentioned there were no discernable differences in special distribution.

The high percentage of ox plus ox sized fragments fits in with King's suggestion (1978. 211) that the more romanised deposits ie villas, roadside settlements, towns and forts tend to less in favour of sheep than the native sites. Although the accompanying increase of pig with the dominance of ox is not seen at this site.

In considering the earlier proximity of the fort Davies (1971, 123) states that military land extended for some distance around the fort and was grown either by the military or leased to civilians, so possibly the same methods of husbandry persisted after the closure of the fort. Davies also shows evidence from excavations at Roman forts that domestic ox produces the largest number of bones, sheep were important and pork was popular (1971. 126).

The relatively high number of horse bones is both interesting and unusual. At Portchester Castle where 36,000 were recovered in all (Grant 1975. 381), horse together with red deer, roe deer, hare, fox, badger, voles, fallow deer, fish and mice formed only 3% of the total, whereas at Magiovinium horse along forms 5.5% of the total which in real terms may be relatively even higher since the numbers of fairly complete horse bones are being directly compared with heavily fragmented bones. Grant (1975. 383) thought that horses might be buried outside the area of occupation which would explain their rarity in domestic refuse as at Portchester Castle and possibly their abundance in the ditches and gullies at Magiovinium which might be the sort of marginal deposits in which horse carcasses were placed.

White (1970. 288) says that horses were used by the Romans for three puprposes, cavalry, chariot racing in the circus, riding and pulling carriages. They were not employed for draught purposes, donkeys and mules were used for this. Presumably most of the horses at Magiovinium were for transport, riding and breeding, no mules were identified from the lower first and second molars (Armitage 1979. 342).

Columella also described three classes of horse, (White 1970. 288), noble stock for the circus and the games, breeding stock for mules (the offspring commanded a high price) and common stock comprising ordinary mares and horses, the Magiovinium horses are most likely to belong to the latter group.

The role that the mule played in the Roman world appears to be important from the literary and pictorial sources (Chapman 1979. 345), but seems to be virtually nil from the bone evidence, the difficulties of identification have been pointed out by Armitage (1979. 339) regarding the recognition of the mule jaw from Billingsgate Buildings, City of London, and it may be that many limb bones of mule remain categorised as horse.

At Magiovinium stock for transport must have been important both when the fort was in use and later when a volume of traffic passes up and down Watling Street and ox, and horse (and/or mules) must have been frequently used in this capacity.

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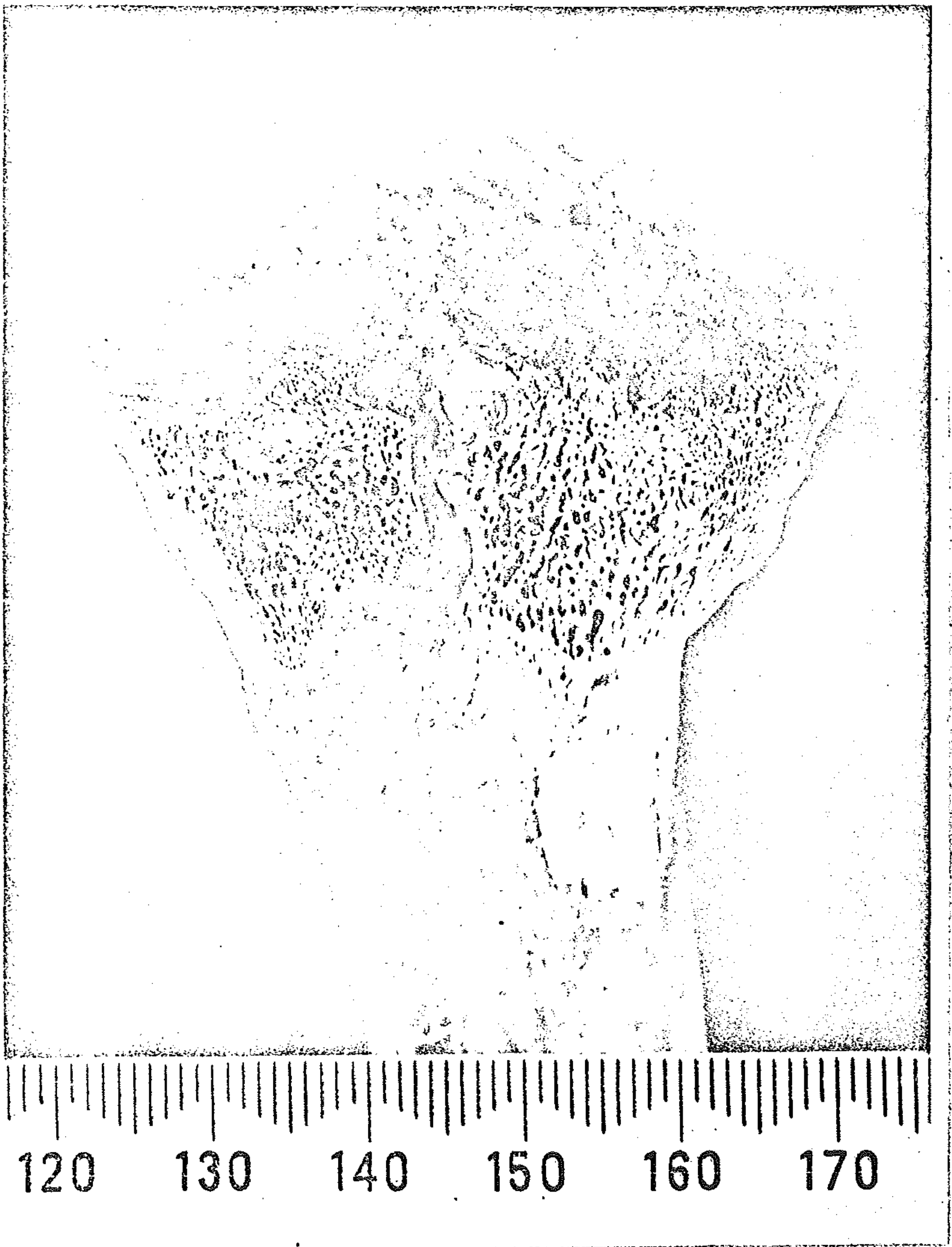
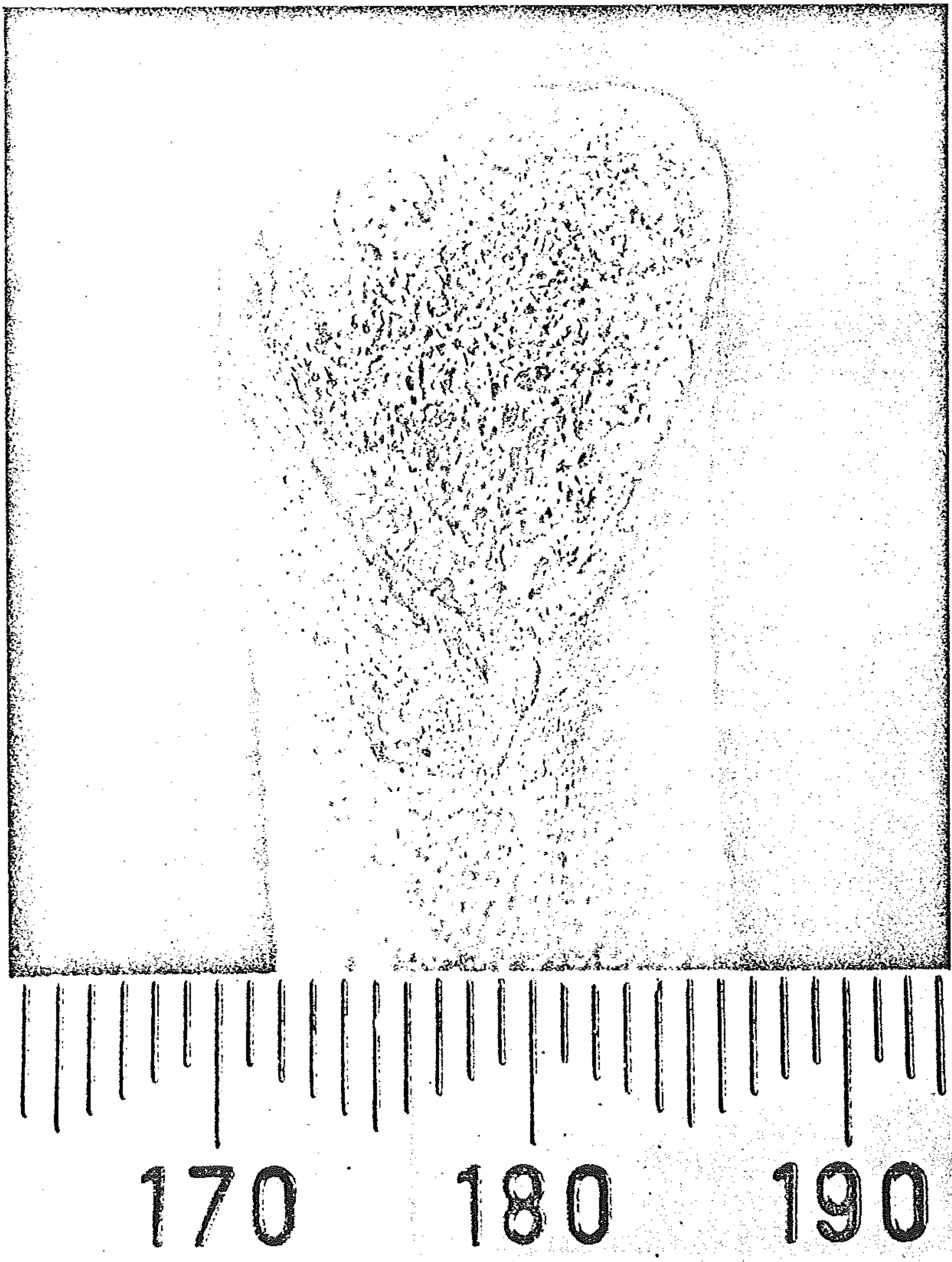
Magiovinium Plate 1

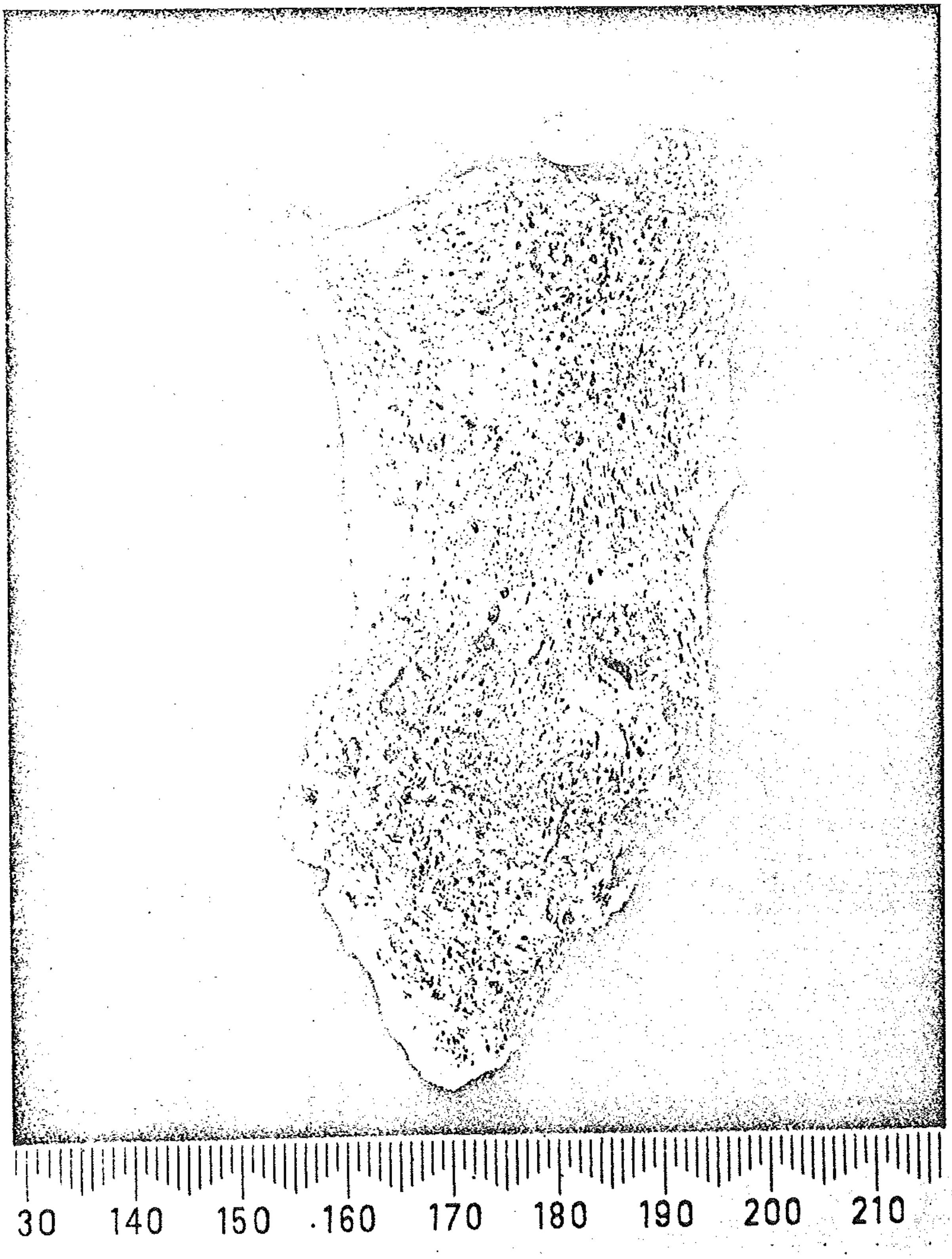


Magnorinum Plate 2

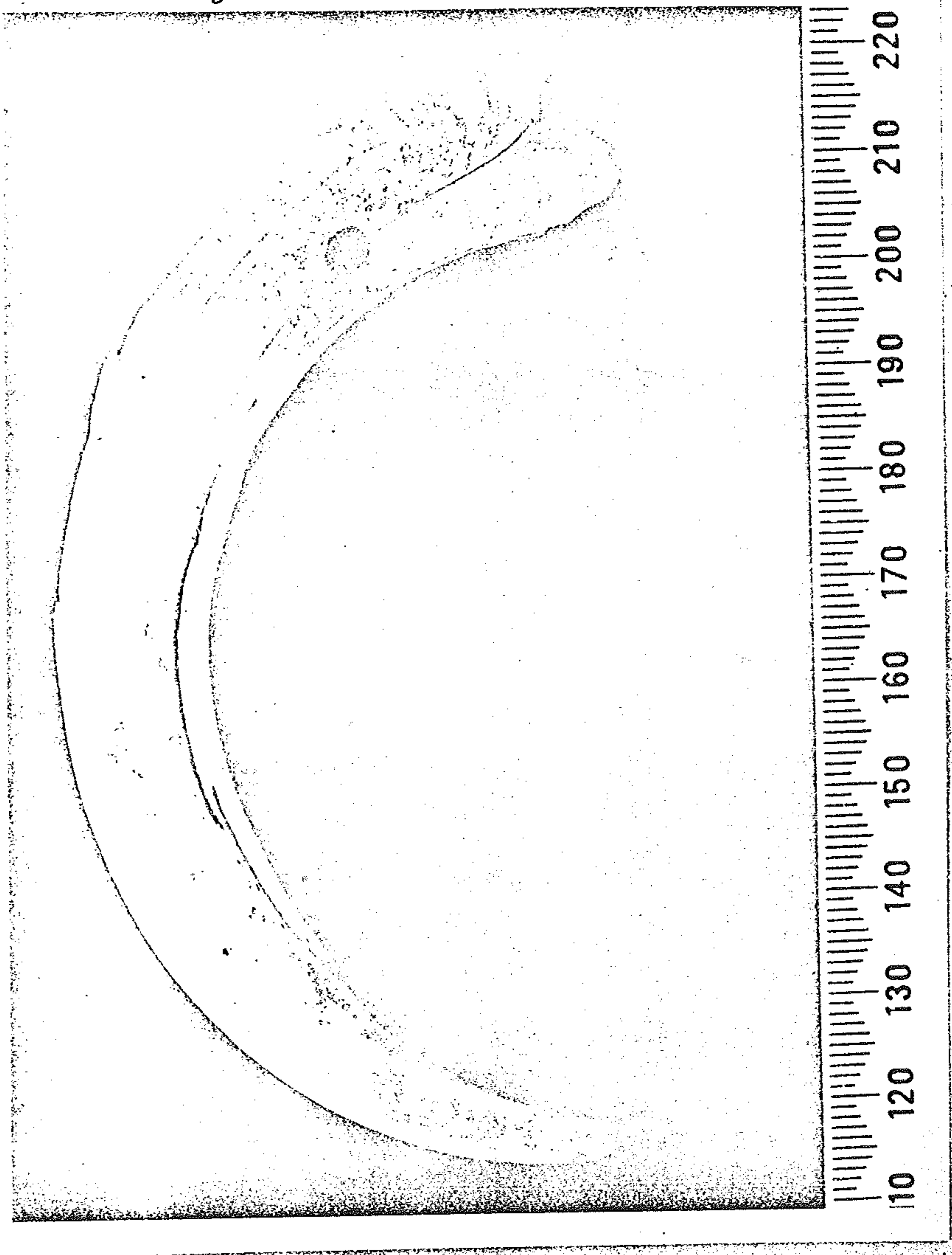
Magrovinium Plate 3



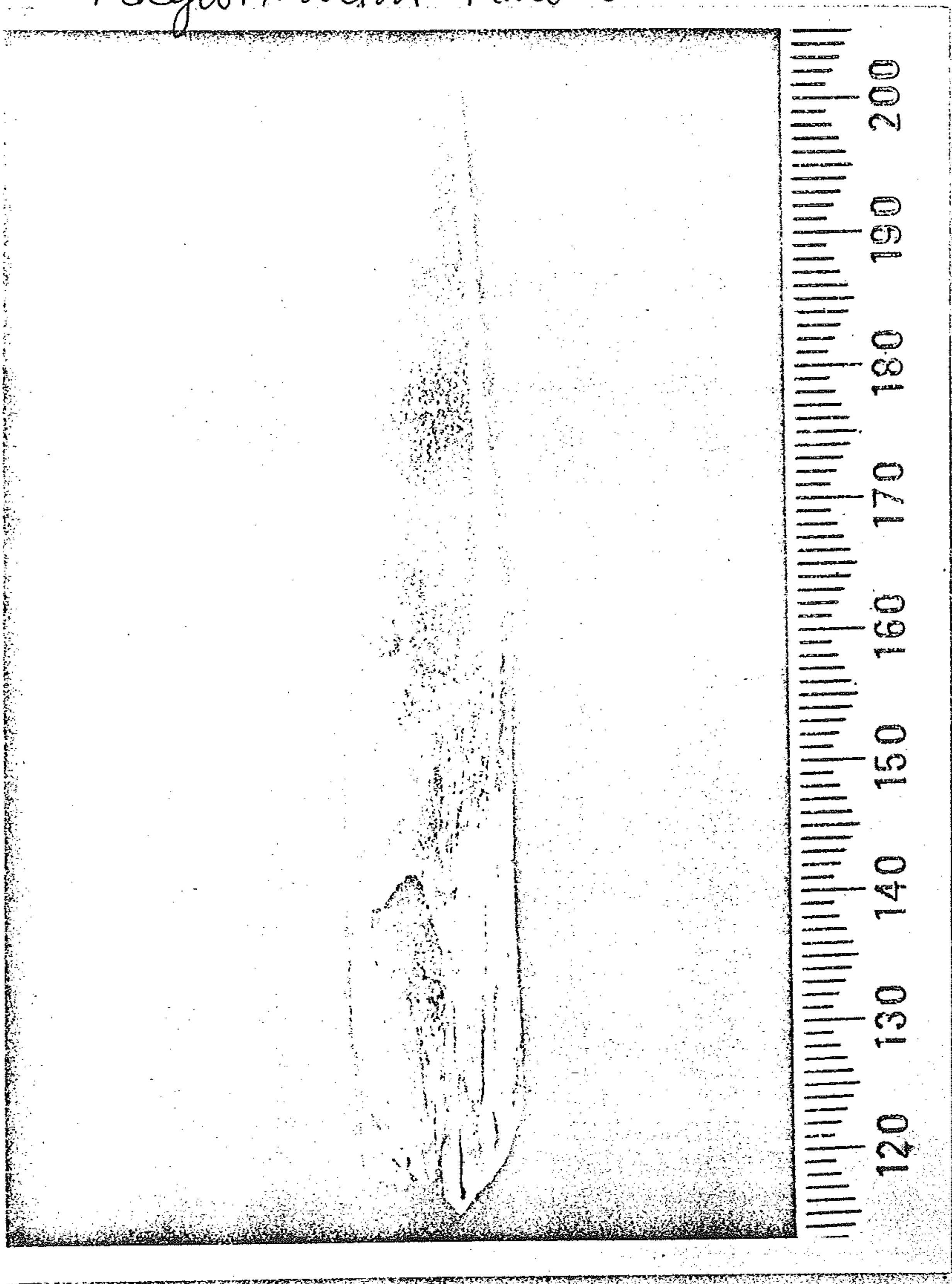
Magiovinium Plate 4



magrorimum Plate 5



Magnorinum Plate 6



# Magiovinium Tables

| | Ox | Goat | Ovicaprid | Pig | Horse | Red Deer | Roe Deer | Oxsized | Ovicapsized | Dog | Cat | Hare | Unidentifiable | Fox |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| skull | 5 | - | 1 | - | 8 | - | - | 1 | - | - | - | - | 1 | - |
| skull frag | 17 | - | 6 | 6 | 6 | - | - | 270 | 19 | - | - | - | 36 | - |
| mandible | 137 | - | 261 | 42 | 24 | - | 1 | 131 | 51 | 11 | - | 1 | 1 | - |
| maxilla | 34 | - | 33 | 20 | 12 | - | 1 | 2 | - | 8 | - | - | - | - |
| palatine | 9 | - | - | - | - | - | - | 1 | - | - | - | - | - | - |
| horncore | 101 | 1 | 4 | - | - | - | - | - | - | - | - | - | - | - |
| antler | - | - | - | - | - | 4 | - | - | - | - | - | - | - | - |
| hyoid | - | - | - | - | - | - | - | 6 | 4 | - | - | - | - | - |
| scapula | 84 | - | 20 | 16 | 15 | - | - | 183 | 34 | 3 | - | - | - | - |
| humerus | 39 | - | 37 | 15 | 25 | - | - | 18 | 54 | 7 | - | - | - | - |
| radius & ulna | 2 | - | 2 | 1 | 7 | - | - | 1 | 1 | - | - | - | - | 1 |
| radius | 40 | - | 49 | 12 | 32 | - | - | 14 | 58 | 7 | - | - | - | - |
| radius eph | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ulna | 17 | - | 11 | 17 | 6 | - | - | 12 | 8 | 7 | - | 1 | 1 | - |
| metacarpal | 98 | - | 88 | - | 20 | - | - | 2 | 40 | - | - | - | - | - |
| 1st phalanx | 107 | - | 20 | 2 | 21 | - | - | 1 | 9 | - | - | - | - | - |
| 2nd phalanx | 45 | - | 1 | 1 | 9 | - | - | - | - | - | - | - | - | - |
| 3rd phalanx | 22 | - | 1 | 1 | 6 | - | - | 3 | - | - | - | - | - | - |
| os coxae | 26 | - | 13 | 2 | 21 | - | - | 106 | 36 | 2 | - | - | - | - |
| femur | 17 | - | 2 | 1 | 31 | - | - | 27 | 19 | 5 | - | 1 | - | - |
| femur eph | 5 | - | - | - | 2 | - | - | 5 | 2 | - | - | - | - | - |
| patella | 1 | - | - | - | 4 | - | - | - | 4 | - | - | - | - | - |
| tibia | 38 | - | 58 | 10 | 31 | - | - | 20 | 79 | 8 | - | 1 | - | - |
| tibia eph | 2 | - | - | - | - | - | - | - | 2 | - | - | - | - | - |
| calcaneum | 25 | - | 10 | - | 5 | - | - | 5 | 4 | - | - | - | - | - |
| astragalus | 66 | - | 6 | 1 | 9 | - | - | - | - | - | - | - | - | - |
| centroquartal | 6 | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| metatarsal | 106 | - | 103 | - | 20 | - | - | 5 | 83 | - | - | - | - | - |
| rib | 1 | - | 1 | - | - | - | - | 912 | 279 | 20 | - | - | 4 | - |
| costal cart. | - | - | - | - | - | - | - | 2 | - | - | - | - | 1 | - |
| atlas | 11 | - | 3 | 1 | 4 | - | - | 1 | 3 | 2 | - | - | - | - |
| axis | 7 | - | 1 | - | 6 | - | - | 5 | 1 | 2 | - | - | - | - |
| cervical vert. | 1 | - | - | - | 12 | - | - | 40 | 1 | 1 | - | - | - | - |
| thoracic vert. | 2 | - | - | - | 24 | - | - | 74 | 15 | - | - | - | - | - |
| sacrum | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| caudal vert. | - | - | - | - | 2 | - | - | 3 | - | - | - | - | - | - |
| vertebrae | 1 | - | 2 | - | 8 | - | - | 126 | 15 | 10 | - | - | - | - |
| upper tooth | 124 | - | 95 | 6 | 133 | 1 | - | 1 | 1 | - | - | - | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| lower tooth | 107 | - | 106 | 25 | 84 | - | - | 3 | 3 | 4 | - | - | - | - |
| metapodial | 21 | - | 1 | 23 | 6 | - | - | 4 | 6 | 4 | 1 | 1 | - | - |
| mp eph | 11 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| tarsal | 1 | - | - | - | 1 | - | - | 10 | - | - | - | - | - | - |
| fibula | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - |
| 4th mp | - | - | - | - | 18 | - | - | - | - | - | - | - | - | - |
| long bone frag. | - | - | - | - | 14 | - | - | 909 | 441 | - | - | - | 23 | - |
| fragment | - | - | - | - | - | - | - | 732 | 24 | - | - | | 3018 | - |
| Total | 1340 | 1 | 935 | 204 | 626 | 5 | 2 | 3637 | 1296 | 101 | 1 | 5 | 3085 | 1 |
| | | | | | | | | | | | | | Total | 11239 |

MAGIOVINIUM. Table 1.

| | Ox | Ovicaprid | Pig | Horse | Ox sized | Ovicapsized | Dog | Cat | Unidentifiable | Red Deer |
|---|---|---|---|---|---|---|---|---|---|---|
| skull frag. | | - | - | - | 10 | - | - | - | 2 | - |
| mandible | 13 | 10 | 2 | - | 5 | 2 | 1 | - | - | - |
| maxilla | 2 | 1 | 2 | - | - | - | 2 | - | - | - |
| palatine | 1 | - | - | - | - | - | - | - | - | - |
| horn core | 7 | - | - | - | - | - | - | - | - | - |
| antler | - | - | - | - | - | - | - | - | - | 2 |
| hyoid | - | - | - | - | - | 1 | - | - | - | - |
| scapula | 10 | - | - | - | 19 | 1 | 1 | - | - | - |
| humerus | 3 | - | 1 | - | 2 | 4 | 1 | - | - | - |
| radius | 3 | - | 1 | 1 | - | 1 | - | - | - | - |
| ulna | 1 | 1 | - | - | 1 | - | - | - | - | - |
| metacarpal | 7 | 3 | - | - | - | 1 | - | - | - | - |
| 1st phalanx | 5 | 1 | - | 1 | - | - | - | - | - | - |
| 2nd phalanx | 5 | - | 1 | 2 | - | - | - | - | - | - |
| 3rd phalanx | 1 | - | - | 1 | - | - | - | - | - | - |
| os coxae | 1 | 3 | - | - | 5 | - | - | - | - | - |
| femur | - | - | - | 1 | 2 | 1 | 3 | - | - | - |
| tibia | 2 | 2 | 1 | 1 | 2 | 6 | 2 | - | - | - |
| calcaneum | 1 | - | - | - | - | - | - | - | - | - |
| astragalus | 1 | - | - | - | - | - | - | - | - | - |
| metatarsal | 13 | 4 | - | 1 | - | - | - | - | - | - |
| rib | - | 1 | - | - | 24 | 10 | - | - | 3 | - |
| costal cart. | - | - | - | - | 1 | - | - | - | - | - |
| atlas | - | - | - | - | - | 1 | 1 | - | - | - |
| axis | - | - | - | - | 1 | - | - | - | - | - |
| thoracic vert. | 1 | - | - | - | 7 | - | - | - | - | - |
| vertebrae | - | - | - | - | 12 | 2 | - | - | - | - |
| upper tooth | 8 | 1 | - | - | - | - | - | - | - | - |
| lower tooth | 3 | 3 | 2 | 1 | - | - | - | - | - | - |
| metapodial | 2 | - | 2 | - | - | - | 1 | 1 | - | - |
| long bone frag | - | - | - | - | 28 | 15 | - | - | - | - |
| fragment | - | - | - | - | 37 | - | - | - | 124 | - |
| Total | 90 | 30 | 12 | 9 | 156 | 45 | 12 | 1 | 129 | 2 |

Total = 486

MACIOVINIUM Table 2
Group 1 (inc 1544)    Total plus birds = 501

| | Ox | Goat | Ovicaprid | Pig | Horse | Roe Deer | Ox sized | Ovicaprid sized | Dog | Unident | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| skull | 2 | - | - | - | 1 | - | - | - | - | - | |
| skull frag | 9 | - | 1 | - | 6 | - | 63 | 2 | - | 1 | |
| mandible | 15 | - | 13 | 8 | 2 | - | 14 | 4 | 1 | 1 | |
| maxilla | 10 | - | 1 | 2 | 3 | 1 | - | - | 2 | - | |
| palatine | 3 | - | - | - | - | - | - | - | - | - | |
| horn core | 26 | 1 | 2 | - | - | - | - | - | - | - | |
| hyoid | - | - | - | - | - | - | 1 | - | - | - | |
| scapula | 15 | - | - | - | 2 | - | 27 | 2 | 1 | - | |
| humerus | 5 | - | 2 | 1 | 5 | - | 3 | 3 | 1 | - | |
| radius & ulna | - | - | - | - | 1 | - | - | - | - | - | |
| radius | 6 | - | 3 | - | 6 | - | 3 | 1 | - | - | |
| radius eph | 1 | - | - | - | - | - | - | - | - | - | |
| ulna | 4 | - | - | 1 | - | - | 2 | - | - | - | |
| metacarpal | 19 | - | 2 | - | 10 | - | - | 1 | - | - | |
| 1st phalanx | 15 | - | 1 | - | 6 | - | - | - | - | - | |
| 2nd phalanx | 4 | - | - | - | - | - | - | - | - | - | |
| 3rd phalanx | 3 | - | - | - | 3 | - | - | - | - | - | |
| os coxae | 1 | - | 1 | - | 8 | - | 18 | 1 | 1 | - | |
| femur | 7 | - | - | 1 | 7 | - | 5 | - | 1 | - | |
| femur eph | 2 | - | - | - | 1 | - | - | - | - | - | |
| patella | 1 | - | - | - | - | - | - | - | - | - | |
| tibia | 7 | - | 6 | - | 8 | - | 3 | 3 | 1 | - | |
| calcaneum | 2 | - | - | - | 3 | - | - | 2 | - | - | |
| astragalus | 4 | - | - | - | 4 | - | - | - | - | - | |
| metatarsal | 11 | - | 3 | - | 5 | - | - | 5 | - | - | |
| rib | - | - | - | - | - | - | 95 | 4 | - | - | |
| atlas | 2 | - | - | - | 1 | - | - | - | 1 | - | |
| axis | 1 | - | - | - | 2 | - | - | - | 1 | - | |
| cervical vert. | 1 | - | - | - | 8 | - | 14 | - | - | - | |
| thoracic vert. | - | - | - | - | 5 | - | 11 | 1 | - | - | |
| sacrum | 2 | - | - | - | - | - | - | - | - | - | |
| caudal vert. | - | - | - | - | - | - | 1 | - | - | - | |
| vertebrae | - | - | - | - | - | - | 12 | - | - | - | |
| upper tooth | 21 | - | 2 | - | 34 | - | - | - | - | - | |
| lower tooth | 13 | - | 5 | 2 | 12 | - | - | - | - | - | |
| metapodial | 4 | - | - | - | 1 | - | - | - | - | - | |
| mp eph | 5 | - | - | - | - | - | - | - | - | - | |
| tarsal | - | - | - | - | 1 | - | 3 | - | - | - | |
| 4th mp | - | - | - | - | 4 | - | - | - | - | - | |
| long bone frag | - | - | - | - | 14 | - | 95 | 7 | - | - | |
| fragment | - | - | - | - | - | - | 273 | - | - | 234 | |
| Total | 221 | 1 | 42 | 15 | 163 | 1 | 643 | 36 | 10 | 236 | Total = 1368 |

MAGIOVINIUM Table 3
Group 2 (Total is 1370 inc birds).

| | Ox | Ovicaprid | Pig | Horse | Red Deer | Ox sized | Ovicapsized | Dog | Unidentifiable |
|---|---|---|---|---|---|---|---|---|---|
| skull | 1 | - | - | 6 | - | 1 | - | - | - |
| skull fr | - | 1 | - | - | - | 53 | - | - | - |
| mandible | 15 | 10 | 5 | 12 | - | 23 | - | - | - |
| maxilla | 2 | - | 1 | 1 | - | - | - | - | - |
| horn core | 1 | - | - | - | - | - | - | - | - |
| antler | - | - | - | - | 1 | - | - | - | - |
| scapula | 5 | 2 | - | 5 | - | 16 | - | - | - |
| humerus | 3 | 1 | 1 | 7 | - | 4 | 1 | - | - |
| radius | 4 | 1 | - | 5 | - | - | 5 | - | - |
| ulna | - | 1 | 1 | 1 | - | 3 | 1 | - | - |
| metacarp. | 17 | 6 | - | 7 | - | - | 1 | - | - |
| 1st phal | 3 | 2 | - | 5 | - | - | 1 | - | - |
| 2nd phal | 1 | - | - | 2 | - | - | - | - | - |
| 3rd phal | - | - | - | 1 | - | 2 | - | - | - |
| os coxae | 7 | - | 1 | 5 | - | 25 | 1 | - | - |
| femur | - | 1 | - | 7 | - | 7 | 3 | - | - |
| patella | - | - | - | 1 | - | - | - | - | - |
| tibia | 10 | 1 | - | 6 | - | 5 | 2 | - | - |
| calcaneum | 4 | - | - | - | - | - | - | - | - |
| astragalus | 4 | - | - | - | - | - | - | - | - |
| metatar | 15 | 1 | - | 5 | - | - | 2 | - | - |
| rib | 1 | - | - | - | - | 95 | 3 | - | - |
| atlas | 1 | - | 1 | 1 | - | 1 | - | - | - |
| axis | - | - | - | 1 | - | - | - | - | - |
| cerv vert | - | - | - | - | - | 8 | - | - | - |
| thor vert | - | - | - | 7 | - | 20 | - | - | - |
| vertebrae | - | - | - | - | - | 8 | - | - | - |
| up tooth | 10 | 7 | - | 26 | - | - | - | - | - |
| lo tooth | 13 | 1 | 1 | 34 | - | 2 | - | 3 | - |
| metapod | 2 | - | - | 1 | - | - | - | - | - |
| tarsal | - | - | - | - | - | 2 | - | - | - |
| 4th mp | - | - | - | 4 | - | - | - | - | - |
| long b.fr. | - | - | - | - | - | 68 | - | - | - |
| fragment | - | - | - | - | - | 130 | - | - | 73 |
| Total | 119 | 35 | 11 | 150 | 1 | 473 | 22 | 4 | 73 Total = 888 |

MAGIOVINIUM Table 4
Group 3 (889 inc 1 bird bone)

| | Dom Fowl | Mallard | Crow | Raven | Swan | Barn Owl | Unident |
|---|---|---|---|---|---|---|---|
| furcula | - | - | - | - | - | - | 1 |
| coracoid | 3 | 1 | - | 1 | 1 | - | 1 |
| scapula | 5 | - | - | - | - | - | - |
| humerus | 6 | - | 1 | - | - | 1 | 2 |
| radius | 4 | - | - | - | - | - | 1 |
| ulna | 6 | - | - | - | - | - | - |
| carpometacarpus | 1 | - | - | - | - | - | - |
| sternum | 2 | - | - | - | - | - | - |
| os coxae | 2 | - | - | - | - | - | - |
| femur | 6 | - | - | - | - | - | - |
| tibiotarsus | 10 | - | - | - | - | - | 1 |
| tarsometatarsus | 6 | - | - | - | - | - | 1 |
| synsacrum | 2 | - | - | - | - | - | - |
| fragment | - | - | - | - | - | - | 2 |
| Total | 53 | 1 | 1 | 1 | 1 | 1 | 9 Total = 67 |

MAGIOVINIUM Table 5
Birds

| | Ox | Ovicaprid | Oxsized | Unident |
|---|---|---|---|---|
| skull frag | - | - | 1 | - |
| mandible | - | 1 | - | - |
| scapula | 1 | - | - | - |
| metacarpal | 1 | - | - | - |
| os coxae | 1 | - | - | - |
| rib | - | - | 2 | - |
| long bone fr | - | - | 1 | - |
| fragment | - | - | - | 3 |
| Total | 3 | 1 | 4 | 3 Total = 11 |

MAGIOVINIUM Table 3b
Group 2 ii

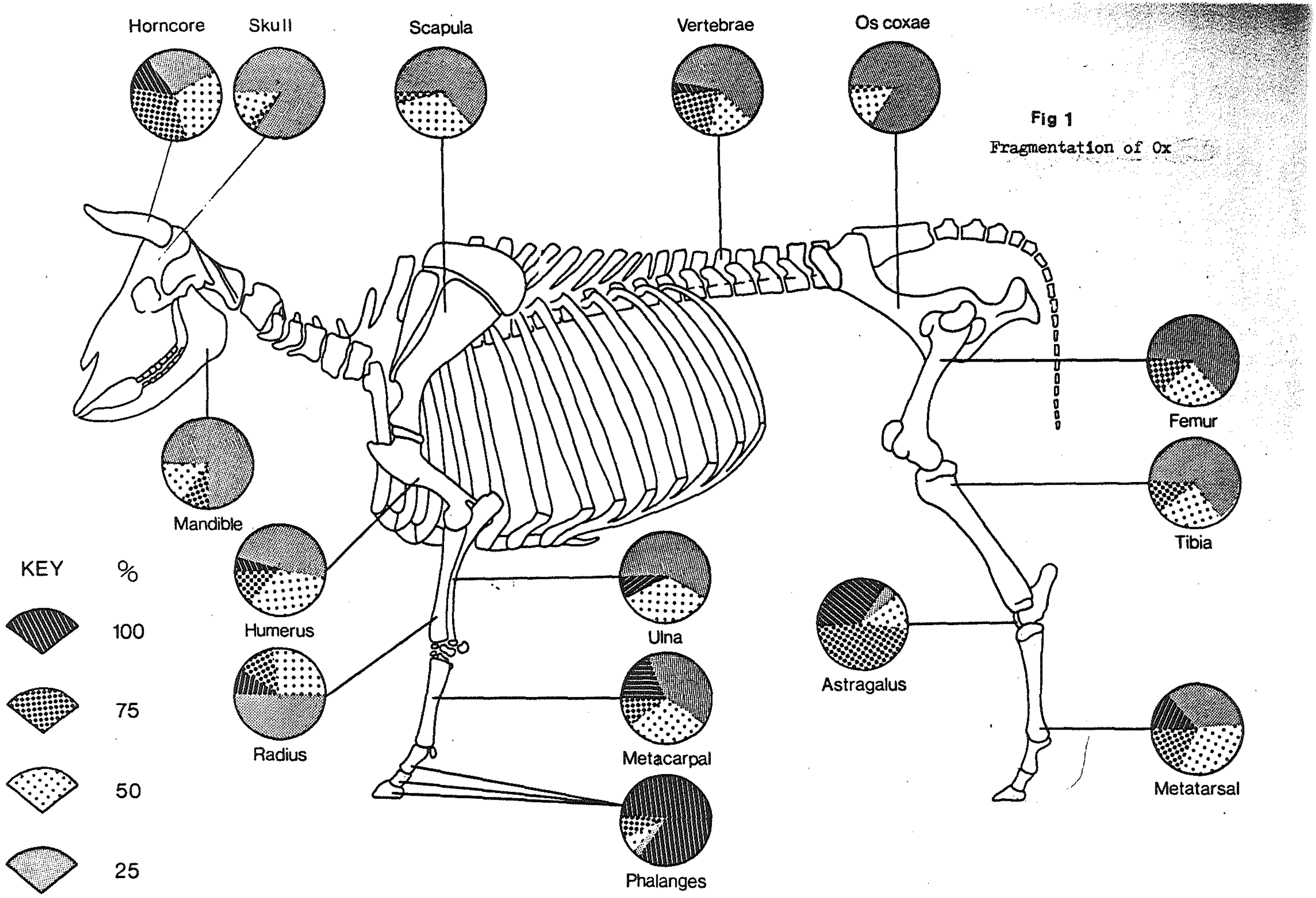



**Fig 1**
Fragmentation of Ox

**Fig 2**

Fragmentation of Ovicaprid

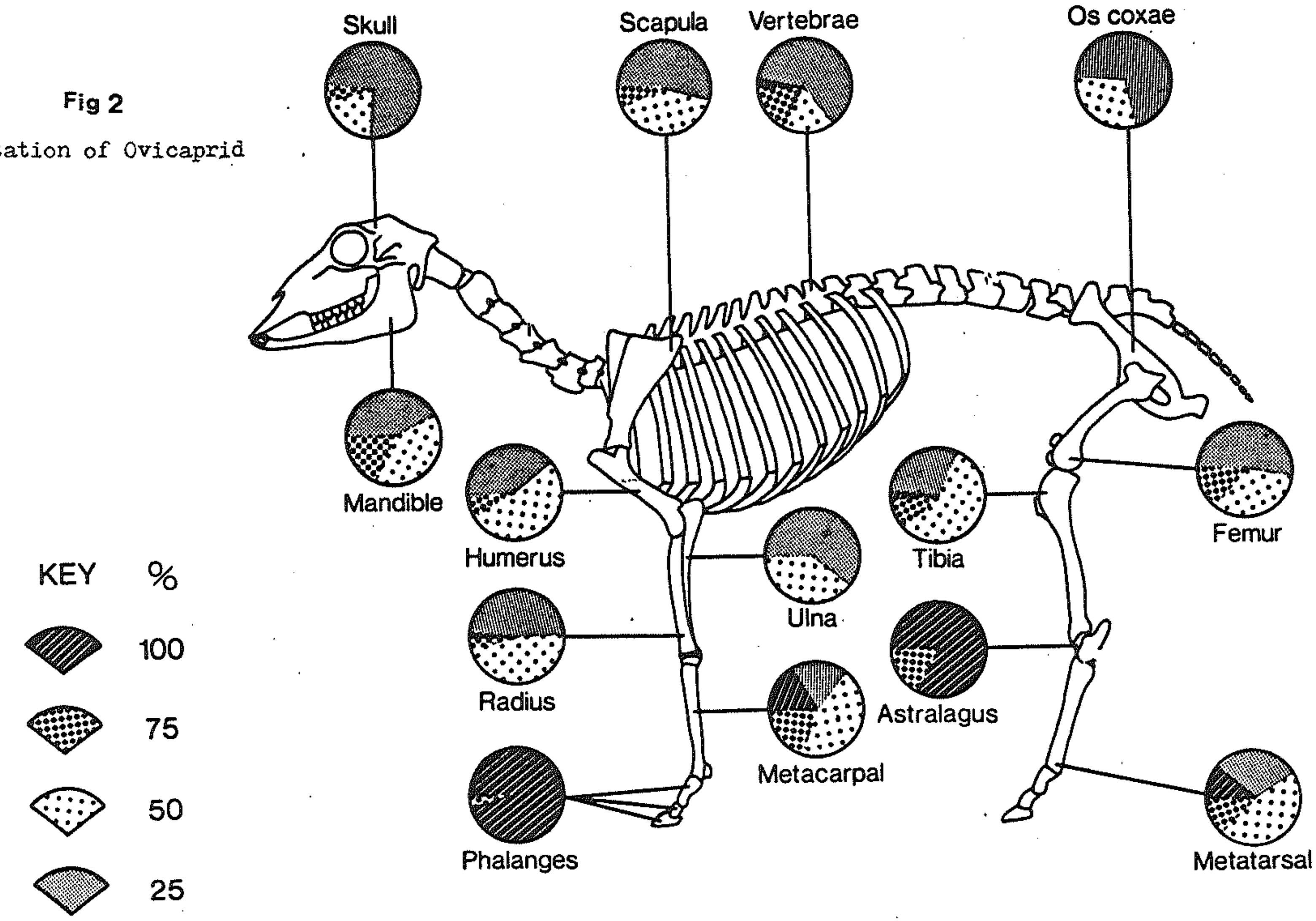
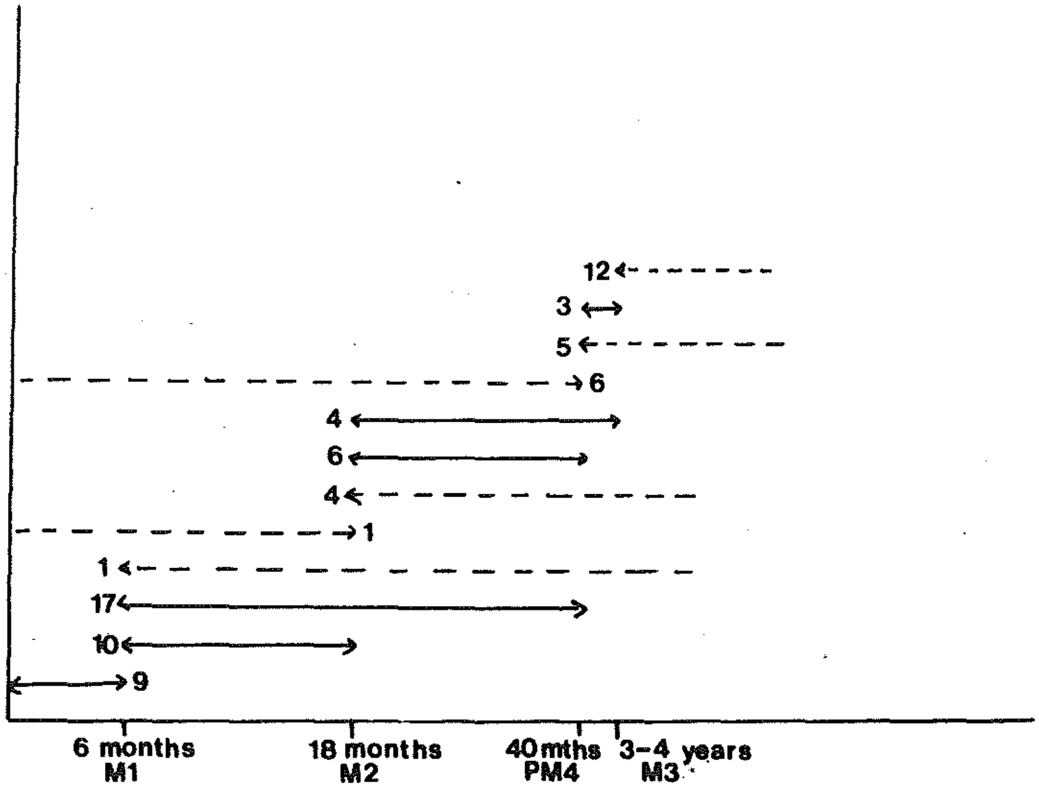
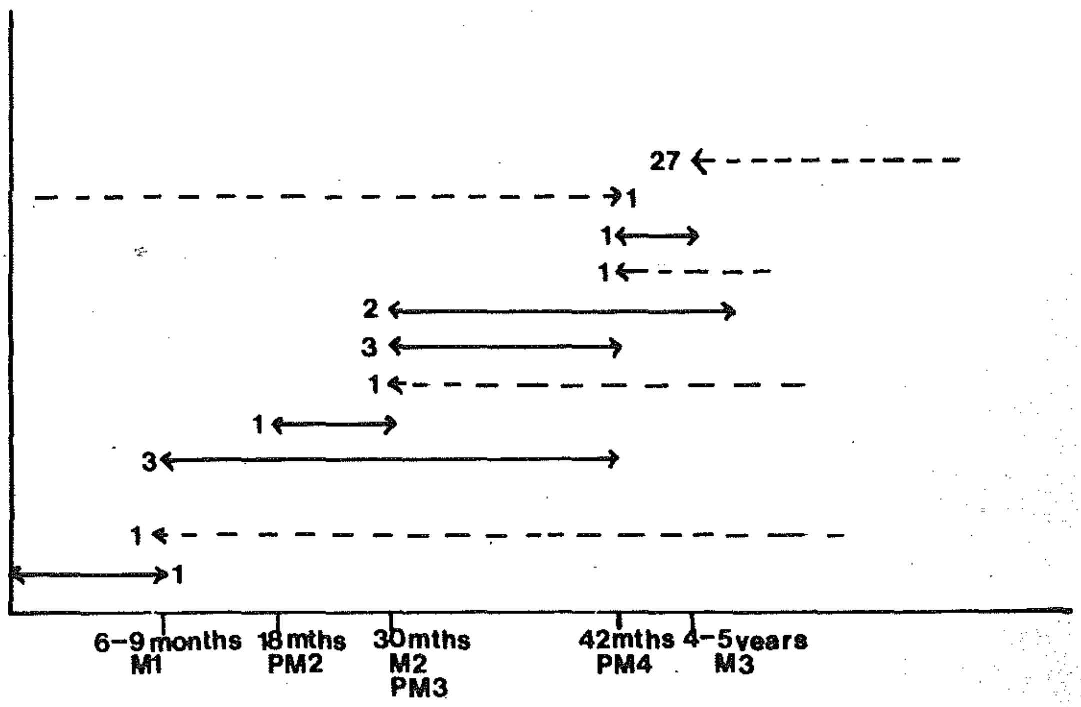


Fig 4



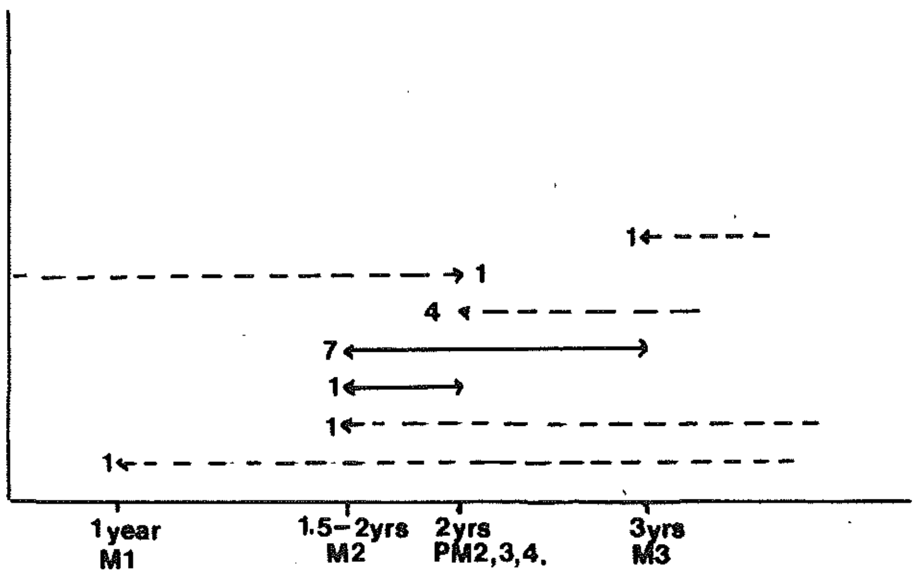

MAGIOVINIUM ; The ageing of sheep jaws recovered from areas 1, 2 & 3 using Silver's data for the tooth eruption of semi wild hill sheep in 1790

Fig 3




MAGIOVINIUM; the ageing of ox jaws recovered from areas 1, 2 & 3 using Silver's data for the tooth eruption of C19th Chauveau cattle.

Fig 5




MAGIOVINIUM; the ageing of pig jaws recovered from areas 1,2 & 3 using Silver's data on the tooth eruption of late C18th pigs.

Fig 6

Ox Metatarsals; a comparison of the length ranges between selected Roman sites.

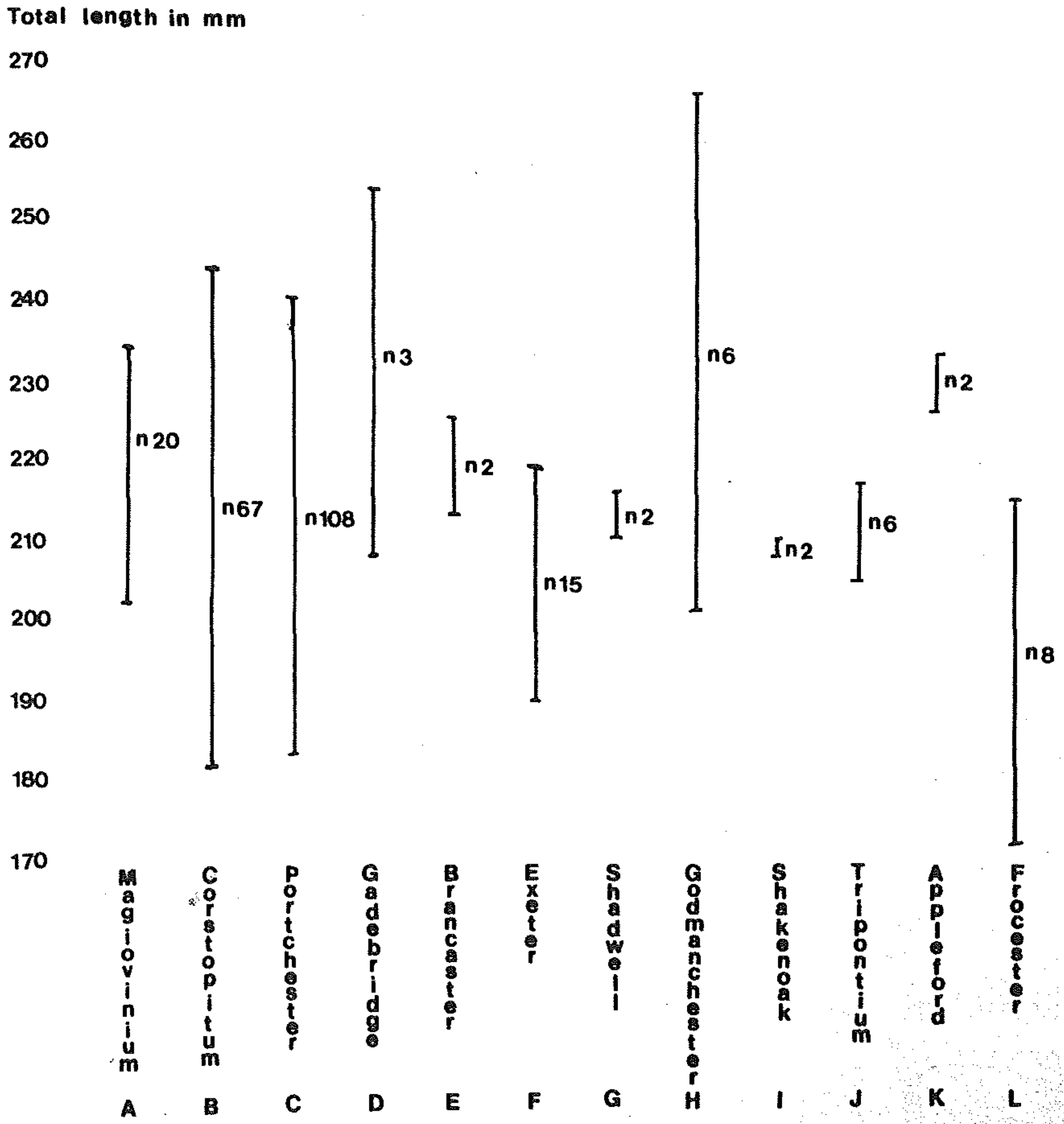


Fig 8

Ox Tibiae

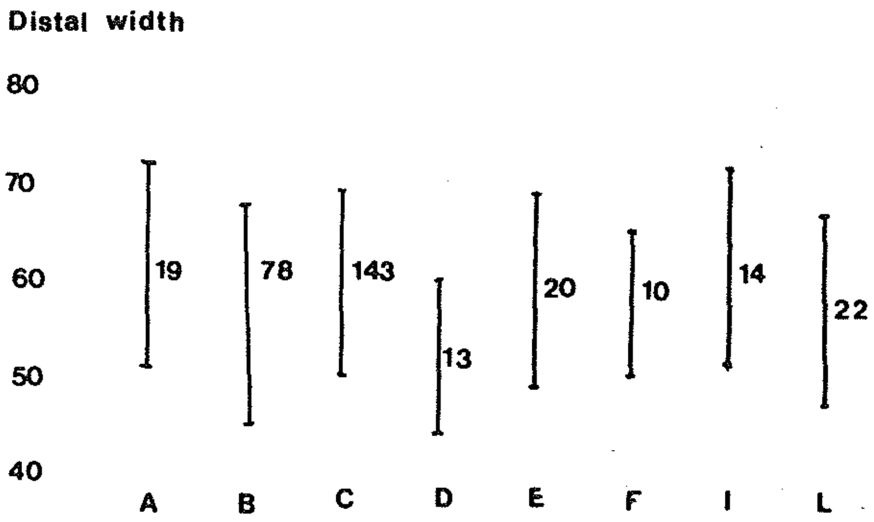



Fig 7

Ox Metatarsals

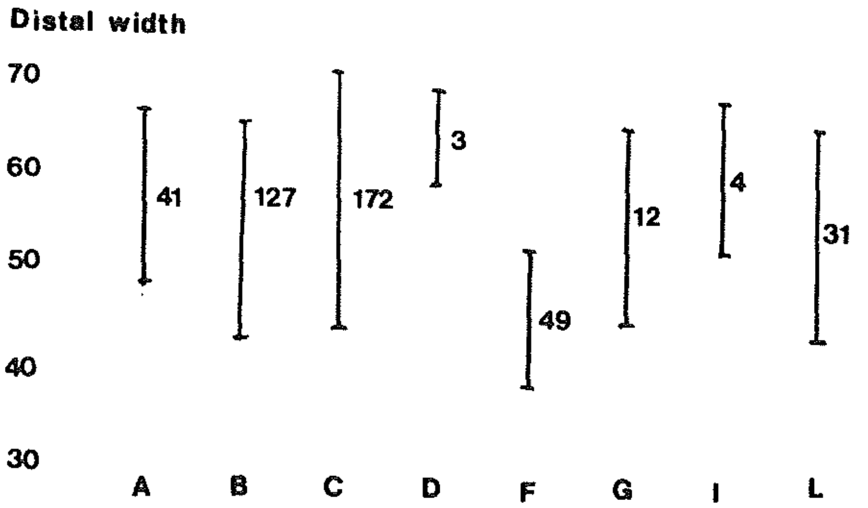
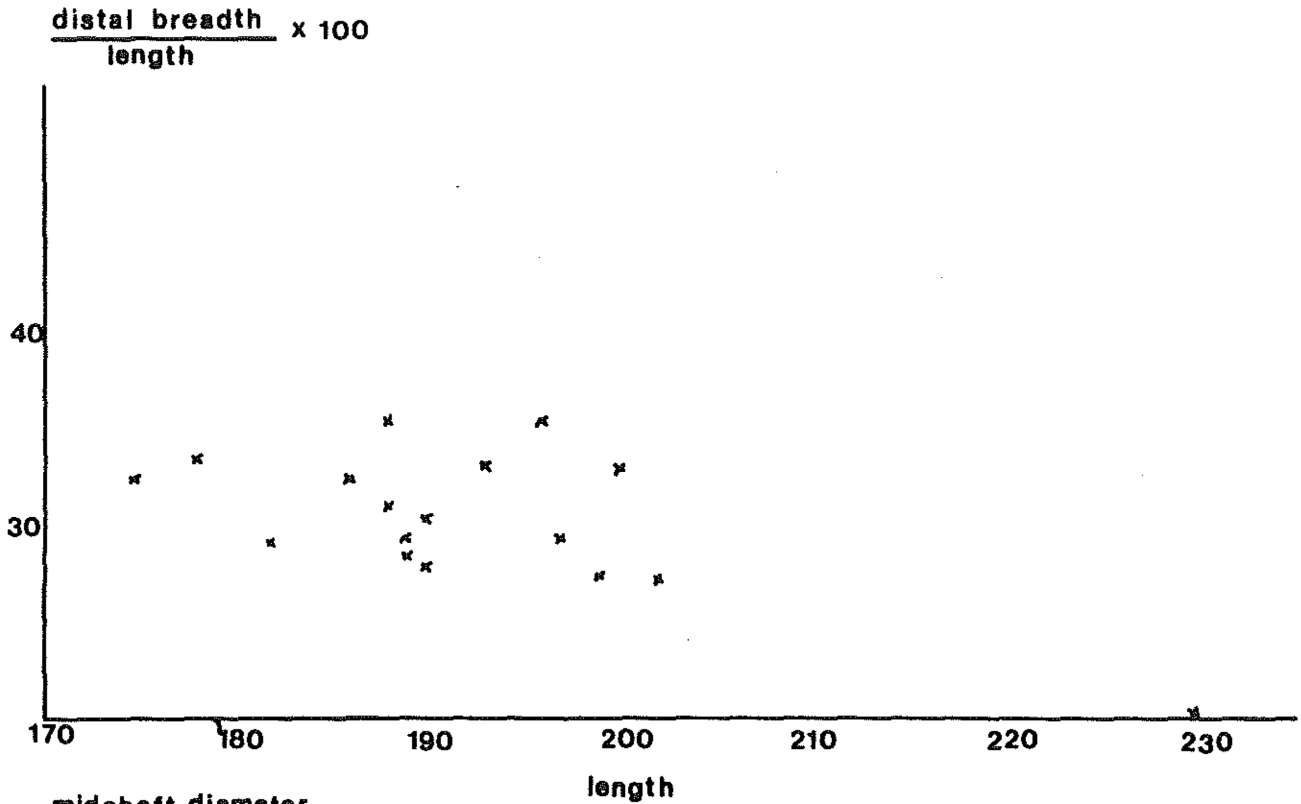


**Fig 9**

Ox; metacarpals
n=17



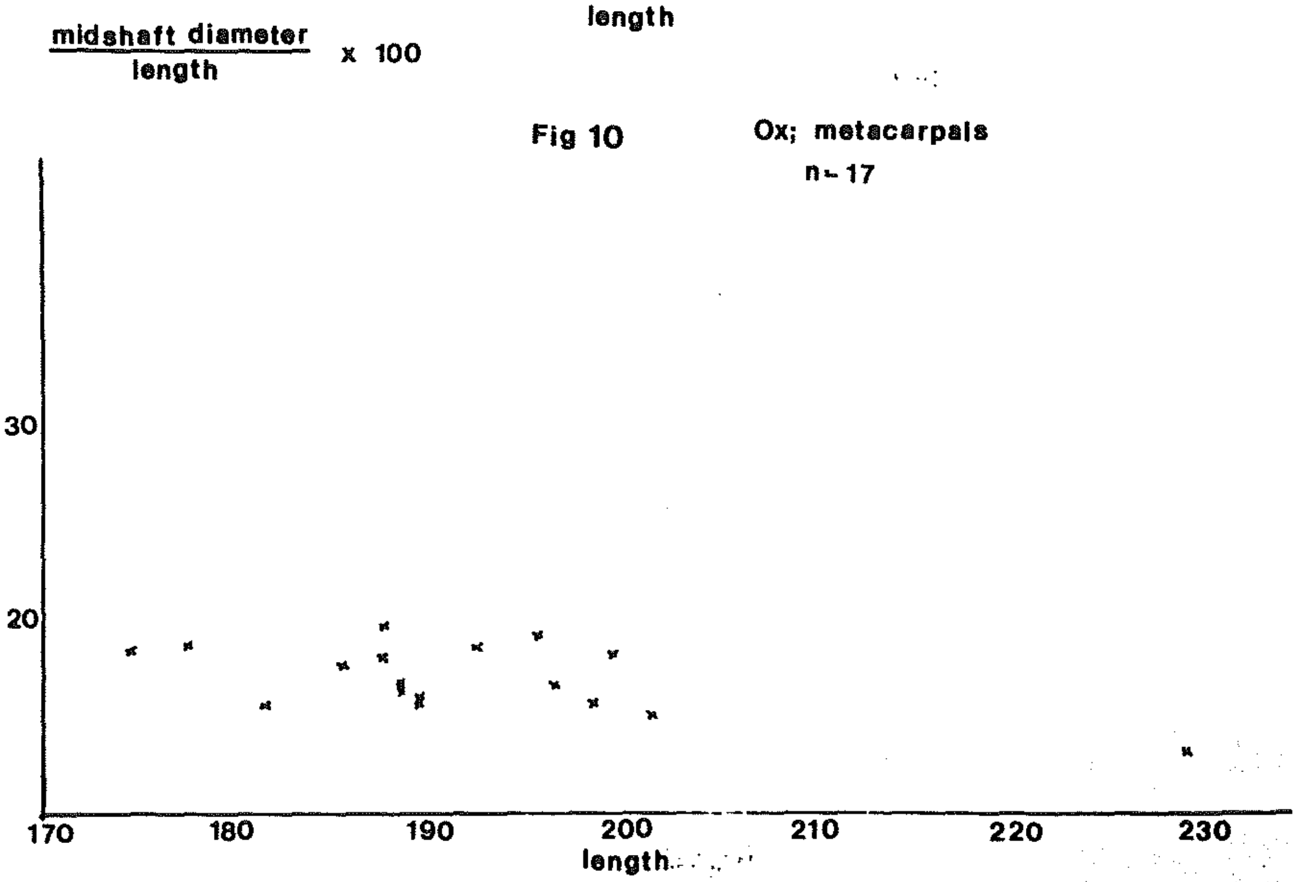
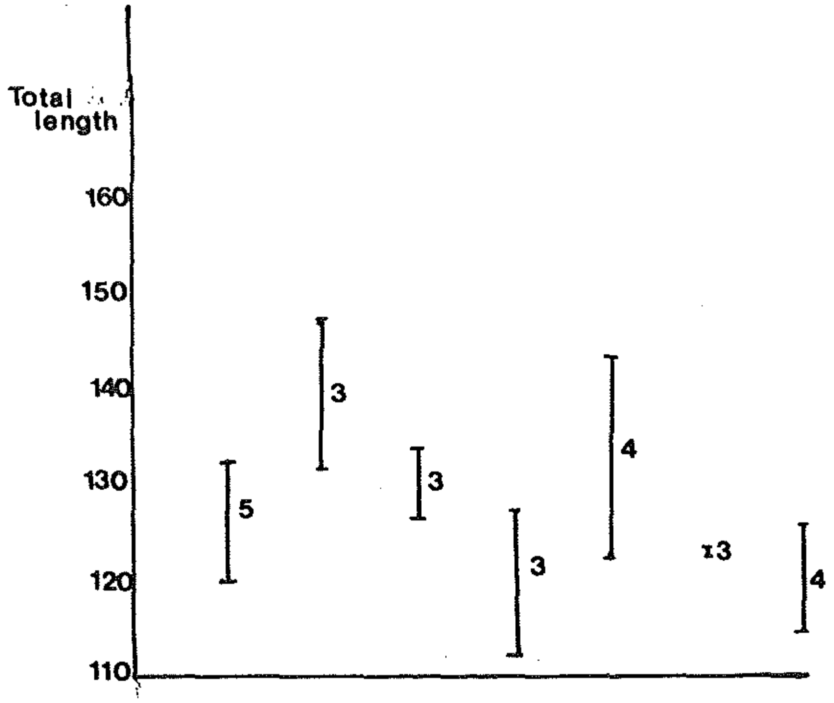




**Fig 10**

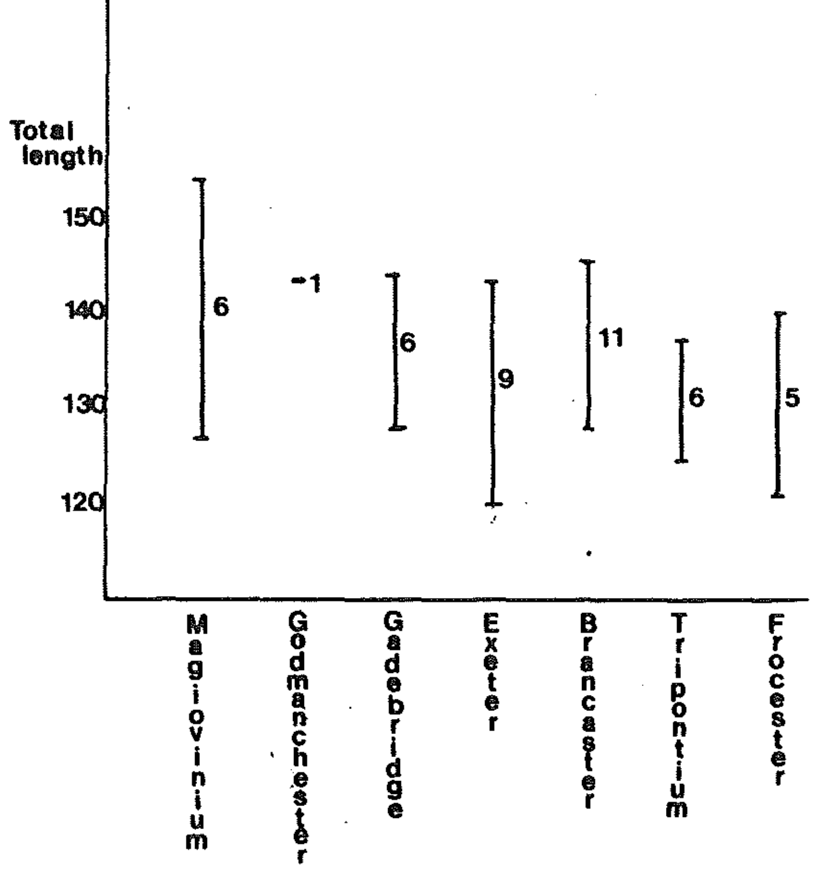
Ox; metacarpals
n- 17

Fig 11




Sheep Metacarpals

Fig 12




Sheep Metatarsals

Fig 13

Horse Metacarpals

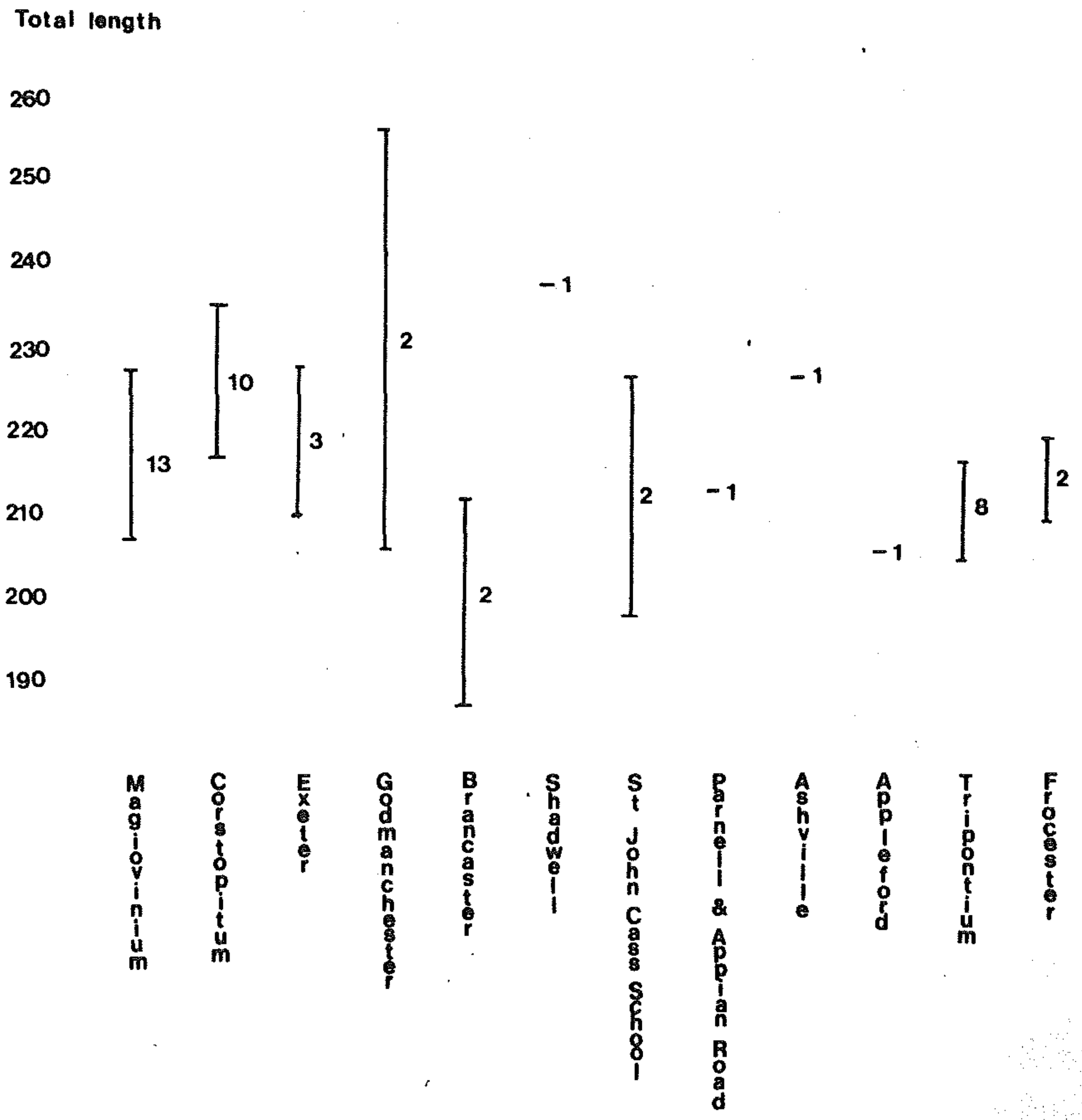
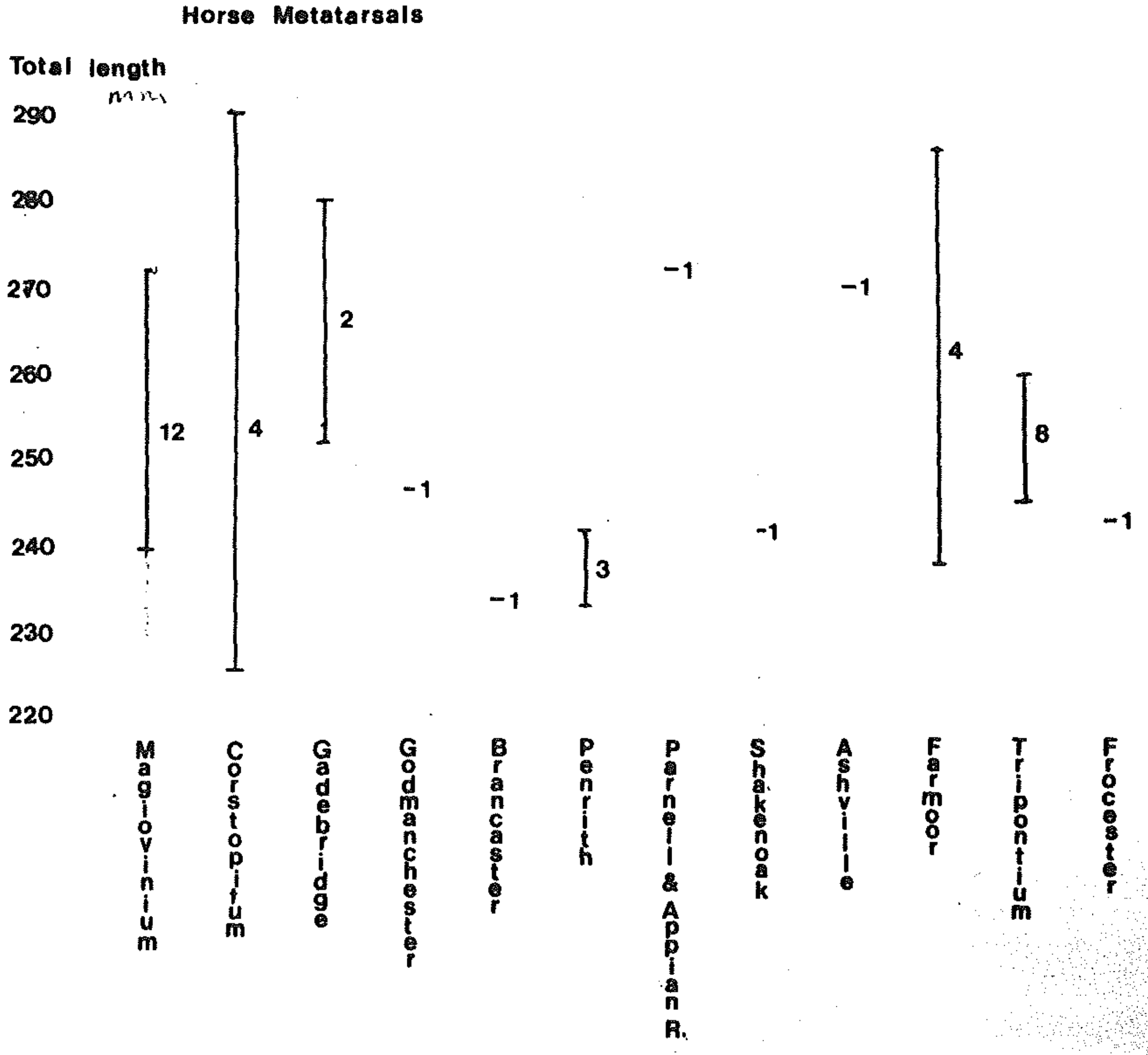


Fig 14



Horse Metatarsals
Total length
mm
290
280
270
260
250
240
230
220
12
4
2
-1
-1
3
-1
-1
-1
4
8
-1
Magiovinium
Corstopitum
Gadebridge
Godmanchester
Brancaster
Penrith
Parnell & Appian R.
Shakenoak
Ashville
Farmoor
Tripontium
Frocester