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Summary

A small assemblage of animal bones was recovered mainly from 3rd/4th century AD contexts at Great Holts Farm. The majority of the bones are in excellent condition and derive from the waterlogged fills of a late Roman well. Beef was the most commonly eaten meat, but a variety of other resources including some wild animals were also exploited. The size of cattle was very large and might indicate that these animals were recent imports from the continent. The simultaneous presence of sparrowhawk and thrush bones may represent early evidence for hawking, although the use of this raptor as a decoy is also possible. The evidence from the mammal and bird bones appears to corroborate the interpretation derived from the study of the plant remains and the fish bones of a relatively affluent life-style and of overseas contacts of the Great Holts Farm inhabitants.

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ANCIENT MONUMENTS LABORATORY REPORTS SERIES

The Roman mammal and bird bones excavated in 1994 from Great Holts Farm, Boreham, Essex

Umberto Albarella

Introduction

The site of Great Holts Farm (TL753118), 40m above sea level, is situated to the immediate west of the modern farm, 5Km to the north-east of Chelmsford, Essex (Fig.1). The underlying subsoil, a glacial mix of sand, silt, gravel and clay above Chelmsford gravels, was sealed by a topsoil of silt clay loam (Germany 1995).

The excavation took place in two stages. The first was undertaken between November 1992 and June 1993, the second between September 1994 and November 1994. This report concerns *only* the bone assemblage uncovered during the second stage of the excavation. The assemblage deriving from the first excavation was assessed by Rosemary Luff in January 1994, but the bones were not available for the final study. The excavation was carried out by the Essex County Council Field Archaeology Group, under the direction of Mark Germany and Maria Medlycott.

A Roman farmstead and a small number of prehistoric and medieval features were uncovered by the excavation. The Roman farmstead was laid out in the second half of the 1st century AD. In the 3rd century a large Roman farmhouse was constructed in the central part of the farm area. This building was then replaced by a new farmhouse with annexed bath suite, when the farm was expanded in the late 3rd/early 4th century (Fig.2). A well, ponds and a granary/storehouse were also present (Figs.2 and 4). Though the site might have been occupied in the 5th century (early Saxon pottery was found), later features are only represented by a medieval small house or granary in the north-western corner of the site (Germany 1996).

There was no animal bone in the prehistoric features and a small quantity only from the 1st-2nd century and the post-Roman periods. Most bones derive from the late Roman phase (3rd-4th century AD), and a good percentage of these from the bottom of the well 567 (first half of the 4th century) (Tab.1; Fig.3).

Methods

Animal bones from most contexts were hand-collected. Small samples were taken and wet sieved (mesh size 0.5mm) from a number of "dry" contexts. These

samples were mainly aimed at the recovery of plant remains, and produced no animal bones (Peter Murphy pers. comm.). This is probably due to the acidic conditions of the soil.

Due to the instability of the surrounding soil, the waterlogged fills from the bottom of the late Roman well had to be removed mechanically in blocks. Samples from these blocks were taken and water sieved through a 0.5mm. mesh. These produced quite a few bones, mainly of birds and fishes (Tab.2).

The mammal bones were recorded following a modified version of the method described in Davis (1992) and Albarella & Davis (1994). In brief, all teeth (lower and upper) and a restricted suite of parts of the postcranial skeleton were recorded and used in counts. These are: skull (zygomaticus), scapula (glenoid articulation), distal humerus, distal radius, proximal ulna, carpal 2-3, distal metacarpal, pelvis (ischial part of acetabulum), distal femur, distal tibia, calcaneum (sustentaculum), lateral part of the astragalus, naviculo-cuboid, distal metatarsal and proximal phalanges (1, 2 and 3). At least 50% of a given part had to be present for it to be counted.

For birds the following were always recorded: scapula (articular end), proximal coracoid, distal humerus, proximal ulna, proximal carpometacarpus, distal femur, distal tibiotarsus, distal tarsometatarsus.

Horncores with a complete transverse section and "non-countable" elements of particular interest were recorded, but not included in the counts.

Wear stages were recorded for all P_4s and dP_4s as well as for the lower molars of cattle, caprines and pig, both isolated and in mandibles. Tooth wear stages follow Grant (1982) for cattle and pig and Payne (1973, 1987) for caprines.

Measurements are listed in Appendix. These in general follow von den Driesch (1976). All pig measurements follow Payne & Bull (1988). Humerus HTC and BT and tibia Bd measurements were taken for all species as suggested by Payne & Bull (1988) for pigs. Measurements "a" and "b" in cattle metapodials are taken as in Davis (1992).

The bones from this site will be stored at the Chelmsford and Essex Museum, Chelmsford.

Provenance and preservation

All animal bones derive either from fills of pits and ditches or from the well (Tab.1). The bones from pits and ditches were moderately well preserved, whereas the bones from the well were generally in excellent condition, due to the waterlogged environment. However, a few cattle metapodials from the well (context 6459) had very eroded surfaces, which suggest that they had been subject to aerobic conditions for some time, and therefore that the backfilling of the well does not represent a single event. Context 6459 is at the top of the sequence of waterlogged levels located at the bottom of the well (Fig.3) and may thus represent the top level of the initial backfilling. Unfortunately we do not know what was the condition of the bones above, because part of the well contents was removed by machine (Fig.3).

A few bones had been gnawed by carnivores, although this condition was not particularly common. No gnawing marks were recognized on the bones from the well.

The bones from the well were probably in a primary deposit, as were those from context 6082 (late Roman), as suggested by the presence of a pig astragalus and calcaneum in articulation. The bone condition, the context, and the small quantity of material from other phases suggest that there is no significant residual or intrusive material in the late Roman assemblage.

Overview of the bone assemblage

Cattle is by far the most common species (Tab.1), as is typical of sites of full Roman tradition (see King 1984, but also Table 6 in Robinson and Wilson 1987). Due to the lack of "whole earth" samples, we cannot establish to what extent this is due to a recovery bias, but it seems improbable that better recovery could have significantly altered the frequencies of the main species.

The assemblage from the late Roman well seems to be related to some special activities and can hardly be used for establishing the relative economic importance of the different animals. The hand-collected assemblage from the well is mainly represented by elements of cattle skull and feet (Tab.3). Most metapodials were complete. Cut marks, almost certainly due to skinning, were found on carpals, metapodials and phalanges (Plates 1 and 2). This sort of deposit can be associated with primary butchery waste or to tanning waste (see Schmid 1972 and Serjeantson 1989). The lack of horncores, generally associated with these sort of deposits, may be due to the fact that they were used elsewhere for making tools. Evidence of horn and antler working has indeed been found in other parts of the site. Five cattle horncores, three chopped from the skull, and two antler fragments, one sawn at the base (Plate 3), were recovered from the late Roman period. The sawn antler is the only one to have been found in the well. The tip of this antler is worn, probably due to some kind of use.

The cattle bones from the well derive from mature animals, some of them with severe arthropathies (Plate 4), a condition perhaps associated with working stress generated by ploughing or by pulling carts (Jewell 1963, Bartosiewicz *et al.* 1993). However, the absence of similar conditions from cattle - probably also used for traction - on other sites suggests that the nature of the terrain may also have been a factor.

The measurements are listed in the appendix. These can be useful as a part of a more general database of metric data from Roman sites. The eleven complete cattle metapodials are particularly valuable in this respect and are discussed in the next section.

Several species of birds were found, mainly in the sieved samples from the well (Tabs.1 and 2). Most of the duck and goose bones are relatively small and may derive from wild animals. Woodcock and plover provide tasty meat, and, when found in sites of later periods, tend to be associated with people of high status (see for instance Maltby 1982 and Albarella and Davis 1996). The fact that they were eaten by the inhabitants of Great Holts Farm is demonstrated by the

presence of cut marks on one of the woodcock bones (Plate 5). Woodcock remains have been found in several other Roman sites and are particularly common at Exeter (Maltby 1979) and Silchester (Serjeantson in press). The intriguing presence of both sparrowhawk and thrushes is discussed below. This variety of birds, together with the presence of wild mammals such as red deer and hare (Tab.1) appears to corroborate the interpretation derived from the plant remains (Murphy forthcoming) of a relatively affluent life-style at Great Holts Farm.

The cattle metapodials

The size and shape of the eleven cattle metapodials found in the fills at the bottom of the late Roman well (first half of the 4th century AD) are compared to those from other Roman sites in eastern England (Figs.5-6).

It is clear that both the metacarpals and metatarsals at Great Holts Farm are from very large animals. The metatarsals are particularly massive (Fig.5), and this can only marginally be due to their abnormally splayed out distal ends.
The difference in size between the Great Holts Farm animals and those from the other sites is very marked (for both lengths and distal widths of metacarpals and metatarsals $p < 0.01$ according to a two tailed Student's t-test)

Though larger, these specimens are not much more robust than those from other sites (Fig.6). The metacarpals from three Roman sites considered here (Great Holts Farm, Colchester and Lincoln), seem to cluster in two groups (Fig.6 top). It is tempting to suggest that the specimens in the "more gracile" group, which are more numerous, belong to cows and the more robust ones to oxen (it is unlikely that such a high number of bulls could be kept on site). However, a clear shape difference between females and castrates only occurs in some cattle breeds (see Fock 1966, Albarella in press). Ox metapodials can appear more female-like or male-like according to their breeds and, presumably, to the age of castration. Furthermore, differences in shape between different breeds or populations can be even larger than between different sexes. However, when this is the case, the difference is generally more pronounced in metatarsals than in metacarpals (Albarella in press), the former being less sexually dimorphic (Grigson 1982, Higham 1969, Howard 1963). In the case of the Roman sites considered here the clustering can be detected in the distribution of the metacarpals (Fig.6 top), but not of the metatarsals (Fig.6 bottom) and it is therefore more probably due to a sex difference than to the contemporary presence of two different breeds.

The conclusion that the metapodials from Great Holts Farm derive from both females and castrates is important for our interpretation of their large size. Indeed this hypothesis rules out the possibility that the larger size of the Great Holts Farm animals is due to the fact that they are all oxen, whereas most of the bones from the other sites are from females. My suggestion is that the Great Holts Farm animals rather belong to a genuinely larger and perhaps different type of cattle.

In his study of the Dutch Eastern River area Lauwerier (1988) has argued

that the large cattle found in Romanized sites reflects the import and subsequent improvement of the local stock through interbreeding. In one site, Druten (3rd century AD), there is contemporary presence of two size groups, which Lauwerier interprets as being derived from two different populations: a larger, imported, type and a smaller, native, one. The 4th century cattle from another site, Nijmegen, are intermediate in size between the two Druten groups and might be the consequence of subsequent interbreeding. No large animals were found in Dutch regions outside the Roman empire.

A remarkable difference in the size of cattle from *Germania romana* and *Germania libera* was noted by Teichert (1984). The cattle from the Roman provinces were definitely larger, although a few large cattle were also found in the area occupied by the Germans. This suggests the existence of some trade between the Germans and the Romans. With the retreat of the Romans, large cattle were no longer to be found north of the Alps (Teichert 1984).

Dobney *et al.*(1996) have noticed an increase in size of the Lincoln cattle from the 1st-2nd century to the 3rd. In the 4th century there is greater variation, but the very large animals found in the 3rd century are no longer present. Although caution is necessary, due to the very small number of measurements from the 3rd century, Dobney *et al.* (1996) also raise the possibility that the largest specimens may be recent Roman imports, and that later animals may represent the product of interbreeding between local and imported stock.

Reviewing cattle size from European archaeological sites, Audoin-Rouzeau (1991) also suggests that the large Roman cattle found in northern Europe were the product of importation rather than local improvement.

Using the average multiplying factor for males and females recommended by von den Driesch and Boessneck (1974), the height of cattle from Great Holts Farm has been calculated as being c.130 cm. This makes them similar in size to the larger group from 3rd century Druten and in the upper range of the large cattle from *Germania romana*. They are also larger than the largest 3rd century cattle from Lincoln. Few Roman sites have similarly large cattle (see Audoin-Rouzeau 1991) and, interestingly, some of them are from Italy (see also King 1994).

On the basis of the evidence discussed above my suggestion is that the cattle from Great Holts Farm may represent imported rather than native stock and, due to their very large size, recent imports, which have not interbred with local populations.

Sparrowhawk and thrushes

The distal part of a sparrowhawk tarsometatarsus (context 6463) and many thrush post-cranial bones (MNI =15) were collected from the waterlogged samples at the bottom of the well (Tab.2.; Fig.3).

Thrush bones have been identified as such (*Turdus* sp.), rather than starling (*Sturnus vulgaris*) on the basis of the morphological criteria suggested by Stewart (1992), in particular those which apply to the proximal carpometacarpus.

The size of the bones is also more compatible with *Turdus* than *Sturnus*. Large size overlap occurs between the different *Turdus* species (Stewart 1992) and therefore specific identification of these bones has not been possible. However, the bones are of a medium-large size and they certainly do not belong to the rather small redwing (*Turdus iliacus*). When compared with the metric data presented in Stewart (1992), they seem to fit particularly well with the distribution of the blackbird (*Turdus merula*), and are quite consistently larger than any of the song thrush (*Turdus philomelus*) bones, but partly overlap with the larger fieldfare (*Turdus pilaris*) and mistle thrush (*Turdus viscivorus*).

The thrush bones are derived from various parts of the body (Tab.4), but no skulls were found. This might be due to the fragmentation of these fragile elements, although a genuine lack of heads, probably connected to their early separation and discard, cannot be excluded.

Sparrowhawk bones have only occasionally been found on Roman sites in Britain (Parker 1988), but they are much more common in later periods. In a number of medieval sites they are found as complete skeletons, and they are generally interpreted as tamed birds used for hawking (Mulkeen and O'Connor forthcoming). Sparrowhawks are unlikely birds to be found in archaeological sites for any other reasons, as they do not scavenge, and are too small and tough to make valuable meat or feathers. At Great Holts Farm there is only one bone rather that the whole skeleton, though it is possible that the rest of the body was in fact in the well but was not collected.

Thrushes occur much more commonly in Roman sites (Parker 1988), and they are generally interpreted as eaten birds (Coy 1987). Evidence from Roman Nijmegen, Netherlands (Lauwerier 1993) suggests that thrush were imported and probably considered a delicacy. This is also confirmed by documentary sources such as Varro and Apicius (quoted by Lauwerier 1993).

Turdids are among the birds most commonly caught by the wild sparrowhawk, and much more so by the trained bird, for which they can represent as many as 90% of the prey (Prummel forthcoming). It is therefore tempting to correlate the presence of sparrowhawks and thrushes and to suggest that the raptor was a tamed bird kept to catch passerines and possibly other birds, such as woodcocks. However, we do not have evidence that hawking was practised in Europe before the 4th-5th century (Prummel forthcoming) and in Britain until mid Saxon times (Parker 1988). Due to the almost total absence of any pictorial or literary evidence, it is obvious that the Romans were not commonly engaged in hawking.

Nevertheless, falconry is very ancient and it was practised as early as the 8th century BC by the Assyrians, and by the 5th century BC was a common practice in Persia and Arabia (Epstein 1943). Although Romans were obviously not keen falconers, it is unlikely they were totally unaware of this practice. There is a passage in an epigram of Martial (40-102 AD), in which there is quite definite reference to hawking. Epstein (1943) suggests that "it is just possible that (....) a few Roman gentlemen, who had learned it in one of Rome's Asiatic or African provinces, practised this sport".

The well 567 at Great Holts Farm was an integral part of a building (Fig.2) and was probably covered by a portico (Fig.4) (Germany 1996). Its indoor location is also confirmed by the absence of weed seeds deriving from the local

vegetation (Murphy forthcoming), and by the presence of insects of indoor habitats (Robinson forthcoming). It is assumed that the well deposit is represented by material intentionally dumped in the well, derived from human activities (Murphy forthcoming).

We can therefore rule out the possibility that the bird bones do not have an anthropogenic origin, a hypothesis which had to be taken into account in view of the absence of cut marks on the thrush bones. Since both the sparrowhawk and the thrushes are the product of human activities, the possibility that they represent an early case of hawking must be raised. As discussed above there are hardly any other reasons why a sparrowhawk should be kept or killed and its association with such a high number of thrush bones could be significant. Another possibility is that the sparrowhawk was used as a decoy to attract and catch small birds, as suggested by Rielly (1985) for his remains of hobby (*Falco subbuteo*) bones from the site of Settefinestre in Italy and as depicted in the "Small Hunt" mosaic at Piazza Armerina in Sicily (4th century AD) (Parker 1988, Rielly 1985).

Whatever is the explanation, it is not here suggested that the date of the introduction of hawking in Europe should be moved back by one or two centuries. The occasional case of falconry may have occurred anywhere in the Roman Empire and, since it was not part of a widespread phenomenon, may have escaped the attention of the pictorial and literary sources of the time. Whether interpreted as an early case of hawking or as the use of raptors as decoys, the presence of the sparrowhawk emphasizes the overseas connections and the upper class style of life of the inhabitants of Great Holts Farm.

Conclusions

The small assemblage of mammal and bird bones from Great Holts Farm provides an interesting insight into the life and economy of a Roman farmstead in Essex. As is common for Roman sites in the north western Provinces of Europe, beef was the most commonly eaten meat. A variety of other resources, including wild mammals, birds and fishes attest to the prosperous life-style of the Great Holts Farm inhabitants. This is somewhat surprising, due to the rather unpretentious flooring of the building (Murphy forthcoming) which initially indicated that we were dealing with a low status site (Germany 1996)

The assumed wealth of the site is confirmed by the presence of a number of "exotic" plants, such as Mediterranean stone-pine (*Pinus pinea*), sweet chestnut (*Castanea sativa*), walnut (*Junglans regia*), grape (*Vitis vinifera*) and olive (*Olea europaea*) (Murphy forthcoming). Of these species only the olive was definitely imported (Murphy forthcoming), but all others, although they can grow in Britain, are typical Mediterranean plants. The presence of the Spanish mackerel (*Scomber scombrus*), and possibly also of the scad (*Trachurus trachurus*) among the fish remains also suggests imported goods, perhaps in the form of stored fish (Locker forthcoming).

The evidence from the mammal and bird bones also points to overseas contacts, although no exotic species were found. The first piece of evidence is represented by the size of the cattle remains. This is very large and suggests the

presence of non-native, recently imported livestock. The second piece of evidence is the simultaneous presence of a sparrowhawk tarsometatarsus and a large number of thrush bones. This is tentatively interpreted as an early indication of hawking or, alternatively, of the use of the raptor as a decoy. Both these practices would suggest a connection between the Great Holts Farm inhabitants and the southern Provinces or Rome itself.

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	EARLY ROMAN (1st/2nd cent. AD)	LATE ROMAN (3rd/4th cent. AD)			MEDIEVAL	*TOTAL*
		well (4th cent.)	other contexts	total		
Cattle (*Bos taurus*)	6	64	28	92	3	*101*
Caprine (*Ovis/Capra*)	-	2	6	8	1	*9*
(sheep (*Ovis aries*)		(1	(-	(1	(1	*(2*
(goat (*Capra hircus*)		(-	(-	(-	(-	*(-*
Pig (*Sus scrofa*)	1	1	5	6	-	*7*
Equid (*Equus sp.*)	-	-	5	5	1	*6*
Dog (*Canis familiaris*)	-	-	-	-	2	*2*
Cat (*Felis catus*)	-	-	1	1	-	*1*
Red deer (*Cervus elaphus*)	-	+	1	1	-	*1*
Hare (*Lepus sp.*)	-	1	1	2	-	*2*
Chicken/pheasant/guinea fowl (*Gallus/Phasianus/Numida*)	-	1	2	3	-	*3*
Goose (*Anserinae*)	-	2	-	2	-	*2*
Bird (*Aves*)	-	-	-	-	2	*2*
TOTAL	7	71	49	120	9	*136*

Table 1

Number of identified specimens (NISP) by taxon, at Great Holts Farm (hand-collected assemblage). + = present, but not "countable" (Davis 1992).

	6459 (V=c.601)	6461 (V=c.301)	6462 (V=c.601)	6463 (V=c.1051)	6465 (V=c.151)	TOTAL
Cattle (*Bos taurus*)	-	-	-	1	-	1
Hare (*Lepus sp.*)	1	-	-	-	-	1
Chicken/pheasant/guinea fowl (*Gallus/Phasianus/Numida*)	16	-	1	-	-	17
Goose (*Anserinae*)	4	-	-	2	-	6
Duck (*Anatinae*)	3	2	2	-	-	7
Sparrowhawk (*Accipiter nisus*)	-	-	-	1	-	1
Woodcock (*Scolopax rusticola*)	11	1	9	1	-	22
Golden/grey plover (*Pluvialis sp.*)	1	-	-	-	-	1
"Thrush" (*Turdus cf. merula*)	33	4	33	56	5	131
TOTAL	69	7	45	61	5	187
Fish	5	3	34	62	-	104
GRAND TOTAL	74	10	79	123	5	291

Table 2.

Number of identified specimens (NISP) by taxon from the late Roman (4th cent. AD) well at Great Holts Farm (sieved collection). 6459-6465 are the different contexts at the bottom of the well. "V" is the volume of the sample sieved from that context. The samples have been sieved using 0.5mm. meshes and are not "whole earth" (Mark Germany, pers. comm.). For a detailed analysis of the fish bones see Locker (forthcoming).

	6459	6460	6462	6463	TOTAL
Cranium	2	-	-	1	3
Teeth (max. & mand.)	8	1	6	1	16
Radius	-	-	1	-	1
Tibia	-	1	-	-	1
Carpal	-	-	2	-	2
Calcaneum	1	-	-	-	1
Metacarpal	6	-	1	-	7
Metatarsal	9	-	1	-	10
Phalanges (1,2 & 3)	14	-	9	-	23
TOTAL	40	2	20	2	64

Table 3.

Representation of cattle body parts by number of identified specimens (NISP) from the late Roman well (4th cent. AD) at Great Holts Farm (hand-collected assemblage). 6459-6463 are the different contexts at the bottom of the well.

	6459	6461	6462	6463	6465	TOTAL
Coracoid	2	1	4	12	-	19
Scapula	-	1	3	5	-	9
Humerus	10	-	4	3	1	18
Carpometacarpus	4	-	4	3	1	12
Ulna	6	-	2	4	1	13
Femur	-	-	1	2	-	3
Tibiotarsus	6	1	7	15	-	29
Tarsometatarsus	5	1	8	12	2	28
TOTAL	**33**	**4**	**33**	**56**	**5**	**131**

Table 4.

Representation of thrush body parts by number of identified specimens (NISP) from the late Roman well (4th cent. AD) at Great Holts Farm (sieved assemblage). 6459-6465 are the different contexts at the bottom of the well.

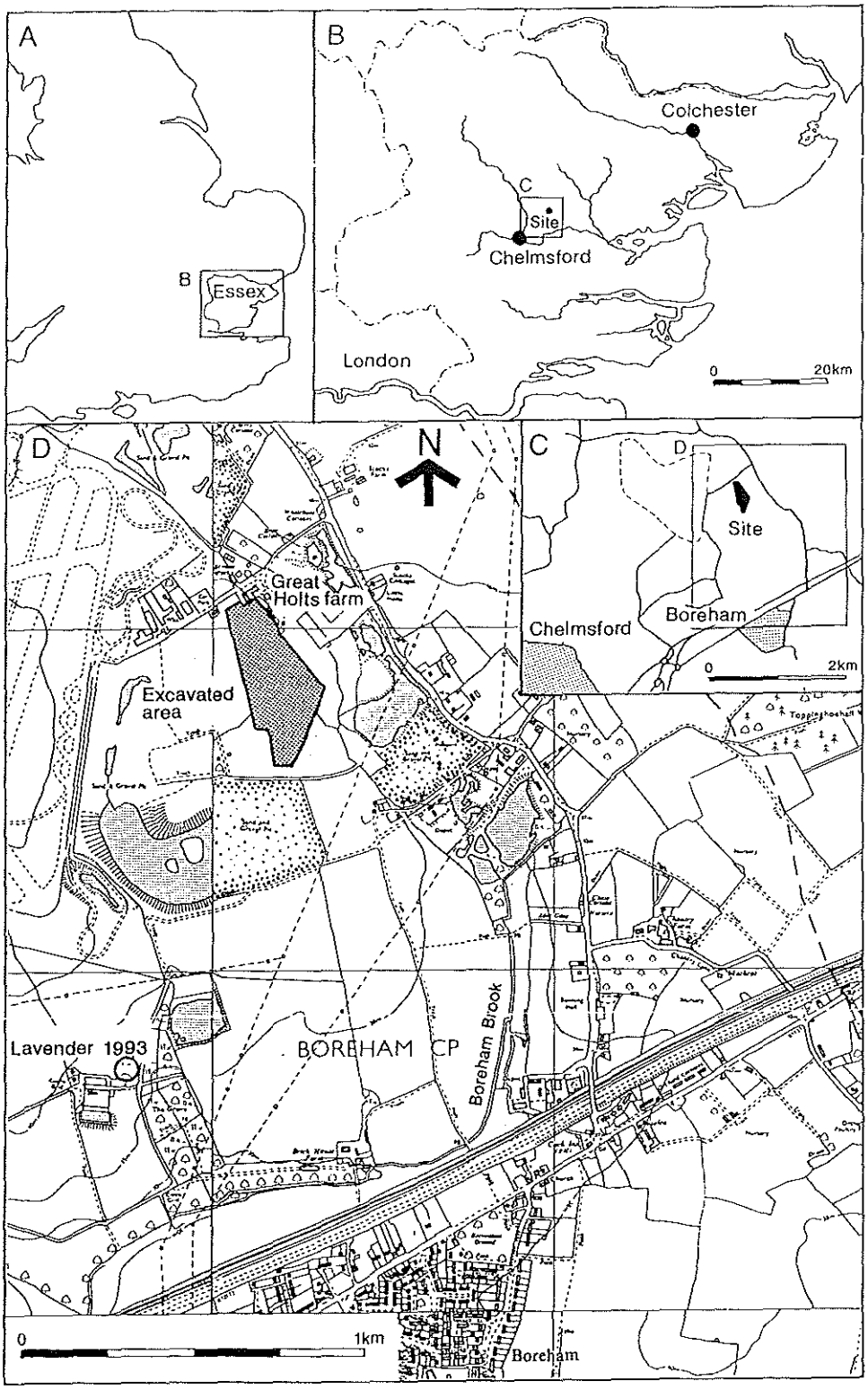


Fig. 1. Location of Great Holts Farm (courtesy of the Essex County Council Field Archaeology Group).

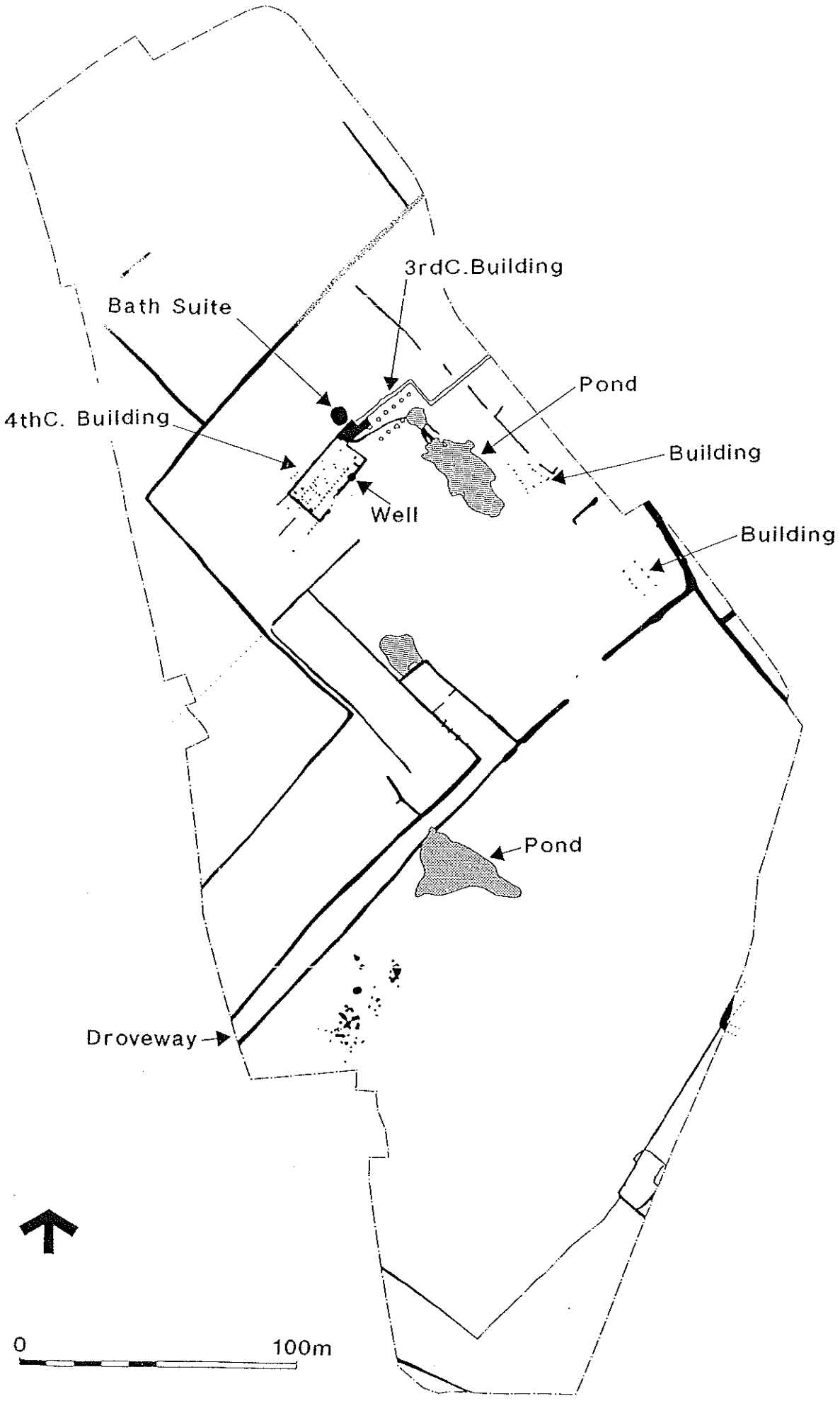


Fig.2. Plan of the late Roman phase (courtesy of the Essex County Council Field Archaeology Group).

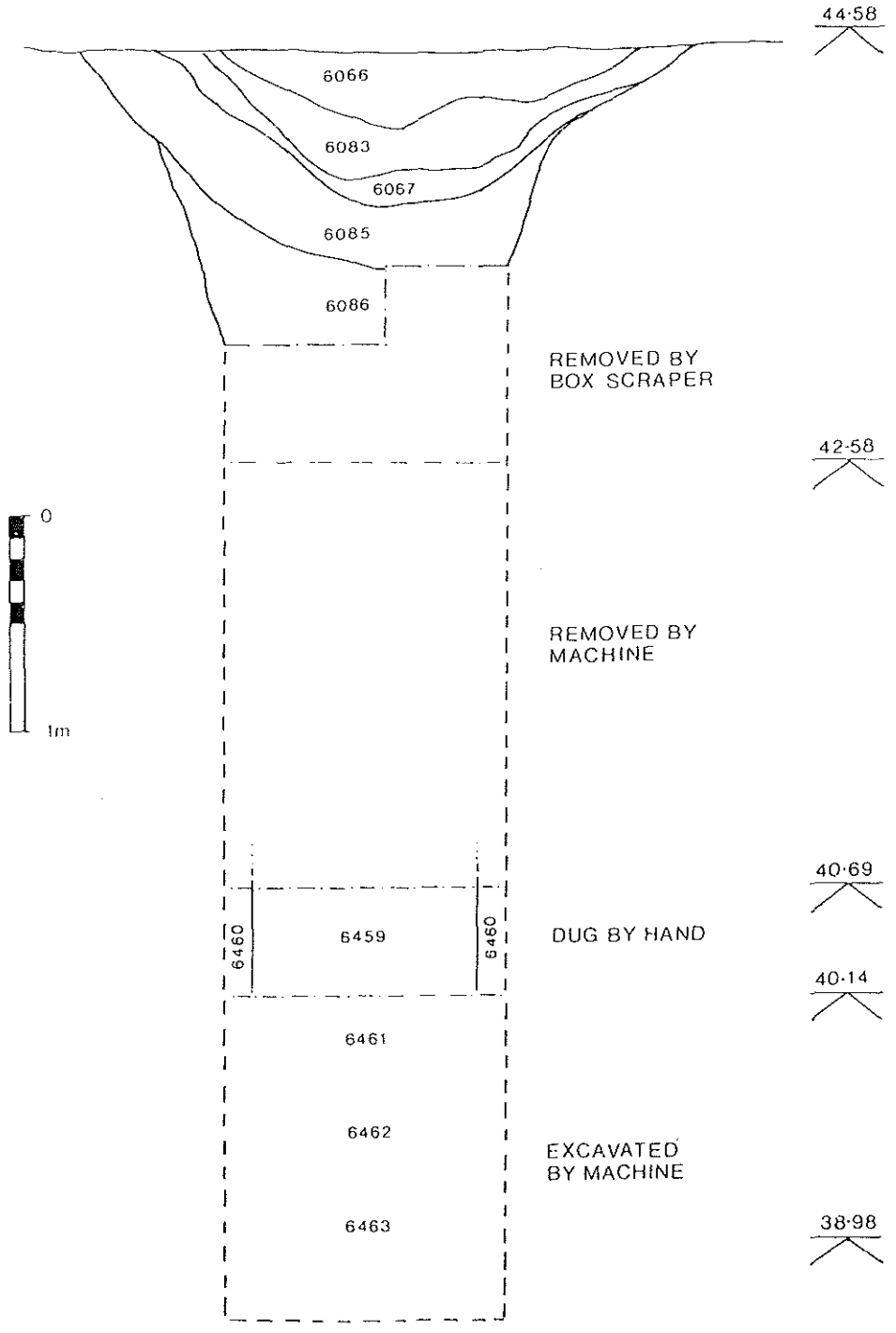


Fig.3. Section of the late Roman well 567 (first half 4th century AD) (courtesy of the Essex County Council Field Archaeology Group).

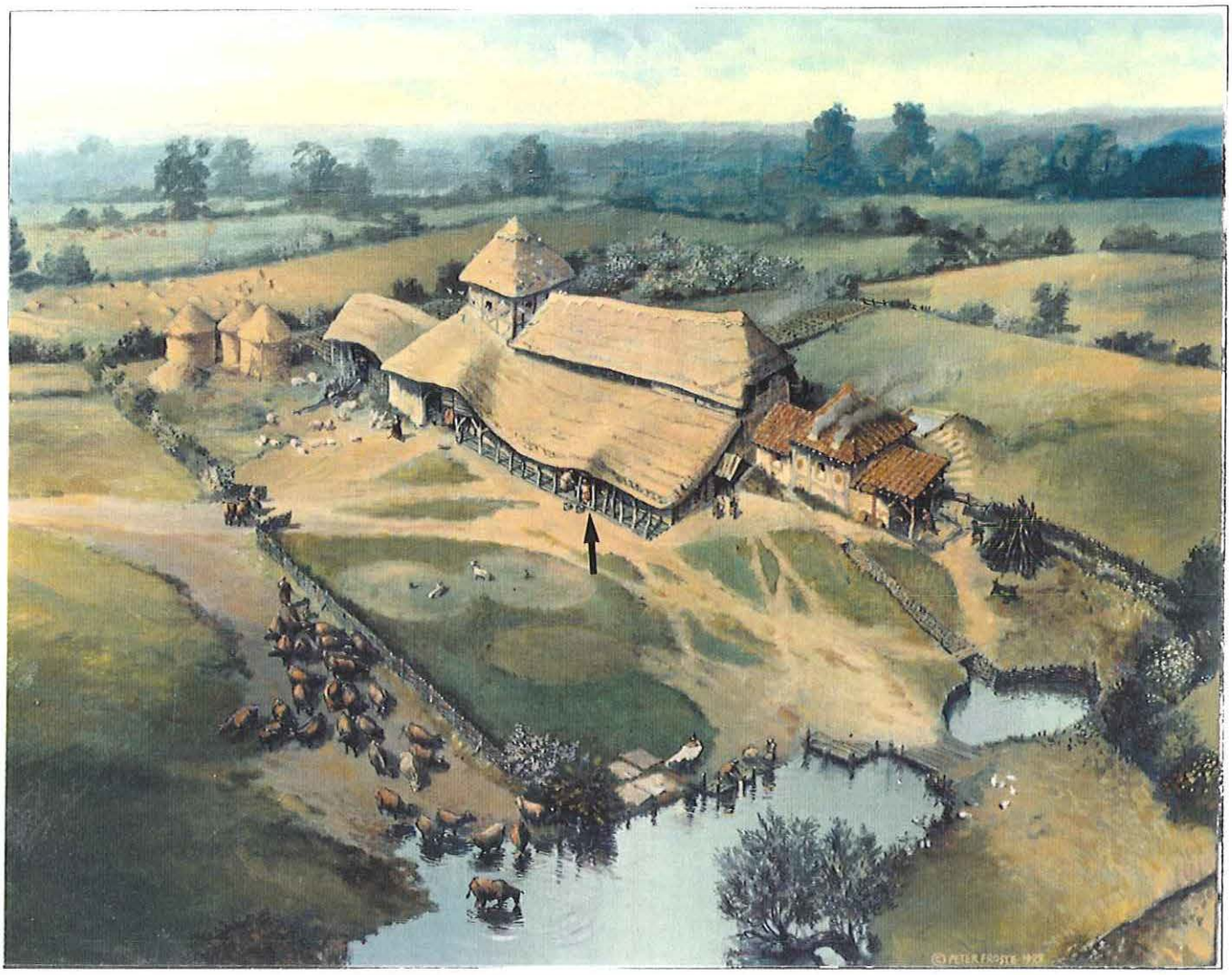
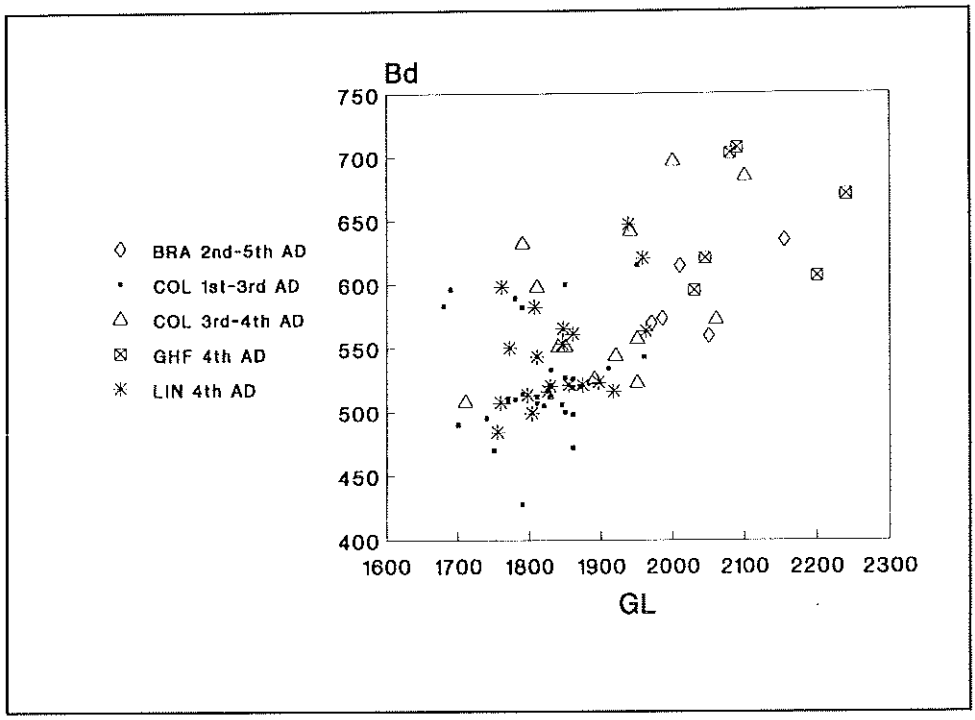


Fig.4. Reconstruction painting , by Peter Froste, of the farm in the early 4th century AD. The rise in the roofline indicates the position of well 567 (courtesy of the Essex County Council Field Archaeology Group).



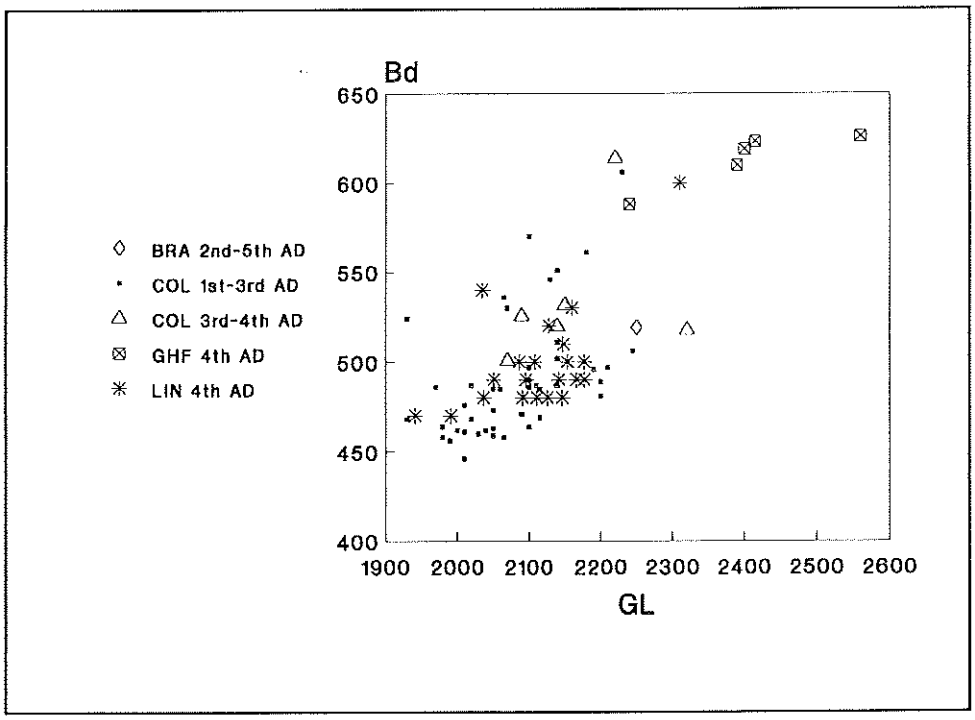
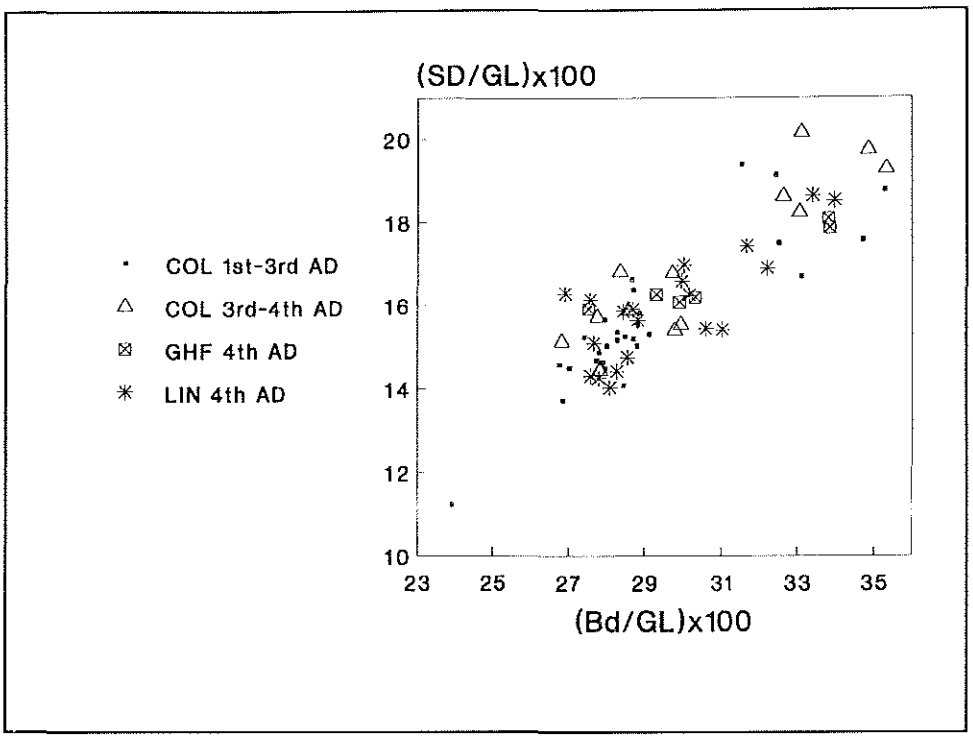


Figure 5.

Size of **cattle metacarpals** (top) and **metatarsals** (bottom) at Great Holts Farm and other Roman sites. BRA = Braintree (Smoothy 1993), COL = Colchester (Luff 1993), GHF = Great Holts Farm, LIN = Lincoln (Dobney *et al.* 1996). GL = greatest length, Bd = distal breadth. Measurements in tenths of mm.



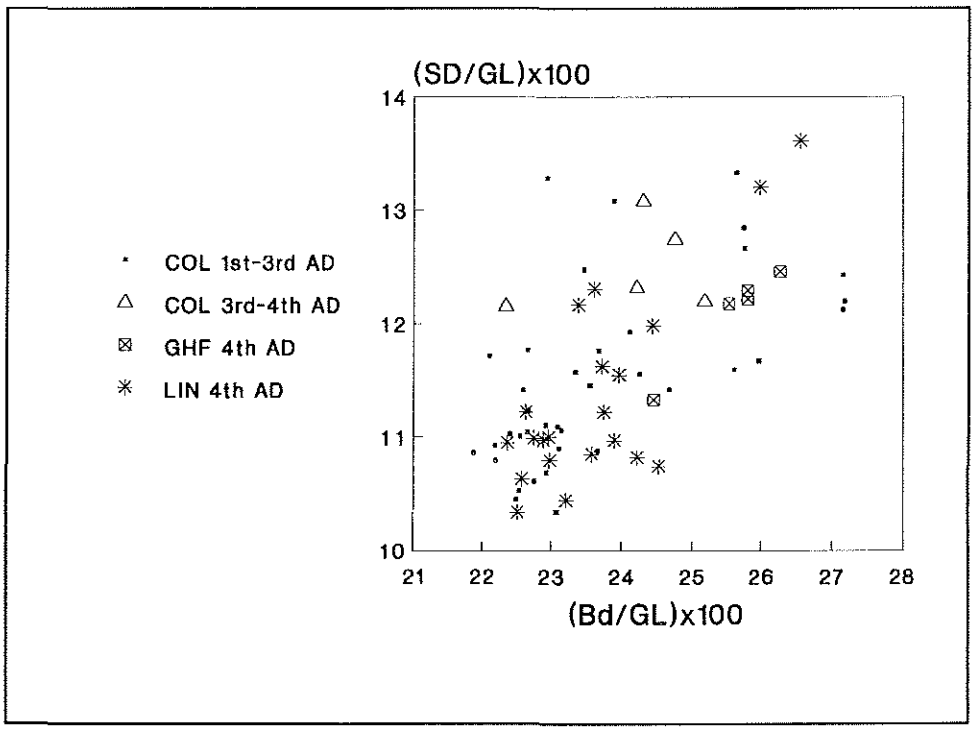


Figure 6.

Shape of **cattle metacarpals** (top) and **metatarsals** (bottom). COL = Colchester (Luff 1993), GHF = Great Holts Farm, LIN = Lincoln (Dobney *et al.* 1996). GL = greatest length, Bd = distal breadth, SD = smallest breadth of diaphysis.
These diagrams are size independent: the higher the value the more robust is the specimen.

Plate 1.

Cattle metatarsal with a cut mark, probably due to skinning

Plate 2.

Cattle 1st phalanx with cut marks, probably due to skinning

Plate 3.

Sawn antler tine

Plate 4.

Arthropatic cattle metatarsal

Plate 5.

Woodcock humerus with cut marks

APPENDIX.

Great Holts Farm (GHF). **Measurements** of animal bones and teeth. All measurements are in tenths of a millimetre. See text for an explanation of how measurements are taken.

Key:

Phase:
ERO early Roman (1st-2nd AD)
ROM Roman (1st-4th AD)
LRO1 late Roman (3rd-4th AD)
LRO2 late Roman (4th AD)
MED medieval

Parts of skeleton (ELEM) are coded as follows:
HU humerus
MC metacarpal
PE pelvis
FE femur
TI tibia (tibiotarsus in birds)
AS astragalus
CA calcaneum
MT metatarsal (tarsometatarsus in birds)

Taxa (TAX) are coded as follows:
B *Bos* (cattle)
OVA *Ovis aries* (sheep)
S *Sus* (pig)
EQ *Equidae* (equid)
FEC *Felis catus/silvestris* (cat)
GN *Gallus/Numida* (domestic fowl or guinea fowl)
GNP *Gallus/Numida/Phasianus* (domestic fowl, guinea fowl or pheasant)
ANS *Anserinae* (goose)
ANA *Anatinae* (duck)
ACN *Accipiter nisus* (sparrowhawk)
SCR *Scolopax rusticola* (woodcock)
TU *Turdus* (thrush)

Epiphysial fusion/age (FUS)
is coded as follows:
F fused
H fused/fusing
J juvenile (in birds)

Approximate measurements are designated:
c - within 0.2 mm
e - within 0.5 mm

TEETH

Context	Phase	Taxon	M3L	M3WA	M3WC
5923	LRO1	B		167	
6082	LRO1	B		163	
6082	LRO1	B	378	156	
6074	MED	B	379	161	
6082	LRO1	S	c366	159	148
5908	ROM	S	c322	151	146

BONES

Context	Period	Element	Taxon	Fusion	GL[1]	Bd	Dd[2]	BT	HTC	SD[3]	Lm[4]	BatF	a	b
6459	LRO2	CA	B	F	1233									
6115	LRO1	HU	B	H					335					
6396	ERO	MC	B	F		574						536		
6459	LRO2	MC	B	F		684						631	328	324
6459	LRO2	MC	B	F	2030	595	283			330		564	282	282
6459	LRO2	MC	B	F	2045	620	306			331		584	299	289
6459	LRO2	MC	B	F	2080	703	333			376		607	343	325
6459	LRO2	MC	B	F	2090	707	337			373		611	347	326
6459	LRO2	MC	B	F	2200	606	304			350		576	294	283
6462	LRO2	MC	B	F	2240	670	324			360		642	324	312
6179	LRO1	MT	B	F		c554	c286			277		519	c270	c250
6459	LRO2	MT	B	F						309				
6459	LRO2	MT	B	F		628	299			345		592	301	292
6459	LRO2	MT	B	F	2240	588	306			279		564	275	268
6459	LRO2	MT	B	F	2390	610	301			291		566	293	282
6459	LRO2	MT	B	F	2415	623	314			295		583	287	284
6459	LRO2	MT	B	F	2560	626	318			290		586	302	288
6459	LRO2	MT	B	F	c2400	619	311			295		586	286	281
6459	LRO2	MT	B	F	e2290		330			309				
6459	LRO2	MT	B	F	e2350		317			325		c605		
6462	LRO2	MT	B	F	2390					306				
6460	LRO2	TI	B	F		735								
6334	MED	TI	OVA	F		274								
6082	LRO1	AS	S		404									
6459	LRO2	HU	S	H				311						
6179	LRO1	HU	EQ	F				728	374					
6179	LRO1	HU	EQ	F				741	364					

Context	Period	Element	Taxon	Fusion	GL	Bd	Dd	BT	HTC	SD	Lm	BatF	a	b
5891	LRO1	TI	EQ	F		648								
6179	LRO1	HU	FEC	F		164			43					
6459	LRO2	MT	GN		739	c127				65				
6459	LRO2	MT	GN		769					58				
6459	LRO2	MT	GN		784	128				59				
6459	LRO2	MT	GN		790	132				66				
6459	LRO2	MT	GN	J	768	127				62				
6459	LRO2	HU	GNP	J	688	144				65				
6459	LRO2	TI	GNP			107	114			60				
6459	LRO2	TI	GNP			115	126			64				
6459	LRO2	TI	GNP		1116	114	122			67	1079			
6459	LRO2	TI	GNP		1123	110	123			65	1082			
6462	LRO2	TI	GNP			113	117			62				
6459	LRO2	FE	ANS			199	167			80				
6463	LRO2	HU	ANS			243								
6463	LRO2	TI	ANS			170	170							
6459	LRO2	FE	ANA		536	116	102			46	515			
6461	LRO2	FE	ANA			82	65							
6459	LRO2	HU	ANA			148								
6459	LRO2	TI	ANA			84	92			42				
6463	LRO2	MT	ACN			62								
6459	LRO2	HU	SCR			105								
6459	LRO2	HU	SCR		552	100				43				
6462	LRO2	HU	SCR			100				45				
6462	LRO2	HU	SCR		543	102				45				
6463	LRO2	HU	SCR			101								
6462	LRO2	MT	SCR		394	72				31				
6462	LRO2	TI	SCR			63	63			35				
6459	LRO2	HU	PL			84								
6462	LRO2	FE	TU			55	40							
6463	LRO2	FE	TU			53	38							
6463	LRO2	FE	TU		301	56	43			24	285			
6459	LRO2	HU	TU			63								
6459	LRO2	HU	TU			69								
6459	LRO2	HU	TU			76								
6459	LRO2	HU	TU			77								
6459	LRO2	HU	TU			78								
6459	LRO2	HU	TU			79								
6459	LRO2	HU	TU		287	74				28				
6459	LRO2	HU	TU		289	74				27				
6459	LRO2	HU	TU		300	74				27				
6462	LRO2	HU	TU			74								
6462	LRO2	HU	TU			75								
6462	LRO2	HU	TU			76								
6463	LRO2	HU	TU			67								

Context	Period	Element	Taxon	Fusion	GL	Bd	Dd	BT	HTC	SD	Lm	BatF	a	b
6463	LRO2	HU	TU			71								
6463	LRO2	HU	TU		298	75				31				
6465	LRO2	HU	TU			79								
6459	LRO2	MT	TU			39								
6459	LRO2	MT	TU		324	41				18				
6459	LRO2	MT	TU		339	39				17				
6459	LRO2	MT	TU		340	35				16				
6459	LRO2	MT	TU		342	41				18				
6461	LRO2	MT	TU			40								
6462	LRO2	MT	TU			33								
6462	LRO2	MT	TU			35								
6462	LRO2	MT	TU			35								
6462	LRO2	MT	TU			38								
6462	LRO2	MT	TU			39								
6462	LRO2	MT	TU			39								
6462	LRO2	MT	TU		328	39				18				
6462	LRO2	MT	TU		336	40				18				
6463	LRO2	MT	TU			34								
6463	LRO2	MT	TU			36								
6463	LRO2	MT	TU			38								
6463	LRO2	MT	TU			38								
6463	LRO2	MT	TU			41								
6463	LRO2	MT	TU			41								
6463	LRO2	MT	TU			42								
6463	LRO2	MT	TU		326	40				17				
6463	LRO2	MT	TU		329	37				16				
6463	LRO2	MT	TU		329	37				16				
6463	LRO2	MT	TU		330	40				19				
6463	LRO2	MT	TU		337					17				
6465	LRO2	MT	TU			39								
6465	LRO2	MT	TU		331	36				16				
6459	LRO2	TI	TU			38	36							
6459	LRO2	TI	TU			41	41							
6459	LRO2	TI	TU			42								
6459	LRO2	TI	TU			42	41							
6459	LRO2	TI	TU			46	41							
6459	LRO2	TI	TU		477	40	39			21	466			
6461	LRO2	TI	TU			42	37							
6462	LRO2	TI	TU			37	38							
6462	LRO2	TI	TU			37	38							
6462	LRO2	TI	TU			41	40			20		[illegible]		
6462	LRO2	TI	TU			43	40							
6462	LRO2	TI	TU			43	42							
6462	LRO2	TI	TU		467	40	39			21		455		
6463	LRO2	TI	TU			37	37							
6463	LRO2	TI	TU			38	38							
6463	LRO2	TI	TU			39	37							
6463	LRO2	TI	TU			40	39							
6463	LRO2	TI	TU			40	40							
6463	LRO2	TI	TU			41								
6463	LRO2	TI	TU			41	39							
6463	LRO2	TI	TU			41	39							
6463	LRO2	TI	TU			41	41							

Context	Period	Element	Taxon	Fusion	GL	Bd	Dd	BT	HTC	SD	Lm	BatF	a	b
6463	LRO2	TI	TU			42	36							
6463	LRO2	TI	TU			42	38							
6463	LRO2	TI	TU			42	39							
6463	LRO2	TI	TU			42	41							
6463	LRO2	TI	TU			44	42							
6463	LRO2	TI	TU		476	37	37			19		454		

1."GL1" in astragalus

2."2" in mammal metapodials

3."SC" in birds

4."La" in tibiotarsus