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Technical Report: Biological remains from the medieval moat at Hall Garth, Beverley, North Humberside

by

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Summary

Residues and washovers from a series of small bulk-sieved samples of deposits associated with the medieval moat at Hall Garth, Beverley have been examined for their content of biological remains. Plant macrofossils and invertebrates, particularly molluscs, gave evidence for the changing water quality within the moat (and a pre-existing ditch) and for the vegetation around the moat.

Vertebrate remains, most of them not contemporaneous with the main phase of occupation of the Hall, appear to indicate the moat was being used in the post-medieval and early modern period as a dumping ground for the town's noxious waste. Activities of the tanner and the knackerman are particularly evident. Biometrical data from early modern sheep suggest the continued utilisation of unimproved breeds with the emphasis on wool rather than meat production.

Keywords: Beverley, Humberside, moat, medieval, post-medieval, early modern, plant macrofossils, insects, vertebrate remains, molluscs, environmental interpretation

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Introduction

The moated site at Hall Garth is situated to the south of Beverley Minster and is traditionally thought to have been the manor which the Archbishop of York acquired in Beverley at some time around AD1280. At the same time he acquired land to the south of Beverley where he established a deer park.

The excavations, which centred around the moat and bridge area, revealed five phases of activity. These phases range from one of medieval date, prior to the digging of the moat in the fourteenth century, up to its eventual filling in the early 20th century.

Phase 1: Medieval, but prior to 14th century. This phase incorporates the early features pre-dating the digging of the moat.

Phase 2: First quarter of the 14th century. Deposits deriving from the excavation of the moat and the construction of the bridge.

Phase 3: Early to mid 14th century to late 15th century. Deposits representing the continued filling of the moat and bridge foundation.

Phase 4: 16th to 17th centuries. Moat silts forming after the relining of the moat with clay.

Phase 5: 19th and 20th centuries.

An assessment of the potential of the site for bioarchaeological analysis was undertaken by the Environmental Archaeology Unit (EAU) in 1994 (Dobney *et al.* 1994).

Sediment samples had been bulk-sieved to 1 mm following procedures outlined by Kenward *et al.* (1980). For the most part, single subsamples from each context had been processed, but in some cases, there were multiple subsamples. No precise records of the weights of sediment processed are available, but the residues and washovers were all small—none more than about a litre in volume.

The bone consisted of a small amount of mostly hand-collected material.

Following the assessment it was considered worthwhile to examine and record the plant and invertebrate remains (especially molluscs) in greater detail in order to increase the information concerning local environment and vegetation.

It was recommended that a detailed record be made of the vertebrate assemblage, concentrating particularly on the possible tanners' waste.

Methods

Plant remains

Plant macrofossils were recorded from a selection of the washovers to represent all of the phases for which samples had been taken. The washovers were small (usually only about 100-200 cm^3) and consisted of small wood and herbaceous detritus fragments, mostly less than 15 mm in maximum dimension. No attempt was made to make systematic counts of remains; rather, a list of taxa recorded during 'scanning' of the material was made and a rough and subjective estimate of frequency made on a three-point scale. The residues were checked briefly during the assessment stage of this work and components other than plant remains from these and from the washovers are also listed.

Invertebrate remains

Insect remains were picked from the residues and washovers of bulk-sieving by eye; the combination of the coarse mesh size and method of sorting means that the recovered material is non-representative and it has been treated accordingly.

The shells of land and freshwater molluscs were also extracted from washovers and residues and identified using the reference collection of modern specimens held within the EAU, and with reference to criteria discussed by Ellis (1969; 1978), Evans (1972) and Macan (1977).

Vertebrate remains

Where possible, all animal bones were identified to species using the reference collection housed at the EAU, York. These were recorded using the diagnostic zones system described by Dobney and Rielly (1988). Detailed butchery information was noted for each fragment, where present, as was any evidence of pathology.

Tooth eruption and wear stages were recorded using the method of Levine (1982) for horse mandibles and maxillae, Grant (1982) for cattle and pig mandibles, and Payne (1973; 1987) for the sheep/goat mandibles. All measurements follow those set out by von den Driesch (1976), with pig tooth measurements after Payne and Bull (1988) and additional measurements outlined by the sheep/goat working group (Appendix 1). Withers height estimations were calculated using guidelines given by Kieswalter (Boessneck and von den Driesch 1974) for horses, Teichert (1975) for sheep, Harcourt (1974) for dogs, and Fock (1966) for cattle. All biometrical data are shown in Appendix 2.

Additionally, a record was made of the preservation, colour and angularity of each assemblage for each context, as well as a semi-quantitative assessment of the proportions of butchery, dog gnawing and fresh breakage.

Results

Plant remains

The results of the investigation of plant macrofossils are presented in Table 1. Very little pattern can be discerned in the records; for the most part the deposits contained a mixture of remains of aquatic and waterside plants with weeds of waste ground and cultivated land—very much what might be predicted for deposits in a feature of this kind, forming in a body of water in an area of human activity. True aquatics are most prevalent in the lowermost level examined (context 44), consistent with the archaeological interpretation of this deposit as the fill of a ditch pre-dating the moat when the water was clean and little dumping of rubbish had taken place. The presence of flax seeds (linseed) in this sample is of interest. In the absence of other 'useful' plants, these seeds may indicate that retting of flax, involving steeping bundles of harvested flax stems in a body of water, was taking place. The increased nutrient status and disturbance to the land around the ditch resulting from this activity may account for the large numbers of *Ranunculus sceleratus* achenes.

The assemblage from the sample from context 27 (phase 3) is the only other one in the series examined to contain a suite of plants indicating relatively clean standing water and perhaps points to a period in which activity around the moat was reduced.

Despite the evidence from mollusc and vertebrate remains for dumping of probable food waste in the later parts of the fills, no plant remains attest this particular activity.

Insect remains

Insect remains from phase 1 were rare and of no interpretative value. Phase 2 samples produced very small numbers of insects, both terrestrial and aquatic. There were many more remains from phase 3, with sufficient aquatics to indicate that some of the deposits were waterlain and a terrestrial component which included dung beetles, ground beetles, and Elateridae (click beetles). Samples from phase 4 also gave fairly large numbers of remains, again a mixture of terrestrial and aquatic forms, the former including ground beetles and a range of decomposer taxa. These records of insect remains provide only the most limited information since the recovery technique ensured that small species, whose remains are normally many times more abundant than those of large insects, would be lost.

Molluscs

Most of the molluscs recovered from the Hall Garth washovers and residues were freshwater species, although there were a number of land snails and a few fragments of marine species. The recorded freshwater species were generally catholic in habitat tolerance, but some tended to be more typically found in slow-moving water, or in shallow water with dense vegetation. The land snails were mostly typical of shaded habitats, with some catholic and marsh species. Table 3 shows species present.

Phase 1

In the only sample from phase 1 (context 44), the fill of the earlier ditch, the species were mostly freshwater, and many are catholic in their range of habitats. The occurrence of *Planorbis planorbis*, *Valvata cristata*, and *Anisus vortex*, however, suggests that there may have been slow-moving water and areas of quite dense plants, whilst the presence of *Lymnaea truncatula* and the Succineidae suggests marshy ground. The freshwater assemblage was quite diverse, suggesting the presence of a range of habitat types and that there had been time for the invasion of those habitats. The land snail assemblage, however, was less diverse.

Phase 2

The only samples from phase 2 (7 and 18), contained very few snails of little interpretative value.

Phase 3

The samples from the earliest context (21) and from context 19 (overlying it), also contained very few shells of little interpretative value.
The sample from context 27, one of the silt fills of the moat, (stratigraphically later than 19), contained large numbers of shells of a wide range of species. Most were freshwater but several land snail species were also present.

The freshwater species were dominated numerically by *Gyraulus albus*, *Valvata piscinalis*, *V. cristata* and *Bithynia tentaculata*, all species which tend to be quite widespread. *Gyraulus albus* flourishes amongst weeds and on stems of plants (Ellis 1969). *Valvata piscinalis* requires plenty of mud and running water, which it generally finds amongst dense growth of plants such as *Sparganium* in slow streams, backwaters, and ditches (Boycott 1934). *V. cristata* may also be found in slowly flowing and still water, and is fairly common where mud and running water are plentiful, such as thick weed beds in streams and lakes (Macan 1977). *Bythinia tentaculata* requires clean water, but is less particular and more common (Boycott 1934). Taking into account the preferences of the more abundant species, it is likely that there was slow-moving or still water, with a muddy substrate and a substantial amount of weed growth. *Lymnaea stagnalis*, *L. peregra*, *Planorbis planorbis*, *Anisus vortex*, *Armiger crista*, *Hippeutus complanatus* and *Planorbarius corneus* are also habitually found in dense freshwater vegetation. *L. stagnalis* 'is fond of a flesh diet, and not only devours dead animal matter, but has also been known to attack living animals, such as fish or newts' (Ellis 1969, 104). Its occurrence may therefore have been encouraged by the disposal of kitchen waste including proteinaceous matter in the moat.

The land mollusc assemblage, of low diversity, was dominated by slug plates, in addition to which there were single individuals of the catholic species *Cochlicopa lubrica* and *Aegopinella nitidula*, and three Succineidae. The presence of *Ostrea* (oyster) and *Mytilus* (mussel) fragments suggests that domestic waste was dumped into the moat.

The sample from context 9, an organic silt forming part of the fourteenth century fill of the box frame of the bridge (also stratigraphically later than 19), contained few shells apart from numerous fragments of *Helix aspersa*. These may have been the result of a natural aggregation of animals, or may have been introduced in some material dumped into the box frame. The few individuals of freshwater species again suggest a still or slowly-flowing body of

water, containing weedy growth and probably with a muddy substrate.

The sample from context 24, a silty clay (stratigraphically later than 9), contained few shells, of little interpretative value: there were 16 individuals of the land snail *Helix aspersa*, one other individual land snail, and three individuals of freshwater species, as well as valves of oyster and the large freshwater mussel *Anodonta*.

The sample from context 23 (which overlay 24), was described as a pale silt, and with context 9 it formed part of the fill of the fourteenth century box frame of the bridge. It contained rather larger numbers of shells, most of which were of freshwater species. The assemblage was dominated numerically by *Bithynia tentaculata*, with smaller numbers of *Valvata piscinalis*, *Planorbarius corneus*, and *Lymnaea peregra*, and small numbers of a range of other freshwater species. Although the numbers of individuals were quite low, a range of species was represented which are fairly catholic in their habitat preference. Some of the land snail species (less well represented than the freshwater species) are indicative of shaded habitats, whilst others are more catholic in taste.

Phase 4

The sample from the earliest context (15), a dark reedy silt (stratigraphically later than context 27) contained very large numbers of shells. Although most were freshwater species, a small proportion were land snails. The assemblage was dominated numerically by *Lymnaea peregra*, but there were also large numbers of *Bithynia tentaculata*, *Valvata cristata*, *Anisus vortex*, *Gyraulus albus* and *Planorbis planorbis*. These species can thrive in water of rather poor quality and their large numbers suggest that the moat may have become de-oxygenated, perhaps as a result of dumping of refuse, or increased algal growth.

There were also species represented which are normally associated with marshy areas, as well as land snails of fairly shaded conditions and some catholic species, collectively perhaps suggesting damp grassland; they may have lived on the moat banks or in its immediate surroundings.

The recovery of so many shells of *Ostrea*, (oyster) together with fragments of *Mytilus* (mussel) and *Cerastoderma* (cockle) suggests that kitchen waste was dumped into the moat at this time.
The sample from context 14, (a grey silt which overlaid 15), also contained large numbers of shells. Most of the species represented were freshwater, but land snails and the remains of edible molluscs were also recovered. This assemblage was dominated numerically by *Lymnaea peregra*, with lower numbers of *Bithynia tentaculata*, *Valvata cristata*, *Anisus vortex* and *Planorbis planorbis*. Whilst these species tend to be fairly catholic, the presence of low numbers of *Lymnaea stagnalis*, *Bathomphalus contortus* and *Planorbarius corneus* suggests that the moat was becoming more stagnant. Again the species represented are tolerant of low water quality. Marshy ground in the immediate vicinity is indicated by the presence of the Succineidae and *Zonitoides nitidus*.

The land snails were dominated by the fairly catholic species *Trichia hispida* and the shade-preferring *Discus rotundatus*, with the shade-loving element reinforced by the presence of *Carychium tridentatum*, *Clausilia bidentata*, and the catholic component emphasised by the presence of *Cochlicopa lubrica* and *Vallonia*. This fauna probably reflects damp grassy vegetation along the margins of the moat or on its banks.

The sample from context 13 also contained quite large numbers of snails, although not as many as 14 and 15. Most of the species represented indicate fresh water but there were also large numbers of some land snail species, as well as fragments of oyster. The freshwater species are dominated by the fairly catholic *Lymnaea peregra*, with lower numbers of *Bithynia tentaculata*, *Valvata cristata*, *V. piscinalis*, *Anisus vortex*, *Planorbarius corneus* and *Planorbis planorbis*, and a single *Lymnaea stagnalis*.

The land snails comprised two main components: a shade-preferring group dominated by *Discus rotundatus*, with a few

individuals of *Aegopinella nitidula*; and a more catholic group dominated by *Helix aspersa*, with some individuals of *Trichia hispida*. Here, too, damp grassland is indicated.

The presence of some fragments and valves of *Ostrea* (oyster) suggest that some food debris continued to be dumped in to the moat.

The sample from context 43 contained very large numbers of shells, mostly of freshwater species, but with some land snails. The freshwater species were dominated by *Valvata cristata*, with lower numbers of *Lymnaea peregra*, *Bithynia tentaculata*, *Planorbis planorbis*, *Anisus vortex*, *Gyraulus albus*, *Hippeutus complanatus*, *Valvata piscinalis*, and *Armiger crista*. Pockets of marshy vegetation are suggested by the presence of the Succineidae.

The land snail assemblage was dominated by *Discus rotundatus*, with *Oxychilus alliarius*, Limacidae, *Trichia hispida*, *Cepaea*, and *Cochlicopa lubrica*. It is likely that this represents damp grassy vegetation on the moat sides or edges.

Phase 5

The hand-collected shell from the three contexts in this phase contained a few oyster valves, and a whelk (*Buccinum undatum*).

An interesting phenomenon, occurring in a number of contexts from phase 3 and 4 (27, 23, 15, 43), is a discrepancy between the number of shells and the number of opercula identified as *Bithynia tentaculata*. This may imply a taphonomic process operating against the opercula. One possible mechanism might be a rate of water flow fast enough to remove the opercula but not the shells from the deposits. Conversely, samples from contexts 13 and 14 (phase 4) showed similar numbers of shells to opercula, suggesting a slower water flow where little or no sorting occurred. However, some factor of preservation or recovery cannot be ruled out.

Summary

In phase 1, there was slow-moving water with areas of quite dense aquatic vegetation, and associated marshy ground. The increasing evidence for the dumping of kitchen waste in phase 3 may have facilitated the increase in numbers of molluscs, although similar habitats to those of the earlier periods seem to be represented.

The fills of the box frame, although fairly similar to those of the moat, had a higher land snail component which it is suggested may have been introduced at least in part with dumped material of some kind.

The molluscs from the phase 4 fills suggest that the moat was becoming more stagnant, perhaps as a result of the continued dumping of refuse, and the land snail assemblages suggest that part of the moat sides or edges supported rank grassland.

Vertebrate remains

The small assemblage of hand-collected animal bone recovered from the site, amounted to a total of 638 fragments (weighing 28,645 g) , of which 405 (23,930 g) were identified to species. An additional 88 fragments were recovered from several of the bulk-sieved samples. Very little of the bone is from the first two phases, most of it being dated to phases 3, 4 and 5. Consequently, most of the material has little connexion with the occupation of the manor at Hall Garth, instead reflecting activities subsequent to its decline and demise. The most interesting aspect of this assemblage is the large number of sheep metapodials from phase 5, which almost certainly represents waste from tanning.

Preservation

Preservation overall was very good, with little evidence of either chemical or physical modification on the most of the fragments. Colour ranged from fawn to dark brown and was, on the whole, consistent throughout single contexts. Few bones showed any characteristic signs of dog gnawing or burning and, although fresh breakage was

present, it was very limited in extent. The general condition of the bone assemblage showed little indication of exposure prior to incorporation into the moat deposits.

Species representation

Tables 4 and 5 list the range of species and the number of identified fragments from both the hand-collected and the bulk-sieved material. Common domestic species are, not surprisingly, well represented, these being cattle, caprine, pig, horse, dog and cat. Of the 231 fragments identified as caprine, 103 (45%) were positively identified as sheep (using criteria of Boessneck 1969), whilst no definite identification of goat remains were made. It is therefore assumed, for the purposes of this analysis, that all caprine remains were sheep.

As well as domestic species, a small number of fallow deer remains were recovered, with limited numbers of small mammal, bird, fish and amphibian remains, almost all from the bulk-sieving residues. It is impossible to gain a realistic impression of the relative frequencies, and hence importance, of each taxon because of the small size of the assemblage and the fact that the bulk of the material appears to represent specialised deposits, possibly industrial waste.

Cattle

Only 59 fragments have been definitely identified as cattle, although a further 134 fragments were recorded as large mammal, and most of these were almost certainly cattle. The most abundant elements are mandibles, humeri and radii, although a range of other elements are represented, including (in the large mammal fraction) cranial, vertebrae, rib, and shaft fragments, all probably of cattle (Table 6). Although numbers are small, the cattle remains probably represent both primary butchery and domestic waste. Nearly all the humeri and radii showed evidence of butchery, as did a large proportion of the vertebrae, which had been chopped in half indicating splitting of carcasses. Horncore removal was apparent as chop marks at the base of a single horncore.

Epiphyseal fusion and tooth wear data for cattle are shown in Table 7. Numbers are extremely limited but it is evident that several post-natal and juvenile individuals are represented.

Withers height estimations were calculated from only two bones (one from each of phases 3 and 4). Both animals had the same height: 1.14 m.

Sheep

Although the most common species, the remains of sheep are over-represented by virtue of the fact that a large proportion of the Hall Garth assemblage comprises probable waste from hide preparation—that is, 69 metacarpals and 67 metatarsals, almost all from phase 5 (Table 8). Bones from phases 3 and 4 represent a range of skeletal elements, both meat-bearing and non-meat-bearing and, although numbers are few, forelimbs appear more numerous than other elements. Unlike the industrial waste from phase 5, sheep bones from earlier phases probably reflect disposal of domestic refuse, although the presence of chopped horncores may suggest other craft activities (see discussion of butchery below).

Age structure

Tables 9 and 10 summarize the epiphyseal fusion data for long bones, and age categories based on tooth eruption and occlusal wear from the limited number of mandibles recovered (only from phases 4 and 5). Most of the long bones from phase 4 were fused, as were 83 of 97 aged metapodials from phase 5 (the latter indicating ages greater than two years). Although only 14 mandibles with teeth were present, all represent animals older than two years. Six of nine mandibles from phase 4 were from animals of 6-10 years, as were two of four mandibles from phase 5.

Butchery

In all three phases where sheep remains were present, there was evidence of horncore removal. In most of the cases this had been achieved by chopping through the

base of the horncore. In addition, most skulls had been split sagittally in order to remove the brain. Five scapulae from phase 4 also showed characteristic damage to the blade consistent with suspension from a butcher's hook. Long bones showed chops through the articular ends, probably the result of joint preparation

A number of metapodials from phase 5 had distinctive chops through the distal condyles, indicating removal of the feet. Since no phalanges were present in the assemblage, these were probably removed at an earlier stage of carcass preparation, possibly at a different location.

The presence of knife marks running longitudinally along the anterior aspect of some of the metapodials is certainly consistent with the skinning process, during which they would be removed prior to tanning.

Biometry

The large and discrete dump of sheep metapodials recovered from phase 5 deposits, in addition to measurements from a smaller number of metapodials, humeri and radii from phases 3 and 4, provided numerous biometrical data, (Appendix 2). A great proportion of long bones were complete, enabling the calculation of withers heights for a large number of individuals. Table 11 shows the mean values of a range of elements and it is apparent that little variation exists between phases. Similarly, mean values for withers heights also indicate a possible continuity through time (Table 12).

More detailed analysis regarding the size and shape of the animals represented provided an opportunity to address a number of pertinent questions regarding the demographic structure of the sample and possible differences in their genetic background:

- Do the sheep represent a single genetic stock or is there any clear evidence for the presence of larger, improved breeds in East Yorkshire during the early modern period?
- Is there any evidence of the exploitation of wethers (castrates), which played such a major role in the medieval and post-medieval wool trade?

In order that a fuller appreciation of the significance the Hall Garth data can be gleaned, comparative measurements from specimens of several unimproved breeds from the EAU research collection have been included. Most of these are unimproved Shetland sheep (including ewes, wethers and rams) but also included are several Herdwicks (only wethers and rams), and single Soay and White-faced woodland ewes.
In addition to relevant modern comparative data, historical and regional comparisons have been made with a similar assemblage of sheep metapodials from late medieval and post-medieval Selby, N. Yorkshire. Figures 1-19 show the relevant biometrical data presented as standard bi-variate plots.

The Hall Garth sheep

Figures 1-9 and 12-17 represent data from single measurements and, as such, only provide information regarding basic size difference. Figures 10 and 11, and 18 and 19, on the other hand, represent changes in the proportions or shape of the bones.

It is clear that little in the way of distinct clustering is apparent. Plotting greatest length (GL) against minimum shaft diameter (SD) (Figure 1) shows a homogeneous group with several of the individuals from phase 4 perhaps representing outliers from the main body of data. Figure 4 shows similar uniformity, although several of the phase 5 individuals are perhaps long-legged relative to the breadth of the distal condyles. Figure 7 shows an even tighter grouping from all phases with all measurements exhibiting a close linear relationship. When shape rather than size is considered, more distinct clustering is apparent (Figure 10). Here, three clusters may represent sexual groups, i.e. ewes and rams, with wethers possibly defined by the central group. If this is indeed the case, it would suggest that the Hall Garth assemblage comprised mainly wethers, with few rams and even fewer ewes represented.

Measurements from the Hall Garth metatarsals appear more widely dispersed, but in the case of greatest length against distal breadth (Figure 12), distinct clustering is again apparent. However, using the shape index (Figure 18), no clustering is evident from the phase 5 individuals, although two bones from phase 4 appear as outliers to the main distribution and may indicate the possible presence of a different breed or variety.

Modern comparative data

Bi-variate plots of the modern comparative data (Figures 3, 6, 9, 11, 14, 17 and 19) reveal some interesting features. When viewing data by both size and shape, the larger, more robust breeds (Herdwick and White-faced woodland) can almost always be clearly distinguished from the smaller, more gracile breeds (Shetland and Soay).

When dealing only with those data representing the unimproved Shetland sheep, two distinct groups are apparent, a distinction less obvious when using shape indices and proximal breadth and depth measurements. The smaller and less robust individuals are represented only by ewes and the larger, more robust individuals comprise both entire rams and wethers. It is interesting to note that values for the wethers remain completely distinct from those of the ewes and, although they are not quite as robust, they fall within the range for rams. It is normally assumed, from similar archaeological data that, where values with a close linear relationship show no distinct clustering, males and females occur at the extremes, with castrates falling between the two and overlapping with both. It is clear from these modern comparative data that this may not in fact be a safe assumption, given the model for unimproved Shetland sheep.

In the case of the Hall Garth metapodials, it is clear that most of the individuals fall within the unimproved Shetland size range represented mainly by the ewes and smaller wethers.

Tanners' waste from Selby

Waste from hide working was also recovered during evaluation excavations on land to the rear of Gowthorpe, Finkle St., and Micklegate, Selby. Similar to the Hall Garth assemblage, this consisted of sheep metapodials of mainly early post-medieval date, although there was some additional material thought to be of 13th-15th century date and some of early modern date (which was almost certainly reworked from the early post-medieval material). Values for measurements again fall generally within the range for the unimproved Shetland group, although here most individuals fall toward the upper end of the distribution, outside those for modern Shetland ewes (Figures 2, 5, 8, 13 and 16). Biometrical data from the Selby metacarpals, however appear very similar to those from the Hall Garth material, with little evidence of clustering apparent. As was the case at Hall Garth, data from the metatarsals show more distinct clustering, again into two possible groups. The significance of these groupings is similarly open to interpretation, although a linear relationship suggests that distinct breeds are not represented.

Pathology

A number of pathological conditions were noted in the sheep bones from the Hall Garth excavations. A group of twelve metatarsals, for example, showed areas of swelling on the proximal anterior aspect of the shaft. This took the form of a vertical ridge of highly remodelled bone positioned parallel with and medial to the position of the median extensor tendon. Five also showed very slight remodelling on the opposing posterior aspect. This condition, of unknown aetiology, has been noted on metatarsals from a number of other sites, for example from the medieval and post-medieval deposits from Selby (Carrott *et al*. 1993) and from post-medieval excavations at Walmgate (O'Connor 1984) and Lawrence Street (Dobney 1993), York.

Five mandibles and one maxilla, from the Hall Garth material exhibited a particularly consistent pattern of abnormal wear. This consisted of excessive wear of the

permanent fourth premolar (P4) and first molar (M1). This could be the result of periods of penning where bars or hurdles were chewed through boredom. A further mandible shows abnormal wear on the M1 but since the P4 is missing it is not possible to tell whether it follows the same pattern as those previously described.

Pigs

Pig remains form a very small proportion of the assemblage, with only 16 identifiable fragments in total, the most frequent element being mandible fragments (Table 13).

Tooth eruption and wear sequences suggest that two individuals were between four and six months old, two were 12-16 months, whilst one was greater than two years of age at death.

A single mandible shows abnormal wear on the first molar (M1), possibly indicative of penning. Butchery was noted on few fragments, including a skull chopped sagittally; few useful measurements could be made.

Horses

From Table 14 it is apparent that horses were represented in the assemblage almost exclusively by skulls and mandibles, mainly from phase 4. These were three almost complete skulls, three incomplete ones and two complete mandibles. Neither of the pairs of mandibles corresponded to the skulls, indicating that at least eight individuals were represented. As well as cranial elements, several long bone fragments were also identified. A single juvenile distal tibia fragment showed evidence of butchery in the form of chop marks.

Epiphyseal fusion data, available from only two fragments, suggest that juveniles were present in the assemblage whilst the larger body of data from the skulls and mandibles indicates that most were aged between 5 and 15 years at death, with only two individuals being less than two years old (Table 15). The presence of large and robust canine teeth from two of the mandibles and maxillae is probably indicative of males or castrates, although such teeth can occur in older females.

Biometry

Three complete bones (a radius and two tibiae) provided estimations of withers heights (Table 12). Results indicate medium-sized ponies of between 13.1 and 13.2 hands for the three phases represented. The individuals from phases 3 and 4 fall within the height range for medieval horses (Clutton-Brock 1992), as does the individual of 19th-20th century date.

A number of the cranial measurements were used to create two commonly-used indices devised for the analysis of equid skulls. According to the classification scheme suggested by Nobis (1962) and used by Armitage (1991), values from the frontal index (after Bökönyi 1974) show that two of the three measurable skulls fall into the average-broad-forehead category. The third falls into the narrow-forehead category but is an individual between one-and-a-half and two years old, and so had not yet reached full size.

Fallow deer

A total of fourteen fallow deer fragments were recovered, mostly from phases 3 and 4, most of the bones being metapodials, phalanges and vertebrae (Table 16).

One metatarsal showed knife marks on the distal epiphysis, whilst a scapula had had the spine removed.

Phase 4 deposits produced a cast antler showing slight palmation, indicating that the animal was approximately three years old, whilst the fusion data suggest that all remaining individuals were mature.

Dogs

Dog remains were present throughout phases 2-5 and were represented by a range of elements (Table 17). However, most of the fragments from phase 4 appear to represent just two individuals. All of the bones appear

to be from mature individuals and the mandibles and maxillae suggest that the animals were older than 7 months at death.

Withers heights were calculated from a total of 20 complete bones (nine deriving from only two individuals) from phases 3, 4 and 5, and show a range of sizes from 28-68 cm, representing animals in the size range represented today by miniature poodle to greyhound.

Cats

A total of ten cat bones were recovered (all except one being from phase 4), of which five represent a single individual. There is no evidence of skinning marks on any of the bones.

Birds

Nine bird bones were present in the hand-collected material (Table 4). Most were from domestic birds (5 chicken), with 1 each of duck and goose which may, of course, be from wild birds. The remaining fragments were elements from facultatively synanthropic scavengers, these being a possible rook ulna and the tibiotarsus from a raptor, tentatively identified as red kite. An additional small passeriform tibiotarsus (identified as possible goldfinch) and a single unidentifiable bird fragment were recovered from bulk-sieving residues.

Fish

Very few fish bones were recovered from either the hand-collected or bulk-sieved residues (Tables 4 and 5). Those in the hand-collected assemblage include a single hyoid bone of a cod, one basioccipital bone of a member of the cod family (Gadidae) and one unidentifiable cleithrum. The cod family are, of course, marine fishes and so must have been brought in to Beverley from coastal fisheries.

The sieved samples contained 25 bone and scale fragments, representing a natural death assemblage from within the moat.

In phase 1 (pre-moat) a single vertebra of the eel was identified. Remains from phases 2, 3 and 4 have revealed a typical still- or slow-flowing water fish community with pike and perch no doubt predating the smaller members of the carp family. Colonisation of the moat may have resulted from its initial filling, possibly by the diversion of a local watercourse.

Discussion

Although the bone assemblage from Hall Garth is small, it provides some interesting data which relate mainly to activities occurring once the nearby building had fallen into disrepair (phase 3 onwards). Evidence for economic activities during the main phase of occupation of the site is therefore almost wholly lacking since, not surprisingly, little material appears to have been deposited in the moat at that time. The plot appears to have been vacant during post-medieval times and it is likely that it was used as a convenient dumping ground for refuse of both a domestic and commercial nature through to the early modern period.

Material from 16th-17th century deposits included a number of horse skulls and mandibles, as well as the remains of both dogs and cats. There is no evidence from the bones of skinning marks, although the utilisation of pelts and skins cannot be ruled out. It is, however, more likely that these remains represent noxious waste collected from other parts of the town and dumped in the fast-filling ditch. Horse remains might indicate the activities of knackers or fellmongers. The site of Witney palace (Oxfordshire) provides an interesting comparison since this high status moated site also gave evidence of possible specialist activities subsequent to its decline and abandonment in the late medieval and post-medieval period. At that site, large numbers of mainly horse and dog remains were recovered from late medieval and post-medieval moat and dump deposits, and have been interpreted as horse knackering carried out in order to feed hounds kept for deer hunting (Wilson and Edwards 1993). The size range of dogs at the Hall Garth is similar to that for dogs from Witney Palace,

although both smaller and larger individuals are also present in the Hall Garth material. The horses from Witney Palace ranged in height from 13 to 16 hands, whereas all the horse remains from the Hall Garth represent ponies around 13 hands.
Whilst the horse bone at Witney Palace may well reflect knackering activities occurring there, the limited numbers of horse remains from Hall Garth makes it difficult to draw any definite conclusions. During medieval and post-medieval periods horse carcases, although rarely consumed, were fully utilised, with bones used for button making and fertiliser, grease for candlemaking, hair for furniture, mattresses and violins, hides for leather goods, and meat for feeding cats and dogs (Edwards 1987). Some indication of craft activity is represented in phases 3, 4 and 5 in the form of sheep horncores and crania which bear evidence of horn removal. This may hint at the presence of a hornworker's workshop in the vicinity.

The presence of obvious tanners waste suggests that this area of Beverley in the 19th century was possibly industrial and continued to be used as a dumping ground for local processing waste. Similar deposits of late medieval and post-medieval date have been described from other excavations in the region, for example, at the adjacent site of Lurk Lane (Scott 1991), from Selby (Carrott *et al.* 1993), and at two sites in York, i.e. Lawrence Street (Dobney 1993) and Walmgate (O'Connor 1984). Distal limb elements were often left attached to the hide and removed later during the tanning process (Serjeantson 1989).

The biometrical data from both Hall Garth and Selby, representing the post-medieval and early modern periods, indicate that those sheep whose hides were being exploited were from stock which more closely resembled small unimproved breeds than improved ones in both size and stature. What was apparently 16th century tanning waste from the adjacent site of Lurk Lane (Scott 1991) has produced similar evidence for small unimproved sheep. There is little evidence of the presence of larger, more improved breeds in either assemblage, although they may be represented by some of the more obvious outliers. Their absence can be interpreted in a number of ways:

- That improved breeds were still uncommon and not widely utilised in the region until relatively late.
- That only the hides of unimproved breeds were used.

- That the material is reworked from earlier deposits.

The fact that wool was of much higher importance than mutton in the late medieval and post-medieval periods probably explains the absence of the larger breeds, which were mainly utilised as meat carcass animals. In this regime, wethers were usually kept in much greater numbers and to far greater ages (Trow Smith 1957) than would be economically viable today, when the emphasis is on meat production. Beverley was an important regional market town and is mentioned by Henry Best in his farming and memorandum books as a regular trading point for wool during the 17th century, where packhorses transported bales to the woollen mills of West Yorkshire (Woodward 1984). However, the Hall Garth metapodials are all from 19th-20th century deposits which indicates that these unimproved stock were still commercially exploited for their wool in East Yorkshire very late indeed.

The presence of fallow deer remains (mainly from phase 3) is interesting since a deer park, established by the Archbishop of York and documented around 1250, is known to have existed immediately adjacent to Hall Garth. Although numbers are small, the fact that most of the elements are from non-meat-bearing parts may hint that carcasses were dressed prior to their distribution. Venison was a prized commodity, available only to high status individuals through gifts, and it was also customary for the owners of parks to donate venison for major local feasts (Neave 1991).

The presence of urban scavengers, in the form of ?red kite and ?rook, attests to the possibly squalid nature of the area during the post-medieval period. Red kite was once a common sight in medieval and post-medieval urban centres, attracted by accumulations of human refuse.

Conclusions

The assemblages of biological remains from the Hall Garth, although small, provide some interesting information. During the pre-moat phase (phase 1) evidence from molluscs and plant remains indicates the presence of clean and slow-moving water, with the possible retting of flax in the vicinity.

In later phases increased dumping of rubbish is indicated by numerous animal bones and some shellfish, with the non-marine mollusc assemblage suggesting increasingly stagnant conditions within the moat. By the post-medieval period, dumping of waste from tanning and perhaps other activities is evident.

Retention/disposal

All the biological material and sediment residues from these excavations should be retained for the present.

Archive

All paper and electronic archives pertaining to the work described here are currently stored at the EAU, York, along with the residues, washovers, hand-collected shell, and bone.

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Table 1. Plant taxa and some other components recorded from selected samples from deposits at Hall Garth, Beverley. Plant parts can be read from Table 2; abundance scores on a three-point scale from + (rare) to +++ (abundant).

Period	**1**	**2**	**3**	**3**	**3**	**4**	**4**	**5**
Context/Sample	**44/1**	**18/2**	**21/1**	**9/3**	**27/1**	**23/1**	**14/1**	**5/1**
Taxon								
Aquatic/waterside plants (including taxa of damp waste places)								
(a) Floating/submerged aquatics								
Lemna sp(p).	-	-	-	-	+	-	-	-
Ceratophyllum demersum	-	-	-	-	+	-	-	-
Groenlandia densa	++	-	-	-	-	-	-	-
Myriophyllum spicatum	-	-	-	-	+	-	-	-
Potamogeton cf. natans	+	-	-	-	-	-	-	-
Ranunculus Subg. Batrachium	-	-	-	-	-	-	-	-
Scorpidium scorpioides	-	+	-	+	-	+	-	-
Zannichellia palustris	+	-	-	-	+	-	-	-
(b) Emergent aquatics								
Alisma sp(p).	-	-	-	-	-	-	++	-
Apium nodiflorum	-	-	-	-	-	-	+	-
Sparganium sp(p).	-	-	-	-	+	+	+	-
(c) Waterside,fen and wet grassland taxa								
Eleocharis palustris sl	-	-	+	+	-	-	-	-
Lycopus europaeus	-	-	-	-	+	-	+	-
Menyanthes trifoliata	+	-	-	+	-	-	-	-
Pedicularis palustris	-	-	-	+	-	-	-	-
Ranunculus flammula	-	-	-	+	-	-	-	-
Solanum dulcamara	-	-	-	-	-	+	-	-
Thalictrum flavum	-	-	-	-	+	+	-	-
(d) Plants typical of damp places with high nutrient status								
Bidens sp(p).	-	-	-	-	-	-	+	-
Chenopodium Section Pseudoblitum	-	-	-	-	+	-	-	-
Polygonum hydropiper	+	-	-	-	-	-	-	-
Ranunculus sceleratus	++	+	+	+	+	+	++	+
(d) Other plants probably to be included in this group								
Carex sp(p).	+	+	++	++	+	-	-	-
Drepanocladus sp(p).	-	-	-	-	-	+	-	-
Weeds of arable land/waste places								
Agrostemma githago	-	-	-	-	-	+	-	-
A. githago (seed fgts)	+	-	-	-	-	-	-	-
Anthemis cotula	-	-	-	+	-	+	-	-
Atriplex sp(p).	-	+	+	-	+	+	+	-

Context/sample	**44/1**	**18/2**	**21/1**	**9/3**	**27/1**	**23/1**	**14/1**	**5/1**
Brassica rapa	-	+	-	-	-	+	+	-
Brassica sp./ Sinapis arvensis	-	+	-	-	-	+	-	-
Chenopodium album	+	-	-	-	-	-	-	-
Conium maculatum	-	+	+	+	+	++	+	-
Coronopus squamatus (fr)	-	-	-	-	-	+	-	-
Dipsacus fullonum	-	-	-	-	-	+	-	-
Euphorbia lathyris	-	-	-	-	-	-	-	+
Hyoscyamus niger	+	+	-	-	-	-	+	+
Lapsana communis	-	+	-	-	-	-	-	-
Polygonum aviculare agg.	-	-	-	+	+	+	-	-
P. persicaria	-	-	+	-	-	+	-	-
Sonchus asper	-	-	+	-	-	+	+	-
S. oleraceus	-	+	-	+	-	+	+	-
Urtica dioica	++	+	+	++	++	+	++	-
U. urens	-	-	-	-	-	-	+	-
Woody plants and mosses of woodland/bark								
Antitrichia curtipendula	-	-	-	+	-	-	-	-
Corylus avellana	-	+	-	-	-	-	-	-
cf. C. avellana (b/bs)	-	-	-	+	-	-	-	-
Neckera crispa	+	-	-	-	-	-	-	-
Quercus sp(p). (b/bs)	-	-	-	-	+	+	-	-
Rosa sp(p). (prickles)	-	-	-	+	-	-	-	-
Salix sp(p). (b)	-	-	-	-	+	+	+	-
Sambucus nigra	+	+	+	+	+	+	++	+
Unclassified								
Arctium sp(p).	-	-	-	+	+	-	+	-
Brassica sp(p).	-	-	-	-	-	-	-	-
Calliergon cuspidatum	-	+	-	-	+	+	-	-
Carduus/Cirsium sp(p).	+	+	-	+	-	+	+	-
Eurhynchium sp(p).	-	-	-	+	-	-	-	-
Homalothecium sericeum/ lutescens	-	-	-	-	-	-	+	-
Hypochoeris sp(p).	-	-	-	-	-	+	-	-
Linum usitatissimum	++	-	-	-	-	-	-	-
Potentilla anserina	-	-	-	+	-	-	-	-
Potentilla sp(p).	-	+	-	-	-	-	-	-
Prunella vulgaris	-	-	+	-	-	-	-	-
Pteridium aquilinum (stalk fragments)	-	-	+	-	-	-	-	-
cf. Pteridium aquilinum (pinn fgts)	-	+	-	-	-	-	-	-
Ranunculus Section Ranunculus	-	+	+	+	+	+	+	+
Raphanus raphanistrum (pod segs/fgts)	-	-	-	-	-	+	-	+
Rubus fruticosus agg.	+	-	+	-	+	-	-	+
Rumex acetosella agg.	-	-	-	+	-	-	-	-

Context/sample	**44/1**	**18/2**	**21/1**	**9/3**	**27/1**	**23/1**	**14/1**	**5/1**
Rumex sp(p).	+	+	+	+	+	-	+	-
Stellaria media	+	-	-	-	-	+	-	-
Other components								
Daphnia (ephippia)	-	+	-	-	-	+	-	-
bone fragments	-	-	-	-	-	-	-	+
brick/tile	-	+	-	+	+	+	+	-
caddis larva cases	-	-	-	-	+	-	+	-
charcoal	-	-	-	-	-	-	-	-
dicot leaf fragments	-	-	-	+	-	-	-	-
earthworm egg capsules	+	-	-	+	-	-	+	-
fish scale	-	+	-	+	-	-	-	-
herbaceous detritus	+	++	+	+	++	++	++	-
moss	-	+	+	+	+	+	-	-
ostracods	+	+	+	-	-	-	+	-
oyster shell fragments	-	-	-	-	-	-	-	+
root moulds (mineralised)	-	-	-	-	-	-	-	-
stones	-	++	++	++	-	+	-	++
twig fragments	-	-	-	-	-	+	-	-
wood fragments	+	+	++	++	++	++	-	-

Table 2. Complete list of plant taxa from Hall Garth, Beverley, with vernacular names and parts recovered. Taxonomic order and nomenclature follow Tutin et al. *(1964-80) and Smith (1978).*

Vascular plants

Pteridium aquilinum (L.) Kuhn (bracken) stalk fragment(s)
cf. *P. aquilinum* (?bracken) pinnule fragment(s)
Salix sp(p). (willows) bud(s)
Corylus avellana L. (hazel) nut(s) and/or nutshell fragment(s)
cf. *C. avellana* bud(s) and/or bud-scale(s)
Quercus sp(p). (oaks) bud(s) and/or bud-scale(s)
*Urtica dioic*a L. (stinging nettle) achene(s)
U. urens L. (annual nettle) achene(s)
Polygonum aviculare agg. (knotgrass) fruit(s)
P. persicaria L. (redshank) fruit(s)
*P. hydropipe*r L. (water-pepper) fruit(s)
Rumex acetosella agg. (sheep's sorrel) fruit(s)
Rumex sp(p). (docks) fruit(s)
Chenopodium Section *Pseudoblitum* (red goosefoot, etc.) seed(s)
C. album L. (fat-hen) seed(s)
Atriplex sp(p). (oraches) seed(s)
Stellaria media (L.) Vill. (chickweed) seed(s)
Agrostemma githago L. (corncockle) seed(s)/fragment(s)
Ceratophyllum demersum L. (rigid hornwort) fruit(s)
Ranunculus Section *Ranunculus* (buttercups) achene(s)
R. sceleratus L. (celery-leaved crowfoot) achene(s)
R. flammula L. (lesser spearwort) achene(s)
R. Subgenus *Batrachium* (crowfoots) achene(s)
Thalictrum flavum L. (common meadow-rue) achene(s)
Coronopus squamatus (Forskål) Ascherson (swine-cress)fruit(s)
Brassica sp(p). (cabbages, etc.) seed(s)
B. rapa L. (turnip) seed(s)
Brassica sp./*Sinapis arvensis* (brassica/charlock) seed(s)
Raphanus raphanistrum L. (wild radish) pod segments and/or fragment(s)
Rubus fruticosus agg. (blackberry/bramble) seed(s)
Rosa sp(p). (rose) prickle(s)
Potentilla anserina L. (silverweed) achene(s)
Potentilla sp(p). (cinquefoils, etc.) achene(s)
Linum usitatissimum L. (culitvated flax/linseed) seed(s)
Euphorbia lathyris L. (caper spurge) seed(s)
Myriophyllum spicatum L. (spiked water-milfoil) nutlet(s)
Conium maculatum L. (hemlock) mericarp(s)
Apium nodiflorum (L.) Lag. (fool's watercress) mericarp(s)
Menyanthes trifoliata L. (bogbean) seed(s)
Lycopus europaeus L. (gipsywort) nutlet(s)
Hyoscyamus niger L. (henbane) seed(s)
Solanum dulcamara L. (woody nightshade) seed(s)
Pedicularis palustris L. (marsh lousewort) seed(s)
Sambucus nigra L. (elderberry) seed(s)
Dipsacus fullonum L. (wild teasel) fruits(s)
Prunella vulgaris L. (self-heal) nutlet(s)
Bidens sp(p). (bur-marigolds) achene(s)
Anthemis cotula L. (stinking mayweed) achene(s)
Arctium sp(p). (burdocks) achene(s)
Carduus/Cirsium sp(p). (thistles) achene(s)
Hypochoeris sp(p). (cat's ears) achene(s)
Sonchus asper (L.) Hill (prickly sow-thistle) achene(s)
S. oleraceus L. (sow-thistle) achene(s)
Lapsana communis L. (nipplewort) achene(s)
Alisma sp(p). (water-plantains) carpel(s) and/or seed(s)
Potamogeton cf. *natans* L. (?broad-leaved pondweed) pyrene(s)
Groenlandia densa (L.) Fourr. (opposite-leaved pondweed) pyrene(s)
Zannichellia palustris L. (horned pondweed) fruit(s)
Lemna sp(p). (duckweeds) seed(s)
Sparganium sp(p). (bur-reeds) fruit(s)
Eleocharis palustris sl (common spike-rush) nutlet(s)
Carex sp(p). (sedges) nutlet(s)

Mosses

Leucodon sciuroides (Hedw.) Schwaegr. shoot fragment(s)
Antitrichia curtipendula (Hedw.) Brid. shoot fragment(s)
Neckera crispa Hedw. shoot fragment(s)
Drepanocladus sp(p). shoot fragment(s)
Scorpidium scorpioides (Hedw.) Limpr. shoot fragment(s)
Calliergon cuspidatum (Hedw.) Kindb. shoot fragment(s)
Homalothecium sericeum/H. lutescens shoot fragment(s)
Eurhynchium sp(p). shoot fragment(s)

Table 3. Records of molluscs from Hall Garth, Beverley. (a) Freshwater and land snails

Context	**44**	**7**	**18**	**9**	**19**	**21**	**23**	**24**	**27**	**28**	**29**	**12**	**13**	**14**	**15**	**26**	**43**	**Total**
Phase	**1**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**4**	**4**	
Valvata cristata (Müller)	9	-	-	1	-	-	11	-	130	-	-	-	7	29	137	-	252	576
Valvata piscinalis (Müller)	-	-	1	-	-	-	6	-	118	-	-	-	6	4	25	-	36	196
Bithynia tentaculata (L.)	4	-	-	3	2	-	48	-	95	-	-	-	14	23	174	-	77	440
Bithynia tentaculata (opercula)	1	-	-	-	-	-	16	-	48	-	-	-	10	25	122	-	187	409
Bithynia leachii (Sheppard)	-	-	-	-	-	-	5	-	2	-	-	-	-	5	9	-	4	25
Carychium tridentatum (Risso)	-	-	-	-	-	-	-	-	-	-	-	-	-	1		-	-	1
Physa sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	2
Lymnaea truncatula (Müller)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Lymnaea stagnalis (L.)	-	-	-	-	-	-	-	-	10	-	-	-	1	7	1	-	2	21
Lymnaea peregra (Müller)	-	-	-	-	-	-	12	-	40	-	-	-	18	44	267	-	111	492
Planorbis planorbis (L.)	4	-	-	3	-	-	5	1	21	-	-	-	9	30	80	-	65	218
Planorbis carinatus (Müller)	-	-	-	-	-	-	1	-	-	-	-	-			2	-		3
Anisus vortex (L.)	1	-	-	5	-	2	9	-	14	-	-	-	11	35	119	-	68	264
Bathyomphalus contortus (L.)	3	-	-	-	-	-	-	-	-	-	-	-		7		-		10
Gyraulus albus (Müller)	-	-	-	-	-	-	4	-	147	-	-	-	2	-	44	-	67	264
Armiger crista (L.)	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	30	42
Hippeutis complanatus (L.)	-	-	-	-	-	-	1	-	1	-	-	-	-	-	5	-	56	63
Planorbarius corneus (L.)	-	-	-	5	-	-	14	2	1	-	-	1	5	4	8	-	1	41

Context	**44**	**7**	**18**	**9**	**19**	**21**	**23**	**24**	**27**	**28**	**29**	**12**	**13**	**14**	**15**	**26**	**43**	**Total**
Phase	**1**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**4**	**4**	
Ancylus fluviatilis (Müller)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Succineidae	2	-	-	-	-	-	4	-	3	-	-	-	1	5	12	-	14	41
Cochlicopa lubrica (Müller)	1	-	-	1	-	2	2	1	1	-	-	-	-	14	5	-	2	29
Pupilla muscorum (L.)	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Vallonia sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	5
Discus rotundatus (Müller)	-	-	-	-	-	-	4	-	-	-	-	-	20	19	14	-	18	75
Vitrea sp.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	2
Aegopinella nitidula (Draparnaud)	2	-	-	-	-	1	-	-	1	-	-	-	3	1	7	-	-	15
Oxychilus cellarius (Müller)	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	2
Oxychilus alliarius (Miller)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	5	7
Zonitoides nitidus (Müller)	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	10
Limacidae	-	-	-	-	-	-	-	-	47	-	-	-	-	1	-	-	7	55
Clausilia bidentata (Ström)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
Trichia hispida (L.)	-	-	-	-	-	-	-	-	-	-	-	-	5	22	5	-	5	37
Cepaea sp.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-	2	5
Helix aspersa (Müller)	-	-	5	77	2	-	5	16	-	1	1	1	21	2	16	2	-	149
Total (33 taxa)	29	+	6	96	4	6	138	20	691	1	1	2	133	295	1058	2	1010	3508

Table 3. (b) Freshwater bivalves and marine molluscs

Context	**44**	**7**	**9**	**23**	**24**	**27**	**29**	**12**	**13**	**14**	**15**	**26**	**43**	**10**	**11**	**25**	**Total**
Phase	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**4**	**4**	**5**	**5**	**5**	
Sphaerium spp.	+	-	+	+	-	+	-	-	-	4	+	-	+				4
Anodonta ?*cygnea* (Linné)	-	+	+	-	+	-	+	-	-	-	+	-	-				+
Ostrea edulis (L.) frags	-	-	-	-	-	+	-	-	+	+	-	-	-	-	-	-	+
Ostrea valves (upper)	-	-	-	-	3	-	-	2	5	4	26	2	-	-	1	2	45
Ostrea valves (lower)	-	-	-	-	3	-	-	-	2	13	30	-	-	1	-	3	52
Mytilus sp. frags	-	-	-	-	-	+	2	-	-	1	2	-	-	-	-	-	5
Cerastoderma edule	-	-	-	-	-	-	-	2	-	-	3	-	-	-	-	-	5
Buccinum undatum Linné	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Total (6 taxa)	+	+	+	+	6	+	2	4	7	22	61	2	+	1	1	6	112

Table 4. Total bone fragment counts for the hand-collected material.

Taxa	**Phase2**	**Phase 3**	**Phase 4**	**Phase 5**	**Total**
Bos f. domestic cattle	4	8	38	9	59
Ovis f. domestic sheep	-	7	29	67	103
Caprine sheep/goat	-	11	38	79	128
Sus f. domestic pig	-	3	9	4	16
Equus f. domestic horse	-	3	11	5	19
Dama dama (L.) fallow deer dee	1	8	5	-	14
Canis f. domestic dog	1	3	31	8	43
Felis f. domestic cat	-	-	9	1	10
Gallus f. domestic chicken	-	3	2	-	5
Anser sp, goose	-	-	1	-	1
Anas sp. duck	-	1	-	-	1
cf. *Corvus frugilegus* L. ?rook	-	-	1	-	1
cf. *Milvus milvus* (L.) ?red kite	-	-	1	-	1
Gadus morhua L. cod	-	-	1	-	1
Gadidae cod family	-	-	1	-	1
Fish unidentified	-	-	2	-	2
Sub total	***6***	***47***	***179***	***173***	***405***
Large mammals	-	21	102	16	139
Medium mammals	-	4	35	7	46
Carnivore	-	1	16	-	17
Unidentified	-	3	22	6	31
Sub total	***-***	***29***	***175***	***29***	***233***
Total	**6**	**76**	**354**	**202**	**638**

Table 5. Bone fragment count for the bulk-sieved residues. ( ) = number of identifiable scales

Taxa	**Phase 1**	**Phase 2**	**Phase 3**	**Phase 4**	**Total**
Ovis f. domestic sheep	-	-	-	1	1
Caprine sheep/goat	-	1	1	3	5
Dama dama (L.) fallow deer	-	-	2	-	2
Talpa europaea L. mole	-	1	-	-	1
cf. *Mus musculus* (L.) ?house mouse	-	-	1	-	1
cf. *Apodemus sylvaticus* (L.) ?wood mouse	-	-	1	-	1
Clethrionomys glareolus (Schreber) bank vole	-	-	3	-	3
Murine mouse	-	-	2	-	2
Microtine vole	-	-	3	-	3
cf. *Carduelis carduelis* (L.) ?goldfinch	-	-	-	1	1
Anguilla anguilla (L.) eel	1	-	-	-	1
Perca fluviatilis L. perch	-	-(9)	1(1)	-	1(10)
Esox lucius L. pike	-	1(2)	-	-	1(2)
Cyprinidae carp family	-	3	1	1	5
Gadidae cod family	-	-	-	1	1
cf. *Rana temporaria* L. frog	-	-	2	-	2
Amphibian	-	-	2	1	3
Large mammal	-	-	1	-	1
Medium mammal	-	-	2	2	4
Small mammal	-	2	8	3	13
Unidentifiable bird	-	-	-	1	1
Unidentifiable fish	-	1	-	3	4
Unidentifiable	-	-	5	14	19
Total	1	20	36	31	88

Table 6. Representation of cattle skeletal elements

Element	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Total**
Horncore	2	-	1	1	4
Maxilla	-	-	2	2	4
Mandible	-	-	6	3	9
Scapula	-	1	1	-	2
Humerus	1	2	2	1	6
Radius	-	-	6	-	6
Ulna	-	-	2	-	2
Metacarpal	-	-	4	-	4
Pelvis	-	-	3	-	3
Femur	-	2	1	-	3
Tibia	-	-	1	-	1
Fibula	-	-	-	-	-
Calcaneum	1	1	1	1	4
Astragalus	-	-	2	-	2
Metatarsal	-	1	2	-	3
Metapodial	-	-	1	-	1
Phalanx 1	-	-	-	1	1
Phalanx 2	-	-	-	-	-
Phalanx 3	-	-	1	-	1
Atlas	-	-	-	-	-
Axis	-	-	-	-	-
Loose teeth	-	1	1	-	2
TOTAL	**4**	**8**	**37**	**9**	**58**

Table 7. Cattle epiphyseal fusion data (Age categories after O'Connor 1984); (d=distal, p=proximal)

Age category	**Element**	**Phase 4**		**Phase 5**	
		Fused	**Unfused**	**Fused**	**Unfused**
Early	Humerus-d	1	-	1	-
	Radius-p	2	2	-	-
	Phalanx 1-p	-	-	-	1
	Phalanx 2-p	-	-	-	-
Intermediate	Metapodial-d	4	-	-	-
	Tibia-d	1	-	-	-
	Calcaneum-p	-	1	1	-
Late	Humerus-p	1	-	-	-
	Radius-d	1	2	-	-
	Ulna-p	-	2	-	-
	Femur-p	-	-	-	-
	Femur-d	-	1	-	-
	Tibia-p	-	-	-	-

Table 8. Representation of sheep skeletal elements

Element	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Total**
Horncore	-	-	3	-	3
Maxilla	-	-	4	-	4
Mandible	-	4	6	4	14
Scapula	-	2	10	2	14
Humerus	-	1	8	-	9
Radius	-	2	13	3	18
Ulna	-	1	2	-	3
Metacarpal	-	3	7	69	79
Pelvis	-	3	2	-	5
Femur	-	-	-	-	-
Tibia	-	-	3	1	4
Fibula	-	-	-	-	-
Calcaneum	-	-	-	-	-
Astragalus	-	-	-	-	-
Metatarsal	-	2	8	67	77
Metapodial	-	-	-	-	-
Phalanx 1	-	-	-	-	-
Phalanx 2	-	-	-	-	-
Phalanx 3	-	-	-	-	-
Atlas	-	-	-	-	-
Axis	-	-	1	-	1
Loose teeth	-	-	-	-	-
Total	**-**	**18**	**67**	**146**	**231**

Table 9. Sheep epiphyseal fusion data

Age category	**Element**	**Phase 4**		**Phase 5**	
		Fused	**Unfused**	**Fused**	**Unfused**
Early	Humerus-d	6	-	-	-
	Radius-p	9	-	3	-
Intermediate 1	Phalanx 1-p	-	-	-	-
	Phalanx 2-p	-	-	-	-
	Metacarpal-d	5	1	41	5
Intermediate 2	Tibia-d	2	-	1	-
	Metatarsal-d	6	-	42	9
	Ulna-p	2	-	-	-
	Femur-p	-	-	-	-
	Calcaneum-p	-	-	-	-
Late	Radius-d	7	2	2	-
	Humerus-p	2	-	-	-
	Femur-d	-	1	-	-
	Tibia-p	2	-	-	-

Table 10. Age categories of sheep mandibles (Age range after Payne 1973)

Age range	**Tooth**	**Wear Stage**	**Phase 4**	**Phase 5**
0-2 yrs	DP4			
2 yrs	P4 no M3		1	
> 2 yrs	P4		1	
2-3 yrs	M3	2-4		1
3-5 yrs	M3	5-10	1	1
6-10 yrs	M3	11G	6	2
> 10 yrs	M3	>11G		

Table 11. Summary of sheep/goat measurements

Element	Measurement	Minimum	Maximum	Number	Mean
Humerus	SD	12.3	14.5	3	13.7
Radius	GL	126.7	160.6	10	144.3
Radius	SD	14.0	17.4	12	15.7
Radius	BFp	25.2	29.0	12	27.3
Metacarpal	GL Phase 3	108.0	121.0	3	113.2
Metacarpal	GL Phase 4	106.6	125.0	5	114.6
Metacarpal	GL Phase 5	101.8	142.1	36	115.9
Metacarpal	SD Phase 3	12.3	13.6	3	13.0
Metacarpal	SD Phase 4	11.2	15.3	7	13.0
Metacarpal	SD Phase 5	11.5	16.5	60	13.2
Metacarpal	BFp Phase 3	20.3	22.8	3	21.2
Metacarpal	BFp Phase 4	20.0	24.8	6	21.8
Metacarpal	BFp Phase 5	19.7	25.6	63	22.5
Metacarpal	BFd Phase 3	23.6	24.5	2	24.1
Metacarpal	BFd Phase 4	23.8	25.5	3	24.6
Metacarpal	BFd Phase 5	22.1	27.0	37	24.6
Metatarsal	GL Phase 4	118.4	139.0	5	128.2
Metatarsal	GL Phase 5	112.1	145.0	32	123.2
Metatarsal	SD Phase 4	10.4	11.8	6	11.2
Metatarsal	SD Phase 5	9.3	13.5	66	11.3
Metatarsal	BFp Phase 4	18.6	21.4	6	19.5
Metatarsal	BFp Phase 5	13.3	22.9	59	19.8
Metatarsal	BFd Phase 3	21.1	23.5	2	22.3
Metatarsal	BFd Phase 4	19.7	24.7	7	22.5
Metatarsal	BFd Phase 5	21.2	25.9	34	23.1

Table 12. Estimated withers heights (cms)

Horses

Phase	Height in cm	Height in hands
3	135	13.1
4	135	13.1
5	137	13.2

Dogs

Phase	Minimum	Maximum	Total no.	Mean
3	58	58	1	58.00
4	28	68	16	46.06
5	29	64	3	45.67

Sheep/Goat

Phase	Minimum	Maximum	Total no.	Mean
3	54	61	3	58.00
4	52	64	18	57.39
5	49	69	63	56.25

Table 13. Representation of pig skeletal elements

Element	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Total**
Maxilla	-	-	-	-	-
Mandible	-	1	2	3	6
Scapula	-	-	-	1	1
Humerus	-	-	1	-	1
Radius	-	-	1	-	1
Ulna	-	-	1	-	1
Metacarpal	-	-	-	-	-
Pelvis	-	-	2	-	2
Femur	-	-	-	-	-
Tibia	-	2	2	-	4
Fibula	-	-	-	-	-
Calcaneum	-	-	-	-	-
Astragalus	-	-	-	-	-
Metatarsal	-	-	-	-	-
Metapodial	-	-	-	-	-
Phalanx 1	-	-	-	-	-
Phalanx 2	-	-	-	-	-
Phalanx 3	-	-	-	-	-
Atlas	-	-	-	-	-
Axis	-	-	-	-	-
Loose teeth	-	-	-	-	-
Total	**-**	**3**	**9**	**4**	**16**

Table 14. Representation of horse skeletal elements; ( ) = number of cranium fragments without maxilla.

Element	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Total**
Maxilla	-	1	5	-	6
Mandible	-	-	2	-	2
Scapula	-	-	1	1	2
Humerus	-	-	-	-	-
Radius	-	-	-	1	1
Ulna	-	-	-	-	-
Metacarpal	-	-	-	-	-
Pelvis	-	-	-	1	1
Femur	-	-	-	-	-
Tibia	-	1	2	-	3
Fibula	-	-	-	-	-
Calcaneum	-	-	-	-	-
Astragalus	-	-	-	-	-
Metatarsal	-	-	-	-	-
Metapodial	-	-	-	-	-
Phalanx 1	-	-	-	-	-
Phalanx 2	-	-	-	-	-
Phalanx 3	-	1	-	-	1
Atlas	-	-	-	-	-
Axis	-	-	-	-	-
Loose teeth	-	-	-	2	2
Total	**-**	**3**	**10**	**5**	**18 (1)**

Table 15. Age and sex of horse maxillae and mandibles

Phase	**Element**	**Sex**	**Age**
3	Maxilla	Female	9m - 2y
4	Maxilla	Female	1y4m - 2y
4	Maxilla	Male	4y6m - 11y
4	Maxilla	Male	5 - 11y
4	Maxilla		5 - 11y
4	Mandible	Male	10 - 12y
4	Mandible	Male	12 - 15y

Table 16: Representation of fallow deer skeletal elements

Element	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Total**
Antler	-	-	1	-	1
Maxilla	-	-	-	-	-
Mandible	-	-	-	-	-
Scapula	-	1	-	-	1
Humerus	-	-	-	-	-
Radius	-	-	-	-	-
Ulna	-	-	-	-	-
Metacarpal	-	1	-	-	1
Pelvis	-	1	-	-	1
Femur	-	-	-	-	-
Tibia	-	-	-	-	-
Fibula	-	-	-	-	-
Calcaneum	-	-	-	-	-
Astragalus	-	-	-	-	-
Metatarsal	1	3	-	-	4
Metapodial	-	-	-	-	-
Phalanx 1	-	2	-	-	2
Phalanx 2	-	-	-	-	-
Phalanx 3	-	-	-	-	-
Atlas	-	-	-	-	-
Axis	-	-	1	-	1
Loose teeth	-	-	-	-	-
Cervical vertebra			3		3
Total	**1**	**8**	**5**	**-**	**14**

Table 17: Representation of dog skeletal elements

Element	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Total**
Maxilla	-	-	2	-	2
Mandible	-	1	2	1	4
Scapula	1	1	1	-	3
Humerus	-	-	2	1	3
Radius	-	1	3	2	6
Ulna	-	-	5	-	5
Metacarpal	-	-	1	-	1
Pelvis	-	-	-	1	1
Femur	-	-	5	2	7
Tibia	-	-	3	1	4
Fibula	-	-	2	-	2
Calcaneum	-	-	-	-	-
Astragalus	-	-	-	-	-
Metatarsal	-	-	4	-	4
Metapodial	-	-	-	-	-
Phalanx 1	-	-	-	-	-
Phalanx 2	-	-	-	-	-
Phalanx 3	-	-	-	-	-
Atlas	-	-	1	-	1
Axis	-	-	-	-	-
Loose teeth	-	-	-	-	-
Total	**1**	**3**	**31**	**8**	**43**

Table 18: Repesentation of cat skeletal elements

Element	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Total**
Maxilla	-	-	-	-	-
Mandible	-	-	3	-	3
Scapula	-	-	1	-	1
Humerus	-	-	1	-	1
Radius	-	-	-	-	-
Ulna	-	-	-	-	-
Metacarpal	-	-	-	-	-
Pelvis	-	-	1	-	1
Femur	-	-	2	1	3
Tibia	-	-	1	-	1
Fibula	-	-	-	-	-
Calcaneum	-	-	-	-	-
Astragalus	-	-	-	-	-
Metatarsal	-	-	-	-	-
Metapodial	-	-	-	-	-
Phalanx 1	-	-	-	-	-
Phalanx 2	-	-	-	-	-
Phalanx 3	-	-	-	-	-
Atlas	-	-	-	-	-
Axis	-	-	-	-	-
Loose teeth	-	-	-	-	-
Total	**-**	**-**	**9**	**1**	**10**