## ANIMAL BONES

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(The cross-references denoted '*CQ*' in this paper relate to *Charter Quay, The Spirit of Change*, Wessex Archaeology 2003)

Animal bones were recovered from 51 contexts. Following assessment 34 contexts were selected for detailed analysis in consultation with the excavator. The targeted contexts were chosen as representative of feature types and period, and of sufficient size to offer useful data. Some contexts chosen during assessment were rejected for archaeological reasons.

### Methods

Species identifications were made using the author's modern comparative collections. Ribs and vertebrae of the ungulates (other than axis, atlas, and sacrum) were normally identified only to the level of cattle/horse-sized and sheep/pig-sized. Unidentified shaft and other fragments were similarly divided. Any fragments that could not be assigned even to this level have been recorded as mammalian only. Sheep and goat were separated using the methods of Boessneck (1969) and Payne (1985). Recently broken bones were joined where possible and have been counted as single fragments. Measurements follow von den Driesch (1976) in the main and are in millimetres unless otherwise stated. Withers height calculations of the domestic ungulates are based on factors recommended by von den Driesch and Boessneck (1974). Archive material includes metrical and other data not presented in the text and is kept on paper and digital media.

### General results

The animal bone fragments recovered amounted to 2009 separate bones. The condition of the material is variable but well preserved on the whole and 60% of the bone could be identified to taxon. More than 20 taxa could be identified in the collection: horse, cattle, sheep/goat, pig, roe and fallow deer, rabbit, rat, geese, domestic fowl, duck, pigeon, passerines, thornback ray, eel, cod, ling, whiting, plaice, and frog. Sheep was positively identified but no bones could be attributed to goat. A summary distribution of the taxa recovered from each context is given in Table AB1.

*Medieval pits*

Thirteenth century deposits from five pits offered a small group of 268 bones (see *CQ* p21, Fig. 32). The bones vary in condition, most are well preserved or slightly eroded but occasional fragments are heavily eroded and some are burnt. Pit 674 contained a high proportion of burnt bones, mostly of small undiagnostic fragments. A few bones are also gnawed, giving indirect evidence for dog. Most contexts produced a few bones only, of cattle and sheep together with some pig and fragments of these size classes. The lower fill of 681 is a little different, with 11 bones from the right foreleg of a horse and 66 bones of two or more frogs. Withers height estimates of 1.325 m and 1.345 m can be calculated for two of the horse bones. Sheep remains include skull fragments from both horned and hornless animals, two of which had been split in half to access the brain. The bones of the domestic ungulates are of a

mixture of anatomical elements, but are mainly of butchery and meal waste rather than primary slaughter waste. No anatomical, or species, groups were noted. Available measurements are few but indicate the small animals considered typical of this period. Hunted mammals are represented by one bone of an immature fallow deer. Birds are mainly represented by goose (probably domestic) and fowl. A pair of carpometacarpi (distal bones of the wing) are from a medium sized goose smaller than greylag, the wild ancestor of domestic geese. These bones could be from the white-fronted goose, a winter visitor. Both are cut at the most distal end, to remove the wing tip. Fish remains from the same pit (651) include several from good-sized plaice, and a ling vertebra. Both of these are salt-water fish probably brought in via London.

*Late medieval deposits*

Bones from these contexts number 176. The bones of cattle are more evident in this group, as are bones of fowl. Duck, pigeon (probably domestic), and rat (including gnawing) were identified in the material from the 14th/15th century cellar 2762 (see *CQ* p. 30, Fig 53). The levelling deposit 2112 accounts for many of the cattle remains as it contained a dump of bucrania – that part of the skull which includes the horn cores (see *CQ* p. 31). Two of these exhibited abnormal perforations of the nuchal part of the cranium, as described and illustrated for Roman material at Lincoln (Dobney *et al.* 1996). The origin of these perforations is, as yet, unclear although several suggestions have been made. These include, among others, developmental abnormalities and a pathological response to bearing a yoke across the head. None of the crania and horn core fragments show signs of chopping and the bucrania appear to have been thrown away without removal of the horns. The silt deposit 2132 also contained a cattle group, in this case mainly of foot bones. Skull and foot bones are both waste from slaughter, but they may also indicate the subsequent processing of hides as these parts may be transported to the tannery attached to the skin (Serjeantson 1989; MacGregor 1998).

*15th to 17th century deposits*

Oven deposits 924 and 925 contribute 112 specimens of the 483 in this group. Very few of the bones are charred and it seems probable that much of the material was deposited after the oven went out of use, rather than being contemporary. A large number of fish bones are present and, despite the usual large number of undiagnostic fragments, five species can be identified: plaice, whiting, thornback, eel, and roach (see *CQ* p. 43). This latter is an obligate freshwater species and, therefore, must have been locally caught. The catadromous eel may also have been caught in the river, whereas the other three species are wholly marine and must have been brought to Kingston. Excepting the roach, these species are amongst the most commonly found in medieval and post-medieval deposits. Two other species frequently found, cod and herring, are not present but the sample is rather small. An assortment of other bones is present, mainly of domestic ungulates and including skull and foot bones as well as prime meat bones. A few pig and sheep bones had been gnawed, one by rat the others by dogs.

<u>Dump 3446, 16th century</u>
These 122 bones were recovered from a dump near the revetments, and possibly associated with the Sun Inn (see *CQ* p. 43). The complete deposit was excavated and sieved. All of the

bone material was dark in colour and in good condition. None of the bones show any evidence of gnawing from dogs or rodents. The bones are summarised in Table AB2.

Just four of the bones are of cattle, two scapula fragments and the distal radius of a veal calf, together with a fragment of tibia (shin) from an older animal. This latter had been repeatedly chopped obliquely mid-shaft. The majority of the cattle/horse-sized fragments can be positively identified as cattle vertebrae and ribs, and it is likely that all the fragments in this category are of cattle. Seven of the eight vertebrae had been axially divided using a heavy cleaver or axe. Eight of the eleven rib fragments had also been chopped, in this case obliquely through the rib shaft. This type of butchery can been seen in rib-steaks and crown- or rib-roast. Fragments of shaft are absent; these are often common in assemblages and are thought to indicate marrow extraction and stews. The cattle remains in this (admittedly small) deposit thus represent good quality beef and veal joints. The seven sheep bones include both immature and fully fused specimens. One fragment is of the proximal part of a metacarpus; the remainder are of pelvis and leg bones. Four had been chopped through. The majority of the sheep/pig-sized ribs and vertebrae can also be identified as sheep/goat. As with the cattle many of the sheep vertebrae had been axially divided, and the ribs chopped about halfway along. This could indicate the consumption of chops, both of mutton and lamb as indicated by the fusion state of the bones. Pig is represented by four bones of at least two young individuals. One bone is of a sucking pig of a few weeks old, the others are a little older and one of these had been cut.

Apart from the remains of cattle sheep and pig there are remains from smaller animals. The 14 rabbit bones are from at least two sub-adult animals. None had any visible butchery marks, but this is not unusual as smaller animals can be prepared, cooked, and eaten without leaving marks. Rabbits are unlikely to have been living on the site (other than possibly in hutches), given its urban nature. The fowl bones are all of immature birds, bar one from a laying hen. A bone from the wing of a sparrow-sized bird was also present. No cut marks are present and this may be an incidental find from a bird living in the vicinity rather than from a consumed bird, although this is not entirely ruled out. Fish remains are largely of fin rays and other undiagnostic fragments, but include two cod and one flatfish (probably plaice) vertebrae. One of the cod vertebrae had been chopped laterally, a mark consistent with splitting open the fish for drying, salting, or smoking.

In summary, the animal bones in this discrete deposit are a well-preserved group, probably from a single disposal episode. The recovered bones were not available to dogs or other scavengers, either at table or on disposal, although any bones given to, or taken by, dogs and removed elsewhere will not be evident. The remains are not of slaughter waste, nor of primary butchery but, rather, represent meal remains. Most of the animals were immature and some were very young. Meat of this type is highly suitable for roasting and grilling, and is usually more expensive than other cuts. The remains thus probably indicate high quality meal waste rather than the preparation waste from, for example, pies and stews, where cheaper, tougher, cuts can be used. Beef, veal, mutton, lamb, pork, rabbit, chicken, cod, and plaice were on the menu.

Pit 3452 (16th/17th)

Excavation close to the river revealed several pits tightly packed with horse bones. Pit 3452 was completely excavated for analysis, and a sample was retrieved from the top of pits 3208, 3454, and 3464 (see *CQ* p. 51).

Initially the bones were assessed as being a group of bones from several horse skeletons, possibly similar to an earlier deposit from Eden Walk (Serjeantson *et al.* 1992). Analysis of the ages and number of individuals only was recommended. On close examination the material proved to be even more interesting than was at first supposed and the brief was expanded to examine other aspects of the deposit.

The total number of specimens recovered from this pit is 2566. Due to the close packed nature of the deposit some bones had been fragmented during excavation, these have been reconstructed as far as possible. Loose teeth comprised mainly incisors together with cheek teeth from the maxilla (upper jaw). Most of the skulls, including the maxillae, were heavily fragmented and loose teeth that could not be easily placed in their correct position were assumed to belong to one of these skulls and not counted. The mandibles (lower jaws) were largely intact and the few loose cheek teeth easily replaced. The final total of individually recorded bones is 667.

Individual bones positively identified to horse number 417, in addition there are 151 cattle/horse-sized specimens, many of which are vertebrae and vertebral fragments, of which 130 could be identified as horse with some certainty.

In addition to horse there are bones of cattle, sheep, pig, roe, and fallow. This latter species is represented by parts of a femur and tibia and by a complete metacarpus. The size and colour of the bones suggests that they are unrelated. The roe bones consist of a chopped tibia fragment and a metatarsus; like the fallow metapodial this bone is very dark. Pig is represented by three fragments; of skull, femur and tibia. The 18 sheep/goat bones include five definitely of sheep, some with horns. The bones are a mixture of anatomical elements and, like the other non-horse bones, are mixed in colour and preservation. Some of this group of bones also carry dog-gnawing marks.

Cattle remains are more numerous; 61 positively identified specimens. Several of the cattle/horse-sized fragments may also be of cattle (mainly ribs). A good many of the bones are hard and dark, others are paler and often gnawed. Heavy chop marks are present on 13, a few have knife cuts. The bones are less complete than those of horse, but the size and fit of some bones suggests that at least one complete hind limb is present and has the same preservation as the horse assemblage. Two of the bones offer withers height estimates of 1.312m and 1.199m respectively. This latter is rather small and probably female.

As indicated above the vast majority of the remains are of horse. The bones are largely complete, although many were slightly damaged when attempting to extract them and some were not complete when deposited. The skulls suffered the most damage and none were lifted even nearly complete. All the bones have a ‘clean’ pale appearance and are comparatively light in weight. Some dog gnawing is present but most of the bones are untouched.

A summary of the anatomical distribution of the horse bones is given in Table AB3. Almost all elements are represented to some degree. There is, however, a shortage of some elements and, for one animal at least (see ageing), the complete skeleton is definitely not represented. The MNI (minimum number of individuals) is likely to be an under estimate of the true number of animals. In all there are bones from at least eleven animals. While some elements are clearly associated it is well nigh impossible to assign the bones to the various individuals. How much of the missing bone was in the unexcavated fills of the other pits is impossible to calculate; however it seems likely that certain elements are genuinely under represented. Just one caudal vertebra was recovered, for example; although this is not a large bone other small elements were recovered and there are several for each animal. The tail may not have been still attached to the rest of the spine when the carcasses were transported to the pits. There is some evidence that tails were often removed with the skin (Thomson 1981), horsehair is a useful secondary product, more so than the short tuft from the tails of cattle.

Butchery marks were observed on 47 specimens (Table AB4). Three vertebrae had been chopped across, presumably to divide the spine into more manageable chunks. Other, finer, marks were not observed on vertebrae perhaps in part because these were rather fragmented and also that analysis had concentrated on the limb bones. The other two chop marks are both on femora; in both cases the blade had skimmed the top of the caput, probably when disarticulating the femur from the pelvis. All other marks are from knives, or perhaps light cuts from a cleaver. The majority of the pelves had many small marks, mainly involving the acetabulum and, again, probably made when removing the hind leg. Corresponding marks on femora indicate that at least five animals had been disarticulated in this way. Marks on the major limb bones also appeared to be from disarticulation. Cuts across an axis indicate that the head was separated from the body at this point. Cut marks across the nose, eyes, and foot bones show that some of the horses were skinned before disarticulation. The cuts on the lateral (outer) side of one jaw might also indicate skinning or perhaps removal of the cheek. Long knife cuts either side of a scapula spine indicate that meat had been stripped from at least one animal.

Most of the horse limb bones are measurable and estimates of withers height can be calculated from those that are complete. The five values available from pit 3208 and one from pit 3454 are included in the analysis (Table AB5). In total 67 withers heights could be calculated; the smallest value is 1.243 m and the greatest is 1.503 m, many are around 1.4 m or 14 hands. It is difficult to assign pairs of measurements to any particular animal, indeed for some identical values there may be three bones, all from the same side and therefore different animals.

While the majority of the horse bones are fused, and therefore mature, there are several unfused bones. These are a pair of pelves, a left humerus and part of an articulating hind limb (tibia, metatarsus, calcaneum, and astragalus); all of which may belong to a single animal of about a year to 18 months old. As horses are not usually raised for meat, but have a long working life, the age information gained by study of the epiphysial fusion states and the dental eruption is less useful than for the other domestic ungulates. Estimates of the age of mature horses can be obtained from examining the crown height of the cheek teeth, although even this is rather imprecise for old animals (Levine 1982). Several of the animals represented by the bones, including the immature individual, are not represented by jaws. There are, however, seven jaw pairs that can be used for age estimation. The youngest animal

represented was female and about 10 years old; still comparatively young for horse. Three, all male, would have been about 15-16 years old. One was about 18-19 years and shows some oral pathology; this example could not be sexed as the anterior of the jaw, including the canine area, had been fragmented. Another jaw pair represents a male of over 20 years; one of the mandible pair may have had a root abscess and the P2 on both sides is so far worn that it is reduced to two stumps. The remaining individual must have been very aged; the third molar crown height could barely be measured at about 12 mm, it can be 78 mm in a young horse and is still often around 21 mm in horses of 19 years (Levine 1982, Appendix III).

Pathologies were present in addition to those mentioned above on the mandibles. The major limb pathologies are listed in Table AB6. Most of the listed bones have minor pathologies, probably age related, which would not have interfered with the normal working life of the animal. Trauma is represented by two broken and not yet healed ribs. Animals that fall and break major bones are killed immediately today and this is also likely in the past, other serious damage may not manifest for some time and bone damage would begin to heal. Major problems appear to be restricted to the feet and the spine, and mainly of long standing. Several groups of ankylosed lumbar vertebrae were noted, as well as others where the extra bone growth and lipping had not yet formed a fused bridge to the next vertebra. This type of pathology is quite common in horses, and not just in old animals (Stecher and Goss 1961). The causes are not fully understood but may include overloading. Similar bone growth round thoracic vertebrae may indicate the infective condition known as fistulous withers. At the top of the spine, inflammation can result in a condition known as poll evil (Lawson 1832). This might explain some of the porosities and exostoses found on the occipital and atlas of three individuals. In the foot bones fusion of some, or all, of the peripheral metapodia and tarsi/carpi with the metapodia is often seen in archaeological material, and is common in this collection. A simple fusion which does not involve the articular surfaces of the hock (hind) and ‘knee’ (fore) joint is referred to as spavin and several examples of this are indicated. Although the ankylosis of the joint may cause stiffness and limit movement, the animal would be able do some work. When the fusion results from extra growth of bone in response to infection, where the articular surfaces are damaged, this is best described as infective arthritis (Baker & Brothwell 1980). This condition is likely to cause more severe lameness (see *CQ* Fig. 101). At least two animals were affected in this manner, the worst closely resembling one reported for Market Harborough (Baxter 1993). Three metatarsi had small lumps or swollen areas mid-shaft which might indicate a response to minor damage. The proximal spreading and exostosis of one first phalanx may indicate a mild case of high ringbone. Several have small areas of extra bone growth and some have linear invaginations or ‘cracking’ in the midline of the proximal articulation. One of the third phalanges clearly exhibits sidebone, with ‘wings’ of extra bone growth. Another third phalanx and the matching second phalanx are severely pathologic; the articular surfaces are eburnated and have several areas of necrosis (dead and lost bone). Necrosis also affects the fore edge of the hoof area. This animal must surely have been very lame. Damage to the foot and the resulting infection can be caused by poor shoeing and foot hygiene. Although simple treatments and techniques of management can be effective, in the absence of modern antibiotics some of these conditions would have been incurable. Many of the other bones also had slight porosities, or more pronounced muscle and ligament attachments than modern reference material, perhaps suggesting the remains of animals with a long history of hard work.

Discussion

A scan of the material from the top of the other features revealed similar assemblages; it is highly probable that these pits were all filled at the same time.

The tightly packed nature of the deposit implies that these pits served as the final disposal point for the remains of at least 11 horses. This disposal taking place after they had been processed to a greater or lesser degree, rather than burial of complete or substantial parts of carcasses. There is evidence of both skinning and disarticulation of the horses, with at least some meat removal. The bones are not, however, chopped and split in the usual manner for cattle bones for meat and marrow. Dogs also had some access to the carcasses before disposal in the pit, but the horse bones are little damaged. Other material in the pit is generally dark, heavier, and often eroded and gnawed. This material may have been lying around for some time before being buried along with the horse bones.

Dumps of horse bone have been found at several sites before, indeed a collection was recovered from Eden Walk (Serjeantson *et al.* 1992). In this case, however, the bones are from the late 14th century. Unlike the present collection, pelves were common but the overall number of animals represented is similar (twelve). Again the animals are mature or even aged. The size of the Eden Walk animals is of great interest; the withers heights were calculated using the same factors and are, therefore directly comparable. They range from 1.19m to 1.43m, only two of which were over 1.4m, typical values for medieval material. In contrast the size range from the Charter Quay material is 1.24m to 1.50 with 34 of the 67 values over 1.4m. Similar values for post-medieval animals are recorded for Market Harborough (Baxter 1993), and for Witney Palace, Oxfordshire (Wilson and Edwards). Documentary evidence for Oxford supports this range and indicates that most were around 1.4m (roughly 14 hands). Today anything under 14.2 hands is classified as a pony, but this does not mean that smaller animals cannot carry a heavy person or pack. The majority of medieval horses seem to have been pony-sized; improvements were encouraged by Henry VIIIth's 1537 requirement for landowners to keep mares of 13 hands and over, and an Act of 1541 for stallions to be 15 hands and over (Chivers 1976).

At Jennings yard Windsor, a site also near the river, a group of partial horse carcasses had been dumped in a gully probably dating to the late 14th century (Bourdillon 1993). These bones gave withers heights from 1.269m to 1.455m. They also appeared to have been skinned and accessible to dogs before burial, but were not stripped for meat. Although probably incomplete at burial this did not appear to be from deliberate disarticulation and the remains are less closely packed than those from Charter Quay. In common with the material from Eden Walk, the site also had dumps of cattle horn cores, often an indication of tannery waste.

Horse remains from most medieval and post-medieval sites are consistently of older and/or diseased animals presumably at the end of their useful lives, the animals at Charter Quay are no exception. The bones represent animals in decline or aged, the (single?) young horse appears to have some disease.

Although even old plough oxen would have been more valuable than horse because they could be fattened up for slaughter, horses no longer fit for work through age and/or disease would still provide hide, hair and glue. In addition, although horsemeat was not usually intended for human consumption it could be fed to hounds; the group of 18th century horse

bones from Witney Palace is likely to be the waste from this activity (Wilson and Edwards 1993).

*17th century deposits*

A variety of features offering 415 specimens of 17th century material include 150 fragments from well 302 and 158 fragments from drain 304. The otherwise unremarkable collection from 302 includes a curious group of cattle and horse metapodia. Several of these had been roughly whittled to a point at the proximal end (see *CQ* p. 52). No parallels are known to the author, although unused pinners bones do have some common features.

Oven 926 offered just 25 fragments, mainly of rabbit. None of the bones was burnt, indeed one was stained by proximity to a copper alloy object, and the bones may not be contemporary with use of the oven.

Fills 664 and 665 in the top of pit 662 together offer 82 bones. The cattle bones are mixed in anatomical element and from calves as well as older beasts. A portion of chopped pelvis exhibited eburnation (abnormal wear and polishing) on the acetabulum. This pathology is indicative of arthritis, and probably of an old animal. The fish bones include two vertebrae from a large cod and one from a conger.

**General Discussion/conclusions**

The medieval assemblages are quite different in character to the post-medieval ones. The medieval deposits are rather generalised; a mixture of bone material from domestic activities together with some suggestions of slaughter waste and tannery waste. This mixture is commonly seen in medieval material.

In contrast the material from the post-medieval deposits is mainly composed of discrete dumps of episodic disposal; some domestic such as the dump in 3446 and others almost certainly from industrial activities, such as the horn cores and metapodia from 302 and 304. The horse bone dump is a special deposit and falls somewhere between.

These horses may have been purchased by a knacker or fellmonger from the local horsefair; for selling on the hide to the tanner or whittawyer. A skinner is recorded for the area in the 14th century, and a tannery to the north of the site, adjacent to Kingston Bridge. Cattle horn cores and metapodia may well indicate waste from tanning and ancillary crafts.

Skinning and dismembering horses, and the pits full of decaying bones, are rather odorous processes and probably not welcome in high status areas. Tanning and related industries are often situated near rivers for easy water access and this part of the town may have become a specialist area.

For the medieval period supply of livestock would have been mainly from the local area, but by the post-medieval period trade in livestock was extensive and far-reaching; beef for London was driven from as far away as Scotland to be fattened in East Anglia and the Home Counties (Armitage 1982a; 1982b).

The medieval assemblage from Old Malden is not dissimilar with the domestic ungulates dominant and a few bones of other species; in this case goat, deer, hare and domestic poultry, while negligible amounts of bone were recovered from post-medieval contexts.

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## ANIMAL BONE TABLES

### Table AB1. Summary of animal bone

| Date | Feat. | Unit | Cxt. | horse | cattle | sheep/ goat | pig | roe | fallow | cattle/ horse-size | sheep/ pig-size | mammal | rabbit | rat | fowl | goose | other bird | fish | amphibian | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13th | pit | 651 | 783 | - | 1 | 1 | - | - | - | 1 | 3 | - | - | - | - | 4 | - | 38 | - | **48** |
| | pit | 674 | 672 | - | 1 | 2 | 1 | - | - | 2 | 5 | 21 | - | - | 2 | - | 1 | - | - | **35** |
| | pit | 674 | 673 | - | 3 | 2 | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | **7** |
| | pit | 681 | 679 | - | 5 | 3 | 4 | - | - | 1 | 5 | - | - | - | - | 1 | - | - | - | **19** |
| | pit | 681 | 685 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | **1** |
| | pit | 681 | 698 | 11 | - | 3 | - | - | - | 2 | 2 | - | - | - | - | 4 | - | - | 66 | **88** |
| | pit | 736 | 732 | - | 2 | 4 | - | - | - | - | 5 | - | - | - | - | - | - | - | - | **11** |
| | pit | 736 | 733 | - | 3 | 4 | - | - | - | 4 | - | - | - | - | 1 | - | - | 1 | - | **13** |
| | pit | 736 | 734 | - | 2 | 2 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | **5** |
| | pit | 736 | 735 | - | - | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | **2** |
| | pit | 742 | 740 | - | 2 | 6 | - | - | - | 5 | 9 | 2 | - | - | - | 1 | - | - | - | **25** |
| | pit | 742 | 782 | - | - | - | 1 | - | 1 | 4 | 3 | 2 | - | - | - | 2 | - | 1 | - | **14** |
| | | | **Total** | **11** | **20** | **28** | **6** | **0** | **1** | **22** | **33** | **25** | **0** | **0** | **3** | **12** | **1** | **40** | **66** | **268** |
| | | | ***%*** | ***4.1*** | ***7.5*** | ***10.4*** | ***2.2*** | ***0*** | ***0.4*** | ***8.2*** | ***12.3*** | ***9.3*** | ***0*** | ***0*** | ***1.1*** | ***4.5*** | ***0.4*** | ***14.9*** | ***24.6*** | |
| | *% cattle, sheep, pig* | | | | ***37*** | ***51.9*** | ***11.1*** | | | | | | | | | | | | | 54 |
| 13th/14th | level | | 2118 | 1 | 9 | 8 | 2 | - | - | 18 | 17 | - | - | - | 3 | - | - | 4 | - | **62** |
| | silt | | 2132 | - | 16 | 10 | 5 | - | - | 24 | 5 | - | - | - | 2 | 2 | 1 | 1 | - | **66** |
| | dump | | 2488 | - | 1 | - | 1 | - | - | 3 | - | - | - | - | - | - | - | - | - | **5** |
| 14th | level | | 2112 | - | 14 | 2 | 1 | - | - | 3 | - | - | - | - | 2 | - | - | - | - | **22** |
| 14th/15th | cellar | | 2762 | - | 2 | 1 | 2 | - | - | 1 | 2 | - | - | 1 | 2 | - | 7 | 3 | - | **21** |
| | | | **Total** | **1** | **42** | **21** | **11** | **0** | **0** | **49** | **24** | **0** | **0** | **1** | **9** | **2** | **8** | **8** | **0** | **176** |
| | | | ***%*** | ***0.6*** | ***23.9*** | ***11.9*** | ***6.3*** | ***0*** | ***0*** | ***27.8*** | ***13.6*** | ***0*** | ***0*** | ***0.6*** | ***5.1*** | ***1.1*** | ***4.5*** | ***4.5*** | ***0*** | |
| | *% cattle, sheep, pig* | | | | ***56.8*** | ***28.4*** | ***14.9*** | | | | | | | | | | | | | 74 |
| 15th/16th | oven | | 924 | - | 2 | 5 | 4 | - | - | 2 | 3 | 7 | 1 | - | 1 | - | 12 | 47 | - | **84** |
| | oven | | 925 | - | 3 | 2 | 4 | - | - | 1 | 5 | - | - | - | - | - | 1 | 11 | 1 | **28** |
| | cellar | | 2740 | - | 5 | 2 | 3 | - | - | 4 | 9 | - | - | - | 4 | 4 | - | - | - | **31** |
| | cellar | | 2753 | - | - | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | **3** |
| | cellar | | 2754 | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | **2** |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | cellar | | 2756 | - | - | - | - | - | - | - | 3 | - | - | 1 | 1 | - | - | - | - | **5** |
| | pit | 662 | 663 | - | - | 2 | - | - | - | 1 | 3 | - | - | - | - | 1 | - | - | - | **7** |
| | pit | 662 | 666 | - | 30 | 21 | 16 | - | - | 16 | 5 | - | - | - | 6 | - | 1 | 2 | - | **97** |
| 16th | dump | | 3446 | - | 4 | 7 | 4 | - | - | 19 | 21 | 34 | 14 | - | 6 | - | 2 | 11 | - | **122** |
| | pit | 651 | 816 | - | - | - | - | - | - | 6 | 2 | 10 | 2 | - | - | - | 2 | 6 | - | **28** |
| 16th/17th | oven | | 916 | - | - | 1 | 1 | - | - | 7 | 3 | 61 | - | - | - | - | - | 3 | - | **76** |
| | | | | | | | | | | | | | | | | | | | | |
| | | | **Total** | **0** | **44** | **40** | **32** | **0** | **0** | **58** | **57** | **112** | **17** | **1** | **18** | **5** | **18** | **80** | **1** | **483** |
| | | | ***%*** | ***0*** | ***9.1*** | ***8.3*** | ***6.6*** | ***0*** | ***0*** | ***12*** | ***11.8*** | ***23.2*** | ***3.5*** | ***0.2*** | ***3.7*** | ***1*** | ***3.7*** | ***16.6*** | ***0.2*** | |
| *% cattle, sheep, pig* | | | | | ***37.9*** | ***34.5*** | ***27.6*** | | | | | | | | | | | | | 116 |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16th/17th | pit | 3452 | 3451 | 417 | 61 | 18 | 3 | 2 | 3 | 151 | 12 | - | - | - | - | - | - | - | - | **667** |
| | | | | | | | | | | | | | | | | | | | | |
| | | | **Total** | **417** | **61** | **18** | **3** | **2** | **3** | **151** | **12** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **667** |
| | | | ***%*** | ***62.5*** | ***9.1*** | ***2.7*** | ***0.4*** | ***0.3*** | ***0.4*** | ***22.6*** | ***1.8*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | |
| *% cattle, sheep, pig* | | | | | ***74.4*** | ***22*** | ***3.7*** | | | | | | | | | | | | | 82 |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17th | well | | 302 | 7 | 17 | 19 | - | - | - | 4 | 41 | 34 | 20 | - | 7 | - | 1 | - | - | **150** |
| | drain | | 304 | - | 12 | 12 | 6 | - | - | 20 | 31 | 29 | 2 | - | 18 | 4 | 20 | 4 | - | **158** |
| | oven | | 926 | - | - | - | 2 | - | - | 4 | 1 | - | 10 | - | - | - | 1 | 7 | - | **25** |
| | pit | 662 | 664 | - | 2 | 1 | 2 | - | - | 2 | - | - | - | - | - | - | - | 2 | - | **9** |
| | pit | 662 | 665 | - | 19 | 1 | 3 | - | - | 7 | 12 | 20 | - | - | 2 | - | - | 9 | - | **73** |
| | | | | | | | | | | | | | | | | | | | | |
| | | | **Total** | **7** | **50** | **33** | **13** | **0** | **0** | **37** | **85** | **83** | **32** | **0** | **27** | **4** | **22** | **22** | **0** | **415** |
| | | | ***%*** | ***1.7*** | ***12*** | ***8*** | ***3.1*** | ***0*** | ***0*** | ***8.9*** | ***20.5*** | ***20*** | ***7.7*** | ***0*** | ***6.5*** | ***1*** | ***5.3*** | ***5.3*** | ***0*** | |
| *% cattle, sheep, pig* | | | | | ***52.1*** | ***34.4*** | ***13.5*** | | | | | | | | | | | | | 96 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Grand total** | | **436** | **217** | **140** | **65** | **2** | **4** | **317** | **211** | **220** | **49** | **2** | **57** | **23** | **49** | **150** | **67** | **2009** |
| | *percentage overall* | | ***21.7*** | ***10.8*** | *7* | ***3.2*** | ***0.1*** | ***0.2*** | ***15.8*** | ***10.5*** | ***11*** | ***2.4*** | ***0.1*** | ***2.8*** | ***1.1*** | ***2.4*** | ***7.5*** | ***3.3*** | |
| | *% ecl. horse* | | | ***13.8*** | ***8.9*** | ***4.1*** | ***0.1*** | ***0.3*** | ***20.2*** | ***13.4*** | ***14*** | ***3.1*** | ***0.1*** | ***3.6*** | ***1.5*** | ***3.1*** | ***9.5*** | ***4.3*** | |
| *% cattle, sheep, pig* | | | | ***51.4*** | ***33.2*** | ***15.4*** | | | | | | | | | | | | | 422 |

**Table AB2. Summary of bone from dump 3446, including butchery and gnawing**

| | **cattle** | | **cattle-sized** | | **sheep/goat** | | **pig** | | **sheep/pig-sized** | |
|---|---|---|---|---|---|---|---|---|---|---|
| skull, jaws, teeth | 0 | | 0 | | 0 | | 0 | | 0 | |
| vertebrae | 0 | | 8 | seven axially chopped | 0 | | 0 | | 6 | five axially chopped |
| ribs | 0 | | 11 | eight chopped | 0 | | 0 | | 15 | nine chopped |
| scapula | 2 | calf | 0 | | 0 | | 0 | | 0 | |
| pelvis | 0 | | 0 | | 2 | chopped | 0 | | 0 | |
| humerus | 0 | | 0 | | 0 | | 1 | | 0 | |
| radius | 1 | calf | 0 | | 0 | | 0 | | 0 | |
| ulna | 0 | | 0 | | 1 | | 1 | chopped | 0 | |
| femur | 0 | | 0 | | 2 | one chopped | 0 | | 0 | |
| tibia | 1 | chopped | 0 | | 1 | chopped | 0 | | 0 | |
| fibula | 0 | | 0 | | 0 | | 2 | | 0 | |
| foot bones | 0 | | 0 | | 1 | | 0 | | 0 | |
| shaft fragments | 0 | | 0 | | 19 | | 0 | | 15 | |
| **total** | **4** | | **19** | | **26** | | **4** | | **36** | |
| other bones: | 6 | fowl | | | | | | | | |
| | 1 | passerine | | | | | | | | |
| | 1 | bird fragment | | | | | | | | |
| | 2 | cod, chopped | | | | | | | | |
| | 1 | plaice | | | | | | | | |
| | 8 | fish fragments | | | | | | | | |
| | 14 | rabbit | | **Grand total: 122** | | | | | | |

## Table AB3. Horse: Anatomical distribution

| **Anatomy** | **NISP** | ***NISP %*** | **MNI** |
|---|---|---|---|
| skull | 23 | *4.3* | 6 |
| maxilla | 10 | *1.8* | 5 |
| jaw | 14 | *2.6* | 7 |
| atlas | 4 | *0.7* | 4 |
| axis | 5 | *0.9* | 5 |
| sacrum | 6 | *1.1* | 6 |
| other vertebrae | 30 | *5.5* | - |
| vertebral fragment | 96 | *17.7* | - |
| scapula | 7 | *1.3* | 4 |
| pelvis | 13 | *2.4* | 8 |
| humerus | 19 | *3.5* | 8 |
| radius and ulna | 22 | *4.1* | 11 |
| femur | 22 | *4.1* | 9 |
| tibia | 14 | *2.6* | 9 |
| patella | 2 | *0.4* | 1 |
| astragalus | 12 | *2.2* | 8 |
| calcaneum | 11 | *2.0* | 8 |
| carpal | 37 | *6.8* | - |
| tarsal | 29 | *5.4* | - |
| metacarpus | 14 | *2.6* | 7 |
| metatarsus | 18 | *3.3* | 11 |
| peripheral metapodial | 52 | *9.6* | 7 |
| phalanx 1 | 23 | *4.3* | 6 |
| phalanx 2 | 21 | *3.9* | 6 |
| phalanx 3 | 24 | *4.4* | 6 |
| foot sesamoids | 13 | *2.4* | 3 |
| **total** | **541** | | **11** |

NISP - number of individually recorded specimens that cannot be joined with any other
MNI - minimum number of individuals represented by the bones taking account of side and fusion

## Table AB4. Horse: distribution of butchery marks

| **Anatomy** | **NISP** | **No. with marks** | ***% of marks*** | ***% of bones*** |
|---|---|---|---|---|
| skull | 23 | 7 | *14.9* | *30.4* |
| maxilla | 10 | 0 | *0.0* | *0.0* |
| jaw | 14 | 1 | *2.1* | *7.1* |
| atlas | 4 | 0 | *0.0* | *0.0* |
| axis | 5 | 1 | *2.1* | *20.0* |
| sacrum | 6 | 0 | *0.0* | *0.0* |
| other vertebrae | 30 | 7 | *14.9* | *23.3* |
| vertebral fragment | 96 | 0 | *0.0* | *0.0* |
| scapula | 7 | 2 | *4.3* | *28.6* |
| pelvis | 13 | 11 | *23.4* | *84.6* |
| humerus | 19 | 0 | *0.0* | *0.0* |
| radius and ulna | 22 | 5 | *10.6* | *22.7* |
| femur | 22 | 8 | *17.0* | *36.4* |
| tibia | 14 | 1 | *2.1* | *7.1* |
| patella | 2 | 0 | *0.0* | *0.0* |
| astragalus | 12 | 0 | *0.0* | *0.0* |
| calcaneum | 11 | 0 | *0.0* | *0.0* |
| carpal | 37 | 0 | *0.0* | *0.0* |
| tarsal | 29 | 0 | *0.0* | *0.0* |
| metacarpus | 14 | 1 | *2.1* | *7.1* |
| metatarsus | 18 | 1 | *2.1* | *5.6* |
| peripheral metapodial | 52 | 0 | *0.0* | *0.0* |
| phalanx 1 | 23 | 2 | *4.3* | *8.7* |
| phalanx 2 | 21 | 0 | *0.0* | *0.0* |
| phalanx 3 | 24 | 0 | *0.0* | *0.0* |
| foot sesamoids | 13 | 0 | *0.0* | *0.0* |
| **total** | **541** | **47** | | ***8.7*** |

**Table AB5. Horse withers height estimations (using the factors of Kiesewalter in Driesch and Boesseneck 1974)**

| | | humerus | | radius | | metacarpus | | femur | | tibia | | metatarsus | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cl (mm) | *wht (m)* | Ll (mm) | *wht (m)* | Ll (mm) | *wht (m)* | Gl (mm) | *wht (m)* | Ll (mm) | *wht (m)* | Ll (mm) | *wht (m)* | | |
| pit fill | 3251 | 260 | *1.266* | 308 | *1.337* | 211 | *1.353* | 378 | *1.327* | 285 | *1.243* | 248 | *1.322* | | |
| | | 275 | *1.339* | 310 | *1.345* | 212 | *1.359* | | | 310 | *1.352* | 253 | *1.348* | | |
| | | 275 | *1.339* | 310 | *1.345* | 214 | *1.372* | | | 320 | *1.395* | 255 | *1.359* | | |
| | | 278 | *1.354* | 316 | *1.371* | 218 | *1.397* | | | 325 | *1.417* | 260 | *1.386* | | |
| | | 288 | *1.403* | 316 | *1.371* | 219 | *1.404* | | | 325 | *1.417* | 265 | *1.412* | | |
| | | 288 | *1.403* | 320 | *1.389* | 220 | *1.410* | | | 332 | *1.448* | 266 | *1.418* | | |
| | | 296 | *1.442* | 322 | *1.397* | 222 | *1.423* | | | 335 | *1.461* | 268 | *1.428* | | |
| | | 300 | *1.461* | 322 | *1.397* | 223 | *1.429* | | | 335 | *1.461* | 270 | *1.439* | | |
| | | | | 322 | *1.397* | 224 | *1.436* | | | 340 | *1.482* | 273 | *1.455* | | |
| | | | | 325 | *1.411* | 225 | *1.442* | | | 342 | *1.491* | 277 | *1.476* | | |
| | | | | 326 | *1.415* | 225 | *1.442* | | | | | 280 | *1.492* | | |
| | | | | 335 | *1.454* | 226 | *1.449* | | | | | 282 | *1.503* | | |
| | | | | 336 | *1.458* | 226 | *1.449* | | | | | | | | |
| | | | | 338 | *1.467* | | | | | | | | | | |
| | | | | 345 | *1.497* | | | | | | | | | | |
| pit fill | 3208 | | | 320 | *1.389* | | | | | 335 | **1.461** | 275 | **1.466** | | |
| | | | | 310 | *1.345* | | | | | 320 | **1.395** | 280 | **1.492** | | |
| | | | | | | | | | | 330 | **1.439** | | | | |
| | 3454 | | | | | | | | | | | 265 | **1.412** | | |
| **Total** | | | ***8*** | | ***17*** | | ***13*** | | ***1*** | | ***13*** | | ***15*** | **Total** | ***67*** |
| **max weight** | | | ***1.461*** | | ***1.497*** | | ***1.449*** | | ***1.327*** | | ***1.491*** | | ***1.503*** | **max weight** | ***1.503*** |
| **min weight** | | | ***1.266*** | | ***1.337*** | | ***1.353*** | | ***1.327*** | | ***1.243*** | | ***1.322*** | **min weight** | ***1.243*** |
| **mean** | | | ***1.376*** | | ***1.399*** | | ***1.413*** | | ***1.327*** | | ***1.420*** | | ***1.427*** | **mean** | ***1.394*** |

## Table AB6. Pit 3452, horse pathologies (others listed in archive)

| specimen | anatomy | side | abnormality |
|---|---|---|---|
| 928 | femur | right | slight porosity under caput |
| 929 | femur | left | slight porosity under caput |
| 930 | femur | right | slight porosity under caput |
| 931 | femur | right | slight porosity under caput, and round the distal epiphysial junction |
| 932 | femur | left | slight porosity under caput, and indentation at caput epiphysial junction |
| 940 | femur | left | slight porosity under caput, and ridge round the epiphysial junction |
| 942 | femur | left | small bone growths on shaft more noticable than usual |
| 943 | femur | left | small bone growths on shaft more noticable than usual |
| 944 | femur | right | small bone growths on shaft more noticable than usual, and porosity round the distal epiphysial juction |
| 945 | femur | right | small bone growths on shaft more noticable than usual |
| 946 | femur | right | small bone growths on shaft more noticable than usual |
| 947 | femur | right | small bone growths on shaft more noticable than usual, and porosity round the distal epiphysial juction |
| 971 | tibia | right | ridges on shaft rather pronounced |
| 974 | tibia | right | slight exostosis round distal articulation |
| 975 | tibia | right | swollen area and some surface porosity mid-medial-back of shaft, infection? |
| 686 | radius | right | slight porosity and exostosis round distal epiphysial junction |
| 951 | radius | left | slight porosity and exostosis round distal epiphysial junction |
| 952 | radius | left | slight porosity and exostosis round distal epiphysial junction |
| 953 | radius | left | slight porosity and exostosis round distal epiphysial junction |
| 954 | radius | left | slight porosity and exostosis round distal epiphysial junction |
| 956 | radius | right | slight porosity and exostosis round proximal epiphysial junction |
| 960 | radius | right | slight porosity and exostosis round distal epiphysial junction |
| 962 | radius | right | slight porosity and exostosis round proximal epiphysial junction near ulna |
| 963 | radius | right | slight porosity and exostosis round proximal epiphysial junction near ulna |
| 966 | radius | left | proximal slightly spread |
| 1042 | radius | left | slight porosity and exostosis round distal epiphysial junction |
| 908 | metacarpus | left | small bone growths on shaft proximal back |
| 909 | metacarpus | left | medial peripheral metapodial fused on |
| 910 | metacarpus | left | medial peripheral metapodial fused on |
| 911 | metacarpus | left | medial peripheral metapodial fused on |
| 915 | metacarpus | right | medial and lateral peripheral metapodia fused on |
| 916 | metacarpus | right | medial peripheral metapodial fused on |
| 917 | metacarpus | right | slightly pitted distal |
| 1037 | metacarpus | right | medial peripheral metapodial fused on |
| 926 | metatarsus | right | slight porosity and exostosis round distal epiphysial junction |
| 927 | metatarsus | right | slight porosity all over shaft |
| 983 | metatarsus | right | small lump mid front shaft |
| 984 | metatarsus | right | small swelling mid front/medial shaft |
| 985 | metatarsus | right | patchy porosity all over shaft periosteum, unfused distal |
| 1024 | metatarsus | left | gross swelling proximal medial and fusion with tarsals and peripheral metapodia |
| 1025 | metatarsus | right | gross swelling proximal medial and fusion with tarsals and peripheral metapodia, matches calcaneum and astragalus 1026,1027 |
| 1039 | metatarsus | left | two small swelling/lumps mid front/medial shaft |
| 1007 | astragalus | left | slight exostosis distal lateral |
| 1020 | astragalus | right | infected eroded articulation, with tarsal and calcaneum 1019 |
| 1027 | astragalus | right | exostosis and some pathology of articular surface, with metatarsus 1025, calcaneum 1026 |
| 1019 | calcaneum | right | infected eroded articulation, with tarsal and astragalus 1020 |

| | | | |
|---|---|---|---|
| 1026 | calcaneum | right | exostosis and some pathology of articular surface, with metatarsus 1025, astragalus 1027 |
| 855 | phalanx 1 | | small bone growths on shaft, and cracking mid proximal articulation |
| 856 | phalanx 1 | | small bone growths on shaft, and cracking mid proximal articulation |
| 857 | phalanx 1 | | small bone growths on shaft |
| 858 | phalanx 1 | | small bone growths on shaft |
| 859 | phalanx 1 | | small bone growths on shaft |
| 860 | phalanx 1 | | small bone growths on shaft |
| 861 | phalanx 1 | | small bone growths on shaft, and cracking mid proximal articulation |
| 862 | phalanx 1 | | cracking mid proximal articulation |
| 863 | phalanx 1 | | cracking mid proximal articulation |
| 864 | phalanx 1 | | cracking mid proximal articulation |
| 865 | phalanx 1 | | cracking mid proximal articulation |
| 866 | phalanx 1 | | cracking mid proximal articulation |
| 1022 | phalanx 2 | | exostosis on shaft, necrosis and eburnation of distal articulation, with phalanx 3 |
| 1023 | phalanx 3 | | eburnation of proximal articulation, extensive necrosis, with phalanx 2 |
| 849 | phalanx 3 | | slightly spread and 'dished' profile |
| 850 | phalanx 3 | | extra bone growth forming 'wings' at the sides of the proximal articulation |
| 851 | phalanx 3 | | indented side of shaft, healed trauma? |
| | vertebrae | | various - listed in archive and described in text |