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# The Environmental Archaeology of Industry

*Edited by Peter Murphy and Patricia E. J. Wiltshire*



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## 8. Tawyers, tanners, horn trade and the mystery of the missing goat

*Umberto Albarella*

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Skin and horn are raw materials that have been used by most human societies for a very long time. The production of horn objects and leather have been activities that took place on a sufficiently large scale to deserve the definition of "industry". This paper is concerned with the interpretation of animal bones deriving from such industries, in particular in medieval and post-medieval times in England. The problems faced by the zooarchaeologist when dealing with material that may derive from industrial waste are discussed. It is argued that only rarely can animal bones alone provide an understanding of which type of craft or industry was practised in an area. The solution to the problem generally lies in the integration of different lines of evidence. A review of the animal bone data from central England raises a number of questions on how the two practices may have changed towards the end of the medieval period. The role of the goat is discussed in connection with the possibility of a long distance trade of skins and horns.

*Keywords:* Leather working, horn working, medieval, post-medieval England, zooarchaeology.

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### INTRODUCTION

To contemporary men and women living in the western world "animal" and "industry" represent opposite and incongruous concepts. They can hardly be combined in a single mental picture. Animals remind us of wilderness, zoos, farming and pets, whereas the idea of industry is likely to be associated with chimneys, fumes, chemicals and pollution. Industrial activities tend to be regarded as all but dissociated from the animal and, more generally, natural world. This is as good an indication as any of how much our world has changed in the last century or so. In fact, for most of our history, industrial activities relied heavily on the processing of animal products and were therefore closely associated with farming and husbandry (see Clarkson 1966, 26). In the present world, dominated by the production of synthetic materials, it is easy to forget that the most important industries and trades in medieval England were based on the processing of wool and woollen textiles (Clarkson 1966, 25; Farmer 1991; Dyer 1988).

The production of leather – discussed in this paper – could be regarded as "second or third only to the manufacture of woollen cloth as an industrial occupation" (Clarkson 1966, 25) in early modern England, and it was doubtless also of great importance during the Middle Ages (see Cherry 1991). Clarkson (1960–61, 245) regards it as "one of the forgotten occupations in English industrial history". The importance of leather in medieval England is also proved by a survey of animal products traded to London in the period 1290–1315 AD. This shows that "hides" were the animal products most frequently marketed (Murphy and Galloway 1992, Fig. 5), indeed they were more commonly referred to than trade in meat.

In this paper I intend to discuss the question of the identification of leather and horn working activities in the archaeological record – in particular through the use of animal remains – and to review the evidence of such activities for medieval and post-medieval central England. Although horn working must have been widespread during



the Middle Ages, this was not an industrial activity that could be compared in importance to the leather trade. Whereas leather workers are frequently mentioned in medieval and early modern documents, the profession of horner seems to have been rare, and only London and York had officially registered guilds of horners (MacGregor 1991, 373). However, leather and horn working were closely associated activities (MacGregor 1998, 11), whose archaeological evidence cannot always be disentangled. At least on methodological grounds it is therefore necessary to discuss the two trades together.

The fact that this paper deals with the post-Roman period in England does not imply that leather working was not practised before. The question of how old is the use and processing of hides and skins raises the problem of defining what we mean by "leather working". The skins of animals represent a perishable material that will eventually rot if it is not cured. There is little doubt that Palaeolithic people used animal skins for clothing, making objects and possibly building tents. This means that they must have adopted some system, however primitive, to preserve the skins as leather. Blunt-edged concave tools, very similar to metal tools used until recently for scraping away the epidermis and the hairs from the skin, have been found in Palaeolithic sites (Forbes 1957, 4). Complex methods of leather preparation involving oils, mineral and vegetable agents are known to have evolved gradually since prehistoric times. Implements probably used in connection with leather working are known for Neolithic and Bronze Age Europe (Forbes 1957, 13–16). Archaeological evidence of a prehistoric (pre-dynastic) tannery was discovered in Egypt. "Goat skins ready for processing, tools, finished leather and tanning materials of acacia pods" were all found (Forbes 1957, 23). Evidence of leather working is abundant in ancient (dynastic) Egypt, in the form of leather objects and pictorial representations on reliefs and wall paintings in tombs. We also know that tanning was practised in ancient Mesopotamia and Greece. A passage in Homer mentions the preparation of a hide with oils (Waterer 1956, 148–9). Already in early Roman times leather working was a formally organised profession and tanners are mentioned amongst the first guilds (Forbes 1957, 49). This suggests that by then leather working was already regarded as an industry. This may have already been the case in Ancient Egypt and Mesopotamia, whereas it is unlikely that in pre-urban societies the trade was sufficiently centralised and organised to deserve the definition of industrial activity. Therefore, if for "leather working" we simply mean the use and basic processing of animal skins for human use, the practice possibly goes back to the Palaeolithic. If we are instead dealing with leather working as a properly organised industry this is likely to have started evolving with the beginning of urbanisation.

There is abundant archaeological evidence that horn was also a material commonly used since prehistoric times. Since this was never as important an industry as leather working, it is more difficult to track it down in the ancient

sources. Horning could even be an itinerant activity (MacGregor 1989, 117), therefore making this profession more elusive (at least archaeologically) and not necessarily connected to urban centres. However, the fact that in medieval England at least two cities had guilds of horners (see above) means that, although perhaps in a localised way, horning could also be regarded as an industrial activity.

#### THE LEATHER AND HORN TRADES

If we consider the importance of leather, its widespread use, and the length of its history, it is not surprising that its trade was characterised by a large variety of professions involved, materials used and systems adopted. In theory the preparation of leather may look like a simple matter. Animal skins are made of three main layers and the work of the tanner is to get rid of the internal and external (hairy) layers, and to preserve the middle portion (*derma*). In practice, there are many different ways to achieve this result.

A full account of how the leather trade was organized in medieval and early modern England is provided by several sources and it would be redundant to repeat it here. However, in order to analyse critically the archaeological evidence, the basic stages and types of leather preparation, as known from archaeological and particularly historical sources, are briefly described in Table 9.

The processes described above represent generalisations, and variations certainly occurred. Practices changed over time and differences between different areas of the country are also known. The evidence is mainly based on 16th and 17th century sources and, although it seems that the essential processes were inherited from medieval times, the possibility that in earlier times things may have been done in a slightly different way has to be considered.

The process called "tanning", strictly speaking, only applies to the use of tannin from vegetable products (in England, mainly oak bark), which is described in the left column of the table. However, tawing, which is typical of the light leather trade, is also occasionally called "mineral tanning" and the word "tanning" is sometimes loosely used to include all aspects of the leather processing. In addition to the two main processes described above, oil tanning or "chamoising" probably also deserves a mention. This was sometimes adopted to process the skins of animals such as sheep, deer, seal and calf (Waterer 1956, 155; Thomson 1981, 173).

The heavy leather trade was a much more controlled and regulated activity than the light leather trade. The separation of the various professional figures involved in the trade was quite rigid for the former, but the activities of the whittawyer, the fellmonger and the glover could from time to time be carried out by the same craftsman (Thomson 1981, 171).



Table 9. Basic stages and types of leather preparation, as known from archaeological and particularly historical sources. The information is mainly based on the evidence provided in Thomson (1981), though the works of Waterer (1956), Forbes (1957), Clarkson (1960-1 and 1966), Serjeantson (1989), Basing (1990), Cherry (1991) and Shaw (1996) have also been taken into account.

**CATTLE HIDES  
(HEAVY LEATHER TRADE)**

**Butcher:** sells hide to the tanner, generally with horns and hooves still attached. Sometimes the horns are cut off and sold to the horner by the butcher himself. The hide may be treated with salt as an interim preservative.

**Tanner (washing and liming):** trims off bones and horns, washes the hide; immerses hides in lime pits (alkaline solution) to ease the removal of external and internal layers; extracts hide and scrapes the surface fat and hair.

**Tanner (drenching):** soaks hides in an acidic liquor made of rye, barley or ash bark (and/or urine) for further cleaning and removal of excess lime.

OR soaking in an alkaline solution made of dog or other animals' dung and bird droppings.

**Tanner (proper tanning):** immersion in tanning pits filled with a tanning liquor (oak bark) to preserve the hide and to give it a uniform colour; hides moved to other water-filled pits where they are laid with several layers of ground oak bark; after several months (at least 9) the hides are dried and sold to the currier or the shoemaker

**Currier:** converts the hard leather produced by the tanner into a more uniform and softer material through various operations some implying mild tanning.

**Shoemaker or other leather worker:** converts the leather into a finished product.

**SHEEP, PIG, HORSE, DEER, DOG  
AND OTHER SKINS  
(LIGHT LEATHER TRADE)**

**Butcher:** sells hide to the whittawyer (medieval) or the fellmonger (post-medieval), generally with horns and hooves still attached. Sometimes the horns are cut off and sold to the horner by the butcher himself.

**Fellmonger (post-medieval):** takes the skin from the farmer or butcher, removes wool (if sheepskin), preserves skin in salt and sells it to the whittawyer

**Whittawyer (phase 1):** acquires skin from butcher, fellmonger or (unlike the tanner) from casualty animals. Skins are limed, unhaired and washed and then usually trampled in a barrel (or tub) together with a mixture of materials including alum and oil.

**Whittawyer (phase 2):** the leather is then softened and dried and eventually sold (generally to the glover).

**Glover or other leather worker:** converts the leather into a finished product.



Horn is a keratinous material that covers the bony horncores of all bovids (i.e. animals like cattle, sheep, goat, antelopes but *not* deer). It is a plastic material very suitable for the manufacturing of objects. The first job of the horner was generally the separation of the horn from the horncore. This could be achieved by leaving the horns in the open air and waiting for the bond between the horn and the horncore to rot, so that the horn sheath could eventually simply be pulled off. Alternatively, soaking the horns in water could speed up the process. Horn removal could be facilitated by the use of a knife to loosen the horn sheath around its root (MacGregor 1991, 364). The practice of soaking the horns seems to have been predominant in England, whereas in various parts of the European mainland horns would commonly be pulled off dry (MacGregor 1989, 117). Once the horn had been separated it could be flattened, after being heated dry, and then cut and moulded to make objects. However, the finished product may not have been made by the horner, but by other craftsmen, among whom lantern-makers became predominant from the 17th century onwards (MacGregor 1991, 374). Very thin layers of horn are transparent and can therefore be used as lantern panes.

#### THE ARCHAEOLOGICAL EVIDENCE

Leather and horn are only preserved in the archaeological record in exceptional circumstances, waterlogging being probably the most common of these. Although occasional finds of leather and horn are well known (see for instance Eryvnick *et al.* in this volume) and can provide invaluable information, more often we have to resort to indirect evidence, such as that provided by bones and horncores.

The skinning of an animal often leaves marks on the bones that can easily be detected by the zooarchaeologist. Skinning marks are normally produced by a sharp edged knife and tend to be thin, but clearly recognisable due to their very sharp edges. They are normally located at the extremities of the skeleton, since any other location would damage the pelt or hide. Cut marks located on phalanges, distal metapodials, nasal and orbital bones are almost certainly due to skinning, whereas cuts on proximal metapodials, carpals, tarsals and mandibles may also be associated with butchery, though skinning is in many cases still the more likely explanation. Cuts on frontal bones can be caused during the skinning of the animal but if located close enough to the base of the horncore may also be related to the extraction of the horn (see below). On small animals, such as cats and hares, skinning marks can be found as high on the limbs as at the level of the radius (Figure 14) and tibia and occasionally the humerus. Skinning marks on animal bones are frequently found on sites of all possible periods and areas, which confirms the universal use of hides and pelts for human purposes.

Chop, cut or saw marks at the base of horncores are also commonly found on mammal remains from archaeological



Figure 14. Cut marks on a cat radius from period 6 (late 16th–18th century) at Castle Mall, Norwich.

sites. Although less frequently, skulls with chopped off horncores are also found. Of these only sawn horncores can be taken as unquestionable evidence of the use of the horn sheath. The separation of the horncore from the skull presumably facilitated the extraction of the horn and if carried out with a saw it was unlikely to have been done by a butcher, particularly in pre-modern times. The use of saws in butchery practices is only known as a late post-medieval phenomenon. On some sites we also have evidence of cattle horncores that have been chopped close to the tip (Figure 15). This could be done to facilitate the removal of the horn sheath or because the tip in itself could be used to make objects such as handles or buttons (MacGregor 1989, 117). Horncores that have been chopped off also imply the possibility that the horn was extracted and used, but this cannot be proved, as the horncores may have been chopped off to be kept within the skin and eventually discarded by the tawyer or tanner at a later stage. Cut marks at the base of horncores may have been caused by the use of a knife to facilitate the extraction of the horn, but may alternatively be due to cutting the skin around the horns.

While evidence such as this is very useful in detecting an interest in leather and horn as working materials, if found on isolated specimens it tells us nothing about the





Figure 15. Cattle horncore sawn near the tip from period 6 (late 16th–18th century) at Castle Mall, Norwich.

existence of specialised workshops or the practice of leather and horn working as an industrial activity. To detect such features we have to turn our attention to specific deposits of animal bones, which are characterised by the fact that they derive from only one or two species, have a strong bias towards certain parts of the body – such as limb extremities and horncores – and may have evidence of cut or chop marks carried out in a regular and consistent way. When encountered these assemblages can be interpreted as industrial waste. We must then consider however the question of which craft, industry or trade may have been responsible in the accumulation of such assemblages.

#### THE INTERPRETATION OF ANIMAL BONE ASSEMBLAGES AS INDUSTRIAL WASTE

The interpretation of unusual assemblages of animal bones as deriving from tanning or other leather working activities relies on the assumption that once a carcass had been skinned, the extremities of the skeleton were left within the skin. We have documentary, pictorial, ethnographic

and archaeological evidence that support this assumption. Schmid (1972, 45), Thomson (1981, 162), Cherry (1991, 295) and Shaw (1996, 107) all agree that appendages of the skeleton would be left attached to the skin. Serjeantson (1989, Figs. 5 & 6) and Armitage (1990, 84) refer to pictorial evidence of this practice dating to the 16th (Germany) and 19th century (England). Shaw (1996, 117) describes skins still retaining their horns, which he observed in Moroccan present day tanneries. The best evidence of all is probably that deriving from excavated tanneries that produced deposits of animal bones. This is discussed below.

The question of which bones would have been left attached to the skin is debatable. There must have been a certain degree of variety in this, though horncores, phalanges and tail vertebrae were probably kept on a regular basis. MacGregor (1985, 42) has doubts that metapodials were ever left attached to the skin, but as we will see, the archaeological evidence is at odds with his suggestion. Nevertheless, the bones associated with an early 18th century pit at Walmgate (York) indicate that, in an assemblage interpreted as waste from sheepskin processing, phalanges were much more common than metapodials. This led O'Connor (1984, 36) to conclude that "skins arrived on site with phalanges still attached, but only a minority bore both phalanges and metapodials". "Skull" is mentioned by Shaw (1996, 107) as one of the appendages left with the skin, but this is unlikely to be the whole skull – which is heavy and bulky – and more probably refers to the frontal. The reason why this practice was adopted is discussed by Serjeantson (1989, 139–40), who quotes Schmid's (1974) suggestion that the tanner would establish the age of the animal by analysis of the horns. Serjeantson also suggests that the leather worker might have used the feet as a supply of neat's-foot oil, which would have eventually been utilised to dress the leather. It is also possible that the practice was a consequence of market practices, with the tanner being in charge of the supply of horns to the horner and metapodials to the bone worker.

It is therefore possible that concentrations of bones of the distal limb or of the top of the skull (including horncores) may be related to tanning waste. The interpretation of such assemblages is, however, far from straightforward as a number of different activities may lead to the accumulation of similar bone assemblages.

To get a better understanding of the composition of an animal bone assemblage deriving from leather working, it is worth paying attention to the type of bones found on sites that are unquestionably interpreted as tanneries, on the basis of structural and other evidence. Surprisingly this is a source of information that has been under-used by zooarchaeologists. One of the best and most revealing examples is represented by the site of The Green at Northampton (Shaw 1996). There is structural evidence – mainly in the form of circular and rectangular pits – that in the period spanning the late 15th to the 17th centuries the site was occupied by a tanning complex. Documentary,



soil, chemical and zooarchaeological evidence are all consistent with this interpretation. The study of the animal bones (Harman 1996) revealed a number of bone assemblages from pits that, because of their composition, are most likely to derive from the industrial activities occurring on site. For instance, two pits dated to the 15th–16th century contained numerous sheep metapodials, whereas another pit of the same period was full of cattle horncores, cattle frontal bones (with no evidence of cut marks) and complete bones of mature horses deriving from different parts of the body (Harman 1996, 95–97). One of the pits in the 17th century phase had abundant cattle metapodials and, to a lesser extent, cattle horncores and frontal fragments. Most of the metapodials had chop and cut marks probably produced when they were cut off from the rest of the carcass (Harman 1996, 98).

An oval pit – probably dating to the 16th century – found on a site at St Albans (Hertfordshire), interpreted on the basis of archaeological and documentary information as a tannery, contained oak bark and cattle horncores (Saunders 1977, 10). Recent excavations at a tannery site in Birmingham produced accumulations of cattle horncores, leather fragments and lumps of decomposed bark in pits dated to the late 17th and 18th century (Murray 2000). Structural evidence from the York site of Skeldergate (11th–12th century) is strongly suggestive of a tannery (see Addyman 1984, 11) and accumulations of cattle and goat horncores were found at this site. O'Connor (1984, 28–9) suggests that these are more likely to derive from horn working activities, but, in view of the general archaeological evidence, his suggestion may need to be reconsidered. The deposit of sheep foot bones from probable tanning pits at Walmgate has already been mentioned (see above). Shaw (1996, 111–4) provides a useful review of known post-Roman tanneries in England. This shows that accumulations of horse bones, sheep metapodials, sheep, goat and, particularly commonly, cattle horncores can all represent tanning waste.

Among cases from overseas, remarkable are the 15th to 18th century tanneries found in Bruges (Belgium). These are described by Hillewaert and Eryvynck (1991) and Eryvynck *et al.* (in this volume). Huge numbers of cattle horncores with no evidence of cut marks were found, but no bones from the post-cranial skeleton. Another well known tannery (of late medieval date) is that excavated at 's-Hertogenbosch-Gertru (Netherlands). This produced bones from a greater variety of body parts, but cattle and particularly goat horncores were by far predominant (Prummel 1982, 121). Early medieval goat horncores and foot bones were found in Basel in connection with tanning liquor plants and pieces of leather clothing (Schmid 1973). A group of fifty-nine 15th century pits interpreted as tanning pits at Vác in Hungary were found in association with sheep and goat horncores, deer skull fragments and a lynx skeleton (Bartosiewicz 1995, 73). There are undoubtedly many more sites, but a full review of the European evidence is beyond the scope of this paper.

The animal bone evidence for horn workshops is much scantier. This is not surprising, considering the minor importance that this activity had in comparison with leather working. The only case I am aware of is that of Hornpot Lane in York. This remarkable site provided evidence for 14th century furnaces, a fireplace and a large shallow pit, which was lined with clay and wood and filled with large numbers of cattle and goat horncores (Wenham 1964, 26–7). This was interpreted as a soaking pit, where horns were kept in preparation for their extraction from their bony core. Cram (1982) suggests that pits from the 16th and 17th century excavated at Water Street, Stamford (Lincolnshire), which were filled with cattle horncores, might belong to a horn workshop, too. However, the lack of any other supporting evidence, such as that existing for Hornpot Lane, indicates that his assumption has to be treated with caution. The Water Street site resembles others interpreted as tanneries (see also Mahany 1982, 47 and Shaw 1996, 114).

This brief review of faunal finds from tanneries and horn workshops tries to answer the question of how animal bone assemblages that may derive from industrial activities, but for which we have no structural evidence, could be interpreted. Moreover, the evidence allows us to make a number of other considerations:

- The archaeological findings support and complement the evidence deriving from other sources that animal skins would travel with appendages of the skeleton still attached. This may not always have been the case, but it certainly happened with some regularity.
- Cattle horncores are the bones most commonly and most abundantly found on tannery sites. This confirms the dominant role that cattle hides had in the leather trade.
- The presence of horncores of various animals on tannery sites suggests that horns may either not have been utilised, or that the horner would receive only the outer sheaths from the tanner. When and if the latter occurred, the horn working activity would have become zooarchaeologically invisible (except in cases of waterlogged preservation).
- The occasional presence of cattle bones mixed with bones of other animals indicates that, as also suggested by Shaw (1996, 116–7), the division between the heavy and the light leather trade may not have been as rigid as the documentary evidence seems to imply.
- Whereas in the case of cattle, sheep and goat only bones of either the head or the feet are generally present, elements of all parts of the horse skeleton are found on tannery sites. This means that tanneries would receive cattle hides, sheep and goatskins, but complete horse carcasses. Since horses were not generally consumed, their carcasses would not have been processed by a butcher.

There are several types of animal bone assemblages that



Table 10. Types of animal bone assemblages that we may expect from workshops related to the main professions involved in the leather and horn trades.

	Butcher	Leather worker	Horner
Skull fragments (including teeth) and feet	X		
Horncores, (frontals) and feet	(X)	X	
Feet	X	X	
Horncores	X	X	X

are usually interpreted as signifying specialised activities. Having seen what sort of animal bones are found in connection with leather and horn working, we are now in a better position to evaluate these assemblages in a critical way.

Table 10 shows what kind of assemblages we may expect from workshops related to the main professions involved in the leather and horn trades. A typical assemblage that would have been generated by a butcher is characterised by an abundance of bones of the head and feet, as these are the parts of the body that carry the least amount of meat, often regarded as being of lower quality. These are the assemblages that zooarchaeologists normally define as "primary butchery waste". However, there are parts of the head, such as brain, tongue and cheek muscles, which can be eaten. These could have been traded by the butcher, in which case only the bones of the feet ended up in the primary butchery waste. There is late medieval documentary evidence that butchers may have sold horns, either still attached to the bony core or off it, directly to the horner (Armitage 1990, 84). If the latter procedure were followed the butcher would eventually have the problem of disposing of large amounts of horncores. Accumulations of horncores may therefore have been built up by a butcher. We have seen that deposits of horncores, foot bones or a combination of the two can all represent leather working waste. On the contrary, the horner would have no need to receive any parts of the skeletons, other than the horncores. In fact, as mentioned above, even those may not always have reached the horner's workshop.

The interpretation of these assemblages of animal bones is therefore far from being straightforward, especially in the absence of structural or other archaeological evidence. The only case in which we can quite confidently attribute a deposit to one of the activities associated with the leather trade is when concentrations of foot bones and horncores – with or without the frontal part of the skull – are found in the same context. It is not impossible that such assemblages may have been formed by a butcher, but it is unlikely, as the butcher would have processed the carcasses and the horns in different moments and the rubbish generated by such activities would therefore only rarely end up together in the same context, provided that this is in a primary deposit. These bones can get mixed up as a

consequence of re-deposition, but such contexts will normally contain a variety of remains deriving from different activities and will not be possible to associate them with a particular craft in the first place.

We have seen that some pits found on tannery sites do contain combinations of horncores, metapodials and phalanges, but such deposits are otherwise rare. An accumulation of sheep phalanges, metapodials and horncores was found in a late medieval pit at the site of Castle Mall (Norwich) (Figure 16). All horncores had been chopped at the base and many of the metapodials bore skinning marks. The assemblage was interpreted as deriving from a whittawyer (Albarella *et al.* 1997). If fellmongers were already active in the 15th–early 16th century they could have also been responsible for it. Another interesting assemblage is represented by a large group of calf foot bones found in an 18th century pit at Kingston upon Thames (London) (Serjeantson *et al.* 1986). The absence of a water supply in the vicinity and of historical evidence of the presence of a tannery in the area, led the authors to suggest that a middle man, such as a fellmonger, could have "removed the feet before passing the skins on to the tanner" (Serjeantson *et al.* 1986, 232).

#### THE EVIDENCE FOR CENTRAL ENGLAND

In this section I will review the zooarchaeological evidence for leather and horn working activities in central England. The area under consideration includes East Anglia, the East Midlands and the West Midlands, up to the Welsh border. I have taken into consideration 275 animal bone assemblages of post-Roman date. The actual number of sites is lower than that because one site may have provided several bone assemblages of different dates, and these are included individually in the count. For this reason the expression "period/site" rather than "site" will be used. Out of the total considered a mere twenty-one period/sites have assemblages that have been interpreted as horn or leather working waste. These are listed in Appendix 1. Appendix 2 gives the characteristics of these bone assemblages. Some of the period/sites have provided evidence for the industrial use of more than one species, for instance at Midland Road (Bedford) there are accumulations of horncores of cattle, sheep and goat (Grant 1979a). This list is not fully comprehensive, but a substantial proportion of the sites in the region is likely to be included.

The results of this survey are presented in a diagrammatic form in Figures 18 to 22. The period under consideration has crudely been divided into "Saxon to mid medieval" and "late medieval to post-medieval". An analysis of these bar charts suggests the following:

- The actual number of sites that have provided evidence that *may* signify leather or horn working is small. Therefore, even though the total number of period/sites taken into account is quite large, any





Figure 16. Accumulation of sheep horncores, metapodials and phalanges from period 5 (mid/late 14th to mid 16th century) at Castle Mall, Norwich.

conclusions that can be drawn from the analysis of such a small sample have to be tentative.

- No sites of early or mid Saxon date have provided bone evidence that can be associated with industrial activities. However, the total number of animal bone assemblages known from this period is much lower than for any of the later periods.
- Most of the accumulations of horncores belong to the earlier period, whereas assemblages interpreted as tanning waste are mainly of late medieval or post-medieval date (Figure 18).
- The increase in the number of tanning waste sites is not matched by an equivalent increase of sites with evidence of skinning marks on the bones. On the contrary, the decline in the frequency of horn-waste assemblages goes hand in hand with a reduction in the frequency of evidence of horn working (chop and cut marks on horncores) (Figure 19).
- All sites that have provided possible evidence of industrial waste are located in towns. The few castles and industrial sites are also located in urban areas (Figure 20). Most of the evidence comes from the towns of Bedford, Warwick, Norwich, Northampton, Leicester, Lincoln and Hertford.
- Evidence of skinning is found with greater frequency on bones of non-food animals such as cats (Figure 17) and horse, than on cattle and sheep. Evidence for horn working is found with almost equal frequency in goat, sheep and cattle (Figure 21).
- Similar proportions of cattle and sheep assemblages have a predominance of bones from the extremities of the body, but no such assemblages have been

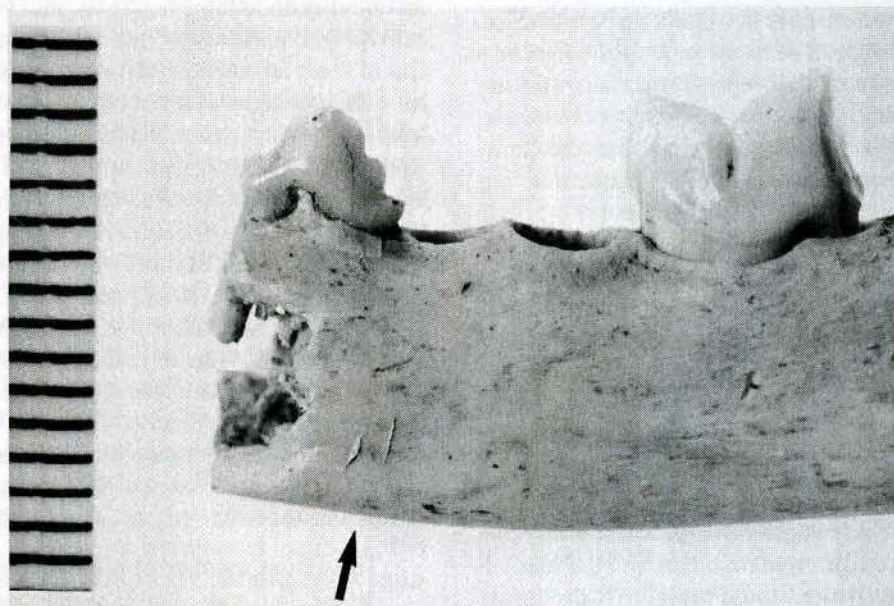


Figure 17. Cut marks on a cat mandible from period 4 (late 12th to mid 14th century) at Castle Mall, Norwich.



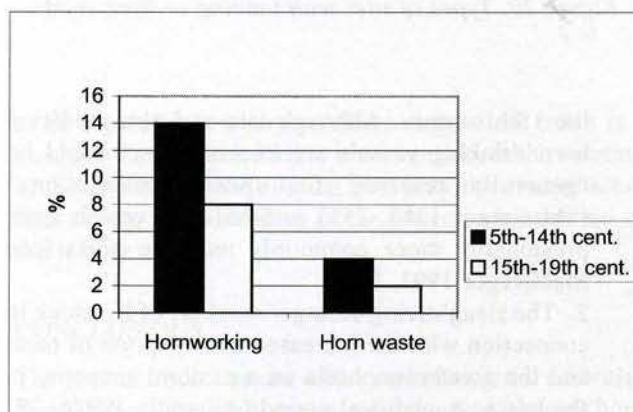
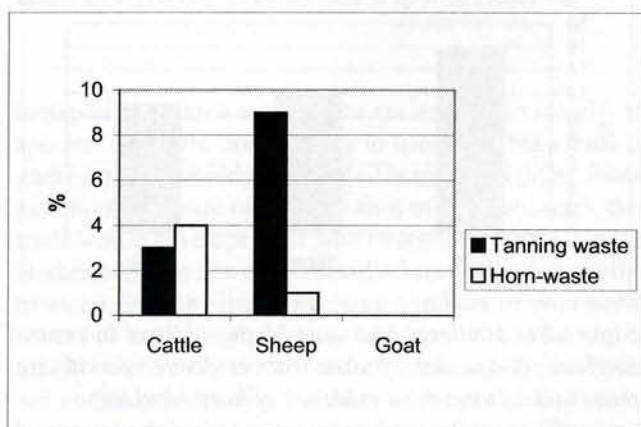
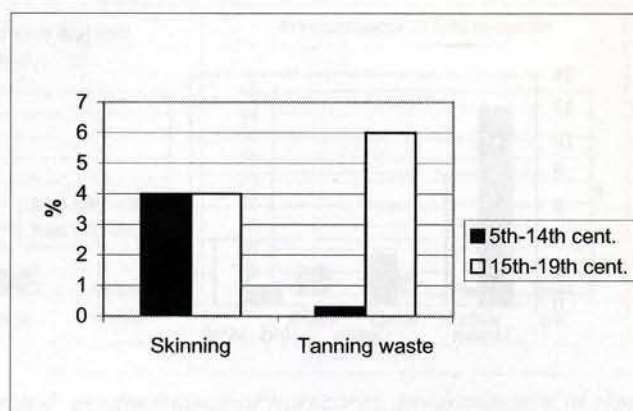
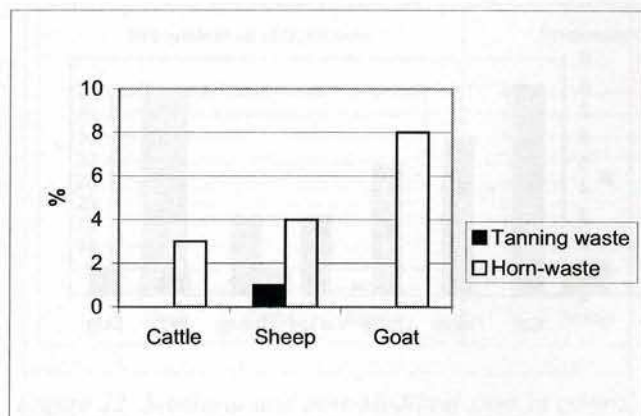


Figure 18. Frequency of tanning and horn-waste for different species in central England: 5th–14th centuries (top) and 15th–19th centuries (bottom).

Figure 19. Frequency of animal bone assemblages with evidence of skinning or tanning waste in central England (cattle and sheep); frequency of animal bone assemblages with evidence of horn-working or horn-waste in central England (cattle, sheep and goat).

recorded for the goat. On the contrary, the proportion of assemblages with goat bones in which horncores predominate is far greater than for cattle or sheep (Figure 22).

These observations may lead to a number of working hypotheses, which it is hoped will be tested against a larger sample of sites.

- The unchanged proportion of assemblages bearing skinning marks seems to suggest that the intensity of the exploitation of animal hides and skins was similar in medieval and post-medieval times in central England. However, the fact that most “tanning waste” sites are concentrated in the later period may suggest that towards the end of the Middle Ages the leather trade was becoming more and more an industrial activity organised on medium to large scale. This would have led to the formation of large accumulations of bone waste, which are more likely to be found by archaeologists. More commonly than in the later period, in medieval times unspecialised workers may have processed skins using small-scale facilities.

These would have left less substantial bone assemblages, which are more likely to have been overlooked in the archaeological record.

- The evidence points to fact that the exploitation of horn may have declined in the later period. We have seen that accumulations of horncores can also derive from tanneries. Thus their reduction in numbers may also indicate that the practice of leaving the horns in the skin may have been in decline. However, the fact that there is also a reduction in the frequency of assemblages with chopped or cut horncores suggests that the former is a more likely explanation. This phenomenon may be due to any – or more likely to a combination – of the following reasons:
  1. Objects originally made in horn were replaced by others made with alternative materials. We have seen that by the 17th century horn was almost exclusively used to make lantern panes. Wenham (1964, 30) mentions a decline of the horn craft in York in the 16th century, though there was apparently a revival in



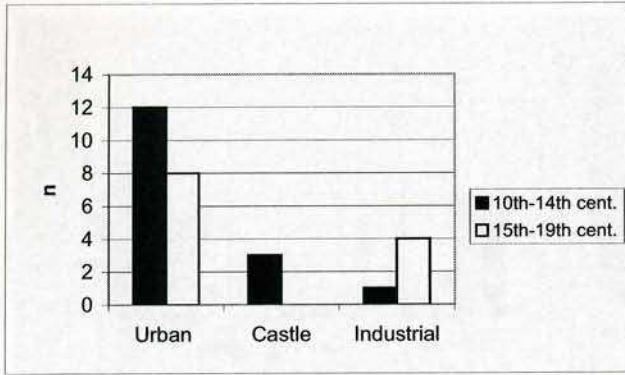


Figure 20. Types of sites with tanning or horn waste.

the 18th century. Although late and post-medieval horn drinking vessels are known, these would be “generally reserved for special celebrations” (MacGregor 1985, 152), and ordinary vessels were presumably more commonly made in glass (see MacGregor 1991, 374).

2. The slaughtering of larger numbers of livestock in connection with the increased consumption of meat and the greater emphasis on a pastoral economy in the late/post medieval period (Albarella 1997a, 28) may have caused the creation of a *surplus* in the supply of horn. A less intensive use of the horns would therefore be expected. It is interesting in this respect to notice that in both post-medieval tanneries at Northampton and Bruges cut marks were not observed on any of the cattle horncores (see above).

3. Hornless breeds of cattle and sheep became increasingly common in the modern period.

- Leather and horn working were predominantly – if not exclusively – urban activities. This is consistent with the documentary evidence (see Cherry 1991, 301). There are some known cases of the practice of the leather craft in the countryside (Clarkson 1966, 38; Kowaleski 1995, 301–2; MacGregor 1998, 23), but these have hitherto not been found in the archaeological record. Considering the fact that tannery was a disagreeable activity that would generate water pollution and unpleasant smells it may be surprising that its practice was located in the middle of an urban centre. However, many animals would be brought to urban markets “on the hoof”, and it would therefore make sense to have tanneries located in the proximity of such a large supply of hides and skins. In some respect the hide trade could be regarded as a “by-product of urban meat consumption” (Kowaleski 1995, 303).
- The high frequency of cat bones with cut marks reminds us of the fact that, although leather deriving from cattle hides was probably the most important product, the skins of smaller animals were also prized.

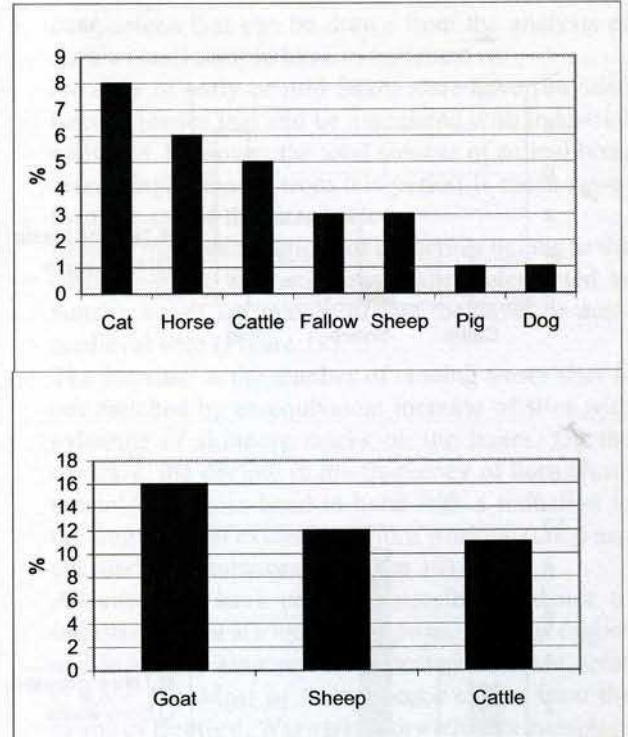


Figure 21. Medieval and post-Medieval sites in central England: frequency of sites with evidence of skinning; frequency of sites with evidence of horn-working.

Some of these would be more valuable with the fur on (“pelts”) and would be dealt with by the “skinner” or “furrier” (Serjeantson 1989, 129).

#### MISSING GOATS

The anomaly of the large predominance of horncores in goat assemblages and the simultaneous complete absence of accumulation of goat foot bones (Figures 18 and 22) represents one of the most intriguing aspects of the zoo-archaeological evidence for the English medieval period and merits some brief discussion.

Of the 275 period/sites under consideration only 27% had stated evidence of the presence of the goat, and in most cases with only a few specimens. The problem of the under-representation of the goat in the archaeological record in comparison with the data from historical documents has been discussed elsewhere (Albarella 1999, 873–4). As we have seen, the most puzzling piece of evidence regarding the goat is the fact that this under-representation applies to all anatomical elements except horncores. The latter can be found in large numbers and sometimes are even more common than sheep horncores. The fact that horncores are more easily distinguished between sheep and goat than any other bones suggests that this over-representation of goat horncores may be due to an identification bias. However, this would not explain the dearth of



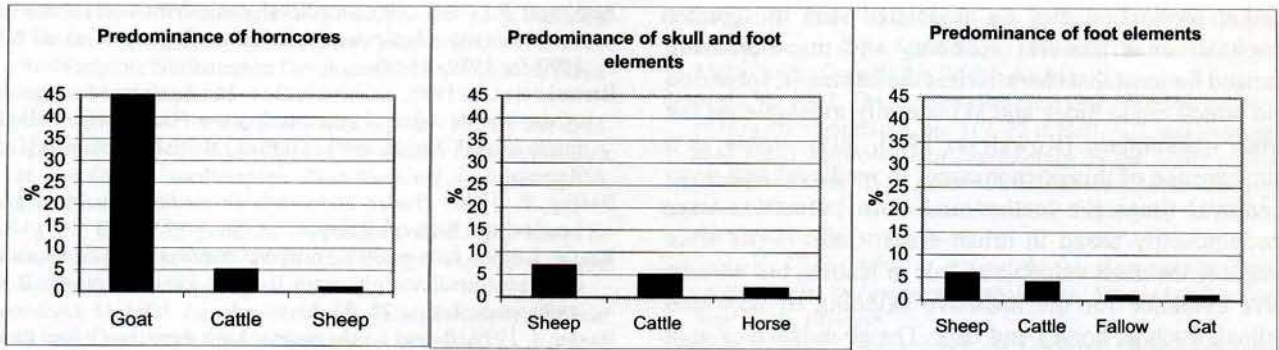


Figure 22. Medieval and post-Medieval sites in central England: predominance of horncores; predominance of skull and foot elements; predominance of foot elements.

metapodials, which are the next easiest bone to identify to species. It is therefore tempting to speculate that a trade in goat horncores could have existed in medieval times. Since goat bones are rare on English sites of different sorts, this trade would have operated with overseas countries. In the Netherlands the site of Dorestad offers a situation similar to many English sites, with large numbers of goat horncores but hardly any post-cranial bones. Yet at the above mentioned tannery site of 's-Hertogenbosch-Gertru there are not only horncores but also many goat post-cranial bones, which in fact outnumber those of sheep (Prummel 1982, 122). This situation is unknown for English sites.

If horncores had been traded in view of the use of the horn as working material, we should wonder why a horn trade is hardly ever mentioned in the documents. The various historians I have interrogated on the subject could not come up with a single reference to such a trade. It is therefore more likely that the horncores may have been imported with their skins. The trade in hides and skins is well known for the medieval period. For instance, regions located in the west of England regularly imported skins (mainly sheep and calf) from Ireland (Clarkson 1966, 28), whereas goatskins were imported at the Norwegian site of Gamlebyen, near Oslo (Lie 1988 in Noddle 1994, 120). It is possible that a similar trade took place between England and the European mainland. At the medieval site of Haithabu in northern Germany, goat bones only represented 10% of the total of sheep/goat remains, but up to 40% of the identified leather remains derived from goat (Reichstein and Tiessen 1974 in Noddle 1994, 119).

The assumption that such a trade in goatskins may have existed opens the other question of why goatskins would travel with attached horncores, but no foot bones, as we have seen was commonly the case for sheep. Perhaps, this further anomaly might support the assumption of a long distance trade, in which it would have been desirable to get rid of as much weight and bulk as possible. However, the horncores – often large specimens from males – would have been a valuable source of horn and could not be left behind (see also Noddle 1994, 120). At this stage this has

to be regarded as a very tentative suggestion, but it is a question that is worth further investigation, as the solution of the mystery of the missing goat may throw additional light on our understanding of the general organisation of the leather trade.

## CONCLUSIONS

The leather trade was one of the main industrial activities in medieval and early modern England. Although horn working was not of equal importance, the two trades were connected and it therefore makes sense to investigate them together. The zooarchaeological evidence for these practices can only rarely be easily interpreted. The evidence for the exploitation of skins and hides is normally straightforward, as cut marks located in specific parts of the skeleton are generally diagnostic of skinning. The use of the horn is more difficult to detect, as only saw marks on the horncores can provide unambiguous evidence for its occurrence. Accumulations of horncores and foot bones can be associated with specialised activities, but, in the absence of other evidence, only deposits of foot bones and horncores found together in the same context can confidently be attributed to one of the leather working activities. The existence of horners' workshops cannot be detected exclusively on the basis of the animal bone evidence, as butchers and tanners may also have accumulated horncores. This difficulty in the interpretation of animal bone assemblages of industrial origin emphasises the need for an analysis based on the integration of different sources of evidence. Zooarchaeologists should be wary of interpreting their evidence in isolation and should pay great attention to the general archaeological context. Hall and Kenward (in this volume), in analysing the tanning process from an archaeobotanical and archaeo-entomological point of view, stress a similar point.

A review of the evidence from central England hints at the possibility that leather working became a more centralised activity towards the end of the Middle Ages, whereas the horn trade may have declined. The intensification of



leather production may be associated with the greater emphasis on a pastoral economy and the increasing demand for meat that characterises the late medieval period and which made hides and skins easily available on the urban marketplace (Kowaleski 1990, 307). Partly as a consequence of this phenomenon, in medieval and post-medieval times the leather and horn industries were predominantly based in urban areas. Cattle hides were probably the most valuable source of leather, but we also have evidence for the intensive skinning of non-food animals such as horses and cats. The abundance of goat horncores, accompanied by the scarcity of post-cranial bones of the same species, leads to the suggestion that there may have been an international trade in goatskins and horns.

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#### References

- Addyman, P.V. 1984. The archaeology, pp. 10–11 in O'Connor, T. *Selected groups of bones from Skeldergate and Walmgate* (The Archaeology of York, The Animal Bones 15/1). York: Council for British Archaeology.
- Albarella, U. 1997a. Size, power, wool and veal: zooarchaeological evidence for late medieval innovations, pp. 19–30 in De Boe, G. and Verhaeghe, F. (eds), *Environment and subsistence in medieval Europe* (Papers of the 'Medieval Europe Brugge 1997' Conference Volume 9). Brugge: Institute for the Archaeological Heritage of Flanders.
- Albarella, U. 1997b. *The medieval animal bones excavated in 1996 from Coslany Street, Norwich, Norfolk*. London: Ancient Monuments Laboratory Report New Series 86/97.
- Albarella, U. 1999. 'The mystery of husbandry': medieval animals and the problem of integrating historical and archaeological evidence. *Antiquity* 73 (282), 867–75.
- Albarella, U., Beech, M., and Mulville, J. 1997. *The Saxon, medieval and post-medieval mammal and bird bones excavated 1989–91 from Castle Mall, Norwich, Norfolk*. London: Ancient Monuments Laboratory Report New Series 72/97.
- Armitage, P. 1978. Hertfordshire cattle and London meat markets in the 17th and 18th centuries. *The London Archaeologist* 3(8), 217–23.
- Armitage, P.L. 1990. Post-medieval cattle horn cores from the Greyfriars site, Chichester, West Sussex, England. *Circaea* 7(2) 1990 for 1989, 81–90.
- Bartosiewicz, L. 1995. *Animals in the urban landscape in the wake of the Middle Ages. A case study from Vác, Hungary* (BAR International Series 609). Oxford: British Archaeological Reports.
- Basing, P. 1990. *Trades and crafts in medieval manuscripts*. London: the British Library.
- Baxter, I. 1998. Late medieval tawyers' waste and pig skeletons in early post-medieval pits from Bonners Lane, Leicester, U.K. *Anthropozoologica* 28, 55–63.
- Baxter, I. 1999. *Report on the animal bone from the Oxford Road Watermill (HAT 291), Aylesbury, Buckinghamshire*. Unpublished Report.
- Cherry, J. 1991. Leather, pp. 295–318 in Blair, J. and Ramsay, N. *English medieval industries. Craftsmen, Techniques, Products*. London and Rio Grande: the Hambledon Press.
- Clarke, C.P., Gardiner, M.F. and Huggins, P.J. 1993. Excavations at Church St. Waltham Abbey 1976–87: urban development and prehistoric evidence. *Essex Archaeology and History* 24, 69–113.
- Clarkson, L.A. 1960–61. The organization of the English leather industry in the late sixteenth and seventeenth century. *The Economic History Review*, second series XIII (1,2 & 3), 245–256.
- Clarkson, L.A. 1966. The leather crafts in Tudor and Stuart England. *The Agricultural History Review* XIV part I, 25–39.
- Cram, L. 1982. The pits and horncores, pp. 48–51 in Mahany, C., Burchard, A. and Simpson, G. *Excavations in Stamford Lincolnshire 1963–69*. London: The Society for Medieval Archaeology monograph series.
- Dobney, K., Jaques, D. and Irving, B. Undated. *Of butchers and breeds. Report on vertebrate remains from various sites in the City of Lincoln* (Lincoln Archaeological Studies 5). Lincoln: City of Lincoln Archaeology Unit.
- Dyer, C. 1988. Documentary evidence: problems and enquiries, pp. 149–161 in Astill, G. and Grant, A. *The countryside of medieval England*. Oxford: Blackwell.
- Farmer, D. 1991. Marketing the produce of the countryside, 1200–1500, pp. 324–430 in Miller, E. (ed.) *The Agrarian History of England and Wales. Volume III 1348–1500*. Cambridge: Cambridge University Press.
- Forbes, R.J. 1957. *Studies in Ancient Technology. Volume V*. Leiden: E.J. Brill.
- Grant, A. 1979a. The animal bones, pp. 94–95 in Hassall, J. Midland Road, pp. 79–95 in Baker, D., Baker, E., Hassall, J. and Simco, A. Excavations in Bedford 1967–77. *Bedfordshire Archaeological Journal* 13.
- Grant, A. 1979b. The animal bones, pp. 58–62 in Baker, D and Baker, E. The excavations: Bedford Castle, pp. 7–64 in Baker, D, Baker, E, Hassall, J and Simco, A. Excavations in Bedford 1967–77. *Bedfordshire Archaeological Journal* 13.
- Grant, A. 1979c. The animal bones, pp. 103–107 in Hassall, J. St John's Street, pp. 97–126 in Baker, D., Baker, E., Hassall, J. and Simco, A. Excavations in Bedford 1967–77. *Bedfordshire Archaeological Journal* 13.
- Grant, A. 1983. The animal bones, pp. 51–2 in Hassall, J. Excavations in Bedford 1977–1978. *Bedfordshire Archaeology* 16, 37–64.
- Hall, A.R. and Tomlinson, P. 1996. *User guide to the Environmental Archaeology Bibliography (EAB)*. London: Ancient Monuments Laboratory Report New Series 6/96.
- Hamilton, J. 1992. Animal bone, pp. 30–1 and Fiche in Cracknell, S and Bishop, M.W. Excavations at 23–33 Brook Street, Warwick, 1973. *Birmingham Warwickshire Archaeological Society* 97, 1–40 and Fiche.



- Harman, M. 1979. The mammalian bones, pp. 328–32 in Williams, J.H. *St Peter's Street Northampton, excavations 1973–1976*. Northampton: Northampton Development Corporation Archaeological Monographs 2.
- Harman, M. 1996. The mammal bones, pp. 89–102 in Shaw, M. The excavation of a late 15th- to 17th-century tanning complex at The Green, Northampton. *Post-Medieval Archaeology* 30, 63–127.
- Hillewaert, B. and Ervynck, A. 1991. Leerlooierskuipen Langs de Eekhoutstraat, pp. 109–23 in *Stad Brugge Stedelijke Musea Jaarboek 1989–90*. Bruges.
- Kowaleski, M. 1995. *Local markets and regional trade in medieval Exeter*. Cambridge: Cambridge University Press.
- MacGregor, A. 1985. *Bone, Antler, Ivory and Horn. The technology of skeletal material since the Roman period*. London: Croom Helm.
- MacGregor, A. 1989. Bone, antler and horn industries in the urban context, pp. 107–128 in Serjeantson, D. and Waldron, T. (eds) *Diet and crafts in town. The evidence of animal remains from the Roman to the Post-Medieval period* (BAR British Series 199). Oxford: British Archaeological Reports.
- MacGregor, A. 1991. Antler, bone and horn, pp. 355–88 in Blair, J. and Ramsay, N. *English medieval industries. Craftsmen, Techniques, Products*. London and Rio Grande: the Hambledon Press.
- MacGregor, A. 1998. Hides, horns and bones: animals and interdependent industries in the early urban context, pp. 11–26 in Cameron E. (ed.) *Leather and fur. Aspects of early medieval trade and technology*. London: Archetype.
- Mahany, C. 1982. Two urban sites and a Saxo-Norman pottery kiln, pp. 13–104 in Mahany, C., Burchard, A. and Simpson, G. *Excavations in Stamford Lincolnshire 1963–69*. London: The Society for Medieval Archaeology monograph series.
- Murphy, M. and Galloway, J. 1992. Marketing animals and animal products in London's hinterland circa 1300. *Anthropozoologica* 16, 93–100.
- Murray, E. 2000. *The Custard Factory, Digbeth, Birmingham*. Assessment of the animal bone. Unpublished report.
- Noddle, B. 1994. The under-rated goat, pp. 117–128 in Hall A.R. and Kenward H.K. (eds) *Urban-rural connexions: perspectives from environmental archaeology*. Oxford: Oxbow.
- O'Connor, T. 1984. *Selected groups of bones from Skeldergate and Walmgate* (The Archaeology of York, The Animal Bones 15/1). York: Council for British Archaeology.
- Prummel, W. 1982. The archaeozoological study of urban medieval sites in the Netherlands, pp. 117–22 in Hall, A.R. and Kenward, H.K. (eds) *Environmental archaeology in the urban context* (Research Report 43). London: Council for British Archaeology.
- Saunders, C. 1977. A sixteenth century tannery in St Albans. *Hertfordshire's Past* 3, 9–12.
- Schmid, E. 1972. *Atlas of animal bones. For prehistorians, archaeologist and quaternary geologists*. Amsterdam-London-New York: Elsevier.
- Schmid, E. 1973. Ziegenhörner als Gerberei-Abfall. *Schweizer Volkskunde* 63 (5/6), 65–6.
- Schmid, E. 1974. Als das Gerben noch ein langwieriges Geschäft war. *Ciba-Geigy-Zeitschrift* 4/1, 8–11
- Scott, S. 1986. *A sixteenth century cattle horn assemblage from the site of St Mary's Guildhall, Lincoln*. London: Ancient Monuments Laboratory Report Old Series 4965.
- Serjeantson, D. 1989. Animal remains and the tanning trade, pp. 129–46 in Serjeantson, D. and Waldron, T. (eds). *Diet and crafts in town. The evidence of animal remains from the Roman to the Post-Medieval period* (BAR British Series 199). Oxford: British Archaeological Reports.
- Serjeantson, D., Waldron, T. and McCracken, S. 1986. Veal and calfskin in eighteenth century Kingston? *The London Archaeologist*, 5 (9), 227–231.
- Shaw, M. with contributions by Denham, V, Harman M., and Evans J. 1996. The excavation of a late 15th- to 17th-century tanning complex at The Green, Northampton. *Post-Medieval Archaeology* 30, 63–127.
- Thomson, R. 1981. Leather manufacture in the post-medieval period with special reference to Northamptonshire. *Post-Medieval Archaeology* 15, 161–175.
- Waterer, J.W. 1956. Leather, pp. 147–90 in Singer, C. and Holmyard, E.J. *History of Technology. Volume II*. Oxford: at the Clarendon Press.
- Wenham, L.P. 1965. Hornpot Lane and the horners of York. *Annual Report of The Council of the Yorkshire Philosophical Society for 1964*, 25–56.



## APPENDIX 1

## LIST OF PERIOD/SITES FROM CENTRAL ENGLAND THAT HAVE PROVIDED ANIMAL BONE ASSEMBLAGES INTERPRETED AS DERIVING FROM LEATHER OR HORN WORKING.

The sites are named in accordance to the terminology adopted for the Environmental Archaeology Bibliography (EAB) (Hall and Tomlinson 1996).

N	SITE	LOCALITY	REFERENCE	PERIOD	TYPE
1	Midland Rd	Bedford	Grant 1979a	10th–13th	Urban
2	Empire Cinema 78	Bedford	Grant 1983	11th–12th	Urban
3	Brook St (25-33) 73	Warwick	Hamilton 1992	11th–12th	Urban
4	Castle Mall AML 72/97	Norwich	Albarella <i>et al.</i> 1997	11th–12th	Castle
5	Empire Cinema 78	Bedford	Grant 1983	11th–12th	Urban
6	St Johns St (29–39) 74	Bedford	Grant 1979b	11th–13th	Urban
7	Bedford Castle 69–73	Bedford	Grant 1979c	12th–13th	Castle
8	Coslany St AML 86/97	Norwich	Albarella 1997b	12th–14th	Urban
9	St Peters St (Nhtn) 73–6	Northampton	Harman 1979	12th–14th	Urban
10	The Green 83	Northampton	Harman 1996	12th–14th	Industrial
11	Church St (Waltham Abbey) 76–87	Waltham Abbey (Essex)	Clarke <i>et al.</i> 1993	14th–16th	Urban
12	St Peters St (Nhtn) 73–6	Northampton	Harman 1979	15th–early16th	Urban
13	Bonnors Ln	Leicester	Baxter 1998	15th–early16th	Urban
14	Castle Mall AML 72/97	Norwich	Albarella <i>et al.</i> 1997	15th–early16th	Urban
15	The Green 83	Northampton	Harman 1996	15th–early16th	Industrial
16	St Marys Guildhall (Linc.) AML 4965	Lincoln	Scott 1986	16th	Urban
17	Lincoln sites (bones)	Lincoln	Dobney <i>et al.</i> Undated	16th	Urban
18	The Green 83	Northampton	Harman 1996	16th–17th	Industrial
19	Oxford Rd Watermill	Aylesbury (Buckinghamshire)	Baxter 1999	17th	Urban
20	Hertford Castle	Hertford	Armitage 1978	17th–18th	Urban
21	The Green 83	Northampton	Harman 1996	18th–19th	Industrial



## APPENDIX 2

DETAILS OF THE ANIMAL BONE ASSEMBLAGES FROM THE PERIOD/SITES LISTED IN APPENDIX 1  
IN THE "INTERPRETATION" COLUMN THE COMMENTS IN BRACKETS ARE BY THE AUTHOR.

N	SPECIES	CHOPPING, CUTTING, SAWING	DISTRIBUTION OF BODY PARTS	INTERPRETATION
1	Cattle	Evidence of chopped and sawn horncores	Predominance of horncores	Horn working waste (due to the mix of species present horn working is probably a more likely explanation than tanning)
1	Goat	Evidence of chopped horncores	Only horncores	Horn working waste (due to the mix of species present horn working is probably a more likely explanation than tanning)
1	Sheep	Evidence of chopped and sawn horncores	Predominance of horncores	Horn working waste (due to the mix of species present horn working is probably a more likely explanation than tanning)
2	Goat	Evidence of chopped horncores	Only horncores (66 complete)	Horn working waste (tawing also possible)
3	Sheep	Horncores chopped off skulls	Predominance of skull elements with horncores chopped off (all from a single pit)	(primary butchery leading to the collection of skins for tanning and/or horns for horn working)
4	Sheep	One context has four skulls with horncores chopped off	Apart from the group of four skulls there is a variety of body parts	Horn working waste (though probably leading to horn working, this should more properly be defined as butchery waste)
5	Sheep		One group mainly represented by horncores	Horn working waste (tawing also possible)
6	Cattle	Evidence of chopped horncores	Predominance of horncores	Horn working waste (due to the mix of species present horn working is probably a more likely explanation than tanning)
6	Goat	Evidence of chopped horncores	Only horncores	Horn working waste (due to the mix of species present horn working is probably a more likely explanation than tanning)
6	Sheep	Evidence of chopped horncores	Predominance of horncores	Horn working waste (due to the mix of species present horn working is probably a more likely explanation than tanning)
7	Cattle	Evidence of chopped horncores	Horncores predominant but other bones also present	Primary butchery or horn working waste
7	Goat	Evidence of chopped horncores	Group of nine large horncores (no other goat bones)	Horn working waste (tawing also possible)
8	Cattle	Evidence of chopped horncores and skinning	Predominance of horncores	Horn working waste (tanning also possible)
8	Goat	Evidence of chopped horncores	Predominance of horncores	Horn working waste (tawing also possible)



## APPENDIX 2. continued

N SPECIES	CHOPPING, CUTTING, SAWING	DISTRIBUTION OF BODY PARTS	INTERPRETATION
9 Cattle	Evidence of chopped horncores	Accumulation of horncores at the bottom of a pit (horse bones at the top)	Horn working waste (this is much more likely to be tanning waste)
10 Sheep	Probable combination of primary butchery waste and refuse from skinning processing; most metapodials broken, either proximal or distal end present; horncores regularly chopped and skulls halved sagittally	Predominance of head and feet but head remains (mainly frontals) by far predominant (MINI is 110 for skulls and 26 for feet)	Horn and tanning waste
11 Sheep		Mainly head and foot elements (all from the same pit)	Interpreted as waste from an industrial process, likely to be sheepskin production. Cut marks are not mentioned.
12 Sheep	Cut marks on carpals and tarsals	Only foot elements (carpals, tarsals, metapodials and phalanges) of immature animals	Slaughtering waste (tanning also possible)
13 Sheep	?skinning cuts mainly on mid-shaft of metapodials, anterior on metacarpals and posterior on metatarsals	Most bones from a special deposit of metapodials, carpals, tarsals and phalanges; most carpals recovered in the sieved assemblage	Waste from a tawyer, fellmonger or glover
14 Sheep	Evidence of chopped horncores and skinning	Only horncores and foot bones	Tawing waste
15 Sheep		Mainly head and foot elements but metapodials by far predominant (75); mostly complete bones	(Tanning waste not mentioned in the text but obvious on the basis of context)
16 Cattle		Only horncores	Horn working waste (tanning also possible)
17 Sheep		Mostly metapodials	Tanning waste
18 Cattle		Concentration of horncores in three different tanning pits; most of these are still attached to the skull and there is no evidence that these were utilised	Tanning waste
18 Sheep		One tanning pit has only metapodials and phalanges, another has skull fragments and metapodials and a third has just one sheep foot	Tanning waste
19 Sheep	Most ?skinning cuts on mid-shaft of metapodials	Concentrated in a number of contexts; predominance of carpals, tarsal, metapodials and phalanges present; few horncores	Tanning waste (since no tanning pits present, primary butchery is also possible, though less likely)
20 Cattle	Evidence of chopped horncores	Only horncores	Horn working waste
21 Cattle	Most metapodials chopped, others have cuts near the proximal end; both activities probably related to the detachment of the metapodials from the carcass	Horncores with skull fragments (not chopped) and large quantities of metapodials (mainly proximal but some distal ends too), all from the same pit	Tanning waste (for this period not supported by structural evidence)