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Building and tanning in the 18th and 19th centuries: an analysis of cattle horncores from Greenwich High Road (London)

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SUMMARY: The assemblage from Greenwich High Road has interesting implications for our understanding of 18th and early 19th century tanneries and also of the use of bones as building material. The study of the age at death of the animals revealed that the horncores are mostly from fully adult individuals, probably culled draught animals. This hypothesis is supported by biometrical analysis. The comparison of the Greenwich horncores with modern data and archaeological evidence suggests that the Greenwich assemblage is predominantly composed of oxen. The horncores were used to line a drain on the site and are likely to represent waste material resulting from the activities that took place in the nearby tannery. Skins and horns were removed for craft purposes while the bony cores, with no economic value, were simply used as cheap and ready material to help the construction of the drain.

INTRODUCTION

The site excavated at Greenwich High Road, situated close to the bank of the River Thames in south-east London, is an important and relatively rare example of an 18th and 19th-century tannery complex. Excavations carried out by Wessex Archaeology in August 2008 unearthed a series of structures characteristic of a tannery site. The remains included a series of large pits associated with the tannery, along with a bony-lined drain on the western edge of the tanning pit area. Horncores (*i.e.* the bony cores within the horns) from these contexts form the basis of the present study. The 18th and 19th century faunal assemblage from Greenwich High Road has the rare potential to

provide valuable information about the kind of animals that were used for leather production as well as the industrial process itself.

BACKGROUND TO THE SITE

The archaeological excavations, commissioned by CgMS Consulting, took place in the area between 43 and 81 Greenwich High Road. Five evaluation trenches were excavated in order to understand the archaeology of the site. While the eastern area was found to be heavily truncated by the recent construction of drainage and footings, the western area contained largely undisturbed archaeological remains dating from the late 18th to the early 19th century. The excavation revealed the presence of tanning pits, thought to have been dug between 1778 and 1830, as well as a drain (5.25m long and up to 0.62m wide), in the north-western part of the site [feature 1006]. This was walled exclusively with the horncores of domesticated cattle. The horncores were laid in a tight row with a north/south alignment, giving it the appearance of a bone wall composed of three layers (Fig. 1). The northern end of the drain was truncated during construction of the extant building[1].

The use of horncores for the construction of features has previously been attested at a few sites[2]. Feature [1006] at Greenwich, with layers of horncores arranged to form a drain, is very similar to the drain discovered at the Forest House estate (Leyton, Essex; late 17th century)[3], while it is different from the drain discovered at Upsdell Avenue N.13[4] (Palmers Green; late 17th-early18th century) where only a single line of horncores was present.

This paper will focus on cattle horncores found in three contexts of the site: the horncore drain [1006] and two fills of a pit that may have been dug for drainage [1047; 1048]. This pit, which has been used to dump horncores, was oval in shape with steep vertical sides and a flat base (Fig. 2), and located in the south-western corner of the excavation. Both fills contained horncores, which, unlike those from the drain, did not appear to be deliberately laid within the pit, though later disturbance cannot be ruled out.

A few other animal bone specimens that were recovered at Greenwich High Road have been reported by Grimm[5] and are not included in the current study. Of this material, it is worth mentioning a sheep/goat metatarsus from [1007] and an equid metacarpus from [114]. While the horncores and metapodia are likely to be associated with the industrial activities of the tannery, other bones (such as various fragments of cattle and sheep/goat bones, and four complete duck heads) are probably the remains of food waste. Fragments of whale bone were also found (from [1003, 1006 and 1048]) suggesting the likelihood of oil extraction or the use of whale blubber at the site.

TANNERIES IN ENGLAND

The processing of hides into leather is known from the archaeological record from the prehistoric period[6]. In Britain, historical and archaeological evidence shows that tanning, however, developed from a craft activity into a fully-fledged industry only in the post-medieval period[7] and, in the 16th and 17th centuries, it was second in importance only to the wool textile industry[8]. The large body of legislation controlling the trade in leather and wool demonstrates their importance to the national economy[9]. There was further growth in the 18th and 19th centuries and, by the end of the 19th century, there had been a transition from relatively small and numerous urban tanneries to a reduced number of larger tanning centres in parallel with technological changes[10].

Several studies of tannery complexes have been undertaken and the form and function of tanning sites is currently relatively well understood[11]. Sites were almost always located close to rivers or streams, due to the need for a constant supply of water[12], and on the edge of settlements, as the smell and waste products that they generated would have been unpleasant for those living nearby. Physical elements of tanning sites have been used to identify them in the archaeological record and one of the most common characteristics is the presence of large tanning pits of rectangular or rounded shape, lined with wood and, from the 16th century onwards, more commonly with stone or brick[13]. Examples from various periods have been excavated, such as at The Green, Northampton[14]

(15th-17th century), St Albans, Hertfordshire[15] (16th century) and Skeldergate[16], York (11th-12th century). Other material, such as the presence of leather working tools[17], remains of plant materials that were used as tanning agents[18], or the presence of a particular beetle species[19] (for instance *Trox scaber*), have been used as an indication that tanning was taking place at a site.

The composition of animal bone assemblages can also provide evidence of leather production. Bones of the feet as well as horncores were frequently left attached to hides and an abundance of these elements is suggestive of leather working activities[20]. Nevertheless, it is important to keep in mind that it is the combination of evidence, rather than merely the faunal assemblage, that helps the interpretation. In fact, deposits of horncores may also be associated with horn-working activities, which were, as suggested by both archaeological and historical records, mainly located in the eastern parishes of London[21].

At Walmgate in York, a series of 18th century tanning pits were excavated and found to contain hundreds of sheep metapodia and phalanges[22] and a similar assemblage was recovered from St. Peters Street, Northampton[23]. An accumulation of sheep phalanges, metapodia and horncores was found in a late medieval pit at the site of Norwich Castle[24]. At The Green in Northampton (15th to 17th century), structural evidence of leather production was found in the form of circular and rectangular pits, some containing sheep metapodia and others filled with cattle horncores and frontal bones[25]. Other accumulations of cattle horncores from 16th-century St. Albans, Hertfordshire[26] and 17th to 18th-century Birmingham[27] were found in association with bark fragments and have been interpreted as suggestive of a tanning industry at the sites. The frequency, location and type of butchery marks on animal bones, such as cut and chopped horncores, can also be indicative of tanning.

A large town where a large population requires a large amount of meat represents the best scenario for the development of a tanning industry. Leather, along with bone and horn, was a by-product of meat production and it represented a valuable raw material which was used for many purposes. One

use of bones, although less popular and well known than bone-working for the production of objects, was its use as a building material. Several examples of this kind of structure have been documented[28]. Examples include a wall underneath an 18th-century cottage in Ware, Hertfordshire, which had been repaired using cattle metapodial bones set in mortar[29]. In north London, agricultural land drains constructed in the late 17th-early 18th century were lined with cattle horncores[30] and other horncore lined land drains dated to the late 17th-early 18th century were discovered at Old Hatfield, Hertfordshire[31]. In the east end of London, two industrial pits had been reinforced with cattle horncores organised in neat rows[32]. At St Mary's Guildhall in Lincoln, horncores and skull fragments appear to have been deliberately laid in horizontal layers during the 16th century[33]. Finally, a Ha-Ha from Shropshire, built between 1797 and 1802 surrounding the garden of an Italianate villa, was supported by an extensive horncore wall[34]. The use of bone as building material was common in the Midlands and south-eastern England in the 17th and 18th century, and, in most cases, was associated with butchery, horn working and tanning[35].

It appears fairly certain, from the features excavated at Greenwich High Road and the evidence of the faunal remains, that the area was the site of industrial activity during the late 18th and early 19th century and that leather working is the most likely activity to have generated horncores as a waste product. The rest of this paper will test this hypothesis further and will also address the issue of the age and sex composition of the cattle herds that were presumably used for the production of leather during that period in London.

METHODS

All contexts at Greenwich High Road were excavated by hand and no sieving or flotation was undertaken. Analysis of the faunal remains was carried out at the Department of Archaeology, University of Sheffield with reference to the collection of skeletal material held there. As the collection from Greenwich High Road consists entirely of horncores the recording protocol adopted reflects this. Specimens were only regarded as 'countable' when at least half of a circumference

section was present. For these specimens, the presence of attached skull was also recorded, along with the side, and the general level of preservation. In addition, the porosity of the horncore at different points along its length was recorded following the method outlined by Armitage[36] with the aim of establishing the approximate age of the specimens. Horncores were separated into six age classes depending on the porosity at different points along the length (Table 1).

Even more than other ageing methods, horncore porosity can provide only a very approximate indication of age[37]. Additional age information was gathered from the state of fusion of the skull sutures, specifically the frontal-parietal suture that runs from the frontal part of the skull to the upper edge of the temporal fossa, immediately below the base of the horncores. The exact age at which cattle skull sutures fuse can be difficult to estimate but the fusion of the frontal-parietal suture is arguably the most useful indicator in archaeological material[38]. The skulls were separated into age classes based on the system outlined by Armitage[39] as shown in Table 2.

The degree of preservation of each horncore was recorded, as well as the presence of butchery marks along with their position on the bone. Finally, the presence of pathologies was also noted. Measurements taken on the horncores were the maximum and minimum diameter of the horncores at the base of the ring of bony nodules and the length of the outer curvature[40].

RESULTS

OVERVIEW OF THE ASSEMBLAGE

The entire assemblage is composed of 120 ‘countable’ horncores (Table 3 and A1).

Of these, 76 specimens had parts of the skull attached, while in the remaining 44 specimens the skull was absent. In addition, a further 571 'non-countable' fragments were recorded (the details of which are in the site archive). The preservation of the assemblage was average. In many cases the horncore surface was crumbly in texture, making it difficult to estimate porosity, record butchery and take measurements. The remains were fragmented and most specimens showed at least some damage. Gnawing marks were completely absent, unsurprisingly for elements that contain little fat and are therefore of limited interest to scavengers. In addition, the horncores may have been incorporated rapidly within the structure, preventing scavengers' access. No evidence of burning was noted.

AGE AT DEATH

The determination of the age at death of the specimens from Greenwich High Road may be useful in establishing the nature of the cattle specimens that were selected for introduction to the site as hides, carcasses or living animals. 95 specimens could be attributed to a specific age category (Fig. 3). No infant cattle were identified but two horncores belong to young animals aged one-two years at death; the majority were, however, fully adult.

According to the analysis of cranial suture fusion, the frequency of juvenile and sub-adult specimens is also very low but young adults are better represented than in the previous method and the proportion of adults and old adults is far more heavily in favour of the former category (Fig. 4).

The difference between the two approaches is probably due to the imprecision of the methods and the inevitable subjectivity in the establishment of the level of porosity of the horncore, as well as its likely variability. Nevertheless, the two methods are consistent in identifying a strong majority of the horncores in the adult range. This is unsurprising because horncores used for construction were more likely to be of the denser, adult type. In addition – and with the exception of specialised

productions such as *vellum* – leather was more likely to derive from adult cattle which would have already fulfilled their role as meat, milk and/or traction providers.

SEX RATIO

As with age at death, the analysis of the sex ratio can help to determine the type of animals (or their hides) that were selected. Cattle horncores are often overlooked as a potential source of sexing data. The reasons for this are many but include the lack of modern comparative material to establish a precise methodology and, also, the subjectivity of the existing methods. An attempt has been made here to sex the horncores from Greenwich High Road. Since a comparison of the basal measurements of cattle horncores has proved useful when investigating archaeological assemblages[41], that approach has been adopted here.

Sex distinction relies on the assertion that male (i.e. bull) and female (i.e. cow) horns differ in shape[42]. In males, the greatest width will tend to be larger than the smallest width, i.e. the horncores tend to be ovoid in shape. The more circular horncores of females[43] should result in maximum and minimum width measurements that are similar. Other factors, such as environment, nutrition, breed and age, can also have an influence on the size and shape of this element[44]. In an assemblage that includes horns from both males and females, when the measurements are plotted together, we would expect to see a group of specimens with a high maximum diameter value and a lower minimum diameter interpretable as males (with an elliptic horncore base diameter) along with a second group with maximum and minimum diameter of a similar size, more likely to be interpreted as females (with a more circular horncore base). No such distinction can be seen in the specimens from Greenwich High Road (Fig. 5).

There is no evident separation into groups based on the basal shape of the horncore. In theory, the female animals should plot along the line marked in the diagram, indicating equal values for

maximum and minimum diameters and therefore a circular shape of the base of the horncore. Some specimens do indeed plot close to the line, but no clustering is detectable. An additional factor that should be taken into account is the potential, and indeed likely, presence of castrates/oxen (i.e. male bovine which has been castrated and used for draft work) in the sample. The horncores from castrated animals usually have morphologically intermediate characteristics[45], and, therefore, may blur the distinction between the two sexes.

It is useful to compare the measurements of the horncores from Greenwich with measurements from a study conducted by Sykes and Symmons[46]. For this study, the authors collected measurements of horncores from a heterogeneous sample of 19th and 20th century cattle of known age, sex and breed. Their data demonstrate that the basal shape of the horncore is in fact, of little use when used for discriminating the sex of the animals, while size is a better indicator. The study led the researchers to conclude that, through the use of the basal measurements as indicator of absolute size, a threshold that allows the separation of bulls, cows and oxen, can be established.

Fig. 6 shows that there is indeed size variation linked to sex in the data from Sykes and Simmons[47], though a small degree of overlap between females and males exists, and the few castrates lie within the range of both females and males. The Greenwich High Road specimens plot more towards the upper range of the distribution and, therefore, appear to be mostly from males (bulls and/or oxen). However, the level of variability is high so uncertainty remains.

BIOMETRICAL ANALYSIS

In the 17th century, London experienced a significant growth in population. From the 200,000 people recorded in 1600, the population of London became, in 1690, as large as 530,000, making it the largest city in Europe[48]. While the city area was the heart for trades, the main focus of growth was located in the suburbs as here lands were available and the control from the authorities was loosen[49]. Population growth meant a growth in food demand. As a consequence, an important

stimulus was provided to the development of cattle husbandry. Cattle were bred and raised in the northern and western parts of the country in order to supply an expanding urban population. Many of these animals ended their lives in the markets of London and, as a result, it is likely that cattle found in 18th and 19th century London were of diverse types and from diverse backgrounds[50].

In order to understand if different types of animals were present at Greenwich High Road, the data from the site have been compared with those from other sites of similar period or composition. For the comparison, two other assemblages have been used: Norwich Castle[51] (in particular the late 16th to 18th-century phase) and the Ha-Ha excavated at Cronkhill, Shropshire[52] (1797- 1802).

Written, as well as zooarchaeological evidence attests to the presence of different cattle types in Britain during the 18th and 19th century. Cattle types are often subdivided into the broad categories of 'short', 'medium' and 'long' horned on the basis of horn length[53]. According to Armitage[54], short horned animals were widely distributed in the 12th and 13th century and are known to have still been present as late as the 16th century, but not later. Medium horned animals were found during the 18th century[55], while long horned animals – different from the Longhorn breed of the 18th-19th centuries - appeared late in the 14th century, became widespread in the 16th century[56] and are found from that time onwards. As a result, it is possible that both medium horned and long horned cattle are represented in the Greenwich High Road cattle assemblage but the occurrence of short horned cattle is unlikely.

Medium horned cattle have lengths of their greater curvature of 220-360mm, while, in long horned animals, this measurement is more than 360mm[57]. Many of the horncores at Greenwich High Road had missing tips or were broken, preventing measurements of outer curvature length for all but three of the specimens. With measurements of *c.* 330mm, *c.* 270mm and 275mm (A2), all those specimens fall within the medium horned cattle size range.

In Figs. 7 and 8, horncore base measurements from Greenwich High Road have been compared to those from Norwich Castle and the Ha-Ha at Cronkhill. The Norwich assemblage was composed of animals of different types; a comparison between the horncores from the 16th to 18th century deposits with those from earlier periods revealed that the former were much larger, exhibiting different shapes and with a smaller base relative to their length. This was interpreted as proof of the appearance of new breeds[58].

Biometrical studies conducted on the Ha-Ha assemblage revealed the presence of medium horned cattle, a few longhorn cattle and, perhaps unexpectedly, a small number of short horned specimens[59]. Figs. 7 and 8 show that, when the three sites are compared, Greenwich High Road horncores plot in general towards the larger end of the plot, showing large base measurements.

The Greenwich distribution has a small tail, with a few smaller specimens plotting in the middle of the Norwich distribution (Fig.7) and even overlapping with Cronkhill (Fig.8). These may be medium horned specimens, though those that are definitely medium horned, on the basis of the outer curvature length, are slightly larger. The larger Greenwich specimens, plotting at the very top of the graph, may well represent long horn types.

To test if the size differences between the horncores from the three sites were statistically significant, an independent Student's T-test (A3, Table 1 and 2) was conducted on the maximum and minimum diameter of the horncores. The results of the Student's T-test confirm the high level of difference between the three assemblages. Since p is highly significant (<0.05), the difference is due to factors other than contingency[60]. The differences between the assemblages may be due to breed/type, age and/or sexual dimorphism. In terms of the horncore base, the Greenwich animals are the largest and those at Cronkhill are the smallest. The T-test is considered to be a 'robust' test, minimally influenced by normality or variance[61]. Nevertheless, a non-parametric test, the Kruskal-

Wallis test, was also carried out on the horncore measurements (A3, Table 3). The results confirm the significance of the difference between the three assemblages.

Fig. 9 shows the results when the only three Greenwich specimens for which the greatest length was available are plotted with the greatest length of the specimens from the other sites. Both Norwich and Cronkhill have specimens with a short length (small number); in all three sites there are specimens with a medium length (the clear majority), while only Cronkhill has long-horned animals (just two). There is poor correlation between the maximum diameter and the greatest length of the horncores (note the cloud-like appearance of the scatter), which means that it is difficult to establish the type of cattle exclusively from the horncore basal measurements. In all aspects of the biometrical analyses the Greenwich animals appear to be more similar to those from Norwich than Cronkhill.

In order to better understand the shape of the horncores from the three assemblages, biometrical indices have been plotted together. Fig. 10 shows, on the horizontal axis, the ratio between maximum diameter and greatest length and, on the vertical axis, the ratio between minimum diameter and greatest length. Two groups can be seen. The most abundant group plots in the left-bottom corner of the scatterplot and mainly includes the horncores from Cronkhill, with a few from Norwich and the three specimens from Greenwich (of which only one falls in the lower range of the distribution). The other group, which occupies the upper-right corner, is mainly composed of specimens from Norwich along with two horncores from Cronkhill. This distribution shows that most of the Cronkhill specimens have a low ratio between the measurements taken at the base and the greatest length while the specimens from Norwich, plotting at the top of the graph, have higher ratios values, thus the horncores from Cronkhill are slender while those from Norwich are more robust. There are, therefore, not only size, but also shape differences between the cattle horncores from the three sites.

An uneven distribution of age groups could also have produced the differences seen between the assemblages, but the data do not support such an assumption. In fact, if we consider that the Greenwich High Road and Cronkhill assemblages, for which the same method of ageing was adopted[62], were dominated by the horncores of fully adult and even older animals, we would expect the same pattern in both assemblages if the main factor affecting the distribution was age.

A different sex-ratio at the sites could also be responsible for such a significant difference. Phillips, through the study of the basal shape of the horncores, observed that the Ha-Ha assemblage was mainly composed of female specimens (42 out of 48 were identified as belonging to cows). This archaeological evidence is supported by historical sources, according to which the economy of Shropshire during the 18th and 19th century was based on dairy activities[63]. With regard to Norwich, the shape of cattle metapodials[64] did not reveal any identifiable groups[65], but remains of bulls, in an urban context, are unlikely to feature strongly. Males would either be killed very young, or castrated, with very few entire specimens kept into adulthood for reproductive purposes.

The wider spread in size of the Norwich specimens, compared to the other sites, may indicate the presence of females and castrates, with the females being smaller than the castrates. The identification as females of the clustered group from Cronkhill, with a few larger male outliers, is supported by this analysis. The higher proportion of larger specimens at Greenwich indicates a greater proportion of males, in comparison to females, at this site. For historical and husbandry reasons these males are likely to have been castrated (i.e. steers and/or oxen). Although morphological differences between the cattle slaughtered at the three sites are likely (in view of the geographic differences), these are not required to explain the morphometric pattern, which may simply be due to a different proportion of the sexes. To sum up, Greenwich appears to have a predominance of castrates, Cronkhill of females and Norwich a more even mix of the two.

BUTCHERY AND PATHOLOGIES

Few cut marks and chop marks were observed on the Greenwich horncores. The cut marks were located on the frontal part of the skull, on the occipital or, less frequently, near the area where the horncore attaches to the skull. Chop marks were identified on only three specimens and were located on the frontal part of the skull, on the occipital, and on the middle of the horncore. Considering that cut marks located on the front part of the skull are usually related to skinning and those located close to the base of the horncore usually indicate the removal of the horn sheath[66], the evidence at Greenwich is especially indicative of skinning activities, though de-horning probably also occurred.

Regarding pathologies, the only abnormality observed was the presence of cranial perforations on the posterior area of the skulls for twelve specimens. This phenomenon has been observed and investigated by other researchers[67] and different hypotheses regarding its origins have been put forward (including parasites, tumors and infections, congenital and yoking pressure).

HORNCORES AS ARCHITECTURAL MATERIAL

In the past, animals have had a long association with architecture and, from very early times, they have played a role in rituals attending the laying of foundations of houses, bridges and fortifications[68].

In the case of Greenwich High Road, such an interpretation seems unlikely, though not impossible, as the nature of the site as an industrial outlet is clear and supported by archaeological and historical evidence (i.e. structural evidence, oak chipping and other materials used in the tanning process).

The lack of cattle postcranial material at the site suggests that the slaughtering of the animals did not take place at Greenwich High Road and that the horncores found at the site were probably a by-product, together with the hides, of the meat trade. We know from archaeological and historical

evidence that horncores were often still attached to the skins when sent to tanneries[69]. Once at the tannery, the sheaths that covered the horns were removed and sold to horn-workers. At this stage, what was left was the bony core which, as it is of no economic interest, was discarded or used in alternative ways, such as building material, as in the case of Greenwich High Road. Indeed, at the site, by taking advantage of natural and 'ready to use' bone waste[70] cattle horncores were used as a substitute for the more traditional brushwood to line a drain.

CONCLUSIONS

The assemblage from Greenwich High Road has interesting implications for our understanding of 18th and early 19th-century tanneries. At the same time, the alignment of horncores [1045] provides us with useful information regarding the use of by-products of the meat trade for construction purposes.

Although the assemblage was fairly fragmented, and the combined application of two methods to age cattle horncores highlighted the high degree of subjectivity inherent in using descriptions of horncore porosity, it was possible to make an approximate estimate of the age at death of the animals. The cattle horncores from Greenwich are mostly from fully adult individuals, which probably indicates a supply from culled draught animals.

This hypothesis is supported by the biometrical analysis which, by comparing the Greenwich horncores with modern data[71] and archaeological evidence from Norwich[72] and Cronkhill[73], has led to the suggestion that the Greenwich assemblage is predominantly composed of oxen. The Norwich assemblage seems to have a more diversified sex composition, while, at Cronkhill, a predominance of females is suggested, likely indicating the local use of cows for dairying. Age and breed are also factors that can affect the morphometry of the horns, but all sites are dominated by adults, and, although breed variation almost certainly contributes to the pattern, it is unlikely to explain it fully,

as most animals can be characterised within the medium-horn category (though the long-horn is reported at Cronkhill).

At Greenwich, the horncores employed in the lining of the drain are likely waste material resulting from the activities that took place in the nearby tannery and the same is almost certainly the case for those from the pit fills. The absence of anatomical elements other than horncores attests that the animals were probably slaughtered elsewhere and that the tannery was only supplied with hides, to which still some skull and horncore was still attached, but very few foot bones. Cut marks and chop marks suggest that all the valuable parts to which the horncores were attached, including the skins and the horn, were removed to be worked. The bony cores, with no economic value, were simply used at the site as cheap and ready material to help in the construction of the drain.

The evidence from Greenwich provides us with a fascinating insight into the meat trade as well as the leather and horn industries, and, in general, into everyday life in late 18th and early 19th-century London. Further work on similar animal bone assemblages should help us to understand further the network of activities associated with animal husbandry and characterising urban life in the early modern period.

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