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RESEARCH PAPER

The Cattle Mandibles, Cranial Fragments and Metapodials from the Burgstraat in Ghent (Belgium)

Emmy Nijssen

The Burgstraat is an archaeological site which is located within the high-medieval part of the town of Ghent. Excavations conducted by BAAC Vlaanderen in 2011 revealed numerous structures, artefacts and ecofacts at the site - some of which date to the 12th century. This paper focuses on SP141, a 13th century waste deposit. The contents of SP141 are mostly zooarchaeological remains. The investigated sample consists of 2652 animal bone fragments, which predominantly represent domestic cattle (Bos *p.f.* Taurus). Interestingly, this large concentration of cattle remains consists primarily of cranial fragments. At the Burgstraat, mandibles and maxillae appear to have been divided in a systematic manner of butchery. The function of the processing of the cranial parts presents part of an economic chain where animals are brought into the urban economic system for their meat, horn, hide and bone. This paper explores the role of the cattle remains from SP141, and presents the results of preliminary analyses at the site, including age and demographic data.

Introduction

In an urban medieval context it is not uncommon to find large waste deposits—the majority of which can be termed general household waste—that consist of a mixture of waste such as, pottery shards, glass, animal bone and other organic material (Evans 2010: 269). However, frequently waste deposits may have a specific content, such as those built up entirely of animal bone. Often these bones appear to represent the selection of one or more animal species or specific body-parts. Usually these are interpreted as the remains of the medieval meat processing, or other related crafts, e.g. tanners' waste (Baxter 1998: 59).

The excavation at Burgstraat in Ghent was conducted in 2011 by *BAAC Vlaanderen bvba* (BAAC Flanders Ltd.) and lead by Robrecht Van Overbeke. The site itself is located just outside the tenth century AD, city wall in the northeast part of the town. The earliest structures/deposits at the Burgstraat date back to the twelfth century. After the thirteenth century the site was incorporated

Baac Vlaanderen, BE
enijssen@yahoo.com

into the heart of the medieval town, it was at this time that the second defence wall was built. The site has been continuously occupied since.

The excavated structure called S141 dates to the thirteenth century AD and contained a remarkable amount of cranial and mandibular fragments, most of which were identified as cattle. This deposit was interpreted as a type of artisan waste, based on similarities between the waste deposit (S141) on this particular site and similar ones in other cities (Alen & Ervynck 2005: 193; Fondrillon & Marot 2013: 210).

During excavation the finds from S141 were all hand collected. Unfortunately, not the entire deposit could be collected for further study, nevertheless, the excavated sample was determined to be sufficiently representative of the assemblage. The sample was further reduced during zooarchaeological analysis, as only three-fifths of the collected sample could be investigated, this was due to time constraints. Despite the analysed sample being considerably smaller than the initial deposit, it is still possible for the assemblage to help answer questions related to medieval crafts and industries in general and in the case of the Burgstraat, specific questions such as: Can certain butchery or age patterns be recognised? If so, what is the bigger picture around these patterns? Do these cattle bones merit further investigation and could they yield further insights?

General quantification

A total of 2626 bones and bone fragments, of which 506 could not be determined (body part, nor type of animal), were excavated and analysed from S141. The quantity of non-cattle bone is nearly negligible, with 27 fragments (1% of the total sample) were identified as sheep/goat. One fragment was identified as pig, representing only 0.04% of the entire sample.

The remaining bones (2093) and bone fragments were identified as cattle, an overview of the number of different skeletal parts is provided in Table 1. Cranial bones dominate the collection, although two horn cores were present in the assemblage. None of the crania were complete, even the maxilla and the mandibles are highly fragmented, which accounts for the vast number of loose teeth in the assemblage.

Both the mandibles and the maxilla appear to have been divided in a systematic way. For the purposes of recording the assemblage, they are divided into anterior, medial and posterior categories. In total, the most frequently occurring fragment was the medial part, which includes the dental row. This was both the most frequent occurring part on both the left as for the right side.

The part of the mandible and maxilla, which occurred least frequently among the analysed sample, was the anterior portion. When considering the posterior part, it was determined that preservation differed between mandibles and maxilla, which a higher prevalence of posterior mandibles compared to maxilla. It is considered that this differential preservation is the result of the higher degree of fragmentation of the crania, and subsequently the maxilla. Nevertheless as illustrated in Table 1 no significant side differences were recorded in the preservation of the mandible or maxilla, and no significant differences was noted in absolute number of mandible versus maxilla parts.

Only 224 fragments were identified as post cranial element, the most frequently recorded post-cranial remains were shaft fragments from the metapodi (metacarpals and metatarsals). There were 506 or (19.3%) unidentified fragments in the assemblage. Based on their shape and size, it can be assumed that these were also from large mammals, probably cattle, potentially bringing the total number of cattle bones to 2626.

Taphonomical interpretation

The metapodial and cranial bones of an animal are considered non-meat bearing, and are usually removed immediately after the

Structure nr 141

			total	total %
maxilla	left	complete	0	0.0
		anterior	29	1.1
		medial	100	3.8
		posterior	55	2.1
	right	complete	0	0.0
		anterior	15	0.6
		medial	101	3.8
		posterior	62	2.4
	indet	complete	0	0.0
		anterior	0	0.0
		medial	95	3.6
		posterior	6	0.2
	total		463	17.6
mandibula	left	complete	0	0.0
		anterior	6	0.2
		medial	116	4.4
		posterior	140	5.3
	total		580	22.1
total max and mand			1043	39.7
horn core			2	0.1
cranial			354	13.5
loose teeth			487	18.5
pelvis			1	0.0
metacarpus/tarsus		complete	2	0.1
		proximal	17	0.6
		distal	25	1.0
		shaft-fragment	152	5.8
phalanges			10	0.4
vertebra			15	0.6
rib			2	0.1
indet			506	19.3
	total		1583	60.3
cranial and post-cranial			2626	100.0

Table 1: Absolute number of bone fragments of cattle, by skeletal part. Including the unidentified parts which are represented by the 'indet' category.

animal has been killed (Ervynck 2011: 106). The meat bearing bones may travel from the medieval slaughterhouse to butcher shops and possibly on to marketplaces where they find their way to the consumers' house.

Analysis of the skeletal assemblage excavated from structure S141 appears to be a deposit primarily consisting of non-meat bearing cattle parts. This does not, however, mean that it was waste material, as these elements may have contributed to the medieval economy, as will be explained later. The few bones from sheep/goat and pig that are found in the deposit are probably part of an 'accidental' deposit of household waste.

The cranial parts

The division of the mandible and maxilla into anterior, medial and posterior arguably indicates systematic butchery practices, most likely with an axe (Outram 2001: 402). Division of the mandible occurred at the diastema as illustrated in **figure 1**. The posterior region was frequently divided from the dental row posterior to the last molar, either the M_2 or M_3 depending on the age of the animal. A similar division of elements was seen among the maxilla (Groot 2010: 17; Alen & Ervynck 2005: 198).

The rest of the crania were much more fragmented and as such butchery practices were more difficult to decipher. Some parts of the frontal can be recognised as well as part of the zygomatic arch or the orbit. Strikingly, only two fragments of horn core were found, both were rather small. The lack of horn core in the deposit can be explained by the fact that usually when cattle are butchered, the organs including the brain will be recovered for consumption while the hide along with the portion of the cranium that includes the horn core are taken to the tanners for further trading and processing. The part of the hide that is taken to the tanners will usually include the part of the cranium that includes the horns (Ervynck 2011: 106). At the tanners, the horns would be separated from the skins and sold off to the horn workers. These craftsmen used this first 'plastic', the horn, to make small objects like boxes, cups and spoons (Rixon 2000: 19; Davis 1995: 190). The two horn cores found in the Burgstraat deposit are only a few centimetres long and therefore would have been too small for the horn to be worked, and as such would not have been of value (Ervynck & Hillewaert et al. 2003: 65).

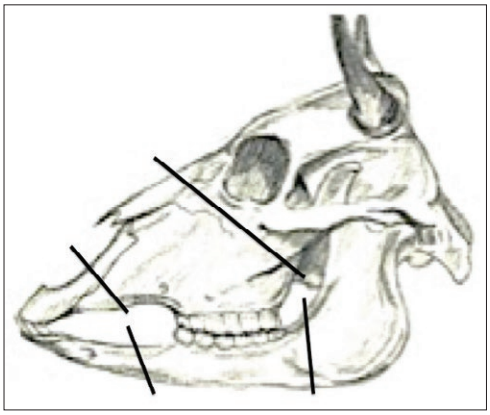

Figure 1: Cattle skull showing the parts where the mandible and maxilla are divided.

Due to the fact that the preservation of the mandibles is superior to the maxilla, with less secondary fragmentation, more detailed observation of the treatment of the mandibles were possible. It is suggested that deposit is composed of skeletal material where bone marrow and marrow oil were extracted. This is based on similarities with a late medieval assemblage from Malines, Belgium (Alen & Ervynck 2005: 197). The economic applications of bone marrow are abundant: it was used for direct human consumption, (Outtam 2001: 402). Bone marrow and oil was therefore an economically valuable product during the medieval period. For marrow extraction it is believed that bones were heated so that they can be cut with less effort and to liquefy the marrow to ease extraction. There is little evidence that the bone assemblage in Ghent was heated, although this does not necessarily

discount the marrow extraction hypothesis. The lack of burn marks on the bones might indicate that there was still a layer of soft tissue (periosteum) present at the time of heating, which can limit evidence when heated for a short time, but it does facilitate the chopping of the bones and extraction of the marrow oil. Boiling bones, however, while leaving little evidence of heating will also facilitate the marrow oil extraction (Outram 2001: 405–406).

A preliminary macroscopic analysis of the cut marks indicates that the mandible was struck from the buccal, towards the lingual side. This procedure was used for dividing the anterior, medial and the posterior part. Both the left, as well as the right mandible show this pattern. Cut marks on the mandible were smooth, which supports the hypothesis the bones were slightly heated before butchery (Vanderhoeven & Ervynck 2007: 162).

Zooarchaeological remains which indicate the extraction of marrow and marrow oil have already been found at many sites, such as Wellington Row in Roman York, ZAC Avaricum in Bourges (France) and the late medieval Lamote site in Malines (O'Connor 1995: 7; Fondrillon & Marot 2013: 207; Alen & Ervynck 2005: 193–200). The butchery practices associated with marrow extracted were found to differ from site to site. For example, the chopping pattern at the Lamote site in Malines is different from that of the Burgstraat in Ghent, such that in Malines the mandibles where chopped in two, cut somewhere in the middle of the dental row to divide them in anterior and posterior parts, whereas in Ghent the division is made at the diastema and after the last molar. In Bourges the mandible was chopped after the last molar, horizontally and vertically, separating the (anterior)-medial part from the posterior part (Fondrillon & Marot 2013: 209–210). It is unknown if these differences are the result of different functional demands, such as the recovery of the tongue or other meat from the head.

The post-cranial parts

The small number of metapodia recovered was highly fragmented, just like the cranial bones. This may also indicate marrow and/or marrow oil extraction. At both the Lamote site in Malines and the site in Ghent, only a small number of metapodial fragments were recovered, compared to the number of cranial remains. Metacarpals and metatarsals were used during the medieval period for the production of a number of bone objects, which might account for the low proportion at these sites (MacGregor 1985).

Age of the cattle

One of the aims of this research was to determine the age at which the animals were butchered. Age estimation was conducted using the method established by O'Connor (O' Connor 1989: 161), which uses five stages of dental wear and eruption of the molars (Groot 2010: 61). O'Connor's method was chosen instead of Higham's method, which uses 23 dental stages, due to the efficiency of O'Connor's method and the limited time available for analysis (Higham 1967: 105–106; Groot 2010: 53). Eruption/wear stages were then linked to absolute age at death, however, these ages are an estimation as tooth eruption and especially the wear can be influenced by many factors, such as health and nutrition. There were only 131 (69 right and 62 left) suitable mandible fragments, where enough teeth were present for age estimation methods.

As indicated in **table 2** (see also **figure 2**), a large proportion of the assemblage were young individuals with immature and sub-adult individuals comprising 60% of the sample. More importantly, the sub-adult category forms just under 40% of the total. The second most frequent group is the 'old' group, which contains 30 fragments representing 22.9% of the sample. The smallest of all age groups is the adult group making up only 15.3% of the sample. It is clear that the proportion of young animals butchered in Ghent is higher than at other thirteenth -fourteenth century sites in Leicester or Malines (Gidney 2000: 176; Allen & Ervynck

2005: 169). On the other hand, the percentage of older animals in Ghent is much lower than the 50% of four to five-year-old specimens found in Malines. It is important to keep in mind that the age-estimation methods differ between Ghent and Malines, therefore the results may be subject to slight variation.

It has been argued by Allen and Ervynck (2010: 169, 199) that marrow from young animals is not desirable since it will contain too much blood, compared to the amount of marrow. The higher proportion of younger animals in Ghent might be explained by different economic factors. In modern cattle breeds it is considered optimal to butcher the animals when they are younger than 36 months since they have an optimal balance between fat and meat at that point (S.N. 2013: FAO). This is consistent with the age profile of the Ghent assemblage. The FAO of the United Nations also indicates that cattle older than four or five years are still good for consumption and they can be used as draft- or dairy animals as well (S.N. 2013: FAO). Therefore it is possible for the age distribution in the Burgstraat assemblage reflects the animals entering the abattoir at the optimal time in terms of their meat. It has also been argued that the differences in age profile between these sites, is the result of sex differences.

Younger butchered cattle assemblage have argued to be more likely to be comprised predominantly of males. This is because cattle reach an optimal muscle mass between the age of 19 to 36 months. Around this age their growth speed will decrease due to the fact that they reach their adult size and weight (McGrory & Svensson *et al.* 2012: 3328). Older cattle groups are suggested to include both male and female animals, perhaps with a skew towards the females, this is to maintain the herd and provide draft animals, while only the females will be kept as dairy producers. This is most likely why the females are kept longer (McGrory & Svensson *et al.* 2012: 3329). Unfortunately, since it is not possible to estimate sex from this assemblage, due to poor preservation of metapodials and the horn cores, and insufficient funds for DNA-analysis, further interpretation is not possible at this time.

Conclusion and recommendations

Analysis of the thirteenth century animal assemblage in Ghent indicates systematic processing cattle crania. In this assemblage, the lack of post-cranial fragments is most striking—especially from the 'meatier' parts of the skeleton. Conversely, the cranial bones are abundant, even compared to the metapodia. Systematic butchery of mandibles and maxilla can be seen as one of the steps in an economic chain, that begins with the breeding of the animal, butchery, consumption of the meat and the entrails; parallel to this there is

	After O'Connor		After Higham
	N	%	
juvenile	2	1.53	7 to 17 months
immature	27	20.61	17 to 24 months
sub adult	52	39.36	24 to 38 months
adult	20	15.27	40 to 50 months
old	30	22.90	50 months or older
total	131	100.00	

Table 2: Absolute number and percentages of the different age groups determined from mandibular dental wear and eruption S141.

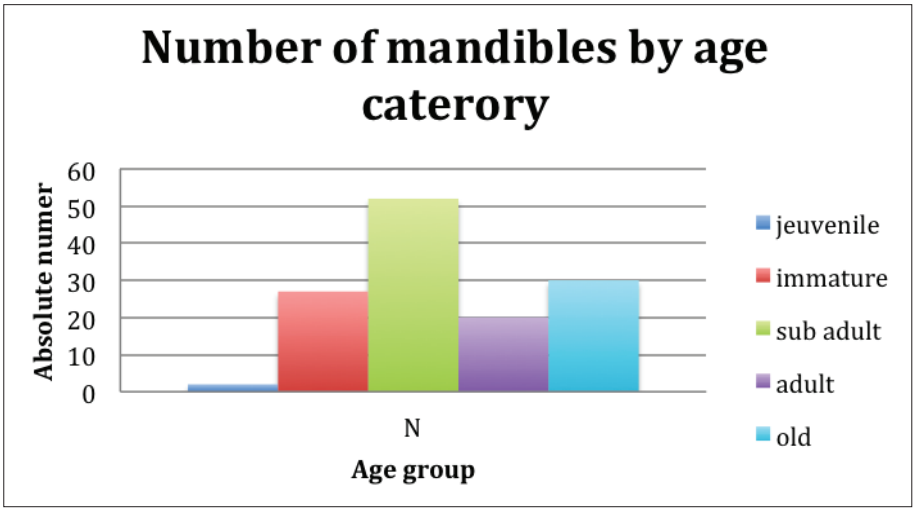

Figure 2: The absolute number of mandibles by age group, illustrating the high proportion of younger animals (immature and sub-adult) and old animals.

the preparation of the hide for leather, remodelling of the horn, and lastly extraction of marrow and marrow oil from the bones.

The age profile developed using O'Connor's method identified a high prevalence of young animals in the assemblage (17 till 38 months), with a second large group of older individuals (age 50 months or over). The large amount of younger animals (immature and sub-adults) is not consistent with existing literature where it is considered that mainly older animals were consumed in medieval times (Davis 1995: 187–188).

The cattle bone deposit from S141 in the Burgstraat in Ghent has further research potential. Firstly, the entire assemblage has not been investigated. Secondly, more investigation into potential pathological lesions or the systematic way of post-mortem processing, could be done, e.g. looking at the presence of DEHP or other lesions, as well as the presence of burn marks, chop-, cut- and shear marks, as well as the general taphonomy of this structure compared to nearby deposits. Thirdly, the relationship between the age groups and the sex ratio should be investigated further, which would require DNA analysis (Pigière 2009: 247). DNA analysis, would be the most valuable addition to our knowledge of medieval cattle breeding and processing in an urban area like high medieval northwest Belgium.

Competing Interests

The author has no competing interests to declare.

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