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Skin, leather, and fur may have disappeared, but bones remain… The case study of the 10th century AD fortified settlement Sand in Lower Austria

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(with 8 figures and 1 table)

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Abstract

Sand was a fortified settlement situated in a wooded area at a bend of the Thaya River in Lower Austria. The site was erected at around 930 AD and probably destroyed by the Magyars in the second half of the 10th century. The historical role of Sand remains enigmatic. The fact that the site had only a very short lifetime has the benefit that the material derives from a well-defined period. In this paper we investigate the excavated faunal remains and their archaeological context.

The vast majority of the faunal material constitutes primary waste. According to the number of identified specimens the prevalent species in Sand is cattle (almost 35 %); wild taxa are surprisingly abundant (about 40 %), dominated by wild boar, red deer and wild Bovidae (especially European bison). The analysis of the animal bones yielded insights into many important aspects of the economy of Sand; one of them is evidence for skinning and skin/fur processing at the site, indicated by species representation, age profiles, cut marks and skeletal element representation. This interpretation is further supported by archaeological evidence. The indications for skinning are mainly concentrated in the Westwall area.

Keywords: early medieval period, animal bones, Bioarchaeology, Archaeozoology, skinning, fur animals, cut marks.

Zusammenfassung

Sand war eine befestigte Siedlung in einem bewaldeten Gebiet in einer Flussschlinge der Thaya in Niederösterreich. Diese Siedlung wurde um 930 AD gegründet und wahrscheinlich von den Ungarn in der zweiten Hälfte des 10. Jahrhunderts zerstört. Die historische Rolle von Sand ist

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noch immer enigmatisch. Die Tatsache, dass die Fundstelle nur eine sehr kurze Besiedlungsphase aufweist, hat als Resultat, dass das Fundmaterial von einem gut definierten Zeitraum stammt. In dieser Arbeit untersuchen wir die ausgegrabenen Tierreste und deren archäologischen Kontext. Die überwiegende Mehrheit der Tierknochen repräsentiert primären Abfall. Die dominierende Tierart in Sand ist nach der Fundzahl das Rind mit fast 35 %. Die Wildtiere sind mit etwa 40 % überraschend häufig und werden von Wildschwein, Rothirsch, und wilden Bovidae (vor allem Bison) vertreten. Die Analyse der Tierknochen erlaubt Einblicke in viele wichtige Aspekte der Wirtschaft von Sand; einer von ihnen ist ein Hinweis auf Tierhäutung und Haut/Pelz-Bearbeitung. Diese Interpretation basiert auf der Verteilung der Tierarten, Altersverteilung, den Schnittspuren und der Skelettelementsverteilung und wird durch die archäologischen Funde unterstützt. Die Indizien für diese Produktion konzentrieren sich vor allem im Gebiet des Westwalles.

Schlüsselwörter: Frühmittelalter, Tierknochen, Bioarchäologie, Archäozoologie, Abhäutung, Pelztiere, Schnittspuren.

Introduction

Animal bones are an integral part of archaeological finds. Their investigation can significantly contribute to better understand past ways of life. Their study reveals information about socio-economic structures, technology and know-how, dietary habits, traditions and rituals, ecological exploitation, environmental reconstruction and even dating (Karali 2005: 9). Faunal assemblages can also deliver information about activities that are no longer detectable by other find categories.

In this paper we explore the possible evidence of skin and fur processing, based on the faunal material and the archaeological finds, from the early medieval site of Sand in Lower Austria. The site is a 0.7 ha fortified settlement that experienced a very short occupation period; it was erected about 930 AD (dated by dendrochronology Grabner 2002) and it was abandoned in the second half of the 10th century AD (Felgenhauer-Schmiedt 2001, 2011, 2012). Sand was discovered by chance by Kurt Bors in 1992 and excavations were conducted from 1993 to 2008 (Felgenhauer-Schmiedt 2001, 2006, 2011, 2012).

Skinning is one of the main steps during the processing of carcasses, which were usually intensively exploited to obtain different materials and products, such as horns/antlers, meat, or internal organs. Skin and fur are among some of the most valuable materials that were extensively used in the early medieval period (Grömer *et al.* this volume). Evidence for their exploitation is usually connected to faunal remains and relevant archaeological context (*e. g.*, tanning pits).

Although skin products are not preserved in Sand and specific architectural features are difficult to identify, the analysis of the animal bones suggests processing of skin and fur.[3] This paper presents and discusses these indications.

[3] An explanation of the terms is given by Grömer *et al*. this volume.

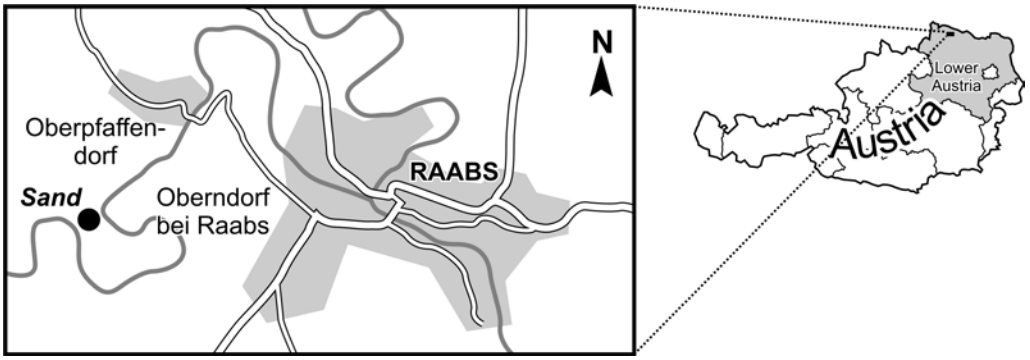

Fig. 1. Location of Sand, near Raabs an der Thaya, Lower Austria.

Setting and context of the site

Geographical location

Sand is located at the northern part of Waldviertel, Lower Austria, near the borders with the Czech Republic (Fig. 1), at an altitude of *c*. 450 m above sea level (asl). Here, the eastern part of the Bohemian Massif forms an undulating plateau ranging between *c*. 200–1400 m asl. The climate of Sand is classified as cool boreal and reflects its location in Central Europe at the plateau margin close to areas influenced by Pannonian climates (KILIAN *et al*. 1993: 55).

The site is in a wooded area at a bend of the Thaya River, which offered natural protection and is located close to former trading routes. Key landscape features are the Thaya and Kamp rivers. The Thaya has two major tributaries, the Moravian and the German or Austrian Thaya; both tributaries meet at Raabs, 1.6 km from Sand. The role of Sand in historical evolution is highlighted by two parameters: a) the site is located at the later borders between Germans and Slavs (FELGENHAUER-SCHMIEDT 2011, 2012), b) its location is on a very important North-South trading route (OBENAUS 2011).

Archaeological context

Sand consists of five different parts: a) the central structure (*Burghügel*), b) two settlement terraces, the upper (Sand 1) and lower terrace (Sand 2) and c) the structures in the areas of Westwall and Nordwall (Fig. 2). At the central structure (*Burghügel*) the excavation brought to light foundations, suggesting the existence of a wooden structure with stone foundations, built at the highest part of the stronghold. At this part of the site precious findings (*e.g.*, jewellery) were retrieved. The distinctive location of this structure has been interpreted as a tendency for separation of the elite groups that later developed (FELGENHAUER-SCHMIEDT 2011).

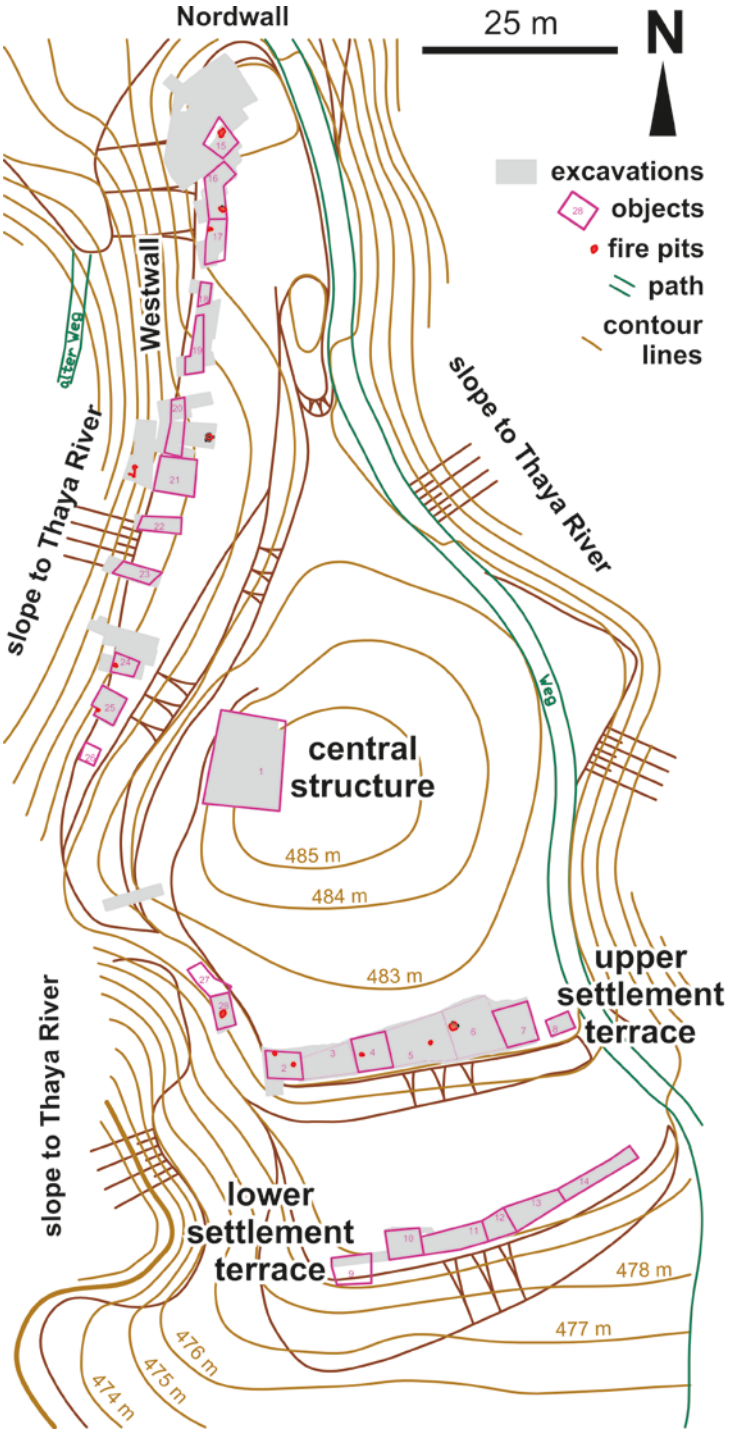

Fig. 2. The most important areas excavated in the stronghold of Sand with object number (Source: S. Felgenhauer-Schmiedt).

The two settlement areas exhibit massive fortifications especially in the south. The wooden structures recorded in these areas were built directly on the fortification wall. A distinctive feature of the upper settlement terrace is Object 6 in its western part (Fig. 2); this object is the biggest of the terrace and its architecture indicates very careful and conscientious construction. Thus, Object 6 (upper settlement terrace) has been interpreted as residence of a local administrator. Object 13 at the lower terrace also presents special characteristics, including its size (Fig. 2). The northern (Nordwall) and western (Westwall) parts were also fortified. Directly in front of the Nordwall and Westwall wooden structures have been found.

The material culture and the architectural features indicate that each area had a different character, suggesting internal social hierarchies (Felgenhauer-Schmiedt 2011). Raw materials were apparently imported from the surroundings and small-scale trading activities have been demonstrated. The study of the archaeological finds indicates the presence of an elite group (Felgenhauer-Schmiedt 2001, 2011, 2012). The investigated faunal material derives from the two settlement terraces and the Westwall area. For this reason we provide more information about the archaeological context of these areas later in the text.

Historical context

According to the archaeological finds, Sand was possibly destroyed by the Hungarians (finds of so called Hungarian arrowheads) in the early part of the second half of the 10th century AD (Felgenhauer-Schmiedt 2001). In this period Hungarian raids were a usual phenomenon that devastated a large part of Eastern Europe for many decades, causing fear and insecurity (Benda *et al*. 1988: 21). In the early 10th century key events took place including the fall of the Moravian Empire (906) and two serious defeats of the Bavarians in 907 (Pressburg) and 910 (first battle of Lechfeld) by the Hungarians.

When Sand was erected, a peace treaty between Henry I and the Magyars had been signed (924); it lasted nine years. Although Henry I defeated the Magyars shortly thereafter (933), they continued their raids and attacks (Makkai 1990: 13; Cartledge 2011: 9–10). The situation began to change with Otto I (936), who defeated the Magyars at the decisive battle of Lechfeld in 955 (Makkai 1990: 13–14; Majoros 2008: 55–56). The role of Sand in this specific political scenery remains unknown and it seems that the destruction of the site occurred after the defeat of the Magyars in 955.

Material and methods

In total, 9830 animal bones have been identified and analysed (Saliari forthcoming). The number of identified specimens (NISP) showed that the most important domesticated species was cattle (almost 35 %) followed by pigs, horses and goats.[4] Interestingly,

[4] All small ruminant bones that could be identified derive from goats. One question that remains open is whether differences in the features of sheep and goat skin help explain such a selection.

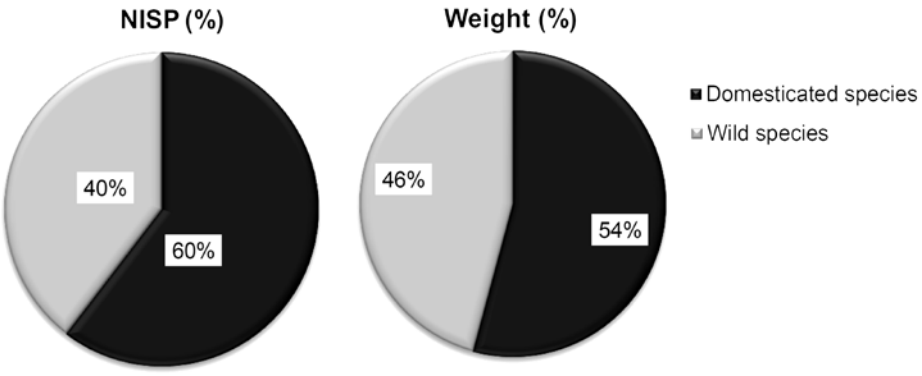

Fig. 3. Distribution of domesticated and wild taxa in Sand based on NISP (%) and weight (%).

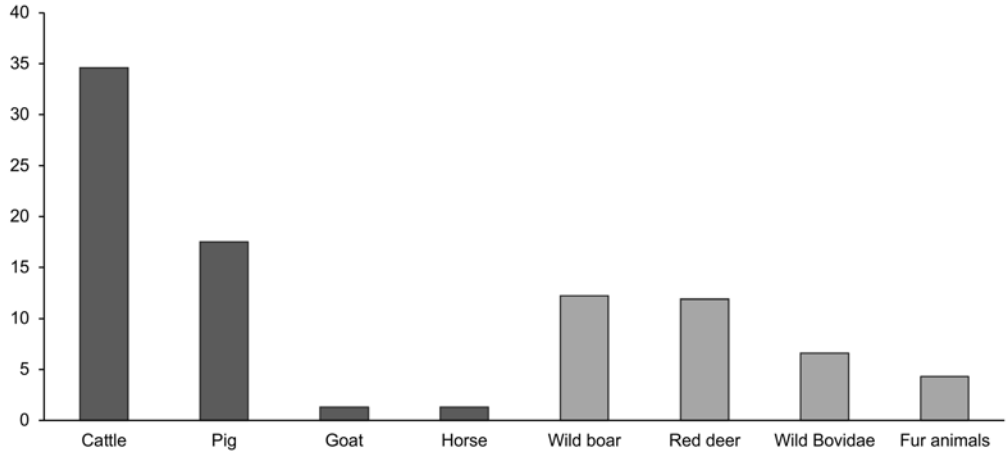

Fig. 4. Prevalent domesticated and wild species found in Sand [NISP (%)].

wild species make up almost 40 % (NISP) (Fig. 3); wild boar, red deer and wild Bovidae (especially European bison) top the list (Fig. 4).

The investigated animal bones derive from the upper settlement terrace, the lower settlement terrace, and the Westwall area. Faunal remains were found on the surface at the interior of the various objects (structures), and most of the material represents primary waste (Felgenhauer-Schmiedt forthcoming). The faunal assemblages from the upper settlement terrace (3172 bones) were studied by Pucher & Schmitzberger (1999a, 1999b), and Pucher (2009), whereas the material from the lower settlement terrace (1778 bones) and the Westwall area (4880 bones) is the subject of a dissertation (Saliari forthcoming). The fact that Sand was in use for only approximately 30–40 years and was not resettled later (Felgenhauer-Schmiedt 2001, 2011, 2012) is a great advantage for the analysis of the archaeological finds and the animal bones, because the material expresses cultural practises from a very limited period.

The animal bones were identified at the Museum of Natural History (1. Zoological Department, Archaeological Zoological Collection) based on the Adametz Collection, the Osteological Collection and other archaeological faunal assemblages, already studied and archived at the museum. The quantitative analysis is based on the number of identified specimens (NISP), the minimum number of individuals (MNI) and the weight analysis, depending on the questions posed. The age profile is based on the state of fusion of the epiphyses, the dental eruption and the wear stages (Pd_4, M_3) according to Habermehl (1975). We addressed the sex ratio utilizing metrical methods and morphological observations on horn cores, teeth, pelves and metapodials of adult body size (Fock 1966; Albarella 1997; Pucher 2004; Hillson 2005; Ruscillo 2014). The standard of von den Driesch (1976) is used for the measurements.

Evidence for skin and fur exploitation

Spatial organisation and archaeological finds

Several artefacts from Sand can probably be related with processing of skin, fur and possibly leather. Among the small metal tools, some retrieved items constitute part of the equipment of shoemakers, saddle makers and of people who are generally occupied with leather processing (Walcher 2004: 125). Small nails with a big round head would probably have been used for skin and leather objects; one bone needle that could have been used for skin processing was also recorded (Felgenhauer-Schmiedt forthcoming).

Upper settlement terrace

Archaeological finds suggest that intensive economic activities took place at the upper terrace (Felgenhauer-Schmiedt 2011). In particular, Objects 3, 4 and 5 provided a very high number of pottery and pottery wastes, suggesting production at the site. Object 7 has been interpreted as a pottery workshop because unbaked pottery has been found. Finds from Objects 4, 5, 6 and 7 indicate that metal (slag) and textile (spindle whorls) processing was also done in this area. Most of the botanical remains (Popovtschak 1998; Kohler-Schneider & Vitalos 2010) were unearthed from Object 3 and especially 5. Finally, according to Walcher (2004: 125) one metal awl indicates leather processing. A number of knives and other metal implements could be used in various ways, including for processing of material such as wood and leather (Walcher 2004).

Lower settlement terrace

At this part of the site the material culture indicates significantly less economic activities, in contrast to the upper settlement terrace and the Westwall area. The excavation

yielded post holes, grindstones (Objects 10–14), botanical remains, including cereals (Object 9) and a few spindle whorls (Objects 9, 11, 12, 13, 14). The objects of this terrace have been interpreted as resting rooms (Objects 11, 12, 14), but also as places where products might have been stored (Object 10) (Felgenhauer-Schmiedt forthcoming). According to Walcher one metal awl suggests leather processing (2004: 125).

Westwall

The Westwall area exhibited only a stone wall as fortification. Nonetheless, the site archaeologist assumes that wooden blocks, which have not been preserved, would have supported the stone wall (Felgenhauer-Schmiedt pers. obs.). In some areas of the Westwall intensive economic activities have been recorded, but it remains challenging to interpret the function of the Objects 18, 19, 20, 22 and 23. The main finds include pottery and animal bones. Metal processing – as demonstrated at the upper settlement terrace – has not been documented. Object 21 (Fig. 2) produced a high concentration of spindle whorls and one loom weight, indicating textile production. In this object faunal remains with a high concentration of cranial elements were excavated. Interestingly the soil in Object 21 was – in comparison to other finds – glossy and greasy. Objects 24 and 25 seem to be connected to the central structure (*Burghügel*); they contained hearths and a clay floor.

The Westwall area is the only location where artefacts made of antlers were manufactured and where most bone artefacts (63 %) were recovered. The presence of semi-finished bone artefacts and of production waste indicates that they were made at the site. One bone needle, appropriate for skin processing, was also discovered. In summary, this area produced abundant evidence, pointing to the intensive processing of animal material (Felgenhauer-Schmiedt forthcoming).

Archaeozoological observations

Species representation, skeletal element distribution, cut marks, age profile, relevant craft context and sometimes seasonality are archaeozoological indications usually related to skin and fur exploitation (Fairnell 2003: 7–14).

Species representation

A number of species would have been exploited for their skin, such as cattle and goat. A very interesting observation is the wide variety of fur-bearing animals found in Sand; according to NISP they represent almost 4 % of the identified bones (Fig. 4) (Pucher & Schmitzberger 1999, 1999b; Saliari forthcoming). The relevant species include the European otter (*Lutra lutra*), European badger (*Meles meles*), European polecat (*Mustela putorius*), European pine marten (*Martes martes*), red squirrel (*Sciurus vulgaris*),

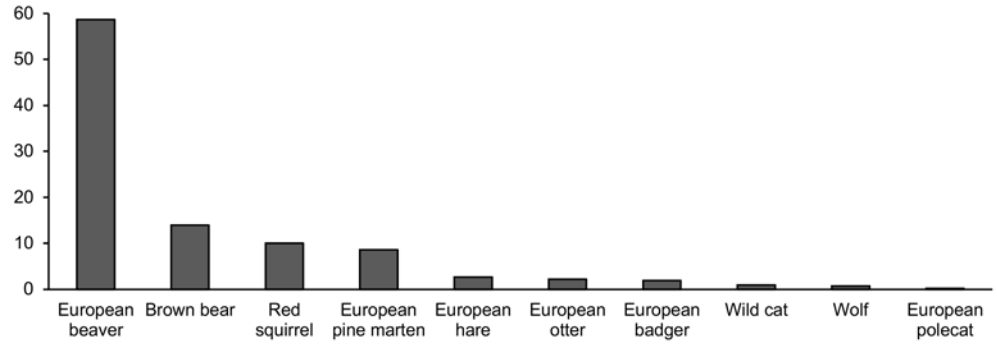

Fig. 5. Distribution of fur-bearing animals in Sand (NISP%).

European beaver (*Castor fiber*), European hare (*Lepus europaeus*), wolf (*Canis lupus*), wild cat (*Felis silvestris*) and brown bear (*Ursus arctos*). According to NISP the three dominant species among the fur-bearing animals are beaver, brown bear and red squirrel (Fig. 5).

Modification traces

In Sand, cut and chop marks indicate that animal bones were severely chopped (PUCHER pers. obs.; SALIARI forthcoming); recorded marks are related to dismemberment, filleting, marrow extraction and cooking preparation; some of these marks have been interpreted as evidence of skinning.

Cut marks probably related with skinning activities are in particular documented on cattle, goat, red deer, roe deer and elk bones (Fig. 6). Cattle, goat and red deer exhibit cut marks on the frontal bone. Additional marks have been detected on the cranium cycling the base of the horn cores/antlers for all the aforementioned species (Fig. 6). Cut marks pointing to skinning were recorded at the phalanges of cattle and red deer and on the distal shaft of goat metatarsals. Most of the bones of domesticated animals with potential skinning marks belong to adults, but several such bones stem from immature animals; for instance, one of the goat crania that exhibited skinning marks comes from a very young individual. Therefore, it is not surprising that their skin was also used. The study of goat horn cores indicates mainly female animals.

Concerning fur animals, not all the bones exhibited marks, which could be connected to skinning activities. An interesting find includes one mandible of European pine marten from the Westwall area. Shallow oblique and longitudinal marks were observed at the lingual side of the *corpus mandibulae* and at the basal part. Note that the great majority of bones exhibiting potential skinning marks derives mainly from the Westwall area.

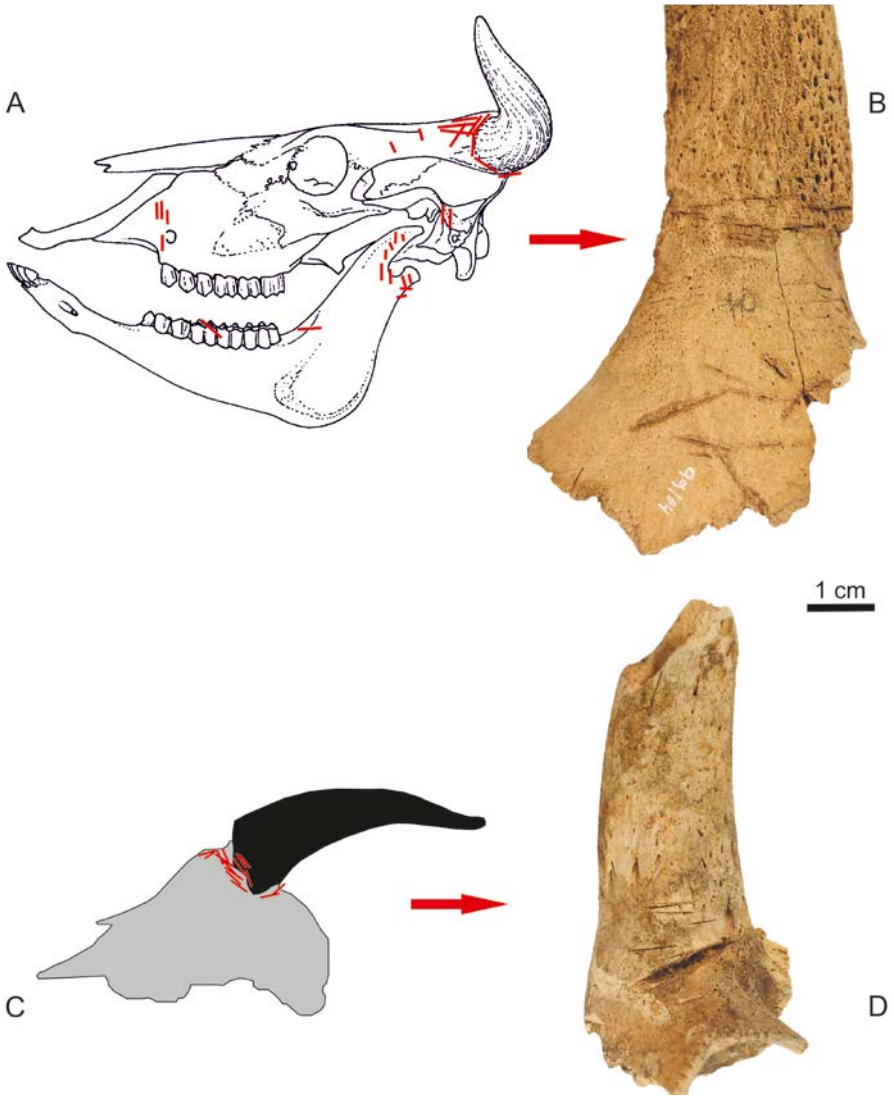

Fig. 6. **A**: Cut marks recorded on cattle crania (sketch: Erich PUCHER). **B**: Marks on the cranium (right side) of a cow from the Westwall area (photo: Andreas KROH). **C**: Cut marks on goat crania (sketch: Konstantina SALIARI). Marks on the cranium (left side) of a female goat from the Westwall area (photo: Andreas KROH).

Skeletal element distribution

The element distribution of domesticated species in Sand suggests that the domesticated animals were imported to the site as whole individuals; some of them (goats and pigs) might also have been kept there (PUCHER & SCHMITZBERGER 1999a, 1999b; SALIARI forthcoming). This supports the assumption that these animals were skinned at the site. The

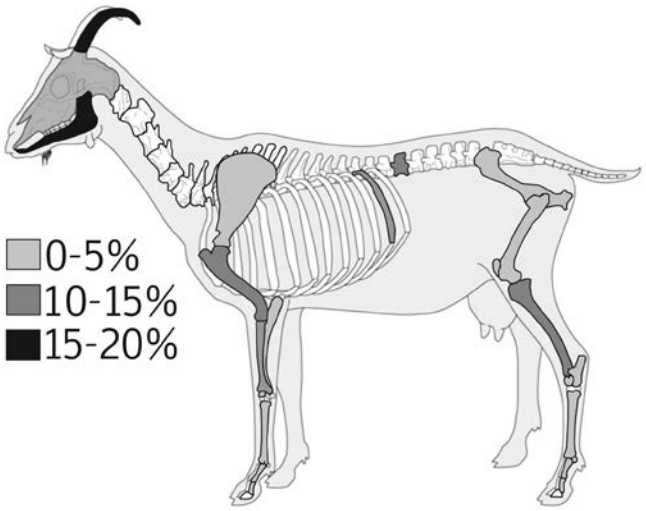

Fig. 7. Skeletal element distribution for goats (NISP%). A high concentration of horn cores was recorded at the Westwall area.

analysis of skeletal element distribution also suggests that some wild species, including red deer and wild boar, were transported to the site as whole carcasses (SALIARI forthcoming). Interesting observations in Sand regarding the element distribution include the high concentration of goat horn cores, mainly in the Westwall area (29 specimens) (Fig. 7a-b) and the high frequency of red deer feet bones, especially phalanges.

Concerning fur-bearing animals, brown bear, European beaver, European pine marten and red squirrel provided a sufficient number of bones for further investigation. The majority of brown bear bones derive from the fore limbs, feet bones and head region. Beaver is mainly represented by bones of the head, especially mandibles, followed by hind limbs and vertebrae ribs. The best represented area for European pine marten is the head (›50 %), due to the high number of mandibles. Red squirrel exhibits mainly bones of the fore and hind limbs (Tab.1).

Discussion

Evidence for skinning is suggested by the analysis of the faunal remains, the archaeological context and the archaeological finds. The processing of various materials (pottery, metals and textiles) has been archaeologically verified and further exploitation of animal skin and fur was probably included in the repertoire of the activities of the inhabitants. Logically some kind of at least primary processing took place at the site, because animal skin requires further processing as soon as possible, to avoid insect and bacterial damage (RUSS-POPA pers. comm.). The archaeozoological evidence is discussed below.

Species representation

A great variety of domesticated and wild species such as cattle, goats and red deer have been exploited for their skin since prehistory. The category of fur animals has attracted

special interest and various studies illustrate that hunting activities aimed to acquire a variety of materials, including fur (Benecke & Hanik 2003). Some of the most popular fur animals include badger, wolf, fox, hare, beaver, pine marten, polecat, bear, red squirrel, stoat, seal, and weasel (Fairnell 2003: 17).

The utility of fur has often been underestimated, due to lack of preserved organic material, which needs very special conditions to survive (*e.g.*, Grömer 2016); in cases of mummified bodies or other exceptional finds, it becomes clear that pelts were used more frequently than believed (Sykes 2011: 327–345). Evidence including pictorial record and written sources indicates the importance of furs in various aspects of daily life (Grömer *et al*. this volume). Sometimes it is surprising how many different skins and pelts were combined, how they were used, and the techniques applied. A recent study concluded that Ötzi's clothes, for example, were assembled from five different animal species (cattle, sheep, goat, red deer and brown bear) (Urbanus 2016: 18).

Table 1. Element representation of fur-bearing animals. Abbreviations: European otter (LU), European polecat (MP) European pine marten (MA), European badger (MM), red squirrel (SV), European beaver (CA), European hare (LE), wolf (CL), wild cat (FS), brown bear (UA).

Element	LU	MP	MA	MM	SV	CA	LE	CL	FS	UA
Calvaria		1	6	2		9				1
Maxilla				1		22				5
Mandible	2		14	1	2	37		1	1	4
Vertebrae	2		2			16				
Costae	1					32	5			8
Scapula			1			8	2			2
Humerus	1		2		10	17			1	7
Radius			1	1	1	9			1	5
Ulna			2	1		11				4
Carpalia										1
Metacarpus						11				3
Pelvis			1	2		29			1	2
Femur	1		3		18	7	2			
Patella										2
Tibia	1		2		10	21	2			
Talus						2				2
Calcaneus			1			2				2
Metatarsus						5		2		2
Mtapodials										1
Phalanx 1						2				3
Phalanx 3										3
Baculum	1									
Total	9	1	35	8	41	240	11	3	4	57

The occurrence of fur animals in an archaeological assemblage can be used as an indication that people were interested in pelts (Fairnell 2003: 17). Certainly, some species were hunted for other reasons as well; some of them, such as beaver, bear and hare, were part of the diet (Kunst & Galik 2000: 249–258; Schmölke 2004: 132) or their products might have been used for multiple purposes, such as medicine (Pucher *et al*. 2007). Studies on settlements have shown that dietary habits cannot be used as an argument against the interest of people in pelt utilisation (Brather 2008: 205). Many studies show that some fur animals played an important dietary role (*e.g.*, fasting period in monasteries see Kunst & Galik 2000); in such cases the context is crucial when interpreting species representation.

The concurrent presence of many fur species in faunal assemblages strengthens the possibility that their pelts were exploited (Pucher & Schmitzberger 1999a; Schmölke 2004: 132). According to NISP fur animals represent around 4 % of the total material in Sand (Fig. 4) and most of the bones were retrieved from the Westwall area (Saliari forthcoming). The occurrence of pelt animals in Sand was favoured by the environmental setting in a wooded area and especially by the proximity to the Thaya River (Pucher & Schmitzberger 1999a). Some of these animals (beaver, bear, otter, *etc*.) were consumed (indicated by cut and chop marks), but meat acquisition was most likely not the only motive for hunting activities. In Sand the weight analysis which is used to evaluate the role of the species as meat suppliers (Ziegler 1990: 2) indicates that these animals contributed minimally to the diet of the inhabitants. Clearly, the species representation is strongly affected by many factors such as taphonomy and excavation techniques. Nonetheless, the archaeozoological analysis has shown that the species contributing most to the diet were cattle, bison, red deer, wild boar and pig (Fig. 4), which are found at high percentages (Saliari forthcoming).

Modification traces

Chop and cut marks are among the most frequent categories of modifications. The analysis of the marks (orientation, position, *etc*.) can provide valuable information about cultural practices and preferences. However, identifying activities based solely on the study of cut marks can be challenging. This is because different activities might leave similar marks or not at all; marks related to skinning tend to be shallower and are therefore not always detectable (Knight 2002: 68).[5] These marks are more common on elements with less meat, such as cranium, mandibles, metapodials and phalanges (Binford 1981: 101, 107, 136–142; Reitz & Wing 2008: 128–131). Nonetheless, a less skilled skinner might produce a higher number of marks (Fairnell 2008: 47–60).

It remains difficult to understand all the aspects that influence butchery and skinning techniques, because of the great variety of factors that must be taken into consideration,

[5] The theoretical background about skinning and the processing steps involved treating the skin after skinning is given at Grömer *et al*. this volume.

including species, know-how, experience, techniques, cultural practises, tradition, and personal preferences. Nonetheless, numerous publications have attempted to deal with these issues (Binford 1981; Marshall 1989; Serjeantson & Waldron 1989; Knight 2002; Fairnell 2003; Seetah 2005; Bartosiewicz 2006, 2009; Kunst & Fitzgerald 2011; Harjula 2015). Some of them use experimental methods (Braun *et al*. 2007; Val & Mallye 2011) while others are based on ethnographical studies (Binford 1981), or on professional experiences (butchers *etc*.).

Skinning in Sand would have certainly occurred as part of multiple processes (for meat, sinews, *etc*.), and materials such as skin and fur are unlikely to have been thrown away. Marks on the phalanges can be attributed to other activities too, but cuts on specific parts of the cranium and metapodials have been usually interpreted as skinning marks (Binford 1981: 136–142; Lisowski 2014; Knight 2002; Bartosiewicz 2006). The abundance of bones from young animals with marks is usually interpreted as being related to their very good meat and skin quality. Marks on dog bones indicate cynophagy (Saliari forthcoming), but comparative archaeological record from other sites such as Feddersen Wierde in Germany suggests that dog skin might also have been exploited (Ewersen 2010).

Concerning fur animals the fact that many species are represented by a low number of bones needs to be taken into consideration when interpreting the distribution of marks. In Sand, chop and cut marks on bones of beaver, otter and brown bear have been interpreted as butchering marks (Saliari forthcoming). An interesting find comes from the Westwall area: the mandible of a European pine marten exhibits marks at the corpus mandibulae and the basal part. Cut marks at the basal part of mandibles are usually interpreted as the result of skinning (Strid 2000). Experimental methods (Val & Mallye 2011) and archaeological examples (Strid 2000) have shown that marks on specific areas of the crania, mandibles, metapodials and even pelves of fur animals are related to skinning activities (Strid 2000; Fairnell 2003). An important aspect in the present case is that bones that clearly exhibit these possible (skinning) marks derive mainly from the Westwall area.

Skeletal element distribution

The frequency of skeletal elements must cautiously interpreted, because many factors affect the representation of the various body parts, including cultural practices, taphonomy, excavation techniques and species identification (Reitz & Wing 2008: 191). For instance, small-sized animals and young individuals can be strongly affected by taphonomic processes. Moreover, smaller bones are sometimes overlooked due to lack of appropriate excavation techniques. In Sand, two more factors deserve mention: a) the fragmentation of the material, due to severe butchery techniques, and b) the high number of wild taxa which caused some difficulties during the identification of small and/or uncharacteristic fragments.

In Sand, the element distribution of goats points to potential tanning waste (Fig. 7). Bones such as mandibles, radii and tibiae are well represented and they belong to the bones that have better chances to survive.[6] Interestingly, a high frequency of horn cores has been also recorded. Horn cores are usually easily recognizable and their high representation can be product of such an identification bias. However, accumulations of horn cores have often been connected to craft contexts,[7] including horn exploitation and tanning (Prummel 1978: 399–422; Noodle 1994: 117–128; Bartosiewicz 1995: 72–73, 2006: 466; Deschler-Erb 2012; Rehazek & Nussbaumer 2012). Even the absence of horn cores (especially in kitchen waste) has been interpreted as a probable indication of tanning activities (Noodle 1994: 117–128)[8]. In Sand, a high concentration of goat horn cores was found in the Westwall area, where intensive economic activities have been documented and craft contexts recorded (processing of bones and antlers).

Another noteworthy observation is that red deer, which were transported as whole carcasses, exhibit a high number of feet bones, especially phalanges. According to the archaeological record, comparable finds have been connected to skin exploitation. Similar observations were made in Gars-Thunau (Kanelutti 1990: 139, 1993), an early medieval (probably Slavic) fortified settlement (9th–10th century AD). The abundant goat horn cores and Cervidae feet bones have been interpreted to indicate small-scale tanning activities (Kanelutti 1990: 139, 1993). In another example from site of Hainburg in Lower Austria (13th–15th century AD) the accumulation of metapodials and phalanges of small ruminants is thought to indicate skin exploitation (Galik 2004).

Nonetheless, apparently not all the animals were skinned in Sand. The example of bison suggests that only meaty parts of this animal arrived to the site. Cut marks on one bison metapodial from the upper settlement terrace could indicate skinning activities at the killing site (Pucher pers. comm.).

Conclusions

Archaeological and archaeozoological observations and their spatial context within the Sand site can be summarized:

The bones of fur animals constitute almost 4% (NISP) of the identified bones. A surprising wide variety of fur-bearing animal species has been documented, including the European otter (*Lutra lutra*), European badger (*Meles meles*), European polecat (*Mustela putorius*), European pine marten (*Martes martes*), red squirrel (*Sciurus vulgaris*), European beaver (*Castor fiber*), European hare (*Lepus europaeus*), wolf (*Canis lupus*), wild cat (*Felis silvestris*) and brown bear (*Ursus arctos*).

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[6] These bones also have parts that are found more often than others. In Sand, most of the tibia fragments derives from the distal epiphyses (Saliari forthcoming).

[7] When the context is appropriate.

[8] When the skin was given away with the horn cores still attached.

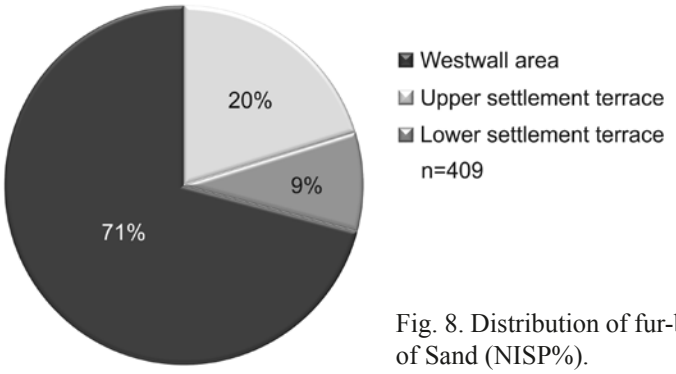

Fig. 8. Distribution of fur-bearing animals among the areas of Sand (NISP%).

The character of the site indicates that people worked to meet their daily needs (metal processing, textile production) and that production was of key importance. Skin and fur constituted vital elements of daily-used equipment (see GRÖMER *et al*. in this volume) and therefore it is possible that the residents also produced leather/fur.

Additionally, several important indications related to skin and fur processing derive from the Westwall area, including numerous fur animals (71 % NISP, Fig. 8), bones with cut marks indicating skinning activities and a high frequency of immature animals (especially cattle) that deliver very good skin quality. Additionally, craft contexts related to exploitation of animal material, such as modified bones and antlers, were found mainly in the Westwall area, including special accumulations (Object 21) possibly related to tanning waste (abundant cranial elements).

Finally the isolated character of the Westwall area might have favoured tanning activities, as this process is usually related with unpleasant odours. According to BARTOSIEWICZ (2009) tanning was *"a foul-smelling enterprise"*. Architectural features related to tanning are usually isolated and built following a specific orientation, related to the direction of the wind. The same publication notes that tanners usually worked along river banks, because the preparation of hides required a lot of water. In Sand, one of the entrances located close to the Westwall, Object 27 (Fig. 2), leads directly to Thaya River (water availability). Although the Westwall area contains many faunal remains and the archaeological finds support skin processing there, there is currently no direct evidence for the whole production process.

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