

Sledge runners or tools?

Experimental and micro-wear approaches in the study of a curious assemblage of abraded hemi-mandibles of the Late Iron Age site “La Brocante” in Avenches (Switzerland)

Patins de traîneau ou outils ?

Approche expérimentale et étude fonctionnelle d'un ensemble singulier d'hémi-mandibules abrasées du site de la fin de l'âge du Fer “La Brocante” à Avenches (Suisse)

Hildegard MÜLLER, Dorota WOJTCZAK, Nicole REYNAUD SAVIOZ, Aurélie SCHENK

Abstract: In the western part of today's Switzerland, in central Europe, the modern town Avenches is built on top of the Roman Colonia Aventicum. The capital of the Celtic tribe Helvetii was already a major settlement prior to the Roman conquest. Excavations in the pre-Roman layers at the site of “La Brocante” unearthed an interesting bone assemblage, among which a total of 38 hemi-mandibles with wear marks were present, mainly from cattle. Due to historical pictorial evidence or ethnological sources, such transformed skeletal elements are often referred to as skates or sledge-runners in the literature. However, structures and archaeological finds suggest that the hemi-mandibles may have been used in diverse artisanal activities. Multiple experiments were conducted to better understand the use of such bone elements, including the use of replicas as sledge runners or as tools to process hides, flax or horns. As a result, the use-wear analysis of the artefacts and comparison to the replicas point to the use of hemi-mandibles as sledge runners and/or tools for hide work. The archaeozoological study also supports this hypothesis, since the anatomical representation and cut marks attest to slaughtering, butchering and craft activities involving bones. In this context, cattle have played a key economic role by supplying meat, energy, and raw materials.

Combined with the archaeological contexts, the results obtained by the archaeozoological and use-wear analysis point to a site regularly frequented by craftsmen, who were opportunistic in their use of resources, such as reusing sledge runners as tools.

Keywords: Hemi-mandible, use-wear, experimental archaeology, sledge runner, hide working tool, Second Iron Age, Avenches, Aventicum, tannery.

Résumé : Au cœur du territoire des Helvètes, la colonie romaine d'Avenches/Aventicum (Suisse) est idéalement située au centre de l'Europe et au carrefour de routes commerciales, terrestres et fluviales. Les investigations archéologiques qui y sont menées dévoilent, depuis une dizaine d'années, une vaste agglomération celtique ayant précédé la ville romaine, au plus tard depuis 120 av. J.-C. Un projet de recherche multidisciplinaire destiné à mieux connaître le passé gaulois d'Aventicum (« ORIGINES. Les origines gauloises d'Avenches ») a rendu possible l'étude exhaustive de la faune. C'est ainsi qu'un grand nombre d'ossements portant des modifications anthropiques a pu être isolé. La majorité provient du site de « La Brocante » qui fait l'objet de cet article. L'intérêt de ce gisement tient, entre autres, à la présence de grandes fosses situées au voisinage de l'ancien lit d'un ruisseau et qui sont reliées entre elles par des canaux. Même si l'étude du site n'est pas encore achevée, on peut raisonnablement avancer que ce secteur était notamment consacré à des activités artisanales nécessitant de l'eau courante. La matière osseuse y est en outre remarquablement bien conservée, en raison d'un enfouissement rapide et d'une humidité permanente causée par le ruissellement permanent des eaux souterraines.

Sur un assemblage de près de 4 500 restes de faune, une cinquantaine d'éléments squelettiques abrasés, polis, striés ou encore perforés ont été repérés. Parmi ces derniers figure une importante série de 38 hémi-mandibules dont le corps présente une abrasion plus ou moins forte de la partie basale, souvent accompagnée d'un poli sur les surfaces latérale et médiale. Ce lot rassemble essentiellement des mâchoires inférieures de bovins ($n = 31$), mais aussi de chevaux ($n = 3$), de chiens ($n = 3$) et d'un ours brun. Inédite, la mise en évidence d'hémi-mandibules abrasées issues de ces deux carnivores constitue une réelle surprise.

De telles mandibules, de bœuf et de cheval, également datées du second âge du Fer et de l'époque romaine, sont mentionnées depuis des décennies, tant sur le territoire suisse qu'à l'est de l'Autriche. Tantôt interprétées comme des patins de traîneau d'après des sources iconographiques médiévales et des exemples ethnographiques, ou comme des outils utilisés dans le cadre d'activités artisanales (cornaterie et tannerie), leur fonction demeurait hypothétique.

Cette grande série d'hémi-mandibules et le contexte archéologique singulier ont motivé la mise sur pied d'expérimentations et d'analyses tracéologiques pour enfin apporter une réponse à ces interprétations présumées. Quarante hémi-mandibules de bœuf, de cheval et de chien ont ainsi été préparées puis testées comme patins de petits traîneaux, mais aussi comme outils dans le traitement de peaux, de fibres végétales et de corne.

Dans le détail, des petites luges, formées d'un plateau posé sur deux mandibules de grands mammifères, plus stables que les traîneaux composés d'une mandibule, et portant une charge de 14,3 kg ont été tirées sur :

- pré semi-humide, sur une distance de 6,3 km ;
- de la neige (recouvrant un pré), sur une distance de 3,2 km ;
- une prairie gelée avec une faible couche de neige, sur une distance de 4 km ;
- de la glace, sur une distance de 5 km.

Les hémi-mandibules utilisées comme outils, issues de bovins et de chien, ont servi à :

- casser et à séparer des fibres de lin (teillage-broyage et battage), pendant une demi-heure à trois heures ;
- écharner des peaux (de cerf), pendant une demi-heure à une heure ;
- dérouler des étuis cornés (chauffés), pendant une demi-heure à une heure.

La comparaison des traces ainsi produites sur les répliques avec les stigmates observés sur 32 exemplaires archéologiques de bœuf ($n = 25$), de cheval ($n = 3$), de chien ($n = 3$) et d'ours brun ($n = 1$) apporte les informations suivantes :

- la majorité des hémi-mandibules de bœuf (20 sur 25) ont servi de patins de traîneau et, dans un deuxième temps, 12 d'entre elles, au moins, ont assurément été utilisées pour le travail des peaux. Cinq hémi-mandibules de bœuf ont servi uniquement au travail des peaux ;
- deux des trois exemplaires d'hémi-mandibules cheval ont uniquement servi de patins, tandis qu'un exemplaire a d'abord servi de patin puis d'outil ;
- les trois hémi-mandibules de chien ont servi au travail des peaux et celle d'ours a rempli les deux fonctions (patin et outil) ;
- aucun exemplaire n'a servi au travail des fibres végétales ni à celui de la corne.

L'apport de l'analyse tracéologique à la problématique de ces artefacts s'est montré essentiel. Si celle-ci a permis de confirmer l'utilisation des mandibules comme patins de traîneau, elle a également prouvé leur implication dans les activités de tannerie. Cet artisanat spécialisé est parallèlement mis en évidence par l'étude des traces visibles sur d'autres éléments squelettiques – os longs et côtes de bœuf et de cheval – ainsi que par les analyses archéozoologiques. Ces dernières révèlent en effet une surreprésentation notable des éléments céphaliques, ainsi que la fracturation des crânes et des os à cavité médullaire, qui sont autant d'indices du travail des peaux (tannage à la cervelle et la moelle). La double fonction, de plusieurs exemplaires, de même que l'attestation d'hémi-mandibules d'espèces animales plus rares témoignent en outre d'un certain opportunisme. Ce dernier serait aussi à l'œuvre dans l'acquisition des mandibules, dans la mesure où ces éléments anatomiques étaient disponibles en grande quantité sur place. Le site "la Brocante" servait en effet non seulement de lieu d'abattage et de boucherie, mais aussi d'espace de valorisation des sous-produits animaux, avec des effectifs bovins très nettement prédominants.

Mots-clés : hémi-mandibule, trace d'utilisation, archéologie expérimentale, patin de traîneau, outil pour le travail des peaux, second âge du Fer, Aventicum, tannerie.

INTRODUCTION

The modern Town of Avenches is located in the western part of Switzerland, in central Europe (fig. 1). During Celtic and Roman times, it was at the heart of the territory of a Celtic tribe called the Helvetii, at the crossroads of major land, river, and lake routes. Due to its favourable situation for trade and commerce, as well as the movement of goods and people, it was already a major Celtic settlement by the end of the 2nd century BC. Following the Roman conquest, Aventicum was re-founded

a decade before the turn of our era as the capital of the Helvetii territory and was placed under Roman administration. The new town, built according to an orthogonal plan with insulae, was elevated to the status of a Roman colony by the Emperor Vespasian around 70 AD (Castella et al., 2015).

Between 2014 and 2022, several excavations led to the discovery of 46 hemi-mandibles of various animal species bearing wear marks, recognisable as polished, striated and abraded areas on the ventral, lateral and medial surfaces of the mandibular body. One of them was uncovered in a presumed tanner's workshop within the

insula 3 of the Roman town (Wojtczak and Müller, 2023), while the others date back to the Late Iron Age, more precisely from the mid-1st century BC, within the perimeter of the Celtic settlement. The 38 specimens discovered on the site “La Brocante”, located along the former bed of a small stream (Le Ruz), will be the focus of this article (fig. 1). Although the studies are still ongoing, the structures – large pits connected by canals – and the archaeological finds indicate that artisanal activities related to the processing of plant fibres or the working of hides and possibly wool were carried out in this area (Schenk and Amoroso, 2019, p. 320). Therefore, the presence of a large number of abraded hemi-mandibles raises the question of their use in craft activities.

Such artefacts are not the first of their kind: Similar modified skeletal elements, also dating from the Late Iron Age and Roman periods, have already been found in Switzerland and eastern Austria; they are often referred to as sledge-runners. This suggestion stems from historical pictorial evidence from the 14th and 16th centuries depicting men or children sitting on sledges made of horse mandibles, as well as ethnographic sources from the late 19th century (Stopp and Kunst, 2005; Gostenčnik, 2010).

Scholars have also suggested the idea of these objects being tools related to horn smoothing, following the discovery of similar hemi-mandible with numerous cattle horn cores in the Roman town of Vitodurum/Oberwinterthur in Switzerland (Morel, 1991, pp. 130–132).

Reviewing the literature, it became clear that experimental archaeology and use-wear analyses have never been published on this kind of material. Thus, an experimental approach and micro-wear analysis were carried out in the hope of finally providing an answer to these different interpretations.

1. FAUNAL REMAINS

A multidisciplinary research project aimed at a better understanding of the Celtic past of Aventicum (“ORIGINES. Les origines gauloises d’Avenches”) has enabled us to carry out an exhaustive study, still ongoing, of the fauna. The assemblage of “La Brocante” includes around 4,500 hand-collected animal remains, among which cattle are the most represented (55% of NISP

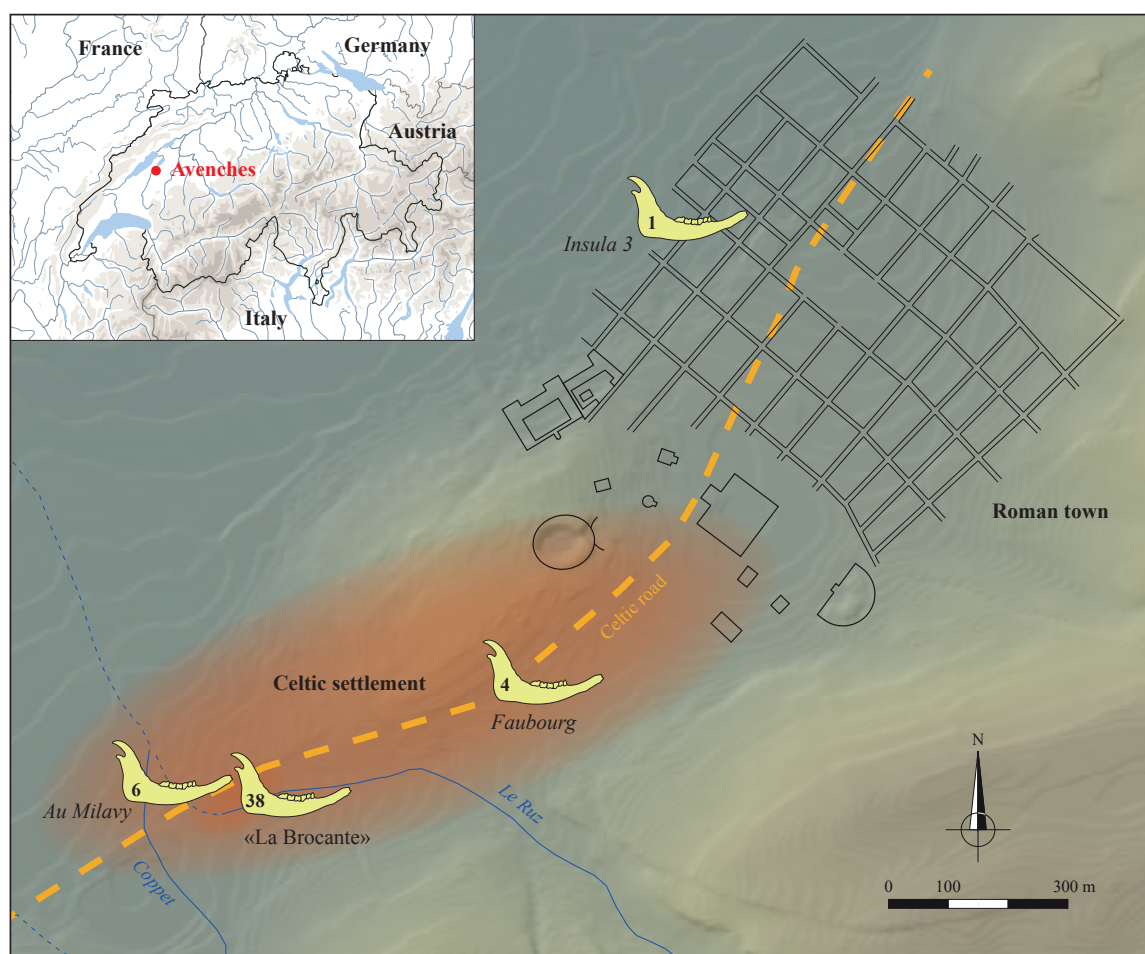


Fig. 1 – Map of the Roman town of Avenches/Aventicum and the approximate perimeter of the Celtic settlement, with the spatial distribution of the hemi-mandibles (CAD A. Schenk).

Fig. 1 – Plan de la ville romaine d’Avenches/Aventicum et du périmètre approximatif de l’agglomération celtique, avec la répartition spatiale des hémimandibules (DAO A. Schenk).

and 70% of mass). When studying the faunal remains, 38 hemi-mandibles with use-wear visible on the ventral, lateral and medial surfaces of the body, were isolated by the naked eye or by using the Wild M3Z Stereo Microscope.

“La Brocante” offers ideal conditions for observing all kinds of anthropogenic modifications, which highlight the exploitation of animal raw materials. This exceptional bone preservation is mainly due to rapid burial and continuous humidity caused by constant groundwater runoff; animal remains are also characterised by a low secondary fragmentation. The stigmata indicate the recovery of skins, furs and bones, but rarely that of horns and tendons. Osseous modifications not only concern hemi-mandibles since polish, wear, striations, and perforations also occur on four long bones from cattle and horse, one skull and at least one rib from cattle. The abraded hemi-mandibles come mainly from cattle ($n = 31$) but also from horses ($n = 3$), dogs ($n = 3$), and a brown bear. The astonishing discovery of specimens from these two carnivores was unexpected.

The modified bones, including the abraded hemi-mandibles, represent 1.9% of all horse ($n = 266$) and 1.8% of all cattle ($n = 1,594$) bones. The three dog lower jaws with light abrasion appeared among 27 remains attributed to the domestic canid, and the unique brown bear remain identified is a modified hemi-mandible. From a total of 144 cattle lower jaws—complete or fragmentary (but composed by body and/or angular process)—25 show abraded areas (18.7%). These modified jaws are all from adult animals (aged 5–7 and over), except for one juvenile, while all the lower dental series indicate the presence of adult and juvenile cattle in similar proportions. In addition, four of the 25 identified horse hemi-mandibles and three of the five dog hemi-mandibles show signs of wear marks.

2. EXPERIMENTAL ARCHAEOLOGY AND USE-WEAR ANALYSIS

The use-wear analysis was performed by a low- and high-power approach (e.g. Semenov, 1964, p. 22; Odell and Odell-Vereecken, 1980, pp. 88–90; Mansur, 1982, pp. 213–233; Legrand, 2007; Évora, 2015, pp. 160–161; Wojtczak and Kerdy, 2018) using Leica Z16 APO combined with the camera attachment Leica DFC420 (up to 10× magnification) as well as the digital Microscope Keyence VHX 6000 (up to 200× magnification). To better observe the traces, the surfaces were cleaned by soapy water with a pH value of 7.5, distilled water, and dried with a nonabrasive cloth. This was necessary to remove dirt and sweat from the previous handling of the artefacts and replicas with no gloves.

To examine the origin of the traces, the reference collection of use-wear from the Prehistory Working Group at IPAS¹ was used, and further experiments were conducted. These experiments were carried out based on

the observed traces, archaeological context and literature research (e.g. Herman, 1902; Semenov, 1964; MacGregor, 1985; Morel, 1991; Küchelmann and Zidarov, 2005; Stopp and Kunst, 2005). Due to time and resource limitations, the sledge runner experiments focused mainly on the body of the lower jaw (horizontal ramus), and more specifically on the basal part of the sledge and the question of what kind of trace patterns were developed there.

In total, 20 mandibles from contemporary cattle, horse and dog were used as replicas during the experiments. Due to hygienic and storage reasons, the bones were cooked between 60 and 80°C for up to three hours with the use of soap. They were used in the following two experiments.

Mandibles used as sledge runners

The sledge constructions were built with two mandibles for more stability. G. F. IJzereef (1974, pp. 183–184) already described such a set-up as a “catamaran-type of sledge”.

- Four mandibles from cattle and a pony were used as sledge runners for transport (14.3 kg) on a semi-humid pasture on the edge of a forest for three hours and over a distance of about 6.3 km.
- Two mandibles from cattle were used as sledge runners for transport (14.3 kg) on snow (pasture, humid) for two hours and 3.2 km.
- Two mandibles from cattle were used as sledge runners for transport (14.3 kg) on frozen snow (some grass was still visible) for 2 hours and 4 km.
- Three mandibles from cattle and a horse were used as sledge runners for transport (14.3 kg) on ice for up to 3.5 hours and 5 km.

Hemi-mandibles were used as tools (in total 18 experiments)

- Four hemi-mandibles from cattle and dog were used to break flax (Teillage-broyage). One cattle hemi-mandible was used for 90 minutes, a second for 130 minutes and a third for 180 minutes. One dog hemi-mandible was used for 60 minutes.
- Four hemi-mandibles from cattle and a dog were used as a scutching knife for flax (Teillage-battage). One cattle hemi-mandible was used for 30 minutes, another for 60 minutes and a third for 180 minutes. One dog hemi-mandible was used for 30 minutes.
- Six hemi-mandibles from cattle and dog were used for hide scraping. The hide of a red deer was soaked for three days in ash-water. The hair side was scraped with a dog hemi-mandible for 30 minutes and a cattle hemi-mandible for 60 minutes. The flesh side was scraped with one cattle hemi-mandible for 30 minutes and two others for 60 minutes and a dog hemi-mandible was used for 60 minutes.
- Four hemi-mandibles from cattle and dog were used for horn working. Firstly, the horns were softened in boiling water. Then two cattle hemi-mandibles worked

the horn for 30 minutes, and a third for 60 minutes. One dog hemi-mandible was used for 30 minutes.

The presence and development of traces on replicas were assessed using low and high magnifications before, during and after the experiments. Due to publication restrictions, this article focuses on the sledge-runners; additional findings and a more in-depth discussion of all trace types will be published separately.

2.1. Traces on the replicas

The experiments using the mandibles as sledge runners (fig. 2d) created the most distinctive traces (fig. 2a, fig. 2b and fig. 2c). Even though the different grounds produced some variations, a common trace pattern was recognised on the molar region of the hemi-mandible's body: First there is the attrition of matter on the ventral

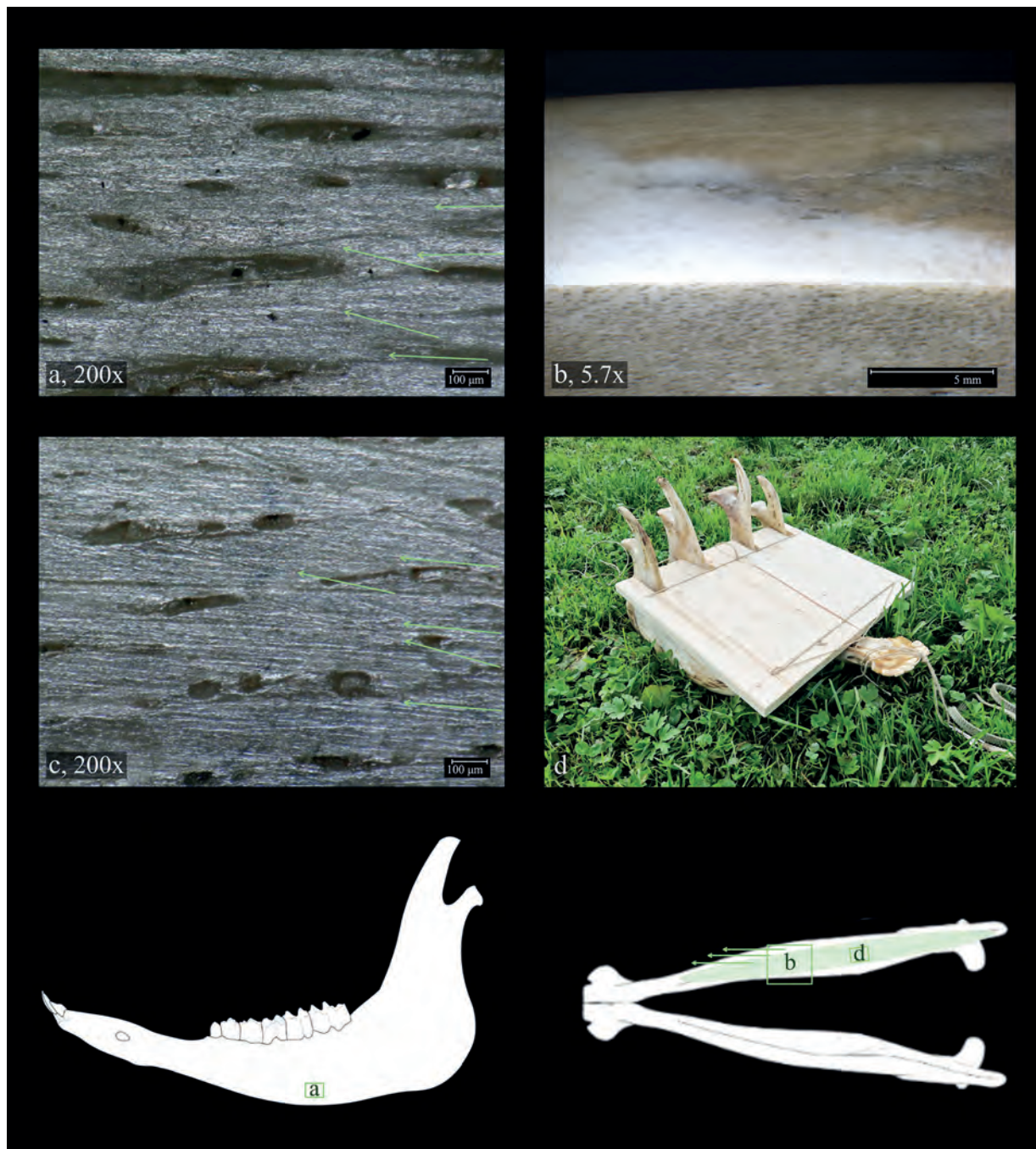


Fig. 2 – The traces on the replica sledge runners are very distinctive (d): The loss of matter (b), and the striations are longitudinal to diagonal at about 15° to the axis of a hemi-mandible (c). Narrow longitudinal striations are visible on the medial and lateral sides (a; photos and CAD H. Müller and D. Wojtczak).

Fig. 2 – Les traces observées sur les répliques utilisées comme patins de traîneau (d) ont des caractéristiques très spécifiques : l'attrition y est très marquée (b), et les stries sont longitudinales à obliques, à environ 15° par rapport à l'axe d'une hémi-mandibule (c). Des stries longitudinales et étroites sont visibles sur les faces médiale et latérale (a ; clichés et DAO H. Müller et D. Wojtczak).

surface with a sharp angle on the medial side and a more rounded on the lateral side (fig. 2b). Second, there are the striations on the base run at an angle of about 15° to the axis of a hemi-mandible, if the hemi-mandibles were fixed in anatomical connection beneath the sledges. The single hemi-mandibles attached parallel and straight do not have striations at such an angle but run longitudinally. Regardless of direction, they are all quite long (fig. 2c) and exhibit notable variation in width depending on the surface substrate—ranging from less than 2 µm up to 7 µm, with occasionally even broader widths. In addition, another group of striations on the medial and lateral sides can be observed: They run longitudinally to diagonally and are much narrower (<2 µm) than the ones on the ventral edge (fig. 2a). All of those striations occur generally in multiple parallel running strokes and are a variation of the “rough-bottomed through” described by M. E. Mansur (1982, pp. 217–218).

The traces generated on the hemi-mandibles used as tools to process flax (fig. 3b), horn or hide (fig. 3a) are quite different. These consist mostly of brilliant polishes with transversal to diagonal striations on the ventral border developed onto the sides (lateral and medial). Those striations are also the “rough-bottomed through” type, but are much shorter than the striations observed on the sledge runners. The striations developed by scutching flax were not only short, but also tapered at the ends (fig. 3f). The traces observed on the replicas used to break flax are even more different. Instead of striations, these are marked by a certain degree of breakage and/or compression and a weak generic polish (fig. 3d).

By contrast, the polish produced by the scraping of the hide is very characteristic (fig. 3c): It is greasy and visible in even deeper areas with many micro craters (mostly 2–6 µm) and micro pits (<2 µm). Furthermore, alongside the narrow longitudinal and transversal striations (1–2 µ) are many broader transversal or diagonal ones. These can be straight but also occur in more undulating forms. The formation of broader striations can be explained by the ash grit left after the hide treatment. Striations left by the contact with horn are randomly orientated and distributed (fig. 3e).

2.2. Traces on the artefacts

Most of the artefacts show wear patterns similar to those created on the replicas used as sledge runners. The attrition of matter is mainly on the ventral border (fig. 4b), the “rough-bottomed through” striations on the base run at an angle up to 15° to the axis of a hemi-mandible (fig. 4b and fig. 4c), and narrower variations of those striations are on the medial and lateral sides (fig. 4a). It is not yet possible to differentiate confidently between traces generated by specific ground types on the sledge runners. No articulated hemi-mandibles were identifiable within this assemblage.

Many artefacts interpreted as sledge-runners present a second generation of different traces that are also concentrated on the base of the mandibular body but devel-

oped onto the lateral and medial sides as well. This wear pattern (fig. 4a and fig. 4c) is a greasy polish with many micro craters and micro pits, and two different kinds of “rough-bottomed through” striations are distinguishable. The first are very narrow striations (<2 µm) that run in various directions, and the second group consists of broader striations that run mostly diagonal to transversal (fig. 4a and fig. 4c). Based on our experiments, we interpret this second generation as traces from hide work.

It is also worth noting that some artefacts showed manipulations on the diastema and/or the vertical ramus, as in the case of a right hemi-mandible from an adult cattle (fig. 4d): This artefact is missing a substantial part of the vertical ramus and the edge pulling towards where the coronoid process has been manipulated, but no clear manufacture traces can be seen. These edges are rounded and polished, suggesting they were modified before the use.

Like many artefacts, the one specimen shown in figure 4 is strongly affected by PDSM—post-depositional surface modification (e.g. Levi Sala, 1986, pp. 229–230). This term brings together all changes to the surface that happened after the deposition of artefacts. Despite these alterations, most of the traces were still very well preserved, which enabled us to interpret the results as followed (tabl. 1).

3. DISCUSSION

The traces on the artefacts point towards their use as sledge runners and tools for hide work. The hemi-mandibles proved to be very versatile and practical tools during the experiments.

The traces and manipulations observed on the artefacts—namely, the striations, the abrasions, and the missing ramus—have also been noted by researchers on artefacts from other sites (IJzereef, 1974, pp. 183–184; Stopp and Kunst, 2005, p. 187). While the study from B. Stopp and G. K. Kunst is interesting due to geographical and chronological proximity, G. F. IJzereef’s research about a medieval jaw-sledge from Dordrecht, Netherlands, is very relevant because of his proposed construction of the sledge. As previously mentioned, he refers to a “catamaran-type of sledge” with two complete mandibles. But here is where the manipulated ramus come into play: to create “a broader bench”, the ramus is cut off on the two inner hemi-mandibles. This idea is very interesting, but whether such a construction was used in “La Brocante” would need further investigation.

Experiments showed that contact with diverse substrates produced various patterns of traces on the hemi-mandibles. Most prominent are loss of matter (through attrition) and the occurrence of striations on the ventral surface of the replicas. Though we can observe diversity within the traces produced during experiments, we cannot confidently identify the ground on which the archaeological specimens were used. However, a

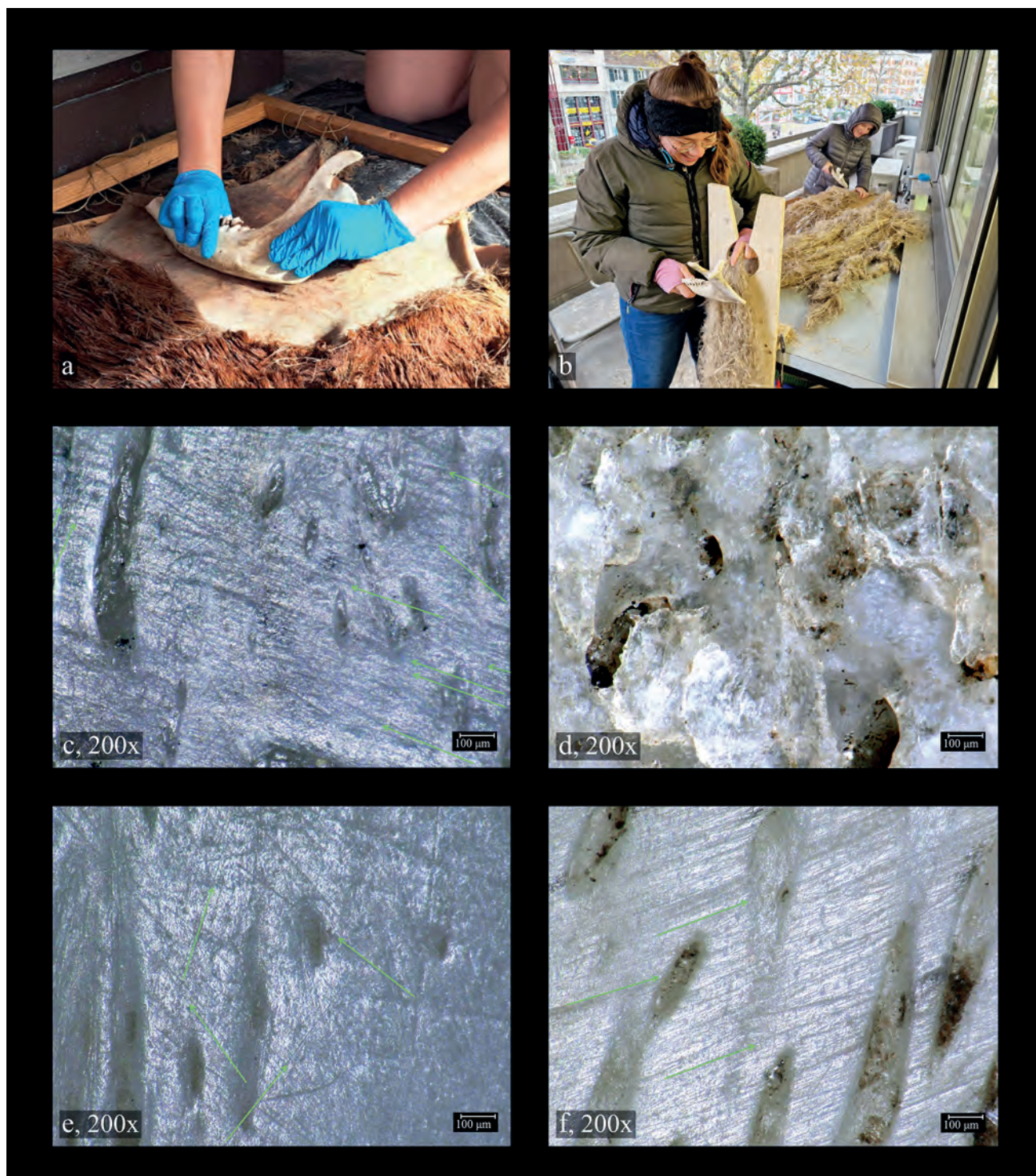


Fig. 3 – The striations produced using hemi-mandibles as tools run mostly diagonally to transversally to the axis of a hemi-mandible and are generally short. This is especially true for the striations resulting from scutching flax, which are also tapered at the ends (b and f). The striations developed through scraping hides were accompanied by a greasy polish which is even visible in deeper areas (a and c). Striations left by the contact with horn are randomly distributed and oriented (e). Breaking flax is the exception: no striations were created but caused a certain degree of surface breakage (b and d; photos and CAD H. Müller, D. Brönnimann and D. Wojtczak).

Fig. 3 – Les stries produites par l'utilisation des hémimandibules comme outils sont généralement obliques ou transversales par rapport à l'axe de l'hémimandibule et généralement courtes. Cela est particulièrement vrai pour les stries résultant du teillage-battage du lin, qui sont, de plus, effilées aux extrémités (b et f). Les stries développées par le raclage des peaux sont accompagnées d'un poli gras qui est encore visible aux endroits les plus profonds (a et c). Les stries laissées par le contact avec la corne sont réparties et orientées de manière aléatoire (e). Le teillage-broyage constitue une exception : il ne laisse pas de stries mais provoque une certaine fragmentation de la surface (b et d ; clichés et DAO H. Müller, D. Brönnimann et D. Wojtczak).



Fig. 4 – Two generations of traces are visible on a right hemi-mandible of an adult cattle. The more abrasive traces with the longitudinally to diagonally striations (a, b and c – dashed arrows) are superimposed by the greasy polish and transversally to diagonally striations (a and c – solid arrows). This artefact is missing a substantial part of the ramus (coronoid and condylar process) since only the angle is preserved. These edges are rounded and polished, suggesting they were modified before use (d; photos and CAD by H. Müller and D. Berney, SMRA).

Fig. 4 – Deux générations de traces sont visibles sur une hémi-mandibule droite d'un bovin adulte. La partie la plus abrasée, qui porte des stries longitudinales à obliques (a, b et c – flèches en pointillés), est recouverte par un poli gras et des stries transversales à obliques (a et c – flèches pleines). Il manque à cet exemplaire une partie substantielle du ramus (processus coronoïde et condyloire) puisque seul l'angle est préservé. Les bords de la cassure sont arrondis et polis, ce qui suggère qu'ils ont été modifiés avant l'utilisation (d ; clichés et CAD H. Müller et D. Berney, SMRA).

Interpretation	Cattle hemi-mandibles	Horse hemi-mandibles	Bear hemi-mandible	Dog hemi-mandible
Sledge runners		1		
Sledge runners (PDSM covering possible 2nd use)	4	1		
Sledge runners, unknown 2nd use	1			
Sledge runners, hide working	12	1	1	
Sledge runner, possible hide working	2			
Hide working	5			1
Possible hide working				2
PDSM	1			

Tabl. 1 – The interpretation of the hemi-mandibles from “La Brocante” is based on the observed traces on the artefacts and in comparison, with the traces developed during the experiments (table H. Mueller and D. Wojtczak).

Tab. 1 – L'interprétation des hémimandibules de « la Brocante » est basée sur les traces observées sur les artefacts et sur la comparaison avec les traces développées au cours des expérimentations (tableau H. Mueller et D. Wojtczak).

single-use on clean ice is unlikely since we observed longitudinal striations on the lateral and medial sides and a more rounded microrelief than on the replicas used on clean ice. We assume that the sledges were used on heterogeneous surfaces due to the presence of flat homogeneous microtopography with the simultaneous occurrence of numerous and various striations. More investigation is required to more precisely comprehend their development.

In addition, many artefacts used as sledge runners show traces of secondary use in connection with hide work. Most notable are the greasy polish and the diagonal to transversal bigger striations, the latter probably due to the use of ash in hide processing.

The data obtained from the archaeozoological study (which, it should be remembered, is preliminary) confirms this interpretation and raises the question of the acquisition of the hemi-mandibles. As already mentioned, the lower jaws from “La Brocante” with wear marks come mainly from cattle (31/38 specimens). Although the number of abraded hemi-mandibles from horse, dog and brown bear is lower than that of cattle, it is interesting to note that, in relation to the number of identified remains, the bones of these three species were more often utilized. One special feature is the first-ever evidence of the use of dog and bear specimens. The fact that no other bear remains were found on the site could indicate that this precise hemi-mandible was brought to the site on purpose to be used as sledge runner and then for hide work or solely for the latter.

As far as the other animal species are concerned, another explanation for the acquisition of abraded lower jaws can be put forward: The anatomical representation and cut marks indicate that live cattle, horses, and dogs were brought to “La Brocante” to be slaughtered and the by-products processed on-site. Indeed, bones from all great anatomical regions – head, thoracic cage, limb,

and feet – are represented, and numerous skinning and butchery cut marks have been observed. Furthermore, the fauna provides various indications of tanning activity, such as the over-representation of cranial remains and, to a lesser extent, of lower legs, which are anatomical elements that may have been left in the hides brought to the tanners. The presence of numerous cattle and goat cranial fragments (consisting of frontal bones and horn cores) also supports this idea, since pictorial evidence of tanneries from more recent times (16th century) shows horns left in cattle hides (Leguilloux, 2004, p. 53). Moreover, the recovery of brains and marrow, as demonstrated by the fairly systematic fracturing of skulls and medullary bones, was perhaps not (only) linked to consumption: The fat contained in this organ and this substance could also be used for tanning hides (Gade, 2021).

All these aspects point to the fact that the area of “La Brocante” has been chosen for the slaughter, the butchery and the processing of animal by-products on-site. In this context, the hemi-mandibles used as sledge runners and/or tanning tools were supplied by the slayed animals. This would also explain the abundance of abraded hemi-mandibles from cattle, compared with those from horse (of similar size), as cattle is the most common animal species in this sector.

Traceological analyses were not limited to the hemi-mandibles alone but were also carried out on 17 other animal and human bones (long bones, ribs and a skull) bearing traces of wear, which were also discovered in the fossilised stream of Le Ruz that runs through the site of “La Brocante”. The identification of striations, polished areas, worn edges and perforations strongly suggest that at least eight of them were used as tools to scrape skins (both on the hair side and the flesh side) or served as anvils for perforating soft materials (such as skins or leather). The remaining nine were most likely employed for similar tasks.

All these results support the hypothesis that specialised craftsmen carried out their activities on the site. Therefore, the dual function evidenced in more than half of the mandibles—first as sledge runners, then for hide working—suggests that the two uses may have taken place within the same craft context. For example, to drag heavy waterlogged hides from one place to another with the help of a sledge construction, as well as for processing animal hides when the hemi-mandibles were used independently as tools. The absence of identifiable articulated hemi-mandibles within this assemblage may be attributed to taphonomic processes. Alternatively, it could be a result of their reuse as tools, during which the mandibles were deliberately disarticulated.

CONCLUSION

Anatomical representation and cut marks attest to slaughtering, butchering, and craft activities that involve bones on the site “La Brocante” in Avenches. As the predominant species, cattle have played a key economic role by supplying food (both meat and milk), energy, and raw materials. Although these large ruminants provided most of the modified hemi-mandibles, three other species were also used, namely horse and, attested for the first time, dog and brown bear.

The unprecedented use-wear analysis carried out on such modified hemi-mandibles not only confirmed the sledge runner hypothesis, but also highlighted the use of those anatomical elements as tools in the hide processing. By using the mandibles as sledge runners and/or as tools, the craftsmen showed an opportunistic use of their resources.

The contribution of traceology was fundamental in confirming the suspicion of tanneries raised by the archaeological context and zooarchaeological data. In the end, traceology, archaeology and zooarchaeology each provide evidence, of their own, that the site was frequented by craftsmen specialized in the processing of animal hides/skins. The results presented in this short article underline, if proof were needed, the importance of an interdisciplinary dialogue.

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NOTE

1. IPAS Integrative Prehistory and Archaeological Science, University of Basel, Switzerland.

Hildegard MÜLLER
IPAS, DUW, University of Basel
Basel, Switzerland
hildegard.mueller@unibas.ch

Dorota WOJTCZAK
IPAS, DUW, University of Basel
Basel, Switzerland,
dorota.wojtczak@unibas.ch

Aurélie SCHENK
Archéologie cantonale,
Site et Musée romains d’Avenches
Avenches, Switzerland
aurelie.schenk@vd.ch

Nicole REYNAUD SAVIOZ
Laboratoire d’archéozoologie
Sion, Switzerland
nicole.reynaud@labo-archeozoo.ch

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