CRAFTING BONE – SKELETAL TECHNOLOGIES THROUGH TIME AND SPACE

Proceedings of the 2nd meeting of the (ICAZ) Worked Bone Research Group

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Infrastructural support by

The staff of the Roman Department of the Aquincum Museum

Worked Bone Research Group 2nd Meeting
Budapest 31 August – 5 September 1999

BAR International Series
2001

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Special Assemblages

Participants in the WBRG 1999 Budapest conference (left to right): Ülle Tamla, Elisabeth Brynja, Tina Tuohy, Liina Maldre, Karlheinz Steppan, Heidi Luik, Gitte Jensen, John Chapman, Alice Choyke, Janet Griffitts, Andreas Northe, Noëlle Provenzano, Jörg Schibler, Nerissa Russell, Colleen Batey, Lyuba Smirnova, László Daróczi-Szabó, Daniella Ciugudean, Mária Bíró, Kordula Gostenčnik, Eszter Kovács, Christopher Morris, Sabine Deschler-Erb, Ans Nieuwenberg-Bron, Katalin Simán, Isabelle Sidéra, Mickle Zhilin

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Introduction

Archaeologists and Archeozoologists, both study worked osseous materials (bone, antler and tooth, including ivory, in short all referred to as "bone"). Such reports, however, are often buried at the very back of faunal analyses appended to site reports. Furthermore, the two groups of specialists have had little chance to interact, even within Europe since they tend to attend different conferences and write for different fora.

At the root of this problem lay the arbitrary, largely institutional division between pre- and proto-historians, often imposed on bone manufacturing experts by nothing but formalism in research tradition. The most exemplary series of studies n this field is entitled: "*Industrie de l'os neolithique et de l'age de metaux*" (Bone industry *from the Neolithic and Metal Ages*). Another classic, a book, is sub-titled "The Technology of Skeletal Materials *since the Roman Period*". In very early prehistoric assemblages, attention is often focused on the question of whether a particular piece of bone was worked or not. In later assemblages, it is the intensity of manufacturing that often renders objects zoologically non-identifiable, so that important aspects of raw material procurement, including long distance trade, remain intangible.

The history of raw material use, however, is continuous and many of the constraints and possibilities inherent in skeletal materials are the same whether one is dealing with Paleolithic or Medieval artifacts. Indubitably, the organization of manufacture, the function and value of bone artifacts (as well as some technological innovations such as the regular use of metal tools or lathes), differ substantially between simple and complex societies through time. On the other hand, fundamental questions of tensile characteristics, procurement strategies, style and certain technological requirements are not only similar diachronically, but also open up new vistas when apparently unrelated periods are compared. The function of these objects as social markers, for example, remains remarkably constant through time, even if details vary. The papers in this volume reflect these conceptual similarities and differences as did the papers delivered at the conference itself.

The first meeting of what was to become the Worked Bone Research Group (WBRG) was organized by Dr. Ian Riddler in the **British Museum, London, in January 1997**. The committment and enthusiasm of that first workshop has greatly inspired subsequent efforts in recruiting a wide range of bone specialists, capable of contributing to discussions concerning bone manufacturing.

In keeping with the aims of the Worked Bone Research Group, since 2000 an official working group of the International Council for Archaeozoology (ICAZ), an effort was made to present these papers on the basis of what *connects* them rather than segregating them by archaeological period or region. Contributions mostly include articles based on papers delivered in September 1999 at the second Worked Bone Research Group meeting in Budapest, organized by the editors with the unfailing support of the Aquincum Museum (Budapest) and its staff. Several people who were unable to be present at this conference were also asked to contribute papers. Finally, five of the studies in this volume, originally delivered at a symposium on bone tools organized by Dr. Kitty Emery and Dr. Tom Wake, entitled "*Technology of Skeletal Materials: Considerations of Production, Method and Scale*", at the 64th Annual Meeting of the Society for American Archaeology (Chicago 1999), were added thereby expanding the academic spectrum both in terms of research tradition and geographic scope.

There are a total of 36 papers in this volume. Research was carried out on materials from Central and North America to various regions of Europe and Southwest Asia. The authors represent scientific traditons from Estonia, Hungary, Romania, and Russia, European countries in which, until recently, ideas developed in relative isolation. Other European countries represented include Austria, Denmark, France, Germany, Great Britain, Greece, and Switzerland. Last but not least, the North American scholarly approach is also represented here.

Schools of thought may be said to be exemplified by what used to be Soviet research, well known for pioneering works on taphonomy, experimentation and traceology. Bone manufacturing was first brought to the attention of Western scholars by the publication in 1964 of the translation of S. A. Semenov's *Prehistoric Technology*, published originally in 1957. Scholars in France have also carried out decades of co-ordinated work on operational chains in the manufacturing process from the selection of raw materials to finished products, with special emphasis on prehistoric modified bone. An entire working group, "Unspecialized Bone Industries/Bone Modification", is directed by Marylene Patou-Mathis. This working group itself is part of a larger research program on bone industry "*La Commission de Nomenclature sure l'Indistrie de l'Os Prëhistorique*" headed my Mme. H. Camps-Fabrer. Several specialists such as Jörg Schibler in Switzerland, have created laboratories where ground laying work has been carried out for years on worked osseous materials, especially from Swiss Neolithic Lake Dwellings and Roman Period sites. Language barriers have often prevented these important bodies of work from being as widely disseminated as they deserve. Arthur MacGregor in England, writing in English, has had a decisive influence on specialists working on more recent Roman and Medieval worked bone assemblages in Europe.

The work of all of these groups as well as certain individual scholars is well known within limited circles. Otherwise, however, the overwhelming experience of most researchers on worked bone have been feelings of isolation and alienation from most archaeological or archaeozoological work related, most importantly, to the absence of an international forum where their often specialized work can be presented and problems discussed.

In spite of the fact that there have been many practical obstacles to information flow between specialists in this field, there are really remarkable similarities of approach which should ultimately lead to the development of more compatible paradigms in research. Agreement on methodologies will have a positive feedback on communications, helping the field to grow and develop properly.

It seems that, at last, archaeologists and archaeozoologists and other specialists are talking to each other and sharing methodologicial points of view. One striking example of this can be seen in the the emphasis on raw materials studied in parallel to types found in the majority of papers in this volume. Previously studies often concentrated on typo-chronological questions, ignoring the questions of raw material morphology and availability. The series published by the *Centre National de la Recherche Scientifique*, edited by Mme. Henriette Camps-Fabrer in France is largely to be credited for beginning this new trend. It contains many papers concentrating on understanding manufacturing sequences and, indeed, from Europe to North America there are papers which explicitly deal with manufacturing sequences in individual assemblages.

There is also a consistent emphasis on experiment and manufacturing techniques present in much of the work in this volume. The related but fraught question of function continues to tantalize and frustrate most specialists. A number of articles attempt to apply techniques of hard science, such as scanning electron microscopy or light microscopy, together with experiment to get objective, "processual" answers to this important group of questions. Other researchers rely deductively on analogy, archaeological context, gross morphology, and textual sources as they try understanding how these objects were used.

When editing the volume, we tried to concentate on the underlying main concepts represented by each paper rather than grouping them diachronically or by geographical region. As a result, contributions follow a line from the theoretical through the problems of raw material selection, manufacturing techniques, experimental work, technical function and socio-cultural interpretations. Obviously many of these papers deal with several of these aspects simultaneously. Finally, analyses of assemblages are grouped to show the current state of general application of these principles as illustrated in papers in the rest of the volume. Reports on bone tool types will ultimately benefit from more unified typologies and also provide researchers with comparitive databases from regions beyond their own.

Finally, a word on the organization of papers in this volume. Although the editors have tried to group these papers by what they see as the main theoretical and methodological thrust of the authors it should be understood that most papers, to a greater or lesser extent, overlap between these artificial sub-titles. Happily, almost all these works include considerations of raw material exploitation, manufacturing and functional analyses and all make some attempt to consider the social context from which these artifacts emerged. It is exactly this cross-cutting of boundaries which allows us to hope that the study of worked osseous materials is well on the way to developing into a discipline in its own right.

In addition to the generous support given by our sponsors and technical editors for this volume, organizing the conference would not have been possible without the active help of numerous colleagues. Special thanks are due to Paula Zsidy, Director of the Aquincum Museum, Katalin Simán, archaeologist and two students from the Institute of Archaeological Sciences (ELTE, Budapest): László Daróczi-Szabó and András Markó. The Hotel Wien, Budapest and its efficient manager provided a comfortable setting for our discussions at a reasonable price. Last but not least, help with abstract translations by Cornelia Becker, Noelle Provenzano as well as Marjan Mashkour and Turit Wilroy should also be acknowledged here.

ROMAN PERIOD EQUID ILIUM IMPLEMENT FROM PANNONIA SUPERIOR (NW HUNGARY)

László Bartosiewicz

Abstract: This "Y" shaped bone tool, recovered at a Roman Period rural site in northern Pannonia superior, was carved from an Equid pelvis. An iron blade was inserted in the bottom of the bifurcation cut into the *crista iliaca*, while the corpus served as a handle. The bone surfaces were covered by use wear in the form of high polish. On the basis of these features it was hypothesised that the tool was used as a cutting device.

Key words: horse bone manufacturing, composite tools, worked pelvis, Roman Period

Résumé: Un outil en os en forme de Y, découvert sur un site romain au nord de la Pannonie était taillé dans un pelvis d'Equidé. Une lame de fer était insérée dans le bas de la bifurcation coupé dans la crête illiaque. L'aile de l'os ilium servait de manche. La surface de l'os était recouvert de traces d'usure avec un fort poli. D'après ces caractéristiques on peut avancer l'hypothèse que l'objet ait été utilisé comme un appareil de coupe.

Mots clés: Industrie sur os de cheval, objets composites, pelvis travaillé, Période romaine

Zusammenfassung: Ein "Y"-förmiges Knochenwerkzeug, gefunden in einer laendlichen Siedlung aus der Römerzeit, war aus dem Darmbein eines Equids geschnitzt. Eine Eisenklinge war in den unteren Teil der Einkerbung in die *crista iliaca* eingefügt. Die Darmbeinsäule diente als Griff. Beide Knochenseiten zeigen Politurglanz, der hauptsächlich von Handhabung stammt. Aufgrund dieser Merkmale wurde die Hypothese aufgestellt, dass das Werkzeug als Schneidegerät diente.

Schlüsselbegriffe: Pferdeknochenverarbeitung, zusammengesetzte Werkzeuge, bearbeitete Becken, Römerzeit

Introduction

To date, the bone tool discussed in this paper is unique in Hungary in terms of the selection of its raw material, its special shape as well as its possible function. This artefact came to light during the course of rescue excavations along the future trail of Motorway 1 between the Hungarian city of Győr and the border with Austria. Ménfőcsanak-Széles telep, a multi-period settlement, is located 9 km southwest of Győr along the Rába River, a right bank tributary to the Danube (Figure 1). Various branches of the Danube have formed the largest "inland delta" in Central Europe in this area.

Excavations were directed by Dr. Eszter Szőnyi of the János Xántus Museum in Győr in co-operation with the Archaeological Institute of the Hungarian Academy of Sciences. The archaeological periods identified at this site included the Bronze and Iron Ages, the Roman Imperial Period (AD 1st-4th c.) and the early medieval Period of the Árpád Dynasty (AD 11th-13th c.). During the Roman Period of direct interest here, the settlement lay within the province of Pannonia superior, near its northern, Danubian limes.

Find circumstances

The periods represented at this site included the Bronze and Iron Ages, the Roman Imperial Period and the early medieval Period of the Árpád Dynasty. Unfortunately, many animal bones came to light from mixed contexts that rendered their stratigraphic dating impossible.

In October 1990, Feature 173 of irregular oblong-shape came to light in Surface 17 of the approximately 2.5 ha site. On the basis of a stone-lined fireplace within, it was identified as a semi-subterranean building. This feature was deepest at its northwestern side. The bone tool under discussion here came to light in the southern section at approximately 80 cm below the modern day surface. Using the evidence of ceramic typo-chronology, the feature was associated with the Roman Period rural settlement.

Object description

The tool was made from the left ilium of a medium size Equid, probably horse. Although no morphological features on this part of the skeleton make the distinction between horse, mule and hinny possible, it is exactly the Roman Period when the presence of these latter may also be reckoned with (White 1970: 295). Using anatomical terms of the *Nomina Anatomica Veterinaria* (Fehér 1980), the manufacturing of this tool may be outlined as follows:

The pelvis fragment was first roughly cut to size: the *corpus ossis ilii* was hacked approximately into half transversally, above (cranially from) the *foramen nutriticum*. Both the lateral *tuber coxae* and the medial *tuber sacrale* were removed by more careful carving.

In the next step, the bone was carved into a bifurcate shape, starting from the direction of the *crista iliaca*: a piece of the *ala ossis ilii*, measuring approximately 5 by 5 cm was cut out. As a result, the stubs of the *tuber coxae* and the *tuber sacrale* gained the shapes of two asymmetric wings on either side of this incision.

Finally, the iron blade was inserted into the spongious structure between the two layers of compact bone at the bottom of the incision. The visible part of this heavily corroded, approximately 4 mm thick piece of iron is 42 mm wide as can be seen on the x-ray photo (fig. 6). Its irregular edge sticks out to between 5-12 mm from the bone. Functional interpretation is hampered by the fact that the original sharpness of this blade cannot be appraised.

The *corpus ossis ilii* served as a handle. No signs of additional hafting could be identified on the bone.

Aside from the minor fragments, broken off of the open spongy bone surface at the places of the two removed tubers, the bone was well preserved. Only a few rootmarks are visible on the highly polished surface. A modern crack across the bone could be easily restored.

Refuse bone material from the site

One of the many aspects bone tools should be viewed from is their relationship to the pool of raw materials available to their manufacturers. The choice of raw material is the first step in manufacturing, and its consistency is closely related to the planned or expedient nature of the end product (Choyke 1997). Hence, Roman Period animal remains recovered from the site help reconstructing the thought process involved in producing this artifact.

In chronological terms, faunal material from the AD 2nd-3rd century rural settlement of the Roman Period dominated with 2128 bone fragments of which 1700 could be identified. While only half of the animal remains could be unambiguously associated with closed and datable features, Roman Period bones numbered as many as the rest of the datable fragments (tab. 1).

Since the Roman Period component of this assemblage is the largest, it includes the broadest range of species. The percentual distribution of bones from homoiotherm animals shows a steadily increasing diachronic contribution of horse remains (fig. 3). Never-the-less, the percentage of horse remains hardly exceeds 10% even during the Period of the Árpád Dynasty. An increase of pig remains is also apparent through time. The relatively great contribution of bones from sheep (and often non-distinguishable goat) is of interest from an environmental point of view. The humid floodplain area would have been more suitable for pig keeping, as was the case during the Copper Age in the immediate proximity of the site (Figler *et al.,* 1997, 223, Fig. 6). Thus a cultural preference for mutton to pork may be hypothesised at the settlement under discussion here. The detailed list of animal remains from Feature 173 (Appendix) offers a glimpse at the types of meat consumed in this dwelling.

As opposed to pig, a purely meat purpose animal, horse was probably kept for its chief form of secondary exploitation: draught power and/or riding. Horse meat was evidently consumed as shown by the heterogeneous distribution of skeletal parts (fig. 4). When the 129 individual Roman Period horse bones are pooled by body regions (Kretzoi 1968), their percentual distribution potentially characterises the forms of exploitation. In the case of specialised meat purpose animals bones representing high nutritive value (“meaty” trunk and proximal limb bones) tend to dominate. When horse meat is avoided, terminal and dry limb bones occur almost exclusively as they are often the only bones left in the hide after skinning the carcass off-site. Sometimes even the ritual display of horse skulls may be reckoned with (Bökönyi 1978). At Ménfőcsanak, at least two thirds of the horse bone fragments represent high quality meat, while two thirds originate from peripheral body regions of poor nutritive value (fig: 5).

Most importantly, the common occurrence of horse bones (including skeletal parts representing high nutritive value such as the hind quarters), shows that the raw material of this tool was commonly available at Ménfőcsanak. Therefore, in spite of the curious choice of the raw material, the worked piece of Equid ilium may be considered a local product.

Analogies and possible functions

Aside from the producing of metapodium skates and runners in protohistoric times (Choyke 1999), the manufacturing of Equid bones is relatively rare in the Carpathian Basin. By the time horse became relatively common in this area (i. e. its bones were readily available in the food refuse), metals replaced most utilitarian bone tools, especially those improvised from a variety of fragments in a “prehistoric fashion”. Following prehistoric times, bone retained some of its importance in composite tools, e. g. in the form of handles. In fact, this worked ilium fragment may be looked upon as a sophisticated form of hafting that facilitated the use of the tool’s active part, the iron blade.

With the exception of an ethnographic llama ilium axe from Gran Chaco (Argentina/Bolivia; János Gyarmati, personal communication), the manufacturing of complete ilia, a structurally rather weak flat bone, is unknown to me. Small, hap-

	Bronze Age	Iron Age	Roman Period	Árpád Period	Total
cattle (*Bos taurus* L. 1758)	77	53	663	159	952
sheep (*Ovis aries* L. 1758)	3	20	50	14	87
goat (*Capra hircus* L. 1758)	2		6		8
sheep or goat (*Caprinae* Gill 1872)	33	76	468	74	651
pig (*Sus domesticus* Erxl. 1777)	6	21	246	56	329
horse (*Equus caballus* L. 1758)	6	9	129	40	184
ass (*Equus asinus* L. 1758)			1		1
dog (*Canis familiaris* L. 1758)	2	1	41	7	51
aurochs (*Bos primigenius* Boj. 1827)	2	2	10	2	16
red deer (*Cervus elaphus* L. 1758)	2	6	22	2	32
roe deer (*Capreolus capreolus* L. 1758)			3	1	4
wild pig (*Sus scrofa* L. 1758)			3		3
bird (*varia*)	5	1	30		36
fish (*varia*)	115	3	28	4	150
Identifiable total	253	192	1700	359	2504
Large ungulate	82	14	291	70	457
Small ungulate	37	16	134	38	225
Small carnivore	1				1
Total	373	222	2125	467	3187

Tab. 1 The number of chronologically identifiable bone fragments at Ménfőcsanak

Measurements	mm	%
Greatest length of tool (between the *crista iliaca* and the butt end of handle)	174.2	100.0
Greatest width of tool (between the tip mediodorsal and lateroventral points)	222.2	127.6
Width of mediodorsal "wing" (rest of *tuber sacrale*)	102.0	58.6
Width of lateroventral "wing" (rest of *tuber coxae*)	76.0	43.6
Length between the butt end of handle and bifurcate incision	114.9	66.0
Distance between the bifurcate incision and the line of *crista iliaca*	48.9	28.1
Greatest diameter of the butt end (hacked *corpus ossis ilii*)	42.2	24.2
Smallest diameter of the butt end (hacked *corpus ossis ilii*)	27.2	15.6
Width of the iron blade	47.5	27.3
Thickness of the iron blade	6.0	3.4
Tool weight, g	182.0	–

Tab. 2 Measurements of the horse ilium tool

hazardly produced, second class tools (points, “knives” etc.), however, may have been made from non-distinct splinters of this flat bone.

In terms of shape, an analogous Norse find from Drimore (South Uist) was re-published by MacGregor (1978: 175, Fig. 93g). Although the raw material and exact size of that artefact were not specified, its handle and broad, perpendicular edge make it look similar to the tool under discussion here. Most importantly, however, that is a genuine bone tool with a straight edge, without the deeply inserted iron blade characteristic of the Ménfőcsanak specimen. Therefore its functional classification as a “cleaver” seems irrelevant in identifying this latter.

Although no direct analogies could be identified, a few composite tools made from bone and metal may be cited here.

Bone beamers, used in “shaving off” hair from animal hides after skinning are well known even from prior to the introduction of metals (late Neolithic in Hungary; ethnographic examples from North America: Cornwall 1968: Fig. 13/2). Modern day versions of this tool, made from reindeer metapodia by the Sami, have been improved by inserting an long iron blade along the bone’s shaft (László Torma, personal communication). They are directly related to the steel beamers used in modern tanneries (Seymour 1985: 120).

In the Ardennes, the proximal halves of Equid radii were turned into bark peeling instruments. Their diaphyses were carved into a chisel shape and a small metal blade was inserted in the side of the epiphyseal end. After the tree was incised with the blade, the “chisel” served to actually peel off sheets of bark from oak (especially *Quercus cerris* L. 1758), used in tanning animal hides (Cattelain 1989: 31).

In the absence of direct analogies, however, general properties of and use wear on the tool should be considered in an attempt to reconstructing function. Given its peculiar shape and careful execution, the implement under discussion here must be considered planned, even if the systematic production of such tools has been unknown. This tool would certainly represent an osteomorphological tool “type” in and of itself (Bartosiewicz Choyke 1994). Identifying it as a functional type, on the other hand, would be a lot more complex task.

The planned nature and composite structure of the tool indirectly points to a rather narrowly defined function. Features worth considering include:

The corroded iron blade, possibly used in cutting relatively hard materials.

The ample bone “handle” (the bone tool itself), possibly transmitting force and facilitating a shovel-like forward movement of the tool.

The bifurcate working ends funnelling the material to be processed against the metal blade.

The excellent surface preservation of the tool is, to some extent, suggestive of possible use in an indoor activity.

Use wear in the form of high polish is especially pronounced on the marks of hacking at the butt end of the handle and on protruding features on the convex surface (*facies sacropelvina*) such as the *linea acuata* and *facies auricularis* on the medioventral side of the bone. These latter may have been caused by more than simple handling, since no matching modifications have accumulated on the concave surface (*facies glutaea*). Contact with a relatively soft material during repeated shovelling movement may have contributed to this polish on the tool’s concave “bottom”.

There is little doubt that that the horse ilium tool was a cutting device, although the medium on which it was used is more difficult to identify. Both structurally and ergonomically it is very different from sickles (whose classical form has long been known by the time of the Roman Period): it seems less suitable for performing the momentous repeated motion needed for harvesting common grass-like plants such as domestic cereals. According to the kind personal communication by Harry Kenward, the tool “looks like a string-cutter. They can be bought in plastic sometimes today, and gardeners sometimes make them out of bits of wood and old blades.”

A perhaps more abrupt, but also more forceful forward thrust along the tool’s long axis may have been related to planing.

An alternative interpretation thus would be a hafted plane-iron, set in a bone body, similar to Modern Age planes with winged wooden handles (Mouret 1993: 63; Seymour 1985: 88). The convex surface, would have allowed easy handling and could account for the wear on the bone’s lateroventral side (*facies sacropelvina*). This version, however, is contradicted by the lack of damage to the same part of the bone, that should have been caused by some harder pieces of the wood. In fact, while a few, irregular scratchmarks occur on the less worn laterodorsal surface, the aforementioned convex side is highly polished, especially in the longitudinal band that roughly corresponds to the blade.

Between these two extremes, working on medium resistant vegetable materials such as harvesting reed or breaking vegetable fibres after retting may be hypothesised. In this latter case, the cutting function of the blade must be ruled out. In the recent past, the breaking of especially resilient hemp usually took heavy-duty wooden implements on stands (Barber 1991:13; Anttila 1998: 25, fig. 5; Ferigo 1999: 176-178, figs. 1-2). Using a dull metal ridge embedded in the bone may have made operating a hand-held breaker easy. Even then only finer plants, such as linen could be processed this way.

This interpretation, however, is supported by the asymmetric wear on the two layers of compact bone between which the piece of iron was wedged. On the concave side, heavy wear on the bone is limited to the narrow and steep edge next to the iron blade (light surface reminiscent of a Levi's back-pocket design in fig. 2, top). The corresponding, broader edge on the convex side (fig. 2 bottom) has been flattened and obliterated by extremely high, "mirror" polish, characteristic, for example, of rib fragments used as linen combs in the Swiss Neolithic (Schibler 1981: 38). Such polish, therefore, may have been caused by bunches of plant pulled across the iron with major force.

Conclusions

The osteological analysis of the composite Equid ilium tool brought to light from the Roman Period rural settlement of Ménfőcsanak offered the following information:

The tool was carefully planned and executed. The bone component actually served as a handle to the iron working edge. No sign of additional hafting (e. g. with wood) could be detected.

The raw material was easily available in the settlement's food refuse, since horse meat was eaten here. The manufacturing of a pelvis fragment, however, may be considered an unusual but carefully contemplated choice.

The tool was probably used in cutting medium strong plants or processing thready vegetable materials. The tool's shape and its forms of wear offer a number of alternative interpretations within the thus defined range of activities.

Ethnographic examples illustrate the ample range of complex activities in which such a tool may have been used.

A detailed study of relevant ethnographic analogies as well as the possible extraction of identifiable plant remains from the working edge may bring us closer to understanding the function of this interesting bone tool. These aspects, however, fall beyond the scope of this short archaeozoological report.

Acknowledgements

Thanks are due to Harry H. Kenward (University of York) and János Gyarmati (Hungarian Ethnographic Museum, Budapest) for their help with identifying analogous implements. Marjan Mashkour and Eric Pellé (Muséum National d'Histoire Naturelle, Paris) kindly provided relevant references from the ethnographic literature. Linguistic help with the text was provided by Alice M. Choyke, Marjan Mashkour and Turit Wilroy.

Appendix

Detailed list of animal remains recovered from Feature 173

Centre 0-100 cm:
adult cattle left complete tibia
adult sheep right distal humerus

NW, -40-140 cm:
juvenile cattle radius diaphysis fragment
adult cattle left mandible corpus fragment
large ungulate 3 rib fragments
caprine cervical vertebra fragments
caprine 4 rib corpus fragments
subadult pig left complete metacarpus
adult domestic hen right complete femur
adult small Cyprinid fish 2 fragmented branchyostegalia branchyostegalia

NW fill:
horse metacarpus diaphysis
domestic hen right scapula corpus fragment
fill domestic hen left proximal ulna
fill adult domestic hen right proximal metatarsus
fill domestic hen rib corpus fragment

SW, -40-110 cm:
subadult cattle left tibia fragment

Among the stones of the fireplace:
subadult cattle atlas fragment
caprine cervical vertebra fragment
caprine humerus diaphysis
subadult caprine proximal femur
subadult pig left os incisivus
adult pig left complete astragalus
adult pig left complete calcaneus
domestic hen right tibiotarsus diaphysis healed fracture on diaph.
adult small Cyprinid fish 3 precaudal vertebrae
small Cyprinids non-identifiable fish rib corpus fragment

Note

[1] Fish bone is not deemed comparable with these remains in quantitative terms and was thus not included in this diagram.

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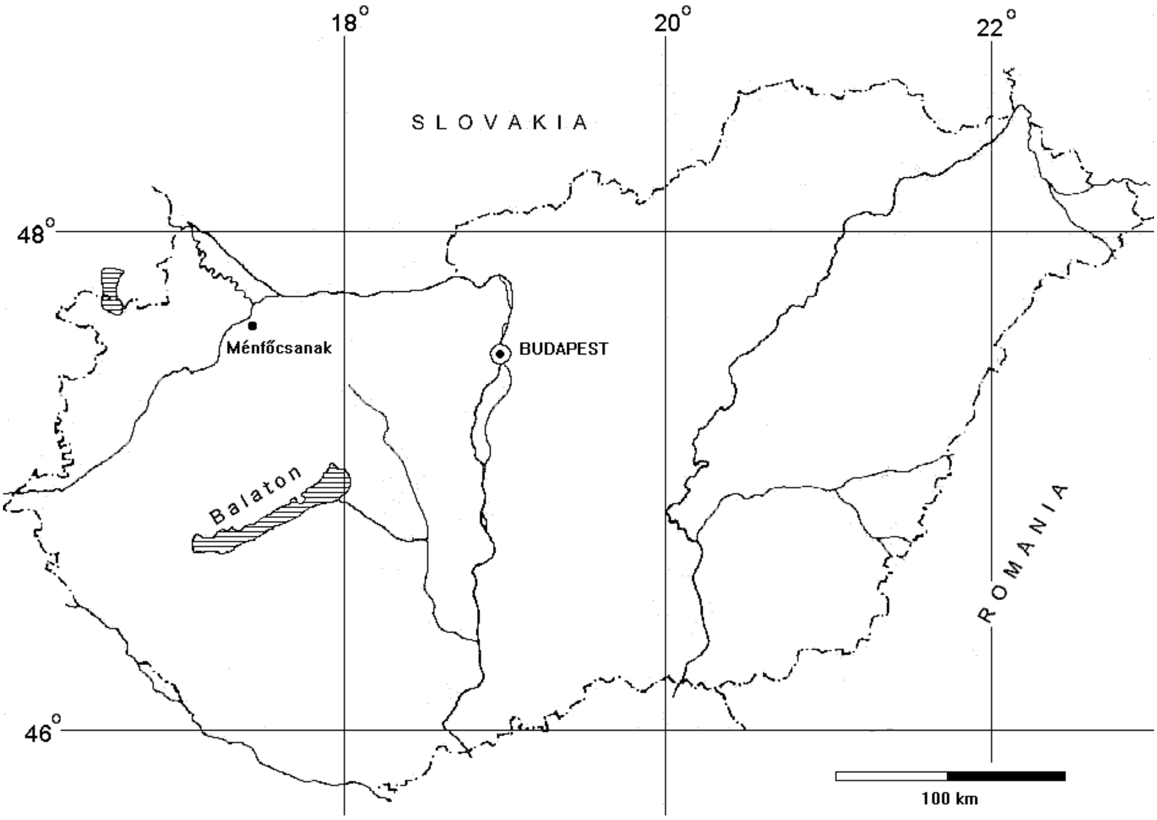

Figure 1. The location of Ménfőcsanak–Széles telep in present-day Hungary

Figure 2. The laterodorsal (*facies glutaea*; top), cranial (*crista iliaca*; middle) and medioventral (*facies sacropelvina*; bottom) views of the horse bone implement, showing the position of the iron blade (Photo: Tibor Kádas, Nos. 153.816-818)

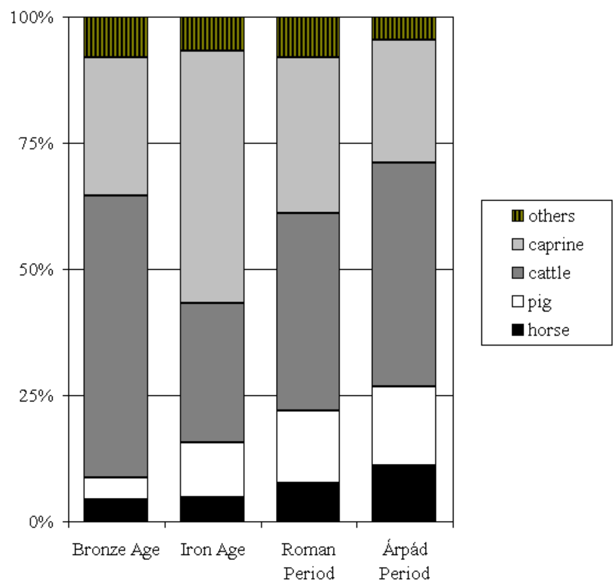

Figure 3. The diachronic distribution of bones from homoiotherm animals at Ménfőcsanak

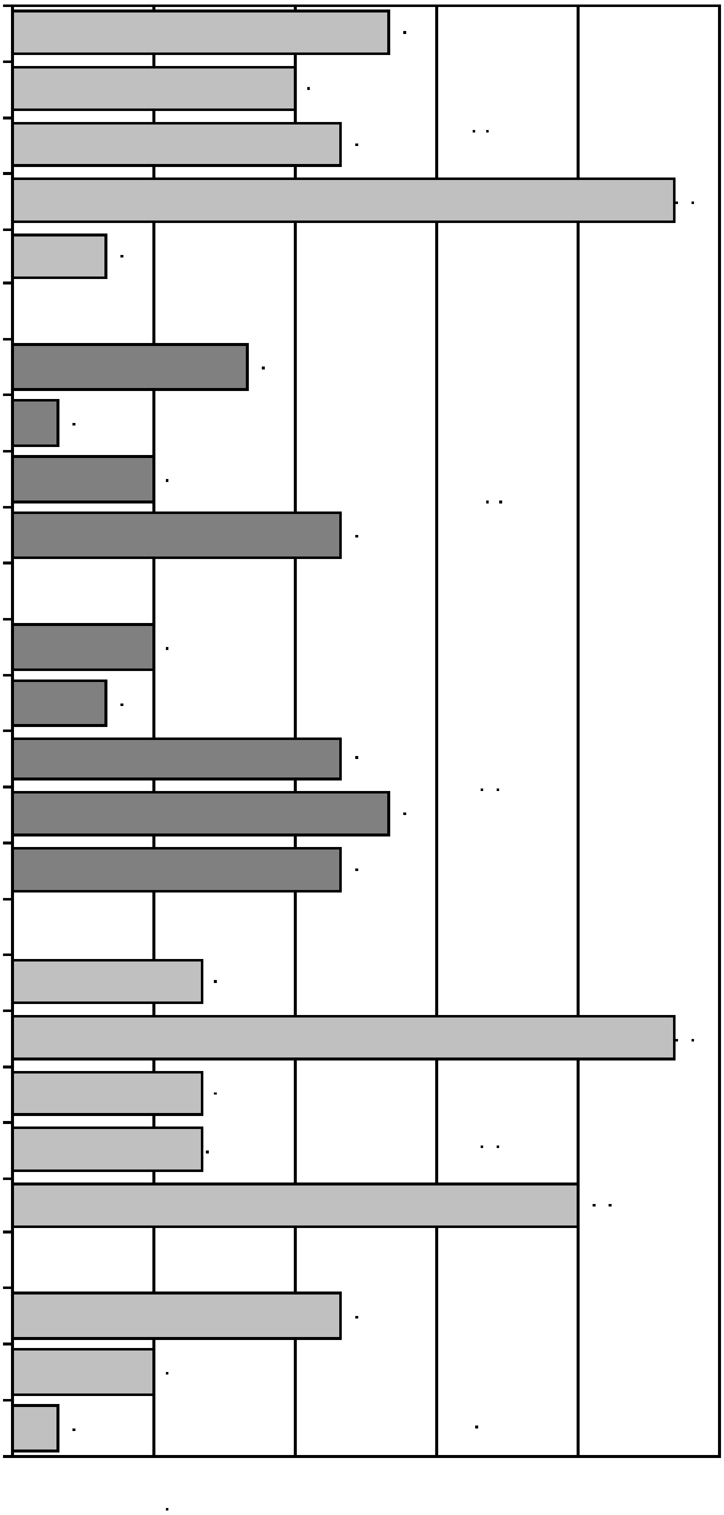

Figure 4. The frequencies of Roman Period horse bone fragments at Ménfőcsanak by Kretzoi’s categories

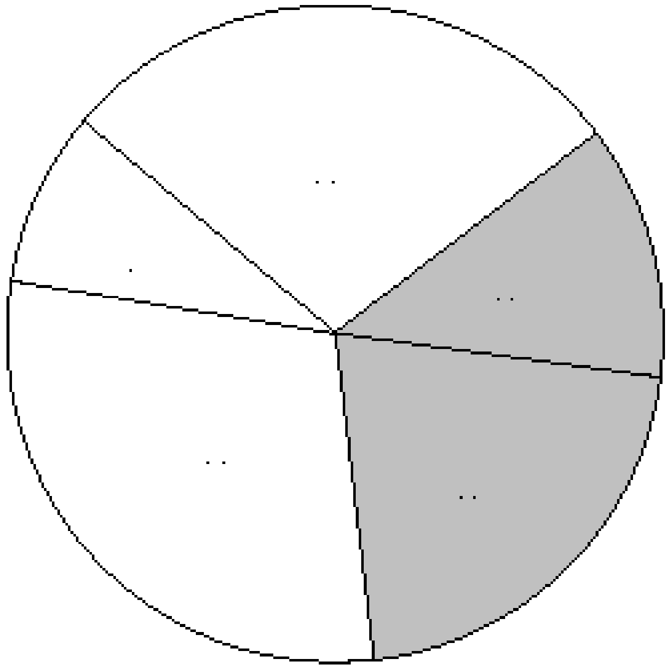

Figure 5. The percentual distribution of horse bones by Kretzoi's categories

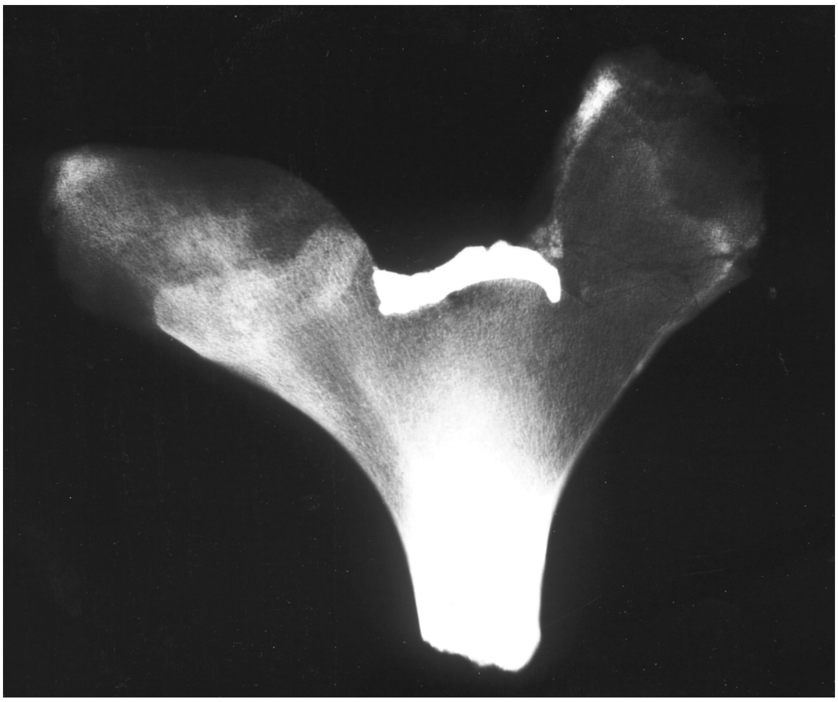

Fig. 6 X-ray picture of the ilium tool, showing the position of the iron blade. The short surviving stub of the blade is indicative of a shallow insertion into the *substantia spongiosa* (Photo: Dr. Béla Fenyves)