CRAFTING BONE – SKELETAL TECHNOLOGIES THROUGH TIME AND SPACE

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

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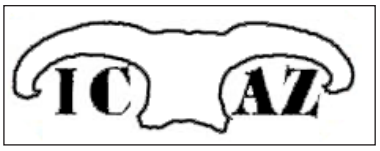

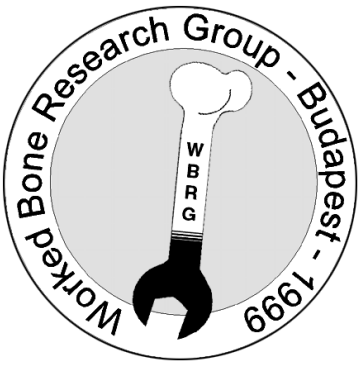

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CRAFTING BONE - SKELETAL TECHNOLOGIES THROUGH TIME AND SPACE

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Budapest, September 1999

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.

WORKED SHOULDER BLADES: TECHNOTYPOLOGICAL ANALYSIS OF NEOLITHIC BONE TOOLS FROM SOUTHWEST GERMANY

Karlheinz Steppan

Abstract: Between 1987 and 1993 the Sites and Monuments Service of Baden-Württemberg excavated a large part of an extensive Neolithic interrupted ditch system within the municipal area of Bruchsal (Kraichgau). According to the calibration results of twenty-nine ^{14}C data the recovered bone assemblages can be attributed to at least two occupation phases between ca. 4100 and 3700 BC. The results of the taphonomic analysis caracterize the well preserved bones as butchery and kitchen refuse additionally modified by dog gnawing before their final deposition in the enclosure ditches. Among these assemblages several hundreds of bone and antler artefacts including unfinished and worn-down objects are giving proof of the local manufacture of bone and antler tools. The great number of worked shoulder blades occuring in different states of manufacture respectively use wear allow the detailed reconstruction of their production. Additionally, the experimental manufacture of a hafted shoulder blade provided further information about the probably applied hafting technique of this type of tool.

Keywords: Neolithic, southwest Germany, bone artefact, archeozoology, experimental archaeology

Résumé: Entre 1987 et 1993, le Service des Sites et Monuments de Bade-Württemberg a fouillé une grande partie d'un système extensif de fossés interrompus du Néolithique sur la commune de Bruchsal (Kraichgau). La calibration de 29 datations radiocarbone permet d'attribuer les assemblages d'industrie osseuse découverts à au moins deux phases d'occupation entre 4100 et 3700 av. J.-C. Les résultats de l'analyse taphonomique caractérisent les ossements les mieux conservés comme des déchets de boucherie et de cuisine, ayant également été rongés par des chiens, avant leur abandon définitif dans les fossés. Ces assemblages comprennent plusieurs centaines d'artefacts en os et bois de cervidé dont une partie d'objets non achevés ou totalement usés qui démontre le caractère local de leur fabrication. Le grand nombre d'omoplates travaillées et découvertes à différents stades de fabrication et d'utilisation permet une reconstitution détaillée de leur production. De plus, la reconstitution expérimentale d'une omoplate emmanchée a fourni de plus amples informations sur la technique probable d'emmanchement de ce type d'outil.

Mots-clés: Néolithique, Allemagne du sud-ouest, industrie osseuse, archéozoologie, archéologie expérimentale

Zusammenfassung: Von 1987 bis 1993 hat die Aussenstelle des Landesdenkmalamtes Baden-Württemberg das jungneolithische Grabenwerk im Gewann "Aue" fast vollständig untersucht. Anhand der Kalibrationsergebnisse von neunundzwanzig ^{14}C-Daten lassen sich im Zeitraum von 4100 bis 3700 v. Chr. mindestens zwei Besiedlungsphasen unterscheiden. Neben Schlacht- und Speiseabfällen umfassen die untersuchten Fundkomplexe auch zahlreiche Geweih- und Knochenartefakte. Abfallprodunkte, Halbfabrikate und verbrauchte Werkzeuge belegen die lokale Herstellung und verwendung der Beingeräte. Unter den Knochenwerkzeugen befinden sich zahlreiche bearbeitete Schulterblätter. Die technotypologische Untersuchung der prähistorischen Fundstücke und die experimentelle Anfertigung eines Exemplares erlauben die detaillierte Rekonstruktion der verschiedenen Arbeitsschritte, die zur Herstellung dieser Werkzeuge erforderlich waren.

Schlüsselworte: Neolithikum, Südwestdeutschland, Knochenartefakte, Archäozoologie, experimentelle Archäologie

Introduction

The archaeological record in the northwestern part of Baden-Württemberg includes remarkable local concentrations of Neolithic interrupted ditch systems (fig. 1).

At least four interrupted ditch systems attributed to the so-called "Michelsberg" culture are known from the environs of Bruchsal. At about 200 metres above sea level, these enclosures are situated at the border between the Northern Upper Rhine valley in the West and the loess covered hilly landscape in the East (fig. 1: 11-14).

The archaeological investigation of two immediately adjoining interrupted ditch systems in the urban area of Bruchsal was conducted by the Karlsruhe office of the Sites and Monuments Service of Baden-Württemberg between 1983 and 1993. At the site of Bruchsal-Aue a large part of the extensive ditch system was uncovered (Behrends 1998).

Skeletal element	Standard	Bruchsal-Aue		Relative Weight Difference
	g%	g	g%	
Cranium	13.0	70738.2	12.5	-0.5
Mandible	5.6	77258.8	13.7	8.1
Subtotal	18.6	147997.0	26.2	7.6
Atlas	1.0	7833.8	1.4	0.4
Axis	1.0	4479.9	0.8	-0.2
Cervical 3-7 vertebrae	4.0	16400.0	2.9	-1.1
Thoracic vertebrae	7.2	16750.0	3.0	-4.3
Lumbar vertebrae	4.8	14333.3	2.5	-2.2
Sacrum	2.0	2219.7	0.4	-1.6
Ribs	13.8	34943.2	6.2	-7.6
Subtotal	33.8	96959.9	17.2	-16.6
Scapula	**4.6**	**15542.7**	**2.7**	**-1.9**
Pelvis	6.5	34860.8	6.2	-0.3
Subtotal	11.2	50403.5	8.9	-2.2
Humerus	6.1	46852.7	8.3	2.2
Femur	6.9	41182.3	7.3	0.4
Patella	0.5	862.4	0.2	-0.3
Subtotal	13.4	88897.4	15.7	2.3
Radius/Ulna	5.4	42343.3	7.5	2.1
Tibia	5.5	42060.6	7.4	1.9
Subtotal	11.0	84403.9	14.9	4.0
Carpals	0.9	3489.9	0.6	-0.3
Astragalus	0.9	6780.9	1.2	0.3
Calcaneum	1.3	11366.2	2.0	0.7
Tarsals	0.5	3909.3	0.7	0.2
Subtotal	3.6	25546.3	4.5	0.9
Metacarpal	2.5	24472.6	4.3	1.8
Metatarsal	2.8	32681.2	5.8	3.0
Metapodials	0.0	670.6	0.1	0.1
Subtotal	5.3	57824.4	10.2	4.9
First phalanges	1.4	7562.4	1.3	-0.1
Second phalanges	0.8	3515.5	0.6	-0.2
Third phalanges	1.0	2249.1	0.4	-0.6
Subtotal	3.2	13327.0	2.4	-0.8
Total	100.0	565359.4	100.0	0.0

Tab. 1 Relative weight of the skeletal elements from Bruchsal-Aue

According to the calibration results of twenty-nine ^{14}C dates, the recovered bone assemblages can be attributed to at least two occupation phases between ca. 4100 and 3700 BC.

Among the numerous finds there were about 28,000 mammal bones, with a combined weight of over a metric ton. The results of the taphonomic analysis characterize the well preserved bones as butchery and kitchen refuse, additionally modified by dog gnawing before their final deposition in the enclosure ditches (Steppan 1998).

Among the bone assemblages several hundreds of worked bone and antler fragments including unfinished and worn-down objects provide proof that there was local manufacture of bone and antler tools. The bone tool assemblage of Bruchsal-Aue is characterized by a great number of worked shoulder blades. This type of bone tool is known since the first excavation of the Neolithic hill-top site of "Michelsberg" near Untergrombach (fig. 1: 14) at the end of the 19th century (Lüning 1968, 76).

Raw material

Above all the worked shoulder blades found at Bruchsal-Aue come from cattle. Additionally, other ungulate species (red deer, aurochs and horse) are represented in small numbers. Most of the worked shoulder blades are completely worn down (fig. 2) but some specimens, broken in an early stage of use, show that complete shoulder blades were used as raw material (figs. 3 and 4).

Taking into account the weight of the skeletal elements of a standard individual (adult cow from Subboreal Denmark), it turns out that the scapula (including the worked specimen) is clearly underrepresented within the total cattle bone assemblage from Bruchsal-Aue (Table 1). Besides other sources of taphonomic loss, this relative weight difference probably reflects the deliberate choice of this skeletal element for the local production and use of these bone tools.

Typology and technology

According to the results from experimental work, the manufacture of these bone tools probably started with the complete removal of the spine (fig. 5) and the lateral part of the thoracic margin using an adze. The sharpened cranial margin formed the working edge of the bone tool.

The distal articulation of the shoulder blade was worked in two different ways: Type 1 has a shaft hole in the centre of the *fossa articularis* combined with a narrow, more or less, rectangular "window" on the medial side of the collum (figs. 2 and 6).

In Type 2 the opening on the medial side of the *collum* was elongated towards the distal articulation (figs. 7 and 8).

Experimental work

Besides a wooden hammer and bone "chisels", the experimental manufacture of a worked shoulder blade (Type 2) was mainly done with the help of a small cleft hafted adze.

First, the spine was completely removed using the adze (fig. 5). Afterwards the opening on the medial side of the *collum* was cut out. In the beginning, we used a wooden hammer and bone "chisels" with success near the articulation (cancellous bone). When we reached the collum (thick compact bone) we had to use the small hafted adze. Surprisingly, the traces left by the adze resembled the traces found on the prehistoric specimen (fig. 9).

In order to complete the tool, the cranial margin of the shoulder blade was sharpened with a piece of fine-grained sandstone.

Finally, the shoulder blade was hafted using a wooden toe haft and a narrow strip of wet rawhide was wrapped round the *collum scapulae* and the toe haft. After the wet rawhide strip dried a durable connection between the two components was ensured.

The original use of worked shoulder blades

Beyond the techno-typological analysis of the worked shoulder blades their original use is of great interest. In order to reconstruct its original use additional archaeological and ethnographic evidence from Europe, Asia and North America should be considered.

Germany

In 1899, Bonnet interpreted the worked shoulder blades from the site of Untergrombach (fig. 1: 14) under consideration of the archaeological features (ditch, pits) as spades (Lüning 1967, 76). In a short report concerning two interrupted ditch systems near the city of Heilbronn (fig. 1: 15) Koch (1971) mentioned some worked shoulder blades (the drawings show three completely worn down respectively broken specimen) as adzes with socket hafting. Considering a single specimen (again a completely worn specimen) from the interrupted ditch system of Heilbronn-Klingenberg (fig. 1: 16) the worked shoulder blades were interpreted as wood working implements (Schlenker 1994, 53f).

The occurrence of this type of bone artefact seems to be restricted to sites attributed to the Michelsberg culture. Despite cultural contacts (Schlichtherle 1998) the worked shoulder blades do not occur in the contemporaneous Neolithic settlemts of the Northern Alpine Foreland (Lake Constance, Upper Suebia).

France

In France, only a few specimens are published from Michelsberg or Chasséen culture sites in the northern part of the country respectively (Thévenin et al. 1977).

England

In England, worked shoulder blades are reported from Neolithic flint mines (Cissburry, Harrow Hill). In combination with antler handles they may have served as shovels or digging implements in Neolithic flint mining. However, experimental work proved the scapula shovels to be inefficient tools for this kind of work (Shepherd 1980, 32f.).

China

A number of settlements of the Lake Tai-hu and Ho-mu-tu culture are scattered across the rich freshwater wetlands of the coastal plain of Hang-chou Bay south of Shanghai. Due to the remarkable conditions of preservation two agricultural implements of the Ho-mu-tu rice farmers could be reconstructed. Carved wooden handles and water buffalo shoulder blades were combined to make efficient spades for preparing rice paddies (Smith 1995, 126).

North America

Archaeological and ethnograhic evidence for the use of worked shoulder blades comes from the Plains Indians in North America. The conditions for agriculture were not ideal on the harsh plains with their short growing season and frequent droughts. But despite these disadvantages the Mandan, Hidatsa and Arikara women produced large stores of food on the river terraces using only a digging stick, a rake and at least a hoe made from wood and a buffalo shoulder blade (Peters 1995).

Conclusions

Considering the available archaeological and ethnographic evidence, the worked shoulder blades from the settlements of the Neolithic Michelsberg culture in Southwest Germany were probably used as agricultural implements (hoe). Despite cultural contacts, this type of bone tool does not occur in the contemporaneous Neolithic settlements of the Northern Alpine Foreland. Considering their dispersal area in Southwest Germany the occurence of these implements coincides with fine-grained top-soils on aeolian sediments (loess).

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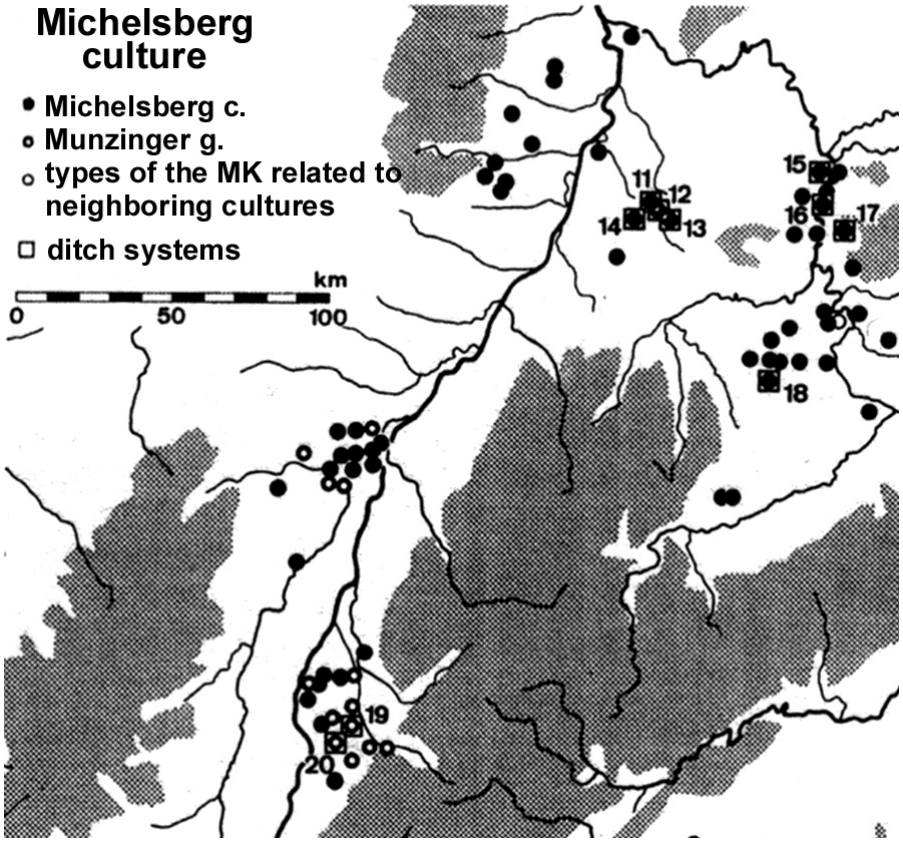
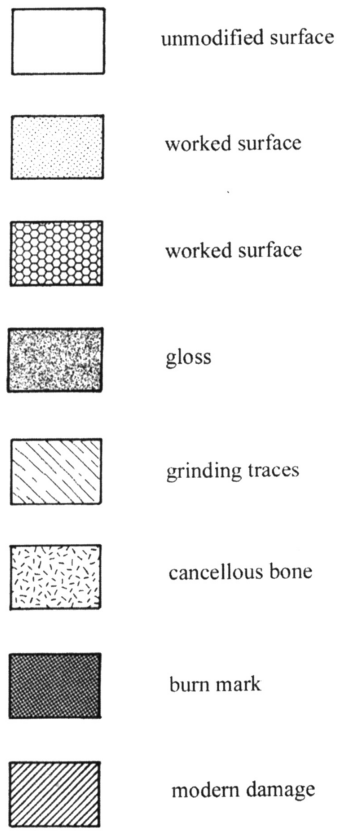


Fig. 1 Upper Neolithic sites in Southwest Germany: location of the "Michelsberg" culture interrupted ditch systems (11-16) mentioned in the text (Matuschik 1991)



Key to the wear patterns on tools shown in figs. 2-3, 6-8

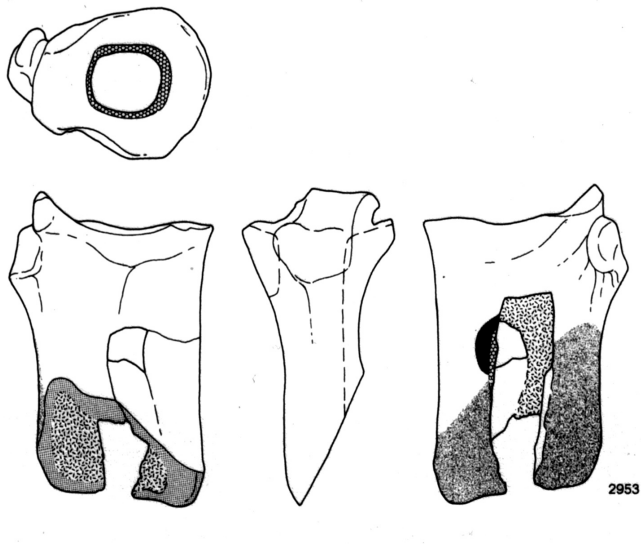


Fig. 2 Bruchsal-Aue. Worked cattle shoulderblade. M = 1:2. (Drawing: K. Mikiffer)

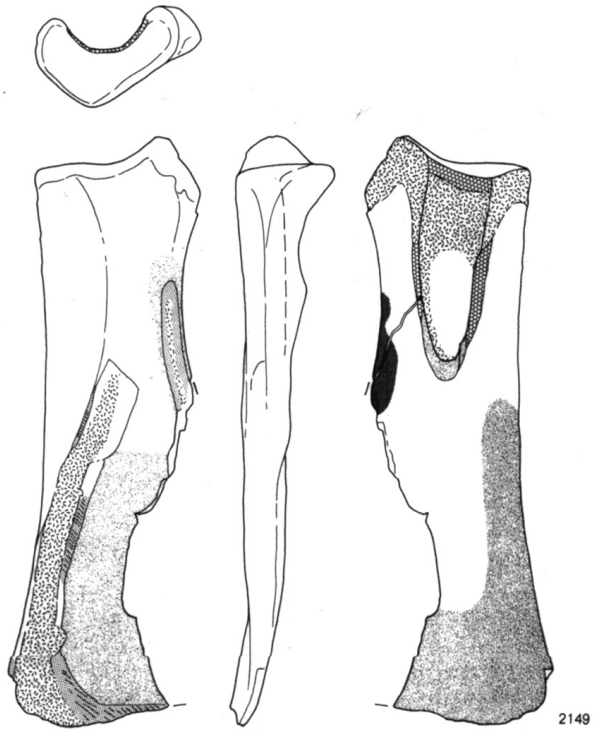


Fig. 3 Bruchsal-Aue. Worked cattle shoulder blade. M = 1:2. (Drawing: K. Mikiffer)

Fig. 4 Bruchsal-Aue. Worked red deer shoulder blade. M = 1:2. (Photograph: M. Seitz)

Fig. 5 Spine of recent cattle shoulder blade removed by an adze. M = 1:2. (Photograph: P. Eglin)

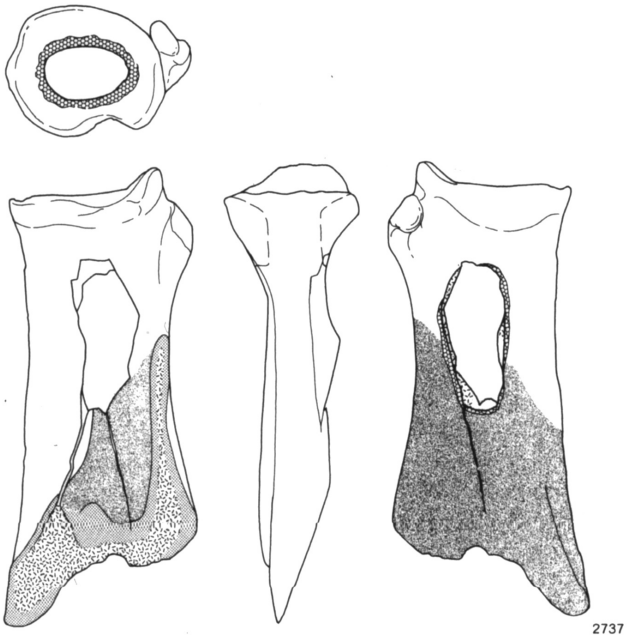


Fig. 6 Bruchsal-Aue. Worked cattle shoulder blade. M = 1:2. (Drawing: K. Mikiffer)

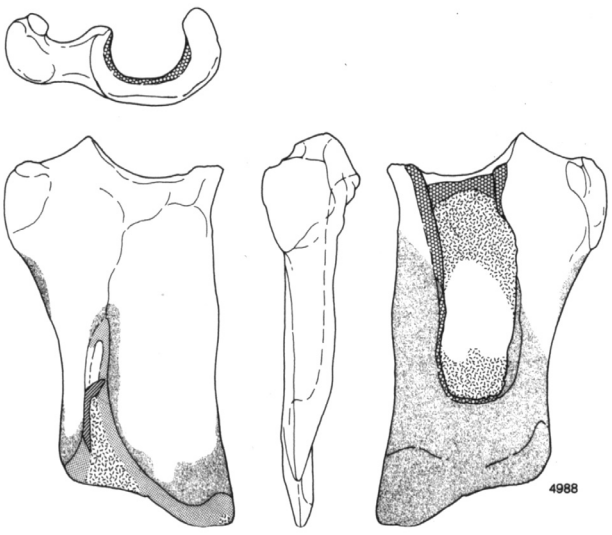


Fig. 7 Bruchsal-Aue. Worked horse shoulder blade. M = 1:2. (Drawing: K. Mikiffer)

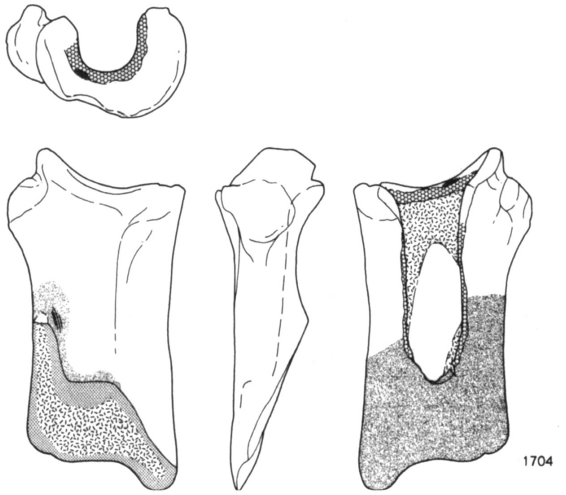


Fig. 8 Bruchsal-Aue. Worked cattle shoulder blade. M = 1:2. (Drawing: K. Mikiffer)

Fig. 9: Bruchsal-Aue. Worked cattle shoulder blade. M = 2:3. (Photograph: M. Seitz)