

CRAFTING BONE – SKELETAL TECHNOLOGIES THROUGH TIME AND SPACE

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

Editors

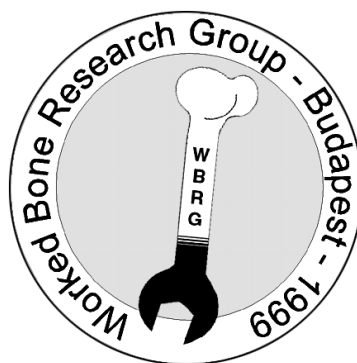
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Introduction

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 in 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 commitment 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 traditions 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 sur l’Industrie de l’Os Préhistorique*” headed by 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 methodological points of view. One striking example of this can be seen in 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 concentrate 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 comparative 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.

WORKSHOPS AND MANUFACTURING TECHNIQUES AT APULUM (AD 2nd-3rd CENTURY)

Daniela Ciugudean

Abstract: Apulum was the capital of Upper Dacia and of Dacia Apulensis, in the Roman province of Dacia. It was also the Governor's residence and the biggest political, military, economic and cultural center in the region. The worked bone and antler inventory is the largest yet found from sites in Roman Dacia. Finds of bone and antler tool waste as well as half finished objects show that workshops operated at various points in the surrounding town. These served the military and local populations.

Keywords: Rumania, Roman Apulum, workshops, waste and spoiled objects, recovery methods, raw materials, species and bone part

Résumé: Apulum était la capitale de la Dacie supérieure et de la Dacie Apulensis, dans la province romaine de Dacie. C'était également la résidence du gouverneur et le centre politique, militaire, économique et culturel le plus important de la région. La série d'objets en os et bois de cervidés est la plus importante recueillie jusqu'ici dans un site romain de Dacie. La découverte de déchets de fabrication et d'objets techniques en os et bois de cervidés montre que plusieurs ateliers étaient en activité aux alentours de la ville. Ceux-ci approvisionnaient les militaires et les populations civiles locales.

Mots-clés: Roumanie, Apulum, Epoque romaine, ateliers, déchets de fabrication, pièces techniques, méthodes de récupération, matières premières, identification anatomique

Zusammenfassung: Apulum war die Hauptstadt des Oberen Dakien und von Dacia Apulensis, in der römischen Provinz Dakien. Es war ebenfalls der Regierungssitz des Gouverneurs und das größte politische, militärische, ökonomische und kulturelle Zentrum der Region. Das Inventar an bearbeitetem Knochen und Geweih ist das umfangreichste, bisher im römischen Dakien entdeckte. Nachweise für Verarbeitungsrückstände und Halbfabrikate von Knochen- und Geweihgeräten zeigen, daß in der umgebenden Stadt an verschiedenen Punkten Knochenwerkstätten existiert haben. Diese versorgten sowohl das Militär wie auch die lokale Bevölkerung.

Schlüsselworte: Rumänien, römisches Apulum, Werkstätten, Abfall und ruinierte Stücke, Bergungsmethoden, Rohmaterialien, Species und Knochenbereich

Apulum was the capital of Upper Dacia and of Dacia Apulensis, in the Roman province of Dacia. It was also the Governor's residence and the biggest political, military, economic and cultural center in the region (Diaconescu & Piso 1993).

After the Roman conquest in AD 106, the emperor Trajan established the headquarters of the XIII Gemina Legion here. This legion remained in Apulum until AD 275. The legionary fortress was built between AD 107-109 (Moga 1985: 2). During the 2nd and the 3rd century, two Roman towns were built nearby the legionary fortress (Diaconescu & Piso 1993: 78, fig. 3). The first city – *Municipium Aurelium Apulense* – was promoted to this rank under the rule of Marcus Aurelius (AD 161-180). After the year AD 180 this city, situated on the banks of the Mureş river (today the residential district Partoş) became the *Colonia Aurelia Apulensis* (Ardevan 1998: 48; Diaconescu & Piso 1993: 79, fig. 4).

Under the rule of emperor Septimius Severus (AD 193-211) the *Municipium Septimium Apulense* developed from the

ancient *canabae* (Macrea 1969: 180; Popa 1975; Ardevan 1998: 48; Oprean 1998: 127) around the fortress of the XIII Legio Gemina. It was promoted to the rank of *Colonia*, probably after the year AD 250 (Daicoviciu 1950; Ardevan 1998: 49-50). These towns were the largest and the most developed in the province of Dacia (Mann 1983: 40).

The walls of the Roman fortress have been used from Roman times until the 18th century, when the medieval bulwark fortress overlapped with them. During the Middle Ages the nobles of Alba Iulia collected mainly sculptural and epigraphic monuments, as well as other Roman objects, discovered in different parts of the city. Unfortunately, most of them have been lost over subsequent centuries.

Among the thousands of Roman finds, there were a small number of bone, antler and ivory items which I recently analyzed in a catalogue (Ciugudean 1997). This collection, including almost 600 carvings, presently seems to be the largest from the province of Dacia.

I shall point out the main places of provenience for these artifacts. By the end of the 19th century, B. Cserni began systematic excavations in the southeastern area of the medieval citadel where he supposed the Roman baths were placed (Cserni 1902) but where recent discoveries have identified the Governor's residence. Anyway, 125 worked bone specimens were collected from this zone, between 1898 and 1901.

Ten years later the same archaeologist carried out his investigations in Partoş – *Colonia Aurelia Apulensis*. He collected 316 bone carvings from a large building with 12 rooms. Of these carvings, 271 were pins and needles. His conclusion was that many women had lived there over a long period of time. We can add to his supposition that it is more likely that a workshop may have rather functioned there (Cserni 1913: figs. 23-24).

Excavations carried out after the Second World War did not recover more carvings. The archaeological investigations between 1981 and 1985 in the northern Roman cemetery of Apulum (Ciugudean 1996), unearthed unexpectedly few bone finds (3 dice, one ring and a needle (Ciugudean 1997: Pl. XXXIII/3,4,6; VII/9; XVIII/5) from 149 graves (both cremation and inhumation burials).

Between 1980 and 1982, the building of a residential district on the northern and southern sides of the medieval citadel destroyed significant Roman remains. The archaeologists carried out some surveys, but methodical research was almost impossible in this important area where the *canabae* gradually developed around the fortress. In spite of all these difficulties, a considerable number of Roman finds were recovered from this area. Almost 100 bone carvings have come into the possession of our museum from the earliest levels of the settlement, associated with the first colonists who established themselves in Apulum. The level was dated using coins issued by the emperors Trajan and Hadrian. The presence of partially worked objects and offcuts and of bone bow stiffeners, which do not appear in other parts of the settlement, are remarkable among these materials.

Beginning in 1995, rescue excavations on Dealul Furcilor, located in the southern part of the fortress and nearby the other Roman cemetery from Apulum resulted in the recovery of 23 bone items (pins, needles, a roundel of antler, tooth pendants and a flute: Ciugudean 1997: Pl. XI/4, XIV/1,2,3,7,8; XVI/15; XII/4-5; XXXIV/1; Ciobanu & Rodean 1997: fig.7/1-5).

As mentioned before, offcuts and spoiled or refuse materials were found in different parts of the town. They will be presented together with the working techniques they reveal.

St. Moşilor and Gemina (northern area of the canabae)

a. Red deer antler (Length 450 mm): the base of the beam was sawn off close to the burr. One entire tine (Length 330 mm)

shows three visible marks of hacked or chopped grooves. We cannot specify why the artisan abandoned them. Most successful seems to be debitage from the second tine, chopped with a saw or a jagger in two sequences and then snapped off. The third tine (Length 150 mm), thicker than the others, was more difficult to separate from the beam. Several marks can be observed all around it (almost 17 unsuccessful hacks), followed by six sharpened jagger or hatchet strokes. Finally the tine was separated. The cutting angles measure between 8-15° (fig.1).

b. Off-cut: crown from a red deer antler sawn from the beam in two sequences and then broken. Two tines survive. If the longer one is perfectly sawn, the other preserves a few slight marks close to the end which seem to be cut roughly with another tool and then snapped off. The surface was trimmed (fig.2).

c. Handle: made from a red deer tine. The extremity shows traces of several slanting saw cuts up to the cancellous tissue. One side of the tool is partially smoothed. Two obvious marks were made close to the opposite end, which was sawn off and trimmed. The internal cancellous tissue has been bored out (along two thirds of the object's length; fig.3).

d. Cylinder, cut from a hollowed section of antler tine. It was sawn across at both ends. An almost regular socket was obtained after the removal of the internal cancellous tissue. The outer surface was trimmed off with a knife on unequal facets. Evidence of unidentified black-as-pitch traces at both ends and on the external surface. This object could represent a stage in the manufacture of a tool handle or maybe a hinge (Ciugudean 1997: 36, cat.445, Pl. XXXVIII/3). Length 35 mm (fig.4).

e. Unfinished item from a roe deer tine. The tip was cut aslant. Closer to the broken base there are six more or less shallow marks of false starts. The cutting operation seems unsuccessful and the tine abandoned (Ciugudean 1997: 50, cat. 526, Pl.XXXVII/3). Length 54 mm (fig.4).

f. Goat (Ibex?) horn core with the base chopped off from the skull and a visible hacking mark. The tip of the horn was sawn off. Probably intended to be made into a tool handle (Ciugudean 1997: 35, cat.451, Pl. XXIX/6). Length 104 mm (fig.4).

g. Tip of a goat horn core with sawn off base (Ciugudean 1997: 35, cat.449, Pl. XXIX/4). Length 85 mm (fig. 4).

h. Handle made from a goat horn core with sawn off base (Ciugudean 1997: 35, cat.450, Pl. XXIX/5). Length 120 mm (fig. 4).

i. Domestic sheep horn core (ram) with saw cut base. (fig. 6).

j. Off-cut: a length of a long bone sawn across at both ends.

Length 20 mm (fig. 4).

St. Republicii

a. Off-cut: tubular fragment chopped from a long bone. Several hacked marks at both ends (Ciugudean 1997: 49, cat.523, Pl.XXXVII/1). Length 95 mm (fig. 5).

b. Off-cut: sawn off from a long bone. Near one of the partially sawn and snapped off ends there are two cutting marks (Ciugudean 1997: 49, cat.525, Pl.XXXVII/3). Length 55 mm (fig. 5).

Roman baths (Ancient excavations carried out by B. Cserni in the south-eastern area of the fortress)

a. bone plaque: pierced by six conjoined circles. Possibly waste from bone counter manufacture (Ciugudean 1997: 50, cat.524, Pl. XXXVII/2). Length 95 mm; width 19 mm; thickness 2 mm (fig. 5).

“Horia, Cloșca și Crișan” College (western area of the site)

The latest and most interesting discovery was made in the western area of the town, in the yard of the College “Horia, Cloșca și Crișan”, during rescue excavations in 1998-1999. It consists of an assemblage of mammal bones found in a waste pit, in the proximity of some Roman buildings badly damaged by an early medieval site.

Before the complete analysis of the hundreds of bones and the identification of species, a preliminary examination revealed fragments of ribs and vertebrae, skulls, shoulder blades (scapulae), pelvic bones (pelvis), metapodials, femora, fibulae, tibiae, radii and, ulnae. However, due to the unique character of this find in the province of Dacia, we decided to present a brief report at this meeting.

We also could demonstrate instances of slaughtering and traces of utilization among these bones. We selected 170 such bones. Some of them are cracked epiphysis fragments, but many are evidently hacked across and lengthwise (fig. 7). The articulations have been carefully cut off and removed. Furthermore, there are parts of long bones including: humerus, radius and ulna, femur and, tibia. We suppose that this debris comes from the processing of good bone glue, from the collagene inside.

On the other hand, rough bone waste can provide evidence for the existence of a specific handicraft. When bone tubes were needed, the articulations at the end of the regular and strong metatarsus were sawn off, resulting in a natural tube, which required further working to achieve the desired form. Handles, small boxes and very often hinges for doors or furniture, were manufactured from them. This could also have been the case for several tubular-shaped fragments neatly sawn off at both ends, found in our pit. Some roughly carved bone splints from

long bone or cut ribs, which might have been used by the Romans in many ways, after their working into different objects should be mentioned too. However, some researchers may consider the bones from this waste pit simple remnants of meals.

Undoubtedly, many new and interesting additions to this brief evaluation will come out after the identification and the taxonomic classification of all the bones. Unfortunately, the scientific study made by an archaeozoologist will not be ready until the end of this year.

Four other unfinished artefacts were also found in the Roman building found nearby.

a. Unfinished antler item: one end is now broken off. The outer surface has been trimmed off longitudinally down its whole length with a knife. The piece has been polished. Length 128 mm (fig. 6).

b. Goat horn: the tip is now broken off. The opposite end has been cut for part of the section in two sequences and then broken. There is another abandoned saw cut near it. Probably intended to be made into a tool handle. Length 103 mm (fig. 5).

c. Off-cut: a length of a long bone (cattle) sawn off and partially broken at both ends. Length 95 mm. Not illustrated.

d. Goat horn snapped off from the skull. Length 160 mm. Not illustrated.

Bone manufacturing

Certain conclusions on the manufacturing techniques or the technical process of bone carving can be drawn concerning the bone finds from Apulum. Taking into consideration the offcuts, the unfinished objects or the waste material, the primary sawing into one or more sequences is the most common and generally used cutting process which is most evident. Microscopic observations on the cross-sections or trimmed surfaces of some pieces allow identifying traces of other types of tools: chisels, jagers or hatchets which produce different kinds of striations.

Polishing was probably done with an abrasive like wet sand or a piece of sandstone, followed by greasing and smoothing with leather. The aim of rasping or trimming the outer surfaces into facets can be rather considered as a flattening of irregularities rather than serving an ornamental purpose, especially in the case of antlers.

The identification of the bone workshops is mainly based on the finds of offcuts, bone refuse and half-finished objects. The occurrence of bone refuse from manufacturing demonstrates that the artefacts were locally made. The existence of a workshop can be also demonstrated by the distribution of some particular types of objects or decoration patterns in a certain

space. We can illustrate both situations in the case of the finds from Apulum. There are two main areas with discoveries of raw materials, offcuts and unfinished items:

The first one is located in the northern part of the ancient town (Moșilor and Gemina streets), an area generally considered to be located within the *canabae* of the Roman fortress.

The second one is within the western area of the town (the yard of the college "Horia, Cloșca și Crișan"), where the pit with offcuts and raw material was recently found.

Besides these places, which may indicate the location of two workshops, unfinished items and bone refuse were also found in some other areas of the ancient town, but in smaller numbers.

The activity of bone and antler workshops at Apulum can be also supported by the presence of some particular types of bone artifacts. One significant case is the hairpin with the head in the shape of a *kantharos*, which was a copy of similar copper pins (fig. 8) found in the graves of the northern cemetery. It is also a good example how copies of certain metal objects were made in a cheaper material such as bone.

No offcuts, unfinished objects or waste materials have been found so far inside the fortress of the XIII Gemina Legion, which clearly shows that the Roman soldiers bought the bone, antler or ivory items from the merchants or the small workshops which were active during the AD 2nd and 3rd century at Apulum as well as in the most of the Roman towns of the northwestern provinces. They produced objects for daily use not only for citizens but also for local people in the immediate area.

Conclusions

This paper has tried to offer a general view on the manufacturing of bone and antler objects in one of the most important Roman towns from the province of Dacia. This attempt has suffered because bone collection in excavations has long been neglected, so that much information has been lost forever. The absence of archaeozoologists both in fieldwork and in the laboratories is another important handicap, but we hope that their number will grow in the future, to the benefit of our research.

References

Ardevan, R. 1998. *Viața municipală în Dacia romană* (Municipal life in Roman Dacia). Timișoara, Bibliotheca Historica et Archaeologica Banatica X.

Ciobanu, R. & Rodean, N. 1997. Raport preliminar privind cercetările arheologice de salvare din Dealul Furcilor – Alba Iulia (Preliminary report concerning the rescue excavations Dealul Furcilor – Alba Iulia). *Apulum* 34, pp. 177-196.

Ciugudean, D. 1997. *Obiectele din os, corn și fildeș de la Apulum* (Objects made of bone, horn and tusk from Apulum). Bibliotheca Musei Apulensis V, Alba Iulia.

Ciugudean, H. 1996. *Anul 1000 la Alba Iulia - între istorie și arheologie* (Alba Iulia 1000 years - between history and archaeology). Catalogul expoziției, Alba Iulia: 4-5.

Cserni, B. 1902. *Alsófehér vármegye történelme a római korban. Alsófehér vármegye őskora* (The history of Alsófehér county during the Roman Period. The ancient history of Alsófehér county) II/1. Nagyenyed, pp. 126-170.

Cserni, B. 1913. Jelentés a Colonia Apulensis területén 1911-12-ben végzett ásatásokról (Report on the excavations in the area of Colonia Apulensis during 1911-12). *Múzeumi és Könyvtári Értesítő* VI, Budapest, pp. 34-35.

Daicovicu, C. 1950. Așezarea autohtonă de la Apulum (Alba Iulia). *SCIV* 1: pp. 227-228.

Diaconescu, A. & Piso, I. 1993. Apulum, La politique édilitaire dans les provinces de l'Empire romain. *Actes du 1er Colloque Roumano-Suisse, Deva 1991*. Cluj-Napoca, pp. 67-83.

Macrea, M. 1969. *Viața în Dacia romană* (Life in Roman Dacia). București, pp. 180-201.

Mann, J. C. 1983. *Legionary Recruitment and Veteran Settlement during the Principate*. Institute of Archaeology, Occasional Publication 7, London, p. 40.

Moga, V. 1985. *Din istoria militară a Daciei romane, Legiunea XIII Gemina* (The military history of Roman Dacia, Legio XIII Gemina). Cluj-Napoca, p. 2.

Oprean, C. 1998. Castrul legiunii I Adiutrix de la Apulum în timpul lui Traian. Consecințe asupra urbanismului roman la Apulum (The castrum of legio I. Adiutrix in the time of Traian. The consequences of Roman urbanism in Apulum). *Apulum* 35, pp. 121-134.

Popa, A. 1975. Orașul roman Apulum (The Roman town of Apulum). In *Alba Iulia 2000*. Alba Iulia, pp. 67-76.

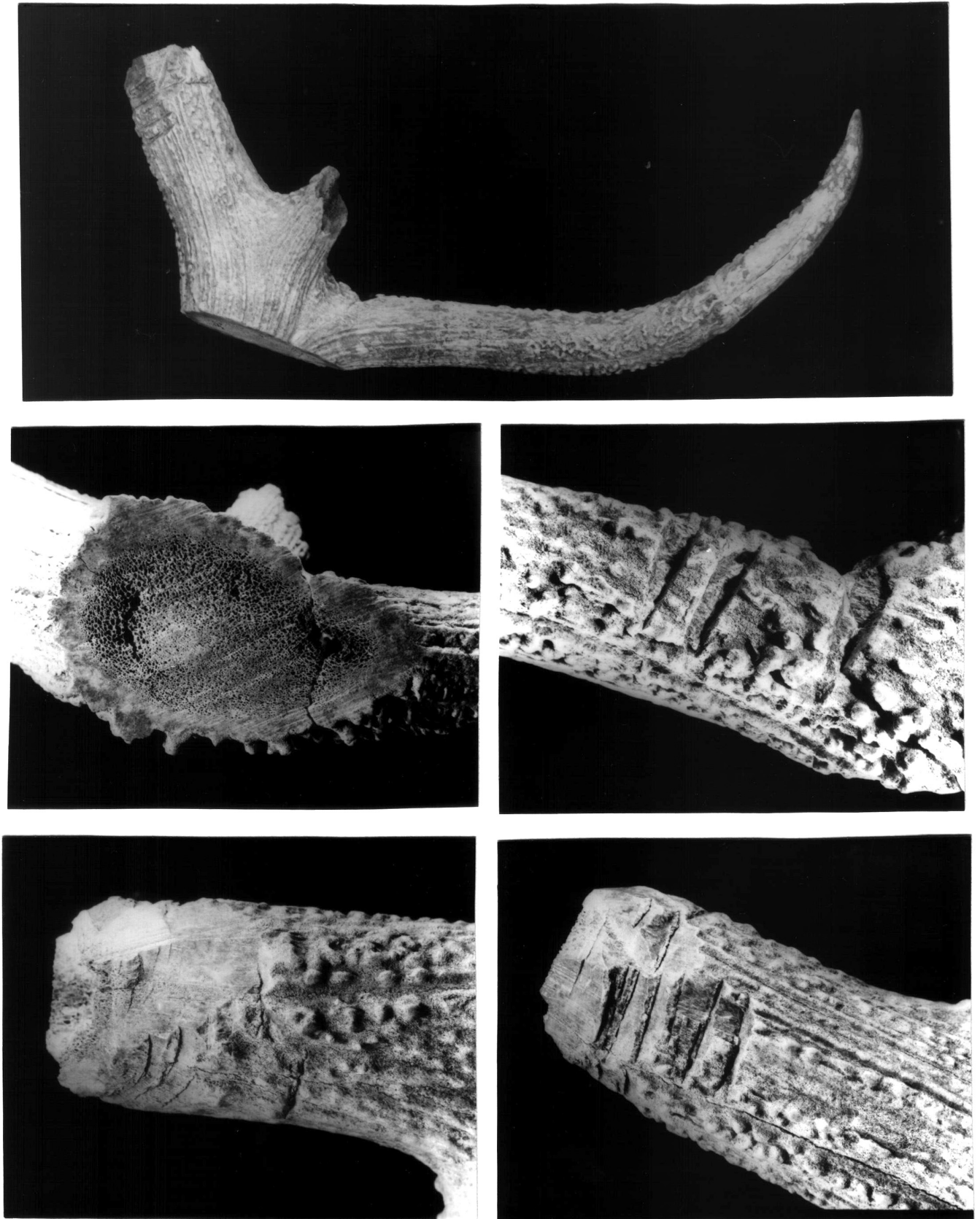


Fig. 1 Various aspects of antler cutoff "a" from St. Moșilor and Gemina

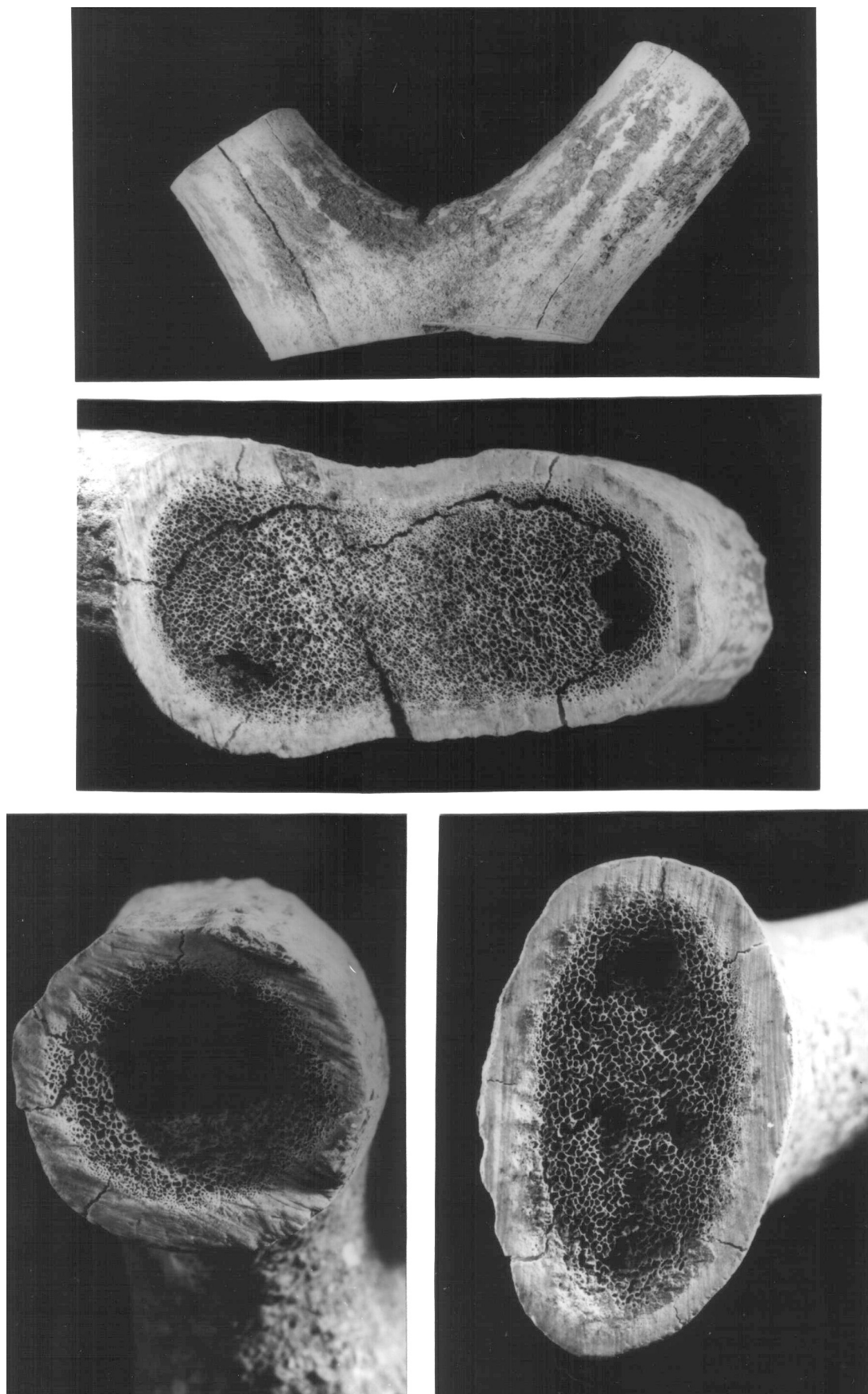


Fig. 2 Various aspects of antler object "b" from St. Moșilor and Gemina



Fig. 3 Various aspects of antler object "c" from St. Moșilor and Gemina

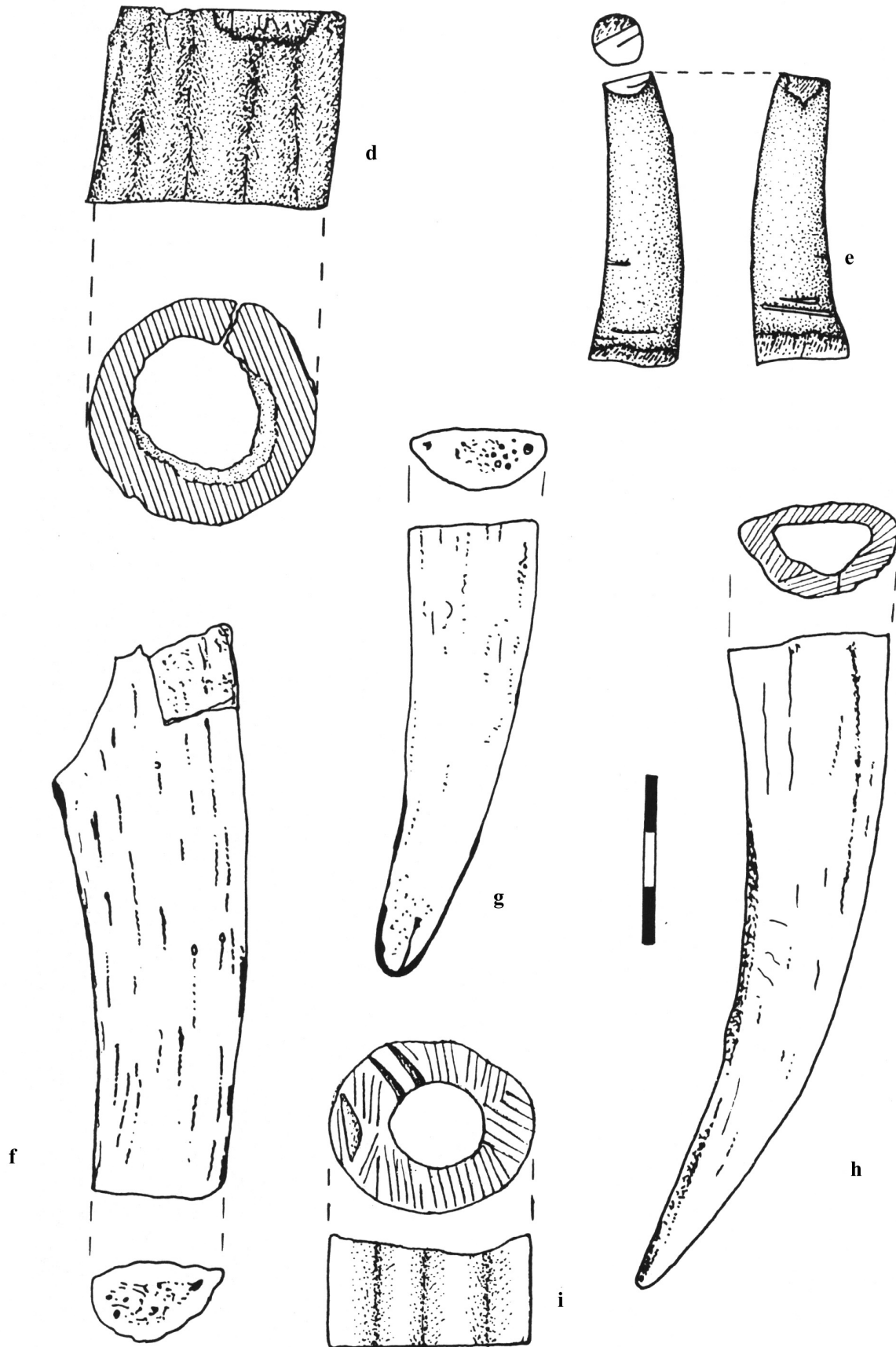


Fig. 4 Bone and antler objects "d" to "i" from St. Moților and Gemina

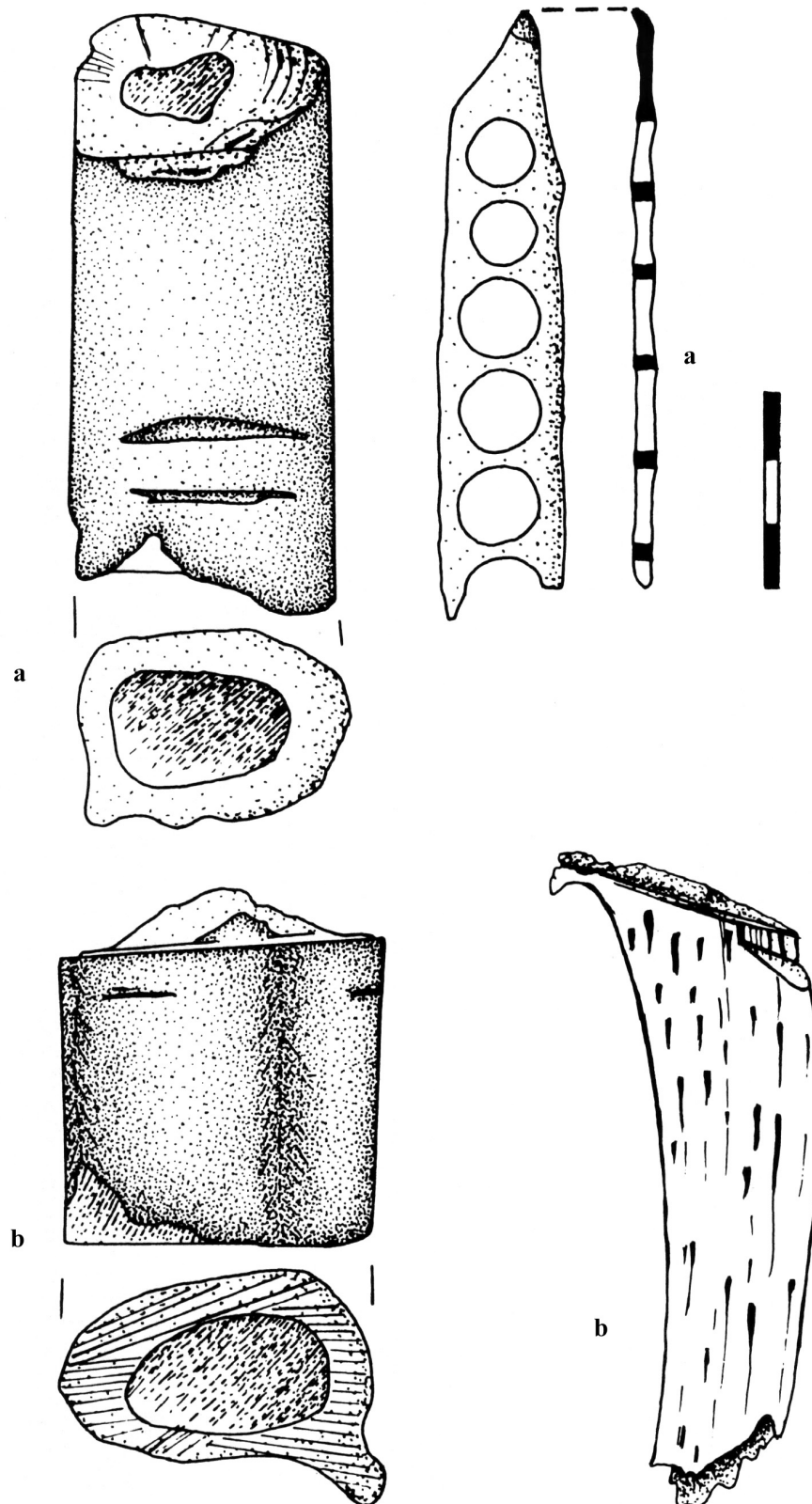


Fig. 5 Bone cutoffs "a" and "b" from St. Rebulicii (left), from the Roman baths (top right) and horn core "b" from the Horia, Cloșca și Crișan College (bottom right)



Fig. 6 Two aspects of antler object "a" from the Horia, Cloșca și Crișan College (top) and of horn core "i" from St. Moșilor and Gemina (bottom)

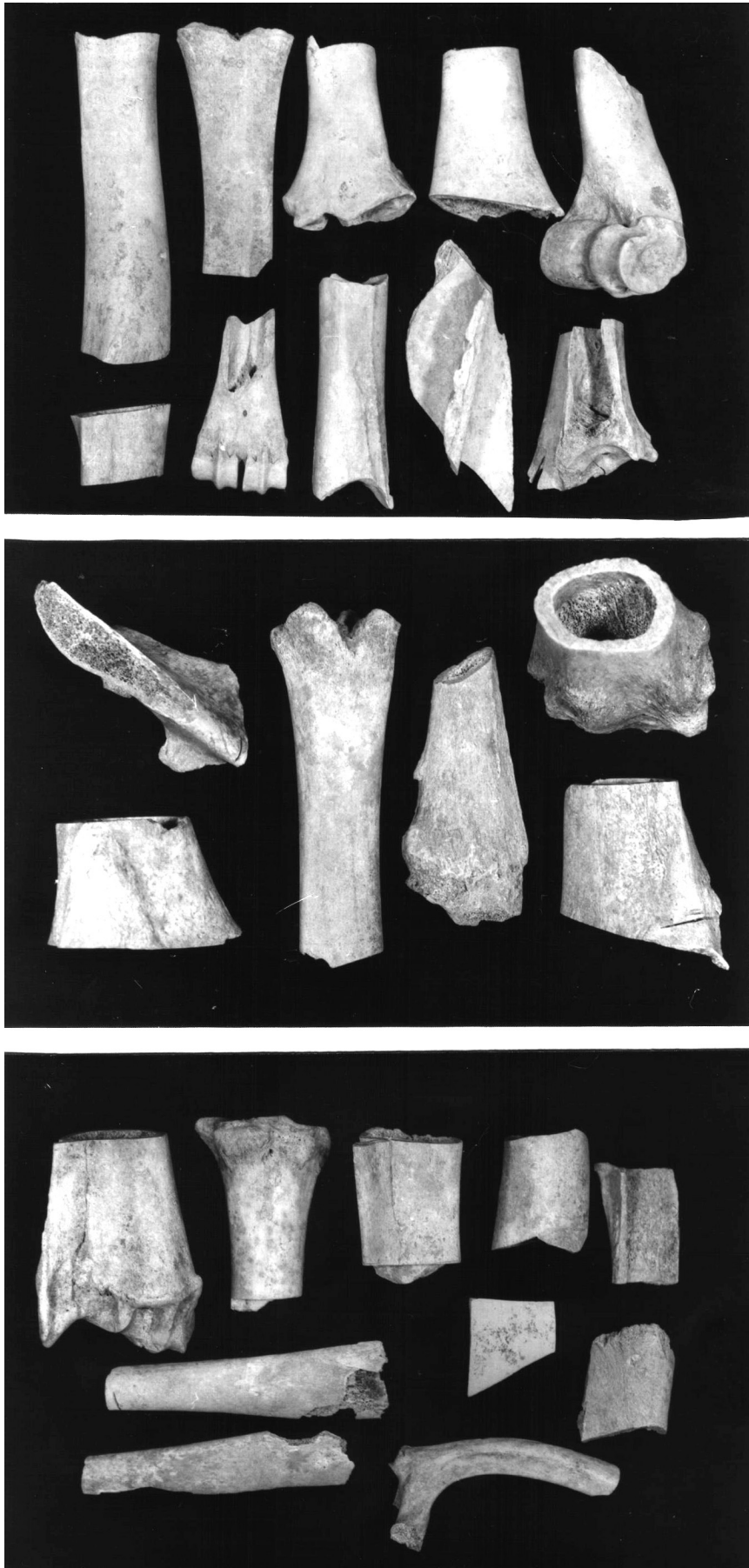


Fig. 7 Bone cutoffs from the waste pit at the Horia, Cloșca și Crișan College site

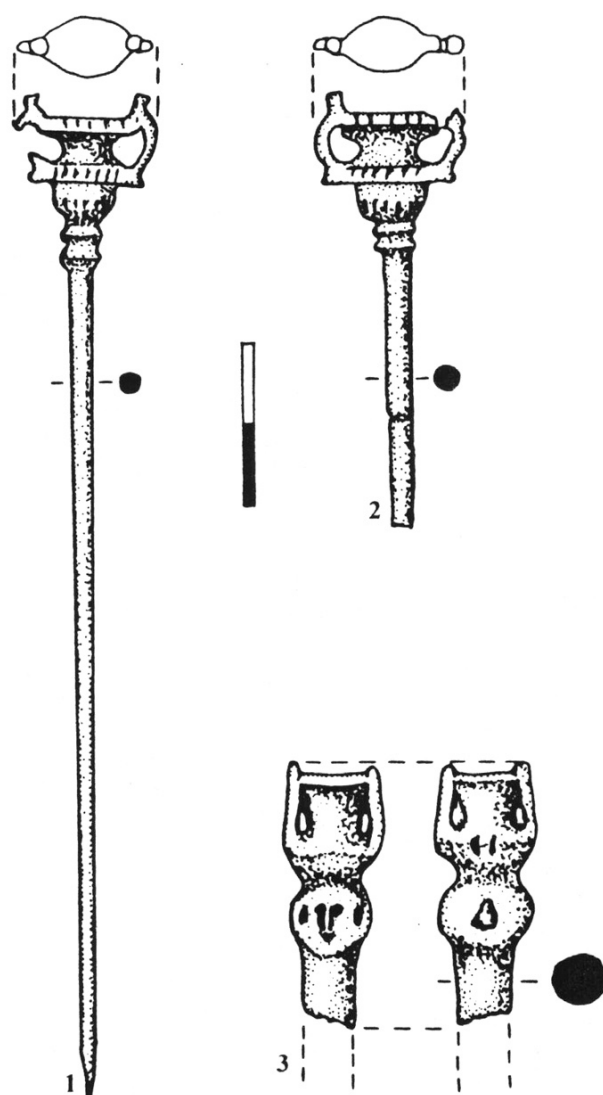


Fig. 8 Hairpins: Nos. 1-2. copper, 3. bone from the northern cemetery