CRAFTING BONE – SKELETAL TECHNOLOGIES THROUGH TIME AND SPACE

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

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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.

TECHNOLOGY OF THE MANUFACTURE OF MESOLITHIC BONE AND ANTLER DAGGERS ON UPPER VOLGA

Mickle G. Zhilin

Abstract: Excavations of stratified peat sites, carried out by the author on Upper Volga during recent years, have yielded large numbers of various types of bone artifacts, including numerous daggers and hunters' knives. Preforms and half-finished daggers were also found together with lithic tools, used in boneworking.

Keywords: Mesolithic bone daggers, Upper Volga, technology, manufacture

Résumé: Les fouilles de sites stratifiés en milieu de tourbieres conduites ces dernieres années par l'auteur sur le cours supérieur de la Volga ont livré un grand nombre d'artefacts en os de types variés, dont de nombreux poignards et couteaux de chasse. Des ébauches ainsi que des poignards en cours de fabrication ont été également découverts en association avec les outils lithiques utilisés pour le travail de l'os.

Mots-clés: Poignards en os, Mésolithique, Volga supérieure, technologie, fabrication

Zusammenfassung: Ausgrabungen in stratifizierten Moorsiedlungen, die von dem Autor während des vergangenen Jahres an der Oberen Wolga durchgeführt wurden, haben eine große Zahl verschiedener Typen an Knochenartefakten ans Licht gebracht, einschließlich zahlreicher Dolche und Jagdmesser. Rohstücke und halbfertiggestellte Dolche wurden zusammen mit Silexgeräten gefunden, die für die Knochenbearbeitung Verwendung fanden.

Schlüsselworte: Mesolithische Knochendolche, Obere Wolga, Technologie, Herstellung

Introduction

Intensive field surveys, carried out by the author in 1988-1999 resulted in the discovery of more than 50 peat bog sites in the Upper Volga Basin. About 20 of these sites have Mesolithic cultural layers where organic materials have been preserved. Thirteen of these have been excavated. An abundance of lithic tools made possible a comparison of peat sites with "sandy" ones as well as the accurate cultural attribution of the former. As a result, we have now complexes of lithic and organic remains, characterising the whole spectrum of prehistoric life, which can be placed in a reliable cultural-chronological framework, together with data on the development of the environment. Finished and half-finished daggers, blanks for their production and waste, accompanied by lithic tools used for manufacturing of bone artifacts, provide a good opportunity for studying the technology of bone and antler dagger manufacture using various methods.

The beginning of the Mesolithic in Central Russia is traditionally connected with the transition from the Pleistocene to the Holocene, which is dated in the Upper Volga Basin to approximately 10000 BP. The climate and vegetation changed several times during the Mesolithic (Spiridonova and Aleshinskaya 1996; Zhilin 1998). The beginning of the Preboreal (about 10000-9500 BP) is marked by the gradual spread of birch-pine forests, which resulted in the taiga type forest coming to dominate in the landscape about 9600 BP. From that time, the forest became the most important element in the landscape, though its composition changed through time. About 7800 BP the taiga gives way to mixed temperate zone forests, which dominated in the landscape up to the Atlantic optimum. The emergence of pottery about 7100 BP marks the end of the Mesolithic.

Faunal remains from habitation sites show that throughout the whole of the Mesolithic, various forest animals were hunted. Elk was most important from the earliest period up to the Neolithic. Beaver was the second most significant animal, hunted mainly for its meat, judging from numerous butchering marks, preserved on various beaver bones. Among other species, red deer and roe deer, brown bear, wild pig, badger, otter, wolf, fox and, hare were occasionally hunted, but even if their numbers are combined they contribute quite modestly compared with elk and beaver. Reindeer is represented by single bones and never played an important role even in the early Mesolithic. Fowling and fishing were also important from the early Preboreal, with their role gradually increasing. Hunting and fishing were supplemented by food-gathering. Both inland and edible water plants as well as molluscs were exploited.

Three main cultures are distinguished in the Upper Volga Basin in the first half of the Mesolithic (Koltsov 1989; Zhilin 1995). The Ienevo culture is linked with the Lyngby-Ahrensburgian tradition. Only one Ienevo site, Stanovoye 4, yielded some bone artifacts but no daggers were among them. The Resseta culture is poorly studied. It spread in the first half of the Boreal, possibly slightly earlier. Bone tools are scarce with no known daggers. The Butovo culture emerged in the Upper Volga Basin in the early Preboreal and is connected mainly with the population of the Swiderian culture. Bone and antler artifacts are numerous at these peat bog sites, including about 20 types of arrowheads, various barbed points, spearheads, daggers, fishing hooks and a wide range of tools used in everyday life: knives, perforators, needles, woodcutting tools, scrapers and burins-scrapers, punches and pressure-flakers, accompanied by numerous ornaments, made mainly from animal teeth. This culture developed over the course of the whole of the Mesolithic and formed the basis for the local early Neolithic. All daggers, analized in the present paper, are from settlements of the Butovo culture.

Straight daggers, made of long bones

Preliminary treatment of bone and antler depended upon the type of raw material used and, on the other hand, upon the desired size and shape of the finished dagger. The groove and splinter technique, well-known in the European Mesolithic, was widely used for producing blanks for various types of daggers. Longitudal grooves were cut with a burin, which usually had a narrow working edge, from one to the other end of a long bone to a depth of 2/3 to 5/6 of the thickness of the bone wall. The distance between such grooves regulated the width of the blank and the finished dagger. After the grooves were finished, the bone was broken into long splinters (fig. 1, 1). It is worth noting that the epiphyses of the bone were usually removed before making these longitudinal grooves for obtaining blanks. In other cases the bone was longitudally cut with epiphyses preserved, and the preserved part of it was used as a handle tip (fig. 3, 2). Most simply, they were just broken off. Usually, however, the epiphyses were either cut off with an axe or adze or a transverse cut was made with a chisel or a saw after which the epiphyses were broken off.

If the removal of such blank was successful, the simplest straight flat daggers were produced by cutting off useless parts of the blank with a burin, planing the surface first with a scraper and then with a knife (fig. 1, 2). Slotted variants of the same or similar types (figs. 1, 3; 2, 2,3) were first provided with one or two slots for microliths, and only then carefully planed and often polished. Traces of the use of a flint burin are visible only inside the groove. After, the slots were filled with glue (fig. 2, 3 shows a longitudinally broken dagger, where glue is visible in the slots) made of coniferous pitch, usually with an admixture of beewax and often combined with charcoal dust. The glue in slots was heated and microblades, usually without any retouch were placed in the slots. Our experiments showed that it was sufficient to hold a dagger for several minutes just above burning charcoal to cause the glue to melt in the slot. It did not run out of the slot, so it was possible to fix microblades in the slot on the opposite side. When several inserts remained, they are stuck into the slot so that the dorsal sides face in one direction and the ventral sides in the opposite direction. Microblades are usually the same size and often, judging by peculiarities in the flint, were removed from the same core. When the dagger cooled, this glue held the microblades very tightly, so that often they were crushed, but did not fall out. Microblades were very rarely sharpened in the final Mesolithic using a fine flat ventral retouch, but normally they only display use-wear traces. Among other features, often, but not necessarily, there are perforations at the end of the handle (figs. 2, 2; 3, 2; 5), probably used for attachment to some thin belt or rope. The perforations are always made from two sides, either by drilling with a borer, or just cutting or scraping with a burin (compare fig. 5, 1, 2). Often a natural hole is slightly widened with a burin (fig. 3, 2). The next feature is some transverse shallow cuts, marking the border between the blade and the handle (figs. 2, 1; 6, 1).

Flat, massive blanks were also made with the "groove and splinter" technique and later shaped into daggers by the methods described above (figs. 2, 1; 6, 1). Of special interest are specific blanks, made by the same technique from parts of long bones, which had natural longitudinal ribs and depressions, making the cross-section of these daggers more complicated. Such daggers appear in late Preboreal and early Boreal times (fig. 3). Large numbers of such fragments suggest that this was done chiefly to supply the thin blade of a dagger with these ribs, making it more resistant to breakage. Many such daggers are ornamented with geometric designs, composed of very thin lines engraved by a very sharp burin, most probably, a broken flint blade. After being ornamented most of these daggers were carefully polished, most probably using a dry hide, judging from the typical hide polish found on them. Numerous striations indicate that the hide was not clean or possibly initially coated with some very thin abrasive agent when it was raw or wet, just like modern abrasive "hide" (paper or textile). Glossy polishing was produced by clean hide in the final stage of the manufacturing process.

Another technique was also used for making preforms for massive long straight or slightly concave daggers. Large, long elk bones were split into halves with a hard hammerstone, after which the interior, concave part of a long bone was trimmed with crude flaking and fine retouching to flatten it, while the outer surface remained convex (fig. 4). After this, a burin, scraper, knife and borer were used for the secondary treatment of such a preform, shaping it into a massive finished dagger (compare figs. 4, 1; 5, 1). Preforms, made of long bones other than metapodia, were less specialised. Daggers of various shapes and sizes were made from them (figs. 5, 2; 6, 1 for example). After flaking and before being shaped into finished daggers, massive preforms were put into water for some considerable time to soften the bone, which was important for planing, cutting and scraping. All intact massive blanks (fig. 4) were discovered in gyttia layers near the shoreline of the settlement. Most probably, after soaking they were heated to make them even softer. This is a well known technique in the ethnographic literature. However, the bone would have had to be dried before flaking, otherwise the flaking would have been unsuccessful.

Other types

Various flat bones were also used for making daggers, sometimes, with rather sophisticated forms (fig. 6, 2). Traces of preliminary treatment cannot be seen. Possibly, in this case, there was no need to make any preform and the dagger was shaped from the very beginning with the help of burin and scraper and later also with a knife and borer. The slot was made in the usual manner, inserts – unretouched microblades – were fixed with the 3-component glue, described above. Clear traces of binding, possibly with stripes of leather or birch bark, are seen on the handles of some daggers (fig. 6). Usually the traces of this binding run over the hole in the handle, so we know that the belt or rope must have started beneath this binding. The same phenomenon is also observed on the perforated handles of other types of daggers.

Curved daggers were made of antler: the shape of the raw material either dictated the form of the finished dagger or demanded too much work to make it straight. Antlers of most cervidae are curved. The main tasks for the Mesolithic craftsman in this case were: 1. sharpening one end, usually the end of the antler beam, 2. making slots for inserts and mounting the latter with glue and, 3. shaping the handle. The first operation was carried out with a knife, or at least, no traces of burin or scraper working were observed. Usually the surface of the antler beam was also carefully planed so that no traces of the natural antler surface may be seen. Slots were made with a burin as described above. The treatment of the handle was more individual: either it was carefully planed with a hole, drilled at the end, and bound with birch bark (fig. 7, 1), just roughly cut with an adze and slightly planed (fig. 7, 2), or very carefully narrowed with two perforations in it (fig. 8, 1). The last variant suggests the use of some solid, probably wooden or bone handle with a hollow for the tang of the knife, like many such artifacts made in later periods. Antler daggers are rarely found and most of them are individual in character.

Daggers with an oblique blade are more common. They were made either from various flat bones or from the ulnae of large mammals. The first variant was made with the help of direct percussion on a preform, after which the blade was carefully planed with a knife. Traces of initial flaking and retouch may sometimes be clearly seen (fig. 8, 2). Making daggers of elk (fig. 9, 1) or brown bear (fig. 9, 2) ulnae involved two main operations: 1. sharpening the thin end, which served as a blade, and 2. shaping the thick end into a handle. An oblique cut near the end of the bone was made with a burin, creating the dagger point while the other lateral edge remained straight. Both edges and parts of surfaces near the point were sharpened by planing and sometimes polished. Protruding parts of the bone, which made grasping difficult, were chopped off, broken away using direct percussion with a hammerstone, or cut off with a burin. The latter left deep cutmarks, later removed by planing, although some are usually still visible on the blade or handle of such daggers (fig. 9).

The last group of daggers is composed of piercing artifacts with blunt edges, which were not used for cutting. These are called stylettes. Some were made from the lateral metacarpal bones of elk and red deer (fig. 10, 1). This bone already has the form of an finished stylette. It was only necessary to sharpen its end by precise planing. Epiphyses were preserved and some of these artifacts were ornamented and polished. Another type of similar, but longer and more massive daggers was made of splinters, cut from elk long bones, as described above. The blunt lateral sides were planed with a knife. The point was sharpened by precise planing, and the handle was shaped by longitudal cuts with a burin. Traces of binding are visible on the handles of some of these artifacts.

Conclusions

Results of the investigation described above show that the technology of the manufacture of bone and antler daggers in Central Russia in the Mesolithic was well developed and rather sophisticated. All the main methods of boneworking were employed in the manufacture of these artifacts. A good knowledge of the raw materials and preference for specific bones for each type of dagger can be clearly seen. Standardisation of technological schemes and methods is observed in the production of the most widespread daggers. At the same time, some rare types, especially antler daggers, each display an individual approach in their manufacture.

The dagger, as an important and powerful weapon, emerges in Upper Volga Basin in the early Mesolithic and survives until the late Neolithic. The most complicated to manufacture were composite daggers with flint inserts, which may be called hunters' knives, since they are also very effective in butchering. They were most widespread during the middle Mesolithic. Later their number decreases rapidly, something connected with the general decrease in the role of composite weapons. More primitive daggers with only piercing functions demanded less time and effort in their production. At the same time, in the early Neolithic, a well developed trend for making large flint knives can be observed. It led to the mass production of large flint daggers and hunters' knives, which replace bone daggers in the middle and late Neolithic.

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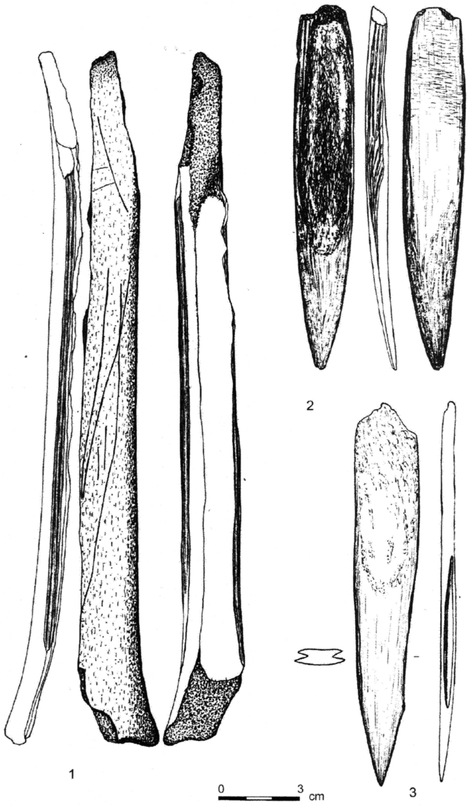

Fig. 1. 1- Stanovoye 4, layer III; 2 - Ozerki 5, layer IV; 3 - Okayomovo 5, layer III

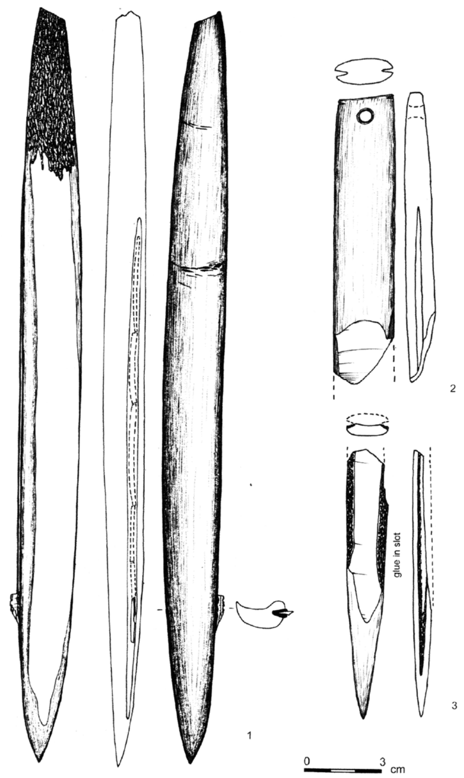

Fig. 2. 1 - Stanovoye 4, layer III; 2,3 - Ivanovskoye 3, layer IV

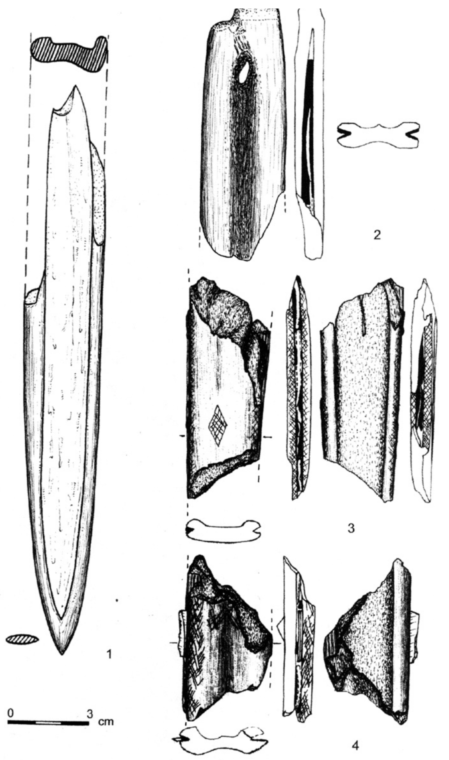

Fig. 3. 1 - Podozerskoye peat bog, stray find; 2-4 - Stanovoye 4, layer III

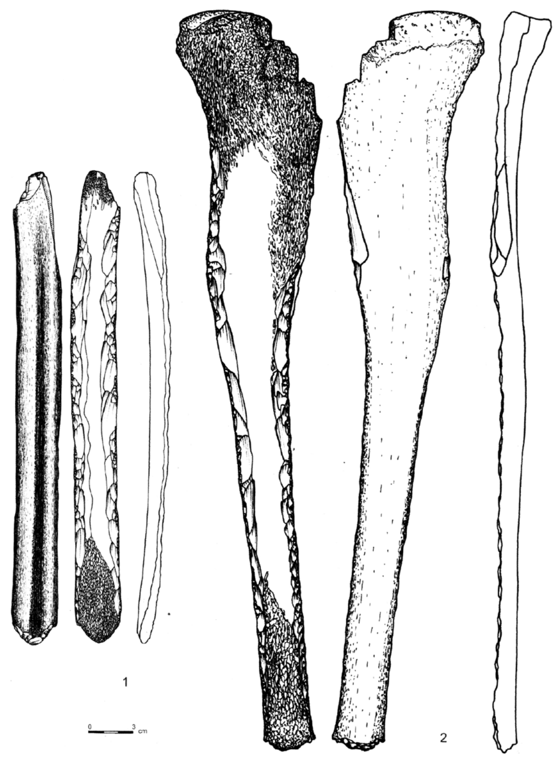

Fig 4. 1-2 - Ivanovskoye 7, layer III

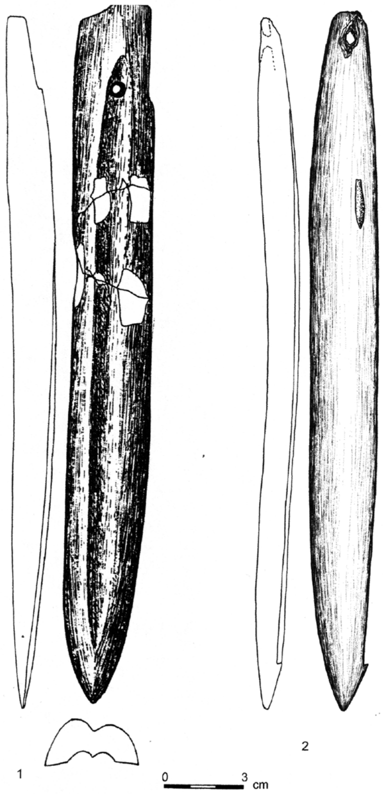

Fig. 5. 1 - Okayomovo 5, layer III; 2 - Stanovoye 4, layer III

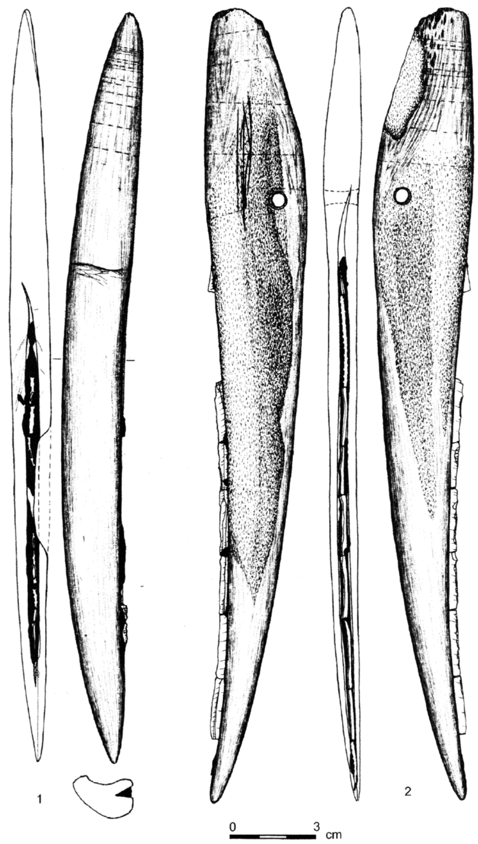

Fig. 6. 1,2 - Stanovoye 4, layer III

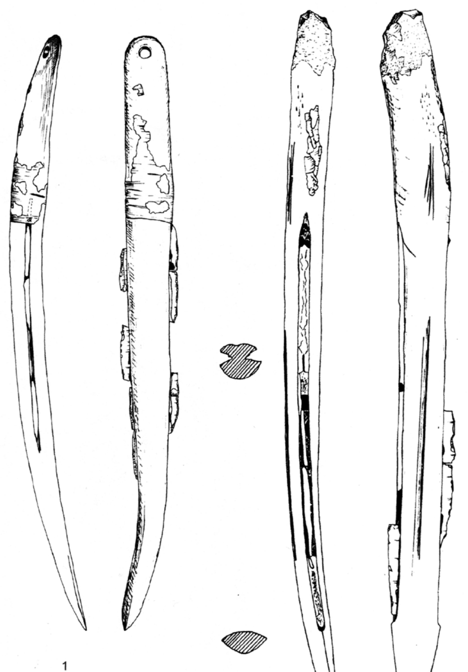

Fig. 7. 1,2 - Zamostje 2, after V.M. Lozovski, 1996

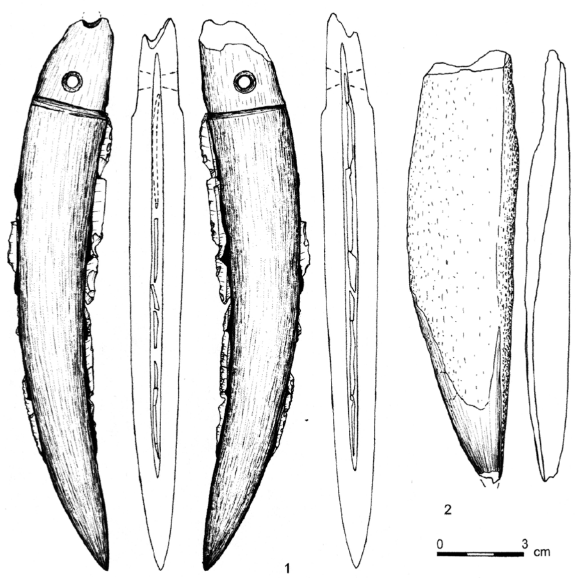

Fig. 8. 1 - Stanovoye 4, layer III; 2 - Ivanovskoye 7, layer IV

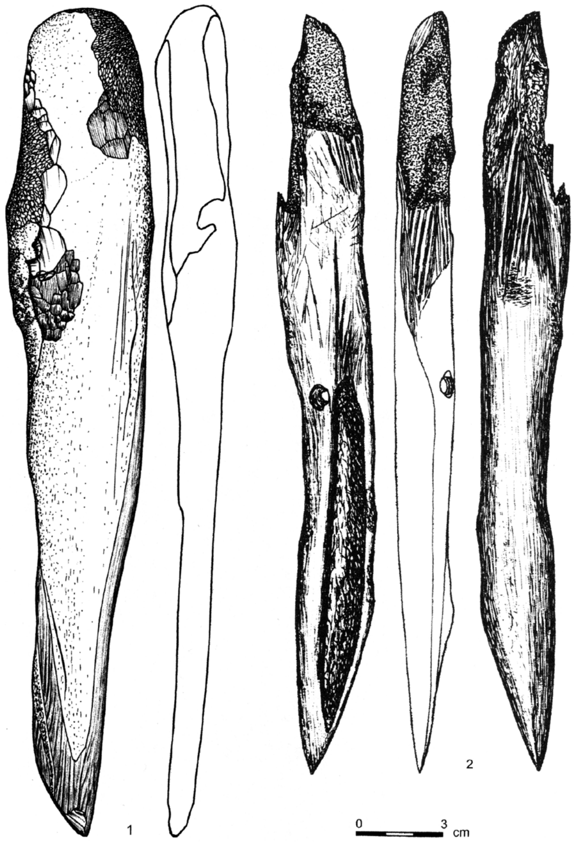

Fig. 9. 1 - Ivanovskoye 7, layer IV; 2 - Ozerki 5, layer IV

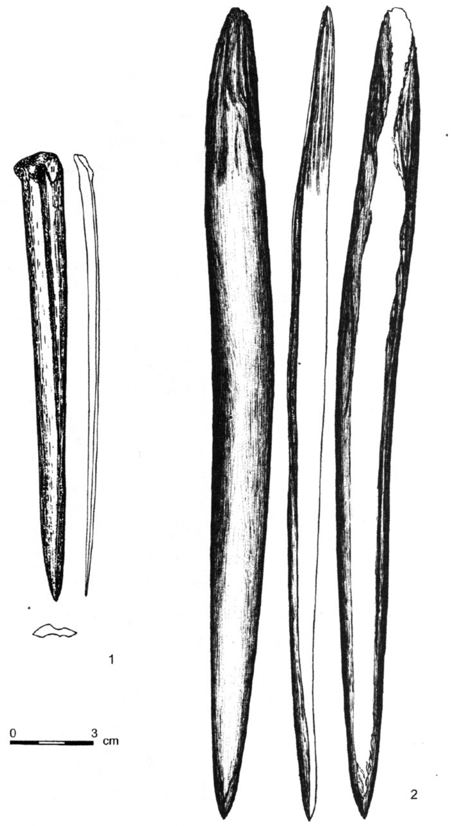

Fig. 10. 1 - Okayomovo 5, layer III; 2 - Stanovoye 4, layer III