

CRAFTING BONE – SKELETAL TECHNOLOGIES THROUGH TIME AND SPACE

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

Editors

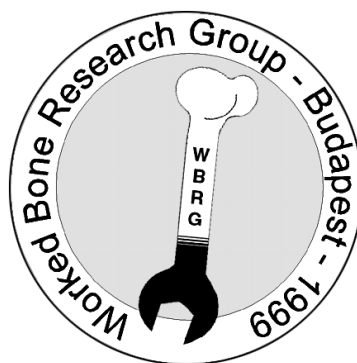
Alice M. Choyke & László Bartosiewicz

Technical editors

Krisztián Kolozsvári
Mrs. Katalin Kővágó - Szentirmai

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

Table of Contents

Introduction	III-IV
 General Theory	
Genevieve LeMoine – <i>Skeletal Technology in Context: An Optimistic Overview</i>	1
 Raw Material Exploitation	
Lyuba Smirnova – <i>Utilization of Rare Bone Materials in Medieval Novgorod</i>	9
Liina Maldre – <i>Bone and Antler Artefacts from Otepää Hill-fort</i>	19
Sabine Deschler-Erb – <i>Do-it-yourself Manufacturing of Bone and Antler in Two Villas in Roman Switzerland</i>	31
Rosalia Christidou – <i>Study of Bone Tools at Three Late/Final Neolithic Sites from Northern Greece</i>	41
 Manufacturing Technology	
Jörg Schibler – <i>Experimental Production of Neolithic Bone and Antler Tools</i>	49
Daniella Ciugudean – <i>Workshops and Manufacturing Techniques at Apulum (AD 2nd-3rd Century)</i>	61
Kitty F. Emery – <i>The Economics of Bone Artifact Production in the Ancient Maya Lowlands</i>	73
Karlheinz Steppan – <i>Worked Shoulder Blades: Technotypological Analysis of Neolithic Bone Tools From Southwest Germany</i>	85
Noëlle Provenzano – <i>Worked Bone Assemblages from Northern Italian Terramare: A Technological Approach</i>	93
Aline Averbouh – <i>Methodological Specifics of the Techno-Economic Analysis of Worked Bone and Antler: Mental Refitting and Methods of Application</i>	111
 Function	
Mária Bíró – <i>A Round Bone Box Lid with a Mythological Representation</i>	123
Cornelia Becker – <i>Bone Points - No Longer a Mystery? Evidence from the Slavic Urban Fortification of Berlin-Spandau</i>	129
Mickle G. Zhilin – <i>Technology of the Manufacture of Mesolithic Bone and Antler Daggers on Upper Volga</i>	149
Tina Tuohy – <i>Bone and Antler Working on the Iron Age Sites of Glastonbury and Meare in Britain</i>	157
Gitte Jensen – <i>Macro Wear Patterns on Danish Late Mesolithic Antler Axes</i>	165
Yekaterina Antipina – <i>Bone Tools and Wares from the Site of Gorny (1690 - 1410 BC) in the Kargaly Mining Complex in the South Ural Part of the East European Steppe</i>	171
Andreas Northe – <i>Notched Implements made of Scapulae - Still a Problem</i>	179
Janet Griffiths – <i>Bone Tools from Los Pozos</i>	185
Sandra L. Olsen – <i>The Importance of Thong-Smoothers at Botai, Kazakhstan</i>	197
Janet Griffiths and Clive Bonsall – <i>Experimental Determination of the Function of Antler and Bone 'Bevel-Ended Tools' from Prehistoric Shell Middens in Western Scotland</i>	207
 Social Context	
Isabelle Sidéra – <i>Domestic and Funerary Bone, Antler and Tooth Objects in the Neolithic of Western Europe: a Comparison</i>	221
George Nash – <i>Altered States of Consciousness and the Afterlife: A Reappraisal on a Decorated Bone Piece from Ryemarksgaard, Central Zealand, Denmark</i>	231
Nerissa Russell – <i>The Social Life of Bone: A Preliminary Assessment of Bone Tool Manufacture and Discard at Çatalhöyük</i>	241
Alice M. Choyke – <i>Late Neolithic Red Deer Canine Beads and Their Imitations</i>	251
Colleen Batey – <i>Viking and Late Norse Combs in Scotland: An Update</i>	267
Nerissa Russell – <i>Neolithic Relations of Production: Insights from the Bone Tool Industry</i>	271

Special Assemblages

Péter Gróf and Dániel Gróh – <i>The Remains of Medieval Bone Carvings from Visegrád</i>	281
László Bartosiewicz – <i>Roman Period Equid Ilium Implement from Pannonia Superior (NW Hungary)</i>	287
E.E. Bulten and Anneke Clason – <i>The antler, bone and tooth tools of Swifterbant, The Netherlands (c. 5500 – 4000 cal. BC) compared with those from other Neolithic sites in the western Netherlands</i>	297
Heidi Luik – <i>Bone Combs from Medieval Tallinn, from the Excavations in Sauna Street</i>	321
Steven R. James – <i>Prehistoric Hohocam Bone Artifacts from Southern Arizona: Craft Specialization, Status and Gender</i>	331
Arthur MacGregor and Ailsa Mainman – <i>The Bone and Antler Industry in Anglo-Scandinavian York: the Evidence from Coppergate</i>	343
Ernestine Elster – <i>Middle Neolithic to Early Bronze Age Bone Tools from Sitagroi, Greece</i>	355
Ülle Tamla and Liina Maldre – <i>Artefacts of Bone, Antler and Canine Teeth among the Archaeological Finds from the Hill-Fort of Varbola</i>	371
Kordula Gostenčnik – <i>Pre- and Early Roman Bone and Antler Manufacturing in Kärnten, Austria</i>	383
Index of Authors	399



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 Griffiths, Andreas Northe, Noëlle Provenzano, Jörg Schibler, Nerissa Russell, Colleen Batey, Lyuba Smirnova, László Daróczy-Szabó, Daniella Ciugudean, Mária Biró, Kordula Gostenčnik, Eszter Kovács, Christopher Morris, Sabine Deschler-Erb, Ans Nieuwenberg-Bron, Katalin Simán, Isabelle Sidéra, Mickie Zhilin

CRAFTING BONE - SKELETAL TECHNOLOGIES THROUGH TIME AND SPACE

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

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 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.

THE BONE AND ANTLER INDUSTRY IN ANGLO-SCANDINAVIAN YORK: THE EVIDENCE FROM COPPERGATE

Arthur MacGregor and Ailsa Mainman

Abstract: The excavation of the Viking Age site at 16-22 Coppergate in York, produced what remains for England by far the most extensive body of archaeological material recovered from the Anglo-Scandinavian period. As well as adding numerous to the existing corpus of artefacts in bone and antler, the evidence recovered from Coppergate holds clues that might shed light on the broader question of the contemporary character and organizational basis of the bone and antler industry. The Coppergate site produced a rich variety of objects in bone and antler, covering the full range of manufactures from the commonplace to more intricate items which certainly demanded a high level of skill and which might independently indicate a professional or semi-professional level of craftsmanship.

Keywords: Viking Age, Coppergate, York, tool type variety, skates, combs, workshops

Résumé: La fouille d'un site de la période Viking au 16-22 Coppergate, à York, a livré ce qui demeure pour l'Angleterre l'ensemble archéologique le plus riche découvert pour la période Anglo-Scandinave. Augmentant considérablement le corpus des artefacts en os et bois de cerf, les vestiges découverts à Coppergate fournissent des indices éclairant la question plus large du caractère contemporain et de l'organisation du travail de l'os et du bois de cervidé. Le site de Coppergate a livré une grande diversité d'objets en os et bois de cervidé, couvrant l'ensemble des productions, depuis les plus communes jusqu'aux plus complexes qui nécessitent certainement un degré élevé d'habileté, et indiquent d'autre part l'existence d'un niveau de connaissance à caractère professionnel ou semi-professionnel.

Mots-clés : Période Viking, Coppergate, York, patins, ateliers de fabrication de peignes à long manche

Zusammenfassung: Die Ausgrabungen im wikingerzeitlichen York/Coppergate Nr. 16-22 erbrachten eine der größten archäologischen Fundansammlungen, die bisher aus der anglo-skandinavischen Periode freigelegt werden konnte. Sie erweitert nicht nur in vielerlei Hinsicht den bisher bekannten Korpus an Artefakten, durch die Befunde aus Coppergate können auch weitergehende Fragen zum Charakter und zur damaligen Organisation der Knochen- und Geweihindustrie besser beantwortet werden. Aus Coppergate stammt eine große Fülle verschiedener Geweih- und Knochenartefakte, die das gesamte Repertoire von Alltagsgeräten bis hin zu hochwertigen Produkten einschließt, deren Anfertigung ein hohes Maß an Geschicklichkeit voraussetzt. Allein hierdurch wird die Existenz eines professionellen oder zumindest halbprofessionellen Handwerks belegt.

Schlüsselworte: Wikingerzeit, Coppergate, York, Schlittschuhe, Werkstätten für die Herstellung von Kämmen

Excavation of the Viking Age site at 16-22 Coppergate in York, initiated in 1976 and carried on continuously over the following five years (Hall 1984), produced what remains for England by far the most extensive body of archaeological material recovered from the Anglo-Scandinavian period, an era covering approximately the late 9th century to the second half of the 11th century. The bone and antler finds are described and discussed by MacGregor, Mainman and Rogers (1999).¹

As well as adding numerous to the existing corpus of artefacts in these materials, the evidence recovered from Coppergate seemed likely to hold clues that would shed light on the broader question of the contemporary character and organizational basis of the bone and antler industry. In chronological terms, the Coppergate finds lie at a critical point at which the bone and antler workers (like those specializing in a range of other crafts) were presented for the first time with

opportunities to modify the itinerant basis on which hitherto they had been forced to conduct their lives, as urban growth in centres like York began to provide stable markets capable of being serviced from settled workshops.

This evolutionary process had been explored at Lund by Christopherson (1980) and at Birka and Ribe by Ambrosiani (1981). A hypothetical framework for similar development in the British Isles had been proposed by MacGregor (1980; 1991), although the evidence to date had been largely inferential. The Coppergate material held out for the first time the opportunity of testing this hypothesis using material from England.

The excavation at 16-22 Coppergate

Lying within the historic core of the city (whose foundation is marked by the establishment of a Roman legionary fortress in

AD 71), the terrain in which Coppergate is situated came to particular prominence during the Anglo-Scandinavian period when its position at the confluence of York's two rivers proved especially advantageous (fig. 1). The major artery, the River Ouse, gave easy access via the Humber to the North Sea, while the lesser River Foss provided sheltered moorings close to the commercial centre of the growing town. The Old Norse derivation of the street-name Coppergate (*Koppargade* - the Street of the Cup-makers) confirms the character of settlement in the area at this time.

In terms of manufacturing output, evidence from both Coppergate and a number of contemporary sites excavated in the vicinity demonstrates a wide range of Anglo-Scandinavian artisanal expertise. Hearths, slags and crucibles indicate a variety of metal-working activities from blacksmithing to the casting of fine ornaments in copper alloys, lead alloys and precious metals. Amber and jet were worked here, as was glass. A thriving leather industry is evidenced, textiles were manufactured, wood-working (including the lathe-turning of bowls and cups) was widely practised.

The site at 16-22 Coppergate embraced major parts of four adjacent properties fronting on to the street (fig. 2). The principal facades of the succession of buildings occupying the respective street frontages all lay beyond the limits of the excavation, sealed behind the sheet-steel piling that enclosed the area available for excavation.

In the early/mid 10th century the principal structures occupying each of these tenements were of post-and-wattle construction, but by the late 10th – mid 11th century all had been replaced by timber buildings with sunken floors. To the rear of these buildings, which may have combined domestic with industrial or commercial accommodation, the remainder of each property was occupied by yards and more ephemeral structures. In order to distinguish one area of activity from another and in order to facilitate analysis, the tenements were divided from front to back into four zones as indicated on fig. 2 (inset).

The manufacturing evidence

Prominent among the evidence for manufacturing recovered from the site² is material indicating the presence of a well-established bone and antler industry, ranging from finished objects showing signs of sometimes prolonged use, to rough-outs, blanks, partly completed objects and quantities of waste indicating that such items were not only used at Coppergate but were in some instances being manufactured there.

As on other settlements of this period, red deer antler accounts for the most substantial component of the raw material (fig. 3). Both shed antlers and those from slaughtered animals were being imported to the site and cut up there for manufacture, burrs showing natural ruptures outnumbering those still attached to their pedicles by a proportion of 3:1; at the same time, deer bones are noted as being infrequent among food

refuse from the site. The important role played by shed antler is a feature that was already manifest in Anglian levels at nearby Fishergate (Rogers 1993), and was to continue until the second half of the 11th century. The reasons for its ultimate decline include increasingly strict regulation of the forests by Norman barons, over-exploitation of woodlands in the immediate vicinity of major towns, the increasing abundance of cattle bones as an alternative source of raw material in towns, and, most importantly, the rise of an efficient horn industry that allowed the production of combs that were both larger and lighter, as well as being more resilient (MacGregor 1998).

A uniform approach to the cutting-up of the antlers is well attested. Saws were used for the initial dividing of the antler, which shows signs of being rotated at intervals to stop the saw becoming too deeply embedded and finally being snapped. Most of the discarded bases exhibit two cuts at right-angles to each other, one of which marks the separation of the brow tine; in a few instances the brow tine is intact, while in others the beam has been cut parallel to and close to the corona. All these features can be widely paralleled at contemporary sites in Scandinavia (Ambrosiani 1981), on the Jutland peninsula (Ulbricht 1984), and towards the western limits of Scandinavian influence in Europe, at Dublin (Dunlevy 1988), although in contrast to the practice at Hedeby in particular, the pedicles, singled out by Ulbricht as representing the most dense and valuable tissue, are utilized only rarely at York. The crown of the antler, with its tines facing in several directions, tends to be discarded as too difficult to exploit, while the remainder of the antler beam is only rarely found (five substantial fragments), being for the most part intensively utilized. Quantities of discarded cancellous tissue from the core of the beam were found, some of it in the form of quadrants showing that the beam had been quartered before the hard tissue was removed. Shavings of dense tissue - evidently softened before it was worked - were also recovered, although these were more common at Fishergate where more extensive soil-sieving was carried out.

In contrast to the evidence from the antler, bone waste from the site showed little coherent patterning, suggesting that exploitation of animal bone was more opportunist and haphazard in nature. Only some waste from which beads had been drilled in a manner more common in the medieval period gave any indication of an industrial pattern of utilization while, curiously, the only such indicators provided by the distribution of the material took the form of a small group of associated bone pins manufactured from pig fibulae - exactly the kind of product we are inclined to ascribe to manufacture at a household level rather than by mass-production. A single comb and a sword pommel from the site were made of cetacean bone, implying a willingness to utilize this material but not abundant access on a scale that would imply deliberate hunting. With the possible exception of the northern and western isles of Scotland, this is the pattern common to the whole of the British Isles at this time.

Rather more evidence might have been expected for the emerging horn industry at Coppergate, but once again it was by no means abundant. This lack of evidence is probably accounted for at least in part by the poorer survival rate of horn in comparison with bone, antler and ivory. Four fragments of cattle horn were recovered from the site, along with horn-cores which readily confirmed the presence of such an industry. Those illustrated here (fig. 4) show the two most common forms of waste products: two fragments which have been sawn right through while the horn sheath was still securely attached, producing short, cylindrical lengths which might or might not have been flattened-out into plates, and a core which has been left largely intact but which has been grooved all the way round by the saw as the horn sheath was released. These fragments, although few in number, demonstrate the degree to which the practices familiar in the post-Conquest period were already established by the late 11th century at Coppergate, although it remains difficult to speculate on the size of the industry at this time.

Chronological and spatial distribution of the evidence

An attempt was made to plot some of this data, principally that provided by combs. First the manufacturing evidence, in the form of rough-outs, blanks, unfinished combs and related waste, was analyzed. By way of establishing a 'normal' use pattern for the site, the complete and broken combs were entered on a separate plan and the results of both surveys were tabulated. These charts register fairly abundant evidence from Period 3 (late 9th century), with a peak of activity in the early to mid 10th century and with a slow decline thereafter, conforming very much to the picture established elsewhere. It may be noted that, as with all urban sites of this nature, there is evidence for a considerable degree of residuality in the evidence recovered from Coppergate, with material from the earlier layers being continually redeposited through the digging of rubbish-pits, drains and foundations, with inevitable implications for the statistics.

When transferred to the site-plans (fig. 2), these data provide indications of the distribution of finished combs in the mid 10th century and in the late 10th to mid 11th century respectively (top), compared to the distribution of evidence for antler utilization and comb manufacture from the same periods (bottom). None of the constituent groups of material is very large and virtually all are the result of hand collection on site, rather than sieving.

The Period 4B (mid 10th century) distribution for normal use shows the incidence of finished combs centred around the street-frontage properties (Zone 1), especially in the wattle buildings on Tenements B, C and D, with scatters in Zones 2 and 3. Such inconsistencies as there are may be affected by the partial nature of the excavation of these properties, or by the different degrees of destruction wrought on the earlier levels during their respective redevelopment.

The manufacturing evidence from this period is again mainly concentrated on the street frontage area (Zone 1), especially on Tenements B and C, suggesting that antler working was carried out in and around the post-and-wattle buildings of this phase, with associated activity in the yards lying to the rear of the buildings.

This pattern of activity changes in Period 5B (late 10th to mid 11th century). On Tenement A, where two successive structures were recovered from this period, the evidence remains slight. On Tenement B, two broadly contemporary structures, one behind the other, provided less evidence than in the earlier phase. There was no recognizable structure at the front of Tenement C at this time, but two successive structures in Zone 2, together with the yard behind, produced significant quantities of evidence.³ A small amount was again found in Zone 1 on Tenement D, plus a few fragments from the yards.

The distribution suggests possible production in and around the post-and-wattle structures of Tenements B and C in the mid 10th century, but by the mid to late 10th century this activity had become focused on structures in Tenement C, Zone 2. With all due caution, it may be possible to infer from this evidence the presence of a workshop where one or more skilled craftsmen engaged in the production of antler combs on a commercial basis. Given the huge quantities of waste that would have been generated by such an industry had it operated here for any length of time, compared to the small numbers of fragments we are dealing with here at Coppergate, we are still a long way from being able to substantiate this hypothesis, but for the moment it forms at least a useful pointer for future research.

The range of production

The finished artefacts from Coppergate form a highly coherent body of material which, added to the significant numbers of contemporary finds from earlier excavations in the city, place York in the premier league of European towns of the Viking Age. In the British Isles only Dublin comes close; Birka, Ribe and Hedeby are most readily comparable, although restrictions imposed by the unbroken nature of settlement at York up to the present day mean that much of the evidence remains to be recovered, sealed as it is under the standing buildings and road surfaces that carry the everyday traffic of York's twenty-first century commerce.

Composite combs (fig. 5) constitute the most numerous category, with over 200 examples recovered, fragmentary or complete, mostly from 10th and 11th century levels. An attempt was made to categorize these combs in various ways – by their profile or outline, by the cross-sections of their side-plates and their tooth-plates (whether V-shaped, faceted or biconical), by the varying patterns of riveting employed in securing the plates, and so on. More work needs to be done to discover whether these variations represent changes through time or different practices employed by contemporary craftsmen.

Double-sided combs were comparatively infrequent, with only twelve examples from Coppergate. Of these, only three had teeth displaying any differentiation between coarse and fine – a common occurrence during this period.

Several examples of handled combs were found, bringing the numbers found in England to around 100. Two methods of construction were found here: one involving cutting a slot into an antler tine, into which the tooth-plates are riveted, the other with composite, riveted handles. These were mostly concentrated in the earlier Anglo-Scandinavian layers, adding weight to the suggestion by Ian Riddler (1990) that their origins lie in the preceding Anglian or Middle Saxon period. Whether or not the pairs of riveted bone mounts found frequently on the site represent further evidence for combs – perhaps with the teeth cut on horn plates – remains to be proven.

Comb-cases from the site were few but showed some interesting varieties in the way the terminals were formed at either end. A fragment of a bone buckle was found, adding to others from earlier excavations in York, as well as some impressive strap-ends, showing a familiarity with contemporary art styles that might conceivably suggest 'professional' production. The same is true of some of the more elegant dress-pins, but (with due deference to the cache of pig-fibula pins mentioned above) others were likely to have been made by the end user.

Other suggestive pieces include a wooden box-lid of the mid 11th century with riveted strips of bone, decoratively carved (the third such set found in York); a series of motif-pieces, probably carved by manufacturers of decorative metalwork in the course of their trade; a few knife-handles and gaming-pieces. One find of especial interest was identified by the excavator as the bow from a small saw (fig. 7) – perhaps itself used in bone and antler working.

More certainly made by the user as required were some of the items associated with textile manufacture (although even here some, showing signs of having been lathe-turned, must have been beyond the capacities of the ordinary household). Ice-skates were so numerous as to suggest to some that there had been a factory producing them on site, but it is clear from quite recent historical evidence that almost any small boy would have been self-sufficient in this respect. (Most of these finds, however, are appropriate in terms of size for use by adults).

In summary, the Coppergate site produced a rich variety of objects in bone and antler, covering the full range of manufactures from the commonplace to the more intricate which certainly demanded a high level of skill and may independently indicate a professional or semi-professional level of craftsmanship. The distribution of these objects across the site, together with their associated waste products, provides more persuasive evidence for the systematic production of some such items, notably combs, in specific premises and in sufficient numbers to allow us to start thinking in terms of workshops, however transient, although even on this highly productive site concrete evidence of the status of these producers continues to elude us.

Notes

¹ In the published report, the artefactual considerations are treated principally by Arthur MacGregor while the distributional analysis is by Ailsa Mainman. the contribution of our co-author, Nicola Rogers, is concerned with medieval material from elsewhere in York.

² Details of the other crafts practised on the site are published in various fascicules of the series *The Archaeology of York* ed P.V. Addyman, as follows: (vol. 16 *The Pottery*) (16/5, 1990) 'Anglo-Scandinavian Pottery from 16-22 Coppergate', by Ailsa Mainman; (vol. 17 *The Small Finds*) (17/5, 1989) 'Textiles, Cordage and Raw Fibre from 16-22 Coppergate', by Penelope Walton; (17/6, 1992), 'Anglo-Scandinavian Ironwork from 16-22 Coppergate', by Patrick Ottaway; (17/7, 1992) 'Non-ferrous Metalworking from 16-22 Coppergate', by Justine Bayley; (17/8, 1992) 'The Anglian Helmet from Coppergate', by Dominic Tweddle; (17/11, 1997) 'Textile Production at 16-22 Coppergate', by Penelope Walton Rogers; (17/13, 1997) 'Craft, Industry and Everyday life: Wood and Wood-working', by Carole Morris; (17/14, 2000), 'Craft, Industry and Everyday Life: Anglo-Scandinavian Finds', by A. Mainman and N. Rogers; (17/15, 2000), 'Craft, Industry and Everyday Life: Medieval Finds', by Patrick Ottaway and Nicola Rogers; (17/7, forthcoming), 'Craft, Industry and Everyday Life: Leather and Leatherworking', by Ian Carlisle; (vol. 18 *The Coins*) (18/1, 1986) 'Post-Roman coins from York Excavations 1971-81', by E. Pirie; (vol. 14 *The Past Environment of York*) (14/7, 1995), 'Biological evidence from Anglo-Scandinavian Deposits at 16-22 Coppergate', by H. Kenward and A. Hall; (vol. 15 *The Animal Bones*) (15/3, 1989) 'Bones from Anglo-Scandinavian Levels at 16-22 Coppergate', by T. O'Connor.

³ These numbers may be slightly inflated by a sampling exercise carried out on the animal bones from this area.

References

- Addyman, P. V. ed. 1976. *The Small Finds*. The Archaeology of York 17, London.
- Ambrosiani, K. 1981. *Viking age combs, comb making and comb makers in the light of finds from Birka and Ribe*. Stockholm Studies in Archaeology 2, Stockholm.
- Christopherson, A. 1980. *Raw material, resources and production capacity in early medieval comb manufacture in Lund*. Meddelanden från Lunds Universitets Historiska Museum, nya ser. 3, pp. 155-65.
- Dunlevy, M. 1988 A classification of early Irish combs. *Proceedings of the Royal Irish Academy* 88C, pp. 341-422.
- Hall, R. A. 1984. *The Viking Dig*. York.

MacGregor, A. 1989. Bone, antler and horn industries in the urban context. In *Diet and Craft in Towns*, eds. D. Serjeantson T. Waldron. British Archaeological Reports, British Series 199, Oxford, pp. 107-28.

MacGregor, A., Mainman, A. J. & Rogers, N. S. H. 1999. Craft. Industry and everyday life: bone, antler, ivory and horn from Anglo-Scandinavian and Medieval York. In *The Small Finds. Craft, Industry and Everyday Life*, ed. P. V. Addyman. The Archaeology of York 17/12, London, pp. 1869-2072.

MacGregor, A. 1991. Antler, bone and horn. In *English Medieval Industries*, ed. J. Blair and N. Ramsay. London, pp. 355-78.

MacGregor, A. 1998. Hides, horns and bones: animals and interdependent industries in the early urban context. In *Leather and Fur. Aspects of Early Medieval Trade and Technology*, ed. E. Cameron. London, pp. 11-26.

Riddler, I. 1990. Saxon Handled Combs from London. *Transactions of the London and Middlesex Archaeological Society* 41, pp. 9-20.

Rogers, N. S. H. 1993. Anglian and other finds from Fishergate. In *The Small Finds*, ed. P. V. Addyman. The Archaeology of York 17, London, pp. 1203-1512.

Ulbricht, I. 1978. *Die Geweihverarbeitung in Haithabu*. Berichte über die Ausgrabungen in Haithabu 7, Wachholtz, Neumünster.



Fig. 1 Sketch-map of central York, showing the alignment of Coppergate with the site of the excavation shaded

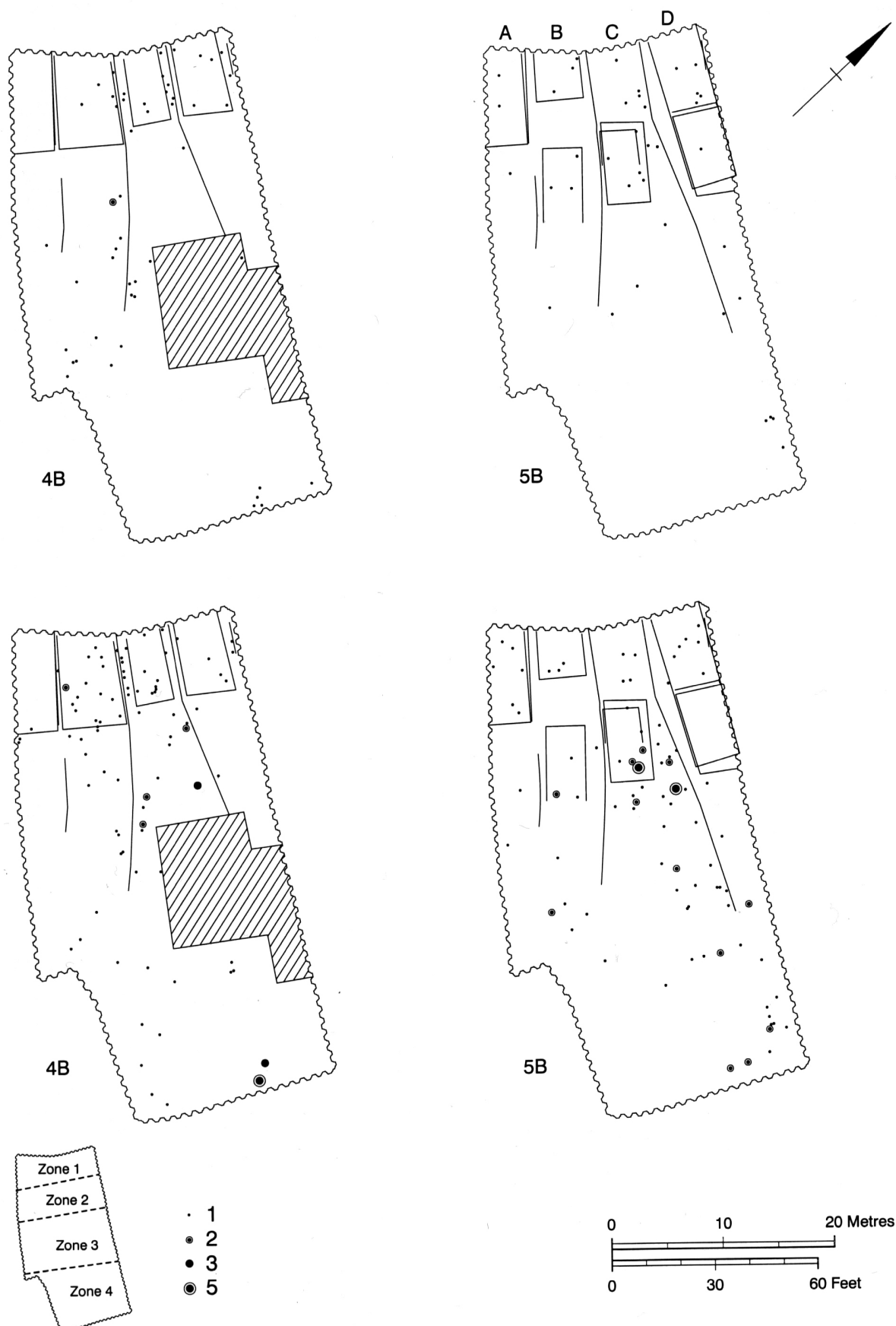


Fig. 2 The excavation at 16-22 Coppergate. The distribution of finished antler combs and broken, used comb fragments is shown for Periods 4B and 5B (above), compared with the distribution of antler manufacturing debris (below). Scale 1:500. Inset is a key showing the division of the site into zones (1-4), as discussed in the text, while the tenements (A-D) are identified at top right

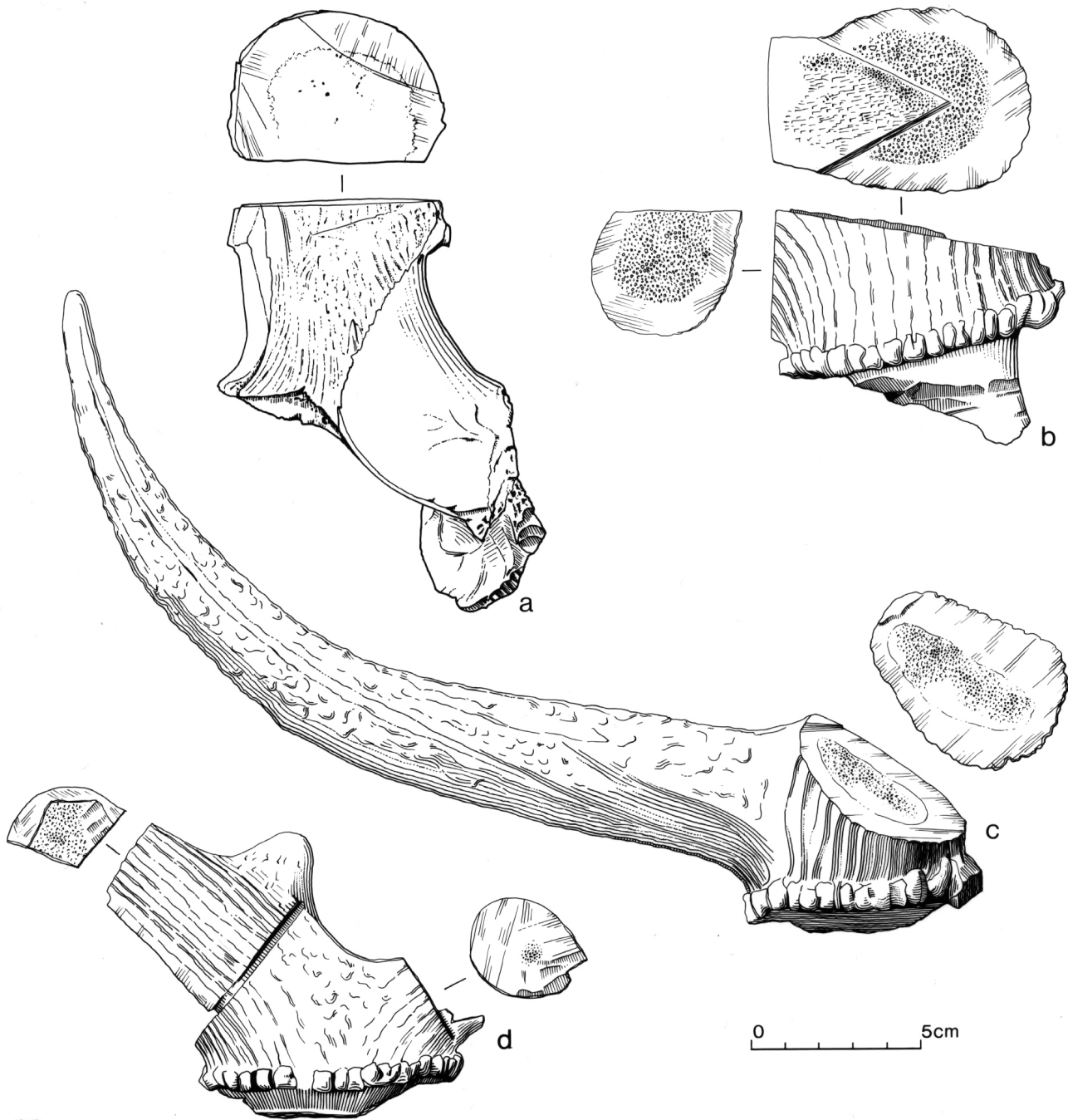


Fig. 3 Antler waste from Coppergate, including burrs from slaughtered (a-b) animals and from antlers shed in the wild (c-d)



Fig. 4 Sawn horncores from Coppergate. The two smaller fragments have been sawn through, while the larger one is grooved circumferentially by the blade

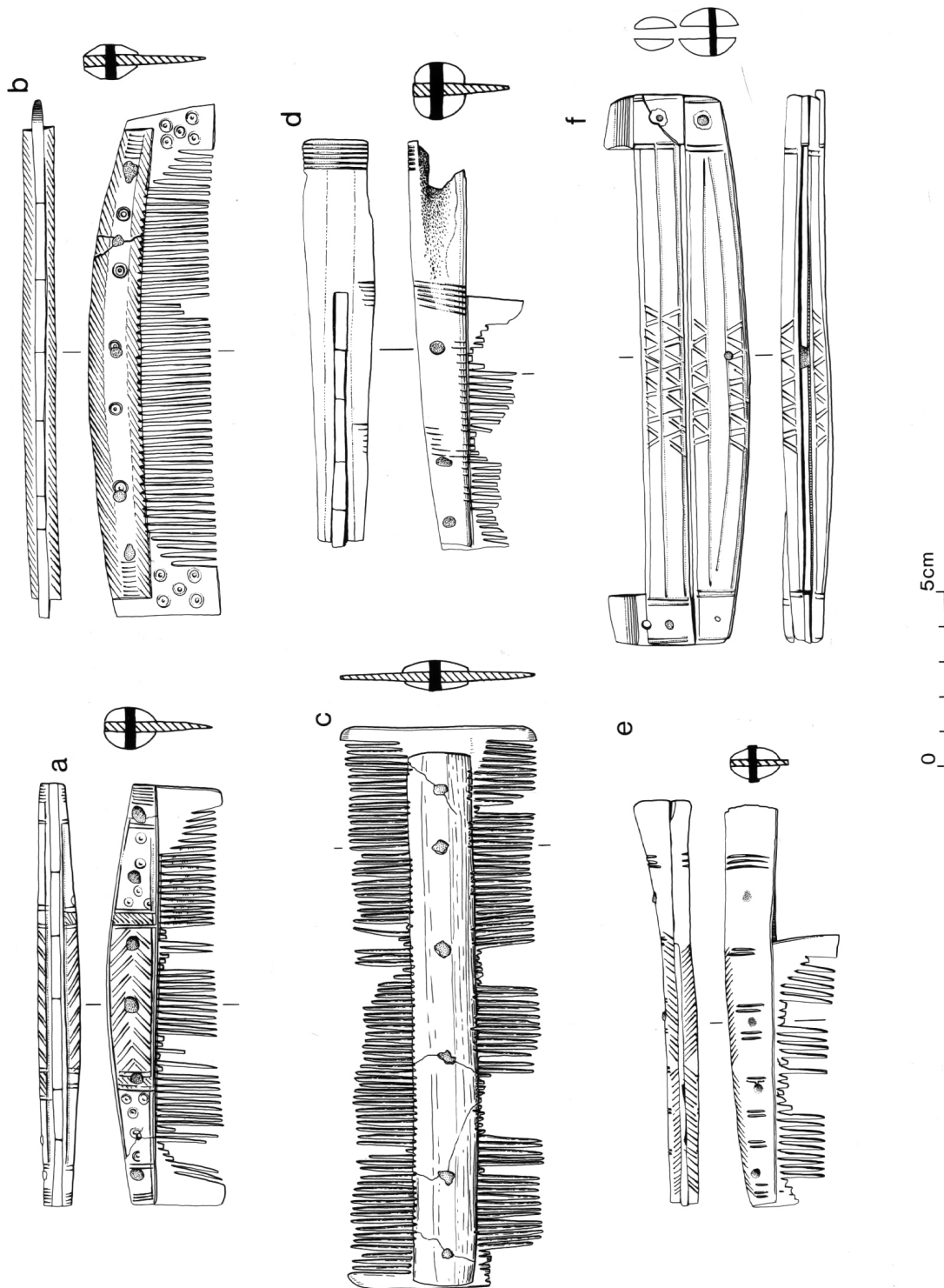


Fig. 5 Samples of antler combs from Coppergate: a, b single-sided; c, double-sided; d handled (solid handle); e, handled (composite handle); f, comb-case

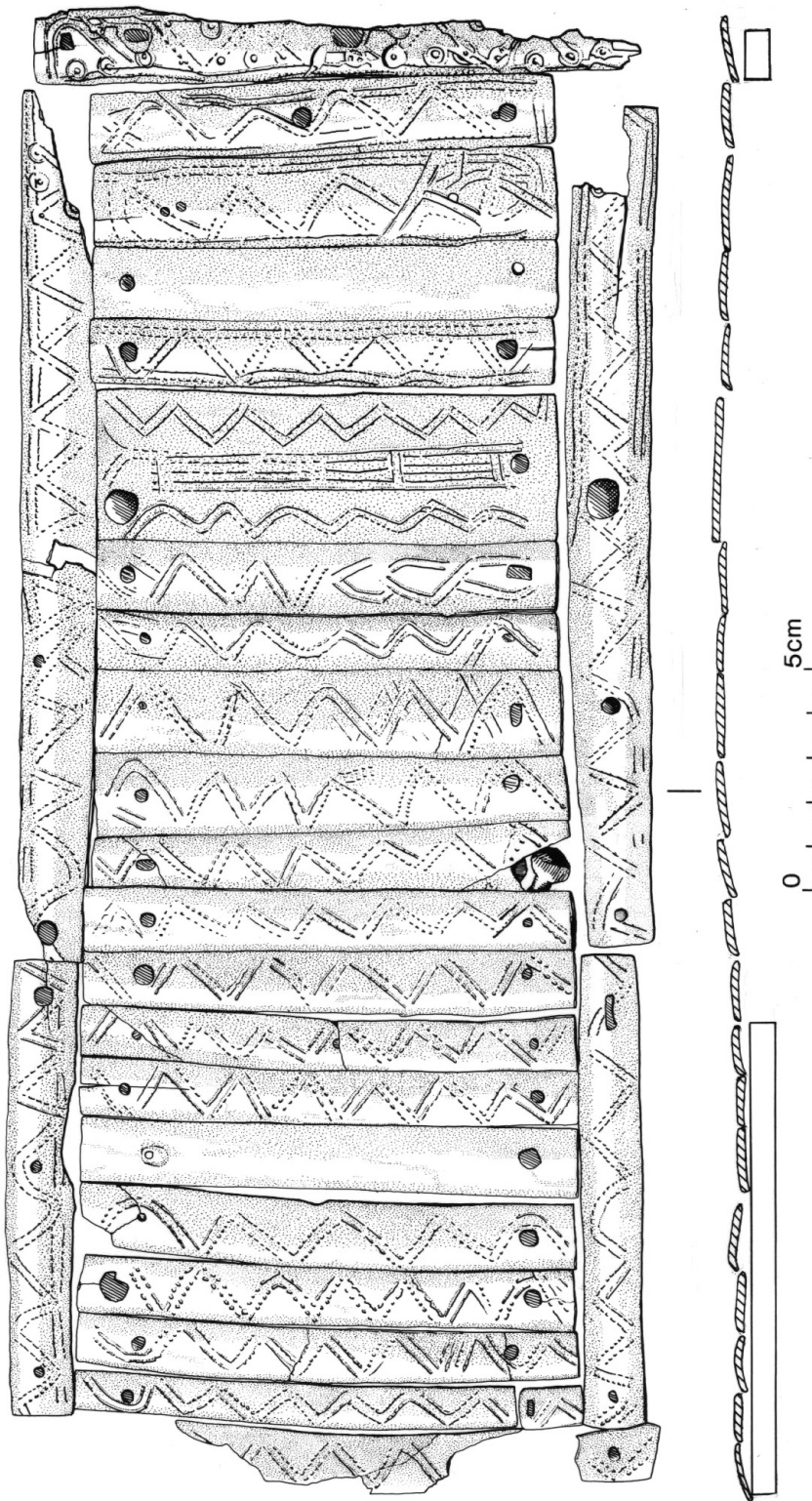


Fig. 6 Bone mounts (all but one of split rib) on the remains of the lid of an oak box or casket

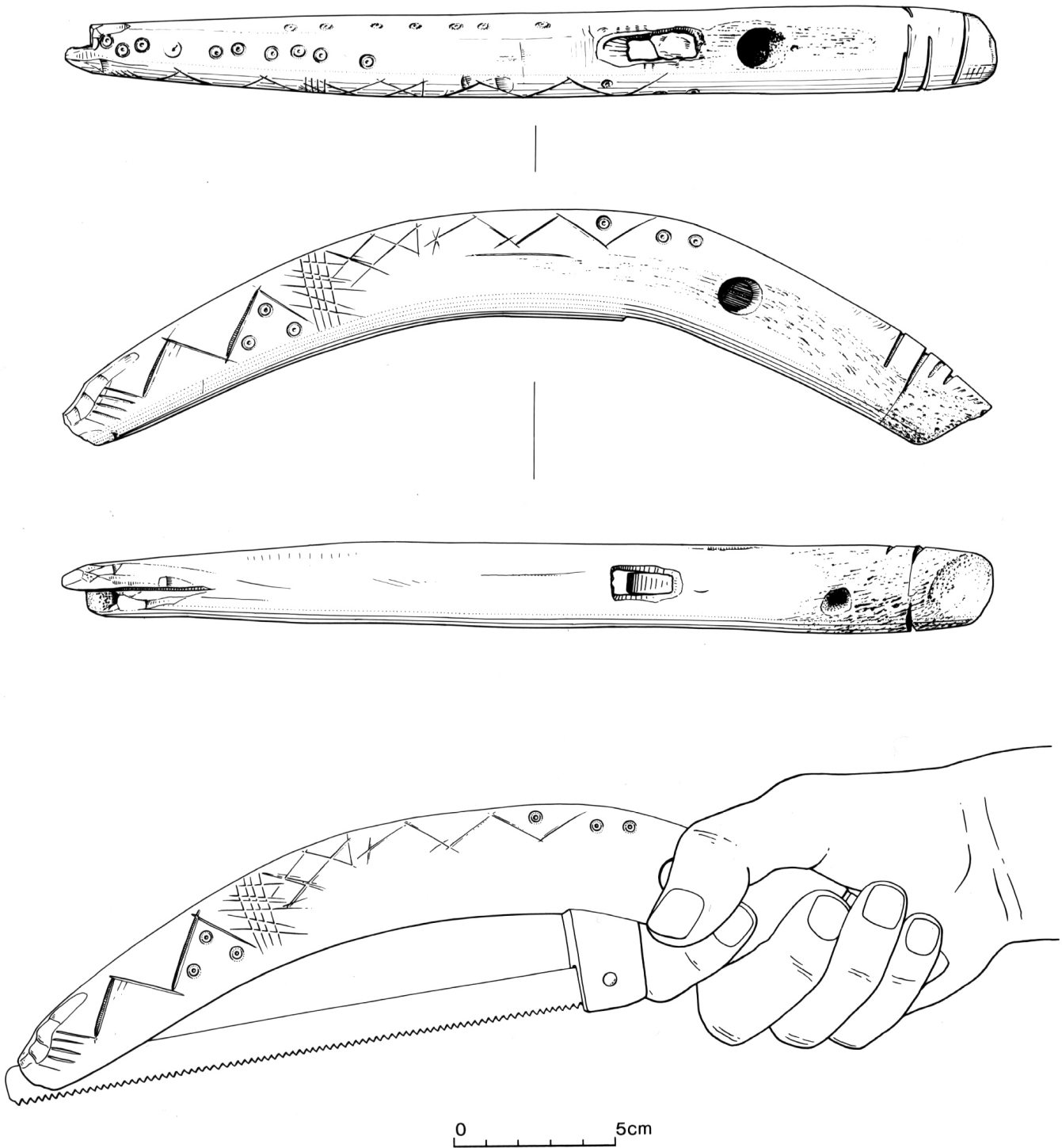


Fig. 7 Antler saw-bow, as found at Coppergate and with hypothetical reconstruction