A TECHNOLOGICAL STUDY OF SELECTED OSSEOUS ARTIFACTS FROM THE UPPER PALAEOLITHIC OF BRITAIN AND BELGIUM

A thesis submitted for the degree of Doctor of Philosophy

by Isobel Patricia McComb

Jesus College, Oxford

Hilary Term 1988

Abstract

This thesis records the study of over one thousand selected, bone, antler and ivory artifacts from the Upper Palaeolithic in Britain and Belgium, with particular reference to manufacture. The methods used include the experimental manufacture and use of certain bone and antler artifacts, and the recording of the traces produced. This information is used as a reference collection with which to compare the archaeological material. Both the experimental and the archaeological implements are examined either with the aid of a handlens, or at a variety of magnifications using an optical microscope and a scanning electron microscope. Upper Palaeolithic bone tool types as a whole are considered for comparative purposes, as are some ethnographic artifacts.

The artifacts studied here are ordered into twenty-six different tool types, each of which is discussed in turn; this includes a description of the raw materials used, of the identifiable traces of manufacture and their interpretation, and of the identifiable traces of use, and their interpretation. The regional and chronological distribution of the specimens is also considered, as is any variation in each type, for example in size or in the raw materials used. Some regional and chronological patterning is found, but in the absence of reliable contextual information, its interpretation is often speculative. It is concluded that a large scale programme of radiocarbon accelerator dating of actual artifacts is required to solve this problem.

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This thesis records the study of over one thousand selected, bone, antler and ivory artifacts from the Upper Palaeolithic in Britain and Belgium, with particular reference to manufacture. The principal aim of this study is to document the techniques used in the production of a bone tool industry. Another aspect involves comparing the osseous industries of Britain and Belgium to look for regional and chronological patterning in tool types, raw materials and techniques of manufacture, with the aim of obtaining information about the relationship between the two areas. A further aim of this thesis is to seek evidence for the activities carried out during the Upper Palaeolithic, and in particular those which are not as clearly represented by the lithic industries.

The methods used to fulfil these aims are described in the first two chapters. Chapter 1 contains a description of how each artifact was inspected with a handlens and recorded, as well as of the techniques used to carry out a microscopic study of selected pieces. This process involves making silicone rubber casts of the relevant parts of the artifacts and examining the casts in a scanning electron microscope and/or under a light microscope. The use of appropriate ethnographic sources to help interpret the archaeological specimens is also discussed in this chapter.

Chapter 2 contains a description of the experimental work carried out to replicate and record the techniques of manufacture commonly found on Upper Palaeolithic bone artifacts. The results of this study proved invaluable when interpreting the surviving traces of manufacture on archaeological specimens. Some experiments were carried out to reproduce traces of use on bone and antler artifacts, but these were limited in number, because it appears that traces of use are not preserved on the same regular basis as traces of manufacture on osseous artifacts. This chapter also contains a brief review of various forms of natural modification to which osseous materials are liable, so that they are not confused with artificial modification.

In Chapter 3, the nature of the archaeological material studied here is discussed and the artifacts are ordered into twenty-six different tool types, which are arranged into three groups. It is noted that most of the artifacts considered here unfortunately come from nineteenth century excavations. The variables which are known to have affected the preservation of these assemblages are considered, with particular reference to the fact that only very small amounts of worked bone have been found in Britain compared with the relatively large collections made in Belgium. It is concluded that the variation in the distribution of finds is probably a true reflection of the Upper Palaeolithic distribution, and that it is likely that only small scale, temporary

occupations of Britain took place from more regular bases on the Continent. The chronological and cultural sequence of the Upper Palaeolithic in both Britain and Belgium is also discussed in Chapter 3 to provide a framework for the analysis of the artifacts, which is presented in Chapters 4, 5 and 6.

In these three chapters, each tool type is considered in detail; this description includes a discussion of the raw materials used, of the traces of manufacture and their interpretation, and of the traces of use and their interpretation. The regional and chronological distribution of the specimens is considered, as is any variation within each type, for example in size, in raw materials used, or in techniques of manufacture. Chapter 4 contains such a description of the first of the three groups of artifacts, that is the 'points and rods'. This group includes all the pointed implements, with the exception of pins and needles, and the antler and ivory rods, which may have once been pointed at one end, although this feature is not regularly preserved. In Chapter 5, the 'hand-held implements' are described; this group consists of all the functional objects, other than the above, which are interpreted as having been for hand-held use, as opposed to being projectiles. All the pieces which have been identified as 'decorative objects' are discussed in Chapter 6, at the end of which, the unfinished pieces, or 'working débris' are described.

The last chapter contains a detailed review of the chronological and regional distribution of the artifacts considered here, and it is found that certain tool types, raw materials and techniques of manufacture show regional and chronological patterning. However, the frequent absence of reliable contextual, and thus chronological, information makes the interpretation of these results somewhat speculative. It is suggested that this problem could be solved by a large scale programme of radiocarbon accelerator dating of actual artifacts. The probable activities which are represented by these objects are also discussed in this chapter, and they include sewing, for which there is direct evidence provided by the discovery of eyed needles. It is concluded that osseous artifacts probably formed a central rather than a peripheral part of the tool-kit of Upper Palaeolithic human groups.

Further information about the sites on which these artifacts were found is presented in an inventory, which forms an appendix to the main text (Appendix 1). The inventory also includes a list of the osseous implements from each site which are discussed in the text. A second appendix contains a list of tool types and their definitions, while in the third appendix may be found a list of the particular artifacts which belong to each tool type. The fourth appendix contains a list of the museums and institutions visited in the preparation of this thesis.

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This project has involved making numerous, often repeated visits to museums, and I would like to record here my deep thanks to the various curators and staff for their help and co-operation. Owing to their number, they are listed in Appendix 4, and I hope that they will not mind being thanked in this manner. I would like, however, at this point to say thank-you to M. Leguebe and the staff of the Institute of Natural Sciences for their kindness during the many weeks that I worked there.

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Chapter 1

Aims and Methods

Introduction

The aims of my research are presented in this chapter, and the methods adopted to fulfil these aims are also discussed here in detail. I shall begin with a brief review of recent studies of bone implements, particularly those belonging to the Upper Palaeolithic, in order to provide a context for my research. It begins with the publication in 1964 of the English translation by M.W.Thompson of Semenov's "Prehistoric Technology", which gives an account of his attempts to recreate and study microscopically the traces resulting from the manufacture and use of stone tools. However, the book also includes a consideration of the technology involved when working osseous materials (i.e. bone, antler and ivory), which is particularly useful for its detailed descriptions of ivory working, information about which is lacking in Western Europe. This work still provides an invaluable starting point for anyone attempting to study either stone or bone tool technology, particularly at the microscopic level.

Although various descriptions of bone tools and of their manufacture and use have appeared throughout Palaeolithic studies (for example, Peyrony 1935, Clark and Thompson 1953), it could be said that recent, modern and systematic studies of bone implements began with the publication of Mme Camps-Fabrer's doctoral thesis in 1966. This was a study of bone implements from the EpiPalaeolithic and Neolithic of North Africa, which was more descriptive of bone tool morphology than of technology, but included a very detailed and precise bone tool typology. It has been adapted and used to describe implements from the European

Palaeolithic and Neolithic by Desse (1977), and Leroy-Prost (1975), among others.

Since 1966, the number of publications on bone tools has substantially increased. These include four conference volumes edited by Mme Camps-Fabrer in 1974,1977,1979,1982, which contain some descriptive papers, as well as others which deal with replicative experiments designed to yield information mainly on manufacture and less frequently on use (such as Bouchud 1977; Camps-Fabrer and d'Anna 1977; Dewez 1974,1977; Newcomer 1977; Otte 1974,1977). Other important works which have appeared elsewhere include Newcomer (1974) and Rigaud (1972,1984) on technology, and Leroy-Prost's typological and technological studies of Aurignacian bone tools (1974, 1975,1978,1979).

Certain studies of particular Upper Palaeolithic tool types are considered in detail in this thesis; they include Julien on barbed points (1977,1982), Sieveking on bone discs (1971) and Stordeur on needles (1977,1979). Other interesting articles include a number of studies relating to function, such as Campana (1979) on arrow-straighteners and thong-smoothers, Peltier (1986) on more general forms of use, and MacGregor's (1975) article on bone skates, although the latter have not been identified in the collections studied here, notwithstanding the amount of ice which must have been around during parts of the Upper Palaeolithic. Olsen (1979,1980,1984; see also Arndt (Olsen) and Newcomer 1986) has provided a particularly useful body of information on the experimental replication of manufacture and use of a wide range of types of bone implement. Similarly, MacGregor's (1985) book, which concentrates on Post-Roman osseous artifacts, has proved to be a very useful work of reference, particularly because of the information he includes on bone, antler and ivory as raw materials. A number of technological studies of

ethnographic artifacts, which are very relevant to this project include Stordeur (1980), Jenness (1937) and Stewart (1973).

Any survey of the literature concerning traces of use on Palaeolithic implements should also include the work carried out by Keeley (1974,1977,1980) on recognising traces of use on stone tools in the form of microscopic polishes. As regards the scrupulous planning and execution of both his experimental and his artifactual studies, Keeley has not only provided a great impetus to research into the function of both stone and bone implements, but has also set very high standards for such work.

Although studies of the use of stone artifacts have helped stimulate similar research on bone tools, it should be remembered that stone and bone are very different raw materials, and so, the results from such research into the two materials may not be comparable. Osseous materials are more liable to natural damage than stone, which may result in phenomena such as chipping and polish, which could resemble possible traces of use (see section on Taphonomy, Chapter 2). Furthermore, traces resulting from manufacture are very different on bone from those observed on stone, and there is no reason why traces of use on bone should resemble those recorded on stone.

This brief review of recent research, which is intended to be introductory rather than comprehensive, is sufficient to suggest that systematic, technological studies of osseous artifacts have only just begun and that there is much yet to be achieved. However we can say, in the late 1980's, that a number of useful starting points exist, thanks to the work that has so far been done.

Aims

In my own research I set out to study selected bone, antler and ivory implements from the Upper Palaeolithic in Britain and Belgium, with particular reference to techniques of manufacture. The aim of this project is to derive as much technological information as possible from these objects, which have previously been studied more for their decorative than for their functional qualities. My chosen approach is very much in line with current research on other kinds of Palaeolithic artifacts and I hope that this project will complement the work being carried out by my colleagues on stone tools from the same areas.

It seemed to me important to study this material, not only to gain a detailed knowledge of bone tool technology, but also because of the information it might provide about other facets of the Upper Palaeolithic, which may not be so clearly witnessed by stone tools. Thus, the appearance of eyed needles and finely-tipped awls provides evidence for sewing and for leather working somewhat different from that offered by a stone scraper bearing a microscopic polish, which is believed to have resulted from working a hide. Bone and antler barbed points suggest methods of hunting and fishing in which the point was hafted to create a spear, or conceivably even an arrow. Ivory beads found with pierced teeth and shells indicate personal adornment.

Another particular aim of this study is to salvage information from the physically deteriorating assemblage of British osseous artifacts, while it is still in a suitable state to examine. These artifacts have never been the object of a major technological study, which could provide a more rounded picture of the material culture and life style of the British Upper Palaeolithic populations than that indicated by stone tools alone. At the outset I sought some form of context for this

assemblage in Continental Europe and a review of the literature suggested to me that Belgium would provide a most suitable comparison. This is not only because it has yielded an abundance of Upper Palaeolithic osseous implements, unlike the Netherlands and Northern France, but also because like those areas, it is sufficiently close to Britain for direct contact to have been probable. The many similarities between the Upper Palaeolithic stone industries from Britain and Belgium (see Campbell 1977,1980,1986; Dewez 1981; Jacobi 1980; Otte 1979) also suggested that it would be profitable to make a study of the osseous industries from both areas. While I could have obtained a greater quantity and variety of Continental Upper Palaeolithic bone tools if I had turned to the caves of South and South West France, the immediate relevance to the British material would have been slight at best.

It will be seen that even with the relatively meagre number of surviving specimens from the British Upper Palaeolithic, chronological and regional patterning may be recognised not only in tool types, but also in raw materials and techniques of manufacture. Some similar features also emerge from the far more abundant Belgian material. Useful comparisons of this nature can also be made between both areas. This looks like being a very useful source of information in studying relationships between these human groups, particularly in view of recent advances in radiocarbon dating (Hedges 1981) which have enabled bone, antler or ivory objects to be directly dated with the removal of only a tiny sample. This development could also help to overcome the problem of the general lack of contextual and thus chronological information for these pieces. Because of this and also because a lot of interesting technological information may be derived from these artifacts, which in certain cases, such as most of the ivory rods from Paviland Cave, may not survive much longer, it is important that they should be properly recorded without delay.

Methods

My preliminary study of the literature relating to the Upper Palaeolithic in Britain and Belgium gave some indication of the existence and the whereabouts of certain interesting collections. Enquiries made to a number of museums then revealed a suitable corpus of material. Many of the artifacts considered here have already been published in one form or other, but generally with only the briefest of descriptions, so this is the first major technological study of a whole mass of Upper Palaeolithic osseous implements from Britain and Belgium. Neither every site, nor every artifact could be considered, owing to difficulty in obtaining access to material, or to failure of museum staff to locate relevant artifacts, or to the fact that particular artifacts were being studied in detail by other researchers; to these factors must be added the inevitable constraints on the time and money available to any graduate student.

In order to make the best use of the resources available to me, I concentrated on working in those museums which held the larger collections of artifacts in a good condition, for example the Musées Royaux d'Art et d'Histoire and the Institut Royal des Sciences Naturelles in Belgium, and the British Museum, the British Museum (Natural History), the Oxford University Museum and the Torquay Natural History Society Museum in Britain. Many separate but complete collections of Upper Palaeolithic osseous artifacts are held in the two Belgian museums mentioned above, whereas in Britain the artifacts tend to be dispersed among many local British museums or even occasionally to remain in private hands, which involved more travelling than that required when considering the Belgian material.

The study of the corpus of over one thousand artifacts presented here involved visiting the various museums listed in Appendix 4 to inspect

artifacts. Three implements were also lent to me for study with the very kind permission of Frank Carpenter of Preston Museum and of Philip Powell at the Oxford University Museum. Every artifact was carefully inspected initially at x8 and x15 magnifications with a handlens (Microtec, Oxford), which is a most useful and portable little device. The artifact was then measured and drawn, and relevant information was recorded on an individual form or in a similar manner in a notebook. This information included as many basic details as were available, such as the name of the site and of the excavator, as well as the name of the museum and the artifact's museum number, in order to aid their location by later researchers. Other useful information relating to raw material, colour, condition, nature of breakage and any identifiable traces of débitage, modification and use was also recorded.

Once the presence of such traces had been identified with the aid of a handlens, various methods were employed to help interpret them, as appropriate. One very important general interpretative approach involved the experimental replication and recording of techniques of manufacture commonly found on Upper Palaeolithic osseous artifacts. This work and the attempted reproduction of traces of use will be described in detail in the following chapter.

Another important method involved the more detailed examination of selected artifacts, using both optical and scanning electron microscopes, to seek further evidence for methods of manufacture and traces of use. A Leitz Metallux II light microscope was used in Oxford at magnifications of up to x100, for viewing and photographing both experimental and archaeological pieces. Light microscopes were also made available to me in most of the larger museums visited. This equipment proved to be most useful for preliminary viewing, to inspect and identify general areas of interest, in order to save time when using the scanning electron

microscope (SEM). Unfortunately, however, light microscopes are inadequate for the more detailed aspects of this sort of work, because of their low resolution and minimal depth of field, which limit the area in focus at any one time to a shallow plane, so that constant adjustments have to be made to the focus and the image is never totally sharp. Even if one can overcome this to some extent, by constant adjustments of focus to cover eventually a whole tool surface, one cannot possibly achieve photographs with large areas wholly in focus. These disadvantages have been noted by other researchers working on bone artifacts (see Bouchud 1977, Olsen 1984). This means that not only is the interpretation of traces difficult, but even worse, it is sometimes actually impossible, due to the imperfect focus, to distinguish traces of working from the fibres and particles of dust, which, almost inevitably, become attached to museum pieces. Since the fragile nature of these artifacts means that they cannot be cleaned properly for microscopy, as one would clean a stone tool, good focus is even more essential.

In contrast to this, the SEM has the advantages of high resolution, good focus and depth of field, and great power of magnification. As the beam of electrons which forms the image cannot penetrate through air, the object being inspected has to be placed in an evacuated chamber. The only serious practical disadvantage for my research was that the SEM made available for me to use with the kind permission of the Department of Metallurgy and Materials Sciences, University of Oxford had a very small viewing chamber, which meant that one could not use it to scan a complete artifact directly. Furthermore, any non conductive material being viewed in this machine requires to be given a metallic coating. Clearly, the cutting up and metal coating of fragile and valuable (not to say unique in many cases) archaeological specimens was not a project likely to appeal to museum curators. However, these problems were easily and inexpensively

solved by taking accurate silicone rubber casts of the modified surfaces, which could be designed to fit within the viewing chamber. This technique of making good quality replicas has been successfully used by several other researchers on bone and antler (for example, Shipman 1981; Olsen 1984) and also on hominid teeth (for example, Puech 1976). A rapid, total vacuum may be achieved in a small chamber containing a silicone rubber cast, which both speeds up the number of specimens which can be examined and improves the penetration of the electrons and hence the image.

Casting of specimens in silicone rubber proved to have further advantages. One of these is that the cast can easily be taken away from a museum and inspected at one's leisure. The use of this technique was an essential part of this project, in that I would not have been allowed to take Belgian artifacts home to Britain for study, but by making accurate casts of areas of interest, I was able to take the information I needed away with me. It is also the case that sometimes traces may be seen on a cast with the naked eye, which are not easily visible on the bone surface, owing to its highly reflective quality, and also because such traces may occur on parts of the original which are hard to inspect, whereas the casts are flexible and almost indestructible.

Much useful information about casting techniques was given to me by Dr. Sandra Olsen and Jill Cook (British Museum, Quaternary Section), for which I am most grateful. As a result of their advice and my consideration of published information on the casting of archaeological specimens, I adopted the following approach. Two different casting techniques were tested on pieces of unworked bone, both fresh and ancient, as well as on a number of experimental pieces. One method involved making reproductions using acetate films: this proved to be fairly successful, but was rejected, as it involved wetting a bone surface with acetone, which seemed potentially dangerous to the object, in spite of its rapid evaporation.

The other method involved making replicas of a bone surface with silicone rubber: that made by Radiospares Limited (Stock Numbers 552-602 and 555-588) produced a very good replica, which was of a higher quality than that obtained with acetate films. It is also easy to use and causes no harm to the bone. However, it is important to stress that, whatever method is used, undamaged bone surfaces must be chosen for casting, since there would clearly be a risk of removing surface material in the casting process, were the surface in a friable state. I devoted much experimental time to obviating this risk and would urge others to do the same.

The procedure used consisted of lightly smearing the bone surface with a releasing agent to aid the removal of the cast; face cream was used most successfully for this purpose, as it causes no damage to the bone. The silicone rubber may then be squeezed out of the tube, like toothpaste, onto the bone surface. No catalyst is required, as the substance is already activated. Then it is advisable to press the silicone rubber lightly with a spatula to ensure that it has made full contact with the bone surface. It should then be left for a good twenty-four hours to make sure that it has set properly, after which it peels off easily, leaving the bone surface intact. It was found that the setting time may vary dramatically according to temperature, so it is advisable to test the silicone rubber on a piece of unworked bone at the museum where one will be taking casts of archaeological material, in order to ascertain what the drying time might be. As it is shorter when the temperature is higher, it is helpful to leave the casts under an angle-poise lamp for some time as the localised heat will speed up the drying process. Such heat does not cause harm to the object being cast. It is also advisable to make the casts in a well-ventilated room as fumes are given off when the cast is setting.

In the course of my research, I made a total of 104 casts of parts of 68 artifacts (see Table 1:1) from eleven of the sites considered here. This was with the kind permission of the British Museum (Natural History), Torquay Natural History Society Museum and Oxford University Museum in Britain, and the Musées Royaux d'Art et d'Histoire and the Institut Royal des Sciences Naturelles in Brussels. A further cast was very kindly made for me of the Cat Hole needle by the Department of Archaeology of the National Museum of Wales.

There was never any question (for reasons of time and resources) that I would be able to cast all the artifacts that I studied, and I had therefore to make a selection. Certain specimens were chosen for casting, because they had particularly interesting traces on their surfaces, which looked as if they would yield useful information. However, casts were only made of those pieces with suitably undamaged surfaces, so as to avoid causing further harm, as indicated above. The selection of specimens for casting was also conditioned by the willingness or otherwise of museum curators to expose items in their care to this process. My gratitude to those curators who were willing is recorded above, and I hope that the outcome of my work will justify their confidence, and that others will be allowed to use similar methods in other museums.

Table 1:1
Number of Artifacts from which Casts were Made

Site Name	Number of Artifacts
Kent's Cavern	5
Torbryan Caves	3
Coléoptère	14
Chaleux	6
Goyet	17
Frontal	5
Verlaine	3
Magrite	4
Spy	5
Remouchamps	2
Forêt	4

In Table 1:1, most of the site names listed are abbreviated versions for reasons of space, and are often quoted in this form in other tables and in the text as well. The full names of the sites considered here may be found in Appendix 1.

Olsen (1984,71) advises using the negative silicone rubber cast for microscopy, instead of a positive cast derived from the negative, as there may be some loss of detail in carrying out two stages of replication. For this reason, I too contented myself with inspecting the original cast under the microscope. However, I decided that it might be a worthwhile exercise to produce positives, in order to have some surviving form of the original after the negatives had been cut up into small segments for viewing in the SEM. I first attempted to produce positives with Araldite (Ciba-Geigy) using the silicone rubber casts as moulds, as recommended by Shipman (1981,362) and Cook (1986,140). However, I encountered great difficulties in getting rid of the many air bubbles that formed and I also found that the Araldite casts would not set properly and remained slightly sticky to the touch. Another similar resin, Speed Epoxy (Deluxe Materials), was also tried, but again with limited success. In order to help the casts set they were baked at a low heat, but after rather too much time, money and effort had been expended on the problem, the epoxy resin casts still proved to have very poor reproductive and setting qualities. It was then suggested to me by Mrs Barbara Moore that I should try a polyester resin (TC702PA) made by Trylon, which is actually intended for casting and is very easy to use and can be bought in art and craft shops. It set well and made a good reproduction with few air bubbles. However, for the reasons given above the silicone rubber negatives were used for microscopy.

For viewing in the SEM, the silicone rubber cast had to be cut into segments which were approximately 2cm long and 1cm wide, and then mounted

on a round, metal stub with Araldite. The lower edges of the cast and parts of the Araldite and the stub were painted with silver paint to ensure good contact between the upper and lower surface of the specimen. It was then sputter-coated with gold, in order to ensure good conductivity. Each specimen was inspected at a range of magnifications; those between approximately x30 and x100 proved to be the most informative.

It is best to use all the available methods of microscopy in a complementary fashion, as each has certain advantages. Inspection of large collections of artifacts may be achieved fairly rapidly with the aid of a hand lens and may yield a lot of useful information particularly about techniques of manufacture. The light microscope can then be used to inspect a manageable number of selected pieces in order to seek further evidence which may appear at higher magnifications, and also to identify particular areas of interest for scanning electron microscopy. It will usually prove advisable to examine only the most promising specimens in an SEM, because this is a very time-consuming process and also, as SEM s are expensive pieces of equipment which are of use to researchers in many disciplines, access to such a microscope is inevitably limited. If I had had to pay for the time I was allowed, this part of the project would have been quite impossible.

Another approach, of an indirect nature, to identifying traces of manufacture and use on Upper Palaeolithic bone implements is to use ethnographic evidence, not only from written sources, but also from actual artifacts. A collection of Eskimo implements held in the Pitt Rivers Museum in Oxford was examined by me. A number of documentary sources also provided useful descriptions of artifacts and of how they were used by the Eskimo and by North American Indians. This sort of information is

invaluable when one is attempting to fill out details of the activities only hinted at by the archaeological specimens.

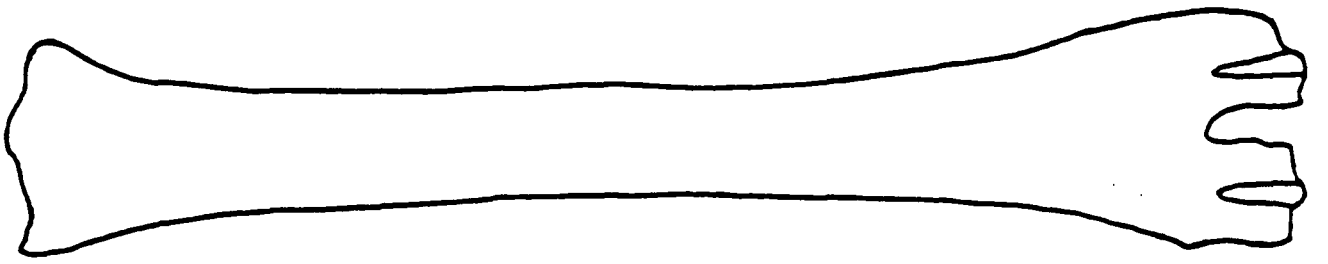
One possible approach which I considered and rejected as being inappropriate was statistical analysis. The reason why no elaborate form of numerical analysis was attempted lies in the inadequacy of the material as a reliable statistical sample and the lack of detailed, contextual information. Thus, there was no possibility of any form of spatial analysis. The collections considered here are generally very depleted, so that even detailed reconstructions of frequencies of artifacts cannot be attempted, although it seems reasonable to indicate the occurrence of particularly large numbers of one type within a single assemblage. The poor and often incomplete condition of the artifacts means that it is often impossible even to calculate accurately their original dimensions. However, in certain cases, formal comparisons of surviving dimensions could reasonably be made within one tool type. In this thesis, these simple calculations are represented graphically and expressed in terms of means and of ranges of variation.

Orientation and Naming of the Various Parts of Osseous Artifacts

The term 'osseous' is frequently used here as a substitute for 'bone, antler and ivory' (see Guthrie 1983,274), mainly for the sake of brevity.

The part of each artifact which has been identified as the working end is called the 'tip' or 'distal end'; this term signifies that this end of the implement is furthest away from the hand holding it. The other end of the artifact which is closer to or even in contact with the hand is named the 'base' or the 'proximal end' (see Camps-Fabrer 1977a,19-22). The area between the base and the tip, or the proximal and distal ends is called the 'shaft' (see fig.1:1). These terms 'distal' and 'proximal'

Diaphysis/Shaft

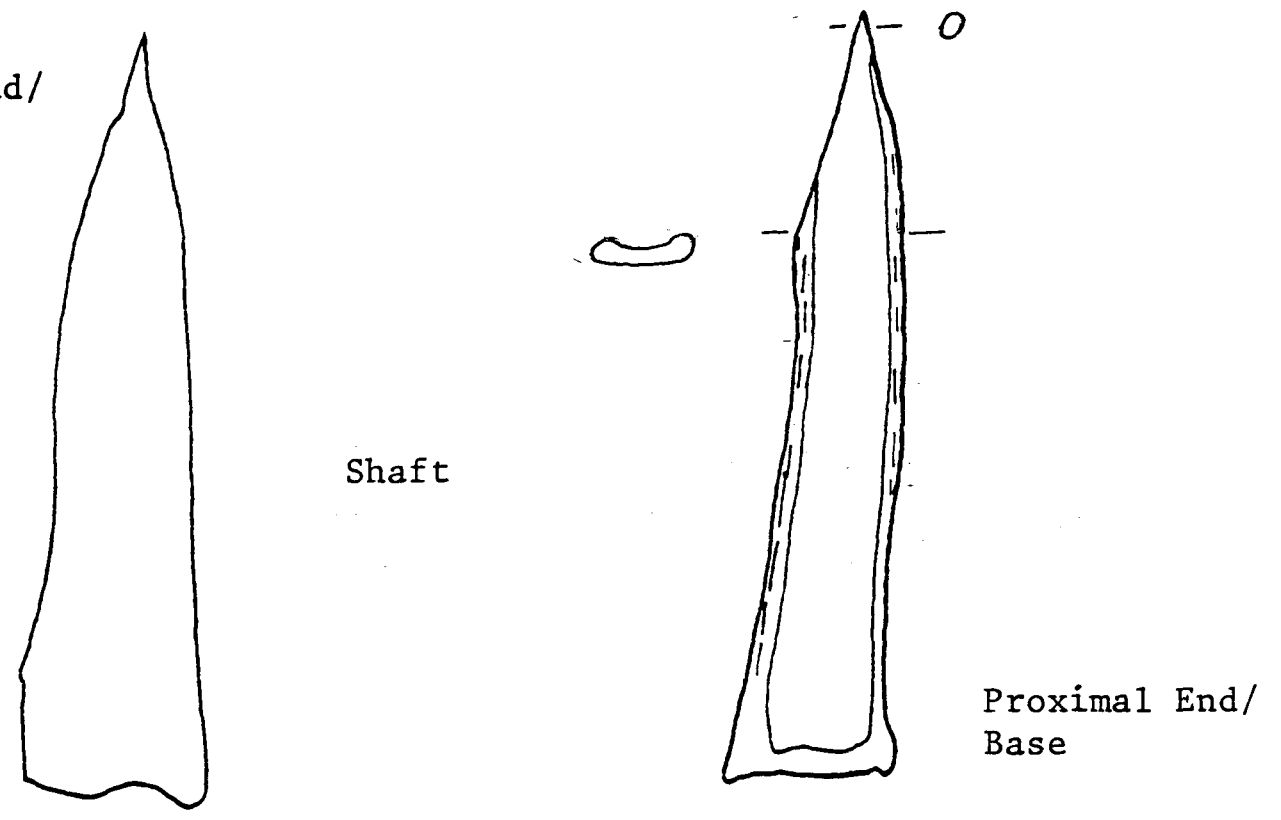


Proximal Epiphysis/
Articular End

Distal Epiphysis/
Articular End

Fig. 1:2 Orientation and Naming of Parts of Bones

Distal End/
Tip



Shaft

Proximal End/
Base

Outer/Upper Surface

Inner/Lower Surface

Fig. 1:1 Orientation and Naming of Parts of Osseous Artifacts

are borrowed from anatomy, where 'proximal' describes the end of the bone that is closer to the centre of the body, that is the proximal articular end or epiphysis. The other articular end, which is further from the centre of the body, is termed the 'distal epiphysis'. The area between the two articular ends is called the 'shaft' or the 'diaphysis' (see fig.1:2).

The outer or upper surface of an artifact is that which corresponds with or is closer to the outer surface of the original material. Likewise, the inner or lower surface is that which corresponds to the innermost part of the original raw material, that is the marrow cavity or the spongy, inner tissue (see Chapter 2).

In the figures, each artifact is oriented with its presumed working end uppermost, as agreed by Newcomer (1974,140-141) and Camps-Fabrer (1977a,19-22). All the lines on each drawing, apart from the outline, represent striations and incisions rather than shading. Cancellous tissue is drawn as broken lines and little circles (see fig.1:1). All the artifacts are drawn actual size, unless stated otherwise.

This concludes the discussion of the aims of and the methods used in this thesis, and before embarking on the detailed study of the actual archaeological material, the natural and artificial modification of bone will be considered in the following chapter, which also includes a description of my experimental work.

Chapter 2

Natural and Artificial Modification of Bone

This chapter includes a description of the raw materials from which the artifacts studied here were made, as well as a consideration of various characteristic features which may aid their identification. The principal natural processes which may modify bone are also briefly discussed here, but the main part of this chapter concerns the artificial modification of these raw materials and the experimental work which I carried out to replicate and record various techniques of manufacture and use.

Raw Materials

The raw materials which appear to have been used for tool making in the region of this study during the Upper Palaeolithic consist of reindeer antler, animal bone, usually from long bones, and mammoth ivory. This latter material is believed to have come from the tusks rather than from the other teeth, which are all molars, because they were heavily coated with enamel and thus difficult to work (MacGregor 1985,17). No artifacts made of horn appear to have been preserved in this area, although horned creatures such as ibex did exist at that time (Dupont 1872,89), and even appeared in the mobiliary art (Twiesselmann 1951,24, Fig.7).

The Nature of Bone, Antler and Ivory

Bone consists of organic material mainly in the form of the fibrous protein collagen, onto which mineral crystals of hydroxyapatite, that is a complex of tricalcium phosphate and calcium hydroxide, are deposited. This combination of approximately one third organic matter and two thirds inorganic matter gives bone both resilience and toughness, as well as hardness and rigidity (Brothwell 1981, 18).

Two different types of bone structure are visible to the naked eye, though they are identical at the microscopic level (MacGregor 1985,7). Cortical bone, which forms the outer layer of bones, is a hard and compact material, with no visible gaps in its structure. Cancellous tissue is a softer, spongy tissue, which is full of little holes; it is found in the interior of bones and in particular, within the articular ends or epiphyses of limb bones. All limb bones have a cavity in the shaft or diaphysis, which is filled with bone marrow, with the exception of bird bones which are hollow. The function of the bone skeleton is to support and protect the vital organs, while linking various physiological systems. Viewed from a completely different angle, the essential hardness and resilience of bone makes it an ideal raw material for tool making.

Antlers are bony outgrowths which are carried by most kinds of deer and by stags only, with the exception of reindeer. The ratio of organic to inorganic matter in antler is comparable to that of skeletal bone. Antler consists of an outer casing of cortical bone with an inner core of cancellous tissue. Different species of deer share the same microstructure of antler, but the shape of the antlers varies. Relative proportions of cancellous to cortical tissue may vary both according to species (Bouchud 1974), and also within a species depending upon the mineral content of the bone. An example of the latter is demonstrated by

Penniman (1952,Plate 18,Fig.1) in a photograph which shows that the antler of a female reindeer without a calf contains less cancellous tissue than that of a lactating female with a calf. This is caused by calcium being needed for milk and thus being taken out of the bloodstream. Because of this variation, MacGregor has suggested that,

> "species identification on the basis of the texture of the cancellous tissue and its abundance relative to the surrounding cortical tissue, as proposed by Bouchud (1974) seems a little unwise" (1985,22).

The function of antler appears to be for display. It too provides an excellent raw material for tool making and one that is conveniently shed annually and so only requires gathering.

Mammoth ivory tusks are highly developed upper incisors, which are almost entirely composed of dentine with a small tip of enamel (MacGregor 1985,17; Penniman 1952,13). The tusk continues to grow throughout adult life and so the pulp cavity at the base of the tusk remains wide open, which is not the case for most teeth. Elephant ivory has an unusual appearance in cross-section which was well described by Sir Richard Owen as long ago as 1856, for it

> "shews lines of different colours or striae proceeding in the arc of a circle, and forming by their decussations minute curvilinear lozenge-shaped spaces...due to the enormous number of minute tubes of which ivory is composed, each about one-fifteen-thousandth of an inch in diameter, very close to each other, starting from the pulp cavity, and radiating outwards in all directions" (quoted in Penniman 1925,p13).

The same feature has been observed on mammoth ivory and aids its identification within archaeological collections (see below).

Mechanical Properties of Bone, Antler and Ivory

Experiments have been carried out by both archaeologists and materials scientists to test the mechanical properties of these raw materials (see Albrecht 1977; Bonfield and Li 1965,1966; Evans 1973; MacGregor 1985). This research has involved testing the hardness of these materials under various conditions and their compressive and bending strength. The results obtained by MacGregor (1985,29) indicated that antler proved of the three to be the toughest raw material, owing to its "markedly better capacity to absorb shocks and sudden impact loads." Albrecht (1977) also found that antler had both high compressive and bending strength. Ivory had notably high compressive strength, but low elasticity. In each case, bone had a lower average than antler (op.cit., 121, Fig. 1).

Identification of Bone, Antler and Ivory

It is important to be able to identify the raw materials from which artifacts are made, because it is a useful source of information about which raw materials were selected for which tasks. The discovery (see above) that antler has a particular capacity for absorbing shocks suggests that it would be the ideal raw material for projectile points, and indeed certain Upper Palaeolithic specimens which have been identified as probable projectile points, including most barbed points and split-based points, are made of antler.

Some research has been carried out on identifying different types of raw material through studying thin sections under a microscope (Bouchud 1974; Penniman 1952). However successful this process is, it possesses certain disadvantages such as the necessity to remove a small sample from each artifact and, apart from the question of damage to the specimens,

this would be quite time-consuming if one were inspecting a large museum collection. The guidelines used here for the identification of raw materials are very simple and straightforward and require no equipment apart from a handlens. Two useful works of reference on bone identification used by me were Cornwall (1974) and Schmid (1972). Actual bones may be identified where diagnostic features such as articular ends are preserved, for example on artifacts classified here as Groups 1 and 2 points (see Chapter 4). Traces of a marrow cavity which have not been obliterated by working also indicate that an artifact is made of bone. Another guideline is that cancellous tissue belonging to bones generally contains larger cavities than is the case for antler. This feature is illustrated by MacGregor (1985,10,Fig.9).

When fresh, reindeer antler seems to have a slightly greyish colour compared with the whiteness of fresh bone. However, it is impossible to provide rules for archaeological pieces, as they are frequently stained by chemicals in the deposit in which they were buried. As was suggested above, antler seems to have cancellous tissue which is composed of smaller elements compared with those in bone cancellous tissue.

Ivory will split longitudinally when it is desiccated, which it often appears to be in the collections studied here, with the result that it shows a 'cone-in-cone layered structure' (Penniman 1952, 22, Plate IV). This feature does not occur in bone or antler. When it is broken transversely, ivory may be seen to be composed of longitudinal rods which appear as tiny discs in cross-section. Similarly, when an unworked surface of ivory is exposed by natural, longitudinal splitting it exhibits natural longitudinal corrugations brought about by the arrangement of the tiny rods (Penniman 1952, Plate III). These two features are also unique to ivory. It is usually the case that when an artifact in the collections studied here shows no features diagnostic of any particular raw material,

it appears to be made either of cortical bone or antler. Unless the outer surface is particularly well preserved, firm identification by visual means is likely to be impossible. In my work with valued museum specimens I could not undertake further analysis of a destructive nature.

Natural Modification and Taphonomy

A consideration of this subject is essential to ensure that human modification of bone is not confused with natural modification. For bone, antler and ivory are all liable to a whole range of natural processes such as chemical alteration, trampling by large animals and gnawing by carnivores and rodents, the results of which may resemble human modification. It is for this reason that taphonomy or "the study of processes that operate on organic remains after death to form fossil deposits" (Gifford 1981,366) has yielded results which are of great value when studying bone artifacts. In recent years, much interesting research has been carried out in this field (see Andrews and Cook 1985; Behrensmeyer 1978; Brain 1980; Cook 1986; Haynes 1980,83; Hill 1976, 1983; Myers et al. 1980; Shipman 1981; Sutcliffe 1970,73), which has been the subject of a very useful, detailed review by Gifford, herself a taphonomist, in 1981. No taphonomic studies were undertaken here, as they lie outside the scope of this thesis, but I needed to satisfy myself that the objects I was studying were all genuine examples of humanly modified bone, antler and ivory, and I found that familiarity with published taphonomic studies proved most useful. In particular, Shipman's (1981) article on both natural and artificial modification of bone, with its accompanying SEM micrographs, provided an invaluable guide in identifying and interpreting natural modification within the collections studied.

Many pieces considered here which have genuinely been humanly modified, in that they bear recognisable traces made by stone tools, have also been adversely affected by certain natural processes. These will be briefly discussed below.

One of the most common forms of natural damage affecting the collections considered here is desiccation, which may occur post-depositionally, or even after retrieval if the artifact is not carefully conserved. This may lead to the exfoliation not only of tiny fragments, but also of whole surfaces. This is clearly of some consequence when trying to determine whether and by what means an object has been humanly worked.

Chemical alteration through acids in a deposit or through regurgitation by carnivores may not only conceal or destroy actual traces of working, but can also bring about modification which mimics that produced artificially. Examples of this include a number of bone fragments from Pin Hole Cave (Creswell Crags), which superficially may appear to have been worked, as they are perforated and/or polished and they sometimes bear scratches. However, these phenomena are not accompanied by any identifiable, regular traces of modification such as the typical striations left by scraping with a stone tool, and were recognised by Kitching (1963,120-22), as a result of his researches in Southern Africa as having been caused by the gastric acids of a carnivore, probably a hyaena. For when hyaenas chew and crunch bones, they actually swallow bone fragments of substantial size (Sutcliffe 1970), which are subsequently modified by acids in the hyaena's stomach prior to regurgitation,

> "in the course of feeding, adult hyaenas frequently swallow substantial fragments of bones. After feeding they subsequently regurgitate everything indigestible" (op.cit.,1112).

This may result in

> "scalloping of the bone surface; knife sharp edges between two eroded faces; and even circular holes" (ibid.).

Another source of natural damage which I have recognised in the collections studied here is gnawing by animals. However, tooth marks should be distinguishable from artificial features in that there are no striations associated with them.

In certain cases, a network of fine incisions is visible on a bone surface; this has been brought about by roots growing around the buried bone and then secreting acids into the bone surface. The absence of striations within the incisions again shows that they are of natural origin. Furthermore, post-depositional chipping and abrasion may not only destroy traces of working, but may also result in scratches and striations which may superficially resemble traces of working.

These natural forms of modification can generally be recognised as such, because they are not accompanied by the regular occurrence of grouped striations and the other traits resulting from working with stone tools, which will be described in the following section.

Experimental Work

(i) Introduction

Having begun this project without any experience of working osseous materials, I thought that the most useful first step would be to attempt to recreate well-documented methods of bone tool manufacture such as the groove and splinter technique (Clark and Thompson, 1953), so that I could observe the results at first hand. My aim was purely to familiarise myself with the raw materials and to aid my identification and interpretation of

traces of manufacture preserved on archaeological specimens. I hoped that this would also help me to recognise working débris and to determine why certain bones were selected for tool making. Thus, it was not the intention to carry out any original work in this area and my efforts also consciously repeated the experimental work of other researchers, including Newcomer (1974), Olsen (1984) and Rigaud (1972). It seems to me to be essential that any researcher making a detailed study of bone tool technology should have some practical experience of how bone may be worked rather than relying on published accounts, even if, like myself, he or she is not seeking to break new ground: this greatly aids the identification and interpretation of traces of manufacture when archaeological specimens are considered.

The raw materials used in the experiments reported here included reindeer and fallow deer antler, and bones of domestic cattle, sheep, pigs and rabbit. They were worked with quartzite hammerstones and grinding stones and with implements made from East Anglian flint. Some of these raw materials were very kindly supplied by Nick Barton, Phil Harding, James Knight, the Jesus College chef and various Oxford butchers, to all of whom I am most grateful. No experimental work was carried out on ivory, owing to the difficulty in obtaining suitable raw material, but information from published sources (Semenov 1964) and my own observations of archaeological specimens suggest that very similar manufacturing techniques were used on ivory to those used on bone and antler.

An attempt was made to reconstruct the various processes undergone by bone or antler, from when they are first obtained until the completion of an implement. The first stage for bone would probably be cleaning, because a bone with muscle, fat and periosteum still attached is very difficult to work as it is slippery. This is supported by ethnographic evidence (see below). By contrast, a mature antler which has lost its

velvet consists purely of bone with no adhering soft tissue, so it needs no cleaning.

Another form of preparation for working, which could be carried out at any stage, was softening of the raw material. Soaking in water proved to be an effective method, as suggested by various authorities (Clark and Thompson 1953,149; Newcomer 1977,293), though this worked less well on bone than on antler. Other techniques such as steaming are mentioned in the literature (Semenov 1964, 159-160; MacGregor 1985,63-64), but they were not attempted, as soaking in water seemed to be a perfectly adequate method.

Apart from these various forms of preparation, the first stage in bone tool production is '<u>débitage</u>' or '<u>blank extraction</u>', by which suitable pieces of raw material are deliberately extracted from either whole bones, antlers etc. or from fragments, as blanks, which will then receive '<u>modification</u>' to make them into finished implements. The term 'débitage' is regularly used for bone as well as stone in the literature (see Newcomer 1974, Stordeur 1977), while the equivalent term 'blank extraction' has also been adopted here for the sake of variation. The term 'modification' is used here to refer to all kinds of artificial, post-débitage working of an artifact.

One very crude method of débitage is direct percussion to produce splinters of bone. In marked contrast to flint, with its classic features of conchoidal fracture, experimental breaking of bone failed to reveal any characteristic features, which could be used to identify splinters which had been deliberately extracted by percussion. However, traces of the groove and splinter method of débitage are easily identified both on blanks and on the raw material from which they have been extracted. I successfully reproduced this technique on both antler and bone, as was the case for the other two methods of débitage considered here, longitudinal

sawing, and sawing and snapping. Examples of these methods are clearly preserved in the archaeological material studied here, and I found my experimental work of great use in enabling me to recognise them.

As was mentioned above, the second stage in bone tool production is the modification of the blank. Possible methods include flaking, scraping, grinding, perforating and incising. As I discovered with regard to blank extraction, flaking appeared to show no diagnostic traces to enable pieces deliberately modified in this way to be identified with complete confidence. The more common methods of modification used on bone, antler and ivory artifacts appear to have been scraping with stone tools and grinding with a grindstone. Fortunately the two are generally distinguishable one from the other, owing to the fact that they leave different traces on the bone surface, as described below. These two techniques may be used not only to shape the raw material, but to smooth the surface and even apply a polish.

The question of whether different types of stone tool might leave characteristic traces on a bone surface was also considered in some detail, though it was concluded that the experimental findings could only rarely be applied to the archaeological material. The perforating and incising of bone was also studied; the former involved the production of eyes for a number of needles and the latter, the cutting of a series of transverse incisions on one piece of reindeer antler and the production of a series of barbs on another.

The work outlined above is the first part of the experimental section of my research; the second part concerns the use of bone tools in specific tasks in order to document any traces of use that occur. Such traces could take the form of breaking or chipping, or a polish or further striations and incisions. The aim of this experimental work was to test whether a bone implement would show traces of use according to the

task it performed and the material it was used on, in much the same manner as flint artifacts (Keeley 1977). This proved to be a much more difficult area than manufacture to consider, because there is little archaeological evidence to show that any individual bone tool was used in a particular fashion on a particular material, and one is left to guess at what experiments would be most relevant and useful. Furthermore, bone being much softer than stone, it is liable to many kinds of natural, post-depositional damage (see Taphonomy), some of which may obliterate or, even more confusingly, mimic traces of use. It is also the case that, as with stone tools, one type of bone implement may have been used in a variety of ways and that even one individual artifact need not always have had the same function. It became clear to me that a proper exploration of utilisation traces on bone requires to be a whole separate research project, and I doubt whether anyone undertaking it could feel assured from the outset of positive results, though I hope some would be forthcoming.

(ii) Experimental Work Relating to Bone Tool Manufacture

(a) Cleaning

Before working, the limb and rib bones which I used were very thoroughly cleaned, with three exceptions, which all proved to be very slippery and difficult to handle. The method of cleaning which was most frequently used here involved cutting and scraping away the periosteum and any remaining connective tissue with various retouched and unretouched flint flakes. After a little practice, this process only took five or ten minutes. After cleaning this way, the bones looked white and quite shiny; they were also covered with fine, shallow striations running in many different directions and of varying lengths, where little shavings of bone had been removed. These striations are generally wavy in outline and quite broad where several have overlapped. There were also some deeper incisions where the stone tool had cut more firmly into the bone (Plate 2:1). There



Plate 2:1 Bone cleaned by scraping

is documentary evidence for the scrupulous cleaning by scraping by the Nunamiut Eskimo of North Central Alaska of bones intended to be broken, in order to extract the marrow for consumption (Binford 1978,153), for the same reason that the bones are otherwise too slippery to handle.

It should be noted that some of the striations resulting from cleaning with stone tools could possibly be confused with traces resulting from the modification of bone blanks by scraping. This is not surprising as the second operation is in some respects a more purposeful continuation of the first one on the same surface.

(b) Methods of Softening Bone, Antler and Ivory

Softening bone and antler by soaking in water is well documented in the literature (Clark and Thompson 1953,149; Semenov 1964,159-160). During the experiments recorded here, it appeared that reindeer antler could regularly be made softer by soaking in cold water. The effect was very marked, even when the antler had only been in the water for a few minutes. Bone could also be made a little softer by soaking when fresh, which made it easier to cut and incise. However, this method appeared to be much less effective on bone than on antler, and it was found that after about a week, bone could no longer be softened in this way and it became dull and lifeless in appearance.

Other techniques described in the literature include the softening of bone, antler and ivory by steaming (Semenov 1964,160) or by immersing it in a weak acid solution which could be derived from plants, such as sorrel (MacGregor 1985, 63-66), though MacGregor suggests that plain water is just as effective. The softening of these raw materials with urine among the Koryak Eskimo and by boiling among the Alaskan Eskimo is recorded by Thompson (Footnote in Semenov 1964,159). Ethnographic evidence for the warming of bones over a fire to make them easier to break is also indicated by Binford (1981,148,152). I am not aware of any direct evidence

to indicate what methods may have been chosen to soften bone, antler and ivory during the Upper Palaeolithic, but it seems improbable to me (on the basis of my experiments) that these materials were worked, antler particularly, without softening them, and it is also clear that the softening would have been easy to achieve.

(c) Débitage

Percussion

This method could have been used as a crude way of producing bone splinters which may have been modified to make tools. In order to test whether any characteristic features would be produced by this technique, I broke a number of bones by direct percussion: almost all the bones broke obliquely across the shaft in a 'spiral fracture', which is characteristic of bone (Bonnichsen 1979,35-36) (fig. 2:1). The traces of percussion observed on the broken bones included the removal of small flakes at the point of impact, cracking and sometimes crushing of the bone. I could not satisfy myself that any particular features were exclusively characteristic of deliberate percussion with a hammerstone. This was tested by flaking fresh cow bone, which was so thick and compact that it could be treated almost like a 'core' in flint knapping. When impacted, the bone came away in layers, so that one blow resulted in a series of removals on which no particular features could be seen. This makes deliberate percussion very difficult to identify on archaeological material.

I have noted the views expressed by Binford (1978, 153-154; 1981,163-164) and Bonnichsen (1979,223,233) that particular features may be identified on bone as resulting from deliberate percussion.

These characteristics include impact scars, which

> "are commonly created when diaphyses are broken with hammerstones. These negative scars are generally crescentic in shape, occur on the marrow cavity side of the bone, and may exhibit small step fractures" (Bonnichsen op.cit.,223).

What appears to have been the same feature was also observed by Binford and described by him as follows,

> "impact scars from hitting the bone during marrow cracking are quite distinctive. First they are almost always at a *single* impact point, which results in driving off short but rapidly expanding flakes inside the bone cylinder. At the point of impact the bone may be notched, in that a crescent-shaped notch is produced in the fracture edge of the bone" (1981,163).

Both authors also record the occurrence of a conchoidal fracture pattern on bone, as does Myers (1980,488) on paleontological specimens. Attempts were made by me to reproduce this phenomenon, but they were all unsuccessful even on the cow bones, which were the thickest bones considered here.

It seems probable that this was a result of having used different techniques of percussion, with hammerstones of different weights on different bone types. My own experiments were too limited for me to do anything other than record what appeared to be an absence of diagnostic traces and to conclude that it might be unwise to rely on such traces as certainly indicating human modification of bone without other evidence for human presence.

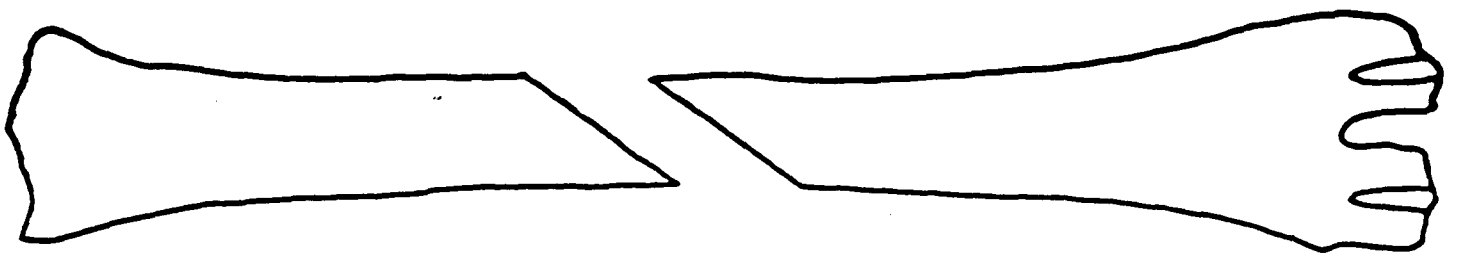


Fig. 2:1 Spirally fractured bone

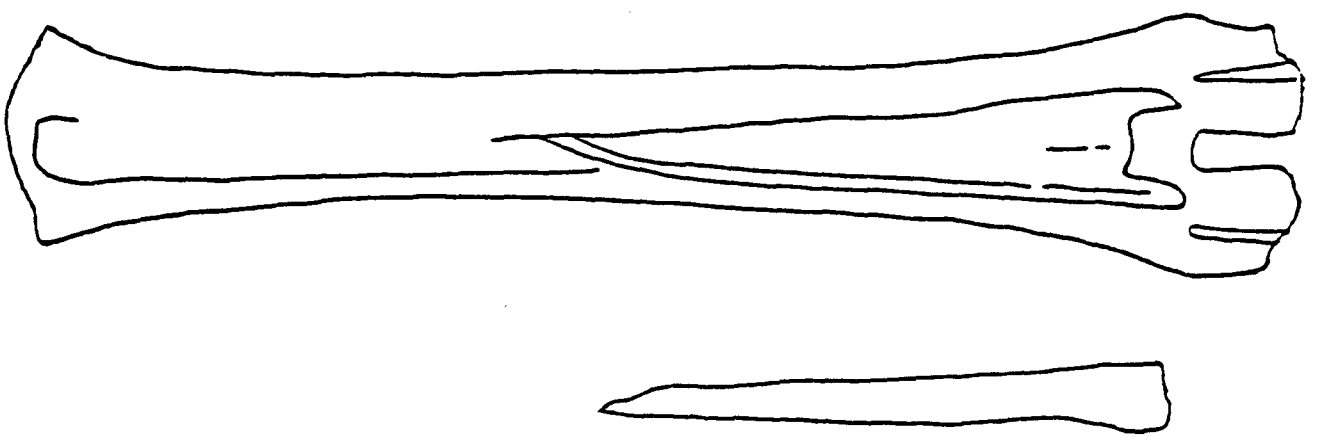


Fig. 2:2 Use of the groove and splinter technique on bone

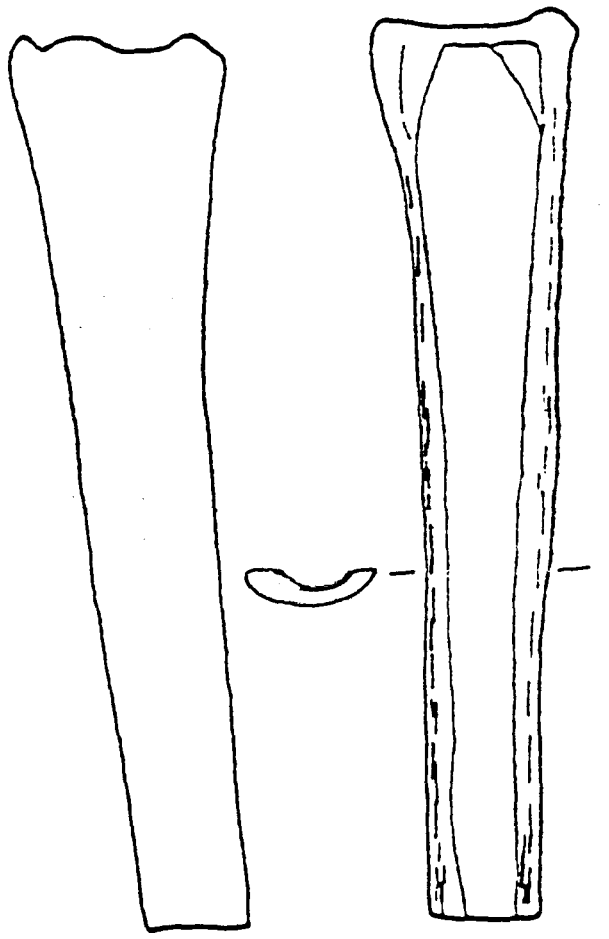


Fig. 2:3 Longitudinal sawing of bone

Flaking as a method of blank production seems most inefficient, as it is both wasteful of raw material and difficult to control. Whether it was often deliberately used in the Upper Palaeolithic is impossible to tell, owing to the absence of ^x diagnostic features. ^x regularly occurring and

Archaeological evidence for the deliberate flaking of mammoth ivory is put forward by Semenov (1964,154-155), either with or without preparatory grooving with a burin.

Groove and Splinter

In contrast to flaking, the groove and splinter method of blank production is most efficient and economical. It involves incising two deep, parallel grooves in the raw material and then extracting the splinter from between them. In this way, little raw material is wasted for a splinter can be cut close to the desired size of the finished artifact.

This method has previously been recognised and discussed by various archaeologists including Clark in 1949, but it was Clark and Thompson who, in 1953, produced a detailed analysis of this technique in both the Upper Palaeolithic and the Mesolithic of Europe and gave it the name used here. Clark and Thompson indicate that,

> "study of the grooves, experiment with fresh antler, and comparison with Eskimo practice suggest that the principal tool used was the flint burin, and it is significant that burins were the most numerous finished implements in the flint assemblage from Star Carr" (1953,149).

This may have been the case for Star Carr, but when using this technique on bone and reindeer antler, I found that the working edges of burins were too thick to be effective at making the grooves deeper. A supply of flints with thin, strong, retouched edges proved to be most useful, as they could be lowered into the groove, so as to make it deeper without making it too wide. Unretouched flakes and blades tended to break up during this process.

It was suggested by Clark and Thompson (1953,150,Plate XXI,No.4) that wedges may have been used to help extract the splinters from the grooves and that a small flint fragment embedded in the cancellous tissue of an antler from Valby in Copenhagen may have been part of such a wedge. However, it was my experience that flints did not make good wedges, as they tended to shatter when struck, unlike antler which was used most successfully. It may be that the flint fragment referred to may have broken off a flint implement when the grooves were being cut.

The use of this technique on ivory is also documented in the literature (Clark and Thompson 1953,154; Semenov 1964,155-158) and was also recognised by me on certain archaeological specimens studied here.

Rigaud (1984) indicated that he had found clear evidence for the use of an antler or wooden wedge in the groove and splinter technique on two pieces of antler, from each of which a splinter has been extracted, and also on a number of antler blanks produced this way. They were found at La Garenne-Saint Marcel (Indre). The evidence took the form of rounded depressions which Rigaud suggested may have come about through pressure from a wedge. Not having been able to examine the originals, I find it difficult to assess this evidence. However, it should be noted that antler and bone splinters may break in a very irregular fashion across the cancellous tissue, if a sufficiently deep groove has not been made in the antler.

The groove and splinter technique was tried out by me on both bone and antler in order to produce blanks of various sizes. The factors affecting this process on bone did not seem to include whether the bone was wet or dry, but the condition of the flint tools used and the experience of the person carrying out the experiments proved to be important. By contrast, it was essential for the antler to be soaked, or else it was too hard to work. One antler splinter produced by this technique had become curved, as

a result of being softened by soaking and bent out of shape by pulling it out of the grooves. On the outer surface of the splinter, deep scores could be seen from attempts to cut the grooves. On the inner surface and edges of the splinter, there were some longitudinal striations, but these were very difficult to see under the thick polish produced by the repeated action of the stone tool incising the grooves in the antler. Similar traces including a heavy polish could be seen on a rib bone splinter produced in the same way.

An attempt was made to extract a blank designed for the manufacture of a needle by this technique, from a sheep metapodial. Two longitudinal, converging grooves were made in one surface of the bone to produce a suitable-sized blank, which was snapped off at one end. On the outer surface of the blank, a number of irregular striations from cleaning could be seen, as well as a deep, longitudinal incision parallel to one edge, resulting from an attempt to start a groove. The lower part of both edges was jagged, where they had been snapped out, while the upper part was covered with mainly wavy, longitudinal striations from making the grooves. Some facetting could be seen towards the wider end. Similar traces could be seen on the edges of the bone itself where the blank had been removed (fig.2:2).

Longitudinal Sawing

Another very economical method of blank extraction involves splitting a bone in two longitudinally by sawing. This method was successfully replicated on a sheep metapodial. In order to provide a convenient straight edge from which to start sawing, the distal end was first removed by sawing, in this case with a hacksaw rather than with stone tools for the sake of speed. The bone was then easily split in two by sawing longitudinally using unretouched flakes for thirty-five minutes (fig.2:3). The bone was not soaked prior to working. The traces of this process

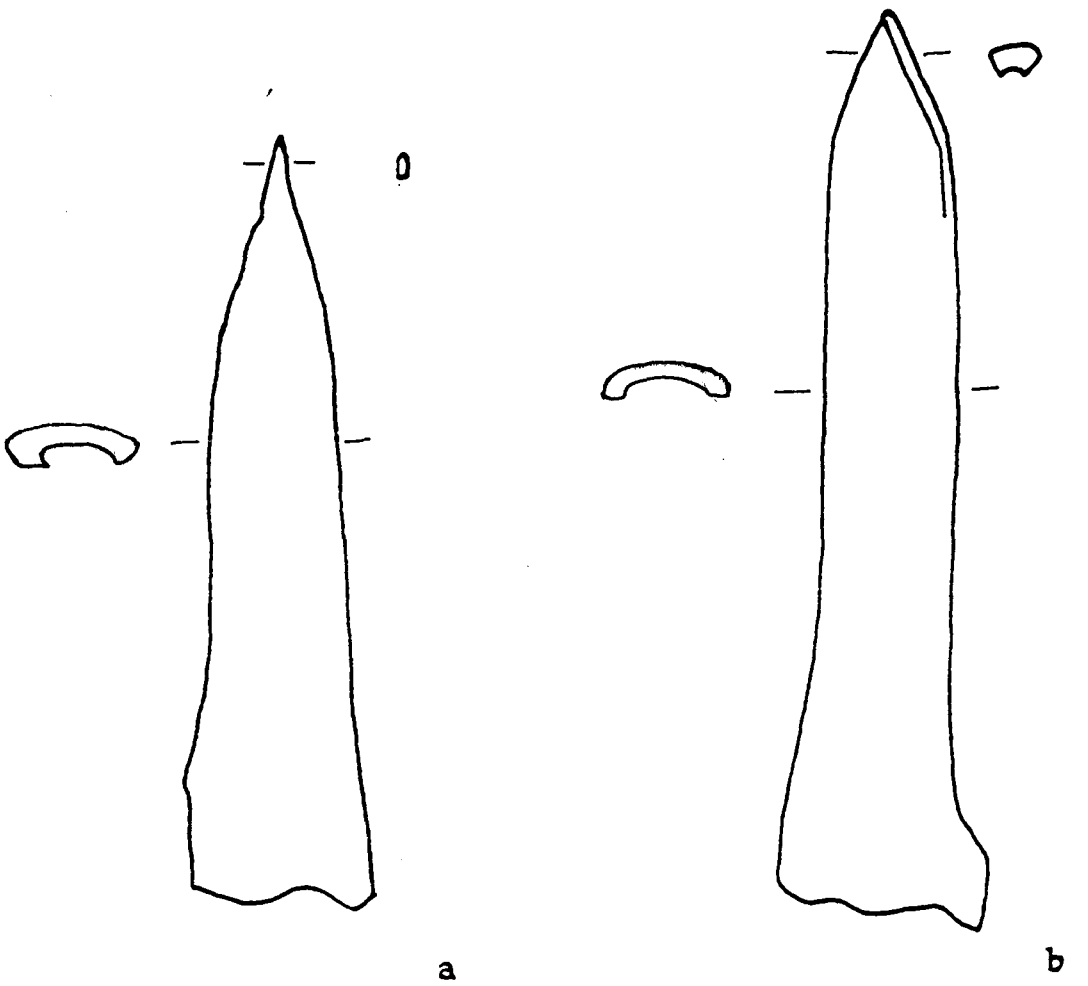
consisted of some curving striations on the outer surface of the bone beside the edges, where the stone tool had slipped. Mainly longitudinal striations from sawing could be seen on the edges of the two halves of the bone, as well as some jagged areas where the bone had been snapped off rather than fully sawn through. The two halves were then modified, one by scraping, the other by grinding into pointed implements (figs 2:4).

Sawing and Snapping

This technique is particularly useful for removing unwanted or damaged pieces of raw material, including articular ends. For cylindrical pieces, this involves sawing transversely right round the shaft to produce a ring-shaped groove. This is made progressively deeper until the area to be removed may be snapped off. Typical traces of this process take the form of deep scores in the outer surfaces from attempts to start the groove. While the outer ring of bone or antler is flat and polished and bears many fine striations from sawing, the area within it is rough where the remaining bone or antler had been broken off (fig.2:5). In my experiments, one antler tine which was worked in this way proved to be so difficult to break off that it had to be struck twelve times with a hammerstone until it broke off along the groove. This left a number of small triangular or V-shaped depressions in the antler tine with a crushing inwards of the cortical material. The use of sawing and snapping on mammoth ivory was documented by Semenov (1964,150). This method may also be used on flat pieces of bone, but in that case it is only necessary to saw from one surface before snapping off.

(d) Modification

The two main methods of modification identified by me and by other workers on bone artifacts are scraping with stone tools and grinding with some form of static or hand-held grindstone, which can be any suitable piece of either coarse- or fine-grained rock, depending upon the finish



a b

Fig. 2:4 Pointed bone implements modified by

a Scraping
b Grinding

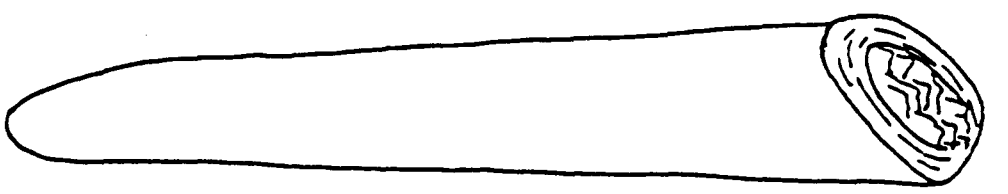


Fig. 2:5 Sawing and snapping of antler

required. The use of flaking as a method of blank modification is not well documented in the archaeological record, though as experimental replication (see above) failed to produce distinctive features characteristic of this process, it is very difficult to recognise. It is not a particularly useful process as it is difficult to control.

Scraping with stone tools will leave striations on the bone surface, owing to irregularities in the edge of the stone tool, which run parallel to the direction of working; they may vary in width and depth depending on the nature of the working edge used. Other traces left by this process may include the building up of facets if the bone is worked for too long in one place; careful scraping may also be used to give a bone a fine, polished finish. Stone tools may also be used reduce a piece by whittling, which gives the piece an irregular stepped appearance. A feature which is diagnostic of scraping, but not of grinding, is the production of <u>chattermarks</u>, so named by Newcomer (1974,149, Plate 3A-E): these are regular undulations in the bone, perpendicular to the direction of working, and are formed when the stone tool fails to maintain regular contact with the bone surface, but jumps from point to point along the line of work. A related feature consists of little transverse incisions or steps, also made perpendicular to the direction of working, where the stone tool has slipped and dug into the bone. Flint tools are also essential for certain forms of blank modification such as piercing holes, cutting out barbs and for making decorative incisions.

Working with or on a grindstone may produce grouped striations running parallel to the direction of working. The width and depth of the striations, and to some extent their arrangement, is dependent on the quality of the grindstone, that is whether it is coarse- or fine-grained. Facetting may also be produced by grinding if the surface is not evenly worked. Chattermarks are <u>not</u> formed by grinding, as a grindstone makes

regular contact with the bone surface and for the same reason, little transverse steps are not produced either. Grinding may be particularly useful in certain contexts, for example when working a large piece of bone or antler, it is faster and quickly leads to the production of a smooth and regular surface. It can also deal with irregularities in the bone surface more effectively, whereas large ruts may develop when scraping. A heavy polish may be produced by grinding, which may obliterate striations left by the preceding stages of work. During the modification experiments carried out here, I found that damp sand made an effective abrasive for reducing surfaces, and also that the application of fat, which may be derived from the bone itself, to a bone surface when grinding led to the very rapid production of a heavy polish. It is probable that a deliberate polish was applied to a bone tool to give it an attractive finish and this could have been achieved by either scraping or grinding or even by rubbing the bone with a piece of leather, according to what sort of finish was required. It is worth recalling that the process we call polishing may take place either by the removal of surface irregularities by abrasion, or by the application of a substance to fill in the gaps between the irregularities, or even by a combination of both methods.

A blind test was carried out by me with the aid of Nick Barton to identify methods of modification used on six bone and antler needles produced by him for that purpose, using the techniques described above. The results suggested that the outline of the edges and surfaces, that is whether they were regular or whether they showed the undulations typical of scraping, may give one a better clue to the techniques of blank modification used than the shape or arrangement of the striations, the precise nature of which is dependent on the asperities on the grindstone or stone tool.

A further programme of experiments was devised to test whether different types of stone artifacts would leave characteristic traces on a bone surface. Examples of particularly common Upper Palaeolithic stone implements were chosen, even if, like the burins, they are not generally thought of as scraping implements. Each piece was held at an angle of approximately 45 degrees and was used to scrape individual segments of rib bone in a longitudinal direction. The tool types chosen were dihedral burins, end scrapers, retouched blades and backed knives. The traces produced with a metal knife were also tested for comparative purposes. A further comparison was also made with results observed when scraping bone with unretouched flakes and blades. This series of experiments was also repeated some months later, in order to verify the results outlined below.

Scraping

Dihedral burins: a very fine, lightly polished finish was obtained on the bone segment when scraping with the edges of the burin facets. In spite of the polish, the bone surface could still be seen to be covered with very fine, narrow longitudinal striations with little transverse steps, where the stone tool had dug into the bone.

End scrapers: a fairly smooth surface was produced by scraping with the curved, retouched end. At first the striations were very coarse, being wide, deep and undulating, but when the bone was worked a little more carefully, very different results were achieved with much finer, though still quite irregular striations.

This bone proved to be a little less finely worked than that described above, but it would be difficult, if not impossible, to distinguish the two if one did not know how they were worked, particularly in an archaeological context.

Retouched Blades: such a smooth surface was produced by scraping with a straight retouched edge that in certain areas it was difficult to see

any striations. However, where the striations were clearly visible, they proved to be quite irregular and curving; some chattermarks were also visible.

Backed Knife: tiny helical shavings were removed when scraping with an unretouched edge, so as to produce a less smooth and more irregular surface than those described above, owing to greater variation in the depth of the striations. Lots of quite fine, regular striations were visible as well as a few transverse steps where the stone tool had suddenly dug in and stopped.

Metal Knife: this led to the production of a smooth surface with lots of tiny chattermarks in the path of the longitudinal striations in a 'tyre-tread' like pattern. These striations are broad, shallow and irregular, with some facetting of the bone. The metal knife moves across the bone in the same manner as stone tools, but produces more extreme traces as the working edge is so much stronger.

The result of the tests seemed to be that the bone scraped with a burin was the most finely worked example, owing to the quality of the working edge, even though a burin is generally thought of as a boring rather than as a scraping tool. However, I would not claim to be able to distinguish the traces of scraping with a burin from scraping with an end scraper or indeed any retouched edge on an archaeological piece. The greatest distinction appears to lie between scraping with a finely retouched edge and with an unretouched edge, since a strong, regular edge produces a better, more even finish as there are no rough projections digging into the surface of the bone. An unretouched edge, being more brittle, is liable to have fragments break off, creating notches and indentations, which accordingly produce an uneven finish with rough striations varying in width and depth.

Small distinctions between the striations and surfaces produced by these different methods of scraping may also be affected by factors other than the nature of the tool used. These include the degree of force used, for with greater force chattermarks are more likely to be produced, with less force a finer surface may be obtained. The degree of skill on the part of the person using the stone tools may also be an important factor. The condition of the bone and the time taken when working bone should also be taken into consideration. Further variables are discussed by Newcomer (1974,151).

My conclusions were that when scraping, the best results may be achieved by using a short, thick, retouched edge, which is thus both regular and strong. It would seem unlikely that one could confidently identify archaeological bone tools as having been worked by particular stone implements, although it is often possible to tell the difference between a ground and a scraped surface. It is also reasonable to suggest that, if a piece has been finely worked by scraping, then a strong, retouched edge must have been used, whereas if it has been crudely worked, it is more likely that an unretouched piece was used.

Similar experiments have been carried out by others to see if particular stone tools leave characteristic traces on bone. These include the work of Rigaud (1972), Newcomer (1974) and d'Errico et al. (1984). However carefully this interesting experimental work is carried out, there is still the problem of applying the results to archaeological material which may have undergone many processes associated with use and deposition, so that such traces are unlikely to be preserved in ordinary circumstances. As was mentioned above, there are a number of factors which may affect the nature of the traces other than just the type of stone tool. Moreover, a stone tool need not always be used in the same manner: for example, I found that the dorsal ridge of an end scraper could be used

most effectively for scraping a bone surface. Although it is an unretouched edge, its highly obtuse angle prevents it from being brittle. One might also bear in mind that different varieties of flint and chert certainly have different textures which could in some cases affect some of the general points I have made above.

Piercing

I cut out a number of bone and antler needle blanks using the groove and splinter technique, with flints or in some cases with modern metal tools for the sake of speed, and modified them all by scraping. They were then pierced by drilling with flints. The first example was produced by making a small groove in one surface near to the proximal end; this groove was then made progressively deeper using flints with tough triangular points, including two micropiercers, in a circular, clockwise motion. After substantial progress had been made, a matching groove was made in the opposite surface and made deeper by carefully rotating the flint tools in it, until the two depressions met. An eye made like this is roughly hour-glass shaped in profile, though assymetrical, as the part which was extracted from the first surface is deeper than that extracted from the second surface. A further four antler needles were perforated by the same drilling process using six piercers in total. This process is very easy, but care is needed to ensure that the hole is not located too close to one edge. Each example was perforated from one surface and neatened from the other surface, giving it a roughly hour-glass profile. With a little practice, this process takes only a few minutes. Traces of drilling could be seen within all the eyes, which were either circular or subcircular: these traces consisted of helical striations.

Incising

Upper Palaeolithic bone, antler and ivory artifacts appear to have been frequently decorated with grouped incisions, and several examples

will be found among the specimens studied in Chapter 6. In order to replicate this, a reindeer antler tine was soaked and then incised four times transversely using a number of retouched flint flakes. The incisions varied in length from 2.5 to 1.1cm and in width from 0.2 to 0.1cm, while their depth appeared to be about 0.1cm. When I examined the results in detail, I found that each incision was flanked by a number of shallow striations, where attempts had been made to start cutting. All four incisions had bucket-shaped profiles and were covered with fine, longitudinal striations, but no polish. I found it much easier to cut transverse than longitudinal incisions in antler, which was also the case with bone.

Available time only permitted me to carry out one experimental replication of functional incisions. I cut a series of barbs down one side of a reindeer antler splinter which I had produced by the groove and splinter technique. The easiest method proved to be by making transverse incisions in the side at regular intervals; these incisions defined the lower edge of one barb and the upper edge of the next one. Each barb is marked with a few tiny notches on its outer edge, as a result of attempts to make the defining incision to which I have referred. Within each incision, some compressed antler as well as minute striations could be seen. This very limited exercise in replication proved to be very useful when interpreting traces on barbed points in archaeological collections (see Chapter 4: Barbed Points).

(iii) Experimental Work Relating To Use

It should be underlined here that great care is needed to design experiments which are relevant and can thus provide valid evidence in the interpretation of archaeological material. This was certainly easier for the first experimental section, where actual modification could be observed on archaeological pieces, for instance the production of an eye

of a needle, and then replicated and the resulting traces compared with those on the archaeological specimen. By contrast, it is not known for certain in exactly what manner and with which materials Palaeolithic or indeed any prehistoric implements were used. Thus, a lot of time could be wasted in carrying out irrelevant, ill-conceived experiments. When attempting elaborate reconstructions of the function of particular implements, one should also continually bear in mind the actual state of the archaeological material. In the case of those European Upper Palaeolithic osseous implements which I have either studied in detail myself, or have seen on display in museums, the artifacts are rarely complete and often the surface is in a very eroded condition, with the result that it is not only highly improbable that traces resulting from use have survived, but it is even more improbable that they could be distinguished from traces of modification and natural, post-depositional damage.

An experiment concerning the use of an antler wedge is described separately in Chapter 5 in the section dealing with wedge-shaped segments.

An experiment was carried out to test whether bone and antler needles could be used for sewing animal skins, or whether bone awls would have been required to punch holes first, so that the needles could be used to draw the thread through the holes. The materials used in this test consisted of a cleaned and cured rabbit skin, some soft commercial leather which was 1mm thick, two bone needles, three awls made from the rabbit tibiae, and coarse string as a substitute for the animal sinew or plant fibre, which would no doubt have been used as thread during the Upper Palaeolithic.

After having consulted various ethnographic sources (Birket-Smith 1959; Kluckhohn et al. 1971; Lowie 1954) for descriptions of the methods used to work hides, I established that, whatever the particular

techniques used, the skin first had to be cleaned, then cured by the application of a lubricant (such as brains) to keep it supple, and then dried and stretched to prevent it from shrinking. The skin could also be dyed at a later stage (Kluckhohn et al. 1971,203), but I did not concern myself with this.

A rabbit was bought and skinned by my husband. The skin was then thoroughly washed by me in hot, soapy water, in order to clean it and to stop it from smelling; this proved most effective. The various layers of membrane and blood vessel still attached to the skin had then to be removed. A flint side scraper was used most successfully to perform this awkward task, for the thickness of the membrane varied so that in places when it was pulled away using just fingers, the skin would tear. By contrast, the side scraper could be used not only to ease up the edges of the membrane, but also to scrape over the top of it, in order to break up one layer of membrane without damaging the layer below.

Once it was properly clean, the skin was left to dry a little before some duck fat was rubbed into it using a sub-cylindrical piece of fallow-deer antler which had been manufactured for that purpose. The duck fat proved not to contain the necessary lubricants, so a commercial hide polish had to be used instead. As the hide showed no signs of shrinking, no attempt was made to stretch it.

Three awls were made from the rabbit tibiae: these, by nature of their raw material and the techniques used in their manufacture closely resembled certain archaeological specimens, made from hare tibiae, which are classified as Group 2 Points in this study. The right tibia had already been broken towards its distal end, so that all that was required to turn it into a point was to neaten and sharpen its distal end by scraping. The left tibia was complete, though cracked, and so the fused fibula was easily snapped off and then the distal end was removed by a

blow from a hammerstone. It would have been more advisable to remove the distal end by sawing; for the shaft broke obliquely in two, but in fact the distal end of each part could be sharpened by scraping to form two more points.

The awls were used to pierce the rabbit skin, which was easily done, as it is very fine, producing oval-shaped holes with a little flap of skin attached. The awls were then used to pierce the soft leather which was bought for the purpose. It proved to be impossible to punch a hole through the leather with one action which was the case for the rabbit skin, but instead a groove was made by scraping with the tip of an awl, which was then rotated within the groove until it passed through the leather. With a little practice, this became very easy to do, and a row of neat holes could quickly be produced through which the thread could be passed by hand.

The tips of the awls were carefully examined microscopically before and after they were used, but no traces of use were recognised. This may be because the awls were not used for long enough: it is possible that when piercing a thin and supple skin an awl would not encounter any resistant or abrasive material and so it would take a considerable time for any traces of use in the form of wear or polish to build up.

There is ethnographic evidence for this form of sewing without needles among the Plains Indians,

> "The essential clothing was made by women, who sewed with buffalo sinew for thread, punching holes with a bone awl" (Lowie 1954,49).

This may be how Upper Palaeolithic garments were sewn prior to the invention of the needle, which appears to have taken place in the later part of this period (see Needles).

A bone needle made by me was used to sew a line of stitches in the rabbit skin in the usual fashion. Another, much finer bone needle made by James Knight and kindly lent to me by him for study, proved to be even more effective, owing to its much sharper tip. Neither needle could be used to pierce the bought leather on its own, without risking serious damage to the tip. Both needles were very carefully examined both before and after use, but neither needle exhibited any new traces. However, this test did show that both needles and awls could be used separately for sewing quite fine skins, but for thicker and coarser skins the needles could not be very effectively used without the awls.

What is needed is a long-term experimental study of sewing with bone needles and awls and of the traces produced on their surfaces, following up the interesting work carried out by Bouchud (1977). This sort of programme unfortunately lies outside the scope of this thesis owing to constraints on time and money.

The number of published studies relating to function carried out on bone implements is limited and those which may be related to the Upper Palaeolithic are particularly so. These include Bouchud (1977), Campana (1979), Peltier (1986), Olsen (1979,1984) and Arndt (Olsen) and Newcomer (1986). The reasons for the low number of these studies may include the need to carry out a series of experiments over a long period of time, which may be impractical as, unlike for taphonomic studies, the researcher has to be continuously involved in the work to the detriment of other potentially profitable lines of enquiry. This problem was to some extent solved by Campana, who used a mechanical arm to test the long term working of arrow-straighteners and thong-smoothers (see Chapter 5: Perforated Bâtons), although an even more sophisticated device would be needed to sew skins or work hides continuously. This difficulty could be overcome by using a human researcher instead of a machine to spare a little time

every few days over a year to carry out such a task. Such an arrangement would require careful organisation, not least of the raw materials, but would probably provide a more valid comparison with Upper Palaeolithic working techniques than the approaches described above.

The second major difficulty associated with experiments relating to use concerns the application of the results to the archaeological material. As I indicated above, clear experimental findings may prove to be somewhat ambiguous on actual archaeological specimens. It is also to my mind more important at our present state of knowledge to concentrate on reproducing and documenting traces of manufacture, not only because they can reveal a lot of useful information themselves about working techniques but also to help prevent the mis-identification of traces of use.

Chapter 3

The Nature of the Archaeological Evidence

Introduction

In the following three chapters, the corpus of the material that was studied in the preparation of this thesis will be presented. It consists of over one thousand bone, antler and ivory artifacts from seventeen British and thirteen Belgian Upper Palaeolithic sites (figs 3:1 and 2). These artifacts include a number of unfinished examples as well as abandoned pieces of working débris, which will be discussed at the end of the third chapter, with an analysis of the techniques of manufacture that they illustrate. A further sample of working débris, which was too large in number to permit a detailed inspection, will be listed in the inventory under the appropriate site headings. The purpose of the present brief chapter is to show in what order the archaeological evidence is presented and to explain the basis for that order.

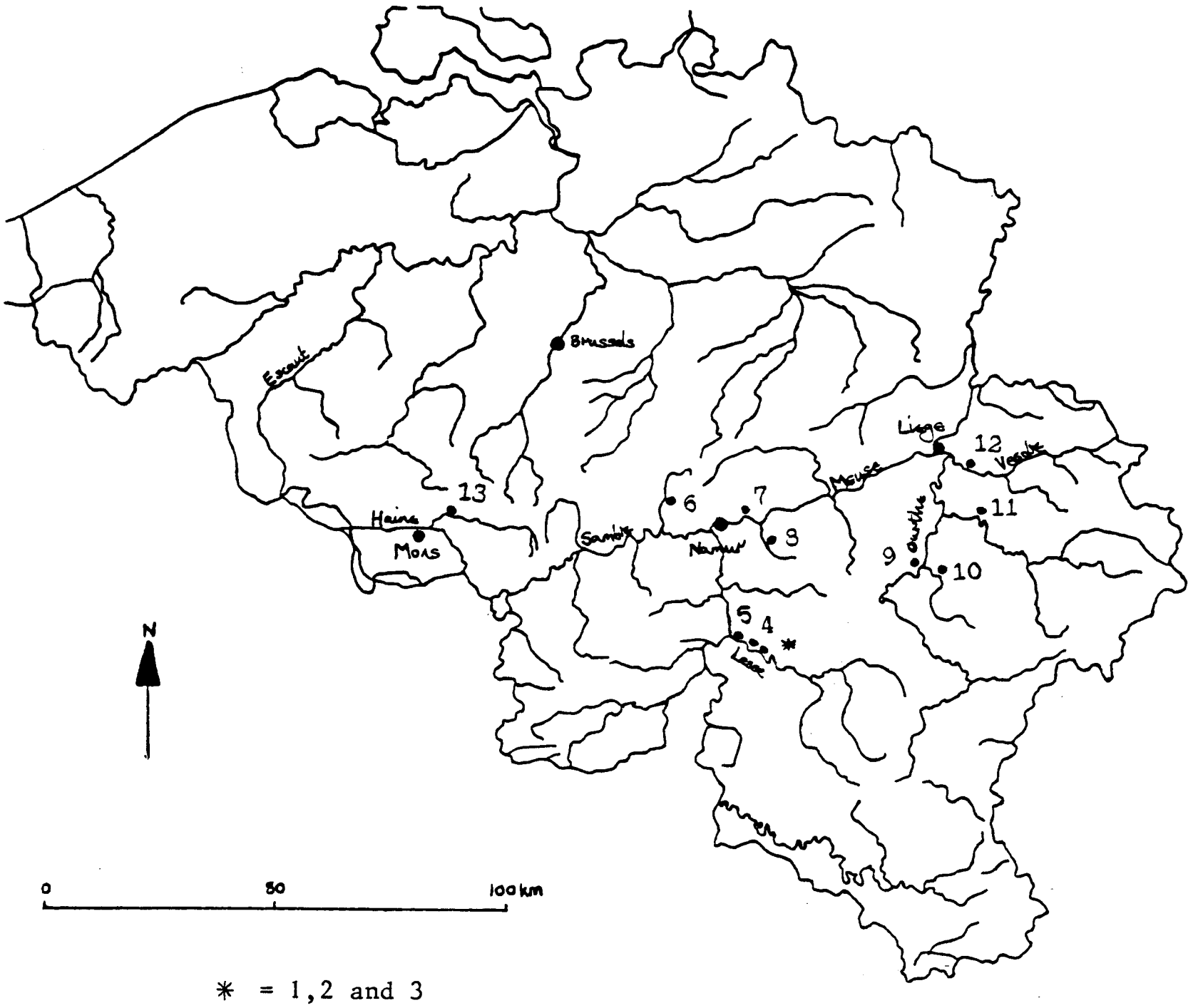
Typology

The artifacts have been ordered into twenty-six broad types (see Appendices 2 and 3) on the basis of their shape and the techniques used in their manufacture. The intention was to produce as simple a bone tool typology as possible, because many of the objects considered here are in either a corroded or an incomplete condition, so that it is probable that characteristic features will have been lost. Therefore, general similarities were looked for rather than minor differences which may have been quite insignificant to the makers and users of the artifacts.



Fig. 3:1 Distribution map of British Upper Palaeolithic sites considered here

1 Paviland Cave 2 Cat Hole 3 Little Hoyle 4 Ogof Garreg Hir
5 Upper Kendrick's Cave 6 Ffynnon Beuno 7 High Furlong
8 Church Hole Cave 9 Pin Hole Cave 10 Robin Hood's Cave
11 Mother Grundy's Parlour 12 Fox Hole Cave
13 Gough's (New) Cave 14 Aveline's Hole 15 Hyaena Den
16 Kent's Cavern 17 Torbryan Caves



* = 1,2 and 3

Fig. 3:2 Distribution map of Belgian Upper Palaeolithic sites considered here

1 Trou du Frontal 2 Trou des Nutons, Furfooz 3 Trou du Renard 4 Trou de Chaleux 5 Trou Magrite 6 Grotte de la Betche-aux-Rotches, Spy 7 Grotte de la Princesse 8 Grottes de Goyet 9 Trou des Nutons, Verlaine 10 Grotte du Coléoptère 11 Grotte de Remouchamps 12 Grottes de Fond-de-Forêt 13 Maisières Canal

Given the state of the material, there may be some overlapping between certain tool types, for example between very narrow Group 4 points and wide needles, but to me it seems of fundamental importance that I should not create minor sub-categories of dubious validity. Subdivisions defined on criteria of consistent technological or typological criteria are quite another matter.

Most of the tool types described here, such as needles, are well-known in the literature concerning the European Upper Palaeolithic. For others, such as antler rods, otherwise known as 'sagaies' (de Sonneville-Bordes 1960,335) or 'antler points' (Campbell 1977:II:14), I have suggested new names, which are thought to be more useful, because they are descriptive of the tool's morphology and/or of the techniques used in its manufacture rather than of implied function. For the same reason, I have adopted alternative current terms such as 'barbed point' instead of harpoon (Hallam et al. 1973) and 'perforated bâton' for 'bâton-de-commandement', along the lines of Leroy-Prost's 'bâtons percés' (1975,138). However, in the case of pins and of needles in particular, it is hard to escape the notion of function, as it is so clearly suggested by details of the tool's morphology, that is heads for pins and eyes for needles.

The emphasis in this study has been deliberately placed on functional artifacts which probably had some everyday use, and are accordingly important for building up a picture of the activities carried out by Upper Palaeolithic communities and of the tools and techniques that they used. However, decorative objects have not been neglected, for they clearly form an important part of the osseous artifact assemblage.

In the following three chapters, the appearance of the various pieces and the traces of working and of use on their surfaces will be described and interpreted, in order to suggest how they were made and used. As will be seen, the traces of manufacture are much easier to identify and

interpret than are traces of use, so that interpretation of function still has often to be based on evidence from experimental replication and ethnographic analogy. The geographical and chronological distribution of each tool type is considered, but this is often hampered by an absence of contextual (and thus chronological) information. For this reason, it has proved important to seek good parallels for such artifacts in the rest of the European Upper Palaeolithic, within the constraints of the time available to me.

The various tool types have been arranged into three groups, each corresponding to a chapter, with the section on working débris placed last. The first group consists of points and rods, including the barbed points and all the various categories of pointed implement with the exception of needles and pins. Antler and ivory rods have also been placed in this group, because it is clear from the West European material in general that they were often pointed at one end, though they were fragile and because of breakages, this feature is not always preserved. If some of them were originally blunt-ended, there is absolutely no way of telling in the case of a broken specimen. A careful consideration of their shapes and of the traces of working on their surfaces suggested that some of these pieces, for example barbed points and split-based points, were designed to be projectile heads, whereas others such as Groups 1, 2 and 3 points appear to have been intended for hand-held use.

The second group consisted of functional objects, other than the various classes of point, which are also interpreted as being for hand-held use. These tool types consisted of pins, needles, bone segments with polish, wedge-shaped segments, perforated antler bâtons, whistles and spatulae. These implements must have been associated with a wide range of the activities carried out by the communities studied here, and the group is a deliberately broad one for convenience of presentation.

The third group consists of objects which have been identified as being primarily decorative. They include perforated ivory discs, ivory rings, pendants of various forms, perforated bone fragments, perforated shells, perforated teeth, various kinds of beads, pieces with incised decoration and a few examples of representational art. The various types of working débris which I have identified are described in that same chapter.

So as not to overburden the text, further information about the various sites which are considered in this thesis is presented in an inventory, which forms an appendix to the main text (Appendix 1). The inventory contains not only a description of each site and information about the relevant publications, but also a list of the osseous implements from each site which were studied in detail in the preparation of this thesis.

The Sources of the Archaeological Evidence

It is important to note that most of the Belgian and British worked bone available for study comes from nineteenth century excavations, such as those of Pengelly at Kent's Cavern and those of Dupont at the caves of Goyet, Magrite, Chaleux, Frontal and Nutons. These assemblages necessarily constitute a very important part of the corpus considered here and so it is most unfortunate that these rich and interesting sites could not have been excavated and recorded using modern techniques and to the highest modern standards. However, it should be appreciated that both Pengelly and Dupont were very scrupulous excavators for their time and that some of the later, twentieth century excavations of sites considered here actually show an unforgivable decline in standards. As the inventory shows, very little recently excavated material has been included for

discussion here; this is largely because major excavations of Upper Palaeolithic sites in the region of this study with good or even adequate preservation of bone rarely take place nowadays, a state of affairs explained both by modern financial constraints and by the fact that such sites are infrequently found. The chance that intact examples remain undiscovered, having survived the depredations of early excavators and of both modern and nineteenth century quarrying and construction seems a small one, but I certainly would not rule it out. Meanwhile I can only regret the quality of information relating to the pieces I studied, and seek to make the best I can of them.

Most of the material described here comes from Belgian rather than from British occupations; indeed certain particularly abundant Belgian sites such as Chaleux, Goyet or Spy have each yielded many times the total number of surviving osseous artifacts attributed to the whole Upper Palaeolithic occupation in Britain. This could either be a true reflection of the Upper Palaeolithic habitation record in the region as a whole, or it may be attributed to other factors. It is possible that more Upper Palaeolithic material has yet to be found in Britain either in caves which have yet to be explored, if any exist, or on open sites. In Belgium, the open site of Maisières Canal with its fascinating stone and bone industries, which radically changed the overall appearance of the Upper Palaeolithic in that region, was only discovered about twenty years ago, many years after the 'classic' sites such as Spy and Goyet had been found.

However, the notion that in Britain only small amounts of worked bone were originally deposited is supported by the fact that even the most abundant sites there, such as Paviland, or the Creswell and the Mendip caves (for example, Gough's Cave or Aveline's Hole) did not produce substantial bone artifact assemblages of the Belgian kind. It could perhaps be suggested that early British excavators were less competent

than their Belgian counterparts, though I rather doubt this and even if it were so, they could hardly have overlooked an abundance of worked bone like that found at Spy. Again, in general, the preservation of both surviving worked bone and faunal and human remains does not seem to be particularly poor in Britain compared with that observed in Belgium, to the extent that it could account for the relative paucity of British bone artifacts.

Other factors to do with the post-excavation treatment and storage of the artifacts are relevant to this discussion, though in themselves they cannot explain the great difference in numbers of bone artifacts. Many of the Belgian Upper Palaeolithic osseous artifacts are housed in two main museums; these are the Musées Royaux d'Art et d'Histoire and the Institut Royal des Sciences Naturelles, both of which are in Brussels. The reason for this is partly that many major excavations were led by teams from those institutions, but also other excavators have been persuaded to donate or sell their collections to these museums. This makes it less likely that collections will have been lost than if they were scattered throughout the country in local museums or private collections, as is the case for Britain. The gathering of a substantial body of such material in one place is also very helpful to researchers. Furthermore, certain British artifacts are known to have been destroyed during the Second World War; these include all the worked bone and antler as well as the perforated shells from Aveline's Hole, which formed part of the collections of the University of Bristol Spelaeological Society.

In the present state of research, it seems entirely probable that the variation in the distribution of finds is indeed a true reflection of the Upper Palaeolithic. It is possible and indeed likely that only small scale, temporary occupations of Britain by hunter/gatherers took place from more regular bases on what is now the Continent. The fairly large

accumulations of stone tools recovered at certain British sites such as Paviland and Gough's Cave (Campbell 1977:1:7-8) may be explained by many generations of short-term visitors having occupied these caves. This is not improbable, given the vast timescale we are dealing with. It is of interest to consider whether the nature of the osseous artifacts and the working débris from both the British and Belgian sites might suggest whether implements were actually manufactured on every site, or whether there were particular workshops from which finished artifacts were exported. This is why the study of bone, antler and ivory artifacts presented here is relevant not merely to understanding the techniques of production used on particular artifacts, but also to any attempt to establish the nature of the activities carried out by the relevant Upper Palaeolithic communities; indeed, it may shed light on the very nature of human settlement in Britain and Belgium during the Late Glacial period, and the relationship between the two areas.

In order to begin to study this question, it is necessary to consider briefly the known cultural and chronological sequence in the research area, starting with a definition of the Upper Palaeolithic period in Europe.

Chronological and Cultural Sequence

The beginning of the Upper Palaeolithic period in Europe is conventionally linked to the appearance there of anatomically modern man Homo sapiens sapiens during the Last Glaciation, approximately 35-40 000 years ago. This was associated with the general spread of a blade-using technology, which is believed to have evolved from the Mousterian (Wymer 1982,181). This technology is also characterised by the first appearance of the regular use of bone, antler and ivory as raw materials. The period

ended with the marked improvement in climatic conditions, which followed the retreat of the last ice sheets from Northern Europe, approximately 10 000 years ago.

There are a substantial number of occupation sites dating from this period in Britain and Belgium, which prove that these areas were settled during the second half of the last glaciation. However, the nature, duration and continuity or otherwise of this occupation have yet to be determined. The interpretations of the Upper Palaeolithic material from Britain and Belgium by various authorities, starting with Garrod in 1926, are laid out in Tables 3:1 to 3:4. They show that there appears to be general agreement (allowing for differences in terminology over some 60 years) on the nature of the cultural sequence, which is clearly very similar in Britain and Belgium. However, there is disagreement about whether the occupation of North West Europe was episodic (Jacobi 1980) or continuous (Campbell 1980,1986) during this period.

This fundamental difference in interpretation is particularly important when the Last Glacial Maximum is considered, that is the period from 20 000 to 15 000 years BP (as defined by Campbell 1977:1:37), when the ice sheets covered most of Britain but not Belgium (fig.3:3). Previously, Campbell (1977:1:99) proposed that there was a hiatus or gap in the settlement at this time, which separated his Earlier from his Later Upper Palaeolithic industries. However, more recently (1980,1986), Campbell has argued that human groups were likely to have continued to occupy or visit that part of their territory, which was not actually covered by ice, in an uninterrupted fashion. This view (1986,8-10) was influenced by the results of his studies of adaptations made to various environments by Australian hunter/gatherers.

By contrast, Jacobi (1980,28) suggested that most of North West Europe, including Holland, Belgium, Northern France and Britain was free

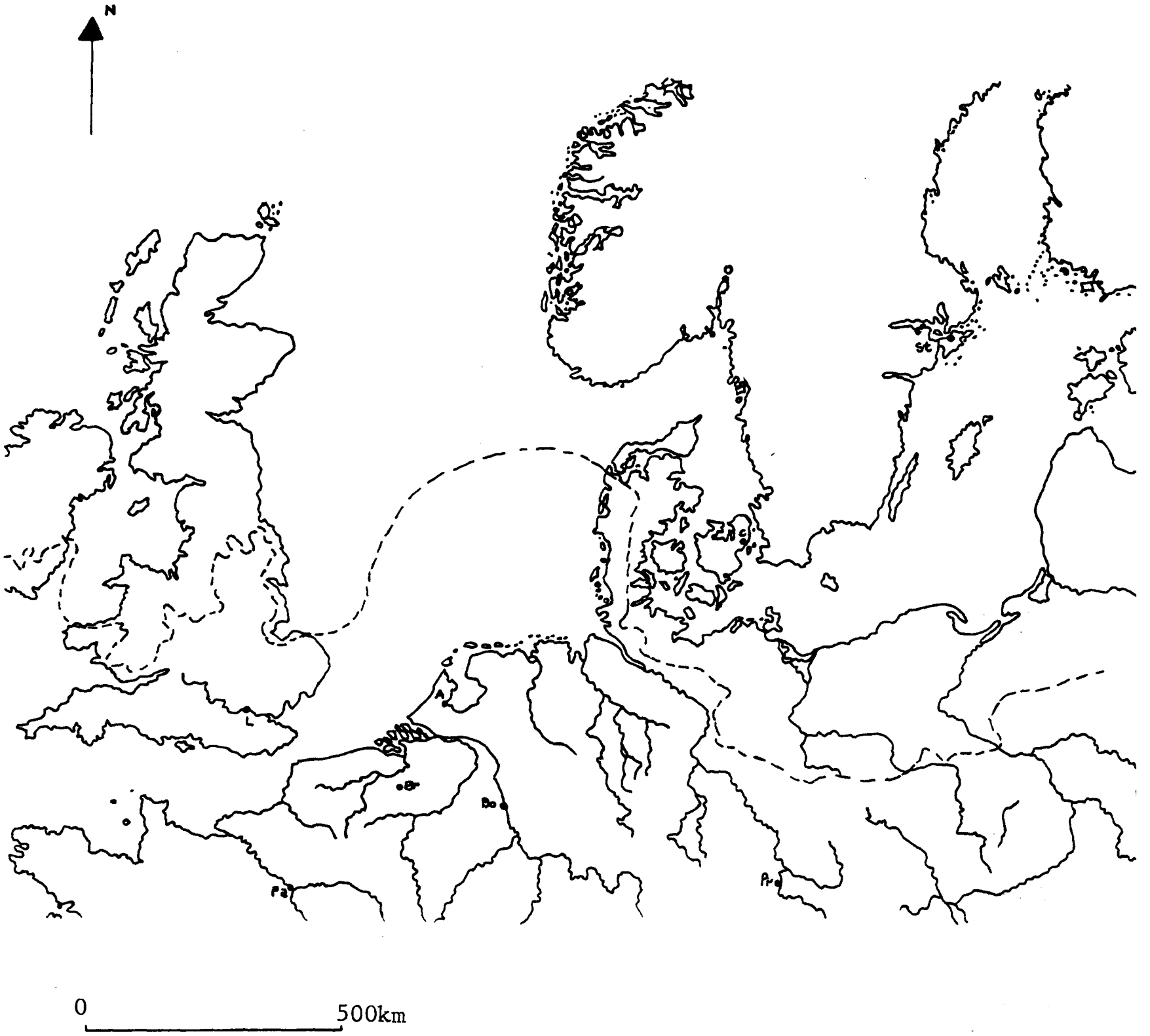


Fig. 3:3 Map showing the extent of the Last Glacial Maximum in Northern Europe, after Haesaerts (1984,23)

Table 3;1 British Upper Palaeolithic Cultural and Chronological Sequence;
1926 - 1977

*Garrod (1926)		Campbell (1977)/Wymer (1977)		Dates Years BP
(Lower;(?)Paviland				
(Middle;Paviland				
(	Kent's Cavern			
(	Ffynnon Beuno			
(	Cae Gwyn	Earlier Upper Palaeolithic;-		
Aurignacian(Upper;	Paviland			
(	Creswell	Leaf Points		c34-28 000
((?)Cat's Hole				
(Proto-Solutrean;		Aurignacian		- c18 000
(	Paviland			
(	Kent's Cavern			
(	Creswell			
(	Ffynnon Beuno			
		Gap in Settlement Owing to Glacial Maximum		c20 000 - c15 000
Solutrean (	Creswell Crags	Later Upper Palaeolithic;-		
Magdalenian (	Creswell Crags			
with (	Kent's Cavern	Backed Tools		c14 500
important (	Aveline's Hole			
Aurignacian (	Cheddar	Creswell Points(		
survivals (	Victoria Cave		(Creswellian	
('Creswellian')		Penknife Points(		- c10 000

* only selected sites are listed here

Table 3:2 Belgian Upper Palaeolithic Cultural and Chronological Sequence: 1961-1986

de Sonneville-Bordes Chronology (1961)		Otte (1984)	Dates Years BP	Dewez (1981,1986)	Dates Years BP
		Leaf Points (Spy, Goyet	c35 000 - c33 000	Lincombian	c39 000 - c28 000
Typical Aurignacian (Fond-de-Forêt, Spy (Goyet	First Part Of Würm III	Aurignacian (Spy, Goyet (Marche-les-Dames (Trou Magrite	c31 000 - c25 000	Aurignacian	c32 000 - c27 000
Upper Perigordian/ Gravettian (Goyet,Spy		Upper Perigordian/ Gravettian (Maisières, Trou Magrite (Goyet, Spy	c28 000 - c24 000	Maisierian/ Upper Perigordian/ Gravettian	c28 000 - c22 000
Gap in Settlement Owing to Glacial Maximum	End of Würm III Würm III/IV Much of Würm IV	Gap in Settlement Owing to Glacial Maximum		Gap in Settlement Owing to Glacial Maximum	
Upper Magdalenian (Chaleux, Goyet (Frontal, Nutons	End of Würm IV	Magdalenian	c14 000 - c12 000	Magdalenian	c14 000 - c12 000
		Creswellian	c13 000 - c10 000	Creswello-Tjongerian	c14 000 - c10 000
		Tjongerian	c13 000 - c10 000		
		Ahrensburgian	c10 000	Ahrensburgian	c10 400

Table 3;3 British Upper Palaeolithic Cultural and Chronological Sequence: 1980-1986

Campbell (1980,1986)	Dates (1986) Years BP	Jacobi (1980)	Dates (1980) Years bc
Lincombian	c38 000	Leaf Point Technology	c36 000
(Kent's Cavern		(Kent's Cavern	
(Paviland Cave		(Paviland Cave	
(Pin Hole Cave		(Pin Hole Cave	
(Robin Hood's Cave -	c28 000	(Robin Hood's Cave	
Aurignacian	c30 000	Aurignacian Technology	c31 000
(Kent's Cavern		(Kent's Cavern	
(Paviland Cave		(Paviland Cave	
(Ffynnon Beuno -	c27 000	(Ffynnon Beuno -	c28 000
Maisierian	c28 000	Upper Perigordian	c26 000
(Kent's Cavern		(Gravettian) Technology	
(Paviland Cave		(Kent's Cavern	
(Pin Hole Cave		(Paviland Cave	
(Robin Hood's Cave -	c22 000	(Pin Hole Cave	
Creswellian:			
'ProtoCreswellian'	?c25 000		
(Kent's Cavern (?)			
(Robin Hood's (?) -	c20 000		
Lower Creswellian	?c20 000		
(Kent's Cavern		Gap in Settlement	
(Pin Hole Cave -	c15 000	Owing to Glacial	
Middle Creswellian	?c15 000	Maximum	
(Kent's Cavern			
(Gough's Cave -	c12 000		
Upper Creswellian	c12 000		
(Paviland Cave			
(Cat Hole -	c11 000		
Final Creswellian	c11 000		
(Aveline's Hole		Federmesser Technology	c9 500
(King Arthur's Cave -	c10 000	(Kent's Cavern	
		(Gough's Cave	
		(Aveline's Hole	
		(Creswell Caves	

Table 3:4 Belgian Upper Palaeolithic Cultural and Chronological Sequence: 1980-1986

Campbell (1980,1986)	Dates (1986) Years BP	Jacobi (1980)	Dates Years bc
Lincombian (Goyet, Spy	c38 000 - c28 000	Leaf Point Technology (Goyet, Spy	Between c30 000 and c40 000
Aurignacian (Spy, (Trou du Renard	c32 000 - c27 000	Aurignacian Technology (Spy (Trou du Renard	?c30 000 - c25 000
Maisierian (Maisières (Goyet, Spy	c28 000 - c22 000	Upper Perigordian/ Gravettian Technology (Maisières, Spy	c26 000 - ?
Creswellian:			
'ProtoCreswellian'	?c25 000 - c20 000	Gap in Settlement Owing to Glacial Maximum	
Lower Creswellian	?c20 000 - c15 000		
Middle Creswellian	?c15 000 - c12 000		
*(Presle			
Upper Creswellian	c12 000 - c11 000	Magdalenian (Verlaine	c12 000
Final Creswellian	c11 000 - c10 000	(Coléoptère	- c11 000
		Federmesser Technology	c10 000 - c9 000

* The Grotte de Presle (Hainaut) is not considered in this study, but it appears here, as it is considered to be the principal Creswellian site in Belgium (Campbell 1986,27).

of human populations during the time of the Last Glacial Maximum and that the settlement of Britain was episodic during the whole of the Upper Palaeolithic.

Both Campbell and Jacobi seem to have observed the archaeological material in a similar fashion, in that they each independently produced a sequence of the same four types of technology, which differ only in detail. However, their different hypotheses for the nature of the Glacial occupation of North West Europe led them to make very different interpretations of the material and of the dating evidence available to them.

What is required to solve this problem is a greatly expanded programme of radiocarbon dating, in order to produce whole series of reliable dates directly related to Upper Palaeolithic occupation levels, which will indicate when these areas were occupied by human populations. In particular, securely dated archaeological material from the Glacial Maximum is what would be needed to prove that Britain and Belgium were occupied during this period. So far one date has been obtained from the 'Red Lady' skeleton from Paviland which falls within this period, that is 18 460 ± 340 years BP (BM-374) (Campbell 1977:II:19), but this is only an isolated example which needs to be checked by attempting to obtain another date from the skeleton, and I understand that negotiations to obtain new readings are now in hand.

Since this new dating evidence has yet to appear, I propose in this study to return in broad outline to Campbell's (1977) simple and attractive framework of an Earlier and a Later Upper Palaeolithic period, and to apply it to both Britain and Belgium. The earlier period would include the early leaf-point industry (which Campbell has termed 'Lincombian'), and the Aurignacian, as well as Gravettian/Maisierien/ Perigordian Va type technologies (see Campbell 1986), as found in Britain

and Belgium. The radiocarbon dates for these industries appear to fall approximately between 36 000 and 20 000 years ago (Campbell 1977:II:19; Gilot 1984; Jacobi 1980). There is no evidence to suggest that occupation during these ten millennia was continuous in either Britain or Belgium. The Glacial Maximum provides a useful division between the Earlier and the Later Upper Palaeolithic. It should be recognised that during this time climatic conditions must often have been particularly unfavourable to human occupation and that this may have led to substantial movements away from North West Europe. It is also possible that human groups also abandoned these regions for long periods earlier in the Upper Palaeolithic.

The Later Upper Palaeolithic in Britain is represented by various 'Creswellian' industries, while the same period in Belgium seems to have included a complex of contemporary Creswellian/Tjongerian and Magdalenian industries, the relationship between which is most uncertain, followed by an Ahrensburgian technology. In Britain there are no classic Magdalenian sites, and the Ahrensburgian is also unknown. The available radiocarbon dates suggest that Late Glacial occupation may have begun during the thirteenth millennium BP in Britain (Gillespie et al. 1985; Gowlett et al. 1986, 1986 ,1987) and the fourteenth in Belgium (Gilot 1984). A much earlier date of 16 270 ± 230 years BP (Lv-1385) included by Gilot (p120) from the Trou des Blaireaux, Vaucelles, is not relevant because, as Dewez has indicated (1986,227), it does not appear to have been associated with human occupation. In both countries, an interesting cluster of dates is emerging at around 12 000 BP. The one radiocarbon date for the Ahrensburgian in Belgium comes from the Grotte de Remouchamps and is 10 380 ± 170 years BP (Lv-535) (Gilot 1984,121). This will serve at the present time to provide a lower age limit for the Upper Palaeolithic and thus, for formal purposes, for this study.

This concludes the description of the chronological and cultural framework for this study, and now the various tool types will be considered in some detail, beginning with the points and rods.

Chapter 4

The Artifacts: Points and Rods

Introduction

As was stated above (Chapter 3), all the artifacts considered in this study have been placed into various categories (see Appendices 2 and 3), which are presented here, for the sake of convenience, in three groups. This chapter contains a full description of the first of these groups, which consists of the points and rods, including the barbed points and all the various categories of pointed implement with the exception of needles and pins. The antler and ivory rods have also been placed in this group, as they were often pointed at one end. This chapter also includes brief descriptions of two pointed artifacts, believed to have been parts of projectiles, but for which there is not sufficient contextual evidence to place them in any of the categories established here. Because they are both interesting pieces, they appear here as footnotes to the main text (see below).

Group 1 Points

These artifacts are made from whole bones which have been split in two longitudinally and then worked to a point at one end, one of the articular ends having been removed. The remaining articular end provides the proximal end of the piece in the form of a convenient handle (fig.4:1). These tools are termed Group 1 points in this study and are equivalent to Camps-Fabrer's 'Poinçon pris sur os fendu longitudinalement. Poinçon type III', identified by her among the Epipalaeolithic and Neolithic osseous artifacts of North Africa (1966,167). This same tool type was also recognised by Desse in the European Neolithic (1977,241). Such pieces

were also identified by Olsen in collections of bone artifacts made by the Pueblo Indians of Arizona (1984,266). Group 1 points are a common feature of the French Upper Palaeolithic, where they have been joined together with the Group 2 points by Leroy-Prost (1975,134) and termed 'poinçons à base en epiphyse'. Thirty-three examples of this type have been recognised in the British and Belgian Upper Palaeolithic collections studied here, and their distribution is given in Table 4:1 below.

Table 4:1
Number and Distribution of Group 1 Points

Site Name	With a surviving articular end	Without	Total
Ogof Garreg Hir	-	1	1
Robin Hood's Cave	1	-	1
Kent's Cavern	2	-	2
Torbryan Cave	1	1	2
Pin Hole Cave	-	1	1
Grotte de Goyet	5	8	13
Trou Magrite	3	2	5
Grotte de Spy	-	5	5
Grotte de la Princesse	-	1	1
Trou des Nutons	1	-	1
Grotte de Coléoptère	-	1	1
Totals	13	20	33

When the methods of manufacture of these points were studied here, it appeared that the original bones had been split by longitudinal sawing, as diagnostic traces of this process could be seen mainly on the inner edges of these pieces. This type of point usually seemed to have been modified by scraping, which sometimes resulted in a glossy or polished finish to the piece.

Traces of use were looked for on these artifacts but with only limited success, which is to be expected with such damaged and often fragmentary pieces. Certain examples were identified which showed some form of modification, usually to the tip, which could have been associated with use, though with what particular kind of use, it is impossible to say. Ethnographic evidence provides some useful hypotheses, which may to some

extent be supported or rejected by experimental replication, though no conclusive proof can be obtained by using these methods. It is suggested that at least some of these pieces could have functioned as awls to perforate skins when sewing, or else as basketry awls to help separate stitches.

Group 1 points appear to have a wide geographical distribution throughout the area being studied, and the little dating evidence available seems to indicate considerable chronological distribution as well. This is to be expected as this is not a particularly specialised type of artifact, and indeed similar pieces appear wherever bone is regularly modified, some examples of which are given above.

Manufacture

Most of these pieces have been made from small limb bones, while two examples have been made from phalanges and one from a possible vertebra fragment.

(i) Débitage

Traces of débitage were identified on the inner edges of these pieces and sometimes on the sides as well: they consist of a combination of longitudinal striations, facets and chattermarks. These three features were not necessarily all present in every case. The location of such traces on the inner edge of the bone is characteristic of longitudinal sawing, which I have successfully replicated experimentally (see Chapter 2). It is an economical way of producing a bone blank for a point with a relatively large proximal end. On several pieces, traces of unsuccessful attempts at longitudinal sawing may be seen, for example on Goyet 94, deep longitudinal incisions may be seen alongside the edges of the lower part of the piece, while on the proximal end of the point from Robin Hood's Cave there are a few deep, longitudinal cuts (fig. 4:1).

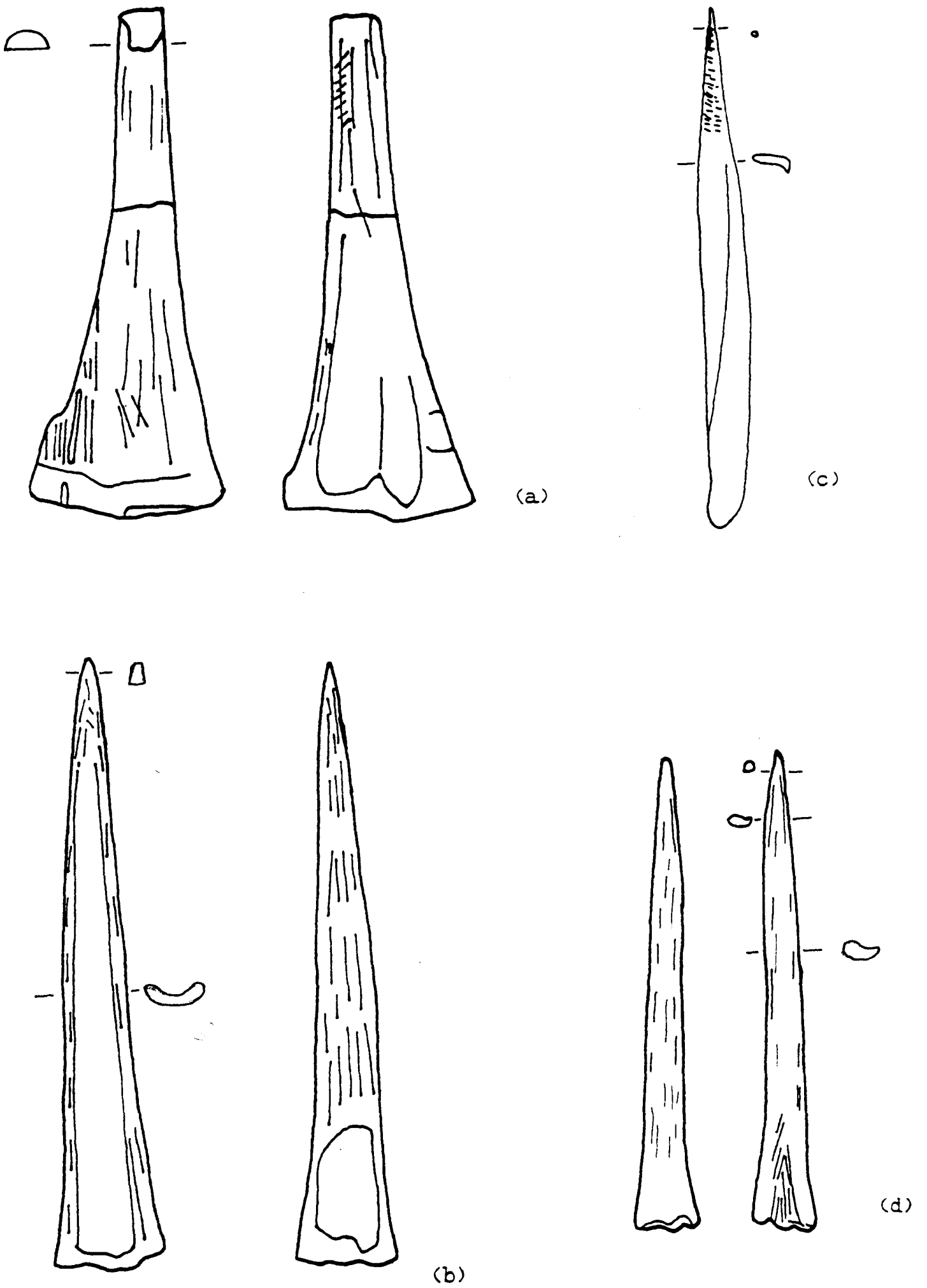


Fig. 4:1 Group 1 Points: (a) Robin Hood's Cave 1
(b) Kent's Cavern 9
(c) Goyet 68
(d) Kent's Cavern 8

At some stage, one of the articular ends must have been removed from the bone. From my own experience, I would suggest that it would be require less work to remove one end by sawing transversely prior to sawing the rest of the bone in two longitudinally. On Goyet 55, there are two, deep, transverse incisions just over 0.5cm from the present distal end, which may have been markers for the removal of that articular end, which were clearly disregarded. The presence of a group of deeply incised, longitudinal incisions on the upper surface of the piece near to one side also suggests that a much smaller blank was marked out on the piece than that which was actually produced.

(ii) Modification

In order to study the surviving traces of modification on these pieces more closely than is possible with a handlens, casts were made of eight specimens, which were studied in the SEM and/or under the light microscope. In this way, it could be seen that the traces of modification usually consist of longitudinal striations, facets and chattermarks, which cover much of the upper surface of the artifact and both surfaces of the tip. Such traces are characteristic of scraping a bone surface with a stone tool. The lower surface is also sometimes modified, but less often than the upper surface. Striations are occasionally visible in the marrow cavity, for example on Kent's 9 (fig. 4:1) and Torbryan 2; these probably result from the cleaning out of the bone, including the removal of the marrow, with a stone tool. Traces of working were recorded photographically on Kent's 9 (Plate 4:1).

Seven of the artifacts studied in this group appeared to be uniformly polished and this was probably a deliberate manufacturing polish made by careful scraping. Of these pieces, Pin Hole 10 was particularly finely worked. A more localised polish was identified on a number of other pieces, which requires more caution in interpretation. In four cases, this

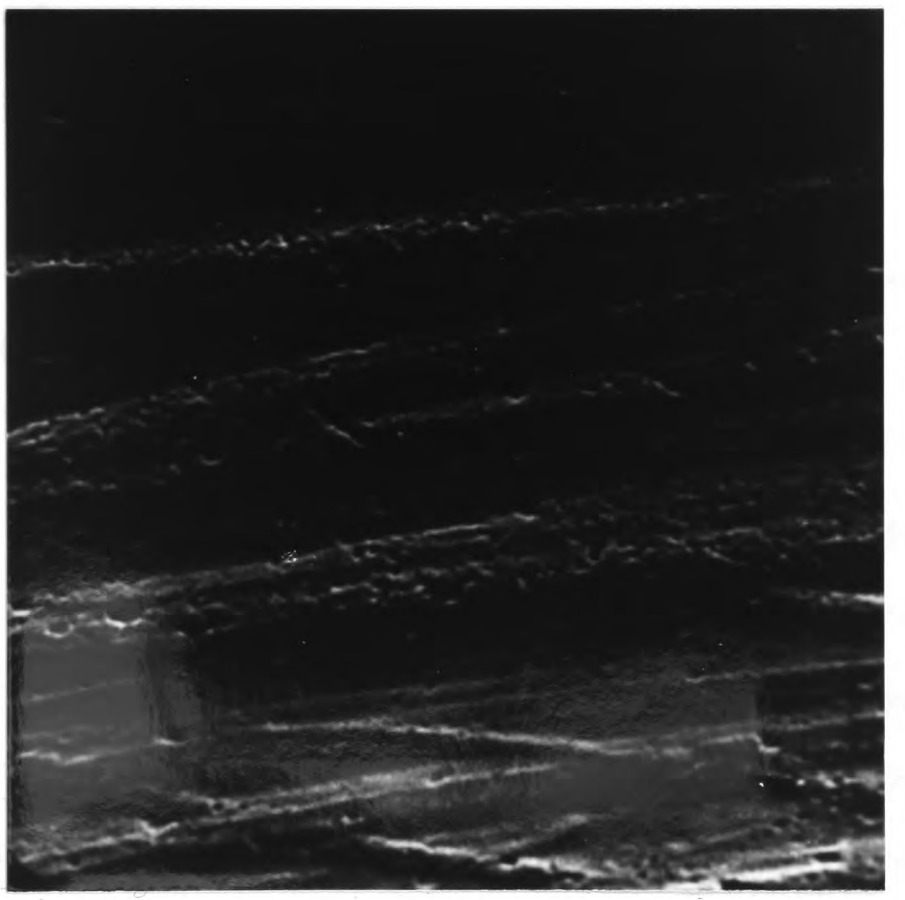


Plate 4:1 Traces of modification on the outer surface of Kent's Cavern 9 (x49) (SEM photograph)

polish is closely linked with traces of modification and therefore seems likely to be a feature of manufacture: these pieces are Robin Hood's 1, Nutons 6, Goyet 74 and Spy 20. On the last named, the polish is confined to the upper surface of the tip, which is where most modification has taken place. Likewise, Goyet 74 has a polished tip, but it has been particularly heavily worked. Magrite 57 is another doubtful case, because it is possible that its polished tip may have come about through post-excavation, conservation techniques. However, there are a number of pieces on which localised polishes, which may be associated with use, have been identified (see below).

Particularly interesting traces of modification may be seen on a number of pieces, including Goyet 68, the distal end of which is covered with longitudinal facets, which are cut by lots of tiny, transverse and oblique incisions (fig. 4:1). The longitudinal facets appear to be associated with scraping, which was how the rest of the upper surface was worked. In order to determine the nature of the modification represented by these little incisions, a silicone rubber cast of this area was made and examined in an SEM. It appeared that these little incisions probably represent the individual strokes of a stone tool. Similar traces could be seen on the distal ends of two Group 4 points (see below). On the outer surface of Kent's 8, there are such irregular, longitudinal striations, that it must have been worked by scraping with a rough-edged tool or else ground on a coarse-grained grindstone (fig. 4:1).

A series of transverse incisions may be seen along the outer surface of Coléoptère 21 (fig. 4:2), which are seventeen in number and appear to be arranged as follows : 2 2 1 2 2 2 5 1. The last two figures could have been one group of six. These incisions are not very regularly spaced and look like the casual 'doodling' on bone, which seems to be typical of the

Magdalenian period in Belgium, to which this piece belongs (see Chapter 6: Incised Pieces).

A number of Group 1 points may have been broken before they were completed. One piece which was clearly unfinished when broken was Trou des Nutons 6. For along one of its sides, there is a clear ridge where the inner, cancellous tissue was broken off during débitage and which has not been subsequently neatened. The inner edges of Torbryan 1 have not been worked either, which suggests that it too was unfinished. There are also several pieces where the proximal end has not been neatened after debitage, such as Goyet 36 and 37, but this may not always have been thought necessary.

Function

(i) Traces of Use

It is generally difficult to differentiate traces of use from the many, often complex traces of manufacture. Only three pieces in this category have complete distal ends; the others have been broken during manufacture, use, deposition or even excavation, such as the Robin Hood's point (Boyd Dawkins, 1877, 592).

Certain pieces, however, show polishes which may well be related to use. On the point from the Grotte de la Princesse (fig. 4:2), all the worked areas are lightly polished, but there is a particularly heavy polish on the proximal end of the upper surface, which may result from regular handling with greasy fingers or from holding the artifact within a piece of hide. A very heavy polish was also visible on the proximal end of the point from Ogof Garreg Hir (fig. 4:2), but as this was on a very rounded, natural-looking end with few traces of working visible, it may have been a result of post-depositional, chemical alteration. The tip of Goyet 82 is highly polished, even though it does not appear to have been

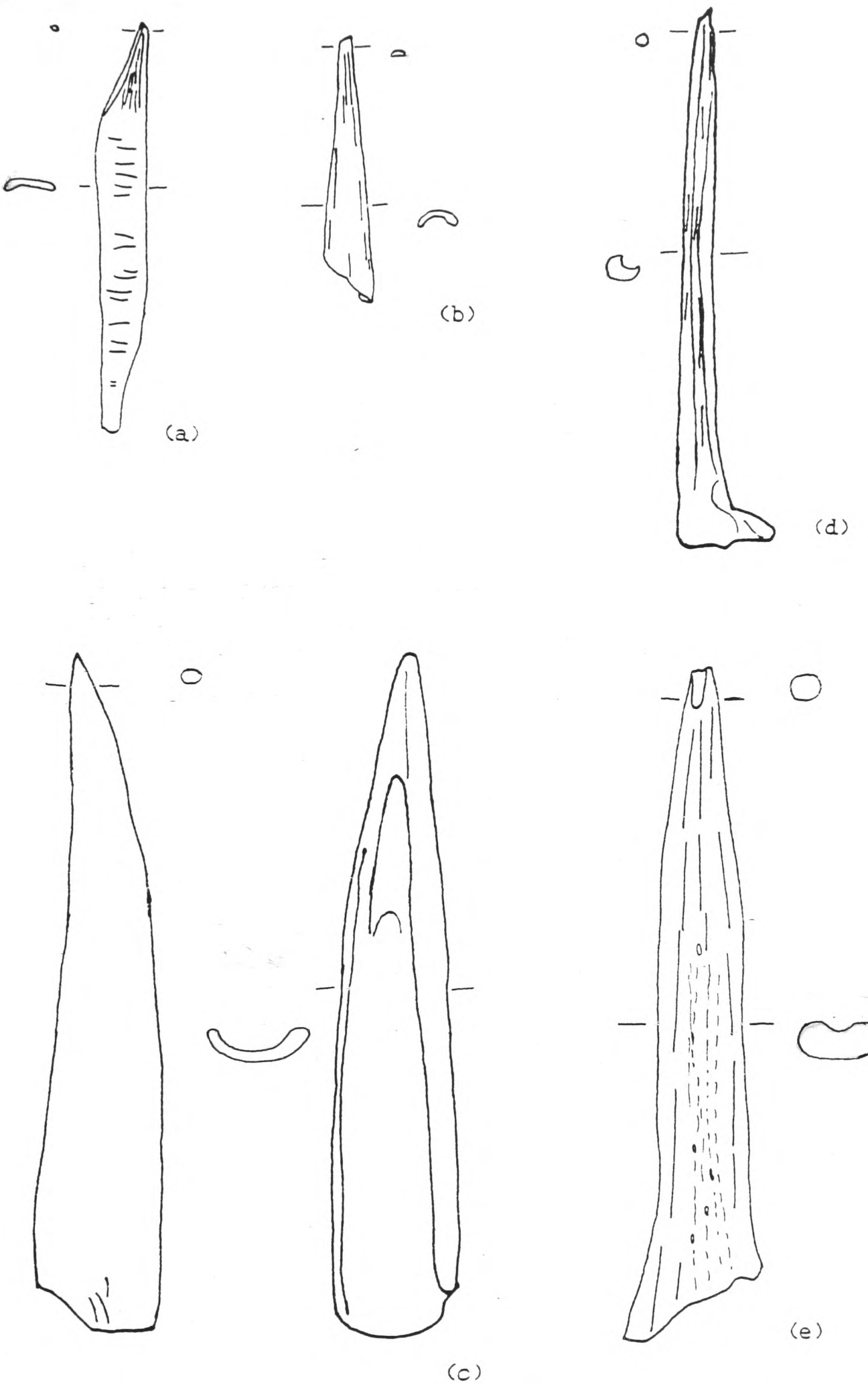


Fig. 4:2 Group 1 Points: (a) Coléoptère 21
(b) Grotte de la Princesse 1
(c) Ogof Gárreg Hîr 1
(d) Goyet 4
(e) Goyet 44

particularly heavily worked, which may indicate that the polish resulted from use, though on what material is unknown.

In two cases, Magrite 29 and Goyet 68, the distal end does appear to be worn, i.e. traces of manufacture on the tip appear to have been obliterated. However, in the case of Magrite 29, it is possible that that this may be a result of careful modification of the tip, which has erased previous, cruder traces of working. This feature was recognised on Goyet 68 under observation in the SEM, where the traces of modification were seen to dwindle away just before the very end of the tip. Even if these were genuine traces of use and not an effect created by the microscope, it would still be impossible to determine the material on which this piece was used.

(ii) Use

As little information about their use could be derived from the study of the traces on the surfaces of the Group 1 points, other sources of information have to be looked for. The actual shape of these artifacts is suggestive, for these pieces usually have a narrow, pointed, distal end with a wide proximal end and so are not streamlined for flight. Thus, they are more likely to have been used while held in the hand. This means that probable functions to be considered include use as awls or as pins, deliberately making use of the articular end to provide the head of the pin, for example Goyet 4 (fig. 4:2).

Ethnographic records may also provide useful ideas, for example as was discussed in Chapter 2, awls were used instead of needles for sewing by the Plains Indians, and this technique was successfully replicated in the present study, though the replica awls acquired no use traces thereby. Eyed needles in the South West of France are known to have dated from the Solutrean (Stordeur 1979,39) and there seems to be no reason to suggest that they were invented any earlier in the region of this study (see

Chapter 5: Needles). It is assumed that skins were sewn during the Earlier Upper Palaeolithic (and doubtless earlier) to make clothes and tents, or skin coverings for structures, and for these tasks awls may have been used in the same manner as that described ethnographically.

Clark (1974,110) has recorded that the awls used by the Koniag Eskimo fulfilled a variety of functions, including perforating hides, bark and thin wood for sewing, and basket making. It is possible that Group 1 points may also have been used as basketry awls. Useful information about this activity has been documented among the Indians of Arizona, from both historic and modern contexts. An experimental study of the necessary techniques was carried out by Olsen,

> "of the three basic types of basketry, i.e. coiled, twined and plaited, only the first requires an awl in its manufacture. Coiled baskets are constructed from two types of elements, the passive, horizontal foundation and the active, vertical stitches. When coiled baskets are made, an awl is used to separate the elements of the foundation to allow penetration of a stitch through the previously formed coil. The repeated penetration of the awl tip through the coils eventually polishes the awl tip" (1984,174).

The following description of the equipment used by modern Pima Indians in basket making is of interest as it also describes the traditional tools used,

> "the tools of the modern Pima basket-maker are few: the awl, now made of steel instead of the bone of earlier days, is used to help penetrate the coil to allow the insertion of the sewing element of willow or devil's claw: and the penknife, which replaced the earlier sharpened stone, for splitting willow shoots, devil's claw pods, and cattail" (Gogol 1982,6).

Some pieces for example Goyet 44 (fig. 4:2) and Magrite 57 seem a little thick at the tip to be perforating tools of any kind. But there is no reason why all the points in this group need have been used in the same manner. In the absence of traces of use, it would require some remarkably

detailed contextual evidence to provide direct evidence for actual use, and such is wholly lacking at the sites concerned.

Variation and Distribution

These pieces vary in length from 10.2 to 2.15cm, but they are all incomplete, with the exception of Kent's 9 which is 9.55cm long. This means that the original distribution in size of these artifacts cannot be obtained. The width of the shafts varies from 3 to 0.3 cm and their thickness from 1.9 to 0.15 cm. These dimensions reflect the size of the bones chosen to make this type of tool. As these measurements could not always be taken in the same location, owing to the fragmentary nature of many of these pieces, they too reveal little about the original variation in size. Only three of these pieces have a complete distal end, Kent's 9, Coléoptère 21 and Goyet 82, and of these it was only possible owing to the shape of the tip to take a reliable measurement from Goyet 82. The tip of this piece is 0.1cm wide and 0.05cm thick.

Group 1 points are found throughout the region being studied, although they have not been identified on every site considered here. However, as most of the assemblages described here come from incomplete collections, there need be no great significance in the absence of this type from particular sites, given its widespread distribution. The little chronological information available also seems to indicate that there is much variation in the age of these artifacts.

Of the Belgian points, two examples, Nutons 6 and Coléoptère 21 date from the Later Upper Palaeolithic, as they come from sites belonging to the Magdalenian, and the Magdalenian and Ahrensburgian respectively. In contrast to this, Grotte de la Princesse 1 seems to be attributable to the Aurignacian, as it was found on a site of that age. As regards the points from the Grotte de Spy, no certain attribution is possible, because this is a very complex, multiperiod site and it is not clear to which

occupation these pieces belonged. Those points from Goyet and Trou Magrite which have been labelled have clearly been regarded as part of the Upper Aurignacian component of these multiperiod sites. However, this is no firm indication of their age, as almost all the finds from these two caves, held in the Institute of Natural Sciences, have been labelled as such. This includes pieces such as needles which are more usually seen as belonging to the Later Upper Palaeolithic (see Chapter 5: Needles).

In Britain, there is not even sufficient evidence to indicate whether or not these pieces belong to a particular stage of the Upper Palaeolithic. The exact provenance of the points from Kent's Cavern is unknown and so even their attribution to the Upper Palaeolithic is uncertain. The point from Ogof Garreg Hir may be Upper Palaeolithic, but it was merely found in a disturbed deposit with a possibly Later Upper Palaeolithic stone tool (Campbell 1977:2:121). It is not certain to which stage of the Upper Palaeolithic the two points from the Creswell Caves belonged.

However, Group 1 points are not a very specialised type, so within the Upper Palaeolithic, they may not have been strictly peculiar to any one area or occupation. After all, similar pieces are not uncommon in other bone industries, such as the European Neolithic (J.Desse 1977,241). However, such artifacts are rarely selected for detailed description or illustration as they are not particularly attractive-looking.

Group 2 Points

These artifacts are made from small, selected limb bones from which one articular end has been removed, then the shaft has been worked to a point at that end. The remaining articular end provides the proximal end of the piece (fig. 4:3). They differ from Group 1 points in that the bone shaft is left whole instead of being sawn longitudinally. Eight examples of this type are considered here: they all come from British sites. Their distribution is laid out in Table 4:2 below.

Table 4:2
Number and Distribution of Group 2 Points

Name of Site	Raw Material: Hare Tibiae	Hare/Fox Ulnae	Total
Church Hole	2	-	2
Gough's Cave	5	-	5
Pin Hole Cave	-	1	1
		Total	8

The study of the methods used to produce these pieces suggested that as the first stage, one of the articular ends was removed by either breaking the bone obliquely across the shaft, or else by sawing transversely across the shaft. In only one case did traces survive to indicate which method was used, and it appeared to be by sawing. Two different techniques also appear to have been used to make the distal end of the piece pointed; these were by sawing or by scraping. Traces of one or other method were identified on most of the points. Where traces of modification were identified on the surfaces of these pieces, they appeared to be characteristic of scraping. One piece, Gough's 5, had been elaborately decorated with groups of carefully arranged transverse incisions; it is discussed in some detail below.

These artifacts were also examined in the hope of finding traces of use, but without success. The shape of these pieces suggested, as it did

for the Group 1 points, that they were used as perforating tools and the same range of functions as that indicated for the Group 1 points seemed probable. However, in contrast to the Group 1 points, it is most probable that at least the seven points made from hare tibiae all shared the same function.

The seven hare tibia points are so similar in appearance, that some relationship between the two sites which have yielded them seems probable. They all belong to the Upper Palaeolithic. No pieces of this type have been recognised in the Belgian collections, but very similar pieces have been identified at the Russian Upper Palaeolithic site of Gontsy in the Ukraine (Boriskovsky 1958, 235,Fig.167,7-12). The eighth Group 2 point studied here belongs to a series of this type found at Pin Hole Cave. No parallels have been found in Belgium. Similar pieces from the Gravettian site of Dolní Věstonice in Czechoslovakia are illustrated by Klima (1963,405, Taf.64,Nos. 873 and 875). Olsen has described a comparable series of 'ulna awls' (1984,286) from Mogollon Pueblo in the Arizona desert.

Group 2 points are equivalent to Camps-Fabrer's 'Poinçon avec poulie articulaire. Poinçon type II' (1966,167), which she has also recognised in the European Neolithic (Camps-Fabrer et d'Anna 1977,322). This type also appears in the French Upper Palaeolithic and is termed 'poinçons à base en epiphyse' by Leroy-Prost (1975,134), as are Group 1 points in her typology (see above).

Manufacture

Seven out of the eight pieces described here were made from hare tibiae, the delicate fibulae having been removed presumably as a deliberate feature of the manufacturing process, to facilitate the use of these points. The eighth piece was made from a fox ulna and was one of a series of fox and hare ulnae from Pin Hole Cave (see Kitching 1963, Plate

1). It seems clear that particular bones were selected for making this type of tool.

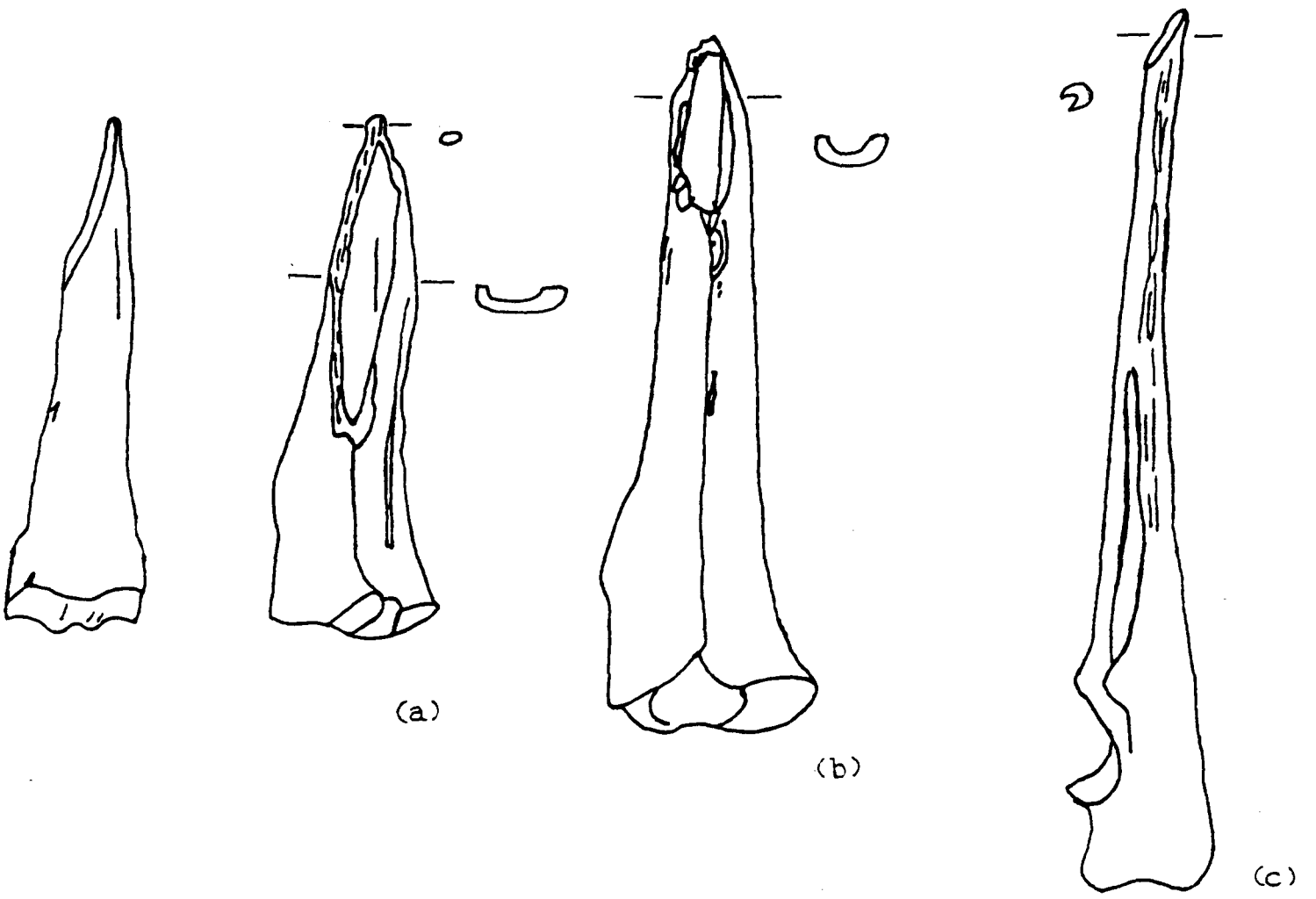
(i) Débitage

This stage either consisted of breaking the bone obliquely, which had to be done without cracking the part required for manufacture, or in order to avoid this, sawing the shaft in two, transversely or obliquely. No traces survive to indicate which method was used, with the exception of one deep, transverse incision, which may be seen on Gough's 3, about 1.2 cm from the tip, which could be interpreted as a preparatory cut made prior to sawing the shaft in two.

(ii) Modification

(a) Production of the tip - The point was produced either by longitudinal scraping of the distal end, or else further material was removed by sawing. One example appears to have been neatened by scraping alone. With another two pieces, it is difficult to tell, while five points seem to have been modified by sawing. One example is Gough's 3, on which a jagged area may be seen just above the tip, where a splinter has been snapped off, though this could also be where the piece was originally broken (fig.4:3).

(b) Further modification - On three pieces, striations could be seen in the marrow cavity, these no doubt result from the necessary cleaning out of the bone. On the Gough's points, there was generally little modification except around the tip, with some longitudinal striations on the surfaces. These are believed to result from scraping, as they are very irregular. On one surface of Gough's 2, there are some deep incisions which are filled with red ochre, though finer, modifying striations may also be seen. Another Gough's point, Number 5, shows more elaborate modification which will be discussed below. The Church Hole points were rather more crudely worked than the Gough's points, with much more



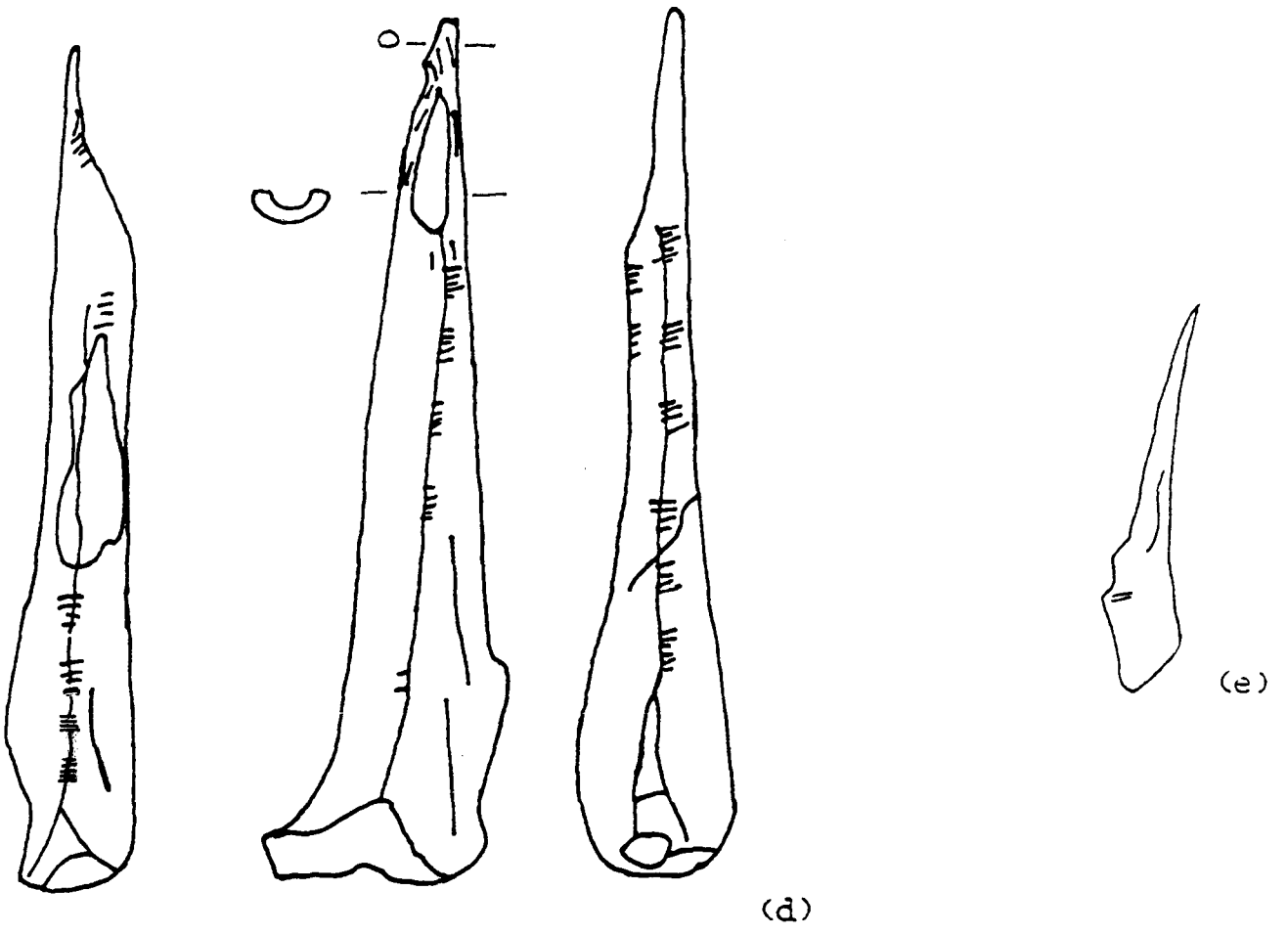


Fig. 4:3 Group 2 Points: (a) Gough's Cave 3
(b) Church Hole Cave 6
(c) Pin Hole Cave 11
(d) Gough's Cave 5
(e) after Parry (1928, P1XX, Fig. 6, length is 84 mm)

modification to the surfaces (fig. 4:3). This took the form of irregular, mainly longitudinal striations which became finer towards the tip, which was in one case facetted with chattermarks. On the Pin Hole point, some regular, longitudinal striations may be seen: these are likely to be associated with scraping, given the irregular shape of the piece (fig. 4:3).

Gough's 5 has been particularly heavily modified compared with the other Gough's pieces, in that its surfaces are covered with striations, which are generally irregular on the shaft and finer towards the tip. This piece has been further modified with three series of deliberate, short, transverse incisions; these are arranged in groups of 4,5 and 6 along each of the three natural, longitudinal ridges of the bone (fig. 4:3). The groups are arranged as follows, listing from the proximal end to the distal end:-

Internal ridge: 5,4,4,4 [damage] 4

Anterior ridge: 6,4,4,4,4,6

External ridge: 2 - 5,5,5,5

Tratman (1976, 125) has suggested that there were originally three groups of four incisions on the part of the internal ridge which is now missing, assuming that the spacing of these groups remained regular and that the number of incisions in any group did not change in the middle of the shaft. That is to my mind a reasonable hypothesis, which suggests that there were originally 33 transverse incisions on this ridge.

As regards the anterior ridge, Tratman (1976, 125) has recorded the same sequence as that laid out above, which indicates that there were 28 incisions on this particular ridge.

The listing of the traces on the external ridge is not as simple for various reasons. Four groups of five incisions are clearly visible on the distal and the middle parts of the shaft, but towards the proximal end, it

was difficult to distinguish the incisions owing to the particularly poor condition of that part of the piece and these incisions, unlike the others, had not been filled in with black ink. Moreover, the traces on this ridge were more irregular, as regards both the lengths of each group and the spacing between each groups. Tratman suggested (1976, 125) that there were six groups of 5's, giving a total of thirty incisions, which is a hypothesis which would be impossible to prove, given how damaged the piece is.

The grouped incisions on this piece are clearly different in nature from the casual incisions on other pieces which arise from modification. Their function will be considered in the following discussion of Group 2 points.

Function

(i) Traces of Use

No definite traces of use were identified on any of these pieces, though in every case, the distal end was either chipped or broken, which may have resulted from use. Two pieces were in a particularly fragile condition: these were Gough's 4 and 5, which were both cracked and had been broken in two and imperfectly glued together again. This damage could have been sustained during or after deposition as easily as during use.

(ii) Use

In the absence of any identifiable traces of use, information about function has to be derived from other sources. Like the Group 1 points, the shape of these pieces with their large proximal ends shows that they were clearly not designed for flight and were no doubt made to be used while held in the hand. They have short tips, which may have had some perforating function.

They may have been used with or instead of needles, when sewing hides or skins to make the perforations through which the thread could be

passed, in the manner of the Plains Indians documented by Lowie (1954,49), which was described in detail above (see Group 1 Points). Another possible use for these pieces could be as basketry awls, as was outlined above for the Group 1 points.

The point from Pin Hole is naturally slender, with a relatively large proximal end, which makes it the perfect shape for a pin, though whether it was actually used as such is impossible to tell. One pin has been identified in the British collections, Kent's 1 and it seems unlikely that there was a need for such an object at only one site. It seems probable that other pins have yet to be recognised; the series of points made from ulnae from Pin Hole Cave are good candidates.

If Gough's 5 was used as a point, then it is probable that its function was the same as that of other points of this type. Like the other pieces, it has a damaged distal end with no identifiable traces of use. However, Tratman has suggested (1976, 125) that "after the cuts were made the bone ceased to be used as a point". His reason for this seems to be that "these cuts show no signs of obliteration by use or deliberate polishing".

It is not necessarily the case that these traces would have been obliterated or polished through use, for it depends on where contact was made with the material on which such pieces were used. Furthermore, as was observed above, some of the incisions on the external ridge <u>are</u> worn and indistinct, indeed the whole piece is in a very fragile and damaged condition, though Tratman (1976, 125) suggests that this was an effect of deposition rather than use. However, there is no proof of this.

As regards the possible function of the transverse incisions, they may have been purely decorative and there is no reason why the fact that they are arranged in interesting little groups should preclude this. However, these incisions may have had some greater significance, for example as

some form of counting or recording device, but, unfortunately such things are hard to prove.

Tratman put forward the hypothesis that "some fairly complex system of numeration is displayed on the notched point" (1976,129) based on his observations of the regularity of the grouped incisions and on his belief that this piece ceased to be used as a point, after these incisions were made (1976, 126).

Even if these incisions do have some numerical significance, this piece may still have been used as a point. Indeed, the incisions might even be a record of tasks performed during a certain period of time using that particular point. It would require greater skill and more time to make the original point, which is a particularly fine piece, than it would to make these particular marks, which suggests that the function of the bone as a point might not have been lightly made redundant.

Variation and Distribution

These pieces vary in length from 9.9 to 6.05 cm, but all of them are either chipped or broken. The only dimensions which allow any reconstrucion of the original size distribution are those of the proximal end, as the measurements were clearly made in the same location each time. Proximal width varies from c. 2.2 to 0.6 cm and proximal thickness from 2.05 to 0.85 cm. These dimensions inevitably reflect the size of the bone from which the pieces were made, but may still be fairly closely related to function, since a wide choice of bones must have been available, but only hare tibiae and a fox ulna were selected. In no case is the tip complete.

The Pin Hole point belongs to a series of modified fox and hare ulnae, whose precise age is unfortunately unknown. These pieces appear to be peculiar to this site, which suggests that either some particular activity was being carried out at this site for which these points in

particular were required, or that different tools were selected for this activity on other sites. One possible British parallel for these pieces was found at the Later Upper Palaeolithic occupation site at Gough's Cave by Parry (fig. 4:3) and is described by him as an,

> "awl or pricker, with very sharp point, formed from the ulna of a goat(?); length 84mm" (1928,115).

This piece was not made available for me to study. Similar-shaped points made from ulnae are illustrated by Klima amongst the finds from the Gravettian site of Dolní Věstonice (405, Tab.64:873,875).

The points from Church Hole and Gough's Cave also clearly belong to a specialised group, given their similarity in raw material and methods of modification. All of these pieces date to the Later Upper Palaeolithic. Only five specimens from Gough's were made available for study, although Parry refers to the existence, apart from Gough's 5, of,

> "ten piercers of this type but without the markings. They come from layers 9 to 16 and are of Upper Palaeolithic date. These piercers have been found at Kent's Cavern and at Creswell Crags" (1930,49).

The Creswell points are no doubt those from Church Hole, whereas a similar, though coarser, specimen found at Kent's Cavern was recovered from a Post Glacial context. This piece is held in the collections of the Torquay Natural History Society Museum and is labelled .1858.

What was probably a third example of this type was excavated by McBurney from the Later Upper Palaeolithic site of Cat Hole. It was described as,

> "a small bone awl ... reminiscent of larger and better preserved specimens from Gough's Cave" (McBurney 1959, 268).

This piece unfortunately cannot now be found.

These hare tibia points are restricted to these two or three sites and nothing like them has been found in the Belgian collections, although a large proportion of rabbit bones has been identified among the faunal remains excavated by Otte and Téheux at Chaleux (1986,67). The fact that these unusual pieces are so similar to one another suggests that there was some close contact at least between Gough's Cave and Church Hole. The reason why these tools are restricted to to these sites may be because they were used for some activity which was performed by other types of artifact on other sites and that the variation was a result of local preferences, as the necessary raw materials were certainly available elsewhere (see above).

A similar series of points was found at the Upper Palaeolithic site of Gontsy in the Ukraine. They are described as,

> "Le groupe le plus important des outils en os est celui des petites alènes (jusqu'à 9cm de longueur), faites d'os longs fendus, de lièvres (fig.167;7-12). Une dizaine d'exemplaires entiers ont été rencontrés. Ils sont très bien conservés, et présentent des extrémités bien affilées. On a trouvé en outre plusieurs dizaine de fragments" (Boriskovsky 1958,235).

This group as a whole is not represented in the Belgian collections being considered here, although one Group 2 point, which does not resemble any of the pieces described above, exists in the collections of the Institute of Natural Sciences and comes from from the Trou du Chène at Montaigle in the Molignée Valley, which contained a very poor Magdalenian level (de Sonneville-Bordes 1960, 424). It seems likely that on Belgian sites, as on most British sites, some alternative to the Group 2 points was used, and it is worth stressing that the features on which this type rests are essentially related to one method of manufacturing a hand-held bone point; functionally similar tools could be created in many different ways, according to taste and the raw materials available.

Group 3 Points

These artifacts are generally made of splinters of bone, though two examples considered here are made of ivory, which have been worked to a point at one end (fig. 4:4). A careful study of the traces of manufacture preserved on their sides and surfaces suggested that either no systematic débitage was involved, or else it was restricted to the deliberate cutting out of the tip, so as to predetermine its size and shape. Forty-six examples of this type are considered here, six of which belong to the subgroup of pieces whose tip has deliberately been extracted prior to modification (subgroup 3(i)). Their distribution is laid out in Table 4:3 below.

Table 4:3
Number and Distribution of Group 3 Points

Name of Site	Group 3(i)	Group 3	Total
Kent's Cavern	-	1	1
Gough's Cave	-	1	1
Fond-de-Forêt	-	2	2
Grotte de Coléoptère	-	1	1
Trou du Renard	1	2	3
Trou de Chaleux	-	2	2
Grotte de Spy	-	7	7
Maisières Canal	-	1	1
Trou du Frontal	-	3	3
Verlaine	-	3	3
Grotte de Goyet	3	8	11
Trou Magrite	2	9	11
Totals	6	40	46

It is possible that various Group 3 Points may have been produced by deliberate percussion, but my own experimental replication of this technique suggested that no characteristic traces would be produced (see Chapter 2), and indeed none were recognised here. It appeared that these pieces were usually modified by scraping: this was indicated by the surviving traces on the better preserved pieces. In certain cases, modification resulted in a polished finish to those parts of the artifact

which had been worked. These pieces were also studied in the hope of identifying traces of use; this included making silicone rubber casts of the distal parts of four pieces which looked particularly promising and examining them microscopically. Unfortunately no unambiguous traces of use could be discerned; however, it was useful to be able to inspect the traces of manufacture on the distal area. These points share the same possible range of functions as those outlined for the Groups 1 and 2 points, which means that they could have been used for sewing, for basketry or as pins. There is no reason to suppose that all the Group 3 points shared the same function, nor that any piece had only the one function.

This type is found throughout the region being studied and it also appears to vary considerably in age. This is to be expected, as Group 3 points are a particularly unspecialised type, which is found wherever there is regular modification of bone. Such artifacts have been recognised by Camps-Fabrer in her study of bone industries from North Africa and described as 'Poinçons d'économie. Poinçon type I' (1966,167). This term is used by other French sources when describing French Upper Palaeolithic collections (Leroy-Prost 1975,128). Olsen describes these points as "splinter awls" (1984,266), which she has identified amongst assemblages from Indian pueblos in Arizona.

Manufacture

(i) Débitage

Most of these pieces are clearly just modified splinters of bone, with no traces of débitage. An additional four pieces show traces on their sides, but as these pieces are a most irregular shape, these traces are much more likely to have been associated with modification rather than with blank extraction; these include the ivory point Maisières 6. Three further points show striations on the surfaces close to one edge, but

again the irregular shape of these artifacts suggests that they were not the result of débitage.

The six exceptions to this are pieces where the distal end has been cut out of the original raw material, (bone in all cases), the reason being to predetermine the size and shape of the active part of the piece, that is the tip. The best example of this is Magrite 33 which shows traces of extraction in the form of two short, deep, longitudinal incisions cutting into the base of the tip (fig.4:4). They are interpreted as the furthest extension of the original grooves made in the bone to mark out the tip.

(ii) Modification

Nineteen of these points show regular traces of modification in the form of longitudinal and oblique striations and longitudinal facets, which probably result from scraping, as these pieces would be too awkward a shape for grinding, such as Kent's 7 (fig.4:4, Plate 4:2). A further twenty-one show clear chattermarks or an irregular, bumpy surface which is a regular feature of scraping, but not of grinding. Of these, Magrite 1 (fig. 4:4) has been particularly carefully and smoothly worked by scraping, resulting in criss-crossing, fine, longitudinal striations and chattermarks (Plate 4:3).

Of the remaining pieces, one was roughly hacked to a point (Spy 6), for the other five, the method of modification is less clear. The greatest variation lies not in the method of modification, but in its extent. In twenty cases, modification was apparently confined to the tip, which in thirteen cases was polished, or especially smooth. On the other hand, twenty-six pieces had been modified on the surfaces as well as on the tip; of these one point had a polished tip, while three examples were smooth all over. No reworking was identified on any of these pieces.

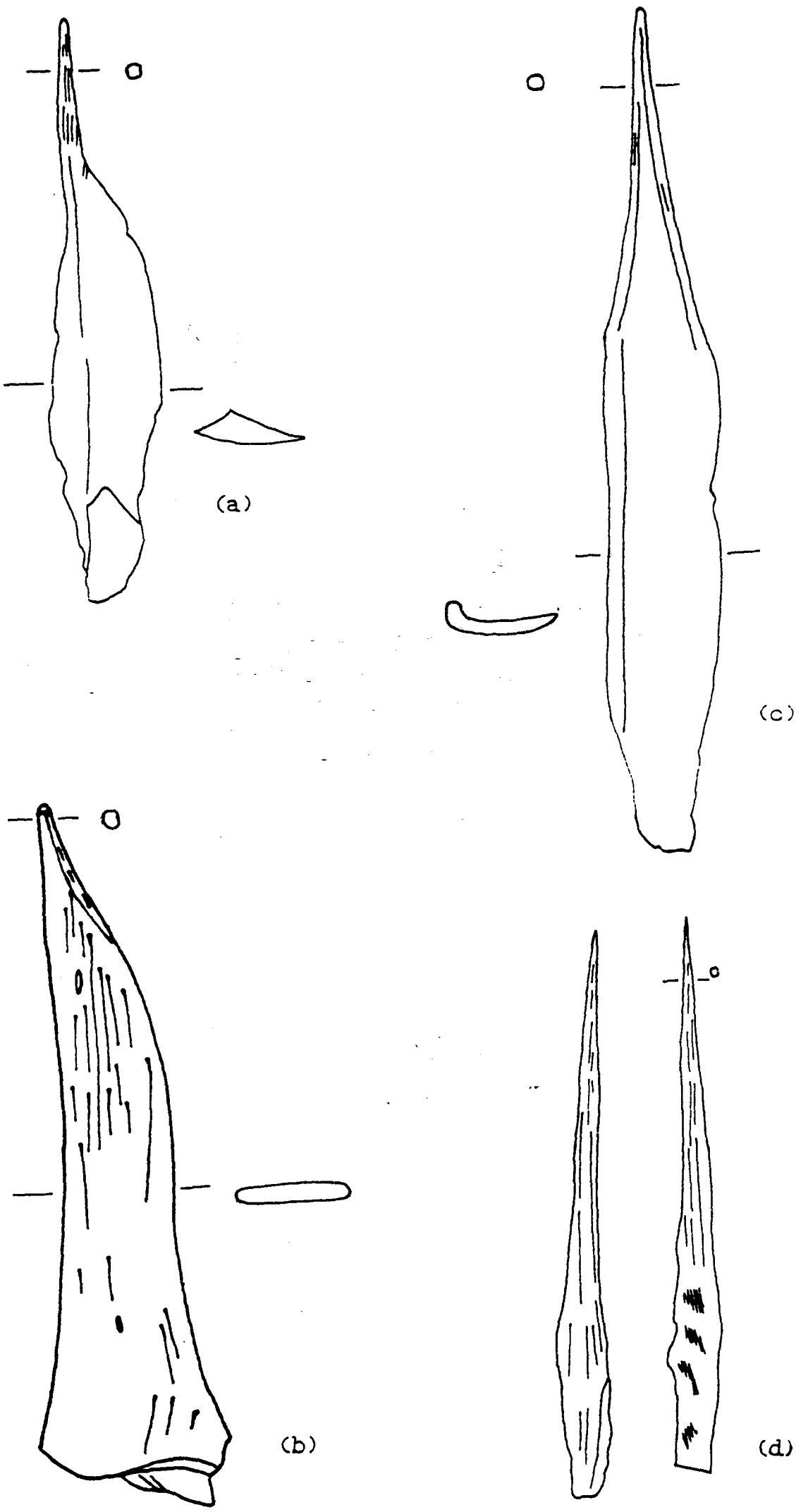


Fig. 4:4 Group 3 Points: (a) Magrite 33
(b) Kent's Cavern 7
(c) Magrite 1
(d) Goyet 95

Function

(i) Traces of Use

As usual, this is difficult to identify and to distinguish from natural damage, chemical alteration and even from traces of manufacture. Almost all of these pieces were broken, which suggests that breakage may have occurred during use and that these pieces were then thrown away, as it would be easier to sharpen a new splinter, rather than to rework a broken piece and indeed no reworking was identified.

Seventeen of these artifacts had particularly smooth or polished tips, but in thirteen cases the tip was the only part of the tool to be modified, showing traces of longitudinal striations, so this is more likely to be manufacturing polish than use polish, although it could be a combination of the two. Even though all of the upper surface of Goyet 95 has been modified, its long tip is particularly smooth, which may be a result of use. Goyet 26 was smooth all over, but particularly on the lower surface of the tip. However, as this piece did appear to have been liberally coated with preservative, this polish need have no relation to the function of the piece.

(ii) Use

These are extremely simple, even rudimentary pointed artifacts, which could be easily and quickly produced, as little technical skill was required and there would be plenty of raw material available. The irregular shape of these pieces suggests that they were not designed for flight, but were hand-held artifacts with the point functioning as a perforator. Therefore, these points are likely to have had the same range of possible functions as Group 1 and 2 points. Thus, they may have been used with or instead of eyed needles when sewing hides or skins to make perforations through which the thread could be passed. They could likewise have been used in basketry to separate the stitches, while some of them,

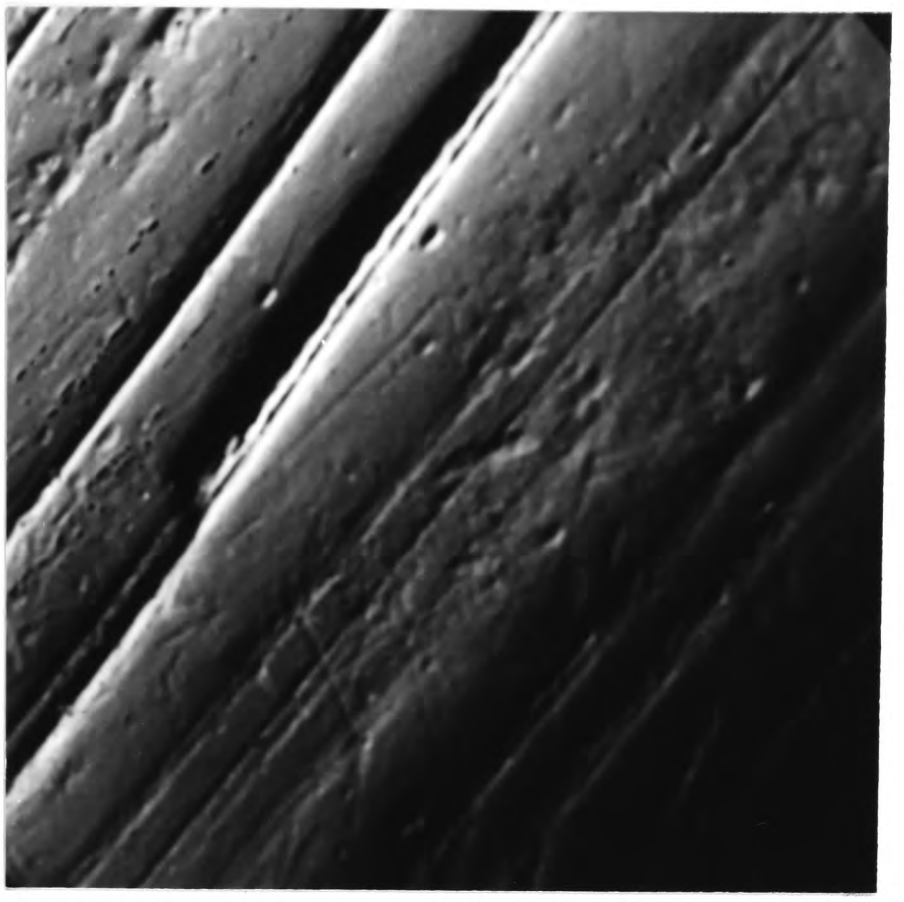


Plate 4:2 Traces of modification on the outer surface of Kent's Cavern 7 (x36) (SEM photograph)

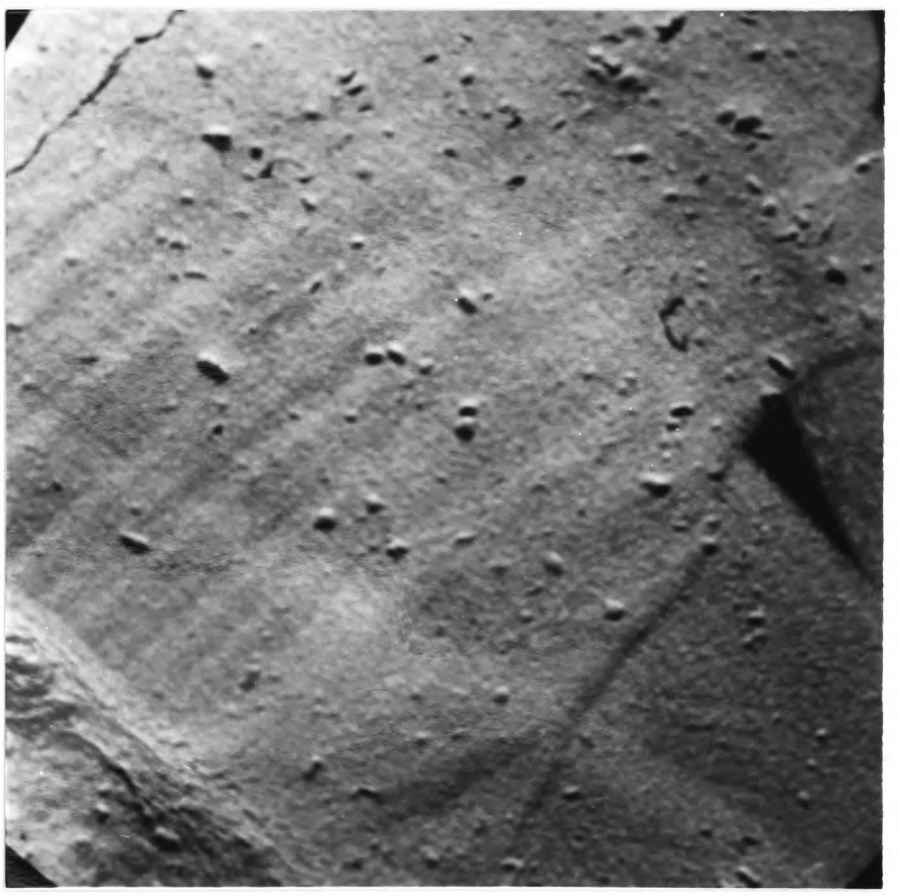


Plate 4:3 Traces of modification, including chattermarks, on the outer surface of Magrite 1 (x33) (SEM photograph)

for example Goyet 95 (fig.4:4), a group 3(i) point, could have been used as pins. Owing to the simplicity of these artifacts and the large range of variation in their shapes, it is improbable either that they all shared the same function or that each piece had only one, sole function.

Variation and Distribution

These points varied in length from 14.1 to 1.75 cm.

Because of this, the width and thickness of the shafts could not be measured in the same location each time and so, it is not possible to reconstruct the original size distribution of this artifact type. The one tip which appeared to be complete belonged to Coléoptère 22 and was 0.1cm wide and 0.1cm thick.

It would be inadvisable to read much into the variation in the numbers of such pieces attributed to each site. This is because these cannot in any way represent the original distribution, for it is highly unlikely that all such seemingly insignificant pieces were collected by excavators and even if they were, many may still lie unremarked among faunal collections. Furthermore, limitations on time and on access to collections mean that even the figures presented here may not fully represent the distribution of extant artifacts of this kind at the sites studied.

Even so, it is clear that such pieces are geographically widespread in Belgium, in that they were identified on all the Belgian sites with the exception of two, from which very small samples were studied i.e. Trou des Nutons and Grotte de la Princesse. This type was only identified in two British collections, but this is probably not particularly significant, as generally smaller numbers of artifacts were inspected and this is a type which could easily have been overlooked by collectors, excavators and classifiers alike.

As the point from Kent's Cavern was found in the Black Band, that is a deposit largely composed of charcoal from hearths in the Vestibule, it may be attributed to the Later Upper Palaeolithic. Similarly, Gough's 6 comes from a series of occupations which belong to this period. Of the ten Belgian sites considered here which are known to have yielded Group 3 points, three may specifically be attributed to the Magdalenian; these are Frontal, Chaleux and Verlaine. The Grotte de Coléoptère has also yielded only Later Upper Palaeolithic material, but from a Magdalenian and an Ahrensburgian occupation. Maisières Canal and Trou du Renard are both Earlier Upper Palaeolithic uniperiod sites; the former belongs to the Perigordian and the latter to the Aurignacian. The other four caves contained occupations from a whole range of Upper Palaeolithic cultures. Spy 2 had been labelled 'Perigordien' and was apparently found in the "premier niveau" at the site (de Loë et Rahir 1911,Pl.1,14), though this may not be a correct attribution. No published information exists for the points from Fond-de-Forêt, whereas all of the pieces from Trou Magrite and Goyet, in the Institute of Natural Sciences, which have been labelled have been seen as coming from Mousterian/Aurignacian deposits. Unfortunately, it does seem that the basis for this sort of cataloguing was not very sound, though on the other hand, this does not mean that these pieces could not have belonged to this period.

Thus, chronologically, this type again seems to be widespread rather than being restricted to any period or particular occupation, no doubt because it was a simple, unspecialised and probably multipurpose tool.

Group 4 Points

These are bone, antler or ivory artifacts which have been deliberately extracted and modified to produce a distal point, as opposed to natural splinters which have been worked to a point (see Group 3 Points). Sixty-eight examples of this type have been identified within the collections studied here and their distribution is given below in Table 4:4.

Table 4:4
Number and Distribution of Group 4 Points

Paviland Cave	2
Creswell *	1
Little Hoyle	1
Torbryan Cave	1
Trou du Frontal	4
Grotte de la Princesse	2
Remouchamps	1
Verlaine	1
Trou de Chaleux	4
Grotte de Spy	12
Grotte de Goyet	19
Trou Magrite	17
Fond-de-Forêt	3
Total	68

* From one of the caves at Creswell, but which one is unknown.

When the methods used in the production of these pieces were studied, they proved to be very similar in each case, generally consisting of extraction by the groove and splinter technique, which was followed by modification by scraping. In spite of this, there is much variation in the shapes of these artifacts, which suggests that there may also have been some variation in their function. Silicone rubber casts were made of the distal ends of seven selected pieces, which were examined microscopically in order to see whether any traces of use could be distinguished from the signs of modification. The results of this study proved inconclusive; however, the shapes of the objects were suggestive of certain functions. Ethnographic evidence also provided useful information. The possible

functions thus indicated involved the use of projectile points for hunting or fishing, or of awls either for perforating skins when sewing, or for use in basket-making.

The tools in this group are found throughout the region of this study and appear to vary greatly in date. This is to be expected, as Group 4 points do not represent a very specialised type, with the exception of subgroups i to iv, and like Groups 1 and 3, points produced in this way occur wherever regular modification of osseous materials takes place. This category is a deliberately wide one, because, owing to the fragmentary nature of many of the pieces considered here, I could not attempt with any confidence to organise them into smaller more specific groups. Group 4 points are equivalent to Olsen's category of,

> "shaped awls with plain bases: those modified by grooving and snapping, scraping, abrading, or any combination of the above along both edges and the tip and possessing a base without the articular condyle present" (1984,266).

This tool type was identified among the awls from Mogollon Pueblo in Arizona. No direct equivalent in the form of one category could be found for the Group 4 points among the typologies of Camps-Fabrer (1966) and Leroy-Prost (1975). Instead, they are equivalent to a series of more precisely defined classes, which, as has already been mentioned, would not have been appropriate here. One of Leroy-Prost's more important categories is of 'pointes triangulaires' (1974,451; 1975,114-116), which is worth considering briefly, in order to explain why it does not appear here. Such pieces are described by Leroy-Prost as,

> "pointes de morphologie triangulaire, de section subrectangulaire, elliptique ou biconvexe, en os ou en bois de cervidé" (1974,451).

They resemble the distal portions of broken split-based points (see Split-based Points), and indeed Leroy-Prost has admitted that this is what some of her examples may be; however, she has argued that others were deliberately produced as such. Her reasons for this theory include the presence of such 'pointes triangulaires' on sites where split-based points are absent, and the fact that on sites where they are found together and the split-based points have a subrectangular cross-section, these pieces are elliptical in cross-section (1975,115). These points never seem to be complete in the illustrations, although at least one example is described by her as follows,

> "l'une d'elles possède une base sciée en oblique" (1975, 115, Fig.13,No.4).

This suggests that this piece was deliberately cut at the base, but the illustration leaves one in some doubt about this. Leroy-Prost is clearly convinced of the existence of this type, which may indeed have been a genuine separate tool type in South West France, and has attributed it to the earliest stages of the Aurignacian (1975,116), but I certainly encountered no examples.

Amongst the Belgian collections, Otte has recognised a category of 'sagaies à base massive', which are either lozenge shaped, that is equivalent to the 'lozenge-shaped points' studied here (see Lozenge-shaped Points), or triangular, which are clearly equivalent to Leroy-Prost's 'pointes triangulaires'. Two 'almost complete' specimens of the latter type have been identified by Otte, one of which is illustrated (1977,199,198, Fig. 3,No.14). However, I am not happy about the identification of this triangular form in Belgium, because I have not encountered any complete examples, or any specimens which were so near complete that there could be no doubt about their attribution, and so such

pieces are considered to be Group 4 points, rather than a separate subcategory of dubious validity.

Manufacture

As many of these pieces consist of small, often heavily-worked fragments, it is not always clear what raw material they were made from. However, an attempt was made to carry out some identification based on the shape and texture of the cortical and cancellous tissue. The approximate figures obtained are as follows: there appear to be thirty antler pieces, thirty of bone, one of ivory and seven very doubtful pieces. There seems to be a very low occurrence of Group 4 points made of ivory, but this may be explained to a certain extent by the fact that most of the carefully modified ivory shafts have been classified as rods, some of which may have been pointed (see Ivory Rods).

(i) Débitage

Fifty-nine examples were probably extracted by the groove and splinter technique, for each has a regular shape with a combination of longitudinal striations, facets and chattermarks on the sides. These traces closely resemble those produced by me when experimentally reproducing this technique (see Chapter 2). It is a useful method for predetermining the size and shape of the final artifact, so that the minimum of modification is required after débitage.

Goyet 133 and 134 may have been cut out by longitudinal sawing, rather than by the groove and splinter method, because most of the traces such as longitudinal striations which are interpreted here as traces of extraction are located on the lower surface, rather than on the sides.

Four pieces, Frontal 12, Remouchamps 4, Verlaine 4 and Goyet 80, are covered all over with striations, which may conceal traces of débitage by the groove and splinter method on the sides. The very regular shape of these pieces would seem to confirm this theory. It is presumed that

Chaleux 76 and 80 were also produced by the groove and splinter technique as they are regular shaped, but they are so corroded that few or no traces of working have survived. Frontal 4 is also a very regular shape with clear traces of modification and so, even though no actual signs of débitage were recognised, it is probable that it too was extracted by the groove and splinter technique.

(ii) Modification

As a general rule, where traces of modification are preserved, they seem to extend over much of each piece, though the tip is worked with particular care. Thirty-one examples show mainly longitudinal striations and facets, which often resemble those which have been produced experimentally by scraping. Three of these artifacts, Goyet 81 and 138 and Verlaine 4, also have uneven surfaces which support the idea that they were scraped.

Another twenty-nine points were identified which had been worked by mainly longitudinal scraping, which resulted in longitudinal striations, facets and chattermarks, or little, transverse steps.

Forêt 4 was a very corroded and desiccated piece, but judging from the uneven outline of its distal end, it must have been shaped by scraping. A further six pieces show only a few striations on their surfaces; this may be because they are in a very poor condition, for example Chaleux 76 and Goyet 53, or else like Paviland 41, it is possible that little modification was needed after débitage. An additional example, Goyet 108, also has only a few transverse incisions visible on its upper surface, but was probably worked by scraping owing to the uneven nature of its surfaces.

Thus, most of these artifacts are pieces of bone or antler with a recognisable distal point. They appear to have been extracted by the groove and splinter technique and then modified by scraping. They are usually broken. However, certain pieces show particular features of

modification, which are laid out in Table 4:5 below, in which 'Y' stands for 'yes' and '?' for 'possibly'.

Table 4:5
Nature of Modification of Group 4 Points

Name:	Whittled Tip	Bevel	Perforation	Incised Decoration
Torbryan 3	Y	?	---	---
Magrite 60	Y	-	---	---
Hoyle 1	-	-	Y	---
Goyet 65	-	Y	Y	Y
Magrite 25	-	Y	---	Y
Spy 21	-	-	---	Y
Goyet 71	-	-	---	Y

As may be seen in Table 4:5, Magrite 60 and Torbryan 3 (fig.4:5) have tips which have been crudely whittled down by longitudinal scraping, resulting in longitudinal striations, facets and an untidy, stepped appearance. This is clearly a crude technique and indeed it seems to have been rarely used, for the point usually seems to have been shaped by initial débitage. Because the profile of the tip is steeper than that of the rest of the piece in both cases, it is probable that this technique was used to rework a broken tip.

Both Goyet 65 and Hoyle 1 (see Table 4:5) are perforated at the proximal end, which in the case of Goyet 65 is also double bevelled; this may have been designed to make perforation easier (fig.4:5). On both pieces, the perforation has been made by scraping from both surfaces, though mainly from the lower surface on Hoyle 1, then the hole was punched through the remaining piece of bone and this was not subsequently neatened. No traces of use could be distinguished in either perforation. Whether the presence of a perforation would have affected the function of these pieces as points will be discussed below (see Function).

Magrite 25 (see Table 4:5) has a shallow, double bevel at the proximal end; it is very worn, but on its upper surface, a few oblique striations are visible which show that it was deliberately produced. The significance

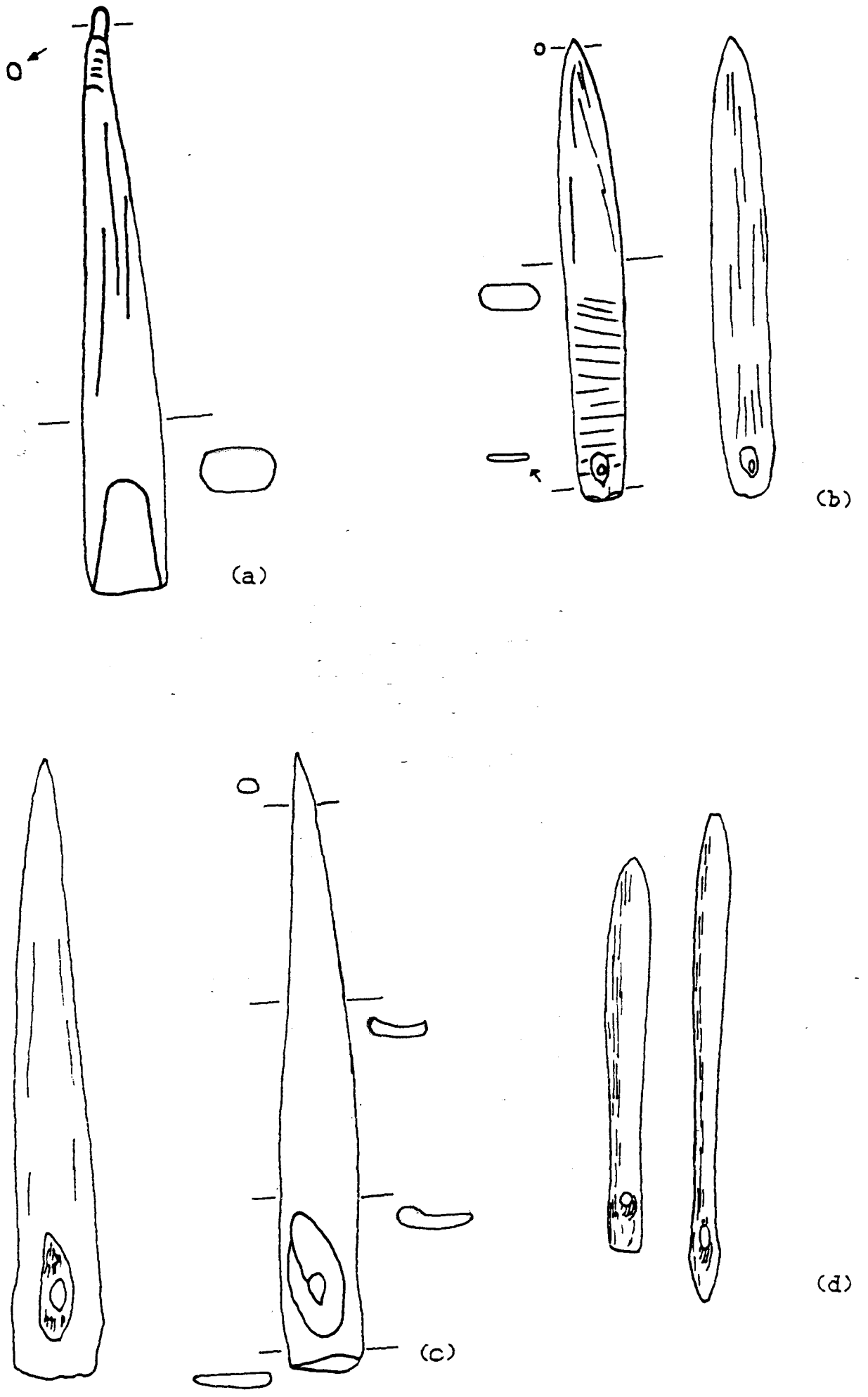


Fig. 4:5 Group 4 Points: (a) Torbryan Cave 3
(b) Goyet 65
(c) Little Hoyle 1
(d) Eskimo fish needles, after de Saint Périer (1928, 19, Fig. 2)

of this feature will be discussed below. Torbryan 3, which like Magrite 25 appears to have been very neatly finished off at the proximal end, may have been deliberately intended to be single bevelled, but this is doubtful. Some material is missing from the upper surface of this piece at the proximal end, but no traces of working may be seen in this area which is quite corroded.

The best example of incised decoration on these pieces is on Magrite 25, for on the proximal half of the upper surface (fig.4:6), the longitudinal striations produced by scraping are cut by a series of approximately 18 deep,curving, oblique incisions. The number of incisions is approximate because it is not always possible to distinguish them, for example, a pair of incisions may be very similar to one which has been cut twice. On Goyet 65, a series of fourteen transverse and oblique incisions could be seen on the lower surface of the bevelled area (see above), as well as nine incisions on one edge of the bevel and a less well preserved series on the other edge.

Two other artifacts which are listed in Table 4:5 as having incised decoration have been modified in a very different manner from Magrite 25 and Goyet 65. They each have one or more facets on their surfaces which are covered with tiny incisions. In the case of Spy 21 (fig.4:6), its surfaces have been worked by longitudinal scraping, but there is one longitudinal facet running down the middle of each surface, which is covered with grouped, oblique striations, the method of modification that they represent is unknown. On the distal end of Goyet 71, a number of very short, longitudinally oriented facets may be seen, which are again covered with little,oblique striations. A Group 1 point, Goyet 68, showed similar traces on its distal end. I took a silicone rubber cast of this area, which was covered with longitudinal facets and then with tiny transverse and oblique incisions. Under examination in a scanning electron

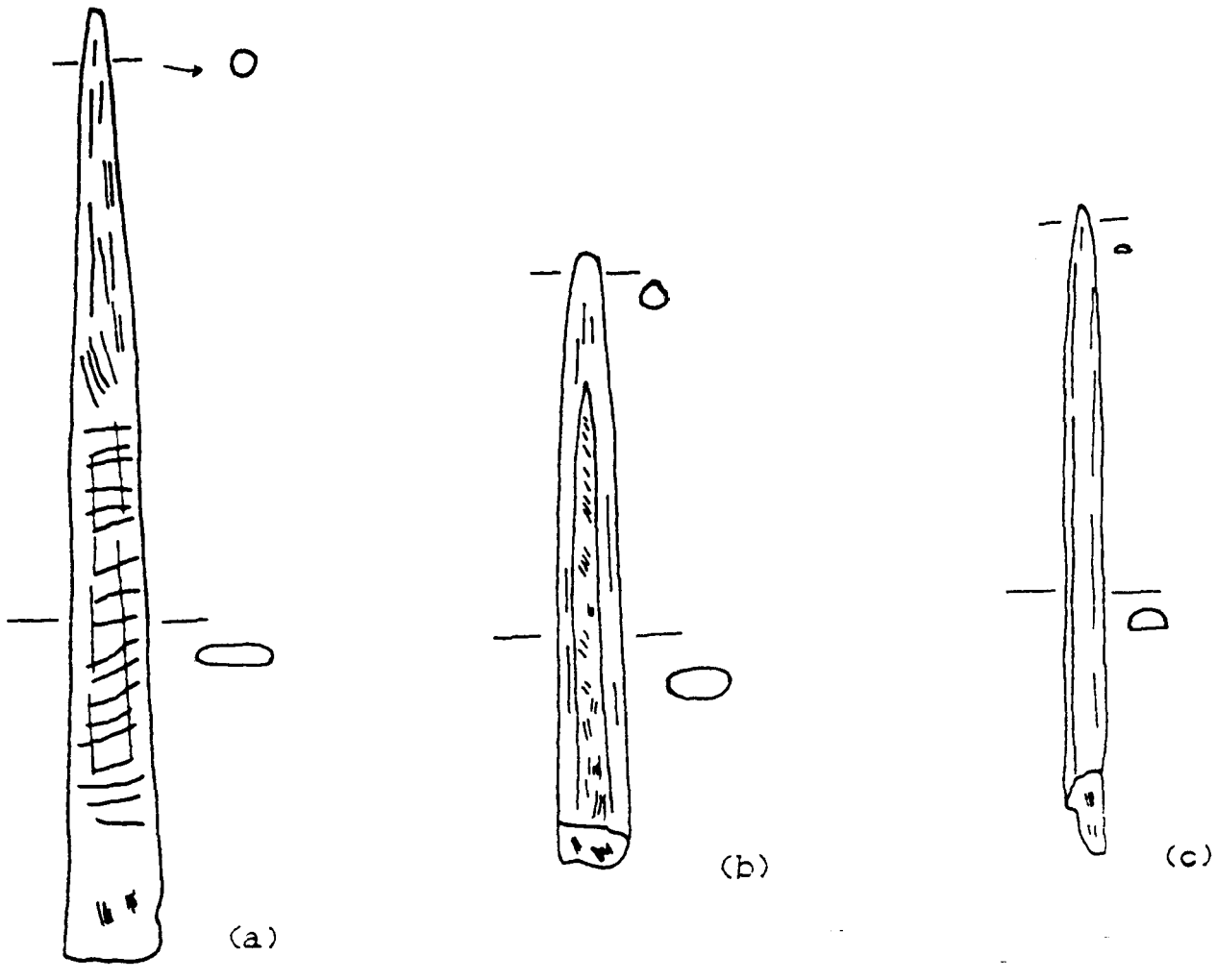


Fig. 4:6 Group 4 Points and Split-based Points:
(a) Magrite 25
(b) Spy 21
(c) Grotte de la Princesse 2
(d) Magrite 3
(e) Magrite 17

microscope, it appeared that these little incisions probably represent the individual strokes of a stone tool.

Seven pieces were identified as being possibly unfinished, because they had either been roughly worked or else had received little modification after débitage. These include Magrite 46 and 68, and Spy 154. This was probably also the case for Goyet 144, which is finely worked at its distal end, but unmodified at its proximal end.

Four pieces are curved in profile, Magrite 36, Spy 27, Goyet 146 and 148, but it is not known whether this was an original feature. Goyet 67 was curved, but not in profile.

Apart from the two pieces with whittled tips (see above), four other Group 4 points show signs of reworking. Goyet 151 looks as if it has been reworked, as its tip is at a very steep angle compared with the rest of the piece. From what remains of Goyet 145, its widest part seems to have been just before the narrow, pointed area, which suggests that a broken, formerly longer tip has been reworked. Magrite 44 is a tiny piece with a very fine tip, which rapidly flares out at the sides, which suggests that it is a reworked, broken point. Verlaine 4 has a very irregular-shaped tip, which suggests that it may have been roughly reworked after being broken.

Function

(i) Traces of Use

It is possible that at least some of the damage that these pieces sustained was as a result of use, but this, of course, cannot be proved. Fourteen pieces are particularly polished, though in some cases, for example Grotte de la Princesse 4 and Goyet 25, they have clearly been treated with preservative, but in others such as Goyet 144 and Spy 135, it is probable that such a uniform polish was a result of manufacture. For a polish may be produced on osseous surfaces by careful scraping and this

technique may be used to give an artifact a smooth finish. Another six pieces are generally smooth, probably as a result of manufacture; these are Goyet 138,145 and 146, Spy 21 and 19, Chaleux 106 and Magrite 4, 36 and 58. Goyet 142 was smooth all over, particularly on its flat surface, but this was thought to be a feature of manufacture. The worked areas of Goyet 133 and 134 were polished, which was most probably a result of manufacture. The tip of Goyet 71 was lightly polished, though whether this was a result of manufacture or use is unknown, for this area has been heavily worked (see above) and it is this which may have produced the polish.

In contrast to the pieces described above, Grotte de la Princesse 2 (fig.4:6) is smooth all over, but is particularly polished on the lower surface of the tip, which may have been through use. Similarly, when a silicone rubber cast of Spy 27 was examined in an SEM, it appeared that the traces of manufacture on the tip are blurred, possibly as a result of a polish from use. Even if this were not a phenomenon produced by the microscope, it would still be impossible to attribute it to use in any particular manner, on any particular material.

(ii) Use

One major problem associated with determining the use of Group 4 points is that this category includes artifacts with a wide range of sizes, shapes and possible functions. As these pieces are generally in a fragmentary condition, there is little information about use to be derived from the artifacts themselves. However, as was the case for the Groups 1,2 and 3 points, the size and shape of the artifacts may be used to suggest the general nature of their function. Certain artifacts are more likely to have been used while held in the hand, because they have a thick proximal end, which does not appear to have been designed for flight. These pieces are believed to have had some form of perforating function.

By contrast, those pieces which appear to have been streamlined for flight are more likely to have been projectile points. Some examples will be described below, though it should be borne in mind that most of the specimens in this category are too fragmentary for even the most tentative classification to be attempted.

The shape of Grotte de la Princesse 2 (fig.4:6) suggests that it was used while held in the hand, and the polish on its tip, described above, could lead to its interpretation as an awl for perforating skins, possibly with the lower surface of the tip staying in contact with the greasy surface of the skin.

By contrast, Magrite 25 is a good candidate for the 'projectile' category on the basis of its shape. It is a narrow, symmetrical piece with a distal point and a bevelled base, probably designed to fit either into a cleft or bevelled haft. The series of incisions on the proximal half of the shaft may be a representation of some form of binding or, more likely they may have been designed to help the binding grip the shaft.

Frontal 4 is a long, slender, carefully worked point, which looks as if it was designed to be some form of projectile. No traces of hafting or use could be distinguished, as it is in a poor condition. This is exacerbated by the fact that this piece is displayed still held in the lump of breccia in which it was found (Plate 4:4).

It is curious that Hoyle 1 and Goyet 65 are perforated when they are much larger than the usual range of needles and it seems hard to imagine how the perforations could have added to their function as points, though it need not have detracted from that function. They could have been pendants, but in neither case is the perforation at all worn, which suggests that neither piece was ever actually strung, although it is possible that they had yet to be used.



Plate 4:4 Trou du Frontal 4

The shape of Hoyle 1 (fig.4:5) is suggestive of a hand-held implement rather than of a projectile point, which may have had some perforating function owing to its narrow distal end. Goyet 65 is different in outline, in that its sides are mainly parallel and only meet quite abruptly at a thick tip. The presence of the double bevel is curious; it may have been intended either to aid perforation or else to have been a copy of the larger, functional bevelled bases of the antler rods. In that case, the incisions on the bevel may be a representation of those seen on the bevels of antler rods (see Antler Rods). It is possible that Goyet 65 was a representation in miniature of a hunting device, which was designed to be worn as a pendant.

Another possible use for such pieces may be that described by de Saint-Périer, who found a similar specimen in a Middle Magdalenian context at la Grotte des Harpons, Lespugue (1928,18,Fig.1:2). On the basis of comparisons with Eskimo examples (fig.4:5), de Saint Périer suggested that his piece may have been used as a needle for passing through the gills of fish, so as to attach them to a line which could be conveniently carried. Thus,

> "il passe dans l'ouïe du Saumon une grosse aiguille en os ou en ivoire, perforée à sa base, le *ququartaun*, munie d'une lanière qui est maintenue dans la perforation par un gros noeud. L'extrémité libre de cette lanière porte un autre noeud qui l'arrête lorsque l'aiguille, traversant la bouche du Poisson, a tiré la lanière jusqu'à son extrémité. Le pecheur jette alors le Poisson sur son dos et l'emporte" (op.cit.,21).

Variation and Distribution

As the vast majority of these pieces are broken, the original distribution of lengths is unknown and also there is no means of suggesting by variation in lengths any distinction in size or proportions between 'awls' and 'projectiles'. Similarly, because the distal and

proximal parts were usually missing, the shaft measurements could not always be taken at the same point, so no useful comparisons may be made.

This type is found throughout the region being studied, but where it is absent from particular sites, it should be remembered that almost all of the assemblages considered here are from incomplete collections. The age of the sites on which these artifacts were found ranges from the Aurignacian at the Grotte de la Princesse to the Magdalenian at Chaleux. This widespread distribution is to be expected, as this is not a particularly specialised tool type.

Group 4(i) Split-based Points

These artifacts are pointed at one end and split perpendicular to the long axis of the piece at the proximal end. They are either oval or plano-convex in section. One piece is lozenge shaped, while the rest are roughly triangular, that is to say that their maximum width is at the base, as opposed to being at the midpoint of the long axis (fig.4:7). Only pieces with split bases actually present or else a very strong indication of the former existence of a split base, for example Magrite 3 (fig.4:6), are included: similar shaped pieces which may have been broken above such a feature have been rejected and placed in the category of Group 4 points. Nine split-based points have been recognised in the collections studied here (see Table 4:6). Such pieces are called "pointes à base fendue" or "pointes d'Aurignac" by continental writers (see de Sonneville-Bordes 1960, 43; Leroy-Prost 1974,449,1975,104; Otte 1977,196).

Table 4:6
Number and Distribution of Split-based Points

Grotte de Goyet	1
Grotte de Spy	1
Trou Magrite	7
Total	9

Split-based points were designated the type fossil for Aurignacian I by Peyrony (de Sonneville-Bordes 1960,43) and clearly do belong to the Early Aurignacian, but Leroy-Prost has suggested on the basis of recent stratigraphic information that they are not reliable indicators of the first stage of this period (1975,112,114). Split-based points have also been found in Early Aurignacian contexts in Central and Eastern Europe (Kozlowski and Kozlowski 1977,207; Wymer 1982,203,205), though the majority seem to originate from undatable assemblages (Albrecht et al. 1972,83).

A study of the techniques used in the manufacture of these points suggests that they were first extracted by the groove and splinter technique, then the base was split either by cutting out some material, or by wedging the piece open without the removal of any material. These two possible methods will be discussed in some detail below. The surfaces appear to have been modified by longitudinal scraping, resulting in a polish on some pieces. Traces of damage probably relating to use were identified at the proximal end of Magrite 3. The shape of these pieces suggests that they were projectile points with the split base functioning as a hafting device.

Manufacture

These pieces are made from either cortical bone or antler; in three cases the raw material has been identified as antler, because tiny, cancellous tissue is visible on one surface.

(i) Débitage

These artifacts were probably cut out of the original raw material by the groove and splinter technique; typical signs of this process may be seen on the sides of most of these artifacts in the form of longitudinal striations, facets and chattermarks. This process no doubt provided the basic shape of these pieces, as most of the traces of modification appear to be confined to the surfaces and not the sides.

(ii) Modification

Much modification of these artifacts has taken place, mainly by longitudinal scraping of the cortical parts of both surfaces. The resulting traces consist of longitudinal striations, facets and chattermarks; these pieces are often smooth and finely worked.

Another important stage of modification was the splitting of the proximal end, clear traces of which may be seen on the better preserved pieces. This feature must have been artificially produced, for antler does not normally split longitudinally in the natural state. Goyet 106 and Spy 4 are almost complete and so it can be seen that they have both been deliberately and carefully split (fig.4:7). Five other pieces of this type show signs of proximal splitting, but are unfortunately so eroded that no traces of working are visible, with the exception of the longitudinal facet visible on one side of the split on Magrite 17 (fig.4:6), which suggests that the edges of the split were neatened. Magrite 3 may have broken just above the proximal split, for at its proximal end, which has been transversely broken, one surface has been thrust upwards.

Two methods of producing a split base have been identified by prehistorians; one of these methods suggested by Henri Martin (Peyrony 1935,429-430) involves wedging open a split so that no material is actually removed, whereas, with the other technique, which was

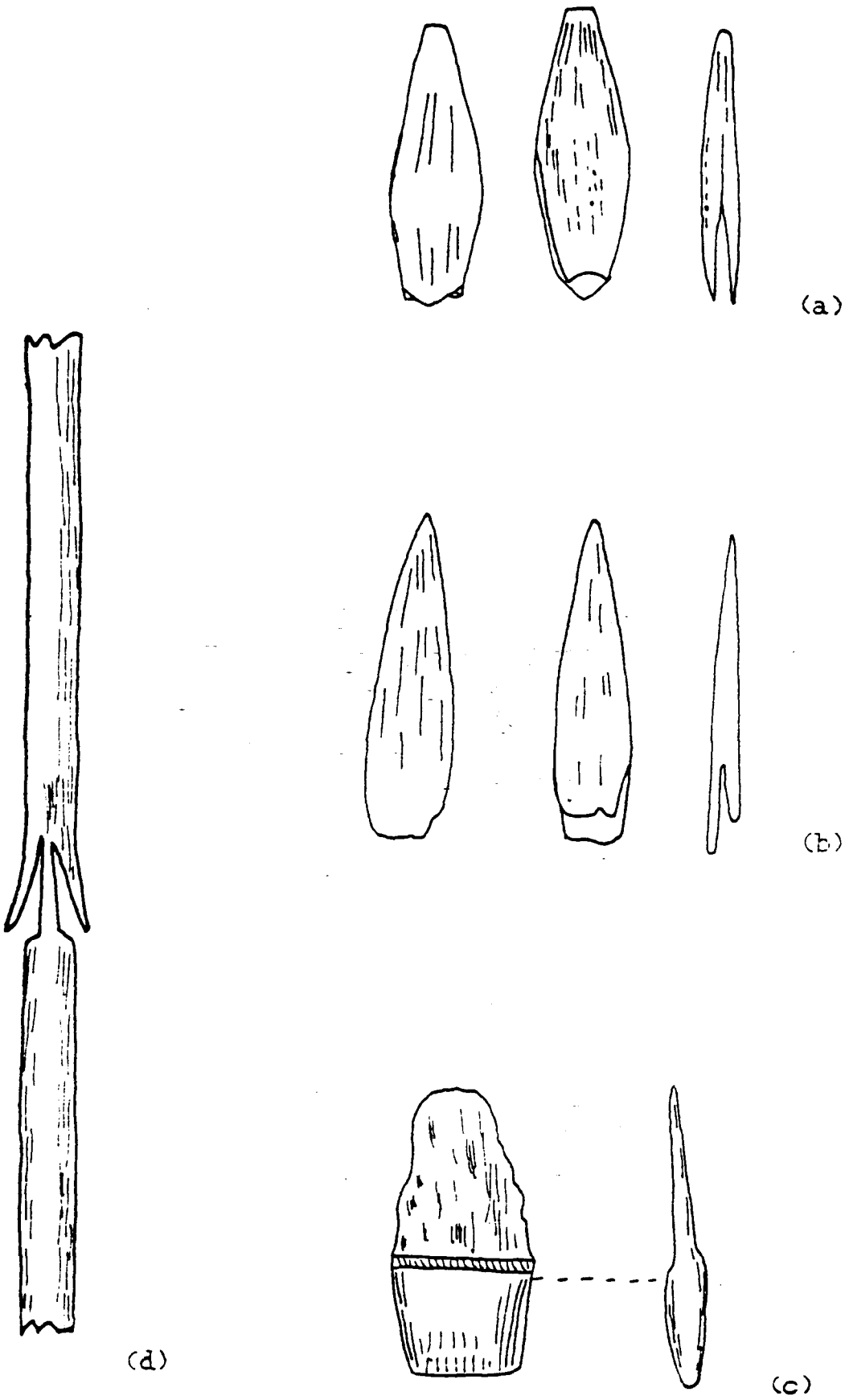


Fig. 4:7 Split-based Points and their Manufacture: (a) Goyet 106 (b) Spy 4 (c) Débris from Manufacture identified by Peyrony (1935, 426, Fig. 9, No. 4) (d) Method of Manufacture reconstructed by Peyrony (Fig. 9, No. 5) Scale for (c) and (d) is 5:6

reconstructed by Peyrony, material is actually cut away from the base of the piece (Peyrony 1935,427-429). This latter method was rediscovered by Peyrony as a result of finding both split-based points and pieces of working débris during his excavations of Layer A at the Abri Castanet (Dordogne) (fig.4:7). These pieces of working débris,

> "se composent d'une base à section quadrangulaire ou ovalaire, faisant saillie sur une languette la surmontant, comme le fait le manche d'un couteau sur la lame" (Peyrony 1935,427).

From their appearance, Peyrony worked out that they formed the missing pieces from between the 'lips' of the split bases. Peyrony successfully tested this technique, which will be described in detail below, in that he not only produced a split-based point, but he also produced a piece of working débris, similar to those which he had found. No such pieces were identified among the collections studied here, and it was the absence of such débris from the site of La Quina which persuaded Dr. Henri Martin that the bases were just torn open (Leroy-Prost 1975,106).

Having examined 111 split-based points, Leroy-Prost came to the conclusion that both methods of manufacture were used,

> "Ces deux méthodes nous apparaissent complémentaires et non pas opposées. Il est incontestable que certaines bases fendue sont le résultat d'un simple clivage de la matière première." (1975,111).

A series of experiments were carried out by Newcomer in order to test these conclusions. He found that antler was the best raw material for the purpose and that,

> "bone and ivory are not elastic enough to form a good split" (Newcomer 1977,299).

Using a flint blade as a wedge, Newcomer successfully hammered open the base of an unfinished point and made the following observations,

> "Done carefully, this produces a good split and involves the removal of little or no material from inside the split, though once the split is opened and allowed to dry open, it can be very difficult to tell whether material was removed or not" (ibid.).

The second method involved carrying out a reconstruction of Peyrony's experimental technique for producing a split base,

> "the outer surface of the antler splinter is sawn transversely to a depth of about 1 mm. and a split induced in the longer end of the splinter (which will become the point)...Once the split is started, the splinter is turned over and a similar saw cut made on the inner surface of the antler, directly opposite the first, and a split begun on the inner side. The split is then carefully deepened by bending the tongued piece back and forth until the split is deep enough or the tongued piece breaks out. Should the tongued piece break out prematurely, the split can be deepened by forcing the lips of the split base apart" (ibid.).

Newcomer's conclusion is that,

> "there is no easy way of telling which of these methods was used on given prehistoric split-based points, and no doubt Leroy-Prost (1975:111) is correct in thinking that both methods were used" (op.cit., 300).

When I examined the bases of the small number of surviving Belgian split-based points, I could not suggest with any confidence by which method they had been split.

Function

(i) Traces of Use

The polish that may be seen on some of these pieces is probably associated with manufacture rather than use, as it is either uniform or restricted to those areas which were clearly worked. Each piece, apart from Spy 4, has either been broken or chipped at the distal end, while in all cases the proximal end has been broken or chipped. This regular damage may result from use. Magrite 3 shows interesting damage to the proximal end, in that one surface has been thrust upwards: this may have resulted

from a sudden impact breaking the delicate,split end and forcing the hypothetical shaft to which it was hafted hard into the piece.

On Magrite 18, there are particularly rough traces of working on the base, which may be the result of reworking.

(ii) Use

The most likely interpretation of the information that may be derived from these pieces is that they were projectile tips, with the split base functioning as a hafting device. The split end was probably intended to fit onto a double-bevelled shaft; the join could then be glued with resin and bound with sinew to hold it. Whether these shafts belonged to arrows or spears is unknown and probably will remain unknown, until hafted split-based points are recovered. What appear to be arrow-shafts have been recovered from Ahrensburgian contexts in Northern Germany (Clark 1975,75-77), but no such evidence has been found in the region of this study, though this may be a result of the differential preservation of archaeological remains.

Possible traces resulting from hafting have been identified on the bases of certain points, all from the Grotte d'Isturitz (Pyrénées-Atlantique) by Leroy-Prost (1975,1978), which, one must presume, are not traces of working,

> "ces pièces, dont la pointe est encore intacte, portent des traces de mâchures, de compression, localisées à leur base,sur les lèvres, aussi bien sur la face supérieure que sur la face spongieuse. Elles semblent correspondre à l'action d'une très forte pression. Comme il n'est guère vraisemblable que ces pièces aient eu une utilisation multiple, on ne peut que suggérer une insertion dans une hampe, maintenue très serrée à l'aide d'une ligature ou d'une résine" (1975,110).

Variation and Distribution

These artifacts vary in length from 3.55 to 6.8 cm, but only two pieces are obviously near complete. These are Goyet 106 and Spy 4, which

are 3.55 and 4cm long respectively, but these are shorter than all the other pieces. The proximal dimensions also give little indication of the original size variation, for as all these pieces were broken, the measurements could not all be made in exactly the same location on each piece. The one apparently complete tip belongs to Spy 4 and is 0.1cm wide and 0.05cm thick.

This type of artifact is not found in Britain, but has been recovered on at least four, geographically quite widespread sites in Belgium. The eight pieces described above come from three of these sites, the fourth is the Trou du Sureau, near Montaigle in the Molignée Valley, where a lozenge-shaped, split-based, antler point was found during Dupont's excavations (Dupont 1872,77,Fig.5). This was clearly a lovely artifact, which unfortunately could not be found when I visited the Institute Royal des Sciences Naturels in Brussels, where this piece is held. Mme de Sonneville-Bordes (1961,424) has indicated that it was stored in a series labelled '3e niveau', which consisted mainly of a typical Aurignacian industry mixed with some Mousterian.

In France, split-based points have been traditionally regarded as a type fossil of Aurignacian I, based on the sequence found by Peyrony at La Ferrassie (de Sonneville-Bordes 1960,43). However, this belief has been reassessed by Leroy-Prost, who has argued (1975,112,114) that although split-based points belong to the earlier part of the Aurignacian, they are too few in number to be a type fossil and, furthermore, information from recently excavated sites suggests that such pieces do not appear to be the earliest form of Aurignacian point. Split-based points are also found in the Aurignacian of Central Europe, for example at Vogelherd in Germany and Istállóskö in Hungary, though they often come from undatable contexts (Albrecht et al. 1972,83); Kozlowski and Kozlowski 1977,206, Fig.1,207,216,218; Wymer 1982,205).

Owing to the general similarity of the Belgian pieces to those from France, these artifacts are attributed to the Aurignacian, though what stage they represent in the ill-defined local sequence is not known. Although a number of these artifacts do appear to have come from layers which have been identified as Aurignacian, for example Magrite 59 and 66, there is unfortunately insufficient, reliable stratigraphic evidence from the Belgian sites either to confirm or to dispose of this hypothesis. This type does not appear on all the Belgian Aurignacian sites studied here, such as Trou du Renard, which in any case is thought to represent a later stage of the Aurignacian (Otte 1984, 163), but this tool type is found in all the sizeable collections. However, such artifacts do not occur on any of the non-Aurignacian sites such as the Magdalenian sites of Chaleux or Trou des Nutons or on the Gravettian/Maisierian site of Maisères Canal. This supports the theory that these pieces were restricted to Aurignacian occupations.

A reason why this should be the case and why this type does not occur in Britain is suggested by Leroy-Prost's study of such pieces from the much better documented contexts of South West France, where this type is short-lived and is only found in the Early Aurignacian. Leroy-Prost concluded (1974,457) that the hafting arrangement ie. the split base was not particularly resistant and so ceased to be manufactured after a short time and was replaced by more solid and reliable projectile tips. It may be that the split-based points tended to break on impact, which would render them most inefficient. It is probable that either such pieces were invented independently in Belgium or else spread there from South West France (or indeed from Central Europe) and were rejected after a short period of time in favour of more reliable points. Thus, they did not spread either to other Belgian sites or to Britain, where other hunting devices would have been used.

Group 4(ii) Spindle-shaped Points

These are bone,antler or ivory artifacts which are either oval or subcircular in section; they are thickest in the middle and taper to both ends, being pointed at one end but not necessarily at both (fig.4:8). Four examples of this type have been identified, which all come from Belgian sites, see Table 4:7 below.

Table 4:7
Number and Distribution of Spindle-shaped Points

Trou Magrite	1
Maisières Canal	1
Grotte de Goyet	2

Total 4

This type is directly equivalent to Leroy-Prost's "pointes fusiformes" (1974,455;1975,121), which are also sometimes referred to as "pointes biconiques" (de Sonneville-Bordes 1960,23),or "sagaies bipointes" (Otte 1977,193). Otte (p195) also has a separate category of 'sagaies biconiques', for which the published information suggests that they are not sufficiently different from the 'sagaies bipointes' to merit this extra grouping, particularly given the small numbers of artifacts involved.

'Pointes biconiques' were recognised by Peyrony as a type fossil for Aurignacian IV from Layer H'' at La Ferrassie (Leroy-Prost 1974,449). However, the 'pointes losangiques à section ovale' from Layer H' at the same site, which Peyrony considered to be the type fossil for Aurignacian III, are so similar that again given that such pieces are so few in number, it may make more sense to group them together in one category, as Leroy-Prost (1974,455) and de Sonneville-Bordes have done (1960,55). Indeed, such pieces are found in both Layers H' and H'' at La Ferrassie,

and there seems to be insufficient evidence for using them to characterise one or other stage of the Aurignacian.

Bipointed artifacts have also been recognised in the Upper Palaeolithic of Eastern and Central Europe (Kozlowski and Kozlowski 1977,207). Similarly, Camps-Fabrer (1966,168) has identified a class of "poinçons doubles" in her study of Epipalaeolithic and Neolithic collections in North West Africa.

Comparisons made with spindle-shaped points from the South West of France (Leroy-Prost 1974,458,1975,123; de Sonneville-Bordes 1960,43,215) and from Central and Eastern Europe (Kozlowski and Kozlowski 1977,219) suggest that these pieces belonged to the Earlier Upper Palaeolithic, though there is not sufficient evidence to determine to which stage of this period they belonged.

The regular shapes of these points and the characteristic traces on their sides and surfaces suggested that they had been deliberately extracted by the groove and splinter technique and then modified by scraping. This appeared to be confirmed by the results of the microscopic study of silicone rubber casts made of all of these pieces, with the exception of Maisières 32. Three examples were probably once pointed at both ends prior to breakage, although the two ends do not appear to have been identical. One of these three pieces, Maisières 32, was clearly double-bevelled at one end; this feature is interpreted as a hafting device. A longitudinal groove has deliberately been made at the proximal end of the fourth point, Goyet 7, which may have been intended to hold tiny, flint chips as armatures.

These pieces were examined for traces of use, but none were recognised, though it is possible that the ends of these pieces became damaged through use. The shape of these artifacts and the high quality of their production suggest that they were projectile points.

Manufacture

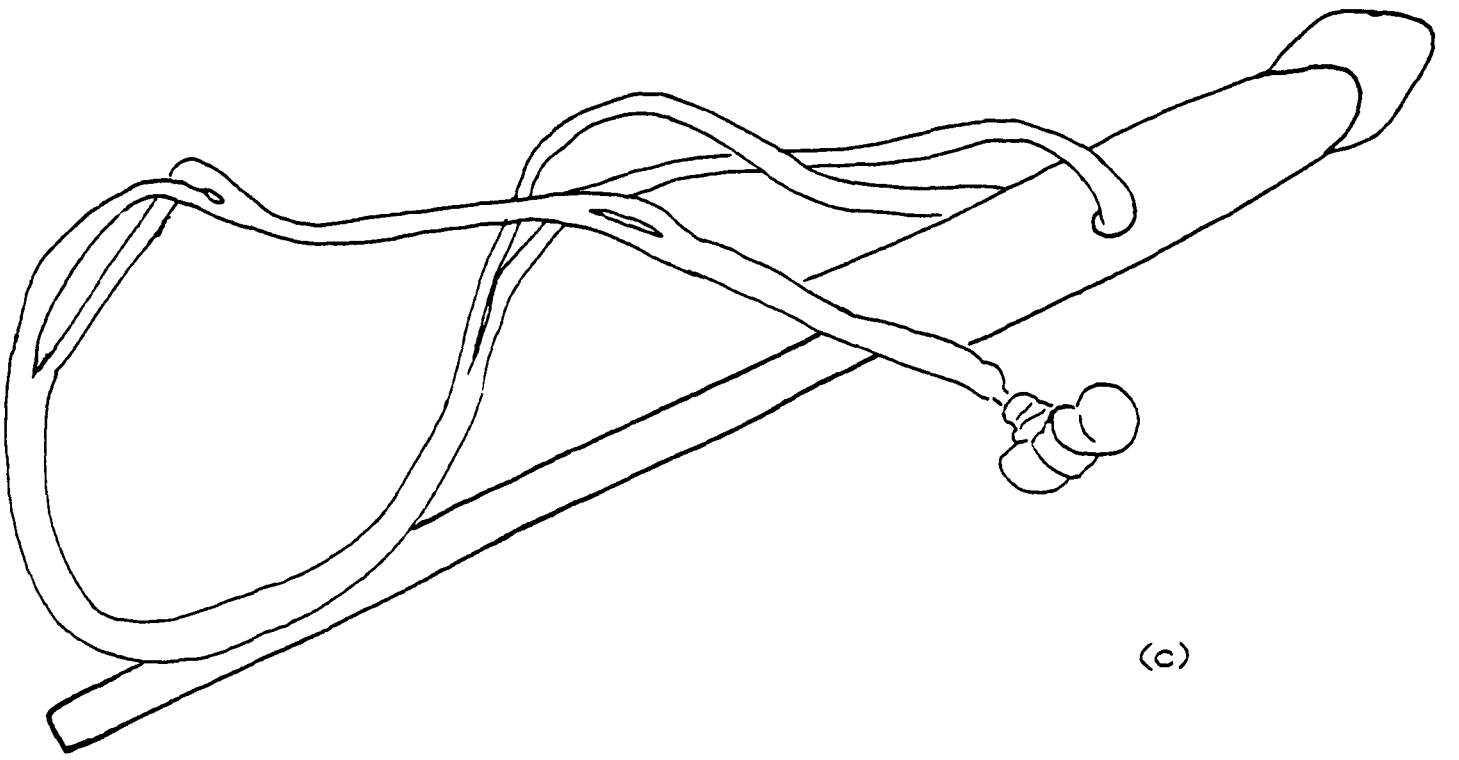
All these pieces were made from cortical bone or antler, with the exception of Maisières 32, which is made of ivory.

(i) Débitage

Three of these artifacts showed regular traces of working on their sides such as longitudinal striations and facets, which combined with their regular shape suggests that they were all extracted by the groove and splinter technique. By contrast, Goyet 13 was covered with traces of modification, which, owing to its regular shape, probably conceal similar traces of débitage on the sides.

(ii) Modification

Each piece has been heavily worked by longitudinal scraping, the characteristic traces of which are clearly visible on the surfaces in the form of longitudinal striations, facets and chattermarks. Magrite 2 (fig. 4:9) and Goyet 13 (fig. 4:8) have been particularly finely worked and are thus very smooth, for careful scraping may produce a polish on a bone surface. Three of these pieces were probably pointed at both ends, though this does not mean that the two ends were identical to one another. Of these three, Maisières 32 (fig. 4:9) was clearly double bevelled at one end; in the other two cases, one end was clearly thicker than the other, which was probably a deliberate feature (see Use). The fourth piece, Goyet 7 (fig.4:8), may have been transversely broken at its wider end, though it is possible that it was deliberately produced that way. It has a curious feature on one surface at its proximal end, that is a longitudinal groove, approximately 2.5cm long and 0.25cm wide. Only a few possible traces of production in the form of striations are visible within it, as this surface was unfortunately quite eroded, however, it was clearly artificial.



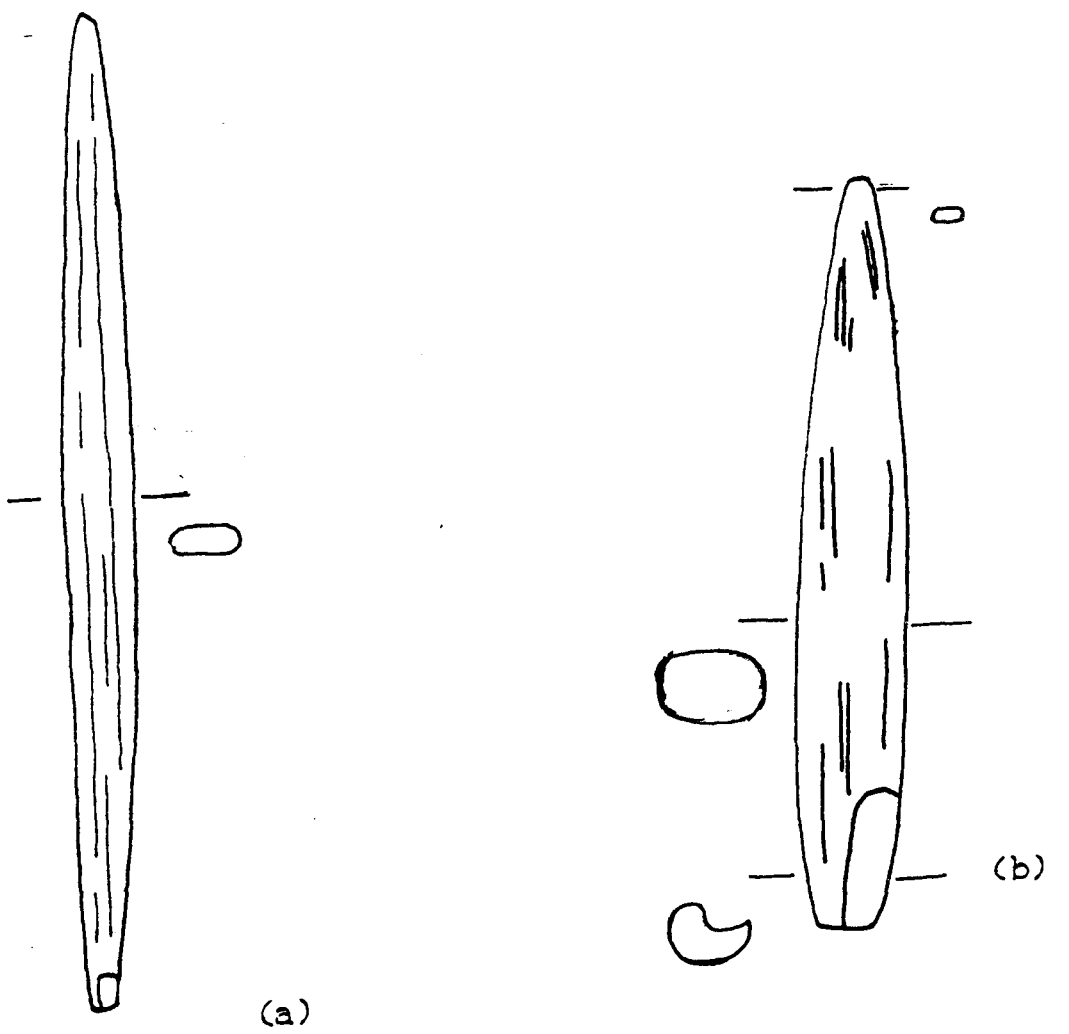


Fig. 4:8 Spindle-shaped Points: (a) Goyet 13
(b) Goyet 7
(c) Eskimo model of a whaling harpoon (Scale 7:10)

Function

(i) Traces of Use

No traces of use were identified, although it is possible that the ends of these pieces became damaged through use.

(ii) Use

These points have been so carefully shaped and streamlined, that they appear to be designed for flight, in contrast to the points belonging to Groups 1,2 and 3, which must have been used while held in the hand. Maisières 32 is like a tiny dart, as it is such a slender piece with its tiny, distal point and double-bevelled proximal end, which was presumably designed to fit into a cleft or socketed haft. There is no evidence to prove whether the longitudinal groove in the proximal end of Goyet 7 was designed to hold tiny, flint armatures (see Antler Rods) or whether it was part of some highly sophisticated hafting device, where the base of the point slotted into the haft or vice versa. The other two examples, Goyet 13 and Magrite 2, appear to be pointed at both ends, with one end being thicker than the other and this is likely to have been the proximal end, which could have been held in a cleft or socketed haft. Such pieces could have been simple projectile tips, being pointed at one end and attached to a shaft at the other, or they could have been intermediate parts belonging to more complex weapons.

In the absence of recognisable traces of use on these artifacts and of other direct archaeological evidence for the manner in which these pieces were used and against what prey, it becomes necessary to seek archaeological and ethnographic information from other areas and periods for such tool use. Similar-shaped pieces made of bone or wood have been used as linkshafts by modern Bushman groups in Zambia in order to connect arrowheads, again made of wood or bone, with arrowshafts made of reeds or wood (fig. 4:9). Late Stone Age wooden linkshafts were found in a

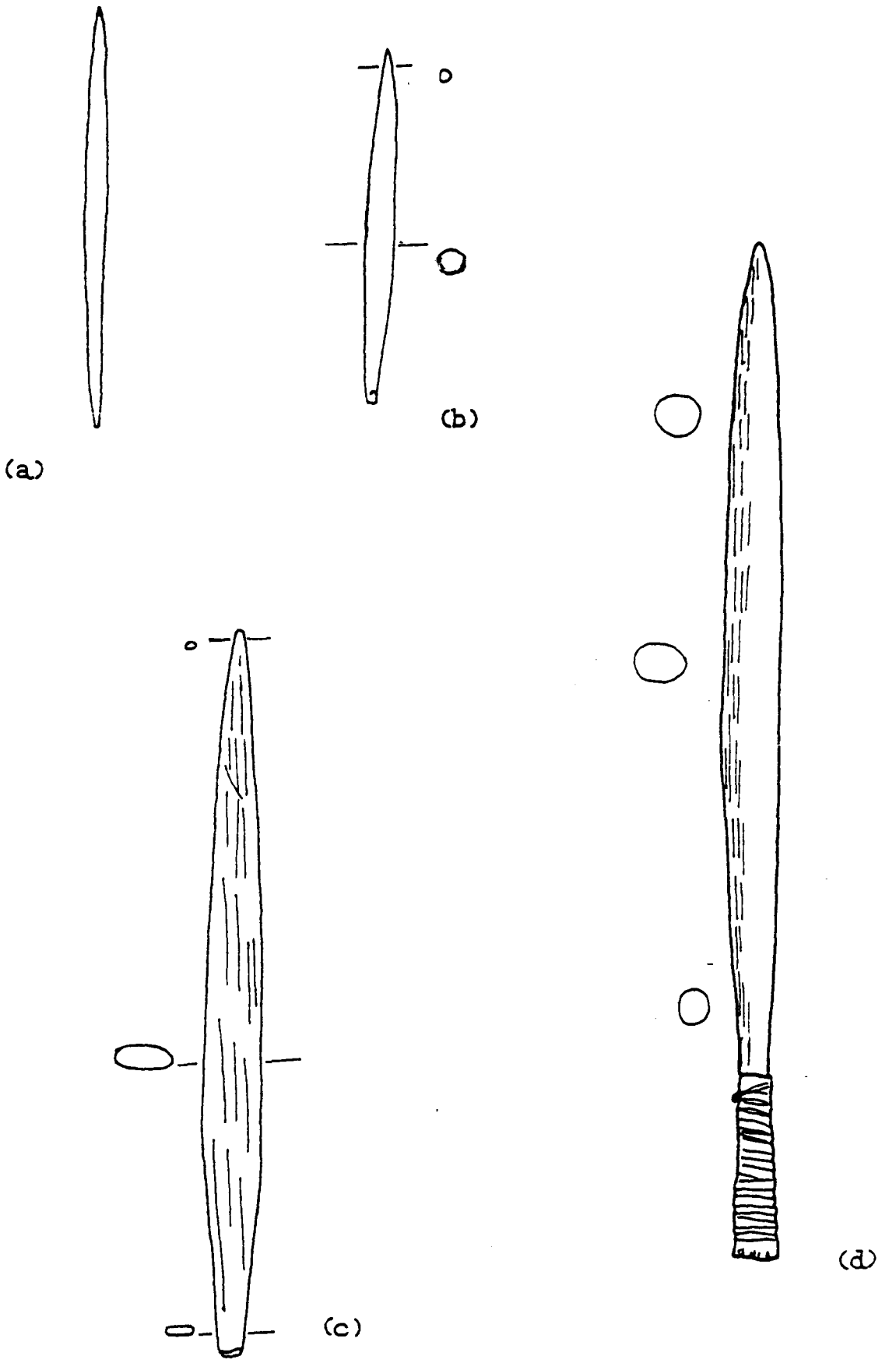


Fig. 4:9 Spindle-shaped Points: (a) North American Indian fish gorge, after Stewart (1973, 131) (b) Maisières 32 (c) Magrite 2 (d) Modern Bushman bone linkshaft from Zambia, with a point made of reed and sinew, after Fagan and Van Noten (1966, 250, Fig. 2:1)

remarkably good state of preservation at Gwisho hot-springs, Lochinvar, Zambia (Fagan and Van Noten 1966). Ethnographic records suggest that this particular combination of projectile point, linkshaft and arrowshaft was,

> "used with vegetable poisons against a wide variety of game" (op.cit.,251).

Another possible parallel for the 'spindle-shaped point' is provided by the foreshaft of the classic Eskimo harpoon, the various component parts of which consisted of a detachable head, a bone,antler or ivory foreshaft, socket pieces to join the foreshaft and the main wooden shaft and an ice pick at the base of the shaft (Giddings 1967,73-74). Eskimo models of such whaling harpoons which were made at the turn of the century and which are held in the Pitt-Rivers Museum, Oxford (fig.4:8), have a very slender foreshaft, but it is only pointed at the distal end, where it fits into a hole in the base of the harpoon head. Thus, it does not provide such a good parallel for these Palaeolithic points.

The evidence presented above suggests that spindle-shaped points may have been used as parts of composite projectiles, though against what prey is not certain. Another very different function is that proposed by Clark (1948,46-47) that bipointed pieces may have been used with lines as gorges for angling, for which there are certainly modern and ethnographic parallels. An example of the type of fish gorge used by the Northwest Coast Indians is illustrated by Stewart and reproduced here (fig. 4:9); it may be seen that it resembles in particular Goyet 13 and the example from Trou Magrite.

Which of these explanations is the right one must remain unknown until such an artifact is found hafted, or in close association with the remains of some particular prey, as has been the case for certain barbed points (see Barbed Points).

Variation and Distribution

These points ranged from 10 to 4.55cm in length; they are all either chipped or broken at both ends. Thus, there is no surviving information about the range of variation in length or in the size of the ends. The midshaft width varied from 1.15 to 0.35cm and midshaft thickness from 1 to 0.3cm.

These pieces come from three Belgian Upper Palaeolithic sites. Otte (1977,195) has suggested that these artifacts belong to the Upper Perigordian, as this industry is the only one represented at one of the sites (Maisières Canal) and is present at both the others. However, the Aurignacian is also represented at Goyet and Trou Magrite and Magrite 2 is supposed to have come from that level. It is possible that Goyet 13 and Magrite 2,which are quite similar in appearance, were Aurignacian examples of this type, with Maisieres 32 being an Upper Perigordian example. However, Goyet 13 is actually labelled Upper Perigordian, though on what basis is unknown. Certainly in the Perigord region (de Sonneville-Bordes 1960,215), this type appears in both periods. However, there is insufficient stratigraphic information to determine to which part of the Earlier Upper Palaeolithic these Belgian examples belonged.

Goyet 7 presents a further problem, in that its longitudinal groove is not a typical feature of the Earlier Upper Palaeolithic in this region, being more commonly seen on Later Upper Palaeolithic antler rods. However, in the Perigord region, "sagaies à cannelures", which are equally spindle-shaped do appear in the Upper Perigordian (de Sonneville-Bordes 1960,215 and 172,Fig.102,Nos.2,4,6), while at the Earlier Upper Palaeolithic site of La Faurelie was recovered,

> "une pointe fusiforme entière qui offre la particularité d'une cannelure située au voisinage de l'extrémité apicale" (Leroy-Prost 1975,122).

Goyet 7, like Goyet 13, is held in the collections of the Cinquantenaire Museum and is labelled Magdalenian, though again there may be no stratigraphic basis for this. It is most unfortunate that these pieces cannot be dated owing to the absence of contextual information and that direct methods such as radiocarbon accelerator dating would have to be employed if their age is ever to be known, although even that might not enable us to distinguish between the Aurignacian and Perigordian time-ranges.

Bipointed pieces from Eastern and Central Europe have been described and illustrated by Kozlowki and Kozlowski (1977) from both among their category of "pointes aplaties" (p207,Nos.2.1 and 2.9) and also from a separate category of 'pointes fusiformes'(p207-209), which appear to be a feature of both the Aurignacian and the Gravettian in those regions. However, judging from the published drawings, they are not generally particularly similar to the Belgian examples.

The restricted number and distribution of spindle-shaped points is interesting, as they are also an uncommon type in South West France (Leroy-Prost 1974,455;1975,121). They were particularly carefully manufactured artifacts compared with the other types of point described here and may have enjoyed only limited popularity given the effort involved to make them. Other forms of point were presumably used for the same function both on these and on other sites.

Group 4(iii) Whittled-based Points

These are generally triangular, bone,antler or ivory artifacts with a distal point and a base, which has been whittled, in most cases, into a short, pointed 'tang' (fig.4:10). These points are oval or subcircular in section. Eight pieces have been assigned to this category; they all come

from Belgian sites (see Table 4:8). These artifacts are also called "sagaies à base découpée" by Otte (1977,195) and "pointes à soie" by Leroy-Prost (1974,457; 1975,127). Pieces which are similar in general outline, but which probably differ as regards methods of manufacture also appear in Central and Eastern Europe and are described as "pointes sub-cylindriques ou sub-coniques, allongées, base conique, section circulaire" (Kozlowski and Kozlowski 1977,209,208,Fig.2,3.4).

Table 4:8
Number and Distribution of Whittled-based Points

Site Name	With Tang	Without Tang	Total
Grotte de Goyet	1	-	1
Maisières Canal	2	-	2
Grotte de Spy	1	-	1
Trou Magrite	3	1	4
Totals	7	1	8

A study of the traces of manufacture preserved on these pieces suggested that they had been deliberately extracted by the groove and splinter technique. After this, their proximal ends were shaped by whittling. The surfaces appear to have been modified by scraping, which has resulted in a polish on one piece, Maisières 2. No traces of use were identified on these pieces and indeed it is not clear whether they were actually finished or not. If the 'tang' was a deliberate feature of the intended artifact, as opposed to just being a stage of manufacture, then these pieces may have been specialised projectile points designed to fit into a socketed shaft. The available chronological evidence suggests that these pieces were manufactured during the Earlier Upper Palaeolithic.

Manufacture

Two of these points were made of ivory, three of antler and three of cortical material, which could be either bone or antler.

(i) Débitage

All of these pieces appear to have been cut out by the groove and splinter technique, the traces of which consist of longitudinal striations and facets on the sides, as well as chattermarks in some cases. The exception to this is Spy 156, which has been heavily worked all over, so that the traces of modification may conceal any signs of débitage.

(ii) Modification

In every case, the proximal area has been whittled down by longitudinal scraping on one or both surfaces and then when it was sufficiently thin, the proximal end was snapped or cut off. As a result of this process, the proximal area is roughly pointed or rounded in shape, forming a small 'tang'. The one exception to this is Magrite 19 (fig.4:10). Its base certainly appears to have been whittled, but it is very neatly finished without the short, pointed or rounded 'tang' that is characteristic of the other pieces in this group. The proximal area on all of these artifacts is covered with longitudinal striations from scraping and is stepped in appearance, where the stone tool has cut into the surface of the piece.

These artifacts were modified by scraping, leaving the surfaces covered with characteristic traces in the form of longitudinal and oblique striations, facets and occasionally chattermarks. Maisières 2 (fig.4:10) is highly polished all over, which is probably a result of manufacture, as the polish is so uniform. The distal end of this piece has also been made roughly double-bevelled by scraping, probably as a crude method of reduction. Maisières 33 has split longitudinally, which is a natural feature of decayed ivory, peeling off part of the flat surface: an attempt has been made to whittle down both ends by scraping the convex surface.

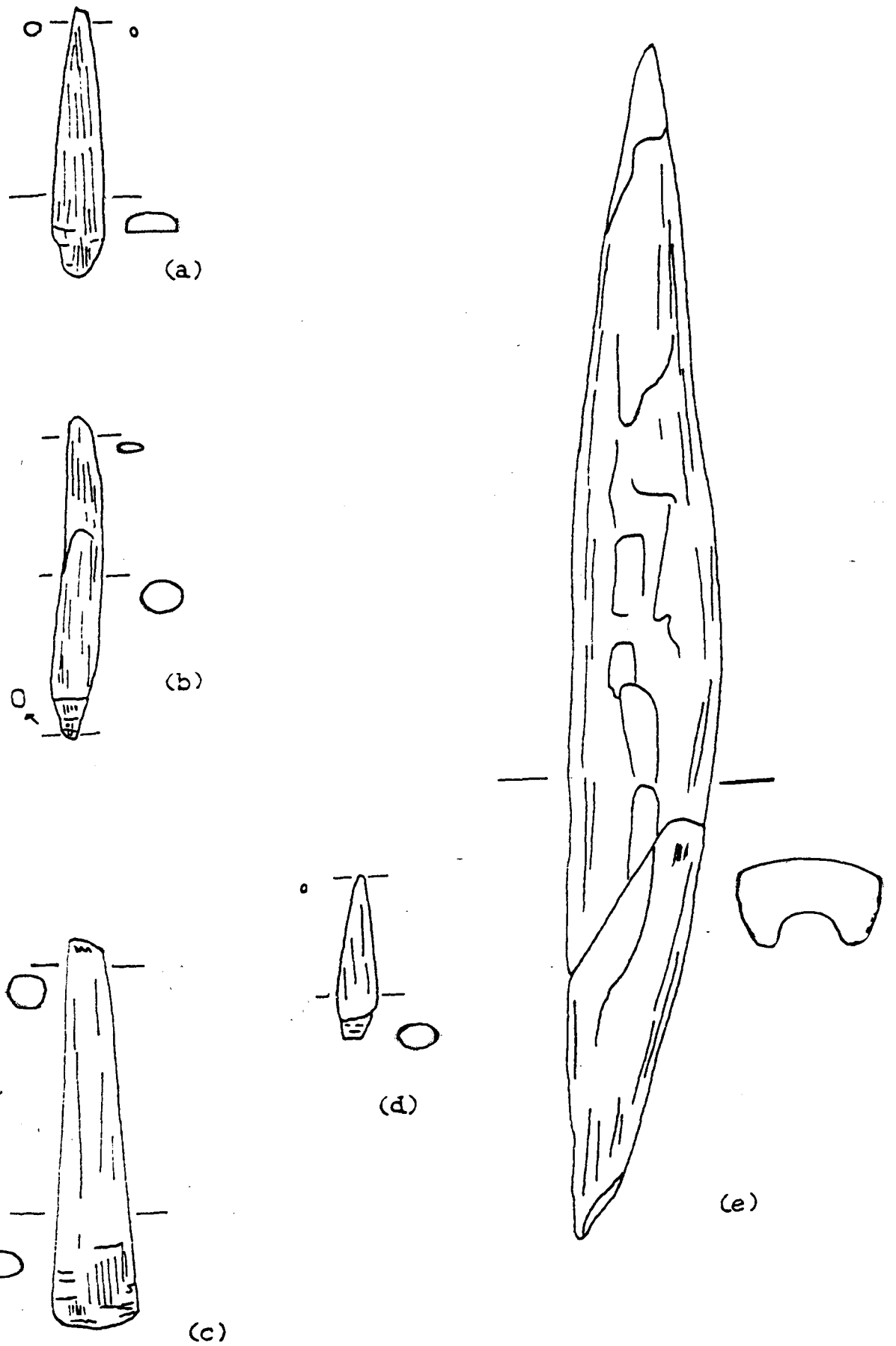


Fig. 4:10 Whittled-based Points and a Lozenge-shaped Point:
(a) Magrite 7 (b) Maisières 2 (c) Magrite 19 (d) Spy 156
(e) Goyet 88

Function

(i) Traces of Use

No possible traces of use were identified, apart from the damage to the tips of all of these pieces, which may have resulted from use. It is questionable whether these pieces were in fact complete, for either the whittled, proximal "tangs" could have been designed to be used for hafting, or else the intention may have been to remove them and to neaten the proximal end, as in the case of Magrite 19. The former seems to be more likely, for it would have been easier to remove any unwanted material by transverse sawing rather than by whittling. However, certain pieces do look unfinished, such as Maisières 2 and 33, and Magrite 6, so they may just be uncompleted Group 4 points which have been shaped in a curiously elaborate fashion.

(ii) Use

It is possible that these whittled ends were deliberately produced hafting devices belonging to specialised projectile tips, which could have been fitted into a hollow shaft. If this was the case, then Magrite 19 must either have been hafted in a different manner, or else it may not have been a projectile point, but rather an artifact such as a perforating tool to be used while held in the hand.

Variation and Distribution

These points vary in length from 5.3 to 2.2cm; they are all either chipped or broken. Spy 156 (fig.4:10) is particularly small and is very much a borderline case, as it is quite similar to the many Type b ivory bead blanks found at Spy, apart from its pointed 'tang' (see Chapter 6: Beads Type b). The only dimensions which may reflect the original range of variation in size of these points are the width and thickness just above the 'tang', as they can be measured in the same location each time. The width ranges from 1.2 to 0.4cm and the thickness from 0.7 to 0.3cm.

Within this group, the two points from Maisieres are particularly crude and rounded, which may just reflect the fact that they are made of ivory instead of cortical bone or antler.

This type is restricted in number and in its distribution, for it has been found on only four Belgian Upper Palaeolithic sites. Such artifacts are not found in Britain.

The examples from Maisières are presumably associated with the Upper Perigordian or Gravettian which constitutes the sole occupation of this site. However, the other pieces in this category all come from multi-period sites, where they are not obviously associated with this period. At least three of these artifacts (Magrite 6,7,11) have been classified in their collections as having come from an Upper Aurignacian level, though this information may not be reliable. This type seemingly appeared in both Aurignacian and Upper Perigordian levels in the Perigord, Poitou and Charente regions, but was generally a very uncommon type there as only six examples have been identified (Leroy-Prost 1974,457; 1975,128). This indicates that this type may be attributed to the Earlier Upper Palaeolithic in general, but not with any certainty to either the Upper Perigordian or the Aurignacian in particular.

Otte (1977,196) has suggested that such points have been recognised by Mme de Sonneville-Bordes in the collections from the Magdalenian site of Chaleux. However, in the relevant publication, there is no drawing of this type, but only the following written decription "une sagaie à base en forme de soie" (de Sonneville-Bordes 1960,432), which may refer to something quite different. No pieces of this type occur anywhere else in the Belgian Magdalenian, nor have I observed any whittled-based points in the large assemblage from Chaleux. A similar shaped piece from an Upper Magdalenian level at the Abri Morin (Dordogne) is illustrated by Deffarge

et al. (1977,102,Fig.2,No.4), although its base appears to have been hacked rather than whittled into shape.

A point from the Eastern Gravettian site of Dolní Věstonice in Czechoslovakia, which seems to be generally similar in outline to the pieces described here, is illustrated by Kozlowski and Kozlowski (1977,208, Fig.2,No.3.4). However, its conical base was clearly an intentional feature of the finished artifact and there is no indication that it was produced by whittling. Even so, it does show that there must have been some use for points with such a basal feature.

The available evidence indicates that whittled-based points were made during the Earlier Upper Palaeolithic by certain groups in Belgium and that different tools were made in other places to fulfil the same function.

Group 4(iv) Lozenge-shaped Points

These artifacts are large, fairly flat, lozenge-shaped pieces made of reindeer antler, whose cross-section is either gently curved or oval. The sides are symmetrical with regard to the long axis of the piece. This group consists of only two examples from the Grottes de Goyet; they are Goyet 88 and 33.

A study of the techniques used in their manufacture suggested that these points were extracted by the groove and splinter method and that their surfaces were then worked by scraping. Goyet 33 is pointed at one end and finished off transversely at the other: its maximum width lies between the pointed end and the midpoint of the longitudinal axis (fig.4:11). Goyet 88 was probably once pointed at both ends and its maximum width lies at what must be approximately the midpoint of the longitudinal axis (fig.4:10). These artifacts were also examined in the

hope of identifying traces of use, but none could be found, though it is possible that the damage to the ends could have occurred during use. From their shapes, it is concluded that these artifacts were probably projectile points of some kind, which may have been either thrown or used with a stabbing action.

These artifacts are equivalent to the "pointes en os losangiques aplaties" found at La Ferrassie and deemed typical of Aurignacian II by Peyrony (de Sonneville-Bordes 1960,43), though their time span clearly extended to beyond this period (de Sonneville-Bordes 1960,59). They are called "pointes losangiques" by Leroy-Prost (1974,452), who has carried out a major study of such pieces from South West France and has concluded that there is too little unambiguous stratigraphic information available for these points to be made a type fossil for a specifc stage of the Early Aurignacian (1975,120-121). One of the Belgian examples, Goyet 33, is classified by Otte as a "sagaie à base massive losangique" (1977,199,198, Fig.3,No.14). Similar pieces have also been recognised in the Aurignacian of Central and Eastern Europe (Kozlowski and Kozlowski 1977,207, 206,Fig.2,No.2.4).

Manufacture

(i) Débitage

These pieces appear to have been extracted by the groove and splinter technique, both because they are regular shaped and also there are characteristic traces of this process on the sides in the form of longitudinal striations,facets and in the case of Goyet 33, chattermarks. On both examples, most of the traces of working appear to be associated with débitage, which suggests that these pieces were extracted in such a way as to minimise the amount of modification required.

(ii) Modification

On the upper surfaces of these pieces, a number of quite regular, longitudinal striations may be seen, which were probably associated with scraping in that they resemble the individual strokes of a stone tool. Various traces of further modification, particularly to the ends, may be seen on Goyet 33, which has been finely worked and smoothly finished. The lower surface of the 'base' or square end has been made gently bevelled by longitudinal scraping and is covered with grouped, longitudinal striations. The 'tip' or pointed end is also bevelled and is longitudinally facetted on both surfaces, which may have resulted from reworking, as the profile of the piece appears to have been altered. It is possible that the pointed end of Goyet 33 could be the base, which appears to be Otte's interpretation (1977, 198, Fig. 3, No. 14), as it is the square end which is at the top of the page, for the agreed convention is that a drawing of a bone tool has the distal end towards the top of the page and the proximal end towards the bottom (Newcomer 1974, 140-141). It may be that this piece was originally pointed at both ends.

Goyet 88 is unfortunately broken at both ends, though the marked convergence of the sides suggests that they were both originally pointed. Its maximum width is approximately at the midpoint of the longitudinal axis. In contrast to this, Goyet 33 is only chipped at its ends and its maximum width lies between the tip and the midpoint of the longitudinal axis.

Function

(i) Traces of Use

No traces of use were identified, although the damage observed on the ends may have occurred through use.

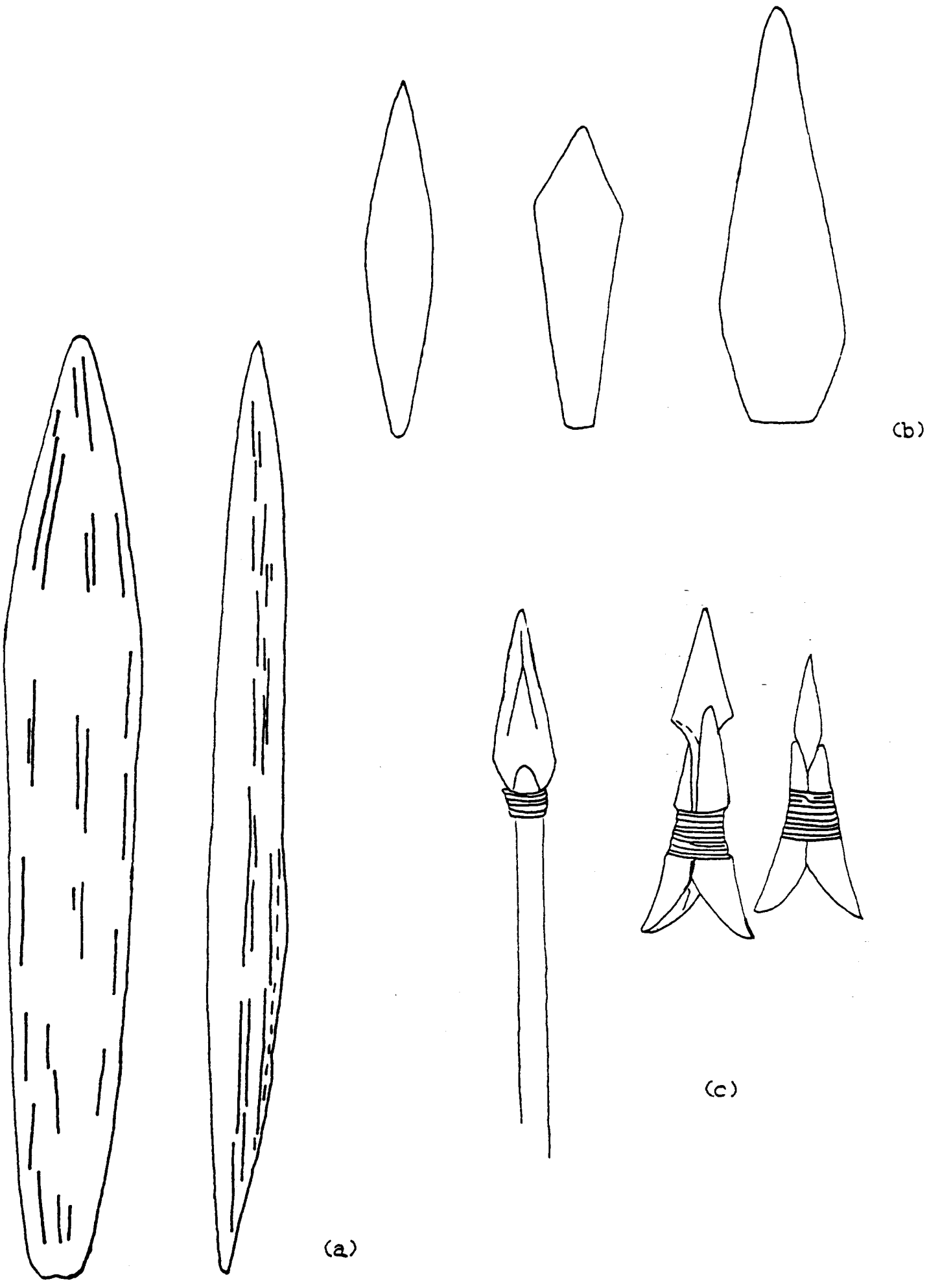


Fig. 4:11 Lozenge-shaped Points:(a) Goyet 33 (b) North American Indian projectile points, after Stewart (1973, 139) (c) Hafted examples of the above, after Stewart (ibid.)

(ii) Use

In the absence of both recognisable traces of use and of any contextual evidence for the function of these pieces, other sources of information need to be sought, such as may be found in the ethnographic record. In her study of Northwest Coast Indians of North America, Stewart (1973,139) describes bone projectile points which would fall into the 'lozenge-shaped point' category (fig. 4:11). As regards the method of their use, Stewart describes how,

> "some projectile points were attached to wooden shafts in much the same way the flaked stone points were. The mounted points were used with a bow or as spears, while others were cutting points for toggling harpoons" (ibid.).

Goyet 33 may have been such a projectile point, with the narrow, pointed end being the tip, while the bevelled base could have been designed for hafting. If this was so, it must have been attached to a substantial shaft for the piece not to be unbalanced. The distal end of the shaft would itself have to have been bevelled or forked, in order for it to fit onto the bevelled end of the point. The size and shape of this artifact suggest that it may have been used with a stabbing action, instead of being propelled through the air. Likewise, Goyet 88 could have been a large, projectile point or a spear used held in the hand, for example when fishing or hunting small aquatic mammals. Either end of this piece could have been the tip, with the other end as the base, which could have fitted into some form of socketed haft. As neither end is preserved, there are no traces left to indicate how this piece was either hafted or used.

Variation and Distribution

Goyet 33 and 88 are respectively 14.5 and 15.8cm long, while the maximum widths of their shafts are 2.1 and 2cm, with the thickness of the shaft at that point being 1.2 and 1.15cm respectively. These pieces vary in shape, in that their maximum widths are in different positions with respect to the long axis.

Leroy-Prost (1974,452-455; 1975,117-120) has studied seventy lozenge-shaped points from South West France. She has divided the twenty-five complete examples into four groups based on differences in length. The two Belgian examples fall into the most common group, consisting of pieces whose length varies between 130 and 170 mm.

These pieces are clearly very restricted in number; they come from the same site, that is Dupont's "troisième caverne" and conceivably from the same occupation. Goyet 33 comes from a disturbed deposit in Gallery 1, whereas Goyet 88 was recovered with a stone industry attributed to the Aurignacian in the Salle du Mouton during the excavations of the Institute of Natural Sciences.

Therefore, the little stratigraphic information available suggests that these artifacts may have belonged to an Aurignacian occupation, but it is, without direct dating, impossible to be more precise.

In the South West of France, this type has traditionally been seen as being typical of Aurignacian II (de Sonneville-Bordes 1960,59), though it is known to have appeared a little earlier in the Aurignacian and to have persisted into its middle phase. Leroy-Prost's more recent,detailed survey of these points has led her to believe that there is too little stratigraphic evidence to support the theory that this is an Aurignacian II type fossil (1975,120), though its attribution to the Earlier Aurignacian is not in doubt.

A similar-looking type is catalogued and illustrated by Kozlowski and Koslowski (1977,207,206,Fig.2,No.2.4): such pieces are described as "pointes aplaties, losangiques, section ovale". This type is apparently characteristic of the Eastern Aurignacian (Kozlowski and Kozlowski 1977,219). However, closer parallels may be found in the French collections (Leroy-Prost 1977,452,Fig.33).

It is possible that only two examples of this type seem to have survived, because smaller,broken fragments have not been recognised as being parts of lozenge-shaped points and have been overlooked by excavators. If this small number were to reflect the size of the original assemblage, then it would suggest that this was a most unsuccessful type in the region of this study perhaps because of its size. It may have been quickly replaced by other forms of point and thus, never spread to other sites. However, as this type was clearly found in relative abundance in South West France (Leroy-Prost 1975) and in Eastern and Central Europe (Kozlowski and Kozlowski 1977), it is the first explanation which seems the more probable.

Miscellaneous:1

Spy 32

Spy 32 is to all intents and purposes a barbed and tanged arrowhead made of ivory (fig.4:17). Its shape suggests that it does not belong to the Palaeolithic, but rather to a later prehistoric occupation. Few traces of working could be seen on its surfaces, which show many little cracks, as if this piece had been burned. No information about its context could be found. It is included here as an interesting footnote to this section on what appear to have been projectile points.

Antler Rods

These artifacts are made from narrow, worked reindeer antler shafts, and may be pointed at one end and double-bevelled at the other, although in many cases, neither feature survives. The majority of these pieces are rectangular or roughly subrectangular in section (fig.4:12); they are classified here as Type (a) rods (see Table 4:9). There is considerable variation in the cross-section of these pieces, but as they do not fall into easily definable groups and as the techniques used in their production are identical, they have all been put in the same category. This is with the exception of a series of cylindrical rods (fig.4:13) which are clearly distinguishable from the Type (a) rods in both shape and, in most cases, in the techniques of manufacture used. These are classified here as Type (b) rods (see Table 4:9). This type of artifact is usually called a "sagaie" by continental writers (de Sonneville-Bordes 1960, 355) or a "point" by British writers (Garrod, 1926, 135; Campbell 1977:II:14). I have decided to use the term "antler rod", because it provides a more accurate description of this type, which is not always pointed.

The techniques of modification used on these pieces were carefully studied, which included making silicone rubber casts of selected specimens and examining them in an SEM and/or under a light microscope. All the other examples were inspected with the aid of a handlens. As a result of this study, differences in the methods of débitage used on the Type (a) and (b) rods were observed, although the traces of modification were very similar. There is some interesting variation between the two groups, as regards the features produced at their ends. The characteristic form of the Type (a) rod with its distal point and proximal bevel only occurs once among the Type (b) rods, which show a wider range of possible end

features. Having studied the shape of these pieces and the damage which they are believed to have sustained during use, I reached the conclusion that their most probable function was as projectile points.

Table 4:9
Number and Distibution of Antler Rods

	Type (a)	Type (b)	Totals
Fond-de-Forêt	2	-	2
Trou des Nutons	5	-	5
Trou du Frontal	1	1	2
Grotte de Goyet	21	3	24
Trou de Chaleux	36	5	41
Trou Magrite	4	1	5
Verlaine	5	-	5
Grotte de Spy	-	1	1
Church Hole	-	3	3
Mother Grundy's Parlour	-	1	1
Fox Hole	-	2	2
Totals	74	17	91

In South West France, both single and double-bevelled antler rods do appear in the Aurignacian in small numbers (Leroy-Prost 1975,88), but they become much more common from the Middle Magdalenian onwards, so much so that double-bevelled rods are a characteristic feature of the Upper Magdalenian (de Sonneville-Bordes 1960,335) not only in that region, but also elsewhere in Europe. For example, double-bevelled rods are known in the Late Magdalenian at Andernach in the Rhine Valley and from a site of similar age at Kesslerloch in Switzerland (Wymer 1982,207).

Manufacture

(i) Débitage

The first stage in the production of Type (a) rods was the cutting out of a blank from an antler beam or tine by the groove and splinter technique. Regular traces of this process, identical to those reproduced experimentally by myself (see Chapter 2), may be seen on the sides of these pieces in the form of longitudinal striations, facets and chattermarks. However, in certain cases, such as Goyet 137, some of these

traces may represent later, post-débitage modification, where they cut into the antler. Because the groove and splinter technique was used, the upper surface and sides of these artifacts are composed of cortical material, while much of the lower surface is made of cancellous tissue.

Within the collections studied here, there are unfortunately no surviving examples of antler beams or tines from which such blanks have been extracted, though highly typical waste-products would certainly have been left. This contrasts with the numerous examples of pieces of bone and antler from which smaller, narrower blanks have been removed for the manufacture of needles (see Chapter 5: Needles).

The Type (b) rods appear to be generally composed of modified tines, which in cross-section consist of an outer ring of cortical antler, with an inner circle of cancellous tissue. The only débitage required would be the removal of the tine from the beam of the antler, either by percussion which is a little difficult to control, or by sawing through and then snapping off the tine. Goyet 167 (fig. 4:13) shows traces of having been sawn and snapped at one end, which may well represent such a removal of the tine. But in most cases, subsequent modification has obliterated such evidence, as one would expect.

However, not all the blanks were whole tines separated from the antler beams: certain Type (b) rods differ in appearance from those described above, in that they are mainly composed of cortical antler, but show traces of cancellous tissue along one surface. This suggests that they were originally extracted by the groove and splinter technique and were made cylindrical at a later stage of modification. These pieces include all the British examples, as well as Chaleux 54, Frontal 31, Magrite 37 and possibly Goyet 42.

On two Type (a) rods, that is Goyet 45 and 46, a few transverse incisions may be seen at the bevelled end, which probably result from the

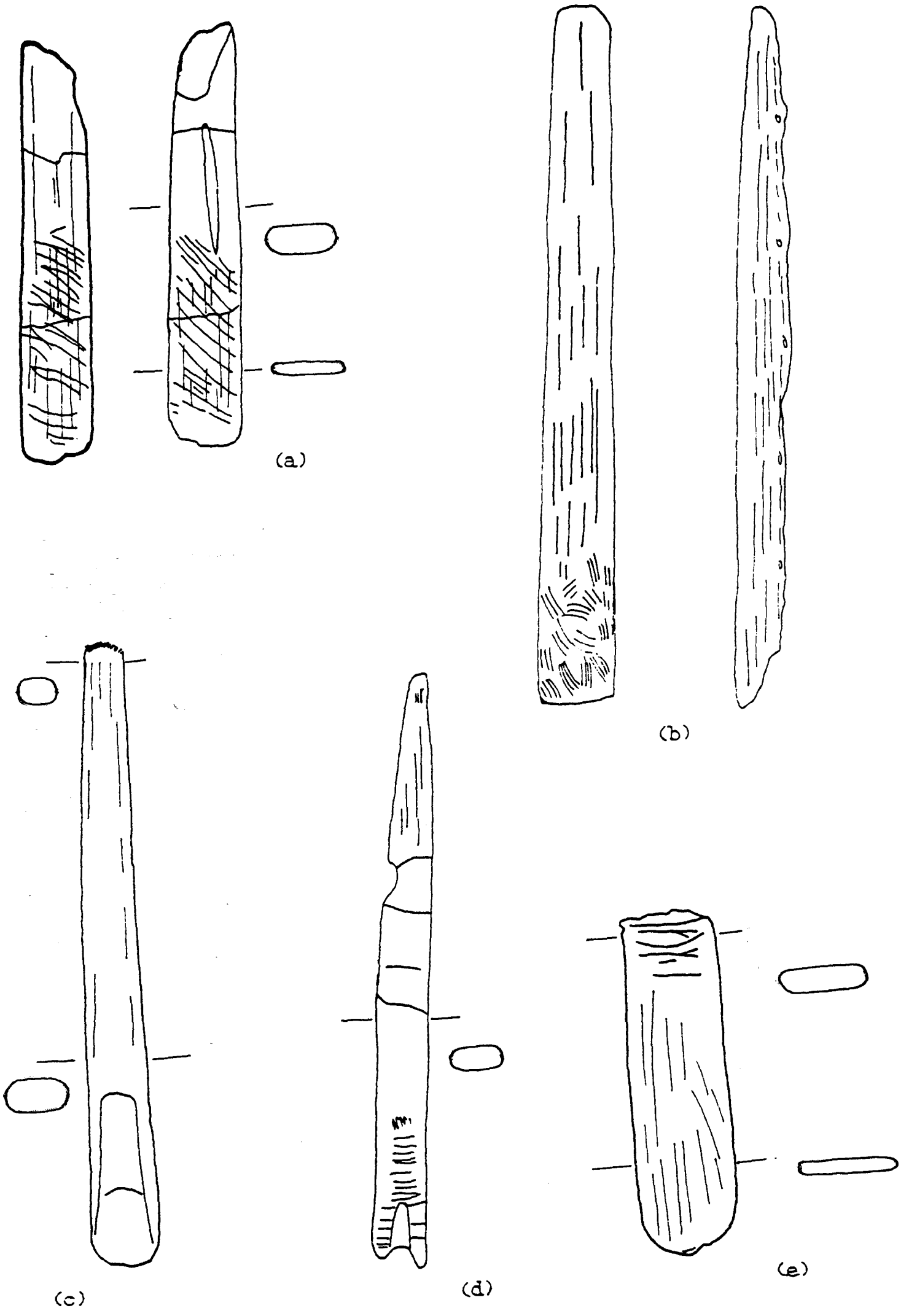


Fig. 4:12 Type (a) Antler Rods: (a) Chaleux 33 (b) Chaleux 49 (c) Goyet 39 (d) Chaleux 65 (e) Chaleux 84

removal by sawing of that end of the blank. This may have occurred during débitage, or as an early stage of modification.

(ii) Modification

For both types of rod, it appears that the blank was worked by scraping in a mainly longitudinal direction, resulting in characteristic features, such as striations, facets and in some cases, chattermarks. Most modification of this kind would have been required for those Type (b) rods which were made from extracted blanks, in order to make them approximately cylindrical. Much of the shaping of the Type (a) rods was carried out at the cutting out stage, while in the case of the majority of the Type (b) rods, they were no doubt made from tines which had been carefully selected for their shape and size.

Table 4:10
Features on the Ends of Type (a) Antler Rods

			Pointed	Broken off distal end	Sawn off distal end
Double bevelled	36	=	8	25	3
Single bevelled	1	=	1	-	-
No bevel	36	=	13	23	-
No. of rods	73				

The table above shows the various combinations of end features on Type (a) rods, starting with the double-bevelled rods of which there were thirty-six examples, eight of which were pointed at the distal end, twenty-five of which had lost their original distal end through breakage, and so on. As may be seen from Table 4:10, many of these rods have been made double-bevelled at the proximal end and pointed at the distal end, though unfortunately as few of these pieces are complete, the two features can only rarely be effectively studied on the same piece. A further six non-bevelled pieces which had lost their distal ends still showed significant narrowing of the shaft towards one end; these included Chaleux

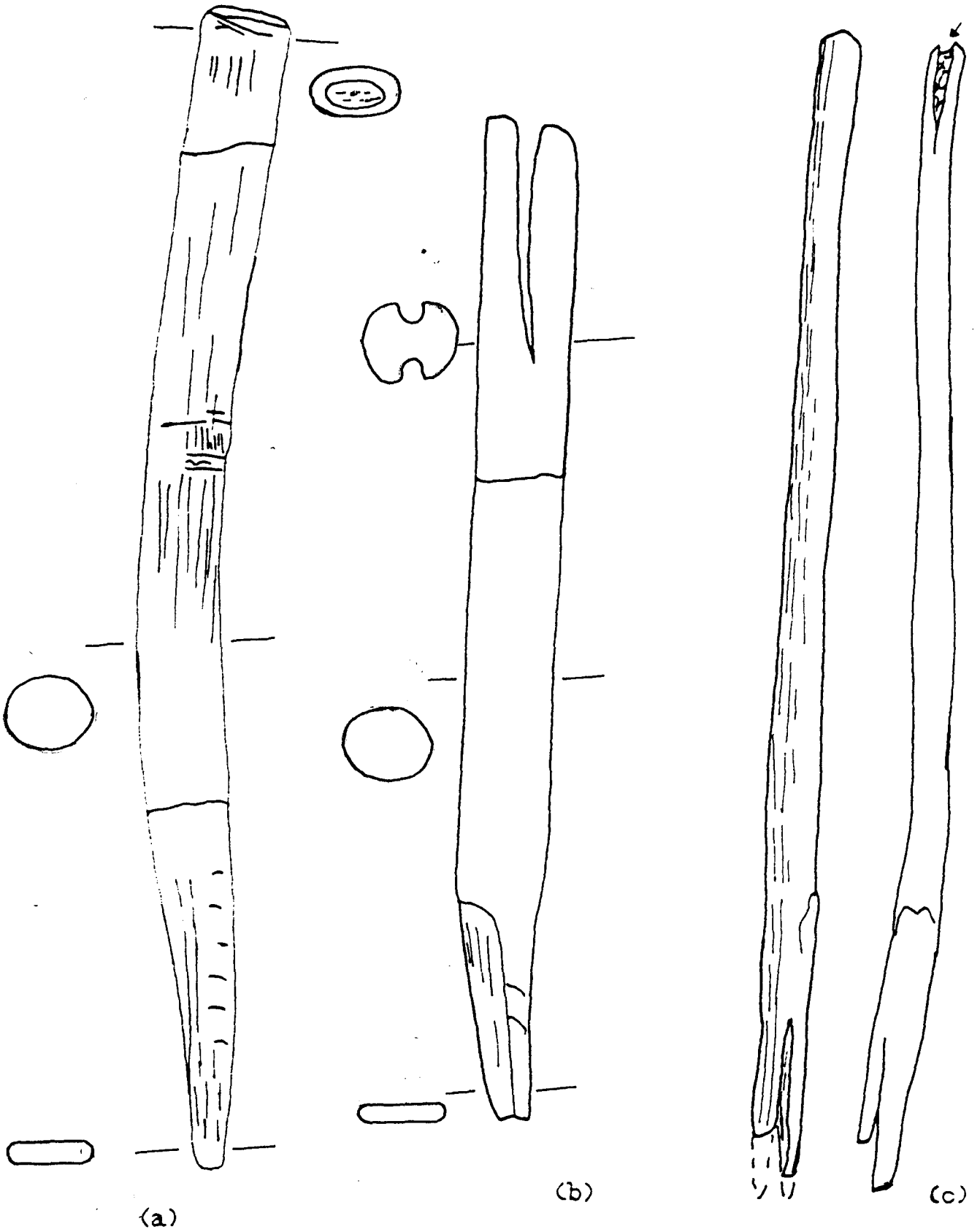


Fig. 4:13 Belgian Type (b) Antler Rods and an Ahrensburgian Foreshaft: (a) Goyet 167 (b) Chaleux 61 (c) Ahrensburgian Foreshaft, after Clark (1975,76,Fig.5:2)

47, Goyet 39 (fig. 4:12) and Goyet 43. One of the pointed and double-bevelled rods, Chaleux 65 (fig. 4:12), had had a small fork cut into the bevel, which may indicate the existence of a hafting arrangement, which was more complex than that of the simple double bevel. This feature will be discussed in greater detail below.

Table 4:11
Features on the Ends of Type (b) Antler Rods

		Pointed	Broken off Distal End	Hollowed-out	Cleft	Sawn off end
Double bevelled	9 =	2	3	1	2	1
No bevel	7 =	-	4	3	-	-
Spy 1	1 =	1*	-	-	1*	-
No. of rods	17					

* Both features appear on the same artifact

As is shown in Tables 4:10 and 4:11, one important difference between the Type (a) and Type (b) rods is that on the Type (b) rods, a much wider range of possible features at the extremities can be seen, for example, Spy 1 (fig.4:14) is pointed at one end and cleft at the other, while Chaleux 61 (fig.4:13) and 64 (fig.4:14) are both bevelled at one end and cleft at the other. This curious coincidence of what are usually both 'proximal' features will be discussed below.

Two of the non-bevelled rods with a hollowed-out area at one end are Church Hole 4 and 5, while Church Hole 3 is a segment of rod, without any features at the ends (fig. 4:15). If they were indeed component parts of a single rod, as was suggested by the Abbé Breuil (Garrod 1926,135,Fig.31,No.5), then the whole rod would have had a hollowed-out area at each end, the significance of which will be discussed below. Similar hollowed-out areas could also be seen on at least one end of Fox Hole 1 and 2 (fig.4:15).

A proximal bevel is usually formed by longitudinal scraping and frequently, the resulting longitudinal striations are cut by a number of short, transverse or oblique incisions. They are often arranged as a

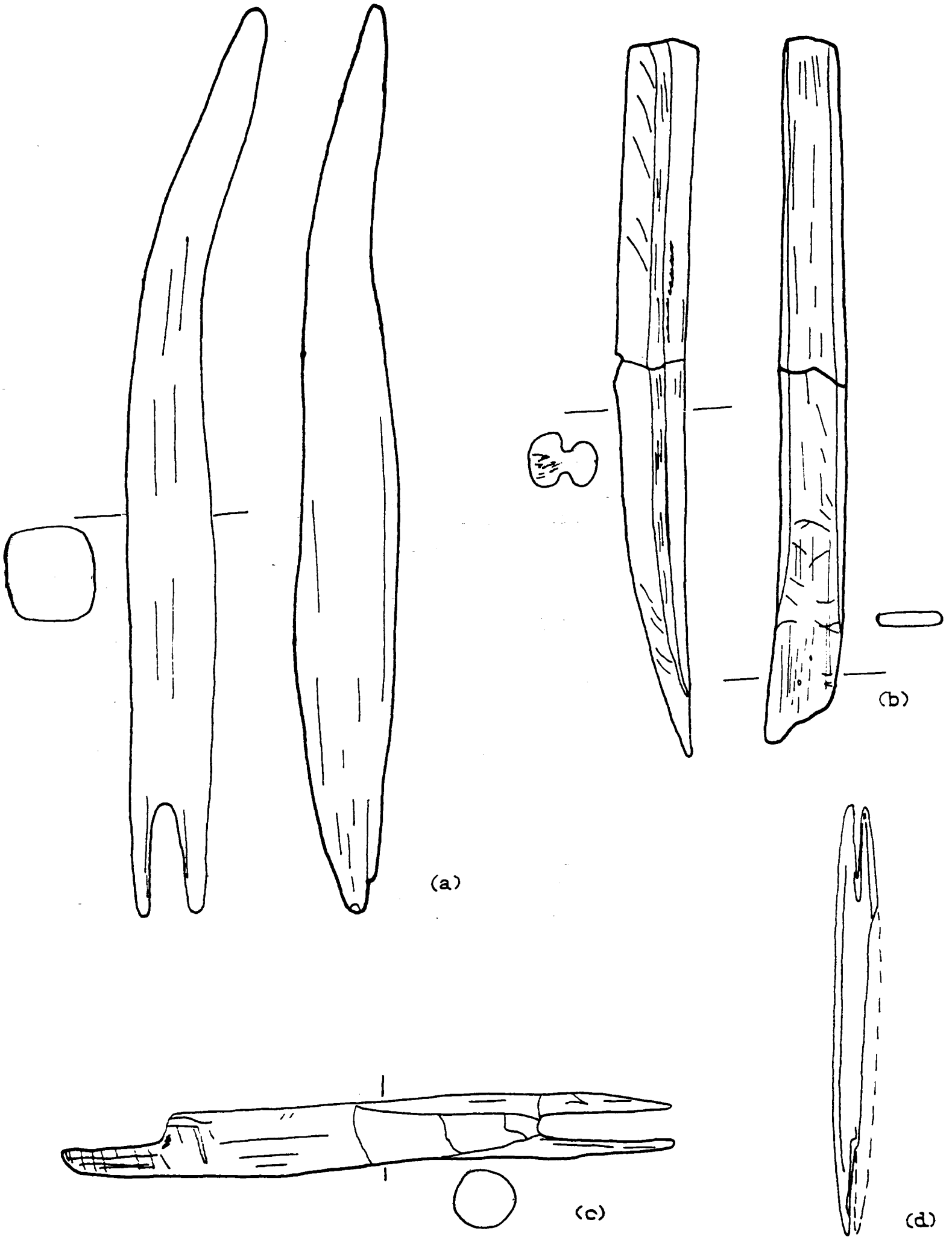


Fig. 4:14 Belgian Type (b) Antler Rods and an Eskimo spearhead: (a) Spy 1 (b) Chaleux 62 (c) Chaleux 64 (d) Eskimo spearhead, after Giddings(1967,188,Fig. 65c)

series of curving, oblique incisions, or in a criss-crossing pattern. Such traces are generally found on the upper, cortical surface of the bevel and less often on the lower surface, which may be at least partly composed of cancellous tissue. The bevelled area of Chaleux 49 (fig.4:12) is very smooth and finely-worked and its upper surface is covered with tiny, grouped incisions, running in all directions. Such incisions may have been purely decorative, perhaps copying the binding that joined the base of the rod to a corresponding bevel on the shaft to which it was fitted, or they may have been functional, intended to break up the surface of the bevel to give it more grip.

The hollowed-out areas visible on the ends of a number of the British pieces must have been made by boring, cutting and scraping, given their shape. When this feature is well preserved, as on the Church Hole rods, clear, longitudinal striations may be seen. The cleft ends of three of the Type (b) rods are thought to have been made by removing cancellous tissue by scraping.

In a number of cases, grouped transverse incisions may be seen particularly on the sides of these rods, for example on Verlaine 39, Chaleux 55 and 34. On Goyet 105, a large number of little, oblique incisions may be seen distributed around its distal end for approximately 3.5cm down the shaft (fig.4:16). These incisions do not bear any obvious functional significance, although in the ethnographic record, there is evidence for the incising of ownership marks on artifacts (Sollas 1915, 446).

On Chaleux 33 (fig.4:12), two deep, parallel, longitudinal incisions may be seen on the lower surface, one to each side, which are reminiscent of those often seen on Magdalenian barbed points, for example that from Goyet. On barbed points, these incisions are interpreted as defining the barbed area (see Barbed Points), whereas on this piece they have no clear

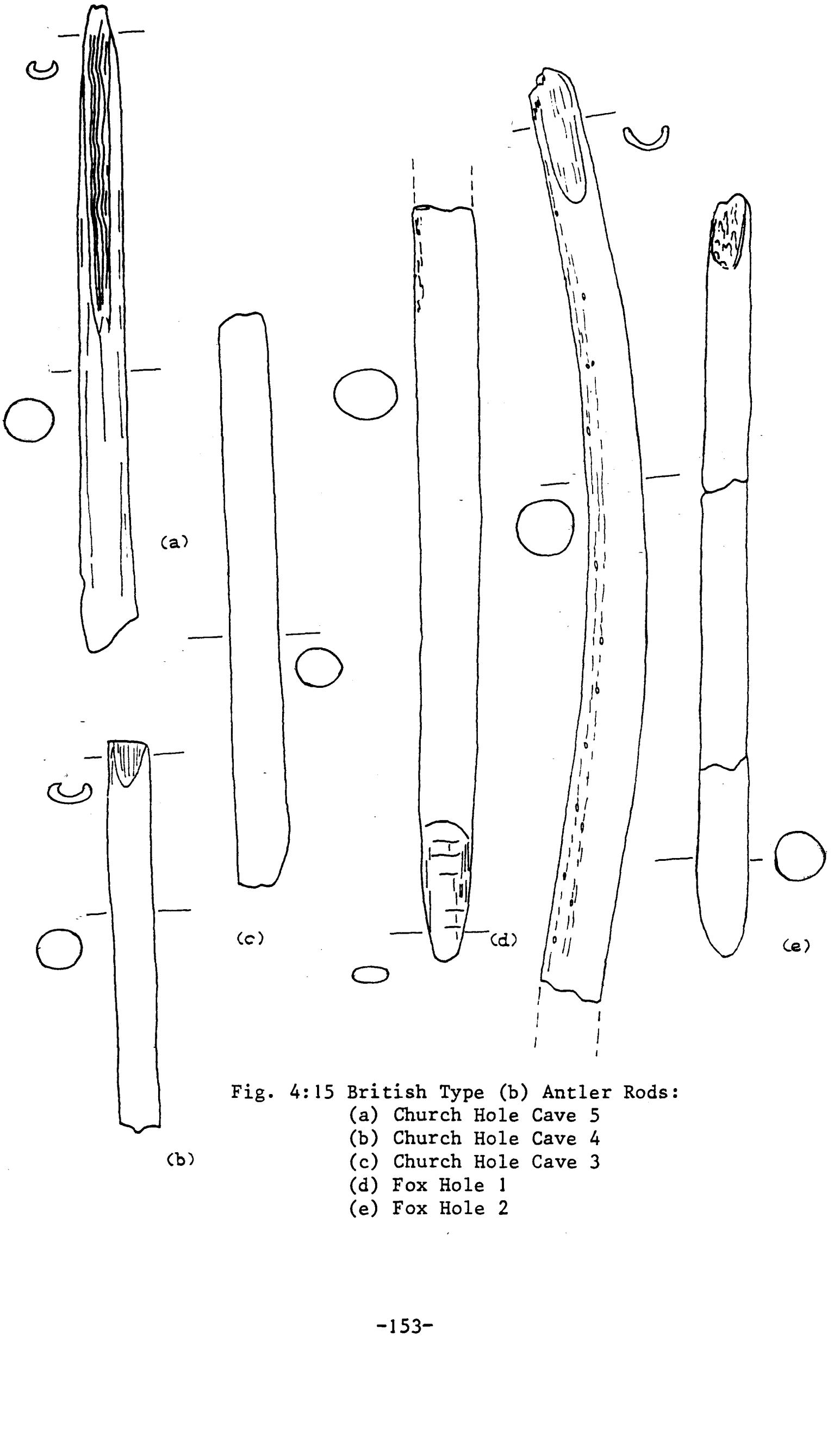


Fig. 4:15 British Type (b) Antler Rods:
(a) Church Hole Cave 5
(b) Church Hole Cave 4
(c) Church Hole Cave 3
(d) Fox Hole 1
(e) Fox Hole 2

functional significance. They could be either decorative or some form of mark of ownership.They may even form a link between the two types of artifact, although no barbed points have been found at Chaleux.

A feature of some of these pieces is a longitudinal groove often in the middle of one or both surfaces, for example on Chaleux 33 and Frontal 22. Similar grooves may be seen on examples from the South West of France (see de Sonneville-Bordes 1960,390,Fig.212,Nos.1,2 and 3). In the case of the Type (b) rod Chaleux 62 (fig.4:14), a longitudinal groove ran along the middle of each of the two sides, and this is thought to have shared the same function as the other grooves, that is to hold tiny, glued-in, flint chips as armatures. Most of the cortical parts of Chaleux 1 show scored decoration, which includes a groove on the upper surface, which may have served the same purpose. Archaeological evidence for this feature has been found on two Magdalenian sites in France. At Pincevent (Seine-et-Marne), an antler rod was discovered with a stone bladelet stuck into each side of the shaft, into what appeared to have been grooves. A similar discovery had previously been made by Allain at Saint-Marcel (Indre) of an antler rod with a groove down the middle of one surface, which was filled with tiny, broken up flint flakes (Leroi-Gourhan 1983). There are also ethnographic parallels for such pieces in the form of Eskimo antler projectile heads with slots, in which stone armatures were fitted (Giddings 1967,188,Fig.65,a,192,Fig.68).

Sixteen rods are smooth, though not polished. Goyet 155 is smooth all over, but is polished on one side, which may be a result of manufacture, because the sides have been particularly heavily worked. Four pieces appear to be uniformly polished, though at least three of them may have been varnished after discovery. The worked areas of Goyet 137 are smooth, which again suggests that this results from manufacture. While Goyet 136 is generally quite smooth, the bevelled area is highly polished, as is the

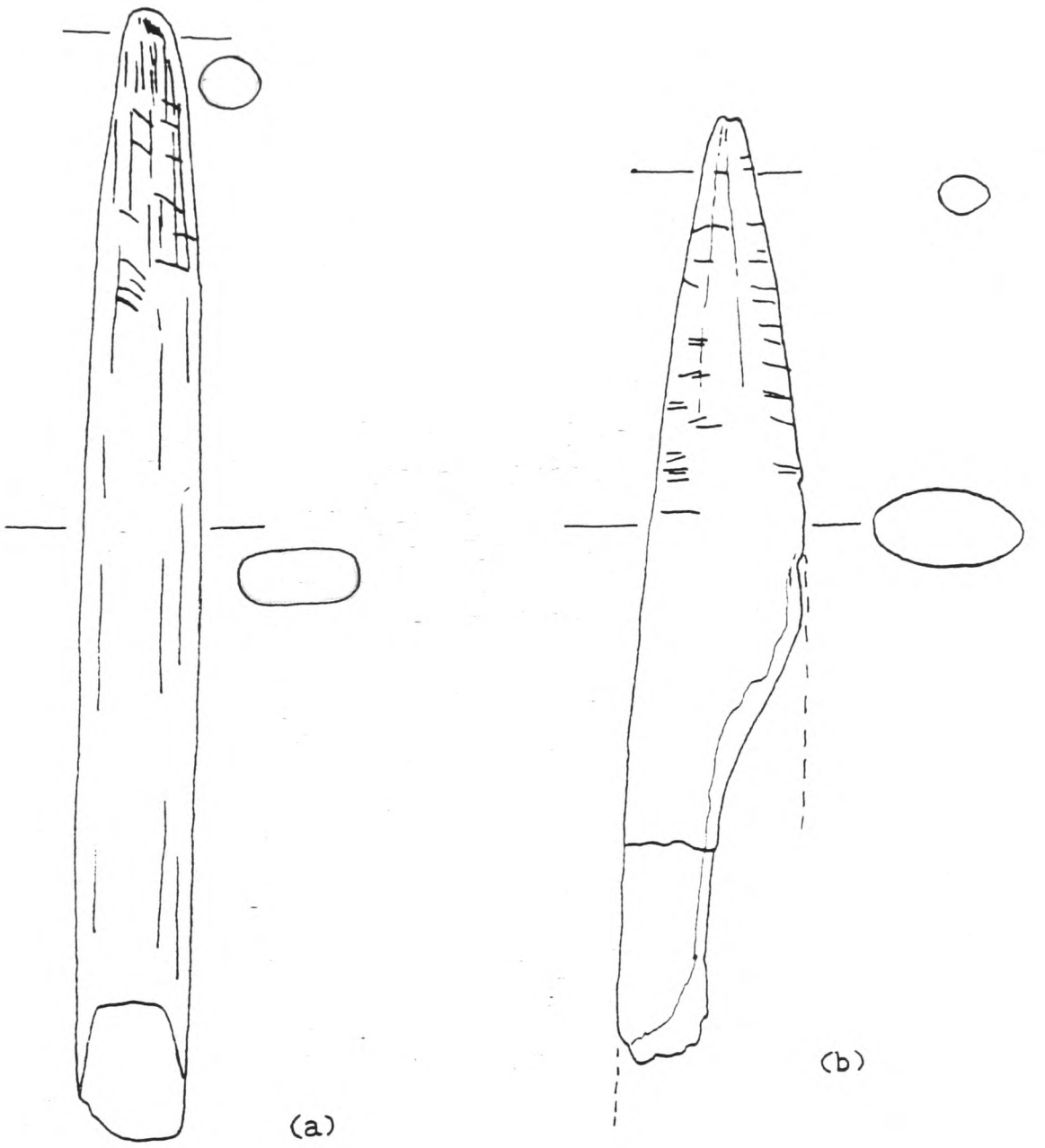


Fig. 4:16 'Sagaies d'Isturitz': (a) Goyet 105 (b) sagaie d' Isturitz, after de Sonneville-Bordes (1971,4,Fig.1) Scale for (b) is 2:3

tip on the same surface. This may be because these parts received most modification, for careful scraping of a bone tool may lead to the smoothing and polishing of the bone surface, which is useful for finishing an artifact.

Goyet 123 is a particularly large example of a Type (a) rod in that it is 35cm long, although in all other respects it is typical of this group. A similar piece which was 47cm long was found at Pincevent and was interpreted by Leroi-Gourhan not as an unusually large piece, but as a carefully modified blank, which was intended for splitting transversely into two rods, each approximately 25cm long (Leroi-Gourhan et Brézillon 1972,204). This seems an unlikely and most inefficient method of manufacture, in that it might make sense to extract as long a blank as possible, but it would surely be better then to split it in two immediately after débitage and then modify each piece accordingly. But why go to the trouble of carefully working and shaping a large piece and then produce two rods, which would require further modification and which certainly in the case of Goyet 123 would have been ill-proportioned?

A number of the rods are curved in profile, for example Verlaine 38, Magrite 24, Goyet 123 and 43. This may have happened during débitage, for a blank may easily become bent, while being levered out, especially if the antler has been softened for working. Piel-Desruisseaux (1986,215) has suggested that such a blank would have been straightened, prior to modification,

> "cette baguette, naturellement courbe, sera redressée à chaud, peut-être à l'aide d'un bâton percé"

It would seem likely that the rods would be less efficient when not straight, but the archaeological evidence suggests that either this process was not always carried out, or that the pieces became warped or

bent post-depositionally. Various types of artifacts considered here have shared this feature; these include barbed points and needles. So it is impossible to determine which was the cause of this phenomenon. Similarly, Spy 1 is curved, though not in profile. This may have occurred during manufacture, perhaps while removing the tine from the antler beam, though it could also have happened post-depositionally.

Eight rods appear to be unfinished, in that they are irregularly shaped, often with roughly snapped-off cancellous tissue which has yet to be trimmed. These include Nutons 5, Verlaine 40, Chaleux 46 and 47.

In contrast to the above, traces of reworking have been identified on various pieces, including Frontal 22, where a lot of material has been broken off the upper surface at the distal end and then has been scraped over wih curving, longitudinal striations. On Chaleux 42, there appears to have been further working around the distal end or resharpening to make the point narrower.

It is curious that in three cases the bevelled area appears to have been deliberately sawn off from the rest of the shaft; these are Chaleux 84 (fig.4:12) and Goyet 19 and 46 which are small, bevelled pieces of antler rods. This process was clearly carried out by sawing and snapping in two cases, whereas on the third specimen, Goyet 19, the traces of working are rather different, consisting of deep, curving incisions towards one side, which suggest that it was cut off. The reasons why this happened are unclear, for these areas are carefully worked and, although chipped or broken in the case of Goyet 19, they do not appear to be particularly damaged compared with those bevelled areas visible on near complete antler rods. It is, however, possible (see Deffarge et al.1977) that when the distal end of an antler rod was irreparably broken, it was then decided to try to salvage other parts of the rods for use as wedges. These pieces were examined for possible traces of use, but none were

identified, apart from the damage to the bevelled edge described above, which could have resulted from use as a rod.

Function

(i) Traces of Use

Most of these artifacts are broken, frequently with the loss of the distal end, which may result from use. One possible example of this is Goyet 160, which was transversely broken at the distal end with a lot of damage to the upper surface. On the other hand, material at the tip of Goyet 39 (fig.4:12) has been driven outwards in a "mushrooming effect" (see Arndt and Newcomer,167), which may have resulted from compression of the point on impact. Possible damage from use may be seen on the very end of the bevelled area of Chaleux 49 (fig.4:12), which looks as if something, such as a shaft, has been driven into it, forcing up the cortical surface.

(ii) Use

It seems probable that the Type (a) rods at least were used as projectile points. This is suggested by their appearance, that is to say their distal points and double-bevelled bases. The latter were clearly intended to fit onto or into a hollow, forked or bevelled shaft and were possibly fixed with resin glue and bound with sinew. Chaleux 65 has a forked double-bevel, which hints at a more elaborate form of hafting, perhaps with a small projection from the haft fitting into the fork. Some rods which are not double-bevelled do have bases which have been extensively modified by scraping, possibly as preparation for hafting, these include Goyet 43 and 18.

As no hafts survive from the Upper Palaeolithic in Britain, Belgium and France, the only information about the methods of hafting used must come from other sources, such as the archaeological record elsewhere and from the ethnographic record.

Of the Type (b) rods with both surviving ends, only one follows the pattern outlined above for the Type (a) rods , that is Magrite 37, which is like a characteristic Type (a) rod, though small and circular in cross-section. Spy 1 is pointed at one end and split at the base; this must have been a hafting device, presumably designed to fit onto a bevelled shaft. However, there are other Type (b) rods, which do not have distinguishable proximal and distal ends, even when complete or nearly so: Chaleux 64 and 61 are both double-bevelled at one end and cleft the other, which is somewhat confusing as they appear to have two "proximal" ends.

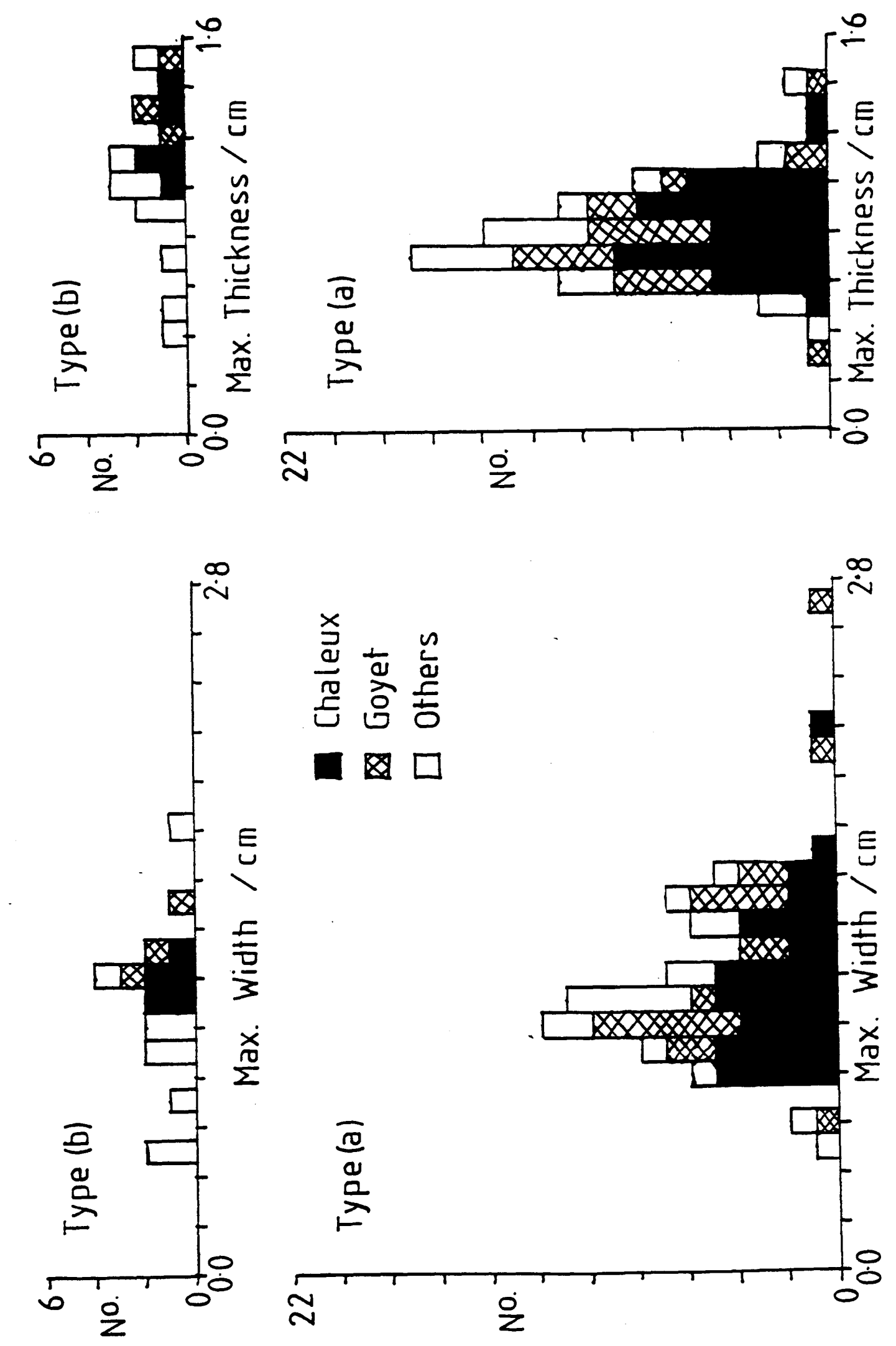
Information about how such pieces with no distal point may have been used is provided by Ahrensburgian arrowshafts recovered at Stellmoor (fig.4:13). These pieces were cleft at both ends, and it seems that the proximal cleft was intended for sliding the arrow onto the bow string, and the distal cleft for holding a stone projectile point. Clear evidence for this was found in two examples where the tangs of the stone projectile points, tanged points in this case,were still held in the distal cleft of the arrow (Clark 1975,76,Fig.5,1,2). An Eskimo spearhead fragment which was cleft at both ends is illustrated by Giddings (1967,88,Fig.65c), which was also probably once tipped at one end with a stone projectile point (fig.4:14).

As regards the British Type (b) rods, it needs to be determined whether the hollowed-out areas seen on most of these pieces were distal or proximal features. It is possible that they were distal features, which were used to contain sharp, flint armatures to increase the penetration of the rod into the animal which was being hunted and to aid its retention. The grooves on the surfaces and sides of the Belgian antler rods are thought to have served a similar purpose (see above). Fox Hole 1 is double-bevelled at one end with a hollowed-out area at the other, which would support this theory. Fox Hole 2 also has a hollowed-out area at one

end and it may be single-bevelled at the other, however, this is not certain. If the Church Hole fragments did belong to one rod (see Garrod 1926,135,Fig.31,No.6), then this piece must have had a hollowed out area at each end. If so, it is hard to see how it functioned. Two Eskimo arrowheads are illustrated by Bandi (1969,61,Fig.20, middle pair in top row), one of which is hollowed-out at one end and appears to be bevelled at the other, whereas the second example has a hollow groove running down much of the shaft from one end, but it does not reach the other end, which may have been modified for hafting. This suggests to me that there was originally more than one Church Hole rod, rather than one specimen which was hollowed-out at both ends, but as each of the three segments has lost material from both ends, they certainly do not fit together very convincingly now.

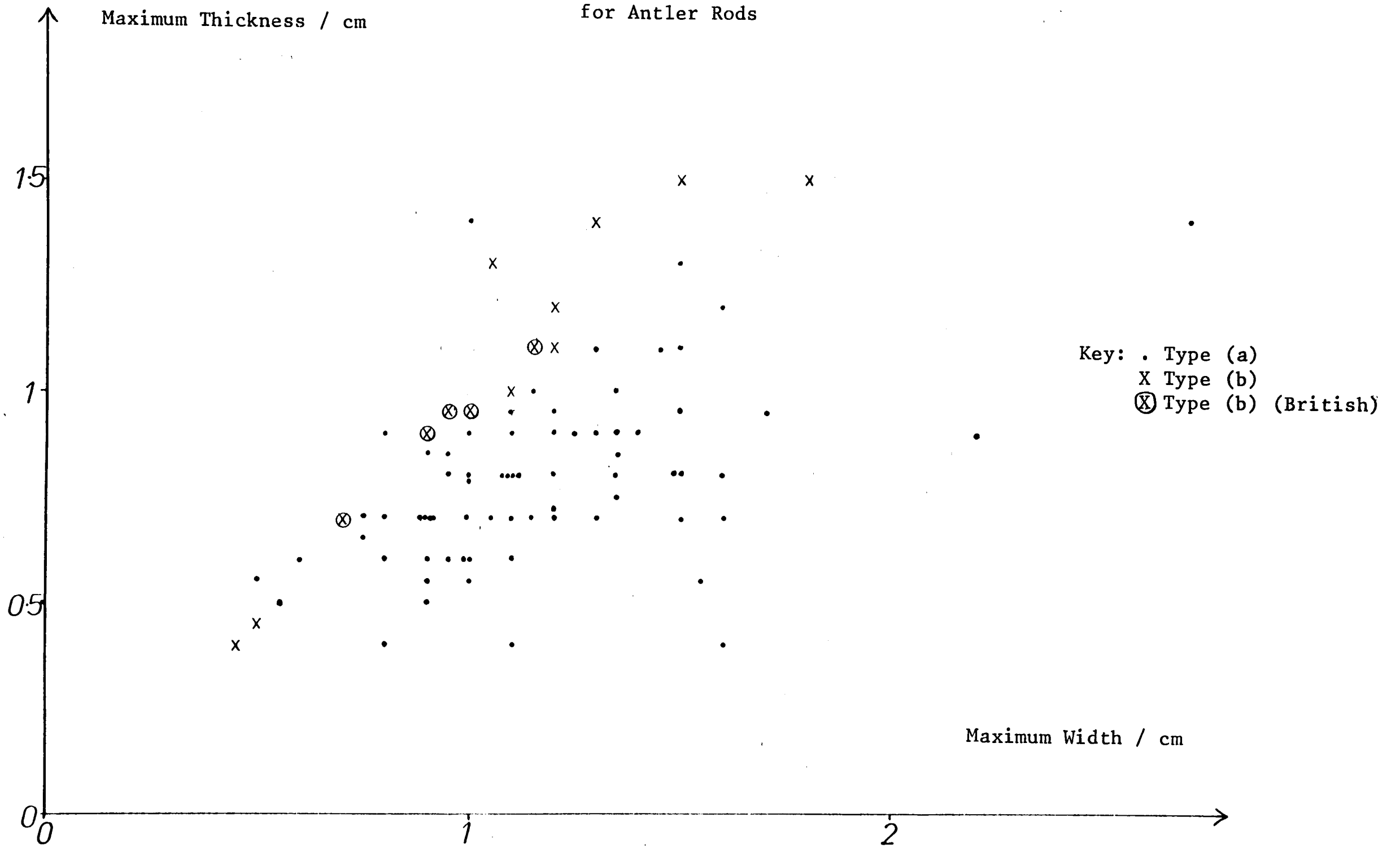
Variation and Distribution

The rods vary in length from 35 to 2.65cm, however, as they are almost all incomplete, little information may be derived from their lengths. The mean length of the fifteen near complete pieces is c12.85cm, though this need not be any indication of the original size distribution. There is less variation in the dimensions of the shaft, which must reflect the size of the original raw material. Graph 4:1 shows that its width varies from 2.7 to 0.45cm and its thickness from 1.4 to 0.3cm. The width and thickness values for Type (b) rods are very similar, which is because they were approximately cylindrical. The width of the Type (a) rods clusters around 1 to 1.1cm, while the thickness is usually 0.7 to 0.8cm, thus reflecting the roughly oblong cross-section of these pieces. This phenomenon may also be seen in the scatter diagram (Graph 4:2) where width is plotted against thickness, for the Type (b) rods cluster about a diagonal line showing that width and thickness increase at the same rate, while the Type (a) rods are generally grouped to the right of that line revealing that



Graph 4:1 Distributions of the Maximum Shaft Widths and Thicknesses for Antler Rods

Graph 4:2 Maximum Shaft Width vs. Maximum Shaft Thickness for Antler Rods



their widths are greater than their thickness. This diagram also shows that the British rods fall in the middle of the distribution of Type (b) rods.

Examples of antler rods have been found on most of the important Magdalenian sites in Belgium, such as Trou du Frontal, Chaleux, Verlaine and the Trou des Nutons at Furfooz. However, no antler rods have been found at the major Magdalenian site of Grotte du Coléoptère. Multiperiod sites with Later Upper Palaeolithic occupations have also yielded antler rods, as at Trou Magrite, Fond-de-Forêt and even Spy, which is famous for its abundance of Earlier Upper Palaeolithic material, but which shows signs of some Later Upper Palaeolithic activity, including two needles. But in spite of the fact that Spy 1 is so similar to the other Type (b) rods with regard to the manufacturing techniques used, its design is unique in that it is pointed at one end and cleft at the other and it is possible that it does not really belong here, but that a likely-looking tine was modified this way to form a projectile. It was apparently found in the "premier niveau" at Spy (de Loë and Rahir 1911,8,PlII,3), in which a whole series of occupations is represented, which probably included some Later Upper Palaeolithic presence (Dewez 1981,37-38), but I would hesitate to attribute this piece to that period on purely typological grounds for the reasons given above. Antler rods have been found in considerable numbers at Goyet. Most of the antler rods from Trou Magrite and Goyet, which are held in the Institute for Natural Sciences, are labelled "Aurignacien Supérieur", as they are believed to come from layers attributed to that period. However, the presence of very similar pieces in large numbers within purely Magdalenian assemblages would suggest a later date, unless we are to suppose that these quite specific types actually had a wide distribution in time. However, the hypothesis of a Magdalenian context for antler rods is supported by the fact that such pieces, in general, do

appear to date from the Later Magdalenian in the Perigord region (de Sonneville-Bordes 1960,335). Furthermore, in Britain, the rods from Church Hole and Mother Grundy's Parlour have recently been radiocarbon accelerator dated to the thirteenth millenium BP. The date for the Church Hole industry is 12 240 ± 150 years BP (OxA -735)(Gowlett et al.1986,210), while the following dates have been obtained for Mother Grundy's Parlour: 12 060 ± 160 years BP (OxA-733) and 12 190 ± 140 years BP (OxA-734) (Gowlett et al.1986,210).

However, there is some typological evidence to suggest that Goyet 105, a Type (a) rod, belonged to the Earlier Upper Palaeolithic. It has a thick, subcircular, facetted tip, which is 'decorated' with short, oblique incisions (fig.4:16), which has been identified as a basal fragment of a 'sagaie d'Isturitz' by Otte (1977,199;1979,404). This type of artifact has been recognised by de Sonneville-Bordes as a type fossil of Perigodian Vc, that is the Upper Perigordian with Noailles burins (1971). These pieces consist of worked shafts of reindeer antler with similar arrangements of little transverse and oblique incisions around a longitudinally facetted, sub-oval point. A study of such pieces made by Movius in 1973 underlines the geographical restriction of these pieces to the South West of France and their chronological restriction to the Upper Perigordian with Noailles burins. De Sonneville-Bordes herself recognised a Noailles burin amongst the material from Goyet (1961,429), although this is an apparently very rare occurence in Belgium (de Laet 1982,90). The resemblance between Goyet 105 and some, though not all, of the 'sagaies d'Isturitz' is striking (see fig.4:16). The case for the contemporaneity of these pieces cannot be proved without direct chronometric dating, but in the absence of this and of any contextual information, it has to be admitted that on typological grounds, it is possible that Goyet 105 is an Earlier rather than a Later Upper Palaeolithic piece. Whether this is a result of a direct

relationship between the two areas is more doubtful. Evidence can be produced to suggest that the geographical distribution of such pieces need not have been so restricted, in the form of an ivory rod from the Gravettian site of Dolní Věstonice (Klima,1963, 401,Tab 62,850), which is also very similar in appearance with its little oblique incisions in spite of the difference in raw material, which may just be a result of the easy availability of mammoth ivory at that site.

None of these 'sagaies d'Isturitz' has ever been found with both ends preserved (Movius 1973,85), so it is not known whether these are distal or proximal fragments. Like de Sonneville-Bordes (1971), in the absence of proof that these are not distal pieces, I prefer to see them as such owing to their shape.

Antler rods as a whole may represent a Later Upper Palaeolithic fashion in hunting equipment, replacing the various Earlier Upper Palaeolithic points described above, such as the split-based point. They may have been used as alternatives to the presumably contemporary barbed points, or even against different game. This may be why no antler rods were found at the Grotte du Coléoptère, which is remarkable for the number of barbed points found in its deposits. However, the distributions of the two types are certainly not mutually exclusive, for one barbed point and a roughout were found at Verlaine, while a beautifully worked, biserial, barbed point was discovered at Goyet.

From my own limited experience of working bone and antler (see Chapter 2), I would suggest that it would be easier and would require a lot less skill to produce an antler rod, and then make grooves in it for armatures, than to make a barbed point. This provides a possible further reason for the choice between the production of barbed points and antler rods.

The Belgian antler rods are reasonably widespread throughout the limestone region of Southern Belgium, whereas the surviving British rods

have a more restricted (northern) distribution. To the examples from Creswell and Fox Hole in Derbyshire may be added two rods from Victoria Cave in Yorkshire, which were first described by the Abbé Breuil (1921-22,275) as,

> "two highly fossilised long cylindrical assegais of reindeer horn of quite Magdalenian appearance".

One of these is clearly double-bevelled (Breuil 1921-22,Fig.9; Garrod 1926,121,Fig.28). Although it was not known in which part of the cave these pieces were found, Breuil (p278) suggested from their patina and from the sticky,grey clay adhering to one of them that they came from a 'Magdalenian' level. These pieces may be tentatively classified as belonging to Type (b). A similar artifact was found nearby at Kinsey Cave supposedly in cave earth including Late Pleistocene fauna and several human bones (Jackson and Mattinson 1932,6). It may be attributed to Type (a), because Jackson and Mattinson (1932,8) indicate that its

> "section is oblong with rounded corners".

These pieces may have been shafts from projectiles, of which the points are not preserved. A further rod was found at Victoria Cave, which is quite different in design, although it shares some features with the antler rods described above.

> "The lance-point is of reindeer-antler and was found in a part of the cave not explored previously. It was in three pieces which fitted together accurately, and occurred below a bed of stalagmite. The point is slightly curved and measures 221mm. in length, the greatest diameters being 10mm. and 13mm. One end tapers to a point and the other to a single-bevelled base. The bevel is 55mm. long, hollowed slightly along its length as if scooped out by a round-nosed flint scraper, and is situated upon the broad concave side, which, for the greater part of its length, is ornamented with three indistinct and fine wavy lines, making a saw-tooth or dog-tooth design. The convex side is deeply grooved from near the base to the tip of the other end. Both the narrow sides are smooth. The whole surface shows traces of carbonic acid weathering" (Jackson 1945, 148, Pl XIIa).

This unusual piece, which is held in a private collection, may have been used as a projectile point with the single bevel, visible in the illustration, as a hafting device. The deep groove along the convex surface may have been intended to contain lots of tiny,sharp flints as armatures. The chevron pattern may be seen in various forms not only in the British Upper Palaeolithic, for example on the Kendrick's Cave decorated mandible and in Belgian contexts, as on a splinter of bone from Trou du Renard.

The generally northern distribution of antler rods in Britain may have to be extended south-west as far as King Arthur's Cave in the Wye Valley, because of the following description of a piece found there. It was,

> "a fragment of a polished bone rod, oval in section, bevelled at one end. The long axis is slightly curved. A fish(?), somewhat conventionalized, is engraved upon it, the hinder part deeply, the fore part faintly incised. The opposite side of the rod is also cut. There are a few tooth-marks, which scarcely obscure the engraving" (Taylor 1927,64,62,No.17).

This artifact was unfortunately destroyed during the Second World War, so its attribution to this group is only tentative.

Miscellaneous:2

Hyaena Den 1

It is worth mentioning at this point the existence of a 'rod' (fig.4:17) in the collections of Wells Museum, which was presented to the museum by a Mr F. Brooks in 1895 and is labelled as having come from the Hyaena Den, Wookey Hole. The exact provenance and the age of the artifact are unknown. Enquiries made at the museum failed to yield any further information. Because of the lack of contextual information about this

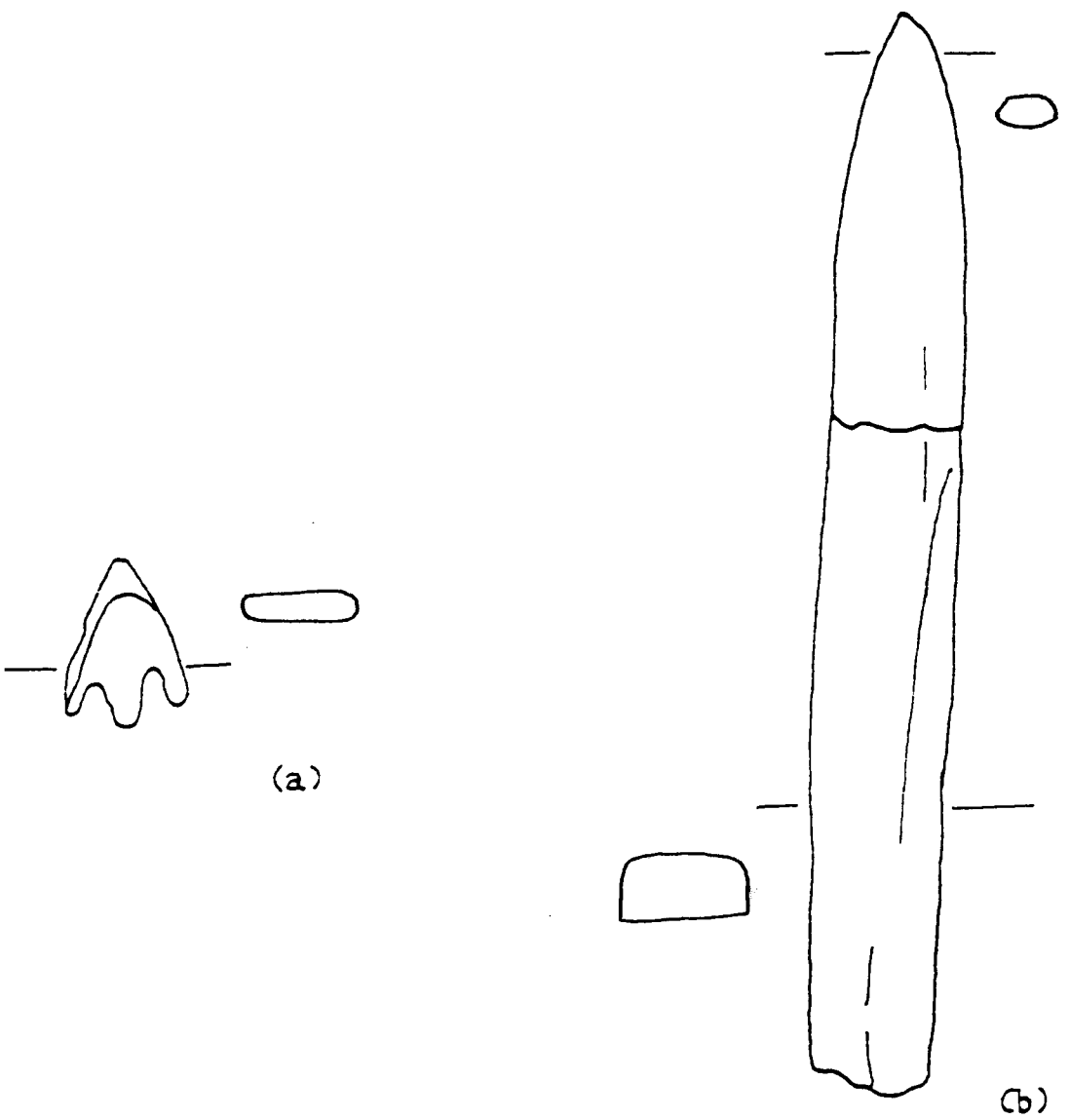


Fig. 4:17 Miscellaneous Artifacts: (a) Spy 32
(b) Hyaena Den 1

piece, it is merely presented here as a footnote to the section on antler rods.

This piece is labelled as having been made from a long bone fragment. It is square in cross-section, and is pointed at one end and broken transversely at the other.

Manufacture

(i) Débitage

The regular shape of this piece and the presence of regular, longitudinal striations on its sides suggests that it has been produced by the groove and splinter technique.

(ii) Modification

The upper surface of this piece was quite corroded, but a number of traces of working were preserved on it, including a few deep, irregular, longitudinal striations, which looked as if they had been made with a stone tool. On both surfaces of the pointed area, some short, transverse striations could be seen. The sides of the shaft, although generally straight, are slightly rippled, as if from vigorous scraping, while on the sides of the pointed area, there are a number of transverse steps in the bone, where the stone tool, moving in a longitudinal direction has slipped and dug into the bone, leaving a transverse incision. It is probable that all the traces visible on this area are associated with modification by scraping.

The pointed area is short and thick, without the gradual narrowing down to a point which is a feature of so many Belgian antler rods, for example Chaleux 42 and 44. It may be that the original distal end broke and then was roughly reworked, so that it was short and thick, and bore many traces of shaping. An alternative explanation for the unusual shape of this area is that it was the base, and as such was intended for hafting

into a socketed spear- or arrow-shaft. However, it is not possible to tell which was the case, in the absence of the other end of the piece.

Function

(i) Traces of Use

No traces of use were identified on this artifact.

(ii) Use

It is possible that Hyaena Den 1 represents part of a broken projectile point.

Ivory Rods

These are narrow rods of worked ivory, believed to have come from mammoth tusks; certainly the head and parts of the tusks of a mammoth were found within the deposits at Paviland (Buckland 1823,84), while seven mammoth tusks were found at Spy (Rucquoy 1886-1887,324). These artifacts are classified here in three groups based on clearly visible differences in their cross-sections: Type (a) are square or subrectangular, Type (b) are circular and Type (c) are semicircular in cross-section (see Table 4:12 for numbers and distribution of rods).

Table 4:12
Number and Distribution of Ivory Rods

	Type (a)	Type (b)	Type (c)	Totals
Pin Hole Cave	2	-	4	6
Kent's Cavern	1	-	-	1
Paviland Cave	2	3	23*	28
Fond-de-Forêt	1	-	-	1
Maisières Canal	1	-	1	2
Grotte de Goyet	-	5	1	6
Trou Magrite	-	1	1	2
Trou de Chaleux	-	-	1	1
Grotte de Spy	-	36	23	59
Totals	7	45	54	106

* 6 of the Paviland rods were permanently mounted on display and could not be studied properly.

A careful examination of these artifacts revealed that most, but not all of the Type (a) and (c) rods were originally Type (b) rods, which on becoming desiccated have split longitudinally along the 'grain' of the ivory. This is a natural feature of ivory, frequently observed on Upper Palaeolithic artifacts, which is not shared with bone or antler. These pieces are usually broken at both ends, though in the few cases where the ends survive (see Table 4:13), they are either pointed or bevelled. These artifacts are usually called 'sagaies en ivoire' by continental archaeologists (de Sonneville-Bordes 1960,23), while the British ones use the term 'rod' (Garrod 1926,60) or 'rod-shaped segment'(Campbell 1977:II:14) for Paviland type rods with no surviving end features. A bevelled example, that is Pin Hole 2 may be described as an 'ivory javelin-head' (Garrod 1926,147) or as an 'ivory bevel-based point' (Campbell 1977:II:14). My preference would be to describe both types as 'ivory rods' with or without features such as bevelling at the end, because the methods used in their manufacture are very similar and furthermore, one of the conclusions of this study is that the Paviland type rods may just be either broken or unfinished versions of the bevelled and pointed rods.

The traces of working on the sides of these artifacts combined with their regular shape suggests that they were extracted by the groove and splinter technique. Where traces of modification could be discerned, they generally seemed to result from scraping. A relatively small number of pieces still show modification to their ends in the form of points and bevels: it is thought probable that many of the other rods could also have possessed such features which have not survived. Seven rods show incised decoration on their surfaces, which could have been characteristic of this type, but with poor preservation, such traces of working may have been lost. Owing to the decayed condition of most of these pieces and the

absence of any clearly distinguishable traces of use, it is impossible to come to any firm conclusions about their function, although the possibility that some of these pieces were projectile points, and others bead blanks or for ceremonial use is discussed below. It is concluded that there can be no doubt that some ivory rods were associated with the mass production of ivory beads, however, this was clearly not the case for the whole assemblage, for certain pieces appear to have been designed to be projectile points.

A consideration of both the variation in size and the geographical distribution of ivory rods leads me to the conclusion that the Spy rods may have been intended both for local use and for export to the nearby site of Goyet for bead manufacture, whereas the ivory rods from Paviland may have been exported to the other British and even Belgian sites.

With these artifacts, variation in condition is particularly noticeable. For example, little of the original surface has been preserved on the examples from Paviland; this may be the result of the action of salt in the air on the ivory. By contrast, ivory from the inland sites such as Pin Hole Cave and Spy is in a much better condition.

Ivory rods are generally a common feature of the Earlier Upper Palaeolithic in Europe, for example a double-bevelled ivory rod was found at the French Aurignacian site of Abri des Roches de Pouligny-Saint-Pierre (Indre) (Leroy-Prost 1975,88,Fig.4,No.1). A very similar piece from the Czechoslovakian Earlier Upper Palaeolithic site of Predmost is figured by Breuil (1924,531,Fig.13,No.2). What appear to be simple ivory rods with no such features preserved from the Gravettian site of Dolní Věstonice are illustrated by Klima (1963,40, Tab.62, Nos.848,849,850). It may be that most of the ivory rods considered here belong to the Earlier Upper Palaeolithic, but this is not proven, and, as is discussed below, there are considerable problems involved in the dating of worked ivory,

and it is concluded that great care is required in interpreting the available dating evidence.

Manufacture

(i) Débitage

As no differences in the method of blank production were observed among the three types of rod, all the British examples will be discussed first and then the Belgian ones. Signs of the débitage were looked for to see whether or not the same method was used on ivory as has been observed so frequently on antler in particular (see Antler Rods), that is the groove and splinter technique. Another interesting possibility was that blanks could have been extracted by percussion, as is described by Semenov (1964,154,Fig.77,No.2), using guidelines in the form of incised grooves.

No information could be obtained from the Paviland rods, as they are in a very poor condition (Plate 4:5). However, their regular shape suggests that they were deliberately cut out using the groove and splinter technique. Paviland 5 and 9 are each very neatly finished at one end, but no tool marks are visible. The Pin Hole rods are not particularly informative either, with the exception of Pin Hole 2 which shows clear traces of extraction by the groove and splinter technique in the form of longitudinal striations on the sides. A few longitudinal striations may be seen on Pin Hole 6, which also suggest that this piece was produced in the same manner. Irregular striations may be seen on the sides of Kent's 5 which, along with the regular shape of the piece, indicate that it was produced this way.

The groove and splinter technique was also probably used on forty-nine of the rods from Spy, because of the longitudinal striations and facets on their sides. There are clear traces of extraction by the groove and splinter method in the form of longitudinal striations and facets on the sides of four of the Goyet rods, while the other two show traces of



Plate 4:5 Ivory rods from Paviland Cave



Plate 4:6 Fond-de-Forêt 16

working on all surfaces. Longitudinal striations, facets and chattermarks may be seen on the sides of all the rods from Chaleux, Trou Magrite, Fond-de-Forêt and Maisières Canal, so there can be no doubt that the groove and splinter technique was practised on ivory in this region. No evidence for the use of percussion as a method of blank extraction was found, though it may have been used as a method of modification on the Fond-de-Forêt rod (see below).

(ii) Modification

It was thought that some variation in methods of modification might be seen among the three types of ivory rod, but this proved not to be the case. Therefore, following the pattern laid out above, all the British rods will be discussed and then the Belgian ones. Information about those rods with surviving end features and incised decoration will be laid out in Table 4:13 below, where 'Y' means 'yes'.

Table 4:13

Ivory Rods with Surviving End Features and Incised Decoration

	bevel	point	other end feature	incised decoration
Type (a)				
Maisières 61	--	Y	------	-------
Fond-de-Forêt 16	double	-	------	-------
Type (b)				
Goyet 158	--	-	whittled base	-------
Goyet 161	single?	Y	------	Y
Goyet 159	single	Y	------	-------
Goyet 20	--	Y	pointed base	Y
Goyet 22	--	Y	------	-------
Magrite 63	--	-	sawn and snapped base	-------
Spy 202	double	-	------	Y
Spy 99	--	-	------	Y
Spy 69	attempted	-	------	-------
Spy 54	--	Y	------	-------
Spy 136	--	*	------	-------
Type (c)				
Pin Hole 3	--	-	------	Y
Pin Hole 2	double	-	------	Y
Magrite 42	--	Y	------	-------
Chaleux 113	--	Y	------	-------
Maisières 60	--	Y	------	-------
Spy 158	--	*	------	-------
Spy 203	--	-	------	Y

* denotes pieces converging towards a point at one end which is broken off

Owing to their highly desiccated condition, there is little information about modification to be derived from the Paviland rods. However, it is clear that there is no reason to suggest that Paviland Type (a) and (c) rods were deliberately made as such. The evidence that exists, such as the difference in colour and texture between the convex and flat surfaces indicates that these pieces were originally cylindrical and, on post-depositional desiccation, have undergone natural, longitudinal splitting of the ivory. Two of the Type (c) Pin Hole rods, numbers 5 and 7, may have once fitted together to form one cylindrical rod, given the similarity in their dimensions and the fact that each has an unmodified, flat surface showing only natural corrugations. By contrast, various striations may be seen on the rounded surfaces of both artifacts, but what form of modification they represent is unclear. These rods are very similar to those from Paviland. The two Type (a) rods from Pin Hole also probably result from such longitudinal splitting, in that only natural corrugations may be seen on their surfaces.

Pin Hole rods 2 and 3 fit together (Campbell 1977,II,252,Fig.102, Nos.3,4), end to end, to form part of a double-bevelled ivory rod (fig.4:18). This piece has also split longitudinally, for the flat surface of each fragment only shows natural corrugation. The double bevel has been made by scraping and is covered with longitudinal striations, then oblique striations, which are in turn cut by a pattern of deep,oblique incisions. The convex surface of the shaft is smooth, even polished, with quite irregular, longitudinal striations often cut by grouped, oblique striations. These traces, which are probably associated with scraping, are mainly visible to each side of the incised, helical design cut with a stone tool, which runs longitudinally down the middle of the shaft. The incisions making up the design are c0.025cm wide. As this engraving cuts

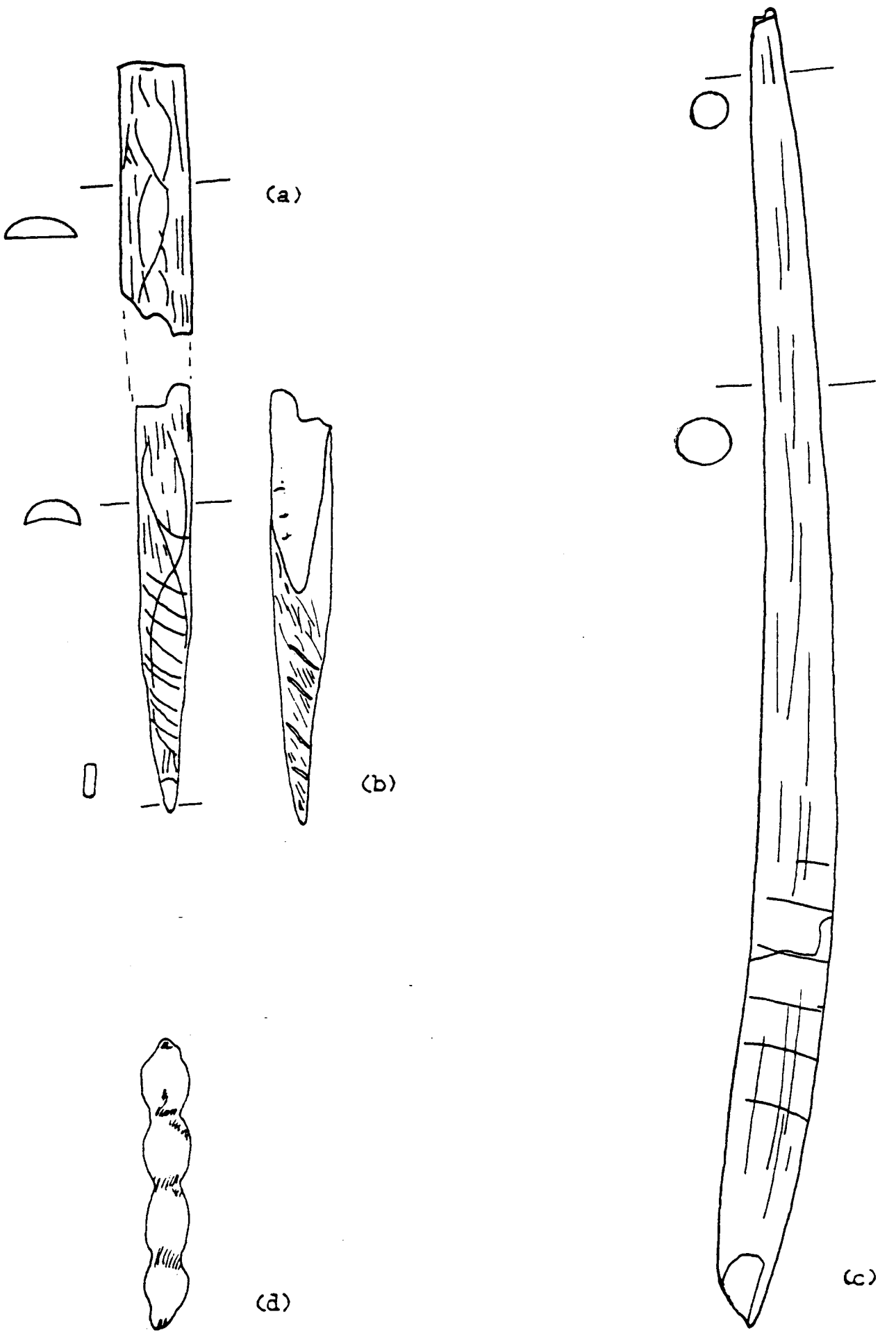


Fig. 4:18 Ivory Rods: (a) Pin Hole Cave 3 (b) Pin Hole Cave 2 (c) Goyet 20 (d) segmented ivory rod from Spy, after Ausselet-Lambrechts (1930,6,Fig.5:9, length is 50mm)

the other striations, it must have been the final stage in the production of this piece.

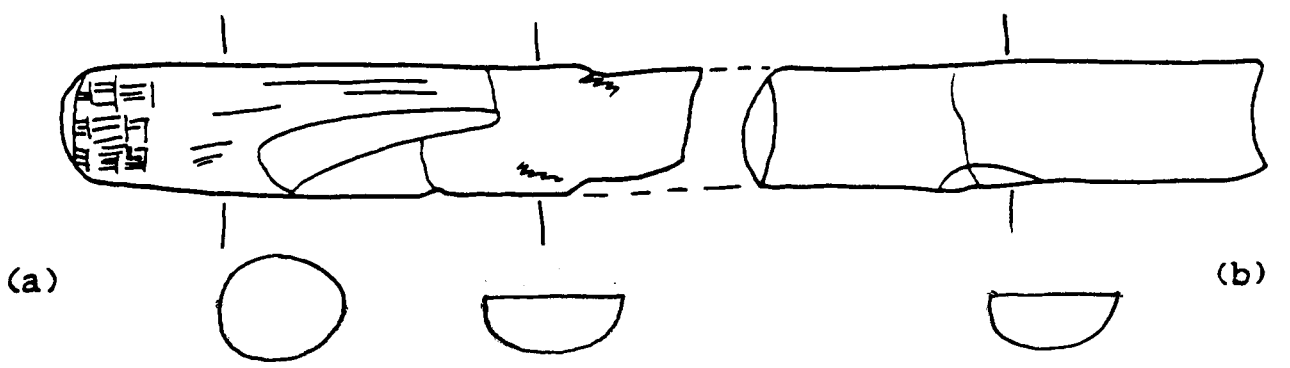
The sides of the Kent's Cavern rod were covered with rough, irregular, longitudinal striations from scraping, which may represent both débitage and modification. However, no traces could be seen on the surfaces, which were either very eroded, or covered with deposit.

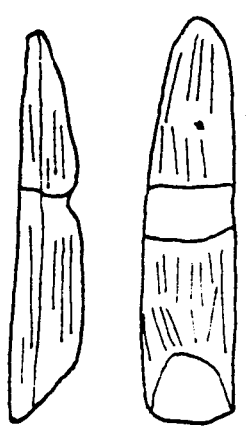
Thirty-four of the Type (b) rods from Spy appear to have been modified by longitudinal scraping, from the facets and striations on their surfaces and from their irregular outlines. Of these, Spy 202 (fig.4:19) has a transversely incised double bevel, which has been worked by longitudinal scraping. This is one of the larger ivory rods from Spy, as it actually falls within the range of Paviland dimensions, unlike most of the examples from Spy (see below). A few of these pieces show incised decoration, for example Spy 99 (fig.4:19), which has five transverse, incisions running round the shaft.

Three of the Type (c) rods from Spy, numbers 9,220 and 221, show clear working of the flat surface, which indicates the deliberate production of a semi-cylindrical rod. However, on all the other Type (c) rods, there are no traces of modification of this surface, which suggests that they were not intended to be this shape. Spy 189 has a longitudinal groove in its flat surface, which is c0.85cm long and c0.2cm wide, its purpose is unknown, for it is covered with deposit ,so no traces of working may be seen. Seventeen examples of Type (c) rods show longitudinal striations and facetting thought to be associated with modification by scraping. Of these, Spy 110 has longitudinal striations and chattermarks on its convex surface. Only a few incisions or striations may be seen on six of these rods, so the method of modification used is unknown. Both Spy 158 and 136 appear to be converging towards a point at the distal end, which is broken off in each case.

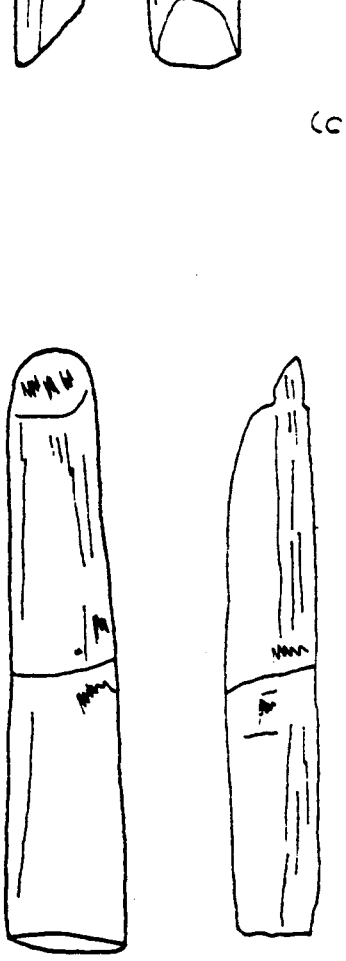
Both surfaces of the Type (a) and also possibly of the Type (b) rod from Maisières (fig.4:19) show longitudinal striations, facets and chattermarks, which closely resemble the traces produced experimentally by longitudinal scraping. They are both pointed at the distal end. The convex surface of Chaleux 113 (fig.4:19) has been worked by longitudinal scraping, resulting in longitudinal striations and facets; the flat surface appears to have been produced by natural, post-depositional, longitudinal splitting of the desiccated ivory, although a couple of incisions may be seen. The base may have been deliberately shaped with a steep, single bevel, while the distal end has been worked to a thick point. The surfaces of Type (b) rod Magrite 63 appear to have been worked by longitudinal scraping, resulting in longitudinal striations and facets. This piece is quite smooth. Traces of sawing and snapping may be seen on the proximal end; the fact that this end has not been neatened suggests that either the piece is unfinished, not having been fully modified after débitage, or that it was in the process of being substantially reworked. Magrite 42 (fig.4:19) is a clearly unfinished Type (c) rod, for the distal end was still being formed by scraping and snapping. A large number of tiny striations may be seen running in all directions on the flat surface, which is very smooth with some natural corrugations, so either this was a deliberately produced semi-cylindrical rod, or else it was a selected, naturally split piece which has received some modification. The rounded surface is corroded, but can be seen to have been smooth with some longitudinal striations visible.

The ivory rod from Fond-de-Forêt is an extraordinarily large piece (Plate 4:6), being approximately 31cm long, which appears to have been crudely worked by scraping, mainly in a longitudinal direction. Traces consist of irregular, mainly longitudinal striations and chattermarks, particularly towards each end. This rod is curved in profile and has at

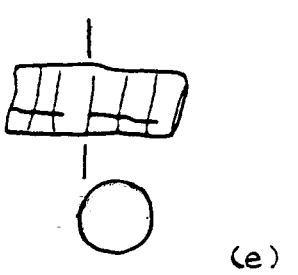




(c)

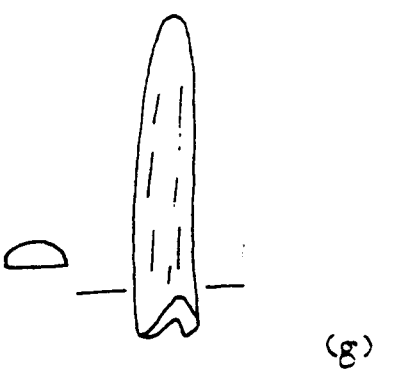


(d)



(e)

(f)



(g)

Fig. 4:19 Ivory Rods: (a) Goyet 158 (b) Goyet 157 (c) Chaleux 113 (d) Magrite 42 (e) Spy 99 (f) Spy 202 (g) Maisières 60

one end, what appears to be a roughly flaked, double bevel, that is it seems to have been worked by percussion. The other end is rounded. This piece has suffered lot of damage, in the form of what may or may not have been deliberate flaking of the distal end of the upper surface; however, it is still quite polished.

The ivory rods from Goyet are most interesting as regards their variation in shape. The one Type (c) rod, Goyet 157, is likely to have been a naturally split cylindrical rod, because its flat surface has not been worked and shows only natural corrugations. It closely resembles both in size and shape, Goyet 158, which is a partially longitudinally split, cylindrical rod; they are probably parts of the same piece (fig.4:19). The convex surface of Goyet 157 appears quite polished, with traces of scraping in the form of longitudinal striations, facets and a number of fine,grouped,oblique striations. One interesting feature of Goyet 158 is that one end has been very neatly whittled down on all surfaces by longitudinal scraping, presumably to trim that end. Its surfaces appear to have been modified by longitudinal scraping from the facets and striations visible. Where it is not too corroded, this piece is smooth.

All the other Goyet rods are pointed at one end, while Goyet 20 is pointed at both ends, but with an identifiable, finer distal end and a thicker, proximal end. Goyet 159 has a steep, single bevel at its proximal end, which has been worked by scraping, and a shallow, distal bevel, which may result from reworking the tip. The proximal end of Goyet 161 may look as if it is single-bevelled, but it must have been obliquely broken instead, as no traces of working are visible. All of these pieces appear to have been worked by mainly longitudinal scraping. On Goyet 20, which is curved in profile, some of the chattermarks are very deep and regular, somewhat like a tyre tread in appearance, so it must have been worked with great force using a very sharp edge.

Two of the Goyet rods have received incised decoration, Goyet 161 is almost completely covered with tiny, sometimes grouped, transverse incisions. Goyet 20 (fig. 4:18) has three groups of oblique incisions on one side, as well as a series of ten incisions encircling the basal portion at 0.6cm intervals, which may reflect some form of binding, or indeed may have been designed to receive a binding and help it to grip.

Function

(i) Traces of Use

No unequivocal traces of use were identified on any of these pieces, though several may have been damaged through use.

(i) Use

The poor condition of the Paviland rods makes it difficult to suggest how they were used. They appear to have been originally cylindrical, but of unknown length and whether they possessed such features as incised decoration, or points or bevels at their ends is impossible to tell. They may indeed have been unfinished roughouts for bevelled and pointed rods. They are believed to have been deposited in the cave in association with the burial of the "Red Lady", for the ivory rods were found around the skeleton, which suggests that they were grave goods of some kind. Many of the Paviland rods are stained with red ochre from this deposit. The Paviland rods are very similar both in dimensions and in general appearance to the rods from Pin Hole.

As was described above, Pin Hole rods 2 and 3 are parts of a double-bevelled rod, with relatively elaborate, incised decoration. This piece may have been a projectile, with the double bevel acting as a hafting device and the oblique incisions on its surfaces providing greater grip for the binding or glue to affix it to a shaft. It is, however, also possible that this could have been some form of non-functional, ornamental rendering of the more usual antler rod in ivory. Unfortunately, the distal

end has been very neatly broken off transversely, leaving no surviving traces to show whether this was accidental or not. In the absence of a distal end, it is not clear whether or not this piece was indeed some form of point. It is of interest that its general dimensions, apart from its length, resemble those of the Paviland rods, which of course have no features such as bevels or incisions preserved. They might have been closely similar to this piece, for all we can tell and this is a reminder of how vital good preservation is if we are ever to understand Upper Palaeolithic bone, antler and ivory industries.

The ivory rod from Kent's Cavern was in such an eroded condition that no clear end features have survived, so it could either have been used as a projectile, or else it may have had some form of ceremonial function associated with burial, since a number of hominid skeletal remains were found in the cave, which may be attributed to the Upper Palaeolithic (Campbell 1977:II:89).

The Fond-de-Forêt rod is remarkable for its size, length c31cm, width 2.6cm and thickness 2.05cm and surely could not have been used in its present form as a projectile. Danthine (1952?,126) has suggested that this was an instrument used for working skins, with the rounded end as a polisher and smoother ("lissoir") and the bevelled end as a scraper or "grattoir"; that is

> "un instrument destiné au travail des peaux: l'extremité arrondie ayant servi de lissoir, la base biseautée étant intervenue comme une sorte de grattoir pour nettoyer, égaliser, assouplir les cuirs et les fourrures" (Danthine 1952?,126).

This is not impossible, but it does seem to be unnecessarily big for such purposes. It may be just a roughly worked block of raw material, which was intended to be sculpted, possibly to form a large spearhead or else to be cut up into lots of smaller blanks. This was also the

conclusion of De Puydt and Lohest about a similar specimen which they found at Spy, which was not studied here owing to lack of time,

> "un bâton plat d'une longueur de 340 mill.; sa largeur, légèrement variable, est en moyenne de 20 mill., il est plus étroit au centre que vers les extrémités, son épaisseur est d'environ 5 mill. Imparfaitement polie et brisé aux deux bouts, il pourrait n'être que l'ébauche d'un instrument" (1886,19-20).

Because of their shape, the Maisières rods are interpreted as points, which may have used to tip arrows and spears. Chaleux 113 is a rather curious shape with its rounded tip and its steeply finished base, which does not appear to be designed for hafting. This piece does not look pointed enough to be an awl, nor does it appear to have been shaped as a projectile. It is probable that both rods from Trou Magrite were unfinished; they may have been designed to be points, although the surviving distal end of Magrite 42 looks as if it was going to be rounded rather than pointed.

Most of the rods from Spy were cylindrical pieces of worked ivory, of which only two examples, Spy 36 and 158, had been made narrower at the distal end, while Spy 202 is crudely double-bevelled and Spy 69 shows a possible attempt at a bevel. All the other rods lack features of this nature; it is possible that they have not survived. Almost all of the rods are broken at both ends and so their original lengths are unknown.

These rods may be the remnants of broken projectile points, which have lost their extremities, these being the most fragile parts. Possibly they had some ceremonial use and like the Paviland examples, were deposited as grave goods with a burial. Dewez (1981,27) has suggested that there was an Upper Palaeolithic burial at Spy, which was overlooked by the early excavators of the site.

Another possible function for these pieces indicated by Otte (1974) is that they were bead blanks. This could have been the case, because the

widths and thicknesses of these rods are very similar to those of a series of ivory beads, frequently found in the deposits at Spy, which are discussed below (see Chapter 6: Beads, Type b). The rods could have been sectioned transversely to form blanks, which were then made thinner at one end for perforation. A lot of bead working was clearly carried out at the site, while an ivory bead has been found at Paviland, which could have been produced the same way (see Chapter 6: Beads, Type a).

Such a segmented rod of ivory was found at Spy by De Puydt and Lohest (fig.4:18) and is described by them as,

> "une lamelle d'ivoire brisée très mince, longue de 50 mill., formée de quatre petits ornaments plus ou moins ovales" (1886,18,Pl.VI,Fig.12).

Similar examples have been found elsewhere in the European Upper Palaeolithic, for example at the Czechoslovakian site of Predmost (Breuil 1924,535,Fig.16.1), which has yielded both Eastern Gravettian and Aurignacian industries (op.cit.,523). Further examples from the site of Mezin in the Soviet Union are illustrated by Müller-Karpe (1966,T245,Nos.19-21).

However, it is surely not likely that a burial, such as Paviland, would contain a workman's raw materials as opposed to finished artifacts, except in the circumstances that the skeleton belonged to the ivory worker himself. Ivory beads have not been found at Pin Hole, Kent's Cavern, Chaleux or Maisières, though one ivory bead is known from Trou Magrite (see Chapter 6: Beads, Type k), while a number of ivory beads were discovered at Goyet, including a very similar series to those found at Spy (see Chapter 6: Beads, Types a and b).

By contrast, all the Goyet rods with the exception of 157 and 158 are pointed , which would suggest a different function. The two exceptions, Goyet 157 and 158 are probably both parts of the same, naturally split,

cylindrical rod. This piece would seem a little large to be a bead blank and has been so carefully worked that it suggests that it was not intended to be cut up into various pieces , for example the surviving end on Goyet 158 has been very neatly finished off. This may have been some form of projectile, with the whittling of the end being preparation for hafting. Goyet 161 is a curious little piece, which may be the distal fragment of a projectile point, with its elaborate, incised decoration. Goyet 22 may also be some form of point: the tip has possibly been reworked, as its profile is steeper than that of the rest of the piece. Another likely, heavy projectile point is Goyet 159, which is pointed at one end and double-bevelled at the other. The most attractively worked example is Goyet 20, which is a lovely, curved point: the curvature may or may not be post-depositional. Its general shape and its curvature somewhat resemble an ivory model of an Eskimo sealing harpoon made in 1900 and held in the Pitt-Rivers Museum (Plate 4:7). The pointed base could have been fitted into a hollow shaft and then held by binding with sinew, this process being copied by the transverse incisions on the base. How such a piece would have been propelled is unknown, as neither arrow nor spearshafts have ever been recognised in the British and Belgian collections. It is possible that a number of the rods are segments from similar pieces.

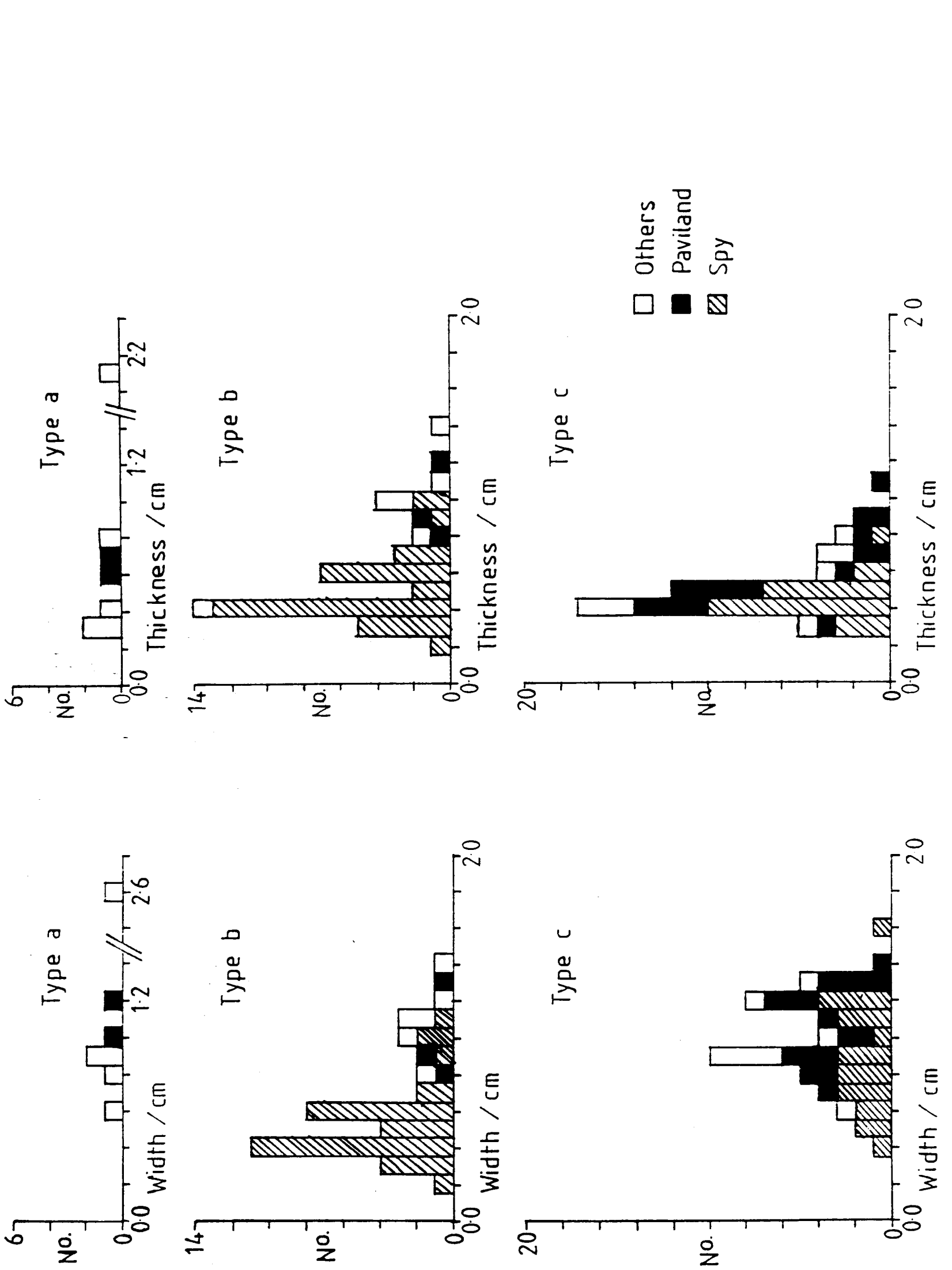
Variation and Distribution

The ivory rods vary in length from 0.7 to 31.5cm, but the majority range from 0.7 to 4.8cm. As may be seen from Graph 4:3, the width of the rods ranges from 0.15 to 2.6cm and their thickness from 0.15 to c2.05cm.

It is a pity that almost all of the ivory rods come from multiperiod sites, where they cannot with any certainty be attributed to any particular Upper Palaeolithic occupation. This is particularly true for the rods from Trou Magrite, Goyet and Fond-de-Forêt. The ivory industry from Spy is usually attributed to the Aurignacian, as it was found in De



Plate 4:7 Ivory Model of an Eskimo Sealing Harpoon



Graph 4:3 Distributions of Widths and Thicknesses of Ivory Rods

Puydt and Lohest's second ossiferous layer, which is believed to belong to this period (De Puydt and Lohest 1886,17;Otte 1979,311-312;Dewez 1981,30). However, there is no definite dating evidence to confirm this. Chaleux 113 must belong to the Magdalenian, as it comes from a series of occupations dating to that period, but it is not particularly similar to any of the other rods and there is certainly no evidence to suggest that the ivory rods all belong to the Later Upper Palaeolithic. Likewise, the two rods from Maisières Canal must belong to the Upper Perigordian, but even though they do resemble the Spy rods in particular, this does not mean that ivory rods of that kind are a purely Upper Perigordian phenomenon. Similarly, all the British rods come from multiperiod sites, and their attribution is also uncertain.

It has been generally believed that mammoth became extinct in the region under consideration at the time of the Last Glacial Maximum (Stuart 1982,164). Therefore, ivory artifacts are most frequently viewed as an Earlier Upper Palaeolithic phenomenon, for which there is certainly a lot of evidence in the form of large ivory industries on sites which predate the glacial maximum, such as the Abri Castanet (Dordogne). However, the presence of an admittedly very small number of ivory artifacts from Chaleux shows that this material was still being worked a few thousands of years after that event. Furthermore, a recent radiocarbon accelerator date of 12 700 ± 160 years BP (OxA-1021) (Hedges et al.1988) obtained from unmodified remains of mammoth found in Condover, Shropshire suggests that the mammoth may have survived the glacial maximum.

Unfortunately the problem of dating the working of ivory cannot be solved so easily, because, unlike bone or antler, ivory need not be fresh when worked and even fossil ivory may be successfully sculpted (MacGregor 1985,40). This means that any radiocarbon date obtained from such pieces

would date the ivory itself, as opposed to the time of its being worked, so only a terminus post quem could be derived.

The distribution of these artifacts is geographically fairly widespread in the research area, but with large concentrations on only two sites, which may signify that the working of ivory was only carried out in certain centres and that finished products were then exported to other areas. Paviland was clearly the major ivory-working centre in Britain and it is possible that rods were taken from there to other sites such as Pin Hole Cave and Kent's Cavern, where only a limited number of rods have been found. They resemble the Paviland rods in size, but are in a much better condition owing to the fact that they were buried in a more agreeable environment. As there are no 'trace elements' in fossil ivory which can be compared from piece to piece, it is as yet impossible to tell whether or not such fragments came from the same tusk. Another British specimen, the present whereabouts of which are unknown to me, was found by Parry in an Upper Palaeolithic context at Gough's Cave. The diameter quoted by Parry (see below) suggests that this piece could have easily formed part of the assemblage from Paviland (see Graph 4:3),

> "parts of a cylindrical rod of ivory (probably mammoth), split along the natural grain, having a diameter of 12.5mm. The largest piece measured 139mm." (1928,113).

The rods from Spy are generally thinner and narrower than those found in the rest of Belgium, with the exception of the two rods from Maisières, which suggests that they were not sent as rods to other sites, but were used at Spy, possibly for bead making. The close similarity of certain ivory beads from Spy and Goyet (see Chapter 6: Beads), seemingly produced by segmenting ivory rods, suggests that either the necessary raw materials were supplied to Goyet from Spy or finished beads. The actual surviving rods from Goyet, in common with those from Trou Magrite, Chaleux and

Fond-de-Forêt may not have been locally made, as there are few signs of ivory working on these sites, but they may have been imported from some other site, perhaps even from Paviland Cave.

Barbed Points

These are pointed bone or antler artifacts, with a series of barbs along one (uniserial) (fig.4:20) or both (biserial) edges (fig.4:22). Ten uniserial and four biserial barbed points are considered here (see Table 4:14 below); they were found in Magdalenian contexts in Belgium and in equivalent Later Upper Palaeolithic deposits in Britain. They were previously called harpoons on the basis of their resemblance to the Eskimo artifacts of that name, which were used for hunting sea-mammals and may be defined as follows,

> "the harpoon head was a weapon that detached from its shaft; the toggling harpoon head was one that toggled, pulling sideways, to lodge itself in the animal's flesh; the composite toggling harpoon head was one that was composed of multiple components" (Stewart 1973,136).

However, as it is not known how the Palaeolithic specimens were hafted, or in what manner they were used and against what prey, it seems inappropriate to call them harpoons. For this reason, the more descriptive term 'barbed point' has been commonly adopted (Hallam et al. 1973).

Table 4:14
Number and Distribution of Barbed Points

Site Name	Uniserial	Biserial
Coléoptère	6	-
Verlaine	-	1
Goyet	-	1
Kent's Cavern	2	1
Aveline's Hole	-	1
High Furlong	2	-

Barbed points are a Late Magdalenian development (de Sonneville-Bordes 1960,335), and are found in greatest abundance in South West France, for example at La Madeleine (Dordogne) and in Cantabrian Spain (Obermaier 1924,157-158) at Valle, Santander and Aitzbitarte near San Sebastian. However, Upper Palaeolithic barbed points also occur in other parts of Europe: barbed points from Magdalenian contexts at Pekárna in Czechoslovakia and Brillenhöhle in Germany are illustrated by Müller-Karpe (1966,T220,9,T175,1-8). Further examples have been found at Kesslerloch in Switzerland and Andernach in Germany (Wymer 1982,207-209). Working débris from the manufacture of barbed points has also been recognised at the Magdalenian site of Gönnersdorf in Germany (Berke 1977). The vast array of literature on Upper Palaeolithic barbed points includes a major study of such artifacts carried out by Julien (1977,1982).

Barbed points continued to be developed and used into the Post Glacial under very different environmental conditions, for example at Star Carr in Britain. The illustrations of some of these pieces (Clark 1954,154, Fig.64,P20,P132) suggest that there was a very strong resemblance between them and particular Upper Palaeolithic specimens, such as the barbed points from High Furlong. By contrast, in the very late Magdalenian and the Epi-Palaeolithic of South West France and Northern Spain, barbed points underwent radical changes, the reasons for which are uncertain. These 'Azilian' barbed points, named after their type-site of Mas d'Azil (Ariège) are made of red deer instead of reindeer antler and are very robust-looking in comparison with Magdalenian specimens. Furthermore, they often have a hole "en boutonnière" drilled in the base, probably for attachment (Thompson 1954; Mons 1979).

The barbed points considered here were carefully examined to see whether any traces of working were preserved on them which could indicate how they were made. The presence of two unfinished pieces within this

sample (Verlaine 1 and Coléoptère 12) helped shed light on the techniques of manufacture used. Both the uniserial and the biserial barbed points appeared to have been deliberately and carefully cut out, probably by the groove and splinter method. The blanks then seemed to have been modified by scraping; this modification included the reduction of one or both edges prior to the production of the barbs. The barbs were formed by a combination of cutting and scraping. Some variation was observed in the shapes of the base of these pieces, which was considered in some detail, as it was felt that this could signify the method of hafting used and thus, the method of use. Descriptions of the methods of hafting and use of Eskimo and North American Indian barbed points or harpoons yielded a lot of interesting and pertinent information (Birket-Smith 1959; Giddings 1968; Stewart 1973), as did published experimental work on the propulsion of osseous projectile heads (Guthrie 1983; Olsen (Arndt) and Newcomer 1986). The possible prey that these weapons were used against is also discussed below.

It was concluded from the available types of information briefly outlined above that these barbed points may have included both detachable pieces similar to Eskimo harpoons and also fixed projectile heads. It also seems probable that, as a group, they were used against a wide range of types of prey.

Manufacture

Uniserial Barbed Points

The two examples from Kent's Cavern, numbers 3 and 4, are believed to have been made of antler (Garrod 1926,42). The original of Kent's 4 seems to have disappeared, for it is known to have been in the British Museum in 1926 when Garrod's book came out, but no record of its whereabouts exists after that date. I was able to identify as a cast the piece in Torquay Natural History Society Museum, which was believed by many to be the

original. Enquiries made at the British Museum suggest that the barbed point was destroyed during the Blitz, for it is believed to have been displayed in a case which was badly damaged then. The High Furlong barbed points have been identified as being made of bone by means of a radiological examination (Hallam et al. 1973,123).

The identification of the raw material from which the Coléoptère barbed points were made is tentative and is based on the appearance of the cancellous tissue. Coléoptère 26,12 and 11 are believed to be made of antler, as their cancellous tisue is very fine, whereas Coléoptère 8 and 9 are thought to be have been made from bone, because of their thick,crude cancellous tissue. The raw material from which Coléoptère 10 was made has yet to be identified.

(i) Débitage

All of these pieces are likely to have been deliberately extracted, rather than fashioned from whole bones or casual fragments, as each has a very regular shape. A number of examples, such as Coléoptère 8 and 9 have traces on their non-barbed edges (Plate 4:8), consisting of longitudinal striations, rough facets and chattermarks; these may either be associated with débitage by the groove and splinter technique or with modification. It would clearly be most economical in terms of time, work and raw material to cut out a blank at the beginning, which was as close as possible to the size and shape of the finished artifact. No definite waste products from the manufacture of barbed points were identified in the collections studied here, though no doubt they once existed. Some idea of the information that has probably been lost may be provided by the Mesolithic site of Star Carr where 191 barbed points were found (Clark 1954,115,123) as well as 83 red deer antlers from which blanks had been extracted by the groove and splinter technique. Similarly, although no actual barbed points were recovered from the Magdalenian site of



Plate 4:8 Coléoptère 8 and 9



Plate 4:9 Kent's Cavern 3

Gönnersdorf, traces of the manufacture of such artifacts were recognised in the form of one barb and pieces cut out from between barbs (Berke 1977).

(ii) Modification

In order to facilitate the cutting out of the barbs along one edge, that side would be made thinner by working both surfaces, so that it was easier to cut through. This resulted in the blank being approximately tear-shaped in section, with the rounded end representing the non-barbed edge and the narrow end the barbed edge.

Eight pieces show in cross-section that they were trimmed by working both surfaces; of these, Coléoptère 10 clearly only received minimal reduction of its surfaces. The other two barbed points were only made thinner on their upper surfaces, prior to cutting out the barbs. These were Coléoptère 12, which is unfinished, and Coléoptère 9. Certain pieces show incisions on their surfaces which are interpreted here as having been intended to mark out the barbed area (fig. 4:20). These include Coléoptère 11 and 12, each of which has a neat, longitudinal groove on the upper surface next to the barbed area. On Coléoptère 8, a longitudinal incision on the lower surface appears to define the barbed area, whereas a similar feature may be seen on the upper surface of Coléoptère 26.

It is most probable that the trimming of these pieces and their general shaping were carried out by scraping with stone tools rather than by grinding with a grindstone. One reason for this is that it would seem unlikely that such a major change in techniques as using a grindstone would have taken place between possible débitage by cutting out a blank and cutting out the barbs using stone tools. Furthermore, the better preserved pieces indicate as much, for example on Kent's 3, the base has clearly been shaped by scraping with a stone tool, leaving deep, longitudinal and oblique striations on the outer surface, which is stepped

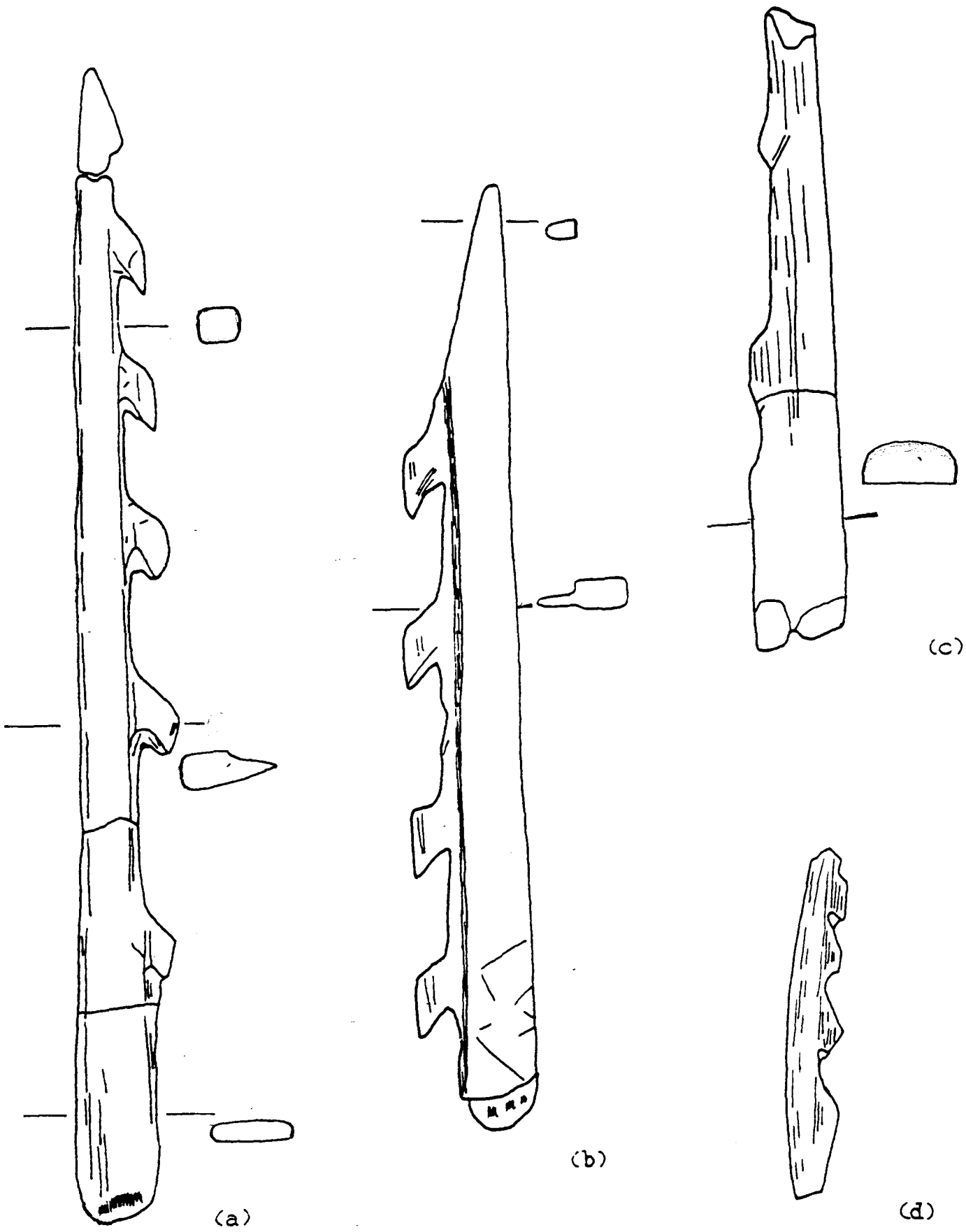


Fig. 4:20 Uniserial Barbed Points:
(a) Coléoptère 26 (distal end after Dewez 1975, 131, Fig. XV)
(b) Coléoptère 11
(c) Coléoptère 12
(d) Kent's Cavern 4, after Garrod (1926, 41, Fig. 4:14) Scale 2:3

with chattermarks (Plate 4:9). Casts were made of three of these pieces, which were examined by me in the SEM to see if any further information about the manufacture of these pieces could be obtained. When Coléoptère 9 was inspected this way, very clear traces of working probably resulting from scraping could be recorded (Plate 4:10).

On the upper surface of Coléoptère 11, a group of oblique incisions may be seen near to the base, which must have been made with a stone tool (fig.4:20). They may have been decorative perhaps simulating binding to a haft, or they may have helped to make the binding hold.

In most cases, the barbs were formed by making an oblique groove in the trimmed edge, either just in one surface, or with matching grooves in both surfaces. This forms the lower edge of the barb. The material beneath the barb was cut and/or scraped away, leaving little oblique nicks,striations and incisions. Likewise, the upper edge of the barb was shaped by scraping, leaving striations and sometimes deep,transverse steps where the stone tool has cut into the bone or antler. Typically, few traces may be seen on the surfaces of the barbs.

The table below shows how the barbs were cut out and their resulting shape.

Table 4:15
Nature of Barbs on Uniserial Barbed Points

Tool Number	Shape of Barbs	Cutting from which surface(s)
Coléoptère 26	angular	both surfaces
Coléoptère 8	angular	lower surface
Coléoptère 9	less angular	upper surface
Coléoptère 10	rounded	both surfaces
Coléoptère 11	angular	both surfaces
Coléoptère 12	broken	upper surface
High Furlong 1	rounded	both surfaces
High Furlong 2	angular	both surfaces
Kent's Cavern 3	originally angular	no information
Kent's Cavern 4	now rounded, may originally have been angular	no information

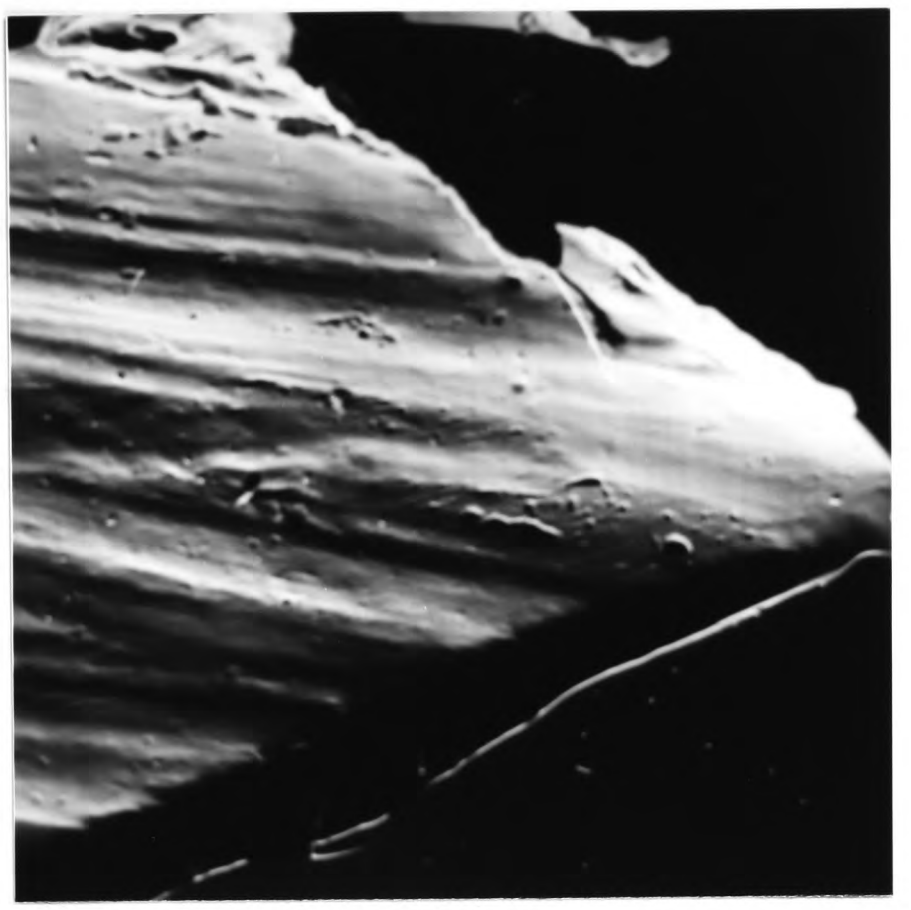


Plate 4:10 Traces of modification on the fourth barb of Coléoptère 9 (x80) (SEM photograph)

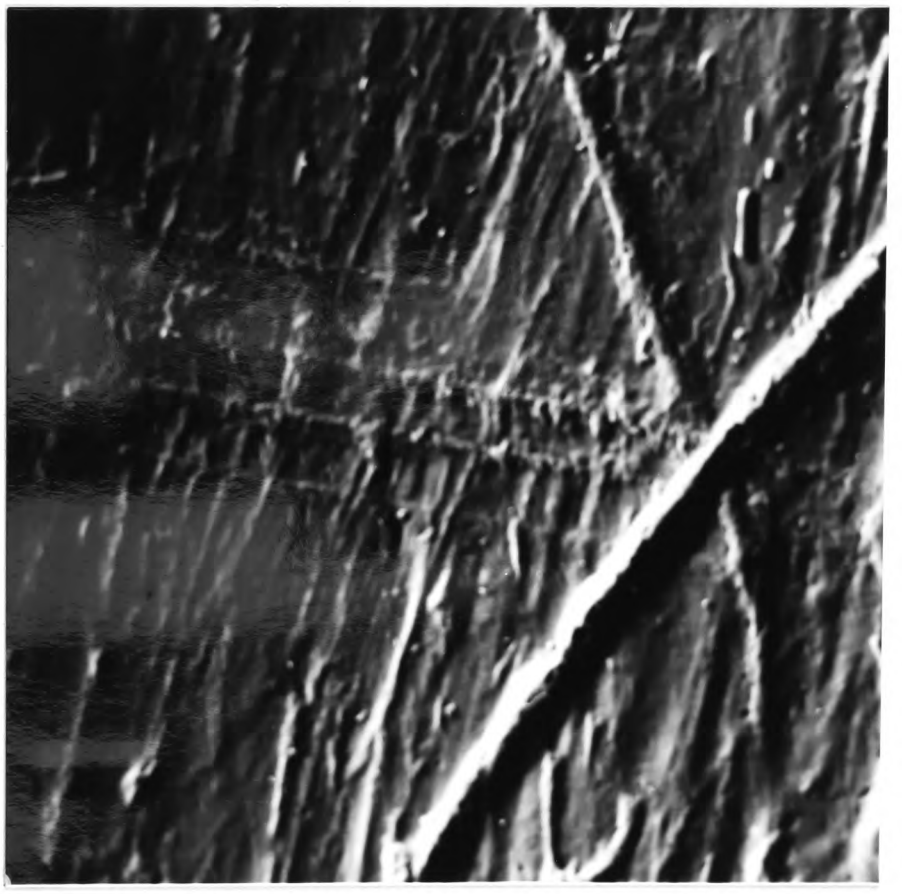


Plate 4:11 Traces of modification visible on the barbed edge of Coléoptère 12 between the barbs (x43) (SEM photograph)

Particular features related to the production of the barbs have been noted on a number of pieces. On High Furlong 1, a barb has been broken during manufacture, as the shaft was too thin at that point to support it; it was later scraped over to neaten it, leaving a small lump (Plate 4:12). It seems that the definition of the barbs on High Furlong 2 (fig. 4:21) may have been made sharper, after they were produced, by drawing a sharp-edged stone tool along the bone underneath the barb. When a cast of Coléoptère 8 was inspected in the scanning electron microscope, an oblique incision could be seen running parallel to the lower edge of the sixth barb on the lower surface. It is likely to have been a trial cut. Coléoptère 12 is clearly unfinished (fig. 4:20), but it seems that each of its two barbs was produced in a different manner. The upper barb, that is the one closer to the distal end appears to have been formed by cutting and scraping, while the lower one was probably shaped by progressive scraping. Its upper surface is covered with longitudinal striations. When a cast of this piece was viewed in the SEM very clear traces of this process could be seen; they took the form of longitudinal striations, chattermarks and various deep, oblique incisions (Plate 4:11).

In her preliminary study of Magdalenian barbed points, Julien (1977,185) divided them into two groups based on the number and arrangement of the barbs, that is whether the barbs formed a closely packed series or were carefully spaced out,

> "Le premier sous-ensemble est bien défini, c'est celui des harpons unilatéraux, à barbelures petites et nombreuses, il correspond à notre groupe B" (Julien 1977,185).

Whereas the second subgroup

> "comprend, d'une part, la totalité des harpons bilatéraux, d'autre part, le groupe A des harpons unilatéraux, à barbelures plus grandes et peu nombreuses" (Julien 1977,185).

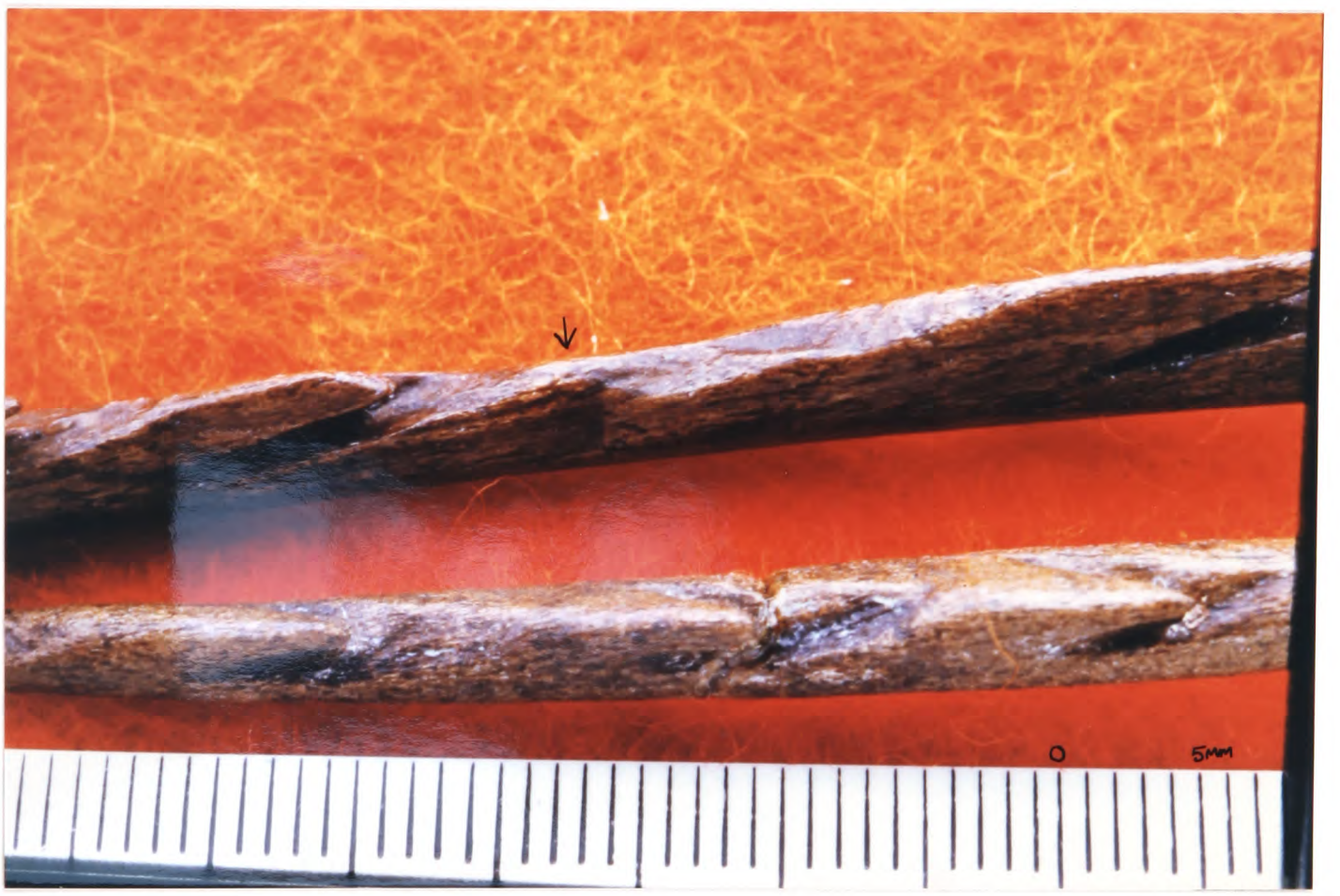


Plate 4:12 High Furlong 1 and 2 The unfinished barb on High Furlong 1 is indicated by the arrow

This system for describing barbed points is very simple and attractive; however, the method of classification which Julien subsequently published in 1982 is a lot more elaborate, in fact too elaborate, which makes it a lot less useful. For she adds to the 1977 criteria that Group A points generally have fewer than five barbs, whereas Group B examples may have from five to fifteen barbs (1982,43). Thus, Coléoptère 26 which has five barbs must fall into Group B, although the barbs are large, well-formed and spaced out. Julien has attributed all five finished barbed points from the Grotte du Coléoptère to Group B (1982,215, Table 41). However, the arrangement of their barbs suggests to me that they clearly belong to two distinct groups. Two examples, Coléoptère 8 and 9 have very tightly packed and quite crudely worked barbs where the same incision marks out the top of one barb and the base of the next, whereas for the other three pieces, the barbs are further apart and in the cases of Coléoptère 26 and 11, they have been very skilfully worked.

The ten uniserial barbed points considered here do in fact fit very nicely into the two subcategories, outlined by Julien in 1977, the significance of which will be discussed below. The Group A uniserial barbed points have an average length of 12.2cm and the length of the barbs ranges from approximately 0.6 to 1.75cm. The number of barbs ranges from 2 to 6 and what is most interesting is that the distance between the barbs ranges from 0.7 to 2.5cm. The barbed points which have been placed in this category are Coléoptère 26,12,11 and 10.

The second of these subgroups, which corresponds to Julien's Group B consists of artifacts whose average length is 9.2cm, while the barbs vary in length from approximately 0.2 to 1.9cm. The number of barbs ranges from seven to three, if the lowest projection on Kent's 4 is interpreted as a hafting device, instead of as a barb. Where it can be measured, the distance between the barbs lies between only 0.2 and 0.5cm. The examples

of this type are Kent 3 and 4, High Furlong 1 and 2 and Coléoptère 8 and 9.

Julien (1977,185;1982,206) has suggested that the variation in the uniserial barbed points is because they were intended to be used to hunt different prey. Another possible reason why these two types exist became clear to me when I was attempting to produce a barbed edge on an antler roughout (see Chapter 2). For the easiest method for the inexperienced is to produce a series of closely packed, small barbs by making oblique incisions in the edge, which provide the lower edge of one barb and the upper edge of the barb below. Much greater skill is required to produce a Type A barbed point, not only in making the actual barbs, but also in producing a blank of a suitable shape prior to cutting out the barbs. In support of this, it was observed that Type B barbed points Coléoptère 8 and 9 were crudely worked and in particular, their non-barbed edges were rounded and roughly shaped, whereas of the Type A barbed points, Coléoptère 26 and 11 have been very neatly worked, the barbs have been carefully cut out and the shaft is square and skilfully shaped. As all the Coléoptère pieces come from the same layer and are believed to be contemporary, this variation is most likely to reflect differences in the skill and experience of the toolmakers.

A number of pieces have been modified at the proximal end in a manner which may be associated with hafting. The upper surface of Coléoptère 26 has been reduced at the proximal end by scraping, probably to make it a more suitable shape for attachment either to a bevelled or a socketed haft. On Coléoptère 9, below the lowest barb, there is on the barbed edge a small,round projection, which could have been a failed barb, as on High Furlong 1, but, owing to its regular shape and its location at the base of the piece, it is interpreted here as a hafting device (fig. 4:21). The upper surface of the shaft next to this projection has been made thinner

by longitudinal scraping, perhaps to make it easier for the base of the barbed point to fit into the haft with a line attached to just above the basal projection: the projection would serve to prevent the line from slipping off after the head had been detached.

The base of Kent's 3 is roughly V-shaped and projects from the shaft at one side. The pointed end looks as if it has been designed to fit into a socket with a line attached to the shaft, above the basal projection (Plate 4:9). The lowest "barb" of Kent's 4 (fig.4:20) may have been part of a similar arrangement (Garrod 1926,41,Fig.4,No.14).

The distal end of a number of pieces also show some interesting features. Both inspection with the aid of a handlens and in the SEM revealed that the tip of Coléoptère 8 has been very heavily worked, resulting in both the usual traces such as longitudinal facets and tiny chattermarks and also a curiously flattened appearance compared with the rest of the piece. This suggests that it may have been reworked. Likewise, the tip of Coléoptère 9 may have been reworked, because it is spatulate and heavily modified. The tip of High Furlong 2 has either been reworked or else just very carelessly modified, for one edge is curved in profile, probably where the stone tool has cut into the bone. My experimental work has shown that it is difficult to produce a narrow,straight tip by scraping, without digging into the bone and producing a profile like that of this tip.

Not one of these pieces appeared to have been polished through manufacture or use, but such a feature may have been concealed by the heavy varnish or preservative with which at least seven examples were coated. Four of the barbed points, High Furlong 1 and 2, Coléoptère 9 and 11 are curved in profile to various degrees. This would make more sense as a post-depositional effect than as a design feature. However, two curved barbed points were found in such close association at Star Carr (Clark

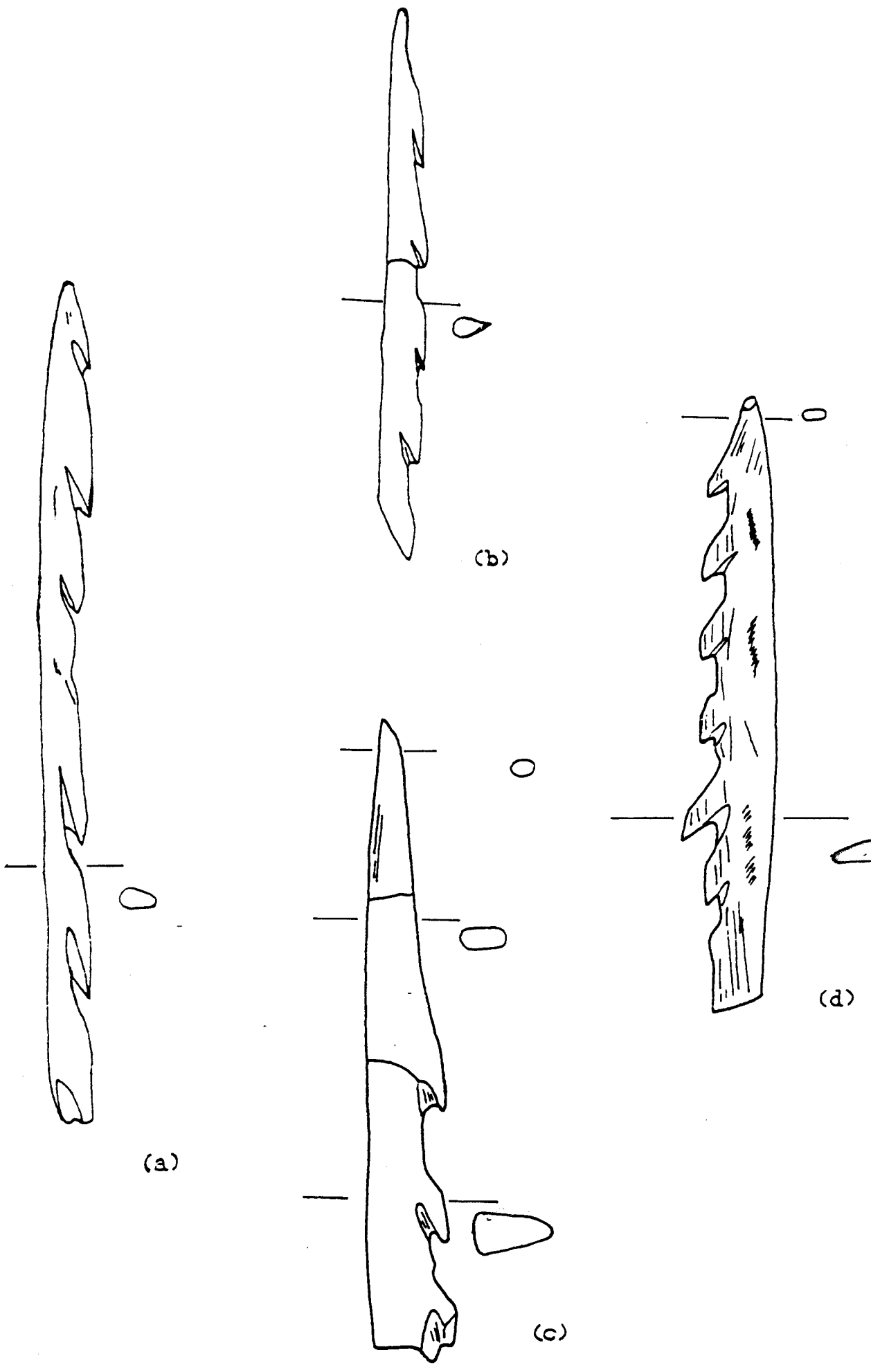


Fig. 4:21 Uniserial Barbed Points: (a) High Furlong 1
(b) High Furlong 2
(c) Coléoptère 10
(d) Coléoptère 9

1954, Plate XII), that it seems probable that they were once bound and hafted together.

Biserial Barbed Points

All four barbed points in this group appear to have been made from antler. The example from Aveline's Hole was destroyed during the War, but two casts of this piece exist, one in the British Museum (Natural History) and one in the collections of the University of Bristol Spelaeological Society.

(i) Débitage

The regular shape of all of these pieces suggests that they were carefully cut out, presumably by use of the groove and splinter technique. The longitudinal striations visible on the outer edges of the barbs and on the sides may have been associated with extraction as opposed to modification.

(ii) Modification

On all of these pieces, with the exception of Verlaine 1, each edge was made thinner than the central shaft, in order to facilitate the production of the barbs. It will be recalled that this process was also observed on the uniserial barbed points. On Goyet 109 and Kent's 2, both surfaces of each edge were reduced, as may be seen from their cross-sections, while on Aveline's 1, only the upper surface of each edge had been trimmed (fig.4:22). This is clear from the casts, but may also be seen on the original published drawing of this piece (Davies,1920-21,82,Fig.10,No.1). In all three cases, there has been some marking out of the areas to be made thinner, as was observed on some of the uniserial,barbed points. On Goyet 109, deep,longitudinal incisions may be seen running along each side of the shaft on both surfaces (fig.4:22); on Aveline's 1, similar longitudinal incisions may be seen to either side of the centre shaft, on the upper surface only. On Kent's 2, deep,

longitudinal incisions may be seen on either side of the shaft on the upper surface and towards one side on the lower surface. The right longitudinal incision on the upper surface is cut by a series of seven, three times paired, curving, oblique incisions, which may have been markers for locating barbs (fig.4:22). This feature was also recorded on certain barbed points from Star Carr (Clark 1954, 124, P20, 110,162).

The method of modification used was most probably scraping with stone tools, so as not to change radically the techniques used between extracting the blank and cutting out the barbs, also using stone tools. The traces visible on the barbed points seem to confirm this. Goyet 109 appears to have been longitudinally scraped all over, as its surfaces, including the barbs, are covered with longitudinal striations, little facets and chattermarks. Various striations, sometimes grouped, both longitudinal and oblique may be seen on the surfaces of Verlaine 1, which look similar to those produced experimentally by scraping, as they resemble the individual strokes of a stone tool (fig.4:22). The longitudinal striations visible on the shaft and barbs of Aveline's 1 are likely to have been associated with scraping, given the angular shape of the piece. A cast was made of Kent's 2 and inspected in the SEM to examine more closely the shaft which is covered with longitudinal facets formed by working too heavily on one area, and a mixture of both crude and fine, longitudinal striations. The tip is facetted with chattermarks and fine, longitudinal striations may be seen on the barbs. These traces suggest modification by scraping.

Both Goyet 109 and Aveline's 1 share what seems to be a typically Magdalenian feature (see de Sonneville-Bordes 1960,422,Fig.242,1-17; Julien 1982,107,109,Fig.46), that is deep, oblique incisions which cut the longitudinal striations resulting from modification on both surfaces of the barbs and hence are a final addition. They seem most likely to have

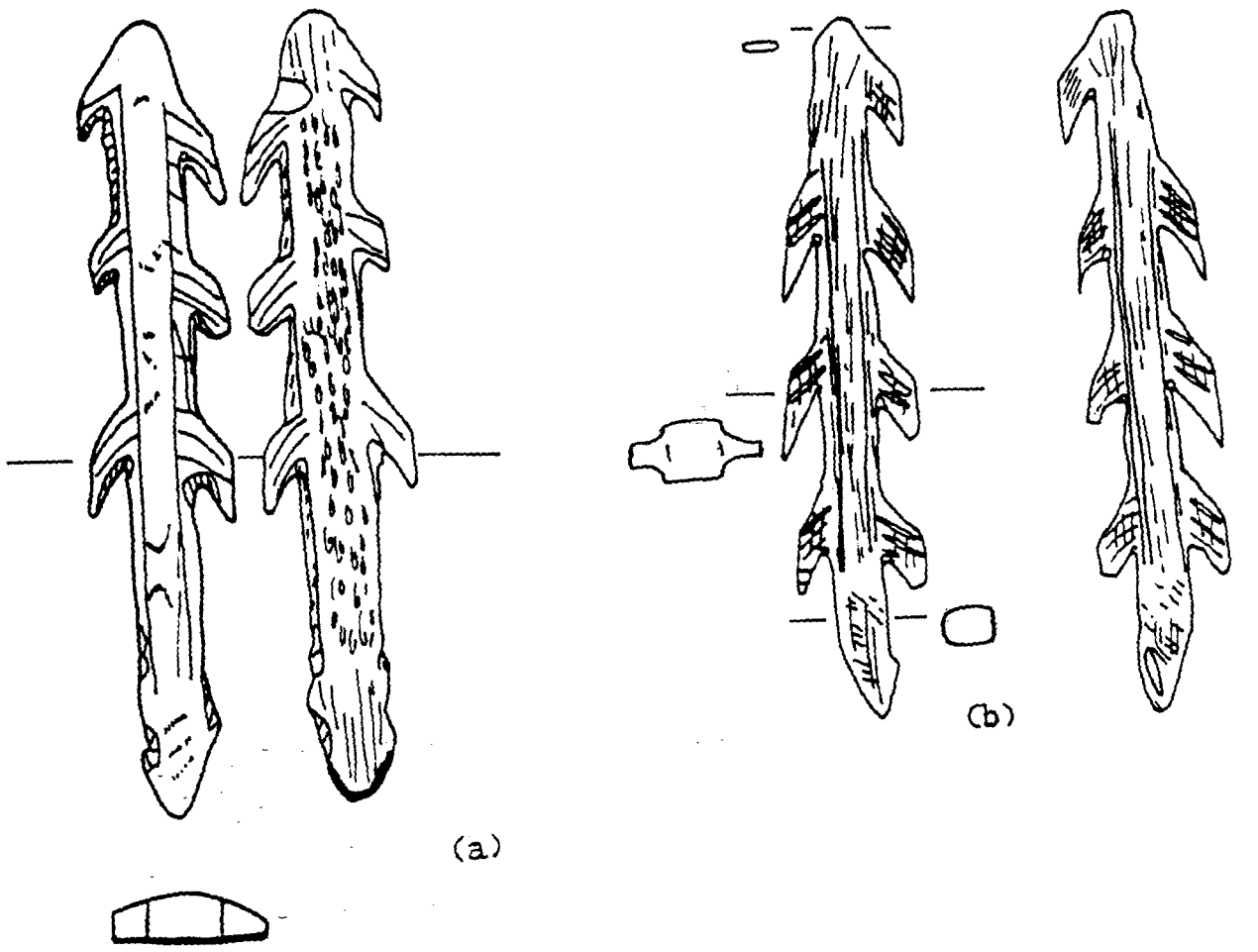


Fig. 4:22 Biserial Barbed Points:
(a) Aveline's Hole 1, after Davies (1920-21, 82, Fig. 10, No. 1)
(b) Goyet 109
(c) Kent's Cavern 2
(d) Verlaine 1

been purely decorative, but may conceivably have had some function, for example to contain poison (Deffarge et al. 1974,214).

The techniques used to cut out the barbs are not as clear as those used on the uniserial barbed points; for example, there are no large, oblique incisions below each barb. With the exception of Verlaine 1, they are very carefully cut out and then the material from between the barbs is cut and scraped away. The barbs on Goyet 109 are angular and have been very neatly cut out from both surfaces and there are traces of longitudinal scraping between the barbs. The barbs on Aveline's 1 are angular and were probably produced in the same way. The Kent's 1 barbs are angular and very finely produced: little, V-shaped incisions may be seen between them, where the stone tool has cut into the bone. Towards the lower edges of the first two barbs on the left, when viewed from the upper surface, two deep,oblique incisions may be seen, which probably result from attempts to cut out the barbs. Verlaine 1 is quite different, being a crude,incomplete piece, which bears no resemblance to the artifacts described above. It is remarkably wide and thick, with no doubt most of the shaping remaining to be carried out after débitage. There was no trimming of the shaft prior to the production of the barbs and it may indeed have been abandoned in this state, as so much work would be required to finish it. The method of barb production employed on this artifact is also unusual, for towards one side of the piece, a number of very deep,oblique incisions have been made in the upper surface, which appear to be the outline of a barb. Further down, on the opposite edge, material has been cut and scraped away to form a barb in a slightly more conventional manner, but leaving deep, crude, oblique incisions.

The organisation of the barbs on the three finished pieces is as follows. The eight barbs on the example from Kent's Cavern are arranged in four, opposing, pairs of barbs; Goyet 109 and Aveline's 1 have different

numbers of barbs, seven and six respectively, although, their organisation is very similar in that the first barb is an extension of the tip and is not clearly separated from it as was the case for Kent's 1. From the distal end, the barbs lie alternately on each side of the shaft, except for the last two which are paired opposite each other. This arrangement would suggest that the barbed point from Kent's Cavern with its long, unbarbed, distal area would have had greater penetration.

In her first analysis of Upper Palaeolithic barbed points, Julien (1977,185) placed the biserial barbed points in Group A with those uniserial barbed points which had larger barbs than those belonging to Group B. This seems to take no account of the fact that there was clearly variation in the number and arrangement of barbs on biserial barbed points (see above). To some extent Julien remedied this in her more detailed system published in 1982, where biserial barbed points were still viewed as having more in common with Group A uniserial barbed points than with those of Group B, but were further divided into another set of Types A and B on the same grounds, that is to say the number and organisation of the barbs. However, it seems to me that criticisms can still be made.

Type A biserial barbed points have relatively large barbs, which are less numerous and larger than those of Type B points (1982,48). Type A pieces have between 2 and 7 barbs and Type B pieces commonly have between six and ten barbs (p47). Julien (1982,215 Table 41) groups together the barbed points from Aveline's Hole and Kent's Cavern under Category B, with Goyet 109 as a Type A barbed point. This is most curious, because as was observed above, Goyet 109 and Aveline's 1 are particularly similar,so it seems rather unhelpful to separate them artificially into different groups. There appears to be an over-categorisation of the artifacts in Julien's 1982 report, which is rather far removed from the actual appearance of the artifacts, and maybe also from how their makers would

have viewed them, as was demonstrated above with reference to the uniserial barbed points from the Grotte du Coléoptére.

Apart from the obvious similarity between the barbed points from Goyet and Aveline's Hole, the arrangement of their barbs being alternate rather than opposed sets them apart from the barbed point from Kent's Cavern. Furthermore, although incomplete, the Kent's Cavern barbed point has more barbs and they are more closely spaced than those of the other two barbed points.

My own relatively simple analysis of the finished biserial points in my sample based on Julien's paper published in 1977, gave the following results. Goyet 109 and Aveline's 1 are complete and are 7.05 and 8cm long with six and seven barbs respectively. The lengths of the barbs range from 0.69 to 0.9cm and from approximately 0.3 to 0.8cm, which is a little low for the uniserial Group A points, but the distance between the barbs varies from c0.7 to 1.1cm, which is well within the expected distribution. On the other hand, Kent's Cavern 2 has been broken transversely just below the lowest pair of barbs, but it has eight barbs and is 5.9cm long. The length of the barbs ranges from only 0.4 approximately to 0.6cm and the distance between them from only 0.3 to 0.6cm. This to my mind places it clearly within the Group B range of variation, unlike the other two pieces.

The base of the shaft of Goyet 109 is roughly V-shaped, with a proximal point and a slight projection on one side above which a line could be tied, while the pointed base could be fitted into a socketed shaft. In one surface of the base, there is a deep,oblique groove full of longitudinal striations, which is a highly unusual feature whose origin or function is unknown. Both surfaces of the base are covered with a number of tiny,oblique incisions and the base had clearly been very carefully worked to produce the right size and shape, the tiny striations

doubtless resulting from this process. Davies' drawing (1920-21,82,Fig.10,No.1) of the barbed point from Aveline's Hole suggests that this piece had a very similar proximal end to that of Goyet 109. The basal area is slightly wider than the rest of the shaft and narrows to a point at the proximal end. There is a slight projection on one side of the proximal area and a notch in the other, onto both of which a line could be tied. The pointed base could easily fit into a socket. Both the cast and Davies' drawing of the original suggest that there were a number of short,transverse incisions on the upper surface of the proximal end. These features add up to a remarkably close resemblance between the barbed points from Aveline's Hole and Goyet, which indeed was commented upon by Garrod sixty years ago (1926,87). My detailed study of the casts of the Aveline's barbed point and of the original from Goyet might even be taken to suggest that there was a relationship between the two sites, but we cannot at present confirm from direct chronometric evidence that their occupations were precisely contemporary.

The tip of Goyet 109 may have been reworked, as it is spatulate in profile. Likewise the steep profile of the tip of Kent's 2 and the facetting on its lower surface suggest that it too may have been reworked. Since the manufacture of a barbed point must represent a substantial investment of time, it seems only reasonable to expect that damage would have been repaired whenever possible, rather than a new point being made.

None of the biserial barbed points appeared to be polished, but the condition of the artifacts makes this a rather tentative observation. Goyet 109 had been so heavily impregnated with some resinous substance, that it was even hard to believe that it was made of antler. Pinkish, probably ochreous patches of deposit may be seen on Verlaine 1 and Kent's Cavern 2.

Function

As a result of the detailed analysis of the various dimensions of Upper Palaeolithic barbed points in her first publication, Julien came to the conclusion that,

> "il paraît légitime de regrouper harpons unilatéraux et bilatéraux sous le terme générique de harpon: l'identité des proportions et des dimensions relatives à la longeur fait croire à une identité de fonction" (1977,185).

Julien suggests that the choice between producing either biserial or uniserial barbed points may have been dependent upon either the robustness of the raw material available, or more probably the nature of the intended prey. In the present, highly incomplete, state of the archaeological record, these are purely matters for speculation.

From my own study of a considerably more limited number of barbed points, I reached a number of conclusions about the function of these artifacts, which are outlined below.

(i) Traces of Use

Casts of all the barbed points from Coléoptère, with the exception of Number 26, were made and examined by me using an SEM, but although clear traces of manufacture were observed, which have been described above, no unequivocal traces of use were identified. Similarly a cast of the biserial point from Kent's Cavern was examined in the same manner with the same result.

High Furlong 1 has a compressed tip, visible even to the naked eye, which may have occurred either during impact or post-depositionally, but it was impossible to determine which, because the piece was in such a poor condition that no typical traces of impact survived such as those reproduced experimentally on or near the tips of osseous projectile points by Arndt (Olsen) and Newcomer, which consisted of "crushing, rounding or

bevelled breaks" (1986, 167,169,Plates 20-23). The two barbed points from High Furlong were also inspected in an SEM by J. Cook (British Museum, Quaternary Section) in consultation with myself, but no further potential traces of use were identified. It is quite likely that any or all of the damage to the tips, barbs and bases of all of the barbed points may also have been a result of use, but unfortunately I see no way of demonstrating this, given the condition of the pieces and in some cases their uncertain history since deposition and since discovery. This is disappointing, but I do not take it to mean that high-magnification study of bone and antler artifacts will never be productive of useful information.

(ii) Use

Upper Palaeolithic barbed points are generally believed to have been projectile points, which could have been hafted to a long shaft and propelled by hand or with the aid of a spear-thrower. It certainly seems probable that this tool type was some form of projectile head, but how it was hafted, propelled and against what prey are matters which are uncertain. To help solve these problems, in the absence of identifiable traces of use on the actual artifacts, ethnographic and other archaeological evidence needs to be considered in conjunction with the information derived from the technological study of these artifacts.

To begin with, various ethnographic specimens which may provide useful information will be considered. The harpoon heads which I have examined in the Pitt-Rivers Museum in Oxford, which were made by Eskimo groups from Baffin Land and Cumberland Sound, were generally much larger and heavier than the Upper Palaeolithic examples, but this need not surprise us since they were intended for hunting large sea mammals such as seal, walrus and whale.

The Eskimo examples generally have only a spur at the proximal end, rather than a series of barbs and work in a different way from projectile

heads which are bound to a spear-shaft. For these are toggle harpoons which are attached to the shaft by a line and are loosely fitted into the haft, so that they may leave the shaft sideways on impact driving the proximal spur hard into the wound both to aid penetration and also to secure the harpoon head within the creature, in the same manner as rows of barbs are intended to function.

Birket-Smith said of the Eskimo that,

> "the harpoon is his principal weapon. In its essentials the ice harpoon is everywhere the same. It has a loose head fastened to a rather short line of seal thong which is held in the hand. The head consists of an antler or walrus tusk stem with a blade that is nowadays made of iron, but formerly, if not entirely absent, was made of stone or hard bone. The most widespread form has a thin stem with a spur at the base. In the east there are various other types as well, but they all work in the same way; the shock of the thrust loosens the head from the shaft and on being pulled by the line it turns sideways in the wound, and 'anchors' the line. The shaft may be of wood, antler or narwhal tusk and the butt end often holds a powerful bone pick for cutting holes in the ice" (1959,77, see Plate opposite page 85).

Similar composite harpoons with a detachable head are described and illustrated by Giddings (1967,73-74) and Pearce (1985,11).

It is also instructive to consider Stewart's (1973) detailed description of the hunting equipment of the Northwest Coast Indians. The weapons used include some which are very similar to the Eskimo examples, no doubt because they were intended for use against the same prey,

> "used mostly for sea-mammal hunting, the barbed harpoon was an efficient weapon. The point, or head of the harpoon, had a retrieving line fastened to it, with line guards or some other means of preventing the line from slipping off. When the harpoon struck its prey, the loosely hafted shaft fell away, leaving the barbed point embedded in the flesh" (Stewart,132).

The examples illustrated by Stewart (p132) include both pieces with a perforated base and those with a basal projection.

However, within the same assemblage existed barbed points which were hafted differently and used against different prey. This was the "fixed barbed point" which,

> "was permanently attached to the tip of the shaft. These points, often carved from antler, armed various types of hunting equipment. A single or two small points tipped arrow or spearshafts; long slender points were sometimes hafted in clusters for hunting birds, and yet others formed side prongs for leister spears" (Stewart,134).

Thus, the study of the ethnographic record has revealed that two main types of barbed projectile head existed; these are detachable, or harpoon, heads and fixed points. The results of my study of the manufacture of this small sample of Upper Palaeolithic barbed points may indicate whether they belonged to one or other, or even both groups. Three of the barbed points, Goyet 109,Aveline's 1 and Kent's Cavern 3 have a pointed proximal end with some form of basal projection, which suggests that the base fitted into a socketed haft. The basal projection may have been intended for the attachment of a line to the shaft; this would suggest that these were detachable projectile points, as there would be no need for a line if they were bound to a shaft. Kent's Cavern 4 is incomplete, but the lowest barb looks very similar to the basal projection of Kent's Cavern 3. Coléoptère 9 has a rounded, basal projection to which a line could be attached, while the upper surface of the proximal end had been reduced by scraping, possibly for hafting.

However, in the case of Coléoptère 26, the upper surface of the proximal end has been heavily scraped, probably as preparation for hafting, but there is no obvious feature for the attachment of a line and the base is square, which suggests that it was hafted in a different manner from the barbed points described above. It is probable that this was not a detachable piece, but that it was glued and bound to the shaft;

this was probably the same for Coléoptère 11. All the other barbed points are broken above the proximal end, so it is impossible to suggest how they were hafted.

Clark (1954,127) identified traces of resin on the tangs of two barbed points from Star Carr, which he interpreted as the remains of the glue which was used to affix the barbed point to its haft. No such traces were identified on the pieces studied here.

Julien has suggested (1982,206) that in those few cases where the base consists of a long bevel, barbed points could have been hafted, presumably in twos and threes as tridents. This seems to have been the case for the two curved uniserial barbed points from Star Carr mentioned above (see above); however, there is no evidence to suggest that any of the barbed points considered here were hafted in such a manner.

There is unfortunately little archaeological evidence available to indicate how these pieces were propelled, and it in fact consists of negative evidence. The spear-thrower, which is a feature of the Middle and Upper Magdalenian in South West France and of certain Magdalenian sites in Switzerland and Southern Germany, i.e. Kesslerloch and Petersfels (Garrod,1955), has not been found in the region of this study. It is certainly possible that in Northern Europe such artifacts were made of wood, which has not been preserved, but this can only be a matter for speculation. Arrowshafts were found in an Ahrensburgian context at Stellmoor in Northern Germany (Clark 1975,75-77), but there is no unequivocal evidence for the existence of the bow in the Late Glacial in the region of this study, and so we are left to conclude that these projectiles were propelled by the human arm alone. However, this conclusion may be purely a reflection of the differential preservation of archaeological remains.

Having considered the way in which these artifacts were used, the evidence for the prey against which they were used will be discussed. Barbed points may have been hunting devices used for spearing, stabbing or shooting land mammals, birds or fish. It is entirely possible that barbed points were used against a whole range of different types of prey, depending upon the particular circumstances. Within this small number of pieces, there is direct archaeological evidence for the nature of the prey against which the two specimens from High Furlong were used. This is because they were found in such close association with an elk skeleton, one barbed point amongst the ribs, and the other actually resting on the left metatarsal, that they were clearly embedded in the body of the beast. This provides indisputable proof that these seemingly delicate points were used to hunt large land mammals, such as elk. The fact that this deposit consisted of just the articulated elk skeleton and the two barbed points suggested that the animal had evaded its hunters.

Similar direct archaeological evidence but for fishing with barbed points has been found in the Mesolithic,

> "characteristic points have on three occasions been found actually impaling pike skeletons lying in old lake-deposits: one was found sticking into the skull of a pike at Kunda in northern Esthonia and another from the same site was noted in the back of a metre-long pike; a third find of similar character was made by a peat-digger in the old lake-bed at Esperöds Mosse, Tranäs, Scania, in south Sweden" (Clark 1948,58).

Artistic representations may provide rather less certain indications about the use of barbed points. A Magdalenian association of barbed points and sea mammals and fish is described by Déchelette,

> "sur des canines d'ours composant le collier d'un squelette découvert dans une sépulture de cette époque, à l'intérieur de la grotte Duruthy, à Sorde (Landes), on voit plusieurs répresentations d'armatures de harpons. Ceux-ci portent des barbelures, au nombre de deux, de trois et même de quatre, de chaque côté de la tige. Deux des dents ainsi ornées de harpons sur une de leurs faces présentent sur l'autre face, la première, l'image d'un phoque, la seconde, celle du poisson" (1934,154).

However, as Déchelette indicated (ibid.), paintings of various bison on the walls of the grotte de Niaux (Ariège) could be interpreted as showing them 'harpooned' with both uniserial and biserial barbed points.

The evidence, such as it is, for the use of barbed points against particular prey suggests that they may have been used against a wide range of types of game.

In conclusion, it seems probable, from the different types of hafting arrangement witnessed by the variation in the shape of the proximal ends of these pieces, that more than one type of projectile is represented within the category of barbed points. This implies that both detachable and fixed projectile points were in use. In the absence of any evidence for the bow or for the spear thrower, it has to be presumed that they were hafted to spears and thrown without the aid of such devices. The archaeological and ethnographic evidence presented here is certainly incomplete, but it does suggest that barbed points may have been used against a wide range of types of prey

Variation and Distribution

The dimensions of these artifacts have already been discussed in detail above, so they will not be considered here.

The barbed points considered here come from a widely spaced scatter of Later Upper Palaeolithic sites and occupations in Britain and Belgium. With the exception of the multiperiod sites of Goyet and Kent's Cavern, all the sites which have yielded barbed points contain purely

Later Upper Palaeolithic material. They are all occupation sites, apart from High Furlong, where the two barbed points were found in close association with an elk skeleton (see above). To this distribution should be added a uniserial barbed point found at the Trou des Nutons, Verlaine, it is described by Doize (1960,25,27,Fig.1) as,

> "un fragment du fût d'un grand harpon plat présentant deux barbelures très fortes, peu détachées du fût, et un début de renflement basilaire".

This piece was unfortunately unavailable for study when I visited the University of Liège, in whose collections this barbed point is held.

An unusually large number of radiocarbon dates exist for the layers in which the barbed points were found. Most of the samples dated were of unmodified bone splinters, which provide a date for the deposit in which they were found,assuming that they were in situ, but not for the actual barbed points, so they should be used with care. However, the dates for the High Furlong barbed points were taken from the elk skeleton in which one of the points was actually embedded, so that provides in effect a direct date.

The Magdalenian layer at Verlaine was dated from bone splinters to 13 780 ± 220 years BP(Lv-690) (Gilot 1984,120). Two radiocarbon dates have been obtained from unmodified,bone splinters in the Magdalenian layer at the Grotte du Coléoptère; these are 12 400 ± 110 years BP (Lv-717) and 12 150 ± 150 years BP (Lv-686) (Gilot 1984,120). A similar date of 12 400 ± 300 years BP (Jacobi et al. 1986,123) was obtained from the High Furlong elk skeleton.

Two radiocarbon dates have been derived from unworked bone splinters from the Black Band in Kent's Cavern; these are 14 275 ± 120 years BP (GrN-6203) (Campbell 1977,42) and 11 570 ± 410 years BP (BM-2168)(Jacobi et al. 1986.,10). One of the Kent's barbed points, Kent's 4 was actually

found in the Black Band, while the other two specimens were found in the Cave Earth below this level. Thus, the relationship between the barbed points and the radiocarbon dates is clearly not a close one.

A number of Early Mesolithic radiocarbon dates have been obtained from human bone from Aveline's Hole (Hedges et al. 1987,290; Gowlett et al. 1986,209), though a date for the Late Glacial occupation of the site, which is witnesesed by the stone and bone tool industry, has been achieved from a cut bovid phalange. It is dated to 12 380 ± 130 years BP (OxA-1121) (Hedges et al. 1987, 290). Unfortunately, this still does not provide a direct date for the barbed points.

It is a pity that none of the material from Goyet has been radiocarbon dated, for it is a site which has yielded an abundance of fascinating bone artifacts, whose ages remain obscure, and I would strongly recommend that a dating programme be initiated.

A combination of these radiocarbon dates, the geographical distribution of these pieces and the technological evidence outlined above suggest that these artifacts were hunting devices used towards the very end of the Upper Palaeolithic. For some reason, they replaced the various Earlier Upper Palaeolithic points which are described above, but were contemporary with the antler rods (see above) which are also interpreted as projectiles for hunting and which sometimes appear on the same sites, for example at Goyet and Verlaine.

This concludes the study of the points and rods, which will be followed in the next chapter by a discussion of the hand-held implements.

Chapter 5

The Artifacts: Hand-held Implements

Introduction

This chapter contains a description of those functional objects, other than the various classes of point, which are interpreted as having been for hand-held use. These tool types consist of needles, pins, bone segments with polish, wedge-shaped segments, perforated antler bâtons, whistles and spatulae. Three artifacts which do not fit into any of the above categories, but which would appear to have been functional, hand-held implements are also described here, but as footnotes to the main text (see below).

Needles

These are bone, antler or ivory artifacts which are very comparable in shape to modern, metal needles, with a pointed, distal end and a perforated, proximal end (fig.5:1). As Table 5:1 shows, a number of near complete examples of this type have been recognised among the British and Belgian Upper Palaeolithic collections, as well as proximal, distal and shaft fragments. Furthermore, a series of roughouts for needles or needle blanks are considered here, which have yielded a lot of useful information about the techniques of manufacture used on these pieces and this will be discussed below. Signs of use were also looked for on the needles; these include wear on the eyes and proximal ends, polish on the tips and consistent breakage patterns. The results of this study and the close resemblance of these pieces to modern needles suggests that they were indeed used for sewing. It is not possible to tell on what materials they were used, and this seems likely to have varied from needle to needle.

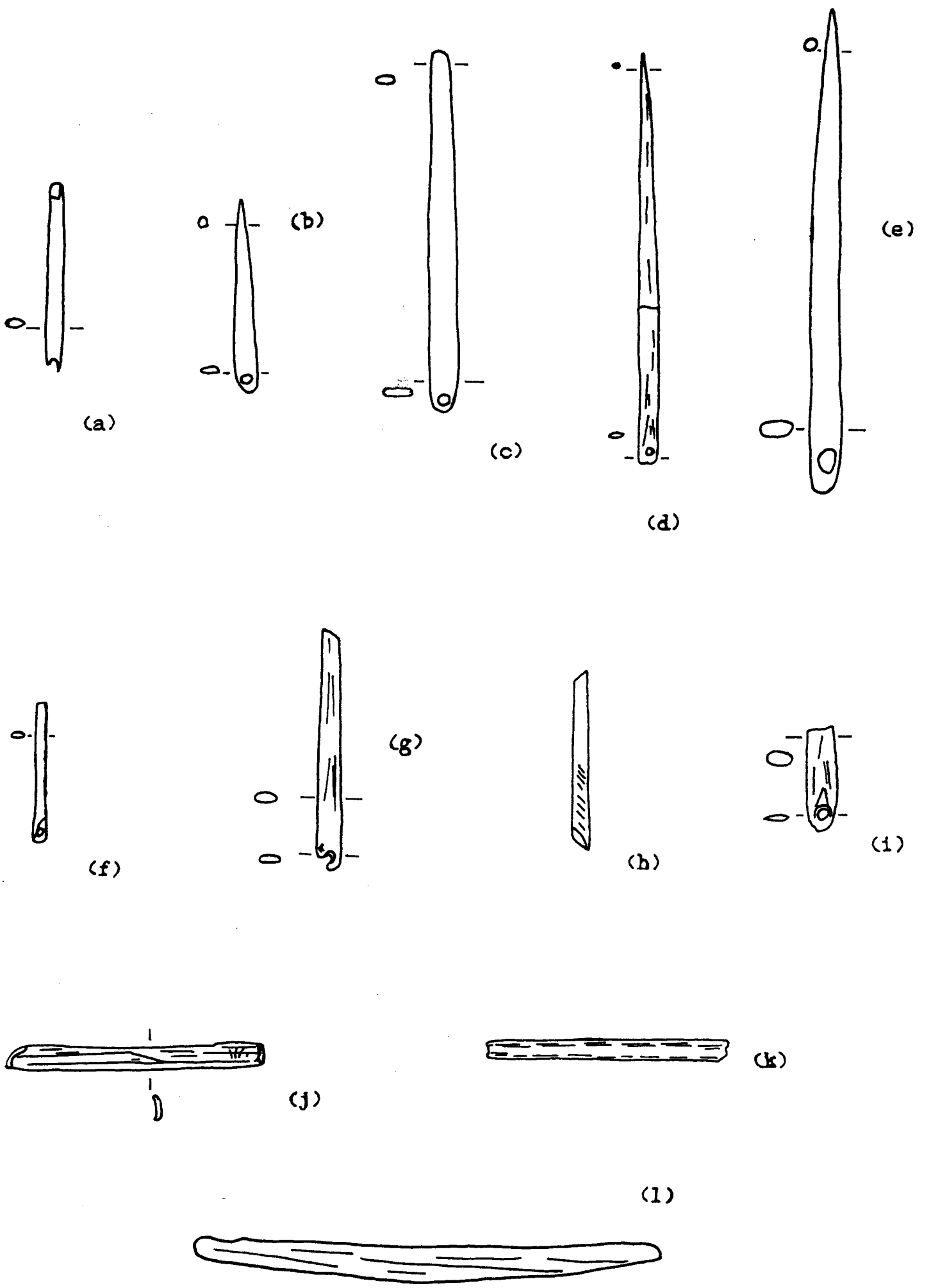


Fig. 5:1 Needles: (a) Frontal 2 (b) Coléoptère 2
(c) Coléoptère 1 (d) Coléoptère 3
(e) Church Hole 1 (f) Kent's Cavern 6
(g) Frontal 28 (h) Cat Hole 1 (i) Spy 182
(j) Goyet 177 (k) after Taylor (1927, 62, No. 18)
(l) Paviland 39

Needles first appear at the end of the Solutrean in the Vézère Valley (Stordeur 1979,39) and they remain restricted to the South of France and Northern Spain during the Lower Magdalenian (I and II). Their distribution becomes more widespread within France and Spain in the Middle Magdalenian (III and IV), and they only become known throughout Europe in the Upper Magdalenian (V and VI). Many needles are still found in South West France and Northern Spain in the Upper Magdalenian, but they are also found regularly in Northern Europe in Britain, Belgium and Germany, for example at Andernach and Gönnersdorf in the Rhine Valley and Petersfels in the south of the country. A needle from the Czechoslovakian site of Pekárna is illustrated by Müller-Karpe (1966, T220,8). Numerous examples were also found in the Ukraine, some of which found at the Kostienki series of sites appear to have come from contexts contemporary with the Magdalenian (Stordeur 1979,97). Needles are a common feature of the Upper Magdalenian in Europe and a correspondingly large amount has been written about this tool type, including a very useful summary by Stordeur in 1979.

Table 5:1
Numbers of Needles, Needle Fragments and Needle Blanks

	Needles	Prox Ns	Dist Ns	N'shafts	N'blanks	Totals
Goyet	2	2	4	-	12	20
Verlaine	2	-	-	2	-	4
Coléoptère	4	-	2	2	-	8
Frontal	6	-	-	1	5	12
Chaleux	3	-	12	4	5	24
Spy	-	1	1	-	-	2
Magrite	-	-	-	1	-	1
Kent's Cavern	1	-	-	-	-	1
Church Hole	1	-	-	-	-	1
Cat Hole	-	-	-	1		1
Paviland	-	-	-	1	1	2
Totals	19	3	19	12	23	76

Manufacture

Apart from Paviland 39 which is made of ivory, all of these pieces are made of cortical material, which may be either bone or antler. A number

of needle blanks from Goyet, such as numbers 174 and 177, have been identified by me as having been cut out of a very thin, bird bone, as their 'veined' or slightly hollow lower surfaces resemble the inner surface of such a bone.

(i) Débitage

Most of the needle blanks and some of the finished needles show traces of deliberate extraction, in that they have a regular shape and that on their sides, longitudinal striations, facets and sometimes chattermarks may be seen. It was evidently worthwhile from the maker's point of view to go to the trouble of producing a blank of the right size and shape in a controlled manner, rather than searching for a suitable existing splinter of bone, so that the minimum of further modification would be required.

Finished needles generally have an oval cross-section which is flatter and thinner at the proximal end, while the distal area is usually rather rounder in section. However, some of the needle blanks which have received little or no modification may be triangular in cross-section such as Chaleux 4, or oblong such as Frontal 32 and Goyet 171, reflecting the method of débitage used. For two distinct methods of blank extraction appear to have been practised, traces of which may be seen not only on the needles themselves, but also on the pieces of raw material from which the blanks were extracted, a number of which have been identified within the Belgian collections.

One method of débitage was by the groove and splinter technique, whereby two parallel, longitudinal incisions were cut into the raw material and these were made progressively deeper by incising until, in the case of bone or antler, the softer, cancellous tissue was reached. Then the narrow splinter of cortical material, the needle blank, could be levered out. This blank would be roughly triangular in cross-section, with uneven sides, which would bear many longitudinal striations. The

Belgian collections include a number of pieces of bone, antler and ivory from which such narrow blanks have been extracted. In some cases, several such removals have been made, for example from Frontal 14, which is part of a horse radius in which at least three transverse and nine longitudinal grooves had been made. A number of these pieces had themselves been deliberately extracted by sawing or by the groove and splinter technique from a bone, antler or tusk prior to the removal of any needle blanks. This was probably in order to produce a 'core' of raw material which could be comfortably worked, as opposed to a whole bone or antler (see fig.5:2).

The second form of débitage involved cutting out narrow strips from very thin, bird bone, to produce regular blanks which were roughly square or oblong in cross-section. This process was carried out by sawing; the groove and splinter technique would not have been either necessary or appropriate for bird bones, being thin-walled and hollow. A series of needle blanks from Goyet have clearly been produced this way from their straight edges and their veined or slightly hollow lower surfaces which are clearly part of the inner surface of the bone. These include Goyet 171,172 and 173. A number of pieces of bird bone have been identified, which have had narrow, long strips removed from them by sawing. These include Goyet 165 (fig.5:2) and Chaleux 6. Most of the pieces of raw material had themselves been deliberately extracted, and we can say something of how this was done. A number of articular ends of bird bones in the assemblage from Chaleux have been identified as waste products from this process; these include numbers 67 and 69 (fig. 5:2), which have been removed from the rest of the bone by transverse sawing and snapping. On what little remains of the shaft attached to the articular end, a number of deep, longitudinal incisions may be seen, which must have extended from the main portion of the shaft. It is probable that both articular ends

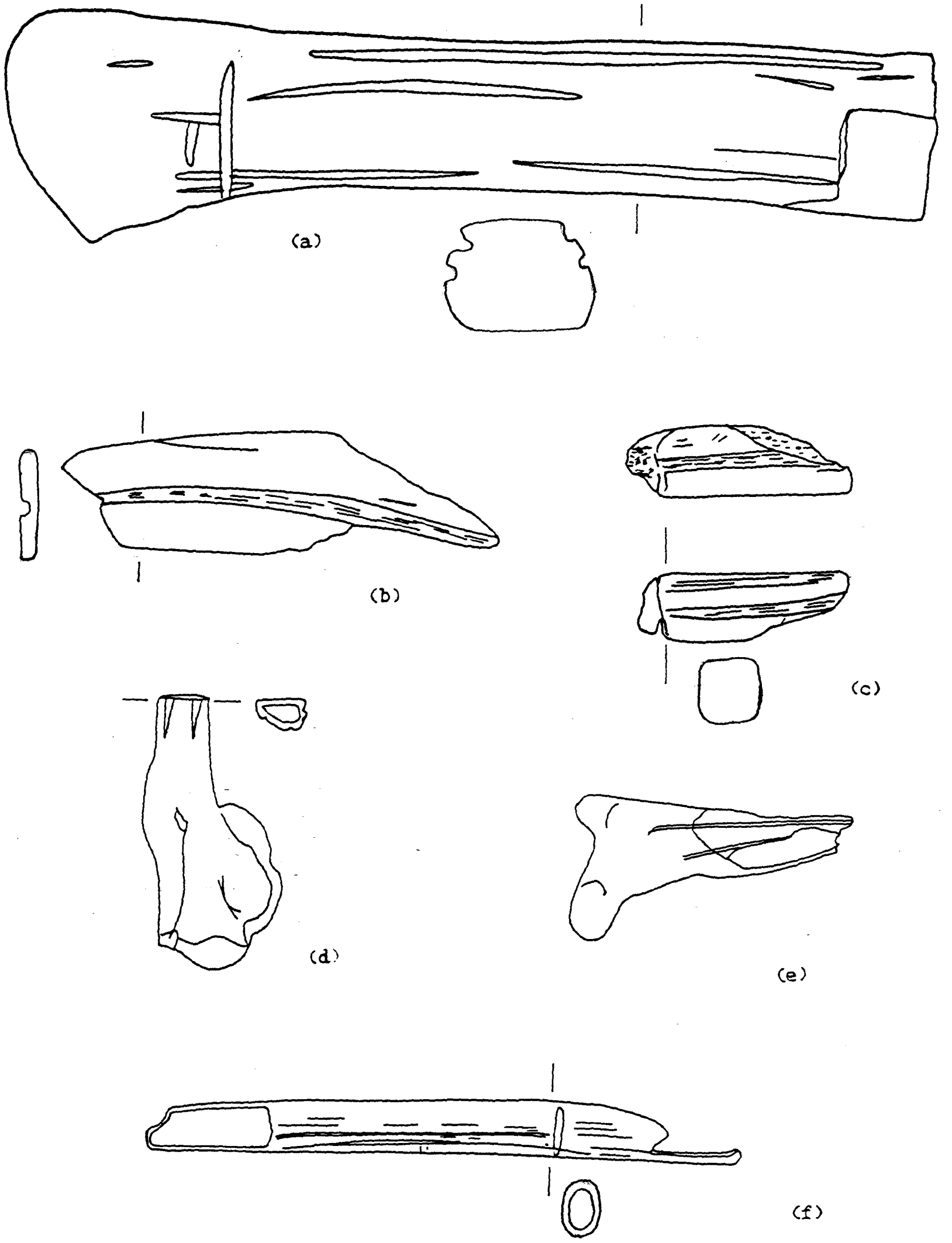


Fig. 5:2 Working débris associated with needle manufacture: (a) Frontal 14 (b) Frontal 30 (c) Frontal 8 (d) Chaleux 69 (e) Chaleux 70 (f) Goyet 165

were removed from these bones, so that the shaft might be left free to be neatly divided into narrow strips by longitudinal sawing from both ends.

(ii) Modification

Characteristic traces of scraping may be seen on the surfaces of most of the finished needles; they take the form of longitudinal and oblique striations, facets and chattermarks. Longitudinal striations and little transverse features, which are interpreted here as being where the stone tool with which the needle was worked had dug into the bone, were identified on one surface of Frontal 2 and photographed in the SEM (Plate 5:1). On fifteen pieces, there is a widespread polish which has obliterated most of the traces of working. As it is so uniform, this type of polish is likely to have been produced during manufacture. I have reproduced experimentally a similar uniform polish on a bone tool by careful scraping with a fine-edged stone tool; this technique can be used to give the artifact an attractive, glossy finish, which tends also to consolidate and strengthen the surface. The distal fragments also show similar traces of scraping, producing longitudinal striations, curving, oblique striations, longitudinal facets and chattermarks. At least nine examples were polished all over, which further suggests that this was a deliberate feature of manufacture. Traces of scraping in the form of longitudinal striations on the shafts and around the eyes of two needles, Coléoptère 3 and Verlaine 2, were observed and photographed using a scanning electron microscope (Plates 5:2 and 3).

Some rather different traces of modification, in the form of longitudinal and oblique striations and facets, could be seen on the proximal fragments, which may in fact have resulted from preparation for making the eye. This process is described below.

Most of the needle shafts seem to have been worked by scraping: chattermarks are visible on four examples. On one surface of Cat Hole 1

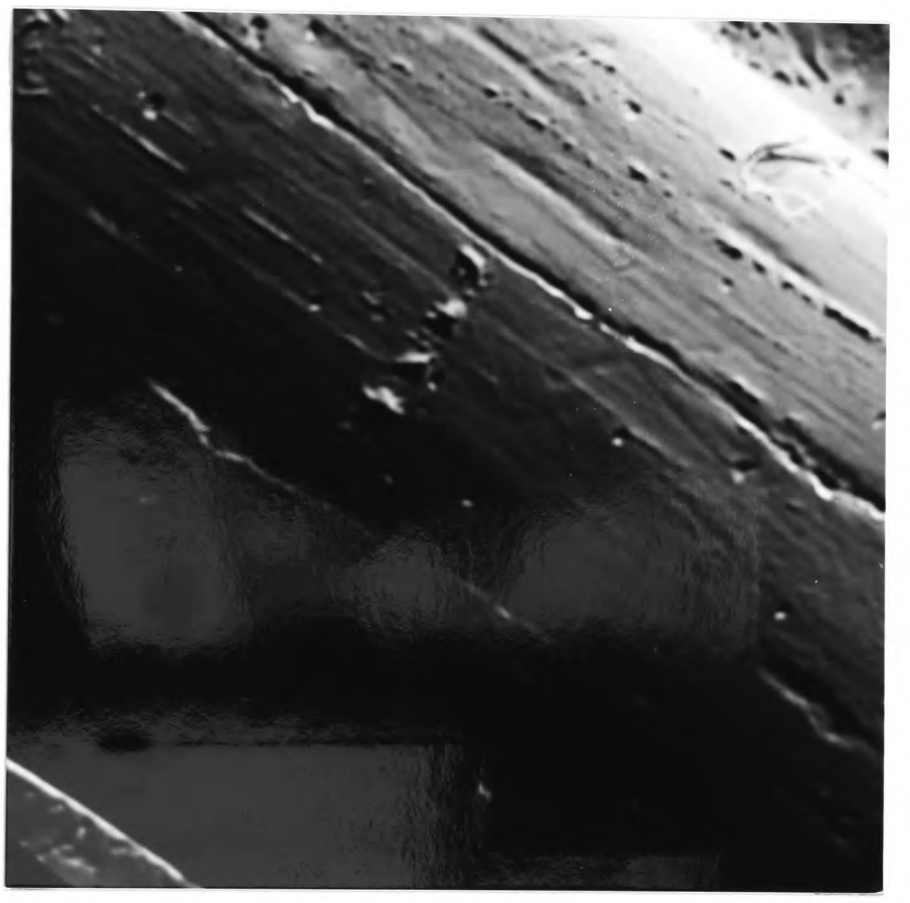


Plate 5:1 Traces of modification on one surface of Frontal 2 (x55) (SEM photograph)

(fig.5:1), there is a series of quite deep, oblique striations mainly on the proximal half of the shaft, which are combined with grouped, irregular, longitudinal striations towards the distal end, which resemble traces of scraping. The oblique striations look like the individual strokes of a stone tool and may have been decorative, as their oblique orientation and the fact that they are so widely spaced suggest that they were not associated with shaping. These striations may have been a sign or marker of possession, for which there is ethnographic evidence, though not specifically for needles (Sollas 1915,446). Seven needle shafts have been made smooth through modification.

Thirteen of the needle blanks which had undergone some modification had longitudinal striations and facets on their surfaces, while another six had chattermarks as well. Nine of these pieces have been made uniformly smooth through modification. Particularly interesting traces of modification were observed on the surfaces of Frontal 3 in the form of regular, grouped, oblique striations. When a silicone rubber cast of this piece was inspected using an SEM tiny features perpendicular to the direction of working were observed. These traces are interpreted here as being where the implement with which this piece was worked dug into the surface, and thus this strongly suggests that this surface was scraped, rather than ground, as one might expect given the unusual direction of working.

Six needles are either curved or twisted in profile; it is not known whether this was an original feature or not. Two of the needle blanks are also curved in profile. One of these pieces, Paviland 39 (fig. 5:1), is pointed at both ends and looks as if the curvature were an original feature. It may have been deliberately produced that way in order to fulfil a particular function; after all when one buys metal needles, they come in packs containing a range of sizes, so that they may be used on a

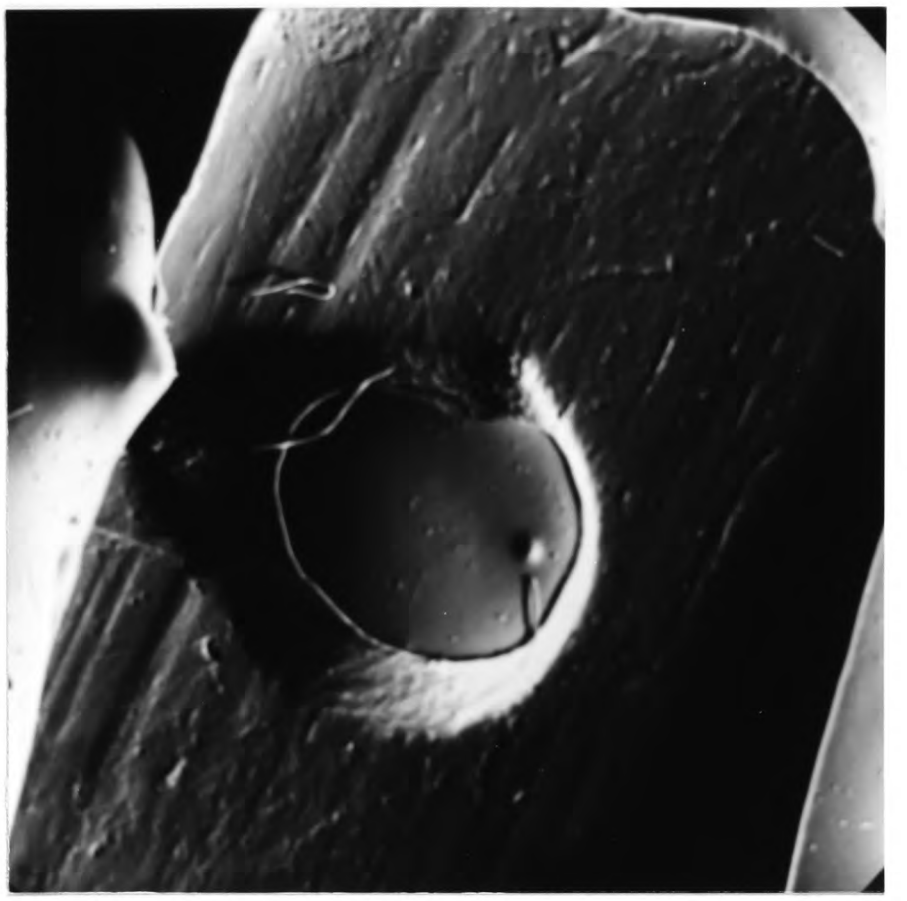


Plate 5:2 Traces of modification around the eye of Coléoptère 3 (x33) (SEM photograph)

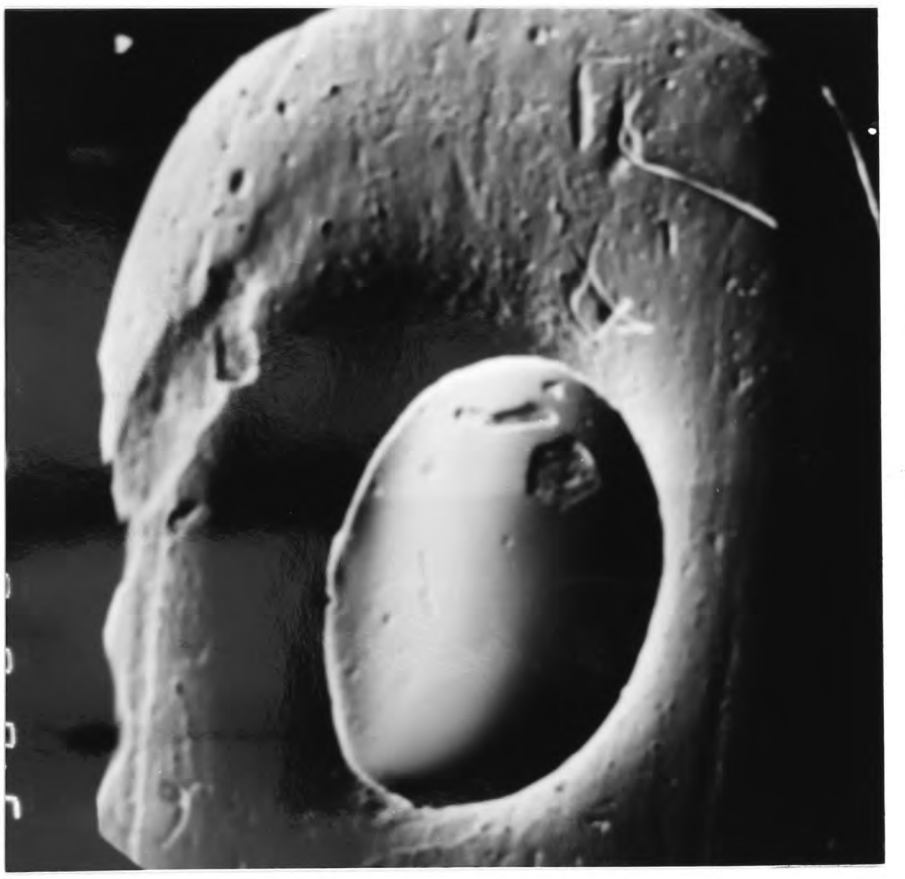


Plate 5:3 Traces of modification around the eye of Verlaine 2 (x33) (SEM photograph)

variety of materials, so there is no reason why there should not have been variation in both the size and the shape of Upper Palaeolithic needles. Packing needles which were used for sewing up sacks of wool used to be curved, while Stordeur (1977,256) referred to the use of curved needles by mattress makers. There may be some doubt about the identification of Paviland 39 as a curved needle, as it is unfinished and unperforated, however, I have examined an attractively worked, finished needle from the Grotte du Placard (Charente) in the Bourlon collection in Cambridge, which appears to have been deliberately made to be curved in profile.

Prior to making the eye, the proximal end of the needle is generally made thinner, probably by scraping off material from both surfaces. This feature was identified on fourteen of the complete needles, although the proximal end of Kent's 6 did not appear to have been trimmed prior to perforation (fig.5:1). In the case of Chaleux 119, the proximal end is actually thicker than the distal area. Two of the proximal fragments had clearly been reduced prior to perforation, particularly Spy 182. When a silicone rubber cast of this piece was examined by me in a scanning electron microscope, it was seen to be covered with clear, grouped, longitudinal and oblique striations, as well as longitudinal striations round the eye and some shallow, transverse steps, where the stone tool has cut into the bone. On one surface of Goyet 183, some grouped, longitudinal striations may be seen especially just below the eye, no doubt as part of the preparation for making the perforation. On the other surface, a combination of some longitudinal and many, grouped, oblique striations could be seen.

Certain needle blanks have been made thinner at one end by scraping both surfaces prior to perforation; these include Goyet 184,172 and Frontal 10. On Goyet 8, both surfaces at the proximal end have been made facetted; the facets are composed of tiny, grouped, oblique striations,

which again probably represent very detailed preparations for making the eye. These are likely to have been made by scraping, as clear individual strokes could be seen when a silicone rubber cast of this piece was examined by me using a scanning electron microscope. It is probable that prior to making the eye, a preliminary guiding incision was made at the proximal end, with the twin function of marking the location of the eye and providing a small hollow into which the perforating tool could be inserted in order to prevent it from slipping. Generally, any such markers would be obliterated when the eye was made, but they may have survived on certain needle blanks which have been discarded before the perforation was made. On Goyet 177, three oblique and transverse incisions may be seen near to one end, though whether this represents a marker for the eye, or guidelines for cutting out the blank is unknown. Likewise, on Goyet 171, three, little, oblique incisions may be seen 0.3cm from the proximal end on one surface. However, a clear example of such a marker was identified on one of the Goyet needle blanks by Saccasyn della Santa (1946,24, Fig.5, No.2) and Stordeur (1979,128, Fig.23,No.4), it takes the form of a small cross, with two shallower incisions below it, incised on one surface at the proximal end.

Goyet 171 is a particularly important needle blank, because it clearly demonstrates the sequence of stages in the manufacture of a needle. The proximal end has been sawn off transversely from one surface and then the whole piece has been very carefully worked by scraping, this includes the production of a fine tip, which is circular in cross-section. However, this piece had not been perforated, although the proximal area had already been made thinner on both surfaces. This suggests that the production of the eye was the final stage of manufacture. This would fit with my experimental findings (see Chapter 2) that perforation is a quickly and easily performed task compared with cutting out or shaping the piece. It

is also the stage which is least likely to result in irreparable damage to the artifact.

The eyes of the needles are generally circular or subcircular; three were oval, while the perforation belonging to Church Hole 1 was roughly pear-shaped. Their lengths vary from approximately 0.4 to 0.1cm and their widths from 0.4 to approximately 0.1cm. The usual method of perforation appeared to be by drilling from both surfaces, which gives the perforation a biconical or hour-glass profile. Sometimes perforation appeared to have been carried out mainly from one surface, for example Goyet 183. On Spy 182, clear traces of drilling could be seen, particularly on the lower part of the eye on both surfaces. On Frontal 28, striations may be seen emanating from the lower part of the eye on both surfaces, which suggest that the perforation was begun by scraping and then continued by drilling. Sometimes, the perforation has been subsequently neatened by running a stone tool around it, probably so as not to snag the thread, which gives it a cylindrical rather than biconical profile. During my own experimental work, I have made eyes for needles using microperçoirs, perçoirs and even unretouched, flint flakes, usually with a circular motion in a clockwise direction. Any stone tool with a sharp, narrow, yet robust projection can be used equally effectively, and Upper Palaeolithic industries, especially those of the Magdalenian, abound in such pieces (de Sonneville-Bordes 1961).

Two of the needles show evidence for reworking. The tip of Coléoptère 3 was particularly steep in profile compared with the rest of the piece, perhaps as a result of further shaping after breakage, while there is a slight notch in the proximal end which may be what remains of an earlier perforation, which has been broken and scraped over to neaten it, prior to making a second perforation. Coléoptère 2 also looks as if its tip has been reworked; this is a curiously ill-proportioned piece, in that it is

short but quite wide, so that it resembles the distal part of a larger needle, which has been broken and the lower half reused.

A number of distal fragments such as Chaleux 13 look as if they may have been reworked, as the tip is more sharply angled than the rest of the shaft. However, it is not always easy to tell, as a lot of very careful working is required to produce a fine,sharp tip and it is possible that these are only roughly worked pieces.

Function

(i) Traces of Use

The only needle which bears any localised polish is Goyet 170, where it is the proximal end which is highly polished, possibly from the repeated contact of that end with some material. None of these pieces has a localised,distal polish. A number of needles such as Chaleux 12 have been broken across the perforation, which may mean that they snapped when pressure was put on them while being bent during use. In the case of Frontal 2 and 28, a small section of the eye had been broken, which suggests that a thread may have been so sharply pulled through the material by the needle, that it snapped off a small part of the proximal end (fig.5:1). A number of needles show what may be traces of use on various parts of the eye. For example, when silicone rubber casts of Verlaine 3 and Frontal 2 were inspected by me in the SEM, it was observed that traces of working had been obliterated on the lower part of the eye in both cases. What this signifies is unclear, for any wear resulting from the passage of the thread is likely to be on the upper or proximal part of the perforation. Traces of working had also been obliterated in this area on Frontal 25.

Six of the distal fragments, including Coléoptère 4, Goyet 180 and Chaleux 20, seem to be particularly polished at the tip, this could either be the result of heavy working of the tip or else it could be owing to

use, but from contact with what sort of material,it is impossible to say. Most of the distal pieces appear to have come from finished needles and so they may have snapped off during use. No traces of use were identified on the proximal fragments, apart from what may be wear of the same nature as that described above on the lower edge of the eye of Spy 182. As was said above, this is an unlikely location for wear from the thread, however, it may have resulted from repeated contact between the needle and the material it was passing through.

Silicone rubber casts were made by me of fifteen archaeological specimens, they were all examined under the light microscope and then, with the exception of three examples, were inspected in a scanning electron microscope. This microscopic inspection yielded a lot more information about manufacture than use, as traces of the former are consistently preserved which is not the case for the latter.

(ii) Use

From their close resemblance to modern, metal needles, it is assumed that these Upper Palaeolithic artifacts were also used for sewing. The eye of the needle is generally so small that it suggests that a very fine thread was used. It could have been made of sinew, leather thongs, horse hair or plaited vegetable fibres. In modern ethnographic contexts, needles can be used not only for sewing clothes, but also for other tasks as well, such as net-making (Clark 1974,110); it is, however, impossible to tell on which materials the Paleolithic examples were used, and we have no preserved sewn objects to help us. The presence of pinky-brown, ochreous traces on a number of pieces, such as Chaleux 3 and Frontal 1 and 2, particularly in the eye, could certainly have resulted from contact with an ochred substance. This may have come about through the sewing of hides which had been treated with ochre, because it is thought to have certain preservative properties which would be useful when preparing

skins. Against this, such ochreous traces may be seen on some of the needle blanks which suggests that the ochre may just have been a feature of the deposits within which these pieces lay.

Needles, for all their simple appearance, are in fact quite complex artifacts in that they combine two functions: that of the tip is to pierce the material being sewed and that of the eye to hold a thread and draw it through the hole made with the distal end. It is probable that prior to the invention of the needle, sewing took place by making holes in the material with an awl and then pushing the thread through the holes, in the manner of the Plains Indians described by Lowie in 1954, and discussed in detail above (see Chapter 4: Group 1 Points).

Having made the not insignificant, technological progress to a tool, whose identical design is still being used approximately twelve thousand years later, it seems probable that the needle was actually used as such and not just to pass thread through previously made holes. Stordeur, who has carried out a detailed analysis of a large number of Upper Palaeolithic needles, has argued (1979,191) that from the very shape of the needle it had a piercing function, as well as a thread-pulling function. The care with which the distal end was worked has convinced her of this (1979,191),

> "la pointe est souvent cassée, souvent réparée; quand elle est intacte, elle est acérée. Pourquoi le serait-elle s'il ne s' agissait pour l'aiguille que de passer à travers un trou déjà fait?".

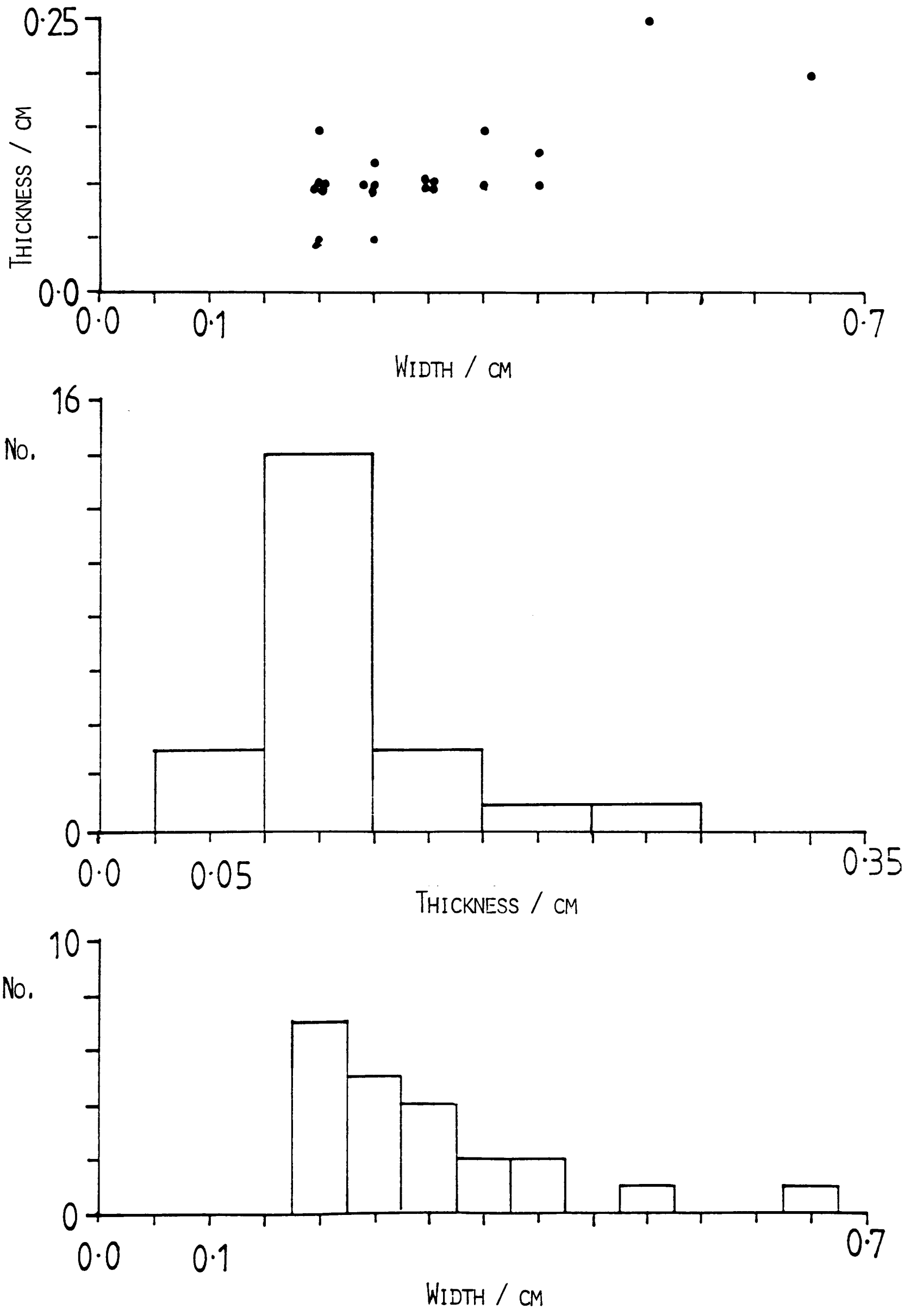
In order to test this theory, I used a couple of bone needles made by myself to sew lines of stitches in a rabbit skin (see Chapter 2), which I prepared with the help of my husband. Both needles easily pierced the fine, supple skin with no difficulty and could clearly be used in the same manner as metal needles. The relatively short time required to carry out

this experiment did not allow any traces of use to build up, but it did demonstrate the effectiveness of these artifacts on such a material. A parallel experiment was carried out on commercial leather (see Chapter 2), which proved to be too resistant to be pierced by the needles alone without risk of damage. Stordeur (1979,192) concluded that needles could have been used on their own to sew finer, more supple skins, whereas an awl could have been used alongside them to help pierce harder and thicker skins. This would be my conclusion as well, based on my experimental work, that needles could be used most effectively on a thin, supple skin, although awls may still have been useful to punch an initial, small hole through a tougher hide, and that would certainly make it simpler to pass a thread through the hole using a needle. A similar programme of experiments was carried out by Bouchud (1977), who achieved comparable results.

Variation and Distribution

Only one of the needles, Church Hole 1, is genuinely complete; it is 7.55cm long. The other needles and needle fragments vary in length from 6.3 to 1.6cm, but their original variation in length is unknown. However, a more significant distribution in size may be derived by measuring the width and the thickness of the shaft across the middle of the eye. For in each case, the measurement is known to have been made in exactly the same location and these dimensions do not appear to have altered post-depositionally. This is the maximum width, which is of interest as it also gives the diameter of the hole made by the needle when passed through the material. This is a small sample statistically, as it consists of only twenty-two sets of measurements which were taken from all the needles and all the proximal fragments. Graph 5:1 shows that the widths of the shafts across the eye varied from 0.2 to 0.65cm and the thickness from 0.05 to 0.25. There was clearly greater variation in width than there was in

Graph 5:1 Widths and Thicknesses of Needle Shafts Across the Eye



thickness, which was generally 0.1cm. The description of the methods of manufacture used on these pieces provides an explanation for this distribution, for the width of the shaft varied according to the size of the original blank, but whatever the width, the area round the eye was regularly trimmed to facilitate the production of the eye.

The six surviving tips which have been identified, for example Chaleux 26 and 27, vary in width from approximately 0.03 to 0.1cm and their thickness lies at around 0.05cm. However, these dimensions are so small that they can only be approximate. Those pieces which have been identified as needle blanks range in length from 7.3 to 1.5cm, but they are often incomplete.

Based on the metrical data that Stordeur (1979,184-185) obtained from eighty-six complete pieces, she was able to divide the needles in her sample into two groups based on their length. Most examples were under 8cm in length, while a smaller number were over this length; it is probable that the majority of the specimens considered here fell into the first group. Stordeur suggested (p185-186) that the smaller needles were used for sewing, whereas the longer specimens may have been destined for another use. As was said above, there is no reason why Palaeolithic needles should not, like their modern counterparts, have varied in size according to the particular task for which they were destined.

Needles are found on Upper Palaeolithic sites throughout the limestone region of Southern Belgium. They have also been discovered on five sites in Britain, one of these was in the most northern part of the distribution of Upper Palaeolithic sites at Church Hole Cave, Creswell Crags, one came from the south from Kent's Cavern, Torquay and two from the Gower Peninsula, at Cat Hole and Paviland. The fifth discovery was made in King Arthur's Cave in the Wye Valley, where the shaft of a bone needle was found in the same deposit as a bevelled bone rod (see Chapter 4: Antler

Rods). Both are believed to date to the Later Upper Palaeolithic. In size, the King Arthur's Cave needle looks quite similar to the needle from Cat Hole, judging by the illustration in Taylor's article (1927,62,Fig.2, No.18), which is reproduced here (fig.5:1). This piece was unfortunately destroyed during the Second World War.

As regards the age of the needles, Stordeur carried out a detailed study to check the long held view that that the needle was invented during the Solutrean (1979,27). Her conclusion (1979,39) is that,

> "la plus vielle aiguille connue vient de la région du Bassin Aquitaine, de la vallée de la Vézère, du site de Laugerie-Haute; elle date du Solutréen supérieur".

However, the vast majority of needles in South West France date from the Magdalenian (Stordeur, ibid.) and it seems that the British and Belgian examples are also likely to belong to the Late Glacial period, on the basis of such slender stratigraphic information as we possess. Certainly none is demonstrably older.

Most of the Belgian needles come from the exclusively Magdalenian sites of Chaleux, Verlaine and Frontal, and from the Magdalenian occupation at Coléoptère. The rest were found at the complex, multiperiod sites of Spy, Trou Magrite and Goyet. However, Saccasyn della Santa (1946,14) suggested that needles appeared during the Aurignacian in Belgium, owing to their retrieval from layers attributed to that period at Goyet and Trou Magrite. From my knowledge of the collections in the Institute of Natural Sciences, a vast array of tools clearly of varying ages have been attributed to the "deuxième niveau" at Goyet, where no doubt a number of occupations were represented and not just the one ascribed to the Upper Aurignacian. Similarly, the material from Trou Magrite seems to be regularly labelled Aurignacian almost by default, even though the whole range of local Upper Palaeolithic cultures is represented

at the site (Dewez 1985). There seems to be no sound evidence to suggest that needles were made in Belgium prior to the Later Upper Palaeolithic.

Three of the British examples, Cat Hole 1, Kent's 6 and Church Hole 1, certainly come from Later Upper Palaeolithic occupations; that at Church Hole has recently been radiocarbon accelerator dated to 12 240 ± 150 years BP (OxA-735) (Gowlett et al. 1986, 210). The Kent's Cavern needle was found in the Black Band (Pengelly 1869,191), which is an accumulation of charcoal from Later Upper Palaeolithic hearths. It must be assumed that the needle from Paviland Cave forms part of the Later Upper Palaeolithic component of that site.

Pins

These are bone or ivory artifacts with a narrow, roughly cylindrical shaft, which are worked to a point at one end, with a swelling at the other end. Two pins have been recognised in the Belgian collections, one from the Upper Perigordian site of Maisières Canal and the other from the Magdalenian site of Verlaine, however, there is some doubt about the authenticity of the latter object (see below). Another example was found at Kent's Cavern; its provenance suggests that it may be of Earlier Upper Palaeolithic date. Such pieces seem to be uncommon in the Upper Palaeolithic as compared with needles for example, although a review of the literature yielded a number of comparable pieces. These included two French examples, one of which came from the Aurignacian site of Abri Castanet (Dordogne) (Peyrony 1935,244,Fig.7,No.4) and the other from the Châtelperronian at the Grotte du Renne (Yonne) (Leroi-Gourhan et al. 1976,1324, Fig.3,No.12). A further parallel from the site of Predmost in Czechoslovakia, which has yielded both Gravettian and Aurignacian industries, is illustrated by Breuil (1924,531, Fig.13, No.5). Pins were

recognised by Camps-Fabrer in the Epipalaeolithic and Neolithic of North Africa (1966,168-169), while hairpins have been identified by Olsen among the bone tool assemblages recovered from Indian pueblos in Arizona (1979,343).

These are carefully worked pieces of quite elaborate design, which appear to have been extracted by the groove and splinter technique, and then further shaped by scraping. Kent's 1 is the plainest piece, as it shows no traces of decoration, and has a simple proximal end which flares out from the shaft in the shape of a cone (fig.5:3). The other two pins are more elaborate, in that one example, Maisières 4 has a perforated, oval proximal end, the size of which would have precluded this piece from being a needle (Plate 5:4), whereas the proximal end of Verlaine 50 is a representation of a man's head (Plate 5:5). These two pins also show incised decoration on their shafts.

Manufacture

Maisières 4 is made of ivory, while the other two pins are made of cortical bone.

(i) Débitage

It is probable that all three pieces were deliberately extracted by the groove and splinter technique, to judge by their neat and regular shapes. Furthermore, Maisières 4 and Verlaine 50 each have likely traces on their sides such as longitudinal striations, facets and chattermarks, the positions of which suggest that they result from débitage as opposed to modification. Kent's 1, however, is covered with traces of modification, which conceal any signs of débitage.

(ii) Modification

The traces of modification on each of these pieces will be described in turn, and then compared below.

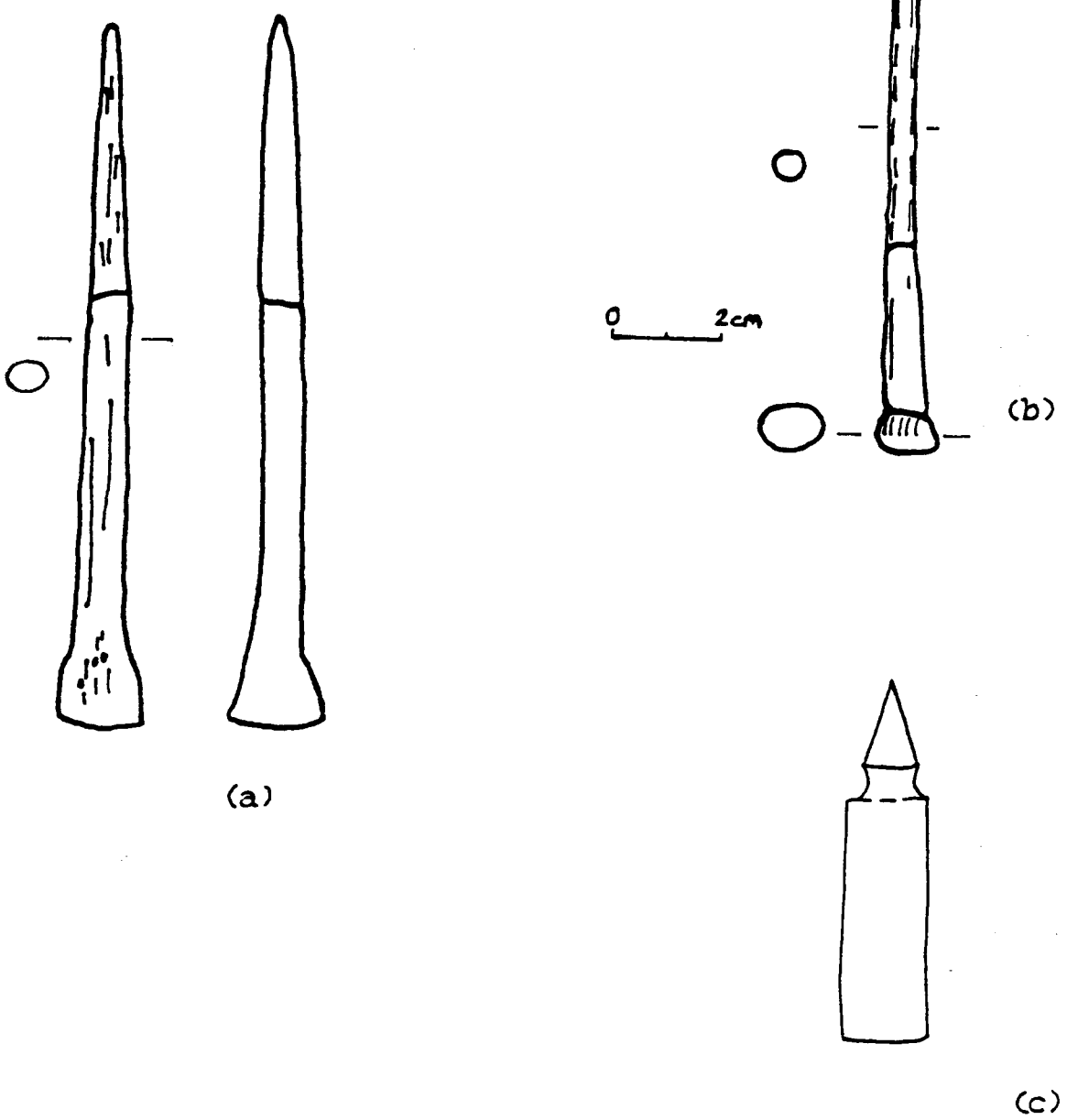


Fig. 5:3 Pins: (a) Kent's Cavern 1 (b) pin from the Grotte du Renne, after Leroi-Gourhan et al. (1976,1324,Fig. 3, No.12) (c) Eskimo wound plug

The shaft of Maisières 4 is covered with long, longitudinal and oblique striations, facets and chattermarks, which are a characteristic of scraping, rather than of grinding. The proximal end of Maisières 4 is oval with an oval perforation, which has been made by roughly scraping from both surfaces, leaving deep, longitudinal and oblique incisions. On each side of the proximal end, a number of short,transverse incisions may be seen, which may be a continuation of a series of nine transverse incisions observed on the shaft. Seven incisions may be seen on one side of the proximal end and nine on the other. These traces were made after the piece had been shaped and smoothed; they may be purely decorative. This piece is uniformly smooth, which is most probably a result of manufacture

The pin from Kent's Cavern is shaped like a golf tee with a roughly conical head. From its shape, the head must have been worked by scraping, but only a few, short, longitudinal striations and some shallow facetting may be seen. The flat base of the cone, which is the proximal end of the piece, is uneven and covered with short striations, running in all directions, which may have resulted from scraping. Clear facetting and quite crude and irregular, longitudinal striations may be seen on the shaft, with tiny chattermarks on the tip, which must have resulted from modification by scraping. This piece is gently curved in profile. Kent's 1 no longer appears to be particularly smooth, even though it was described by its excavator as having,

> "a considerable polish. It is, perhaps, more than probable that it was an article of the toilet, and hence the polish it bears, instead of having been designed, may have been the result of the constant use to which it was put" (Pengelly 1867,31).

The shaft and proximal end of Verlaine 50 have probably been worked by scraping and cutting. Four deliberate longitudinal incisions may be seen, one towards each side of each surface, which are reminiscent of the



Plate 5:4 Maisières 4



Plate 5:5 Verlaine 50

longitudinal incisions visible on the shafts of certain biserial barbed points, for example Goyet 109. Further incised decoration could be seen halfway down the surface of Verlaine 50 which corresponds to the back of the human figure which this piece represents, in the form of a network of criss-crossing striations. This piece is not particularly smooth.

The proximal part of Verlaine 50 is roughly oval and has been shaped to resemble a man's head by cutting, scraping and incising. The face has two eyes, eyebrows, hair, a nose, a mouth, a moustache and a beard. There are depressions to represent the ears, in each side of the head. Doubts have been cast on the authenticity of this piece, as it is so unusual and because it comes from a very poorly documented site. The Abbé Breuil suggested that this piece and a fish-shaped pendant from the same site (see Chapter 6: Pendants) were made on fossil bone;

> "je les considère comme de très habiles falsifications, mais malgré la maitrise de leur auteur, on peut constater aisément que tous deux ont été façonnés avec des os *déjà fossiles* à l'époque où ils ont ètè travaillés" (Breuil 1930,507).

The pin is clearly described in the second bulletin put out by Destinez and Moreels about their excavations in May 1888 (1888a,146), but the pendant is not mentioned.

Doize (1960,30) makes the following observations about the two excavators of the Trou des Nutons at Verlaine,

> "Destinez a laissé le souvenir, comme préparateur à l'Université de Liège d'un homme consciencieux et intègre. Son coéquipier, Moreels, était miniaturiste. Personnellement, j'ai un peu connu feu Moreels, qui se flattait d'avoir toujours <<admirablement>>, c'était son mot, nettoyé ses découvertes archéologiques, et de n'avoir jamais ménagé ses peines pour obtenir des objets bien propres. N'y aurait-il pas lieu attribuer à ce souci éxagéré de propreté certaines retouches involontaires?".

Neither the pin nor the pendant was modified accidentally; they have been deliberately and carefully produced. Whether the pin was a fake or not was

impossible to tell during the all too brief inspection using a handlens that was possible. Lejeune, however, (1984,222) clearly accepts the Verlaine pin as genuine, whereas she has grave doubts about the authenticity of the fish-shaped pendant (1984,230).

The shafts of all three pins appear to have been worked by scraping, for on their surfaces, mainly longitudinal striations may be seen and in two cases chattermarks. On each of these pieces, the proximal end of the shaft becomes narrower before flaring out to form the "head". On this narrow area or "neck", a number of short, deep, transverse incisions may be seen, where the stone tool has dug into the bone or ivory, while shaping this area. Although there are differences in the appearance of these pieces, the same techniques have been used in their manufacture.

Function

(i) Traces of Use

The "forehead" of Verlaine 50 appears to be worn, which may have resulted from handling or use. The distal tips of all three pieces are broken and this may have occurred during use, as they are all fairly delicate, particularly Maisières 4.

(ii) Use

If the tips of these pieces had been very pointed, then they could have been used as awls for perforating hides, but in that case there would have been no need to modify the proximal end so carefully. The elaborate working of the proximal end strongly suggests that these pieces were used as pins, possibly to fasten clothing. Maisières 4 is a particularly fragile-looking example and because of this, de Heinzelin (1973,32) has made the charming suggestion that this piece was a hair pin and that the perforation could have held some form of light decoration such as feathers or flowers. This seems to be entirely possible.

Sollas suggested (1915,456-457) that Palaeolithic 'pins' such as Kent's 1 were too crude to have been used to fasten skins together, but that instead they were wound plugs, like those used by the Eskimo to secure the blood of the hunted animal. The two examples illustrated by Sollas (p457,Fig.249,2,3) are slender and pin-like, in particular No.3, however, the piece made by Western Eskimo that I examined, which is held in the Pitt-Rivers Museum, is a very different shape (fig.5:3). It may be seen that most of the shaft is of the same thickness as the proximal end, and that it only tapers abruptly just above the tip. It seems particularly improbable that such carefully decorated and fragile pieces as Maisières 4 and Verlaine 50 served to plug the wounds of dead animals. In the present state of the archaeological evidence, I see no reason not to consider these pieces as pins.

Variation and Distribution

These three pieces do not vary greatly in size, but the significance of this is not clear, as it is such a small sample. They all appear to have been produced using very similar manufacturing techniques, even though the actual shape of the proximal end and the amount of incised decoration vary greatly, as we have seen. But all three artifacts clearly belong to the same type.

Geographically, these pieces come from widely dispersed sites and this was probably also the case for their chronology. If Verlaine 50 is genuinely Upper Palaeolithic and comes from that site, which has yielded Magdalenian artifacts, then it probably does date from that period. Maisières 4 comes from the Upper Perigordian/Maisièrian occupation at Maisières Canal. The pin from Kent's Cavern probably also belonged to the Earlier Upper Palaeolithic, for it was found low down in the Cave Earth in the fourth foot level (Pengelly 1867,31). Garrod (1926,36) attributes this piece to the 'Middle Aurignacian', that is equivalent to what is now

simply called the Aurignacian, owing to its apparent association with 'Middle Aurignacian' type scrapers. She also indicates that,

> "similar pins with rounded heads, though often more roughly worked have been found in Middle Aurignacian levels in France, e.g. Isturitz, La Ferrassie, Abri Blanchard, etc." (ibid.).

A bone pin which appears to be very similar to Kent's 1 is illustrated by Leroi Gourhan et al. (1976,1324,Fig.3,No.12) and reproduced here (fig.5:3). It forms part of the Châtelperronian assemblage found at the Grotte du Renne, Arcy sur Cure (Yonne). Similarly, a bone point with a rounded head from the Aurignacian site of Abri Castanet (Dordogne) is illustrated by Peyrony (1935,424,Fig.7). An example of a "poinçon cylindrique" made of ivory from the Earlier Upper Palaeolithic site of Predmost in Czechoslovakia also seems to fit into this category (Breuil 1924,531,Fig.13,No.5). Other points with narrow shafts and relatively large proximal ends may also have been used as pins, such as the Group 2 point Pin Hole 1 (see Chapter 4: Group 2 Points) and the Group 1 point Goyet 4 (see Chapter 4: Group 1 Points).

This type of artifact is known throughout prehistory, with many examples made of metal in the later periods. During the Upper Palaeolithic, bone or ivory would be the perfect raw materials for making objects such as pins, owing to their flexibility and their resilience.

Bone Segments with Polish

These artifacts are composed of polished pieces of rib bone, with rounded or square ends, which are generally curved in profile (fig. 5:4). Twenty examples of this type are considered here, they were all found at Goyet, some by Dupont, others during the excavations of the Institute of Natural Sciences. Such pieces are well known throughout the Upper

Palaeolithic of South West France and have been termed 'lissoirs' by various writers (for example de Sonneville-Bordes 1960,23; Leroy-Prost 1975,92; Camps-Fabrer 1977a,22). This name suggests that they were used to make something smooth, which is not certain (see below), and for this reason they are called 'bone segments with polish' here.

Owing to the absence of clear, distinguishing features, this tool type has clearly always proved difficult to define. After a lot of thought, I have decided to adopt the criteria given by de Sonneville-Bordes for this type, that such pieces are made of bone, and particularly from ribs (1960,23), as opposed to the wider, and looser definition given by Leroy-Prost that such pieces can be made of any osseous material, and have a wide range of shapes (1975,92). The pieces which I have attributed to this group include some very good examples, and also some rather less satisfactory pieces. I have also identified four pieces of worked antler which are similar to the less typical bone segments with polish, but after some consideration I have decided not to include them in this category. This is because not only would it weaken this group, but also the antler objects in question, Goyet 133, 134, 144 and Magrite 4, resemble split-based points which were found at those two sites, and may have been artifacts of this type which have broken above the base. Therefore, they have not been included in this group, but have been placed in the category of Group 4 points.

The traces of working preserved on these artifacts were carefully studied, and they suggested that these pieces had been deliberately cut out either by the groove and splinter technique or by longitudinal sawing, and had then been modified by scraping. It is generally thought that these were some form of hide processing tool owing to their polish (Piel-Desruisseaux 1986,237). This theory is examined here using both experimental and ethnographic evidence, and it is decided that in the

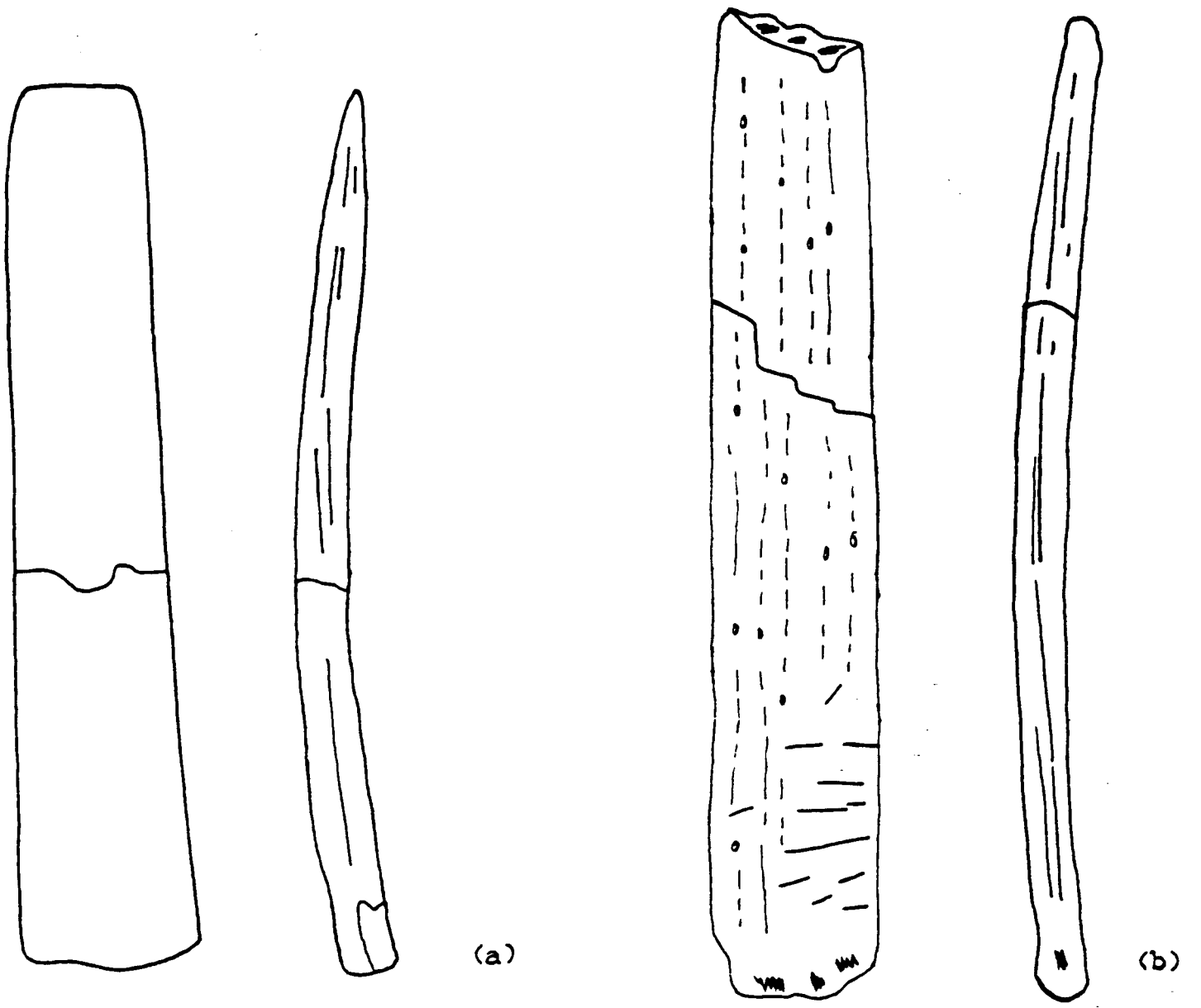


Fig. 5:4 Bone segments with polish: (a) Goyet 35 (b) Goyet 154 (c) Goyet 59

present state of knowledge this theory could neither be conclusively proved nor discounted. Although this tool type is certainly found in the Upper Palaeolithic of South West France and in Belgium, a review of published sources for the rest of Europe failed to reveal any further comparable pieces. However, as they are not particularly attractive or distinctive artifacts, it is perhaps unlikely that they would be selected for detailed description or illustration.

Manufacture

(i) Débitage

Some examples were extracted by the groove and splinter technique, and others by longitudinal sawing, depending on whether the bone was cut into from a surface or from the sides. This is indicated by the regular shape of these artifacts and from the traces of working on their sides and lower surfaces in the form of characteristic longitudinal striations and/or longitudinal facets and chattermarks.

(ii) Modification

Thirteen examples show traces of modification to their surfaces in the form of longitudinal and oblique striations. The presence of such traces on a further four pieces associated with "chattermarks" or an uneven surface suggests that these artifacts were modified by scraping. The other three artifacts of this type are very corroded, so few or no traces of modification survive, though given their close similarity in appearance to the better preserved examples, it is likely that they were modified in the same way. A group of approximately ten transverse incisions may be seen on one surface of a clearly scraped example, Goyet 154, near to one end (fig. 5:4). What form of modification they might represent is unknown, as they do not appear to be decorative.

Nine pieces of this type are not polished, but six of these are particularly corroded. Of the other ten artifacts, six have a uniform

polish, while four are particularly polished towards the ends and Goyet 29 is particularly smooth on its lower surface. This polish is unlikely to have resulted from treatment with preservatives, because other pieces in this collection do not share this feature. Therefore, this is probably a genuine Palaeolithic polish, though it remains to be determined whether it is a manufacturing polish or whether it resulted from use.

One last characteristic of this group may have been important. Ten of these artifacts are curved, no doubt reflecting the natural curvature of the rib from which they were extracted. They may have been deliberately selected, so as to make use of this feature, possibly so that these tools could be held at a convenient angle.

Function

(i) Traces of Use

The polishes described above may have resulted from use, even where the polish is very widespread. For if these pieces were used to work greasy materials such as hides or skins, it is probable that the hands of the person carrying out such a task would become equally greasy and that handling of the tool could result in a polish on the shaft as well as on the working end. The high polish on the surviving ends of a small number of pieces may indicate that they were actual working ends.

Most of those pieces which are almost complete appear to be symmetrical about a transverse axis, which means that either end could have been used. However, Goyet 35, which is almost complete, is wider at one end than the other, while the narrower end is polished and bevelled (fig.5:4). This suggests that some of these pieces may have been held at the broader end, with the narrower extremity as the working end.

Both ends of Goyet 60 are worn, which is probably a result of use rather than chemical alteration or movements in the deposit, as the 'wear'

is restricted to the extremities. This piece could, however, have been held in the middle and used at both ends.

(ii) Use

Owing to the shape of these pieces and their polish, it seems most likely that they were used in the preparation of greasy materials such as hides. For after they have been removed from the animal, hides have to be cleaned and then rubbed with fat or some other agent such as brains to make them soft and supple.

In order to reproduce this activity, a bâton made of fallow deer antler was made and used by me to rub fat into a cleaned rabbit skin for at least one hour in order to make the skin supple. There was no chipping or other damage, as the tool had only encountered the fat and the soft hide. The amount of time required to carry out this task effectively was not sufficient to allow the formation of a polish.

There is ethnographic evidence for working hides with both stone and bone tools. This include Lowie's description of this process carried out by Plains Indians,

> "skin dressers employed several implements of bone, horn and antler. Fleshers with minute notches forming a finely dentate edge were made from the foot bones of large game animals... In dressing a deerskin the hide was thrown over a log and cleared of hair with a rib or leg bone" (1954,57).

The illustrations of these pieces show (op.cit.,58,Fig.46) that with their serrated working edges, they are quite different from the artifacts discussed here. Birket-Smith has also described the hide-working techniques of the Eskimo, but unfortunately does not give full details of or illustrations of these implements,

> "the skin is cleansed of remnants of flesh and is scraped and softened with stone and bone scrapers of various forms. These are for the most part held in one hand" (1959,129).

Other ethnographic descriptions of skin-working include the use by the Navaho of stone cobbles for smoothing hides (Kluckhohn et al.1971), which is described in greater detail below (see Chaleux 103). Olsen's study of osseous artifacts made by the Indian inhabitants of Pueblo sites in East Central Arizona has revealed that,

> "many North American Indian cultures were known to have used bone scrapers or beamers for removing the hair on hides" (1980,55).

The artifacts in question are both described and illustrated by Olsen (1979,352,Fig.4; 1980,56,Fig.8c), and consist of implements made of ribs and innominate bones, the working edges of which were polished.

A review of the ethnographic sources suggests that it is probable that bone artifacts were used for working hides during the Upper Palaeolithic in the region of this study, and the general appearance of the bone segments with polish indicates that they may have been used for just such a purpose; however, this has yet to be proved. As the archaeological context of these pieces can furnish no useful evidence, any such proof would have to be derived from the artifacts themselves, and in particular from their polish. To be able to identify specifically a 'hide polish' on bone, as has been done on stone (Keeley 1977), would be highly desirable; however, as a result of both my own experimental work and the inspection of literally hundreds of archaeological implements, I have come to the conclusion that the sources of particular polishes may not be identified.

By contrast, Peltier (1986) has indicated as a result of her own experimental work, which has involved a very detailed study of function, that

> "comme sur les roches, nous avons pu constater que les micropolis varient selon la matière travaillée et dans certains cas, selon l'état de cette matière" (op.cit.,6).

I am not convinced of this, in particular because, as we have already seen, osseous materials are not only liable to a whole range of natural effects, which may mimic traces of use, but also very great care is needed to distinguish traces of modification from signs of use. It is all too easy to believe that one has identified traces of use, if one is not fully aware of all the various processes that an artifact has undergone, from being a piece of raw material to a finished product. This can be difficult enough with experimental pieces, but with archaeological specimens where one cannot know their full history, it is to my mind very doubtful that this area of research can have fruitful, practical applications, and indeed Peltier admits,

> "les quelques pièces préhistoriques observées jusqu'a présent nous ont permis d'identifier les traces de façonnage utilisées, mais l'étude de leurs traces d'utilisation n'a pas donné de résultats concluants en raison de leur mauvais état de conservation" (p7).

My views are in line with those of Olsen, who has had much experience of working with osseous implements and has written,

> "although hide polishes seem to be more glossy than polishes caused by waterborne particles, digestion or plant silica, this is very subjective. Through the use life of any tool the wear traces are cumulative, so that classification of polishes must rely more on the tool's morphology, other types of wear which indicate the motions involved, ethnographic analogy, and possibly archaeological context" (1984,169).

For these reasons, I believe that the intensive study of the polish on the bone segments with polish could yield only ambiguous results.

Variation and Distribution

The length of these pieces varies from 17.3 to 3.35cm, although only seven pieces appear to be near complete; they range in length from 17.3 to 6.8cm. The width of the shaft ranges from 2.2 to 0.75cm and its thickness from 1.75 to 0.2cm.

It is curious that all of these artifacts come from one site and that this type does not appear in any of the other collections considered here. There are various possible explanations for this. It is unlikely that all of the excavators of all the other sites consistently overlooked or failed to recognise this type of artifact, or that some particular activity was taking place there that did not happen anywhere else. It seems more probable that on other sites different tools were used for such activities as skin-dressing, for as we have seen, among the North American Indian tribes, stone cobbles have been used as an alternative to bone tools of various kinds for the same task. It is possible that on other Upper Palaeolithic sites in the region of this study stones were used for hide-working, which have not been recognised, or other bone tools, one possible example of which is described below.

It is clear that many occupations dating from the Mousterian and from the Earlier and Later Upper Palaeolithic are represented at Goyet and in particular in Dupont's "troisième caverne" and its offshoots. Unfortunately, there has been much mixing of material, so it is both a difficult and a dangerous process to assign artifacts to particular periods.

Those pieces recovered during the unpublished excavations of the Institute of Natural Sciences which have received any cultural attribution are labelled "aurignacien" or "aurignacien supérieur". Whether there was any basis for this is unknown. Approximately half of the artifacts recovered during Dupont's excavations in 1868-1869 are labelled "2e niveau" and have been attributed to the Upper Aurignacian. This would seem to tie in with the more recent finds, though again the attribution could be incorrect. The other pieces in the Dupont collection are labelled "1e niveau", but there is no sound stratigraphic evidence to confirm that the these pieces are younger than the rest of the group which they resemble so

closely. There is no difference in size, appearance or condition between the two groups. This problem of chronology could only be solved by radiocarbon accelerator dating of selected pieces, whose size could clearly bear the removal of the tiny sample required.

Miscellaneous:3

Chaleux 103

This is a modified limb bone fragment, labelled 'Equus caballus radius', which has a very heavy polish at one end (Plate 5:6). A microscopic study of the traces on its surfaces suggested that it had been modified by scraping and then a heavy polish had been applied. It is possible that this came about through rubbing a greasy substance into the surface of a hide, and as such, this piece could be interpreted as having been equivalent to the bone segments with polish described above.

(i) Débitage

No traces of blank extraction were recognised on this piece.

(ii) Modification

A number of shallow striations could be seen on the upper surface of this piece, all of which was polished, though the rounded end was particularly heavily polished. A silicone rubber cast was made of the upper surface so that it could be examined microscopically. When the cast was inspected using both optical and electron microscopes, very fine, grouped, longitudinal and oblique striations could be seen; these traces were associated with little transverse steps, which are characteristic of scraping. It was observed that many of the striations stopped very abruptly, the possible significance of which will be discussed below.

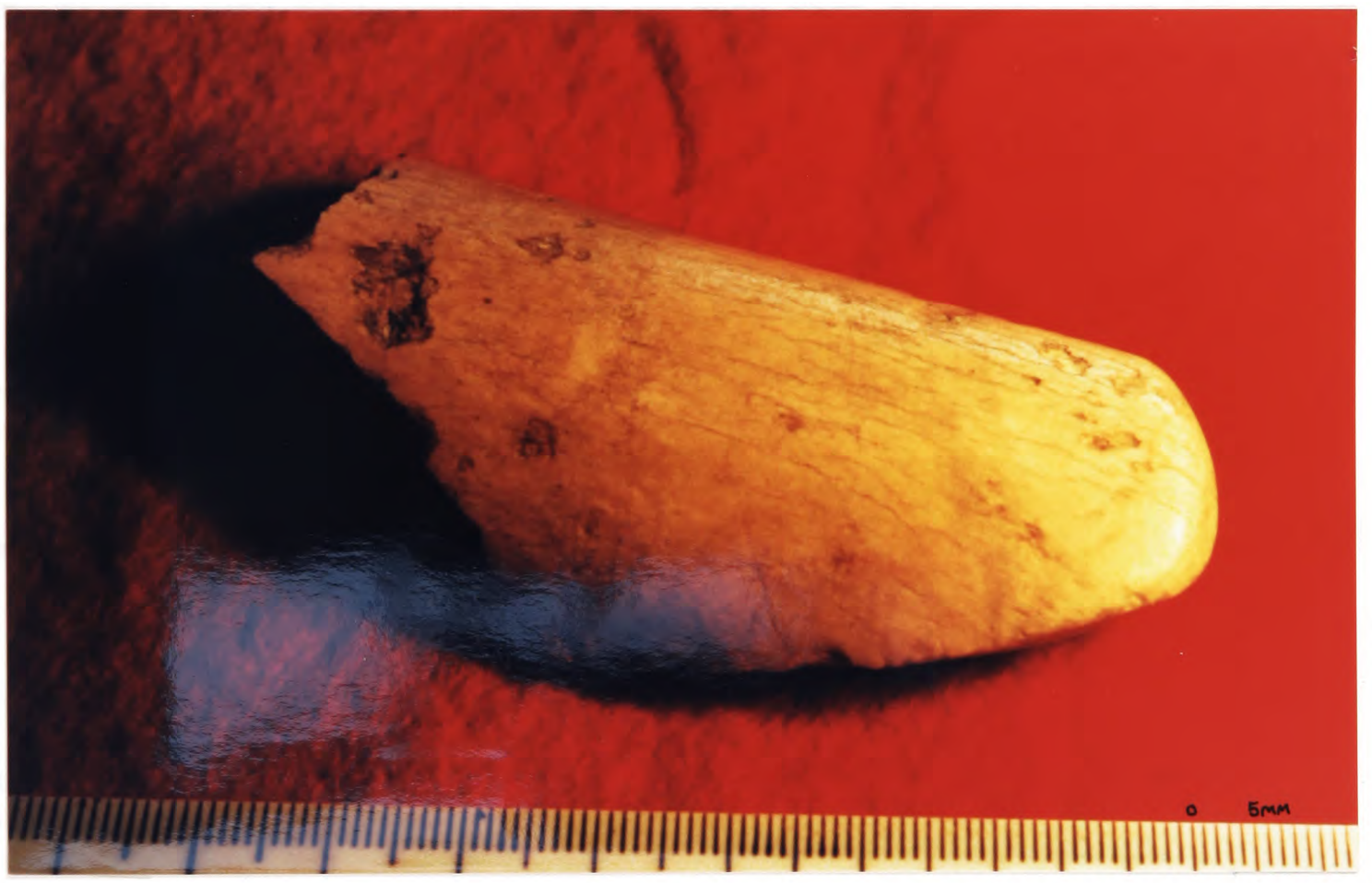


Plate 5:6 Chaleux 103

Function

(i) Traces of Use

The striations thought to have been produced by scraping may have ended abruptly, because they had been partly obliterated by the heavy polish which had developed through use.

(ii) Use

Owing to the rounded shape of this piece and its remarkable polish, it is possible that it may have been used for working hides to make them supple, either just by rubbing or by working some substance such as fat or brains into the hide. Both methods have been documented ethnographically, though using rounded stones instead of bone. Lowie described the methods used by the Plains Indian women when leather-working,

> "she thoroughly rubbed into the surface an oily mixture of fat with buffalo or other brains, first with her hands, then with a smooth stone" (1954,66).

A number of variations on the same theme are documented by Kluckhohn et al.,

> "The Navaho used unworked cobbles to smooth rough places when dressing buckskins, to remove miscellaneous hairs along the rough edges of the hide, and to beat rawhide" (1971,215).

Another method described by their informants was that,

> "A rounded piece of stone was used to pound a hide to remove the hair which remained after scraping. When almost all of the hair was removed, the hide was buried in moist sand. Later it was taken out and pounded. Grease and brains were smeared on the pelt and it was again covered with sand. Finally it was removed and pounded once more to make it pliable" (ibid.).

It is suggested here owing to the remarkable polish on the surface of this piece, its shape and the ethnographic evidence, that Chaleux 103 was used as a hide-working tool, and was thus an alternative to the bone

segments with polish described above. No similar artifact was identified among the collections studied here, though it is possible that such pieces were not regularly collected, or that they have not all been so well preserved. It is possible that for certain functions such as hide-working an elaborately worked tool was not always used. A naturally occurring splinter of bone or a rounded stone may have fulfilled this function perfectly with little or no modification required.

This piece appears to have been of Later Upper Palaeolithic date, as it was found on the Magdalenian site of Chaleux.

Wedge-shaped Segments

These are artifacts made of bone, antler or ivory, though more usually antler, which are tongue-shaped in plan and semi-circular in cross-section. The narrower, distal end is either single or double-bevelled (fig.5:5). This category consists of five artifacts (see Table 5:2 below), three of which are made of antler and are very similar to one another, to which have been added an example made of bone, and one of ivory, but which are generally similar in appearance. A sixth example, made of ivory, was recovered from the Grotte de Spy, but owing to constraints on time and money it was not possible for me to examine this piece myself, so the description given below is based on published information alone.

Wedge-shaped segments are known in the Upper Palaeolithic of South West France, where they are usually called 'coins' (wedges) or 'ciseaux' (chisels) (Deffarge et al. 1974). These seem to me to be inappropriate names, in that in each case they indicate a specific function, which has never been proven or even generally agreed upon for this tool type. It is for this reason that the more descriptive term 'wedge-shaped segment' has

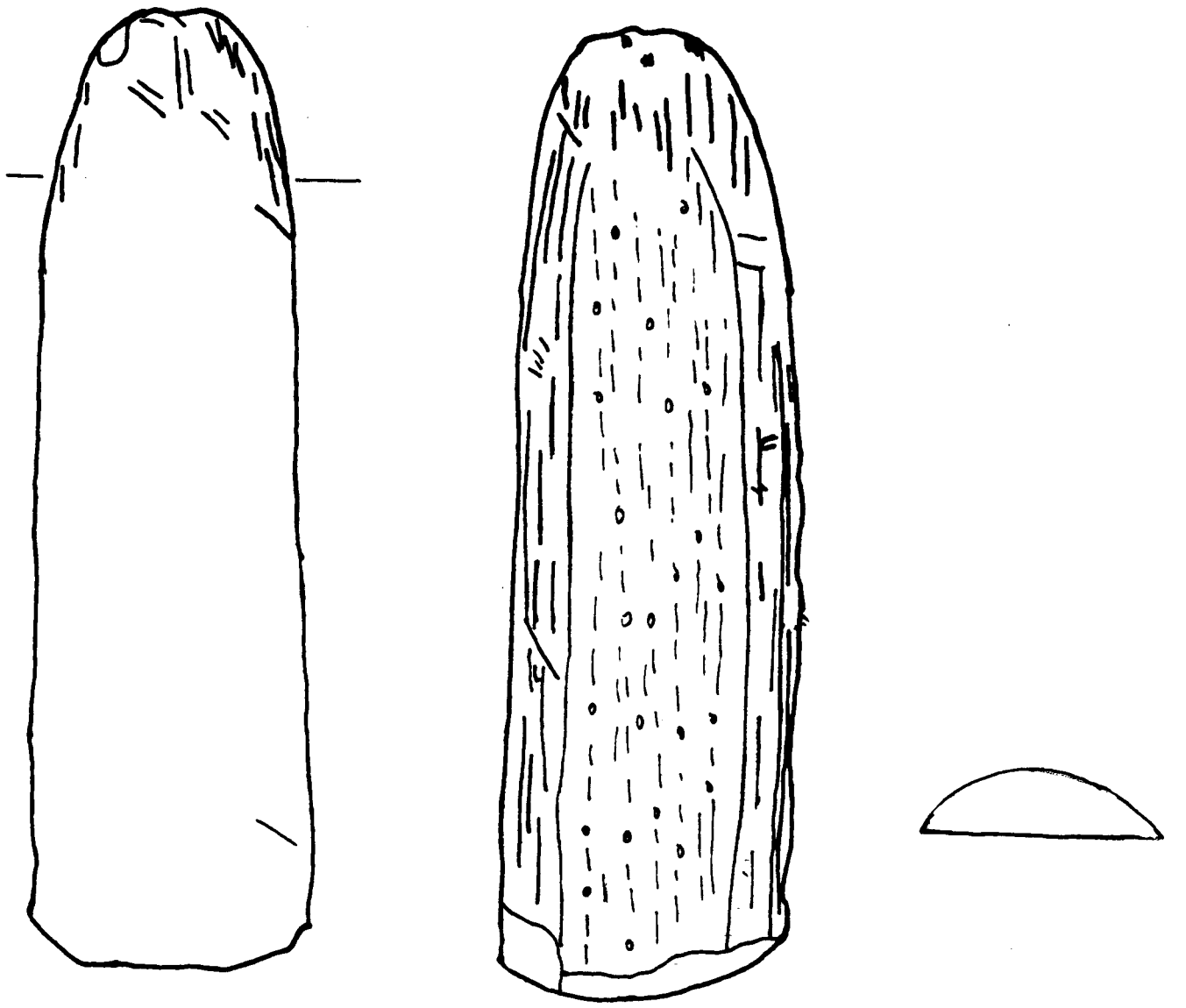


Fig. 5:5 Wedge-shaped segments: (a) Chaleux 2 (b) Goyet 17
(c) North American Indian antler wedge, after Stewart (1973,117)

been invented for them here. In South West France, such artifacts are known from Gravettian (Deffarge et al.,95) and Aurignacian contexts (Peyrony 1935,425,427), but they only become relatively abundant in the Magdalenian. A search through the illustrated literature concerning the Upper Palaeolithic in Europe failed to reveal many comparable specimens. Those found include some examples from Dolní Věstonice (Klima 1963,87,Fig. 32, 4,Tab 57,826-829).

The pieces studied here appear to have been deliberately extracted; certain examples show traces of the groove and splinter technique and of longitudinal sawing. They then appear to have been modified by scraping. Possible traces of use were identified on these specimens in the form of breaking and chipping, and some obliteration of the traces of manufacture on Goyet 17. Both experimental and ethnographic evidence were drawn on when considering the function of these pieces, and it was concluded that they were indeed used as wedges for splitting wood, bone and antler.

Table 5:2
Number and Distribution of Wedge-shaped Segments

Site Name	Bone	Antler	Ivory
Trou de Chaleux	-	1	-
Grotte de Coléoptère	-	1	-
Grotte de Goyet	1	1	-
Paviland	-	-	1

Manufacture

(i)Debitage

It is not clear by what method Paviland 33 (Plate 5:7) and Goyet 24 (fig. 5:6) were produced, though as each has a very regular shape, it seems very likely that they were deliberately extracted. Of the three antler examples, two show clear traces of extraction by longitudinal sawing, for longitudinal striations may be seen on the cortical parts of the lower surface. The third piece, Coléoptère 16 (fig.5:6), was either



Plate 5:7 Paviland 33 (length 8.8 cm)

produced by longitudinal sawing or by the groove and splinter technique, as striations may be seen on the sides as well as on the lower surface.

Where the proximal end survives, it is usually so eroded that no traces of working may be seen. In the cases of Goyet 17 and Chaleux 2, the proximal end is thicker than the rest of the piece and resembles the base or coronet of the antler, with its slightly scalloped effect. One deep, oblique incision may be seen on the proximal end of Chaleux 2.

(ii) Modification

On the specimens made of antler, modification is restricted to the surfaces at the distal end, which is generally the best preserved part of the artifact. Traces of modification consist of grouped, longitudinal and oblique striations, with in one case, chattermarks. Two of these pieces are double-bevelled at the distal end, whereas the third is only bevelled on the upper surface. No polish survives on these artifacts.

When casts of these pieces were viewed using a scanning electron microscope, the following information was derived. Goyet 17 (Plate 5:8) had been neatly worked, using a retouched tool with a straight edge, whereas Coléoptère 16 showed many, quite irregular striations, so much so that it might have been worked with an unretouched tool. The striations may be seen under the light microscope to be hooked away from the tip, so this piece appears to have been roughly worked towards the proximal end. A number of oblique incisions may be seen near to the edges on the upper surface of Chaleux 2, where the stone tool has slipped during débitage (Plate 5:9).

The bone example of this type, Goyet 24, is double-bevelled at its narrower, rounded end and appears to have been worked by scraping, for a number of longitudinal striations may be seen in the probably natural, longitudinal groove which runs the length of the lower surface, where a grindstone could not have been used. A few longitudinal striations may

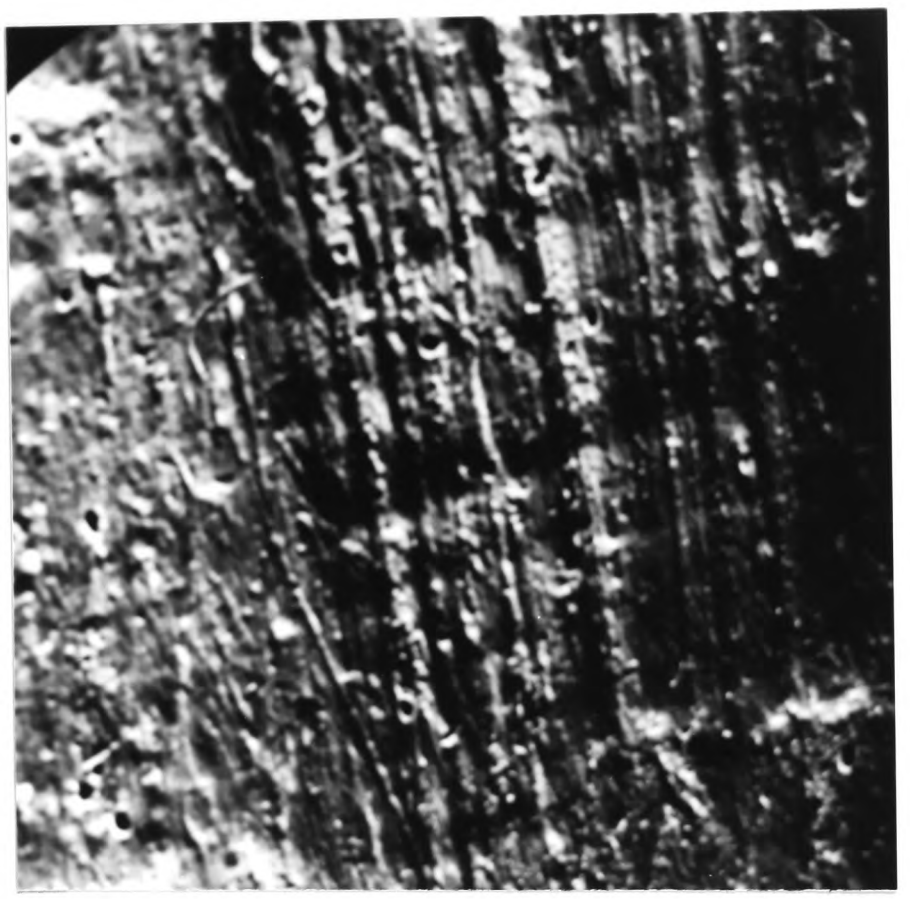


Plate 5:8 Traces of modification on the upper surface of Goyet 17 (x 36) (SEM photograph)

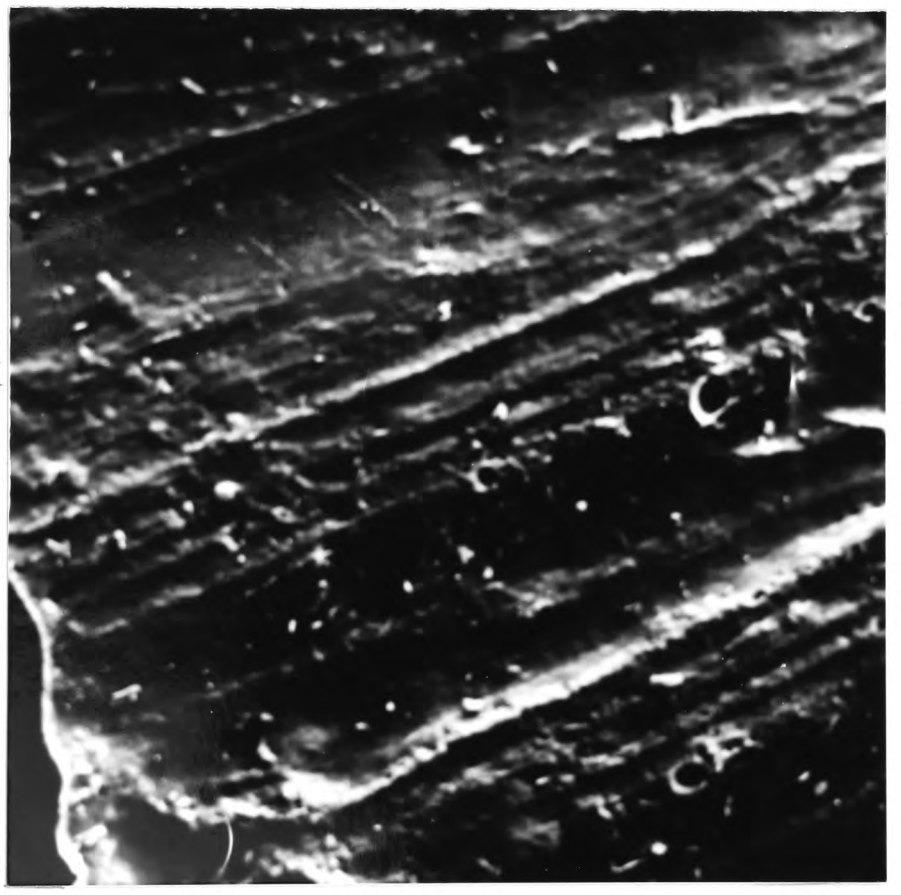


Plate 5:9 Traces of modification on the upper surface of Chaleux 2 (x50) (SEM photograph)

also be seen towards the distal end of the upper surface. This piece has unfortunately been heavily varnished, which makes observation difficult.

In contrast to the antler examples of this type, Paviland 33 is smooth and is covered with traces of working on both surfaces. It is single-bevelled at the distal end. A curious feature of this piece is that on each side at the proximal end, there is a smooth, worked area which makes the piece narrower. On one of these areas, no traces may be seen, whereas on the other, there are some striations.

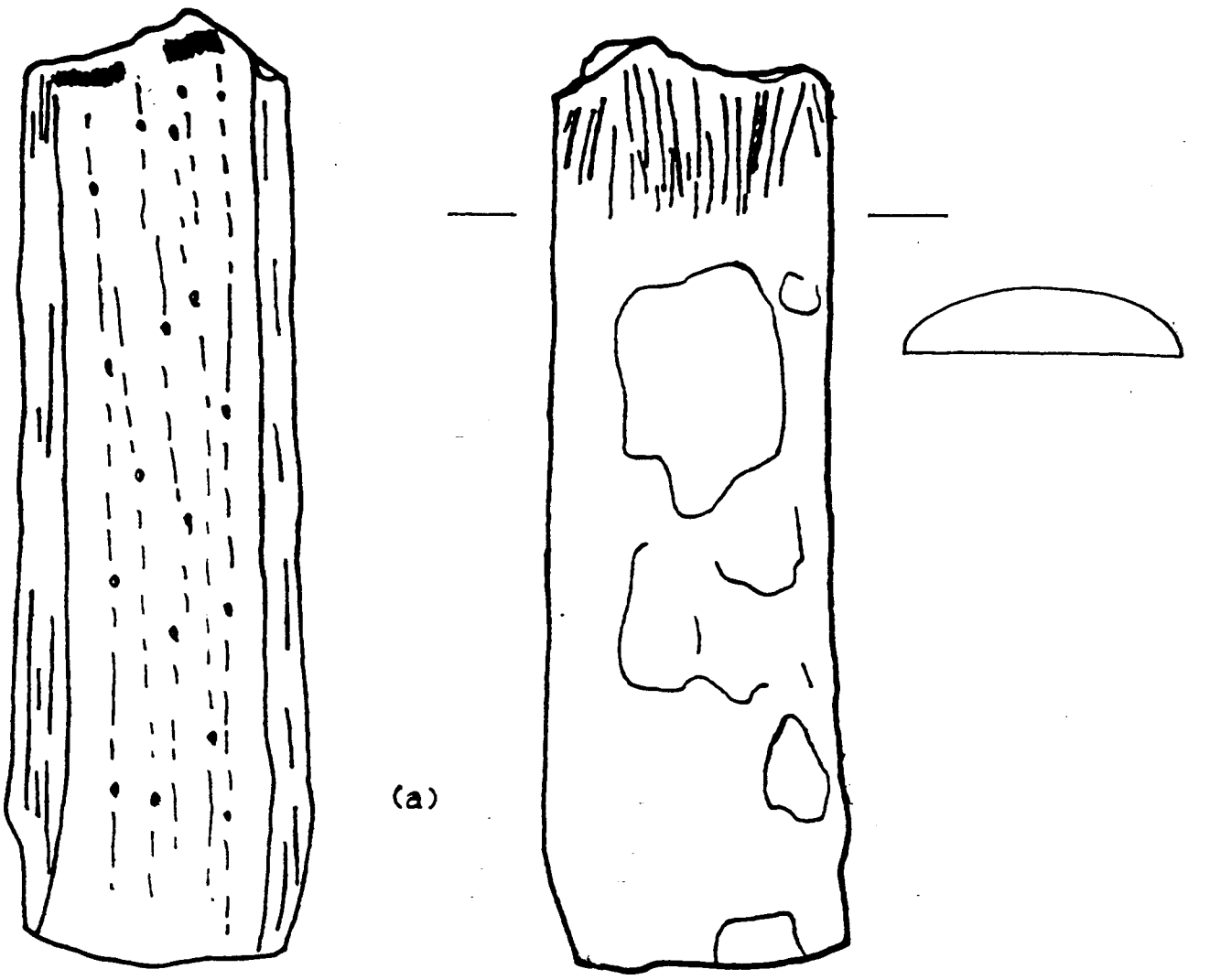
Function

(i) Traces of Use

Each piece has been chipped at the distal end, apart from Coléoptère 16, which has received a rough, transverse break. This may have resulted from use. The proximal ends of Goyet 24 and Paviland 33 are missing, which also may have happened through use. Unfortunately, the proximal ends of the remaining three artifacts are so eroded that no possible traces of use may be seen, apart from a deep, oblique incision on Chaleux 2, which is equally likely to be the result of modification. When viewed in a scanning electron microscope, the traces of working on Goyet 17 become curiously indistinct on both surfaces at the distal end, which may indeed indicate the presence of wear through use, in the sense of rubbing or smoothing of the surface.

(ii) Use

Written ethnographic sources document the use by the Eskimo and by North West Coast Indians of bone, antler and ivory wedges for splitting wood (Giddings 1967,51,75,238; Stewart 1973,110; Clark 1974,110). A bevelled ivory wedge used for this purpose is illustrated by Giddings (op.cit.,75,Fig.17e), and bone and antler wedges by Stewart (op.cit.,117), one of which is reproduced here (fig. 5:5). The similarity in appearance of the three specimens made of antler considered here to those



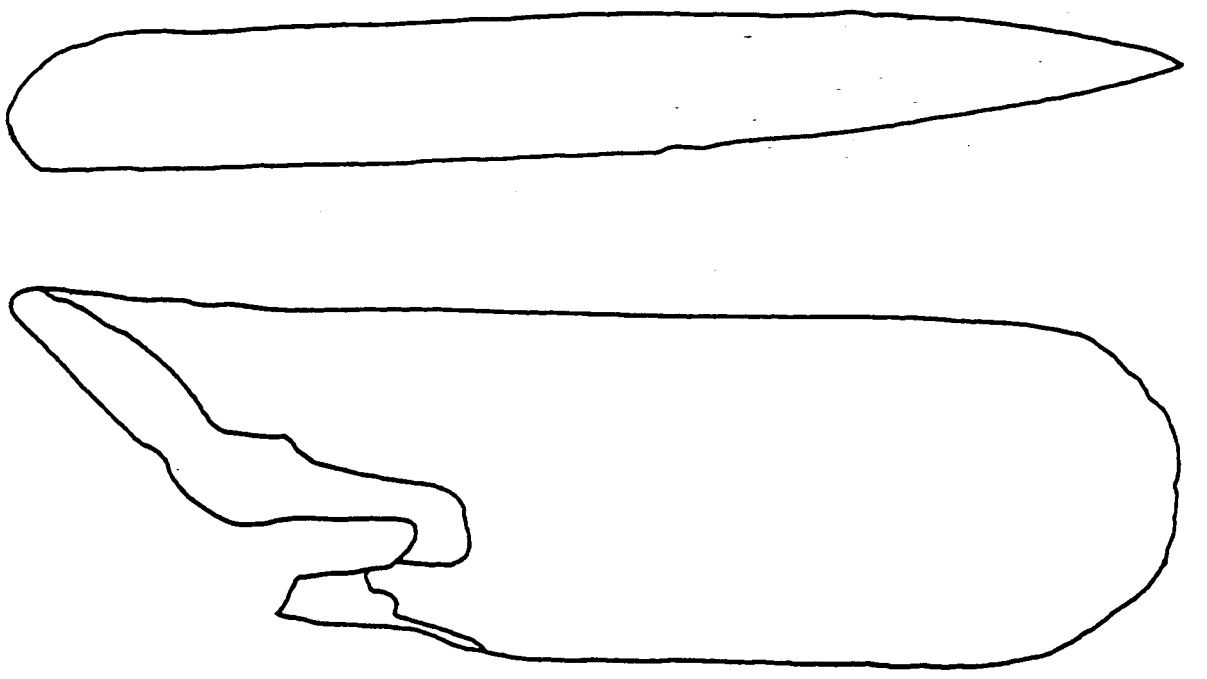


Fig. 5:6 Wedge-shaped segments: (a) Coléoptère 16 (b) Goyet 24

ethnographic artifacts suggests that they too may have been used as wedges for splitting materials such as bone, antler and wood. In order to go some way towards either verifying or discounting this hypothesis, a suitable ethnographic specimen was closely examined to see whether it bore any comparable traces of use to those observed on the archaeological specimens. A series of experiments was also carried out to reproduce this process.

Within the collections of the Pitt-Rivers Museum in Oxford, there is an artifact which is similar to these wedge-shaped segments. It is labelled "chisel-shaped wedge of whale's bone, for splitting timber from ruined Eskimo hut Utorqar-Amerdloq Fjord, West Greenland". This piece is roughly tongue-shaped; it is approximately oblong in cross-section, with a rounded and chipped distal end (Plate 5:10). Some oblique incisions may be seen on the damaged proximal end. The distal end is double-bevelled, though the bevel on one surface is short and may have partly arisen from use, in the manner of the experimental antler wedge which is described below. No further traces were observed.

An attempt was made by me to replicate the use of an antler wedge in splitting bone and antler, in order to see what traces of use were produced. A single-bevelled antler wedge, measuring only 3.9cm in length, was used by myself to wedge open both a shaft of antler and various pieces of bone, which were being split by longitudinal sawing. As a result of this, the bevel became smooth, particularly at its proximal end, where there was much contact with the bone or antler. The distal end became chipped and slightly bevelled on the previously non-bevelled surface through compression. There was some obliteration of the traces of working on the distal end of the piece.

The study of both an experimental and an ethnographic specimen suggested that the traces observed on the archaeological pieces were not



Plate 5:10 Eskimo wedge

incompatible with those produced through use as wedges. The damage to the distal ends is consistent with that observed experimentally. Unfortunately, the three surviving proximal ends were very eroded. However, Deffarge et al. (1974a,94) quote earlier writers who had observed that the proximal end of such pieces from South West France was often hammered, although Deffarge et al. also note that traces of percussion on the proximal end are found much less frequently than traces of use on the distal end (p.94-95).

Another possible use for these artifacts could be as hide or skin working tools, though the traces of damage on these pieces, such as chipping, were not produced experimentally. An explanation for this has been provided by Deffarge et al. (1974a,95), who have studied a similar series of artifacts from South West France, that the damage to the distal end could result from the tool hitting something hard or resistant like a stone perhaps, while moving backwards and forwards across the hide. This may be the case, but if these pieces were used in this way, one would expect to see some rounding or smoothing of the edges and surfaces, whereas, apart from the obliteration of some of the traces of working on Goyet 17, the traces of manufacture seem very clear and distinct. The shape of these pieces would also seem to me to be not well designed for this particular function.

Taking into consideration all the evidence outlined above, it seems most probable that the three antler pieces were used as wedges. They could have been used to split bone, antler or wood.

It has been suggested (Camps-Fabrer 1977a,22) that a chisel ("ciseau") has a double-bevelled distal end, whereas a wedge ("coin") is single-bevelled. However, there seems to be no reason why a Palaeolithic wedge need not also have been double-bevelled. Furthermore, there is some variation in the nature of the bevelling in this group, even amongst the

three antler pieces, which are otherwise so similar that it seems unlikely that, in this case, there is any functional significance in the choice between single or double bevelling to produce a transverse, distal edge.

The shape of the other two pieces with their bevelled distal ends suggests that they too were probably intermediate tools used as wedges for splitting open raw materials for subsequent tool making. The ivory wedge-shaped segment has been put into this group, because it seems to have more in common with these artifacts than with any other tool type. However, it possesses some unique features in that it is made of ivory and also the fact that there is a narrowing facet on each of its sides, towards the proximal end. It is most regrettable that the proximal end is missing, as it would be interesting to know whether this piece continued to become narrower right up to its proximal end, as that would very much change the shape that we have assumed in discussing it.

It is possible that these narrowed areas were associated with hafting, or with adding extra grip to the artifact, or they could even be where previous blanks had been removed and then so as not to waste material the final core was modified. I would hesitate to suggest what the function of this piece might have been.

Variation and Distribution

These pieces vary in length from 11.5 to 8.8cm, two examples are almost complete and they measure 9.9 and c11cm long. Proximal width ranges from c3.8 to 3.15cm and proximal thickness from c1.4 to 1cm. The lengths and widths lie within the range recorded for the examples from Abri Morin (Dordogne) by Deffarge et al. (op.cit.,88), although the pieces studied here are thinner. Distal width varies from 3.5 to 2.15cm and distal thickness from 1.15 to 0.45cm.

There are only a few pieces in this group, but they have a widely scattered geographical distribution, even amongst the three antler

pieces. The tools from South West France that the antler examples resemble all come from the Magdalenian (Deffarge et al.,85), during which period they are relatively abundant, although they are known to have been made at least since the Gravettian (op.cit.,95). A similar piece made of reindeer antler found at the Early Aurignacian site of Abri Castanet (Dordogne) is illustrated by Peyrony (1935,425, Fig.8,No.4).

One of the Belgian examples, that is Chaleux 2, is clearly Magdalenian, as it comes from an exclusively Magdalenian series of occupations. On the other hand, Goyet 17 comes from a multiperiod site, and was merely labelled Magdalenian in its museum collection, though the basis for this was most probably typological. The third antler artifact is from the Grotte de Coléoptère and was found in Layer A1 (Hamal-Nandrin et Servais 1925,5), which lay above the Magdalenian level and has been attributed to the Ahrensburgian. The other two pieces which have been placed in this category are of Upper Palaeolithic age, but it is, as yet, impossible to be more precise than that. A similar shaped piece made from the end of a mammoth tusk was found in the 'deuxième niveau' at the Grotte de Spy by De Puydt and Lohest (1886,21) and is classified as a 'coin' by Otte (1979,292,294,Fig.120,No.5). This piece clearly shows traces of flaking at its wider proximal end, which could have as easily resulted from the piece still being in the process of being modified by percussion, as from hammering. As I was not able to examine this piece myself, I cannot judge whether this piece is a wedge-shaped segment.

One reason why only such a small number of these artifacts has been recovered may well be that some specialised and not very frequent activity was being carried out on these sites, though it seems curious that in at least three cases, only one example of this type was required. Perhaps other, as yet unrecognised, tools were used instead; these could

have included pieces made of wood, which have not been preserved, or of stone, which have not been recognised.

Perforated Bâtons

These are objects made from the beam of an antler, that is the main shaft, with a large perforation at the wider end, where at least one tine joins the beam. These artifacts have usually received some form of incised decoration. The traditional term for this type is "bâton-de-commandement", but the name "perforated bâton" has been widely adopted by modern authorities (see Leroi-Gourhan 1972,205; Leroy-Prost 1975,138). It is a considerably more useful term, because it is purely descriptive with no implied function, which is particularly important as these interesting pieces probably had more than one use. Five antler bâtons have been found in the region of this study, two at Gough's Cave and two at Dupont's "troisième caverne" at Goyet. The fifth was found at the Grotte de Spy. Three of these pieces are described here in detail; the second bâton from Gough's was unavailable for study and is considered below only on the basis of published information. Similarly, the bâton from Spy could not be examined by me owing to constraints on time and money.

The three pieces which I was able to examine in detail were produced by sawing off a section of the main shaft of an antler. Traces of the removal of a tine by sawing may be seen at the perforated end of Gough's 9. On the two better preserved examples, Goyet 111 and Gough's 9, it appeared that the shafts had been modified by scraping. Furthermore, traces of incised decoration also survived on these pieces, which in one case consisted of a helical pattern of parallel incisions and in the other, of an elaborate naturalistic representation of a fish and leaves.

It appeared that the two Belgian bâtons had been perforated by drilling, whereas the perforation on the Gough's bâton had been made by scraping and then its edges, in particular the lower edge, had been made to bevel outwards. These artifacts were also examined for traces of use with some apparent success, in that the perforation on the Gough's bâton was observed to be highly polished in contrast to the rest of the piece. Wear was also recognised on the lower edges of the perforations of the Goyet bâtons. Ethnographic and experimental evidence for use were considered (Jenness 1937; Campana 1979; Olsen 1984); they suggested that perforated bâtons may have been used either as shaft-straighteners or as thong-smoothers.

Perforated bâtons as a whole are a feature of all of the Upper Palaeolithic in South West France, though they are particularly abundant in the Magdalenian, when they are often highly decorated. Early examples include those found by Peyrony at the Aurignacian site of Abri Castanet (Dordogne) (1935,428,Fig.11). A detailed survey of Aurignacian perforated bâtons has been carried out by Leroy-Prost (1975). Such artifacts have also been found in Magdalenian contexts in Cantabrian Spain, in Germany and in Switzerland (see Obermaier 1924,120-121), and at the Czechoslovakian site of Pekárna (Müller-Karpe 1966,T220,5). It is most probable that the perforated bâtons considered here are also of Later Upper Palaeolithic date.

Manufacture

(i) Débitage

Blank extraction for these pieces consisted of cutting off a section of the main beam of an antler: this involved removing features such as the coronet, the burr and the brow tine from the lower end and by cutting across the beam and any tines at the other end, before the beam became too curved. At the perforated end of these pieces, it can be seen that at

least one tine has been removed by sawing. Traces of this process are clearly preserved on Gough's 9 in the form of curving, longitudinal striations.

(ii) Modification

On the two better preserved bâtons, signs of modification may be seen on the shafts in the form of longitudinal striations, which are particularly crude on Gough's 9 (Plate 5:11) and are probably associated with scraping. By contrast, Goyet 110 is in a very poor condition, so few traces of working have survived, and indeed the upper part of this piece has a large lump of breccia stuck to it (fig. 5:7).

Owing to its decayed condition, no incised decoration is preserved on the surfaces of Goyet 110. On the bâton from Gough's, a pattern of deep, parallel incisions varying in number from 5 to 6 or 7 may be seen running round the shaft in a long spiral. A criss-cross pattern of striations may also be seen on one surface below the perforation. There is on Goyet 111 the most elaborate incised decoration recorded on any Belgian Upper Palaeolithic artifact; on one surface there is a representation of a trout or salmon-like fish with features such as gills, fins and even scales, while on one side of the bâton decoration composed of leaves may be seen. On both surfaces, there are a number of deep, longitudinal and oblique incisions. Around the perforation, a 'blanket-stitch' type of pattern may be seen, consisting of longitudinal incisions with groups of tiny, transverse incisions arranged perpendicular to it. The perforated end is quite bird-like, as it is curved on one side like the back of the head and pointed on the other side like a beak, with the perforation as a monstrous eye. This may be a deliberate feature, because just below the 'beak', that side is notched at least four times, which may represent the feathers on the bird's breast (Plates 5:13 and 14).



Plate 5:11 Gough's Cave 9



Plate 5:12 Eskimo perforated bâton

The perforations on the Goyet bâtons are roughly circular and have been made by rotation from both surfaces, as their profiles are still biconical. Traces which seemed most likely to be associated with manufacture were observed within the two perforations. On Goyet 110, they took the form of longitudinal striations, at least three curving, oblique striations and chattermarks. The traces of working visible within the perforation of Goyet 111 consist of longitudinal striations and a few oblique incisions.

The perforation on Gough's 9 appears to have been made by scraping. It is now broken obliquely, but was probably once roughly oval in shape, with the edges bevelled outwards, like four petals on a wild rose. Each 'petal' is smooth and polished with only a few irregular striations visible, though on one surface of the perforation, there were deep incisions and protrusions from roughly cutting away material.

Function

(i) Traces of Use

In spite of seeming quite robust, all three bâtons had been broken transversely across the shaft, so their original shape is unknown. This is a pity, particularly in view of the fact that various spear-throwers illustrated by Garrod (1955,25,Fig.2,5,28,Fig.3,3) are perforated at the non-hooked end. However, the artifacts considered here appear too robust to have been parts of spear-throwers. Gough's 9 has also been broken obliquely across the perforation, whereas the two examples from Goyet had two or three deep cracks emanating from the perforation. This damage may have resulted purely from use, or else it may have come about through the antler not being able to withstand the manufacture of such a large perforation and cracking under the additional strain undergone during use.

The perforation on Gough's 9 was highly polished in contrast with the rest of the piece and this localised polish may have been a result of



Plate 5:13 Goyet 111: View of surface with incised fish decoration (length is 14.4 cm)



Plate 5:14 Goyet 111: View of surface with 'barbed wire' pattern

friction which occurred only in the perforation, possibly through use. Possible traces of use were also identified on the Goyet bâtons. On Goyet 110, this took the form of a very slightly worn area below the perforation on the less well preserved surface; on the other surface, a facet could be seen on the lowest part of the perforation. Similarly on Goyet 111, wear could be seen mainly on the lower part of the perforation. The location of the wear on these two bâtons appears to indicate a different form of use from that of Gough's 9, which will be discussed below.

(ii) Use

Similar shaped, perforated pieces of bone and antler have been identified in the ethnographic record: they were used for straightening arrow- and spear-shafts and for smoothing thongs. The accounts of these activities include the observations made by Birket-Smith of the use of arrow-straighteners by Eskimos during his fieldwork in the Arctic,

> "the arrows have shafts of wood and heads of bone or sometimes of copper and nowadays of iron. It is of considerable archaeological interest that the bone head, after being softened in hot water, is trued and straightened with an implement consisting of a piece of antler with one or more holes in it" (1959,88).

Birket-Smith concluded that this was also the function of Upper Palaeolithic perforated bâtons (ibid.).

Within the Soviet Union, Semenov recorded the practice of,

> "softening and stretching thongs, probably sewn ones, used in the making of sheepskin and fur clothing, harnesses, saddles and footwear" (1964,191).

Different groups used different artifacts for carrying out this process: in the Caucasus a wooden hook was used, whereas,

> "the Netetz thong-stretchers are of very individual shape, made of deer antler with an aperture cut through them. In order to stretch and soften the thong both the aperture, through which the thong is passed, and the tines over which it is stretched, are made use of" (ibid.).

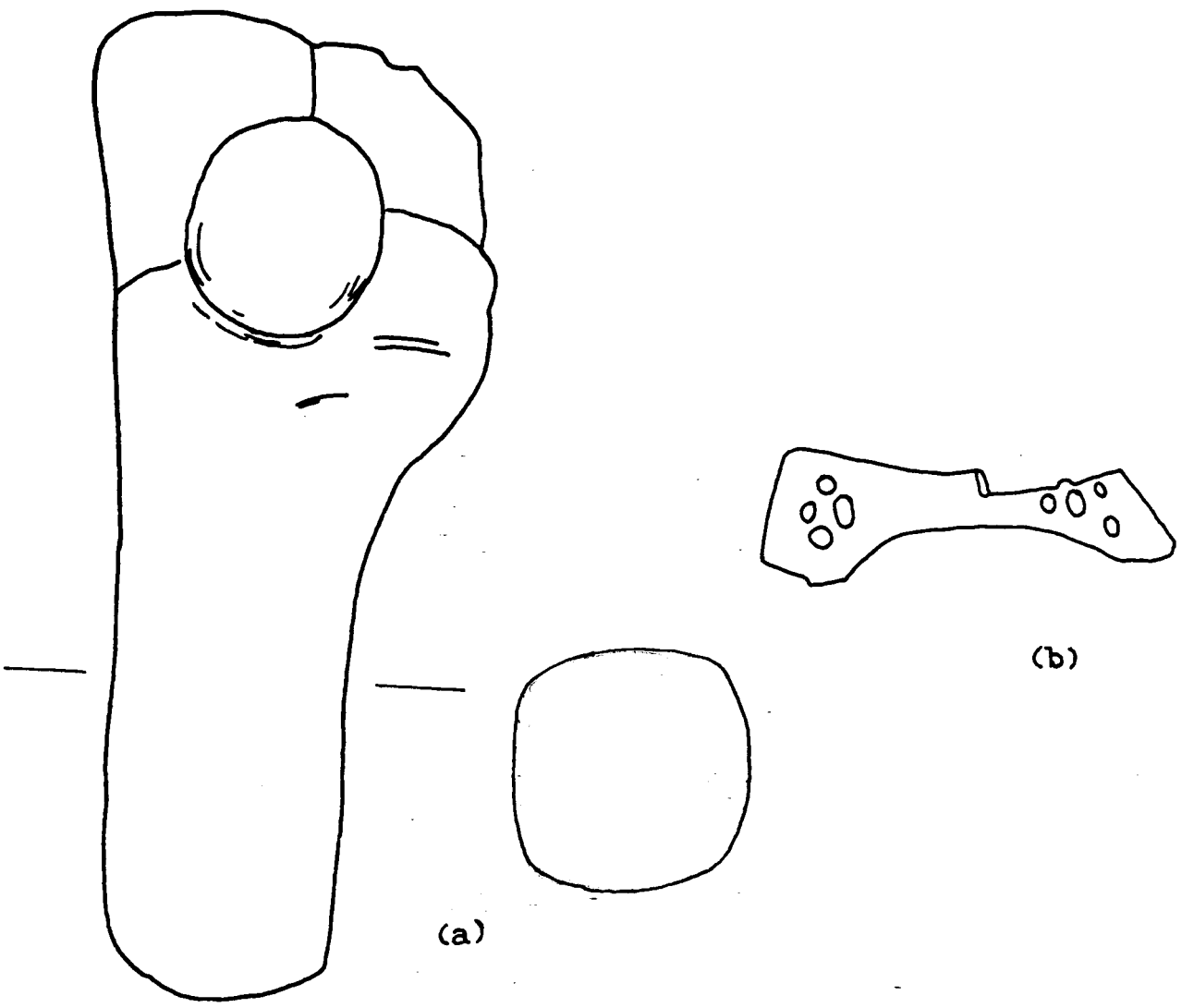


Fig. 5:7 Perforated Artifacts: (a) Goyet 110 (b) Eskimo thong-smoother, after Jenness (1937, Plate Ea)

There is now a considerable body of experimental evidence which supports the ethnographic information in suggesting that perforated bâtons' may have been used either to straighten shafts or to smooth thongs. From his own experiments, Leroi-Gourhan has suggested that perforated bâtons were regularly used for straightening blanks for antler rods,

> "En dépit, des différentes hypothèses qui ont été formulées sur la fonction du bâton percé, je pense que celle qui l'assimile à un levier pour corriger à chaud l'incurvation des baguettes de bois de renne est la plus probable" (1972, 205).

When producing antler blanks by the groove and splinter method, I found that a combination of soaking the antler to make it softer and trying to bend the splinter out of the groove could easily result in the production of a curved blank. To make an efficient projectile from such a blank would necessarily involve straightening it.

The manner in which shaft-straighteners were used may have varied, for the experimental work of Campana (1979) and Olsen (1984) involved actually sliding the shaft backwards and forwards through the aperture, whereas Guthrie (1983,280) lashed the point being worked straight within the aperture and then left it to dry in that position, which was clearly a lot less time consuming.

Jenness observed that the various types of Eskimo arrow-straightener held in the National Museum of Canada all shared one important feature, relevant to their function, which was that,

> "it is bevelled in the same direction at front and back to prevent any denting of the arrowshaft, which was almost always made from soft spruce-wood" (Jenness 1937,73).

This was also a characteristic of an Alaskan Eskimo arrow-straightener made of ivory, which was examined by me in the Pitt-Rivers Museum in Oxford. Its perforation is roughly diamond-shaped and its edges are bevelled outwards (Plate 5:12), so as not to dent the shafts being worked, in the manner described by Jenness.

The thong-smoothers (fig. 5:7) could be distinguished from the arrow-straighteners on the basis of differences in appearance,

> "the thong-smoothers from Greenland are cruder implements, with smaller holes (too small for an arrow-shaft), that are either not bevelled at all, or bevelled at the edges only" (Jennesss 1937,73).

Having examined a number of Eskimo examples, Jenness did not accept the hypothesis that European Upper Palaeolithic perforated bâtons were used as arrow- or spear-shaft-straighteners,

> "for the illustrations I have seen of these objects seem to reveal circular holes with rather sharp edges, such as one would imagine to be scarcely suited for the straightening of arrowshafts" (Jenness 1937,37).

This is certainly the case for the Goyet bâtons, but not of course for the specimen from Gough's Cave.

The production of such a bevel as a result of use and <u>not</u> as a feature of manufacture is described by Olsen,

> "Wear on bone shaft-straighteners from the Plains consistently developed diagonally on opposite sides of the hole, parallel to the long axis of the bone. The attrition is caused by friction generated by arrowshafts as they are repeatedly drawn through the hole with pressure applied to straighten bends in the shaft" (1979,351).

Similarly, Campana (1979) carried out a detailed study of the very distinctive traces of wear visible on a deer scapula with a large

perforation found on the Natufian site of Mugharet El Wad, Mount Carmel. The inner surfaces of the artifact showed the following traces of wear,

> "the exterior margins of the hole on both faces of the scapula, have been worn to a quatrefoil shape. The surfaces of these worn-in lobes are very regular, smooth and polished. The lobes all angle inwardly so that the outer margin of the hole is much larger than the interior, giving it an hourglass-shaped cross-section. The lobes of the hole that lie along the long axis of the object are more worn and consequently larger than those at right angles to them" (1979, 237).

This is most interesting in view of the presence of a similar feature on Gough's 9, that is the various bevelled areas round the perforation. Campana reported that under the microscope, it also appeared that all the lobes had "clear, fine, parallel scratches running through the hole" (op.cit.,238). Unfortunately, it was not possible to examine the Gough's bâton at a sufficiently high magnification for any such traces to be visible.

With the aim of reproducing the wear on the archaeological perforation, Campana devised an experiment using a mechanical arm to pass a wooden shaft through a perforated cow's scapula 10 000 times (op.cit., 240); this resulted in lobes on alternate edges of the perforation. These lobes were angular and distinct rather than rounded, while fine, parallel scratches could be seen running parallel to the axis of the cylindrical surface of the hole.

In order to test his hypothesis that the use of a thong-smoother would necessarily produce very different traces of wear, a mechanical device was again used to pass a leather thong through a perforated fragment of cow bone 10 000 times: it appeared that,

> "the wear on this experimental specimen shows a smoothly curved surface, with no lobes, and with a rounded rather than an angled edge on the worn area of the hole. There are very fine scratches running through the hole but they are not exactly parallel, following the curvature of the worn surface instead" (op.cit.,241).

Olsen carried out a similar series of experiments and obtained almost matching results. One of these involved straightening willow shafts in a perforated piece of mule deer antler, which produced a bevel on the rim of the perforation as well as a good polish. As a result of her experimental observations, Olsen suggested that the development of wear is probably dependent on the thickness of the cortical bone of the shaft-straightener, the nature of the shaft and the amount of force used. In contrast to this, it seemed that even though thong smoothers have a similar shape, they have a different wear pattern; this consists of a polish, fine, transverse striations and attrition on the edge of the hole. However, no cylindrical groove is formed on opposite sides of the upper and lower surfaces, but instead, the rims are worn and rounded in the same spot on the two surfaces.

The wear recognised on the lower parts of the perforations of Goyet 110 and 111 suggests that some material was being rubbed backwards, forwards and downwards over the lower part of the perforation. This is most suggestive of smoothing a thong, which has been documented both experimentally and ethnographically (see above). However, it does seem curious that the Goyet perforations are so big, if they were only being used as thong-smoothers, for certainly the Eskimo thong-smoothers illustrated by Jenness, one example of which is reproduced here (fig. 5:7), had much smaller perforations (see 1937, Plate E, opposite p.73).).

There appears to be considerable evidence for use on Gough's 9 in the form of not only the heavy polish in the perforation, but also the bevelling outwards of the edges of the perforation, which may have been intended to protect the shafts being straightened, as indicated by Jenness (1937,73). However, the experimental work carried out by Campana and Olsen indicates that this bevelling may have been made as a result of use,

rather than as preparation for use. The presence of deep incisions and protrusions from roughly cutting away material within the bevel of Gough's 9 suggests to me that this was a deliberate feature of manufacture, as was the case for the Eskimo examples. Further evidence for this having been a result of manufacture rather than of use is provided by the appearance of the second perforated bâton from this site (see Variation and Distribution). It seems ironic that the two specimens from Gough's appear to have been shaft-straighteners because no surviving bone or antler shafts were found at that site, whereas a substantial number of antler rods were recovered at Goyet. If shafts were being worked at Gough's, then they were most probably made of wood.

Traditional theories about use have not been entirely forgotten, for Wymer has expressed the view that even if some of these pieces functioned as arrow-straighteners or thong-smoothers, the highly decorated pieces may have been ornamental as opposed to the simpler versions, which were functional:

> "if these perforated 'bâtons' have to be relegated to the role of tools, this cannot be the case with some elaborately decorated lengths of bone or ivory. These really may have been ceremonial wands" (1982,264).

Variation and Distribution

The three antler bâtons considered here in detail range in length from 10.85 to 14.42cm, but as they all have been broken transversely across the shaft, these measurements cannot represent the original variation in size. The shafts varied in width from 2.5 to 2.1 cm and in thickness from 2.2 to 1.25cm, which must reflect the size of the chosen antler beams. Where the bâtons were in a sufficiently well-preserved condition for the dimensions of the perforation to be measured, the width could be seen to vary from 2.2 to 1.6cm and the length from 2.5 to 1.9cm.

In view of the possible function of these pieces as arrow-straighteners, it is of interest to review the relevant dimensions of the antler rods studied here. Upper Palaeolithic antler rods from the region of this study range in width from 2.7 to 0.5cm with a mode of 1cm. Their thickness ranges from 1.5 to 0.3cm with a mode of 0.7cm.

The second Gough's bâton is described and illustrated by Clay (1929) and is clearly so very similar to Gough's 9 that it suggests that they were made at the same time. The second bâton is described as,

> "made from an antler of reindeer, one face being slightly rounded, the other almost flat. The rounded face is decorated with six bands of linear incisions, while the flat is plain except for a single similar band in the middle. The perforation is oval, inclined at an angle to the shaft, and bears on its lower lip on the flat side and on its upper lip on the rounded side well marked grooves which have evidently been cut with a flint implement" (1929,345).

As the photograph of this piece illustrates further (op.cit., facing p346), the edges of the perforation are also bevelled outwards or 'inclined at an angle to the shaft' and the presence of the deliberately-made, deep, oblique incisions on these bevelled areas strongly suggests that the perforation was made bevelled prior to use. However, it is entirely probable that the bevelled areas or 'petals' would have become deeper through use. Whether the role of the incisions within the perforation was entirely decorative, or whether they were intended to guide the shaft through the perforation or grip it more tightly is unknown.

Perforated bâtons are characteristic of all of the Upper Palaeolithic, though they are particularly abundant in the Magdalenian, during which period they often received the most elaborate decoration (Leroy-Prost 1975,138; Piel-Desruisseaux 1986,223). Decorated, perforated bâtons from Cantabrian Spain have also been dated to the Magdalenian (Gowlett et al.

1987,291-293). Similar pieces have been found to the east of the region of this study, for example at the German Magdalenian site of Gönnersdorf in the Rhine Valley (Bosinski 1981,80) and further south in Germany at Petersfels and in Switzerland at Kesslerloch (Wymer 1982,207).

The two British perforated bâtons also probably belong to the Later Upper Palaeolithic as they come from the site of Gough's Cave, which dates from this period. As regards the Goyet bâtons, the contextual evidence is less helpful, as these pieces come from a multiperiod site, however, the elaborate decoration on Goyet 111 seems to indicate that it, at least, came from a Magdalenian occupation of the cave.

A perforated antler bâton was found at the Grotte de Spy in the 'deuxième niveau', which suggests that it may have been part of the Aurignacian industry at that site (de Loë and Rahir 1911,11,Pl V,9). This piece appears to be in a very poor condition.

"Whistles"

These are perforated pieces of bone, which may have been designed to be used as whistles. It is probable that when a hole is made in any hollow bone shaft some kind of musical note could be produced. Here an attempt has been made to identify those pieces which were deliberately modified with the intention of producing whistles. As Table 5:3 shows, three pieces which have been assigned to this category are perforated reindeer phalanges. This is a type which is quite frequently found in the European Upper Palaeolithic and interpreted as a whistle, for example at La Madeleine (Dordogne), Petersfels in Southern Germany and Pekárna in Czechoslovakia (Megaw 1960,6; Harrison 1978,7). The other three objects considered here are perforated pieces of rib or limb bone: one of these, Goyet 132, has been worked with particular care. Parallels for such pieces

exist in the Aurignacian at Isturitz (Pyrénées-Atlantiques) and Istállóskö in Hungary, and in the Gravettian at Pekárna in Czechoslovakia (Megaw 1960,7-8). Ethnographic parallels for both sorts of whistles may be found in the literature describing North American Indians (Sollas 1915,458; Kluckhohn et al. 1971,361). In these areas, whistles fulfilled a number of functions; they were used when hunting, for ceremonial purposes and in healing the sick.

Table 5:3
Number and Distribution of "Whistles"

Site Name	Reindeer Phalange	Rib	Limb Bone	Total
Maisières	2	-	-	2
Goyet	1	-	1	2
Chaleux	-	-	1	1
Verlaine	-	1	-	1
Total	3	1	2	6

When traces of manufacture were looked for on these artifacts, it became clear that the only piece with any surviving signs of débitage was Goyet 132, which bore traces of the removal of the articular ends by sawing. On the whole, few traces of working could be seen on the pieces made from reindeer phalanges, but probably all that was required to turn a phalange into a whistle was a perforation. However, various traces of modification were identified on the other pieces, including a possibly decorative series of transverse incisions on Verlaine 13.

Of the reindeer phalanges, only Goyet 127 was clearly deliberately perforated; it had two holes, one in each surface at the distal end. One of the phalanges from Maisières was transversely broken, although it may once have been perforated through one surface in the same manner as the other phalange from Maisières. Verlaine 13 and Chaleux 90 each had one seemingly artificial perforation in one surface, but Goyet 132 had two perforations, one on one surface at one end and a second in the middle of

the other surface. This piece is clearly rather more complicated than the other 'whistles'.

I could produce a sound from all the 'whistles' with the exception of the two from Maisières, however, de Heinzelin (1973,36) clearly succeeded in making those particular examples work, and has claimed that they reproduced the calls of particular birds and so could have been used as lures. This will be discussed below, as well as other possible 'whistle' functions for these pieces, such as toys or signalling devices

It was concluded that the present chronological and geographical distribution of these artifacts is unlikely to reflect the full original distribution of Upper Palaeolithic whistles. This is because in the majority of cases, such pieces are likely to be just perforated bone fragments, which have received the minimum of modification, like Chaleux 90, and so, they may have been overlooked in many cases.

Manufacture

(i) Débitage

No stage of blank extraction was needed for the pieces made from whole reindeer phalanges. As the other "whistles", with the exception of Goyet 132, have been broken at both ends, it is impossible to tell if any form of débitage took place. On Goyet 132, it can be seen that the articular ends have been very neatly sawn off, leaving longitudinal striations and tiny facets on the remaining edges (fig.5:8).

(ii) Modification

No traces of modification could be recognised on Maisières 44, though it is possible that there were some striations on Maisières 45, which were associated with working. However, some traces could certainly be seen on the third piece made from a reindeer phalange, that is Goyet 127; these traces consisted of various striations and a few oblique incisions on one surface, but there were no organised signs of modification. It is probable

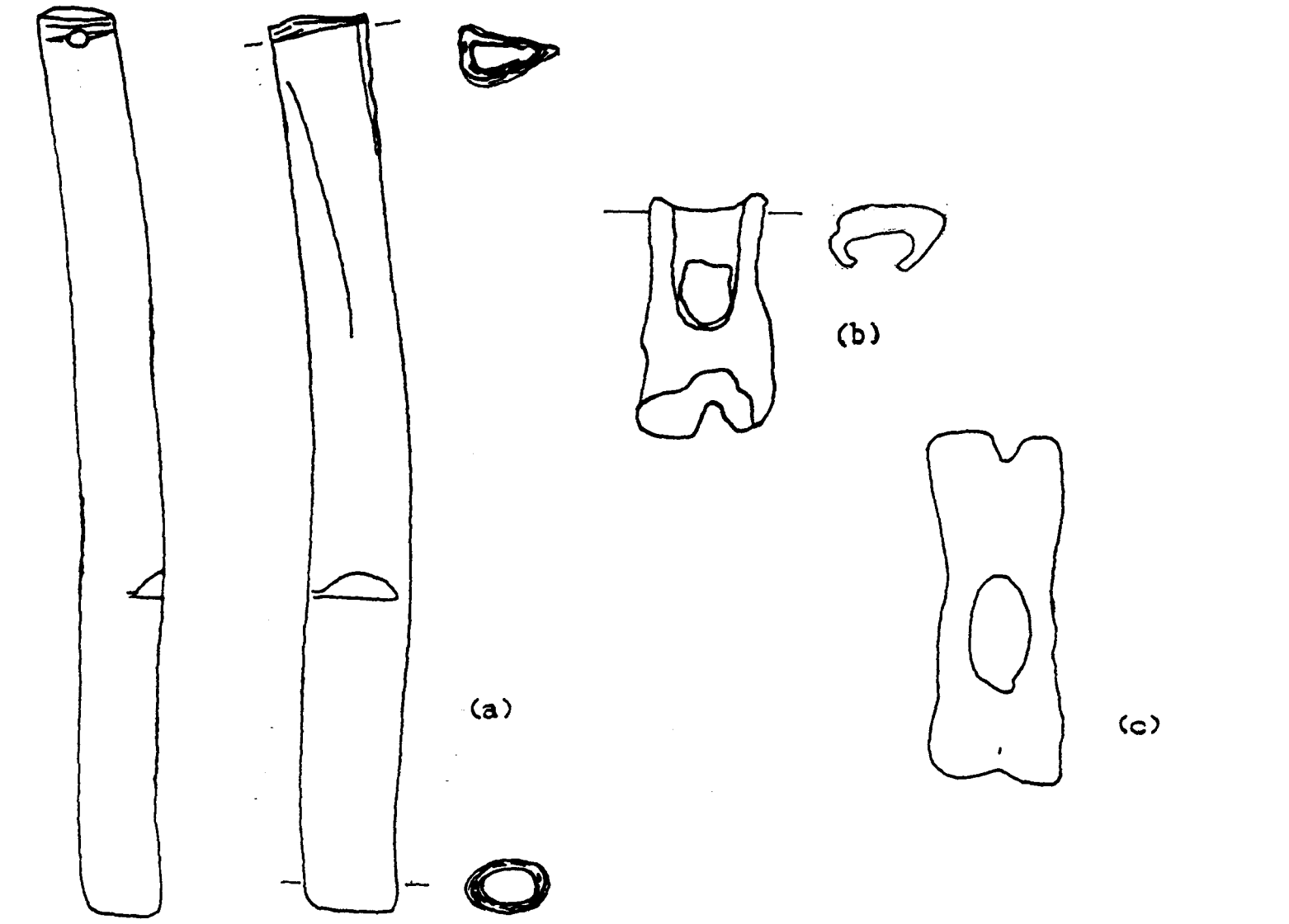


Fig. 5:8 "Whistles": (a) Goyet 132 (b) Maisières 45 (c) Maisières 44 (d) Goyet 127 (e) Chaleux 90 (f) Verlaine 13

that little modification was necessary for these pieces and that the perforation was all that was required to turn them into whistles (fig.5:8).

Only a few tiny, longitudinal striations may be seen on Chaleux 90. However, various striations may be seen on Verlaine 13, including some tiny, longitudinal striations clearly made with a stone tool around the perforation. A series of tiny, transverse incisions are located along part of one edge; they seem likely to have been purely decorative (fig.5:8).

Unlike the two perforated bone fragments described above, Goyet 132 is remarkable for the obvious care with which it was made and also because it was clearly intended to be a "whistle" of a more advanced form. It is beautifully worked and polished all over, probably as a part of its manufacture. The surfaces are covered with fine, often grouped, longitudinal and oblique striations, associated in one area with longitudinal facetting and chattermarks, which indicate that Goyet 132 was worked by scraping.

The perforation on Maisières 44 is an uneven-looking, oval hole, located in the middle of one surface, with no traces of working by cutting, scraping or drilling, which suggests that it was produced by percussion. Maisières 45 is broken transversely across the shaft, and it can be seen that on one surface a little segment of bone has been broken off but held in place by sediment (fig.5:8). De Heinzelin has suggested that it was originally stuck there deliberately with some form of resin glue (1973,36). However, it is equally probable that the bone was naturally broken and the little fragment of bone was held in place fortuitously; this view is supported by the absence of traces of working. By contrast, Goyet 127 has clearly been perforated through both surfaces at the distal end by a combination of scraping and drilling , judging from the profile of the perforations. Both holes are subcircular.

Chaleux 90 has an oval perforation, which has been made through one surface probably by drilling, given the nature of its profile. The perforation on Verlaine 13 is irregular in shape, having probably been punched through one surface, but the traces of scraping around the hole, described above, suggest that it is indeed man-made, and not some trick of subsequent damage.

Goyet 132 has been perforated twice; one perforation is located at one end of one surface, while the other one is located in the middle of the other surface. The first perforation is small, regular and circular and made by drilling; it resembles the hole in the back of a modern recorder below the mouthpiece. This perforation lies between two deep incisions, of which the upper one is transverse and the lower one is oblique. On the other surface, a semi-circular perforation has been cut approximately 6.4cm further down the shaft. This piece may be that found by and referred to by Dupont as "un sifflet d'os" (1872,115). However, it is difficult to be sure that this piece is genuine, as it is so sophisticated compared with the simple pieces made from antler phalanges, although 'flutes' as well as simple 'whistles' have been recognised in the European Upper Palaeolithic, for example at Isturitz (Pyrénées-Atlantiques) (Megaw, Pl II,5,7).

Function

(i) Traces of Use

No traces of use were identified, although all of these pieces, with the exception of Goyet 132, were either cracked, chipped or broken.

(ii)Use

Upper Palaeolithic perforated reindeer phalanges are generally believed to have been used as whistles, although Harrison (1978,9-13) has shown that some examples have in fact been naturally produced, with the hole being located in the weakest point of the bone. This does not mean

that such pieces were not used as whistles, though, it does indicate that they were not deliberately produced as such and thus would not properly belong in this group.

Of the examples considered here of perforated reindeer phalanges, Goyet 127 has clearly been deliberately double perforated, so that whether it was a whistle or not, it could still have been worn as a pendant. I certainly could get some sound out of it, which was not the case for the two pieces from Maisières, for which there also seemed to be no evidence to prove that they had actually been worked. However, de Heinzelin who led the excavation of this site by the Institute of Natural Sciences claims (1973,36) that the perforation on Maisières 44 is not just a simple hole, but that it had been tidied or modified ("ajusté"). Apparently, this piece can be made to produce the sound of the call of a merlin or peregrine falcon, which has been identified by an ornithologist. Similarly, Maisières 45 was made to produce the sound of a curlew, which it was suggested could have been used as a decoy. So it seems that these pieces do work as whistles and may indeed have been used as lures, but there is still no evidence to prove that they were deliberately produced. One important point that should be made is that with such a simple device a whole range of notes and pitches may be produced rather than one specific sound, which could be said to resemble only one bird call.

I succeeded in producing a sound from Chaleux 90; although it does not look like a formally produced piece, it does have a worked shaft and an artificial perforation, so it is a good candidate for this group. The fact that Verlaine 13 has received a reasonable amount of modification, including that around the perforation, suggests that the perforation itself is artificial, in spite of having been produced by percussion. At present, one end of the piece is closed by a combination of cancellous tissue and sediment, so it does not make a very good whistle.

Goyet 132 is a unique object among the collections studied here, in that it is a carefully designed and produced wind instrument.

Even if it is presumed that all these pieces were designed to produce at least one musical note when blown, it still is not clear what their specific function was. They may have been intended purely as musical instruments designed to produce a sound for pleasure. Along the same lines, they may also have been children's toys. However, they could have functioned as signalling devices for hunters, in order to enable them to communicate easily with each other without frightening their quarry, or as an extension of this, they could actually have been used as lures to attract unwary birds or animals.

Variation and Distribution

There is much variation in the size and shapes of these artifacts, which is hardly surprising as the only feature that they share is that they are perforated.

As regards geographical and chronological variation, these pieces are not good indicators. It seems only too likely that many other potential whistles, consisting of perforated bone fragments still lie unrecognised among both archaeological and faunal collections, for few of these pieces are likely to be as elaborately worked as Goyet 132 and so may be easily overlooked. Therefore, there is, no doubt, little significance in the distribution outlined below.

All these "whistles" come from a small number of Belgian sites. The two pieces from Maisières come from a single period settlement, which is attributed to the Maisièrian or to the Gravettian. Chaleux 90 and Verlaine 13 both come from Magdalenian sites, but the attribution of the examples from the complex multiperiod "troisième caverne" at Goyet is very difficult. Goyet 127 is labelled 'premier niveau' which is thought to be associated with the Later Upper Palaeolithic, whereas Goyet 132 is marked

'deuxième niveau' which might suggest an Earlier Upper Palaeolithic date. However, even if one presumes that these pieces were correctly attributed, it is clear that each 'niveau' or layer contained occupations from more than one period.

Garrod (1926,47) refers to the existence of a leg bone of hare with multiple perforations which was found at Kent's Cavern, but it appears that the perforations are more likely to have been of chemical than human origin.

Spatulae

These are dagger-like implements made from limb bones, which have a broad proximal end and a narrow, sometimes bevelled distal end with a number of protrusions on each side of the shaft (fig.5:9). Only three examples of this type have been recognised in the region of this study and they were all found in Paviland Cave (Sollas 1913,37). There is some doubt about the age of these implements owing to their resemblance to more recent artifacts such as the well known and ubiquitous 'apple-corer' (see MacGregor 1985,180), although parallels have also been drawn by the Abbé Breuil with similar pieces from the French Magdalenian (Sollas 1913,37). In an attempt to prove finally whether or not these unusual artifacts do belong to the Upper Palaeolithic, I have arranged for a sample taken from Paviland 1 to be submitted for radiocarbon accelerator dating in Oxford, and it would clearly be wise to withhold further comment until the result is available.

Manufacture

(i) Débitage

The shape of these pieces suggests that they were made by splitting the bone in two longitudinally by sawing, because the outer surface is

purely composed of cortical material, while cancellous tissue may be seen on the inner surface. One articular end would have been removed either before or after this process was carried out: as a result of my experimental replication of this technique, I would suggest that it would be easier to split the bone after the removal of one articular end, either by percussion or by sawing to avoid cracking and, thus, weakening the bone.

(ii) Modification

These pieces were clearly worked by scraping, as the edges of the shaft have been sculpted, so as to form paired protrusions on either side of the shaft (fig.5:9). Some signs of modification may be seen on the sides in the form of facetting and, in the case of Paviland 1, of very regular longitudinal striations. However, few traces of working are preserved on these artifacts, which are smooth with some longitudinal facetting but few striations visible. On the two spatulae with surviving tips, clear traces of scraping could be seen; the lower surface of the tip of Paviland 3 showed facetting and some curving striations, while the tip of Paviland 1 has been made double-bevelled leaving a variety of longitudinal, oblique and transverse striations.

Function

(i) Traces of Use

All of these spatulae have suffered midshaft breaks, which have been (recently) mended in the case of Paviland 1, but not for the other two pieces, which now consist of only one distal portion and one proximal portion; they do not fit together. The two surviving tips, belonging to Paviland 1 and 3, are chipped: this damage could have resulted from use.

(ii) Use

If for the purposes of this paragraph we assume these pieces to be of Upper Palaeolithic age, it seems unlikely that they were used as 'marrow

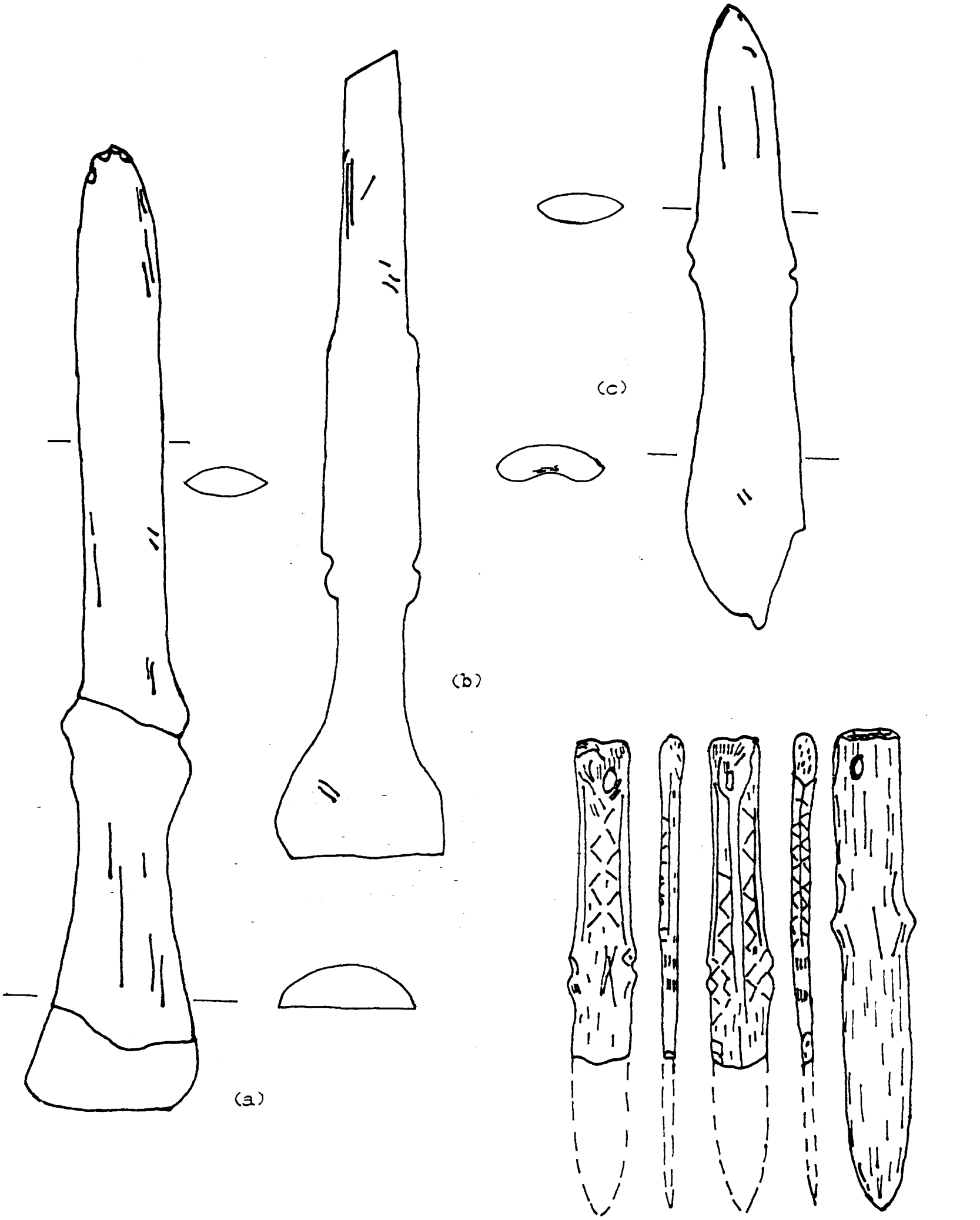


Fig. 5:9 Spatulae: (a) Paviland 1 (b) Paviland 2 (c) Paviland 3 (d) spatulae from Laugerie-Haute, after Müller-Karpe (1966,T84,6 and 7) Scale for (d) is 1:2

scoops', as they were named by Sollas (1913,37), for their shape is not designed to contain anything, unlike the 'apple-corers' described by MacGregor (1985,180). These spatulae could have been toys, though their design recalls metal daggers rather than any known British or Belgian Upper Palaeolithic artifact of which one would expect such a toy to be some form of copy. They could have been used as eating or cooking utensils, which would be highly preferable to stone implements which could easily chip leaving tiny, sharp splinters in the food, but this is mere speculation.

Variation and Distribution

These three artifacts are very similar in size and shape, and as they are such an unusual type, it is probable that they were all made at the same time. Similar-shaped bone tools are known from the Neolithic right up to the earlier part of this century and are thought to have been used to core apples and test cheeses (see MacGregor 1985,180); however, in contrast to the Paviland spatulae, most of such pieces do include a complete articular end and, at least for part of its length, the full circumference of the shaft. The Abbé Breuil (see Sollas 1913,37) indicated that the shape of these spatulae resembled Magdalenian examples from Laugerie-Haute (Dordogne) (Breuil 1912,200,Plate 25:4); these same pieces are also figured by Müller-Karpe (1966,T84,Nos.6 and 7). The French spatulae (fig.5:9) are very similar in size and in shape to the Paviland examples in that they have one or two paired protrusions on the sides and a rounded tip. The proximal end does not flare out in the same way as it does in the case of Paviland 1 and 2, and this end is perforated on the French pieces but not on those from Paviland. Another difference is that decorative incisions have been made on the French pieces, which are particularly elaborate on one example. The likeness between the Paviland spatulae and those from Laugerie-Haute is much closer than the comparison

with more recent spatulae. It is to be hoped that the problem of whether or not these artifacts from Paviland are Upper Palaeolithic will be resolved by radiocarbon accelerator dating.

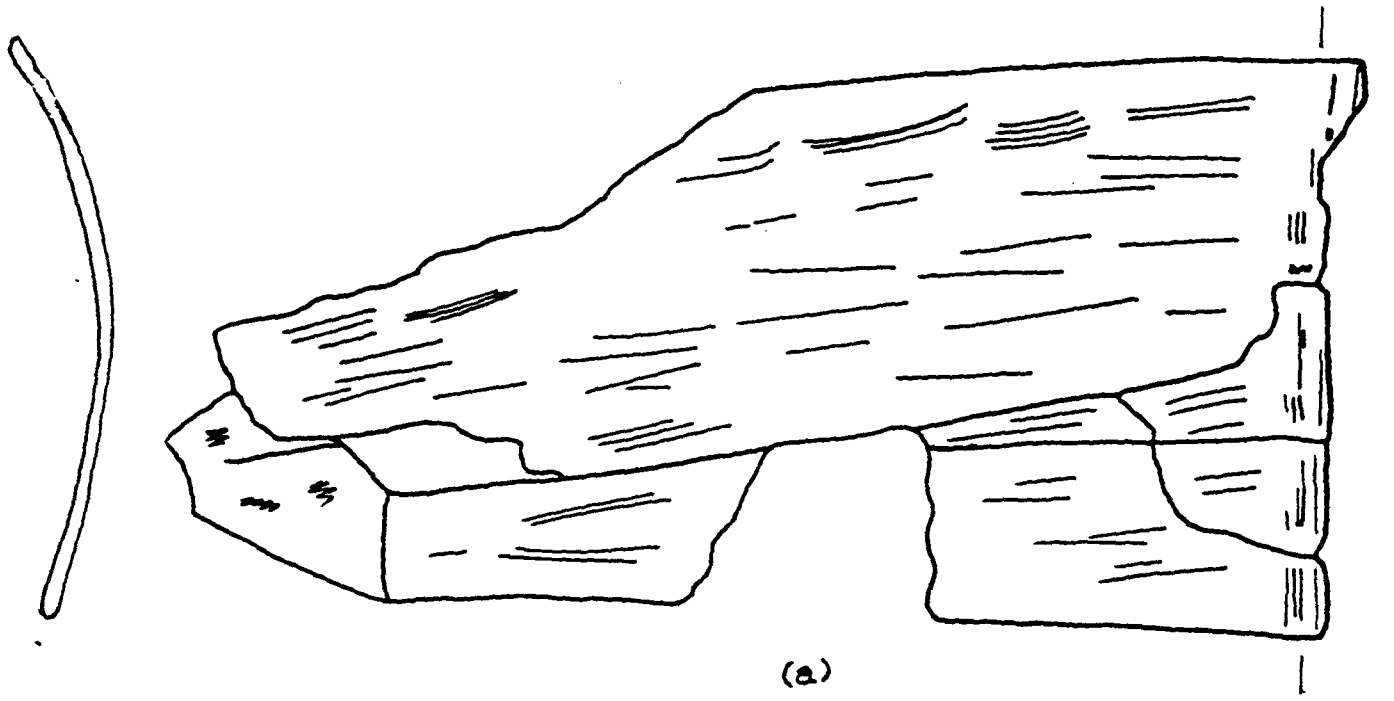
Miscellaneous:4

Maisières 7 and 31

These are very thin pieces of worked ivory (fig.5:10), which are curved in cross-section. The remaining traces of manufacture suggest that they have been sawn off transversely at one end, and then their surfaces were modified by scraping. They are highly polished, but by what process is unknown. The nature of their function is also enigmatic. It was suggested by de Heinzelin that they represented the edges of containers,

> "des bords de récipient, l'un d'un diamètre original de 11-12cm, l'autre d'un diamètre intérieur-extérieur de 2 et 3cm" (1971,71).

Their appearance certainly suggests as much, but it is not clear what the rest of the container would look like, and this problem is discussed below. The possibility that these were just pieces of raw material, which had yet to be divided into smaller blanks is also considered, in which case, the curvature of these pieces would be a natural effect of having been cut out from a tusk. These pieces constitute two out of the possible three examples of this type among the collections studied here (see Chapter 6: Incised Pieces), although parallels may be found in the Eastern Gravettian, for example at Dolní Věstonice in Czechoslovakia (Klima 1963,407,Tab65,884).



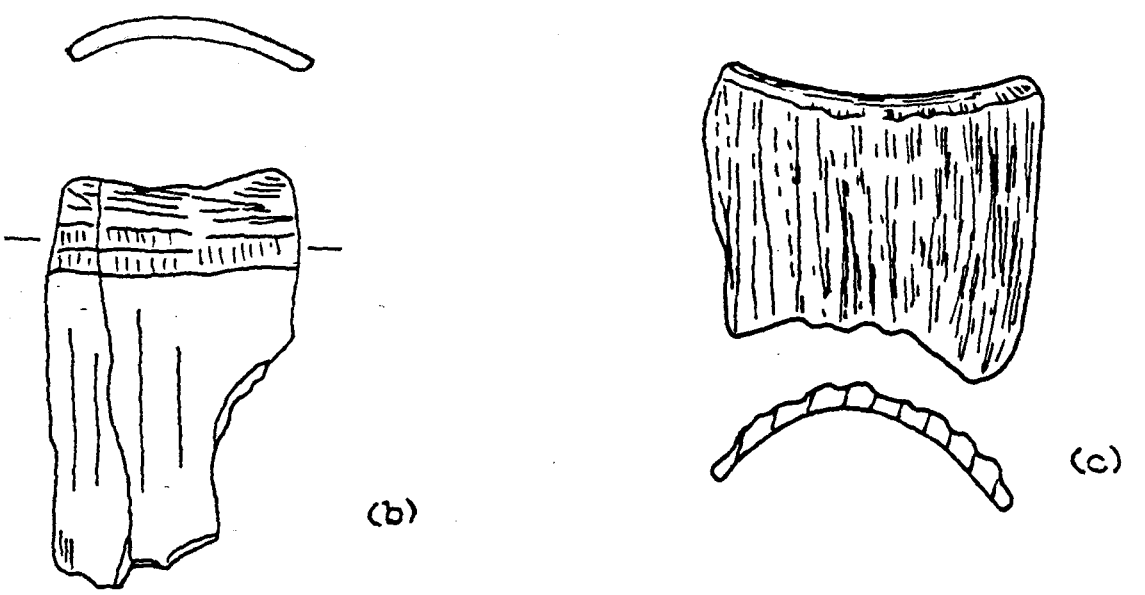


Fig. 5:10 Miscellaneous Artifacts: (a) Maisières 7 (b) Maisières 31 (c)* after Klima (1963,407,TAB 65:884)

* Dolní Věstonice

Manufacture

(i) Débitage

Each specimen has clearly been sawn off transversely at one end. On Maisières 7, lots of transverse incisions may be seen running parallel to the sawn edge; some facetting may be seen on the edge itself. Maisières 31 had clearly been whittled down from the upper surface by longitudinal scraping and then by sawing transversely. These traces of working are very well preserved.

(ii) Modification

No traces of working could be seen on the lower surface of Maisières 7; however, its upper surface is covered with longitudinal and oblique striations and chattermarks. Some of these striations are hooked at one end, which indicates that the surface was vigorously scraped with a stone tool. The surfaces of this object were polished, though by what process is unknown, because the rough scraping documented by the traces on its surfaces would be most unlikely to lead to such a smooth finish, while deliberate polishing after scraping would probably have to a certain extent obliterated such traces.

Some longitudinal striations could be seen on the lower surface of Maisières 31, whereas on the upper surface, apart from the traces associated with the sawn end, only a few longitudinal and oblique striations were preserved. Most of the upper surface was composed of large, natural corrugations.

Function

(i) Traces of Use

No traces of use could be distinguished on either of these pieces.

(ii) Use

Both of these specimens have been very carefully worked, which suggests that they may have been finished artifacts, though it is possible

that they were intended to be cut up into blanks, perhaps for the manufacture of tiny points, such as Maisières 32 (see Chapter 4: Spindle-shaped Points).

De Heinzelin's suggestion that these were parts of containers is a very attractive one given the curved section and the clear 'rim' of these pieces. However, it is not clear to me, and it is not explained by de Heinzelin, how they were made. Containers could be made from hollowed-out 'horns' of ivory, but in that case I would expect them to be both thicker and to show traces of hollowing-out on their inner surfaces, which these pieces do not. It is possible that various strips of ivory may have been cut out, perforated and tied together in the manner described for Eskimo armour and illustrated by Giddings (1967,159,Fig.58), however, no traces of such a process have survived on the fragments considered here. Without having carried out any replicative experiments in ivory-working, I would hesitate to suggest to what type of artifact(s) these fragments belonged. It is that sort of research and further archaeological evidence which will solve this problem.

A third piece of ivory from Maisières, number 8, which bears an incised lozenge design on its upper surface (see Chapter 6: Incised Pieces), is also thin and curved in section, which suggests that it too may have shared the same function as the two pieces considered here.

Within the region of this study, such pieces have only been recognised at the Upper Perigordian/Maisièrian site of Maisières Canal. Otte has indicated the existence of parallels on other European Upper Palaeolithic sites including the Eastern Gravettian site of Dolní Věstonice (in Haesaerts and de Heinzelin 1979,72). The example from that site which is illustrated by Klima (1963,407,Tab65,884) appears to be very similar to the pieces described here (fig.5:10), but is unfortunately only a fragment.

This concludes the discussion of the hand-held implements, which will be followed in the next chapter by a consideration of the decorative objects.