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# Mesolithic bone tools of South-West Europe: the example of the French site of le Cuzoul de Gramat

Benjamin Marquebielle

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Uniwersytet  
Wrocławski



# Written in Bones

**Studies on technological  
and social contexts  
of past faunal skeletal remains**

edited by  
Justyna Baron  
Bernadeta Kufel-Diakowska

Uniwersytet Wrocławski  
Instytut Archeologii

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# Mesolithic bone tools in Southwestern Europe: the example of the French site of “Le Cuzoul de Gramat”

The Mesolithic osseous material industry of southwestern Europe seems to be less developed than in northern Europe, where Mesolithic bones tools are plentiful and have been more extensively studied. Only a small number of studies have been realized and no general synthesis exists at present. Is this because the Mesolithic populations had virtually no osseous material industry or did the remains simply suffer from poor preservation conditions? This paper advances some arguments in favour of the second hypothesis by presenting the results of a technological study of the osseous material industry at the French site of “Le Cuzoul de Gramat”, situated in the Lot region. This deposit is famous for its substantial stratigraphy that is dated to the recent phases of the Mesolithic. Faunal remains, and thus the osseous material industry, are well preserved in the limestone environment. We identified several technical transformation schemes and provide evidence of real choices in the selection of raw materials and their exploitation. It is quite a new image of the Mesolithic osseous material industry that begins to appear.

**Keywords:** axe, Le Cuzoul de Gramat, deer antler, Mesolithic, technological analysis, wild boar canine

## Introduction

Surrounded by Azilian cultures and their harpoons and Neolithic cultures and their awls, the Mesolithic cultures of southern France seem to have developed only a small-scale osseous material industry. While there are a large number of Mesolithic sites, these deposits often consist of open-air sites or are situated in environments unfavourable to the preservation of organic material.

Does this scarcity imply that bone tools were rare during Mesolithic? Or does it simply show that the remains of this exploitation suffered from poor taphonomic conditions? And, in this latter case, is it still possible to reveal the typological, technical and economic peculiarities of the Mesolithic osseous material industry? To try to answer this, we began by

studying a site with good conditions for the preservation of organic remains and a long period of occupation.

The French site of “Le Cuzoul de Gramat” is one of the major sites for understanding the Mesolithic in southern France. It was first excavated between 1922 and 1933 by R. Lacam and A. Niederlender, who published a very good study (Lacam *et al.* 1944). Their work helped develop the first cultural and chronological definitions of the French Mesolithic. However, R. Lacam and A. Niederlender presented only a small number of bone tools in their publication. They did not see, or did not pay attention to the significant amount of debitage waste. Nowadays, with the development of technological studies, these

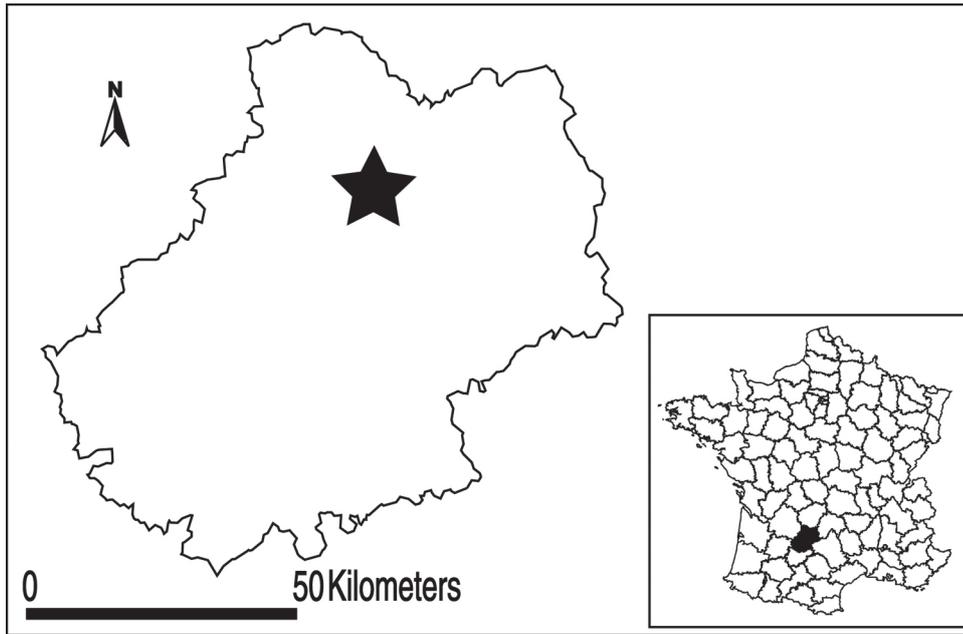


Fig. 1: localisation of Le Cuzoul de Gramat. DAO : A. Marquebielle

remains appear to be rich in information concerning the modalities of exploitation of osseous raw materials, often even richer than the finished objects. In 2005, N. Valdeyron, of the University of Toulouse, began new excavations and allowed us to study the

osseous material industry of the ancient collections (Marquebielle 2007), by applying a technological approach, such as that defined in particular by A. Averbouh (Averbouh 2000; Averbouh, Provenzano 1999).

## The site and stratigraphy of “Le Cuzoul de Gramat”

Le Cuzoul de Gramat consists of a rock-shelter and a cave located in the Lot region of France (Fig. 1). It is situated at the bottom of a vast depression (doline) in a karstic region. It is famous for its substantial stratigraphy – covering the entire Mesolithic period (providing information especially about the recent phases) – and for a Mesolithic burial. R. Lacam and

A. Niederlender defined seven stratigraphic levels (Fig. 2). Adhering to the Mesolithic partition of the time (Coulonges 1935), they attributed the oldest level to the Sauveterrian period, the five following to the Tardenoisian period and the most recent to the Neolithic. At present, the term “*Tardenoisian*” is no longer used for the Mesolithic of southern France

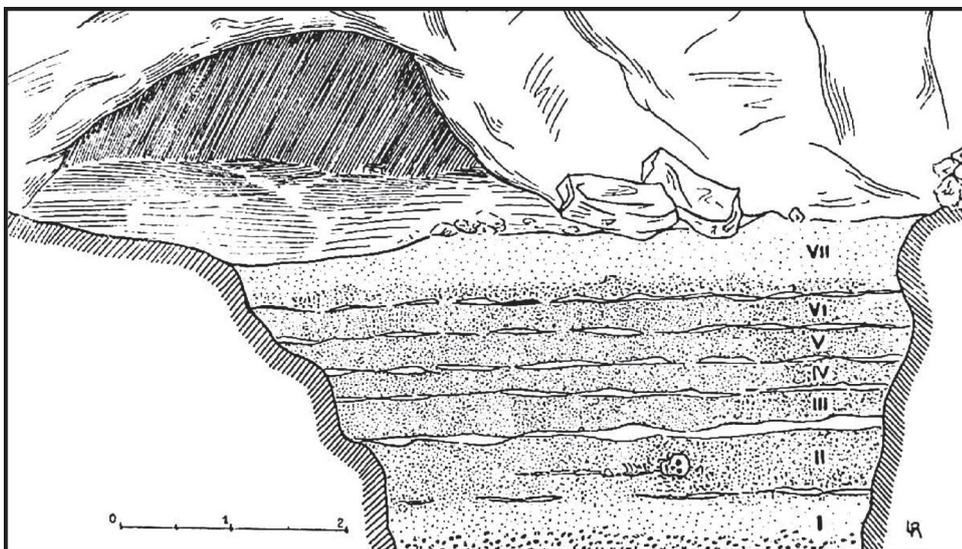


Fig. 2: stratigraphic section made by R. Lacam et A. Niederlender. Skeleton is represented in level II

but it is necessary to understand it here in the sense of the “second Mesolithic”.

We know now that levels 1 and 7, as defined by R. Lacam and A. Niederlender (the oldest and the most recent respectively, the numbering of levels being inverted in the publication), are not homogeneous. Level I, the oldest, is a mixture of early Mesolithic levels and earlier levels (such as the Azilian). Level VII, the most recent, is a mixture of levels dated to the Neolithic, the Bronze Age and historic peri-

ods. The “Tardenoisian” levels, as R. Lacam and A. Niederlender called them, on the other hand, are well dated to the second Mesolithic thanks to the lithic industry. We consequently studied the osseous material industry of these levels, considering the five levels as one because firstly, the distinction between Tardenoisian I and II is now obsolete and secondly, the stratigraphic origin of numerous remains is not clear (many are simply marked “Tardenoisien”, for example).

## Studying an old collection

We studied a collection from ancient excavations, and while the work of R. Lacam and A. Niederlender was very good, their research objectives, and thus their methods of excavation and preservation, were very different from those employed today. Firstly, remains were selected during the excavation (we found lithic artefacts, bone tools and faunal remains in their back dirt). While some characteristic lithic objects could be identified as belonging to the Mesolithic, it is often more difficult, or even impossible, to do the same with osseous remains, whether they were worked on or not. Secondly, since the end

of the ancient excavations, the state of the collection has evolved. A significant portion of the bone tools have disappeared (we found only 26 bevelled objects while R. Lacam and A. Niederlender spoke of 42 objects) or the distribution of the remains per level is different from that described in the publication. The evolution of the collection of the antler objects is the most difficult to appraise because in the publication there is no precise account of these types of remains. We thus worked on only a sample of the osseous material industry found on the site and all our conclusions must therefore be moderated.

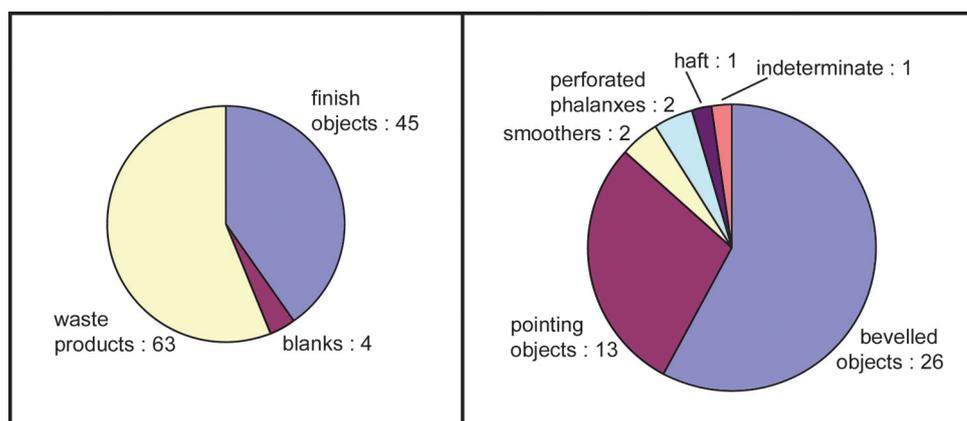
## The remains

### General remarks

When A. Lacam and R. Niederlender published the results of their excavations, they presented mainly finished objects and mentioned some antlers presenting marks of sawing. In reality, the number of the debitage waste products is greater than the number of finished objects, representing 56% of the remains (Fig. 3). A massive bevelled object, which they identified as an axe or a pick, is the most studied tool (Fig. 4). Objects shaped with the canine teeth

of wild boars are also well described. They called these “*tranchet de cordonnier*”, in reference to a tool used by shoemakers to cut leather. By considering the morphology of their active part, we deliberately chose to group together these two types of objects in the same category as the bevelled objects. This category contains the greatest number of objects (26 artefacts) (Fig. 3). Perforating objects are well represented with 13 objects and the other finished objects are represented by only 1 or 2 examples (perforated objects, handles, smoothers and one indeter-

Fig. 3: items repartition by category of products and finished objects repartition by types



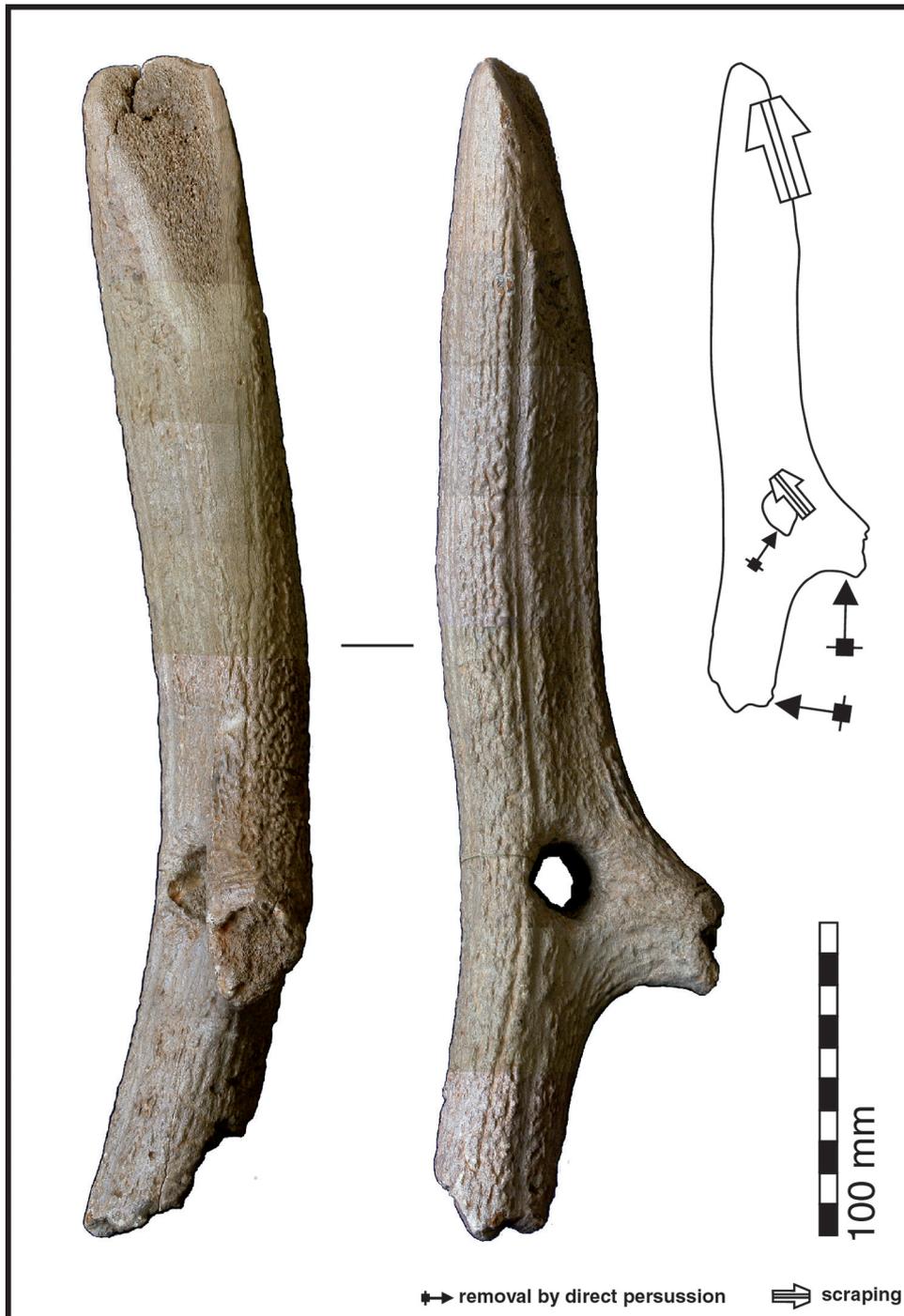


Fig. 4: the “axe” of Le Cuzoul de Gramat

minate object with a double perforation). Blanks are represented by only 4 remains, most on deer antler. The debitage waste products represent the greatest number of objects, with 63 remains. They are almost all on antlers, except 2 waste products on wild boar canines.

The state of preservation of the remains is relatively good but varies depending on the raw material. Bone and dentine remains are the best preserved. The antler objects present various states of preservation: the un-worked surfaces are often powdery but the technical traces are readable.

### Finished objects

The bevelled objects constitute the majority of the finished objects. Only 7 of these are made with deer antler and most are shaped on antler segments. The biggest object, which measures 367 mm long and 48 mm wide in its mesial part is made on the lower beam (Fig. 4). The distal part forms a simple bevel and the proximal part has a circular perforation, which is linked with its hafting: there is only one object of this type in the collection. R. Lacam and A. Niederlender identified it as an axe to work

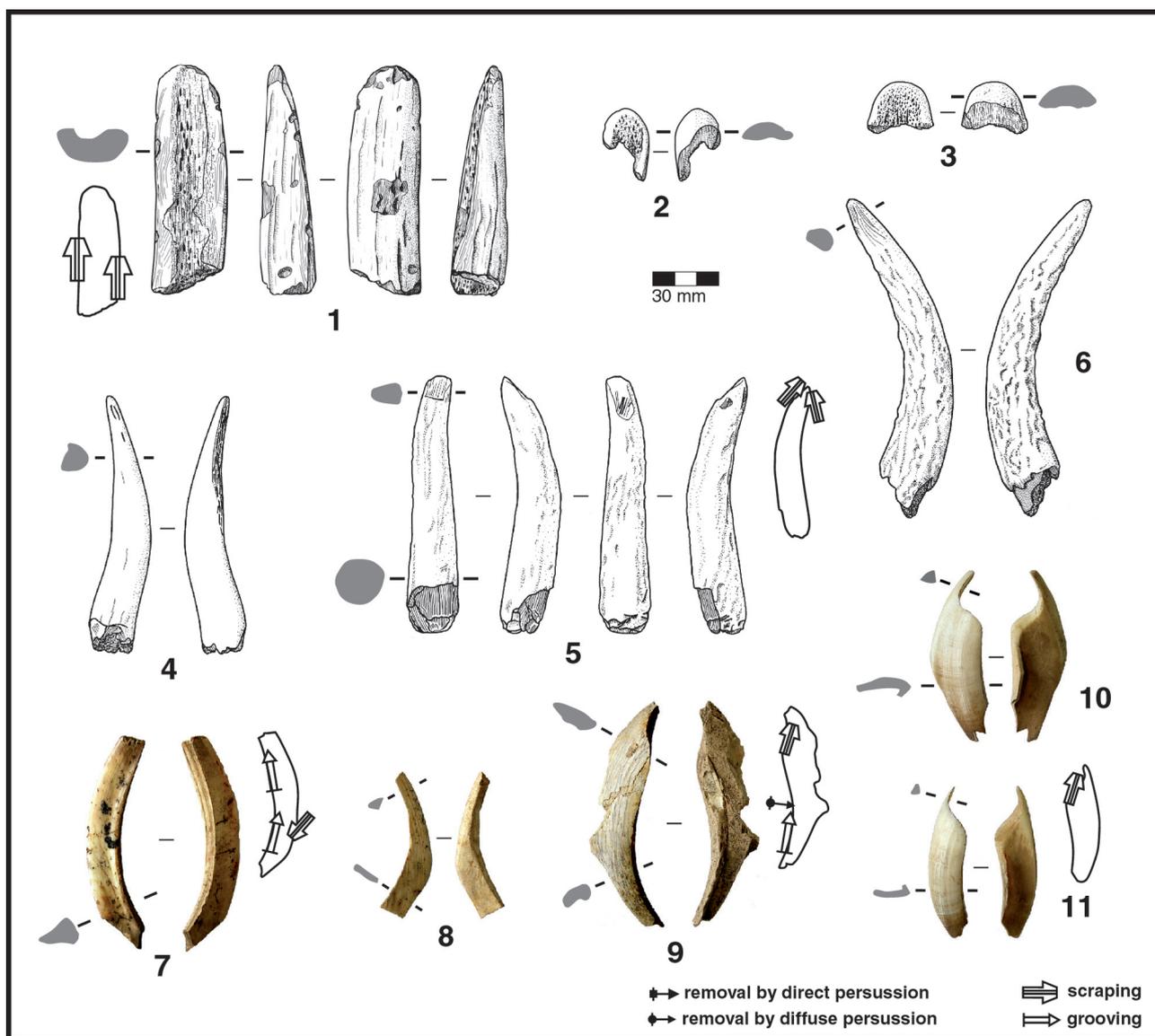


Fig. 5: bevelled objects (n° 1, 4, 5, 6: from antler segments; n° 2, 3: from antler flat blanks; n° 7: lateral convex bevel object on canines of wild boars; n° 8: lateral concave bevel object on canine of wild boars; n° 9-11: "tranchet de cordonnier" of R. Lacam et A. Niederlender or distal concave bevel object on canines of wild boars)

wood or a hoe to dig the ground. It is reminiscent of the northern Mesolithic axes and particularly some mattocks (Smith 1989): it presents the same morphology and similar use-wear traces. These use-wear traces correspond more to working the ground than to working with wood. The striations of shaping are still visible and the surface of the bevel is only slightly polished, while working with wood (cutting or barking) tends to highly polish the surface of the bevel and to erase the traces of shaping. These types of massive bevelled objects, often too quickly qualified as axes based on a simple morphological comparison, are well known in northern Europe but are much rarer in the south. In France, there are only a few examples at the sites of Le Poeymaü (Laplace-

Jauretche 1953), Les Balmettes (Monin, Pelletier 2000) and La Vieille-Eglise (Ginestet *et al.* 1984), but they are often fragmentary or complete objects with no perforation.

Four other bevelled objects of smaller dimensions were made on antler tines. One of them (Fig. 5:1) is a fragment of an object shaped on large tine (this object measures 104 mm long and 32 mm wide). This fragment could be the distal part of a bevelled object with morphology similar to Vatte di Zambana's "axe" (Rozoy 1978). Three other objects were made from the extremity of a tine (Fig. 5:4-6). Of close dimensions, they measure on average 130 mm long; the active part is a simple bevel for two objects and a double bevel for one. These objects are morpho-

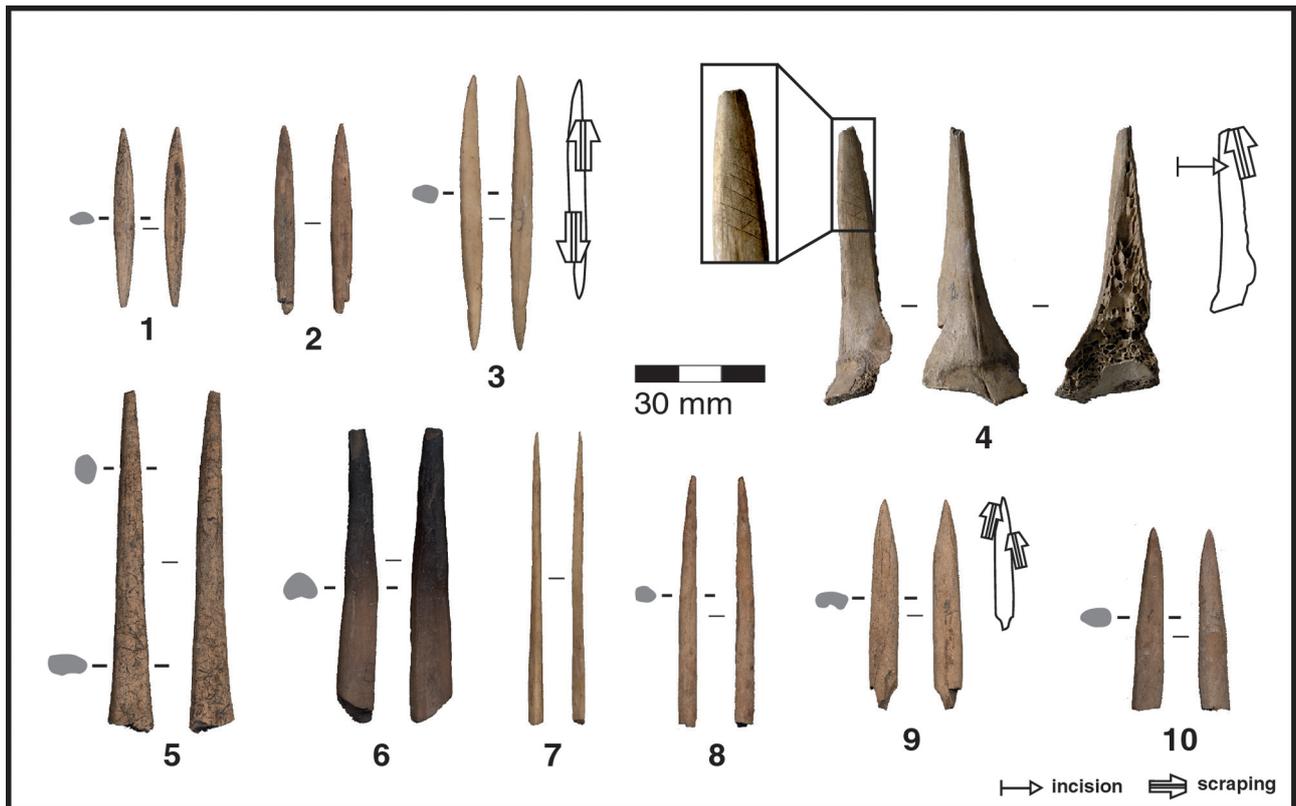


Fig. 6: perforating objects all made with bone (n° 1-3: straight elements with double points; n° 4: decorated awl and detail; n° 5-10: fragments of awls)

logically similar to wedges and chisels made on whole tines, which are well known during the Neolithic (Camps-Fabrer, Ramseyer 1998).

Only two bevelled objects could have been realized on a flat blank, and they are fragmentary (Fig. 5:2-3). They are two distal parts of small dimensions (31 and 26 mm long). The objects are thin with a plano-convex section and the spongy substance appears on the inferior face. This morphology could suggest a flat blank, such as a baguette, but the modalities of debitage are unclear. In addition their small size, their shaping and use erased the possible traces of debitage and polished the surface. Does this correspond to the debitage of a baguette by extraction, by splitting or a debitage of elongated fragments by percussion? We cannot be certain for the moment.

The great majority of the bevelled objects are made with the canines of wild boars and these objects present various morphologies (19 items). The bevel edge constituting the active part is sometimes concave and localized in distal extremity (Fig. 5:9-11) or concave, convex or straight and localized on one or two sides (Fig. 5:7-8). The dimensions of the items are also variable, between 35 mm for the smallest objects with straight bevels and 96 mm for the biggest objects with a distal bevel (the “*tranchets de cordonnier*” of R. Lacam and A. Nieder-

lender). This type of object is known at other French Mesolithic sites with various names and presumed functions. They are sometimes described as perforating objects (Péquart *et al.* 1937; Rozoy 1978) or as perforating and sharp objects (Barbaza 1989). In a recent study of the Swiss sites of Ogens and Birs-matten, they are presented as burins that were used in the same way as their lithic counterparts, to scrape and groove (David 2000). In numerous publications, they are simply presented as being shaped teeth or tools made with the tusk of wild boars, without any other interpretation, which underlines the perplexity of the authors. Use-wear analysis of Neolithic objects mainly indicates their use in wood working (Maigrot 2001). Some modern hunters-gatherers of Irian Jaya use this type of object to shape the shaft of arrows, or less often to shape daggers made of bone (Chiquet *et al.* 1997). Though it is tempting to apply these hypotheses to our societies of Mesolithic forest hunters-gatherers, the Neolithic and modern tools present some differences. They are made in particular of a whole canine while the Mesolithic tools are shaped on split teeth. Nevertheless, in both cases, the active part sought after is a bevel, as seems to be the case for the Mesolithic objects as well.

The perforating objects, all realized on bone, consist mostly of fragments of awls that are broken at

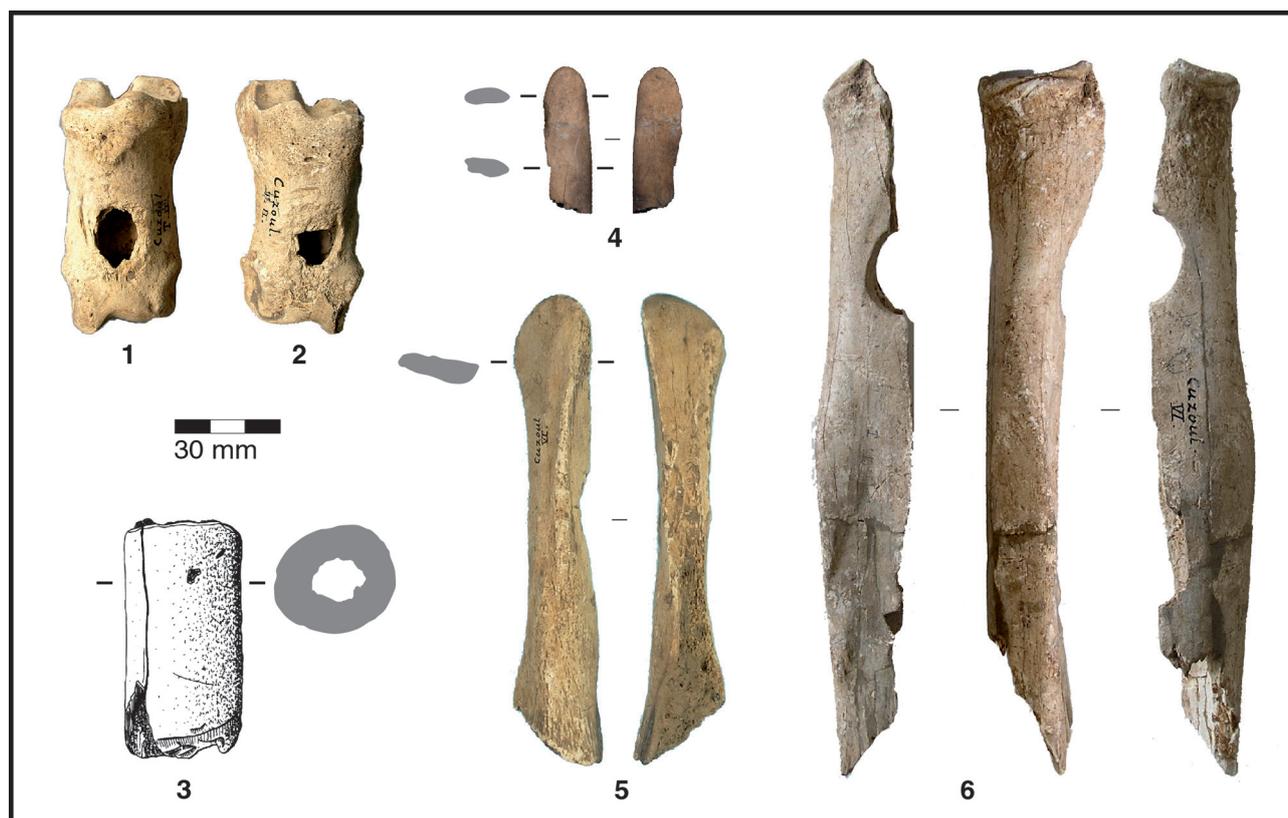


Fig. 7: n° 1, 2: perforated phalanxes; n° 3: possible handle; n° 4, 5: smoothers; n° 6: indeterminate object with double perforation

their proximal extremity and often also in their distal part (Fig. 6:4-10). They measure between 11 and 81 mm and are thin (between 2 and 10 mm wide). Some fragments are very slender, while the others are more massive, though comparisons are difficult because no object is complete. One large unbroken awl is indicated in the publication of 1944 (Lacam *et al.* 1944) as accompanying the skeleton in the grave, but this object is regrettably lost. We have only an indistinct representation that we did not include in our technological study. Another awl, realized on a fragment of a deer vertebra, is the only decorated object of the collection, with a sort of small grid or succession of crosses made by incision (Fig. 6:4). At French sites, a small number of objects with this type of decoration are known, at Rouffignac, Dordogne (Barrière 1973; Rozoy 1978) or in Brittany (Péquart 1934; Péquart *et al.* 1937; Kayser 1988). Three perforating objects are straight elements with double points. They are 42, 44 and 69 mm long, and present a regular oval section. This type of object is frequently identified as being a straight fish-hook. However, the large size of one of the objects and the absence of any arrangement in connection with the fixation of a line other interpretations possible: arrowhead, double awl, etc. (Averbouh, Cleyet-Merle 1995). Unlike awls, the shaping of

the straight elements with double points is very important.

Other types of finished objects are represented by only single examples or by a very small number of items. Two objects could be fragments of smoothers. One is a fragment (53 mm long) of an active part (Fig. 7:4). It is shaped on bone and is highly polished by use. The second object, also made of bone, has larger dimensions (160 mm long). Its distal part is also very worn and polished by use (Fig. 7:5).

Among the objects, we also identified 2 bovid phalanges with a hole on their anterior face (Fig. 7:1-2). Traces of removal by direct percussion with the active cutting part of a tool are visible near the perforation, created by a nicking action. These perforations do not appear to be compatible with an alimentary exploitation of bones: the perforations have a smaller diameter and are relatively regular, and thus seem little poorly to the easy recovery of marrow. The function of these objects remains unknown; they may have been small-sized containers (Rozoy 1978). According to the publication of 1944 (Lacam *et al.* 1944), other objects of this type were discovered but have since disappeared.

One object in the collection could be a handle (Fig. 7:3). It is a deer antler section, 56 mm long, with its spongy tissue hollowed out and a com-

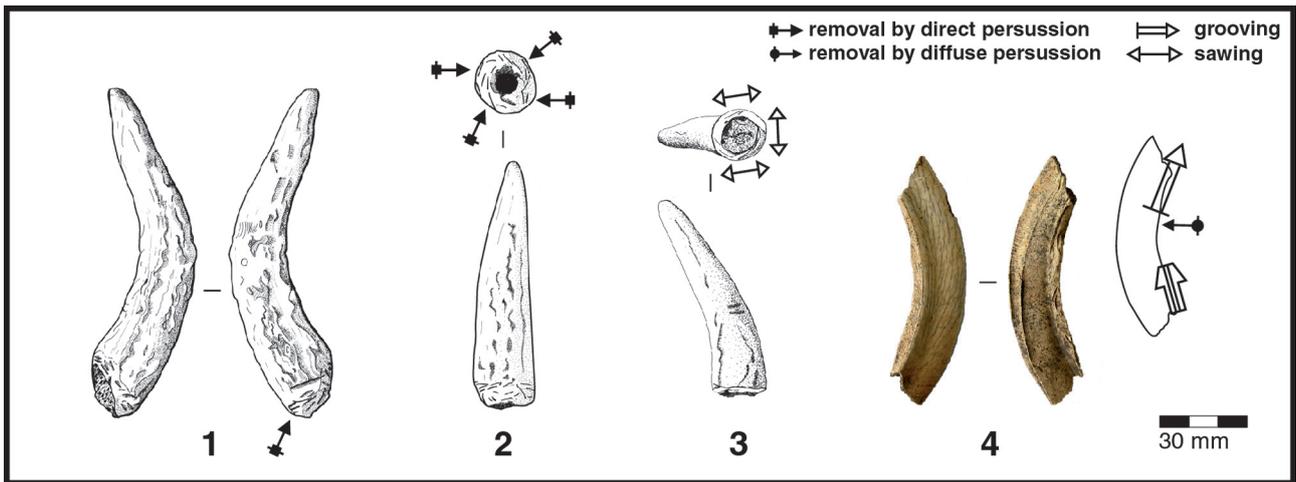


Fig. 8: possible blanks (n° 1-3: end of tines; n° 4: vestibular face of wild boar canine)

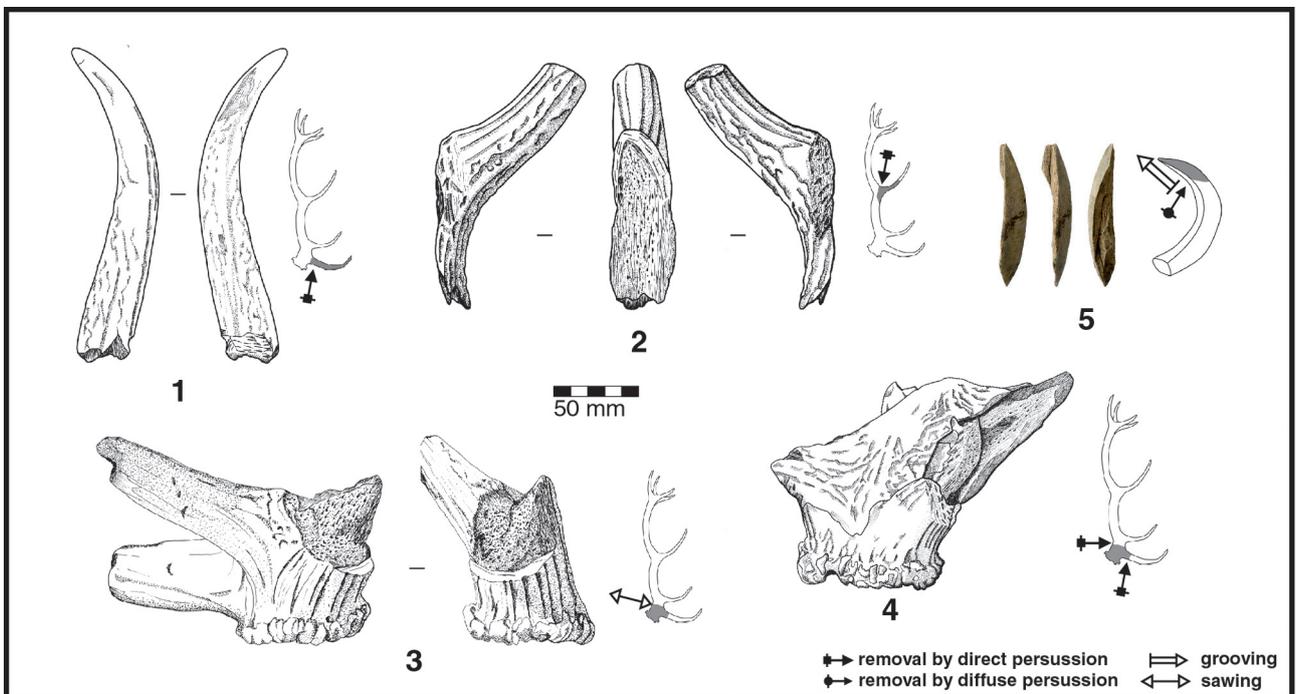


Fig. 9: waste products (n° 1, 2: antler tine; n° 3, 4: antler base; n° 5: fragment of wild boar canine)

pletely smooth surface. However, the bad state of preservation of the spongy part and the former unfortunate restoration damage obscure the technical traces. It is thus difficult to be sure of the deliberate human origin of the disappearance of the spongy tissue.

There is also a large fragmentary object in the collection, realised on bone. It is missing an entire side and also an extremity, thus we have only a vague idea of its general morphology (Fig. 7:6). It is shaped on a whole radius of red deer and presents a bifacial circular perforation with a very regular shape at its extremity. This perforation could be con-

nected with a hafting but we cannot be sure if this object is a handle or an active part intended to be fit to a handle.

### Blanks

We found only four probable blanks. Three tines of deer antler could be blanks, due to very neat debitage marks (Fig. 8:1-3). In addition, one of the pieces has dimensions very similar to the bevelled finished objects on tine. We know our definition of an antler blank is somewhat problematic, however. We rely on clear debitage marks to distinguish blank to waste,

but the finished objects on tine present rather sloppy debitage. Moreover, as discussed below, the production of blanks on tine seem to be secondary. Yet, we consider these three pieces as blanks, while waiting for more information about antler exploitation thanks to recent excavations.

The fourth blank is made with a wild boar tusk (Fig. 8:4). Its morphology and size are similar to that of the finished objects with a lateral concave bevel and they have debitage traces but neither shaping nor use marks. Its status as a blank is more assured than that of the blanks on tine because there are debitage traces and blank regularisation removals made by diffuse percussion after the debitage.

### Waste products

Waste products are the most numerous objects in the assemblage. They are represented by 63 pieces, the majority on deer antler (and only two pieces on wild boar tusk).

The majority of waste results from a transverse exploitation of antler (58 pieces). Ten of them are basal parts, which provide important information about the size and the origin of the antler, along with numerous indications of technical order (Fig. 9:3-4). All these basal parts originate from shed antler. Six basal parts correspond to a large antler size class (with a circumference of more than 170 cm). All these bases are debitage waste products resulting from blank production by sectioning, showing tech-

niques of sawing or removal by direct percussion. Tines represent the majority of the waste products on antler and come from the lower part of the antler (eye, bez and trez tine) (Fig. 9:1-2). As for the waste products on basal parts, they present traces of sawing or removal by direct percussion, though the majority of tines seem to have been cut without any preliminary work – the fracture plans are irregular, with more or less intensive saw teeth marks – (Averbouh, Provenzano 1999). In general, the debitage waste originates from the lower part of the antler (basal part, low beam, base, eye or trez tine) and there is no waste originating from the higher part of the antler (higher beam or palmation).

A very small amount of debitage waste results from a longitudinal exploitation of blocks. Two waste products attest to a splitting of the wild boar canine. One of these remains shows the end of a grooving realised in the longitudinal axis of the tooth, on the distal face (Fig. 9:5). This groove is associated with removals by diffuse percussion, maybe a beginning of shaping, but nothing comparable with the regularization of blank. Neither of these two objects show traces of use. Debitage waste that would indicate a longitudinal exploitation of the antler is much less explicit. Only three pieces, originating from the lower beam, could indicate a splitting or a fracturing by diffuse percussion. These pieces are elongated and flattened sections. Their superior faces correspond to the natural surface of the antler and their lower faces show the spongy substance.

### Raw material

The Mesolithic groups of Cuzoul used antler, bone and dentin to produce their osseous material industry. The antler raw material is represented only by red deer antlers. The size classes are variable, but the large size class dominates. If we consider the ten basal parts of the collection, only two of them originate from small size class antlers. If we consider all the tines, the size and thickness of compact parts also indicate the use of well developed antlers. The basal parts all come from shed antlers. These indicate a harvest and therefore a supply of antlers not directly related to hunting. The surfaces are relatively well preserved. There are no rodent traces. This suggests that the antlers were collected soon after their shedding, at the end of winter or the beginning of spring, as deer lose their antlers around February and March.

Regarding the bone raw material, it is more difficult to define what kinds of bones were used. This is mainly due to the shaping of finished object and the

absence of waste products and blanks. This is particularly true for perforating objects. The only exception is the dorsal vertebra of a deer from which the decorated awl was clearly shaped. The thickness of some other finished objects and traces of the medullary cavity on some of them indicate rather long bones of large species. The identification is clearer for a small number of objects. The largest smoother made from a red deer femur, the indeterminate object with a double perforation on a deer radius, and two bovid phalanges were perforated. All the species identified are present in the faunal assemblage and the bone supply could therefore be related to hunting, but this cannot be stated with certainty due to the small number of identifications and their inaccuracies.

As far as dentine is concerned, raw material was strictly selected. Mesolithic groups used only the lower canine (sometimes called the "tusk") of male wild boars. Most often, the right-side canine was selected. The dimensions of the finished objects in-

dicating the large size of the teeth of well developed adults. The wild boar canines are of triangular section, hollow on the greater part of their length and deeply embedded in the jaw. Yet, the low thickness of some objects indicates they were made using the base of the tooth. This means that the tooth had to be extracted from the mandible and the bones were

then fractured carefully to avoid damaging the canine. The wild boar bones in the faunal remains are numerous, but the ancient selection of these remains and the absence of recent archaeozoological study do not allow us to determine if mandibles were fractured in a specific way, which could indicate an extraction of the canine.

## Debitage

The information aboutdebitage is very different for the various raw materials, mainly due to the differences ofdebitage among the waste products that were preserved. However, the aims and methods ofdebitage still seem to be very different depending on the raw material.

In the case of deer antler, the main objective of thedebitage is to produce segments. A first type ofdebitage aims to produce blanks on the lower beam. This type of blank is not present in the collection but several waste products and one finished object (the "axe") are indirect indications. The basal parts of antlers are the most voluminous waste products of thisdebitage phase and they provide the most information concerning thedebitage of the proximal part of the beam. Thedebitage of the beam into segments was made in two stages. Initially, a preliminary stage was realized, mostly on the posterior face of the antler, by sawing into the compact part of the antler, or less often by nicking. On ten basal parts of the collection, only two, of different size classes, show traces of nicking. This preparatory work is limited to a single face and affects only the thickness of the compact part of the antler. After this, the final separation is made by flexion or direct percussion. The result is an oblique transverse truncation. Thisdebitage could combine two advantages. Firstly it is fast, and secondly it allows the active part of the future bevelled tool to be preformed. It is difficult to be sure because we have only one finished object made from a whole beam and no blank which would allow us to specify the first stages of the shaping, but mental refitting between the axe and some basal parts is valid, in terms of morphologies, size classes and technical traces.

The second type ofdebitage of deer antler aims to produce blanks on tines. These blanks can be whole tines, shaped into bevelled objects, or segments of tine, possibly shaped into handles (but we have few indications about items on tine segments). Thedebitage of tines is made, as for the beam, in two stages: a preliminary phase by sawing or nicking before a final separation by flexion. Mostly, the preliminary work is fast and concerns only one face of the tine,

but there is variability and we noted no relationship between the type of work (by sawing, by nicking, peripheral or not, deep or not) and the shape, size or type of tine. The preparatory work is mostly made by nicking and is limited to a single face of the tine. Thedebitage is often made without this sort of work, and directly by flexion. The resulting fracture planes are then oblique, with more or less intensive saw tooth marks. It seems that the Mesolithic populations looked for a fastdebitage, whether or not there was preliminary work. The "cleanliness" of thedebitage seems to be very secondary, as we can see on the finished objects, which present traces of fastdebitage, not erased by shaping.

Mental refitting shows that the Mesolithic populations mainly looked for blanks coming from lower beams. Thedebitage waste products of the beam (basal parts and tines) are numerous by comparison with blanks and finished objects on beams. The production of blanks on tines, whatever they are, seems secondary, the majority of remains on tines being waste products.

The majority of deer antler remains indicate a transverse exploitation of block but it could indicate some possibilities of longitudinal exploitation. On one hand, we have two bevelled objects whose morphology indicates that they were shaped on flat blanks, such as baguettes. On the other hand, there is somedebitage waste that could indicate either a splitting or a longitudinal fracturing of the antler: they present traces of longitudinal sawing in connection with fracture planes that are themselves equally longitudinal. It is very difficult, however, to associate these two types of remains within one technical transformation scheme. The idea of a longitudinal exploitation of deer antler is, for the moment, very hypothetical (Fig. 11).

We have little information concerning bonedebitage. This is due mainly to the high shaping degree of the tools, whosedebitage traces have been erased. The morphology of some awls, whose sides are longitudinal fracture planes, could indicate bone breaking by direct percussion. Other awls also present marks of the medullar cavity on their lower face,

which indicate a long bone origin. However, these kinds of bones were often broken to recover the marrow. Were these bones therefore fractured to cook them or were they fractured to produce blanks (or both)? There are too few bone artefacts, consisting of only finished objects and no waste products, to help us. Moreover, there is no recent zooarchaeological study to inform us on alimentary bone exploitation. Regardless, if we consider only the number of bone tools and their morphological variety, we can suppose firstly, that the production of bone tools was not very significant, and secondly, that the morphology of blanks was varied. A debitage by fracturing, using direct percussion could have been a simple and efficient solution producing flat blanks that were shaped into perforating objects.

For the wild boar canines, the debitage modalities are well known. There are only two waste products but the traces on the finished objects allow us to reconstitute the main stages of the debitage. All the remains made on the canine teeth of wild boars indicate a longitudinal exploitation of the teeth. The purpose of the debitage is to obtain elongated, flat blanks, which we could compare with dentine blades. In fact, the debitage of the wild boar canines takes advantage of the natural characteristics of the raw material. This tooth, because of its hollow structure and its triangular shape, presents lines of natural weakness in the longitudinal axis. Furthermore, after the death of the animal, it tends to crack, especially if it is extracted from the mandible and placed in a dry environment or near a heat source (Maigrot 2003). It is this weakness in the longitudinal axis that is exploited during the debitage. The mesial edge of the canine, constituted by the junction of both enamelled faces, is a first zone of natural weakness. A longitudinal grooving, made on the distal face of the canine (the only one without enamel), makes it possible to prepare a second line of fracture. The splitting can be realized by inserting

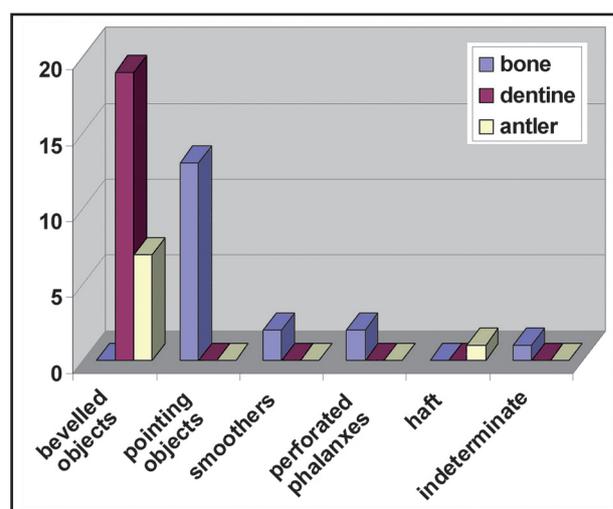


Fig. 10: repartition of types of finished objects per raw material

a wedge at the base of the tooth: we have no traces of this but an experiment proved the validity of this method. We obtained two blanks. The first one, wide and long, is constituted by the lingual face of the canine; it presents a double regular curvature in the longitudinal axis and in the transverse axis. The second blank is constituted by the vestibular face of the tooth, which is less wide than the lingual face and has a less pronounced, or even-nonexistent, longitudinal and transverse curvature.

Nevertheless, the debitage of canine teeth seems to have been realized according to various modalities. Indeed, a number of objects do not present traces of grooving and we can imagine that Mesolithic people were able to take advantage directly of well placed natural fissuring. Some finished objects are also shaped on blanks of small dimensions and varied shapes, though we cannot determine if these represent specifically produced blanks or the opportunistic re-use of debitage waste products.

## Shaping

Scraping is the main technique used for shaping. On the antler blanks, scraping was used to shape the active part into a bevel. This scraping is unifacial; it is carried out either at the end of the internal curvature of a tine, at the end of a section on beam, or on the lower face of a possible flat blank. The scraping is limited to the active part and does not extend to the rest of the surface of the object, which is left without modifications, except for one object, the axe, which is the only antler tool to present a perforation on the proximal part. The perforation was made on both faces since it presents a section “*en diablo*”

(Camps-Fabrer 1974). Some concentric striations on the first millimetres of the perforation, indicating the use of scraping, are concomitant with little readable traces, possible marks of a superficial nicking of the antler to prepare the perforation.

Scraping is used in a more intrusive manner on bone objects. Indeed, most of the awls and all the straight double-points show a complete scraping, which shaped the active part and covered the entire surface of the object. We must nevertheless remark that the majority of awls are fragmentary and that the only complete example, the decorated awl on

a deer vertebra, is shaped only on the distal part: this was perhaps also the case with the other awls, for which we no longer possess the proximal part. The complete scraping is done with particular care for the straight double-points, extending over the whole surface, and their final shape is symmetric, both in the vertical and horizontal axes. Some objects on bone, of little evident function, present a perforation. For perforated phalanges, the shaping is realized by removal by direct percussion. Concerning the perforated object with an indeterminate function, shaped on the radius of a deer, we observe only that the perforation was made by scraping.

On certain objects made on wild boar canines, a first stage of shaping seems to have been real-

ized by diffuse percussion. It would have allowed the support to be formed by eliminating the vestiges of the distal face resulting from the splitting of the tooth. The active part of the object was then shaped by scraping. The localization of this shaping is variable and depends on the morphology of the blank. For wide and concave supports, on the lingual face of the canine, the scraping is concentrated on the distal part – whereas for the less wide and rectilinear supports, on the vestibular face of the canine, it is more concentrated on the mesial part, on one side. The shaping is always localized on the lower face of the object, by scraping of the dentin. The superior face, covered with hard enamel, is not modified and constitutes the superior face of the bevel.

### A first step toward understanding the Mesolithic osseous material industry of Southern Europe

Each new method of analysis has brought a new vision. The technological approach has revealed a whole realm of Mesolithic material culture that is far from ideas of poverty and opportunism. The Mesolithic populations of Le Cuzoul de Gramat used varied raw materials, in some cases carefully selected. They knew how to transform them by adapting the modalities of exploitation according to the characteristics of the raw material and the objectives of the production (Fig. 10). We have underlined particular selections and exploitations of various raw

materials which do not agree with the image of regression traditionally associated with the Mesolithic osseous material industry.

Concerning the exploitation of antlers, only deer antler was used. The supply was assured by the harvest of shed antler, and large sized antlers of big size class were favoured. Their exploitation was mainly oriented toward blank production in the form of segments by sectioning beams or tines, which were shaped in bevelled objects by longitudinal scraping, limited to the active part (Fig. 11). In the present

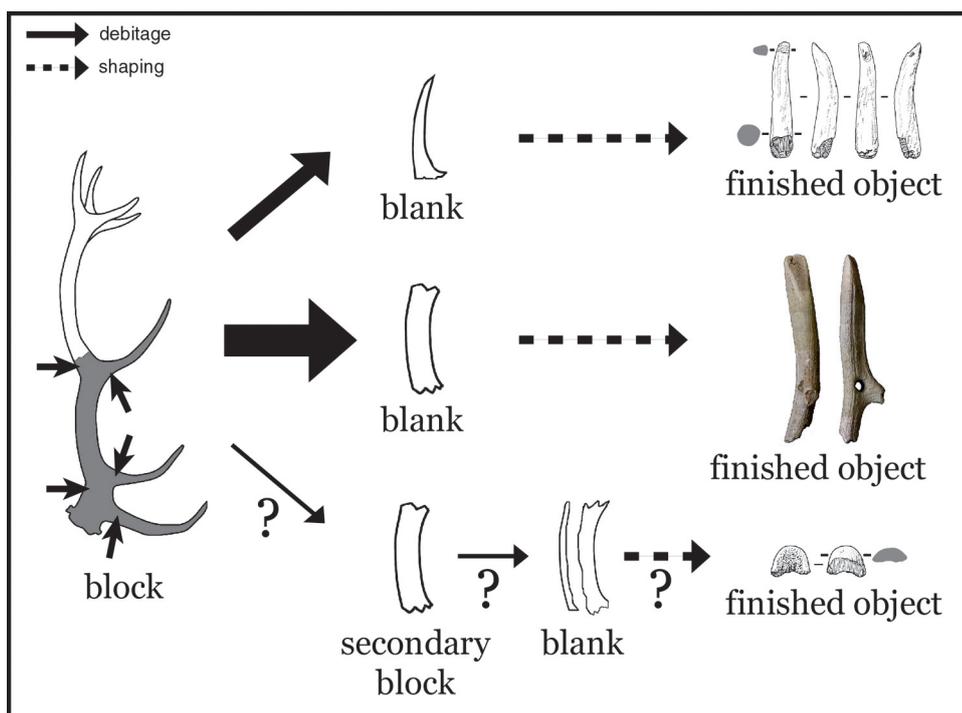


Fig. 11: technical transformation scheme of deer antler

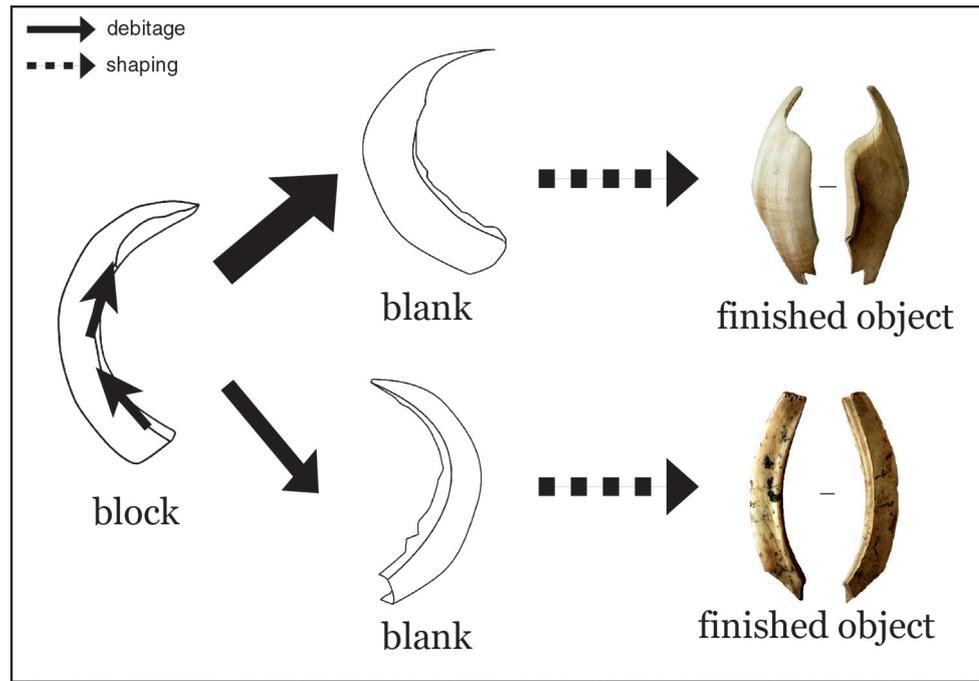


Fig. 12: technical transformation scheme of wild boar canine

state of our research, the significant number of debitage waste products on tines and mental refitting indicate that the production of blanks on beams seemed to be more frequent than the debitage of blanks on tines. The very low number of finished objects on segments of beams (a single example: the axe), compared with the number of characteristic waste products, indicates that Le Cuzoul de Gramat was a site of production of this type of object, undoubtedly in association with a contemporary occupation of the site during the period of antler shedding.

The exploitation of bone is more difficult to understand because the great majority of bone remains are represented by intensively shaped finished objects. The selection of the raw material and the debitage modalities are thus difficult to grasp. The exploitation of this raw material nevertheless shows peculiarities: firstly, the shaping was done by scraping, as it was for the other objects, but is sometimes very extensive and concerns the totality of the surface of the object, and; secondly, the production is mainly directed to the production of perforating objects.

Concerning the exploitation of teeth, the selection of the raw material was particularly selective: only the lower canines of adult male wild boars were used, with a clear preference for the right-side canine. The debitage of the canines was exclusively directed toward the production of flat blanks, mainly on the lingual face (11 finished items out of a total of 19 objects in the collection) (Fig. 12). This regularity in the choice of blanks can be dictated by various imperatives. Nevertheless, some experiments

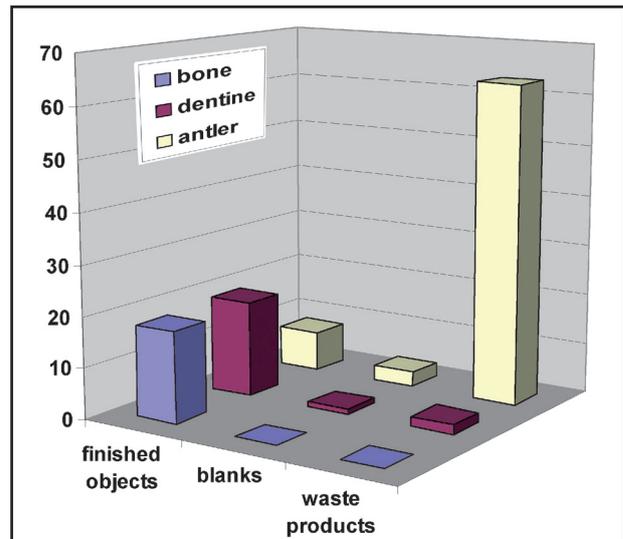


Fig. 13: repartition of finished objects, blanks and waste products per raw material

showed us that objects shaped on the lingual face of the right-side canine were particularly ergonomic when used as a scraper. We can thus evoke the hypothesis of the search for a particular morphology for these objects, in connection with their use. The production of tools made with the canines of wild boars is also remarkable because it is the only technical transformation scheme that employs the technique of grooving, used to prepare the splitting of the tooth.

Deer antler is the most abundant raw material (almost twice as many antler remains as bone and dentin remains combined) and the majority of these

remains are debitage waste products. However, if we consider only the finished objects, antler objects are in the minority, while objects in bone and dentin are much more numerous (Fig. 13). It would thus appear there was a difference in the exploitation of the various raw materials: we have indications of a local and intensive transformation of antlers, but no equivalent for bone and dentin. It is nevertheless necessary to qualify our comment. In the collection of R. Lacam and A. Niederlender, we identified only very few blanks and waste products in bone and den-

tin. However, this kind of object is uncharacteristic and small and would thus not have been recognized and collected during the excavation. In addition, the former excavations concerned only a part of the deposit, in front of the cave: this zone could be a working area more specialized in the exploitation of antler (we know now there were occupations inside the cave and in the open-area in front of the cave). The results of the recent excavations will help us to specify, or correct, this image of differential exploitation, favouring antlers.

## Comparisons and synthesis

In southern France, Cuzoul de Gramat yielded a major collection of osseous industry remains. Samples from other Mesolithic sites are smaller or do not present the same variability in terms of raw materials and types of exploitation.

Thirty km around Cuzoul, in the Lot region, three sites provided small collections (less than 20 items at each site): Les Fieux (Valdeyron, *et al.*, in press), les Escabasses (Marquebielle, in progress) and Fontfaurès (Barbaza, 1989). The site of Le Sanglier is an exception as it yielded dozens of antler remains (mostly debitage waste products). The study of this collection is in progress (Séronie-Vivien, 2001 and Marquebielle, work in progress).

This case of a high number of remains is uncommon, however. If we compare it with sites within a radius of 150 km around Cuzoul, small collections of osseous industry remains are standard. The sites of Rouffignac, in Dordogne (Barrière, 1973 and Marquebielle, in progress) and Clos de Poujol in Aveyron (study of osseous industry by E. David in Bridault *et al.*, 2009) each yielded nearly thirty items, often broken but recognizable, whereas the sites of Cuze de Neussargues and Baraquettes, in the Cantal region (Rozoy, 1978 and Surmely, 2003) and the site of Salzets, in Aveyron (Rozoy, 1978), yielded only fragmentary osseous industry remains that are less numerous and burned.

Much further from Cuzoul, at the mountain site of Poeymaü in Pyrénées-Atlantique, the osseous industry collection is large, composed of more than fifty items consisting mostly of finished objects (Laplace, 1953 and Marquebielle, in progress). But at other Pyrenean sites, such as Troubat in Hautes-Pyrénées (Barbaza, 1989) and Balma Margineda in Andorra (Guilaine *et al.*, 1995), the Mesolithic populations left only slight indications of an osseous industry (less than around ten items on each site).

At some sites, the osseous industry is large and varied, but we had to compare with long distance

sites, such as the British sites of Téviac and Hoëdic, (Péquart *et al.*, 1937 and Péquart, 1934). This is a particular context, however, as these two sites were cemeteries and finished bone objects were found in the graves. In a context of an occupation site, the Swiss site of Birmatten can be compared with Cuzoul. It contains a long stratigraphic sequence under a rock shelter and various raw materials were used in large quantities (Bandi, 1963 and David, 2000).

In general, though Mesolithic collections are small, diverse raw materials were used at each site. At the great majority of sites, three osseous raw materials were exploited: bone, deer antler and dentine (often from wild boar canines), even at small scale or low occupation frequency sites, such as Les Fieux or l'Aulp du Seuil, an altitude rock shelter in Isère (Bintz *et al.*, 1999 and Marquebielle, in progress).

Concerning finished objects, some implements recovered from the excavations at Cuzoul are very frequent on all Mesolithic sites that have yielded an osseous industry. Awls, for example, are always present and generally quickly and very simply made on bone (the distal part was shaped by scraping a splinter).

Bevelled antler tools (such as the Cuzoul axe) are rarer but known also over the whole French territory. This type of implement, made on antler segments, has been found in the Pyrénées (Poeymaü), the Alps (La Vielle Eglise: Ginestet *et al.*, 1984 and Marquebielle, in progress) and beyond the French borders in Portugal, Switzerland, Italy, England (see Rozoy, 1978) and especially in all of northern Europe (see David, 1999).

Bevelled objects on wild boar canines with a "tranchet" shape are less common in Europe and known in a smaller region, between the Pyrénées, Britain and northern Switzerland. Though wild boar canines were used in northern Europe, their exploi-

tation was different than at Cuzoul or in the Swiss examples (David, 2000): it was simpler and included no finished objects with the characteristic "tranchet" shape. In the southern regions of Europe, however, wild boar canines were also used to produce objects with various and simple shapes.

In all of southern France, Mesolithic populations exploited osseous raw materials in the same manner that we observed at Cuzoul, which could be considered, for the moment, as a reference site.

Nevertheless some manufacturing processes used at others sites are unknown at Cuzoul. For example, to produce bevelled objects on wild boar canines, and only in this case, Mesolithic populations at Cuzoul used grooving. But at some other French sites, grooving was used with other raw materials: deer antler at Clos de Poujol (maybe in connection with

harpoon fragments recovered at this site) or bone at Rouffignac. In the northern Europe, during the Mesolithic, grooving was widely used in connection with the manufacturing of projectile points and bevelled or perforating objects (David, 1999). We had to clarify the use of grooving in southern Europe, where this technique seems to have been more frequently used during the Epipaleolithic (Azilian harpoons: Mons, 1995) and Neolithic (bone awls: Camps-Fabrer, 1990).

It is now necessary to enlarge the kind of study we conducted at Cuzoul to other sites in order to attempt to specify the role of the osseous material industry within the economy of Mesolithic populations, as well as to understand how this industry evolved through time and if this evolution was concomitant with changes in the lithic industry.

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