LABORATOIRE TRAVAUX ET RECHERCHES ARCHÉOLOGIQUES
SUR LES CULTURES, LES ESPACES ET LES SOCIÉTÉS

2018-2019 # 10

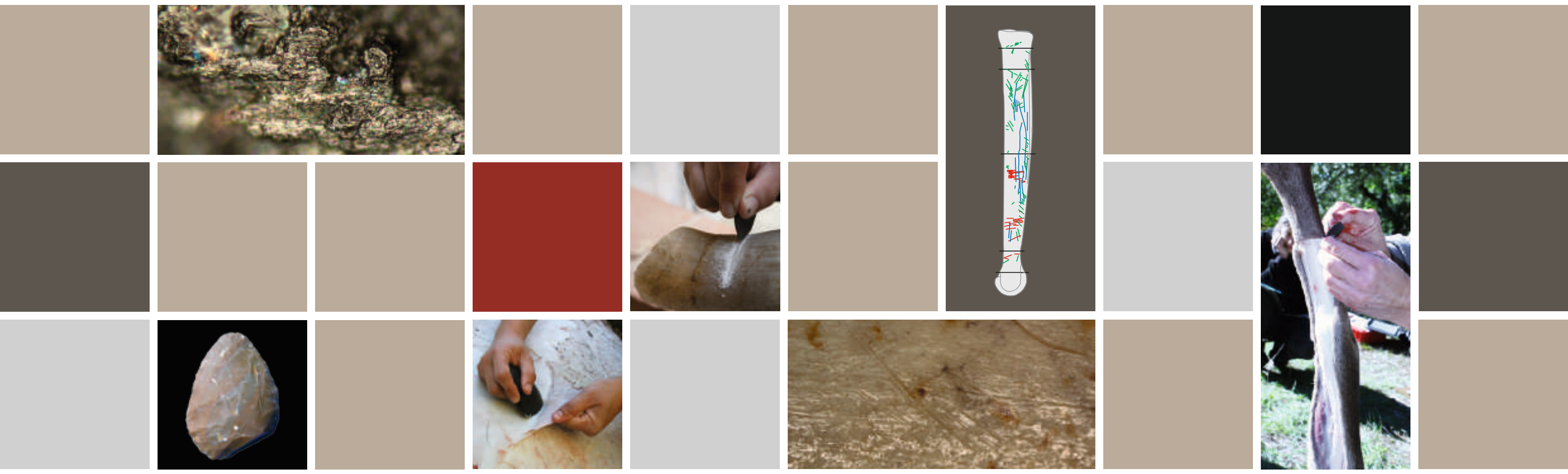
directed by

Céline Thiébaut
Émilie Claud
Sandrine Costamagno

PROCUREMENT AND PROCESSING OF PLANT AND ANIMAL MATERIALS BY NEANDERTHALS: exploring means and strategies

Results of a study based on an experimental approach and the archaeological analysis of several sites in Western Europe, carried out in the context of the "Des traces et des Hommes" PCR

With contributions by:
M. Brenet, É. Claud, D. Colonge, S. Costamagno, M. Coutureau, M.-G. Chacón-Navarro, S. Chong (†), A. Coudenneau, M. Deschamps, C. Lemeur, C. Lemorini, S. Maury, V. Mourre, Ch. Servelle, M.-C. Soulier, C. Thiébaut, A. Val, F. Venditti



P@lethnology
Archaeology and Humanities

Contributions should be addressed to:

P@LETHNOLOGY REVIEW
CNRS / UMR 5608 – TRACES
Maison de la recherche
5 allées Antonio Machado
31058 Toulouse cedex 9, FRANCE

Phone: +33 (0)5 61 50 36 98
Fax: +33 (0)5 61 50 49 59
Email: francois.bon@univ-tlse2.fr

This digital publication received support from

Contents

8 - The points reference collection

(A. Coudenneau, F. Venditti, C. Lemorini, M.-G. Chacón-Navarro)

A - Why such a reference collection?

Middle Palaeolithic studies are punctuated with academic debates and reflections on how to understand the behavioural similarities between *Homo neanderthalensis* and *Homo sapiens*. Many Anglo-Saxon researchers have argued that organized hunting could only be carried out by Anatomically Modern Humans (Rendu, 2007). Indeed, despite a growing number of archaeological data speaking in favour of controlled hunting, some authors are still believing that Neanderthals were mostly scavengers (Binford, 1985; Dibble, Mellars, 1992; Stringer, Gamble, 1994). The meat-rich diet of Neanderthals in western Europe is now firmly established: for example, isotopic analyzes have shown that their diet placed them amongst high-ranking carnivores (Bocherens *et al.*, 1991; Richards, Trinkaus, 2009), but this information obviously does not allow saying if it is a food acquired by hunting or by scavenging. In fact, only archeozoological studies have shown that Neanderthal groups not only hunted but also had complex strategies, sometimes with game selection.

These results are in contradiction with old studies that did not agree. The example of Grotte Vaufrey is telling: a 1988 study by L.R. Binford concluded that during the Saalian period the inhabitants of the cave were scavengers (Binford *in* Rigaud, 1988). However, a methodological review and a new study of the material made it possible to conclude that, on the contrary, the Neanderthals of Grotte Vaufrey had conducted selective deer hunting (Grayson, Delpech, 1994). Other studies have shown that in the Middle Palaeolithic there are examples of specialized slaughter sites for acquiring carcasses of large herbivores such as bison (Mauran: Farizy *et al.*, 1994; Coudoulous: Jaubert *et al.*, 2005; Les Fieux: Gerbe, 2010), aurochs (La Borde: Jaubert *et al.*, 1990) or reindeers (Les Pradelles: Costamagno *et al.*, 2006). In addition to these specialized sites, examples of archeozoological studies demonstrating the existence of intentional and organized predatory behaviour in the Mousterian are now numerous.

However, determining which technical means were used for this predation according to the hunted game and the various groups of Neanderthals that populated Europe remains to be done. By technical means, we mean at the same time the hunting weapons used, the strategies and the collective or individual organization set up during the hunt. Regarding hunting weapons, numerous research conducted in the Near East have demonstrated the use of lithic elements as hunting points on sites of the Middle Palaeolithic, based on several specimens of Levallois points (Shea, 1988, 1997, 2003; Bergman, Newcomer, 1983; Solecki, 1992; Wendorf, Schild, 1993; Plisson, Beyries, 1998). But little data are available for the European continent.

In 1995, three wooden spears were unearthed at a coal mining site in northern Germany, the Schöningen site (Dennel, 1997; Thieme, 1997). They were accompanied by knapped stone tools and the remains of ten horses with traces of butchery. The spears measure between 182 and 225 cm with a maximum diameter ranging from 2.9 to 4.7 cm. They were made from the trunk of a young pine tree whose branches were cut and the bark removed. The lengths of the weapons are not identical but they are showing the same model of construction. The basal part of the tree was used to make the distal part of the spear. Therefore, its pivotal point is always located in the upper third of the weapon. This balancing model corresponds to the standards used in the manufacture of modern javelins so as to obtain the best possible ballistics. These weapons could have been used as projectile weapons.

Woody material elements are obviously exceptional and most direct clues of use of hunting weapons are to be found within the lithic assemblages. The site of Bouheben (Landes) delivered several points with traces of impact taking the form of face or transverse bending fractures with step termination (Villa, Lenoir, 2006). A Mousterian point discovered on the site of Angé (Loir-et-Cher) also shows traces of use as a hunting weapon (Soressi, Locht, 2010; Locht *et al.*, 2015). In the Iberian Peninsula, recent research also highlights the probable presence of flint points used as hunting weapons (Lazuén, 2012b). While some doubts remain about some of the points that have been the subject of publications (for a more exhaustive synthesis and a discussion, see Part II, chapter 4.3), it is nevertheless conceivable that the Neanderthal groups made hunting weapons in stone and did not settle for wooden spears alone, even in Europe. However, the data remain rather disparate and without a systematic interdisciplinary analysis, it is difficult to restore more accurate hunting behaviours concerning the methods of prey acquisition by Neanderthal groups. The study of the bone remains is inseparable from that carried out on the stone points to understand the preferred hunting methods (see Part I, chapter 3).

While faunal data are quite abundant and have been the topic of more systematic studies on the subject of hunting for several decades (Rendu, 2007; Gerbe, 2010), the question of hunting weapons remained a recurrent one and deserved a methodological and structured research to be set up on the lithic industries of western Europe, as no large scale functional study of the triangular elements had been done for this geographic area. This type of study is all the more legitimate since the Middle Palaeolithic series of Western Europe are full of triangular tools (flakes of triangular morphology, Levallois points, pseudo-Levallois points, Mousterian points, convergent side scrapers). However, amongst all these products only three major categories of objects have been named points:

- Levallois points: triangular flakes obtained by a Levallois debitage and whose debitage axis coincides with the technical axis (Bordes, 1961a). These points can be classified according to their more or less elongated morphology (ordinary Levallois points, ogive-like Levallois points, elongated Levallois points) or according to the presence of retouching (Soyons points, retouched Levallois points, Emireh points), or again according to their place within the debitage (first order, second order Levallois point, ...);
- Pseudo-Levallois points: triangular flakes most often obtained by Discoid debitage (but other processes are possible) and whose debitage axis does not coincide with the technical axis (Bordes, 1953b). The triangular flakes thus obtained are rather short and thick flakes with a butt and a back that take a significant place in the periphery of the object;
- Mousterian points: they are side scrapers with two converging edges forming an acute angle and whose lower face is flat (Bordes, 1961a). This definition remains ambiguous in the sense that the notion of acute angle should be specified. In addition, the means for obtaining such objects are varied and they are to be defined in each series.

In the context of the Research Program, a significant reference collection of triangular tools could be gathered and served as a base for the comparative use-wear analysis of various Middle Palaeolithic archaeological series rich in triangular elements from the sites of Payre, Mauran, Les Fieux and Coudoulous. This reference collection has also been used to study series integrated into a doctoral research (Coudenneau, 2013): Spy (Belgium), Beauvais (Oise) and Therdonne (Oise).

We wanted to create a reference collection for the triangular items as exhaustive as possible, thus going beyond the elements only dedicated to hunting activities. Previously only two series of experiments had been conducted with this aim. One concerns a series of twelve points fitted and used as thrusting weapons (Plisson, Beyries, 1998). If this experiment allows a first approach, the tested corpus is insufficient to cover all the questions relating to the elaboration of solid identification criteria of the hunting traces on the Mousterian lithic elements. The other series of experiments was conducted by J. Shea to interpret industries in the Near East (Shea, 1988, 1997, 2003). It is problematic because it takes into account criteria for identifying traces that are too inaccurate for the Middle Palaeolithic of Europe. Indeed, these experiments focus mostly on Levallois points and take into account only the possibility of their use as a projectile. For our part, we have integrated into our experiments different types of points (Mousterian points, Levallois points and pseudo-Levallois points and triangular flakes) used as throwing and as thrusting weapons.

B - Used tools and activities carried out

The points intended for the experiments were made by different experimenters (J.-B. Boudias, V. Mourre and C. Thiébaut) in connection with the various techno-types of points encountered at the studied sites: Mousterian points, pseudo-Levallois points, Levallois points and triangular flakes. The raw materials used are also related to the studied sites: Coniacian flint from the Yonne region, Bedoulian flint from Murs, Forcalquier flint, quartz and white quartzite from the Lot region, Pyrenean quartzite. In total, 198 pointed elements including 182 flint and 16 quartz and quartzite were used.

The corpus gathers 198 triangular elements used according to different modes of action for varied activities. We also have 35 items dedicated exclusively to the fracturing (intentional or accidental) of the lithic blank, in order to be able to compare these fractures with those related to use, in particular as hunting points. With the exception of the points used during hunting activities, the pointss were generally held with bare hands or with a leather cover. The durations of use are variable: the points used during hunting activities were projected between one and ten times maximum. As soon as a fracture appeared, or, if necessary, after ten shots, the use of the point has been stopped. The duration of use of the other points is generally between 5 and 220 minutes. The methods of use correspond mainly to butchery, hide working and woodworking.

a - Hunting

107 points (95 in flint and 12 in quartz / quartzite) were used as weapon extremities on various animal carcasses killed before the experiment and held in anatomical position (figure 10). At the beginning of the work of the Research Program, having little financial means and little experience, we had to resolve to use two carcasses of adult sheep. In a second time, three cervids (does and red deer) were used. The presence of cervids being confirmed on many sites of the Middle Palaeolithic, it was indeed interesting for us, as for other specialists, to study identical species to those hunted by the Neanderthals. The first ewe was gutted during the shots, unlike the carcasses that followed. The points were attached to the handle with bindings of plant cord (linen) reinforced by an adhesive made of wax, ocher and resin, heated and poured on the insertion area of the point into the handle.

The first experiment involved 15 flint points (7 unretouched and 8 retouched) shot mechanically, by a system consisting of an underwater shotgun, on the gutted ewe. The points were fitted on shafts of light poplar wood. These shafts were drilled in the central length to allow the arrow of the rifle to come into the shaft. The purpose of this first session was to obtain preliminary information on projectile fractures, by limiting the parameter of variation induced by hand throwing. We could also determine that it is best not to gut the animal before the experiment to add additional inertia to the target and perhaps a little more realism to this experimental activity. Finally, it allowed us to note that, whatever the size of the point, its effectiveness is determined by two conditions: the sharpness of the point and the protruding of the edges relative to the handle. The more the point protrudes from the handle, the easier it will penetrate into the animal.

The second experiment involved 30 retouched flint points used as throwing thrusting weapons on a non-gutted ewe. The objective this time was to check whether there are significant differences between the morphology of fractures obtained by mechanical propulsion and that of the fractures obtained with thrusting weapons on the retouched blanks. All the haftings of the points were axial. The shafts used were beech and pine studs 1 to 2 m long and 2 to 3 cm in diameter.

Having found no fundamental differences between the traces observed on the points that were thrown mechanically and those used in thrusting weapons, the 32 flint points used for the third experiment were in thrusting weapons, but this time, on a carcass of cervid (adult deer). These are 14 unretouched points and 18 retouched points. In this session, we wanted to check if the thickness of sheep wool could have an influence on the formation of the fractures by comparing the fractures obtained during the experiments on the sheep and those obtained on an animal whose hair is less thick and compact. This experiment allowed us to observe that the hide of the red deer was easier to penetrate. It was also an opportunity to test some lateral hafting: seven retouched points were dedicated to this test. We found that the morphology of our points was not appropriate to this type of hafting: as the bindings did not lend themselves to side hafting, we used the adhesive alone. The problem is that a large number became dislodged during the experiment. The shafts were similar to those of the previous experiment.

The last two experiments with red deer involved 20 flint points (5 unretouched and 15 retouched) and 12 points in quartz and quartzite. The quartz and quartzite points were used in the same way as the flint points, that is to say as thrusting weapons with an axial hafting and fixed to the handle by means of plant rope bindings and of an adhesive made of a mixture of resin, wax and ocher.

b - Butchery

Regarding butchery activities, in the broad sense, 55 active areas were dedicated to various actions carried out for the carcass processing of different species: Deer, Fox, Boar, Reindeer, and Bison. With the exception of two deer metapodials that were simply disarticulated, all the butchery operations from skinning to disarticulation were carried out on the other species. The objectives of the actions conducted out were multiple:

- recover the hide;
- remove the meat;
- retrieve the tendons;
- recover the bones.

A total of 15 unretouched flint points, four unretouched quartzite points, two retouched flint points and nine flint Mousterian points were used during the different stages of the butchery *chaîne opératoire.* Six points were used for skinning, three for disarticulation, eight for defleshing, nine points for complete butchery except skinning and four were used at all stages of the butchery *chaîne opératoire* from skinning to disarticulation.

The points have proved effective for most stages of this *chaîne opératoire*. The point allows to open with great efficiency the various tissues and the cutting edges allow a good cutting of the flesh.

c - Hide working

For the working of hide, nine active parts from eight points were used for different activities: two points were used to deflesh fresh hide (rabbit and sheep) in tangential cutting, a Mousterian point (two active areas) was used to deflesh a dry, ash coated sheep hide by scraping the grain to remove the last residues of flesh and fat. Finally, five points were dedicated to the piercing of hide: two were used to pierce fresh hide in a rotational motion before setting it on a frame, three were used to pierce dry and tanned hides to make sewing holes. One of these points was used in a continuous contact gesture (i.e non-percussive) and by applying pressure on the point placed perpendicular to the leather without rotational movement. The other two points were used in a continuous contact gesture with again a punctiform contact but by applying a rotational movement. The points have proved very efficient for this work. The punctiform contact actions constitute a functional specificity of these points.

d - Acquiring and processing wood

Different activities, from the acquisition to the making of objects in wood were carried out with 21 flint points:

- for the first phase, only the acquisition by sawing (continuous contact gesture, longitudinal action) has been implemented. A poplar branch of small diameter was sawn with a retouched point;
- during the second phase, for the preparation of the wooden supports, two retouched points were used to plane. The small branches that could interfere with the making of objects were sawn with an unretouched point and a retouched point;
- the processing of the acquired and prepared wood into finished objects was carried out using thirteen points, having worked the wood in the dry state (boxwood and pine), for the manufacture of handles and spears, using the "diabolo" technique. Two points were used in grooving (retouched), four in scraping (two unretouched, two retouched) and seven in planing (six retouched and one unretouched). With the exception of the longitudinal grooving for which the point can guide the gesture by creating a distinct groove, for the other operations the presence of a point is completely useless without being inconvenient;
- we also drilled dogwood and oak wood to obtain a hole in which we could pass a tie (e.g. for suspension). For this activity, three points were used: two Mousterian points on dry wood and a Mousterian point on green wood (figure 7). The points have proved very efficient for this use, the drilling of green wood being easier. The thickness of the wood may be a limiting factor for the success of this operation. When the diameter of the handle to be drilled was too large (> 20 mm), we made a hole on both sides of the handle until both resulting holes met.

e - Bone working

Two distinct objectives guided the activities carried out on the bones: a food objective and a technical objective. In the context of butchery activities and more specifically for the bone marrow extraction, six unretouched points were used to scrape the periosteum before fracturing of the bones. Well aware that the making of bone objects is rare in the Middle Palaeolithic, different actions have nevertheless been carried out on this material in order to discriminate the traces obtained from those produced by the activities on wood: two points, one unretouched and one retouched, were used to scrape a fresh bone to prepare the surface before grooving, three unretouched points were used to saw bones and three retouched points to groove a fresh bone.

f - Seashell working

To complete the reference collection, five points were used to drill very hard materials like seashells (*Nucella lapillus*).

C - Description of use-wear traces

a - Frequent macro-traces

Macro-traces are present on almost all the active parts of the used points. These macro-traces are mainly scars, except for the points used during hunting activities, for which the observed macro-traces are mainly fractures. Only five points have no trace. These are points used on fresh hide: defleshing and piercing of the hide before setting them on a frame. This scale of observation is not negligible, whether the points are unretouched or retouched.

b - Differences with unretouched cutting edges

Macro-traces on the cutting edges of the retouched points can be compared to those on the unretouched cutting edges with equivalent angle described in the literature (e.g. Gonzáles Urquijo, Ibáñez Estévez, 1994; Lemorini, 2000). The cutting edges of the retouched points follow the same use-wear modes as the unretouched edges. Without radically modifying the features of the macro-traces noted on the unretouched edges, we can nevertheless observe some notable differences in the case of the butchery activities and on the tools used to work wood. For activities involving materials of greater relative hardness, these differences are almost non-existent.

The main differences are:

- the scars of the retouched active parts tend to be smaller in size;
- on the retouched points, the retouched face shows less numerous scars, more often discontinuous and isolated;
- the scars present on the retouched edges have more frequently a step termination.

On the other hand, the position, the morphology and the direction of the scars are little affected by the presence of retouch. It is the same for rounding and blunting.

c - Description of macro-traces according to the modes of use

Traces linked to hunting activities

Flint points

The traces associated with hunting activities have particular features compared to those produced during other activities. They are mainly fractures (80 % of cases), sometimes accompanied by scars (figures 65-67).

The fracture analysis of experimental hunting points allows us to make several observations:

- the fractures observed on the points used as hunting weapon are bending fractures with step termination or apical scarring (Coudenneau, 2013: 41-45; table 12, figures 65-66) with step termination. The presence of apical scarring seems to be a real feature of this mode of use since we do not find them for any other tested activity;
- the presence of a single item with a bending fracture and a step termination in an archaeological serie cannot be a proof of the use of this item as a hunting weapon. Indeed, other causes can produce this type of fracture. And the presence of an apical scarring on a single item in a series should also be interpreted with caution. This type of scarring actually constitutes the physical translation of a particular application of the forces, but it is not impossible that other domestic activities or taphonomic events could also produce such fractures;

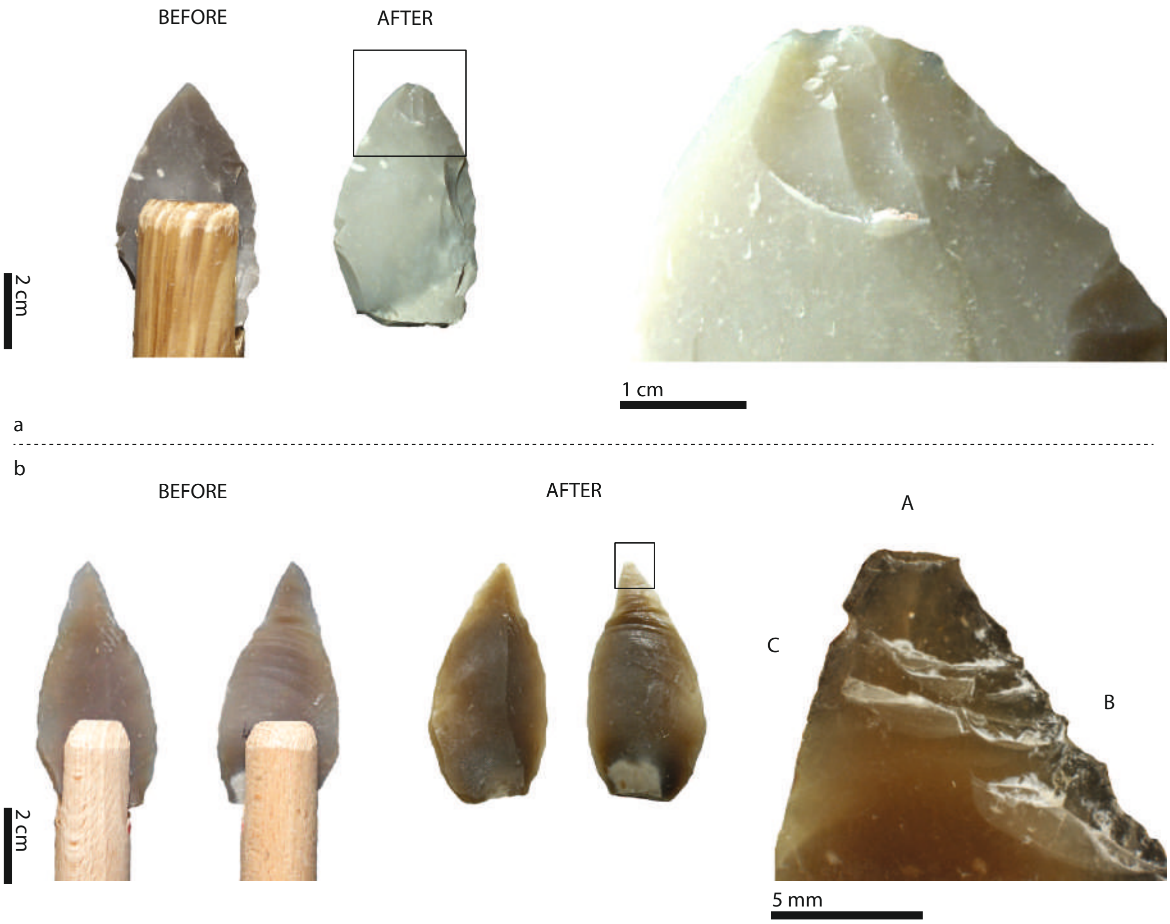


Figure 65 - Examples of points used experimentally as hunting weapons. a: ventral surface before and after use and detail of the apical scarring with a step termination; b: dorsal and ventral surfaces before and after use and detail of the apical scarring with a spin off termination (A) and the associated scars (B and C) (photographs and CAD: A. Coudenneau).

- there are variations in the fracturing modes of the artefacts also related to the presence or not of retouch and to the relative thickness of the fur of the hunted animal. Thus the denser the coat (sheep), the more the resulting fractures tend to be bending fractures. Conversely, fractures produced during hunting actions on red deer are more frequently apical scarring. However, these variations are at most nuances and should be handled with care;
- the presence of a double fracture does not seem to be related to a particular factor amongst those we tested. As during debitage, it is very likely that a less marked or more diffuse contact with the material causing the fracture may produce such an effect. It is also possible that, during its journey inside the animal, the item meets bones several times and thus breaks twice. Double fractures are most often an association between a bending fracture and an apical scarring;
- the scars of the lateral edges are not, strictly speaking, a discriminating feature of this type of use, but quadrangular scars with step termination, or combinations of scars associating half-moons and quadrangular or trapezoidal morphologies with transverse or step terminations may be an additional evidence of use as a hunting weapon. This evidence gains weight when associated with a fracture such as those described above;
- in all cases, the recurrence of traces considered as diagnostic within the same archaeological series will be a significant element to guarantee interpretations based on these experimental analyses.

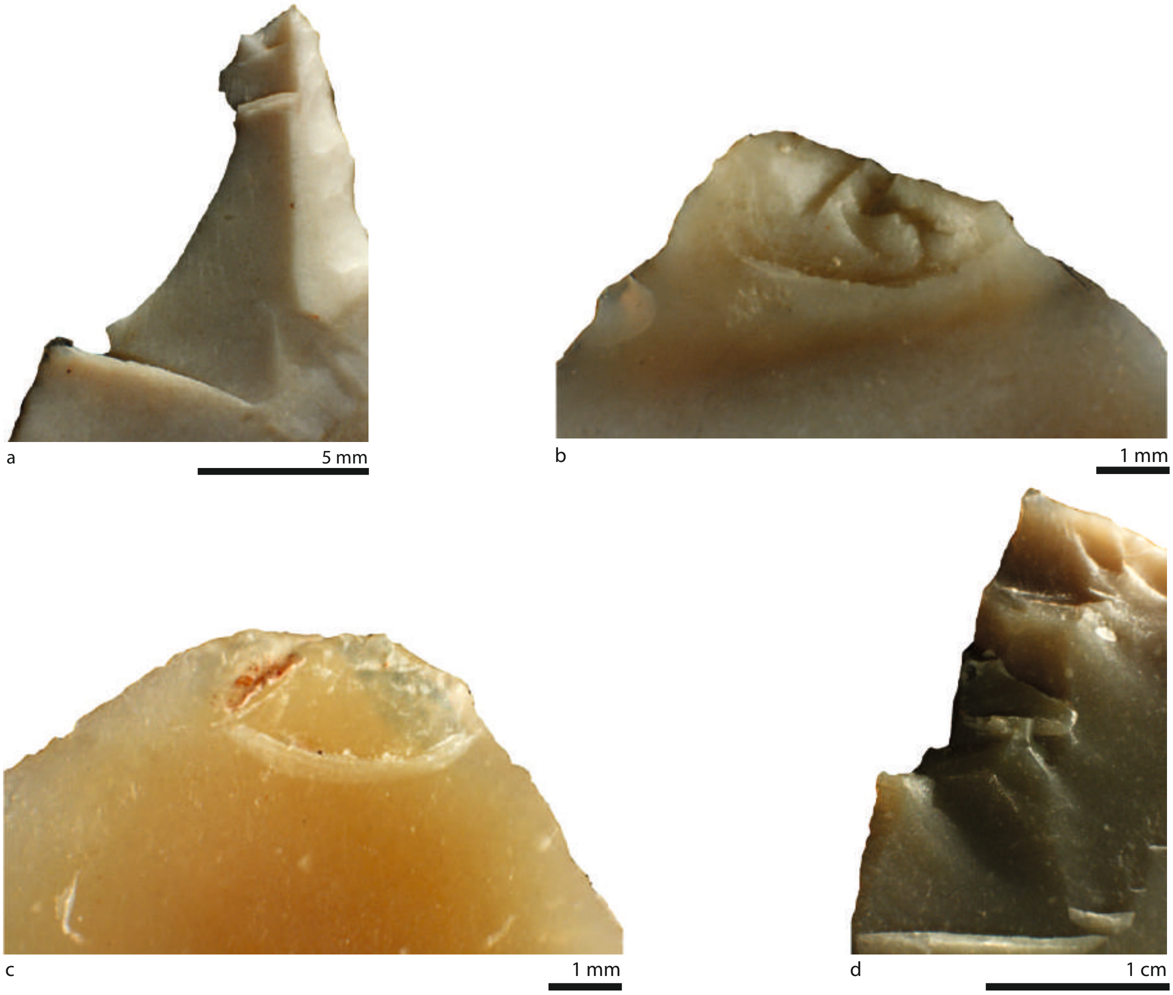
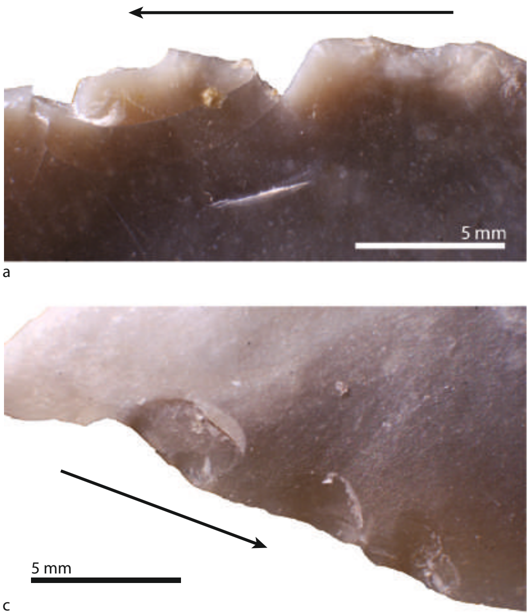


Figure 66 - Examples of fractures observed on points used experimentally as hunting weapons. a: apical oblique scarring with a step termination and a step-terminating bending transverse fracture; b: step-terminating bending fracture; c: apical scarring with a step termination; d: apical oblique scarring with a spin off termination (photographs: A. Coudenneau).



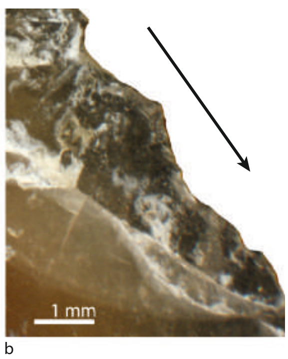


Figure 67 - Examples of scarring observed on points used in hunting. a: association of quadrangular and half-moon scarring with step terminations; b: quadrangular scarring with step terminations; c: combination of quadrangular, semi-circular, and trapezoidal scarring with step terminations. The arrows indicate the direction of movement (photographs: A. Coudenneau).

The quartz and quartzite points (F. Venditti, C. Lemorini)

Before giving the functional results of experimental impacts for quartz and quartzite points, it is necessary to describe briefly the features of these raw materials and the methodology used to analyze them.

Some quartz and quartzite are composed of coarse quartz grains that produce an irregular surface with many prominent ridges (Knutsson, 1988a: 42). It can happen that the traces of use are not distributed evenly along an active edge, not allowing detecting them easily. It is therefore necessary to locate them on the different planes of the crystals, which means observing them on highly localized surfaces. Moreover, on each part, the degree of development of the traces can be very different, even if it is the product of the same activity. Therefore, if one can use any method of observation for fine-grained rocks, in order to detect traces of use on the materials referred to here, one must carefully analyze all the edges of the object, to locate the most developed traces that allow the best interpretation. It is obvious that the time required by this type of analysis is necessarily longer than for other types of raw materials.

In addition, the surfaces of the quartz crystals are almost never plane and smooth and they may show imperfections related to the origin of the crystals themselves or abrasions due to knapping activities. These imperfections or abrasions may have a morphology that resembles some of the micro-traces. It is therefore necessary to have casts of the surface before the use of the item to be able to control each crystal composing it. For this purpose, we used a two-component silicone (*Provil Novo Light Fast Set*, *Heraeus*) that, in addition, helped us to attenuate the phenomenon of light reflection typical of quartz crystals and allowed a better observation of the lithic surface (see Part I, chapter 2.3).

Following the methodology developed for this analysis, we observed all the points using a stereomicroscope in reflected light to identify scars or fractures produced by the impact of the point on the animal.

After low magnification observation, we performed the analysis of the casts of the used points with a metallographic microscope with 100 ×, 200 × and 500 × magnifications, provided with reflected light and an interferometry system.

Out of the 12 points used, three were not analyzed because they did not have pre-use casts; amongst the nine others, five points show a combination of traces typical of the action carried out.

We are presenting here the description of each analyzed test and the description of the recognized traces.

Point no. 2:

Point no. 2 was used twice without being able to penetrate into the animal. The faint traces visible on the surface of some crystals are chaotic abrasions and a stronger abrasion that has destroyed the left side of the crystal edge (figure 68).

Point no. 5:

Point no. 5 was used three times, then we stopped using it as it moved in its handle. Slight converging abrasions developed on the ventral surface of the apical part (figure 69[b]).

Pointe no. 6:

Point no. 6 was used several times and the fifth shot hit a rib causing an invasive fracture with a *snap* termination (figure 70[c]). In this case, we found a large crystal that, in the pre-use cast, presented converging technological abrasions that disappeared after the use of the item. It is possible that the contact with the subcutaneous fat has caused the disappearance of the abrasions present on the crystal by obstructing the small holes produced by the abrasion.

Indeed, fresh hide working and skinning activity did not produce diagnostic traces.

The subcutaneous fat may cause alterations in the crystals that homogenize the appearance of their surface without developing a distinctive and recognizable feature. It thus becomes difficult, if not impossible, to recognize this type of trace on archaeological materials.

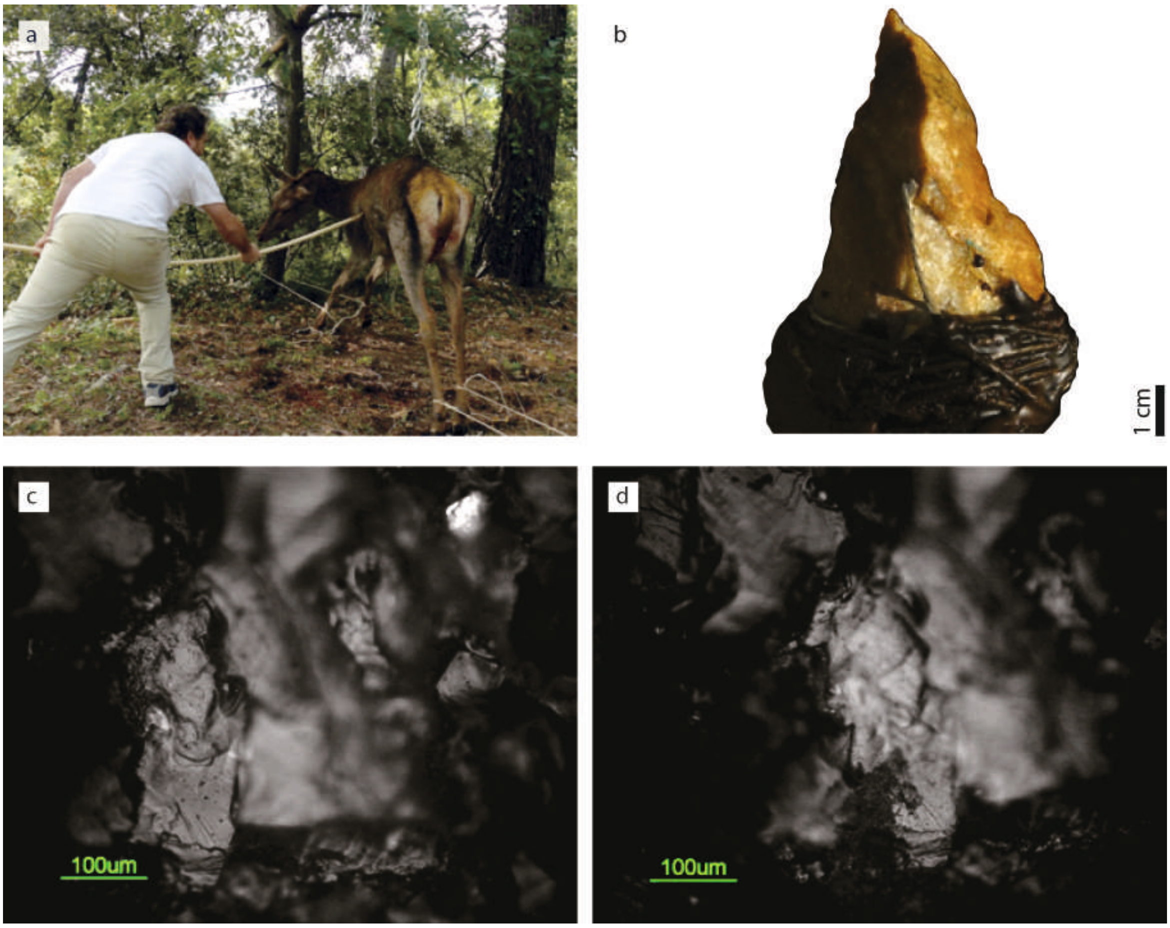


Figure 68 - Point no. 2. a: experimental set-up; b: point before use; c: unused crystal on the edge before use; d: abraded crystal on the left edge (photographs a-b: PCR Des Traces et des Hommes; c-d: C. Lemorini and F. Venditti).

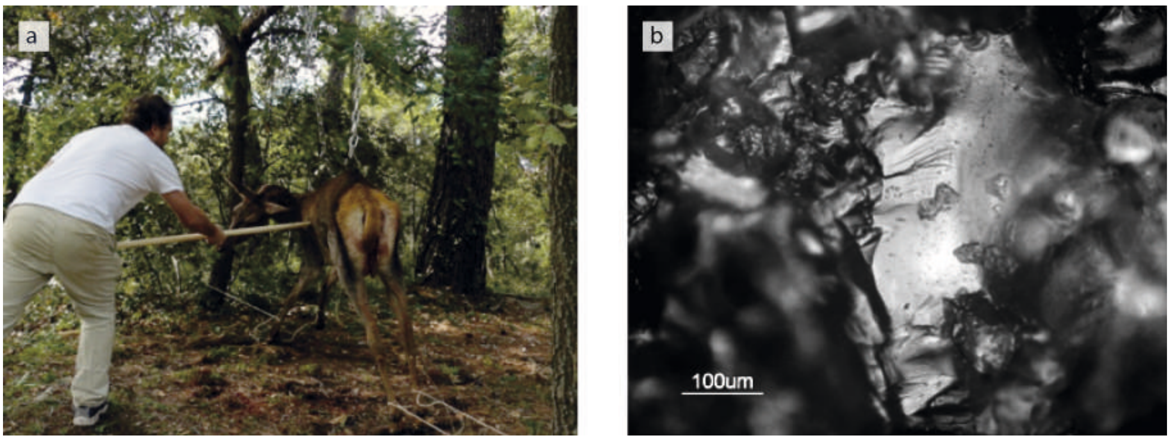


Figure 69 - Point no. 5. a: experimental set-up; b: micro-traces produced during experimentation: crystal showing a row of superficial abrasions after use (photographs a: PCR Des Traces et des Hommes; b: C. Lemorini and F. Venditti).

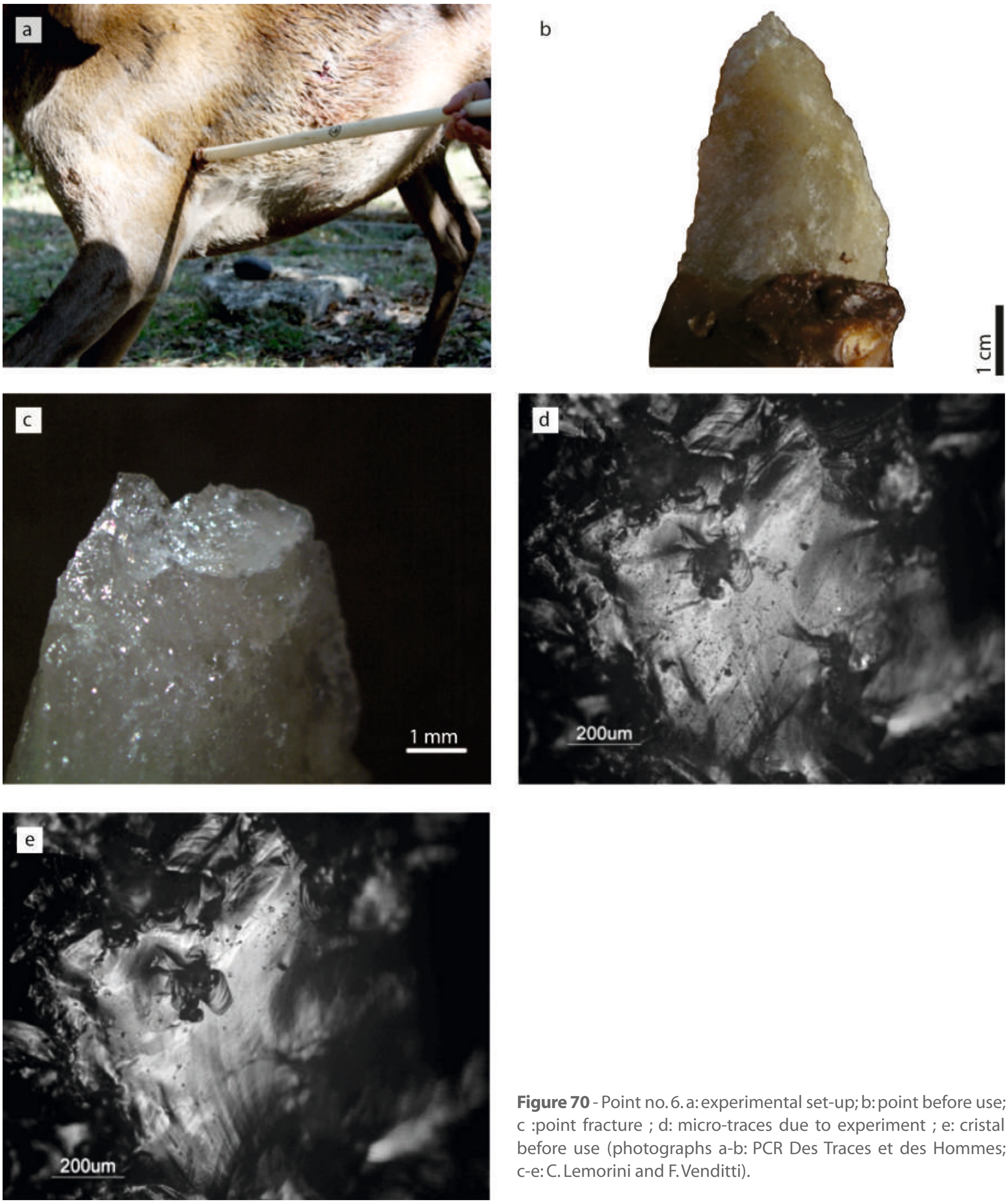


Figure 70 - Point no. 6. a: experimental set-up; b: point before use; c :point fracture ; d: micro-traces due to experiment ; e: cristal before use (photographs a-b: PCR Des Traces et des Hommes; c-e: C. Lemorini and F. Venditti).

Pointe no. 7:

With point no. 7, ten shots were done that hit the stomach of the animal. There was only one micro-trace of contact with meat near the point; it affected the edges and the central part of the crystal (figure 71). Contact with the fleshy tissues may affect the surfaces of the crystals on the cutting edge either by slight abrasions with a light bottom that change the generally smooth surface of the crystals or by deeper abrasions, with a dark gray bottom, that can be attributed to more violent contact with the tissues or sometimes with the bone (for example in butchery activities). These abrasions can be located either on the edge of the crystals, by breaking them up, or towards the center of their surfaces and they can have a distinct direction or a chaotic orientation.

Figure 71 - Point no. 7. a: experimental set-up; b: point before use; c: micro-traces produced during the experiment: crystal showing abrasions that can be attributed to contact with meaty tissues after use (photographs a-b: PCR Des Traces et des Hommes; c: C. Lemorini and F. Venditti).

Pointe no. 4:

Point no. 4 showed the most significant traces of the series. We encountered three different types of traces but in combination and in agreement with the action carried out (figures 70, 73-74).

This point ran through the deer twice: the first shot penetrated the fleshy tissue through the skin and touched a rib. The second shot caused a *snap* fracture and only the proximal part of the item remained inserted into the shaft (figure 72).

By comparing the crystals before and after their use, the entire part of the point that came into contact with the hide, the fleshy tissues and the bone shows several crystals with:

- superficial and slight abrasions typical of contact with fleshy tissues;
- deeper abrasions with a direction perpendicular to the point and therefore in agreement with the impact movement;
- crystals with smooth and luminous surfaces probably due to contact with the subcutaneous fat.

Out of the 12 points thrown, 5 points bear micro-traces, but in only one case the three types of micro-traces described above (superficial abrasions, deep and perpendicular abrasions, smooth and luminous crystals) were present concomitantly. For three cases, the impact with the carcass caused fracturing: this is snap fracturing of the distal or mesio-distal part of the point.

It is obvious that only the combination of different traces on the same item can give a high degree of reliability to its final interpretation as a hunting point.

Experimentation has shown that this combination does not always develop and therefore, from an archaeological point of view, it is likely that some impacts will never be reliably identified. The reasons are as follows:

- in some cases the points remain intact;

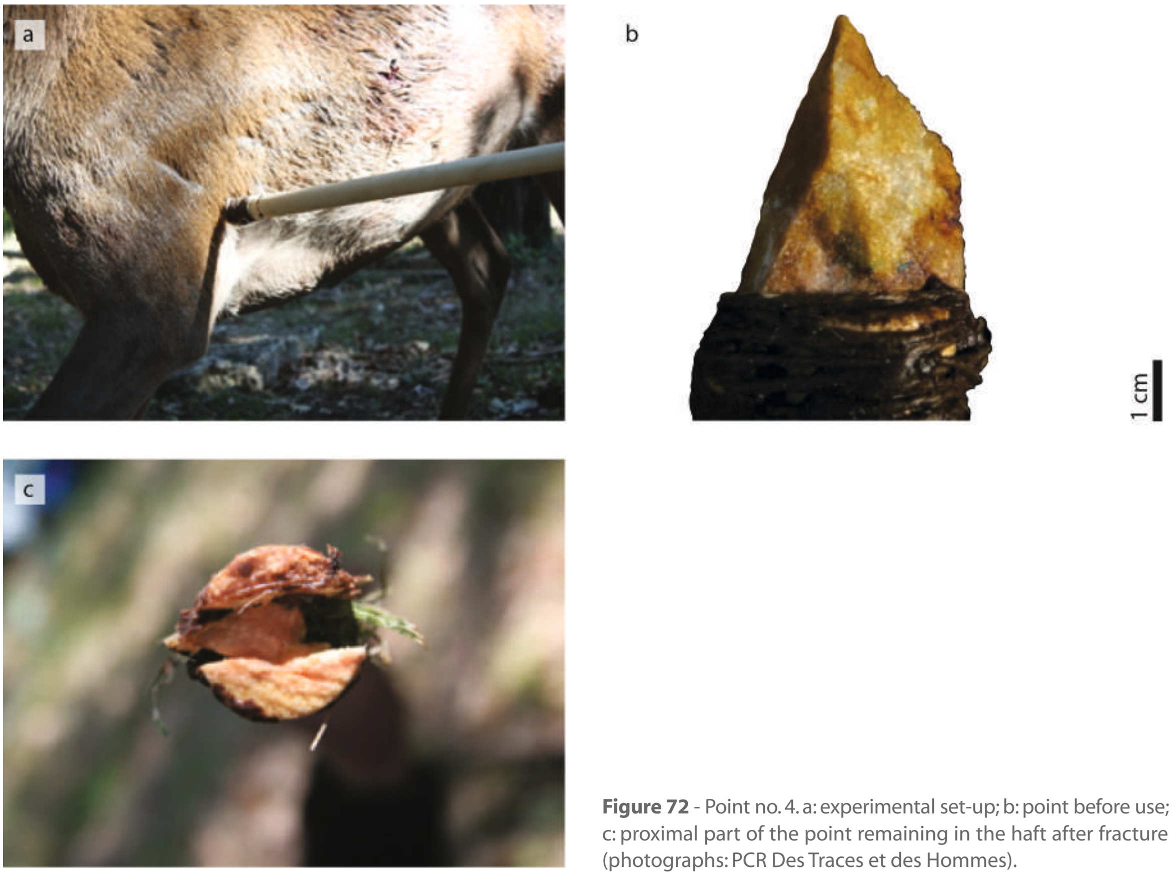


Figure 72 - Point no. 4. a: experimental set-up; b: point before use; c: proximal part of the point remaining in the haft after fracture (photographs: PCR Des Traces et des Hommes).

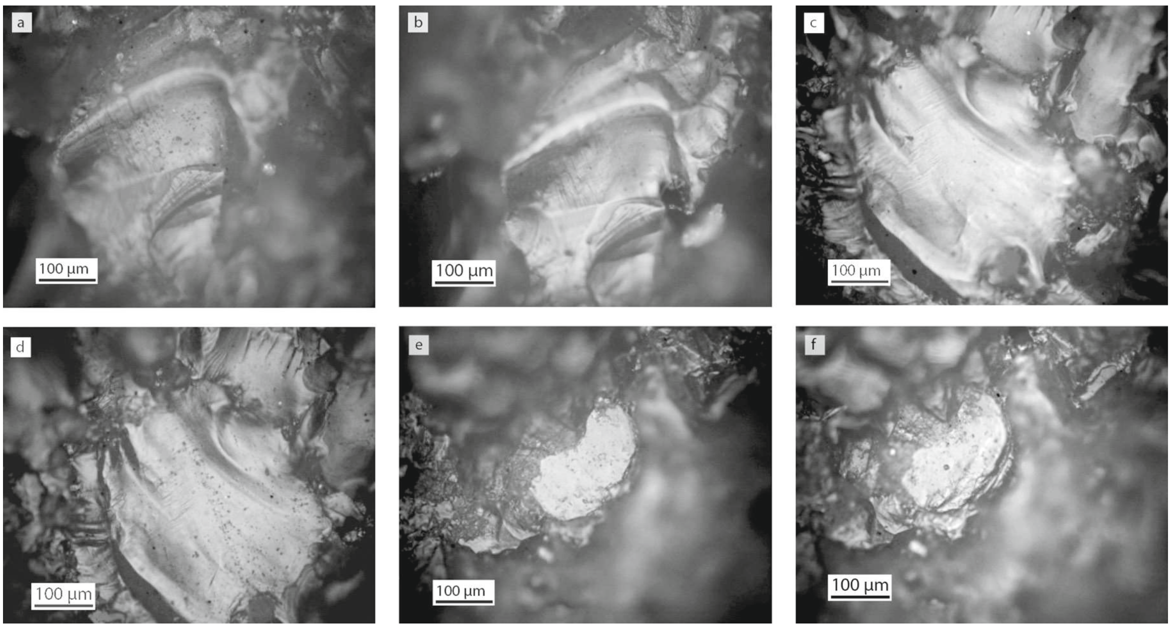


Figure 73 - Point no. 4. a, c, and e: crystals observed before use; b: smooth and polished crystal after use; d: crystal with a slight abrasion oriented perpendicular to the point, after use; f: crystal bearing traces typical of butchery, after use (photographs: C. Lemorini and F. Venditti).

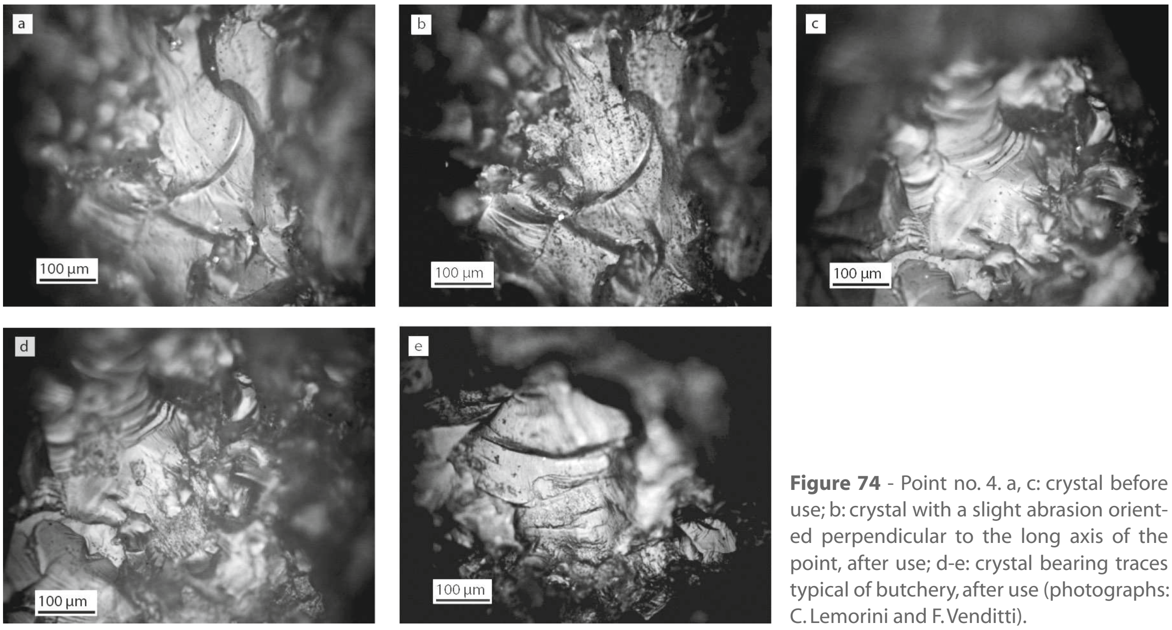


Figure 74 - Point no. 4. a, c: crystal before use; b: crystal with a slight abrasion oriented perpendicular to the long axis of the point, after use; d-e: crystal bearing traces typical of butchery, after use (photographs: C. Lemorini and F. Venditti).

- the single presence of *snap* fractures is not evidence of impact given that this morphology can develop also for technological or taphonomic reasons;
- the single presence of traces of fleshy tissue could be due to the butchery activity;
- the single presence of abrasions is not an obvious evidence since this type of trace can be found on the natural surface of the crystals.

Cutting soft animal materials without bone contact

These operations are certainly the most difficult to identify archaeologically on the basis of macro-traces because they only occur very rarely, especially when treating a fresh hide. For these operations, it will therefore be necessary to rely more on micro-traces.

Of the seven points used to deflesh hides, only two show scars. They are small scars that develop only on one face, they are continuous, aligned, semi-circular (anecdotally quadrangular and triangular scars are seen), with feather and oblique terminations. A point used in defleshing hide also bears a very slight rounding on the tip of the cutting edge.

Cutting soft animal materials with bone contact (soft to medium-ard materials)

The defleshing, disarticulation and possibly skinning operations produce scars that reflect accidental bone contact. The macro-traces observed on the points and characterizing the butchery activities are:

- fractures: in almost half of the cases, they appear on the experimental items. They are face and burin-like bending fractures with a feather termination. These fractures appear only under certain conditions: a bone contact, in particular in the context of disarticulation, and the presence of a pointed distal part;
- scars (figures 75-76): these are scars that appear on both faces of the tools alternately from one face to the other. They are arranged in series, by combinations of scars of various morphology. The combination of various morphologies, and in particular the presence of triangular scars is a reliable indicator of the use of the cutting edges for a butchery activity. The terminations are step or hinge, and the axis of symmetry is deviated (oblique orientation).

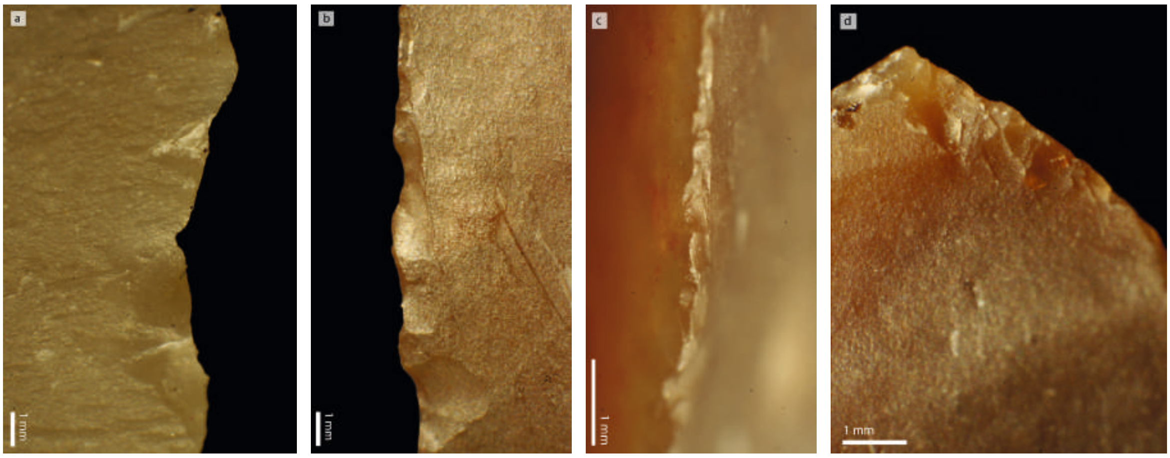


Figure 75 - Scarring observed on experimental points used in butchery activities. a: combination of quadrangular and triangular scarring with hinge and step terminations; b: combination of quadrangular, trapezoidal, semi-circular, and triangular scarring with feather and step terminations; c: view along the tip of the edge, showing a pattern alternating scarring; d: combination of quadrangular and trapezoidal scarring at the distal extremity of a point (photographs: A. Coudenneau).

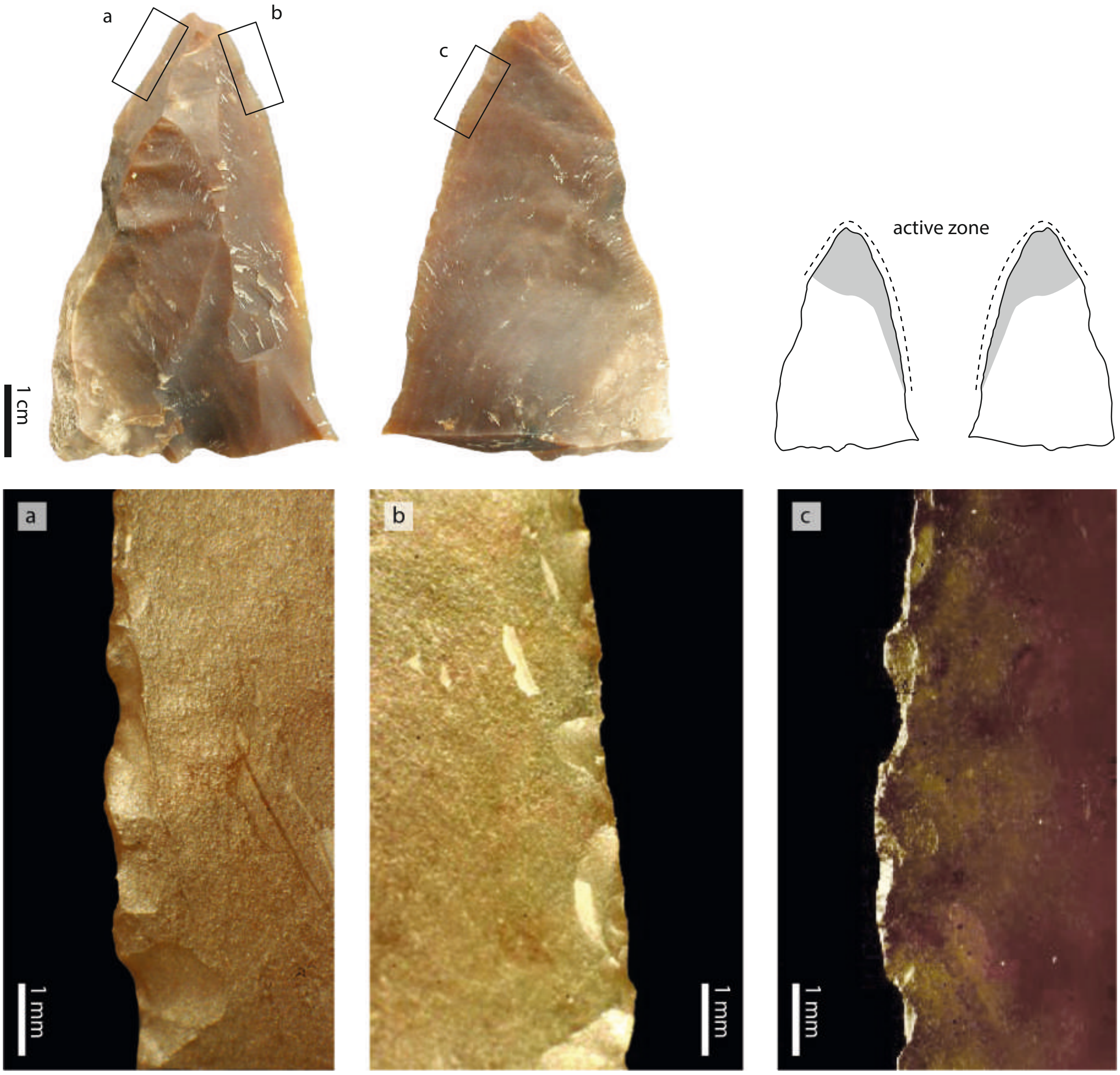


Figure 76 - Experimental point used in butchery activities and the macro-traces produced during use.
a-c: combinations of scarring observed (photographs and CAD: A. Coudenneau).

Scraping of soft abrasive organic material (hide)

Hide scraping activities do not produce fractures. It is mainly activities involving contact with dry hide or leather (tanned and softened skin) that produce scars. These scars depend on the nature of the contact. The two Mousterian points used to scrape the dry hide, covered with ashes before tanning, bear bifacial, discontinuous, aligned to superimposed scars, with a combined morphology: quadrangular, semi-circular and trapezoidal, with fine or step and oblique termination. This is a rather atypical distribution for this type of contact that usually produces traces on the face opposite to the contact face. The main feature of the macroscopic traces observed on these items is the presence of a very strong rounding on the active edge. This rounding starts from the cutting edge towards the interior of the item on the face in contact with the hide.

Drilling soft to medium-hard material (hide)

The actions of punctiform contact on the dry hide produced fractures, but in this case, they are traces little characteristic of the material. They are rather demonstrating the action. These are bending fractures with feather termination (figure 77). More than ever, these fractures alone cannot be diagnostic and must be combined with other legible traces. In the absence of other traces, it will be impossible to conclude when passing to the study of the archaeological material. The leather piercing and perforating activities produced scars that develop alternately on both edges of the point in the distal part. These scars are isolated to aligned. They are all with quadrangular morphology and hinge termination. They are oblique and very small. A marked rounding is also present on the items used in drilling on the edges and on the ridges of the distal part, in contact with the hide. On the other hand, no rounding is observed on the tem used in perforation.

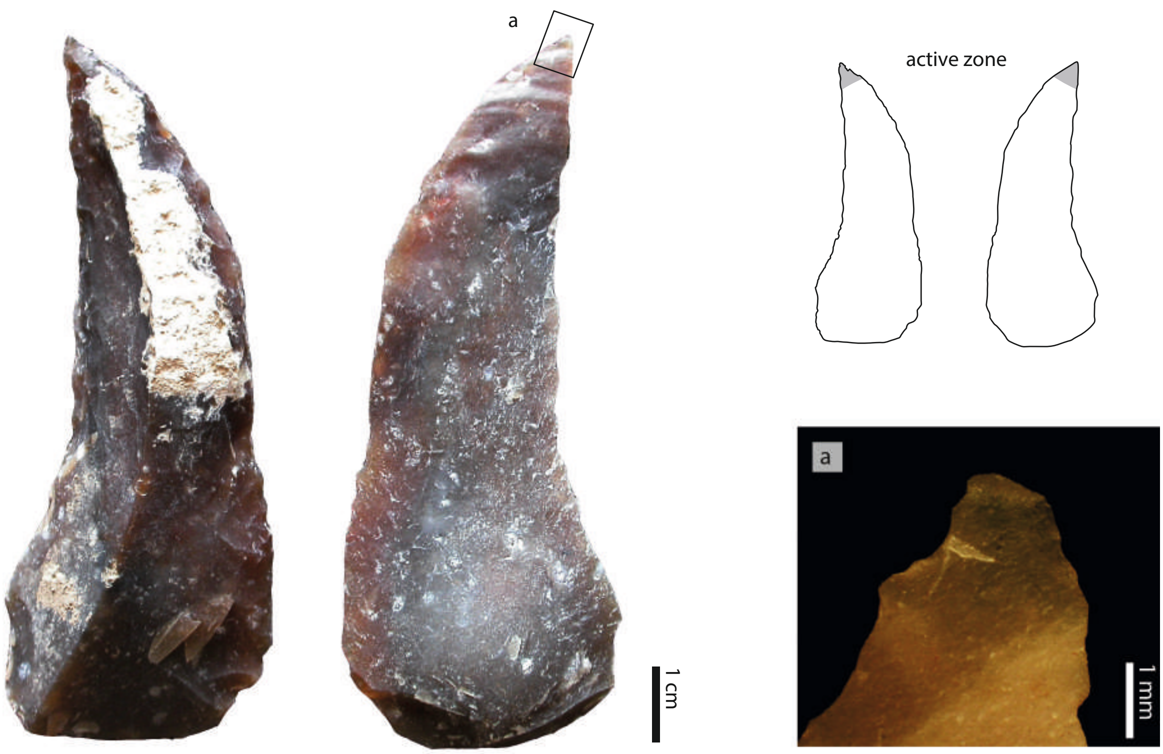


Figure 77 - Mousterian point used in punctiform contact on a tanned hide and the associated macroscopic and microscopic traces. a: scarring and bending fracture (photographs and CAD: A. Coudenneau).

Longitudinal action on medium-hard materials (wood)

The longitudinal contact actions produced scars on both faces of the active edge. These scars are distributed discontinuously by alternating from one face to the other, thus forming a sinuous cutting edge. There is no exception to this statement amongst the nine points used in longitudinal contact action. The organization of the scars is aligned to superimposed (figure 78[a-b]). On a point used to incise the bark to remove it, the scars are isolated. The morphologies of the scars are generally quadrangular. These quadrangular scars are very often combined with various morphologies: quadrangular and half-moon or quadrangular and trapezoidal. The mode of action and the state of freshness of the wood do not seem to condition the morphology of the scars. The terminations of the scars are snap, hinge or step. On two points that worked on green wood, we observe feather terminations. We find scars with step termination indifferently on dry or green wood. All the observed scars are oblique.

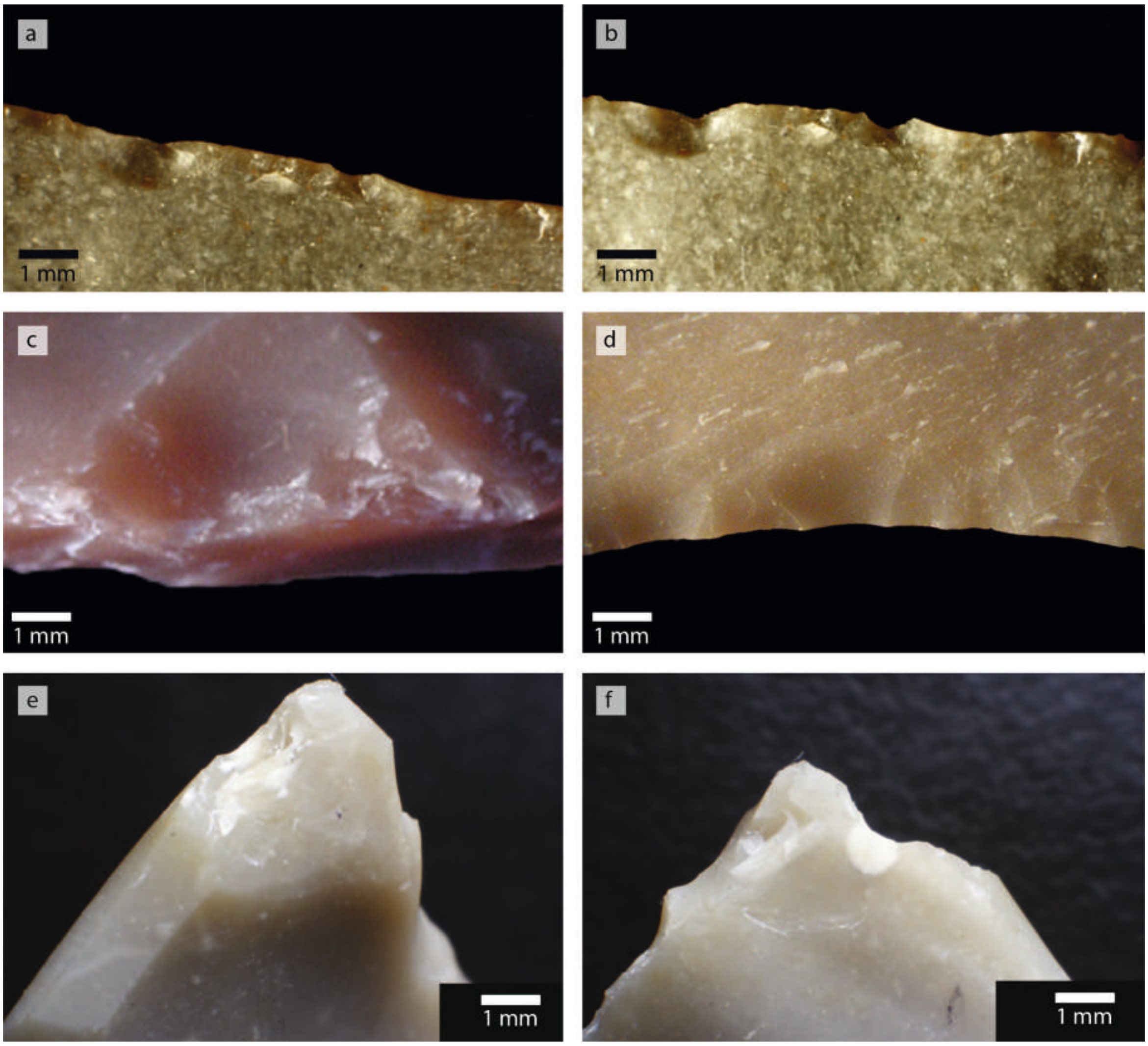


Figure 78 - Scarring on points related to working wood. a-b: scarring produced during continuous longitudinal contact; c: scarring produced during percussive longitudinal contact; d: scarring produced during transverse continuous contact; e-f: scarring produced during punctiform contact, observed on the dorsal surface of the point (e) and the ventral surface (f) (photographs: A. Coudenneau).

A rounding is visible on two of the points used in longitudinal action. It is a rounding of low intensity, which develops on the ridges of the negatives of removals of the retouch. This rounding seems related to the friction of the upper parts of the retouched face of the object against the wood during the action.

We finally notice that there is no significant difference in the development of macro-traces obtained on hardwood or softwood.

Transverse action on medium-hard materials (wood)

The transverse actions produced scars that develop on only one face: the trailing face, that is to say the face opposite to the leading face. Only three active areas have bifacial scars. These scars are distributed continuously along the active edge and they are aligned with each other. The morphologies of the observed scars are very predominantly quadrangular (11 cases out of 16, that is to say 69 % of the cases). They are rarely combined with other morphologies of scars and when it happens it is with scars of trapezoidal or half-moon morphologies. The terminations of the observed scars are usually feather (figure 78[d]). For the retouched edges, a hinge or step termination is not excluded. Scars obtained during a transverse contact action on wood are perpendicular. A single point has a very weak rounding on the cutting edge.

Drilling medium-hard materials (wood)

The points make it possible to perform rotational actions to drill wood. This is one of their functional specificity. We are therefore checking the specificity of the macro-traces obtained for this type of use on the wood. Three points have been dedicated to this use. For each experiment, the distal part of the two edges as well as the convergent extremity were involved. The scars are positioned alternately from one edge of the tool to the other. They are continuous throughout the active area and superimposed. They are scars of quadrangular morphology, but we also observe semi-circular scars on a point used on a dense and dry wood. The terminations of these scars are step (figure 78[e-f]). The symmetry is variable and depends on the axis in which the action took place. The tool used on green wood has a rounding on the ridges of the point that have been in contact with the wood.

Longitudinal action on hard materials (bone)

Longitudinal actions produced scars in all cases. They are bifacial and discontinuous scars that alternate from one face of the tool to the other. They are numerous, large in dimensions, aligned to superimposed, of quadrangular and half-moon morphology and with snap and step terminations. No rounding has been produced, certainly because of the continuous scarring of the active edges that prevents the preservation of a rounding.

Transverse action on hard materials (bone)

The transverse contact actions produced scarring in all cases. These scars appear most often on the face opposite to the trailing face but some of them are found on the leading face. These chips are continuous and superimposed. They are quadrangular and trapezoidal scars with step termination. They are perpendicular (figure 79). No rounding was observed.

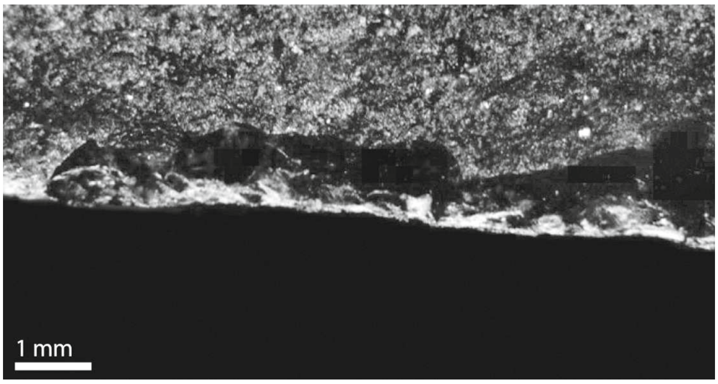


Figure 79 - Traces observed on experimental points that came into contact with bone: microscopic scarring produced by scraping the periosteum (photograph: A. Coudenneau).

Punctiform action on hard materials (bone and shellfish)

The punctiform actions on hard materials produced macro-traces in all cases. The scars are either bifacial or located on one face alternately all along the active area. They are continuous and superimposed. They are quadrangular with a step termination, sometimes feather when it comes to drilling shellfish (figure 80). They are oblique. No rounding was found. At the point, there are fractures and crushing. These are twisted transverse bending fractures. The termination is step. The twisted aspect of the fractures is a valuable indication of the type of motion, as well as the direction of the scars and their position on the item. Crushing is visible on the distal extremity, but also on the sharp ridges of the point. No rounding is observed probably because of the constant scarring that prevents the preservation of a rounding.

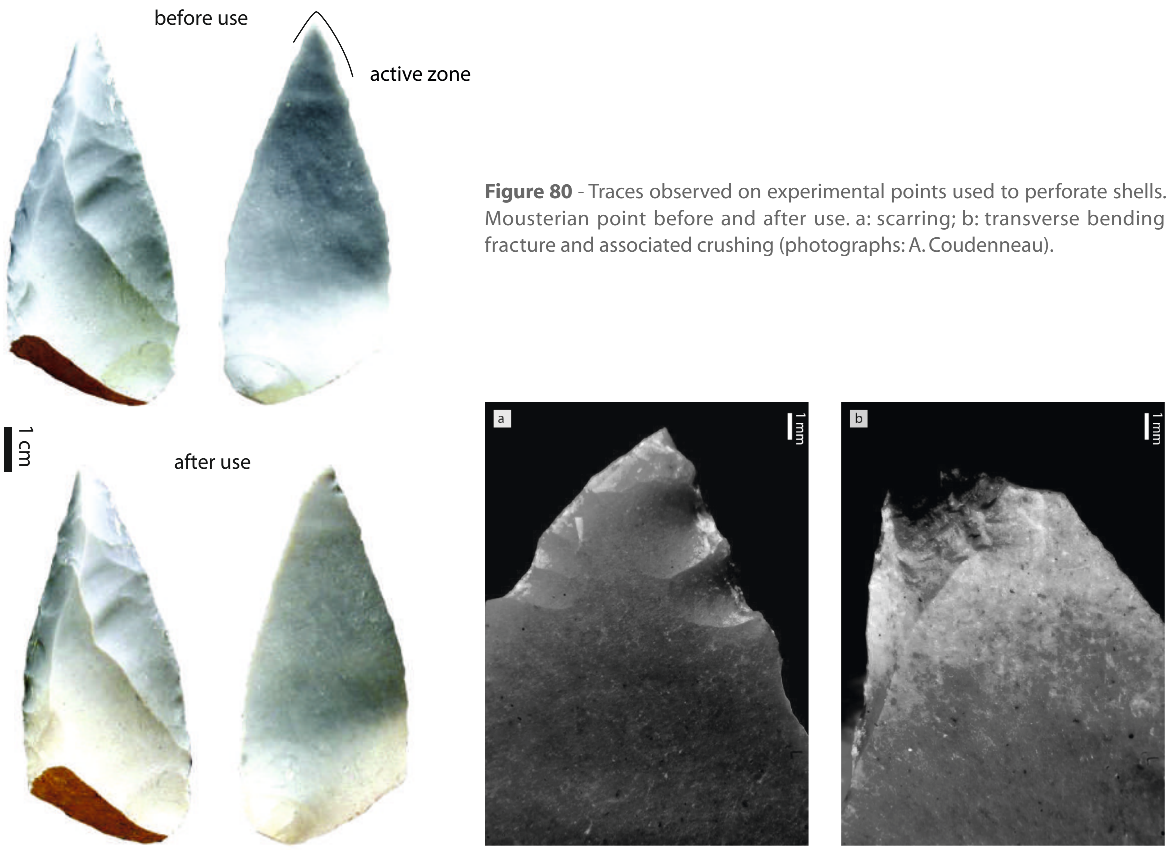


Figure 80 - Traces observed on experimental points used to perforate shells. Mousterian point before and after use. a: scarring; b: transverse bending fracture and associated crushing (photographs: A. Coudenneau).

d - Synthesis of results from the experimental reference collection study

As a result of this study, we find that points have been effective for many activities.

The reference collection of unretouched and retouched points in flint and quartzite was mainly constituted in order to have criteria of interpretation of the traces of use-wear in connection with hunting activities. As such, several results can be retained:

- the most recurrent fractures of the hunting points are bending fractures (face, transverse or burin-like) with step termination (60 %) and axial, oblique or burin-like apical scarring with step termination (20 %). But only the latter proved to be truly diagnostic of the use of points as throwing or thrusting weapons. They are characterized by the combination of a cone initiation with a "languette" of the bending fracture type and result from a pair of forces that include the impact of the point in the animal and the pressure exerted by the oscillation of the shaft of the spear (in the case of a javelin type throwing) or by its twisting (in the case of a thrusting mode) during the penetration of the point into the animal (Coudenneau, 2013);
- bending fractures are quite numerous on the points used as hunting weapons, but they can also result from the carcass processing. "Languettes", reaching large dimensions, were thus observed on two used points: one, Mousterian, used in complete butchery, disarticulation included, has a transverse burin-like bending fracture 9.8 mm in length and an unretouched pseudo-Levallois point used to deflesh a rabbit hide has a transverse bending fracture whose "languette" is 3 mm long. Thus, although quite rare on the points used in a continuous contact gesture, their presence alone on a point cannot, even less on an isolated object, indicate with certainty a use as hunting points. These new data thus feed into the debate initiated by our predecessors and we should remain cautious about the interpretation of bending fractures on triangular elements;
- lateral scars are not strictly speaking a discriminating feature of this type of use. Nevertheless, the presence of quadrangular scars with step termination, or of a combination of half-moon, quadrangular or trapezoidal scars with snap or step terminations, may be a further indication of use as a hunting weapon. These clues gain even more weight if they are associated with an apical scarring.

The nature and the frequency of the impact traces vary notably according to the morphology of the points in parallel with other variables like the nature and the organization of the materials crossed or touched during the shots (hide, meat, bone: ribs or long bones, ...) or the fixing modes of the point on the shaft, as recently mentioned by A. Coudenneau (2013) and V. Rots and H. Plisson (2014). The latter have recently insisted on the need to use an experimental reference collection specific to each chrono-cultural period or even to each case study and to consider the other use-wear traces possibly associated with fractures, without which the risk of misinterpretation could be important. Moreover, several authors, such as J. Pargeter (2011) or L. Chesnaux (2014) have highlighted the fact that fractures usually considered as diagnostic, such as complex bending fractures (whose "languette" is longer than 2 mm) or burin-like fractures (see for example Fisher *et al*., 1984; O'Farrell, 2004) can also occur during the debitage of the blank and during trampling. It is therefore important to ensure that the traces are posterior to retouching if retouch is present and to be particularly vigilant in the case of unretouched points, especially if the fractures are observed punctually at the scale of a site (one or two items only, no standardization of the concerned items). The repetition of impact traces on several points of the same serie coupled with the knowledge of the economic and taphonomic context of the site can make it possible to overcome the problems of convergence with other modes of use.

P@LETHNOLOGY
Archaeology and Humanities