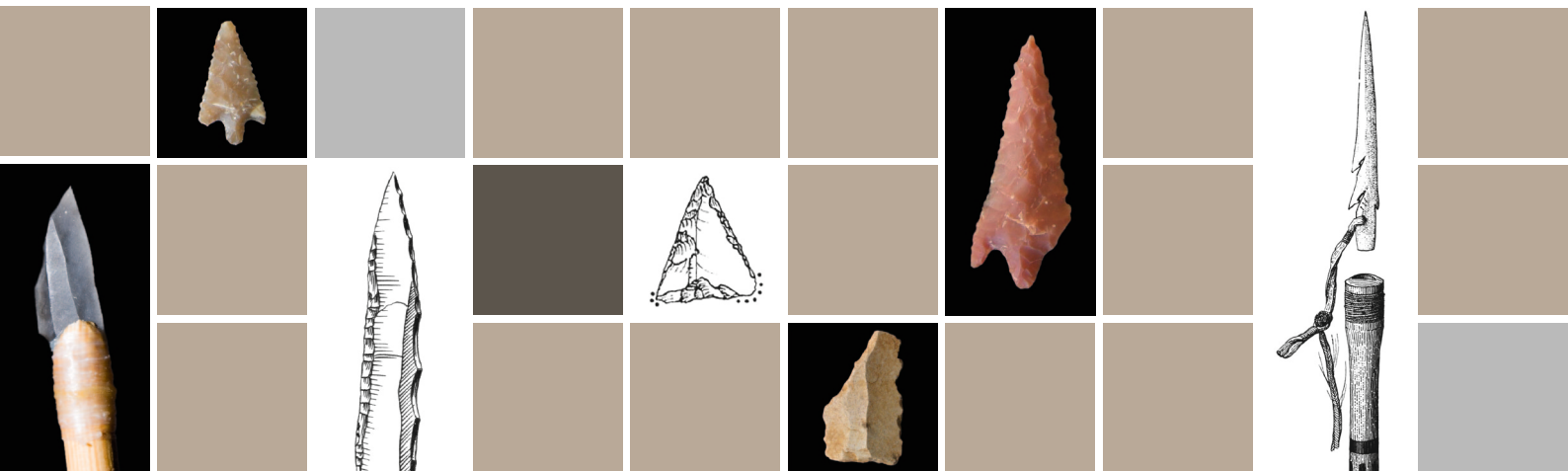


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**PROJECTILE WEAPON ELEMENTS  
FROM THE UPPER PALAEOLITHIC TO THE NEOLITHIC**  
**Proceedings of session C83**



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**Jean-Marc PÉTILLON, Marie-Hélène DIAS-MEIRINHO, Pierre CATTELAIN, Matthieu HONEGGER, Christian NORMAND & Nicolas VALDEYRON**  
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# NEW LIGHT ON PALAEOOLITHIC, MESOLITHIC AND NEOLITHIC PROJECTILE WEAPON ELEMENTS

Jean-Marc PÉTILLON, Marie-Hélène DIAS-MEIRINHO, Pierre CATTELAIN, Matthieu HONEGGER, Christian NORMAND, Nicolas VALDEYRON

Stone or bone, transverse heads or points, barbs, foreshafts, harpoon heads... Projectile weapon elements are found in many forms in prehistoric sites, at least from the beginning of the Upper Palaeolithic. These artefacts first attract archaeologists with their great numbers, often dominating proportions in tool assemblages, but they are also interesting due to their clearly dynamic role in prehistoric material culture: the morphology and/or technical characteristics of many of them vary significantly through time and space, thus constituting a useful tool for archaeologists in the construction of chronologies and the definition of cultures. Researchers often integrate these variations with other types of transformations—such as ecological or economic ones—to build interpretative models of the evolution of societies.

The important role of projectile weapon elements in archaeological research is also due to their association with activities that are never mundane: hunting activities, of course, but also, very likely, in the context of conflicts between individuals or groups.

Wild animals are a vital resource for most hunter-gatherer groups and they continue to play a significant economic and/or socio-cultural role in many agro-pastoral societies. While faunal remains found in habitat sites allow us to identify the species exploited, acquisition techniques, on the other hand, leave very few traces: collecting and scavenging require very minimal equipment and the majority of objects used for hunting are made from perishable materials (nets, traps, pikes, throw-sticks, slings, bows, quivers, atlatls, etc.). Weapon elements, when they are preserved, are usually the only material allowing us to address this fundamental field of activity. The same is true for war weaponry, at least from periods anterior to the appearance of metal equipment (swords, helmets, greaves, etc.). Here again, weapon elements are one of the few remains that can provide information concerning violence and the practices of war in prehistory. Furthermore, only the rare fragments of weapons made from bone material—such as the Magdalenian atlatl hooks—or the bows and arrows preserved in some Mesolithic and Neolithic sites, allow us to investigate the relationship between whole weapon systems and the individual element(s) of which they are composed.

We will not retrace here the history of research concerning projectile weapons, but refer the reader to the synthetic article by H. Knecht (1997a). This text recounts how the preoccupations of archaeologists, at first essentially classificatory (typology, morphology), expanded in the 1980's to include technological questions in the general sense: reconstruction of the modes of fabrication, use and maintenance of weapon elements. The colloquium “La chasse dans la Préhistoire/ Hunting in Prehistory”, held in Treignes (Belgium) in 1990, provided one of the first opportunities to assemble numerous works in progress in Europe in this domain (Bellier *et al. dir.*, 2000). A few years later, the collective work *Projectile Technology* (Knecht *dir.*, 1997b) provided a broad perspective of research conducted during the beginning of the 1990's, in archaeology in the strict sense, as well as in the domains of experimental archaeology and ethnoarchaeology.

The pace of these works slowed during the later 1990's, but a new dynamic has emerged over the past several years. The originality of recent research lies in the integration of different approaches, such as the simultaneous study of the fabrication and use of an assemblage of weapon elements, the joint study of the lithic and osseous weapon elements in the same assemblage, and the integration of faunal data. With the goal of promoting these approaches, we decided, around ten years after the publication of *Projectile Technology*, to revive this theme in the context of the 15th Congress of the UISPP.

The idea to organize this colloquium emerged from discussions, exchanges and collective research among the six coordinators. Though we focus on different periods, problems and material types, we realized that we are faced with similar questions concerning the identification and interpretation of weapon elements. Our aim was thus to bring together specialists from different horizons in order to encourage debates and discussions that would reveal common research problems and convergent ideas.

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This colloquium was held in Lisbon, Portugal on September 7 and 8, 2006. It consisted of around twenty, 20 minute long presentations, complemented by numerous valuable discussions. There were about fifty attendees at all times. The enthusiasm of the participants was very encouraging and we believe will lead to numerous “sequels”—perhaps in the form of workshops with more limited themes, which we will further discuss below.

Faced with such a broad and complex topic, we obviously had no pretention of exhaustiveness. First, for practical reasons, we had to limit the chronological range of this colloquium to the Upper Palaeolithic, Mesolithic and Neolithic, though we are well aware that this type of restriction is always somewhat arbitrary. Moreover, even within the chronological range chosen, the presentations did not constitute a complete panorama of research in progress (we regret, among others, the under-representation of studies of osseous weapon elements).

In this volume, the reader will thus encounter just a glimpse of a vast domain of research, in the form of 16 articles based on the studies presented during these two days. These contributions represent the work of 25 authors and co-authors working in nine countries. We emphasize that nearly half of them are Ph.D. students or recent graduates without stable employment, and that many of the results presented are part of university theses or collective research projects in progress.

The subjects treated are equally chronologically distributed between the Upper Palaeolithic (6 contributions), the Final Palaeolithic and Mesolithic (4 contributions) and the Neolithic (5 contributions). Geographically, except for two excursions into the African continent—Nubia and South Africa—the colloquium was focussed on Western and Mediterranean Europe (Spain, France, Luxemburg, Germany, Italy, Greece).



In general, the studies presented can be divided equally into two broad approaches and domains of questioning, which we distinguish as functional perspectives and diachronic perspectives.

### Functional perspectives

Weapon elements or elements of cutting tools (knives, sickles)? This question is often raised, especially in studies of lamellar (bladelet) tools, and the morphology of the objects alone does not provide a definitive response. Two very distant cases, that of Archaic Aurignacian bladelets (Normand *et al.*) and Holocene circular segments in Nubia (Honegger), illustrate the complexity of this problem. An integration of the contexts of discovery and analysis of microwear and impact fractures allows these authors to propose a distinction between weapon elements and elements of other tools. As a result, in both cases, a population of artefacts usually considered to be homogeneous is shown to be composed of several functional categories.

Venturing beyond the identification of weapon elements, several authors investigate their hafting methods. Were they attached to the extremity of the weapon, or laterally, on its side; in the axis of the projectile or at an angle (lithic “barbs”)? This problem is particularly pertinent for Mesolithic microliths (Chesnaux, Grimaldi), but also exists for elements whose hafting mode would seem more evident, such as Gravettian backed points (Borgia) or Hamburgian shouldered points (Weber). Experimentation is now considered to be an indispensable tool for addressing such questions and all of these studies present the results of experimentation with a bow and arrow with the goal of obtaining diagnostic traces on the experimental weapons elements that can be compared with those observed on archaeological objects.

In this domain, the ensemble of this volume reveals a degree of heterogeneity. More than twenty years after the first publications of systematic projectile experiments and descriptions of impact traces, the protocols and methods applied in this type of experimentation are still far from homogeneous; the nomenclature of fracture types is not always standardized; and experimental reference bases for several types of lithic projectile elements are still unrealized. Moreover, all of the authors are aware of the necessity of distinguishing between projectile impact fractures and other types of breaks (trampling, fabrication, etc.), but numerous taphonomic parameters in this domain are still not fully controlled.

This problem alone probably merits the organization of an international colloquium in order to establish conventions accepted by all. Fortunately, speaking the same language does not mean that we all have to say the same thing... but it does have the advantage of facilitating inter-site comparisons, which are currently very difficult (how do we interpret the varying frequencies of a fracture type from one site to another, or the sometimes extremely variable percentages of weapon elements with diagnostic impact traces?).

Some of the experiments published in this volume lead to other functional hypotheses. In the case of Sauveterrian microliths, for example, the short depths of penetration obtained through shots into *suidae* with a bow and arrow incite the experimenters to wonder if poisons may have been used (Chesnaux), or if these weapon elements were specialized for the hunting of small prey (Grimaldi).

This question of functional specialization constitutes the central theme of two other contributions. Based on the context of discovery of the weapon elements—and in one case on ethnographic comparisons—the authors attempt to determine, respectively, whether we can identify weapon elements specifically associated with war in



the Neolithic during the 3rd Millennium (Dias-Meirinho) and if the barbed points of the Upper Magdalenian were specialized in the acquisition of a specific prey animal (Pétillon). The preliminary nature of the results of these studies demonstrates the difficulty of pushing functional analyses to this fine degree of resolution.

### Diachronic perspectives

The eight other articles present either a study of one assemblage replaced in a broader chronological perspective, or the data of several assemblages covering a long time range. All of these contributions address, more or less explicitly, the same question: what factors are at the origin of the typo-technological variations observed among panoplies of weapon elements? The responses given, or at least initiated, and the models proposed are very diverse—at minimum because each archaeological situation is specific and our state of knowledge is highly variable from one period, or one region, to another. Meanwhile, it is important to emphasize that weapon elements are seen in these studies as indicators of social phenomena. Changes in weapon element kits are presented as evidence of social evolutions. These evolutions can, if we greatly simplify the observations of the authors, be divided into two broad categories: cultural and economic.

In studies of weapon elements, the “cultural” argument is often favoured to explain the (non) diffusion of discrete technical traits, these “tiny details (...) including—and perhaps especially—the most insignificant in appearance, such as the simple choice of lateralization” (Valentin, 2008, p. 64). Attempts to correlate weapon elements and other aspects of material culture have yielded nuanced results. In the Moselle region (Hauzeur and Löhr), for example, the distribution of weapon element lateralization does not fully correspond to the zones of influence of different Neolithization trends, thus demonstrating the role played by the traditions of the preceding Mesolithic substratum. Furthermore, these evolutions do not appear to be linked with exchange networks since the left lateralization of armatures is accentuated through time, while the majority of the flint used come from regions where right lateralization dominates. This phenomenon is comparable to that which prevails on the Ionian island of Cephalonia (Stratouli and Metaxas): though the island participated very early on in abundant exchanges with the rest of the region, the evolution of weapon elements does not reflect this situation since the Middle Neolithic ensembles persisted there well after their disappearance elsewhere. The authors attribute this “technical conservatism” to a specific, insular way of life in which hunting was invested with a particular status. But it is through a well documented Palaeolithic example that we can most clearly approach the mechanisms of the transmission of cultural norms: the technological study of the Gravettian assemblage of Tercis (Simonet) reminds us of the crucial importance of apprenticeship behaviours—and their consequent variation in skill levels—for the perpetuation or transformation of a weapon element “standard”.

The evolution of the raw materials and fabrication techniques used to produce weapon elements also reflects the economic structure of prehistoric groups. For example, from the beginning to the end of the Magdalenian, between the Rhone and Ebre Valleys, the variations in lithic ensembles show changes in the degree of anticipation and planning for needs, as well as the more or less broad integration—or on the contrary, autonomy—of different regional groups (Langlais). This problematic echoes that of a project concerning hunter-gatherers of the Quercy region between the 10th and 5th millennia (Valdeyron *et al.*): in this case the model is still being constructed, but already raises the question of the influence of the progressive closing of the landscape on the economy of Mesolithic groups and the repercussions on the composition of weapon kits (changes in the accessibility of raw materials, group mobility, fauna hunted, etc.). The question is also raised for the Azilian in western France (Naudinot) where variations in the standardization of weapon elements appear to be related to more or less simplified debitage



methods, but the technological variations themselves must still be replaced within the global economic evolution of these groups. Long term economic evolution is also proposed to explain the variations in Neolithic weapon elements in eastern Spain (Fernández López de Pablo *et al.*): the decreasing frequency of microliths throughout the Neolithic is correlated with a diminution of hunting activities, while the resurgence of weapons in certain Final Neolithic contexts would reflect the colonization of new territories and the elimination of the existing wild fauna.

The same authors also suggest that an increase in armed conflicts could have played a role in the development of some types of weapon elements. This hypothesis evokes the scenario put forth for Bushmen weapons (Bosc-Zanardo *et al.*). According to the model proposed, the “concretization” of Bushmen weapon elements—in the sense of G. Simondon (2001), meaning the convergence of functions into a structural unit—was made possible in the 19th century by the generalization of metal use and was perhaps strongly incited by the multiplication of wars during this period. For a prehistorian, this contribution provides material for reflection... This study of Bushmen weapons benefited from an integration of historical, ethnological and archaeological sources. It thus reminds us of the difficulty, when our only source is archaeological, of understanding the conditions of the emergence of a technical innovation—and in particular, of identifying the necessary conditions (here the generalization of metal) and the inciting conditions (here increasing conflicts), the two here being, moreover, intimately related!

We will end this brief “tour” of a vast domain by expressing our gratitude to the University of Lisbon for accommodating this colloquium, and of course, the national administration of the UISPP for their organization of the 15th Congress. We also thank all the participants, orators and attendees, in particular those who accepted the role of session president or moderator. Each article in this volume was submitted to a reviewing committee composed of the present authors joined by François Bon, to whom we express sincerest appreciation. We are also grateful to the editorial committee of the journal *Palethnologie* for opening its columns to us, and finally to Noëlle Provenzano for her useful comments on an earlier version of this text.

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Article translated by Magen O'Farrell



# Functional prospects

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# THE FUNCTION(S) OF ARCHAIC AURIGNACIAN BLADELETS : DATA AND THOUGHTS BASED ON EXAMPLES FROM ISTURITZ CAVE (PYRÉNÉES-ATLANTIQUES, FRANCE)

Christian NORMAND, Magen O'FARRELL & Joseba RIOS GARAIZAR

## Abstract

Very early on, prehistoric groups in the western Pyrenees benefitted from the favorable geographic situation and vast dimensions of Isturitz Cave. The excavations conducted there in the beginning of the 20th century revealed evidence of frequent occupations during the Middle, and especially Upper Paleolithic. Starting in 1999, new research in the Saint-Martin gallery has focused on its Aurignacian stratigraphic sequence. The base of this sequence is composed of rich Archaic Aurignacian assemblages with a lithic industry largely dominated by bladelets. In this paper, we present the first results of usewear analyses of these bladelets, which reveal diverse functions. However, we also insist on the need to validate our hypotheses through experimentation.

**Key-words :** Projectile weapon element, Aurignacian, Isturitz, Pyrenees, bladelet production, bladelet function.

The abundance of bladelet debitage in the Aurignacian is now well demonstrated and numerous studies have emphasized the major role played by these productions throughout the duration of this techno-complex (e.g., Arrizabalaga, 1995; Chiotti, 1999; Bon, 2000; Bordes, 2002; Maíllo Fernández, 2003; Teyssandier, 2003, to cite only the most recent examples). This role must be considered from at least two perspectives: that of the Aurignacians themselves for whom the production and utilization of these tool blanks often constituted major activities, and that of the archaeologists for whom the typological and technological variations of these objects provide data that can contribute to the formulation of precise chronological phasings of Aurignacian assemblages. Recent research has indeed demonstrated the existence of significant morphological and dimensional differences among these “bladelets”, as well as variations in the location, organization and intensity of retouch. Based on these criteria, a few principal morpho-types have been defined (e.g., “Font-Yves”, “Dufour” and “Roc-de-Combe” bladelets; e.g., Demars & Laurent, 1992), each more or less exclusively associated with different phases of the Aurignacian (*ibid.*). In the Archaic Aurignacian<sup>1</sup>, percentages of retouched bladelets regularly exceeding 25% of the total tool assemblage have been observed at all sites where excavation methods have insured their collection. This is particularly true in a group of assemblages from sites extending from the Cantabrian-Pyrenean zone (El Castillo – e.g., Cabrera Valdez *et al.*, 1997, 2001 and 2006; Maíllo Fernández, *op. cit.*, Cueva Morín – e.g., González Echegaray J. & Freeman L. G., 1971 and 1973; Maíllo Fernández, *op. cit.* and 2006. Labeko Koba - Arrizabalaga et Altuna, 2000. Gatzarria - Laplace, 1966; Saénz de Buruaga, 1991) to Italy (Riparo Mochi - e.g., Laplace, 1977; Kuhn et Steiner, 1998. Fumane – e.g. Bartolomei *et al.*, 1992; Broglio *et al.*, 1996, 2002 and 2003), without forgetting the Grotte du Renne at Arcy-sur-Cure (e.g., Schmider *et al.*, 2002), and of course the Mediterranean coast

with sites such as Arbreda (e.g., Maroto Genover *et al.*, 1996; Soler Masferrer, 1999), La Laouza (e.g., Bazile, 1974; Bazile *et al.*, 1981; Sicard, 1995; Bazile & Sicard, 1999), Esquicho-Grapaou (e.g., Bazile, 1984; Sicard, 1994; Bazile & Sicard, *op. cit.*), Mandrin Cave (Slimak *et al.*, 2006) and many others. Such percentages have logically motivated several researchers to investigate the function of these objects. Their use as elements of composite projectile weapons has been proposed, for example at the Grotte du Renne (e.g., Schmider & Perpère, 1996) and for those attributed to the Early Aurignacian at Le Flageolet (Rigaud 1993). This function was regularly associated with the great rarity—and often total absence—of osseous projectile points in Archaic Aurignacian assemblages (Liolios, 1999). Nonetheless, very few detailed studies of these bladelets have been conducted and that of the assemblage from Fumane (Broglio *et al.*, 1996 and 2005) has remained exceptional for some time. This latter study was limited, however, to retouched blanks and macro-usewear traces (*ibid.*, p. 498) since surface alterations prevented further studies (*ibid.*, p. 498). It thus seemed pertinent to us to present the data resulting from analyses currently in progress of a large set of bladelets recovered during excavations from 2002 to 2005 of the Archaic Aurignacian levels at Isturitz. In contrast to the studies previously presented, ours concerns retouched and non retouched pieces and analyses of both macro and micro traces, the generally good preservation of these bladelets permitting the latter. Nonetheless, even if the samples analyzed are probably representative of the bladelet tool kits of the Archaic Aurignacian groups at Isturitz, our results must be considered as preliminary since the excavations are not yet finished and the quantity of bladelets in these assemblages will certainly increase significantly, and, most importantly, several complementary studies (especially experimentation) remain to be conducted.

<sup>1</sup> - Rather than “Protoaurignacian”, we chose this designation following the recent arguments of F. Bon (Bon, 2006). As this author emphasizes, it is evident that this has no implications for the quality of the material productions and even less for their authors.



## Isturitz Cave

### *Geographic context*

Isturitz Cave is located a short distance from the current shoreline of the Atlantic Ocean and the first lateral foothills of the Pyrenees. It occupies a favorable position in the piedmont of the Western Pyrenees, which constitutes a zone of passage and contact between the Aquitaine plain, the Basque-Cantabrian ledge and the Ebre Valley, the latter accessible to the south by a series of mountain passes less than 30 km away (fig. 1).

This site, administratively situated in the districts of Isturitz and Saint-Martin-d'Arberoue (Pyrénées-Atlantiques), is closely linked to a valley with a general north-south orientation and traversed by the small Arberoue River (approximately 20 km long) and a few tributary streams (fig. 2). The ensemble is fed by several springs originating in relatively gentle reliefs forming two approximately parallel bands, punctuated by the indentations that separate the principal massifs and provide access to the neighboring valleys. Around 200 km to the north, the altitude increases progressively in a southward direction while remaining moderate, with a maximum of 571 m for the summit of Hocha Handia. These different factors contribute to the accessibility of the zone and its role as a route of communication between the Adour plains and the first Pyrenean foothills. This route could already have played a significant role in the movements of prehistoric human groups, as well as of herbivore herds during their seasonal migrations between these two biotopes.

The cave penetrates into a hill constituted of Urgonian limestone (altitude 209 m). The name of the hill, Gaztelu, refers to the presence of a royal Navarrian castle (Normand, 1997). It forms a sharp stone spur 500 m long and 300 wide, rising around 100 meters above the valley below, which it partially blocks. As it traversed this obstacle, the Aberoue River carved out several levels of cavities, three of which are currently known: the Erberua network, through which the stream of this name still runs, the Oxocelhaya network and the Isturitz network (fig. 3).

The Isturitz network, which has a general north-west/south-east orientation, probably originally formed a vast

tunnel more than 120 m long and as much as 50 m wide in some places. It was open at its two extremities but successive collapses progressively filled in the south-east entrance and greatly reduced the size of the opposite one, which remained nonetheless accessible (fig. 4). Two zones have been distinguished in this cavity: the Saint-Martin Gallery (or South Gallery) and the Grand Gallery or Isturitz Gallery (or North Gallery). There are also two “annex” galleries, the Rhinolophes Gallery and the Phosphate Gallery, as well as some small adjacent ones. The Isturitz Gallery is astonishingly large with a surface of more than 1500 m<sup>2</sup>, accentuated by the height of its ceiling, which attains 15 m in some locations. Its floor currently presents a double inclination, originating from its two extremities, which converge near the stairway dug into the floor in 1953 to provide access to the Oxocelhaya network. The maximum slope, located at the foot of the entrance on the Isturitz side, corresponds to a large talus formed by the back dirt of previous excavations, and whose gradient seems to be very close to that before the excavations. Nonetheless, fragments of floors still attached to the walls show that a large portion of the calcite covering was destroyed during these excavations. The physical configuration of the Saint-Martin Gallery, which was much less altered by previous excavations, is quite different. In addition to its smaller surface area, its roof is never more than 2 m high and numerous concretions link it to a locally thick floor (30 cm).

### *History of research*

Isturitz Cave has always been known and over many centuries it inspired erroneous legends and attributions (Normand, in press a). At the end of the 17<sup>th</sup> century, it already appeared in texts as a Roman gold mine. It is not until 1786 that the Baron of Dietrich finally described it as a natural cavity.

In 1895, numerous prehistoric remains were observed during an industrial exploitation of phosphates (to be used as fertilizers) in the Phosphate Gallery. The progressive destruction of the site was finally interrupted in 1898 following legal proceedings. Several prehistorians, such as E. Piette and H. Breuil then expressed ambitions to



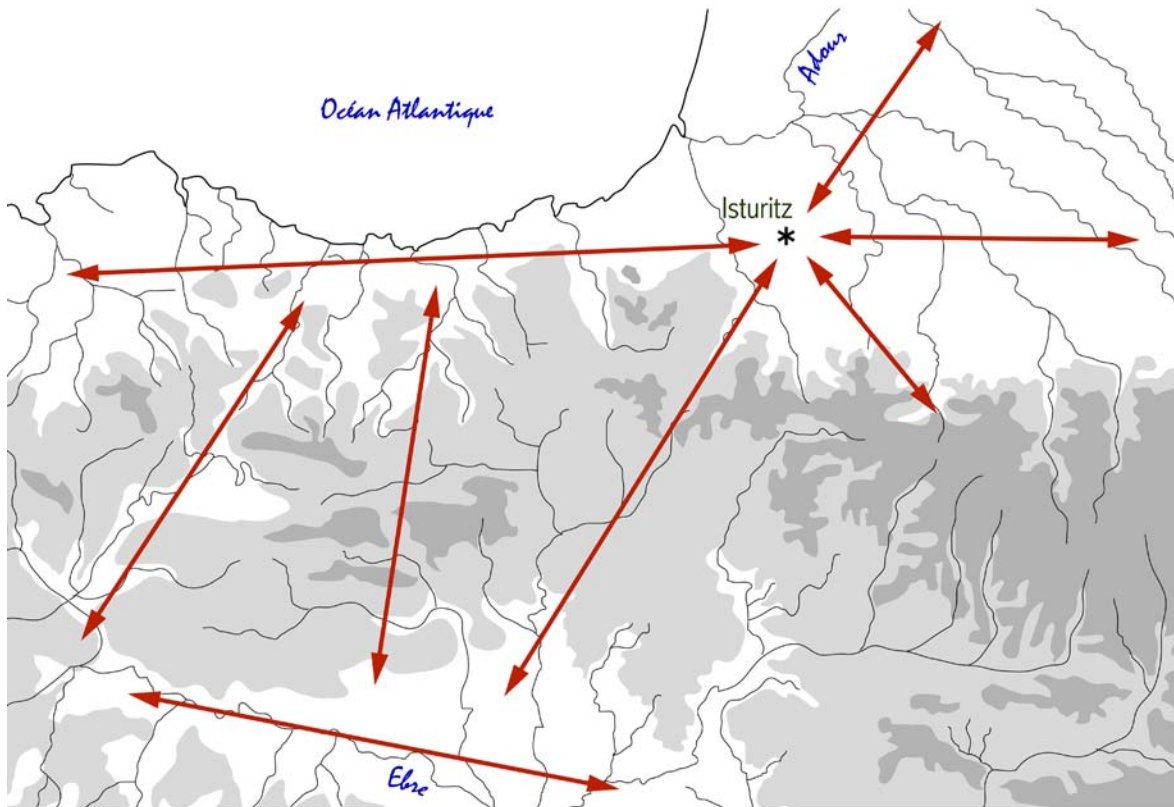


fig. 1 : Location of Isturitz Cave and the main potential circulation routes.



fig. 2 : Arberoue Valley from the southern entrance to the cave.





fig. 3 : Gaztelu Hill and its main sites.

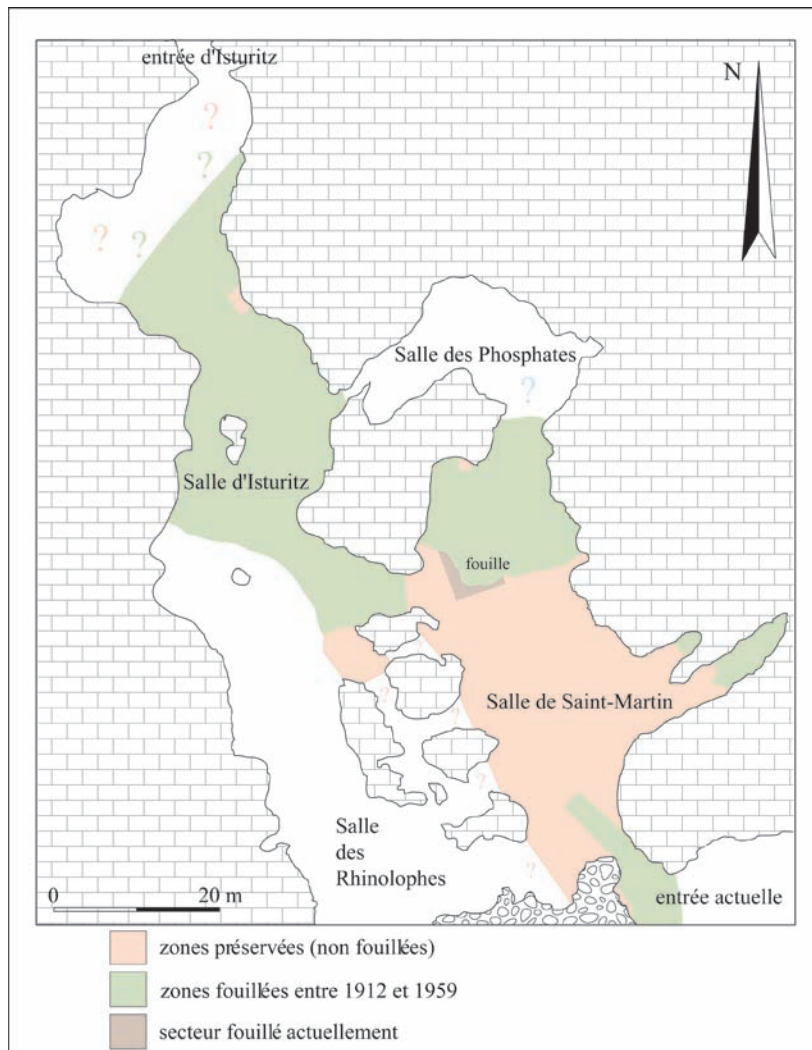


fig. 4 : Plan of Isturitz Cave, extension of the Aurignacian levels and location of the zone currently under excavation.



excavate the site, but never took concrete action. F. Mascaraux made at least one test trench, but the first real research began in 1912 with the work of E. Passemard. He abandoned the cave in 1923 after excavating a test trench in the Saint-Martin gallery that reached 7.5 meters in depth without attaining bedrock (Passemard, 1944). R. and S. de Saint-Périer then obtained authorization to conduct excavations that would continue more or less intensively until the death of the Count in 1950 (Saint-Périer, 1930, 1936, 1952). This phase of research was terminated in 1959 with excavations under the south-east porch, with the participation of G. Laplace. Due to a lack of publications, it is impossible to precisely determine the degree to which this latter intervened in the cave. It is nonetheless certain that he collected numerous artifacts from the screening of the back dirt of a clandestine excavation made in 1985/1986 in the profile corresponding to the limit of the excavations of R. and S. de Saint-Périer. It is this destruction that incited the owner of the site to call upon the Regional Archaeology Service of the Aquitaine to evaluate the archaeological potential of the site. This operation was conducted from 1996 to 1998 (Normand & Turq, 2007). The following year, an official excavation program was begun and is still in progress at the time of the writing of this paper.

### *The general archaeological context*

It is impossible to present here all of the abundant data that have resulted from the enormous human investment made in the excavation and research of this site, which is attested by an abundant bibliography (Normand *in*: Normand *et al.*, 2005).

We have already mentioned the principal characteristics of Isturitz Cave: a favorable location in the heart of the Aquitaine-Pyrenean-Cantabrian zone and a vast surface area accessible to large human groups. These factors could alone explain the attraction of this site to prehistoric hunter-gatherers very early on and over a long period of time. Various research projects have indeed revealed a remarkable succession of Paleolithic occupations (e.g. Passemard, 1922, 1924 and *op. cit.*; Saint-Périer, *op. cit.*), which has led the scientific community to consider

Isturitz as the principal prehistoric site of the Western Pyrenees and one of the most important habitat sites for this period in Europe.

Though the archaeological remains and stratigraphies described by the principal excavators of this site present several problems—artifact selection, globalization of the stratigraphic levels, lack of consideration of the variations that forcibly existed in a site of this size, etc.—it is nonetheless possible to reconstruct the principal characteristics of its human occupations, which are summarized here and in table 1:

- in the Isturitz Gallery, above levels containing only fauna, a nearly complete Upper Paleolithic sequence was revealed, and above it an Azilian level followed by Bronze Age burials deposited on a large dripstone floor near the north entrance. While the Aurignacian and Solutrean occupations were considered to be relatively scarce, the Gravettian and Magdalenian occupations were judged to be particularly important due to the abundance of objects of all types that they have yielded;

- in the Saint-Martin Gallery, the first human occupations recognized are attributed to the Mousterian, with artifacts that are sometimes associated with abundant bear remains. Rich Aurignacian and Magdalenian assemblages have been identified in the levels above, while only a few objects attest to possible Gravettian and Solutrean passages in the site. As in the preceding gallery, deposits of Bronze Age human remains are found at the top of the archeological sequence.

### **The Aurignacian**

#### *Early data on the Aurignacian stratigraphies*

E. Passemard and later R. and S. de Saint-Périer noted the presence of dense but unequally distributed Aurignacian artifacts over a surface of nearly 1700 m<sup>2</sup> in the two galleries (e.g. Esparza San Juan, 1995; Normand, 2005-2006; Normand & Turq, *op. cit.*). In the Isturitz Gallery, only one level was observed: level A for E. Passemard (Passemard, 1944) and Ist V for R. and S. de Saint-Périer (Saint-Périer, 1952).



Salle d' Isturitz		Salle de Saint-Martin		Entrée sud
Passebard	Saint-Périer	Passebard	Saint-Périer	idem et Laplace
surface	surface	surface	surface	Isturitz es
<i>A. du Bronze à contemp.</i>	<i>A. du Bronze à contemp.</i>	?	<i>A. du Bronze</i>	Magdalénien ?
stalagmite	stalagmite	stalagmite	stalagmite	Aurignacien
stérile	stérile	?	<i>A. du Bronze</i>	"Protaurignacien"
B	Ist. Ia	E	S I	Moustérien
<i>Azilien ?</i>	<i>Magdalénien et Azilien</i>	<i>Magdalénien moyen</i>	<i>Magdalénien moyen</i>	
F I	Ist. I	xy	sans dénom.	
<i>Magdalénien sup.</i>	<i>Magdalénien sup.</i>	<i>Solutréen ?</i>	<i>Solutréen</i>	
E	Ist. II	<i>Gravettien ?</i>	S II	
<i>Magdalénien moyen</i>	<i>Magdalénien moyen</i>	<i>Aurignacien</i>	<i>Aurignacien</i>	
<i>Solutréen (à la base)</i>		A	S III	
F II	Ist. IIIa et b	<i>Aurignacien</i>	<i>Aurignacien</i>	
<i>Solutréen</i>	<i>Solutréen</i>		S III base	
C	Ist. III		<i>Préaurignacien</i>	
<i>Gravettien</i>	<i>Gravettien</i>	M	S IV	
F3	Ist. IV	<i>Moustérien</i>	<i>Moustérien</i>	
<i>Gravettien</i>	<i>Gravettien</i>	repaire d'ours		
A	Ist. V	<i>Moustérien</i>		
<i>Aurignacien</i>	<i>Aurignacien</i>	P	S V	
Limons	sans dénom.	<i>Moust. à hachereaux</i>	<i>Moustérien</i>	
<i>faune (arrêt à -6,5 m)</i>	<i>faune</i>	sans dénom.		
		<i>faune (arrêt à -7,5 m)</i>		

tab. 1 : Synthèse of the stratigraphies described according to authors and sectors.

This latter assemblage was attributed exclusively to the “Middle” Aurignacian (Saint-Périer, *op. cit.*). Meanwhile, considering published accounts and our own observations, it is legitimate to imagine that the Aurignacian archeostratigraphy was much more complex (Normand, *op. cit.*). At the entrance to the Saint-Martin Gallery, only one assemblage was also signaled, this time attributed to a “Protoaurignacian with marginally backed pieces” (Laplace, 1966), but two assemblages can be distinguished (“lower” and “upper” assemblages) in the Saint-Périer collection at the Musée d'Archéologie National (personal observation), which is coherent with our own data (Normand et Turq, *op. cit.*). Inside the gallery, E. Passemard described an assemblage (xy) with an uncertain attribution since he speaks of objects with Gravettian or Solutrean characteristics (Passemard, *op. cit.*). Lower in the sequence, he found a very rich Aurignacian level that he also named “A” or “*couche truffée*” (“stuffed level”). R. and S. de Saint-Périer recognized three Aurignacian levels, from top to bottom: S II, S III and S III base (Saint-Périer, *op. cit.*). Their precise chronological attributions are questionable due to their selection of objects that resulted in an over-representation of obvious “Aurignacian” characteristics and evident contaminations. Consequently, though A and S III have always been attributed to a “Typical” Aurignacian (Passemard, *op. cit.*, p. 22; Saint-Périer, 1952, p. 201 and 1965; Esparza San Juan, *op. cit.*, p. 100), S II was qualified as Middle Aurignacian (Saint-Périer, *op. cit.*, p. 188), as an evolved “Typical” Aurignacian (Saint-Périer, 1965), as an Aurignacian II or III Barthélémy de Saizieu, 1981, p. 84), as an Aurignacian I (Bicard-See & Moncel, 1984 and 1985), and finally as a “Typical” Aurignacian more recent than S III (Esparza San Juan, *op. cit.*, p. 107). Level S III base, on the other hand, was first attributed to a “Pyrenean facies of the Lower Aurignacian or Chatelperronian” (Saint-Périer, 1952, p. 226) and then to a “Preaurignacian” (Saint-Périer, 1965), and finally to a “Protoaurignacian” (Esparza San Juan, *op. cit.*, p. 91). We use these data as a base of reference in our current research.

#### *Localization of the current excavations and representativity of the assemblages*

The test excavations conducted in 1996/1998 showed that inside the Saint-Martin Gallery and under the porch of its entrance, rich Aurignacian *sensu lato* levels must still occupy a surface of between 500 and 700 m<sup>2</sup>, while approximately 350 m<sup>2</sup> were concerned by earlier research (Normand & Turq, *op. cit.*; fig. 4). Among other factors, the high discrepancy observed between the contents of these levels and those of the old collections, as well as the opportunity to conduct detailed analyses of the stratigraphies, which were apparently simplified in previous studies, incited us to undertake new research. We chose to concentrate on a zone corresponding to the stratigraphic profile left by R. and S. de Saint-Périer at the end of their work.

Three sectors, separated by two enormous stone blocks, were delimited (fig. 5):

- the “Principal excavation” sector, with a maximum surface of nearly 7 m<sup>2</sup>, corresponding to bands 28 and 33 of the general grid system;
- the “Profile” sector, with a surface of approximately 4 m<sup>2</sup>, divided among bands 34 and 39 of this same grid;
- the “Extension” sector, covering approximately 8 m<sup>2</sup>, of which a large part is occupied by a third block.

In total, taking into account the space occupied by the stone blocks, only around 15 m<sup>2</sup> of the 1500 originally occupied by the Aurignacian levels (or less than 1 %) are concerned by our current excavations. We must therefore question the representativity of the data resulting from this “sample”. It is evident that we will never know precisely what was present in the areas affected by earlier research. Nonetheless, in addition to the assemblages collected from these zones, we have two other sources of information: the objects recovered through screening of the back dirt of early excavations (with an average of 400 tools per m<sup>3</sup>) and the test excavations made in other parts of the cavity. These elements show that the assemblages collected during the early excavations present internal components that are generally similar to those observed in the zone



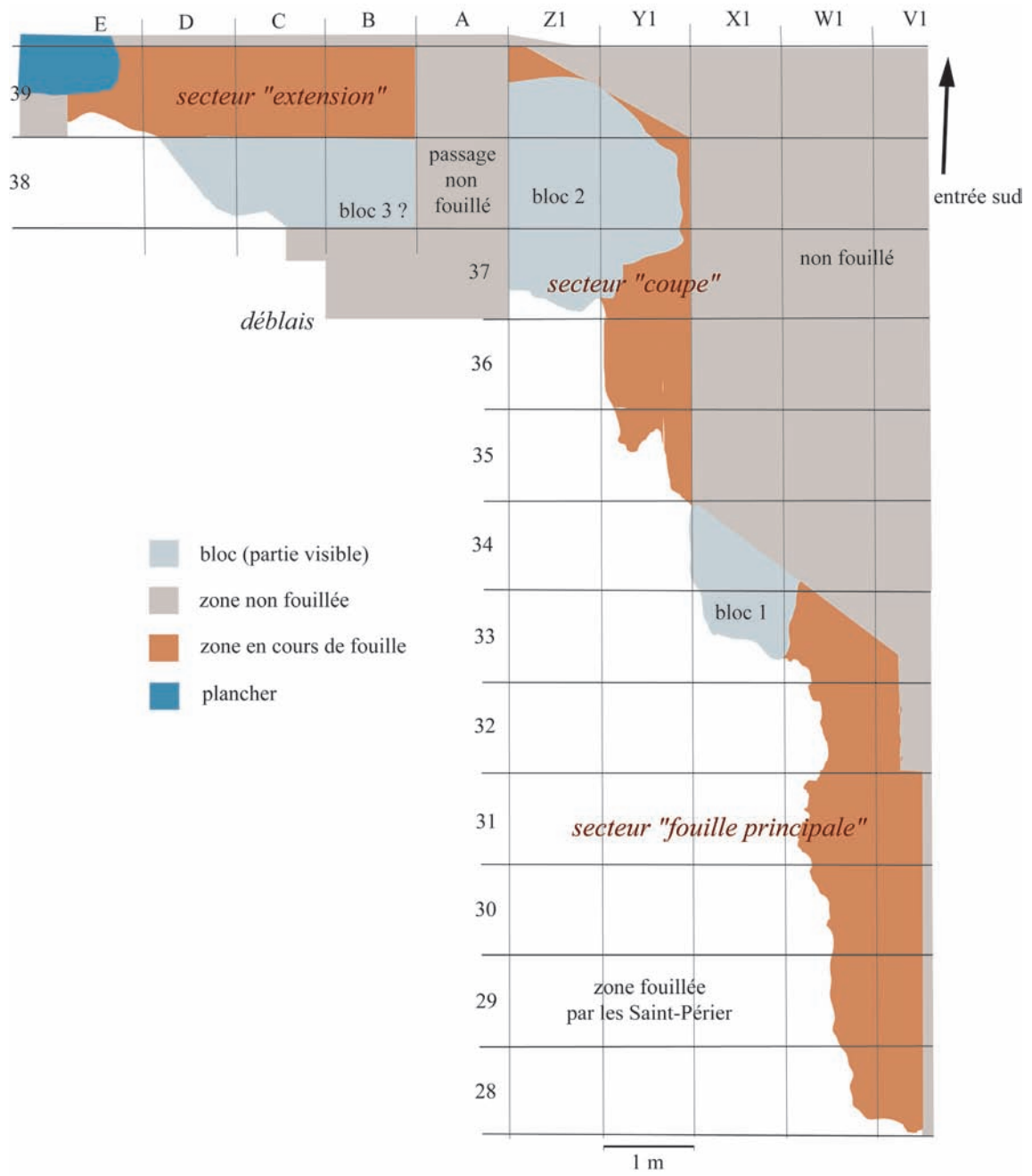


fig. 5 : Plan of the zone currently under excavation.

currently under excavation. Variations do of course exist within the lithic tool assemblage, but they concern almost exclusively typological percentages and do not appear to be significant relative to the percentages of each tool type. Most importantly, we have not observed differences in the domains treated in this paper. Therefore, we consider the data furnished by this work in progress to be globally representative of that which exists in the Aurignacian of the entire Saint-Martin Gallery.

### *Geo-stratigraphy*

The sedimentological studies conducted since the beginning of the current excavations have revealed evidence of two principal site formation processes: rock fall and water flow (e.g., Texier, 1997; Texier & Lenoble, in press). Though only the “Principal excavation” sector was subject to detailed analyses, we know that these two agents played a comparable role in the other two sectors as well.

Rock fall and water flow determined the nature of the lithostratigraphy observed, with a double variability:

- a vertical variability created by alternating periods of accumulations of stone fragments originating from the cave ceiling and of water runoff that displaced sediments;

- a horizontal variability, deduced in the “Principal excavation” sector by the presence of a joint through which water flowed—and still flows—with varying intensity in different zones of the site. This process was particularly significant in bands 28 and 29, as well as in square W1 31.

In addition, repeated freezing and thawing episodes provoked cryoturbations at certain times during the formation of the deposits. These are locally represented by diverse alterations of the levels: undulations, sediment sorting, injections, etc. Solifluction also played a minor role. Five units (I, II, III, IV and V) were distinguished in the “Principal excavation” sector, and can be resumed as follows (Texier, *op. cit.*, Texier & Lenoble, *op. cit.*):

- Unit I. Laminated dripstone floor of variable thickness, interstratified with decanted brown to brown-black clays;

- Unit II. Angular limestone blocks and stones, very heterometric and non-oriented. On the top, stone debris filled in with a dark gray, sandy clay. In the middle, an open stone debris present only to the north of the witness section. At the base, a semi-open stone debris filled in with a yellow matrix. Its thickness varies from 0.1 to 1 m;

- Unit III. Stacked lenses covering bands 28 and 29. These levels yield two facies: sub-horizontal, layered to laminated loams and alternations of layers of sorted pseudo-sands or gravels filling in channels. Starting at band 30, there is a clastic based gravel with a dark gray, loam-clay based matrix, around 1 m thick;

- Unit IV. Yellow, clayey loams with a polyhedral form (thickness between 0.3 and 0.6 m);

- Unit V. Rock and gravel deposits with an open to semi-open texture (thickness unknown).

### *Archeo-stratigraphies*

The Aurignacian sequences, which vary somewhat in the different sectors, are contained in geological units II, III and perhaps IV, in which artifacts are rare and for the moment non diagnostic. This latter unit, with an average thickness of 50 centimeters, clearly separates the archaeological assemblages currently under excavation from the underlying Mousterian levels, which are very poor in this sector of the cave. In our opinion, this assures the absence of contamination of the Aurignacian by material from the Mousterian levels.

The sedimentary processes had an evident impact on the archaeological assemblages making it possible to divide the assemblages into two groups according to their geological context:

- in one group, the assemblages are associated with levels in which water runoff played a significant role. These assemblages “*yield lenses of materials in secondary position*” and “*the result is a diffusion of the material of each occupation into the overlying levels*” (Texier & Lenoble, *op. cit.*). The integrity of these assemblages is thus questionable and they are not included in current analyses;



- in the second group, the assemblages are contained in stone debris deposits in which there is a risk of “displacement of the smallest objects”, though “the stratigraphic position of the objects does not seem to have been altered” and in which “the process of solifluction did not have a significant impact on the constitution of artifact accumulations” (Texier & Lenoble, *op. cit.*). We thus consider these assemblages and the information they provide to be reliable. Finally, out of the approximately thirty assemblages distinguished throughout all the sectors, only around twelve appear to be statistically reliable. These are indicated in bold type and italics in table 2 where we integrated a proposition of correlations with the descriptions of our predecessors.

### Chronological attributions

According to the typo-technological results now available for levels 4d1 and 4III, we can definitively attribute these assemblages to the Archaic Aurignacian (Normand, 2006). This attribution is compatible with the two dates thus far obtained, each from a fragment of burned bone: one from the top of level 4d (Gif 98237: 34630 ± 560 BP), and the other from its base (Gif 98238: 36550 ± 610 BP) (Turq *et al.*, 1999).

The main characteristics of the assemblages of levels 4b1 and 2, 4I and E 4I (limited presence of carenated pieces and Aurignacian retouch, antler split based points, etc.) indicate an early phase of the Aurignacian. Meanwhile, other elements (the coexistence of morphologically variable blanks, several bladelet production strategies, personal ornaments in the form of perforated Bovid teeth, etc.) show some differences from the “classic” Early Aurignacian currently described in the Aquitaine

region (e.g., Chiotti, 1999; Bon, *op. cit.*; Bordes, *op. cit.*; Bordes & Tixier, 2006; White, in press), which could be explained by territorial and/or chronological variations (Normand, *op. cit.*).

Levels 4c4 and 4II could represent an evolution from the Archaic to Early phases of the Aurignacian.

The chronological attributions of levels 3b summit, 3I and E 3I are more difficult to determine. Though most of the objects from these levels still present similarities with Early Aurignacian objects, certain other elements contradict this attribution. One consists of the dates obtained for the upper part of level 3b summit (Beta 136048: 28290 ± 240 BP; Beta 136049: 29400 ± 370 BP; Barandiaran *et al.*, 2000), which indicate a more recent phase. Another consists of a few objects also found in the upper part of level 3b summit, including two mesial parts of small blades with direct, abrupt retouch on one edge. Also notable is the presence of four busked burins in level SII. Though no subdivision was observable during excavation, it is likely that these assemblages contain both Early Aurignacian objects, probably the most numerous, and at the top, other more recent objects to which the dates would correspond.

### Archaic Aurignacian bladelets

#### General data on the Archaic Aurignacian

Though collected in different sectors of the site, in this study we regroup all assemblages from levels 4dI and 4III. The few divergences observed between these assemblages, mostly related to quantities and typological variations, do not appear to justify their separation in the present context. Nonetheless, certain aspects will be discussed when we judge them to be pertinent.

<i>Passemard</i>	<i>Saint-Périer</i>	<i>secteur "fouille principale"</i>	<i>secteur "coupe"</i>	<i>secteur "extension"</i>
y	S II	C 3a	absent	absent
		<b><i>C 3b sommet</i></b>	<b><i>C 3I</i></b>	<b><i>E 3I</i></b>
		C 3b base	C 3II	E 3II
A	S III	<b><i>C 4b1</i></b>	<b><i>C 4Ia</i></b>	<b><i>E 4Ia</i></b>
		<b><i>C 4b2</i></b>	<b><i>C 4Ib (et c?)</i></b>	<b><i>E 4Ib</i></b>
		C 4c1, 2 et 3	absent	non encore fouillé
		<b><i>C 4c4</i></b>	<b><i>C 4II</i></b>	non encore fouillé
		C 4c5	absent ?	non encore fouillé
		C 4c6 et 7	?	non encore fouillé
		C 4c8 à 11	absents	non encore fouillé
		<b><i>C 4d1 a, b, c et j</i></b>	<b><i>C 4IIIa, b, c et d</i></b>	non encore fouillé
A ou ?	S III base	base de C 4d et/ou C 5 ?	base de C 4III et/ou C 5 ?	non encore fouillé

tab. 2 : Proposition of correlations of Aurignacian sequences of old and recent excavations.

The objects attributable to the Archaic Aurignacian are generally very abundant and varied. They correspond to two occupations, which were probably frequent and dense, during the warm season (Rendu, 2005). Horse was the principal species hunted, followed by large bovids. Reindeer and red deer were hunted less frequently in almost equal numbers (Costamagno, 2005; Costamagno & Letourneux, 2006). A substantial use of bone as a combustive material is demonstrated by the presence of a high proportion of burned fragments.

The relatively abundant osseous tools consist mostly of bone smoothers and awls, along with rare retouchers and a small, mesial fragment of an antler point of an undetermined type (Goutas, 2005 and 2006).

Before the 2006 excavation season, the lithic tool assemblage consisted of 689 pieces (now around 1,000). Retouched bladelets are the dominant tool type, composing 60 to 70% of the assemblage depending on the sectors and sub-assemblages. Retouched blades represent between 11 and 14%, burins between 5 and 9%, and end scrapers between 3 and 8%. The accumulated percentage of splintered pieces, notched or denticulated pieces and side scrapers is lower than 10 %. The raw material used was almost exclusively flint, mostly from close sources (25 to 30 km from the site). Flints of more distant origins were also used, especially from the high Erbre Valley, attesting to movements of over 150 km through the Pyrenees, while flint from the northern Aquitaine is almost totally absent (Tarrío and Normand, 2006). A few objects made on cobbles complete this inventory, principally hammerstones and/or anvils, or more rarely grinding stones (A. de Beaune, 2006).

The personal ornaments include around fifty perforated gastropods (mostly littorines), as well as two pendants in amber and one in a tender stone with a zoomorphic or anthropomorphic form (White, 2005).

#### *Bladelet debitage*

We have defined bladelets as all elongated blanks with a maximum width of 1.2 cm. Consequently,

blades are defined as those blanks with a width greater than this (Normand & Turq, 2005). We made this distinction during the first years of our research based on the absence, in the assemblages then collected, of inverse retouch on blanks with a width greater than 1.2 cm. The analyses that we present in this paper lead us to reconsider the validity of this limit (now arbitrary) between these two categories of products and associated concepts.

Though not yet counted with precision, the total number of blades and bladelets, retouched or not, is over 6,000. If we consider the totality of objects susceptible to be used as a tool blank, meaning all flakes over 2 cm and all blades and bladelets, these latter represent respectively 15% and 70% of this total. We must meanwhile note that the fracturation rate is very high since less than 7% of bladelet blanks were found whole. This clearly amplifies the percentages and we will later present our hypotheses to explain this phenomenon. It is nonetheless clear that blade and bladelet production was the primary objective of flint knappers at Isturitz during the Archaic Aurignacian, and that a large part this production took place at the site (Normand, *op. cit.*).

Around 100 cores, 85 of which are bladelet cores, are associated with this production. The debitage process, always performed by percussion with an organic hammer, most often began after a simple abrasion of the striking platform lip. We will not describe the details of the strategies used, or their implications, as this information has already been published elsewhere (Normand, in press b). We can, however, recall the principal characteristic, which is the great variety of strategies employed.

Six principal core types were identified based largely on their morphology and the location of the exploited surface <sup>2</sup> :

- 4 cores with exploitation surfaces that were generally reused as new striking platforms after their abandon (fig. 6) ;

- 2 carinated and 5 atypical carinated cores. One specimen, which has the general morphology of carinated cores, could be transitional to the next type described as it

<sup>2</sup> - To this inventory we must add 5 pieces on which bladelet debitage was barely begun.



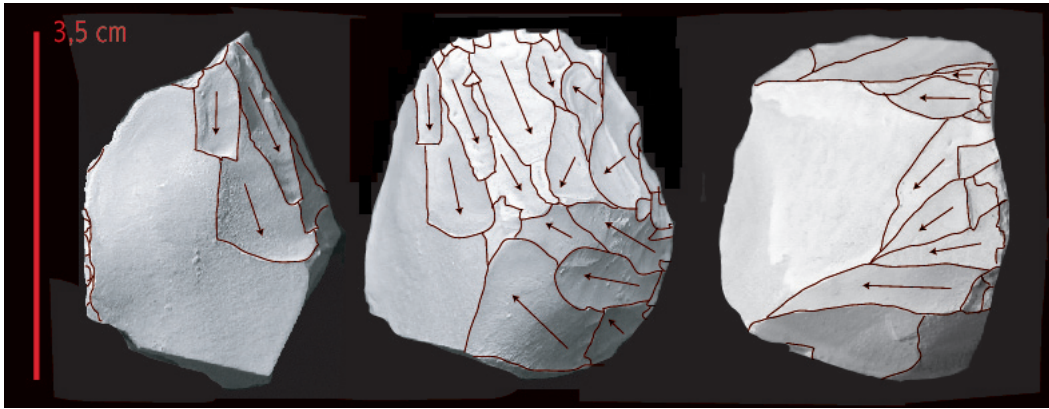


fig. 6 : Core with multiple exploitation surfaces.

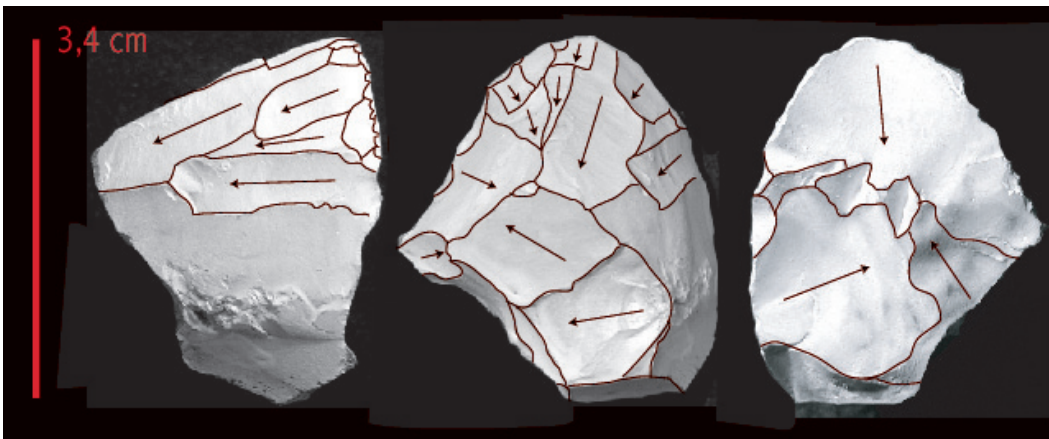


fig. 7 : Core with a carinated morphology.

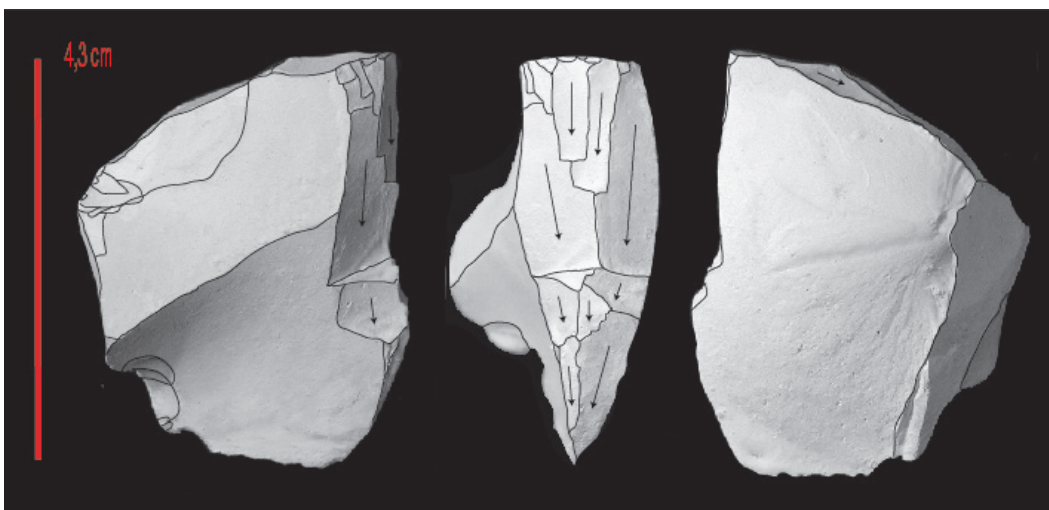


fig. 8 : Core on flake exploited along its edge with unipolar debitage.



has a modified striking platform and was exploited along the edge of the flake (fig. 7) ;

- 29 cores on flakes exploited along the edge, including 2 on platform rejuvenation flakes. All debitage is unipolar (fig. 8), except for one piece with bipolar debitage (fig. 9);

- 14 conical (*pyramidal*) cores. These cores have a unipolar exploitation surface that is usually triangular due to maintenance by convergent, and sometimes overshoot, removals from the sides of the core (fig. 10);

- 20 cylindrical (*prismatique*) cores. The exploitation surface of these cores is rectangular due to maintenance by removals from a secondary striking platform opposite the primary one. There is no clear limit between the exploitation surface and the sides of the core, from which bladelets are often removed. These cores are most often distinguished from the preceding ones by their non-convergent or only slightly convergent removals that are not overshoot. A few specimens show a reorientation and/ or reimplantation of this surface (fig. 11);

- 6 trapezoidal cores. This form could represent a continuity between the two preceding types. Two of these cores indeed combine the maintenance of the exploitation surface by removals of convergent flanks and removals from a secondary striking platform opposite the primary one.

Despite this variability, it is possible to distinguish two bladelet production types:

- the first, corresponding to the three first core types, is autonomous and almost always realized on flakes whose entire volume (“multiple exploitation”) or thickest axis is exploited, thus favouring an axis parallel to the flake surfaces (“flake-edge core”, exploited along the edge of a flake), or more rarely, perpendicular to the flake surfaces (carinated core). The bladelets produced are often rectilinear in profile, rather thin, and almost never twisted. They are relatively standardized within each category. However,

those produced from cores with multiple exploitation surfaces and carinated cores are smaller (2 cm in length at the end of production) than those produced from “flake-edge cores” (approximately 4 cm in length):

- the second, corresponding to the cylindrical, conical and trapezoidal cores—mostly on nodules—furnishes blanks that are often produced in continuity with blades, generally beginning with a block of relatively small dimensions<sup>3</sup>. The blanks obtained are distinguished from the preceding ones by a high dimensional variability, as is shown by the length of the last products, between 1.7 and 4 cm. Their morphology is generally the same as that of the bladelets described above, though the distal extremities of bladelets produced from conical cores are slightly more curved in profile and more pointed than those produced from cylindrical cores. In addition, during the blade production phase, bladelets (usually very rectilinear) are sometimes produced through the exploitation of the ridges created during blade production.

### *The bladelets*

The analyses presented here were conducted on a collection of 451 retouched pieces (165 from level 4d1 and 286 from level 4III) and several hundreds of non retouched objects. We begin with our observations of the retouched pieces.

#### *Fragmentation:*

We have already mentioned the high degree of fracturation of blade and bladelet blanks; less than 7% of these blanks were found whole. This percentage is even higher for retouched bladelets since 97% of them are represented by fragments (fig. 12).

Mesial fragments are the most numerous (285 for 63.2%), with a slightly higher domination in level 4III (67.1%). Proximal fragments are much less numerous at 22.2%, followed by distal fragments at 12.4%.

Among numerous possible explanations for this fragmentation, we cite only the principal ones here, which all may apply to different degrees:

<sup>3</sup> - One of these blocks is slightly less than 5 cm long.





fig. 9 : Core on flake exploited along its edge with bipolar debitage.

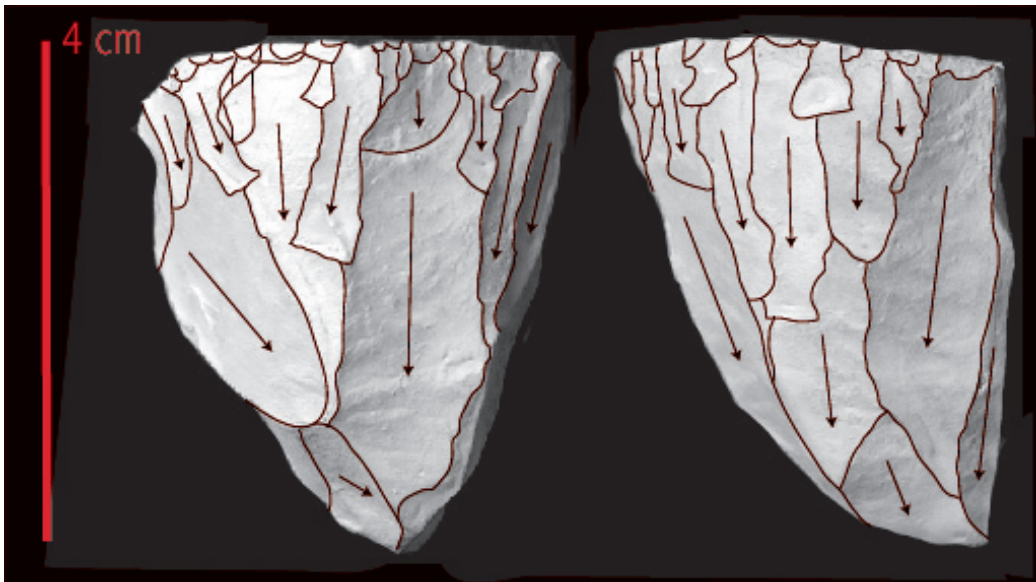


fig. 10 : Conical core.

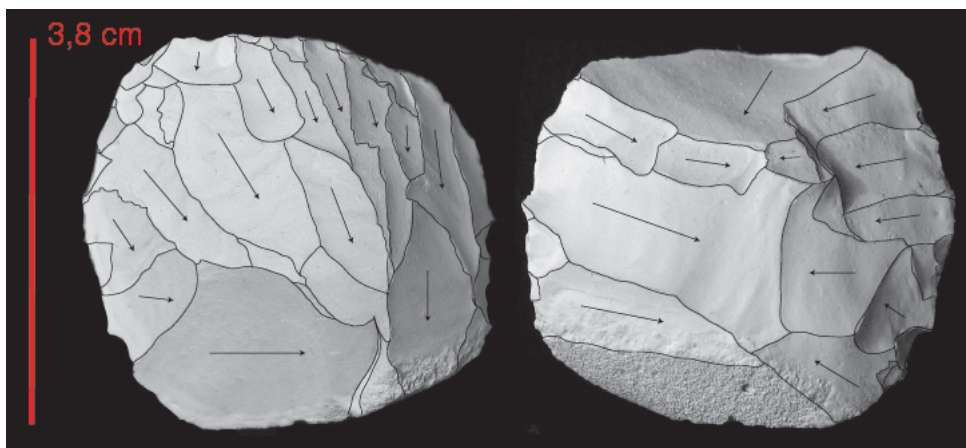


fig. 11 : Core with a cylindrical morphology.



- the first is associated with the evident *in situ* production of bladelets, resulting in their fracturation during debitage or retouch;

- the second is related to trampling on a ground surface rich in limestone blocks. In this sense, it is probably significant that the average length of fragments found in the "Profile" sector, where the stone debris density is high, is much lower than in the "Principal excavation" sector, where there is less limestone debris. This hypothesis is supported by the higher percentage of refits of fragments found near each other in the former sector;

- the third corresponds to a voluntary action in order to obtain fragments with a specific morphology, in this case the rectangular pieces corresponding to mesial fragments;

- the last may be associated with a specific utilization during which the bladelets were broken.

We will further explore these two latter hypotheses in the section devoted to functional analyses.

Whatever the cause, our observations seem to indicate that this fracturation often resulted in the creation of 4 to 5 fragments from one bladelet. This would explain the high proportion of mesial fragments relative to distal and proximal ones, but it cannot explain the discrepancy between distal and proximal fragments, which may be related to the retouching of these objects.

#### *Retouch:*

Diverse localizations, intensities and degrees of regularity of the different retouch types were observed (fig. 13). Retouch serves to regularize and/or reinforce the edge of the piece, as well as to reproduce a specific model from blanks with heterogeneous morphologies and dimensions. The nature of the blank thus dictates more or less intensive modifications by the toolmaker.

The amplitude of bladelet retouch thus varies from a slight delineation, barely visible to the naked eye, to intensive modifications. The latter are often abrupt or semi-abrupt and can result the removal of several millimetres of material. In the case of slight modifications, it is sometimes difficult to distinguish voluntary retouch from unintentional use traces. The criteria used are the regularity of the edge and

a continuous modification at least 5 mm in length. This variability occurs not only on different objects and in conjunction with the lateralization of the retouch, but also on the same object. For example, sometimes only one part of one or both edges of a piece is retouched. Furthermore, the intensity of retouch is rarely constant; the highest intensity is most often located on the mesial part of the edge and least often on the distal part. In fact, naturally pointed distal extremities were frequently not retouched at all. If we consider the distal parts retained, it seems that the desired form was a natural or modified point since 80% of those analyzed have this morphology (fig. 14). The fact that some of these distal extremities were left unretouched could at least partly explain the discrepancy noted above between the numbers of proximal and distal fragments: many of these latter may have been left among the tiny non retouched elements that have not been studied in detail. The proximal extremities of bladelets were also sometimes modified into a point, and both ends of one slightly asymmetric bladelet were pointed in this way. When there is retouch, it is most often alternate, or sometimes direct; in one case, the retouch is alternate on the entire piece, except for a few millimetres from the extremity where it becomes direct. This reorientation is also applied to mesial fragments, though it remains rare (6 pieces). On all of the bladelets, alternate or inverse retouch is much more frequent (more than 92%) than direct retouch on one or two edges. Alternate retouch, meanwhile, is clearly more frequent than inverse retouch at 62%, though there is a strong discrepancy between levels 4d1 and 4III (respectively 70% and 49.7%), for which we have not yet found an explanation.

On the pieces with alternate retouch, the inverse retouch is usually more intensive and constant than the direct retouch, whose variability applies particularly in this case. It is thus possible that the knapper gave priority to the inverse retouch, while the direct retouch was used only as a "method of adjustment".

Finally, this retouch, whatever its amplitude, does not always form a regular delineation, and in certain cases can create a denticulated edge. This could represent a deliberate intention or an unfinished state of this modification.



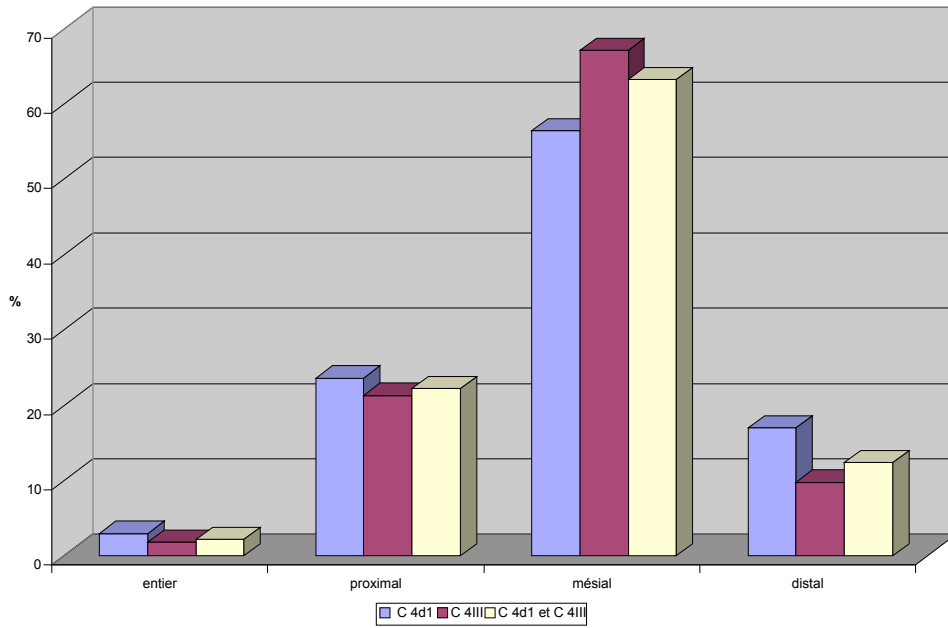


fig. 12 : Distribution of bladelet fragment types in assemblages 4d1 and 4III.

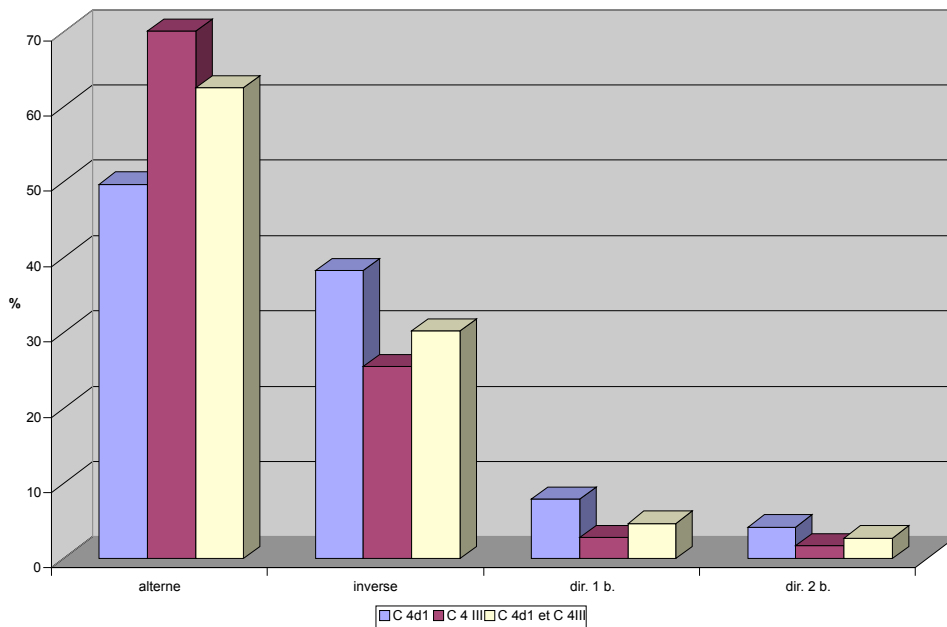


fig. 13 : Distribution of retouch types on bladelets in assemblages 4d1 and 4III.



As has already been observed at many other Aurignacian sites (e.g., Bon, *op. cit.*; Bazile *et al.*, 1981; Bordes, *op. cit.*; Broglio *et al.*, *op. cit.*; Chiotti, *op. cit.*; Lucas, 2000; Maillo Fernández, *op. cit.*; O'Farrell, 2005; Pelegrin et O'Farrell, 2005; Schmider & Perpère, *op. cit.*; Teyssandier, *op. cit.*), the bladelet retouch at Isturitz is strongly lateralized, with inverse retouch almost always on the right edge (more than 95% of the time). On the other hand, when there is only direct retouch, no clear lateralization is observable.

#### *Morphology and dimensions:*

The highly fragmented state of almost all of the bladelets studied makes their morphological analysis very difficult. Nonetheless, in concordance with our observations of bladelet production strategies, the majority of retouched blanks show a high degree of investment (fig. 15) and a morphology that is generally very regular, with a straight to very straight profile (more than 80%). When the profile is curved, it is usually slight and located on the distal part of the bladelet. Only three pieces have both curved and twisted profiles, including one that is whole, but relatively irregular and with only partial inverse retouch (4.4 cm long).

Analysis of the metric characteristics of retouched bladelets is even more difficult since the length, width and thickness of the original blanks are greatly modified by the retouch. Once they are retouched, use, post-depositional processes and other factors lead to a high degree of fragmentation of these pieces. It is thus impossible to determine the exact length of bladelets before they were broken. Meanwhile, according to the few whole examples recovered, this length would have varied from 2.5 to 4 cm, with an average of around 3.6 cm, which corresponds well to the lengths determined based on the lengths of the negative bladelet scars on cores (and the dimensions of the cores in the case of flake cores). This data must be considered with caution, however, as the dimensions of several fragments attest to a higher length, which can perhaps be associated with production on block cores.

The width of the bladelets for all retouch types varies from 2.5 to 11.5 mm, with a high frequency between 3.5 and 6.5 mm (fig. 16). We obtained a bimodal curve separating

the pieces with alternate retouch from those with inverse retouch, the peak width of the former at between 4 and 5 mm, and that of the latter, which is logically wider, at between 5.5 and 6.5 mm. The pieces with direct retouch on 1 or 2 edges show a much greater variability with no visible peak in width (fig. 17).

The majority of retouched bladelets are between 1 and 2 mm thick (fig. 18). In contrast to the width, there seems to be a difference in bladelet thickness between levels 4d1 and 4III, those of 4d1 being generally thicker (fig. 19). On the other hand, there is no significant difference in thickness between bladelets with alternate retouch and those with inverse retouch. As with the width, the thickness of pieces with direct retouch is more variable (figure 19).

#### *Bladelet functions*

The two analyses presented in this paper were conducted according to different methods and procedures that we will present separately. Though the results are complementary, they also present a few divergences that we will attempt to explain in the conclusions of this paper.

#### *Analysis 1: macro-fractures and edge damage*

##### *Methods*

The methodology employed in this study has already been fully described elsewhere (O'Farrell, 2004 and 2005). The macro-fractures were analyzed with the naked eye and with low magnification (10x to 40x). Lacking an experimental database specific to Aurignacian bladelets, the fractures observed were divided into three categories—simple, complex and probable complex—based on criteria established in previous studies of other projectile types (O'Farrell *op. cit.*) and adapted to this context:

- *complex fracture* (definite projectile function): all fractures with an extension (fracture lip length) greater than 1.5 mm long, on a face or edge, and all fractures with a step termination, whatever the length of the fracture extension;

- *probable complex fracture* (possible projectile function): fracture with a hinge or feather termination



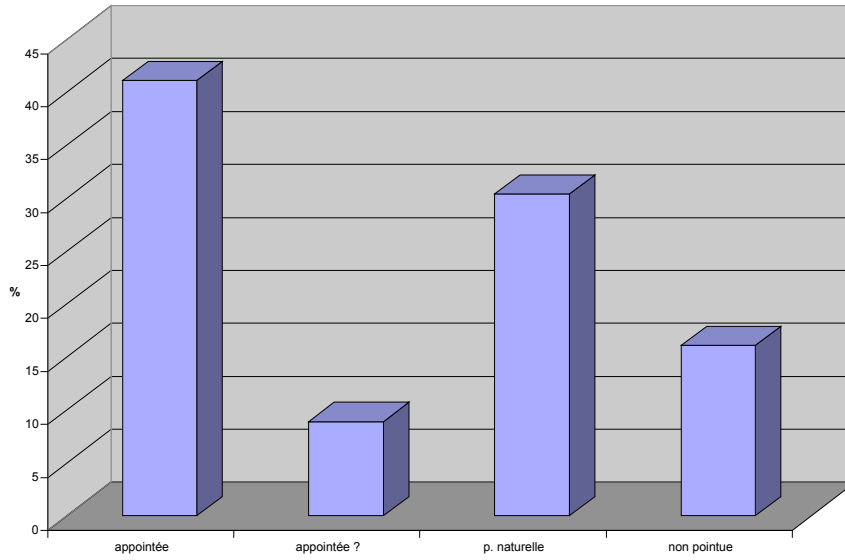


fig. 14 : Morphology of the proximal fragments of the retouched bladelets.



fig. 15 : Sample of retouched bladelets from 4d1 with a regular morphology.



and a fracture extension of at least 1.5 mm, if it is combined with a high amplitude of these characteristics and/or traces characteristic of projectile use on one or more edges;

- *simple fracture* (unknown function): « snap » fracture with no extension (lip) or a very short extension (< 1.5 mm).

Until they are experimentally verified, these criteria must not be considered as definitive, but rather as highly indicative of a distinction between tools fractured during use as a projectile weapon element and others broken and/or damaged through other processes. For the moment, we consider that:

- the complex fractures correspond to fractures produced by a violent axial impact, and thus to projectile accidents;

- the probable complex fractures correspond to probable projectile accidents;

- the simple fractures are produced by diverse processes such as fabrication, trampling, geological phenomena, or indeed, use as a projectile. These processes are either non identifiable or identifiable in relation to the context of the fracturation (e.g. separate criteria showing the tool was in the process of fabrication, refits, sedimentary context amenable to fracturation by trampling or geological processes, etc.).

### Results

This study integrates two phases of analysis: 1) a complete techno-functional analysis and low power microscopic (10x to 40x) observations of 165 retouched bladelets from level 4d1, and; 2) low power microscopic observations of 286 retouched bladelets and a large sample (number not recorded) of nonretouched bladelets from level 4III in order to determine if unretouched bladelets also present complex fractures.

Among the 165 retouched bladelets of level 4d1, six pieces with one or more complex fractures were identified, for a percentage of 4% (fig. 20). In level 4III, one or more complex fractures were identified on eight pieces, equaling 2.5% of the sample studied (fig. 21). If we combine the two samples, the percentage of pieces with complex fractures equals 3%. No probable

complex fracture was identified. On the other hand, other types of damage, mostly edge chippings, were observed.

This percentage of complex fractures is relatively low compared to the results of identical analyses conducted with Aurignacian bladelets from Brassempouy (O'Farrell, 2005), Castanet (Pelegrin & O'Farrell, 2005) and Roc de Combe (O'Farrell, in preparation). In addition to the fact that these assemblages are not attributed to the Archaic Aurignacian, several other, non exclusive hypotheses could explain this discrepancy, including:

- a statistical bias given that these other samples are much smaller than that of Isturitz;

- a more extensive utilization of bladelets at these sites in comparison with those of Isturitz, resulting in a greater amplitude of use traces;

- a greater in-situ fabrication of bladelets at Isturitz, accompanied by evidence for more systematic bladelet retouching, resulting in a greater number of simple fractures before their utilization;

- or, more diverse bladelet functions at Isturitz.

Among the unretouched bladelets of level 4III, eleven have characteristic complex fractures. Most of these are made on blanks that are morphometrically similar to those of the retouched bladelets with complex fractures. It is thus tempting to attribute the same function to them and identify them as projectile weapon elements. However, since none of them show the determinant criteria of retouch that has been “cut through” by the fracture (the retouch thus being anterior to the fracture), and lacking an experimental analysis of the fractures that can be produced during bladelet production, we must consider this as a hypothesis that remains to be tested.

Despite the small number of retouched bladelets with complex fracture(s) at Isturitz, it is possible to make a few observations comparable to those made with bladelets from Brassempouy and Castanet (O'Farrell, *op. cit.*; Pelegrin & O'Farrell, *op. cit.*):

- all of the complex fractures are on mesial bladelet fragments. This could argue in favor of a voluntary fracturation of some pieces in order to obtain



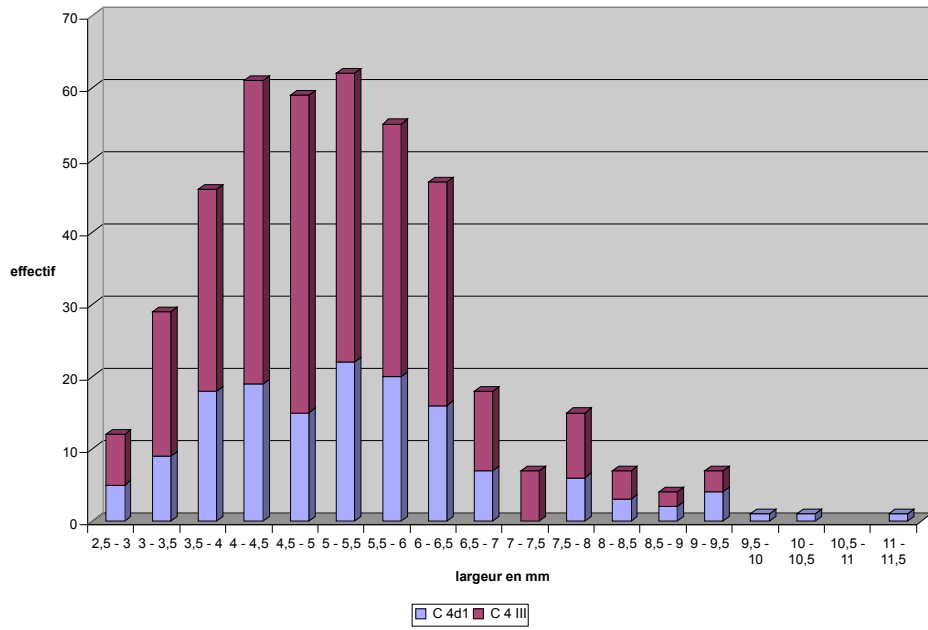


fig. 16 : Width of retouched bladelets in assemblages 4d1 and 4III together.

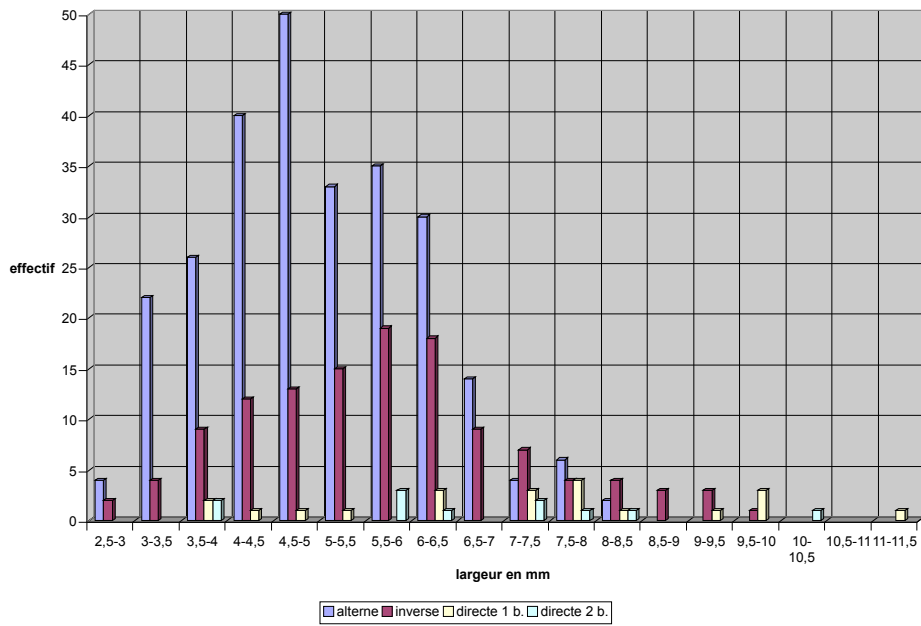


fig. 17 : Width of retouched bladelets in assemblages 4d1 and 4III separated.



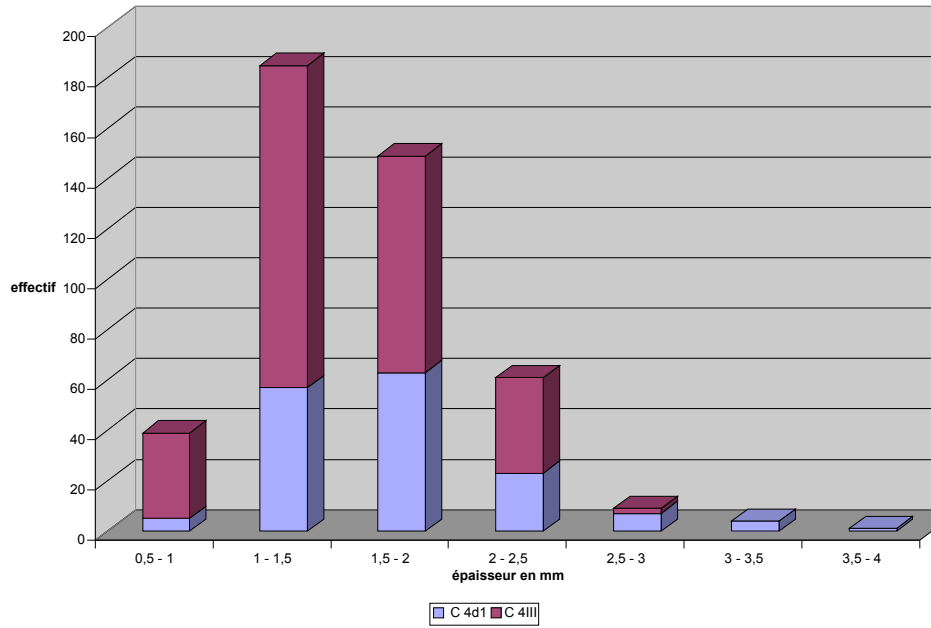


fig. 18 : Thickness of retouched bladelets in assemblages 4d1 and 4III together.

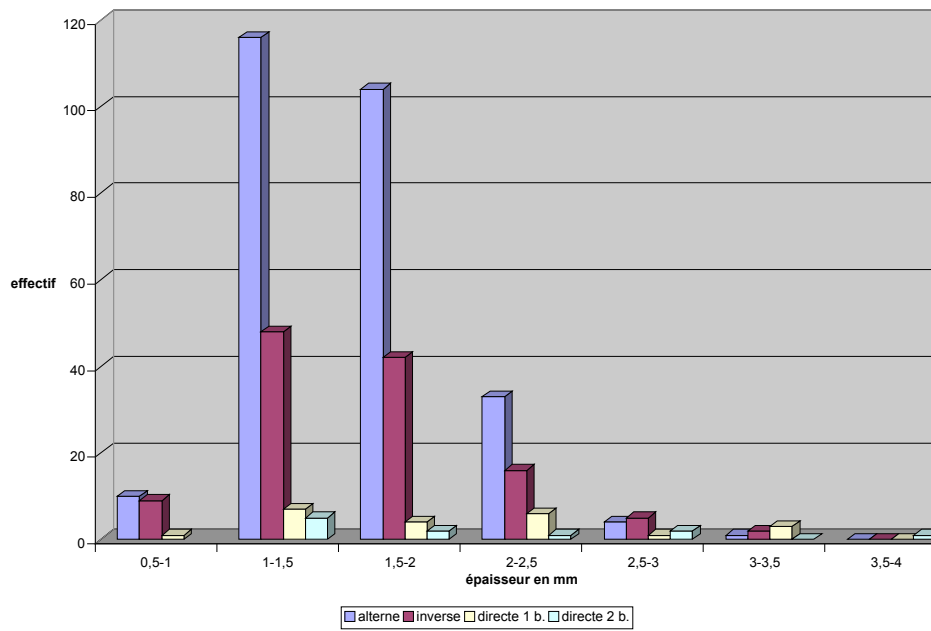


fig. 19 : Thickness of retouched bladelets in assemblages 4d1 and 4III separated.



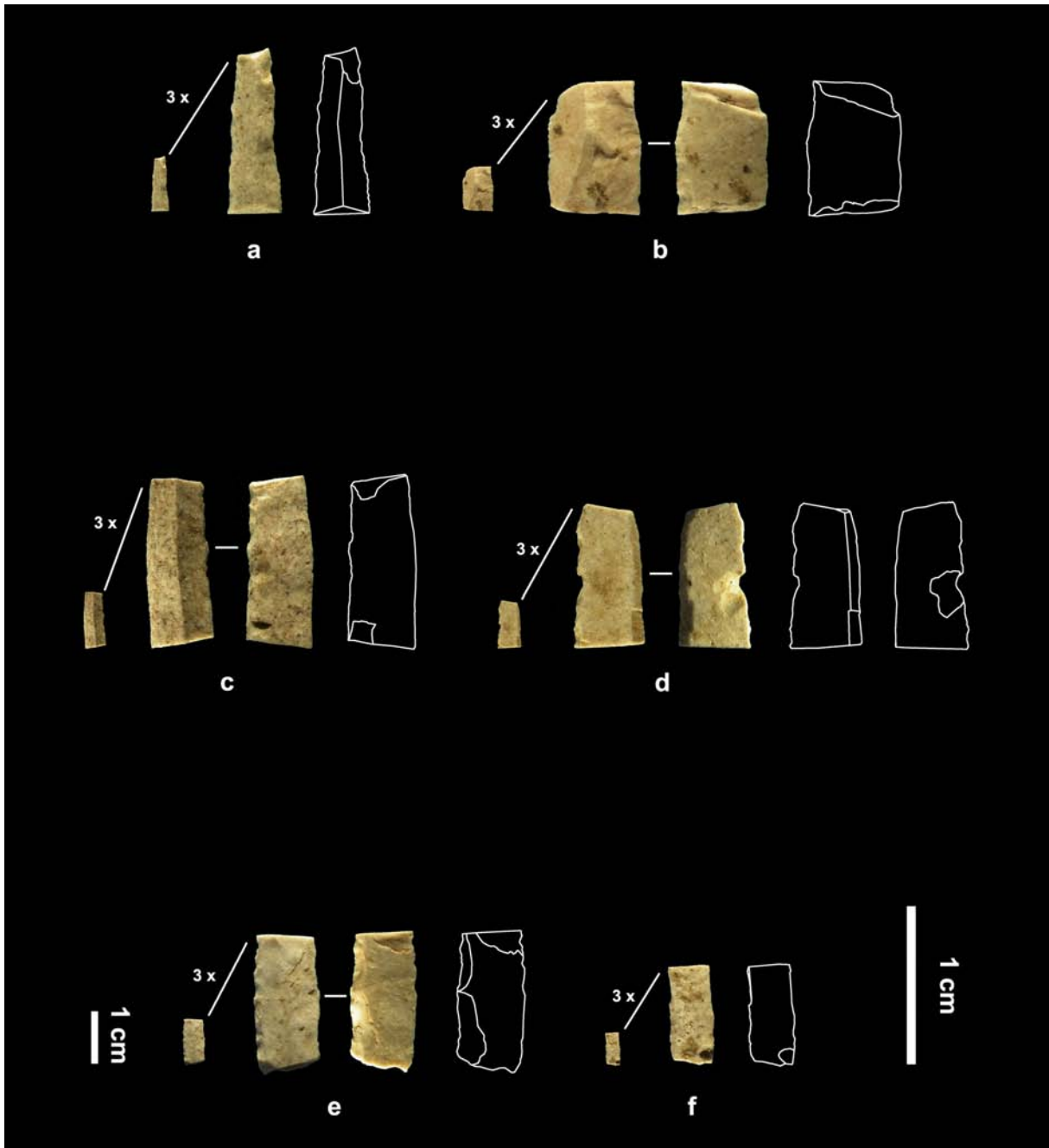


fig. 20 : A few retouched bladelets of assemblage 4d1 with complex fractures (a and f) or complex fractures and other damage (b, c, d and e).





fig. 21 : A few retouched bladelets of assemblage 4III with complex fractures (a, c, d and g) or complex fractures and other damage (b, e and f).



regular and rectilinear elements that would facilitate lateral hafting in a series, as has already been proposed for the bladelets of Brassempouy (Bon, *op. cit.*);

- their morphology is regular and their profile is rectilinear;

- the presence of inverse retouch, whether or not it is combined with direct retouch on the opposite edge, seems to be a determinant element since the complex fractures are always found on pieces with inverse or alternate retouch, and never on pieces with direct retouch only. In addition, there is a slight predominance of complex fractures on pieces with the most intensive inverse retouch;

- the majority of complex fractures are located on or near the edge with inverse retouch (fig. 22).

As for retouched bladelets in general, we can use only the width and thickness of bladelets with complex fractures as a measure of their dimensions. With the exception of one piece, all fall into the range already described above for bladelets in general. The majority of these pieces are between 4 and 4.5 mm wide and 1 and 1.5 mm thick (fig. 23). In contrast, none fall into the category of the larger bladelets, which were probably produced in a continuous reduction sequence with blades.

#### Analysis 2: micro and macrowear analysis

##### Methods

In addition to around one hundred tools representative of the entire tool assemblage of level 4III, 95 bladelets (83 retouched and 12 non retouched), with morphological characteristics similar to those of the objects concerned by the preceding study, were analysed according to microwear analysis methods already applied to other sites (González et Ibañez, 1994). However, the particular nature of bladelet use, usually considered to be associated with projectile weapons or non intensive cutting actions, complicates the formation of micro traces. Therefore, in several cases, the determination of the activity realized had to rely on macro-traces, thus partially overlapping with the preceding study. This situation is complicated even further considering that,

according to some analyses, the majority of bladelets (around 2/3) used as projectile barbs do not show identifiable traces (Caspar, 1988; Ibañez, 1993).

##### Results

Forty retouched and five non retouched bladelets, comprising 47.4% of the sample, showed identifiable use traces with a total of 48 active zones, for an average of 1.1 per piece. Diverse activities were identified (table 3 and figs. 24 and 25).

Twenty-nine bladelets, including the five non retouched ones, show traces related to use in a cutting (16 active zones) or scraping (10 active zones) action on diverse materials: soft (skin, meat, etc.), hard (osseous), or semi-hard (antler and/or vegetal) (fig. 26). The working movement and material concerned were precisely determined in only seven cases, while in six cases, neither the movement nor the hardness of the material could be clearly determined.

For the pieces with alternate or inverse retouch, a clear correspondence between the active zone and the edge opposite the edge with inverse retouch was observed. This could indicate that when these tools were hafted, the inverse edge was fixed against the haft. Regardless of this factor, these activities correspond to cutting actions made with knives in which the bladelets were associated with a shaft made of another material (wood?). These knives were used in large part for butchery activities (disarticulation, meat cutting, etc.), or scraping, here also with composite tools, perhaps corresponding to precise activities with diverse materials such as the finishing and/or maintenance of hafts and projectile points. It is interesting to note that the analysis of other tool categories also revealed a high frequency of activities associated with hard and semi-hard organic materials, perhaps including the fabrication and maintenance of hunting weapons.

Within the totality of identified macroscopic traces, 16 retouched bladelets, most with alternate retouch and made from local flint, possess one or several, more or less intensive traces that we consider to be indicative of use as a projectile barb (fig. 27). Among these bladelets, nine (or 9.5% of all the pieces analyzed and



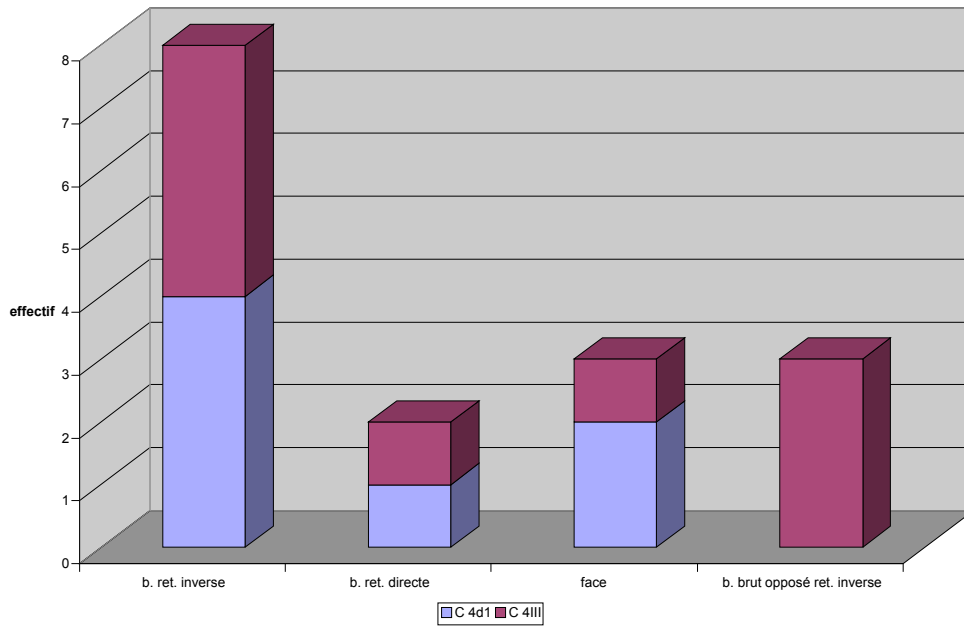


fig. 22 : Position of the complex fracture relative to the edge of the bladelet.

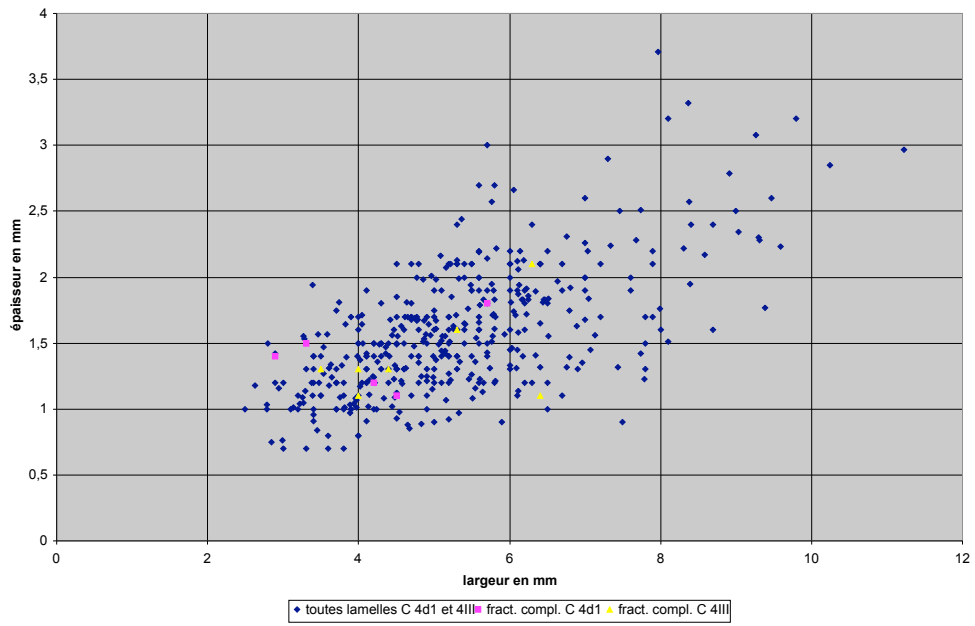


fig. 23 : Distribution of retouched bladelets according to their widths and thicknesses.



	nombre	sans traces	utilisées	%	zones act.	z. a./pièce
<i>lamelles</i>	95	50	45	47,4	48	1,1

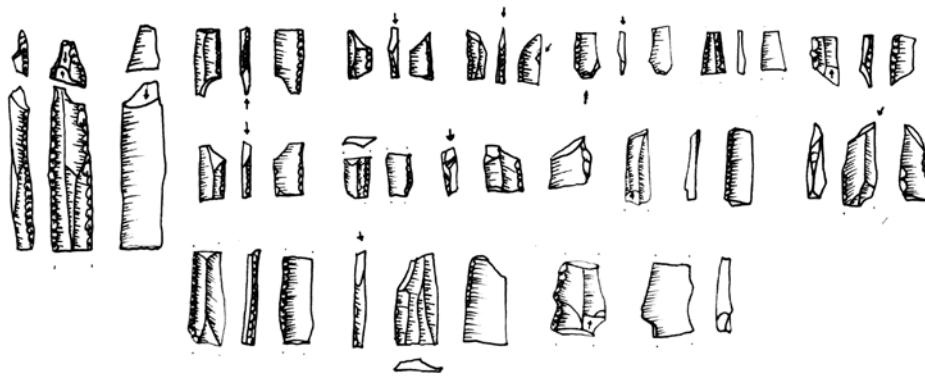
activité	z. active	%
<i>projectile</i>	16	33,3
<i>boucherie</i>	1	2,1
<i>mat. tendre</i>	9	18,7
<i>mat. dure</i>	5	10,4
<i>m. semi-dure</i>	4	8,3
<i>indéterminé</i>	13	27,1
<b>TOTAL</b>	<b>48</b>	<b>100</b>

action	z. active	%
<i>coupage</i>	16	33,3
<i>raclage</i>	1	20,1
<i>projectile</i>	9	33,3
<i>indéterminé</i>	6	12,5
<b>TOTAL</b>	<b>48</b>	<b>100</b>

tab. 3 : Activities and actions of the bladelets analyzed.

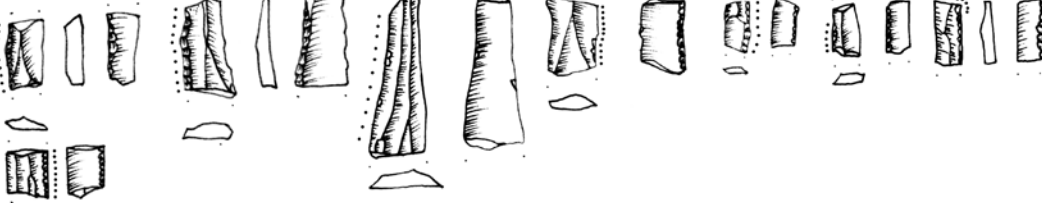
Projectiles



Matières organiques dures et demi dures



Matière tendre



Indéterminée

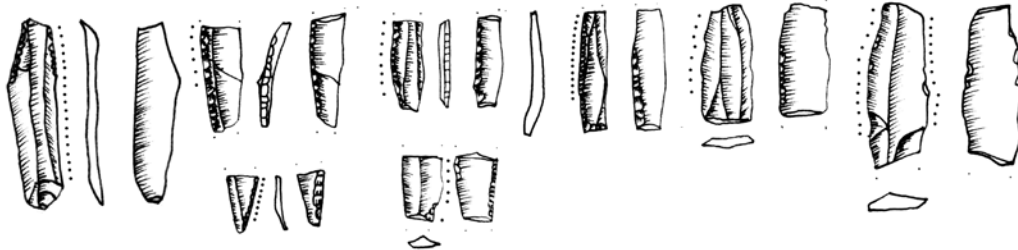
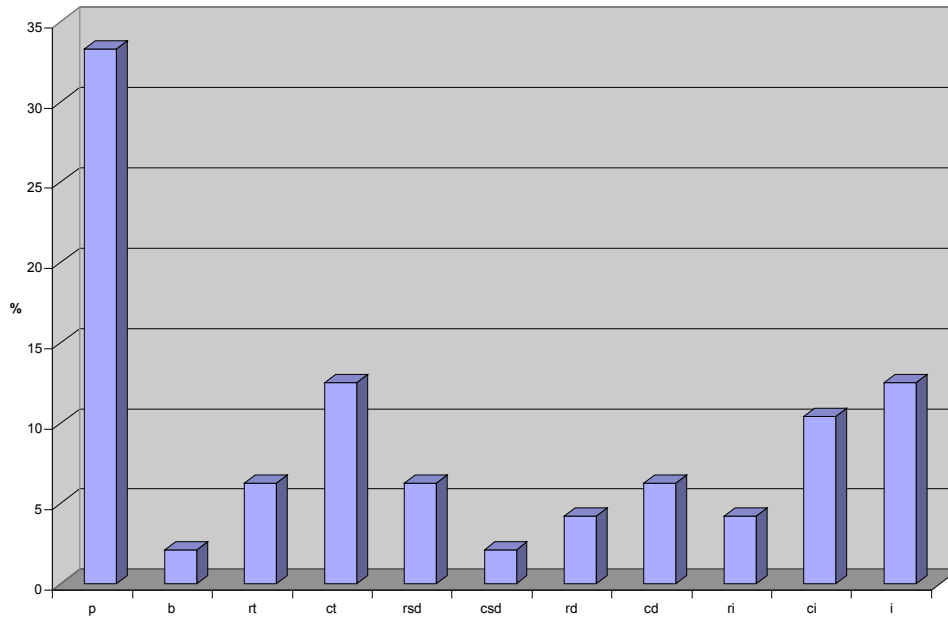
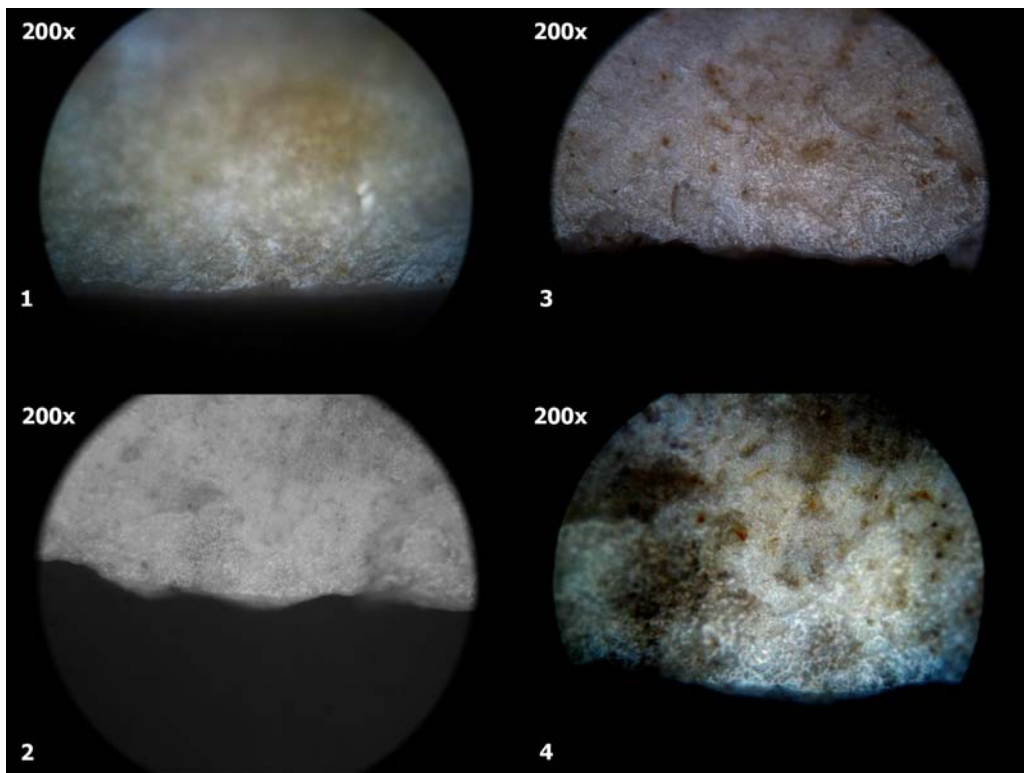


fig. 24 : Bladelets of assemblage 4III with use traces and corresponding uses.





**fig. 25** : Distribution of uses relative to all the active zones. p: projectile; b: butchery; rt: scraping of soft material; ct: cutting of soft material; rsd: scraping of semi-hard material; csd: cutting of semi-hard material; rd: scraping of hard material; cd: cutting of hard material; ri: scraping of undetermined material; ci: cutting of undetermined material; i: undetermined use.



**fig. 26** : 1: cutting of hard organic material; 2: cutting of skin; 3: cutting of hard organic material; 4: scraping of soft material.



nearly 19% of those with use traces) are thus interpreted as possible projectile weapon elements, and seven as definite projectile weapon elements (7.4% of all pieces and 14.6% of those with use traces). These percentages are much higher than those indicated by the preceding analysis of macro fractures. There are several possible explanations for this discrepancy, such as the use of more restrictive criteria in one of the studies. We will further address this question at the end of this paper.

As with other use traces, those associated with an impact are generally located on the edge opposite the one with inverse retouch, once again indicating that this edge is the one that was fixed against the haft. The causes of this localization, apparently in contradiction with the conclusions of the preceding study, will be discussed below. Except for two pointed examples, these pieces have a rectangular and rectilinear morphology and relatively small dimensions (11.3 x 4.75 x 1.8 mm average). A morphometric comparison of bladelets used as projectile weapon elements and those employed for other activities shows significant differences: the former have a generally more regular morphology and are narrower than the latter, with some overlapping of the two ensembles at around 5 mm (fig. 28). This type of metric differentiation has also been observed for bladelets from several Basque sites of the Late Upper Paleolithic, with average widths of 6 mm or more for the bladelets used in butchery activities and less than 6 mm for the others (Ibáñez y González, 1996).

### Conclusions

The studies presented here of Archaic Aurignacian bladelets recently excavated in the Saint-Martin gallery of Isturitz Cave allow us to make several observations and formulate hypotheses to be further explored in future research. Some elements—such as the absolute priority accorded to blade and blade production—confirm that which has already been observed for other assemblages (for a general discussion, see Le Brun-Ricalens, ed., 2005; for a specific discussion of bladelets, see Bon, 2005), and it is not useful for us to elaborate further on this subject.

Other elements, however, merit further discussion. But we must first remind the reader that though they are probably reliable, some data must still be considered as preliminary until they can be confirmed by further research. It is now indispensable to complete our studies with others, including experimental analyses<sup>4</sup> of the entire life span of bladelets from their fabrication to their discovery. This need underlies all the ideas that we propose in the remainder of this paper.

At least some of the retouched and nonretouched bladelets that we have analyzed appear to have served as composite projectile weapon elements. All or some of them appear to have been hafted along at least one side of a projectile point shaft in a manner that we have not identified (In a groove? In a groove with an adhesive? With an adhesive alone?). For bladelets with inverse retouch, the absence of microwear on the edge with this retouch strongly suggests that this is the edge that was fixed against the shaft. Meanwhile, the presence of several bladelets with at least one pointed extremity could suggest that some were attached in an apical position.

What is certain is that these bladelets had multiple functions, comparable to those of Fumane (Broglia *et al.*, *op. cit.*) or of level VII of Labeko Koba (Rios, study in progress). Several of the bladelets in our study revealed diverse activities, such as butchery and the maintenance of tools and/or weapons in hard or semi-hard materials (bone, antler, wood, etc.). These bladelets thus likely served as composite elements of knives or “scrapers”. The blanks of these bladelets are relatively variable even if their morphology is often regular and their profile rectilinear. When they were retouched, which is not always the case, this retouch was indiscriminately alternate, inverse or direct.

Our usewear analyses showing the presence of complex fractures and other traces show that some bladelets were used as composite projectile weapon elements, thus attesting to the use of such weapons in the Archaic Aurignacian of Isturitz. Meanwhile, we have not determined the nature of the projectiles that were armed

<sup>4</sup> - For example, the type of experimentation recently conducted with Magdalenian Forked Based Points (Pétillon, 2006).



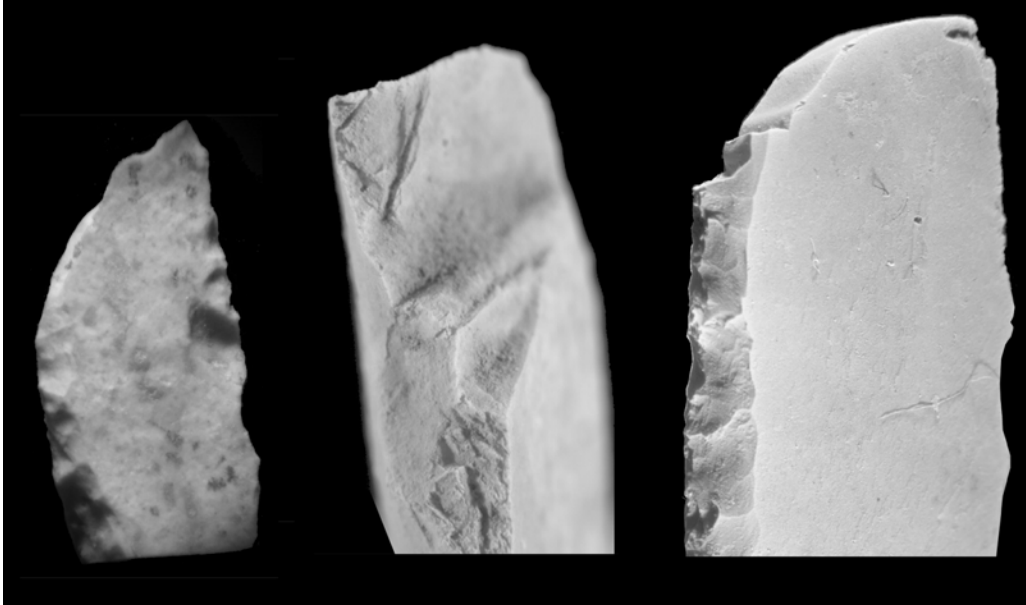


fig. 27 : Examples of impact fractures and chipping.

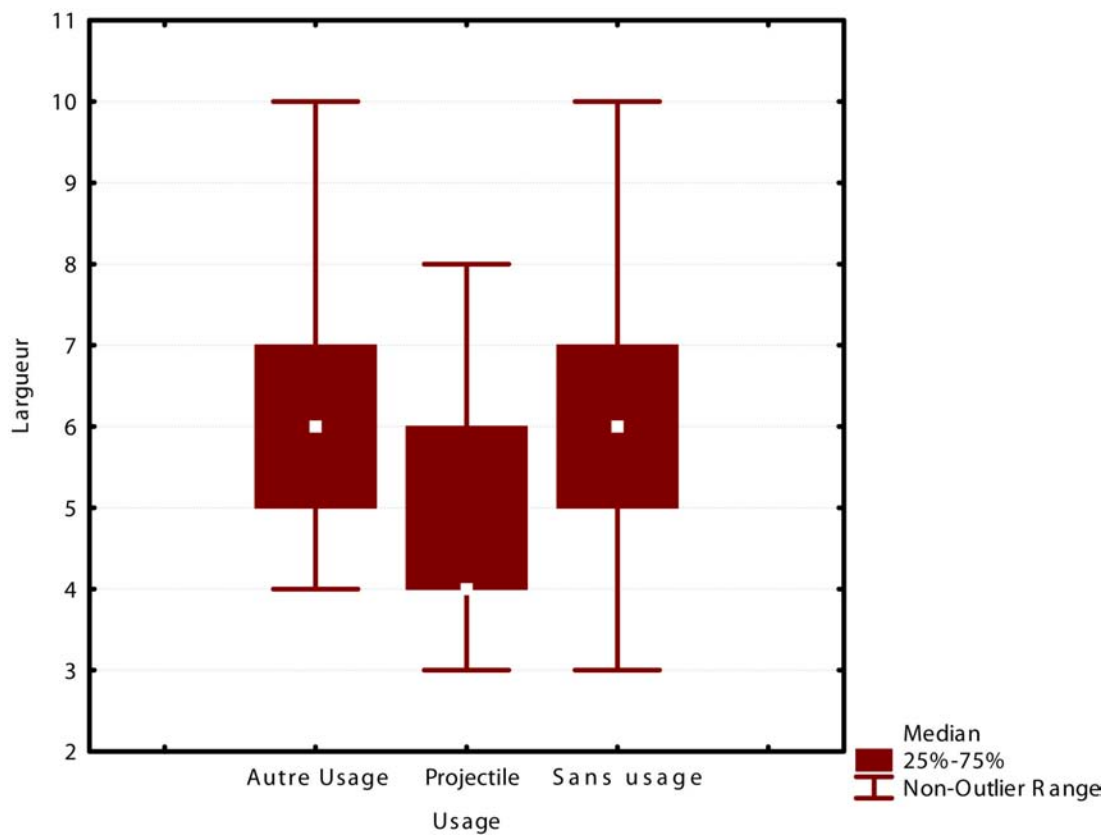


fig. 28 : Box and whiskers graph of the width of analyzed bladelets.



with these bladelets. Were they spears or arrows, for example. Though the former are the most commonly recognized for this period, a recent article justifiably argued that the use of the bow and arrow during the Aurignacian cannot be excluded (Cattelain, 2006).

The presence of only one antler point fragment in the rich assemblages of levels 4d1 and 4III suggests that the shafts of these weapons were principally made from wood—which also correlates with presence of pointed bladelets mentioned above. Wood could have been used due to a lack of other materials or for more complex reasons (Liolios, *op. cit.*; Otte, 2001).

The bladelets used as composite weapon elements were more carefully selected than those used for other functions. It seems that morphometric characteristics allowing a significant degree of standardization were favored. This factor appears to correlate with the use of inverse retouch (often intensive) or alternate retouch, though it is possible that some nonretouched pieces may have had the same function. The dimensions of the bladelets used as weapon elements were also generally smaller than those of bladelets used for other functions. It follows that the largest blanks were not those selected for use as weapon elements. These larger blanks—in particular, the long bladelets with direct retouch that do not have characteristic impact traces—do not seem to be associated with projectiles, but more likely with the other functions discussed above.

Meanwhile, it is difficult to determine the relative importance of the different functions associated with bladelet tools, especially since each of the usewear approaches applied gave different percentages. This result, though it may seem curious, if not contradictory, illustrates a factor that we emphasized above: the necessity of integrating different, complementary, analyses in functional studies of lithic and osseous tools. The use of bladelets as projectile weapon elements undoubtedly results in a large range of stigmata, extending from an absence of visible traces to intensive chippings and complex fractures. The proportionally low frequency of typical impact traces and/or fractures on these tools might be explained by their fragility: simple fractures would be more frequent

on bladelets used as weapon elements since these tiny pieces could be easily broken before being subject to forces sufficient to produce a complex fracture. Meanwhile, it is evident that the potential damage to composite weapon elements depends on many other factors as well. For example:

- the nature and intensity of the hafting “attachments”—of which we are completely ignorant—between the different components of a projectile weapon. A bladelet that could be easily detached surely suffered less damage than one that was strongly attached;

- a piece with a long use duration probably accumulated more damage than one abandoned after a short use duration;

- finally, even for a weapon shot only one time, the traces produced by contact with an animal, or any other element, likely differs according to the hardness of the material impacted, the type of projectile or the force of the person or tool projecting the weapon.

Another contradiction relates to the position of use traces relative to the edge with inverse retouch, which is probably the edge that was fixed against the shaft. The majority of complex fractures are located on or near this edge while most of the other traces are located on or near the opposite edge. It appears that some complex fractures could thus result from a shock between bladelets set in a series on the projectile shaft, or the between the bladelet and the projectile shaft itself, rather than from a contact with the target.

Returning to bladelets in general, it is interesting to ask what was the relationship between production strategies and the function(s) of the corresponding products? To us, these blanks appear to be multifunctional, but were they for the Archaic Aurignacian artisans, and what was their conception of what we call bladelets? Was the objective of their production to obtain blanks to be used for multiple functions through a random employment of all the production strategies known to them? Or was each strategy associated with products with a specific function?

We observe that:



- some bladelets were produced through a continual *chaîne opératoire* (reduction sequence) with blades, while others were obtained independently of blade production;

- some bladelets had functions comparable to those of blades (cutting, scraping, etc.), while others were used as projectile weapon elements, a function that blades apparently never had.

Can we thus draw a link between these two situations and deduce that the bladelets with a greater dimensional variability, produced in continuity with blades, were intended to be used in the same way as blades, while the bladelets produced through autonomous strategies, which allow the fabrication of more homogeneous blanks, were intended for use as projectile weapon elements? We do not yet have a definitive response, but it is perhaps not accidental that the largest blanks, produced from the same cores as blades, as well as those with direct retouch similar to that of blades, do not appear to have been used as weapon elements. In other words, among the range of blanks that we call “bladelets”, there could exist two categories of objects that played different roles: those used to arm hunting tools and those employed in butchery and/or manufacturing activities, complementary to the activities realized with blades. In this case, the latter, including the “big bladelets” considered to be characteristic of the Archaic Aurignacian, could thus have been considered by their producers as small or very small “blades”, and not as “bladelets”.

As early as the Archaic Aurignacian, we would thus observe the association of an autonomous production of relatively small and morphologically standardized blanks for use as composite weapon elements with another production of blanks with a high dimensional variability for use in more “domestic” activities, though we remain cautious concerning the meaning of this term (Tartar *et al.*, 2006). From this perspective, without minimizing a number of other more or less clear distinctions, the roles of laminar and lamellar productions in the Archaic Aurignacian of Isturitz would not be fundamentally different from those identified in the Early Aurignacian. In both

cases, « bladelets » would have been obtained in an autonomous manner from cores on flakes (“flake-edge cores”), while « blades » would have been obtained from other types of cores, mostly on larger flint nodules (Normand, in press b).

These ideas are still hypothetical, reflecting only part of a very complex whole that extends well beyond the scope of this paper. They venture well beyond simple interrogations concerning the function of a blank type at a given moment during the Aurignacian. They delve further into questions concerning the nature, articulation and evolution of the binomial relationship of weapons and tools during the Archaic Aurignacian, and thus allow us to make comparisons with the Early Aurignacian. In the end, these interrogations address the relationships in this domain between these two phases of the Aurignacian, and reveal the importance of such questions to our understanding of the origins of this techno-complex.

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# ANCIENT GRAVETTIAN IN THE SOUTH OF ITALY : FUNCTIONAL ANALYSIS OF BACKED POINTS FROM GROTTA PAGLICCI (FOGGIA) AND GROTTA DELLA CALA (SALERNO)

Valentina BORGIA

## Abstract

This study is concentrated on the modalities of use of the Gravettian backed tools, considering the Adriatic side and that Tyrrhenian of southern Italy.

A first part of the work has regarded the functional analysis of the backed instruments found in the Ancient Gravettian layers of Grotta Paglicci (Foggia). The methodological proposal derived from this study, based on the association of the techno-typometric and typological analysis with the use-wear analysis, has been extended for a comparison to the backed tools from a Gravettian site, almost coeval, on the opposite side of our peninsula: Grotta della Cala (Salerno).

**Key-words :** Grotta Paglicci, Grotta della Cala, Southern Italy, Gravettian, backed points, functional analysis.

## Introduction

The present work regards the comparative examination of the Gravettian backed points coming from two important Italian sites: Grotta Paglicci (layers 23 and 22) and Grotta della Cala (layer GL11), both localized in the south of the Italian peninsula, but on opposite sides (Fig. 1). A first part of this work, the one regarding Grotta Paglicci, has been carried out as a PhD project by the author (Borgia, 2006).



fig. 1 : Location of the archaeological sites

The twofold objective of the research has been to understand the ways of use of these tools and, particularly, to know if they had been used or not. For this purpose, various methodologies of analysis have been adopted:

- study of the technological, typological and typometrical characteristics of the artifacts, in the belief that information about prehistoric tools use come from the study of production methods sooner than from use-wear analysis;

- experimentation with controlled parameters, necessary part of every functional study since it allows the interpretation of the archaeological data;

- observation of tools under the microscope, according to the use-wear analysis methodologies, both low and high power magnification.

The same methodological approach has been also adopted for the analysis of the backed tools found in layer 11 of Grotta della Cala, referable to a cultural phase between the Ancient and the Evolved Gravettian. The aim was to identify analogies and differences between the artifacts of the two sites, and therefore to better identify the main functional characteristics, discriminating them from those dependant on available resources or cultural traditions.

## The archaeological contexts

*Grotta Paglicci, layers 23 and 22 (Fig. 2).*

Part of the rich Upper Paleolithic series of the cave, layers 23 and 22 have been dated between  $28.100 \pm 400$  BP (layer 23 A) and  $26.800 \pm 300$  BP (layer 22B) (Palma di Cesnola, 1993). In accordance with the radiocarbon datings, the study of faunal remains and charcoals (Palma di Cesnola, 2004) allows to insert these levels to cold and dry oscillations that should correspond to the interpleniglacial and the beginning of the II pleniglacial (isotopic stage 2). Big mammals are dominated by urus (*Bos primigenius*, up to 50 %, NISP) and horse (*Equus ferus*, up to 19%): these ungulates evidently were the preferred hunting game; another highly represented ungulate is ibex (*Capra ibex*, up to 33%) (Boscato, 1994 et 2004). Inside layer 22 (levels F-D) it is possible to distinguish an euthermic climatic oscillation, that could fit in the interstadial of Kesselt (Maisière), characterized by an increase of urus at the expense of caprinae, and the contemporary increase of forest micromammals (*Apodemus*).

The typological analysis of lithic industry, according to the method of Laplace (Laplace, 1964), has led to attribute these complexes to the oldest phase of the Italian Gravettian, which is known as 'of backed points' or 'indifferentiated' (Laplace, 1966; Palma di Cesnola, 2004). In the lithic complexes entire and fragmented backed tools make up to 80% (Level 22E) of the retouched tools.

*Grotta della Cala, layer GL11 (Fig. 3).*

The layer, dated  $25.720 \pm 240$  BP, is part of the series recovered in the atrium of the cave (Benini *et al.*, 1997; Borgia and Wierer, 2005; Boscato *et al.*, 1997 ;

# GROTTA PAGLICCI

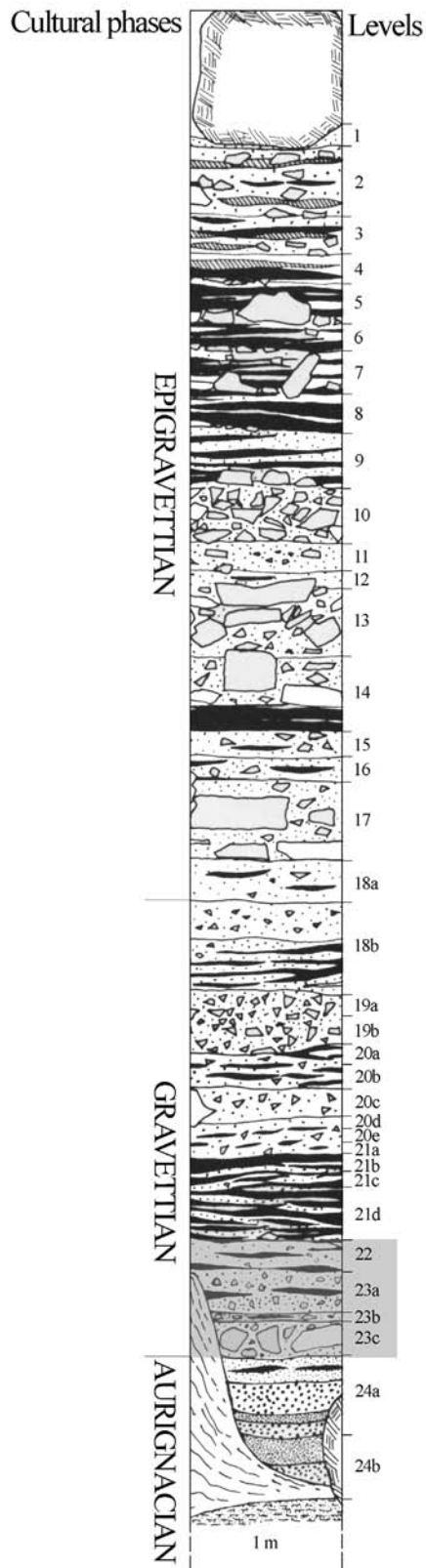


fig. 2 : Stratigraphy of the Upper Paleolithic sequence of Grotta Paglicci



Gambassini, 1993; Palma di Cesnola, 1971). The faunal association found in this horizon indicates, compared to the Gravettian layers of Paglicci, a more humid and temperate environment. Among ungulates, red deer prevails (74.5%, NISP), followed by roe deer (14.4%); wild boar (*Sus scrofa*), urus (*Bos primigenius*), ibex (*Capra ibex*) and chamois (*Rupicapra sp.*) have been identified as well (personal communication of Dr. Paolo Boscato). The remarkable difference between the big mammals of the two sites is probably due not so much to the temporal hiatus that elapses between them nor to different hunting targets, as for the climatic diversity between the Tyrrhenian coast and that Adriatic of Italy; on this side less frequent precipitations cause a more dry environment with scarce arboreal cover (Boscato *et al.*, 1997). As for lithic industry, layer 11 has been inserted in a moment of transition between the Ancient and the Evolved Gravettian, with characteristics that preannounce the burins of *Noailles* phase. Also in this case backed tools dominate the industry, with percentage up to 50%.

the mode that coincide almost always with the average. The points of Grotta della Cala appear smaller; this data reflects the whole lithic industry and it is probably explicable with the characteristics of the raw materials: flint or jasper pebbles of small dimensions and not exceptional quality. At the site of Paglicci, instead, there is abundant and good quality flint.

Another important datum concerns the profile of the supports, because it is closely linked with the hafting of the points and the shooting ballistics (Tab 2).

In both lithic assemblages this profile is usually rectilinear, and this is a characteristic evidently pursued, but probably it is not an essential requirement, since a large percentage of pieces (100%, in level 22D of Paglicci) does have concave, sinuous or twisted profile.

It should be underlined, however, that these features are never very accentuated (and at times corrected by retouch), and the longitudinal axis, even in these cases, can remain rectilinear. As regards the edge delineation of the points (Tab. 3), we notice a difference between the two sites: in Paglicci the rectilinear delineation of the back, opposite to a convex delineation, prevails (and always beginning from the level 22 D, the concave delineation appears); in Grotta della Cala we find instead a convex delineation (or lightly sinuous) of the back, opposite to a convex edge. (Fig. 4-5).

The points are formed therefore from a rectilinear or convex edge, created by means of an abrupt retouch, and by a convex shearing/cutting edge, often not retouched. These characteristics provide the tools with a transversal section shaped like a right angled triangle, less often like an equilateral triangle (the latter case often determined by a bilateral backed retouch)

Within points without bilateral retouch, in 92% of the cases the edge opposite to the back has been modified by a secondary retouch which, depending on its position, has the function of creating the necessary convergence to make the point, or both the points in the recurrent case of the bi-points (simple direct retouch or abrupt, sometimes also inverted), to narrow the apexes, or, more often, the bases (inverted flat retouch), to correct the profile of the support (direct or inverse

### Typometric and morphological analysis of the archeological material

Despite the fragmentariness that characterizes this type of tools, the intact backed points coming from the considered levels (Grotta Paglicci: 80 intact elements on 1100; Grotta della Cala: 14 intact elements on 169) allow us to have a statistically important sample for being able to face some morphometrical remark. In order to facilitate the exposition of data, we have taken as reference the values of only the richest of the nine levels in which layers 23 and 22 of Grotta Paglicci are subdivided: the 22 F (27 intact elements). As for Grotta della Cala, where layer GL 11 has been divided in 3 levels (11 upper, 11 lower, 11 indistinct), we will consider here the data of level 11 indistinct (6 elements).

A first observation, regarding the typometric data of the table above, concerns the great variability in the length of the points, while width and thickness are more homogeneous, as it can be seen from the median and

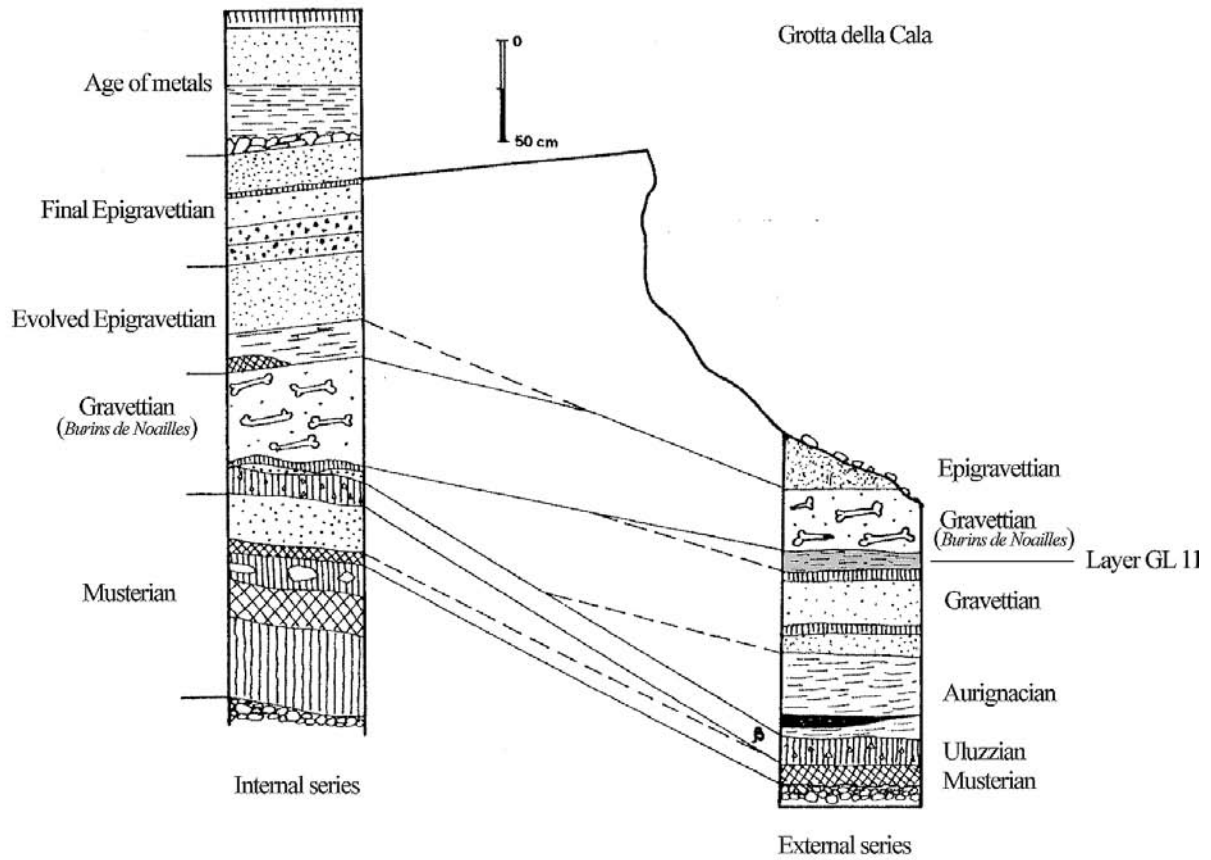


fig. 3 : Stratigraphy of Grotta della Cala

<i>Grotta Paglicci (22F)</i>	<i>length</i>	<i>width</i>	<i>thickness</i>	<i>Grotta della Cala (11)</i>	<i>length</i>
Average (mm)	34,4	5,1	3,1	Average (mm)	20,5
Min (mm)	16	3	1	Min (mm)	12
Max (mm)	72	9	7	Max (mm)	28
Median (mm)	35	5	3	Median (mm)	21,5
Mode (mm)	27	5	3	Mode (mm)	26
Standard dev.	11,6	1,7	1,2	Standard dev.	6,9

tab. 1 : Intact points dimensions



<i>Grotta Paglicci %</i>	<i>23 C</i>	<i>23 B</i>	<i>23 A</i>	<i>22 F</i>	<i>22 E</i>	<i>22 D</i>	<i>22 C</i>	<i>22 B</i>	<i>22 A</i>
Rectilinear	100	83,3	65,0	44,4	30,0	-	50,0	100	60,0
Convex	-	-	-	-	-	-	-	-	-
Concave	-	-	10,0	25,9	10,0	100	-	-	40,0
Sinuuous	-	-	20,0	22,2	40,0	-	50,0	-	-
Twisted	-	16,6	5,0	7,4	20,0	-	-	-	-
Total specimens	1	6	20	27	10	4	6	1	5

<i>Grotta della Cala %</i>	<i>11 inf.</i>	<i>11 sup.</i>	<i>11</i>
Rectilinear	75,0	100	66,6
Convex	-	-	-
Concave	-	-	16,6
Sinuuous	25,0	-	-
Twisted	-	-	16,6
Total specimens	4	4	6

tab. 2 : Longitudinal profile of the ventral face

<i>Grotta Paglicci %</i>	<i>23 C</i>	<i>23 B</i>	<i>23 A</i>	<i>22 F</i>	<i>22 E</i>	<i>22D</i>	<i>22 C</i>	<i>22 B</i>	<i>22 A</i>
Rect - conv	100	100	85,0	88,8	80,0	25,0	83,3	-	100
Rect - sin	-	-	-	-	10,0	-	-	-	-
Sin - conv	-	-	5,0	3,7	10,0	25,0	-	100	-
Conv - conv	-	-	5,0	7,4	-	-	-	-	-
Conc - conv	-	-	5,0	-	-	50,0	16,6	-	-
Total specimens	1	6	20	27	10	4	6	1	5

<i>Grotta della Cala %</i>	<i>11 inf.</i>	<i>11 sup.</i>	<i>11</i>
Rect - conv	25,0	-	33,4
Rect - sin	-	-	-
Sin - conv	-	-	-
Conv - conv	75,0	100	66,6
Total specimens	4	4	6

tab. 3 : Edge delineation of the backed points





fig. 4 : Intact points of Grotta Paglicci (level 22F)



fig. 5 : Intact points of Grotta della Cala



flat retouch) and, finally, to calibrate the width of the piece (simple retouch or flat in mesial position). Independently of the typological classification, various recurrent morphologies have been identified, representing very similar percentages in all the levels (Fig. 6). On the base of the data listed here, despite the typometric and typological differences noticed within the points, it has been possible to insert the points of Paglicci, and later on those of Grotta della Cala, in a scheme of morphologies (Montoya, 2002).

The most frequent form at Paglicci (77.7%) is the bi-point with a rectilinear back opposite to an unretouched convex edge. Within this group there is a standardization of the forms despite a notable variety in dimension (Fig. 6 a).

A different morphology of bi-point (7.4%) presents a transversal section shaped like an equilateral triangle (sometimes trapezoidal isosceles) in that the retouch is bilateral or the supports used have a trapezoidal form (Fig. 6 b). These last points show more standardized dimensions (L = 28/35 mm, w = 3 mm).

Both these morphologies can have, moreover, a truncated base (Fig. 6 c).

In Grotta della Cala we find morphologies that can be assimilated to those described above (Fig. 7).

An example of bi-points with rectilinear back and convex edge is not present within the intact points, but this morphology can be recognized between fragments.

The bi-points with convex back, those distinction seemed uncertain, have been comprised in this same category.

Also the morphology without shearing edge is present to Grotta della Cala, with dimensions very exiguous. The truncated point is completely absent. This last one could be considered a “regional” factor, independent from functional reasons: following the Ancient Gravettian phase, the truncated tools spread only on the Adriatic coast, while are not diffused on the Tyrrenic. Another particularity of this “parallel” evolution of the

Italian Gravettian is the diffusion, this time only on the Tyrrenic coast, of the burins of *Noailles* (Palma di Cesnola, 1993).

In both lithic complexes a small number of backed tools is not insertable in the categories described above. These tools, even though provided with a backed retouch, have distinctive morphological features which would exclude them from the main group of points conceived as throwing weapons elements <sup>1</sup>.

### The experimental phase <sup>2</sup>

Preliminarily to the functional analysis of the backed points of Paglicci, an experimentation on approximately 70 points has been carried out. Points have been realized on the base of the morphologic characteristics of the more recurrent model in the industry: a bi-point of small dimensions (average length from 25mm to 40 mm) with a rectilinear abrupt retouch opposite to a non retouched, more or less convex, shearing edge. The transversal section is triangular and the profile nearly always perfectly rectilinear (Fig. 8). The presupposition of departure of this study, and therefore of the experimentation, was that at least one, and probably the main function of the backed points were that one of point of projectile. The experimental phase has been lead therefore on this base, proceeding to produce only tools making part of a throwing weapon. Part of the tools (n. 35), reproduced using a raw material as close as possible to the archaeological one, have been hafted in several positions (Fig. 9) in viburnum haft (length. 80 mm, diam. 8 mm) using sinew lashes and glue, and fired with a bow towards an animal target and towards the ground (shooting distance: 6m), the latter to simulate an error on the part of the hunter. Another portion of the experimental points (n.16) were hafted and hurled against a wall with a 90° angle, or broken by hand or with the aid of a percussion (n. 18) so as to obtain a greater variety of fracture types. Following

<sup>1</sup> - Well-developed use-wear due to hide working have been determined on some “atypical” backed points of Grotta Paglicci.

<sup>2</sup> - It is necessary to underline that this experimentation, conducted with own means by the author, has been carried out in order to have at disposal a case records of flint fractures. Data obtained, even though are not coming from a faithful reproduction of a hunting context (the target was constituted by a heap of animal pieces), are presented here as they show many analogies with other studies (Fisher *et al.*, 1994; Odell and Cowan, 1986, O' Farrell, 2000; Plisson and Geneste, 1989; Soriano, 1999) and they have however allowed to create a comparison with the archaeological material.



<i>Grotta Paglicci</i>	23	23	23	22	22	22	22	22	22	<i>Grotta della Cala</i>	11	11	11
%	C	B	A	F	E	D	C	B	A	%	inf.	sup.	
▲	-	-	30,0	11,2	10,0	15	-	-	-	▲	16,6	-	60
◄	100	100	70,0	88,8	90,0	75	100	100	100	◄	83,4	100	40

tab. 4 : Transversal section of the backed points

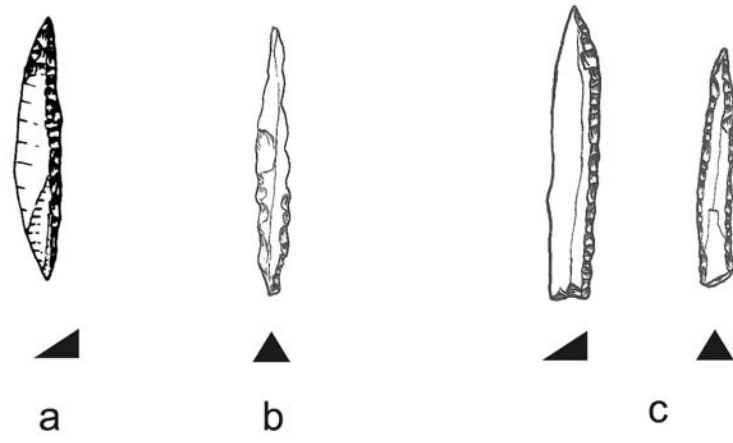


fig. 6 : Morphologies of backed points of Grotta Paglicci

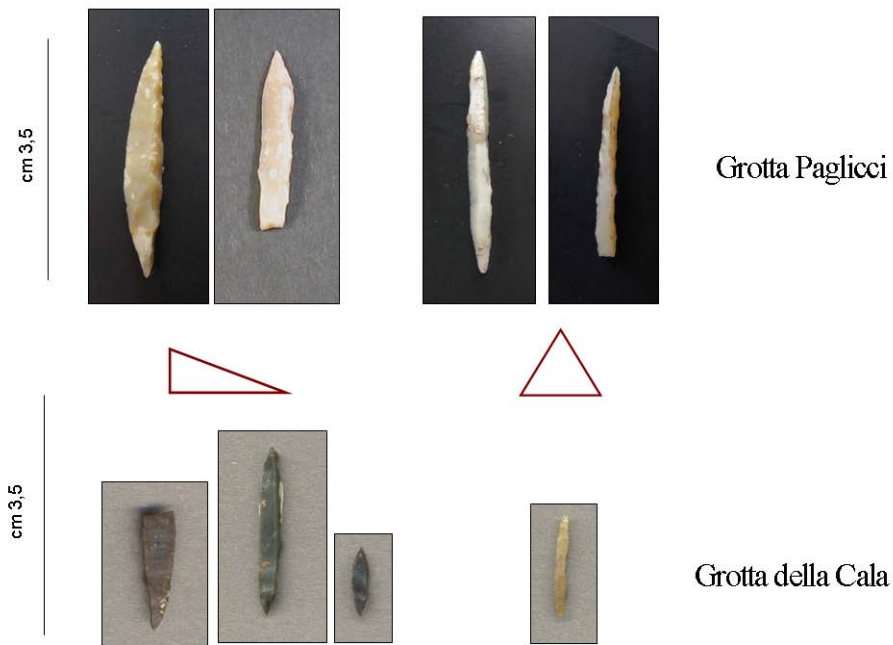


fig. 7 : Morphologies of backed points of Grotta Paglicci and Grotta della Cala



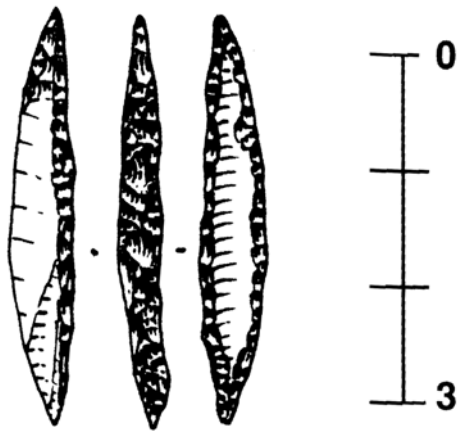


fig. 8 : Morphology of bi-point reproduced in the experimental phase

the impact, the points that had been hafted in lateral position (Fig. 9,d) did not sustain any macroscopic damage (but microscopical); the others broke, in 70% of the cases above halfway of their length from the base. As a consequence, according to this method of hafting, the base fragments (always functionally orientated) are longer than the apical fragments. In 4 cases the points literally disintegrated.

As far as the analysis of the fractures caused by impact on the points is concerned, a classification scheme was created, based on the terminology forwarded by various authors on the principal functional studies on projectile points (Ho Ho Committee, 1979; Fischer *et al.* 1984; Plisson and Geneste 1989; Soriano 1999; Perpère 2000). The scheme is based on the position of two main types of complementary fractures, cone and bending (Fig. 10, n°1 a-b), which are formed in the moment of the impact and tend to have a determined disposition: the fractures cone involve the part of the instrument turned towards the impact, those bending the part of the instrument turned towards the base. Whilst in the *cone* fractures no sub groups were identified, the *bending* fractures were divided in 4 sub groups on the basis of their endings (step, feather, hinge, snap, Fig. 10, n° 2), Among these sub groups some have been identified as highly diagnostic of their projectile function: the *bending* fractures with step ending, and especially the *spin-off* fractures, in

which tiny splinters are removed starting from a *bending* fracture for the inflection produced by the impact. Other elements considered as diagnostic of the impact are the *enlèvements burinants* and the *fissurations*, indicative of a violent force (Fig. 10, n°5 -7).

The type of the fractures, as can be seen in the table below (Tab.5), largely repeats the alternating scheme proposed *cone/bending*, in which the *cone* fractures involve the proximal part of the apical fragments and the *bending* fractures involve the distal part of the base fragments (Fig. 11 a).

On the tips one notes many cases of *enlèvement burinants* and the *bending* fractures, frequently of step type (50%), present *spin-off* (Fig. 11 b-e). It should be noted however, and this data is of extreme importance, that in some pieces (13%) the typical position of the *cone/bending* fractures is inverted.

As far as the macrotraces on the lateral margins of the experimental tools are concerned, despite the fact that many authors (in particular: Odell, 1981) have noted how, following impact, microfractures are created obliquely to the longitudinal axis, on the points used in this experimentation (as on the points of the Gravettian of Paglicci) these microfractures have an orientation and a disposition of a chaotic nature, and therefore it has been impossible to establish a regular relationship between these and the impact itself. A separate notation should be made concerning the microtraces on the experimental pieces; it is particularly interesting to note the differences between the points hafted in an apical position and those in a lateral position. On the latter (Fig. 12) one frequently notes, albeit light, shining linear traces, called linear polishes (or linear features) (Moss, 1983; Fischer *et al.*, 1984; Plisson and Geneste, 1989), positioned perpendicularly to the margin on the extremities of the pieces, probably caused by the abrasion which occurred at the moment of the insertion of the handle. Also present, on the lateral margins, extremely light polishes or longitudinal linear features, which are caused by the contact with the animal target (Fig. 11 f-g). In contrast, on the points hafted in an apical position (Fig. 13), the traces are almost absent and only on the

Typology of fractures %		None (intact)	Cone	Bending	Enlèvement burinant	Spin-off
		Apex dist	28,5	14,2	-	57,1
Apex prox	-	-	83,3	16,6	-	-
Base dist	-	-	17,6	70,5	11,7	22,7
Base prox	90,9	-	-	-	9,1	-

tab. 5 : Type of fractures on experimental tools

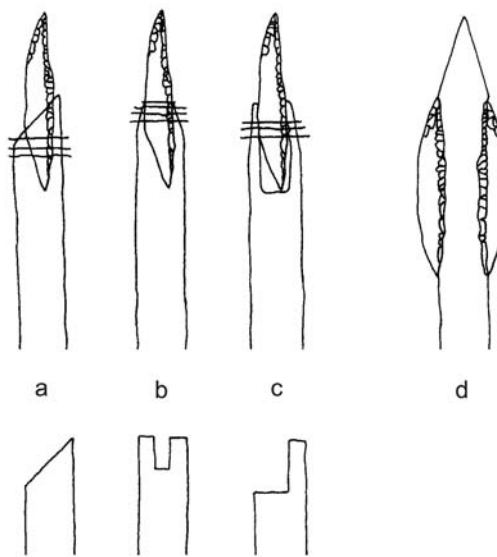


fig. 9 : Different experimented positions of hafting

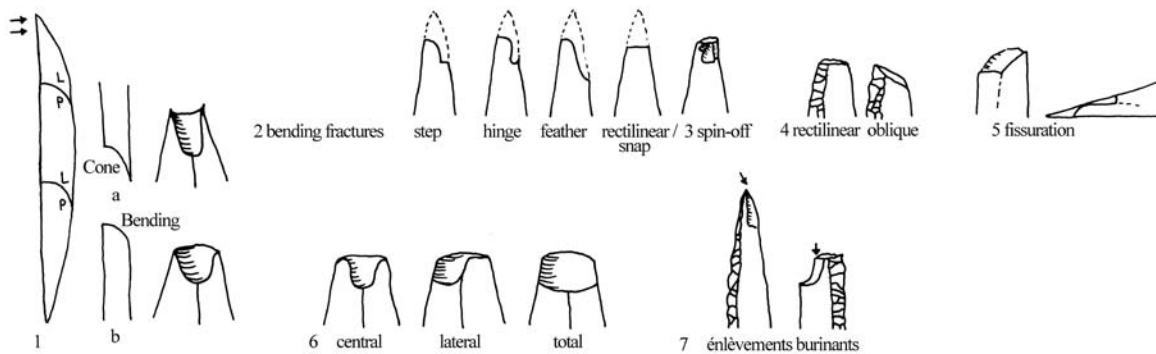
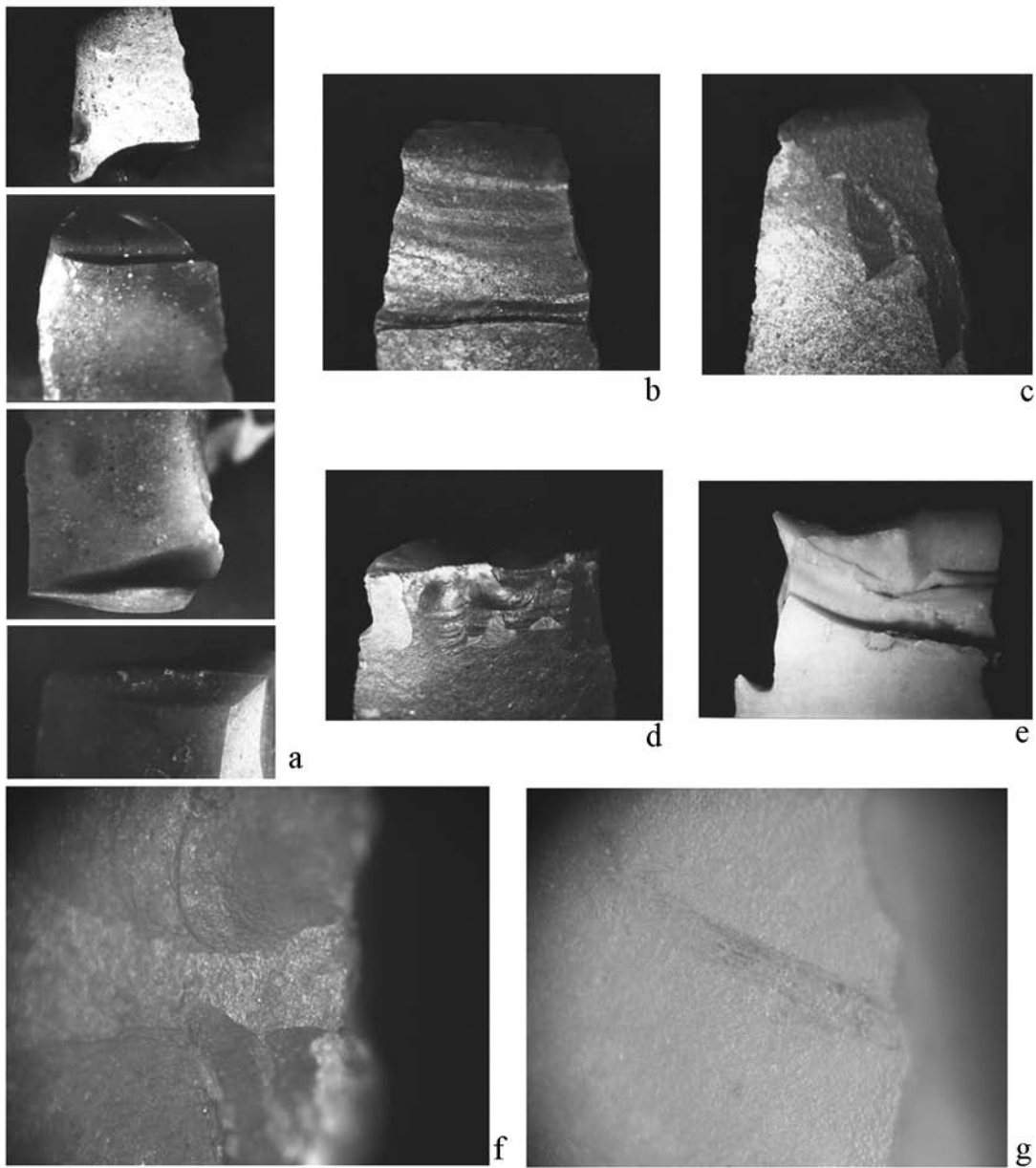


fig. 10 : Scheme for the classification of fractures





**fig. 11** : Experimental phase; a: reconstruction of a fragmented point with the typical disposition of bending/cone fractures; b-c: bending fractures; d-e: bending fractures with spin-off (20X); f-g: microwear on lateral edges (100X)

base portions of some of the pieces thrown towards the ground, this was caused by the less firm hafting of these pieces, used in the very first phase of experimentation. As for pieces hurled against a wall, or broken by hand, this additional experimental phase produced positive results in that, if the fractures present on the hurled pieces reveal precisely the percentages cited in table 1 as far as the position of the *cone* and *bending* is concerned, the points broken by hand leave no traces of anything which can be diagnosed as resulting from impact: the fractures are almost always rectilinear (or Snap), and the percussion point is often recognizable (Fig. 14)

#### *Classification of the fragments*

In order to be able to make typometric and morphological evaluations, as well as traceological ones, on the fragments of backed tools, it has been necessary to divide these specimens in three principal categories, in relation to their presumed functional orientation: apex fragments, base fragments and median fragments (Tab. 6).

Because of the high incidence of the bi-points within the intact specimens, the main problem has been that one to distinguish apexes from the pointed bases. Within the intact points of Paglicci it has been noticed that in 20% of the cases they show both perfectly pointed apex and base, while in the other specimens there is a marked difference between the two ends: the end less pointed (40%), flatter (16%), somewhat angled (8%), or with the retouch failing to arrive right at the very tip (16%) was considered as the base. Naturally these characteristics, rather evident in intact pieces, sometimes have not been recognized among fragments, considering also that the position of the secondary retouch is not associated in an univocal way to an extremity rather than to the other. For this precise reason a non classifiable category was created among the fragments.

In the case of Grotta della Cala this division has been easier as many fragments were clearly recognizable like fragments of base: decidedly not pointed and often *dejétées*.

According to this division we noticed that in Paglicci (22F) apical fragments prevail (but the single levels percentages are variable), whilst in Grotta della Cala fragments of base

clearly predominate (Tab. 6). Median fragments have identical percentages in the two sites.

%	Paglicci (22F)	Cala
Fr. apex	38,5	13,0
Fr. base	12,4	47,3
Fr.apex/base	23,4	13,6
Median	25,7	26,0
N. of elements	338	169

tab. 6 : Fragments of backed tools

From a typometric point of view, in both sites we note that fragments of base, in line with the experimental data, are longer and wider than the fragments of apex. As regards median fragments, the analysis of the material of Paglicci has allowed to propose that at least a part of these instruments were distinct functional elements, probably conceived as lateral elements of an arrow or a javelin. This possibility, that it does not exclude that many median elements were the result of points fragmentation, would seem confirmed from some characteristics: the very similar dimensions, a perfectly rectangular form (Fig. 15), a flat direct lateral retouch, which is extremely rare in the intact specimens and the presence of some intact elements (Fig. 16) morphologically assimilable to fragments. In the material of Grotta della Cala, the median fragments seem to have the same morphologic characteristics and the same particularity regarding the lateral secondary retouch.

#### *Fractures analysis*

Fractures analysis of the fragmentary elements has brought to light some problematic. In the archaeological material fractures do not show the same alternation of cone and bending noticed in the experimental phase. In both the sites, within apical fragments (Tab. 7) cone fractures (proximal) prevail, as in the experimental points, but it continues to prevail also in the fragments of base. Moreover, removal length of bending fractures is higher than 3 mm only in the 1% of cases and many rectilinear fractures, totally absent in the experimental points, are found in the archaeological material.



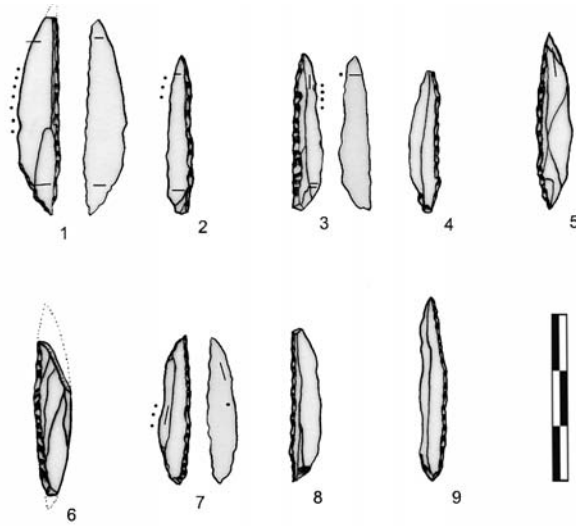


fig. 12 : Microwear on laterally hafted points

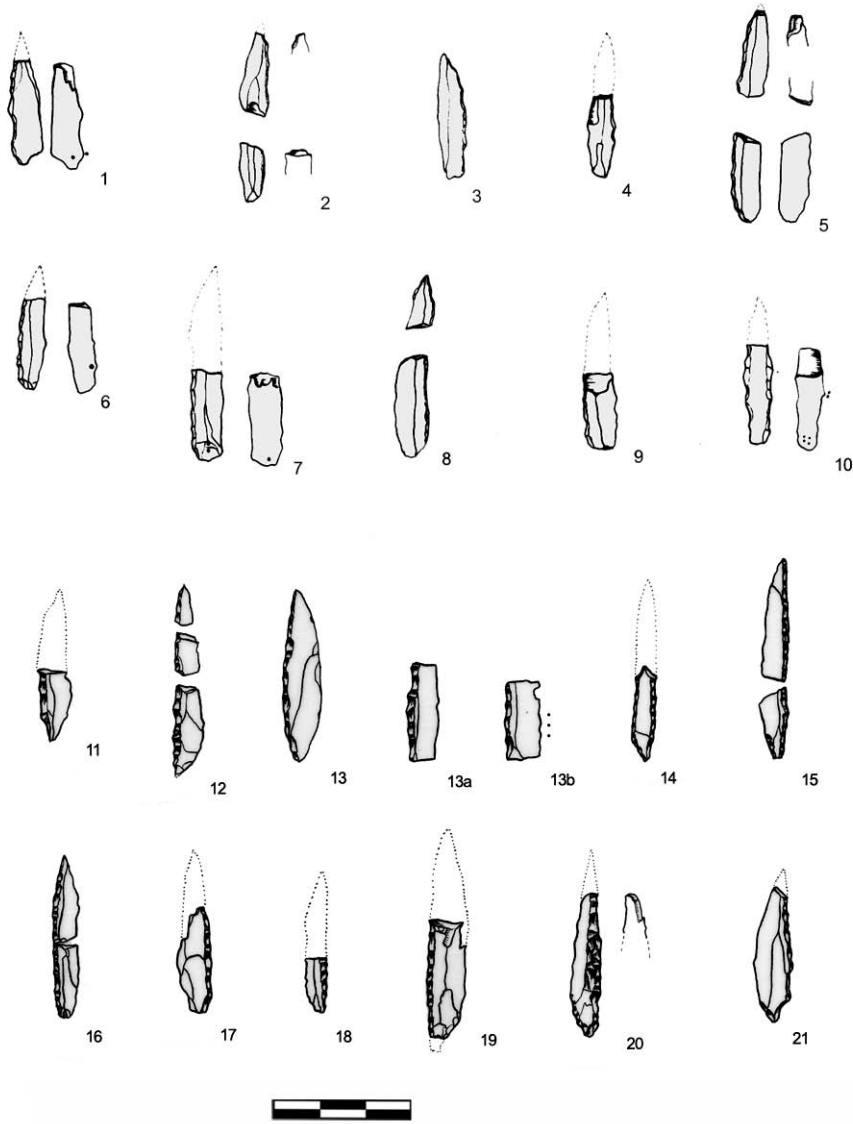


fig. 13 : Microwear on points hafted in an apical position



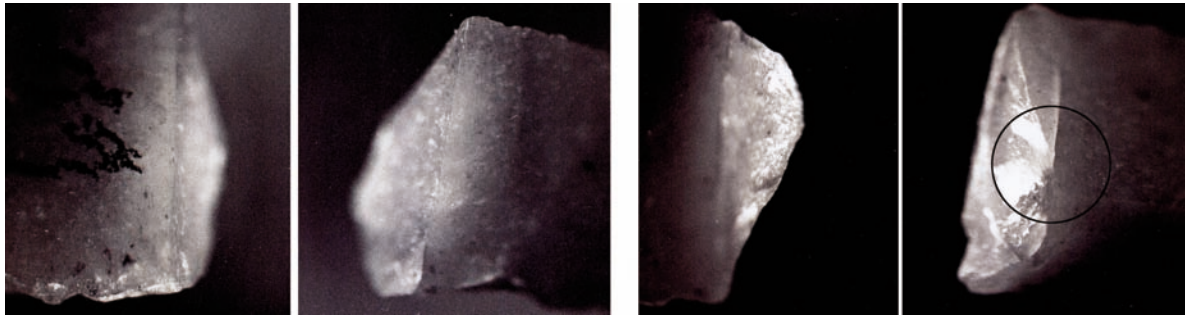


fig. 14 : Fractures on a point broken with the aid of a percussion (20X)



fig. 15 :- Median fragments of Grotta Paglicci (level 22F)

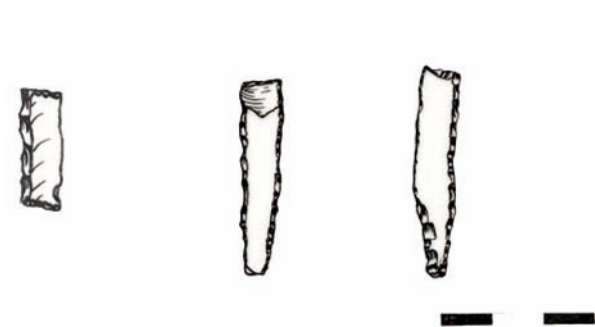




fig. 16 : Truncated blades of Grotta Paglicci



	<i>Grotta Paglicci (22F)</i>		<i>None (intact)</i>	<i>Cone</i>	<i>Bending</i>	<i>Rect.</i>	<i>Enlèv. burinant</i>	<i>Spin-off</i>
	%							
	Apex	dist	98,3	-	-	-	1,6	-
		prox	-	44,1	17,5	29,1	-	-
	Base	dist	-	38,4	33,3	30,7	-	2,5
		prox	100	-	-	-	-	-

	<i>Grotta della Cala</i>		<i>None (intact)</i>	<i>Cone</i>	<i>Bending</i>	<i>Rect.</i>	<i>Enlèv. burinant</i>	<i>Spin-off</i>
	%							
	Apex	dist	90,4	-	-	4,7	4,7	-
		prox	-	47,6	23,8	28,3	-	-
	Base	dist	-	46,1	30,7	23,0	-	1,9
		prox	100	-	-	-	-	-

tab. 7 : Classification of fractures on the archaeological material

This data lead us not so much to criticize the methodology of classification of fractures, that seems confirmed from many experimentations, as to think that it is not simple to distinguish, in the whole archaeological assemblage, the utilized points from those fragmented for post-depositional causes. If we take into consideration analogous studies on the Gravettian backed points, we notice that two characteristics are assumed as essentials in order to determine the use of projectile of these instruments: the higher percentage of base fragments and/or the presence of diagnostic fractures, in particular bending with removals higher than 3 mm (Dermdarsky, 2003, site of Stillfried; O' Farrell, 2000, site of Corbiac; Perpère 2000, site of Abri Pataud; Soriano, 1999, site of Rabier).

Except for Paglicci (where nonetheless the apex-base distinction is difficult), in all the other sites fragments of base prevail (Tab. 8). This datum is associated by researchers with the common employment of the tools as projectiles, supposing that the proximal part of the point, remaining in the haft, could return to the camp with the hunters' equipment, whilst the distal part might be easily lost following the impact. In the Abri Pataud site, moreover, unlike what we notice at Paglicci and la Cala, bending fractures prevail on base fragments, and in a complementary way the cone fractures are found on fragments of apex (in conformity with the suggested

scheme, Fig. 10 n°1). At Paglicci and la Cala, cone fractures, however, seem to be prevailing by far. On the other hand, the complementariness of cone and bending fractures as a result of the impact, and the prevalence of base fragments, implies that the points have been hafted in the apical position (Fig. 9 a-c), while perhaps the bi-points with a shearing edge fit better in a lateral position (Fig. 9 d).

That would explain the concavity or the torsion of the profile of many specimens of bi-points, because it does not cause any particular problems in the lateral hafting, and their dimensional variability (in particular in their length). The specimens without a shearing/cutting edge instead, with an equilateral triangle section, always present extremely rectilinear profiles and axes and more standardized dimensions: these instruments, with characteristics that seem more calibrated with the entire system of the throwing weapon, could have an apical position.

For the tiny points of Grotta della Cala, it is difficult to suggest a type of hafting, unless we classify them as apical elements of very thin hafts (Fig. 17).

The scarcity of diagnostic elements of an impact is particularly obvious if we translate the data of Paglicci and la Cala in conformity with the scheme proposed by Magen O' Farrell (2000) for the study of the backed points of the site of Corbiac (Tab. 9).



%	<i>Intact points</i>	<i>Fragments of apex</i>	<i>Fragments of base</i>	<i>Median fragments</i>	<i>Undetermined fragments</i>
Paglicci	6,7	27,2	16,6	28,7	20,6
Cala	7,6	11,4	43,7	24,0	12,5
Rabier	-	27,1	38,3	30,9	-
Abri Pataud	7,0	15,0	46,0	31,0	-
Stillfried	25,6	12,1	51,3	10,8	-
Corbiac	19,0	24,0	31,0	26,0	-

tab. 8 : Intact points and fragments percentages

In this scheme the material is not divided between fragments of apexes and bases, but the types of fractures are considered as a whole.

In the three sites the outcome is that of a substantial homogeneity, due to the fact that the percentages of the diagnostic fractures of an impact are always very small.

In particular we can see the very high percentage of rectilinear/*nette* fractures (never produced as a result of the impact in the course of experimentation); cone fractures in Corbiac come out instead decidedly in an inferior number than bending fractures.

We can undertake a comparison as regards the totality of the simple and complex fractures also with the sites of Rabier (Soriano, 1999) and Stillfried (Derndarky, 2003); the majority (75%) of the points of Rabier present simple fractures, and in the material from Stillfried only 8 elements with diagnostic fractures from the impact have been determined, therefore approximately 90% of the fractures would turn out to be simple (Tab. 10).

A particularly interesting datum derives from the analysis of the fractures of the median elements of Paglicci and la Cala. In both sites the greater part of the fractures seems to have a post-depositional or voluntary origin. In fact, in the case of an impact on median fragments we should find both a bending fracture and a cone fracture, whereas in the material taken into consideration this case occurs only rarely (Tab. 11). The propagation axis of the fractures, often (over 20% of the cases) does not coincide, to demonstrate that two distinguished events have generated these fragments.

#### *Microtraces analysis*

The microtraceological analysis, carried out on a sample (n. 106) of intact and fragmentary points from Grotta Paglicci<sup>3</sup>, has not been helpful in characterizing the traces due to the impact. On 31% of the pieces examined microwears are present, but in this calculation also pieces with very light polishes have been included. It is not possible to determine only on the basis of use-wears if an instrument has been used as an element of a weapon for throwing, but the position of the microwears can instead be helpful to understand the modalities of hafting. In the case of Paglicci, traces on the intact points are positioned in the shearing edge, without having an apparently recurrent position (Fig. 18). The point with a truncated base and a equilateral triangle section shows polishes on the base (Fig. 18, n. 3).

Contrary to what has been observed in the study of the backed points coming from other complexes (not only Gravettian: Gurova, 1998; Derndarsky, 2003; Donahue, 1988; Lemorini and Rossetti 1989-99, O' Farrell, 2000; Plisson and Geneste, 1989), on the material from Paglicci we haven't found any traces that can induce us to think that these instruments were used as drills or knives.

#### **Conclusions**

The comparative study of backed points from Grotta Paglicci and Grotta della Cala has allowed us to make some considerations regarding the Gravettian hunting weapons. The observation derived from the analysis of the points of Paglicci, concerning two main morphologies of tools, with or without a shearing/cutting edge, seems to be applicable also to Grotta della Cala, in spite of the differences that regard the dimensions of the points.

<sup>3</sup> - A bad condition of tools has made difficult the use-wear analysis of backed points coming from Grotta della Cala.



%	Simple							Complexes					
	cone		Flexion- face				Flex lat.	Flexion-face			Flexion-latérale		
	trans	obl	FN	P	C	M		P	C	M	P	C	M
Corbiac	7,2	1,7	46,0	3,1	23,1	-	1,3	1,0	4,4	5,8	1,7	3,7	1,3
Paglicci	31,9	4,8	32,5	-	-	13,2	9,0	1,8	-	6,0	-	0,6	-
Cala	43,0	1,2	35,4	-	-	15,1	2,5	-	1,3	-	1,2	-	-

**tab. 9** : Proposed scheme for the classification of backed points fractures (O'Farrell, 2000). Legenda: Simple/simple bending fractures not diagnostic of an impact (removals < 3mm); Complexe/complex: bending fractures with removals > 3mm; FN: fracture rectilinear/nette; P: plume/ bending feather; C: charnière/bending hinge; M: marche/bending step

<i>Site</i>	<i>Simple fractures</i>
Paglicci	91,4 %
Cala	97,2 %
Corbiac	82,4 %
Rabier	75 %
Stillfried	90 %

**tab. 10** : Simple fractures percentages

%	<i>Paglicci</i>	<i>Cala</i>
<i>22F</i>		
Cone/cone	22,9	28,2
Bending/bending	6,9	5,1
Rettilinea/rettilinea	9,6	10,2
Bending/cone	13,9	23,0
Rettilinea/cone	23,2	15,3
Rettilinea/bending	23,2	17,9

**tab. 11** : Fractures on median fragments



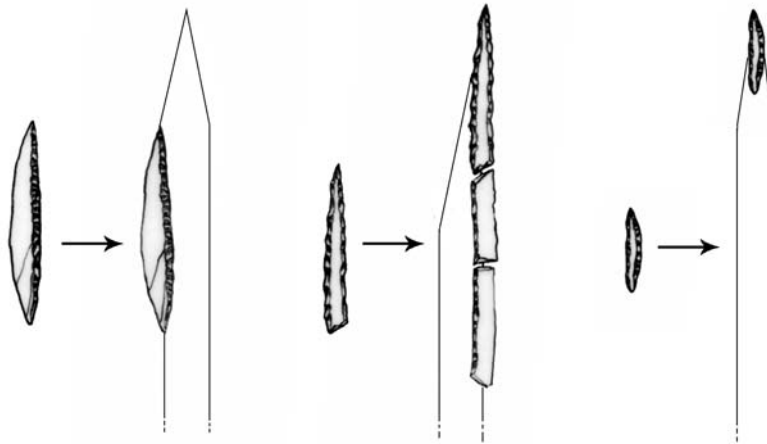


fig. 17 : Reconstruction of hafting of backed points

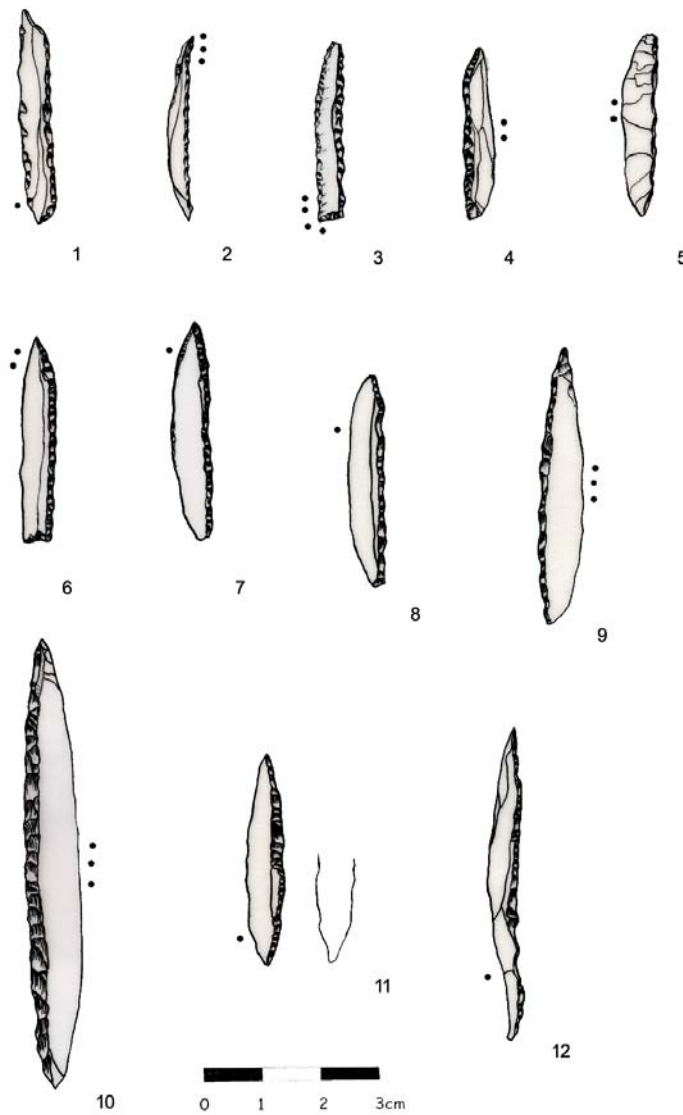


fig. 18 : Microwear on intact backed points of Grotta Paglicci



A remarkable dimensional variability, concerning essentially the length, is however present also within the elements from Paglicci (Fig. 11), and the smaller dimensions of the points from Grotta della Cala could be only due to the morphology of the raw material. It remains to be explained whether the dimensional variations in apparently similar and standardized tools did have a functional meaning or not, whether we are in the presence, contemporarily in the same site, of elements conceived for different weapons, maybe for preys of different sizes.

Other differences between the two sites, such as the profile of the back, nearly always convex at la Cala and rectilinear at Paglicci, as well as the presence of truncated tools only in Paglicci, seem to be due to variations of a “regional” kind. We shouldn’t forget that the Appennines, even though not particularly high and with numerous passes at a low altitude, seem to have created a barrier between the Adriatic and Tyrrhenian areas.

Finally, as far as the analysis of the fractures is concerned, the comparison between the two sites has brought to light the same problems: it is clear that only a small number of points have got diagnostic fractures from an impact, therefore it is difficult to quantify the percentage of instruments actually used, being unable, moreover, to rely on the support supplied from the microwear analysis.

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# WHAT ARE THESE BARBS FOR ?

## PRELIMINARY STUDY ON THE FUNCTION OF THE UPPER MAGDALENIAN BARBED WEAPON TIPS

Jean-Marc PÉTILLON

« If the arrow is of the barbed kind, you should disentangle the flesh caught between the barbs as much as you can, and then pull it out. »  
translated from Bruno da Longobucco, *Chirurgia magna* (1252)

### Abstract

Based on previous works by M. Julien (1982) and G.C. Weniger (1995), this paper presents some preliminary hypotheses on the possible functions of the osseous barbed points from the Upper Magdalenian (*ca.* 13,500-12,000 calBC). Taking as a starting point the statement that their appearance and development coincide with an increased interest in small animal hunting (fish, birds, lagomorphs), we attempted to correlate the relative abundance of barbed points with the representation of small game, but the data from our test area (Northern Pyrenees) did not provide conclusive results. A survey of the barbed points of Northern American hunter-gatherers known by ethnography shows a clear functional trend: « simple » barbed points are mostly used for fowling, for hunting big and small land game, and for war; while « true » harpoons are mostly used for fishing and hunting sea mammals and aquatic mammals. However, when based on a rigorous operational definition of harpoons, the morphology of the Magdalenian barbed points appears not to allow their positive classification as harpoon heads. Thus, their function remains largely undetermined. We therefore suggest several possible directions for future research on this topic.

Key-words : osseous industry, barbed points, hunting weapons, Magdalenian, zooarcheology, ethnography, functional study.

Projectile points made of osseous material – bone, antler and ivory – appear in Europe at the very beginning of the Upper Paleolithic. They thereafter undergo numerous variations in shape, dimensions, surface features (decoration, longitudinal grooves...) and, most of all, hafting method. Most of these changes are not readily interpretable in operational terms. It is difficult to say, for example, if the shift from single- to double-beveled antler points at the beginning of the Upper Magdalenian has anything to do with a change in the weapon system operation – since both types of points can be hafted to similar projectiles projected in the same way against similar targets. There is however one Paleolithic technological innovation that stands out from this point of view: the addition of barbs.

In Europe, the first single-barbed osseous points probably date back to the Gravettian (see chronology below); but the major development of barbed tips begins with the Upper Magdalenian *ca.* 13,500 years BC, and continues into the subsequent Epipaleolithic and Mesolithic cultures, and to a lesser extent into the Neolithic. Compared to unbarbed osseous points, barbed weapon tips represent an important technological change: they are specifically designed to prevent their extraction from a wound. Because this particular feature obviously affects the weapon operating mode, it undoubtedly points to some kind of change in the game acquisition techniques.

The question we want to address here is the following: how, and to what extent, did the introduction of barbed points modify Paleolithic predatory behavior? What was their exact role and importance in the hunting kit? In other words, the issue considered here is that of the function(s) of the barbed points.

According to F. Sigaut, determining the function of an artifact implies establishing « the complete and exact set of ends to which an implement is used » (Sigaut 1991, p. 23). Dealing here with artifacts closely related to hunting, our main goal will be to determine the

type(s) of game against which barbed points were used. Of course, we cannot be sure to achieve such a precise diagnosis with Paleolithic artifacts (Sigaut *ibid.*), and this paper must be considered as a preliminary study exploring the feasibility of the project. It does not yield conclusive results but rather indicates possible relevant directions for future research.

For reasons detailed below, we will concentrate on the barbed items from the Upper Magdalenian, especially the artifacts usually called « *harpons* » in the French literature. For more than one century, these artifacts have been the subject of an abundant literature, the books by M. Julien (1982) and G.C. Weniger (1995) being the most comprehensive studies to date. The present paper only intends to develop some of their ideas in a new perspective.

#### Defining the scope of the study : a brief overview of Paleolithic osseous barbed items

On a projectile or thrusting spear, a « barb » can be defined as a more or less pointed lateral prominence, intended to hinder or forbid extraction of the weapon from the wound. Laterally-hafted flint bladelets, very common in many Upper Paleolithic cultures and occasionally found in association with osseous points (Nuzhnyj 1989), have sometimes been described as « lithic barbs ». However, in many cases it is not clear whether these implements had a real « holding » role or merely a shredding function, and we prefer to avoid using the word « barb » in this context.

In the present state of our knowledge, the oldest known barbed tips would be the bone points from the Ishango and Katanda sites (Nord-Kivu, Congo Democratic Republic), with respectively estimated dates of 20,000 BP and 90,000 BP. So far, these artifacts remain chronologically isolated, all other African barbed points known to date being of Holocene age (Yellen 1998).

In Europe, the oldest barbed items from the Upper Paleolithic, not included in the present study, are



probably the self-barbed antler points (fig.1a) from the Gravettian (Goutas 2004, p. 201), the Solutrean (e.g., Peyrony 1929, 1934; Castel *et al.* 2006, fig.7), the Cantabrian Lower Magdalenian (Pokines & Krupa 1997) and the Badegoulian (Séronie-Vivien 2005, p. 151). From the first discovery of this type of artifact, at the beginning of the twentieth century, it has been suggested that « this point type may have been hafted laterally so that the point was in line with the axis of the spear shaft and the basal portion protuded as a barb » (Pokines & Krupa 1997, p. 241-242). The geographical distribution of these points is limited to Cantabrian Spain and South-Western France, and they seem to represent a relatively small portion of the weapon kit<sup>1</sup>. As they are absent from the Middle Magdalenian, they cannot be considered as the direct ancestors of the barbed points of the Upper Magdalenian.

The origin of the latter has sometimes been sought among the artifacts called « *protoharpons* », which appear during the Middle Magdalenian in some sites in France and Spain (fig.1b). We refer the reader to P. Cattelain's definitive clarification on these items, which constitute a small group of *ca.* 60 poorly defined objects with heterogeneous morphometric characteristics and unclear typological attribution (Cattelain 1995). For these reasons, they will not be considered here. The same goes, in our opinion, for the *ca.* 100 « *foënes* » found almost exclusively in Upper Magdalenian sites from Southern France (fig.1d). These small multi-pointed objects also have very heterogeneous characteristics, and in several cases their use as projectile elements is far from certain (for more details see Bellier *et al.* 1995).

Our study focuses on the classical « *harpons magdaléniens* »: antler points with one or two rows

of barbs, of *ca.* 130 mm long on an average, which M. Julien divided into seven main morphometric categories (fig.2, and see Julien 1995). Although « *harpon* » is the usual French name for these artifacts, we will follow G.C. Weniger's opinion (Weniger 1995, p. 2) and call them « barbed points », a name that bears much less presupposition about their function. Their appearance in the stratigraphic layers has long been used as a marker for the beginning of the Upper Magdalenian; the oldest reliable radiocarbon dates for these points go back to around 13,500 calBC<sup>2</sup>, and continue at least until 12,000 calBC. Between 1,500 and 2,000 specimens have been accounted for in Magdalenian sites, their distribution area stretching from the northern and eastern coasts of Spain to central Germany. Their well-known typology, their long-lasting chronology, their high numbers and their wide geographical distribution make of them a very suitable case a thorough functional investigation.

Although the timing of their disappearance is still debated, it is generally admitted that, from 12,000 calBC on, the Magdalenian barbed points gradually transform into other types, specific of the subsequent Azilian culture (fig.1c). Being very different from a typological and technical point of view, used in a much more forested environment and in a very different technological context, these Azilian barbed points – and all the more recent types coming from the Final Paleolithic, the Mesolithic and later cultures – will not be addressed in this paper.

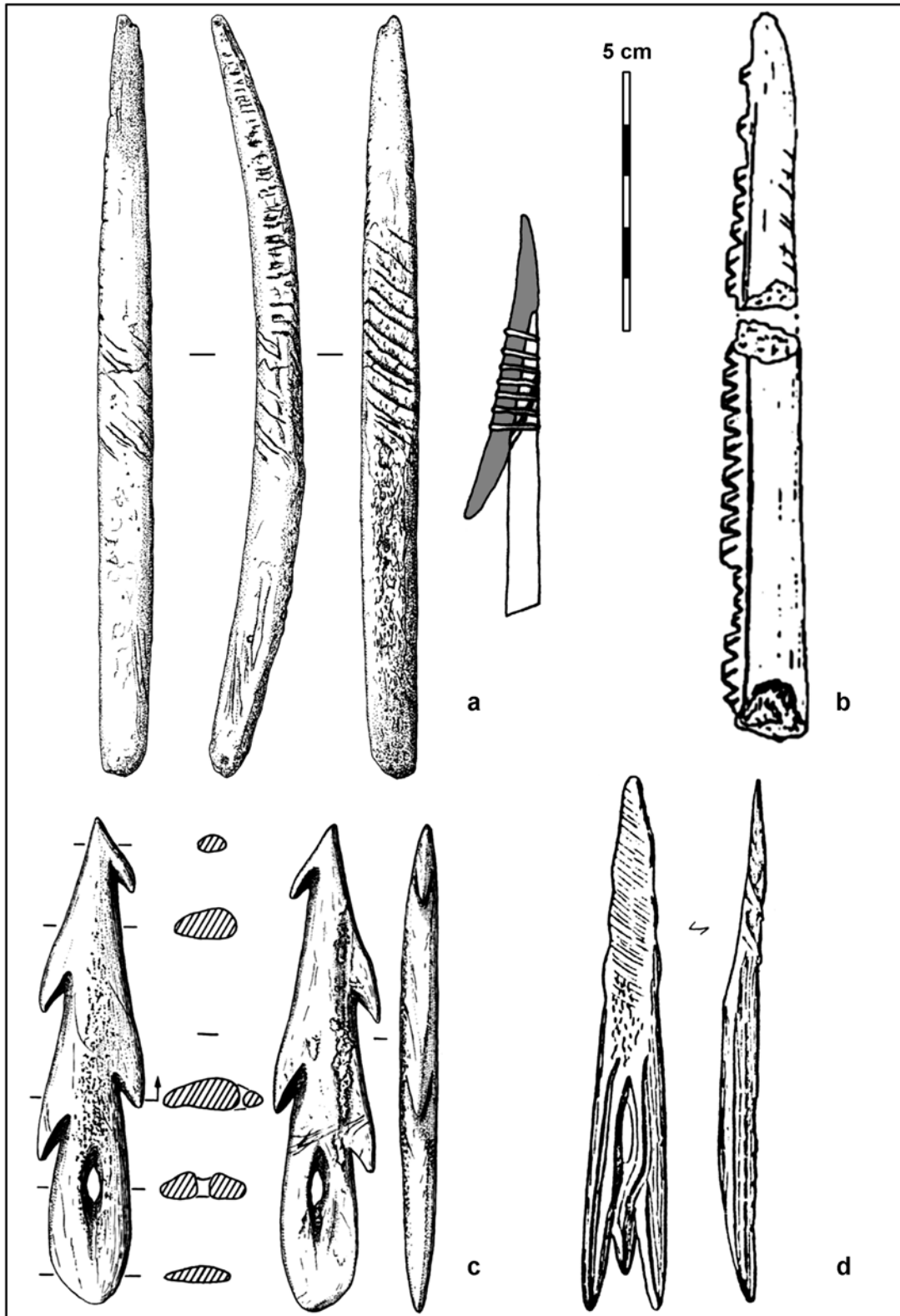
### Archeological perspectives : barbed points against zooarcheological data

Taken as a whole, the Magdalenian hunting spectrum is largely dominated by several species of large and medium-sized ungulates (bovids, horse, red deer,

<sup>1</sup> - J.T. Pokines and M. Krupa (1997, table 1) report about eighty specimens in 13 sites for the whole Cantabrian Spain. There is no detailed list for the French sites, but the total number of specimens is very likely much smaller than that of Spain.

<sup>2</sup> - E.g., the 14C AMS date of 13,020±130 BP (13,910-13,050 calBC) on a barbed point from Bruniquel-Montastruc (Tarn-et-Garonne) and the 14C AMS date of 13,140±120 BP (14,070-13,180 calBC) on a barbed point from Fontalès (Tarn-et-Garonne) (Tisnerat-Laborde *et al.* 1997). All 14C dates have been calibrated with the CALIB program (Stuiver and Reimer 1993, version 5.0.1.) using the IntCal04 dataset (Reimer *et al.* 2004). In accordance with the authors' instructions, cal age ranges of samples with standard deviations greater than 50 years have been rounded to the nearest 10 years.





**fig. 1** : palaeolithic barbed items not included in the present study. a: self-barbed point and its probable hafting mode (Le Petit Cloup Barrat, Solutrean; after Castel et al. 2006, fig.7. Hafting diagram by Pokines & Krupa 1997, fig.2). b: « protoharpon » (Fontalès, Magdalenian; after Pajot 1969). c: Azilian barbed point (La Vache, Azilian; drawing by D. Molez, after Julien & Orliac 2004, fig.158). d: « foëne » (Laurerie-Haute, Magdalenian; after Bellier et al. 1995, fig.6).



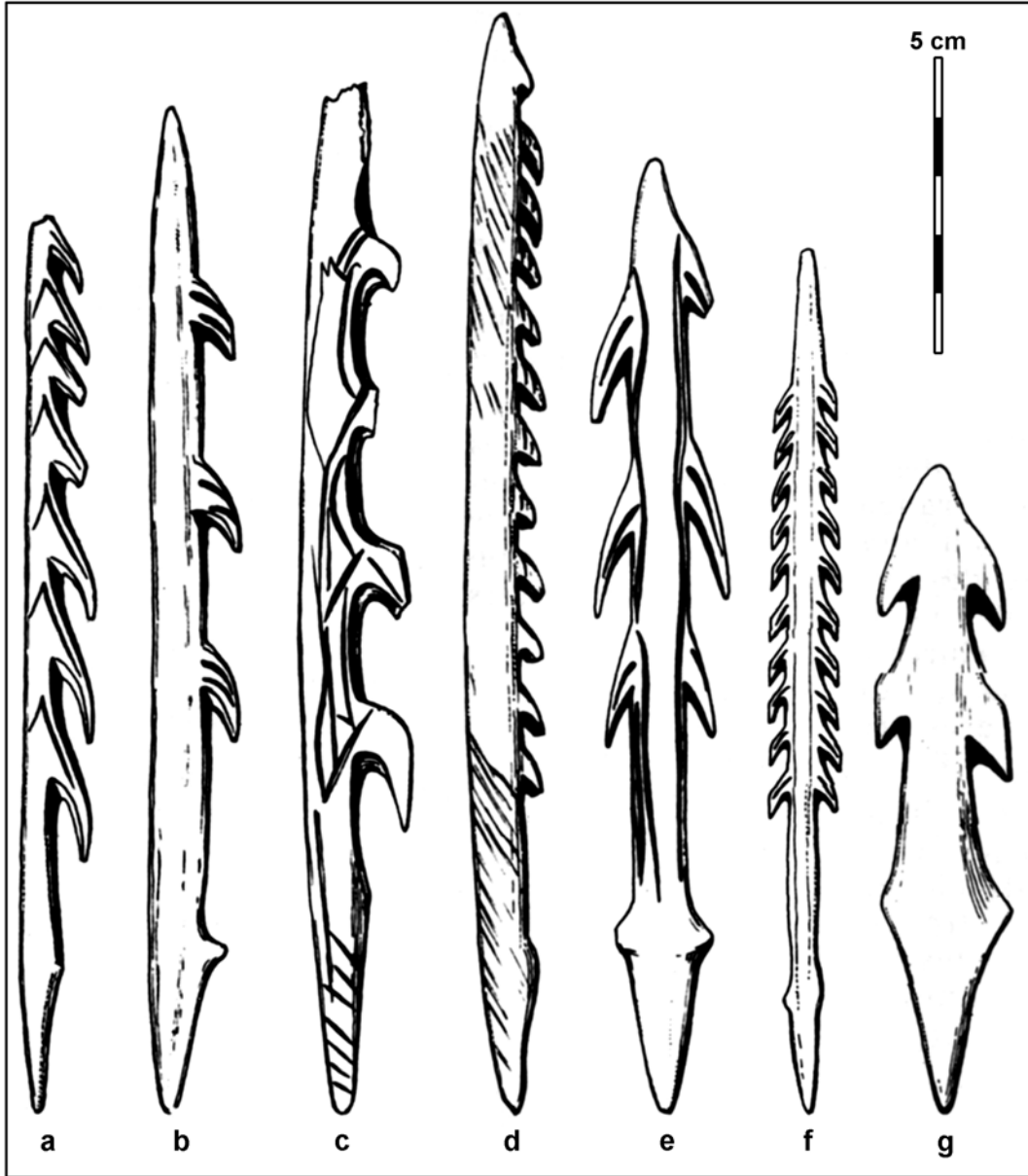


fig. 2 : typology of the Magdalenian barbed points after M. Julien. a: one row of barbs, type A1 (Mas d'Azil). b: one row of barbs, type A2 (Mas d'Azil). c: one row of barbs, type A3 (La Madeleine). d: one row of barbs, type B (Bruniquel). e: two rows of barbs, type A (Sainte-Eulalie). f: two rows of barbs, type B (Laurerie-Haute). g: two rows of barbs, type C (Gourdan). After Julien 1982, fig. 42 to 45.

reindeer and ibex). Regional variations<sup>3</sup> are today more often interpreted as adaptations to specific local and/or seasonal conditions, affecting the available animal resources (Costamagno 2004; Gaudzinski & Street 2003).

However, the beginning of the Upper Magdalenian is marked by a significant increase in the exploitation of small game – especially fish and birds, but also hare, rabbit and marmot in specific areas. This diversification does not seem to be the answer to environmental change, as it begins before the warm-up and reforestation of the Bølling-Allerød interstadial (Costamagno & Laroulandie 2004). Nevertheless, since barbed points make their appearance in the Magdalenian weapon kit at the same time, it was tempting to correlate these two archeological facts, and to hypothesize that barbed projectiles had a specific role in the capture of small animals.

We tested this hypothesis by confronting the zooarcheological data (relative representation of the hunted species) and data from the osseous industry (frequency of barbed points in the assemblages). When considering the idea that the proportion of the different types of tools in an archeological assemblage roughly indicates the intensity of the different activities performed on the site (Binford 1983, p. 144-146), if barbed points were used against a specific type of game, one can expect remains of this game to be particularly abundant in sites that yielded a high proportion of barbed points in their industry.

For several reasons, we chose the northern side of the Pyrenees as a test area:

- along with northern Aquitaine and Cantabrian Spain, it is one of the 3 regions that yielded the greatest number of Magdalenian barbed points;
- it is also one of the regions where the Upper Magdalenian increase in small game hunting is well documented (Costamagno & Laroulandie 2004);

- it counts more than 70 Magdalenian sites (Clottes 1989, p. 292), which could provide a good study sample in the first place.

We selected the sites that fulfilled four criteria:

- presence of an indisputable Upper Magdalenian occupation;
- fairly abundant and well preserved osseous industry and faunal remains;
- artifacts of known stratigraphic origin;
- precise quantitative data available on fauna and osseous artifacts.

Only seven sites met these conditions (tab.1): they are all cave and rockshelter sites, and they form two groups in the western and eastern parts of the range (fig.3), a location that only reflects the state of research in the Pyrenean region. The small size of the sample makes statistical analysis useless. Moreover, the data must be considered with caution at least for three reasons. Firstly, some of these excavations are old, and the collecting of the faunal remains has been very selective (such is the case at Isturitz: Pétillon *et al.*, in press). Secondly, the absence of systematic sediment sieving at Isturitz, but apparently also at La Vache (Laroulandie 2000, p. 268-269), greatly reduces the proportion of small animals – especially fish – in the fauna. And lastly, the central sector of two of the sites (Arancou and Dufaure) has respectively been truncated by an illicit excavation and by an ancient, poorly-documented excavation. Despite these limitations, several results have been obtained.

In all the known Upper Magdalenian sites, the majority of the osseous points are unbarbed. The proportion of barbed points in the osseous weaponry was evaluated in the following way (tab.2): the total number of osseous points (barbed+unbarbed) was first added together, then the percentage of barbed points within this total was calculated, isolated barbs being excluded from all counts. This percentage is a more significant index

<sup>3</sup> - E.g., the importance of red deer and ibex hunting in Cantabrian Spain (Straus & Clark 1986), the importance of ibex hunting in central and eastern Pyrenean high altitude sites (Fontana 1998, p. 229-238), the great number of saiga antelope in some Lower and Middle Magdalenian sites of the Gironde (Costamagno 2001), etc.



Site	Location	Type	Excavation	Layers
Arancou	Pyrénées-Atlantiques	cave	Chauchat 1987-2001; Dachary 2002-04	ens. B + rubble
Belvis	Aude	cave	Sacchi 1963-86	C1 to C4
Dufaure	Landes	rockshelter	Breuil & Dubalen 1900; Straus 1980-84	4
Duruthy	Landes	rockshelter	Arambourou 1958-75	3
Les Eglises	Ariège	cave	Clottes 1964-77	4 to 9
Isturitz (grande salle)	Pyrénées-Atlantiques	cave	Passemard 1912-22; Saint-Périer 1928-37	I/F1
La Vache (salle Monique)	Ariège	cave	Robert 1952-64	1 to 4

tab. 1 : Upper Magdalenian sites of the northern Pyrenees included in the sample.

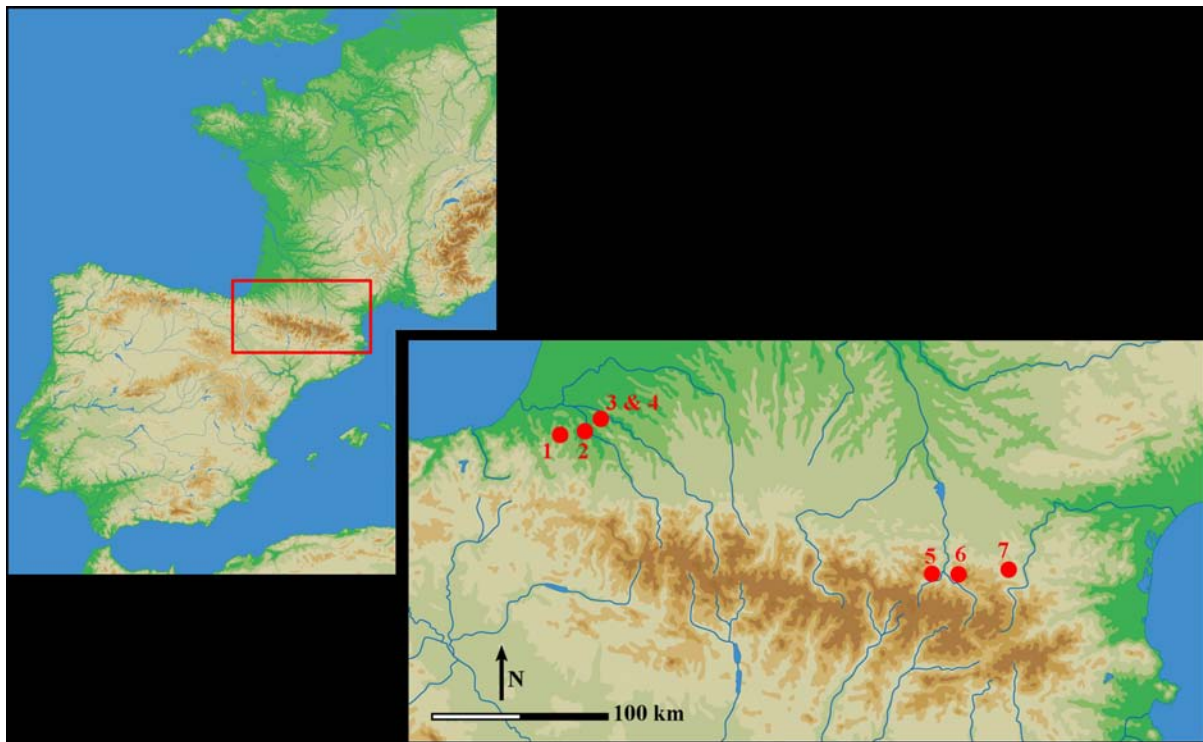


fig. 3 : map of the Pyrenees showing the location of the sites included in the sample. 1: Isturitz. 2: Arancou. 3: Dufaure. 4: Duruthy. 5: La Vache. 6: Les Eglises. 7: Belvis.



than the absolute number of barbed points, as the latter does not allow inter-site comparisons because of its dependence on factors such as duration of occupation or overall size of the dwelling, factors that should not be taken into account here.

The percentage of barbed points in the osseous weaponry appears to be very variable, from less than 7% at Isturitz to more than 30% at Duruthy. Three groups can be distinguished: a first one where barbed points represent less than 10% (Isturitz, Les Eglises), a second one around 15% (La Vache, Belvis and probably Dufaure), and a third one above 20% (Arancou, Duruthy).

Faunal data was compiled from the seven sample sites (tab.3). The MNI (Minimum Number of Individuals) would have been the best counting unit for comparison purposes, but since it was not available for all the sites, we used the NISP (Number of Identified Specimens). Carnivores were excluded as, in all well-documented cases, they appear more as the natural inhabitants of the cave than as the game of the Magdalenians. In all sites, the main ungulate species is either reindeer or ibex (except at Arancou where red deer dominates). Birds are almost always well represented. The same is true for fish – at least in sites where the sediment has been sieved – except at Dufaure. Lagomorphs are sometimes relatively abundant (Les Eglises, La Vache, Belvis) but are absent in the majority of the sites (Isturitz, Dufaure, Arancou, Duruthy); they have never been a very important animal resource for the Magdalenians of this region (Costamagno & Laroulandie 2004, p. 409).

These figures do not point at any obvious association pattern between the barbed points and the faunal spectrum, especially with the relative abundance of small game. The conclusion seems to be that barbed points as a whole were not dedicated to the capture of a specific type of game. But more importantly, this first survey of the data from northern Pyrenees mainly shows that there are few Magdalenian sites where the necessary information is available. In this situation, before any positive or negative conclusion can be

drawn, enlarging the study sample to other regions is a priority: the inclusion of data from other sites can greatly alter the picture. A good example is the recently published monograph on the Bois-Ragot cave (Vienne). In this site, the Upper Magdalenian layer 5 yielded a very high percentage of barbed points (29/78 = 37%; see Christensen & Chollet 2005, p. 224-229), and a faunal spectrum largely dominated by small game: birds, fish, and especially the arctic hare (*Lepus timidus*) which makes up 84% of the bone count for this level (Griggo 2005; Cochard 2005; Laroulandie 2005; Cravinho & Desse-Berset 2005).

### Ethnographical perspectives: barbed points of hunter-gatherers in northern America

We have followed another research axis, which was to characterize the usage context of barbed points among the hunter-gatherers known by ethnography, and to discuss any possible inferences on the Magdalenian material. A similar work has already been done by M. Julien, mostly using ethnographical literature coming from the American continent. She concludes that Magdalenian barbed points were probably used in a water environment – mainly for fishing, but also possibly for hunting ungulates trapped in water (Julien 1982, p. 144-150). However, this research has been conducted on the assumption that a large majority of the Magdalenian points were harpoon heads (Julien 1982, p. 137-142), but M. Julien later qualified this hypothesis and suggested that part of the Magdalenian barbed heads might have been hafted to non-harpoon projectiles used in land game hunting (see Julien 1999; Julien & Orliac 2004, p. 246-247).

The identification of the Magdalenian barbed points as harpoon heads is also questioned by G.C. Weniger (1992, 1995, 2000). His own work relies on a comparison between Magdalenian barbed points and a sample of 311 ethnohistorical barbed weapon tips from northern America – mostly western Alaska and the Northwest Coast. Morphometric attributes allow him to distinguish four different functional categories among the Magdalenian material: spearheads, harpoon heads,



Site and layers	Unbarbed osseous points	Barbed osseous points	Osseous points total	Percentage of barbed points	References
Isturitz I/F1	705	48	753	6.4	Pétillon 2006
Les Eglises 4 to 9	40	4	44	9.1	Clottes 1983
La Vache (salle Monique) 1 to 4	1,481	250	1,731	14.4	Bertrand & Pinçon 2004; Julien & Orliac 2004
Belvis C1 to C4	65	12	77	15.6	Sacchi 1992
Dufaure 4 [+ 1900 excavation]	32 [+12]	4 [+8]	36 [+20]	between 11.1 and 21.4	Straus 1995
Arancou ens.B [+ rubble]	1 [+81]	9 [+16]	10 [+97]	minimum 23.4	Chauvière 1999; Dachary 2005
Duruthy 3	66	29	95	30.5	Arambourou 1978

tab. 2 : number of barbed and unbarbed osseous points in the Upper Magdalenian levels of the northern Pyrenean sites.

Site and layer	Percentage of barbed points	Ungulates (including dominant species)	Birds	Fish	Hare, Rabbit	References
Isturitz I/F1	6.4	265 (reindeer: 135)	768	0	0	Pétillon <i>et al.</i> in press
Les Eglises 4 to 9	9.1	9,097 (ibex: 9,085)	1,576	521	84	Delpech & Le Gall 1983; Laroulandie 1998
La Vache (salle Monique) 1 to 4	14.4	81,603 (ibex: 71,451)	54,724	present	1,121	Pailhaugue 2004; Laroulandie 2000; Le Gall 1992, fig.4
Belvis C1 to C4	15.6	2,113 (ibex: 1,512)	62	21	140	Fontana 1999; Le Gall, Vilette in Sacchi 1992
Dufaure 4	11.1 to 21.4	4,011 (reindeer: 2,356)	133	2	1	Altuna & Mariezkurrena 1995; Eastham 1995; Le Gall 1995
Arancou ens.B [+ rubble]	minimum 23.4	552 [+ 2,093] (red deer: 342 [+ 1,253])	20 [+ 1,255]	1 [+ 610]	0 [+ 0]	Fosse 1999; Eastham 1999; Le Gall 1999
Duruthy 3	30.5	2,851 (reindeer: 2,206)	126	52	1	Delpech 1978; Costamagno 2006; Laroulandie 2006

tab. 3 : representation of ungulates, birds and lagomorphs in the Upper Magdalenian levels of the northern Pyrenean sites (NISP). Concerning Duruthy, only the ungulate remains of the upper terrace have been taken into account (see Costamagno 2006).



harpoon-arrows and fixed arrowheads. In his opinion, all categories would have been used for fishing, but fixed spear- and arrowheads would also have been used for big land game hunting (Weniger 1995, p. 193-199 and table 77).

Our intention was to go back on this survey with a different methodology. Contrary to G.C. Weniger, we concentrated on the ethnographical literature and not on the actual study of the ethnographical artifacts. Contrary to M. Julien, we included all kinds of barbed points in our ethnographical survey. Our purpose is to build a comprehensive database on the parameters and modes of use of these points. The « Human Relations Area Files » of Yale University (New Haven, Connecticut) were used as the main investigation tool, thanks to the complete and updated version available at the Collège de France in Paris.

Our database is far from complete, but several general trends can already be drawn. Research was conducted primarily on hunter-gatherer groups of the northern half of North America, roughly corresponding to the territories of Alaska and Canada, thus including the Northwest Coast, the northern Athapascan and the northern Algonkian Indians, as well as the Inuits. This choice was justified by the fact that these groups are well-known for using a varied range of osseous barbed points; and also because their natural environment is closer that of the Magdalenians than that of the hunter-gatherers living in temperate, tropical or desert regions.

Most of the useable information was found in 19th century and early 20th century ethnographical observations. But even then, hunter-gatherer societies had been deeply altered by contacts with the Europeans. The very quick replacement of osseous materials by metal in the making of barbed points, the eventual replacement of traditional weapons by guns and steel traps in all hunting activities, except

fishing and sea mammal hunting, are only some of the strong biases that must be taken into account when interpreting the ethnographical data.

The data on barbed points was collected for 22 different groups (tab.4, fig.4). In each case, the two main pieces of information recorded were the nature of the game and the type of weapon used. Concerning the second point, the lack of accuracy of many descriptions limited us to a distinction between *harpoons* and *other barbed projectiles*. However the distinction is functionally very significant, as can be seen in tab.5. Harpoons are most often used in water environments, for fishing, hunting sea mammals or aquatic mammals such as beaver and otter. Barbed spears and arrows, on the contrary, are most often used for fowling, hunting big and small land game, and for war. Of course, there are exceptions in the two categories, so this disjunction must not be considered as a strict rule but does nonetheless represent a significant trend. Thus, if we were able to determine whether Magdalenian barbed points are harpoon heads, we would have made an important step in establishing their possible function. Indeed, since we have almost no material evidence of sea mammal and aquatic mammal hunting in the Magdalenian, the most probable use for Magdalenian harpoons would be fishing.

### An operational definition of harpoons

However, before any further discussion of the Magdalenian material, it is necessary to specify our definition of the harpoon. O.T. Mason defines the harpoon as « a piercing and retrieving device with a moveable head. (...) The head is always set loosely on the end of a shaft, to which it is attached by means of a line » (Mason 1900, p. 197). Similarly, for A. Leroi-Gourhan, a harpoon is characterized by its detachable head, tied to a line used to hold the prey<sup>4</sup>. G.C. Weniger also characterizes the harpoon as « a hunting weapon, thrust or thrown, whose tip

<sup>4</sup> - « Ce qui distingue catégoriquement le harpon, c'est sa tête détachable, qui reste prise dans le corps de l'animal alors que la hampe de l'arme se libère. La tête est rattachée à une ligne de cuir ou de corde au moyen de laquelle on manœuvre l'animal blessé » (Leroi-Gourhan 1945, p. 54).



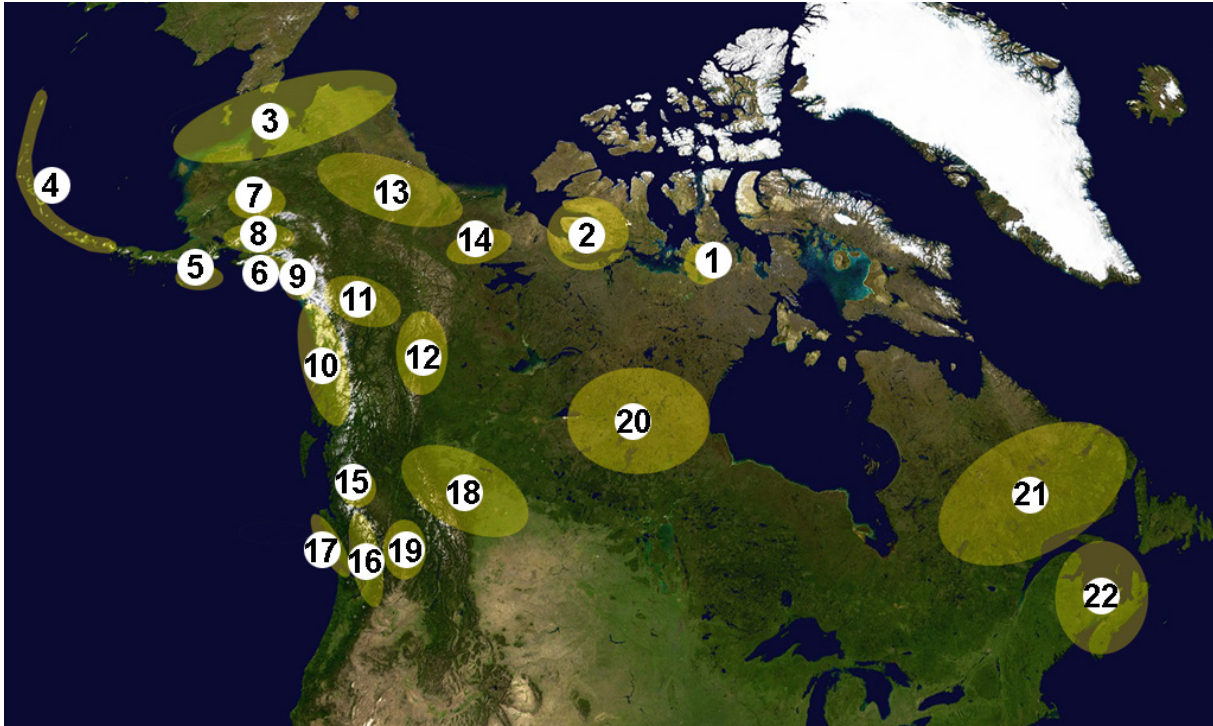


fig. 4 : satellite view of the North America's northern half with location of the hunter-gatherer groups included in the ethnographical sample. Numbers refer to the list in table 4. Satellite picture from NASA / Wikipedia.

Group	Main references
1 Netsilik Eskimo	Taylor 1974
2 Copper Eskimo	Stefánsson 1914; Cazdow 1920; Jenness 1922, 1946
3 Bering Strait Eskimo	Nelson 1899
4 Aleuts	Veniaminov 1840; Jochelson 2002/1925; Collins 1945; Antropova 1964; etc.
5 Koniag	Birket-Smith 1941; Heizer 1952; Clark 1974; Hrdlicka 1975/1944
6 Cugach	Birket-Smith 1953
7 Ingalik	Osgood 1970/1940
8 Tanaina	Osgood 1937
9 Eyak	Birket-Smith & De Laguna 1938
10 Tlingit	Knapp & Childe 1896; Oberg 1937; Krause 1956; De Laguna 1972
11 Southern Yukon Indians	McClellan 1975
12 Kaska	Honigmann 1954
13 Kutchin	Osgood 1936
14 Hare	Richardson 1852; Hara 1980
15 Bella Coola	McIlwraith 1948
16 Coast Salish	Barnett 1975/1955
17 Nootka / Makah	Swan 1870; Drucker 1951
18 Shuswap	Teit 1909
19 Thompson Indians	Teit 1900
20 Chipewyan	Birket-Smith 1930
21 Montagnais / Naskapi	Hind 1972/1863; Turner 1889-90; Lane 1952; McGhee 1961
22 Micmac	Denys 1908; Le Clerq 1910; Wallis & Wallis 1955

tab. 4 : hunter-gatherer groups of northern North America included in the ethnographical sample.



is mobile and linked by a line to the shaft, to another object or to the user »<sup>5</sup>.

These definitions focus on the morphological (or structural) attributes of the harpoon: the mobility of the tip and the presence of a line. However, we would like to suggest another definition. In our opinion, the word « harpoon » does not refer to a specific weapon morphology, but rather to a specific *modus operandi*, or operating mode. From this point of view, we can give the following definition of the harpoon: *a harpoon is a projectile, or thrusting spear, used in hunting. Its use aims mainly at preventing the escape or loss of the struck animal, by creating a link between it and a « drag » or impediment. This drag can be the user himself, another person or an object (float, detached shaft of the projectile, etc.). Therefore, a harpoon always has a tip designed to remain: a) caught in the target's body; b) directly or indirectly linked to the drag.*

According to this definition, the mobility of the tip and the presence of a line are morphological attributes that can – and often do – derive from the harpoon's operating mode, but they are not always present. In fact, this definition was prompted by an observation drawn from our ethnographic survey: several hunting weapons which can be defined as harpoons as to their operating mode do not have a detachable tip or a line. This appears clearly when classifying all projectiles and thrusting spears according to the three following criteria (fig.5):

- presence or absence of a line;
- fixed or detachable head;
- presence or absence of barbs.

Eight theoretical categories result from this classification, but since we do not know any example of a weapon with a line and a fixed unbarbed tip, all projectiles and thrusting spears can be placed among the seven A to G categories shown in fig.5.

Category A corresponds to the « classical » conception of a harpoon with a detachable barbed head and a line

(fig.6a). Category B groups together harpoons with unbarbed detachable heads: such as several types of « toggle harpoons » from the Arctic (fig.6c), or some with a specific design like the turtle harpoon of the Seri Indians in the Gulf of California (fig.6d). Category C refers to projectiles that are also harpoons, although they have no detachable head: the point is fixed, barbed, and the line attached to the shaft. Harpoons of this category are described by Le Jeune as being used in the 17th century by the Montagnais for beaver hunting: « Another method of hunting beaver involved the use of a barbed iron point fixed to a shaft. A string or cord was then attached to the shaft. When the beaver was struck with this kind of harpoon, it dove beneath the surface of the water, taking the harpoon with it. The hunter held the cord that was attached to the shaft (...) (Le Jeune, 1632-JR, vol. 6, p. 61) » (Lane 1952, p. 8; see Denys 1908, p. 481 for the description of a Micmac beaver hunting technique, using similar harpoons shot with a bow).

Categories D and E are not harpoons. They have a barbed or unbarbed detachable head, but no line: in this case, the detachment of the head only ensures that the point will remain in the wound, inflicting more damage to the target. This is a fairly common feature for projectiles used in war or in big land game hunting. Categories F and G correspond to « regular » projectiles and thrusting spears with a barbed or unbarbed fixed point and no other special feature: they are not harpoons either.

However, within categories F and G, a specific sub-category of thrusting spear must be considered: the multipronged specimens called « leister spears » or « leisters ». Used mostly for fishing, they work by impaling the fish on one or several prongs; often, the grip on the body is secured by lateral prongs that act as pincers (this feature is not always present: see Blackmore 1971, fig. 43). This type of weapon can have barbs (category F': e.g., fig.6e, after a Copper Eskimo salmon spear), but can also be unbarbed

<sup>5</sup> - « Nach unserer Definition handelt es sich um eine Jagdwaffe, deren Spitze mobil ist und durch eine Leine mit dem Schaft, einem anderweitigen Objekt oder dem Benutzer der Waffe verbunden ist. Sie wird geschleudert oder gestoßen » (Weniger 1995, p. 20).



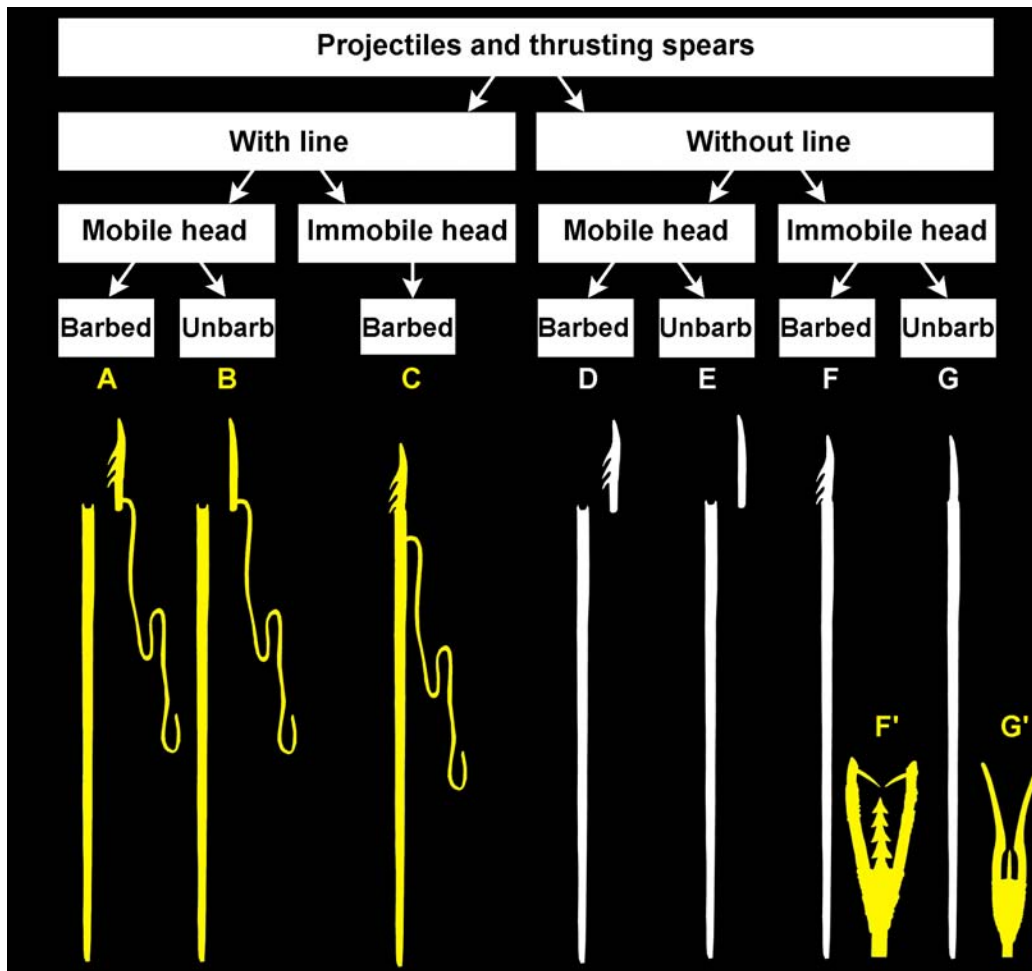


fig. 5 : typology of projectiles and thrusting spears. See text for description of the categories; harpoons are represented in yellow.

	Harpoons	Other barbed projectiles
Whale	5 (+1?)	2 (+1?)
Other sea mammals (seal, sea otter, sea lion, etc.)	12	2
Fish	17	3
Aquatic mammals (beaver, otter)	8 (+1?)	0
Birds	1 (+1?)	6 (+2?)
Small land game (rabbit, hare, squirrel, marmot, fox)	2 (+1?)	3 (+2?)
Cervids (deer, caribou, moose)	0	6
Bear	0	4
Other or unspecified large land game	0	4 (+1?)
War weapons	0	7
Total number of observations	45 (+4?)	37 (+6?)

tab. 5 : use of harpoons and other barbed projectiles related to game type among the groups of the ethnographical sample. Uncertain occurrences (because of a too vague description) are in parentheses.



(category G': *e.g.*, fig.6f, after the reconstruction of a Mesolithic leister from Aero; see Lane 1952, p. 9 for the description of a similar unbarbed leister used by the Montagnais for fishing eel). The functional principle of these spears is similar to that of harpoons: fixing the animal's body to the spear point in order to ensure its recovery by the hunter. Here the « drag » is the hunter himself, who keeps the weapon in his hands. Therefore, although leisters have no line and no detachable head, in our opinion they must functionally be considered as a specific sub-type of harpoon. The fact that leisters are nothing but specialized harpoons can clearly be seen with some fishing harpoons of the Coast Salish, that have both a detachable head with a line (our category A harpoons) and a three-pronged head similar to that of leisters (fig.6g).

To sum up these distinctions, we can say that:

- all projectiles and thrusting spears that display a line are harpoons. The presence of a line can therefore be considered as a diagnostic criterion for the identification of this type of weapon.

- however, not all harpoons have a line (*e.g.*, leisters). Thus the absence of line, in itself, is not a sufficient criterion to conclude that a weapon is not a harpoon.

- barbed and unbarbed tips, mobile and fixed heads are all found on both harpoons and non-harpoon types, and thus cannot be considered as diagnostic criteria to identify harpoons.

### Reconsidering the « Magdalenian harpoons » debate

Equipped with this typology, is it possible to determine to which category of projectile or thrusting spear Magdalenian barbed points were hafted ? Fig.5 clearly shows that, when tips are isolated from their haft, the only diagnostic evidence is the presence on the points of a line fastening system. If Magdalenian barbed points do display a feature designed for fastening a line, then they were most presumably detachable harpoon heads of the « category A » type. If they do not, then it is not possible to decide in the first place if they belonged

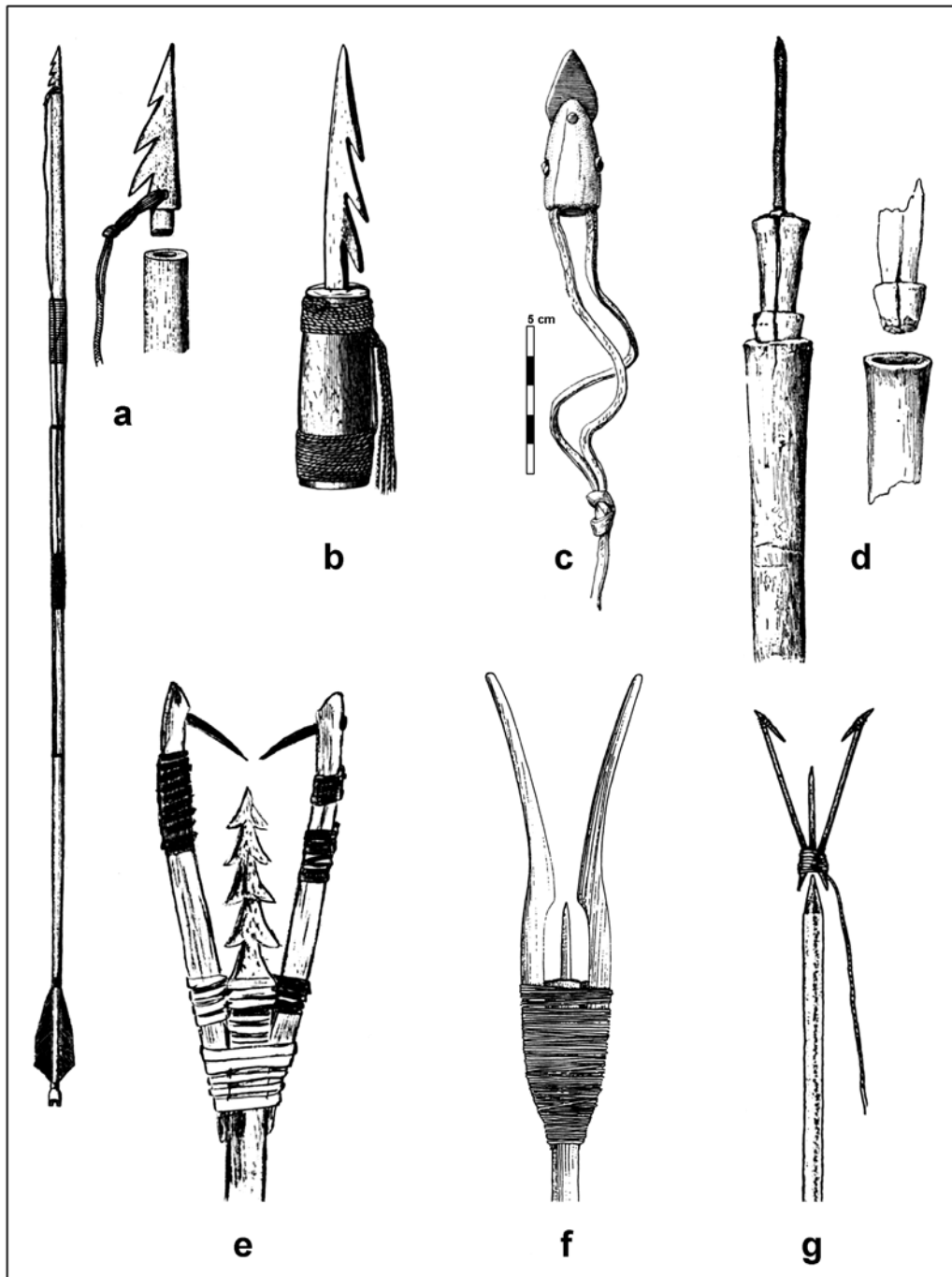
to harpoons from categories C or F', or to the D or F « non-harpoon » types.

We would like to stress that the question of the line fastening system must be considered independently from the problem of determining if Magdalenian barbed points were fixed or detachable. As we said before, this second criterion alone is not diagnostic of harpoons. Detachable barbed points can belong to harpoons (category A) or non-harpoon types (category D). The same goes for fixed barbed points: see harpoons of categories C and F', and non-harpoons of category F. The possible existence of wooden foreshafts is a further call to caution. The Shuswap beaver harpoon, for example, is a « category A » harpoon with a barbed detachable head and a line; the head, however, is composed of an osseous point firmly fixed to a wooden foreshaft, this foreshaft being detachable from the shaft (Teit 1909, p. 523; see here fig.6b). Thus, if the osseous point was found isolated from its unpreserved wooden foreshaft and shaft (*i.e.*, in a classical Paleolithic archeological context), it would perhaps be correctly classified as a fixed point, but there would be no way to identify it as an element of a composite harpoon head.

Keeping these limitations in mind, let us now take a closer look at the proximal part of the Magdalenian barbed points (Julien 1982; Weniger 1995). Some of these points have a conical or double-beveled base with no other particular feature (fig.7): since they show no evidence of the fastening of a line, we cannot decide whether they were harpoon heads or not. However, these specimens are a minority (tab.6).

The other barbed points have a conical base, 25-30 mm long on an average, with one or two lateral spurs protruding by 1 to 4 mm from the shaft (fig.8). The spurs are generally on the same side of the shaft as the barbs: points with one row of barbs (R1) have one spur, while points with two rows of barbs (R2) have two, except for a few specimens (fig.8c, 8f). On both R1 and R2 points, spurs can be « clear cut » and steeply « erupt out of the base » (« sharp lateral bulb »: Weniger





**fig. 6** : examples of harpoon types. a: category A (Alaskan sea otter harpoon arrow, with detail of the head; after Mason 1900, pl. 17). b: category A (head of Shuswap beaver harpoon with osseous point and wooden foreshaft, total length 24 cm; after Teit 1909, fig. 240). c: category B (head of a seal harpoon from Cumberland Sound; after Mason 1900, fig. 58). d: category B (head and shaft of Seri turtle harpoon, shown without its line, with detail of hafting; after Mason 1900, fig. 15). e: category F' (head of a Copper Eskimo salmon leister, with central antler prong; HRAF sketch after Cazdow 1920, pl. II). f: category G' (head of reconstructed Mesolithic leister from Aero, Sweden; after Andersen 1981:63). g: category A (head and shaft of Coast Salish fishing harpoon, with three-pronged « leister-type » detachable head; after Barnett 1975, fig. 22). Objects are not to scale.



2000, p. 84, and see fig.8a, 8e), or be « smooth » and « evolve gradually out of the base » (« light lateral bulb »: Weniger *ibid.* and fig.8b, 8d). These spurs can of course be interpreted as being used for the fastening of a harpoon line: they would have been designed to prevent the line from slipping along the base of the point. Several ethnographical weapons show similar features (*e.g.*, fig.9a). However, as already stated by several authors, such lateral spurs can also be used to ensure the firmer lashing of a fixed barbed point on its haft. Such is the case, for example, for some Fuegian barbed points (fig.9b). For its demonstrative value, we must also quote the Aleutian barbed spearpoints described by W. Jochelson:

« The throwing-lance may be distinguished from a harpoon by the fact that all its parts are fixed and immovable. This lance was formerly the chief weapon in war, and also used to kill aquatic animals after they had been struck by a harpoon. The throwing-lance usually consists of three parts [see here fig.9c]: *a*, a wooden shaft (...); *b*, bone ring or belt (...); and *c, d*, the compound head, consisting of the barbed bone head (...) and stone point (...). Above the tang is a hole or sometimes 2 or a projection [*e*], by means of which the head is permanently tied to the shaft and bone belt. Such perforation or projections are sometimes seen above the tang of the head of a simple harpoon. But the tang of both these weapons differ; that on a harpoon is always broad and flat, while on the head of a throwing-lance it is usually conical in form. Writers on pre-historic archaeology usually regard the bone heads of implements of the latest Palaeolithic period of Western Europe as harpoon-heads. The present writer believes that most of these were not harpoon-heads, but heads of throwing-lances or arrows, *i.e.*, that they were permanently tied to the shaft. We refer particularly to the heads ascribed to the Magdalenian and Azilian epochs [*sic*], which were attached to the shaft by means of projections above the tang, or the tang had a conical and not a flat form » (Jochelson 2002/1925, p. 54-55).

We also found cases of lateral spurs on the base of detachable barbed points of non-harpoon projectiles

(category D). For example, each of the Southern Tutchone barbed arrowheads depicted by C. McClellan has a lateral spur very similar to that of many Magdalenian R1 points (G.C. Weniger's « light lateral bulb »): compare fig.8b and fig.10. These barbed antler points are detachable, but are not harpoon heads: they are apparently used for moose hunting. It seems that here, the spur is not used to fix a lashing or a line, but only serves as a notch to prevent the point from « backfiring » into the shaft on impact and split it.

Therefore, the presence of one or two lateral spurs on the proximal part of the Magdalenian barbed points is not enough in itself to identify them as harpoon heads. But G.C. Weniger suggests the use of another criterion: the location of the striations to be found on the proximal part of many Magdalenian specimens.

« These striations are different from decorations and are well known from the simple Magdalenian bone points. They are recorded from the beveled part of the base and are interpreted as technical aid. They rough up the surface, which results in a better fixing of the base on the shaft (Allain & Rigaud 1986). (...) It is important to distinguish the proximal part (the area between the tip of the base and the lateral bulb) and the distal part of the base (the area between the bulb and the barbed zone) [see here fig.11]. If the equation : *striations = rough surface = better fixing* is correct, then there are three reasons to put striations on the different parts of the base :

- (1) *proximal base = better fixing of base on shaft = immobile* [fig.11a];
- (2) *distal base = better fixing of harpoon-line = mobile* [fig.11b];
- (3) *proximal base + distal base = better fixing of base + better fixing of binding = immobile* [fig.11c] » (Weniger 2000, p. 84).

This criterion allows G.C. Weniger to demonstrate that the majority of the R1 barbed points are fixed (Weniger 1995, p. 129-140), while the majority of R2 barbed points are mobile and tied to a line, and are therefore



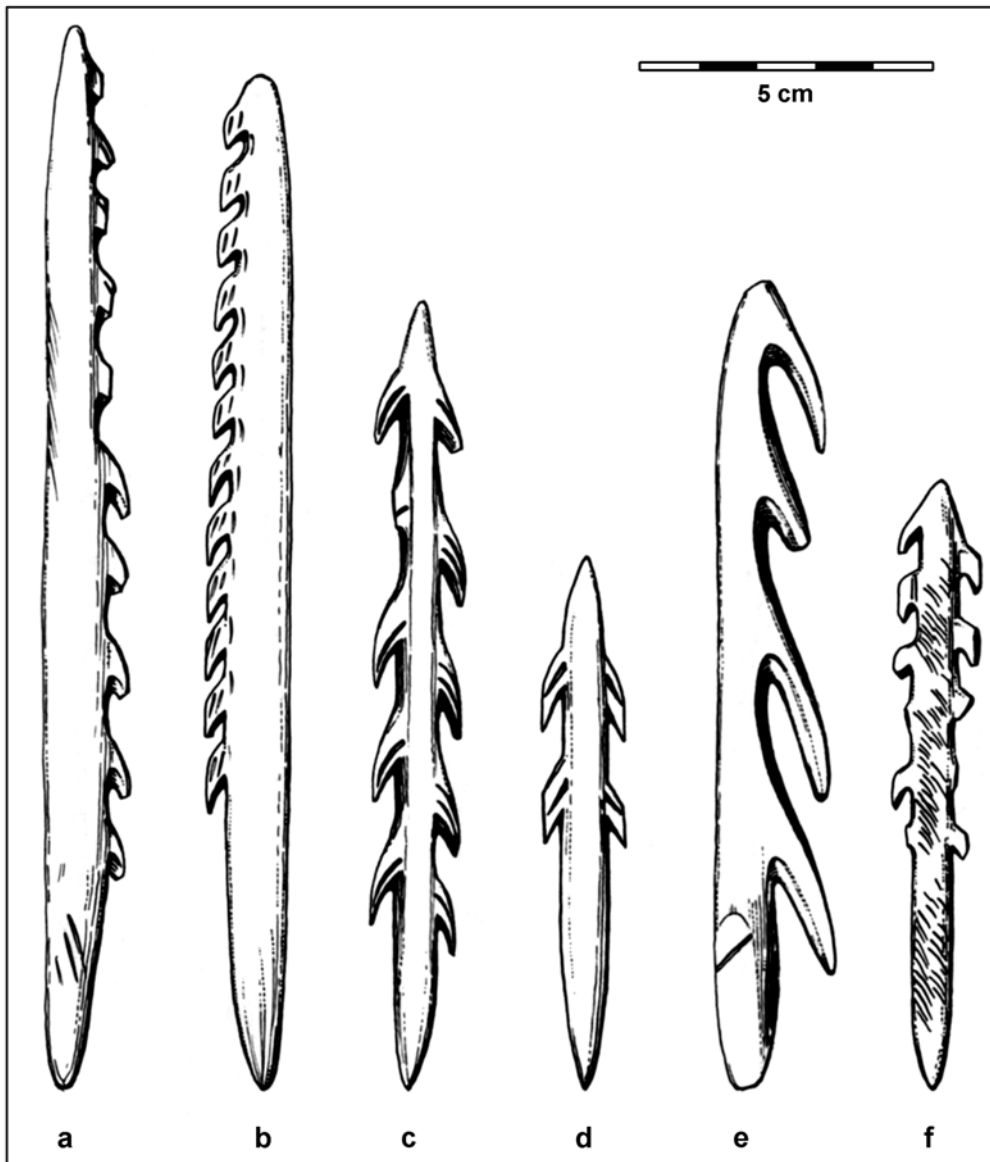
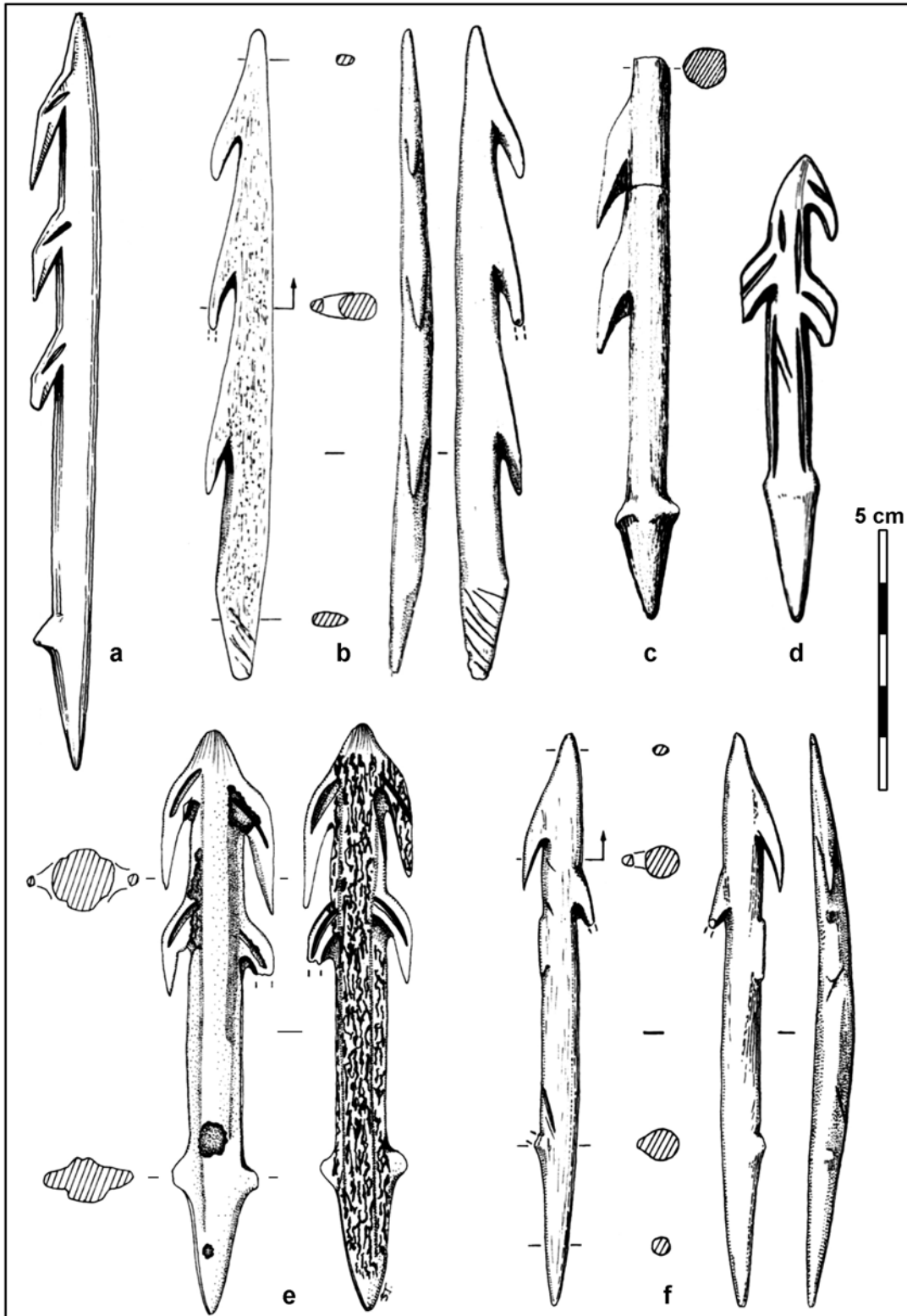


fig. 7 :Magdalenian barbed points with « simple » conical or double-beveled base. a: Bruniquel / Plantade. b-c: Fontalès. d: Gourdan. e-f: Isturitz. Artifacts curated in the Musée d'archéologie nationale (Saint-Germain-en-Laye, France), except for fig.7a (Musée de Montauban) and fig.7b-c (Musée de Saint-Antonin). After Julien 1982, fig.74, 77, 79, 96, 99, 100.

		No feature	Light spur(s)	Sharp spur(s)	Perforation	Other	Total
Julien 1982	One row of barbs (H1)	28 13%	93 43%	79 36%	14 6%	5 2%	219 100%
	Two rows of barbs (H2)	18 6%	72 22%	223 68%	10 3%	3 1%	329 100%
Weniger 1995	One row of barbs (H1)	19 14%	52 39%	37 28%	16 12%	10 7%	134 100%
	Two rows of barbs (H2)	8 6%	6 4%	111 82%	9 7%	2 1%	136 100%

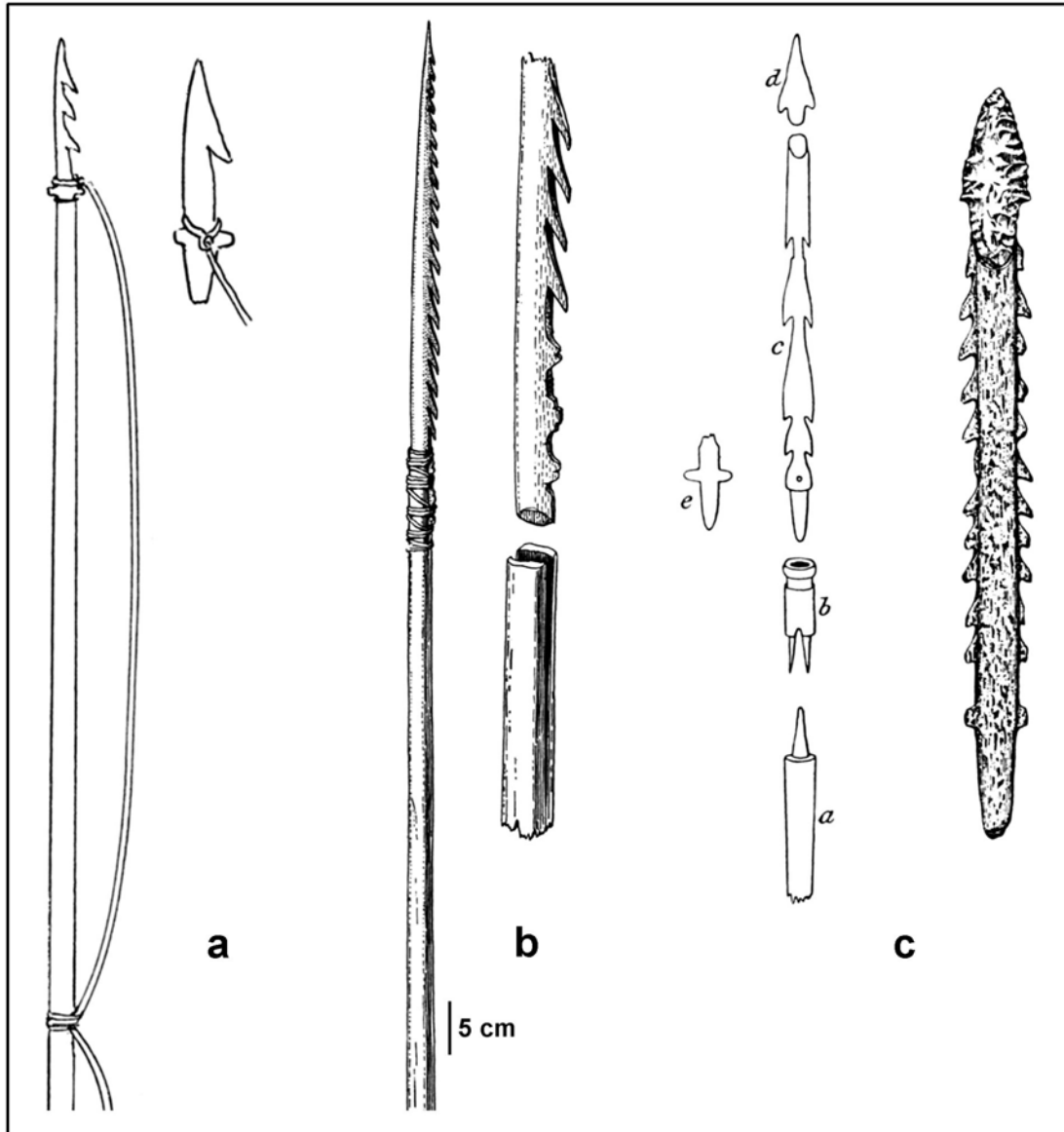
tab. 6 : proximal features of Magdalenian barbed points. Samples studied by M. Julien (1982, p. 71-72) and G.C. Weniger (1995, p. 132 and 167).





**fig. 8** : Magdalenian barbed points with lateral spur(s) on the base. a: R1 point with one sharp lateral spur (Mas d'Azil; after Julien 1995, fig. 9). b: R1 point with one light lateral spur (La Vache; drawing D. Molez, after Julien & Orliac 2004, fig. 152). c: R1 point with two sharp lateral spurs (Duruthy; after Arambourou 1978, fig. 16). d: R2 point with two light lateral spurs (Limeuil; after Julien 1982, fig. 104). e: R2 point with two sharp lateral spurs (La Vache; after Tymula 2004, fig. 197). f: R2 point with one sharp (?) lateral spur (La Vache; drawing by D. Molez, after Julien & Orliac 2004, fig. 156).





**fig. 9** : ethnographical examples of mobile and fixed haftings for points with lateral spurs on the base. a: Northwest Coast harpoons with detachable head (after Stewart 1973, p. 132-133). b: Fuegian spear with fixed barbed head (after Mason 1900, plate 2). c: Aleutian composite spearhead, fixed and barbed (after Jochelson 2002/1925, fig. 9 & 54b). Objects are not to scale.

harpoon heads (Weniger *ibid.*, p. 166-168). However, the use of this criterion to differentiate mobile points from fixed ones has been questioned by M. Julien (1999, p. 134). We subscribe to her arguments, stressing that, as pointed out by G.C. Weniger (Weniger 1995, p. 132), striations are almost absent on the ethnographical material: they are specific of the Magdalenian points. Therefore, their interpretation does not rely on ethnographical comparisons, but only on « common sense » arguments. In our opinion, particularly problematic is the fact that the same feature – that is, the striations on the distal part of the base – is interpreted in two contradictory ways (fastening of a harpoon line, firmer hafting of a fixed point) depending on its association with the striations on the proximal part of the base. We must also stress that the R1 points with lateral perforation, that G.C. Weniger calls « Cantabrian type » and interprets as mobile (see below and fig. 12), apparently quite frequently show striations on the proximal part of the base. Indeed, among the 20 such points coming from eight Cantabrian sites and shown by C. González Sainz (1989, p. 29-98, *passim*), 13 have striations on the proximal part of the base, a feature supposed to be characteristic of fixed points. Moreover, the authors quoted by G.C. Weniger (Allain & Rigaud 1986) indeed suggest that the striations on the base of osseous points allowed a more efficient action of the hafting adhesive, and thus a better adherence of the point to its haft (which was confirmed by an experimental test: Allain & Rigaud 1989, p. 221-222); but they do not suggest that these striations might allow a firmer grip of a lashing or a line on the point – which is a different question, and was not tested experimentally.

For all these reasons, we consider that the presence and location of the striations on the base of the barbed points is not a conclusive argument to determine if the lateral spurs were used to fasten a harpoon line or to ensure a better fixing of the point on the shaft. Therefore, in our opinion, it is not possible to say in the first place if these points were harpoon heads or not.

One last minority group of Magdalenian barbed points deserves particular attention (fig. 12). Found only in sites of the Spanish Cantabrian coast and composed

almost exclusively of R1 points (fig. 12c is one of the few exceptions), this group is characterized by a base with a lateral perforation, 5x3 mm wide on average (Weniger 1995, p. 100). This feature has generally been interpreted as being a linehole – hole for a harpoon line – and these points have always been classified as harpoon heads. There are indeed numerous ethnographical examples of such artifacts (*e.g.*, fig. 13a, among many others). However, just as in the previous case of lateral spurs, basal perforations can also be used to strengthen the lashing of a fixed barbed point (*e.g.*, fig. 13b). G.C. Weniger stresses that in his ethnographical sample, the basal holes of the fixed points are smaller in diameter than the harpoon lineholes, while the Magdalenian values fall within the « linehole » range (Weniger *ibid.*, p. 44, 53, 61, 100). However, other ethnographical examples seem to contradict this trend. Here again, we will concentrate on one well-documented illustrative case: the barbed arrows of the Ingalik, Athapascans from south-western Alaska.

The material culture of the Ingalik has been observed in the 1930s and published in detail by C. Osgood (1970/1940). Among their five arrow types, two display Caribou bone barbed points, with one row of barbs, a « conical butt » about 1 inch long and a central hole near the base. The first point type (fig. 13c) is 5 to 8 inches long, has 3 to 8 barbs and is fixed: the tip « is fitted into a hole at the end of the arrow shaft, spruce gum glue (...) being added. Sinew lashing line binding the end of the arrow shaft goes through this hole (the tip is not detachable) » (Osgood *ibid.*, p. 204). The second point type (fig. 13d) is smaller, « only a few inches in length », and has generally three or four barbs; « the conical butt fits into a socket at the end of the arrow shaft. This tip is detachable and is fastened to the arrow shaft by means of a braided sinew line about 3 feet long which is attached to the hole. (...) When the water animal or fish is struck, the tip comes out and the arrow shaft drags » (Osgood *ibid.*, p. 205). These two types of arrow have very different functions: the first one is used « to kill all kinds of small birds and animals, and for war », and also as a replacement



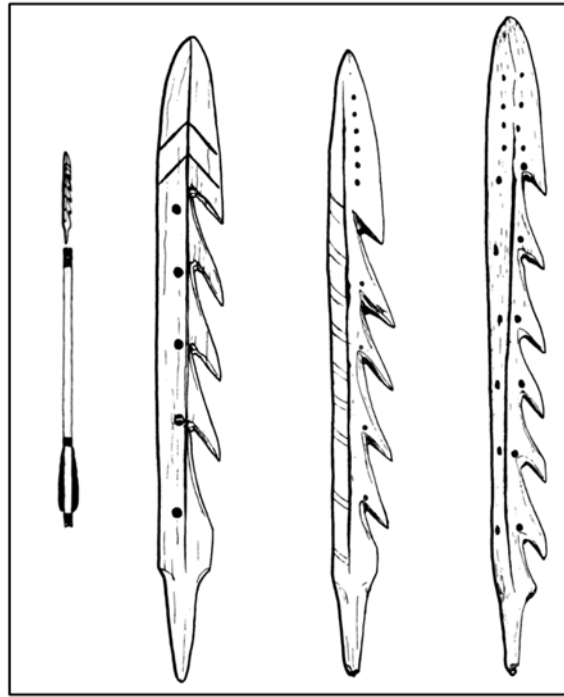


fig. 10 : Southern Tutchone barbed arrowheads for moose hunting, made in 1949. The heads are detachable, made of antler, and about 8 inches long. After McClellan 1975, p. 283 & 285.

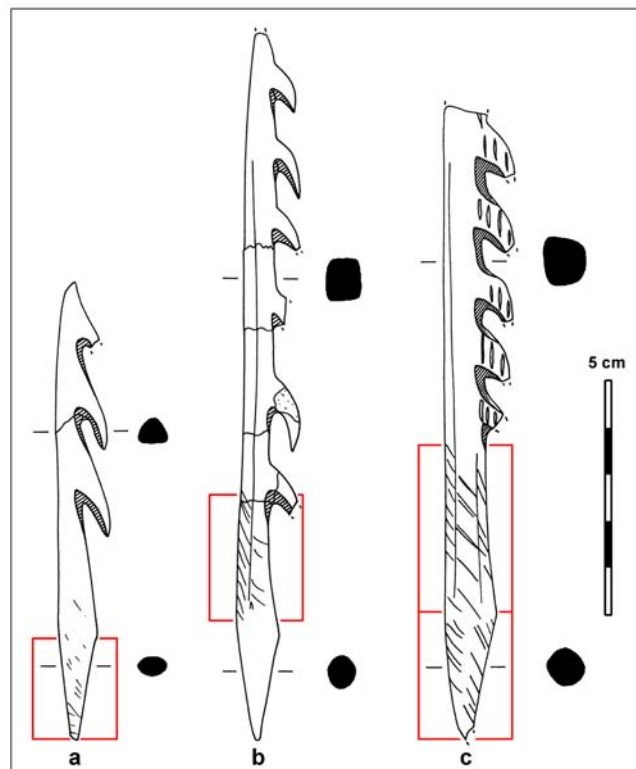


fig. 11 : location of striations on the base of Magdalenian barbed points. a: proximal part of base (La Vache). b: distal part of base (Laugerie-Basse). c: proximal and distal parts of base (Laugerie-Basse). All artifacts are curated in the Musée d'archéologie nationale (Saint-Germain-en-Laye, France). After Weniger 1995, pl. 30, 33, 36, modified.



arrow for big land game; the second one is used « for otter, beaver, and other water animals; also for big fish, such as salmon and large pike » (*ibid.*).

What we want to stress is that, here again, if these osseous points had been found isolated from their unpreserved shafts and lashings, it is doubtful that their respective operating modes would have been correctly reconstructed (let alone their specific functions!). In particular, the fact that the first type is a barbed arrow (category F in our typology on fig.5) and the other one an actual harpoon (our category A) would have been difficult to establish: both points have a similar base with a conical shape and a central round hole that – judging from C. Osgood's sketches – seems to be about the same size and in both cases serves to hold a sinew line.

The Ingalik arrows are not just an isolated example: W. Jochelson already stressed the same problem concerning basal perforations on the Aleutian barbed points (see above). Finally, our conclusion is that, given the variability of the ethnographic material, it is not possible to definitely interpret the basal perforations on the Cantabrian barbed points as lineholes. Thus, their identification as harpoon heads cannot be ascertained.

### Discussion

This survey shows that the Magdalenian barbed points, as a whole, do not present a preferential association with one type of game, and that they cannot be interpreted as harpoon heads on a simple morphological basis. This can paradoxically be considered as a positive result, as it means that debate about these items is still wide open. According to the ethnographic data, the list of their possible functions is even longer than expected: indeed, the use of barbed points as war weapons appears to be quite common in our sample (see tab.5) and there is no *a priori* reason to dismiss this possibility for the Magdalenian specimens.

The relevance of further research on this topic appears when one considers the importance of barbed points in the weapon kit of the Final Paleolithic in western and northern Europe. Starting from their probable region of

origin in south-western France and/or Cantabrian Spain, the Magdalenian barbed points spread southward along the Spanish Mediterranean coast (Cacho & De La Torre Sáinz 2005; Villaverde & Roman 2005-06), eastward to south-eastern France and the Rhone valley (Comber 1967, p. 356), and above all to the Northeast: they are present in central Germany, some 1,000 km away from south-western France, and in all the regions in-between (Julien 1995). Later on, barbed points can still be found in the northern European Final Paleolithic cultures, such as Creswellian (Barton & Dumont 2000, p. 153-154), Hamburgian (Bosinski 1990, p. 254) and Ahrensburgian (Andersen 1988, p. 535; Johansen 2000, p. 211-212). In western Europe, they are one of the few antler items that go on being to be manufactured after the Magdalenian, into the Azilian phase (Thompson 1954). Later on, they are found in many Mesolithic cultures, especially in northern Europe (*e.g.*, Czesla, 2006).

This brief overview shows that osseous barbed points clearly rank among the Paleolithic innovations that met with a certain « technological success »: they knew a widespread diffusion and long persistence, under very changeable cultural traditions and environmental conditions (the Bølling-Allerød warm-up). Relatively speaking, this « success » might be compared with the « huge development » and quick dissemination of bladelet production at the beginning of the Upper Paleolithic (Bon 2005, 2006, p. 141-142); and, just as this latter phenomenon, it certainly needs to be explained. This explanation involves characterizing the technological advantage represented by barbed points from a functional point of view for the Paleolithic people. Starting from the results outlined in this paper, we consider several possible directions for future research on this topic:

- 1) Enlarging our Pyrenean sample of archeological sites to other regions, and see if any association with a specific game might appear (see above).
- 2) Within this sample, refining the typological distinctions between the different barbed points. Particularly striking is the fact, already noted by M. Julien (1982, p. 156), that



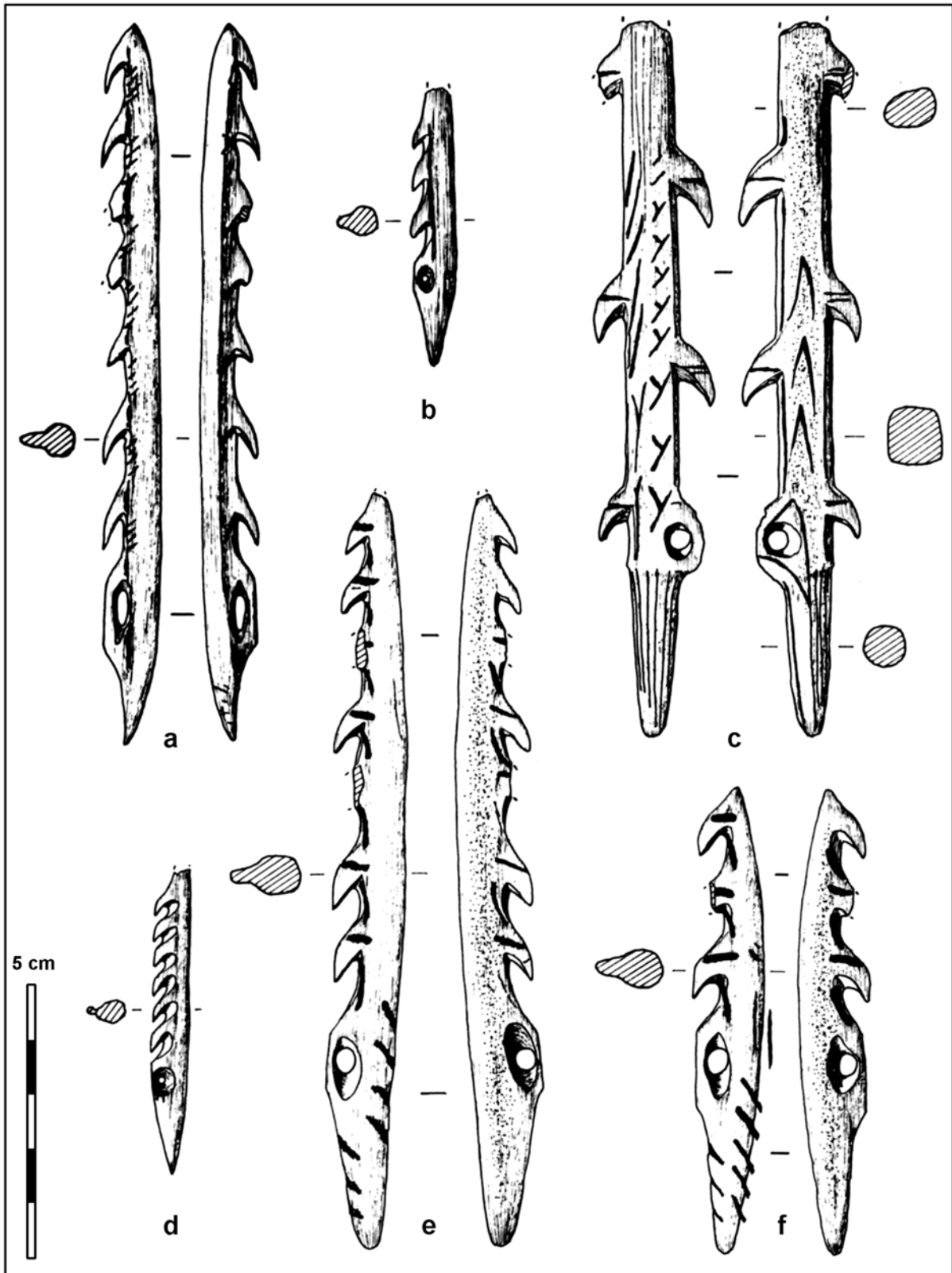
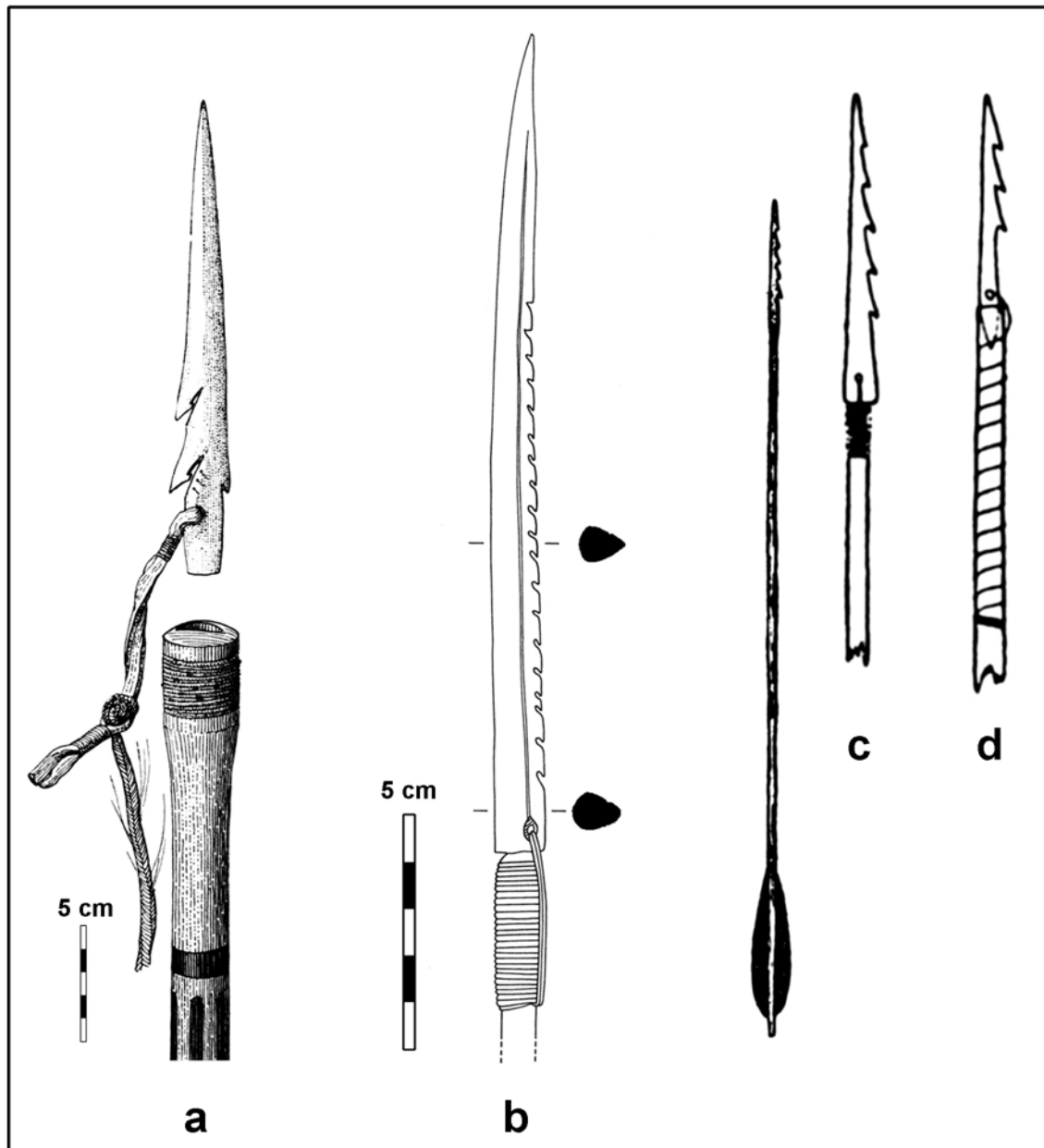


fig. 12 : Magdalenian barbed points with basal perforation (« Cantabrian type »). a: La Pila, level 4.3. b: El Valle. c to f: El Pendo. All artifacts except for fig.12a are curated in the Museo de Prehistoria de Santander. After González Sainz 1989, fig. 20, 25, 33.





**fig. 13** : ethnographical examples of mobile and fixed haftings for points with perforations on the base. a: Kodiak harpoon with detachable head (after Mason 1900, pl. 19). b: Bering Strait Inuit fixed arrowpoint (after Weniger 1995, pl. 15). c-d: Ingalik fixed and detachable arrowpoints (see description in text; after Osgood 1970/1940, p. 203). Objects are not to scale.

points with two rows of barbs (R2) are the large majority in most sites of south-western France, but are poorly represented in the other regions: they are rare in Cantabrian Spain; completely absent in Mediterranean Spain, where only R1 points have been found; etc. A closer investigation is necessary to study whether this situation result from functional factors.

3) Focusing our ethnographical sample on the barbed points that bear the closest morphological resemblance to the Magdalenian ones. Indeed, technological analogies between our archeological and ethnographical samples have been limited by the fact that many hafting types very common in North America – perforated bases, toggle harpoons – are rare or absent in the Magdalenian. However, closer parallels can be drawn from the Pacific coast groups (Aleuts, Northwest Coast Indians) who did make an extended use of barbed points with a conical base and lateral spurs – the most common Magdalenian hafting. Concentrating the research on these groups might provide better clues to understanding Magdalenian barbed points hafting.

4) Finally, in the long term, experimental perspectives must also be considered. Our own experiments with P. Cattelain (CEDARC / Musée du Malgré-Tout) on projectiles demonstrated that, for some osseous point types, the nature and location of impact damage could provide a clue to determining the projectile delivery mode (bow or spearthrower: see Pétillon 2006). Similarly, we cannot rule out the possibility that, on osseous barbed points, the nature and location of impact fractures (especially on the proximal part) might be characteristic of a specific hafting mode – *i.e.*, fixed or detachable head.

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### Article translated by Magen O’Farrell



# FABRICATION AND USE OF HAMBURGIAN SHOULDERED POINTS : NEW DATA FROM POGGENWISCH AND TELTWISCH 1 (AHRENSBURG VALLEY, SCHLESWIG-HOLSTEIN, GERMANY)

Mara-Julia WEBER

## Abstract

The objective of this paper is to present certain characteristics of Hamburgian shouldered points that can be compared with Magdalenian lithic points. The collections studied are those of Poggenwisch and Teltwisch 1. The blanks of these points are narrow and thin blades with a relatively rectilinear profile. One question that is raised is whether they originate in part from a specific *schema opératoire* \* (operational scheme) employed with the objective of obtaining these blanks, which seem to have been detached using a soft stone hammer. Despite some common characteristics, I observed a difference in the degree of standardisation between the two collections studied. The microburin technique was used during the shaping of the blanks into points. The basal modifications are highly variable, which has not yet been explained. One of the causes could be related to the hafting method, for which I propose an alternative that takes into account the profile of the points, as well as the lack of wood in the environment.

**Key-words** : Schleswig-Holstein, Poggenwisch, Teltwisch 1, Tardiglacial (Late Glacial), Classic Hamburgian, shouldered points, technological analysis, functional analysis.

\* : Schéma opératoire : operational scheme - In technological analysis, this term designates a global and synthetic consideration of several reduction or production sequences (chaînes opératoires) that share the same technical and economic principles. It is represented by the transformation of several raw material volumes (after Averbough, 2000). It consists of a series of operations conducted in order to realize a project (after Inizan *et al.*, 1995)

## Introduction

The Hamburgian is the first archaeological culture encountered on the northern European plain after the last glaciation. Its sites are distributed between the Rhine in the Netherlands and the Oder Basin in Poland, and to the north, until the middle of the Jutland Peninsula. According to C14 dates and palynological analyses, the Hamburgian dates essentially to the GI (Greenland Interstadial) 1e and is thus associated with a tundra landscape with reindeer and horse.

Shouldered points are one of the characteristic elements of the Hamburgian lithic industry, or at least of its so called “classic” facies<sup>1</sup>. This is its principal difference with the Magdalenian, which is partly contemporaneous and probably originates from the Hamburgian: in the Magdalenian, points made from osseous materials are dominant, the efficacy of which was augmented by microlithic armatures in the form of backed bladelets, which are absent from Hamburgian assemblages. Meanwhile, varied lithic points are also found in Magdalenian contexts, raising suspicions of mixtures: in southwest France (Sonneville-Bordes, 1969b, pp. 184-186), in the Jura, in Switzerland and southwest Germany (Peters, 1930; Sonneville-Bordes, 1963, p. 224, 226-227, 232-235, 244-245, 252, 258-260, 1969a, p. 177; Thévenin, 2003, pp. 114-116), in Thuringia and in the Paris Basin (Allain, 1978, p. 474; Burdukiewicz & Schmider, 2000, p. 101; Schmider, 1971, p. 168). In this latter region in particular, lithic points dominate and backed bladelets are rare (Lang, 1998; Valentin, 1995), which results in an axial armature/lateral armature ratio comparable to that of the Hamburgian. The similarities appear to concern the laminar debitage as well. Consequently, one of the objectives of this analysis of Hamburgian shouldered points, integrated within a technological study of the lithic

industries of this culture, is to identify characteristic elements that could contribute to a comparison with Magdalenian lithic points. In addition to the details of their fabrication, it is necessary to consider the hafting techniques and mode(s) of propulsion employed, which are related to hunting strategies. These hunting strategies may be at the origin of differences in weapon armatures between the Magdalenian and Hamburgian (Pelegrin, 2000).

I present a study of the shouldered points of two Classic Hamburgian sites located near each other in the Ahrensburg Valley (fig. 2), at the limit of the maximal extension of the Weichselian ice sheet: Poggenwisch (Rust, 1958) and Teltwisch 1 (Tromnau, 1975a).

Poggenwisch is one of the sites associating a habitat zone on a sandy terrain and a kettle in which organic materials are preserved. It was discovered during the realisation of systematic test pits in 1950 and the habitat site was excavated from May 28 to July 1, 1951, under the direction of Alfred Rust (Rust, 1958, pp. 94-95) who had previously directed excavations at Meiendorf and Stellmoor (Rust, 1937 et 1943). Over a surface of 114.5 m<sup>2</sup>, a lithic assemblage of 2,864 objects<sup>2</sup> was collected and recorded by meter square unit. Inspired by his discoveries at the site of Borneck (Rust, 1958, pp. 30-44), Rust interpreted the distribution of stones on the ground and the presence of small sandy mounds as elements of a tent (Rust, 1958, pp. 97-104). From July 4 to August 27, 1951, an ancient pond located 30 metres from the habitat site was also excavated (Rust, 1958, pp. 106-113): thirty-five siliceous material artefacts were recovered, but none of them was characteristic of the Hamburgian. However, the waste products of the fabrication of tools from reindeer clearly attest to the presence of the double grooving technique, which is exclusive during the Hamburgian, but very rare during the

<sup>1</sup> - The only Hamburgian division that seems pertinent is that distinguishing classic groups with shouldered points and a Havelte group with tanged points (Bohmers, 1947), a division that is not discernable based on common domestic tools. The Havelte points (fig. 1) are generally more streamlined than the shouldered points, the length of the basal retouch relative to the entire length is less than that of the shouldered points, and the tang retouch is often, but not exclusively, alternate. The stratigraphy of the site of Ahrenshöft LA 73 (Clausen, 1998), as well as the distribution of C14 dates, indicate that the Havelte group is more recent than the classic group (Grimm & Weber, 2008). This could explain the absence of classic sites in Denmark, which would have been re-colonized only in a second wave.

<sup>2</sup> - Rust speaks of 2840 remains (Rust, 1958, p. 95), but the addition of numbers furnished by the different classes of artefacts gives a total of 2864 objects.





**fig. 1** : Two examples of tanged points of the Havelte type, characteristic of the late phase of the Hamburgian. Ahrenshöft LA 58 D. Unless otherwise stated, all of the photos are © Archäologisches Landesmuseum Schleswig-Holstein.



**fig. 2** : Location of the Classic Hamburgian sites of Poggenwisch and Teltwisch 1 in the Ahrensburg Valley. Rectangles: Hamburgian sites. Triangles: Ahrensburgian sites. Circles: Federmesser sites. Crosses: isolated remains. After Tromnau, 1975c, fig. 2.



Ahrensburgian<sup>3</sup>. The most important Hamburgian artistic artefact also comes from this pond: a reindeer baton decorated with a meandering motif and a human head at one extremity. The small faunal assemblage (around 800 objects, after Rust, 1958, p. 106; Bratlund, 1994) is dominated by reindeer (MNI: 15) and indicates autumn hunting. The presence of a tool made from a wing bone of a *Cygnus cygnus* can be interpreted as evidence for a bird hunting episode in summer, but which would have occurred elsewhere. Poggenwisch has the earliest C14 date of the Hamburgian (H-31-67: 13 050 ± 200 BP; Münnich, 1957), but even though there are no clear dating problems, its antiquity raises doubts concerning its validity. This is even more true since the other reliable dates range between 12 570 ± 115 BP and 12 440 ± 115 BP (Fischer & Tauber, 1986; Grimm & Weber, submitted; Lanting & van der Plicht, 1996; Tromnau, 1992), which places the Poggenwisch occupation between those of Stellmoor and Meiendorf. In order to test this hypothesis of an early age for Poggenwisch, three reindeer antlers, all attached to the cranium and two of which have traces of anthropogenic modification, are in the process of being dated by AMS at the Kiel laboratory (Grimm & Weber, 2008).

Around 250 metres north of Poggenwisch, there is a sandy threshold between two ancient ponds (Tromnau, 1975a, pp. 14-21). The site of Teltwisch 1, located on this threshold, was discovered on the surface by Rust in 1951. Excavations were undertaken in advance of road construction that would endanger the presumed sites. Seventeen Tardiglacial sites were thus discovered under the direction of Gernot Tromnau between December 1967 and August 1971. Teltwisch 1 was excavated from July 1 to August 9, 1968, over 99 m<sup>2</sup>, with plans made below the current soil level and then by 10 or 5 cm deep

levels. The artefacts were recorded by square metre. The 7,790 lithic artefacts showed a vertical distribution over around 15 cm at a depth of 40 to 55 cm below the current surface. Around the excavated surface, 30 test pits, each covering a surface of approximately 0.3 m<sup>2</sup>, yielded very few remains, leading the excavator to believe that the habitat site had been completely excavated. Three attempts to excavate an ancient pond (Tromnau, 1975a, pp. 71-72) 30 m south of the site yielded only one reindeer bone in the horizon attributed to the Dryas III. Two other ponds on the Teltwisch, however, seem to contain abundant faunal remains. Lacking organic remains, the only chronological indication at Teltwisch 1 is given by the position of artefacts below a paleosoil attributed to the Allerød (Tromnau, 1975a, p. 16) and probably representing an Usselo soil, which was also identified at a site 80 km to the northwest (Kaiser & Clausen, 2005).

I will now present a critical review of the collections studied, particularly the point assemblage from Teltwisch 1. From a comparative perspective, I will then address the question of the blanks and the shaping of the points, as well as questions relative to their utilization, such as hafting and propulsion methods.

## Evaluation of the sources : the question of homogeneity

### Poggenwisch

At Poggenwisch, the Hamburgian shouldered points (fig. 3) were found exclusively in the habitat zone of the site (Rust, 1958; fig. 1). Their number is difficult to determine as the figures published by Rust are contradictory: first, the number shown between parentheses after the word

<sup>3</sup> - During excavations, a few bone remains were also found in the deepest ten centimetres of a peat, with a maximum thickness of 2.9 m, under the modern soil level (Rust, 1958, p. 105). This position corresponds to a depth of around 3.1 to 3.2 m and overlies the Hamburgian horizon in this part of the pond of approximately 2.4 to 2.3 m. At 2.75 m depth, fragments of reindeer antler appear and, according to Rust, were found in primary position. According to the palynological observations, the peat in which these remains were found is interpreted as dating to the Preboreal and, starting with a high augmentation of tree pollens, to the Boreal (Schütrumpf, 1958, p. 18). More recently, the radiocarbon dating of a reindeer scapula from this peat gave a result of 9992 ± 53 BP (KIA-11171; Benecke & Heinrich, 2003), which would confirm the attribution of the lower part of the peat to the Preboreal. However, the reindeer antler mentioned, which is under the bones in the peat, was dated to 11,250 ± 50 BP (GrN-11262; Lanting & van der Plicht, 1997, p. 116). Lanting and van der Plicht explain this date through a revision of the interpretation of Schütrumpf, meaning that they attribute the lower part of the peat to the pine phase of the Allerød (middle phase), which would be directly overlain by the Boreal, the final phase of the Allerød, the Dryas III and the Preboreal being absent in this pond. If this new interpretation is correct, KIA-11171 would have a problem and would represent an intrusion from the missing Preboreal horizon. On the contrary, if we accept the attribution of Schütrumpf, the bones would be intrusive into the peat where GrN-11262 could be polluted by older humic acids that rose with the water table.



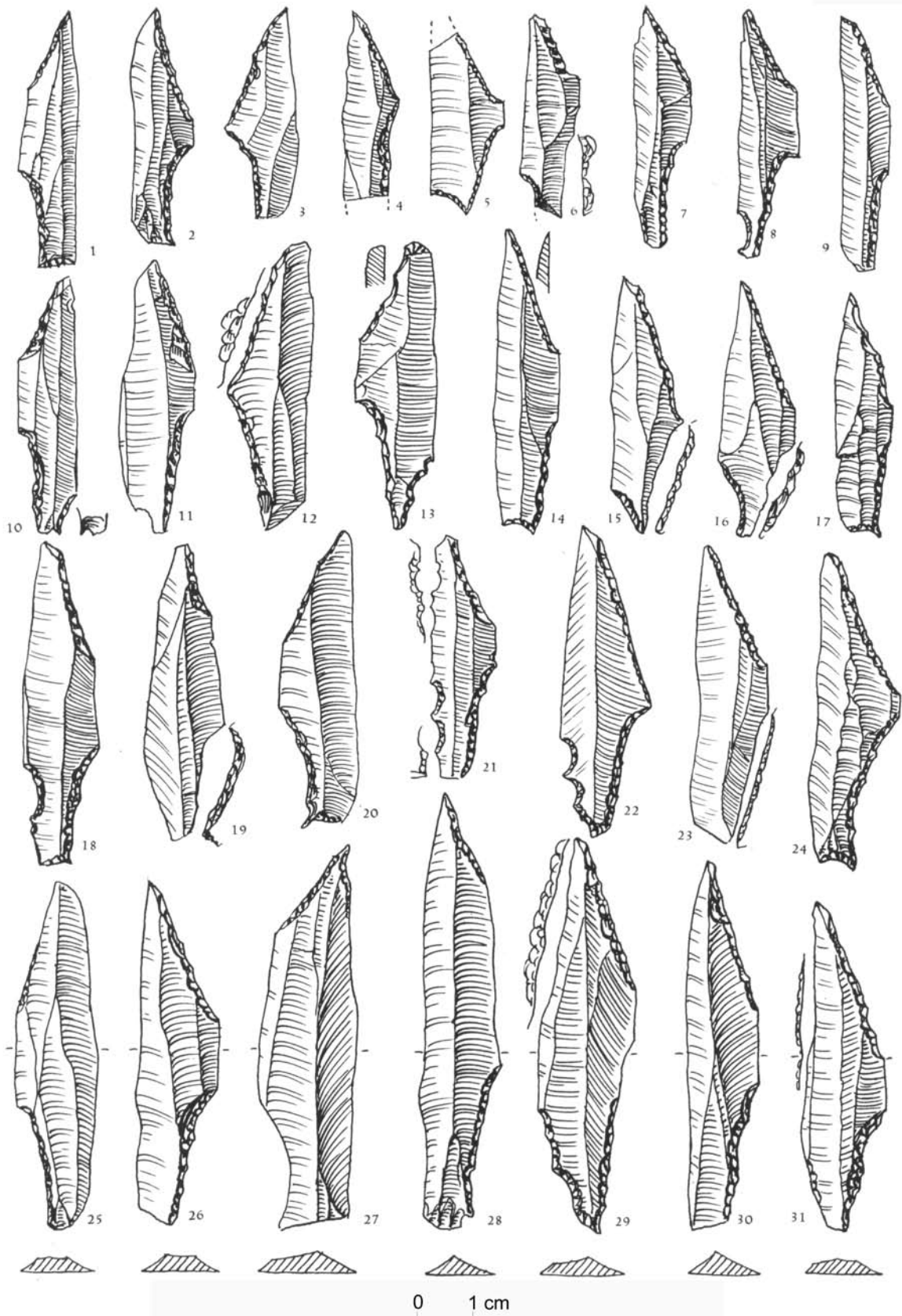


fig. 3 : Hamburgian shouldered points from Poggenwisch. After Rust, 1958, plate 44.



“Kerbspitzen”—or “shouldered points”—is 45 (Rust, 1958, p. 96); second, in the sentences that follow this number, he speaks of 35 whole or almost whole pieces, eight basal fragments and one point fragment, for a total of 44 pieces; third, in the description of pieces by basal retouch type, he mentions 39 whole points and eleven basal fragments, thus 51 pieces including the apical fragment. When the artefacts from this site arrived at Landesmuseum Schleswig in 1968, only 37 pieces were present (according to the Archäologisches Landesmuseum Schleswig-Holstein archives), and today there are only 26. I exclude three, which are, in my opinion a fine Zinken, a probable ancient point blunted at the apex and with use retouch on the adjacent unretouched edge, and a blade with lateral retouch, for which an attribution as a point cannot be totally excluded. At least the two first pieces were counted by Rust among the points since they are included with in the illustrations of points that he published (fig. 3, n° 13, 27). If we accept the description of basal retouch by Rust (Rust, 1958, p. 96) as the most reliable indication of the number of points, ten basal fragments are missing. The fragment that is still present has direct shoulder retouch associated with inverse retouch on the edge opposite the truncation. Consequently, it seems to represent one of the two fragments described by Rust as having alternate retouch, the truncation not having been observed. The nine other basal fragments consist of two fragments with only direct retouch, five fragments with direct retouch plus a truncation, one fragment with direct retouch opposite direct retouch with a notch and one fragment with only inverse retouch.

Still based on this description of bases by Rust, and considering the whole and almost whole points, eight points with only direct retouch and four with only direct retouch and a truncation would be missing. One point with only direct retouch that I classified as undetermined due to its basal fracture can nonetheless be included in the first group. The points with direct retouch on the two edges of the base, without distinction based on the presence or absence of a truncation, appear eight times according to Rust, while I counted three examples. However,

it is possible that one of the two points associating direct retouch with alternating retouch was included in this group. Rust mentions three points with direct retouch and opposed notches; I found two points of this type, one meanwhile with ventral retouch on the same edge as the dorsal notch. Only one of the two points with only inverse retouch is still present, while all of the pieces with alternate retouch appear to be accounted for.

In addition, on the plate published by Rust, ten points that are not present in the assemblage available today are represented (fig. 3, n° 1, 3, 5, 9, 15, 18, 22, 23, 25, 26). The forms, dimensions and retouch locations of these ten points are comparable with the available collection of points (see below). Even if this sample of points is insufficient for certain statistical calculations, such as parametric tests, it is thus still representative of the original assemblage.

An additional apical fragment designated as “Rust inheritance” does not have a clear discovery context and is thus not included in this study.

### *Teltwisch 1*

It is especially necessary to evaluate the sources of the assemblage of Teltwisch 1. At this site, 53 shouldered points (fig. 4) and backed points (fig. 5) were found (Tromnau, 1975a). Today, I count 43, plus four fragments that could be fragments of the bases of points. Two pieces had already disappeared before their arrival at the museum (G. Tromnau, personal communication) and the difference remaining between the counts might be partly explained by differences in the classification of some ambiguous fragments.

### *The presence of backed points*

An element inciting caution is the ten or so backed points found along with the shouldered points (fig. 5). The excavator speaks of “Gravette Points” (Tromnau, 1975a). I identified seven of them in the assemblage (fig. 6), but I question the projectile point attribution of some of them. In any case, they do not form a homogeneous group due to their morphology and the nature of their retouch.

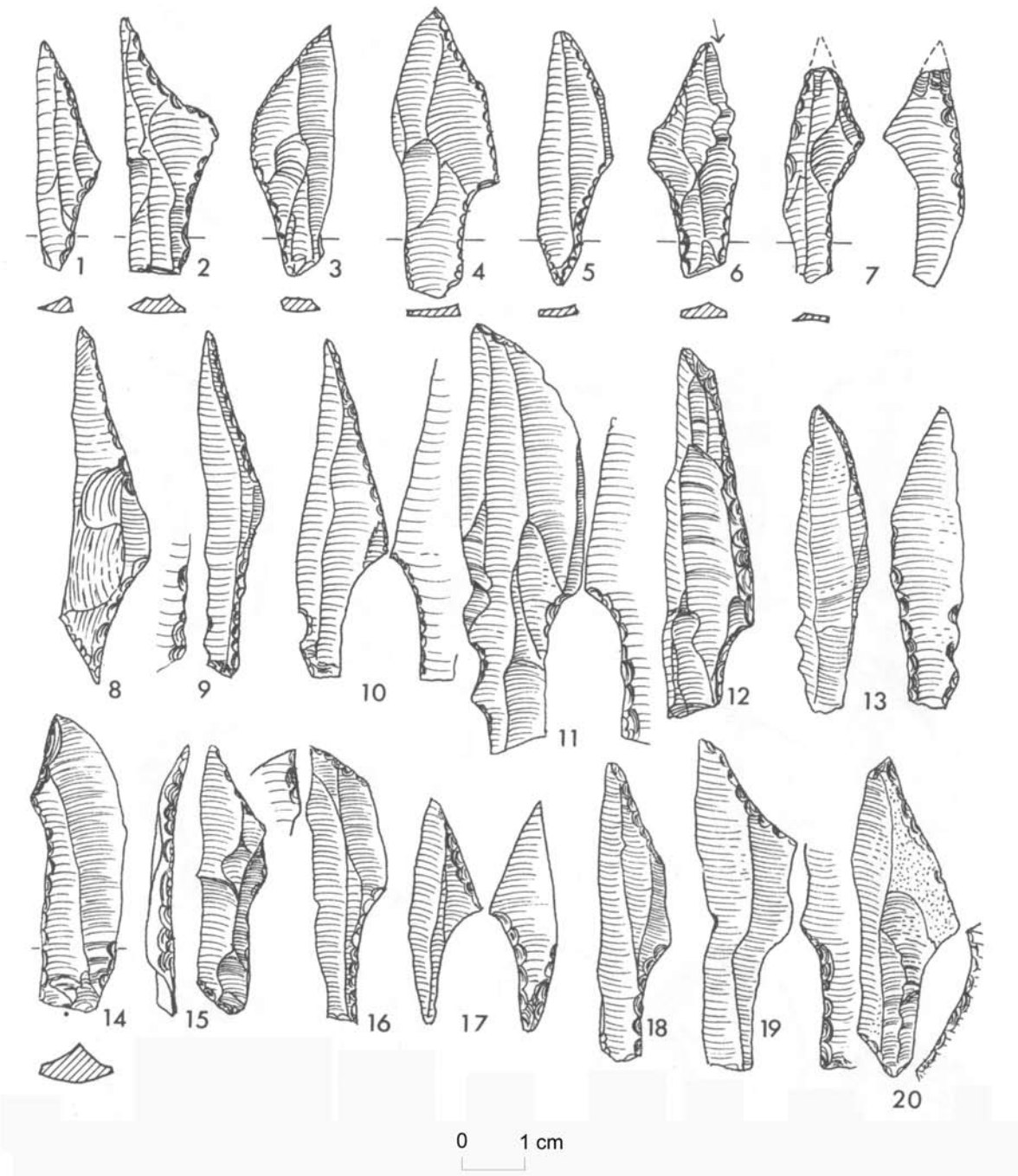


fig. 4 : Hamburgian shouldered points from Teltwisch 1. After Tromnau, 1975a, plate 1.



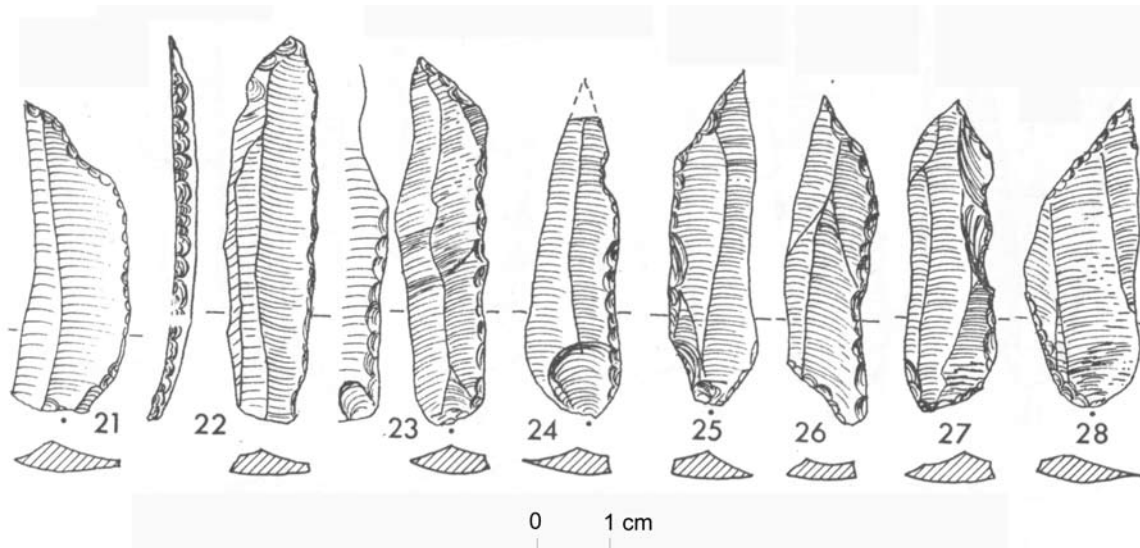


fig. 5 : Backed points from Teltwisch 1. Scale 1:1. After Tromnau, 1975a, plate 1.

- The backed point (fig. 6, n° 1), whose blank can be situated at the beginning of the full blade debitage phase due to a refit (see below), looks more like a Federmesser or arched-backed point. It is oriented with the apex on the distal part of the blank. The back retouch avoids the bulbar base, not beginning until 7 mm from the butt. This retouch is direct, continuous and slightly curved; its delineation nonetheless has an angle that allows distinction between the apical and lateral retouch. Both are abrupt, but the width and depth of the retouch scars of the lateral retouch is more variable. Moreover, it does not correct the slightly curved and twisted profile of the blank.

- One point (fig. 6, n° 2) is made on a blank that resembles an elongated flake. It has direct, non-shouldered basal retouch and alternating apical retouch, separated by an unretouched edge and organised in a way that suggests it may be a preform of an arched-backed point. The apex is again located on the distal part of the blank. The retouch is abrupt, except for the ventral part of the apical retouch, which forms an angle of 100° to 110° with the ventral face. The retouch scars of the basal and lateral retouch are narrower and have edges that are more parallel than those of the apical retouch. The inclination of the butt relative to the axis of the piece is also an indication that the blank was removed from the edge of the blade removal surface.

- The position of the blank on the core also seems to be the cause of the curved and twisted profile of one the two pieces that I do not consider as projectile

points (fig. 6, n° 3). The transverse flake scars on one of the planes of this blank indicate that it was probably located at the junction between the blade removal surface and the side of the core. Its proximal part was removed by diagonal truncating retouch that forms a small spur with lateral concave retouch that extends along only 9.5 mm. Both of these retouches are direct and abrupt and the 3 mm wide spur has bladelet retouch. This latter retouch type, as well as the morphology of the ensemble of these retouches, leads me to consider this part of the piece to be a Zinken-type active part that was probably reworked, and not a projectile point base, even if such bases appear on Federmessers (Schwabedissen, 1954, fig. 11, j). In addition, the state of the edge of this part is reminiscent of the active parts of blade-firestones. On one of the edges there is abrupt retouch that becomes more irregular in the mesial part, which is the thickest part of the blank. On the distal part, fine retouch along 9 mm forms a point with the opposite edge. This edge also has light use retouch on the dorsal face, along 5 mm and especially in a zone where its delineation is convex. This leads me to interpret the unretouched edge as the active part and the retouched edges as the hafted edge or a blunted zone where the fingers could be placed during use of the unretouched edge.

- The same tendency can be observed on a more or less rectilinear point with a back that does not attain the apex and has no independent apical retouch.

The second piece that I do not attribute to the group of backed points (fig. 6, n° 4) is a blade or elongated flake with a right distal fracture and direct abrupt retouch on the proximal and mesial parts of one of the edges. Since the opposite edge is slightly damaged, I again propose that this piece was used as a knife rather than as a projectile point.

- One point (fig. 6, n° 5) could be classed as an atypical stemmed Federmesser. One of the edges is modified by abrupt and continuous retouch that attains the opposite edge and thus forms a point. The base, however, does not consist only of the proximal part of the retouched edge, which is straighter than the mesial and distal parts, but also of a direct truncating retouch that is oblique, slightly concave and also abrupt. An 8 mm long stem was thus created. This type of basal modification is rare among Federmessers, but does not contradict this attribution (Schwabedissen, 1954, fig. 11, g, j).

- The typological and functional determination is difficult in the case of another backed point (fig. 6, n° 6). As in the preceding cases, the base of the point is on the proximal end of the blade blank. On one edge, direct, or very direct, abrupt retouch insures the general rectitude of the edge despite its sometimes sinuous delineation. However, this retouch does not cover

the entire edge, but stops at 6 mm from a truncating distal retouch that forms the apex with the unretouched opposite edge. On the most distal part, there is a removal scar that seems to represent a trihedral point that preceded the apical abrupt retouch. The use of the microburin technique seems to have already existed during the Hamburgian (see below). The combination of a straight edge and an oblique truncation that creates an apex occupying less than one seventh of the entire length of the point is atypical and does not correspond to Federmessers or to Creswell Points, whose back angle is located in a less distal position. The attribution of this piece becomes even more difficult considering the inverse retouch present on the basal half of the edge opposite the back. This could have a function related to hafting, but not necessarily the hafting of a projectile point since the hafting of a knife is also possible.

- Finally, a last point (fig. 6, n° 7), also with a straight back, also has apical retouch on the opposite edge, which rejoins the retouched edge at an angle of 70°. The retouch of the entirely retouched edge is regular, composed of narrow removal scars and has an inclination close to 90°. This is also the most streamlined piece (L = 52,1 mm, W = 12,1 mm), made on the most regular blank in terms of the rectitude of the profile and the parallelism of the dorsal ridges relative to the debitage



fig. 6 : Backed points from Teltwisch 1 still available today.

axis. This point, which is the most carefully retouched of the backed points, has use traces that could indicate use as a projectile point: on the base, an oblique ventral chip that starts from a lipped fracture (prolongation < 2 mm) with a hinge termination, itself not diagnostic of an impact fracture (cf. Plisson & Geneste, 1989), could result from crushing in the weapon shaft during a frontal shock. Ventral chips with visible negative bulbs and step terminations along the entire unretouched edge could indicate scraping against a hard material. Meanwhile, we cannot exclude that these latter traces could be the result of a secondary utilisation as a knife, or even that the piece was oriented in the opposite direction. In this case, the atypical apex would in fact be a truncated base and the lipped fracture combined with a chip would be the result of an impact on the apex.

The homogeneity of the assemblage has been contested due to these pieces, which could represent a characteristic Federmesser group assemblage according to some authors (Bokelmann *et al.*, 1983). Moreover, such points are present at all the Danish Hamburgian sites belonging to the late phase of the Havelte (Holm, 1991; Holm & Rieck, 1992; Vang Petersen et Johansen, 1996); these sites meanwhile include domestic tools common in the Federmesser groups, leading to doubts concerning their homogeneity (Clausen, 1998). In addition, one of them, the site of Slotseng (Holm, 1991), includes two Federmesser group locales next to two Hamburgian locales. However, the late chronological position of these Havelte sites could have conferred them a transitory nature. Moreover, judging by the published illustrations, the Classic Hamburgian assemblages of Heber and Deimern in Lower Saxony also have backed points (Tromnau, 1975b).

A second element characteristic of the Wehlen group—that of the Federmesser groups that Schwabedissen declared as typologically of an early nature but not forcibly the earliest of all the groups (Schwabedissen, 1954, p. 70-71)—is a scraper with a stem retouched around its entire perimeter (Schwabedissen, 1954, pl. 57). Some Magdalenian scrapers resemble this type in their lateral retouch that is oblique relative to their longitudinal axis. In my opinion, however, the difference

resides in the blank, the Magdalenian scrapers being made on the most regular blades while the Wehlen scrapers often have surfaces other than those originating from the blade removal surface (cortex, frost-shattered surfaces, and negatives of flakes or blades removed from one or two platforms). Among the Teltwisch 1 scrapers, some have continuous retouch on the two edges, which converge slightly toward the base. Their dorsal faces, however, correspond to debitage removal surfaces and I thus do not consider them as indications of a Federmesser type occupation.

The situation is somewhat different in the Ahrenshöft LA 58 D assemblage, which belongs to the Havelte group (Clausen, 1998). It contains scrapers on very regular blades with or without retouched edges, but it also includes two scrapers with similarities to the Wehlen scrapers. The first (Clausen, 1998, fig. 19, n° 10) is made on a more or less laminar blank which has a natural surface on its dorsal face and which appears to have been detached with a soft stone hammer; the two edges are entirely retouched and slightly convergent. The retouch is inclined or even abrupt along at least 3 mm and irregular. The second is also made on a blank detached with a soft stone hammer. It has cortex, a frost-shattered surface and, on the dorsal face, negatives detached from that same platform as the blank itself. One of the slightly convergent edges has inclined retouch that is fine over most of its length and long on the distal part. The second edge has long retouch on the distal part, use retouch in the mesial part and fine retouch on the proximal part. Finally, a few other scrapers in this assemblage (e.g. Clausen, 1998, fig. 19, n° 8) are made on regular blade supports but the negative retouch scars are wider than those on Hamburgian scrapers in general. From an evolutionary perspective, we could see a development from Magdalenian and Classic Hamburgian end scrapers, to end-scrapers with “Federmesser” retouch, present at least in this Havelte-type assemblage, to Wehlen end-scrapers, whose precursors would belong to the Havelte group. We can meanwhile not exclude the possibility of a mixture with a Federmesser type assemblage at Ahrenshöft, which could be indicated by the presence of a backed

point (Clausen, 1998, fig. 19, n° 4). This piece could nonetheless be a Havelte point since it is broken at the base and the unretouched edge has a negative adjacent to the fracture, which could represent an element of the retouch forming the stem.

#### *Spatial arguments*

A few spatial arguments argue against the possibility of a mixture with a Federmesser group occupation at Teltwisch 1: the distribution of backed points concurs with that of shouldered points (Tromnau, 1975a, fig. 8); the general distribution of remains, which show a single principal concentration (Tromnau, 1975a, fig. 6 and 7) that can be seen in the spatial arrangement of refits, and; the presence of refits over long distances.

I was recently able to refit one of the backed points onto a small series of three blades detached from the same platform as the blank of the point (fig. 7). This refit shows that at least this point was manufactured in place. A transverse fracture removed the extremity of the apex, but the morphology of the fracture surface is not characteristic of an impact fracture. This fracture could even be the reason for which the point was not used (H. Paulsen, personal communication). The fact that it was

found in a meter square next to that of the last blade, in the middle of the concentration, is another argument that it was abandoned in the location of its fabrication. It also shows that blank production occurred in the same location as the transformation of blanks into points, at least in this case. Consequently, we can exclude the idea that this point originates from a simple Federmesser hunting station. On the other hand, if this was a habitat site, we would expect to find domestic tools as well, but there are none. Nonetheless, we cannot exclude that the points were found in a peripheral zone of such an occupation, and that the domestic tools are to be found beyond the excavated surface.

#### *Technological arguments: the debitage technique*

Other questions subsist since the butts of the point and the three blades show traces of percussion with a soft stone and an internal point of percussion (far from the edge of the striking platform), while the majority of Hamburgian blade blanks show traces of percussion with a soft organic or mineral hammer and a tangential point of percussion (skimming the edge of the striking platform). At least three hypotheses to explain this are possible.



fig. 7 : Refit of a backed point (marked with ochre) and three blades from Teltwisch 1.

- Given the presence of cortex zones on the distal part of the blades, and a frost-fractured surface on one of them, one hypothesis would be that these blades were produced during the preparation of the core or at the very beginning of the full blade debitage phase.

- A second hypothesis would be to consider this type of percussion as a third type used to produce blades within the Hamburgian blade debitage strategy. It is true that a small proportion of blades at Teltwisch 1 indicate this type of percussion, but until now we tended to consider them as the result of core preparation or maintenance—what we could call laminar flakes.

- Finally, a third hypothesis could go further and interpret this refit as evidence of an occupation by Federmesser groups in the same location as that of Hamburgian groups. The only differences between these occupations would be the point types and lithic production strategies. It is true that among the four backed points with the proximal end preserved, three show this internal type of percussion, which could indicate a relationship between these two elements. Unfortunately, no detailed description of the apparently variable debitage techniques of Federmesser groups in northern Germany exists. An element of information is available for the site of Alt Duvenstedt (Clausen & Hartz, 1988) where it seems that large irregular butts with visible points of impact exist along with small, thin butts; the bulbs are pronounced and the angles between the striking platform and flaking surface exceed 70°. The blades in question at Teltwisch 1 could thus correspond to those of Alt Duvenstedt.

In order to obtain more elements that would allow a choice between these three hypotheses, it may be useful to observe the butts of other tools and blades in these meter squares and to look for other pieces belonging to this same refit. For the moment, we have not found these pieces. Based on the flint type, one short scraper with a cortical zone covering more than half of its dorsal surface could come from the same raw material nodule. Unfortunately, the square meter provenience is not indicated for this object. Here again, we can ask whether this type of scraper belongs to the toolkit of the Federmesser groups or if it is one of the flake tools that

appears in the Hamburgian inventories. Again based on the raw material, the backed point with probable impact traces was made from a red, translucent flint from which two shouldered points were also made. Another element to add to the puzzle in favour of one of the three hypotheses would be the proportion of blades at Poggenwisch made with the internal impact method.

Whatever the case, we prefer for the moment to exclude these seven ambiguous pieces from our study.

## Point fabrication

### *Blanks*

#### *The dimensions*

The blanks from which the shouldered points were made are short, narrow and thin blades. The lengths of the points do not exceed 78.3 mm at Poggenwisch where the average length of whole or almost whole pieces is 53.5 mm ( $n = 19$ ,  $\sigma = 10.1$ ,  $cv = 19.0\%$ ). The lengths of the missing whole points that are shown in the illustrations by Rust ( $n = 9$ ; Rust, 1958, pl. 44), range from 38 to 63 mm; if we add them to the lengths of the points present and round off to the millimetre, the average is only slightly different at 53 mm. The points at Teltwisch have an average length of 45.6 mm ( $n = 23$ ,  $\sigma = 7.8$ ,  $cv = 17.1\%$ ), rather close to the median of 46.1 mm, and their distribution presents a modal class of 46 to 48 mm (table 1), while that of the Poggenwisch points is between 42 and 44 mm. Based on the whole or almost whole pieces, the average width is 13.2 mm at Teltwisch ( $\sigma = 2.3$ ) and 13.1 at Poggenwisch ( $\sigma = 2.0$ ), with a lower coefficient of variation at Poggenwisch ( $cv = 15.0\%$ ) than at Teltwisch 1 ( $cv = 17.2\%$ ). Once again, the average is barely different at Poggenwisch ( $av = 13$  mm) if we include the measurable widths of the pieces represented by Rust. Though the distribution of widths in the Teltwisch 1 assemblage shows a modal class between 10 and 12 mm (table 2), and that of Poggenwisch between 13 and 14 mm, the distribution curve is skewed toward the upper values at Teltwisch 1 relative to Poggenwisch. Since the maximum thickness can be determined on only around ten whole points at



Poggenwisch (2.5 – 4.6 mm,  $m = 3.5$  mm,  $\sigma = 0.6$ ,  $cv = 17.3$  %) (note 4), no comparison is possible. In the Teltwisch 1 assemblage, there is a modal class in the distribution curve between 3.4 and 4.2 mm (table 3) in which the average ( $av = 3.9$  mm,  $\sigma = 0.7$ ,  $cv = 17.6$  %) is integrated, as well as the median of the same value.

An intentional standardization can be seen in the refit of two points from Poggenwisch. At 44.7 mm and 44.2 mm (incomplete due to a pseudo-burin removal) their lengths are nearly identical; their thicknesses of 2.7 mm and 3.1 mm are also rather close and only the width varies slightly at 13.3 mm and 11.0 mm respectively. Consequently, the weight differs little from one point (2.6 g) to the other (2.4 g). Considering the greater morphological and dimensional variability of the points at Teltwisch, which appears through a simple observation of the two assemblages, we would expect greater dimensional variability in this assemblage. A parameter that shows this difference is the relationship between length and width. Since these assemblages have fewer than 30 individuals, it is not possible to calculate the linear regression or coefficient of determination  $R^2$  between these two parameters (Chenorkian, 1996), but the point cloud (table 4) of the length and width shows a lower dispersion at Poggenwisch. Could this greater homogeneity of proportions be due to a greater standardisation of blades in general at Poggenwisch? An example of the relationship between the standardisation of blanks and the dimensions of points is presented by H. Plisson and J.-M Geneste (1989) who observe that the Solutrean Points at Forneau du Diable have smaller dimensions than those of other contemporary assemblages because they are “better adapted to the morphology of the debitage” (Plisson & Geneste, 1989, p. 75) due to the standardisation of the blanks. A second aspect that shows greater variability at Teltwisch 1 is the relationship between the length of the whole point and the length of the shoulder (table 5). Once again, the dispersion is greater in the Teltwisch 1 assemblage than in that of Poggenwisch. This shows that at Poggenwisch,

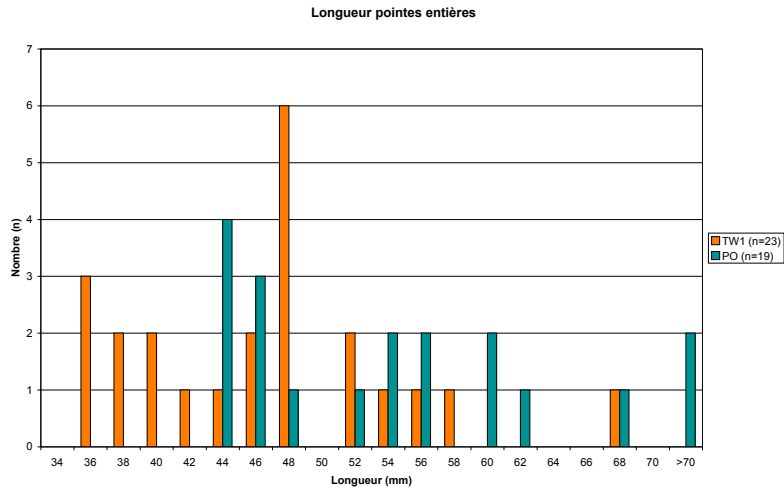
a relative standardisation existed not only in blank manufacture, but also later in the production sequence during the shaping of the blanks into points.

### *The profile*

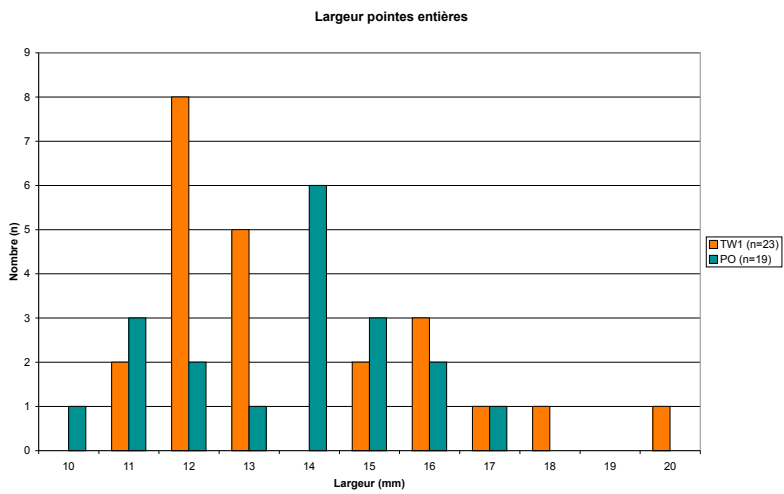
A rectilinear profile seems to be a consistently sought after feature of lithic points. This can be explained by the fact that a point with a symmetric profile will have greater resistance at impact (the force being applied along the axis of the piece) relative to a “crooked” point on which the force of impact will bear on the lower or upper face of the apical end (H. Paulsen, personal communication). Solutrean shouldered points, whose retouch serves in part to straighten the profile, are an example of this principle (Plisson & Geneste, 1989), despite the difference in rectitude between Type A and Type B points (Plisson & Geneste, 1989, p. 75). It is in fact the extremities that most often have retouch on their inferior face, corresponding to the same principle as the basal ventral retouch of Chwalibogowice points, for example. The tanged points of the Swiderian (Taute, 1968, fig. 1, n° 4) have not only abrupt lateral retouch to form the tang, but also, at the base of the tang, retouch on the ventral face that is orthogonal to the axis of the points. Hamburgian shouldered points are also made on relatively rectilinear blades, but very few are totally rectilinear (fig. 8, n° 1; Poggenwisch:  $n = 0$ ; Teltwisch 1:  $n = 3$ ). Almost all of the others have a rectilinear mesial part, along the greater part of their length, associated with at least one extremity that diverges from the axis of the piece. This is most often the basal extremity (fig. 8, n° 2; Poggenwisch:  $n = 10$ ; Teltwisch 1:  $n = 11$ ), while the apical extremity (fig. 8, n° 3; Poggenwisch:  $n = 4$ ; Teltwisch 1:  $n = 4$ ) is as often concerned as are both extremities at once (fig. 8, n° 4; Poggenwisch:  $n = 3$ ; Teltwisch 1:  $n = 4$ ). In a few rare cases, the curvature is continuous and more (fig. 8, n° 5; Poggenwisch:  $n = 1$ ; Teltwisch 1:  $n = 0$ ) or less (fig. 8, n° 6; Poggenwisch:  $n = 3$ ; Teltwisch 1:  $n = 1$ ) pronounced. Almost half of the pieces (Poggenwisch:  $n = 10$ , including 8 only slightly

<sup>4</sup> - The other pieces are now in display cases in the Archäologisches Landesmuseum Schleswig-Holstein and have glue on their lower face, making it impossible to measure their maximum thickness.

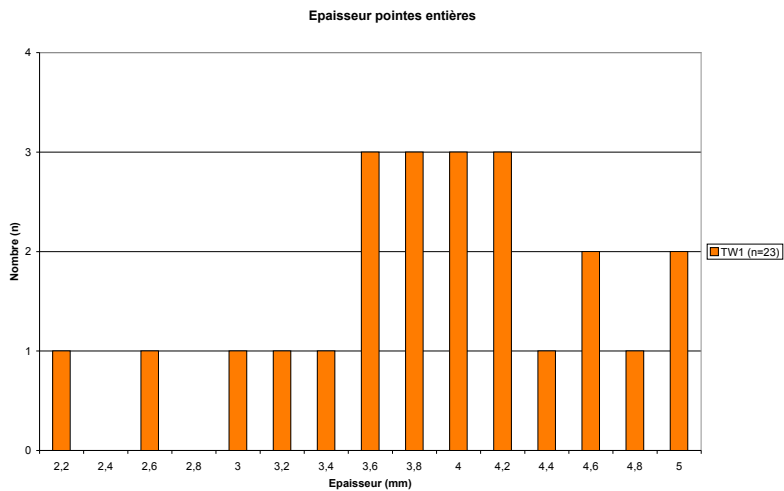




tab. 1 : Refit of a backed point (marked with ochre) and three blades from Teltwisch 1.

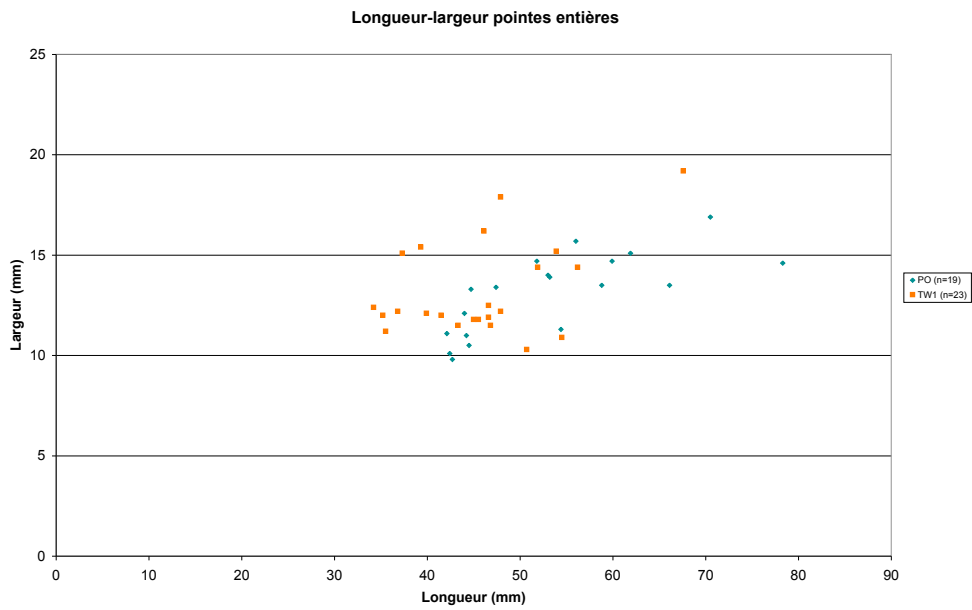


tab. 2 : Distribution of the widths of the whole or almost whole shouldered points from Poggenwisch and Teltwisch 1.

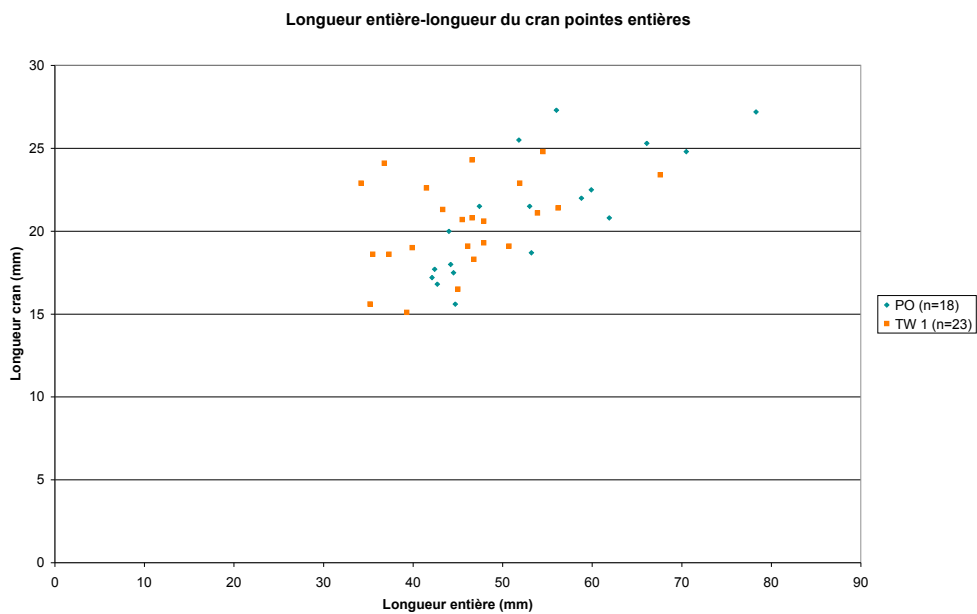


tab. 3 : Distribution of the thicknesses of the whole or almost whole shouldered points from Teltwisch 1.





**tab. 4** : Relationship between the length and width of the whole or almost whole shouldered points from Poggenwisch and Teltwisch 1.



**tab. 5** : Relationship between the length of the shoulder of the whole or almost whole shouldered points from Poggenwisch and Teltwisch 1. One of the points from Poggenwisch was excluded due to a measure less precise than the others.



twisted; Teltwisch 1: n = 10, including 9 only slightly twisted) are also more or less twisted (fig. 8, n° 7). Due to fractures, the profile cannot be determined on two points from Poggenwisch and 13 from Teltwisch 1. In addition, the limits between these forms are sometimes difficult to define. On the one hand, it is possible that this intentional rectitude could have influenced the choice to use a bipolar core reduction method. This utilisation is manifest in the dominance of cores with two opposed striking platforms, as well as by certain refits that indicate a rapid change of the striking platform even at the beginning of the laminar debitage phase, while most of the dorsal faces have unidirectional blade negatives. The question is thus raised as to whether bipolar core reduction was chosen for economic reasons (easier correction of the flaking surface and less costly in raw material) or because it allowed a flattening of the flaking surface and thus more rectilinear blade profiles. On the other hand, if the points were hafted in a manner that assured their base would follow the axis of the shaft, the apical would no longer be in line with it (see below), thus creating a disadvantage at the moment of impact. Moreover, among the points that have clear impact traces, we find examples with inclined and/or twisted extremities, while some of the points without macroscopic impact traces are (almost) rectilinear.

#### *The debitage technique*

The type of hammer or flaking technique used is rarely identifiable since the proximal part of the blank was usually removed during the shaping of the point. Only one shouldered point from Teltwisch 1 permits a description of the knapping stigmata. The characteristics that suggest the use of a soft stone hammer in a tangential striking direction are a butt thickness of less than 1 mm and tightly spaced undulations on the first millimetres. At Poggenwisch, four points still have their proximal end. The bulb of the longest one is splintered (fig. 9). Another one has a possibly splintered bulb, and another a cone of percussion that strongly indicates they belong to the “soft stone hammer” group. There is one more example with non diagnostic stigmata. In all of the other cases, we can reason only by analogy. Since

the blades and blanks whose stigmata indicate the use of a stone hammer often have dense and pronounced undulations over most of their length, the twenty or so pieces (including the fragmented ones) that also have these undulations seem to indicate the use of this type of hammer as well. Finally, the five proximal microburins from Teltwisch 1, as well as one of the two from Poggenwisch (see below), all have butts less than 1 mm thick, which correlates with the observations made on the points themselves. The observable stigmata thus concur to suggest that debitage with a soft stone hammer was the principal technique employed in both of the assemblages studied.

#### *The place within the core reduction sequence (chaîne opératoire)*

Most of the blades used as point blanks originate from an advanced stage of the reduction sequence of blade debitage. As we have already seen, their widths are reduced and their lengths rarely exceed 60 mm. These values correspond to the last negative blade scars on the cores, or are lower than these. The fact that only one point from Teltwisch 1 has cortex and that there are no crested blades are also indications that the point blanks were not produced at the very beginning of the full blade production phase. In addition, there is only one point with a frost-shattered surface, three points with a cleavage surface and two with an ancient surface. There is a similarly small proportion of natural surfaces at Poggenwisch where only one point (fig. 8, n° 5) has a frost-shattered surface. The presence of preparatory negatives perpendicular to the laminar negatives on the dorsal surface of only two points from Poggenwisch and two points from Teltwisch 1, as well as the rarity of natural surfaces, show that the point blanks originate from the central parts of the blade removal surfaces and that they belong to the full blade debitage phases. This observation is supported by the parallelism of the edges of the negative blade scars on most of the points. If we consider the missing points from Poggenwisch, which are illustrated on the plate published by Rust (fig. 3, n° 1, 3, 5, 9, 15, 18, 22, 23, 25, 26), we can observe that their upper faces also have mostly parallel removal





**fig. 8** : Different profile types of shouldered points (n° 5 and 7 Poggenwisch, n° 1-4 and 6 Teltwisch 1).



**fig. 9** : The longest point from Poggenwisch with a splintered bulb.



scars, indicating a position of the blank in the middle of the blade removal surface. Numbers 1 and 3 also have removal scars that are slightly divergent relative to the axis of the piece, which indicates a lateral position on the blade removal surface. Finally, number 22 has a natural surface next to a blade negative, which could also suggest a position at the junction between the removal surface and one of the flanks of the core.

The point blanks seem to originate from blade debitage phases during which the striking platform was only rarely changed, unless the products of the opposed striking platform were too short to be manifest on the distal part of the blanks, given that most of the points have removal scars on their upper face oriented in the same direction as the points themselves. For the points from Poggenwisch, the use of only one striking platform is nearly exclusive since all the negatives of 20 pieces are oriented in the same direction as the blanks. The three others have, respectively, four out of five, four out of six and five out of seven negatives oriented in the direction of the blank and one or two undetermined negative(s) (either very small or on the edge). This observation does not change if we include the missing pieces illustrated by Rust (fig. 3, n° 1, 3, 5, 9, 15, 18, 22, 23, 25, 26): in only one case (n° 9), the dorsal negatives are oriented in two opposed directions, while the negatives of all the others are oriented in one direction. It is of course impossible to determine the orientation of the blanks themselves and, consequently, their relation with the negative removal scars on their dorsal faces. At Teltwisch 1, the points with negatives in the direction of the blank dominate with 23 examples out of 36, while only one piece has negatives in the opposite direction only. Six other pieces have negatives in both directions, but the opposed negatives dominate in only one case. Five points have an undeterminable negative next to negatives oriented in the direction of the blank, and one last point is distinguished from this group only by a supplementary negative in the opposite direction. Moreover, most (five out of seven) of the possible backed points from Teltwisch 1 have negatives oriented only in the direction of their blanks.

Among the 68 cores from Teltwisch 1, a group of seven (fig. 10) can be distinguished by their narrowness, the presence of cortex on the flanks and/or on the back, and for some, the type of flint (e.g. fig. 10, n° 1 and 2). For seven of them, the heights of the blade removal surface or surfaces is concentrated between 64 and 74 mm, and in one case, the initial height of one of the removal surfaces can be reconstructed through a refit of 80 mm. For some of the other cores of this group, the presence of cortex or other natural surfaces suggests that the heights of the blade removal surfaces were not much greater at the beginning of their exploitation than when they were abandoned. The maximum widths of most of the visible negative blade scars ranges from 13 to 17 mm, some not exceeding 10 mm. This could indicate an independent reduction sequence with the objective of producing the short and narrow blades that correspond to the point blanks.

Even though the use of a soft stone hammer is also attested for phases other than the end of the blade production phase, the absence of stigmata indicating the use of a soft organic hammer on the points could show that the majority of blanks originate from the end of the blade debitage phase.

### *Point shaping*

#### *The microburin technique*

The microburin technique is especially well known in the Mesolithic period when it served sever blades to obtain fragments that could easily be transformed into microliths. This technique (e.g. Tixier *et al.*, 1980) consists of placing the upper face of a blade on the edge of an anvil with the axis of the blade oblique to this edge. A notch is made on the edge of the blade by striking it with a thin stone hammer. When the notch attains a dorsal ridge, the fracture is produced in the direction of the edge of the anvil, and is thus oblique relative to the axis of the blade. A fragment is thus obtained with a trihedral point (*piquant-trièdre*) that forms one of the edges of the microlith. The waste product is a microburin with a fracture surface that is complimentary to the trihedral point.

It is interesting to note that this technique was also used in the fabrication of projectile points other than microliths and in periods other than the Mesolithic. Its interest for the shaping of shouldered points lies in the removal of the proximal part of the blank, either at the apex or at the base of the point, and in the creation of the apex. Meanwhile, microburins are already known in the Upper Magdalenian (Hahn, 1993), making their presence in the Hamburgian not very surprising. Nonetheless, the use, or not, of this technique constitutes an element of comparison between Magdalenian lithic points in the Paris Basin and Hamburgian shouldered points, which can aid in the distinction between phenomena of convergence and expressions of the same tradition.

Microburins appear in almost all Hamburgian assemblages, Classic and Havelte (Burdukiewicz & Schmider, 2000; Clausen, 1998; Holm & Rieck, 1992; Kabacinski *et al.*, 2002; Madsen, 1983; Mencke, 195; Rust, 1937; Taute, 1959; Tromnau, 1975b, pl. 62; Zoller, 1963, fig. 6, n° 2), though the phenomenon of the microburin technique during the Tardiglacial has not been studied in detail. In the Teltwisch 1 assemblage, I identified five proximal microburins (fig. 11), as well as one distal example and one other one that has a microburin type fracture surface on its distal extremity and a straight fracture with a hinge terminated prolongation on its proximal extremity. All of the proximal pieces are less than 12 mm wide (in two cases, the maximum width does not correspond to the initial maximum width of the blade) and three of them are even less than 10 mm wide (including one incomplete width). The thicknesses vary between 1.9 and 3.8 mm. These values correspond to those of the narrowest and finest points, but also to the calibres outside of the inferior dimensional limits of this assemblage and which are thus not represented. Two explanations appear possible: either such points were manufactured at the site and taken away but not brought back, or the microburins were also used for the fabrication of other tool types. Due to the lack of sieved materials, it is possible that microburins are underrepresented in the inventory. This hypothesis seems even more probable at Poggenwisch where I have currently identified one

atypical proximal microburin whose fracture face continues in the direction of the retouch. Moreover, the other waste products of the fabrication of these points, such as fragments with a straight fracture or Krukowski microburins, corresponding to the types AI, BI, and II, CI and II illustrated by Madsen (1992, fig. 79), are present in both assemblages.

In a paper on microliths where he mentions that the microburin technique was used during the Hamburgian, Mencke (1951) already refers to trihedral points on some tools from Meiendorf and Hamburgian sites located near Cuxhaven. Rust, who still used the denomination “Mikro-Stichel” (Rust, 1937), the direct translation of the French term, observed possible trihedral points on six points from Poggenwisch (Rust, 1958, p. 96) (note 5). This feature was also detected by Taute on some shouldered points at Deimern 28 (Taute, 1959). Hartz spoke of trihedral points as a common element of Hamburgian shouldered points (Hartz, 1987, table 1), though he did not give numbers or relate them to the microburins. According to him, the apical edge thus created would not require further retouch (*op. cit.*, p. 9). Trihedral points are also a common element between the Classic Hamburgian and the Havelte group since Madsen found them under some apical retouch of Havelte Points from Jels (Madsen, 1996, p. 68), which correlates with the presence of microburins in the two Havelte assemblages of the site (Holm & Rieck, 1992; Madsen, 1992). On the points from Teltwisch 1, I observed four proximal trihedral points and one distal one on the apical extremities, along with four other possible ones (fig. 12). On the points from Poggenwisch, there are two proximal and three distal ones, along with two possible proximal ones and one possible distal. All of these trihedral points have retouch on the area adjacent to the edge, either over their entire length, or only on the part opposite the apex. On three of the points for which we have only the drawings (fig. 3, n° 15, 18 and 22), the apical retouch does not seem to join the unretouched edge, which could indicate the presence of trihedral points. At Teltwisch 1, three other points seem to have remains of trihedral points on their base (fig. 12). In addition, I observed apical trihedral points on





**fig. 10** : Three examples of a group of cores from Teltwisch 1 that could have been used to produce shouldered point blanks.





fig. 11 : Two proximal micro-burins from Teltwisch 1.

the points from Meiendorf, Hasewisch and Stellmoor, which are located in the same valley. On the contrary, the shouldered points and points with an angular back of the Paris Basin do not seem to have been manufactured by this technique (Burdukiewicz and Schmider, 2000). At Tureau de Gardes locus 7, Krukowski microburins have been identified (Caspar in Lang, 1998).

#### *Modification of the apex*

In general, the apex is formed by the unretouched edge and an oblique truncation, with or without a preceding trihedral point. On some points, the morphology of the apex suggests that one pointed extremity was clearly intentional. First, three points from Poggenwisch and 14 from Teltwisch 1 have an unretouched edge converging toward the truncation in a way that the angle formed between these two elements is smaller than with a straight unretouched edge. Five of the seven backed points from Teltwisch 1 also show this feature.

Second, some points have retouch on the first apical millimetres of the unretouched edge. In one case at Teltwisch 1, this retouch forms an inverse notch that creates a thorn-like apex; a second point of this assemblage has dorsal retouch along around five millimetres, creating a slight inclination of the edge and, along with the truncation, thus forms the apex. In a similar manner, on one of the backed points (see above; fig. 6, n° 7) the retouched edge meets an oblique truncation.

In contrast, one of the points from Poggenwisch, known from the illustration by Rust (fig. 3, n° 25), has only incomplete apical retouch, as if the least effort possible was made to create an apex.

#### *Retouch*

On the blanks, the apical and basal retouch is situated in such a way that the apex is located on the distal extremity 57 % of the time at Poggenwisch (n = 13/23) and 58% at Teltwisch 1 (n = 21/36). With the apex oriented at upward, the retouched edge is located on the right 86% of the time in both assemblages.

The location of the basal retouch is somewhat variable, thus resulting in a variable morphology of the point bases. At Teltwisch 1 (table 6), excluding the backed points, only 36% of the points on which we can determine the basal modification represent what we could call “the Hamburgian type point” with direct, unilateral retouch. Less than half the pieces have unilateral retouch. The proportion of exclusively direct retouch is 68%. On the contrary, at Poggenwisch, direct unilateral retouch represents 52% of the cases. Unilateral retouch is also found on more than half the points (57%), but the proportion of direct retouch (71%) is only slightly higher than at Teltwisch 1. On the missing points illustrated by Rust, direct unilateral retouch is dominant (n = 6; fig. 3, n° 1, 3, 5, 9, 25, 26) and sometimes associated with a truncation. Two pieces combine direct retouch and one or two direct notches (fig. 3, n° 18, 22), while two other points have inverse retouch (fig. 3, n° 15, 23), in one case next to a truncation (fig. 3, n° 15).

We shall now focus on this variability of the shouldered point bases. When we consider the differences between two assemblages, we can imagine chronological, geographic or functional explanations. These latter are also feasible for intra site variability. However, we cannot exclude the possibility that different individuals made the points, or even that they were made by one individual with changing behaviours. The refitting of two shouldered points at Poggenwisch (see above) is

<sup>5</sup> - It is interesting to note that in the same volume in which he presents the trihedral points of Poggenwisch, Rust declares that the microburin technique was not used for the fabrication of shouldered points (Rust, 1958, p. 33) when he speaks of the microburins of the site of Borneck.





**fig. 12** : Examples of trihedral points (piquants-trièdres) on a shouldered point from Poggenwisch (1) and a backed point from Teltwisch 1 (2). Three points from Teltwisch 1 also have remains of trihedral points on their base, including two examples shown here (3.4).



a good example of this variability existing between products presumed to be made by the same person: the first point has inverse retouch associated with direct retouch and a small direct truncation, while the second point has direct shoulder retouch and on the opposite edge, a notch that is also direct. In addition, the first base is on the proximal end of the blank, while the second is on the distal end. I favour the interpretation of an adaptation of the projectile point to the shaft. The retouch on the first point could also play a role in the correction of a slight proximal twisting. Whatever the case, this refit brings our attempts to explain the variability of shouldered points somewhat back into perspective.

Another interesting question concerns the function of inverse retouch in the modification of point bases. As I already said, on some points, this retouch seems to correct a twisted profile in order to facilitate their hafting. One point from Poggenwisch (fig. 8, n° 7) shows the consequence of direct retouch on a twisted proximal end of a blade: hafting in a lateral groove seems to be impossible. Since inverse retouch at Teltwisch 1 appears three times on the distal end of the blank and six times on the proximal end, it is possible that this type of retouch also served to thin the zones with a bulb of percussion. At Poggenwisch, however, inverse and alternating retouch are equally present on the proximal and distal ends of blanks, and at Teltwisch 1, the points with inverse retouch fall in the middle of the distribution of point thicknesses and the distribution of shoulder thicknesses. Could this thus be a choice made at the moment of the transformation of the blank, simply influenced by the ease of manipulating it? Perhaps, but the inverse retouch has an angle inferior to that of the direct retouch, which could influence hafting (see below). The function of the truncations found on half of the points also remains to be determined. In one case at Teltwisch 1, an inverse truncation removed the bulbar part of the blank, which would have created an arched profile at the base of the point. During experimental fabrication of shouldered points by H. Paulsen, we realized that intentional fracturation by percussive retouch can create short retouched zones at the base of

points, notably on the unretouched edge and the basal extremity. We must thus re-examine the archaeological points from this perspective in order to attempt to explain part of the basal retouch and, consequently, find the reason for the morphological heterogeneity of the bases. In other cases, especially that of true notches, the retouch opposite the shoulder could serve to protect the ligature, as Beckhoff (1967) has already proposed.

## Use

### Hafting

Two hafting methods have been proposed for Solutrean shouldered points, including one in which the point was inserted into a lateral groove (Plisson & Geneste, 1989). This principle has also been proposed for Hamburgian shouldered points (fig. 13; Beckhoff, 1967; Lund, 1993). The difference between the models of Beckhoff and Lund reside in the manner of mounting the point into the groove: for Beckhoff, the unretouched edge is inserted into the groove, while for Lund it is the shoulder that is inserted. This latter proposition seems more logical considering the presence of notches or simple retouching of the base of the unretouched edge of a few points: in Lund's proposition, these notches or retouching are located outside the shaft can and thus allow fixation of the ligature. Moreover, in Beckhoff's version, the asymmetry of shouldered points is not compensated for (see below).

One of the advantages of this type of hafting relative to a complete insertion—known for Ahrensburgian tanged points (Rust, 1943) and proposed for Hamburgian points with bilateral basal retouch (fig. 13 a; Beckhoff, 1967)—could be the ease with which the point can be detached at the moment of impact without breaking the shaft since the resistance on the side of the groove would be less than on the side with the shaft. The preservation of the shaft is important in an environmental context where wood is rare. The experimental shots made by Geneste and Plisson (1986) with replicas of Solutrean shouldered points also showed that if this type of hafting is associated with resin and no ligature, the points break at the apex or come out of the shaft without damage. In



Série	Type de retouche basale										Indéterminable n		
	Directe		Inverse		Dir. + dir.		Dir. + inv.		Dir. + alterne			Inv. + inv.	
	n	%	n	%	n	%	n	%	n	%	n	%	
Teltwisch 1	10	37	2	7	9	33	4	15	0	0	2	7	13
Poggenwisch	11	52	1	5	4	19	3	14	2	10	0	0	2

**tab. 6 :** Basal modifications of the shouldered points from Poggenwisch and Teltwisch 1. The percentages are calculated based on the determinable points only.

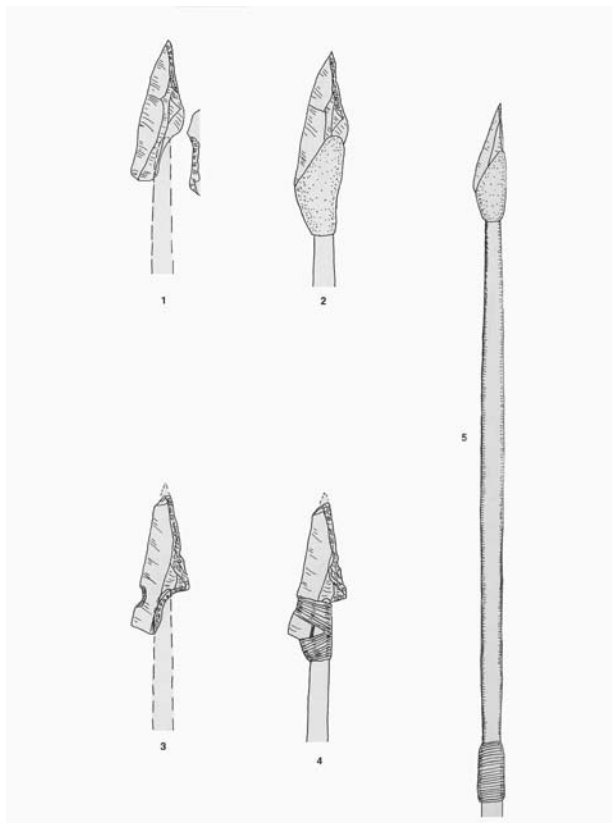
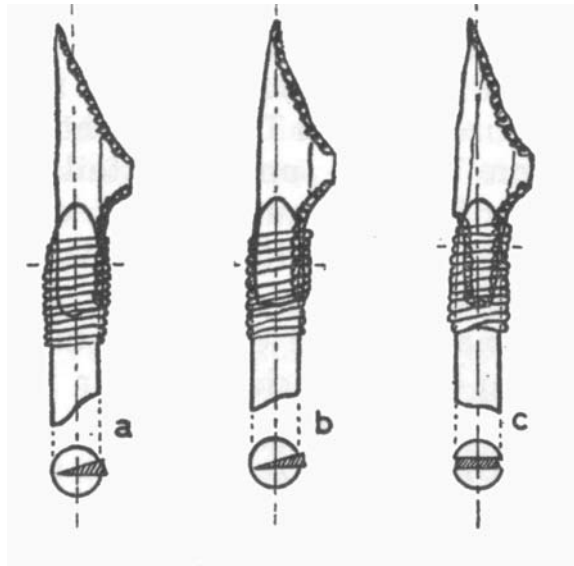
addition, positioning the point at a slight angle relative to the shaft (fig. 13 b; Lund, 1993) allows the apex to be positioned in this same axis, thus compensating for the asymmetry of shouldered points. The disadvantage of an apex positioned outside of the axis of the shaft, as seen from above, is that only the blunt apical truncation comes in contact with the target and is thus confronted with a greater resistance than that of the unretouched sharp edge (Lund, 1993). The basal part jutting out from the shaft could play the role of a barb. However, this hafting method would require a larger shaft and thus a more massive projectile in order to be effective. Such a projectile is hardly compatible with a bow, but conceivable as a spear that is launched by hand or with a spearthrower.

A disadvantage of this technique could meanwhile be that the weapon armature is positioned outside of the longitudinal axis of the projectile (see above). When the point is nearly rectilinear and the apex diverges only slightly from the axis of the shaft, this is not problematic, but if the point possesses an inclined extremity and does not remain within the limits formed by the edges of the shaft, as seen from a lateral view, the point is more vulnerable at impact. This phenomenon has been observed during experimentation (Odell & Cowan, 1986, cited by Lund, 1993). In addition, a point that extends beyond the limits of the shaft creates a circular motion around the axis of the projectile during flight and thus reduces the precision of the shot (personal communication, H. Paulsen). With a sufficiently wide groove and mastic, this difficulty can be overcome (note 6), but for the Hamburgian we have no direct evidence of the use of resins. And since birch was present only in dwarf forms (Usinger, 1998), pine is the only tree that could have furnished resin, but in small quantities. Though we cannot exclude the use of glues made from animal materials, the objective of experiments conducted with H. Paulsen was to find an alternative hafting technique

that would allow us to rectify the profile of projectiles without the use of mastic. His proposition (fig. 14) was inspired by the Neolithic points found in the Olenij Ostrov cemetery in Lake Onega (fig. 15; Gurina, 1956; Taute, 1968). These points were mounted on bevelled bone foreshafts and correspond to the principle of single-bevelled bone points: the shoulder of the point is supported by the bevelled distal extremity of the shaft. A similar hafting type is known in the Saqqaq culture of Greenland for the mounting of bifacial points onto spears and arrow foreshafts (Grønnow, 1988, fig. 8, 10). In our case, the point was mounted on the shaft with a tendon ligature that becomes very rigid when dry. As the basal part of the point, sometimes inclined, was fixed onto the oblique face of the shaft, its apex was positioned in the axis of this latter or at least remained, from a lateral view, in the zone delimited by these edges. The variation of the thickness of the points at the shoulder also presented no problem. On the contrary, for the pieces with inverse retouch, only the edge touched the lateral part of the shaft, making the fixation of the point more unstable and the junction between the point and the shaft less solid.

With H. Paulsen, we tested the efficacy of this hafting method through experimental shots. Since the method of propulsion used with Hamburgian shouldered Points is unknown (see below), we chose to use a Holmegård type bow (Becker, 1945), which is the oldest type currently known and which has an estimated draw weight of 21 to 32 kg (Junkmanns, 2001). The arrow shafts were made from pine since this tree is attested in the region at the GI-1e (Usinger, 1998) and the oldest arrows known, found at Stellmoor (see below; Rust, 1943), were made from this wood. Eleven copies of the shouldered points from Poggenwisch (table 7) were manufactured and six of them were chosen to arm the arrows. The arrows were 79 cm long and 8 to 10 mm thick. The weight of the projectiles varied between 30 and 36 g (table 8). We





**fig. 13** : Propositions for the hafting of Hamburgian shouldered points. a: after Beckhoff 1967, fig. 4; b: after Lund, 1993, fig. 3.



used the simplest type of fletching known, consisting of three half feathers attached at their extremities (fig. 15), which is the system used by American Indians on the northwest coast (Miles, 1963).

The target was a piece of pork thorax around 4 cm thick and containing the ribs. The layer most exposed to the arrows consisted of pure fat; toward the interior of the thorax, there was a layer of meat with fat, then another layer of fat and the ribs. A difference relative to a living target was that the fat was less flexible. In order to avoid damaging the arrows that traversed the meat, the target was placed in front of an empty and open cardboard box so that its depth would protect the projectile heads (fig. 15). The shooting distance was 6 metres. The points traversed the target with no difficulty. When there was contact with bone, the point broke leaving the shaft undamaged (fig. 16). We believe that the frequency of breaks almost immediately below the shoulder is related to the solid ligature, in a manner similar to the observation of Plisson and Geneste (1989) that fractures just above the shoulder were due to the ligature. On the Teltwisch 1 points, this fracture type was produced five times, while it is absent on the points from Poggenwisch (present or illustrated by Rust). We can thus wonder if these points were hafted with a ligature as solid as that used at Teltwisch. Five pseudo-burins are also present at Teltwisch 1 and four at Poggenwisch.

Following the shots, the fragments of points n° 3 and 5 were recovered from the meat. In order to collect the small fragments of point n° 5 without damaging the ribs, the meat was boiled two times for one hour, 32 and 29 hours after the shots. A second post-shot operation was to remove the points from the shafts in order to document their state after use. It was sufficient to put the projectile tips in water for a few minutes, after which the tendon became soft again and could be easily removed.

This was of course just a first stage of experimentation, but these first results already show that this hafting method can be an effective alternative that limits

damage to the shaft. A second result is that, at least with this hafting method, tendon seems to be sufficient to attach the point to the shaft during the entire use of the projectile. We also observed that the asymmetry of the Hamburgian shouldered points did not have negative consequences for the penetration of the points into the target, even if the form of the perforation reflects the cutting edge and abrupt edge. Finally, we were able to confirm that the points could easily be replaced, even without the use of fire.

#### *Method of propulsion*

The question of the propulsion method used during the Hamburgian is related to the question of the appearance of the bow. The oldest known bows date to the Mesolithic and are classed as Holmegård types after the first discoveries in Scandinavia (Becker, 1945). The same types have also been found in northern Germany (Junkmanns, 2001; Stodiek & Paulsen, 1996) and as far as Russia (Burov, 1980: Vis I). The existence of bows starting in the Dryas III is attested by the approximately one hundred Ahrensburgian arrows discovered in the Stellmoor kettle in the Ahrensburg Valley (Rust, 1943). The fragments of pine wood found at the same site, which Rust interpreted as bow fragments, are more doubtful however, as is a fragment of pine wood found at Mannheim (D) and dated to the Magdalenian (Rosendahl *et al.*, 2006).

Unfortunately, no remains of arrow shafts, spears, bows or spearthrowers have been found in a Hamburgian context. The only evidence could be the two arrow smoothers found at the Havelte site of Luttenberg (NL; Stapert, 2005).

We must thus determine if it is possible to equip oneself with a bow in an environmental context of shrub tundra. A first solution could be to import one from the south, perhaps in the context of annual migrations. Pine was available locally, but is not well adapted to this use because it is not resistant to tractive force. A bow made from this material can be reinforced by tendons, as

<sup>6</sup> - According to Lund (1993, p. 409), even the points with a curved profile can be hafted if we first apply a little resin in the groove and then push the retouched edge into this resin.



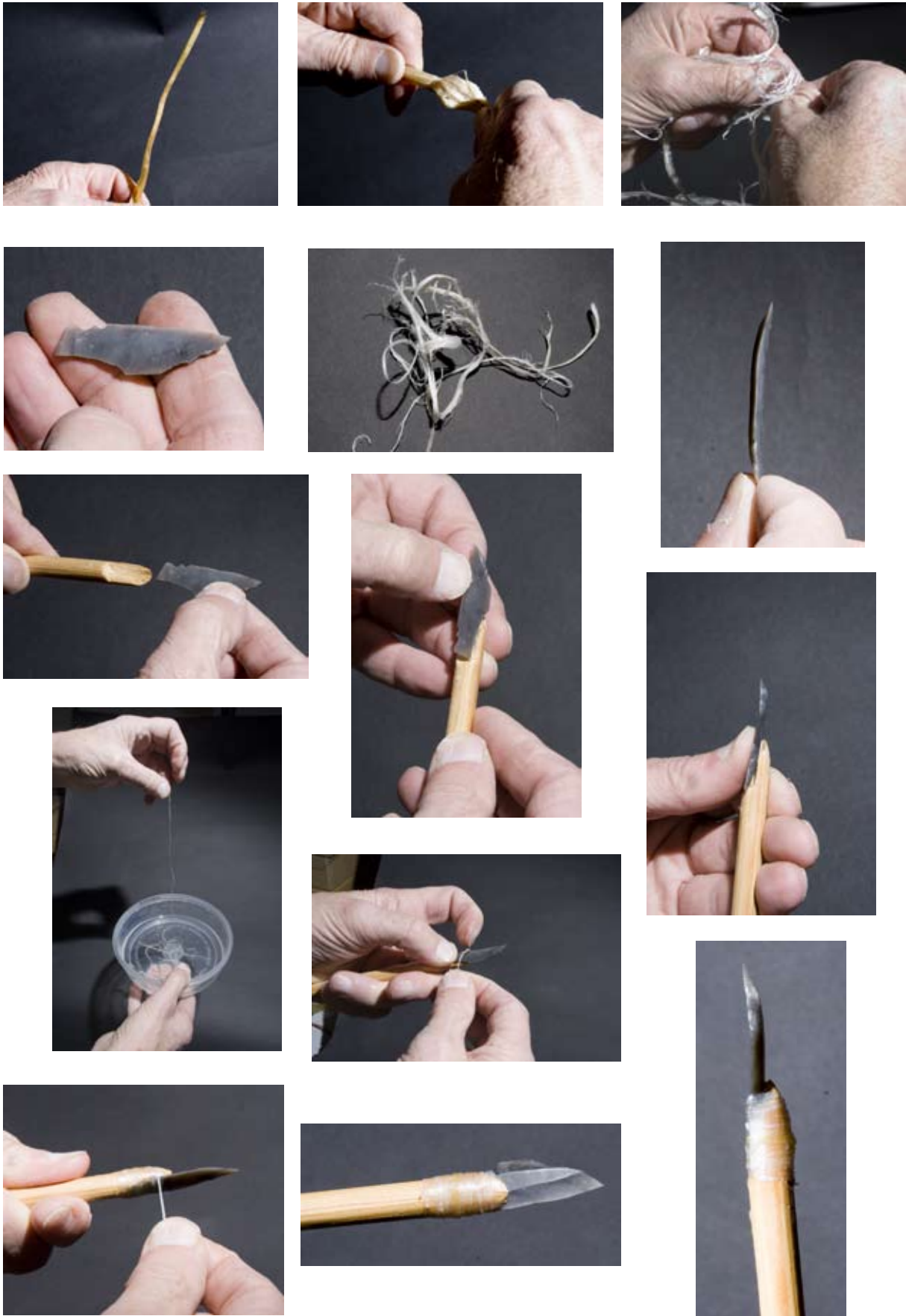


fig. 14 : New proposition for the hafting of Hamburgian shouldered points.



Pointe n°	Longueur (mm)	Largeur (mm)	Epaisseur (mm)	Poids (g)	Aménagement basal	Orientation	Profil
1	82,6	20,8	5,8	9,9	retouche directe	apex distal	apex incliné, torse
2	86,7	20,3	4,4	8,8	retouche directe	apex distal	apex incliné, torse
3	60,1	14,7	4,4	3,8	retouche directe plus troncature	apex distal	apex et base inclinés
4	54,6	17	3,8	3,6	retouche directe	apex distal	rectiligne
5	42,9	12,4	3,9	1,8	retouche directe bilatérale	apex proximal	rectiligne
6	41,4	11,9	3,6	1,9	retouche directe bilatérale	apex proximal	rectiligne, légèrement. torse
7	48,4	13,5	3	1,7	retouche directe	apex distal	légèrem. courbe
8	43,4	12,7	3,6	1,8	retouche directe bilatérale	apex proximal	légèrem. courbe
9	39,7	12,2	2,8	1,1	retouche directe	apex proximal	légèrem. courbe et torse
10	38,7	13,2	3,4	1,4	retouche directe	apex proximal	apex et base inclinés
11	39,8	13,3	3,7	1,6	retouche directe plus 2 coches directes	apex distal	base inclinée, torse

**tab. 7 :** Experimental shouldered points manufactured to imitate Hamburgian shouldered points, especially from Poggenwisch. The points marked in orange were used in the projectile experiments.

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Projectile	Armé par pointe n°	Poids (g)	Nb de tirs	Cause d'abandon	Type de fracture
a	3	33	3	fracture par heurt à os	apex distal: droite au-dessous cran: à lang., term. en gond, plus pseudo-burin
b	5	30	5	fracture par heurt à os	base d'apex: pseudo-burin 3/4 d'apex: pseudo-burin 4/4 d'apex: pseudo-burin moitié cran: à lang. > 2 mm
c	7	31	1	fracture par heurt à carton	au-dessous cran: à lang., term. en gond
d	8	34	1	séparation du fût	-
e	9	35	2	fracture par heurt à carton	au-dessous cran: à lang., term. en gond, plus pseudo-burin
f	11	36	1	fracture par heurt à mur	moitié apex: à lang., term. en marche au-dessous cran: à lang. > 2mm, term. en marche

**tab. 8 :** Characteristics of the projectiles used in the experimental shots and their utilisation during these experiments.



**fig. 15** : Projectile experiments with shouldered points hafted as proposed in figure 14: on the left, the base of an arrow, on the right, the construction used as a target. a: photo M.J. Weber. b: photo W. Lage.

are the bows of Inuits, which were also made from bone, horn and reindeer antler (Cattelain, 1997). We thus cannot exclude the use of bows during the Hamburgian. It is also possible that spearthrowers were used, but in different hunting contexts.

If we follow Rozoy's observation (1992) that weapon armatures weighing less than 10 g were used with arrows, as well as Cattelain's (1997) observation that the dimensions of ethnographic arrow and spear armatures overlap between 5 and 15 g, the shouldered points from Teltwisch 1 would more likely be arrowheads since all except one of them weigh less than 3 g (table 9). The dozen or so measurable pieces from Poggenwisch fall within the same range. Ethnographic studies show, however, that we must be cautious since spears can also be armed with light points (Cattelain, 1997). Furthermore, various experiments (e.g. Browne, 1940) have shown that most projectile points can be used in both ways (Knecht, 1997).

In general, hunting with a spearthrower is associated with driving (Rozoy, 1992), while bow hunting is associated with the ambushing strategy. Ethnographic examples, however, show that these associations are not valid in every case (Cattelain, 1997). One example is that of the Inuits of the Bering Strait (Cattelain, 1997) who hunt reindeer herds with a bow an arrow and only two hunters. The combination of bow hunting and an attacked herd has an archaeological correlate in the Ahrensburgian occupation of Stellmoor (Rust 1943); a mass kill

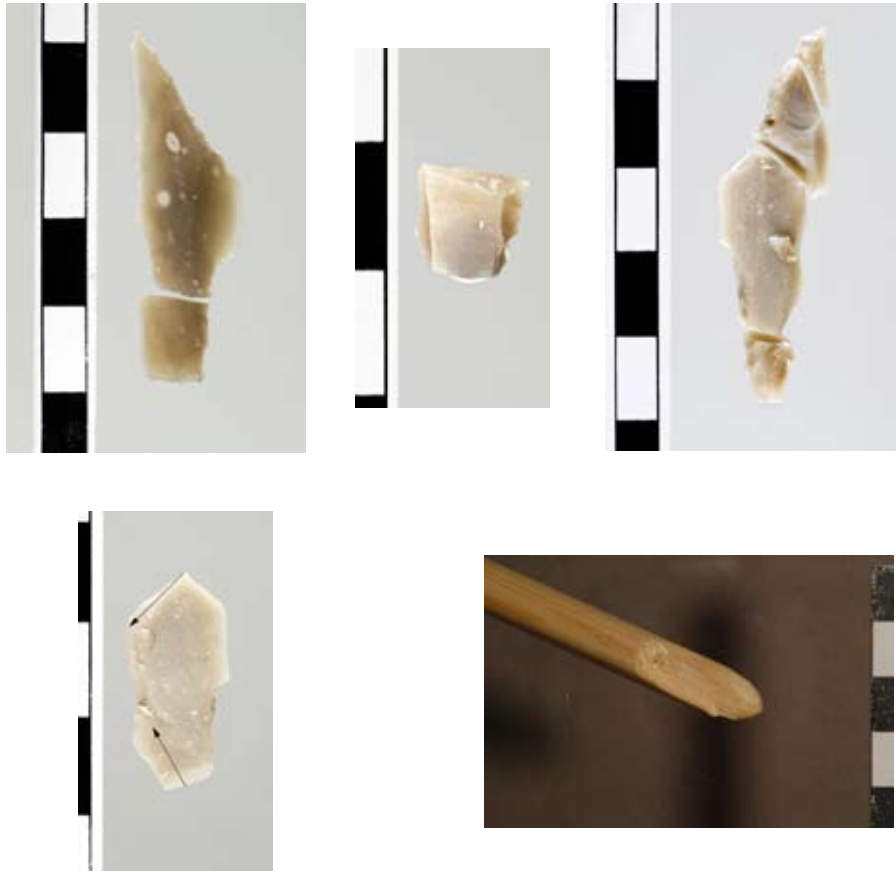
was proposed due to the large number of carcasses found in the kettle and the results of an analysis of the projection angles indicating that the hunters attacked the reindeer from all sides (Bratlund, 1994; Grønnow, 1985). On the contrary, for the Hamburgian of the same site, ambush hunting was proposed based on projection angles that came only from behind and directly on the side.

Another approach to understanding the propulsion method would be to compare Hamburgian shouldered points with Ahrensburgian points, which are indisputably arrowheads (Rust 1943).

### Comparisons with Magdalenian lithic projectile points in the Paris Basin

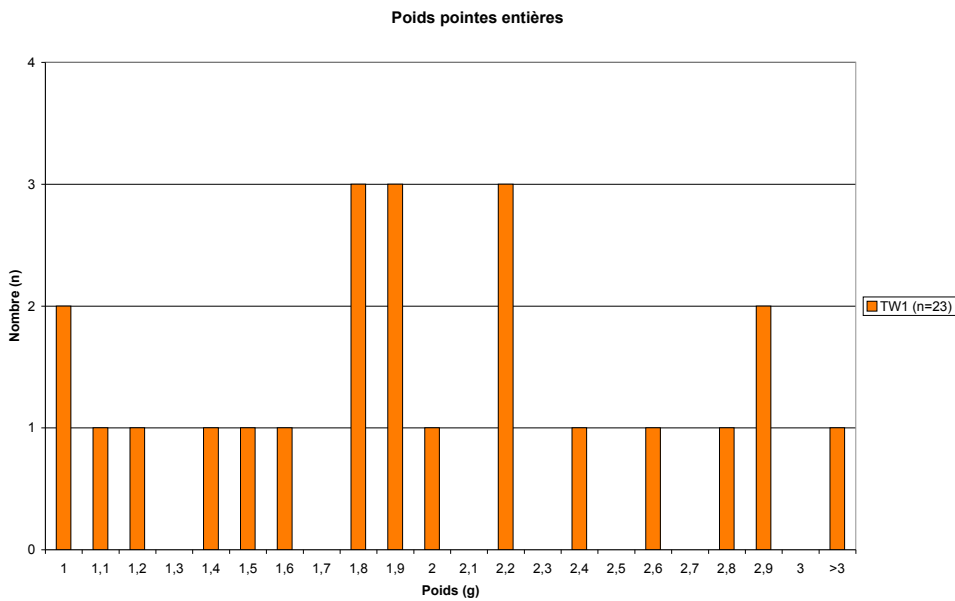
Burdukiewicz and Schmider (2000) have already compared Magdalenian shouldered points from the Paris Basin to Hamburgian shouldered points from the Oder Basin. The dimensions of the points from Poggenwisch and Teltwisch 1 correspond well to those of the Paris Basin; their lengths and thickness are even closer to those of the Magdalenian than they are to the Hamburgian points of Poland. However, if we include the points from Tureau des Gardes locus 7, we see that they are wider and thicker than our Hamburgian points. In terms of profile rectitude, 70% of the points from the Oder Basin are curved while most of the points from the Ahrensburg Valley have only one or two inclined extremities. Those from the Paris Basin are also mostly rectilinear in profile (Burdukiewicz & Schmider, 2000). Another similarity between the Paris Basin and northern





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**fig. 16** : The two points (above: n° 3; middle: n° 5) that impacted bone during the experiments and the shaft of point n° 3 after use. Point n° 3 has a fracture with a prolongation (lip) with a hinge termination; the mesial fragment of point n° 5 has a pseudo-burin removal on its ventral face toward the apex and on its base a fracture with a prolongation >2mm long and a termination type that could not be determined. a-d: © Archäologisches Landesmuseum Schleswig-Holstein. e: photo M.J. Weber.



**tab. 9** : Distribution of the weights of the whole or almost whole shouldered points from Teltwisch.

Germany is the dominance of cores with two striking platforms from which the blade-blanks were produced. The use of a soft stone hammer is also very common in the three regions.

On the other hand, a clear difference between the fabrication of Hamburgian points and Magdalenian points of the Paris Basin lies in the use of the microburin technique in the first tradition and its absence in the latter (Burdukiewicz & Schmider, 2000). This absence might be explained by the fact that during the Magdalenian it was not necessary to remove the proximal part from the longer point blade-blanks in order to transform them into points.

### Conclusions

The shouldered points of the two Hamburgian sites in the Ahrensburg Valley presented here have many elements in common, including the profile, blank fabrication methods, retouch and use of the microburin technique. Meanwhile, the Poggenwisch assemblage, though it is smaller, appears more homogeneous in terms of the morphology and proportions of points. For the moment, we have no explanation for this difference.

Two other non resolved questions concern the hafting and propulsion methods employed. To obtain additional elements of response, it would be useful to enlarge our projectile experiments to include lateral hafting, spears, other distances, other targets, etc.

Finally, a comparison with Magdalenian points from the Paris Basin shows similarities in the fabrication of blanks and—in part a consequence—their dimensions and profile. However, it appears that the second stage of the production sequence, which is the transformation of the blank into a point, is not completely identical. An example is the use of the microburin technique, which is a common element even between Hamburgian points that are otherwise different, such as those from northern Germany and from Poland. These observations, concerning different traditions, could be explained by their occurrence within the same time span or comparable living conditions during the Tardiglacial period.

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# SAUVETERRIAN MICROLITHS : EVIDENCE OF THE HUNTING WEAPONS OF THE LAST HUNTER-GATHERERS OF THE NORTHERN ALPS

Lorène CHESNAUX

## Abstract

In this paper, I present interpretations of the stigmata of fabrication (observation of retouch methods) and use (observation of impact traces and hafting glue residues) of microliths and hyper-microliths (arrowheads) of the Middle Mesolithic Sauveterrian period. Based on the first results obtained from the sites of Grande Rivoire, Pas de la Charmate (Vercors, Isère) and Sinard (Trièves, Isère), a reconstruction of the hafting modes of these tools is proposed. The results of a first experimental test are also presented.

**Key-words :** Mesolithic, typology, hunting, experimentation, weapon elements, usewear analysis, hafting

## Introduction

The Middle Mesolithic Sauveterrian of southern France is characterized by the great morphological variability of its microliths (Sauveterrian points, different types of scalene and isosceles triangles and segments) and their very small size.

The function of microliths has long been a topic of speculation. J.-G. Rozoy (1978) summarizes the different hypotheses that have been put forward: tools for tattooing, for engraving, to pull snails out of their shell, to pierce skins, etc. Meanwhile, as early as the 19<sup>th</sup> century, several authors proposed the hypothesis that they functioned as arrowheads (Mortillet, 1896). The debates were later greatly enriched by numerous ethnographic examples (Vayson de Pradene, 1936).

All of the other hypotheses were refuted by several discoveries of hafted microliths, such as the famous Loshult arrow found in a peat bog in Sweden (Rozoy, 1978). A few other microliths were found embedded in human and animal bones (Odell, 1978; Nuzhnyj, 1989), including the elongated scalene with a small short side implanted in a human vertebra in Burial 8 at Téviec (Péquart, 1937, cited in Rozoy, 1978).

In addition, several projectile experiments (in particular that realized with Sauveterrian microliths by S. Pilibert, 2002) have shown that the impact traces observed on experimental microliths are similar to those observed on archaeological ones.

It is thus now generally accepted that these tools were used to as elements of composite projectile weapons. Meanwhile, there is no relationship between the traditional typological characterization of these tools (classification according to their form and dimensions; GEEM, 1969; Valdeyron, 1991) and their real functional role.

Through an interpretation of the forms of these microliths relative to their function (identification of the active parts such as the point and/or edge), based on a technological and traceological analysis (observation of the retouch methods indicative of intended uses; comparison of archaeological use traces with experimental impact fractures), I have been able to reconstruct assemblages of projectile elements that

could have been used on the same arrow shaft. I will thus first review the typological criteria used for the classification of these projectile elements.

This study was conducted on a collection of Early Sauveterrian and Late Sauveterrian microliths from the sites of Grande Rivoire (Sassenage, Isère - Vercors), Sinard (Isère - Trièves) and Pas de la Charmate (Châtelus, Isère -Vercors).

In the summer of 2006, projectile experiments were realized in order to test hypotheses concerning the reconstruction of Sauveterrian arrows (proposed in my DEA thesis and presented below), to constitute an experimental reference base and to evaluate the efficacy of these weapons.

## Geographic context (figure 1) and study collection (tables 1 and 2)

The collection studied is composed of microliths from levels C2a and C2b of Pas de la Charmate (Bintz, 1990; Bintz, 1992), from the deep test trenches in the Middle Mesolithic levels (horizons D and C) of Grande Rivoire (excavation in progress: Picavet, 1991; Nicod & Picavet, 2003; Nicod *et al.*, 2003) and part of the assemblage from the Late Sauveterrian level of Sinard (Pelletier *et al.*, 2004).

The Grande Rivoire rock shelter is located on the northern slope of the Vercors massif (560 m altitude) in the commune of Sassenage (Isère). The site has a full southern exposure and is situated at the base of a Senonian limestone escarpment, extending into a steep talus slope. The Furon River runs below.

Levels D and C, attributed to the Middle Mesolithic, are dated to 7974-7554 BC and 7467-7056 BC respectively (LY 5434: 8740 ± 106 BP and LY 5433: 8278 ± 80 BP). The microlith collection from these levels is limited (table 1: 1 Sauveterrian point, 2 segments, 2 points-barbs (c.f. below) and 14 scalene and isosceles triangles) since it originates from test trenches covering a surface of only 2.5 m<sup>2</sup>. This current collection thus represents only a sample of the total assemblage that these levels will yield during future excavations.



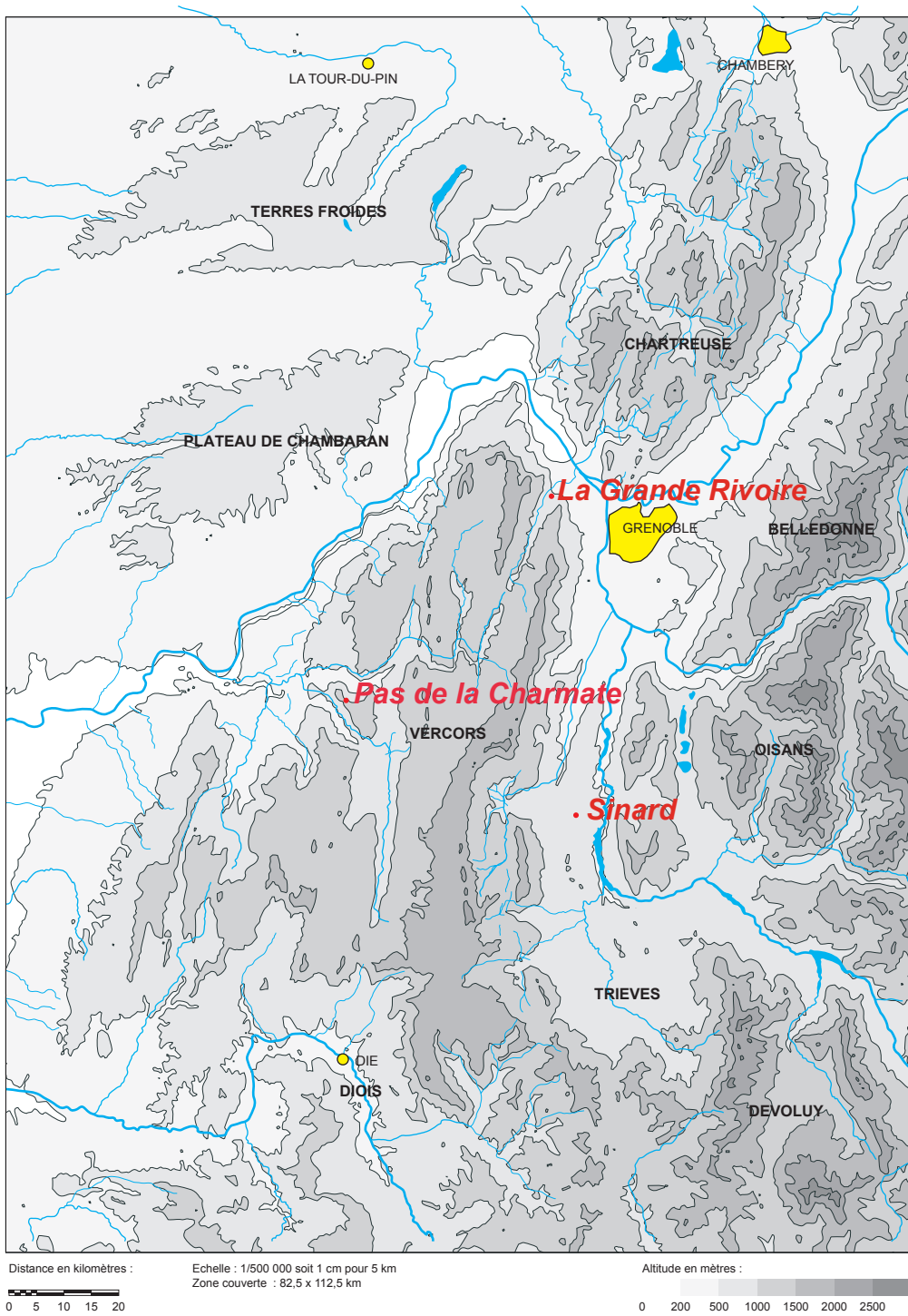


fig. 1 : Map of the northern Alps (after C. Bernard, AVDPA).



	Sauveterrian points	Point-barbs	Segments	Triangles
<i>Level C</i>	0	0	0	5
<i>Level D</i>	1	2	2	9
<i>Total</i>	1	2	2	14

tab. 1 : Number of microliths studied by type in levels C and D of Grande Rivoire.

The open-air site of Sinard (Isère, 830 m altitude) was discovered during preventive archaeology operations. “The geographic context is that of the Drac plateau, which extends through the Trièves Valley. The course of the Drac in this region follows the axis of the alpine trough and marks the limit between the external crystalline massif of Tailler and the subalpine sedimentary limestone massif of Vercors” (Pelletier *et al.*, 2004, p. 604).

Within the microlith assemblage (scalene triangles and Sauveterrian Points) attributed to the late phase of the Middle Mesolithic, I selected 60 whole or almost whole scalene triangles. I did not include the highly fragmented microliths, whose function is more difficult to determine. I will later conduct a detailed analysis of these fragmented pieces since they can contribute significant information, especially in terms of site function (Chadelle *et al.*, 1991).

The Pas de la Charmate rock shelter (Isère, 1100 m altitude) “is located at the western extremity of the Allier Plateau and marks the passage between the Petite and Grande Cornouze” (Bintz, 1992, p. 2). The site is situated near a path leading to the Vercors plateau and near a permanent water source.

The microlith collection studied originates from a homogeneous sedimentary level (C2) excavated by successive horizontal layers and later divided into two assemblages: C2a and C2b (respectively attributed to the recent and early phases of the Middle Mesolithic Sauveterrian).

This level has been dated to 7888-6474 BC and 7300-

6821 BC (Ly-4204 : 8240 ± 260 BP; Ly-5662 : 8100 ± 100 BP).

The collection is composed of 44 Sauveterrian Points, 52 point-barbs (cf. below), 246 segments, 298 scalene triangles and 11 isosceles triangles (table 2; analysis in progress).

### Preliminary remarks

It is important to note that the homogeneity of these microlith assemblages may be disturbed by a possible mixing of occupation levels. My study of these assemblages thus remains purely functional.

A global study of these artefacts, integrating raw material procurement and production strategies, is in progress in collaboration with David Pelletier. Following these studies, we will be able to propose a chronology of the arrowheads used by these Mesolithic groups.

### A new typology

The typology presented here is based on the criteria of presence or absence of certain active parts. In the case of projectile weapon elements, a distal point is necessary to pierce and penetrate into the flesh of the animal and a sharp edge, associated or not with a proximal point, is needed to cut and tear the flesh (in a flesh piercing system).

In the collection studied, I detected these two functional types, the former represented by Sauveterrian Points and point-barbs (scalene triangles), and the latter by isosceles and scalene triangles, as well as segments.

I was able to re-evaluate the criteria for the determination of a type through both the observation

	Sauveterrian points	Point-barbs	Segments	triangles
<i>Pas de la Charmate</i>	44	52	246	298
<i>Grande Rivoire</i>	1	2	2	14
<i>Sinard</i>	0	0	0	60
<i>Total</i>	45	54	248	372

tab. 2 : Number of microliths studied by type from Grande Rivoire, Pas de la Charmate and Sinard.

of discrete initial shaping actions attesting to precise utilisation intentions and to the recording of possible traces of ballistic damage on the active parts (Christensen and Valentin, 2004).

I was thus able to reconstruct plausible hafting systems for each microlith type.

For the moment, however, this typology remains a working hypothesis. Through experimentation, I will be able to confirm or reject the pertinence of these functional types.

#### *Axial points*

##### - Sauveterrian Points

The typological denomination of these objects is unequivocal. This type of microlith is formed by invasive, abrupt retouch on both edges (Christensen & Valentin, 2004), which meets to form a sharp distal point.

Usewear analysis of 44 Sauveterrian points from Pas de la Charmate revealed that one third of them have traces characteristic of use as an axial projectile element (bending fracture with a feather, step or hinge termination, sometimes associated with secondary spin-off fractures, according to the fracture types described by Fischer *et al.*, 1984) (figure 2a). The other third have smooth (Philibert, 2002), or “snap terminating bending fractures” according to Fisher *et al.*, whose origins can be diverse (damage from use or taphonomic processes). No traces were observed on the other microliths.

##### - Point-barbs

The objects that have already been called point-barbs (Philibert, 2002) correspond to the type “scalene triangle with a small short side” in the GEEM typology (1972).

Their general tapering form creates a large, sharp point and a rather long cutting edge (the third side), terminating at the other extremity with a small point projecting parallel to the axis of the piece.

The abrupt edge retouch, which forms the back of the tool, is progressively more intensive from the base to the large point. This results in a slightly oblique back and clearly accentuates the sharpness of the large point. The base is formed by a concave truncation that delineates a small, sharp point directed in the direction opposite that of the large point (figure 2b).

This tool was thus conceived to obtain a piercing distal point and a proximal flesh tearing point, associated with a long cutting edge.

Its use as an arrowhead has been confirmed, in proportions similar to those of Sauveterrian Points, by the presence of bending fractures on the distal extremity, which are diagnostic of a frontal impact (figure 2b).

#### *Barbs*

##### - Scalene and isosceles triangles

I identified 298 triangles in levels C2a and C2b of Pas de la Charmate, 60 in the Sinard assemblage and 14 in levels C and D of Grande Rivoire. Their dimensions are detailed in table 3.

All of these microliths are particular in that they have a non pointed distal end. The large point of the scalene triangles often corresponds to a small transverse zone constituted either by the butt of the original blank, by its hinged distal part, or by a portion of vestigial cortex. The back of the tool is formed by abrupt, rectilinear retouch. The base is formed by a straight or concave truncation that is always oblique. The obliqueness or concavity of the truncation allows the formation of the small point (figures 3a and 3b). The acuity of the small point is sometimes accentuated by a slight scraping-retouch of the proximal part of the sharp edge of the piece (or even by abrupt retouch of the edge: figure 3c). All of these modifications seem to have had the objective of creating this narrow point, which forms a protuberance toward the exterior, while preserving a sufficiently long cutting edge (figure 3d). This sharp edge and the narrow point would thus be the only flesh tearing parts of these weapon elements. We can thus imagine that these triangles were hafted as barbs with their backed edge glued against the weapon shaft.

##### - Segments

I identified 246 segments in levels C2a and C2b of Pas de la Charmate and 2 in level D of Grande Rivoire.

They have the same dimensional characteristics as the triangles, except that they are thicker (table 3). These objects are formed by curved, abrupt retouching



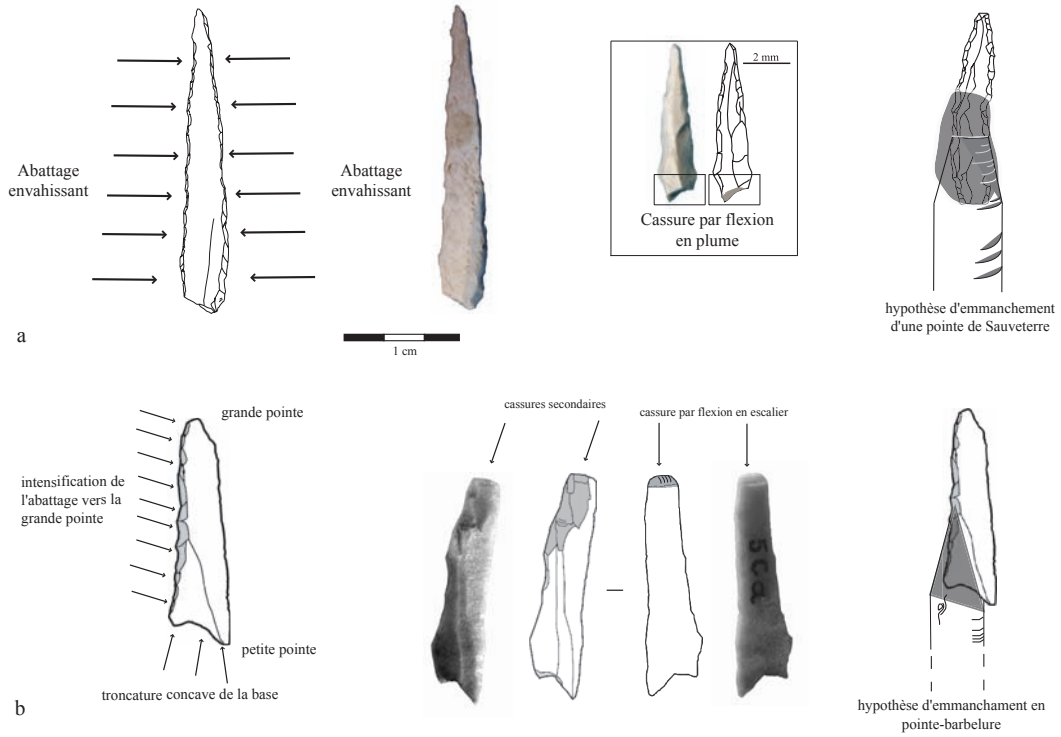


fig. 2 : Characteristics of axial points. a: Sauveterrian point; b: point-barb.

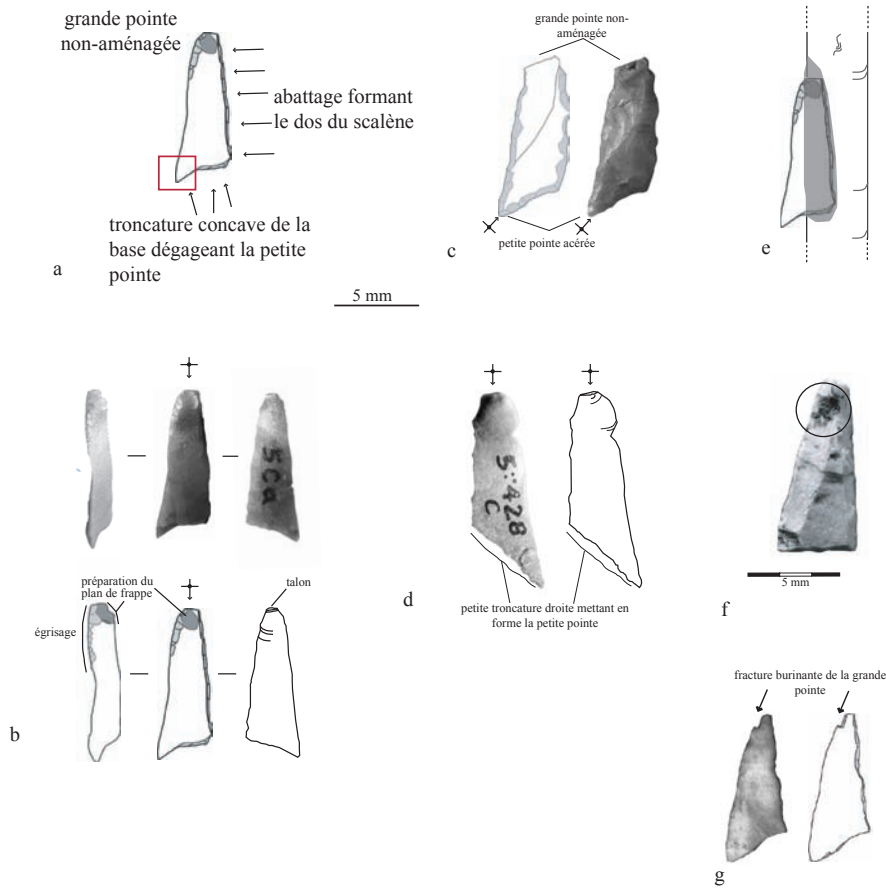


fig. 3 : a, b, c and d: retouch methods of triangles; e: Hafting hypothesis; f: Probable fossil remains of the adhesive; g: Example of a burin-like fracture on the distal part of a weapon element.



along one edge, which creates a point at each extremity. The opposite edge is either left unretouched, or slightly retouched by scraping (Pelegrin, 2004), or backed by semi-abrupt retouch.

The acuity of the two points is always accentuated by a curving of the abrupt retouch toward the point and/or by light, semi-abrupt retouch of the opposite edge at the location of the point (figures 4a and 4b).

As with the triangles described above, these sometimes inconspicuous actions reveal the objective to form a point associated with a sharp edge.

These segments could thus have been used as barbs with the distal part of the truncation glued against the weapon shaft (figure 4c).

#### - Use traces on barbs

The origin of the fractures of the barbs can be difficult to determine since they are often simple snap fractures, which are not diagnostic of use as a projectile weapon element.

Only six barbs (four triangles and two segments) present a diagnostic bending fracture with a lip on their small point (figure 5). Burin-like fractures are visible on the small or large points of eight barbs (figure 3g). These traces could be the result of a secondary shock at the moment of impact.

Microscopic analysis (maximum magnification 200x) revealed no impact striations on these barbs.

Meanwhile, the presence of more or less discrete black spots on the barbs is likely evidence of their hafting. These spots, whose analysis is in progress, could be fossil residues of the hafting adhesive.

#### - Summary

Segments and triangles have the same active parts and similar dimensions. It thus appears that they had an identical function.

The width of the barbs, in contrast to their length, varies little. Whether they are “short” or “long”, they are never less than 3.5 mm wide. This width could correspond to a threshold of flesh cutting efficacy (figure 6).

Meanwhile, segments and triangles do not seem to have been made from the same blank types. First, the average thickness of segments (2.1 mm) is greater than that of triangles (1.2 mm). And second, segment blanks were fragmented by the microburin technique (remains of a trihedral point on the extremity opposite the flesh cutting point of the object: figure 7), while no triangles show evidence of fracturation before retouching.

We have thus revealed two different traditions for the fabrication of projectile weapon elements, which are either diachronic, or synchronic but representative of different techno-economic behaviours.

## Experimentation

### *Two hypotheses for the assemblage of weapon elements*

It was first necessary to reconstruct a hafting system based on the functional hypotheses for each weapon element type. These assemblage methods are of course hypothetical since we cannot confirm the contemporaneity of the different microlith types (cf. above).

	<b>Length (mm)</b>	<b>Width (mm)</b>	<b>Thickness (mm)</b>
<b><i>Sauveterrian points</i></b>	20-25	2-4.5	2-avr
<b><i>Point-barbs</i></b>	20-24	4.5-5.5	2-mars
<b><i>triangles</i></b>	mai-18	3.5-5	0.9-2.5
<b><i>Segments</i></b>	mai-17	3.5-5	1.5-2.5

tab. 3 : Dimensions of the microliths studied.



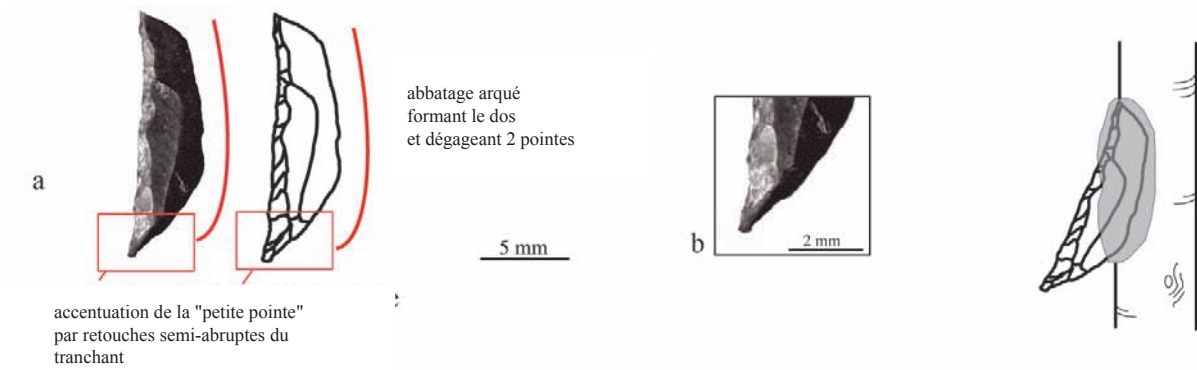


fig. 4 : a : Retouch method of segments; b: Close-up of the small point of a segment; c: Hafting hypothesis.

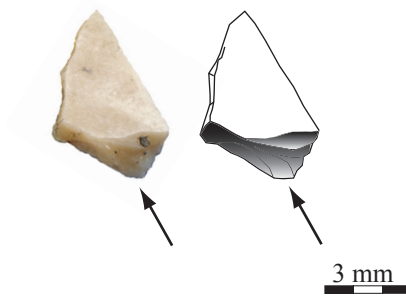


fig. 5 : Bending fracture with a hinge termination on the proximal part of a segment.

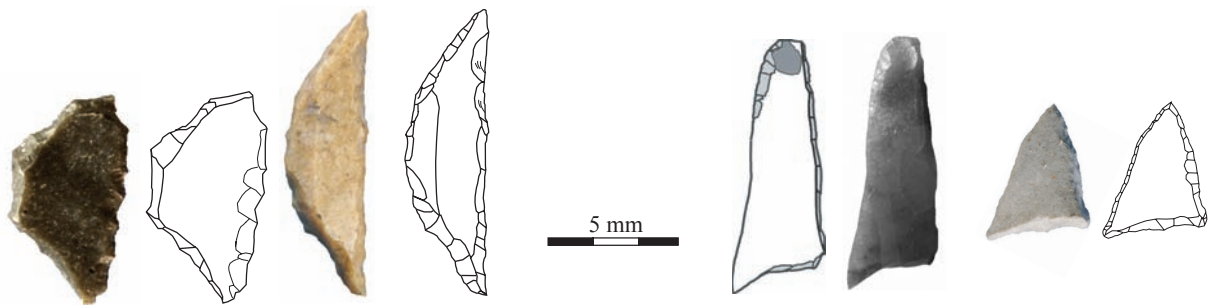


fig. 6 : Segments and triangles.

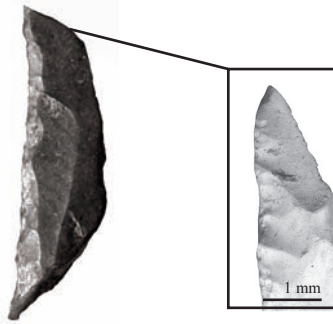


fig. 7 : Trihedral point visible on the distal part of a segment.

Two functional types were identified within the study collection: distal points and cutting edges associated with a proximal point. Each is associated with two weapon element types: points (Sauveterrian Points and point-barbs) and barbs (triangles and segments).

To compare the ballistic functioning of triangles and segments, two types of hypothetical arrows were tested. The first was composed of a Sauveterrian point and four scalene triangles, and the second of a Sauveterrian point and four segments (fig. 8).

We placed a short barb (length of experimental pieces between 5 mm and 11 mm) in front of a longer barb (length of experimental pieces between 12 mm and 18 mm) in order to facilitate penetration.

We did not integrate point-barbs into our haft settings in the interest of varying only one parameter at a time (here the nature of the barbs used in the composition of arrows). We will test these weapon elements in a future experimental session.

#### *Assembly*

The points and barbs were inserted in notches made in the shaft and glued with an adhesive composed of vegetal resin and beeswax. The points were ligatured at the base in order to insure the solidity of the distal part of the arrow.

The cedar arrow shafts were feathered with three half-feathers, 10 cm long. The arrows measured 80 cm long and 0.8 cm in diameter.

Forty arrows were assembled according to this system (20 with scalene triangles and 20 with segments: figure 8).

#### *Experimental procedure*

##### - The shots

Our target was a wild boar (animal represented in the Sauveterrian assemblages of Grande Rivoire and Pas de la Charmate) killed two hours before the first experimental shot.

The 40 arrows were shot into the 75 kg animal from a distance of 15 metres with a 45 lb simple longbow.

The archer shot 32 arrows into the whole left side of the animal and 8 into the ground (figure 9a, 9b and 9c).

All of the shots were realized by the same archer and took around 20 minutes to accomplish.

##### - Recovery of the arrows, lithic elements, and butchering of the animal

It was impossible to pull the arrows out of the animal by hand. We thus cut a space around each arrow with steel knife blade (cf. figure 9d).

The anatomical position of each arrow was precisely described in collaboration with L. Chaix. The weapon elements and fragments of them, still attached to the shaft or not, were recovered.

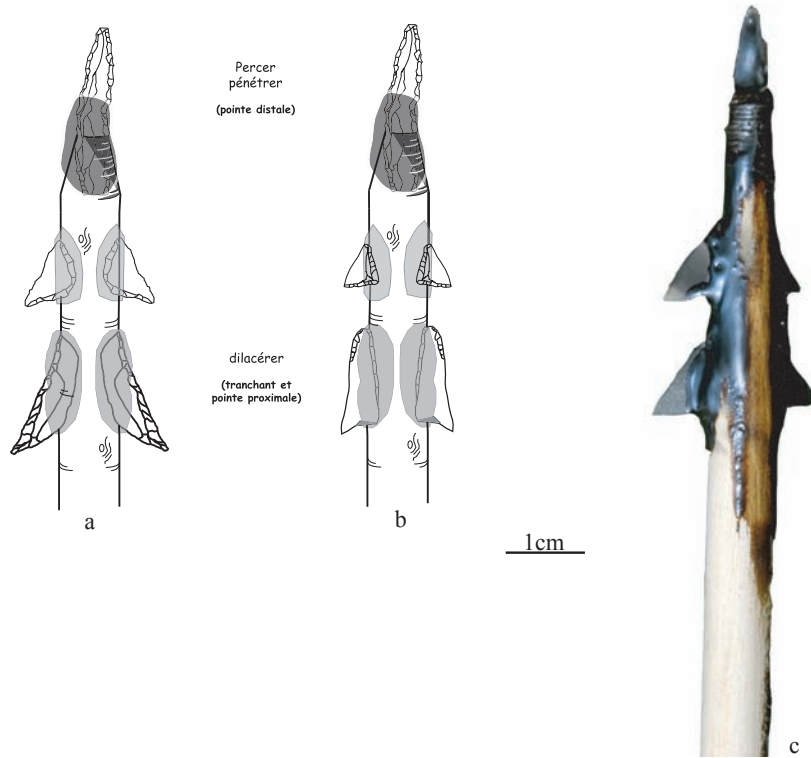
After extracting the 32 projectiles from the animal, it was butchered and its bones were recovered in order to observe possible impact traces (study in progress by L. Chaix).

Finally, the meat was cut, prepared and consumed, and microliths or fragments were found and recovered during these activities.

##### - The experimental reference base

After cleaning the lithic weapon elements with acetone and alcohol, we observed them with a low power microscope and with a metallographic microscope (maximum magnification of 200x) in order to detect all use traces.





**fig. 8** : Experimental reconstruction of two arrow types. a: Assembly of a Sauveterrian point and 4 segments as barbs; b: Assembly of a Sauveterrian point and 4 triangles as barbs; c: Photo of a type “a” arrow before use (photo C. Bernard).

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**fig. 9** : Different stages of experimentation. a, b, and c: arrow shots; d: extraction of the arrows from the wild boar; e: segment that migrated to the surface of the animal during penetration. (Photos C. Bernard)

Twenty-nine Sauveterrian points (nearly 75% of the total sample) were broken in 2 or 3 fragments. The fractures occurred in the location of the ligature and/or at the distal extremity. They were caused by a bending force produced during penetration into the animal. They are smooth (snap fractures) or fractures with a lip with a hinge or feather termination (figure 10).

Only two large segments show impact damage on the proximal point, one with a smooth, snap fracture (figure 11b), and the other with a fracture with a hinge termination (figure 11a).

One large triangle and one large segment have edge damage (figure 12).

High power microscopic observation of all the barbs recovered did not reveal any impact traces such as hafting polish or striations (all the lithic elements were almost entirely covered with the hafting adhesive).

#### *Behaviour of the arrows and lithic elements at impact*

The arrows of both assemblage types had different penetration depths according to the zones of the animal into which they were shot. The arrows that perforated the rib cage penetrated to an average depth of 14 cm, while the others (shot into the backbone, for example) penetrated to an average depth of 9 cm.

Twenty-nine barbs (13 segments and 16 triangles), found on the ground, were detached at the moment of impact and thus did not penetrate into the animal.

Forty-six barbs (25 segments and 21 triangles), found during the butchery and consumption of the meat, were detached during the penetration of the arrow into the animal (figure 9e: segment that migrated to the surface of the skin of the animal after it penetrated it and was detached from the haft). Others migrated deep into the muscles (distance not recorded).

Five distal extremities of Sauveterrian points were also found during butchery and consumption.

Forty-three barbs (26 triangles and 17 segments) remained hafted to the shaft after use (figure 11b).

Forty-two barbs were not found. It is possible that they were lost on the ground or in the viscera of the animal.

#### *Summary*

First, the impact traces created on our experimental weapon elements resemble the traces observed on the archaeological microliths and hypermicroliths.

We also remarked a near absence of traces on the experimental barbs. Therefore, the “snap fractures” and edge “chippings” observed on the archaeological pieces could have a taphonomic origin.

Second, we found that the functioning of segments and triangles used as barbs is identical for this projection method.

It is also interesting to note that some barbs were detached inside the animal, thus augmenting their flesh tearing efficacy.

Could the multiplication of barbs, their occurrence and penetration capacity in the flesh, thus resulting in a significant cutting and tearing of muscles, render these arrow systems lethal? Or did these barbs serve simply as a support for a toxic substance prepared and applied by the Mesolithic hunters. They would thus have the role of inoculating a poison through contact with the numerous blood vessels traversed during their course through the animal (Rozoy, 1978, p.1050; Philibert, 2002, p.133; Surmely, 2006).

This question of course remains unanswered...

#### **Conclusions**

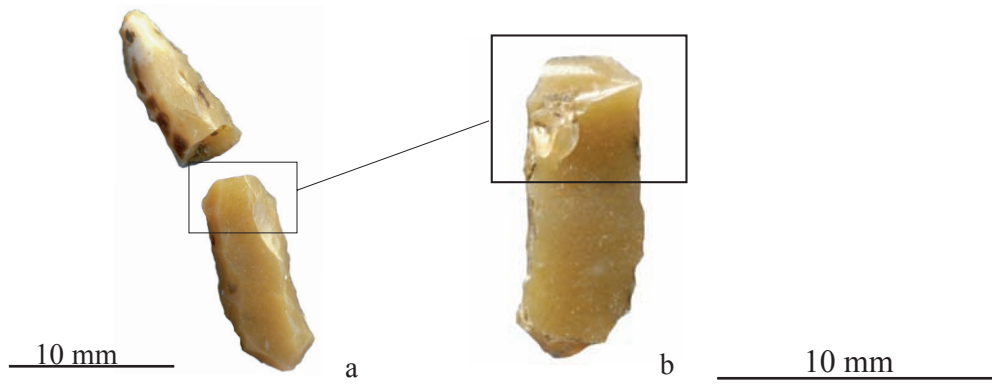
This double approach of identifying the retouch methods used to create the active parts of a tool and observing the impact traces present on them has enabled us to propose a functional typology of Sauveterrian microliths from three sites in the northern Alps.

A procedure associating experimentation (fabrication and use) and observations of the archaeological material has proven to be essential in order to restrict the range of possible functions of this object type (hypermicrolithic projectile weapon elements).

I thus attempted to test the efficacy of the arrow systems that I reconstructed.

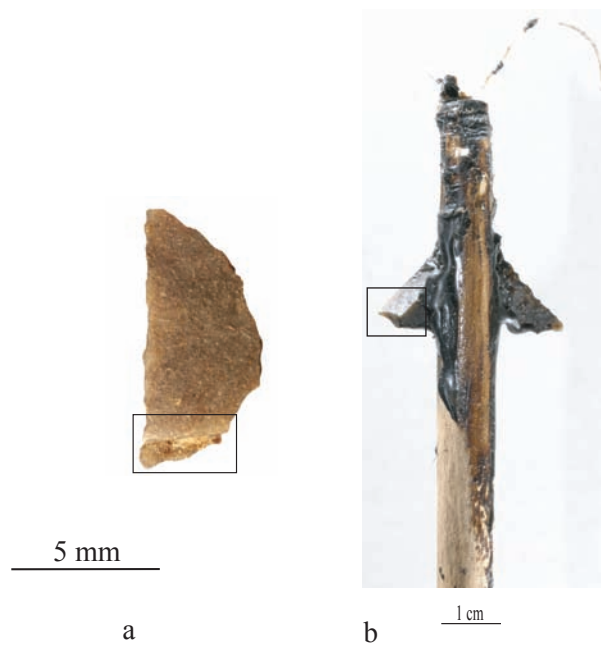
The experimentation team observed that the arrows do not penetrate deeply into the animal, but that the barbs detach from the arrow shaft and tear through the flesh



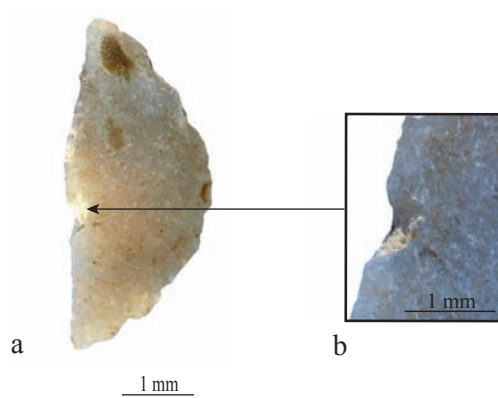


**fig. 10** : Bending fracture with a feather termination of an experimental Sauveterrian point. a: Upper face of the distal and proximal parts; b: Lower face of the proximal part with secondary fractures.

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**fig. 11** : a: Bending fracture with a hinge termination on the small point of an experimental segment; b: Experimental arrow after use and smooth bending fracture (snap fracture) of the small point of a segment still attached to the shaft.



as they penetrate deeply (we unfortunately have no quantitative data on this point).

We were somewhat surprised by the behaviour of these barbs during the penetration of the arrow into the animal. For this reason we will pay special attention in future experiments to the manner in which they are attached to the weapon shaft. We will test an adhesive of birch pitch to attach the microliths and observe whether there is a modification of the functioning of the arrows during penetration (evaluation of the resistance of the adhesive and observation of a possible variation of the types and quantity of damage affecting the weapon elements after use).

We have shown that a double approach, associating functional and experimental analyses, is necessary. Meanwhile, it is now evident that a global study of Sauveterrian weapon elements (production strategies, microlith economy) is also necessary. This will contribute information concerning the distinction between the two barb types—segments and triangles—identified within the same sedimentary level.

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# EXPERIMENTAL OBSERVATIONS OF EARLY MESOLITHIC POINTS IN NORTH-EAST ITALY

Stefano GRIMALDI

## Abstract

We present an analysis of Sauveterrian microlithic backed points from sites located in the Trentino region of the north-eastern Italian Alps: Pradestel, Lago delle Buse & Colbricon. Experimental arrows were produced, hafted and shot into an animal target. The results of this study indicate that these points may have been “ineffective” for the hunting of medium to large-sized prey, such as ibex, red deer, bear, or wild boar. We propose that Sauveterrian microliths can rather be correlated with the hunting of small forest prey such as roe deer, marmot and other animals with thick fur. An alternative hypothesis for the hunting of large game is also proposed.

**Key-words :** Sauveterrian, Backed points, Hunting, Experimental archaeology, Italy, Mesolithic.

## Introduction

In this paper, we present a study of different aspects of microlithic points with retouch on one or two edges (fig. 1), characteristic of the Sauveterrian (Early Mesolithic) period in north-east Ital.: Some authors (e.g., Broglio & Kozłowski, 1984:112) class these tools, as well as other microliths such as geometric and backed and truncated pieces, in the category of weapon elements. This category is generally correlated with projectile weapons, or more precisely, due to their small dimensions, with arrowheads used essentially in hunting activities.

From a technological point of view, there are several possible manners of hafting these tools onto arrows consisting of simple or composite shafts usually made from wood: as a point, as a point accompanied by laterally positioned geometrics, with a geometric used as a point, with several geometrics used as points and lateral elements. These hypotheses are supported by the discovery of a few nearly whole arrows in humid contexts in northern, central Europe, which were hafted in some of these ways (e.g., Clark, 1963 & 1975; Bergman, 1993) (fig. 2).

All of these data lead to the conclusion that microliths were used as arrow armatures. We must also remember, however, that functional analyses of geometrics have also shown that this tool type could have been used in other types of daily subsistence activities (e.g., the functional analyses of quartz objects in Pignat & Plisson, 2000).

The question that we asked is whether it is possible that such small arrowheads, backed on one or two sides, could be used to kill medium to large-sized prey such as red deer, ibex or wild boar, all characterized by a powerful musculature and a thick, hard skin. We thus decided to collect information concerning the behaviour of arrows at the moment of impact and penetration into the body of an animal. We consulted the experience of modern bow and arrow hunters, who are very numerous and well organized over the entire world. Magazines and specialized journals on the subject provided us with

a large amount of practical and technical information. Another particularly interesting source was the essay by Pope, an avid bow hunter during the 1920's (Pope, 1923). Pope had the extraordinary opportunity to spend extensive time with Ishi, a Native American who was the last survivor of the Yahi tribe. With Ishi, Pope learned the bow hunting techniques of Native Americans. In Italy, the only current reference is that of Vittorio Brizzi (1989, 1993 a and b, 1995, 2004), an experienced bow hunter who uses natural materials, including flint points.

## Arrowheads and hunting activities: a problem of weight and efficacy

The efficacy of bow and arrow hunting depends on a series of parameters directly related to the arrowhead. Since we can analyze only the stone points potentially used by the Mesolithic groups of Trentino, we limit our analyses to two of these parameters that are directly related to arrowheads: dimensions and cutting line.

### *Dimensional characteristics of arrowheads*

The ballistic characteristics of a “heavy” arrow are different from those of a “light” one due to the influences of the forces of gravity and air resistance during flight. In general, a heavier arrow is more stable, less resistant to air and is less affected by wind or other obstacles such as leaves or twigs. Consequently, it is preferable to use heavier arrows for more distant targets, near or at the maximum distance of the bow utilized.

Modern red deer hunters recommend the use of arrowheads weighing around six grams (cf. also Comstock, 1990). Since the thickness of the arrowhead must be adapted to the diameter of the shaft, the stem or base of the arrowhead must never exceed two fifths of the thickness of the distal extremity of the shaft, whose optimal thickness for use with a bow is one centimetre.

<sup>1</sup> - « Ligne de tranchant » in French. This characteristic of a projectile point corresponds to the sum of the lengths of its sharp edges and its maximum width.



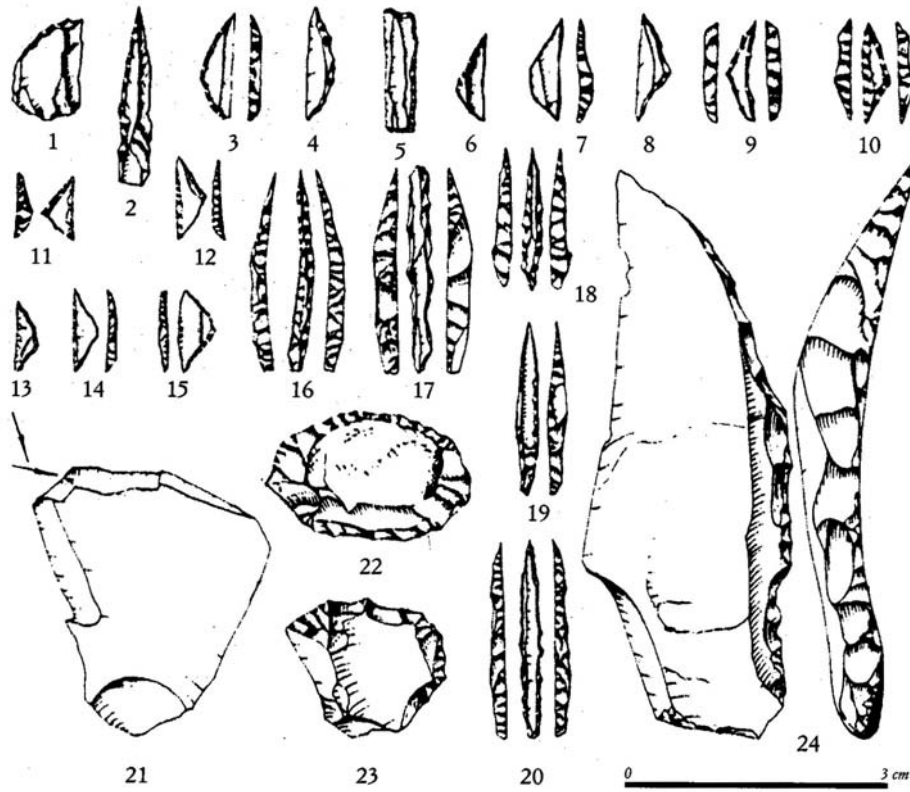


fig. 1 : Typology of the Early Mesolithic (Sauveterrian) in Trentino. Numbers 16-20 are points.

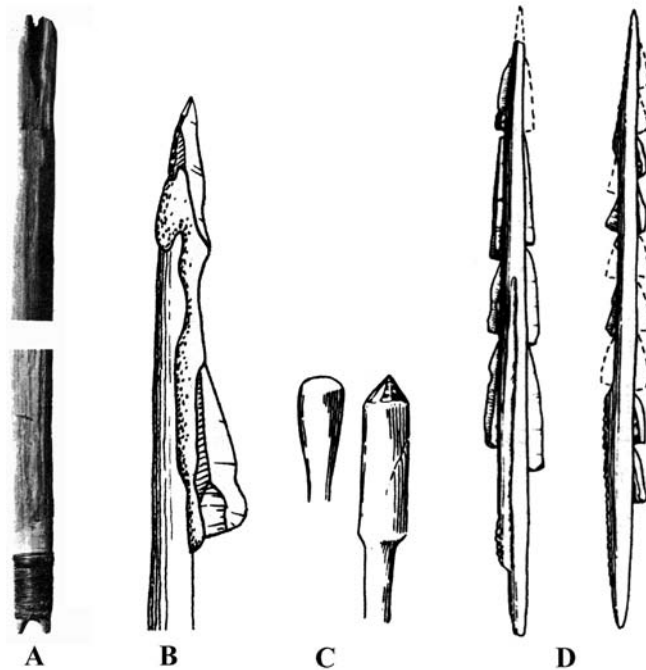


fig. 2 : Archaeological examples of arrows and points. A: base and arrowhead Vinkelose, Denmark; modified after Clarke 1973); B: composite arrow (Loshult, Sweden; modified after Clarke 1973); C: dulled wooden point (Denmark; modifié after Mithen, 1998); D: bone points with laterally inserted geometrics (Scandinavia; modified after Mithen, 1998).



*Functional characteristics of arrowheads*

The effectiveness of the cutting line of an arrowhead is another important element for understanding the characteristics of the arrow on which it is hafted. Intuitively, it is clear that the arrowhead cuts and penetrates the flesh of the animal at the moment of impact, but the depth of the wound is a function not only of the velocity of the arrow, but also of its cutting line, which corresponds to the sum of the lengths of its cutting edges and its width. The initial deformation of the flesh increases the section of the wound relative to the section of the impact: the longer and wider the point, the wider the wound. As intuitively, the efficacy of the cutting line is optimized when certain shooting and precision conditions allow vital points of the animal to be hit; the physical characteristics of the animal itself, such as skin thickness or fur length, can also influence the degree of efficacy.

**Single or double backed points of the Early Mesolithic in Trentino**

We selected points with one or two retouched edges from the Sauveterrian levels of the sties of Pradestel (Bagolini & Broglio, 1975; Bagolini *et al.*, 1973), Lago delle Buse (Dalmeri & Lanzinger, 1995) and Colbricon (Bagolini, 1972; Bagolini & Dalmeri, 1988; Bagolini *et al.*, 1975) (fig. 3). The first table (Table 1) presents the results of this sequence.

*General observations of the archaeological sample analyzed*

Though the archaeological assemblage analyzed may not be numerically significant, we believe it is statistically significant due to its extrapolation from a sample of remains selected based on published information and whose numeric value is sufficient. As proof, we observed a high degree of uniformity among the points of the different sites studied. This uniformity is manifest in the technological and morphological variability previously described, and which is almost non-existent among the three sites. In each one, the sample of points is characterized by:

- a) the dominance of pieces with a trapezoidal section (points with two retouched edges, most often with two backs) in association with pieces with a triangular section (points with one retouched edge and almost always characterized by a single back);
- b) the diffuse presence of pieces with an intermediary (irregular trapezoidal) or variable section (isosceles triangle at the point and trapeze at the central part of the blank); These pieces present, in addition to a principal, carefully retouched edge, a secondary, less carefully retouched edge realized in order to form the apical part of the tool;
- c) a fortuitous blank morphology, at least in appearance (bladelet, laminar flake, flake) associated with an equally fortuitous choice of the position of the point (proximal or distal). Moreover, we observe a selection of blanks with one, or more rarely two, parallel and rectilinear flake scars on the upper face. This characteristic explains the dominance of trapezoidal sections and could be related to a simplification of the hafting of points and/or a better adherence of them.

This low techno-morphological variability—which we again emphasize is the element that makes the analyzed sample homogeneous—is associated with a significant metric standardization. Though the pieces are highly fragmented, consequently limiting the number of whole pieces, we still observe a variability of just a few millimetres between the average length at Colbricon (11 mm) and the two other sites (16 mm at Pradestel and 19 mm at Lago delle Buse). The average widths and thicknesses are homogeneous at all the sites, oscillating between 2 and 3 mm and between 1 and 2 mm respectively.

These dimensional characteristics seem particularly important relative to the weights of these tools. In particular, we observe (table 2) that the length is almost directly proportional to the weight, for whole as well as fragmented pieces. Such a correlation is also partially existent between the width and weight,



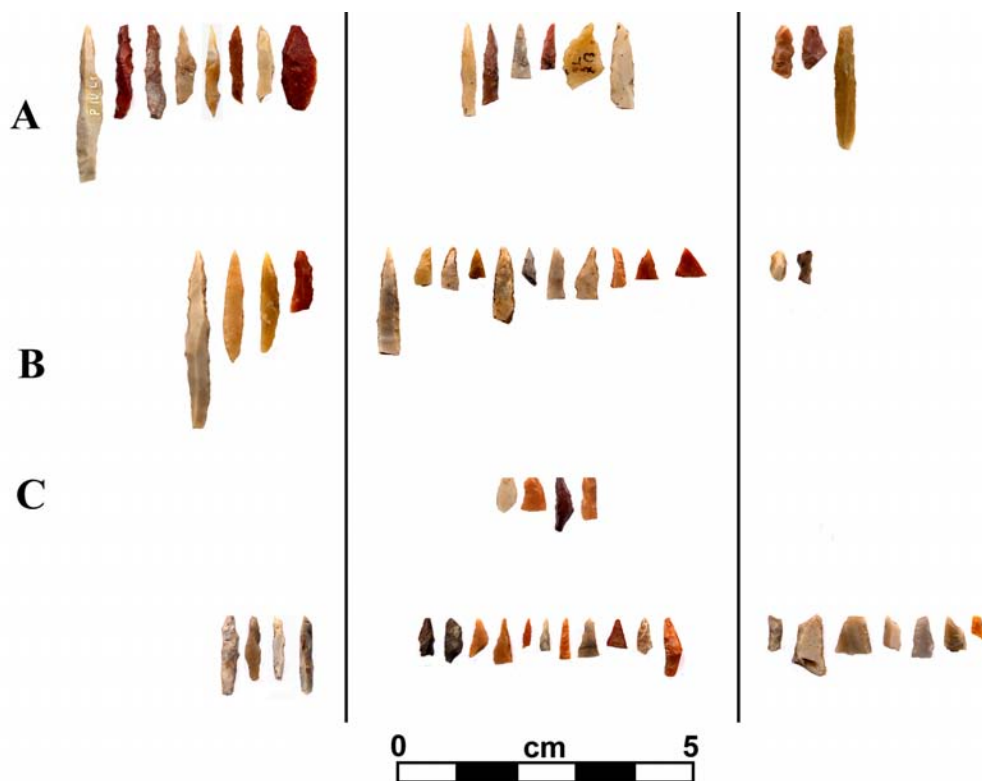


fig. 3 : Microlithic points from the Early Mesolithic levels of Pradestel (A), Lago delle Buse (B) and Romagnano 6 (C above) and 8 (C below). Whole blanks (left), broken (center) and fragmented (right) blanks.

Site	Provenance	Nombres des pieces lithiques	Nombre des pointes	Références
Pradestel	Couche L	1731	17	Broglia A. (1994) – Man and environment in the Alpine region (Paleolithic and Mesolithic), <i>Preistoria alpina</i> , t. 26, p. 61-69
Buse 1	Carré 4-5	1350	3	Dalmeri G., Lanzinger M. (1995) – Risultati preliminari delle ricerche nei siti mesolitici del Lago delle Buse nel Lagorai (Trentino), <i>Preistoria alpina</i> , t. 28,1, p. 317-349
Buse 2	Carré 6		10	
Buse 3	Carré 3-4		2	
Colbricon 6	Complet	5066	4	Bagolini B., Dalmeri G. (1988) – I siti mesolitici di Colbricon (Trentino): analisi spaziale e fruizione del territorio, <i>Preistoria alpina</i> , t. 23, p. 7-188.
Colbricon 8	Carré 1, 5, 14 Carré H7, I4, I7		21	
		8147	57	

tab. 1 : Synthesis of the sample of points with one or two retouched edges.



even if for several pieces an increase in width does not correspond to a clear increase in weight; on the contrary, these pieces tend to remain relatively stable in the weight range of approximately 0,1 grams. Finally, in observing the relationship between thickness and weight, a significant dimensional standardization of the pieces appears: while the thickness oscillates constantly between 1 and 2 mm, the weight is rarely higher than the threshold previously cited.

#### *Conclusions concerning the archaeological sample analyzed*

If we compare the dimensions of the pieces in the archaeological sample with what we have just described, we observe that:

- A- the average weight of the whole pieces is close to 0.1 gram;
- B- the average thickness of all pieces varies between 1 and 2 mm, indicating that the diameter of the shaft was not greater than 5 mm;
- C- the efficacy of the cutting line of nearly all of the points was practically zero due to the generalized absence of sharp edges and their extremely reduced thickness;
- D- the points analyzed correspond to the maximal values that characterize arrowheads used with a bow; this suggests that their utilization could be associated with either light bows, for which we can imagine a draw weight of around 20-30 pounds at full draw length, or more robust bows drawn without reaching the full draw length.

### Experimentation

Understanding the function of Sauveterrian arrowheads requires extensive practical experience in the fabrication and use of these tools. We will now present a few preliminary observations based on an ongoing experimental program conducted with the goal of understanding the functional characteristics of the different morphologies of lithic weapon elements identified through typological analysis.

The sequence of operations was the following.

#### *Point production*

Twenty-three blanks were produced (fig. 4) using the indirect percussion technique with a soft hammer (red deer antler) and hard hammer. The raw material consisted of small flint nodules from the two largest siliceous formations in the region: Biancone and Scaglia Rossa.

A unidirectional reduction sequence was employed to produce bladelets or laminar flakes with the following characteristics: a) the greatest possible length; b) the most regular edges possible, and; b) the straightest profile possible. Among the blanks obtained, we selected those with morphological characteristics adapted to the production of points with one or two backed edges, according to the criteria “minimum effort for maximum result”. The blanks chosen thus had morphological characteristics already functionally adapted to a rapid transformation into points, such as a homogeneous thickness over all or a large part of the length of the blank. This characteristic turned out to be particularly significant as we observed that variations in thickness had a negative influence on the quantitative production of points since they almost always resulted in fractures of the blank at the points of greatest imbalance. The qualitative production of points was also influenced by the curvature of the profile: the greater the profile curvature, the shorter the final point.

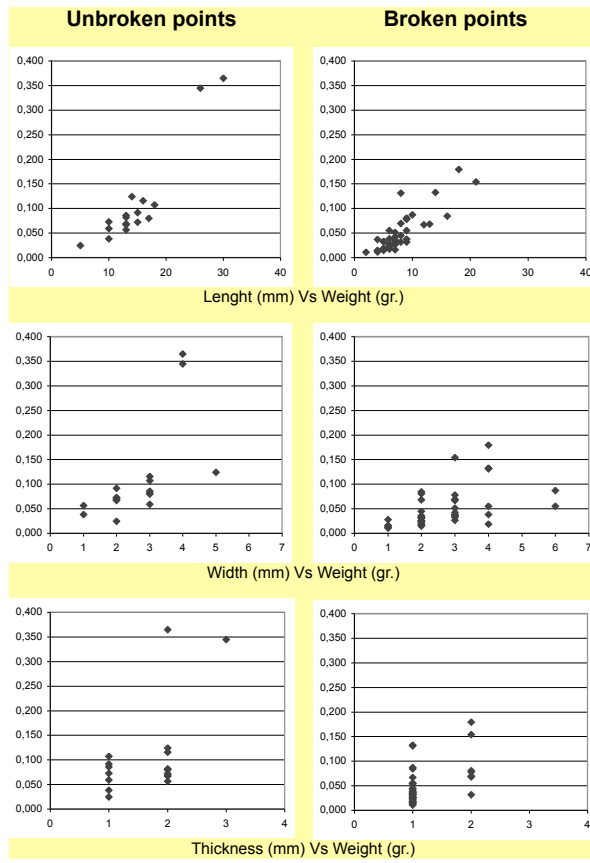
The selected blanks were transformed using the pressure technique applied with a copper compressor. The retouch was realized with the aim of producing one point from each blank, though in several cases the dimensions and morphology of the original blank would have allowed the production of two, or more rarely, three points.

The time taken to produce each point was approximately 40 minutes.

#### *Arrow production*

Nine arrows were produced using the experimental points (fig. 5). The arrows shafts were made from common dogwood (*Cornus sanguinea*) and pine (*Pinus*) branches. Their average length was 70 centimetres and average weight 26 grams. The shafts were made from branches collected about one year ago, from which we





tab. 2 : Dimensional relations of the microlithic points.

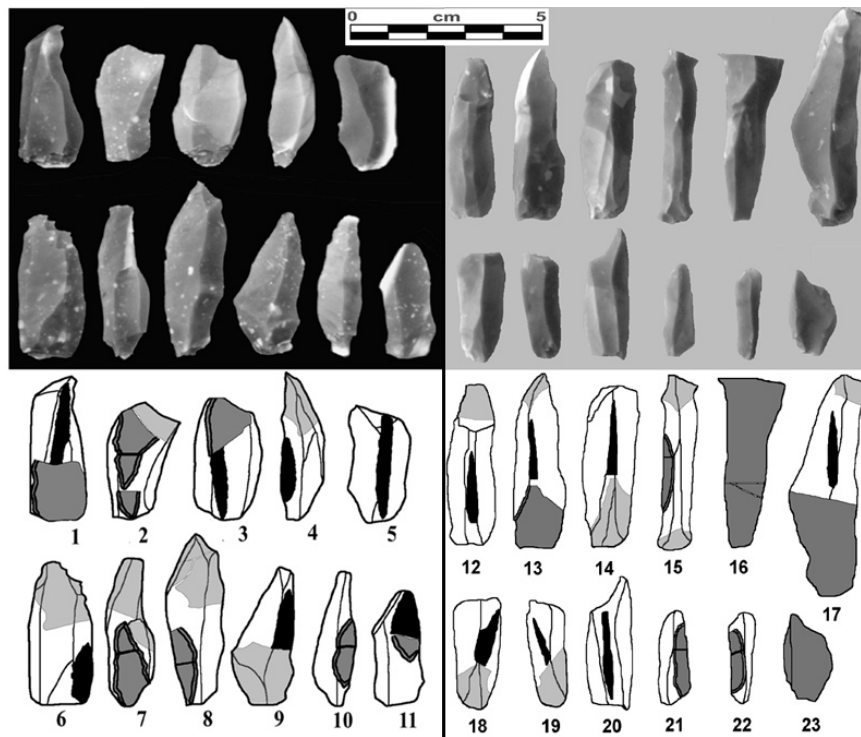


fig. 4 : Experimental lithic blanks and reconstitution of the technological categories produced by the experimental production of points; points produced (black), retouched fragments (dark gray with black edges), non retouched fragments (light gray), and extension of the blank surfaces destroyed by pressure retouch during the fabrication of the point (white).



removed the outer skin and then straightened them. All of the operations described from here on were realized with the aid of modern instruments since the objective of this study was not to experimentally verify the function of other lithic tool types. The shafts were then scraped, polished and straightened. In particular, around the last ten centimetres of the shafts was thinned by scraping and polishing in order to reduce their diameter to adapt them to the small dimensions of the points.

The fletching was realized with goose feathers attached to the shaft with a ligature composed of tendon. The nock was cut and polished. Finally, the terminal part of the shaft was perforated so that around one third of the length of the point could be inserted into it. The adhesive was made from a heated mixture of beeswax and bitumen. After filling the cavity at the end of the shaft with adhesive, the points were inserted into it after being slightly heated. Adhesive was then reapplied around the point in order to smooth the profile of the arrow between the wood and lithic parts. It took around two hours to produce the arrows.

#### Arrow use

The arrows were used following two procedures. The goal of the first was to verify the ballistic properties of the arrows and the second to verify the functional properties of the points.

The first procedure (fig. 6) was conducted with two bows with different draw weights of 30 and 55 pounds. The sequence of shots was made at a distance varying from 7 to 15 metres from the target. The target was composed of a synthetic material (*Etaphoam*) and 5 centimetres thick. We observed that the small dimensions of the points did not limit the penetration of the arrows. In fact, the arrows generally traversed the target and came out the other side (at a length determined by the distance and bow used). Another observation concerns the properties of the arrows during flight. With both bows, the arrows were stable and sufficiently linear in their trajectory toward the target; the “bowman’s paradox” phenomenon turned out to be very limited regardless of the type of bow used. No appreciable difference was observed in terms of the ballistic properties of the arrows relative to the type of bow used.

The objective of the second procedure was to observe the functional properties of points at the moment of their penetration into the animal tissue. This time, the target was the carcass of a small pig, weighing around 9 kilograms (fig. 7). Thirty shots were made at a constant distance of 10 metres, using a bow with a draw weight of 40 pounds. The arrows penetrated a few centimetres into the carcass without ever traversing the thickest parts formed by the anterior thigh and the neck (fig. 8 and 9). In some cases, the arrows perforated the entire body of the animal, but only in the ventral part where the thickness is not greater than 5 centimetres. The arrow shafts were not damaged. The points, on the other hand, were all broken in the same manner characterized by a transverse fracture relative to their functional axis, located at the point of contact with the shaft, in which the proximal fragment remained inserted (fig. 10).

#### Conclusions

The data presented in this paper allow us to propose several working hypotheses. We observed in particular that the very light weight of the points with one or two retouched edges does not appear to influence the ballistic properties of arrows shot at a distance of approximately 10 metres. At this distance, the arrows allowed precise shots and assured relative velocity and stability. The functional limits were observed at the moment when the arrow hits the target: the penetration capacity seems to be more limited than that of arrows with heavier points, which are thus, at an equal speed, more powerful at impact. Consequently, the small dimensions of microlithic points seem to indicate that they would be “ineffective” if the objective of the hunt was to rapidly bring down medium to large sized prey species that have thick fur and are particularly agile and muscular, such as ibex, red deer, bear or wild boar. It is interesting to note that the use of laterally inserted geometrics cannot be considered as a functional improvement since their principal function is to widen the wound and this is not possible unless the arrow can penetrate the target.



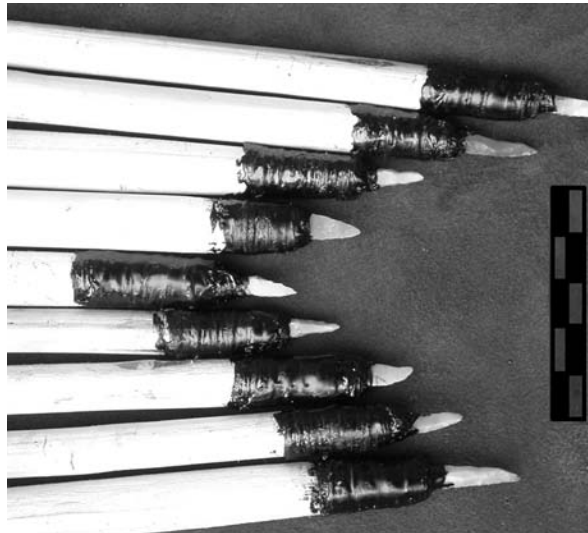


fig. 5 : Experimental arrows.



fig. 6 : . Shooting phase; in the lower part of the target, we can see the first arrow shot with a light bow, which suffered a significant loss of speed; the second arrow shot with a heavy bow shows a more rectilinear trajectory.



fig. 7 : The target.





fig. 8 : Arrows that attained the target.

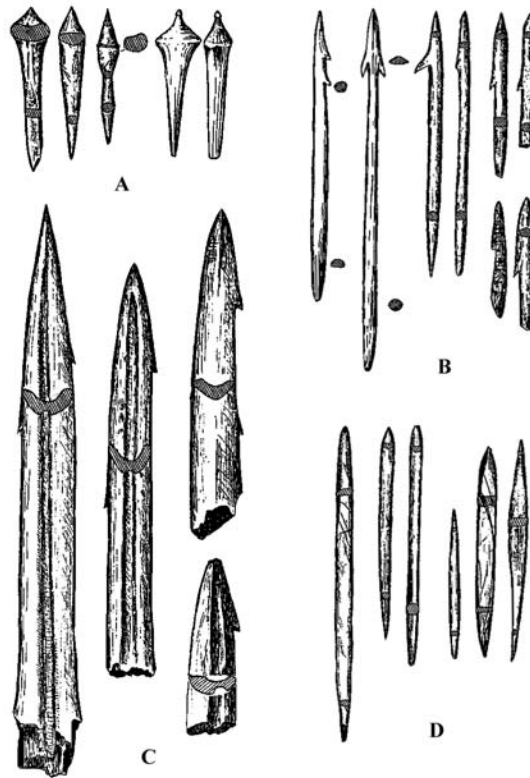


fig. 9 : The penetration depth of the arrow extracted from the target is indicated by the thumb of the hand that is holding it.



fig. 10 : The arrows after use.





**fig. 11** : Zamostje (Russie). Exemples de pointes en bois animal et os provenant de niveaux du Mésolithique ancien (modifié d'après Lozovski, 1996).



**fig. 12** : Abri Pradestel (Trentino, Italie du nord-est). Exemples de pointes en bois animal provenant du niveau sauveterrien.



We thus propose the hypothesis that Sauveterrian microlithic points were associated with less “specialized”, more occasional, hunting activities, conducted individually or as a group, to hunt small forest prey such as roe deer, marmot, beaver, squirrel and other animals with fur. The functional characteristics observed in the sample of archaeological points can be correlated with the necessity to perforate the tissues of smaller animals while tearing them as little as possible. A wound could thus be fatal without damaging the fur or skin. Unfortunately, the frequency of small animal hunting by the Mesolithic groups of Trentino is difficult to confirm due to the absence of faunal remains in high altitude sites such as Lago delle Buse and Colbricon. Small animal remains have been observed, however, in the valley bottom sites of Adige (Boscatto & Sala, 1980; Royston, 2000). In addition, several Mesolithic sites in the Alps have yielded indications of small animal hunting (e.g., Bridault, 1998 and 2000; Chaix, 1998 a and b; Desbrosse *et al.*, 1991; Monin, 2000; Muller, 1914; Patou, 1987; Rehazek, 2000). This indicates that small animal hunting was widespread and constituted an important element of the territorial strategy of Mesolithic groups in mountain and middle mountain regions.

But what about large prey hunting strategies? From a purely speculative perspective, and without excluding the possibility of spear use, we can propose the hypothesis that large animals were hunted with powerful bows that could shoot heavy arrows with different types of points, such as wooden arrow shafts with their points hardened by fire, or bone and antler points attached with resin or ligature. Archaeological examples of these types of points have been discovered in association with animal remains (Rust, 1943; Campbell, 1977) (fig. 2 and 11). In addition, many other sites have yielded bone or antler objects that could have been used as arrowheads or spear points (*cf.* Bonsall, 1989; Crotti, 2000; Lozovski, 1996; Vermeersch & Van Peer, 1990); this type of object has also been found in the valley bottom sites in the province of Trentino (fig. 12). Their morphological characteristics correspond

perfectly to the standards described by modern bow hunters. With its length and penetrating capacity, a bone or antler point, even without sharp edges, fully satisfies one of the necessary parameters for the optimal functioning of a hunting weapon. The other parameter, width, could have been satisfied by the lateral insertion of geometric microliths on one or two sides of the point, which would increase its cutting capacity and thus the size of the wound produced. In this case also, there are two archaeological examples that demonstrate their realization (Bergman, 1993; Larsson, 1983).

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# LUNATE MICROLITHS IN THE HOLOCENE INDUSTRIES OF NUBIA : MULTIFUNCTIONAL TOOLS, SICKLE BLADES OR WEAPON ELEMENTS ?

Mathieu HONEGGER

## Abstract

In Nubia, lunates (circle segments) are one of the most characteristic tools from the beginning of the Holocene to the end of proto-history, or even later. According to some interpretations, they are generally considered as being arrowhead or sickle blades. Taking into account archaeological examples, very diverse in their context and dating, the present article tries to summarize our knowledge on the question of their function. While previous studies have essentially taken into account the existence of traces or organic residues (gloss or polish, hafting glue, handle or shaft) and less often the context of discovery (tips driven into human bones or embedded in skeletons), they have not, on the other hand, considered the question of impact fractures and the dimensions of lunates. By collecting all these observations, it is possible to differentiate small sized lunates having mainly been used as projectile tips or barbs and bigger pieces meant to fit knives for cutting vegetal materials or sickles. We can however not exclude other uses for some of the lunates, as it is possible that pieces of medium dimensions could have had a functioned as arrowheads or sickle blades. Finally, we can observe a tendency through time toward a reduction in size of the lunates and a greater standardization of the pieces intended to be used as projectiles.

**Key-words** : lunates, Nubia, Epipaleolithic, Mesolithic, Neolithic, Kerma, Middle Kingdom, arrowhead, sickle blades, knife for cutting vegetal materials, impact traces

Nubia is a vast region that extends from the first to the sixth Nile waterfalls, straddling the limit between southern Egypt and northern Sudan (fig. 1). Although its prehistory is still poorly known, it is possible to follow the main steps of the evolution of society and its material production since at least the 10<sup>th</sup> millennium BC. One of the most striking aspects of the Holocene chipped stone industry is the relative monotony of its tools, characterized by prevailing backed pieces, and in particular lunates. The latter are of varied dimensions and their function has been diversely interpreted: often considered as sickle blades, they have sometimes been assimilated to arrowheads or barbs and more rarely to tools meant for other uses, such as borers or burins. What we would like to discuss here is the function of these backed pieces, presenting examples from different archaeological contexts, as well site function (settlement or necropolis) and chronology (10<sup>th</sup> to 2<sup>nd</sup> millennium BC). Not pretending to provide conclusive solutions, this outline will allow some clarification as to the use of lunates in the Nile Valley region.

### Cultural and chronological context

Our knowledge of the recent prehistory of Nubia is still incomplete due to the small amount of archaeological research on the subject and the unequal geographical dispersion of studies. The best known sectors are located, on the one hand, in Khartoum area (Central Sudan) where the pioneering works of A. J. Arkell, at the end of the 1940's, contributed to a renewal of research (Arkell, 1949) and, on the other hand, between the first and second waterfall where the building of the high Assouan Dam was, in the sixties, at the origin of many archaeological digs (cf. Wendorf, 1968). Between those two areas, the remaining part of Nubia was long neglected and only recently (Honegger, 2002) has a clearer image been restored, mainly as a result of excavations in the Kerma region (3<sup>rd</sup> waterfall).

The first evidence of the existence of Holocene occupations goes back to the 10<sup>th</sup> millennium BC, a little before the increasing humidity of the climate allowed populations to settle in the desert areas (Kupper and Kröpelin, 2006). Depending on the authors and regions, archaeological cultures of this period are qualified as Epipaleolithic or Mesolithic. They are characterized by human groups in the process of becoming sedentary and who exercise a predation economy based, among others, on the Nile river resources, and who start producing ceramic objects as early as the end of the 9<sup>th</sup> millennium (fig. 2). On this cultural substratum, the components of a Neolithic economy appear between the 8<sup>th</sup> and 5<sup>th</sup> millennium BC. The probably local domestication of bovines was replaced by innovations coming from the Near-East, such as the breeding of caprinae, later followed by the cultivation of barley and wheat. During the 4<sup>th</sup> millennium the proto-historic cultivations appeared, more or less subject to the influence of the emerging Egyptian Kingdom. In the region of the 3<sup>rd</sup> waterfall, the Pre-Kerma culture announces the emergence of the Kerma Kingdom (2500 to 1500 BC) that stood up to Egypt until the colonisation of Upper Nubia by the Pharaohs of the 18<sup>th</sup> dynasty.

The examples chosen to illustrate the question of lunates mainly include the periods presented above: Epipaleolithic-Mesolithic, Neolithic, Kerma and

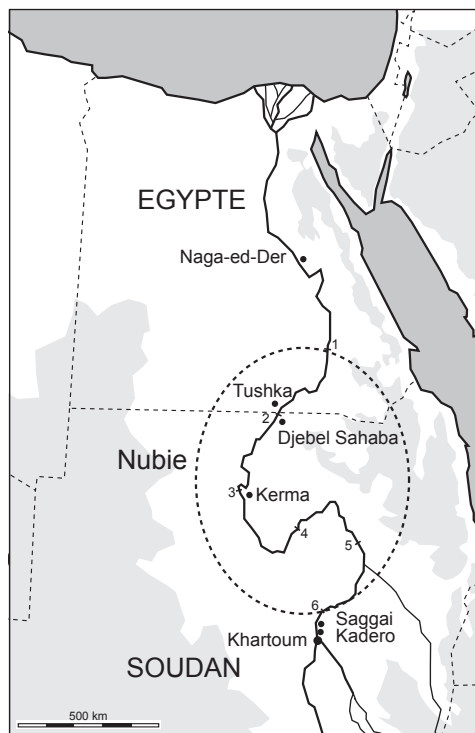


fig. 1 : Map of the Nile Valley, locating the six waterfalls and all the sites mentioned in the text.

Egypt's Middle Kingdom. To this diversity of contexts is opposed the monotony of the tool, whose dimensions represent the main factor of variability.

av. J.-C.	Egypte vallée du Nil	Nubie 1-3 cataractes	Soudan central
2000	Civilisation pharaonique	Groupe C ou Kerma	?
3000	Prédynastique	Groupe A ou Pré-Kerma	final
4000	Néolithique	final  moyen	Néolithique  ancien
5000	?	Néolithique	
6000	Epipaléolithique (sans céramique)	ancien	Mésolithique (avec céramique)
7000		Mésolithique (avec céramique)	
8000	?	Epipaléolithique (sans céramique)	?
9000			

fig. 2 : Chronology of pre- and proto-historic occupations in Nubia and central Sudan, compared with the Egyptian chronology.

**Djebel Sahaba Epipaleolithic (12th to 10th millennium BC)**

Djebel Sahaba is a famous cemetery located in northern Sudan and dating back to the end of the Paleolithic or to the Epipaleolithic. Containing 59 burials, it would seem to be the oldest archaeological testimony of a violent conflictual situation between human groups (Wendorf, 1968, p. 954-995, Guilaine and Zammit, 2001, p. 103-113). Grouping men, women and children, the cemetery yielded 116 flint artifacts in association with 24 burial-

places. Considered as weapon tips at the origin of the death of human beings, these flakes retouched or not, were sometimes found directly embedded in the bones of the skeletons. The other artefacts were embedded between the bones or found inside the skulls. From a typological point of view, the retouched pieces were for the greater part truncated or backed pieces (fig. 3), including a few geometrics and only one not very characteristic lunate. But burins, tips and scrapers were also found, without forgetting that many unretouched flakes must also have had the function of weapon tips. The dating of the cemetery is mostly based on typological comparisons of lithic industry, linking it to the beginning of the Qadan period (12,000 – 10,000 BC), a culture characterized by a flake industry including lunates as one of its most significant tools.

Since few lunates were found in the tombs, the author assumes that this tool must not have been used as weapon tip, unless the Djebel Sahaba is dated at the very beginning of the Qadan period, when lunates were rather rare!

Without arguing about this exceptional site, the question of its dating remains open today and recent attempts to directly date the skeleton bones have unfortunately given no results. The lithic artefacts found in the tombs must be re-examined, focusing on possible impact traces. Anyhow, this assemblage does not solve the question of the function of the lunates, as it contains very few of them. It does provide, however, an assemblage of weapon tips with different morphologies and stockier dimensions than those noted in other contexts (cf. infra and fig. 15).

**El-Barga Mesolithic (8th millennium BC)**

In the Mesolithic, lunates are the generally dominant tool (Haaland and Magid, 1995, p. 61-64). For example, at the site Saggai, north of Khartoum, they represent around 40 % of the tools (Caneva, 1983, p. 209-233). Their dimensions are rather varied, but they are globally greater than those of the Neolithic lunates. Their function has already been discussed many times and opinions diverge according to the author. Some are inclined to think that these tools are weapon tips, on



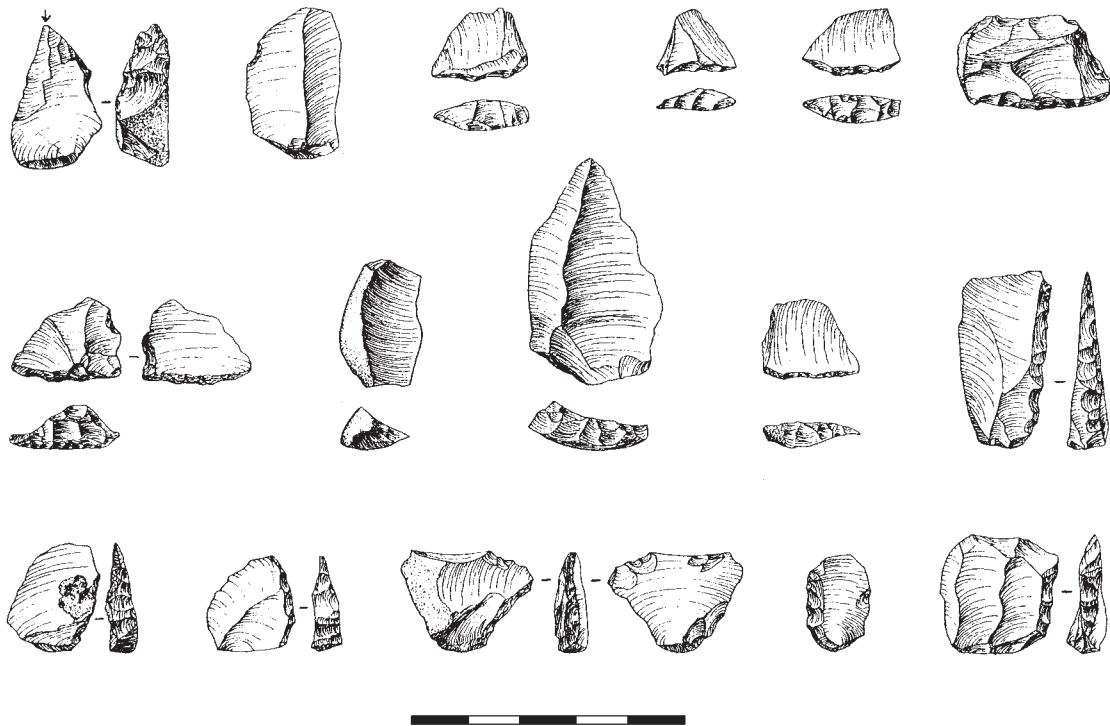


fig. 3 : Djebel Sahaba: example of backed pieces found in burials and considered as weapon tips (from Wendorf 1968, fig. 31, p. 984). Scale: 2/3.

the basis of electronic microscope observations made on Mesolithic and Neolithic assemblages, which did not detect traces linked to cutting vegetal materials (Haaland and Magid, 1995, p. 63). We must admit, however, that the lithic assemblages from desert areas are not well adapted to microwear analysis due to the significant action of aeolian erosion. In other contexts, gloss traces or indications of sickle hafting have been observed, however, either for older periods, like at Tushka around 10,000 BC (Wendorf and Schild 1976) or for the Neolithic (cf. *infra*).

Though microwear analysis or contextual arguments are often referred to during debates, most studied do not take into account the variation in size of the lunates within the same assemblage, nor do they attempt to detect possible impact traces, which would corroborate their function as projectile tips. We have tried to address this question by studying the lithic industry in a Mesolithic deposit in the region of Kerma. The site, called El-Barga, is located 15 kilometres east of the Nile River at the top of a hill. It yielded the remains of a partially buried hut, dug more than 50 centimetres into the bedrock (Honegger, 2004, 2006). Five radiocarbon

dates place the occupation between 7500 and 7100 BC. Graves dating from slightly later are spread around the structure and a Neolithic cemetery lays some ten or so meters to the South.

The hut yielded a chipped stone industry, as well as grinding material, ceramic artefacts, several bone tools, molluscs and many bone remains, namely vertebras and fish bones. The chipped stone industry is mostly made with local flint (chert) found in the form of cobbles in the nearby alluvial terraces. Artefacts representing all stages of the lithic reduction sequence for flakes and short bladelets are present at the site: cortical flakes, splinters, preparation flakes, cores with one or two striking platforms, discoloidal cores and main products. There are 119 tools, a third of which are made of flakes and bladelets with more or less regular removals on the sides. Small or large size lunates represent 31 % of the products, followed by backed pieces, scrapers and borers (fig. 4 and 5). A comparison of the lunate dimensions easily allows them to be separated into two groups: on the one hand, large pieces (width above 9 mm and length above 30 mm) and on the other, smaller ones with

widths between 5 and 8 mm and lengths varying from 16 to 27 mm (fig. 6). On other Mesolithic sites, such as Saggai, lunate dimensions are in about the same range than at El-Barga, but it is more difficult to distinguish between the two groups since the transition between small and large pieces is more progressive (Caneva 1983, p. 226-228). A binocular observation of the impact traces has been performed on the assemblage. Lacking an experimental reference base that corresponds to our lunates, we used general data from experiments aimed at recognizing the types of impacts damage observed on arrowheads (cf. Honegger, 2001, p. 124-125) and in particular those of B. Gassin (Gassin, 1991, 1996). Lipped-fractures, step fractures and sometimes bipolar and burin removals have been identified. As for what is called a simple fracture, obtained by bending without any secondary removal, it cannot be attributed to any impact linked to a use as projectile tip.

Moreover, although the position in which the lunates were hafted on the possible arrow shafts is not clearly known, the fact that the small lunates, when they were incomplete, generally displayed one or two fractured ends, leads us to suppose that one of the latter must have been used as a piercing end. Concerning the large lunates, they often present mesial fractures obtained by simple bending.

A comparison of the fractures shows a notable difference between the two metric categories (fig. 7). The small lunates show 19% of fractures that can be attributed to a projectile impact, while the large ones have none. Part of the small lunates must indeed have been used as projectile tips, though we cannot know if all of them were intended for this use. It is in fact possible that some of them were used for another purpose, closer to the supposed function of the larger lunates. The latter were obviously intended for a different function, probably as elements for knives used to cut vegetal materials, considering that the Sudanese Mesolithic is characterized by the intensive collection of wild gramineae (cf. Haaland et Magid, 1995).

### Neolithic in Nubia (5th millennium BC) and old Kerma (end of the 3rd millennium BC)

During the Neolithic, lunates were less represented in lithic industries than during the previous periods. In the six assemblages from the sites located north of Khartoum, their proportion varies between 1.4 and 13.1% (Haaland, 1987, p. 74-76). If we refer to the measures taken on the lunates of one of the sites, Kadero, their dimensions are slightly smaller than that of their Mesolithic equivalent, in particular in length (Haaland, 1987, p. 122-124, cf. fig. 15). It is again possible to oppose rather small lunates to larger ones. Again, opinions on their function diverge, alternating between arrowhead and sickle element.

We were able to directly observe only a limited number of lunates from the Kerma region. Excavations there have in fact yielded a small number of samples covering the Neolithic and later periods. Our approach was therefore not the same as that used for the whole of the El-Barga site. Here, only a few examples are presented in order to illustrate the function of the large size lunates. Given that the cultivation of barley and wheat was introduced in Nubia around the 5<sup>th</sup> millennium, one can expect to find lithic elements fitting sickles.

Not far from the city of Kerma, a Neolithic habitat that was occupied several times between 4700 and 4300 BC was excavated (Honegger, 2006). The lithic industry in the leached layers of this site was rather poor, but it still yielded some large lunates, with traces of gloss on the sharp edge (fig. 8). In more recent period, corresponding to the beginning of the Kerma civilisation, two tombs dating to 2300 BC, were found in the vast Eastern necropolis of the eponymous site (Bonnet 2000) and yielded large lunates with some gloss and remains of hafting glue (fig. 9). The glue was mainly located in the proximo-lateral part, indicating that the back of the lunate was not completely inserted into the handle in order to offer a sharp edge parallel to the axis of the sickle. An example still inserted in a fragment of handle suggests that the lithic piece was mounted obliquely.

Thanks to the many Neolithic necropolises excavated in Sudan, we have some complementary information on the use of lunates at that time. At Kadruka, about 15





fig. 4 : El-Barga chipped stone industry: borers (1-4), large lunate (5), small lunates (6-11), backed pieces (12-16), scrapers (17-20). Scale: 2/3 (drawing by M. Berti).

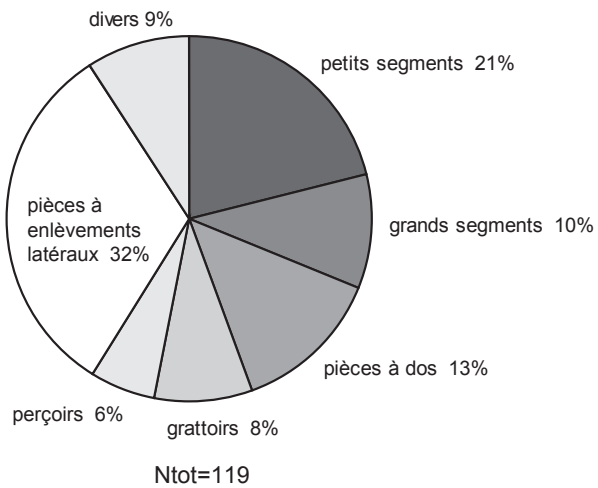


fig. 5 : El-Barga: proportion of the different types of tools of the chipped stone industry.



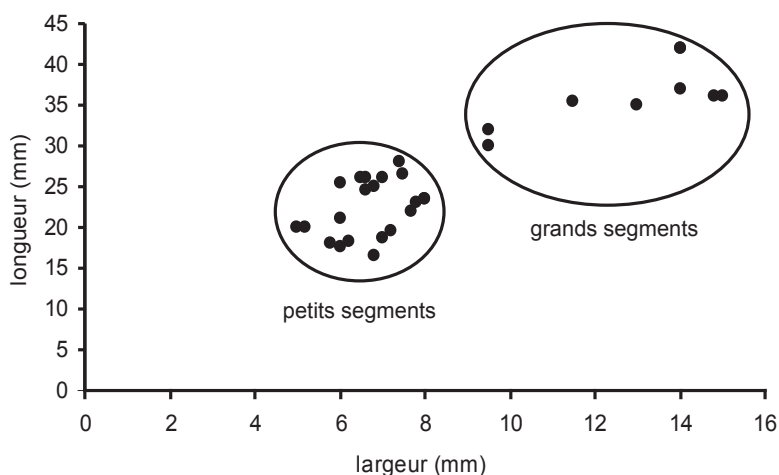


fig. 6 : El-Barga: width/length correlation diagram of whole or slightly fragmented lunates.

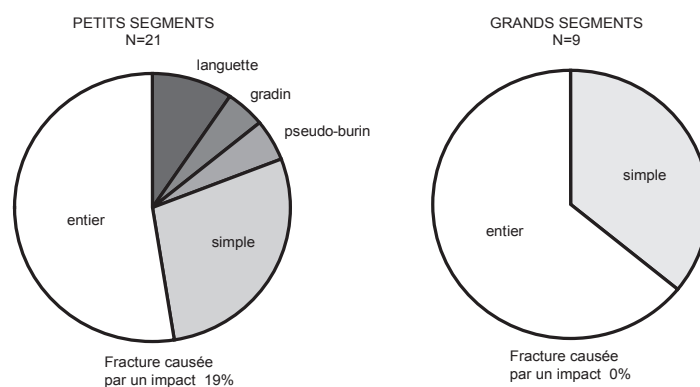


fig. 7 : El-Barga: proportion of the different types of fractures observed on the small and large lunates.

kms south of Kerma, several cemeteries dating back to between 4700 and 4000 BC have been studied over the last two decades (Reinold, 2000). Some burials yielded lunates still inserted in a bone handle (Reinold, 1994). At Kadero, not far from Khartoum, several alignments of 4 to 11 lunates have been discovered in the tombs. Still bearing remains of hafting glue, they have also been interpreted as elements of harvesting knives, the handles of which might have disappeared (Kobusiewicz, 1996).

An example of a sickle found in the Kadruka tomb indicates that Neolithic lunates were inserted so that their sharp edge would be parallel to the edge of the handle (fig. 10, right). The examples found in the two burials belonging to the Kerma civilisation indicate a different type of hafting, the lunates probably being mounted obliquely (fig. 10, left).

We can therefore be sure that lunates used as plant knives blades in fact existed, but it is possible that

other tools may have filled that function as well, such as flakes or backed blades. As for the small Neolithic lunates they could partly correspond to arrowheads, as is regularly suggested in the literature.

### Middle Kerma (beginning of the 2nd millennium BC) and Egyptian Middle Kingdom

In the large Kerma eastern necropolis, a burial dating to around 1900 BC has yielded an assemblage of 36 cornelian lunates, carefully grouped east of the interred individual (fig. 11). The tomb, looted during Antiquity, must have been that of a rather high-ranking figure. He was found lying on a wooden bed with a servant interred beside him (*mort d'accompagnement*). Many other objects were found in the tomb: razors and tweezers near the main subject, as well as many potteries, meat products and sacrificed sheep. The lunates suggested the presence of a quiver and bow, as observed in other burials of the same civilisation.



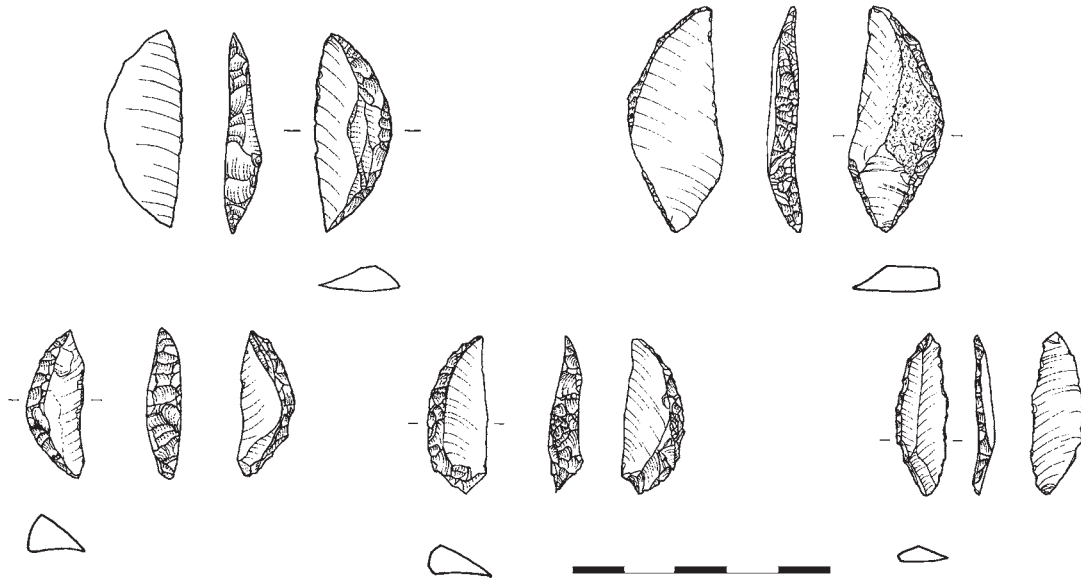


fig. 8 : Large lunates found in a Neolithic settlement site at the location of the Eastern Kerma necropolis (towards 4500 BC). Traces of gloss have been observed on the edge of some of them. Scale: 2/3 (drawing by M. Berti).

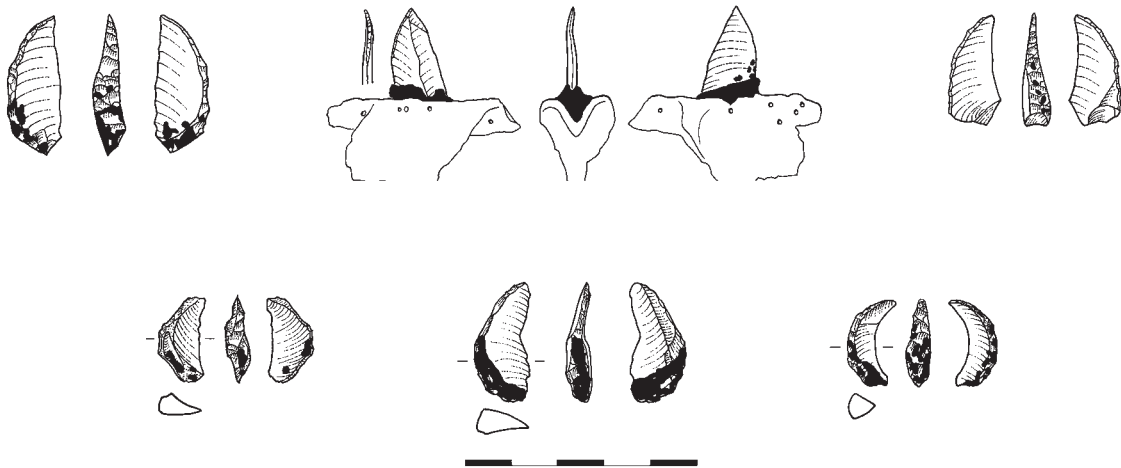
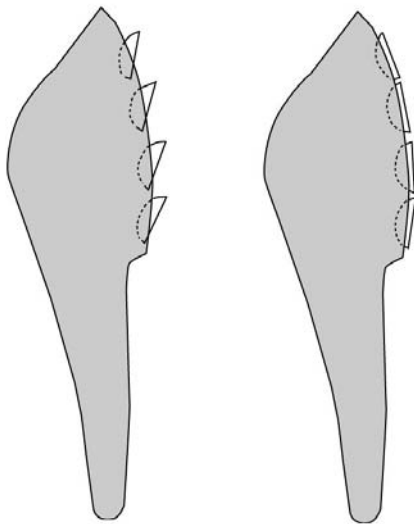


fig. 9 : Large lunates found in two Old Kerma burials in the Eastern necropolis (towards 2300 BC.). Some hafting glue can still be seen on the proximal part and on the back of the piece. A weapon tip is still inserted in a fragment of a wooden handle. Scale: 2/3 (drawing by M. Berti).

They must have been fit on arrow shafts which, like the bow, were not preserved.

The lunates were made from chalcedony flakes. The back was formed by direct, sometimes alternating (crossed), retouch. Their size was notably smaller than the previous examples and their dimensions were remarkably standardized. Their width varied between 3 and 5,2 mm ;while the length ranged from 7,9 to 12,7 mm (fig. 12). Fractures caused by an impact were observed on about 47 % of those 36 pieces (fig. 13). Lipped-fractures, step fractures and above all burin-like fractures generally affected one of the ends of the piece. It would be interesting at some point to draw up the detailed typology of their location and morphology, while conducting an experimental procedure. It is rather difficult to determine the manner in which the lunates were hafted. Many fractures follow the longitudinal axis of the piece, which suggests that one of the ends might have been active. But the burin-like fractures developing along one of the edges could be compatible with a transverse hafting, in the way a transverse arrowhead would be.



**fig. 10** : Proposition of reconstitution of sickles with two different insertion methods for the microliths, in accordance with the observations made at Kadruka (Reinold 1994) and at Kerma.

The study conducted by Clark and al. (1974) on the basis of ancient Egyptian bows and arrows provides significant information on lunate hafting methods. The studied pieces come partly from the Naga-ed-Der

tombs, dating from the 6<sup>th</sup> to 12<sup>th</sup> dynasty, which is a period globally contemporary with the example of the Middle Kerma. An assemblage of 108 more or less fragmented arrows was studied, among which points fitted with flint or chalcedony lunates largely dominated (84 pieces). It is to be noted that these are not the only types of projectile tips known in Egypt or Nubia. Indeed, a great number of them were made of flint, mostly using bifacial retouch, of bone, ivory, wood or even metal for the latest periods. In the classification proposed by Clark *et al.*, five types can be differentiated among the transverse arrowheads, four of them made of lunates (fig. 14). If the ends of the studied arrows were always equipped with a transversely hafted lunate, so as to present their sharp edge, it may happen that the edges of the shaft would be fitted with barbs inserted differently. No other hafting method has ever been recorded, which leads us to assume that it is indeed the dominant process, at least for periods contemporary to or after the Egyptian Kingdom. However, this does not mean that the lunates from the Mesolithic or Neolithic might not have been inserted differently on the arrow shafts.

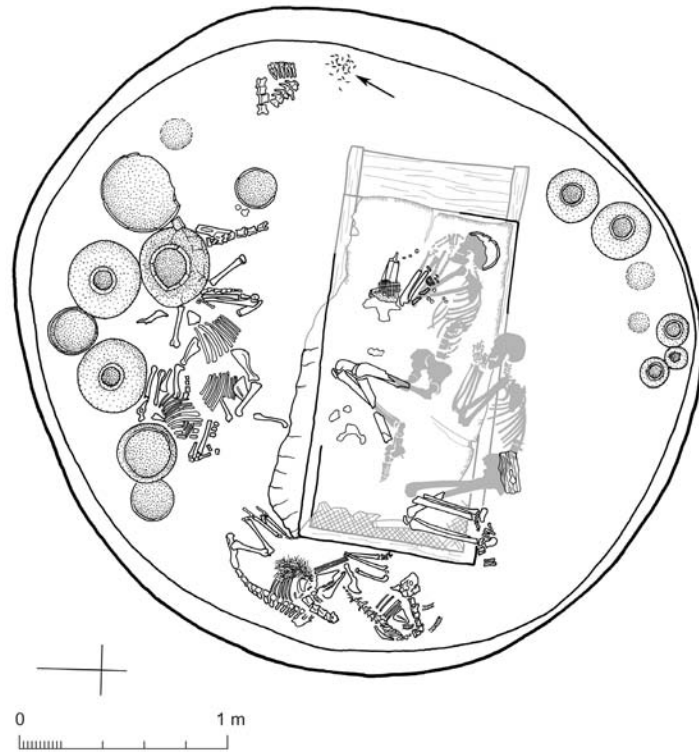
The dimensions of some of the lunates belonging to Naga-Ed-Der have been estimated from the prints left in the hafting glue of some of the shafts (Clark *et al.* 1974, p. 334). They provide values slightly lower than those of the lunates found in the Middle Kerma burials, but their size is also rather standard (fig. 15).

### Discussion

Comparing lunates from very different contexts or periods revealed some information on their function, even if the exercise may have been somewhat risky: it was possibly rather simplistic due to the limited number of examples, which cannot perfectly represent the diversity of the technical and cultural choices of a period lasting several millennia over a vast territory. It is nonetheless possible to draw some conclusions and present a certain number of hypotheses, which can be verified by analysing other assemblages.

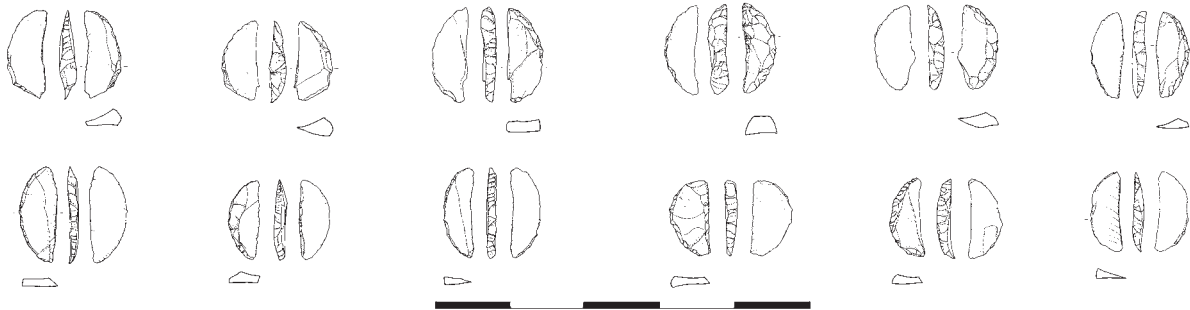
Determinations of the function of lunates by different authors has until now been based on the existence of organic traces or remains (gloss or polish, hafting



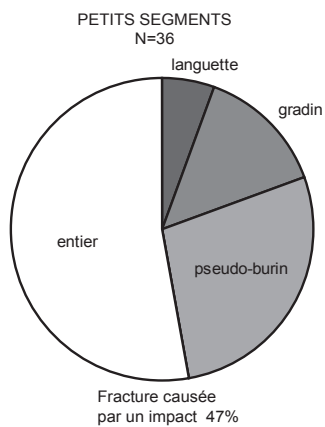


**fig. 11** : Wealthy tomb of Middle Kerma with a main individual and a servant interred with him (mort d'accompagnement) laying on a bed (the greyed parts have been reconstituted), two sacrificed sheep, meat products, pots and copper objects (Kerma Eastern necropolis, tomb 222, towards 1900 BC). The place where the 36 cornelian lunates were found is indicated by an arrow (drawing by M. Berti).

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**fig. 12** : Middle Kerma lunates (tomb 222). Scale: 1/1 (drawing by M. Berti).



**fig. 13** : Proportion of the different types of fractures observed on lunates in the Middle Kerma tomb 222.



glue, handle or shaft), and more rarely on the context of discovery (Djebel Sahaba). The dimensions of the pieces had never been seriously taken into account and the impact fractures had never, to our knowledge, been subject to identification. By combining all these approaches and by comparing very different archaeological situations, it has been possible to draw main trends, which can be summarised on a diagram showing the width and length of the lunates, as well as their function (fig.15). This global view allows us to distinguish two main groups of lunates. On the one hand, the large lunates which must have been sickle or

plant knife elements, and on the other, the smaller ones, which are identified as arrowheads. The two groups sometimes overlap in cases in which lunates could have had one function or the other. In the general picture, which seems after all rather simple, the unretouched or retouched flakes of Djebel Sahaba clearly stand out from the all the other pieces because of their metrics. We are dealing here with Epipaleolithic *armatures* (i.e. weapon or sickle elements) which seem to have been submitted to another tradition and cannot be part of our study on lunates. Finally, it is not excluded that some lunates might have had functions other than that of *armature* – burin, borer, incising tool – as shown by the Egyptian example of naturally curved backed bladelets, fixed at the end of a short shaft and probably having been used as an incising instrument (Clark *et al.* 1974, p. 373). Only microwear analysis can reveal the possible functional diversity of some lunates.

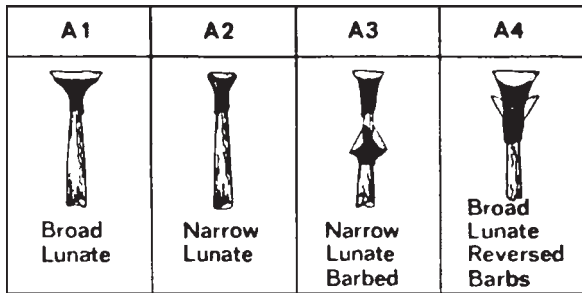


fig. 14 : Outline representing lunates hafted as arrowheads or barbs, the way they were found at Naga Ed-Der, 6e-12e dynasties, 2320-1760 BC. (after Clark et al. 1974, fig. 9, p. 362).

It is generally admitted that the lunate dimensions become smaller through time, from Mesolithic to historical times. This tendency seems to be confirmed by our observations, but needs to be qualified. Indeed, while the El-Barga

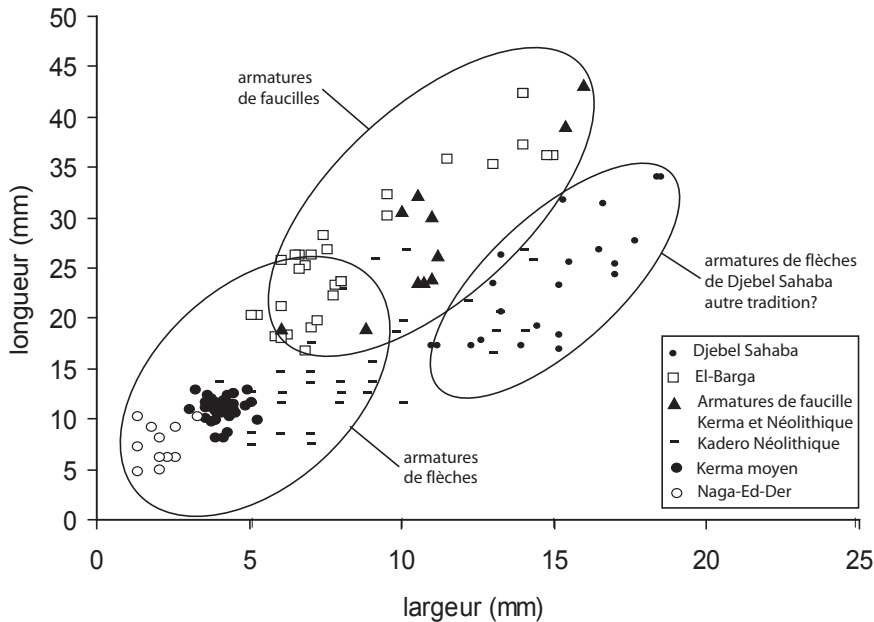


fig. 15 : Width/length correlation diagram of the lunates described in the present article. The smallest pieces were used as arrowheads, while the biggest tended to be used as sickle elements. Some metric overlapping exists between these two functional categories and some of the pieces, such as the ones found at El-Barga, might have been used for one function or the other. Finally, the backed pieces of Djebel Sahaba are usually wider and indicate a different tradition, although one cannot exclude that some of the pieces were not used as weapon tips.



Mesolithic assemblages record dimensions bigger than the Kadero Neolithic ones, the few examples of large lunates used for sickles (Neolithic and Kerma) have dimensions which are still rather large. On the other hand, the *armatures* belonging to Middle Kerma and Naga-Ed-Der have very small and highly standardized dimensions when compared with the previous examples. It is probable that during the recent periods, the tools met much more detailed standards as for function and hafting methods.

Finally, it can be noted that the use of lunates, notably as arrowheads, present an exceptional longevity in the North-East of Africa, compared with other regions (Clark et al. 1974, p. 374). This is particularly true in Nubia, where many such *armatures* can be found dating back to the Meroïtic period – that is between 400 BC and 400 AC.

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Article translated by Magen O'Farrell



# ON THE NOTION OF WAR WEAPONRY IN THE NEOLITHIC

Marie-Hélène DIAS-MEIRINHO

## Abstract

In the context of ongoing, multidisciplinary by the ANR project « GUEROPE » (“War and Violence in the first societies of Europe, an integrated approach”, directed by L. Baray) and a doctoral thesis in progress, I present a study of weaponry, and particularly projectiles, used in interhuman violence. The study and resulting discussion are based on archaeological remains from the end of the Neolithic in France. Certain research procedures and preliminary results are presented in advance of an exhaustive publication in the future.

**Key-words :** weapon elements, war, end of the Neolithic, human bone remains

## Introduction

“Les découvertes plus récentes de MM. De Baye et Prunières ont multiplié le nombre des vertèbres blessées, il en est qui ont reçu le trait de côté et de dos”. “Ces flèches sont le témoignage des combats, elles avaient frappé, elles avaient pénétré dans les chairs et dans les os, elles ont été introduites avec le corps ou avec le squelette dans le sépulcre.” (Cartailhac, 1896). These extracts from *La France préhistorique d’après les sépultures et les monuments* show that in the earliest works on Prehistory<sup>1</sup>, weapon elements embedded in human bones already received a great deal of attention. The principal questions asked of these objects did not concern whether or not war existed during this period, but were rather strictly technical: is it possible that a projectile of this nature could be embedded in this way in this bone? (Cartailhac, 1896; citing the suggestions of de Mortillet). Once this phenomenon was accepted, the fact that these pieces are evidence of war was no longer questioned. There was thus no fundamental discussion on the definition of war or its particular nature during this period. At the time, this subject had no real consequences for the perception of the societies in question since the discipline was in the process of construction and concentrated on chronological aspects. Between these first works and 1970, no new discoveries were made to renew an interest in this type of artifact. The excavation of the hypogeum of Crottes in Roaix finally allowed J. Courtin to conduct new research on such artifacts dated the end of the Neolithic (Courtin, 1984), especially since this hypogeum contains a level interpreted as a “war level”. The spectacular discovery of the frozen mummy of Similaun (Spindler, 1995) would also motivate a new interest in this subject. Not only were the personal objects (bow, arrows and quiver) of this individual preserved with him, but a radiographic examination revealed a weapon embedded in his flesh near one of his scapulae. These rare data open new research orientations into which the work presented in this paper is directly integrated.

## Toward an anthropological approach to violence in ancient societies: the impact of weapons

We must be cautious when developing an anthropological approach to the violence of ancient periods. The major dangers involved in such an endeavor were noted by J. Zammit (1991) who said that we must avoid isolating a case as a trivial event, or generalizing it when considering cultural or social phenomena. We must also take into account the temporal factor since a chronological distortion can create the impression of a tendency based on several similar events. In addition, fluctuations can occur in seriations since objects are not always directly dated. Finally, the ideological distance of the period can prevent us from applying certain social concepts. The methods used to qualify a violent episode in one or several Prehistoric societies and to measure its duration or perceive its consequences, are still in their experimental stages. While impasses are expressed as concepts and interpretations that are rarely renewed (*cf.* Beyneix, 2007), ethnoarchaeological research can open new perspectives for study and interpretation. This complementary approach can inform us concerning the variables in certain behaviors, but as A. M. and P. Pétrequin warned in the context of their research in New Guinea: “l’erreur méthodologique serait de vouloir à tout prix plaquer, sur les sociétés néolithiques d’Europe occidentale, les modes d’organisation socio-économique d’Irian Jaya. Convergences et systèmes écologiques, en termes de tendances, ne signifient pas forcément identité des organisations sociales complexes, autrefois et aujourd’hui. Et sous peine de raisonnement circulaire, les conclusions temporaires de cette démarche ethno-archéologique ne pourront pas être utilisées par les ethnologues qui voudraient donner quelque profondeur historique à leurs démarches” (Pétrequin et Pétrequin, 1990). We thus do not have a principle founded on models that can be applied to both Prehistoric and ethnographically known societies, but rather a common domain of questioning that can be applied to phenomena that are difficult to interpret

<sup>1</sup> - From a historiographic point of view, the first authors studied early periods of Prehistory as much as late periods (for example, Cartailhac, cited here). For this reason, at this level of presentation, we retain the global term Prehistory since it fully transcribes the context of the first works to which we refer.



In the hoplological domain, which addresses human combative behaviors, the study of weaponry is a determinant factor. The interaction between strategies and weapons is sometimes so strong that it is difficult to recognize the effect of one on the other. In prehistoric contexts, we are far from being able to determine the strategies employed, but we can legitimately study the weapons used. Since in the societies of the end of the Neolithic in France hunting is an activity perceptible through faunal assemblages (with highly variable percentages in different sites, cf. Braguier, 2000), it is logical to suppose that we can distinguish between hunting weapons and war weapons. However, the proportion of animal bones with an embedded weapon is very low for this period (Cordier, 1990; Pape, 1982). This considerably limits the possibility of comparing animal remains with human remains, but even more so of isolating projectile weapons dedicated solely to hunting activities<sup>2</sup>. The corpus of human bones with embedded weapons seems to be the only source through which we can determine the use of specific weapons. One of the objectives of our study (project ANR « GUEROPE », dir. L. Baray) is thus to determine which projectiles were associated with violent confrontations between humans and to determine if it is possible to isolate these objects from the full range of contemporary weapons in order to define types exclusively associated with this utilization.

### A systemic procedure

The first stages of this project were devoted to the construction of a reference collection constituted of weapons embedded in bones dated to the 4<sup>th</sup> and 3<sup>rd</sup> millennia, located over all of France. The succeeding stages were devoted to testing the methods that could address our research questions. It is here that we were confronted the major difficulty that some of the weapons cannot be extracted from the bones. This is the case of very deep impacts from which the weapon element cannot be removed without damaging the bone, or when the bone has healed around the weapon element. A technical

solution to this problem was developed in collaboration with J. Zammit. A systematic radiographic procedure allowed us to record information (the internal structure of the bone and the characteristics of the weapon element) at a level almost equal to that of pieces removed from the bones. In addition to these first unpublished data, we also developed a systemic procedure combining technological studies of the projectiles, paleopathological observations and a system for estimating the terminal ballistic<sup>3</sup> for the end of the Neolithic.

### A first basis of reflection on embedded weapon elements

Based on the reference collection<sup>4</sup> (61 objects: Table 1), which includes artefacts found over a large part of France, we defined three study sets: a set with clearly identifiable morpho-types, a set with undetermined morpho-types and a set with partial morphologies. All of these objects are made from stone and no point made from an osseous material has yet been discovered in this context in France.

The set of identifiable weapon morpho-types includes only five categories: transverse, lozenge-shaped arrowheads; triangular forms called “pointes aveyronnaises”; “classic” stemmed or barbed points (Dias-Meirinho, 2006); bifacial, lanceolate points with a wide stem; bifacial or foliate, lanceolate points (Fig. 1).

The set with undetermined morpho-types is composed of pieces whose basal part is identified but the apical extremity is not (Fig. 1). Before radiographic recording, four categories were identified: those with a wide geometric base, with a stem, with lateral basal notches, and blades with unretouched edges. We were able to anticipate the morphology of some pieces (wide geometric bases, cf. Fig. 2) and for these the interpretation of the photos obtained was thus not surprising. Radiographic recording was nonetheless indispensable for paleopathological and ballistic analyses. Our analyses also focused on other pieces in this ensemble, the blades with unretouched

<sup>2</sup> - Here we do not consider arrows that knock the animal out, which can be used in the hunting of small prey.

<sup>3</sup> - The terminal ballistic concerns the effects of the projectile on the object.

<sup>4</sup> - Boutin inventory (unpublished, as well as Guilaine & Zammit 2001; completed by us (« GUEROPE » ANR project, Dias-Meirinho & Zammit, in progress).



département	nombre de pièces
Alpes de haute provence	1
Aveyron	14
Bouches-du-Rhône	3
Gard	2
Haute Garonne	1
Hérault	5
Lozère	16
Marne	5
Tarn	1
Val d'Oise	2
Var	1
Vaucluse	9
Vendée	1
<b>TOTAL</b>	<b>61</b>

tabl. 1 : Study collection.

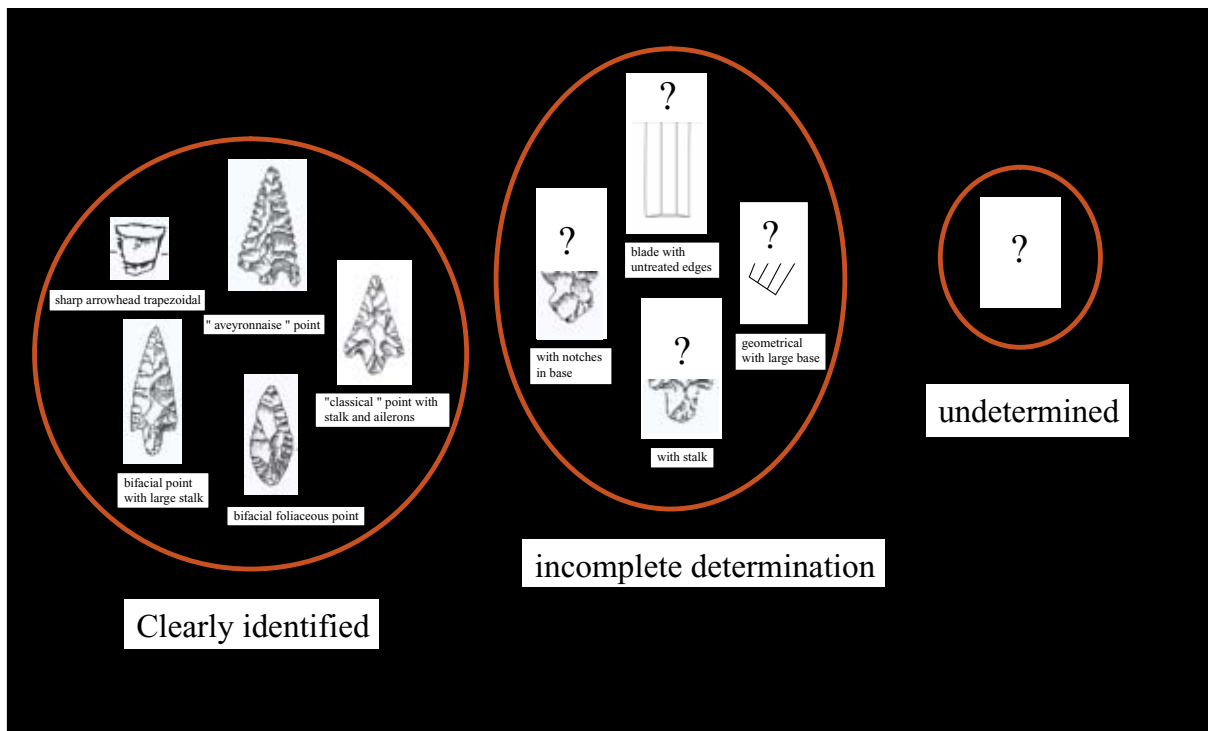


fig. 1 : The three ensembles of the study collection (the representations are examples but not the original pieces).

edges (Fig. 3), whose attribution as a projectile has never been clear. This is illustrated by their designation as “knife-lancets” by J. de Baye (1888) and the fact that they are not usually integrated in the typological classes of weapons (Piel-Desruisseaux, 1998; Binder, 1987)<sup>5</sup>. The two pieces that we have thus far studied come from the excavations led by J. de Baye in the hypogea of the Marne (Les Ronces Villevénard 67751 and Villevénard 67633). The two non-extracted blades have large dimensions: the part extending outside of the bone measures 25 x 13 x 3.3 mm for the first piece, and 32 x 20 x 5.1 for the second one. Based on the first radiographic photos, we were able to estimate that the part remaining inside the bone was at least 32 mm long for the first and 18 mm for the second, resulting in a total length of at least 57 mm and 50 mm respectively. Unfortunately, since these photos were the first that we tested, their quality is not optimal. The contrast of the first photo is too weak between the bone structure and the weapon element, thus preventing us from reconstructing its complete morphology. We can simply estimate that this was a blade with an oblique truncation with a very small angle and unretouched edges. The second photo has a hematoma that partially masks the extremity of the blade (this part seems to be fractured at the interface of the hematoma). Our current results are thus mixed, but based on future photos with the appropriate calibrations, we hope in to be able to present our conclusions on the properties of these weapon elements, and in particular to determine the complete morphology of their apical extremity.

The last set, composed of undetermined pieces, contains objects fixed in bone tissue healed around it with only a very small surface visible, others that were broken at the junction of the bone at the time of impact or during an attempt at extraction by Neolithic people<sup>6</sup>, and others that nearly completely

penetrated the bone. The objects in this set have not yet been subject to radiographic analysis since we first concentrated the objects in the second set in order to refine our image capturing methods. In the future, we will integrate the data on these objects with those obtained from the two other sets.

We note that the objects studied fit perfectly with the usual technical and typological criteria of these morpho-types. We have not observed any technical over-investment in the fabrication, specific forms, or finishing of these pieces. The pressure retouch presents the same qualities and imperfections. In summary, these morpho-types do not diverge from the weapon element schemes found in contemporary domestic and sepulchral assemblages.

We can make one significant observation, however, which is that the range of weapon elements embedded in human bones is particularly restricted relative to the diverse corpus of weapon elements of this period<sup>7</sup>, especially considering the wide geographic distribution of our study collection and certain strong cultural tendencies during this chronological period (Fig. 4). Moreover, among the morpho-types utilized, the perforating categories are more frequent (with greater diversity) than the transverse categories. The adoption of perforating weapons due to their penetrating properties thus also seems to be confirmed in the context of inter-human violence. This manifestation is integrated in the general tendency of observations that we can formulate for the end of the Neolithic: we are at the junction between the full diversification of weapons and definitive fixation of the stemmed and barbed points as the principal model for arrowheads (Dias-Meirinho, Ph.D. doctoral dissertation in progress).

### Perspectives

The possibility of systematizing studies and confronting them with new research questions now seems to be

<sup>5</sup> - This reference is the current basis of the typologies developed for the Neolithic and particularly for the 3rd millennium (such as Bailly, 2002; and Furestier, 2005).

<sup>6</sup> - We do not disregard the possibility of post-depositional fractures, which we verify case by case.

<sup>7</sup> - This first observation will be further explored in our continuing study.



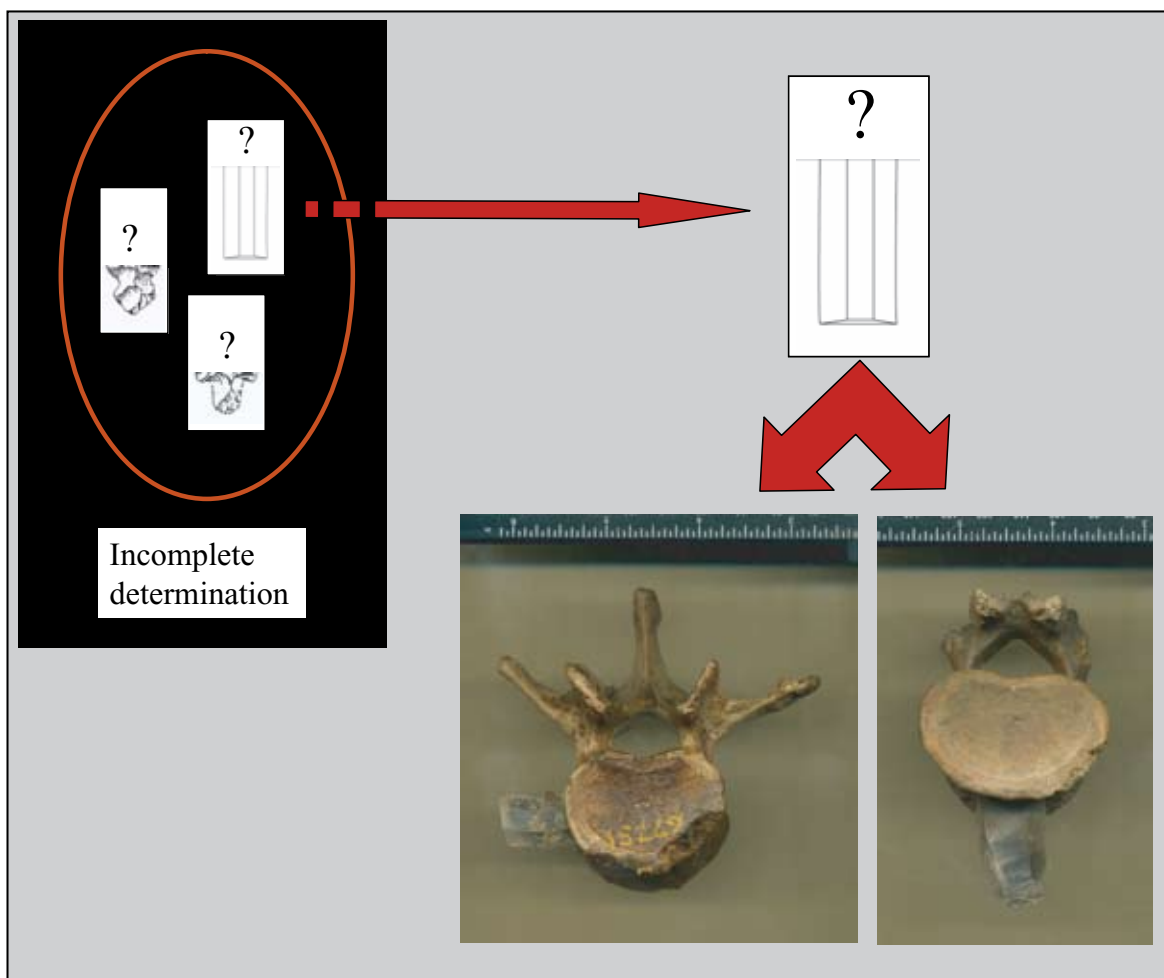


MORPHO-TYPE



SHARP TRAPEZOIDAL ARROWHEAD  
WITH ABRUPT RETOUCH  
ON BLADE BLANK

fig. 2 : La Pierre Michelot, Marne (Baye collection, Musée d'Archéologie Nationale). Weapon element with a wide geometric base and its radiographic image.



**fig. 3** : Examples of pieces with unretouched blades embedded in them (examples from Villevenard, Baye collection, Musée d'Archéologie Nationale).

assured. It will thus be feasible to respond to the question of whether perforating morpho-types, and among them the stemmed and barbed model, accompany modifications in the conception and practice of inter-human violence in these societies. Do these constitute two parallel manifestations or a single response to modifications in the social and/or cultural structure of these societies? This research perspective will advance through exchanges and the integration of observed phenomena (in ethnology and physical anthropology) in the context of the ANR "GUEROPE" project.

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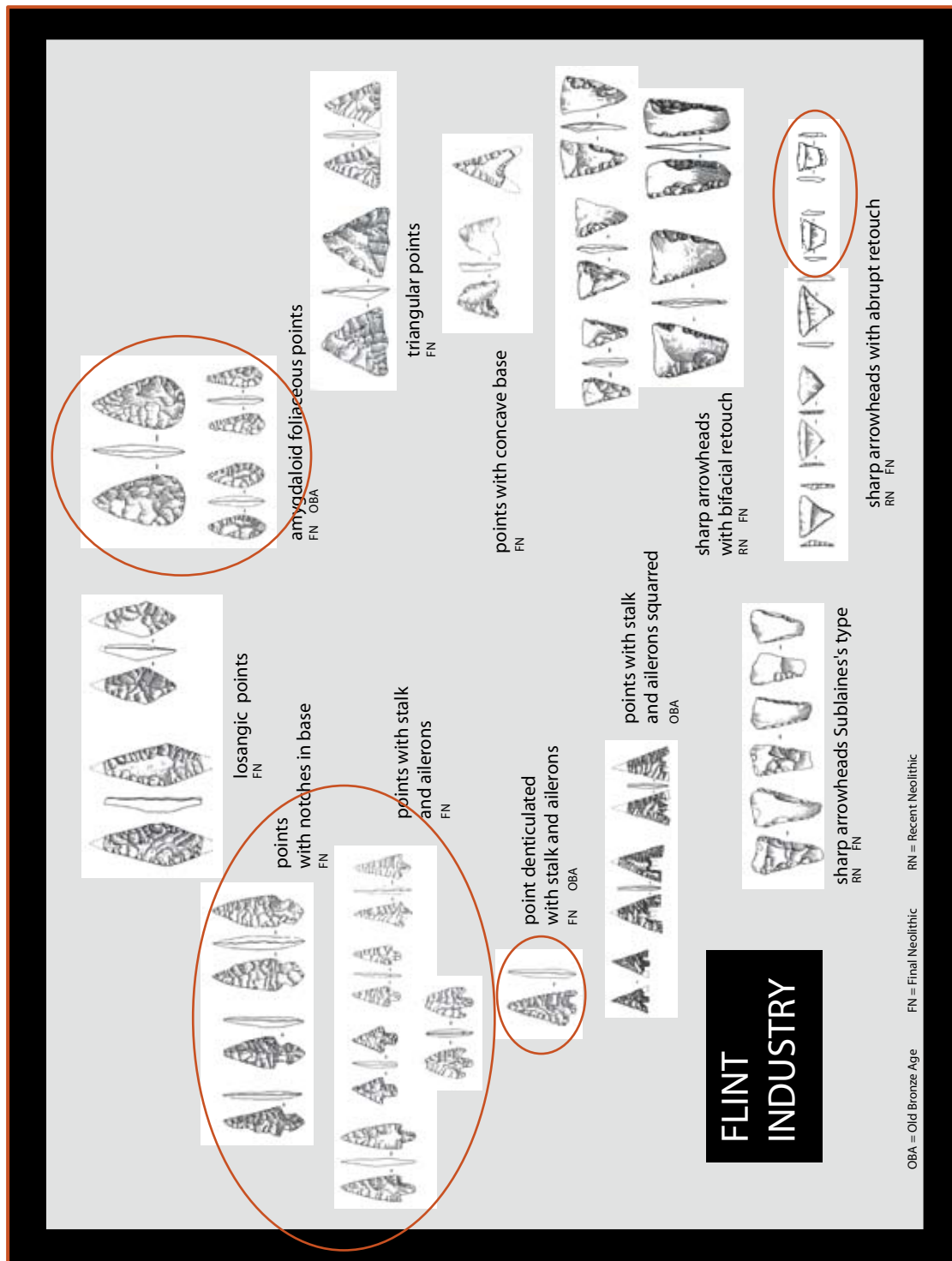


fig. 4 : Place of the morpho-types embedded in human bones within the principal morpho-types of the end of the Neolithic (from the Late Neolithic to the Early Bronze Age).

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# Diachronic prospects

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# A GRAVETTIAN KNAPPING WORKSHOP AT TERCIS (LANDES)

## A PROBABLE CASE OF APPRENTICESHIP IN THE FABRICATION OF LITHIC WEAPON TIPS

Aurélien SIMONET

«When we'll finally understand [...] that a rich culture with no educational system will bring much more to its children than a poor culture with the best educational system in the world, the solution to our educational problems will start appearing.» (Mead M., 1973, p. 219-220).

### Abstract

The site of Tercis, in the Adour Basin, contains several distinct artefact concentrations. It consists of a vast open-air knapping workshop where the production of lithic weapon tips in Tercis flint was a significant activity. Some of the lithic concentrations can be attributed to the Gravettian culture. However, the degree of technical investment varies from assemblage to assemblage, contrasting this probable cultural unity. This paper presents a study of the apprenticeship process revealed by these assemblages in order to stress the high degree of technical investment devoted to projectile tips, and consequently, their significant role in the evolution of lithic production systems.

**Key-words** : lithic weapon tips, Gravette Point, apprenticeship, Gravettian, flint economy, technical investment, Tercis, Isturitz

## Introduction

The site of Tercis provides an opportunity to study isolated lithic concentrations, which together are related to one or several distinct occupation zone(s) (relationships with the sites Isturitz and Brassempouy have been demonstrated through petrographic analyses). One of the concentrations contains a set of poorly made Gravettian weapon tips associated with a flint reduction sequence whose economic objective is unclear. This particular workshop, which can be interpreted as being at least partially linked to the apprenticeship of lithic weapon tip manufacture, is currently unique. This site, replaced in its regional context, can contribute to an understanding of the skill necessary for the fabrication of Gravettian backed weapon tips. Comparisons with another concentration of the knapping workshop showing a different level of competence, and comparisons with the weapon tips found in one of the probable habitat sites (Isturitz), emphasizes the interest of this assemblage in the context of questions relative to technical investment. This approach contributes to the debate concerning the necessity of qualitative descriptions and the need for greater objectivity in notions as difficult as competence level, with all that is implied in terms of typological designations. In this way, lithic weapon tip assemblages will become more coherent, some of their variability will rapidly be explained and the pertinence of weapon tips in the context of reflections concerning human-environment relationships and the characterization of cultural facies will be refined.

## General Presentation

### History

The importance of the site of Tercis—and of the Chalosse ensemble in general—was understood by local scholars (Daguin, 1948; Du Boucher, 1877, 1878, 1879; Pottier, 1872) as early as the end of the 19th century. It is therefore rather paradoxical that the site was then neglected for most of the second half of the 20th century. The work of R. Arambourou (1963), and especially the doctoral thesis by Cl. Thibault on the quaternary terrains of the Adour Basin (Thibault, 1970), are the only scholarly

studies that mention Tercis. Cl. Thibault provides precise stratigraphic and sedimentological information, including the stratigraphic profile of the Vignès slope. He hints at the richness of the site in blade cores, burins and unretouched blades and presents some of the Gravette Points of the Emile Daguin family collection. He proposes an attribution to the evolved Perigordian. We owe all the most recent data to the work of Christian Normand who collected several assemblages attributed to the Aurignacian and Gravettian. For the Gravettian, he also published the assemblage designated as “with backed pieces” (Normand, 1987, 1993).

### The site

The archaeological site of Tercis (Chalosse) is located on the southern slope of an anticline on a hill rising 60 meters above the Adour River. Many flint outcrops were exposed due to this geological resurgence. The site is a gigantic flint knapping workshop used by numerous Middle and Upper Palaeolithic human groups. Many of its concentrations were fortuitously discovered during the mining of a large quarry or the excavation of test trenches. All the concentrations are distributed from west to east along a crest more than one kilometre long. It is highly probable that other occupations remain to be discovered in unexplored sectors. The Gravettian is the best represented technocomplex with several concentrations already discovered. However, this particular context makes any precise chronocultural attribution rather delicate. One concentration contains an assemblage of irregularly backed weapon tips associated with a poorly executed flint reduction sequence. A confrontation of this assemblage with other well executed ones that likely have identical chrono-cultural attributions raises interesting questions concerning the notion of technical investment, a notion that is poorly documented in the archaeological record, and the care taken in the production of lithic weapon tips.

### The assemblage

Most of the archaeological objects originate from surface collections lacking any stratigraphic and/or archaeological context and are therefore cannot be exploited. In the context of lithic weapon tips, three Gravettian assemblages,



each corresponding to a non exhaustive collection of a concentration, are particularly interesting despite the loss of some data. One assemblage was collected by Emile Daguin at the beginning of the 20th century and two concentrations were partially collected by Christian Normand at the beginning of the 1980's. The assemblage collected by Daguin and one of the two concentrations collected by Christian Normand contain backed pieces. The latter was rapidly collected near "Les Vignès" in July 1982. For four days, Christian Normand conducted an emergency excavation, taking advantage of the postponement of construction work due to violent thunder storms. About 750 pieces were collected, though the size of the initial concentration is still unknown. This assemblage is particular in that it reveals a poorly executed flint reduction sequence associated with around twenty backed pieces that are either unfinished, failed or "atypical". The Daguin assemblage is probably the result of a selective collection carried out during several excavations conducted between 1911 and 1920. This assemblage, conserved at the Musée d'Aquitaine, was discovered near the Vignaux farm around 500 metres east of the assemblage collected by Christian Normand (fig. 1). It is characterized by a poorly executed rectilinear blade reduction sequence similar to that of the first assemblage.

#### *The regional context as an elementary archaeological unit*

Tercis, and generally speaking, the entire Chalosse and South-Aquitaine region are very rich in prehistoric occupations. Prehistoric industries were discovered very early and the region has been explored for quite a long time. Human occupations attributed to different techno-complexes have been found there. In our current state of knowledge, sites related to the Gravettian period are, however, less numerous than those attributed to the Magdalenian, for example. The principal Gravettian sites in the South-Aquitaine region and the Atlantic part of the Pyrenees are Brassempouy and Isturitz, respectively located at 50 and 70 kilometres from Tercis as the crow flies. Other than these two famous sites, which have yielded an exceptional quantity of archaeological material, almost no small, limited occupations (stopover

site, hunting station, knapping workshop) have been recognized or reported near these super-sites on the French side. For the moment, we know only Lezia, Hareguy and Gatzarria. Secondary occupations have until now been recognized mainly on the Spanish side. It is too early to specify the reasons for this difference in human occupation density, but it is likely due more to scientific deficiencies and historiographic consequences (incomplete surveys and/or conservation problems) than to a prehistoric reality. In many respects, Tercis represents an isolated example in the French literature. On one hand, it is the most northern site in this French-Cantabrian zone, and on the other it is, as we shall see below, a particular case. Tercis currently offers the only scientifically exploitable secondary occupations in France (perhaps with Gatzarria), providing us with a particular perspective on the larger collections of Isturitz and Brassempouy. The Tercis occupations—and all secondary occupations in general—represent frozen snapshots of the daily lives of human groups. This type of site is essential to obtaining a more paleoethnological and paleoecological view than that offered by long sequences excavated long ago, whose value is essentially diachronic. Only a dialectic study of both these types of prehistoric occupations—from a long and short term perspective—can allow us to progress in our understanding of Upper Palaeolithic societies. A dialectic perspective thus functions in a delicate balance that could be qualified as a field of antagonisms: what we examine in detail in order to have a clearer view prevents us from grasping the whole picture, but at the same time, details are necessary to a characterization of the whole.

#### **The Gravettian assemblages of Tercis**

Table 1 presents the counts of the lithic industry of the three Gravettian concentrations at Tercis. The backed piece assemblage and the Daguin assemblage contain lithic weapon tips, each with a very different degree of technical investment. The assemblage with long blades was treated in a university thesis (Simonet, 2004) that will not be presented here as it consists of a study of objects with large dimensions that does not include the operational sequence (reduction sequence) of weapon tip fabrication.



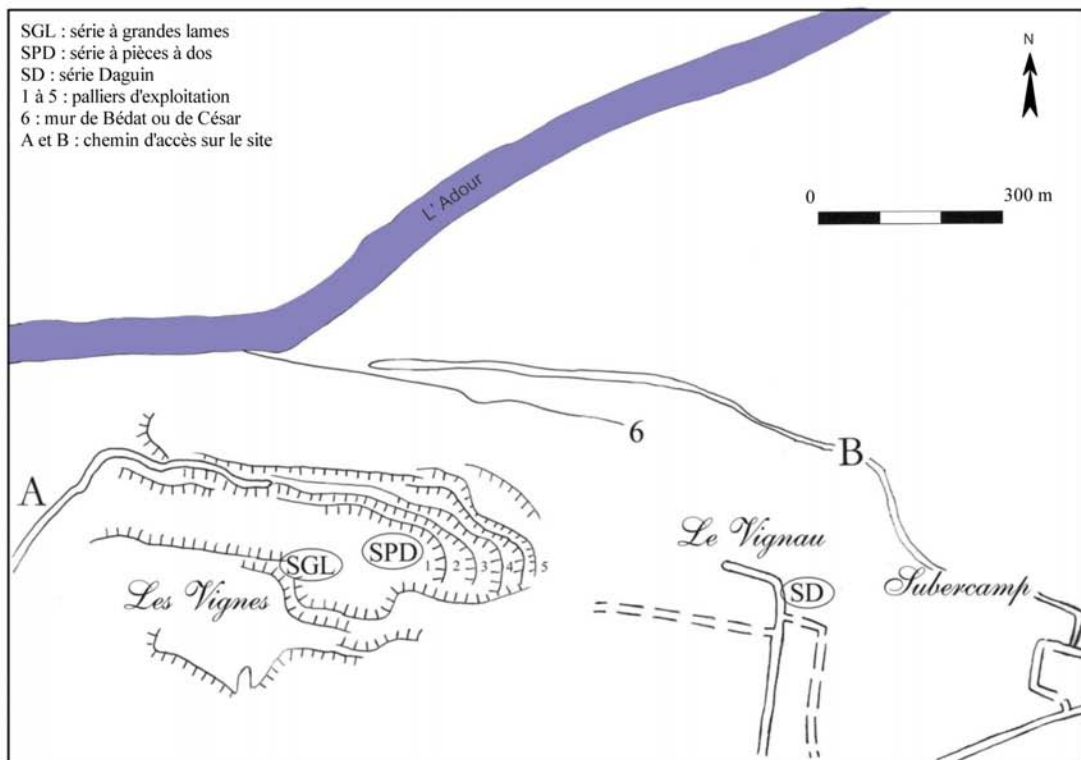
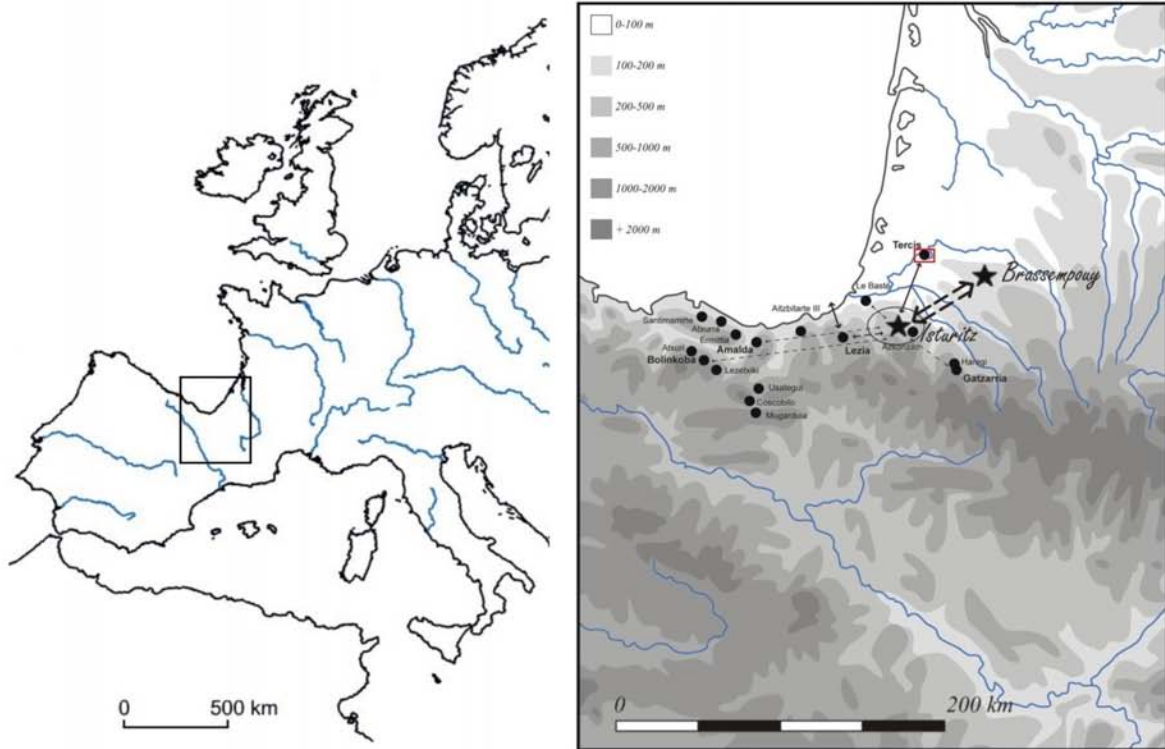


fig. 1 : The Tercis quarry and its geographic location in the context of the Gravettian sites of southern Aquitaine and the Basque country.



	Série à pièces à dos		Série à grandes lames		Série Daguin	
	Nombre	%	Nombre	%	Nombre	%
Eclat et esquille	512	72,2	173	40	environ 60	18,1
Produit lamino-lamellaire	171	23,2	202	46,7	189	56,9
Chute de burin	1	0,1	0	0	?	?
Nucléus	8	1,1	8	1,8	29	8,7
Ebauche de nucléus	0	0	1	0,2	0	0
Casson	1	0,1	2	0,5	0	0
Percuteur	5	0,7	0	0	0	0
Débris	2	0,3	40	9,2	0	0
<b>Total débitage</b>	<b>700</b>	<b>95</b>	<b>426</b>	<b>98,4</b>	<b>278</b>	<b>83,7</b>
Burin dièdre	0	0	3	0,7	1	0,3
Burin d'angle sur cassure	0	0	11	2,5	0	0
Burin sur troncature	0	0	5	1,2	2	0,6
Élément tronqué	0	0	0	0	3	0,9
Pièce à encoche	4	0,5	0	0	3	0,9
Eclat retouché	0	0	9	2,1	4	1,2
Produit laminaire retouché	3	0,4	0	0	17	5,1
Lame appointée	0	0	1	0,2	4	1,2
<b>Total outils</b>	<b>7</b>	<b>0,9</b>	<b>29</b>	<b>6,7</b>	<b>34</b>	<b>10,2</b>
Pièces à dos diverses	29	3,9	0	0	0	0
Pièce à dos semi-abrupte	0	0	0	0	1	0,3
Pointe de la Gravette	0	0	0	0	9	2,7
Lamelle à dos	3	0,4	0	0	1	0,3
Lamelle à dos tronquée	0	0	0	0	5	1,5
Lamelle à dos bitronquée	0	0	0	0	1	0,3
Pièce gibbeuse à bord abattu	0	0	0	0	3	0,9
Pièce à dos partiel	0	0	0	0	0	0
<b>Total armatures</b>	<b>32</b>	<b>4,3</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>6</b>
<b>Total</b>	<b>737</b>	<b>100%</b>	<b>433</b>	<b>100%</b>	<b>332</b>	<b>100%</b>

tab. 1 : Typo-technological counts of the three main Tercis assemblages.

### *The backed tool assemblage*

In the backed tool assemblage collected by Christian Normand, almost all weapon tips (34 pieces) appear to show a low degree of technical investment (fig. 2 and 3). There are almost no domestic tools. It seems clear that an operational sequence dedicated to the production of blanks for backed tools is represented within the workshop. The “atypical” or imperfect aspect is the common element between most of these backed pieces. We observe a lack of normative criteria in the selection of blanks, which is unlike the usual Gravettian behaviour of selecting regular, rectilinear blanks for the fabrication of lithic weapon tips. Moreover, the retouch of these pieces is almost always unfinished. These are therefore tools in the process of fabrication, but quite particular ones since many of them show a lack of functionality. For this reason, Christian Normand proposed, just after the discovery of these pieces in the early 1980’s, that they could be the result of a learning exercise. Only three pieces (fig. 3 – numbers 1, 2 and 3) are distinguished by the quality of their blank, the regularity of their

retouch and their dimensions. These pieces could have been manufactured by experienced knappers. On the contrary, all of the other backed pieces are imperfect or unfinished. The most striking aspect is the heterogeneity of the blanks selected within a single group of objects that appear to be conceptually identical: Gravette Points. This diversity of blanks is the consequence of an economic choice. The greatest investment was made with knapping waste products, such as: side blades (fig. 2; 3, 4, 5, 16, 17), blade-flakes (fig. 2: 6, 9, 10, 19, 20, 21, 18), a distal partial neo-crest (fig. 2: 23), a blade-flake (fig. 2: 14), blade debitage by-products whose role in the operational sequence is no longer legible (fig. 2: 11 et 12) and full debitage products lacking regularity or straightness, with a marked undulation, for example (fig. 2: 1, 2, 13). Three small flakes were also used. Only four tools (fig. 2: 7, 8, 15 and 22) were made on good quality blanks. Two pieces raise questions concerning the possible link between breakage and back retouching. These pieces seem to have been broken during debitage, thus before the retouching of the back.



They are fragments of full debitage products that were used, and not whole, unworked laminar products. Only two tools would thus have been made from whole, good quality blanks (fig. 2 – Nr. 7 and 8). The blank of tool number 8 is nonetheless very small relative to the average size of the debitage products. Though the ensemble of products thus appears to be unsuitable for the production of backed tools, and consequently, to have been intentionally selected for this unsuitability, they also reveal the competence of the artisan who produced them and his mastery of the management of a high quality debitage sequence, as is shown by: the presence of flank blades to correct the arch (fig. 2: 16 and 17) or to thin the base (fig. 2: 4 and 5) to create naturally pointed full debitage products; the use of a distal neo-crest to maintain the distal longitudinal convexity, and; the use of opposed striking platforms. Negatives of opposed removals are thus visible on pieces 7 and 12. It seems strange that the same artisans could have produced the blanks. The blanks may in fact have been secondary products resulting from an operational sequence requiring a higher level of competence, which were given to an apprentice to learn how to produce a backed tool. This would explain why some un-fragmented backed pieces were abandoned (fig. 2: 3 and 23). The knapper knew very well before he began to shape piece number 23 that it would never be functional as a projectile point. Since there was no shortage of raw material in this context, there was absolutely no reason for these pieces to be collected to satisfy functional needs. The other pieces are of little morphological value as they are always irregular, curved, twisted of varied dimensions. Moreover, good blanks seem to have been voluntarily excluded. A dialectic observation of unworked blanks and backed pieces shows a systematic selection of the worst blanks, undoubtedly to avoid wasting raw material... Indeed, in addition to the blank used, the way retouching method is of some significance: the knapper did not try to achieve a precise shape. It is more the gesture itself than the finished object that counts. The knappers(s) seem to have been trained in the art of producing backs, which resulted in pieces that are rather difficult to

classify according to classic typological criteria. This is again contrary to standard Gravettian behaviour, which followed much stricter rules and had as a priority higher quality laminar products. This is shown by the Daguin assemblage, which has, among others, naturally pointed blades on the distal part explaining the frequent correlation between the orientation of the point and that of the blank debitage.

Observation of the 8 cores (fig. 4) associated with the backed pieces displays the same lack of technical investment, a carelessness that results in small second-rate blanks. In a context where there were so many high quality blocks, considering the significant number of objects collected on the site since the 19th century, it seems particularly surprising that the knapper(s) did not choose small, frost split, rolled or altered flint blocks. Indeed, these second-rate blocks cannot be interpreted as the result of a difficult supply of good quality raw material. As for the few knapped blanks, they have no economical finality, as most of them could have been refitted to the core.

It is also interesting to note that some of the laminar blanks, which were abandoned and isolated within the production, were nonetheless of a good quality (fig. 5), which is in contradiction with the concurrent use of bad quality flint. This demonstrates that economising raw material was not the only motivation of the stone knappers. When studying unretouched laminar products it can be demonstrated that the desired type of product is unique. They were trying to produce very standardized straight blades around 2.5 inches long, 0.5 to 0.8 inches wide and 0.2 inches thick (fig. 5). This size corresponds precisely to that needed to produce a Gravette point. The products were knapped using a soft mineral hammer, as shown by the marked abrasion in the butt, the often punctiform or reduced impact trace, the splintering of the bulb and the frequent presence fine, closely spaced undulations. As with this high-quality laminar production knapped using tangential percussion method, products refitted to the cores seem to have been knapped with a soft mineral hammer.



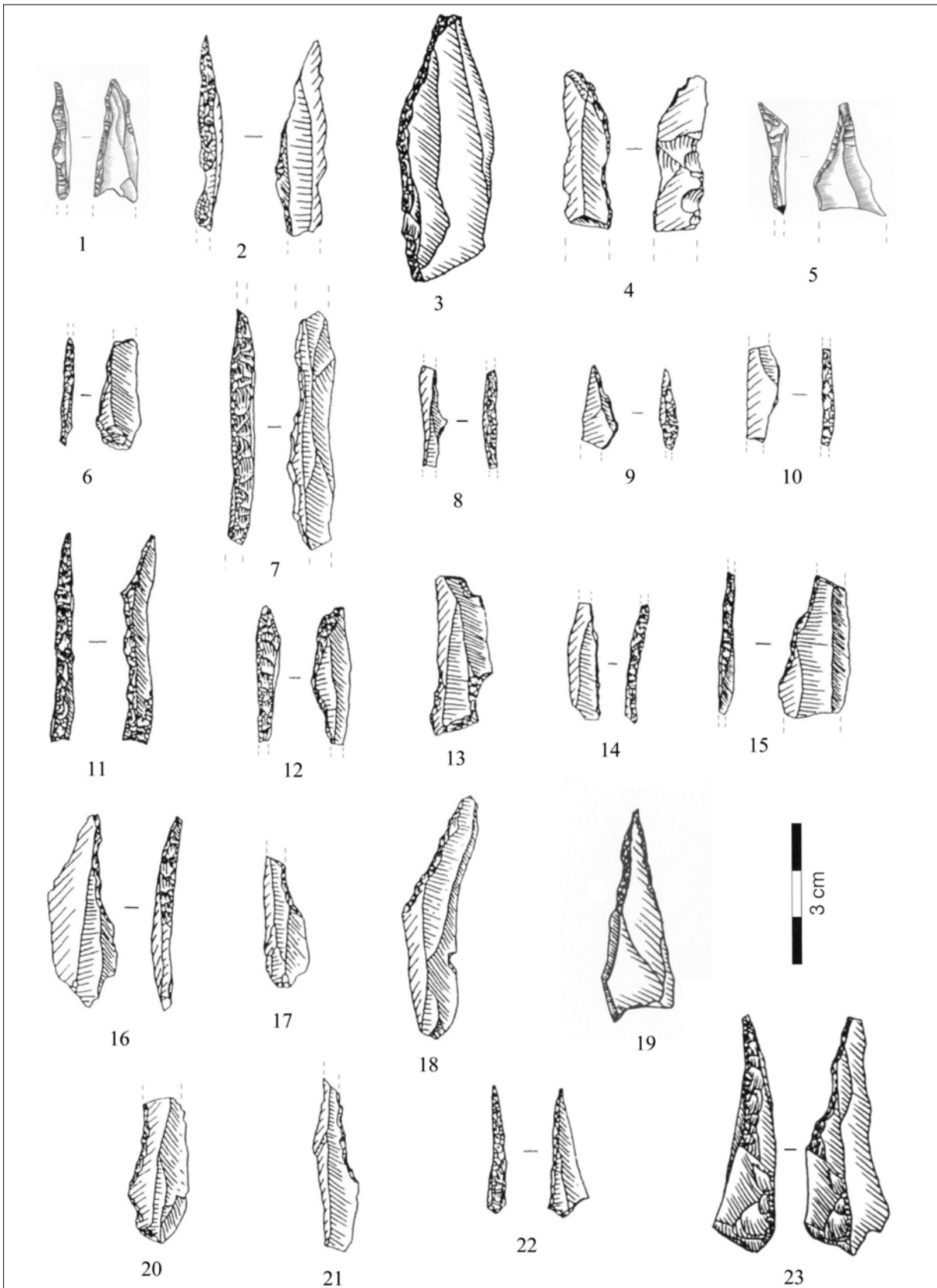


fig. 2 : The backed pieces of the Tercis assemblage collected by Christian Normand (by Normand Ch., 1993, except 1 and 5 by the author).



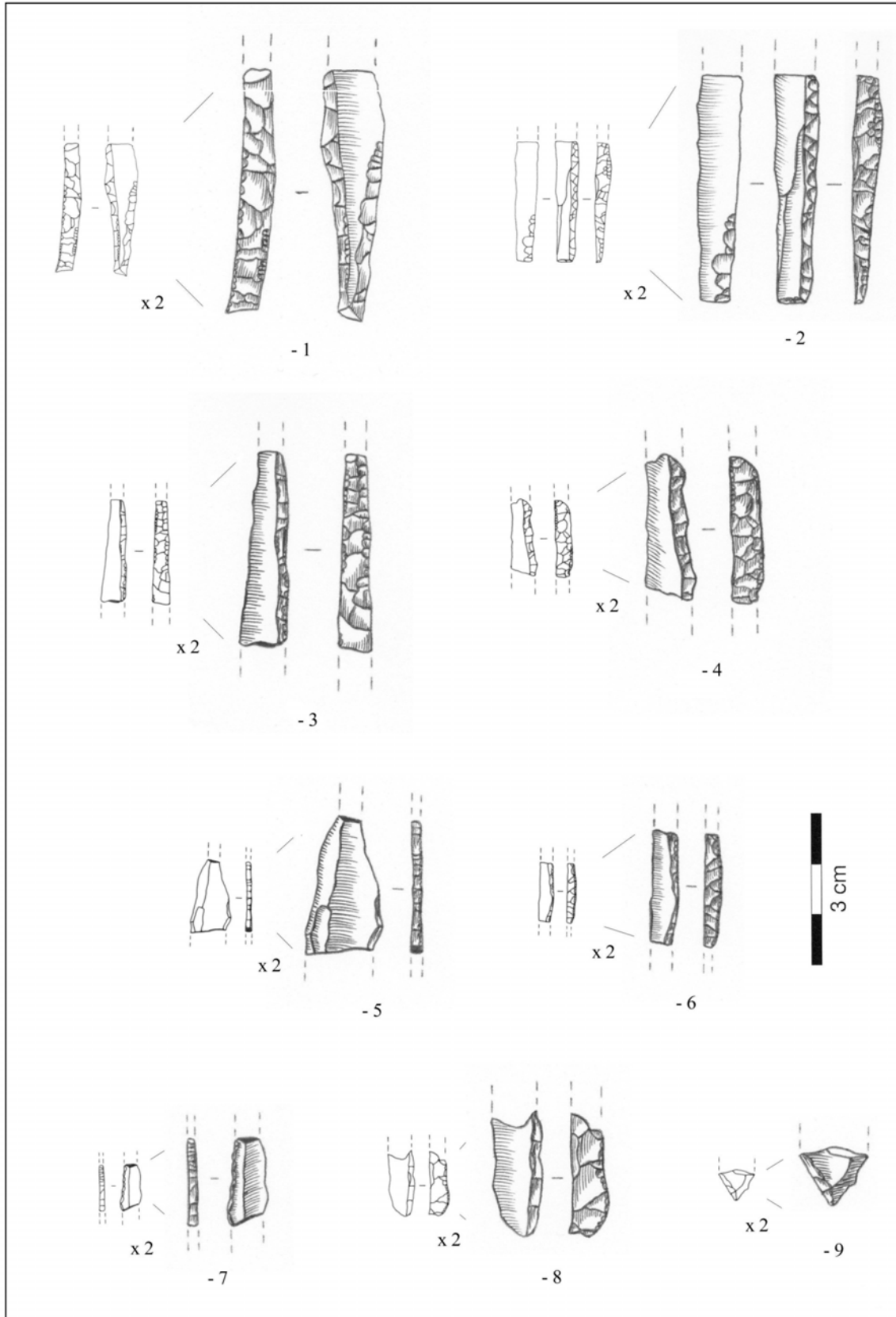


fig. 3 : The small backed pieces of the Tercis assemblage collected by Christian Normand.



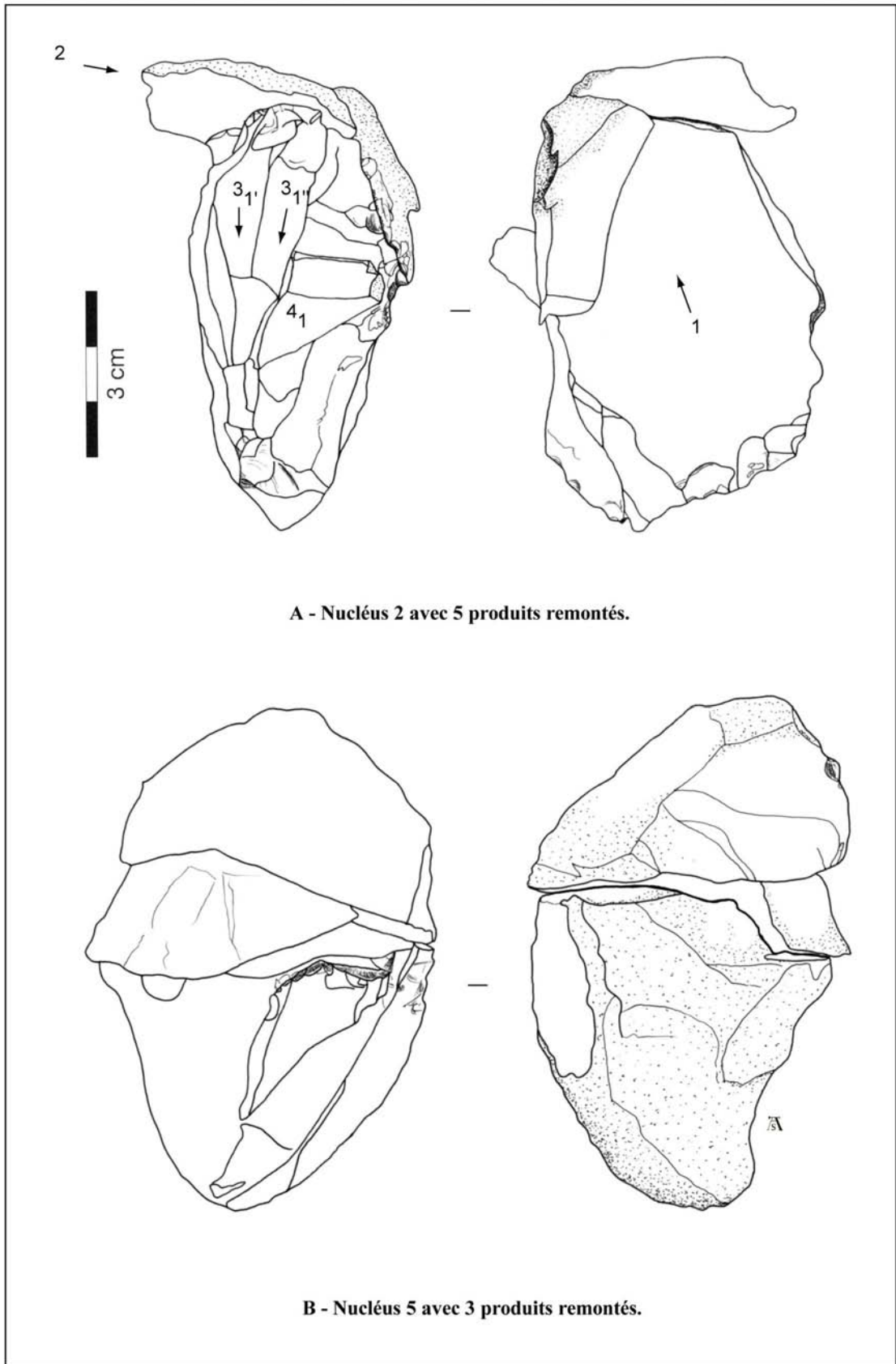


fig. 4 : Two examples among the seven cores present in the Normand assemblage of backed pieces.



However, the abrasion of the platform lip is not very intensive and even almost inexistent, contrary to that of the abandoned unretouched products on which an insistent abrasion can be observed. We can therefore already note two different types of uses: the use of good quality blocks to produce well-made blanks, which were taken away (did the cores stay in an adjacent concentration?) and the use of rather low quality blocks or flakes, used locally as most of the elements of the reduction sequence could be found, but which produced only products close to laminar flakes whose detachment was much less prepared. The difference between the 8 cores used for refitting and the well-made unretouched laminar products knapped in high quality flint is indisputable, especially if we take into account the fact that the abandoned products were of a lesser quality.

On the other hand, many arguments already lead me to individualize core n° 1 (fig. 6). It is the only one made with good quality grey/white flint, which is perhaps a sub-type of the “grey-black Tercis type” flint (Christian Normand, personal communication). This material is slightly out of place among the other pieces made of low-quality grey-black Maastrichtian flint. On the other hand, it is probably the only core that was productive with a complex management of the debitage. Finally, the core was not used in the same location as only one rather big sub-cortical blade is made from the same material, and is therefore the result of its use. All these arguments argue for an individualization of this core (and of the blade with which it is associated), thus corroborating the theories of Christian Normand. All the necessary arguments seem to be present to illustrate an example of an apprentice workshop (the first and only one yet found?) for the fabrication of backed weapon tips:

**Petrographic arguments:** one or more competent knappers(s) selected low quality flint for apprentices so as not to waste good quality flint. Core N° 1 and its single blade could have played the role of a model to guide apprentices; it could represent the “example to be followed”.

**Economic arguments:** This possible demonstration core is the only one that was productive. The other cores produced an average of only two or three irregular laminar products, which were not used. These products could thus be refitted on the cores.

**Technical arguments:** the poorly knapped cores reproduce—in a less careful and smaller manner (because of the low quality of the raw material)—the Gravettian debitage concept based on core reduction with two striking platforms organized into a hierarchy and a curved laminar removal surface with the objective of producing straight blanks. Though reproduced with notable clumsiness, these concepts are visible. They are just simplified, the capacity of using the best process in the context seeming not to have been always applied.

**Spatial arguments:** They are probably the best arguments for identifying debitage made by an apprentice. Indeed, a quality exploitation was made in an adjoining concentration or in a different area of this concentration where it was not collected. Core n° 1 and its blade, as well as all the good quality laminar products that could not be detached from the core in the assemblage, are the only evidence of the careful debitage where the degree of technical investment is much higher.

#### *The Daguin assemblage*

The 29 cores of the Daguin assemblage (fig. 7) and the abandoned laminar products reveal the search for a highly standardised, which was straight, rather thick and 2 to 3 inches long. Two types of exploitation were used there, mostly on flake edges but also on small blocks. The debitage is generally bipolar and organized in a hierarchy with a frontal exploitation extending onto the flanks. However, as there are no refits, it is difficult to determine if the second striking platform had other functions earlier in the reduction sequence. A high level of technical skill is observable in the management of the debitage process. The shaping and the initialization of the debitage are mixed together and the full debitage phase appears to have been quick and efficient. This



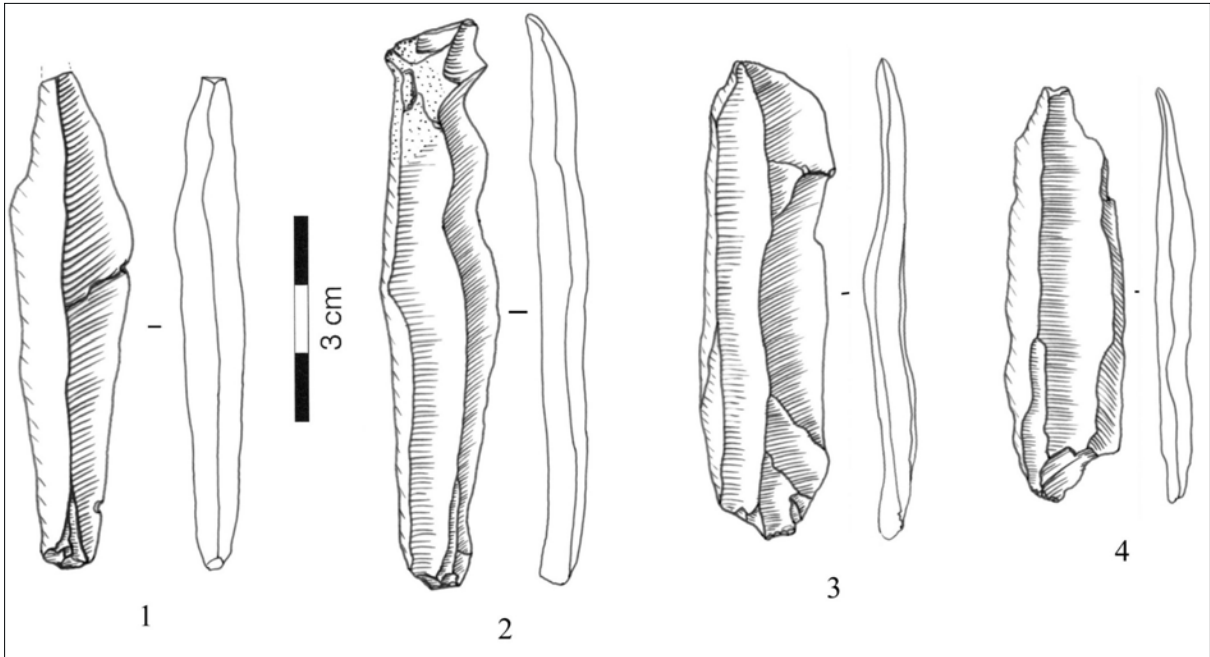


fig. 5 : Rather regular unretouched laminar products. These products, better manufactured than the blanks used for the backed pieces, were not retained. Tercis, backed pieces assemblage.

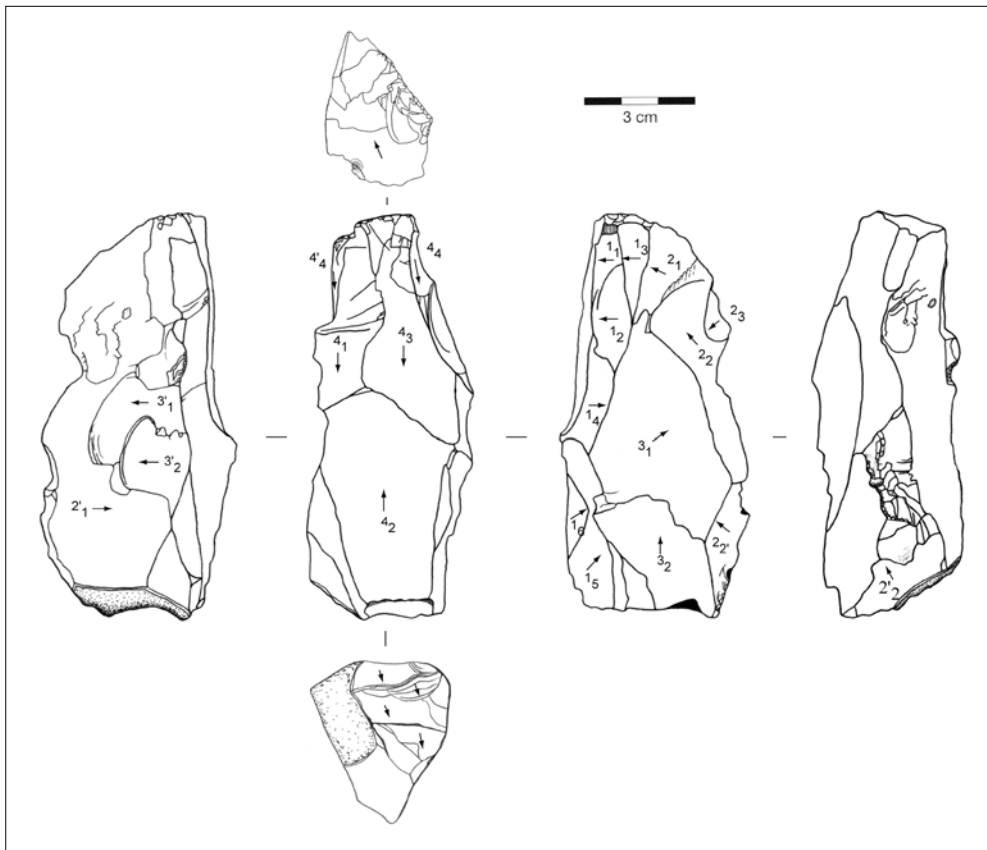


fig. 6 : Core 1. Normand backed piece assemblage.



is a very elegant reduction sequence characterized by a high aptitude for adaptation, needing no complex preparatory phase, for example, which would have resulted only in a waste of raw material often present in the form of small nodules. This operational and technical purity expressed by the search for “**a subtle balance where a low-cost pre-shaping will allow a low-risk laminar extraction**” (Pigeot, 1987) is particularly difficult and signals the work of a very experienced knapper with an excellent knowledge of knapping principles (fig. 7). The general impression is therefore of an adaptation of actions to the raw material more than the strict implementation of more complex debitage modalities which would indeed allow debitage of an even better and more controlled quality, but would use more raw material. This is corroborated by the high number of operational modalities and different debitage rhythms used to produce a single blank (bipolar not organized into a hierarchy, bipolar organized into a hierarchy, opposed-off-centred, unipolar – tightened frontal, widened frontal, semi-rotating). The rhythm is perfectly controlled, as are the lateral and longitudinal convexities, through the use of restoration techniques freely used by the knapper, the last resource being to continue the debitage with an opposed-off-centred technique allowed by a highly arched removal surface and the triangular section of the core. Together with this quality debitage, twenty backed pieces were discovered (fig. 8 and 9). Most of these are very well made, which is in agreement with what was noted on the debitage. One or more knappers(s) of equal competence seem to have worked here. The fact that some pieces were broken while being shaped and/or the existence of pieces broken and abandoned after being used, as well as pieces with an very high distortion relative to an ideal morphological and/or dimensional concept, be it technical or symbolic, may explain their being abandoned in the context of a knapping workshop. For all these reasons, the Gravettian weapon tips of the Daguin series, in the same way as those of the first series, do not represent the fulfilment of the ideal concept. However, (and it is here that the assemblage allows us to advance in our understanding of the technical (and typological)

ideal of these Gravettian groups), it shows a very high level of technical investment. In the end, the weapon tips desired, retained and used by the knappers must have been very similar in size and morphology to those backed pieces.

**The Daguin assemblage corroborates the hypothesis of a distribution of the weapon tips and debitage products in the assemblage of backed pieces into two skill levels. It represents the ideal concept (and not result) intended by the knappers of the first concentration**

If we consider only the Gravette points (disregarding the two bitruncated backed bladelets of the Daguin assemblage), the desired concept can be defined as follows: the size of the points tends toward a length of 2 to 2.5 inches, a width varying between 0.25 and 0.5 inches and a thickness between 0.1 and 0.2 inches. These tools are characterized by a very slender morphology as well as a very straight back. The latter is more often on the right than on the left, made by a dominating, abrupt, alternating (crossed) retouch on the proximal and distal parts. Finally, the unfinished products allow identification of the different production phases: the first one corresponds to initial forming of the back using semi-abrupt retouch. Dividing the shaping process into two different stages allowed the knapper to avoid breaking the blank. This stage indeed appears to be trickier as the pieces are generally abandoned when the blank is broken during the shaping of the back. The unfinished Gravette Point (fig. 9 – n° 1) illustrates this first stage: the right edge has been shaped by semi-abrupt retouch. The blank was broken during this first production phase, which consisted of forming a semi-abrupt back before completely finishing it with abrupt retouch. Object n° 4 (fig. 9) illustrates the second stage. It is a backed piece broken at both ends. The left edge shows direct retouch. Two abrupt retouch shoulders flank a central portion with semi-abrupt retouch. It is thus possible to examine one stage of the work: after having completely worked the edge with semi-abrupt retouch, the knapper performed a second passage to



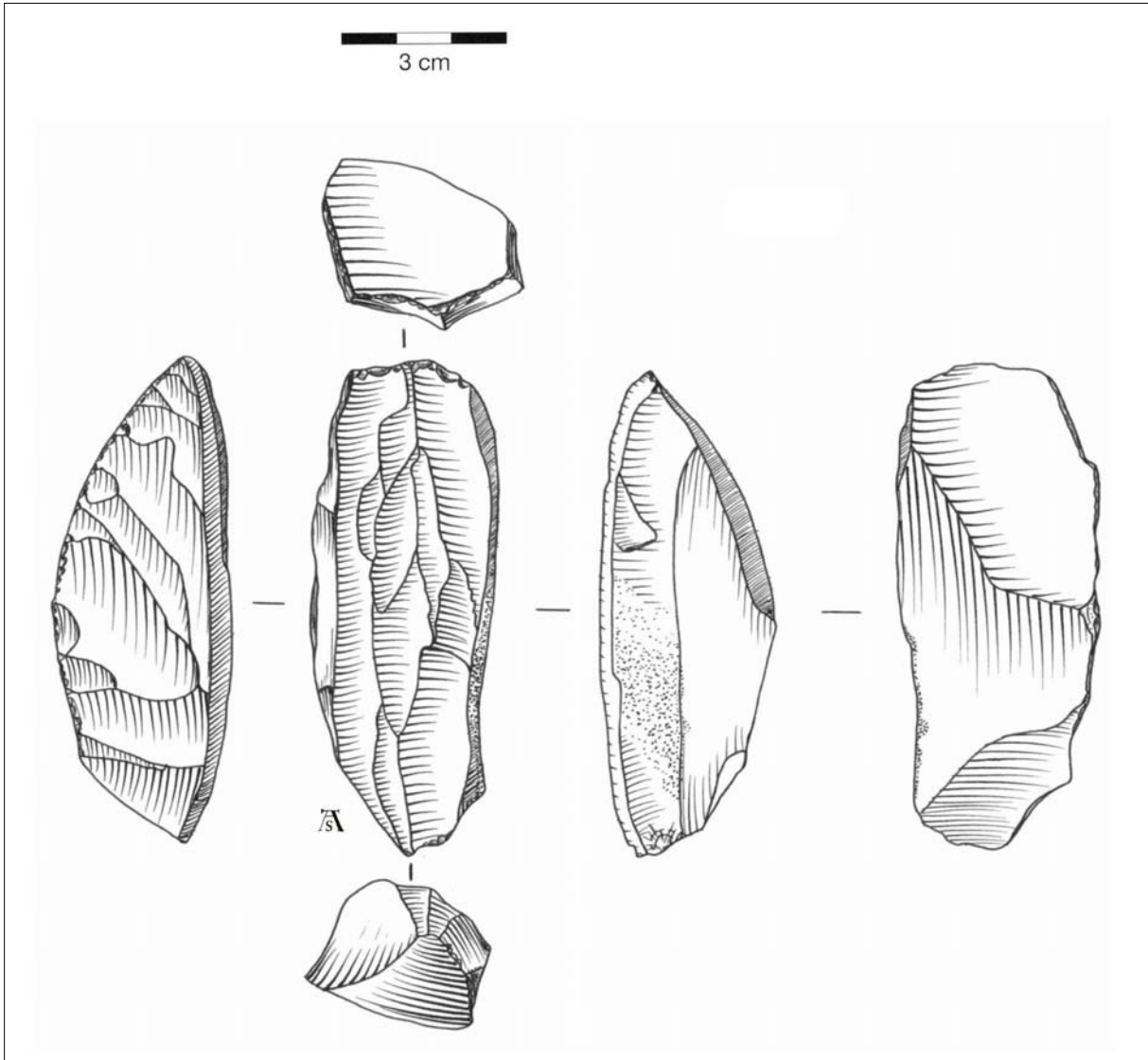


fig. 7 : Core destined for the production of Gravettian laminar blanks. Daguin assemblage.



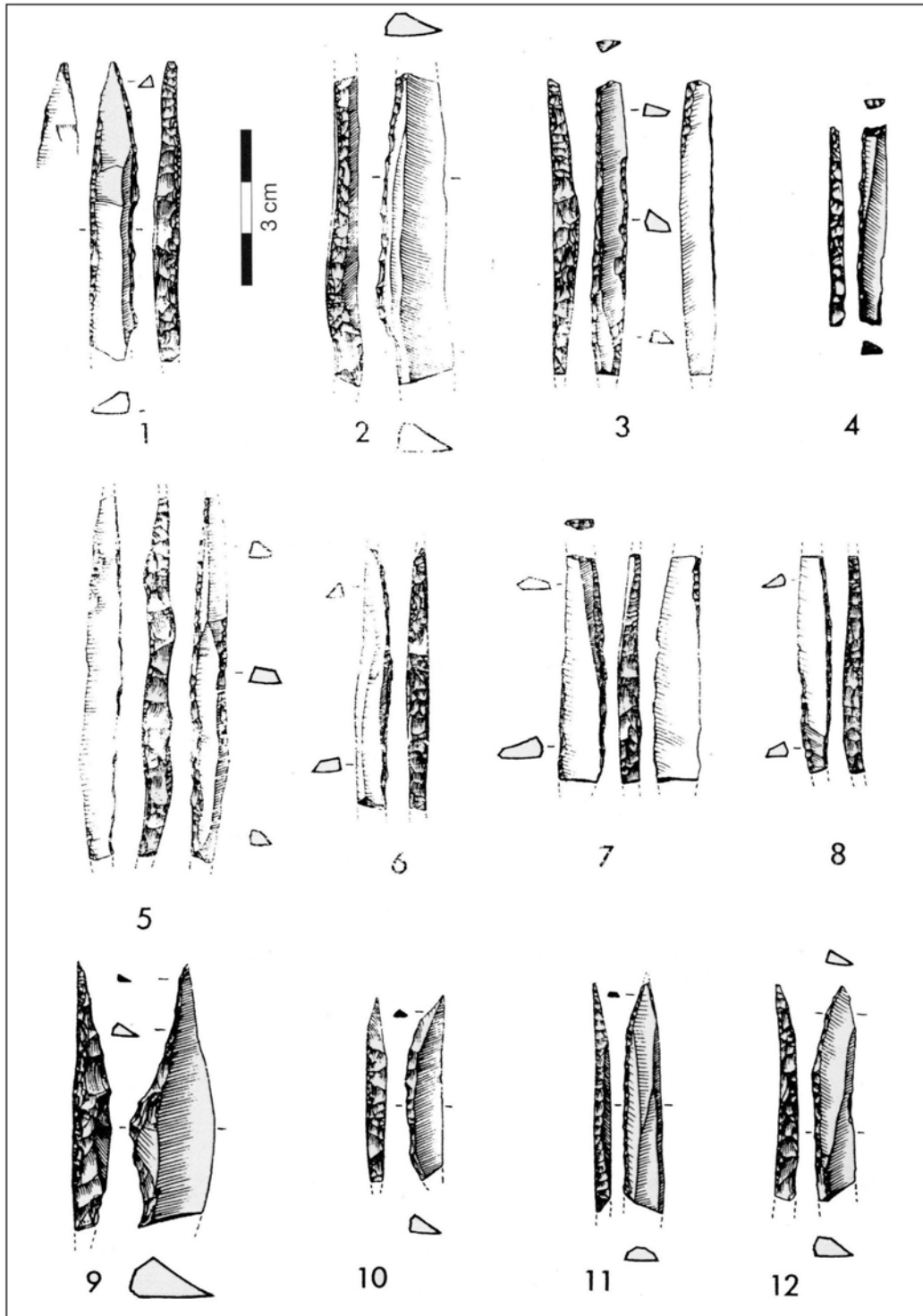


fig. 8 : Backed pieces of the Daguin assemblage (drawing by Pierre Laurent, from Thibault Cl., 1970).



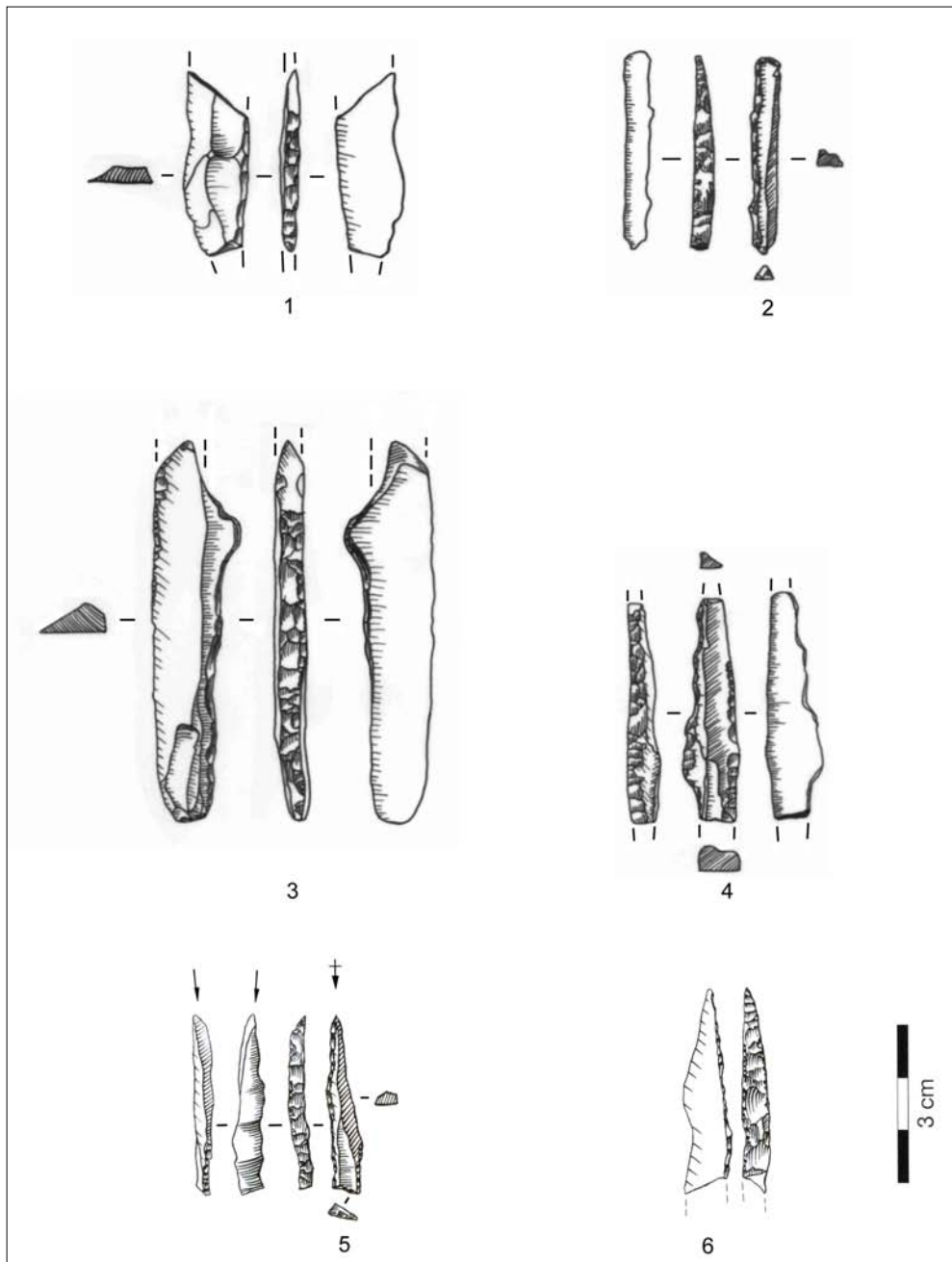


fig. 9 : The other backed pieces of the Daguin assemblage.



make the retouch steeper, beginning at each end. It is at this stage of shaping that the end must have been broken. It is also possible to observe partial direct retouch on the opposite edge, which means the knapper first straightened the edge before completely shaping the back. As for the shaping direction, it is usually difficult to assess. On the unfinished piece n° 4 (fig. 9), the shaping of the back from both distal and proximal ends is similar to the methods used in the backed piece assemblage: retouch is often frequently performed from both ends by several removals joining one another in the central part, as was already noted M. Lenoir and J. K. Kozłowski (1988). Finally, one of the characteristics of the operational modalities seems to be very significant: a diagonal truncation can be felt on the distal extremity of six of the pieces. This production technique, which consists of shaping the back from the ends beginning after having truncated the distal third can be noted on the final (abandoned) shape of pieces 1, 6, 7, 9, 11 and 12 (fig. 8). This knapping method, consisting of starting back retouch with a distal truncation of the laminar blank links the Gravette points of the Daguin assemblage to the backed pieces of the Norman assemblage (fig. 10). This method seems to have been used by beginning knappers in the series collected by Christian Normand. Objects 2, 3, 4, 11, 18 and 23 of this assemblage (fig. 2) clearly show, for example, the first steps of shaping the back with a diagonal distal truncation.

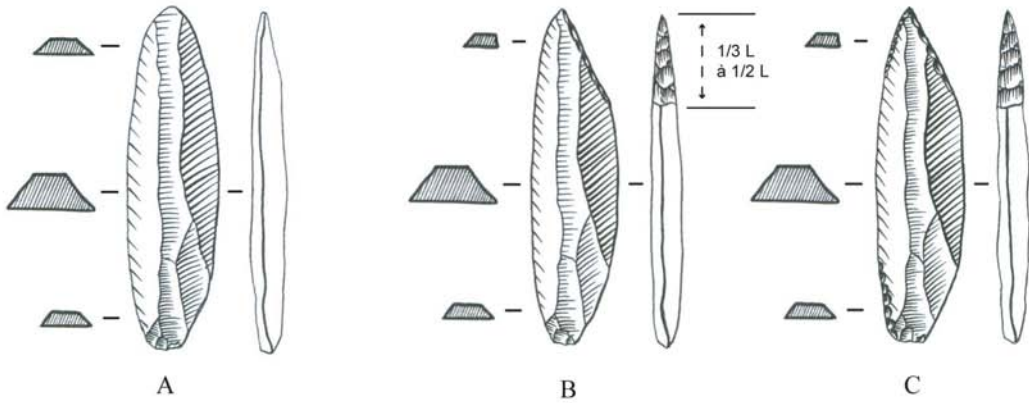
The care taken in the debitage of the Daguin assemblage demonstrates the high degree of technical investment required for the manufacture of Gravette points, but also (and above all) that of the blanks of these points. The blank selection phase also shows a high level of investment given the great number of good quality blanks abandoned on the site. All these elements further emphasize the importance of the apprenticeship process (fig. 11). In the case of Tercis, the role of apprenticeship is perhaps more economic than technical. The aim seems to be more focused on learning how to produce a back without breaking the blank, thus collected among the abundant waste products, than on the production of an ideal piece which would have, in this case, required

the section of a standardized blank. Indeed, the relative number of broken pieces often appears to be rather high. H. Bricker had already observed this (Bricker, 1973) at the Abri Pataud, as did Magen O'Farrell more recently at Corbiac (O'Farrell, 1996, 2004). On the other hand, retouching is not in itself very difficult. This hypothesis seems to us even more plausible since the ideal blank of a Gravette Point is highly standardised and therefore doubly valued. The loss of raw material during the shaping of the back is indeed even more detrimental as the technical investment required for the debitage is high. Knapping straight blades of the desired dimensions and mastering the operational modalities of Gravettian cores like the ones observed in the Daguin assemblage (fig. 7) is technically quite difficult. Consequently, breaking a straight blank while retouching the back would have been particularly annoying, especially if raw materials were scarce.

It is nonetheless possible to contest the reality of these different skill levels. The search for diverse, little standardized flake blanks is a method universally applied within societies whose economy is at least partly based on the exploitation of flint. Indeed, a quick comparison with the Isturitz or the Brassempouy collections, for example, shows how important the use of flakes may be in the Gravettian, in particular for the production of Noailles burins. If we consider that they can represent almost half of the domestic tools produced, we can see that we should absolutely not underestimate the economic importance of the more rapidly produced blanks. We can simply note that, on one hand, this economic behaviour does not exclude the learning process hypothesis and, on the other, if the lower quality blanks found at Tercis had an economic finality, why abandon the best laminar blanks? The hypothesis according to which they were essentially looking for highly standardized laminar blanks, and therefore would abandon the regular blanks, seems to be the obvious one. The waste products of this reduction sequence would then be used by the less competent knappers to learn how to manufacture backed tools. What type of information can we thus try to reveal based on the



**I - Première étape : la variabilité morphologique des supports sélectionnés induit celle des modalités de retouche.** Le tailleur semble préférer amorcer le façonnage du dos par troncature du tiers distal (B) avant de retoucher le bord opposé par retouche directe si nécessaire.



**II - Deuxième étape : façonnage complet du dos par séries de retouches rectilignes.** Le dos est confectionné en plusieurs passes progressivement plus abruptes. Le bris de la pièce au début de cette étape (A) créé une pièce à cran.

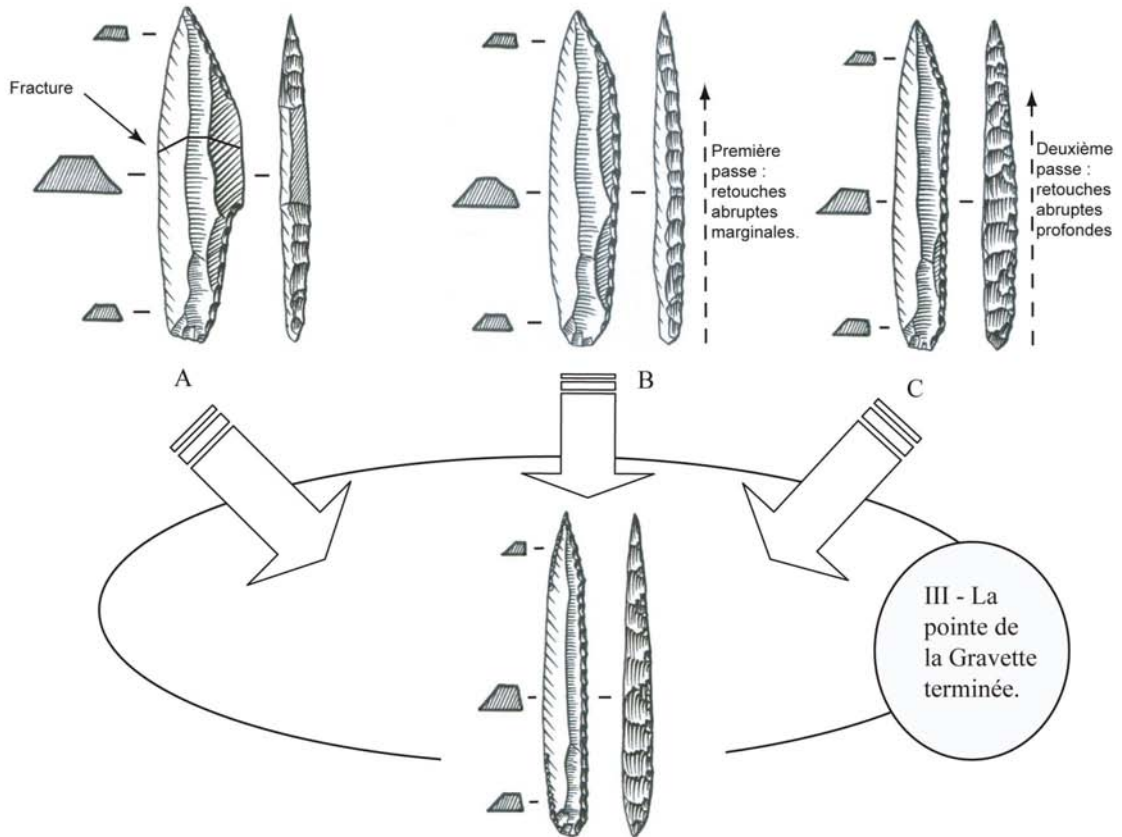


fig. 10 : Manufacturing scheme of a Tercis Gravette point using a distal truncation.



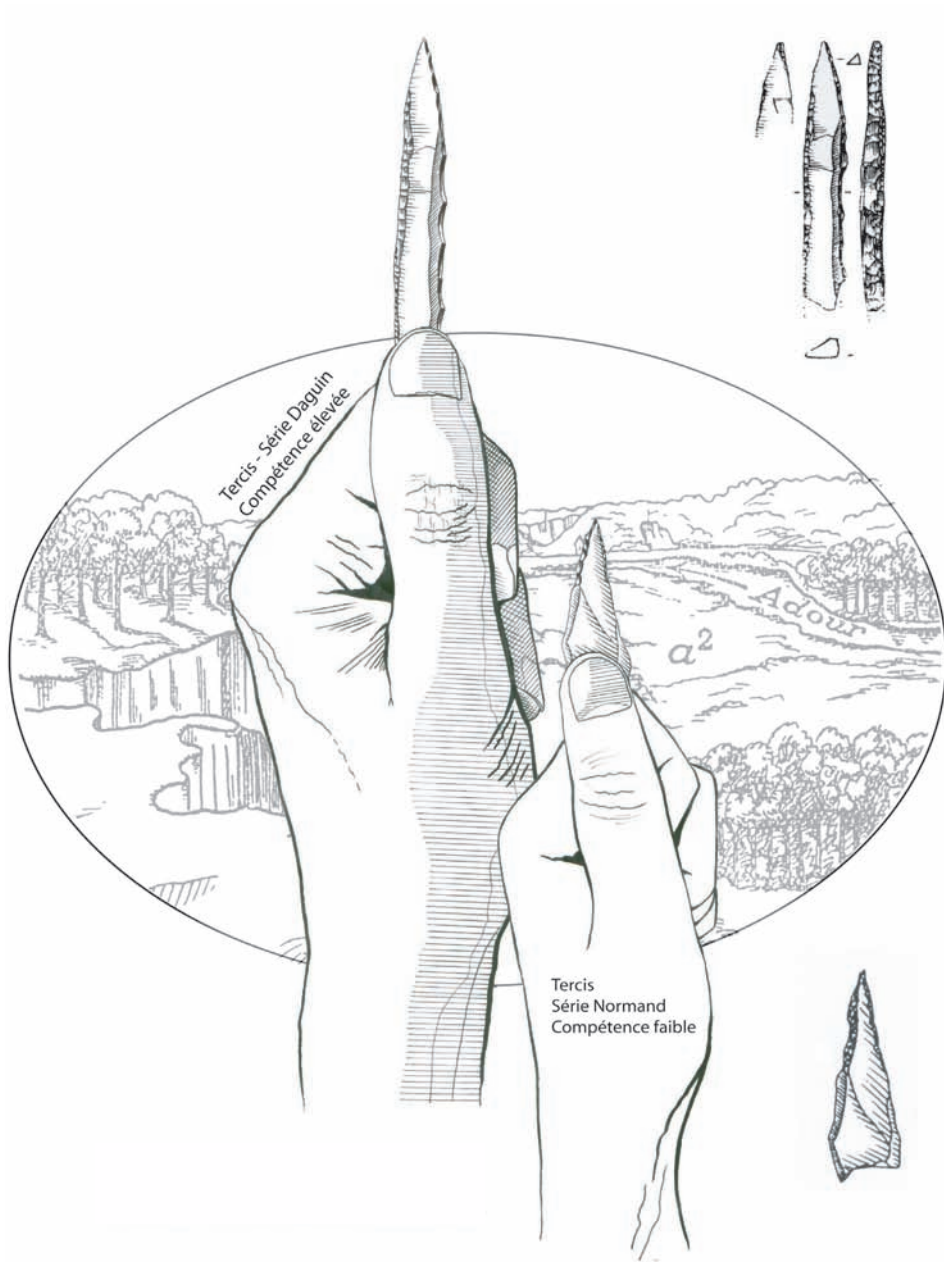


fig. 11 : Tercis (Landes): a site allowing an intimate approach to a Gravettian community through the hypothesis of apprenticeship.

different occupations in the area? Let us now look at the example of Isturitz, which is, along with Brassempouy, the key deposit of the South-West Atlantic zone, as well as the largest collection of Gravettian backed pieces in the geographic area considered.

### Regional perspective : comparison of Tercis and Isturitz layers IV/FIII and III/C.

Since the site of Brassempouy contains a very small quantity of Gravette points, we prefer to focus our comparison here on the example of Isturitz Cave. Two extensive excavation sessions were conducted at this site: that of Emmanuel Passemard from 1912 to 1922, and that of René and Suzanne de Saint-Périer from 1928 to 1952. The recent excavation of Gravettian backdirt from the early Saint-Périer excavations (1952) by Christian Normand, associated with old collections, has yielded an impressive assemblage of Gravette Points. All of these Gravette Points come from Isturitz Cave and can be divided into two Gravettian layers that can be linked to two old excavation seasons: layers IV/III of the Saint-Périer excavation, corresponding respectively to layers FIII/C of the Passemard excavations. Nevertheless, considering the thickness of the layers (sometimes 1 metre for the lower layer IV/FIII), these old distinctions probably represent the confusion of several sub-layers not detected by the excavators.

### *A powerful concept linking the Gravette points of the lower Gravettian layers at Isturitz (IV/FIII) despite a variable outcome.*

The great majority of the Gravette Points come from layer IV. There are 269 in the Saint-Périer collection (IV). I will therefore focus on the study of this collection since the few complete or almost complete Gravette Points of the Passemard collection (8 pieces) or of the sieving operations (3 in 1998, 2 in 2004, 4 in 2005) contribute no supplementary information on the morpho-dimensional characteristics. Among these points, 99 are whole or almost whole (that is more than a quarter!), which is an impressive proportion that may have been augmented by a selective sorting by the Saint-Périers. I will voluntarily ignore questions concerning their

representation within the whole lithic tool kit because of the confusion mentioned above. The proportion of tools is of little interest as they probably mixed tools belonging to different layers. The proportions therefore have no diachronic value.

In terms of the morpho-dimensional characterization of the Gravette Points of layers IV/FIII, they have, beyond their variability in size, a great conceptual homogeneity (fig. 12). The global shape of the points is systematically slender and lanceolate, both edges being symmetrical to the axis joining both ends, the distal part being slightly more slender than the proximal one whose base tends to be rounded. The opposite edge is slightly retouched, but may be left unretouched if the edge of the blade is naturally convex. If it does require retouch, it is direct and made before the back is retouched, as shown by the unfinished points. The retouch logically concerns mainly both ends, as they need to be pointed. As for the back itself, it seems to be shaped with a double notching (fig. 13). Consequently, it is impossible to determine if the shaping was started by preferentially selecting one specific end. The shaping can be on the right side or on the left (if we consider that a typological group corresponds to a homogeneous occupation). Alternating (crossed) retouch is not systematically employed. In general, direct retouch seems to be dominant, at least at first, and physical laws determine the use of alternating retouch when the back extends beyond the central dorsal ridge, which explains why it is very often used at the extremities. Finally, the last characteristic is the low-angle inverse retouch on the extremities, whose cultural meaning has largely diminished since its definition by Denise de Sonneville-Bordes (1954, 1955 and 1956). However, it is no doubt well developed in layer IV at Isturitz, which confirms the data from Abri Pataud where it is most frequent the Noailles layer (David, 1985). This low-angle inverse retouch is more or less invasive and could be linked to the search for lanceolate points. Between the simple marginal inverse retouch and the invasive low-angle inverse retouch, there are many nuances that seem to serve a single goal. In the same way, there are also several different degrees of retouch



development on the edge opposite the back, which is often difficult to dissociate from Vachons type retouch. In the case of Isturitz (IV/FIII), it does not seem useful to attempt to separate Gravette Points from Vachons Points. Since the presence or not of retouch seems to depend mostly on the initial morphology of the blank, it would be much appropriate to include Gravette points and Vachons points in a single category, according to individual preferences. Indeed, the concept underlying the production of points seems so powerful that any shift from the norm must have a technical explanation.

There are some deviant cases, however. For example, one Gravette Point discovered in the backdirt of the Saint-Périer excavation of 2005 (fig. 16 – C) is slightly crooked, which means the piece is not perfectly symmetrical relative to the axis joining both ends. This geometrical deviancy seems to have annoyed the knapper who tried to correct the form through direct retouch, followed by inverse retouch on the opposite edge of the back. Unfortunately, a slight protuberance prevented a complete correction. This point is a good example of a piece manufactured by a competent knapper, though the final goal was not reached. The underlying concept of the object seems identical to that of all the other points, but the intrinsic contingencies of flint knapping sometimes resulted in shifts that we cannot interpret as a flexible feature of the operational concept, but rather as a failure or mistake during production. This object is an excellent example in the search for a common theoretical concept hidden behind obvious differences, whether they are interpreted as skill levels or material contingencies.

Following observations made in the Daguin assemblage, this point represents the failure of a competent knapper, meaning an unaccomplished concept that is nonetheless detectable. Given the high skill level shown by the knapper, his intentions and mistakes can be seen behind the object. The failed pieces, found marginally in association with well-made pieces are, in opposition to the ensemble, even easier to understand. An interpretation of the backed tools from Tercis isolated

from the cultural norm seems more delicate, which explains the difficulty of linking the Tercis concept with that of Isturitz IV/FIII.

#### *A specificity of the upper layer (III/C) of the Isturitz Gravettian*

Nevertheless, in the context of a comparison with Tercis, the points of the upper layer C are much more interesting (fig. 14). The Passemard collection indeed offers Gravette Points designed according to a slightly different operational concept. They are more slender and have a back that is straighter or slightly angular in the proximal third (fig. 14). The base has the shape of a quarter-circle as a slight inverse retouch made the heel rounder from the opposite edge on. The longitudinal symmetry seems therefore much less mandatory. This special morphology, unknown in the lower layers and which contains only lanceolate symmetrical points, concerns almost half of the Gravette Points in layer C (Passemard collection). These Gravette Points could represent a different cultural skill, already noted by Passemard:

«Finally, this remarkable shape appearing in layer FIII, the point with battered back, is developing, but larger and more elegant than previously. [...] All the points are straight and I found no curved ones.» (Passemard E., 1944, p. 36).

This conceptual modification of the “Gravette Point” as an object possesses an obvious diachronic interest. We must still find the reasons for it, however. Is it the morphological concept of Gravette points that changed or their production techniques? In other words, was the morphological change intentional or was it the tacit result of a change of production techniques? Which change (morphological or technical) gave rise to the other?

From this research perspective, the straighter form of the back could be linked to a more gradual back shaping technique than that of the double notching found in layer IV/FIII (fig. 13 and 15). The shaping of the back follows a straight line and is performed in progressively abrupt successive passes, thus corresponding to the

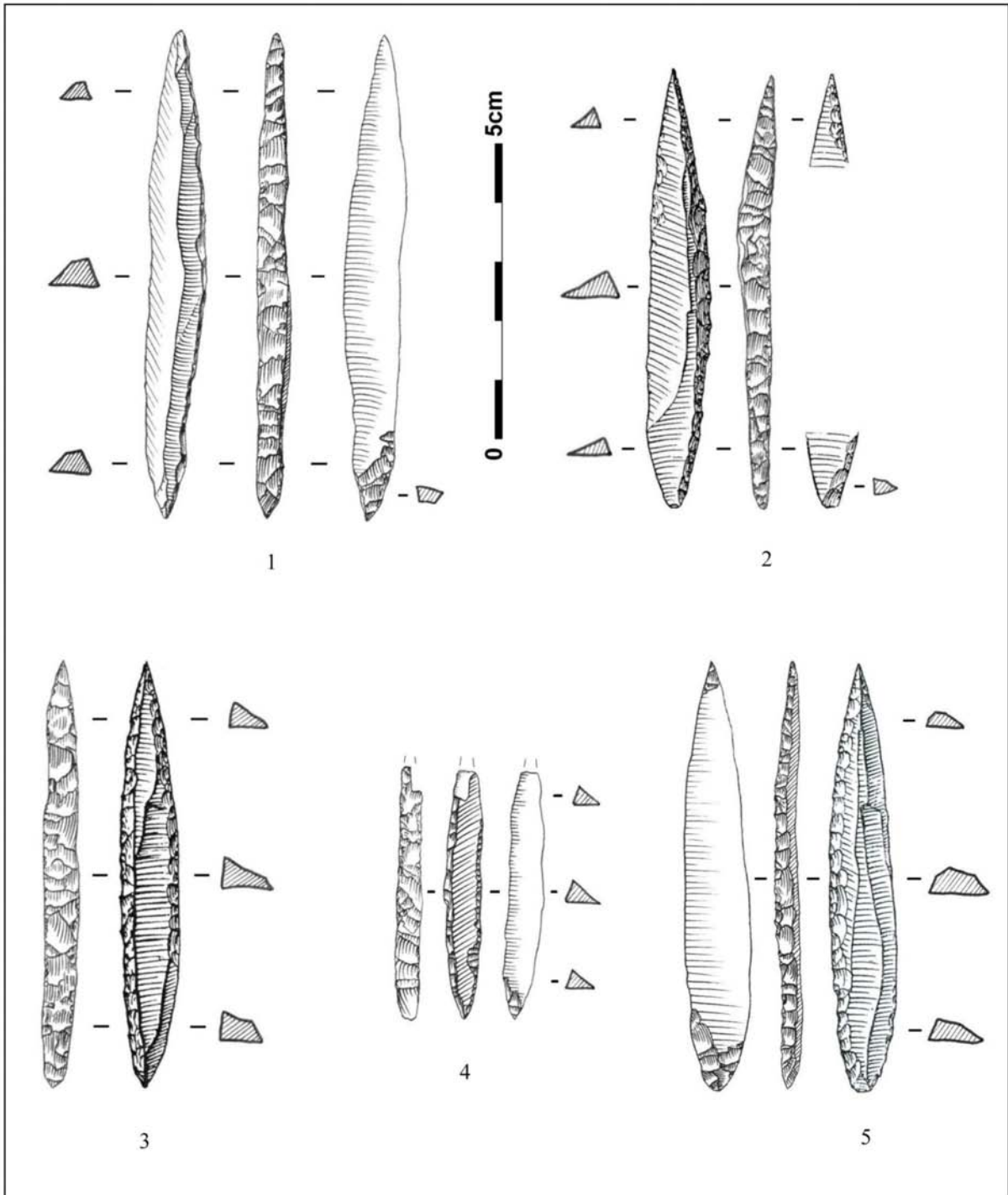
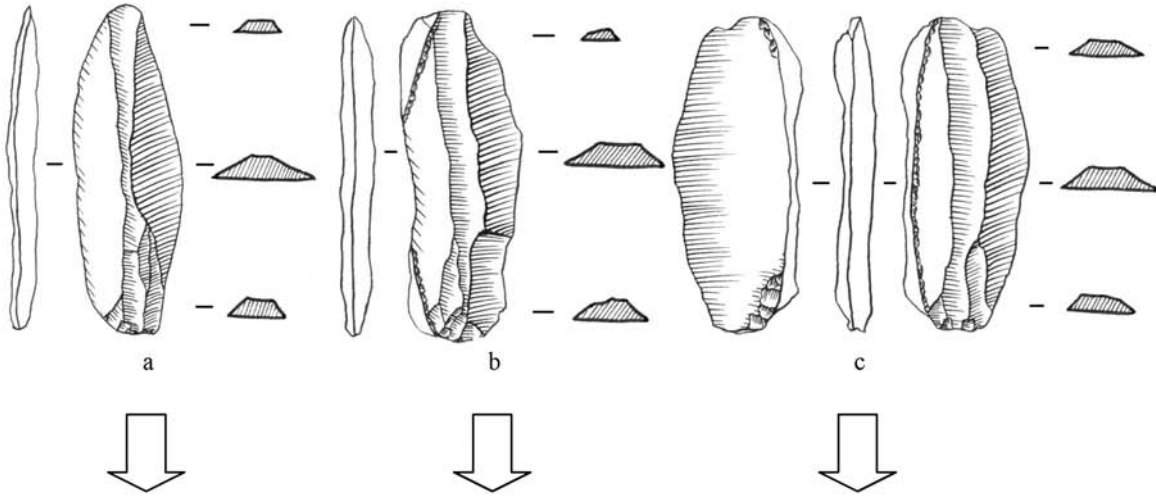


fig. 12 : Gravette points of Isturitz – layer IV/FIII.



**I – Première étape : La variabilité morphologique des supports sélectionnés induit celle des modalités de retouche.** Le tailleur commence par façonner la convexité du bord opposé au dos.

Si besoin, correction du bord opposé au dos par retouche directe et/ou retouche inverse rasante des extrémités.



**II - Deuxième étape : façonnage du dos par double encochage à l'aide d'une retouche directe puis croisée utilisée d'une manière particulièrement insistante aux extrémités...**

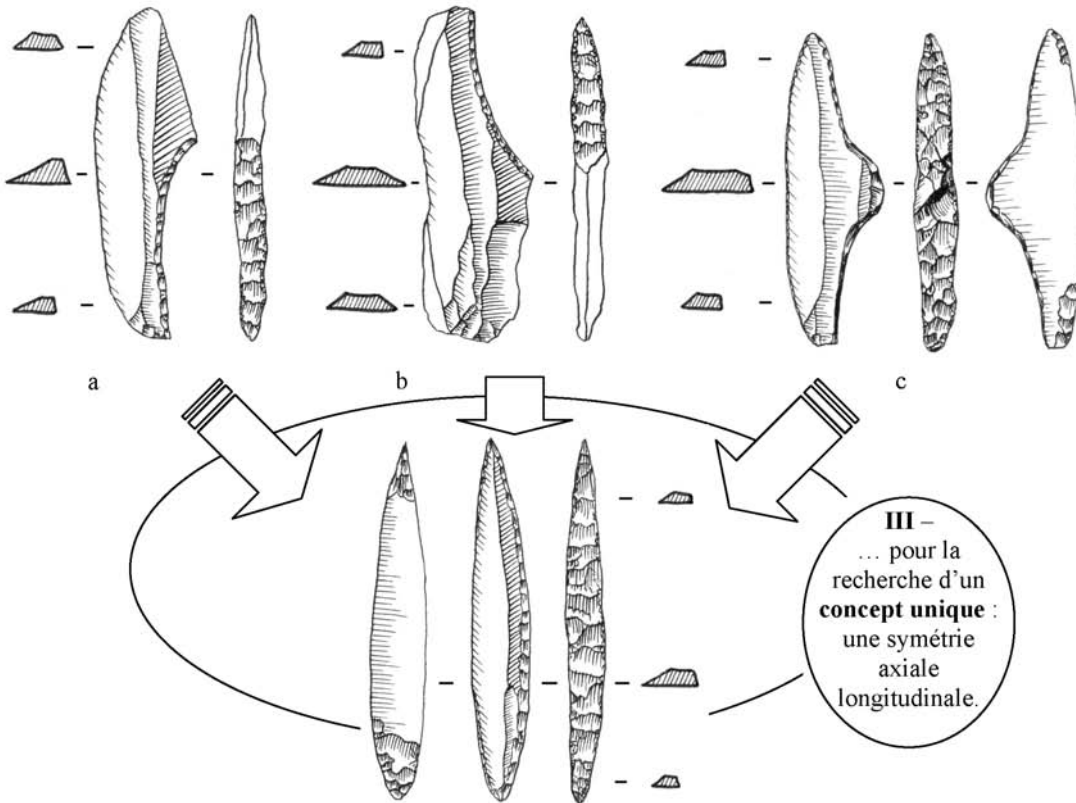


fig. 13 : Isturitz Gravettes manufacturing scheme (layer IV/FIII) made with a double notching.



observations made on the Tercis assemblage (fig. 10). The position of the truncation sometimes displays a notable difference with Tercis. In the Tercis assemblage, it allowed the shaping of the back to be initiated on the distal part, while in Isturitz level C, the morphology of the finished point implies a proximal truncation of the blank. Though the Tercis points (Daguin assemblage) can be considered, due of the straightness of their backs, as being closer to the Isturitz C layer than to the IV/FIII layer, no full identity can be observed between the concepts. It is unfortunate that the lithic assemblage (and the points) of layer C are so few (around twenty pieces). Do the Tercis points fall within the range of variability of the “Isturitz C point” type, a type whose representation—and variability—is still biased due to the small size of the sample? Or is this another Gravettian occupation that can be differentiated (diachronically?) from occupations IV/FIII and III/C of Isturitz Cave? It is unfortunately too early to choose between these two alternatives (fig. 16). We can, however, note that this preferential convergence of the Tercis and Isturitz C points correlates with a body of evidence (stratigraphic, technological and typological) that orients us more toward a chronocultural attribution of the Tercis series to a more recent phase of the Gravettian.

The shaping techniques offer interesting research perspectives concerning the knapping debris that can be associated with the production sequences of weapon tips, such as points with back protuberances, truncated blades, shouldered artefacts and diverse partially backed pieces, etc... Could some of these technical waste products be more closely associated with production modalities that could more easily generate such failures during the shaping of the back? This would lead to the question of whether the increased presence of some waste products might reflect a skill characteristic of a particular facies. To put it more simply, could the proportions of some technical pieces have a chronocultural diagnostic value, related that of the associated weapon tips? For example, the lanceolate Gravette points of layer IV/FIII at Isturitz seem to generate more points with a back protuberance. Their manufacturing technique using a double notching followed by reduction

of the protuberance sometimes failed during the last step, thus creating objects with a specific form (fig. 15). On the contrary, more obliquely blunted pieces (fig. 17) might be found in assemblages such as that of Tercis and Isturitz C in association with Gravette Points with a straighter back and a proximal and/or distal angulation.

Considering the low degree of morphological difference between the Gravette points from Isturitz IV/FIII, Isturitz C and Tercis, all our previous reflections inevitably lead us to a more detailed study of back shaping methods as a culturally diagnostic element. Following the hypothesis that the term “Gravette Point” amalgamates several types of points whose morpho-technical characteristics may or may not overlap, and consequently merges them into a single typological group in the eyes of the Prehistorian, the different types of points would seem to be a result of their production strategy rather than of an intentional search for a particular morphology. More research is necessary, however, to conclusively respond to this question, particularly concerning the dimensions of the points and their implications in hunting strategies. For example, the Gravette Points realized by double notching from Isturitz IV/FIII are generally smaller and lighter than those from Isturitz III/C and Tercis (Daguin assemblage), a difference in size that could explain a change in production techniques.

## Conclusions

If the identity of a culture is closely linked to the transmission of its criteria (the phenomenon of enculturation), it then seems important to define the spheres of activity that imply the greatest investment in terms of apprenticeship. The degree of investment in each of the spheres considered is more or less proportional to its own significance within the society.

Moreover, a close interaction seems to exist between different types of weapon tips and the evolution of lithic production systems (Nuzhnyj, 1993). It is mainly through the study of weapon tips, their production strategies, or even the nature of their raw material procurement, that it will be possible to distinguish cultural sub-facies. What appears to be common among many human groups is



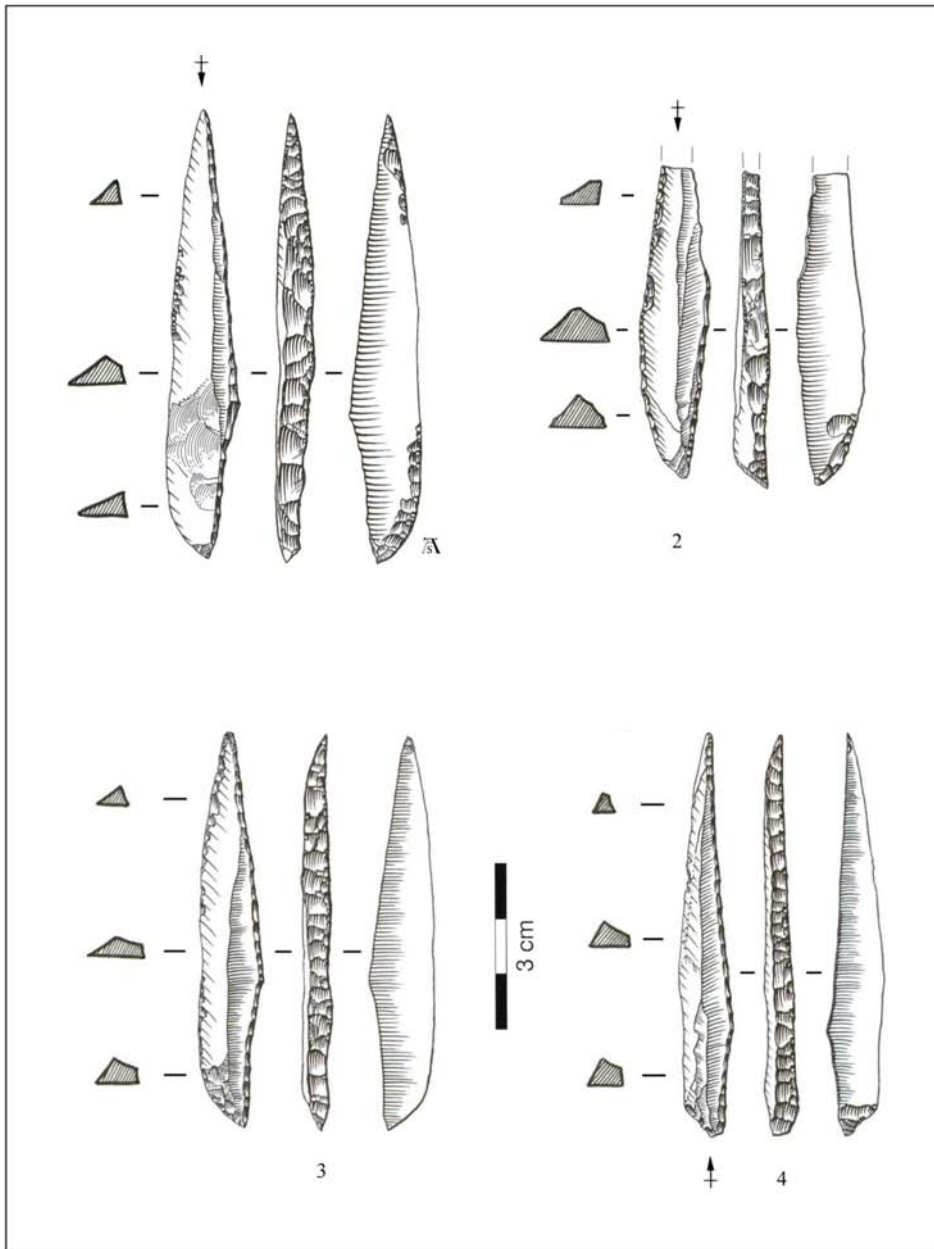


fig. 14 : Gravette points from the Isturitz Cave. Passemard Collection. Gravettian, upper layer (C).

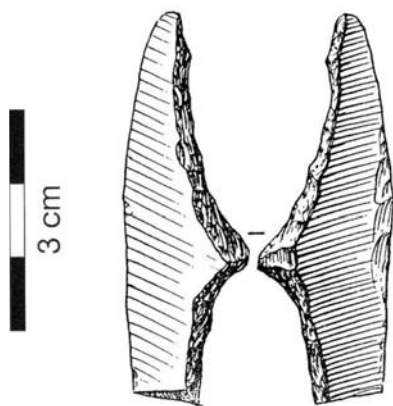


fig. 15 : Gravette point with a back protuberance. Isturitz, Gravettian, lower layer (IV). By Saint-Périer R., 1952).



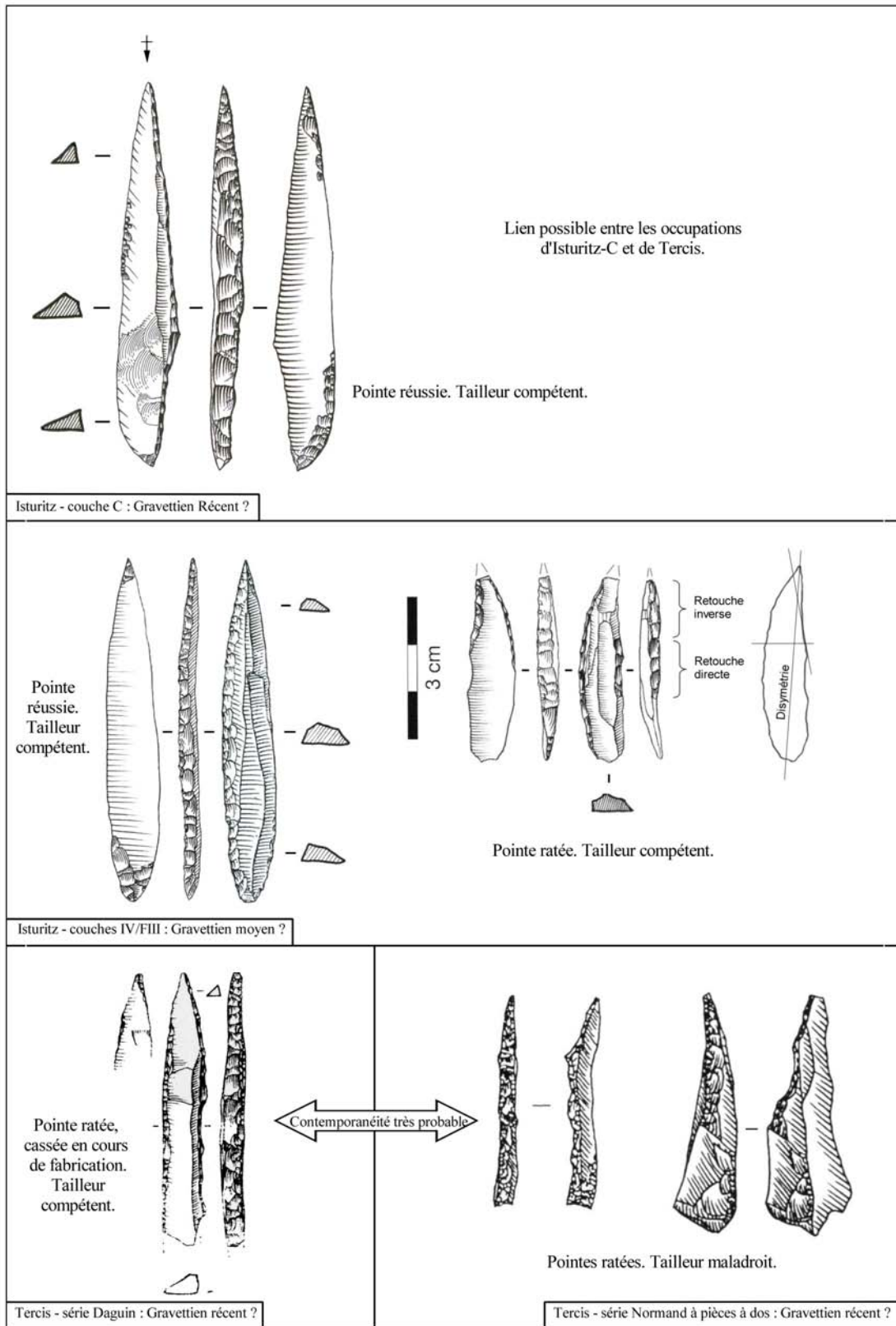


fig. 16 : Gravette points from Isturitz and Tercis. A variety of occupations, cultural and/or individual skill and degrees of success behind a single and blurred typological group.



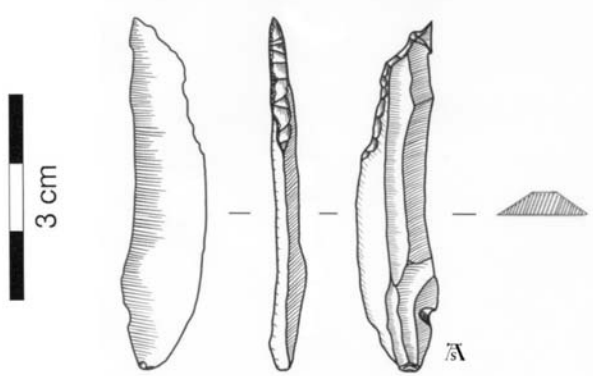


fig. 17 : Truncated piece with partial back: probable Gravette point in the process of fabrication. Pottier assemblage. Tercis.

particularly prevalent in the case of the Gravettian, a techno-complex particularly influenced by its lithic weapon tips.

One interest of more detailed, and thus qualitative, studies of lithic weapon tips, through the integration of new analysis tools arising from technology, is to refine typological classifications. The integration of an object within the total production sequence can considerably modify its typological attribution. Current discussions concerning shouldered points (some shouldered points are in fact unfinished backed pieces) shows the degree to which this typological adjustment can change the inventories of certain tool types, and therefore, socio-cultural and palaeoecological interpretations of them.

The refinement of typo-technological studies of weapon tips is a new, fundamental research direction for the definition of cultural groups. A consideration of the influence of different skill levels may lead to important explanations of the variability of Gravettian weapon tips.

Indeed, some flexibility exists in the definition of the principal Gravettian weapon element types (Gravette Points, Picardie Bladelets, marginally retouched bladelets, truncated and bi-truncated backed bladelets and backed bladelets). It would thus be interesting to investigate to what extent this variability may be the result of a greater or lesser mastery of technical actions

(the detachment of bladelets from Raysse burins, the detachment of straight blades from a curved bipolar core destined to be retouched in Gravettes, for example). Gravettian groups would then distinguish themselves not as much by the exclusive choice of a technical system(s) for the production of blanks as through the “mastery”, “preference” or “care” applied in some of their production strategies.

To each researcher then to contribute his/her own evidence and arguments to the explanation of this qualitative variability: a phenomenon of acculturation, borrowing or imitating the technical actions of a neighbouring group, thus based on the postulate of a previous individualization of cultural groups; a phenomenon of ecological impulse influencing the care invested in the production of weapon tips, independent of the existence, or not, of different technical traditions, an explanation that can, on the contrary, explain the division into different cultural groups; a sociological phenomenon of labour organization and of individual choice, in which case one or more knappers(s) in the community is(are) specialized in the manufacture of weapon tips. These specialists would be more or less skilful in the realisation of a given technical action and inevitably invest more in their preferred technique. It is unfortunate that the organization of labour, a high resolution sociological approach to human groups (as in the case of Etiolles), is barely conceivable for earlier phases of the Upper Palaeolithic.

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# CHRONOLOGY AND TERRITORIES IN THE MAGDALENIAN BETWEEN THE RHONE AND EBRO RIVERS : THE EXAMPLE OF LITHIC POINTS

Mathieu LANGLAIS

## Abstract

The most recent research on Magdalenian lithic and bone projectiles allows us to make comparisons between large territories and in this way to confront the regional typological synthesis on which our thinking is based. A comparative study of several lithic assemblages between the Rhone and the Ebro Rivers, and the definition of standard point manufacturing technologies raise many questions concerning the identity of the Late Glacial (Tardiglacial) Magdalenian. This study is part of a doctoral thesis being currently being realized in collaboration with the universities of Toulouse-Le Mirail (TRACES) and Barcelona (SERP). In this article, we present our first results as food for thought in the characterization of the Magdalenian in Southern France and Northern Spain. Recognized over a large territory, the Lower Magdalenian is very different from the Magdalenian of later phases (Middle and Upper Magdalenian) due to the existence of large backed bladelets and micro-bladelets, sometimes associated with shouldered points on blades. The later Magdalenian is characterized by specific lithic point morphotypes. By integrating this data with the raw material circulation, we raise the question of the chronological, territorial and techno-economical identities of the Magdalenian between the Rhone and Ebro Rivers.

**Key-words :** Late Upper Palaeolithic, Magdalenian, France, Spain, microlithic, techno-economy, territory, chronology.

## Introduction

When studying the identities of Late Glacial human groups, lithic and bone weapon tips can be used to integrate territorial, chronological and techno-economic approaches. Between the Rhone and the Ebro Rivers, the question of human group territoriality is influenced by the Mediterranean, Pyrenean and Atlantic contexts, as well as the history of research. In this respect, several regional typological syntheses have resulted in different chronological structurations of the Magdalenian within the same geographical unit. The recognition of the Badegoulian as an autonomous entity raises questions concerning the genesis of the Magdalenian. Indeed, many scientists now acknowledge the existence, in several sites, of a Lower Magdalenian situated between the Badegoulian and the Middle Magdalenian, i.e. between 17,500 and 15,000 BP, a period that is presently studied in several regions (cf. *infra*). Within each Magdalenian chronological phase, we have compared data on the circulation of raw material in contexts where very little high quality flint is available and on the geographical and chronological diffusion of some forms of lithic weapon tips. Raw material and lithic weapon tips, considered as a cultural identity vector, attest to the territoriality of groups that have adopted or rejected certain morphotypes and are part of the definition of chronological stages as chronocultural entities. A few historiographic reminders of debates concerning Magdalenian lithic weapon tip typology emphasize the interest of collectively re-examining the assemblages.

Between 17,500 and 12,000 BP, i.e. 20,500-13,500 cal. BP, Europe was split into two cultural spaces, the Epigravettian in the East and the Magdalenian in the West (fig. 1). The question, put forward in the 1950's (Jordà, 1954) concerning the existence of an Iberian Epigravettian, south of the Ebro river has been contradicted by several studies based on sedimentological and industrial data (Fortea, 1973; Fortea *et al.*, 1983; Villaverde, 1981, 1984, Villaverde *et al.*, 1999; Cacho, 1989; Martinez Andreu, 1989; Aura, 1989, 1995). According to these studies, the Jordà

Epigravettian appears to be an Epipaleolithic, while the Upper Magdalenian is well documented, particularly in Andalusia, the Murcia and Valencia (*op. cit.*). While the role of the Ebro Tiver has become much clearer, the Rhone River traditionally appears since the end of the Pleniglacial as a cultural border, materialized by the definition of an Italian Epigravettian (Laplace, 1957; Palma di Cesnola and Bietti, 1983; Bietti, 1997; Bracco and Montoya (dir.), 2005). Some sites of the Eastern Lower-Rhone, attributed to the Upper Magdalenian on the basis of their bone industry, such as the Soubeyras shelter, ChinChon in the Vaucluse, or the Adaouste in the Bouches-du-Rhône (Sonneville-Bordes, 1973; Braem, 2003; Onoratini, 1982), have backed points strongly reminiscent of the late Epigravettian (Montoya, 2004). Different studies have questioned the permeability of the Rhone since similar lithic elements have been found in assemblages attributed either to the Magdalenian on the right bank or to the Epigravettian on the Eastern side of the river. This is, for example, the case of the shouldered points with lateral notches found in the Ardèche, in the Upper Magdalenian sites of Deux-Avens and Colombier, but also in the Var, in the Baume de Colle-Rousse and attributed to the Bouverian, which corresponds to a late Epigravettian (Onoratini *et al.*, 1994; Combier, 2003). The definition of an Upper Salpétrian located in the Gard and containing small backed points (Escalon de Fonton, 1964; Onoratini, 1982) questions the relationship between this facies and the Epigravettian. Generally speaking, whether you consider one or the other side of the Rhone river, emphasis placed either on points (Epigravettian), or on backed bladelets (Magdalenian). A true collective critical work on lithic and bone assemblages of sites of this period should be undertaken to better define the synchronic differences between the Epigravettian and the Magdalenian which would justify using two different terms in the Rhone region (Montoya, 2004).

Within the Magdalenian, while there remains a common base of backed, truncated or denticulated bladelets, lithic armature morphotypes and their production sequences allow us to distinguish different chronological, territorial





fig. 1 : Europe at the end of the Pleniglacial and Tardiglacial: two cultural zones (box: study region).

and techno-economic identities. Based on the study of several lithic assemblages between the Rhone and Ebro Rivers, attributed to different Magdalenian periods (fig. 2), we can suggest different explanations for the evolution of the Magdalenian in these regions.

### The beginning of the Magdalenian between the Rhone and Ebro rivers

Since the official recognition of the Badegoulian as an autonomous entity (Allain, 1989), numerous technological studies of the genesis of the Magdalenian have been undertaken. They focus on original bladelet and micro-bladelet productions found over a large territory (Brou and Le Brun-Ricalens, 2005) and particularly in northwestern Spain (Utrilla, 1981, 1996; Altuna and Merino, 1984; Altuna *et al.*, 1985; Corchón, 1995, 2005; Cazals, 2000; Gonzalez Sainz and Utrilla, 2005; Cazals and Langlais, 2006), the Aquitaine (Lenoir *et al.*, 1991; Ladier, 2000), the south of the Paris Basin (Le Brun-Ricalens and Brou, 2003), Vienne (Brou and

Primault, 2002; Primault *et al.*, 2007) and between the Rhone and Ebro Rivers (Bazile *et al.*, 1989; Martzluff and Abelanet, 1990; Langlais, 2004b; Mangado *et al.*, 2005a) (fig. 2). Study of the lithic productions of these sites allow us to identify, between the Badegoulian and the Middle Magdalenian, a Lower Magdalenian characterized by its portable art, bone industry (Ladier, *op. cit.*, 2002) and lithic component. Along with other features, an autonomous production of different types of flakes responded to “domestic” needs (thin flakes used unretouched or barely retouched) as well as needs related to hunting activities (thick flakes used as bladelet cores). Some of the simple methods used to obtain thin and short flakes moreover remind us of the Badegoulian ancestor. (Cazals, *op. cit.*; Bracco *et al.*, *op. cit.*; Ducasse, 2004). Along with imported blades and tools, a production of blades could be implemented locally to manufacture shouldered points and tool blanks. As with flake production, blade manufacture therefore represents a significant complementary domain of activity.



fig. 2 : Location of the studied or compared assemblages.

The highly diversified blade production occupies an important role in the assemblage and responds to the need for microlithic weapon armatures. In this way, a specific lithic armature morphotype is produced from several types of flake/blade knapping (fig. 3). Sometimes called « *hojitas de Juyo* » (Barandiàran *et al.*, 1985) or « *Fontgrasse bladelets* » (Bazile *et al.*, 1989), we are dealing here microblades with a semi-abrupt or abrupt back with an inverse or direct orientation, frequently right lateralized and opposed to a convex cutting edge (fig. 4). These tools are distributed over a vast territory, in variable contexts, according to morphometric traits with little regional variation (fig. 5). Straight profiled, shouldered, truncated, denticulated or pointed blades can sometimes be found with the microbladelets, as at

Gandil, Erralla, Montlleó or Fontgrasse. Though the lithic raw material is generally local, some allochthonous flint pieces and some shells attest to circulations over several hundreds of kilometers between the Pyrenees and the Quercy (Chalard *et al.*, in press; Langlais, current dissertation) or between the Mediterranean and the Atlantic *via* the Ebro valley (Utrilla, 1997; Alvarez, 2005). These data support the stylistic links observed in the artistic manifestations between Cantabria and the Quercy (Ladier, 2000). To this geographical unity within which micro-bladelets appear as a solution adapted to the mobility of the Lower Magdalenian groups can be added another morphotype which, for the time being, has been found only in southern France: shouldered points on blade blanks detached with a stone hammer

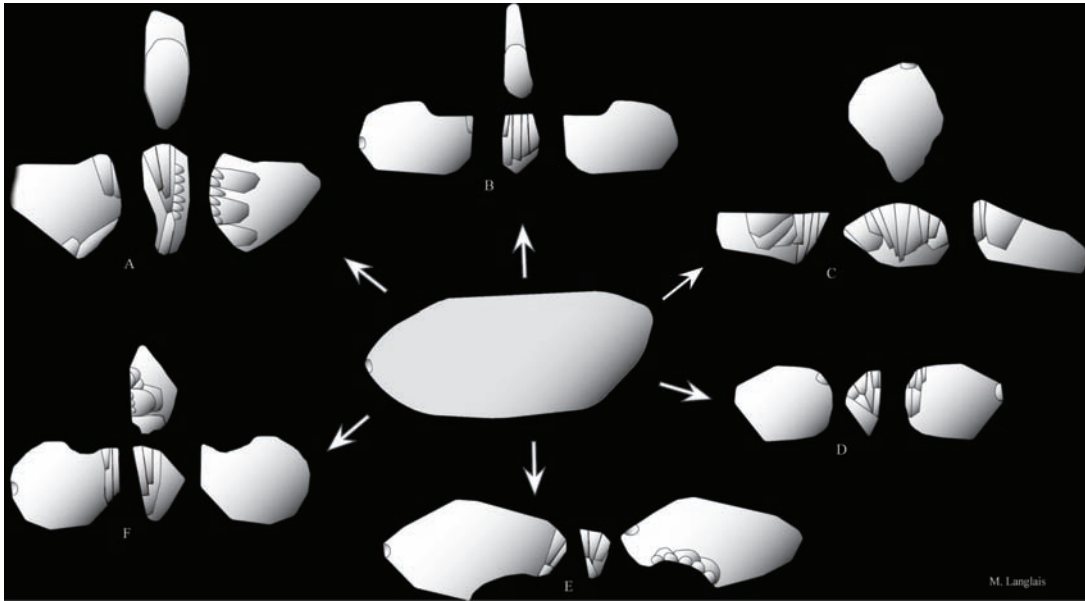


fig. 3 : (Micro)lamellar knapping methods in the Lower Magdalenian (A: “on longitudinal edge”; B: “on transverse edge”; C: “on dorsal front”; D: “on déjeté (off-centre) ventral front”; E-F : “on notched transversal edge”).

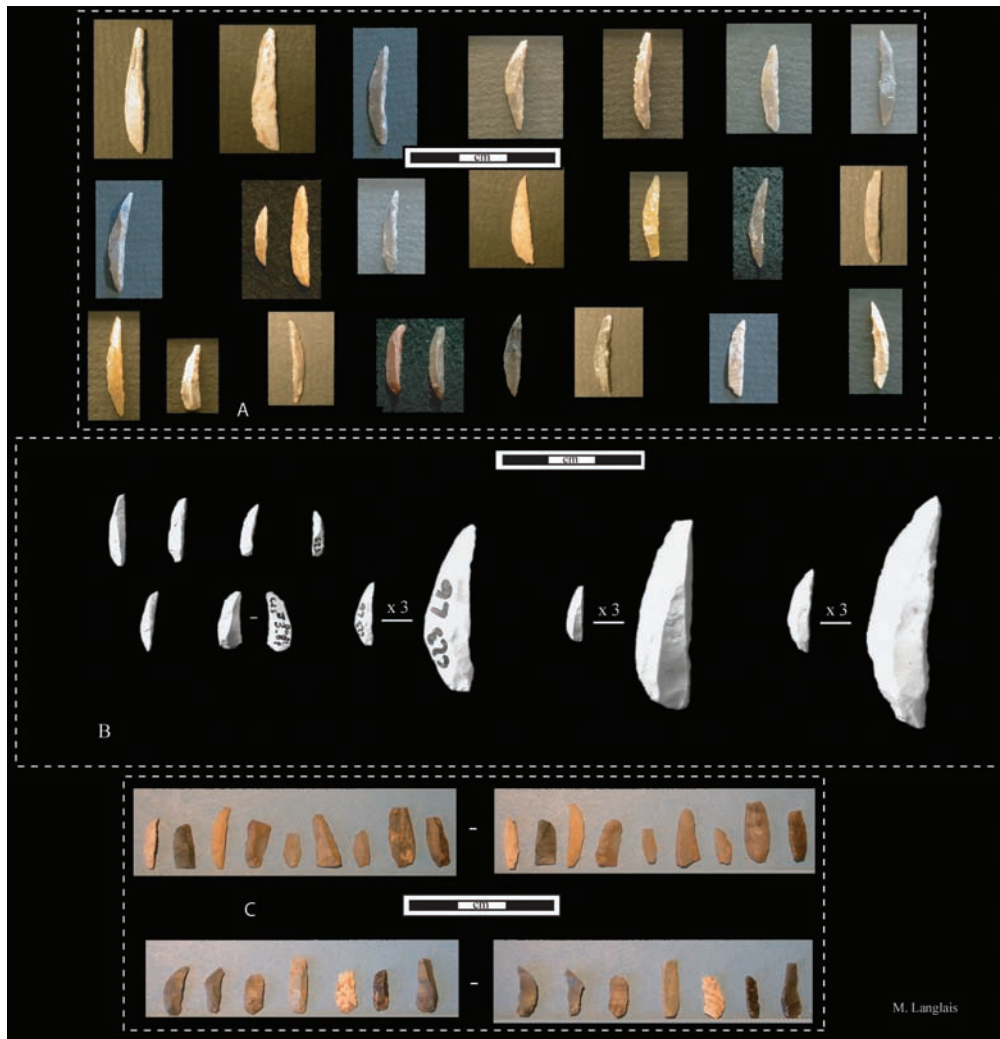


fig. 4 : Examples of backed micro-bladelets from the Lower Magdalenian (A: St-Germain-La-Rivière, Level 4; B: Gandil Level 23-25; C: Montlleó).



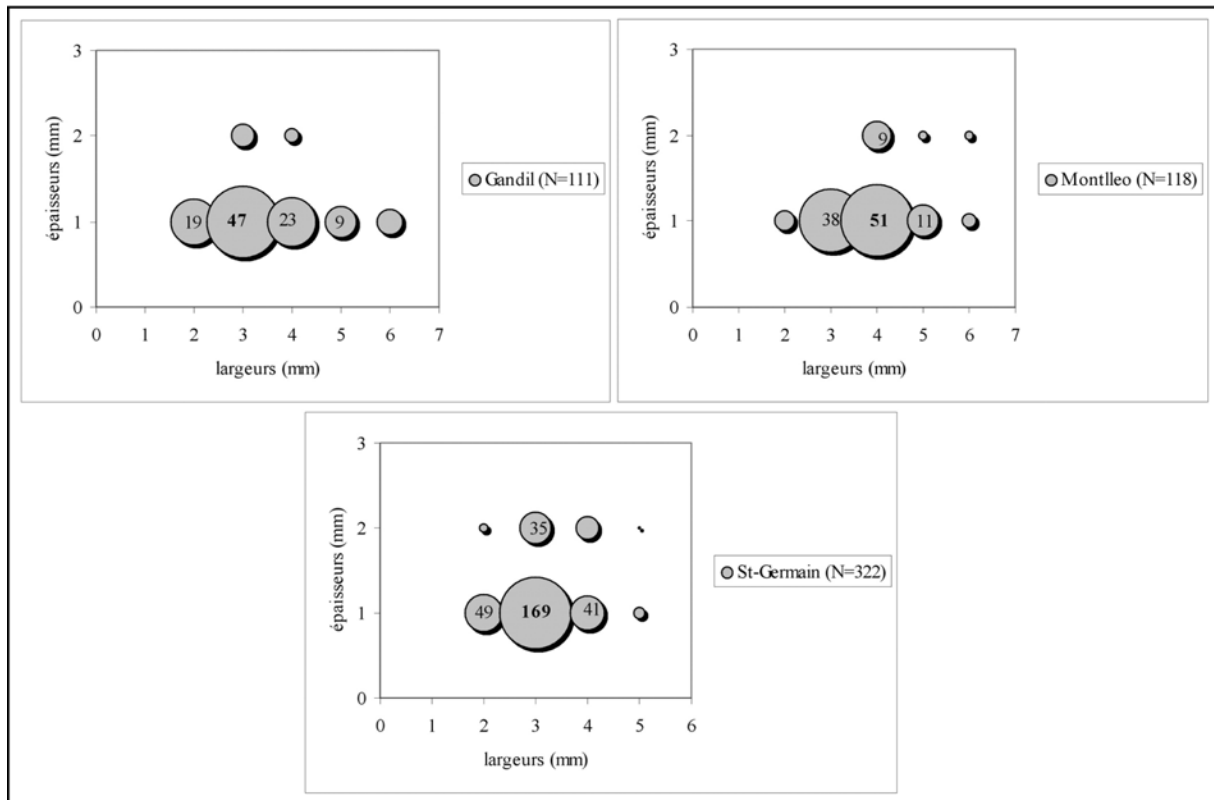


fig. 5 : Dimensions of backed micro-bladelets

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(fig. 6). These pieces have been revealed in open-air contexts in Fontgrasse in the Gard (Bazile *et al.*, *op. cit.*) at the Gandil rockshelter in the Quercy (Ladier, 2000) and probably in Jaurias in the Gironde (Cousté, 1963; Lenoir, 2003).

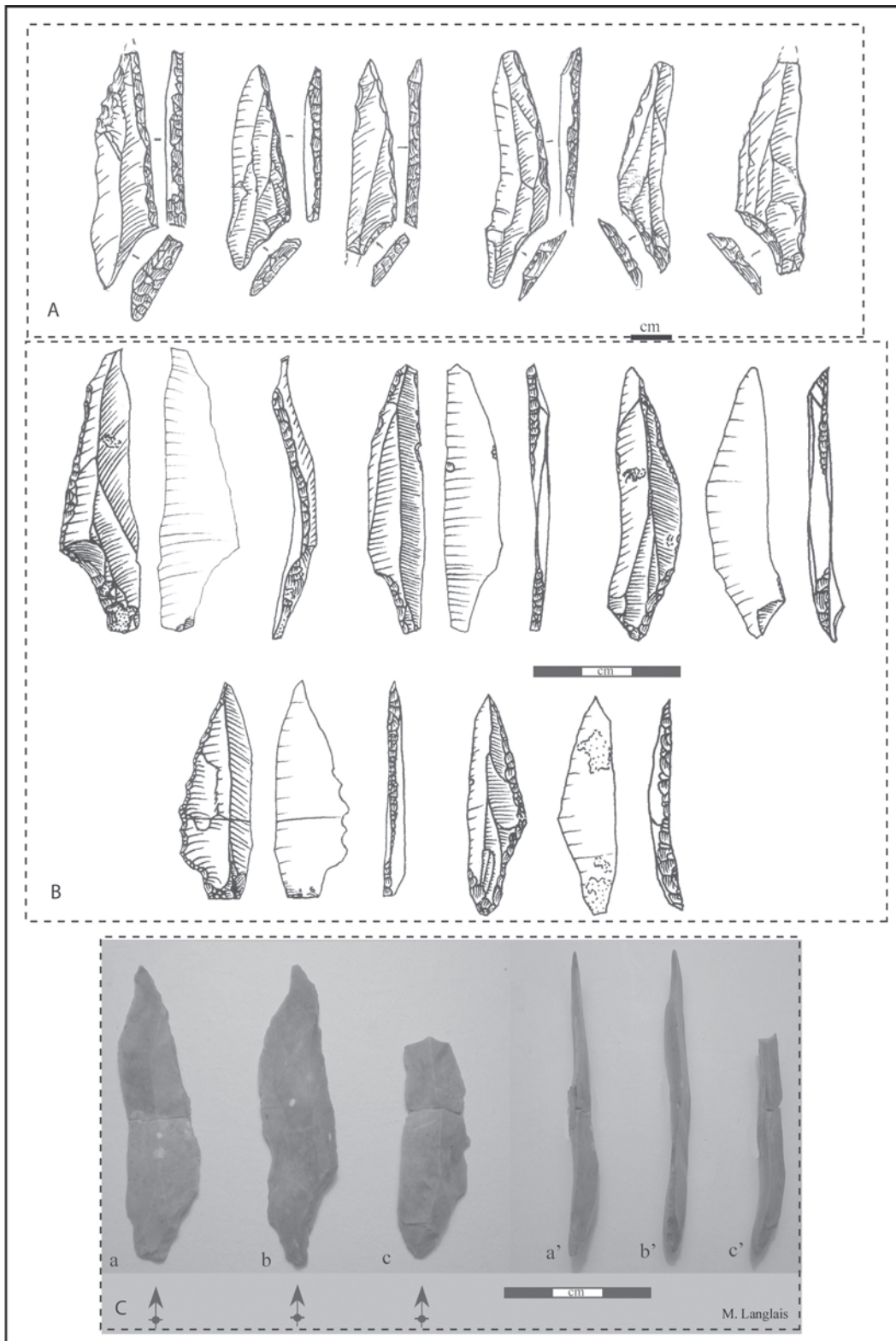
Concerning the origins of the Lower Magdalenian, several interrogations remain concerning the Badegoulian-Lower Magdalenian transition and many studies are currently in progress (Bodu *et al.*, 2005; Ducasse and Langlais, 2005, Primault *et al.*, 2007). The backed micro-bladelets made from carinated cores discovered in the Var in an Early Epigravettian context (Montoya, oral communication), as well as the existence of shouldered points in Italy, seem to indicate that identical choices were within different cultural entities in a diachronic and probably synchronic manner. In this context, the origin of the Lower Magdalenian shows an *a fortiori* phylogenetic complexity within a contact region such as the Rhone and Ebro valleys.

The disappearance of micro-bladelets and shouldered points in the Middle Magdalenian is accompanied by

the confirmation of a techno-economic evolution in the domestic sphere, which is the generalized use of blades as tool blanks. Among the lithic weapon armatures, a comparative study of assemblages attributed to the Middle Magdalenian (15 000-13 500 BP) and Upper Magdalenian (13,500-12,000 BP) shows in addition to a remaining common base of straight profiled backed bladelets, the development of new morphotypes: scalene bladelets in the Middle Magdalenian and geometric armatures (triangles, rectangles, circle segments) in the Upper Magdalenian. These pieces, and in particular the bladelets and scalene triangles, have been the subject of numerous terminological debates focussed on the Aquitaine during the first half of the 20<sup>th</sup> century. I will now discuss these debates.

#### Bladelets or Scalene Triangles ?

During the Perigieux congress in 1934, a collection of triangles from the Puy-de-Lacan excavation (Corrèze, France) was presented and the hypothesis that they were laterally hafted as hunting armatures was proposed (Bouyssonie *et al.*, 1935). For his part, D. Peyrony used



**fig. 6** : Examples of shouldered points from the Lower Magdalenian (A: Jaurias, from Lenoir, 2003; B: Fontgrasse, from Bazile, 1999; C: Gandil Level 20).



the term of scalene triangle to designate truncated backed bladelets with a triangular shape and attributed them to the Magdalenian II at Laugerie-Haute (Dordogne) since they were identified in the second level of the Magdalenian without harpoons, between the levels with raclettes and those of the Magdalenian III with “fluted bone objects” (Peyrony, 1936). However, most of the pieces presented by Peyrony were truncated backed bladelets and not true scalene triangles (Cheynier, 1951; Couchard, 1960). At Puy de Lacan, L. and H. Kidder differentiated two types of triangles, that is bladelets and scalene triangles. These authors insisted on the anteriority of the first relative to the second. “**Bevelled bladelets, most of them broken, can be found at all levels, but scalene triangles [scalene bladelets] are only found at the bottom, in the A layer (...)** At the top, near the surface of the C level and in the D layer, we noticed **some much less elongated triangles (...)**” (Kidder, 1936, p. 23). At the site of Crabillat (Dordogne), which contained a large assemblage of often denticulated scalene armatures, D. and E. Peyrony used the Puy de Lacan data to differentiate elongated triangles - or scalene bladelets - and short triangles, both denticulated or not. Comparing their faunal spectrum (Saiga Antelope *versus* Reindeer), portable art from Laugerie-Haute, Saint-Germain-la Rivière and Martinet, as well as the stratigraphic location of these elements, they concluded that “*the facies of the small triangles from Crabillat, Jolivet and Puy de Lacan corresponded to a later period than that of the elongated triangles and belonged to the final phase of the Magdalenian II*” (Peyrony, 1941, p. 253).

On his side, A. Cheynier characterized the third phase of his Proto-Magdalenian as being a “Lacan-type scalene stage” After the raclette “*another fossil director appeared with the scalene triangle, which was found in abundance at the Lacan-type station*» (Cheynier, *op. cit.*, p.190); the intermediary phase, called the “Parpalló” phase (named after the Valencian site), contained “*bevelled edged bladelets with an oblique truncation and prototypes of scalene bladelets*” (*ibid.*, p. 192). R. Daniel agreed with the Proto-Magdalenian structuring proposed by Cheynier, while subdividing

the scalene triangle stage in two according to the more or less elongated shape of the triangles and the presence or not of Saiga Antelope in the fauna (Daniel, 1952, p. 277). According to L. Coulonges “*the base industry of Martinet and the so-called Magdalenian II or proto-Magdalenian, industries were not Magdalenian at all*» (Coulonges, 1956, p. 2). This author defended the notion of two parallel cultures. On one hand, the sites of Saint-Germain-La-Rivière, Laugerie-Haute, Raymondon and Cavaille contained fauna dominated by Saiga Antelope together with scalene bladelets, while on the other, the deposits of Martinet, Crabillat, Jolivet and Jean-Blancs, contained scalene bladelets associated with Reindeer. “*The deposits of the first group (...) have yielded very few traces of art. It is most of all at the Martinet (second group) that they abound (...)* One can seriously contemplate the possibility of a coexistence during the Upper Palaeolithic of a Magdalenian with harpoons (...) and another civilisation [Saint-Germain] with truncated and triangular flint barbed bladelets (...)” (*op. cit.*, p. 5-6).

Thorough studies conducted in the Maghreb allowed the terminology to be clarified: based on Tunisian Epipalaeolithic assemblages, E. G. Gobert chose the term **scalene bladelets** to refer to “**narrow backed bladelets with a truncated end (...), not to be confused with the scalene triangle, which has three angles. The scalene backed bladelets retain a narrow extremity with a bulb and a hammered facet**” (Gobert, 1952, p. 226). No distinction was made in the typological lists published between 1953 and 1956 and the *lato sensu* triangles (n°79) “*in the Upper Palaeolithic are usually scalenes with a sometimes denticulated cutting edge*” (Sonneville-Bordes and Perrot, 1956, p. 552). Although she differentiated the “Laugerie-Haute type” scalene triangle and the “Crabillat type” denticulated isosceles triangles (Sonneville-Bordes, 1960, p.3 89), D. de Sonneville-Bordes criticized the chronological value of these tools. “*After the Magdalenian with raclettes and before the Magdalenian III with fluted objects, assemblages with identical common tools develop, but are characterized by a greater or lesser quantity*



of scalene triangles (...) Later, levels with sometimes denticulated isosceles triangles developed, for which a definite position was not precisely determined (...) They appeared and developed again at the end of the Magdalenian sequence (...) The triangle was thus a normal component of Magdalenian tools although in very varied proportions.” (op. cit., p. 401). In the context of the typological synthesis on the Maghreb Epipaleolithic, J. Tixier used E. G. Gobert’s work to define scalene bladelets (Nr. 68 of his list) as truncated backed bladelets different from triangles. (Tixier, 1963, p. 113).

Drawing a morphological distinction between bladelets and scalene triangles shows a will to differently interpret the two types, be it chronologically (diachronic) or culturally (synchronic). Some specialists oppose triangles and bladelets because the latter “**lack one angle**” (Cheynier, 1955, p. 8). Bladelets are then designated as “*scalene triangle prototypes*” or “*pseudoscalene triangles*” to emphasize the precedence of these pieces relative to the “true” scalene triangles. In response to these discussions, J. Couchard proposed a morphological definition of these elements as “small tools made on bladelets with abrupt retouch forming **a scalene triangle whose small sides are straight or slightly concave and whose ratio between them does not exceed a quarter in the most extreme cases, the bigger side usually remaining sharp but also sometimes denticulated**” (Couchard, 1960, p. 284). Several authors, belonging to the Epipaleolithic–Mesolithic Study Group, have proposed terminological definitions concerning geometric armatures (Cl. Barrière, R. Daniel, H. Delporte, M. Escalon de Fonton, R. Parent, J. Roche, J.-G. Rozoy, J. Tixier and E. Vignard). The scalene triangle, be it normal, irregular or elongated, is thus defined as “*a microlithic armature having the shape of a triangle with three well defined angles obtained by a combination of two truncations of unequal length (...) and a third larger side (...) The angle of the bigger truncation with the third side is called the big point and the other one the small point*” (GEEM, 1969, p. 356-357).

Cheynier later adopted the term “**pike head**” orally proposed by Kidder to refer to scalene bladelets, in order to avoid confusing them with triangles “*which are fossils too, but from a slightly higher stratigraphic level (...) They are first of all backed bladelets, the edge always being on the left side and the bulb being or having been placed on the proximal side. The unretouched edge is therefore on the right side. The backed edge has a more or less marked distal angle, which is often blunted and rounded. It can also be jutting*” (Cheynier, 1965, p. 317-318). Moreover, he recalls the hypothesis according to which these pieces were used as barbs, hafted on semi-round rods, which chronologically preceded harpoons made from hard animal material (op. cit.). “*The notable improvement in excavation techniques, the exhaustive collection of all remains and the development of typological analysis made the revision of a type lists necessary. Conscious of this necessity, F. Bordes and D. de Sonneville-Bordes gathered a group of typologists (R. Arambourou, F. Bordes, J.-M. Bouvier, M. Brézillon, J. Combier, H. Delporte, M. Escalon de Fonton, H. de Lumley, M. Newcomer, J.-Ph. Rigaud, D. de Sonneville-Bordes and J. Tixier) in 1972 to adapt the type list drawn by D. de Sonneville-Bordes and J. Perrot to the new requirements of the typological classification of tools collected through modern excavations*” (Rigaud, 1982, p. 77-78). This new list included 105 types and took into account the distinction between triangles (n°77) and scalene bladelets (n°78).

At the end of the Magdalenian, the presence of scalene triangles, associated or not with harpoons, was the focus of new discussions on the existence of two groups of triangles posterior to scalene bladelets. These triangles, which are relatively elongated and rarely denticulated, are very different from the Crabillat type. At the sites of Morin and Couze in the Périgord, scalene triangles were found together with other geometric armatures (rectangles, circle segments, trapezoids), harpoons and Azilian (curve backed) or Laugerie-Basse points (Bordes and



Sonneville-Bordes, 1979, p.453; Renard, 1999). This typological association was also noted in Dordogne, at La Faurélie II (Tixier, 1974), in the Quercy at Fontalès (Darasse and Guffroy, 1960), in the Pyrenees at Rhodes II, Massat (Simonnet, 1967, Clottes and Simonnet, 1979) and Belvis (Sacchi, 1968, 1986), in the Hérault at La Roque II (Ravoux, 1966), in the Auvergne at Rond-du-Barry (Bayle des Hermens, 1979) and in the western Pyrenees at Dufaure and Duruthy (Arambourou *et al.*, 1978; Straus (dir.), 1995). The issue of the chronological significance of scalene triangles and bladelets was also raised at Flageolet II (Dordogne) in which layer IX, dated to the Middle Magdalenian, presented typological features that were at first estimated as being characteristic of the Upper Magdalenian (Rigaud, 1970) before being attributed to the Middle Magdalenian with scalene bladelets (Rigaud, 1979; Cazals, 2005). At Martinet (Lot-et-Garonne), J.-M. Le Tensorer described triangles as “*very different objects divided into three groups: sometimes denticulated scalene triangles; scalene bladelets sometimes becoming «pike head» bladelets, themselves becoming «truncated shouldered bladelet»; and finally real «broken backed knives», a sort of Federmesser as described by German authors*” (Le Tensorer, 1979, p. 486).

While scalene bladelets “*appeared at the passage between the Lower and Upper Magdalenian and seemed to last for the whole Middle Magdalenian*” (Demars and Laurent, 1989, p. 108), the Crabillat-type denticulated scalene triangles “*seemed to be characteristic of the end of the Middle Magdalenian and appeared to replace scalene ones*” (*op. cit.*, p. 110). Elongated scalene triangles developed during the Upper Magdalenian and were frequently associated with other geometric armatures (rectangles, circle segments) and backed points (fig. 7). The value of these elements as “fossil-directors” no longer reside only in their presence or absence, but also in terms of their typological association in relation to the technological data of the whole assemblage.

### The Upper Magdalenian between the Rhone and Ebro : scalene bladelets and micro-burins

Based on studies of lithic assemblages attributed to the Middle Magdalenian, such as that of Gazel Cave (Aude, France) excavated by D. Sacchi (1986) and the open-air site of Sant Benet (Girona, Spain), excavated by N. Soler (1977, 1995), several characteristic features have been noted. In addition to autonomous bladelet production on a nodules or flakes, blanks for scalene bladelets were also extracted from blade cores reemployed as bladelets cores. As in laminar production, optimization of the length was a constraint in relation to the locally available mineral resources. Therefore, a large quantity of allochthonous material was imported to satisfy the norms of laminar-lamellar productions (Langlais and Sacchi, 2006). **Scalene bladelets** of the Middle Magdalenian were similar to the “pike heads” of Cheyner and Kidder (cf. *supra*). The production sequence of these pieces might be assimilated with a true manufacturing “recipe” illustrated by a high stability in dimensions (fig. 8) and a preferential lateralization of the truncation and of the back. The weak predetermination of the point during knapping is the consequence of an intention to produce rather wide supports with sub-parallel edges and arrises, obtained by a «semi-rotating» knapping method. Therefore, even before the truncation, the microburin technique was employed to produce a bent point. This “trihedral point” then had to be obliquely truncated, or simply scraped, or sometimes, but rarely, left unretouched (fig. 9). This technique has been well documented for the Middle Magdalenian with scalene bladelets in several deposits located between the Rhone and the Ebro Rivers (Soler, 1995; Corchón, 1995; Cazals, 2000; Langlais, 2004b).

The existence of the **microburin technique** in the Upper Palaeolithic generated many discussions that I will summarize here. Following the first publications concerning this technique in Italy (Chierici, 1875), L. Siret in 1893 presented a collection of pieces from Spanish Epipalaeolithic deposits that he interpreted as “*trapezoid manufacturing waste*” (Siret, 1893). A publication by Rahir (1903) on microburins associated

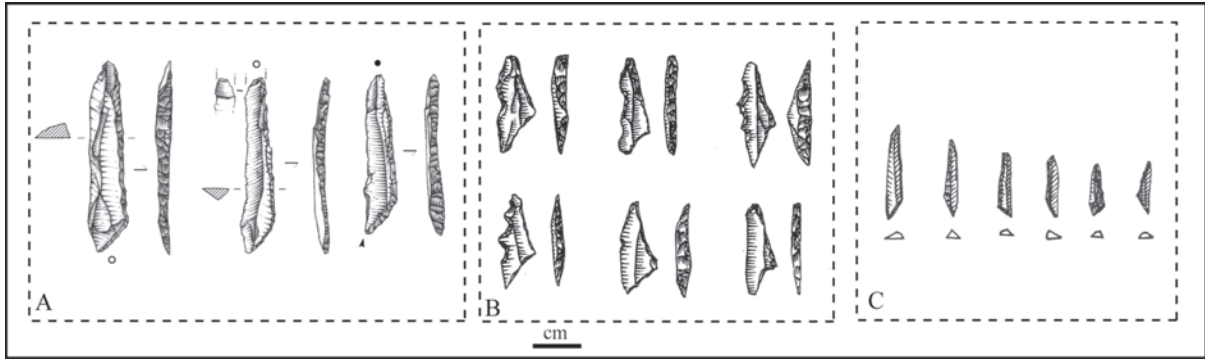


fig. 7 : Bladelets vs scalene triangles (A: scalene bladelets, Gazel, Middle Magdalenian, drawings by S. Ducasse; B: denticulated triangles by Crabillat, from Demars and Laurent, 1989; C: elongated scalene triangles, Belvis, from Sacchi, 1986).

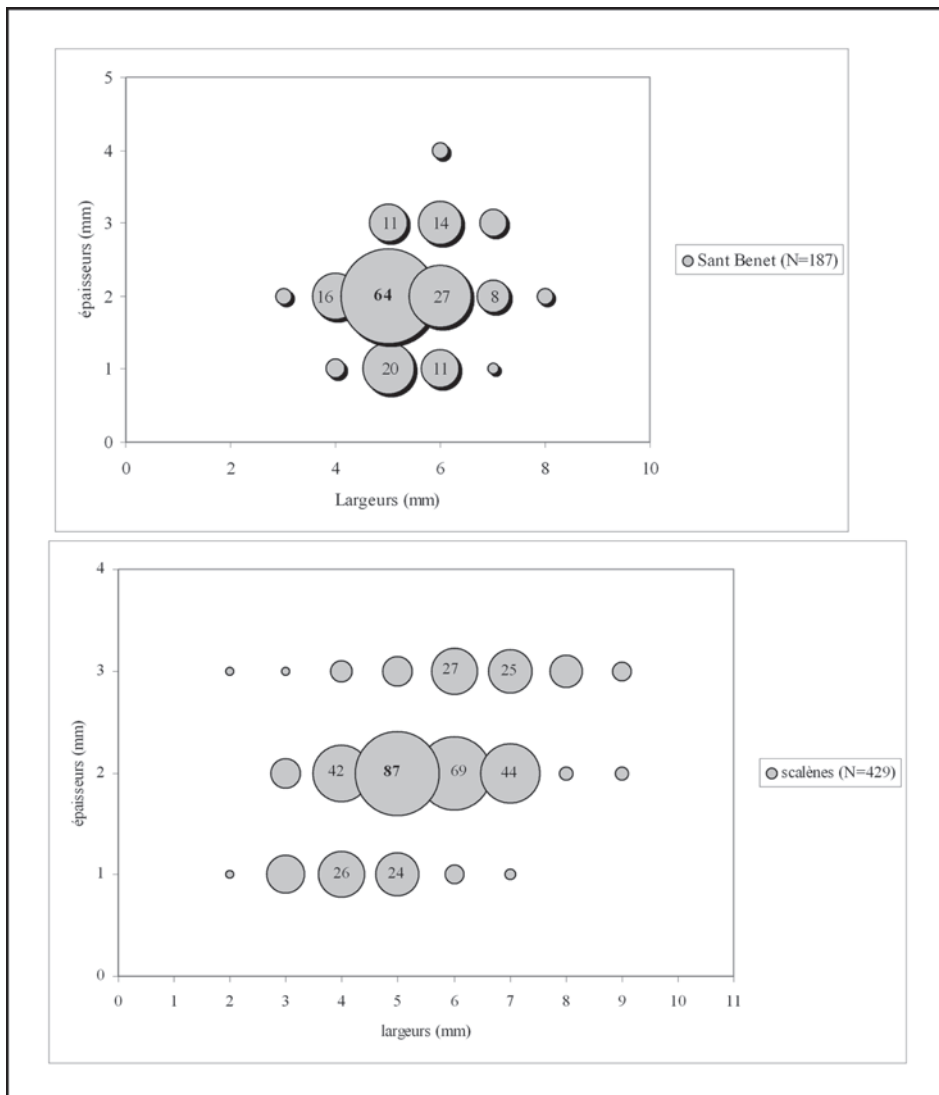
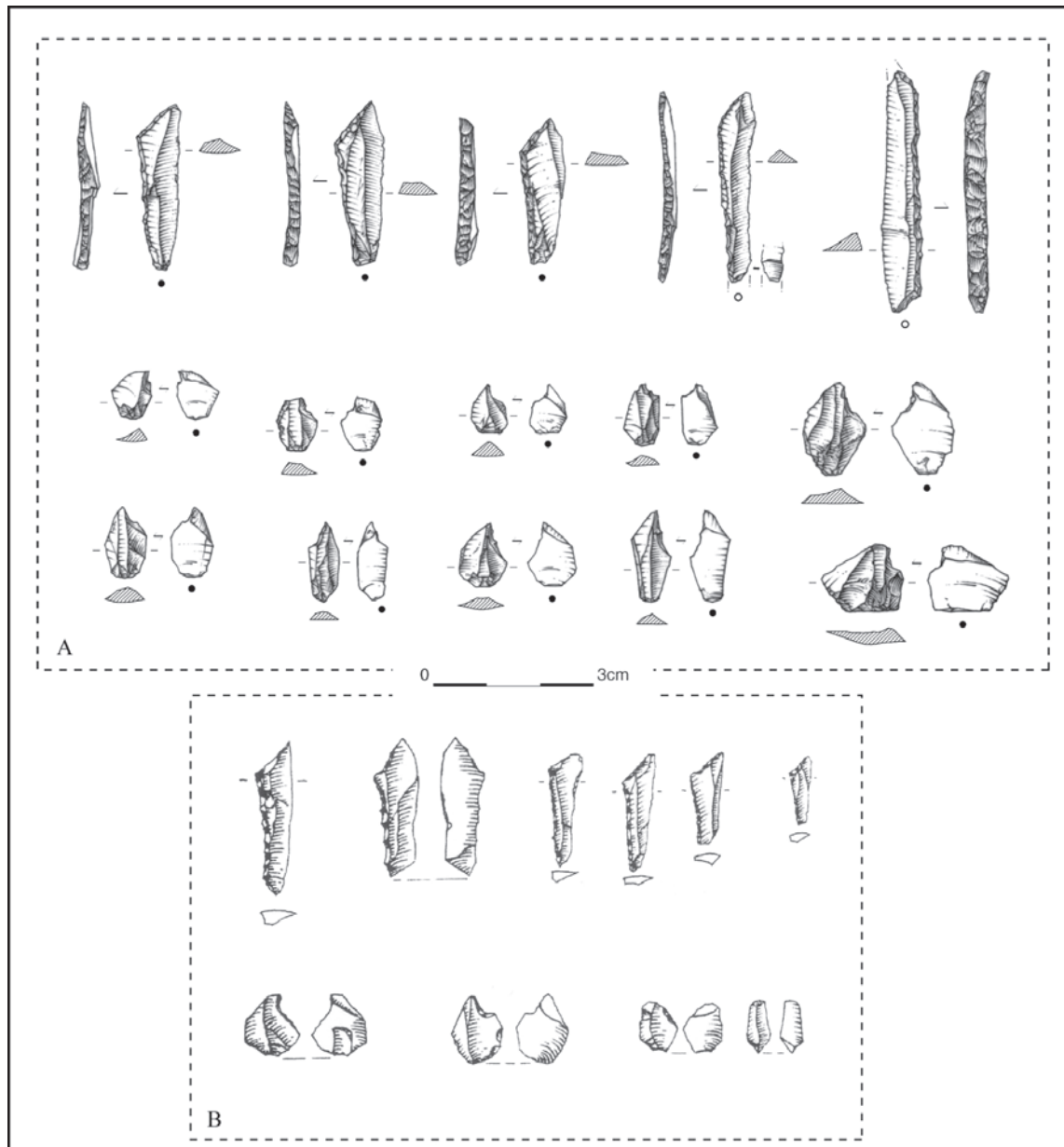


fig. 8 : Dimensions of scalene bladelets.





**fig. 9** : Examples of scalene bladelets and microburins from the Middle Magdalenian (A: Gazel, Level 7 (drawings by S. Ducasse); Sant Benet (from Soler, 1995).

with Reindeer at the site of Remouchamp in Belgium went unnoticed. S. Krukowski recognized microburins in Polish Mesolithic assemblages, which he replaced in the production sequence of some triangular tools belonging to the pygmy flint group (Krukowski, 1914). H. Breuil discovered this type of object in the Haute-Vienne and interpreted them as tools while describing the microburin as “a small, very special object, a sort of very flat angle burin with a small notch retouch at the end” (Breuil, 1921, p. 350). E. Octobon published microburins from sites in the Aisne attributed to the

Tardenoisian, which he first considered as tools before reconsidering this functional interpretation based on the experimental assemblage created by M. Barnes (Octobon, 1935). We can also cite the publication of R. de Saint-Périer on the “Tardenoisian burin” (Saint-Périer, 1921). E. Vignard recognised this technique in Egypt, in what he called the Sebilian (Vignard, 1928), a technique used to produce tools such as wicks. He suggested that “this new technique came more or less directly from Africa with Sebil in Upper Egypt as its origin” (Vignard, 1935, p. 653). Among the possible

landmarks of the diffusion of this technique toward Europe, he reminded us of the different existing studies on the Capsian in North Africa, and in particular those by E. G. Gobert and later by P. Vaufray and the publications by D. Garrod and M. R. Neuville on the Natufian of Palestine. He again addressed this idea in a synthesis of Tardenoisian microliths (Daniel and Vignard, 1935). A.C. Blanc then realised a historiographic evaluation of the microburin, which “*does not appear in Western Europe until the Sauveterrian*” (Blanc, 1939, p. 120-121). However, following the finds made at Romanelli Cave, where microburins were associated with cold fauna, he defended a Mediterranean precocity for this technique and considered the Romanellian as a good candidate for the Southern origin of post-Palaeolithic microburin facies. They are indeed found in the evolved Epigravettian (Bisi *et al.*, 1983). In the context of a revision of the Solutrean material from Parpalló, J.M. Fullola (1976) recalls that L. Pericot published a few microburins from the Solutrean and Magdalenian (Pericot, 1942). According to this author, the microburin technique must be considered as a trend that could have appeared and disappeared (Pericot, 1955). Some prehistorians agree that the expression “trihedral point” came from E. G. Gobert (1952, p. 229) and G. Laplace (Bordes, 1957, p. 580; Fullola, 1976, p. 62). At the site of Crabillat (Dordogne), D. and E. Peyrony noted the existence of “*Upper Palaeolithic type microburins, like those found by M. Lacorre at La Cavaille. And no traces of Tardenoisian type microburins*” (Peyrony, 1941, p. 248). These also include accidental pieces found in the Mousterian. According to F. Bordes, the microburin technique was efficient for the fabrication of points or geometric tools and “*the real microburin appeared during the Upper Palaeolithic*” (Bordes, 1957, p. 582). Though it is possible to accidentally (Krukowski type) obtain objects technically close to a microburin when backing a tool, the systematic use of the technique must be proven by the association microburin debris with shaped points possessing a trihedral point as their point (Bordes, *op. cit.*). At the Upper Magdalenian site of Couze in the Dordogne (Fitte and Sonnevill-Bordes, 1962 ; Bordes and Fitte, 1964), they are associated

with the production of scalene triangles. J. Tixier, who knows this technique well from his work in the Maghreb (Tixier, 1963, p. 137-145), described microburins in the Upper Magdalenian at La Faurélie II (Dordogne), where they were associated with triangles. “*We have here a well known and well mastered technique, probably used to prepare the small truncation of the elongated scalene triangles with a short small side*” (Tixier, 1974, p. 194). Finally, several authors, including J. Tixier, defined the microburin as a waste product and not a tool. “*This is not a small burin, but with the waste product of the fracturation of a blade or bladelet by a special technique*» (Tixier *et al.*, 1980, p. 92).

The use of the microburin technique during the Middle Magdalenian at Gazel level 7, Sant Benet, La Coma d’Infern, Las Caldas level XI and probably Abautz is one more technical characteristic that reinforces the impression of a high standardization in the manufacture of lithic tools during the Middle Magdalenian. While most raw materials circulated in large quantities over vast territories, scalene bladelets seem to have been restricted to southwestern Europe, from the Charente (Chaire à Calvin) and the Corrèze (Puy de Lacan) to the North, down to Mediterranean Spain in the South (fig. 10). The knapping modalities of laminar supports were varied. Autonomous nodules were exploited and blade cores were reworked using an enveloping, pyramidal type strategy with two opposed-off-centre striking platforms, alongside debitage on flake-cores (fig. 11). In this latter case, these were organized productions on the edge of a pre-knapped blank (flake or blade), longitudinally or transversally oriented, among which “**transverse burin on notch**” type cores are present, such as in the Middle Magdalenian at Gazel (level 7), Isturitz (Ist II) and Les Peyrugues (level 3) (fig. 12). Long rectilinear bladelets were also detached from the upper face of a blade at Gazel (Rocher de la Caille or Kostienki type) but this method remains occasional in the Middle Magdalenian with scalene bladelets (fig. 11 B) in comparison to the Middle Magdalenian with spears at Lussac-Angles de la Marche in the Vienne (Lwoff, 1967). This facial bladelet production method



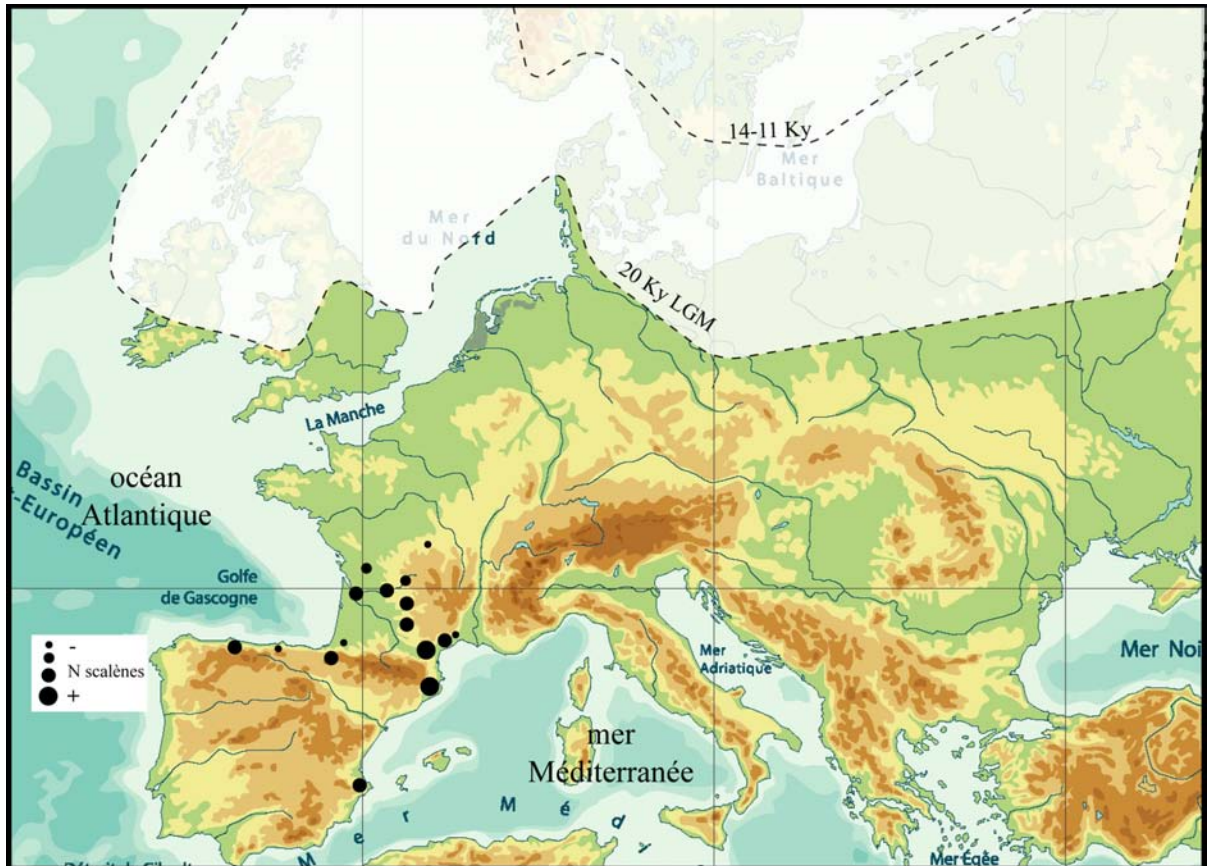
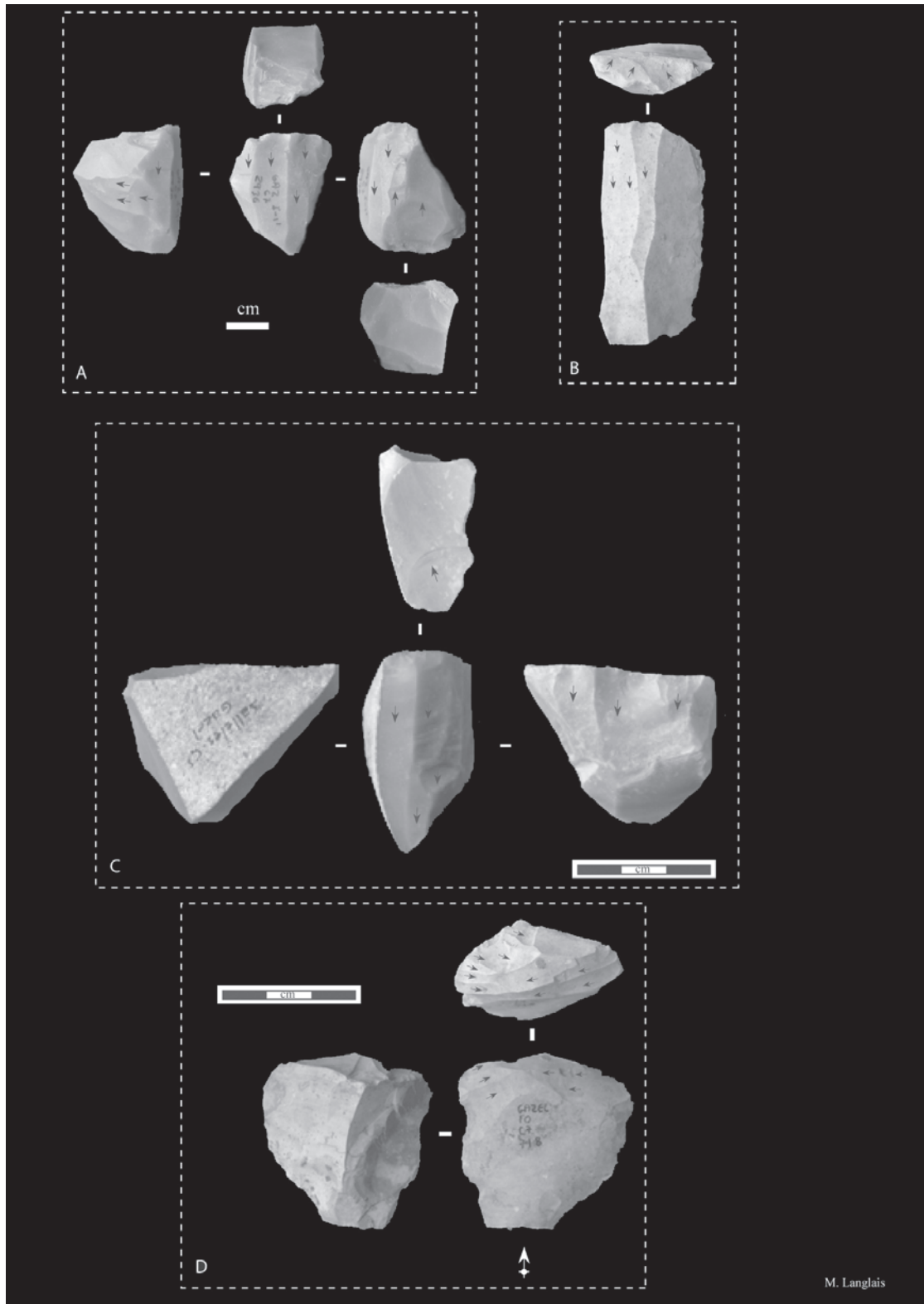


fig. 10 : Territories of scalene bladelets in the cultural zone of the Middle Magdalenian.



**fig. 11** : Lamellar flaking methods in the Middle Magdalenian (A: on nodule, reworked blade core, typical example of “enveloping retouch with two opposed-offset striking platforms”; B: detachment of bladelet from the upper face of a blade (“facial” or Rocher de la Caille type) with a reverse truncation to prepare a striking platform; C: on longitudinal flake edge; D: on transverse flake edge).

has also been documented in the Upper Magdalenian (Alix *et al.*, 1995; Pigeot (dir.), 2004).

### Techno-economic evolution in the Upper Magdalenian

In continuity with the Middle Magdalenian, the role of blades within the domestic tool kit and of bladelets used as weapon points remains essential in the technical system of the Upper Magdalenian (e.g. Valentin and Pigeot, 2000). A study of the lithic assemblage of the Belvis Caves (Aude, France), excavated by D. Sacchi (Sacchi, coord., 1994), and of Parco (Lérida, Spain), excavated by the SERP laboratory of Barcelona (Mangado *et al.*, 2005b), allows us to emphasize some of the techno-economic evolutions that occurred in the Upper Magdalenian. While the production sequences (*chaînes opératoires*) were completely dissociated in the Lower Magdalenian, in accordance with the knapping objectives, Upper Magdalenian blade and bladelet productions were frequently integrated in the debitage of the same raw material volumes. As far as weapon points were concerned, alongside a common pool of simple, truncated and denticulated backed bladelets and inverse retouched bladelets, scalene bladelets (with a preserved bulb) were still present in a reduced and narrow form, accompanied by geometric weapon points (scalene triangles, circle segments, rectangles) and a few backed points, such as at Belvis, Parco and Bora Gran (Corominas excavation) (fig. 13). Geometrics were made on bladelet or micro-bladelet blanks detached during the last phases of a production sequence consisting of frontal lamellar removals from a flake edge (longitudinally and sometimes transversally) or from nodules reduced through enveloping sequence of removals over a wide debitage surface. A simplification of knapping methods correlates with fewer constraints in terms of raw material quality. Therefore, mostly local and regional materials were exploited, rather than materials originating from long distances. In terms of the dimensions of the weapon tips, the leptolithization (blade-bladelet form) of blanks (fig. 14) could be explained by the small dimensions of the regionally available raw material volumes

in the Pyrenees (Lacombe, 1998; Simonnet, 1998), Languedoc (Grégoire, 2000; Bazile, 2002; Langlais, 2004a) and Catalonia (Mangado, 1998), as well as the intention to exploit these materials in an exhaustive manner. In addition, the exploitation of frontal, arched bladelet removal surfaces favours the production of narrower supports. In contrast to the scalene bladelets of the Middle Magdalenian, which show trans-regional standards and traverse variable lithological contexts, thus implying an organized transport of raw materials between the Rhone and Ebro, the geometric weapon tips of the Upper Magdalenian conformed to the local availability of raw materials by becoming less demanding in terms of the quality of the blanks. The standardized manufacturing protocol of the scalene bladelet was replaced by a simplification of production strategies. The abandonment of the preferential lateralization of scalene triangles and the frequent use of a point on the third angle indeed attest to different choices and a completely different style.

The elongated scalene triangle is distributed all along the western Mediterranean coast, in the Pyrenees (Simonnet, 1967, 1984; Schmider, 1978, 2003; Barbaza, 1996), in the Aquitaine (Lenoir, 1983; Demars and Laurent, 1989; Renard, 1999), and up to the Paris Basin at Etiolles Q31 (Pigeot (dir.), 2004). Elongated scalene triangles differ from the denticulated triangles identified at Farincourt in the Haute-Marne (Joffroy and Mouton, 1952) or in Germany (Höck, 2000) and Moravia (Valoch, 1992). At the same time, new forms of lithic points were developing in the northern Aquitaine Basin. Teyjat points from Laugerie-Basse and Magdalenian shouldered points (e.g. Demars and Laurent, *op. cit.*) were not found in the southern Upper Magdalenian, except for a few shouldered points at Duruthy (Arambourou *et al.*, 1978) and a single side-notched flake at Arancou (Dachary, 2002) (fig. 15). Though a decrease in the use of allochthonous materials can be observed, it did not disappear altogether. For example, in the Upper Magdalenian, the Grain de Mil type flint, probably originating from the Charente (Simonnet, to be published), was widely distributed in the Quercy and

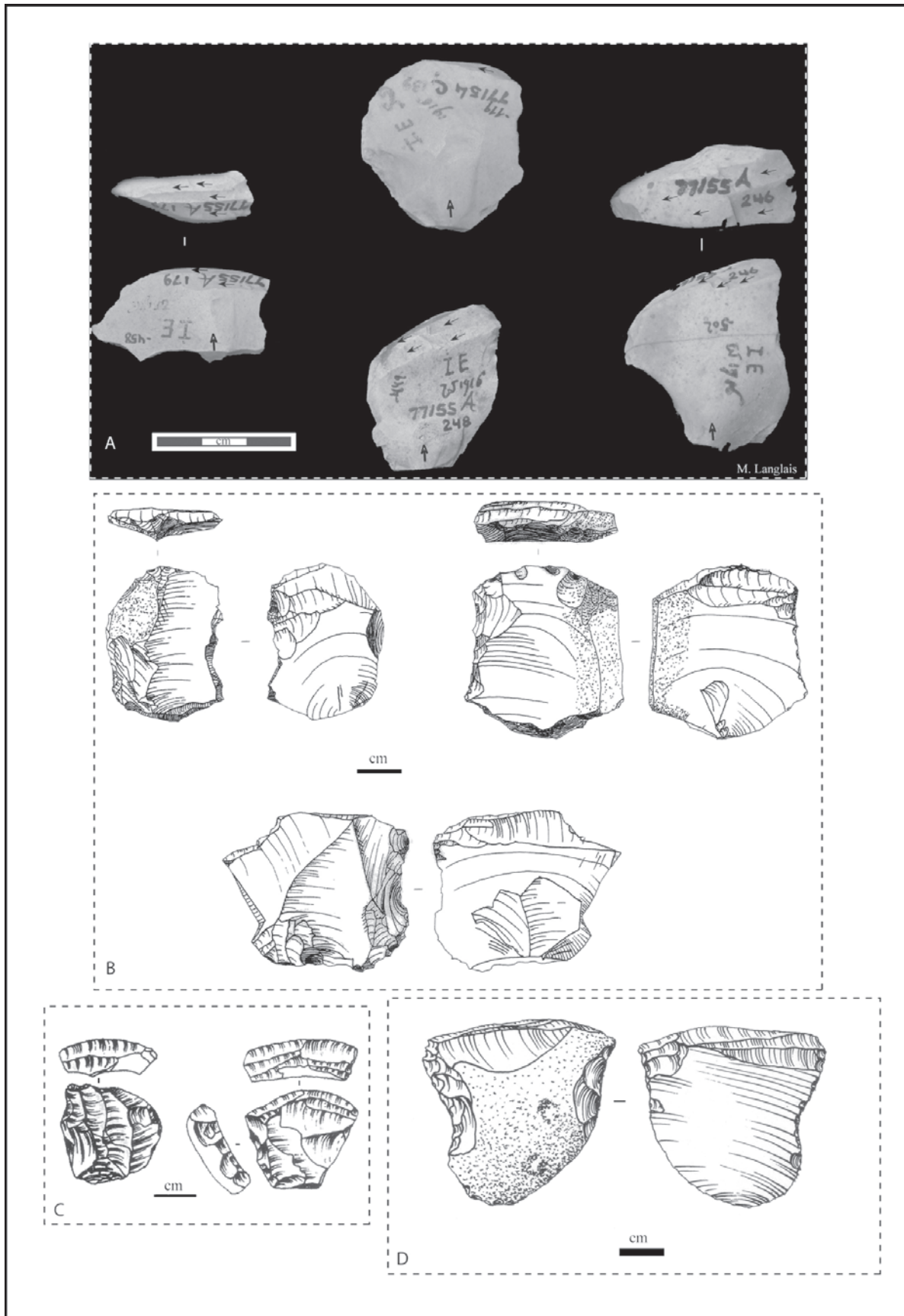
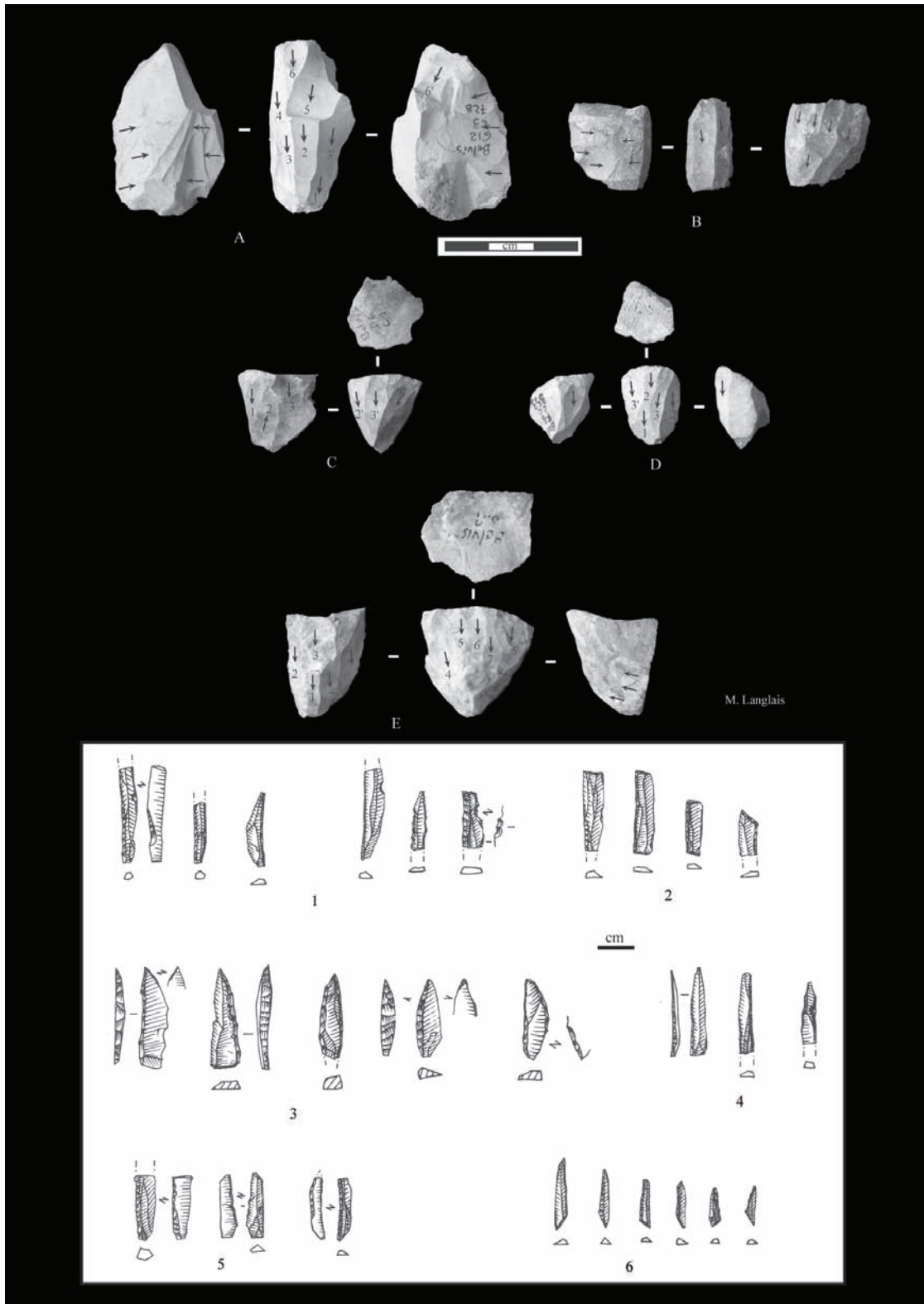
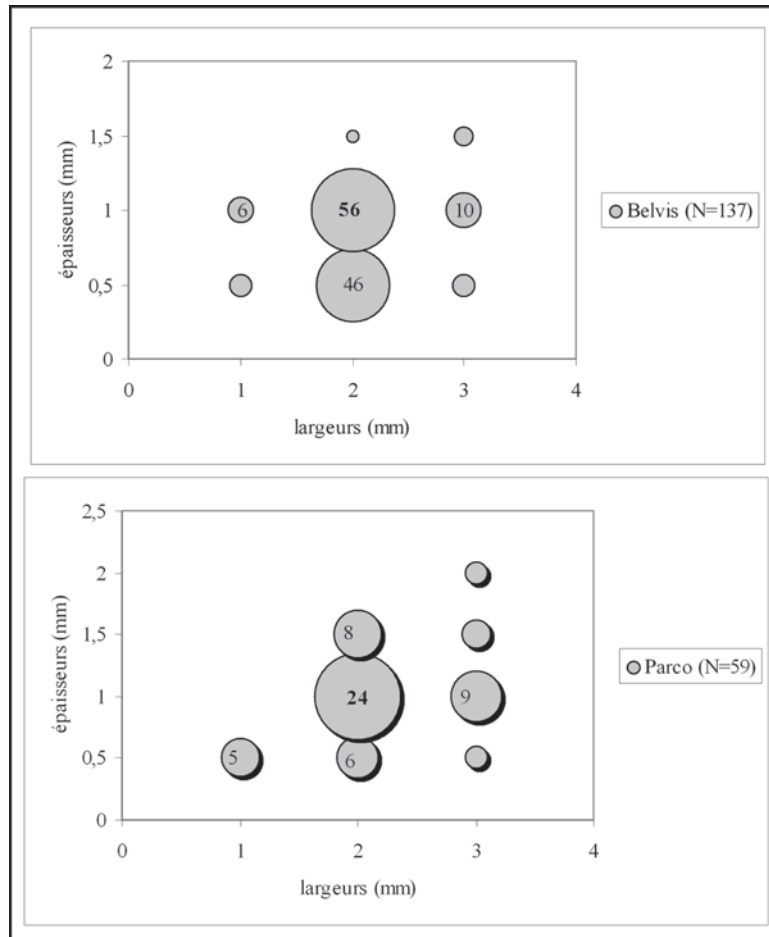


fig. 12 : Examples of blade core of the "on notched transverse edge" type (A: Isturitz , Passemard collection; B: Duruthy, Level 4 (from Dachary, 2002; C: Le Portel (from Baills, 1998 ; D: L'Adaouste, Level 17 (from Onorardini, 1982)).



**fig. 13** : The production of microliths in the Upper Magdalenian of Belvis (A-B: flake edge core with rear crest; C-E: pyramidal type core on nodule; 1: simple marginal backed bladelets; 2: truncated backed bladelets including rectangles; 3: compact backed points; 4: pointed backed bladelets; 5: backed bladelets and alternate retouch; 6: scalene triangles (from Sacchi, 1986)).





**fig. 14** : Territories and lithic armature types of the Upper Magdalenian in southern Europe.

the Pyrenees, while some Perigordian materials were still introduced into the Pyrenees in the form of tools (Dachary, *op. cit.*; Lacombe, 1998; Simonnet, 2004; Langlais, thesis dissertation in progress).

In the Upper Magdalenian, the simplification and imbrication of debitage strategies, compared with those of the Middle Magdalenian, reduced the constraints associated with raw materials. The manufacturing standards for lithic weapon tips became more flexible as they adapted to local environments. An optimal use of local mineral and faunal resources, together with a diversification of hunted species and an increased consumption of small fauna (Le Gall, 1992; Laroulandie, 2003; Cochard, 2004) seemed to go hand in hand with an increased territoriality of groups and/or demographic growth, which probably began during the Middle Magdalenian (Bocquet-

Appel and Demars, 2005). The Magdalenian of the Spanish Levant followed the same evolution as that north of the Pyrenees, despite an endemic lack of Reindeer south of the Pyrenees (Aura and Perez Ripoll, 1992; Aura, 1995; Villaverde, 2001).

The southern roots of the Upper Magdalenian within the Middle Magdalenian can be perceived in the continuity between scalene bladelets and geometric weapon points. However, the first traces of a techno-economic change can be seen before the beginning of the Bølling. Moreover, the regionalisation of lithic weapon element types could illustrate a regional diversity in the adaptation of the human groups faced with a progressive restructuring of the fauna and the compartmentalisation of the zones associated with the end of the ice ages.

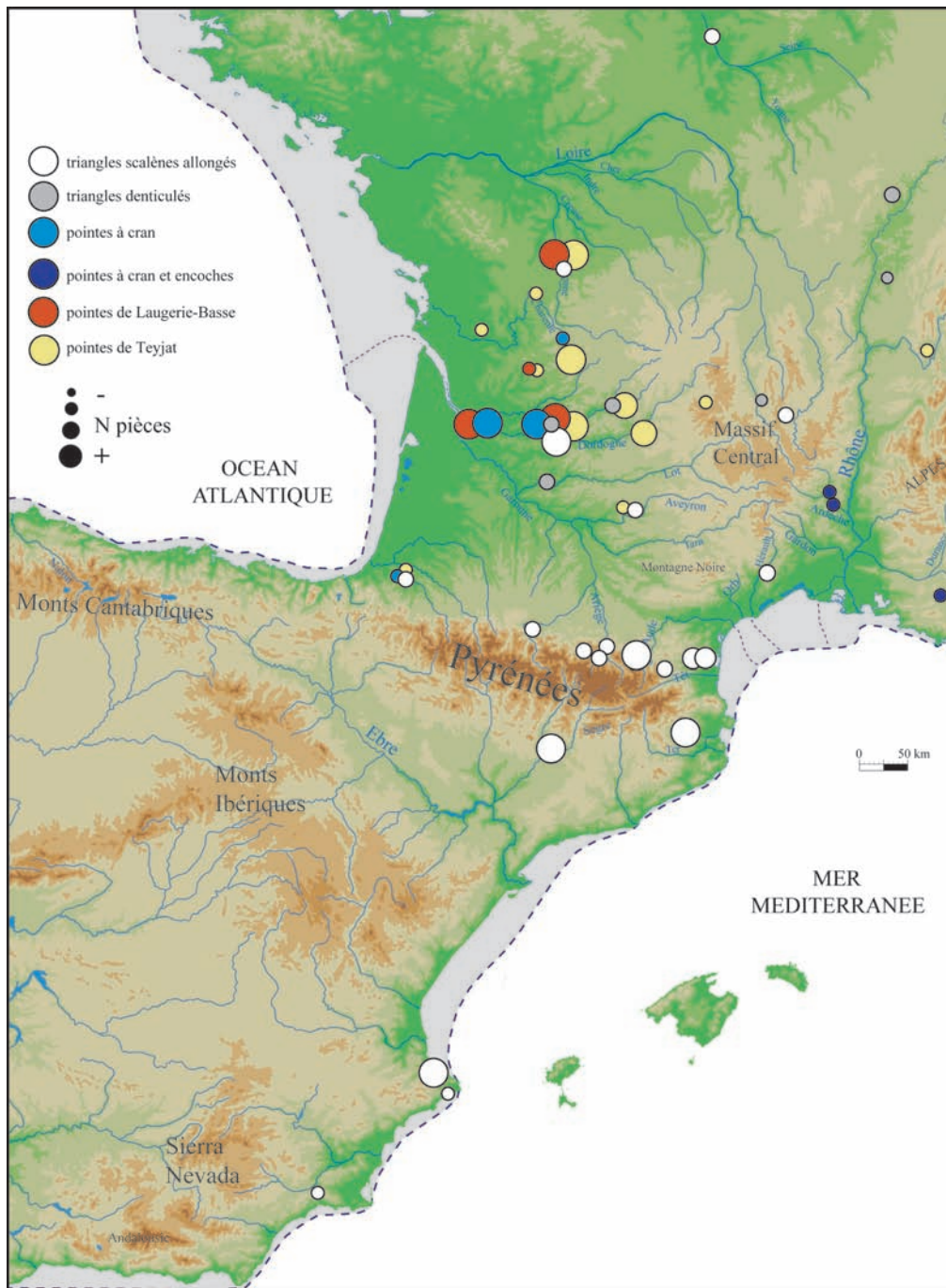


fig. 15 : Territoires et types d'armatures lithiques du Magdalénien supérieur en Europe méridionale

The end of the Magdalenian was characterized by a generalized use of lithic points instead of simple, truncated or denticulated backed bladelets and geometrics. The production of small blades using a stone percussor insured a high productivity level regardless of the raw material locally available (Renard, 1999; Pelegrin, 2000; Valentin, 2000). The hypothesis of a perpetuation of Magdalenian characteristics is largely based on the association of blade tools with bladelets

and backed points, as well as on the portable art. This period is known as the Final or Terminal Magdalenian, or the Epimagdalenian (Sacchi, 1986; Lorblanchet, 1989; Barbaza, 1996). These facies were documented only (except perhaps at Arancou, currently under study by M. Dachary) in levels interstratified between the Azilian and Middle Magdalenian at Gazel or with Upper Magdalenian at Troubat (Sacchi, 1986; Barbaza, 1996). The process of "Azilianization" was marked by

the development of industries with backed points on small blades or bladelets, which have been called by different names (Lower Azilian, Lower Federmesser or Microlaminar Epipalaeolithic) and whose internal phasing is currently being clarified (Bodu and Valentin, 1997; Fagnart, 1997; Fagnart and Coudret, 2000; Valentin and Pigeot, 2000; Valentin *et al.*, 2004; Valentin and Hantai, 2005; Barbaza and Lacombe, 2005).

## Conclusions

Finally, changes in the morphotypes of lithic and bone weapon tips of the Magdalenian took place within a global techno-economic evolution composed of several simultaneous factors. In the **Lower Magdalenian**, we observe a low degree of long-term anticipation of needs through an adaptive and efficient technical system using local raw materials, regardless of the territory. The backed micro-bladelet with convex cutting edge shows **low regional variation** within the Lower Magdalenian. In the **Middle Magdalenian**, the economy seems to have been based on a planning for needs. In the lithic industry, this long-term anticipation is shown by an intended normalization and optimization of the long-term efficiency of blade tools (Pigeot, 1987; Valentin, 1995; Lacombe, 1998; Cazals, 2000) and in the bone industry by the realization of stocks for future needs (Averbouh, 2000; Pétilon, 2006). High geographic limitations to the circulation of resources implied an organized transport and probably exchange network. The scalene bladelet attests to a **regionalization of groups** during the Middle Magdalenian through the diffusion of scalene bladelets and elements of portable art such as bone *contours découpés* (Buisson *et al.*, 1996) over a territory different than that of the Middle Magdalenian of the La Marche type, with spears at Lussac-Angles or La Garenne with “navettes”. The technical system of the **Upper Magdalenian** was greatly inspired by that of the Middle Magdalenian, but simplified to respond to seemingly more short-term needs and focused on a **more local area**. At the same time as scalene triangles were diffused over large territories, new point types were being developed north of the Aquitaine Basin, indicating once more, as with the Middle Magdalenian, stronger regional variation

than in the Lower Magdalenian. East of the Rhone, the Late Epigravettian has points with an obliquely truncated base, some of them mirroring the scalene triangles of the Upper Magdalenian. In this context, even if we should not reject diachronic factors due to the nature of the archaeological record, the hypothesis of synchronic differences remains possible. The leptolithization of the scalene triangle over the entire Franco-Cantabrian zone and the adoption of lithic points in the North raise questions concerning territorial identities during the Magdalenian, the evolution of which seems to be included in a process of regionalization of human groups.

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# LITHIC WEAPON ELEMENTS IN WESTERN FRANCE (BRITTANY AND PAYS DE LA LOIRE) DURING THE LATE GLACIAL PERIOD : A PROPOSED CHRONO-CULTURAL ORGANIZATION AND REDUCTION SEQUENCE

Nicolas NAUDINOT

## Abstract

In recent years, new data on the Late Glacial period in western France have allowed us to develop a model of chrono-cultural evolution based on comparative lithic technology and lithic hunting weapon elements. This period can be divided in to four main phases: Early Azilian, Late Azilian, Final Azilian and Auvours-type industries. Though it presents some particularities, the western Late Glacial appears very similar to that which is well documented neighbouring regions. After a succinct presentation of these cultures, this article will focus on the lithic reduction sequences for the fabrication of weapon elements in order to identify and explain possible variations in the treatment of projectile points between the groups studied. This heterogeneity appears to be linked to a difference in approaches to raw materials and volumetric conceptions between the Late Azilian and Auvours-type industries rather than to a change in the status of weapon elements, which remain central to the production objectives.

**Key-words** : Western France, Tardiglacial, Azilian, Auvours-type industries, lithic technology, weapon armatures, use fractures

## Introduction

After a roughly ten year hiatus, research concerning human groups at the end of the Late Glacial period (Alleröd, Late Dryas and early Preboreal interstadials) has been revived in many regions of western Europe. As western France was somewhat late in this domain, it was excluded from the few broad syntheses proposed in recent years (Thévenin, 1997; Fagnart, 1997; Bodu & Valentin, 1997), despite a few well known early excavations, such as that of Roc'h-Toul at Guiclan in the Finistère region (Le-Hir, 1874; Laplace, 1957; Monnier, 1980). Meanwhile, the recent work of G. Marchand (Marchand *et al.*, 2004) demonstrated that this geographic zone was not deserted by the last hunter-gatherers of the Pleistocene. On the contrary, the seventy sites and indications of sites that have been recently identified and attributed to these cultural entities (*ibid.*) indicate that there was a very dense occupation during this period, despite geological and environmental particularities that were unfavourable to human occupation and which create difficult taphonomic conditions. Nearly three quarters of our study zone are located on the Armorican Massif, a geographic zone whose pedological characteristics prevent the preservation of organic remains (except in some coastal sectors where carbonates deposited by shelly sands allowed the preservation of bone remains). Due to this factor, radiocarbon dating and archaeozoological analyses are rare. In addition, a very low sedimentation rate prevents reliable recordings of occupation floors. Lithic raw material procurement was moreover conditioned by the geological nature of the massif on which there is no flint in primary position. The hunter-gatherer populations were thus required to adapt their technical and economic systems to other stones such as quartz, sandstone or small flint pebbles found in offshore bars or the terraces of the Loire River. One objective of my doctoral dissertation (in progress) is to define these prehistoric groups and reveal the nature of their techno-economic and social systems based on comparative lithic technology. After proposing a model of cultural evolution for these Late Glacial industries in western France, I will focus on the lithic reduction sequences

for the fabrication of projectile weapon elements and attempt to perceive possible variations in the technical investment made in the conception of these tools during these few thousand years of technological changes.

## The Azilianization of the west

The process of Azilianization in western France remains enigmatic. Despite numerous field surveys and new analyses of old collections, only one real site with bipoints is known in the geographic zone considered here. The Magdalenian is also currently totally unknown. Nonetheless, several sites, most located in the Pays de la Loire, were long thought to be associated with this period (Gruet & Jaouen 1957). Recent work (Marchand *et al.*, 2004) on the Late Glacial, however, tends to reduce the age of these occupations, situating them within the transition from the Palaeolithic to the Mesolithic. Three hypotheses can be proposed to explain this absence of sites:

- for unknown reasons (perhaps related to the absence of high quality flint), these human groups simply did not occupy the west, though this appears highly unlikely;
- these sites have not yet been identified or have not been correctly attributed;
- these populations may have occupied zones that are now submerged by the Flandrian transgression. This is the hypothesis that we favour due the presence of several flint outcrops that are now submerged by the Manche River but which would have been accessible during the Bolling/Alleröd. The economic needs of these groups may have pushed them into occupying these sectors near these raw material sources, as well as the large valleys in which large prey circulated. On the southern slope as well, the rising sea level probably erased all potential traces of a coastal occupation that may have been organized around a marine predation economy.

A project currently being developed by the UMR 6566 laboratory to address this issue of submerged flint sources and their possible exploitation by humans during the Palaeolithic should allow us to further explore this hypothesis in the future. Despite



the significant occupation hiatus, one of the earliest excavated Late Glacial sites, Roc'h-Toul, seems to be attributable to first phase of the Azilian. According to published drawings, the lithic assemblage of this rock shelter would be constituted of symmetric bipoints with curved backs, along with small scrapers and burins on blades. According to extraregional references, such as the lower level of Closeau (Rueil-Malmaison, Hauts-de-Seine; Bodu 1995), these latter tools would be characteristic of the Early Azilian. Located off the coast of Brest and dominating the estuary of Elorn, the still unexcavated site of Rocher de l'Impératrice (Plougastel-Daoulas, Finistère), discovered by M. Le Goffic, could prove to be very interesting. Its study will probably prove essential to our perception of the process of Azilianization in the west.

### The Late Azilian

The occupation of this territory by clearly Azilian groups is now well attested. The evidence for this occupation (sites and other traces) is more abundant than for any other group. Recent paleoenvironmental studies of the peat bogs of Mayenne (Barbier & Visset, 1999) provide information on the environment of these hunter-gatherer groups, indicating a steppe landscape with poaceae associated with herbaceae. Birch seems to be the only tree species (no pines). As in the neighbouring regions, the climate warmed up, but the very high humidity level corresponds more to the hygrometric conditions of the Outre-Manche region. Among the approximately fifty Azilian sites identified in the Brittany and Pays de la Loire regions, we can cite Le Perzo (Neuillac, Morbihan), Roc'h Glas (Penvénan, Côtes-d'Armor), Runigou/Notenno (Trébeurden, Côtes-d'Armor) and Lann-Gazel (Trémouezan, Finistère). The best recorded site is Chaloignes (Mozet-sur-Louet, Maine-et-Loire), excavated over a surface of 9200 m<sup>2</sup> by G. Marchand in 1999 before the construction of the A 87 motorway (Angers/La Roche-sur-Yon). G. Marchand demonstrated that the dispersion of tools and debitage products observed in certain loci support the hypothesis that the majority of concentrations correspond to zones of discard after the realization of multiple or specific

activities and not to debitage concentrations in primary position (Fig. 1). Specialized activities are nonetheless perceptible in a few sectors. Locus 1, for example, seems to be essentially associated with the fabrication and maintenance of weapon elements, while loci 4 and 13 were probably debitage zones. It still seems however, that there was a low segmentation of activities at this site, a phenomenon that is observable at other contemporary ones. Though the subject of this presentation is weapon elements, I will rapidly present the debitage strategies of these Late Azilian groups since projectile points cannot be dissociated from their blanks and thus from the core reduction sequences employed in their production. These debitage strategies indicate a low level of technical investment. The bipolar exploitation of cobbles from the Loire River or silcrete plaques was realized with hard stone hammers. Actions related to the preparation of edges and striking platforms and to the maintenance of core convexities are rare. The objective of the reduction sequence seems to have been to produce blade blanks of varied dimensions and regularity, as well as elongated flake-blades. Many researchers see a technical regression in this Azilian technology, though it more likely represents a techno-economic innovation in which the knappers abandoned constraints judged to be of little utility. Following weapon elements, scrapers, made on small, relatively standardized flakes, are the most numerous tools. Burins, which are generally less numerous than scrapers, are mostly made on fractures or natural surfaces. Though truncations are present, they are highly variable. Most of the weapon elements are asymmetric monopoints with curved backs (though three bipoints were also identified) (Fig. 2). While they are most often made on small blades and bladelets, some were made on thick, irregular flakes. If we trust the data from outside of our study zone, this liberty would contradict the technical principles of the first phase of Azilianization with symmetric bipoints. The corpus of monopoints consists of around thirty pieces. G. Marchand reminds us that only whole pieces and fragments with a curved back were recorded, indicating that the number of objects is in fact higher. The width of the weapon elements is between 9 and 13 mm



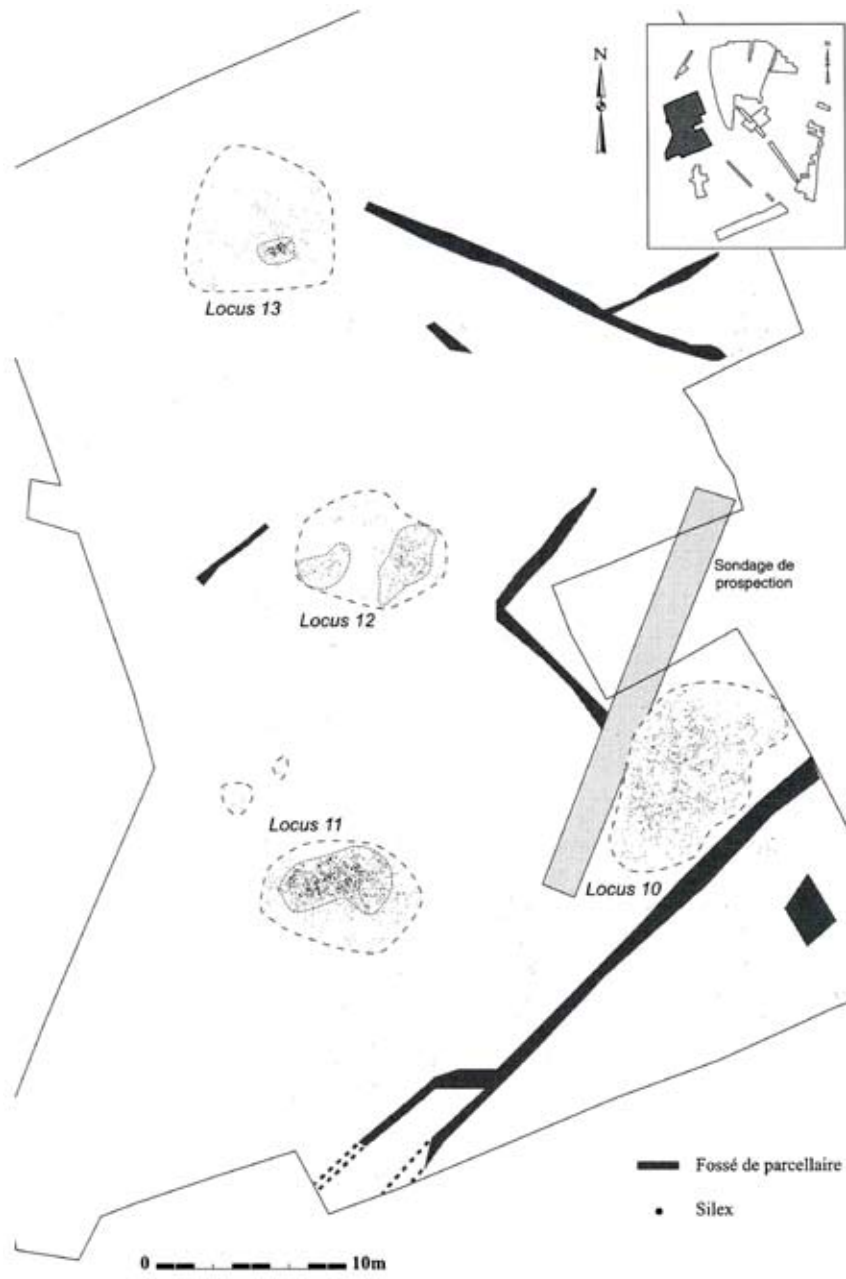


fig. 1 : Plan of the site of Les Chalognes (Mozet-sur-Louet, Maine-et-Loire).

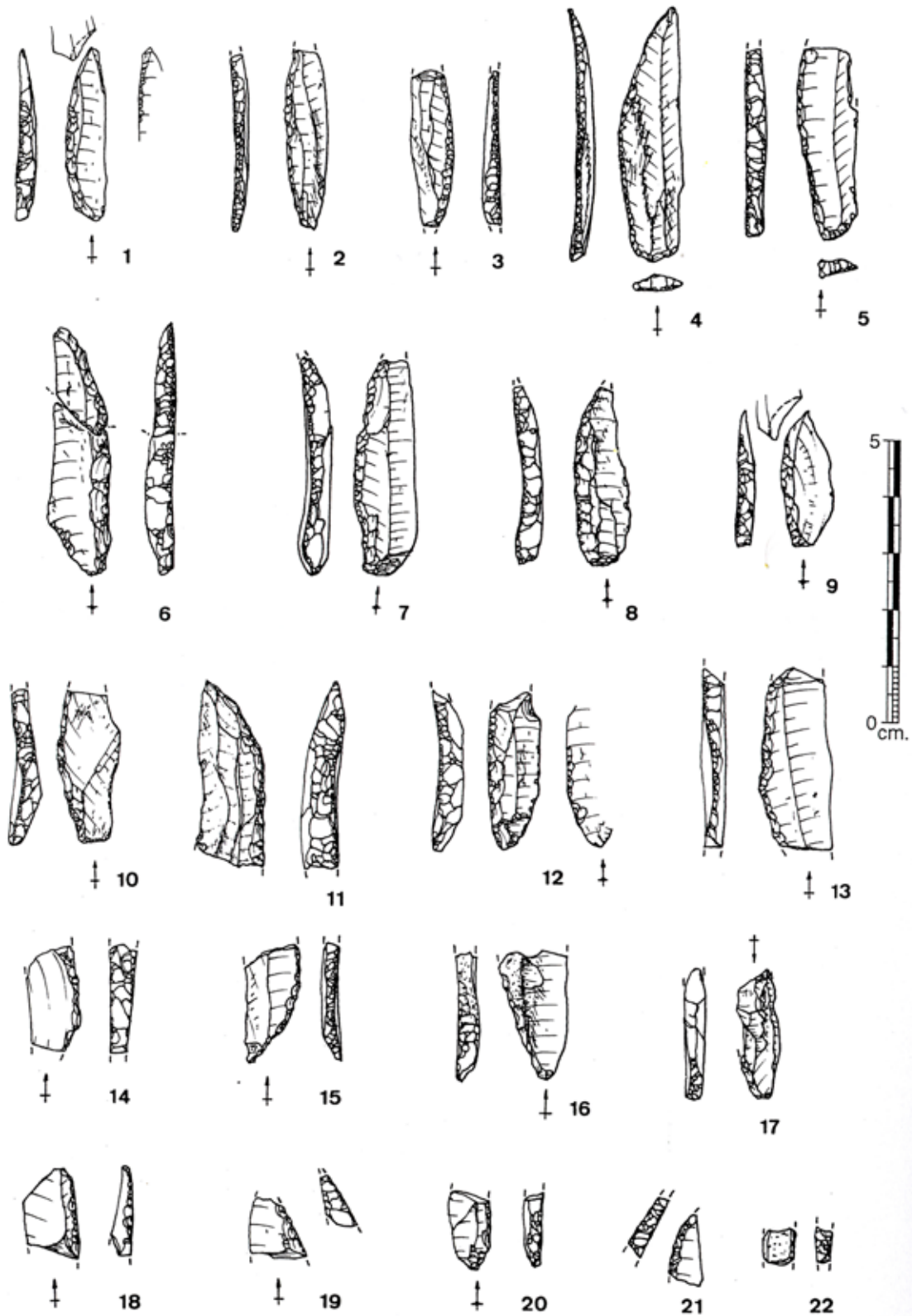


fig. 2 : Curved-backed monophoints of locus 1 at Les Chaloignes (Mozet-sur-Louet, Maine-et-Loire).



with an average of 11 mm. The thickness increases in proportion to the width and varies between 2 and 8 mm with an average of 4 mm. The length is between 25 and 50 mm. These data, along with my observations show a very weak morphometric standardization of monopoints. In clearly Azilianized industries, “...the standardization was mostly created by the retouch...” (Valentin, 1995), but we can see here that retouch was not sufficient to standardize the weapon elements at Les Chaloignes. The back was variably realized on the right or left edge of the blank, contributing to the low standardization of the assemblage. The apical part of the tool was most often located on the distal part of the blank. Five pieces resemble Malaurie Points with an abruptly retouched base, while others have a basal notch on the edge opposite the retouch (Penknife Points or Grundy Points).

Rather than constituting a cultural marker, this retouch seems to have been opportunistically realized for practical reasons related to hafting. The retouch is often alternating and the passage from direct retouch to alternating retouch can be associated with the removal of a guiding ridge through retouch (*cf. supra*). The weight of whole and almost whole points (missing part estimated at less than 5 mm) varies between 0.396 g and 7.539 g for an average of 2.120 g. A large, whole backed object weighing 15 g was excluded from these statistics because we believe it is closer to a backed knife than an Azilian Point. These data remain compatible with use as projectile points even if two pieces weigh over 5 g. It is possible that this dimensional variability attests to different uses of these Azilian Points. The use of some of these points as knives is actually attested. The weights and dimensions are slightly lower than those recorded at other Late Azilian sites within and outside of our study zone. As pointed out by G. Marchand, this phenomenon may be due to the use of Loire River cobbles as cores.

### The Final Azilian

Here we consider as Final Azilian those industries which are often attributed to the “Laborian” tradition, especially in southwest France. These are industries

with Malaurie Points (straight-backed points with an abruptly retouched base). Sites containing these industries are rare in our region, the best known being La Guichaumerie (Ecouflant, Maine-et-Loire; Gruet, 1938; Gruet, 1943; Naudinot, 2003; Marchand, Blanchet *et al.* 2004; Naudinot, 2003, 2004), whose assemblage was collected by M. Gruet at the end of the 1930’s. Study of unpublished documents by the discoverer, along with the marking of a small percentage of pieces, show that the site was probably organized around eight principal zones (Fig. 3). It possesses a lithic industry that clearly differs from the assemblages described above. The reduction sequence becomes more complex (or less simple). The cores are again carefully prepared (use of crests, frequent repairs, careful scraping and smoothing of the edge of the striking platform before debitage with a soft stone hammer) with the objective of producing small, regular and calibrated blades. The core reduction is most often preferentially unipolar in the first knapping sequences, which are particularly invasive. It then becomes regularly bipolar during the extraction of bladelets. If we exclude notches, which were probably created by a post-depositional phenomenon, end scrapers (38) dominate the tool assemblage, followed by truncations (6) and burins (4). There are 14 weapon elements. The blanks used for the latter are always rectilinear blade-bladelets produced during the full debitage phase. These armatures can be divided into three broad categories. The first consists of straight-backed points with a truncated base, corresponding to the definition of Malaurie Points. We have identified one whole piece, one basal fragment and two other more doubtful fragments that have the same morpho-dimensional characteristics as the preceding pieces. Based on stratified sites located outside of our study zone Pont d’Ambon (Bourdeilles, Dordogne; Célérier, 1994, 1998; La Borie-del-Rey in Blanquefort-sur-Briolance, Lot-et-Garonne; Coulonges, 1963; Le Tensorer, 1981); Le Closeau, Rueil-Malmaison, Hauts-de-Seine; Bodu, 1995), the presence of these pieces, associated with these reduction sequences, argues for an attribution to a final phase of the Azilian, which we can place at the beginning of the Late Dryas. Seven





**fig. 3** : Material concentration zones at the site of La Guichaumerie (Ecouflant, Maine-et-Loire) (after the original drawings of Michel Gruet).



pieces can be grouped into the category of bladelets with a straight back. Their width is from 4 to 5 mm, with a thickness of 1 mm. Their back is always formed by very abrupt, direct retouch. One of these pieces still has its apical portion, which is located on the proximal end of the blank and created by a very oblique truncation. The back would thus be located on the left edge of the piece. These weapon elements have many clear similarities with Blanchères Points (La Boissière-Ecole, Yvelines; Valentin, 1995), though considering their low numbers and high fragmentation, we must be very cautious. Finally, we identified three points with an oblique truncation (apical part on proximal end of blank, back on left edge), which are often associated with the preceding points with a rectilinear back in the Mesolithic transitional industries discussed above. Despite the low statistical value of this assemblage, these two categories of weapon elements slightly reduce the age of La Guichamerie, placing it at the transition from the Final Azilian to the Techno-Complex of Auvours-type industries.

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### Auvours-type industries

The site, or more precisely, the sites of Camp d'Auvours (Saint-Mars-la-Brière, Sarthe; Allard, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1982; Allard & Guyot, 1972; Naudinot, 2004) are located on a small, sandy plateau at the bottom of a large alluvial plain of the Huisne River between the Ardenay and Auvours hills, which culminate at around 130 m (Allard & Guyot, 1972) (Fig. 4). These sites were discovered during the construction of a new road in a military camp of the same name. Five sites were identified by Mr. Guyot. The artefacts considered in this paper originate from the largest one, called "Site 1", of which only 5 m<sup>2</sup> are still preserved after the enlargement of the road and installation of a fire-break.

Several other small sites were discovered nearby by amateur archaeologists (Verdier, 1974). Our surveys in this area also revealed a few artefacts around the perimeter of the camp. Occupation of the region must thus have been particularly dense during the Palaeolithic, probably due to the favourable position of this immense alluvial plain along the Huisne River. This latter in fact

opens a path across the Mancelles Alps, which rise a few dozen kilometres to the north of Auvours. To the south, the presence of several confluences, including those of the Huisne, the Loir and the Mayenne, as well as the proximity of the Loire, also likely played an important role in the choice of occupation location. These valleys constituted favourable circulation axes for human groups, as well as for large animals. In addition, on the site itself, there was residual tertiary flint that seems to have been abundantly used by these populations. The site of Camp d'Auvours has often been cited for its stone concentrations, which M. Allard interprets as habitat structures (Allard 1982). The results of recent test trenches (June 2006) moderated this interpretation and argued in favour of a natural origin for these blocks and mixed accumulations. In this case, the blocks would have been detached by gelifraction (frost breaking) from the Ardenay knoll that rises above the site. After they were detached, these stones would have been transported by solifluction and then reshaped by wind and corrosion by Cenomanian sands. It seems that the lithic raw materials had the same origin, which would explain the correlation between the density of these blocks and the flint. Rather than attesting to the presence of a structured hut, the installation of human groups on these dense, localized accumulations of blocks are therefore more likely related to the presence of siliceous materials (Naudinot, 2006). We hope to contribute more elements to this debate in the near future. The attribution of these final Late Glacial industries is highly debated. They are rather similar to the Epi-Laborian level (levels 3 and 4) of La Borie-del-Rey, but this term implies as yet unknown links with southwest France and the prefix "epi" forcibly implies a relationship with the underlying Laborian levels. In 2001, G. Marchand proposed the term "Techno-Complex of industries with straight-backed points" (TCIPDR) (Marchand *et al.*, 2004). Though perfectly adapted to these assemblages, this terminology is problematic due to the existence of non contemporary and extra regional industries that also correspond to this definition, such as the Gravettian and Epigravettian. We thus propose to group these transitional industries under



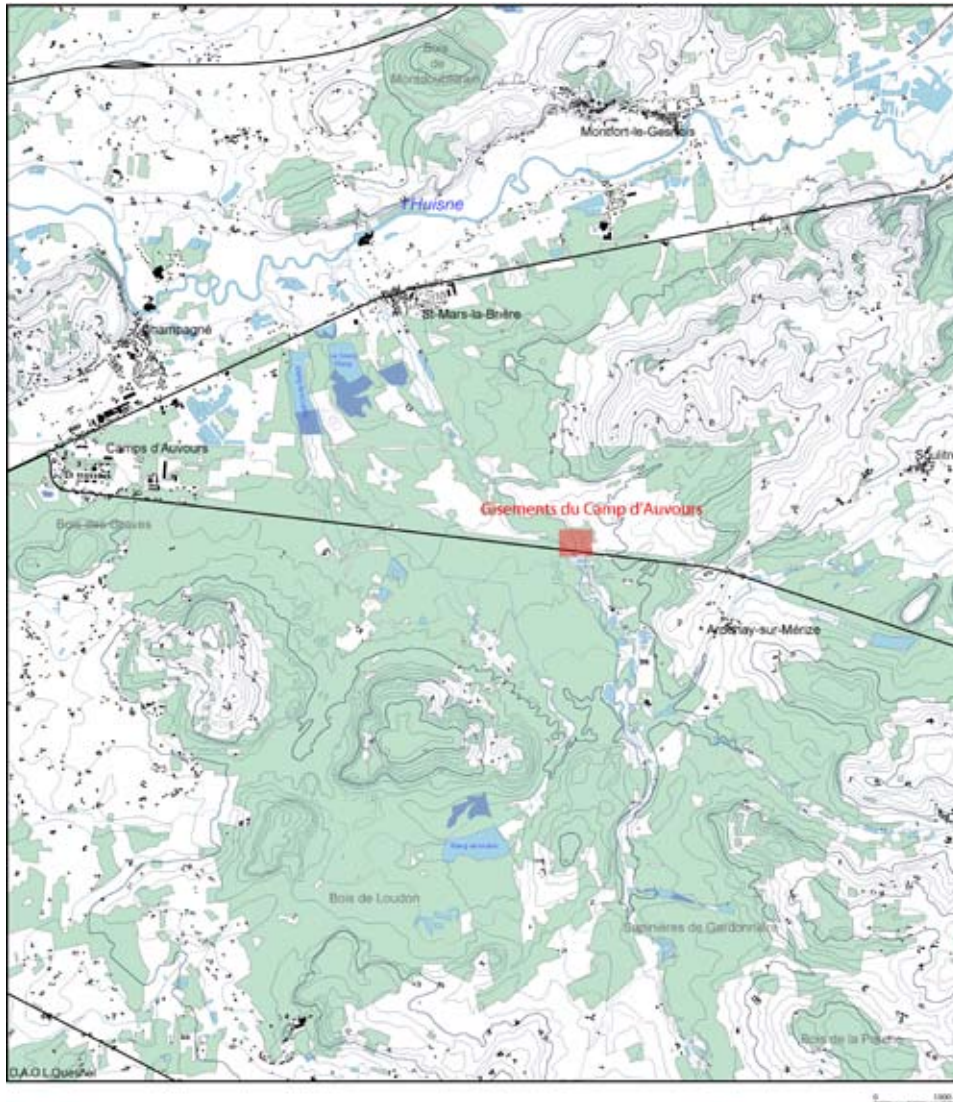


fig. 4 : Location of the site of Camp D'Auvours (Saint-Mars-la-Brière, Sarthe).



the provisional term « Techno-complex of Auvours-type industries » (Fig. 5). The retouched tools are dominated by scrapers (27%) in equal proportions on blades or flakes. They are followed by truncations (24%) and burins (22%), most often on breaks or dihedral. The use of a GIS (Geographic Information System) did not reveal any concentration of a particular tool type, thus indicating multiple activity zones, even if the presence of a sandy level moderates this hypothesis and suggests a post-depositional disturbance of artefacts. We also agree with M. Allard's hypothesis of intensive hearth emptying. As in the sites with Malaurie Points described above, the quality of debitage with a soft stone hammer further increases. The objectives are oriented toward the production of narrow, very regular and calibrated bladelets, the great majority of which were used as blanks for the fabrication of projectile points. Most of the flint blocks were exploited until exhaustion, most often through frontal removals on the widest surface. Preliminary observations of the cores suggest the production of bladelets and a few long blades within the same reduction sequence starting with cores prepared with two posterior-lateral crests. One of the principal characteristics of the management of core volumes in these industries appears to be the desire to permanently maintain a very small angle between the flaking surface and each flank, in order to create a very flat flaking surface (Fig. 6). Observations of the widest blade negatives on the largest repairs or rejuvenations show that this recurring modality was applied from the first flaking phases. This volumetric objective was imposed by the desire to obtain flat, rectilinear blanks. When the knapper wanted to recreate ridges in order to continue flaking on one of the flanks (as during initial flaking), he had only to remove this neo-crest (85% on one surface) and rework the striking platform in order to obtain an appropriate flaking angle between this latter and the new flaking surface. This method does not seem to be completely imposed by the morphology of blocks at Auvours and we also observe this type of flaking organization at other sites in the western zone with totally different raw materials and volumes. This exploitation continues until the exhaustion of the core

unless an accident interrupts the reduction sequence or the convexities of the flaking surface become to flat (the principal risk in this type of core volume management). When the cores are abandoned, they have a generally fan-shaped form with a very large and flat flaking surface framed by two flanks and with a back still with cortex or with traces of posterior-lateral crests (Fig. 6). This assemblage is largely dominated by weapon elements with a straight back and an apex created by a very oblique truncation, which are very similar to the Blanchères Points described above (Fig. 7, 1-10). The retouched back of these very standardized pieces is most often on the left edge of the blank (80%) and the point is made on the proximal end (90%). Their average width is 6 mm, their thickness 2 mm, and length 30 mm. The standard deviation between the dimensions according to the location of the portion measured (basal, mesial, apical) is very low (0.01 for thickness, 0.2 for width), which clearly shows the regularity of the blanks and the straightness of the back. The weight of these pieces varies between 175 and 1092 mg, with an average of 450 mg, which is an ideal weight for use as arrowheads. The presence of two "reddish sandstone" objects with grooves (probable shaft polishers) also argues in this sense. The standard deviation between these weights is much lower than at Les Chalaignes (179 at Auvours versus 1053 at Les Chalaignes) (Graph 1). Analysis of the fractures of all of the weapon elements at Chalaignes (*cf. supra*), as well as microwear analysis of the retouched tools of Locus 1 by S. Philibert, shows no activity specialization at this site; this weight dispersion thus cannot be explained by a selection and significant exportation of weapon elements away from the site. It is more likely simply an illustration of the weak calibration of monopoints with a curved back evoked above. Points with an oblique truncation (Fig. 7, 13-17) are also well represented at Auvours. These are very similar to the points with straight backs and we suspect that they originate from the same reduction sequence. Their average length is 25 mm, with a width of 8 mm and thickness of 2 mm. Their average weight is logically slightly higher (576 mg) than that of the straight-backed points. In addition to these types, there



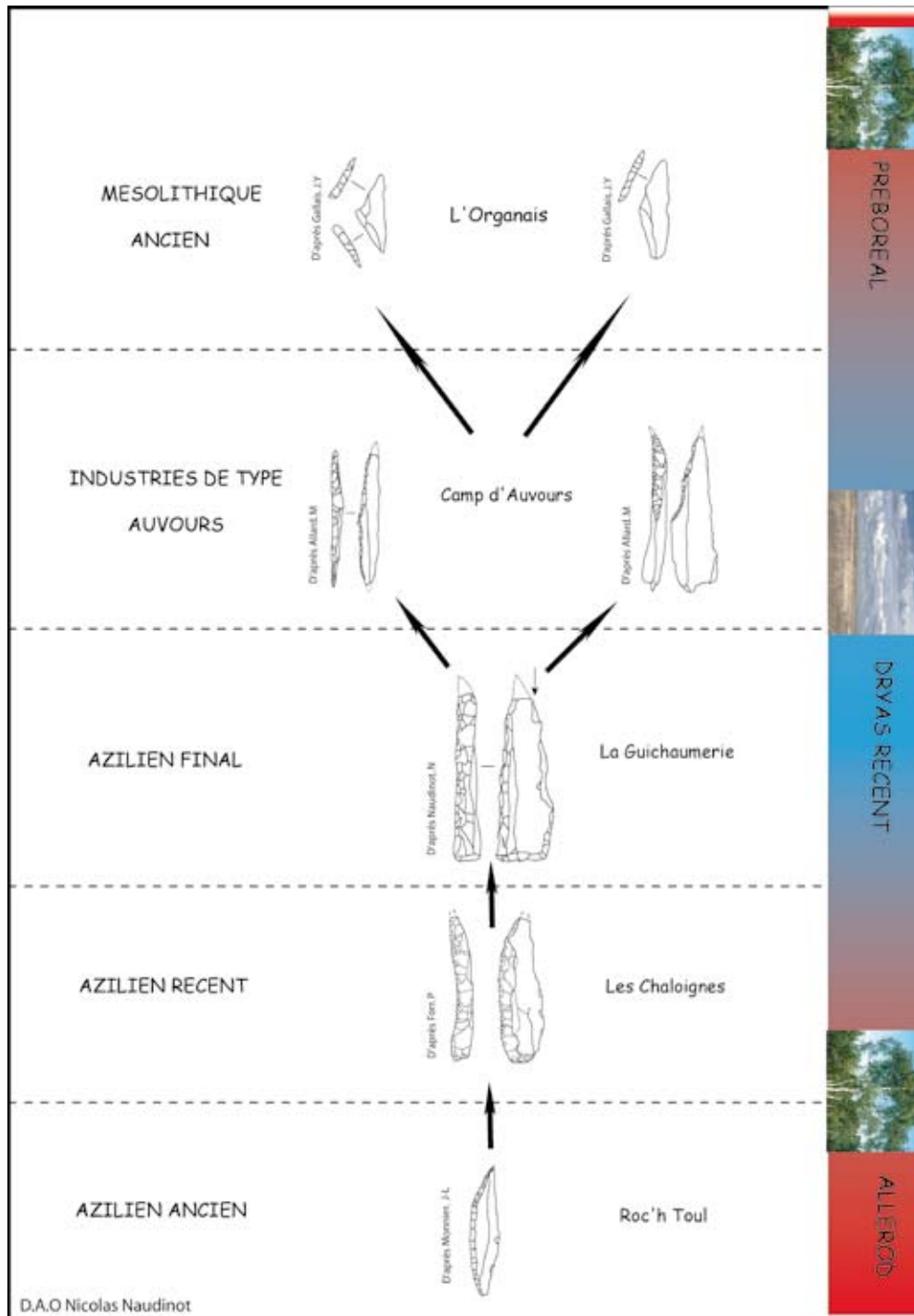


fig. 5 : Succession of Late Glacial lithic weapon elements in western France.



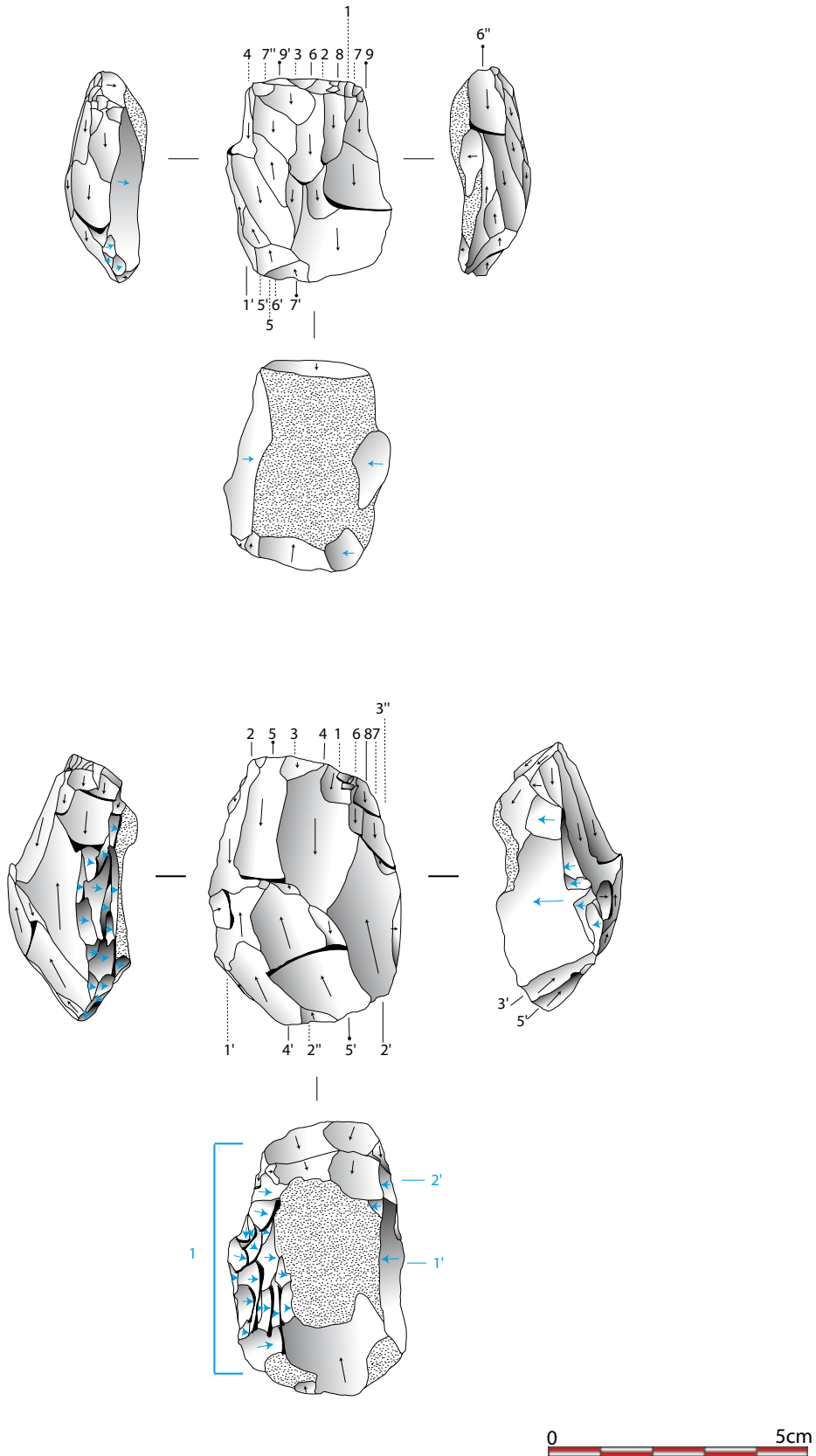


fig. 6 : Diacritic scheme of a core from Camp d'Auvours presenting a typical volumetric organization.



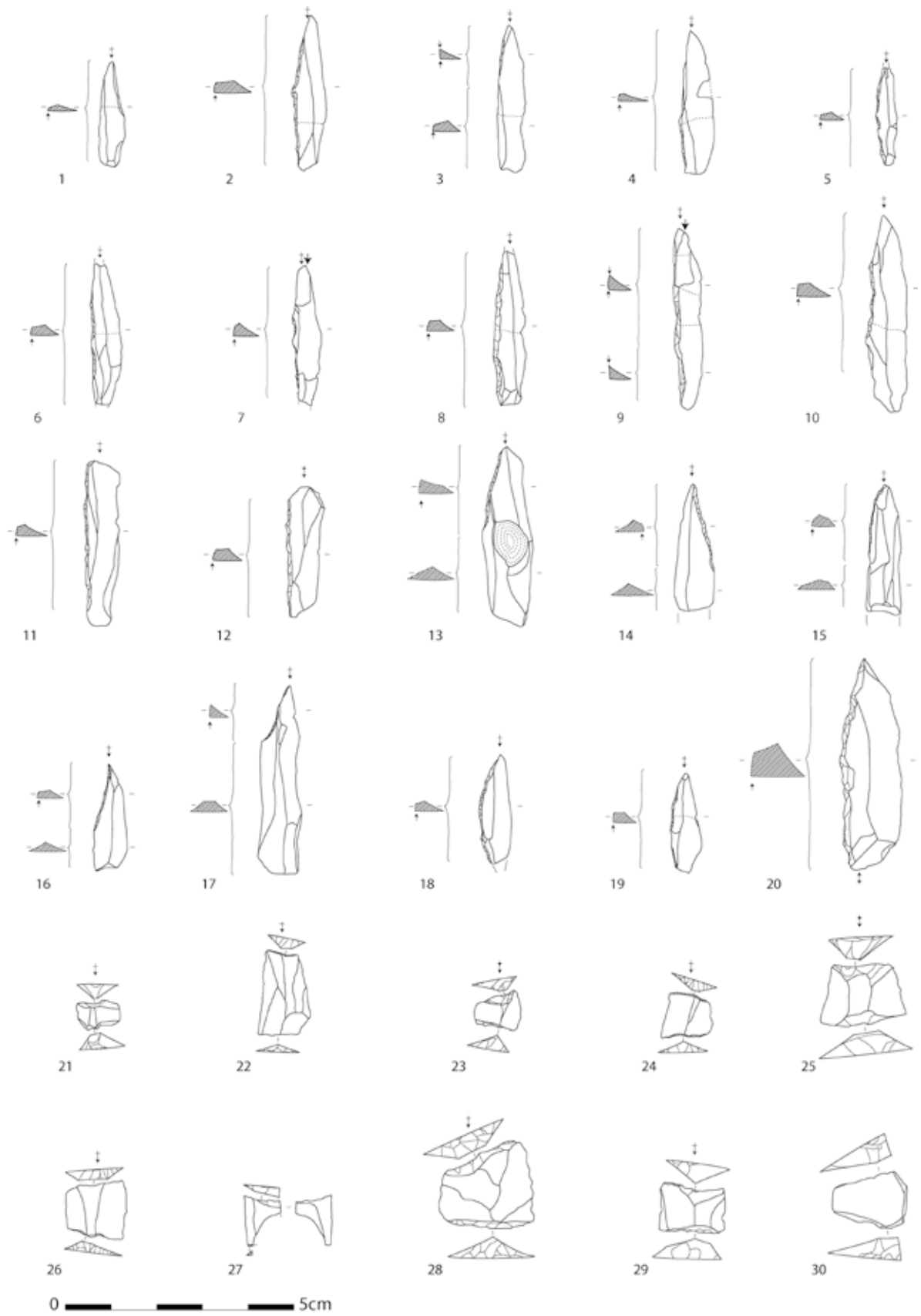


fig. 7 : Weapon elements from Camp d'Auvours (Saint-Mars-la-Brière, Sarthe).

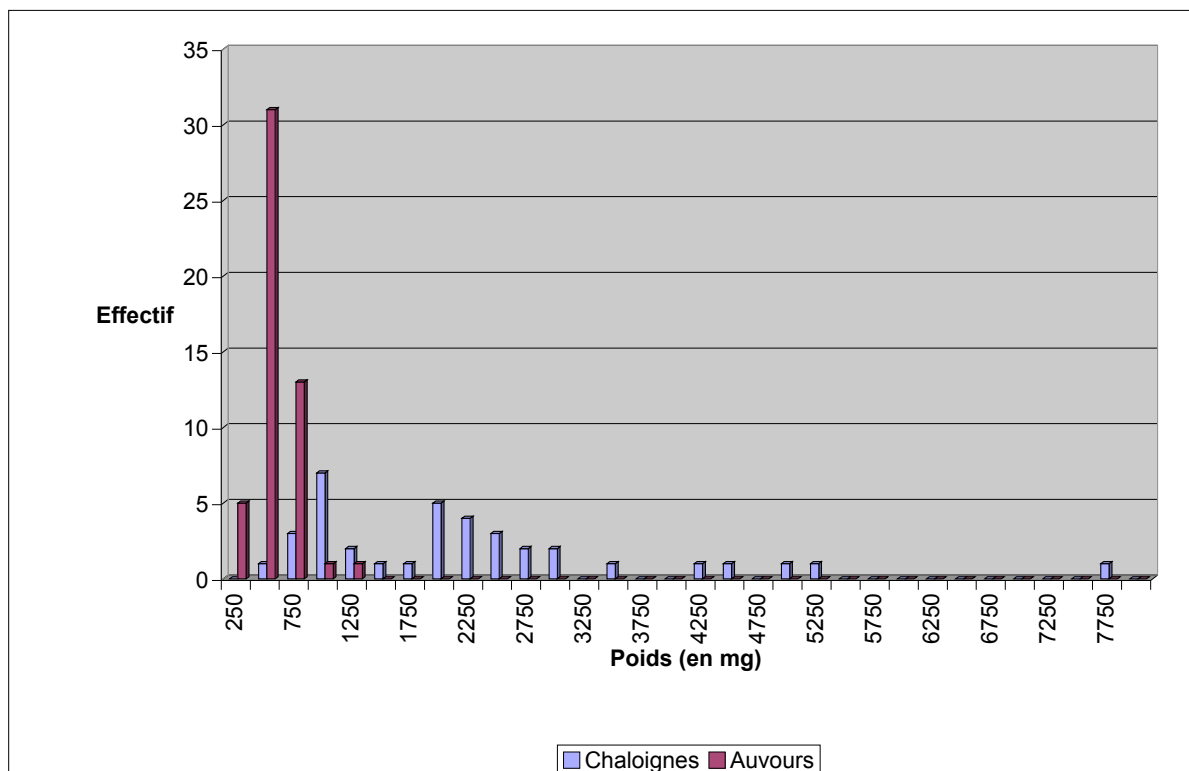


are a few small spindle-shaped points similar to Istres Points (Fig. 7, 19), segments (Fig. 17, 18) and backed bladelets (Fig. 7, 11 & 12). Some bitruncations had also been discovered on the site (Fig. 7, 21-30). They could be considered as intrusive but other ones were also found in other contemporary sites of the area like La Fosse (Villiers-Charlemagne, Mayenne; Naudinot, *unpublished*) or La Vigie-Romaine (Le Croisic, Loire-Atlantique; Rouzeau & Rouzeau, 1984; Sicard-Marchand *et al.*, 2004). These pieces are also present in sites in the southwest, such as Borie-del-Rey. It thus seems reasonable to imagine that these tools could constitute a good marker for the identification of these groups. It is still too early to sketch out an influence zone, but these bi-truncations, and more generally, the development of the principle of truncation, could be an important cultural element in the identification of this techno-complex. Moreover, this technical principle becomes even more significant in the following millennium, during the Early Mesolithic in this region, where points with oblique truncations become considerably more abundant in parallel with triangles.

### Fracture analysis

It was first necessary to validate the hypothesis that the Azilian objects from Les Chalognes and the straight-backed points from Camp d'Auvours were used as projectile points. Based on the methodologies of A. Fischer (Fischer, Hansen *et al.* 1984) and M. O'Farrell (O'Farrell 2000), we thus analysed the fracture types of two samples of these objects. In order to avoid influencing the results, objects with observable heat treatment were not included in this study (thus excluding around 50 pieces from Les Chalognes). A total of 99 diagnostic fractures were identified on the curved-backed monopoints from Les Chalognes. We divided these fractures into five broad categories: cone fractures (Photos 1 and 2), simple fractures (fracture lip less than 2 mm long) on a dorsal or ventral face (Photo 3), lateral simple fracture, complex fracture (fracture lip greater than 2 mm long) on dorsal or ventral face (Photo 4), lateral complex fracture. The limit at 2 mm for fracture lip lengths is not fully confirmed for the tools studied here. A. Fischer places it at 6 mm for Brommian Points and at 1 mm for transverse arrowheads.

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tab. 1 : Fracture types observed on the weapon element fragments at Les Chalognes (left) and Camp D'Auvours (right).

M. O'Farrell places it at 2 to 3 mm for Gravette Points. Cone fractures were divided into three categories according to the location of the point of percussion: on the edge of retouched back, central part or sharp edge. The simple and complex fractures can have a snap (flat), feather, hinge or step termination, with a path/lip extending onto a face of the piece or a lateral edge. Doubt remains concerning the morphology of positive fracture paths/lips at the moment of fracturation. These latter were thus classed in a separate category. The orientation of the fracture was also described for each piece. While simple fractures were the most numerous (41%), complex fractures and cone fractures occurred in roughly equal proportions (respectively 23% and 25%). The number of complex fractures could have in fact been greater, as indicated by the presence of 10% of positive fracture lips, some of which were probably longer than 2 mm. Complex bending fractures located on a surface are more numerous (65%) than lateral ones (35%). In both cases, fractures with a step termination are largely dominant (67% and 87.5% respectively), followed by feather terminations (27% and 12.5%) and hinge terminations (7% and 0%). The majority of the percussion fractures with an incipient cone (fracture fissure) are located on the edge with back retouch (68%), and less often in the central part (32%) of the piece, with none on the sharp edge. The fractures are most often perpendicular to the axis of the tool blank (77%). The oblique fractures (23%) are principally associated with cone fractures. All of these data indicate rather diverse causes for the fractures of Azilian Points at Les Chaloignes. Based on the research cited above, the complex fractures, especially those with step terminations, would have been created by a violent apical impact probably associated with use as a hunting implement. The cone fractures located on the retouched edge are probably diagnostic of fracturation during the retouching of the back of the tool. Finally, it is clear that some of the armatures at Les Chaloignes were broken by trampling or other taphonomic processes such as solifluction or water transport (central cone fractures). The largest category, which is that of simple fractures, is unfortunately not diagnostic even if a large number

of them are likely due to trampling. Therefore, no specialization is observable at Les Chaloignes in terms of the activities associated with these backed tools, some of which can now be considered as projectile points. Within the concentrations, G. Marchand speaks of a large proportion of weapon elements in locus 1, though we did not identify specific fracture types in this locus. This would thus be a sector in which diverse activities associated with weapon elements (fabrication, repair, etc.) took place. In our study of Guichamerie in 2002-2003, we unfortunately did not focus on the fractures of armatures. We can only say that two pieces have burin-like fractures and four others have fractures with lips that argue in favour of the fracturation of a few pieces during use as a hunting weapon element. The small size of the objects from Auvours made their analysis more difficult, despite the use of a low power microscope. Nonetheless, we observed 100 fragments of straight-backed points (50 bases and 50 points), still excluding all pieces modified through heat treatment, which are particularly numerous at this site. Unlike at Les Chaloignes, due to the small size of the objects, we were not able to divide the simple fractures into sub-classes (snap, feather, hinge and step). The simple fractures are largely dominant (72%) and the great majority with lips extending onto a face (92%). The complex fractures (11%) most often extend onto a face (82%) and have a step termination (78%). This argues for a violent apical impact, indicating that at least some of these pieces were used as projectile points. Cone fractures, indicating fracturation during back retouch, are rather rare (7%), which is surprising considering the presence of a very large number of preforms. It is possible that this phenomenon is due to the fragility of these fine blanks, which could thus break by bending before being subject to a real shock from the retouching tool. The intense fracturation of armatures (less than 5% whole), and of the rest of the lithic material at Camp d'Auvours, thus remains enigmatic, even if we currently favour the hypothesis of trampling. The large number of simple fractures could argue in this sense despite their low diagnostic value. The presence at Auvours of small triangular pieces, removed from between two fracture





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ph. 1 & 2 : Cone fractures on the retouched edges of two curved-backed monopoints from Les Chaloignes.



**ph. 3 & 4 :** Complex fractures with step terminations on a face (left) and on a lateral edge (right) on two curved-backed monopoints from Les Chalognes.



surfaces of refit pieces, could be diagnostic of trampling according to M. O'Farrell (O'Farrell, 2000) (Fig. 8). Our analysis of fractures at Camp d'Auvours thus seems to have reached its limits since the probable post-depositional fracturation of the lithic material hinders identification of the primary causes of the fracturation of weapon elements.

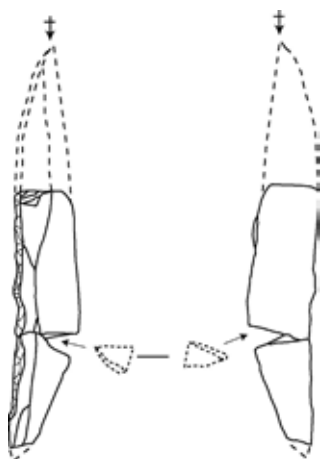


fig. 8 : Triangular removal from a refit weapon element at Camp d'Auvours (Saint-Mars-la-Brière, 72).

### Projectile point retouch modes

Using the diagnostic criteria proposed by J. Pelegrin (Pelegrin, 2004), as well as the results of our own experimentation, we attempted to determine the retouch technique(s) employed to create the backs of the different types of weapon elements in the western Late Glacial period. Our analysis of the Late Azilian monopoints of Chaloignes indicates that stone percussion, rather than pressure, was the technique used for these tools. The back of most of these pieces present deep and irregular removal scars, often with a hinge termination (Photo 5). In contrast, with pressure retouch, J. Pelegrin observes “overlapping overshoot removals”, which are totally absent at Les Chaloignes. These hinge, or micro-hinge, terminations result in fan-shaped flake scars (Photo 6), a morphology that we almost always produced by percussion. The surface that comes in contact with the retouching tool was almost always strongly abraded and non-denticulated, arguing in favour of percussion, but J. Pelegrin reminds us that an edge can be scraped and smoothed after the back has been retouched using the pressure technique. Another

element in favour of this type of retouch, observed from the underside of the pieces, is that the back sometimes takes on a “stepped” form. This morphology is created by numerous hinge terminations and attests to the determination of the knapper to overcome difficulties (Photo 7). Finally, during our experiments, we found that stone percussion (realized with a small, oval shaped cobble with the tool blank placed on the extremity of a red deer antler used as an anvil) was much easier, “comfortable” and rapid than pressure retouch. For the armatures from Camp d'Auvours (rectilinear backed points with a very oblique truncation and simple points with an oblique truncation) the thickness of the blank would have allowed the back to be retouched with the pressure technique. Nonetheless, our observations argue in favour of stone percussion since we find the same stigmata as those observed on the pieces from Les Chaloignes. The pieces broken during fabrication have stigmata identical to those of the finished ones, indicating that the same type of retouch was used from the beginning to the end of the process of fabrication. We must nonetheless be cautious since we have no proof that that the entire assemblage was retouched in the same way. It remains to be determined whether these pieces could have been regularized by pressure retouch before use and if the back of the finest blanks could have been retouched by a simple scraping. Meanwhile, these conclusions appear totally compatible with the mode of life of Late Glacial societies, particularly that of these last Palaeolithic groups. The study of these industries shows that the lithic reduction strategies were oriented toward the production of calibrated and standardized blanks destined for the fabrication of weapon elements, themselves highly standardized, to be mounted on arrow shafts. Ethnographic models show the difficulty of conceiving high quality arrow shafts. In addition to the fabrication of the body, it is necessary to realize the notches and feathering. We thus understand the interest of these calibrated arrowheads; the retouch in fact barely modifies the form of the original blank, but is used to form the apical part and to back the piece in order to facilitate its hafting: “*The dimensional calibration of these tools seems to be in part assured by the debitage*



**ph. 5** : Hinged removals visible on the back of a curved-backed monpoint from Les Chalognes.



**ph. 6** : Deep, fan shaped removal scars on the back of a curved-backed monpoint from Les Chalognes.



**ph. 7** : « Stepped » micro-hinges on a straight-backed point with a very oblique truncation from Auvours, photographed from the lower face of the tool.



*itself*” (Valentin, 1995). If these are indeed the economic strategies developed by these knappers, the hypothesis of back retouch by pressure is difficult to imagine; it offers no advantage for this type of utilization (no thinning necessary) and implies economic concepts that are contrary to those observable in the lithic reduction sequence, which are oriented toward an optimization of the working time.

### Production sequence, deviant pieces and associated fragments

We paid particular attention to the weapon element fragments and abnormal, or “deviant” pieces of the collections in our study in order to better perceive the lithic reduction strategies employed in the conception of weapon armatures during the Late Glacial period in the west, and particularly the during last phase of the techno-complex of Auvours-type industries. The number of deviant points (4 pieces) was too low to allow an understanding of the entire reduction sequence for the fabrication of curved-backed monopoints at Les Chalaignes. It is nonetheless interesting to note that these four objects were all retouched on blanks removed from the junction of the main removal surface and the lateral flank of the core. Considering the technical flexibility of these clearly Azilianized groups, it is possible that in certain situations, the retouch of these curved-backed monopoints was highly opportunistic. Following this reasoning, some points considered here as deviant (essentially piece n°2, which has a relatively straight profile and a thin back) could have in fact been used with a partially retouched back. Since the basic purpose of the back is to create a flat surface to be mounted on an arrow shaft, it is possible that in some cases the artisans simply took advantage of the initial morphology of these blanks. The first point in question has a highly twisted profile, which must have led the artisan to abandon it since it was probably unusable as a projectile point. This blank form indeed seems poorly adapted to this function (probable deviation of the trajectory of the arrow). The presence of small retouch traces on the apical part could show an attempt by the artisan to create the back from the opposite extremity,

but without success given the overly open angle between the faces and the back. The second piece is more problematical. Despite microscopic observation, it is difficult to determine if the removal that occupies the proximal half of the back is anterior or posterior to the retouch. Meanwhile, the presence of a micro-hinge in the location of the back argues for an abandonment of the piece, rather than for a removal scar anterior to the shaping. The presence of forced alternating retouch in this area indicates that the artisan tried to remove a hinge created during the production of the blank. This attempt was partly effective, but not sufficient to allow the back to be completely retouched. Given its morphology, which is identical to the first piece (lateral flank blade), it remains to be determined whether the artisan considered this partial back to be sufficient or if the blank was abandoned. The third object has a partially retouched back. The artisan was forced to abandon the retouching of the piece due to the excessively open angle and thickness of the back. Once again, the form of the blank does not allow us to determine whether this type of piece with an originally flat back was used or not. Only a study of a large collection of pieces with these characteristics could confirm this hypothesis, which would again tend to show that these Late Azilian artisans had a high technical flexibility. The last “deviant” piece has a curved back and one missing extremity (probably apical). The fact that a few millimetres before the fracture were not retouched indicates that the piece was broken during the retouching of the back in this area. At La Guichamerie, one piece is distinct from the rest of the assemblage: it is a point with an angular back, similar to the Creswell Points of Great Britain. We believe it is more likely a point with a straight back abandoned during fabrication. It appears that the relative thickness of the blank at the location of the angle lead the artisan to abandon the back retouch. With its 3,131 weapon elements and fragments, the assemblage at Camp d’Auvours constitutes an exceptional collection for the study of weapon element fabrication strategies. The study and classification of each of these thousands of fragments and deviant pieces, which are sometimes very small (5 mm<sup>2</sup>), was very laborious. This work nonetheless permitted us to understand the reduction



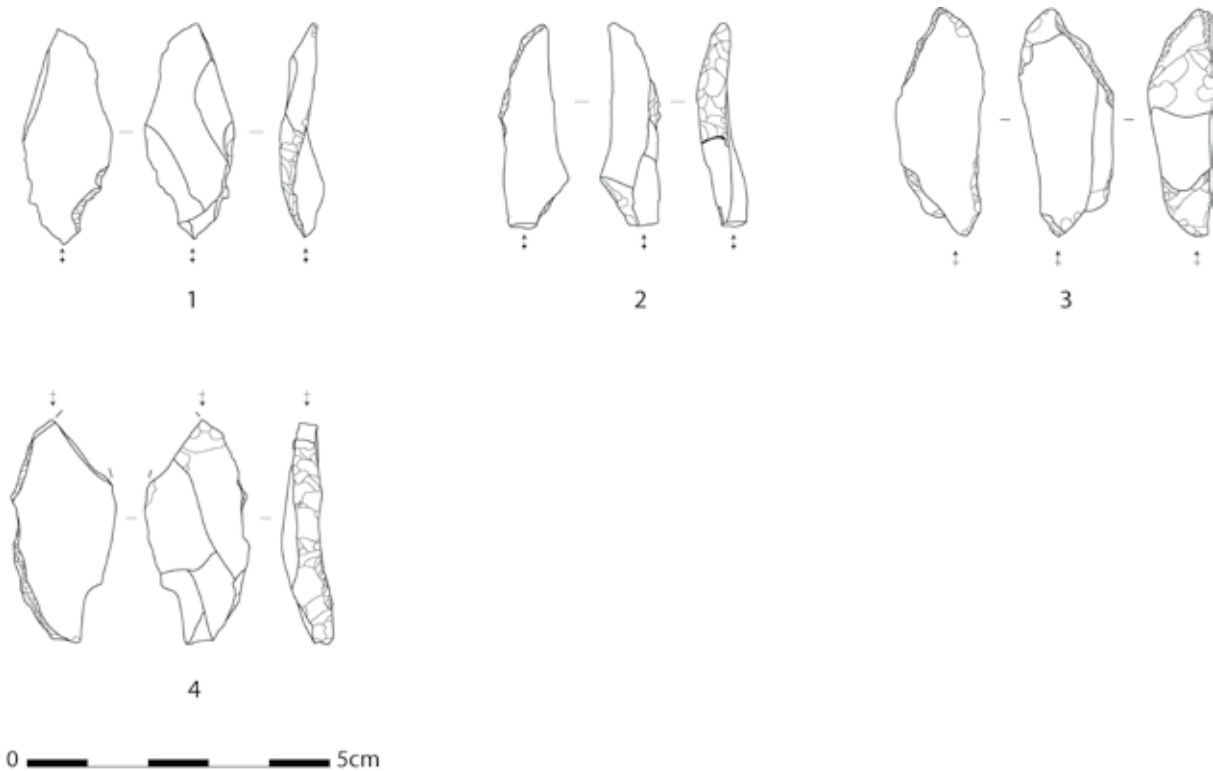


fig. 9 : Preforms of curved-backed monopoints from Les Chalognes.

sequence of these projectile points and to replace the different types of fragments within this scheme (Fig. 10). We are aware that part of our methodology could appear subjective. It was in fact necessary to establish some norms in order to determine the origin of certain fragments. Therefore, based on the statistical data described above, we started from a model of points with the apical part on the proximal end of the blank and the back on the left edge. Some fragments thus considered as bases in our study could in fact be extremities of backed bladelets. Fortunately, the high proportion of fragments of whole points fitting these statistical criteria, as well as the domination of mesial fragments retouched on the left edge when they are oriented with the point at the proximal end, minimizes the margin of error.

The initiation of retouch provokes the formation of a notch (proximal fragments broken during this stage present a half-notch on the fracture opposite the proximal extremity and the distal fragments on the fracture opposite the distal extremity) or a truncation on the proximal part of the bladelet (the fragments have irregular, partial retouching of the proximal extremity). The truncation is then realized on this proximal

extremity. When the retouch reaches the ridge of the blank, it immediately becomes alternating retouch. It seems that this type of retouch becomes necessary when the ridge is attained (Photos 8 and 9). Some authors have suggested that in the case of retouching on an anvil, the change in angle at the moment when the ridge is reached naturally results in alternating retouch through counter-shocks (Brézillon, 1968). This phenomenon can indeed occur accidentally and with very similar stigmata. We thus agree with J. Pelegrin when he suggests that the knapper makes a deliberate choice to turn the blank over to retouch this sensitive zone that is thicker than the face. Once the truncation is realized, the knapper can continue retouching the back toward the distal end of the blank (resulting in fragments with a partial back on the proximal part) or start over from the latter point (sometimes resulting in pieces similar to British Cheddar Points). At this point in the retouching sequence, the knapper can also choose to regularize the truncation in order to obtain a typical point with an oblique truncation. When a backed point with a straight back remains the objective of the reduction sequence, the retouching of the back continues over the entire



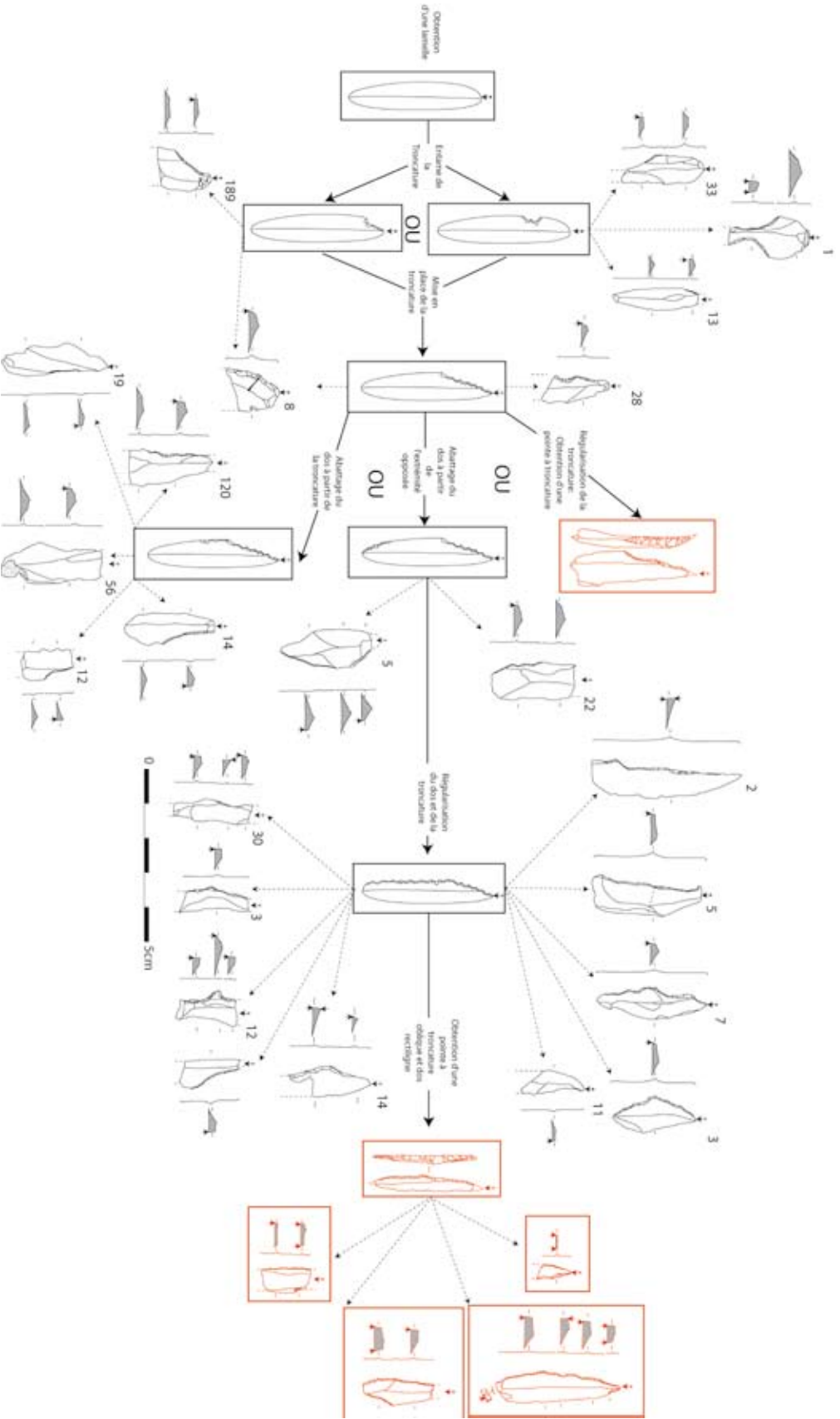
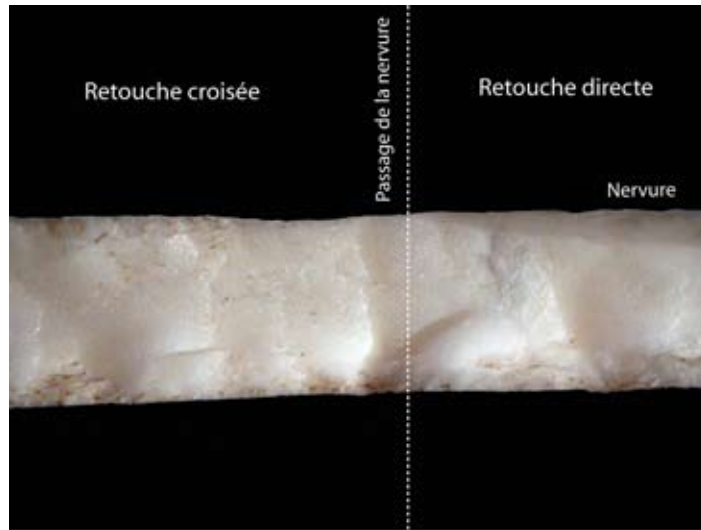
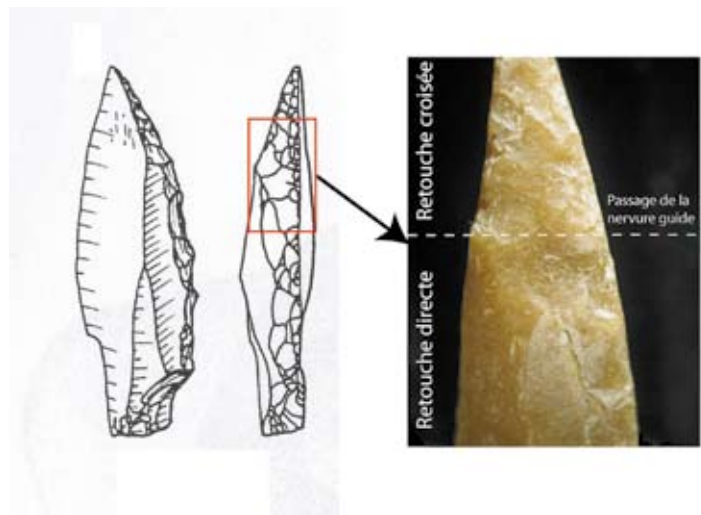


fig. 10 : Reduction sequence for the fabrication of straight-backed points with a very oblique truncation and fragments associated with the different stages of fabrication.





ph. 8 : Changing of retouch by a truncation during the passage from a guiding ridge on a straight-backed point from Auvours.



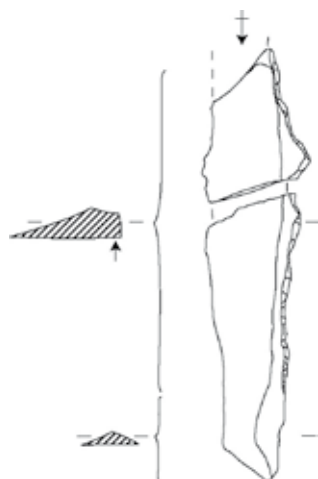
ph. 9 : Changing of retouch by retouch during the passage from a guiding ridge on a curved-backed monopoint from Les Chaloignes.



ph. 10 : Alternating retouch produced by counter shocks during retouch on a stone anvil, during the passage from a guiding ridge.



edge of the blank (when the distal part deviates from the axis of the piece, the retouch stops at the point of the inflection since this part does not need to be backed in order to haft the armature). The fragment resulting from this last backing stage has a total but very irregular, angular or bumpy back. Some pieces are broken during this phase, as is illustrated by a refit piece with an angle on the back at the point of the break (Fig. 11). It is then necessary to regularize the truncation and the back of piece in order to obtain a point with a straight back and a very oblique truncation. Small modifications can then be made (retouch of the opposite edge at the base or point, or abrupt retouch of the base) to correct anomalies of the blank or facilitate its hafting.



**fig. 11** : Two refit fragments with an angle at the point of the fracture.

### Conclusions

These new data concerning the Late Glacial period in western France show an evolutionary model similar to that of neighbouring regions even if a few differences, partly due to environmental and geological particularities in this region, are perceptible. As absolute dating is prohibited by the absence of faunal remains and charcoal, cultural attributions can be made only through comparative lithic technology and typology. The use of small flint cobbles originating from coastal offshore bars or alluvial terraces of the Loire River, along with the use of debitage strategies adapted to substitutive stones available on the massif, forcibly influenced the socio-economic behaviours of the hunter-gatherers of this region. The Early Azilian and its Magdalenian

substratum remain poorly known, while clearly Azilianized industries are very numerous. The sites with straight-backed points, long attributed to the Final Magdalenian and now considered as a transitional facies with the first Mesolithic, are now well characterized but their relationship with presumably contemporaneous southern groups remains to be determined. The technical investment made in the fabrication of weapon elements changes considerably between these two cultures. In contrast to the straight-backed points of Auvours-type industries, the curved-backed asymmetrical points of the Late Azilian phase are not very standardized and less care seems to have been taken in their production. Retouch lateralization shows that in the Auvours-type industries the conception of projectile points responds to clearly defined norms, in contrast the Late Azilian during which either of the edges was randomly chosen to be retouched. The higher standardization (dimensions, morphology, weight, modifications, etc.) of weapon elements in the Auvours-type industries also argues in this sense. This difference in the treatment of these tools is not synonymous with a lack of interest in weapon elements in the last phase of the Azilian, but may rather correspond to a new approach to these objects benefitting from a more simplified debitage strategy. Since weapon elements can be considered as the objective of the lithic productions of these hunter-gatherer groups, variations in the technical investment devoted to them seem to reflect the particular technical conceptions of human groups rather than a varying degree of interest in the object itself. Finally, we note that a large part of the cognitive processes employed in the production sequences of the weapon elements of Auvours-type industries are observable in the first Mesolithic industries of the region. The fabrication of projectile elements with truncations appears during this period in the form of points with oblique truncations and retouched or unretouched bases and triangles. The development of this technique seems to originate in the industries of groups with straight-backed points, whose principal characteristics are observable in the production strategies of the first Mesolithic groups; the precise nature of these relationships and the origins of these changes remain to be determined.

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# THE EVOLUTION OF STONE WEAPON ELEMENTS AND CULTURAL DYNAMICS DURING THE MESOLITHIC IN SOUTHWESTERN FRANCE : THE CASE OF THE HAUT QUERCY (LOT, FRANCE)

Nicolas VALDEYRON, Bruno BOSC-ZANARDO & Thomas BRIAND

## Abstract

Following a recent quantitative and qualitative renewal of archaeological research in the Quercy, this region has become particularly favourable for analyses of the cultural dynamics of Mesolithic societies in southwestern France. These dynamics, principally associated with the evolution of projectile points, are most clearly manifest in the appearance of broad weapon elements (trapeze microliths and other evolved points) at the beginning of the seventh millennium cal BC. Through still poorly understood scenarios, these pieces replace narrow weapon elements (geometric or not). We have developed a research program concerning several thousands of objects recovered at five recently or currently excavated sites in order to obtain a better understanding of these evolutionary processes and to attempt to determine their modalities, rhythms and signification. In this paper, we present the current state of this work and the results obtained for the earliest phases of the Mesolithic.

**Key-words :** Mesolithic, southwestern France, Quercy, cultural dynamics, weapon armatures.

## Introduction

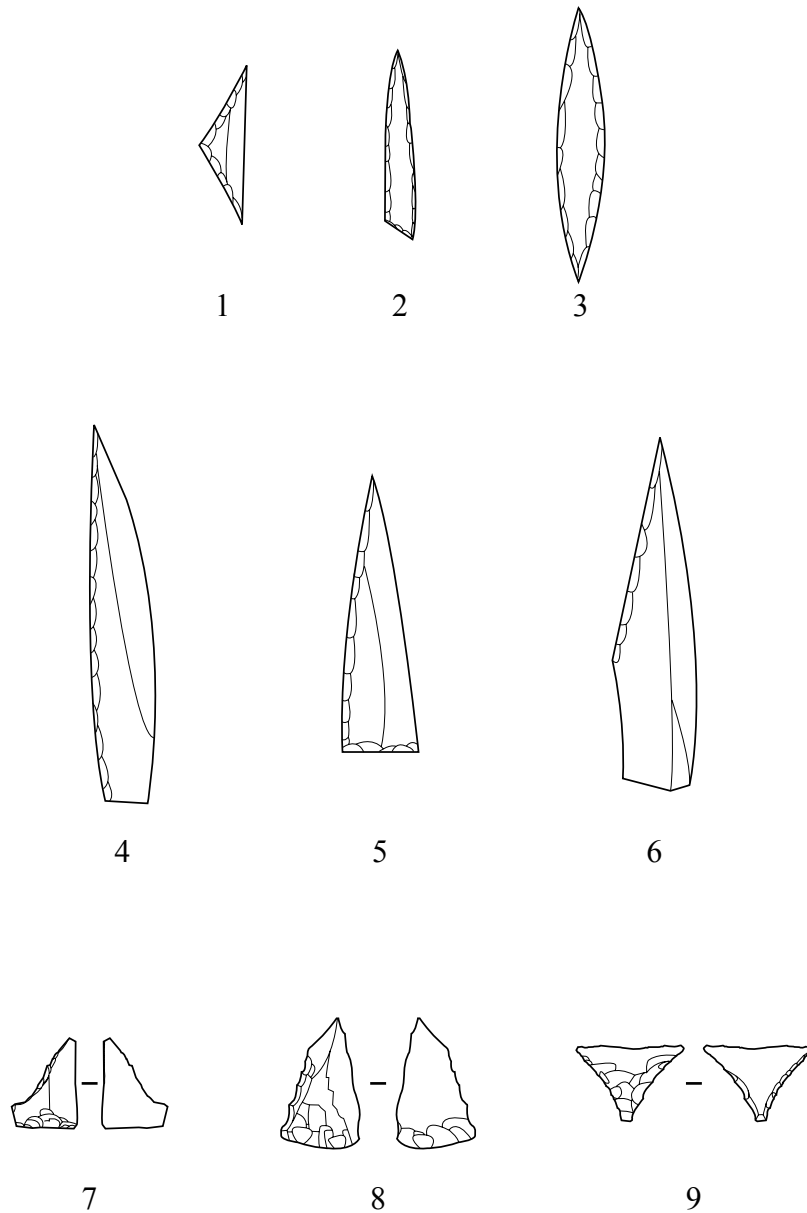
In southwestern France, as elsewhere in western Europe, the beginning of the Mesolithic is characterised by the generalization of geometric microlithic weapon elements (most often triangles and less often segments), accompanied by other points that were also made on narrow blanks detached by direct percussion. During the first half of the seventh millennium cal BC, these elements were replaced by broad weapon elements (trapezes and other evolved points), which are often correlated with the development of new debitage techniques (indirect percussion, perhaps pressure flaking). This phenomenon, identified long ago, has been interpreted as both a rupture—the trapezes would have been the work of artisans coming from elsewhere and belonging to a different cultural tradition—and as a sign of continuity. In this latter case, the indigenous substratum would have evolved and new weapon armatures and associated blank producing methods would have been adopted through contacts, exchanges or imitation. In southwestern France, this alternative rapidly became the basis for the development of contradictory scenarios and as soon as the succession from triangles to trapezes was recognised, two antagonistic positions were successively developed. First, based on the eponymous sites of Sauveterre, Coulounges concluded that there was no relationship between the Sauveterrian that he had identified and the industries with Trapezes attributed to the Tardenoisian (Coulounges, 1935). On the contrary, though he followed the general scheme proposed by Coulounges, Lacam emphasised the continuity of the assemblages that he excavated at Cuzoul de Gramat (Lacam et al., 1944). Cl. Barrière (1956) first favoured the hypothesis of the arrival of exogenous populations, conforming to the then general vision of the Tardenoisian, which had always been perceived as a homogeneous and expansive phenomenon. However, the excavation of the site in the entrance of Rouffignac Cave later led him to imagine a possible internal evolution of the Sauveterrian from a local base (Barrière, 1972, 1973), though he never clearly expressed this hypothesis. J.G. Rozoy finally did though, after studying the remains excavated by Cl.

Barrière at Rouffignac: the Sauveterrian with trapezes was thus introduced, this terminology clearly indicating a supposed relationship between assemblages with triangles and those with trapezes. At around the same time and following a new study of the artefacts excavated by Coulounges at Roc Allan and Martinet, J. Rousot-Larroque developed her theory of the Roucadourian cycle (Rousot-Larroque, 1977, 1985, 1988), which totally contradicted the vision of J.G. Rozoy by claiming the existence of a clear and categorical rupture between the two major phases of the Mesolithic.

Two radically divergent scenarios, sometimes based on the same assemblages, were therefore successively or simultaneously constructed to explain the same phenomenon, namely the passage in the southwest from the First to the Second Mesolithic period. The program that we present here takes this observation as its starting point. While recognizing the strong cultural signification of weapon elements, our goal is to search for reliable answers based on a thorough knowledge of both the sedimentary and stratigraphic contexts and the technical and typological characteristics of these armatures throughout the period. Our primary objective is thus to identify the contents of the quivers (fig. 1) in order to apprehend their techno-typological variability through time and space and understand the rhythms and cultural meanings of these evolutions while attempting to integrate them within a global and dynamic perception of the history of these societies.

In its current stage of development, this program is largely based on data obtained in a geographic zone limited to the karst plateau of the high Quercy and its bordering valleys. Due to the quality of the available record, this zone offers a particularly favourable context for the study of the dynamics and evolutionary processes of projectile points from the end of the 10<sup>th</sup> to the beginning of the 5<sup>th</sup> millennia BC. We will subsequently extend this initial research zone, perhaps to include all of southwestern France. Meanwhile, even within this favourable context, the data available for the most recent phases are still partial and thus cannot be integrated into a long term explanatory scenario that





**fig. 1** : Principal weapon element types in the Mesolithic of the Quercy region. 1: isosceles triangle; 2: Montclus triangle or similar object; 3: Sauveterrian bipoint; 4: linear backed point; 5: backed point (rectilinear or slightly curved profile) with a retouched base; 6: obliquely truncated point; 7: Martinet trapeze; 8: "bâtarde" point; 9: Montclus arrowhead.

would serve as a model. Therefore, we present here data concerning only the earliest phases.

### A workshop zone with many advantages : the high Quercy

The zone studied in our program is centred on the limestone plateau of the Causse de Gramat and extends to the north of the Midi-Pyrénées region, between the Dordogne and the Lot. It covers a surface of approximately 1000 km<sup>2</sup> and is characterised by a succession of Jurassic limestone plateaus cut through by deep valleys. The altitude of these tabular surfaces, which are slightly undulated and dotted with evolved karstic formations, decreases regularly from east to west. It thus passes from nearly 500 m on average in the peripheral depressions of Ségala and Limargue, where contact is made with the Massif Central, to 350 m in the westernmost part of Bouriane, on the edge of the Perigord. The known Mesolithic sites in the sector (fig. 2) are thus located at the junction of three very distinct biotopes—dry limestone plateau, humid crystalline plateau opening onto the Massif Central, hospitable, but often confined valleys—which offered a contrasted ecological potential with numerous, often complementary, resources distributed over short distances. This landscape thus constitutes a significant advantage of the study zone since it may have led to a functional diversification of sites, which in turn influenced the composition of the lithic assemblages.

Another interesting element justifying the selection of this zone is the quantity and quality of research devoted to the characterisation of siliceous raw materials and the identification of their sources. This work has resulted in the creation of an excellent and already efficient dataset applicable on a local as well as allochthonous scale (Morala & Turq, 1990; Séronie-Vivien, 1990; Turq, 1990; Briois, 1991; Chalard *et al.*, 1994 and 1996; Demars, 1994; Morala & Ortega, 2002; Briand, 2005; Chalard *et al.*, in press). The local lithological potential is represented by Mesozoic (*Sécondaire*) flints (mostly Bajocians and Senonians) and Cenozoic (*Tertiaire*) collected from primary sources or alluvial contexts, as

well as jasperoid flints from the lower Lias (*Infralias*). Research in this domain permits us to address questions concerning acquisition territories and mobility (though the specific question of the variable accessibility of flint sources during the Mesolithic due to the evolution of the forest cover has not been clearly resolved), as well as questions directly related to the economy of raw materials and the choices that could have been determined, or at least favoured, by their different qualities. In this paper, the term “local raw material” is used in its broad sense, designating all materials present in the zone considered: the scale chosen is not that of an archaeological site but that of a workshop-zone, meaning all of the Haut Quercy.

A last, but not least point, since it was determinant in the selection of this workshop-zone, is the quality of the available documentation. In this case, it consists of more than a dozen recently excavated or studied (a large number of them by us) open-air or rock shelter sites within a small area, and thus provides, in theory at least, reliable data (particularly stone assemblages) within a revised radio-chronological framework.

Five of these sites constitute the core of this ensemble and have yielded most of the weapon elements studied in the context of this research program. They are:

- a) Fonfaurès (Lentillac-Lauzès, Lot), excavated by M. Barbaza from 1985 to 1987. Located in the high part of the Sagne Valley, this small site occupies an intermediary position (hence its interest) between the Célé Valley, of which the Sagne is a tributary, and the southwestern edge of the Causse de Gramat. It yielded a compact sequence that led to the proposition, in the early 1990's, of a new model for the organization of the southern Mesolithic. This model reaffirmed the unity of the Sauveterrian by demonstrating that the Montclusian is only the middle phase (Barbaza *et al.*, 1991; Valdeyron, 1994). This sequence is organised as follows:
- b) L. 6: Early Sauveterrian (Ly 4449: 9650 ± 130 BP, or 9350/8600 cal. BC to deux σ);



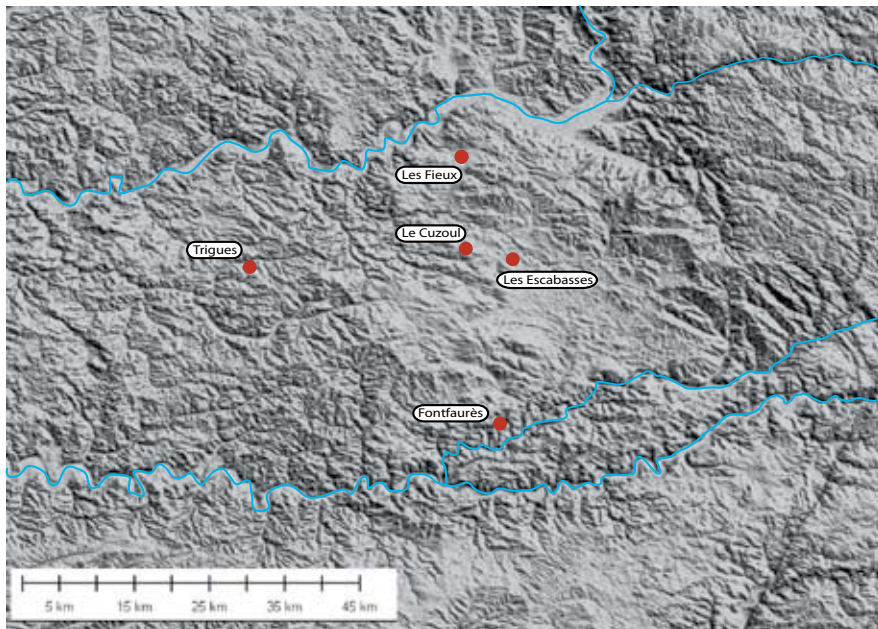
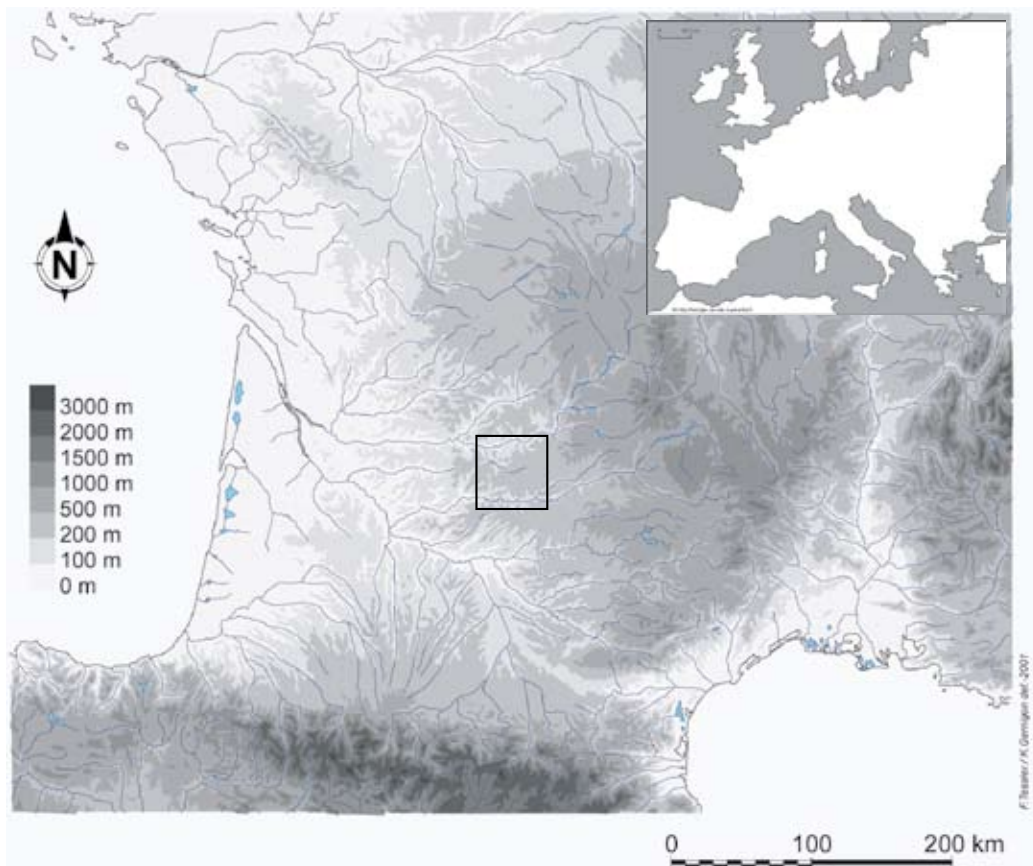


fig. 2 : Location of the Haut Quercy zone and the sites described in the text.



c) L. 5d to L. 5b: Evolved Early Sauveterrian (Ly 4448:  $9140 \pm 160$  BP, or  $8800/7800$  cal. BC);

d) L. 5a, L. 4b, L. 4a, L. 3 (the two latter levels were more or less disturbed by later occupations): Middle Sauveterrian (= Montclusian) in an early phase.

The site yielded 735 tools including 518 weapon elements, thus comprising 70% of the total tool assemblage.

e) The western porch of Les Fieux Cave (Miers, Lot), explored by F. Champagne from 1967 to 1972, and under which one of us (NV) realised a small excavation in 1999 to prepare for the publication of these still largely unpublished data (Champagne & Espitalié, 1972; Champagne & Jaubert, 1981; Champagne *et al.*, 1990; Marcus, 2000; Briand, 2004; Valdeyron *et al.*, 1999). This site is located on the north-east edge of the Causse de Gramat. The Mesolithic sequence (maximum depth 1.5 m) is organised as follows:

- directly below the edge of the overhang, a single layer (layer D), composed of successive levels of charcoal, ashes and more or less rubified earth, is attributed to an evolved Early Sauveterrian;

- in the back of the shelter, three sedimentary ensembles: D1 (equivalent to D), D2 and D3, attributed to the same chronocultural phase as D.

Two dates were realised under the incentive of F. Champagne: one for layer D3 (Gif 1807:  $9450 \pm 190$  BP, pr  $9247/8310$  cal BC) and the other inside the cavity on charcoal trapped in a level sealing, stratigraphically at least, the Mesolithic occupation (Gif 4281:  $9060 \pm 190$  BP, or  $8725-7659$  cal BC). In 2000, new dates were realised on wood charcoal samples collected throughout the entire depth of Layer D. The following results are presented in the stratigraphic order of their collection: Ly 1767 (Poz-531):  $9260 \pm 70$  BP or  $8696/8299$  cal BC; Ly 1765 (Poz-529):  $9220 \pm 70$  BP or  $8611/8294$  cal BC; Ly 1763 (Poz-525):  $9080 \pm 70$  BP or  $8541/7999$  cal BC; Ly 1766 (Poz-530):  $8900 \pm 70$  BP or  $8258/7794$  cal BC; Ly 10805:  $8075 \pm 90$  BP or  $7311/6699$  cal BC (the pertinence of this latter date, obtained at the top of level D but much younger than the others, is questionable).

This site yielded 757 tools including 643 weapon elements (85% of the total tool assemblage).

f) Escabasses Cave (Thémines, Lot). Revealed by the research of M. Lorblanchet (Lorblanchet, 1974), the site of Escabasses, located in the centre of the Causse de Gramat associates both a cave and a rock shelter occupation. From 1994 to 2002, it was subject to a series of interventions conducted in the context of a program directed by one of us (NV). Several studies of the artefacts and recent excavation data are still in progress in preparation for a synthetic publication.

The Mesolithic sequence explored during these latter works is located outside the cavity in the zone of the edge of the porch of the rock shelter. The entrance gallery of the cavity was the subject of only limited work (Valdeyron, 1994, 1995 and 2000a). This sequence is organised in two ensembles located at the base of the archaeological deposit of this porch zone:

- L. 6: Middle Sauveterrian, in an evolved phase (L.6base Ly-12240:  $8310 \pm 55$  BP or  $7521/7145$  cal BC; L.6 middle Ly-12238:  $8275 \pm 60$ , or  $7518/7082$  cal BC; L.6 top Ly-10937:  $8055 \pm 60$  BP, or from  $-7275$  to  $-6822$  BC).

- L. 5: Final Mesolithic (Ly-10938:  $7135 \pm 60$  BP, or  $6157/5844$  cal BC).

All levels combined, this site yielded nearly 800 weapon elements out of a little more than 1,000 tools.

g) Le Cuzoul (Gramat, Lot). This site is located in a limestone sinkhole in the heart of the Causse de Gramat. Its main component is located in a natural rock shelter, composed of the entrance gallery of a cavity and its exterior extensions, which form the two lateral rock shelters extending on either side of the porch. Concordant indications suggest that during different periods of the Mesolithic, at least part of the sinkhole was also used as an open-air habitat. The site was explored between 1923 and 1933 by R. Lacam, who dug test pits first inside the cavity and then in one of the two rock shelters. In addition to a burial, for which the site is internationally known, he revealed a well preserved Mesolithic sequence, covering in particular



the end of the period (Lacam *et al.*, 1944). Starting in 2005, new research has led to a better knowledge of the archaeological sequence through the study of numerous objects found in the back dirt of the earlier excavations and the first results of our own excavations. This sequence clearly appears to be more complete than that published in 1944 since we were able to characterise, in addition to final Mesolithic occupations that had already been well identified (but for which a large quantity of artefacts was collected), occupations during the Azilian, Montclousian and probably the Sauveterrian and Early Neolithic (Valdeyron *et al.*, 2005, 2006 and 2007). Le Cuzoul could thus cover all of the period concerned by our research program, and is thus a particularly strategic site.

The artefacts included in our study collection can be divided into three categories:

- the weapon elements of the Lacam collection (which represents only a small part of the material previously collected), conserved at the Cabrerets Museum and consisting of a few dozen pieces, which correspond to those presented in the publication;
- the weapon elements found during back dirt sieving: these currently represent nearly 400 objects, at least half of which belong to the later phases (their value is of course limited, but they nonetheless offer a good vision of the techno-typological variability, in particular for the broad weapon elements that are still poorly known.
- the weapon elements found in place during our excavations: though only a few dozen have currently been found, they will play an essential role in the future.

h) The site of Trigues (Le Vigan, Lot). Discovered by P. Roussel, this open-air site is located in the Bouriane, west of the Causse de Gramat, around ten km south of Gourdon. It occupies the head of a small valley at around 350 m altitude and covers surface of approximately 3000 m<sup>2</sup> (of little significance in fact, since the artefacts were dispersed over this surface by agricultural machines). Following the collection of

several thousands of lithic artefacts during walking surveys, an excavation was undertaken in 2003 to evaluate the residual archaeological potential of the site. A dozen manual test pits showed that the archaeological level had been destroyed by agricultural activities and research was thus discontinued (Valdeyron *et al.*, 2005).

The very typical lithic artefacts indicate two occupation phases: one during the Early Sauveterrian, and the other during the Late/Final Mesolithic. Though the lack of spatial and stratigraphic data prevents the site from contributing to certain questions, the lithic artefacts can nonetheless participate in a typo-technological analysis. The interest of this site, however, does not lie in its weapon armatures, which are in fact not very numerous (a dozen or so for the Early Sauveterrian and 6 for the Late/Final Mesolithic), but rather in the relative abundance of blades and bladelets produced by a Montbani type reduction sequence and the associated cores, the latter being poorly represented in other Quercy assemblages.

These five sites thus cover all, or at least a large part, of the period concerned by our program (fig. 3) and have yielded a total of nearly 2,500 weapon elements. Of course, all of these data do not have the same documentary capacity. Some, for example, cannot be clearly positioned within the chronological framework. They nonetheless constitute a nearly unique corpus whose quantity and heuristic value should progressively increase, particularly with the advancement of work at Cuzoul. We will thus be able to gradually refine the scenarios based on the chronology, while improving the data (notably paleo-environmental) necessary to replace these artefacts within their original context.

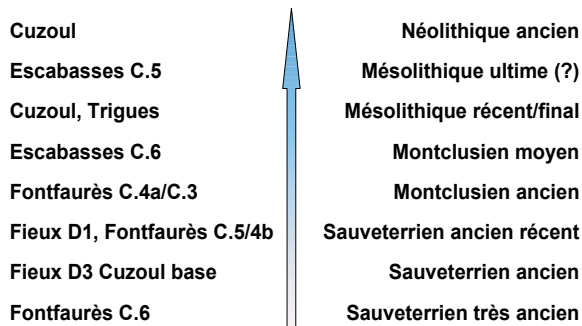
### The First Mesolithic: Early and Middle Sauveterrian (Montclousian)

Let us briefly address the question of functional analyses, which though crucial, are somewhat beyond our personal competencies. The projectile point or lateral element function of these microlithic tools, *a priori* qualified as weapon armatures, has been demonstrated several times



over the last thirty years through use-wear analyses in Early and Middle Mesolithic contexts in western Europe (e.g. Odell, 1978; Dumont, 1988; Khedhaier, 2003). This same result was obtained for the two sites in Quercy that have been subject to this type of analysis, Fontfaurès (Philibert, 1991 and 2000) and Les Fieux (Khedhaier, in press). In both cases, the use of microliths as projectile weapon elements is demonstrated by the presence of micro and macro impact traces on geometric microliths (triangles and segments) and other non geometric types. The simultaneous presence of these tools in the assemblages thus raises the question, which will remain unanswered until their efficacy can be measured, of the criteria used in the choice between different tools and hafting methods. A barb function, with insertion of the large or small truncation, is also attested, at Les Fieux only for triangles and segments (Khedhaier, *ibid*).

### Une séquence presque complète...



### validée par la chronologie C14

**fig. 3 :** Relative position of the different levels of the five reference sites in the Mesolithic chronological sequence of Quercy.

The data obtained at Les Fieux (Marcus, 2000; Briand, 2004), which confirm and complete those reported at Fontfaurès (Briais, 1991), allow a satisfying characterisation of the first part of the production sequence of these armatures. They reveal a number of probably general traits (the analyses in progress at Escabasses give the same indications), along with other elements that appear to be more specifically related to the status of each site (fig. 4).

All of the available local raw materials were used for the fabrication of weapon elements of all types, with

proportions comparable (as far as this can be determined given the small size of these pieces) to those recorded for the other tools in this industry.

Knapping during the full debitage (primary blank production) phase was generally realised on unipolar cores, most often with a soft stone hammer, or sometimes with a small, hard stone cobble. These actions were oriented toward the production of thin, relatively narrow and elongated blanks (short bladelets or small elongated flakes), destined principally for the fabrication of weapon elements. A certain degree of anticipation is perceptible in the rather frequent choice of small raw material volumes (rarely more than 10 cm in length) with natural convexities that allowed the creation of multiple surfaces and reduced the preparation phase. This intention is particularly manifest in the frequent use of stones collected in alluvial contexts: the form and dimensions of these cobbles was perfectly adapted to the production objective (the weapon elements are rarely longer than 20 mm), while allowing a simplification of the initial preparation phases. This simplification of the beginning of the core reduction sequence contrasts with the greater care devoted to the full debitage phase. This is shown by frequent repairs to the striking platform, often careful abrasion of overhangs on the striking platform (though this characteristic is perhaps related to the percussion technique), as well as the frequent correction of convexities. At Les Fieux, as at Fontfaurès, the reduction sequences were spatially separated: the relative rarity of cortical products indicating that most of the cores were prepared elsewhere before being introduced into these sites.

The weapon elements were fabricated after a systematic and rigorous selection of the best blanks. These were the most regular pieces, in particular those with straight dorsal ridges, and a rectilinear or slightly curved profile. Those with a thickness of less than 2-2.55 mm were also preferred. The quality of this Sauveterrian knapping, usually appreciated only after observation of the unretouched products, is often underestimated. The lower quality blanks were sometimes used as second choices, but we often find them in high proportions among the unretouched debitage products, which can



give a false impression of their relative economic value. In the Middle phase, during which triangular geometric armatures of the “Montclus Triangle” type (often hyper-microlithic, always narrow and retouched on three sides) became common, small flake-bladelets were also frequently used as blanks.

The fracturation of these lamellar blanks by the microburin technique is attested, particularly during the early phase, on pieces shaped by truncations (triangles or points). The frequency of this technique is more difficult to estimate as the associated trihedral points are rarely preserved. In addition, since the weapon elements could have been fabricated away from the site, the quantity of microburins present is only indicative. Regardless, the use of this technique does not seem to have been systematic. Moreover, it clearly regresses during the middle phase (observation first made at Fontfaurès and then confirmed at Escabasses). This phenomenon is probably linked to the development of narrow armatures of the “Montclus Triangle” type, whose truncations were usually created by the abrupt edge retouch technique. The truncations, like the backed edges, were realised by abrupt direct retouch, often becoming semi-abrupt retouch on the apical part of the blank. A few of the thicker pieces have abrupt alternating retouch, but they are rare. On all of the weapon element types, the retouch is generally very regular; the delineation of retouched edges only exceptionally takes the form of slight denticulations. On the triangular geometric elements, the third side sometimes has a slight distal retouch, closer to a scraping than to true shaping retouch. A few triangular or ogival points have inverse retouch on the base. This retouch, which is generally semi-abrupt, is in this way distinct from the very flat inverse retouch present in the more recent phases.

Globally, and independently of the type of weapon element considered, these productions are thus associated with the use of relatively simple production strategies, starting from blank production until the shaping of the tool, resulting in relatively standardised products, despite a certain typological diversity (fig. 4 and 5).

This typological diversity opened another research perspective concerning these products, whose typology

was revised in stages and more or less completely (Valdeyron, 1991, 1994).

For several reasons, it is the geometric triangular armatures that captured our attention most: in the majority of sites, this is the best represented weapon element; this type is present (in contrast to the others) throughout the two phases of the First Mesolithic, and; their variations through time seem to have a particular significance, which merited testing. We conducted a Principal Components Analysis on a collection of 421 whole pieces constituted from the assemblages of Fontfaurès and Le Fieux (to which we added a few pieces from the sites of Chez Jugie in Corrèze and Salzets in Aveyron). This test allowed us to propose a morphometric typology in which symmetric forms gradually pass into forms more distant from the symmetry of the two truncations. Isosceles Triangles and Montclus Triangles occupy the two extremities of this range of variation. The novelty of this typology lies not so much in the identification of these extreme types and the associated intermediary types (the G.E.E.M. typology, 1969 and 1972, had already more or less identified these), but in the recognition of a chronological gradient represented in the percentages of the principal types. This gradient marks the passage from the early to the middle phase (Montclusian) of the Sauveterrian, thus also confirming the phyletic nature of the relationship between these two ensembles (fig. 6).

The non geometric weapon elements were not subject to a factor analysis; we applied more classic approaches to these objects, with analyses consisting mostly of adapting to these southern contexts the classifications conceived (those of G.E.E.M.) in order to have a much more general scope. The Fontfaurès sequence allowed us to clarify the rhythm of their appearance and to recognize that some of them have a chronological significance: while the narrow, backed bladelets, linear backed points and points with a retouched base (either ogival or triangular) do not show significant variation in their percentage of representation from level to level at this site, Sauveterrian Points (absent or very rare in the assemblages attributed to the early phase) and obliquely truncated points (which are, on the contrary, absent



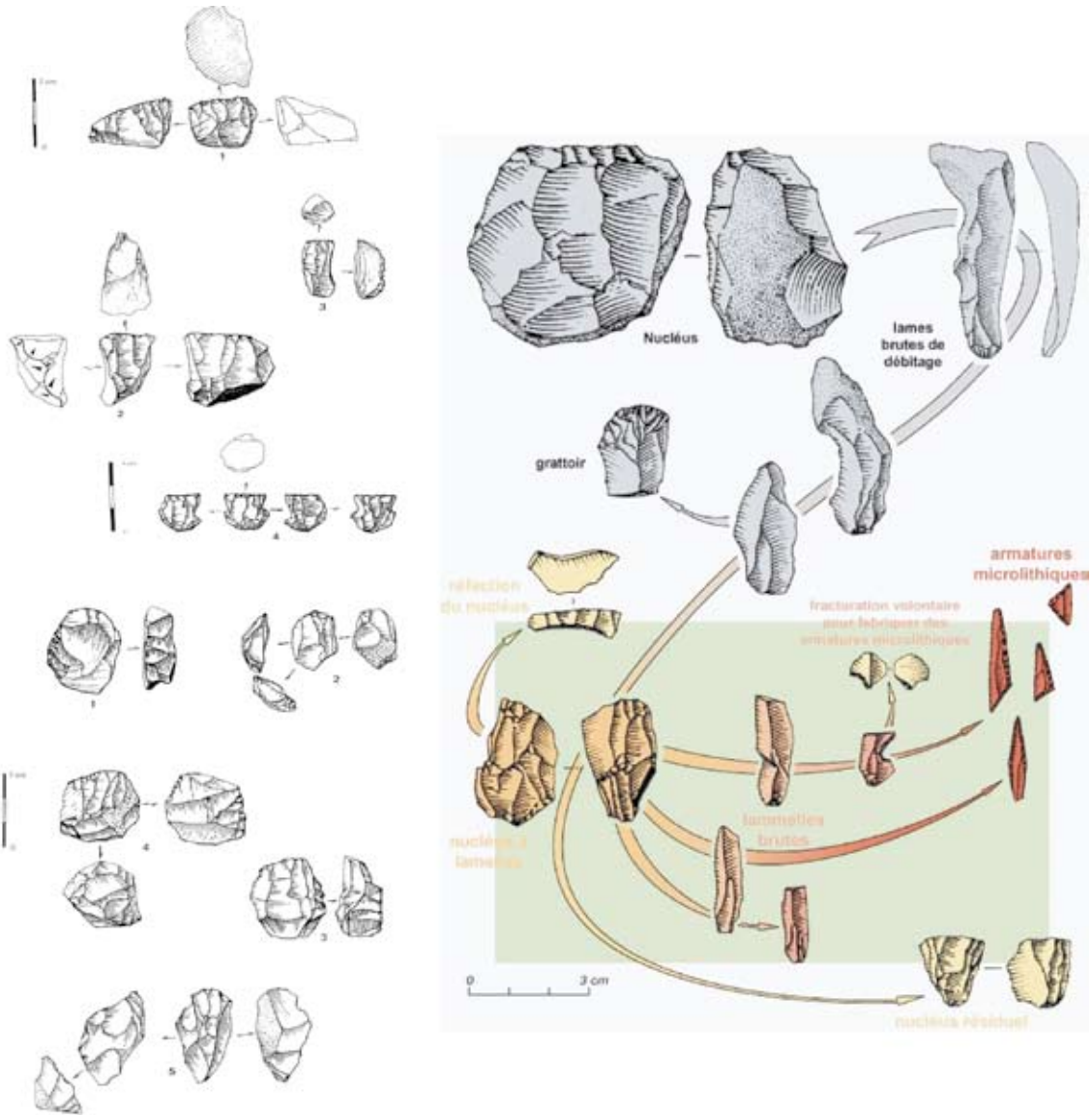


fig. 4 : left, blade core from level D of Les Fieux at Miers (excavation F. Champagen, drawings O. Marcus); right, Sauveterrian core reduction sequence at Fontfaurès at Lentillac-Lauzès (excavation M. Barbaza, after Barbaza 1999).



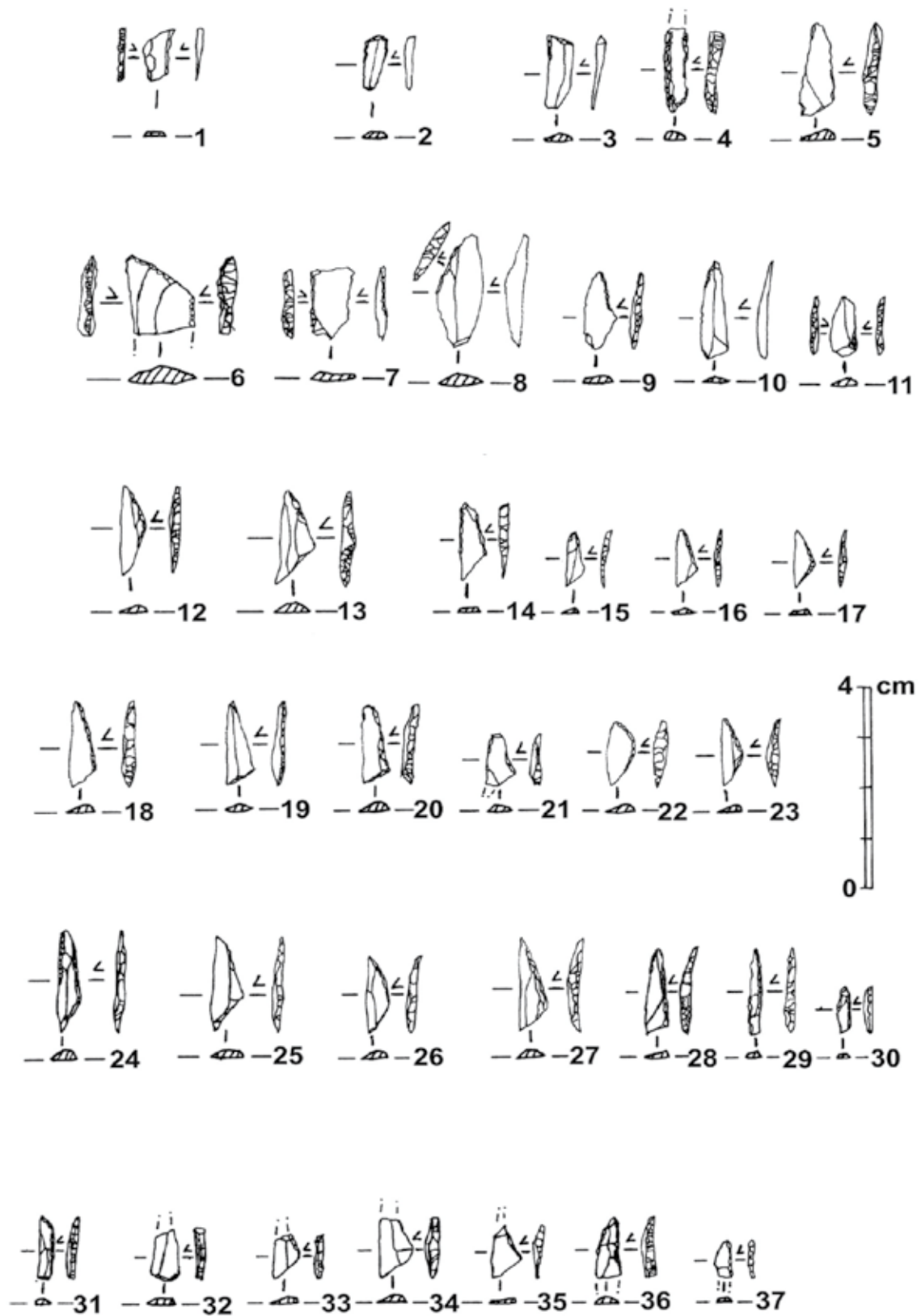
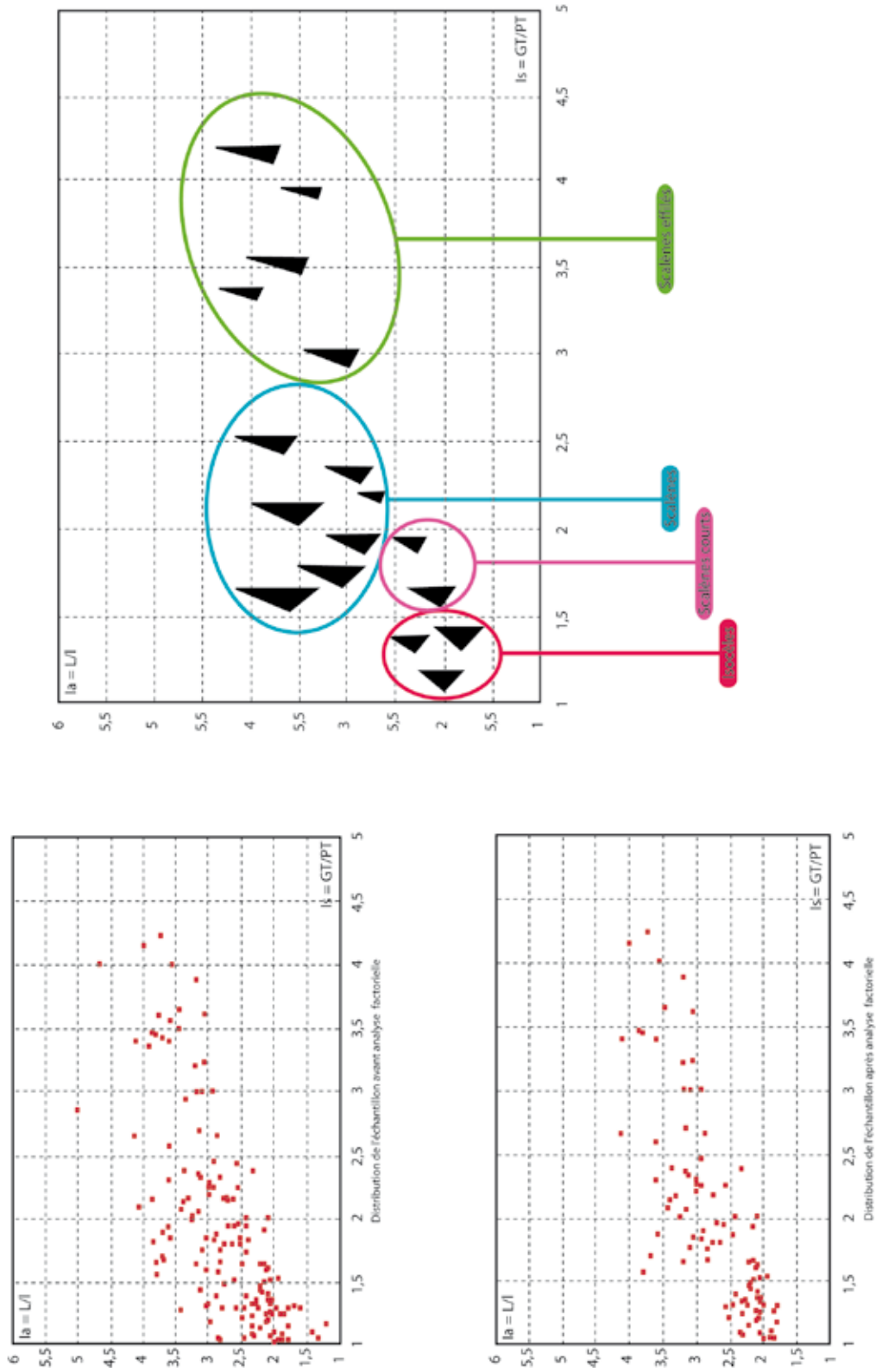


fig. 5 : Diverse weapon elements of the evolved Early Sauveterrian of level D of Les Fieux at Miers (excavation F. Champagne, drawings T. Briand).





**fig. 6 :** Graphical treatment of the results of the Principal Components Analysis applied to a series of 421 geometric weapon elements. Left, distribution of individuals according to the symmetry index "Is" (length of the large truncation/length of the small truncation) and elongation index "Ia" (length/width) before and after the PCA. Right, interpretation of the results showing the existence of four morphometric tendencies whose variations in percentage evolve through time (after Valdeyron, 1994).

or extremely rare in the upper levels) do show such a variation. The first observations made at Les Fieux (Briand, 2004) and at Escabasses seem to confirm the status of chronological marker for these two weapon element types, whose percentage variations indicate changes in the conception of the wounding parts of arrows, even if they always associate a piercing extremity and lateral cutting edges.

### The Second Mesolithic : first data

The current state of the documentation does not yet allow a satisfying characterisation of the production sequences of the broad weapon elements (triangles or trapezes) typical of this period. It also does not allow us to address the question of the relationships between the two major phases of the Mesolithic. Nonetheless, based on observations of the artefacts collected in the back dirt of Lacam at Cuzoul and of the artefacts collected at Trigues, we can make a few significant remarks that are of interest here.

Local raw materials are always largely dominant and our first observations do not seem to show particular choices related to the manufacture of weapon elements. It is possible, however, that some “discrete” features could have played a role in favour of a particular type within a large family of materials. It indeed appears that there was a preference for homogeneous, fine-grained materials, which was perhaps related to more restrictive and demanding production objectives (cf. *infra*).

These materials were exploited primarily to obtain high-quality blade-bladelet blanks (i.e. comparable to Montbani or Montclus types [Rozoy1978]). The pieces observed at Trigues (fig. 7) and Cuzoul are clearly characterised by intentionally laminar products with a slightly curved profile and with edges parallel to the straight dorsal ridges (there are many pieces with three planes). Certain elements, such as the presence of a few concave butts, suggest the use of indirect percussion.

Concerning the shaping of weapon armatures, we must first note the abundant reappearance of the microburin

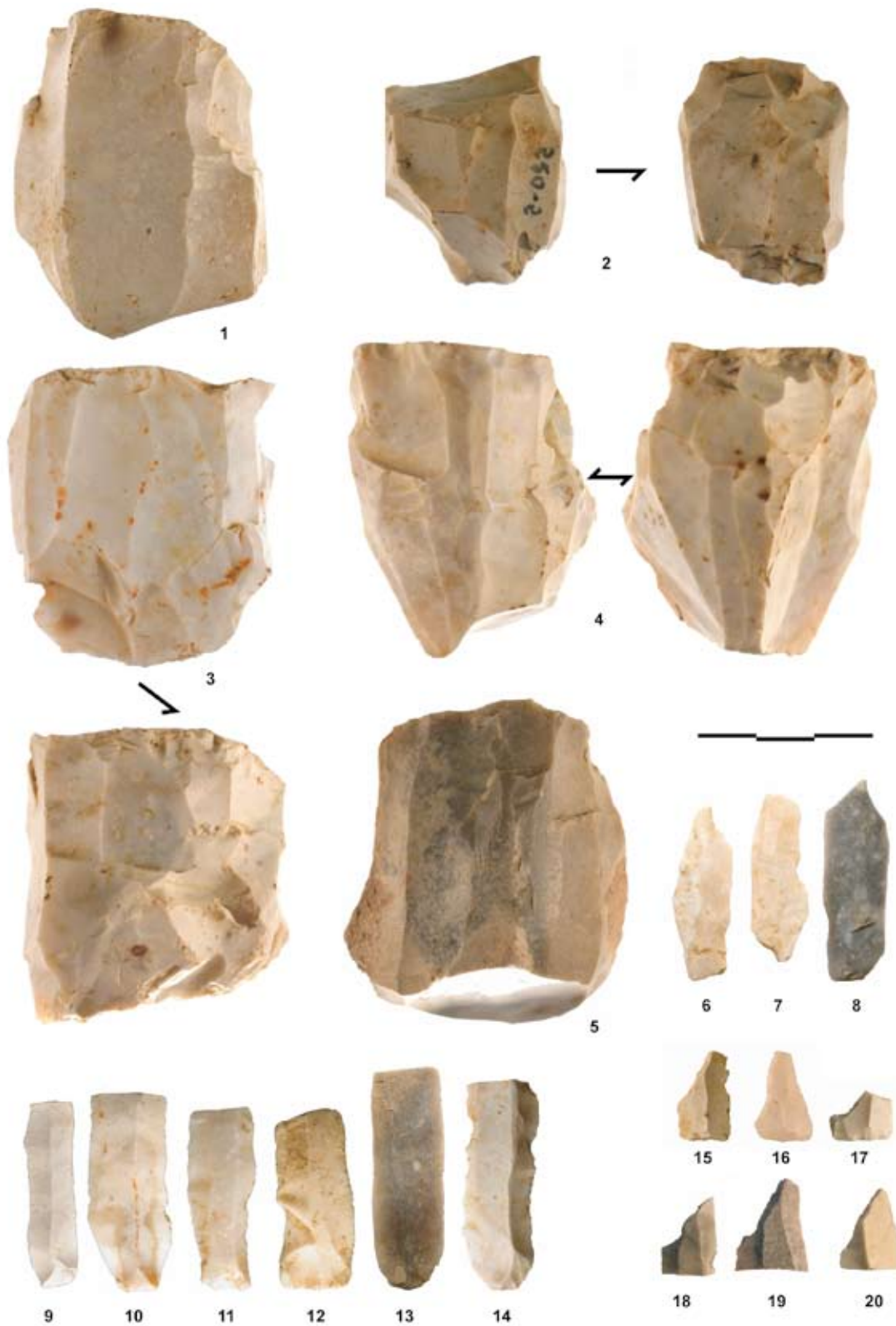
technique. This technique was nearly abandoned during the middle phase, but is then apparently frequently used to sever blanks for the fabrication of trapezes and triangular points. We have recorded several dozen examples at Trigues and already nearly 150 in the disturbed assemblages of Cuzoul (the characteristic morphology of these blanks allows us to attribute them with certitude to the later phases of the Mesolithic. In contrast to earlier phases, trihedral points are very often preserved in this phase, spared at least in part by the abrupt retouch of the notch. This microburin technique is nonetheless not exclusive. Though we have not yet determined the reasons for choosing between these techniques, blanks were also severed by simple breaks. Some of the blanks sectioned by this latter technique also have the remains of a trihedral point: several pieces at Trigues are perfect examples and thus suggest an explanation related to typological criteria (the objects in question are rectangular trapezes in the process of fabrication, the fracture allowing the creation of a small base).

The shaping itself was realised by abrupt retouch, which was always direct and most often in the form of truncations, but also on the edges. This retouch was generally very regular. Many trapezes and points also have inverse retouch on their base. This retouch is sometimes semi-abrupt, but more often flat and was often carefully realized. In most cases, the inverse retouch is posterior to the base modifying truncation. Direct thinning retouch is also present on various types, particularly large, triangular points (the *bâtard*, or hybrid, points of Lacam), on which it often covers a significant part of the base. On the Montclus arrowheads, this retouch often becomes invasive and always starts from an inverse semi-abrupt retouch that serves as the pressure flaking platform. All of these particular pieces merit intensive study in order, for example, to record significant recurrences in the different retouch sequences and their organizational rhythms.

### A temporary conclusion

As we have seen, the Quercy zone is particularly well adapted to a research program concerning the evolution of lithic weapon elements during the Mesolithic. For





**fig. 7 :** lithic artefacts from Trigues at Vigan (prospections P. Roussel); 1-4: unipolar blade/bladelet cores probably knapped by indirect percussion; 6-8: microburins; 9-14: examples of regular blanks with two or three dorsal planes; 15-17: asymmetric trapezes (17 is a Martinet trapeze, the two others approach the definition of this type, particularly by the presence of semi-abrupt inverse retouch of the small base posterior to the truncation); 18-20: trapeze performs (the small base is created from a break).



the latest phases, several studies in progress will soon provide us with datasets that can be compared to those already available for the early and middle phases. These include a functional analysis of the Monclus arrowheads from Escabasses by S. Philibert, as well as a detailed techno-typological study of weapon elements collected in the back dirt of Lacam at Cuzoul by B. Bosc-Zanardo. Following this latter study, which should be rapidly available, the objective of future work at this major site will be to establish a reliable chronological framework that will allow us to reason in terms of coherent associations. For the already well documented phases with triangles, research at Escabasse will soon allow us to establish a relationship with the Montclusian of Fontfaurès, which is clearly older according to recently obtained dates. In this way, we will soon have a complete sequence covering all of the Sauveterrian, which will permit us to follow the evolution of these weapon element groups, if not continuously, at least without significant gaps. It will then be necessary to relate this ensemble to the data from Cuzoul in order to construct a reference base covering all of the Mesolithic and the beginning of the Neolithic, and finally address our original research problem. The time will then be ripe to move beyond the stage of techno-typological and chronological characterisations into other levels of reasoning. For example, we must begin to construct models that draw upon and integrate data concerning habitats, the environment and raw material circulation. It will then be profitable to extend our research zone into other areas: the Brive Basin, where numerous open-air sites have already been recorded (Demars 2000) could be a next step.

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# ARROWHEAD LATERALIZATION : RECENT DATA FROM THE MOSEL REGION IN THE CONTEXT OF THE NORTH-WEST LINEAR POTTERY CULTURE

Anne HAUZEUR & Hartwig LÖHR

## Abstract

Several recent excavations of sites attributed to the Linear Pottery Culture (LPC) in the middle Mosel region have considerably increased the number of assemblages available for study. Typological and morphological analyses of arrowheads have been conducted with special attention to their significant role in cultural identities. In this context, the Mosel Valley is located in a geographic zone that links economic and cultural traditions. The assemblages analyzed are clearly dominated by symmetric arrowheads over asymmetric ones; they perfectly follow a decreasing gradient of symmetric arrowheads, observable on the margins of the Danube towards the Rhine-Meuse territories. The tendency observed for asymmetric arrowheads is variable according to the sites, with a majority of left lateralized pieces. Considering these two associated characteristics, the Mosel assemblages are closer to southern LPC groups than they are to those of the North-West LPC. From a wider geological and chronological perspective, there is no simple or unique explanation for the lateralization of arrowheads. New data on the La Hogue and Limburg Pottery, as well as the LPC in the Mosel region, illustrate the interpenetration of economic and ideological contacts into a traditional Mesolithic and Neolithic base.

**Key-words :** Mosel, North-West Linear Pottery Culture, arrowheads, lateralization

## Introduction

The recent extensive excavation of two sites attributed to the Linear Pottery Culture (LPC) in the Luxembourg territory has considerably increased the number of arrowhead assemblages in the Mosel region (Hauzeur, 2006a). A reanalysis of the lateralization of this tool type thus became pertinent in order to verify that these new data agree with the conclusions reached by one of us (Löhr, 1994), which propose a “significant contribution of the local Late Mesolithic, perhaps in the process of Neolithization (non LPC), to the Neolithization of territories west of the Rhine” (Löhr, 1991:54).

This study successively reconsiders the contextual position of the Late/Final Mesolithic in the Mosel region, the La Hoguette Pottery and Limburg Pottery traditions, and finally, the lateralization of arrowhead assemblages of the LPC in the middle Mosel of Luxembourg and Germany in the context of the Early Neolithic of north-western Europe.

The middle Mosel region is generally distinguished from nearby northern and western regions by the absence of good quality flint. Though the prehistoric populations exploited local or regional materials, such as Jurassic cherts (Dogger and Bajocian) or those of the Trias (Muschelkalk), they also imported large quantities of Upper Cretaceous flint, mostly from Maastrichtian sources in Belgium or Holland, or Coniacian or Campanian sources in the central Paris Basin. The origin of imported products varies quantitatively through time and space.

The Mosel region is located at the junction between the Rhineland and central Paris Basin, and between the southern Rhine and the northern Mosel regions.

The new data for the Neolithic in the Mosel region thus concerns the limit between:

- two arrowhead lateralization traditions;
- three stylistic zones of LPC pottery: the North-West LPC, the Neckar LPC (Jeunesse, 1995) and the Oberrhein-Pfalz style (Lindig, 2002);

- two non LPC groups: the La Hoguette Pottery and Limburg Pottery traditions.

We emphasize that the summary presented here, in light of new LPC assemblages, is an expression of tendencies only, which follow in continuity with the working hypotheses previously proposed.

## The context of the Late/Final Mesolithic

Relative to earlier periods, the Final Mesolithic is characterised by a radical changes in raw material procurement networks (fig. 1). Until this time, Mesolithic groups exploited local or nearby regional siliceous resources for the fabrication of their tools, including arrowheads (Spier, 2000). We observe a change in this procurement behaviour at the end of the Mesolithic. This change is reflected in the dominant importation of Maastrichtian flints from Belgium and Holland, or other flint types from the central Paris Basin, induced by the technical characteristics of the Montbani style. Nonetheless, lithic assemblages from this period are known only from prospections and surface collections. The chronological attributions of some asymmetric arrowheads with flat inverse retouch, characteristic of both the Final Mesolithic and the LPC (Löhr, 1982), may thus be problematic. Their attribution may be further complicated by the use of exogenous materials, which can lead to the recycling of arrowheads and a subsequent decrease in their dimensions. This process can result in a partial loss of morphological characteristics specific to individual cultures.

Morphological analysis of arrowhead assemblages attributed to the Late/Final Mesolithic period originating from sites in the Grand-Duchy and German territories show the presence of evolved arrowheads that are mostly left lateralised, though some right lateralised pieces do exist (fig. 2). The joint presence of two lateralization types in the Mosel region is observed since the Late Mesolithic, as shown by the inventories and maps produced by Hartwig Löhr for western Europe (Löhr, 1994 and fig. 3). Left lateralization seems to increase through time and is particularly common for



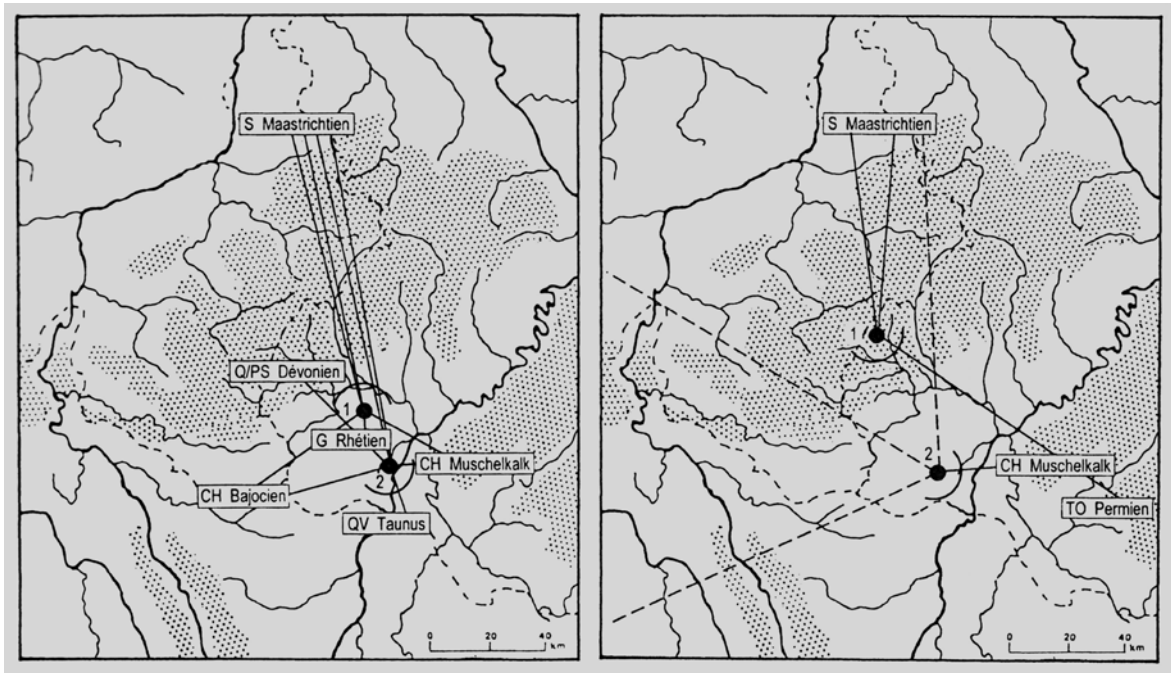


fig. 1 : Raw material procurement networks for the Middle Mesolithic and Recent/Final Mesolithic of the sites of the Grand-Duchy of Luxemburg showing the reduction of local siliceous raw material sources in favour of Belgian-Dutch flint (after Spier, 2000).

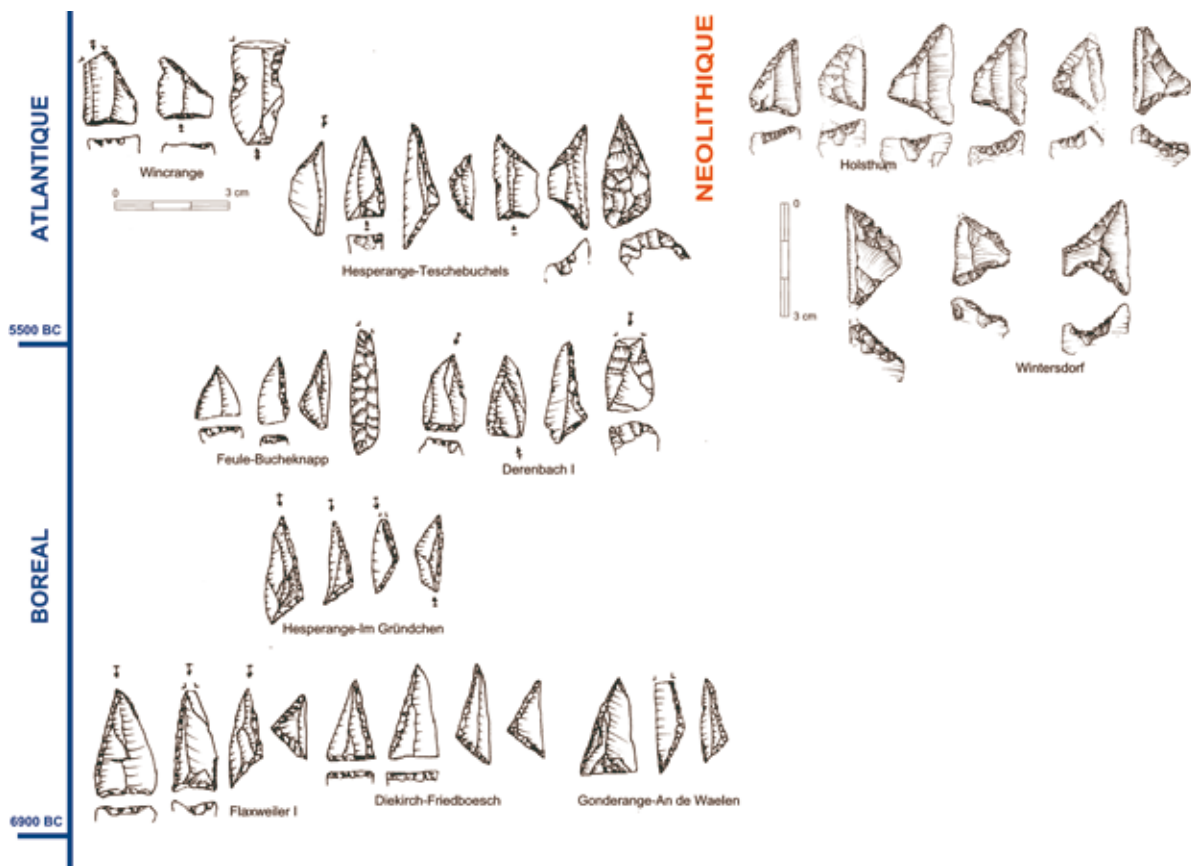


fig. 2 : Schematic table of the evolution Recent and Final Mesolithic industries in the Luxemburgian and German territories of the Mosel basin (after Spier, 1989 and Löhr, 1994).



Danubian type asymmetric points. The clear increase in left lateralized arrowheads in the Mosel territories would have been part of a generalized influence of the later Mesolithic in the Neolithization process (Löhr, 1994:25). This influence seems to have followed the dynamic flows of hunter-gatherer groups in the process of Neolithization or those of the Mediterranean Neolithic spreading toward more northern regions, following the Rhone corridor in particular (e.g., Nicod *et al.*, 1996; Perrin, 2002). We must remember that this latter played an important role at least since the Upper Palaeolithic (Floss, 2000).

The increase in left lateralised arrowheads in the Mosel territories also occurs in contrast with the raw material procurement sources of the northern regions where the right lateralization of arrowheads clearly dominates. We could thus hypothesize that it is above all materials that circulate and not final products. Lateralization would thus have an identification value, more than a simple technical and human one, thus in accord with the conclusions of André Thévenin (Thévenin, 1996).

Lateralization obviously does not show a strict geographic distribution. Rather, it reflects the complexity of cultural “territories” associated with the dynamics of the human groups that inhabit or traverse them (Jochim, 2003). For example, we could imagine the contrary for the clear dominance, during the Final Mesolithic, of right lateralised arrowheads in the Hegau and Lake Constance regions (Hoffstadt, 2001). As in many cases, this observation is based on assemblages from surface collections and must be considered with caution given the known difficulty of typologically attributing certain arrowhead categories to the Late/Final Mesolithic rather than the Neolithic (Löhr, 1982; 1994).

Despite these considerations, a morphological continuity between Late/Final Mesolithic and Early Neolithic arrowhead assemblages in the Mosel region is generally recognized (Löhr, 1994; Spier, 1995; Thévenin, 1995). Whatever its degree of impact, a Mesolithic tradition is now known to exist in a recurrent manner at several locations in western, and even central, Europe

(e.g., Jeunesse, 2000; Ducrocq, 2001; Bánffy, 2004; Mateiciucová, 2004; Marchand, 2006). We can thus also address the question of the means of transmission, probably according to variable modalities, of this tradition—by direct lineages, acculturation, exchange, etc.—between contemporary Mesolithic groups and Neolithic populations (Thévenin, 1996; Mauvilly, 1997; Lodewijcks & Bakels, 2000; Hoffstadt, 2001).

### The La Hoguette and Limburg substratum

The lateralization of arrowheads also plays a role in the process of Neolithization, with all the complexity of the more or less objective interpretations of different researchers and the available data.

The La Hoguette Pottery and Limburg Pottery traditions could represent early waves of Neolithization in northern regions, originating from southern contexts (Impressa-Cardial and Epicardial; e.g., van Berg, 1991; Jeunesse, 1995; Nicod *et al.* 1996; Manen, 1997; Guilaine & Manen, 1997; Manen & Mazurié de Keroualin, 2003). Though we are still tempted to propose a schematic geographic distribution of these two groups, one occupying the central Paris Basin and its northern and eastern margins (Limburg), and the other concentrated in the regions of the upper courses of the Rhone and Rhine rivers (La Hoguette), the multiplication of data collected over the past two decades nuances this schema. Along a line going from the eastern Paris Basin to the regions of the middle courses of the Mosel and Meuse Rivers, an imbricated series of sites has yielded one or the other of these components (fig. 4).

From a chronological perspective, the “Hoguette” tendency appears to have slightly preceded that of the “Limburg”, passing through the Rhone corridor to reach the northern regions (Jeunesse 1987, Tappret & Villes, 1996, Manen, 1997; van der Sloot *et al.*, 2003). This hypothesis is primarily based on the relative chronology of sites that yielded pots of both of these groups, more than on stratigraphic observations and radiometric data, both of which highly insufficient.



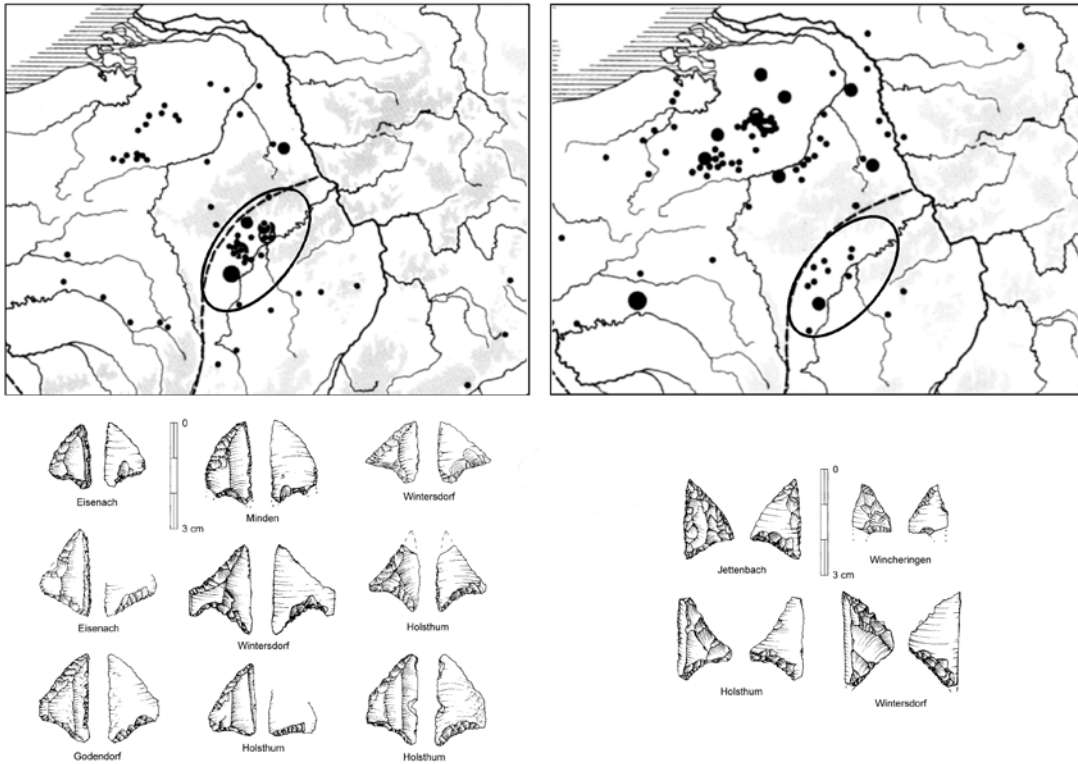


fig. 3 : Geographic distribution of left and right lateralized Danubian type arrowheads in the north-west regions of Europe. The Mosel region is surrounded by an ellipse (after Löhr, 1994).

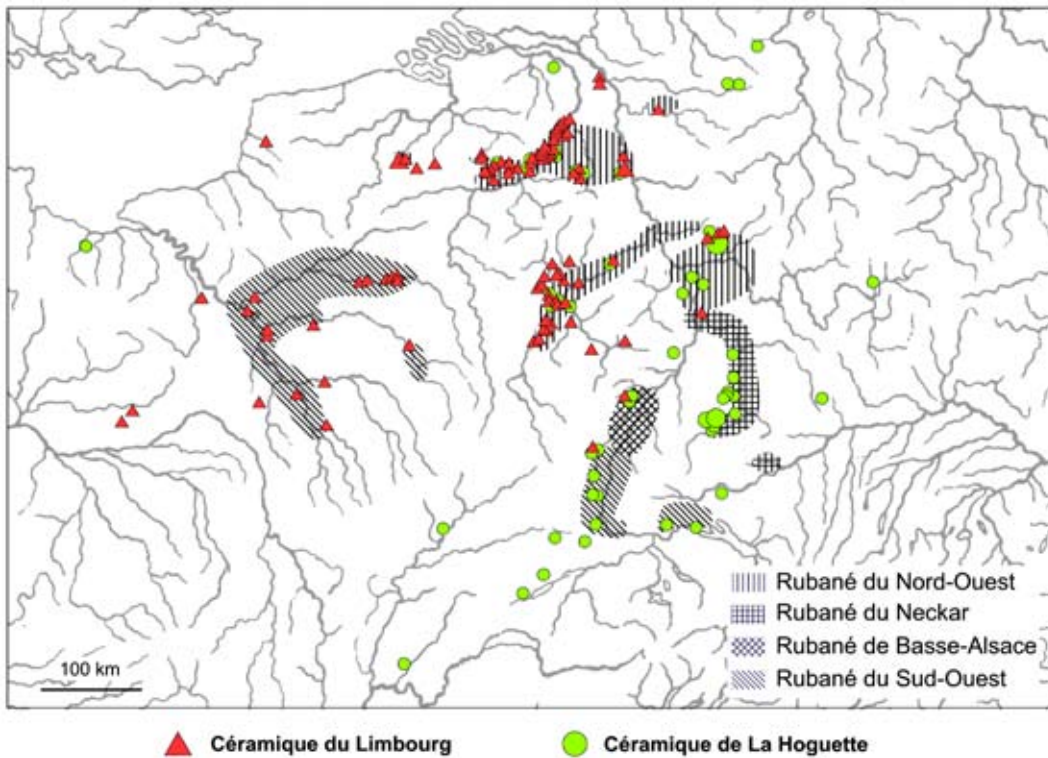


fig. 4 : Geographic distribution of sites that have yielded potsherds or pots attributed to the La Hoguette Pottery (green circles) and/or Limburg Pottery (red triangles) traditions. Inventory after Lüning et al, 1989; Manen & Mazurié de Keroualin, 2003, completed.



Other than rare isolated discoveries, often near Mesolithic assemblages, the majority of assemblages are from Early Neolithic contexts (Lüning *et al.*, 1989; van Berg, 1991). Consequently, there is no reliable data concerning other aspects of the material culture of the artisans of this pottery, in particular, the lithic industries. Only a few sites, such as Suttgart-Bad Cannstatt (Strien & Tillman, 2001), Bavans (Jacotey & Daval, 1997) and Ambérieu-en-Bugey (Jacotey *et al.*, 2000) could contribute to filling in this missing information.

This truncated perception of the material culture of the La Hoguette and Limburg Pottery traditions could be explained by taphonomic factors (Löhr & Ewers-Bartimes, 1985; Jeunesse, 1987). Other than the caves mentioned above, and perhaps certain sites in valley bottoms, a large number of Neolithic sites were disturbed or destroyed by erosion. This process would also have erased the more superficial traces of these still very mobile groups, which did not install permanent structures in depressions, such as those of the Early Neolithic.

In this context, the link that some authors attempt to establish between La Hoguette tradition and the left lateralization of arrowheads, and between the Limburg tradition and right lateralization, appears too schematic and simplistic (Gronenborn, 1997). It is nonetheless true that left lateralization dominates in the southern parts of France and the territories in which La Hoguette pots also dominate (fig. 5). On the other hand, this association of ideas is more difficult to explain for the Limburg tradition. If this tendency indeed originates in the south, it must have abandoned the left lateralization tradition that it was supposed to have had, subsequently adopting the indigenous right lateralization tradition of the territories into which it moved. Unless, of course, Limburg Pottery was the result of an *in situ* evolution of hunter-gatherers adopting certain ideas arriving from Mediterranean regions (Manen, 1997; Jeunesse, 2000).

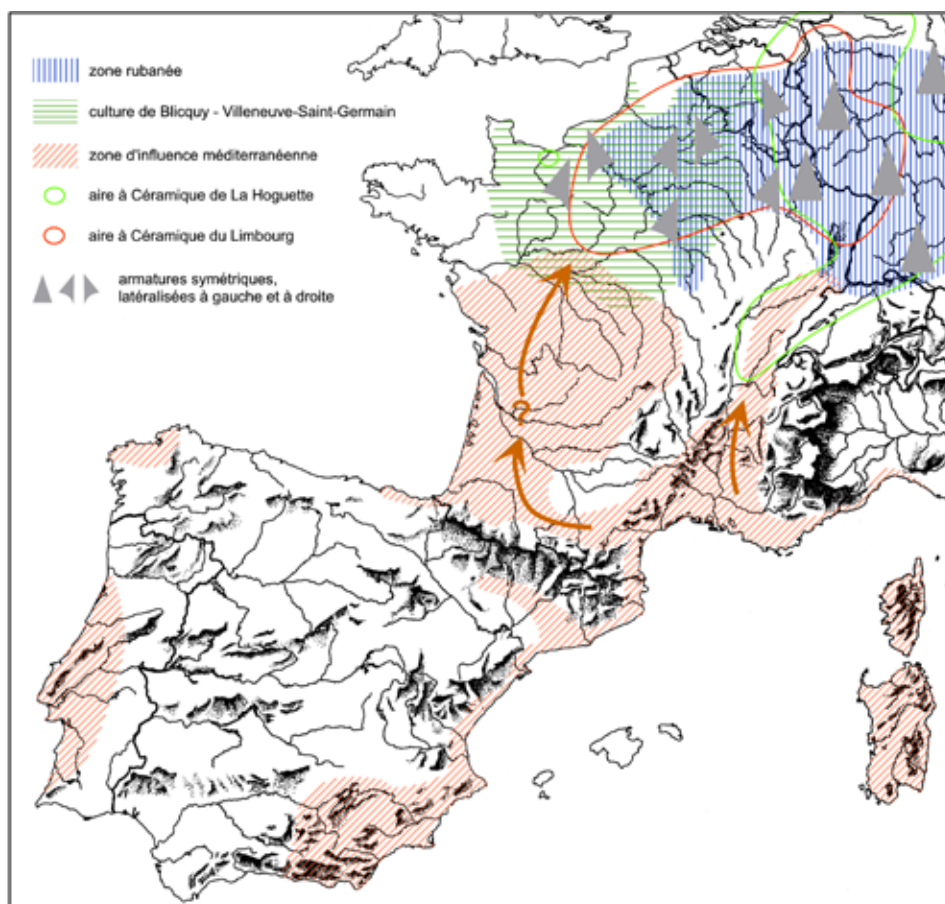
The two traditions are present in the middle Mosel region (fig. 6 and table 1). Some sites have yielded

La Hoguette or Limburg Pottery, isolated and out of context, while others have yielded both pottery styles (Sehndorf, Germany). Most other LPC sites that have yielded non LPC pottery range chronologically from the Middle LPC to the Final LPC. A few sites have yielded potsherds definitely belonging to both the Hoguette and Limburg traditions (Maring-Noviant, Altwies). This joint presence of the two styles reveals the interpenetration of human populations and the dynamics of contacts, but does not currently demonstrate a relationship between the adoption or arrival of a pottery style and the depth of a traditional lateralization rooted in the Mesolithic substratum.

### The Linear Pottery Culture perspective

The LPC of the Mosel region is generally characterized by the massive and regular use of siliceous materials imported from long distances. The percentage of finished or semi-finished products in Belgian-Dutch flint can reach 80% of the total lithic industries of some sites (Hauzeur, 2006a et Schmidgen-Hager, 1993; 2003). We must remember, however, that no site in the Mosel basin is known in its entirety, which is generally the case for all of the LPC in north-west Europe. This factor, which limits the interpretation of analyses, is joined by that of erosion, which has variably disturbed or removed the upper parts of detrital pits.

In the study presented here, whenever possible, Early Neolithic arrowhead assemblages studied through a *de visu* (direct visual) examination. In order to integrate the Mosel assemblages into a broader context, German, Luxembourgian and Belgian LPC assemblages were also analyzed, as well as a few published assemblages of the Late LPC in the Paris Basin, and that of Blicquy-Villeneuve-Saint-Germain (BQY-VSG, table 2). Over the past decade in the Mosel region, the number of arrowheads has tripled. There are now two times more in the German Mosel region, counting the sites of Trier-Euren - Schloß Monnaise (Schmidgen-Hager, 2003) and Wehlen-Ober dem Lieserpfad (unpublished) and five times more in Luxembourg, after the recent excavations at Remerschen-Schengerwis and d'Altwies-Op dem



**fig. 5** : Confrontation of the Hoguette and Limburg zones and zones with lateralized symmetric and asymmetric arrowheads. Schema representing the hypothesis that the Rhone corridor served as a vector of Neolithization, as well as the alternative hypothesis via western France for Limburg Pottery.

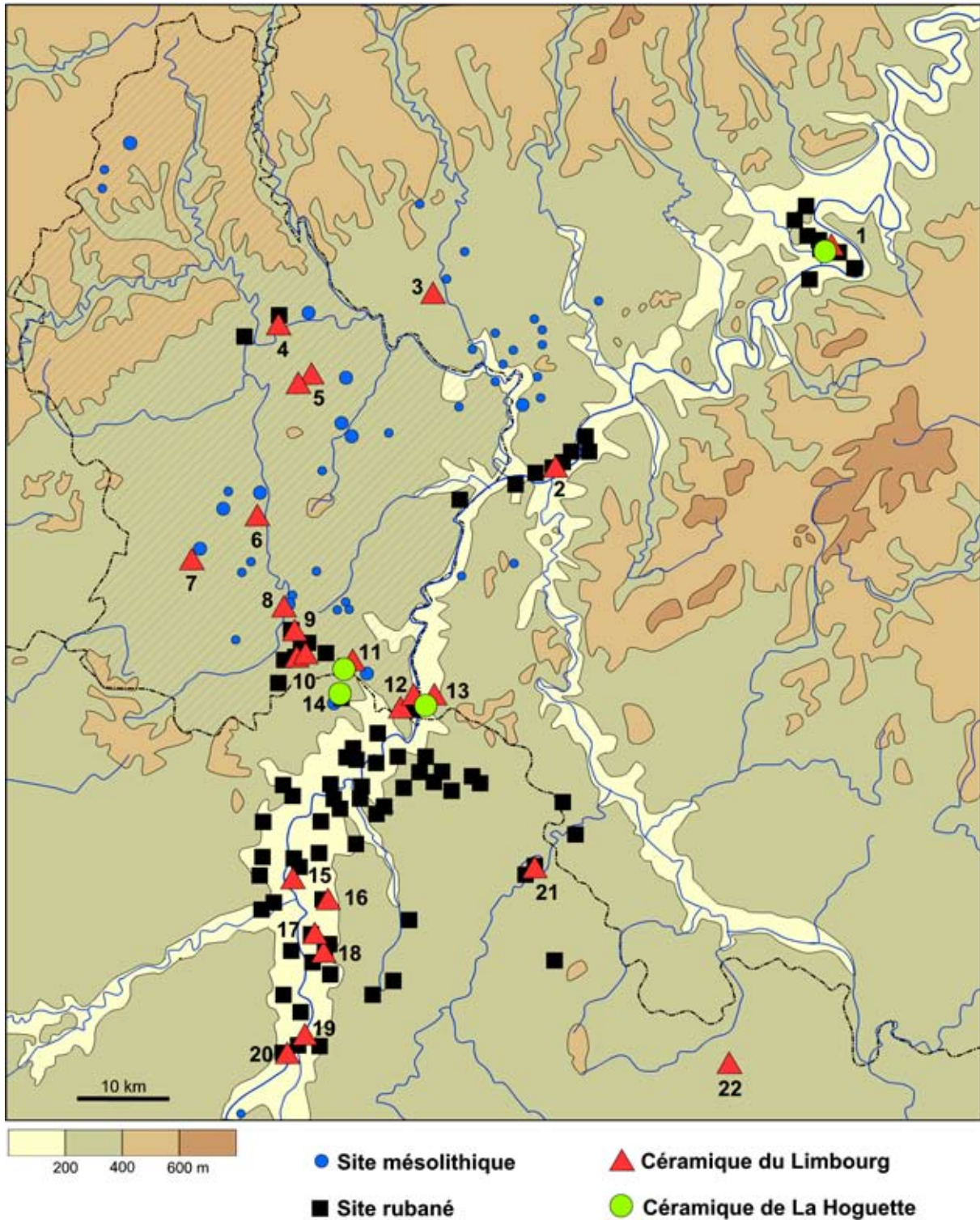
Boesch and the analysis of the E. Marx collection in the Weiler-la-Tour region (Hauzeur, 2006a). The majority of assemblages originate from sites dated by a stylistic chronology of the pottery of the recent and final phases of the middle Rhine LPC (IIc-IIId). A study of the evolution of these industries did not show significant results. This is partly due to the general poverty of the lithic industry in these regions, which lack high quality siliceous materials, and a relative stability of the frequency of typological categories (Hauzeur, 2006b).

This analysis included asymmetric, triangular and trapezoidal arrowheads, as well as symmetrical ones, identified according to the criteria of A. Zimmermann (Zimmermann, 1977), and slightly modified according to our own observations (Hauzeur, 2006a: 46-47). In contrast to a preceding analysis of lateralization (Löhr, 1994), symmetric arrowheads were added because it

appeared that they could play a role in the identification of the morphological criteria of the different assemblages studied. The impact of lateralization is thus better understood and appreciated in the assemblages of Neolithic arrowheads in different regions.

At the regional scale, in north-western Europe, the distribution of assemblages recorded or analyzed (fig. 7) reveals a decreasing gradient of symmetric arrowheads toward the northern and western regions, except for the Leine Valley (Weller, 2003). In the Early LPC—a period absent in the middle Mosel according to current knowledge—right symmetric and asymmetric arrowheads dominate the northern North-West LPC assemblages. In the Graetheide, for example, symmetric arrowheads are dominant, followed by right lateralized ones (Newell, 1970), while in the Belgian Limburg region, these two types are present in nearly the same





**fig. 6 :** Details of the geographic distribution of sites that have yielded pots or potsherds attributed to the La Hoguette Pottery (green circles) and/or Limburg Pottery (red triangles) traditions in the middle Mosel region. 1. Maring-Noviant; 2. Trier-Euren; 3. Peffingen; 4. Diekirch; 5. Medernach; 6. Mersch; 7. Mamer; 8. Hespérange; 9. Alzingen; 10. Weiler-la-Tour; 11. Altwies; 12. Remerschen; 13. Sehndorf; 14. Puttlinge-les-Thionville; 15. Guénange; 16. Rurange-les-Thionville; 17. Ay-sur-Moselle; 18. Ennery; 19. La Maxe; 20. Metz-Nord; 21. Fillstroff; 22. Farébersviller. Details of sources, see table 1. The Mesolithic sites indicated by blue dots correspond to assemblages attributed to the Recent and Final period (after Koch, 1998 and Spier, 1995).

	sites	La Hoguette	Limbourg	sources
DE	Maring-Noviant, Kr. Bernakastel-Kues	x	x	Schmidgen-Hager 1993
DE	Peffingen, Kr. Bitburg-Prüm		x	Löhr 1984
DE	Sehndorf, Kr. Merzig-Wadern	x	x	Fritsch 2000
DE	Trier-Euren - Schloß Monaise		x	Schmidgen-Hager 2003
FR	Ay-sur-Moselle - Les Tournailles		x	Bilan sc. Lorraine 1992
FR	Ennery - RD52C		x	Bilan sc. Lorraine 1997
FR	Farébersviller		x	Thomashaussen 1999
FR	Fillstroff-Averberg		x	Thomashaussen 1999
FR	Guénange		x	Fritsch 2000
FR	La Maxe - Station d'épuration		x	inédit
FR	Metz-Nord - Devant les Ponts		x	Decker 1984
FR	Puttelange-les-Thionville, Himeling	x		Belland et al. 1985
FR	Rurange-les-Thionville - Sur Bruche		x	Thomashaussen 1999
LU	Altwies - Op dem Boesch	x	x	Hauzeur 2006a
LU	Alzingen - Grossfeld		x	Jadin 1996; Hauzeur 2006a
LU	Diekirch - Dechensgaard		x	inédit
LU	Hesperange - Teschelbuchels		x	Löhr & Spier 1982
LU	Mamer - Juekelsboesch		x	inédit
LU	Medernach - Baachbiert		x	Lüning et al 1989
LU	Medernach - Reineschaff		x	Spier et al. 2003
LU	Mersch - Haard		x	inédit
LU	Remerschen - Schengerwis		x	Hauzeur 2006a
LU	Remerschen - Triangle		x	inédit
LU	Weiler-la-Tour - Holzdréisch		x	Jadin 1996; Hauzeur 2006a
LU	Weiler-la-Tour - Mëchel	x		Le Brun-Ricalens & Grisse 1993

tab. 1 : List of known sites in the middle Mosel region that have yielded pottery attributable to the La Hoguette or Limburg Pottery traditions.

	Symétrique	Asym D	Trapèze D	Asym G	Trapèze G	Total I	Atypiques + fgts	Total 2	Source
Altwies - Op dem Boesch	11	2	2	2	4	21	2	23	matériel
Remerschen - Schengerwis	15	4	2	3	3	27	3	30	matériel
Alzingen - Grossfeld	4	0	0	0	0	4	0	4	matériel
Weiler - Holzdréisch	1	0	0	0	2	3	0	3	matériel
Weiler - Huesefeld/Platz	41	4	0	9	3	57	7	64	matériel
Diekirch - Dechensgaard	0	0	0	1	0	1	0	1	Le Brun-Ricalens 1993
Trier-Euren - Schloß Monaise	6	4	0	4	0	14	1	15	matériel
région de Bernkastel-Kues	9	0	0	3	1	13	4	17	Schmidgen-Hager 1993 (N=24)
Wehlen-Ober dem Lieserpfad	10	1	1	5	0	17	0	17	matériel
Hemmersdorf-Auf der Strichen	3	-	-	2	-	5	-	5	Fritsch 1997
<b>Moselle</b>	<b>100</b>	<b>15</b>	<b>5</b>	<b>29</b>	<b>13</b>	<b>162</b>	<b>17</b>	<b>179</b>	
Rosmeer	15	14	3	9	2	43	12	55	matériel
Viltingen	2	6	0	2	0	10	0	10	matériel
Darton - Colla	5	22	7	13	8	55	10	65	matériel
Oleye - Al Zépe	8	5	3	3	1	20	1	21	matériel
Verlaine-Petit Paradis	4	4	1	0	2	11	0	11	Allard 2005 (N=14)
Vaux-et-Borset + (Eloy)	4	5	3	8	0	20	0	20	matériel
Horion-Hozémont + (Dradon)	3	14	1	6	1	25	1	26	matériel
Overhespen	2	3	1	3	0	9	2	11	matériel
Wange	5	9	1	6	1	22	3	25	matériel + 3 dessins
<b>Hesbaye-LBK</b>	<b>48</b>	<b>82</b>	<b>20</b>	<b>50</b>	<b>15</b>	<b>215</b>	<b>29</b>	<b>244</b>	
Hainaut-LBK	9	27	9	3	4	52	2	54	Constantin 1985; Deramaix 1990
Hainaut-BQY	0	17	2	12	0	31	1	32	Cahen & van Berg 1979; Constantin 1985; Constantin et al. 1991
Graetheide	37	33	1	9	0	80	3	83	Bohmers & Bruijn 1959; Modderman 1970
Leinetal	18	0	0	0	0	18	0	18	Weller 2003
Aldenhovener Platte	44	10	7	9	3	73	15	88	Kuper et al. 1977; Zimmermann 1977; Gaffrey 1994
Herxheim	6	1	1	1	1	10	3	13	Schimmelpfennig, en cours
bas Neckar	12	1	1	1	3	18	2	20	Lindig 2002
Bade-Württemberg	5	1	0	0	0	6	3	9	Strien 2000
Kraichgau	92	16	0	13	1	122	-	-	Heide 2001
Jura souabe	25	1	1	4	1	32	5	37	Kind 1989, 1990
Bavière	73	0	0	0	0	68	6	74	de Grooth 1977; Brink-Kloke 1990; Nieszery 1995
Aisne-VSG	1	12	6	15	6	40	0	40	Bostyn 1994; Thévenin 1996
Aisne-RRBP	0	13	4	6	0	23	0	23	Plateaux 1990; Thévenin 1996
Yonne	0	7	4	11	4	26	1	27	Augereau 2004
Normandie-VSG	4	21	8	9	4	46	-	-	Billard et al. 2001; Bostyn 2003

tab. 2 : Detailed inventory of LPC arrowheads in the Mosel and Hesgignon context and global inventory, by region or period, of the reference assemblages. The bibliographic references are not exhaustive but refer to the principal sources of information..

proportions (sites of Rosmeer and Vlijtingen; table 2). For the more recent periods, we observe a clear decrease in symmetric arrowheads in these regions. An increasing gradient of right lateralized asymmetric arrowheads towards the northern regions is detectable, especially in the north of the North-West LPC (Belgium, Limburg, Aldenhoven plateau). On the contrary, toward the west and centre of the Paris Basin, we remark a high proportion of left lateralized arrowheads and the nearly complete absence of symmetric ones (fig. 7; table 2).

In general, we observe a clear relative correspondence between the dominant lateralization types and the different cultural trends or stylistic provinces of the recent LPC, of the RRB and BQY-VSG, despite notable exceptions between sites of a same culture (fig. 8). Still, this correlation between region and lateralization shows the lasting quality of the phenomenon from the Recent/Final Mesolithic to the Early Neolithic.

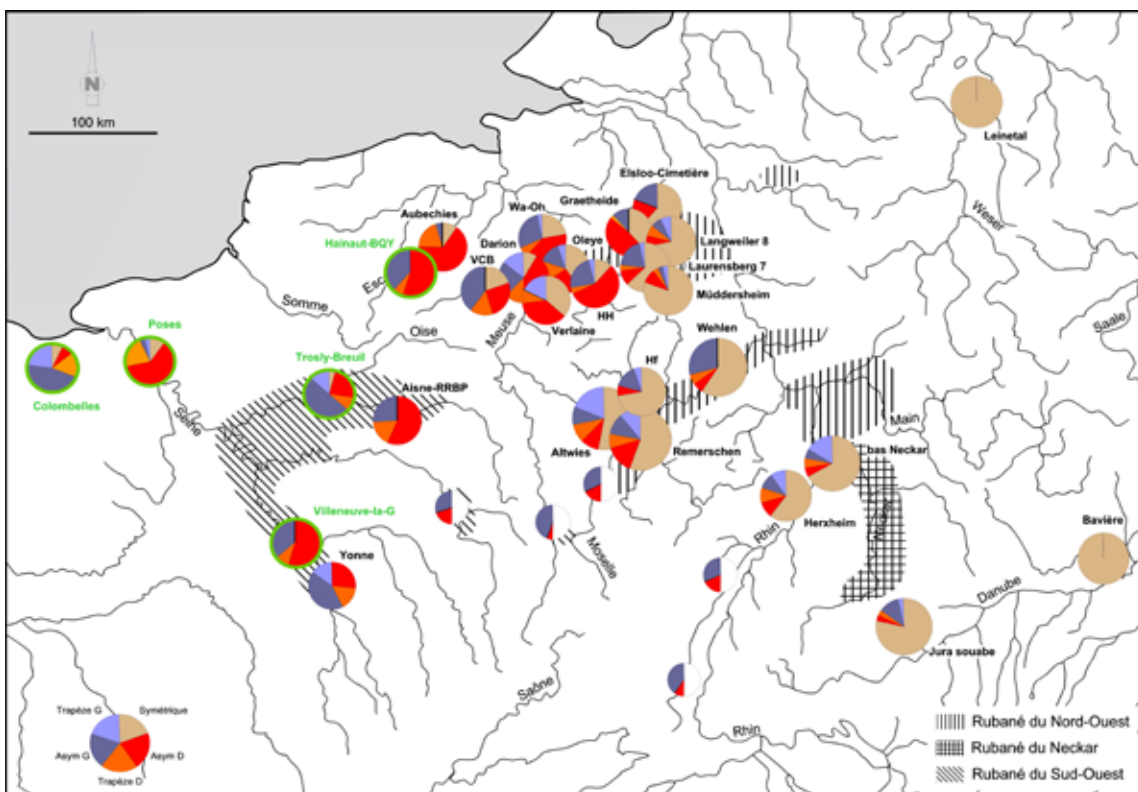
In this rapidly summarized general context, the middle Mosel basin is characterized by a dominance of symmetric arrowheads relative to those whose asymmetry is numerically greater on the left than on the right (fig. 7). The Mosel region is thus more closely correlated with zones where symmetric arrowheads clearly dominate in the lithic assemblages of the LPC, such as the lower Neckar, the Kraichgau or the Swabian Jura. This morphological heritage seems well correlated with the rest of the tool kit, which shows the same affinities oriented toward the south-east (Hauzeur, 2006a). In the north of the North-West LPC, only the excavated sites of Müddersheim and the Aldenhoven plateau have a proportion of symmetric arrowheads clearly superior to the ensemble of asymmetric ones, resulting in a generally strong correlation with the sites of the middle Mosel, whose percentage of symmetric pieces is around 60%. Furthermore, the proportions between right and left lateralization are well balanced, as observed at some sites in Luxembourg (fig. 9). On the contrary, the analyzed assemblages from the Bernkastel-Kues region show a clear dominance of left lateralized arrowheads, two to five times more numerous than right lateralized ones (fig. 9).

In the regions mentioned above and in the assemblages considered, almost all of the arrowheads were made from imported Belgian-Dutch flint (fig. 10 to 13). Some of the arrowheads were made from the recycled blanks of other tool types, such as sickle blades (fig. 12, n° 5), recycled weapon elements (fig. 10, n° 4), or opportunistically fabricated on a poorly adapted blank, resulting in atypical characteristics (fig. 11, n° 10). Traditions are maintained despite the use of imported materials and possible transformation cycles. Even the less perfect arrowheads and preforms reflect the weight of tradition. Only one arrowhead made from Bartonian Tertiary flint from the centre of the Paris Basin is known in the Luxembourg Mosel region (Remersche; fig. 10, n° 9). Its rarity and exceptional status within the whole industry of the site indicates, at the least, that its presence reflects occasional, rather than recurrent, exchange. It is also remarkable due to its very clear asymmetry...on the left!

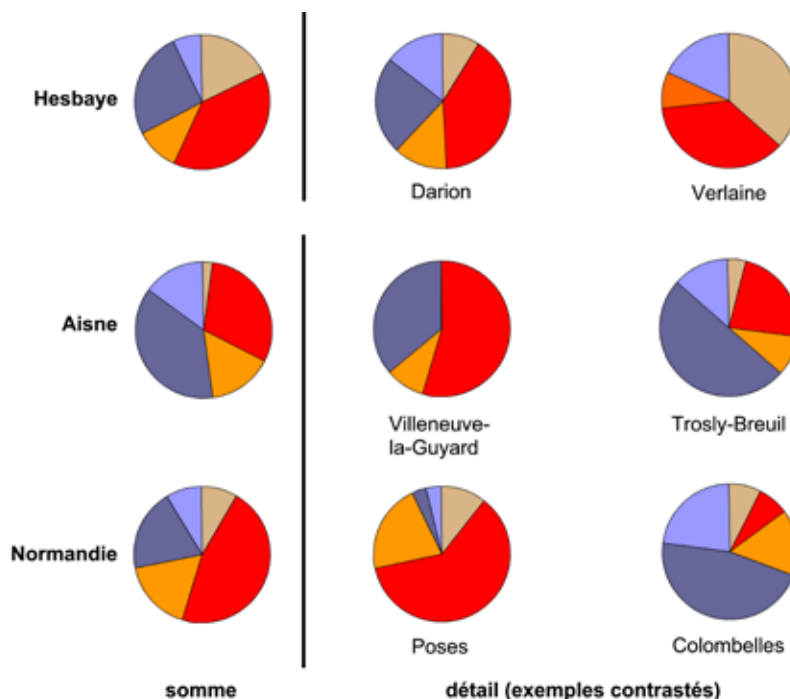
## Conclusions

New data concerning the Mosel region in Luxembourg and Germany, as well as in Belgium, confirm the general trends observed for the recent Linear Pottery Culture. They also reveal the persistence of traditions already present in the Mesolithic substratum, even if it is still difficult to establish reliable contexts for this period in the regions considered.

Nonetheless, some questions remain unresolved, being subject to various conditions. Though arrowheads are clear material expression of a regional, or even cultural, identity, they are not associated with the La Hoguette Pottery or Limburg Pottery traditions. How can we explain the dominance of left lateralization in some sites of the central Paris Basin or right lateralization in the north of the North-West LPC, with the significant presence of Limburg Pottery? The same question is raised in terms of the dominance of left lateralization in the Rhineland zone and the concentration of La Hoguette Pottery. Therefore, only the adoption of a more ancestral Mesolithic tradition by the LPC populations is conceivable, as Chr. Jeunesse (Jeunesse, 2000) has

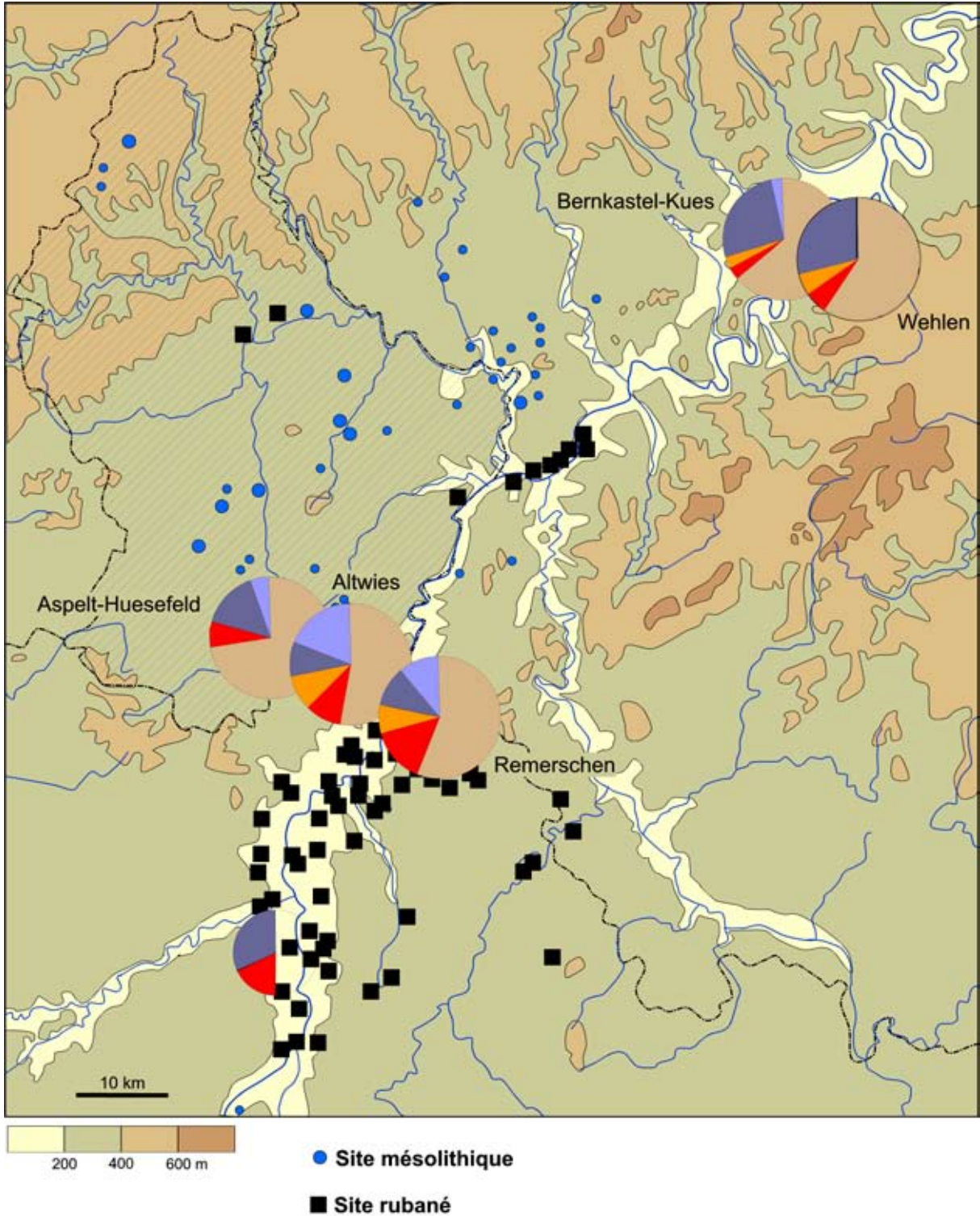


**fig. 7 :** Distribution, shown in pie charts, of the different arrowhead types of the Recent LPC cultures of the North-West, the Recent LPC of the Paris Basin (RRBP) and of Blicquy – Villeneuve-Saint-Germain (VSG) in function of the sites or regions according to the numeric significance of the assemblages. The small pie charts illustrate the sites for which no data exist concerning asymmetric arrowheads. For detailed figures see table 2. The green circles represent the sites or region of the BQY-VSG culture.



**fig. 8 :** Examples of the dichotomous distribution of lateralized arrowheads for sites in a same cultural group. Left, the sum of the different types by region; right, details of the two sites chosen for their extreme variations.

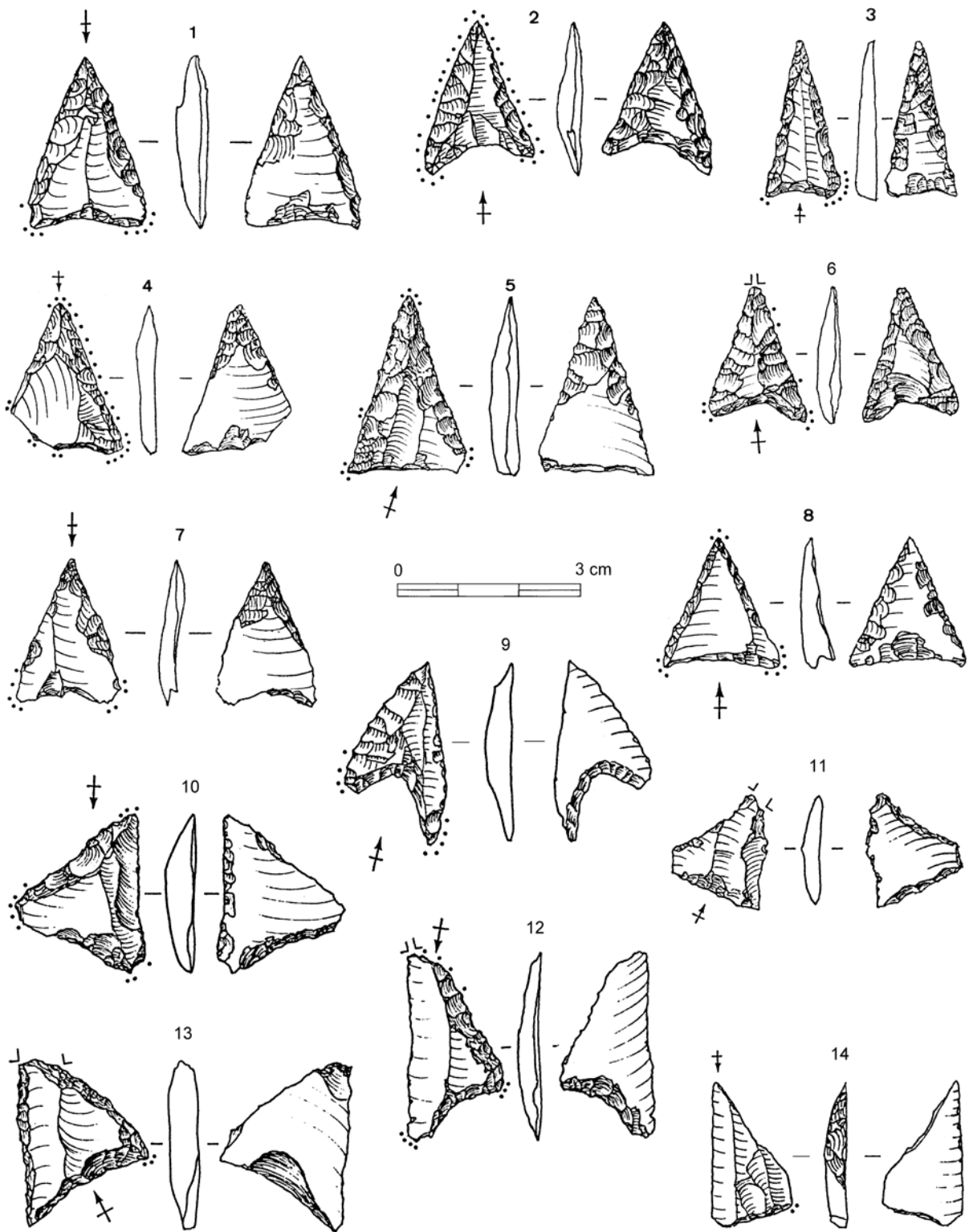




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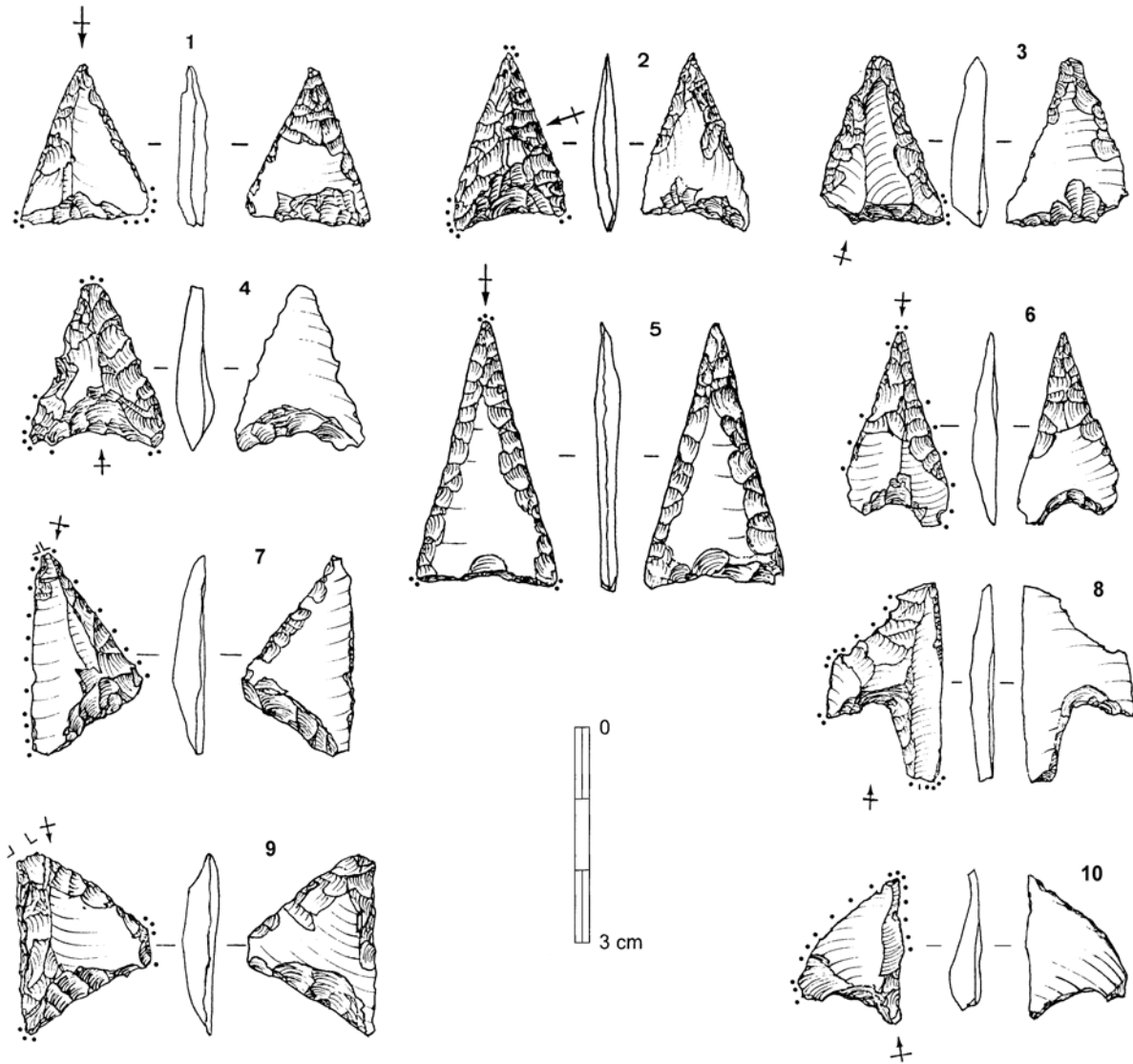
**fig. 9 :** Distribution of the different arrowhead types at LPC sites in the Luxemburgian and German Mosel region (after Schmidgen-Hager, 1993 and 2003; Hauzeur, 2006a and unpublished data). The Mesolithic sites indicated by blue dots correspond to assemblages attributed to the Recent and Final period (after Koch, 1998 and Spier, 1995).





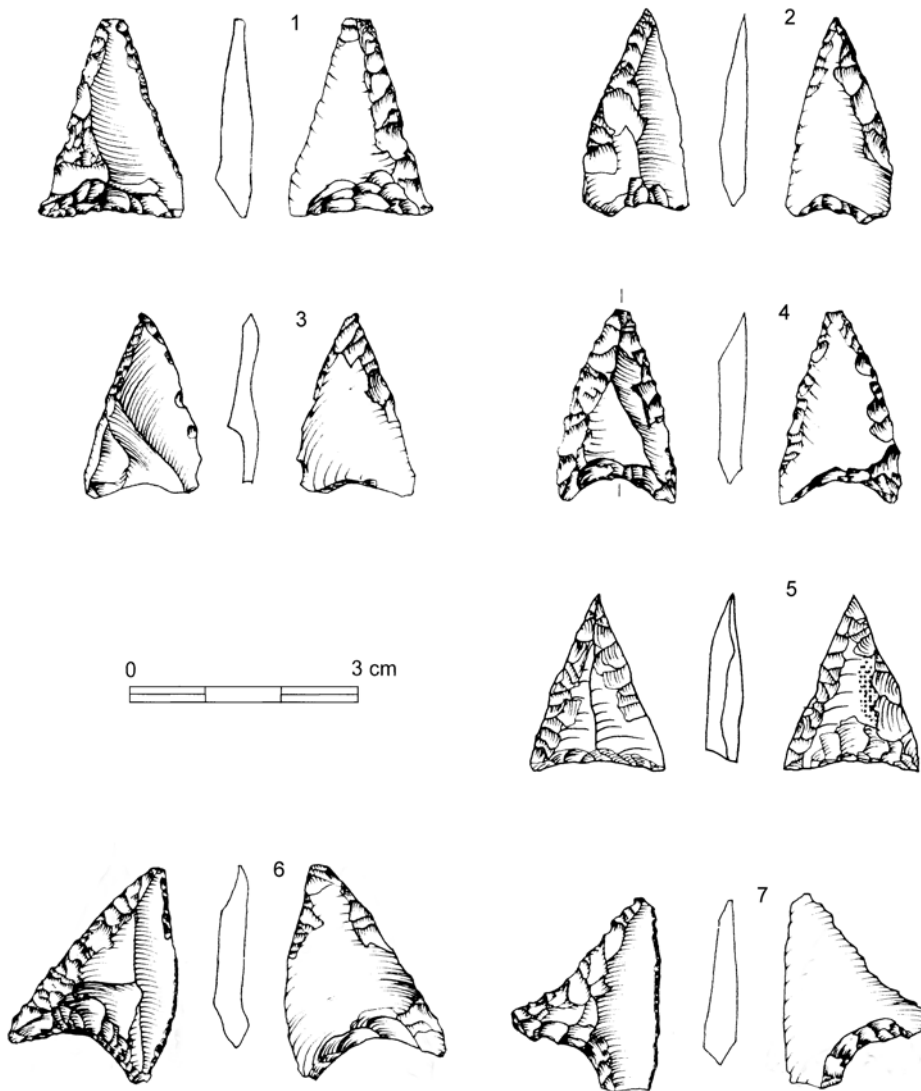
**fig. 10** : LPC of the Grand-Duchy of Luxembourg. Balanced representation of arrowheads at the site of Remerschen – Schengerwis (after Hauzeur, 2006a).





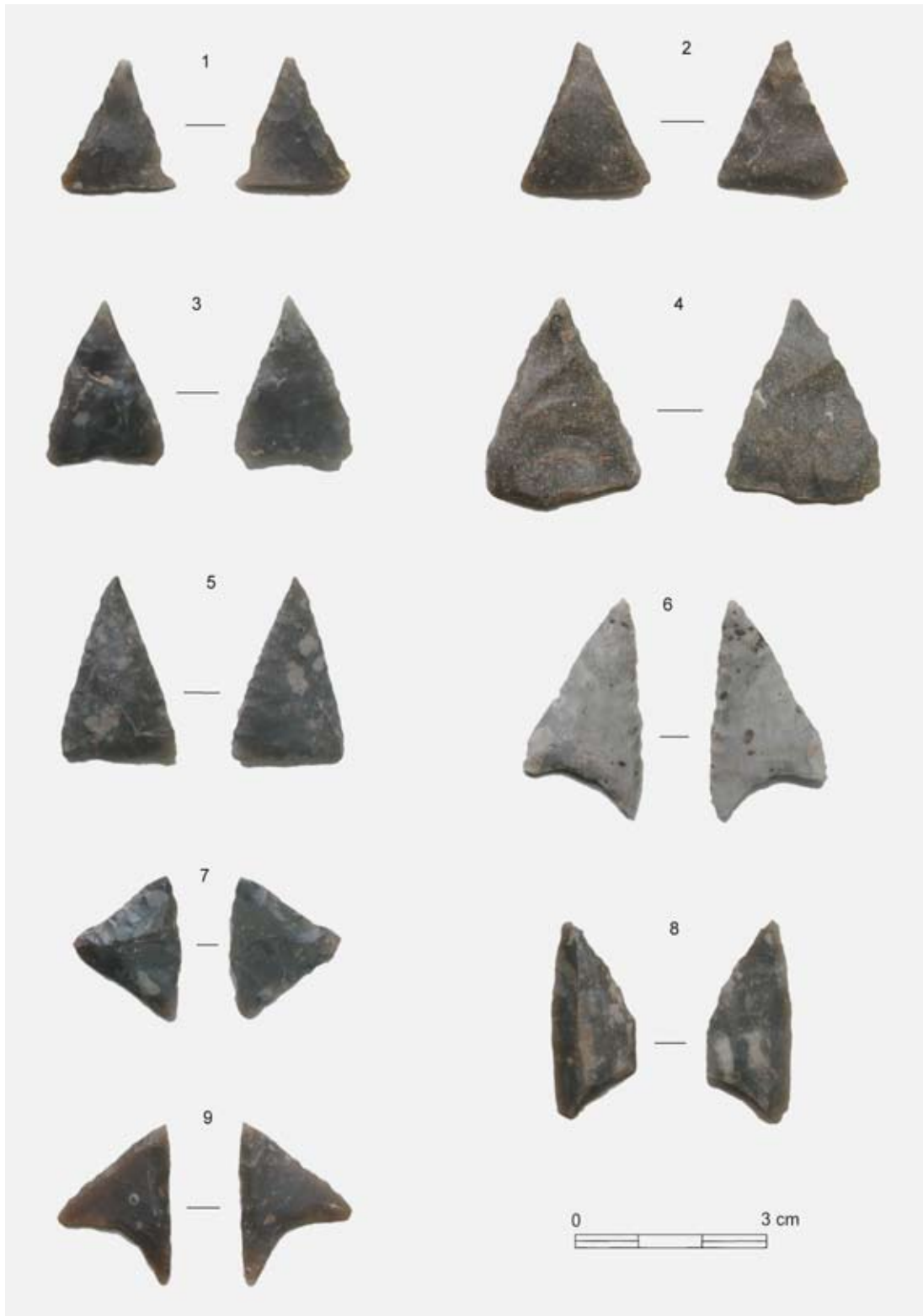
**fig. 11** : LPC of the Grand-Duchy of Luxembourg. Balanced representation of arrowheads from the site of Altwies – Op dem Boesch (after Hauzeur, 2006a).





**fig. 12** : LPC of the German Mosel. Balanced representation of arrowheads at sites in the Bernkastel-Kues region. 1. Maring-Noviant; 2-3 et 6-7. Oberbillig; 4-5. Wengerohr (after Schmidgen-Hager, 1993).





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**fig. 13** : LPC of the German Mosel region. Balanced representation of arrowheads at the site of Wehlen – Ober dem Lieserpfad (unpublished).



already shown in our regions. Furthermore, in the Mosel region, the LPC populations would have adopted the Mesolithic tradition of arrowhead production, at the same time as raw material procurement networks, above all economic in nature, seem to have been disconnected from cultural traditions. The typo-morphological heterogeneity of the middle Mosel assemblages, associating all types of arrowheads, independent of their relative frequencies, indicates an interpenetration—through exchange, contacts, acculturation, etc.—of the cultural traditions present in this region: Mesolithic, La Hoguette Pottery, Limburg Pottery and the Linear Pottery Culture. Unfortunately, we currently have only a few pieces of this rich and complex story, which is just one of the many treasures of the Mosel region.

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### Article translated by Magen O'Farrell

# PROJECTILE TIPS FROM NEOLITHIC LAYERS OF DRAKAINA CAVE ON KEPHALONIA, IONIAN ISLANDS, W. GREECE : TECHNOLOGICAL 'CONSERVATISM' AND SOCIAL IDENTITY

Georgia STRATOULI & Odysseas METAXAS

## Abstract

Drakaina Cave on the cliffs of the steep gorge of Poros in the SE part of Kephallonia Island in the Ionian Sea, Western Greece, has yielded a distinctively large projectile tips assemblage (c. 200 specimens). This consists mainly of asymmetrical points, manufactured throughout the neolithic use of the cave (i.e. from mid 6th to the early 4th millennium), as well as of transverse arrowheads, whose use is restricted to the early phases of the cave's occupation (in the early second half of the 6th millennium), and of tanged or tanged and barbed points, which appear in the site up to the early 5th millennium. Thus, a technological and typological 'conservatism' characterizes the assemblage in terms of manufacturing asymmetrical projectile tips using local raw materials over a period of approximately 1,000 years, while tanged, as well as tanged and barbed points, made also of local cherts, appear late in Drakaina. This pattern contradicts to developments in typology and technology of projectiles that are well known since the beginning of the Late Neolithic (c. 5,300 cal BC) in other parts of the Aegean Neolithic. The paper discusses patterns of morphological and technological variability of the projectiles deposited through time at Drakaina, their raw material exploitation and their life cycle, aiming at approaching functional aspects of the assemblage and understanding facets of the social behavior of site users. In the light of a contextual interpretation, it is proposed that the projectile points of Drakaina were associated with social events taking place periodically on the site.

**Key-words :** Drakaina Cave, Kephallonia Island, Ionian Sea, Neolithic, chipped stone projectile points, material culture change

## Introduction

Recent excavations in the prehistoric deposits of the small Drakaina Cave in the gorge of Poros, located next to the coast at the southeast part of the Kefhalonia Island in the central Ionian Sea (figs. 1, 2), have brought into light successive and rich neolithic layers. Thus, Drakaina is currently one of a few systematically excavated neolithic sites in the Ionian region (Stratouli 2007). Judging from stratigraphic and radiocarbon data, as well as from the recovered artefacts, it is evident that the cave was a place of periodically intensive use from the late Middle Neolithic (MN)/early Late Neolithic (LN) throughout a late phase of the Chalcolithic (CH) (late MN/LN for Drakaina: *c.* 5,600/5,400 – 4,900/4,800 cal BC; CH for Drakaina: *c.* 4,900/4,800 – 3,700 cal BC; the latter corresponds to Late Neolithic II and Final Neolithic (FN) in other sites of central and southern Greece; cf. Demoule and Perlès 1993; Gallis 1996).

Besides other interesting features of the neolithic cultural material of Drakaina, the site revealed a large projectile tip assemblage. Both the remarkable number and the very high relative percentage of the projectile tips in the cave's chipped stone industry (*c.* 200 projectiles out of *c.* 700 retouched tools) raises multi-faceted questions regarding the function and social value of these implements and particularly the nature of the site's use. Further, the clearly differentiated technological and typological attributes of the Drakaina Cave projectiles during the LN and CH, compared with assemblages from open sites and caves in other regions of southern Greece, leads to questions concerning neolithic life in the poorly researched Ionian area, including the structure of the natural and the social environment, the strategies for survival and the ideologies involved in this region of the south-west Balkans.

At Drakaina Cave, projectile types of Middle Neolithic date, known from other sites in central and southern Greece, such as transverse arrowheads and especially shouldered points, persist well into the LN and even the CH period. This trend is accompanied at Drakaina by the markedly delayed appearance of technological and typological innovations concerning the projectiles record, like the use of tanged and barbed points from

the early CH. A similar pattern to Drakaina Cave projectile assemblage is evident at Choirospilia Cave on the south part of the neighboring island of Lefkada, to the north of Kefhalonia, in which shouldered points are stratigraphically associated with polychrome pottery (Velde 1913; Zachos and Dousougli 2003: 25-29), pointing towards a dating in early CH.

This pattern, as indicated by other categories of the Drakaina Cave cultural record, should not be attributed to geographical, or even cultural isolation. As it is evident from imported raw materials and/or finished objects, such as black burnished and painted pottery of LN and CH date (Kiriati in preparation; Stratouli and Goudi in preparation), obsidian from the Melos Island in the south Aegean Sea (Kilikoglou in preparation) and celts made of gabbro from the Grevena region in north-west Greece, or from Argolis in eastern Peloponnese (Stratouli and Melfos 2008), an inter-local communication and exchange network was already established since the early occupation of Drakaina Cave. Therefore, it could be suggested that both the large number of projectile tips from Drakaina Cave and the 'conservative' typological and technological features of the assemblage during the LN and CH may reflect an interplay of social, economic and ideological factors. A differentiated 'mode of neolithic life' could be projected in this pattern, associated with the specific environmental (i.e. climatic, geomorphological) conditions in the area of the Poros Gorge (cf. Torrence 1991, Broodbank 2000: 20-21). In this locally special 'mode of neolithic life and subsistence', which could be even related with aspects of the neolithization process in the region (cf. Pluciennik 1998; Borić 2005), hunting activities would have been endowed with an elevated status, forging the identity of the society and supporting bonds within it. The distinct identity of this neolithic society would be probably evidenced, among other features of material culture of the area, in the long persistence of certain hunting techniques and weapons. On the other hand, the appearance of innovative weaponry (see use of tanged/tanged and barbed points) from an early phase of the CH in the area of the Poros Gorge could be



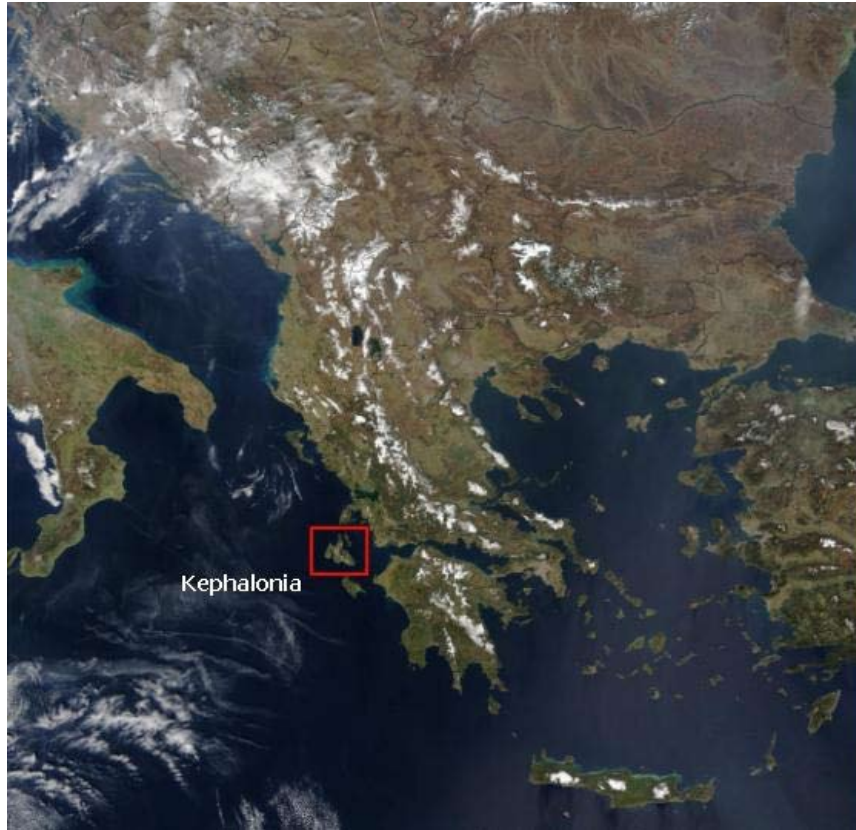


fig. 1 : Satellite image of Greece emphasizing the location of the Kephallonia Island.



fig. 2 : Satellite image of Kephallonia (and Ithaca) with the location of Poros Gorge.



related not only with functional aspects of hunting, but could also indicate changes in social politics, such as reinforcement of communication nets and closer interaction with the adjacent areas.

### Drakaina Cave: setting - chronology - neolithic findings

Drakaina Cave is lying at an altitude of *c.* 70 m above sea level on the south slope of the impressive gorge of Poros (fig. 3). The gorge bridges the Tzannata Basin, which is characterized by diverse micro-environments and is well protected by mountains on all sides, with the shores of both Kefhalonia and the adjacent mainland of western Greece.

In its present form, Drakaina is an open shallow cavity with a sheltered area of *c.* 90 sq. m. (fig. 4). Based on radiocarbon dating (Stratouli *et al.* 1999), human activity started in Drakaina approximately at the mid 6th millennium cal BC, that is in late Middle Neolithic/early Late Neolithic. The neolithic use of the site continued until the early 4th millennium cal BC, i.e. during the Late Neolithic and most of the Chalcolithic. As indicated by sporadic findings, the cave was in use until the late part of the 3rd millennium cal BC, i.e. the late Early Bronze Age II (fig. 5). After a long hiatus in use from the late 3rd millennium BC, the cave was reused in the late 7th/early 6th to the early 2nd century BC as a shrine dedicated to Nymphs, and perhaps to other deities (Chatziotou *et al.* 1995; Chatziotou and Stratouli 2000; Chatziotou 2007).

The neolithic deposits of Drakaina, which measure up to 1,50-1,70 m in thickness, are marked by the presence of several successive lime 'floors' (fig. 5), constructed at intervals over a time span of almost a millennium (Karkanas 2002; Karkanas and Stratouli 2008). These stable constructions, which show a remarkable consistency in the materials and techniques used for their manufacture, covered, or better sealed mostly discontinuous surfaces of no more than 30 sq. m. during the late MN and the LN, and *c.* 50 sq. m. during the CH. The manufacture of these constructions required effort and planning, as well as cooperative work, since it involved the selection of marl and limestone from areas

nearby the site, the transformation of raw materials into lime through a burning process, the transportation of lime into the cave, and the on-site processing of lime, by means of mixing with water and other materials, before its application to the underlying deposit.

Furthermore, the occupational deposits of Neolithic Drakaina comprise *in situ* preserved remains of hearths, lined by stones from the cave environment and millstones in secondary use, as well as material of several raked-out fire installations mixed with burnt food remains (Karkanas and Stratouli 2008).

Moreover, various bioarchaeological remains were recovered from the neolithic layers of the cave, including thousands of animal bones: domesticates are clearly abundant (ovicaprids dominate, followed by pig), while the not numerous wild faunal assemblage consists mostly of cervids (at least two species with red deer being the most common prey) and wild boar (Kotjabopoulou in preparation). In addition, a wide range of mollusks is present (e.g. *Mytilus*, *Patella*, *Phorcus*, *Dentalium*, *Spondylus*, *Columbella*), as well as very few remains of fish and crabs (Theodoropoulou in preparation). The plant/seed assemblage comprises three, or even four species of wheat, as well as two species of barley, a variety of pulses and few fruits. Based on the small number of on-site by-products of crop processing it seems likely that most of the archaeobotanical material from Neolithic Drakaina has been extensively processed (i.e. cleared) away from the site. The pattern that most cereals, pulses, almonds and figs were crushed and therefore fragmented and deformed indicates that the consumed plants were prepared to be rapidly cooked as some form of 'fast food' (Sarpaki in preparation).

The pottery includes a number of large pots, numerous small and medium-sized vessels, suitable for food preparation and consumption, as well as transportation of goods. It is worth noting that most of the pots, particularly those of the patterned wares, are highly fragmented (Stratouli 2007; Stratouli and Goudi in preparation). The chipped stone assemblage consists of *c.* 8,000 lithic artefacts, including *c.* 700 retouched tools (Andreasen in preparation). There is overwhelming evidence of on-site knapping of local cherts. The projectile points are



fig. 3 : Satellite image of Poros area with the location of the gorge and Drakaina Cave (source: Google Earth).

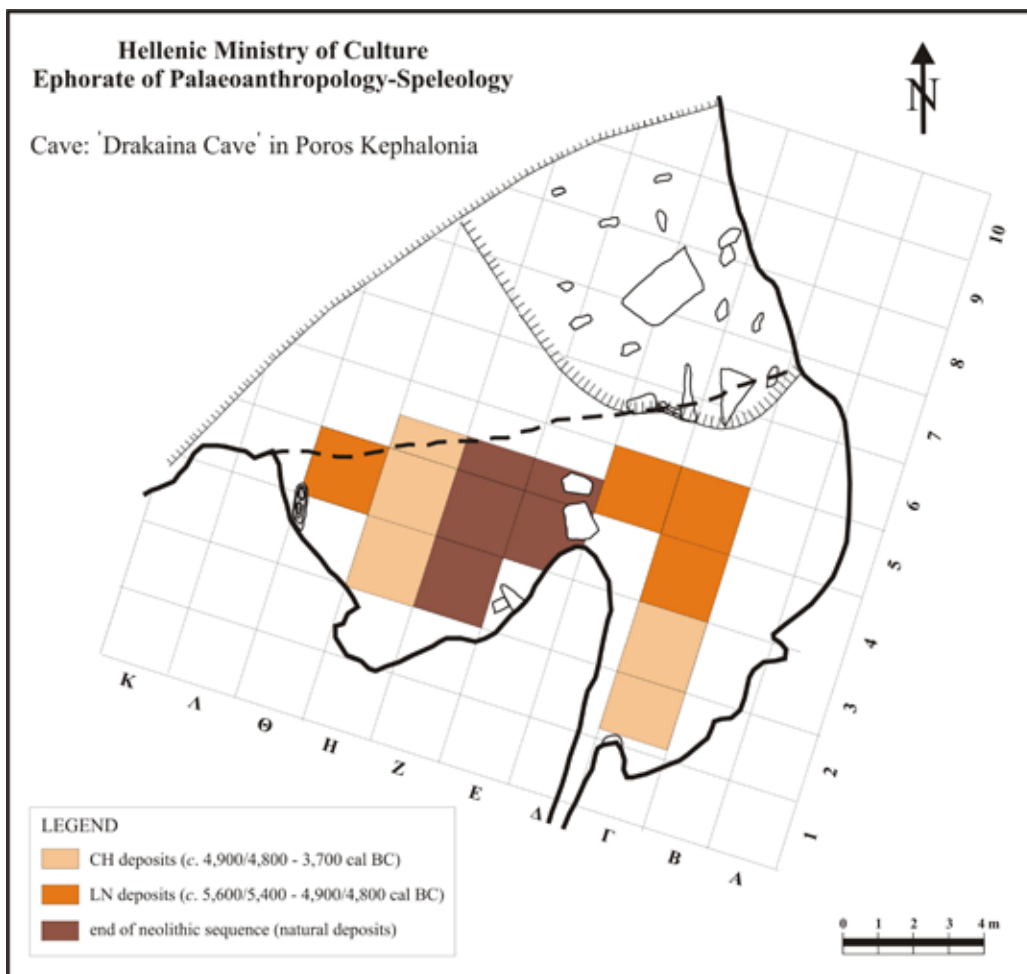


fig. 4 : Plan of Drakaina Cave (after the topographer Th. G. Chatzitheodorou), showing the excavation grid and the neolithic deposits revealed to date in each trench.





**fig. 5 :** View of the western part of Drakaina Cave (cf. Figure 4, Trenches E4 to E5, Z3 to Z5, H3 to H5, and Θ4), showing the stratigraphic sequence of the cave from the level of the natural bedrock to modern times, projected on the west profile of trenches H3 to H5 and on the south profile of trench E4. The red dotted lines indicate the approximate level of preserved lime 'floors' occurring within the neolithic sequence.



the dominant tool category, numbering *c.* 200 specimens. The tool-types represented in the non-projectile chipped stone assemblage from Drakaina include end-scrapers, burins, perforators and notched pieces. Further, the site has yielded a large assemblage of ground stone tools numbering more than 500 specimens, such as passive and active implements of percussion and abrasion, used among others for chert knapping, pigment processing and to some extent for food preparation (Bekiaris in preparation). Other artefacts, like small celts of gabbro and ornaments of talc, were transported to the island through inter-regional networks (Stratouli and Melfos 2008). Finally, two anthropomorphic pendants and some fragmented bracelets made of *Spondylus gaederopus* were deposited in the cave.

The stratigraphic evidence and the composition of the cultural material from the neolithic deposits of Drakaina indicate the use of the cave at intervals and for short periods of time. In our opinion, Drakaina Cave was a place of periodically significant social activity rather than a locus for residence or long-lasting occupation. This assumption is based on the absence of evidence supporting any type of storage of agricultural products, as well as the absence or scarcity of many types of tools indispensable in carrying out activities related to permanent residence (Stratouli 2007).

However, the repeated practice of constructing lime ‘floors’ in Drakaina Cave, whatever it may signify, creation of new surfaces and/or ‘sealing of the past’, is indicative of the cave significance for the neolithic community in the region during the 6th and the 5th millennium BC (Stratouli 2005; 2007). Further, the possibly special character of the events (e.g. gatherings), which took place in this small cave from time to time, is underlined by the deposited cultural record including the projectile points discussed below.

### The projectile tips from Drakaina Cave

The chipped stone industry of the site is marked by the high proportion of projectile points (fig. 6), which

are the prevailing tool category at Drakaina Cave. For the manufacture of the tips under discussion, chert<sup>1</sup> in the form of small and medium sized nodules as well as slabs were extensively exploited during both the LN and the CH occupation of the site. The chert varies in color and flaking quality and is predominantly, if not exclusively, acquired from rich primary and secondary chert sources on the island<sup>2</sup>. It seems very likely that the abundant (mostly secondary) chert deposits a few km away to the north, northwest, west and south of the Poros Gorge were heavily exploited along with nodules from the streambed, which flows through the gorge. A category of honey-colored chert may be of extra-local origin (Melfos in preparation), possibly identical to the so called ‘honey flint’, a raw material of fine quality, which occurs as an import in many lithic assemblages over large parts of Neolithic Greece (Perlès 1992). Furthermore, several pieces of obsidian were recovered, provenanced from the Melos Island in the Cyclades (Kilikoglou in preparation).

A total of 188 chipped projectile points from the pre-2004 excavation seasons were categorized as follows (see table 1): transverse arrowheads (n=10 pieces; figs. 7, 11a), asymmetrical points (n=132 pieces; figs. 8, 9, 11b-f, 12a-b), and tanged or tanged and barbed points (n=23 pieces; figs. 10, 12c-d). Some very expediently manufactured points (n=7 pieces) do not fit in any established typological group. Two CH large triangular points (fig. 12e), three possible preforms and 10 unclassifiable fragments were also recovered. It should be noted that the glue applied on the tang of many specimens (i.e. on 39 asymmetrical points and on 3 tanged and barbed points) and mainly the fractures caused from impact against hard material (cf. table 2) indicate that the implements under discussion were used as hunting weapons (Metaxas in preparation).

The LN deposits yielded transverse arrowheads and asymmetrical points (figs. 7, 8, 11). The ‘asymmetrical

<sup>1</sup> - All siliceous rocks from Drakaina Cave are classified as ‘chert’ (Melfos in preparation).

<sup>2</sup> - For a more extensive discussion on chert sources at Kephallonia Island, see Foss 2002 and Melfos in preparation. For a categorization of chert found in Drakaina Cave see Andreasen in preparation, and Melfos in preparation.





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fig. 6 : Various groups/types of projectile tips from the LN and CH layers of Drakaina Cave.



fig. 7 : Transverse arrowheads from the LN layers of Drakaina Cave.

points' include both shouldered points (figs. 8, 11b-e) and points on which the tang is not formed by a shoulder (fig. 11f). They were both manufactured on suitable blanks, namely flakes and pointed blades. Blanks were detached from the core by means of both hard and soft percussion without any significant preparation (even cortical flakes were occasionally used). The lack of morphological standardization is indicative of the *ad hoc* blank procurement. In most cases, blanks required only marginal modification in order to be transformed into projectile tips. The overall picture of the Drakaina transverse and asymmetrical tips production is the use of a time- and labor-saving manufacture technique.

Concerning the functional properties of the points, it can be noted in general that while the cutting edge of transverse arrowheads served to cut and cause hemorrhage, that of asymmetrical points is shaped to enlarge the wound inflicted by the tip of the point. However, there seems to be no clear typo-morphological boundary between the two groups.

Only few asymmetrical points, mainly made on blades, display invasive or covering retouch. They represent a distinct technological tradition, implementing a more controlled procurement of blanks and more investment in retouch, present at Drakaina Cave from its initial occupation. This practice became more common during the subsequent CH period, when tanged and barbed points came into use in the Drakaina Cave area.

Asymmetrical points continued to be manufactured into the CH period (figs. 9, 12a-b). However, the CH cultural record of the cave is marked by the presence of tanged and barbed points, made mainly on blades of predetermined shape (figs. 10, 12c-d). Their manufacture entails more investment in retouch for the forming of both the tang and the tip. Some skillfully made tanged and barbed points could indicate specialized production in the region.

### Aspects of change of chipped projectiles in the Neolithic of Greece

In contrast to Drakaina Cave, after published data, transverse arrowheads and shouldered points are absent from other LN sites in Greece. Even on Kephalaria,

no artefacts of that kind were included among the findings of a recently conducted extensive survey, according to which several LN and/or CH sites were recognized on the basis of diagnostic chipped stone pieces (Foss 2002). Shouldered points occur at Corinth and Franchthi Cave in the MN or at latest in transitional MN/LN layers (Robinson and Weinberg 1960; Perlès 1973, 2004). At Franchthi, shouldered points were used for a short period at the end of MN and transitional MN/LN, representing a modification of the transverse arrowheads (Perlès 2004). According to our view, this change should be connected with a shift of preference for tips suitable for inflicting a penetrating blow.

The appearance of tanged and barbed points at the beginning of LN at Franchthi Cave and at the same time in a large part of the Aegean (Diamant 1977; Cherry and Torrence 1984; Torrence 1991) signifies a further step in the direction of producing a 'penetrating' projectile tip. However, we suggest that the total superseding of any previously used projectile tip by the introduction of tanged and barbed points made on blades may be attributed to the overwhelming replacement of local cherts by imported obsidian, which occurred at the same period, and to the subsequent implementation of different techniques for its utilization. However, any development in hunting techniques could have caused changes in hunting gear. That can also explain the trend towards penetrating weapons.

Perlès and Vitelli (1999) have stated that the large-scale influx of obsidian into southern Greece reinforced local production and promoted a degree of de-specialization. However, the pressure technique, which was widely implemented for the procurement of obsidian blades -used as blanks for tanged and barbed points-, presupposed considerable skill; therefore, the deduction that the manufacture of obsidian tanged and barbed points was primarily carried out by specialists is probable. In addition, the detaching of obsidian blades allows a more controlled and sparing exploitation of this imported raw material. Essentially, the widespread utilization of obsidian in southern Greece caused the decline of local chert utilization, which seemingly rendered expedient techniques for manufacturing shouldered points on



Group/Type of Projectile Tips	Chrono-stratigraphic horizon			
	LN	CH	unknown	Total
asymmetrical	90	40	2	132
tanged/tanged and barbed	0	23	1	24
transverse arrowheads	10	0		10
triangular	0	2		2
miscellaneous	5	2		7
preforms	0	3		3
unidentified (fragments)	5	5		10
Total	110	75	3	188

**tab. 1** : Distribution of the Drakaina Cave projectile tips' groups/types according to main chrono-stratigraphic horizons of the neolithic use of the site (LN and CH).

Group/Type of Projectile Tips	State of preservation		
	intact	broken	
		impact fractures	other fractures
asymmetrical	83	20	30
tanged/tanged and barbed	6	5	12
transverse arrowheads	10	0	0
triangular	1	0	1
miscellaneous	6	0	1
preforms	3	0	0
unidentified (fragments)	0	0	10
Total (numbers)	109	25	54
Total (%)	58,0	13,3	28,7

**tab. 2** : State of preservation and breakage patterns of the Drakaina Cave projectile tips.



fig. 8 : Shouldered asymmetrical points from the LN layers of Drakaina Cave.

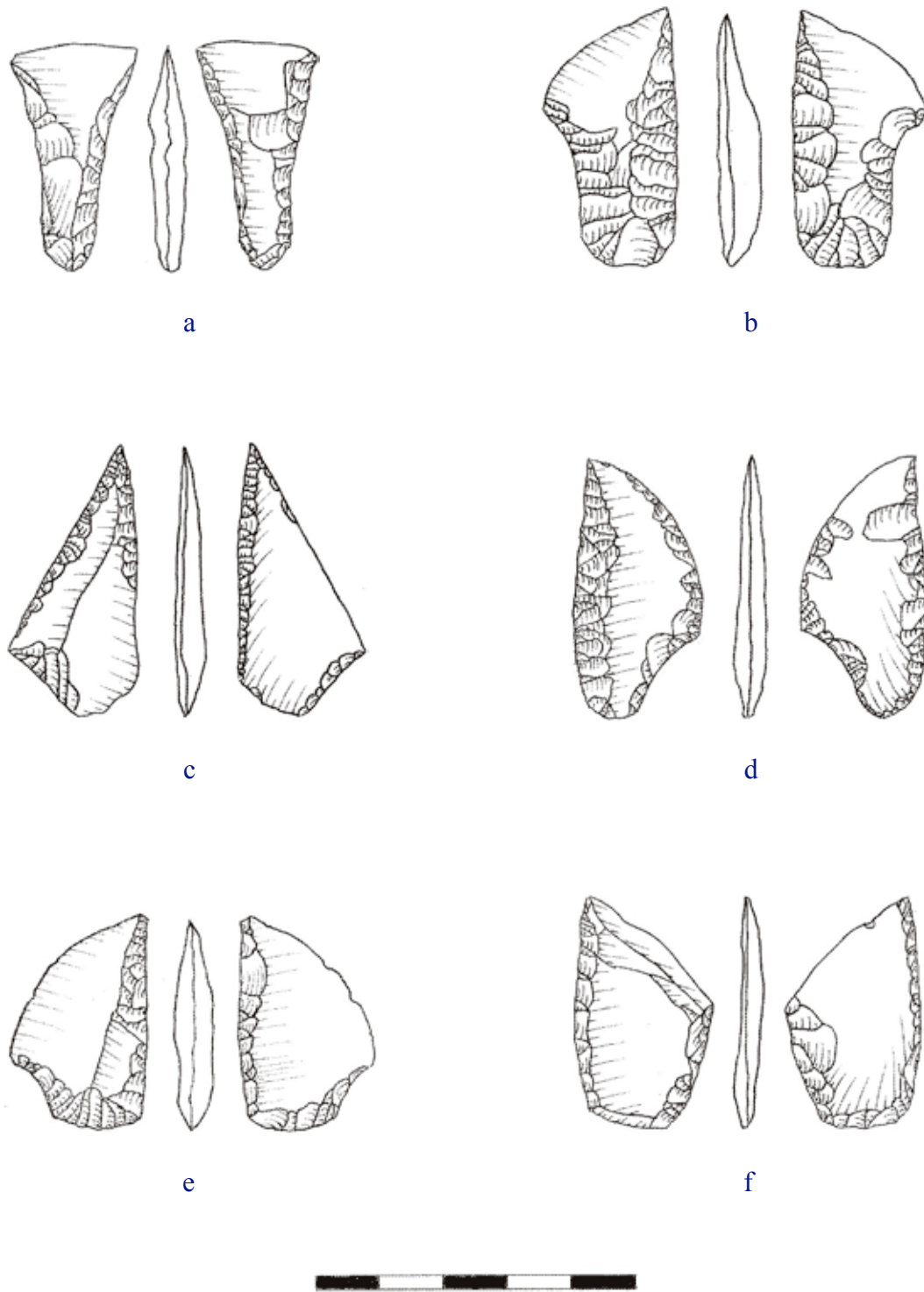


fig. 9 : Various asymmetrical points from the LN and CH layers of Drakaina Cave.



fig. 10 : Tanged/tanged and barbed points from the CH layers of Drakaina Cave.

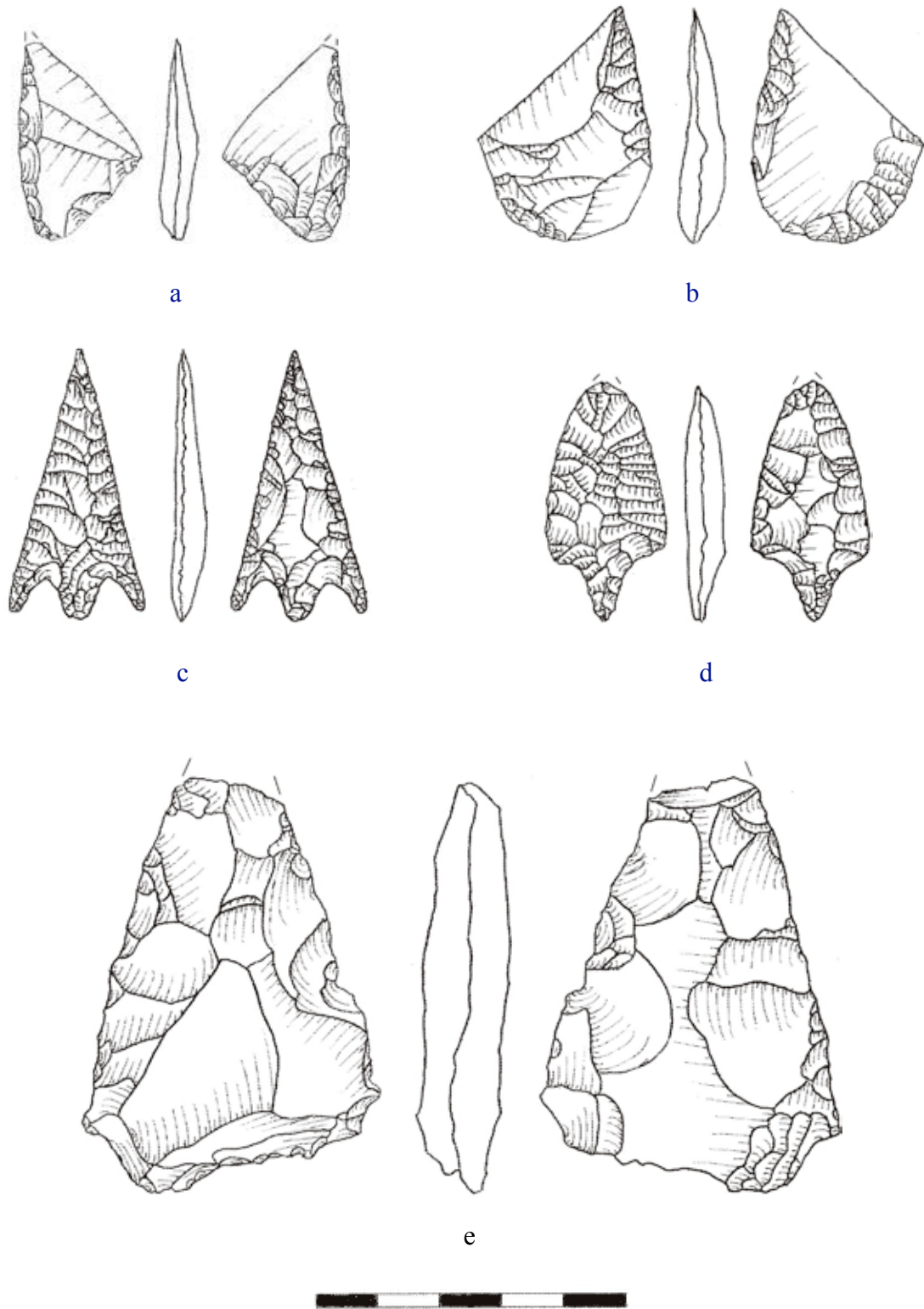




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**fig. 11** : Projectile tips from the LN layers of Drakaina Cave: transverse arrowhead (a); shouldered asymmetrical points (b-e); non-shouldered asymmetrical point (f).





**fig. 12** : Projectile tips from the CH layers of Drakaina Cave: asymmetrical points (a-b); tanged and barbed point (c); tanged point (d); triangular point (e).



flakes unfavorable. The new projectile tip type marks a shift to increased investment in both procurement of predetermined blanks and retouch.

Drakaina Cave does not fit this pattern, since obsidian is scarce equally in both the LN and the CH deposits of the site. The preference for local raw materials in the region of the cave even during the LN and the CH seemingly enabled the persistence of traditional techniques connected with cherts, and as a consequence the long production and use of asymmetrical points and transverse arrowheads. The vast quantity of local cherts in the area of Drakaina permitted individuals to manufacture chipped stone tools in order to cover their own needs, rather than rely on specialists or on the circulation of tools, prepared cores and blanks. Expedient techniques perhaps became popular, because they did not involve significant skills and time investment (Carlstein 1978: 152). According to Andreasen (in preparation), many of the cores from Drakaina Cave, of which some are discarded at an early stage of flaking, demonstrate little concern for preparation and maintenance.

As mentioned above, raw material exploitation did not change during the CH in the region of Drakaina Cave and imported obsidian remained scarce. However, even though the traditional expedient technique of manufacturing asymmetrical points persisted, the transition to the CH in the area of the cave is marked -among other evidence of the site's material culture (e.g. pottery changes)- by the adoption of tanged and barbed points. The appearance of tanged and barbed points in the early stage of the CH at Drakaina Cave could reflect socioeconomic and ideological developments that took place in the region. This is supported by patterns of change mainly in pottery, i.e. production of a distinctive polychrome ware (Stratouli and Goudi in preparation), which also occurs in Choirospilia (Zachos and Dousougli 2003), and of pithoid vessels with plastic decoration, which is a widespread feature of the CH in a large part of south Aegean (Zachos 1987). Similarly, at the MN/LN transition at Franchthi, the shift from cutting to penetrating weapons coincides with a change in ceramic styles, a fact considered to reveal profound social changes as well (Perlès 2004). The

adoption or avoidance of a given technology can have cultural incentives (Rosen 1997, Karimali 2005: 189). In this sense, the adoption of tanged and barbed points in early CH at Drakaina Cave region can be interpreted as another indicator of the incorporation of the local neolithic community in wider interaction networks. Since projectile points could have a symbolic connotation (Perlès 1992), the distribution of a given projectile point type may have further ideological implications. This could be valid for some tanged and barbed points from Drakaina Cave as well, whose manufacture is of superior quality in comparison to the bulk of the projectile points assemblage. Such an assumption can also apply to the case of large triangular points, usually made of chert, traded via an extended network over a large part of the southern Balkans from the beginning of CH or slightly earlier. The latter are considered being of symbolic rather than utilitarian nature (Carter and Ydo 1996: 164-165; Moundrea-Agrafioti 1996: 104).

This brief presentation of the Drakaina Cave projectile tips, compared to other neolithic assemblages from southern Greece, indicates the 'conservative' character of this assemblage in terms of both technology and typology. It also identifies three incentives of change, namely function, raw material exploitation strategies and the plausible symbolic connotations of some artefacts. The latter aspect will be further analyzed in the context of the site.

### Projectile tips and the use of Drakaina Cave

There is compelling evidence that a part of the projectile points from LN and CH deposits of Drakaina Cave was the product of on-site manufacture. This is based on numerous lithic waste and cores unearthed at Drakaina. The vast majority were flake cores when they were discarded (Andreasen in preparation). The scarcity of crested blades rather precludes that blades were detached at an earlier stage of *in situ* core reduction. At least part of the chipped stone production in the cave aimed at producing suitable blanks for the manufacturing of mainly asymmetrical points.

Interestingly, reddish chert was frequently utilized at Drakaina for the production of projectile tips (20



pieces made of reddish chert out of 188 projectiles under discussion), since a very high percentage of the retouched tools made of reddish chert were projectiles. This pattern is perhaps not only connected with the fine flaking quality of the reddish chert. Honey-colored chert, which is of superior quality in comparison to the reddish chert, was also used in the case of Drakaina Cave for the manufacture of non-projectile tools, especially retouched blades. Therefore, it is tempting to suggest that the relatively frequent use of reddish chert in Drakaina Cave for the manufacturing of projectile points was endowed with some symbolic value. The cores of reddish chert recovered from Drakaina were almost exhausted, a fact which possibly indicates a raw material of elevated status, despite it was local and far from being rare. The significance of this raw material may be an outcome of the chert's reddish color and its correlation to blood. In addition, projectile tips made of reddish chert were more frequently burned in Drakaina as finished artefacts (8 artefacts or 40,0 %) than projectiles made of other chert types (9 artefacts out of 153 non-patinated specimens or 5,9 %). However, it is hard to evaluate to what extent burning was deliberate, and if so, what this practice signified. The burning of arrowheads, aiming at the alteration of the original raw material color, has been interpreted in the case of LN sites in Sweden as part of ritual practices (Larsson 2000). The frequency of burned projectile tips made of reddish chert at Drakaina Cave may also imply some kind of ritual activity.

Concerning the conditions under which the material under consideration reached the cave or was deposited there, it is certain that several impact-fractured projectile points were discarded at Drakaina: in sum, 25 impact-fractured pieces out of 188 projectiles, which represents 13,3% of the total projectile assemblage and 31,6% of the broken pieces (cf. table 2). However, the majority of projectile points were deposited in Drakaina unbroken (cf. table 2) and still usable. The rest of the retouched chipped stone tools also display few signs of maintenance. Interestingly, the same pattern has been observed on the ground stone tools, which are also abundant, namely more than 500 pieces (see above). With few exceptions, the ground stone tools seem to have had a short life span, being

discarded shortly after they were initially used (Bekiaris in preparation). Both active and passive ground stone tools, with rather few exceptions, display signs of limited use. Among other features, it should be mentioned that few of the ground stone tools are fractured and abrasion's use wear is usually at an early stage.

The overwhelmingly local provenance of the raw materials used for chipped and ground stone tools at Drakaina may have contributed to the observed trend of discarding many specimens albeit being at fresh condition. However, assuming that the cave was used for gatherings of special character (Stratouli 2005; 2007), we can speculate that chipped stone tools, including projectiles (as well as other artefacts, like ground stone tools and pottery), were specifically used during, or in connection to those occasions and were afterwards disposed in the cave. Following this assumption, cultural directives or beliefs perhaps inhibited any further use of the implements participating in special social occasions. Although such a scenario seems plausible, it cannot be substantiated at the present stage. Ethnographical observations suggest that it is not always possible to distinguish between discard and storage (Sillitoe and Hardy 2003). Nevertheless, the presented evidence points to an integral role of chert knapping in the events that took place in Drakaina Cave. The fact that the projectile tips were mostly manufactured on-site may provide evidence regarding the nature of those events. In this sense, it is possible that they included a series of actions pertinent to hunting, such as preparation (encompassing tasks like the manufacture of projectile tips), and/or the final dismemberment of the carcasses and the disposal of the projectile tips embedded in them.

Hunting presupposes the cooperation of a number of individuals, and can be a way of forging or maintaining bonds between the members of the community or even neighboring ones. In such a case, it would be of significance to participate in events taking place at Drakaina Cave, which preceded or followed hunting expeditions.

The manufacture and deposition of projectile points in Drakaina is indicative of social events on site reoccurring at intervals over a period of approximately 1,000 years.



A similar established practice concerns the construction of lime 'floors' at the cave over many generations. Both patterns are regarded as examples of the incorporation and projecting of particular ideologies and/or identities of neolithic society in the region of Drakaina Cave.

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# GEOMETRIC WEAPON ELEMENTS DURING THE NEOLITHIC IN THE EASTERN IBERIAN PENINSULA : TYPOLOGICAL, TECHNOLOGICAL AND FUNCTIONAL ASPECTS

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Antoni PALOMO

## Abstract

In this paper, we present a global view of the principal traits of the evolution of Neolithic geometric microliths in Eastern Spain (principally in Catalonia and the Valencia region). Our discussion addresses two aspects. The first concerns the morpho-technological and functional relations of these pieces, as well as their diachronic transformation. Following this orientation, we present a summary of recent typological, technological and traceological studies. The second aspect concerns the relationship between microliths and their archaeological context with particular focus on economic data, as well as funerary conditions, which permit us to develop new lines of research and hypotheses.

**Key-words :** Iberian Peninsula, Neolithic, lithic tools, geometric, projectile.

## Introduction

Javier Fortea (Fortea, 1973) conducted an early study of microliths in eastern Spain. Based on comparative stratigraphy, he established an evolution of Late and Final Mesolithic industries of the geometric complex of the Cocina facies. He also revealed differences in the lithic industries of the Cardial Neolithic.

During the 1980's, archaeological data were greatly enriched and microliths were studied as a first indicator of the filiations of industries during the process of Neolithization (Barandiarán and Cava, 1989; Juan Cabanilles, 1984 and 1985). At this time, microliths from phases before the Neolithic were poorly known: the only well defined archaeological culture was in Catalonia—Sepulcrod de Fosa—where the microliths were considered only as characteristic elements of tombs. Outside of Catalonia, the presence of geometric elements alone was sufficient for the identification of an archaeological context, in this case, the Neolithic or Epipalaeolithic tradition (e.g. in the Bas Aragon region).

Later research, during the 1990's and early 2000's, modified our perception of microliths. New excavations in each region yielded a great diversity of archaeological contexts (village, cave, rock shelter) where microliths were present from the Early Neolithic to the Eneolithic periods (fig. 1 and 2). At the same time, methods in lithic studies were renewed with the introduction of concepts such as “*chaîne opératoire*” (operational sequence) and “lithic production”, both of which were employed as a structuring framework integrating raw material studies, a technological approach and microwear analyses.

## Neolithic microliths : a global perspective

A first observation that can be made concerning Early Neolithic microliths is that they show a morphological and technological rupture from Final Mesolithic industries, which are characterized by a dominance of triangles with abrupt retouch and the use of the microburin technique. In addition, significant technological differences in the bladelet debitage of Early Neolithic sites such as Cova de l'Or, Chaves and La Draga,

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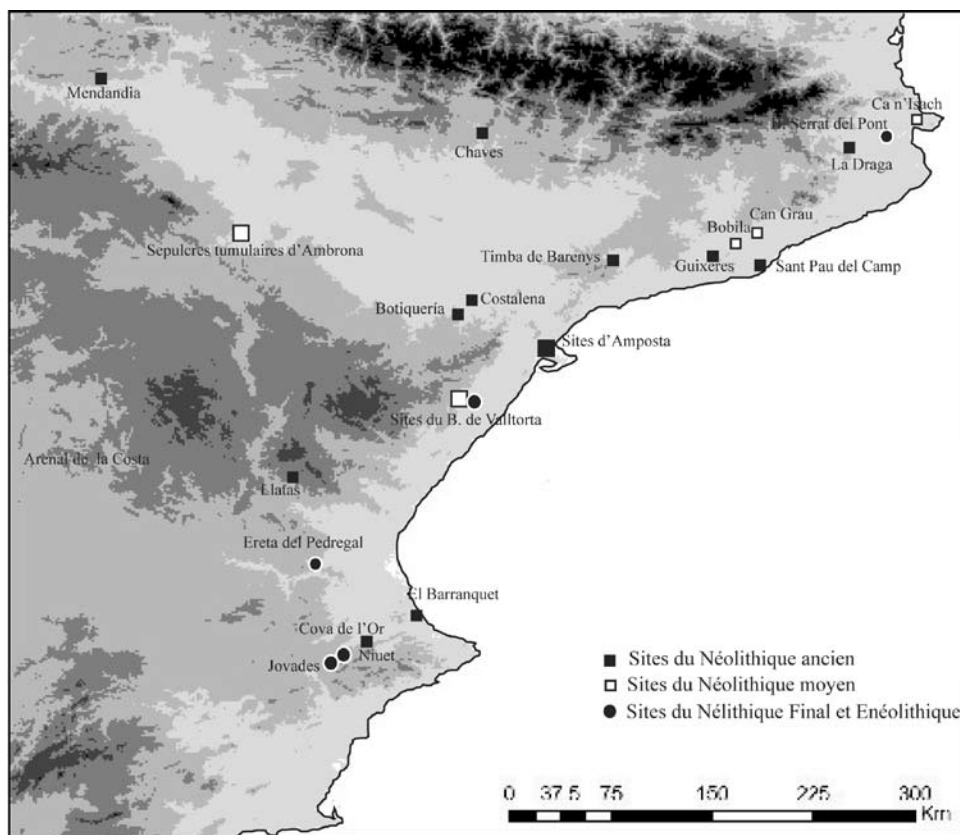


fig. 1 : Locations of sites cited in the text.

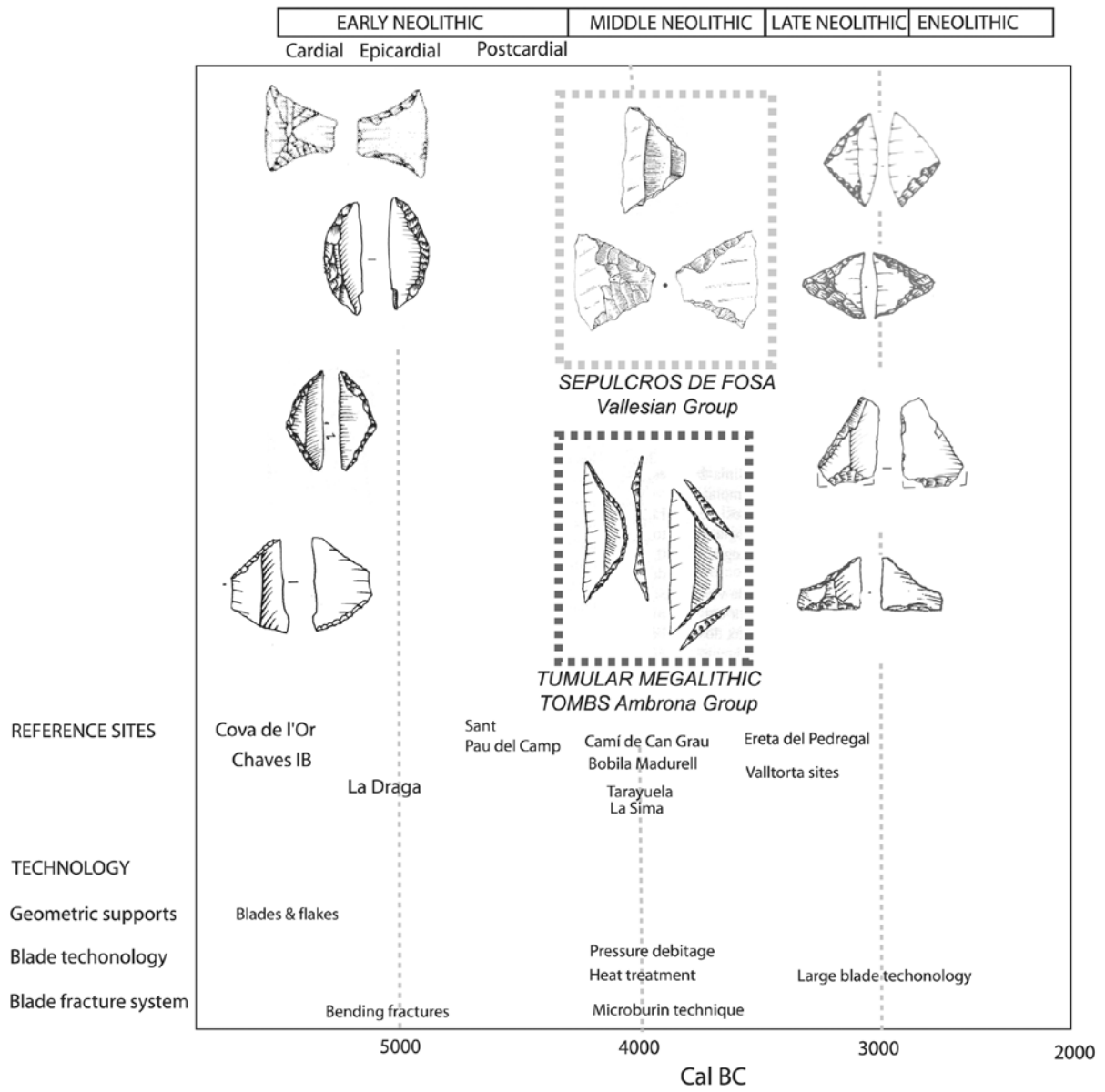


fig. 2 : General evolution of geometric weapon elements during the Neolithic in the eastern Iberian Peninsula.



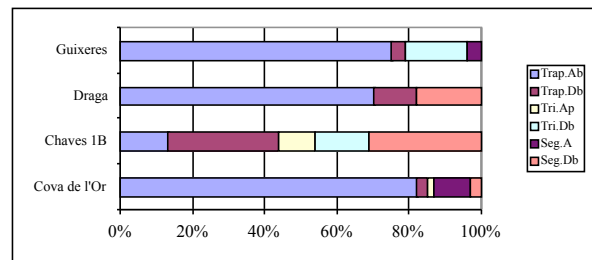
prevent the establishment of a phylogenetic relationship between these two cultural complexes (García, 2005).

In contrast to Mesolithic industries, the micro-burin technique is non-existent, or only very rarely encountered in Early Neolithic assemblages. Analyses of microliths show a general dominance of trapeze forms with mostly abrupt retouch, but also with semi-abrupt, inverse retouch or flat, direct, invasive retouch.

The available data on microliths of the Cardial period show differences that are related to the diversity of Cardial groups and their evolutionary processes (graph. 1). The site of Cova de l'Or contains the largest assemblage of the southern central Cardial group in Valencia (Juan Cabanilles, 1984). These microliths are characterized by a dominance of trapezes with abrupt retouch and a concave side. The other basic geometric forms, such as segments and triangles (in this order of importance) are much less numerous. The segments were formed by abrupt retouch. The site of Guixeres de Vilobí has yielded the most complete lithic assemblage of the Cardial complex in Catalonia. The microliths are composed of trapezes with abrupt retouch. In contrast to Cova de l'Or, however, the symmetric and asymmetric forms are well represented. Triangles with bifacial retouch constitute the second morphological category, while segments with abrupt retouch and bifacial trapezes are poorly represented (Mestres, 1987). The site of La Draga belongs to the following phase, the Late Cardial, in Catalonia. This site clearly illustrates the traits existing continuity through the presence of symmetric trapezes with alternate truncations already observed, as well as by the significant increase in microliths with bifacial retouch, such as trapezes and segments (Palomo, 2000).

The Cardial group of Haut Aragon, represented by the site of Chaves (levels Ib and Ia), shows different behaviours characterized by a high proportion of segments and triangles with bifacial retouch (Cava, 2002). These traits signal the characteristics of the following Epicardial phase (5100-4700 cal. BC), in which we observe a

predominance of segments with bifacial retouch in geometric assemblages, to the detriment of other morphological categories such as triangles and trapezes (Juan Cabanilles and Martí, 2002).



**graph. 1** : Early Cardial Neolithic. Relative frequencies of the principal microlith types. Trap. Ab: trapeze with abrupt retouch; Trap. Db: trapeze with bifacial retouch; Tri. Ap: triangle with abrupt retouch; Tri. Db: triangle with bifacial retouch; Seg. A: segment with abrupt retouch; Seg. Db: segment with bifacial retouch.

Usewear studies were conducted on the microliths of eight Early Neolithic sites (Cardial and Epicardial phases). The site of La Draga is the most representative due to the abundance of its remains. We thus used it to complement the information provided by the other sites. In table 1, we summarize interpretations based on different functional analyses of the arrangement of microliths on arrow shafts. The most common hypothesis, particularly for the segments, is that they were used as a point. The other hypotheses proposed are that of a “tranchant” position, a transversal edge position, and finally, as a barb or in laterally inserted. We must note that the majority of evidence supporting the hypothesis of a “tranchant” position comes from the site of Mendandia (Domingo, 2005). We think that this case could be exceptional since their penetrating capacity is very weak. It is possible that at this site, this particular type of arrowhead was employed to hunt species without penetrating them (birds or small mammals). On the other hand, the interpretation that the segments were used as points is contrasted for the other sites retained since these pieces favour the formation of recognizable edge damage, such as long burin-type fractures initiated on the distal extremities. The triangles with bifacial retouch are more numerous and the results of functional analyses show they were used point or

A. Segments					
Site	n	Point	Tranchet	Barbelure	Reference
C. de Llatas	9	6	2	1	García et Jardón, 1999
Mendandia II	7	0	7	0	Domingo, 2005b
Valltorta	4	4	0	0	Fernández, 2006
C. del Vidre	2	2	0	0	Gibaja & Palomo, 2004
La Draga	2	2	0	0	Gibaja & Palomo, 2004
Kobaederra	1	1	0	0	González e Ibáñez, 1999
<b>Total</b>	<b>25</b>	<b>15</b>	<b>9</b>	<b>1</b>	

B. Triangles					
Site	n	Point	Tranchet	Barbelure	Reference
Botiqueria 6-8	3	2	0	1	Domingo, 2004
Costalena c2	2	1	0	1	Domingo, 2004
C. de Llatas	2	2	0	0	García et Jardón 1999
Kobaederra	1	1	0	0	González & Ibáñez, 1999
<b>Total</b>	<b>8</b>	<b>6</b>	<b>0</b>	<b>2</b>	

C. Trapezes					
Site	n	Point	Tranchet	Barbelure	Reference
La Draga	5	1	3	1	Gibaja, 1999
C. del Vidre	1	1	0	0	Gibaja & Palomo, 2004
C. del Frare	1	0	1	0	Gibaja & Palomo, 2004
Valltorta	2	0	2	0	Fernández, 2006
Botiqueria 6-8	2	1	0	1	Domingo, 2004
<b>Total</b>	<b>11</b>	<b>3</b>	<b>6</b>	<b>2</b>	

**tab. 1** : Compilation of the functional interpretation of usewear analyses conducted on Early Neolithic sites: A. Segments, B. Triangles, C. Trapzes.

on a lateral edge. The narrow form of the segments could be explained by the same mode of use. We must meanwhile remember that our current sample is insufficient to reach reliable conclusions. In the near future, we hope to present the next phase of our studies of this weapon element type, in which we will develop more complete conclusions, especially concerning the interpretation of a lateral position.

For the Post-Cardial Early Neolithic phase (4700-4100 cal. BC), we do not have a representative assemblage of microliths. Only the open-air site of La Timba de Barenys yielded an assemblage of microliths dominated by segments with bifacial retouch. Meanwhile, its only radiocarbon date (Miró, 1996) is problematic because the decorative techniques of the pottery (incised and appliqué) are older, suggesting the presence of an Epicardial phase. On the other hand, the information furnished for the late phase of Guixeres de Vilobí confirms the presence of trapezes with abrupt retouch (Mestres, 1987). In the Valencian Country, excavations conducted in new open-air sites, such as Barranquet de Oliva (Esquembre *et al.*, in press), will probably complete the lack of information for this period in this sector.

For this chronological phase, we can, for the first time, document the use of microliths as grave offerings since they have been found in the tombs of the Sant Pau del Camp necropolis and the inhumations of the Amposta group (Gibaja, 2003; Bosch and Faura, 2003).

For the Middle Neolithic (4100-3500 cal. av. BC), we observe the appearance of geographically separated cultural groups that develop different inhumation practices: Sepulcros de Fosa and tumulaire megalithic tombs.

The microliths of the Sepulcros de Fosa group are characterized by a clear dominance of trapezoidal forms that are particularly symmetric and asymmetric with a few examples of concave truncations and a small, very short base. They are strongly associated with a blade production system on a beige flint of exogenous origin, with heat treatment and pressure debitage (Terradas et Gibaja, 2002).

A typo-metric analysis conducted on a sample of 20 trapezes from La Bóbila Madurell shows an average length of 20.47 mm (standard deviation 3.13) and width of 12.87 mm (standard deviation 1.65 mm). These results attribute a length index of 1.6 with a standard deviation of 0.27.

The principal tumular tombs of the middle Elbe basin are located in the Abrona Valley and were excavated by the research team of Professor Manuel Rojo. The lithic assemblages of these tombs were studied by I. Alegre (Alegre, 2005). The principal characteristics of the microliths are a dominant representation of symmetric trapezes with a small retouched base, similar to the general form of the segments. The typo-metric projection of these trapezes indicates an average length of 25.3 mm and width of 9.17 mm. The combination of these values yields a higher length index (around 2.75) and a very standardized width. A significant number of these pieces have trihedral points on the apical parts of truncations, indicating the use of the micro-burin technique.

The interest of these two cultural groups resides in the fact that they developed different models of arrowheads—both with trapezes—with different typo-metric, technological and morphological characteristics, as is shown by a comparative analysis of the relations between their length and width, and the length of the small base (graph. 2).

The functional study of the microliths of the Sepulcros de Fosa was principally conducted by one of the authors of this paper (Gibaja, 2003). The principal function of trapezes was as a “tranchant” or as a transverse arrowhead with characteristic traits: symmetric and dissymmetric forms, very long transverse edge and different wide models for the small base. These traits reflect the low penetrating capacity of these microliths, as is confirmed by experimentation (Gibaja & Palomo, 2004). Furthermore, usewear analysis showed that a high number of these trapezes were not used, while others that were did not show the significant stigmata of edge damage. Generally, the trapezes used as points have a globally symmetric form with rectilinear, or sometimes concave, truncations (fig. 4). In some cases, their use created striations, as was documented at the sites of n’Isach and Gava de Catalogne.

There are no exploitable data to document the production contexts of the tumular megalithic tombs of the Ambrona

group. However, through a program conducted in the northern Valencian Country, we have been able to study several open-air sites containing the same type of trapezes (fig. 5) (Fernández, 2006a and b). The trapezes were produced *in situ* at these sites, generally with Tertiary flint from Miocene formations in the Elbe basin. One of their most characteristic technological traits is the frequent use of the micro-burin technique. A typo-metric analysis of the micro-burins shows a broad type different from those present in the Final Mesolithic sites. This type can be strictly correlated with the widths of the full debitage blades found in these same assemblages. In terms of usewear, these trapezes have well developed burin-type fractures, suggesting their use as points (Fernández, 2006b).

For the Final Neolithic and Eneolithic periods, we observe a general decrease in microliths in the lithic assemblages. The generalization of bifacial points can partly explain this profound change. This tendency confirms our observations of the regional variability represented by the morphology and technology of microliths (fig. 1).

In north-east Catalonia, we observe the presence of isosceles triangles with bifacial retouch in the sites of Pont de Bauma del Serrat and La Prunera (Borrell, in press). At the same time, in the Valencia and neighbouring regions, such as Murcia, the presence of rectangular trapezes is very characteristic. The principal corpus of these rectangular trapezes from habitat contexts has been documented at the open-air sites of the Valltorta ravine in the Castellón (Fernández, 2006a). In these open-air sites, as well as in some levels in caves such as La Cova de la Pipa, these trapezes were found in association with micro-burins. The rectangular trapezes are characterized by a rectilinear truncation that forms a convergent point on the large base (fig. 6). The side is generally modified by different types of bifacial retouch created by different procedures: semi-abrupt, marginal bifacial retouch; semi-abrupt inverse retouch, and; flat invasive retouch whose flat scars direct and facilitate the insertion of trapezes into the extremity

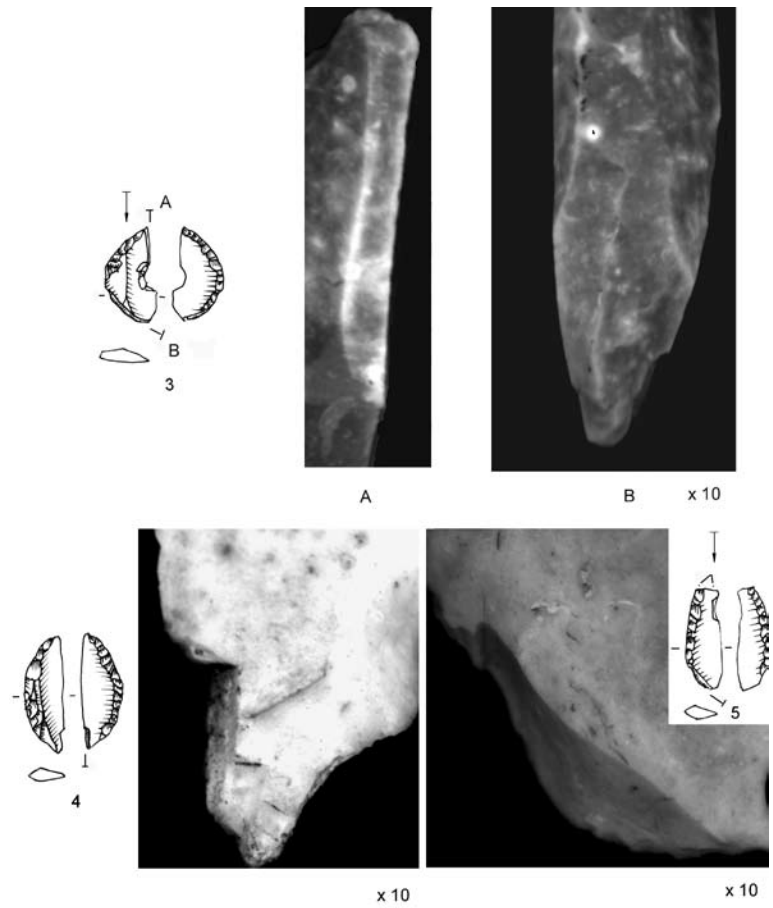
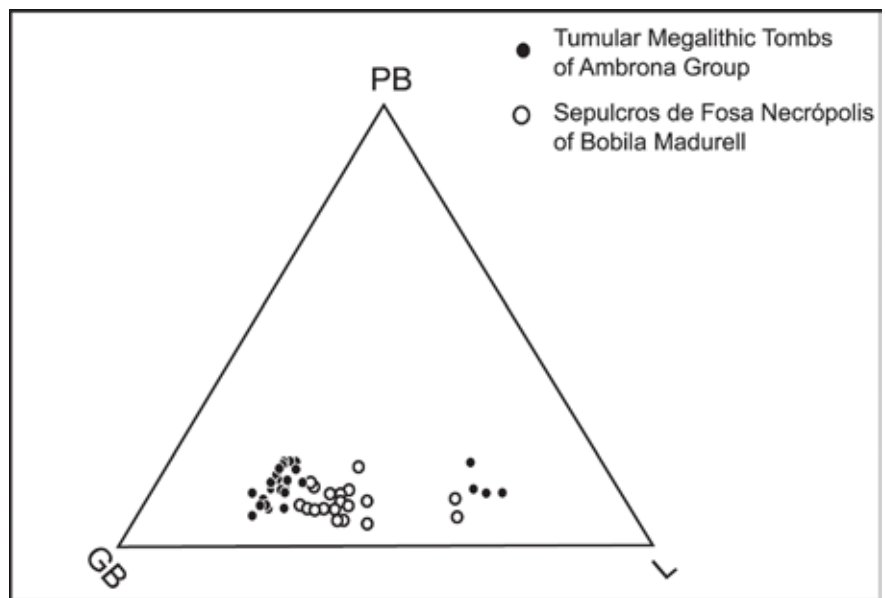


fig. 3 : Burin-like fractures on segments used as points. (Rueda, Valltorta complex of archaeological sites).



graph. 2 : Comparative triangular diagram of the dimensional relationships of Middle Neolithic trapezes.



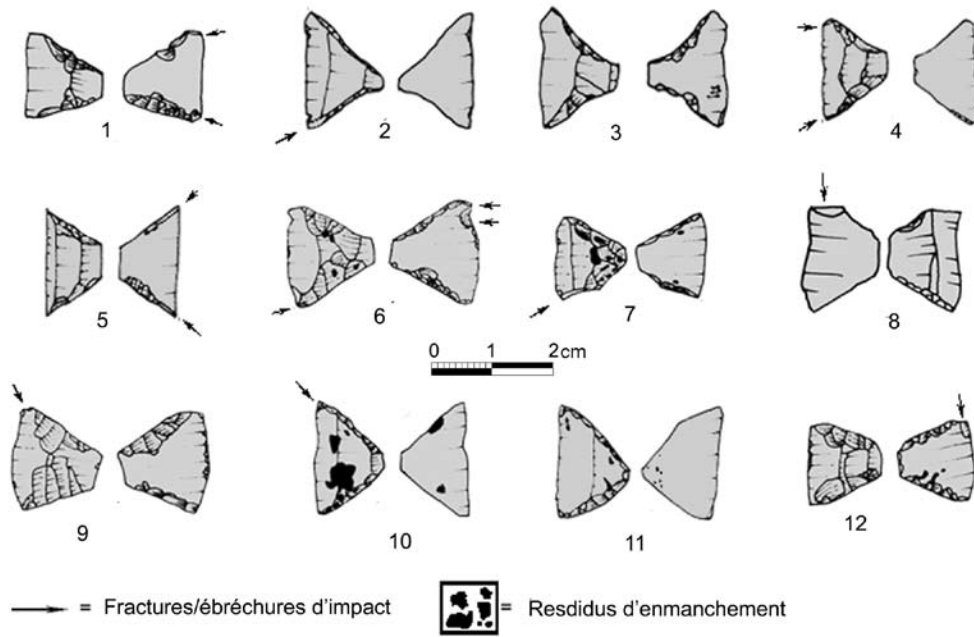


fig. 4 : Middle Neolithic trapezes in Catalonia : 1-5 used as « tranchant » arrowheads; 8-12 used as points; Provenience: 1-5 burial pits of Bóbila Madurell; 6-7 and 9-12 burial pits of Camí de Can Grau; 8 habitation pit of Bóbila Madurell.

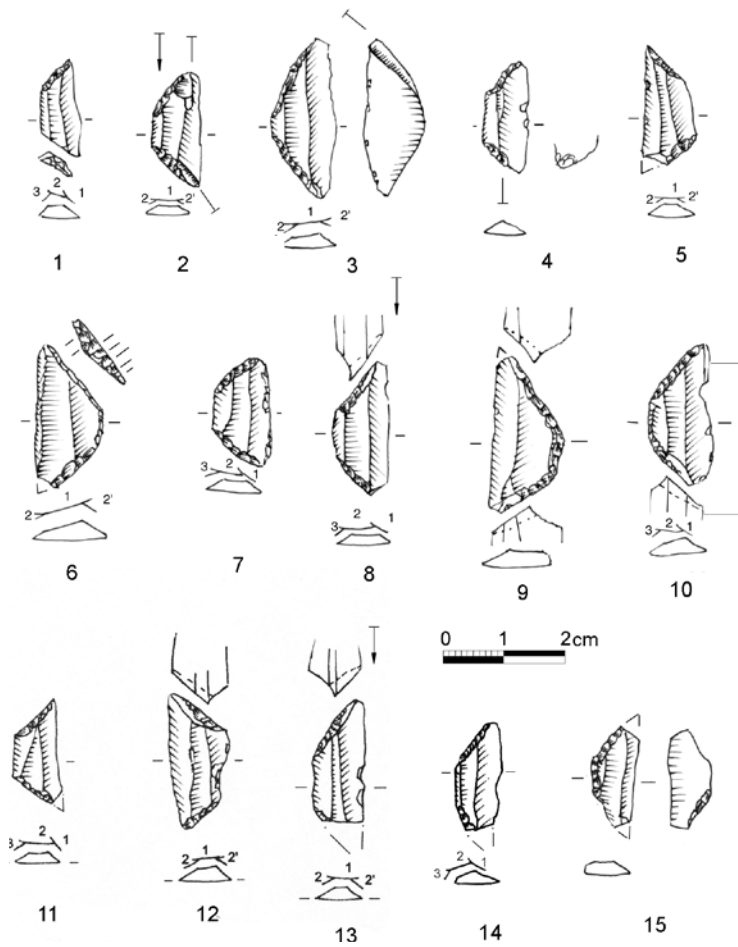


fig. 5 : Long trapezes from different assemblages in the Valltorta ravine (Castellón).



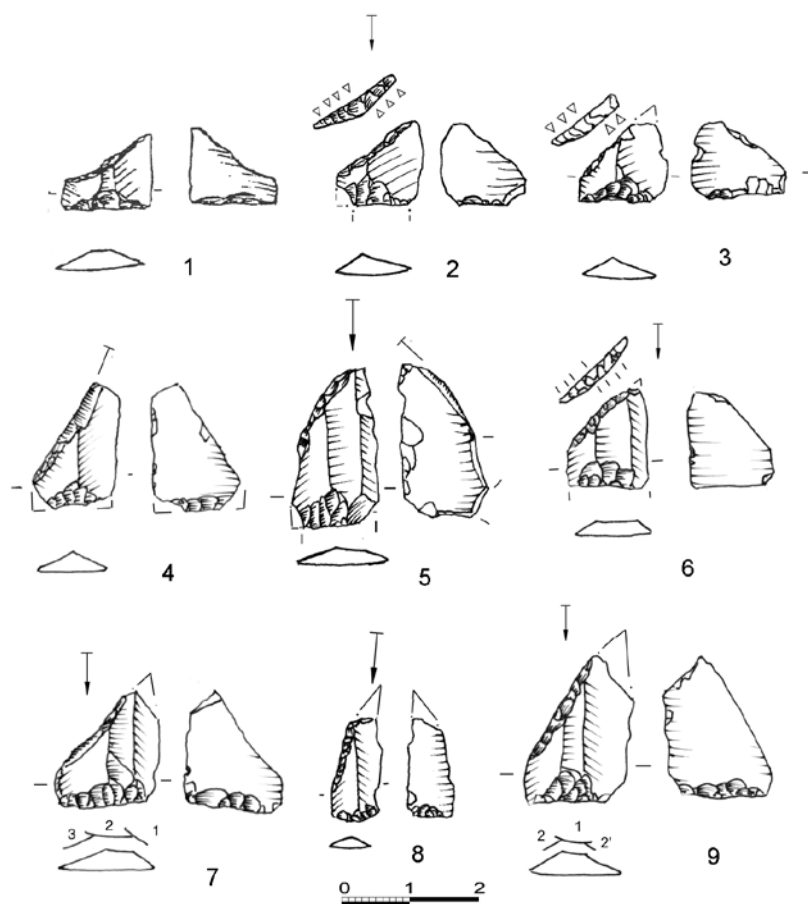


fig. 6 : Long trapezes from different assemblages in the Valltorta ravine (Castellón).

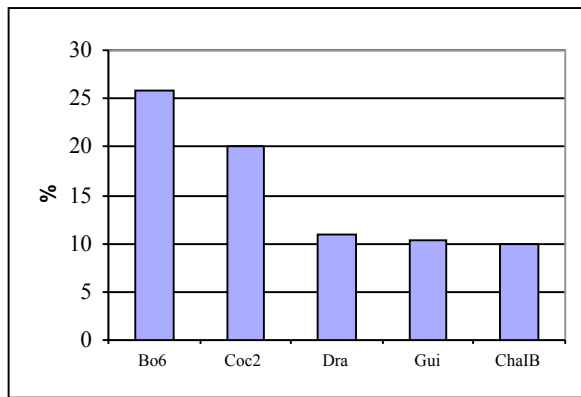
of the shaft. Usewear analysis confirms their use as points (Fernández, 2006b).

#### The economic context of Neolithic microliths

In this section, we will focus on the general evolutionary tendencies of microliths through a consideration of their relationships with other components of the material culture and economy. We should again remark the general quantitative decrease of microliths in assemblages during the Neolithic. This phenomenon occurs in parallel with a general decrease in hunting activities, but in the Middle Neolithic it is also combined with a significant increase in the symbolic value of arrows in association with funerary activities.

In the Early Neolithic, we can establish a clear correlation between the number of geometrics in lithic assemblages and the relative frequency of

wild fauna. However, this global view is obviously conditioned by the status or function of the sites considered (graph. 3): a higher number in caves and rock shelters, considered to be directly associated with hunting activities (e.g. Botiqueria 6: 25.88% and Costalena level 2: 19.99%) (Barandiarán, 1978; Barandiarán and Cava, 1989), and a lower number in villages (La Draga: 11%, Guixeres de Vilobí 10.27 %) (Palomo, 2000; Mestres, 1987) and habitat caves (Chaves IB:10,02%) (Cava, 2002). The faunal assemblages of these sites also show a few differences. For example, at Cova de l'Or wild ungulates represent around 9.7% of the assemblage, while the common red deer is the main hunted species (8.4%) (Pérez 1980). On the other hand, at the lakeside site of La Draga, hunting is implicated in 6.8% of the faunal assemblage, though a larger range of species is hunted (*Cervus elaphus*, *Capra pyrenaica*, *Bos Taurus*, *Sus scropha*) (Saña, 2000).



**graph.3:** Relative frequency of microliths in lithic assemblages during the Early Neolithic. Bo6: Botiquería level 6; Coc2: Costalena level 2; Dra: La Draga; Gui: Guixeres de Vilobí; ChalB: Chaves IB.

For the Middle Neolithic, we have already noted that the microliths are primarily associated with funerary contexts. This situation prevents us from evaluating the economic significance of hunting since representative faunal assemblages are absent.

On the other hand, for the Final Neolithic and Eneolithic periods, we have access to a significant number of contexts (particularly villages) for which faunal analyses could be conducted (Pérez Ripoll, 1999). As we observed in the villages of Jovades, Niuet and Arenal de la Costa, the representation of wild mammals in the faunal assemblages is very low and thus shows a strong correlation with the low frequency of microliths. Arrowheads with flat, bifacial retouch are usually much more numerous than geometric microliths, but they do not reflect the specific role of hunting in the economic system. Meanwhile, and in contrast to the preceding observation, there are sites that present a much clearer association of wild mammals and arrowheads. For example, the site of Ereta del Predregal (Navarrés Canal) has yielded a large number of arrowheads made from local limestone flint (Juan Cabanilles, 1997) and wild ungulates representing 31.5% of the faunal assemblage (*Cervus elaphus* 28.1% et *Capra pyrenaica* 3.4%) (Pérez Ripoll, 1990). This situation strongly suggests that economic and ecological factors influenced hunting practices during the later Neolithic and Eneolithic periods. The site of Ereta del Pedregal could thus be correlated with the economic changes that occur in the

agricultural system during the final Neolithic and with a demographic increase that generated the colonization of new, marginal sectors. The function of hunting would have been to eliminate herbivores that were potential competitors of sheep and to protect and maintain cultivated land. Other hypotheses are feasible, such as the search for additional proteins or the exploitation of wild ungulate resources, such as skin, horns and bones, in the context of exchanges between regions and craft specialization. Meanwhile, these possibilities do not appear to explain the additional production of bifacial points observed in numerous villages during this period. In our opinion, symbolic factors, such as the construction of an archer identity, as well as the development of conflicts between groups, played an important role in the Mediterranean zone of Spain.

#### The social and symbolic context of microliths

In contrast to the Early Neolithic, for which the available data do not allow us to formulate hypotheses concerning the role and symbolic value of projectiles in societies, Middle Neolithic contexts are more favourable context for this endeavour. The differences observed in the concept of trapezes during this period can be correlated with phenomena related to the construction of group identities in the ways that we observed in different funerary practices associated with tumular megalithic tombs and the Sepulcros de Fosa of neighbouring regions. Moreover, in the Sepulcros de Fosa group, the systematic presence of microliths, as the principal components of tomb offerings, is strictly associated with the male gender. This phenomenon could be related to the conception of an archer identity by the different cultural traditions that thus constructed their own identity relative to other groups. A similar interpretation could be made for Levantine rock art in which we observe specific manners of representing arrowheads according to a discrete distribution model (Fernández, 2006b).

Despite their low representation in the lithic assemblages of the later periods of the Neolithic and the Eneolithic, microliths cannot be dissociated from

bifacial arrowheads. The range of formal and stylistic variability could therefore be explained by a different quiver composition, reflecting differences in the rank or status of individuals (Pétrequin and Pétrequin, 1990).

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# BUSHMEN ARROWS AND THEIR RECENT HISTORY

## CROSSED OUTLOOKS OF HISTORICAL, ETHNOLOGICAL AND ARCHAEOLOGICAL SOURCES

Bruno BOSC-ZANARDO, François BON & François-Xavier FAUVELLE-AYMAR

### Abstract

Bushmen weapons were considered very early by ethnology: the vision of these nomadic hunter-gatherers walking away into the horizon of the Kalahari Desert, with their bows and arrows on their back, is one of the most iconic representations of this disappearing lifestyle.

Besides the technical values that were brought into play in the making of this equipment, their role as vector of social values has also been greatly illustrated. It has been shown, in particular, the way in which an arrow creates a link between the hunter and his prey, but also the interactions the arrow conveys between the user of the weapon and the social networks to which he belongs.

Nevertheless, most reference systems are based on the equipment of sub-contemporary and current populations, i.e. on those used by groups occupying a limited territory in the Kalahari Desert, straddling Botswana and Namibia. Yet, only a few decades ago, Bushmen occupied much vaster areas, corresponding to a large western half of Southern Africa, involving the exploitation of territories ecologically more contrasted than today. In addition, the socio-economic status of the ancestors of today's Bushmen was, it seems, more diversified: groups of nomadic hunter-gatherers lived side by side with pastoralists (who also practiced hunting), and it is likely that both sides belonged, to a greater or lesser degree, to societies with close links between them.

Research works realised on several collections of bows and arrows kept in South African museums and compared with historical sources (travel accounts from the 16th to the 19th centuries in particular), also bring to light greater diversity: the diversity of the actual armoury (the spear, the club and the throwing stick in addition to the bows and arrows); diversity in the way the arrows are actually made; and the diversity of their supposed functions (from hunting to war). Behind such diversity, we can try to grasp the complexity of the recent history of the Bushmen populations.

**Key-words :** Bushmen, Khoisan, bow and arrow, archaeohistory, ethnoarchaeology, Southern Africa

## Introduction

When we chose, within the framework of the “Khoisan Archives” programme directed by one of us (F.-X. F.-A.), to take an interest in Southern African populations of hunter-gatherers (Bushmen) and nomadic pastoralists (Khoikhoi), our ambition was to develop a “classic” ethno-archaeological approach, i.e. to analyse the sub-contemporary and contemporary data we could obtain on these populations via ethnology and history, so that, in return, we could interpret the archaeological data.

We then decided to focus our attention on a register of activities and a category of objects: hunting and related instruments, mainly bows and arrows to be specific. Besides the fact that it is with this register of Bushmen equipment that we were counting on developing methodological comparisons on a wider scale (towards European Prehistory in particular), it turns out that these objects are among the most favourable, within the material culture of these populations, to establish a link between the different sources at our disposal, i.e. archaeological, historical and ethnological.

However, contrary to our initial expectations, we quickly realised that this approach, far from opening the doors of a prehistoric past miraculously preserved in the confines of Southern Africa, had more reasons to lead us along the complex historical course which these populations experienced during the last centuries (Fauvelle-Aymar *et al.*, 2007). From this follows the archaeo-historical outline presented in this article, which consists in offering a problematic and theoretical framework for future studies. From a methodological point of view, this study relies mainly on the elaboration of an arrow typology, from which we are trying to extract a discussion on the value likely to be given to arrowhead morphology and its evolution during the recent centuries. From this point of view also, this can only be a preliminary study, hoping it will be followed by a more exhaustive analysis

of equipments (better recognition of other arrow parameters, the use or not of poison in particular, the study of bows, etc.), relying on a more detailed techno-functional approach.

## Societies and arrows

In the eyes of Westerners, Bushmen have always been dependent on their weapons. According to travellers confronted with these populations and their material culture between the 16<sup>th</sup> and the 19<sup>th</sup> centuries, these instruments were more than others the focus of attention, to such a point that the image of the “Hottentot” became rapidly indissociable from that of his bow and quiver (fig. 1). During the first ethnographic surveys and the constitution of the first collections (during the 19<sup>th</sup> century), it was again very naturally this gear which was to be found in the display cabinets and shelves of museums. Then, among the works of ethnologists of the last 50 years, this hunting gear was again often at the centre of their preoccupation when looking into the material culture of the last Bushmen populating certain parts of the Kalahari Desert (fig. 2 and 3).

Beyond the techno-economic meaning of this category of artefacts, these ethnological approaches revealed the cultural and social substance of that category. We think for example of the works of Wiessner (1983), illustrating the fact that arrows and, strangely enough, arrowhead morphology, represent strong markers of group identity (fig. 4)<sup>1</sup>. Moreover, we know, since the works of Marshall (1976), Biesele (1978) and Testart (1985), that among certain groups (the Kung in particular), the owner of the game that was shot down is not the hunter but the one who made the arrow that was used to kill the game. Indeed, during the sharing of hunted animals, the maker of the deadly arrow receives an important portion of the game or is appointed as the person in charge of distributing the carcass, while respecting the codes of the exchange system as practiced by these Bushmen groups. This exchange system, the *Hxaro*, is based on the donation

<sup>1</sup> - « The stylistic information contained in San projectile points was a good indicator of linguistic group boundaries » (Wiessner, 1983 p. 272)





**fig. 1** : Sample of illustrations from the 18th and 19th centuries representing Bushmen. From left to right and from top to bottom: a Bushmen family circa 1779; a Bushmen encampment in the Northern Cape region, drawing executed circa 1785 by Colonel Robert Jacob Gordon, commander of the Dutch garrison at the Cape, before the first British occupation of 1795; drawing by English artist Samuel Daniel who was accompanying Somerville-Truter's expedition in the interior of the Cape region in 1801; the following illustration, executed very probably at the turn of the 19th century, is a painting by the same artist, Samuel Daniel, entitled "Bushmen Hottentots armed for an expedition"; two Bushmen riding oxen and having been labelled "Tame Bushmen" by William Burchell, an English traveller who met and drew them in 1811 in the Karoo; the last plate, the work of C. D. Bell dated 1834, is supposed to represent Bushmen in a cave.



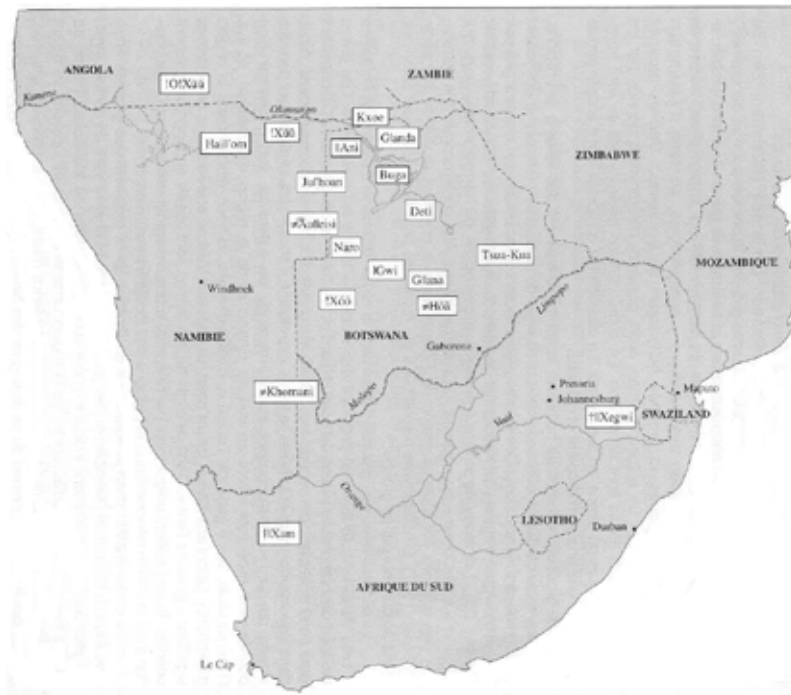
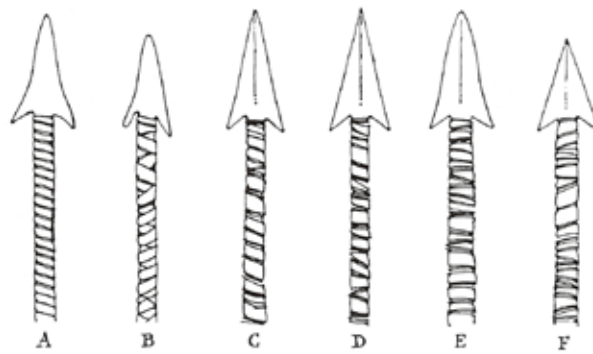


fig. 2 : Spatial distribution of current and sub-contemporary Bushmen groups (from Olivier and Valentin eds., 2005, p. 27).

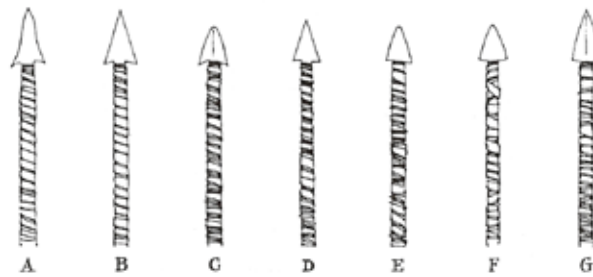


fig. 3 : Photographs of contemporary Bushmen living in the Kalahari (Botswana and Namibia).

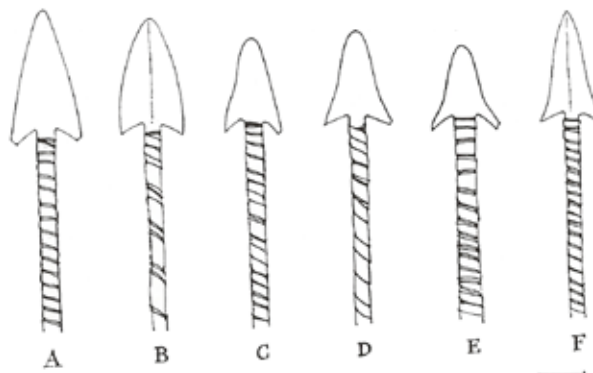




Variabilité des armatures G/wi San



Variabilité des armatures !Kung San



Variabilité des armatures !Xo San

fig. 4 : Variability among arrowheads belonging to several contemporary Bushmen groups, i.e. G/wi (top), !Kung (middle) and !Xo (bottom) (from Wiessner, 1983).



of objects and arrows, with a view to expressing the links between the members of a community. It codifies as such certain social rules, like those for overseeing food resource sharing and mutual assistance (Lee, 1979; Marshall, 1976; Testart, 1985; Wiessner, 1977). Thus, a hunter goes on an expedition with, in his quiver, arrows made by him as well as other hunters, thereby materialising the alliance network to which he belongs. These various aspects have contributed to making of Bushmen and their hunting gear references for ethnologists and prehistorians from around the world who drew from them, if not models, at least much food for thought.

### Bushmen arrows: documentary discordances

Yet, our own ethno-archaeological approach met with many obstacles. Indeed, while, on the surface, the various archaeological, ethnological and historical sources are becoming harmoniously coherent, this is partly an optical illusion; this play of mirrors, from one discipline to another, is rather similar to that of a kaleidoscope. For, in fact, each approach privileges in the other approach what it does not find in its own approach but, when they are compared on the same field, many documentary antagonisms are revealed. This is specifically the case of the hunting gear. For instance, ethnologists believe that they can draw from archaeology the idea according to which the populations they are studying are part of a centennial or even millennial tradition. But what of it, really? And when archaeologists and ethnologists agree to refer to today's Bushmen as the direct heirs of a prehistory that still exists, on what material reality do they base their assertions?

As far as hunting gear is concerned, the established image is that according to which the ancient populations of Southern Africa – the ancestors of today's Bushmen – were, up until the arrival of the first Western sailors then settlers (15<sup>th</sup> to the 17<sup>th</sup> centuries), stone-knappers, with stone being the material on which an important part of their technical equipment relied potentially. Then, and presumably very rapidly, the introduction of metal replaced the use of this millennial material,

which explains its scarcity as early as the 18<sup>th</sup> century, followed by its withdrawal during the 19<sup>th</sup> century. It is indeed around 1870 that the last stone instruments were observed, in the shape of arrowheads to be specific. These components, which date from the second half of the 19<sup>th</sup> century, among which glass which had already often replaced stone (fig. 5), are the only ones that survived to this day. While a serious documentary discrepancy exists between archaeological sources prior to the 18<sup>th</sup> century and subsequent ethnographic documents, this perspective nonetheless establishes the idea according to which technical evolution as implied by the appearance of metal, does not question the actual foundations of the tradition of the hunter-gatherer populations, having simply replaced one material with another.

But this fact alone has serious consequences while other components are confusing the evolutionary picture as each discipline is taking over. This is the case with, first of all, the fact that ethnological, archaeological and historical sources do not take up the same spaces: while ethnology relies exclusively on hunter-gatherer populations whose territories are today concentrated in the Kalahari Desert (fig. 2), historical sources concern mainly regions (the surroundings of the Cape of Good Hope and a hinterland restricted to a few hundred kilometres) where these populations disappeared for over two centuries. We thus project over the same plane populations that are not only separated by several centuries but also, in the worst case scenario, by one or two thousand kilometres. To draw only one of the conclusions of such a finding, we should highlight the differences that exist in terms of ecosystems between the various regions concerned (Sadr *et al.* 2006).

Then, historical sources testify to the joint existence of very different populations, nomadic pastoralists in this case. The societies gathered under the current name of Khoisan indicate indeed, through the past, a much larger complexity as regards socio-economic organisation, by comparison with the last representatives, i.e. today's Kalahari Bushmen and their hunting-gathering lifestyle.

All this justifies the opinion expressed in the





fig. 5 : Arrowheads fitted with glass splinters collected around 1870 (collections of the Iziko Museum, Cape Town).

introduction of this article: before thinking of using an ethno-archaeological approach such as that to which we aspired before undertaking our research work, it proved necessary to reverse our reasoning and to reflect upon the historical process that contributed to creating the current Bushmen populations (Fauvelle-Aymar *et al.*, 2007). What complex filters did their tradition go through? In this case, in the field which is of interest to us, this equates to trying to understand the genesis of their current hunting equipment, which is to a greater or lesser extent the fruit of several historical transformations.

#### Study corpus: study of arrow diversity

As important as Bushmen hunting equipment can be in the eyes of ethnologists and archaeologists, it turns out that we do not have any list gathering the large quantity of data

collected on them. Some of the research work was spent on describing, often very accurately, certain groups of arrows (cf. for example Clark, 1975-1977 or, in a completely different register, Vinnicombe, 1971)<sup>2</sup> and several detailed studies have been conducted on larger corpuses, the best known being those of Leakey (1926), Schapera (1927), Goodwin (1945) and Cooke (1958), although neither of these has truly led to a general typology of this ethnographic equipment. The most complete and recent research on the matter remains that of J. Deacon (1992), which does not really come to a classification, probably because it was not his initial objective.

Therefore, it remains difficult to appreciate the variety of these objects as well as to measure the representativeness of either among them in relation to all known specimens. Thus, to use a symbolic example, it is appropriate to wonder

<sup>2</sup> - Among the descriptions of certain groups of arrows, whether old or recent, cf. also: Van Riet Lowe, 1954; Valiente-Noailles, 1980; Webley, 1994; Liebenberg, 2001.



about the representativeness of the rare ethnographic specimens of arrows made from stone or glass: are they, as has been proposed so often (Goodwin, 1945; Clark, 1975-76-77; Deacon, 1992) representative of the equipment or, at least, of certain equipments prior to the appearance of metal, part of a millennial African tradition? By the same token, do these “mineral” equipments belong to a world apart, as opposed to the world of bone or metal arrowheads? Or can transfers or similarities in terms of sought after properties be flushed out, thus explaining the mechanisms of this alleged relation?

Before tackling the creation of today’s hunting gear, we felt it necessary to undertake the implementation of such a typological index. For this, our study relies on several fields: archaeological sources (traces of equipment etc.) and contemporary ethnological sources (current equipment of Kalahari populations) compared with historical descriptions and museum collections, the time cover of which is limited to the 19<sup>th</sup> century<sup>3</sup>. As regards ethnographic resources kept in museums, our study had access to two major collections, one from the MacGregor Museum in Kimberley, and the other from the Iziko Museum in Cape Town.

Our examination of these two collections concerned a sample of 1,145 arrows (167 complete specimens from the MacGregor Museum and 978 specimens from the Iziko Museum). In order to classify these objects, we adopted a descriptive and analytical approach that allowed us to recognise recurrent criteria. On examining each arrow in detail, we gathered all the elements required for the definition of these criteria. The various components identified are, concerning the head (French *armature*): the distal extremity, the body, the edges, the ailerons (wing tips), the base and the stalk. Concerning the rest of the arrow, we have recognised and described their various parts: the nock, the feathering, the shaft, the intermediary parts (spindle and *tube*), the ligatures and adhesives used, as well as the presence or absence of poison. Each one of these components shows great variability and we count for instance seven different types of nocks and five recognised forms of feathering (fig. 6; Bosc-Zanardo, 2004). It is the preferential associations

of these criteria which convey an ideal or an extreme type (Kantman, 1960; Tixier, 1963). Hierarchising these criteria makes it possible to recognise families, groups, types and sub-types.

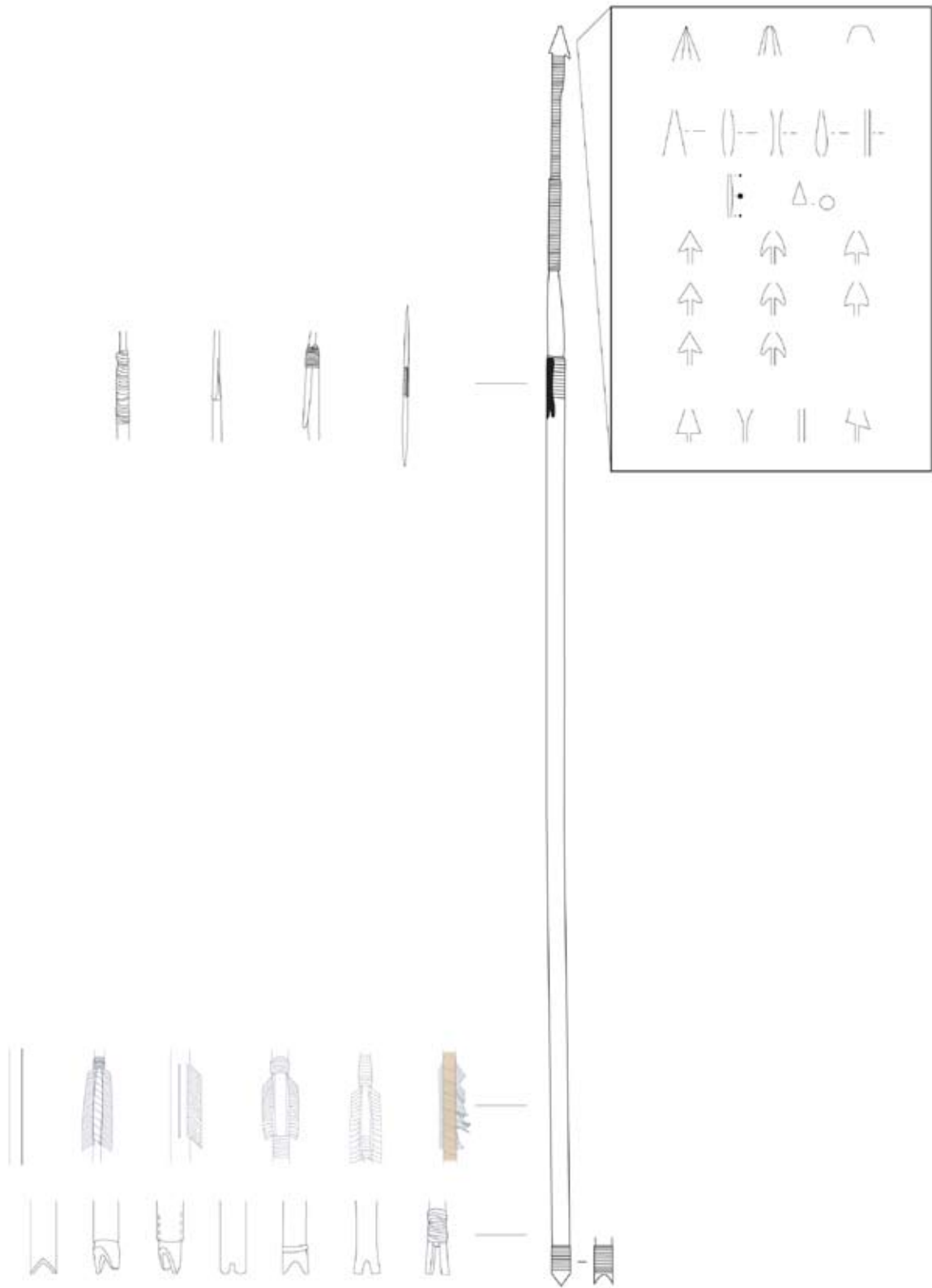
The application of the hierarchised grid to our corpus made it possible to define stable typological categories, most of which prove to be well structured (i.e. gathering a group of recurrent characteristics in a stable manner). We must however recognise that certain typological groups created in this manner are only represented by a small number of individuals which, at this stage, raises the issue of their representativeness.

One of the main objectives of this study is to show that there is a diversity of types which greatly exceeds that recorded among contemporary hunting gear alone. On the other hand, the latter, for the greater part, matches a restricted typological spectrum. Sub-contemporary and contemporary arrows are indeed grouped monotonously around the following criteria: triangular metal arrowheads (with variations in their morphology), associated to poison, with the use of a bone or wooden foreshaft, on light reed stick, devoid of feathering, with different nocking solutions (fig. 7). Yet, in the ethnographic collections that were analysed, covering a period and spaces far more important, this morphology is placed side by side with very different specimens (cf. for example fig. 8 above).

Another point deserves to be highlighted at this stage. The South African ethnographic collections of arrows are comprised of complete objects. However, the state of an archaeological object is more than often sketchy or abbreviated. Indeed, due to the nature of the objects being studied, most archaeologists’ typologies are based only on a portion of an object, i.e. mainly the head. Yet, we are all conscious that certain characteristics of an arrowhead depend undoubtedly on the arrow as a whole. Heads are directly linked to arrows, to bows and, by extension, to the people who make them, handle them, use them; but what meaning does the head have on its own? One of the outcomes of this study was therefore to be able to compare a typology based on complete arrows with data provided by

<sup>3</sup> - Before this, very few collections, if any, reached us, except for the artefact collected by Sparrman in 1775.





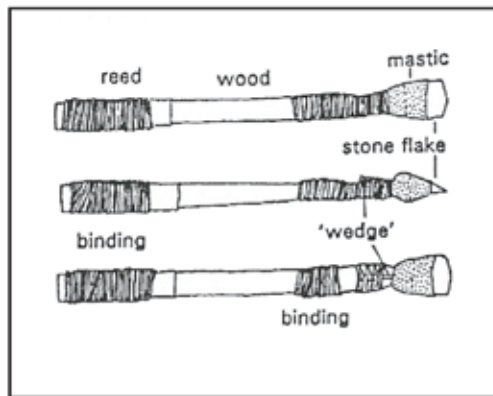
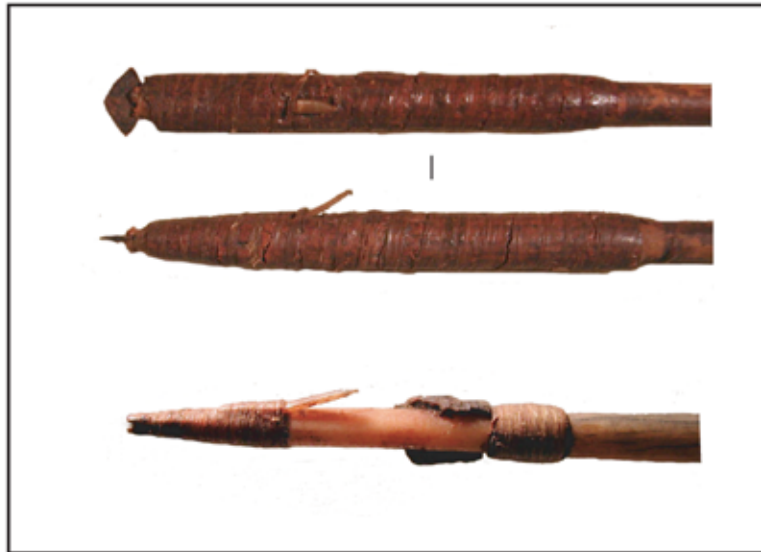
**fig. 6** : Variation of the main constituent characteristics of Bushmen arrows (based on the study of the ethnographic collections of the MacGregor Museum in Kimberley and the Iziko Museum in Cape Town; from Bosc-Zanardo, 2004).





fig. 7 : Specimens of arrows corresponding to the most common type among the current and sub-contemporary Bushmen populations of the Kalahari (collections of the Iziko Museum, Cape Town).





**fig. 8** : Top: arrowheads associating the piercing properties of a sharpened bone head with the cutting properties of a metal diamond-shaped head, and fitted with a micro-barb inserted in the distal ligature (collections of the Iziko Museum, Cape Town). Bottom: arrowhead fitted with a mineral cutting edge, recovered in archaeological context in Adam's Kranz Cave, Eastern Cape (from Binneman, 1994).



the arrowheads alone, to compare in fact an archaeological situation (concerning partially-kept objects – the head in this case) with the reality of the object (the complete arrow). On the same bases as our previous typologies, we thus created a typological index of the arrowheads alone, seeking afterwards to compare them with the classification of the complete arrows. We reached approximately the same result in terms of type definition: comparing the typological grid of the complete arrows with that of the heads alone certainly refines the latter's analysis, but confirms in most cases (85%) the distinctions operated. The arrowhead alone therefore remains a very discriminating component of the arrow as a whole, which is of particular interest to archaeologists.

A last remark concerns the fact that, as recalled previously, arrows are more than just functional objects: they transmit an important quantity of cultural and social information which, according to our study, remains partially within the reach of archaeologists, thanks to the representativeness of arrowheads alone. This is perhaps one of the reasons why it is not unusual to observe the transformation of a portion of the arrow, sometimes presenting strong technical contingencies, into a truly aesthetic motif. A simple example is that of the foreshaft, which is most of the time, in today's specimens, made of a hollow tube into which is inserted the stalk of the arrowhead on one side, and a wooden spindle, itself inserted into the distal part of the shaft, on the other side. But certain arrows in fact have an entirely sculpted monoxylous part, imitating the tube and the spindle, carrying details to the point of reproducing the ligatures by the way of incisions. Finally, what emerges from our analysis is that all the parts of an arrow have the potential to become motifs, *signs*, like what has been brought to light by P. Wiessner as regards arrowhead shapes (1983; fig. 4).

### From diversity to order: first outline of arrow morphology

As mentioned above, our analysis highlights the great diversity of the arrows attributed to Bushmen populations (*sensu lato*) and which were collected during the 19<sup>th</sup> and 20<sup>th</sup> centuries, conveying a variability which is more important

than what one would have suspected from examining (sub-) contemporary pieces alone.

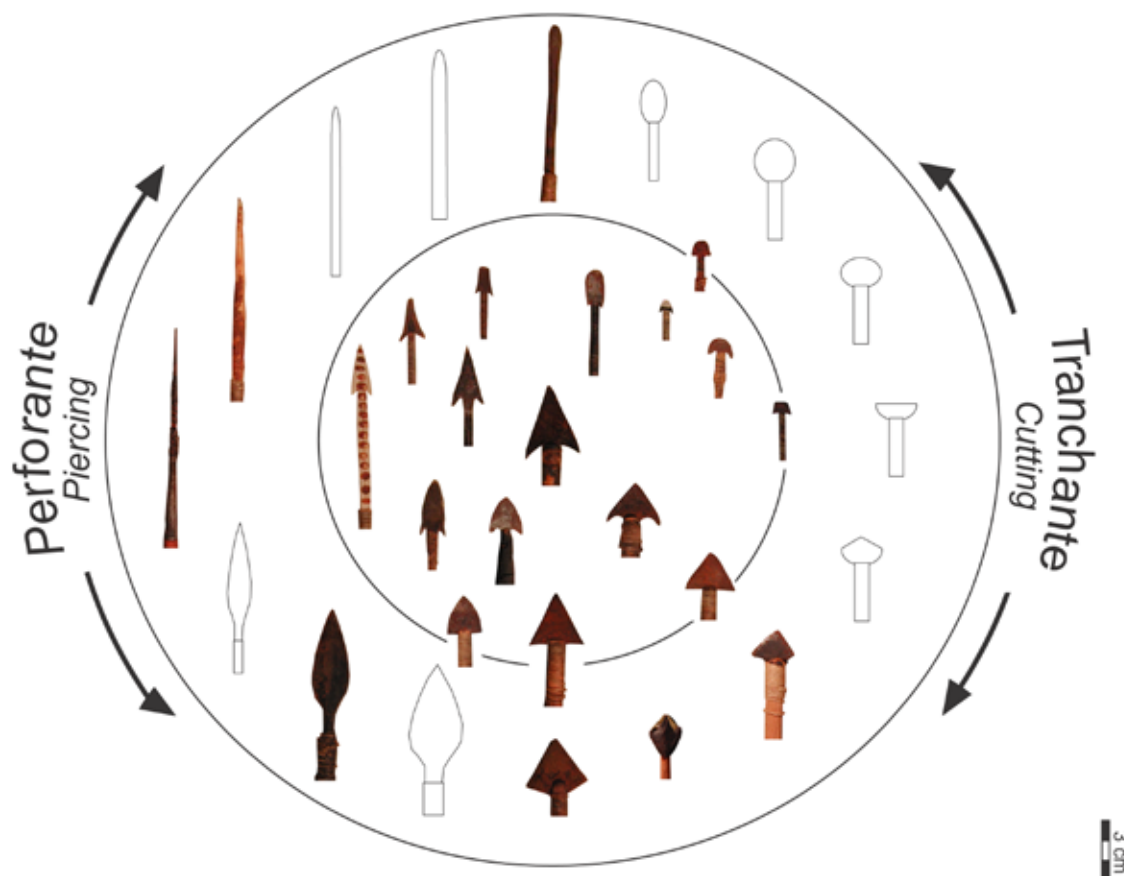
If we focus our attention on arrowhead morphology, or at least on the distal part of the projectile, by accepting during the preliminary phase – to which this article is dedicated – to disregard the rest of the arrow (shaft, foreshaft, feathering, etc.) as well as the presence or absence of poison, it is to work out a classification based on the search for radically different wounding properties, which have often been used to distinguish arrowhead morphologies: we are referring specifically to *piercing* or *perforating* shapes as opposed to *cutting* or *lacerating* shapes. In the remainder of this section (fig. 9), we will be referring to these morphotypes by using the abbreviations P (piercing) and C (cutting).

Morphotype P is represented by « darts », i.e. highly-sharpened bone or metal arrowheads (fig. 9, left). Morphotype C is represented by metallic half-circular or quadrangular arrowheads (fig. 9, right). Besides these objects, other arrowheads embody both properties: these can be diamond-shaped (fig. 9, bottom) or spatula-shaped (fig. 9, top). Concerning spatula shapes, due to the rounded morphology of their extremity, they should be classified under morphotype C, but the very slender nature of the arrowhead, on the whole, associates them undeniably with deep perforating properties. Thus, although the properties of morphotypes P and C show a high contrast, we have to understand that these different shapes are in fact part of a *continuum*. In other words, it means that some arrowheads are exclusively piercing while others are exclusively cutting, although many arrowheads combine both properties, with a “balance point” being reached with diamond shapes in particular.

Moreover, each one of these shapes can be combined with retention properties. Triangular as well as “dart”, half-circular or spatula shapes then can have ailerons<sup>4</sup> more or less well-developed. There again, these different shapes are part of a *continuum*, the epicentre of which corresponds to the triangular shape with ailerons which represents the balance point between piercing, cutting and retention properties (fig. 9, centre).

<sup>4</sup> - We decided to establish a distinction among triangular-shaped arrowheads depending on whether or not they have well-developed ailerons, which most typologies elaborated by prehistorians tend to assimilate, particularly in the context of Neolithic studies.





**fig. 9** : Attempt at classifying morphologically a sample of arrowheads, as per the search for specifically piercing properties (left), cutting properties (right), combined properties (middle), non retentive properties (external border) or retentive properties (internal circle). Photographs: ethnographical artefacts; drawings: theoretical forms.

In short, this analysis allows us to retain the following morphotypes:

- On the one hand, pieces shaped specifically for cutting (metallic half-circular or quadrangular arrowheads) and others specifically for perforating (bone or metal “darts”). Both morphologies can combine with retention properties, either by adding a micro-barb tied up along the arrowhead (as can be seen on the “dart” model), or by making ailerons (as seen on the “cutting” model).

- On the other hand, morphologies that combine all these properties.

Among these, two models of arrows can be distinguished in turn:

- The first corresponds to the association of different elements each contributing to obtaining one of the properties concerned. This is the case of highly-

sharpened bone arrowheads (perforating component), at the extremity of which a minuscule metal arrowhead is inserted (cutting component) and equipped, a little distance away from that extremity, with a micro-barb (retention component; fig. 8 top). One could object that the insertion of a metallic arrowhead with a cutting shape (half-circular) at the extremity of these arrows should bring us to classify them under morphotype C. But, following the example of “spatula” shapes (cf. *supra*), the very slender nature of the bone arrowhead on which the metallic element is inserted, as well as the dimensions of the latter (which barely exceed the width of the bone arrowhead), highlight the fact that a perforating property was being looked for.

- The second corresponds to the integration of all these properties from one object only: the triangular arrowhead with ailerons.

## Elements to be used in the history of arrowheads in Southern Africa

It turns out that this reflection on the combination of different properties, structuring the definition of different types, can perhaps be used to interpret some of the main phases taking place in the manufacturing history of these projectiles during the last three centuries.

Arrowheads showing morphologies found at the two extremities of the spectrum – i.e. on the one hand, darts with a specifically piercing morphology and, on the other hand, exclusively cutting armatures – are those we can more easily identify as part of the equipment of Khoisan populations prior to the 19<sup>th</sup> century.

Thus, concerning morphotype P, bone arrowheads (most often made from ostrich thighbone), are the most commonly used projectile component recorded in archaeological contexts (e.g. Smith and Poggenpoel, 1988). We have every reason to believe that it corresponds indeed to some ancient tradition: we know of bone arrowheads from the Oakhurst Complex (*circa* 12,000-8,000 BP) and we find them thereafter in all the faciès of the Wilton Complex (Sampson 1975, *passim*). The oldest written sources date from the 15<sup>th</sup> century: the first Portuguese testimonies mention indeed highly-sharpened bone or wooden armatures (although these heads might be used more for assegais than for arrows). Bone arrowheads are also found in the artefact collected by Swedish naturalist Anders Sparrman in 1775 (Rudner and Rudner, 1957).

Concerning cutting and, in particular, half-circular morphologies, they are described with remarkable consensus by the travellers of the beginning of the 18<sup>th</sup> century. A German resident in the Cape Colony, Peter Kolbe, describes Hottentot arrows being “fitted with a semi-circle of iron, the size and shape of an *escalin*, or *six sous* coin, cut in the middle, and as thick as a standard knife blade” (Kolbe, 1746, tome 1, p. 157)<sup>5</sup>. The existence of

arrowheads reflecting the specific search for one property or another is therefore well confirmed for phases prior to the 19<sup>th</sup> century.

Furthermore, during the same period, each one of these morphologies can be combined with a retention property. Kolbe, once more, refers to the “semi-circle, or rather half-moon” head previously described as being “barbed, with a small hook at each angle, inward and outward” (Kolbe, *op. cit.*), while Sparrman specifies that, on some of the bone arrowheads which he saw being made, “at the distance of an inch or two from the tip of this bone, a piece of a quill is bound on very fast with sinews (...). This is done, in order that the arrow shall not be easily drawn out of the flesh” (Sparrman, according to Rudner and Rudner, 1957).

However, prior to the 19<sup>th</sup> century, we find very little evidence of projectiles combining all these properties (piercing, cutting and retentive), at least in the shape of triangular arrowheads with ailerons: such objects are not described by the travellers of the 17<sup>th</sup> and 18<sup>th</sup> centuries and it seems in fact that they appear much later, i.e. during the 19<sup>th</sup> century. Nevertheless, such a combination could have been inaugurated previously in the shape of arrowheads made with a bone head, fitted with a micro-barb ligatured on its shaft, and topped by a small metal head inserted on the extremity, taking on a triangular or, more often, half-circular shape (Deacon, 1992; Vinnicombe, 1971). This head is described by Sparrman, and we find it in several of the oldest collections, i.e. in those going back to the 1820s (fig. 8 top)<sup>6</sup>. As already pointed out, to us this head represents an illustration of the search for a combination between cutting (half-circular head), piercing (bone shaft) and retentive (micro-barb) properties.

<sup>5</sup> - Peter Kolbe's text, which is originally in German, is surprisingly similar to a legend handwritten in Dutch and used on a drawing of the end of the 17th century which is kept at the South African Library of Cape Town (drawing and legend edited by Smith and Pheiffer 1993: 60-61). The text reads as follows: “The arrows [of the Khoikhoi] are fairly flat like a thin and non-sharp knife, but like a half-moon, and with a hook on each opposite side, almost like an angle, as sharp as a pocket knife or a blade, [the head being] almost as big as a kayser-groschen broken in half or a half batze”. The kayser-groschen is a currency of the Holy Roman Empire; the batz or batzen is a Swiss silver coin minted since the 15th century and initially representing a bear (batz, bätz...). In the canton of Berne, a half batzen is, in 1718, a billon of 23 mm. The batzen or half-batzen of the canton of Vaud or the Helvetian Republic came later (19th century) but remain in the 22 mm to 25,5 mm range. This very precise description clearly shows the half-circular shape of the armature and its size (slightly wider than 20 mm).

<sup>6</sup> - The components of a quiver kept at the Museum of the Morija Mission (Lesotho) also correspond to this type of arrows. The quiver was obtained from an old Bushman couple by H. Dieterlen in that region around 1880 (Archives of the Morija Mission).



There is every reason to believe that this type of object embodies the search for technical solutions that, subsequently, during the 19<sup>th</sup> century, found their outcome in a morphology which integrates, as one and the same piece (and not by combining three separate components), all these parameters: the triangular head with stalk and ailerons. The development of the triangular head, made of bone or metal, constitutes perhaps the most significant evolutionary tendency of the morphology transmitted to Bushmen hunting gear during the 19<sup>th</sup> and 20<sup>th</sup> centuries. If this hypothesis is correct, we could then measure its genesis by syncretism and the successive adoption of several technical solutions combining characteristics that were previously dissociated (fig. 10).

### From stone to metal

Can this reflection shed new light on the rare arrows fitted with glass or quartz fragments found in the ethnographic collections gathered around the 1870s (cf. *supra* and fig. 5)? In other words, can our analysis find similarities, from the viewpoint of the properties being sought, with the specimens fitted with metal or bone of which we have tried to relate the history? And are we in a position to bring a few clues in favour of their potential meaning in the evolutionary outline we have just proposed? The properties offered by each one of the small stone or glass components that constitute the wounding section of these arrowheads, are mainly cutting properties. It is their symmetrical position, i.e. oblique compared to the axis of the arrow, which

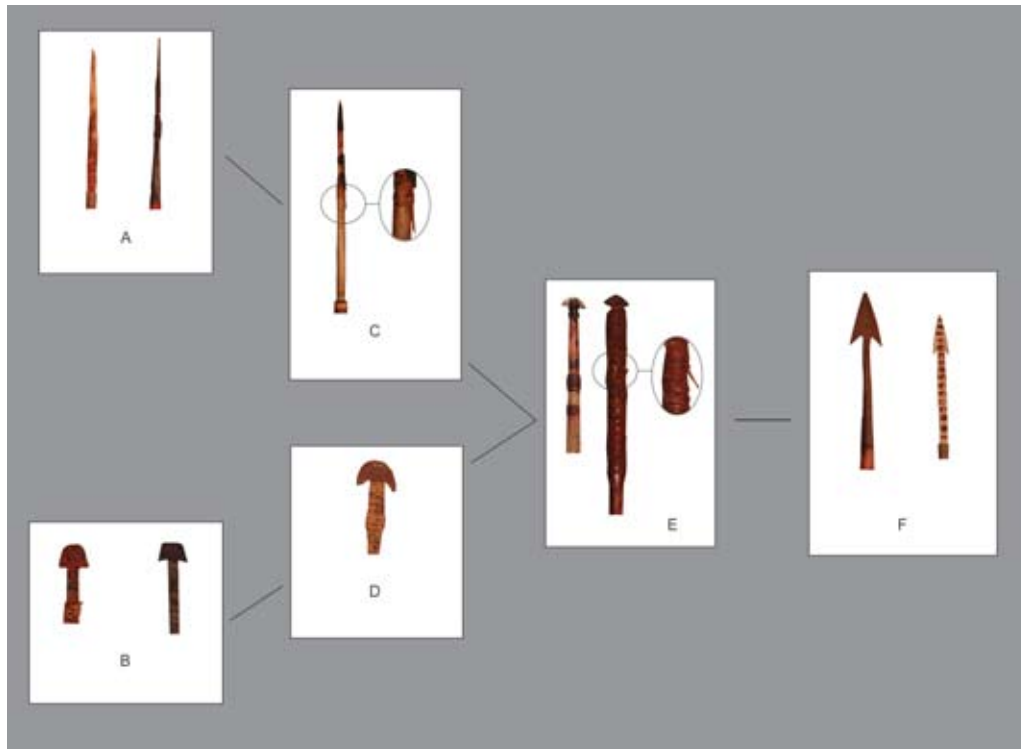
gives the latter a triangular extremity and, therefore, a sharpened silhouette. However, the mounting system used and the layout of the filler show that what was sought for in these arrowheads, was not so much the piercing as the cutting characteristic. The search for a cutting property is a component which, we feel, is very important to highlight, as it is this property which makes it possible to establish different connections:

- firstly, the search for a cutting property mirrors the rare historical descriptions of arrowheads fitted with stone, which emphasize above all the cutting properties offered by obtaining small fragments of quartz (vein and crystalline) or chalcedony<sup>7</sup>. Moreover, and turning now to archaeology, industries during the last two millennia in Southern Africa are frequently dominated by quartz debitage on anvils, producing micro-flakes, with one of the purposes potentially being the search for cutting properties (Fauvelle-Aymar *et al.*, 2006). In line with this hypothesis are the rare specimens of arrowheads fitted with lithic components which are kept in the archaeological register, and which correspond to cutting specimens (cf. Binneman, 1994; fig. 8, bottom). Whatever the case, these “unformal” industries (as per South African terminology) do not in any way offer technologies that make it possible to obtain monolithic arrowheads, e.g. arrowheads with stalk and ailerons<sup>8</sup>. The simplicity of technologies, in terms of lithic production, could therefore go with the search for properties that are above all cutting properties and, especially, with the use of composite elements: the intrinsic simplicity of which could be compensated by the existence of elaborate assembling and fixing solutions.

<sup>7</sup> - Among the main historical and ethnographic quotations on the use of stone in the manufacture of projectiles, is the testimony of Wikar, a Swedish soldier who lived with Khoisans on the banks of the Orange River between 1775 and 1779. He indicates that certain arrows were fitted with “sharp-edged white stone” and adds that the use of stone rather than metal would be due to the fact that “the stone often breaks into pieces in the body of the game” (Mossop, 1935). One century later, Dale (1870) described an arrow picked up by Palgrave in the region of the Orange River, bearing “a small leaf-shaped flake made of quartz crystal”. During the same years, Dunn (1873) reported on how an old Bushman from Bushmanland “showed the manner in which arrowheads are deftly broken by striking one stone with another. At first a few light strokes are given to guide the fracture. Two small chips, whose sharp points are exactly of the same form and size, are cemented to the arrow tip, one on each side. The points of these chips must coincide to form the piercing end”. This description is very close to that which we can make from the projectiles manufactured at Bleek’s request, by Bushmen prisoners, and of which we had the opportunity to study a few specimens at the Iziko Museum (fig. 5). Concerning one of the rare specimens fitted with stone and not glass, Bleek had moreover recorded the following comment from one of his /Xam informants, by the name of Jantje: “This is witteklip [white stone]. We use it. We fix it into the end of a reed. It is not real Witteklip, but is a stone that is like a diamond ». Finally, Leith (1898) declares that “Mr Allan at the lighthouse at Mossel Bay frequently saw arrows tipped with such flakes (vitreous quartz) used by Bushmen in Namaqualand 30 years ago”, while Stow reports (1905) that during his first visits in 1876 in the lower valley of the Orange River, “the Bushmen there invariably used small chips of chalcedony for making the points of their arrows” (quotations gathered by Goodwin, 1945; Rudner, 1979; and Binneman, 1994).

<sup>8</sup> - Nevertheless, while these are not totally absent from the prehistory of Southern Africa, they belong to contexts that are, it seems, definitely older than that with which we are dealing and which concerns the last centuries.





**fig. 10** : The evolution of Bushmen gear from the 18th to the 20th centuries: scheme of arrowhead transformation based on criteria of dissociation/combination of piercing or cutting properties, with or without retention systems. A: Bone or metal piercing arrowheads; B: Metal cutting arrowheads; C: Bone piercing arrowhead with a retentive micro-barb; D: Metal cutting arrowhead with ailerons; E: Bone point with metal cutting head and retentive micro-barb; F: Metal triangular arrowhead with ailerons.

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- In parallel, the search for cutting properties from lithic pieces enables us to make a connection with certain metallic specimens. Indeed, the morphology of these arrowheads, which could be described as that of a barely sharp head corresponding in fact to the joining of two oblique cutting edges, finds precisely its equivalent in certain metal specimens. These are triangular arrowheads, isosceles or flat in shape, the extremity of which seems to be less wounding than the edges which are finely sharpened. More generally, the hypothesis we defended above is based on the assumption that metallic arrowheads (half-circular, quadrangular etc.) prior to the 19<sup>th</sup> century, as opposed to bone arrowheads, favour indeed the search for a cutting property. In this context, it is therefore tempting to make a parallel between stone and metal, around the search for the same properties. The fact that cutting shapes came earlier than piercing shapes or shapes combining these two properties (triangular arrowheads with stalk in particular), can perhaps find an explanation through this comparison. This is not in contradiction to the fact that metal led

to the elaboration of previously unseen shapes, while fulfilling the search for similar properties. As such, metal could have led to heads with integrated shapes (half-circular and quadrangular), where stone required the juxtaposition of several components; some of the forms obtained with metal (half-circular shapes in particular) were indeed beyond the reach of earlier or contemporary stone technologies.

#### Highlighting a technical continuum

In light of these different hypotheses, the evolution of the hunting gear of Southern African populations during the last centuries could be seen as the progressive integration of properties that were not previously associated. As such, the production of metallic arrowheads combining piercing and cutting properties, gradually replace bone arrowheads that were sought for their piercing properties, side by side with stone arrowheads sought mainly for their cutting properties. But this evolution took place by first favouring the replacement of stone with metal,

then fulfilling the search for a similar cutting property. Bone, embodying a piercing morphology, resisted longer before iron arrowheads began to dominate, following a formula integrating, this time, all the properties into one single object, at the cusp of the 19<sup>th</sup> and 20<sup>th</sup> centuries<sup>9</sup>.

Were they to find confirmation in future typological and techno-functional studies, our hypotheses on the evolution of Bushmen hunting gear would illustrate a history more complex than that of a simple “conversion” to metal, accompanied by an “adaptation” favouring a transformation of the weapons’ wounding properties. In reality, as seen previously, metal supply might have acted as a technical *catalyst*.

This evolution raises two series of questions.

First, why did such a phenomenon occur? Why did triangular arrowheads with ailerons become the morphotype crystallising the technical evolution of Bushmen societies during the last two centuries? Why and how did the adoption of metal accompany this transformation? This evolution undoubtedly reflects the increasing influence of external inputs on these societies. As such, it appears that metal begins to become generalised from the end of the 17<sup>th</sup> century among the Khoikhoi cattle keepers of the Western Cape, as soon as they came into contact with the settlers (according to Kolbe’s evidence in particular), while one century later, Sparrman could still gather bone specimens in the eastern confines of the Khoikhoi world. Our luck, as far as Southern Africa is concerned, is that this evolution took place during the last few centuries, and we can therefore envisage that a detailed analysis of the available archaeological, historical and ethnographic data will inform us as much on the pace of the processes concerned, as on the phenomena of geographic circulation, innovation, borrowing and re-appropriation accompanying such processes. In this study, the role played by war or, at least, by armed conflicts that multiplied and underwent a change of meaning during the 19<sup>th</sup> century, will not be undermined: they then take

on the dimension of a fight to the death, to which the texts and memory of the settlers as well as the wall paintings of populations, often reduced to silence, often bear witness.

Secondly, if the relative homogenisation of the technical solutions and materials used seems to be the dominant feature of the arrowhead technology during the very last centuries, the variability and even the discontinuity of previous techniques remains to be interpreted. What meaning does this diversity take on? Is it the reflection of a cultural mosaic far richer than what it became, due to the disappearance of many Bushmen populations during the colonisation? In other words, does this diversity reflect as many vanished groups, of which only the Kalahari populations and their equipment would have survived? Or does it illustrate complex mechanisms of Bushmen society transformation during the last centuries, of which the technical equipments would bear the mark? These two hypotheses are not in contradiction, especially if we tackle them through the following question: What role should we attribute, in this diversity and these technological evolutions, to the economic divide opposing hunter-gatherers and cattle breeders? In this regard, let us simply observe that semicircular metallic armatures with ailerons seem to be associated, at the beginning of the 18<sup>th</sup> century, with a very specific context of highly specialised cattle keepers, among whom hunting might have been only a supplementary activity (Fauvelle-Aymar 2004). Yet, are we really in a position to link these types of arrowheads with specific hunting techniques that, in addition, are likely to identify Khoe pastoralists vis-à-vis San hunters, whose reality of distinction has been a nagging issue of Southern African prehistory?

Irrespective of these different hypotheses and questions, the rapid evolution of arrowheads towards a metallic model associating piercing, retentive and cutting properties (triangular head with stalk and ailerons) could represent the materialisation of a double phenomenon – linked to colonisation – of generalisation of raw material

<sup>9</sup> - However, it seems that the use of bone “darts” was maintained from time to time until the last decades of the 20th century (B. Smith, personal communication).



(metal) and reduction of hunting territories with, in the background, conflicts and the transfer or disappearance of populations. All these questions only aim to highlight the importance of detailed typological studies, which will need to be combined with the study of other aspects (presence or absence of poison, bow strength etc.) and with other archeo-historical data. In any case, this preliminary approach insists on the necessity to adopt such a historical hindsight, before considering the meaning of the contemporary Bushmen weapons.

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