The Late Mesolithic of Western Europe: a technological approach of the blade and trapeze industries

Pierre Allard, Gregor Marchand, Thomas Perrin, Didier Binder, Philippe Crombé, Oreto Garcia-Puchol, Sylvène Michel et Nicolas Valdeyron

Summary : This paper presents an overview of the knapping techniques of the Second Mesolithic during the 7th and 6th millennium in Western Europe. This period is indeed characterised by the emergence of new armatures – the trapezes – and of new techniques of prismatic blade production that show discontinuation from the preceding technical traditions. Dichotomy can be noted between pressure debitage, seemingly restricted to the Castelnovian groups, and different types of indirect percussion observed in the entire study area (Italy, France, Iberian Peninsula and Belgium).

Keywords: Late Mesolithic, Western Europe, technology, lithic industry

The ANR research program « The last hunter-gatherers of Western Europe » (Allard P. dir.) continues a previous research project led by Thomas Perrin (research grant of the Fyssen foundation). The latter had outlined the trapeze bearing sites and the available radiocarbon dates in the entire western European area. This study evidences a progressive spread of the trapezes from Southern (Mediterranean basin) to Northern Europe over time (Perrin *et al.* 2009, Perrin *et al.* this volume). This program is the first stage of a collective study aiming at the identification of the origins and the speed of diffusion of this phenomenon. The aim of the second part is a better understanding of the proper nature of this phenomenon that acts like a package: the new types of armatures seem to be linked to new technical practices and notably to new knapping techniques, percussion by punch and pressure technique.

The present paper, which is a preliminary synthesis of this ongoing research program, presents the current state of the data regarding the identified techniques and their distribution within our study area. This analysis is based on the technological approach aiming at characterizing the knapping techniques, including the utilized strategies, the types of production and the techniques of percussion. As the analysis of the entire dataset on the technological approach goes beyond the scope of this paper, we have focused our presentation on a series of diagnostic examples that illustrate the recent results obtained from these industries. Our study area encompasses France, Belgium, the Iberian Peninsula and Italy.

Our issue here is based on the hypothesis that the change of armatures is linked to a change of knapping techniques which do not evolve from the previous technical traditions. Thus:

1) Which are these new techniques that appeared to be sufficiently attractive in order to spread rapidly across the entire study area?

2) Did the diffusion of these technical changes fit with the expansion of trapezes across Europe during the 7th and 6th millennium cal BC?

3) Is this a uniform phenomenon? If not, where are the discontinuations located?

4) Can the increasing diversity of trapeze types be correlated with the diversity of knapping techniques used for blade production?

Pressure debitage

The description of pressure debitage is one of the latest consequence from the analysis of trapeze industries.
Without revisiting its history of research here (Binder 1987, Binder *et al. in press*, Binder and Collina *in press*), technological studies have permitted to identify pressure debitage in the Western Mediterranean within the Castelnovian complex, more particularly from the first stage on (Binder and Collina *in press*). This particular knapping technique, the pressure debitage, is not easily identifiable on the bladelets by the criteria of regularity and parallel ridges alone. Pressure debitage is a knapping technique performed from the 7th millennium onwards for the production of prismatic bladelets serving as blanks for the manufacturing of trapezes.

The variability in pressure knapping observed in the Castelnovian assemblages seems to be linked to the exploited flint sources. The unity of these assemblages depends on the management procedures of the pressure platform and on low lateral convexity of the surface of the blades. Consequently, the successive removal of several series of blades –the morphology of the raw material block permitting - led to the formation of a curved surface of the blade and to enhanced regularity of the blade production (Binder and Collina *in press*, Ferrari *et al. in press*). In addition, systematic faceting of the striking platforms and the butts can be observed on the blade products.

Thus, the varying regularity of the bladelets is due to the morphology of the materials and/or the stages of initial core preparation which explains the difficulties in the systematical identification of this technique.
For example, experiments conducted on pebbles from the Po plain, of which the shaping out corresponds to a simple opening of the pressure platform for an immediate start without preparation of the surface of the blades, shows high variations in regularity of the products (Ferrari *et al.*, *in press*).

Yet, pressure debitage is categorically identified from the first stage of the Castelnovian *lato sensu*, as it is the case in the Uzzo Cave in Sicily (fig. 1, Collina 2009, Binder and Collina *in press*). This technique clearly belongs to the initial package of the phenomenon of trapeze emergence. It should also be noticed that at the current state of knowledge, this technique is *a priori* not exclusive. As a matter of fact, duality of the percussion techniques can be stated in that indirect percussion is recorded in the Castelnovian lithic assemblages equally systematic.

In the current state of our knowledge, pressure debitage in order to obtain blade and bladelet blanks, seems to be restricted to the area of expansion of the Castelnovian in a wider sense.

Indirect percussion

Consequently, both indirect percussion and pressure debitage accompany the spread of trapezes and illustrate the discontinuation of the Middle Mesolithic knapping techniques, traditionally identified through techniques of direct hard percussion.
At the current state of analysis, it is the only knapping technique observed in the northern and western part of the study area. Nonetheless, a more detailed study is still required in order to better describe distinct, very regular bladelet productions made from small-sized cores.
With respect to the geographical extension of the considered area, it can be stated that technological studies are still indigent. However, some well-documented areas allow the perception of different types of indirect percussion.

- A widespread method: L'Essart (Marchand 2009)

Fracturing of large blocks of Bajocian flint by large flakes is probably an initial stage (heat treatment is not excluded in this context). The laminar surface is limited by two orthogonal sides, the core can be described as a parallelepiped (fig. 1). The plain and slightly inclined striking platform is rejuvenated by the removal of flakes from the surface of the blade, oriented towards the production of regular bladelets of 10-12 mm length with three parallel removals on the dorsal face. Overhangs and butts are carefully abrased. Some cores are worked a half turn around, progressively invading the sides. The exploitation of the surface occurs on the front face and the original size of the nodule allows moving the tablets to the sides.

- The Retzian (Marchand 1999, 2000)

The main production is made from beach pebbles shaped out by hard percussion. The knapping commences by exploiting the natural convexities offered by the pebbles (fig. 1). The surfaces of the blades are narrow as they are removed from the narrow parts of the block. The cores are worked frontally exhibiting a weak lateral convexity that is maintained by angular lateral blades with triangular section.
The striking platform is restored by flake removals and the edge is locally trimmed by microfacetting which is shown by a very high proportion of facetted butts on the bladelets. The debitage is unidirectional and simple or aims at successive serial production.

- Ruffey « A Daupharde »

In Eastern France, the excavation of a large open-air site at Ruffey (Séara *et al.* 2002) has yielded a Late Mesolithic occupation dated to the Early Atlantic period. The technological study (Deschamps 2000) revealed a rather standardised debitage. Narrow blades were struck from the narrow face of prismatic, frontally worked cores (fig. 1). The striking platforms and the butts of the bladelets are dominantly inclined and facetted. The blanks are regular and obtained according to a design 2-1-2'. The surfaces of the blades show very low transverse and longitudinal convexities, the sides and the rear face of the core are left rough.

- Debitage on the edge of Tardenoisian flakes

Although discovered long ago, the sites of the Second Mesolithic of Northern France and Belgium have been little analysed regarding the knapping techniques. The recent discovery of the Lhery site in the Marne valley provides new insights, notably concerning the stages of shaping from large blocks (Séara and Bostyn 2009). Refitting processes show the exploitation of large thick tablets of Bartonian flint which are shaped out by hard percussion and then fractured with massive splintered pieces.

The debitage is unidirectional and the cores are worked frontally from narrow or little invasive tablets with plain striking platforms on massive flakes obtained from the initial fracturing of the tablets. This debitage is similar to the one of L'Essart.

Moreover, one part of the original waste and the flakes obtained from fracturing are subject to a more peculiar exploitation: the surface of the future blade is inscribed on the edge of the flake, to take advantage of the favourable lateral and longitudinal convexities of the blank (fig. 1). The surfaces of the bladelets are narrow with a naturally convergent distal end. The striking platforms are plain. The cores offer burin-like designs.

This type of debitage made from flake blanks and using the same flint type is also identified at Allée Tortue XIV (excavations J.G. Rozoy) as well as at Oeudeghien (excavations P. Crombé) in Belgium (Allard and Crombé unpublished) where a different material is exploited.

This type of debitage thus requires the production of massive flakes and the existence of production sites of these flake blanks is likely. Lhery would be the best documented example of them.

- As a result of the most recent studies a final variant with two components can seemingly be defined. In the collection of « La Bouloie » in the Upper Marne valley (Amiot 1996), which is a fieldwalk collection mainly composed of trapezes and products obtained by punch percussion, a dominant blade and bladelet production made from orthogonal blocks can be observed with unidirectional frontal reduction but with plain, strongly inclined striking platforms (fig. 1). The removal of blades reveals previous microfacetting of the edge of the striking platform which permits to reorientate the flaking angle towards a right angle (Lautridou 2009). In this case, the final microfacetting allows to correct the flaking angle towards the optimal flaking angle identified according to the experts of knapping experiments (Pelegrin and Riche 1999).

A second component can be distinguished by the study in progress on the Tardenois site (Allard and Lautridou *still in progress*) which highlights a small-sized blank production on strongly inclined platforms but without microfacetting prior to the removal of bladelets. This is the case notably at Allée Tortue or also at Mauregny en Haye (excavations J. Hinout). This completely unpublished variant requires better documentation but the sometimes extreme regularity of the products allows the clear assumption that we deal with indirect percussion here. The butts are plain and carefully abrased but present a very acute flaking angle, sometimes of 45/50°, which *a priori* exceeds the accepted limits of punch debitage.

Yet, a standard seemingly emerges from these different types which can be distinguished essentially by the management of the striking platform and the preparation procedures prior to the removal of bladelets:

- an initially weak preparation, notably with the recurrent exploitation of natural surfaces and ridges for the start of the debitage.
- a unidirectional debitage of orthogonal, frontally worked cores with narrow surfaces of the blades.

- a slightly curved blade surface
- regular blanks, with three blade removals, presenting a design 212' on the upper face.

The debitage of L'Essart A - as it was described (Marchand 2009) - that seem to correspond to the common thread of the Late Mesolithic types of production by indirect percussion.

It is remarkable that all these variants or, compared to that, the « standard » debitage are not subject to raw material constraints. This flexibility is probably one of the keys for the success of these methods independent from the available flint materials. Thus, at Ruffey-sur-Seille or at L'Essart, despite distinct variability of the exploited materials, these methods are consistent. The use of large blocks is well attested but an initial shaping out is performed in order to provide materials ready for knapping, in exploiting notably the diaclases or the weak points of the raw material (Marchand 2009, Séara and Bostyn 2009). The debitage of large flake blanks is also attested but seems restricted to the northern part of our study area. The analysis of the site of Oeudeghien is interesting in that the flint quantity and the composition of the artefacts clearly indicate the presence of a production *in situ*, however, *a priori* far from the raw material sources. One may readily assume that these flake blanks have been carried to different places to be knapped, sometimes at several dozens of kilometres from the primary sources.

Debitage by indirect percussion thus involves variants independent from the raw material which become apparent in the knapping procedures, for example the abrasion of overhangs or the microfacetting of striking platforms prior to the removal, but also in the original blocks : through the management of the core types to be knapped (cores with narrow flaking surface on the front face of the Retzian versus pyramidal cores of L'Essart versus flat or discoid cores of the Teviecian versus flake cores of the Tardenoisian).

Some concluding remarks

As a matter of fact, different knapping techniques and variants coexist within the complex of regular blade and trapeze industries during the 7th and 6th millennium cal BC. With this large scale study still in progress, the following conclusions will be subject to further investigation within our future research:

Currently, our assumption sustains a Southern origin for the main route of diffusion of these new armatures, a route that arises from the opposite Mediterranean coast. Finally, if this hypothesis is identical with the one developed by the first European archaeologists, our proposal is to reinforce it by the assessment of radiocarbon dates that can be considered reliable (Perrin *et al.* 2009, Perrin *et al.* this volume). The Castelnovian trend can be perceived as a kind of technical package associating particular knapping techniques (pressure debitage and indirect percussion) with trapezes and notched blades. This package is formally attested to the Italo-Provincal area. On the other hand, doubt still remains regarding the sites in the Eastern part of the Iberian Peninsula which have yielded "early" dates but where the existence of pressure debitage remains to be demonstrated categorically (Garcia-Puchol 2005).

While the origin of these different characteristics has to be better determined, we can on the other hand study the phenomenon of the spread of this original « package ».

It results from the technical overview presented here that pressure debitage does not seem to extend beyond the area of settlement of Castelnovian groups. However this diagnose has to be reassessed considering the variability of pressure already evoked (*supra*). In the remaining part of our study area, indirect percussion associated with different techniques is performed.

The apparent absence of pressure debitage in the northern area also raises the unanswered question of a possible twofold route of diffusion of the trapeze industries, the one southern, the other central. The central European area remains void of pressure debitage during the studied chronological period. In addition, this statement is rather amazing as pressure debitage is well attested in all the adjacent areas of Northern Europe (figure 2).

The chronological dimension is invariably a crucial factor that has to be incorporated into the analysis. Consequently, in the case of pressure debitage we have to evaluate whether this technique is present throughout the entire Castelnovian period or progressively loses its signification during the expansion of these groups. In the same manner, with regard to indirect percussion, an expanded chronological framework of the lithic assemblages would permit to understand whether the different variants are synchronous or diachronic.

The study of this « complex » of trapeze industries encompasses several levels of observation that have to be refined. The phenomenon is considered here globally. But as we have seen, some well defined entities seem to emerge within this complex. This is the case of the Castelnovian: the diversity of trapeze types is opposed to the unity defined by pressure debitage and the geographical space. Similarly, the Retzian is clearly opposed to the Teviecian through the procedures of systematic core preparation by microfacetting but also through the outstanding stylistic unity of the trapeze types. Debitage on the edge of a flake for the creation of blade surfaces seems for instant restricted to the Tardenoisian in a wider sense which means an area extending from the Paris Basin to Belgium and corresponding more or less with the former territory of the Rhine-Meuse-Scheldt techno-complex of the Middle Mesolithic. These are preliminary results for the moment and an interpretation that makes sense has yet to be made for these different practices. The typological evolution of trapezes and derived triangles has to be incorporated into the results obtained from the technological approach in order to determine whether the stylistic and technological entities can be correlated.

Finally, if we admit that the success of these new technical practices is linked to their intrinsic qualities (higher regularity and parallelism of the blanks, control of the gesture and of the impact point as well as higher productivity), this can explain that the investment into the production focuses on the blanks rather than on the processes of retouch.

However, distinct armatures appear occasionally either with a more complex retouch or on other than blade blanks or with techniques that strongly differ from those used for the trapezes. This is the case of the Gazel points, the Montclus arrowheads, the Martinet triangles or also the Bavans projectile points.

The precise intersection between the stylistic entities and the technological variants assumed here has to be demonstrated and will be one of the aims of our research program during the next years. It will probably be possible to subdivide this complex in order to better understand its evolution.

Finally, we would like to develop a compared analysis with the Early Neolithic lithic series in order to understand the interactions between the last hunter gatherers and the first farmers, at least those that can be perceived through the knapped stone remains.

Translation : K. Mazurié de Kéroualin (http://www.linarkeo.com)

Pierre Allard
CNRS – UMR 7055 Préhistoire et Technologie
21, allée de l'Université
F-92023 Nanterre

Gregor Marchand ; Sylvène Michel
Centre de Recherche en Archéologie, Archéosciences, Histoire (CReAAH)
Laboratoire d'Archéosciences (bât. 24-25)
Université de Rennes 1 - CS74205
F-35042 Rennes Cedex

Thomas Perrin
CNRS - UMR 5608 TRACES ("CRPPM")
39, allées Jules Guesde
F-31000 Toulouse
tperrin@free.fr

Didier Binder
Université Nice Sophia Antipolis
CNRS, CEPAM UMR 6130
Campus SJA3
24, avenue des Diables Bleux
F-06357 Nice cedex 4

Philippe Crombé
Ghent University,
Department of Archaeology
Sint-Pietersnieuwstraat 35, B-9000 Gent, Belgium

Oreto Garcia-Puchol
Departament de Prehistòria i Arqueologia
Universitat de València

Blasco Ibáñez, 28
E-46010 València

Nicolas Valdeyron
Université de Toulouse II Le Mirail
Maison de la Recherche,
5, allées A. Machado
F-31058 Toulouse cedex 1

Titles of the figures

Figure 1 : main variants of debitage mentioned in the text : a) pressure debitage at Uzzo Cave (Collina 2009), b) to g) debitage by indirect percussion from the Atlantic coast and Northern France

Figure 2: schematic mapping of pressure debitage and indirect percussion during the Second Mesolithic

AMIOT, C. 1996. Les industries préhistoriques du site de "La Bouloie" à Crenay (Haute-Marne). Première partie: l'Epipaléolithique et le Mésolithique. *Préhistoire et Protohistoire en Champagne-Ardenne*, 20, p. 15 - 33

BINDER D. 1987. *Le Néolithique ancien Provençal : technologie et typologie des outillages lithiques*. Supplément à Gallia Préhistoire n° 24, CNRS, Paris

BINDER D. in press : Mésolithique et Néolithique ancien en Italie et dans le sud-est de la France entre 7000 et 5500 BCE cal : questions ouvertes sur les dynamiques culturelles et les procès d'interaction *In:* PERRIN, T., ALLARD, P., BINDER, ILETT, M., D. MANEN, C., MARCHAND, G. (eds.) *Autour du Néolithique ancien, Actes de la session H du Congrès Préhistorique de France «Transitions, ruptures et continuité en préhistoire», Bordeaux-Les Eyzies, juin 2010.* Société Préhistorique Française.

BINDER D., COLLINA C., coll. Garcia Puchol O., Guilbert R. & Perrin T., in press. Pressure Knapping in the North-Western Mediterranean Region during the 7th millennium cal BC. In Rahmani N., Desrosiers P. *The Emergence of Pressure Knapping: From Origin to Modern Experimentation*. N. Rahmani and P. M. Desrosiers. Heidelberg, Springer Verlag

COLLINA C., 2009. *Evolution des industries lithiques du Néolithique ancien en Italie du sud.* Thèse de Doctorat. Aix-en-Provence et Roma : Universités de Provence et La Sapienza, 2 vol.

DESCHAMPS S. 2000. *Apports de l'étude techno économique de l'industrie lithique du Mésolithique récent de Ruffey-sur-Seille « a daupharde » (Jura), à la connaissance du Mésolithique*, mémoire de maîtrise, Université de Paris I, 114 pages

FERRARI S., BRIOIS F., FONTANA F., PERRIN T., NENZIONI G., in press. Approccio sperimentale alla ricostruzione dei sistemi tecnici litici nel Castelnoviano dell'area bolognese. In : Atti del XLV Riunione Scientifica dell'Istituto Italiano di Preistoria E Protostoria « Preistoria e Protostoria dell'Emilia-Romagna », Modena, 26-31 ottobre 2010.

GARCIA PUCHOL O. 2005. *El Proceso de Neolitizaci—n en la Fachada mediterr‡nea de la Pen'nsula IbŽrica. Tecnolog'a y Tipolog'a de la piedra tallada*, Oxford, Archaeopress British Archaeological Reports, International series 1430.

LAUTRIDOU C. 2009 *Étude d'une industrie du Mésolithique : « la Bouloie » (Haute Marne)*, mémoire master 2, Paris Ouest la défense, 45 p

MARCHAND G., 1999. Éléments pour la définition du Retzien, *in* : Thévenin A. et Bintz P. (dir.), *L'Europe des derniers chasseurs, peuplement et paléoenvironnement de l'Épipaléolithique et du Mésolithique*, actes du 5e colloque international U.I.S.P.P., commission 12, Grenoble, 18-23 septembre 1995, Documents préhistoriques 12, Paris, Comité des Travaux historiques et scientifiques, p. 213-224.

Marchand G., 2000 - Facteurs de variabilité des systèmes techniques lithiques au Mésolithique récent et final dans l'ouest de la France. In : Crotti P. Meso'97. Table-ronde sur l'Epipaléolithique et le Mésolithique, Lausanne, novembre 1997, p. 37-48.

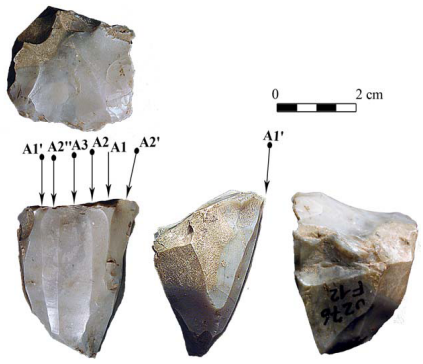
MARCHAND G. (dir.), 2009. *Des feux dans la vallée. Les habitats du Mésolithique et du Néolithique récent de l'Essart à Poitiers (Vienne)*. Presses universitaires de Rennes "Archéologie et culture", 246 p.

PELEGRIN J. & RICHE C. 1999. Un réexamen de la série de Bouvante (Drôme): matières premières lithiques et composantes technologiques, in : *Circulations et identités culturelles alpines à la fin de la préhistoire*, Beeching A. Ed., Valence, Centre d'Archéologie préhistorique, 1999, p. 183-196 (Travaux du CAP, 2).

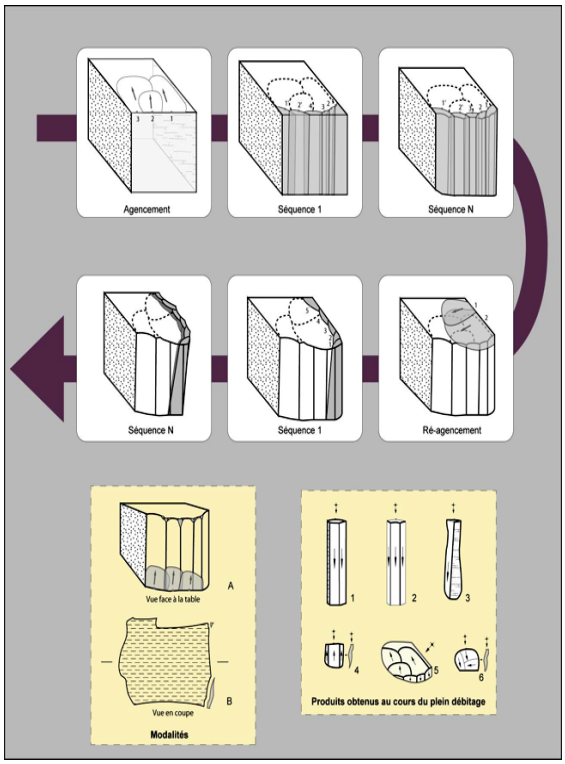
PERRIN, T., MARCHAND, G., ALLARD, P., BINDER, D., COLLINA, C., GARCIA PUCHOL, O. & VALDEYRON, N. 2009. Le second Mésolithique d'Europe occidentale : origines et gradient chronologique *(The late Mesolithic of Western Europe: origins and chronological stages)*. *Annales de la Fondation Fyssen,* 24**,** 160-169.

SEARA F., BOSTYN, F. 2009. L'occupation Mésolithique final du site de Lhéry dans la Marne, in P. Crombé et al. (eds), *Chronology and evolution within the mesolithic of North-West Europe*, Proceeding of an international meeting, Brussels, May 30th-june 1st 2007, Cambridge Scholars publishing, p. 767-784.

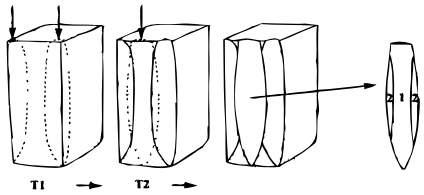
SEARA F., ROTILLON S., CUPILLARD C., (eds) 2002. *Campements mésolithiques en Bresse jurassienne. Choisey et Ruffey-sur-Seille*. Documents d'archéologie Française n° 92, 340 pages



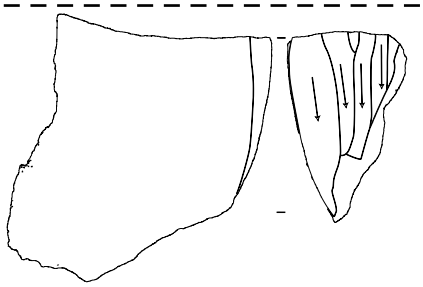
pressure technique, castelnovian core (collina 2009)



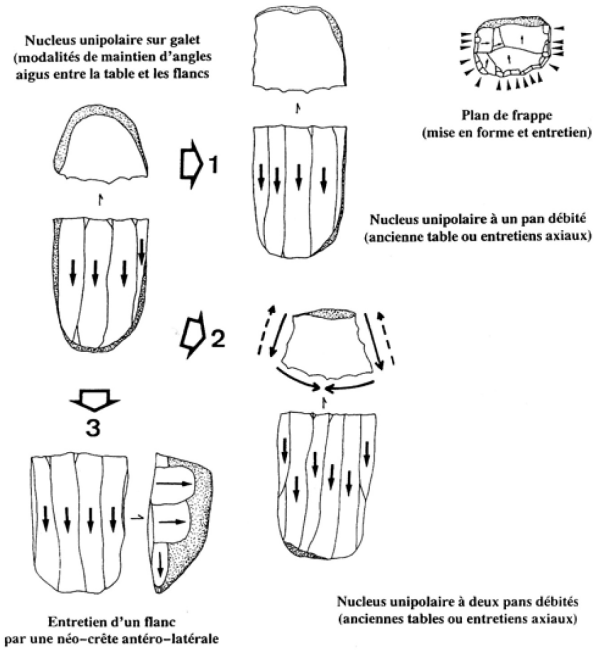
punch technique, L'Essart schema (Marchand 2009)



punch technique, Ruffey sur Seille core (Deschamps 2000)

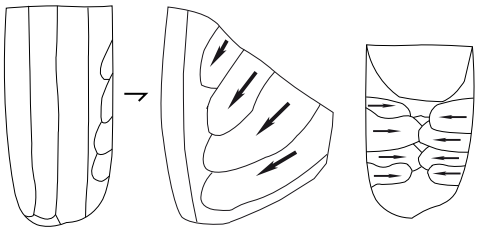


punch technique, tardenoisian core on flake

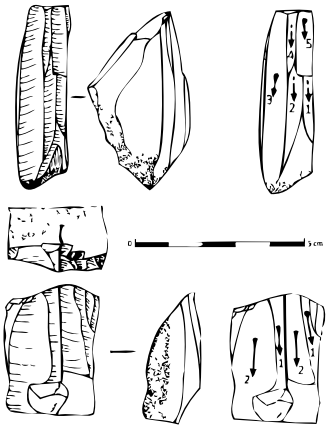


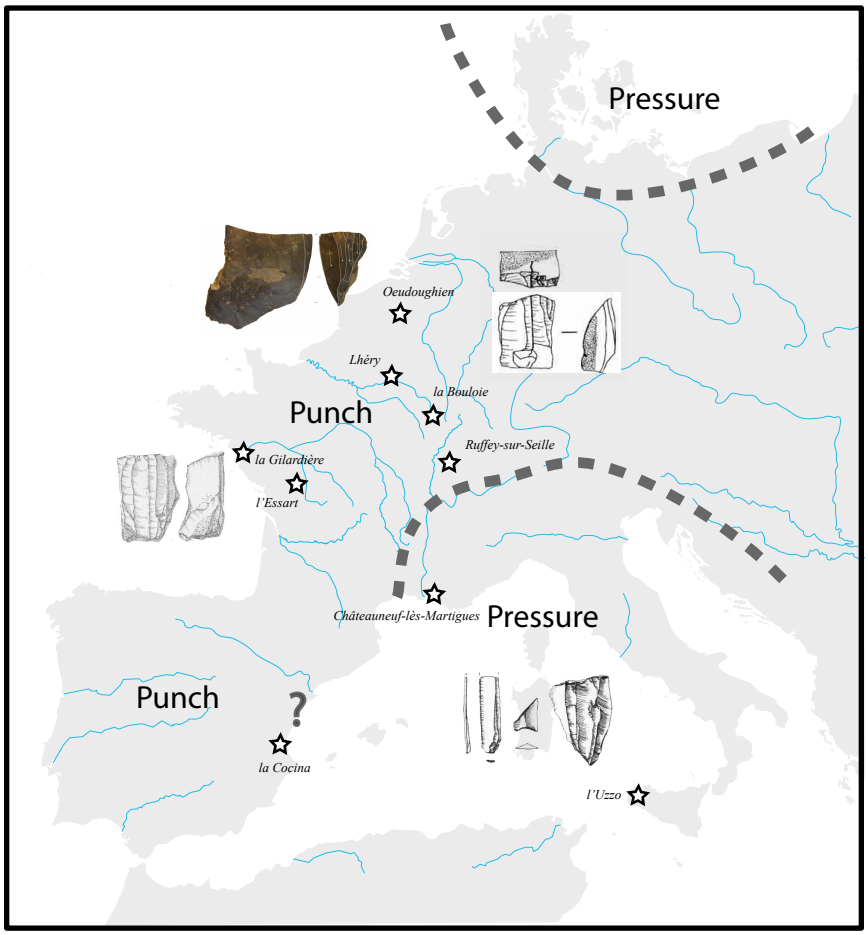
punch technique, Retzian schema (Marchand 2000)

punch technique, facetted striking platform
crests on core back and core side
Sado Valley (Marchand 2001)



punch technique, microfacetted and inclined striking
platform (Lautridou 2009)




Pressure
Oeudoughien
Lhéry
la Bouloie
Punch
la Gilardière
l'Essart
Ruffey-sur-Seille
Châteauneuf-lès-Martigues
Pressure
Punch
?
la Cocina
l'Uzzo