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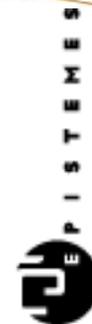
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**Magdalenian and Azilian Lithic Productions in the Paris Basin :
Disappearance of a Programmed Economy**



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Magdalenian and Azilian Lithic Productions in the Paris Basin : Disappearance of a Programmed Economy

The extent of the mutations that occurred in Western Europe between the Magdalenian and the Azilian first became apparent more than a century ago. Since that time, these mutations succeeding one another between the 14th and 12th millennia BC, particularly during the Lateglacial warming, were often seen as a real revolution, frequently described through the filter of myths of catastrophes which then inspired - and at times still influences - prehistoric research. Not so long ago, indeed, some authors could still treat these changes as a veritable decline, or on the contrary a kind of redemption. These value judgements have at least one point in common, and agree with more moderate opinions: they all interpret these upheavals as the forerunners of the changes that would affect the cultures of the early Holocene 2 000 years later, which are usually called "Mesolithic".

Now these various points of view, particularly because they consider the evolution of cultures as a linear phenomenon - and also because they considerably simplify the diversity of the Mesolithic - are hardly compatible with the results attainable by a "paleohistorical" approach (for this notion see Valentin, 2008). This is what we want to show in this essay based on some twenty years of collective research in the Parisian Basin as well as adjacent regions - an appraisal which promotes an explanatory approach putting in perspective varying orders of facts - technical, economic, and even sociological. Of course, "Azilianisation" meant neither decadence nor renaissance, but a progressive cultural adaptation to new environmental circumstances, happening to be different from those characterising the beginning of the Mesolithic.

ECOLOGICAL AND ECONOMIC CONTEXTS
Landscapes, hunting methods and mobility

TWO PRODUCTION SYSTEMS ...
Magdalenian Productions
Late Azilian Productions

... FOR CHANGING EQUIPEMENT AND PROCUREMENT
A modified armament
Tools used in a different way
A distinct management of flint resources

DISAPPEARANCE OF A PROGRAMMED ECONOMY
At what rhythm and according to what logic?

From archaeological data ...

For a century and a half some hundred occupations have been found in the Parisian Basin dating from the period between the 14th and 12th millennia. They have become known in various ways: by simple surface collecting, by limited exploratory excavations, or again by several - happily - extensive excavations, especially at the well-known Magdalenian sites of Pincevent, Étiolles and Verberie.

Thanks to the multiplication of rescue excavations the last ten years have renewed these archaeological sources very deeply. This recent renewal has given a precise chronology and, above all, an environmental context to the facts we are about to examine. Among these facts let us mention the major discovery straight away: the trace, recorded in some deposits as Le Closeau (Bodu (ed), 1998; Bodu, 2000), of the very first mutations at the end of the 13th millennium marking the start of azilianisation (see also Fagnart, 1993; Valentin, 1995).

... to interpretations

The decipherment in progress of these first changes - partly attributed to an early phase of the Azilian - opportunely enriches the explanations we recently advanced by confronting the sharply contrasted choices distinguishing the later phase of the Azilian and the Magdalenian (see especially Julien, 1989; Audouze & Enloe, 1991; Floss, 1992; Fagnart, 1993; Valentin, 1995; Bodu & Valentin, 1997; Street & Baales, 1997). These explanations establish in particular a link between, on the one hand, the transformation of flint tools and knapping methods and, on the other, various evidence suggesting that programming over the long term of hunting activities, and, consequently, the hunters' successive movements diminished a great deal between the Magdalenian and late Azilian (Valentin, 2005a). Thus these hypotheses are inspired by the archaeological applications of the "Optimal Foraging Theory", and particularly by the models on the way hunter-gatherers manage time and risk, adapting their stone tools as a consequence (see in particular Torrence, 1983; Perlès, 1992).

As a complement, these reflections are enriched by a model of J. Pelegrin (2000), inspired by the "Design Theory" (see in particular Bleed, 1986), which enables the changes in armament and the way it was made to be interpreted in the light of this progressive disappearance of a programmed

economy. Since this model was formulated it is worth noting certain predictions concerning hunting tactics have been validated by the analyses and interpretations of O. Bignon (2003; 2008) which the author is seeking today to develop on a vaster archaeo-zoological corpus. Let us point out in passing that these first validations show that the level at which the facts and explanatory scenarios are elaborated can now be used as much for hypothetico-deductive approaches - like that proposed by J. Pelegrin - as for more inductive constructions such as we ourselves put forward here.

Towards other constructions

Of course, our construction is a sketch, made to be tested by new discoveries, analyses, and interpretations as they arise. It is in any case probable that it will be completed in the future by taking into account other less concrete dimensions not developed here. A point about the sociological background, for example, comes to mind that must not be overestimated but not overlooked either: during the Magdalenian the skills and knowledge needed for quite difficult knapping operations could only have been acquired at the end of a learning process which, if not long, was surely methodical (see in particular Pigeot, 1987; Ploux, 1989). In contrast, the simplified knapping methods late Azilian communities used allowed them to get away from what, perhaps by then, was felt to be a social constraint. This may well have been another reason for the success of the new way of knapping.

It must always be borne in mind that all these explanatory ideas are based essentially on a few co-variables observable between technical and economic - or even social, as we have just mentioned - facts. But obviously all the cultural mechanisms underlying these various changes cannot be grasped, and consequently the risk exists of lapsing into excessively mechanistic ways of explaining. So it is also worth remembering on the topic of this underlying cultural logic - to round off the subject matter of the article - what these technical contrasts really mean: not only a change in ways of doing, but also a transformation in "ways of seeing" - following J. Pelegrin's splendid expression. This transformation can easily be seen in the comparison between what these different cultures considered to be knapping waste. Thus, almost systematically, flakes are thrown away by the Magdalenians, but not anymore by the Azilians of the late phase. Technical and economic mutations, therefore, are

accompanied by quite profound changes in ideas. And even if the parallel is daring, it has to be said these changes happened when the art of the Magdalenians disappeared, and consequently, when it is evident an important part of their value system fell apart. Speaking of values, the value of blades in these cultures is obviously one value that needs assessing - its probable symbolic dimension included.

As shall be seen this value conferred on blades resisted despite technical changes into the early Azilian. It is known to have been embedded in Magdalenian history for a long time in South-West France (see in particular Langlais, 2007) before the Magdalenian tendency was expressed in the Parisian Basin - doubtless substance for a new construction...

On cultural terminology

To close this introduction let us now make a few points about the "cultural" terminology. "Magdalenian", "Azilian", it goes without saying these terms do not designate cultures, and still less ethnic groups in the full meaning present-day anthropologists give to these notions, controversial as they are. The fragments of material - and sometimes symbolic - culture that have come down to us are at the most able to identify and define *grosso modo* what we should willingly call "traditions" - essentially of techniques - often encompassed in vast *courants* (i.e. movements of ideas) of continental dimensions (on these notions see Valentin, 2008). So to our way of thinking the adjective "Azilian" refers to regional traditions encompassed by a powerful movement in full expansion during the 12th millennium; as for the noun it means the women or men who produced and reproduced the choices and values these traditions were founded on, and is also used - following an old habit in prehistory - to name the period in which these choices were prevalent. A last word finally on the choice of the term "Azilian" for the Paris Basin: we are responsible for it as well as for progressively abandoning the term "*Federmesser* groups" (Bodu & Valentin, 1997). The latter was used exclusively up till the end of the 1990s when the first discoveries or rediscoveries in the Parisian Basin were confronted with the documentation brought together up to then in northern Europe. Since then broader comparisons from all sides clearly showed that on the scale of our sources - essentially lithic - and of our analyses - resolutely technological - the distinctions between "Azilian", "Tjongerian", "*Federmessergruppen*", or "Final Creswellian" did not make much sense, at least at this

phase of research. The use of a unifying term became evident to take account of the profound and analogous technical, economic, and social upheavals occurring in the 12th millennium in various parts of Western Europe. To designate this process, the term "azilianisation" has become quite consensual. That is essentially why we have retained that of "Azilian" - as have in any case our Swiss colleagues long since - to designate the traditions taking part in this process. This choice can make uneasy those who quite justly note the absence of flat harpoons and painted or engraved pebbles in the Parisian Basin. But why then, not call into question also the use of the term "Magdalenian" in our region? Let us not forget in the Parisian Basin the Magdalenian also had no harpoons - the English "Creswellian" making most use of this invention. As for Magdalenian art in our region, it owes its reputation rather to its rarity, even since the recent spectacular discovery of a richly engraved pebble at Étioilles (Taborin *et al.*, 2001), and particularly since the unexpected discovery of a Creswellian cave art (Bahn, 2008). In short, all these terms are, of course, pure conventions; which is why, in this period of adjusting methods and refounding sources, we felt it was necessary to adopt a standardised nomenclature to efface frontiers that were no more than legacies from past research. In the years to come it will be up to us all to investigate the probable regional specificities. It is precisely with this kind of inquiry that it will be possible to find out how far the rules of inference that are this essay's skeleton can - or cannot - be applied to other regions involved in this vast upheaval we call azilianisation.

ECOLOGICAL AND ECONOMIC CONTEXTS

Landscapes, hunting methods and mobility

P0/1 In the Paris Basin the Magdalenian developed during the 14th and 13th millennia BC in mainly steppe landscapes

P0/2 The Paris Basin late Azilian developed during the 12th millennium BC in mosaic landscapes made up of sparse forests interspersed with grasslands

P0/3 The Magdalenian economies of the Paris Basin depended on planned collective seasonal hunting, during which animals were killed in large numbers

P0/4 From the earliest phase of the Azilian to the end of the 13th millennium in the Paris Basin, hunting activity is little planned and more random, mobilising few hunters

P0/5 The economies of the late Azilian in the Paris Basin depended on punctual hunting during which animals were killed in small numbers

P0_6 The Magdalenian sites in the Paris Basin were occupied for varying lengths of time

P0/7 The late Azilian sites in the Paris Basin were all occupied for very short periods, implying high mobility

P1/1 Between the Magdalenian and late Azilian, in parallel with a modification of the environment, hunting was transformed with more improvisation and less co-operation

P2/1 Between the Magdalenian and late Azilian, the transformation in hunting methods entailed a change in mobility: in the 12th millennium movements are more frequent and less programmed

TWO PRODUCTION SYSTEMS ...

Magdalenian Productions

P0/8 During the Magdalenian flint knapping satisfied two aims: bladelets for projectile armatures (many cutting edges and a few points) and blades for tools

P0/9 During the Magdalenian the production of blades for tools was guided by several requirements: desire for length, standardisation, and - if possible - productivity

P0/10 To meet their aims the Paris Basin Magdalenians carefully selected good fine-grained flints, essentially coming from the immediate environment of each site

P0/11 When the blade-producing blocks are irregular the knappers make use of a shaping out phase that can be rather long and costly

P0/12 The blades are produced exclusively with an organic hammer - soft and elastic

P0/13 Magdalenian blades were not all made for immediate use, and some constituted small panoplies carried from one site to another

P1/2 During the Magdalenian flints were knapped meticulously

Late Azilian Productions

P0/14 During the late Azilian the desired products of flint knapping were: some short blades not very standard for projectile points and knives, short or elongated flakes for other tools

P0/15 During the late Azilian, in the Paris Basin, the flint used was nearly always exclusively local and very variable in quality, in other words hardly selected

P0/16 During the late Azilian the whole knapping process was effected with a soft stone hammer, often inside the edge of the knapping platform (internal version)

P0/17 During the late Azilian systematic use of the soft stone hammer more often in internal version allowed a certain amount of improvisation enabling flints of very variable quality to be exploited

P0/18 During the late Azilian, in the Paris Basin, the blades and flakes were almost all made for immediate use

P1/3 During the late Azilian the method of knapping was very simple but immediately productive and seems to have been accompanied by a certain rapidity of execution

P1/4 In the Paris Basin during the late Azilian - unlike the Magdalenian - provision was no longer made for future tooling needs on a territorial scale

P2/2 Du Magdalénien à l'Azilien récent, dans le Bassin parisien, la taille se simplifie beaucoup

... FOR CHANGING EQUIPEMENT AND PROCUREMENT

A modified armament

P0/19 During the Magdalenian the dominant weapon was an antler sagaie, requiring a long time to make, probably propelled by a spearthrower

P0/20 By the early Azilian, at the end of the 13th millennium, the antler sagaies had almost entirely disappeared, being replaced by quickly made flint points

P1/5 From the Magdalenian to the late Azilian - starting in the early Azilian the armament was modified for quicker production

P2/3 From the Magdalenian to the late Azilian the transformation of the armament was related to new hunting methods resulting in greater losses of armatures

P3/1 From the Magdalenian to the late Azilian great simplification of knapping meets high needs in lithic points

Tools used in a different way

P0/21 During the Magdalenian, tools, at times intensely sharpened even recycled, could be used for quite a long time

P0/22 During the late Azilian tools were not sharpened much and used for only a short time

P1/6 During the Magdalenian the production of long standardised blades facilitated the longevity of several tools

P1/7 During the late Azilian the rather weak blades production agrees with the brevity of tools custom

P2/4 During the Magdalenian, the provision for future needs on territorial scale and the longevity assured to the tools indicate that forethought - sometimes long term - was devoted to lithic production

P2/5 During the late Azilian the lithic production no longer showed signs of provision for the long term

P3/2 Between the Magdalenian and the late Azilian more improvised hunting no longer required lithic production to provide for the long term

A distinct management of flint resources

P1/8 During the Magdalenian the systematic search for good flint gave rise to time constraints and presupposed settling close to good deposits

P1/9 During the late Azilian as flint supplies were obtained with little selection they entailed no time constraints and did not require settling close to good deposits

P2/6 Between the Magdalenian and late Azilian the new knapping method making use of varied flint reduced procurement constraints

P3/3 Between Magdalenian and late Azilian the reduction of procurement constraints was an economic advantage given the increase in mobility

P4/1 Between Magdalenian and late Azilian more frequent movements and hunting needing less planning but weapons easier to replace encouraged transformation of the lithic production

DISAPPEARANCE OF A PROGRAMMED ECONOMY

At what rhythm and according to what logic ?

P0/23 At the end of the 13th millennium, during the early phase of the Paris Basin Azilian, soft stone is already the only percussion method used

P0/24 At the end of the 13th millennium, during the early phase of the Paris Basin Azilian, the requirements for knapping were still very demanding

P1/10 The early phase of the Azilian marks a first stage in the transformations of hunting methods, armament and knapping, the latter still not being much simplified

P5/1 In the Paris Basin armament and knapping were transformed from the end of the 13th millennium following a change in hunting methods. The late Azilian is a second stage in the transformation of knapping

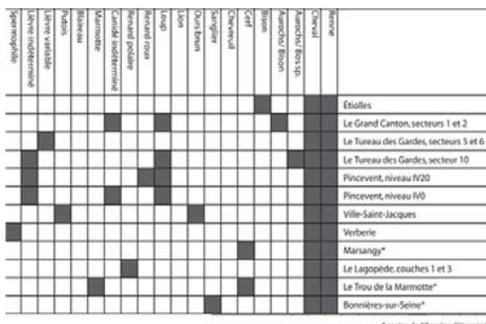
ECOLOGICAL AND ECONOMIC CONTEXTS

Landscapes, hunting methods and mobility

P0/1 In the Paris Basin the Magdalenian developed during the 14th and 13th millennia BC in mainly steppe landscapes

For this time interval corresponding to the end of the Pleniglacial (Oldest Dryas or Heinrich 1 according to the chronologies) as well as the beginning of the Lateglacial (Bølling), palynological surveys show a very open environment for the Paris Basin colonised by juniper (see particularly Limondin-Lozouet et al., 2002; Leroyer & Allenet, 2007). In this environment the Magdalenian hunters killed horses and reindeer above all, the latter being well known for their migratory behaviour. [figures 1 à 2]

Zones polliniques régionales (Chronologie 14C, 10000 ans BP)	Paysages dominants dans le Bassin parisien	Zones pour l'Europe du NW
Zone 7 10 000 - 9 000 av. J.-C. 10 000 - 10 000 av. J.-C.	Nette ouverture du milieu avec une extension de la strate herbacée (Graminées et Stéphanes) aux dépens des boisements.	Dryas récent
Zone 6 11 000 - 10 300 av. J.-C. 11 000 - 10 000 av. J.-C.	Nouveau recul de la steppe à armoises lié à l'incursion des genévriers : les bouleaux sont moins diversifiés.	Allerød
Zone 5 11 000 - 11 300 av. J.-C. 11 300 - 11 000 av. J.-C.	Relative fermeture du milieu : les peuplements de bouleaux se densifient et entraînent un recul de la steppe à armoises.	Allerød
Zone 4 12 000 - 11 000 av. J.-C.	La dynamique de reconquête arborée est interrompue au profit des formations steppiques dominées par les armoises.	Dryas moyen
Zone 3 12 000 - 11 000 av. J.-C. 11 000 - 10 000 av. J.-C.	Les armoises progressent au sein d'une steppe toujours diversifiée tandis que les boisements évoluent : les bouleaux supplantent les genévriers.	Bølling
Zone 2 12 000 - 11 000 av. J.-C.	La couverture végétale devient un peu plus dense : outre une steppe diversifiée (Rubulacées, Chenopodiacées et armoises), des arbustes pionniers comme le genévrier s'implantent.	Bølling
Zone 1 12 000 - 11 000 av. J.-C.	Milieu très ouvert avec une couverture végétale dominée par les Graminées et les Rubulacées, assez claire pour permettre la persécution des espèces forestières du site.	Dryas ancien et tout début Bølling



1 Evolution of vegetation in the Paris Basin according to palynology: pink ground - dominant landscapes during the Magdalenian (after document C. Leroyer).

2 Mammals hunted by the Magdalenians of the Paris Basin (after Bignon, 2008)

P0/2 The Paris Basin late Azilian developed during the 12th millennium BC in mosaic landscapes made up of sparse forests interspersed with grasslands

For this interval of time at the height of the Lateglacial (Allerød), palynological surveys show definite reforestation in the Paris Basin corresponding first to the expansion of birch, followed by that of pine (see particularly Limondin-Lozouet et al., 2002; Leroyer & Allenet, 2007).

In this environment the hunters of the late Azilian killed many aurochs and red deer, species with a territorial behaviour. [figures 3 à 4]

Zones polliniques régionales	Paysages dominants dans le Bassin parisien	Zones pour l'Europe du NW
Zone 7	Nette ouverture du milieu avec une extension de la strate herbacée (Graminées et Stéphanes) aux dépens des boisements.	Dryas récent
Zone 6	Nouveau recul de la steppe à armoises lié à l'incursion des genévriers : les bouleaux sont moins diversifiés.	Allerød
Zone 5	Relative fermeture du milieu : les peuplements de bouleaux se densifient et entraînent un recul de la steppe à armoises.	Allerød
Zone 4	La dynamique de reconquête arborée est interrompue au profit des formations steppiques dominées par les armoises.	Dryas moyen
Zone 3	Les armoises progressent au sein d'une steppe toujours diversifiée tandis que les boisements évoluent : les bouleaux supplantent les genévriers.	Bølling
Zone 2	La couverture végétale devient un peu plus dense : outre une steppe diversifiée (Rubulacées, Chenopodiacées et armoises), des arbustes pionniers comme le genévrier s'implantent.	Bølling
Zone 1	Milieu très ouvert avec une couverture végétale dominée par les Graminées et les Rubulacées, assez claire pour permettre la persécution des espèces forestières du site.	Dryas ancien et tout début Bølling



3 Evolution of vegetation in the Paris Basin according to palynology: pink ground - dominant landscapes during the Azilian (after document C. Leroyer)

4 Mammals hunted by the Azilians of the Paris Basin (after Bodu et al., 1996; Bodu (ed.), 1998; Bridault, 1997; Cordy, 1990; Fagnart, 1997; Griggo, 2005)

P0/3 The Magdalenian economies of the Paris Basin depended on planned collective seasonal hunting, during which animals were killed in large numbers

In the Paris Basin some forty sites occupied by Magdalenians are known; of these sites about ten give us information about how they hunted. Many times the Magdalenian hunters in the Paris Basin would tackle reindeer herds, probably of great size, during the autumn migration (see particularly Enloe, 2000) or family groups of horses ("harems") at other seasons (Bignon, 2003; 2006; 2008). These large - indeed very large - scale episodes could be planned owing to the predictable behaviour of the animals, especially reindeer.

According to what is known of this behaviour these great hunts involved interception tactics or driving (Bignon, op. cit; Enloe, op. cit.; Müller et al., 2006). To complement this, more individual hunting tactics were probably used as well (Bignon, op. cit.). [figure 5]



5 Reindeer in Norway (©Oskartin. <http://animalphotos.info/a/2008/01/14/reindeer-graze-in-grassy-plains-below-mountains/>)



6 Red deer in England (©Neil Philips. <http://animalphotos.info/a/2007/12/22/buck-and-doe/>)

P0/4 From the earliest phase of the Azilian to the end of the 13th millennium in the Paris Basin, hunting activity is little planned and more random, mobilising few hunters

In the Paris Basin only three sites are known to have been occupied during the early Azilian: the cave of Bois-Ragot (Vienne), the cave of Gouy (Seine-Maritime) and the open-air site of Le Closeau (Hauts-de-Seine). On the latter's lower level (locus 46), it has been possible to reconstruct how horses were hunted (Bignon, 2003, 2008; Bignon & Bodu, 2006).

Juveniles and adults too, sometimes old, were targeted in every season and in small numbers, which is perfectly compatible with stalking and pursuit tactics always involving a minimum of hunters.

P0/5 The economies of the late Azilian in the Paris Basin depended on punctual hunting during which animals were killed in small numbers

In the Paris Basin some twenty sites are known to have been occupied during the late Azilian, but there is not much detailed data on hunting methods (Bridault, 1997; Limondin-Lozouet et al., 2002). However, the data we have can be put in perspective by taking advantage of what has been learned about other better documented

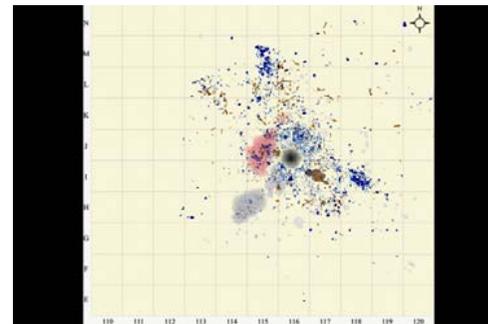
regions such as the central Rhineland (see particularly Baales, 2006; Street et al., 2006).

It can be deduced that during the 12th millennium animals in small groups - or even solitaires like stags - were killed throughout the year. It is highly probable that these tactics were little different from those reconstructed for Le Closeau in the early Azilian. [figure 6]

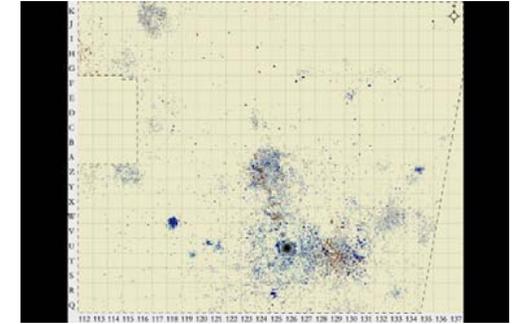
P0/6 The Magdalenian sites in the Paris Basin were occupied for varying lengths of time

This variable duration can be deduced from the varying density itself of the remains left behind from one camp to another, and the changing nature of the surviving structures. This variability may in any case be seen

through the different occupations throughout the stratigraphy of a single site such as Étiolles (see particularly Pigeot (dir.), 2004) or Pincevent (see particularly Bodu et al. (eds), 2006). [figures 7 à 9]



7 A dwelling unit with not very dense remains occupied in autumn: the unit J116 on the level IV40 at Pincevent



8 A dwelling unit with dense remains occupied in winter: the unit T125 on the level IV0 at Pincevent (Seine-et-Marne) (document J. Louvet et G. Debout In Collectif, 2007)

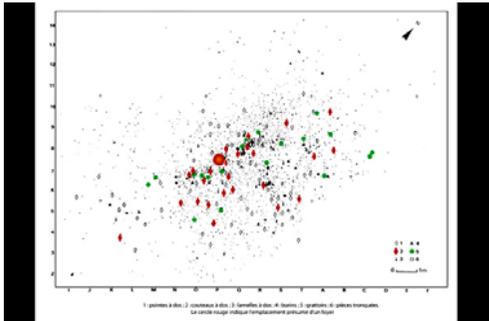


9 The heavy structures of the dwelling unit U5 at Étioilles (Essonne) (document N. Pigeot)

P0/7 The late Azilian sites in the Paris Basin were all occupied for very short periods, implying high mobility

That these occupations were extremely short can be deduced from the density of the remains left behind at each camp site, always lower than any of the Magdalenian deposits. This is the case, for instance, at Saleux in the Somme (Coudret & Fagnart, 2004).

This situation can also be seen in the neighbouring regions such as the Belgian Campine (De Bie & Caspar, 2000), the central Rhineland (Street et al., 2006) or the Swiss plateau (Leesch et al., 2004). [figure 10]



10 The locus 114 at Saleux in the Somme (after Fagnart, 1997 with modifications)

P1/1 Between the Magdalenian and late Azilian, in parallel with a modification of the environment, hunting was transformed with more improvisation and less co-operation

Late Azilian hunters rather seem to have made use of random encounters, exploiting species with territorial behaviour. In contrast, the Magdalenians hunted animals such as reindeer that come together - sometimes in considerable numbers - at predictable times and places.

Interception or driving - tactics requiring the action of many individuals - enabled a large quantity of game to be killed supplying a surplus of meat for preservation. This is what is found, for instance, on the level IV20 at Pincevent, where the occupants processed in a few weeks at least 3.5 tons of food products from reindeer killed during their autumn migration (see particularly Julien In Bodu et al. (eds), 2006, p. 151).

- P0/1 In the Paris Basin the Magdalenian developed during the 14th and 13th millennia BC in mainly steppe landscapes [cf. page 10]
- P0/2 The Paris Basin late Azilian developed during the 12th millennium BC in mosaic landscapes made up of sparse forests interspersed with grasslands [cf. page 10]
- P0/3 The Magdalenian economies of the Paris Basin depended on planned collective seasonal hunting, during which animals were killed in large numbers [cf. page 10]
- P0/4 From the earliest phase of the Azilian to the end of the 13th millennium in the Paris Basin, hunting activity is little planned and more random, mobilising few hunters [cf. page 11]
- P0/5 The economies of the late Azilian in the Paris Basin depended on punctual hunting during which animals were killed in small numbers [cf. page 11]

P2/1 Between the Magdalenian and late Azilian, the transformation in hunting methods entailed a change in mobility: in the 12th millennium movements are more frequent and less programmed

As there was less surplus food to preserve it was necessary to move about more often to find new quarries. And given the absence of the planning caused by the game aggregating in certain places and moments more erratic movements can be predicted.

This transformation in mobility between the Magdalenian and late Azilian has in any case been proved in the central Rhineland, particularly thanks to studying the origins of knapped stones (Floss, 2000; Baales, 2006; Street et al., 2006). In the Paris Basin it is not known for the time being whether this transformation started in the early Azilian, at the end of the 13th millennium: on this theme the data collected at the three known occupations have not been sufficient.

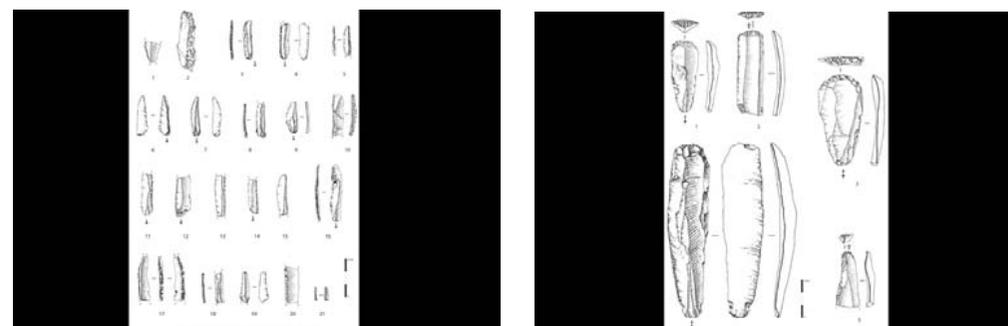
- P0/6 The Magdalenian sites in the Paris Basin were occupied for varying lengths of time [cf. page 11]
- P0/7 The late Azilian sites in the Paris Basin were all occupied for very short periods, implying high mobility [cf. Page 12]
- P1/1 Between the Magdalenian and late Azilian, in parallel with a modification of the environment, hunting was transformed with more improvisation and less co-operation [cf. page 12]

TWO PRODUCTION SYSTEMS ...

Magdalenian Productions

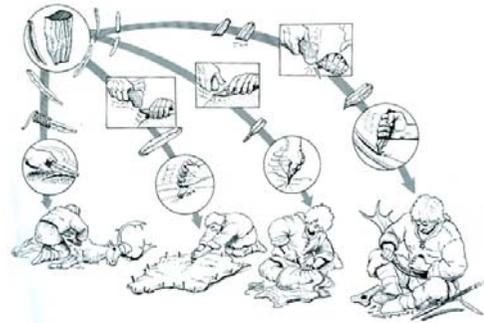
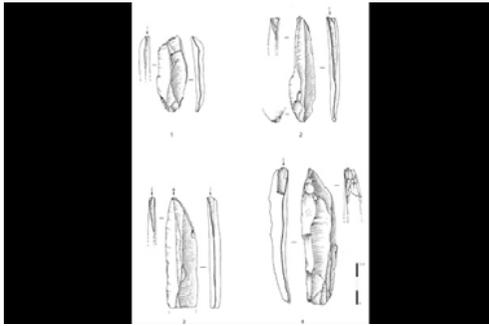
P0/8 During the Magdalenian flint knapping satisfied two aims: bladelets for projectile armatures (many cutting edges and a few points) and blades for tools. Small rectangular microliths, backed bladelets, were stuck to antler sagaies to be used as cutting edges. These cutting edges increased the point's penetrative power while tearing the quarry's tissues causing haemorrhages. Other less numerous projectiles - made from wood or bone - were fitted with perforating flint points at their tips.

These projectile armatures are accompanied by a panoply of varied tools (knives, scrapers, burins, piercers, etc.) used for various tasks relating to the treatment of animal materials (meat, hide, bone, etc.). [figures 11 to 14]



11 Armatures in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds). 2006)

12 Scrapers in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds). 2006)



13 Burins in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds), tools (after G. Tosello) 2006) **14** Artist's view illustrating the use of some Magdalenian tools (after G. Tosello)

P0/9 During the Magdalenian the production of blades for tools was guided by several requirements: desire for length, standardisation, and - if possible - productivity

These dimensional and qualitative requirements - two long rectilinear parallel edges - appear from the examination of the many blades used. They can also be deduced from the technical preferences that can be inferred from the numerous refittings effected particularly at Étioilles, Pincevent, and Verberie, based on which the knapping methods have been reconstructed in detail (see particularly Pigeot, 1987; Audouze et al., 1988; Bodu, 1993; Valentin, 1995; Pigeot (dir.), 2004). [figure 15]



15 Scrapers from Le Tureau des Gardes at Marolles-sur-Seine (Seine-et-Marne)

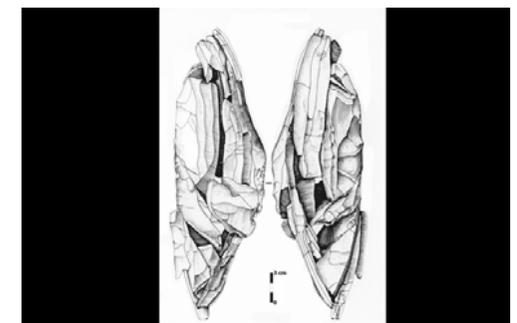
P0/10 To meet their aims the Paris Basin Magdalenians carefully selected good fine-grained flints, essentially coming from the immediate environment of each site

At several sites such as Pincevent and Verberie the supply came from the alluvium of the streams running alongside the settlement. Over and above homogeneity and fineness of grain the Magdalenians checked the blocks' morphology carefully - which according to their ideal should be approaching an elongated ovoid form with very regular convexities.

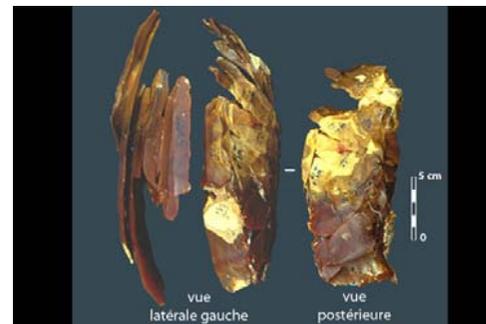
For blades, preferably long (around 10-15 cm), the volumes had to be large anyway. At Étioilles the knappers exploited a flint ledge, exceptional for its quality and peculiarly large size of blocks: at this site the blades were quite often longer than 25 cm. [figures 16 to 18]



16 A very regular block knapped without really being shaped from the dwelling unit Q31 at Étioilles (Essonne) (document N. Pigeot)



17 A regular block knapped after partial shaping from level II.1 at Verberie (Oise) (after drawing Y. Paele In Audouze et al., 1981)

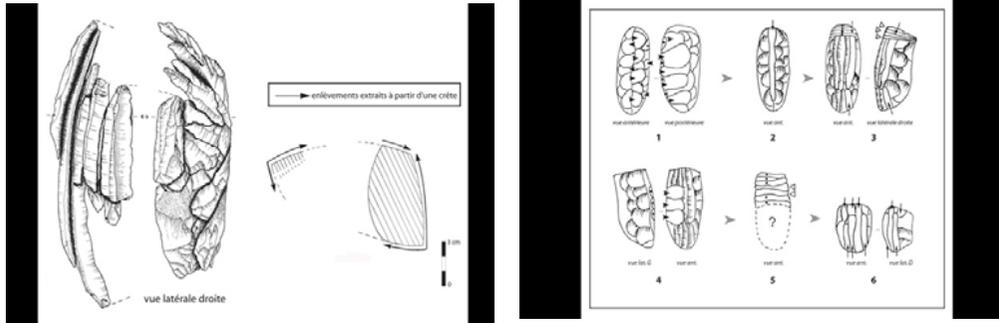


18 A block knapped after careful shaping with two crests at Laitier-Pilé - locus 468.7 (Cher)

P0/11 When the blade-producing blocks are irregular the knappers make use of a shaping out phase that can be rather long and costly

Sometimes the Magdalenians collected flint blocks with a less than optimal morphology; in which case they had to be shaped, i.e. given the right convexities. This preliminary regularisation enabled the number of corrections to be minimised when the blades were knapped.

Partly carried out with a stone hammer this regularisation could produce many flakes the Magdalenians considered to be simple waste, as they hardly ever used them as tools. [figures 19 to 20]



19 Exploitation of a block at Laitier-Pilé - locus 468.7 (Cher) (drawings D. Molez In Valentin, 1995). See photo of the P0-10

20 Principal stages of the chaîne opératoire revealed by the previous refitting. 1 and 2 : shaping out then crest extraction; 3 to 6: blade production (diagrams D. Molez In Valentin, 1995)

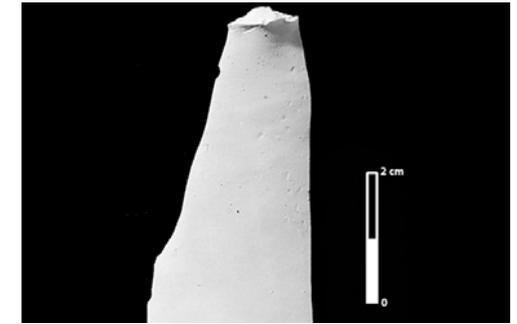
P0/12 The blades are produced exclusively with an organic hammer - soft and elastic

Very probably, the hammers were made from reindeer antler, unfortunately not preserved in the Paris Basin. Their use is deduced from the characteristic stigmata seen on the blades, on the proximal part in particular - i.e. around the zone of impact (for these stigmata's description and interpretation with reference to the experimental corpora, see Pelegrin, 2000).

The use of this percussion technique by the Magdalenians was accompanied by especially careful preparation of the impact zones on the core (cf. frequent use of "en éperon" technique). [figures 21 to 22]



21 Experimental debitage with an organic hammer



22 Ventral face of proximal part of experimental blade knapped with organic hammer (document J. Pelegrin): the recognition of percussion techniques is based on such reference material (Pélegrin, 2000)

P0/13 Magdalenian blades were not all made for immediate use, and some constituted small panoplies carried from one site to another

This behaviour is observed throughout Magdalenian Europe. In the Paris Basin it is manifested by the presence at each occupation of batches - more or less substantial - of used blades made from non-local flints originating 50 to 100 km away (Mauger, 1994).

Most of the time the debitage of these blades did not take place at the occupation where they had been abandoned, but probably at the site of procurement during another stage of the cycle of seasonal movements. [figure 23]



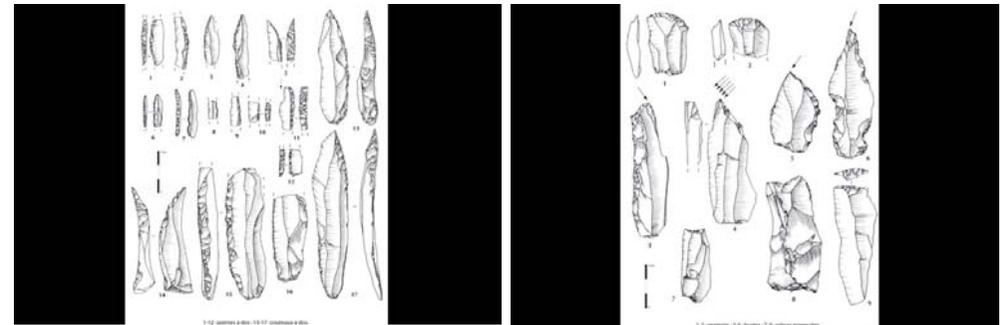
23 Some blades brought to the level IV20 of Pincevent (Seine-et-Marne) from the centre of the Île-de-France to about 70 km to the north, and transformed into scrapers (document Centre archéologique de Pincevent)

P1/2 During the Magdalenian flints were knapped meticulously Size and quality requirements meant Magdalenian blade knapping could only be learned methodically (see particularly Pigeot, 1987; Ploux, 1989; Bodu, 1993).

Experienced knappers were distinguished from others by their care and even by their meticulousness.

- *P0/8 During the Magdalenian flint knapping satisfied two aims: bladelets for projectile armatures (many cutting edges and a few points) and blades for tools [cf. page 13]*
- *P0/9 During the Magdalenian the production of blades for tools was guided by several requirements: desire for length, standardisation, and - if possible - productivity [cf. Page 14]*
- *P0/10 To meet their aims the Paris Basin Magdalenians carefully selected good fine-grained flints, essentially coming from the immediate environment of each site [cf. Page 14]*
- *P0/11 When the blade-producing blocks are irregular the knappers make use of a shaping out phase that can be rather long and costly [cf. Page 15]*
- *P0/12 The blades are produced exclusively with an organic hammer - soft and elastic [cf. Page 15]*

P0/14 During the late Azilian the desired products of flint knapping were: some short blades not very standard for projectile points and knives, short or elongated flakes for other tools The projectile heads were fitted with perforating flint points. The panoply of tools comprised knives, scrapers, and burins used for various tasks relating to treating animal materials. Deciphering knapping methods (see particularly Valentin et al., 2004; Valentin, 2005b) shows a certain lengthening of debitage products remained the prime requirement, but this requirement applied as much to elongated flakes as to true blades when circumstances were favourable; all the same, rather short (about 5-10 cm) blades were preferred for points and knives. Besides, short flakes to make scrapers were also desired products. [figures 24 to 25]



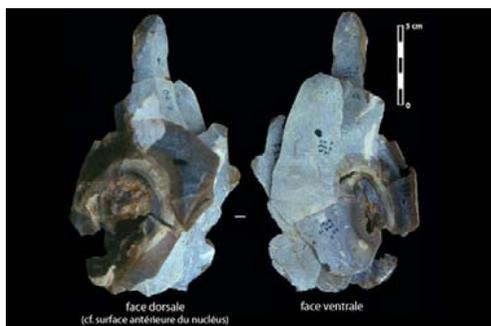
24 Projectiles' armatures and knives from Ambenay (Eure) (drawings C. Billard In Valentin et al., 2004)

25 Tools from Ambenay (Eure) (drawings C. Billard in Valentin et al., 2004)

P0/15 During the late Azilian, in the Paris Basin, the flint used was nearly always exclusively local and very variable in quality, in other words hardly selected

In the Somme basin a clear decline in the overall quality of the material used is observed during the late Azilian when compared to the materials chosen by the Magdalenians (Fagnart, 1997). Elsewhere in the Paris Basin the very variable quality from one site to another reflects nearby flint resources. It is possible, but it remains to be shown, that the morphosedimentary stabilisation of the valleys and slopes during the Allerød as well as the extension of plant cover (Limondin-Lozouet et al., 2002), made access to certain high quality flint deposits difficult. In several places, nonetheless, in the Paris Basin resources, quite good in general, were exploited. But even in these favourable

contexts very mediocre volumes were sometimes collected for knapping. This rather lax selection has also been observed in regions where flint - partially or totally absent - must have been collected at some distance: as is the case, for example, in the central Rhineland (Floss, 2000). [figure 26]



26 This refitting from Ambenay (Eure) shows a first sequence of debitage on a block presenting a visible defect when collected - a fairly deep geode, which prevented the removal of several flakes

P0/16 During the late Azilian the whole knapping process was effected with a soft stone hammer, often inside the edge of the knapping platform (internal version)

Hard sandstone and limestone seem to have been used as hammers going by the stigmata they left on the proximal part of the debitage products (for the description and interpretation of these stigmata referring to the experimental corpora, see Pelegrin, 2000).

For the finest products, some blades in particular, blows were struck on the very edge of the knapping platform, but more often a little bit off the edges so as to remove thicker pieces: so an internal version predominated. [figure 27 to 28]



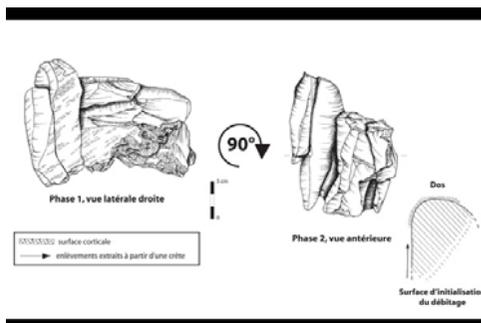
27 Experimental debitage with sandstone hammer



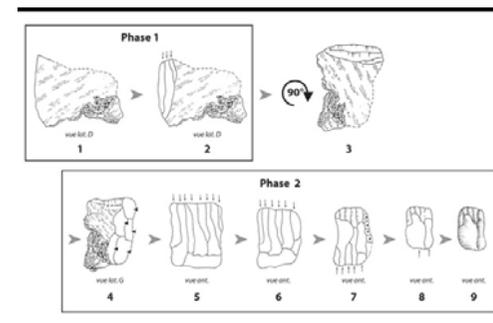
28 Ventral face on proximal part of an experimental blade knapped with a sandstone hammer (document J. Pelegrin)

P0/17 During the late Azilian systematic use of the soft stone hammer enabled more often in internal version allowed a certain amount of improvisation enabling flints of very variable quality to be exploited

The thickness of the pieces removed, determined by frequent blows inside the edge of the knapping platform, enabled the blocks' irregularities and heterogeneity to be overcome. Because of this the preliminary shaping-out of the volumes could remain generally very limited. Occasionally, during debitage, when accidents hindered it from progressing correctly, the knappers would regularise the whole block by removing especially thick products to deal with these unexpected problems. [figures 29 to 30]



29 Exploiting a block for producing blades and flakes at Ambenay (Eure) (drawings D. Molez In Valentin et al., 2004)



30 Principal stages of the chaîne opératoire revealed by the previous refitting. 1 and 2: exploitation of a dihedral formed by the meeting of two natural breaking surfaces; 3: after flattening this first flaking surface, turning the block 90° around; 4 to 9: after regularising the whole, producing blades and elongated flakes (interpretative diagrams D. Molez In Valentin et al., 2004)

P0/18 During the late Azilian, in the Paris Basin, the blades and flakes were almost all made for immediate use

In the flint rich zones of the Paris Basin, only the upper level of Le Closeau site has yielded some flint of distant origin. All the other settlements were supplied from the immediate vicinity.

P1/3 During the late Azilian the method of knapping was very simple but immediately productive and seems to have been accompanied by a certain rapidity of execution

To constitute a panoply of instruments practically all kinds of products could be used: the short and the elongated flakes as well as the occasional blades. The latter, clearly preferred for the points and knives, could be produced from the start of the debitage as part of the very limited shaping-out of the volume.

To conclude, from each volume it was possible to gain in a little time what was needed in order to renew a tool kit with quite heterogeneous supports. In comparison with the Magdalenian it is noteworthy that the operations of regularisation, rather limited, could furnish some useful supports such as short flakes for the scrapers. As for the rapidity of execution it is worth pointing out that a late Azilian knapper did not necessarily have to change hammers while working as did most Magdalenian craftsmen, who used an organic hammer for the debitage and a stone one for the shaping-out or certain maintenance operations.

- *P0/14 During the late Azilian the desired products of flint knapping were: some short blades not very standard for projectile points and knives, short or elongated flakes for other tools [cf. page 16]*
 - *P0/15 During the late Azilian, in the Paris Basin, the flint used was nearly always exclusively local and very variable in quality, in other words hardly selected [cf. page 16]*
 - *P0/16 During the late Azilian the whole knapping process was effected with a soft stone hammer, often inside the edge of the knapping platform (internal version) [cf. page 17]*
 - *P0/17 During the late Azilian systematic use of the soft stone hammer more often in internal version allowed a certain amount of improvisation enabling flints of very variable quality to be exploited [cf. page 17]*
-

P1/4 In the Paris Basin during the late Azilian - unlike the Magdalenian - provision was no longer made for future tooling needs on a territorial scale

This rule seems to have applied to the regions rich in flint like the Paris Basin, and to have had exceptions in poor regions - in particular the central Rhineland and Switzerland (Floss, 2000; Leesch et al., 2004).

- *P0/13 Magdalenian blades were not all made for immediate use, and some constituted small panoplies carried from one site to another [cf. page 15]*
 - *P0/18 During the late Azilian, in the Paris Basin, the blades and flakes were almost all made for immediate use [cf. page 18]*
-

P2/2 From the Magdalenian to the late Azilian, in the Paris Basin, knapping became much simpler

- *P0/14 During the late Azilian the desired products of flint knapping were: some short blades not very standard for projectile points and knives, short or elongated flakes for other tools [cf. page 16]*
 - *P1/2 During the Magdalenian flints were knapped meticulously [cf. page 16]*
 - *P1/3 During the late Azilian the method of knapping was very simple but immediately productive and seems to have been accompanied by a certain rapidity of execution [cf. page 18]*
-

... FOR CHANGING EQUIPEMENT AND PROCUREMENT

A modified armament

P0/19 During the Magdalenian the dominant weapon was an antler sagaie, requiring a long time to make, probably propelled by a spearthrower

heads familiar to anthropologists. Such sagaies were quite probably thrown with a spearthrower; quite abundant in other Magdalenian regions no example of this instrument has been discovered yet in the Paris Basin. [figures 31 to 32]



31 Antler points from the level IV20 at Pincevent (Seine-et-Marne) (document J.-M. Pétillon)

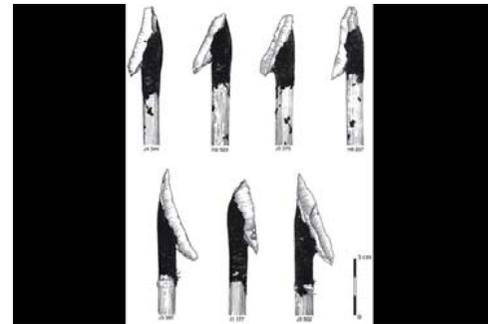


32 Antler point fragment with 2 flint cutting edges from the level IV20 at Pincevent (Seine-et-Marne) (document M. Vanhaeren)

P0/20 By the early Azilian, at the end of the 13th millennium, the antler sagaies had almost entirely disappeared, being replaced by quickly made flint points

Except for a few long barbed points found out of archaeological context (Fagnart, 1997), rather typical of the late Azilian and specific to North-West Europe, the Paris Basin has not yielded any other weapon parts made from antler. On the contrary, from the early Azilian

numerous quickly made flint points are found, probably - given their small size and especially their narrowness - the heads of arrows shot from a bow. [figure 33]



33 Hafting of some early Azilian points from Bois-Ragot (Vienne) reconstructed after traceology (after drawings J. Courbet In Plisson, 2005)

P1/5 From the Magdalenian to the late Azilian - starting in the early Azilian the armament was modified for quicker production

- *P0/19* During the Magdalenian the dominant weapon was an antler sagaie, requiring a long time to make, probably propelled by a spearthrower [cf. page 19]
- *P0/20* By the early Azilian, at the end of the 13th millennium, the antler sagaies had almost entirely disappeared, being replaced by quickly made flint points [cf. page 19]

P2/3 From the Magdalenian to the late Azilian the transformation of the armament was related to new hunting methods resulting in greater losses of armatures

Discussing Magdalenian armatures, J. Pelegrin (2000) specifies, in a predictive model, partly validated since by the results of O. Bignon (2003; 2008) on the evolution of hunting tactics, that the advantage of the tough - and so long-lasting - Magdalenian antler sagaies was also that they could be easily repaired by simple sharpening; all of which justified the long time needed to make them. So their choice made sense - provided the points that had

missed their targets could be retrieved, which mass hunting in places chosen by the hunters - using driving tactics for example - made easier. Again according to J. Pelegrin's model if these points easy to sharpen but long to make then became less attractive it was, perhaps, because they were lost in larger numbers, in, for example, a hunt more akin to individual stalking and consequently in a location harder to confine. Its rapid production then made the lithic point, though fragile, much more attractive, especially when hunting episodes less easy to plan required repairing activities to be less concentrated in time.

- P1/1 Between the Magdalenian and late Azilian, in parallel with a modification of the environment, hunting was transformed with more improvisation and less co-operation [cf. page 12]
- P1/5 From the Magdalenian to the late Azilian - starting in the early Azilian the armament was modified for quicker production [cf. page 19]

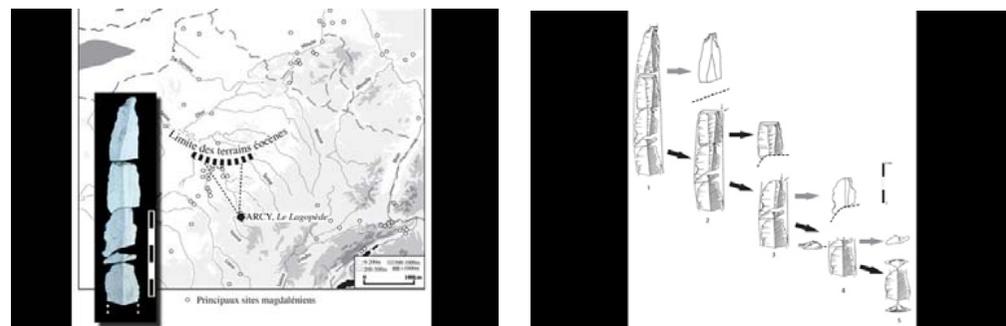
P3/1 From the Magdalenian to the late Azilian great simplification of knapping meets high needs in lithic points

- P2/2 From the Magdalenian to the late Azilian, in the Paris Basin, knapping became much simpler [cf. page 18]
- P2/3 From the Magdalenian to the late Azilian the transformation of the armament was related to new hunting methods resulting in greater losses of armatures [cf. page 19]

Tools used in a different way

P0/21 During the Magdalenian, tools, at times intensely sharpened even recycled, could be used for quite a long time

When piecing fragments of tools back together it became clear that several had been remade intentionally several times while in use. Sometimes, instead of mere sharpening the tool underwent a veritable modification between different moments in its use. [figures 34 to 35]



34 Eocene flint blade transported at least 100 km to the shelter of Le Lagopède at Arcy-sur-Cure (Yonne)

35 Successive transformations of the previous blade according to use and fractures during rejuvenation (drawings D. Molez In Valentin, 1995)

P0/22 During the late Azilian tools were not sharpened much and used for only a short time

Concerning lengths of use, for the Paris Basin comparative traceological surveys between the Magdalenian and late Azilian, - like the one carried out in the central Rhineland, (Plisson, 1985) which shows a reduction in time of use between the two periods - are still lacking. Other surveys on the late Azilian outside the Paris Basin (Moss In Célérier (dir.), 1993; Philibert In Bintz (dir.), 1994; Philibert, 2002) also show quite weak development of use wears on the tools.

P1/6 During the Magdalenian the production of long standardised blades facilitated the longevity of several tools

The blades' length, of course, is what facilitated the successive rejuvenations, or even modifications, while the support's general qualities - long rectilinear edges - survived for a long time.

- P0/9 During the Magdalenian the production of blades for tools was guided by several requirements: desire for length, standardisation, and - if possible - productivity [cf. page 14]
- P0/21 During the Magdalenian, tools, at times intensely sharpened even recycled, could be used for quite a long time [cf. page 20]

P1/7 During the late Azilian the rather weak blades production agrees with the brevity of tools custom

- P0/14 During the late Azilian the desired products of flint knapping were: some short blades not very standard for projectile points and knives, short or elongated flakes for other tools [cf. page 16]
- P0/22 During the late Azilian tools were not sharpened much and used for only a short time [cf. page 20]

P2/4 During the Magdalenian, the provision for future needs on territorial scale and the longevity assured to the tools indicate that forethought - sometimes long term - was devoted to lithic production

In addition to the habit of producing a slight surplus in order to meet future needs on other stages of the nomadic route clues indicate provision for shorter term - possibly collective - needs: for example, on the level IV20 of Pincevent, some talented debitage supplied excellent blades used - sometimes for a long time - at various locations of the same campsite at a distance from the knapping spot (Bodu, 1993).

- P0/13 Magdalenian blades were not all made for immediate use, and some constituted small panoplies carried from one site to another [cf. page 15]
- P1/2 During the Magdalenian flints were knapped meticulously [cf. page 12]
- P1/6 During the Magdalenian the production of long standardised blades facilitated the longevity of several tools [cf. page 21]

P2/5 During the late Azilian the lithic production no longer showed signs of provision for the long term

- P1/4 In the Paris Basin during the late Azilian - unlike the Magdalenian - provision was no longer made for future tooling needs on a territorial scale [cf. page 18]
- P1/7 During the late Azilian the rather weak blades production agrees with the brevity of tools custom [cf. page 21]

P3/2 Between the Magdalenian and the late Azilian more improvised hunting no longer required lithic production to provide for the long term

Rapid production for the use of one or more individuals (no more than a family unit?) was enough to meet needs more irregular than the great collective hunts of the Magdalenian. The latter on the contrary require numerous high performance instruments to deal with large numbers of animals at once (cf. the 3.5 tons of food products of the level IV20 of Pincevent treated in a few weeks).

- P1/1 Between the Magdalenian and late Azilian, in parallel with a modification of the environment, hunting was transformed with more improvisation and less co-operation [cf. page 12]
- P2/4 During the Magdalenian, the provision for future needs on territorial scale and the longevity assured to the tools indicate that forethought - sometimes long term - was devoted to lithic production [cf. page 21]
- P2/5 During the late Azilian the lithic production no longer showed signs of provision for the long term [cf. page 21]

A distinct management of flint resources

P1/8 During the Magdalenian the systematic search for good flint gave rise to time constraints and presupposed settling close to good deposits

- *P0/10 To meet their aims the Paris Basin Magdalenians carefully selected good fine-grained flints, essentially coming from the immediate environment of each site [cf. page 14]*

P1/9 During the late Azilian as flint supplies were obtained with little selection they entailed no time constraints and did not require settling close to good deposits

- *P0/15 During the late Azilian, in the Paris Basin, the flint used was nearly always exclusively local and very variable in quality, in other words hardly selected [cf. page 16]*

P2/6 Between the Magdalenian and late Azilian the new knapping method making use of varied flint reduced procurement constraints

Given present knowledge about the early Azilian: three occupied sites known and studied in the Paris Basin - these constraints still do not seem to have diminished at this phase: the average quality of the flints used at this period is analogous to what the Magdalenians had looked for.

- *P0/17 During the late Azilian systematic use of the soft stone hammer more often in internal version allowed a certain amount of improvisation enabling flints of very variable quality to be exploited [cf. page 17]*
- *P1/8 During the Magdalenian the systematic search for good flint gave rise to time constraints and presupposed settling close to good deposits [cf. page 22]*

- *P1/9 During the late Azilian as flint supplies were obtained with little selection they entailed no time constraints and did not require settling close to good deposits [cf. page 22]*

P3/3 Between Magdalenian and late Azilian the reduction of procurement constraints was an economic advantage given the increase in mobility

- *P2/1 Between the Magdalenian and late Azilian, the transformation in hunting methods entailed a change in mobility: in the 12th millennium movements are more frequent and less programmed [cf. page 13]*
- *P2/6 Between the Magdalenian and late Azilian the new knapping method making use of varied flint reduced procurement constraints [cf. page 22]*

P4/1 Between Magdalenian and late Azilian more frequent movements and hunting needing less planning but weapons easier to replace encouraged transformation of the lithic production

- *P3/1 From the Magdalenian to the late Azilian great simplification of knapping meets high needs in lithic points [cf. page 20]*
- *P3/2 Between the Magdalenian and the late Azilian more improvised hunting no longer required lithic production to provide for the long term [cf. page 21]*
- *P3/3 Between Magdalenian and late Azilian the reduction of procurement constraints was an economic advantage given the increase in mobility [cf. page 22]*

DISAPPEARANCE OF A PROGRAMMED ECONOMY

At what rhythm and according to what logic?

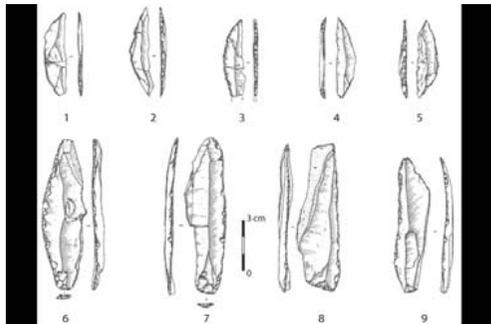
P0/23 At the end of the 13th millennium, during the early phase of the Paris Basin Azilian, soft stone is already the only percussion method used

In comparison with the Magdalenian the clearest contrast is the systematic use of the soft stone hammer at all the stages of blade production. Nevertheless, this new method, used for the most part in its marginal version (blows struck on edge of knapping platform), was applied with great care perceptible at every stage of the chaînes opératoires (see particularly Valentin, 2005b).

P0/24 At the end of the 13th millennium, during the early phase of the Paris Basin Azilian, the requirements for knapping were still very demanding

Both points for arrows and the tools were made almost exclusively from blades, as in the Magdalenian. If blade productivity was still important, slightly less demand for length, and, in lesser degree, another reduction in standardisation, may be interpreted as corollaries of a change in percussion methods (soft stone vs. organic hammer). As has been mentioned above, the raw material was still carefully selected.

[figure 36]



36 Some early Azilian armatures and tools from the lower level of Le Closeau (Hauts-de-Seine). (after drawings P. Alix In Bodu, 2000)

P1/10 The early phase of the Azilian marks a first stage in the transformations of hunting methods, armament and knapping, the latter still not being much simplified

- *P0/4 From the earliest phase of the Azilian to the end of the 13th millennium in the Paris Basin, hunting activity is little planned and more random, mobilising few hunters [cf. page 11]*
- *P0/20 By the early Azilian, at the end of the 13th millennium, the antler sagaies had almost entirely disappeared, being replaced by quickly made flint points [cf. page 19]*
- *P0/23 At the end of the 13th millennium, during the early phase of the Paris Basin Azilian, soft stone is already the only percussion method used [cf. page 23]*
- *P0/24 At the end of the 13th millennium, during the early phase of the Paris Basin Azilian, the requirements for knapping were still very demanding [cf. page 23]*

P5/1 In the Paris Basin armament and knapping were transformed from the end of the 13th millennium following a change in hunting methods. The late Azilian is a second stage in the transformation of knapping

How can this second stage of transformation - in other words the new, much simplified, late Azilian ways of doing things - be explained? Between early and late Azilian hunting weapons no transformation appears to have happened as profound as that which accompanied the beginnings of azilianisation. All the same one is reminded of the turnover in lithic points evoked as the primal cause of azilianisation (Pelegrin, 2000). Did this flow increase during the late Azilian, which could explain a greater need for productivity and facility? To evaluate these production

rhythms it will be necessary to wait for very fine paleoethnographical analyses, that is to say very complete refittings indicating significant utilitarian lacuna. Besides, another possible factor already discussed above is the ease procured by the new techniques for percussion on the flint of very varying quality, which has been collected. During the early Azilian the use of the soft stone hammer mainly in marginal version still made it necessary to select the materials quite carefully, whereas the internal version would later make it possible, as has been seen, to escape the constraints of procurement. Did mobility increase particularly between the early

and late Azilian, also becoming more erratic? This is what should be verified in the regions where, as in the Paris Basin, the different stages of azilianisation can be followed. [figures 37 to 38]

- *P1/10 The early phase of the Azilian marks a first stage in the transformations of hunting methods, armament and knapping, the latter still not being much simplified [cf. page 23]*
- *P4/1 Between Magdalenian and late Azilian more frequent movements and hunting needing less planning but weapons easier to replace encouraged transformation of the lithic production [cf. page 22]*



37 Artist's view of reindeer hunt with spearthrower and sagaie (after G. Tosello)



38 Artist's view of a hunt with bow and arrow (after G. Tosello)

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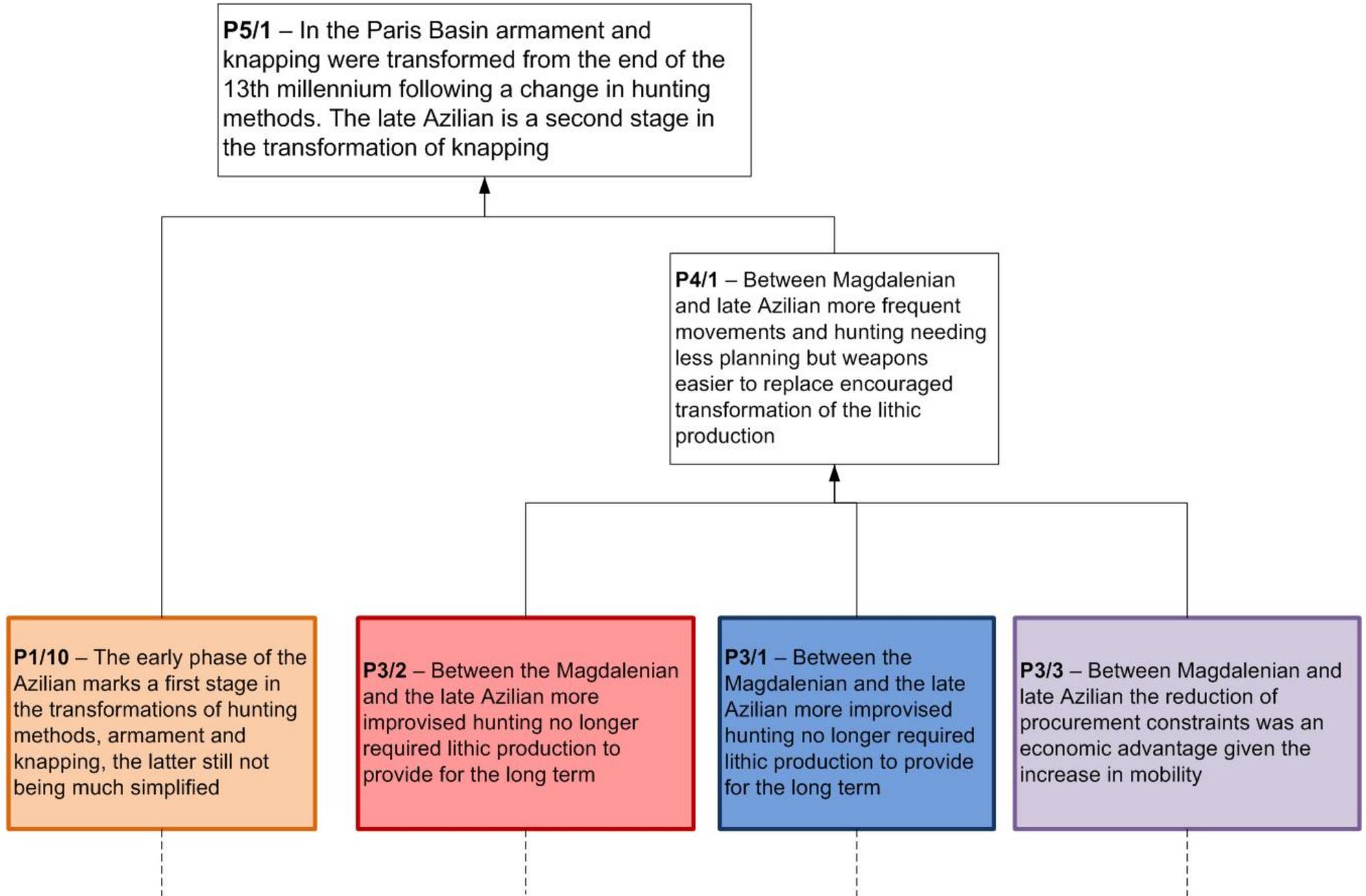
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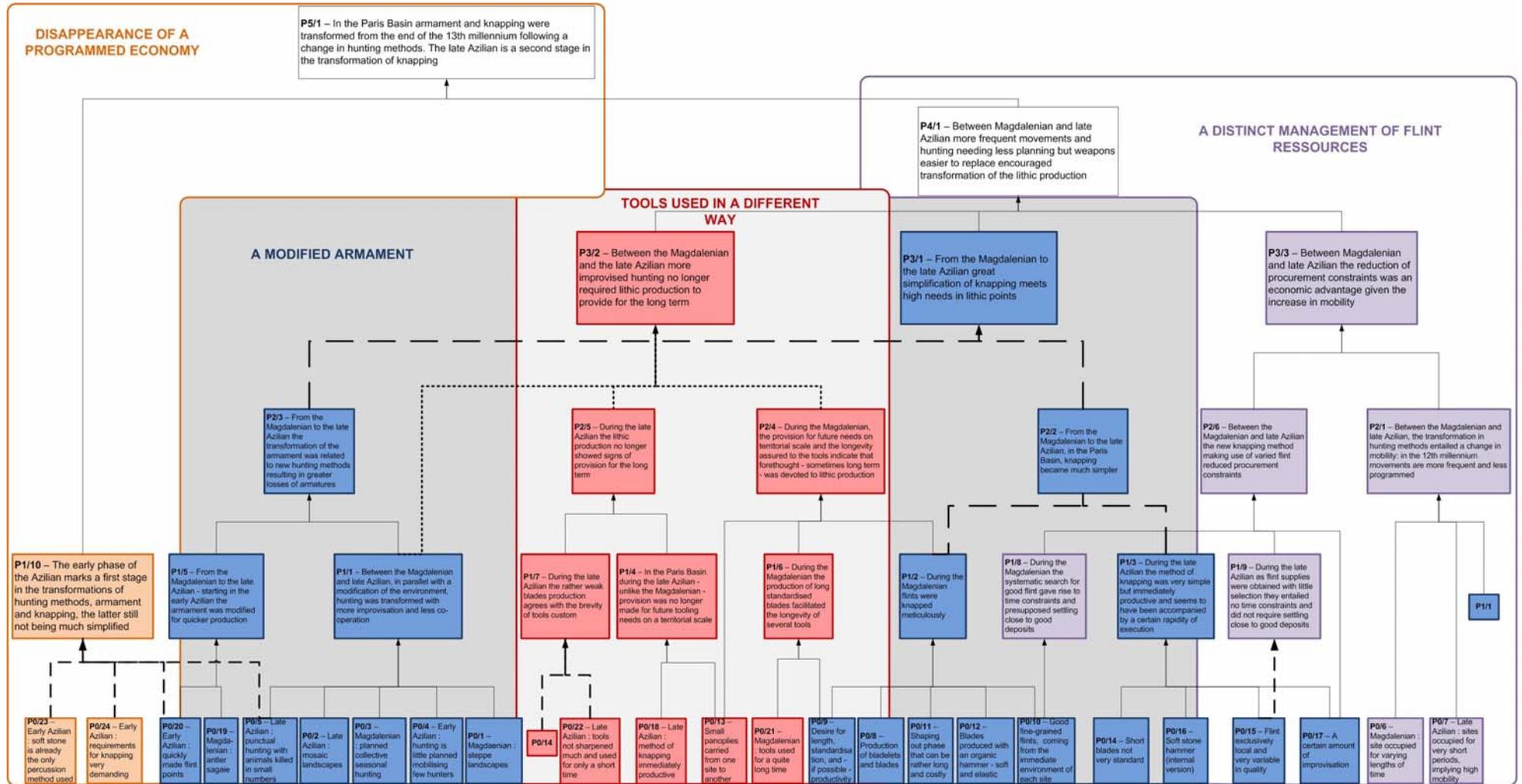
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Zones polliniques régionales Datations ¹⁴ C disponibles	Paysages dominants dans le Bassin parisien	Zones pour l'Europe du NW
Zone 7 10 600 - 9 660 av. J.-C. 10 900 - 10 450 av. J.-C.	Nette ouverture du milieu avec une extension de la strate herbacée (Graminées et steppiques) aux dépens des boisements	Dryas récent
Zone 6 11 050 - 10 570 av. J.-C. 11 590 - 11 050 av. J.-C.	Nouveau recul de la steppe à armoises lié à l'essor des pinèdes ; les bouleaux sont moins développés	Allerød
Zone 5 11 920 - 11 330 av. J.-C. 12 370 - 11 600 av. J.-C.	Relative fermeture du milieu ; les peuplements de bouleaux se densifient et entraînent un recul de la steppe à armoises	Allerød
Zone 4	La dynamique de reconquête arborée est interrompue au profit des formations steppiennes dominées par les armoises	Dryas moyen
Zone 3 12 500 - 11 780 av. J.-C. 13 200 - 12 350 av. J.-C.	Les armoises progressent au sein d'une steppe toujours diversifiée tandis que les boisements évoluent : les bouleaux supplantent les genévriers	Bølling
Zone 2	La couverture végétale devient un peu plus dense : outre une steppe diversifiée (Rubiécées, Chenopodiacées et armoises), des arbustes pionniers comme le genévrier s'implantent	Bølling
Zone 1	Milieu très ouvert avec une couverture végétale, dominée par les Graminées et les Rubiacées, assez claire pour permettre la perception des apports lointains du pin	Dryas ancien ou tout début Bølling

1 Evolution of vegetation in the Paris Basin according to palynology: pink ground - dominant landscapes during the Magdalenian (after document C. Leroyer)

Spermophile	Lievre indéterminé	Lievre variable	Putois	Blaireau	Marmotte	Canidé indéterminé	Renard polaire	Renard roux	Loup	Lion	Ours brun	Sanglier	Chevreuil	Cerf	Bison	Aurochs/Bison	Aurochs/Bos sp.	Cheval	Renne	
																				Étiolles
																				Le Grand Canton, secteurs 1 et 2
																				Le Tureau des Gardes, secteurs 5 et 6
																				Le Tureau des Gardes, secteur 10
																				Pincevent, niveau IV20
																				Pincevent, niveau IV0
																				Ville-Saint-Jacques
																				Verberie
																				Marsangy*
																				Le Lagopède, couches 1 et 3
																				Le Trou de la Marmotte*
																				Bonnières-sur-Seine*

2 Mammals hunted by the Magdalenians of the Paris Basin (after Bignon, 2008)

* moins de 60 restes déterminés

Zones polliniques régionales Datations ¹⁴ C disponibles	Paysages dominants dans le Bassin parisien	Zones pour l'Europe du NW
Zone 7 10 600 - 9 660 av. J.-C. 10 900 - 10 450 av. J.-C.	Nette ouverture du milieu avec une extension de la strate herbacée (Graminées et steppiennes) aux dépens des boisements	Dryas récent
Zone 6 11 050 - 10 570 av. J.-C. 11 590 - 11 050 av. J.-C.	Nouveau recul de la steppe à armoises lié à l'essor des pinèdes ; les bouleaux sont moins développés	Allerød
Zone 5 11 920 - 11 330 av. J.-C. 12 370 - 11 600 av. J.-C.	Relative fermeture du milieu : les peuplements de bouleaux se densifient et entraînent un recul de la steppe à armoises	Allerød
Zone 4	La dynamique de reconquête arborée est interrompue au profit des formations steppiennes dominées par les armoises	Dryas moyen
Zone 3 12 500 - 11 780 av. J.-C. 13 200 - 12 350 av. J.-C.	Les armoises progressent au sein d'une steppe toujours diversifiée tandis que les boisements évoluent : les bouleaux supplantent les genévriers	Bølling
Zone 2	La couverture végétale devient un peu plus dense : outre une steppe diversifiée (Rubiécées, Chenopodiacées et armoises), des arbustes pionniers comme le genévrier s'implantent	Bølling
Zone 1	Milieu très ouvert avec une couverture végétale, dominée par les Graminées et les Rubiacées, assez claire pour permettre la perception des apports lointains du pin	Dryas ancien ou tout début Bølling

3 Evolution of vegetation in the Paris Basin according to palynology: pink ground - dominant landscapes during the Azilian (after document C. Leroyer)

Spermophile	Lievre indéterminé	Lievre variable	Putois	Blaireau	Marmotte	Canidé indéterminé	Renard polaire	Renard roux	Loup	Lion	Ours brun	Sanglier	Chevreuil	Cerf	Bison	Aurochs/Bison	Aurochs/Bos sp.	Cheval	Renne	
																				Le Bois-Ragot, niveau 4
																				Le Closeau, niveau inférieur
																				Gouy, Grotte du Cheval
																				Conty*
																				Pincevent, niveau III.20
																				Saleux*
																				Hangest III.1, niveau supérieur**
																				Le Closeau, niveau supérieur
																				Le Bois-Ragot, niveau 3

4 Mammals hunted by the Azilians of the Paris Basin (after Bodu et al., 1996; Bodu (ed.), 1998; Bridault, 1997; Cordy, 1990; Fagnart, 1997; Griggo, 2005)

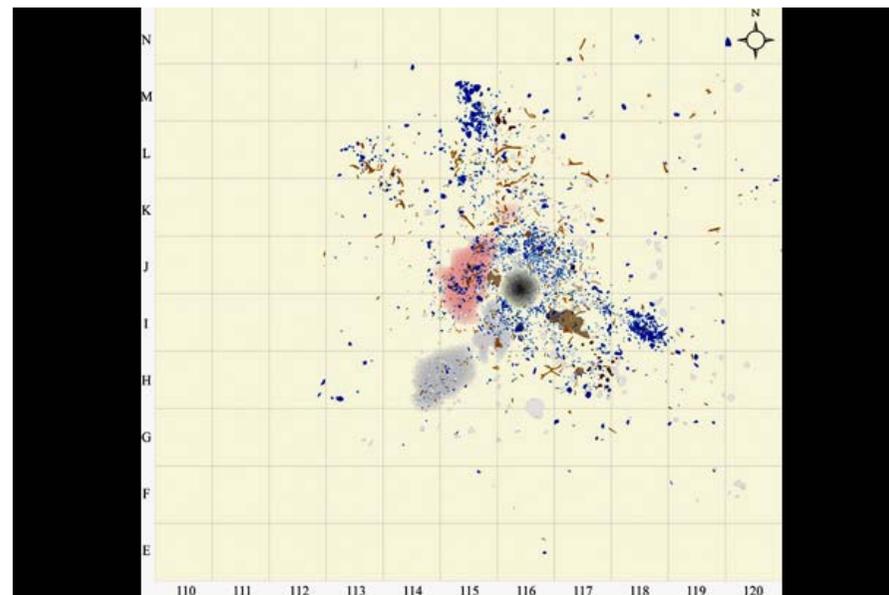
* études préliminaires
** assemblage mal conservé



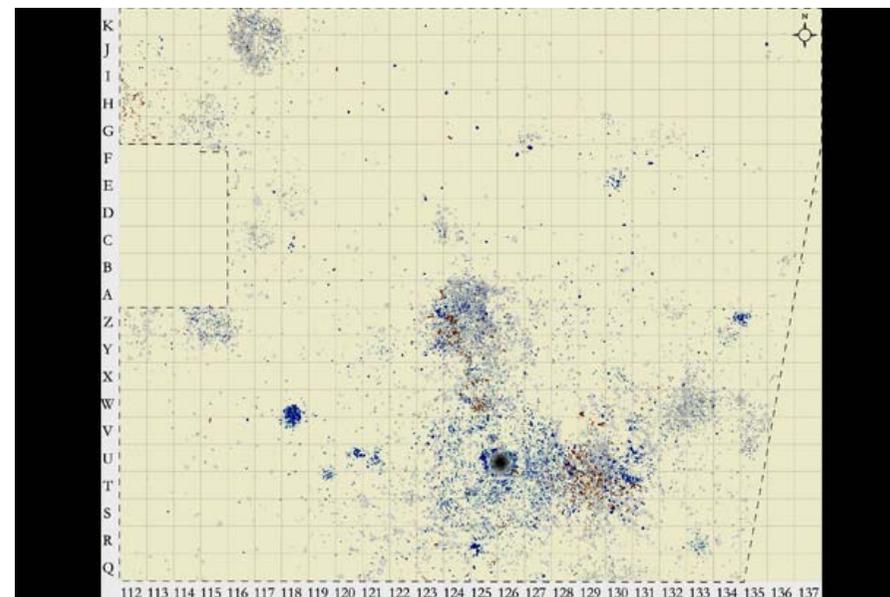
5 Reindeer in Norway (©Oskartlin. <http://animalphotos.info/a/2008/01/14/reindeer-graze-in-grassy-plains-below-mountains/>)



6 Red deer in England (©Neil Philips. <http://animalphotos.info/a/2007/12/22/buck-and-doe/>)



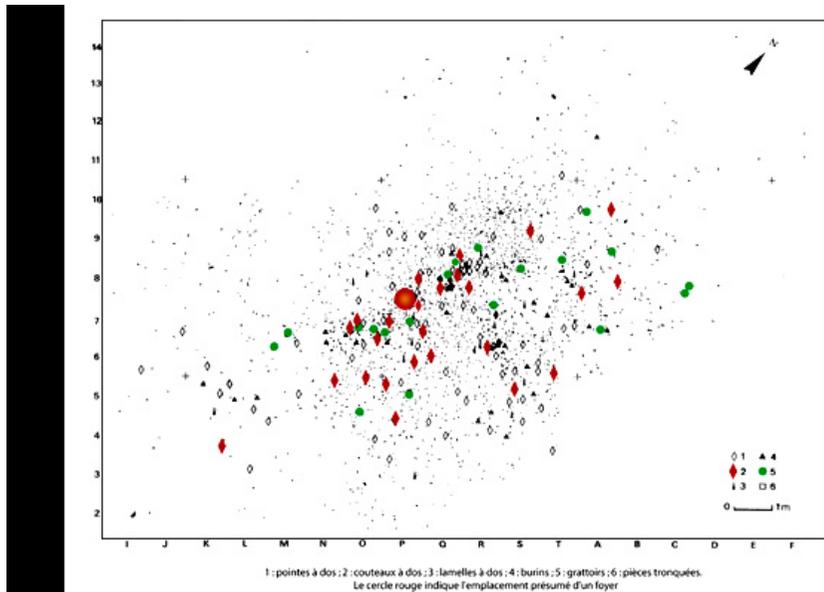
7 A dwelling unit with not very dense remains occupied in autumn: the unit J116 on the level IV40 at Pincevent (Seine-et-Marne) (document G. Debout In Debout, 2007)



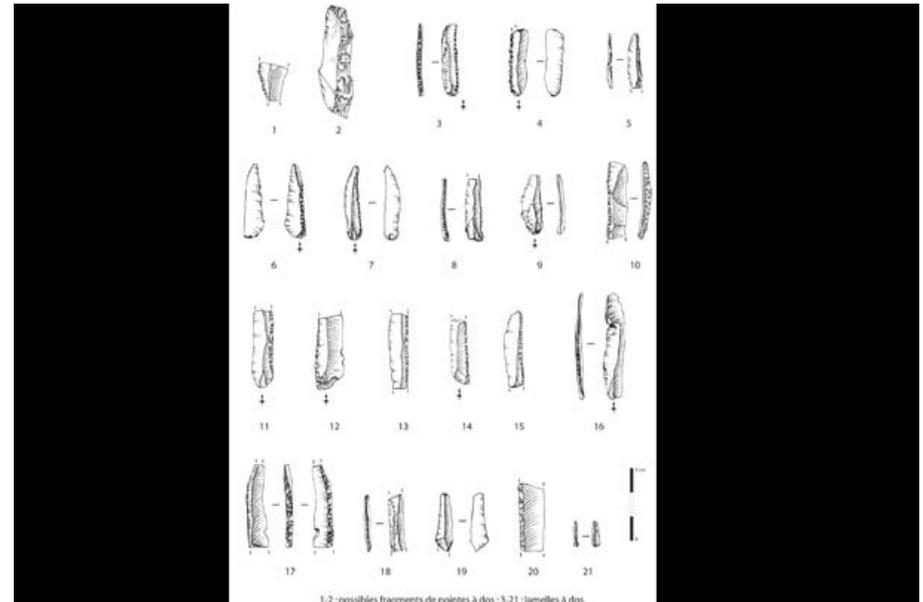
8 A dwelling unit with dense remains occupied in winter: the unit T125 on the level IV0 at Pincevent (Seine-et-Marne) (document J. Louvet et G. Debout In Collectif, 2007)



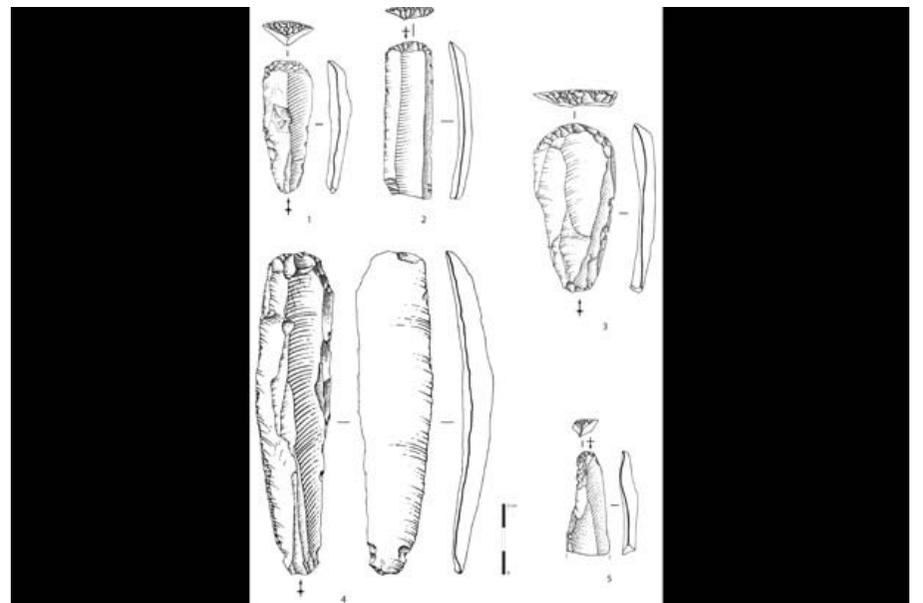
9 The heavy structures of the dwelling unit U5 at Étiolles (Essonne) (document N. Pigeot)



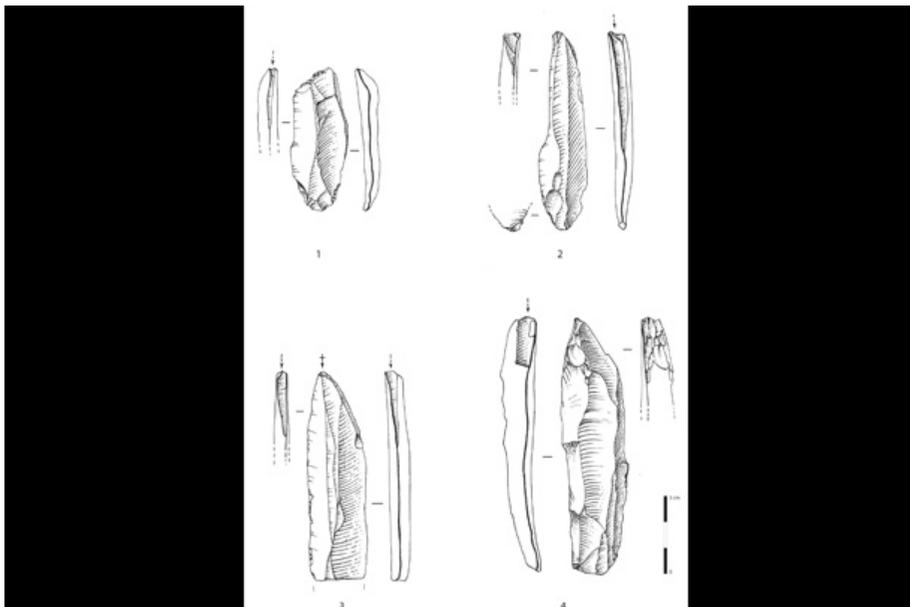
10 The locus 114 at Saleux in the Somme (after Fagnart, 1997 with modifications)



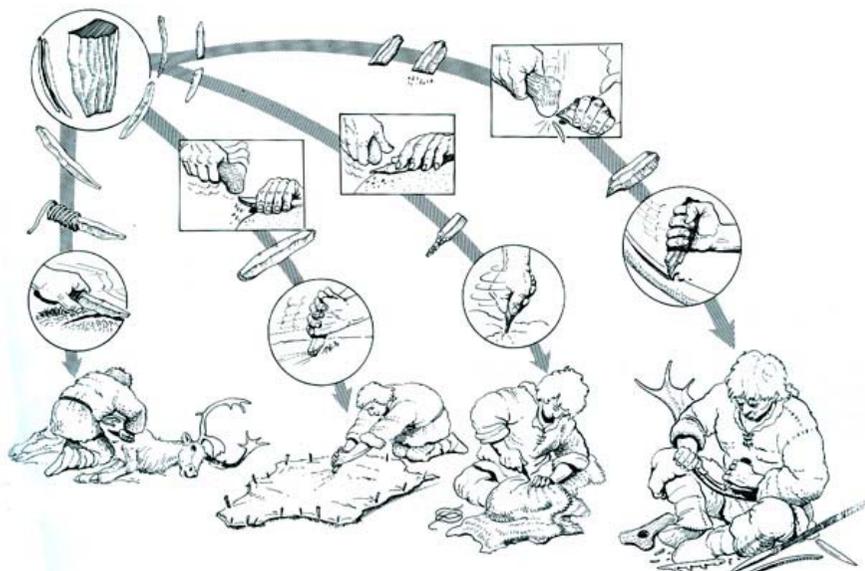
11 Armatures in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds), 2006)



12 Scrapers in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds), 2006)



13 Burins in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds), 2006)



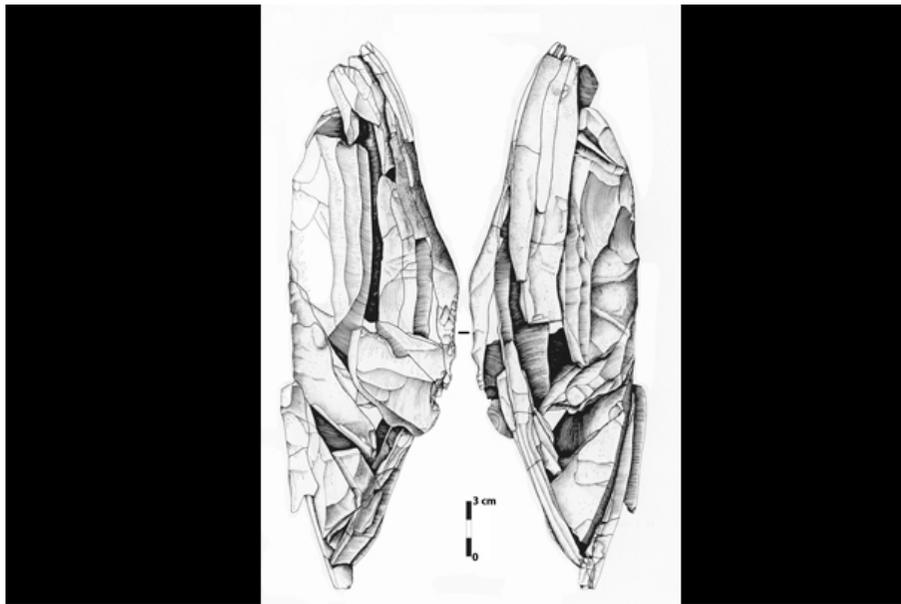
14 Artist's view illustrating the use of some Magdalenian tools (after G. Tosello)



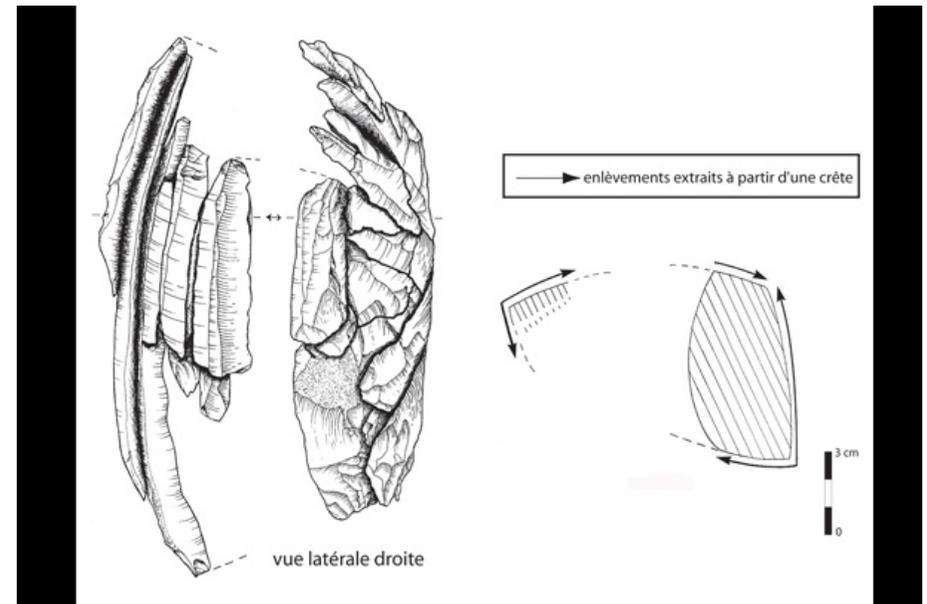
15 Scrapers from Le Tureau des Gardes at Marolles-sur-Seine (Seine-et-Marne)



16 A very regular block knapped without really being shaped from the dwelling unit Q31 at Étiolles (Essonne) (document N. Pigeot)



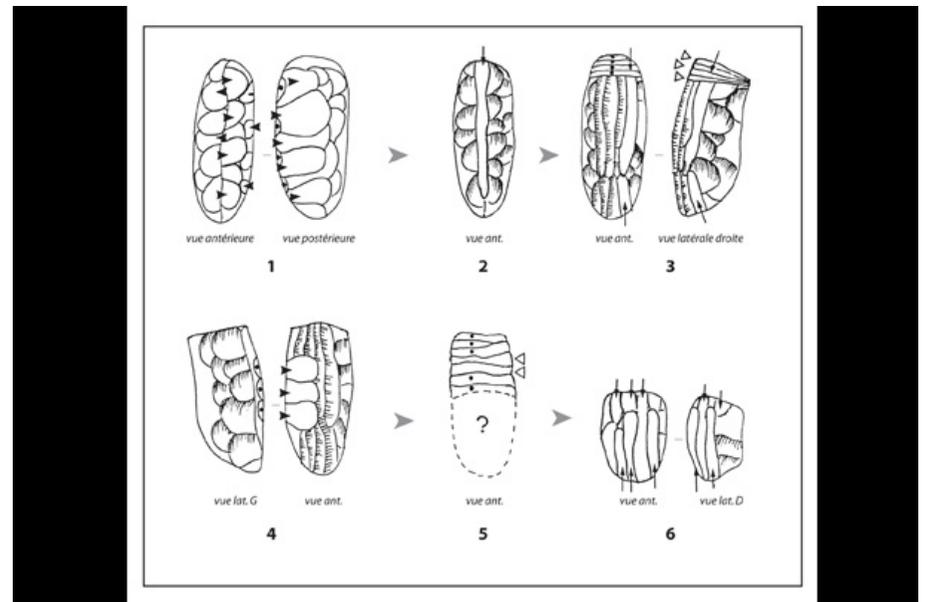
17 A regular block knapped after partial shaping from level II.1 at Verberie (Oise) (after drawing Y. Paele In Audouze et al., 1981)



19 Exploitation of a block at Laitier-Pilé - locus 468.7 (Cher) (drawings D. Molez In Valentin, 1995). See photo of the P0-10



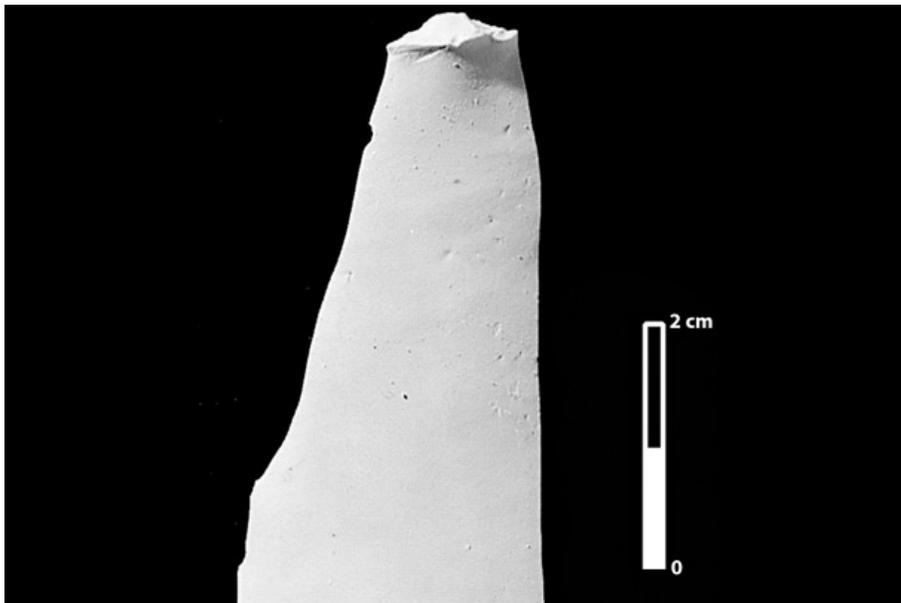
18 A block knapped after careful shaping with two crests at Laitier-Pilé - locus 468.7 (Cher)



20 Principal stages of the chaîne opératoire revealed by the previous refitting. 1 and 2: shaping out then crest extraction; 3 to 6: blade production (diagrams D. Molez In Valentin, 1995)



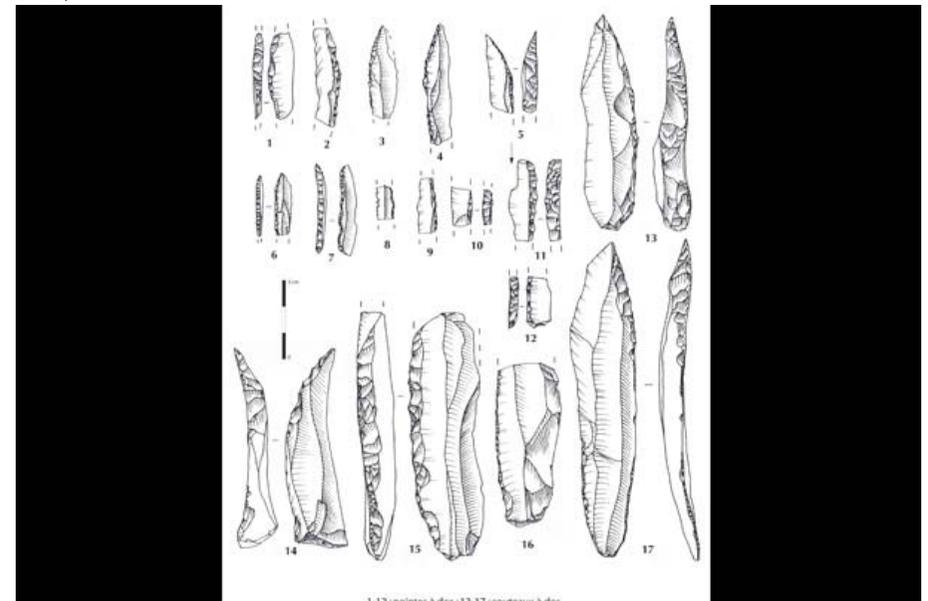
21 Experimental debitage with an organic hammer



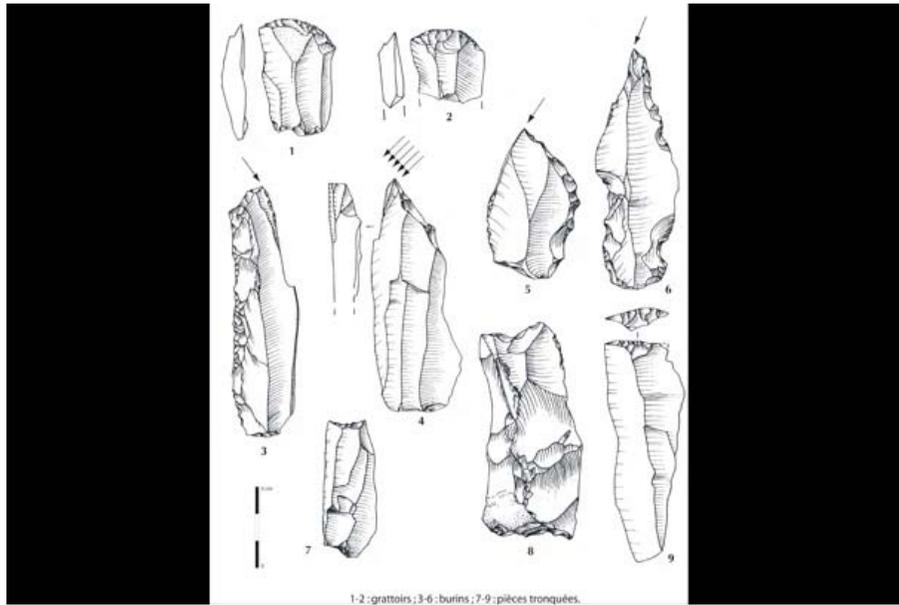
22 Ventral face of proximal part of experimental blade knapped with organic hammer (document J. Pelegrin): the recognition of percussion techniques is based on such reference material (Pélegrin, 2000)



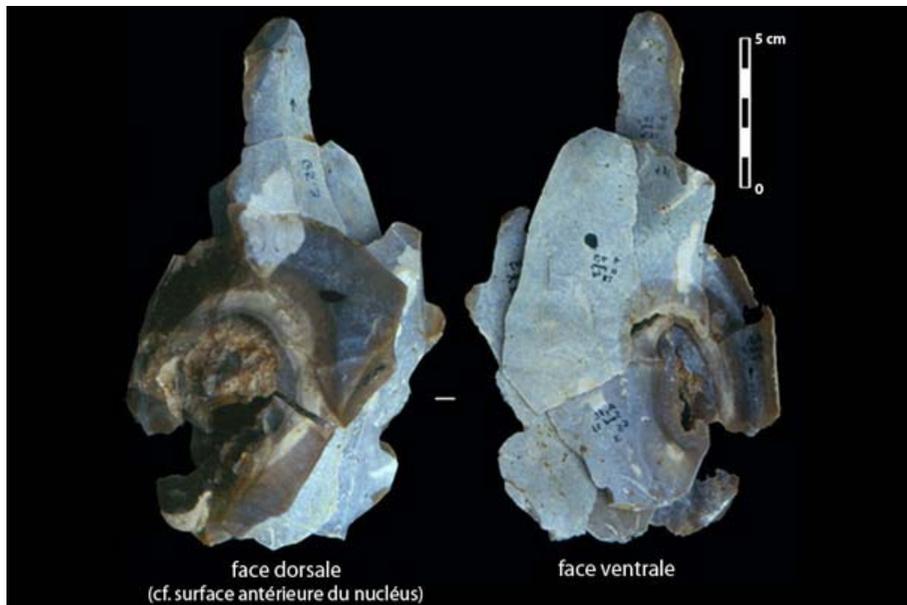
23 Some blades brought to the level IV20 of Pincevent (Seine-et-Marne) from the centre of the Île-de-France to about 70 km to the north, and transformed into scrapers (document Centre archéologique de Pincevent)



24 Projectiles' armatures and knives from Ambenay (Eure) (drawings C. Billard In Valentin et al., 2004)



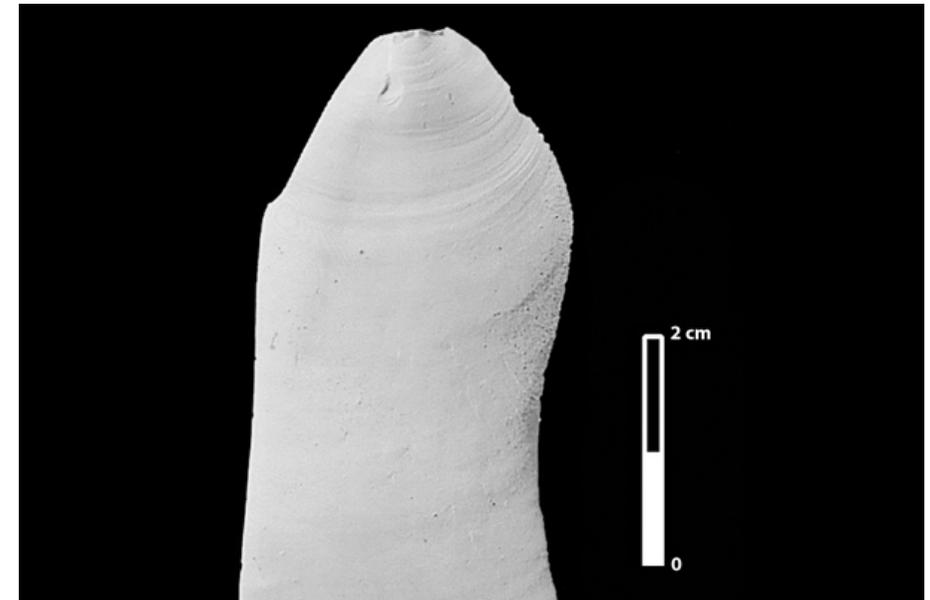
25 Tools from Ambenay (Eure) (drawings C. Billard in Valentin et al., 2004)



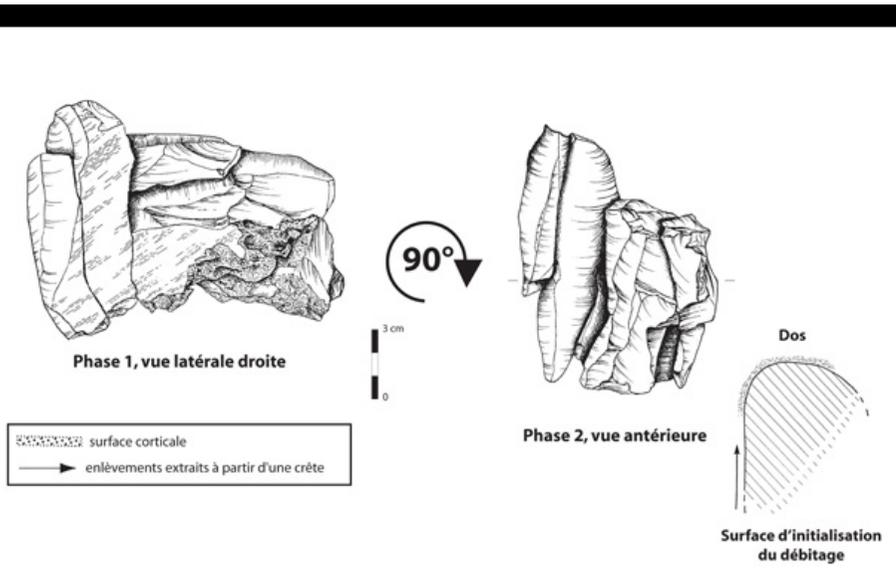
26 This refitting from Ambenay (Eure) shows a first sequence of debitage on a block presenting a visible defect when collected - a fairly deep geode, which prevented the removal of several flakes



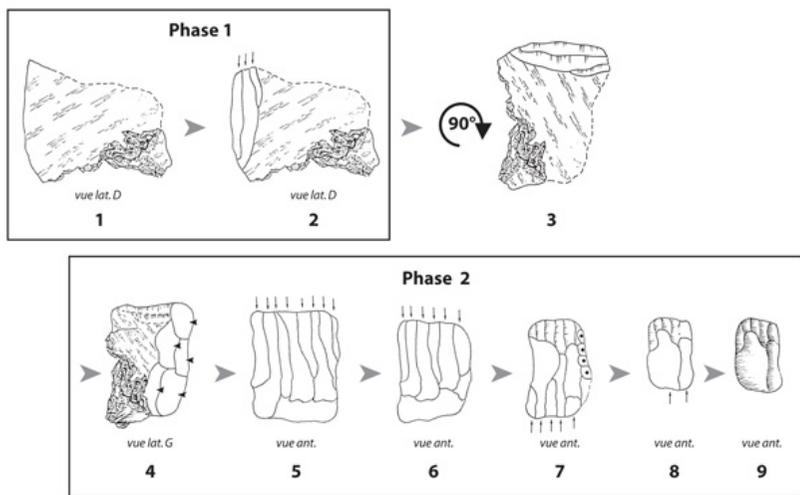
27 Experimental debitage with sandstone hammer



28 Ventral face on proximal part of an experimental blade knapped with a sandstone hammer (document J. Pelegrin)



29 Exploiting a block for producing blades and flakes at Ambenay (Eure) (drawings D. Molez In Valentin et al., 2004)



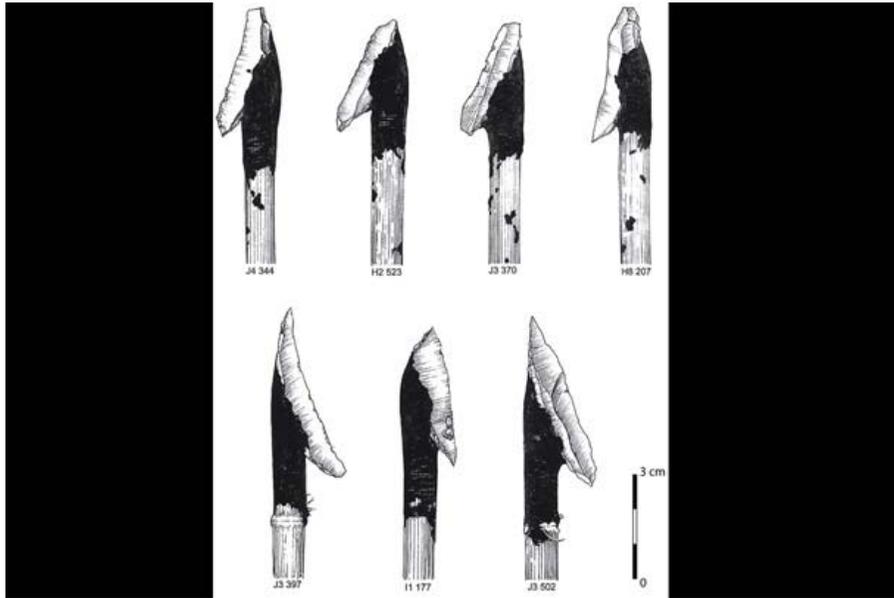
30 Principal stages of the chaîne opératoire revealed by the previous refitting. 1 and 2: exploitation of a dihedral formed by the meeting of two natural breaking surfaces; 3: after flattening this first flaking surface, turning the block 90° around; 4 to 9: after regularising the whole, producing blades and elongated flakes (interpretative diagrams D. Molez In Valentin et al., 2004)



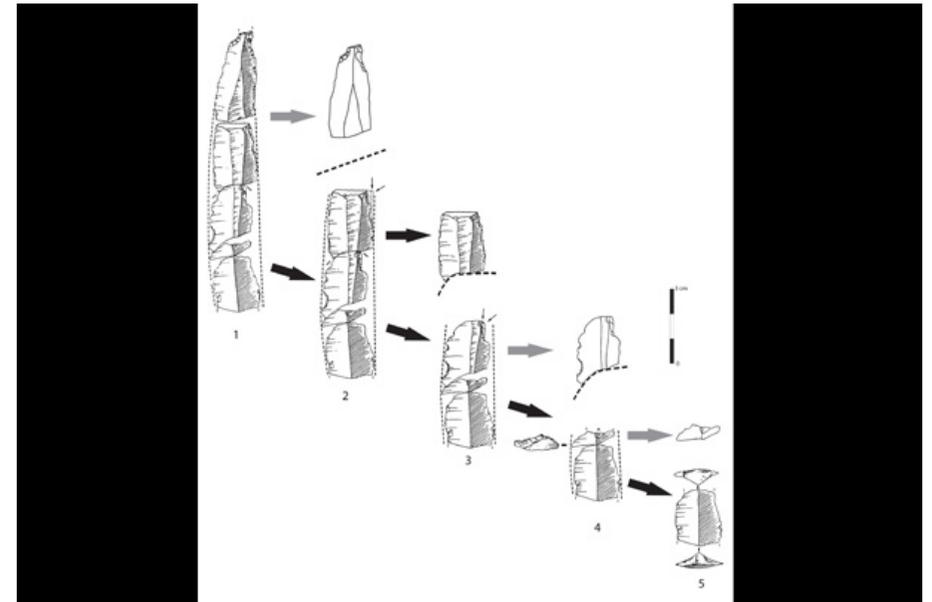
31 Antler points from the level IV20 at Pincevent (Seine-et-Marne) (document J.-M. Pétillon)



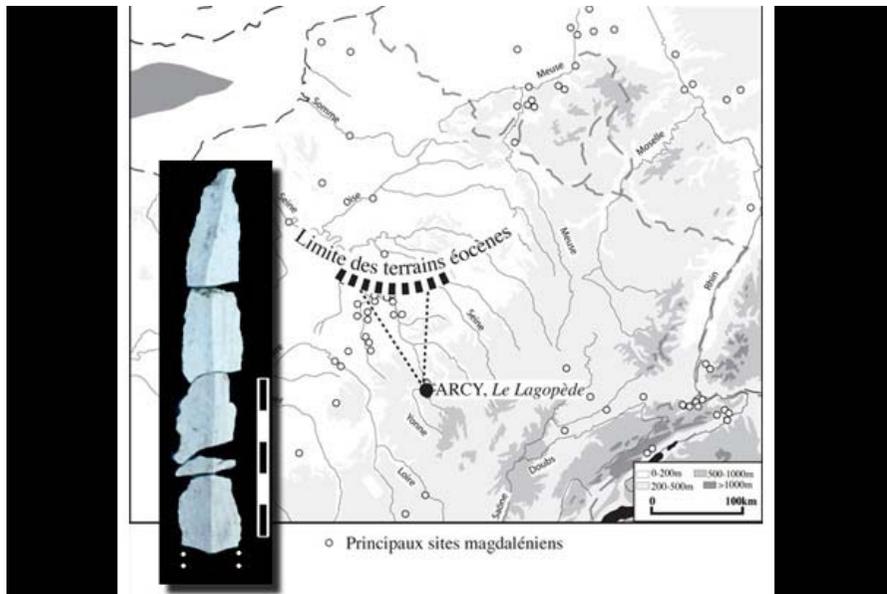
32 Antler point fragment with 2 flint cutting edges from the level IV20 at Pincevent (Seine-et-Marne) (document M. Vanhaeren)



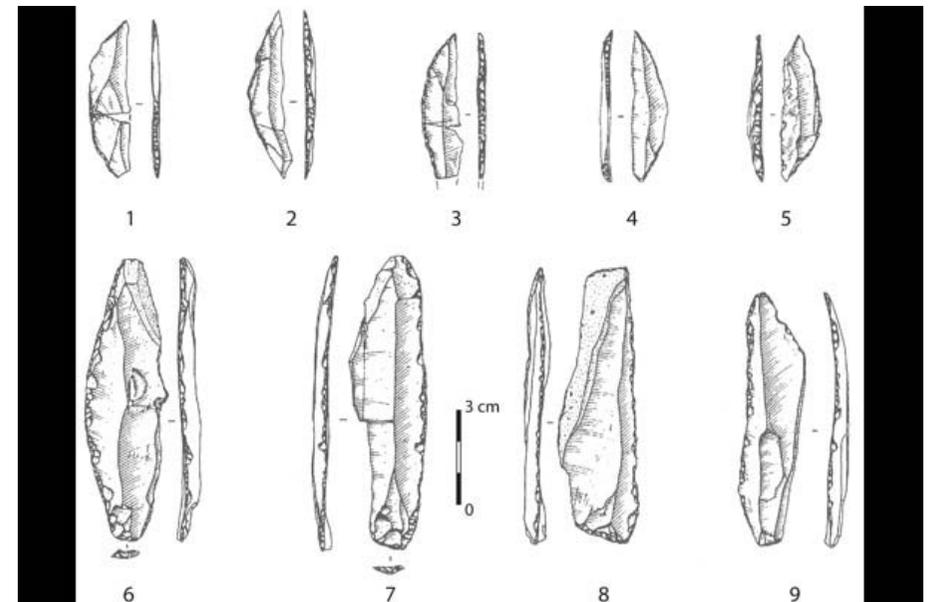
33 Hafting of some early Azilian points from Bois-Ragot (Vienne) reconstructed after traceology (after drawings J. Courbet In Plisson, 2005)



35 Transformations successives de la lame précédente au gré de l'usage et des fractures en cours d'avivage (dessins D. Molez In Valentin, 1995)



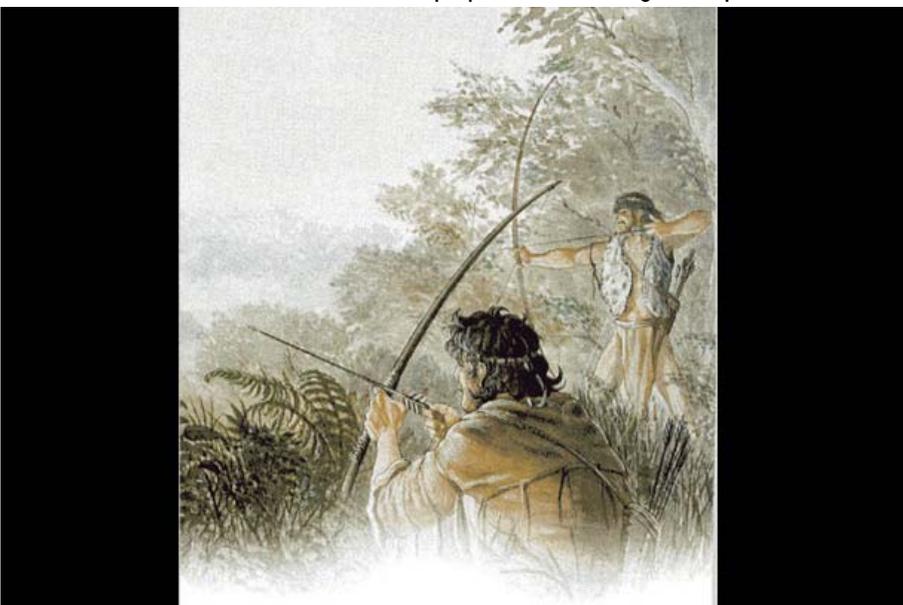
34 Eocene flint blade transported at least 100 km to the shelter of Le Lagopède at Arcy-sur-Cure (Yonne)



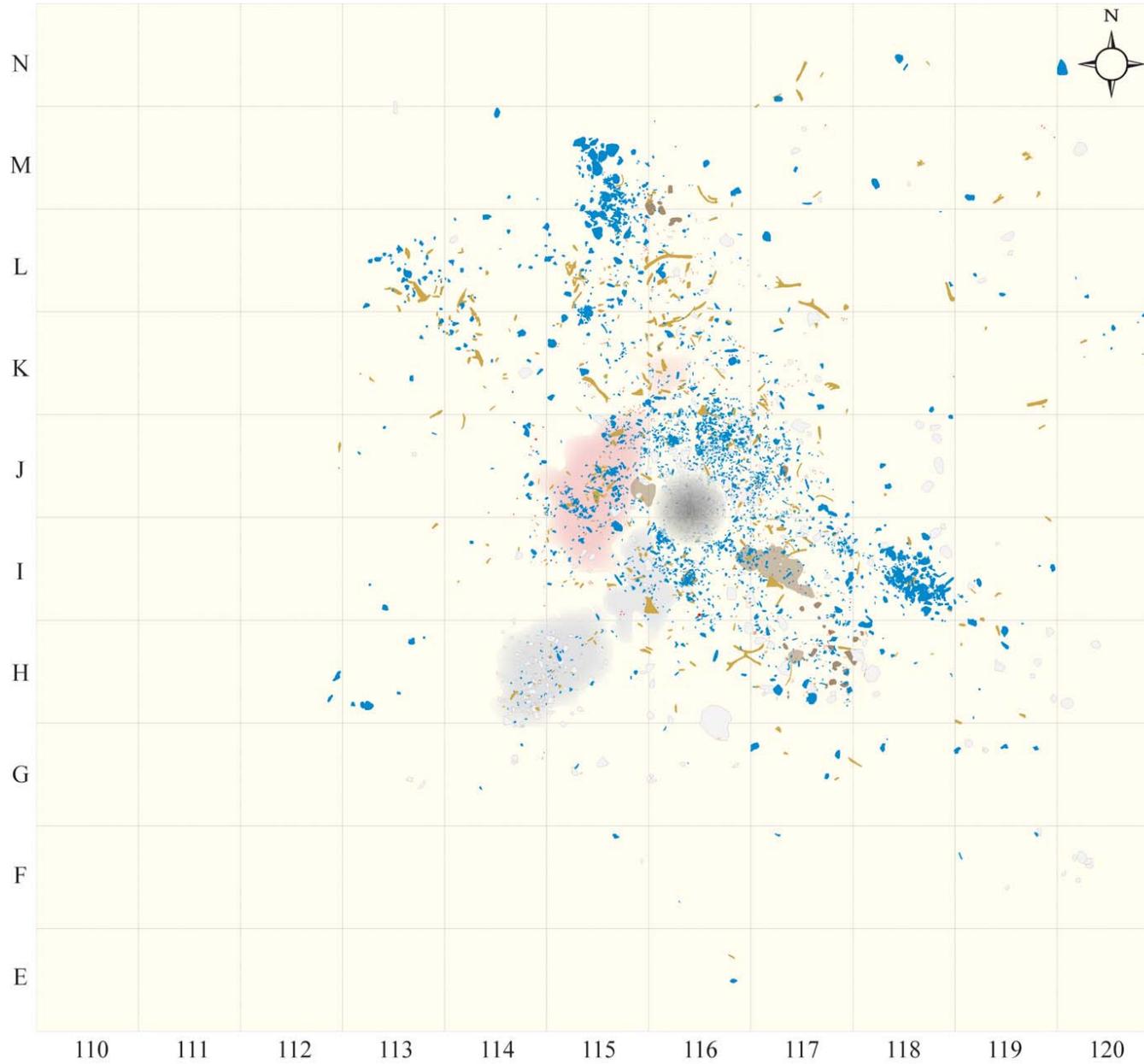
36 Quelques armatures et outils de l'Azilien ancien provenant du niveau inférieur du Cloiseau (Hauts-de-Seine), (d'après dessins P. Alix In Bodu, 2000)



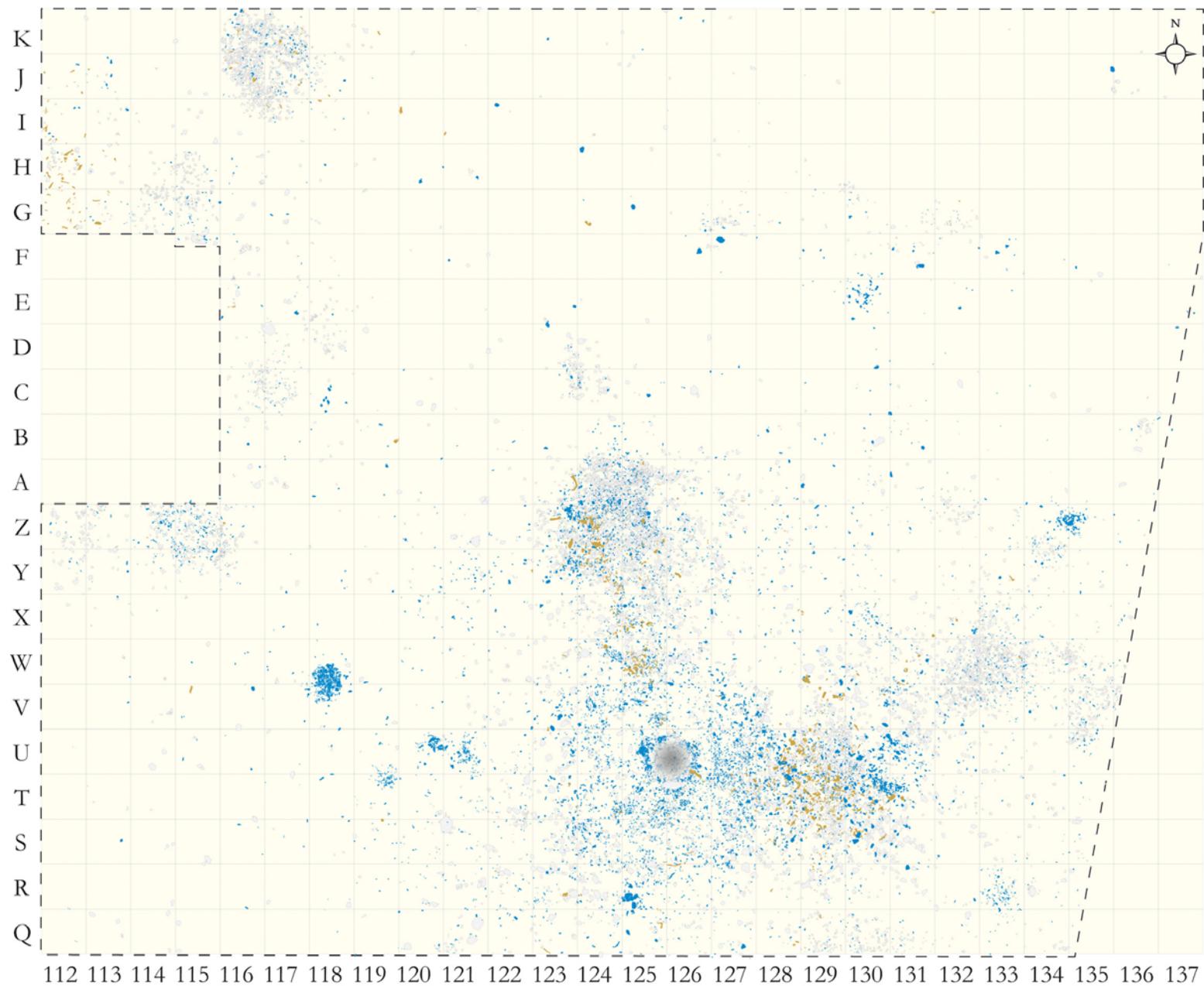
37 Vue d'artiste d'une chasse aux rennes au propulseur et à la sagaie (d'après G. Tosello)



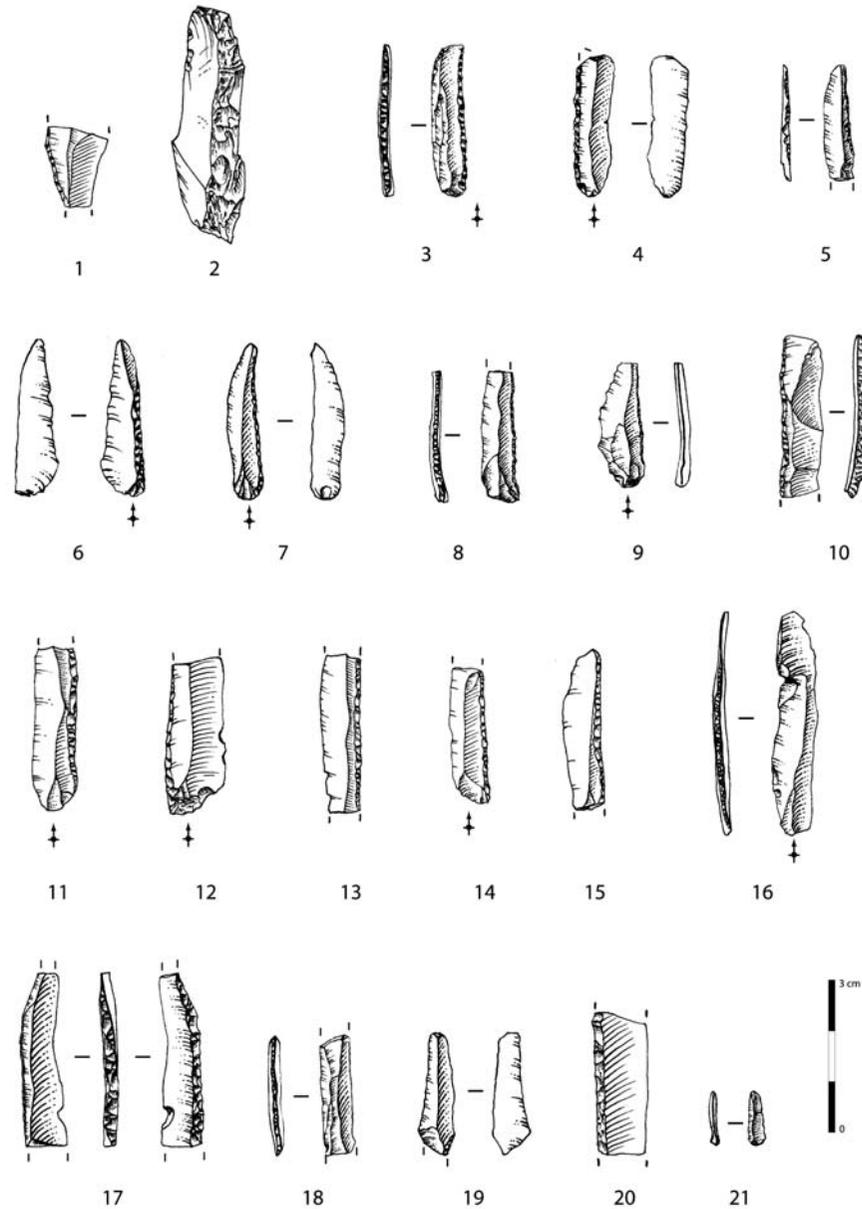
38 Vue d'artiste d'une chasse à l'arc et à la flèche (d'après G. Tosello)



7 A dwelling unit with not very dense remains occupied in autumn: the unit J116 on the level IV40 at Pincevent (Seine-et-Marne) (document G. Debout In Debout, 2007)

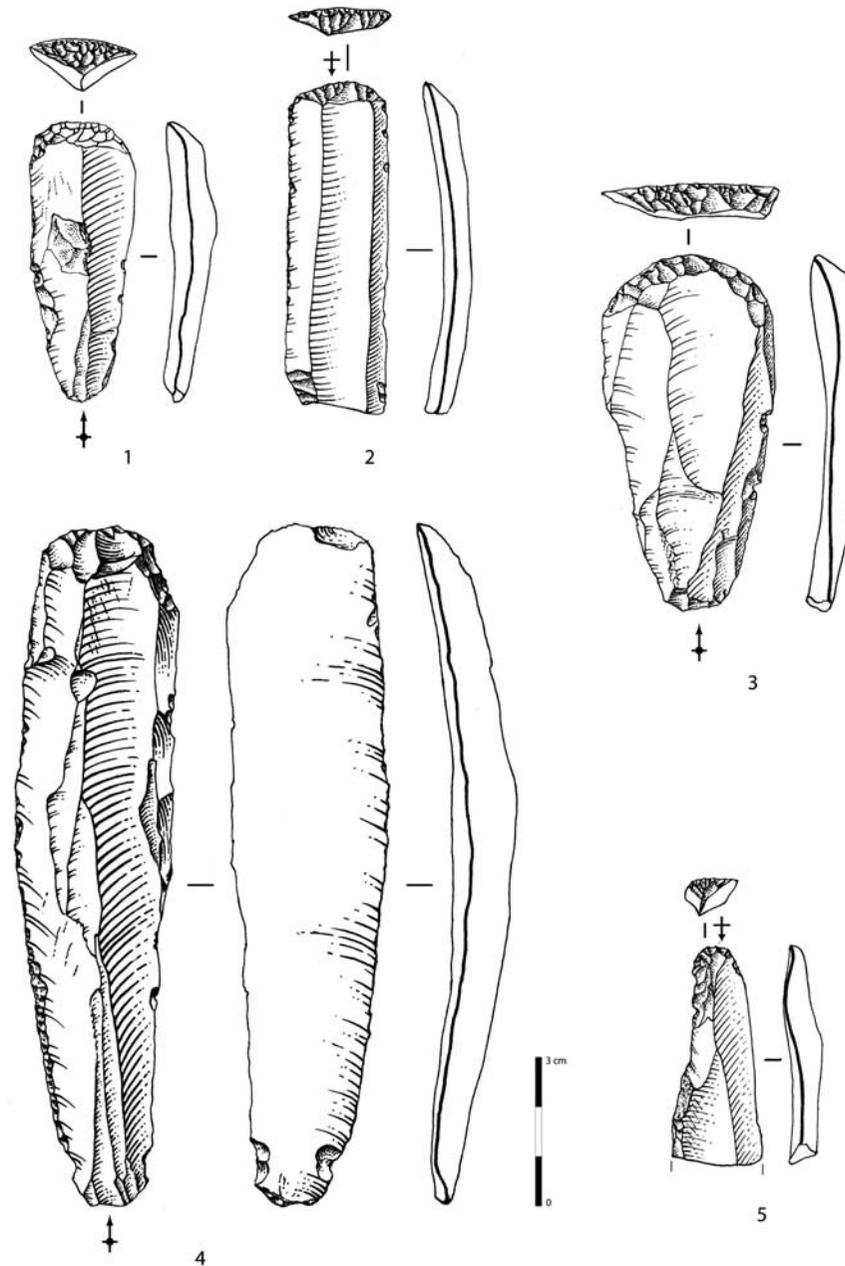


8 A dwelling unit with dense remains occupied in winter: the unit T125 on the level IV0 at Pincevent (Seine-et-Marne) (document J. Louvet et G. Debout In Collectif, 2007)

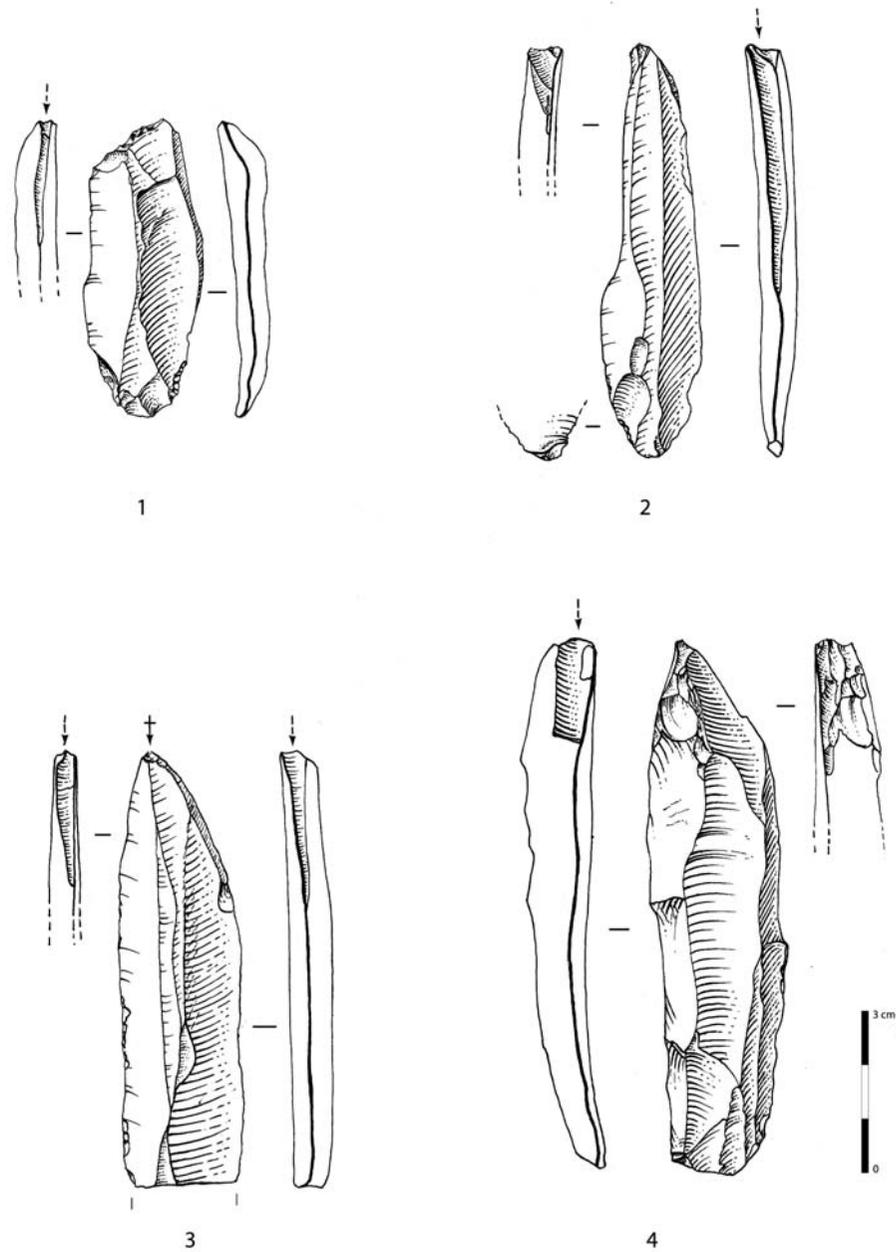


1-2 : possibles fragments de pointes à dos ; 3-21 : lamelles à dos.

11 Armatures in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds), 2006)



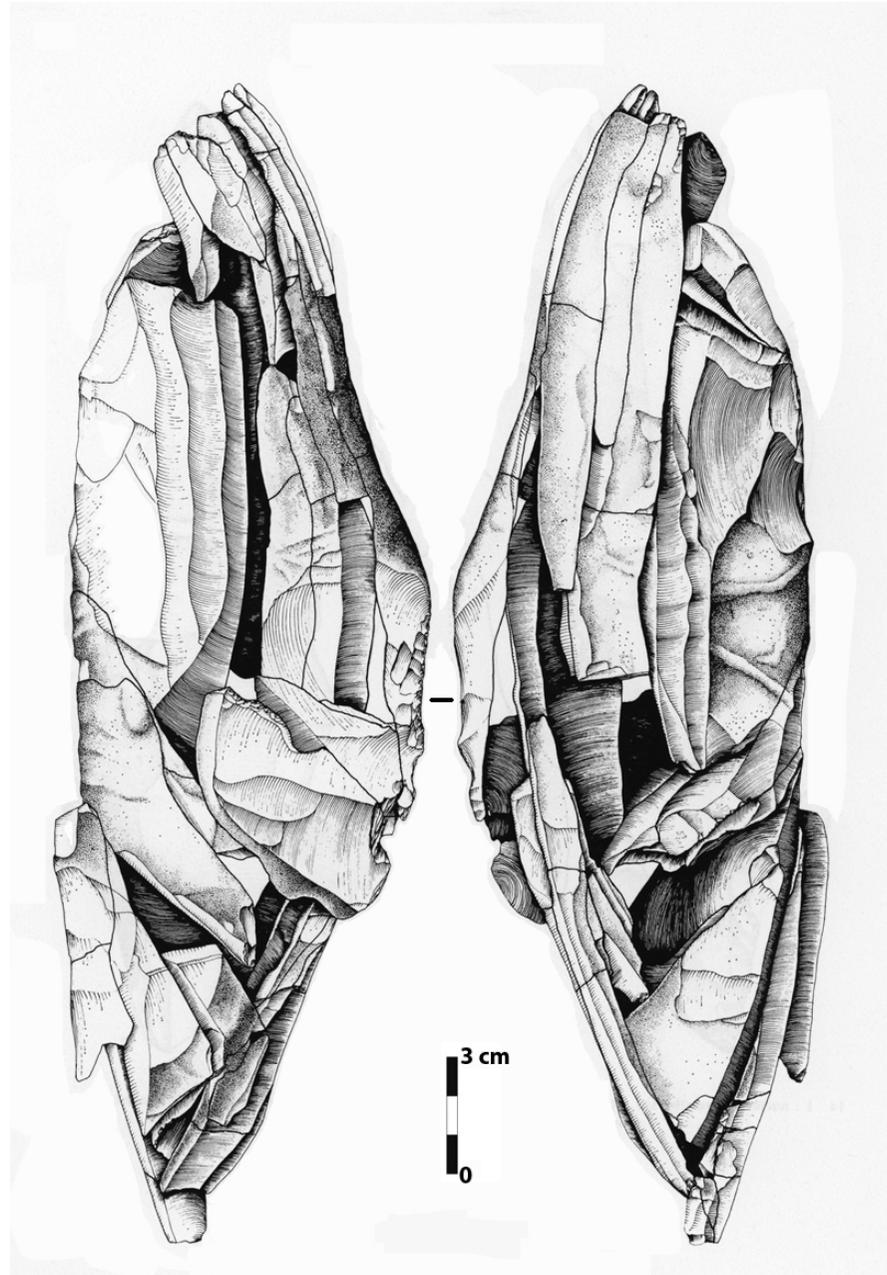
12 Scrapers in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds), 2006)



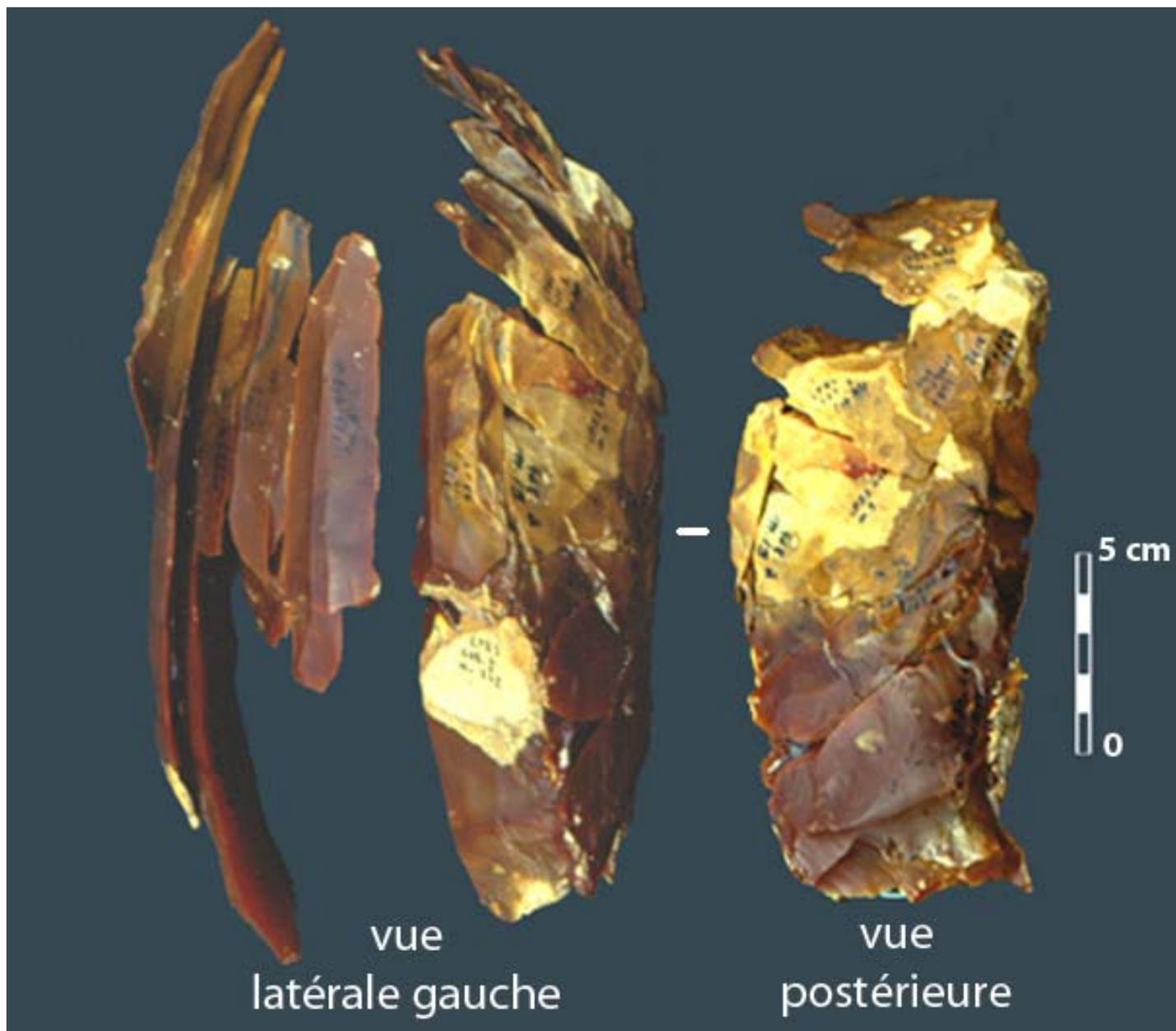
13 Burins in local flint from the level IV0 at Pincevent (Seine-et-Marne) (drawings D. Molez In Bodu et al. (eds), 2006)



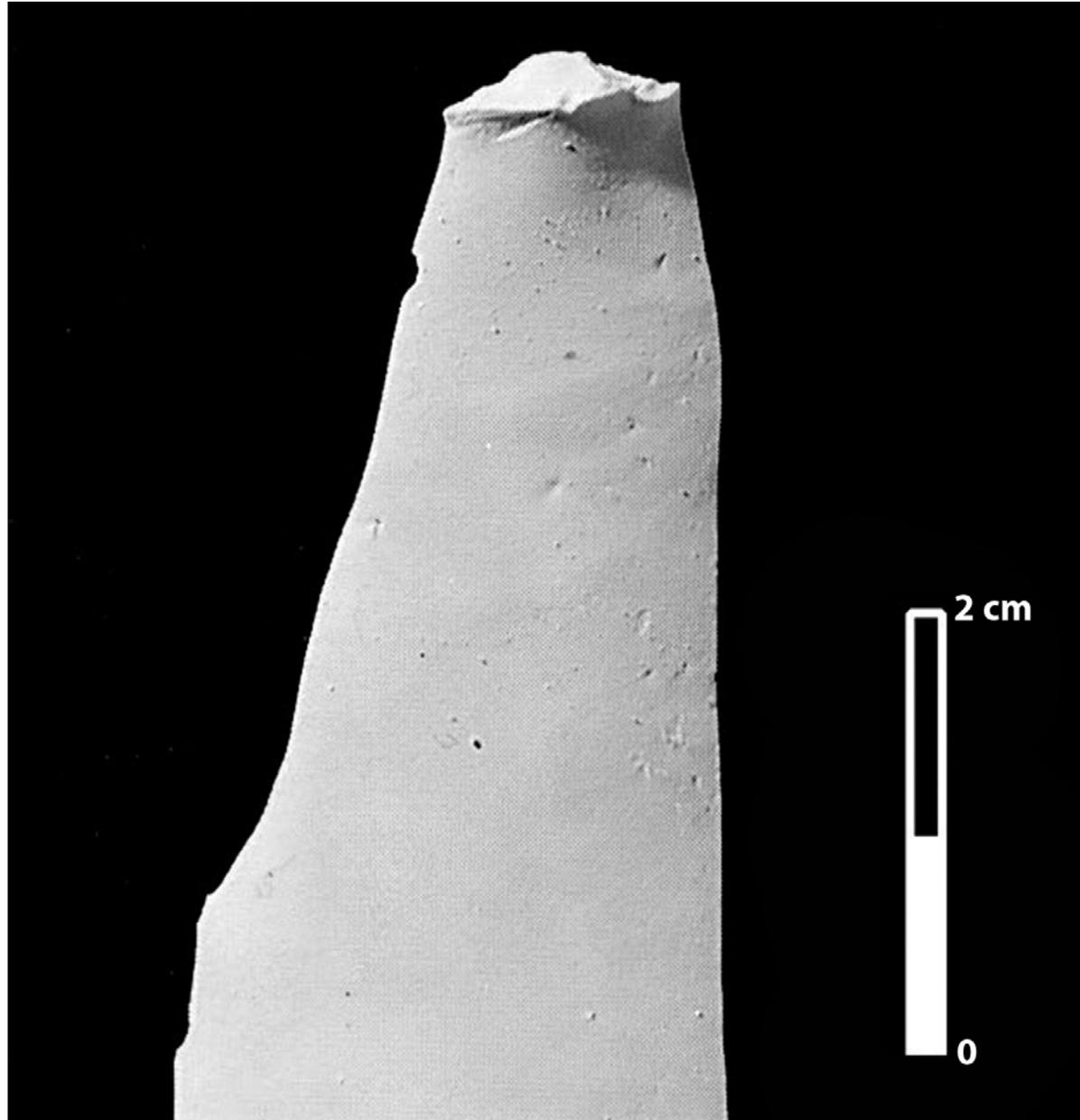
16 A very regular block knapped without really being shaped from the dwelling unit Q31 at Étioilles (Essonne) (document N. Pigeot)



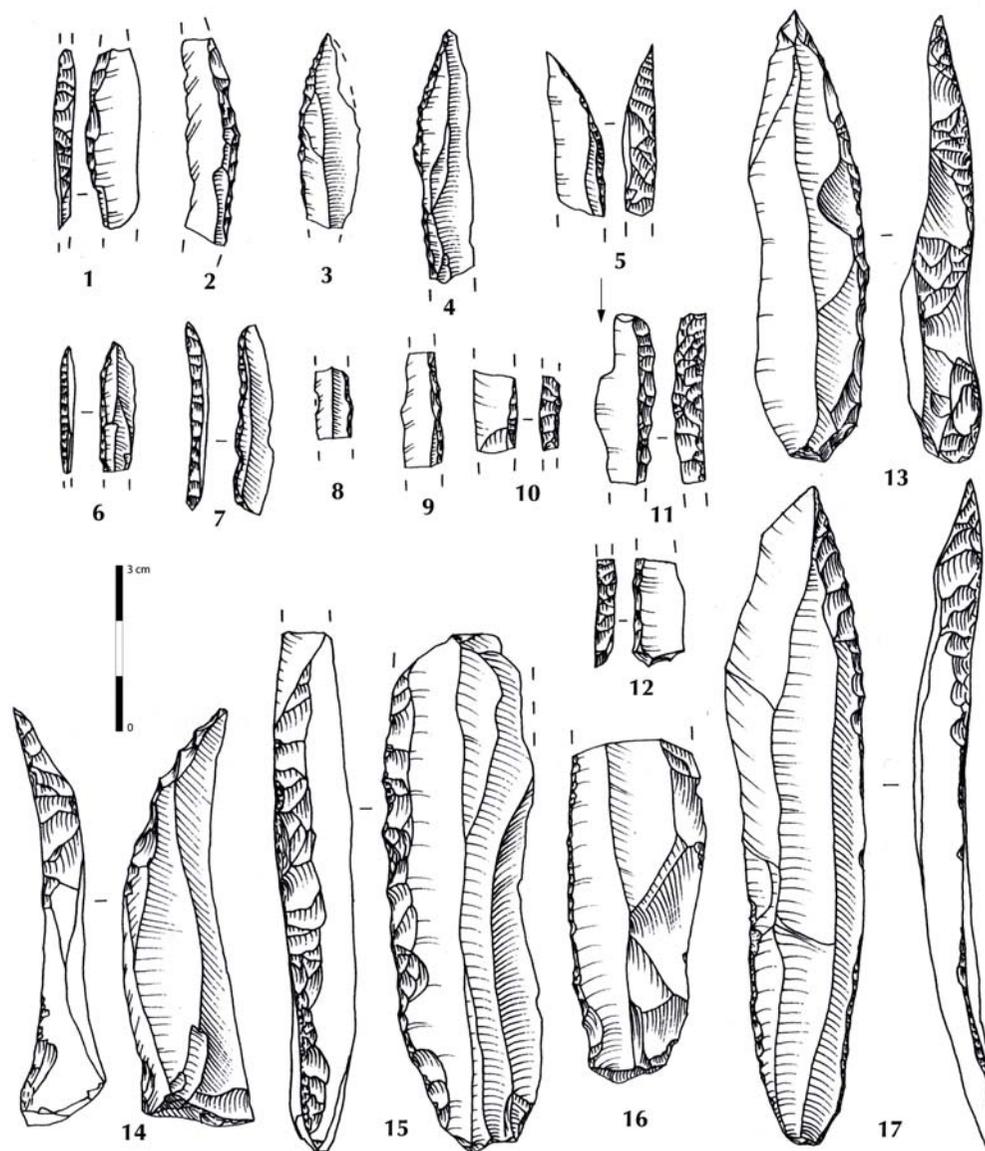
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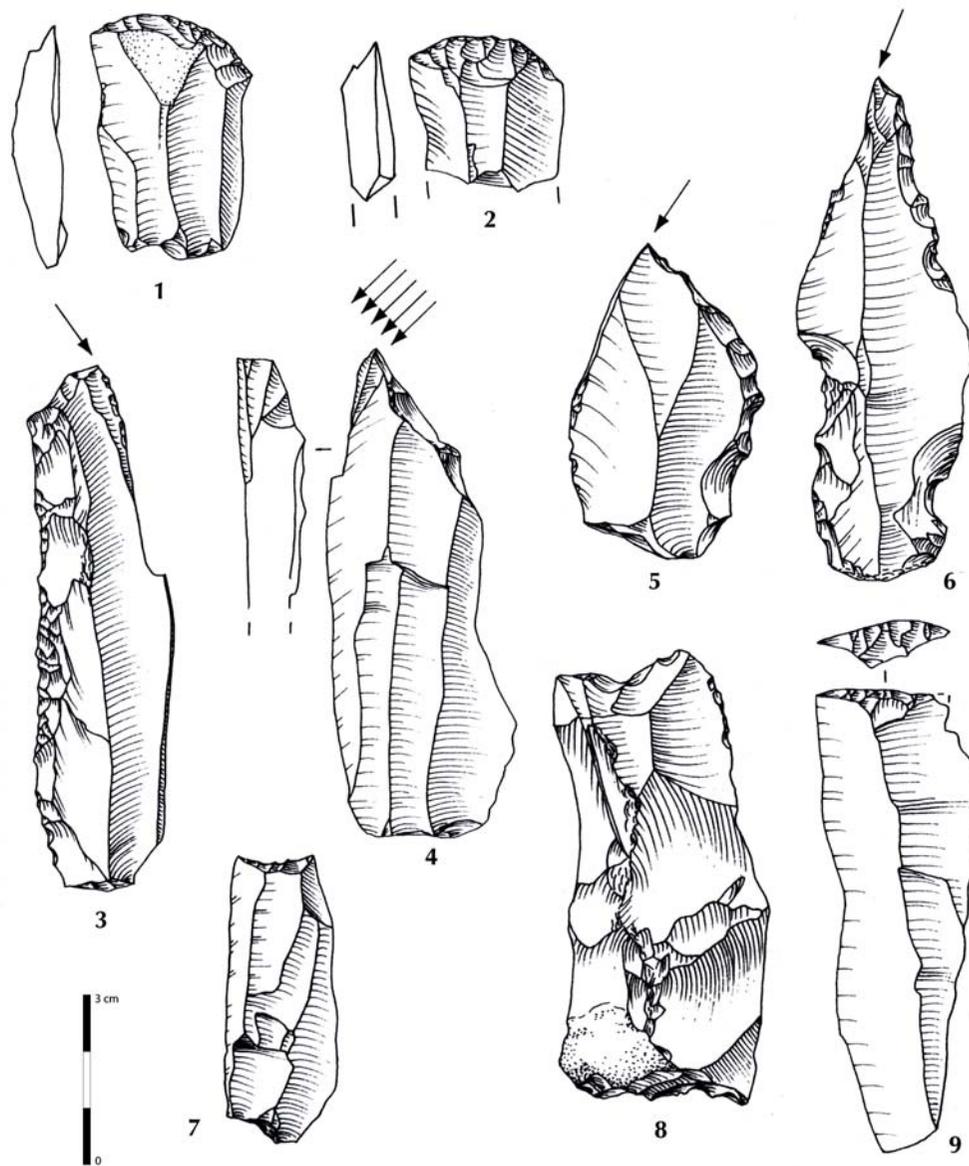


22 Ventral face of proximal part of experimental blade knapped with organic hammer (document J. Pelegrin): the recognition of percussion techniques is based on such reference material (Pélegrin, 2000)



1-12 : pointes à dos ; 13-17 : couteaux à dos.

24 Projectiles' armatures and knives from Ambenay (Eure) (drawings C. Billard In Valentin et al., 2004)

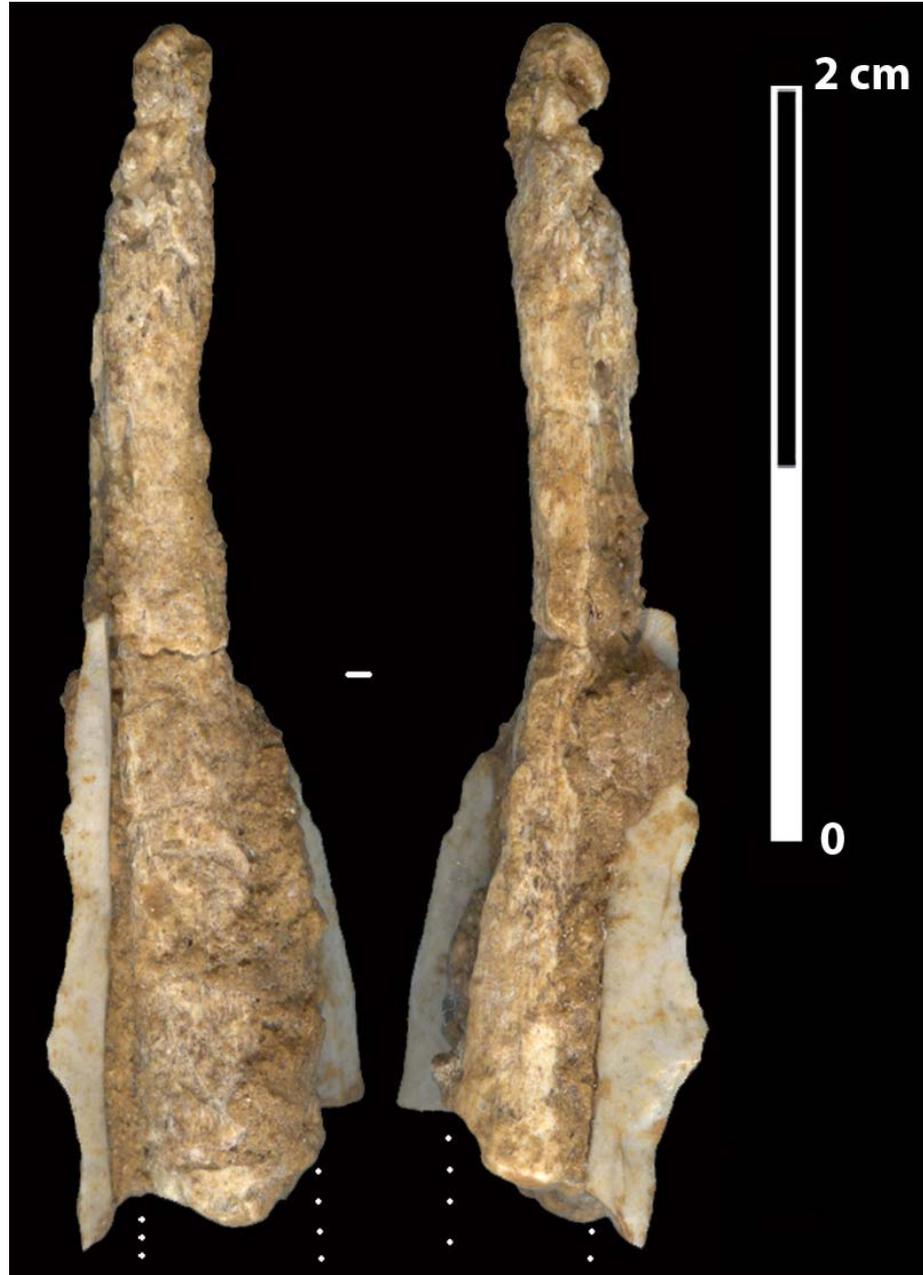


1-2 : grattoirs ; 3-6 : burins ; 7-9 : pièces tronquées.

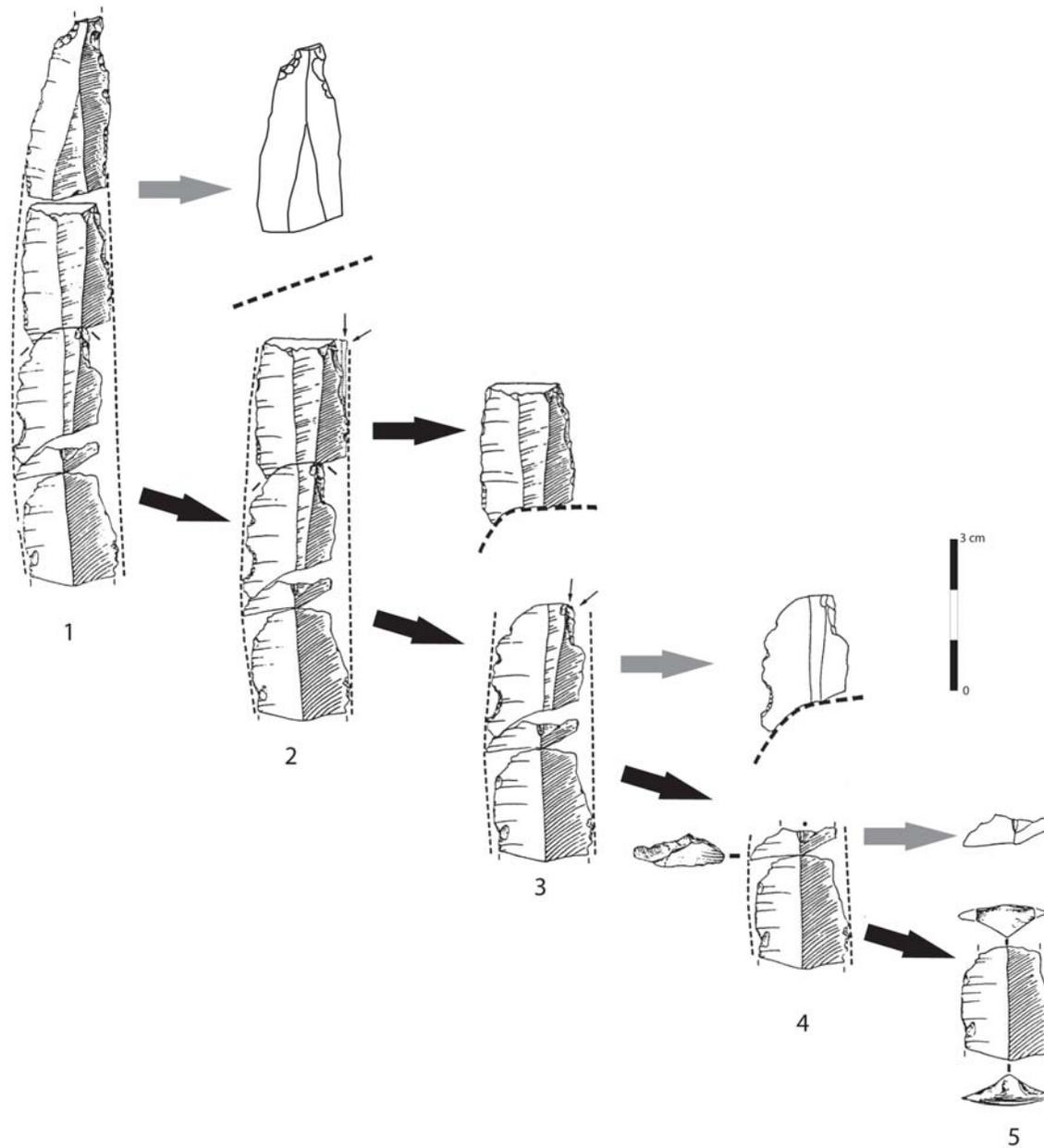
25 Tools from Ambenay (Eure) (drawings C. Billard in Valentin et al., 2004)



31 Antler points from the level IV20 at Pincevent (Seine-et-Marne) (document J.-M. Pétilion)



32 Antler point fragment with 2 flint cutting edges from the level IV20 at Pincevent (Seine-et-Marne) (document M. Vanhaeren)



35 Successive transformations of the previous blade according to use and fractures during rejuvenation (drawings D. Molez In Valentin, 1995)