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# Projectile insets and backed pieces from the Upper Magdalenian of La Madeleine (Tursac, Dordogne, France), new data from lithic technology

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## Introduction

- 1 In the present article, we wish to present part of the morphological and technological data noted on the assemblages of lithic points and backed bladelets from the excavations carried out by D. Peyrony and J.-M. Bouvier in La Madeleine (Tursac municipality, fig. 1).
- 2 Situated on the right bank of the Vézère River and opened up at the foot of a cliff, this extremely large site was excavated by several excavators all along the second half of the 19<sup>th</sup> century. The wealth of lithic and bone material and the quality of the art works found consecrated La Madeleine as the eponymous site of the Magdalenian culture (Lartet and Christy 1875). But it was only after the excavations of D. Peyrony, started in 1910, interrupted in October 1913 (on the centre and the western part of the site) and started again in 1926 (in the east) that a stratigraphy of the shelter was published (Capitan and Peyrony 1928). Then the excavator distinguished three archaeological groups within the Magdalenian occupations: the lower, middle and upper layers (or A, B and C) (fig. 2). The composition of their industries allowed him to confirm the tripartite division of the Magdalenian put forward by Abbot Breuil (Breuil 1912). The reading of D. Peyrony's stratigraphy only progressed with the new excavations of J.-M. Bouvier at La Madeleine in 1968, first on the western reference section and then with excavations in the direction of the centre of the shelter (Bouvier 1973, 1982). The

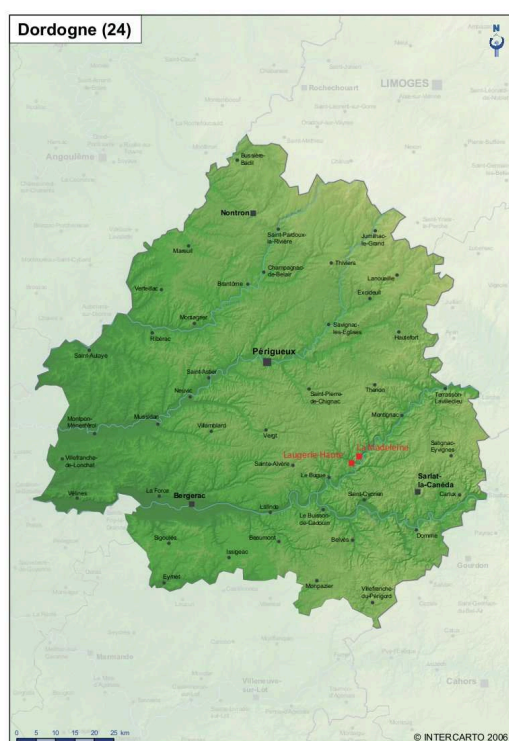
division of the infill sequence was refined, the large cultural horizons A, B and C being subdivided in several distinct occupations. The excavator also found under layer A levels that D. Peyrony did not reach, under flooding sands that he mistook for the natural floor of the site. The new stratigraphy keeps the three sedimentary groups isolated by D. Peyrony but then subdivides the 12 m high infill into 19 geological levels and 18 distinct occupation levels (fig. 3). The lower layer would then correspond to levels 30 to 26, the middle layer to levels 25 to 20 and the upper group to levels 19 to 14.

- 3 After a first global study of the technical behaviours used in La Madeleine (Bundgen 2002), the technologic study of the backed pieces collected by D. Peyrony and J.-M. Bouvier, kept in the National Museum of Prehistory in Les Eyzies-de-Tayac, allowed us to explore the diversity of these objects and to offer the first elements for a reflection on their evolution. Trails for interpretation are offered as a conclusion. They were developed within the wider framework of a reflection on the conception of the Magdalenian hunting weaponry, notably through the examination of strategies applied during the making of composite projectile points (Taylor 2009). These objects allow making hypotheses to explain the diversity of backed bladelets at the site of La Madeleine. The data collected on some of the main levels will be the only one presented: layers A, B, C of the Peyrony series; levels 27, 25 and 19 of the Bouvier series, which are respectively attributed to the Magdalenian IV, V and VI (tabl. 1). Before starting on the presentation of these data, we would like to precise the object of our study and especially give a definition of the term “backed pieces”.

## **1 - Backed pieces: morphological and technical definition of a large category of objects that vary through time and space**

- 4 This group of objects shares common retouching methods and modes: one edge of the blank is knapped by abrupt or semi-abrupt retouch that makes a back. Backed bladelets, blades with backed edge, backed points have thus been described within the various lithic assemblages of the Upper Palaeolithic. The definition of “backed pieces” then becomes a double definition, both morphological, since one can make out the nature of the blank or the outline of the object (for example a point), and technical with the use of the abrupt or semi-abrupt retouch that the term “backed” implies.

Figure 1 - Geographic localization of La Madeleine shelter.



- 5 Among these objects, backed bladelets are systematically present in the lithic groups of the Middle and Upper Magdalenian, most of the time in quantity. Thanks to their large numbers, these objects are the best for analysing the fabrication modes, observing variations, even a possible evolution. Out of the strictly typological and, more recently, technological studies dedicated to the characteristics of the Magdalenian backed bladelets, a certain amount of morphological diversity stands out. The “backed bladelets” are made most of the time on bladelets, but also on small blades. In fact, the term, in its broad sense, covers a diversity of types defined according to the various retouching modes of their blanks (Sonneville-Bordes and Perrot 1956; Tixier 1963; Brézillon 1968). The typological lists set up for the Upper Palaeolithic industries, largely based on observations of the lithic assemblages of Southwest France, include several major types of backed bladelets (“simple”, truncated, denticulated for example), then subdivided according to the characteristics of their retouch (delineation, orientation, regularity...). Their rates can vary (Sonneville-Bordes 1960), but simple backed bladelets (without complementary retouch on the extremities or on the opposite edge to the back of the object) systematically dominate over the other categories. Although they do share a common technical feature, the backing of a lateral edge of the blank by a more or less abrupt retouch, the modes of retouching of the various parts of these objects are in fact much varied when one considers the back itself, the lateral opposite cutting edge or the extremities. Indeed, they can be worked by variously oriented truncations or pointed, as the cutting edge opposite the back can be left untreated, be slightly rectified or strongly retouched, to the point of being denticulated (Piel-Desruisseaux 1998; Demars et Laurent 1989).
- 6 Backed points differ by the working of one or two sharpened extremities (points or bipoints), with the retouch of the back eating into the opposite lateral edge of the

blank. These objects also show a large morphological diversity, the distinction of types being established according to the retouching modes of their blanks (location and delineation of an additional retouch on the back, delineation of the back), which are most of the time small blades (Sonneville-Bordes and Perrot, *op. cit.*). At first these objects were only defined with regard to their specific morphology and a functional presumption, a pointed object often being considered as a point, by definition fitted at the extremity of a shaft. Since then, they have been reassessed critically, notably through a functional approach. Several experimental protocols that were based on sessions of throwing backed points replicas associated to an analysis of the macroscopic (fracture) and microscopic (modifications of the edges of the objects, polishing...) damage have since then confirmed the plausibility of the use of these objects as projectile points, but they did not exclude other uses (see notably the recent work on the curved back points called "Azilian", see Plisson 2005; Célérier et Jacquement 2005). Abrupt retouch is a widely used technical solution to make backed points but the processes responsible for their first appearance as well as their place within the lithic assemblages are still unclear. Indeed, backed points are found in assemblages traditionally attributed to the Upper Magdalenian (Magdalenian IV, V and VI) next to the backed bladelets and seem to develop more in the last manifestations of the Magdalenian although they always are in small number. Then, they have become, for some types, more characteristic of the Epipalaeolithic (notably the curved backed points). These points develop and spread in France at the end of the Magdalenian period from the South West to the Paris Basin, in varied contexts. Belonging in appearance to a dynamic of internal evolution, the lithic points technology seems to have found its place little by little in the making of the Magdalenian weaponry. Indeed, up to date no rupture has clearly been underlined between the emergence of these new technical behaviours and the Magdalenian technical traditions (Sonneville-Bordes 1979; Bordes and Sonneville-Bordes 1979; Célérier and Moss 1983; Schmider 1988; Valentin 1995, 2000, 2005; Fagnart and Coudret 2000; Bodu 2000; Pelegrin 2000; Ladier 2003).

- 7 In parallel to backed points in the broad sense, in the context of a wider reflection on the Magdalenian projectile points, we also studied Magdalenian shouldered points, points with short limb and long shoulder obtained by abrupt retouch, whose "back" is interrupted by a shoulder. In the present state of research, these points developed at the end of the Upper Magdalenian of the south west of France, essentially in the Gironde and the Dordogne (Sonneville-Bordes 1960; Lenoir 1975, 1989; Lenoir and Paquereau 1987). Even if they are not backed pieces from a strictly technological point of view, they are part of the Magdalenian armament and are a specificity of the site. In our research on the evolution of this armament, we did not wish to exclude them from the study of La Madeleine shelter as they are among these new projectile shapes that appeared suddenly among more ancient Magdalenian projectiles.

Figure 2 - La Madeleine shelter stratigraphy by D. Peyrony (after Capitan and Peyrony, 1928).

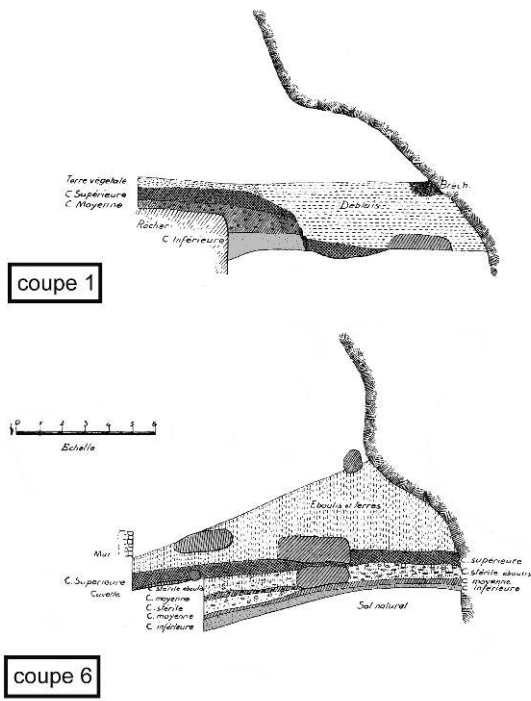


Figure 3 - La Madeleine shelter stratigraphy by J.-M. Bouvier (modified after Bouvier, 1973).

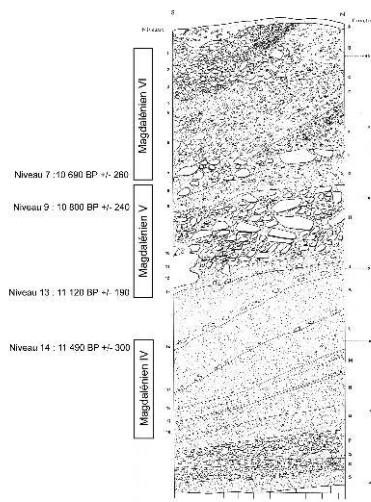


Table 1 - Studied pieces count.

	pièces à dos	supports	nucléus
<b>couche 27</b>	337	398	59
<b>couche 25</b>	299	281	31
<b>couche 19</b>	125	370	86

	pièces à dos	supports	nucléus
<b>Couche A</b>	141	13	114
<b>Couche B</b>	206	10	94
<b>Couche C</b>	256	107	62

## 2 - The making of backed pieces and lithic points in La Madeleine

### 2.1 - Backed pieces debitage and blanks

- 8 From a technological point of view, the methods of debitage remain remarkably similar during the Magdalenian occupation of the site. We will thus describe them in a synthetic manner. A large flexibility in the production patterns is a characteristic of the conception of the backed bladelets but these latter follow however the same strict criteria as to their aim.
- 9 Set up in the vicinity of good quality raw material deposits, the Magdalenian people have mostly used blond and black varieties of local Senonian flint (Santonian, Coniacian and Campanian; see about this Turq 2005 with many references) (tabl. 2). Collected in the bed of the Vézère River that flows at the foot of the shelter in the shape of flakes, plaquettes (neocortex, rolled cortex) or blocks and fragments of blocks in the slope deposits (alterites) immediately nearby, these materials allowed the making of most of the backed pieces and the lithic points found in La Madeleine (between 60% and 90% of the studied objects in the assemblages presented here). Foreign materials (from a distance between 50 and 70 km) have also been brought in and were marginally used. Among them, Maastrichtian flint from the Bergerac Region (Séronie-Vivien and Séronie-Vivien 1987) and a grey blond flint with micro-grainy texture of the “millet grain” type are found. The latter is a Santonian flint found in the Saintes region (Charentes) and corresponds to the material called “millet grain” by R. Simmonet (Simmonet 1999 - p. 82-83; Simmonet *et al.* in press), but a similar type exists with some blond Santonian flint blocks coming from isolated outcrops from the north of the Perigord (A. Morala, personal communication).
- 10 The knappers have selected volumes of small dimensions (fragments of blocks and thick flakes) with a flat or slightly convex breaking up surface opposed to a more convex natural surface. The crest formed by the intersection of the two surfaces was used as a guide for the first removals along the debitage surface of the core. Small elongated blocks have also been selected for their narrow and convex surfaces. The debitage surfaces are located in the longitudinal axis of the blank after a quick and rather simple preparation of the volume; the shaping up can be quick at this stage thanks to the strong criteria ruling the choice of the core blanks. The debitage surfaces

fit in a roughly triangular contour (pl. 1, 2 and 3- in the appendix) often seen on the selected volumes or requiring only a reduced preparation.

- 11 The surfaces remain narrow as the main debitage pattern adopts a frontal unipolar progression; oblique and larger removals on the edge of the surface allow to keep and maintain a narrow and triangular surface, more strongly arched on the edges (pl. 1, n° 1, 3; pl. 2, n° 3; pl. 3, n° 1, 2, 3 – in the appendix). Other patterns of debitage, notably when the progression is firstly frontal and then progressively invests a flank of the core (staggered frontal progression), require the utilisation of a secondary opposite striking platform; it's role seems rather to be the maintenance of the careening and bending in the lower part of the core (pl. 1, n° 2; pl. 2, n° 1). These last patterns could be applied to volumes with a more thorough exploitation, probably when accidents in the debitage could be avoided (loss of favourable angulations for detaching bladelets by accentuating the debitage surface or accentuating the striking platform during its restoration). The opening of this secondary striking platform can be applied as early as the first shaping phase but it also seems to have been used according to the needs during the debitage, notably when it appeared more productive. Indeed on some cores, the debitage progresses laterally on one flank, and implies a more or less marked lateral rotation of the secondary striking platform, which is thus more marked when the debitage is more advanced. The organisation of the removals to re-sharpen the main striking platform (whole core tablets or partial rejuvenation core flakes) as well as the chronology of the lamellar removals on the core (when it is readable enough) indicate that this lateral progression is done by small juxtaposed sequences of debitage.
- 12 On all these cores, a larger and oblique removal on the edge of the debitage surface (which is often twisted) allows obtaining the convexity and new ribs necessary for exploiting again the volume in the direction of the centre of the debitage surface where most of the last lamellar removals attempted on the volumes are situated. Indeed, the wanted bladelets, narrower, are essentially produced at the centre of the debitage surface where the lateral and longitudinal convexities (bending and careening) are maintained by the convergence of the debitage (fig. 4).
- 13 There is apparently no strict independence between the bladelets and the blades in the mind of the knappers, notably during the production of intermediate blanks, small blades and/ or large bladelets. This independence is much more discernible in the economy of the various blanks produced on the site. The smaller bladelets are kept for the making of backed bladelets. They obviously come from cores dedicated to the production of bladelets. The larger bladelets and the small blades, in spite of the selection of some of them for the making of backed pieces (large backed bladelets, backed points and shouldered points) are rather transformed into common tools such as borers, end-scrapers and burins. If from a dimensional point of view the transition between blades and bladelets appears rather done in a progressive manner, these products are nonetheless more strongly distinct in their economy. The backed pieces are made on the most regular blanks, mostly bladelets. These latter are slightly curved, the edges straight or slightly convex, as the distal extremity tends to become finer (pl. 4- in the appendix). These characteristics reflect the strong unipolarity and the convergence of the debitage. Their dimensions vary continuously, but the observation of the smallest blanks selected for the rest of the common set of tools indicates that their presence diminishes strongly in this category of the Magdalenian equipment when the width and the thickness of the blank are lower than respectively 12 and 3



mm. Tools with a length under 25 mm are very rare, as can easily be checked on the intact backed bladelets, when few knapped cores have a residual height below 30 mm. Measurements taken on a selection of the smaller blade-bladelets blanks indicate that their length vary essentially between 25 and 60 mm. Beyond, the blanks are rather blades and tend to be kept for the making of larger lithic points (pl. 5 and 6 – in the appendix) and the Magdalenian transformation tool kit.

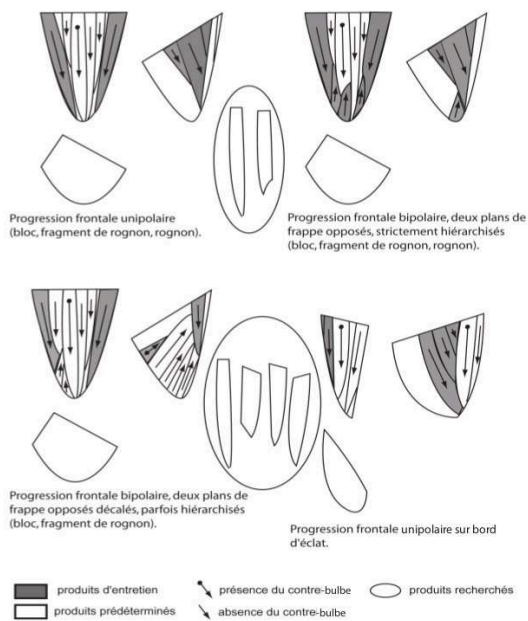
Table 2 - Backed pieces flint types.

	niveau 27		niveau 25		niveau 19	
sénonien blond	205	60,8%	96	32,1%	55	44%
sénonien gris	107	31,8%	84	28,1%	55	44%
bergeracois	2	0,6%	21	7%	0	0%
jaspe	1	0,3%	1	0,3%	1	0,8%
micro-grenu	2	0,6%	34	11,4%	5	4%
calcédoine	0	0%	1	0,3%	3	2,4%
indét/patiné	20	5,9%	62	20,7%	6	4,8%
total	337	100%	299	100%	125	100%

## 2.2 - Dimensions of the backed bladelets

- 14 Several sizes are looked for in the backed bladelets, especially if one considers the width of the objects, the variations in their thickness being much smaller (fig. 5 and 6). A strong variation allowance appears tolerated for these sizes: the width varies essentially between 3 and 8 mm with a peak around 4 mm for the Magdalenian IV and around 5 mm for the Magdalenian V; and, with more flexibility, it varies between 4 and 7 mm for the Magdalenian VI, with a thickness between 1.5 and 3 mm. These figures could be considered as representative of an “average” size bringing together most of the backed bladelets of La Madeleine but the dimensions of these objects may vary as much as 100% on the site. Some backed pieces can be over 8 mm wide. In general more robust, these latter have a width after retouching that varies between 9 and 15 mm for a thickness between 2 and 5 mm. Some of them are backed points, made on blades. Others can however represent an additional objective in the making of backed bladelets on this site.
- 15 Thus the Magdalenian hunters could have had two goals, the main one being the production of backed bladelets of average dimensions, more robust backed bladelets representing a secondary goal. However, these objectives do vary through time with significant differences appearing notably when the distribution of the width and the thickness of the objects are compared statistically (positive Kolmogorov-Smirnov test).
- 16 Backed bladelets are made on whole lamellar blanks. The hypothesis of an intentional segmentation of the blanks in order for example to keep only a certain length of the mesial part, does not agree with the analysis of the bladelets fragmentation. Indeed, the lengths of the backed bladelets fragments and of the raw lamellar blanks are similar (negative Kolmogorov-Smirnov test on the distribution of mesial fragments with simple and complex fractures). On the opposite, the lengths vary considerably with the retouching of short blanks (less than 30 mm) corresponding to the last phases of debitage of the cores and longer bladelets (measuring between 30 and 60 mm, rarely more) (fig. 7).

Figure 4 - La Madeleine : production methods on bladelet cores.



## 2.3 - The retouching of backed bladelets

- 17 The back of the bladelets is straight, fashioned by direct retouch, most often semi-abrupt rather than abrupt. Of a varying intensity, the retouch often decreases and even stops before the distal extremity of the blank (unlike the lithic points). Then the backed bladelets have a dissymmetrical outline: the cutting edge of the object bends in the distal part of the blank; one extremity of the object is sharper than the other. It's orientation cannot be chosen indifferently anymore. The depth of the retouch can also change, varying from a very slight retouch of the edge of the bladelet or the making of a thin back by marginal retouch (the width of the back remains smaller than half of the maximal thickness of the blank, the edge being slightly retouched) to a thick back retouched with an invasive retouch (the width of the back is over half or corresponds to the maximal thickness of the bladelets, the edge is deeply retouched, see “invasive or total back”, Christensen and Valentin *in* Pigeot 2004).
- 18 The proportions between fine and thicker backs evolved during the occupation of La Madeleine: thicker backs dominate during the Magdalenian IV (85% large backs against 15% narrow backs for level 27), the presence of thick and finer backs being more balanced during the Magdalenian V and VI (41% of large backs against 59% for the level 25; 62% of large backs against 38% for level 19). The choice of a more or less invasive retouch does not necessarily appear connected to the dimensions of the chosen blank, as the making of a thick back is not found only on the largest or thickest bladelets. It rather seems connected to the obtaining of a given width of the backed bladelet from a bladelet production varying in dimensions. The groups of bladelets with thin or thicker backs overlap (fig. 8 and 9). Most of these objects, which could be considered as average

in size, have indifferently a thin or a larger back (negative Kolmogorov-Smirnov test). The production of a large range of lamellar blanks then allows selecting various blanks (notably in width) but still obtaining similar objects in width and thickness by retouching more or less the edge of the bladelet.

- 19 These patterns of retouching evolve clearly during the occupation of the shelter, notably for the use and the localization of a complementary retouch of the backed bladelets cutting edge (tabl. 3 and 4). The frequency of this retouch, whatever the types considered (except for denticulated backed bladelets), appears in constant increase, becoming higher in some lithic assemblages of the Magdalenian VI than the one of the backed bladelets without complementary retouch. The frequency of these pieces (Bouvier series) ranges between 7 and 10% for the Magdalenian IV (levels 28 to 26), between 19 and 28% for the Magdalenian V (levels 25 and 24), and reaches a maximum of 41% during the Magdalenian VI (level 19). In the Peyrony series, this increase appears sharper, as the frequencies surge from 23 and 26% respectively for the layers A and B, to 62% for layer C. This latter figure, however, probably needs to be taken with caution because of the apparent selection of the objects in the series (see Taylor 2009). Although variations, for example in the intensity, the orientation or the angle of the retouch, can be seen, one can also note that various intentions appear to guide its use.
- 20 A first intention could correspond to the need to rectify the delineation of the cutting edge of the bladelet, as seems to be the case for the backed bladelets showing a marginal retouch in the distal part of the blank, underlying its tapering characteristic (pl. 7 - in the appendix). The retouch seen on the limb or on the tang of the Magdalenian shouldered points could also respond to a similar intention (pl. 5 and 6 - in the appendix). Other backed bladelets could also result from this intention: they show a semi-abrupt retouch more marginal than the retouch shaping the back and localized in the mesial part, but that can spread on all the length of the cutting edge (pl. 8, n° 1-7, 10-14 and 16-17 - in the appendix). Indeed, the wanted delineation, which is straight or slightly convex, appears to be more a rectification of the morphology of the cutting edge than an additional effort to calibrate these objects. This complementary retouch can then be considered as an extra investment that, although sometimes very discreet, indicates a special care given to the morphology of these backed bladelets.
- 21 Other intentions are visible through a modification rather than a simple rectification of the cutting edge. The notches found on the denticulated backed bladelets for example, greatly modify the cutting feature of the edge. Other transformations, sometimes more discreet, can also be modifications. Several bladelets bear a direct marginal retouch, semi-abrupt and convex in delineation in the proximal part. Depending on the objects, this additional retouch gives them a symmetrical or dissymmetrical character with regard to the longitudinal axis (pl. 9- in the appendix). In some cases, the same type of retouch creates a small shoulder in the proximal part of the bladelet (Magdalenian V and VI). On other bladelets, the complementary retouch spreads to the entire edge and accentuates or actually fashions a convex edge: although it remains regular, the retouch becomes deeper near the extremities of the blank (pl. 8 n° 9, 15 and 18 - in the appendix) (Magdalenian VI). On all these pieces, the additional retouch exceeds the simple rectification of the edge of the bladelet. It could be a special design in relation with the use and/or the fitting in of these objects. It is a difficult question to answer to in La Madeleine where the great variability of the backed bladelets (it is also the case for the lithic points, for which the relative scarceness complicates the perception of

their diversity) is easier to apprehend by their measurements, but much more difficult by the observation of more discreet criteria such as this additional retouch that sometimes barely modifies the original morphology of the chosen blank. Some morphological characteristics (convex edge, straight edge, proximal narrowing, and pointed distal extremity) are indeed found on the debitage products without any need for a complementary retouch. The discretion of these modifications could lead us to minimize the significance of this complementary retouch if its development did not happen in a progressive manner, its presence allowing to distinguish types within the backed bladelets. Moreover, their presence among the lithic assemblages evolve in a clearly oriented manner through time (fig. 10 and 11).

**Figure 5 - Width of backed pieces, from top to bottom: level 27, 25 and 19.**

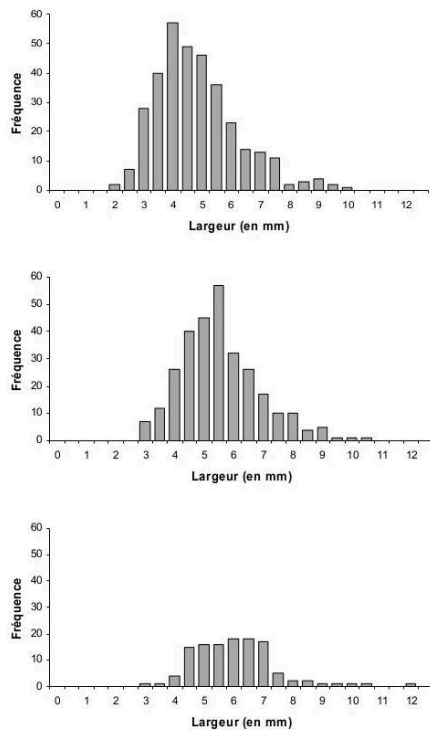


Figure 6 - Thickness of backed pieces, from top to bottom: level 27, 25 and 19.

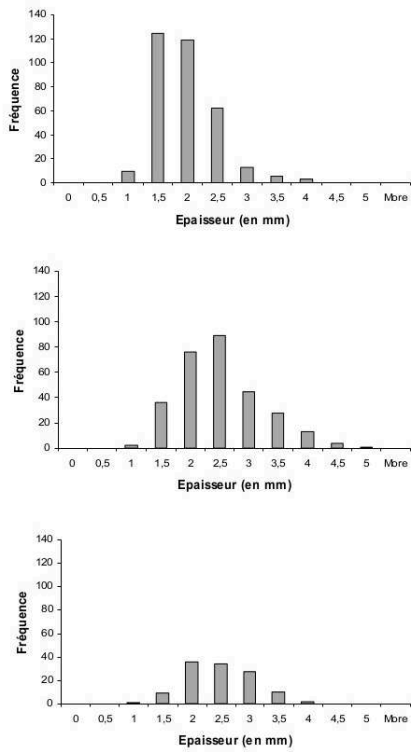
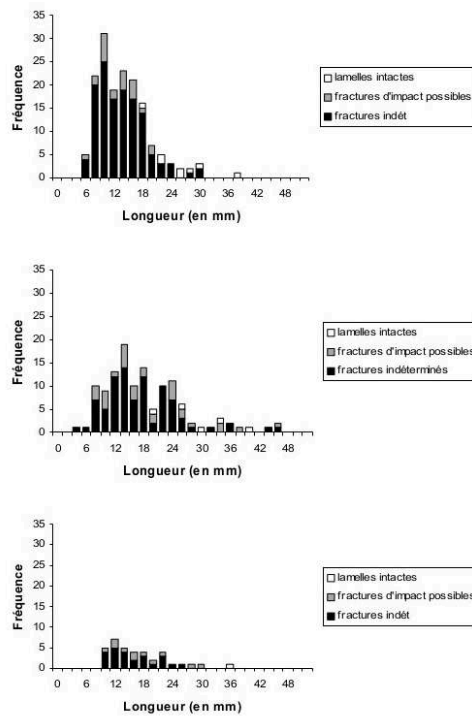
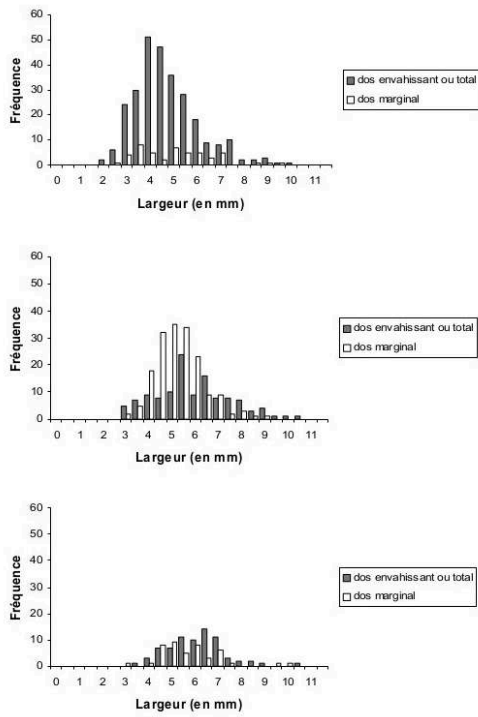


Figure 7 - Length of simple backed bladelet's mesial fragments, from top to bottom: level 27, 25 and 19 (in white: whole bladelets; grey: possible impact fractures; black: undetermined fractures).



**Figure 8 - Width of backed pieces, from top to bottom: level 27, 25 and 19 (in grey: thick back; white: thin back).**



**Figure 9 - Thickness of backed pieces, from top to bottom: level 27, 25 and 19 (in grey: thick back; white: thin back).**

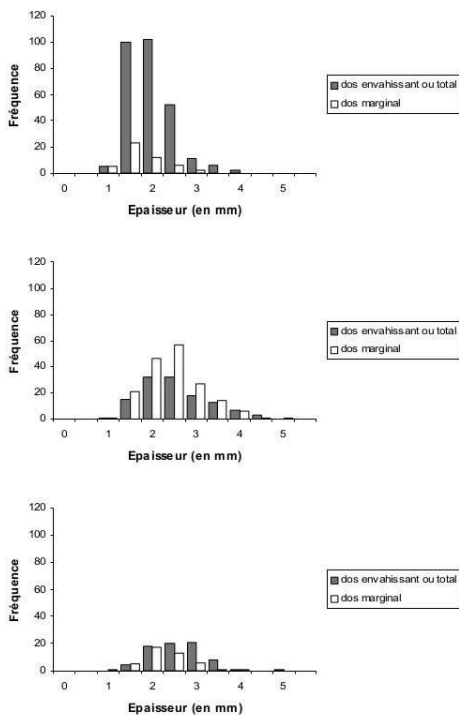


Table 3 - Backed pieces types frequency. D. Peyrony series.

classes	couche A		couche B		couche C	
	n	%	n	%	n	%
lds	87	61,7%	103	50%	39	15,2%
ldop	15	10,6%	31	15,1%	20	7,8%
ldod	3	2,1%	9	4,4%	21	8,2%
ldor	14	9,9%	15	7,3%	107	41,8%
ldd	5	3,5%	12	5,8%	10	3,9%
lde	5	3,5%	2	1%	0	0%
ld ang	0	0%	0	0%	0	0%
ldt	2	1,4%	4	1,9%	3	1,2%
lscal	0	0%	0	0%	1	0%
pd	3	2,1%	11	5,3%	6	2,3%
pdc	1	0,7%	3	1,5%	7	2,7%
pcm	0	0%	3	1,5%	29	11,3%
pièce à cran	2	1,4%	5	2,4%	8	3,1%
ldco	2	1,4%	1	0,5%	0	0%
indét	2	1,4%	7	3,4%	5	2%
<b>n total</b>	<b>141</b>	<b>100%</b>	<b>206</b>	<b>100%</b>	<b>256</b>	<b>100%</b>

Table 4 - Backed pieces types frequency. J.-M. Bouvier series.

classes	niveau 27		niveau 25		niveau 19	
	n	%	n	%	n	%
lds	277	82,2%	209	69,9%	59	47,2%
ldop	13	3,9%	27	9%	17	13,6%
ldod	11	3,3%	17	5,7%	3	2,4%
ldor	11	3,3%	13	4,4%	31	24,8%
ldd	2	0,6%	20	6,7%	1	0,8%
lde	2	0,6%	2	0,7%	0	0%
ld ang	0	0%	0	0%	1	0,8%
ldt	8	2,4%	0	0%	3	2,4%
lscal	4	1,2%	0	0%	0	0%
pd	3	0,9%	1	0,3%	0	0%
pdc	2	0,6%	2	0,7%	0	0%
pcm	0	0%	0	0%	1	0,8%
pièce à cran	4	1,2%	5	1,7%	6	4,8%
ldco	0	0%	0	0%	0	0%
indét	0	0%	3	1%	3	2,4%
<b>n total</b>	<b>337</b>	<b>100%</b>	<b>299</b>	<b>100%</b>	<b>125</b>	<b>100%</b>

Tab. 3 and 4 captions - Lds: simple backed bladelets; ldopod: backed bladelets with complementary retouch on the proximal extremity; ldod: backed bladelets with complementary retouch on the distal extremity only; ldor: backed bladelets with complementary retouch; ldd: denticulated backed bladelets; lde: notched backed bladelets; ld ang: angulated backed bladelets; ldt: truncated backed bladelets; lscal: scalene bladelets; pd: backed points; pdc: curved backed points; pcm: magdalenian shouldered points; ldco: shouldered backed bladelets; indét: undetermined backed pieces.

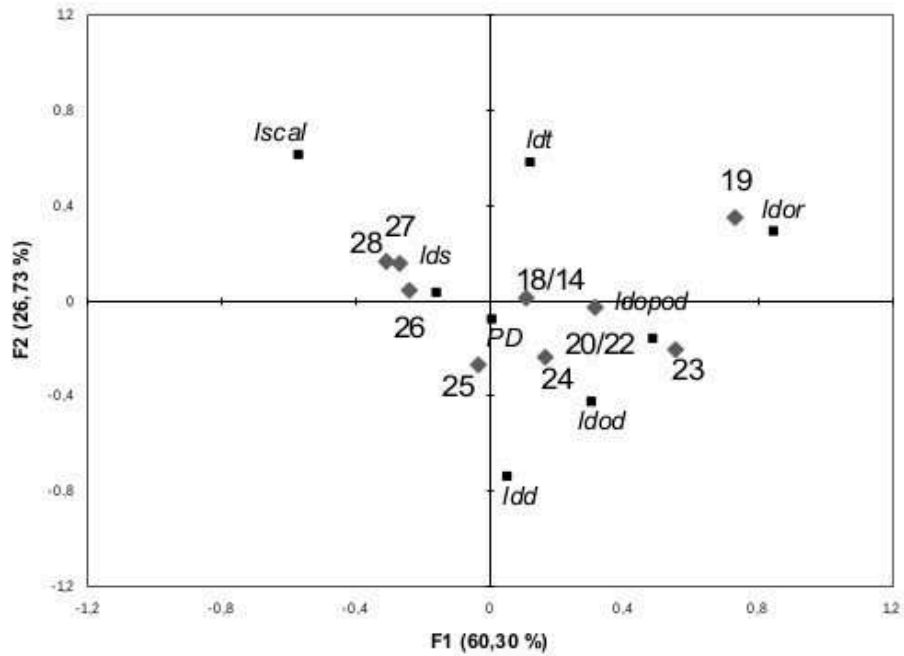
## 3 - From backed pieces to lithic projectile insets

### 3.1 - The use of backed pieces

- 22 Several backed pieces (bladelets and lithic points) show chips and complex fractures (Fischer *et al.* 1984) that can be considered as diagnostic of a use as projectile elements (Célérier and Moss 1983; Plisson and Geneste 1989; Geneste and Plisson 1990, 1993; Chadelle *et al.* 1991; Cattelain and Perpère 1993, 1996; Soriano 1998; O'Farrell 2004; O'Farrell and Pelegrin 2005; Plisson 2005). These are highly developed fractures in flexion (tongues with a step ending, sometimes incipient, transversal hinges), pseudo-burin-like removals that take away part of the opposite edge or of the back of the object (sometimes on a considerable length, over 1 cm) for the most important damage. More discreet modifications of the cutting edge of the pieces are also visible; they are small invasive low angle removals, oblique in relation to the long axis of the piece, or more important tearing off on the active edge (pl. 10, 11 and 12 – in the appendix). The lithic points and the backed bladelets share these damages (all types of lithic objects and all sizes considered together) but the chips are more frequent on the edge of the backed bladelets, the extent of the fractures being altogether lower also on these pieces, with a few exceptions. These observations can be a clue, although tenuous, of a rather lateral fitting of these pieces that exposed less their extremities to shocks.
- 23 The lateral fitting of backed bladelets on a projectile point in hard animal osseous material, without excluding a vegetal origin of the support, is a widely accepted hypothesis since the exceptional discovery of a mesial fragment of an antler spear point still fitted with flint bladelets in Pincevent (Seine-et-Marne) and of bladelets with traces of a fixing putty in Lascaux (Dordogne) (Leroi-Gourhan 1983; Allain and Leroi-Gourhan 1979). Unfortunately, experiments of projectile throwing have essentially focused on the use of spears armed with a lithic point, and characteristic damages linked to the use of a lateral insets, a function usually attributed to backed bladelets, have not been well defined yet. An exclusive function as a projectile has sometimes been questioned for backed bladelets, without being able to precise if an other use, such as cutting implements, had been applied occasionally thanks to a practical aspect of the object for the planned task or as a re-use (Keeley *In* Audouze 1981; Moss *et* Newcomer 1982). If the damages described above can be considered as characteristic of a use of these objects as projectiles elements, it seems difficult in La Madeleine to distinguish them from pieces that only show non diagnostic fractures in flexion (simple breaks). Simple breaks can also happen during an impact but they are not distinct enough from accidental breaks. They are still the most common type of damage, including in the experimental series that aim at producing diagnostic fractures. Another function remains possible for these pieces, but their morphological proximity with objects whose damage suggests a use as projectile element does not allow further distinction at this stage of the analysis (only a traceologic study could precise it at this stage).

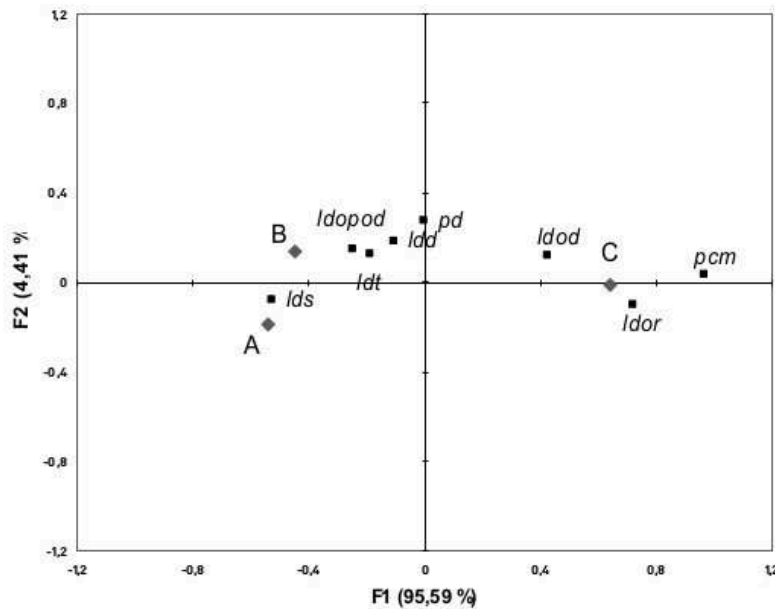


Figure 10 - Backed pieces types distribution. Bouvier series (correspondence analysis : black squares, backed pieces types ; grey diamonds, associated levels).



Lds : simple backed bladelets ; Idopod : backed bladelets with complementary retouch on the proximal extremity ; Idod : backed bladelets with complementary retouch on the distal extremity only ; Idor : backed bladelets with complementary retouch ; Idt : truncated backed bladelets ; Idd : denticulated backed bladelets ; Iscal : scalene bladelets ; PD : backed points.

Figure 11 - Backed pieces types distribution. Peyrony series (correspondence analysis : black squares, backed pieces types ; grey diamonds, associated levels).



Lds : simple backed bladelets ; Idopod : backed bladelets with complementary retouch on the proximal extremity ; Idod : backed bladelets with complementary retouch on the distal extremity only ; Idor : backed bladelets with complementary retouch ; Idt : truncated backed bladelets ; Idod : denticulated backed bladelets ; lscal : scalene bladelets ; PD : backed points.

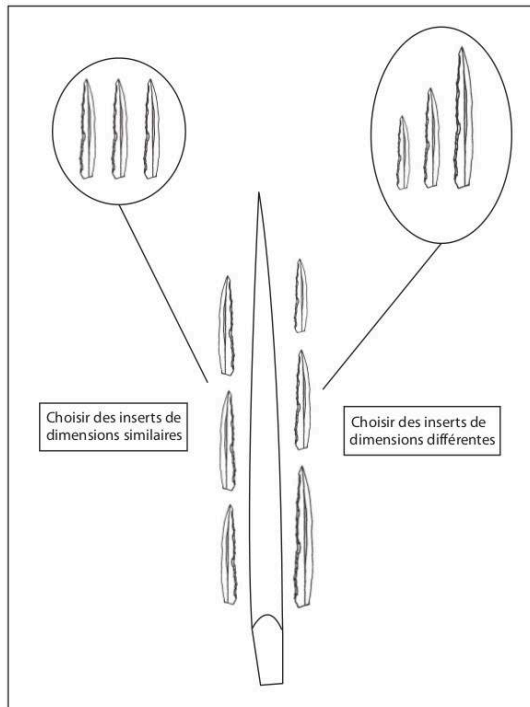
### 3.2 - Lithic inserts and composite points

- 24 The exact status of the backed bladelets that bear a complementary retouch remains a problem. The rectification of the cutting edge can be an argument in favour of inserting such objects in series, the calibration of the inserts and the delineation of the obtained cutting edge then being an important factor for the use of the projectile (penetration and maintenance of the point). The modification of the cutting edge could, however, express a more individual treatment of these backed pieces and/ or a plurality of solutions for fitting them in: unique lateral barbs, presence of a ligature (convexity or proximal shoulder), latero-axial fitting in, even axial for pointed objects? The fragility of these objects, for which the width and the thickness are always much more reduced than the objects typologically defined as lithic points, seems a problem, unless one considers a greater lightness of the whole projectile and notably of the shaft. Much more than the point, it is the shaft that will give it's mass to the projectile and will modify it's ballistic properties. From the point of view of the fracturing however (localization, extent of the complex fractures) it seems difficult at present to distinguish these pieces from the rest of the backed bladelets.
- 25 The retouching of the lithic points, their morphology and their greater resistance would indicate an axial fitting system rather than a lateral one. Several observations in La Madeleine appear to comfort this hypothesis (pl. 9, n° 6 - in the appendix). These objects could then be the clue of new concepts of projectile points, their making

processes integrating themselves progressively among the production of the backed bladelets and the remaining of the Magdalenian toolkit.

- 26 Besides, the large diversity of backed bladelets (dimensions) allows us to consider a plurality of possible combinations between an organic projectile point and lithic inserts, underlining the great adaptive flexibility of such an association (fig. 12).

Figure 12 - La Madeleine : different combinations for composite projectile tips.



#### 4 - First elements for an evolution of the backed pieces in La Madeleine: do they hint at a global modification of the Magdalenian hunting equipment?

- 27 The Upper/ Final Magdalenian thus appears as a significant period of innovation and diversification of the hunting armament in La Madeleine, with the appearance of barbed elements and the development of lithic points. However, it is difficult to understand why such a diversity of projectiles develops when only Reindeers, and more rarely Horses, seem to be hunted at the site.
- 28 Is it because all the production of projectiles was not meant to be used during the hunts on the site, and part of the projectiles could be used elsewhere and then be brought back, maintained and finally abandoned at La Madeleine? The data about the treatment of animal carcasses is lacking to assess whether hunts were carried out in the immediate vicinity of the site or during more distant expeditions; therefore this issue remains open. The hypothesis of a greater permanence of the human occupation appears supported in La Madeleine by the seasonality data available for the Reindeers, but they do not imply that the totality of the human groups always stayed at the site. If

part of the group could move away to hunt with a different equipment, it seems that the hunted preys were the same.

- 29 Harpoons were abandoned and even made in La Madeleine; some objects show traces of repair and the blank rods extracted at the site were suitable for their making. This raises the question of their purpose. One thing is certain: they did not replace the previous projectiles. The exact place of fishing (importance, seasonality) in the Magdalenian People subsistence in La Madeleine remains unknown to date, but it appears difficult for us to justify restricting the use of these barbed projectiles to the only fishing activity sector. The diversity of the bases suggests mobile heads (stops that are wider than the body of the shaft at the level of the base) and also fixed heads (striated bevels). However, their property of retention suggests different capturing techniques if they are used for hunting on the ground. The line of a privileged relationship between one type of projectile and one particular species seems to have to be definitely abandoned in the current state of the available data in La Madeleine. However, the hypothesis of their use in hunting situations needing particular capturing techniques can be put forward as the various projectiles made during the Magdalenian VI have very different properties, and even different weapons with some light projectiles (spear thrower/ bow).
- 30 The evolution of the backed bladelets retouching patterns is clearly more marked during the Magdalenian V and VI when firstly points with curved back and then shouldered points are made, and when the technology of the harpoon develops in the reindeer antler working at the site. Could the noticed evolution in the retouching of the backed bladelets be interpreted as the result of a change in status of the pre-existing conceptions of projectile points that would not be the only technical options anymore? The extra care given to the design of the final morphology of some bladelets could then correspond to a will of defining better the role of the hunting equipment existing prior to the introduction of the new projectile points. Other backed pieces could be related to the invention of new solutions for the fitting in, or represent new associations of inserts, or even lighter projectile points (small backed points?). The evolution of the backed bladelets could then be part of a global modification of the Magdalenian hunting equipment and techniques.
- 31 The issue of this global modification of the equipment remains difficult to grasp in La Madeleine, notably within a chronological framework elaborated around dates that are obsolete today. But confronting the data from the study of the backed pieces and the reindeer antler projectiles (Braem 2008; Taylor 2009) could suggest some discreet leads.
- 32 The development of the production of barbed projectiles suggests a search for new retention properties; it also seems to have incidence on the making of spear heads in reindeer antler at the site. Looking for blanks suitable for the making of harpoons, notably double ones, appears to have led the Magdalenian People to select larger and larger reindeer antler modules, from what we know from the minimal thickness of compacta noticed on the fashioned objects and the rod-blanks left unworked (Taylor 2009, after the raw data from L. Braem). The widths and the thicknesses of the spear heads increased markedly during the Magdalenian V and VI in La Madeleine, showing a general evolution similar to the one of the general dimensions of the backed bladelets and of the lamellar debitage. Similarly, the making strategies of the backed bladelets seem organised loosely around an average dimensional goal thus constituting a range of projectile points. The association between at least part of the backed bladelets and of

the spear heads, suggested by the damage on the lithic inserts, thus appears strengthened by this parallel evolution.

- 33 These discreet changes in the lithic lamellar industry must not, however, make us forget the remarkable continuity of the patterns of lamellar debitage at La Madeleine: we were able to underline the remarkable persistence of the strong principles and the persistent search of a particular morphology for the backed pieces. It is this continuity and the very progressive nature of the observed changes that make the observation and the assessment of the impact of introducing lithic points within the assemblages very delicate. In small numbers, with a great morphological and dimensional diversity, the backed pieces appears to fit in the lithic productions of the site without rupture, being fashioned on intermediate products, at the transition of the blade and lamellar debitage. This situation is not proper to La Madeleine as the connection remains strong between the lithic productions of the final Magdalenian, with the lithic points, and the first Azilian industries in which backed points, especially curved one, become important (Pion 1990, 1997; Bodu 1993, 1998, 2000; Célérier 1998; Chollet *et al.* 1999; Valentin 2000; Leesch *et al.* 2004; Valentin *in* Cholet and Dujardin 2005).

## 5 - Towards a Magdalenian conception of a composite equipment?

- 34 Another great constant, that even seems present within other Magdalenian contexts (Taylor 2009), concerns the flexibility and the adaptive nature proper to the strategies of production and transformation of the lithic inserts blanks, a feature that we are tempted to interpret as a real technical precaution principle that guarantees the efficiency of a composite armament (reliable system). Indeed the selection of a range of varied lamellar blanks, together with a modulation of the level of backing of the pieces that reduces more or less the original width of the selected blank, are likely to reflect the fitting of reindeer antler projectile points of varying sizes. They can then result from a strategy of anticipation, management and adapting on the long term of the hunting armament. This management would then be based on the making of lithic inserts with modes of production that can be partly modulated if needed. These needs can cover: the fitting of differentiated projectile points (this would be the case in the level IV-20 at Pincevent); the refecton or the maintenance of projectiles heads; or even complete changes of lithic insets on an imported armament (for example in the level Q31 in Etiolles). More than anticipation in the duration of the occupation, it is rather the adaptive flexibility of the hunting equipment (at least for the lithic projectiles) that appears to guide the making of the projectiles on the various Magdalenian sites (Taylor 2009). The anticipation at the scale of a full year cycle, and not only of the next occupation, could then justify the use of a relatively polyvalent armament. It could explain the adjustable features of the production of lithic inserts at these sites. However, it seems that this polyvalence, if it is confirmed, could, as a precaution principle, take enough part in the Magdalenian making imperatives and be free from some variation factors such as the differences in the occupation seasons, the frequency or the diversity of the hunted species (see comparisons between levels IV-20 and IV0 in Pincevent).
- 35 The polyvalence and a certain anticipation of the future needs in the conception of the Magdalenian toolkit have already been underlined through the very concepts

underlying the Magdalenian blade debitage, in which the search for a calibrated blade product that would favour the length of the blank then allowed the making of a large tool range that could be re-sharpened identically or modified completely later. Firstly identified in the Upper Magdalenian of the Paris Basin, these concepts could apparently be extended to the whole of the Magdalenian world.

- 36 This synthetic vision of several large Magdalenian lithic assemblages (Taylor 2009) could appear over simplistic in its will to find again their major common features. Indeed the flexibility in the fabrication modes of a tool kit designed “to last” in time (at least at the scale of a yearly cycle?), can be an extra “thread” allowing to unite Magdalenian groups that are clearly distinct in other aspects. But this common strategy, that in our opinion reveals a real principle of technical caution, must not hide more discreet elements: some technical capabilities that give a really particular identity to some Magdalenian groups. The discreet presence of some types of projectiles must also be underlined; they can be more characteristic of specific regions and are a witness of relationships between various groups of Magdalenian hunters (points with forked base, Lussac-Angles, lithic shouldered points).
- 37 These distinctive aspects characterise the conception of the projectiles in the mind of the Magdalenian hunters, especially through the “image” they could have had of it. This “image” can be seen notably through a rigidity of the retouching patterns (lateralisation, orientation of the blank), of the different levels of tolerance for the qualities of the blanks (rectification of the curve by inverse retouch, segmentation of the blank extremities, additional retouching for rectification, truncation and making of rectangles), even in the care given to the retouch. The conception itself of the projectile in the mind of the Magdalenian hunters is also, in our opinion, a factor to consider when one wants to study its morphology, even if this factor, subjective by its nature, is probably more delicate to understand.

## Conclusion

- 38 The necessary and long-awaited close-up observations of the lithic series from La Madeleine, whether ancient or recent, underline the singularity of the site. However, through the questions raised about the conception of a composite hunting armament, they fully fit into the present research that, thanks to technological analysis, shows and explores the variability of the Magdalenian world. The synthesis of the pluridisciplinary researches carried out at La Madeleine and on other major Magdalenian sites in Europe, imperfect because still in construction, allows nevertheless to underline several strong principles in our opinion. Other technological studies are of course necessary to strengthen the outline of the picture being sketched. We hope the present study has contributed to this.

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## APPENDIXES

Plate 1 - Bladelets cores from level 27, Magdalenian IV : n° 1 and 3, frontal unipolar progression ; n° 2, frontal-lateral progression with two hierarchical striking platforms (drawings A. Taylor).

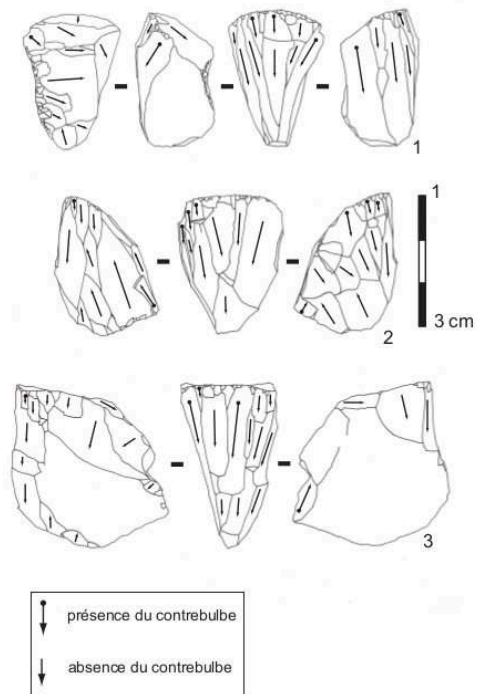


Plate 2 - Bladelets cores from level 25, Magdalenian V : n° 1, frontal progression with two hierarchical striking platforms ; n° 2 and 3, frontal unipolar progression (drawings A. Taylor).

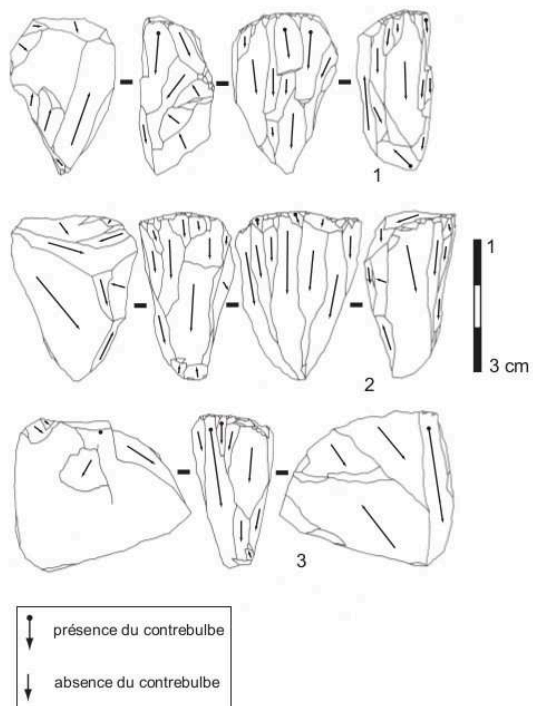


Plate 3 - Bladelets cores from level 19, Magdalenian VI : frontal unipolar progression (drawings A. Taylor).

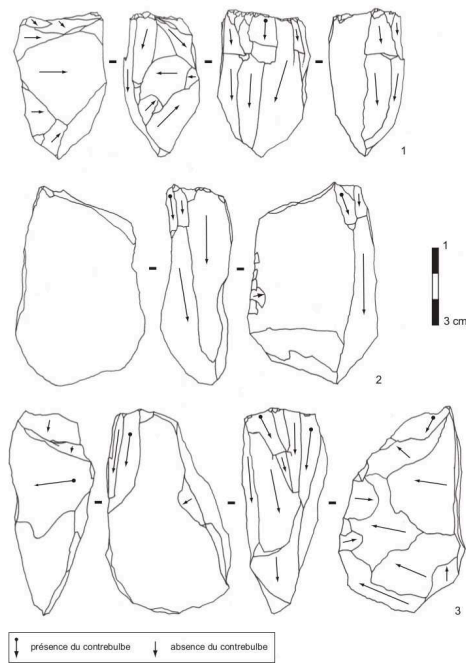


Plate 4 - Simple backed bladelets : n° 1, 2, 13, level 28 ; n° 3, 9, level 26 ; n° 4, 5, 12, level 25 ; n° 6-8, level 24 ; n° 10, 11, level 19 (drawings A. Taylor).

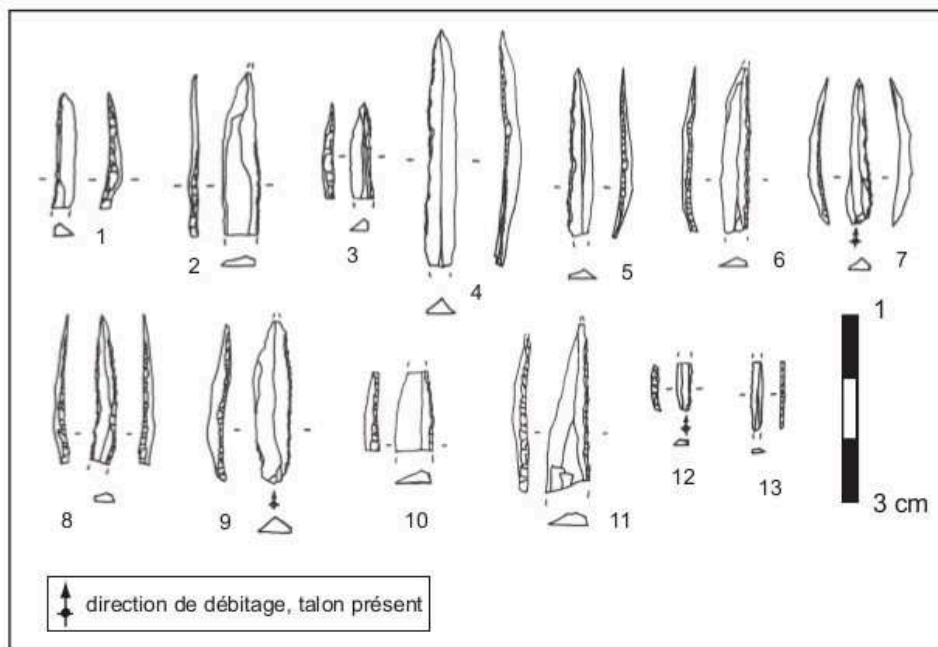


Plate 5 - Lithic points, Peyrony series. Level B, Magdalenian V : n° 1-4, Magdalenian shouldered points ; n° 3, unfinished point ; n° 5-8, backed points (drawings A. Taylor).

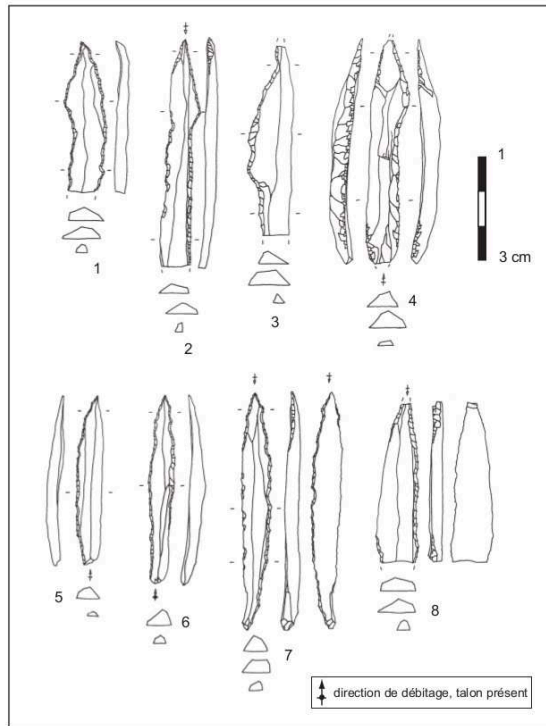
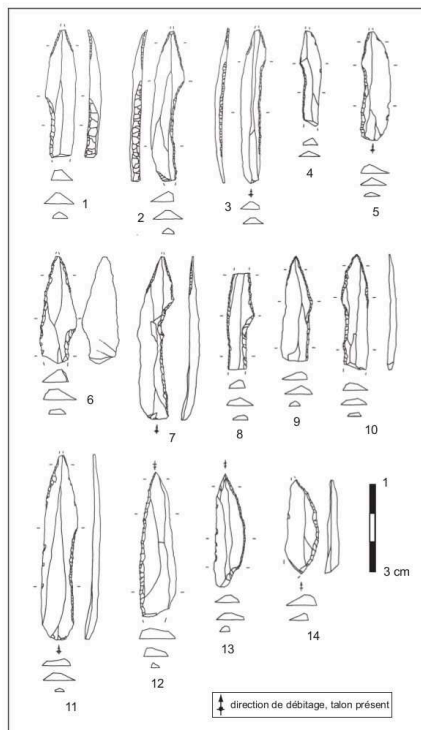
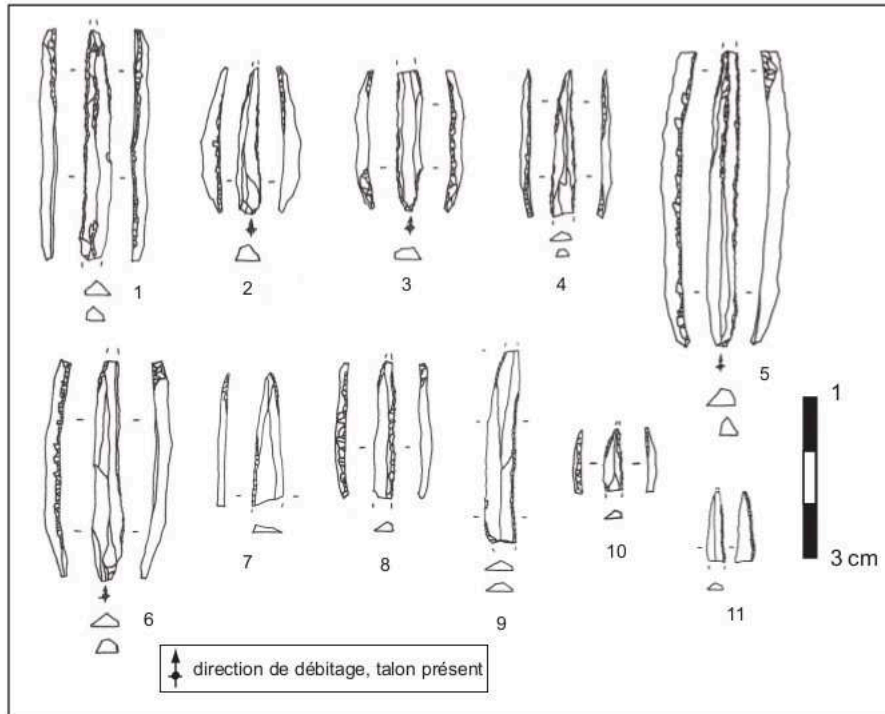


Plate 6 - Lithic points, Peyrony series. Level C, Magdalenian VI : n° 1-3, 5-11, Magdalenian shouldered points ; n° 4, undetermined shouldered piece ; n° 12, backed point ; n° 13-14, curved backed points (drawings A. Taylor).



**Plate 7 - Backed bladelets with complementary retouch on the distal extremity : n° 1-4, n° 6 level 25 ; n° 5 level 24 ; n° 7 level 21 ; n° 8 level 26 ; n° 9 level 22 ; n° 10 level 28 ; n° 11 level 16 (drawings A. Taylor).**



**Planche 8 - Lamelles à dos à retouche opposée : n° 1-3 niveau 24 ; n° 4,5 niveau 23 ; n° 6 niveau 21 ; n° 7-9 niveau 22 ; n° 10 niveau 20 ; n° 11-17 niveau 19 ; n° 18 niveau 17 (dessins A. Taylor).**

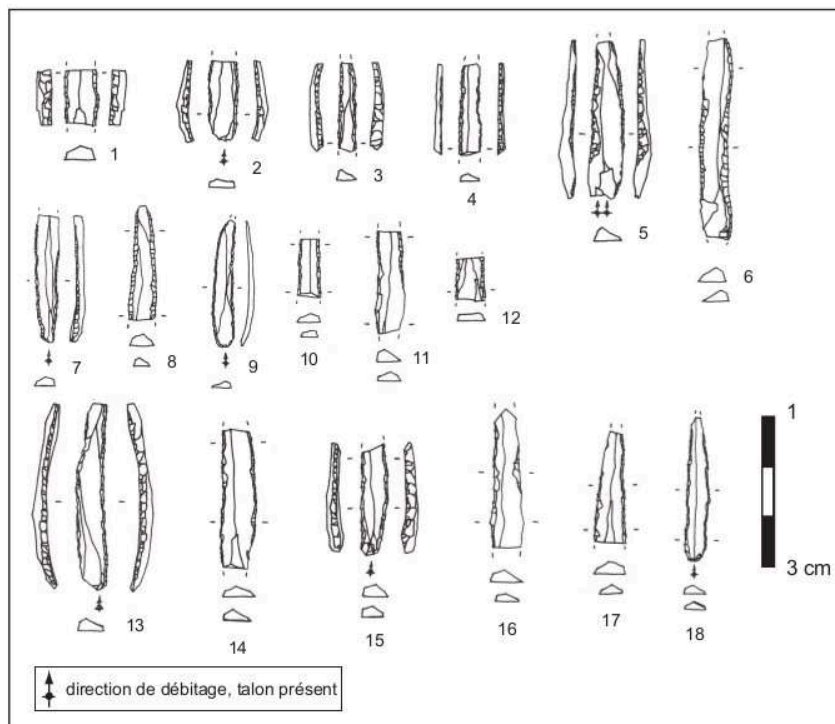


Plate 9 - Backed bladelets with complementary retouch on the proximal extremity : n° 1-3 level 28 ; n° 4-6 level 27 ; n° 7,8 level 26 ; n° 9-11 level 25 ; n° 12-14 level 23 ; n° 15 level 19 (drawings A. Taylor).

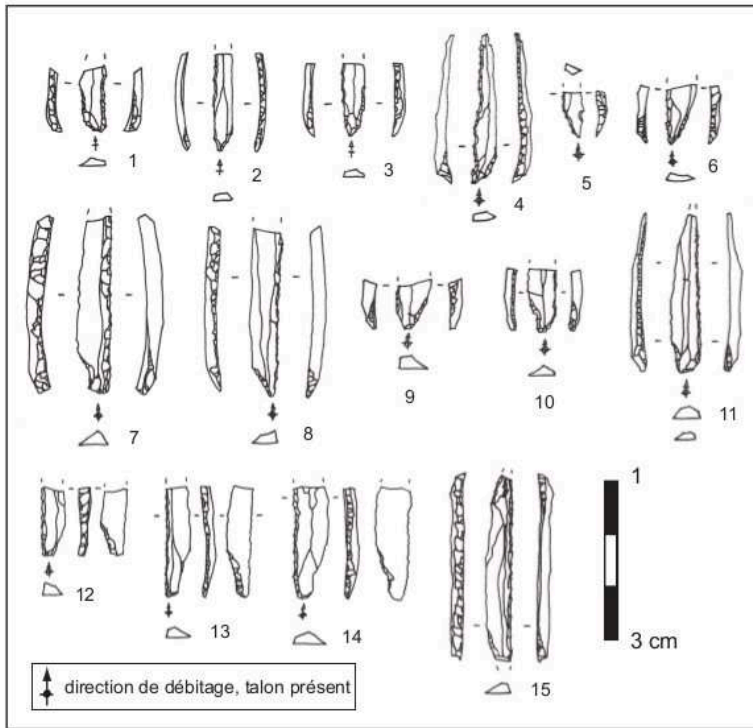
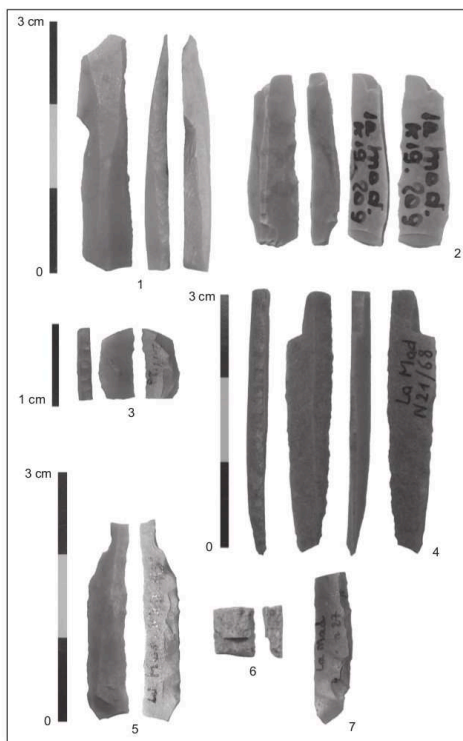
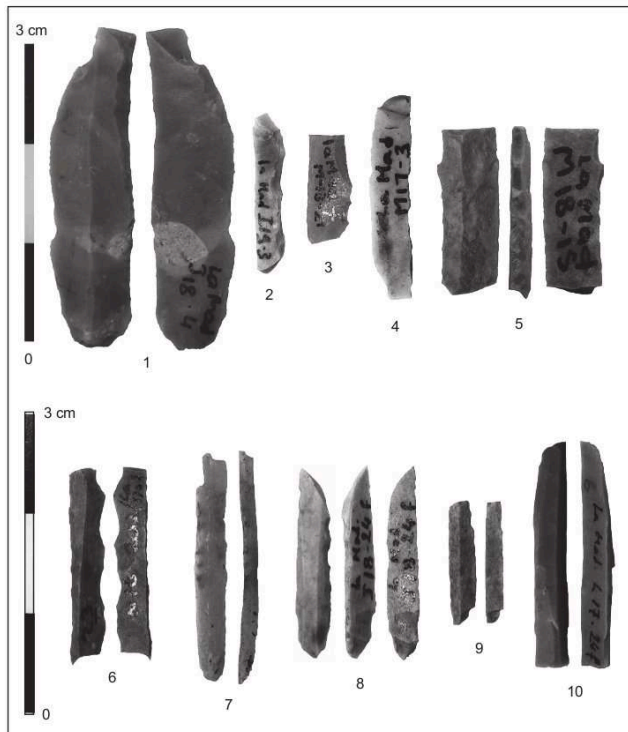


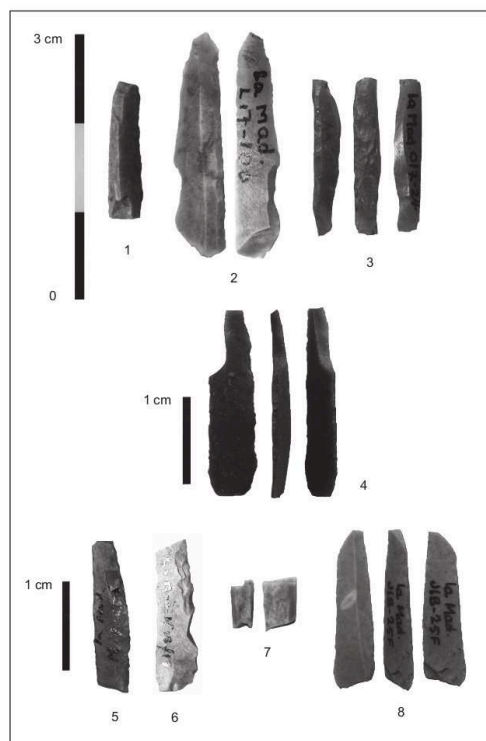
Plate 10 - A few examples of chipping and complex fractures diagnostic of use of backed bladelets as projectile insets..



**Plate 11 - Other examples of chipping and complex fractures diagnostic of use of backed bladelets as projectile insets..**



**Plate 12 - More examples of chipping and complex fractures diagnostic of use of backed bladelets as projectile insets..**





## ABSTRACTS

The technological and morphological reviewing of the backed bladelets and lithic points from the Peyrony and Bouvier series led us to question the status and role of these particular objects in the hunting equipment of the last Magdalenian people.

Firstly, from a technological view point, a great flexibility in the production schemes characterizes the conception of backed bladelets as the methods of debitage and transformation of blanks into backed pieces vary but follow the same strict criteria as to their aim.

Bladelet debitage at La Madeleine clearly aims at the production of tapered blanks, a complementary retouch adjusting the outline of the objects if necessary (edge, proximal or distal extremities). In some cases, this complementary retouch clearly modifies the blank morphology and could then take part in the making of particular types of backed bladelets. The schemes of retouch of these objects evolve progressively but clearly during the occupation of the shelter. The evolution of the lithic insets retouch schemes is clearly more effective during the Magdalenian V and VI, when first curved-backed points, then shouldered points are made, and harpoon technology develops in antler working, emphasizing the evolution in the conception of the hunting equipment. This evolution could be the result of a change in status of previous conceptions of projectile points, which no longer represent the only technical options. The greater care taken in the shaping of some bladelets could come within the intent of better defining the role of the hunting equipment existing before the introduction of new projectile points. Their evolution could then be part of a global modification of Magdalenian hunting equipment and capture techniques.

## INDEX

**Keywords:** La Madeleine, Southwest France, Upper Magdalenian, lithic industry, projectile tips, backed pieces, lithic insets, lithic points, technology, morphology

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