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BLANK PRODUCTION BY EXTRACTION ("DEBITAGE" BY EXTRACTION) AT THE END OF THE UPPER PALAEOLITHIC: A SPECIFIC CASE OF REINDEER ANTLER DEBITAGE DURING THE MAGDALENIAN OCCUPATION AT PINCEVENT, LEVEL IV20, FRANCE (SEINE-ET-MARNE)[1]

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The Pincevent site, first excavated under the direction of André Leroi-Gourhan, is located in the Paris Basin (south of Paris), near the Seine river. It has been repeatedly occupied during the Magdalenian. Amongst these levels is level IV20 that yielded the most abundant remains and also contained the greatest number of stratigraphic unities thanks to the excavated area that covers a surface of 4500 M2. As a matter of fact, the osseous industry from level IV20 is one of the most abundant – if not the richest – series currently known for the Magdalenian of the Paris Basin. It is composed, in decreasing order of importance of manufacturing wastes, finished objects, unmodified blanks or roughouts. The technological approach based on the refitting by default technique has allowed to identify two main methods of debitage: debitage by segmentation and debitage by extraction on which focused this paper.

Keywords: archaeology, France, Upper Paleolithic, Pincevent site, Magdalenian, reindeer antler working, osseous technology, debitage by extraction.

The Pincevent site is dated to the end of the Upper Palaeolithic, and more precisely attributed to the Upper Magdalenian. The site is located in the Paris Basin (at about 80 km south of Paris), near the Seine river. Excavations took place there from 1964 on, without interruption (over nearly 50 years), first under the direction of André Leroi-Gourhan, then under the direction of the members of the centre of research (focusing on ethno-prehistory) he created (Julien, Karlin, 2014b, p. 21).

The Pincevent site and the IV20 level

The Pincevent site has been repeatedly occupied: about fifteen occupational levels were identified. Some of these levels closely succeed one another (with regard to their sedimentation rates and probably also to their dating (Orliac *et al*., 2014. P. 31). The time span ranges from 13200 to 11700 Cal BC. Amongst these levels is level IV20, one of those that yielded the most abundant remains and that contained the greatest number of stratigraphic units because of the excavated area that covers a surface of 4,500 square meters (fig. 1). For that reason and to help to localise its different stuctures, this IV20 level has been excavated in distinct areas and sections from 1964 up until 1995. It has also been subject of publications by stratigraphic units (Leroi-Gourhan, Brezillon, 1972) or by research issues, notably through doctoral theses. The monograph publication of the entire IV20 level was edited in 2014 under the direction of Michèle Julien and Claudine Karlin (Julien, Karlin, 2014a); it assembles contributions from more than 20 specialists.

The occupation of the IV20 level took place during autumn (*Ibid.*). The main activities (Orliac *et al.*, 2014. P. 68) were flint knapping (blade and bladelet production for blade knives, burins, scrapers or for projectile points), hunting (mainly reindeer: almost 70 to 80 reindeers killed, a dozen hares (jackrabbit) and 34 horse bone elements brought back to the camp for technical reasons: sinews and scapula), food processing, processing of soft materials (animal skins), processing/exploitation of hard animal materials, mostly made up of reindeer antler.

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As a matter of fact, the osseous industry from level IV20 is one of the most abundant – if not the richest – series currently known for the Magdalenian in the Paris Basin (Averbouh, 2014. P. 135). It is composed, in decreasing order of importance, of manufacturing waste (73 pieces), finished objects (40 pieces), unmodified blanks or roughouts (17 pieces). The reindeer antler industry is particularly rich and largely dominates the series (fig. 2). The bone industry (Averbouh, 2014. p. 179), on the other hand, only comprises a few objects (needle fragments, atypical "smoother", decorated rib fragment, extraction matrices…).

The working of reindeer antler of Pincevent level IV20

The technological approach based on the refitting by default technique has allowed for the identification of two main methods of debitage. The first one is debitage by segmentation (Averbouh, 2000. P. 153; Averbouh, 2017) or by sectioning (which consists of splitting the antler in order to obtain standardized blanks presenting a semi-anatomic, often bulky and cylindrical shape. Generally associated with the manufacturing of voluminous objects as for instance perforated staffs (*bâtons percés*), spearthrowers, sleeves, picks and so on. The second one is debitage by extraction (Averbouh, 2000. P. 154) on which focused this paper. The technological approach has also identified one main method of shaping: gradual shaping which consists in a global approach of the shapes through the progressive removal of matter more or less simultaneously on the whole of the piece. This method of shaping is generally used to define the outlines, vertical sections, and cross-sections.

To avoid misunderstanding, it is important to keep in mind that the term debitage refers here to the intentional action aiming at producing a blank from a piece of raw material (bone, deer antler, ivory, teeth). With regard to the working of osseous materials, debitage consists in the fracturing of the initial raw material block by sectioning, extraction, bipartitioning or breaking (fig. 3) (Averbouh, 2000. P. 152). The term of shaping refers to the intentional action aiming at shaping a blank independent from the method of transformation selected (*Ibid.*). Shaping encompasses all the operations consisting in the modification of the blank shape: general shaping (shaping of the volume, modification of the outline, the faces…), shaping of attributes determining the morphology (perforations, barbs, lateral or central longitudinal grooves etc.).

Debitage by extraction in Pincevent level IV20

Most of the objects in this level correspond to transformation by extraction (Averbouh, 2014. P. 135). These are abundant waste products, several non-transformed blanks, several preforms and a significant series of bevelled tools and projectile points (fig. 4). The presence of all these objects, particularly those from the first two categories, shows that antler was worked on site, during the occupation. It was possible to constitute homogenous assemblages from a technological point of view, which enabled us to carry out refitting by default. This refitting allowed us to describe and to characterize the types of debitage more accurately. Furthermore, this enabled us to recognize differences between them, on a practical level (with regard to the techniques and procedures employed) as well as a conceptual level (position of the detached piece on the antler, types of extracted blanks and objectives of the debitage).

As is often observed during the Upper Magdalenian, the main debitage method for medium and large-sized antlers is extraction. Most of the objects are on blanks produced in this way. In the level IV20 occupation, we observed the use of at least two main variants of this debitage method – single extraction and multiple extraction – each of which can be divided into two or three types depending on which part of the antler was used (fig. 5) and which type of rod was required.

Single extraction debitage on the internal lateral surface. Single extraction debitage on the internal lateral surface of the beam (Averbouh, 2014. P. 136) (fig. 6: A) produces a strip-type rod with a plano-convex or rectangular section. The length of this rod varies from 160 mm to 320 mm or

more for some parts of the beam, depending on the class-size of the antler, with a width ranging from 10 to 35 mm and a thickness of at least 4 to 6 mm.

Single extraction debitage on the anterior surface. Single extraction debitage on the anterior surface of the beam (Averbouh, 2014. P. 138) produces a long, semi-circular rounded-type rod or a strip-type rod with a plano-convex or sub-rectangular section. The length of this rod varies from 185 mm to 350 mm, but is always relatively wide, from 15 to 17 mm, with a thickness of at least 5 to 8 mm.

Single extraction debitage on the anterior-internal surface. Single extraction debitage from the first part of the anterior-internal surface of the whole beam (Averbouh, 2014. P. 139) produces a long strip-type rod with a rectangular section, and a batten-type rod with a quadrangular section from the second. This type of rod was only identified on large antlers, and is particularly long (600 mm), and relatively wide (17 mm) and thick (from 8 to 10 mm).

Multiple peripheral extraction debitage. Multiple peripheral extraction debitage from beam A and C (Averbouh, 2014. P. 134) (fig. 6: B) produces two to four rods of different types: strip or semi-circular rounded types from the anterior and posterior surfaces; batten types from the lateral external or internal surfaces. Strip and semi-circular rounded-type rods were only identified on large antlers and are relatively long (200 to 300 mm at least and potentially more), quite wide (18 to 20 mm or more) and thick (from 5 to 10 mm). Batten-type rods can be relatively long (200 to 300 mm), quite wide (15 to 16 mm) and thick (10 mm).

Multiple trifacial or bifacial extraction debitage. Multiple trifacial or bifacial extraction debitage from beam A (Averbouh, 2014. P. 143) generally produces two or three strip-type rods, but also batten-type rods. The strip-type rods have a sub-rectangular to oval-rectangular cross-section, are thick or wide depending on their position, quite long (approximately 300 mm), relatively wide (15 to 30 mm) and thick (7 mm). Batten-type rods have a quadrangular cross-section and can reach similar lengths and thicknesses to strip-type rods, but are not as wide (7 mm).

Single extraction debitage from the anterior surface or anterior-internal surface is the most characteristic method at Pincevent. As a matter of fact, we are dealing here with the most common debitage at Pincevent as well as at Verberie (Averbouh, 2010.P. 89), one of the other rare Magdalenian sites that yielded remains related to the working of reindeer antler in the Paris Basin. By contrast, in the current state of research, the working of reindeer antler is quite rare in the other sites

The case of the "matrice" 36-S114.115

The case of this "matrice" (parent antler) is quite representative (fig. 7: A). The debitage was made from a large-sized antler (shed antler or antler broken out of skull). The beam forms an arc between portion A (basis) and portion C (palmation) and can reach a length of at least 700 mm. It produces a major manufacturing by-product: extraction waste or the "matrice" of extraction on which longitudinal grooves can be observed. Their characterization makes it possible to identify the technique that left these marks; to characterize the action and to identify the debitage plane; to define the extracted blank at least on its longitudinal edges; to locate its position on the antler. If it is possible to identify the transversal edge of the blank, then the morphology of the blank (outline, vertical section, cross-section) and its dimensions can be determined.

Although the state of preservation of the "matrice" 36-S114 prevents a more accurate reading of the surface, we can distinguish a complete longitudinal, continuous groove (left), recognizable along its whole length. It displays bundles of parallel and continuous striations on the entire length of the edge and the surface of the groove. The right longitudinal groove presents the same characteristics (except for the fracture on the median part). This shows that a single rod was extracted.

Moreover, if we add information about the angle of incidence of the left edge (± low angle, builds a reflex angle towards the lower face) and the angle of incidence of the right

edge (oblique angle, building a reflex angle towards the lower face), this, associated with the presence of characteristic striations on the edges allows to identify the typical grooving edges: it confirms then, that the technique employed to define the longitudinal edges of the blank is grooving. It would have been interesting to discern whether the direction of the grooving was unidirectional or bidirectional but, unfortunately, reading of the ends does not permit to localize the characteristic stops corresponding to the start and the end of the action. The question of the technique employed to define the ends of the blank was difficult to identify on this specimen (surface condition is poor) but not in the other readable cases of Pincevent, preparing of the split line by removal by direct percussion. On 36-S114, a clear limit can be recognized, with a straight end that allows to identify at least the shape of the proximal end of the blank

If we add to these observations the fact that the left groove edge is positioned at the centre of the inner side (according to the anatomical position) and measures 4.5 mm in width and that the right groove edge is positioned at the centre of the outer side and measures 6.5 mm in width, both edges narrow towards the front side at the height of portion C of the beam, then the morphology of the extracted blank can be deduced. This blank – a strip-type rod with a flat cross-section (*baguette de type bandeau étroit*) – is rectangular shaped, often with a slightly concave-convex and thick vertical section and a globally plano-convex cross-section. Its dimensions estimated are: length ≥ 600 mm; maximum width (proximal end) = 16.5 mm; thickness of the proximal end = 10 mm of which at least 8 mm compact bone tissue.

At the practical level (techniques and procedures), the characterization of this type of debitage is:

- First, defining of the blank by preparing the split lines parallel to the longitudinal axis of the antler by double (unidirectional?) grooving, associated with the preparation of the split lines perpendicular to the longitudinal axis of the antler by “entaillage” (i.e. with the use of the removal by the direct percussion technique).

- Second, detaching the blank, most likely assisted by diffuse percussion by means of an intermediate piece (chisel/wedge) by undercutting along the grooves. The final removal is most probably obtained by levering the intervening portion assisted by an intermediate tool and manually. On account of the state of preservation of the “matrice” (parent antler), it is not possible to identify marks stigmata left by the used technique. However, on other pieces (matrices and rods) from Magdalenian sites, marks left by intermediate tools were observed in the grooves in a regular manner all along the groove**.** Moreover, this is a widely experimented technique resulting in removals without breakage, if it is made gradually. But these experiments were all made on much smaller portions and certainly not on such long and curved segments. It would have been interesting in this context to identify these parent antlers in order to better understand how such a long rod was extracted without any breakage.

At the conceptual level (method, product, productivity), the characterization of this type of debitage is that the blank product has an artificial shape. It shows that the Upper Palaeolithic artisans aimed at exploiting selectively the internal structure of the antler by the method of debitage by extraction. The obtained product is a long rod, globally in the form of a narrow strip. One single rod was extracted stemming from the front side (i.e. anterior surface) of the beam between portion A and portion C of a large-sized reindeer antler.

Refitting by default with the rod 36-W104.90 and the finished objects

Beyond the description of this type of debitage it is possible to characterize the sequence of transformation into which it is incorporated. First because this type of rod produced by this debitage is present within level IV20 generally in the form of fragments of unmodified blanks but also in the form of a complete rod (36-W104) which is one unique piece (fig. 7: B). This rod measures 470 mm in length. Its proximal width is 15 mm and its proximal thickness 10 mm; its mesial width is 16 mm and its mesial thickness is 8 mm (exclusively compact tissue); its distal width

is 8 and its distal thickness is 6 mm (exclusively compact tissue). This enables us to confirm that this type of rod is extracted as a single piece. It confirms also that its proximal portion is wider and its distal portion narrower and that its cross-section mirrors this position: on the first two thirds, it is a strip-type rod with a flat cross-section *(baguette en bandeau étroit*); on the last third, it is a batten-type rod with a quadrangular cross-section (*baguette en tasseau*). The presence of groove edges on either side of its lateral edges confirms that they are continuous and the longitudinal outlining of the blank by parallel grooving. The groove edges show a vertical incidence in both cases and a width varying between 10 mm (proximal part) and 6 mm (distal part). The presence of a removal bulb on the upper face of the proximal end and the possible presence of removal scars (despite a very poor state of preservation) reinforces the assumption that the transversal sectioning of the ends was prepared by notching.

Finally, it can be stated that the edges between the upper side and the groove edges are already rounded. The surface of the rod is in quite poor condition; thus, it is difficult to recognize the marks left by the technique used but at least, it indicates that a first shaping of the blank was made after its "debitage" by the method of gradual shaping. This blank, the rod, presents a perfectly straight vertical section which means that it was bent to shape after its extraction. It could have possibly done progressively and manually, given that the antler is fresh and thus more pliable (its yield point under bending stress is rather high)

The type of finished objects shaped from this rod are also present in level IV20. As a matter of fact, several objects (projectile points and chisels) fit this technology in that they are made from rods with either a flat or quadrangular cross-section (the groove edges are still visible and were not affected by the shaping, they thus show the initial cross-section of the piece). Most of them are made from large-sized antler depending on their dimensions and notably on the thickness of the compact tissue remaining after shaping, which is between 4 and 7.5 mm and they most probably come from the beam (vertical section, dimensions). If we take into account the dimensions of the completely preserved projectile points, they match the rod sizes through their maximum width (between 7 and 10.7 mm), their maximum thickness (between 5 and 8.4 mm) and the thickness of the compact tissue between 4.5 and 6 mm. But their length (between 70 and 191 mm) does not match the rod size. If we take into account the dimensions of the chisels, their maximum width (between 10.6 and 12 mm), maximum thickness (between 8.1 and 10 mm) and the thickness of the compact tissue (between 7 and 7.5 mm) correspond to rod size. But, once again, length, which is 88 mm for the only complete piece, does not match rod size. These elements lead to two assumptions. First, the rod, after its extraction, is subdivided into several blanks. It thus undergoes secondary debitage: in this sense we are not dealing here with a real blank but a secondary block. Secondly, the debitage of the blanks is made by segmentation (see manufacturing waste) adapted to the scheduled lengths of the finished objects according to the types. With regard to the projectile points, dimensions match the medio-distal portion of the rod (the portion with the most quadrangular cross-section); with regard to the chisels, dimensions match the medio-proximal portion (the portion with the flattest cross-section). Both are more or less equidistant; that means in terms of productivity that secondary debitage leads to the production of one to two projectile points (double-bevelled, a major type within level IV20) and 2 additional chisels, if we take as an example the complete rod W104 (i.e. 470 mm in length).

In conclusion, it can be advanced that the Pincevent type debitage by single rod extraction is aimed at the production of a secondary block. This block then undergoes debitage by segmentation yielding at least three to four finished objects, depending on the dimensions of the secondary block (fig. 8).

Conclusion

Beyond this particular case, all the studied cases of debitage by extraction show that several strip or semi-circular rounded rods that may be compatible with the production of bevelled chisel-type tools, were

produced during the occupation of level IV20 (Averbouh 2014). However, the represented equipment only consists of three tools of this type, some of which are broken. If these rods were intended for making other chisels, it is clear that they were not abandoned at Pincevent. These pieces were brought out of the habitat site, and we can reasonably assume that they were a durable element of the Pincevent toolkit. During experimental studies, these tools can be used for several years if their active part is repaired from time to time.

In the same way, several batten rods, flat strip rods and rounded segments, which are potentially compatible with the production of projectile points, were produced *in situ*. However, only about twenty objects of this type were abandoned at Pincevent, which is a lot less than the total number of pieces that we might have expected – nearly twice that number. Again, we must presume that part of the production was taken away when the site was abandoned. However, it is possible that some of the pieces produced by these debitage methods are still in level IV20. The presence of three whole, perfectly functional points in unit 46-R130 raises questions as to why they were abandoned. They were practically connected when found and may have been placed in a now disintegrated container and unintentionally forgotten on the occupation floor. Considering their condition and very slight evidence of use wear, it is possible that they come from the debitage of one of the antlers used in level IV20.

Lastly, several large secondary blocks (about ten at the least, representing a length of 4 to 5 metres of antler, at a conservative estimate) were produced during the occupation of the site in a good quality raw material and the presence of waste potentially linked to sectioning them shows that they were worked at Pincevent. Nonetheless, waste from the full debitage phase is rare compared to the number of large rods to be produced. Although it is easy to understand that small waste is less likely to be preserved than large blocks, this imbalance appears to be excessive. We can thus ask if the occupants of level IV20 did not take some of these rods away with them in order to have secondary preformed large antler blocks to hand, even outside of the acquisition season.

On account of the presence of reindeer herds and the slaughter of some of them in the autumn and until the beginning of the winter (Enloe, David, 2014. P. 551; Karlin, Julien, 2014. P. 565), these nomads were primarily oriented towards the exploitation of a very high-quality raw material available during their occupation of Pincevent: large-sized male adult antlers, and to a lesser extent, medium-sized sub-adult antlers. Evidence from the site shows that they built up stocks of raw material, in the form of secondary pre-formed manageable blocks that could be transported, and were ready to work later on, perhaps during the course of the year, so that they could produce new projectile points, new bevelled tools and other types of objects depending on their needs.

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ПРОИЗВОДСТВО ЗАГОТОВОК ПОСРЕДСТВОМ ЭКСТРАЦИИ (РАЗДЕЛКА ИЗВЛЕЧЕНИЕМ ПРОДОЛЬНЫХ ФРАГМЕНТОВ) В КОНЦЕ ВЕРХНЕГО ПАЛЕОЛИТА: ОСОБЕННОСТИ РАЗДЕЛКИ РОГА СЕВЕРНОГО ОЛЕНЯ В МАДЛЕНЕ НА СТОЯНКЕ ПЕНСЕВАН ГОРИЗОНТ IV20, ФРАНЦИЯ (SEINE-ET-MARNE)[2]

А. Авербух

Стоянка Пенсеван, раскопками которой изначально руководил Андре Леруа-Гуран, находится в Парижском бассейне (к югу от Парижа) близ р. Сены. Это многослойный памятник мадленского периода. Одним из горизонтов, давших наиболее обильные находки и содержащим к тому же большое количество стратиграфических подразделений, является горизонт IV20, занимающий площадь 4,500 кв. м. Костяная-роговая индустрия горизонта IV20 является одной из самых богатых (а может быть, и самой богатой) среди известных к настоящему времени для Мадлена Парижского бассейна. Она включает отходы производства, готовые изделия и заготовки или полуфабрикаты. Технологический подход, основанный на ремонтаже, позволил идентифицировать два главных метода разделки сырья для получения заготовок: посредством сегментации (поперечного расчленения рога) и посредством экстракции (извлечения продольных фрагментов). Последнему методу и посвящена данная статья.

Ключевые слова: Франция, верхний палеолит, Пенсеван, Мадлен, обработка рога северного оленя, технология, разделка посредством экстракции.

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