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The use of bipolar/anvil technique at the Middle Paleolithic site of *Mesvin IV*

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Abstract

The early Saale site of *Mesvin IV* is currently being reviewed. During the technological study of the lithic assemblage we found proof for the use of a bipolar or anvil technique. A lack of appropriate experimental data and comparable contexts makes it at this point hard to understand its importance and relationship with other techniques or methods. For now we are under the impression that the technique only played a minor role.

Keywords: Middle Paleolithic, technology, bipolar/anvil technique, *Mesvin IV*.

1. Introduction

The site of *Mesvin IV* was excavated between 1978 and 1984 by D. Cahen and his team and yielded a rich collection of lithic artefacts and fauna remains. Based on TL-datings, fauna composition, palynological analyses and stratigraphical information, we can say that human occupation(s) probably took place early in the Saale at the border or in the dry bedding of a small river (but see Cahen *et al*., 1984 and Cahen & Michel, 1986 for more information). The site was afterwards destroyed by the incision of a second canal resulting in a mixed assemblage of fresh and rolled material.

The lithic assemblage of *Mesvin IV* is currently being restudied. This research is part of a larger project called MARS or Multimedia Archaeological Research System (Semal *et al*., 2004). During the analyses of the lithic artefacts we were quite surprised by the high number of debitage accidents (such as distal and lateral hinges), fractured or shattered platforms and other fractures. This was in contrast with an important part of the material that showed a well developed and controlled debitage technique e.g. the Levallois products and discoid cores (Ryssaert, 2004). It was only after finding some products with typical ventral bipolar attributes and after discussing the matter with a colleage, Anne Hauzeur, that we realized these features have to do with the use of a bipolar or anvil technique.

2. Some remarks on the definition of anvil and bipolar technique

For the definition of anvil technique we can take a closer look at the description of Bordes (*taille sur enclume*): *le percuteur est fixe et c'est la pièce à tailler qui est mobile. Ce procédé convient particulièrement à l'obtention de très grands éclats... les éclats détachés présentent un très large plan de frappe, très oblique, avec un gros conchoïde de percussion, un point d'impact bien visible et un cône très apparent, parfois multiple* (Bordes, 1947: 17, in: Brézillon, 1971). This proces has also been called «bloc-on-bloc»technique or clactonian technique (Brézillon, 1971). But we know now that this anvil technique is not at all typical for clactonian assemblages. This interpretation was based on common beliefs. A confrontation with experimental material showed that clactonian artefacts did not show the attributes typical for the use of anvil technique (White, 2000).

In more recent stone age studies, e.g. concerning the mesolithic and neolithic in Scandinavia the term is differently used. It points to the reduction of cores positioned on an anvil whereby a hammer is struck under an oblique angle (Callahan, 1987).

Concerning bipolar we make a distinction between using the technique for the retouching of a tool edge (Bordes calls this *percussion directe écrasée*) and using it in order to produce flakes. For the latter we can use the definition of Breuil (1954, in: Brézillon, 1971) who qualifies bipolar as a type of debitage whereby the core is placed between hammerstone and anvil. He does not specify if this is accomplished by a rectilinear or oblique impact.

Callahan (1987) makes a differentiation between bipolar technique as *...the process involves a core being struck straight downward from above, perpendicular to both the core top and the anvil...* and *This differs from anvil reduction, wherein the core is placed identically on the anvil but struck obliquely or with the force being directed away from the point of contact of the anvil* (Callahan, 1987: 13).

The term bipolar is also commonly used for the description of paleolithic cores instead of e.g. bidirectional. Some researchers try to solve the problem by using a combined term as for example *debitage bipolare sur enclume* (de Lumley & Barsky, 2004).

From the first moment it was clear that the features we met in the assemblage of *Mesvin IV* did not meet the ones described by Bordes for the anvil technique. Although this will be further checked in future experiments, we are quite sure that we are dealing with a bipolar technique in the sense of Breuils' definition or anvil technique according Callahans' definition.

3. How to recognize bipolar or anvil products: some references

Most of the literature deals with situations far different from the ones at *Mesvin IV*. A lot of research has been done on American prehistoric technology. Not only technology but also lithic resources are very different compared to the European Middle Palaeolithic. In Europe most of the research has been oriented on more recent periods. Nevertheless there are some common technological attributes that we can use for the recognition of bipolar/anvil technique in the collection of *Mesvin IV*.

Bordes gives us the following clues: *Habituellement, les deux extrémités de l'éclat ainsi obtenu portent la trace du choc et du contre-coup, mais présentent rarement un conchoïde bien développé* (Bordes, 1947, in: Brézillon, 1971). But crushing marks on bipolar products aren't as typical after all. As several authors point out (e.g. Shen, 2001; Kuhn, 1995; de Mortillet, 1883, in: Brézillon, 1971) there is a high degree of broken or shattered pieces and the distal bulb and impact point tend to disappear. The distal ends regularly show a lot of stepped or hinged fractures instead (Shen, 2001). Moreover, experimental research of Kuhn (1995) suggests that the opposing bulb may not even be created if the anvil support is fairly soft: *A better marker of bipolar reduction in the study assemblages is flat or concave 'sheared' bulbs of percussion with strongly marked concentric ripples on the ventral surface, and small semi-circular zones of crushing at the point of impact. Since the most predictable results are obtained by striking directly on the edge of a lenticular pebble, the dorsal and ventral surfaces of split pebbles intersect to form an acute angle, and distinct, measurable platforms are not present on the resulting flakes* (Kuhn, 1995: 97-99).

In his analyses of several mesolithic and neolithic Swedish sites Callahan (1987) does not make a distinction between freehand or anvil flakes. According to his experiments there is an extensive overlap between the attributes of these flake types and it is often only in the more «classic» examples that the two may be distinguished. As a result of his study he only gives some clear attributes of bipolar products. Logically these products show a great amount of variability depending upon the shape of the core and the way the reduction is proceeded. If the flakes are produced from the outside of a block-like core, they can hardly be destinguished from anvil flakes. When a core is split at the centre, this produces unique products. They are typically thin and flat (if not shattered). Struck with a hard hammer they usually exhibit a sharp but crushed platform. Crushing may or may not be exhibited on the opposing end. He also points to the fact that they have usually off-centered ridges. Products struck from the lateral margin of a bipolar core strongly resemble a tranchet or "orange peel". A natural by-product of the bipolar reduction – although not exclusively – is a triangular splinter. These products exhibit strong, steep-angled margins (Callahan, 1987: 30-35).

In the same way the distinction between freehand cores and anvil cores is very often difficult if there is no crushing at the base. Anvil cores may also resemble bipolar cores. The rectilinear splitting and resplitting of a bipolar core results in a number of «wedge-like» or «scalar pieces». However when a core is split from the outside in, it does resemble an anvil core, and can only be distinguished by the direction of the force applied (Callahan, 1987: 20-24).

4. Some experimental results

Literature did not provide us with enough data in order to describe proper criteria for the study of bipolar/anvil reductions at *Mesvin IV*. We dicided to conduct our own experiments. These have a limited character because only 5 cores were succesfully knapped. We selected large flint nodules from the quarry at Harmignies, a kind of flint that was largely used at *Mesvin IV*. Our anvil consisted of a sandstone slab. The cores were reduced by using a quartzite hammer, using direct percussion under an oblique angle. We did not pay a lot of attention to the preparation of striking platforms or exploitation tables. Cores were struck from one platform and the debitage was largely limited to one exploitation phase.

Eliminating cores, debris and flakes less than 2 cm, this experiment only leaves us 80 endproducts for analysis. So it is clear that it can give us an indication of some criteria, but is too limited in order to fully understand the variability and fracture processes of bipolar/anvil techniques.

It is indeed true that an important part of the products show no bulb of percussion (about 35 %) but still 57 % of the pieces show a strongly or weakly pronounced bulb (table 1). A large part of the products was broken during knapping (about 55 %, table 2). Especially lateral fractures are typical and are to our knowledge much more limited in non-anvil direct percussion reduction. Most of the pieces do not show some kind of debitage accident (about 59 %, table 3). Nevertheless hinge or step fractures do occur very regularly (30 %). Some of the lateral fractures have a very distinguishable pattern and resemble a sort of irregular hinge or step fracture. That is why we did not count them within the 'normal' fractures. Only a limited amount of the products have this kind of debitage accident. They are to our opinion as typical for the technique as the crushed distal ends are.

In analysing the experimental results we focused on some attributes that we could compare with the data we had for *Mesvin IV*. Leaves us to remark that some products showed crushing at the distal end (19 %). A lot of the pieces had very sharp platform angles and some had ventral lips. About 27 % of the platforms were broken or shattered. And although we did not have the intention to produce them, a relatively important part could be determined as *couteau à dos naturel*. But this probably resulted more or less out of the unprepared unidirectional reduction method we used. Most importantly we noticed a large degree of variability between the reduction sequences. Off course we ourselves are partly responsible because we have a limited experience in flint knapping. Therefore we only have a limited knowledge in controlling and correcting debitage accidents. Nevertheless we feel that a very large experimental collection can give us workable information. What we also need is a reference collection consisting of comparable flint nodules worked by non-anvil direct percussion techniques, in order to eliminate a placebo effect. We hope to do this in the future with the help of the experienced knappers at the *Préhistosite* at Ramioul.

Bulb of percussion	%
Absent	35,1
Weak	18,2
Strong	39,0
Not determinable	7,8

Table 1 — Bulb of percussion (experimental data).

Fractures	%
None	44,9
Distal	11,5
Medial	7,7
Proximal	2,6
Lateral	29,5
Combination	3,8

Table 2 — Fractures (experimental data).

Debitage accidents	%
None	58,8
Distal hinge/step	30,0
Lateral hinge/step	3,8
Tongue	1,3
Siret	1,3

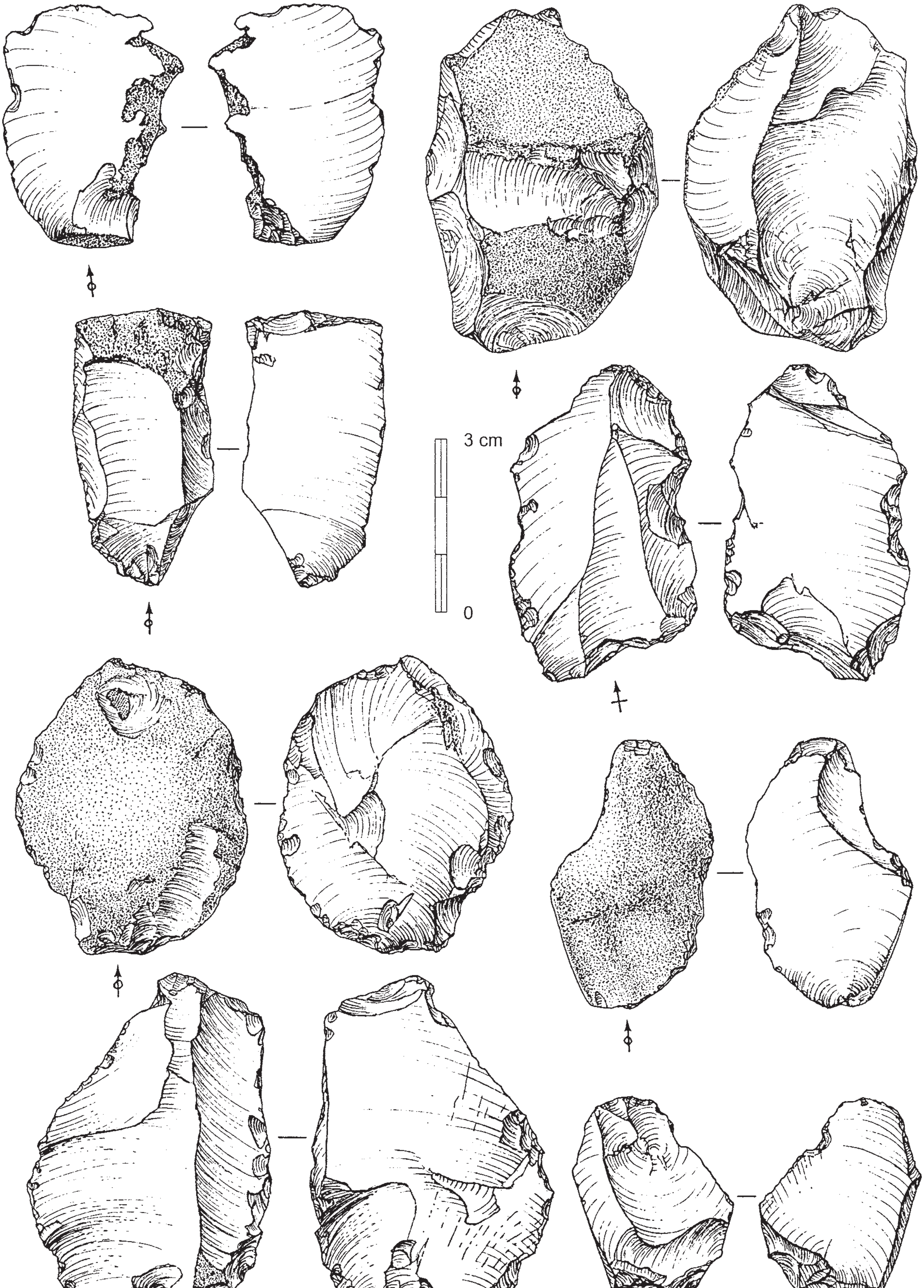
Table 3 — Debitage accidents (experimental data).

5. Bipolar products within the assemblage of Mesvin IV

As we already mentioned in our introduction we recognized some «classic» bipolar/anvil products. Some of them are illustrated in figure 1. Only 5 cores show some typical attributes of which heavy crushing[1] and 'pseudo-flaking' at the base combined with unpronounced bulbar scars are the most important ones. These cores show a great degree of variability but all of them do not seem to be very far reduced. Preparation of the exploitation table seems to be very limited and most of them are unidirectional reduced. The crushing at the base is only encountered marginally within the blanks. In figure 2 some blanks are illustrated with more pronounced impact features on ventral or dorsal side (occasionally they almost resemble an atypical burin blow). But the «classic» bipolar/anvil products largely consist of blanks with irregular lateral fractures combined with absent or concave percussion bulbs. In total we are only dealing with about 40 pieces on a total of 5400 objects that were analysed at the moment of the writing. But we did not recognize the technique until the analyses of the assemblage was already well on its way. So we are sure that we missed some of them.

In our research on the lithic assemblage of *Mesvin IV* we conduct a technological attribute analyses with the help of an *Access* database. We will now look at some attributes that were already integrated in this database before we dealt with the possibility of the

1. This attribute has not been taken in consideration for the rolled part of the assemblage as it is difficult to differentiate it with the crushing due to transport.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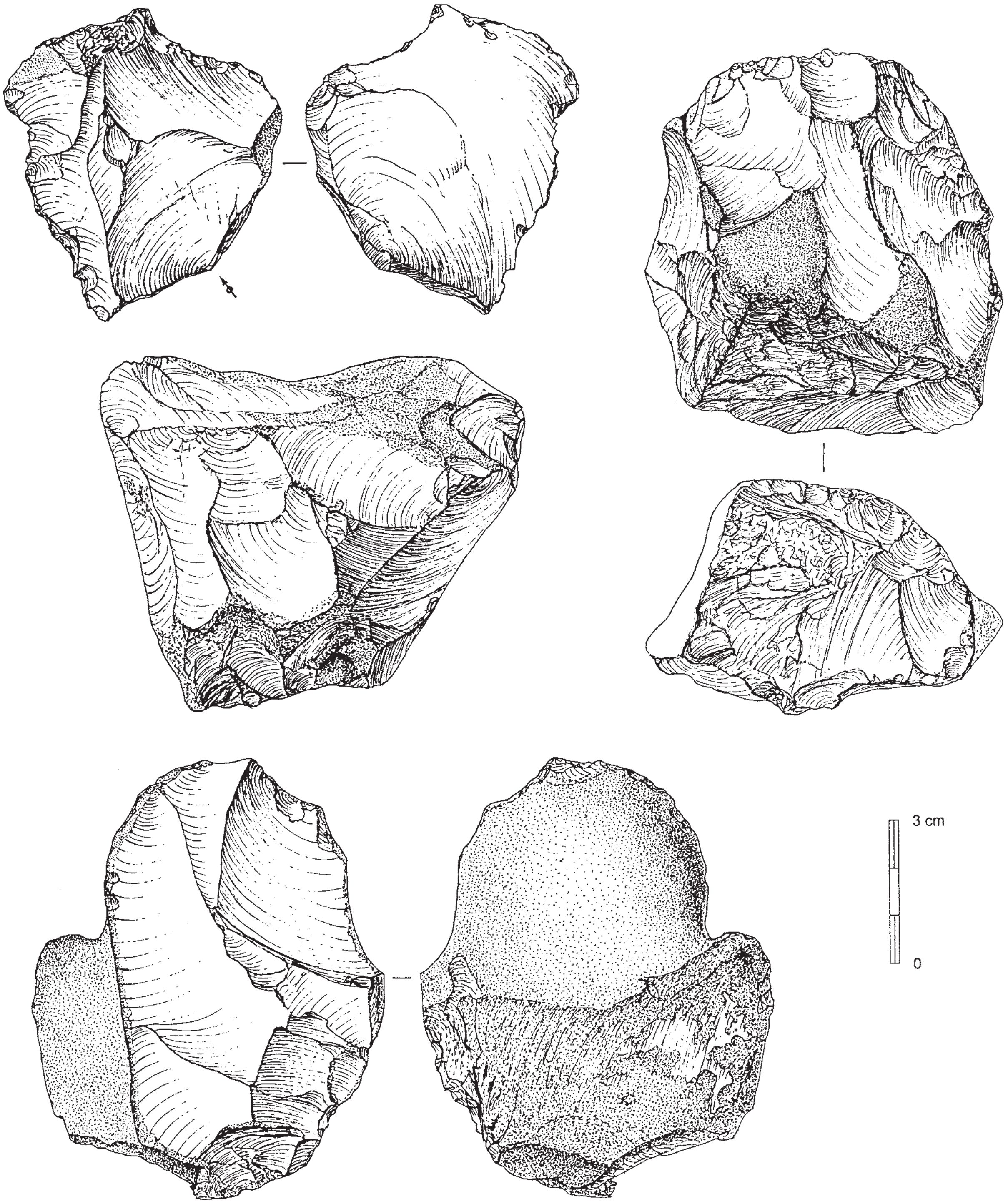

Fig. 2 — Bipolar flake and cores from *Mesvin IV*, with typical ventral attributes.

use of bipolar/anvil reduction techniques. This means that only the development of percussion bulbs, of broken or crushed platforms and the degree of broken, stepped and hinged products can be checked. We checked some variables for different reduction phases (acquisition/initial shaping, preparation/trimming, end products, tools) to see if the technique could have been used for a specific debitage stage.

Fig. 1 — (Opposite). Bipolar blanks and flakes from *Mesvin IV*, with typical ventral and distal attributes.

Although most of the blanks do show a percussion bulb it is to our opinion surprising that only 38 % show a strong bulb (table 4). Some products have no (13 %) or weakly pronounced bulbs (33 %). This is a pattern that we do not entirely expect if we would consider a non-anvil hard hammer technique (as in earlier interpretations of the assemblage). If we look at the reduction phases we see that the absence of weakly developed bulbs are slightly more represented in the earlier stages of the exploitation (table 5).

Percussion bulb	*%*
None	12,6
Weak	33,2
Strong	38,2
Not determinable	16,0
Total	*100,0*

Table 4 — Percussion bulb (Mesvin IV).

Reduction phase	*None*	*Weak*
Acquisition/initial shaping	14,9 %	38,5 %
Preparation/trimming	12,8 %	40,5 %
End products	12,6 %	32,2 %
Tools	9,0 %	23,8 %

Table 5 — Amount of products with no or a weakly pronounced percussion bulb per reduction phase (*Mesvin IV*).

Broken or shattered platforms reach about 9 % (table 6). In the acquisition/initial shaping phase they reach an important value of 19 % (table 7). We have to take into account that at this stage, due to the lack of shaping of the core, there is probably a lesser degree of control over the fracture mechanics resulting in a higher number of broken products.

Platform preparation	*%*
Cortical/natural	10,8
Plane	24,7
Dihedral	5,2
Facetted	7,8
Linear	6,1
Point	13,0
Ôté	0,3
Crushed/broken	9,3
Not determined	22,8
Total	*100,0*

Table 6 — Platform preparation (*Mesvin IV*).

Reduction phase	*Shattered/broken*
Acquisition/initial shaping	19,3 %
Preparation/trimming	2,2 %
End products	0,3 %
Tools	3,3 %

Table 7 — Crushed and broken platforms of products per reduction phase (*Mesvin IV*).

Considering the other knapping accidents about 58 % of the material does not show signs of them (table 8). We see that about 12 % of the products have a stepped or hinged distal end. It is the best represented category of debitage accidents and apparently largely found within preparation/trimming phases and within the blanks (table 9). Off course, when selected, there is a big chance that during the shaping of a tool the hinged or stepped border disappears. Although a part of the archaeological material underwent transportation, still almost 70 % is unbroken (table 10). As for the broken objects it is difficult to discriminate between the ones broken during the production and the ones broken afterwards. Only 1,6 % of the material shows lateral fractures.

In table 11 we see what percentage of the products have a lateral fracture for each debitage phase. There are only slight differences between them.

Although we can be sure that within de assemblage of *Mesvin IV* some products have been produced

Debitage accidents	*%*
None	58,0
Step/hinge	11,9
Outrepassé	1,8
Siret	1,1
Languette	0,1
Corne de diable	0,1
Other accidents	1,2
Not determined	19,1
Total	*100,0*

Table 8 — Debitage accidents (*Mesvin IV*).

Reduction phase	*Step/hinge*
Acquisition/initial shaping	1,6 %
Preparation/trimming	11,1 %
End products	12,6 %
Tools	6,6 %

Table 9 — Step or hinge fractures on products per reduction phase (*Mesvin IV*).

with the aid of a bipolar/anvil technique, it is still not clear what its importance was in relation to the other reduction techniques. Our attribute analyses suggests that it was important enough to show through in the percentage. A more elaborated experimental collection would help but we must not forget that we are dealing with an assemblage witnissing the use of several debitage techniques of which the features will have some kind of overlap.

Fractures	*%*
None	69,8
Distal	9,1
Medial	3,1
Proximal	8,8
Lateral	1,6
Multiple	7,2
Not determined	0,3
Total	*100,0*

Table 10 — Fractures (*Mesvin IV*).

Reduction phase	*Lateral fracture*
Acquisition/initial shaping	1,3
Preparation/trimming	1,4
End products	1,9
Tools	1,6

Table 11 — Lateral fractures for products per reduction phase (*Mesvin IV*).

6. What does it mean ?

One general thought in a lot of the studies on bipolar reduction is the fact that this technique could conserve raw material and maximize flake production. Andrefsky (1998) for example describes this in his handbook as follows: *Bipolar cores, found in all regions of the world, seem to be an especially good example of technology matching the size of raw materials available for use in an area. Bipolar cores ... are typically amorphously shaped and can be easily confused with angular shatter... Several archaeologists ... have suggested that bipolar technology is used to maximize or exhaust the utility of raw materials before discarding it* (Andrefsky, 1998: 147-149). In his research on several North American sites he came to the conclusion that bipolar cores had significantly smaller dimensions compared to freehand cores. He could link this pattern to regions where good quality lithic sources were rare or absent.

But can we use his suggestion to explain the situation at *Mesvin IV* ? It is not yet clear if certain sizes or forms of cobbles were selected for bipolar/anvil reduction. Nevertheless the amount of «small» cores is limited at *Mesvin IV* and neither of them seem to show typical bipolar/anvil features. Secondly the few bipolar/anvil cores we recognized do not seem to be very exhausted. Even more the data suggest that at the time of occupation there was no shortness of raw material at the site. So we should look for another explanation here. Further experiments will help us to understand the technological limits and possibilities of bipolar or anvil reduction on larger nodules. We should also take into account that we could be dealing here with a cultural marker.

Bipolar/anvil reduction seems to be a technique that has very old roots and was commonly used from the Early Paleolithic until quite recently. For example in Irian Jaya the *Dani* are known for the manufacture of polished adzes. But besides the production of these special tools their lithic technology is mainly oriented towards the bipolar reduction of quartz cores into simple small flakes. In contrast to the limited possession of the adzes, every man owns a set of these small flakes and uses them for numerous tasks (Hampton, 1999). For the definition and description of the attributes we dealt with studies on either Early Paleolithic (although anvil reduction is quite more common in this period compared to bipolar reduction, both in the sense of Breuil and Bordes) or on more recent prehistoric periods as the mesolithic and neolithic in northern Europe or prehistoric period in North America. But for the Middle Paleolithic there does not seem to be a lot of comparisons. At his moment we have to admit that our research is still being preliminary and we probably will find more references later on. But maybe it is just due to the low visibility of some bipolar and anvil techniques as Callahan mentions (1987). The example of *Isernia la Pineta* is quite interesting in this light. The assemblage was caraterized by its largely unmodified artefacts and denticulated tools. Microwear analyses confronted the researchers with the fact that the unmodified products showed traces of use and that the so-called denticulated tools did not. Through experiments they learned that these tools were in fact the result of an intensive exploitation of cores with the use of a bipolar technique.

Finally we also want to point to the great amount of variability within the *façonnage* and reduction methods and techniques used at the site of *Mesvin IV*. It is clear that the assemblage (of about 8000 lithic pieces) consists of several occupation phases and therefore we seriously doubt if all these techniques were used within the same group or band. But on the other hand they give insight in the rich possibilities these groups of hominids mastered to enlarge their control on lithic technology.

7. Conclusion

At the Middle Paleolithic site of *Mesvin IV* we found a small group of diagnostic objects pointing to the use of a bipolar (in the sense of Breuil) or anvil (in the sense of Callahan) technique. Some tendencies in the attribute analyses seem to confirm this. But due to a lack of usable experimental data we could not yet grasp the importance and variability of this technique within the assemblage. Moreover we had to deal with a lack of comparable studies. It is also clear that the use of this technique is not easily recognizable and that we have to deal with important overlaps of attributes typical for different percussion techniques. For now we conclude that the technique probably played a minor role within the assemblage. Future research will hopefully tell us more.

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