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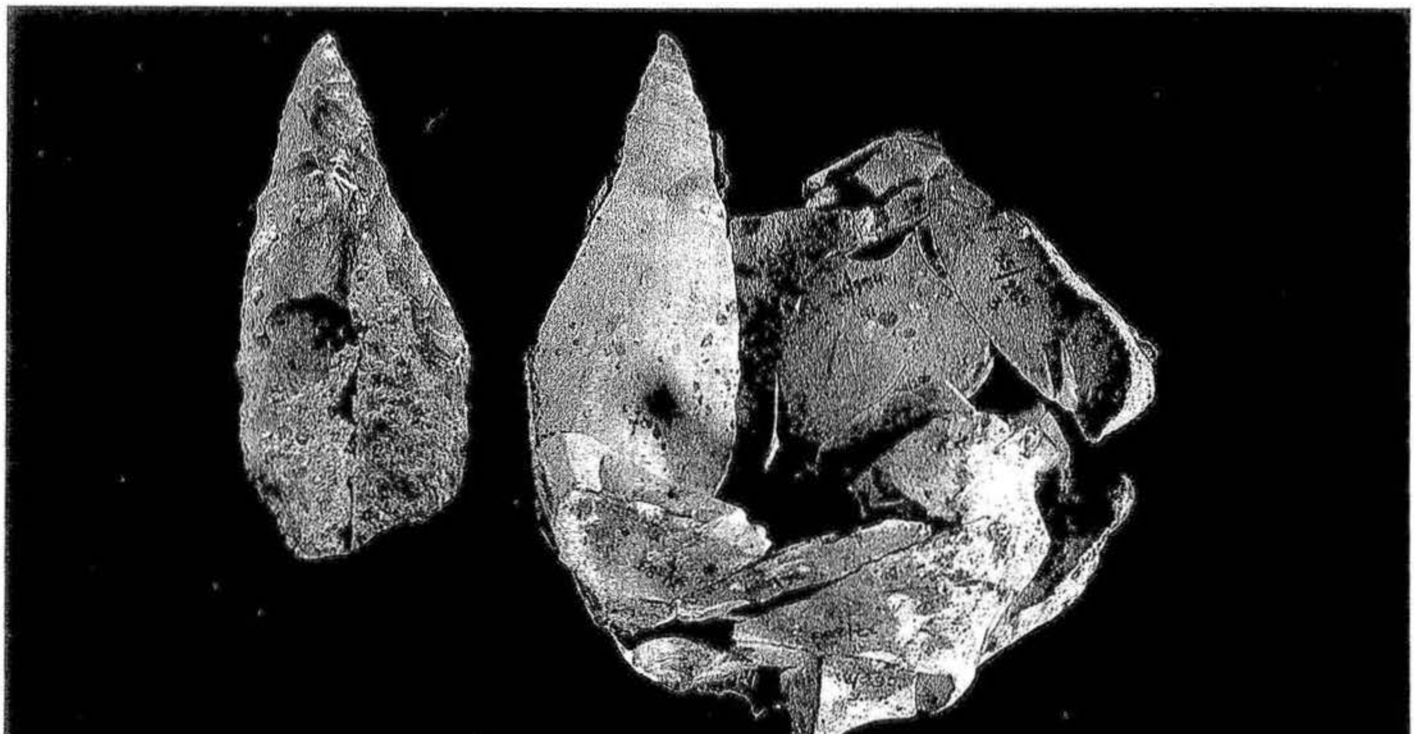

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«SITE J»: AN EARLY WEICHSELIAN (MIDDLE PALAEOLITHIC) FLINT SCATTER AT MAASTRICHT-BELVEDERE, THE NETHERLANDS

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Résumé: La carrière de Maastricht-Belvédère, connue pour ses sites bien préservés datant de l'avant-dernier interglaciaire (stade isotopique 7), a aussi livré un site datant du début de la dernière glaciation (stade isotopique 5). Des analyses technologiques, typologiques et tracéologiques de cet assemblage non-Levallois ont démontré un comportement assez paradoxal avec d'une part, un gaspillage lithique, et d'autre part une forte économie des matières premières. L'article donne une explication strictement fonctionelle de ce paradoxe. Les remontages ont montré que la réduction des outils était parfois si considérable, que certains ont appartenu successivement à des catégories typologiques différentes.

Mots clés: Paléolithique moyen, Technologie, Typologie, Remontage, Réduction des outils, Weichselien ancien, traces d'usure.

Abstract: The Maastricht-Belvédère loess- and gravel pit, well-known for its intra-Saalian interglacial (OIS 7) archaeology, also yielded an Early Weichselian (OIS 5) flint scatter (Site J). Technological, typological and use wear analyses point to a paradox within this non-Levallois Middle Palaeolithic assemblage, as both rather wasteful and economising practices can be observed. This pattern is explained here from a mere functionalistic perspective. Extensive refitting studies show that in some cases tools were reduced to such a degree that they shifted from one typological category into another.

Key words: Middle Palaeolithic, Flint technology, Typology, Refitting, Tool reduction, Early Weichselian, use wear.

1. MAASTRICHT-BELVEDERE SITE J: AN OVERVIEW OF THE SITE AND ITS SETTING

1.1. Introduction

The Belvédère loess- and gravel pit is situated northwest of the town of Maastricht (the Netherlands), on the left bank of the river Meuse, on the northern edge of the North-European loess plain (Fig. 1). In the 1980s an interdisciplinary project studied the exposures of loess and river deposits in the quarry, within the context of the archaeological excavations that took place from 1981 to 1989. The archaeological fieldwork focussed on fine-grained river sediments, dating from an intra-Saalian interglacial, that could be dated by various, independent methods at around 250,000 years ago and was correlated to Oxygen Isotope Stage 7 (cf. Roebroeks, 1988; Vandenberghe *et al.*, 1993). A full interglacial vertebrate and mollusc fauna was associated with abundant Middle Palaeolithic flint artefacts, preserved within various sites over an area of about 6 hectares. Some of these sites were so well preserved that extensive refitting proved possible, e.g. at sites C, F (Roebroeks, 1988) and K (De Loecker, 1992, 1994). On this basis inferences on former *chaînes opératoires* in core reduction could be made (Schlanger, 1994, 1996). For a general overview of the archaeology of the pit the reader is referred to Roebroeks, 1988 and furthermore Roebroeks *et al.* (1992, 1993). The geological setting of the pit, its palaeontology, dating evidence etc. is discussed extensively in Van Kolfschoten and Roebroeks (eds) (1985) and Vandenberghe *et al.* (eds) (1993).

The fine-grained river deposits, Unit IV in the local lithostratigraphy, were covered by a sequence of late Saalian loams (Unit V) in which the Eemian *Parabraunerde* (*Sol de Rocourt*) developed, and by a sequence of Weichselian loesses, up to 8 m thick. In the spring of

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1986 J.P. de Warrimont and K. Groenendijk discovered a well-preserved site in the lowermost part of the Weichselian loess (Unit VI-A), that had to be excavated in a rescue dig: Site J (Fig. 2). The Unit IV scatters were all deposited in a former valley bottom of the Meuse (the Caberg terrace). Site J, however, was situated at the edge of a terrace plateau overviewing the valley, as the river Meuse had cut its bed at least 10 metres deeper in the Early Weichselian.

1.2. The geological context

Figures 3 and 4 give schematic surveys of the geological context of Site J. The finds were situated in Weichselian loess above the (eroded) Eemian palaeosol developed in the top of Unit V (the *Sol de Rocourt*) and below the *Horizon de Nagelbeek*, a weakly developed soil dating to about 20,000 bp (cf. Haesaerts *et al.*, 1981). The geological matrix of Site J consisted of the oldest Weichselian sediment found in the quarry, lithological unit 6.1 (Unit VI-A) in the local stratigraphy. This unit consists of an up to 20 cm thick light greyish (10YR7/4-7/6) loess overlain by an equally thick layer of dark grey-brown (10YR5/6-5/4) loess. The light grey loess was separated from the darker loess by a slight erosional level, occasionally marked by the presence of isolated small (< 10 mm) pebbles. Throughout the unit 6.1 sediments biopores were present, with diameters of up to 5 mm. These were completely absent in the sediments immediately overlying the find bearing loess. The two successive layers of the unit were initially interpreted as a soil that had been formed under steppe-like conditions. They constitute a complex that has often been observed at the base of Weichselian loess profiles in northwestern Europe, the *Sol de Warneton* (Paepe and Vanhoorne, 1967). At Belvédère however micromorphological analysis did not yield any evidence of (steppe-) soil formation at this level.

The chronostratigraphic position of this find bearing unit has been discussed elsewhere (Roebroeks, 1988, p. 100-102), where it was concluded that the presence of permafrost phenomena in the basal Weichselian loesses *above* the findbearing sediments dated the unit *before* the Lower Pleniglacial (cf. Vandenberghe *et al.*, 1985). Furthermore, micromorphological studies by H.J. Mücher indicate that the unit must predate the last period of soil formation of a *sol brun lessivé*-type in the Early Weichselian. The dating evidence firmly places the assemblage in the Early Weichselian, after a first period of loess deposition, possibly in the range of Oxygen Isotope (sub-)Stages 5c to 5a (for more details see Roebroeks, 1988, 100-102). Attempts at dating a few burnt flint artefacts from the site by means of the TL-method failed, as they turned out to be too small for analysis (Huxtable, 1993).

Artefacts were distributed vertically throughout unit 6.1, but the majority was found on the erosional level that separates the light grey-brown from the upper darker loess. Karst formation processes that occurred after the deposition of the sediments led to subsidence of the find bearing deposits. In this relatively lower position the layer was protected from the subsequent erosion that completely obliterated the sediment to the west of the site (Fig. 4).

1.3 Excavation strategy

At the time of discovery, Site J was in the middle of the area that was mined by the quarry, so little time was available for its excavation. Therefore an excavation strategy was chosen that would provide information about the spatial distribution of the finds over the largest possible area. This meant that most of the finds were collected by square meter, except in an area of 23 m^2, where they were individually plotted three-dimensionally in order to acquire more detailed information about their horizontal and vertical distribution. Altogether an area of c. 210 m^2 was excavated that way, at least three times as much as would have been possible in case we had plotted all finds individually (see Roebroeks *et al.*, 1987). Some artefacts (n=116) in the southwestern part of the site were rescued in front of the quarrying machines (Fig. 5), where they were only recorded within three large grid blocks (I, II and III).

1.4 The find material and its spatial distribution

The finds of Site J consist of flint artefacts, a few scattered fragments of charcoal and some poorly preserved fragments of molars. On the basis of their oblong shape and the variation in enamel thickness, the molars were attributed to *Mammuthus primigenius* (Van Kolfschoten, pers. comm. 1987).

In total 2863 stone artefacts were collected, all but three made out of flint. Table 1 gives a first overview of the lithic assemblage, based on the counts before refitting. Flakes and chips without any traces of intentional retouch or signs of use form the bulk of the assemblage (c. 94%), while intentionally retouched tools make up only 3% of the assemblage. Small-sized flints are less abundant in the Site J assemblage than in those from the intra-Saalian valley bottom sites. Compared to the size distributions of those assemblages we only retrieved about half of the fraction smaller than 20 mm, and especially few in the size class smaller than 10 mm (compare Table 2 with data on Sites C and F in: Roebroeks, 1988). The presence of very small debris in the well-excavated squares shows that this discrepancy is not simply attributable to geological processes during burial of the site. Instead it may be a consequence of the fast pace of this rescue excavation, in which many tiny flakes were simply not retrieved.

Based on the general distribution pattern and the fact that many refits were already established in the field we first had the impression that Site J was a 'primary context' scatter (De Loecker, 1988). Subsequent systematic conjoining studies did however show that some reworking of the original scatters took place, be it to a limited degree, but certainly enough to exclude any meaningful spatial analysis of the finds (see section 3.2).

Vertically, the finds concentrated around the minor erosional level between the lighter and darker loess of unit 6.1, but finds were distributed all through the unit. The vertical distribution could amount up to 45 cm (Fig. 6), with artefacts smaller than 20 mm displaying a larger vertical distribution than larger artefacts. The abundant presence of biopores (diameter up to 5 mm) in the findbearing unit may partially explain this degree of vertical distribution, not unusual in open air sites (cf. Roebroeks, 1988, for the lower Unit IV sites and Thieme, 1983, for comparable patterns in the Early Weichselian Westwand/B1 level at Rheindahlen, Germany).

2. TECHNOLOGY AND TYPOLOGY OF THE LITHIC ASSEMBLAGE

2.1. Introduction

This section gives a review of the technology and typology of the lithic assemblage, without taking into consideration the result of the conjoining studies, that will be presented later (section 3). Artefacts larger than 19 mm were subjected to a technological and typological analysis by J. Kolen (1990) and subsequently by M. Van Poecke (1993), who could benefit from the results of an intensive refitting programme. Van Poecke performed a detailed attribute analysis, developed for the Belvédère sites mainly by N. Schlanger and D. De Loecker, building upon studies by Goren-Inbar (1990), Geneste (1985) and Isaac (1977) (see Schlanger and De Loecker, 1992; Schlanger, 1994, 1996 and De Loecker, forthcoming). This analysis includes observations of dimensions (length, width, thickness, maximum dimension, angle of percussion), preservation (breakage patterns, outer surface etc.) and technological observations (dorsal pattern, number of dorsal scars, butt type etc.). For the technological and typological description of the assemblage a simple distinction was made between the products of *primary* and *secondary* flaking. By primary flaking we mean here all flakes and cores - including blanks on which tools were made - produced and/or discarded during the primary reduction of the flint nodules. Flakes selected for further modification (i.e. retouching) represent the secondary flaking stage.

2.2. The raw material

On the basis of the properties of the flint material, such as texture, cortex, inclusions and colour, the artefacts were attributed to at least 14 raw material units (RMUs), interpreted as incorporating the products of as many different flint nodules - an interpretation that survived the results of the refitting programme. The distribution of artefacts over the various RMUs is presented in Table 3. A large part of the assemblage (n=461) falls into a `other' category meaning that these artefacts could not unambiguously be attributed to one of the 14 RMUs. Most RMUs consist of a `Ryckholt-type' like flint, that judging from the rolled cortex was collected in nearby deposits of the river Meuse. The quality of this flint varies significantly. RMU 1 for example is a fine-grained and homogeneous `Ryckholt' flint that was well-suited for flake and tool production, as is also indicated by the fact that 66% (n=88) of the blanks is unbroken. RMU 6, a very coarse flint with many inclusions and fissures, was more difficult to flake and has a `complete' percentage of only 37% (n=61). Evidently no strong selection of raw materials took place prior to flint knapping at Site J, even though raw materials must have been near `at hand'.

While the flint source was probably (very) nearby, an Oxford attempt at dating three burnt flint artefacts from Site J revealed TL characteristics significantly different from those of flints in lower levels, also analysed by the Oxford TL laboratory. In fact, the TL signal of the Site J flints was much stronger (x20) than any of the other flints studied from the pit, which may imply a different geological source (Huxtable, 1993). In the roughly 180,000 years that separated the Unit IV sites from Site J the river Meuse must have eroded flints from other Cretaceous deposits than the ones available during the intra-Saalian (OIS 7) interglacial period. This illustrates, again, the dynamic character of Pleistocene landscapes and the implications thereof for raw material studies.

Some RMUs are represented by a few artefacts only, e.g. RMUs 12 and 13. RMU 12 is a light-grey very fine-grained flint of `Belgian' type, only represented by a double scraper (Fig. 9.2) and a few non-refittable flakes, including three soft-hammer struck resharpening flakes. Most probably the scraper was carried to the location in a reduced form. RMU 13 is a reddish-brown Rullen type of flint present in the form of a few small flakes and a scraper with a refitted spall. Also this RMU may have belonged to the (small) transported toolkit.

The division in RMUs was aimed at documenting the various reduction stages represented at the site, and hence to obtain information on the possible transportation of cores, flakes and tools to and from the locale. Finally, it was expected that such a RMU division could facilitate the conjoining studies considerably.

2.3. Primary flaking: flakes and cores

2.3.1 The flakes

A number of 1189 blanks (retouched and non-retouched items) was submitted to detailed analysis, the results of which are presented in Tables 4-6, and will be glanced over below.

Less than 50% of the artefacts shows traces of the outer surface of the flint nodules. The original cortex has been heavily weathered and/or rolled prior to procurement, and a significant part of the outer surface consists of natural breakage surfaces, along which blocks broke before fluvial transport (pseudo-cortex). Some RMUs contain natural fissures interpreted as frost cracks (*diaclases*), along which nodules broke *during* flint knapping. It is not always easy to differentiate between such fissures and `pseudo-cortex', in fact only refitting can do that job properly. RMUs 1, 7, 9, 10, 12 and 13 do not display any traces of such diaclases, whereas RMU6 is full of them.

Dorsal patterns of negatives are rather uniform, with 'Parallel unidirectional' (simple) and 'parallel and lateral unidirectional' (simple + side) patterns dominating in 50% of the sample (Table 4). More complex patterns (convergent, radial, ridge) and 'opposed and lateral unidirectional' (side and opposed) are rare, and add up to c. 5% only. Flakes with 0 to 4 dorsal scars predominate (c. 86%, n=1022) all through the RMUs with the exception of RMUs 4 and 6, both showing a high amount of diaclase surfaces (classified as '0 scars').

Elaborate preparation of striking platforms was apparently not executed at the site (Table 6). Plain butts (scar negatives) dominate with c. 41%, followed at a distance by dihedral ones (10%). In c. 25% of the sample the butt is missing. Facetted and retouched butts are rare (IF 14.4, IFs 3.6).

2.3.2 The cores

In total 26 cores are present (Fig. 8), 14 of which are made on flakes. The average maximum dimension is 52 mm, the average width 41 mm and the average thickness 26 mm. The primary cores - i.e. those not made on flakes - are somewhat larger than the average, cores made on flakes a bit smaller (cf. Table 7). Most cores are almost as 'wide' as they are 'long'. The average core displays nine negative scars, primary cores having an average of twelve, cores on flakes an average of seven scars (Table 8). The types that appear most frequently (Table 10) are polyhedral and shapeless/miscellaneous forms (classification of the cores mainly based on the typology of Hutcheson and Callow, 1986, and furthermore on Isaac, 1977 and Bordes, 1961).

2.4. Secondary flaking: The tools

Table 11 gives an overview of the tools, based on the study of Kolen (1990). Flakes with (macroscopic) signs of use predominate in the group of complete tools (c. 53%, including the 'backed knives'; see Fig. 7). Scrapers and denticulates (Figs 9 and 10) are less numerous but still dominate the group of intentionally retouched tools (together constituting 36% of the complete items). Among the incomplete tools the percentage of flakes with use retouch is significantly lower (c. 20%), whereas fragments of scrapers and denticulates are well represented here (c. 70%). The relatively large number of broken scrapers and denticulates may indicate that these tools were used intensively and/or in heavy duty tasks, particularly in comparison with the (unretouched) flakes. This conclusion is corroborated by the results of use wear analysis (see section 4). Bifacial tools were not recovered at the site.

The tools are clearly larger than the unretouched flakes: the average maximum dimension of (complete) retouched artefacts is 59 mm against 35 mm for complete flakes (Table 12). Evidently, the largest flakes were selected for the production of cores and tools. Most tools were made by continuous retouching of the dorsal side of a flake. Retouch is usually irregular and steep, with denticulated retouch being the most common. Scrapers display both abrupt and quite flat scalariform retouch, in a few cases a sub-parallel one.

While the larger RMUs produced both denticulated tools and scrapers, the smaller RMUs yielded only scrapers and resharpening flakes struck from scraper-like working edges. The presence of such resharpening flakes (Fig. 11) shows that modification of tools took place at the locale. Both *Long Sharpening Flakes* (LSFs) and *Transverse Sharpening Flakes* (TSFs), as described from the Saalian Middle Palaeolithic levels at La Cotte de St. Brelade, Jersey (Cornford, 1986), are present (see section 3.4).

It has to be emphasised that this short review of the tools did not incorporate the refitting evidence. Refitting did considerably reduce the number of tools, as retouched fragments could be refitted to form a single tool, and various tools were shown to have undergone phases of (refitted) modification (see 3.4).

2.5. Summary

The lithic analysis showed that all stages of core reduction and tool production are present within the assemblage, from the first 100%-cortex flakes up to and including small residual cores and heavily reduced tools. From this and the raw material evidence it seems highly probable that most tools were made and discarded on the spot, but that can only be proven directly by means of refitting (see section 3). Both the flake- and core-data indicate that no 'classical' systematic core reduction took place at the locale. The negatives of earlier removals were used as striking platform for the next phase of reduction, finer facetting of the butts being very exceptional. Circumferences of most cores are irregular and there is no clear regularity in the position of the striking platforms - except in that there is *no* regularity. In line with this is the virtual absence of Levallois products (IL 0.01) and of blades and blade-like flakes (Ilam 0.4).

Finally, the *chaîne opératoire* seems to display a somewhat paradoxical character as far as raw material use is concerned. The presence of large, suitable flakes without macroscopic signs of use (more than 1000 items ≥ 20 mm and more than 100 items ≥ 50 mm; see also section 4) shows that earlier phases in the reduction were quite 'wasteful'. In contrast to this, the number and sizes of scars on the generally small cores shows that later phases of reduction might have been aimed at the production of (sometimes: very) small flakes, until complete exhaustion of most cores. This persistent reduction can also be seen in the reuse of tools, especially when the refitting data are considered.

3. THE REFITTING EVIDENCE

3.1. Introduction

All artefacts larger than 10 mm (n=2425) were submitted to refitting analysis, which yielded a total of 945 refitted pieces (39%). Most of these had a maximum dimension of 20 mm or more, in which size category the refitting percentage was 58%. Artefacts were laid out on tables per raw material unit, and refitting was mainly done by P. Hennekens and J. Kolen, and furthermore by S. Bott, D. De Loecker, M. Van Poecke and W. Roebroeks.

3.2. Refitting evidence and site formation processes

As many artefacts were collected per square metre only, it is impossible to assign exact distances to the refits, except in the three-dimensionally documented part of the site. However, even if we start from the very optimistic assumption that refitted artefacts were linked by the shortest possible lines between the squares they came from, the data clearly show that most refitted components are at distances of more than 210 cm from each other, and that the group of the long refitting lines (*sensu* Cziesla, 1990), i.e. with distances of more than four metres, is even the largest one. This applies to refits between flakes in a reduction sequence (*Aufeinanderpassungen*), refits of broken flints (*Aneinanderpassungen*) and refits of resharpening flakes to their `parent' tools (*Anpassungen*) alike. Figures 13 and 15 illustrate these large distances, by showing the lines joining various refitted artefacts from two refitted nodules, illustrated in Figures 12 and 14, RMU 1 and RMU 2 respectively (note that many of these artefacts have been ascribed *random* coordinates within their square to permit easy visualisation; see also Tables 14 and 15). Compared to the refit patterns obtained at the sites in the lower, fluviatile deposits (OIS 7, cf Roebroeks, 1988), the Site J assemblage has very clearly undergone some reworking, to such a degree that a spatial analysis of the flint distribution has become quite meaningless. An earlier study of the spatial distribution (De Loecker, 1988) led to the following observations:

[1] taking into consideration the rescue character of the excavation the size distribution did not indicate significant removal of small debris by outwash;

[2] no winnowing patterns were visible, as the distribution of small debris was overlapping that of the larger artefacts.

These observations suggest that reworking was caused by processes that did *not* result in the horizontal sorting of artefacts on parameters of size and volume, possibly periglacial soil movement.

3.3. Primary and secondary flaking: The refitting evidence

The reduction sequences as reconstructed by refitting all fit into one general `scheme'. First, large nodules were roughly divided into smaller blocks of flint, mostly along natural fissures (diaclases) within. In some refitted nodules this is very conspicuous as flakes refit with their striking platform onto other striking platforms (RMU 6), with dorsal side to butts and with dorsal side to core (RMU 6.2). This initial stage in the flint knapping process also resulted in large and well-struck flakes (c. 100-200 mm, but probably even larger). Both blocks and large flakes were used as cores, the flakes sometimes -after modification- as tools. The subsequent core reduction was executed in variable and apparently `unsystematic' ways. In their unsystematic outlook the reduction strategies share, however, the following characteristics:

[1] as a rule negatives of earlier removals were used as platform(s) for later flakes/series of flakes, thus resulting in the frequent turning, rotating and `twisting' of cores during knapping. In this sense, flake production at Site J revealed a certain systematics;

[2] cortical surfaces and diaclases only form a minor category of striking platforms;

[3] in just a few cases flakes were produced in long and continuous series from one and the same striking platform and from the same striking surface;

[4] specific activities such as decortication, correction of striking platforms and dorsal surfaces and flake removal hardly occur as well-defined stages;

[5] core reduction was not aimed at the production of `predetermined' flakes -such as in the case of the Levallois technique- and it is impossible to distinguish `goal flakes' from `waste'.

Apart from these general characteristics the reduction strategies show significant variation. In one case (Fig. 8.3) a series of flakes was removed from the proximal part of a large flake, one of the few examples of a relatively long and uninterrupted sequence of flakes from the same striking platform. Then a second series was removed perpendicular to the first, using the earlier negatives as striking platforms, subsequently a third opposing the second, a fourth parallel to the second, and then finally some small flakes again from the striking surface of the first series. After this stage the small residual core (or `flaked flake') -resembling the `high backed' discoidal type- was discarded. In another case (Fig. 12; RMU 1.1) flakes were first removed from the distal end of a large and thick flake, following a semicircular pattern and using the ventral side as striking platform and the dorsal side as striking surface. Subsequently a series of flakes was struck from the same side but using the negatives of earlier flakes as platforms and the ventral side as striking surface. Two flakes from this sequence were used as small cores (`flaked flakes'), illustrating the repeated pattern of transforming flakes into cores in every step of the reduction sequence. Fig. 8.1 shows a small, almost microlithic core, that produced some chips according to a more centripetal pattern, but -again- while periodically twisting the core. Twisting and rotating the core also characterised the reduction of the large flint nodule (RMU 2.1) of Fig. 14, but here probably a more irregular pattern in flaking direction and platform selection was followed. The core is missing, as is a large flake that must have been used secondarily as a core. The variation in reduction strategies is also reflected in the core typology, including both `real' cores and flaked flakes', forms with opposed and with more centripetal patterns of negatives, and large (≥ 80 mm) as well as very small (< 50 mm) residual cores.

The flint knapping executed at Site J is difficult to classify in terms of the `classic' core technologies. It is even problematic to divide the group of residual cores into well-defined classes such as `polyhedral', `multiple platformed', `discoidal' etc. It is easier, in fact, to determine what the flint technology does *not* look like. Flint knapping was not aimed at the production of predetermined Levallois flakes, nor do we have evidence for the *récurrent* technique or disc core technologies. A clear tendency towards laminary flake production, as is observed for some other Middle Palaeolithic sites dating from the Eemian/Early Weichselian (Conard, 1990), is also absent. Weak parallels are known from Rheindahlen B1, where some flint nodules were reduced in similar, seemingly `unsystematic' ways (Thieme, 1983). The core technology employed at Site J remains idiosyncratic, and we have to be satisfied with the varied picture of flexible and often complex core reduction schemes that emerge from the refitting programme.

There is evidence for at least some specialisation of tool production within the separate RMUs. RMU 1 contains 25 (refitted) tools, together representing a total of 36 working edges. Scraper edges (n=14; a Mousterian point was counted as `double scraper' for this purpose) and edges with use retouch (n=15) predominate. Minor categories are represented by denticulates (5), notches (1) and simple retouch (1). There is a strong preference for convex edge forms (n=17). RMU 2 contains 15 (refitted) tools representing 18 working edges. In this RMU denticulates (5) form the dominant class, followed by edges with use retouch (4) and simple (intentional) retouch (3), scrapers (3), notches (2) and a burin. One denticulate was remodified and reused as a notched tool. In this RMU there was no preference for a specific edge form.

As mentioned above, the presence of some Long and Transverse Sharpening Flakes (LSFs and TSFs respectively) indicates that modification and reuse of tools took place at the locale, an interpretation corroborated during refitting as various LSFs and TSFs could be conjoined to their `parent' tools. Whereas LSFs were produced by flaking parallel to the length-axis of tools and so created new cutting edges (Fig. 11), TSFs were made by flaking perpendicular to the working edge, and resulted in notched or irregularly denticulated edges (Fig. 16, below, Fig. 18; cf. Cornford, 1986 for a review of both sharpening techniques). These resharpening techniques were frequently used at La Cotte de St. Brelade, Jersey (particularly in the Saalian level A), but their products have also been recognised at various other Middle Palaeolithic sites in western Europe, such as Maastricht-Belvédère Sites K and N (De Loecker, forthcoming), Edertal-Buhlen (Fiedler and Hilbert, 1987), and at La Quina, Les Tares and La Micoque (Geneste, 1991; Turq, 1992). The technique often involved the preparation of a kind of striking platform at the distal end of the tool, thus resulting in characteristic forms such as `Kostienki knives' (*couteaux de Kostienki*), `Pradnik knives' and burin-like artefacts.

Large LSFs and TSFs are quite easy to recognise archaeologically, and the presence of some use retouch and/or micro wear on new working edges indicates that at Site J tools were reused after rejuvenation, and that we are thus indeed dealing with *re*-sharpening, and not with the final flakes of a first stage of tool manufacture. As a rule the long and transverse sharpening flakes were not used or modified themselves, the only exception recognised so far being a large LSF that was reworked into a Quinson point. In fact, this tool was itself rejuvenated by means of the long sharpening technique, as a smaller (and, evidently, `secondary') long sharpening flake could be conjoined to it (Fig. 11.1). Use wear analysis indicates that the Quinson `point' was used in butchering activities.

Most modification of working edges seems to have been done by continuous retouch, i.e. by removing small TSFs, which is much less visible archaeologically. In the case of Site J only a few of such modification flakes - all smaller than 10 mm -were conjoined. This may be partly related to the fact that such spalls are notoriously difficult to refit, but we should also keep in mind that the size fraction most prone to have contained the spalls is heavily underrepresented in the Site J assemblage, as a result of the excavation strategy chosen (see above, section 1.4). The two spalls refitted to the elongated Mousterian point (Fig. 9.5, the refitted spalls are visibile on the cover of this issue of *Paléo*) for instance, were retrieved in the 3D-recorded squares. The conjoining studies facilitated the identification of resharpening spalls considerably: the number of identified LSFs increased from 8 to 14 and the number of TSFs from 8 to 29 as a result of refitting.

Three TSFs were struck from scrapers, one from a denticulate. This already suggested in an earlier stage of the analysis that scrapers might have been modified into denticulates, as shown convincingly later on by refitting. Refitting showed unambiguously that some tools have been modified for the purpose of reuse to such a degree that they changed from typological category, e.g. from a tool with a scraper-edge to a denticulate (Fig. 17), from denticulate to notch (Fig. 18) or so that virtually nothing remained of the former tool (Fig. 16, below). This is the more striking when confronted with the fact that quite a large number of flakes was not used at all.

3.4. On the informative value of refitting studies

As refitting is a time consuming enterprise, it is worthwhile briefly evaluating what kind of additional information it yielded. In the first place, and very importantly, the conjoining studies clearly showed that individual artefacts had undergone quite some amount of horizontal displacement, to such a degree that the scatter could not be interpreted as a primary context one; this was quite unexpected (cf. De Loecker, 1988). As far as basic technological aspects are concerned, refitting `only' provided the actual proof for inferences made on basis of the lithic analysis (Kolen, 1990) by reconstructing the reduction processes. The conjoining studies showed beyond any doubt that tools were made on the spot, and in some cases demonstrated such a degree of modification that tools changed from one typological category into another. They also underlined the paradoxical character of the assemblage, with a high degree of modification and `economic' treatment of raw materials on the one hand and `wasteful' behaviour on the other, *even within the same block of flint.*

4. USE WEAR ANALYSIS

4.1. Sampling and methods

Until the mid seventies the function of stone implements could only be inferred from the shape and interpretations were often based on ethnographic and ethnohistoric analogies. Now we know that using an implement causes wear traces to develop on the surface: these include edge removals (frequently called use retouch), edge rounding, polish and striations, all of which can be examined microscopically. Experimental research has demonstrated that the configuration and appearance of these traces varies according to contact material and motion (see Keeley, 1980; Van Gijn, 1990 and Odell, 1977 for an outline of the method of studying these traces).

The sample studied by Van Gijn for wear traces (n=118) was taken on the basis of two criteria: the presence of edge removals and the size of the artefact. All implements displaying retouch, whether intentional or from use, were selected, regardless of their size. In addition, a large sample of the artefacts with a length exceeding 20 mm was examined as well, even if the artefacts did not show signs of use or intentional retouch.

The study reported was one of the first instances in which the so-called low power and high power approach were used in an integral fashion. For a long time both techniques were applied at the exclusion of the other and debates raged as to the relative merits of each (a.o. Keeley, 1974; Odell, 1975). In the case of the Belvédère material from the lowerlying interglacial (OIS 7) deposits reported on earlier (Van Gijn, 1988), the combination of high- and low- power microscopy was deemed appropriate because of the fact that much of the material displayed a lightly developed white patination. Such a post-depositional modification largely obliterates polish and striations and also causes edge rounding. Edge removals however, are not affected by patination.

An overview was obtained by stereomicroscope with oblique light, under magnifications ranging from 10-50 x. Especially edge removals can most profitably be studied this way. Subsequently, if traces of wear were visible, the implements were examined by an incident light microscope, magnifications ranging from 100x for scanning to 600x for detailed observation; polish interpretation was done at 300x. The implements were not cleaned chemically for fear of further attacking the stone surface. During examination the tools were cleaned with alcohol to remove finger grease. All implements were studied prior to the refitting.

4.2. Preservation

Almost all artefacts showed one relatively fresh and one abraded aspect. The abraded aspect had a waxy texture and covered the entire surface, making a high power analysis very difficult. The other aspect was usually rather fresh, with polish and striations being in reasonable condition. Traces from brief use instances have however, probably been missed, as well as, on the less well-preserved surfaces, traces from working soft materials like meat or fresh hide. Traces from contact with bone or harder wood and silicious plants would certainly be visible still, and their absence on these tools can therefore be regarded as `real'. Generally, the flint from Site J was less affected by patination than some of the older sites at Belvédère, such as B or C.

4.3. Inferred activities

Of the 118 examined artefacts only 33 displayed interpretable traces of wear (cf. Table 20). Because many of the tools had post-depositional surface modifications, many more were probably used, but traces have been obliterated.

Most implements were not used very intensively, considering the fact that the polish was usually not well-developed. The traces probably represent one use instance and the tools were not kept for further use. Nevertheless, a few implements (n=8) displayed more than one used zone, indicating that if a tool was deemed appropriate, it was not rejected upon completion of the task. In total 40 used zones were therefore identified, on 33 tools. Five times a tool was used twice on hide (with both lateral edges), two implements were used twice for butchering and one for unknown material and hide. No instances of secondary use of the same edge have been observed. If this had occurred, it would probably not be visible anymore, because of the condition of the artefacts.

Traces from contact with hide were observed on 21 edges, ten of which concerned less certain interpretations. Most hide working edges served for cutting purposes (n=15), a few edges were used to scrape hide (n=4) and two were used in an uncertain motion. Six butchering zones, on four implements, are represented in the sample as well. Two edges displayed traces from contact with wood, one from whittling and one from an undetermined motion. Finally, 11 zones had traces from use which were not sufficiently diagnostic to be attributed to a specific contact material; three of these edges were used in a cutting motion, three in a scraping motion and five in an undetermined movement.

If we look at the different tool types in the sample it is clear that intentionally retouched tools, such as scrapers are frequently used, even displaying more than one used zone. The Mousterian point displayed in Figure 9.5 has traces from cutting hide on both lateral edges. Scrapers have indeed sometimes been used for scraping purposes, in three cases on hide, but they also served to cut hide. Two double side-scrapers (Fig. 16) displayed traces from cutting hide on both lateral edges; they were quite heavily used and must have undergone various phases of resharpening. The denticulate (Fig. 10.2) was used on wood. Flakes, including those with use retouch, turned out to be very versatile implements. Cutting hide was the activity most frequently observed on these artefacts. There does seem to be a consistent choice of implements for specific tasks, although the sample is a bit too small to allow for far-reaching conclusions in this respect.

5. DISCUSSION

The main conclusions of the foregoing are:

[1] core reduction and production, use and discard of tools mainly took place within the excavated area;

[2] core reduction displays a paradoxical character in terms of raw material economy;

[3] Levallois products are virtually absent;

[4] scrapers, denticulates and flakes with (both macroscopic and microscopic) signs of use dominate the tool group;

[5] tools were maintained at the site, e.g. by means of specialised resharpening techniques;

[6] use-wear analysis showed that some tools were used quite heavily, whereas other artefacts saw only brief instances of use;

[7] indications for transport of lithics are rare.

Before coming up with possible explanations for this pattern (following Kolen, 1990), it is necessary to briefly discuss the homogeneity of the assemblage, i.e. the question whether we can treat it as the remains of one single use of the location, or that more complex scenarios are more feasible. This boils down to the paramount question of the chronological resolution of such scatters. Work in some of the lower units at Belvédère has convincingly shown that, however well preserved, one can occasionally actually see that an (unknown) amount of time passed between the production of one lithic concentration and an overlapping other (Roebroeks, 1988, p. 58), though these *may* still have been related in terms a continuous use of the place. Information on site formation processes is only usefull to some degree here, as we are dealing with significantly finer amounts of time than we can distill from the geology of a site or even from refits. Actually, even very well preserved sites have thus to be treated as buried surface collections in this respect (cf Binford, 1987). Given the overall techno- and typological homogeneity over most of the RMUs the question is not that important for the interpretation of the pattern mentioned above, and one could even use that homogeneity as an argument that we are indeed dealing with the remains of one single use of the location.

As detailed above, core reduction had a somewhat paradoxical character with respect to raw material use. The emphasis on the production of fairly large and thick unprepared flakes in hard hammer technique implies that at least certain stages in the core reduction processes were wasteful. This is consistent with other characteristics, such as the fact that many larger flakes were left unused at the site (see section 2.5; remember that only 31 of the 118 tools and large flakes displayed traces of use wear) and that the reduction of at least two cores (> 80 mm) was broken off in a relatively early stage. Other observations however point to economising behaviour. Judging from the number and the size of the scars on the cores and the refit-sequences one has to conclude that at least the final phases of some core-reductions may have been aimed at the production of small flakes. In the same vein most cores are small and larger flakes have been used as cores, as convincingly shown by the conjoining studies. Likewise the persistent modification of existing tools, a striking aspect of the Site J assemblage as shown above, could be seen as a strategy to economise raw material (cf Binford, 1979; Hayden, 1986; Keeley, 1982; Wiant and Hassen, 1985).

Various workers have dealt with the functional determinants of `economising' behaviour in technological systems. One could for instance follow Callow (1986) and suggest that, like in the Saalian levels at La Cotte de St. Brelade (Jersey), scarcity of raw material may have led to longer tool lives and in general a more efficient use of flint material (as evidenced at La Cotte by resharpening, smaller cores and waste, reuse of tools and flakes as cores; see Callow 1986, p. 227). In a similar vein, Rolland and Dibble (1990) explain high intensities of retouch in Middle Palaeolithic assemblages as a consequence of increasing raw material shortage (and therefore parsimonious use) in situations where groups were relatively `sedentary'. However, in the case of Site J economising and wasteful behaviour go together, which strongly suggests that tool maintenance was not primarily a response to shortage of flint. The wider (flint rich) setting of the site also makes it very probable that raw material could be procured without any difficulty, for instance in the (nearby) gravels of the river Meuse.

Wiant and Hassen (1985) have pointed out that one has to differentiate between the overall presence and *availability* of raw materials: ethnographic studies show that frequent maintenance and transport of toolkits often take place in areas where lithic resources abound and overlap with food resource areas. In these cases, "The need for a highly curated lithic assemblage ... is related to the limited time critical biotic resources can be exploited. When biotic resources are available, energy expenditure must be organised almost exclusively for their procurement despite the co-occurrence of lithic resources" (Wiant and Hassen, 1985, p.104). Technological responses to such scheduling pressures consist of highly maintainable toolkits, designed for frequent transport and maintenance, unknown from Middle Palaeolithic contexts. The Site J assemblage contains complete refittable sequences of all stages of tool manufacture and use, strongly suggesting that such motives of time scheduling did not play a role here.

A final option, the one we prefer, is that reuse of tools was preferred over the production of new ones, simply if the `costs' of producing new ones were considered to be at odds with the expected `output' of that investment. Such implicit arguments can have played a role in opportunistic technologies, meant for a short use or for activities that did not require much investment. This is a feasible explanation for the character of the Site J assemblage, as both the fairly unsystematic and uneconomic flake production as well as the reuse of tools can be interpreted as an attempt to `minimise' the energy invested in the toolkit.

The absence of evidence for the transport of tools to and from the site is striking when compared with the data from some of the Unit IV (OIS 7) sites. There refitting studies showed that these sites were fixed points in a dynamic system of the transport of flints in the form of prepared cores, finished flakes and tools (Roebroeks, 1988), whereas at Site J virtually all was made, used and discarded on the spot. Geneste (1985) has found a comparable binary pattern in his regional study of the Middle Palaeolithic in the Aquitaine. Elaborating on Geneste's and our data both from Maastricht-Belvédère and northern Europe we suggested a decade ago that such technological differences may have been related to aspects of mobility of Middle Palaeolithic groups (Roebroeks *et al.*, 1988). We assumed that prepared cores and flakes were transported from one locale to another in the anticipation of future needs of `cutting edges'. In this sense the use of the Levallois technique (especially of the *recurrent* form) would represent an economising behaviour towards the transported raw material (our hypothesis did of course not apply to procurement sites such as Baker's Hole in England or Etouvie in northern France, where the Levallois technique *à éclat préférentiel* was used for the production of one or a few flakes per core only). Geneste has shown that non-local raw materials are associated with the use of Levallois-techniques and the occurrence of scrapers, Mousterian points and handaxes (*Moustérien typique, riche en racloirs* and *Moustérien de Tradition Acheuléenne*). In general Levallois strategies seem not to have been applied to local materials, as these were more often used for the production of toolkits with denticulates, abrupt and irregularly retouched tools and notched tools (*Moustérien à denticulés* and *Moustérien typique, riche en denticulés*) (Geneste, 1985). Like in his study area, we were also able to find such a rough correlation between local and transported raw materials and technological and typological differences (Roebroeks *et al.*, 1988). One of the examples cited in that study is the Middle Palaeolithic site of Saint-Vaast la Hougue (Normandy; Fosse *et al.*, 1986), where a Late Eemian/Early Weichselian sequence has yielded a series of Mousterian industries. The *horizons inférieurs* contained an industry with a low Levallois index and dominated by denticulated and notched tools, made on locally collected low quality flint. The upper horizons yielded a Levallois industry with tools dominated by intensively retouched scrapers. Cores and cortical flakes are very rare in this level, where the high quality flint was imported from at least 10 km from the site[(1)].

In this setting the Site J assemblage can be interpreted as an ad hoc or `expedient' technology, geared at activities to be performed on the spot. It has to be stressed again that the assemblage reflects the complete sequence of production of flakes up to and including the discard of intensively reduced tools. The composition of the toolkit neatly fits the pattern described above: dominated by denticulates, irregularly retouched scrapers, notched tools and used flakes.

Another useful way to look at the Site J evidence is by contrasting it with the record from the underlying fluviatile unit of about 250,000 years ago. A striking characteristic of these fine-grained interglacial river deposits is that artefacts were present all over, be it in often very low densities against which the high density peaks of the `rich' excavated sites as C, F and K stood out. Roebroeks *et al.* (1992), following studies by Isaac

(1) *While transport as such is not necessarily an indication of `planning', the point we made 10 years ago is that the items -cores, blanks and retouched forms- Middle Palaeolithic hominids carried around were in general different from the items that `stayed at home'. Middle Palaeolithic hominids were not just carrying stones around. The fact that the toolkits that were carried around were different from the beginning from the non-transported toolkits in technological terms (and not just intensity of retouch, that is indeed a matter of the wear and tear of mobility) might be seen as at least indicating some degree of reflection on what to carry around.*

(1981), have suggested that the high density patches may have been the places where technology was maintained, whereas the low density 'background' scatters were mainly locations where technology was used, for instance in subsistence activities. Excavated areas such as Sites C, F and K contained high amounts of conjoinable flakes (*Aufeinanderpassungen*), that are very rare in the low density scatters G and N, where refits of broken artefacts were more important (*Aneinanderpassungen*). In the background scatters tools are far more important than in the patches; the only patch with an important number of tools (n=137) is Site K, but here almost none of the tools could be refitted into one of the many spectacularly refitted large flint nodules from this site, strongly suggesting that they were all imported in a finished form (De Loecker, 1992, 1994). Almost all of these tools are scrapers, often very well made, as applies to the Unit IV tools in general.

In contrast with these river valley sites, Site J is not present against a background of isolated artefacts and patches even slightly comparable to the Unit IV one. The assemblage seems to have been 'parachuted' unto an archaeologically quite sterile landscape. There are many explanations for this difference, for example differences in the amount of 'time' represented by the Unit IV sediments as opposed to the Unit VI-A loess. Less intensive surveying of the Site J matrix -some isolated artefacts were found - can be a factor too. We, however, prefer the very straightforward explanation that the area was simply used in another way than 180,000 years earlier, when it was in the middle of a river plain. Judging from the omnipresence of the 'background' artefacts in the lower levels, the valley floor saw quite some human activity in this interglacial of 250,000 years ago, and as refit studies have shown, flint cores, blanks and tools were constantly produced, carried around and maintained in (short term) preparation of these various activities (Roebroeks, 1988; Roebroeks *et al.*, 1992). In the Early Weichselian the river plain had turned into a terrace edge which seems to have been visited less frequently. And while the various phases of the *chaînes opératoires* were scattered over the river valley 250,000 years ago, resulting in a spatial fragmentation of reduction sequences (cf Roebroeks, 1988, p. 58-59), Site J has it (almost) all in one place, from the first cortical flake to the last resharpening of a tool, all refitted back into the original nodule.

It is as tempting as naive to assume that the hominids responsible for the deposition of this assemblage were there because of the presence of the mammoth that we only know through remains of a few very badly preserved molars: a group of 'classic' Neandertals, foraging along the Meuse valley, hits upon a (dead?) mammoth and processes the animal with tools made on the spot from flint material collected nearby. In this scenario, the whole Site J record is fully explained, and everything, indeed, 'fits' together. Unfortunately, the absence of any non-dental remains of that mammoth combined with the general problem of the chronological resolution of such assemblages puts this scenario in the domain of pure speculation. It is already difficult enough to explain the paradoxical character of the lithic assemblage: in *strictly functionalistic* terms it may indeed have been *a waste of flint*, but not of *energy*.

Finally, it is worthwhile stressing that the small Site J assemblage has some wider bearing on the problem of Middle Palaeolithic assemblage variability. The refitted modification sequences, with artefacts changing from one typological category into another, neatly fit the picture of Middle Palaeolithic technologies as typologically flexible and as reflecting complex and 'fluid' use histories. By now this is widely recognised as a conspicuous element in Middle Palaeolithic tool use. Earlier, for example, Jelinek (1976) coined the term 'Frison effect' to denominate the frequent remodifications involved in schemes of tool reuse and rejuvenation. Dibble has shown that this effect may well explain variations in Middle Palaeolithic scraper morphology, suggesting that simple scrapers were frequently transformed into double and convergent forms (Dibble, 1984; 1987a and b; see also Rolland and Dibble, 1990). These studies, as well as many recent site analyses, suggest that the explanation of Middle Palaeolithic techno-typological variability - for a long time the 'Holy Grail' of Palaeolithic archaeology - is biased by what some have called the 'finished artefact-fallacy'. Refitting studies -such as the one for Site J- show unambiguously that in some aspects artefacts can indeed better be considered as 'finished with' than as 'finished' (Noble and Davidson 1996, p.198). This serves as another example of the fact that in the archaeological record *intentions* did not get fossilised, but *actions* did.

ACKNOWLEDGMENTS

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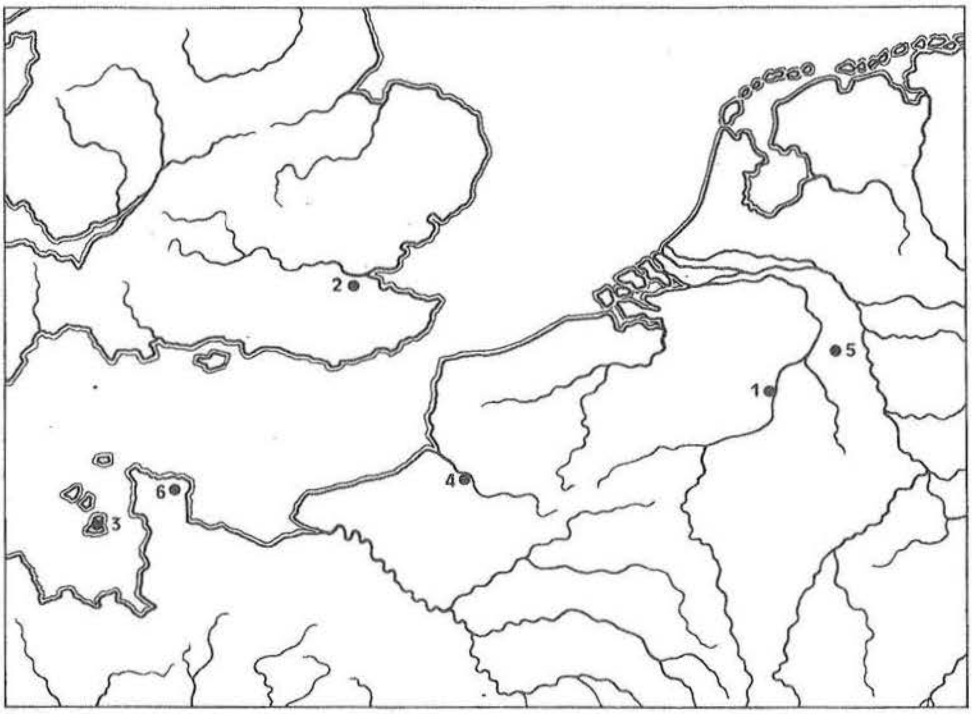


Fig. 1 - The location of the Maastricht-Belvédère pit (1), and other archaeological sites mentioned in the text: 1, Maastricht-Belvédère, 2, Baker's Hole, 3, La Cotte de St. Brelade, 4, Etouvie, 5, Rheindahlen, 6, St. Vaast La Hougue.

Fig. 1 - Situation géographique de Maastricht-Belvédère et des autres gisements mentionnés dans le texte : 1 Maastricht-Belvédère, 2 Baker's hole, 3 La Cotte de St. Brelade, 4 Etouvie, 5 Rheindahlen, 6 St. Vaast La Hougue.

Fig. 2 - Maastricht-Belvédère Site J: The excavation in full swing: the quarrying company has excavated all around the site.

Fig. 2 - Maastricht-Belvédère, Site J.

La carrière en pleine activité. La société d'exploitation de la carrière a creusé tout autour du gisement.

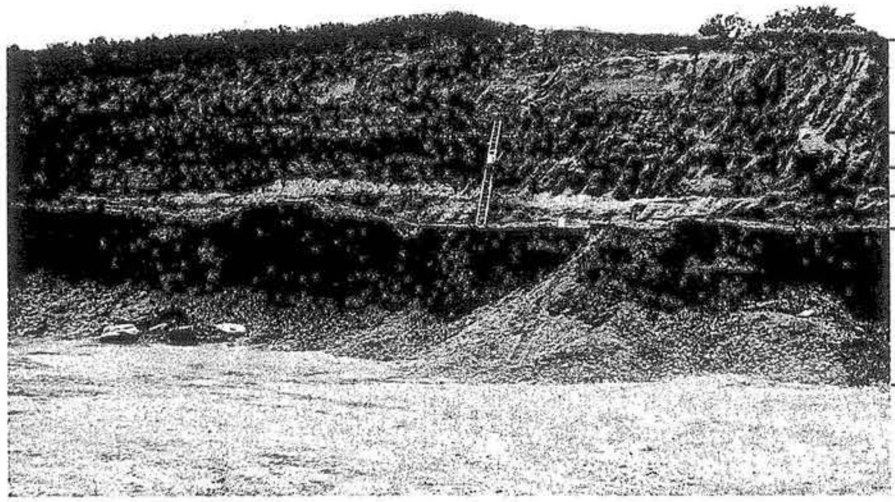


Fig. 3 - Maastricht-Belvédère: Photo of the southern part of the pit, Summer 1987, showing Units III to VII. The Unit IV sediments date to an interglacial of about 250,000 years ago, the site reported on in this paper was at the lowermost part of Unit VI, and dates from the Early Weichselian.

Fig. 3 - Maastricht-Belvédère. Vue de la partie sud de la fouille, à l'été 1987, montrant les unités III à VII. Les sédiments de l'unité IV, interglaciaires, sont datés de 250 000 ans environ. Le gisement qui fait l'objet de cet article était situé dans la partie inférieure de l'unité VI. Il est attribué au début du Weichselien.

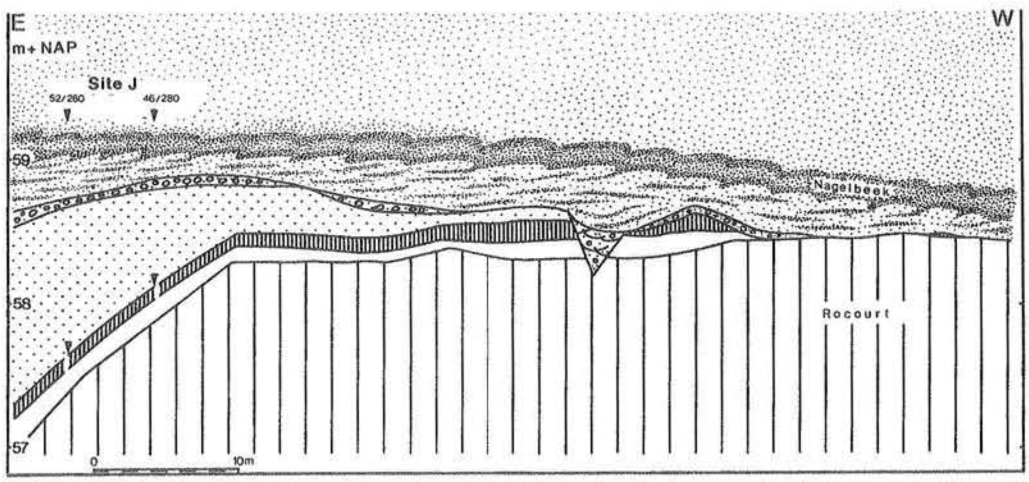


Fig. 4 - Schematic profile showing the stratigraphic position of Site J (NB:vertical magnification 10x), at the base of the Weichselian loess, just on top of loess-like sediments in which the Eemian Sol de Rocourt developed. Subsequent erosion removed the Early Weichselian loesses to the west of the site, in an erosional phase prior to the formation of the Nagelbeek horizon, a weakly developed soil from around 20,000 bp. The Nagelbeek horizon was covered by c. 6 metres of Pleniglacial Weichselian loess. Site J itself was preserved as a result of karst processes, which led to subsidence of the find bearing level (Height in m above NAP [Dutch Ordnance Level]).

Fig. 4 - Coupe schématique indiquant la situation stratigraphique du Site J, à la base du loess weichselien, au sommet des sédiments loessoïdes au sein desquels s'est développé le sol éémien de Rocourt. A l'ouest du site, les loess weichseliens ont disparu au cours d'une phase érosive, antérieure à la formation de l'horizon faiblement développé de Nagelbeek, autour de 20 000 ans BP. L'horizon de Nagelbeek est recouvert par les loess du pléniglaciaire weichselien sur près de 6 m de puissance. Le site J lui-même fut protégé en tant que processus karstique, ce qui entraîna l'affaissement du niveau qui renfermait l'industrie. (L'échelle verticale est dilatée 10 fois. Les altitudes sont exprimées en m par rapport au nivellement général des Pays-Bas, NAP.).

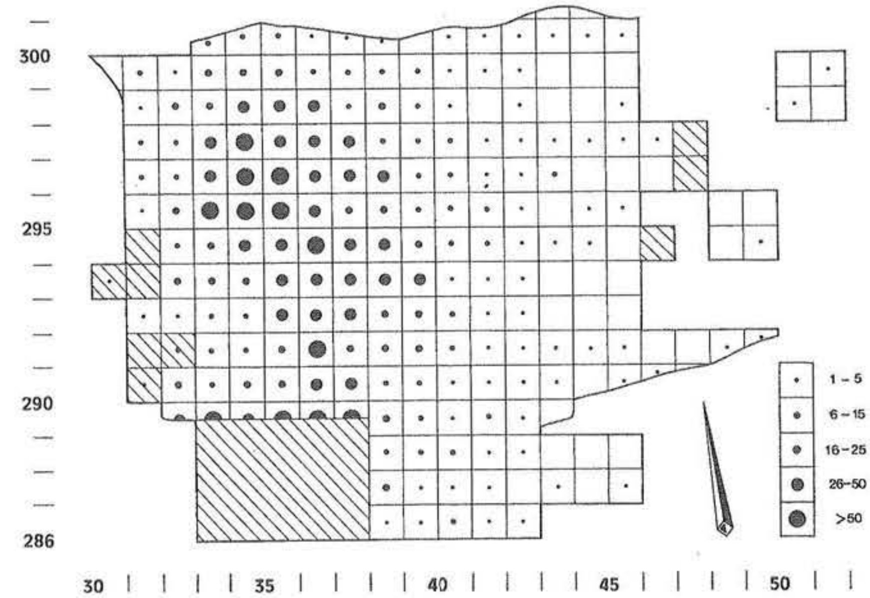


Fig. 5 - Map of the Site J excavation area, showing the number of artefacts per square metre. The shaded areas in the southwestern part of the area were not systematically excavated, there artefacts were recorded within three improvised large trenches.

Fig. 5 - Carte du secteur fouillé avec indication du nombre d'artefacts par m2. Au sud-ouest, la partie en gris n'a pas fait l'objet de fouilles systématiques ; dans cette zone, les artefacts proviennent de tranchées.

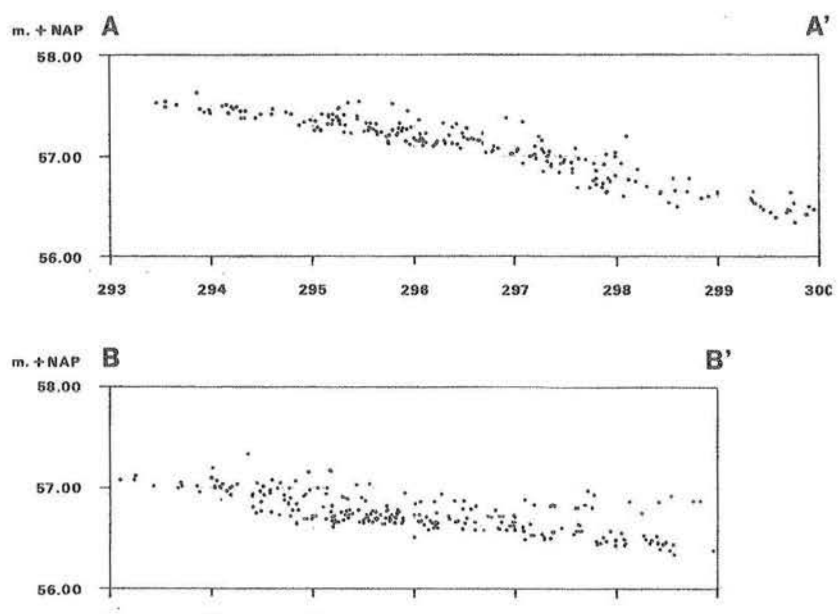


Fig. 6 - A-A': vertical distribution of all flint artefacts recorded in a south-north 7 by 1 m trench (squares 33/293 - 33/299). Height in m above NAP (Dutch Ordnance Level).

B-B': Vertical distribution of all flint artefacts recorded in a west-east 7 by 1 m trench (squares 32/297-37/297). Height in m above NAP (Dutch Ordnance Level).

Fig. 6 - A - A' : répartition verticale des artefacts de silex de la tranchée des carrés 33/293 à 33/299 (orientation S-N, longueur 7 m, profondeur 1 m ; altitudes en m par rapport au nivellement général des Pays-Bas).

B - B' : répartition verticale des artefacts de silex de la tranchée des carrés 32/297 à 37/297 (orientation E-O, longueur 7 m, profondeur 1 m ; altitudes en m par rapport au nivellement général des Pays-Bas).

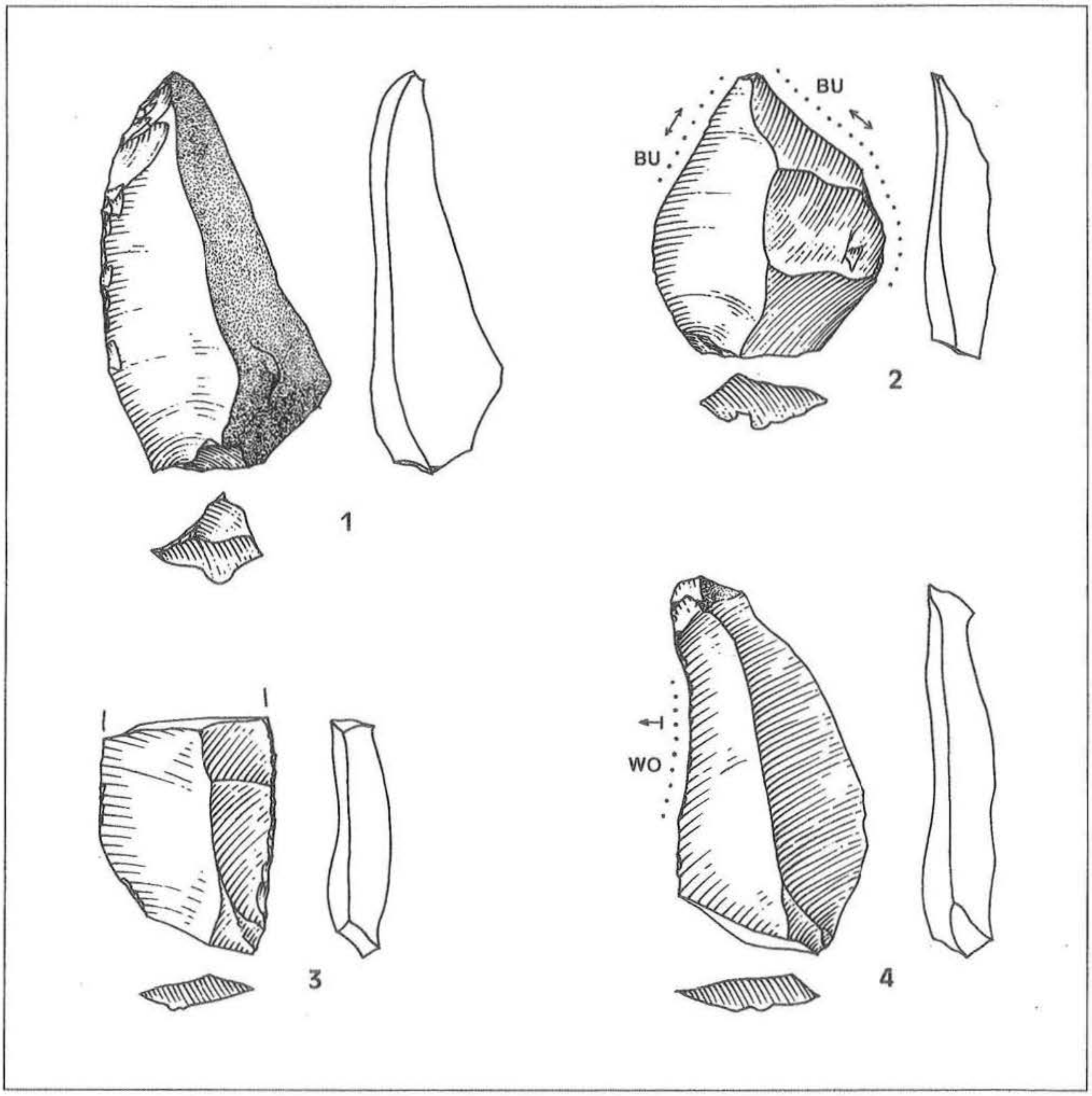


Fig. 7 - Maastricht-Belvédère Site J: 1-4 Flakes (Scale 2:3), with indication of use-wear traces. Small dots stand for lightly developed traces, larger ones for medium developed traces. WO=Wood, BU=Butchering, HI=Hide, UN=Uncertain contact material, NI=Not interpretable. A single arrow indicates a 'transverse'motion, as in 'scraping', a double arrow points to longitudinal motion, as in 'cutting'.

Fig. 7 - Maastricht-Belvédère, Site J. 1-4 éclats (éch. 2/3), avec indication des traces d'usage. Les pointillés légers correspondent à des traces peu marquées, les points plus gros à des traces plus développées. WO = travail du bois végétal, BU = boucherie, HI = peau, UN = contact avec matériau indéterminé, NI = non interprétable. Une flèche simple indique une action transversale, telle que racler ; une flèche double indique une action longitudinale, telle que couper.

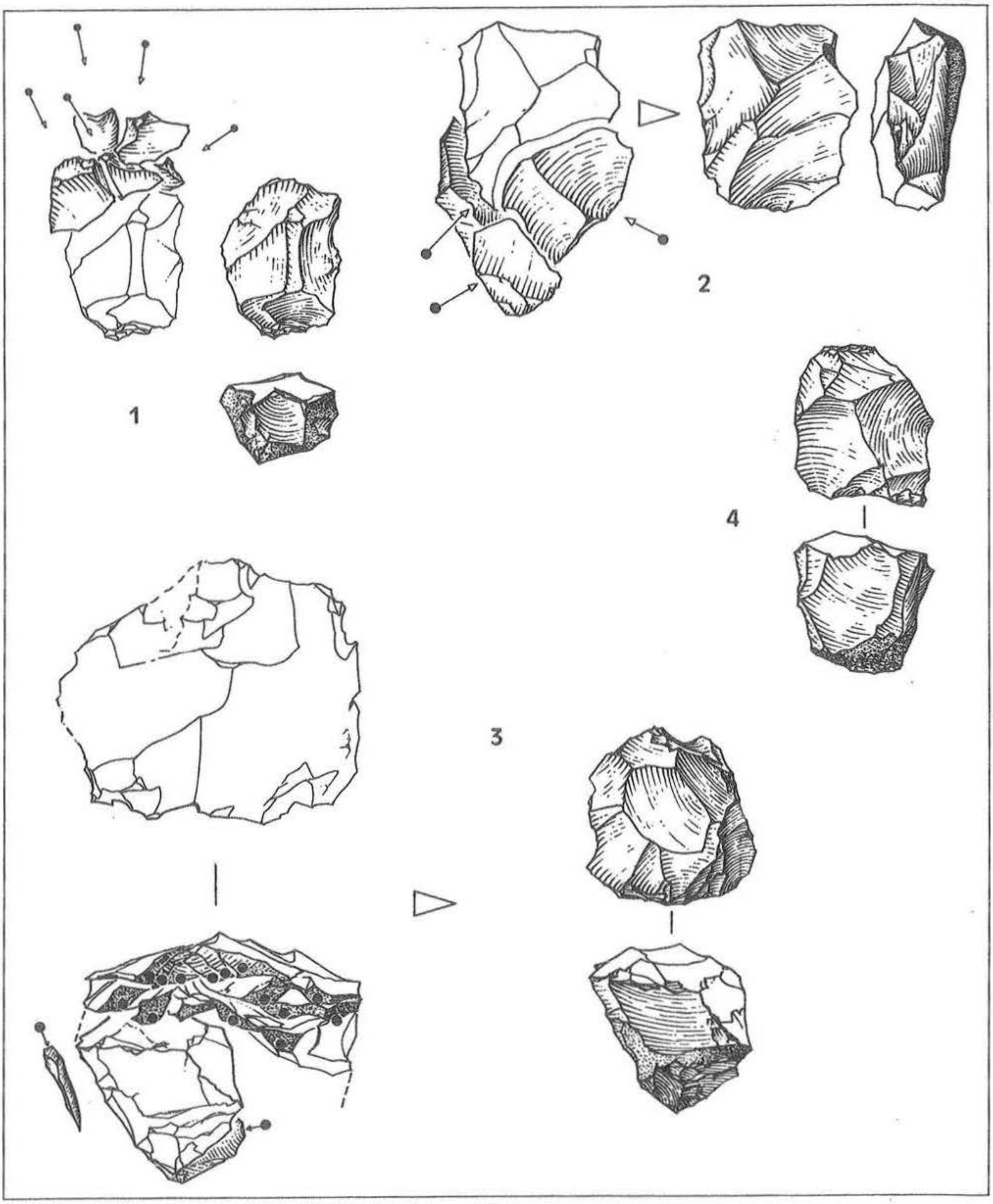


Fig. 8 - Maastricht-Belvédère Site J: 1-4 cores, 1-3 with refitted flakes (Scale 2:3).

Fig. 8 - Maastricht-Belvédère, Site J. 1-4 nucléus, 1-3 avec remontage d'éclats (éch. 2/3).

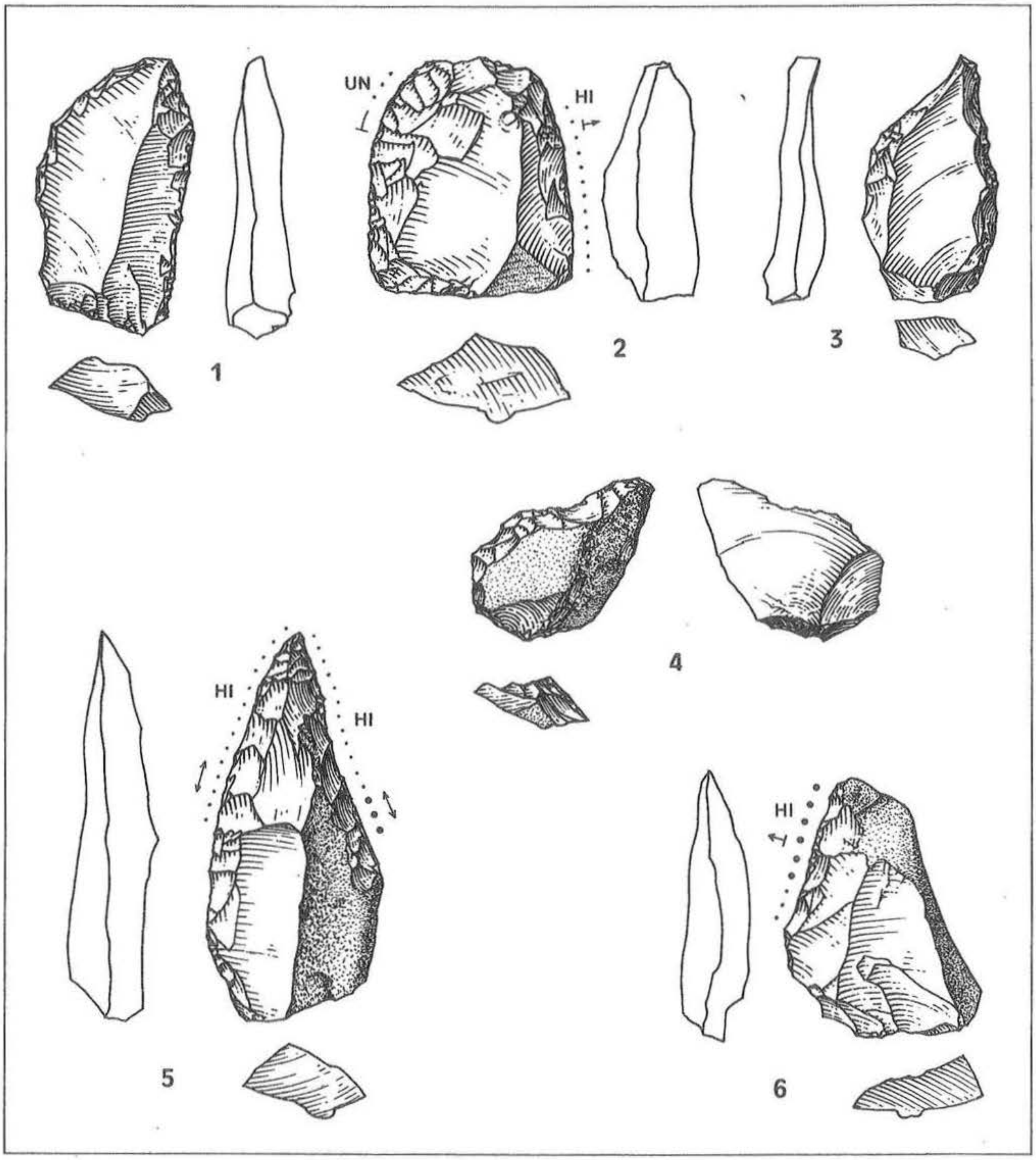


Fig. 9 - Maastricht-Belvédère Site J: 1-4, 6 various scraper forms, and a Mousterian 'point' (5) (Scale 2:3). See Fig. 7 for the use-wear symbols.

Fig. 9 - Maastricht-Belvédère, Site J. 1-4, 6 différentes formes de racloirs ; 5 "pointe" moustérienne (éch. 2/3). Les symboles utilisés sont identiques à ceux de la figure 7.

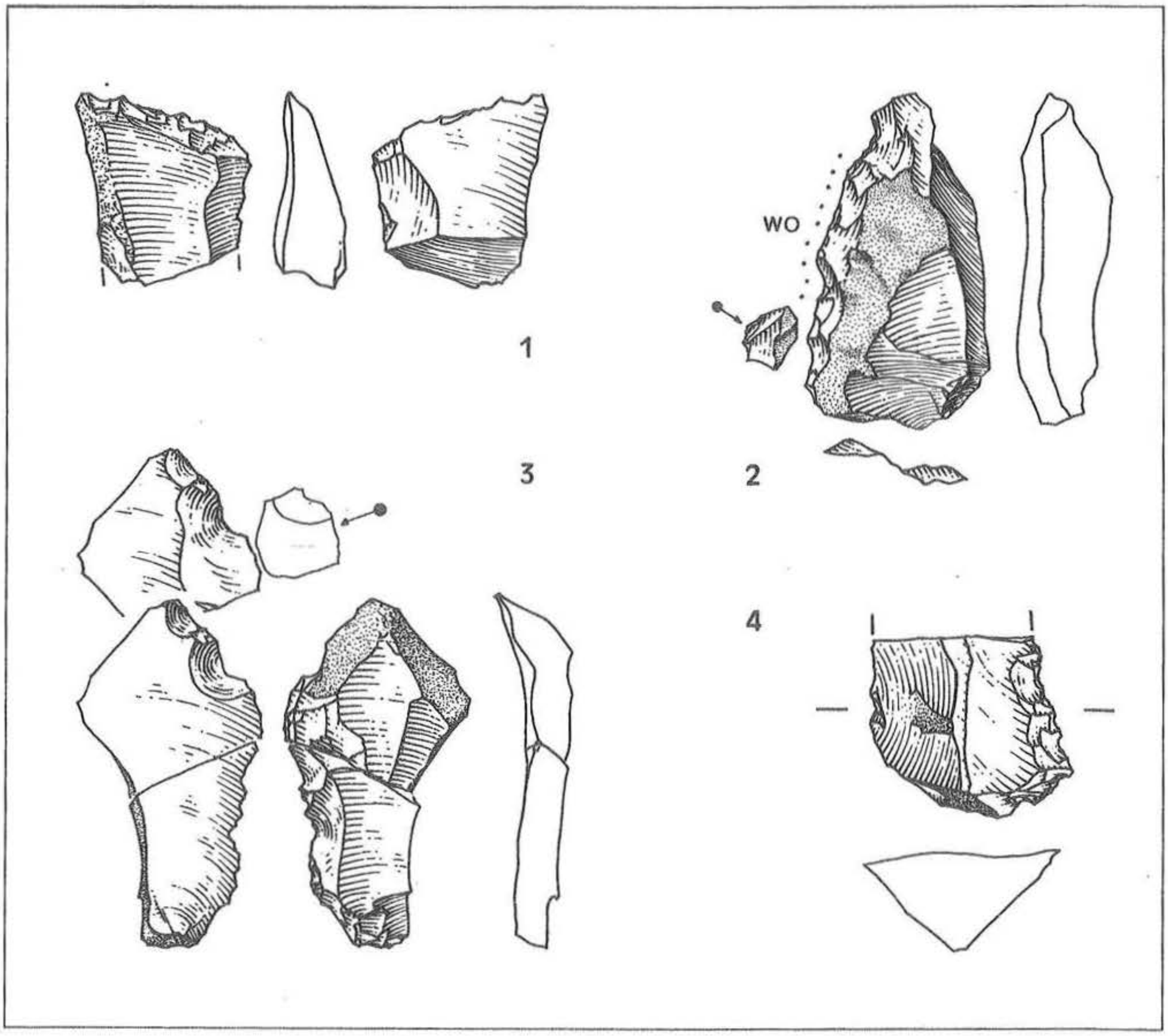


Fig. 10 - Maastricht-Belvédère Site J: 1,2,4 denticulates (2 with refitted spall), 3 notch (Scale 2:3). See Fig. 7 for the use-wear symbols.

Fig. 10 - Maastricht-Belvédère, Site J. 1, 2, 4 denticulé (n°2 remontage d'un éclat de retouche) ; 3 encoches (éch. 2/3). Les symboles utilisés sont identiques à ceux de la figure 7.

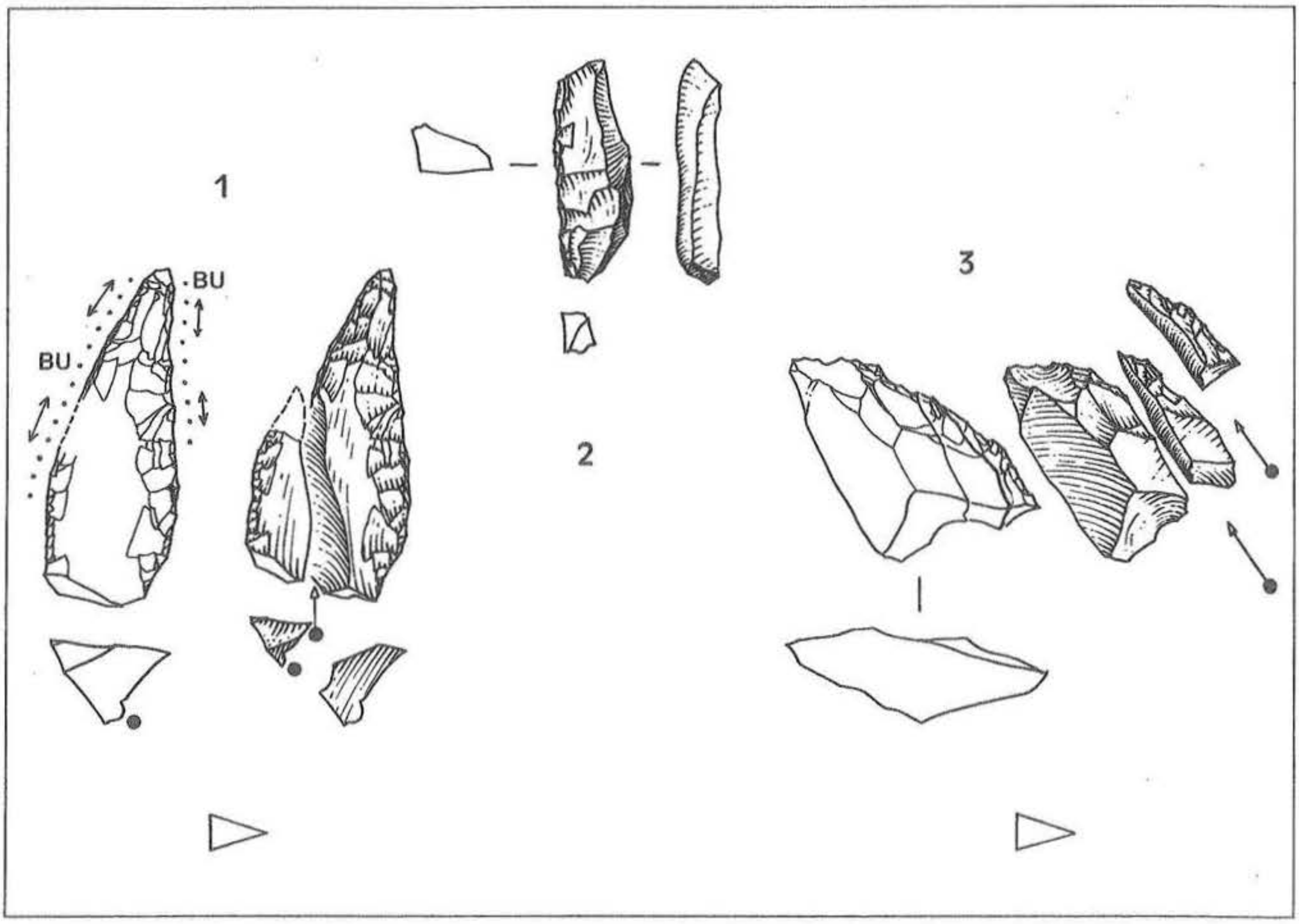


Fig. 11 - Maastricht-Belvédère Site J: 1-3 resharpening flakes (LSFs), some refitted to their 'parent' tool. In the case of the pointed double scraper ('Quinson point'), microwear analysis revealed that the resharpened side was used again, on hide (Scale 2:3). See Fig. 7 for the use-wear symbols.

Fig. 11 - Maastricht-Belvédère, Site J. 1-3 éclats longitudinaux de ravivage (LSF), certains remontés sur l'outil. L'analyse des micro-traces du racloir double appointé ("pointe de Quinson") montre que le bord ravivé à été utilisé par la suite sur de la peau. (éch. 2/3). Les symboles utilisés sont identiques à ceux de la figure 7.

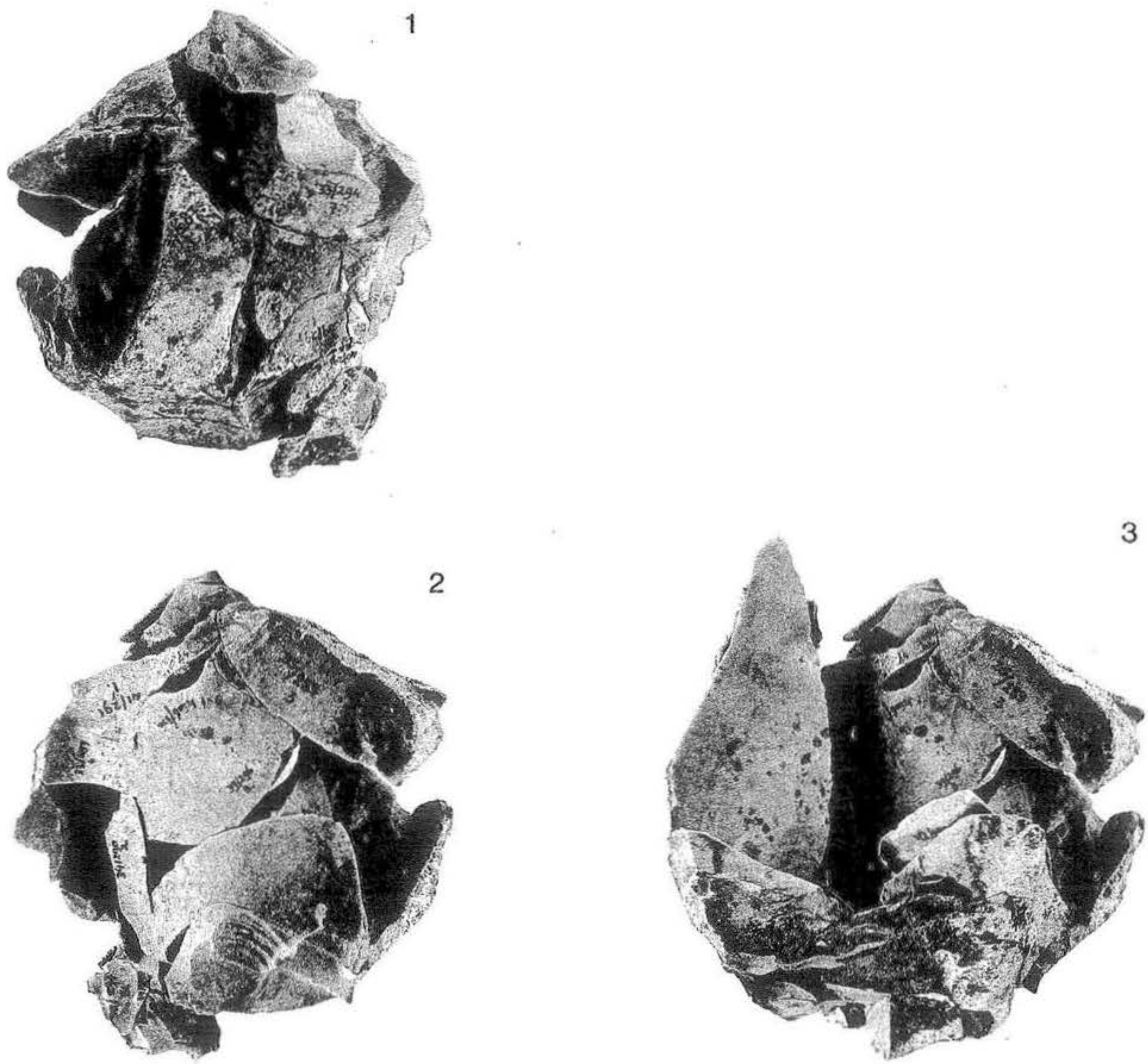


Fig. 12 - Maastricht-Belvédère Site J: Large flake (RMU1.1), completely reduced in at least 37 steps. One flake was retouched into a scraper, three display traces of use, two flakes were subsequently flaked. The composition is a good example of the large flakes that must have been originally present judging from negative scars and refitting results, but were not retrieved in complete form. This group of conjoining artefacts (12.1-2) refits to another group of flakes (12.3), one of which was the blank for a Mousterian point (Fig 9.5), to which two resharpening spalls were conjoined (see also the colour cover of this issue of Paleo). For the refitting 'lines' of RMU1.1 see Fig. 13 (Scale c. 2:3).

Fig. 12 - Maastricht-Belvédère, Site J. Grand éclat (RMU 1.1) intégralement débité par détachement d'au moins trente sept éclats (éch. 2/3). Un des éclats issus de ce nucléus a été retouché en racloir ; trois portent des traces d'usage et deux autres ont été, à leur tour, débités. Cet ensemble montre l'existence de grands éclats seulement attestés par des négatifs d'enlèvements et les remontages mais jamais retrouvés entiers. Cet ensemble (Fig. 12, 1-2) remonte avec un autre groupe d'éclats (Fig. 12, 3) dont l'un a servi de support à une pointe moustérienne (Fig. 9, 5), sur laquelle deux éclats de ravivage sont remontés (cf. illustration couleur en page 1 de couverture). La répartition spatiale des remontages du bloc RMU 1.1 est donnée figure 13.

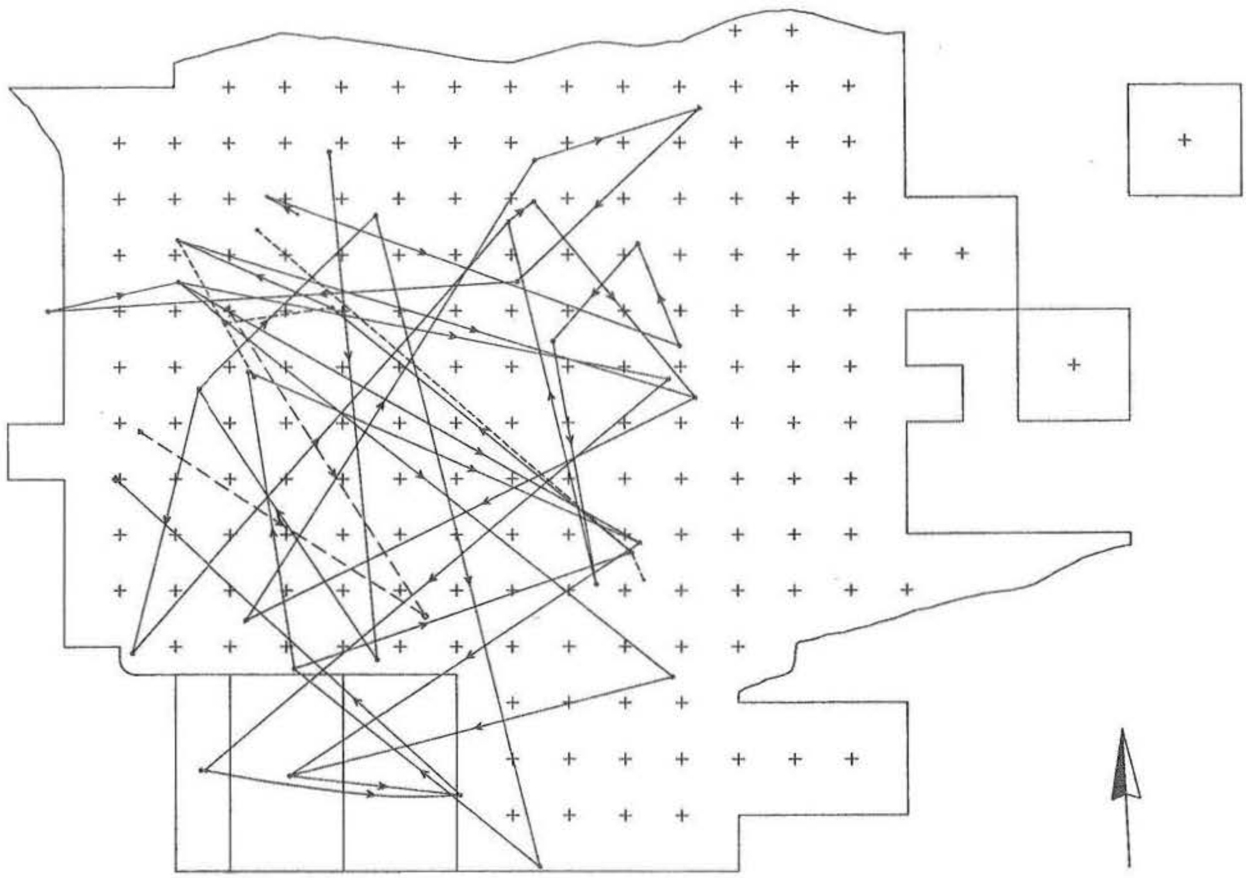
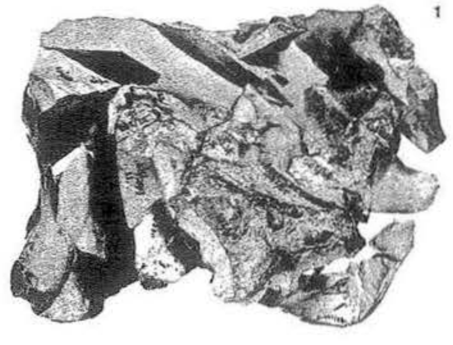


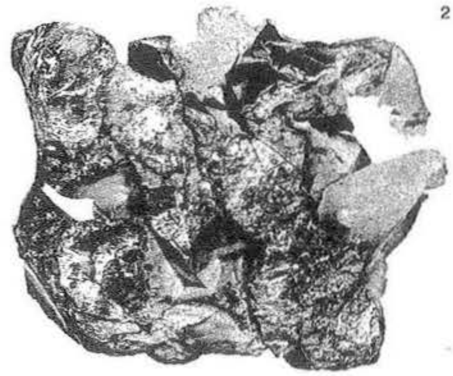
Fig. 13 - Maastricht-Belvédère Site J: Refit lines for refitted group RMU 1.1 (see Fig. 12.1-2), visualization cf. Cziesla 1986. Solid lines stand for dorsal/ventral refits, with arrows indicating the reduction sequence, dashed lines refer to refitted broken artefacts. Artefacts recovered with square metre-provenance only have been assigned random coordinates. Grid in metres.

Fig. 13 - Maastricht-Belvédère, Site J. Matérialisation graphique (Cziesla 1986) de la répartition spatiale des remontages de l'ensemble RMU 1.1. Un trait plein correspond au remontage d'une pièce sur l'autre. L'orientation de la flèche symbolise l'ordre chronologique des détachements. Un trait pointillé indique un raccord de fragments. Aux artefacts dont seul le mètre carré d'origine est connu, des coordonnées arbitraires ont été attribuées. Le carroyage est en mètres.

1



2



3

Fig. 14, 1-3 - Maastricht-Belvédère Site J: Refitted nodule (RMU2.1), consisting of 87 refitted artefacts (1160 gr). This block yielded four denticulates - some with refitted Transverse Sharpening Flakes -, a notch, one scraper, a burin with five refitted spalls, two flakes with signs of use, three flaked-flake sequences and one core. For the 'refitting lines' of this group see Fig. 15 (Scale c. 2:3)

Fig. 14 - Maastricht-Belvédère, Site J. 1-3 remontage du nodule RMU 2.1 comprenant 87 artefacts (1160 g). Ce bloc a fourni, outre le nucléus, quatre denticulés (certains avec remontage d'éclats transversaux de retouche TSF), une encoche, un racloir, un burin (avec quatre chutes remontées), deux éclats portant des stigmates d'usage et trois nucléus sur éclat.

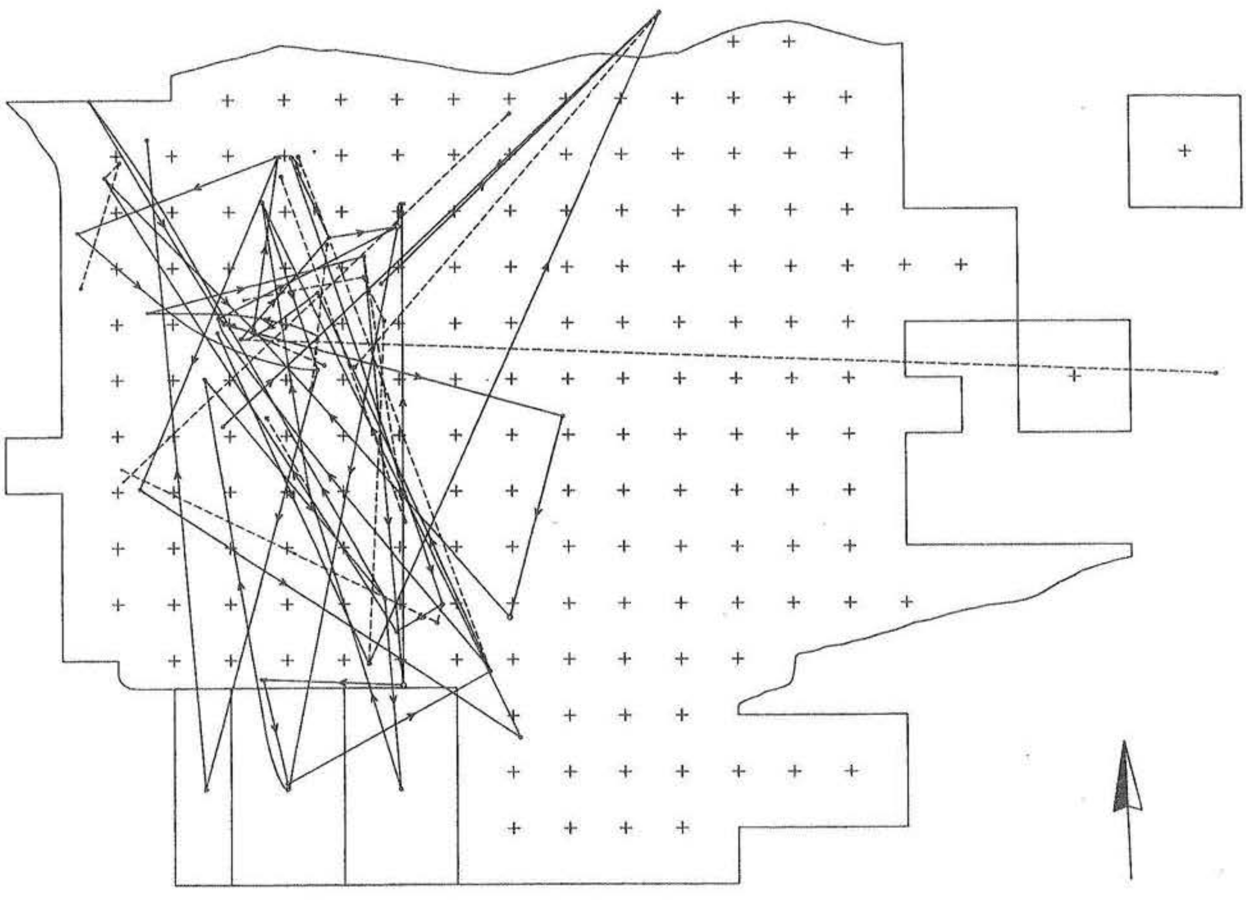


Fig. 15 - Maastricht-Belvédère Site J: Refit lines for refitted group RMU 2.1 (see Fig. 14). See Fig. 13 for explanation.

Fig. 15 - Maastricht-Belvédère, Site J. Matérialisation graphique de la répartition spatiale des remontages de l'ensemble RMU 2.1. Les symboles utilisés sont identiques à ceux de la figure 13.

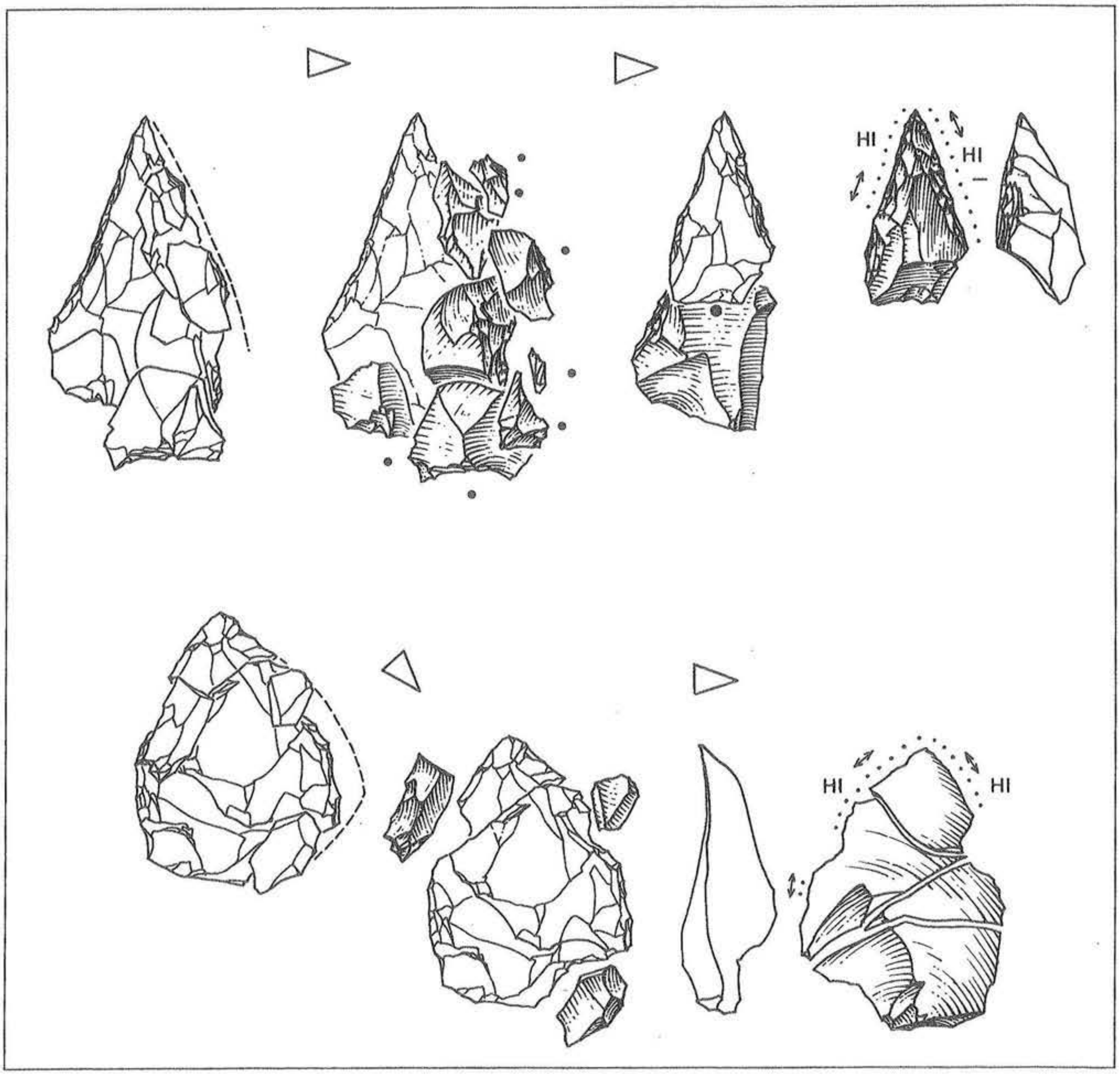


Fig. 16 - Maastricht-Belvédère Site J: Above: RMU 1.2, Various stages of modification of a double scraper. Below: Restgroup 1, four flakes refit to form a double scraper, onto which three TSFs could be refitted. The original scraper form was completely reduced in subsequent modification (Scale 2:3). Both scrapers displayed traces of cutting hide on both lateral edges. See Fig. 7 for the use-wear symbols.

Fig. 16 - Maastricht-Belvédère, Site J. En haut : RMU 1.2, différentes étapes de la modification d'un racloir double (éch. 2/3). En bas : le raccord de quatre fragments d'éclat forme un racloir double sur lequel trois éclats de retouche transversaux peuvent être remontés. La forme originale du racloir a été complètement modifiée. Ces deux racloirs portent des traces de découpe de peau sur les deux bords. Les symboles utilisés sont identiques à ceux de la figure 7.

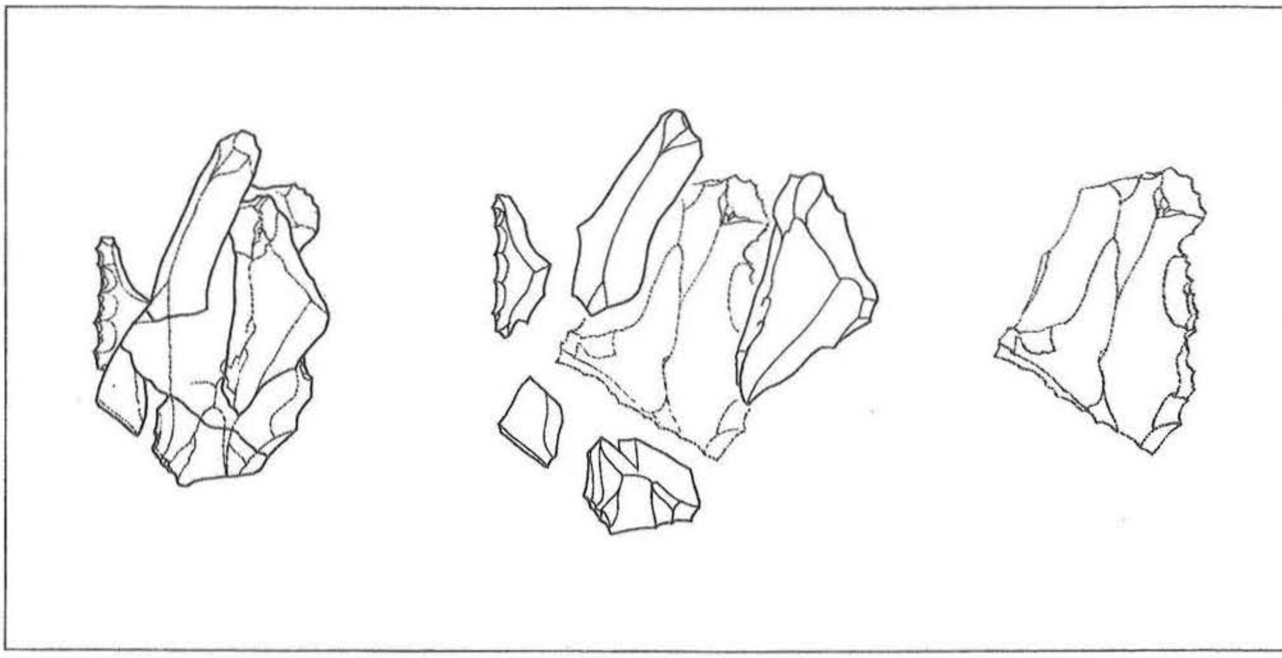


Fig. 17 - Maastricht-Belvédère Site J: The complete refit shows a tool with one scraper edge; subsequent modification has turned this scraper into a denticulate (Scale 2:3).

Fig. 17 - Maastricht-Belvédère, Site J. Le remontage montre un racloir latéral transformé par la suite en denticulé (éch. 2/3).

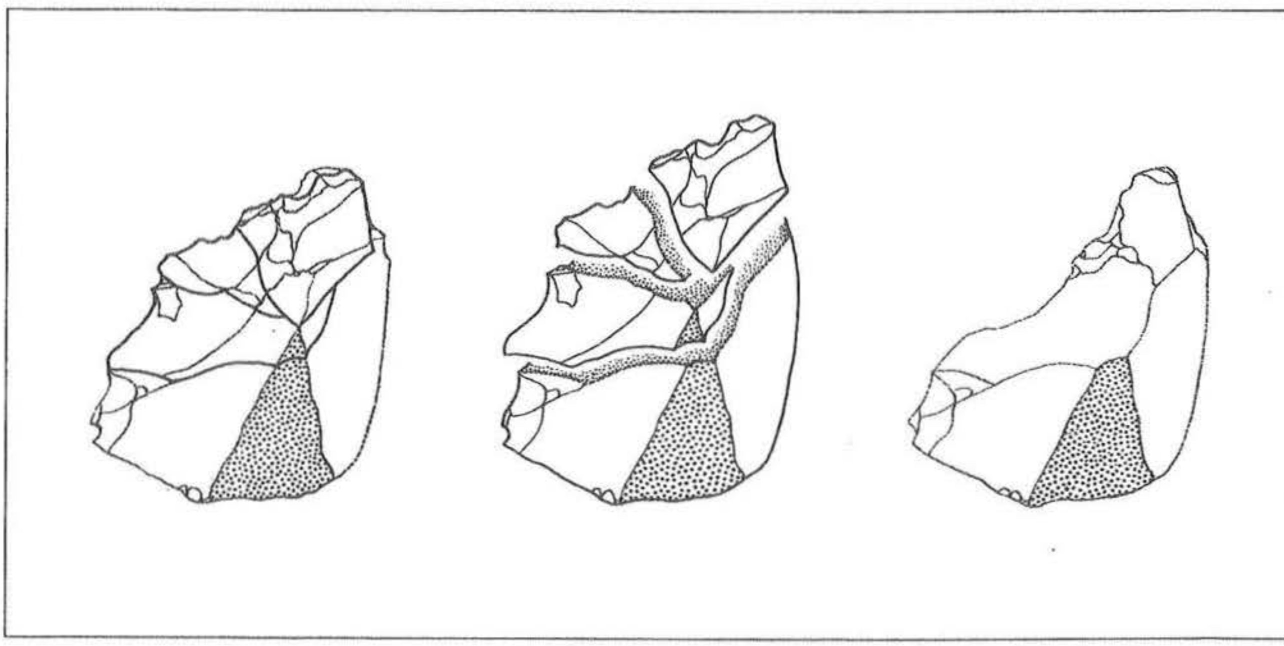


Fig. 18 - Maastricht-Belvédère Site J: from denticulate (complete refit) to notch, by the removal of three TSFs (Scale 2:3).

Fig. 18 - Maastricht-Belvédère, Site J. Passage d'un denticulé à une encoche par enlèvements de trois éclats de retouche transversaux (éch. 2/3).

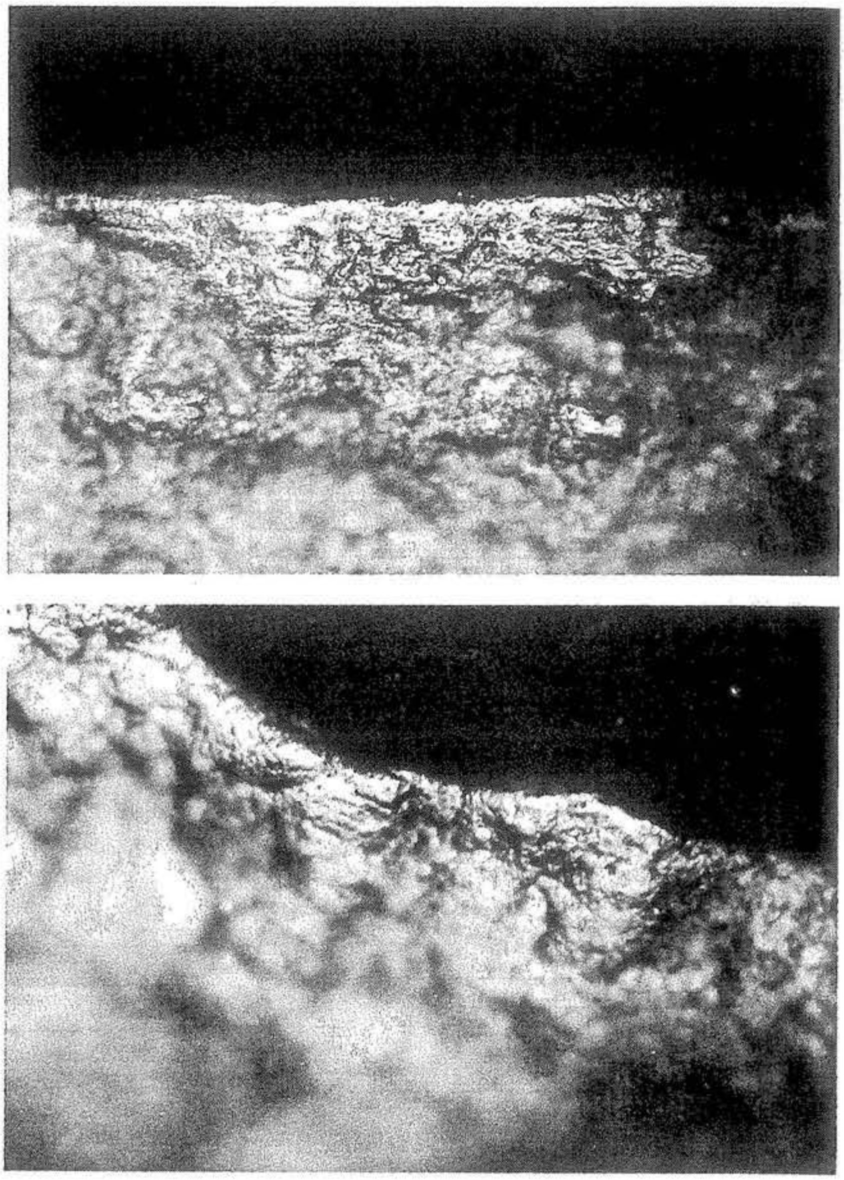


Fig. 19 - Maastricht-Belvédère Site J: Polish from cutting hide seen on tool 37/288.15 (see Fig. 11.1). Above 200 x magnification, below 400 x magnification.

Fig. 19 - Maastricht-Belvédère, Site J. Poli caractéristique de la découpe de peau, observé sur l'outil 37/288.15 (Fig. 11, 2). En haut, grossissement x200, en bas x400.

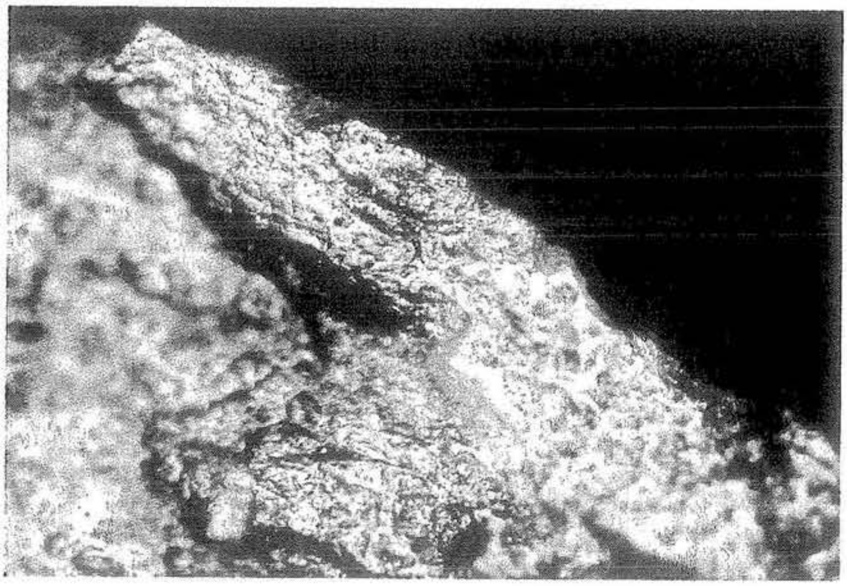


Fig. 20 - Maastricht-Belvédère Site J: Edge rounding and rough polish parallel to the edge, such as is present on various flakes, scrapers and Mousterian point 37/290.43 (Fig. 9.5) (200 x magnification).

Fig. 20 - Maastricht-Belvédère, Site J. Émoussé du bord et poli grossier parallèle au bord sont fréquents sur différents éclats, racloirs et sur la pointe moustérienne 37/290.43 (Fig. 9, 5). Grossissement x200.

	N	%
Tools (complete)	35	1.2
Tools (incomplete)	47	1.6
Flakes with use retouch (complete)	40	1.4
Flakes with use retouch (incomplete)	12	0.4
Bifaces	-	-
Long Sharpening Flakes	8	0.3
Transverse Sharpening Flakes	8	0.3
Chips < 20 mm max. dimension (unretouched)	1507	52.6
Flakes ≥ 20 mm max. dimension (unretouched)	1155	40.3
Core trimming flakes	22	0.8
Quartz and quartzite flakes/fragments	3	0.1
Cores (incl. `flaked flakes')	26	0.9
TOTAL	2863	99.9

Table 1 - Maastricht-Belvédère Site J: An overview of the lithic assemblage (counts are not based on refitting results)

SIZE CLASS (mm)	N	%
0-10	440	15.4
10-20	1067	37.3
20-30	623	21.7
30-40	347	12.1
40-50	192	6.7
50-60	94	3.3
60-70	56	1.9
70-80	25	0.9
80-90	14	0.5
90-100	3	0.1
≥ 100	2	0.1
TOTAL	2863	100.0

Table 2 - Maastricht-Belvédère Site J: Size distribution of the lithic artefacts, based on maximum dimensions in mm. (counts are not based on refitting results)

RMU	NUMBER	WEIGHT IN GRAMS
1	151	1367
2	141	1467
3	52	527
4	194	1931
5	53	432
6	268	2741
7	24	85
8	177	2473
9	9	95
10	5	22
11	11	55
12	12	80
13	10	17
14	4	60
Other	461	1412
TOTAL	1572	12,764

Table 3 - Maastricht-Belvédère Site J: Distribution of artefacts over the various Raw Material Units, all size classes, except for the `other' group (≥ 20 mm only).

DORSAL PATTERN	N	%
Cortex	121	10.2
Natural cracks	15	1.3
Plain	129	10.8
Parallel unidirectional	290	24.4
Convergent unidirectional	3	0.2
Centripetal or radial	7	0.6
Ridge	16	1.3
Lateral unidirectional	77	6.5
Parallel opposed unidirectional	15	1.3
Parallel bidirectional	71	6.0
Paralellel + lateral unidirectional	294	24.7
Opposed + lateral unidirectional	33	2.8
Indeterminate	118	9.9
TOTAL	1189	100.0

Table 4 - Maastricht-Belvédère Site J: Dorsal patterns, based on the dominant pattern formed by scars ≥ 10 mm on tools, tool trimming elements, `flaked flakes' and all unretouched flakes ≥ 20 mm. Chunks are excluded.

DORSAL SCARS	N	%
0	68	5.7
1	238	20.0
2	323	27.2
3	269	22.6
4	124	10.4
5	60	5.0
6	37	3.1
7	13	1.1
8	8	0.7
9	5	0.4
10	2	0.2
11	2	0.2
16	1	0.1
Indet.	39	3.3
TOTAL	1189	100.0

Table 5 - Maastricht-Belvédère Site J: Number of dorsal scars (≥ 10 mm) on tools, tool trimming elements, 'flaked flakes' and all unretouched flakes ≥ 20 mm. Chunks are excluded.

NUMBER OF SCARS	N
1	1
2	1
3	1
4	2
6	2
7	2
8	7
9	1
10	1
11	1
12	2
13	-
14	1
15	1
18	2
21	1
TOTAL	26

Table 8 - Maastricht-Belvédère Site J: Number of negative scars (≥ 10 mm) present per core.

BUTTS	N	%
Missing	294	24.7
Outer surface	73	6.1
Plain (scar negative)	485	40.8
Facetted	4	0.3
Retouched	35	2.9
Dihedral	119	10.0
Polyhedral	17	1.4
Punctiform	66	5.6
Indeterminate	96	8.1
TOTAL	1189	99.9

Table 6 - Maastricht-Belvédère Site J: Butts on tools, tool trimming elements, 'flaked flakes' and all unretouched flakes ≥ 20 mm. Chunks are excluded.

RMU	TOTAL	PRIMARY CORES	CORES ON FLAKE
RMU1	5	1	4
RMU2	2	1	1
RMU3	2	2	-
RMU4	1	-	1
RMU5	2	1	1
RMU6	3	2	1
RMU7	-	-	-
RMU8	6	3	3
RMU9	1	-	1
RMU10	1	1	-
'OTHER'	3	1	2
TOTAL	26	12	14

Table 9 - Maastricht-Belvédère Site J: Total number of cores per RMU, with a subdivision in 'primary' cores and cores on flakes.

MAXIMUM DIMENSION (in mm)	N	%	N (primary)	N (on flake)
30-39	4	15.4	1	3
40-49	8	30.8	4	4
50-59	8	30.8	4	4
60-69	4	15.4	1	3
70-79	-			
80-89	1	3.8	1	
90-99	1	3.8	1	
TOTAL	26	100.0	12	14

Table 7 - Maastricht-Belvédère Site J: Maximum dimensions (in mm) of cores, with a subdivision in 'primary' cores and cores on flakes ('flaked flakes').

CORE TYPOLOGY	TOTAL N	(OF WHICH ON FLAKE)
Discoidal	1	-
High backed discoidal	1	1
Pyramidal/conical	1	-
Polyhedral	8	1
Multiple platformed	4	1
Shapeless/miscellaneous	9	9
Double platformed/opposed	2	2
TOTAL	26	14

Table 10 - Maastricht-Belvédère Site J: Core typology

TOOL TYPES	COMPLETE		INCOMPLETE		TOTAL	
	N	%	N	%	N	%
Simple scrapers	7	9.3	11	18.6	18	13.4
Double scrapers	5	6.7	2	3.4	7	5.2
Transverse scrapers	-	-	1	1.7	1	0.8
'Raclettes'	2	2.7	1	1.7	3	2.2
End scrapers ('grattoirs')	1	1.3	-	-	1	0.8
Scrapers indet. (fragments)	-	-	6	10.2	6	4.5
Notched pieces ('encoches')	3	4.0	4	6.8	7	5.2
Denticulates	12	16.0	20	34.0	32	23.9
Mousterian points	1	1.3	1	1.7	2	1.5
Quinson-points	1	1.3	-	-	1	0.8
Burins	3	4.0	-	-	3	2.2
Mousterian tranchets	-	-	1	1.7	1	0.8
SUBTOTAL (reduced count)	35	46.7	47	79.7	82	61.2
Flakes with (macroscopic) use retouch	33	44.0	11	18.6	44	32.8
Backed knives	7	9.3	1	1.7	8	6.0
TOTAL	75	99.9	59	100.0	134	100.1

Table 11 - Maastricht-Belvédère Site J: A survey of the tools (counts are not based on refitting results)

RMU1 Distances between refits	*Aufeinander-passung*	*Aneinander-passung*	*Anpassung*
0-50 cm	8 (1)	2 (0)	2 (0)
51-210 cm	15 (6)	3 (5)	1 (1)
211-400 cm	17 (14)	3 (2)	3 (1)
> 400 cm	29 (48)	6 (7)	4 (8)

RMU2 Distances between refits	*Aufeinander*	*Aneinander*	*Anpassung*
0-50 cm	8 (0)	6 (1)	1 (0)
51-210 cm	9 (6)	7 (5)	5 (2)
211-400 cm	14 (13)	6 (9)	5 (3)
> 400 cm	23 (35)	12 (16)	2 (8)

Tables 14 and 15 - Maastricht-Belvédère Site J: Length of lines between refitted elements for RMU 1 and 2, for artefacts with exact provenance data and for artefacts collected per square metre. For the last category two options are given, i.e. the shortest possible distance between artefacts collected per square metre only and the longest possible one (between brackets). See text for further explanation.

AVERAGE VALUES (in mm)	FLAKES	TOOLS
Max. dim.	35	59
Length	30	53
Width	28	38
Thickness	9	9

Table 12 - Maastricht-Belvédère Site J: Average size (in mm) of all unbroken flakes and tools.

CONTACT MATERIAL:	Hi			Bu	Wo		Ha		Un			
INFERRED MOTION:	Cu	Sc	Un		Wh	Un	Cu	Un	Cu	Sc	Un	
Scraper (7)	3	3	2							2	1	11
Moust. Point (1)	2											2
Denticulate (1)						1						1
Notch (1)											1	1
Resharp. flakes (3)	3			2								5
Blade-like flake (1)	2											2
Flake use ret (11)	1			2	1		1	2	2	1	1	11
Flake (8)	4	1		2								7
TOTAL	15	4	2	6	1	1	3		8			40
	21			6	2		11					

Table 20 - Inferred activities per artefact type (represented are used zones which do not correspond to the number of implements because one implement may be used twice). The number of implements in each tool type category is listed in brackets. Hi=Hide, Bu=Butchering, Wo=Wood, Ha=Uncertain Hard Material, Un=Uncertain, Cu=Cutting, Sc=Scraping, Wh=Whittling, use ret=with use retouch.

TYPE OF REFIT	N	%
Aufeinanderpassung	643	75.5
Aneinanderpassung	171	20.1
Anpassung	38	4.5
TOTAL	852	100.1

Table 13 - Maastricht-Belvédère Site J: Types of refits (*cf.* Cziesla 1990, see text for explanation). Each contact between two artefacts counts for one observation.

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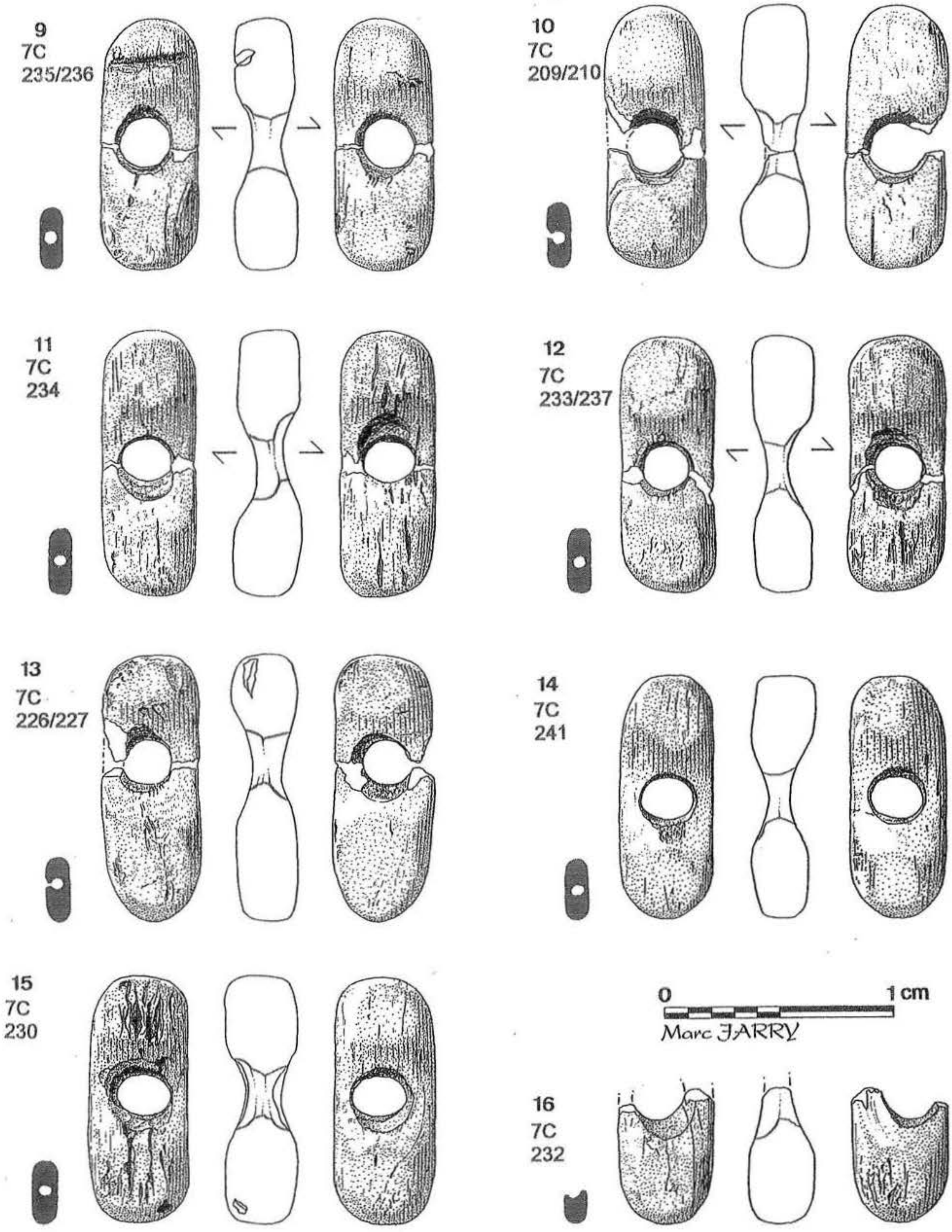

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