The exploitation of quartzite in Layer 5 (Mousterian) of Scladina cave (Wallonia, Belgium): flexibility and dynamics of concepts of debitage in the Middle Palaeolithic

Kévin Di Modica, Dominique Bonjean

THE EXPLOITATION OF QUARTZITE IN LAYER 5 (MOUSTERIAN) OF SCLADINA CAVE (WALLONIA, BELGIUM): FLEXIBILITY AND DYNAMICS OF CONCEPTS OF DEBITAGE IN THE MIDDLE PALAEOLITHIC

Kevin Di MODICA
Archéologie Andennaise asbl – Université de Liège, Rue Fond des Vaux 339d, 5300 Sclayn-Andenne, Belgium, Kevin_dimodica@yahoo.fr

Dominique BONJEAN
Archéologie Andennaise asbl, Rue Fond des Vaux 339d, 5300 Sclayn-Andenne, Belgium, Scladina@swing.be

Abstract*: This study concerns the management of the quartzite pebbles collected close to the site. Approximately fifty refits in a single series permit the reconstruction of the morphology of the core and the description of the technological treatment applied to it. The most complete refit series shows the coexistence of several methods of debitage on this raw material alone; but, also, their succession in the same block. The series provides evidence of a flexibility of concepts of debitage and evidence of dynamic relations between these concepts. Quartzite is the object of special treatment according to several criteria: economic, since flint is not available in the local environment of the cave; morphometric, the production is conditioned by the precise choice in the selection of the blocks; petrology, the nature of the material does not allow the knapper the same important liberty in knapping as flint permits.*
Key Words*: Mousterian, Scladina, Belgium, pebbles, chaîne opératoire*

Résumé*: Cette étude concerne la gestion des galets de quartzite récoltés à proximité du site. Une cinquantaine de remontages permettent de reconstituer la morphologie des blocs de départ et de décrypter le traitement technologique qui leur fut appliqué. Les remontages les plus complets témoignent de la coexistence de plusieurs méthodes de débitage sur cette matière première, mais aussi de leur succession au sein d'un même bloc. La série met donc particulièrement en évidence la flexibilité des concepts de débitage et les relations dynamiques qu'ils entretiennent. Le quartzite est traité spécifiquement selon plusieurs critères. Economiques, puisque le silex est absent à proximité de la grotte; Morphométriques, la production étant conditionnée par des choix précis dans la sélection des bloc; Pétrologiques, le matériau étant plus contraignant que le silex.*
Mots-clés*: Moustérien, Scladina, Belgique, galets, chaînes opératoires*

Resumo*: Este estudo diz respeito à gestão de seixos de quartzito recolhidos na proximidade do sítio arqueológico. Cerca de 50 remontagens permitem reconstruir a morfologia dos blocos originais, bem como descrever o seu tratamento tecnológico. As remontagens mais completas testemunham a coexistência de vários métodos de debitagem aplicados a esta matéria – prima, mas também a sua sequência na exploração do mesmo bloco. Esta série evidencia a flexibilidade dos conceitos de debitagem e as suas relações dinâmicas, sendo o quartzito explorado especificamente de acordo com vários critérios: económicos, uma vez que o sílex não se encontra na proximidade da gruta; morfométricos, já que a produção é condicionada por uma escolha precisa do bloco; petrográficos, porque esta matéria-prima apresenta mais constrangimentos do que o sílex.*
Palavras-chave*: Musteriense, Scladina, Seixos, cadeias operatórias*

INTRODUCTION

The lithic industry of layer 5 of Scladina Cave (Sclayn, Prov. of Namur, Belgium) actually constitutes the most efficient tool for understanding the Mousterian settlement in the Mosan Basin. The excavations of this level, initiated in 1978, have permitted the exhaustive collection of, at present, thirteen thousand two hundred fifty four (13.254) artefacts (Otte and Bonjean, 1998) with a constant refinement of the recording of the stratigraphic context. Today, research on the lithic industry continues both in the field and in the collection.

New excavations are actually underway in layer 5. The goal of these excavations is to determine more precisely the position and mode of deposition of the artefacts within the sedimentary microvariations recently noted in layer 5 of Scladina. Consequently, these new observations, undertaken for a broader understanding of sedimentary deposits at the entrances of Belgian caves, allows for the refinement of the chronological resolution and the palaeoenviroment of the occupation (S. Pirson, thesis in progress. For a glimpse, see Pirson *et al*, 2004; Pirson *et al*, 2005).

In the laboratory, an exhaustive study of the whole lithic industry is going to be started. The first overall observations of the material (see for example Otte *et al*, 1998) indicate evidence of the use of several raw materials and the coexistence of several *chaînes opératoires*. The point now is to describe more closely the variability of the Mousterian behaviour at Scladina before integrating the Scladina evidence into a broader regional perspective (K. Di Modica, thesis in progress). In practical terms and for the first time, the industry is not treated in its entirety. Our preliminary observations of the

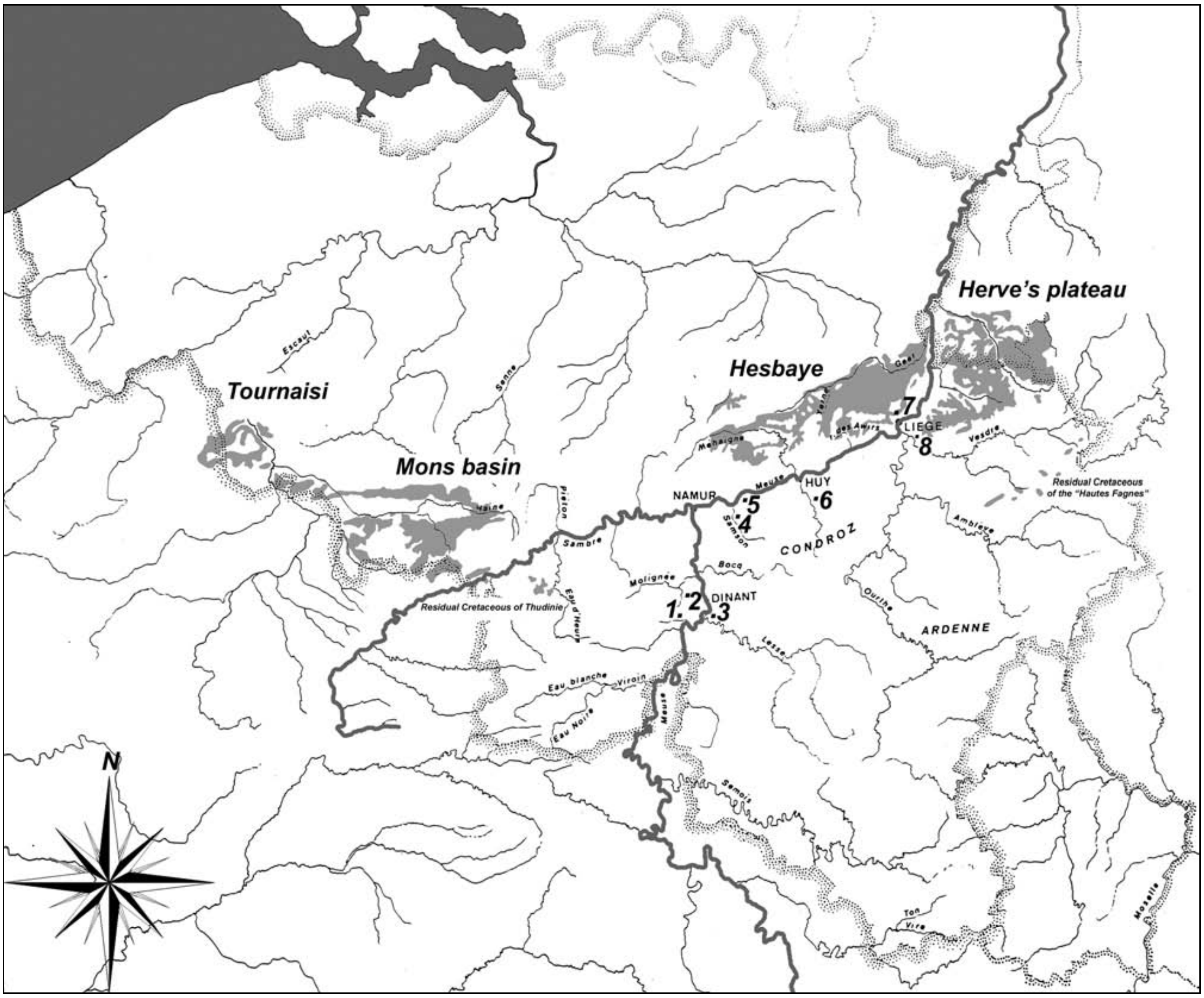

Fig. 4.1 – Localization of Scladina Cave and others Middle Palaeolithic sites where quartzite has been used.
1. Trou du Diable; 2. Trou du Sureau; 3. Trou Magrite; 4. Goyet Caves; 5. Scladina Cave; 6. Trou Al'Wesse; 7. Sainte Walburge Palaeolithic site; 8. Bay Bonnet Caves. Are also represented Sambre and Meuse Rivers and Cretaceous outcrops from Belgium (modified since Caspar, 1984)

material clearly demonstrate a greater variability in the technical behaviour than previously described (Otte *et al*, 1998). Therefore, a specific analysis of each of the raw materials is being undertaken to determine the appropriate subtleties of each assemblage. Secondarily, results obtained in this manner will permit a complete analytical overview of Mousterian behaviour in layer 5 of Scladina.

The first results of this study concern production in quartzite and more specifically techniques of debitage. The numerous refits we have carried out constitute a tremendous method for understanding several issues. The refits permit the consideration of the exploited block morphology and its impact on production as well as the subtleties of the *chaînes opératoires* and the relationship maintained between morphology and *chaînes opératoires*. Integrated into a broader perspective, quartzite products relate back to a specific management of raw materials according not only to the availability of different exploited materials, but also to their intrinsic properties (block morphology, homogeneity, fitness for debitage, hardness, granulometry).

THE RAW MATERIAL

The local environment of the site is divided into two, more or less equal, parts by the Meuse River: north and south. The geological substrate primarily consists of Palaeozoic formations (Carboniferous, Devonian, and Silurian Periods) and of some gravel layers from the Tertiary. Finally, a small Cretaceous plate not exceeding 600 meters is located on the north side of the Meuse, approximately 2.500 meters from the site. Nevertheless, the first local supply source was most probably the vast Cretaceous outcrops of the Hesbaye Plateau, the region situated beyond the Meuse at least 7 km north of the cave (*Cf.* Carte géologique de la Belgique, feuille n° 145).

The exploitation of local material outcrops (limestone and Visean chert) and of alluvial pebbles (quartz and quartzite) therefore compensated for this deficiency in local sources of flint. In regards to the Middle Palaeolithic sites of Belgium, Cretaceous flint was exploited almost exclusively when it was naturally available in the local environment of the sites (less than 5 km and without water courses to cross). The absence of flint, in some cases, generated the use of other local materials, notably to conserve the stock of imported flint.

Orthoquartzite (in the sense of Foucault and Raoult, 2005) is available in the proximity of the site in the form of pebbles from either the banks of the Meuse (located about 300 meters from the site) or from the ancient alluvial terrace (located at a distance of no more than 50 meters from the site). The dimensions and morphology of the pebbles found in close proximity to the site vary strongly as verified by the numerous pebbles recovered from non-anthropic layers of Scladina and from several surveys. On the other hand, those pebbles selected for the production of artefacts were chosen from within this broad range. The selected blocks were primarily ovoid or spherical in shape with dimensions between 6 to 15 cm maximum length. By contrast, none of the selected blocks indicated a detectable preference for texture (sometimes fine, sometimes coarse) or for the colour of the material (different shades of grey, pink, or red).

Three pebbles (grey-green, light grey, and dark grey) possessed a different morphology: the blocks were parallelepipedal with rounded angles.

Some specific varieties of quartzite were favoured for connection (“rapprochements” in the sense of Bordes, 2000; cit. by. Porraz, 2005) and refitting of pieces. Today, these reconstructed blocks permit the consideration of gaps in some of the refits as a real absence in the actual collection as no other pieces could be reapplied to them.

THE COLLECTION

The series is composed of 763 pieces if 21 additional pebbles of raw material are included: those in which the anthropic origins are not assured (n=15); those which served exclusively as hammers (n=4), and those which are only tested (n=2). For the assemblage of artefacts, 157 could be reassembled comprising 50 refits of two to ten pieces.

In parallel to the general inventory which monitors the Scladina collections, the ensemble of lithic material was subdivided in accordance with the raw material and was specifically recorded. A series of identifiers were applied to the material and were composed of an abbreviation of the primary material (Qt in the case of quartzite) and a continuous numerical ordering. Each code thus created (Qt-123 for example) relates either to a group of pieces (of similar aspects or reassembled) or to an isolated piece which presents a noteworthy character (nucleus or hammer, for example).

In a desire for clarity, each piece described in this study will be called by its registration number in order to establish a complete one to one correspondence between the material and the published results. This system will also be applied in subsequent studies. (all the illustrations in this papers, it’s avai-lable on the website of Scladina: www.scladina.be/lithic).

THE REFITS

Twelve refits in particular permit the interpretation of the *chaînes opératoires* either because they are complete or because they show evidence of certain technical characteristics. These refits demonstrate the co-existence of three standardized conceptions of a much more flexible debitage where the gestures are relatively unpredictable and directed toward the production of rough slices without any concern for morphological standardization of the blanks. Two of these refits also showed the application of different *chaînes opératoires* on certain pebbles.

Alternating perpendicular debitage on two surfaces

The Qt-87 refit series presents a very complete succession thanks to nine pieces. The quartzite pebble was first split in two (widthwise), by percussion producing two half cores which were subjected to separate exploitation. One of the two halves was attested to by only one flake which fit on the second part. Therefore, the half pebble constituting the nucleus of this flake is totally absent from the collection.

The exploitation of the second half of the pebble is initialized by the detachment of three flakes, marked by two negatives and a distal fragment of a flake produced in part from the platform freed by the first impact. These slender products precede the production from the same striking platform of a massive flake, which opens a broad surface for flaking (surface A) forming an angle of approximately 85° with the surface of the striking platform (surface B). The preparation of the butt of this very exceptional flake on this material is interpreted as a thinning down of the bulb resulting from the initial impact.

The following removals, marked by three negatives and a flake, are detached on surface B from surface A. The flake (56 mm maximum length) illustrates the production of asymmetrical products at the same time as the installation of technical criteria in preparation for the following phase of debitage on surface A.

Two asymmetric flakes with a back mark the final phase of debitage prior to the abandonment of the nucleus after several failed attempts (noted by a refit series and six fractures on the nucleus).

Refit series Qt-63 recreates a parallelepipedal pebble with rounded angles of moderate dimensions (around 7 cm on the side). The first flake struck initializes the production on surface A benefiting from the rounded angles. This massive flake follows a plan of pre-existing weakness in the pebble. The second flake, asymmetric and possessing a large cortical butt, had been detached in the same way and from the same curve. A third removal from the same surface ended the sequence of debitage on surface A.

Three removals noted by two negatives and a reassembled piece, were subsequently detached from surface B. The reassembled flake is a massive cortical removal, preceded by three fruitless attempts, marked by negatives which created an angle of approximately 80° between the two surfaces. The ensuing two removals were hinged which probably justified the abandonment of the nucleus at this stage of production.

Finally, several flakes on surface B, removed from a third surface were not successful in initiating a new sequence of production. Their position in the *chaîne opératoire* occurred sometime between the first sequence of debitage on surface A and the abandonment of the nucleus.

Refit series Qt-64 shows a series of four removals detached from the same surface (A). The butt of the last flake is not positioned against the surface exploited as the striking platform on surface A but farther behind the middle of the block of raw material which involved the removal of one or several flakes on a second surface B using the first surface (A) as the striking platform.

The Qt-106 refit series shows a sequence of removals on only one surface. The presence of the negative of a perpendicularly removed cortical flake indicated the initiation of debitage on the second surface.

Unifacial debitage

Refit series Qt-91 contains three pieces and marks a sequence of five flakes removed from the same single striking platform developed by the removal of at least one flake started from the cortical surface. The flake products were asymmetrical, elongated, relatively large in size (67, 83, and 94 mm), and with a sharp edge opposing a cortical back.

The Qt-100 refit series is composed of four pieces and is marked by a sequence of 10 centripetal removals on the same surface. The products are slightly asymmetrical and a centripetal modality permits the combination of flake production and the maintenance of convexities on the surface of debitage without going through a specific sequence of preparation.

On the Qt-65 series, four pieces show a management of the surface of debitage similar to that of Qt-100. Four of the pieces show a large cortical butt in opposition to a sharp edge and the last shows a cortical back.

Unipolar debitage in slices

The Qt-85 refit series illustrates the exploitation of an ovoid pebble on a single surface in a unipolar mode. We have distinguished it from other unifacially knapped pebbles by the morphology of the block used, the unipolar modality, and the angulations between the surface of the striking platform and the surface of debitage.

The pebble presents a flat, ellipsoidal morphology. The widest ellipse (determined by the intersection of the ellipsoidal and the plane passing through the longer and the larger axis of the ellipse) attracted the knapper who used it like a single surface of a striking platform throughout the production.

At least four flakes had been removed from the nucleus, of which three were marked by reassembled pieces. The sequence of production is initialized by the detachment of one or several flakes which created a surface of debitage. The angle with the striking platform is around 60° and varied little during the exploitation.

In regards to the reapplied flakes, all had been broken in two according to their length at the moment of debitage (Siret accidents). The pieces which came from this block are easy to isolate, according to the specific colour, but only one refit series between two parts of a flake can be done.

Important crushing scars on the surface of the striking platform of the nucleus, located approximately 1 cm from the ledge, were interpreted as aborted attempts of debitage for a final removal before the abandonment of the nucleus. The concentration and importance of the scars of percussion demonstrate a very high precision of movement, all the more remarkable in view of the nature of the material and the size of the reduced nucleus which obliged the knapper to strike with strength in the immediate proximity of his fingers.

The morphology of the flakes removed from this block is asymmetrical with rough edges opposing a large, curved, thin cortical back.

The succession of concepts of debitage within a single block

Refit series Qt-84 revealed a block for which the morphology was almost complete thanks to nine pieces. The sequence was initialized by a flake perpendicular to the length of the pebble in order to remove the top cortex. This surface served as the striking platform for the detachment of four unipolar removals which started the debitage on the surface A. Two flakes, marked by their negatives, and two others, reassembled, illustrated debitage on surface B from the same surface A. In this way, the first phase of debitage operated on two perpendicular surfaces which alternately served as the striking platform and the surface of debitage. The flake products on surface A are longer than those on surface B.

A gap in the refit series prevents the capture of the passage of debitage to a single surface, no doubt consecutive with the opening of the angle formed by surfaces A and B. This last then becomes a unique surface of debitage and the periphery of the pebble becomes a preparation surface for the striking platform showing six negatives and a reassembled flake which testifies to a cursory preparation of the striking platform.

The Qt-111 refit series brings together 9 flakes on their nucleus, which allows the comprehension of all the nuances of its exploitation (fig. 4.1). A first thick, cortical flake was removed from the nucleus in order to establish a surface of debitage forming an angle of approximately 60° with the surface of the striking platform used (surface A). The weak opening of the angle thus initiated a debitage in slices which render three of the first reassembled flakes and two removals. All the flakes were products of a unipolar mode on surface A. The four first attempts of debitage are failures and only the last removal produces a piece of large size (71 mm maximum length), asymmetric, with sharp edge opposing a cortical back. This flake also permits the clearing of a new surface of which the angle to the striking platform reaches 70°.

This angle continues to open with the debitage to attain 80° to 90°. From this point the pebble is exploited in a multidirectional manner.

Finally, a last series of flakes is removed on two perpendicular surfaces in alternation. A cortical flake shows the start of debitage on surface B, preceding two new removals from surface A and two others on surface B. At this stage of debitage, the two surfaces served alternately as the striking platform and as the surface of debitage in a unidirectional fashion.

Some crushing scars visible on the cortical bottom of the pebble also marked a usage as a hammer probably after its exploitation as a core.

This nucleus marks the succession of three concepts of debitage. Unipolar debitage in slices which reflects the first phase of reduction gives way to a multidirectional debitage following the gradual opening of the angle formed by the cortical striking platform and the surface of debitage. Finally, a technical breakdown is observed at the end of the second phase with exploitation on two perpendicular alternate surfaces. Therefore, this reduction sequence illustrates a wonderful flexibility of concepts and their successive application in a close relationship with the morphological evolution of the nucleus.

Debitage without apparent organization

Three refits (4, 5, and 9 pieces respectively) are achieved in some of the material for which the colour was particularly favoured and unfortunately with an apparent absence of an organization of debitage.

The first (Qt-86) shows a debitage of three flakes from a plane of the cortical surface. The production had been abandoned as soon as the natural striking platform was too reduced as marked by the nucleus.

The second (Qt-88) shows exploitation of a block for which the morphology is relatively quadrangular. The debitage of the first flake freed a surface used as a striking platform for the removal of two massive, cortical flakes on a perpendicular surface. One reassembled piece shows that subsequently, a cortical surface perpendicular to the first striking platform had been exploited for the detachment of flakes whose orientation also perpendicular to the direction of the first debitage. Thus, the position of the nucleus in the hand of the knapper was not fixed and appears to vary according to the opportunities. Two flakes of large dimensions were realized in the same green quartzite resembled those from Qt-58.

The last (Qt-81) is one of the most complete though no specific management of the block could be found. Each removal was detached according to the results obtained in the previous removal and the core turned constantly in the hands of the artisan.

These three refits indicate that the initial morphology of the pebble created a different technical behaviour from those applied to ovoid pebbles. A parallel exists with the quartzite industry of Trou du Diable where the same variability in the morphology of pebbles also engendered different behaviours (Di Modica, 2004 and 2005).

THE NON-REFITTED PRODUCTS

The nuclei

Six non-reassembled nuclei have been examined. Three were the cortical bottoms of pebbles which possessed a single surface of debitage shown as negatives of centripetal removals (Qt-112, 116, and 121). They were not very thick (36, 34, and 22 mm respectively) indicative of their important state of exhaustion. Some traces of crushing on the cortical bottom of nucleus Qt-112 and Qt-116 show a final usage of the block as a hammer before the abandonment of the piece.

The nucleus Qt-114 shows scars of debitage on two perpendicular surfaces in alternation. Some hinged flakes produced from the cortical surface opposite surface A, showed final attempts of debitage before the abandonment of the block.

The Qt-120 nucleus shows a unique technique of debitage for the collection brought about by the specific morphology of the exploited pebble. The flat, relatively thin pebble (31 mm) was exploited from a broad cortical surface. The result is a series of small flakes with a cortical back and sometimes possessing distal cortical excess, indicated by a dozen negatives on the nucleus and some non-reassembled but very similar flakes (Qt-25) This type of debitage is unique in the collection but a quartzite nucleus from Trou du Diable (Di Modica, 2003 and 2005) allows us to consider this type of exploitation as the result of a specific and recurrent intention directly related to the morphology of the pebble.

Nucleus Qt-56 is a nodule exploited on at least four surfaces. The reduced size shows that the nodule is one of the smaller cores in the series with only 42 mm maximum length. The absence of a specific organization of the block allows us to interpret it as a totally exhausted block.

The flakes

Not reassembled, the flakes reveal extremely limited technological information by comparison with the nucleus and, all the more so, with the refits. The sizes of these pieces are consistent with those from exploited blocs and essentially with a size between 2 and 7 cm maximum length (Otte and Bonjean, 1998). Beyond 7 cm, only nine pieces could not be reassembled of which six came from ovoid pebbles and three from parallelepipedal pebbles.Among the pieces from ovoid pebbles were five cortical flakes (Qt-23, Qt-26, Qt-27, Qt-34 and Qt-39) and a flake with a cortical back opposing a sharp irregular edge (Qt-42). For the other pieces, one knapped on green quartzite (Qt-58) resembled the only refit series in this colour of quartzite (Qt-88) and the other was knapped on black quartzite (Qt-61)

The last flake, which reached 117 mm maximum length, is the largest piece from the collection and presents six negatives of centripetal removals. The dimensions of this piece and its uniqueness in the collection lead us to consider it as an isolated product knapped at the supply source and taken to the site. In effect, this piece exhibits not similarity to any other pieces (reassembled or not).

Therefore, this piece shows an additional difference in the management of raw materials since beyond the variability of the debitage indicated by the refits and the cores it splits the activity of debitage into two distinct phases as much geographical as chronological.

HAMMERS, TESTED BLOCKS AND PEBBLES

The selection of pebbles according to their morphology shows first a choice of the raw material. In addition, the Scladina collection contains several nucleus or refits used as hammers in a final stage as well as twenty-two barely touched pebbles used either as hammers or never used.

Three refits are particularly interesting because they indicate either an initial attempt of debitage or some consecutive removals from use like a hammer. On two of these blocks (Qt-109 and Qt-173) it seems related to small removals while on the third (Qt-115), important scars of crushing and an incipient cone mark an attempt to initialize debitage. Following these trials, the pebble had been split in two along the length of a pre-existing weakness in the material. One of the two pieces had been abandoned while the other had been split along the breadth of the half pebble. One of the quarter pebbles obtained served for the removal of five flakes on the cortical periphery along the last ruptured surface.

Four pebbles (Qt- 53, Qt-110, Qt-157 and Qt-168) present unique traces of crushing and are interpreted as hammers.

Four pebbles (Qt-152 and 158) possessed some negatives of removal without any trace of impact and were interpreted as tested blocks. For Qt-158, the morphology of the block, its ergonomics, and the position of three removals forming a large cutting edge on the longitudinal axis of the pebble could suggest a chopper.

Eight pebbles of very important dimensions presented a unique removal. These characteristics did not permit us to consider the removal of these flakes as the result of an anthropic action (Qt-156, Qt-169, Qt-170, Qt-172 and from Qt-174 through Qt-177). Their anthropic origin is probable but, in this case, their function is uncertain.

Again, the situation is less distinct for seven untouched blocks. The absence of all scars does not permit us to declare an anthropic origin. These blocks could very well have been introduced into the layer by colluviums which carried pebbles from the ancient Mosan terraces following the example of those which are observed in other layers.

SYNTHESIS: QUARTZITE EXPLOITATION AT SCLADINA

The actual assemblage of quartzite artefacts from layer 5 is the result of an exhaustive and not completed collection which permits us to accomplish a number of refits, some of which are very complete. As a result, this assemblage is quite exceptional for the Middle Palaeolithic of Belgium and forms the foundation for understanding the practical details of the exploitation of blocks.

Within a complex system of raw material management where rock is treated specifically as a function of its geographical origin (Moncel, 1998, Otte and Bonjean, 1998), the quartzite products show a great behavioural elaboration for the raw materials of local origin that was unsuspected until now (Fig. 4.2).

The place of acquisition of material is also that of the first debitage. The meticulous selection of pebbles according to the morphology accompanies the first test and from the

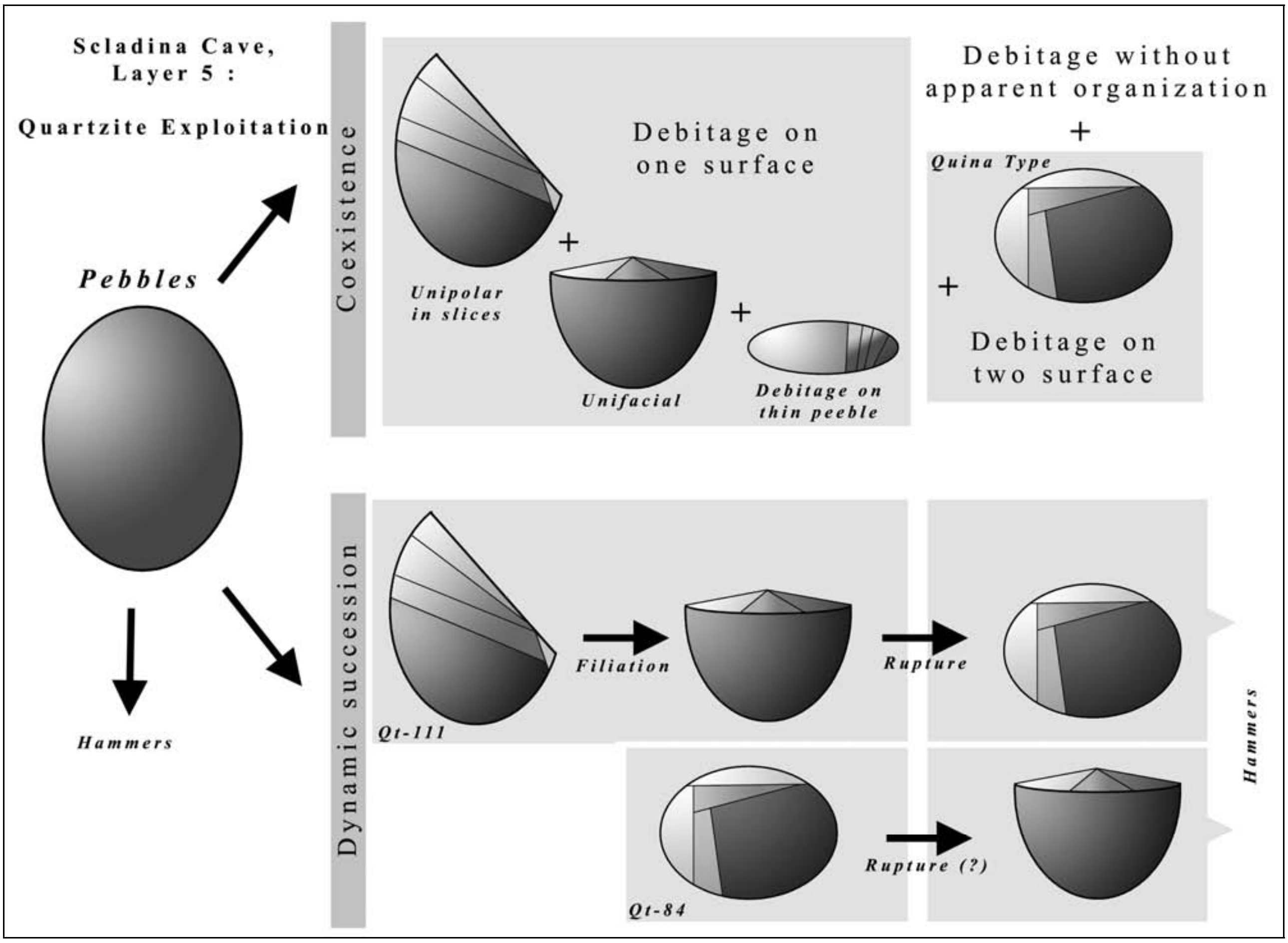

Fig. 4.2 – Schematic representation of quartzite exploitation in layer five of Scladina Cave. The successions of different concepts of debitage on the same block lead us to speak about filiations and ruptures between theses concepts. For example, it is easy to pass progressively from unipolar debitage in slice to unifacial centripetal debitage, but there is a radical change in the treatment applied to the nucleus when the knapper pass to Quina debitage on two perpendicular surfaces

production of flakes of which at least one, of good quality, will certainly be carried back to the site. In the catchments zone and probably during occupation of the cave, the Neanderthals developed some activities which had a direct impact on those carried out at the site. The choice of material and the first stages of debitage circumscribe their subsequent production in a specific morphometric field. Once the blocks are brought back to the site, new choices operate in relation to the function attached to each pebble. Some pebbles become cores, others hammers, and sometimes this occurs successively. The blocks are exploited according to several flexible concepts of debitage, as much adapted to the mechanical constraints of the material as to the morphology of the nucleus. In addition, we connect some of these ideas to others already defined. The unifacial debitage corresponds, according to us, to a much expanded version of Levallois (Boëda, 1994); highly simplified in order to adapt to the constraints induced by the nature and morphology of the exploited block. This important adaptation of the concept is not specific to Belgian territory; it is already in evidence in the exploitation of flint pebbles in the Middle Palaeolithic of Normandy (Monnier *et al*, 2002; Guette, 2002). Debitage on two perpendicular surfaces compares with Quina debitage such as defined by L. Bourguignon (1997). The flexibility and complimentarity of these concepts is particularly evident in their succession on certain blocks.

All the stages of production are therefore represented at the site, but in unequal proportions. Thus, if the debitage in particular is illustrated, the unretouched edges seemed favoured as demonstrated by the low quantity of retouched pieces.

Beyond the restrictive vision of considering quartzite as a simple palliative for flint, the production of asymmetric flakes according to several concepts of debitage, perfectly adapted and adaptable to the morphology of the block, relates back to a particular intention to exploit the intrinsic characteristics of the material. The low number of retouched pieces must, according to us, be understood in this sense. The activities necessitating retouch of the edges had principally been realized on flint, while other activities had been preferentially carried out on reputedly unproductive local rocks such as quartzite, but also quartz or chert, with unretouched tools.

Therefore, beyond the functional interdependence of different supply areas of raw materials, the quartzite series illustrate an internal variability, not only in the exploitation of the local raw material, but also in only one of these materials. Understanding quartzite in this way provides new insight into all the industry from layer 5. Notably, this insight permits the justification of the intensive exploitation of local raw material and provides, especially, a better way of understanding the predominance of a raw material wich is particularly difficult to work: quartz.

REGIONAL CONTEXT

The quartzite production from Scladina fits harmoniously within an original system of raw material management (Di Modica, à paraître), marked by certain difficulties with flint supplies due both to the distance from the main outcrops and topography, because the Cretaceous deposits were situated on the other bank of the Meuse River.

In this case, the outcrops of local raw materials and some alluvial pebbles were exploited. If Scladina constitutes a more interesting example for the study of these rocks, some other anciently excavated sites bring their own contribution, more or less, according to the exhaustiveness of the collection.[1]

In the precise case of quartzite, contained in six sites, a veritable parallel may be made with the lithic industry of Trou du Diable in Hastière-Lavaux (Di Modica, 2003, 2005). There one observes the same technical variability and the same orientation of the production towards asymmetric blanks with a cortical back opposing a sharp edge.

The impressive quantity of refits achieved with the industry opens some new perspectives: some methodological, some technological. First, methodological because these patterns permit more efficient observations than those obtained on only flakes and nuclei. They also allow us to critique the pertinence and the meaning of concepts of debitage such as those described at the moment, not only in terms of subsequent variability and evidence of the coexistance of *chaînes opératoires* on this material, but also from their dynamic succession within the same block. Thus, on the same unattractive material, the ingenuity of the knapper is expressed as much as the subjectivity of the prehistorians, who are too habituated to the compartmentalization of concepts in strict definitions which they entrench in dogma as soon as they define them.

[1] Trou du Sureau, Trou Magrite, Trou du Diable, Trou Al'Wesse, Palaeolithic site of Engihoul, Goyet Caves. One flake in quartzite has also been collected at the site of Sainte-Walburge, north of the Meuse River, in Liège (Ulrix-Closset, 1975). According to its uniqueness in a complete industry of more than eight thousand pieces (8.000), we do not consider it as representative of a particular strategy of exploitation of raw material. There is a similar situation in the Bay Bonnet Caves, two flakes in quartzite are registered in the collection.

Acknowledgments

The authors wish to thanks all the team of the Archaeological Centre of the Scladina Cave for all the work they're doing since 1978. They also want to thanks Cécile Jungels (Royal Belgian Institute of Natural Sciences) and Anne Hauzeur (National Museum of History and Art, Luxembourg) for the review of this paper. Especially, we would associate Sheryl Roy (Malaspina University College, Canada) for his translation of this text from French. Last but not least, Rebecca Miller had the kindness to review a last time the English version.

References

BOËDA, E. (1994) *Le concept Levallois: variabilité des méthodes*. Paris: éditions du CNRS. 280 p. (Monographie du CRA, 9).

BORDES, J.-G. (2000) La séquence aurignacienne de Caminade revisitée: l'apport des raccords d'intérêt stratigraphique. *Paléo.* Les Eyzies-de-Tayac. N°12, p. 387-407.

BOURGUIGNON, L. (1997) *Le Moustérien de type Quina: nouvelle définition d'une entité technique*. Thèse de doctorat en Lettres et en Sciences Humaines, Spécialité Préhistoire, Université de Paris X Nanterre. Paris. 654 p.

CARTE GEOLOGIQUE DE LA BELGIQUE: FEUILLE 145, ANDENNE – COUTHUIN [Matériel cartographique]/ Commission Géologique de Belgique. – Echelle 1/40.000. – Bruxelles: Institut Cartographique Militaire, 1901.

DI MODICA K. (2003) *Stratégies d'exploitation différentielle des ressources lithiques au Paléolithique moyen: l'industrie moustérienne du Trou du Diable à Hastière-Lavaux- (Hastière, prov. de Namur).* Mémoire de Licence non publié de la Faculté de Philosophie et Lettres, Université de Liège. Liège. 229 p., CCXXIII ill.

DI MODICA, K. (2005) Le Trou du Diable (Hastière-Lavaux, prov. de Namur, Belgique): stratégies d'exploitation des ressources lithiques au Paléolithique moyen, *Anthropologica et Praehistorica*. Bruxelles. 116, p. 99-148.

DI MODICA K. (à paraître) Contraintes naturelles et implantations moustériennes dans le bassin mosan (Belgique). In *XVe congrès de l'U.I.S.P.P., session C.34: Settlement Systems of the Middle Paleolithic and Middle Stone Age*. Lisbonne.

FOUCAULT, A.; RAOULT, J.-F. (2005) *Dictionnaire de Géologie*. 6ème édition. Paris: Éd.Dunod. 386 p.

GOEMARE, E. *et. al*. (à paraître) – Les roches taillées et débitées durant le Paléolithique et le Mésolithique en Belgique: mise au point sémantique, critères d'identification macroscopique et implications archéologiques. *Anthropologica et Praehistorica*. Bruxelles.

GUETTE, C. (2002) Révision critique du concept de débitage Levallois à travers l'étude du gisement moustérien de Saint-Vaast-la-Hougue/le Fort (chantiers I-III et II, niveaux inférieurs) (Manche, France). *Bulletin de la Société Préhistorique Française*. 99, p. 237-248.

MONCEL, M.-H. (1998) L'industrie lithique de la grotte Scladina (Sclayn). La couche moustérienne éémienne 5. Les comportements techniques et les objectifs de la production dans un moustérien de type Quina. In Otte, M.; Patou-Mathys M.; Bonjean D., eds. lits. – *Recherches aux grottes de Sclayn. Volume 2. L'Archéologie*. Liège: E.R.A.U.L., p. 181-247. (Etudes et Recherches Archéologiques de l'Université de Liège; 79).

MONNIER, J.-L. *et. al*. (2002) Stratigraphie, paléoenvironnement et occupations humaines durant le dernier interglaciaire dans l'ouest de la France (Massif Armoricain). Comparaison avec l'interglaciaire précédent. In Tuffreau, A.; Roebroeks, W., dir. – *Le Dernier Interglaciaire et les occupations humaines du Paléolithique moyen*. Lille: Centre d'Etudes et de Recherches Préhistoriques. p. 115-142. (Publications du Centre d'Etudes et de Recherches Préhistoriques; 8).

OTTE, M.; BONJEAN, D. (1998) L'outillage. In Otte, M.; Patou-Mathys M.; Bonjean D., eds. lits. – *Recherches aux grottes de Sclayn. Volume 2. L'Archéologie*. Liège: E.R.A.U.L., p. 127-179. (Etudes et Recherches Archéologiques de l'Université de Liège; 79).

OTTE, M.; PATOU-MATHYS M.; BONJEAN D. [eds lits.] (1998) *Recherches aux grottes de Sclayn. Volume 2. L'Archéologie*. Liège: E.R.A.U.L. n°79. 437 p.

PIRSON, S. *et. al.* (2004) La nouvelle séquence stratigraphique de la grotte Walou (Belgique). *Notae Praehistoricae*. Mons. 24, p. 31-45.

PIRSON, S. *et. al.* (2005) Révision des couches 4 de la grotte Scladina (comm. d'Andenne, Namur) et implications pour les restes néandertaliens: premier bilan. *Notae Praehistoricae*. Gent. 25, p.61-69.

PORRAZ, G. (2005) *En marge du milieu alpin. Dynamique de formation des ensembles lithiques et modes d'occupation des territoires au Paléolithique moyen*. Thèse de Doctorat en Préhistoire, Archéologie, Histoire et Civilisations de l'Antiquité et du Moyen-âge, Université de Provence. Aix-Marseille. 387 p.

VAN DER SLOOT, P. (1998) Matières premières lithiques et comportements au Paléolithique moyen. Le cas de la couche 5 de la grotte Scladina. In Otte, M.; Patou-Mathys M.; Bonjean D., Eds. lits. – *Recherches aux grottes de Sclayn. Volume 2. L'Archéologie*. Liège: E.R.A.U.L., p. 115-126. (Etudes et Recherches Archéologiques de l'Université de Liège; 79).