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NUMBER 3

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THE CUTTING EDGE:

New Approaches to the Archaeology of Human Origins

Editors

Kathy Schick
Stone Age Institute & Indiana University

Nicholas Toth
Stone Age Institute & Indiana University

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COVER CAPTIONS AND CREDITS

Top: Homo habilis Utilizing Stone Tools. Painting by artist-naturalist Jay H. Matternes. Copyright 1995, Jay H. Matternes. Inspired by a prehistoric scenario by K. Schick and N. Toth in Making Silent Stones Speak: Human Origins and the Dawn of Technology (1993), Simon and Schuster, New York. Pp.147-149.

Lower right: Whole flake of trachyte lava from the 2.6 million-year-old site of Gona EG-10, Ethiopia. Reported by S. Semaw (2006), "The Oldest Stone Artifacts from Gona (2.6-2.5 Ma), Afar, Ethiopia: Implications for Understanding the Earliest Stages of Knapping" in The Oldowan: Case Studies into the Earliest Stone Age, eds. N. Toth and K. Schick. Stone Age Institute Press, Gosport, Indiana. Pp. 43-75. Photo courtesy of Tim White.

Lower left: Prehistoric cut-marks from a stone tool on Sterkfontein hominin partial cranium StW 53. Reported by T. Pickering, T. White, and N. Toth (2000) in "Cutmarks on a Plio-Pleistocene hominid from Sterkfontein, South Africa". American Journal of Physical Anthropology 111, 579-584. Scanning electron micrograph by N. Toth.

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CHAPTER 5

TECHNOLOGICAL STRATEGIES IN THE LOWER PLEISTOCENE AT PENINJ (WEST OF LAKE NATRON, TANZANIA)

IGNACIO DE LA TORRE

ABSTRACT

This chapter summarizes the lithic technology of two areas from Peninj, the North Escarpment and the Type Section. The purpose of this work is to introduce a comparative overview of the technological strategies in both regions. Such strategies may be studied from two prospects, that of the core reduction sequences, and through the understanding of lithic resources management in the landscape context. Combining both perspectives, hominin adaptations in the Lower Pleistocene at Peninj are explored, as well as the cultural status of the analyzed sites.

INTRODUCTION

As yet, three archaeological areas have been recognized at Peninj (Figure 1); the North Escarpment, the Type Section and the South Escarpment. Situated 8 km away from the Type Section, the North Escarpment is the most distant area from Lake Natron. In this location, Isaac (1965, 1967) excavated RHS (named afterwards Mugulud, Isaac n.d.). The South Escarpment is situated over the Sambu Escarpment, about 4 km southwest from the Type Section. Isaac (1965, 1967) excavated there the Acheulean site of MHS (afterwards named Bayasi, Isaac nd). The third area is the Type Section (named by Isaac as Maritanane), in which the Peninj delta flowed during the Lower Pleistocene. Recent works at Peninj have been focused on the Type Section, with papers already published on its palaeoenvironments, technology and zooarchaeology (Domínguez-Rodrigo et al., 2001, 2002; Mora et al., 2003; de la Torre & Mora, 2004; de la Torre et al., 2003, 2004).

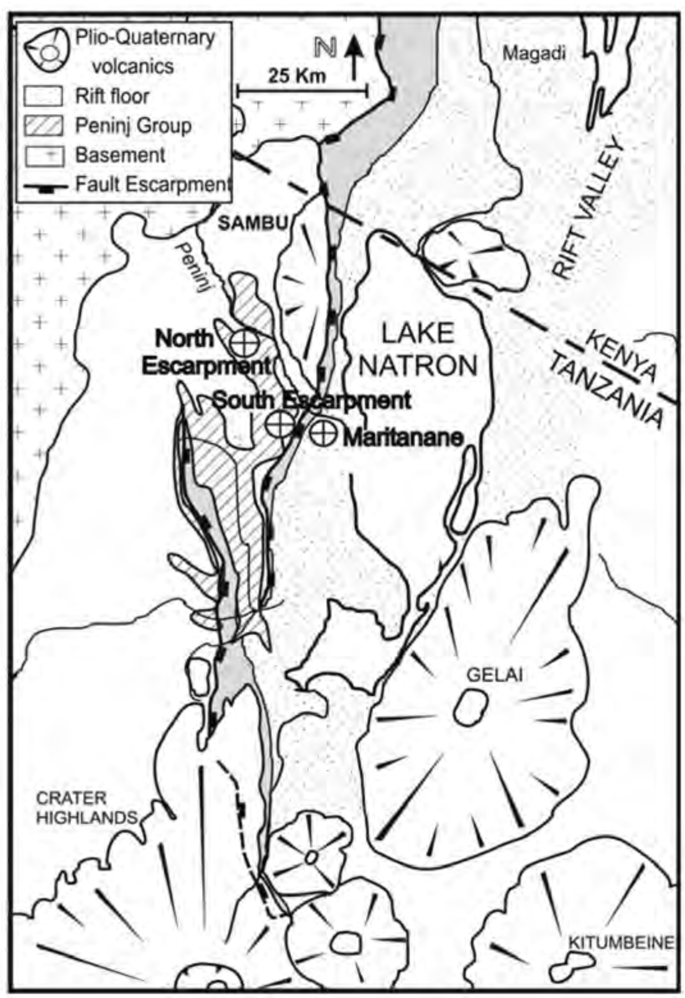

Figure 1. Map of West Natron indicating main archaeological areas (based on Luque, after Mora et al., 2003).

This work summarizes technological and cultural features from two of these zones, North Escarpment and Type Section. Up to now, the North Escarpment was only known by the short descriptions that Isaac (1965, 1967) provided on the site originally named RHS. Nonetheless, artefacts recovered by Isaac were not studied systematically until de la Torre´s (2004) review, in which preliminary results of new excavations at the site were presented. Previous publications on the technology of the Type Section (de la Torre & Mora, 2004; de la Torre et al., 2003, 2004) were restricted to the so-called ST site Complex (Domínguez-Rodrigo et al., 2002), which is just a small area within the Type Section. Following de la Torre´s (2004) study of materials at North Escarpment including Isaac´s collections and artefacts from modern excavations and at Type Section adding unpublished data from the ST Site Complex and further assemblages from this area the purpose of this work is to introduce a comparative overview of the technological strategies in both regions. Such strategies may be studied from two perspectives, that of the core reduction sequences and through the understanding of lithic resource management in the landscape context. Combining both perspectives, an exploration is possible of hominin adaptations in the Lower Pleistocene at Peninj as well as of the cultural status (Oldowan vs. Acheulean) of analyzed sites.

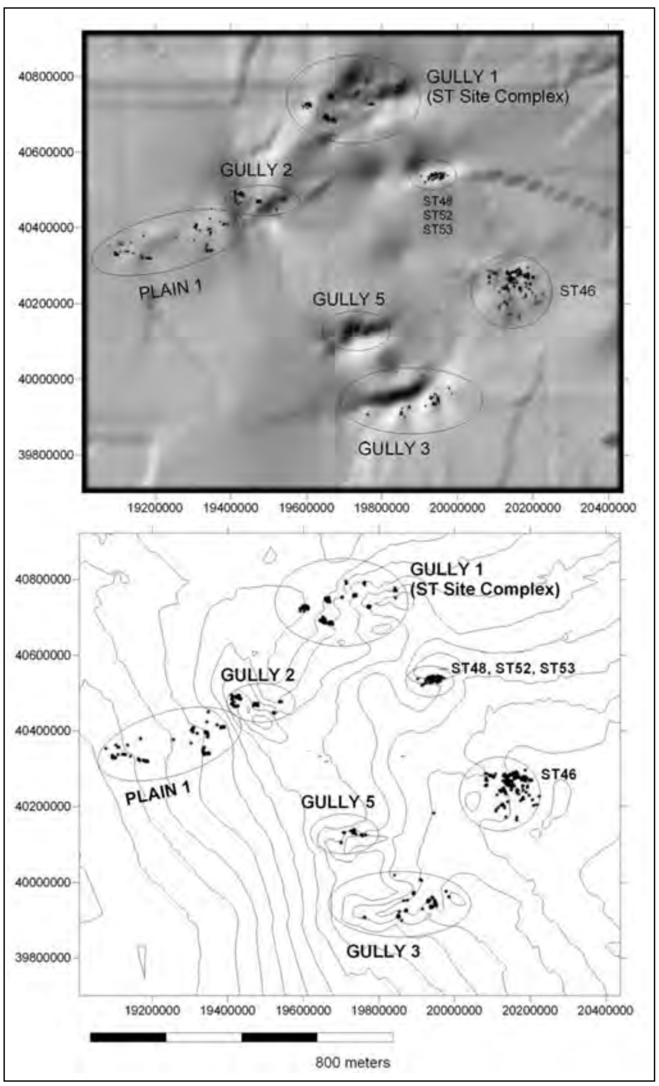

Figure 2. Location of sites in Maritanane.

Stratigraphic and Archaeological Contexts

Most of the archaeological and palaeontological sites at Peninj are located in the Upper Sandy Clays (USC) of the Humbu Formation, which are widely distributed across much of the Peninj Group outcrops, both over the Sambu Escarpment (in which North and South Escarpments are located) and in the Type Section (Maritanane area). Thickness of USC Member is variable, ranging between 4 and 20 m. The base of the Moinik Formation (which is just overlying Humbu Formation) has been dated between 1.37 myr (Isaac & Curtis, 1974) and 1.33 (Manega, 1993), suggesting an average age for

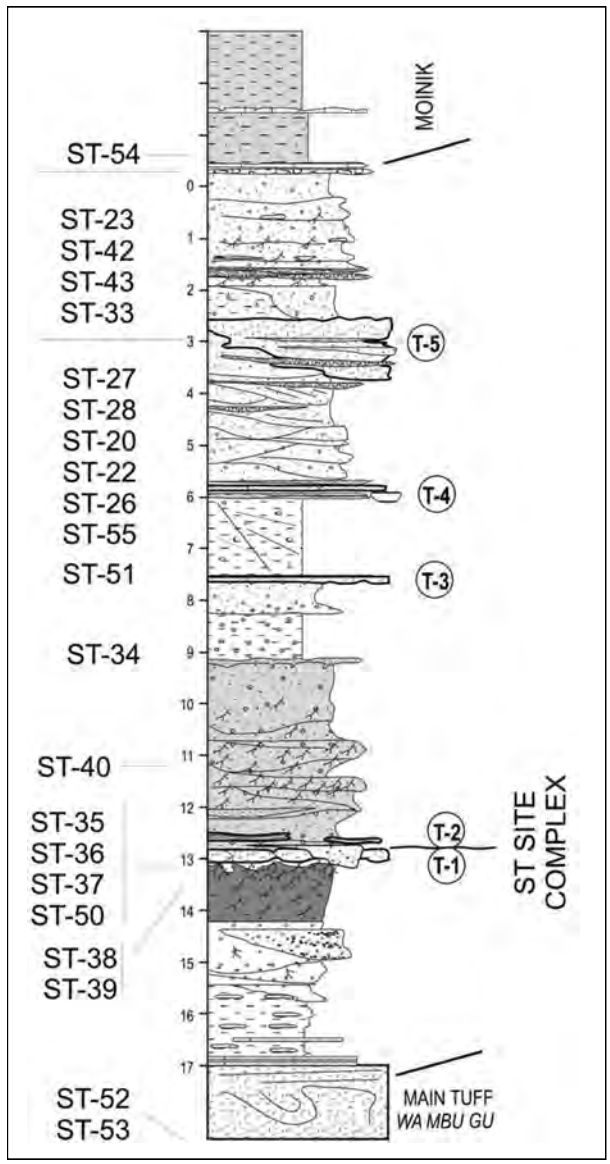

Figure 3. Stratigraphic column of the Upper Sandy Clays with position of mentioned sites in this chapter (based on Luque, after de la Torre, 2004).

sites in the Peninj USC of 1.5-1.4 myr.

In the Maritanane/Type Section, the most relevant area is the so-called ST Site Complex, situated in an upper position of the USC. The ST Site Complex is the densest patch of archaeological remains at the Type Section, also being the most homogeneous in stratigraphic terms, with all archaeological sites situated just above Tuff 1 see a detailed description in Mora et al., 2003. Nonetheless, in the Type Section there are also other gullies in which the Humbu Formation is exposed (Figure 2). In these outcrops bone and artefact densities are lower than in the ST Site Complex. These occurrences are mostly in sediments overlying the Main Tuff, and are located at a range of stratigraphic positions, at the level of the ST Site Complex, but also with some below and many above this horizon. Therefore, small artefact scatters have been identified in localities above Tuff 2, Tuff 4, Tuff 5 (Figure 3) and even in sediments from the Moinik Formation (de la Torre, 2004).

Density of each site is variable within Maritanane (Table 1); only assemblages above Tuff 1 (i.e. sites from the ST Site Complex and ST37, in Gully 2) have substantial numbers of stone tools. Excluding assemblages with artefacts from mixed stratigraphic levels (ST46 and ST48), the rest of the “STs” showed in Table 1 are just surface scattered stone tools which do not constitute archaeological sites as such. To sum up, there are only a few archaeological patches in the area known as the ST Site Complex (most of them actually surface concentrations), and a surface scattering of isolated fossils and stone tools is dispersed through the rest of the Type Section. Therefore, in Maritanene there are no further equivalents to the ST Site Complex, neither in terms of density nor total number of items. In spite of documenting bones and/or scattered artefacts in every outcrop from the USC (although usually on the surface and not in stratigraphy), in the Type Section those remains are dispersed across the landscape, not making conspicuous patches. Beyond Gully 1 (ST Site Complex), the denser patches of bones and stone tools are located in Gully 2 and Plain 1, although these do not reach the volume of materials found at the ST Site Complex. At any rate, it may be interesting to point out that several of the scatters above Tuff 1 show technical features very similar to those from the ST Site Complex, formerly considered as Oldowan (de la Torre et al., 2003).

No further sites associated to Tuff 1 have been recorded yet at Maritanane. Besides small scatters such as ST41, ST51, ST52 and ST53, the rest of the assemblages are clearly Acheulean. Both in Gully 3 and Gully 5, situated stratigraphically on the top of the Humbu Formation (below and above Tuff 5), the scarce stone tools found so far are handaxes and knives typical of Mode 2. Those artefacts, alongside the handaxes recorded at ST46 and

Table 1. Lithic collections from Peninj analyzed in this work.

Site	Number of pieces	Stratigraphic position	Area
ST51	3	Below Wambugu Tuff	Maritanane
ST52	7	Below Wambugu Tuff	Maritanane
ST53	2	Below Wambugu Tuff	Maritanane
ST38	3	Below T-1	Gully 2
ST15	12	Above T-1	ST Site Complex
ST2A	7	Above T-1	ST Site Complex
ST2C-E	146	Above T-1	ST Site Complex
ST2D	3	Above T-1	ST Site Complex
ST2G	5	Above T-1	ST Site Complex
ST3	71	Above T-1	ST Site Complex
ST30	86	Above T-1	ST Site Complex
ST31-32	70	Above T-1	ST Site Complex
ST4	91	Above T-1	ST Site Complex
ST6	11	Above T-1	ST Site Complex
ST35	6	Between T-1 and T-2	Gully 2
ST36	16	Between T-1 and T-2	Gully 2
ST37	54	Between T-1 and T-2	Gully 2
ST50	7	Between T-1 and T-2	Gully 2
Plain 1	13	Between T-1 and T-2	Gully 2
ST40	6	Above T-2	Gully 2
ST34	15	Between T-2 and T-3	Gully 2
ST20	4	Below T-5	Gully 3
ST22	3	Below T-5	Gully 3
ST55	2	Below T-5	Gully 3
ST28	2	Below T-5	Gully 4
Gully-5	2	Below T-5	Gully 4
ST33	4	Above T-5	Gully 2
ST23	2	Above T-5	Gully 3
ST42	8	Above T-5	Gully 3
ST43	3	Above T-5	Gully 3
ST54	11	Moinik	Maritanane
Gully-3	3	Indetermined	Gully 3
ST46	96	Mixed	Maritanane
ST48	30	Mixed	Maritanane
Mugulud (EN1)	508	Above Wambugu	North Escarpment

ST48, suggest that during the sedimentation of the upper part of the Humbu Formation, transporting of large cutting tools to the delta of the Peninj river was a recurrent behaviour. Raw material types and the big size of blanks among handaxes suggest that their catchment area was distant from Maritanane, contrasting with the small cores and flakes found at the ST Site Complex. This tendency towards an input of high-quality basalts and big sized blanks increases in a site placed in the overlying Moinik Formation, at ST54, huge flakes in fine-grained lava have been shaped through systematic soft-hammer *façonnage,* to produce finely trimmed bifaces.

It is not well understood when and how input of handaxes to the Type Section started, although it does seem that at the top of the Humbu Formation this became a systematic pattern. Whether this is due to diachronic issues (the ST Site Complex underlies sites from Gully 3, Gully 5 and Moinik Formation) or to a change in the use of landscape is still a rather difficult question to address.

The scattered distribution of several sites with low densities of archaeological remains at the Type Section contrasts with the pattern observed in the North Escarpment, in which there are very few sites across the landscape (Figure 4); RHS-Mugulud (named recently as EN1), already discovered by Isaac, is the only relevant site recorded as yet. Further assemblages such as EN2, EN3, EN4 and EN5, in the surrounding area of Mugulud (see Figure 4), bear far fewer artefacts than the latter. Being the single significant site in the North Escarpment, Mugulud is particularly relevant since in this specific part of the landscape there is an outstanding concentration of stone tools. Therefore, in less than 200 square meters and in a discrete temporal span (on the top of the Humbu Formation or perhaps at the base of the Moinik Formation), this single site contains more than 160 kilograms of lithic materials. On the contrary, in the entire Type Section–a region with several square kms and with archaeological evidences across all the upper half of the Humbu Formation–aggregates total slightly more than 80 kilograms of stone tools. This significant imbalance among the Type Section and North Escarpment may be considered from two complementary points of view, technology and use of landscape. Both will be reviewed in forthcoming sections, as well as the debate on the status of those industries, clearly Acheulean at Mugulud, but not as obviously Oldowan in the Type Section, such as suggested by de la Torre et al. (2003).

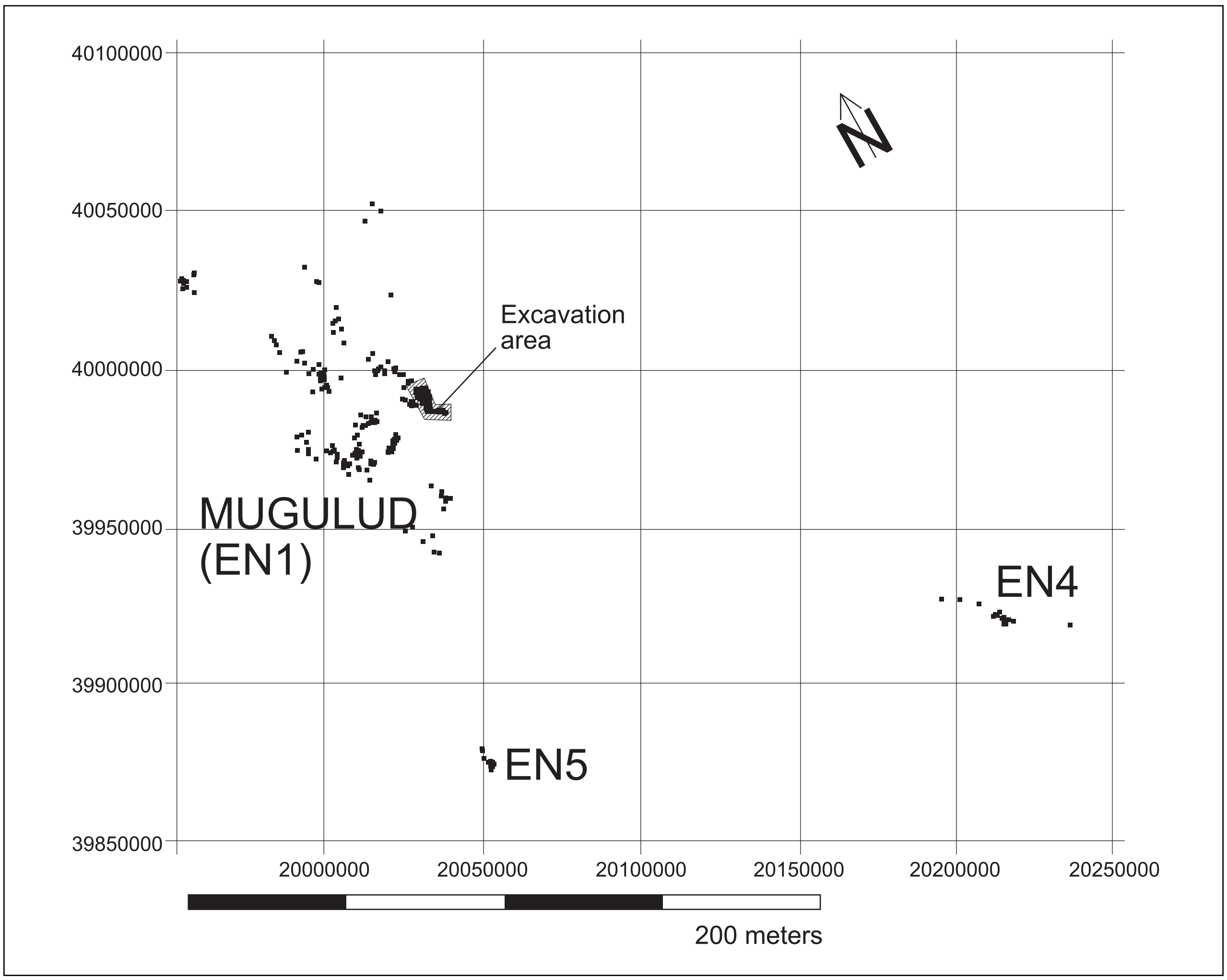

Figure 4. Location of main sites in the North Escarpment.

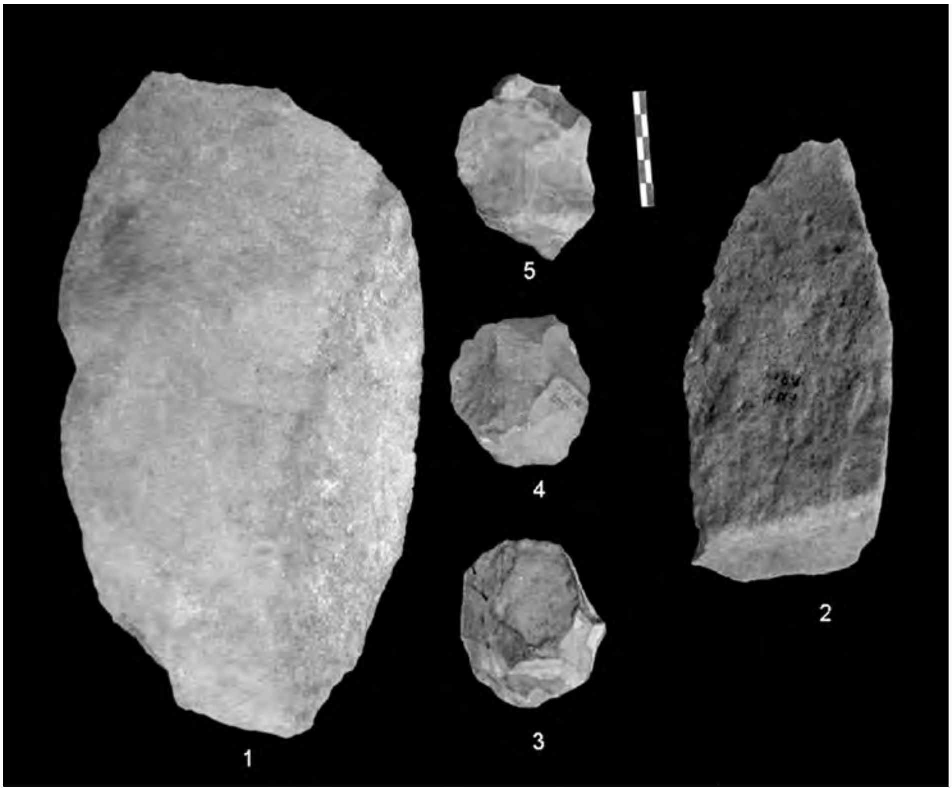

Figure 5. Lithic examples from recent excavations in Peninj. (1-2) Large cutting tools from the North Escarpment. (3-5) Hierarchical bifacial centripetal cores from Maritanane.

TECHNOLOGY AND *CHAÎNES OPÉRATOIRES* AT PENINJ

In Peninj both small-sized *débitage* and typically Acheulean large cutting tools are found. Examples from Figure 5 show that dichotomy; pieces 1 and 2 are flakes resulting from the production strategy of large blanks in the North Escarpment. Examples numbered 3-5 are cores from which even smaller flakes are detached in the Type Section. Given the very size of stone tools such as those from Figure 5, it becomes difficult to support the idea that there is a single *chaîne opératoire*. But size is not the unique argument, and the analysis of knapping methods provides further insights on this issue:

Reduction sequences of small-sized *débitage*

Exploitation types of small-sized cores in the ST Site Complex at Peninj have been already described elsewhere (de la Torre & Mora, 2004; de la Torre et al., 2003, 2004). Therein, the most relevant knapping method is the so-called hierarchical bifacial centripetal method. This system is not only found at the ST Site Complex, but also in other assemblages from Maritanane, and even in the North Escarpment. Examples from the Type Section (Figures 6-9) and Mugulud in the North Escarpment (Figures 10-12) display most of the technical features considered by Boëda (1994: 255) as typical of the Levallois method, such as:

1. Volume of the core is divided into two asymmetrical, secant (intersecting) surfaces with opposing convexities.
2. Those surfaces are 'hierarchized'. The main one is used to obtain flakes through a centripetal structure, and the other side is used to prepare the flake removals on the main surface of the core.
3. The secondary plane (knapping platform) shows secant flakes to the edge dividing the core in two sides, being therefore perpendicular with respect to the flaking axis on the main surface.
4. Angles of the flake removals on the main surface are parallel or sub-parallel to the plane created by the intersection of both surfaces.
5. The technique used in this method is based on direct percussion with hard hammer.

In previous works (i.e. de la Torre et al., 2003, 2004) it has been suggested that, despite reservations imposed by the chronological leap, the hierarchical bifacial centripetal method is following Boëda´s (1993, 1994) criteria similar to the centripetal recurrent Levallois method typical of the Middle Palaeolithic. Thus, in Peninj's cores there is a hierarchical structure of the surfaces, with a plane of intersection in which secant scars to an edge serve as striking platforms for knapping onto the main surface. Moreover, the main surface of Peninj cores shows a more or less centripetal pattern, in which scars are parallel or subparallel to the plane of intersection. Finally, the structure of the knapping surface is not interchangeable along the entire reduction process.

All of this led us to propose in previous works that the hierarchical bifacial centripetal method is the result of a precise technological knowledge, mental template

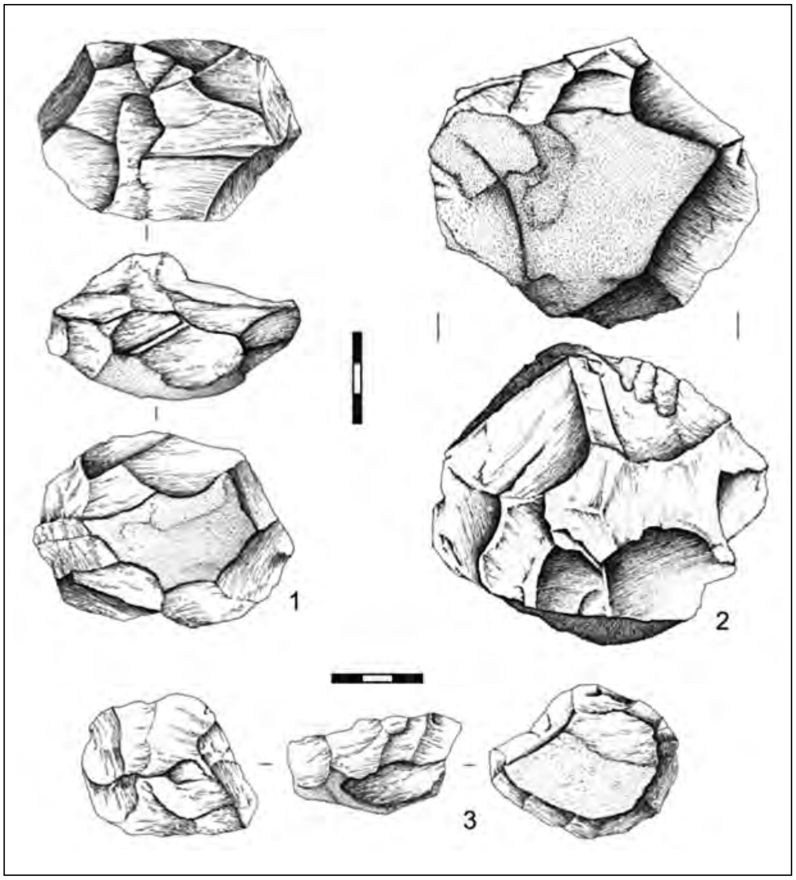

Figure 6. Hierarchical bifacial centripetal lava cores from ST4 in different reduction stages (drawn by Noemi Morán).

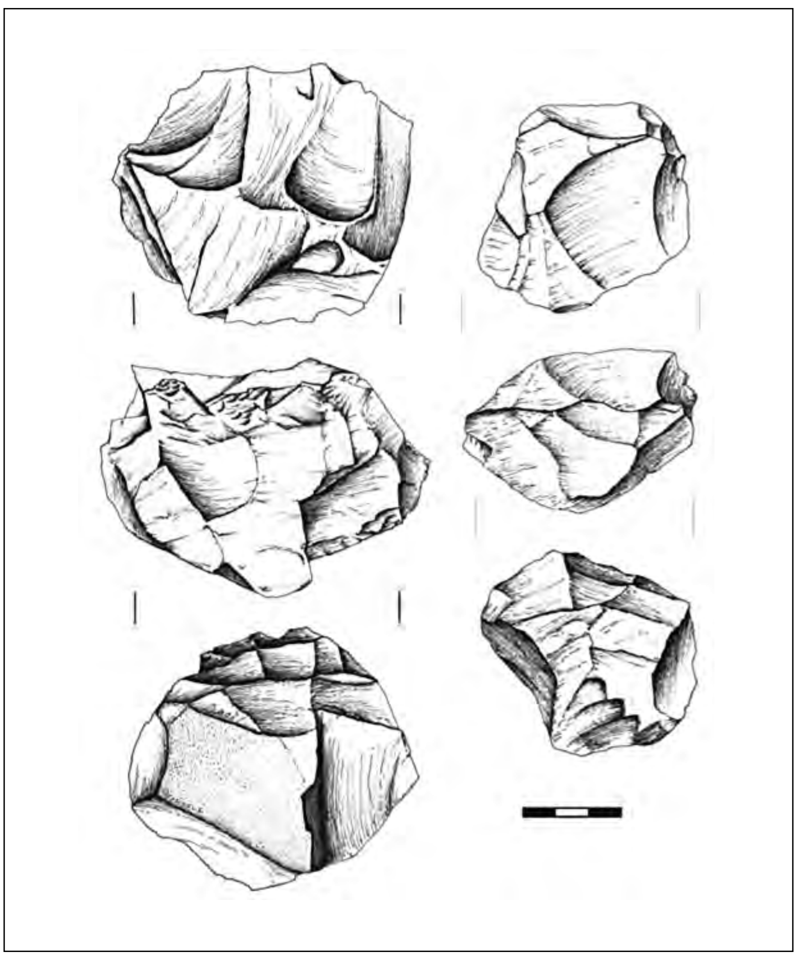

Figure 7. Hierarchical bifacial centripetal lava cores from ST31- ST32 (drawn by Noemi Morán).

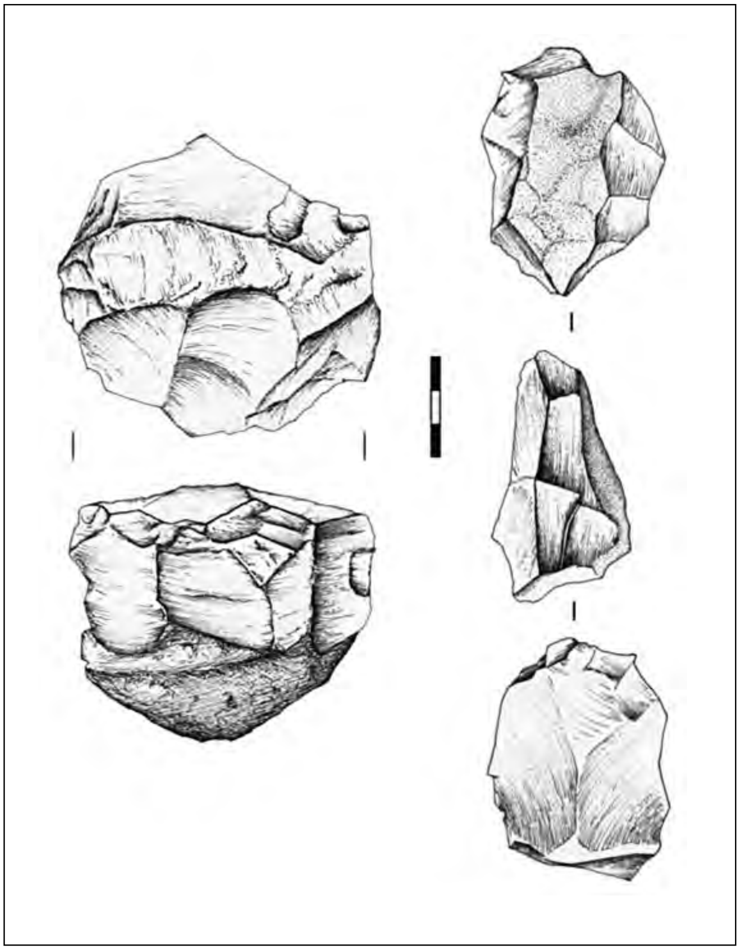

Figure 8. Hierarchical bifacial centripetal cores from ST2 in different stages of reduction (drawn by Noemi Morán).

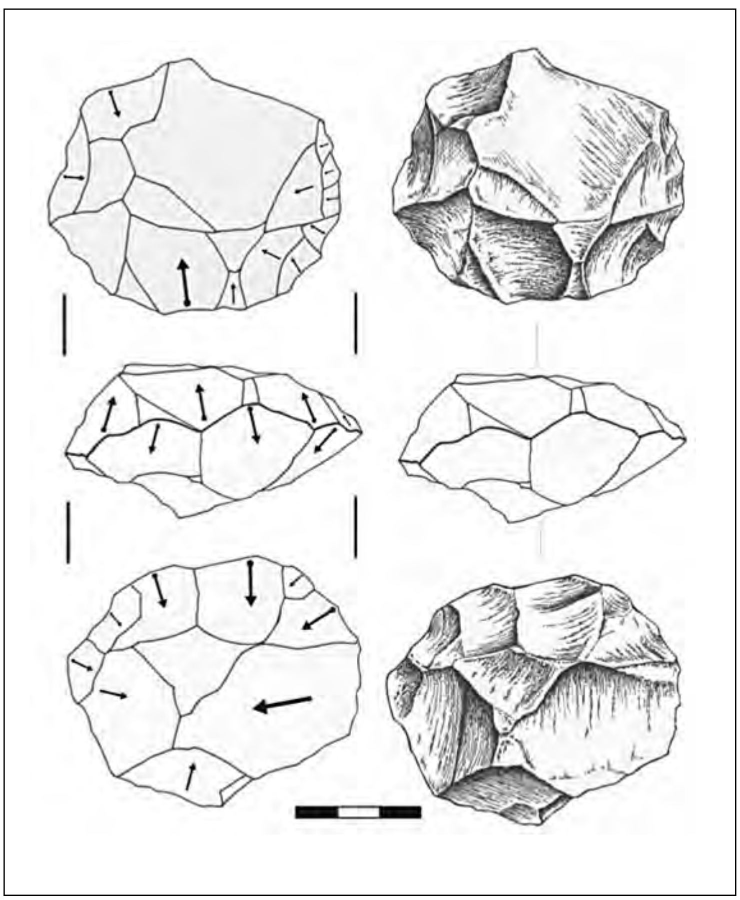

Figure 9. Hierarchical bifacial centripetal core from ST51 (drawn by Noemi Morán).

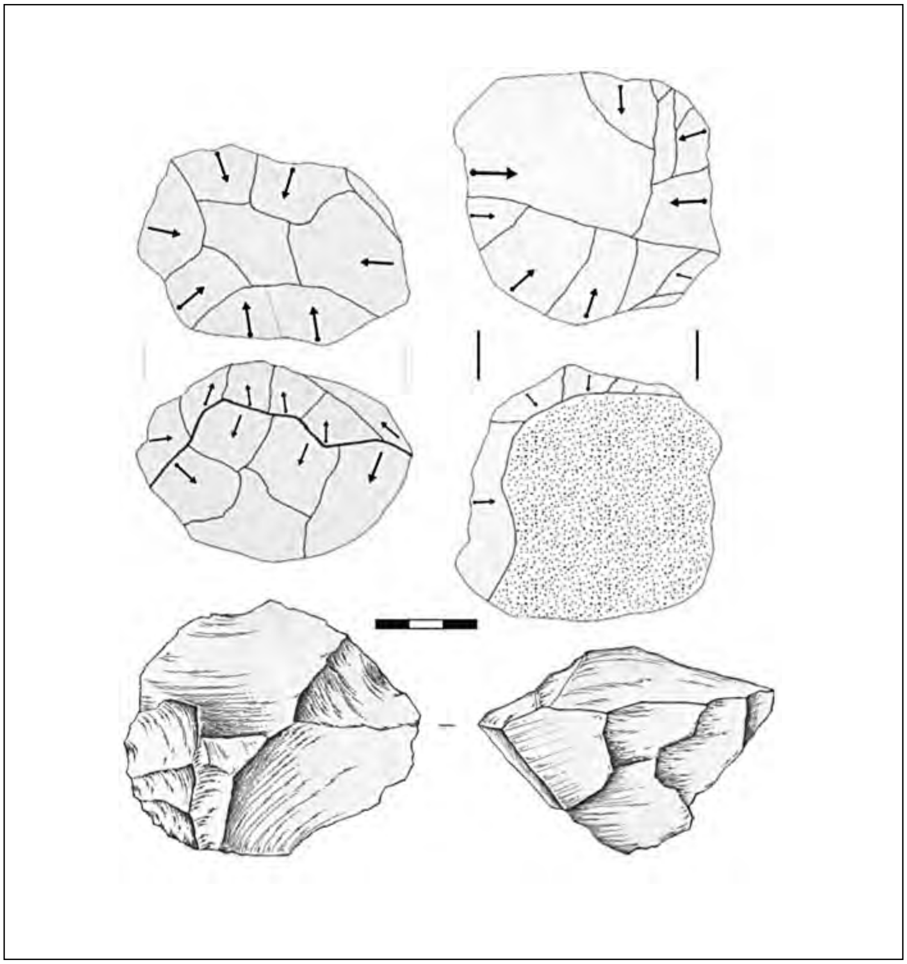

Figure 10. Hierarchical bifacial centripetal cores in Mugulud from recent excavations.

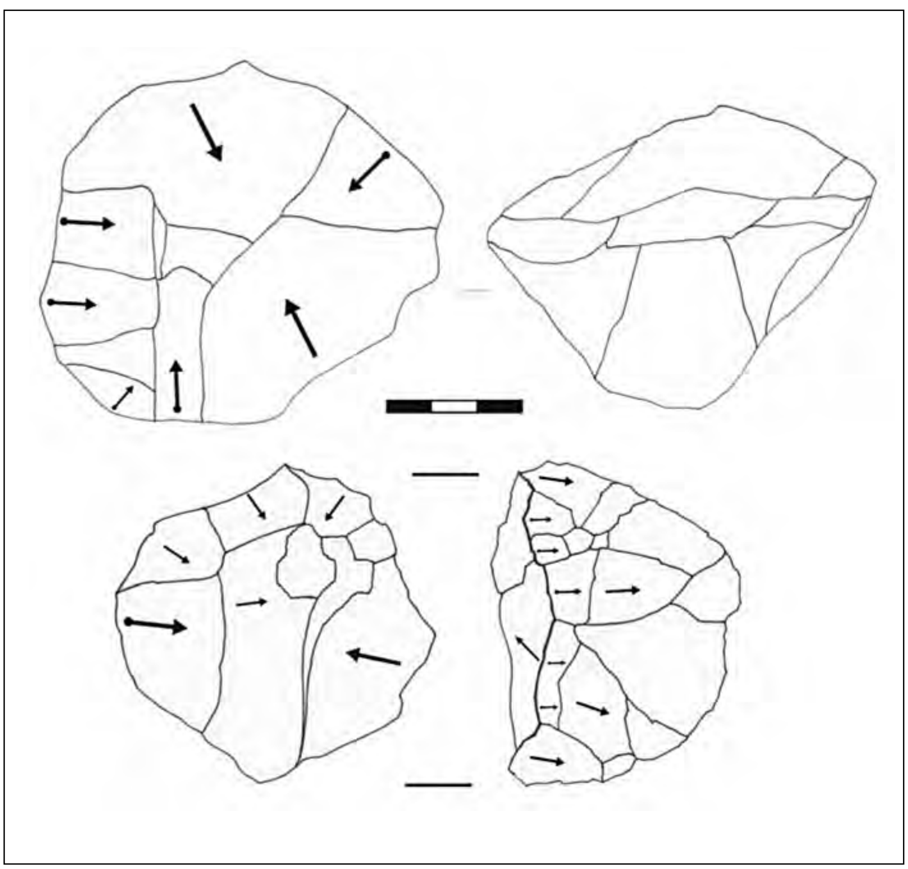

Figure 11. Diacritic schemes of bifacial centripetal cores in Mugulud, from Isaac's excavations.

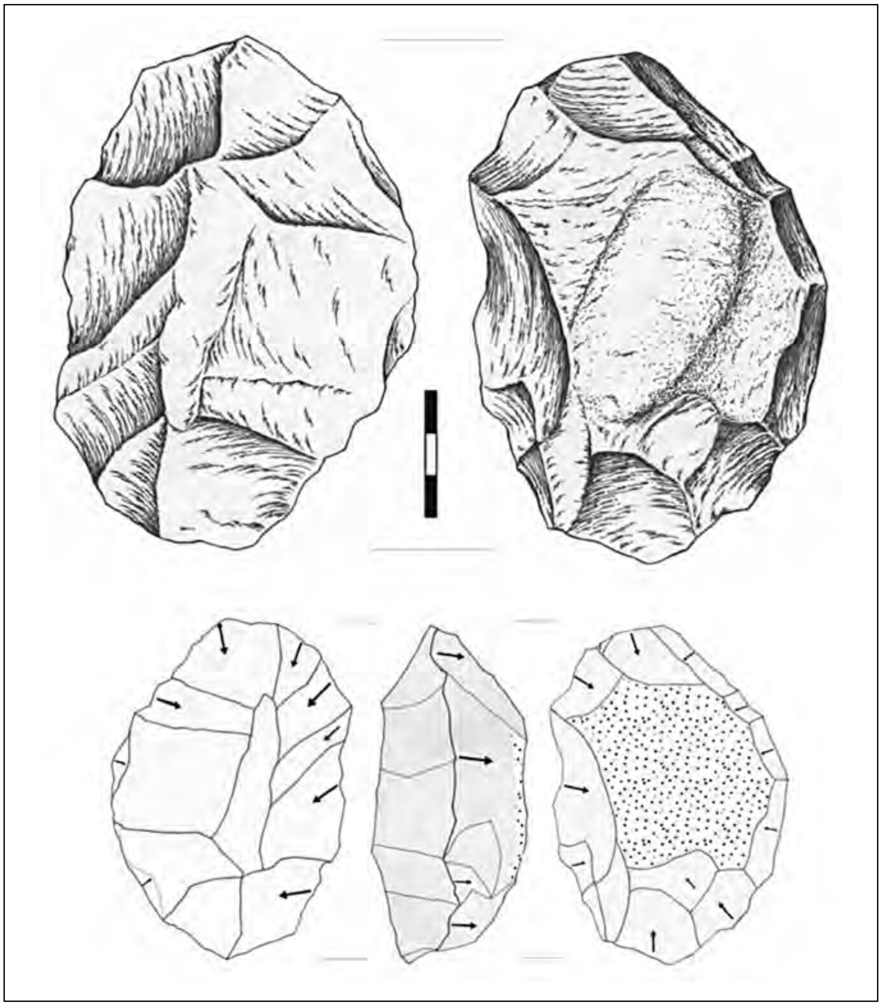

Figure 12. Hierarchical bifacial centripetal core from Mugulud (drawn by Noemi Morán).

and planning of knapping sequences. However, is it enough for including this technology within the Levallois method? New works on this topic make it even more difficult to address the issue about what Levallois method truly is. Slimak (2003), Pasty (2003) and Guette (2002) criticize Boëda´s (1993, 1994) definition of centripetal recurrent Levallois system for being too restrictive. Following Slimak (2003), there are only two real differences between Levallois and discoid methods. First is the management of convexities, which is peripheral in the discoid system and lateral–distal in the Levallois case. The second one would be the configuration of the knapping plane, which is secant among discoid strategies and parallel in the Levallois. Lenoir and Turq (1995) pointed out the similarities between the centripetal recurrent Levallois and the discoid method; following these authors, possible differences would be the non-invasive extractions in the discoid method and, as Slimak (2003) also suggests, that the knapping plane is oblique in relation to the edge of the core. At any rate, Lenoir and Turq (1995) claim that differences between Levallois and discoid methods are neither conceptual or technical, but lie on the degree of predetermination, which at the same time is conditioned by lateral and distal convexities, which respectively determine thickness and length of flakes.

Whereas Boëda (1993, 1994) stressed the immutability of Levallois method along the knapping process – which would maintain a rigid and unchangeable structure during the whole reduction – both Lenoir and Turq (1995) and Slimak (2003) propose that the exploitation of a single core can be carried out changing from a discoid method to a centripetal recurrent Levallois one, and vice versa. Actually, presence of hierarchical surfaces within the discoid method is systematically recognized (i.e. Mourre, 2003; Pasty, 2000, 2003; Terradas, 2003), therefore all the criteria considered by Boëda (1993, 1994) as exclusive from centripetal recurrent Levallois method can be identified also among discoid systems.

Because of all of this, Lenoir and Turq (1995) suggest that the term Levallois *sensu stricto* should be constrained to the lineal (preferential flake) method and the unidirectional and bidirectional Levallois systems. In this sense, Slimak (2003) insists on the conceptual differences between the Levallois *sensu stricto* and discoid methods; notion of the recurrence in the *débitage* constitutes the structural criterion of the discoid concept, whereas in the Levallois method there is a stage of preparation of convexities for subsequently detaching the Levallois flake. Following Slimak (2003), these are the grounds for the differences between both systems; discoidal knapping implies a continuous rhythm of *débitage* in which there is no hierarchical preparation of convexities along the production stages of the predetermined products. On the contrary, Levallois method is characterized by a discontinuous rhythm, with alternation between stages of full *débitage* and phases of preparation of convexities. Therefore, the distinction between both concepts would lie on the identification of the specific knapping rhythms, and not on the classification of cores. In sum, in the Levallois method the exploitation of *débitage* surfaces would be restricted by the bifacial edge itself; after a knapping sequence, the volumetric structure needs to be rejuvenated, being a discontinuity on the *débitage* rhythm that discoid technology does not show (Slimak, 2003). In other words, whereas a Levallois core requires of a complete rearrangement after every flaking sequence, the discoid method allows a sustained reduction, which lasts as long as the volume of the core permits (Terradas, 2003).

A review of recent works on the topic (Slimak, 1998-1999, 2003; Mourre, 2003; Lenoir & Turq, 1995; Terradas, 2003, etc), agrees on proposing that most of the criteria suggested by Boëda (1993, 1994) for defining the centripetal recurrent Levallois method, are already contained in the discoid technique. Therefore, it appears to be a consensus on fading away differences between centripetal recurrent Levallois and discoid methods, reminding earlier claims along those lines (i.e. Pigeot, 1991). In this case, the key criterion for distinguishing between discoid and Levallois would be the management of lateral and distal convexities on the main surface in the latter method (Terradas, 2003; Mourre, 2003; Slimak, 2003; *contra* Boëda, 1993, 1994; Guette, 2002).

When Boëda´s criteria have been applied to the Peninj cores in previous paragraphs, lateral and distal convexities were omitted from the list of features displayed by this industry. In the centripetal recurrent Levallois method *sensu* Boëda (1993, 1994), every scar on the main surface predetermines the following one, so that convexities are maintained through the recurrence of knapping. However, when applying a more restrictive definition of Levallois concept, the requisite of lateral and distal convexities on the *débitage* surface can not be applied to the Peninj technology. Although cores are generally found in their exhausted form (in which knapping surfaces usually have lost convexities), the preparation of lateral and distal convexities typical of Levallois is not consubstantial to the hierarchical centripetal bifacial method defined at Peninj. As aforementioned, this industry displays hierarchical surfaces, the main one focused on obtaining 4-5 cm long flakes, the other dedicated to the preparation of striking platforms. Extractions are centripetal on the *débitage* surface, as well as parallel or subparallel to the configuration plane. By contrast, negatives in the preparation surface are longitudinal, parallel to each other and with secant angle with respect to the intersection plane. All of that, altogether with the recurrent pattern displayed by flakes, led us to propose elsewhere (de la Torre & Mora, 2004; de la Torre et al., 2003, 2004) similarities between the hierarchical bifacial centripetal method at Peninj and the centripetal recurrent Levallois method *sensu* Böeda (1993). If the latter actually is a variant from the discoid method (Pigeot, 1991; Slimak, 1998-1999, 2003; Terradas, 2003; Lenoir & Turq, 1995; Mourre, 2003, etc.), the Peninj technology would also be. In spite of cores such as the one in Figure 12, in which there seems to be some preparation of convexities – also identified in several examples from BK in Olduvai (de la Torre & Mora, 2005) – that is not the general pattern. In sum, the reduction sequences of small-sized *débitage*, following the most recent literature, should be included within the definition of discoid method.

Does this mean a re-evaluation of the technical and cognitive implications already proposed for the Peninj technology? Probably not. Actually, the aforementioned discussion is rather a terminological dispute concerning the status of the centripetal recurrent method as discoid or truly Levallois. As far as technical abilities for predetermination, division of hierarchical surfaces, planning of reduction sequences, volumetric management of cores, etc, are recognized as typical of discoid systems; cognitive, technical and manual skills among knappers are very similar to those underlying the preferential Levallois method. At the risk of being simplistic, the main difference would rest upon the management of knapping sequences for obtaining single products (preferential method) and the systematic exploitation of surfaces (recurrent methods of all kinds). That is to say, upon the continuity of discontinuity of rhythms on the knapping as proposed by Slimak (2003).

Because of these terminological nuances, it would perhaps be advisable to follow more general definitions for describing this technical system, such as that of simple preparation cores as proposed by White and Ashton (2003). Cores studied by these authors are said to display all Boëda´s technical requirements of Levallois method, except for lateral and distal convexities. Thus, White and Ashton (2003) claim some kind of intentionality in the production of flakes, but do not identify predetermination as required for obtaining really standardized flakes. At any rate, and as mentioned elsewhere (de la Torre & Mora, 2004; de la Torre et al., 2003), the specific denomination for the knapping method identified at Peninj may be irrelevant, as far as the complexity of underlying technical process is assumed. Should the Peninj industry be included in the centripetal recurrent Levallois *sensu* Böeda (1993), in the discoid system (as conceived by Lenoir & Turq, 1995; Pigeot, 1991; Terradas, 2003; Mourre, 2003; Slimak, 2003, etc.) or among methods of simple preparation (following White & Ashton, 2003), technology at Lake Natron required remarkable manual and cognitive abilities, as had been already suggested by Texier (1995) for the geographically and chronologically similar assemblages at Nyabusosi.

Beyond questions of terminology identifying, to which techno-culture the hierarchical bifacial centripetal method belongs is the key issue. In this work, Oldowan is considered as a technology based on knapping of small-sized flakes (usually 3-5 cms) from the *débitage* of cores of limited dimensions. This technology is characterized in Olduvai Bed I by relatively simple knapping methods, in which there is not usually preparation of cores, and in which reduction sequences are short and poorly organized (de la Torre & Mora, 2005), as is it at Koobi Fora (Toth, 1985). At Peninj, assemblages from the ST Site Complex at Maritanane have been assigned in previous works to the Oldowan (Domínguez-Rodrigo et al., 2002; de la Torre et al., 2003), precisely because of the production of small-sized flakes detached from equally small cores. As already seen in Figure 5, neither the target of knapping nor the size of artefacts in the ST Site Complex is comparable with those at the North Escarpment Acheulean.

However, while the ST Site Complex industry displays targets typical of the Oldowan – focused upon making regular flakes through free-hand *débitage* – knapping methods for obtaining such products are quite different from those identified at Olduvai Bed I (de la Torre & Mora, 2005). In fact, the ability to exploit the entire volume of a piece through a structured bifacial method followed through a complete knapping sequence – which is what defines reduction in ST Site Complex cores – shares the same technical scheme usually attributed to the Acheulean. Several authors have specifically linked Acheulean technology with Levallois or Levallois-like methods (i.e. Pigeot, 1991; Tuffreau, 1995; De Bono & Goren-Inbar, 2001; White & Ashton, 2003, etc). Therefore, it could be possible that knappers from sites initially considered as Oldowan at the ST Site Complex were the same ones that display an Acheulean technology in the Escarpments. This hypothesis was already outlined in a previous work (de la Torre & Mora, 2004: 204-205), but was discarded perhaps too rashly, thus the ST Site Complex industry was considered as Oldowan.

A plausible hypothesis for explaining differences between the North Escarpment Acheulean and the industry of the ST Site Complex maintains that technological divergences are explained for the same human groups occupying different ecological niches. The behavioural meaning of this proposal will be explored below, but now it is relevant to focus on its technical connotations; conceptually, the onset of the Acheulean meant the appearance of standardized designs (Isaac, 1986; Wynn, 1993), efficiency in the working of *débitage* surfaces (Pigeot, 1991), and in sum the involvement of bifacial structures into the recurrent and systematic management of raw materials.

Boëda (1991) and Pelegrin (1985) point out that any knapping structure (including in such a structure all the required knowledge, as well as the methods and technical skills within a concrete system) is extremely stable; anarchical behaviours do not exist, and any documented variant is just due to individual operational capabilities or to problems derived from a specific raw materials. Therefore, any particular knapping structure is the result of the technical background by a determined group or culture (Boëda, 1991; Pelegrin, 1985).

This perspective leads to a reinterpretation of the Peninj record, dissecting the technological characteristics across each area; at the ST Site Complex, knappers exploited small cores aimed to obtain short and thin flakes. Input and output of handaxes should not be excluded, as some possible biface trimming flakes could suggest in ST30 and ST4 (de la Torre & Mora, 2004; de la Torre, 2004). Anyway, tool-making was clearly focused on the production of small and (usually) unretouched flakes. This *débitage* was carried out through a variety of reduction methods, among which the hierarchical centripetal bifacial system stands out quantitatively and qualitatively. This strategy requires the application of a particular technical knowledge, which is systematically repeated in cores from various sites and in examples discarded at several reduction stages. Therefore, it seems obvious that specialized knapping methods were used in a recurrent manner at the ST Site Complex.

In the North Escarpment the same *débitage* methods were being applied to the production of small-sized flakes; configuration of cores and reduction sequences are identical to those from the Type Section, pointing towards the use of the same technological strategies. Thus, there is a shared knapping general structure (*sensu* Boëda, 1991), that arranges the organization of technology across the entire western side of Lake Natron, and in which reduction methods such as the hierarchical bifacial centripetal method would be the expression of a unique background of technical knowledge.

If the existence of the same technical knowledge in both regions is accepted, and it is also assumed that the same humans could occupy both areas, the single difference between the ST Site Complex and the North Escarpment would be functional. This does not raise interpretative problems upon landscape use by humans from Peninj, as is discussed below. However, it does mean a contradiction with respect to some implications proposed by ourselves on the evolution of technology; de la Torre et al. (2003) suggested that classic Oldowan knappers developed technical strategies more complex than previously thought. Therefore, de la Torre et al. (2003) proposed–erroneously, as recognized by de la Torre & Mora (2005)–that even in the earliest sites at Olduvai technical methods similar to those of Peninj existed. As clarified by de la Torre & Mora (2005), however, Olduvai *débitage* systems similar to those from Peninj are common only after the emergence of Acheulean in Middle Bed II.

At Lake Natron, where archaeological sites earlier than the beginning of African Acheulean at 1.6-1.5 ma have not been discovered yet, assemblages containing large cutting tools and those with only small-sized cores and flakes overlap chronologically. Indeed, technical knowledge seems to be identical; artisans from the ST Site Complex had the cognitive, technical and manual skills typical from the Acheulean, although these were applied in a different manner than at the North Escarpment. Actually, it is probable that both assemblages were manufactured by the same humans. If this view is followed, the former proposal by de la Torre et al. (2003) on the possible existence of predetermined *débitage* systems in the Oldowan prior to 1.6 ma (that is, earlier than the onset of the Acheulean) would be dropped; complex knapping in the delta of Peninj river (ST Site Complex) would be made by the same artisans than those from the Acheulean in the middle river course (North Escarpment), and the differences between the industry from these places would be a functional response to distinct environments, both being integrated within the same background of technical knowledge and tradition. This hypothesis is based upon the shared characteristics of technical process for knapping simple flakes from small cores in both the North Escarpment and the ST Site Complex. Besides, altogether with this small *débitage*, at the North Escarpment there is a complementary *chaîne opératoire* focused on the production of large cutting tools, which will be described in the next section.

The *chaîne opératoire* for the production of large cutting tools in the North Escarpment

The Acheulean production at Peninj is based upon the flaking of big blanks that often are secondarily modified into retouched large cutting tools (de la Torre, 2004). In terms of the *chaîne opératoire*, this means the incorporation of an intermediate stage between the process of fabrication and use of artefacts; yet in the Oldowan production the system is immediate (a flake is obtained from a core, and is used directly), in the typical Acheulean technical system the process has at least three stages (flaking of blank, secondary modification of it and then use). There are further implications on the nature of the Acheulean *chaîne opératoire*; given the massive size of cores, it is assumed that there is generally a chronological and spatial division between the obtaining of large flakes and their introduction into the sites. This spatial and temporal division could not only affect to the obtaining of large blanks, but also to their shaping; as pointed out by Toth (1991) referring to the African Acheulean, the most optimum strategy would be making handaxes on the quarry itself, since the weight of raw material to be transported is reduced, so are the risks of breakage of blanks during knapping. Likely this strategy was common at Mugulud, in which a great part of retouched blanks were introduced partially or totally manufactured. This actually is a further argument to explain low densities of *débitage* identified at this site (Table 2).

Therefore, it is difficult to evaluate what exactly the specific methods of obtaining of large blanks were, as well as the degree of standardization at their production. At any rate, both the few cores recovered and the scarcely preserved butts on those large flakes indicate that percussion platforms were prepared, and that these belong to bifacial systems. Such knapping strategy should have been similar to that described by Toth (2001), in which previous scars were used for preparing striking platforms. Anyway, more structured methods should not be excluded; at Mugulud several cleavers have been found, and it is conventionally accepted that those artefacts are predetermined blanks. Texier and Roche (1995) point out that blanks for making bifaces do not necessarily have to come from structured cores; however, they propose that knapping of a cleaver is linked to the conceptual progress implicit in the introduction of predetermination within the *chaîne opératoire*. Therefore, whereas in the making of a handaxe the predetermination concept is optional, in the case of the cleaver such conceptual scheme is omnipresent, and actually is necessary for the obtaining the bit, the key element among cleavers (Texier & Roche, 1995). Taking this into account, it could be considered that at Mugulud some of the cores for the production of large blanks should have been, at least in some cases, relatively prepared.

At any rate, following the highly skilled configuration of knapping sequences among small-sized *débitage* cores, it appears evident that artisans from Mugulud had a precise technical knowledge which was applied efficiently to obtain specific products. In the case we are now dealing with, such products were large flakes, wider than longer and characterized by large butts and great thickness. The very existence of some intermediate flakes which are thin but show lengths and widths similar to those of the large cutting tools, suggests that the great thickness of the latter is an intentional choice by knappers. In the case of large cutting tools, artisans were aiming to obtain heavy and blunt tools, being careless in the waste of raw material or the effects regarding the cores, whose knapping surfaces would have been badly structured after the removal of such flakes.

Table 2. Lithic categories at Mugulud, including Isaac's collections stored in Dar-es-Salaam Museum and those from recent excavations (figures follow de la Torre, 2004).

	Total	
	n	**%**
Test cores	4	0.8
Cores	22	4.3
Core fragments	2	0.4
Large cutting tools	83	16.3
Small retouched pieces	5	1.0
Hammerstones	20	3.9
Unretouched blanks for LCT	14	2.7
Flakes	101	19.9
Flake fragments	178	35.0
Frags. <20 mm	7	1.4
Angular fragments	39	7.6
Battered frags.	9	1.8
Unmodified pieces	24	4.7
Total	508	100.0

Once those large flakes were obtained, they usually served as blanks in which secondary modification of edges was performed. However, reference to bifaces is not accurate in the case of Mugulud. Edwards (2001) suggests that large flakes at Kalambo Falls could be obtained in less than a minute, but that the *façonnage* of any of its bifaces takes hours. That is not the case in Mugulud at all; as among the large flakes in EF-HR at Olduvai (Leakey, 1971; de la Torre & Mora, 2005), in Mugulud retouch is restricted to the edge of pieces, the volume of pieces not being shaped (Figure 13). Both EF-HR at Olduvai and Mugulud at Peninj could be included among what Böeda et al. (1990) call "*chaînes opératoires des pieces bifaciales supports*". This denomination has an insightful technical meaning, and describes accurately the traits displayed by the large cutting tools in the Early Acheulean at Olduvai and Peninj; at both sites, blanks show two secant surfaces, wherein one is convex and the opposite is flat. Therefore, volume is based on two asymmetrical surfaces, in which a simultaneous *façonnage* is nearly impossible. The shaping of blanks is mainly performed from the flat surface, which in both EF-HR and Mugulud corresponds to the ventral face of flakes, and from such face the entire volume of the piece is shaped, fulfilling criteria defined by Böeda et al. (1990) for those *chaînes opératoires des pieces bifaciales supports* with flat-convex sections.

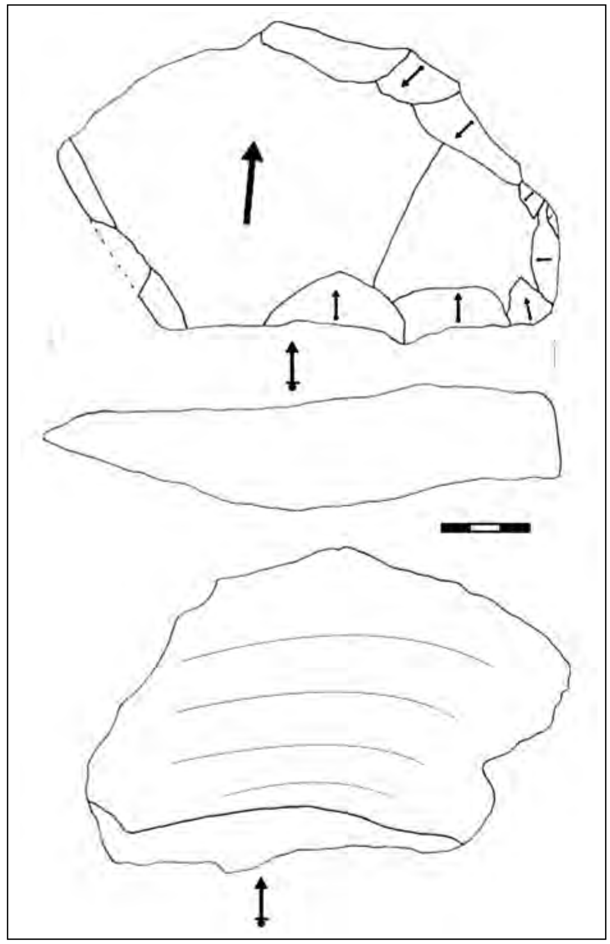

Figure 13. Diacritic scheme of a lava knife from recent excavations in Mugulud, whose retouch is limited to the transversal distal part of the dorsal face.

This knapping technique responds to determining factors imposed by the method in which those blanks are obtained; whereas transforming a convex surface into a flat one is relatively easy, the opposite is extremely difficult (Böeda et al., 1990). This could explain, for example, the reason why authentic bifaces at Isenya are poorly shaped on their ventral faces (Roche et al., 1988; Texier & Roche, 1995), or why at Kalambo Falls transformation of a flake into a well-shaped handaxe is a complex and consuming task (Edwards, 2001). Neither at EF-HR (de la Torre & Mora, 2005) or at Mugulud is there a symmetrical distribution of volume among artefacts, and therefore it could be supported that "*le façonnage de pièces plano-convexes constitue la finalité technique du schéma opératoire*" (Böeda, 1991: 57).

To sum up, in the Early Acheulean at Mugulud the concept of bifacial symmetry does not exist, a notion that we do find in more recent Acheulean sites. Large

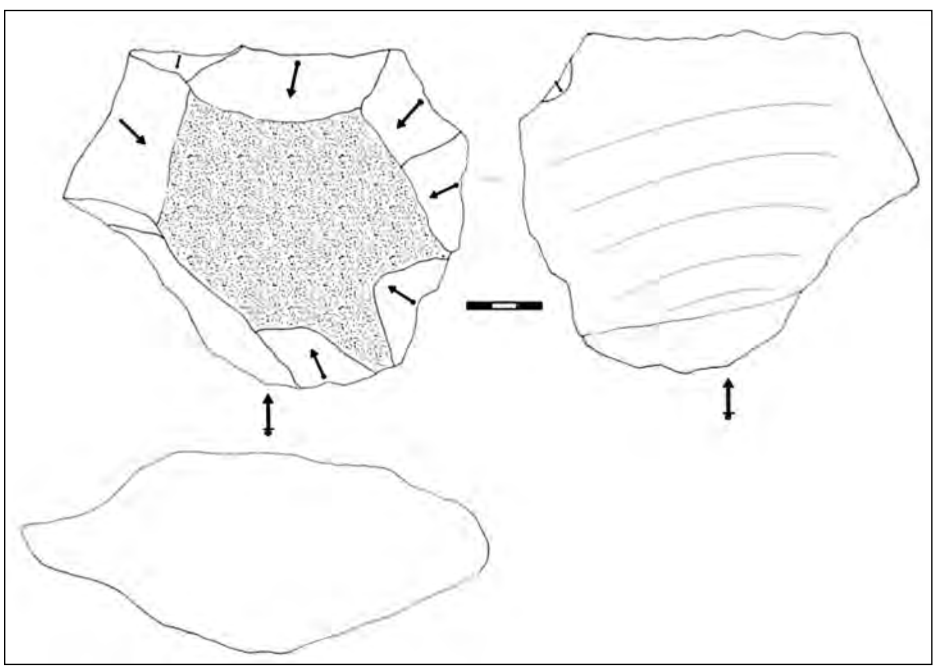

Figure 14. Diacritic scheme of a lava knife from recent excavations in Mugulud. It is a large flake with no retouch on the ventral face and a few blows on the distal-transversal part of the dorsal face, which made a denticulate edge opposite to the blunt part formed by the butt.

cutting tools from Mugulud at Peninj, as well as those from EF-HR at Olduvai, actually are not bifaces but huge side scrapers with (generally) unifacial retouching and pointed forms, however in which there is not shaping of the overall volume, but just a non-invasive working of the edges of pieces (Figure 14). Perhaps that was the reason which led Isaac (1972; Isaac, in VVAA, 1967) to stress the technical similarities between EF-HR and Mugulud. Leakey (1971) also underlined the resemblance between both assemblages, at the same time she discussed differences between Mugulud and BK in Olduvai (Leakey, in VVAA, 1967).

This last point is rather relevant and leads to a further reflection; at BK there are real bifaces, which show a whole management of surfaces, a systematic *façonnage* and the existence of bifacial symmetry (de la Torre & Mora, 2005). Those traits are not present among any of the earlier Acheulean sites in Olduvai such as EF-HR or TK. Are those traits a technical evolution? Or were the artisans from EF-HR and Mugulud not interested in stylistic issues of that kind? Although at Mugulud there are no real bifaces, in a later site from Peninj, ST54 (Figure 15), there are authentic bifaces which actually show exquisite manufacture. Whether this responds merely to a stochastic variation, as suggested by Isaac (1977), or it does reflect an increase of technical skills is a question beyond the scope of this work. Now the point is to analyze what the landscape use strategies were at Peninj.

Technology and Landscape in Peninj Sites

In order to evaluate landscape use in Peninj from a technological point of view, there are two main aspects to be addressed. As reviewed above, one is the dichotomy between the technical systems from the North Escarpment and those from the Type Section. A complementary perspective to be addressed in this section is the study of the configuration of sites and their distribution across the landscape, together with the relationships of those sites with the availability and characteristics of lithic raw materials.

Raw material management

At Peninj it is possible to locate some of the source areas for basalts, nephelinites and quartz found at the sites. Through X-ray diffraction analyzes several types of basalts (basanites, hawaiian basalts, aphitic and aphiric basalts) and piroxenic nephelinites were identified. The original source area for quartz is the metamorphic hills of Oldoinyo Ogol, located to the west of the Peninj Group. Primary source areas for basalts are the Sambu volcano and the Hajaro lavas, whereas most of nephelinites probably come originally from the Pliocene hills of the Shirere and Mozonik volcanos.

However, it is one thing to identify raw material primary source areas, and another to locate the exact spots where hominins could have been supplied from. In the North Escarpment it is assumed that basalt blocks from which large cutting tools are made were abundant in the vicinity of Mugulud. This site, located on the piedmont of Sambu volcano, should have been surrounded by outcrops and lava flows that, because of their weathering, produced large blocks that could be used as cores. Therefore, the immediate abundance of huge basalt blocks at the North Escarpment facilitated obtaining of large blanks. In Mugulud, both hammerstones and small-sized *débitage* cores are mainly made of quartz (de la Torre, 2004). This quartz appears in the site as rounded cobbles of 10 cm in diameter, and probably were collected in a nearby (but still unidentified) stream channel. Its primary source area was the Oldoinyo Ogol Hills and their metamorphic substrate. The scarce nephelinites from Mugulud also appear as rounded cobbles, which we assume also were collected from a local stream channel. In this case the primary source area is more difficult to establish, since topographically those nephelinites were unlikely to come naturally from the Mozonik volcano or the Shirere Hills, located downstream on the Peninj River. There are actually conspicuous differences between nephelinites from the Type Section and those from the North Escarpment, being coarser-grained, less compacted and with bigger pyroxenes. Finally, at Mugulud there are also basalt small rounded cobbles, with similar sizes to the quartz and nephelinites. These small lava cobbles seem to belong to a different variety of basalt than that used for large cutting tools, and actually were managed for alternative tasks, including their use as hammerstones and small-sized *débitage* cores.

Primary raw material source areas should have been similar in the Type Section, being the Oldoinyo Hills (the original location of quartz) and the Sambu volcano and its lava flows for the basalts. At the North Escarpment, the source of nephelinites probably were the Shirere Hills and the Mozonik volcano. At any rate, whereas in the North Escarpment it is assumed that primary sources of raw material procurement were near the site of Mugulud – because of its proximity to the Sambu volcano and its location in the middle course of the Peninj river, which in this area would carry cobbles of considerable size – in the Type Section specific spots of raw material supply are more difficult to determine. First, because of the landscape configuration during the formation of sites: paleotopographic reconstructions of Maritanane (Luque, 1996) suggest a low-energy deltaic environment. Therefore, it is unlikely that there were contemporaneous cobble streams where hominins could get raw material supplies from. An alternative is that some fluvial channels belonging to the lower part of the stratigraphic sequence were exposed during the formation of archaeological sites. This would not be very common either, since the Upper Sandy Clays constitute an agradation phase and not a stage of erosion of underlying sediments.

The other main problem for the identification of raw material procurement sources is the current disposition of sedimentary exposures; contrary to other parts of the

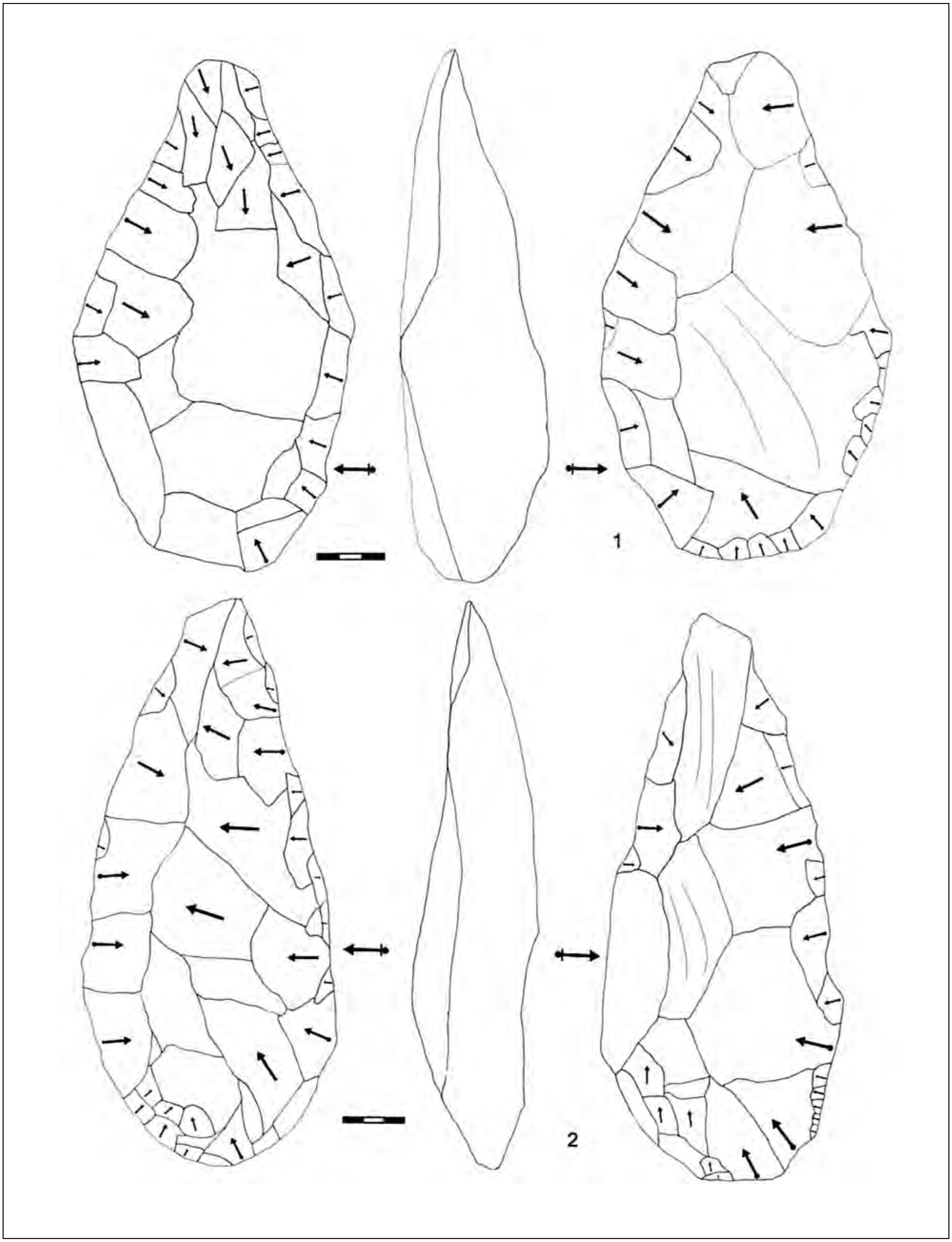

Figure 15. Basalt bifaces from ST54 in Maritanane. (1) The blank is a large (1800 grams and 230 mm length) flake, bifacially worked aiming to create two symmetrical volumes. (2) Exceptionally large flake (more than 2000 grams weight and 300 mm length), which is shaped by flat and invasive retouch, probably with soft hammer.

Peninj Group, the Type Section is a quite small sedimentary area, in which unearthed Plio-Pleistocene sediments are not abundant. Actually, zones such as the ST Site Complex are located on the limits of exposures. Therefore, it could be the case that stream channels where hominins obtained raw materials were a few hundreds of meters away from the sites, and nonetheless we were not able to find them because of the absence of modern exposures.

At this stage, neither experiments nor surveys in search of possible source of raw materials (see de la Torre, 2004) have permitted to establish firmly where the specific spots of lithic procurement were. At any rate, it is possible to provide a general view of the management of lithic raw materials: in the North Escarpment, located in a landscape where big blocks of basalt were abundant, technological processes were focused mainly on the obtaining of large blanks. It has already been mentioned that the intentional great thickness of pieces, as well as the abundance of huge unutilised fragments, etc., suggest an absolute lack of concern on the conservation of raw materials. In other words, artisans at Mugulud were

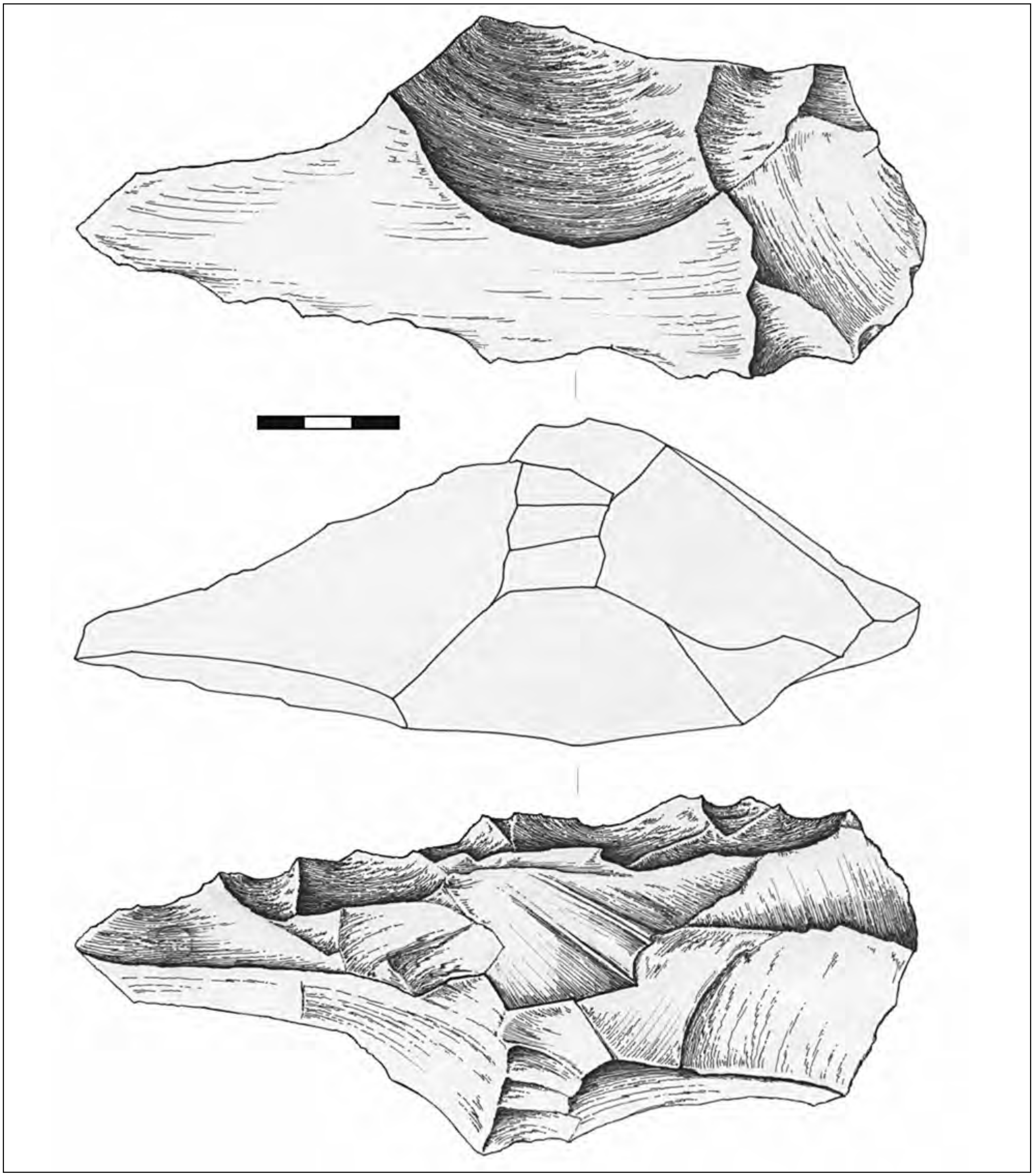

Figure 16. Large cutting tool on flake from ST28 (drawn by Noemi Morán).

not interested at all on maximizing the output of raw materials; their main goal was obtaining huge blanks which afterwards were shaped. Obviously, this behaviour should have been closely related to the immediate abundance of huge basalt blocks that were an almost unlimited resource for raw materials.

The palaeoecological setting of the Type Section, around 8 kilometers to the southeast from the North Escarpment, was very different, being a deltaic environment with low-energy sediments in which raw material availability should have been severely limited. A solution to this scarcity could be the input of artefacts from the Escarpments. This seems to have been the option in some cases, such as in ST23, ST28 (Figures 16-17) and ST54 (see again Figure 15). The large cutting tools and bifaces found at these sites should have been imported from the middle and upper course of the Peninj River, since at Maritanane suitable blocks for obtaining those blanks were not available. Such a strategy, however, has not been observed so far in the sites situated just above Tuff 1, in which sites from ST Site Complex and those from the Gully 2 denote an alternative solution: artefacts in these sites have no petrographic similarities with those from the Escarpments, and up to now no large

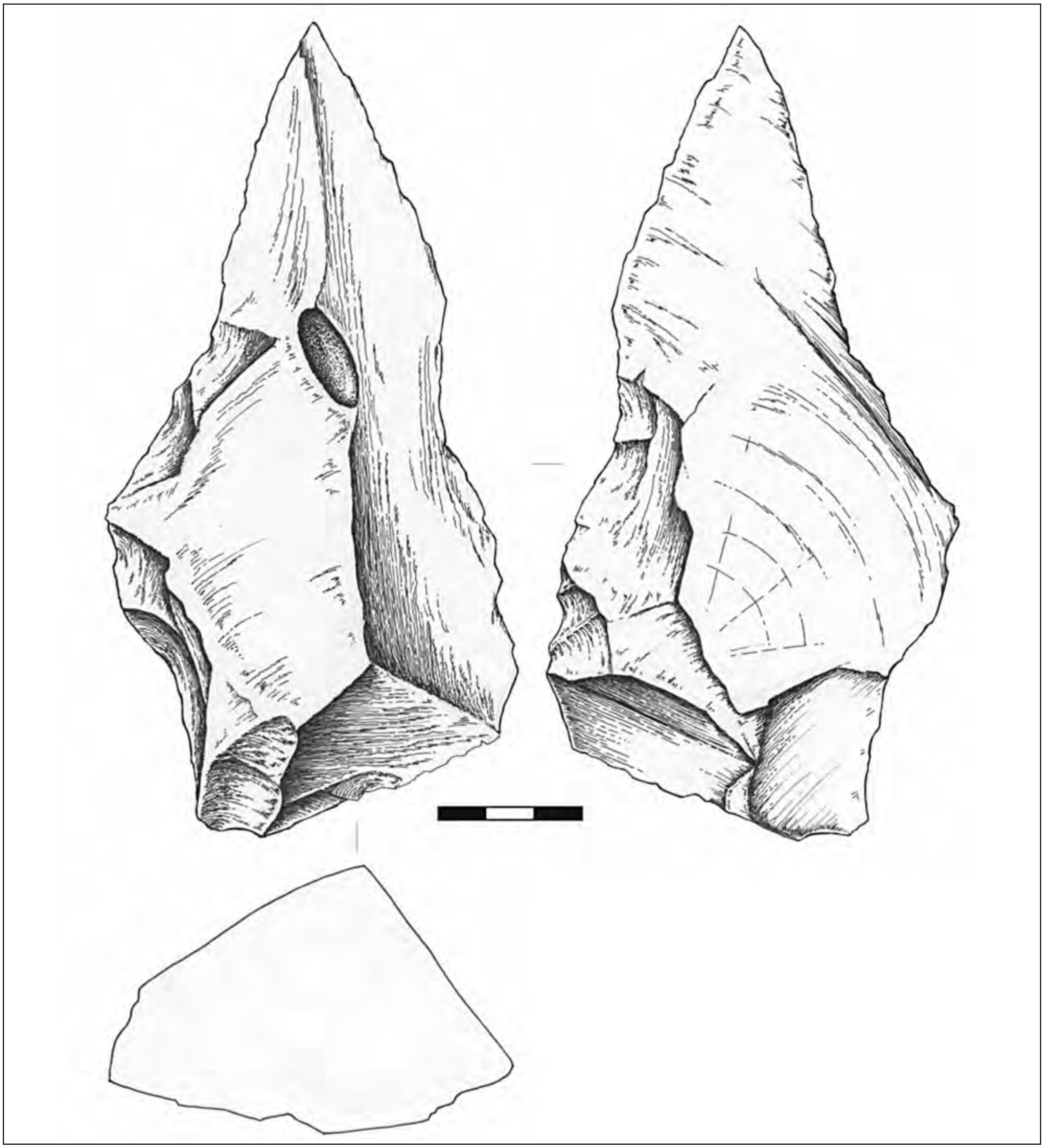

Figure 17. Another example of large cutting tool from ST28 (drawn by Noemi Morán).

cutting tools have been found. Independent of whether or not the same people made large cutting tools in the Escarpments, hominins who occupied Tuff 1 at the Peninj delta were focused on the management of tiny cores. Only small-sized cobbles would be available in a distal stream course such as that of Peninj in the Type Section, and moreover those cobbles should not have been abundant. Response by hominins to such raw material scarcity seems to have been carefully planned; cores were knapped quite often until exhaustion, and usually following a well-reasoned reduction method that would maximize returns of a scarce resource in Maritanane, the lithic material. By this way, availability of raw materials would be a primary factor for understanding the type of technology used in each region at Peninj. But it was probably not the unique reason, so in the following section more functionally-related options are also addressed.

The configuration of sites in the landscape of Peninj

Pollen analyzes (Domínguez-Rodrigo et al., 2001) suggest an open herbaceous landscape for the Type Section, whereas the location of Mugulud in the margins of a fluvial channel indicates that this site could have been situated in a more closed environment. Therefore, it is probable that trophic pressure was higher in the Peninj delta in which the Type Section sites were deposited, and where the herbaceous landscape should have been intensely occupied by carnivores. This could be an important factor to understand why at just a single site such as Mugulud there is a huge accumulation of artefacts, while in the entire Type Section the total of knapped stone tools (including all sites and chronologies) does not add up to even half of that at Mugulud; as a hypothesis, probably more closed environment in the North Escarpment could have been a place to develop longer term activities than at the less secure Type Section, where occupation would be more episodic and dispersed.

Isaac (1977: 86) was convinced that the tendency of Acheulean sites to be associated with seasonal streams was independent of preservation factors that could accumulate artefacts in particular locations, and referred expressly to Mugulud (then RHS), underlining its palaeogeographic similarities to Isimila, Kalambo Falls, Olorgesailie and the Acheulean sites at Olduvai. Potts et al. (1999) agree with such an interpretation, and assume that, although the role of hydraulic processes on the formation of Acheulean sites should not be ruled out, such natural causes do not either explain the outstanding concentrations found in many of the sites at Olorgesailie. The same can be applied to Mugulud; this site was, beyond any doubt, affected by hydraulic agents (see taphonomic discussion in de la Torre, 2004). However, the channel at Mugulud probably had no hydraulic competence sufficient to accumulate large cutting tools which, moreover, do not usually show rounded edges. Therefore, we should not be tempted to explain the outstanding concentration of Mugulud just as a mere post-depositional aggregation. Hominins were intentionally accumulating in that particular spot a huge quantity of large cutting tools, resulting in a lithic collection with more than 160 kilograms.

Behaviour in the Type Section was radically different. As shown in Table 1, most of the “STs” are made of collections of less than a dozen of pieces. This does not necessarily mean these are disturbed sites or scarcely informative spots. On the contrary; Isaac (1981; Isaac et al, 1981) would insist on the importance of taking into account the lithic scatters across the landscape besides the relevance of bigger concentrations. In exposures such as those from Tuff 1 at Maritanane, which can be followed horizontally or in section across several hundred of m^2, documentation of isolated artefacts in the landscape permits the reconstruction of the so-called “background scatter of artifacts” (Isaac, 1981: 136), which was actually the main objective of Isaac (n.d.) in his late research program in Peninj. When this frame of reference is applied to the record from Maritanane, it is observed that most of the “STs” correspond to what Isaac et al. (1981) called intermediate levels of artefact dispersal across the landscape, those in which there is a range of 3-20 stone tools per 25 m^2 (Table 1).

In fact, even the densest concentrations of artefacts in Maritanane – which usually are surface findings, with very few materials in situ (i.e. those from the ST Site Complex) – do not reach the category of real sites in the classification by Isaac et al. (1981). Therefore, even the main sites at the Type Section can be included under the category of minisites; Isaac et al (1981) put FxJj64 as a good example of minisite, wherein only 83 artefacts and 353 bone fragments had been recovered, a figure just slightly smaller than that of ST4, the most important site in Maritanane. Thus, it is obvious that the artefact density in the Type Section is singularly low, even when compared with studies based not on big sites but on artefact dispersals across the landscape, both during the beginnings of the Lower Pleistocene (Blumenschine & Masao, 1991; Isaac et al., 1981; Rogers, 1996) and the final part of this period (Potts et al., 1999). Curiously, in spite of the general dispersion of scattered artefacts across the Type Section’s landscape, the densest concentrations are focused on a particular point of the area; although being in absolute terms a low density of artefacts (mainly if compared to Mugulud), the 28 kilograms from the ST Site Complex are a conspicuous patch in the landscape clearly distinct from the rest of Maritanane.

There are then three different realities in the Peninj record. One is the huge concentration of Mugulud, where hominins systematically discarded artefacts until a patch of more than 160 kilograms was deposited. In the Peninj delta, landscape use was different, and follows two models; one is that of scattered pieces across the landscape of intermediate levels of density (following terminology by Isaac et al., 1981), and includes both assemblages supposedly Oldowan (mainly those from

Gully 2) and distinctively Acheulean (Gullies 3 and 4). Together with this scattering of artefacts, in a particular spot of Maritanane – the ST Site Complex – patches of artefacts related to a small-sized *débitage* technological strategy appear.

What is the functional explanation for these differences on the use of landscape? In the case of the Type Section, most of the artefacts, independently of the density of the patches, usually appear associated with bone remains. This is particularly evident at the ST Site Complex, in which some of the bones show cutmarks (Domínguez-Rodrigo et al., 2002). Therefore, it is assumed that humans visited the Peninj delta in search of animal resources, which in such an open environment should have been abundant.

Functionality for the Mugulud Acheulean site is nonetheless more difficult to specify. At this site, the few recovered bones were probably transported by the channel and their association with stone tools is accidental (see de la Torre, 2004). Consequently, it seems difficult to address why such a huge concentration of artefacts formed on this very spot of the landscape.

Conclusions

Two technological strategies have been identified in the Lower Pleistocene sequence at Peninj. The first involves a typical Acheulean use of landscape, and is located at Mugulud in the North Escarpment; on the piedmont of Sambu volcano, surrounded by big blocks of basalts and probably in a relatively closed environment, hominins were knapping and accumulating stone tools near the margin of a channel. Reasons why those humans made such a great concentration of artefacts – which follow very precise manufacturing methods based on the obtaining of large cutting tools – are unknown.

At any rate, it seems clear that functionally the site was concerned with a thick-edged use of lithics, yet stone tools at Mugulud are usually heavy-duty artefacts in which there was no stinting of raw material. Indeed, the great amount of raw material invested in obtaining large blanks is surprising; there are examples of large thin flakes which indicate knappers were technically skilled in obtaining big blanks with no wasting of raw material or exhaustion of cores. However, that does not seem to have been a concern, and artisans preferred to overexploit knapping surfaces in order to flake massive and thick blanks. The evident waste of raw material was possible because of the proximity of lava raw material sources. This strategy should have been related to the particular activities carried out on the spot, which required a thick-edged use of artefacts. Such heavy- duty tasks – whatever they were – probably were not exclusive, since in Mugulud there is also a *chaîne opératoire* of small-sized flake production which may have been applied to alternative activities, and which are suggesting a prolonged use of the same spot in the landscape.

The Peninj delta in Maritanane shows a different scene from the one at the middle course of the river at the North Escarpment. The open landscape in the Type Section and the inherent trophic pressure of such environments probably did not encourage a prolonged occupation of the area. Also, being the distal part of the fluvial system, raw material availability would have been scarce, making it more difficult to wander across the area. A solution was importing artefacts from the Escarpments, as appears to be the case of the few handaxes found from Tuff 4 onwards. However, during the main occupation of Type Section–that is, such immediately overlying Tuff 1–humans adapted to the limitations of the surrounding environment, and therefore exploited small pebbles locally. Moreover, this exploitation was systematic, using efficient and well-reasoned reduction methods, which allowed artisans to maximize a scarce resource such as lithic raw material in the delta region. This resulted in an apparently typical Oldowan industry, made of small sized cores and flakes, with only a few retouched tools and with no presence of typical *façonnage* processes such as those characterizing the Acheulean.

It is not possible to say exactly whether these hominins were the same as those who formed the Acheulean sites at the Escarpments, although this is a very plausible hypothesis. Chronologically, all mentioned sites are in the same time interval, around 1.6-1.4 ma (Isaac & Curtis, 1974). It could be argued that Mugulud (positioned at the top of the Humbu Formation or at the base of Moinik Formation) is slightly more recent than some of the non-handaxe bearing sites from the Type Section (i.e. the ST Site Complex, over Tuff 1), and that Maritanane assemblages were late Oldowan examples, whereas the North Escarpment witnessed the onset of the Acheulean technology. However, in the South Escarpment – around 3-4 kilometres away from the Type Section – Domínguez-Rodrigo et al. (1997) claim the existence of Acheulean sites older than the supposedly Oldowan-like assemblages from the ST Site Complex. Therefore, it does not seem feasible to explain these technical differences through diachronic issues, nor to ascribe each technology to a particular hominin species.

Actually, both at the South and the North Escarpments small-sized *débitage* methods are very similar to those documented in the Type Section, implying a shared technical knowledge. This leads to a functional differentiation in order to explain the technological variability among Maritanane and the Escarpments; at the Peninj delta river, where raw material sources were scarce, hominins who also occupied the Escarpments were focused on obtaining small flakes, most likely linked to carcass processing. This occupation in the Peninj delta, judging by the densities of archaeological remains, should have been short-term, although repetitive; the ST Site Complex, wherein there are different concentrations placed on the same stratigraphic position and within a particular perimeter, indicates that humans usually occupied that specific area when they would come down to the delta of the Peninj river. As I have argued in this work, a detailed study of their technology can be used to show that such hominins shared the same technical skills as those of the Acheulean sites and, most probably, were the same groups using alternative technologies in different environments.

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