# Chapter 3

# FLK ZINJ

## Introduction

FLK Zinj is the best known site in the African Plio-Pleistocene. The palaeontology (Gentry & Gentry 1978; Harris & White 1979; Fernández-Jalvo *et al.* 1998; Plummer & Bishop 1994; Brodkorb & Mourer-Chauviré 1984; Stewart 1994; Auffenberg 1981; Butler & Greenwood 1973; etc), zooarchaeology (Bunn 1982; Bunn & Kroll 1986; Potts 1988; Oliver 1994; Blumenschine 1995), and the lithic industry (Leakey 1971; Ludwig 1999; Potts 1988; Kroll & Isaac 1984; Kimura 2002) have undergone first-hand analyses, in conjunction with different studies derived from that original information (Capaldo 1997; Domínguez-Rodrigo 1997; Kappelman 1984; Marean *et al.* 1992; Lupo 1998; Binford 1988; etc). Level FLK 22 (or FLK Zinj) is part of the FLK gully, in the central part of the Gorge. Excavations commenced in 1959 after the discovery of the *Zinjanthropus* cranium (OH 5), and continued throughout 1960. Level FLK 22 is 6 metres below the Tuff IF and is therefore slightly older than 1,749±0,007 my (Walter *et al.* 1991).

Leakey (1971) distinguished several levels containing lithic and bone pieces in very low densities in the interval between Level 22 and the Tuff IF, which led her to interpret them as levels with diffused materials. As stated by Isaac and Crader (1981), these levels indicate the densities typical of natural landscapes; Level 15, with 9 so-called artefacts and 259 bone remains, or Level 13, with 11 lithic pieces and 187 bone fragments, contrast greatly with the vast concentration documented in level FLK 22 and suggest the idea of background deposits in sedimentary sequences that are unrelated to archaeological sites.

According to Leakey (1971:49), Level FLK 22 was composed by silty clays approximately 30 cm thick, subsequently noting (Leakey 1971:260) that the thickness of the archaeological material was merely 9 cm. It is a very low or zero energy context, even though Leakey (1971:49) mentions the presence of a small stream that crosses a good part of the site, as well as a 1.5-metre depression in the excavation surface. For Potts (1988:29), both elements indicate the existence of certain erosion phenomena. The upper part of the clays had already been altered by the processes for the formation of a paleosol, which indicates the subaerial exposition of the archaeological material over an indefinite period. It is hard to establish this interval, and estimations based on the bone weathering stages vary, from a few months according to Bunn (1982) for the definitive burying of the remains, to the 5-10 years Potts (1986:30) calculates, and the 10-15 years suggested by Fernández-Jalvo *et al.* (1998). In any case, Bunn (Bunn & Kroll 1986:434), specifies that we are contemplating two different things. On the one hand, bone accumulation processes (which he sees as speedy processes) and, on the other, bone burying processes, which could be slower, as Potts (1986, 1988) pointed out on account of the bone weathering stages, and Kappelman (1984) stated considering sedimentation rates.

Potts (1988:369) estimates that a 290 m² surface was opened in FLK Zinj which Kroll (1994:113) increases to 300 m² and Blumenschine and Masao (1991) to 315 m². A spectacular amount of remains have been unearthed, 2647 lithic pieces and 40172 bones remains according to Potts' aggregates (1988:369). Kimura (2002:296) estimates an average of 8.3 artefacts per m², and Isaac and Crader (1981:64) calculate 7.75 lithic pieces per m².

Leakey (1971:49) noted the enormous density of lithic and bone remains in the central part of the excavation. That concentration, characterised by the millimetric size of the lithic and bone fragments, had a 6.30 x 4.50 metre diameter. The original map shows that the concentration stops abruptly towards the south and east, where Leakey (1971) refers to a marginal 2.4-2.7 metre area where remains are very scattered, after which the amount of archaeological material increases anew. Finally, the density of pieces is very low in the western area of the excavation (cutting E), with a predominance of so-called manuports, and resembles the descriptions of assemblages with scattered material like FLKNN-3 (Leakey 1971:50) or the actual upper levels of FLK. Consequently, it is feasible to assume that this peripheral part of the main concentration underwent a different formation process.

Therefore, it is convenient to quote Binford *et al.*, who "*suspect that the diffuse scatters of large bones and large lithics* (in this part of FLK Zinj) *result from a generalized, episodial accumulation on the landscape that is unrelated in any integrated fashion to the localised activities indicated by the circular and elongate clusters*" (1988:131). These authors reproduce Leakey's warning, who stated that "*the proportions of tool types and of utilised and unmodified material from various parts of the occupation floor are strikingly dissimilar, to the extent that separate analysis of the finds from the central and from the different marginal areas would give entirely different pictures of the industry*" (1971:50).

In his zoo-archaeological analysis, Bunn (1982) identified over 100 groups of bone refits. Many fragments refit bones with tooth and cut marks, consequently enabling the reconstruction of the patterns depicting the movement of the carnivores and hominids that inhabited the site. Both agents' activities are limited almost exclusively to the main concentration area, which once again points towards a contemporaneity of this group as opposed to the scattered materials in the rest of the level. Kroll and Isaac (1984) underscore the fact that both the hominids and the carnivores acted on the whole of the main concentration; consequently noting the difficulty of establishing which was the primary accumulation agent. Yet, given the fact that the bone distribution was very similar to that of the industry, it was considered a basically anthropic pattern, in which the processing of the carcasses by the hominids was a focussed activity, linked to lithic knapping (Kroll & Isaac 1984). Binford *et al.* (1988) propose an interpretation that counters the maps, considering that the presence of bones bearing tooth marks throughout the whole of the main patch area indicates that the carnivores were the main accumulation agents.

Although the spatial dynamics of the bone remains are well-known, the same cannot be said of the lithic material. Kroll (Kroll & Isaac 1984) accessed the maps for the stone material in FLK Zinj, and worked with the lithic refits. Yet we do not know of any published plans that considers lithic refits. These refits obviously do exist, as documented when re-examining the collection. Although our dedication to searching for refits did not unearth sufficient results to present systematic conclusions, we located several refit assemblages (fig. 3.1) that enable the corroboration of the contemporaneity of the material. Unfortunately, it has been impossible to access the original maps, therefore we cannot set forth issues regarding the spatial association of the lithic collection.

Although we mentioned Potts' (1988) reference to a total of 40,172 bone remains, this is not the only available aggregate. Bunn (1982) counted up to 60,000 specimens, of which 16,000 belonged to microfauna and another 40,000 to non-identifiable mammal bones of which 2575 were under 10 mm, 35,033 ranged between 10-20 mm, and 2800 were larger than 20 mm (Bunn 1982). These great density of remains cannot be attributed to activities carried out by hominids or other large carnivores; Brodkorb and Mourer-Chauviré (1984)

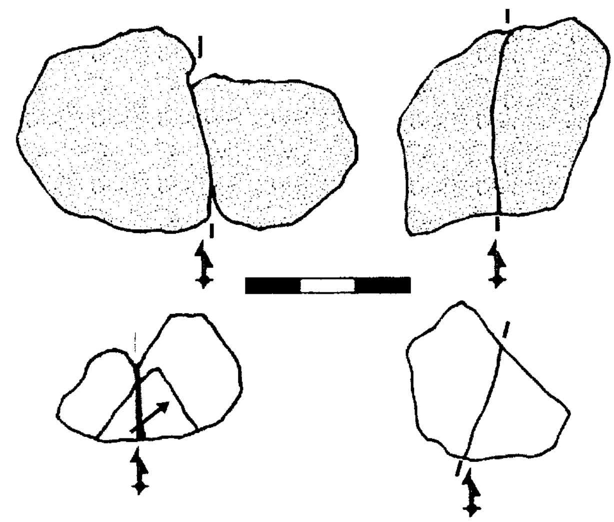

*Figure 3.1.* Refits documented in this study of FLK Zinj. All have been generated by the Siret accident. They are all quartz flake fragments, except for the last one, a lava item which had already been identified by a previous researcher.

identify three different owl species, which reveal a wooded savannah landscape, and suggest these birds could have accumulated the microfauna, as proposed also by Klein (1986) and Fernández-Jalvo *et al.* (1998). Likewise, the abundant fishes must have been deposited during the seasonal regression of the lacustrine area (Stewart 1994), since the shore of the lake would have been 1 km from the site (Hay 1976).

In all, a very significant part of the bone assemblage – at least the part containing microfauna remains (amounting to tens of thousands of pieces in FLK Zinj) – was not linked to human site formation processes. Furthermore, no less than 54% of the bone collection measures less than 1 cm (Potts 1988). In fact, according to Bunn (1982) only 3500 bone remains belong to identifiable mammals. According to this author, the bovidae are the most numerous (MNI=29 individuals), with examples of all sizes. There is also an MNI of 5 suids and 5 equidae, alongside a minimum of 2 giraffes, as well as carnivore and hominid scatters, and a few fragments of hippopotamus and elephant (Bunn 1982). The latter would have appeared in the site fortuitously, since they are only represented via scattered tooth fragments. Potts (1988) performed a parallel analysis, which coincides in general with Bunn's (1982) study, although it sometimes clashes with the MNI, mainly in terms of the bovidae aggregate.

Bunn (Bunn & Kroll 1986) documented cut marks on all bovid genera, and on suids, equidae and giraffes. He also found 400 bone remains with tooth marks made by large carnivores, like hyenas. The number of cut marks and their anatomical position (Bunn & Kroll 1986), as well as the skeletal representation (Bunn 1986) and the fracture patterns (Bunn 1991), suggested hominids accessed carcasses earlier. Even so, the original studies published in the 1980s either furthered this hypothesis, proposing a mixed scene combining

| | Unmodified material included | | Unmod. material excluded | |
|---|---|---|---|---|
| | N | % | N | % |
| Test cores | 19 | 0.7 | 19 | 0.7 |
| Cores | 49 | 1.8 | 49 | 1.9 |
| Retouched pieces | 15 | 0.6 | 15 | 0.6 |
| Hammerstones | 21 | 0.8 | 21 | 0.8 |
| Anvils* | 2 | 0.1 | 2 | 0.1 |
| Whole flakes | 125 | 4.7 | 125 | 4.9 |
| Chips | 1320 | 49.5 | 1320 | 51.6 |
| Flake fragments | 865 | 32.5 | 865 | 33.8 |
| Angular fragments | 131 | 4.9 | 131 | 5.1 |
| Hammerstones fragments | 5 | 0.2 | 5 | 0.2 |
| Fractured hammerstones | 6 | 0.2 | 6 | 0.2 |
| Unmodified pieces | 107 | 4 | - | - |
| Total | 2664 | 100 | 2557 | 100 |

***Table 3.1.*** Lithic categories in FLK Zinj.(*) Artefacts included in more than one category.

hunting and scavenging (Potts 1989) or directly set out the proposal that hominids accessed carcasses secondly (Shipman 1986). Based on these studies, a range of works appeared in favour of one or another hypothesis, considering the original information published by Bunn, Shipman and Potts. Thus, profiles of skeletal representation have been used to defend hominids' secondary access to carcasses (Binford 1986, 1988; Blumenschine 1991; Marean *et al.* 1992; Capaldo 1997), percentages and the location of the marks have been used to defend primary (Oliver 1994; Domínguez-Rodrigo 1997) or secondary access (Blumenschine 1995; Blumenschine & Selvaggio 1991), etc.

Regardless of each author's position, they all agree on stressing that the hominids' action on the bone assemblages in FLK Zinj was primordial, and nobody rejects the fact that a large proportion of the bones were modified anthropically. Proceeding from this starting point, we can now contextualise the systematic analysis of the industry in the general sphere of carcass modification as a fundamental activity in FLK Zinj.

## General characteristics

To our knowledge, the FLK Zinj lithic assemblage has been studied by Leakey (1971), Potts (1988, 1991; Petraglia & Potts 1994), Ludwig (1999), Kimura (2002) and partially (a sample of the choppers) by Bower (1977). As occurred in DK, in FLK Zinj the general aggregate of objects changes in terms of the investigator, ranging from 2470 objects analysed by Leakey (1971:261) – actually 2479 if we consider her own list (1971:58), and 2575 if we consider the 96 pieces this author considers manuports –, to Ludwig's (1999:28) 2284, Kimura's (2002:296) 2497 and Potts' (1988:369) 2647 objects. Our aggregate is larger, since we have identified 2664 pieces, several of which were in drawers corresponding to other sites, which could explain the differences between the analyses presented by Ludwig (1999) and Kimura (2002). The works by Ludwig, Kimura and Potts add new variables to the attributes identified for each piece by Leakey (1971), but do not question the original classification. Consequently, and even with certain nuances, they support the main characteristics suggested by Leakey (1971), who stressed the high percentage of polyhedrons and side scrapers, and included FLK Zinj in the typical Oldowan. Not long afterwards, Leakey (1975) insisted on FLK Zinj's specificity compared to other Oldowan sites, given the scarcity of choppers and the predominance of light-duty scrapers in FLK 22.

This classification offers different results. The first issue lies in dealing with the problem of the manuports or the unmodified lithic material. These objects compose a relevant percentage (4%) of the collection, exceeding the amount of cores, retouched pieces, hammerstones, etc. (tabl. 3.1). Leakey (1971:58) already observed a large frequency of manuports (n=96), which Potts (1988:377) increased slightly (n=99). We have observed that some of the artefacts previously classified as "utilised materials" do not present any visible human traces, thus the category of unmodified material increases once again (n=107).

In itself, the representation of the categories obtained in the total of the collection (tabl. 3.1) raises certain questions, since it is hard to consider that the so-called manuports (*i.e.* potential cores or supposed raw material reserves transported to the site), constitute a larger percentage than the percentage of cores and test cores combined. Furthermore, the so-called manuports present a percentage that is quite similar to the percentage of flakes, when in fact the amount of knapping products usually exceeds the number of cores from which they proceed four-fold, as indeed occurs in the Zinj collection. However, the argument supporting the high relative frequency of unmodified objects is not sound enough to reject their relationship with the rest of the sequence, and calls for other comparisons.

If the so-called manuports were unmodified raw materials accumulated as stock for their subsequent reduction, it would be logical to think that the average size of the manuports (*i.e.* nodules that have not yet been exploited) should be larger than that of the cores, which would be merely the same natural blocks subject to a process of anthropic reduction. Since the knapping process basically involves a loss of core mass, the critical variable to be analysed in this case is the weight of the objects. In line with this reasoning, the weight of the manuports should be greater than that of the exploited cores. The Kolmogorov-Smirnov test corroborated the normality of the distribution of the weights of both the cores and of the supposed manuports, and a T-test was performed subsequently to compare both categories. The results show both samples have a similar average weight in essence, and therefore do not support the aforementioned hypothesis that allow to consider manuports as potential cores.

Alongside these metric comparisons, it is also pertinent to check the representation of each category in terms of the raw material located at the site. As shown in table 3.2 and figure 3.2, quartz predominates as the main raw material in the site as a whole, with 69.4% of the cores, 79.8% of the flakes and 95.9% of the flake fragments made from this raw material. Although Potts (1988:245) described a high number of unmodified quartz blocks, our revision shows that the non-modified objects are fundamentally lavas (99.1%), and appear alien to regular knapping activities at the site. A chi-square test was performed to compare the distribution of raw materials between the cores and the unmodified lithic materials. If the latter were really raw material reserves, it would be logical to consider that the representation of the different types (lava and quartz) would be similar in both categories. Once again, the test presented negative results, rejecting the hypothesis that both samples were from the same assemblage. Therefore, this makes it difficult to consider the proposition stating that the supposed manuports were in the site as functional raw material reserves.

In all, the different comparisons between the modified lithic material (cores, flakes, hammerstones, etc) and the unmodified material, the supposed manuports, display major differences between both samples. These differences are not conspicuous merely via statistical tests, but also by means of analysing more specific aspects such as the quality of the material. Most of the so-called manuports are of very poor quality and are covered by vacuoles which make them unsuitable for knapping, and many of them present extremely irregular forms which render them inappropriate for other activities such as percussion or throwing. As shown in figure 3.2, the hammerstones and anvils present similar percentages to the supposed manuports in the representation of the lavas. However, in this case, the qualitative criterion is essential: whilst most of the unmodified objects are weathered and irregular lavas, among the hammerstones the pattern is the opposite. Numerous examples of very fine-grained lavas can be identified which must have been highly suitable for percussion activities.

On the basis of the analytical study of unmodified material and its comparison to the rest of the collection, we find very serious conflicts that question the relationship between both samples. One last reflection could be of help in this sense. In total, we estimate that in FLK Zinj there is slightly over 74 kilogrammes of lithic material. Of this amount, 30.72 kg are unmodified objects. Thus, would it be logical to consider that the hominids transported almost half of the lithic material to the site and then did not modify it in any manner?

| | Quartz | | Lava | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Test cores | - | - | 19 | 6.7 | 19 | 0.7 |
| Cores | 34 | 1.4 | 15 | 5.3 | 49 | 1.8 |
| Retouched pieces | 14 | 0.6 | 1 | 0.4 | 15 | 0.6 |
| Hammerstones & frag. | 9 | 0.3 | 23 | 8.2 | 32 | 1.2 |
| Anvils* | 2 | 0.1 | - | - | 2 | 0.1 |
| Whole flakes | 99 | 4.2 | 26 | 9.2 | 125 | 4.7 |
| Chips | 1278 | 53.7 | 42 | 14.9 | 1320 | 49.5 |
| Flake fragments | 830 | 34.9 | 35 | 12.4 | 865 | 32.5 |
| Angular fragments | 115 | 4.8 | 15 | 5.3 | 130 | 4.9 |
| Unmodified pieces | 1 | 0.1 | 106 | 37.6 | 107 | 4 |
| Total | 2381 | 100 | 282 | 100 | 2663 | 100 |

***Table 3.2.*** FLK Zinj categories broken down by raw material. Not including a gneiss chunk, being the single example of this raw material in the whole site, which henceforth will not be considered in the analysis. (*) Objects included in more than one category.

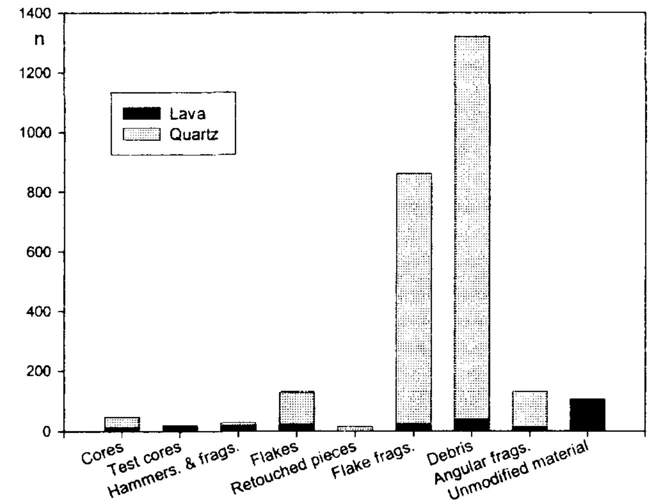


***Figure 3.2.*** Absolute frequencies of the categories according to raw materials.

In our opinion it is quite improbable, and requires the reconsideration of the whole study dedicated to lithic material. Relative frequencies do not change excessively when removing the unmodified objects (see tabl. 3.1). This is due to the very high number of chips (n=1320), which renders the sample of supposed manuports (n=107) insignificant from a quantitative point of view. Nonetheless, these pieces are not irrelevant in terms of their contribution to the total weight of the raw material found at the site. Potts (1988:379) estimates approximately 72 kilograms for the artefact assemblage. If we remove the 30 kilograms of material we consider of natural origin, the FLK Zinj collection is halved, and therefore, conditions all inferences on the intensity of human occupation. Consequently, it is essential that we consider a quite plausible hypothesis based on the fact that no type of raw material reserve was being accumulated in FLK Zinj (*contra* Potts 1988, 1991), and that the hominid's activity was mainly linked to the knapping of lavas and quartzes.

| | Quartz | Lava | Total |
|---|---|---|---|
| Test cores | - | 9698 | 9698 |
| Cores | 5593 | 7238 | 12831 |
| *Débitage* | 10683 | 1821 | 12504 |
| Hammerstones | 917 | 7580 | 8497 |
| **Total** | **17193** | **26337** | **43530** |

***Table 3.3.*** Weight (grams) of the lithic categories according to raw materials.

## Raw materials

The apparent predominance of quartz among lithic material has been mentioned before. In fact, when we remove the so-called manuports from the aggregates, the lava percentages drop all the more, from 10.6% to 6.9%, leaving a total prevalence of quartz in absolute frequencies (93.1%). Nonetheless, it is essential to highlight the fact that such predominance in the number of pieces does not correspond to a real trend in the exploitation of each raw material; erroneously assessing the incidence of each raw material in terms of the number of objects and not considering the total weight, Kimura (2002:295) stated that quartz predominates in FLK Zinj to the detriment of lavas, and compared this dynamic to the reversed pattern in DK. This is not correct; although quantitatively quartzes (n=2380) do seem much more abundant than lavas (n=176), we are, in fact, dealing with an inaccuracy brought about by the vast amount of quartz knapping debris. Consequently, upon assessing the total weight of the raw materials bearing anthropic modification traces (tabl. 3.3), we see that lavas, with over 26 kg of modified material, were more relevant than quartzes, since scarcely over 17 kgs were taken to the site. Since only a few authors (we have only found Brantingham 1998) have supported the predominance of the weight of the lavas, and the rest of the studies (for example Féblot-Augustins 1990; Kimura 2002; Ludwig 1999; etc) have stressed the relevance of quartz as the dominant raw material in FLK Zinj, we must consider the opposite line of argument which we are developing herein.

In an attempt to determine the relationship between raw materials and their distribution in technological categories, two inferential tests have been performed, one based on the objects' absolute frequencies (fig. 3.3) and the other based exclusively on the weight in kilograms of the structural categories (fig. 3.4). Figure 3.3 shows that, in comparative terms, there is an overabundance of lavas in the representation of test cores and hammerstones. Both have a relatively plausible explanation. Most of the test cores, some dubious, correspond to vesicular lavas which we consider local, not transported. Hence, it would be no surprise that the hominids had tested and immediately abandoned poor quality local blocks, whilst the quartzes, found in distant locations, hardly ever were discarded at the site without previous knapping. The issue of lava hammerstones to the detriment of quartz hammerstones is a constant that appears in most Olduvai sites, and is always explained in the same manner. Whilst the nearby streams contained gravel bars with phonolite and basalt cobbles with ergonomic and rounded shapes that could ideally be used as

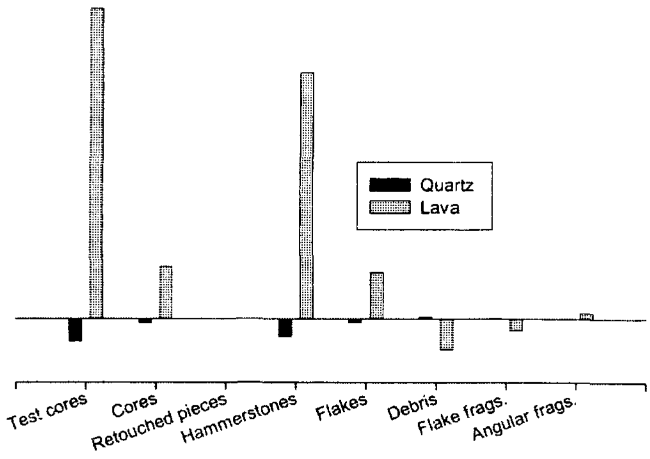


***Figure 3.3.*** Lien Test comparing frequencies and raw materials.

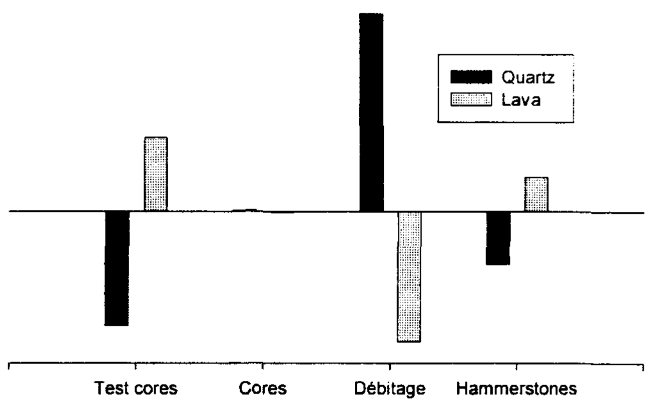


***Figure 3.4.*** Lien Test comparing number of kilograms in each general category and raw materials.

hammerstones, quartz usually (although not always) has a tabular origin and, therefore, presents morphologies unsuited for this type of task.

Comparing the number of kilograms used to configure each technological category (fig. 3.4), we see that the same pattern is repeated in the infra-representation of hammerstones and test cores made of quartz. The Lien test represented in figure 3.4 mitigates the apparent relative overabundance of lava cores to the detriment of the quartz cores in the graphic represented in figure 3.3. Above all, the inferential test represented in figure 3.4 highlights the abundance of quartz *débitage* (flakes, flake fragments, debris) compared to lavas.

This led several authors to erroneously consider FLK Zinj as an essentially quartz-based assemblage, sending us back to table 3.3: the total number of flakes, flake fragments, etc. compose over 10 kilograms of quartz that were, therefore, employed for *débitage* processes. This contrasts acutely with the employment of lavas for *débitage*, with products not even reaching 2 kilograms. This indicates a much greater exploitation of a raw material, quartz, which in absolute terms (about 17 kilograms) is less relevant than lava (approximately 26 kilograms). Moreover, the fact that the 15 lava cores weighs more (7238 grams) than the 34 quartz cores (5593 grams), alongside the almost 10 kilograms of lava test cores, indicates, once again, that the intensity of the reduction of this raw material was quite inferior to that of quartz.

Therefore, we are facing a differential use of raw materials, probably conditioned by two factors: quality and availability. As regards the former, FLK Zinj quartzes are good quality, thus allowing for controlled knapping. This is not the case of the vesicular lavas, with irregularities and vacuoles that provide only a few flakes. Nonetheless, FLK Zinj also presents numerous high-quality phonolite and basalt cobbles, generally used as hammerstones, which could provide well-made flakes, as documented in the assemblage.

As regards the availability of the raw materials, it has already been proposed that the vesicular lavas could have been found in the actual site, from the weathering of the basaltic level, the FLK Zinj's substratum. This local abundance, alongside their poor quality, could explain the low intensity of reduction observed in these lavas. It has also been commented that higher quality phonolite and basalt cobbles must have been available in an area relatively near the site, in stream channels. In contrast, quartz seems to have a distant origin, probably Naibor Soit (Hay 1976). Therefore, the excellent quality of the quartzes, alongside their remote origin, leading the hominids that settled in FLK Zinj to exploit that raw material more intensely.

## Knapping products

From a quantitative level, *débitage* is the most important category of the collection (tabl. 3.1) although, as aforementioned, this would not be the case if we were referring to the total volume of raw material. In any case, the knapping debris comprises the most relevant percentage (51.6%), followed by different types of flake fragments and complete flakes – 4.7% (fig. 3.5). Therefore, the importance of *débitage* processes in the site is quite obvious.

As regards complete flakes, our aggregate (n=125) is substantially inferior to the 258 flakes Leakey described (1971:58). This is due to the fact that Leakey classified items that are actual fractured knapping products as whole flakes. Therefore the former should be contemplated in a different category in the general *débitage* group. Our analysis highlights the great metric homogeneity of the flakes, concentrated in the 21-40 mm range, maximum lengths and widths (tabl. 3.4 and fig. 3.6 & 3.7). The scant lava flakes are slightly smaller (33.77 mm maximum length) than the quartz flakes (37.58 mm), but are included in the same interval (fig. 3.6), and therefore show no significant metric differences. Differences between quartz and lava flakes appear in the cortex indices. Table 3.5 shows that flakes without any type of cortex compose the most relevant percentage (62.4%). Nonetheless, breaking down the flakes in terms of the raw material (fig. 3.8) shows that lava items do not follow the general pattern since, percentage-wise, the cortical types are more frequent in lavas than in quartzes.

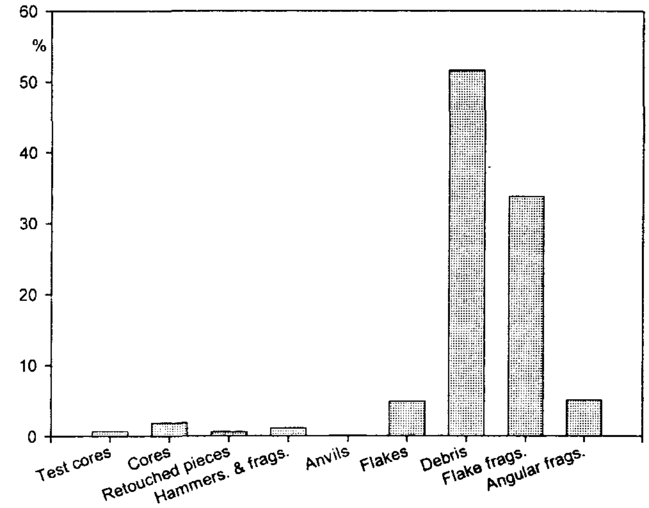


***Figure 3.5.*** Percentages of the categories at FLK Zinj, excluding unmodified lithic material.

| | Minimum | Maximum | Mean | Std. deviation |
|---|---|---|---|---|
| Length | 16 | 82 | 36.78 | 12.13 |
| Width | 4 | 76 | 32.88 | 11.59 |
| Thickness | 4 | 36 | 11.51 | 5.45 |
| Weight | 1 | 174 | 18.89 | 24.21 |

***Table 3.4.*** Dimensions (mm. and gr.) of whole flakes from FLK Zinj.

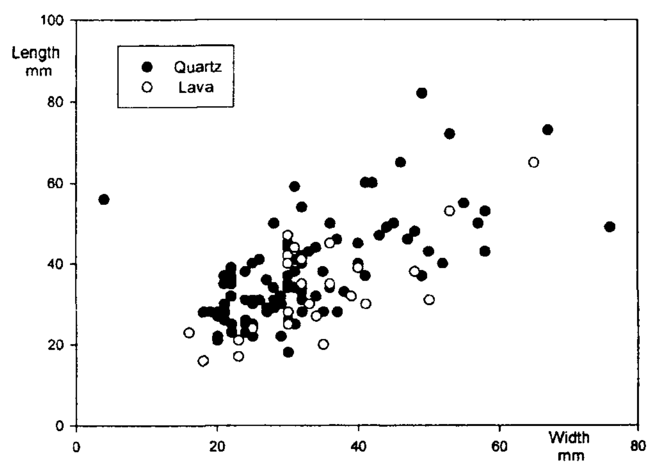


***Figure 3.6.*** Size scatter diagram of whole flakes' dimensions.

Obviously, the difficulty of identifying cortical areas in quartzes prevents an exact evaluation of their relevance in the assemblage. In any case, and even if we focused on FLK Zinj lavas – where it is easier to locate cortical areas –, we seem to be facing a different pattern. Lava flakes are primarily cortical, many of them almost first generation (fig. 3.8). These lava flakes come from low-quality blocks, and in fact present abundant irregularities and vacuoles. That must be the reason for the poor manufacture of these flakes, which generally present blunt edges and irregular morphologies; nonetheless, some good quality items have also been documented (fig. 3.9). Altogether, the scarce number of items, the high cortex percentage and the low quality of these

| Dorsal face | Striking platfom | | | | Total | |
|---|---|---|---|---|---|---|
| | Cortical | | Non-cortical | | | |
| | N | % | N | % | N | % |
| Full cortex | 2 | 1.6 | 3 | 2.4 | 5 | 4 |
| Cortex > 50% | 4 | 3.2 | 10 | 0.8 | 14 | 11.2 |
| Cortex < 50% | 1 | 0.8 | 22 | 17.6 | 23 | 18.4 |
| Non-cortical | 5 | 4 | 78 | 62.4 | 83 | 66.4 |
| Total | 12 | 9.6 | 113 | 90.4 | 125 | 100 |

***Table 3.5.*** Absolute and relative frequencies of cortex in the whole flakes from FLK Zinj.

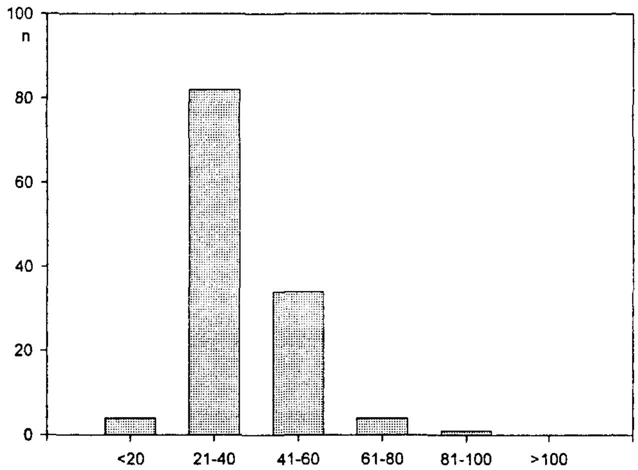


***Figure 3.7.*** Length patterns in the whole flakes (mm).

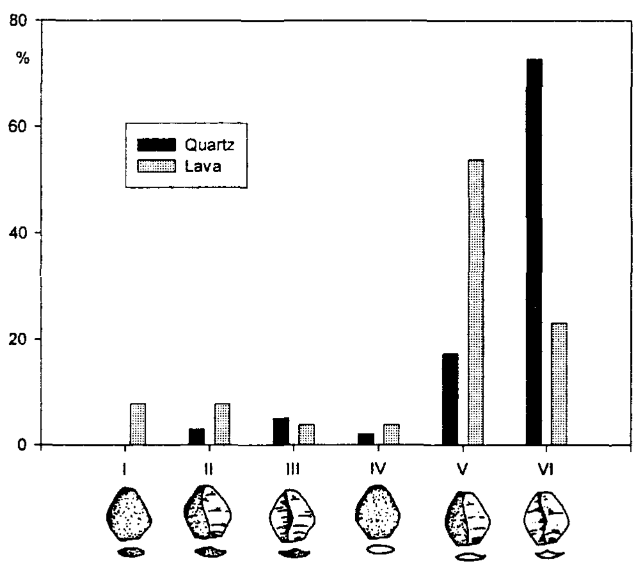


***Figure 3.8.*** Types of flakes at FLK Zinj (divided by raw material), according to Toth's (1982) classification.

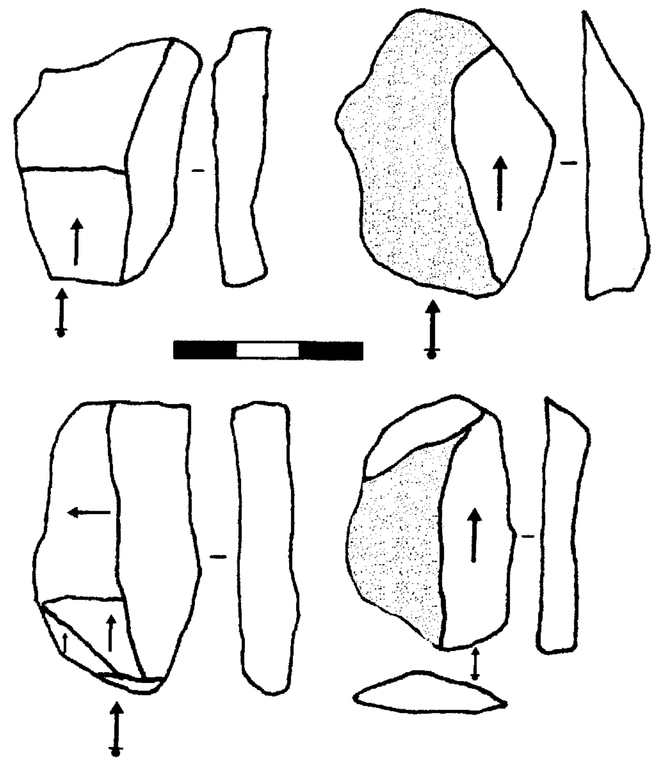

***Figure 3.9.*** High-quality lava flakes from FLK Zinj.

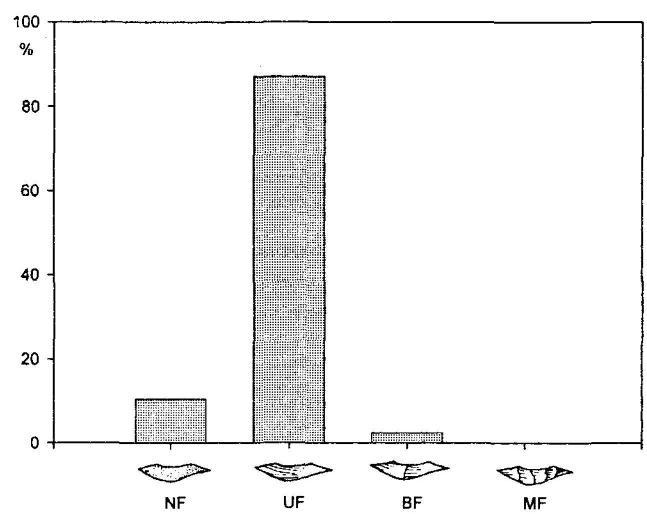


***Figure 3.10.*** Types of striking platforms in the whole flakes from FLK Zinj.

lava flakes, seem to link their production to local vesicular blocks, which would only have been exploited occasionally, and are therefore not linked to the general quartz *débitage* strategy.

In the whole collection of flakes there is a dominant pattern in the management of striking platforms (fig. 3.10), with a predominance of non-cortical butts (90.4%). In any case, knapping platforms are not usually prepared, with 87.2% unifaceted butts and only 2.4% dihedral butts, with no multifaceted butts documented.

Despite the lack of preparation of knapping platforms, the quality of most quartz flakes is surprising. As occurs in DK, this suggests unidirectional exploitation, producing flakes with elongated morphologies and fine, regular sections. The analysis of the number of scars on the dorsal

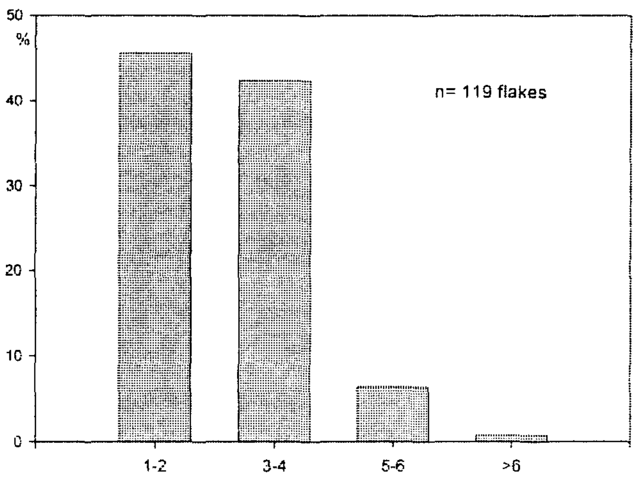


*Figure 3.11.* Amount of scars on the dorsal sides of the whole flakes.

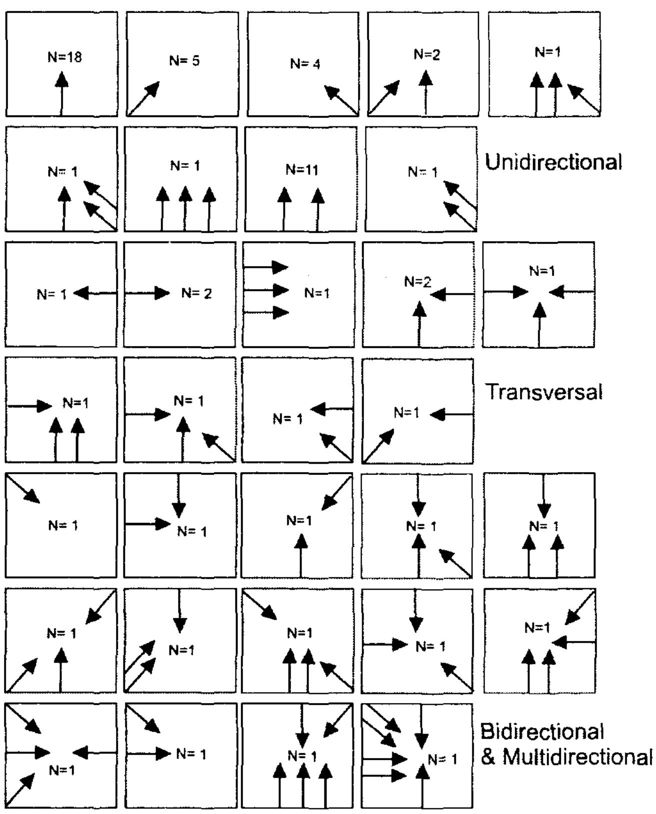


*Figure 3.12.* Diacritic schemes of the whole flakes.

faces indicates a relatively recurrent exploitation of the same knapping surfaces, with 45.6% flakes presenting 1-2 previous scars, and a very similar percentage (47.6%) of items from a slightly more intense reduction (fig. 3.11). Another indication that supports the recurrence in the exploitation appears in the fact that there are a few edge-core flakes which, albeit composing a minimum percentage (5.6%) of the total flakes, do suggest an interest in rejuvenating knapping surfaces that had lost the appropriate angles.

Identifying the direction of the previous scars on the dorsal sides of the quartz flakes can be even more complicated than in the lava examples described in DK. Nonetheless, one example (n=70) from the flake collection has been used to perform a minimum estimation. The main pattern is unidirectional (fig. 3.12), although there are also examples of core rotation, indicating a recurrent exploitation based on multidirectional management.

Altogether, we can refer to knapping products with unifaceted butts from cores with unprepared striking platforms, and in which the direction of the dorsal scars indicates the predominance of unifacial methods which do not present core rotation (fig. 3.13). Flakes suggest the craftsmen were not usually interested in and/or were not capable of rejuvenating the exploitation surfaces. As aforementioned, there are few edge-core flakes and there is little evidence of a systematic rejuvenation of these cores' edges. The number of scars per flake – predominantly 1-2 detachments – also indicates relatively short knapping sequences, although there are some flakes that suggest certain recurrence in their exploitation.

## Retouched pieces

Leakey (1971:58) counts 18 light-duty scrapers and 4 burins, as well as over 70 flakes and fragments that present utilization traces. Ludwig (1999) and Kimura (2002) did not contemplate this category in their classifications, and Potts (1988) reduced the number of scrapers from 18 to 9 items. At first, Potts (1988:377) maintained Leakey's classification (1971) as regards burins, but subsequently stated that these pieces could be natural (Potts 1991). After disagreeing with Leakey's criteria (1971) for the DK study, we thought we would also discard most of the so-called retouched items in FLK Zinj. Nonetheless, this was not the case, and we have classified 15 items as such, reaching a total similar to the 22 retouched

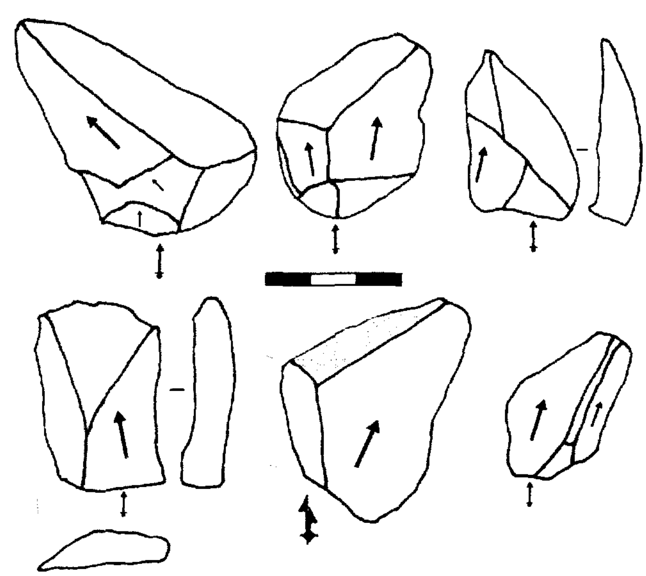

*Figure 3.13.* Quartz elonged flakes from FLK Zinj.

pieces Leakey proposed. In any case, in quantitative terms, these retouched items suppose a minimum percentage of the collection (0.6%) and of the raw material used in this category (in total, only 653 grams among slightly over 43 worked kilograms).

The first issue concerns the burins: none endure a thorough analysis, since in-depth studies indicate that the so-called burin blows are merely fractures. Potts (1991) had voiced doubts regarding the existence of real burins in Bed I, but provided no analytical arguments to discard them. It is ambiguous to distinguish a split fracture ("Siret" flake) from a real burin; consequently, the classification sometimes depends on subjective criteria. Nonetheless, in this case we were lucky enough to identify two fragments that refit, and precisely corresponded to a flake represented in the monograph (Leakey 1971:57) as a burin (fig. 3.14). Thus, this specific example allows us to interpret the so-called burins as knapping fractures and, as in DK, rule out their existence in this part of the Olduvai sequence.

As regards the pieces classified as authentic retouched pieces (fig. 3.16 and 3.17), the predominant raw material is quartz, with only 1 of the 15 retouched objects made of lava. Consequently, retouched pieces follow the same pattern as the rest of the *débitage*, with an absolute prevalence of quartz and a merely incidental presence of lava. 11 of the retouched pieces (73.3%) are flake fragments, in opposition to only 4

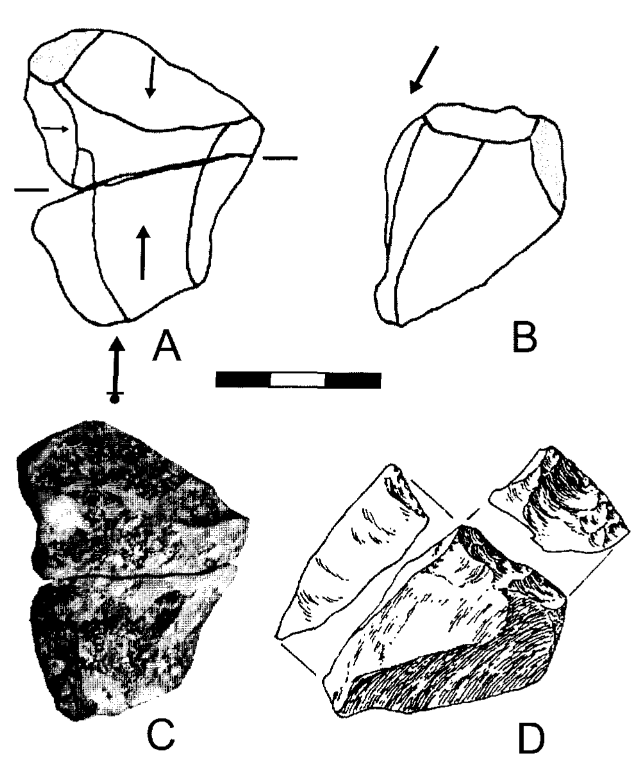


***Figure 3.14.*** Refit of two flake fragments from FLK Zinj. Figure d is part of one of Leakey's (1971:57) plates and represents a so-called quartz burin (b). Nonetheless, it is merely the distal part of a fractured flake (a, c), and therefore, is not a burin blow.

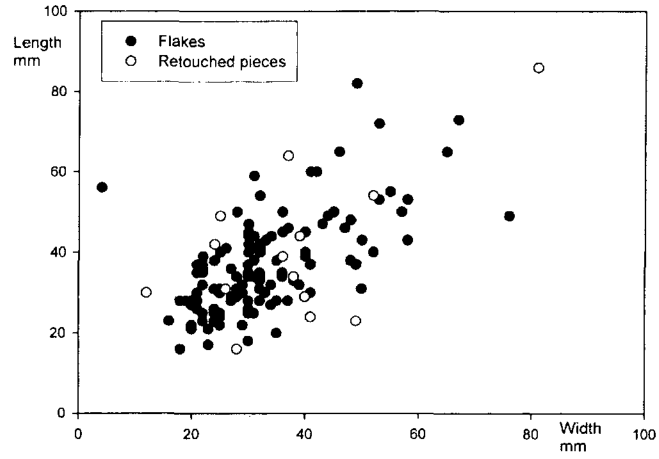


***Figure 3.15.*** Dimensions of the retouched pieces compared with whole flakes.

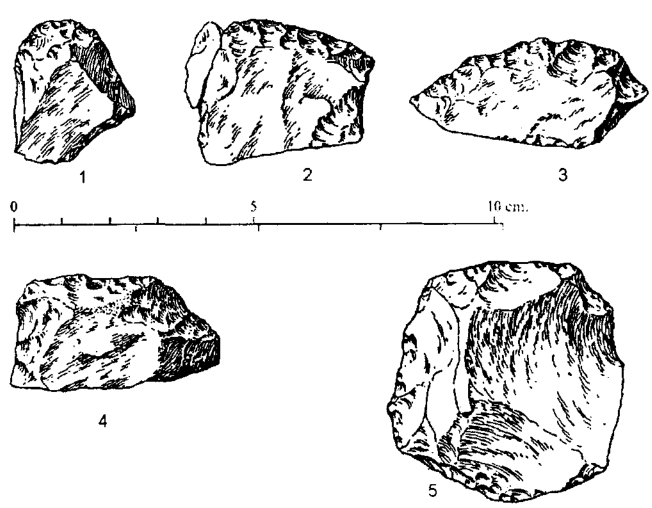


***Figure 3.16.*** Actual retouched pieces from Leakey (1971:57). 1-3: lateral side scrapers; 4: transversal side scraper; 5: lateral-transversal side scraper.

examples of whole flakes. Despite the fragmented character, the average size of the retouched pieces is slightly bigger (40.27 mm maximum length) than flakes (36.78 mm), but do not follow a specific morphometric trend (fig. 3.15) and can be included in the size scatter interval for flakes. In all, neither the raw material nor the dimensions of the retouched pieces stand out in the patterns observed for the rest of the *débitage,* which indicates no preferential selection of blanks for retouching.

Typologically, there is a prevalence of scrapers, especially lateral side scrapers, with 8 examples (53.3%), followed by transversal scrapers with 3 examples (20%) and one single case of a lateral-transversal side scraper. There are also 2 notches and a possible end scraper, which are actually incidental examples in the general dynamics of FLK Zinj, where retouched pieces were not a basic, but a residual element in the framework of the activities performed.

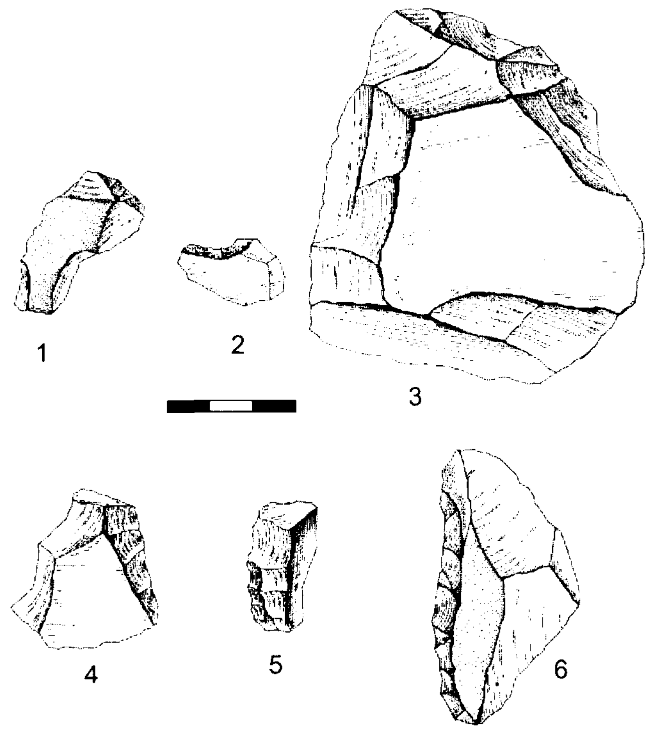


*Figure 3.17.* Retouched pieces from FLK Zinj. All examples are quartz pieces except number 4 (basalt). 1: end scraper; 2: notch; 3-6: side scrapers (drawn by N. Morán).

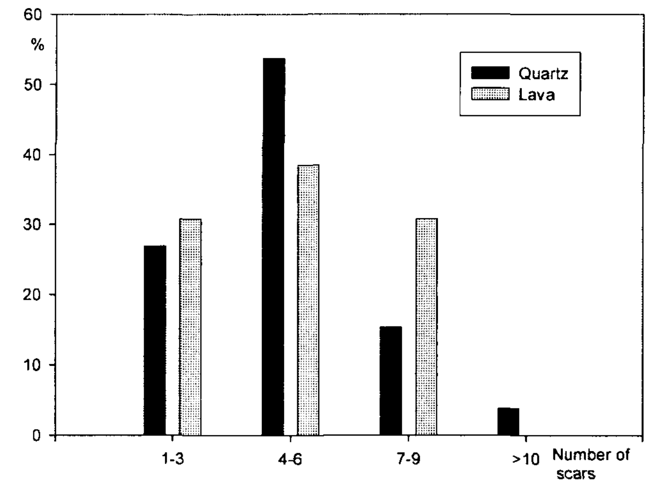


*Figure 3.18.* Amount of scars on the quartz and lava cores from FLK Zinj.

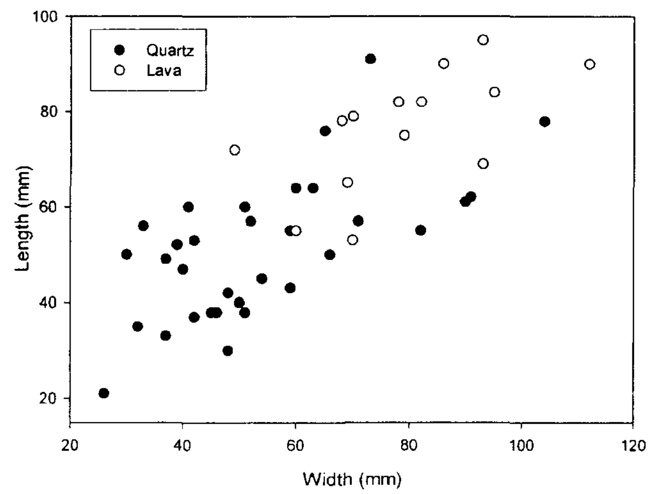


*Figure 3.19.* Size scatter diagram on cores according to raw material.

## Cores

With 49 items, cores compose 1.8% of the total percentage of objects from the site (tabl. 3.2). They seem irrelevant from a quantitative viewpoint. Yet, considering the real volume of employed raw materials, cores are still more relevant than the *débitage* (tabl. 3.3). This classification of cores includes objects Leakey (1971:58) considered artefacts, such as choppers, polyhedrons, discoids and heavy-duty scrapers. Adding all these categories would amount to 38 pieces, still lower than our aggregate, although Leakey did also include 155 core fragments which have merely been considered as cores in this analysis. Potts (1988:378) contributed a similar number of cores (n=28), including several test cores (incidental cores in his terms), and abundant core fragments. Kimura (2002:301) contributed no absolute frequencies, although in view of her percentages, we suppose she classified 84 pieces as cores. Finally, Ludwig (1999:28) identified 37 cores, which leads us to believe he merely included in this category objects that Leakey (1971) classified as choppers, polyhedrons and discoids. In all, core frequencies vary too much in terms of each investigator, therefore we must reconsider the enormous subjectivity implied in any system of analysis.

Considering the issue of the raw materials first, we come upon a dichotomy between the quartz and lava cores. Although the latter are numerically inferior to the quartz cores (see again tabl. 3.2), we have also underscored previously that, as regards the total volume of the raw material, there is paradoxically a greater amount of lavas. This difference could be explained in view of the vast intensity of reduction quartzes underwent. Nonetheless, our aggregates indicate that the number of detachments on cores is identical for both raw materials, with a mean of 5 scars both in quartzes and lavas. The classification of cores in terms of the number of scars (fig. 3.18) does not offer a clear pattern either, therefore we only find significant differences when comparing the dimensions of the quartz and lava cores (fig. 3.19), since the lava pieces are invariably larger (see also tabl. 3.6). Although this trend could be explained given that, hypothetically, the natural lava blanks were larger, given the vast volume of quartz *débitage* and the scarce number of lava products (which are also usually cortical), it seems feasible to link the small quartz cores to the greater intensity of the exploitation of such raw material.

Cortex percentages in cores (fig. 3.20) support this hypothesis, since we found no basalt core in which reduction had been sufficiently intense to eliminate the whole cortex, and in the

| | | Minimum | Maximum | Mean | Std. deviation |
|---|---|---|---|---|---|
| Quartz | Length | 21 | 91 | 51.27 | 14.54 |
| | Width | 26 | 104 | 54.15 | 18.59 |
| | Thickness | 17 | 72 | 35.03 | 11.2 |
| | Weight | 18 | 650 | 152.27 | 129.35 |
| Lava | Length | 53 | 95 | 76.35 | 12.57 |
| | Width | 49 | 112 | 78.85 | 16.26 |
| | Thickness | 37 | 87 | 59 | 12.3 |
| | Weight | 183 | 1000 | 473.42 | 257.78 |

***Table 3.6.*** Dimensions of cores at FLK Zinj.

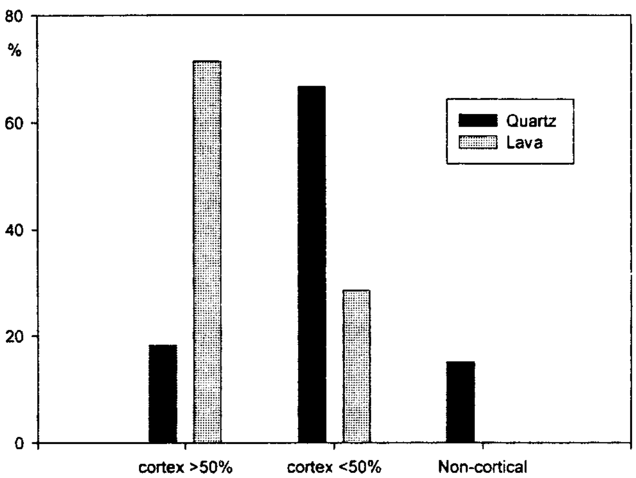


***Figure 3.20.*** Cortical percentages on lava and quartz cores.

most abundant examples of lava (71.4%), cortex prevails over the knapped area. Quartz patterns are different, since many cores present residual cortex. Consequently, there is another argument to support a greater intensity of the reduction of quartzes as opposed to the marginal exploitation of lavas.

Continuing this problem regarding the intensity of the reduction, we can assess the relationship between knapping products and cores, as performed in DK. Based on Leakey's (1971) data and Potts' (1988) information for the lava material, Brantingham (1998: 83) indicates a total of 15 cores and 111 flakes, estimating an average of 7.4 flakes per core. McNabb (1998:17-19), also considering lavas based on Leakey's (1971) publication, counts 18 cores and, contemplating a minimum of 3 and a maximum of 15 scars per core, calculates a minimum of 108 flakes and a maximum of 540. Since both Brantingham (1998) and McNabb (1998) base their calculations on Leakey's (1971) aggregates and said volumes do not coincide with ours, we can reformulate this hypothesis. Based on this analysis, we calculate an average 5.3 flakes per lava core, taking into account cores with a minimum of two detachments and a maximum of 9 scars. Implementing McNabb's reasoning, this would produce a minimum of 42 lava flakes and a maximum of 126. Nonetheless, we only have 26 items at the site. Actually, adding the basalt flake fragments (tabl. 3.2) and whole flakes we could approach the minimum levels established in McNabb's proposal. Nonetheless, there is still a shortfall as regards lava *débitage*, especially given that we have not even considered the test cores, which would further increase the expected number of flakes.

Leakey (1971) had already stressed the imbalance between flakes and what she called choppers and heavy-duty scrapers. In a subsequent work, Leakey (1975) proposed an explanation for the lack of lava flakes in the fact that heavy-duty tools were not manufactured in the sites; therefore, they were already shaped when transported. This statement contains a conceptual contradiction, since we consider these heavy duty tools as cores, not as tools. From this standpoint, it would be logical to think that these lava pieces were flaked at the site, and that the flakes obtained were transported subsequently. In all, endorsing either of these options would imply the acceptance of a model similar to that proposed by Potts when stating that the Olduvai assemblages "*show every indication of a far more complex series of episodes of stone transport, flaking, preferential removal of cores or flakes from sites, and repeated introduction and modification of flaked pieces at sites*" (1991:163). Binford (1987) takes advantage of this imbalance between choppers and basalt flakes as another argument in favour of the multiplicity of events on the site. In his opinion, the deficit proves the artefacts originated from different occupation episodes which were mixed, but were in fact independent. This time we do not agree with Binford (1987), since morphologically and technically the flakes and cores made of lava present common, coherent characteristics, and we do not consider the quantitative criterion Binford puts forward is enough to refer to different taphonomic histories in each of these categories.

We can also apply McNabb's calculations (1998) to quartz cores. According to our classification, there are 34 quartz cores, which present a minimum of 3 and a maximum of 12 detachments, with an average of 5.2 scars per core. Therefore, there would be a minimum of 102 flakes and a maximum of 408 pieces. Although the number of whole quartz flakes recovered in the site (n=99) does not amount to the calculated minimum, if we obtained a minimum number of individuals among the quartz flake fragments (n=830) we may reach the interval contemplated in our calculation. Consequently, it seems that, as regards quartzes, there seems to be an internal coherence between the core percentages and the produced *débitage*. Therefore, we disagree with McNabb (1998:17), who suggested a deficit of quartz cores in FLK Zinj, which would have been transported from the site after undergoing knapping processes. We do not support this stance; hominids transported quartz cores to the site, exploited them intensely generating hundred of flakes and fragments and thousands of chips, and then discarded them, once exhausted, in the site itself.

## Core exploitation systems

In FLK Zinj, Leakey (1971:58) mentioned core-type tools like choppers, polyhedrons, discoids and heavy-duty scrapers. They can all be assigned to the different knapping systems

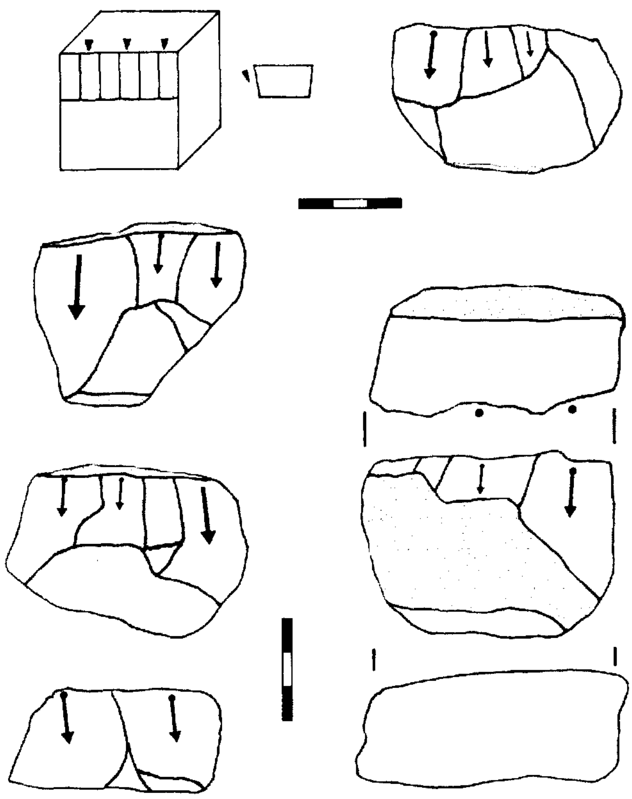

*Figure 3.21.* Unifacial abrupt partial quartz cores. They are interesting in view of their small size and the general reduction strategy, consisting in employing one of the natural tabular planes as a striking platform to obtain a short sequence of flakes on a single exploitation surface.

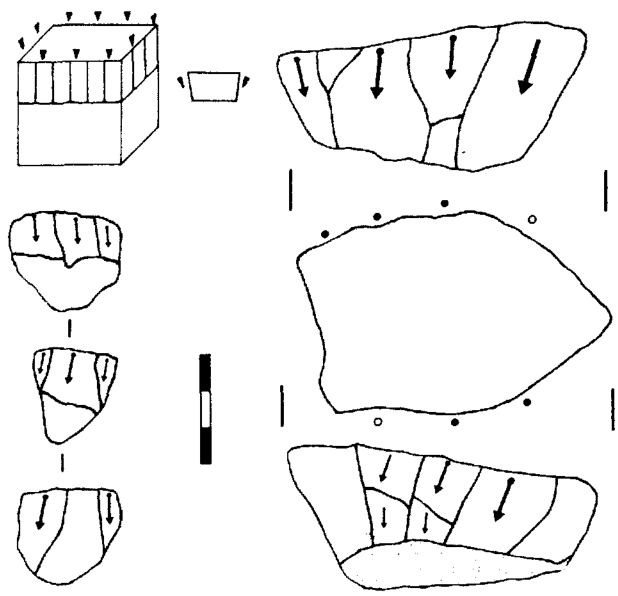

*Figure 3.22.* Unifacial abrupt total quartz cores. Note the exploitation of the whole periphery from a natural plane, both on the medium-sized block and the small quartz fragment.

that we are progressively describing in this book. The most general division divides the FLK Zinj cores (n=49) into unifacial (49%) and bifacial (48,9%), alongside a single core on Kombewa flake which is considered separately. According to the current technological classification, the most relevant exploitation system is the *unifacial abrupt unidirectional* system, which comprises 44.7% of the cores. This group gathers a good part of the pieces Leakey (1971) considered heavy-duty scrapers. Nonetheless, these abrupt angle detachments which Leakey (1971) considered retouched pieces, seem to be linked more precisely to flake detachment, and have therefore been included in the unifacial or bifacial abrupt systems. As in DK, the unifacial abrupt unidirectional method was employed in FLK Zinj both on a single surface (29.8% of the cores) and on independent platforms (14.9%). Nevertheless, the same system was always employed: after selecting an unprepared striking platform, an exploitation surface was knapped until it lost the appropriate angles. Instead of rejuvenating the necessary volumes, the core was discarded – single plane unifacial abrupt system (fig. 3.21 and 3.22) – or rotated until finding a new exploitation surface – independent plane unifacial abrupt system (fig. 3.23). Quartz cores were exploited maximising the blocks' natural tabular shapes as striking platforms, which were used to exploit the periphery of the core. Moreover, that periphery was not always exhausted, and there are many examples in which reduction is partial and craftsmen could not completely configure the core circumference. This exploitation model could provide the aforementioned elongated flakes with longitudinal dorsal patterns.

Sometimes the abrupt detachment method stems from a bifacial scheme (*bifacial abrupt system*), presenting scars on the horizontal plane that could be used to reactivate the platforms and the exploitation of the transversal and sagital planes. We cannot certainly say that detachments from one plane were used to prepare those of the another, therefore it seems more appropriate to refer to a simple interaction between surfaces, considering both as exploitation surfaces. In general, platform preparation is scarcely defined in these cores, in which the most important factor was to exploit a surface until exhaustion and then discard the piece. Furthermore, this bifacial abrupt system (fig. 3.24 and 3.25) achieves a relevant percentage (29.8%) in terms of the total number of cores.

Alongside this type of exploitation, there is a *unifacial simple partial system* (unifacial choppers), with 4.3% of the total number of cores. The interesting thing is that these cores, alongside the bifacial choppers (also 4.3%), are all lava-based. Nonetheless, as occurs in DK, FLK Zinj presents no use-wear traces on the ridges of the choppers that allow them to be classified as artefacts and they are, once again, considered simply another example of the variability of the knapping methods employed on the site. FLK Zinj also presents the *bifacial peripheral system*, albeit represented only by a 4.3% of the total number of cores (fig. 3.26).

The last relevant type of exploitation is the *bifacial alternate system*. In DK, this method was only identified on one core, therefore in that chapter we did not insist on its description.

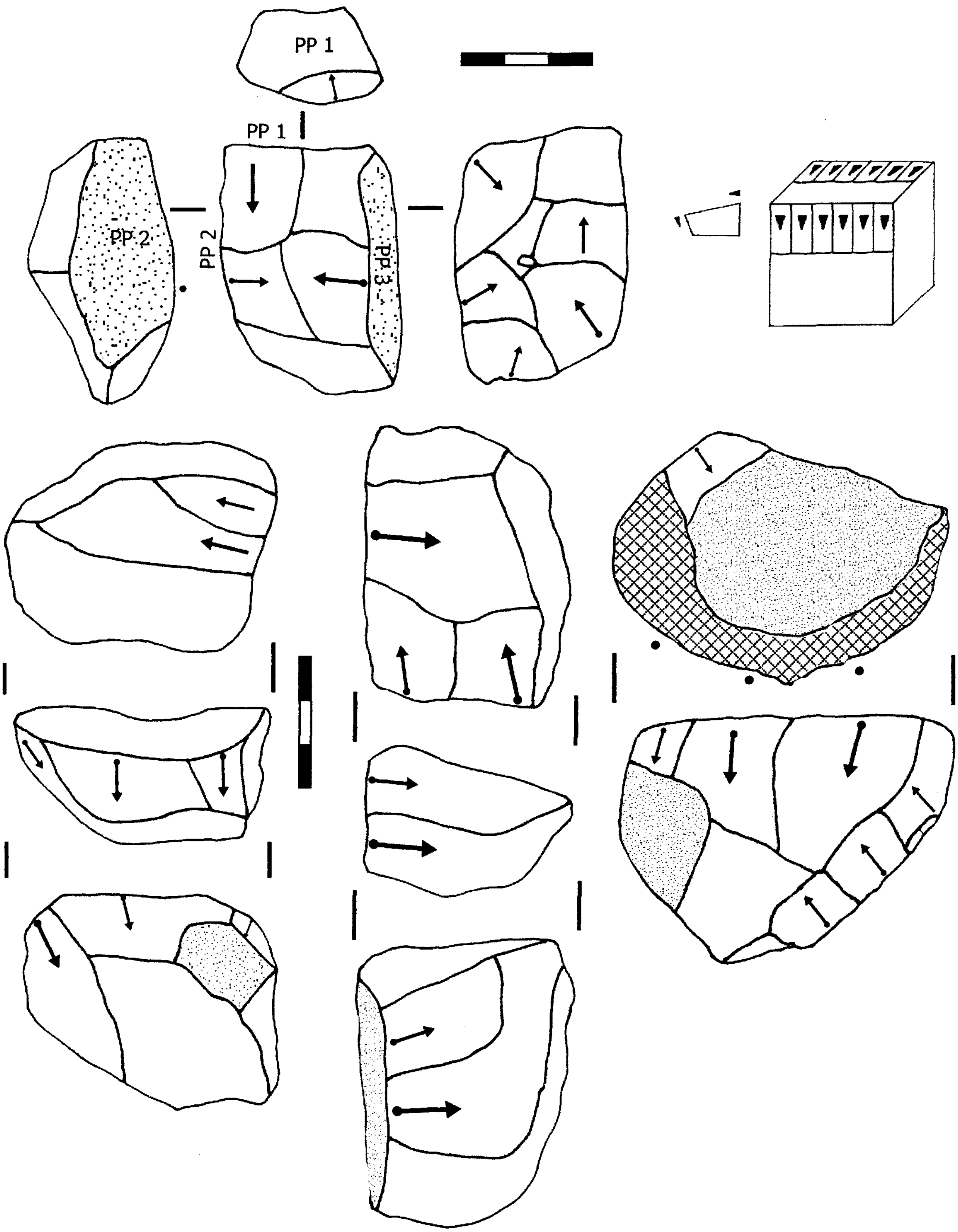


***Figure 3.23.*** Unifacial abrupt unidirectional cores on independent planes. All examples are made of quartz. The weave in the core on the right hand indicates a battered area. Note the example of the upper part of this figure; percussion platforms (PP) 2 and 3 are cortical, indicating the small size of many of the exploited quartz blocks.

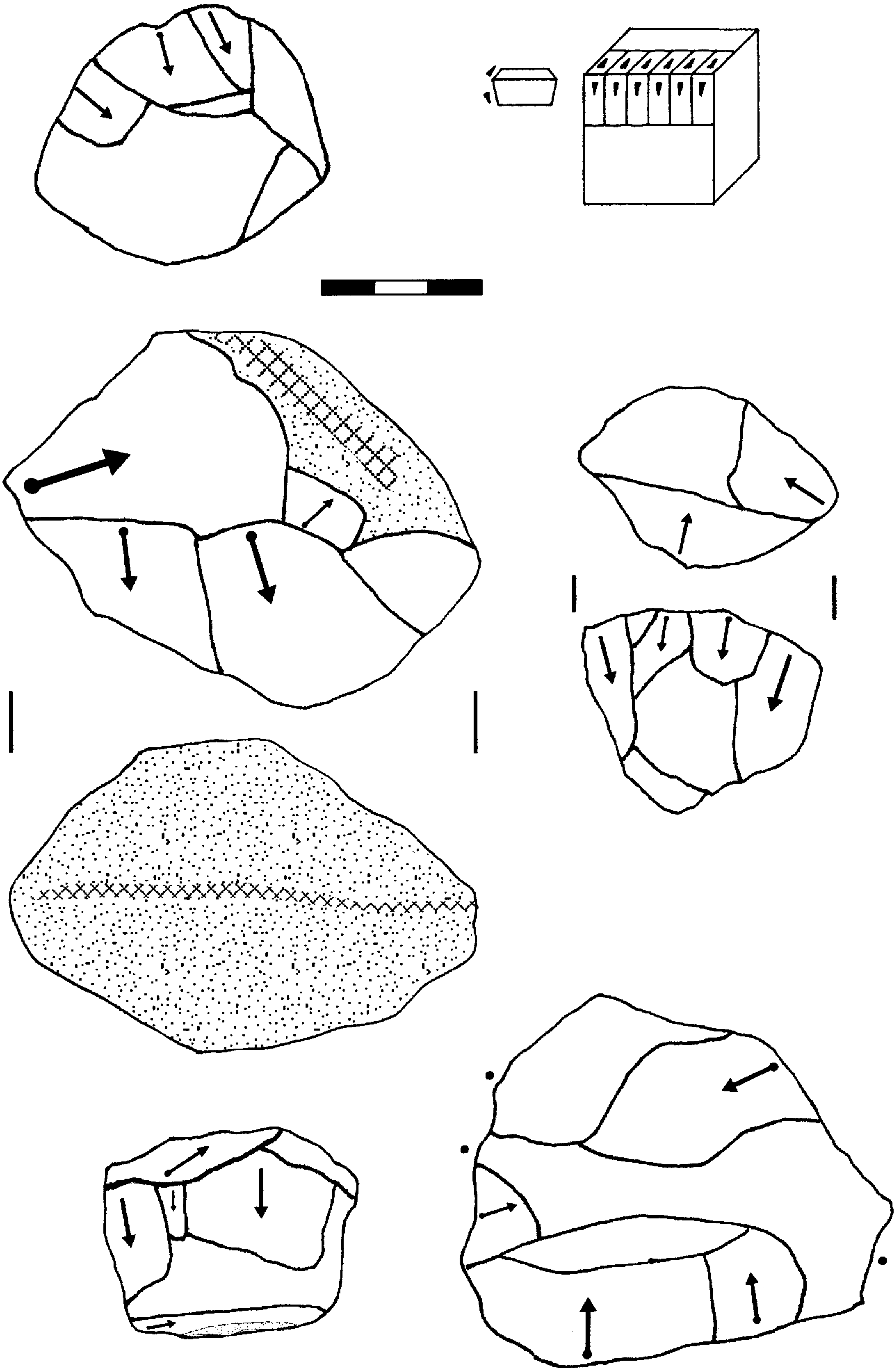

*Figure 3.24.* Quartz bifacial abrupt cores. Grids in some examples indicate areas affected by battering.

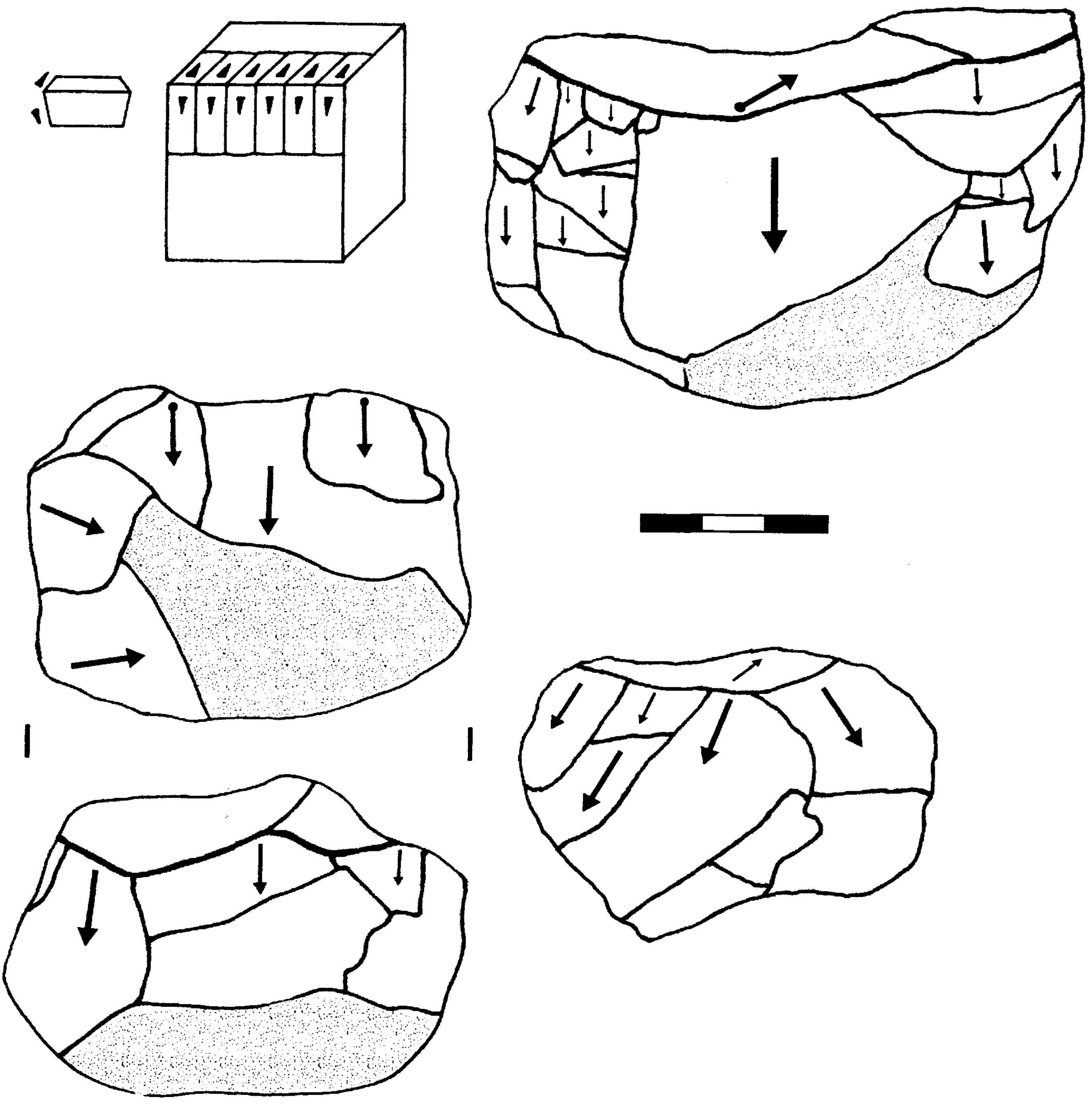

***Figure 3.25.*** Bifacial abrupt lava cores.

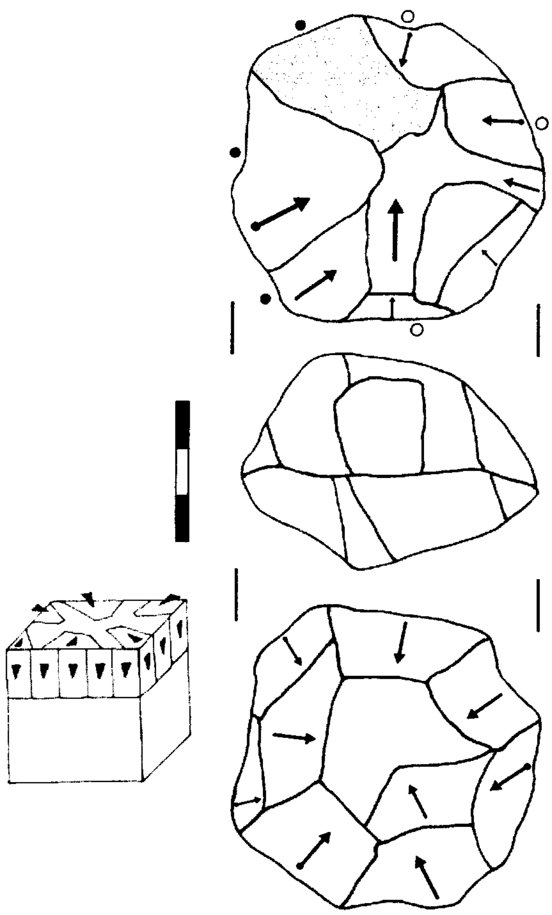

*Figure 3.26.* Bifacial peripheral quartz cores.

On the contrary, in FLK Zinj, the bifacial alternate method accounts for 10.7% of the cores and calls for greater attention. It is characterised by a zigzag configuration plane that manages a bifacial edge by means of alternating detachments from each plane. Such alternation enables the creation of consecutive striking platforms on each surface, and also creates convexities to extract another subsequent series in the next sequence steered by the "guide ridge". It is important to stress the idea that the whole volume of the core is not exploited, only the area closest to the edge, since it is precisely this factor which differentiates this method from the discoid system. Therefore, in the bifacial alternate method the alternation in the exploitation allows craftsmen to solve the angle problem for the subsequent series of flakes. Nonetheless, it does not maintain an adequate volume on the surfaces, which end up collapsing until the core has to be discarded.

A lot of these pieces do not present detachments over the whole circumference, which led Leakey (1971) to classify them as choppers. We have considered them bifacial alternate partial cores (fig. 3.27a), thus differentiating them from those that present knapping all over the periphery of the core – bifacial alternate total system (fig. 3.27b). Despite the technical errors implied in the employment of a edge and not a complete surface (which ends up collapsing the exploitation plane

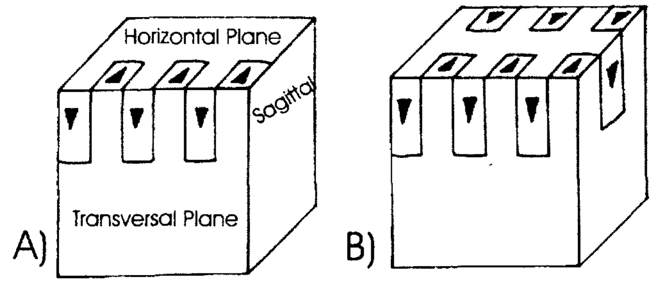


*Figure 3.27.* A: ideal schema for the bifacial alternate partial exploitation method. B: bifacial alternate total method.

completely), we consider the finding of this system in a site as old as FLK Zinj relevant, since it demonstrates that hominids were capable of understanding the dynamics of interaction between surfaces and the advantages of changing the striking plane systematically by alternating detachments (fig. 3.28). This suggests an ever greater control over geometric concepts implicit in lithic knapping.

## Percussion objects

Before considering percussion objects as such, we must underscore a fact that was not documented in DK, but which as from FLK Zinj and in other sites in the sequence will appear as a constant. A great part of the quartz *débitage*, if maintaining the typical characteristics that identify them as knapping products (butt, ventral face, negatives of previous detachments on the dorsal face, etc), present many battering traces. It is evident that in FLK Zinj an important amount of flakes had formerly been part of objects linked to percussion, which were subsequently recycled as cores: battering on the dorsal faces of the flakes support this notion. This does not only apply to flakes; 13 of the cores from FLK Zinj (i.e. 26.5%) present traces of having been used as percussion objects before and/or after being used as cores. Altogether, it is important to assume the polyvalence of many of the categories we identify, which were most certainly included in multifunctional dynamics.

Considering whole hammerstones, broken hammerstones and fragments detached from hammerstones (tabl 3.1), these objects compose over 8 kilograms of raw material and resemble the global volume established for other categories which could, in principle, be considered more significant (see again tabl. 3.3). Of the 21 identified knapping hammerstones, 18 are made of lava and only 3 of quartz. These lava hammerstones, in opposition to the so-called manuports made of vesicular raw material, are high-quality dense, rounded and homogenous cobbles made of basalt and phonolite. Therefore, hominids were obviously selecting a specific type of blanks for their hammerstones, both in terms of the raw material and the ergonomic sizes, morphologies and weights (tabl. 3.7).

We have also identified two anvils alongside these typical knapping hammerstones. Both are made of quartz and also present detachments that mark them as cores, although such

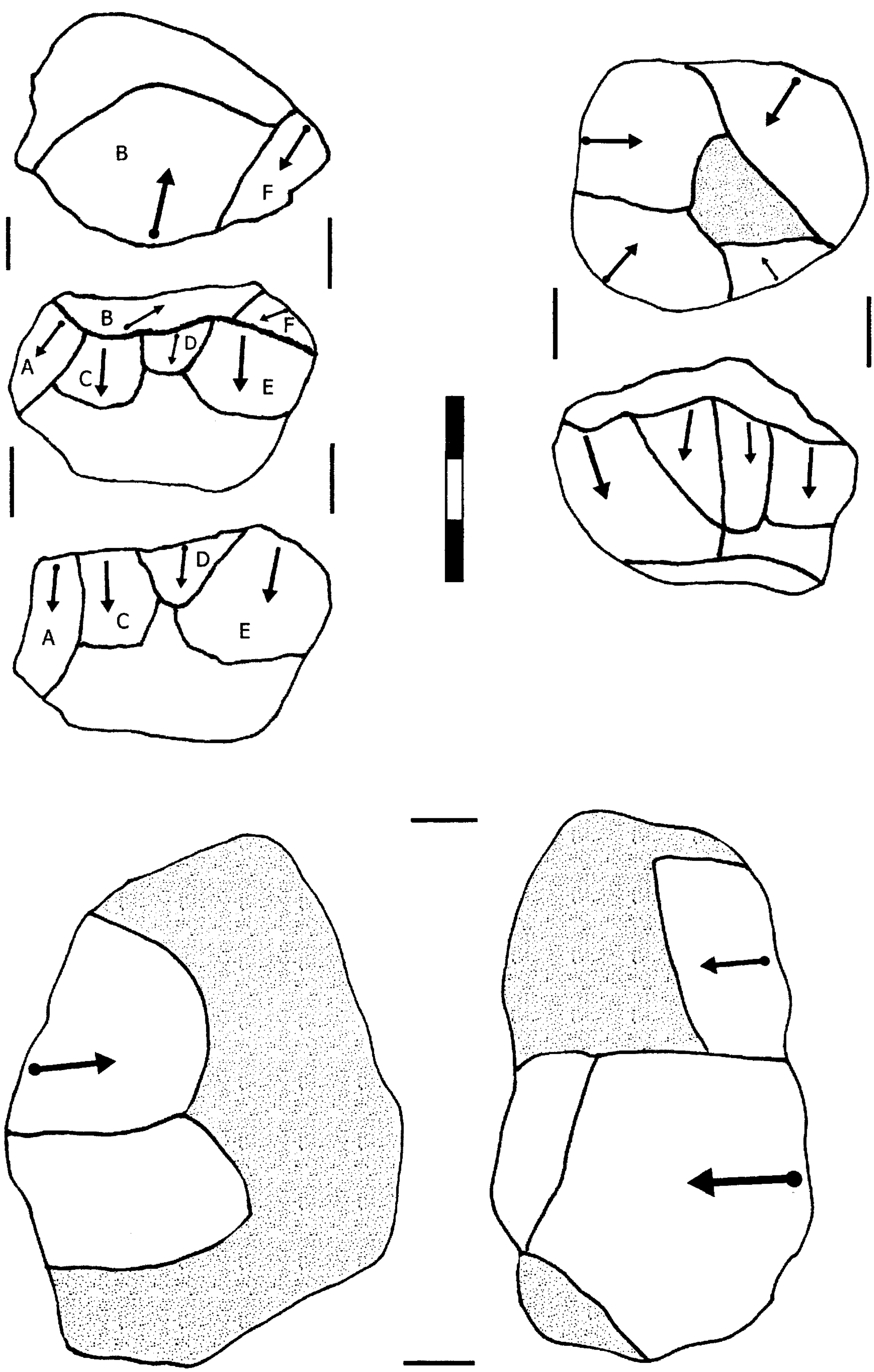


***Figure 3.28.*** Examples of the bifacial alternate system. The upper examples are made of quartz, whilst the lower item is made of basalt.

| | Minimum | Maximum | Mean | Std. deviation |
|---|---|---|---|---|
| Length | 47 | 95 | 75.89 | 13.06 |
| Width | 43 | 80 | 66.78 | 9.6 |
| Thickness | 34 | 75 | 51.94 | 12.09 |
| Weight | 91 | 692 | 351.36 | 160.68 |

***Table.** 3.7.* Dimensions of knapping hammerstones at FLK Zinj.

scars could also have been created by percussion fractures. This type of object achieves fundamental relevance in subsequent sites such as FLK North. We will, consequently, refer to anvils in depth in the following chapter.

In FLK Zinj, we must highlight the clear dichotomy existing between the management of raw material; most of the lavas were used as knapping hammerstones to obtain flakes from quartz cores. Whilst the vesicular lavas that characterise unmodified material are not good for knapping, the basalts and phonolites that appear on hammerstones present excellent qualities to be used as cores. Nonetheless, and although we have several lava cores, the hominids used those basalts and phonolites preferentially as hammerstones. This could be based on a cultural, not a merely functional selection (said lavas are as good quality as the quartzes), and therefore we would be facing idiosyncratic preferences, not merely practical inclinations.

## Conclusions

With a view to reconstructing the behavioural patterns that generated the site, the first level of analysis should be based on formation processes. Capaldo (1997) proposes the reconstruction of a "natural history" of the site, which would begin with a stage in which the humans and carnivores would act, followed by a subaerial stage, a diagenetic stage and a last excavation stage. We would like to commence analysing the last stage. FLK Zinj presents hundreds of lithic debris under 5 mm, and Bunn (1982) also comments on the vast amount of tiny bone fragments. Therefore, it seems obvious that Leakey (1971) took great care to sieve and recover all the materials that appeared. This aspect, alongside the mapping of all the remains and the excavation of a large surface of the site (around 300 m$^2$), guarantee the quality of the available sample from an informative point of view.

As regards the diagenic stage, Capaldo (1997) states that chemical soil processes, fossilisation, the compacting of sediments or animal-related alterations, did not have a serious bearing on the FLK Zinj assemblage. In fact, all the archaeological material was recovered from a sedimentary sequence under 9 cm (Leakey 1971), which once again indicates the high resolution of the assemblage. The previous subaerial stage is subject to more varied interpretations; different authors establish periods ranging from few months (Bunn & Kroll 1986) to even a few years (Potts 1986) required to bury the bone assemblage. As regards the hydraulic alteration, Potts (1988) affirms that up to 15% of the bone remains are abraded, and that some showed preferential orientations typical of a water-based rearrangement. Concerning the lithic industry, Petraglia and Potts (1994) dedicated a monographic study to postdepositional alteration processes. These authors underscored the existence of certain taphonomic alteration processes, and proposed the examples of the lava artefacts, whose edges were usually weathered, thus linking them to an important lapse of time before the burying of the remains, stating that *"the occurrence of hominid and other animal activity (...) over a multi-year period of surface exposure likely contributed to spatial rearrangement of objects at this site"* (Petraglia & Potts 1994:246). That subaerial weathering does not imply severe postdepositional alterations or a relevant hydraulic rearrangement. In the course of this study, we have observed that over 700 quartz fragments are under 5 mm, and no less than 86.7% (n=2309) of the lithic collection is under 20 mm long (fig. 3.29). If we consider this alongside the enormous amount of millimetric bone fragments, we can say that the vast integrity of FLK Zinj is guaranteed.

Indeed, we need to further the issue of weathering and deposit formation processes in order to contemplate the issue of the manuports. Throughout this chapter, we have defended the hypothesis that most of the so-called "unmodified objects of anthropic provenance" are merely natural pieces. We have based our statements on the direct comparison of these objects with pieces genuinely modified by hominids. Nonetheless, we must now offer some contextual arguments to justify the natural presence of large scale clasts in fine-grained sediments such as the ones that characterise FLK Zinj.

We have previously pointed out that the archaeological record of FLK Zinj was subjected to low or zero hydraulic transport (Petraglia & Potts 1994; Potts 1988; etc). Yet, this does not mean that the formation of the archaeological site responds to a single depositional event. On the basis of the bone weathering stages a sedimentation interval that ranges between several months (i.e. Bunn 1982; Bunn & Kroll 1986) and a few years (Potts 1986, 1988) is proposed. Regardless of the real

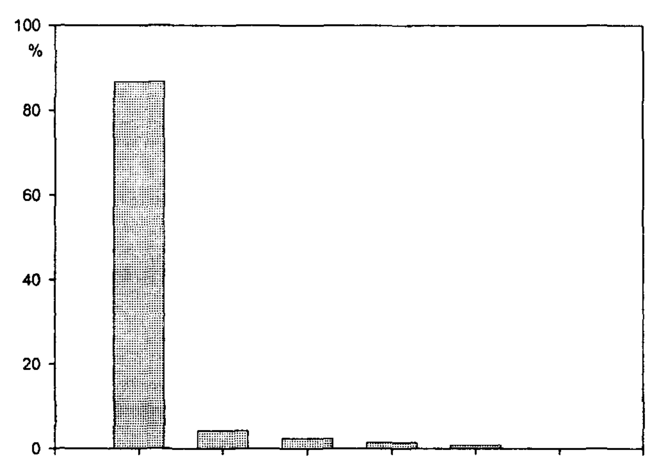


***Figure** 3.29.* Length patterns in all the lithics from FLK Zinj, excluding unmodified material.

deposition interval, a weak paleosol was formed and, as verified even for the Olduvai sequence (i.e. Ashley & Driese 2000), this supposes the combination of a variety of biotic and sedimentary agents in a complex formation sequence.

In this complex site formation process, we must not exclude the possibility of hydraulic supplies of natural clasts, although as we have stated, even though the archaeological remains do not present traces of fluvial traction, the existence of a small channel 35 cm deep and 53 cm wide was documented at FLK Zinj (Leakey 1971; Potts 1988). Even if this channel did not have sufficient significance to alter the original configuration of the archaeological remains, it could have dragged natural clasts from nearby areas. Or perhaps, more probably, the channel eroded and redistributed levels underlying the FLK Zinj site in which there were fragments of lava that were thereby incorporated to the FLK Zinj clay paleosol.

In fact, we do not believe that it was mere coincidence that most of the supposed manuports from FLK Zinj are of a very irregular vesicular lava which is identical to the basalt that emerges from the immediate proximities of the site. Furthermore, the majority of the supposed manuports that Leakey (1971, fig. 24) plots in the *Zinjanthropus* Floor plan are located on the periphery (western and southern area) of the archaeological concentration. Leakey (1967:427) realised the peculiar distribution of the supposed manuports, but finally she did not take it in account. In our opinion, that distribution should be linked to the natural deposition processes of the clasts, and probably of some of the bones (see also Binford *et al.* 1988:131). Despite the silty clays that configure the main body of the stratigraphical level, we consider the erosion of lower levels, the redistribution of clasts and other micro-scale processes that take place in the formation of sites, could have led to archaeological remains becoming mixed with totally different lithic materials produced by natural sedimentation. As we will see below, this hypothesis has relevant consequences as regards assessing the different interpretations of the behaviour that generated FLK Zinj.

After reconsidering the stages of excavation, diagenesis and weathering, we will analyse the last stage included in the reconstruction of what Capaldo (1997) called FLK Zinj's "natural history," which analyses the role played by hominids and carnivores. The first major point is to stress that all researchers, even those who most criticised the integrity of the sequence (Binford 1986, 1987, 1988; Binford *et al.* 1988), assume the participation of two different actors on the FLK Zinj assemblage, hominids and carnivores. Another issue, beyond this work, is to elucidate if hominids accessed carcasses first (Bunn 1982, 1986, 1989, 1991; Bunn & Kroll 1986; Domínguez-Rodrigo 1997; Oliver 1994) or if hominids were transporting to the site carcasses and anatomical portions taken from other carnivores (Binford 1986; Binford *et al.* 1988; Shipman 1986; Blumenschine 1995; Capaldo 1997; Marean *et al.* 1992; Madrigal & Blumenschine 2000; etc). In any case, the presence of cut marks and tooth marks on the bones indicate that both actors partook in the final configuration of the assemblage.

The second point is the direct link between the remains of fauna and the lithic industry. Three factors indicate this relationship. The first is the spatial association that brings together the main patch of bones and the practical entirety of the lithics on a concrete spot. It is no coincidence that in such accumulation, the bone material is completely fragmented and coincides with the area dedicated to quartz *débitage*, whilst complete bones are found in the periphery of the concentration – according to Binford *et al.* (1988) belonging to an different depositional event, not to the main patch – alongside the unmodified material which we have considered natural herein. The second factor that links the remains of fauna and the lithic industry is that the bones present obvious cut marks (Bunn 1982; Potts 1988; Oliver 1994), produced by flakes like the ones analysed herein. Thirdly, we have a vast collection of percussion marks on bone midshafts (Bunn 1989; Blumenschine 1995), which indicate a more (Blumenschine 1991, 1995; Marean *et al.* 1992; Madrigal & Blumenschine 2000) or less relevant (for example Lupo 1998) marrow extraction. Since the two quartz anvils do not seem related to the bipolar technique – only found in FLK Zinj in isolated examples –, these lithic pieces were quite probably used for bone-marrow processing, as proposed by the available experiments (Blumenschine 1995; Blumenschine & Selvaggio 1991; Bunn 1989; etc). Together, all these factors denote that the recovered lithic industry was linked to carcass processing activities.

We can now summarise the type of technological strategies the hominids used to modify these bone remains. Although we do not rule out that part of the unmodified lava objects were genuinely supplied anthropically and are not merely clasts that were deposited naturally, after the hypothesis set forth in the previous pages, we would rather overlook them when analysing the lithic assemblage. This can be applied to lavas, of possible local provenance, but not to quartzes, of certain exogenous provenance. Potts (1988) refers to up to 21 blocks of unmodified quartz, which would be genuine manuports. In this analysis, however, we have observed use traces on all except one, which would be the only manuport and, consequently, the only representative of the raw material transportation stage. This would mean that practically all the lithic material transported to the site was employed during the activities performed there, denying any kind of stockpiling activity for a subsequent visit. With regard to the decortication stage, the knapping products with predominant cortex compose 15.2% of the total number of whole flakes (tabl. 3.5). Yet, when contemplating that percentage with the rest of the lithic assemblage, the initial flaking processes are limited to a mere 0.7%, therefore entailing an enormous drop regarding the relative importance of this activity. The same occurs with the tool retouching processes which, as mentioned previously, only composed 0.6% of the total of the collection. In all, FLK Zinj sees an absolute prevalence of regular flake production activities linked, quite certainly, to carcass processing, and – therefore – to the stage envisaging the employment of the artefacts.

*Figure 3.30.* Typical unifacial exploitation at FLK Zinj, from natural platforms on small quartz blocks.

After explaining the relevance of the *débitage* processes, it would be necessary to insist on the methods used to obtain knapping products: the FLK Zinj hominids did not generally prepare the cores' striking platforms, detaching flakes from surfaces using a unidirectional exploitation from abrupt planes (fig. 3.30), both unifacial and bifacially. Those were the most widespread knapping methods (fig. 3.31), although we have also documented slightly more elaborate systems, such as those involving the bifacial management of edges based on alternating detachments (fig. 3.32), or methods linked to a bifacial peripheral exploitation. None is very complex, and they do not involve a rejuvenation of the knapping surfaces. As a result, the detachment sequences were never very long, since after a few detachments, the core lost the required angles and was discarded.

However, it is not an unorganised or ineffective knapping strategy, quite the opposite. In our opinion, it is a specific, efficient and structured technology. Specific in that the reduction processes follow specific guidelines which, albeit simple, are repeated constantly on the cores and imply a particular knapping system. Furthermore, it is perfectly efficient since they obtain high-quality flakes with well-defined sizes and morphologies. Finally, it is a structured technology given the clear dichotomy between the raw materials used for each task; the *débitage* focuses on quartz, whilst knapping hammerstones are invariably made of basalt and phonolite. As mentioned, there is a selection of raw materials for each tasks which, given the similar quality of lavas from fluvial beds and tabular quartzes, can be explained not through functional criteria, but through specifically cultural grounds.

After describing the site's contextual, taphonomic, zooarchaeological and technological characteristics, it is necessary to briefly consider the nature of FLK Zinj in a more general framework of settlement strategies followed by the Olduvai hominids. Given the evident juxtaposition of bones and lithics, the scarce taphonomic alteration, the limited vertical placement opposed to the vast horizontal area, and the exceptional state of preservation of the remains, FLK Zinj was considered the basic model to define the Olduvai living floors (Leakey 1971) and subsequently type C sites of the African Plio-Pleistocene (Isaac & Crader 1981). Furthermore, FLK Zinj has not only been used as a reference to systematise sites contextually, it has also been considered a paradigm to elaborate different models from which to interpret the behaviour of early humans. Essentially based on the FLK Zinj site,

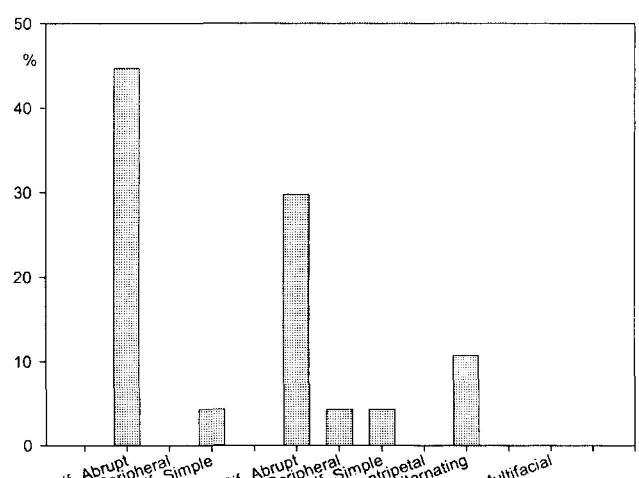


*Figure 3.31.* Percentages of the knapping methods at FLK Zinj.

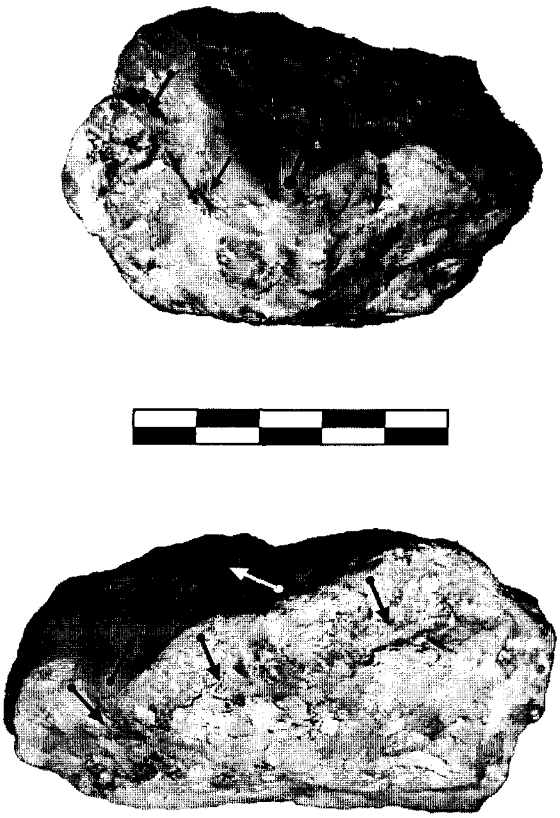

*Figure 3.32.* Examples of quartz cores with alternate bifacial edge.

Isaac (1978) defined his home-base model and subsequently his central-place foraging pattern (Isaac 1983, 1984), whilst Potts (1988) used it as the example for his stone-cache model and his subsequent resource transport hypothesis (Potts 1991), and Binford (1987, 1988) used it as the paradigm for the fortuitous aggregation of independent depositional events. This is no place to discuss the different hypotheses, but we would like to reflect on the materials described herein. Kroll and Isaac (1984) speculated on the fact that most part of the lithic assemblages documented in Koobi Fora or Olduvai could actually have been manufactured by one or two craftsmen in under an hour. This, in a sense, could also be applied to the FLK Zinj case, where there are about 40 kilograms of knapped stones. Considering that the lava cobbles would have been collected near the site, we would only have to explain the import of the slightly over 17 kilograms of quartz documented. Hence, based exclusively on the information provided by the industry, we cannot conclude a recurrent occupation of the site.

Fortunately, the bone remains provide fundamental complementary information. Considering the hominids were the main actors as regards bone accumulation, this settlement would have received fauna remains from very different ecological niches. Moreover, the trip to Naibor Soit, albeit nearby, would make hominids pass by several ecological niches to stock up with quartzes. In all, we see that FLK Zinj was a focal point to which mineral and vegetable resources were taken from different areas of the Olduvai basin, similar to how Isaac (1984) imagined.