Chapter 7

TK

Introduction

The TK gully is located in the northern part of the Olduvai Gorge (see fig. 1.1). The trenches Leakey (1971) excavated encompass the upper part of Bed II, from its top in contact with Bed III and 4 metres deep, identifying 5 archaeological levels. These levels are located above Tuff IIC (around 1.5 my), and near the base of Bed III with a chronology estimated around 1.33 my (Manega 1993). Consequently, we can integrate these archaeological remains in a wide temporal span, nearer 1.33 my than 1.5 my. As regards the stratigraphic succession, and according to Leakey (1971:172), the following archaeological levels have been established, from top to base:

Level 5: the highest in the sequence, it has 1.2 metres of tuffs and clays interbedded with limestones. The base of Bed III appears above these limestones. It is composed by tuff deposits, and contains diffused artefacts.

Level 4: what Leakey (1971:172) designated TK Upper Occupation Floor is, according to this author, a living floor that rests on a clay paleosol in the contact with the overlying tuff. The archaeological deposit is 9 centimetres thick.

Level 3: known as the Intermediate Level, it is below TK Upper Floor and right above TK Lower Floor. It is characterised by tuff sediments with diffused artefacts.

Level 2: another clay paleosol appears 3 metres below the base of Bed III, and approximately 60 centimetres deeper than the Upper Floor, presenting a great number of archaeological remains, also concentrated in an area that is 9 centimetres thick. Leakey (1971) called it TK Lower Occupation Floor.

Level 1: under the paleosol there is a tuff that was eroded by a channel about 90 centimetres thick. It was full of clays and sands, in which Leakey (1971) identified bone remains (only 43 specimens) and lithics (1436 artefacts). Most of the lithic material is quite small, and Leakey did not exclude the possibility that they could have come from the overlying Lower Occupation Floor.

The variable remain densities pointed towards the fact that "*this site appears to represent a camping ground which was reoccupied intensively on two occasions and perhaps visited temporarily at the times when the tuffs between the Upper and Lower Floors and above the Upper Floor were deposited*" (Leakey 1971:173). She considered TK Lower & Upper Floor as genuine living floors in pristine conditions, compared to the other levels, which would be assemblages containing diffused material. That argument led us to focus on TK Lower & Upper Floor, leaving the other levels of the gully out of our analysis. Since in TK Lower & Upper Floor (henceforth TK LF and TK UF, respectively) remains were concentrated in deposits only 9 centimetres thick, Leakey (1971: 260) estimated the lower level had a density of up to 58 pieces per m^3 and the upper level 73 objects per m^3, only surpassed by FC West in the Olduvai sequence. The two trenches (one measuring 6 x 7.5 m and the other 8.7 x 4.5 m) Leakey (1971:172) excavated in TK only amounted to 84 m^2 of exposed surface. Therefore, the thousands of lithic artefacts recovered represented a prodigious concentration.

Both Leakey (1971) and Isaac and Crader (1981) considered both TK levels had not undergone relevant postdepositional alterations, with the former including them in her general classification as living floors and the latter among Type A sites, i.e. sites with concentrations of lithic material but no fauna remains. Despite the vast amount of lithic objects recovered from both levels, bone remains are scarce (230 pieces in TK UF and only 147 specimens in the lower TK LF).

Leakey (1971:261) notes the weathering that affects most of the bone remains in both levels of TK, which, alongside the actual context the remains were found in (a paleosol), indicates that the archaeological collection was exposed on the surface over a long period of time. As a result, we cannot exclude postdepositional disturbances that could have contributed to the disappearance of the bone remains. All these issues must have altered the original configuration of the remains, and hydraulic processes could have partially affected the assemblage (Petraglia & Potts 1994). Despite the poor preservation of the fauna, several tribes of bovidae were identified (Gentry & Gentry 1978:39), alongside proboscideans, equids, suids, giraffids, etc. (Leakey 1971:257). Furthermore, the maps recurrently offer a pattern of juxtaposition between the fauna and the lithic material. In fact, it has been suggested that the modifications visible on the jaw of the *Hippotamus gorgops* from TK LF were caused by hominids (Hill 1983).

General characteristics

Beyond Leakey's (1971) original study, there are first hand studies on choppers (Bower 1977), polyhedrons (Sahnouni 1991), spheroids (Willoughby 1987), raw materials (Kyara 1999) and on the typology (Stiles 1977) of both levels, on the postdepositional alterations of the industry (Petraglia & Potts 1994) and on the technology (Kimura 2002) as regards TK UF, and on the techno-typological characteristics of level TK LF (Ludwig 1999). The authors that analyse both levels (Bower 1977; Willoughby 1987; Kyara 1999) focus mainly on specific aspects, not on the general features of the collections, whilst the analyses of whole collections (Kimura 2002; Ludwig 1999) only examine one of the two assemblages.

At first, Leakey (1971) classified TK LF as a Developed Oldowan B, but then went on to rectify her conclusion and allocated the level to the Acheulean (Leakey 1975). Ludwig (1999) furthered Leakey's (1975) final proposal and included TK LF among the Acheulean assemblages. Kimura (2002) did not stop to rectify the allocation of TK UF to the Developed Oldowan B, which Leakey kept intact in subsequent publications (Leakey 1971, 1975, 1979). As regards aggregates, Ludwig (1999:31) offers a total (n=2115) that is very similar to Leakey's (n=2150) for TK LF, which does not occur with Kimura (2002:296), who studied less pieces (n=4622) in TK UF than Leakey described (n=5180).

These imbalances are probably due to the aggregates for the smaller fragments, which has led us to count more pieces than Leakey herself, with a total number of 2325 lithic remains in TK LF and 5268 in TK UF, although this does include unmodified lithic material, which Leakey (1971) always considered in a different aggregate. In any case, we have obviously analysed all the collection unearthed during the excavations, which will enable a detailed and representative description.

Categories represented in TK Lower Floor

Leakey (1971:183) mentioned 21 manuports, 11 of which were in lava and the rest in quartz, which she contemplated alongside a collection with a prevalence of *débitage*. This study only considers 11 unmodified objects (tabl. 7.1). Furthermore, and in opposition to other sites, we can safely say that at least the quartz objects are genuine manuports: the unmodified quartz objects are enormous tabular blocks, generally weighing over half a kilogram (tabl. 7.2). They can feasibly be considered genuine raw material reserves transported intentionally to the site, not only given their tabular shape

	Quartz		Lava		Gneiss		Total	
	n	%	n	%	n	%	N	%
Test cores	1	0	1	1.9	-	-	2	0.1
Cores	5	0.2	3	5.5	-	-	8	0.3
Large Cutting Tools	7	0.3	3	5.5	-	-	10	0.4
Small retouched pieces	20	0.9	-	-	-	-	20	0.8
Knapping hammerstones	1	0	1	1.9	-	-	2	0.1
Hamm. fract. angles	7	0.3	2	3.7	-	-	9	0.4
Spheroids & Subspheroids	3	0.1	-	-	1	50	4	0.2
Anvils & anvils fragments	16	0.8	1	1.9	1	50	18	0.7
Whole flakes	35	1.6	7	13	-	-	42	1.8
Flake fragments	271	11.9	25	46.3	-	-	296	12.7
Angular frag. & frag. < 20 mm	1890	83.3	1	1.9	-	-	1891	81.3
Battered fragments	9	0.4	3	5.5	-	-	12	0.5
Unmodified material	4	0.2	7	13	-	-	11	0.5
Total	2269	100	54	100	2	100	2325	100

***Table** 7.1.* Lithic categories at TK Lower Floor.

	Minimum	Maximum	Mean	Std. deviation
Length	92	190	149.25	41.58
Width	54	150	98.5	42.65
Thickness	31	55	43	11.343
Weight	230	1854	892	694.055

***Table** 7.2.* Dimensions (mm and grams) of the unmodified quartz blocks at TK Lower Floor.

(which is not linked to natural mechanical traction), but also given the fact that the size of these natural blocks and that of the anvils and the large cutting tools coincide. The lava unmodified material are blocks and cobbles that cannot easily be considered as anthropically transported pieces (i.e. manuports), especially since, as proven for TK UF, they quite probably could have appeared in the sequence naturally.

As regards the distribution of the rest of the categories, there is an absolute quantitative predominance of all types of fragments (tabl. 7.1), essentially chips. In fact, when this data is represented graphically (fig. 7.1) it is hard to infer the importance of the

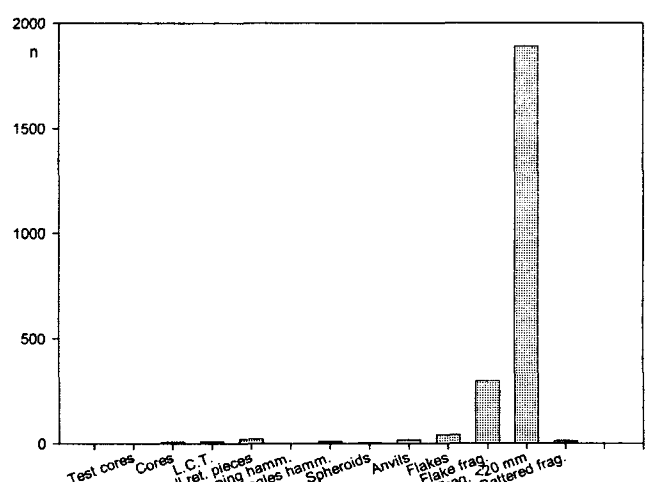

***Figure** 7.1.* Absolute frequencies of the lithic categories at TK Lower Floor.

	Quartz	Lava	Total
Test cores	1830	1151	2981
Cores	2273	2079	4352
Large Cutting Tools	6659	941	7600
Small retouched pieces	1802	-	1802
Knapping hammerstones & frag.	1759	1933	3692
Hamm. fract. angles	4187	1706	5893
Spheroids & Subspheroids	2693	-	2693
Anvils	7525	-	7525
Whole flakes	4577	263	4840
Flake fragments	8845	301	9146
Angular frag. & frag. < 20 mm	10756	105	10861
Unmodified material	3568	2595	6163
Total	56474	11074	69018*

***Table** 7.3.* Raw material invested in each lithic category at TK Lower Floor. (*) Including 1470 grams of worked gneiss.

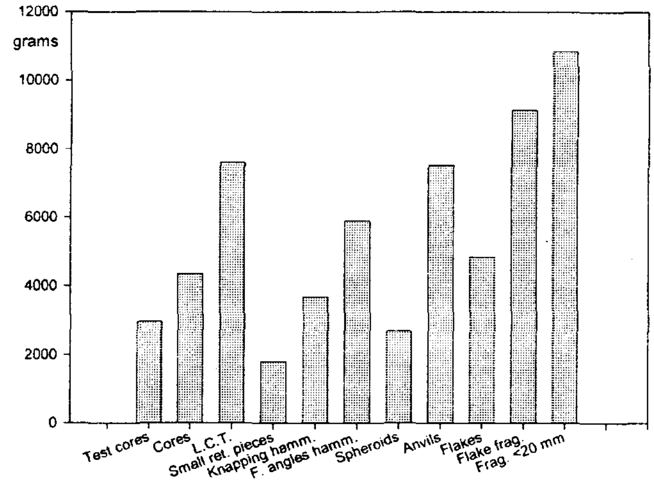

***Figure** 7.2.* Total weight of each category at TK Lower Floor.

other categories, concealed by the vast amount of quartz fragments. This pattern indicates the management of the lithic material, or at least of the quartzes, was performed in the site itself. We cannot assess the genuine incidence of each category only using absolute frequencies; therefore it is essential to turn to the contribution to each category in terms of the investment in raw material (tabl. 7.3 and fig. 7.2). This shows that, although objects linked to *débitage* are very important, other categories like large cutting tools, anvils and different types of hammerstones involve a great investment of raw material.

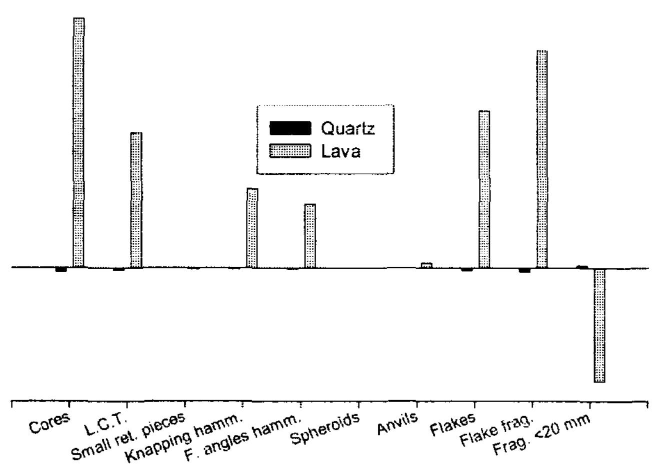

***Figure** 7.3.* Lien Test comparing frequencies and raw materials at TK LF.

Tables 7.1 and 7.3 also denote the vast noticeable difference between the transformations of quartzes as regards basalts. Although quartz is four times more important than lava from a global perspective, the comparative relation of raw materials in the Lien tests indicates an overrepresentation of lavas (fig. 7.3). The exception appears in the category encompassing millimetric fragments, which actually explains the trend; there are too many worked objects in lava (retouched pieces, cores, hammerstones, etc) for the number of *débitage* waste produced in that raw material.

The archaeological explanation for this trend is clear. The lack of millimetric fragments in basalt and trachyte (considering that among quartzes there are 1890 items and a single item in lava) indicates that knapping activities performed on volcanic material was performed out of the site. The same comparison of technical categories by raw material, yet considering global weights not absolute frequencies, offers similar results (fig. 7.4); only the heavy-duty categories (cores, hammerstones, etc.) are proportionally well represented among lavas. The amount of raw material invested in the *débitage* of volcanic rocks is, on the other hand, practically nonexistent. This pattern mirrors the trend that appeared previously in FC West and FLK North, where quartz is always worked *in situ* whilst lava objects seem to be imported once flaked.

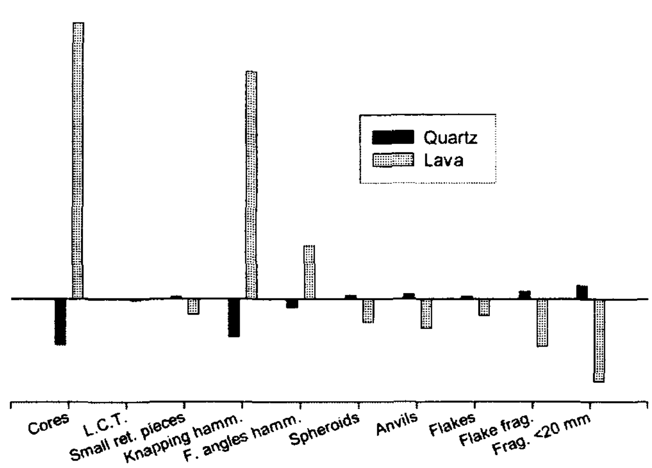

***Figure** 7.4.* Lien Test comparing weight of each category and raw materials at TK LF.

Categories represented in TK Upper Floor

There is a surprising amount of lithic remains in this level, doubling the number of items in TK LF. Leakey (1971:196) counted 4573 artefacts and 139 manuports, slightly under the

	Quartz		Lava		Gneiss		Total	
	n	%	n	%	n	%	N	%
Test cores	-	-	5	2.2	-	-	5	0.1
Cores	7	0.2	11	4.8	1	33.3	19	0.3
Large Cutting Tools	4	0.1	6	2.6	-	-	10	0.1
Fractured L.C.T.	4	0.1	3	1.3	-	-	7	0.1
Small retouched pieces	24	0.5	1	0.4	-	-	25	0.4
Knapping hammerstones	5	0.1	19	6.9	-	-	24	0.4
Hamm. fract. angles	21	0.4	7	3.1	-	-	28	0.5
Spheroids & Subspheroids	47	0.9	1	0.4	-	-	48	0.9
Anvils & anvils fragments	31	0.6	2	0.9	-	-	33	0.6
Whole flakes	22	0.4	20	8.6	-	-	42	0.7
Flake fragments	1346	26.7	84	36.1	-	-	1430	27.1
Frags. < 20 mm	3117	61.9	5	2.2	-	-	3122	59.2
Angular fragments	168	3.3	2	0.9	1	33.3	171	3.2
Hammerstone frag.	2	0	1	0.4	-	-	3	0.1
Anvil fragments	58	1.2	-	-	-	-	58	1.1
Battered fragments	164	3.3	-	-	-	-	164	3.1
Unmodified material	12	0.3	66	28.4	1	33.3	79	1.4
Total	5032	100	233	100	3	100	5268	100

***Table** 7.4.* Lithic categories at TK Upper Floor.

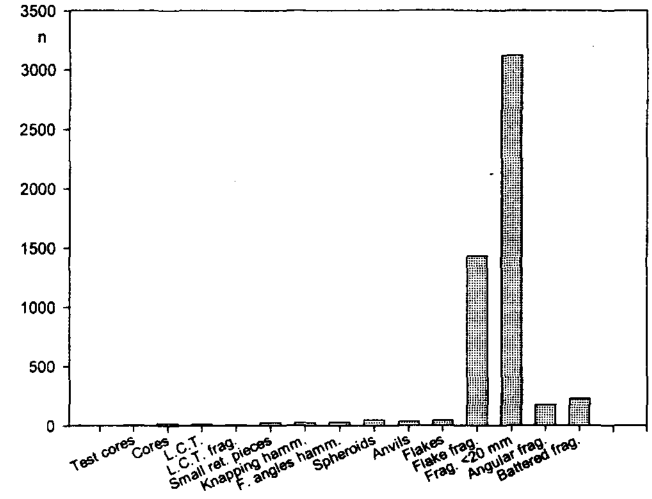

***Figure** 7.5.* Absolute frequencies of the lithic categories at TK Upper Floor.

	Quartz	Lava	Total
Test cores	-	1609	1609
Cores	832	4192	5024
Large Cutting Tools	3754	4557	8311
Fractured L.C.T.	504	480	984
Small retouched pieces	1478	93	1571
Knapping hamm. & frags.	2270	7644	9914
Hamm. fract. angles	6115	4606	10721
Spheroids & Subspheroids	15672	272	15944
Anvils	15239	1473	16712
Whole flakes	1185	614	1799
Flake fragments	31985	1946	33931
Frags. < 20 mm	12570	12	12582
Angular fragments	12745	120	12865
Battered fragments	9918	-	9918
Unmodified material	3884	15756	19640
Total	118151	43374	162330*

***Table** 7.5.* Raw material invested in each lithic category at TK Upper Floor. (*) Including 805 grams of worked gneiss.

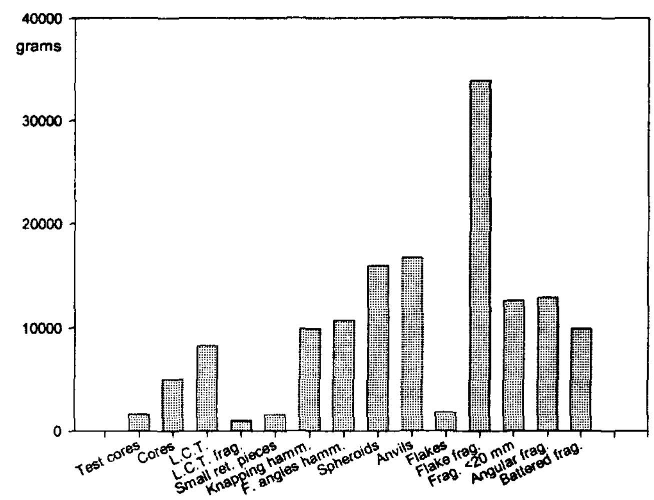

***Figure** 7.6.* Total weight of each category at TK Upper Floor.

5032 analysed herein (tabl. 7.4). The unmodified quartzes are fragments with different sizes which are generally angular, thus strengthening the conclusion that they could actually be manuports. This does not occur with lavas, where there are over 15 kilograms of unmodified material (tabl. 7.5): although part of them are large cobbles that could have been potential blanks for cores, an important sample of unmodified lavas are small rounded fragments with a 4-5 centimetre diameter, which cannot be considered raw material reserves and which are, actually, natural clasts of the sediment.

These clasts indicate that the sedimentary context, although it was basically a clay paleosol, must have had, at some time, sufficient energy to drag larger pieces; a theory that would strengthen the idea Petraglia and Potts (1994) proposed regarding a slight hydraulic alteration. Thus, it seems clear that a good part of the unmodified lava material has a natural origin, and will therefore not be considered in the global recounts on the lithic collection unearthed in TK UF.

As regards the lithic material genuinely subject to human alteration, the *débitage* categories are the most important as regards the number of items (tabl. 7.4 and fig. 7.5), to the extent that they prevent an assessment of the relevance of the other objects. Turning once again to the contribution of each category to the total volume of raw material (tabl. 7.5 and fig. 7.6), shows that, although the fragment categories are the most relevant, other types of objects like anvils and the different types of active hammerstones or large cutting tools constitute essential groups.

As occurred in the underlying level, in TK UF quartz is the most important raw material, not only as regards the number of items, but also as regards the global weight, especially if the 15 kilograms of unmodified material are subtracted from the slightly over 43 kilograms of lavas and compared to the 118 kilograms of quartz transported to the site (tabl. 7.5). The comparison of the number of items in each raw material offers significant results; as in TK LF, the Lien test for absolute fre-

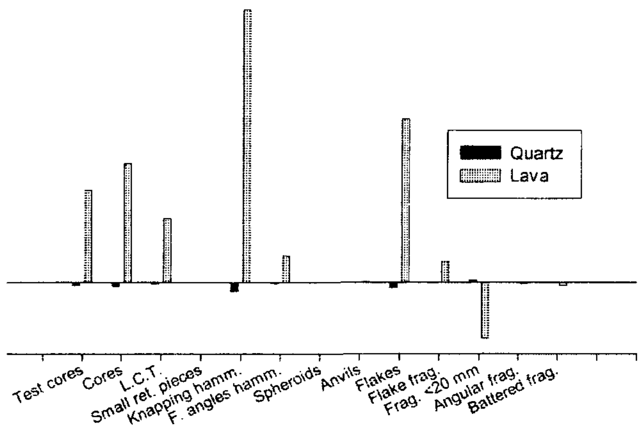

Figure 7.7. Lien Test comparing frequencies and raw materials at TK UF.

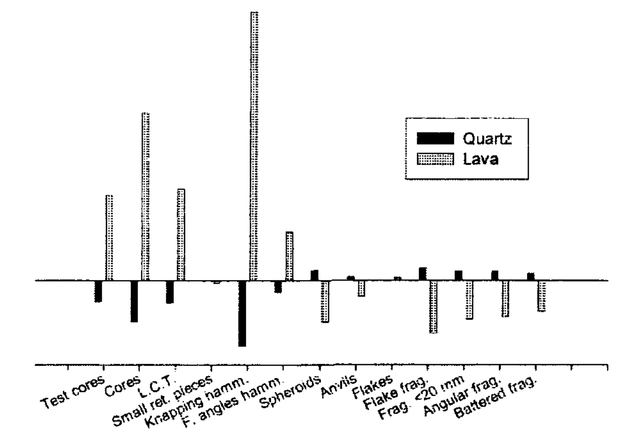

Figure 7.8. Lien Test comparing weight of each category and raw materials at TK UF.

quencies (fig. 7.7) indicates a relative abundance of core-like lava items compared to quartz objects, a trend that is inverted in the chips category. In the flake group, lavas are also comparatively more profuse than quartzes. Yet, there is an absolute absence of small fragments among lavas opposed to the profusion found among quartzes, which once again suggests that reduction processes performed on lavas were not carried out in the site.

The same Lien test, if linked to the number of grams invested per category, not the amount of objects, provides a similar result (fig. 7.8). In all, there is a relative profusion of lava knapping hammerstones. Once again, there is a relative overabundance of core-like objects and large forms among lavas, whilst the comparison continues to provide a similar result in smaller categories. Once again, everything suggests the great intensity of the reduction performed *in situ* upon quartzes compared to the import of lava objects that were transported once flaked.

Knapping products

Provisionally, this section should include all the categories in principle linked to *débitage* activities, which flake fragments, chunks, debris and, obviously, whole flakes are supposed to be. As regards the latter, the existence of a quantitatively identical population (n=42) in both levels of TK allows for a reliable comparison of the qualitative characteristics of each sample. The first aspect analysed was the size of the whole

		Minimum	Maximum	Mean	Std. deviation
Lower Floor	Length	16	120	52.81	26.592
	Width	22	148	54.86	27.449
	Thickness	5	74	19.64	14.778
	Weight	3	830	115.24	204.285
Upper Floor	Length	21	100	44.67	17.13
	Width	22	95	44.4	17.229
	Thickness	6	33	15.71	6.341
	Weight	3	290	42.83	57.748

Table 7.6. Dimensions (mm and grams) of the whole flakes in both levels of TK.

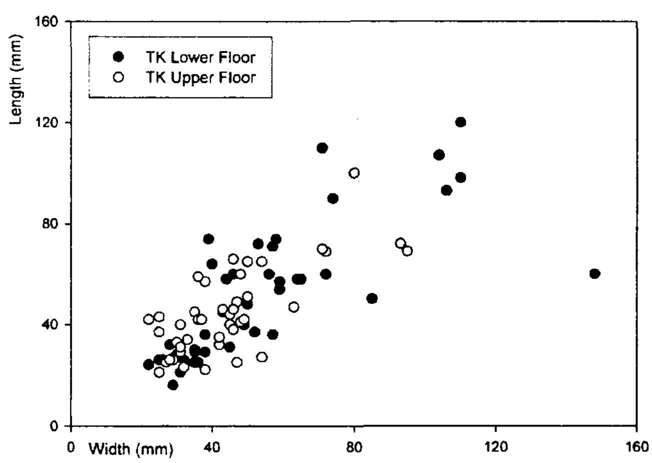

Figure 7.9. Dimensions of the whole flakes at TK LF and UF.

flakes (tabl. 7.6), for which the lengths of the items from both levels were compared, with the T test indicating a statistically significant parity among means. This is represented graphically (fig. 7.9), and is interesting with a view to assessing technical similarities and differences between knapping products from both levels. Moreover, the existence of metric differences between quartz and lava flakes was also considered. In TK LF, the sample of lava products is so small that no representative results could be obtained, but in TK UF lava flakes are almost as numerous as quartz flakes (see again tabl. 7.4). Means were compared again using the T test, and once again showed a statistically significant parity between the lengths of lava and quartz flakes in TK UF (fig. 7.10).

The technical similarities between the flakes from both levels are amazing. Consequently, they present almost identical cortex percentages in TK LF and TK UF (tabl. 7.7), with a similar trend in the distribution of cortical areas according to the Toth's types (fig. 7.11). In both levels, the flakes' butts indicate unprepared striking platforms, which were usually lacking in cortex, although some flakes with prepared butts have appeared in TK UF (fig. 7.12).

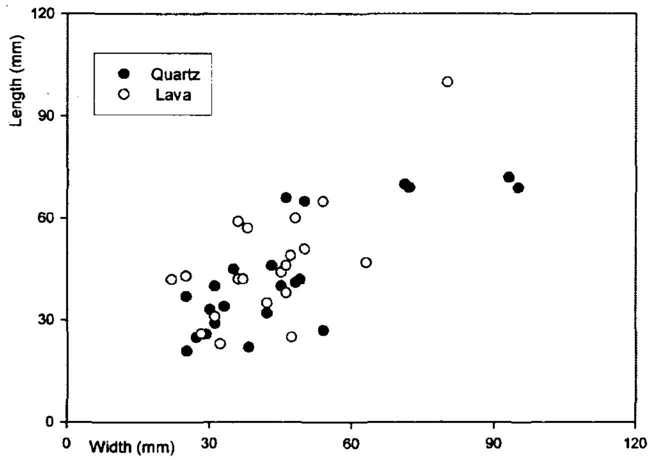

Figure 7.10. Dimensions of quartz and lava flakes at TK UF.

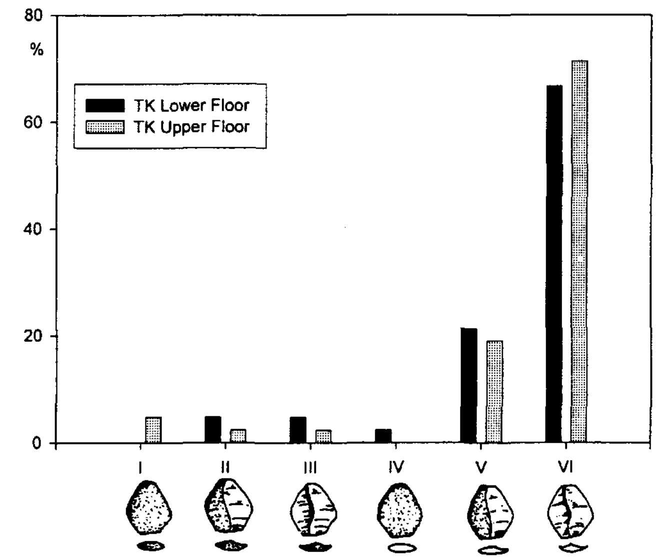

Figure 7.11. Types of flakes at TK LF and UF according to Toth's (1982) classification.

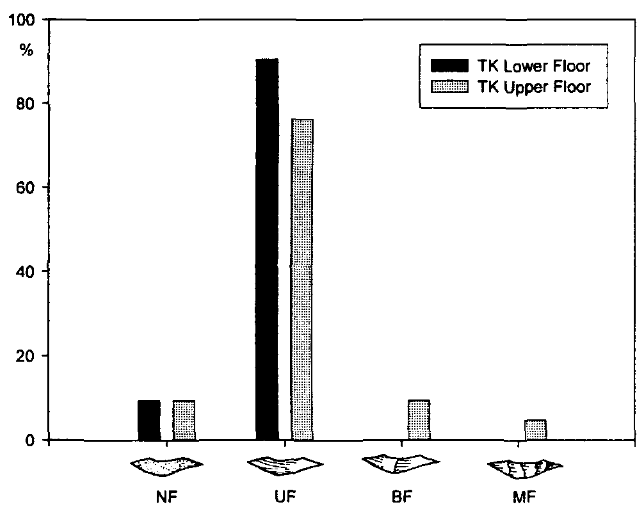

Figure 7.12. Types of striking platforms in the whole flakes from TK.

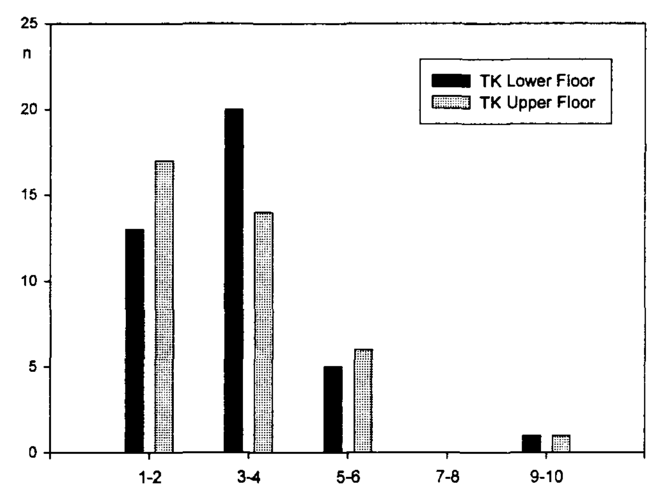

Figure 7.13. Scar patterns on the dorsal sides of whole flakes at TK LF and UF.

The knapping patterns deduced from the flakes' dorsal faces are also analogous in TK LF and TK UF. In TK LF whole flakes present an average of 3.2 previous detachments, quite similar to the mean for TK UF, with 3.1 previous scars, with both presenting similar detachment ranges (fig. 7.13). Furthermore, the flakes from both levels indicate that the cores from which they originated were more structured than in previous sites, providing examples of dorsal faces that denote a recurrent and multidirectional pattern as regards the exploitation of the knapping surfaces (fig. 7.14).

As in EF-HR, TK presents flakes that seem to come from different stages of the *chaîne opératoire* and even from different

Dorsal face	Striking platform								Total			
	Cortical				Non-cortical							
	N		%		N		%		N		%	
	LF	UF	LF	UF	LF	UF	LF	UF	LF	UF	LF	UF
Full cortex	-	2	-	4.8	1	-	2.4	-	1	2	2.4	4.8
Cortex > 50%	-	-	-	-	2	2	4.8	4.8	2	2	4.8	4.8
Cortex < 50%	2	1	4.8	2.4	7	7	16.7	16.7	9	8	21.4	19
Non-cortical	2	1	4.8	2.4	28	29	66.7	69.1	30	30	71.4	71.4
Total	4	4	9.5	9.5	38	38	90.5	90.5	42	42	100	100

Table 7.7. Cortical frequencies in the whole flakes from TK LF and UF.

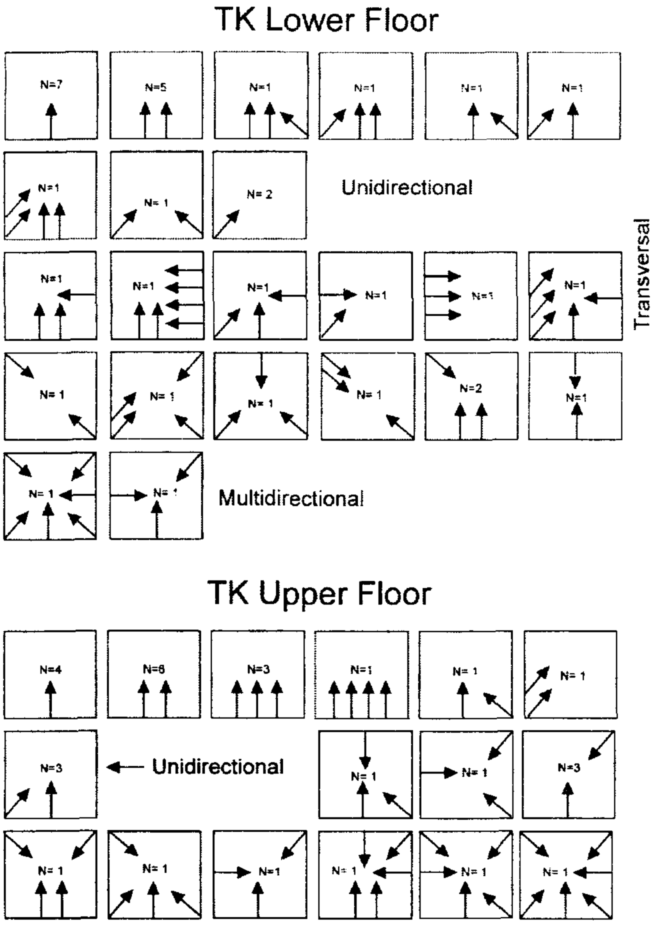

Figure 7.14. Diacritic schemes of the whole flakes at TK (both levels).

knapping systems. Two different types of flakes have appeared. One kind includes the typical *débitage* products measuring 3-5 centimetres, that compose the largest assemblage both in LF and in UF (fig. 7.9). These flakes usually present unifaceted butts, well-developed sections and relatively simple dorsal faces, with 2-3 previous detachments (fig. 7.15 and 7.16). They appear both in quartz and lava, and were generated using the classical system for the production of small-sized flakes described in all the aforementioned sites.

Alongside these small-sized flakes, there is a group of larger objects. Although there are some examples from TK UF, most appear in the level below. Figure 7.9 showed that there are flakes in TK LF that exceed 10 centimetres long, and table 7.6 indicates that some weigh up to 800 grams, thus being genuinely heavy-duty objects. These enormous flakes could be, as in EF-HR, large blanks that subsequently became retouched items. Nonetheless, as explained below, the large cutting tools from TK do not follow the same strategy as in EF-HR, with blocks becoming secondary artefacts, not large flakes.

In TK LF the categories of fragments total over 19 kilograms of raw material, and over 60 kilograms in UF (tabl. 7.3 and 7.5). That is to say, in both levels the different types of fragments compose practically half of the lithic material modified by hominids. The enormous amount of kilograms of flake fragments can be explained, at least partially, in view of the large size of many of the objects: many large fragments were detached from the cores and discarded directly (or at least, were not modified secondarily) after technical errors produced in the actual knapping processes during which the large flakes were obtained. In any case, the over 8 kilograms of non-used flake fragments unearthed in LF and the over 31 kilograms from UF suggest a sensational waste of raw material.

The LF and UF collections present a vast amount of angular and millimetric fragments. The vast amount of quartz chips points to the local nature of the knapping on this raw material, indicating an opposite trend among lavas. With rates above 80% on both levels, the percentage of quartz fragments in TK resembles the aggregates documented in sites like FLK Zinj, with the difference that in TK the importance is not only quantitative, but also relevant in terms of the raw material invested (or wasted, in this case). In both levels the frequency of chips and chunks is too high, in terms of the number of cores and flakes. Therefore, it is useless to attribute their origin solely to knapping processes. As stated in previous chapters, it is hard to allocate this type of fragments to a specific activity accurately, since they do not usually present diagnostic traces that enable researchers to include them in one process or the other. Nonetheless, both in LF and (mainly) in UF percussion activities are extremely well developed (spheroids, anvils and other quartz objects bear witness to this fact), and therefore many of the documented chunks (and probably a lot of the objects classified as flake fragments) were probably generated during these processes and not during knapping. Thus, many should be considered alongside the fragments which do present traces that show they originated from the breaking of the anvils and hammerstones, increasing the number of lithic items linked to percussion activities.

It is important to bear in mind that whole flakes represent 1.8% of the total in TK LF and merely 0.7% in TK UF. Therefore, it is hard to maintain that their production was the primordial goal of the human activities. Despite their technical efficiency, these flakes are peripheral elements in the dominant *chaîne opératoire*. In any case, and irrespective of their marginality, we must describe the processes by which these flakes were obtained, which we will embark upon in the following section.

Cores and *débitage* systems

As occurs with flakes, cores are not relevant categories in any of the two levels in TK. TK LF produced 8 cores whilst UF offered 19, totalling slightly over 4 kilograms in the older level and approximately 5 kilograms in the overlying level (tabl. 7.3 and 7.5). As regards core dimensions (tabl. 7.8), the pieces from TK LF seem larger than those from UF. Yet, the

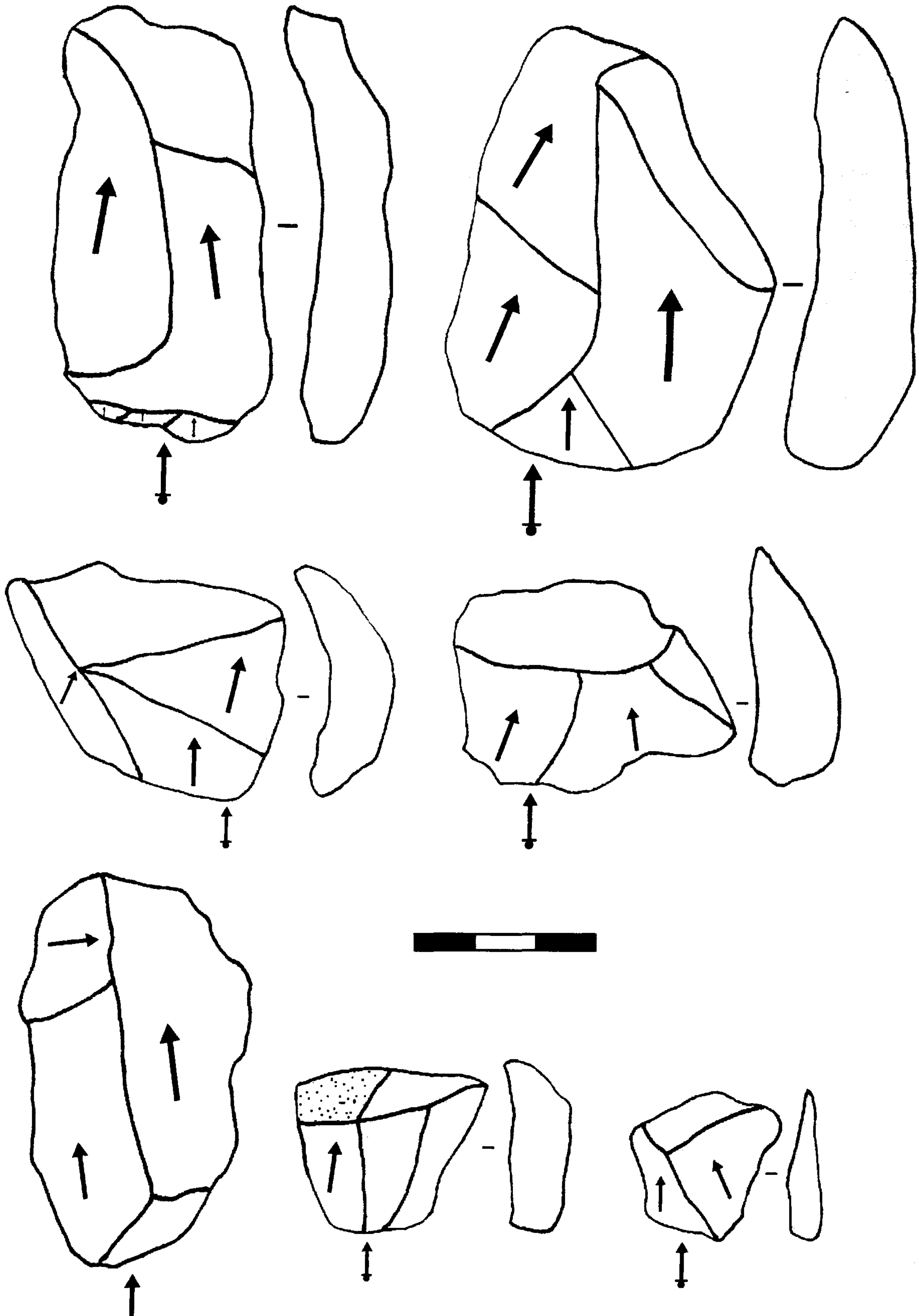

Figure 7.15. Small-sized quartz flakes at TK LF.

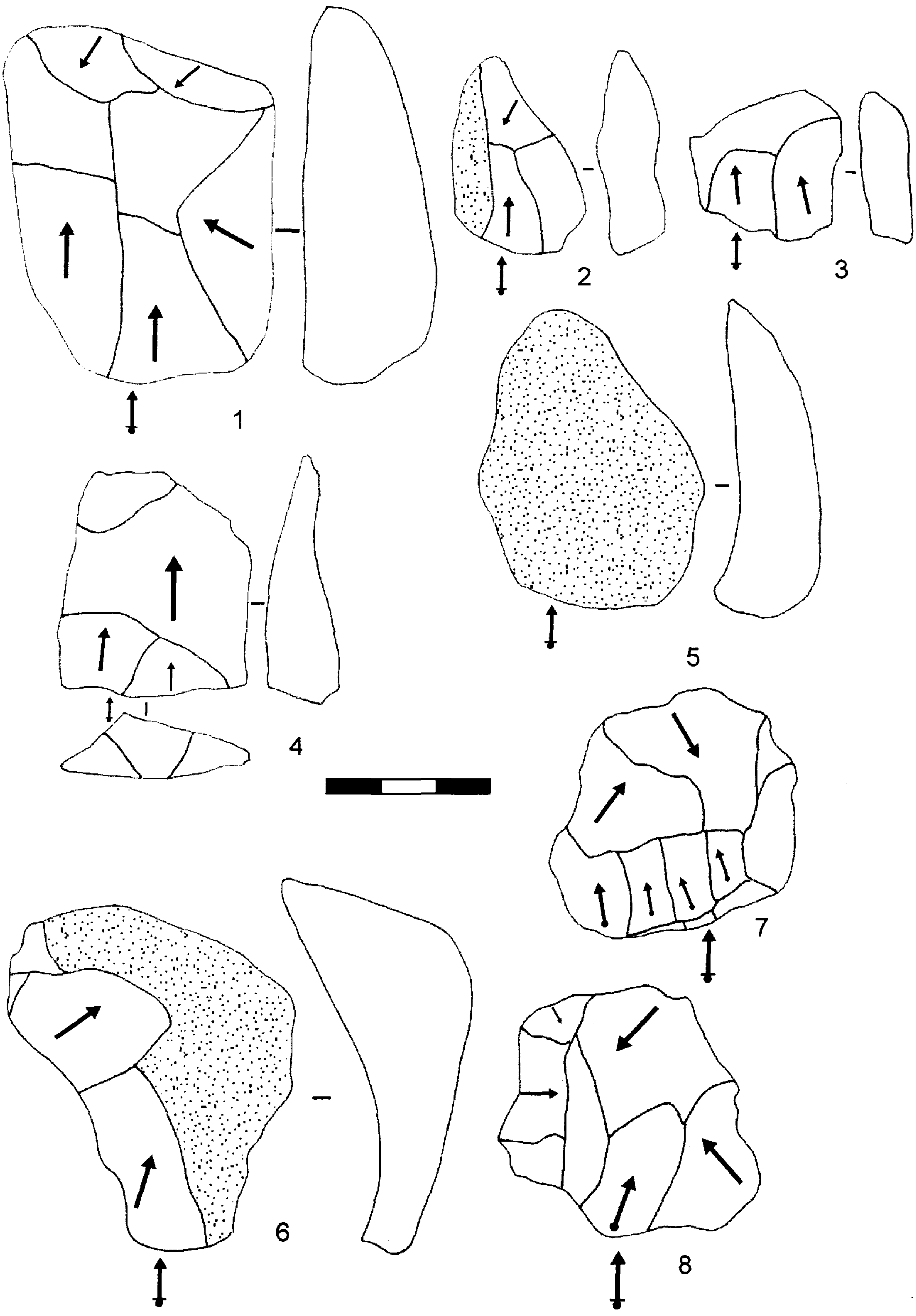

Figure 7.16. Small-sized flakes at TK UF. All examples are lava flakes, except 1 and 2, quartz flakes.

		Minimum	Maximum	Mean	Std. deviation
Lower Floor	Length	50	160	94.63	35.42
	Width	47	97	69.75	20.155
	Thickness	34	88	54.25	19.869
	Weight	113	1186	544	431.054
Upper Floor	Length	44	140	77.89	22.736
	Width	38	145	66.11	23.121
	Thickness	26	68	47.89	11.172
	Weight	47	1341	295.67	301.05

Table 7.8. Dimensions of the cores at TK (mm and grams).

test used to analyse mean parity (Student's T test) demonstrated that there are no statistically significant differences in terms of the length and weight of both core populations, and in fact their dimensions always keep within a similar range (fig. 7.17). These cores measure 8-9 centimetres long and are considerably heavy (see again tabl. 7.8). Therefore, it seems obvious that, compared to other previous Oldowan sites, there is an increase of the size of the blanks for flake obtaining processes, although similar *débitage* systems were implemented.

The cores in both levels also present similarities in terms of the number of detachments on each piece (9 flakes per core in LF and 8.8 in UF), and the range of scars (fig. 7.18). Using McNabb's (1998) calculations, and since in TK LF cores (n=8) present a minimum of 3 detachments and a maximum of 19, there should be at least 24 flakes and a maximum of 152, without considering those obtained from the *façonnage* of the large cutting tools. As regards quartzes, the cores/flakes ratio (7:35) is more ore less coherent, especially when considering the vast amount of flake fragments documented in Level LF. Yet, when moving on to the lavas, the deficit (3 cores: 7 flakes) observed in other sites also appears here and - albeit not as evidently as in FLK North or FC West -, it seems obvious that lava flake production was merely incidental in TK LF. The almost total absence of volcanic chips gives evidence of this notion.

In TK UF the pattern is almost identical. With a minimum of 2 detachments per core and a maximum of 17, there should be a minimum of 14 quartz flakes and a maximum of 119. Among the lavas this pattern ranges between 22-187 flakes. The frequencies observed for flakes in both raw materials merely fulfil the minimum expected frequencies (tabl. 7.4), especially among the lavas, where there are less flakes than among quartzes, despite the number of cores being substantially greater. Consequently, certain contradictions arise, not only concerning quantitative aspects but also metric issues as well: the core scars are systematically smaller than the flakes. This pattern is interpreted as evidence of the recurrence of the reduction sequences, and therefore also of the fact that flake production was more important than the absolute frequencies imply. Therefore, this information provides an additional argument that represents a lava flake deficit compared to the number of cores, which can only be explained using behavioural criteria, not taphonomic causes. The problem, ob-

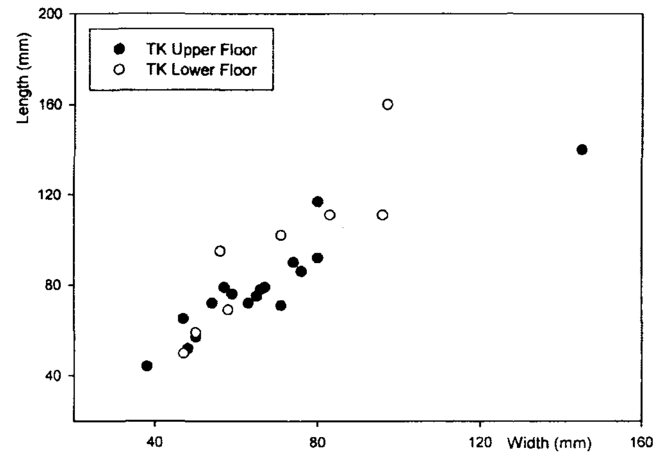

Figure 7.17. Dimensions of the cores at TK LF and UF.

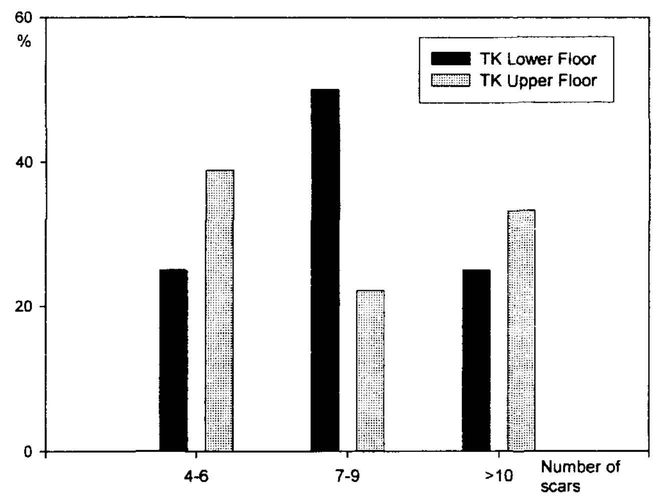

Figure 7.18. Amount of scars on the cores from TK.

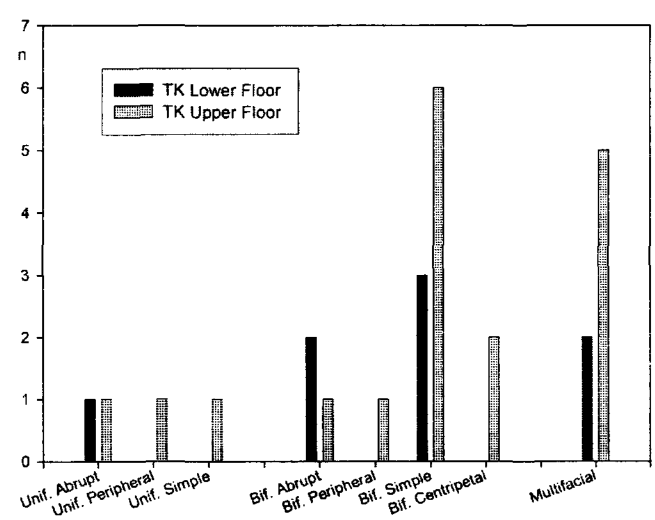

Figure 7.19. Absolute frequencies of the knapping systems at TK (both levels).

viously, lies in deducing the type of behaviour that led the Olduvai hominids to store knapping products separate from the cores from which they came from.

With regard to exploitation methods, there are no significant differences between both levels. The bifacial simple partial system and multifacial cores (fig. 7.19) dominate in both assemblages, although it is important to state that TK UF presents a series of examples that could be included in the bifacial hierarchical centripetal exploitation, which is practically unknown in the whole of the previous Olduvai sequence. Choppers appear both in quartz and lava, and present the same characteristics as in other sites, with simple angle partial edges opposite cortical areas (fig. 7.20 and 7.21). Multifacial or polyhedral cores are more profuse in TK than in previous sites. This trend can probably be explained in view of the greater intensity of the reduction observed in this assemblage. One of the two polyhedral cores from LF is made of quartz, whilst this raw material was used for three of the five polyhedral cores from UF. This data has been included so as to underscore that there is no visible trend in the emergence of quartz polyhedrons, and that, therefore, they are not necessarily linked to subspheroids and spheroids (where a clear preference towards quartz is noticeable), as some authors have suggested (for example Willoughby 1987; Texier & Roche 1995).

TK UF presents a core allocated to the bifacial peripheral strategy with a prepared striking platform, where detachments are managed around an edge without working the volume of the core. The working of the whole of the knapping surface appears in the core represented in figure 7.22, presenting a hierarchical organisation of the planes (one for preparation, another for exploitation). It is symptomatic to see the difference between the size of the example represented in figure 7.22 and figure 7.23, as well as the greater structuring noticeable on the smaller of the cores compared to the vast cortical areas on the larger core's preparation surface. This could prove the existence of recurrent exploitation stages using the same reduction system throughout the whole knapping sequence.

The sizes and reduction methods implemented when working with the cores in both levels coincide with the trends observed when referring to flakes. Although the cores from TK are *grosso modo* larger than in other sites, the knapping products are also generally larger. This system was used to produce flakes with an average size ranging between 3-5 centimetres, and in which cores are obviously always larger than flakes (fig. 7.24). Yet figure 7.24 also indicates that there are a series of flakes, some over 10 centimetres long, that exceed the general size range established for cores. These are the aforementioned large flakes, produced by a knapping system similar to that implemented to obtain large cutting tools as described in EF-HR. Nevertheless, the large cutting tools in TK are usually shaped on blocks; therefore, large flakes would not be linked to that *chaîne opératoire*. It does not seem likely that these large flakes come from the *débitage* cores documented in the site, although there are even rejuvenation products from those large blanks. Thus, we encounter a new mystery, since enormous flakes have been found, yet without their corresponding cores, and furthermore, these items are not related to the *façonnage* of the large cutting tools.

Retouched pieces

The small retouched pieces are almost exclusively in quartz and generally on flake fragments, thus following the general trend established for the rest of the lithic categories (tabl. 7.1 and 7.4). Composing 0.8% of the total number of items in TK LF and 0.4% in UF, the slightly over two kilograms of small retouched pieces in the oldest level and the almost four kilograms in the more recent one, suppose an insignificant volume of raw material compared to the rest of the collection. In any case, they are important in view of their qualitative information. In fact, it is important to recall that in LF the number of whole flakes (n=42) is not, from a comparative perspective, that greater than the number of retouched pieces (n=20), with a pattern that is also quite similar in level UF (42 flakes compared to 25 retouched objects).

The dimensions of these small retouched pieces are similar in both levels (tabl. 7.9), and Student's T test shows a statistically significant equality in the means regarding length and weight. The same results are obtained after when comparing the dimensions (length and weight) of the whole flakes assemblage in both TK levels and the small retouched pieces, since the Student T test also proves equality between means. This can be verified graphically thanks to figure 7.25.

In terms of the typological characterisation, in TK LF Leakey (1971) described a great number of side scrapers and different types of end scrapers, as well as burins, awls and *outils écaillés*. With regard to the pieces classified as end scrapers, in our opinion Leakey (1971:180) was attributing the natural, spontaneous forms of certain fragments to an intentional retouch process, whilst in fact the scarce numbers of retouched objects are merely simple side scrapers. The same occurs with burins; none is genuine, with the other groups of retouched pieces also limited to different types of side scrapers (fig. 7.26).

Our classification of the small retouched pieces from TK UF differs from Leakey's (1971). This author referred to 77 side

		Minimum	Maximum	Mean	Std. deviation
Lower Floor	Length	25	93	51.3	17.945
	Width	24	85	45.2	16.913
	Thickness	10	47	21.1	9.222
	Weight	11	414	90.1	97.924
Upper Floor	Length	17	84	47.12	18.791
	Width	20	75	36.92	15.055
	Thickness	10	25	15.88	4.157
	Weight	7	212	62.84	66.227

Table 7.9. Dimensions of the small retouched pieces from TK (mm and grams).

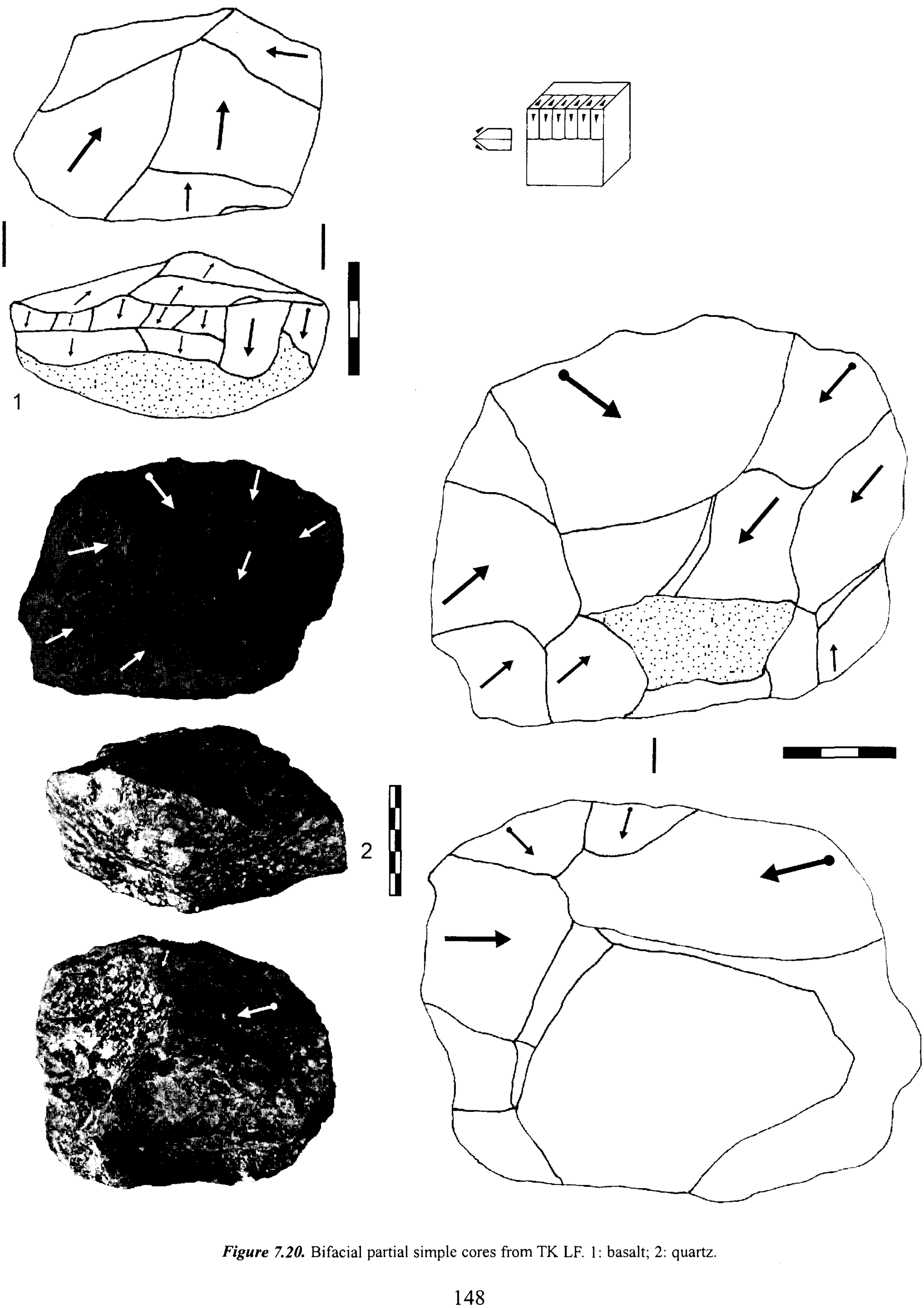

Figure 7.20. Bifacial partial simple cores from TK LF. 1: basalt; 2: quartz.

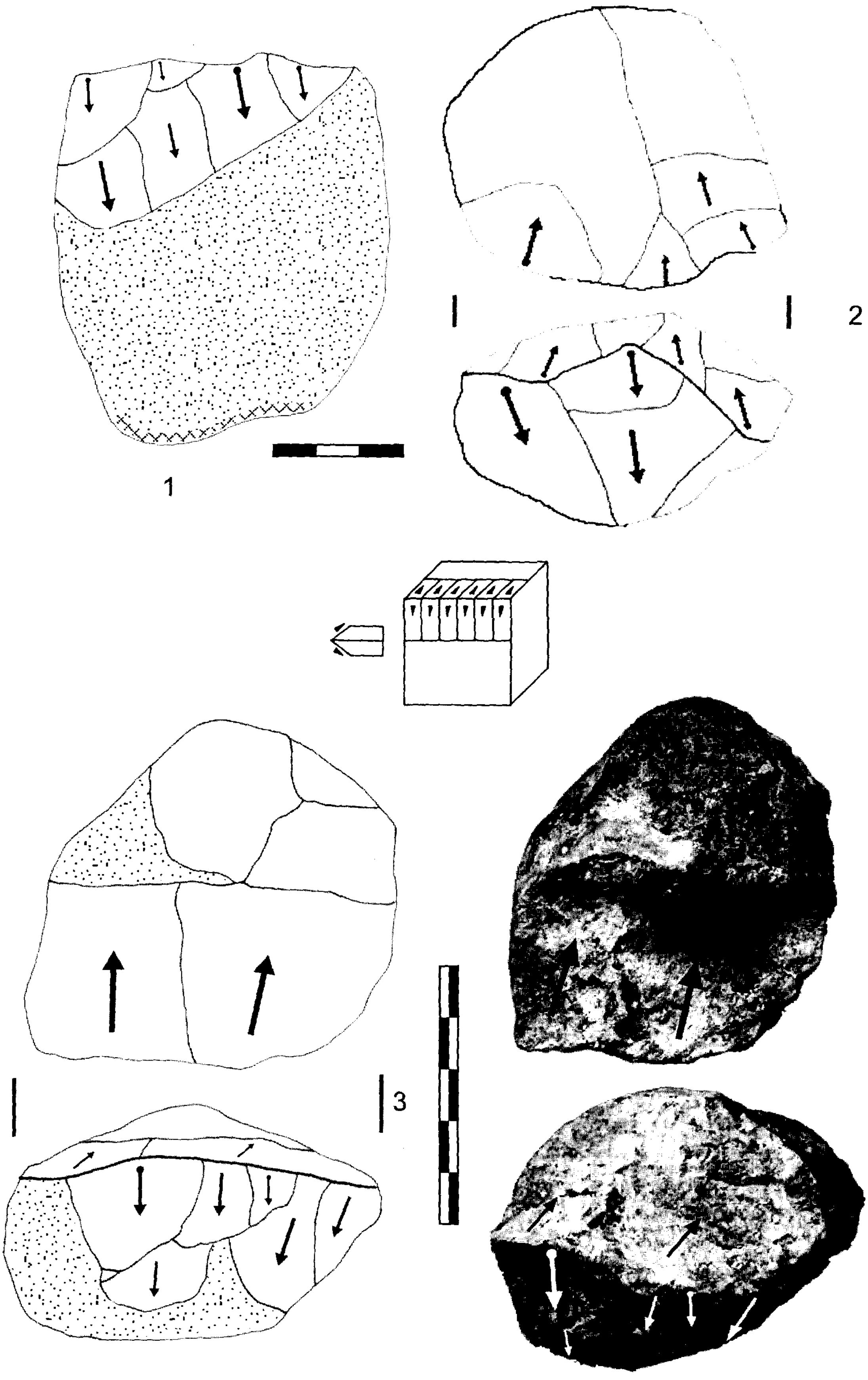

Figure 7.21. Choppers in TK UF. 1: basal unifacial simple partial exploitation, with percussion marks on the cortical base; 2: quartz chopper with alternate bifacial detachments; 3: phonolite bifacial simple partial system.

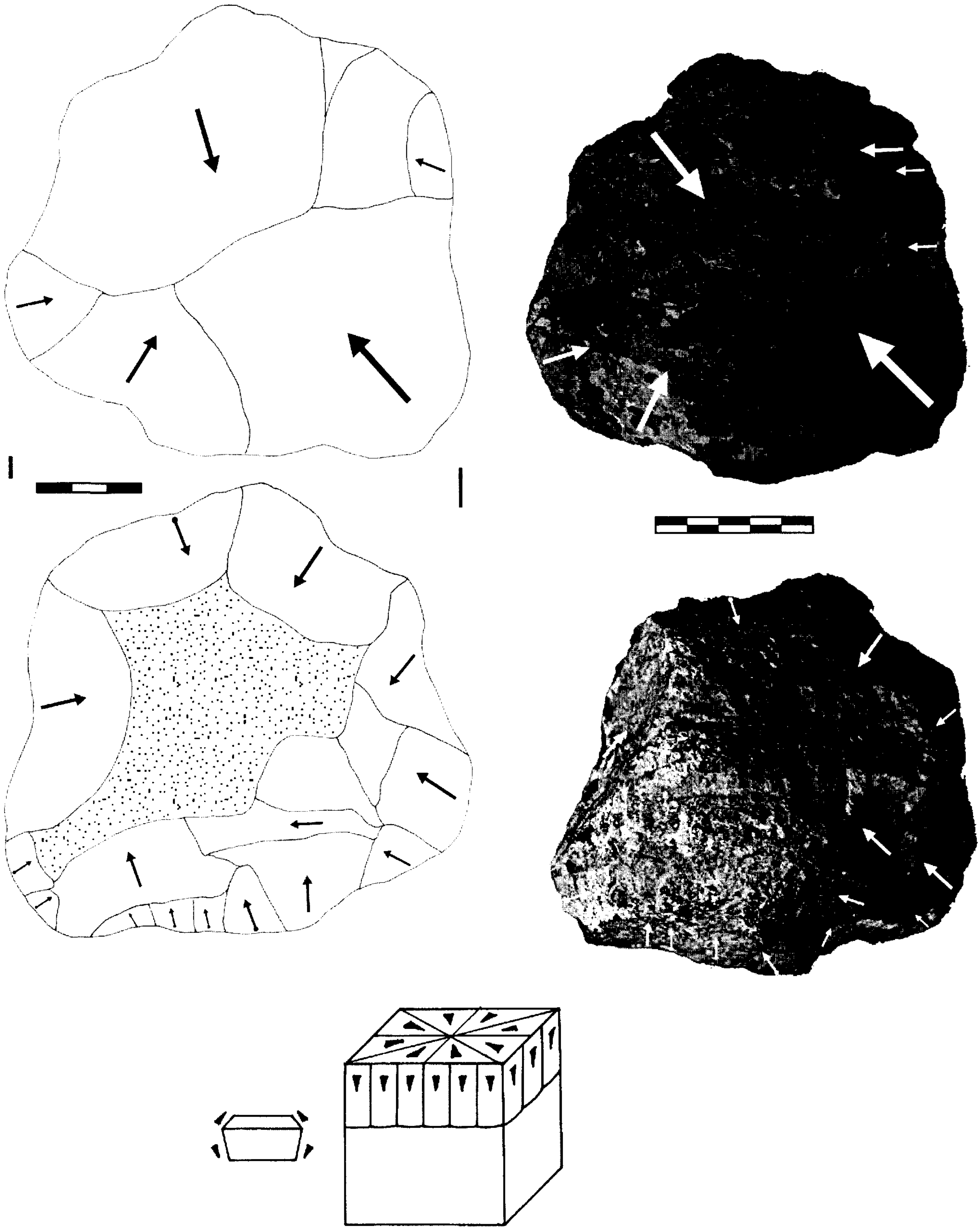

Figure 7.22. Large basalt core in TK UF, exploited using the bifacial hierarchical centripetal system.

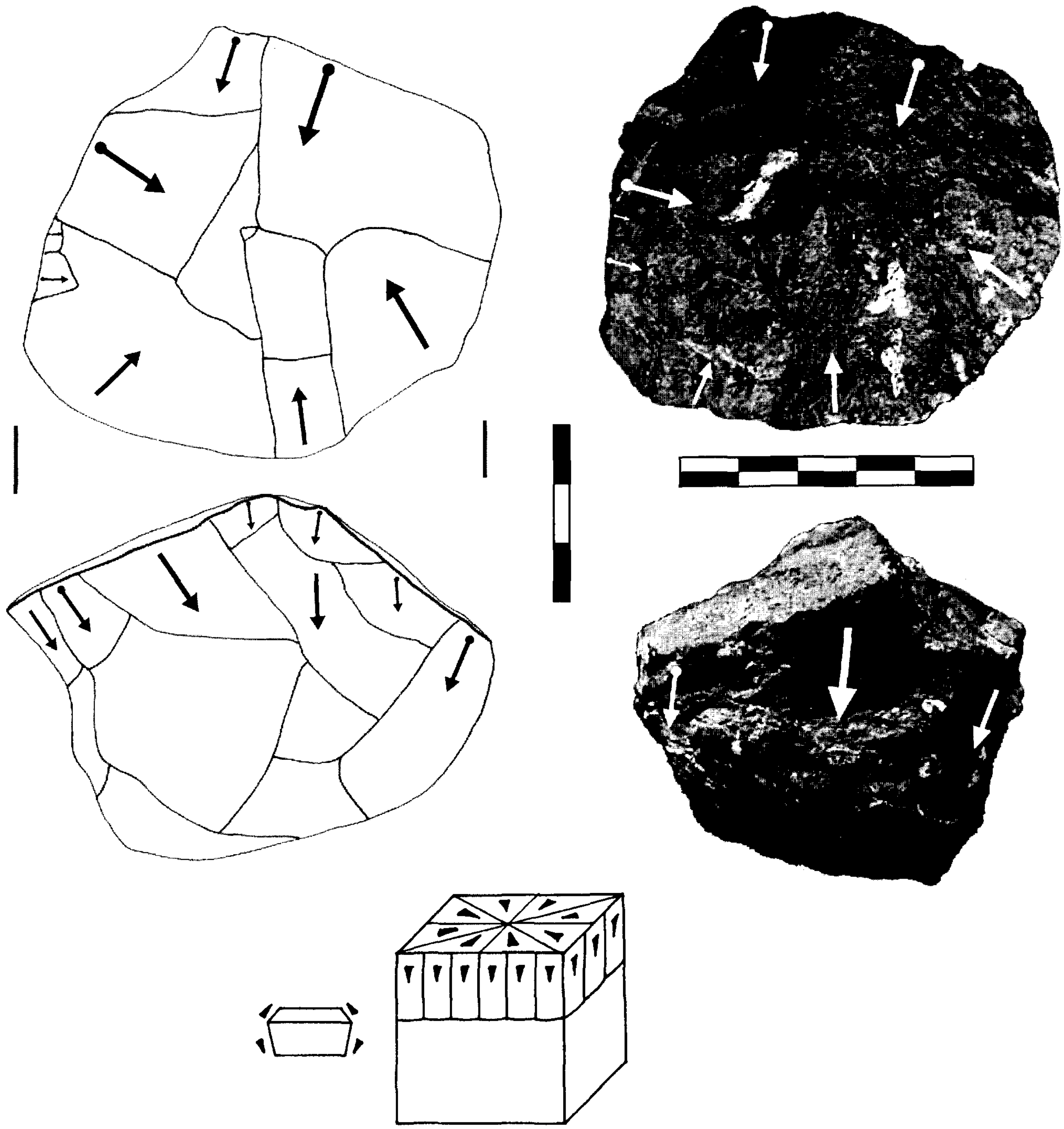

Figure 7.23. Another example of the bifacial hierarchical centripetal system, also in basalt and from TK UF, although in a more advanced stage of exploitation than examples from figure 7.22.

scrapers and end scrapers, of all types, and a great number of burins and awls, counting a total of almost one hundred small retouched pieces. In our total, we have considered most of the so-called burins, awls and end scrapers as simple flake fragments, Siret or chunks, and have only identified 25 small retouched pieces, all continuous or denticulate side scrapers (fig. 7.27). Furthermore, some of these objects are quite large, seeming more similar to the heavy-duty objects from EF-HR than small retouched pieces (fig. 7.28). In fact, the limit between one and the other becomes subjective, and the examples from figure 7.28 are only included in the small retouched pieces group given the truly enormous size of the large cutting tools in TK. In all, it is more than evident that in TK, as occurred in EF-HR or FC West, secondarily modified blanks are larger than those in the sites in Bed I.

Altogether, we cannot refer to standardised retouched pieces like burins, or propose the existence of specific morphologies

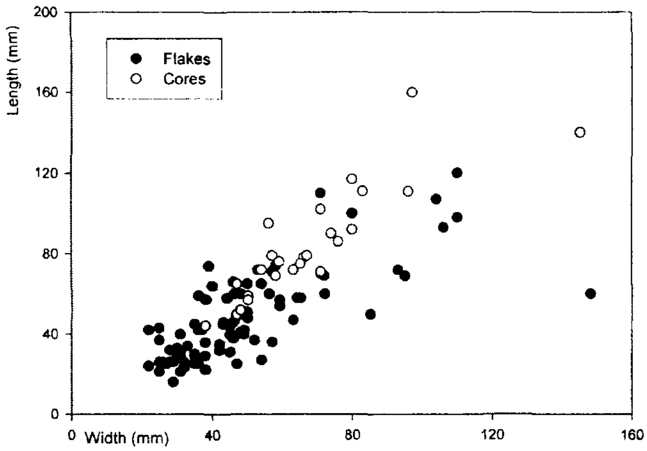

Figure 7.24. Dimensions of the flakes and cores from both levels of TK.

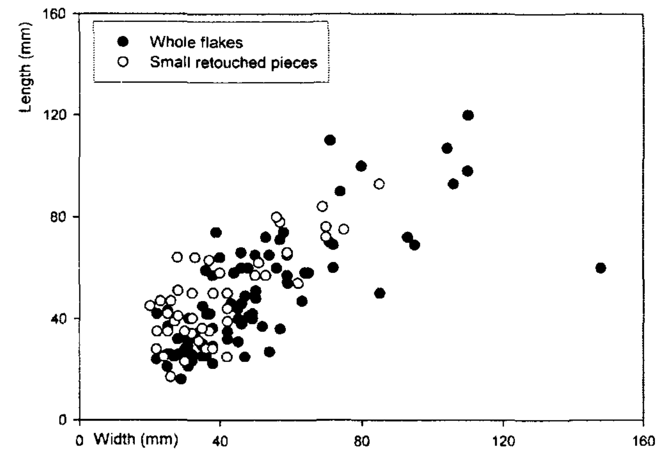

Figure 7.25. Dimensions of the small retouched pieces at TK.

like awls, nosed scrapers, etc. In fact, most of the objects originally considered retouched pieces are nothing of the sort. They are flake fragments or chunks even. Hence, the absolute frequencies for small retouched pieces proposed herein (tabl. 7.1 and 7.4) differ from Leakey's, drastically cutting the number of pieces subjected to secondary modifications.

Despite the scarce relevance in absolute terms, the relative frequencies of these retouched pieces are very high compared to other categories like flakes or cores, and take on greater importance if compared to the shortage of this type of pieces in older sites. Therefore, the small retouched pieces, which have been reduced to side scrapers and denticulates herein, have a qualitative importance only exceeded by another group of objects, which will be described below: large cutting tools.

The objects we have designated as large cutting tools were classified by Leakey (1971) as genuine bifaces. Their relevance in both levels of TK is critical, since Leakey (1971, 1975) used these pieces for the cultural allocation of both the assemblages. As mentioned above, at first Leakey (1971) classified TK LF and UF as Developed Oldowan B, and then changed the category of TK LF to Acheulean (Leakey 1975). This is no place to assess the cultural connotation of the industrial classifications (see chapter 9), although it is necessary to mention why Leakey rectified her initial consideration. In the original publication both levels were included in the Developed Oldowan category in view of the scarce biface percentage (15 bifaces in TK LF and 24 in UF). Nonetheless, upon reclassifying TK LF, Leakey (1975) stated that, despite the shortage, the bifaces from that lower level presented the same characteristics as other Acheulean sites, and that those qualitative features should be considered to decide their cultural allocation. Since in all subsequent publications focusing on this inventory (for example Bower 1977; Davis 1980; Stiles 1979, 1980; Kimura 2002; Ludwig 1999; etc) have continued to respect the nomenclature set down by Leakey, and given the fact that she based her arguments on the features of the bifaces, it is essential to study the attributes of the large shaped pieces in TK.

The first issue is the actual identification of those large cutting tools. In fact, we suggest that some of the pieces Leakey classified as bifaces, are actually chunks (fig. 7.29). This is critically relevant in terms of metrical comparisons between bifaces (one of the basic criteria Leakey implemented to differentiate Oldowan and Acheulean), and also implies major imbalances as regards the number of items. In TK UF, where Leakey (1971:174-175) counted up to 15 bifaces considering whole and fragmented pieces, our total only amounts to 10 large cutting tools, some of which are not even the same as those Leakey called bifaces. In TK UF, where the examples from figure 7.29 were unearthed and where Leakey (1971:187-189) counted 24 bifaces, we have only identified 10 large cutting tools and 7 possible fragments from that kind of items.

Despite the low absolute frequency, we agree with Leakey in thinking that the large cutting tools compose a fundamental category in the technical activities developed in TK. It is important to recall that, in terms of the raw material invested to obtain them, these pieces constitute one of the main groups in both levels (fig. 7.2 and 7.6). Consequently, it is significant to state that, despite the chronic bias of lavas in both levels, in TK LF 3 of the 10 large cutting tools are volcanic rocks, and that in UF large quartz tools are a minority (tabl. 7.4). Given the profusion of quartz from a quantitative viewpoint in both assemblages, and the general shortage of lavas in the *débitage* categories, it seems obvious that the basalt large cutting tools entered the site once worked.

Regarding dimensions (tabl. 7.10), it is important to state that Student's T test demonstrated that the length and the weight of the large cutting tools from both levels in TK present an identical distribution; i.e. no significant differences appear with reference to the dimensions of both populations. Therefore, one of Leakey's (1971, 1975) arguments to distinguish the "bifaces" from LF and those from UF, based on the smaller size of the so-called Oldowan bifaces, collapses when the comparison is limited only to whole pieces that have undergone genuine working processes (fig. 7.30).

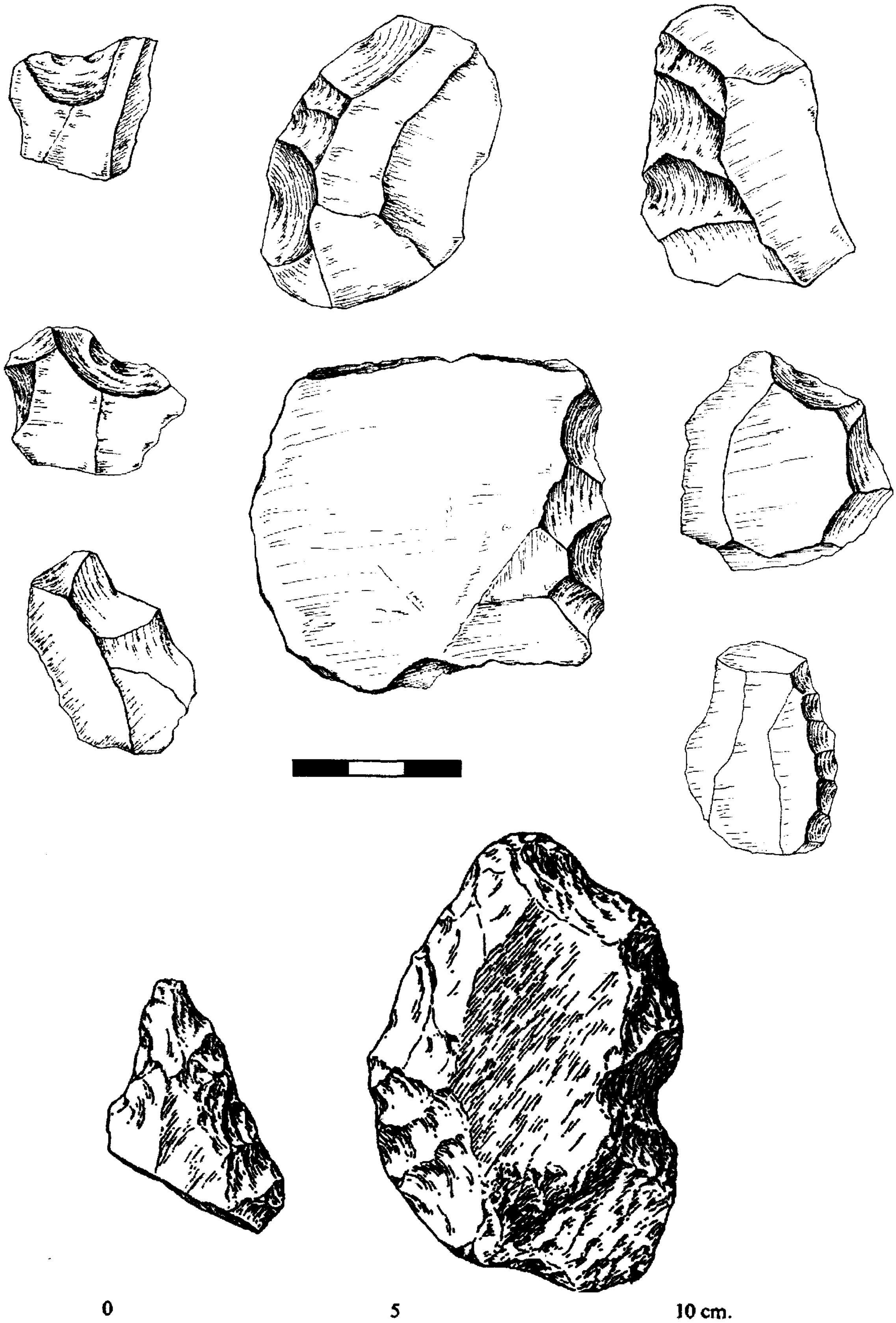

Figure 7.26. Small retouched pieces (side scrapers, notches and denticulates) in quartzite from TK LF. All drawings by N. Morán, except the last two taken from Leakey (1971:182), in our opinion the only examples that were genuinely retouched of all the pieces from TK LF represented in figure 84 of Leakey's monograph.

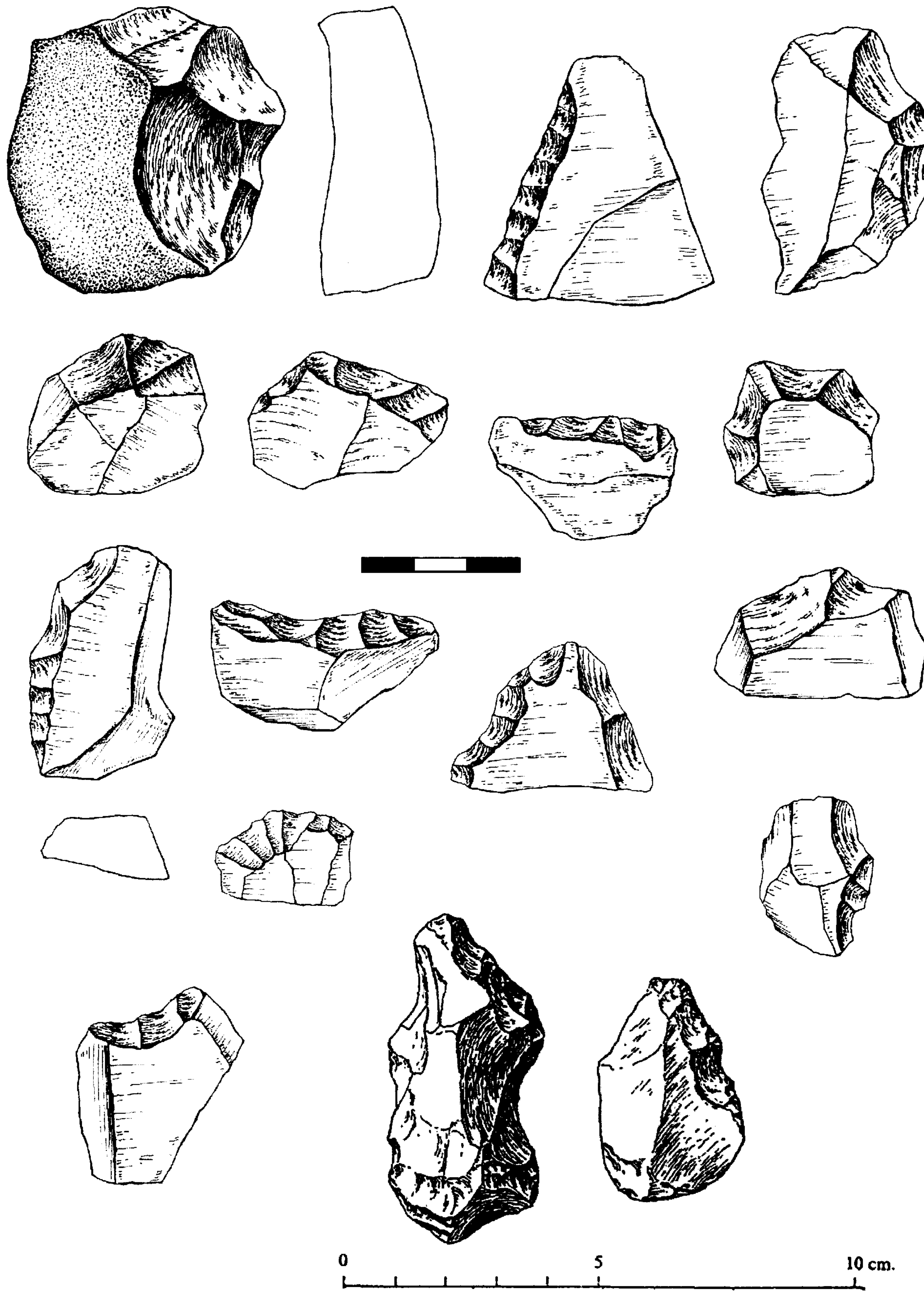

Figure 7.27. Small side scrapers and denticulates in TK UF. All examples in quartzite except of the first one which is in basalt. The last two examples are from Leakey (1971:182), and are in our opinion the only retouched pieces from UF in figure 84 of the monograph. Other drawings by N. Morán.

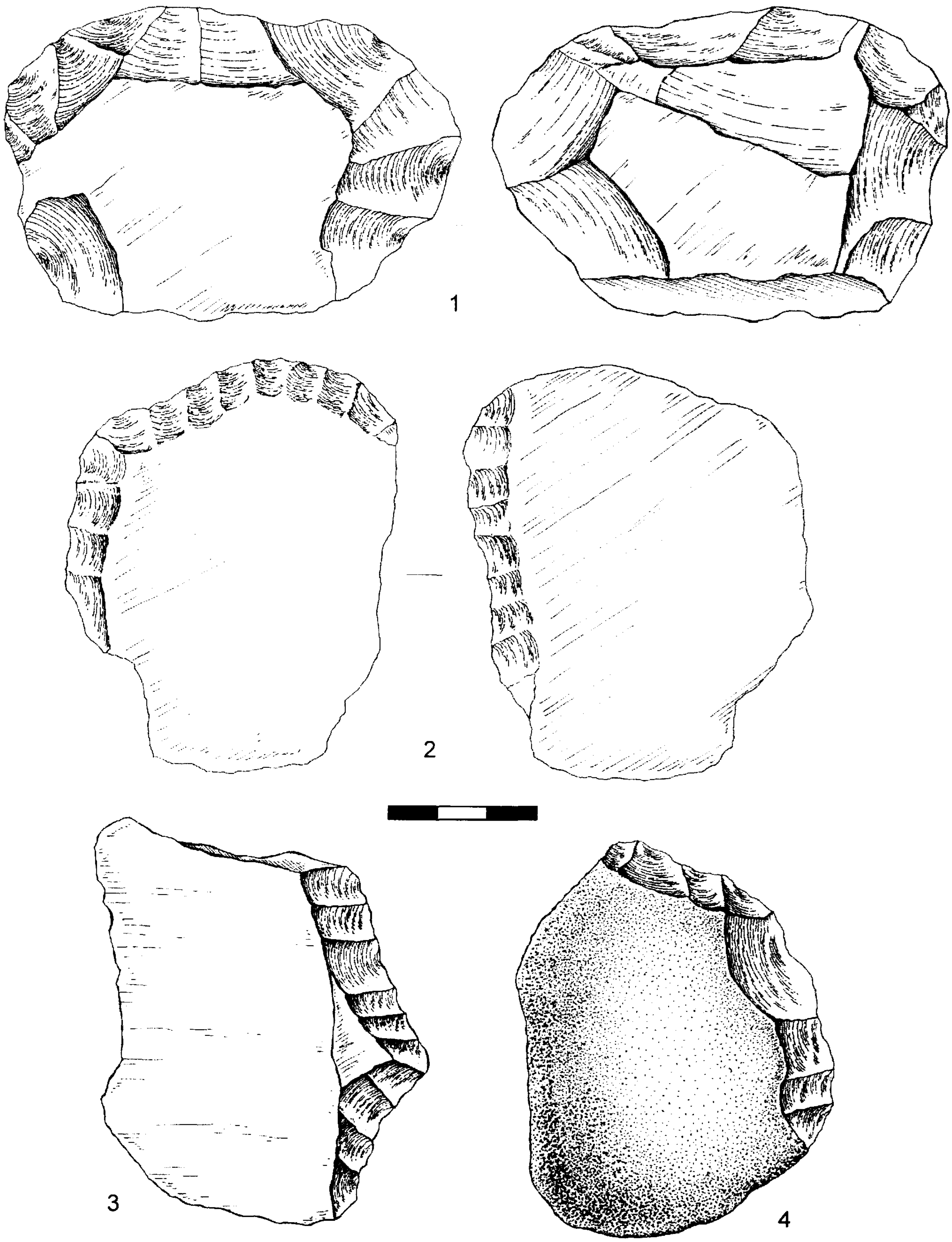

Figure 7.28. Medium-sized retouched pieces from TK UF. 1: quartz bifacial simple side scraper; 2: denticulate quartz side scraper. A small natural fragment of a quartz block is used to retouch the edge; 3: tabular quartz fragment with retouched edge, creating a simple side scraper; 4: small basalt cobble with a retouched edge forming a simple side scraper (drawings by N. Morán).

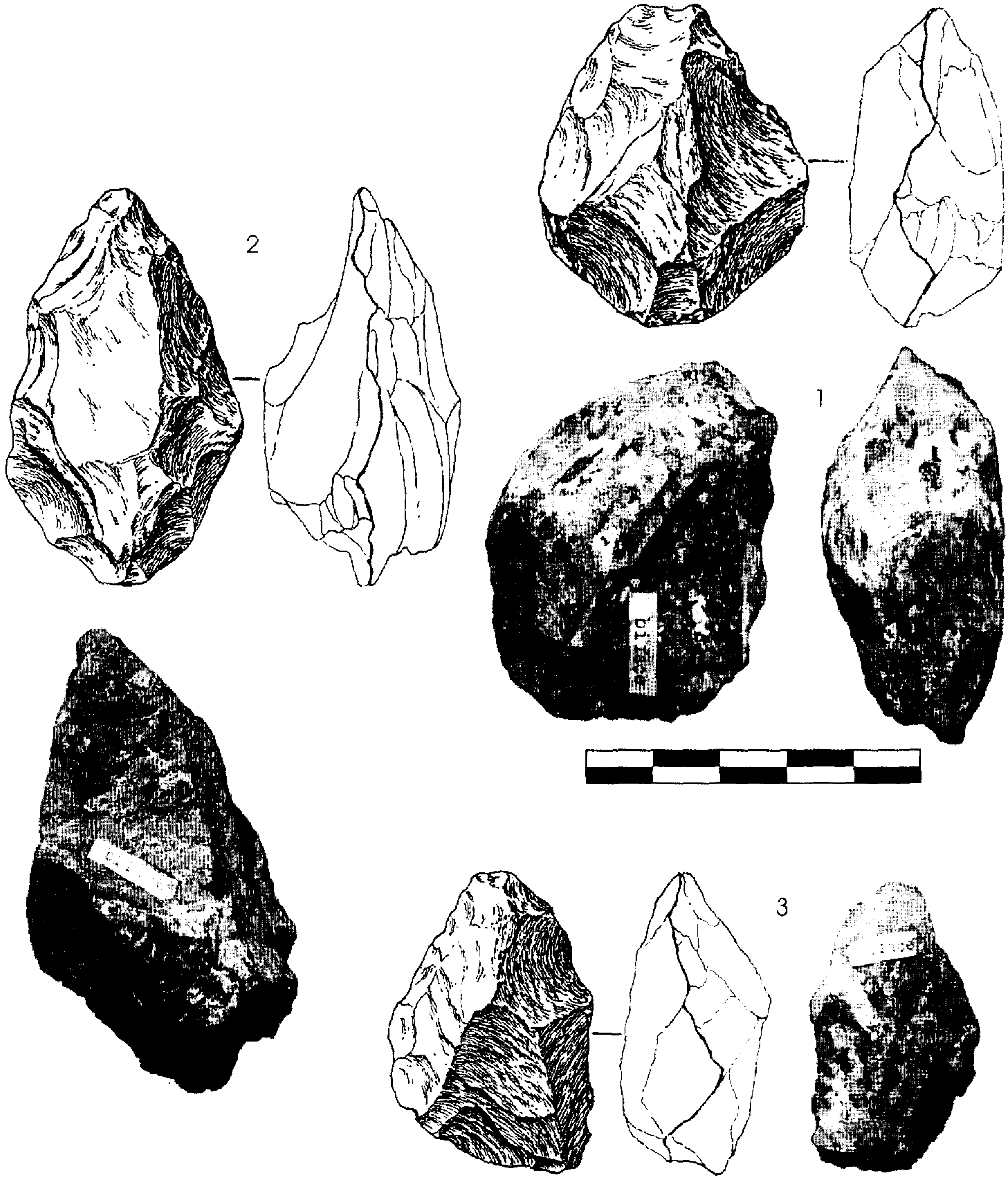

Figure 7.29. Bifaces from TK UF according to Leakey (1971:190). No. 2 could be a fragment of basalt biface since it has an edge presenting retouching on both surfaces. Nonetheless, its small size is not due to the technical tradition that manufactures small bifaces (which would, according to Leakey, associate it to the Developed Oldowan B), but is simply due to the fact that it is a fragment detached from a larger shaped piece. Nos. 1 and 3 are, in our opinion, large quartz chunks, not shaped pieces. The edge on No. 1 is completely blunt, and the ridges do not seem to have been caused by knapping, but by fracture.

		N*	Minimum	Maximum	Mean	Std. deviation
Lower Floor	Length	9	100	290	156.11	60.267
	Width	9	60	118	86.11	16.12
	Thickness	9	30	55	44.67	7.73
	Weight	9	289	2230	844.44	604.792
Upper Floor	Length	10	73	265	137.9	58.685
	Width	10	59	168	97.4	31.994
	Thickness	10	27	74	46.4	15.414
	Weight	10	199	1788	831.1	585.038

Table 7.10. Dimensions (mm and grams) of the large cutting tools from TK. (*) Only complete examples.

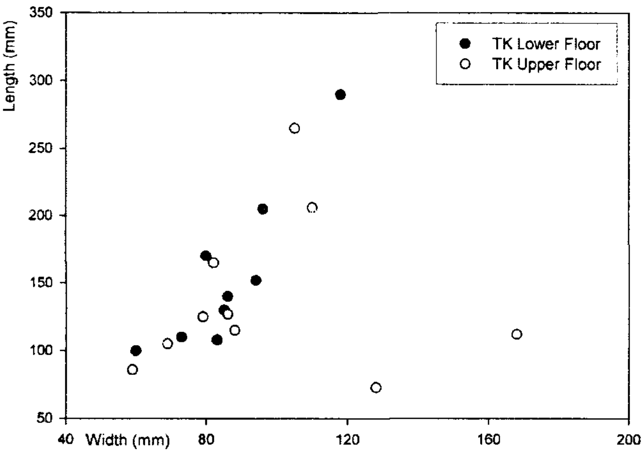

Figure 7.30. Dimensions of the large cutting tools. The tendency observable in some pieces in which the X axis strays from the main concentration is explained via measurement criteria; in the few objects for which the technological axis could be oriented, the length was measured from the butt to the distal point. As in EF-HR, these are short, thick flakes, therefore their length is well below their width. Since most of the material was divided in terms of the typological axis, they appear as two different groups when we are in fact processing a very homogeneous sample, from a metrical point of view.

The intensity of the reduction was also similar. TK LF shows a minimum of 3 detachments in the less worked piece and approximately 19 on the piece that has experienced the most intense reduction, with an average of 8.75 scars per object. TK UF, with a minimum of merely two blows and a maximum of 15 detachments, presents an average of 8 scars, quite similar to the underlying level. The other main argument Leakey (1971) outlined, i.e. the preferential selection of flakes as blanks in the Acheulean and of cobbles or blocks in the Oldowan, is not fulfilled in TK either. In the lower level, only two of the large cutting tools have been shaped on flake, despite their consideration as Acheulean items; another 4 pieces were shaped on blocks, and it is impossible to identify the original blank used for the other 3 items. In TK UF, of the 10 whole pieces, 3 used flakes as blanks, another three modified a cobble directly, one piece was shaped on a block and the 3 remaining pieces were worked on an indeterminate blank. In all, no specific pattern can be delimited to discriminate between both levels, neither considering metric terms, the intensity of the reduction or even the type of supports used for retouching. Therefore, the following step calls for an examination of possible differences that could appear in the *façonnage* methods.

TK presents what could be considered as perhaps the most stunning *façonnage* system in Beds I and II, and it should come as no surprise that it appears in both levels, not merely in one of them. We have called this system the rhomboidal reduction method and, whilst it is similar to the technique described by Bar-Yosef and Goren-Inbar (1993:153-154) in 'Ubeidiya, it consists in exploiting the quartz blocks' tabular planes as opposite striking platforms. The *façonnage* process for these blocks is performed as follows (see fig. 7.31): the horizontal plane (henceforth PH), which exploits the block's tabular surface, acts as a striking platform from which one of the edges is struck (edge 1) so as to create a unifacial ridge. Subsequently, instead of turning the block over and striking that edge 1 from the opposite horizontal plane (PH′), that PH′ is used to work the opposite edge (edge 2). Consequently, this produces a continuous ridge around the whole of the piece's perimeter, in which there is generally no interaction between the detachments from one face and the other. The only area that presents a recurrent bifaciality is the tip. In these areas, the unifacial retouch on edge 1 from the PH opposes another retouch from PH′ also on that edge 1; the same usually occurs on the other edge. Therefore, and via a bifacial retouch with simple angles on both planes, the craftsmen obtained a forceful tip on one of the ends of the block.

This type of tasks generate "false" bifaces since, with the exception of the tip of the piece, the volume is never distributed on two planes, either symmetrical or asymmetrical, since only the edge of each surface is modified. In fact, knappers are not interested in penetrating the blocks; they only aim to modify the external edges, with a view to creating objects with forceful rims. Nonetheless, these pieces are always connected to a pointed tip. That tip is the only area on the whole of the artefact to undergo intense bifacial works, which could possibly explain the great amount of this type of fragments (fig. 7.32), probably resulting from knapping mistakes that occurred during the manufacturing process.

In any case, the knapping method, which denotes a truly relevant technical complexity, cannot be connected to the bifacial *façonnage* of the volumes, and is in fact linked to an alternating and/or bifacial work of the edges of blocks presenting suitable natural morphologies. This original strategy implemented to obtain large cutting tools appears in both levels in TK (which once again rejects a cultural difference between LF and UF), and will be more comprehensible after understanding figures 7.33 to 7.38.

In this so-called rhomboidal system, there is an example (fig. 7.39) that differs slightly from the previous models. As previously, the exploitation is unifacial, since there is no interaction of the strikes on one edge, or an alteration of the blows on both surfaces. On the other hand, the knapper worked a whole plane first, and once shaped, he moved on to the other

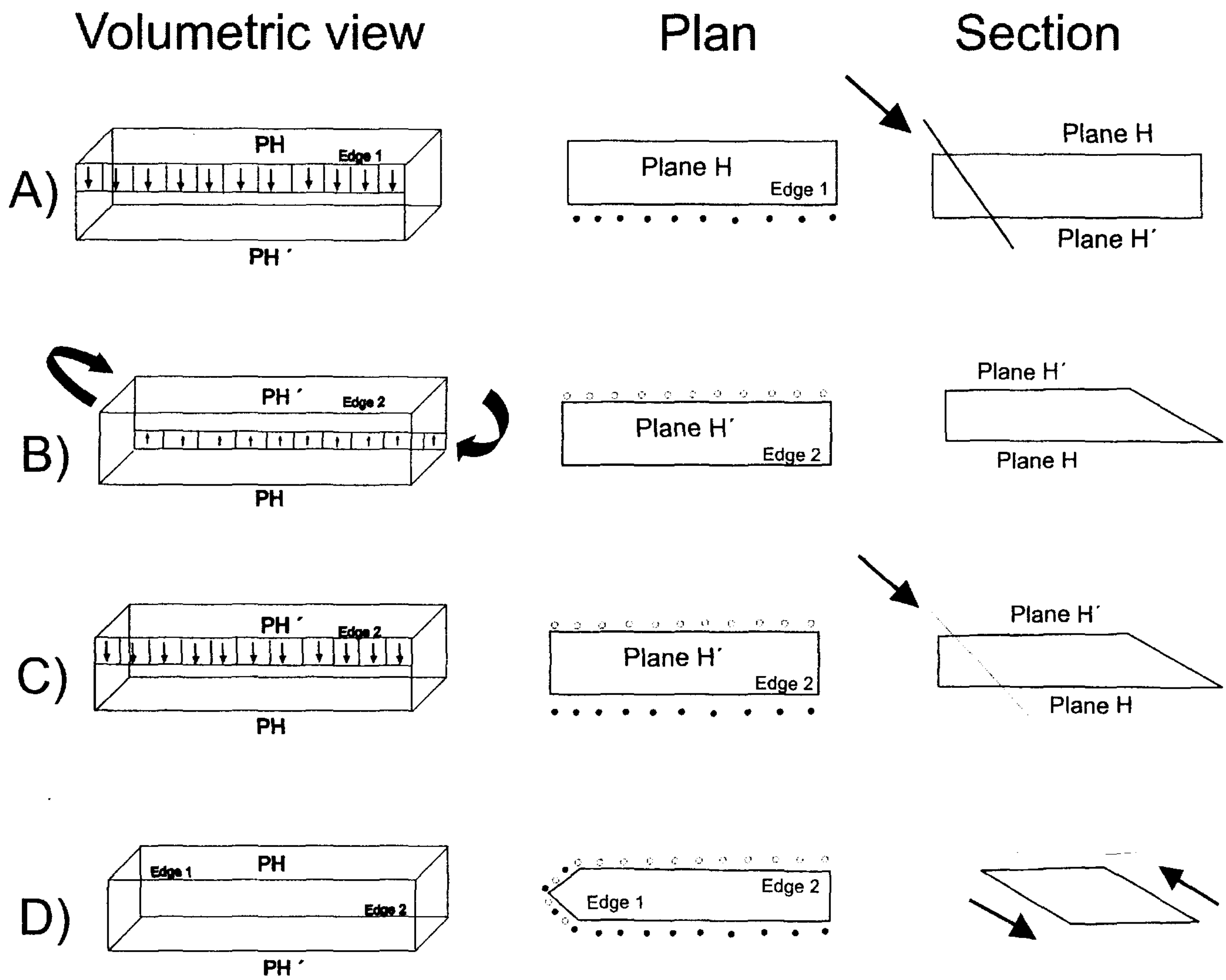

Figure 7.31. Ideal diagrams for rhomboidal exploitation used for large cutting tools. A: the Horizontal Plane (PH) acts as a striking platform on the edge of the piece; B: this produces an edge in the PH, which leads knapper to turn over the block; C: the same work is performed from the PH´ on edge 2, which is the edge opposite to edge 1 on the PH; D: this produces two edges worked unifacially, and one distal end that is worked bifacially to obtain a point.

surface. Compared to previous examples, the first innovation lies in the fact that when working this excellent quality basalt, tool-maker is interested in working the entire volume of each surface, based on invasive detachments, many of which have a flat angle.

The second innovation appears in that, quite probably, this piece was shaped using a soft hammerstone. As aforementioned, figure 6.19 demonstrated soft percussion could have been performed in FC West. Nonetheless, that example is not as evident as the current one. Especially as regards figure 7.39, but also in terms of other examples such as the one represented in figure 7.40, these objects present the typical traces left by a soft hammerstone (Newcomer 1971), with flat, invasive detachments, that do not break the piece's edge, leaving very diffuse negative bulbs of percussion on a perfectly regular edge. If this is considered alongside the presence of certain flakes with lineal butts that could have been generated by this type of *façonnage*, it is possible to assume that -at least as regards TK LF - the hominids could have possibly used soft hammerstones to shape the large cutting tools. If this were the case, and although it is difficult to soundly confirm the presence of a soft hammerstone using these analytical parameters (Mewhinney 1964), we would be facing the oldest known evidence of the use of organic materials in lithic knapping processes.

Unquestionably, the large cutting tools composed one of the most important categories in TK. The volume of raw material invested, the relatively standardised forms they present and the careful transformation give notice of the relevance they had in the technical activities performed in the site. Moreover, it is essential to state that there are no relevant differences between the types of large cutting tools represented on both

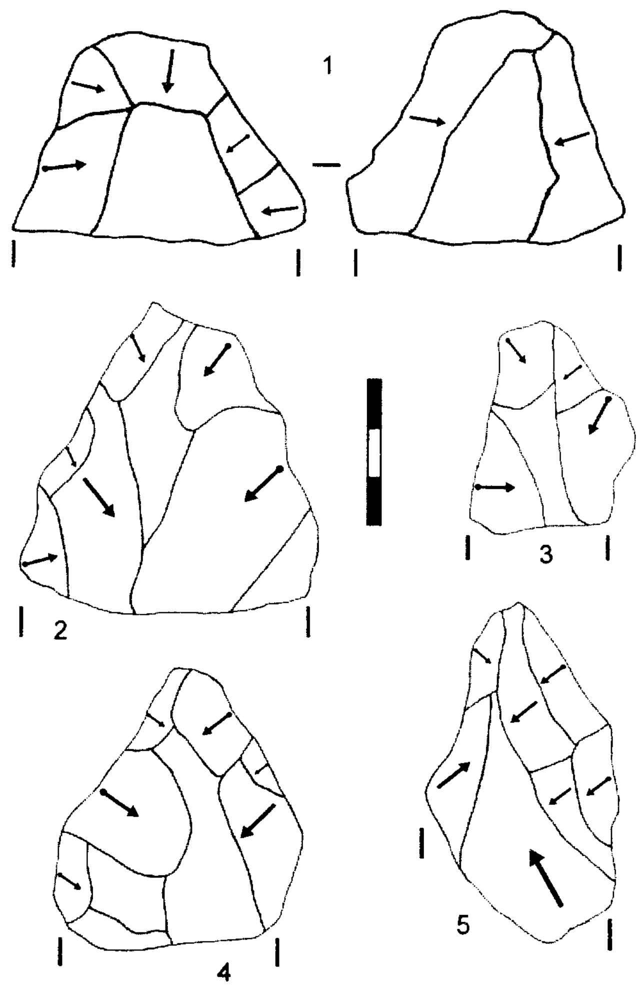

Figure 7.32. Possible points from large cutting tools fractured by accident during knapping and/or use. 1: example from TK LF; 2-5: examples from TK UF.

levels. Consequently, the objects Leakey (1971) called bifaces should not be used as an argument to distinguish TK LF and UF from a cultural point of view. As regards that definition of bifaces, the term presents a series of problems, since it is not exactly a bifacial strategy in most cases. In all, and compared to EF-HR or FC West, in TK there are examples that could be classified as genuine bifaces (fig. 7.41), although they do not compose the dominant trend.

In fact, this criterion should not be used to distinguish TK from the previous Acheulean sites. In our opinion, both TK levels present an identical technological strategy, which consists in the configuration of large tools, with forceful edges and pointed ends. Whilst EF-HR basically presents large side scrapers on flakes, of different morphologies, TK gives notice of a search for more standardised forms which always present a pointed area; whether they were shaped on a flake (fig. 7.42) or a cobble (fig. 7.43 and 7.44) is indifferent, it should not be used with cultural connotations, and responds to a shared goal: the pursuit for enormous forceful edges.

Percussion objects

Percussion processes, both in TK LF and UF, were one of the most important activities. Tallying the different types of hammerstones and fragments with percussion traces (tabl. 7.3), TK LF totals 19,803 grams of raw material exclusively linked to these processes, which could be considered alongside a vast amount of the quartz angular fragments which are devoid of percussion traces but were surely generated during such an activity. This trend is even more evident in TK UF, with a minimum of 63,208 grams of raw material invested in percussion activities, without considering the large amount of chunks and millimetric fragments that were almost certainly also caused by these activities.

The shortage of knapping hammerstones in TK LF is surprising, although it is compensated by the number of hammerstones with fracture angles, which could previously been used for *débitage* processes. Nonetheless, they are relatively profuse in TK UF, and present the trend observed previously in other sites, with a predominance of lava stream cobbles as blanks. The dimensions (tabl. 7.11) vary, and it is particularly interesting to document large pieces, ideal for obtaining large flakes, alongside small hammerstones perfect for retouching and the final shaping of the large cutting tools.

Hammerstones with fracture angles are the most relevant category concerning percussion objects in TK LF, and generally appear on quartz cobbles (tabl. 7.1). They also abound in TK UF, usually in quartz (tabl. 7.4), although in this level the number is substantially lower than the subspheroid-spheroid category. The comparison of average maximum lengths and weights of the hammerstones with fracture angles from both levels indicates there are differences between the occupations in terms of weight (greater in TK LF), although concerning

		N	Minimum	Maximum	Mean	Std. deviation
Lower Floor	Length	2	84	86	85	1.414
	Width	2	77	97	87	14.142
	Thickness	2	61	92	76.5	21.92
	Weight	2	568	870	719	213.546
Upper Floor	Length	24	57	180	86.83	25.052
	Width	24	41	125	68.63	20.295
	Thickness	24	30	96	55.67	17.522
	Weight	24	79	1317	387.83	328.844

Table 7.11. Knapping hammerstones at TK (mm and grams).

		N	Minimum	Maximum	Mean	Std. deviation
Lower Floor	Length	9	62	129	87.22	23.6
	Width	9	59	97	72.78	15.106
	Thickness	9	42	88	61.33	16.148
	Weight	9	270	1113	654.78	363.687
Upper Floor	Length	28	51	106	82.29	13.51
	Width	28	30	98	63.93	16.434
	Thickness	28	28	91	51.39	14.786
	Weight	28	76	1074	382.89	264.354

Table 7.12. Hammerstones with fracture angles at TK (mm and grams).

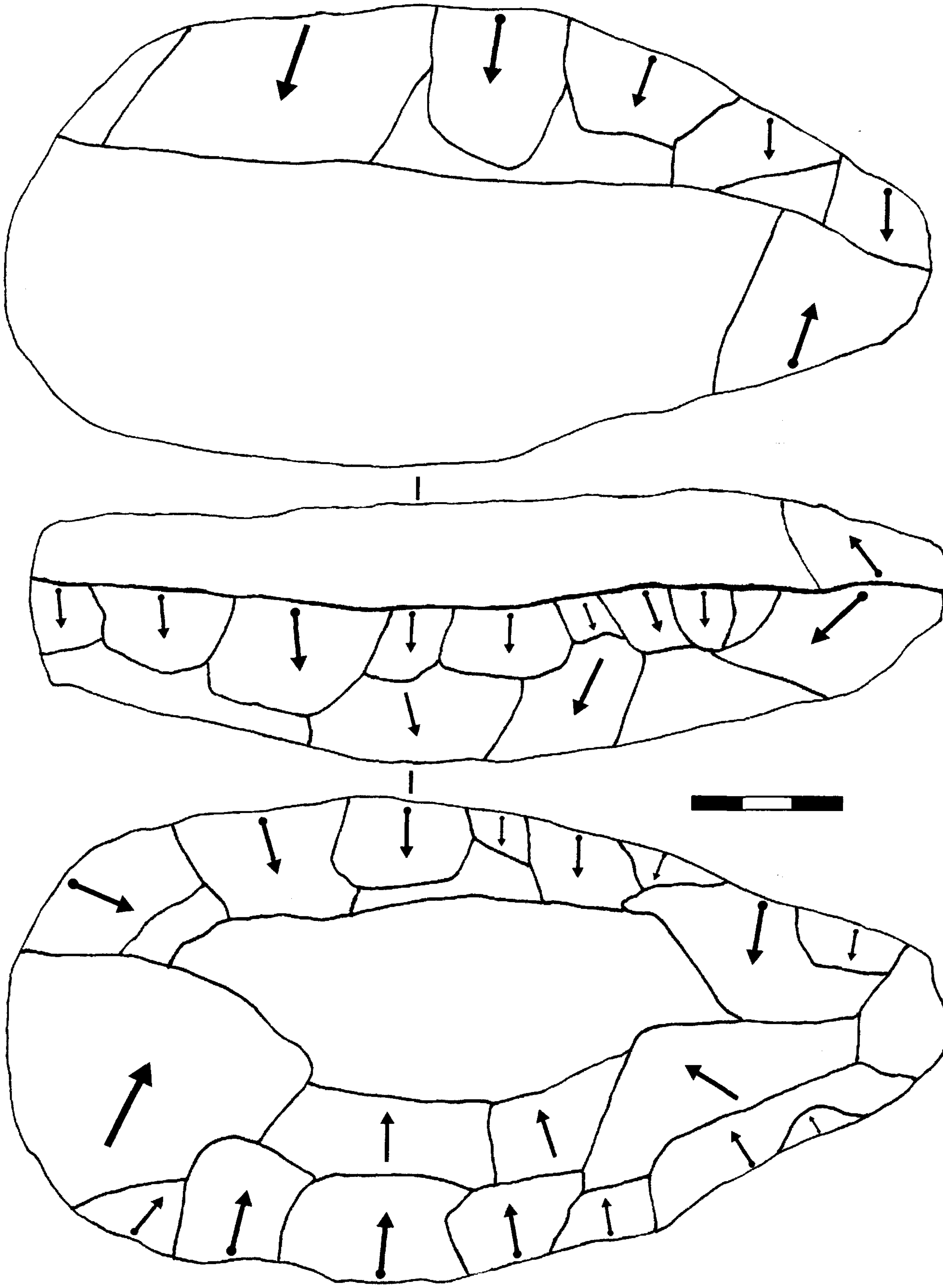

Figure 7.33. Large cutting tool made of quartz in TK LF exploited using the rhomboidal strategy (see explanation in fig. 7.31). It is a quartz block with two natural planes which act as platforms to create the edges. There are never any invasive detachments that modify the volume of the piece, and the goal is to create resistant edges, linked to a heavy mass (the object weighs over 1200 grams).

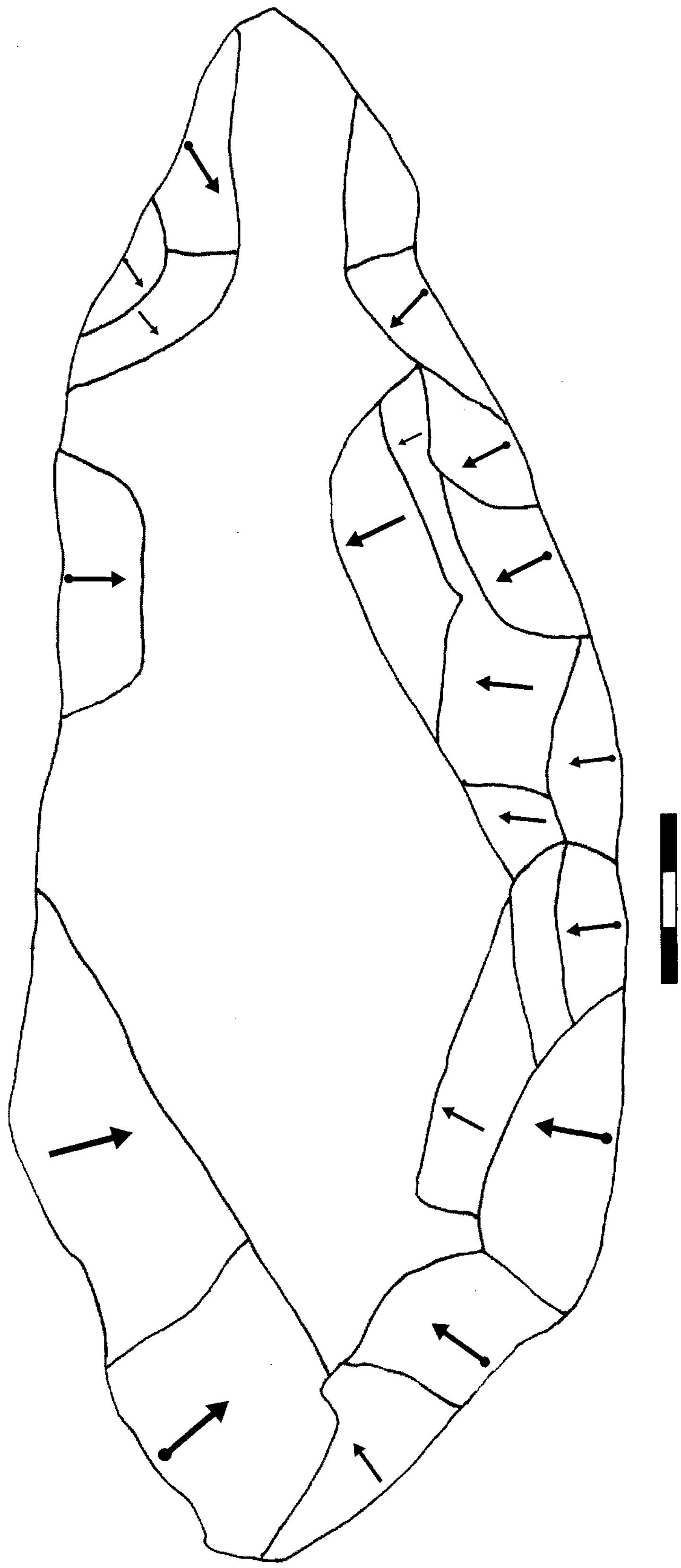

Figure 7.34. Another quartz example from TK LF worked using the rhomboidal strategy. This figure depicts what is known as Face A, with simple angle detachments from the PH, which compose a unifacial edge sometimes appearing opposite to a flat retouch from PH′. Subsequently, the other edge is exploited from PH′ (Face B) also via simple-angled retouching, which becomes bifacial especially when working the point. As in the previous case, the volume of the piece is not shaped, with activities focusing only on the outer edge, obtaining an object weighing over 2,200 grams with a forceful edge.

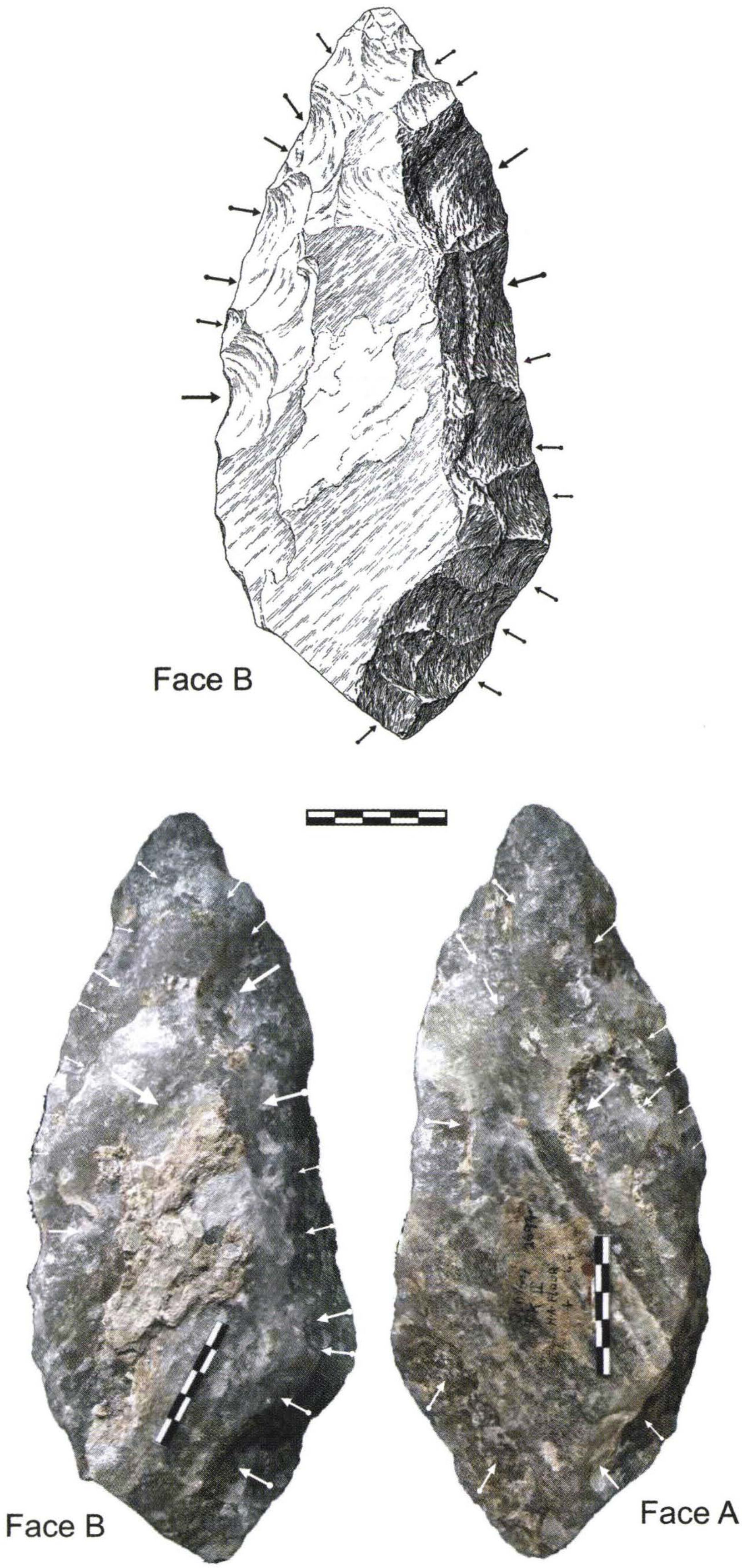

Figure 7.35. Face B of the same piece depicted in figure 7.34. The original drawing is by Leakey (1971:178), to which we have added the diacritical diagram and photographs of both faces.

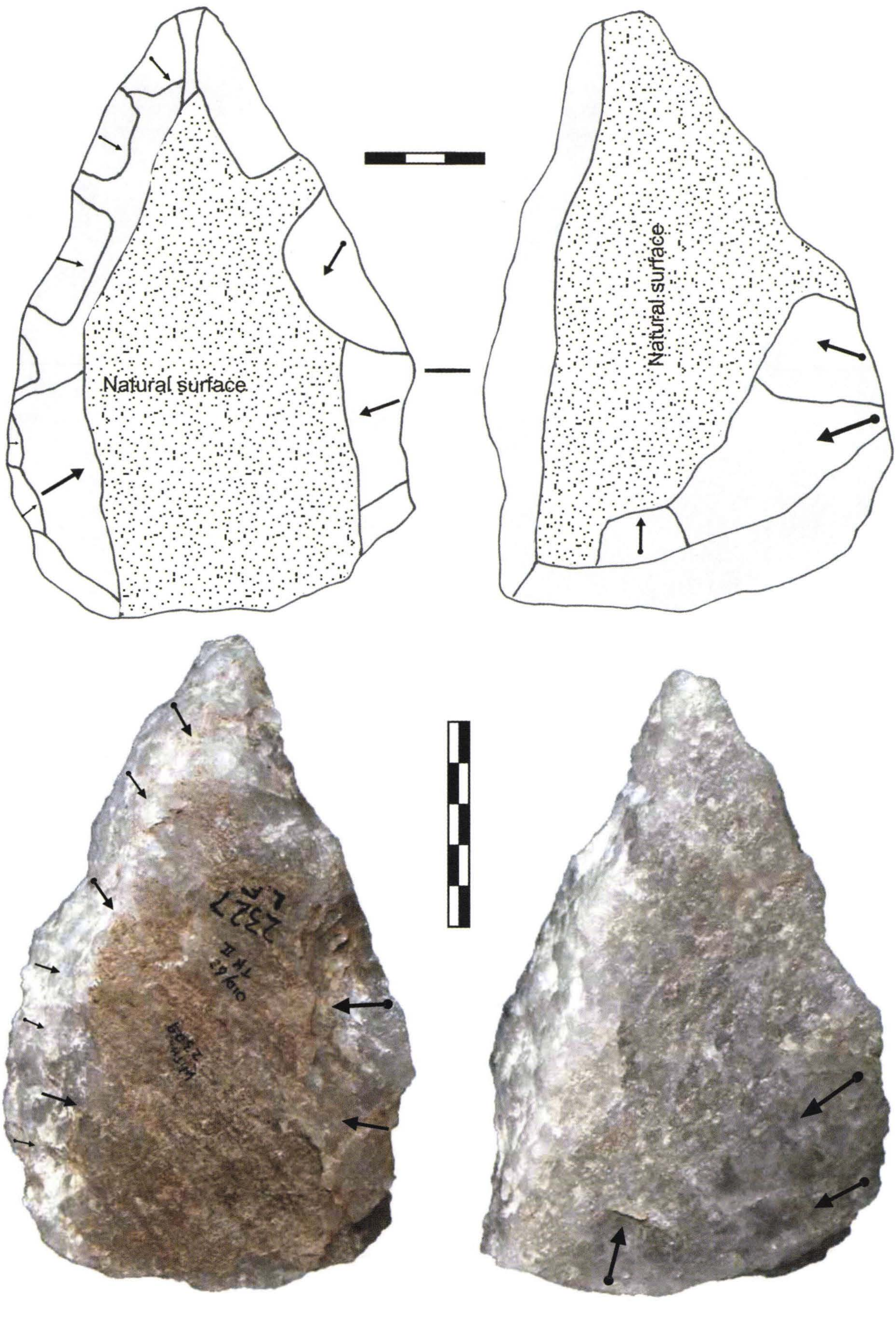

Figure 7.36. Large cutting tool made on quartz block. Example from TK LF.

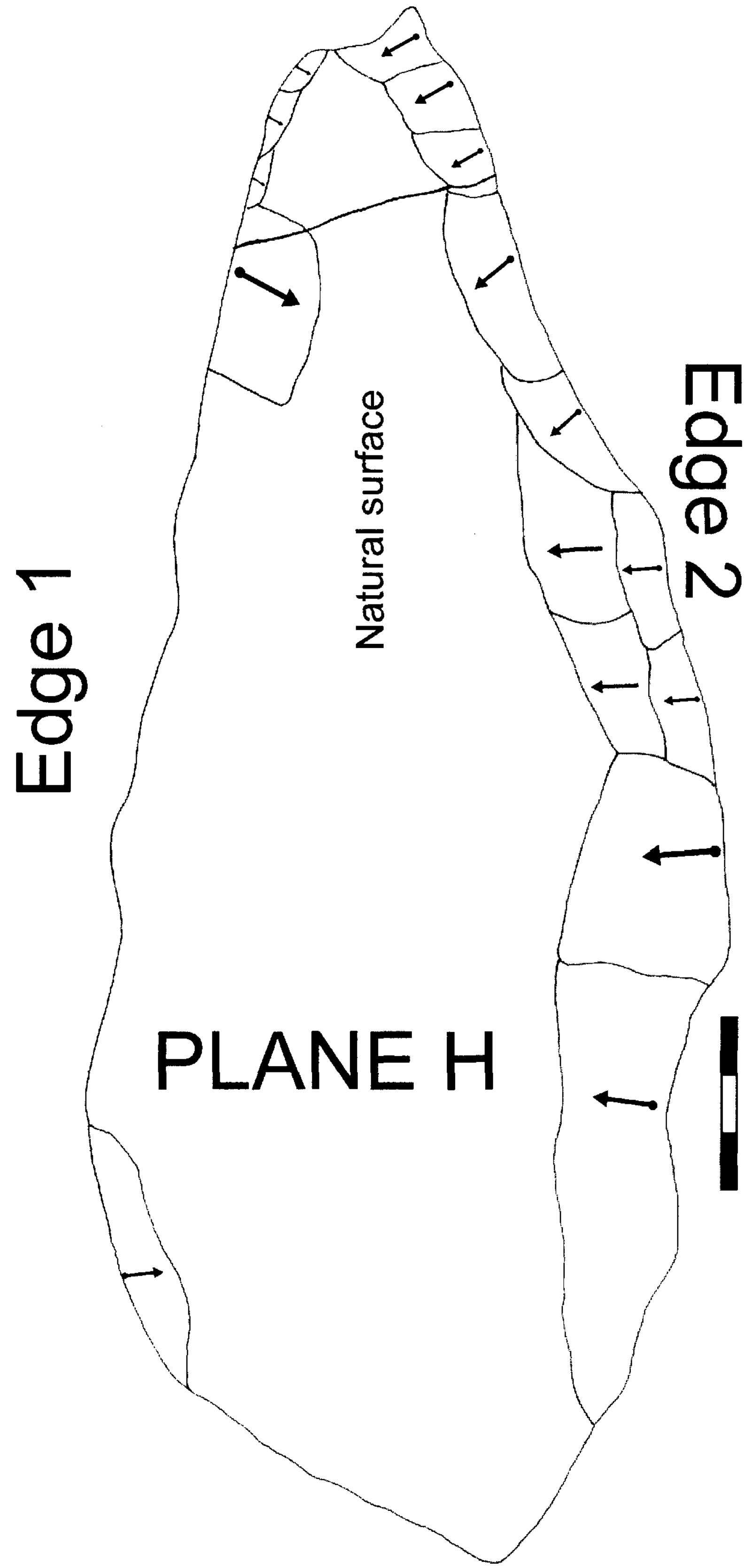

Figure 7.37. Large cutting tool made on quartz block from TK UF. The exploitation is identical to that documented in the underlying level; plane H acts as the striking platform to retouch edge 1 with an abrupt angle around the whole perimeter except on the pointed area, where detachments are performed with a simple angle and are alternated with some flat angle extractions from PH′. Edge 2 is also worked from this PH, combining flat-angled extractions from PH′ with simple-angled retouch performed from this PH.

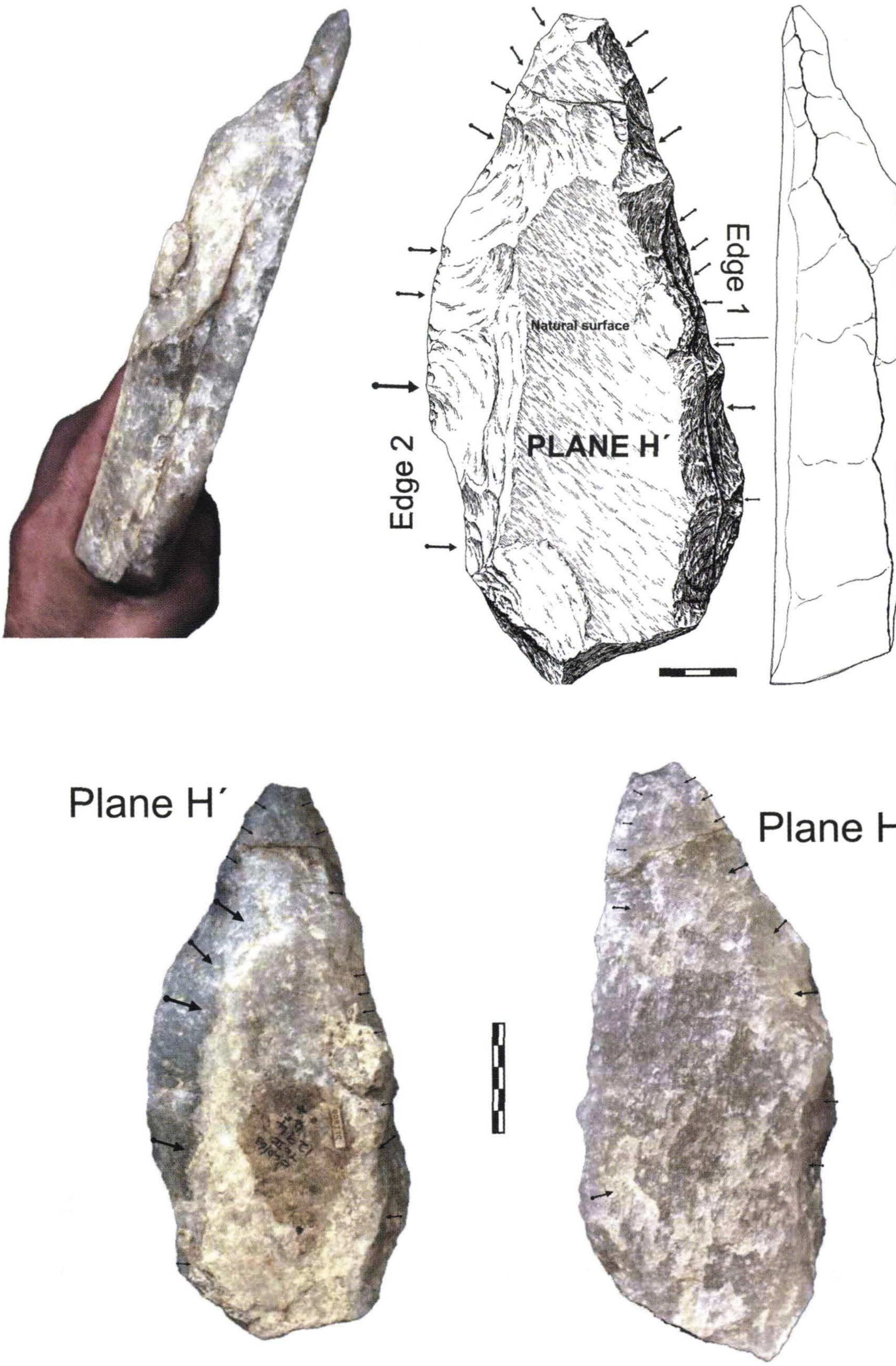

Figure 7.38. The other face of the same piece represented in figure 7.37; in this case the diacritical diagram is based on an original drawing by Leakey (1971:188), and photographs of both faces. Here, the PH´ acts as a striking platform essentially to work edge 2. Edge 2 is practically not worked from this PH´, except for the point. By using this rhomboidal strategy, a new false symmetry is achieved and a ridge is created around the whole perimeter of the piece.

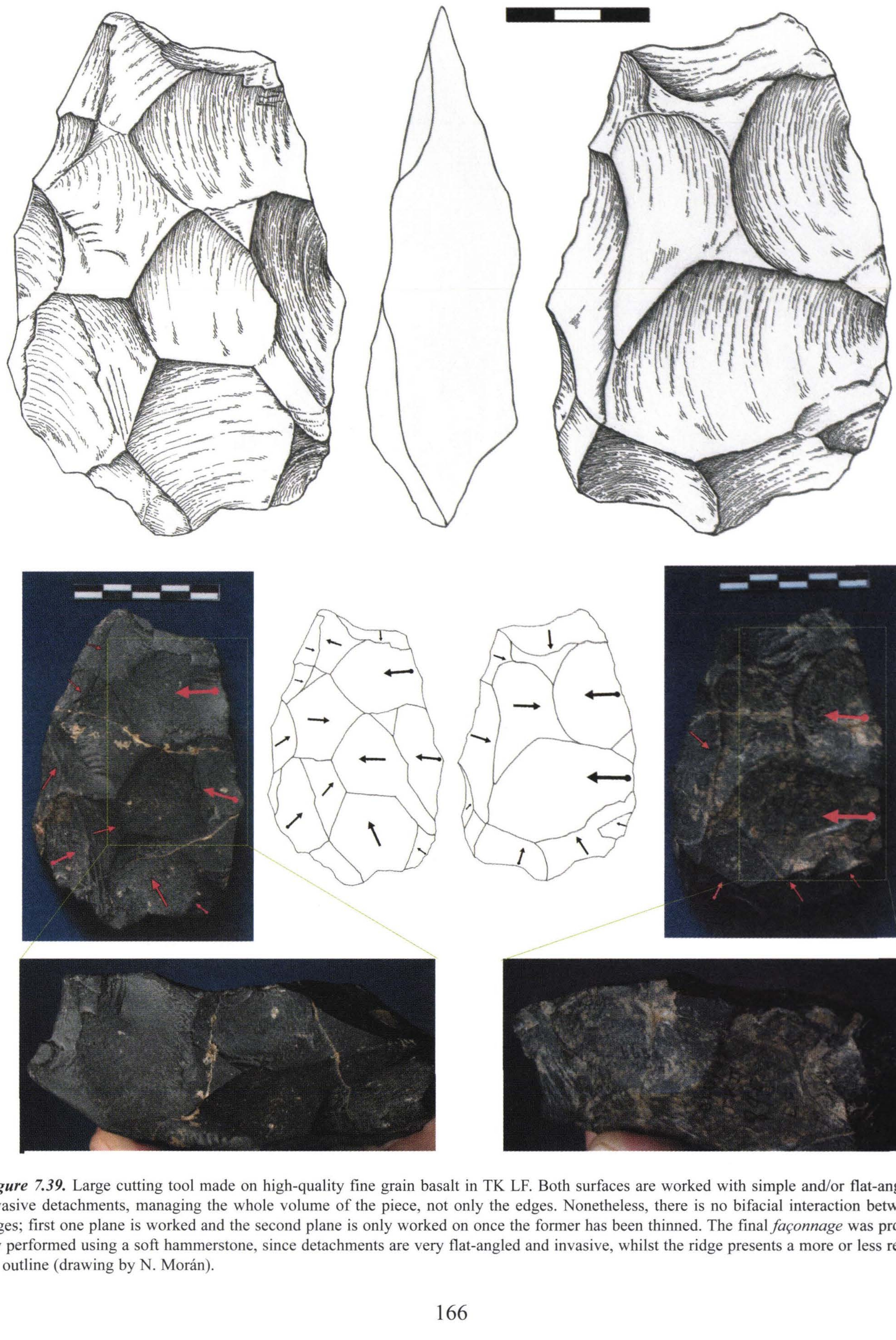

Figure 7.39. Large cutting tool made on high-quality fine grain basalt in TK LF. Both surfaces are worked with simple and/or flat-angled invasive detachments, managing the whole volume of the piece, not only the edges. Nonetheless, there is no bifacial interaction between edges; first one plane is worked and the second plane is only worked on once the former has been thinned. The final *façonnage* was probably performed using a soft hammerstone, since detachments are very flat-angled and invasive, whilst the ridge presents a more or less regular outline (drawing by N. Morán).

Figure 7.40. Quartz large cutting tool in TK LF on Siret flake, with flat-angled retouching that could have been performed with an elastic hammerstone, although this is not as evident as in the previous example.

the length, both samples could belong to one same population (tabl. 7.12).

The issue of the hammerstones with fracture angles takes on a special relevance in TK LF, since in our inventory this category includes several objects Leakey (1971) classified as knapped pieces. Nonetheless, they do not present any of the attributes typical of knapping processes; the so-called detachments do not come from any of the edges, the scars present convex forms or the concavities appear in the centre, not by the edge, and the few times in which the strike comes from the edge, the ridge is completely battered and the detachment does not genuinely stem from the edge, but from a inner area, forming obtuse angles that could not have been created by a knapping process. In all, it seems that these modifications were produced by percussion, not by knapping. If we include

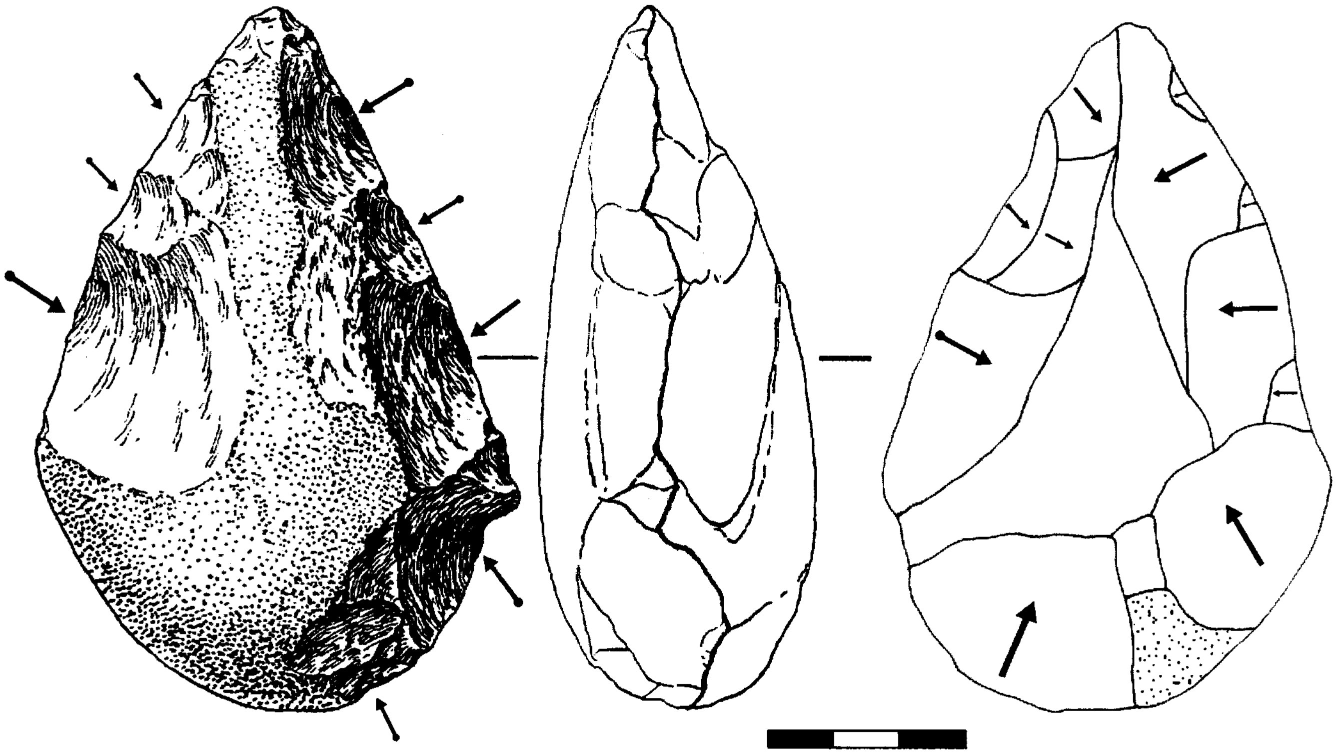

Figure 7.41. Biface on basalt cobble in TK UF. Diacritical diagrams based on Leakey (1971:190).

these objects (most of which are made of quartz) in our category of hammerstones with fracture angles, we could be facing the first stage of the alteration of the quartz blocks that led to the subsequent formation of the subspheroids and finally of the spheroids.

As regards the latter, Leakey (1971) counted 60 subspheroids and 16 spheroids in TK UF, and 31 subspheroids-spheroids in TK LF. An examination of Leakey's (1971:175 and 191) description unveils that she referred to subspheroids under 3 centimetres in diameter, and others that did not exceed 5 centimetres. Willoughby (1987:27) seems to agree, since she provides the same amount of spheroids-subspheroids. Nevertheless, in our opinion, a good part of these objects are merely small-sized chunks; pieces that do not present any traces of knapping or ridges, with natural surfaces that do not even present percussion scars. Furthermore, an important amount of these objects classified as subspheroids- spheroids are under 3 centimetres in diameter, which is functionally ineffective. In all, we consider these fragments are nothing but pieces detached from genuine hammerstones. Moreover, as aforementioned when referring to unmodified lava material, we mentioned the existence of basalt clasts measuring 4-5 centimetres which probably have a natural origin. This hydraulic deposition could also be contemplated for rounded quartz pieces which, in any case, cannot be included among the objects considered subspheroids or spheroids.

According to this aggregate, TK LF only presents 4 subspheroids/spheroids, whilst this frequency escalates enormously in TK UF, with 48 of these objects. As aforementioned, the objects denominated hammerstones with fracture angles herein could simply comprise an initial stage of the modification of quartz blocks. This argument grows sounder as regards TK, since most of the hammerstones with fracture angles are made of quartz, a trend that is invariable among subspheroids and spheroids. Consequently, the presence of the latter would simply indicate a greater intensity in terms of the use of quartzes in percussion processes. Subspheroids/spheroids are usually smaller than hammerstones with fracture angles (fig. 7.45), although they are obviously in the same size scatter as the latter. The fact that the spheroids and subspheroids (see also tabl. 7.13) are generally smaller than other percussion categories can be interpreted as another indication of the intensity with which they were used. In any case, in TK UF spheroids and subspheroids had a qualitative exceptional importance and, since they total 16 kilograms of raw material, they suggest percussion activities were especially relevant and intense.

		N	Minimum	Maximum	Mean	Std. deviation
Lower Floor	Length	4	80	96	87.25	7.182
	Width	4	75	88	81	6.055
	Thickness	4	72	88	81	6.683
	Weight	4	630	920	830.75	135.517
Upper Floor	Length	47	44	150	67.57	17.178
	Width	47	38	140	59.28	16.353
	Thickness	47	30	104	50.85	13.418
	Weight	47	71	3100	333.96	465.008

Table 7.13. Dimensions of subspheroids and spheroids (mm and grams).

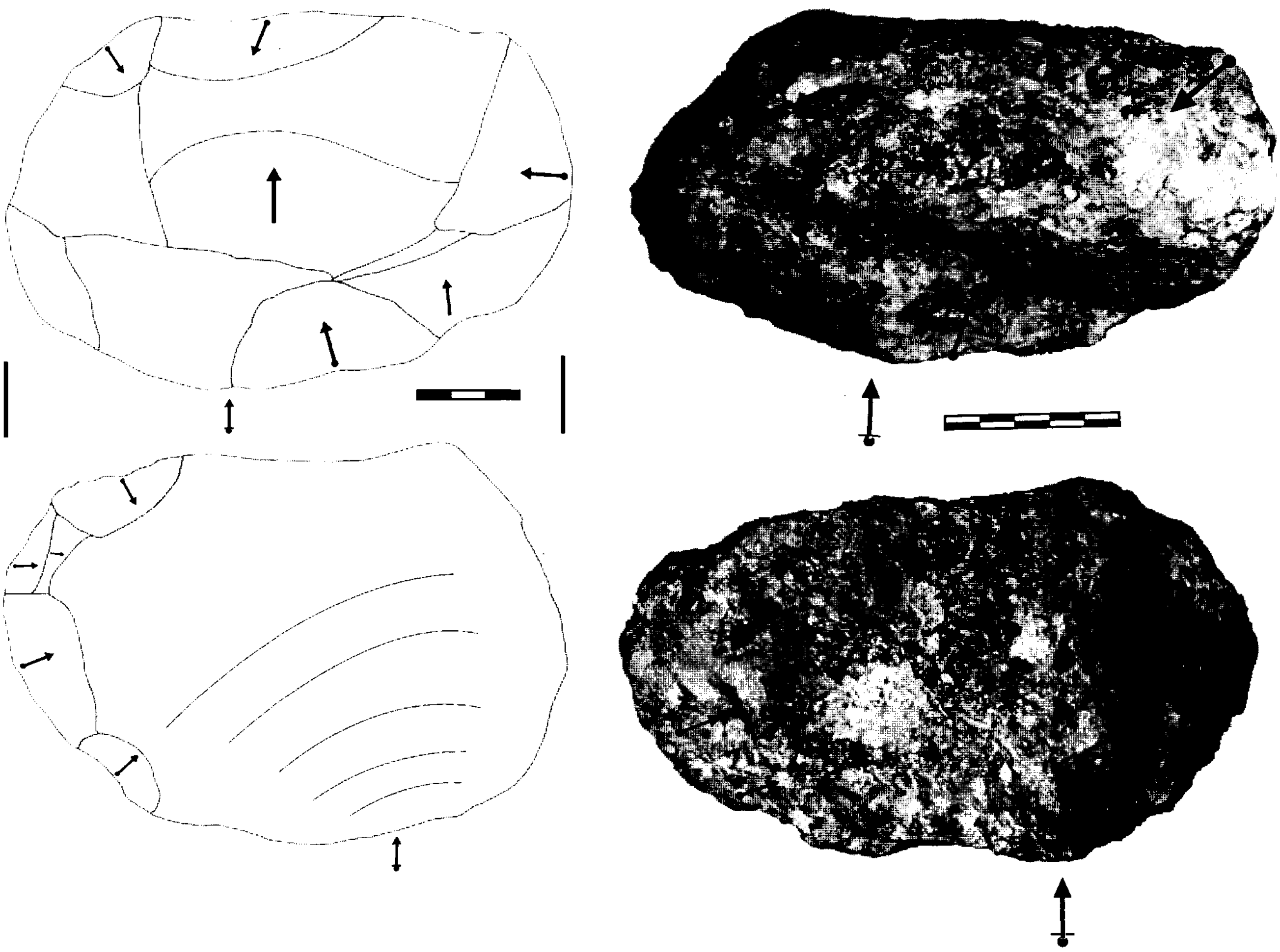

Figure 7.42. Large cutting tool in TK UF. Enormous quartz flake weighing over 1300 grams, that nonetheless presents slight retouching, limited to the edges, performed directly on the transversal distal edge, and reversed on the lateral right side. This piece represents the typical strategy observed in EF-HR, where this type of enormous side scrapers on flake appeared showing slight retouching processes, but forceful edges.

The importance of the spheroids and subspheroids in terms of the raw material invested in percussion processes is only surpassed by anvils. With over 7 kilograms in TK LF and almost 17 kilograms in TK UF (tabl. 7.3 and 7.5), the anvil group is relevant not only in terms of the global weight, but also from a quantitative perspective. It is important to bear in mind that there are more anvils than cores in TK LF, and that not only does this trend appear in TK UF, but anvils almost amount to the same total as flakes (tabl. 7.1 and 7.4). As in the rest of the sites where anvils have appeared, in TK these objects are mainly made of quartz. The anvils found in TK are larger than in other assemblages, and there are several examples over 10 centimetres maximum lengths that weight almost 2 kilograms (tabl. 7.14). There is a huge metric and morphological similarity between the anvils from both levels (fig. 7.46), corroborated using Student's T analysing the equality of the length and weight averages.

The tabular blocks used as anvils (fig. 7.47) are practically identically in terms of their size and shape to those used as blanks for manufacturing some of the large cutting tools on both levels. The presence of identical blocks in different occupations and the fact that the same blocks are used both to manufacture large cutting tools (in principle a category that must have been very valued given the time invested in their production) and as simple platforms on which heavy-duty activities were performed (i.e. anvils, objects without intentional modification, therefore, more expeditious items), can lead to two conclusions. In the first place, the source of the raw material was located nearby, and, secondly, that it was profuse enough to be used extensively.

		N	Minimum	Maximum	Mean	Std. deviation
Lower Floor	Length	8	67	140	93.5	23.139
	Width	8	49	105	72.13	20.733
	Thickness	8	36	85	59.25	17.613
	Weight	8	218	1889	765	591.252
Upper Floor	Length	33	57	155	93	26.858
	Width	33	45	130	73.79	22.352
	Thickness	33	25	89	52.24	16.832
	Weight	33	85	1901	506.42	413.574

Table 7.14. Dimensions of the anvils (mm and grams).

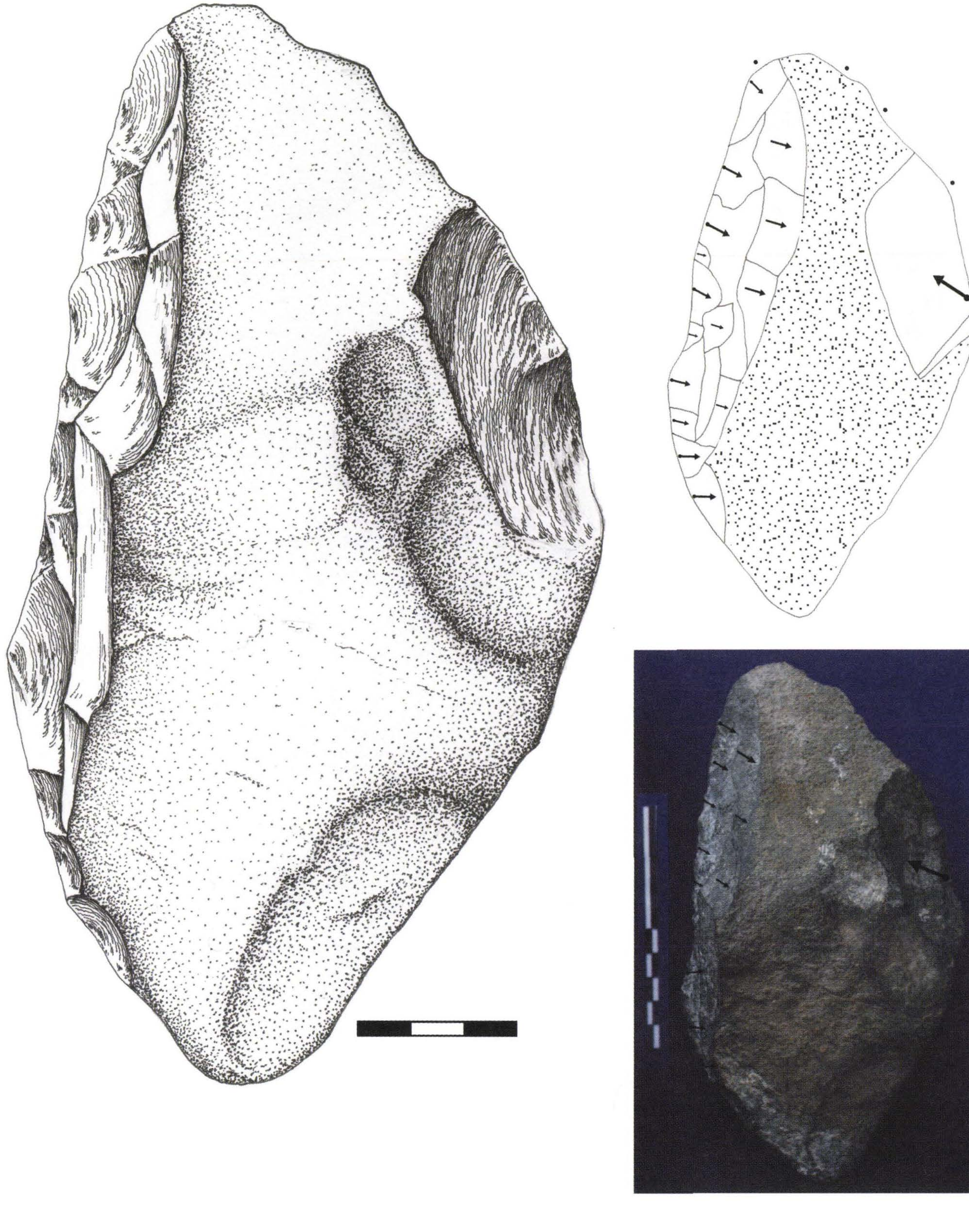

Figure 7.43. Large cutting tool on basalt cobble in TK UF. It is actually the same rhomboidal exploitation system presented in the examples on quartz blocks. The plane depicted in this figure is used as a striking platform for abrupt detachments from the face in figure 7.44, focusing almost exclusively on the distal part to create the point visible in the other figure (drawing: N. Morán).

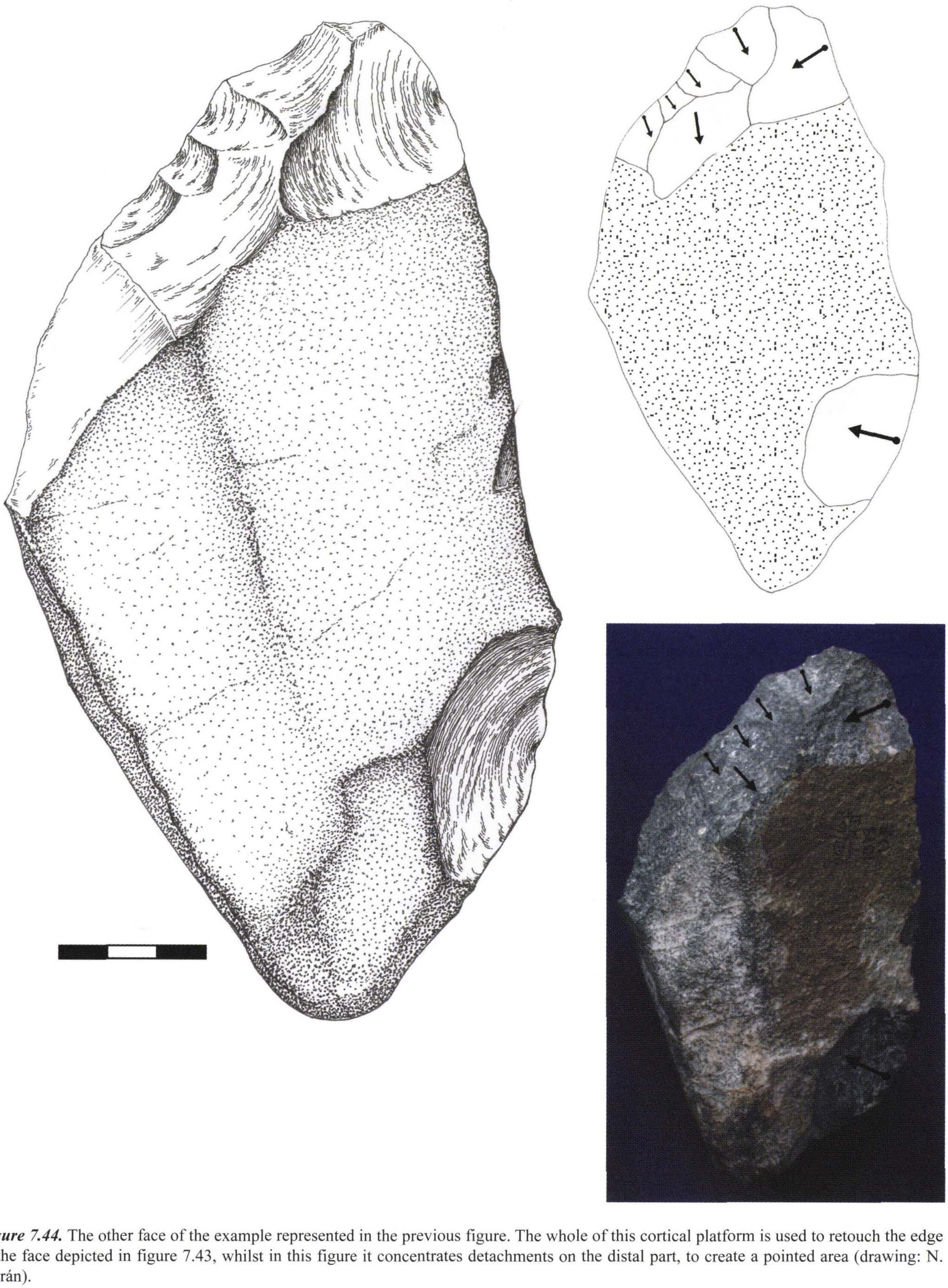

Figure 7.44. The other face of the example represented in the previous figure. The whole of this cortical platform is used to retouch the edge of the face depicted in figure 7.43, whilst in this figure it concentrates detachments on the distal part, to create a pointed area (drawing: N. Morán).

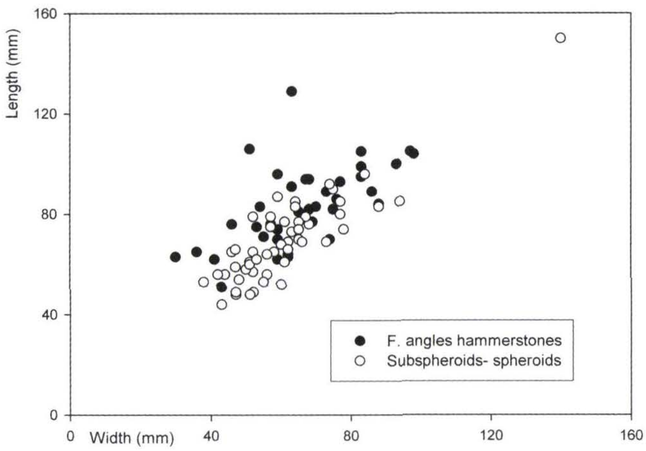

Figure 7.45. Dimensions of the hammerstones with fracture angles and subspheroids/spheroids.

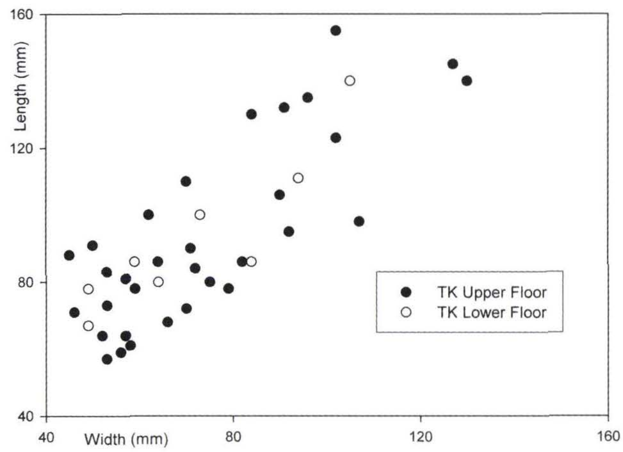

Figure 7.46. Dimensions of the anvils in both levels of TK.

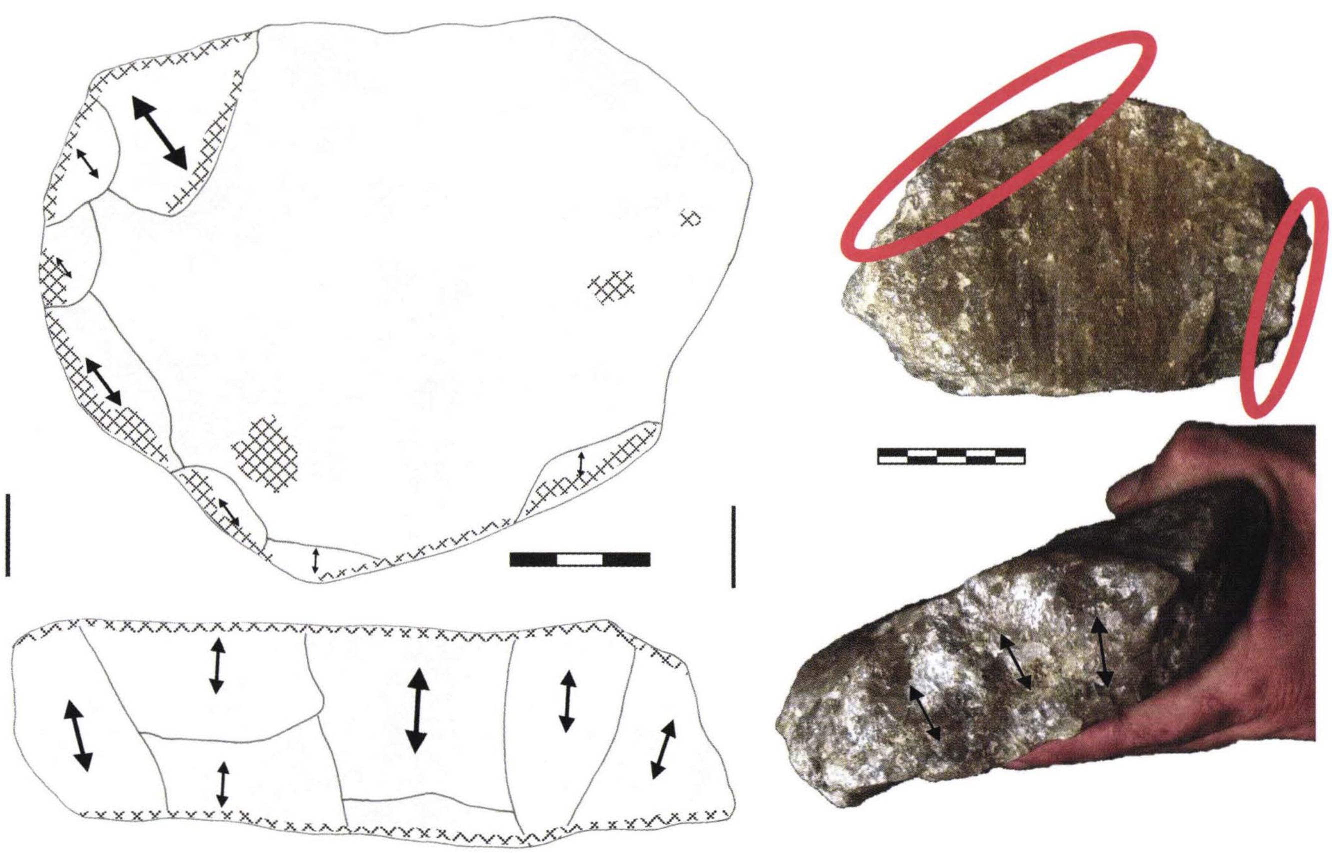

Figure 7.47. Anvil from TK UF on an enormous tabular quartz block. The circles indicate the areas most affected by striking, and the bidirectional arrows indicate the scars of the bipolar fragments detached during percussion.

The major importance of percussion activities performed in TK must be underscored. These activities are not limited to different active and passive hammerstone categories. Both in TK LF and in TK UF, it is amazing to see the amount of small fragments devoid of butts, ridges or dorsal faces that could allow us to safely attribute them to knapping processes. The progressive modification processes hammerstones with fracture angles, spheroids and anvils underwent must have generated thousands of fragments, fragments which we precisely include in the millimetric chips categories, given the difficulty of safely allocating them to a specific technical activity. All these objects, considered alongside the huge amount of kilograms invested in percussion objects, provide an idea of the relevance these processes had in TK.

Conclusions

The first issue lies in a joint assessment of the similarities and differences in the inventory of both levels in TK. Although the absolute frequencies in TK LF (n=2269) are substantially lower than those in TK UF (n=5268), we can in no case refer to differences regarding the material or the intensity of the occupation. Leakey (1971:174) warned that the lower level was only excavated in one of the two trenches (specifically, the smallest one, measuring 6 x 7.5 m), therefore it is logical that less pieces were unearthed. Consequently, if we consider the number of pieces recovered from each level and the difference in terms of the size of the excavated surface, the proportion between both levels corresponds perfectly, although Leakey (1971) calculated a slightly greater density for UF than for LF.

The Lien tests provides interesting results in the general comparison of the categories in both levels (fig. 7.48): TK LF presents proportionally more flakes and retouched pieces than the upper level, whilst the latter presents an overrepresentation of spheroids and hammerstones. The rest of the categories seem to be identical on both levels. This statistical trend has a notable archaeological coherence; the categories that predominate in TK UF (knapping hammerstones, hammerstones with fracture angles and spheroids) are directly linked to percussion activities. Categories that abound proportionally in TK LF (flakes and retouched pieces), however, are linked to knapping processes.

This obviously does not exclude the fact that knapping activities and heavy-duty percussion processes were used alternatively in both settlements. Both processes have been documented both in LF and in UF. In any case, and since we have insisted on the fact that - from a technical point of view - both levels are practically identical, if we were establish a difference between the lower and upper floors in TK, that discrimination would probably be based on the greater intensity of the percussion processes in the most recent assemblage.

As in other sites analysed previously, both levels in TK prove quartz was worked *in situ*, since there are elements in practically all stages of the *chaîne opératoire*. Consequently, enormous quartz manuports that could have been perfect blanks for large cutting tools or to be used as anvils have been identified. There is also (at least in TK LF) a coherent proportion between quartz flakes and cores. Moreover, the hammerstones, retouched pieces and different size fragments indicate the intensity of the quartz reduction performed *in situ*. There are some imbalances between certain large quartz flakes and the small quartz cores. Since the quartz large cutting tools are usually tabular, these flakes could possibly not come from the same reduction sequences as identified on the preserved cores. Yet, apart from that possible exception, quartz did undergo all stages of the *chaîne opératoire* at the actual site. Hominids imported natural blocks, which were used either as knapping blanks (cores, large cutting tools) or as platforms to perform percussion activities (anvils), which were transformed into different object categories and broken down until they were discarded in the settlement itself.

The contribution of quartz blocks is amazing: in LF there are over 56 kilograms whilst at least 118 kilograms appeared in UF (tabl. 7.3 and 7.5). Considered independently, this enormous amount of the same raw material in a specific point of the landscape should already make us consider the availability of quartz in the territory. The intensity of the transport of one same type of rock, the size of many of the objects that almost weigh two kilograms, the presence of large blocks without any trace of use (real manuports), or the employment of enormous blanks simply as platforms on which to perform a specific activity (anvils), all indicate that the hominids in TK were not concerned in optimising the benefits of the transported raw material. Rather, in view of the discarded fragments and the vast amount of kilograms included in the waste categories, we could say that the craftsmen were not at all concerned about maximising the performance of the quartzes. It is hard to rationalise such an exaggerated waste of raw material, as documented in both settlements. Furthermore, quartz was not even used primarily to obtain flakes or sharp edges. In TK LF, obtaining sharp edges could still be sus-

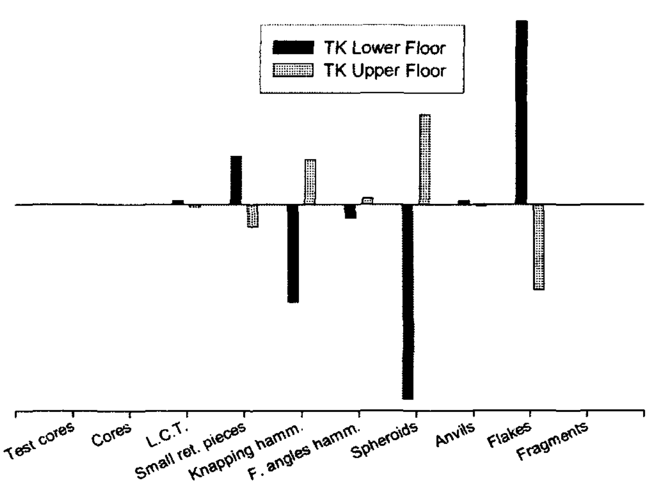

Figure 7.48. Lien Test comparing absolute frequencies of the different categories at TK LF and UF.

tained as one of the main goals expected of the activities performed: taking into consideration retouched pieces and flakes would total approximately 13 of the 56 kilograms of quartz documented (tabl. 7.1 and 7.3). Yet, in TK UF there are not even 7 kilograms of sharp edges among the 118 kilograms of quartz transported, thus composing an incidental portion of the assemblage.

Actually, in TK (mainly in the most recent level) knapping activities were peripheral processes in terms of quartz management. Therein, the most noticeable aspects are the *façonnage* of a few objects, the *débitage* of a few flakes, but a very intense processing of lithic categories connected to activities other than knapping. The profusion of hammerstones with fracture angles indicates those ridges were used to strike objects, not to detach flakes. Likewise, the anvils present surfaces that are entirely modified by percussion, a more intense process than the procedure that would be caused if they were used as platforms for bipolar knapping. Neither does it seem that these anvils were used as blanks on which to place the large blocks being worked on to obtain the large cutting tools. In that case, those shaped pieces would present percussion and alteration traces; which is not the case. Moreover, although spheroids could have perfectly been used in their final rounding stage as knapping hammerstones, during the stages in which the angles were broken they would not have presented suitable surfaces, and also show a percussion intensity that is not documented in *débitage* processes.

Nevertheless, although it seems obvious that quartz participated in percussion actions, not in knapping processes, the activities it was used for are still unclear. In order to answer this question, we should turn to the bone inventory from TK to justify the massive use of quartz in carcass management processes. However, TK presents an almost nonexistent bone collection, which is poorly preserved; therefore the investment of these huge amounts of quartz is subject to a serious functional uncertainty.

Continuing along the line of the uncertainties, it is time to consider the *chaîne opératoire* of lavas. Here, the problems we encounter regarding interpretation are even more serious than in the case of the quartzes. In principle, we should not deny the presence of *in situ* knapping, since there are fragments that reveal the existence of technical errors in the actual site, some cortical flakes that coincide with the exploitation systems observed on the cores, and in fact groups of pieces that seem to come from the same cores have even been documented. Nonetheless, the proportions of the *débitage* are quite inferior to those expected in view of the number of cores. In fact, there are no examples that could be included among knapping waste, a fact that raises even more doubts regarding the existence of flake production activities performed *in situ*. As opposed to what occurs in other sites, TK does not present a concentration of lavas in the percussion categories. Quite the opposite: the scarce number of items are usually linked to knapping activities; a few cores and flakes, some large cutting tools and the occasional *débitage* fragments. The problem is, paradoxically, that these *débitage* processes do not seem to have been performed in the site where they were found, and must have been imported once worked. As a hypothesis, we could suggest that they were imported for their quality; although throughout Bed II in Olduvai we have seen how the quality of the lavas employed increases, in TK, as occurs in EF-HR, the trend becomes specially evident, since phonolites, trachytes and very fine basalts with an excellent potential for knapping have been located.

Consequently, in opposition to quartzes, the *chaîne opératoire* of the lavas from TK is very fragmented, suggesting that there was a space-time separation between the processes entailing obtaining, decorticating, producing and discarding the lithic remains. In any case, the lavas had a peripheral importance in the activities performed in TK if compared to quartzes. Excluding unmodified material, in TK LF the 8479 grams of lavas comprise a mere 13.4% of the total amount of worked raw material, and in TK UF the 27618 grams of basalts, phonolites and trachytes suppose 19.3%. Except for one of the few pieces in gneiss, the rest of the raw material included was made of quartz. Therefore, we are facing a dichotomy in the selection and use of raw materials, which was probably linked to the function of the settlement, in which percussion activities (whichever they were) seem to have been much more important than knapping processes.

Despite the marginality in terms of the investment of raw material, we would like to conclude this chapter mentioning the guidelines that govern the manufacture of the large cutting tools, given their technical connotations and their chrono-cultural implications. In both levels of TK there are examples obtained from the so-called rhomboidal strategy, which entails a unifacial exploitation from opposite planes of each of the edges of the piece. In these cases, as with other shaped objects on cobble, block or flakes, it seems like the goal is always the same: to achieve elongated morphologies and, most importantly, pointed ends. They are always large objects that do not pursue a bilateral symmetry or the correct distribution of the surfaces, but rather aim to obtain forceful edges. Contrary to EF-HR or FC West, TK does present examples that could be classified as bifaces, at least in terms of the management of two surfaces separated by one edge (fig. 7.39 and 7.41). Therefore, although craftsmen do have the technical know-how, they still prefer to work the edges, not the volumes.

In any case, and with regard to historical-cultural estimations, we do not think there is proof to separate TK Lower Floor from the upper level from a technological point of view based on those large cutting tools (fig. 7.49). That is to say, if - in view of its technical features - Leakey (1975) finally considered TK LF as an Acheulean occupation, an analysis of the shaped pieces (be they genuine bifaces or not) cannot sustain its discrimination from TK UF. In our opinion, both levels in TK belong to a single technological tradition. The presence of large flakes, and especially the existence of objects whose morphology is modified secondarily via *façonnage* to obtain forceful edges, leads us to include both assemblages in the Acheulean technology.

Figure 7.49. Large cutting tools identical, morphologically and technologically, from different levels. A: TK Upper Floor; B: TK Lower Floor.

The lithic knowledge implied in these objects allows the technical and/or cultural identification of this site. Nonetheless, and to conclude the chapter, we must underscore the fact that these large cutting tools were simply one part of the activities developed. In fact, it is a peripheral category in the assemblage of worked material, presenting few whole examples and some more fragments of these shaped items that indicate the pieces were knapped and/or used *in situ*. In all other respects, the technology in TK focused on different processes, most probably linked to alternative activities connected to percussion.

Considering the material recovered from the rest of the levels that compose the site alongside the assemblages from LF and UF, Leakey (1971:197) totalled over 10,000 pieces in TK. From this point of view, the reasons that led the hominids to collect over 200 kilograms of lithics in a specific point of the landscape are a mystery, as is the fact that they were subjected to such intense work processes as noticeable in the LF and UF inventory. Unfortunately, based on the available evidence it is hard to reconstruct these activities, and until we have alternative information to that provided by lithic material, answering that question will be a complicated task.