

## CHARACTERIZATION OF LITHIC COMPLEXES FROM BUIA (DANDIERO BASIN, DANAKIL DEPRESSION, ERITREA)

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*Abstract.* This paper discusses a very partial sampling of the archeological evidence found in more than 200 sites containing lithic artefacts and faunal remains which have been surveyed in the Dandiero (Buia) Basin (Danakil Depression, Eritrea). All the lithic complexes are referred to the Acheulean. The authors present the results of a preliminary study carried on some of the most important assemblages, especially the complex referred to the *Homo*-bearing levels. The lithic assemblages are characterized by different frequencies of hand-axes, cleavers, choppers and flakes. The techno-typological characters of the artefacts, all of which conform to an Acheulean standard, allow to us propose some preliminary hypotheses about their variability. The analyzed assemblages are then compared to the Early Paleolithic lithic complexes in East Africa.

*Riassunto.* Le ricerche nel Bacino del Dandiero (Buia, Dancalia, Eritrea) hanno messo in evidenza più di 200 siti con resti di industrie litiche e di faune. I contesti sono tutti riferibili all'Acheuleano. Sono presentati i risultati di uno studio preliminare su alcuni contesti litici più significativi, primo fra tutti quello che ha restituito i resti fossili umani. Le industrie sono caratterizzate con percentuali diverse da bifacciali amigdalari, hachereaux, choppers e da una componente su scheggia. I caratteri techno-tipologici dei singoli insiemi permettono di avanzare alcune ipotesi che giustificano, all'interno di una fisionomia omogenea acheuleana, la variabilità riscontrata a livello quantitativo e qualitativo. I complessi esaminati vengono inseriti nel quadro delle conoscenze del Paleolitico inferiore dell'Africa orientale.

### Introduction

This paper discusses a very partial sampling of the Acheulean archeological evidence found in more than

200 sites containing lithic artefacts and faunal remains which have been surveyed in the Dandiero Basin. This exceptional archaeological opportunity, both in terms of site density and the quantity and variability of the artefacts, will need many years of work, not only to finish the research, but just to build a reliable historical and paleo-ecological reconstruction of the area, using an interdisciplinary approach. This study, therefore, constitutes the first necessary step for a cultural definition of the archaeological evidence that will be developed in future research projects, keeping in mind the following factors:

- raw materials acquisition strategies and use,
- reconstruction of different technological choices,
- detailed techno-typological and typometrical analysis of significant lithic assemblages,
- variability in typological composition of the lithic assemblage and, more particularly, bifaces reduction sequences variability,
- functional interpretation of the different artefact groups,
- functional interpretation of the various sites,
- relationships between archaeological sites and environmental and economic variables.

The points above are a radical synthesis of the main research goals of the archaeological unit of the Buia Project. Beginning with some significant test-cases we

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can set up the methodological and interpretative bases.

Among the analyzed sites the first one chosen is where human fossil remains have been recovered (UAHS: Uadi Alad Homo Site). UAHS is not only exceptional for its findings, but it is also an exemplar of the complexity of the archaeological research in the area, which has to deal with different elements such as the presence of tilted stratigraphical successions, active erosive processes, and problems concerning the historical interpretation of chronologically separate assemblages. All of this is set apart from the actual practical problems, which are not discussed here, concerning the maintenance and the guarding of archaeological sites in the actual environmental context of the Dandiero.

The A030 site, where analytical research of lithic assemblage on the surface can be considered finished, is a typical example of the surface deposition contexts very often encountered during the survey (the artifacts are in secondary positions, although only modestly displaced). This lithic assemblage also contains a repertoire of Acheulean artefacts that, at the present stage of research, constitutes the most general standard for the greater part of the lithic assemblages.

The A094 site is related to A030 in terms of biface typology and technology. The lithic assemblage analysis of the site is not yet accomplished, so we have offered just a sampling of bifaces that we consider strongly homogeneous since the whole site seems in an almost primary position due to the recovery of a widely exposed section with primary or sub-primary archaeological layers.

The A063 site is also considered in this study (notwithstanding the fact it is in its initial phase of research and therefore, only preliminary data are available), because of the existence of an articulated stratigraphical sequence with at least three archaeological layers and because of the original techno-typological characteristics of the artefacts pertaining to this site.

### The lithic production of the UAHS site

The analyzed assemblage of UAHS (Uadi Aalad Homo Site) includes all of the lithic artefacts recovered during the in-depth site survey performed during the 2003 mission. The greatest majority of stone tools were recovered at the base of the exposed sections (which contains the archaeological levels) and in the gullies (which form along the slopes of the sections). Up to now, the early Paleolithic lithic assemblage recovered from UAHS is composed of 190 elements, including 133 flakes, 13 bifaces, 1 trihedral pick, 26 choppers, 9 hammerstones, 6 cores and 2 hammers (Table 1). In addition to these artefacts, a thin obsidian bladelet was found. Because of its technological attributes, this tool

is considered intrusive in the Early Paleolithic context and therefore, will not be considered in the following observations. The assemblage, which entirely belongs to the Early Paleolithic, is not examined and interpreted as a whole, but in relationship to three different surface deposition areas which are recognized on the basis of the interpretation of erosive activities. This analysis also allows us to distinguish all the material of the whole

	UAHS area 1	UAHS area 2	UAHS area 1-2	UAHS area 3	Total
flakes	98	22	5	8	133
bifaces	1	10	1	1	13
trihedral pick	1				1
choppers	15	9		2	26
hammerstones	8		1		9
cores	4	1		1	6
hammers	1	1			2
<b>Total</b>	<b>128</b>	<b>43</b>	<b>7</b>	<b>12</b>	<b>190</b>

Tab. 1 - Lithic assemblage divided according to the three surface dispersion areas (areas 1-3) ant to artefact typology.

assemblage that most probably pertains to the same stratigraphical levels where the human fossil remains were recovered.

Two main areas of artefact surface dispersion have been recognized. The first one, called the UAHS area 1 and located along the northwest border of the surveyed zone, corresponds to the main gully that runs parallel to the base of the section containing the hominid-bearing levels. These findings, recovered at the base of the section, can therefore be associated with reasonable certainty to the human remains, given that in the same area, during the 2003 mission, a pubic symphysis fragment was recovered (Macchiarelli et al. 2004). The second area, named the UAHS area 2, is located on a higher level along the northeast border of the surveyed zone, on the opposite side of the aforesaid exposed section, and at the base of a powerful deposit stratigraphically superimposed on the *Homo*-bearing levels. According to their relative position the artefacts can be attributed to younger stratigraphical horizons. In the northern extremity of the UAHS area 1, where the *Homo*-bearing levels are clearly eroded at the top and where some artefacts and faunal remains were found, some intrusive elements can be related both to UAHS area 1 or area 2. The few artefacts found in this limited zone were most probably mixed together and therefore, were separately taken into consideration in a cautious attempt to isolate the two different areas as much as possible. The area was labeled UAHS area 1-2. The area labeled UAHS area 3 contains a few surface artefacts that were recovered along the western limits of the area and that pertain, according to our reconstruction, to some extra-

neous contexts where the thin obsidian bladelet was also found.

### UAHS area 1 lithic assemblage

Fifteen choppers, one hand-axe, one trihedral pick, 4 cores, 8 hammerstones, 98 flakes and a pitted pebble interpreted as a hammer (all presumably related to the hominid-bearing-levels) were found in the UAHS area 1 which covers a surface of nearly 240 sq. meters (Table 2). The artefacts mainly have unworn edges and surfaces (78 observations). Those which are scarcely abraded are the minority (37 elements), while those heavily abraded are even more rare (13 cases). Eleven artefacts show a patina, while the secondary retouches are almost absent. The physical conditions (abrasion, patina etc.) of the artefacts are not here considered as an important parameter in order to hypothesize different chronology because of the variation in mineralogical-petrographical propriety of the raw material. Excluding the flakes, the original blanks used for the artefacts of bigger dimensions (bifaces, choppers)

nas. The choppers' maximum lengths (15 observations) are between 53 and 173 mm, with a major amount grouped between 53-99 mm (10 elements). In a few cases (4 elements) the dimensions are between 100-150 mm, and one exceptional case is longer than 170 mm. The length/width ratio (l/w) seems to be very standardized with a squat morphology (1,0-1,3). The maximum thickness of the pebbles varies from 22 to 90 mm, with most (10 pieces) having a thickness of less than 60 mm. The distribution of the width/thickness ratio (w/t) (15 observations) suggests a preference for thick pebbles (1,4-1,7: 8 elements). The cutting edges are indifferently made with bifacial or unifacial flaking; among the latter, two elements show a very generic manufacture with few scars and irregular cutting edges. When an elongated pebble was used, the cutting edge was made on the short side and accordingly the transverse choppers are more frequent than the lateral ones (respectively, 9 and 4 elements). Only one artefact is worked along the whole profile creating a discoid morphology. The sides are mostly rectilinear, sub-rectilinear

	choppers	biface	trihedral pick	Total specialized tools		flakes		cores	hammerstones	hammer	Total	
				n°	%	n°	%				n°	%
quartz	3			3	2,3	84	65,6	1			88	68,7
quartzite	2			2	1,6	5	3,9	2	2	1	12	9,4
basalt	4	1	1	6	4,7	7	5,5				13	10,2
marble	4			4	3,1	2	1,6	1	2		9	7
quartzarenite									4		4	3,1
schist	2			2	1,6						2	1,6
<b>Total</b>	<b>15</b>	<b>1</b>	<b>1</b>	<b>17</b>	<b>13,3</b>	<b>98</b>	<b>76,6</b>	<b>4</b>	<b>8</b>	<b>1</b>	<b>128</b>	<b>100</b>

Tab. 2 - UAHS area 1: typological groups related to the raw materials.

are rounded shape pebbles. The raw materials used for choppers, cores and hammerstones are: quartz, quartzite, quartzarenite (exclusively used for hammerstones), basalt and marble – all with very similar frequencies, while schist artefacts have lower frequencies. The bifaces and the trihedral pick are on basalt flakes, while the flakes are mostly on quartz and, with a great quantitative difference, on basalt, quartzite and marble. The general frequencies of the different raw materials used suggest a clear differentiation between large artefacts and flakes.

*Choppers* (Fig. 1, A-C). Choppers are here considered all flaked pebbles which present one or more of the following characters: regular and stright cutting-edge, short negatives, edge regularized by thin retouches. The raw materials used for choppers manufacture are different and are present with equal proportions (Tab. 2). The physical condition is generally unworn with the majority of tools with unworn or scarcely weathered surfaces and edges, while only three specimens show heavier weathering and external pati-

and exceptionally sinuous. The unifacial choppers have an acute angle ranging from 60° to 75° (only one element has an angle of 98°), while bifacial choppers possess acute (45°-56°, three cases) and more obtuse angles (76°-104°, four cases). The manufacture is generic and poorly done, with lateral sides rarely regularized by thinner retouches. The scars possess both moderate invasiveness which scarcely influence the original pebble morphology and greater invasiveness. In conclusion, all the examined parameters, both morphological, dimensional and technical, seem to suggest a codified production standard.

*Biface*. The only hand-axe (Fig. 3), made on a basalt flake, has an elongated cordiform morphology, with a lateral butt. Both faces show wide, single and unrefined retouches, unifacial along a straight-edged margin and bifacial on the opposite side. The tip is scarcely defined and the base is rounded and regularized with a few wide scars. The dimensions of this artefact are large: length 221 mm, width 125 mm, thickness 42 mm.

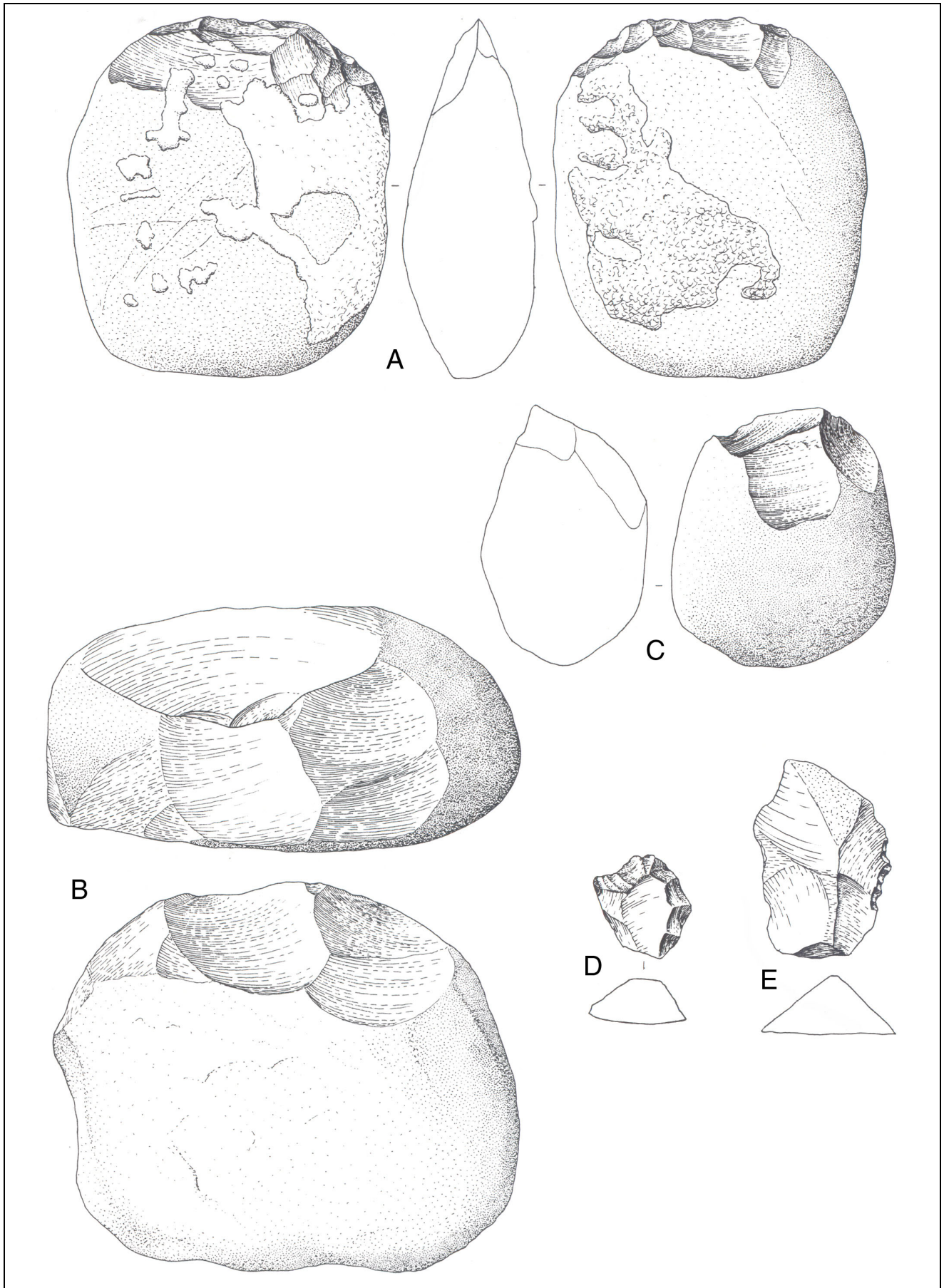


Fig. 1 - UAHS area 1 lithic assemblage. A-C: choppers; D-E: retouched flakes (1/2 natural size; drawings by O. Filippi. A-C after S. Yemane and D-E after F. Martini).

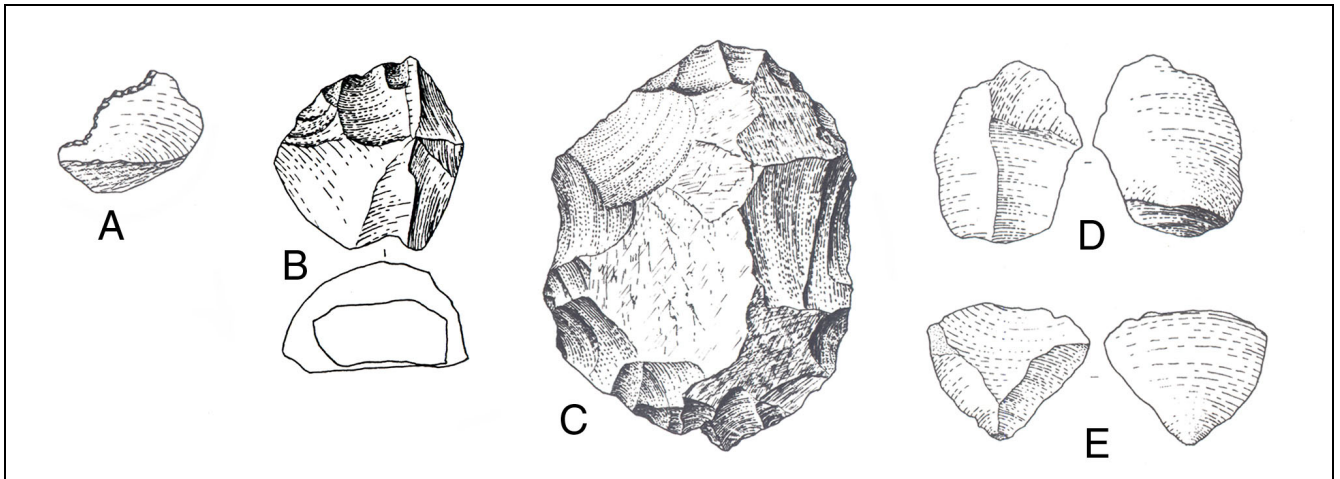


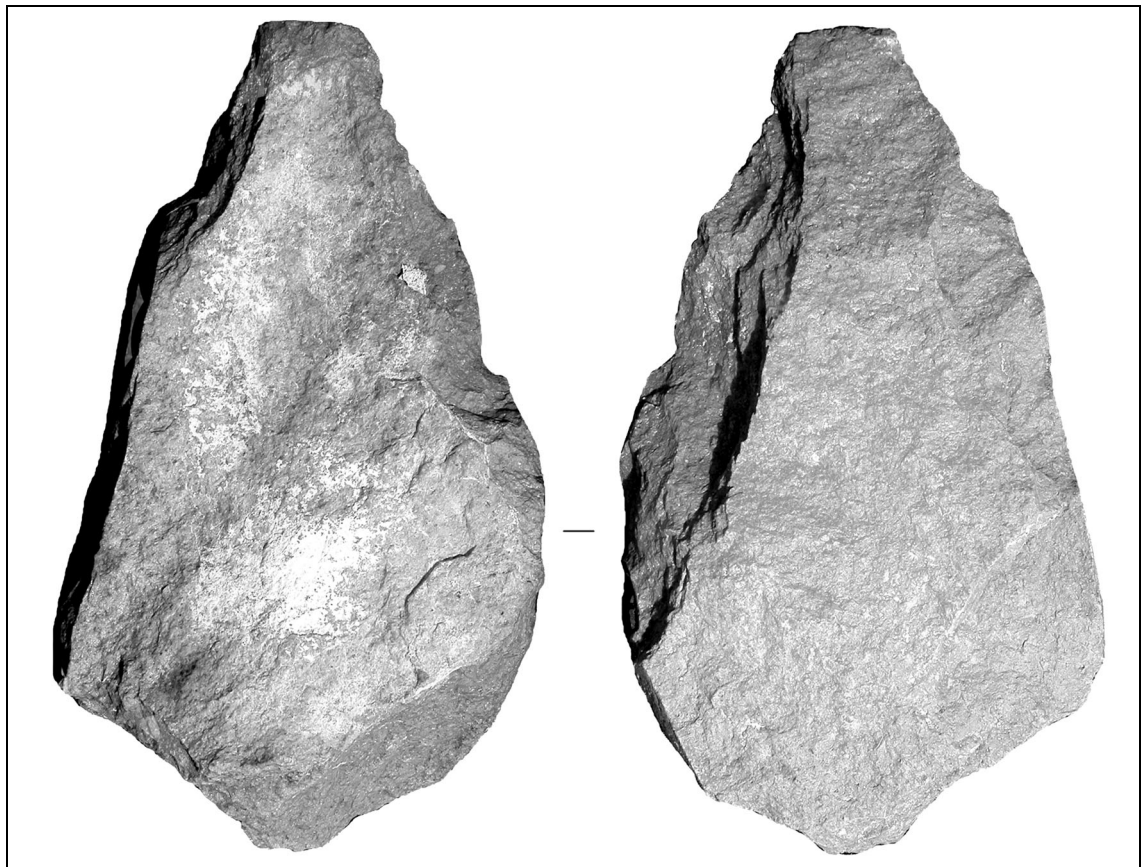
Fig. 2 - UAHS area 1 lithic assemblage. A-C: retouched flakes; D-E: unretouched flakes (1/2 natural size; drawings by O. Filippi after F. Martini).

*Tribedral pick.* This piece poses some problems of typological attribution, but it has been cautiously referred to this group by virtue of a thick pointed trihedral extremity. The artefact was made with a poorly developed sequence which shows a first step of making a long longitudinal scar which became the striking platform for a bilateral flaking sequence with a single wide scar on one side and a series of more refined scars on the other side. The base is convex and roughly regularized by a few short retouches. This tool is made on a basalt flake with patina on the ventral surface. The dimensions

are moderate: length 113 mm, width 87 mm, thickness 53 mm.

*Flakes.* Among 98 artefacts, 13 are retouched (Laplace 1964), and made almost exclusively of quartz. The end-scraper (G6), on a small flake with a lateral straight-edged margin and asymmetrical morphology, was made with wide and invasive retouches all along the profile of the artefact (Fig. 1D). The truncation (T2), on a small, wide and very flat fragmentary flake, has a poorly-made sub-rectilinear retouch. The lateral side-scrapers (R2),

Fig. 3 - UAHS area 1 lithic assemblage. Biface (1/2 natural size).



all of small and moderate dimensions, show three cases of partial and rare invasive retouches (Fig. 1E), while in just one occurrence the retouch is almost total and stepped. A notch (D1) was made by a lateral, wide single scar. The four denticulate scrapers (D2) are not homogeneous in their dimensions (there are small, medium and large flakes) and manufacture. In fact, elements with marginal and partial retouches (Fig. 2A) are present together with a basalt flake with elaborate wide and invasive lateral-transverse retouches. Among the thick denticulate scrapers, one artefact was made with transverse oblique retouches (Fig. 2B) and one is a small flake with a flat and wide butt and refined retouches. A carinated end-scrapers (cfr. rabot), on a very thick quartz flake of moderate dimensions, is made with very elaborate bilateral-transverse retouches and a well defined nose with wide and invasive retouches (Fig. 2C). The unretouched flakes (85 elements), are mostly in quartz (72 specimens), quartzite (5 pieces), basalt (6 artefacts)

and marble (2 elements). Despite the high number of fragmentary pieces, some differences can be noted in the maximum length when related to the various raw materials. In fact, quartz flakes (Fig. 2D, E) are small (27 observations on 32 determinable samples with lengths less than 50 mm), basalt flakes seem slightly bigger, given the small sample of this specific raw material. The available flake sample also suggests the existence of a dimensional standard regarding the length/width ratio (prevalence of wide flakes, rare flake-blades and only one blade) and the width/thickness ratio (prevalence of flat and very flat blanks). The reduced number and the generic direction of negative scars suggest a limited and unorganized use of the cores and the presence of flat and wide butts, with an occasional prominent bulb as a clear sign of violent percussion.

*Cores.* Four cores are present and all show a scarcely exploited surface except for one which has two

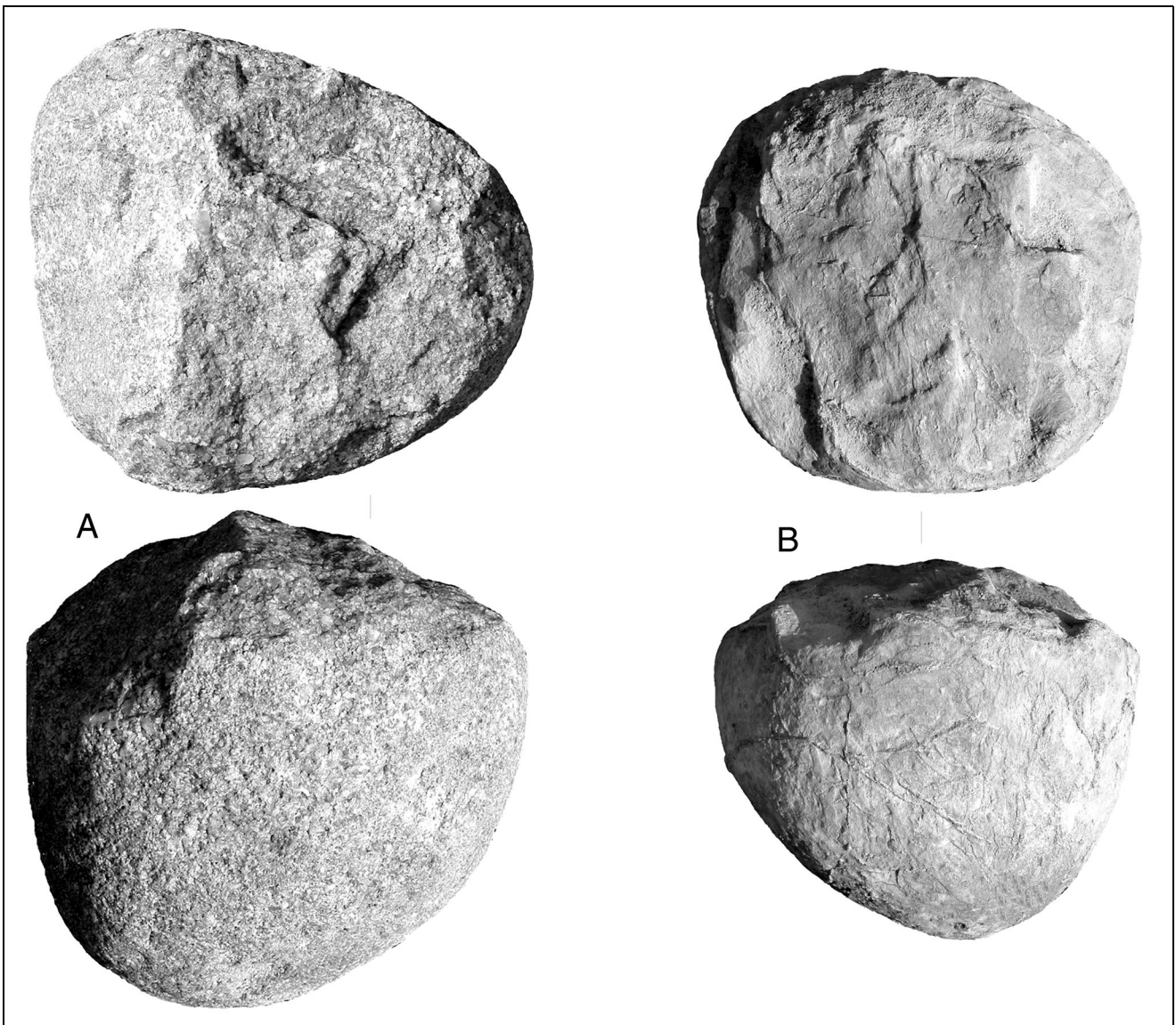


Fig. 4 - UAHS area 1 lithic assemblage. Hammerstones (1/2 natural size).

	choppers	bifaces	flakes	core	hammer	Total
marble	6	1	1	1		9
quartz	3		16			19
quartzite			1			1
basalt		5	4		1	10
schist		4				4
Total	9	10	22	1	1	43

Tab. 3 - UAHS area 2: typological groups related to the raw materials.

adjacent striking platforms, with wide negative scars with a sub-centripetal direction on one face and sub-parallel on the other one. The other three cores show a limited worked area, with few rough negative scars that start from one striking platform (one piece with a higher number of negative scars shows a morphology similar to the choppers). The raw materials are marble, quartzite and quartz. The maximum dimension of the cores ranges from 96 and 114 mm and the thickness is between 55 and 84 mm.

*Hammerstones.* Some elements in the site, defined here as hammerstones, seem to be used more as a pebble for a violent percussion than a real artefact. In the UAHS area 1 eight similar elements are recovered (Fig. 4). The raw materials used are quartzite and for larger elements, quartzite and marble. The original blanks are

thick rounded pebbles used without a preliminary manipulation. In some cases they are large (over 200 mm), in any event decidedly bigger than all the other artefacts. These objects have a wide and flat or weakly convex pitted extremity, probably originating from a violent impact along the same surface. These pitted surfaces are also marked by negative scars starting from the lateral sides of the surface along the whole profile and a few negative scars starting from the surface borders and lying orthogonal to this. This evidence shows two different strategies of pebble use: one which implicates the frontal impact of the whole surface (pitted surface), the other one is related to percussion along the borders of the same surface (centripetal negative scars). In some cases, it is possible that the pebble use was preceded by preliminary shaping, through the removal of a cap which creates the used surface; even if the visible traces of this hypothetical preliminary operation are not observed. In some elements, with a convex surface or with a sort of almost polyhedral extremity, it is certain that the morphology of the pebble has not preliminarily been modified and that the flattening of the pebble extremity is due only to percussion. This typological group is present quite exclusively in the UAHS area 1 with 8 elements (one element is probably in the mixed zone UAHS area 1-2)

*Hammer.* A quartzite hammer, on a sub-rounded pebble (maximum dimension 82 mm), shows a pitted

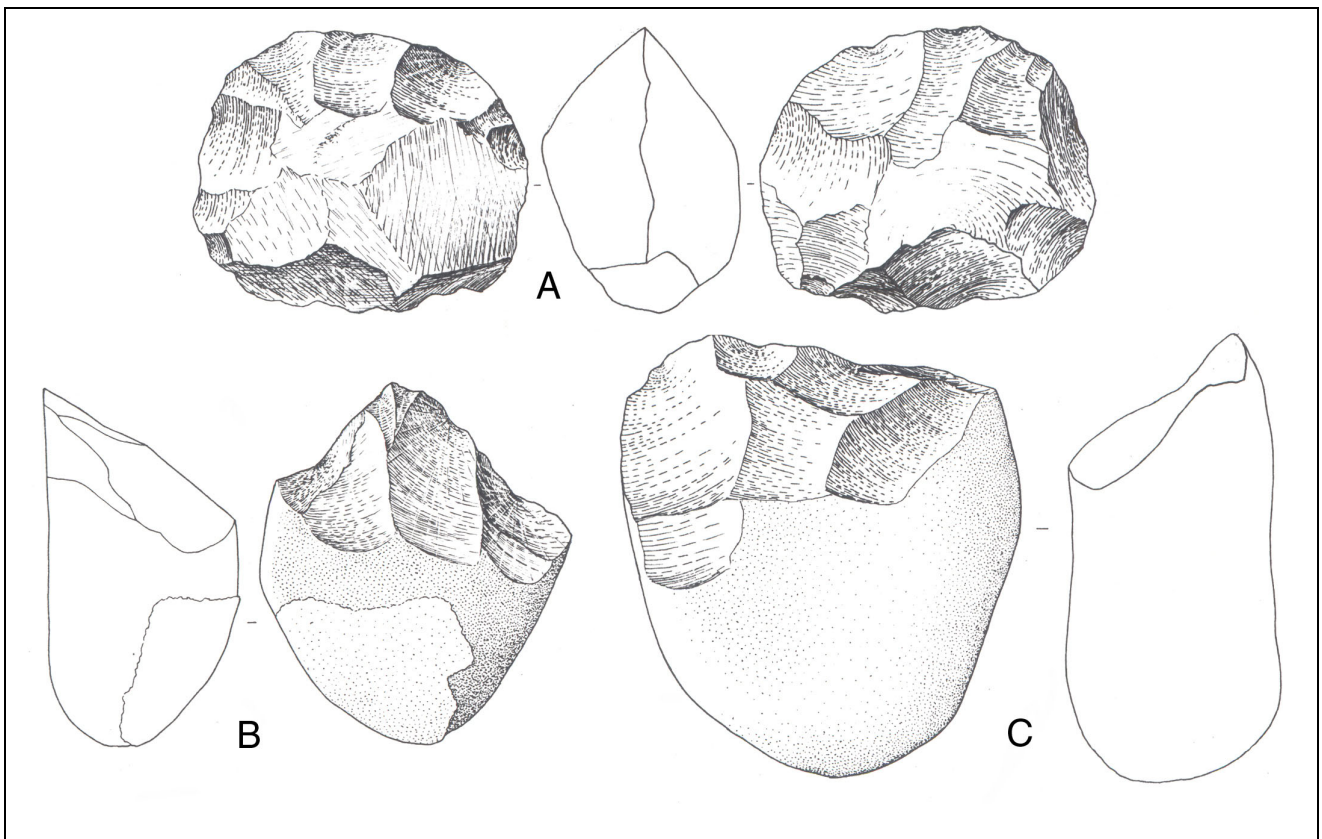


Fig. 5 - UAHS area 2 lithic assemblage. Choppers (1/2 natural size; drawings by O. Filippi after S. Yemane).

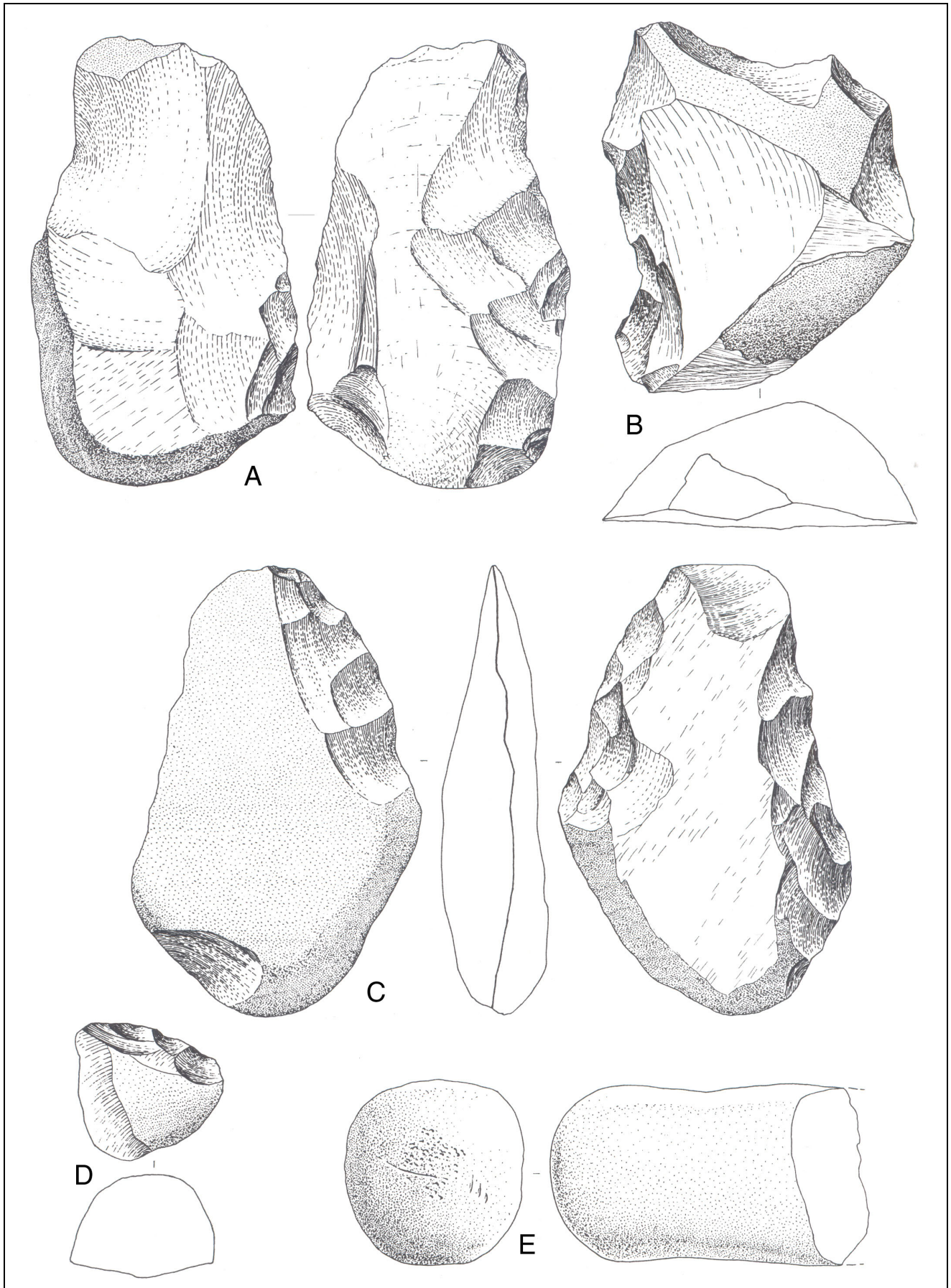


Fig. 6 - UAHS area 2 lithic assemblage. A, C: bifaces; B, D: retouched flakes; E: hammer (1/2 natural size; drawings by O. Filippi. A, C, E after S. Yemane and B, D after F. Martini).



extremity. On the other short end there are some small scars, related to violent percussion that confer to the piece a core-like aspect.

### UAHS area 2 lithic assemblage

Rare choppers, some bifaces, a modest quantity of flakes and an elongated basalt pebble used as hammer, for a total of 43 elements (Tab. 3) appear in this area, spanning a surface of nearly 200 sq. meters.

*Choppers* (Fig. 5). Nine choppers were recovered, mostly with an unworn aspect and more rarely with slightly abraded surfaces and edges. Only one element has external patina, while secondary retouches are completely absent. The original blanks, except for a quartz flake, are all rounded pebbles. The raw materials used for these tools are marble (6 elements) and quartz (3 elements). The maximum dimensions range from 93 and 164 mm, with a major cluster ranging between 93 and 105 mm (6 pieces), while the thickness varies from 49 to 66 mm. The length/width ratio shows a certain frequency of squat tools (dimensions between 1,1-1,3 in 6 elements), with a few more slender choppers (1,4-1,6). The width/thickness ratio (9 observations) suggests a preferential choice of thick blanks (1,2-1,5: 6 elements). Bifacial and unifacial choppers are quite equally represented (5 and 4 elements each). Most of the choppers are transversal (6 cases), with only three lateral choppers; the profile of cutting edges are indifferently rectilinear, sub-rectilinear (5 times) and sinuous (4 times). The edge angle has very similar frequencies to those recorded in UAHS area 1. In fact, unifacial choppers angles are between 45°-72° and bifacial choppers possess wider angles (69°-84°).

The choppers' manufacture is characterized by wide, unrefined, barely organized and invasive scars. These characteristics seem to suggest a morphological and technological standard. Some specific elements are to be noted: a chopper with a well formed tip made with wide unrefined unifacial negative scars (Fig. 5B); one element on a thick quartz flake of large dimensions with a flat and wide butt (Fig. 5A).

*Bifaces* (Fig. 6A-C; Fig. 7). In the whole area 10 bifaces, made of basalt, schist and secondarily in marble (Tab. 3) were recovered. The artefacts show a homogeneous typology (6 elongated cordiform and only one oval) and 3 cleavers. The physical condition is mostly smooth, and unworn bifaces (4 cases) are present. The original blanks are for the most part schist and basalt flakes (9 cases), often with a lateral corticated butt, while the only marble artefact is made from a big pebble. Biface lengths range between 132-197 mm and the artifacts have a good length/width ratio (1,2-2,1) with schist hand-axes shorter and squatter than basalt ones.

The thickness is substantially reduced and as a consequence the width/thickness ratio (1,4-3,0) show values that are often greater than 2,0. The elongated cordiform hand-axes show different techno-typological patterns. One includes two elements of large dimensions that are poorly made (Fig. 6C), the other one includes three smaller and thicker hand-axes, characterized by a more accurate and elaborate manufacture, with pointed and well defined tips (Fig. 7A). The oval specimens have large dimensions with a scarcely elaborated manufacture (partly bifacial) which slightly modifies an already-existing sub-oval morphology (Fig. 7B).

*Flakes*. Among the 22 flakes of UAHS area 2, 8 elements are retouched (6 quartz flakes and two big basalt flakes). The only side-scraper (R2), on small sub-carinated flake, has an almost invasive accurate bilateral retouch, convex on one side and rectilinear, almost denticulate on the other side.

The two lateral-transverse scrapers (R4) are varied both in their dimensions and manufacture. The first is a medium-sized flake with a prevailing transverse, sub-scalar retouch; while the other one is a small flake with a prevailing lateral retouch. A very fragmentary small flake has an unrefined and slightly invasive steep retouch (A2). A notch (D1), on a small flat flake-blade has a wide and invasive retouch and a carinated denticulate scraper (D6) on a small and very thick flake shows single wide retouches (Fig. 6D). Two denticulate scrapers on flat and corticated basalt flakes, quite unworn but showing a heavy patina, are decidedly anomalous if compared to quartz flakes. One (length 146 mm) has wide bilateral and transverse retouches (Fig. 6B), the other (length 214 mm), on fully corticated flake, has similar lateral-transverse retouches. The unretouched flakes are on quartz (10 elements), basalt (2 specimens), marble and quartzite (one artefact each), with moderate (6 elements on 10 determinable) and small dimensions.

*Cores*. Only one core comes from the UAHS area 2, and it is in marble, with a maximum dimension of 102 mm and with a morphology comparable to choppers, because the flaked part is localized on one side of the pebble.

*Hammer*. It is an elongated oval basalt pebble with a quadrangular section; a short convex extremity shows very dense pitted surface (Fig. 6E).

### UAHS area 1-2 lithic assemblage

The small amount of artefacts, isolated in UAHS area 1-2 include:

- a very small (112 mm) and thick elongated cordiform hand-axe on basalt flake with a very accurate and

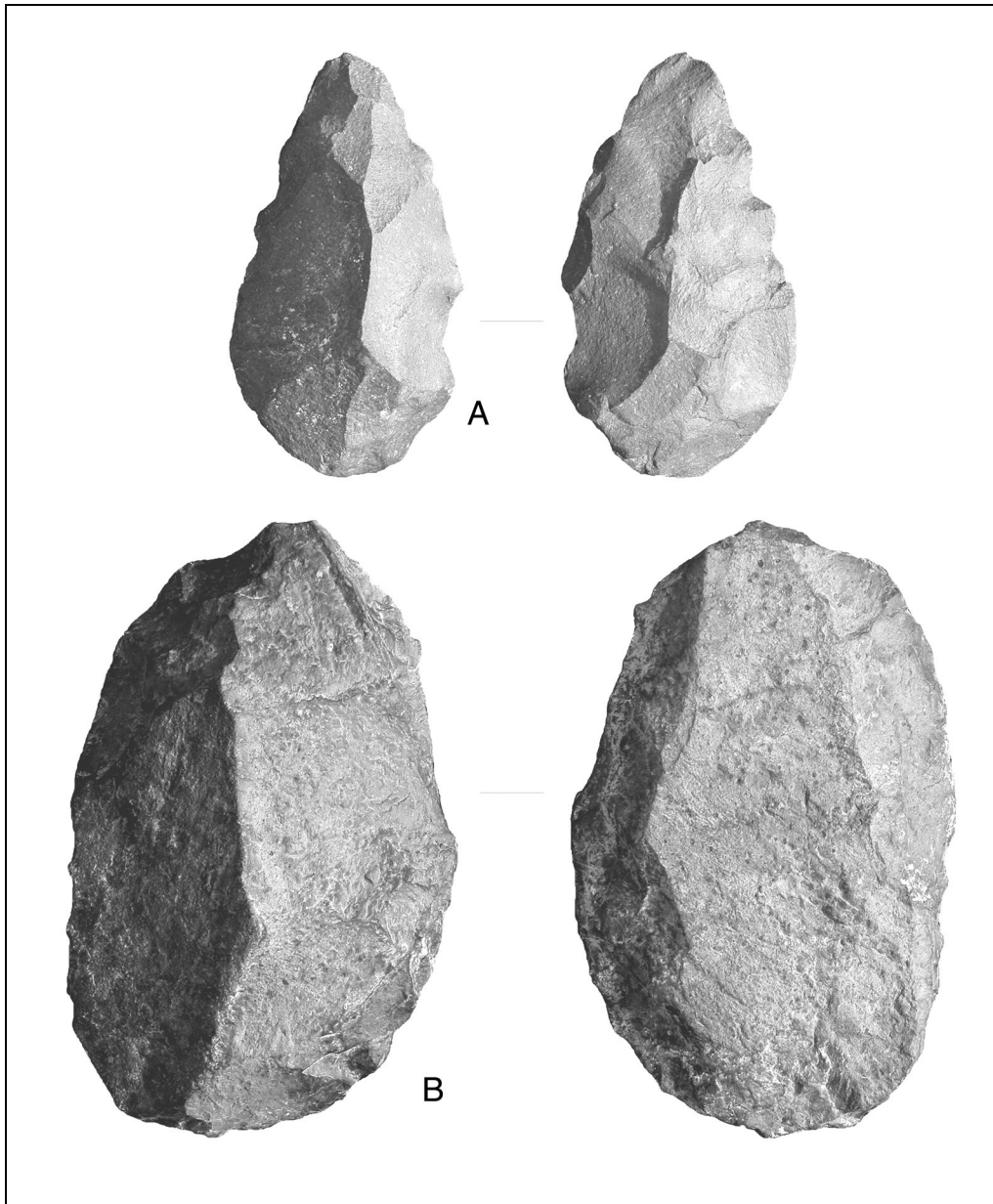


Fig. 7 - UAHS area 2 lithic assemblage. Bifaces (1/2 natural size).

invasive manufacture and sharply defined tip. (Fig. 8A);

- a quartzarenite hammerstone used only along the two longer sides (maximum dimension 130 mm);
- 5 flakes, three in basalt, one in quartz and one in quartzite; four are unretouched and one, classified as a carinated denticulate scraper with very wide and invasive retouches, is similar to a chopper in its manufacture.

#### UAHS area 3 lithic assemblage

Scattered on a surface of nearly 240 sq. meters, 12 slightly weathered artefacts were recovered in UAHS area 3, which is adjacent to area 1 but was distinguished by different depositional and erosive events:

- two transverse choppers, one unifacial and one bifacial, with rough and invasive retouches made on marble pebbles with similar lengths (114 and 113 mm);

- an hand-axe on flat basalt flake, with a lateral corticated butt, is anomalous for its large dimensions (236 mm), the cordiform morphology and for its sinuous lateral edges, although the unrefined morphology is similar to other artefacts recovered from the other areas. (Fig. 8B);
- eight flakes, 6 in quartz and 2 in basalt. Two small quartz flakes are retouched (one truncation and a side-scraper) with a partial and unrefined manufacturing technique;
- a core, made on a thick basalt pebble is poorly exploited, although various striking platforms were used.

#### Observations and comparisons among the lithic assemblages of the various areas.

The stratigraphical sequence of the UAHS has been divided provisionally into a lower (UAHS area

1) and an upper series (UAHS area 2) which are topographically divided because of tilting layers and different patterns of erosive activity.

In the lower series, the hominid-bearing levels are well visible in the exposed section and along the same section at about the same level, some artefacts are present in primary position. These artefacts, at the moment and lacking a precise stratigraphic correlation in the series, could be attributed both to the *Homo* level and

to other layers. Accordingly, the findings recovered at the base of the exposed section in the UAHS area 1 could be related to the hominid-bearing level. The series that overlap hominid-bearing levels don't show exposed artefacts and therefore, it is not possible to accurately ascertain an archaeological level. Nevertheless, on a stratigraphical basis, it is reasonable to attribute UAHS area 2 findings to a younger series.

A comparison between the two lithic assemblages

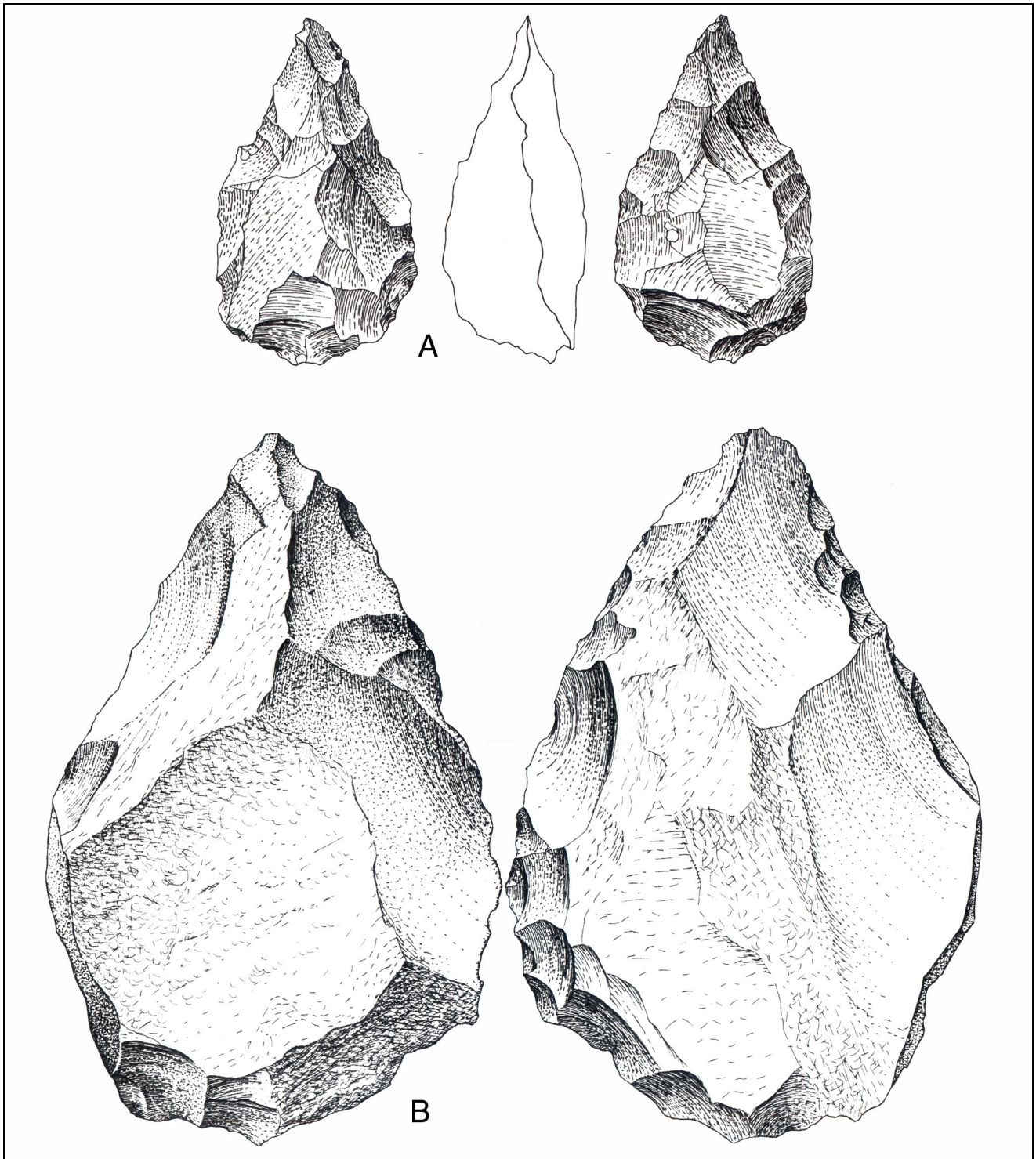


Fig. 8 - UAHS lithic assemblage. Bifaces from area 1-2 (A) and from area 3 (B) (1/2 natural size; drawings by O. Filippi after S. Yemane).

of UAHS area 1 and UAHS area 2 (the low number of items from the UAHS area 3 doesn't allow a specific comparison) shows on one hand some techno-typological similarities and on the other hand some differences, linked above all to the assemblage typological composition. This does not seem to contradict the different topographical and stratigraphical positions and the interpretation of the erosive processes the two areas underwent.

The different role of choppers/bifaces ratio in the two areas is evident, with the great majority of choppers in the UAHS area 1 (15 elements and 1 bifacial, in a total of 128 finds) in comparison to the UAHS area 2 (9 choppers and 10 bifacial in a total of 43 finds) (Tab. 1). In addition, only in UAHS area 1 do specialized tools like the trihedral pick and the hammerstones appear.

A detailed comparison of choppers of the two areas (15 elements in UAHS area 1 and 9 in UAHS area 2) shows some similarities:

- typological homogeneity, with similar proportions among unifacial and bifacial choppers (unif/bif ratio: 0,9 in UAHS area 1 and 0,8 in UAHS area 2) and among transverse and lateral choppers (transverse/lateral choppers ratio: 2,2 in UAHS area 1 and 2,0 in UAHS area 2). Nevertheless the following differences exist:
- a greater number of different raw materials in UAHS area 1 (marble, basalt, quartz, quartzite and schist) in comparison to area 2 (only marble and quartz);
- a different dimensional standard, with a good number of smaller elements in the area 1 (maximum dimension ranging from 53-99 mm in 10 out of 15 pieces) and larger choppers in the area 2 (6 elements with a maximum dimension ranging from 93-105 mm). Pebble morphology is squat in UAHS area 1 while in the area 2 more slender elements appear. Pebble thickness of the UAHS area 1 choppers has a wide range (from 22 mm to 90 mm) with a good presence of flat pebbles (7 pieces with thickness less than or equal to 50 mm), while in UAHS area 2 slightly thicker pieces are present (49-66 mm);
- chopper manufacture in UAHS area 1 is both with scarcely invasive negative scars which don't modify the original morphology of the pebble and with wider and invasive scars, while in UAHS area 2 a technological standard consists of wide and unrefined negative scars.

The comparison of the flake assemblages shows some techno-typological similarities that prevail over the differences:

- a very strong prevalence of quartz in comparison to the other raw materials;
- prevailing microlithic flakes (from 15 mm to 50 mm), although the UAHS area 2 flake assemblage is very poor;

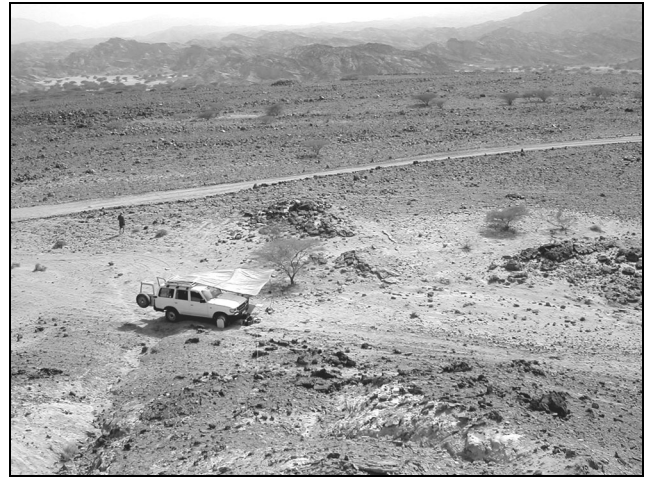


Fig. 9 - A030 site overview.

- the presence of generic tools (end-scrapers, truncations, side-scrapers and notches) in quartz, often made using partial and marginal retouches.

The most evident difference is linked to the presence of particular tools in UAHS area 2: two denticulate side-scrapers on big basalt flake, decidedly anomalous in the general assemblage of the whole site, with elaborate and invasive single retouches. These two findings point to the use of huge basalt blocks as cores in the site, in addition to the widespread use of quartz blocks.

#### The lithic production of the A030 site

The lithic assemblage of the A030 site (Fig. 9) was recovered from an area of nearly 200 sq. meters, with a principal concentration on 50 sq. meters (Fig. 10) containing the greater part of the artefacts and an external zone with rarer elements. The surveyed area was delimited by a 1 sq. meter grid and taphonomic analysis and graphic documentation of the artefacts distribution were realized. In addition, all the tools were positioned through the use of a total station within the area that was geo-referenced.

The lithic tools, which came from an eroded colluvial layer, were not in their original positions, but one can hypothesize short distance transport because of the minor abrasions of the surfaces and the limited presence of secondary retouch, both in terms of number and extension. This hypothesis can also be confirmed by some refittings of broken artefacts. These surface findings obviously raise the question of the cultural homogeneity of the assemblage: according to numerous techno-typological and typometrical parameters, the results of the integral analysis of the artefacts cautiously suggest, a certain homogeneity of the A030 site.

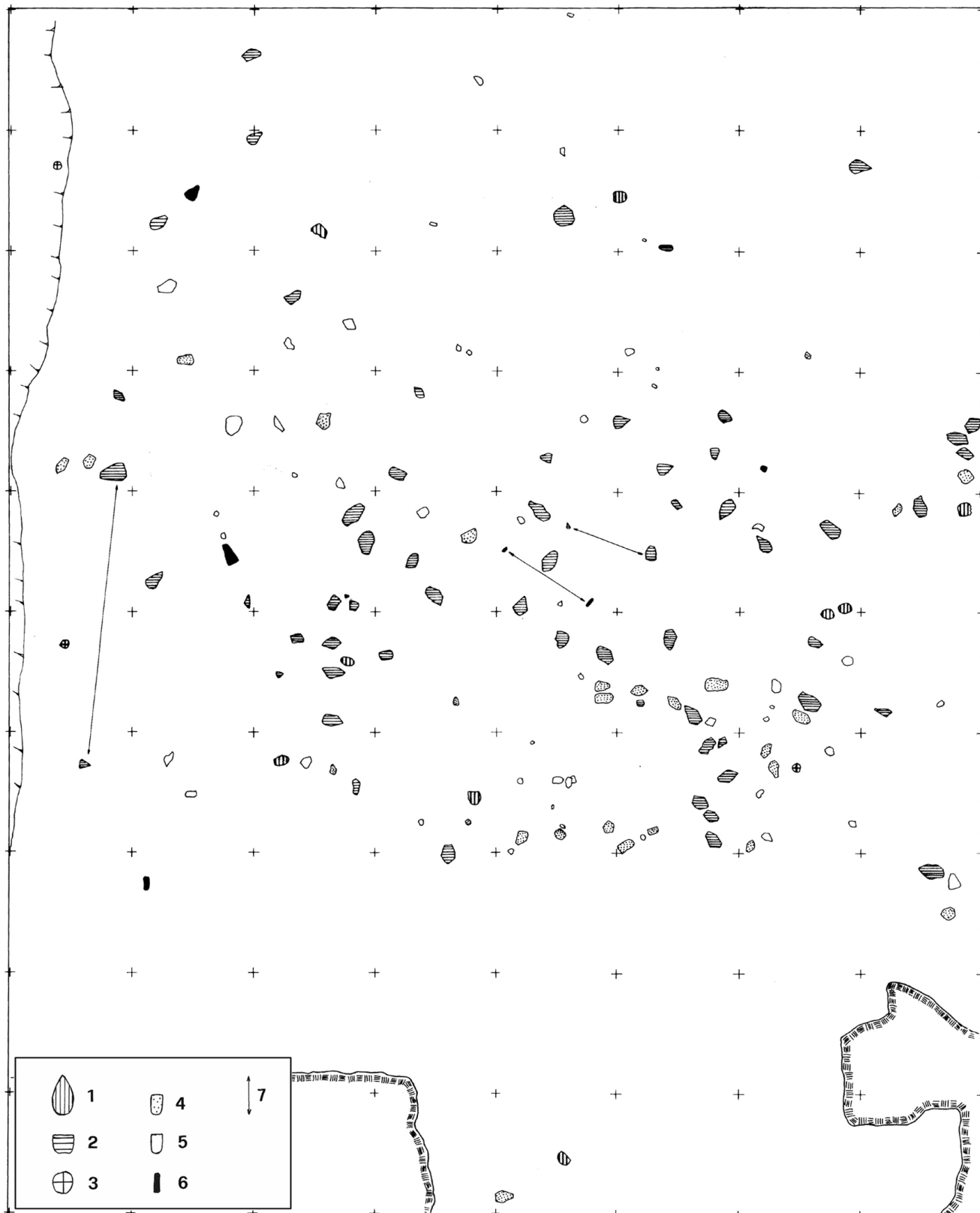


Fig. 10 - A030 site, area of major concentration of the lithic assemblage and faunal remains (1 meter-based grid). Legend: 1) hand-axe; 2) chopper; 3) core; 4) retouched flake; 5) unretouched flake; 6) bone; 7) refitting of broken artefacts.

**The lithic assemblage: technology, typometry and typology**

The total number of findings is 213 elements (the totality of the artefacts lying on surface) and includes

mostly bifaces (105 evidences), choppers (15 artefacts), flakes (50 unretouched and 39 retouched) and cores (4 elements). The raw materials utilized in this site include schist (113 artefacts equal to 53,1%), basalt (38 artefacts:

	schist			basalt			chlorite-schist			quartz and			marble			Total
	F	PF	A	F	PF	A	F	PF	A	F	PF	A	F	PF	A	
choppers		1			1					2	8		1	2		15
		0,5			0,5					0,9	3,8		0,5	0,9		
bifaces	5	56	4	18	4		1	11	4				1	1		105
	2,3	26,3	1,9	8,5	1,9		0,5	5,2	1,9				0,5	0,5		
flakes	8	34	5	11	4					25	2					89
	3,8	16	2,3	5,2	1,9					11,7	0,9					
cores										2	2					4
										0,9	0,9					
Total	13	91	9	29	9		1	11	4	29	12		1	2	2	213
	6,1	42,7	4,2	13,6	4,2		0,5	5,2	1,9	13,6	5,6		0,5	0,9	0,9	

Tab. 4 - Raw materials (n° and %) and physical state for different stone tool typologies (F: is fresh, PF is scarcely abraded; A: is abraded).

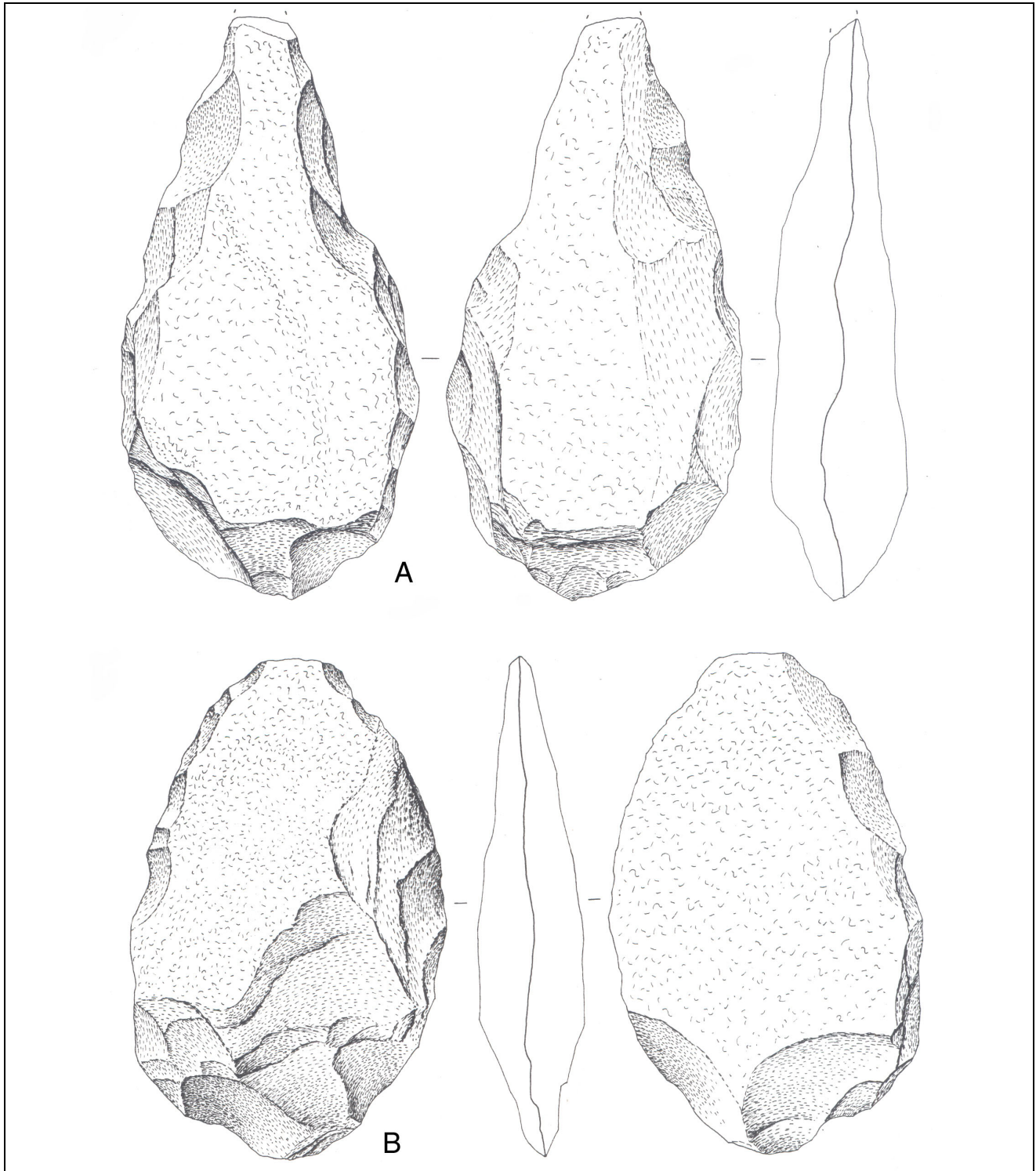


Fig. 11 - A030 site lithic assemblage. Bifaces (1/2 natural size; drawings by O. Filippi).

17,8%), quartz and quartzite (41 artefacts equal to 19,2%) and finally, with lower frequencies, chlorite-schist (16 elements: 7,5%) and white marble (5 elements equal to 2,3%). The physical condition (Tab. 4), always to be related to the different raw materials and their properties, shows a great majority of slightly abraded artefacts (scarcely smoothed surfaces and edges, limited secondary retouches: 120 observations equal to 56,3%), followed by unworn elements (79 observations: 37,1%), and abraded artefacts (heavily smoothed surfaces, abraded edges and rare secondary retouches: 14 specimens: 6,6%). In spite of the different weathering patterns, the artefacts can be considered homogeneous and affected by the same dynamics of removal, transport and exposure. The artefacts made with stronger rocks predictably appear less worn or damaged compared to other raw materials.

*Choppers.* The 15 artefacts that pertain to this category are made on pebbles with a sequence of adjacent scars on one or more sides, which creates a cutting edge. The choppers are almost all made on pebbles and their morphologies are both rounded and irregular with some edges more or less abraded. One artefact is made of a fragment of schist. The employed raw materials are, in order of frequency: quartz and quartzite, marble and as a single presence, schist. Based on 14 complete specimens, the chopper lengths range from 75 mm to 160 mm, with a major cluster (9 specimens) of 100 mm-150 mm. The chopper morphology is mostly squat (length/width ratio: 1,1-1,2) with rare more slender pieces (l/w: 1,8). The chopper thicknesses are 37-86 mm; with the majority of pieces (10 elements) being 37-57 mm in thickness. The distribution of the width/thickness ratio (14 observations) points out the use of two different kinds of pebbles, some thick ones (w/t 1,4-1,6: 4 elements) and some others that were flatter (w/t 1,8-2,0: 5 pieces). More than the half of the pebbles originally possessed a sub-circular profile and the two main flat dimensions for the most part are equivalent; this similarity doesn't allow us to distinguish a short border from a long border and therefore, a classification of the artefacts belonging to the category of transverse and lateral choppers becomes very elusive. According to our classification the two different typologies are fairly equivalent. If more than one side is retouched, a primary edge is recognizable and the other one has less invasive retouches. The cutting edges, located mainly on one side (Fig. 13G), are created with wide, invasive and unrefined scars and show a prevailing bifacial manufacture (11 elements), only 4 elements are unifacial. The majority of the choppers possess a regular convex retouched profile in frontal view, sometimes sub-angular, and only 3 elements possess a rectilinear cutting edge. In many cases the delineation is continuous and

only in two cases does the cutting edge show marked denticulation. In a superior view, the profile of the cutting edge is mostly rectilinear, sometimes sinuous or slightly sinuous, without clear differentiation. Only one element possesses very wide and unrefined scars which create a sort of tip. The angles of the cutting edges have an average inclination of 45° to 60°. Few choppers with steeper scars have an inclination equal or close to 90°.

*Bifaces* (Fig. 11, 12, 14, 15). The bifacial tools culturally characterize the production of the A030 site and constitute the majority of instruments in the findings, totaling 105 elements (71 hand-axes, 20 cleavers and 14 biface fragments that are undeterminable on a typological basis). The physical condition of the artefacts suggests that they had not undergone a significant displacement from the original context, but rather, they seem to have been submitted to a long lasting surface exposure. In fact, the edges are weakly abraded and the surfaces scarcely smoothed (76,2% on 105 observations) with very few secondary retouches (18,1%) and ripples due to wind erosion are present on the artefacts in schist. The artefacts made with softer rocks (schist and chlorite-schist) are obviously quite altered. The bifaces in basalt possess more rarely abraded surfaces or edges and they mostly present patinas of surface exposure ("desert varnish"). The bifaces are made of few raw materials that almost entirely correspond to the variability observed in the Dandiero. In decreasing order they are schist (65 observations equal to 61,9% on the total of the bifaces), basalt (22 observations: 21,0%), chlorite-schist (16 observations: 15,2%) and white marble (2 observations: 1,9%). Only the first three raw materials (schist, basalt, and chlorite-schist) offer some elements for discussion because of their relative number. In fact, of 91 specimens clearly assignable to hand-axes or cleavers, 46 hand-axes (50,5% of 91 total) and 8 cleavers (8,8%) are on schist, while 10 hand-axes (11,0%) and 11 cleavers (12,1%) are made of basalt. The chlorite-schist is used for the manufacture of 13 hand-axes (14,3%) and only one cleaver (1,1%), while two hand-axes (2,2%) are made in marble. Basalt seems the preferred raw material for cleaver manufacture, while the two other rocks are chosen indifferently for hand-axes and cleaver manufacture. Both natural blanks (polyhedral irregular pebbles or pebbles with at least one flat surface) and flakes were used in bifacial manufacturing. The first are dominant (85 specimens equal to 81,0%) compared to the bifaces on flakes (20 samples equal to 19,0%). Some very slight differences can be connected to the different raw materials: for example, chlorite-schist bifaces are all made on pebbles, while over 80% of the schist bifaces and about 70% of the basalt ones come from pebbles or fragments. At the

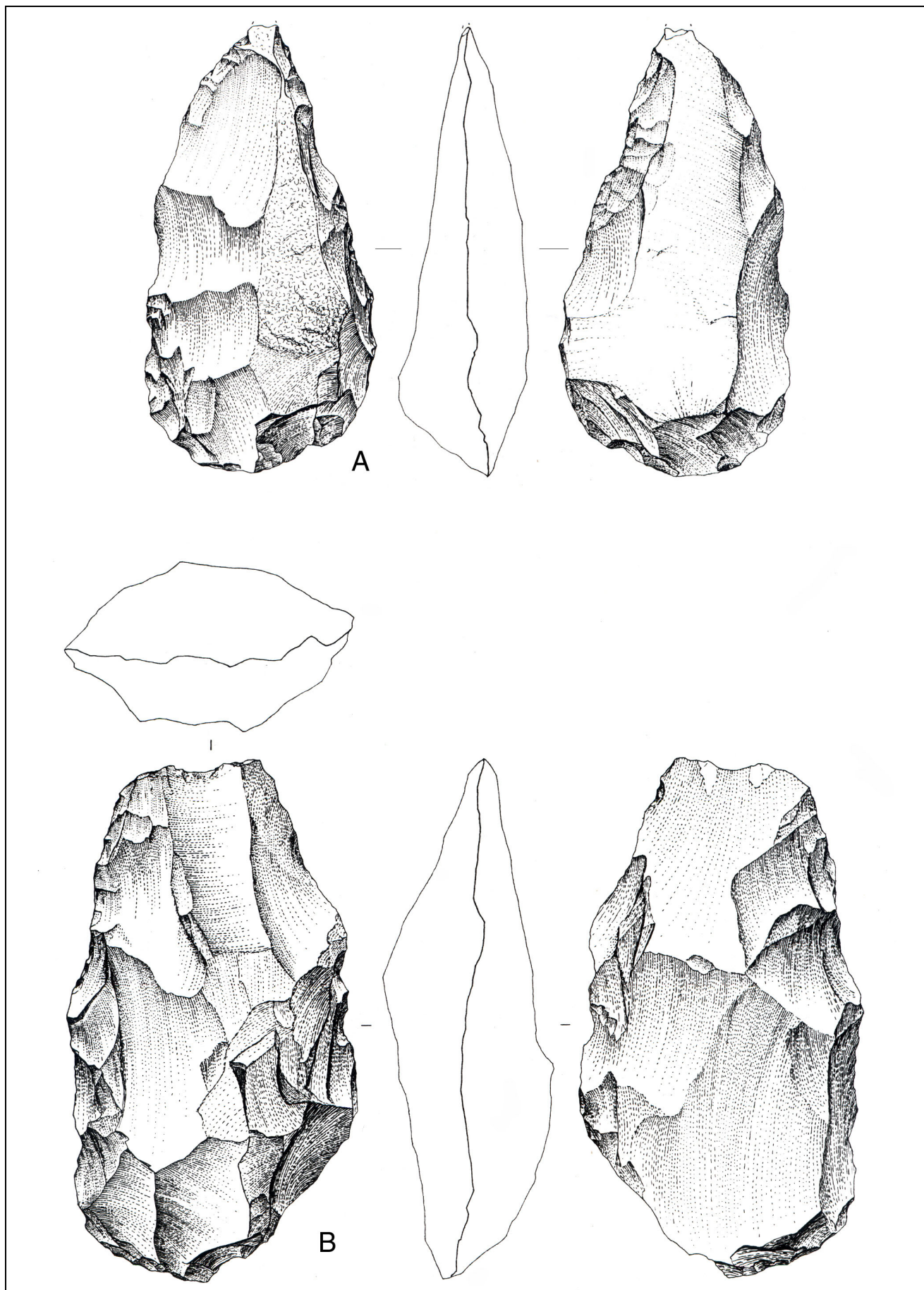


Fig. 12 - A030 site lithic assemblage. Bifaces (1/2 natural size; drawings by O. Filippi).



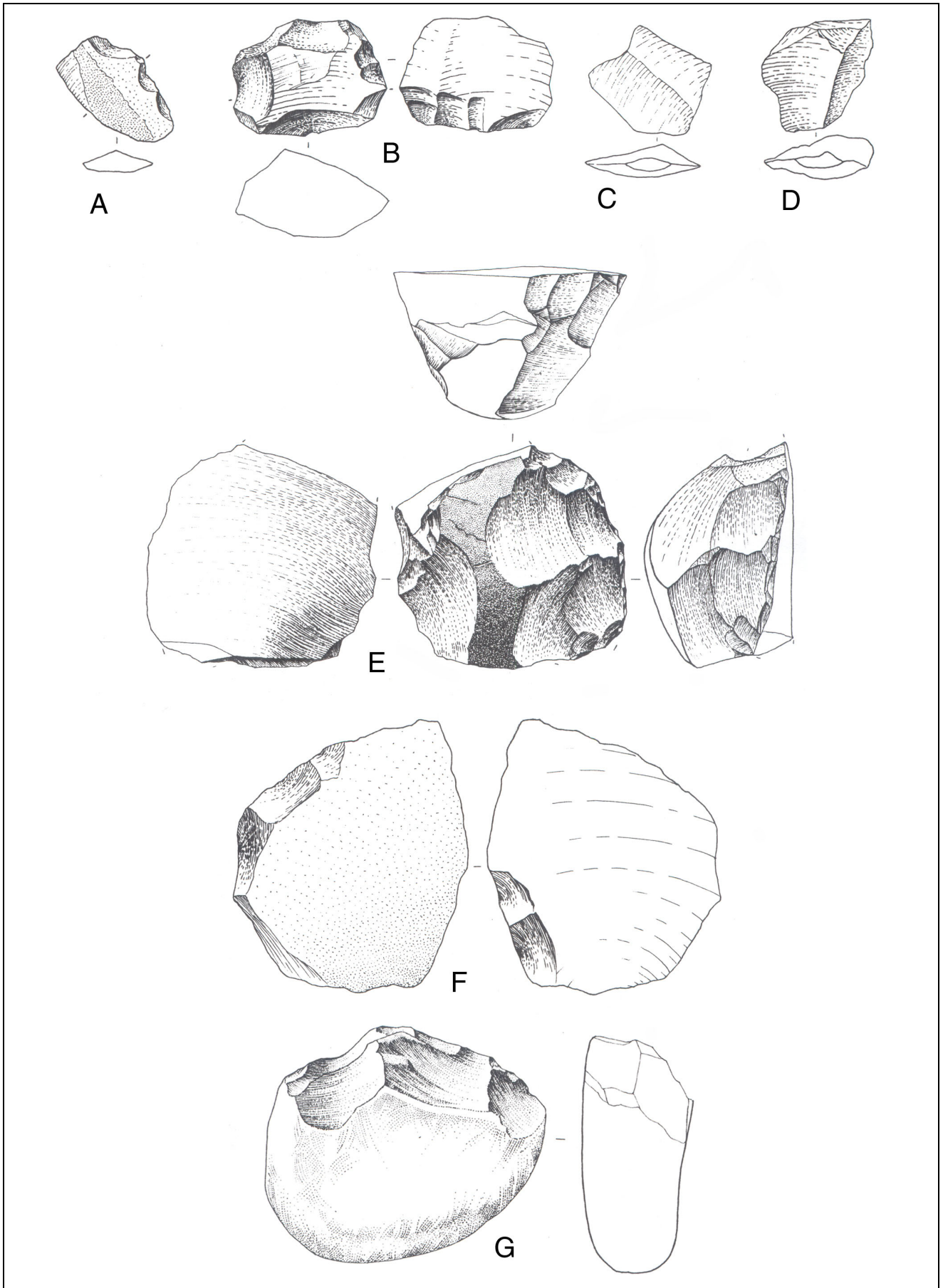


Fig. 13 - A030 site lithic assemblage. A, B, E, F: retouched flakes; C, D: unretouched flakes; G: chopper (1/2 natural size; drawings by O. Filippi).

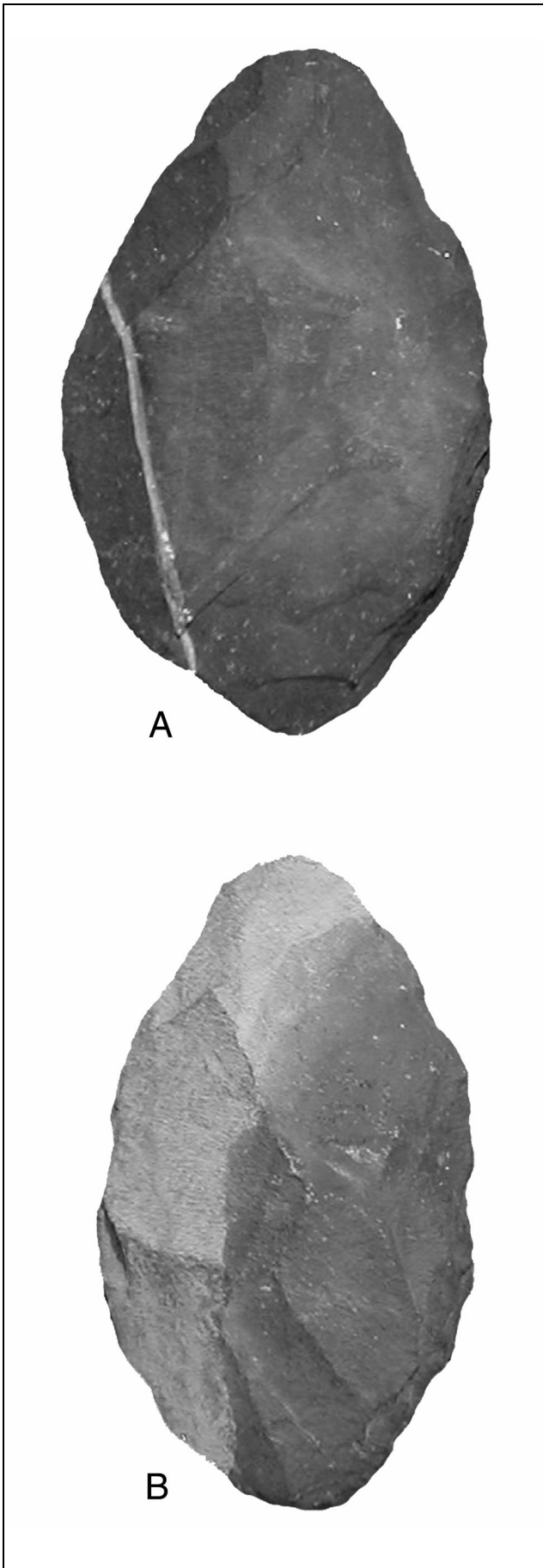


Fig. 14 - A030 site lithic assemblage. Bifaces (1/2 natural size).

moment a raw material procurement strategy oriented to primary outcrops has not been demonstrated and it is possible to hypothesize a unique procurement strategy of the collection of pebbles or blocks along the various river banks of the basin. No significant observation can be proposed about the shape of the bifaces which is almost exclusively symmetrical (96,7% on 93 observations). Typometrical analysis was performed on 83 entire elements and 2 fragmentary elements. The biface lengths (85 observations) range from 104 mm to 223 mm (Tab. 5) with a consistent amount of bifaces having lengths from 140-189 mm (61,2% of the findings).

The lack of significant typometrical variation among the bifacial tools made on flakes or in pebbles suggests the existence of standard lengths which do not seem to be affected by the dimensions of the original blank. The same typometrical standard seems to be shared both by hand-axes and by cleavers (Tab. 5). The lengths of the bifaces seem to be conditioned by the raw materials used (Tab. 6). Schist artefacts generally have reduced dimensions, ranging from 130-169 mm, basalt bifaces shows specimens ranging from 150-189 mm, while chlorite-schist hand-axes seem to be, in general, longer (8 samples range from 170-199 mm), with some elements longer than 200 mm.

The length/width ratio, based on 83 observations (Tab. 7) seems to be homogeneous even when comparing pebbles and flaked bifaces or hand-axes and cleavers, with a standard ratio among 1,4-1,9 and a major correspondence among 1,6-1,7.

The only noticeable difference can be linked to different raw material use (Tab. 8); in fact, basalt and chlorite-schist bifaces are decidedly more slender (major cluster around 1,6-1,9) while those made of schist are more squat (around 1,4-1,5).

The width/thickness ratio of bifaces, based on 84 observations, shows a substantial equivalence of the frequencies (Tab. 9) with correspondence to the type of utilized blank, although the bifaces on flake seem flatter than those made on pebbles. Slight differences can be observed between the hand-axes and cleavers. In fact, these latter tools are usually thicker.

Once again, raw materials seem to be a discriminating parameter in biface manufacturing (Tab. 10). Basalt artefacts appear thicker (major cluster among 1,8-2,5), while those on schist and chlorite-schist are grouped among higher frequencies (2,6-3,3) and therefore are flatter.

As far as biface weight is concerned (Tab. 11), the greatest number of pieces are around 200-800 gr., with a maximum peak around 400-700 gr. Hand-axes and cleavers possess similar weight frequencies and there are no particular differences due to the blank type, even if the pieces on flake tend to seem heavier. The heavier pieces in chlorite-schist in comparison to

mm	hand-axes on pebble		hand-axes on flake		tot. hand-axes pebbles + flakes		cleavers on pebble		cleavers on flake		tot. cleavers pebbles + flakes		bifaces pebbles + flakes	
	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%
100-109	2	2,4	2	2,4	4	4,8	2	2,4			2	2,4	6	7,1
110-119	2	2,4	1	1,2	3	3,6			1	1,2	1	1,2	4	4,7
120-129	3	3,5	1	1,2	4	4,7			2	2,4	2	2,4	6	7,1
130-139	5	5,9			5	5,9	2	2,4			2	2,4	7	8,2
140-149	7	8,2	2	2,4	9	10,6	1	1,2			1	1,2	10	11,8
150-159	7	8,2	1	1,2	8	9,4			2	2,4	2	2,4	10	11,8
160-169	7	8,2	1	1,2	8	9,4	2	2,4	2	2,4	4	4,8	12	14,1
170-179	5	5,9	2	2,4	7	8,3	1	1,2	1	1,2	2	2,4	9	10,6
180-189	8	9,4	1	1,2	9	10,6	1	1,2	1	1,2	2	2,4	11	12,9
190-199	1	1,2	1	1,2	2	2,4	1	1,2			1	1,2	3	3,5
200-209	3	3,5			3	3,5			1	1,2	1	1,2	4	4,7
210-219	1	1,2			1	1,2							1	1,2
220-229	2	2,4			2	2,4							2	2,4
Total	53	62,4	12	14,1	65	76,5	10	11,8	10	12	20	23,6	85	100

Tab. 5 - A030 site: bifaces lengths related to blank typology and in regular classes.

those in the other raw materials (Tab. 12) are related to their greater dimensions.

In conclusion, the analysis of the various parameters examined (typometry and weight) shows a substantial homogeneity among hand-axes and cleavers in relation to their original blank and dimensions. On the other hand the different raw materials utilized seem to be a discriminating parameter which affects typometrical data. The typological analysis of bifaces, according to F. Bordes typological scheme (Bordes 1961), allowed us to distinguish hand-axes (Fig. 11, 12A, 14, 15A), which are the majority (71 elements: 78,0% on 91 determinable tools), and cleavers (Fig. 12B, 15B). Biface typology (Tab. 13) is dominated by two major morphologies, "limandes" (Fig. 14) (32 elements equal to 35,2%) and elongated cordiforms (Fig. 11A, 12A, 15A) (25 elements: 27,5%), while oval (14 elements equal to 15,4%) and cordiform morphologies (12 elements equal to 13,2%) are less common and sub-triangular (5 elements equal to 5,5%), sub-cordiform (2 ele-

ments: 2,2%) and discoid morphologies (1,1%) are present in minimal frequencies. The hand-axes typological subdivision seems to overlap the general subdivision, while the cleavers show mostly "limande" morphology.

The raw materials selected for biface production (Tab. 14) point out the preferential use of schist for "limande" and, secondly, cordiform morphologies, while basalt and chlorite-schist have a closer relationship with the cordiforms and, above all, with the elongated cordiforms.

The hand-axes mostly possess rounded or scarcely pointed tips (in accord with the large presence of rounded biface typologies); when a pointed tip is present, it is made with few wide, overlapping and unrefined retouches. Among all the findings very pointed morphologies such as "ficron", common in evolved Acheulean African collections, are not present and only in few cases do some hand-axes possess a pronounced point which shows wide and invasive scars. These invasive scars also affect the thickness of the blank and

mm	schist		basalt		chlorite-schist		marble		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
100-109	4	4,7							4	4,7
110-119	3	3,5	1	1,2					4	4,7
120-129	5	5,9	1	1,2					6	7,1
130-139	6	7,1	2	2,4	1	1,2			9	10,6
140-149	7	8,2	1	1,2					8	9,4
150-159	6	7,1	2	2,4	1	1,2			9	10,6
160-169	6	7,1	5	5,9					11	12,9
170-179	4	4,7	3	3,5	4	4,7			11	12,9
180-189	5	5,9	3	3,5			1	1,2	9	10,6
190-199					4	4,7	1	1,2	5	5,9
200-209	3	3,5	1	1,2	1	1,2			5	5,9
210-219					2	2,4			2	2,4
220-229			1	1,2	1	1,2			2	2,4
Total	49	57,6	20	23,5	14	16,5	2	2,4	85	100

Tab. 6 - A030 site: bifaces lengths related to raw materials.

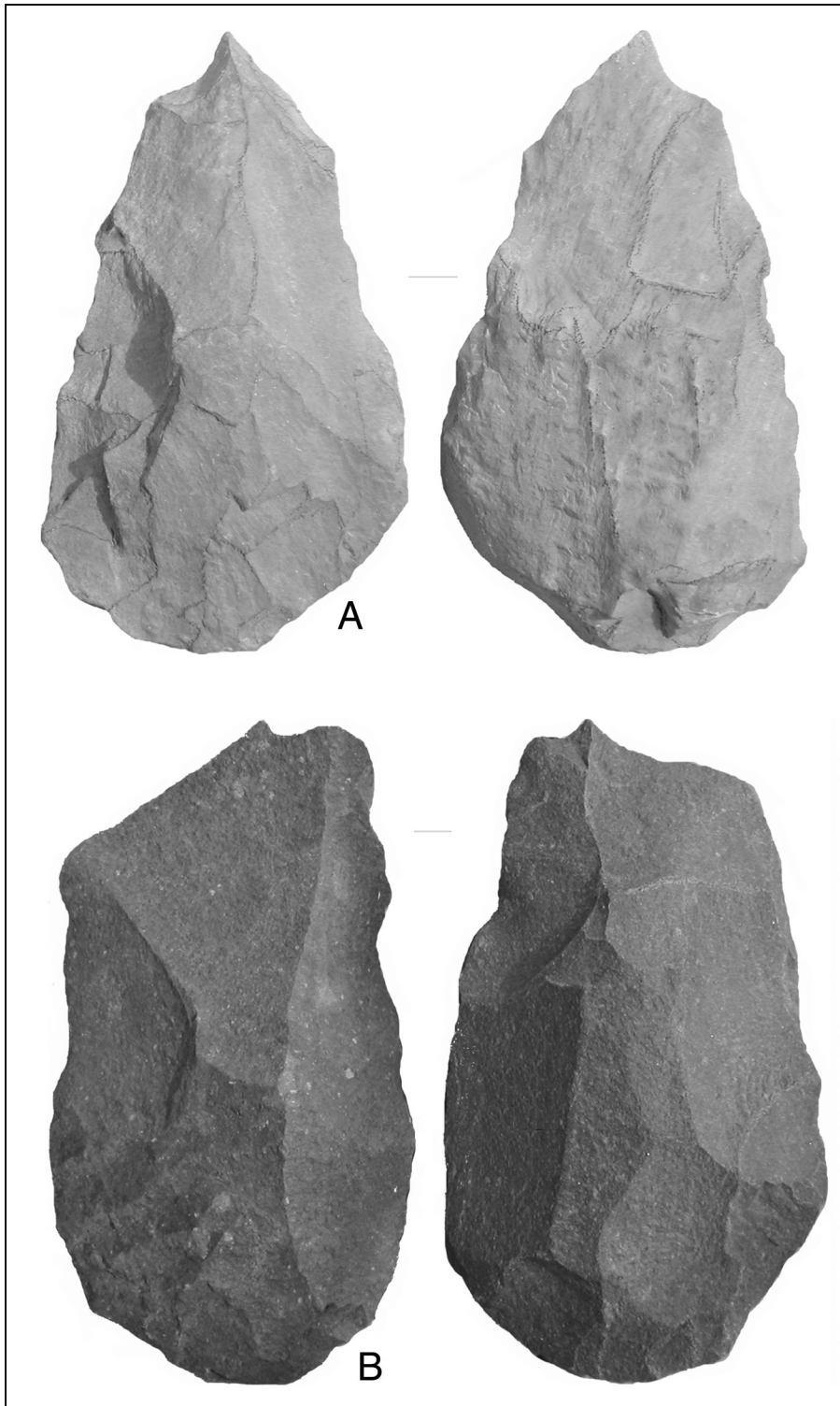


Fig. 15 - A030 site lithic assemblage. Bifaces (1/2 natural size).

partial refined retouches, almost always located on the median or proximal portion. Many bifaces show unequal manufacture on the two faces. One is broadly and widely retouched and the other, often the ventral face of the flake bifaces, is poorly transformed by a few partial and short scars. The hand-axe lateral edges are mostly sub-rectilinear (35 cases of the 73 observations) and rectilinear (26 cases), while sinuous morphologies are rarer (12 cases). As already seen, cleavers share similar original blanks and dimensions with hand-axes and they also seem to be reduced according to a similar technology. The transverse cutting edge is similarly made both with a single wide, intrusive and unrefined transverse scar and also with shorter and thinner transverse scars. The distal cutting edge length is similarly wide or narrow and is not linked to the invasiveness of the scars. The butt is almost always rounded off and finely refined by retouches. Only one specimen possesses a very thick rounded base with an elaborate sequence of parallel scars starting from the butt. A particular characteristic that seems to distinguish cleavers from hand-axes is the moderate presence

flatten the distal portion of the artefact in comparison with the base. The latter, which is often convex, is created with transverse scars regularized by thinner retouches, both unifacial and bifacial. Natural butts due to rounded cortical extremities or natural lateral straight-edged margins are rare and very often occur on schist artefacts with single or double side scarps. The hand-axe lateral side manufacture is more often intrusive, made with wide scars, sometimes refined by

of widespread refined retouches on one face which regularize the cleaver shapes overlapping former wide scars. Very few cleavers show accurate bifacial transverse retouch which create in most cases a strong angular discontinuity with the lateral sides of the blank and confers a somewhat rectangular morphology to the artefact. The cleaver reduction sequence seems to be different according to the various raw materials utilized. In fact, basalt cleavers are more accurately

l/w	hand-axes on pebble		hand-axes on flake		tot. hand-axes pebbles + flakes		cleavers on pebble		cleavers on flake		tot. cleavers pebbles + flakes		bifaces pebbles + flakes	
	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%
	1,0-1,1	1	1,2			1	1,2					0		1
1,2-1,3	1	1,2	1	1,2	2	2,4					0		2	2,4
1,4-1,5	12	14,5	3	3,6	15	18,1	3	3,6	1	1,2	4	4,8	19	22,9
1,6-1,7	20	24,1	5	6	25	30,1	6	7,2	5	6	11	13,2	36	43,4
1,8-1,9	14	16,9	3	3,6	17	20,5	1	1,2	4	4,8	5	6	22	26,5
2,0-2,1	3	3,6			3	3,6					0		3	3,6
Total	51	61,4	12	14,5	63	75,9	10	12	10	12	20	24	83	100

Tab. 7 - A030 site: bifaces length/width ratio (l/w) related to blank typology and in regular classes.

l/w	schist		basalt		chlorite-schist		marble		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
	1,0-1,1			1	1,2					1
1,2-1,3	1	1,2			1	1,2			2	2,4
1,4-1,5	16	19,3	2	2,4	1	1,2			19	22,9
1,6-1,7	22	26,5	8	9,6	6	7,2			36	43,4
1,8-1,9	8	9,6	8	9,6	5	6	1	1,2	22	26,5
2,0-2,1			1	1,2	1	1,2	1	1,2	3	3,6
Total	47	56,6	20	24,1	14	16,9	2	2,4	83	100

w/t	hand-axes on pebble		hand-axes on flake		tot. hand-axes pebbles + flakes		cleavers on pebble		cleavers on flake		tot. cleavers pebbles + flakes		bifaces pebbles + flakes	
	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%
	1,0-1,3	1	1,2			1	1,2			2	2,4	2	2,4	3
1,4-1,7	3	3,6			3	3,6	1	1,2	3	3,6	4	4,8	7	8,3
1,8-2,1	3	3,6			3	3,6	3	3,6	2	2,4	5	6	8	9,5
2,2-2,5	9	10,7	2	2,4	11	13,1	3	3,6	2	2,4	5	6	16	19
2,6-2,9	18	21,4	2	2,4	20	23,8	1	1,2			1	1,2	21	25
3,0-3,3	8	9,5	5	6	13	15,5	1	1,2			1	1,2	14	16,7
3,4-3,7	4	4,8	2	2,4	6	7,2	1	1,2	1	1,2	2	2,4	8	9,5
3,8-4,1	4	4,8	1	1,2	5	6					0	0	5	6
4,2-4,5	2	2,4			2	2,4					0	0	2	2,4
Total	52	61,9	12	14,3	64	76,2	10	11,9	10	11,9	20	23,8	84	100

Tab. 9 - A030 site: bifaces width/thickness ratio (w/t) related to blank typology and in regular classes.

w/t	schist		basalt		chlorite-schist		marble		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
	1,0-1,3			3	3,6					3
1,4-1,7	2	2,4	3	3,6			2	2,4	7	8,3
1,8-2,1	4	4,8	4	4,8					8	9,5
2,2-2,5	8	9,5	6	7,1	2	2,4			16	19
2,6-2,9	11	13,1	2	2,4	8	9,5			21	25
3,0-3,3	11	13,1	1	1,2	2	2,4			14	16,7
3,4-3,7	6	7,1	1	1,2	1	1,2			8	9,5
3,8-4,1	5	6							5	6
4,2-4,5	1	1,2			1	1,2			2	2,4
Total	48	57,1	20	23,8	14	16,7	2	2,4	84	100

manufactured, while schist artefacts are very often poorly-made, similarly to what was observed for hand-axes.

*Flakes.* There are 89 flakes (50 unretouched artefacts - Fig. 13C, D - and 39 retouched), made of schist

in half of the specimens (Tab. 15) then, with lower frequencies, on quartz, quartzite and basalt. The different raw materials show some differences since a great majority of retouched flakes are of schist, while unretouched ones are of different raw materials without distinction.

grams	hand-axes on pebble		hand-axes on flake		tot. hand-axes pebbles + flakes		cleavers on pebble		cleavers on flake		tot. cleavers pebbles + flakes		bifaces pebbles + flakes	
	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%
100-199	1	1,1	1	1,1	2	2,3					2	2,3	2	2,3
200-299	7	8	2	2,3	9	10,3	2	2,3			2	2,3	11	12,6
300-399	3	3,4	1	1,1	4	4,6			1	1,1	1	1,1	5	5,7
400-499	9	10,3			9	10,3	2	2,3	1	1,1	3	3,4	12	13,8
500-599	12	13,8	4	4,6	16	18,4	2	2,3			2	2,3	18	20,7
600-699	7	8	1	1,1	8	9,2			1	1,1	1	1,1	9	10,3
700-799	5	5,7	2	2,3	7	8	2	2,3	4	4,6	6	6,9	13	14,9
800-899	3	3,4	1	1,1	4	4,6			1	1,1	1	1,1	5	5,7
900-999	2	2,3			2	2,3			1	1,1	1	1,1	3	3,4
1000-1099	1	1,1			1	1,1	1	1,1	1	1,1	2	2,3	3	3,4
1100-1199	2	2,3			2	2,3	1	1,1			1	1,1	3	3,4
1200-1299	1	1,1			1	1,1							1	1,1
1600-1699	1	1,1			1	1,1							1	1,1
1900-1999			1	1,1	1	1,1							1	1,1
Total	54	62,1	13	14,9	67	77	10	11,5	10	11,5	20	23	87	100

Tab. 11 - A030 site: bifaces weight (in grams) related to blank typology and in regular classes.

grams	schist		basalt		chlorite-schist		marble		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
100-199	2	2,3							2	2,3
200-299	10	11,5			1	1,1			11	12,6
300-399	4	4,6	1	1,1					5	5,7
400-499	10	11,5	2	2,3					12	13,8
500-599	13	14,9	3	3,4	2	2,3			18	20,7
600-699	2	2,3	6	6,9	1	1,1			9	10,3
700-799	7	8	2	2,3	3	3,4	1	1,1	13	14,9
800-899	3	3,4	1	1,1	1	1,1			5	5,7
900-999			1	1,1	2	2,3			3	3,4
1000-1099			1	1,1	2	2,3			3	3,4
1100-1199			1	1,1	1	1,1	1	1,1	3	3,4
1200-1299			1	1,1					1	1,1
1600-1699	1	1,1							1	1,1
1900-1999			1	1,1					1	1,1
Total	52	59,8	20	23	13	14,9	2	2,3	87	100

Tab. 12 - A030 site: bifaces weight related to the raw materials.

	hand-axes on pebble		hand-axes on flake		tot. hand-axes pebbles + flakes		cleavers on pebble		cleavers on flake		tot. cleavers pebbles + flakes		bifaces pebbles + flakes	
	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%
limande	14	15,4	6	6,6	20	22	5	5,5	7	7,7	12	13,2	32	35,2
cordiform	12	13,2			12	13,2							12	13,2
elongated cordiform	17	18,7	4	4,4	21	23,1	2	2,2	2	2,2	4	4,4	25	27,5
sub-cordiform	2	2,2			2	2,2							2	2,2
ovalar	12	13,2	1	1,1	13	14,3			1	1,1	1	1,1	14	15,4
sub-triangular			2	2,2	2	2,2	3	3,3			3	3,3	5	5,5
discoid	1	1,1			1	1,1							1	1,1
Total	58	63,7	13	14,3	71	78	10	11	10	11	20	22	91	100

Tab. 13 - A030 site: bifaces typology (Bordes 1961) related to blank typology.

	schist		basalt		chlorite-schist		marble		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
limande	23	25,3	7	7,7	2	2,2			32	35,2
cordiform	10	11			1	1,1	1	1,1	12	13,2
elongated cordiform	8	8,8	10	11	6	6,6	1	1,1	25	27,5
sub-cordiform	1	1,1	1	1,1					2	2,2
ovalar	8	8,8	2	2,2	4	4,4			14	15,4
sub-triangular	4	4,4	1	1,1					5	5,5
discoid					1	1,1			1	1,1
Total	54	59,3	21	23,1	14	15,4	2	2,2	91	100

Tab. 14 - A030 site: biface typology (Bordes 1961) related to raw materials.

The physical condition of these artefacts is quite unworn, with patinas only on 27 elements (30,3%), mostly in schist. The surfaces are mostly unworn (44 cases on 89 observations: 49,4%), scarcely smoothed (44,9%) and in a limited number heavily smoothed

(5,6%). The edges appear mostly unworn (53 cases: 59,6%), followed by slightly abraded specimens (37,1%) and very rare heavily abraded elements (3,4%). Secondary retouch is always limited in number and extent and is observed on 33 elements (37,1%). The

	schist		basalt		quartzite		quartz		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
unretouched	20	22,5	11	12,4	6	6,7	13	14,6	50	56,2
retouched	27	30,3	4	4,5	3	3,4	5	5,6	39	43,8
Total	47	52,8	15	16,9	9	10,1	18	20,2	89	100

Tab. 15 - A030 site: flakes raw materials.

	unretouched	retouched	Total
30-39	4	1	5
40-49	3	1	4
50-59	2	2	4
60-69	5	2	7
70-79	2	2	4
80-89	3	2	5
90-99		6	6
100-109		1	1
110-119		2	2
120-129		3	3
130-139		2	2
140-149		1	1
150-159		2	2
Total	19	27	46

Tab. 16 - A030 site: flakes maximum lengths (in mm).

	schist	basalt	quartzite	quartz	Total
	n.	n.	n.	n.	n.
30-39	1	1		3	5
40-49	1			3	4
50-59		2	1	1	4
60-69	3	1	2	1	7
70-79	3		1		4
80-89	4	1			5
90-99	5	1			6
100-109	1				1
110-119	2				2
120-129	3				3
130-139	2				2
140-149	1				1
150-159			2		2
Total	26	6	6	8	46

Tab. 17 - A030 site: flake maximum lengths (in mm) related to the raw materials.

shape of the flakes is mostly asymmetrical (58 cases on 75 determinable observations). The maximum length (Tab. 16) of the flakes, both retouched and unretouched (46 elements), ranges mostly from 50 mm and 100 mm (26 elements), followed by larger artefacts (more than 100 mm: 11 elements) and then by smaller artefacts (26 mm-49 mm: 9 elements).

Some differences seem to be related to the differ-

ent raw materials (Tab. 17) with small unretouched quartz flakes prevailing, and flakes of a greater dimension in schist.

The length/width ratio (l/w) (Tab. 18) calculated on 43 elements shows the same percentage for the two categories flakes (l/w: 1,0-1,5) and large flakes (0,8-0,9) (41,9%); while flake-blades (1,6-1,9) occur in moderate percentages and blades on schist are rare (2,3%).

The flat (w/t 2,3-3,0) and very flat (w/t 3,1-6,0) artefacts clearly prevail (Tab. 19), with 47 cases out of 54 observations, equal to 87,1%. These general characteristics don't seem to be affected by the various raw materials.

The cortex on the dorsal surface of flakes (Tab. 20), is absent on half of the findings (50,6%), probably related to a prolonged flaking sequence on each core. On the other hand, a moderate presence of fully corticated surfaces (23,6%) is almost totally related to schist flakes.

The typology of retouched flakes (Tab. 21) is analyzed following the Laplace typological list (Laplace 1964) and shows a great prevalence of side-scrapers (29 on 39 retouched flakes). There is a preferential use of the schist in comparison to other raw materials.

The carinated end-scraper (G9, cfr. rabot), made on a large symmetrical flake with a wide and open-angled striking platform, has an oblique rectilinear front created by accurate retouches (Fig. 13E). The side-scraper (R2) is the most frequent artefact (12 specimens). It is often made by total retouches, rarely bilateral, with single wide negatives that are more or less invasive, especially in schist side-scrapers. The morphology of the retouched sides is mostly convex or sub-rectilinear. The flakes, both symmetrical and asymmetrical, have a wide and inclined flat striking platform. The dimensions are generally large, ranging from 91 mm to 158 mm. Two side-scrapers (R2 or R3), are on natural blanks. One has convex partial retouches and poorly-made inverse scalar retouches, the other one is a scraper with

Tab. 18 - A030 site: flake length/width ratio (l/w) (Bagolini 1968) related to the raw materials.

l/w	schist		basalt		quartzite		quartz		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
0,1-0,5	1	2,3							1	2,3
0,6-0,7	4	9,3	2	4,7			2	4,7	8	18,6
0,8-0,9	4	9,3	1	2,3	1	2,3	3	7	9	20,9
1,0-1,5	12	27,9			3	7	3	7	18	41,9
1,6-1,9	4	9,3			2	4,7			6	14
2,0-2,9	1	2,3							1	2,3
total	26	60,5	3	7	6	14	8	18,6	43	100

w/t	schist		basalt		quartzite		quartz		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
1,1-1,8			1	1,9	1	1,9			2	3,7
1,9-2,2	2	3,7	1	1,9			2	3,7	5	9,3
2,3-3,0	4	7,4	2	3,7	3	5,6	8	14,8	17	31,5
3,1-6,0	22	40,7	1	1,9	3	5,6	1	1,9	27	50
> 6,0	3	5,6							3	5,6
Total	31	57,4	5	9,3	7	13	11	20,4	54	100

Tab. 19 - A030 site: flake width/thickness ratio (w/t) (Martini 1975) related to the raw materials.

	schist		basalt		quartzite		quartz		Total	
	n.	%	n.	%	n.	%	n.	%	n.	%
0	20	22,5	12	13,5	7	7,9	6	6,7	45	50,6
1	5	5,6	1	1,1	2	2,2	4	4,5	12	13,5
2	1	1,1	1	1,1			2	2,2	4	4,5
3	3	3,4					4	4,5	7	7,9
4	18	20,2	1	1,1			2	2,2	21	23,6
Total	47	52,8	15	16,9	9	10,1	18	20,2	89	100

Tab. 20 - A030 site: cortex on the dorsal surface related to the raw materials.

	schist	basalt	quartzite	quartz	Total
G9 (carinated end-scraper)		1			1
R2 (lateral side-scraper)	9	1	2		12
R3 (transversal side-scraper)	6	1		1	8
R2 o R3 (side-scraper)	2				2
R4 (lateral-transversal side-scraper)	6				6
R5 (carinated side-scraper)				1	1
D2 (denticulate side-scraper)	2			2	4
E1 (pièces écaillés)	2	1		2	5
Total	27	4	3	5	39

Tab. 21 - A030 site: flake typology (Laplace 1964) related to the raw materials.

mm	A094 bifaces	A030 bifaces
100-109	0	4
110-149	6	27
150-169	14	20
170-199	12	25
200-229	1	9
Total	33	85

Tab. 22 - Bifaces maximum length in A094 and A030 sites.

w/t	A094 bifaces		A030 bifaces	
	n.	%	n.	%
1,0-1,3			3	3,6
1,4-1,7			7	8,3
1,8-2,1	1		8	9,5
2,2-2,5	9		16	19
2,6-2,9	12		21	25
3,0-3,3	12		14	16,7
3,4-3,7	1		8	9,5
3,8-4,1	1		5	6
4,2-4,5	1		2	2,4
4,6-4,9	2			
Total	39		84	100

Tab. 23 - bifaces width/thickness ratio (w/t) in A094 and A030 sites.

unilateral bifacial manufacture and thinner refined overlapped retouches.

The lateral-transverse scrapers (R4), very often

made on an asymmetrical blank, are very elaborate, and are characterized by accurate and wide retouches flanked, in some cases, by other scaled retouches; two specimens possess a vague hand-axe morphology and present invasive and wide retouch and are made on flakes of large dimensions, (from 86 mm to 124 mm). The only carinated side-scraper (R5), on small flake, is made with a bilateral-transverse retouch associated with a ventral thinning retouch (Fig. 13B). The four denticulate scrapers (D2) are very different: two, on small quartz flakes, have few unilateral, unrefined and invasive retouches (Fig. 13A). The other two denticulate scrapers, of schist and of bigger dimensions (length > 100 mm) possess in one case marginal and accurate retouches and in the other one alternate invasive retouches (Fig. 13F), recalling a sort of hand-axe morphology. The five "pièces écaillés" (E1) have diversified dimensions (from 44 mm to 130 mm) and poorly-made manufacture with mostly invasive retouch.

*Cores.* The four cores, all in quartz and of moderate dimensions (from 66 mm to 86 mm) are quite elaborate. Two specimens have a polyhedral morphology with no main orientation of the striking platforms used for flake and small flake production. One core has three striking platforms (two opposite and a main orthogonal platforms) used for flake and small flake production. The last specimen has poorly elaborated



adjacent striking platforms for short large flakes, which recall some chopper morphology with a very open cutting edge angle.

#### Lithic assemblage of A094 site

The A094 site was discovered during a survey in 2002 and in the 2003 mission a systematic analysis of all the surface artefacts began. The archaeological layers were cut by wide gullies which create large exposed sections with Acheulean stone tools still embedded in a caliche soil. This latter shows evidence of low disturbance post-depositional events and point to a modest displacement of the artefacts, which are all fairly in good condition. The artefacts were analyzed separately according to a preliminary subdivision of the site in four study-areas, recognizable on the basis of their relative position to the two sections and the direction of the gullies. The majority of the artefacts are bifacial tools (hand-axes, cleavers), rare choppers are present together with unretouched and retouched flakes (e.g. two carinated end-scrapers "rabots") of different sizes, hammerstones and cores.

We present here a preliminary description of the findings, after the conclusion of the lithic artefacts analysis and without any distinction of the study-areas due to the homogeneous character of the artefacts. The following observations essentially concern the bifacial tools, pointing to a preliminary comparison with the best analyzed contexts (UAHS and A030 site) and indicating the most diffused techno-typological tendency of the Acheulean in the Dandiero, especially for the bifacial production which is better documented in other sites, such as A030 site.

The sample offered here includes 41 bifacial tools (24

hand-axes, 7 cleavers and 10 indeterminable fragments unassignable to one class). These are mostly made of chlorite-schist and secondarily, with similar frequencies, of schist and basalt. The physical condition is unworn and almost unworn, patinas of exterior alteration are absent and the secondary retouches are nearly irrelevant. The maximum length of the bifacial tools range between 150-169 mm (Tab. 22) (class dimensions in Tab. 22, were estimated in order to recover as best as possible the original dimensions of the fragmented specimens, except for specimens that were too fragmentary). Compared to the same classes of A030 site bifacial tools, it is

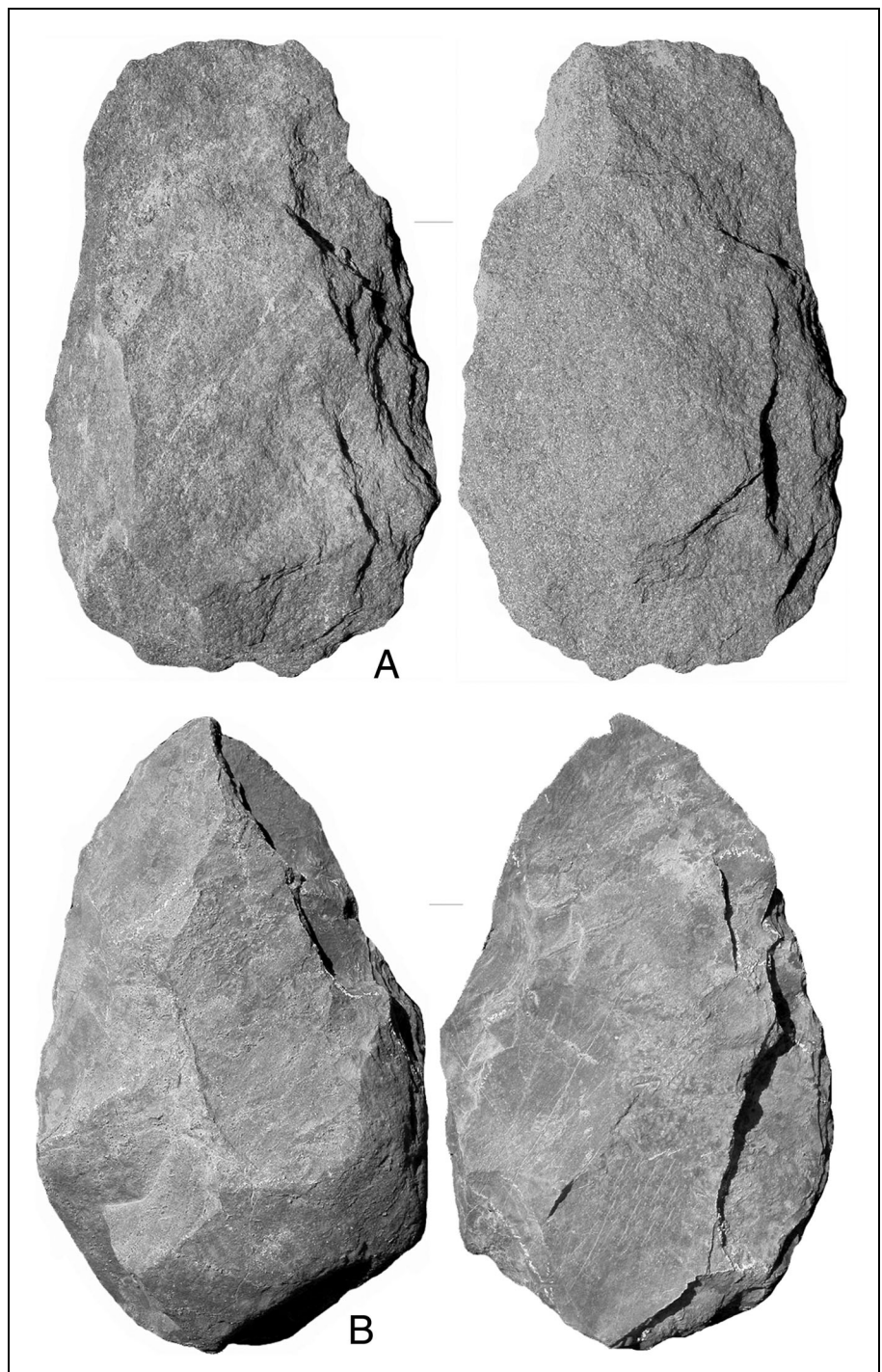


Fig. 16 - A094 site lithic assemblage. Bifaces (1/2 natural size).

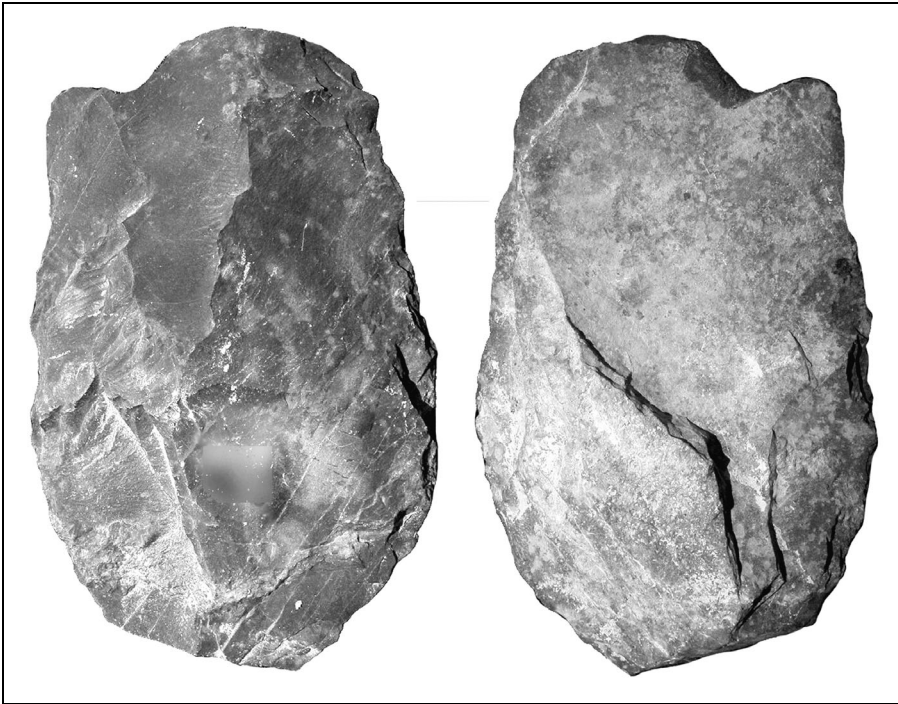


Fig. 17 - A094 site lithic assemblage. Biface (1/2 natural size).

flake tool. The lateral edges are mainly sub-rectilinear, probably due to the general amplitude of the retouches and the general limited thickness of the artefacts. A distinctive character of this lithic complex, when compared to the A030 site for example, is in the abundance of bifaces made on flakes, which constitute the majority of the artefacts, and which seems to suggest a different strategy of blank production, but which is not the subject of this paper.

interesting to notice in both sites a preponderance of bifaces of a moderate size (110-169 mm) and, very rarely, of greater dimensions (> 200 mm). The remarkable presence at A030 of small sized biface can be explained by the abundance of schist bifaces, generally characterized by moderate dimensional standards.

The limited number of analyzed samples doesn't allow for any considerations on biface elongation, however the width/thickness ratio suggest an homogeneity among the two analyzed assemblages (Tab. 23) particularly in the abundance of flat tools with frequencies among 2,2-3,3 and in the rarity of thick artefacts. The tendency to build, sometimes thin, bifaces can be explained because of the preferential use of thin schist and chlorite-schist natural fragments or flat flakes.

The typology of bifacial tools (Fig. 16; Fig. 17) shows certain homogeneity: a greater majority of the specimens possess an elongated cordiform morphology, while discoid and oval forms are rare. These morphologies and their manufacture seem largely comparable to those seen in A030 site: the tips were made using unique, wide and unrefined retouches, which very often emphasize the apical portion; the proximal ends appear rounded by transverse retouches and in a more limited number of cases natural unmodified and rectilinear portions are present. The two sides are almost never modified by overlapping scars and have rough and unique retouches which are sometimes discontinuous. A subsequent regularization, made by tiny accurate retouches overlapped by wider ones, is rarely noticed and always has a limited extent. The reduction sequence observed on the two faces is frequently diversified; the less worked face often corresponds to the ventral face of a

#### The lithic assemblage of A063 site

The A063 site, which was discovered during the 2001 mission, has not yet been object of an integral survey and only few surface artefacts were preliminary analyzed. Nevertheless, the preliminary observations carried on a few surface items showed some technological characteristics that hint at a slightly different bifacial technology when compared to other sites of the area. As aforementioned, the following data are based only on field observation and need to be reinforced through detailed analysis of a greater number of artefacts. The site, more than the surface findings, showed an exposed section that contained an interesting stratigraphic sequence with three archaeological horizons. In the upper layer, which contains caliche soil with characteristics close to those recognized in UAHS, a chlorite-schist elongated cordiform hand-axe in primary context is visible. The artefact shows a similar morphology to those coming from the A030 site and other sites of the Dandiero. Along the eroded slope of the section on the south east side, 20 artefacts (choppers, hand-axes, a trihedral pick and flakes) have been observed. We wish call to attention in the short context of this article only to some hand-axes that justify a more detailed description for their original characteristics in the general context of the basin.

The external aspect of the artefacts is unworn and very unworn, neither superficial alterations nor secondary retouches are noticed. The hand-axes are poorly made and of moderate length. These artefacts are very thick, with the base of the pebble often totally unworked and naturally rounded. One artefact is made

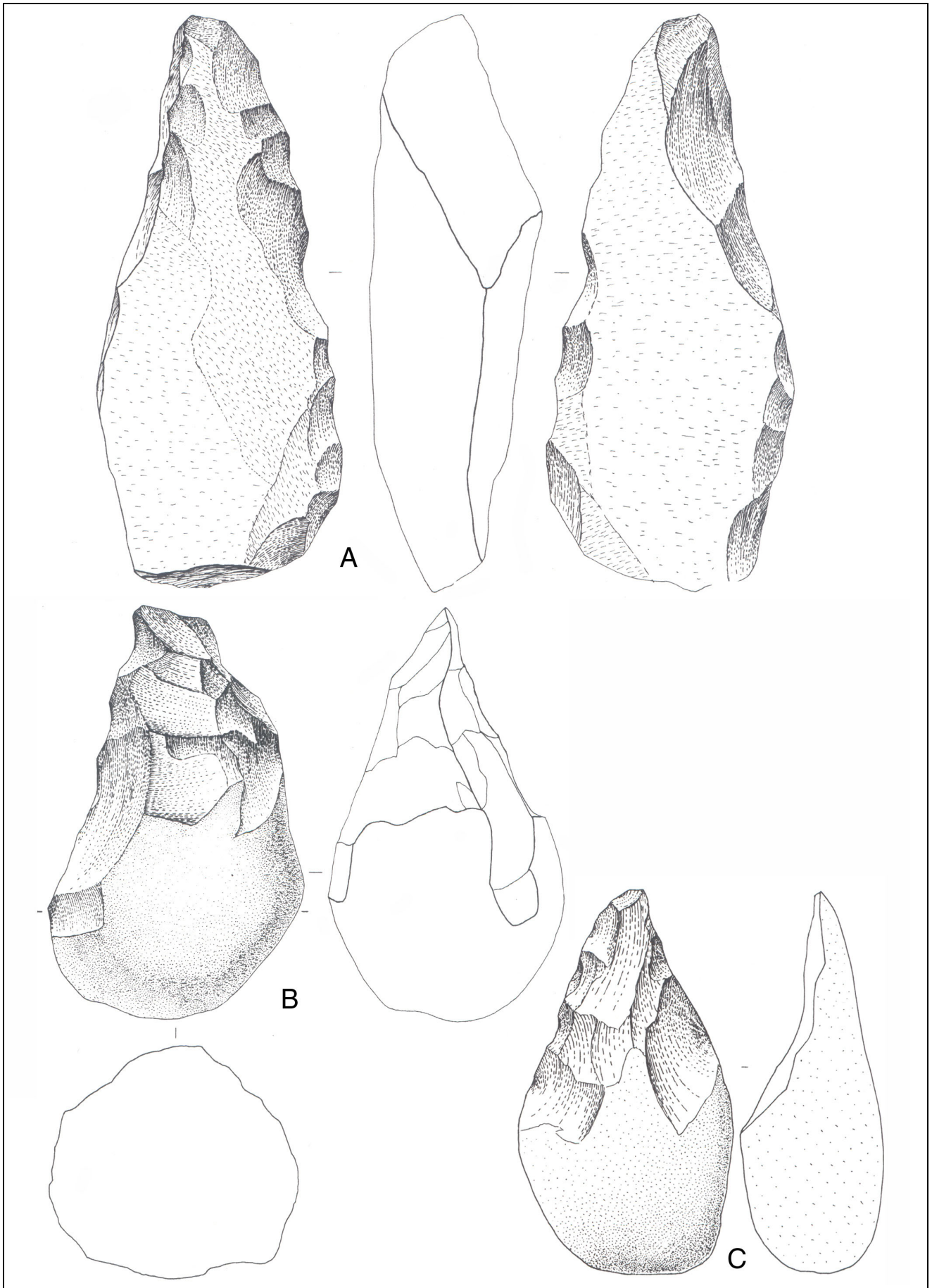


Fig. 18 - A063 site lithic assemblage. A: trihedral pick; B: biface; C: pebble with unifacial retouches; (1/2 natural size; drawings by O. Filippi).

from an elongated ovate pebble of basalt (Fig. 18C), worked with a rough sequence of wide and overlapping unifacial retouches that interest the medial and distal portion of the piece and create a slender and well formed apex. The side crests are concave and sinuous, due to the unifacial retouch. (length 150 mm; width 81 mm; thickness 56 mm). Another hand-axe, on an elongated and thick schist pebble (Fig 18B), is characterized by the thickness of the sub-circular natural base and by the wide and overlapping retouches located in the median and distal portion, which create a pointed apex. The side crests are curvilinear, (length 160 mm; width 97 mm; thickness 89 mm). A very slender basalt trihedral pick on a natural blank (Fig. 18A) has been worked with few unrefined retouches that don't modify substantially

the original morphology of the blank. The apex is well formed and possesses a trihedral morphology and it is made using a natural straight-edged margin from which a few wide and overlapping retouches start. The side crests are rectilinear (length 223 mm; width 91 mm; thickness 66 mm). A hand-axe is made on a basalt flake (Fig. 19A), and worked differently on the two faces. On one face the retouches are very rough, wide and overlapping and localized on the medial and proximal part. On the other face they exclusively focus on the more accurate and rounded apex. Two lateral fractures prevent us from verifying the original artefact morphology. In any case it is not so elongated and the base is rectilinear and thinned with few intrusive retouches. The side crests are rectilinear and partially sinuous (length

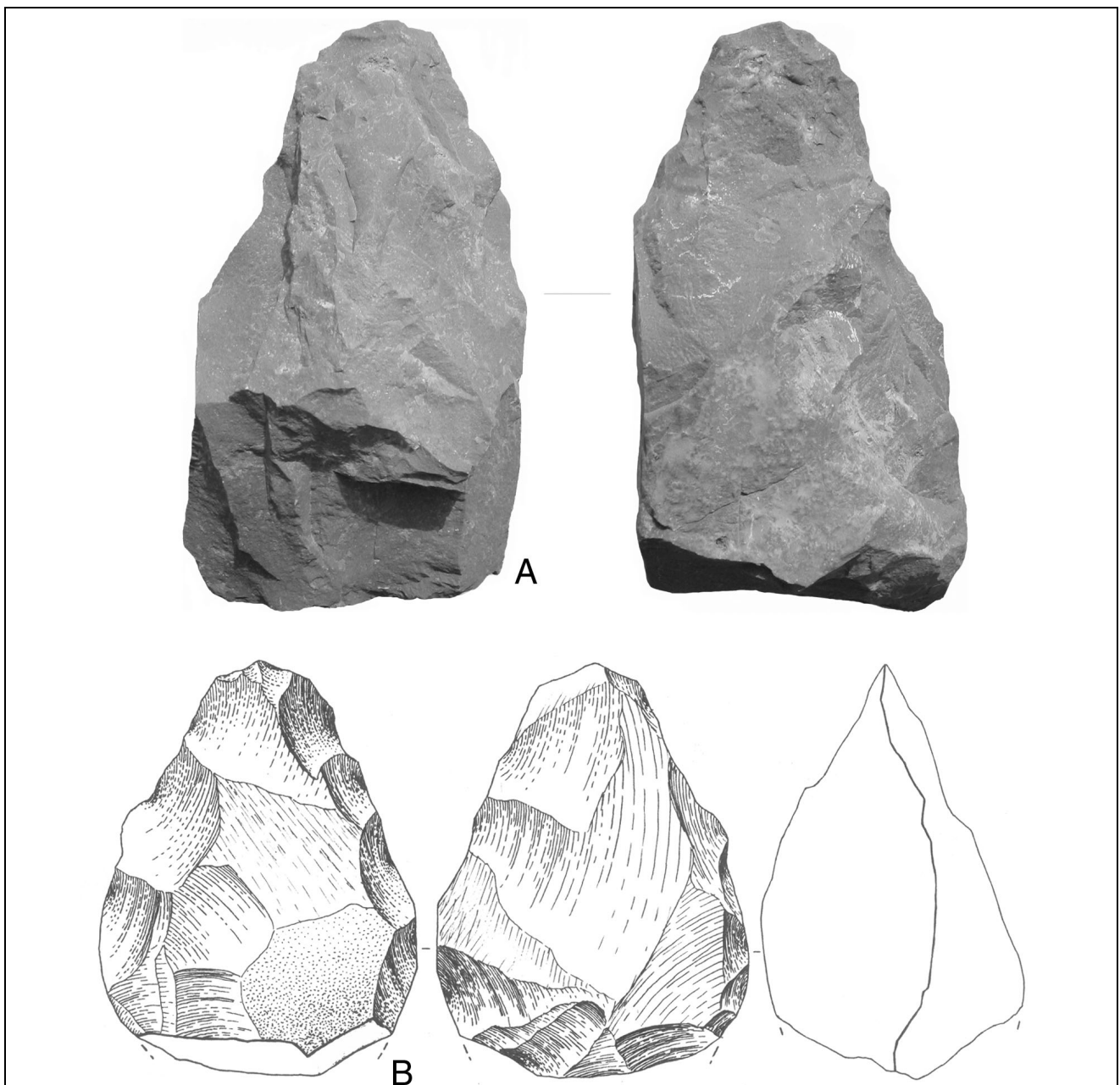


Fig. 19 - A063 site lithic assemblage. biface (1/2 natural size).

Fig. 20 - A006 site. Lithic artefacts concentration, general view (A) and detail (B).

180 mm; width 96 mm – fragmentary; thickness 72 mm). We finally bring to attention a hand-axe (Fig. 19B) made on a basalt natural blank, worked with diversified bifacial retouches along the two faces. The first one is made with wide negatives without further regularization which create sub-rectilinear sides and a rounded apex, on the opposite face ample overlapping scaly negatives appear that also involve the base. The side crests are curvilinear sinuous. (length 125 mm fragmentary – and in every case not more than 135 mm; width 94 mm; thickness 80 mm). The site is also characterized by some generic choppers, flakes (some with double bulbs) and a denticulate scraper on a fragmentary basalt flake of very large dimensions with few unrefined retouches on one face, which can be also interpreted as a hand-axe in the early phases of the reduction sequence.

The general techno-typological characters of this small group of materials diverge from all the other sites observed so far in the Dandiero, which have already been described in detail, such as the UAHS and A030 sites. The diverse characteristics are pointed out by the recurrent use of thick blanks, the unrefined retouches that normally don't modify the original morphology of the blank, the presence of hand-axes made of pebbles still bearing wide cortical portions and the presence of particular artefacts, such as the trihedral pick and the unifacial hand-axe made of pebbles which have not yet been found elsewhere.

#### **Preliminary observations on the lithic assemblages of the Dandiero in the general framework of the Acheulean of East Africa: problems and research perspectives**

##### **Techno-typological variability of the Acheulean lithic assemblages**

The characteristics of the Acheulean lithic com-



plexes analyzed so far point out a strong variability in relation to some individually examined parameters. This preliminary report, based only on surface findings, does not take into account all the data related to the spatial distribution of artefacts, which will be one of the major topics in the future missions at all the sites which underwent a minor post-depositional disturbance. The A006 site, for example, where an elliptical concentration of bifaces spread across several square meters (Fig. 20) may reflect a sub-primary context with little post depositional disturbance.

*Raw materials.* The raw materials list of each site includes more or less the same rock types (Tab. 24, frequencies are referred to the assemblage totality with no typological distinction), which nevertheless appear in different percentages in the lithic assemblages compared here. The use of quartz characterizes the two

UAHS areas, mostly in the production of flakes (in the UAHS area 1 a quartz core is also present), but also, although in smaller percentages, of choppers (3 samples each in UAHS area 1 and 2). At the two other sites (A030 and A094) this kind of rock was used for the same typologies of artefacts, but is much less important. Schist and chlorite-schist are important raw materials at the A030 and A094 sites. These two rocks are employed most frequently for the production of bifaces in both sites and at the A030 site the numerous schist flakes of small size could also be produced during biface reduc-

the comparison among the UAHS area 1, UAHS area 2 and A030 (Tab. 25) shows a certain variety of raw materials in UAHS area 1 and in A030 in comparison with UAHS area 2, where only two kinds of rock are present. The dimensions are not homogeneous: choppers of small dimension are present in UAHS area 1, while specimens of greater dimension in area 2 and even greater in A030 are found. The dominant chopper morphologies in all three contexts are squat, with very few elongated specimens in the UAHS area 2 and at A030. The thickness frequencies are high in all the

raw material	UAHS area 1		UAHS area 2	A030		A094*
	n.	%	n.	n.	%	n.
quartz	88	68,7	19	41	19,2	7
schist	2	1,6	4	113	53,1	21
basalt	13	10,2	10	38	17,8	12
chlorite-schist				16	7,5	19
white marble	9	7,0	9	5	2,3	7
quartzite	12	9,4	1			
quartzarenite	4	3,1				5
total	128	100	43	213	100	71

Tab. 24 - Raw material variability in lithic assemblage of UAHS, A030 and A094 (\* these values refer to a significant sample of material and comprehend also flakes, choppers and hammerstones).

	UAHS area 1	UAHS area 2	A030
min/max dimensions (in mm)	53-173*	93-164**	75-160#
dimensional major cluster (in mm)	53-99*	93-105**	100-150#
min/max length/width ratio (l/w)	1,0-1,3*	1,1-1,6**	1,1-1,8#
l/w major cluster	1,1-1,2*	1,1-1,3**	1,1-1,2#
min/max width/thickness ratio (w/t)	1,2-2,5*	1,2-2,1**	1,2-2,3#
w/t major cluster	1,3-1,6*	1,2-1,5**	1,4-1,6 / 1,8-1,9#
unifacial/bifacial	0,9*	0,8**	0,4°°
transversal/lateral	2,2°	2,0**	1,3§

Tab. 25 - Choppers: dimensional parameters (\* 15 elements, \*\* 9 elements, # 14 elements, ° 13 elements, § 15 elements, § 7 elements).

tion sequences (schist cores are absent at the site), although this preliminary hypothesis is still to be confirmed. In all these sites basalt appears in moderate frequencies and seems to be used not only for biface manufacture, but also for some specialized tools (for instance, two “rabots” in A094, a “rabot” in A030, two big denticulate scrapers in UAHS area 2). In the production of choppers and cores white marble is always present, although in low frequencies (marble flakes are also scarce) and bifaces and hammerstones (always of moderate dimensions) rarely are made of this kind of rock. Quartzarenite pebbles are exclusively used as hammerstones. In conclusion, the parameters for raw material don't seem to be homogeneous but rather, it seems that the choice of distinct raw material types is related to the different typologies of artefacts. In fact, quartz is used in the majority of flake production, while schist followed by basalt and chlorite-schist prevail where bifacial components are dominant.

*Techno-typological characteristics of the choppers.*

The production of choppers is not homogeneous and

lithic assemblages, nevertheless in UAHS area 2 and at A030 rare flat pebbles are present. The typological analysis show a dominance of bifacial and transverse choppers in the three sites, although at the A030 site the majority of these two typologies possess slightly lower frequencies.

*Techno-typological characteristics of bifaces.* The techno-typological analysis of bifaces, which have been totally accomplished for some sites (UAHS, A030) and is still partial in other ones (A094), together with preliminary field observations don't show homogeneous characteristics. A widespread tendency in the Dandiero, exemplified by A030 bifaces and confirmed by the sampling of A094 site, can be synthesized in the following techno-typological parameters:

- contemporaneous presence of hand-axes and cleavers, always with a clear majority of the first typology;
- frequent use of flakes with a lateral striking platform;
- preferential use of schist, basalt and chlorite-schist, rarity of other rocks, absence of quartz;
- strong presence of bifaces with length 110-200 mm,

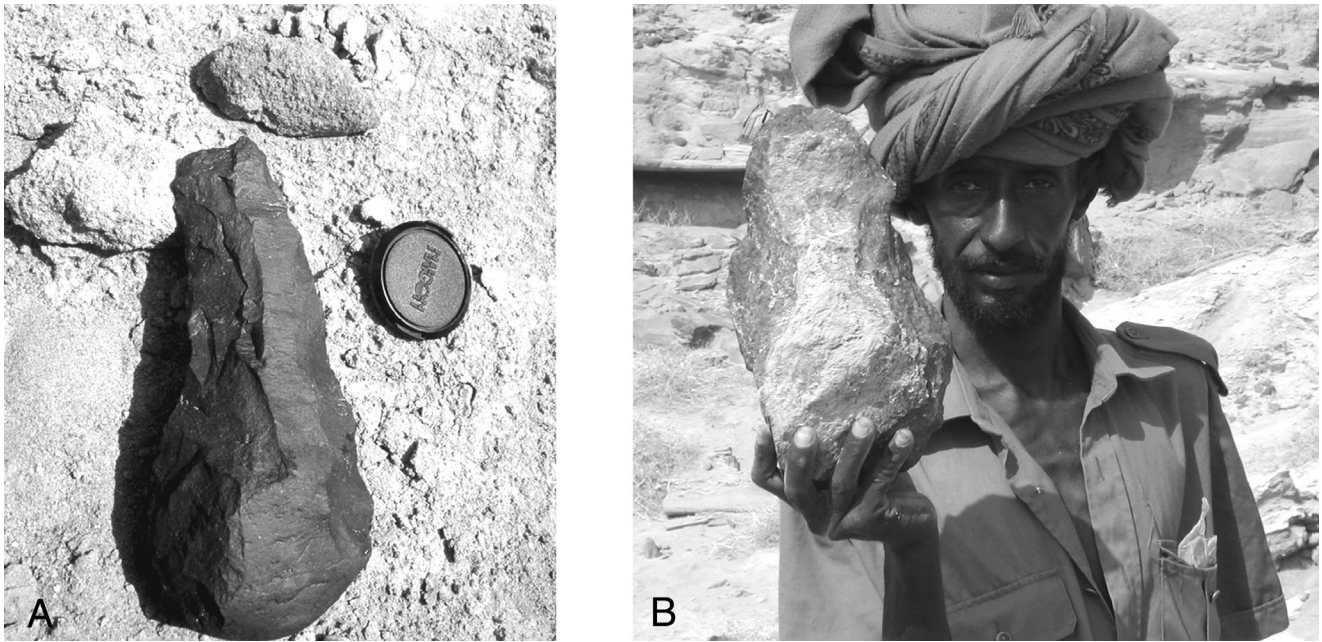


Fig. 21 - Big bifaces from A006 site (A) and from the Dioli area (B).

with a moderate elongation, frequently flat and very flat, with a symmetrical shape;

- major presence of elongated cordiform and cordiform bifacial morphologies, together with a certain typological variability (oval, “limandes”, discoidal morphologies);
- hand-axes with tips made using wide, unique and unrefined retouches; bases rounded off by transverse retouch; lateral edges created by short, often poorly done and rarely refined retouches, rectilinear or sub-rectilinear lateral edges that are rarely sinuous;
- diversified importance of the manufacture of the two faces, in fact hand-axes on flakes show the dorsal surface always reduced by invasive scars, compared to the ventral one);
- cleavers with the cutting edges made by very few transverse hits and only rarely refined by lateral retouches.

In some sites, for instance the A006 site that is not described in this preliminary analytical study and in a few other sites (Fig. 21), a strong presence of elongated bifaces of great dimension (lengths around 300-400 mm)

typological groups	UAHS area 1	UAHS area 2	A030
flakes	98	22	89
bifaces	1	10	105
Trihedral pick	1		
choppers	15	9	15
hammerstones	8		
cores	4	1	4
hammer	1	1	
<b>Total</b>	<b>128</b>	<b>43</b>	<b>213</b>

Tab. 26 - Typological groups in the various sites.

has been observed. The bifaces are made by wide and rough scars sometimes with an unworked cortical butt and with prominent and pointed tips; these lie together with smaller bifaces with techno-typological characteristics similar to the ones at the A030 site for example. Future investigations and the systematic study of these large bifaces will allow a precise comparison which is only hinted at here.

At the present time at the A063 site, the small sample of artefacts that has been recovered has allowed a cautious hypothesis of this original techno-typological aspect of the whole Dandiero. The hand-axes are often made on thicker blanks than in the other sites, with a very rough manufacture of wide scars that almost exclusively are located in the distal extremity. The major part of the blanks are therefore unworked and corticated, tips are strong, thick and pointed, lateral edges are curvilinear and sinuous, with a more irregular morphology than in the other assemblages. The general technological characteristics, both in bifaces and in the trihedral pick found at this site and based on a weak elaboration of thick and very thick blanks, could indicate a more ancient Acheulean production. This hypothesis is still to be tested within the wider context of the whole Basin.

*Quantitative comparison between different typological groups (choppers, bifaces, flakes, hammer stones).* The analytical data (Tab. 26) are limited only to three lithic assemblages (UAHS area 1, UAHS area 2, A030), but the considerations hereafter proposed are also based on observations carried out during the survey phase and allow us a clearer understanding of the importance and

meaning of some typological groups in their individual contexts.

In almost all the Acheulean sites of the Dandiero a strong preponderance of bifacial tools is present. In this homogeneous framework the UAHS area 1 represents a different lithic assemblage, characterized by a major presence of choppers, rather than bifacial tools. The lithic industry of UAHS area 1 also possesses a strong component of retouched and unretouched quartz flakes, of small and medium dimensions, more abundant with respect to other analyzed contexts. This characteristic also seems to be shared with few other sites according to the preliminary survey data.

At the moment we cannot give a clear answer for the difference found in the UAHS area 1, which contains an assemblage nearly deprived of bifaces and rich in choppers, given the fact that usually in contexts rich in bifaces the quantity of small and medium quartz flakes is a minor component and more often is associated with larger flakes (often retouched scrapers and denticulate, as, for example, in A030 site and UAHS area 2) made from a greater variety of rocks. The hammerstones, not always present in the lithic assemblages, seem inconsistent with both the chopper and quartz flake assemblage contexts (UAHS area 1) and to those with a dominant bifaces percentage (A094 site).

### **Interpretative hypotheses of the techno-typological variability**

The preliminary general framework that has been exposed on the basis of some test-cases together with field observations, points out an intense presence of Acheulean human groups in the Dandiero, which is proven by diversified archaeological evidence, due both to post-depositional and erosive events that affected the sedimentary sequence and to the relative quantity of findings recovered on the various sites. The analyzed samples have shown a particular pattern of variability and have been examined following techno-typometrical and typological parameters. These have shown that the general variability of the lithic assemblages can be interpreted according to different hypotheses, still to be confirmed or disproved by further in-depth studies.

In synthesis, the techno-typological tendencies recognized are the following:

- the small number of artefacts so far recovered at the A063 site seem to point out a poorly made reduction sequence with archaic characteristics, at the moment unique in the Acheulean of the Dandiero;
- the UAHS area 1 assemblage, which contains a strong component of choppers and quartz flakes and almost lacks bifacial tools, seems to be an aspect rarely found in the whole basin;
- the lithic assemblages of the A030 and A094 sites, with a strong biface component, exemplify the most

diffused techno-typological standard of the whole basin. The inner variability of each single context does not seem to affect an observed general homogeneity; – the poorly made large bifaces that characterize the A006 site widen the variability of the Acheulean assemblages with large amounts of bifacial tools.

This general techno-typological variability, both in the typological composition of each single assemblage and also in the bifacial tools, could be explained for example with an hypothesis that implies different chronologies for the various assemblages of the basin, whose organic sequence cannot be reconstructed at the moment. A second hypothesis considers that the different technological strategies were used contemporarily and that artefacts variability in the various assemblages would be explained by the different sites' functions, therefore implicating diversified activities performed on each site (lithic workshop, butchery site, and occasional standing campsite). Yet another hypothesis considers all the sites as contemporary and does not take into account the site function, therefore attributing the variability to the presence of different human groups with cultural and technological traditions in the same territory.

These preliminary proposed hypotheses imply a wide approach to each single site through the reconstruction of the stratigraphical successions, reliable chronological dating, paleo-environmental reconstruction, use-wear analysis and through an in-depth study of raw material acquisition strategies, bifaces reduction sequences and technological strategies of handmade tools, all of which will be studied and examined during the successive missions of the Buia Project.

### **Chronological and cultural framework**

The assemblages of the Dandiero, characterized by bifacial tools, are a small part of the wider East African Acheulean context. This cultural and technological aspect is present in many sites of the region dominated by the Rift Valley system (from Eritrea to Tanzania) and the related lithic assemblages, even if all not precisely dated, all belong to a wide chronological period (1,5 to 0,2 My). On the basis of this datings, East African Acheulean assemblages are the most ancient on the whole continent and it is probably here where the Acheulean originated and where the diffusion of these lithic complexes in the African continent began (Clark 1994). The main archaeological finding in the Dandiero is the high number of Acheulean sites in which bifaces quantitatively characterize the lithic assemblages. The assemblages possess a large techno-typological variability, both in the assemblage composition and biface variability, which is still to be fully understood and which can be interpreted with more than one hypothesis. The large concentration of artefacts observed in the



Dandiero can be related to numerous other sites recovered in East Africa, such as at Bodo and Olorgesailie (de Heinzelin et al. 2000; Isaac 1977), where they are often found in perilacustrine or river bank environments like in the Buia area. An interesting finding, still to be confirmed by further investigations, is the presence of an assemblage with abundant choppers and few bifaces in a larger context dominated by bifaces. In this site (UAHS area 1) the chrono-stratigraphical sequence seems to be more ancient than an assemblage with typical dominant bifacial tools (UAHS area 2). Although the chronological span has not been well determined as yet, the dating of around 1,0 My in the levels containing remains of human fossils (area 1 UAHS) seems coherent within the general framework of East African Acheulean, yet we find an assemblage rich in choppers and with rare bifaces.

The presence in the Dandiero of Acheulean assemblages characterized both by a prevailing bifacial component and by dominant choppers can be compared to the Middle Awash area (de Heinzelin et al. 2000). There, in Early Pleistocene levels, both Mode 1 (Clark 1968) and Mode 2 (MAK-A1, only as an hypothesis and on the basis of techno-typological considerations) are documented. In the same way, in the Early Middle Pleistocene layers, dominant Mode 2 assemblages are found together with less numerous Mode 1 lithic industries. In the western portion of the Middle Awash (de Heinzelin et al. 2000) both Mode 1 and Mode 2 lithic industries are present in the Daka Member (whose lowermost part is dated around 1 My). Many Acheulean complexes, generally dating from the end of Early Pleistocene to the beginning of Middle Pleistocene, have in common a certain abundance of choppers and a presence of a slightly rough bifacial manufacturing technique, when compared to the more accurate and refined technology which characterize the later phases of the Acheulean.

Bifacial tool variability, exemplified in the A030 and A094 sites, which yielded artefacts with some evolved Acheulean characteristics, could be explained also by a more recent chronology of these contexts than of the Mode 1 artefact assemblages.

The biface typology of the Buia sites can be compared with both early and middle Acheulean sites of East Africa on the basis of artefact morphology, rough manufacturing techniques with few wide negative scars and of the rare presence of refining retouches which does not substantially modify the original blank morphology. Our site dating of around 1,0 My excludes the possibility of comparison with other more ancient lithic contexts, which possess some similarities. For example in Olduvai Gorge, the EF-HR (Bed II) lithic assemblage possesses numerous bifaces (53,8%), mostly made on flakes with an irregular oval shape, with wide and unworked portions. The manufacture is often poorly done and of marginal quality. Some trihedral picks and one

cleaver are present, while the choppers are a little more numerous. These archaic techno-typological characters and the relative quantitative variability of the various classes of artefacts in Olduvai Gorge do not seem to possess a strong chronological meaning, given that they appear also in the upper levels (Beds III and IV) (Leakey 1994), together with more evolved characters. In the area of Konso Gardula (Asfaw et al. 1992), in a sequence dated between  $1,895 \pm 0,011$  My and  $1,36 \pm 0,02$  My, some sites (KGA 3, 5 and KGA 7 to 12) were recovered where the bifaces and the trihedral picks constitute the most numerous artefact groups. These elements are made using a poorly refined technique, with wide, invasive and oblique scars that very often are partial, which left part of the tool unworked. Some elements are of large dimensions (length up to 270 mm). Some rare cleavers are present among the bifacial tools. Retouched flakes are very rare and not standardized. The authors propose a comparison of these complexes with the industries of EF-HR and SHK in the Olduvai area. The site of Peninj, in Tanzania (1,6-1,4 My) (Isaac 1967) also belongs to this chronological period and shares with the other sites similar characteristics in lithic assemblage characters. Closer to the chronology hypothesized in the Dandiero are some East African Acheulean sites, such as those already quoted above in the Middle Awash area, where numerous Acheulean lithic assemblages have been recovered, dating from Early Pleistocene to Middle Pleistocene. Among the most ancient industries, connected to the late Early Pleistocene and early Middle Pleistocene and representative of both Mode 1 and Mode 2, the site of MAK A-1 should be pointed out for the presence of thick and roughly made bifaces, often with a cortical proximal end, which are similar to some artefacts found in the A063 site. The most ancient industries of the Dawaitoli Formation and of the U-T Member show flatter bifaces, made on big flakes, with lateral wide, unrefined and sometimes partial manufacturing calling to mind the artefacts of A030 and A094 sites. The same biface typology is also present in the western Middle Awash contexts such as BOU-A6 and BOU-A14, included in the lower part of the Daka Member (de Henzelin et al. 2000) whose basal levels are dated to 1,042 My. Some of the sites found in the Olorgesailie area (Isaac 1977) show scatters of lithic artefacts with techno-typological characters similar to those recovered in the Dandiero. These similarities seem also to be confirmed by the radiometric age of the layers, which fits with the chronological span hypothesized for the Dandiero. In Melka Kunture (Chavaillon et al. 1978, 1979; Piperno et al. 1974), in the upper valley of the Awash river, the level J of the Garba XII site (1,0-0,8 My) yielded an assemblage with many choppers and end-scrapers on pebble, few bifaces, rare cleavers and flakes, both retouched and unretouched.

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