Prehistoric archaeology. The site of Gombore I

Débitage and tools on flake

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Débitage

Since 1966, the Oldowan level at Gombore I has yielded a rich assemblage principally including trimmed pebbles. The choppers that have been trimmed over much of their surface seem often very similar to handaxes or archaic handaxes. With these tools on pebble, and in proportions that vary widely according to sector, there are basalt and obsidian flakes that are often the débitage or waste from pebble flaking, but which have sometimes been used or even retouched.

While numerous trimmed pebbles have crush marks from utilization on their ridges, some do not seem to have been used after trimming was completed. They are often of obsidian, a fragile material that reacts badly to violent impact, but which yielded sharp edged flakes; the idea of a core comes quickly to mind.

It is difficult to distinguish cores from trimmed pebbles; numerous objects have probably been cores, because flakes they have yielded have been used to cut or, after retouch, to scrape etc., and they have then become tools such as choppers, polyhedrons, thick scrapers or planes. Polyhedrons in particular puzzle excavators because they have all yielded usable flakes but, in their final state, they often have impact marks on the ridges.

It is in this context that a remarkable obsidian artefact was found that was never anything other than a core (Fig. 33, *1*) because its ridges have no trace of utilization. Its general shape, described by N. Chavaillon (1975), has one slightly convex surface which retains the trace of six fairly concentric flake scars, one of which measures about 80 x 50 mm. The other face is pyramidal. Flakes and blades have been removed by impacts originating from the upper face without previous preparation of the striking platform. The platforms are mostly flat, but are dihedral in two cases. This pyramidal face has at least 9 negative flake scars, including one of a blade (85 x 40 mm) with a very flat section, and one of a triangular flake (72 x 54 mm). The Gombore I assemblage comprises numerous flakes of obsidian or basalt; one could easily fit one from among them to the triangular flake negative observed on the core. It is a flake with a flat platform, and has the trace of a flake removed in the same axis and cutting the same ridge. Here, in an Oldowan context, is a flaking technique announcing much more advanced artefact manufacture. The study of this large obsidian core has removed any doubts that may have remained about flaking techniques used by Oldowan toolmakers. Numerous obsidian or basalt blocks have been cores. They have yielded

usable flakes and blades; and successively, most of them have been used or even transformed into tools. They are then, from a typological point of view, choppers, polyhedrons, etc.

In this chapter we shall only study flaking products and those objects that remained as cores, even if some were slightly modified for use a second time.

Cores

There are 250 cores from Gombore I, as well as 45 less usable objects that are broken or in a poor condition.

Raw material

The raw material used is an important feature because obsidian was either not found at the site, or was there in very small quantity, while other materials like trachyte, basalt and rare tuff were in the vicinity. We therefore have 120 (48%) obsidian cores and 130 (52%) cores in other materials. The 45 fragments do not teach us too much: 40 (89%) are of obsidian, but this material breaks very easily; it was undoubtedly more precious and was therefore used to the end.

Dimensions

Cores have different dimensions depending on the raw material.

Obsidian cores are mainly between 40 and 80 mm (63%) long. The smallest, between 20 and 40 mm, represent 18.5% (29 mm for the smallest). It is notable that 18.5% are over 80 mm. Among the latter, extreme lengths are 109, 128 and 129 mm. The core described above is actually one of them (128 mm).

Cores in other materials are distributed in a wider variety of size categories. They are rarely under 60 mm (4% with 30 mm for the smallest) and their number increases between 40 and 60 mm to 12%, and between 60 to 80 mm to 18.5%.

Most are from 80 to 100 mm long (31%), and then the proportion decreases from 100 to 120 mm with 18.5%; there are only 10% between 120 and 140 mm; finally, there are only 6.5% above 140 mm. The largest is in fact a passive chopper (308 mm) from which 5 convergent removals could have been used.

Weight

Among obsidian cores, weights range from 12 to 1510 g. A large block of obsidian has evidence of two removals, but its "function" as a core is not evident. The general average is 149 g, the most common category (40 to 80 mm long) has an average weight of 73 g.

Other materials: Here again there is an exceptional piece, the passive chopper cited above, that is not included in the statistical count because it weighs more than 10 kg. Weights range from 30 to 2760 g, with an average of 580 g. The cores in the best represented dimensional category, from 80 to 100 mm, weigh on average 473 g for 40 objects.

Proportions

Flattening: Core thickness in relation to length and width ranges from "very thick" to "rather flat" or, rarely, "flat" but varies according to raw material.

Obsidian cores are mainly "rather thick" (48%), with "thick" and "rather flat" equivalent categories with 21% each. "Very thick" cores represent only 10% of the total.

Among cores in other materials, "very thick", "thick" and "rather thick" categories are equally represented (28% each). Only 15% are "rather flat" and 1% are "flat" cores.

Cortex

The cortex is not always easy to distinguish on cores, especially those of basalt or trachyte.

Among obsidian cores, cortex completely covers the ventral face on 11, and 22 others, or 28% of the total, are only partially covered.

Among corse in other materials cortex completely covers the ventral face on 14 and 17 are only partially covered, making 31 cores (24%) in total. However, these numbers are very relative as the cortex is often indistinguishable from a flat or rounded face that has already been flaked, but has been worn or is in a poor condition.

Some smaller cores also have cortical areas on the upper face or on edges (even on the striking platform).

Core types

The distribution is as follows, according to raw material:

Type of core	Obsidian		Other materials		Total	
	N	%	N	%	N	%
Unipolar	57	47.9	50	38.5	**107**	42.8
Bipolar	20	16.8	12	9.2	**32**	12.9
Centripetal	23	18.5	19	14.6	**42**	16.5
Polyhedral	17	14.3	33	25.4	**50**	20.0
Prismatic	2	1.7	9	6.9	**11**	4.4
Pyramidal	1	0.8	7	5.4	**8**	3.2
Total	**120**		**130**		**250**	

Unipolar cores are by far the most common. The only noticeable difference between those of obsidian and those in other materials seems to be a larger proportion of polyhedral cores among the latter.

Unipolar cores

Unipolar cores (Fig. 32) are the most numerous (107 pieces). They are also the simplest as a removal or sometimes an area of cortex on a block or on a pebble is enough to serve as a striking platform to detach one or more flakes. However, some are more elaborated, the detached flake having cut into older facets or negative flake scars on the upper face of the core.

The flakes obtained were all usable, small, wide or rather elongated, with a regular outline.

Six unipolar cores were also tools. In two cases, one of the edges was trimmed as a side-chopper; another core was casually trimmed as a heavy end-scraper; the striking platform used for flaking a wide flake is the ventral face of a rabot which become a core. Another core having yielded several flakes was retrimmed, creating a beak. Finally, one unipolar core was retouched and used as a denticulate.

Raw material

There are 57 unipolar obsidian cores or 53% of the group. Other raw materials were used for 50 including basalt (22 pieces), trachyte (18), tuff (9) and another unidentified volcanic rock.

Dimensions

Lengths range from 29 mm for the smallest (an obsidian core) to 192 mm for the largest, a block of trachyte that only yielded one wide flake. The categories with the largest numbers are those which range from 40 to 59 mm (rather small cores) and from 60 to 79 mm (rather large cores) which represent 60% of the whole. Among the smallest, 9 out of 10 are of obsidian. Above 100 mm, 10 out of 14 are of basalt or trachyte.

Proportions

Elongation

The length/width (l/w) index gives the following percentages results:

Elongation	Obsidian %	Other materials %	Total %
Very short	5.3	18.4	**11.3**
Short	15.8	30.6	**22.6**
Rather short	40.3	32.6	**36.8**
Rather long	33.3	18.4	**26.4**
Long	5.3		**2.9**

On the whole, obsidian cores are more elongated than cores in other materials. Most are rather short.

Flattening

This index yielded the following data:

Flattening	Obsidian %	Other materials %	Total %
Very thick	8.8	12.2	**10.4**
Thick	19.3	18.4	**18.9**
Rather thick	49.1	36.8	**43.4**
Rather flat	22.8	30.6	**26.4**
Flat		2.0	**0.9**

Unipolar cores are mainly “rather thick”. The raw material differences are less marked than in the total cores.

Ventral face

Analysis of the ventral face is not always easy because of the physical state of the cores, but it was possible in 77 cases.

The face is completely cortical in 20 cases (8 are of obsidian and 12 in other materials).

It is partially cortical on 20 cores (15 of obsidian and 5 in other materials). In this case the cortex is adjacent to 1 or 2 facets (2 obsidian) or several facets (11 obsidian and 3 in other materials).

Cortex is present on the ventral face on 51% of the unipolar cores.

Ventral faces have traces of preparation removals out of the cortex, or more or less clear prior facets:

Facets	Obsidian	Other materials
1 or 2 facets	2	2
Several facets	36	13

Cores of obsidian have a ventral face more frequently worked than others. Furthermore, the presence of cortex is much more frequent on unipolar cores (a bit more than 50% of the cases) than in the total cores where it only reached 28%.

Upper face

Unipolar cores have frequently kept fairly important areas of cortex on the upper face with 12 of obsidian and 6 in other materials. They have also yielded one or more flakes.

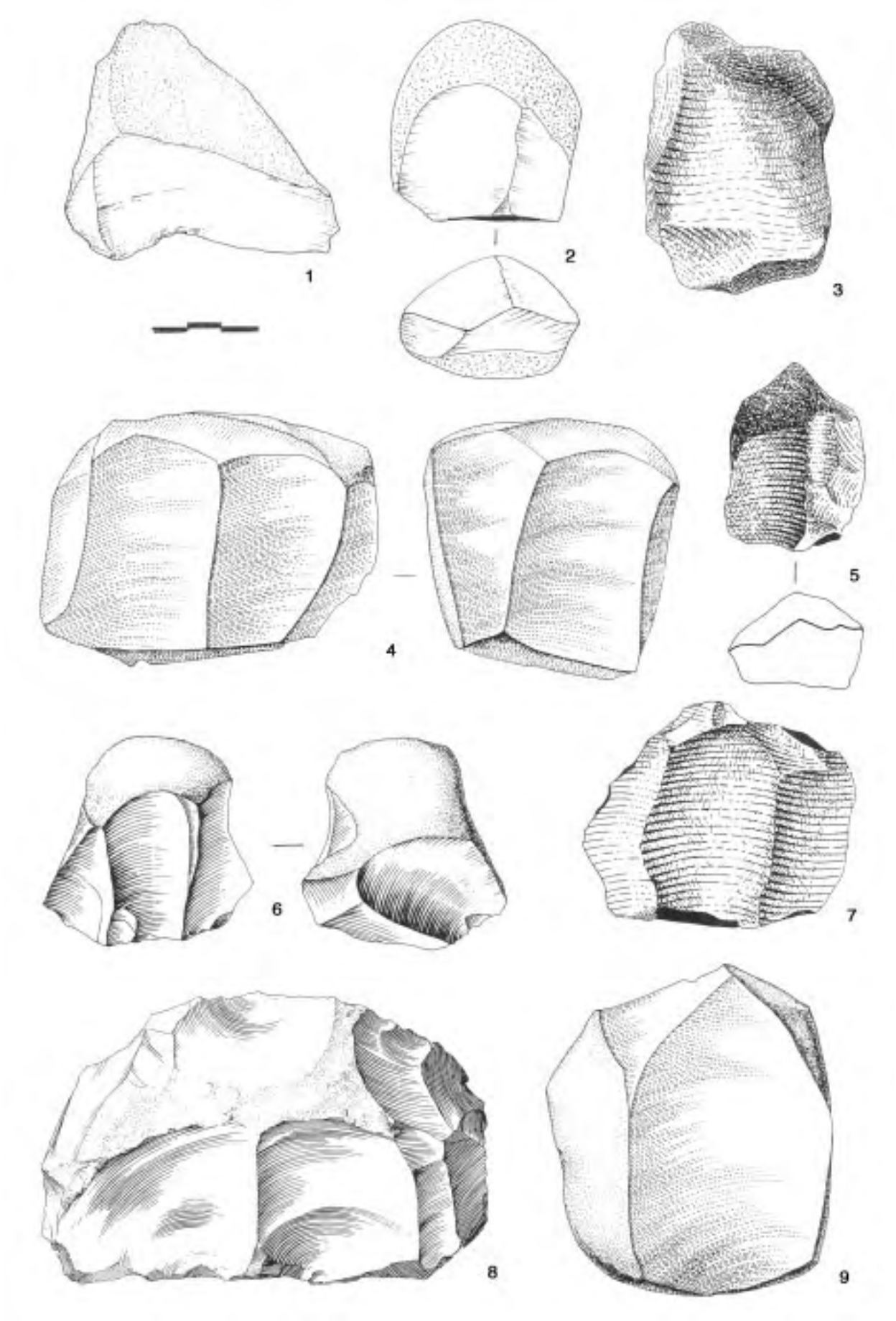

Fig. 32. Gombore I. Lithic industry from Level B. 1-9: unipolar cores; 8 has been reused as lateral chopper. 1-8: obsidian; 9: trachyte. *Drawings by J. Chavaillon (1, 2), J. Gire (3-5, 7,9) and C. Chavaillon (6, 8)*

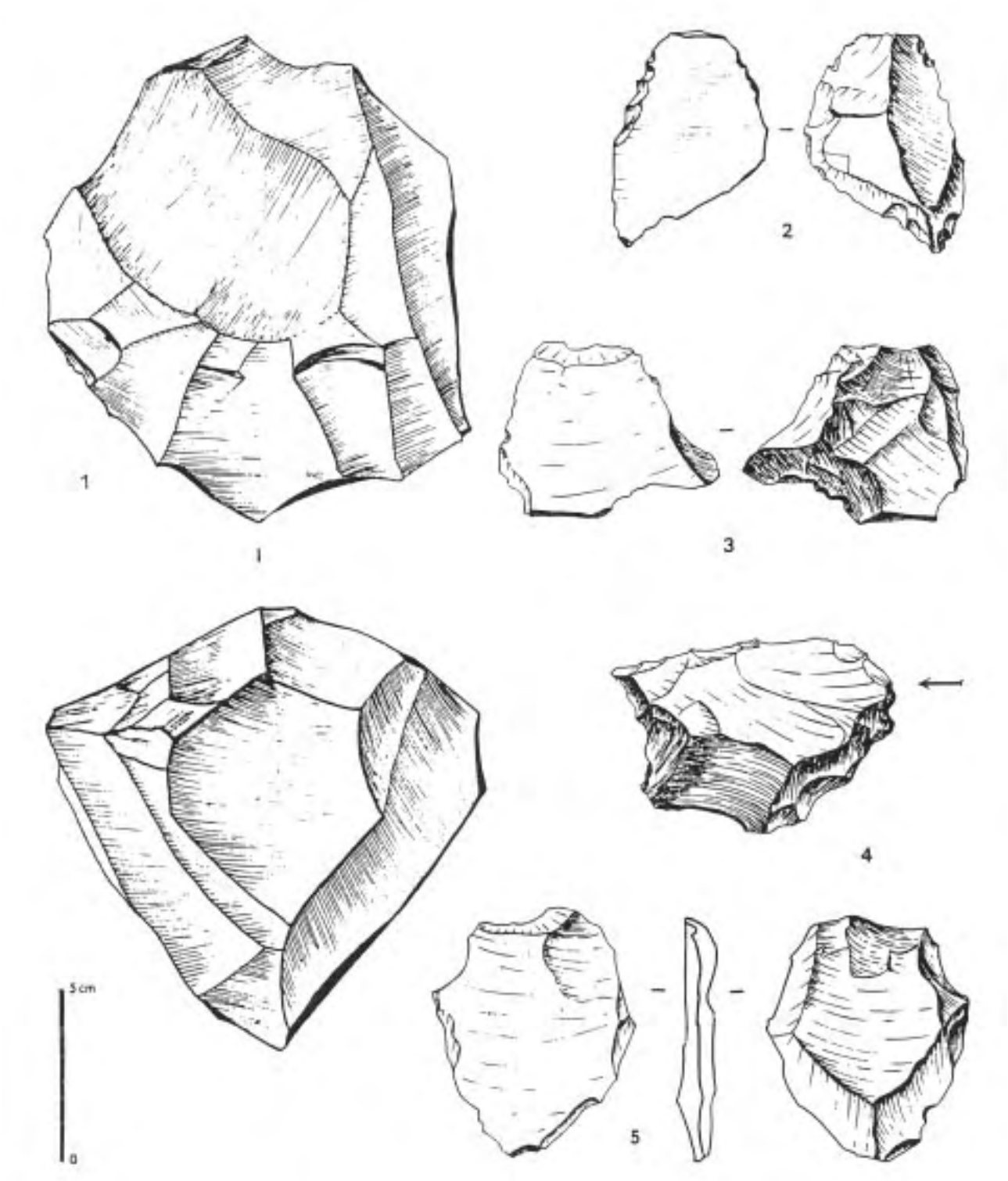

Fig. 33. Gombore I. Lithic industry from Level B. 1: centripetal core; 2: oblique flake with flat butt, slightly denticulate retouch and utilization marks; 3: flake with flat butt (an inverse removal put in evidence a kind of utilized perforator); 4: flake with flat butt; 5: triangular flake with flat butt. 1: obsidian; 2-5: basalt.
Drawing by J. Chavaillon

Cores of this category have been classified according to whether they have traces of a single removal, of a main removal cutting across 2 or 3 smaller removal negatives, or finally, of 4 removals or more. The numbers are as follows:

Removals	Obsidian	Other materials	Total
1 single removal	19	25	**44**
1 main removal	18	13	**31**
2 or 3 removals	18	9	**27**
4 removals or more	2	3	**5**

The comparison between raw materials shows that obsidian cores have, on the whole, yielded more flakes than others.

A - 41% of unipolar cores have yielded a single flake, cutting into cortical areas or with small traces of preparation facets, but occupying the largest part or the whole of the upper face.

The extreme case, and the most simple, is a basalt pebble on which the ventral face is completely cortical and a fracture was used as striking platform to detach a rather long flake (50 mm long and 33 mm wide).

Among flakes so obtained, 26 (59%) have a proportion index of less than 1 (they are wider than they are long).

Proportions	Obsidian	Other materials	Total
Index < 1	10	16	**26**
Very wide	1	3	**4**
Wide		2	**2**
Rather wide	1		**1**
Rather long	5	1	**6**
Long	2	3	**5**

A single flake occupies nearly all the upper surface of the core in 34 cases out of 44; some are slightly plunging (4 cases), whatever the raw material.

B - On 29% of unipolar cores, there is a trace of a main removal, occupying a large part of the upper face, but cutting across traces of small, mostly convergent preparation removals. They are a bit more numerous among obsidian examples.

The proportions of the flakes obtained are not very different from those of the previous category (however there are fewer flakes that are wider than they are long).

Proportions	Obsidian	Other materials	Total
Index < 1	10	6	**16**
Very wide	3	2	**5**
Wide	3	2	**5**
Rather wide		1	**1**
Rather long	1	2	**3**
Long	1		**1**

The illustrated piece is a good example: the ventral face is rounded, keeping a bit of cortex and prepared by some facets, the striking platform is flat and the flake obtained is rather long and rather wide (70 mm).

C - A smaller number (25%) are unipolar cores with the trace of two removals (22% of the cases) or of three removals (3% of the cases), generally parallel or slightly convergent. The raw material is obsidian in two cases out of three. The dimensional proportions of the last flake detached from these cores, when it can be determined, show greater elongation, so:

Proportions	Obsidian	Other materials	Total
Index < 1	5	1	**6**
Very wide		1	**1**
Wide	2	1	**3**
Rather wide			
Rather long	4	3	**7**
Long	3	3	**6**

All the striking platforms are flat except for two that show some small trimming facets. The illustrated core (Fig. 32, *2*) shows two parallel flakes detached from a flat striking platform, the rest of the upper face remaining cortical.

D - Finally, 5 unipolar cores (2 of obsidian) have traces of four parallel removals from a flat striking platform (or cortical in one case), wide or rather long. On one of these pieces negative flake scars are superimposed: after the removal of two flakes, a second blow was given at the same place on each base, yielding small wide flakes.

Striking platforms

They are often hard to study, because of their poor state of preservation. Out of 107 unipolar cores, 57 are still visible:

Striking platform	Obsidian	Other materials	Total
Cortical	6	10	**16**
Flat	17	22	**39**
Dihedral	2		**2**
With facets	1	1	**2**

They are mostly flat (about 65%), the impact has been directed onto a simple natural facet or a fracture; in 27% of the cases the striking platform is cortical. There is little variation in the proportions of these types of striking platforms, whether the core yielded one flake or several.

The preparation of the striking platform before use is thus mostly restricted to obtaining a well-directed facet toward the upper surface.

Bipolar cores

There are 32 bipolar cores (Fig. 34, *1*)and they generally have two opposing striking platforms, sometimes set slightly obliquely in relation to each other, and perpendicularly in only one case.

They differ only slightly from unipolar cores. They often have yielded a single flake from each striking platform, but are sometimes more elaborate.

Two bipolar cores, after first being used as cores, have been retouched on one edge and used as rabots.

Raw material

Out of 32 bipolar cores, there are 20 of obsidian, 11 of basalt or of trachyte and 1 of tuff. Obsidian is more frequent than in the previous category: 62% against 53%.

Dimensions

The smallest obsidian core is 30 mm long. The largest one, 189 mm long, is an oblong block of trachyte that yielded two wide and long flakes, one of which is cut by a small opposing flake. The size categories with the largest numbers are 40-59 mm (rather small) for obsidian, and 80 to 99 mm for other raw materials.

The largest obsidian core is a pebble 109 mm long, with a completely cortical surface, except for two large and very wide opposing removals (dimensions of the last detached flake: 83 x 29 mm). It is the only obsidian object over 100 mm.

Proportions

Elongation

Elongation	**Obsidian**	**Other materials**	**Total**
Very short	2	2	**4**
Short	3	3	**6**
Rather short	5	1	**6**
Rather long	5	5	**10**
Long	5	1	**6**

Bipolar cores occur in all categories, with most being “rather long”. Obsidian bipolar cores are on average more elongated than the others.

Flattening

Flattening	**Obsidian**	**Other materials**	**Total**
Very thick	1	2	**3**
Thick	2	4	**6**
Rather thick	12 (60%)	5 (42%)	**17** (53%)
Rather flat	5	1	**6**

Bipolar cores, like unipolar ones, are mostly “rather thick”, but the proportion is slightly higher than amongst unipolar cores.

Ventral face

The distribution of cortex and facets from negative flake scars was studied on 24 cores as follows:

Upper face	**Obsidian**	**Other materials**	**Total**
Cortical	3	2	**5**
Partial cortex	5	3	**8**
1 or 2 facets	1		**1**
3 or more facets	12	4	**16**

Cortex is present on the ventral face of 13 bipolar cores and completely covers 5. The proportion is slightly higher than for unipolar cores, with 54%.

Trimmed ventral faces, with or without remaining cortex, are present on 17 (13 of obsidian), but those with several preparation facets dominate with 16 cases (12 of obsidian). They are completely trimmed in 5 cases (4 of obsidian).

Upper face

Upper face	Obsidian	Other materials	Total
Partial cortex	2	4	**6**
2 to 3 removals	17	9	**25**
4 removals or more	3	3	**6**

Bipolar cores, like those described above, have kept areas of cortex on the upper face in similar proportions (2 cases of obsidian and 4 in other materials). The two striking platforms are usually opposed (29 case out of 32); one obsidian core has 2 striking platforms perpendicular to one another. Two other pieces show 2 striking platforms set obliquely to one another.

Number of flakes detached from bipolar cores:

Number of flakes	Obsidian	Other materials	Total
2	13	6	**19**
3	4	3	**7**
4 and more	3	3	**6**

The most common case is a core with two opposing striking platforms, having yielded 2 flakes that were detached opposite to and intersecting each another.

An obsidian core, with a completely cortical ventral face, yielded 2 very wide, opposing flakes, with a cortical striking platform. The last detached flake is 83 mm wide and 29 mm in the striking platform axis. It is a simple pebble of obsidian from which 2 very wide flakes were detached without any prior preparation.

Conversely, there are some much more complex cores. One of them, for example, was prepared on the ventral face by several facets; its upper face has 4 flake removals detached from two perpendicular striking platforms (three in one direction cut by a fourth one).

The shape and proportions of flakes detached from bipolar cores can only be judged from the last detached flake or flakes, which distorts the assessment.

These last flakes are often smaller or somewhat unsuccessful. As with unipolar cores, flakes that are wider than they are long, that is to say “very wide”, with the striking platform on the longest side, are noticeably common. For example, there is an oblong pebble of obsidian which yielded 2 very wide flakes from cortical striking platforms. The second flake cuts slightly across the first. These two flakes might constitute good naturally backed knives. Five other cores have similar characteristics.

On the other hand, eight bipolar cores are much more complex. One of basalt yielded 2 parallel-sided blades (l/w index about 2,5) from the same striking platform, and a small flake was attempted on the opposite platform.

The flaking of another piece, with two opposing striking platforms, one flat and the other cortical, yielded 5 successive flakes on one side and at least 2 on the other. The illustrated piece (Fig. 34, *1*) has the scars of 5 removals.

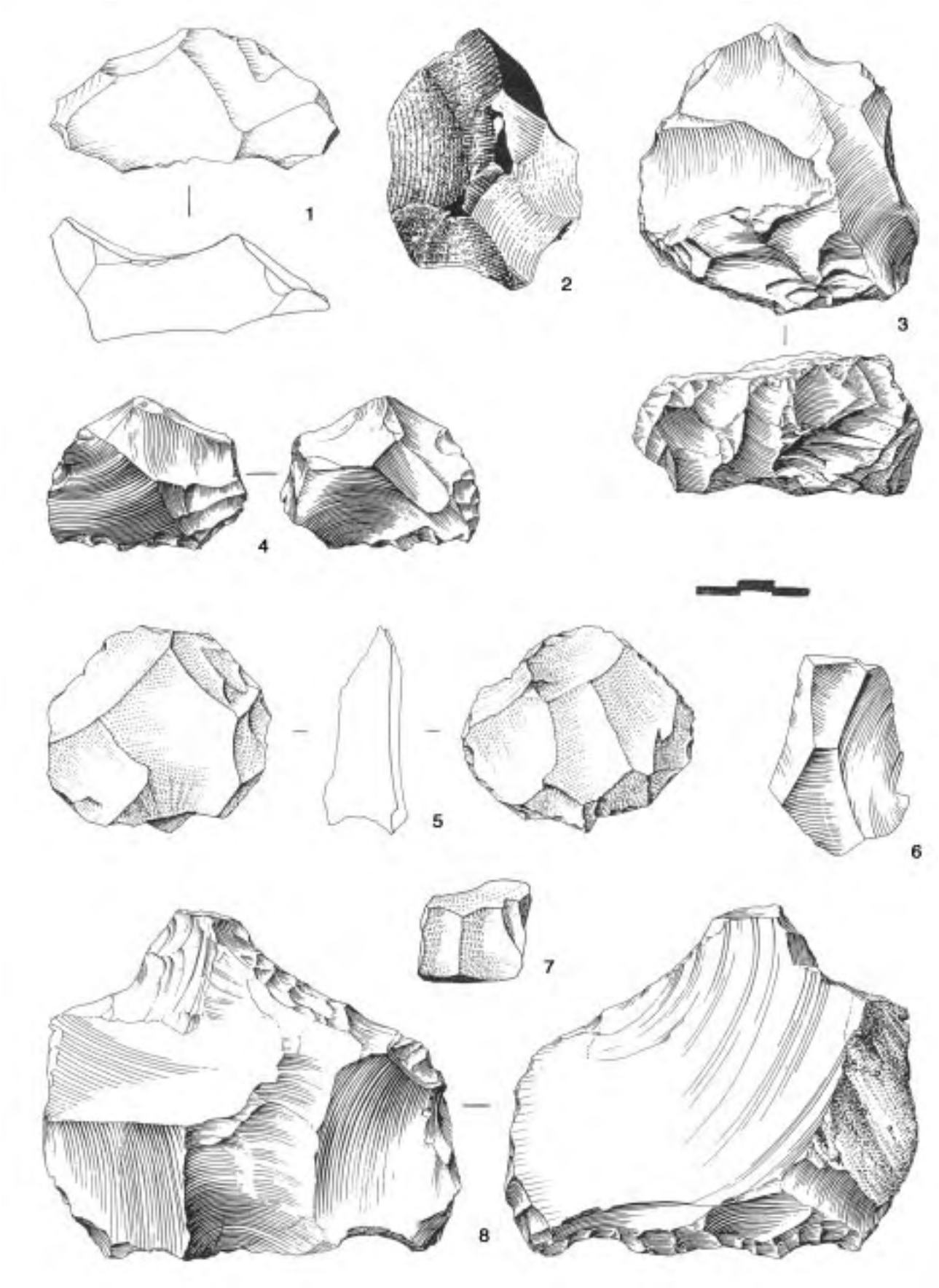

Fig. 34. Gombore I. Lithic industry from Level B. 1: bipolar core; 2-5; centripetal cores; 6: fragment of core; 7: prismatic core; 8: centripetal core successively utilized as concave side-scraper. 1-4, 7, 8: obsidian; 5: basalt; 6: trachyte. *Drawings by J. Chavaillon (1), J. Gire (2), C. Chavaillon (3, 4, 6, 8) and J. Jaubert (5, 7)*

Striking platforms

Striking platforms of bipolar cores are usually barely visible. Clear striking platforms have been found on 16 bipolar cores:

Cortical platforms	9 (7 of obsidian)
Flat platforms	6 (1 of obsidian)
Facetted platforms	1 (of obsidian)

Centripetal cores

On centripetal cores, flakes have been detached from several striking platforms all around the perimeter of the upper face.

They generally have not been used after their function as cores (or there are no traces of secondary utilization).

Exceptionally, one large block of basalt received many impact marks as a passive chopper after yielding 4 large flakes.

Raw material

There are 42 centripetal cores distributed between:

Obsidian	23
Trachyte	10
Basalt	8
Welded ignimbrite	1 (large core)

The proportions are very close to those of unipolar cores, with 54% on obsidian.

Dimensions

The smallest is an obsidian core 32 mm long. The largest, of trachyte, measures 142 mm.

Obsidian cores from 32 to 100 mm long are regularly found distributed among the various categories, while among cores of other materials, those between 80 and 100 mm are the most common.

Proportions

Elongation

Elongation	Obsidian	Other materials	Total
Very short	5	4	**9**
Short	5	6	**11**
Rather short	6	5	**11**
Rather long	6	4	**10**
Long	1		**1**

Centripetal cores are distributed equally between the different categories from “very short” to “rather long”.

Flattening

Flattening	Obsidian	Other materials	Total
Very thick		2	**2**
Thick	3	2	**5**
Rather thick	14	9	**23** (55%)
Rather flat	6	5	**11**
Flat		1	**1**

The "rather thick" category dominates with 55%.

Ventral face

On 12 cores the ventral face is too damaged to be studied:

Ventral face	Obsidian	Other materials	Total
Cortical	1	1	**2**
Partial cortex	3	6	**9**
1 or 2 facets	4	2	**6**
3 or more facets	13 (62%)	7	**20** (54%)

Among the thirteen usable cores, there are two with a completely cortical ventral face and nine (with three of obsidian) which have some cortex. The proportion of cores with cortex on the ventral face drops to 37%. Apart from the cortex, present or not, six have 1 or 2 preparation facets, and most (54%) were trimmed by several facets. Obsidian cores have been more heavily trimmed than the others.

Upper face

Only 4 centripetal cores have retained a cortical area on the upper face:

Upper face	Obsidian	Other materials	Total
Partial cortex	1	3	**4**
3 removals	11	12	**23**
4 removals or more	10	9	**19**

Cores that have yielded three flakes are quite similar; the striking platforms are distributed on the perimeter of the piece, and removals converge toward the centre and more or less intersect each other. The illustrated piece (Fig. 34, *3*) is a good example.

Two cores are a bit different. On one of them, four flakes have been detached from the same edge (the striking platforms are distinct, this is not a unipolar core); they converge toward the centre and cross. The second has 3 striking platforms established on 3 edges, but grouped at one end of the core.

Cores that have yielded four flakes or more have striking platforms distributed around the entire periphery. The total number of detached flakes is, in this category, impossible to establish with certainty, each flake cutting the previous ones; some cores could yield eight or ten flakes before being rejected, mostly among those of obsidian.

On the illustrated piece (Fig. 34, *4*), the ventral face was trimmed by several facets and the upper face yielded at least four flakes, the last of which was "very wide" or "wide" and rather "small". However, some were "long", and there is even the negative of a small "blade" (48 x 18 mm).

Striking platforms

On centripetal cores, the striking platforms are usually flat, sometimes dihedral. It seems that dihedral platforms were not particularly sought after.

Special case

One of the centripetal obsidian cores (Fig. 34, *8*) was reworked by a large removal. One edge was transformed into a concave scraper and the opposite edge was reworked by retouch to form three juxtaposed notches.

Polyhedral cores

There are 50 polyhedral cores that have been flaked on several surfaces. They have yielded flakes from striking platforms distributed without apparent order. They have often been used for other functions as well (11 cases, or 22%).

The most frequent use is as a rabot (7 objects with 4 of basalt, 2 of various volcanic rock and 1 of obsidian). One of the striking platforms is flat and was used as base for one or two rabots. The resharpening of a basalt core yielded a rabot base along three sections of the perimeter. In four cases, a polyhedral core, after the removal of several flakes (up to 11), was used as a polyhedron, as seen in the numerous impact traces on its ridges.

Raw material

The distribution is as follows:

Obsidian	17
Trachyte	9
Basalt	20
Lava	1
Tuff	1
Various	2

Basalts dominate, as well as obsidian.

Dimensions

The maximum length varies according to the raw material:

Dimensions	Maximal length (mm)	Obsidian	Other materials	Total
Small	20 - 39	3	2	**5**
Rather small	40 - 59	6		**6**
Average	60 - 79	4	4	**8**
Rather large	80 - 99	3	7	**10**
Large	100 - 119		12	**12**
«	120 - 139		6	**6**
«	140 - 159	1	1	**2**
Very large	160 - 180		1	**1**

There is a clear disparity between obsidian cores and those on blanks of other rocks.

Among the former, a large block of obsidian (2 kilos) is different because it yielded a few flakes that were detached in several directions; the other objects of obsidian are distributed among the different categories, the smallest measures only 31 mm and the "rather large" are 80 to 99 mm. The most common category is that of "rather small" (40 to 59 mm). The largest obsidian core measures 86 mm long.

For cores in other materials, the dominant category is from 100 to 139 mm. The largest measures 172 mm.

Proportions

Elongation

Elongation	Obsidian	Other materials	Total
Very short	3	9	**12**
Short	5	9	**14**
Rather short	5	9	**14**
Rather long	3	6	**9**
Long	1		**1**

The distribution is homogenous and is centred around "short" cores.

Flattening

Flattening	Obsidian	Other materials	Total
Very thick	5	18	**23**
Thick	7	14	**21**
Rather thick	4	1	**5**
Rather flat	1		**1**

"Very thick" and "thick" dominate. "Very thick" polyhedral cores look like polyhedrons. However, they lack crushing or scaling on ridges which would be a sign of utilization. They have often yielded fine flakes.

Cortex

Three obsidian cores and 14 in other materials (or 34%) have cortical areas. These areas are rarer on obsidian cores than on others, where they are present on 42%.

In five cases, the cortex covers an important part of the surface of the piece and was used as a striking platform for the removal of some flakes.

Results of flaking

The number of flakes detached from polyhedral cores is very variable: some have yielded from 3 to 6 usable flakes, cutting prior facets, or are cut by smaller flakes that have failed in some way.

The number of facets or of removal traces can reach 22. They intersect without order and have sometimes yielded fine flakes, generally wide or very wide.

Number of flake scars	Obsidian	Other materials	Total
3 to 6	6	13	**19**
7 to 9	1	6	**7**
10 to 12	4	7	**11**
13 to 15	2	2	**4**
19 to 22	1	2	**3**

On six other cores the poor state of portions of the surface does not allow the facets to be counted.

Striking platforms

Most striking platforms on polyhedral cores are flat, and some are dihedral. In some cases resharpening was done and a flake has cut previous flakes scars. From the resulting surface, new flakes have been detached.

These cores have yielded fine flakes that are sometimes long.

Prismatic cores

There are only a few prismatic cores (11, with 2 of obsidian). From the ventral face, usually the result of a large removal (sometimes a natural facet), flakes have been detached that more or less converge towards the opposite side of the piece.

The particular shape of these cores, after flaking, often led to them being used as rabots, as is the case in four examples.

Raw material

Obsidian	2 or only 18%
Basalt	4
Trachyte	5

Dimensions

Dimensions	Maximum length (mm)	Obsidian	Other materials	Total
Small	20 - 39	1	1	**2**
Rather small	40 - 59			
Average	60 - 79			
Rather large	80 - 99		6	**6**
Large	100 - 119	1	1	**2**
«	120 - 140		1	**1**

They are usually between 80 and 99 mm, with two small cores of 30 and 33 mm. Three cores are over 100 mm and the largest reaches 123 mm.

Proportions

Elongation

Elongation	Obsidian	Other materials	Total
Very short	1	1	**2**
Short		5	**5**
Rather short	1	2	**3**
Rather long		1	**1**

They are mainly “short” or “rather short” cores.

Flattening

Flattening	Obsidian	Other materials	Total
Very thick		6	**6**
Thick	2	2	**4**
Rather thick		1	**1**

These polyhedral cores are mainly “very thick” or “thick”.

Cortex

Areas of cortex are comnmon: seven cores have retained some and six have a large cortical surface.

One characteristic piece (Fig. 34, *7*) is an obsidian pebble with a large removal that has created a flat surface from which 4 parallel “long” or “rather long” flakes have been detached. There is no trace of re-use as a rabot.

Others have been flaked many times creating stepped negative flake scars; one of them has been used as a rabot as well.

Results of flaking

Most prismatic cores yielded 4 to 6 usable flakes. On two pieces, there are at least 10 removals, among the last of which are traces of use as a rabot.

Pyramidal cores

They are 8, one of which is of obsidian. Quite similar to those described above, they are distinguished by the fact that flake removals converge. Two pyramidal cores have been used as active hammerstones, one in the point area, the other on one edge.

Dimensions

Dimensions	Maximum length (mm)	Obsidian	Other materials	Total
Rather small	40 - 59		2	**2**
Average	60 - 79		2	**2**
Rather large	80 - 99			
Large	100 - 119		2	**2**
«	120 - 139	1		**1**
«	140 - 160		1	**1**

Their dimensions range from 45 mm for the smallest to 143 mm for the largest. The only obsidian core is a very fine piece.

Proportions

Elongation

Elongation	Obsidian	Other materials	Total
Very short	1	4	**5**
Short		2	**2**
Rather short			
Rather long		1	**1**

They are “very short” or “short”; the only elongated core is in fact a bipyramidal core.

Flattening

Flattening	Obsidian	Other materials	Total
Very thick	1	5	**6**
Thick		2	**2**

They are also all “thick” (2) or “very thick” (6).

Cortex

Except for the obsidian core, all have retained some cortex which either forms the base from which flakes have been detached (5 cases), or covers fairly large areas.

Results of flaking

Between 3 and 9 flakes have been detached from each of the 7 basalt cores and they converge towards the extremity (or both extremites for one of them). The very fine obsidian core, on the other hand, yielded at least 24 flakes (Fig. 33). This is the piece that was described at the beginning of this chapter.

Conclusions

Cores at Gombore I are very varied. In fact they include every core type found in the Acheulian or in Middle Stone Age industries, except for the Levallois technique which is completely absent.

They have yielded hundreds of flakes that were used as they were, retouched or transformed into tools such as scrapers. However, it should be remembered that there are only 250 cores which is a low number when compared with the tools on pebble of every kind that surrounded them.

On the Gombore I Oldowan level, the number of cores does not exceed 11 per square metre in the zone of highest concentration. There are more often only 1 or 2, or even none at all.

Débitage products

They are 2100 pieces, distributed as follows:

Raw flakes	648
Raw flake fragments	397
Utilized flakes	413
Utilized flake fragments	103
Retouched flakes	133
Retouched flake fragments	51
Tools on flake	355

Flakes will first be studied as a group (raw, used or retouched) as the products of flaking.

Flakes

As has already been pointed out in the study of cores, it is sometimes difficult to distinguish a true core, that is to say an object prepared for the purpose of yielding usable flakes, from, for example, a poly-

hedron prepared for a particular use and which, in the course of preparation, yielded waste products or flakes, some of which were usable.

The study of flakes (Figs. 35; 36, *1-7*) is equally ambiguous: how can one know whether a given flake came from a core that was deliberately flaked to obtain flakes, or whether it is only a by-product of the manufacture of another object such as a polyhedron or hammerstone? Some well-shaped flakes that are regular, often elongated and even lamellar, leave no doubt as to their origin; but others are of a size and shape that is unusual in flake industries. On average, about 34% of flakes are "wider than long". The length of a flake is usually measured from its platform in line with the flaking axis. But here, in 34% of the cases, this dimension is lower than the perpendicular measurement. Thus a lamellar flake (l/w ratio between 1,6 and 2,19) can have a platform in the middle of one of its lateral edges, although this did not prevent many of them from being used or retouched. There are 1194 whole flakes with 551 flake fragments. Many of them have been used (their edges are blunted, scaled or crushed) and some have been casually retouched (flat or more abrupt retouch, scattered on the edges or grouped in small patches, does not necessarily qualify then as "tools" or "pieces"). The distribution according to raw materials is:

Types	**Obsidian**		**Other materials**		**Total**	
	N	%	N	%	N	%
Raw flakes	306	54.5	342	54.0	**648**	54.5
Utilized flakes	190	34.0	223	35.0	**413**	34.5
Retouched flakes	65	11.5	68	11.0	**133**	11.0
Total	**561**		**633**		**1194**	

The percentage of used or retouched flakes hardly varies according to the raw material used. The total flake category is analysed together first, followed by the particular sub-categories of used and retouched flakes.

Raw material

Obsidian	561 (47%)
Basalt	355
Trachyte	173
Lava	12
Tuff	89
Various	4

There are fewer flakes of obsidian than other raw materials. At 48%, the percentage is very close to that of obsidian cores.

Dimensions: 1167 flakes

Dimensions (mm)	**Obsidian**	**Other materials**	**Total**	**%**
Very small flakes < 20	3		**3**	0.2
Small flakes 20-39	275	105	**380**	32.5
Rather small flakes 40-59	151	275	**426**	36.5
Average flakes 60-79	83	172	**255**	22.0
Rather large flakes 80-99	15	55	**70**	6.0
Large flakes 100-149	8	18	**26**	2.2
Very large flakes > 150		7	**7**	0.6
Total	**535**	**632**	**1167**	

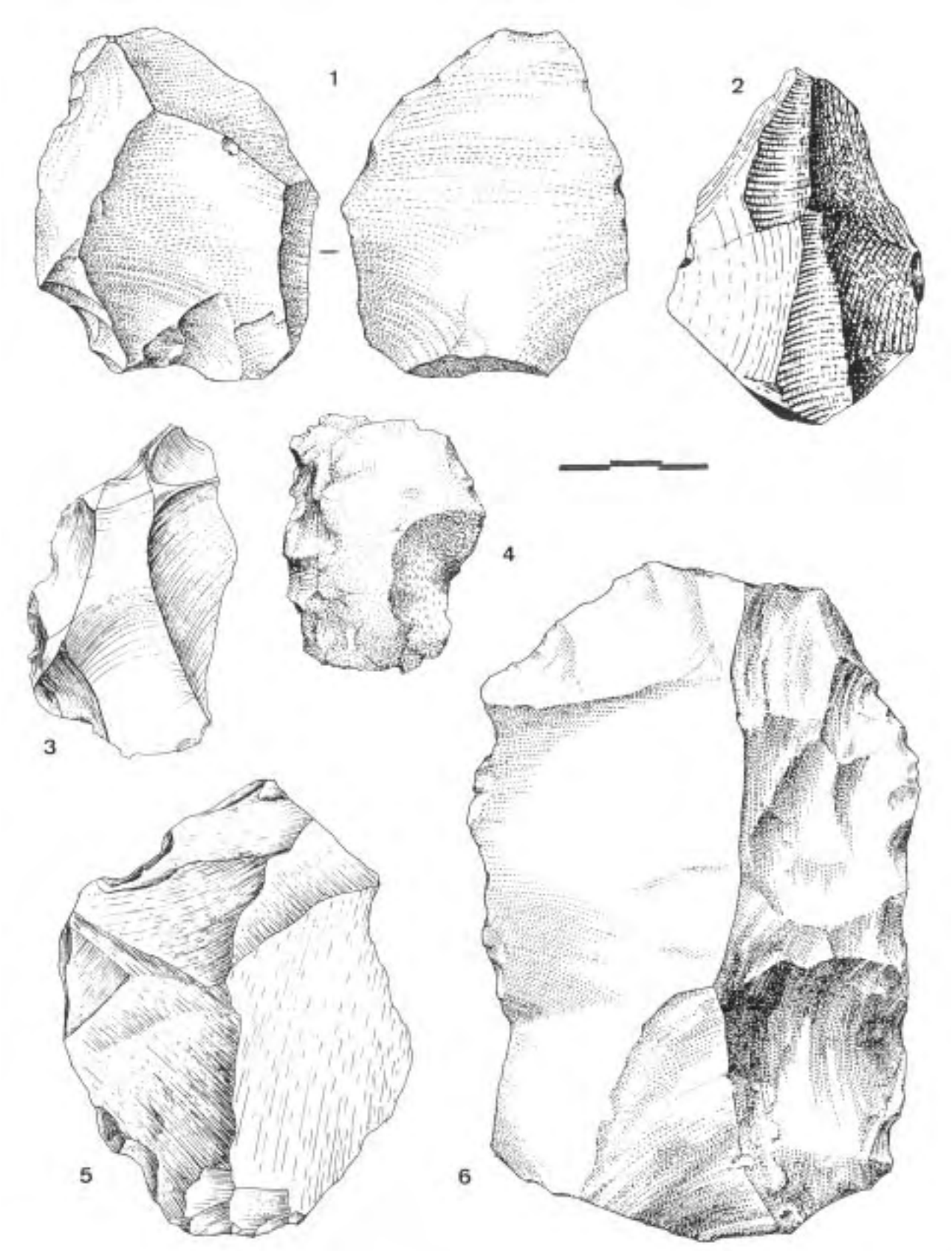

Fig. 35. Gombore I. Lithic industry from Level B. 1-6: unmodified flakes. 1, 2, 4, 6: basalt; 3, 5: obsidian. *Drawings by J. Jaubert (1, 4), J. Gire (2), M. Bouhey (3, 5) and C. Chavaillon (6)*

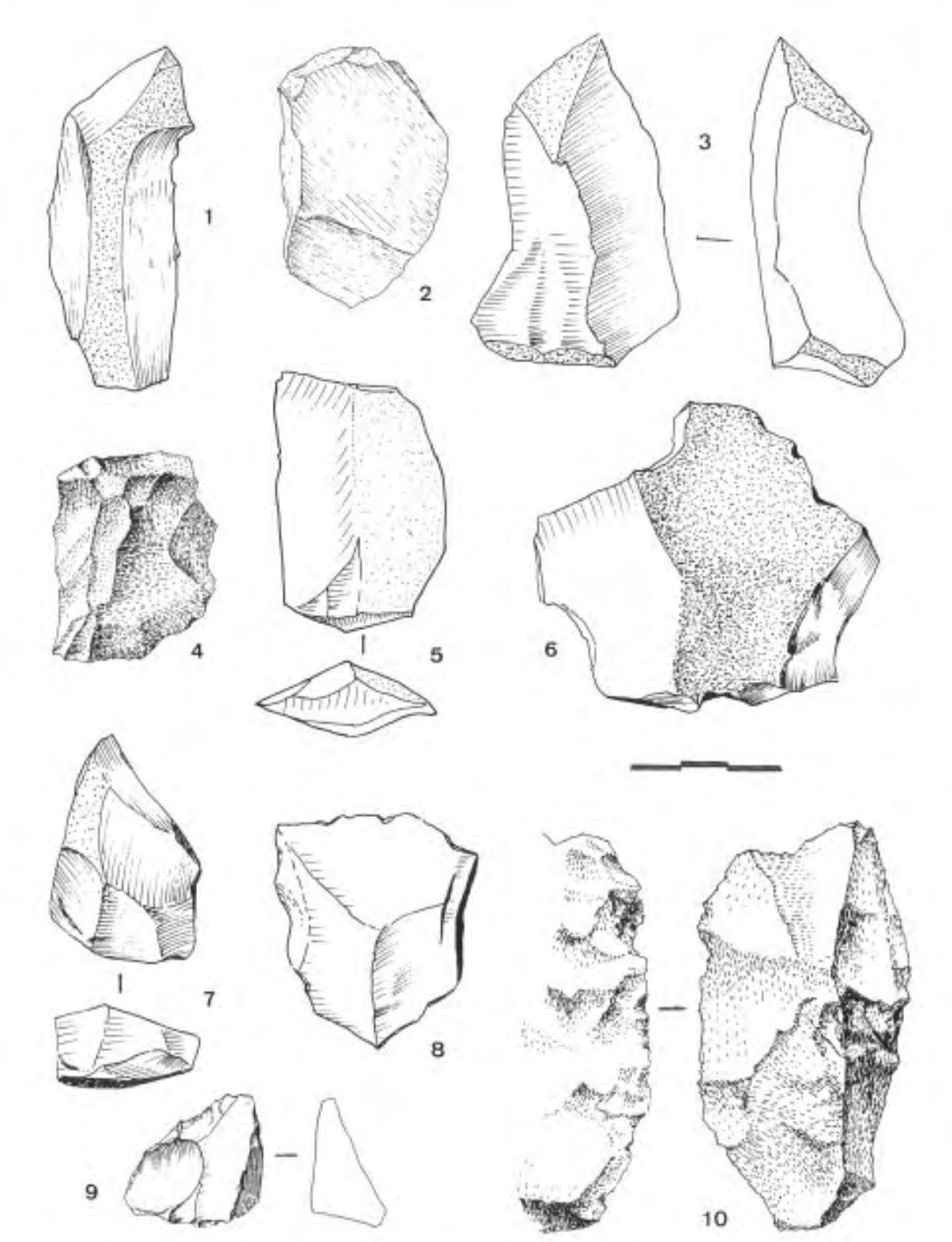

Fig. 36. Gombore I. Lithic industry from Level B. 1-7: unmodified flakes; 8-10: utilized flakes. 1-3, 6-8: basalt; 4-10: trachyte; 5, 9: obsidian. *Drawings by J. Chavaillon (1-3, 5-8), J. Jaubert (4, 10) and C. Chavaillon (9)*

The most common categories shift according to raw material, obsidian flakes usually being between 20 and 60 mm long, while those in other materials are between 40 and 80 mm.

Proportions: 1165 flakes

The first thing to take into account is the orientation of the flaking axis in relation to the largest dimension of the flake.

In the first case, the length of the flake more or less coincides with the axis passing through the platform of the flake. This is the case for 768 flakes (66%) with 341 of obsidian and 427 in other materials.

In the second case, the flake is conversely "wider than long", the length being more or less perpendicular to the platform axis in 397 cases or 34%, with 191 obsidian and 206 other materials.

Therefore the maximum length of 34% of the flakes is perpendicular to the flaking axis. Among these, obsidian flakes are slightly more common than others (36%).

On the other hand, whatever the orientation of flake lengths, they are distributed in six categories according to proportions from very wide flakes with a l/w index close to 1, to the exceptional blade.

The following table concerns 1148 flakes:

L\w	Obsidian	Other materials	Total	%
Very wide flakes	48	64	**112**	9.5
Wide flakes	66	81	**147**	13.0
Rather long flakes	106	156	**262**	23.0
Long flakes	202 (38%)	213 (34%)	**415**	36.0
Lamellar flakes	98	96	**194**	17.0
Blades	9	9	**18**	1.5

The range of proportions is quite wide but centres on long flakes, which make up 36% of the total.

Striking platforms: 600 flakes

Striking platform	Obsidian	Other materials	Total	%
Punctiform/linear	75	34	**109**	18.0
Cortical	15	53	**68**	11.5
Flat	153 (57%)	222 (67%)	**375**	2.5
Dihedral	25	23	**48**	8.0

Flat platforms are the most common, especially in materials other than obsidian.

The angle formed by the platform and the ventral face could be measured on 494 flakes. Punctiform and linear platforms have no angle and on cortical platforms the angle is usually difficult to measure. Lastly there are flat and dihedral platforms, the former being in the majority.

Angle	Obsidian	Other materials	Total	%
< 89°	5	11	**16**	3.2
90 - 99°	30	49	**79**	15.9
100 - 109°	50	88	**138**	27.9
110 - 119°	66	87	**153**	30.9
120 - 129°	48	49	**97**	19.6
> 130°	9	2	**11**	2.2
Total	**208**	**286**	**494**	

Flaking angles are usually between 100° and 120°, while dihedral platforms have an angle that is on average slightly lower than that of flat platforms (40% have an angle between 100° and 109°).

Upper face: 1194 flakes

The upper face of some flakes is completely covered with cortex, but those that retain one or more areas of cortex are more common.

Cortex	Obsidian	Other materials	Total
Total cortex	11	152	**163**
Partial cortex	50	164	**214**
Total	**61**	**316**	**377**

There is a considerable difference between obsidian flakes and those in other materials: only 16.18% of the former have kept some cortex and 2.91% are completely cortical. However, a quarter of the flakes in other materials have cortical areas and in another quarter cortex covers the entire upper surface.

This difference clearly arises from the fact that obsidian was found some distance from the site and blocks had to be prepared at the source, while trachyte or basalt pebbles were found in the immediate vicinity and were trimmed on the site.

Besides the presence or absence of cortex, the upper face of the flakes is flat (that is to say formed by a single non-cortical facet), or it has two or more preparation facets.

This analysis was carried out on 1000 flakes. Besides those with entirely cortical surfaces, about thirty flakes have an upper face that has been altered too much for the flakes to be counted.

Upper face	Obsidian	Other materials	Total	%
Flat	30	24	**54**	5.4
With two facets	71	64	**135**	13.5
With several facets	421	390	**811**	81.1
Total	**522**	**478**	**1000**	

The great majority of flakes (81%) have an upper face with several facets resulting from core preparation, or prior facets from a polyhedron or some other flaked piece from which they were made, regardless of the raw material.

Some conclusions can be drawn from this analysis of 1194 flakes from Gombore I B.

- Obsidian brought to the site, and other raw materials found on the spot as pebbles, have been used in very similar proportions (47% for obsidian).
- Flake dimensions are generally between 20 and 80 mm, and are slightly smaller for obsidian. Smaller or larger objects represent only 9% of the total.
- In 34% of cases, the flaking axis does not correspond to the largest dimension which is often perpendicular to this axis. It is certain that many flakes do not come from core flaking, but from the preparation of tools on pebble such as polyhedrons and others.
- “Long” or “rather long” flakes are the most common, but nearly 10% are “very wide” flakes (nearly as wide as long) and 17% are “lamellar” flakes; the proportions are very varied.
- Flat platforms clearly dominate; when cortical platforms, including those with a single facet, are added the total goes up to 74%.
- The angle formed by the platform and the ventral face is obtuse (59% between 100° and 120°) and can exceed 130°.

- The study of the upper face shows that obsidian was brought onto the site as ready-trimmed blocks, while other raw materials, coming from pebbles, were found and trimmed on the spot. Usually this upper face has several facets (81%) that are traces of preparation before flaking.

These 1194 flakes often remain in the raw state, but some have been used (413, or 34.5%) or retouched (133, or 11%).

Utilized flakes: 413

These flakes (Figs. 36, *8-10*; 37; 38, *1-3*; 39, *1*, *5*, *8*) have scaling on the edges, traces of crushing, or sometimes working edges that are clearly blunted.

Raw material

	N	%
Obsidian	190	46
Basalt	148	36
Trachyte	46	11
Lava	2	
Tuff	26	6
Various	1	

The percentages of utilized flakes compared with the total assemblage hardly vary, regardless of raw materials. Basalt is slightly more common with 36% of utilized flakes against 30% for the total.

Obsidian at 46% is similar in proportion to other materials.

Dimensions: 412 flakes

Dimensions	**Obsidian**	**Other materials**	**Total**	**%**
Very small	1		**1**	
Small	95 50%	27	**122**	29.6
Rather small	53	77 35%	**130**	31.5
Average	33	81 37%	**114**	27.6
Rather large	5	24	**29**	7.0
Large	3	8	**11**	2.6
Very large		5	**5**	1.2
Total	**190**	**222**	**412**	

Proportions: 404 flakes

The length is measured along the platform axis for 298 flakes or 72.5%, and the proportions are nearly the same for both obsidian (71%) and other materials (73.5%). Flakes on which length is nearly perpendicular to the platform axis represent about 28% (slightly more for obsidian with 29.5%). This proportion is lower than that of total flakes (34%). The distribution of length along the platform axis on 404 flakes is as follows:

Proportions	**Obsidian**	**Other materials**	**Total**	**%**
Very wide	20	24	**44**	10.8
Wide	30	30	**60**	14.8
Rather long	38	63	**101**	25.0
Long	62	72	**134**	33.1
Lamellar	33	28	**61**	15.0
Blades	2	2	**4**	0.9
Total	**185**	**219**	**404**	

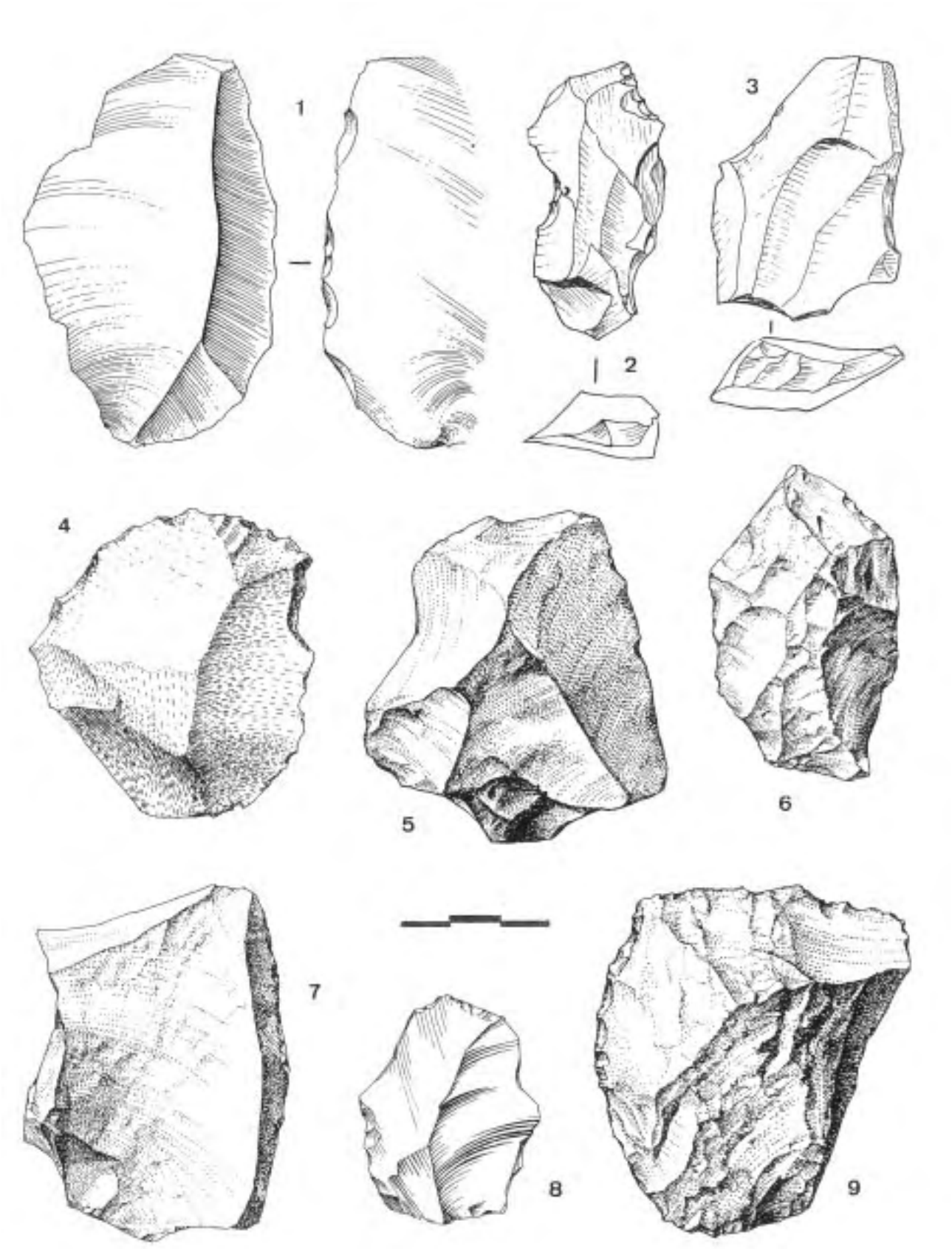

Fig. 37. Gombore I. Lithic industry from Level B. 1-9: utilized flakes. 1, 3, 8: obsidian; 2: jasper; 4-7, 9: basalt.
Drawings by C. Chavaillon (1, 5-9), J. Chavaillon (2, 3) and J. Jaubert (4)

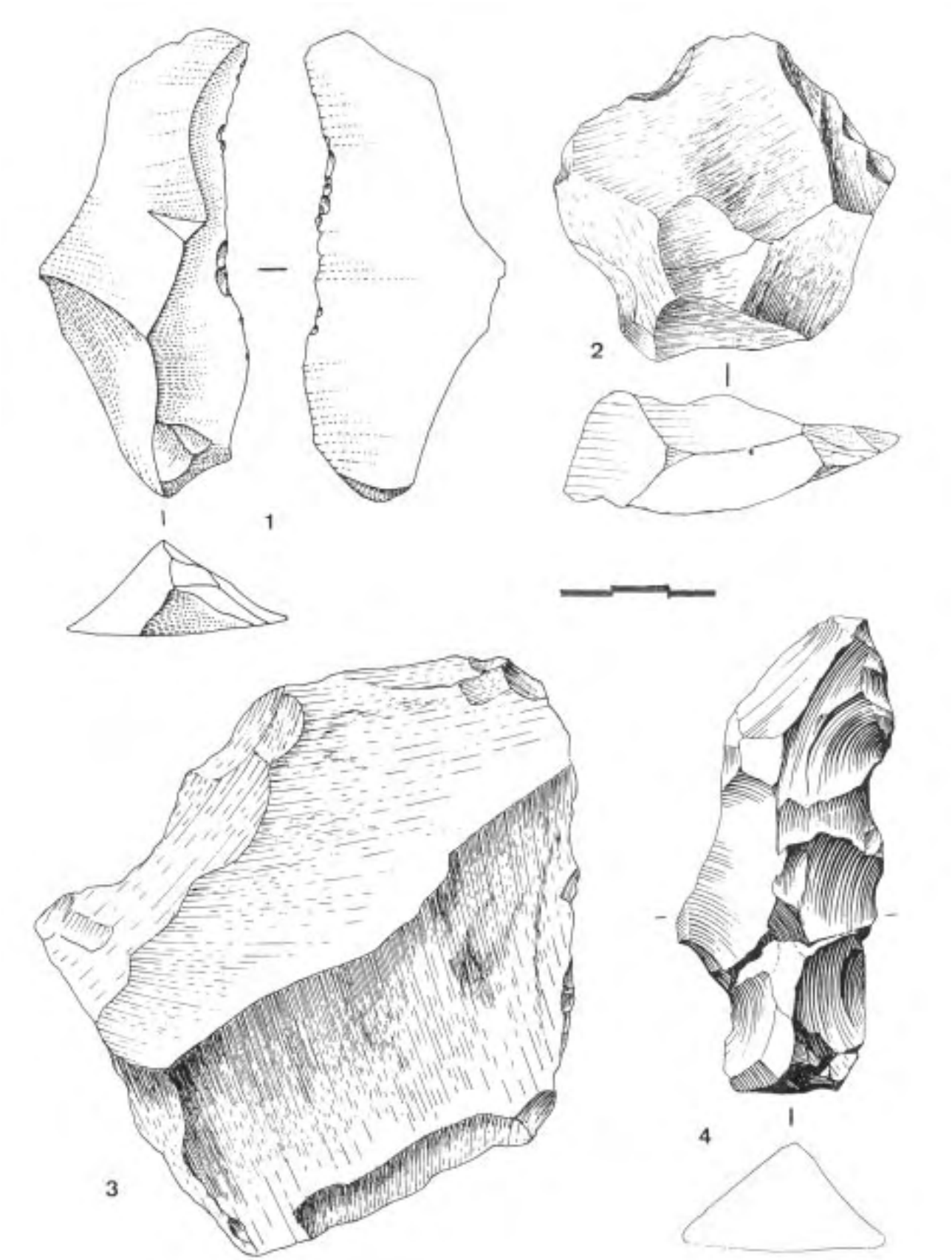

Fig. 38. Gombore I. Lithic industry from Level B. 1-3: utilized flakes; 4: crested blade. 1-3: basalt; 4: obsidian.
Drawings by J. Jaubert (1), J. Chavaillon (2, 3) and C. Chavaillon (4)

Proportions vary slightly in comparison with total flakes; on average, they are a little wider.

Striking platforms: 303 flakes

Striking platform	Obsidian	Other materials	Total	%
Punctiform/linear	31	20	**51**	17.0
Cortical	7	20	**27**	9.0
Flat	83	116	**199**	65.5
Dihedral	9	17	**26**	8.5
Total	**130**	**173**	**303**	

There is little difference when compared with total flakes, but flat platforms are slightly more common.

Platform angle: 225 flakes

Angle	Obsidian	Other materials	Total	%
< 89°		3	**3**	1.3
90 - 99°	11	15	**26**	11.5
100 - 109°	25	50	**75**	33.3
110 – 119°	34	50	**84**	37.3
120 – 129°	19	18	**37**	16.5
> 130°				
Total	**89**	**136**	**225**	

There is no significant difference when compared with total flakes.

Upper face

Presence or absence of cortex on 404 flakes:

Cortex	Obsidian	Other materials	Total	%
Total		41	**41**	10.1
Partial	13	64	**77**	19.0

There is a slight diminution in the presence of cortex on utilized flakes, especially for flakes with a completely cortical upper face.

Facets of the upper face on 363 flakes:

Upper face	Obsidian	Other materials	Total	%
Flat (not cortical)	10	5	**15**	4.1
With two facets	25	25	**50**	13.7
With several facets	145	153	**298**	82.0
Total	**180**	**183**	**363**	

The upper faces of utilized flakes are hardly distinguishable from those in the total assemblage.

It appears that the users did not make a choice between the flakes available to them, but just used what was at hand.

Retouched flakes: 133

The Oldowan toolmakers at Gombore I retouched 133 flakes (Figs. 39, *2*, *3*, *6*, *7*; 40). Retouch is direct or inverse, flat or more abrupt, clustered or not, and on one or more edges, but these objects cannot be classified amongst pieces.

Raw material

	N	%
Obsidian	65	49.0
Basalt	34	25.5
Trachyte	27	20.3
Lava	2	1.5
Tuff	5	3.7
Various	0	

There are 49% of obsidian and 51% of other materials. Obsidian flakes have been retouched slightly more often than the total flakes.

Dimensions: 133 flakes

Dimensions	**Obsidian**	**Other materials**	**Total**	**%**
Very small				
Small	28	4	**32**	24.0
Rather small	18	21	**39**	29.3
Average	14	26	**40**	30.0
Rather large	1	10	**11**	8.3
Large	4	5	**9**	6.9
Very large		2	**2**	1.5
Total	**65**	**68**	**133**	

The comparison of flake lengths indicates some selection. Small flakes, less than 40 mm, represent 32.5% of total flakes, 32% of utilized flakes and 24% of retouched flakes. Conversely, large and very large flakes (more than 100 mm) go from 2.8% of the total to 8.4% of retouched flakes.

Proportions: 132 flakes

There are 85 flakes, comprising 64.4%, on which maximum length is along the platform axis. There is little difference in the percentages for obsidian and other materials. It seems that this trait was not selected for utilization.

The l/w ratio was measured on 132 flakes:

Proportions	**Obsidian**	**Other material**	**Total**	**%**
Very wide	5	7	**12**	9.0
Wide	5	14	**19**	14.4
Rather long	12	21	**33**	25.0
Long	29	17	**46**	34.8
Lamellar	11	8	**19**	14.4
Blades	2	1	**3**	2.3

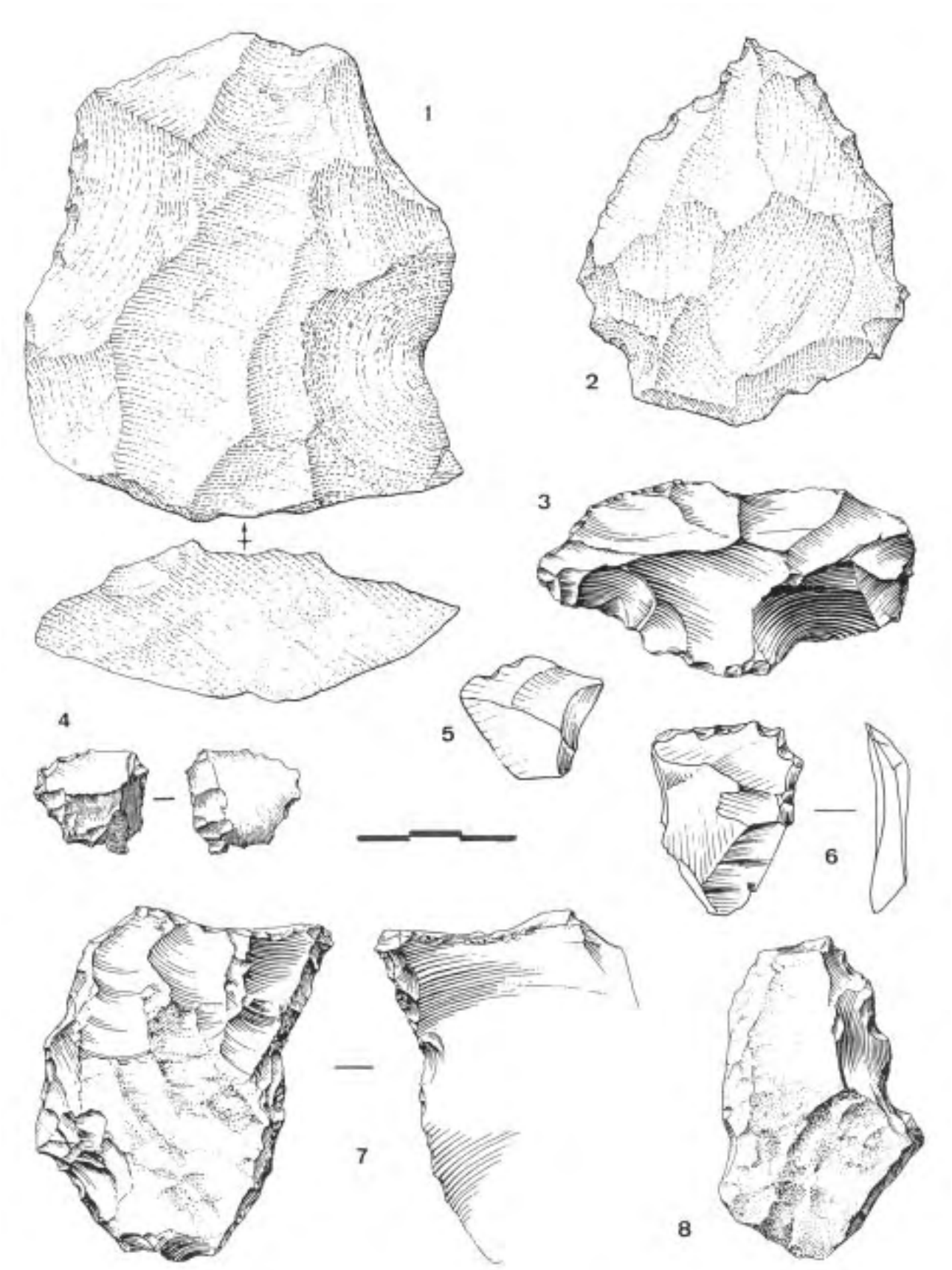

Fig. 39. Gombore I. Lithic industry from Level B. 1, 5, 8: utilized flakes; 2: retouched flake; 3: very large retouched flake; 4: utilized flake with partial inverse retouch; 6: distally retouched flake; 7: retouched flake with direct and inverse retouches. 1, 2: basalt; 3-8: obsidian. *Drawings by J. Jaubert (1, 2), C. Chavaillon (3, 4, 7, 8) and J. Chavaillon (5, 6)*

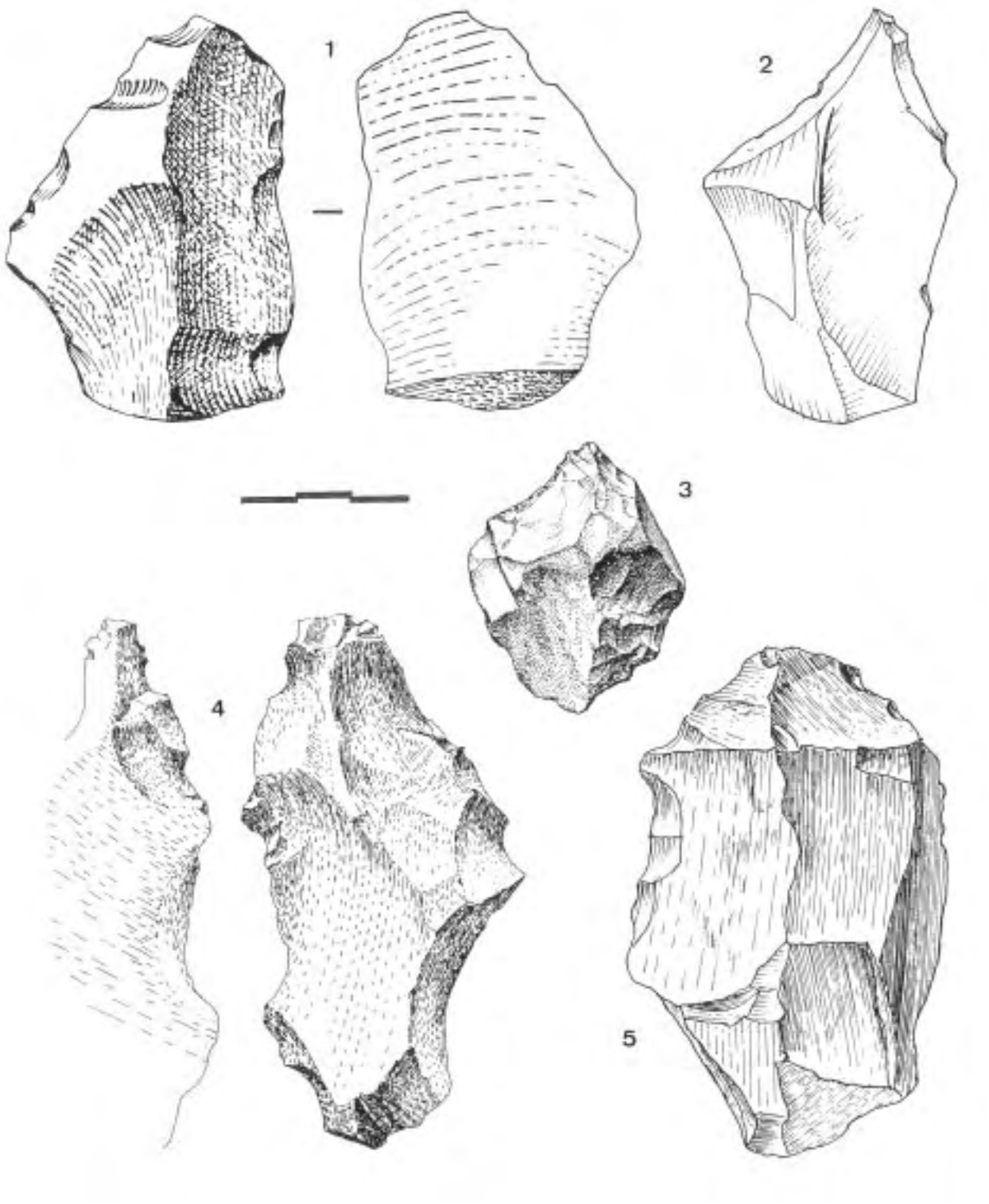

Fig. 40. Gombore I. Lithic industry from Level B. 1-5: retouched flakes. 1, 3, 4: basalt; 2, 5: obsidian. *Drawings by J. Gire (1), J. Chavaillon (2, 5), C. Chavaillon (3) and J. Jaubert (4)*

Long or rather long flakes always dominate.

Striking platforms: 94 flakes

Striking platform	Obsidian	Other materials	Total	%
Punctiform/linear	15 (43%)	2	**17**	18.0
Cortical		16	**16**	17.0
Flat	17	38	**55**	58.5
Dihedral	3	3	**6**	6.5
Total	**35**	**59**	**94**	

The percentage of retouched flakes with a punctiform or linear platform is curious. Whereas it is 17% for all obsidian flakes, it goes up to 28% for utilized flakes and up to 43% for retouched flakes. The examination of these flakes shows no other common characteristic that distinguishes them. Retouched obsidian flakes with a flattened platform (only 35) are also of interest.

However flat platforms are the most abundant in all cases.

Platform angle: 68 flakes

Angle	Obsidian	Other material	Total	%
< 89°		4	**4**	6.0
90 - 99°	2	17	**19**	28.0
100 - 109°	5	10	**15**	22.0
110 - 119°	3	12	**15**	22.0
120 - 129°	6	4	**10**	14.7
> 130°	3	2	**5**	7.3
Total	**19**	**49**	**68**	

The platform angles are distributed without clear dominance of any one class (as among flakes in general).

Upper face

Presence or absence of cortex: on 133 flakes

Cortex	Obsidian	Other materials	Total	%
Total	2	19	**21**	15.7
Partial	10	17	**27**	20.3

The fact that a flake had an upper face completely covered with cortex was not an obstacle to use.

These cortical flakes represent 13.5% of all flakes, 10% of the utilized flakes and 16% of the retouched flakes, setting aside obsidian flakes with 2%, 0% and 3% respectively.

Number of removals on the upper face: 109 flakes

Upper face	Obsidian	Other materials	Total	%
Flat (not cortical)	5	8	**13**	12.0
With two removals	11	6	**17**	14.0
With several removals	46	33	**79**	72.5
Total	**62**	**47**	**109**	

Flakes with several removals on the upper face are always the most common.

Oldowan toolmakers at Gombore I used four different rocks: obsidian, basalt, trachyte and, more rarely, tuff. The quality of the obsidian led them to go and collect this raw material several kilometres away from the site. They trimmed and prepared it at the extraction source, which explains why a portion of the obsidian preparation flakes are missing in the counts. Obsidian yielded 48% of trimmed flake pieces, basalt 31.5%, trachyte 13% and tuff 6.5%.

Finally, the use rate of different raw materials is as follows (in %) on 1489 flakes:

Raw material	Unmodified flakes	Utilized flakes	Retouched flakes	Pieces on flake
Obsidian	42	26	9	24
Basalt	37	32	7	24
Trachyte	53	24	14	9
Tuff	59	26	5	9

Flake fragments: 551

They are distributed as follows:

Flake fragments	Obsidian	Other materials	Total
Raw	216	181	**397**
Utilized	57	46	**103**
Retouched	34	17	**51**
Total	**307**	**244**	**551**

Raw material

	N	%
Obsidian	307	56.0
Basalt	166	30.0
Trachyte	47	8.5
Lava	3	0.5
Tuff	25	4.5
Various	3	0.5

The proportion of obsidian is higher among fragments than among whole flakes, which probably derives from the fragility of this material.

For other materials, basalt has the same percentage (30%); there are fewer flake fragments of trachyte, and tuff goes in the opposite direction.

Other characteristics visible on broken flakes are similar to those of whole flakes, especially in the case of platforms which are mostly flat.

Among broken obsidian flakes 70% are raw flakes, 19% are utilized and 11% are retouched. Other materials have similar proportions (74% of broken flakes are raw, 19% are used and 7% retouched).

Fractures on broken flakes are sometimes more or less parallel to the flake axis (longitudinal fractures), and at other times are perpendicular or oblique to this axis.

The former seem to have occurred during flaking while the others occurred later as a result of utilization of used or retouched flakes or of trampling on the ground. Longitudinal fractures are found on 9% of raw flakes (a bit less on obsidian with 7%), 7% of utilized flakes and 12% of retouched flakes.

The remaining portion of the flake can be the proximal section including the platform (38% of raw flakes, 10% of utilized flakes and 28% of retouched flakes), the distal section (respectively 46%, 66% and 50%) or the medial section (16%, 24%, and 22%).

Among the 51 broken retouched flakes, 23 are probably fragments of trimmed pieces:

1 end-scraper of basalt, probably a flake end-scraper on the tip with a longitudinal fracture,

10 side-scraper fragments,

3 notches (two of basalt),

5 pieces with inverse retouch,

4 pieces with abrupt retouch.

The number of side-scraper fragments is notable and compensates to some extent for the small number of side-scrapers compared with end-scrapers among trimmed pieces.

Tools on flake

There are 355 tools on flake. Of the raw materials used, obsidian is the best quality material but it was found some distance away and had to be transported, whereas basalt and trachyte were found on the spot. They were used in nearly equal quantities to make tools on flake, but obsidian was used less often. It can be noted that the proportions of both materials are the same as for cores: 48% of obsidian and 52% of other materials.

They are distributed as follows:

Tools	**Obsidian**	**Other materials**	**Total**	**%**
Side-scrapers	18	21	**39**	11.0
End-scrapers	31	31	**62**	17.0
Burins	1	3	**4**	1.0
Awls	6	2	**8**	2.0
Beaks	15	6	**21**	6.0
Naturally backed knives	13	19	**32**	9.0
Notches	42	30	**72**	20.5
Denticulates	23	42	**65**	18.5
Diverse pieces	23	29	**52**	15.0
Total	**172** (48.5%)	**183**	**355**	

The categories best represented are notches, denticulates and side-scrapers. The percentage of scrapers is interesting because whereas notched pieces, mainly clactonian, are often roughly trimmed, the retouched ends and angles of end-scrapers are well defined.

Comments

An "end-scraper", for us, is a piece on which the "front", or working end (active part), is thick and formed by quite extended retouch. The angle formed by the ventral face and the retouch is generally between 70 and 90°.

This end-scraper "front" is usually at the end of the flake (distal scraper), but at Gombore I it can be on the sides (lateral end-scraper).

A "side-scraper" is formed by much flatter retouch, creating a sharp working edge that is usually lateral but sometimes distal (transverse side-scraper) or oblique (déjeté side-scraper, for example).

Side-scrapers: 39

Side-scrapers are quite common.

Raw material

Obsidian	18	(46%)
Basalt	5	
Trachyte	14	
Tuff	2	

Obsidian side-scrapers represent nearly half of the group. Other materials, which are coarser, will be grouped together in the analysis. Trachyte side-scrapers are the most common.

Dimensions

The length of obsidian side-scrapers ranges from 32 mm for the smallest to 100 mm. For other materials, they range from 36 to 109 mm (the longest is of basalt). A very atypical object not included is a fragment of a very large flake of trachyte measuring 162 mm that is retouched as a convergent convex side-scraper.

Obsidian tools are on average 73 mm long and those on other materials are 77 mm.

Widths range from 19 to 66 mm for obsidian and from 25 to 76 mm for other materials. Averages are 40 and 53 mm respectively.

Obsidian side-scrapers are a bit smaller than those made of basalt or trachyte.

The most common categories are those from 40 to 59 mm (rather small pieces) and 60 to 79 mm (average pieces) which constitute 64% of the total.

Dimensions	**Obsidian**	**Other materials**	**Total**
Very small			
Small	6	3	**9**
Rather small	7	3	**10**
Average	4	9	**13**
Rather large		2	**2**
Large	1	4	**5**

Proportions

The length/width or l/w index is used.

Proportions	**Obsidian**	**Other materials**	**Total**	**%**
Very wide	2	1	**3**	8.0
Wide	1	3	**4**	10.0
Rather long	2	6	**8**	20.5
Long	9	5	**14**	36.0
Lamellar	4	5	**9**	23.0
Blade		1	**1**	2.5

Side-scrapers, especially those of obsidian, are quite elongated. Their proportions are those of the piece not necessarily those of the original flake that is often broken, incomplete or modified by retouch.

Striking platforms

The platforms of flakes retouched as side-scrapers could be studied on 26 pieces:

Striking platform	Obsidian	Other materials	Total	%
Punctiform/linear	2	1	**3**	
Cortical		1	**1**	
Flat	8	12	**20**	76.9
Dihedral				
Facetted	1	1	**2**	

The large majority of platforms are flat. Two side-scrapers have facetted platforms: one is a complex obsidian piece with convex side-scraper retouch and a notch which has retouch everywhere including in the striking platform zone. The other one is a flake with a cortical upper face, retouched as a convex side-scraper with some facets on the striking platform.

Upper face

Twelve side-scrapers have kept some cortex on the upper face. Three of them (2 basalt and 1 trachyte) are completely covered with cortex and one is a fine lateral convex side-scraper. The other two are cruder convex side-scrapers. The upper faces of nine side-scrapers (two of obsidian) have fairly large cortical areas, sometimes central (as is the case for 2 pieces of obsidian and 1 of trachyte). Others are retouched on one edge, the opposite edge being cortical or partly cortical, on the right edge in three cases and on the left in four. Whether there is cortex or not, upper faces can be flat, or have two or more facets, so:

Upper face	Obsidian	Other materials	Total
Cortical		3	**3**
Partially cortical	2	7	**9**
Flat (1 facet)			
With 2 facets	1	1	**2**
More than 2 facets	14	9	**23**

Side-scrapers are mostly made on flakes that were prepared on the core by several removals, sometimes keeping an area of cortex.

Side-scraper types

Side-scrapers	Obsidian	Other materials	Total	
Simple	10	11	**21**	54%
Double		2	**2**	
Convergent	1	3	**4**	
Déjeté		1	**1**	
Transverse	5	1	**6**	
On ventral surface	1	1	**2**	
Alternate	1	2	**3**	

The most common are simple lateral side-scrapers. Transverse, on ventral face or alternate side-scrapers can also be considered as "simple" side-scrapers, which increases their proportion to 82%. Double-sided, convergent or déjeté scrapers are rarer.

Simple lateral side-scrapers

There are 21 and the working edge can be:

Working edge	Obsidian	Other materials	Total
Straight	5	1	**6**
Convex	4	9	**13**
Concave	1	1	**2**

The retouched working edge of the side-scraper can be on the left side (10 cases) or on the right (11 cases), both on obsidian and other raw materials. The retouch is regular in 12 cases (Fig. 41, *6* for example), and less regular or tending towards denticulate retouch in 7 other cases.

The length of the retouched working edge on side-scrapers ranges from 20 to 70 mm for obsidian pieces (average: 41 mm) and from 32 to 52 mm for others (average: 44 mm). This edge can be retouched along the full length as is the case in 4 out of 6 simple straight side-scrapers, 9 out of 13 convex side-scrapers and 2 concave side-scrapers. For the others, the proportion of the total length that has been retouched ranges from 52% to 83%. Two simple lateral side-scrapers on obsidian are coupled with a denticulate edge; a third side-scraper has a small distal end-scraper (Fig. 41, *8*).

Double side-scrapers

Only 2 pieces, both of trachyte, are double side-scrapers. The retouch is irregular and is on a cortical flake for one and on a broken flake for the other. They are biconvex side-scrapers.

Convergent side-scrapers

There are 4, one of obsidian and three of trachyte. One convergent side-scraper with straight edges has regular retouch on the left side, and wider and irregular retouch on the right side. The end is not pointed (the two working edges do not join). Of three biconvex convergent side-scrapers, two are large pieces (108 and 162 mm long) and are quite crudely retouched. The retouched edges converge and join on one of them, but not completely on the other. The third side-scraper, of obsidian, on the contrary, has regular retouch. The edges nearly join but are separated by a very small area of cortex (Fig. 41, *7*).

Déjeté side-scrapers

The unique déjeté side-scraper is a fine piece of basalt, 93 mm long (Fig. 41, *10*). The two retouched edges do not quite converge, but are regular.

Transverse side-scrapers

There are 6 of which 5 are of obsidian. Four are convex and two are concave. The length of the working edge ranges from 25 to 58 mm with an average of 44 mm. The retouch is regular in four cases. One unusual piece is convex with a lightly denticulated working edge between two clactonian notches (Fig. 42, *1*).

Side-scrapers on ventral face

There are two: one is of obsidian and the other is of trachyte. One is convex and the other is straight with regular retouch, very similar to normal lateral side-scrapers.

Side-scrapers with alternate retouch

The right edges of two basalt pieces have direct retouch starting at the platform and proceeding to the ventral face thus forming lateral side-scrapers that are concave then convex.

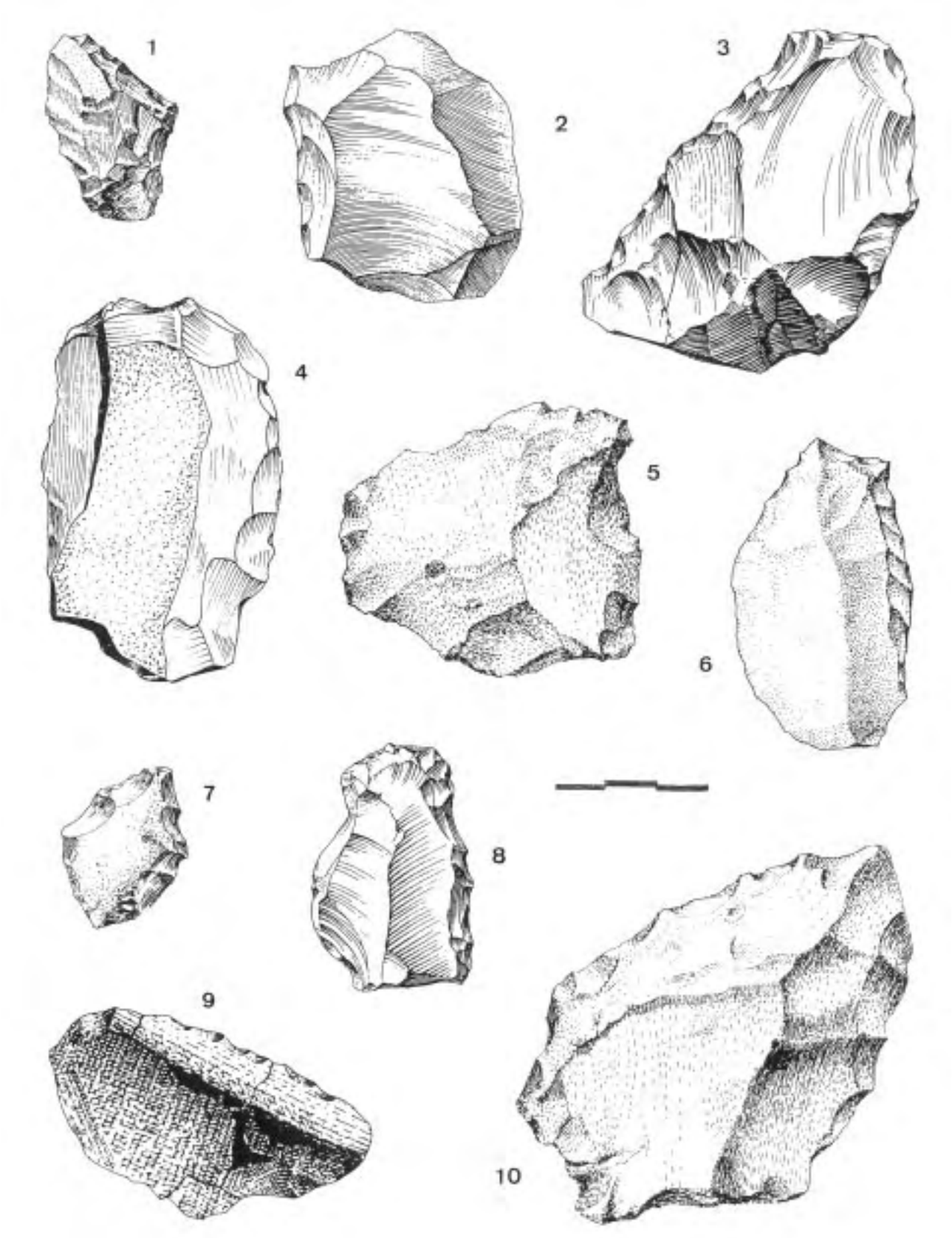

Fig. 41. Gombore I. Lithic industry from Level B. 1-3: straight simple side-scrapers; 4-6, 8: convex simple side-scrapers; 7: biconvex convergent side-scraper; 9: transversal convex side-scraper; 10; déjeté side-scraper. 1-3, 7-9: obsidian; 4-6: trachyte; 10: basalt. *Drawings by C. Chavaillon (1-3, 7, 8), J. Chavaillon (4), J. Jaubert (5, 6, 10) and J. Gire (9)*

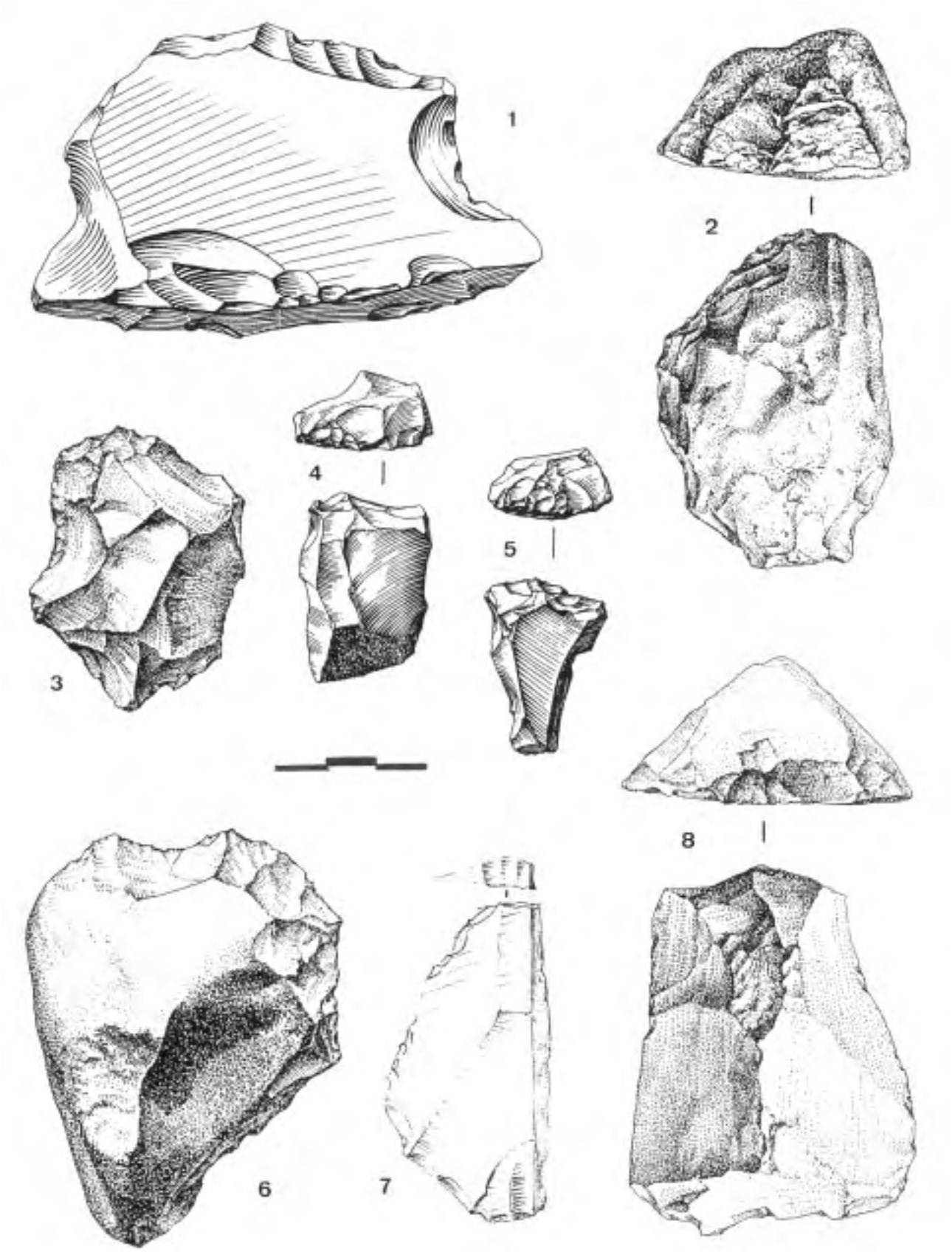

Fig. 42. Gombore I. Lithic industry from Level B. 1: convex transversal side-scraper within two notches; 2, 4-6: typical end-scrapers; 3, 7, 8: atypical end-scrapers. 1, 4, 5, 7: obsidian; 2, 3, 6, 8: basalt. *Drawings by C. Chavaillon (1-6), J. Chavaillon (7) and J. Jaubert (8)*

A transverse side-scraper of obsidian was retouched on an edge opposite to the platform with normal retouch from the right side and then on the ventral face. The resulting side-scraper is concave then convex.

Conclusions

In this assemblage side-scrapers are made on elongated flakes of which 46% are obsidian (only one is on a blade). They are mostly simple side-scrapers. Out of a total of 45, counting double pieces, the shape of the working edge on 9 is straight, on 30 is convex, on 4 is concave, and on 2 is concavo-convex.

Convex side-scrapers are the most common.

End-scrapers: 62

There are 62 end-scrapers but it is not always possible to distinguish between a "typical end-scraper" and an "atypical end-scraper". The former category (24 pieces) includes those with a working end formed by quite regular, continuous retouch. The angle formed by the front of the end-scraper and the ventral face is about 80°. It ranges from 70° to 88°.

Those classified as atypical end-scrapers (38) have an irregular working end that is not as high and on which the retouch is slightly denticulated or a bit abrupt.

Raw material

Various rocks are used.

Material	Typical end-scraper	Atypical end-scraper	Total	
Obsidian	14	17	**31**	50%
Basalt	7	16	**23**	
Trachyte	2	4	**6**	
Tuff		1	**1**	
Unspecified rock	1		**1**	

Half of the end-scrapers are of obsidian.

Dimensions

The lengths of end-scrapers range from 18 mm for an obsidian flake fragment retouched as a distal end-scraper, to 146 mm. The latter is a large obsidian flake, a complex piece that combines an end-scraper and a beak trimmed by two notches (Fig. 51, *4*). This exceptional piece (146 x 105 mm) was excluded when calculating the average, so the average length of obsidian pieces is 48 mm.

In other materials, the smallest end-scraper is 40 mm long, the largest 107 mm. The average is 66 mm.

The width of obsidian end-scrapers ranges from 11 to 105 mm. The average, calculated without the largest piece, is 34 mm. For other materials, widths range from 22 to 78 mm, with an average of 41.5 mm.

Width	Obsidian	Other materials	Total
Very small	1		**1**
Small	13	1	**14**
Rather small	8	12	**20**
Average	6	12	**18**
Rather large	1	5	**6**
Large	2	1	**3**

Obsidian end-scrapers are mainly “small” or “rather small”. Those made of other materials are “rather small” or “average”.

Proportions

This is the ratio of the length in relation to the width, the piece being orientated along the technical (striking platform) axis.

Porportions	Obsidian	Other materials	Total	
Very wide	3	2	**5**	
Wide	1	4	**5**	
Rather long	4	4	**8**	
Long	17	10	**27**	44%
Lamellar	6	10	**16**	26%
Blades		1	**1**	

Obsidian end-scrapers are mainly “long”. End-scrapers of other materials are “long” or “lamellar”.

Striking platforms

This analysis could be carried on only 33 end-scrapers.

Striking platform	Obsidian	Other materials	Total
Punctiform/linear	4	2	**6**
Cortical	1	3	**4**
Flat (1 facet)	5	15	**20**
Dihedral	1	2	**3**
Facetted			

As for side-scrapers, flat platforms are the most common (61%).

Upper face

Some cortex has been retained on the upper face of 39% of end-scrapers. This face is completely cortical in five cases. The illustrated piece (Fig. 43, *4*) is a cortical flake on which the distal end has been transformed into an end-scraper with some alternating retouch that is clearly visible on the right edge.

The upper face of 16 other end-scrapers (5 of obsidian and 11 in other materials) has cortical areas of varying size from small (Fig. 42, *4*) to very large (Figs. 42, *6*; 43, *1*). Whether they have cortex or not, the upper face of end-scrapers can be flat, or have two or more facets.

Upper face	Obsidian	Other materials	Total	
Flat (1 facet)	1		**1**	
With two facets		2	**2**	
With several facets	28	16	**44**	93.6%

The large majority of end-scrapers have been trimmed on flakes prepared on the core.

End-scraper morphology

There are different types according to the extent and situation of the “front” or working end of the end-scraper:

Type	Obsidian	Other materials	Total	
End-scraper on flake tip	22	22	**44**	72.1%
End-scraper on two ends	1	2	**3**	
End-scraper "unguiform"	1	1	**2**	
Lateral end-scraper	4	4	**8**	
Bilateral end-scraper	1	1	**2**	
End-scraper on platform	1	1	**2**	

In addition, there is an obsidian end-scraper trimmed on a core. Most of the end-scrapers are trimmed at the end of a flake (sometimes even on both ends). Among the illustrated end-scrapers, n° 2 (Fig. 43) is a good example of a lateral end-scraper.

Position of retouch

Retouch usually starts from the ventral face of the piece, cutting into the upper face, but the reverse can happen:

Retouch	Obsidian	Other materials	Total	
Normal	27	27	**54**	87%
Inverse	4	4	**8**	

Height of the front

On obsidian pieces, the height of the worked end of end-scrapers ranges from 4 to 24 mm, with an average of 8.9 mm. For end-scrapers of other materials, the range is from 6 to 19 mm, with an average of 11.5 mm.

Double tools

One typical obsidian end-scraper is coupled with an awl, and a second one with a beak (Fig. 51, *4*).

Two atypical end-scrapers (the first on obsidian and the second on basalt) are coupled with a beak and with a denticulate respectively (Fig. 43, *7*).

Comments

Considering the end-scrapers from Gombore I as a whole, the following remarks can be made.

An end-scraper can be of obsidian or another material (mainly trachyte) in nearly equal proportions.

The length of the piece is highly variable. End-scrapers have been trimmed on small flakes as well as on flakes 100 mm or more long. The end-scraper is often retouched on the distal extremity by elongated even lamellar retouch (Fig. 43, *1*, for example), but can also occupy the side of a very wide flake (Fig. 43, *2*).

The blank can be a cortical flake on which the only worked section is limited to the front of the end-scraper, but it can also be an elaborate flake, prepared before removal from the core by several flakes.

Although 71% of end-scrapers are made at the distal end of a flake, they can also be found on edges, even on the platform, or anywhere, as is the case with two "unguiform" end-scrapers. Inverse end-scrapers (flaked from the upper face) are less frequent (13%) but do occur. There is even one piece with two end-scrapers, one normal on the left edge, the other one inverse on the right edge. The front can be quite high (4 to 7 mm in 12 cases) but reaches 10 to 15 mm (19 cases) or more for 4 of them. The front of the end-scraper is mostly convex with 23 on obsidian and 25 on other materials. It can also be straight (10 cases with 6 of obsidian) or even concave (4 cases with 2 of obsidian).

The assemblage gives the impression of great diversity. End-scrapers are also numerous: there are 62 compared with only 39 side-scrapers.

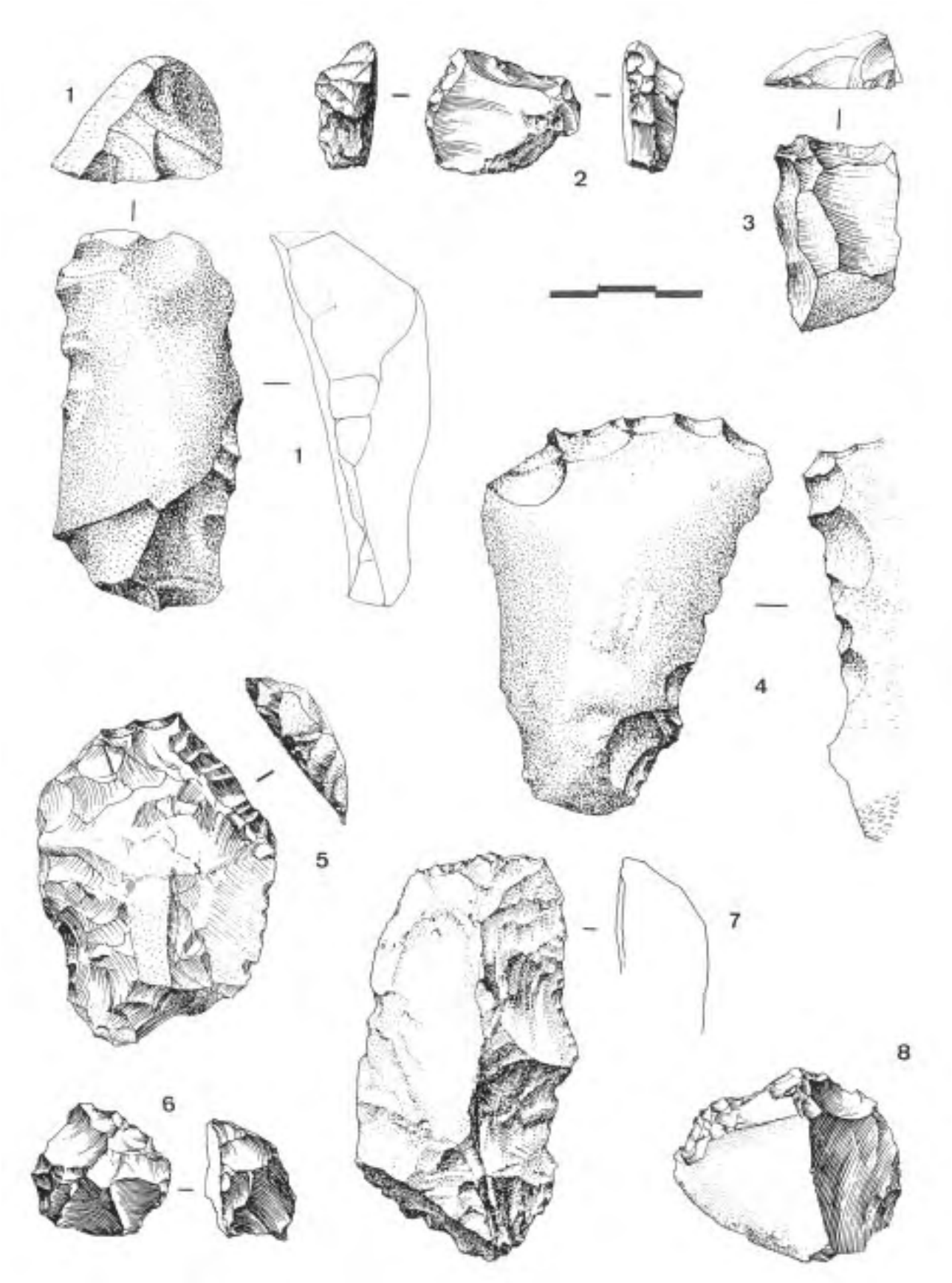

Fig. 43. Gombore I. Lithic industry from Level B. 1: typical end-scraper with cortical face and retouched edges; 2: lateral typical end-scraper; 3, 7, 8: atypical end-scrapers; 4: typical end-scraper, with alternate retouch on the right edge; 5: lateral typical end-scraper with straight distal edge; 6: lateral typical end-scraper. 1: trachyte; 2, 3, 5, 6, 8: obsidian; 4, 7: basalt. *Drawings by J. Jaubert (1, 4), C. Chavaillon (2, 6-8) and J. Chavaillon (3, 5)*

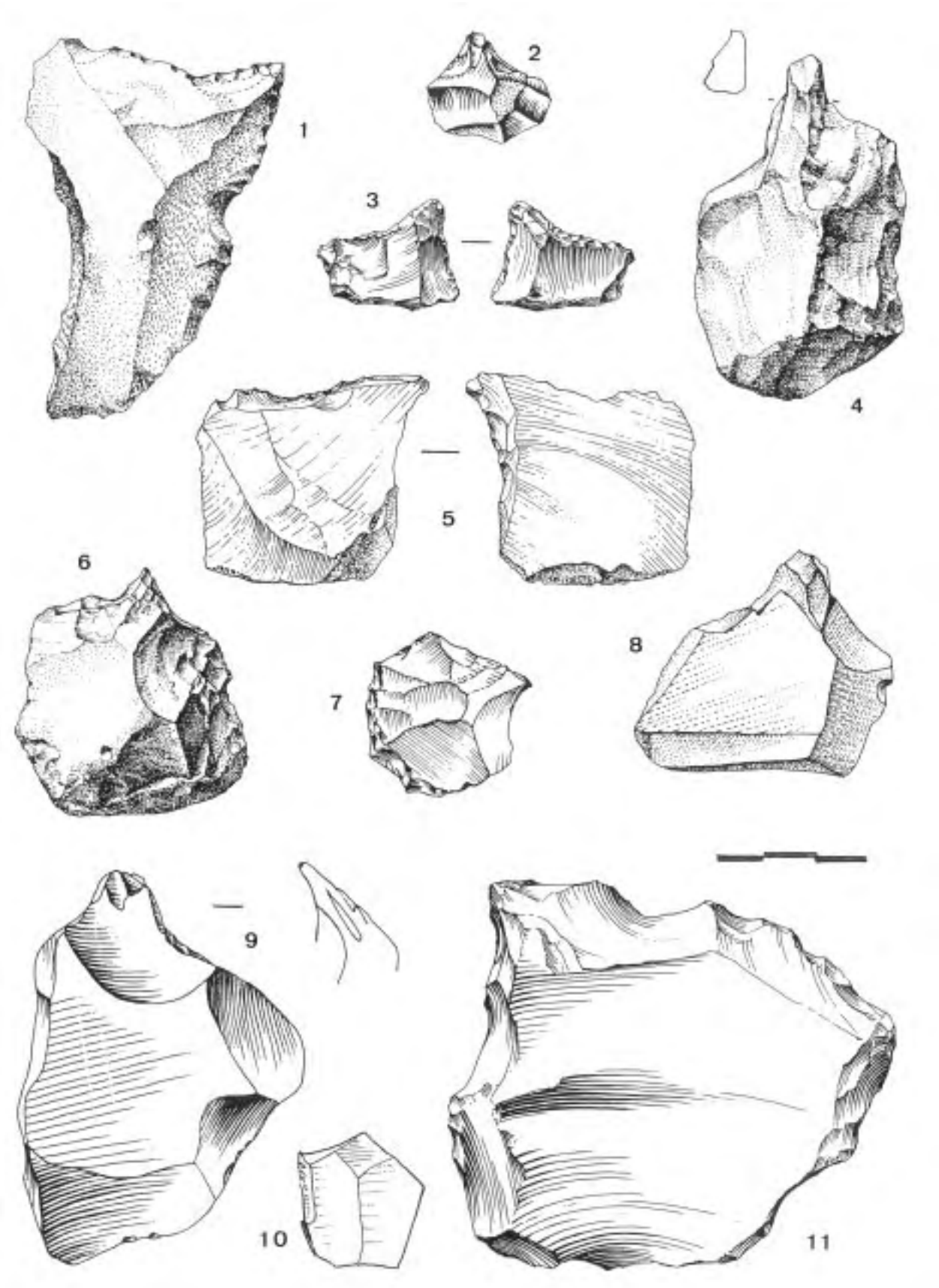

Fig. 44. Gombore I. Lithic industry from Level B. 1: atypical awl; 2, 4-6: typical awls; 3: awl obtained within two alternate notches; 7: atypical end-scraper on the left edge and awl on the right edge (alternate burin-beak obtained with a distal notch and retouch on the right edge); 8: alternate burin-beak; 9: awl obtained within a notch on the right edge and retouch on the left edge; 10: atypical burin; 11: awl on the distal part of the left edge. 1, 4, 6, 8: basalt; 2, 3, 5, 7, 9-11: obsidian. *Drawings by J. Jaubert (1, 8), C. Chavaillon (2-7, 9, 11) and J. Chavaillon (10)*

Burins: 4

Gombore I yielded a single typical basalt burin and three atypical burins, one of obsidian, one of basalt and one of tuff.

- One large basalt flake is a naturally backed knife. The left working edge, opposite to the back, is retouched and utilized; the distal end has a wide "burin blow" which seems to have been used.
- A broken flake of obsidian, small and wide, has a removal of the "burin blow" type which cuts the left edge, but a later fracture casts doubt on the "burin" classification (Fig. 44, *10*).
- A large tuff flake has a wide "burin blow" on its distal end, which seems to have been used. Some scaling is also present along the working edge (Fig. 50, *2*).
- On a basalt flake the right edge was removed from the distal end by a flake which seems to be a "burin blow". The blow was struck on a fracture.

Awls: 8

There are only eight awls.

Typical awls	5 (4 of obsidian)
Atypical awls	3 (2 of obsidian)

Dimensions

Lengths range from 24 to 74 mm with an average of 40 mm.

Widths range from 15 to 51 mm. The average is 30 mm.

As for dimensional categories:

Dimensions	Obsidian	Other materials	Total
Small	5		**5**
Rather small	1		**1**
Average		2	**2**

Proportions

They range from very wide to lamellar pieces.

Proportions	Obsidian	Other materials	Total
Very wide	2		**2**
Wide	1		**1**
Rather long			
Long	1	1	**2**
Lamellar	2	1	**3**

Striking platforms

Only two platforms are identifiabble. Both are linear, one of obsidian, the other of basalt.

Upper face

Only one piece of basalt has retained cortex. While one piece of obsidian has an upper face with two facets, all the others have several preparation facets.

Typical awls

One of them (Fig. 44, *7*) is associated with an end-scraper on a small obsidian flake. The end-scraper is trimmed on the right side of the flake and the awl on the left side by regular proximal retouch. A notch on the distal part determines the awl. A small awl (Fig. 44, *3*) is trimmed by two alternate notches on a broken obsidian flake. A larger basalt piece (Fig. 44, *4*) is trimmed on a rather large lamellar flake with a linear platform. Two quite clear notches form an awl of quadrangular section.

Two other obsidian awls have their point trimmed by one or two notches.

Atypical awls

On a large flake fragment of basalt with a little cortex on its upper face, two retouched edges form a kind of rather crude awl (Fig. 44, *1*).

Two small obsidian flakes have retouch on both edges that converge and form a small awl on each one.

Beaks: 2

Beaks are similar to awls but are more numerous. They comprise true "beaks", large thick awls (14) and alternate burin-like beaks (7).

Raw material

Raw material	Beaks	Burin-like beaks	Total	
Obsidian	12	3	**15**	71%
Basalt	2	4	**6**	

As with awls, most are of obsidian.

Dimensions

Lengths range from 28 to 137 mm for obsidian with an average of 80 mm and from 54 to 78 mm (average: 59.5 mm) for basalt.

Dimensions	Obsidian	Basalt	Total
Small	4		**4**
Rather small		4	**4**
Average	5	2	**7**
Rather large	1		**1**
Large	5		**5**

Widths range from 21 to 106 mm (average: 59 mm) for obsidian and from 35 to 69 mm (average: 50.5 mm) for basalt.

Proportions

Proportions	Obsidian	Basalt	Total
Very wide		1	**1**
Wide	2	2	**4**
Rather long	2	2	**4**
Long	9	1	**10**
Lamellar	2		**2**

Beaks and burin like beaks are mostly made on long flakes.

Striking platforms

Striking platform	Obsidian	Basalt	Total
Punctiform/linear	1		**1**
Cortical		1	**1**
Flat	3	1	**4**
Dihedral	1		**1**
Facetted			

Upper face

Only 2 pieces of obsidian retained cortex: a small area on one, and a larger area on the other.

On the other hand, 4 out of 6 of basalt pieces retained quite large areas of cortex (Fig. 44, *6-8*).

Apart from the cortex:

Cortex	Obsidian	Basalt	Total
Flat upper face (1 single facet)	1	1	**2**
Upper face with 2 facets	2	2	**4**
Upper face with several facets	12	3	**15**

Upper faces with several facets dominate very clearly.

Beaks are large awls, often badly made. The position of the beak is opposite the platform in 8 cases and is lateral in 6 cases.

The beak is formed by two notches (3 pieces), by a notch on one side and retouch on the other (8 cases, such as Fig. 44, *9*), or by retouch on both faces (3 cases).

Naturally backed knives: 32

At Gombore there are no typical or atypical backed knives, that is to say pieces on which the "back" was obtained by abrupt retouch after the flake had been removed. However, there are 32 naturally backed knives of two kinds. Either the natural back is cortical (8 cases with 3 of obsidian: Fig. 45, *3*) or the back is formed by facets made during preparation of the core before removal of the flake. It then becomes a knife with a prepared back (see "Methodology", in this volume).

Raw material

Raw material	Cortical back	Prepared back	Total	
Obsidian	3	10	**13**	41%
Basalt	2	10	**12**	
Trachyte	2	3	**5**	
Tuff	1	1	**2**	

Dimensions

The length of naturally backed knives ranges from 32 to 93 mm for obsidian (average: 57.5 mm) and from 42 to 121 mm for other materials (average: 75 mm).

Widths range from 17 to 52 mm for obsidian with an average of 32 mm and from 30 to 74 mm for other materials (average: 45 mm).

Dimensions	Obsidian	Other materials	Total	
Small	1		**1**	
Rather small	7	7	**14**	44%
Average	3	5	**8**	
Rather large	2	4	**6**	
Large		3	**3**	

Proportions

Proportions	Obsidian	Other materials	Total	
Very wide				
Wide				
Rather long		1	**1**	
Long	3	7	**10**	
Lamellar	8	11	**19**	59%
Pieces on	2		**2**	

Naturally backed knives are more elongated than any of the categories described above: 59% have lamellar flake proportions which corresponds well with their assumed function as “knives”.

Striking platforms

Platforms are still present on 22 pieces.

Striking platform	Obsidian	Other materials	Total	
Punctiform/linear	1	2	**3**	
Cortical		1	**1**	
Flat	6	10	**16**	73%
Dihedral	2		**2**	
Facetted				

Flat platforms dominate.

Upper face

There are nine pieces, 3 of obsidian and 6 of trachyte or basalt (29% of the total), that have areas of cortex on the upper face. On knives with a cortical back, this cortical area is an extension of the cortex on the back.

Upper face	Obsidian	Other materials	Total	
Flat upper face (1 facet)	1	1	**2**	
Upper face with 2 facets	2	6	**8**	
Upper face with several facets	9	12	**21**	68%

Working edge

The working edge opposite to the natural back was the useful part. Only one piece of obsidian has a blunted working edge. All others have utilization traces with scaling or chipping; on three, this edge is denticulated with non-adjacent notches; two others have a clactonian notch, probably due to utilization.

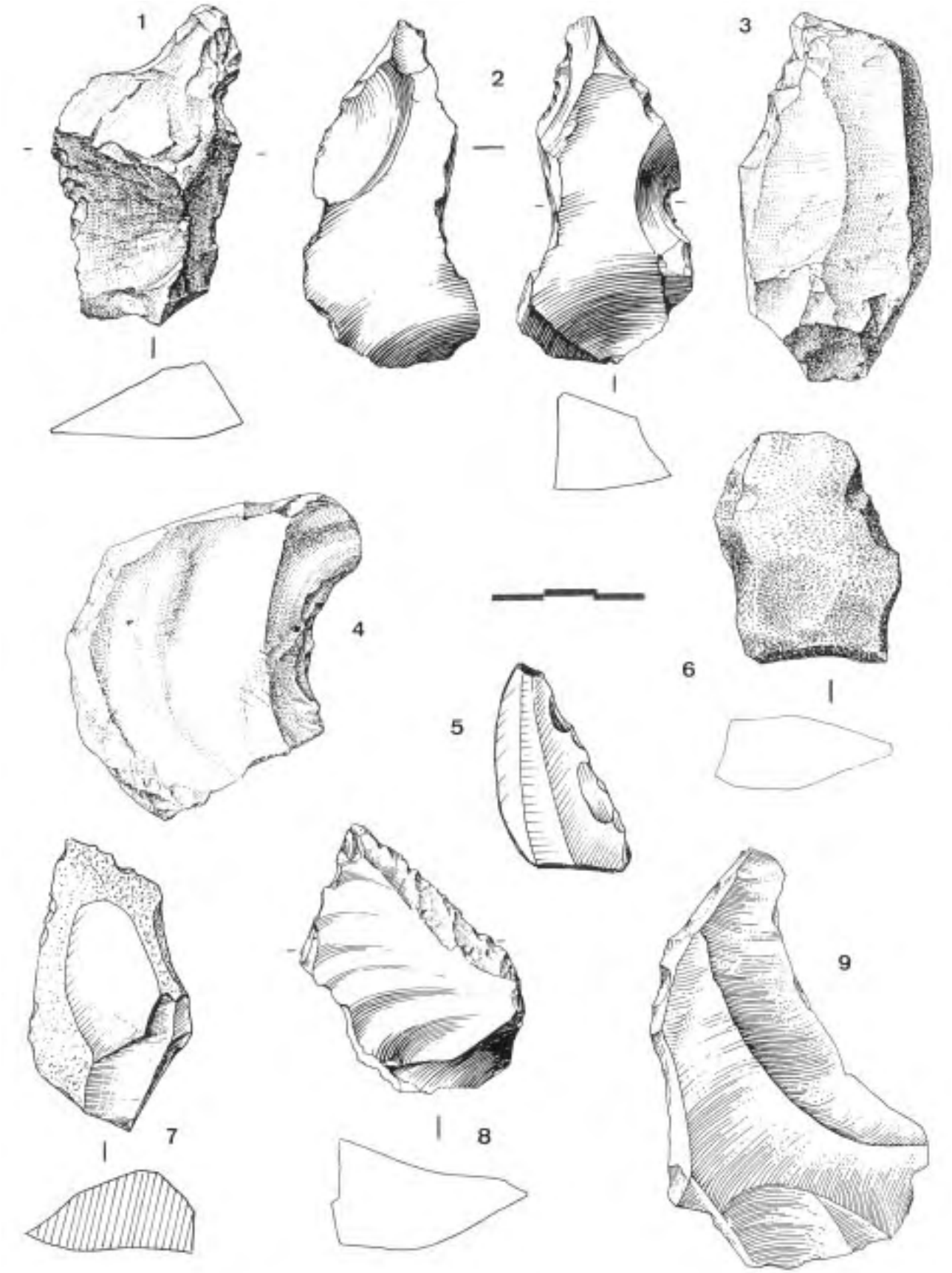

Fig. 45. Gombore I. Lithic industry from Level B. 1, 5-9: naturally backed knifes with utilized opposite cutting edge; 2: naturally backed knife with alternate retouch and utilization marks on the opposite cutting edge; 3: naturally backed knife with utilized and retouched opposite cutting edge; 4: naturally backed knife with utilized opposite cutting edge showing notches. 1, 3, 7: basalt; 2, 5, 8, 9: obsidian; 6: trachyte. *Drawings by J. Jaubert (1, 3), C. Chavaillon (2, 4, 8, 9), J. Chavaillon (5, 7) and J. Gire (6)*

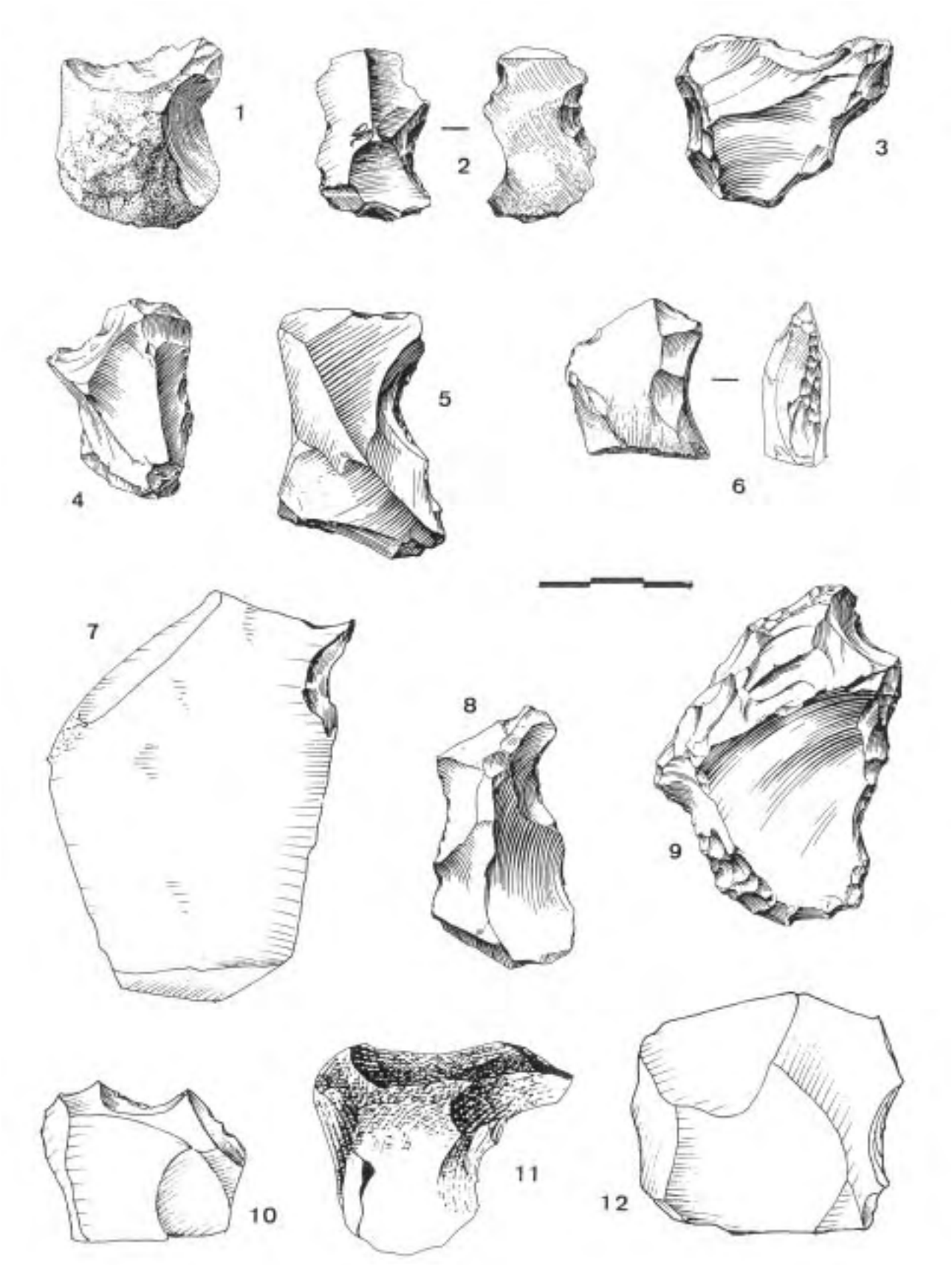

Fig. 46. Gombore I. Lithic industry from Level B. 1: pieces with two notches; 2: piece with two alternate notches; 3, 4, 10: pieces with distal notches; 5, 6, 8, 11, 12: pieces with lateral notches; 7: piece with inverse notches; 9: notches with retouch on both lateral edges. 1-6, 8-10, 12: obsidian; 7: trachyte; 11: basalt. *Drawings by C. Chavaillon (1-6, 8, 9), J. Chavaillon (7, 10, 12) and J. Gire (11)*

Finally, three naturally backed knives have some normal or inverse retouch.

Working edge	Obsidian	Other materials	Total	
Used	9	15	**24**	75%
Retouched	2	1	**3**	
Denticulated	1	1	**2**	
Blunted	1		**1**	
With notch		2	**2**	

Finally, if one considers the orientation of the piece, the working edge opposite to the back can be found on the right or left edge:

Orientation	Obsidian	Other materials	Total
Right working edge	9	9	**18**
Left working edge	4	10	**14**

There is no clearly preferred orientation. Knives with a prepared back bear witness, as do cores, to the degree of evolution of the flaking technique at Gombore I. Many cores were rejuvenated by resharpening: a blow struck on one side removed part of the core edge and allowed the removal of new flakes. Among these resharpening flakes, 24 have been used as knives as well as knives with a natural cortical back.

Double pieces

One basalt knife with a prepared back has a burin on the distal end.

Another piece, of obsidian, has a wide clactonian notch at the platform end of the working edge.

Notched pieces: 72

There are numerous notched pieces. Out of a total of 72, 42 are of obsidian.

Raw material

Obsidian	42	58%
Basalt	17	
Trachyte	11	
Lava	1	
Tuff	1	

The proportion of obsidian is relatively high.

Dimensions

The length ranges from 23 to 118 mm for obsidian, with an average of 52 mm. In other materials, length ranges from 43 to 135 mm, with an average of 70.6 mm.

Dimensions	Obsidian	Other materials	Total
Small	17		**17**
Rather small	15	8	**23**
Average	5	15	**20**
Rather large	1	3	**4**
Large	4	4	**8**

Small, rather small and average pieces are equally distributed throughout, while those of obsidian are clearly smaller. Widths range from 17 to 97 mm for obsidian with an average of 37 mm and from 31 to 96 mm for other materials (average 54 mm).

Proportions

Proportions	Obsidian	Other materials	Total
Very wide	4	2	**6**
Wide	3	4	**7**
Rather long	9	8	**17**
Long	15	11	**26**
Lamellar	11	5	**16**

Long flakes are most common, with lamellar pieces also well represented.

Striking platforms

The analysis concerned only 42 pieces (55% of the total) as many notches were made on broken flakes.

Striking platform	Obsidian	Other materials	Total	
Punctiform/linear	4	3	**7**	
Cortical	1	2	**3**	
Flat	14	12	**26**	62%
Dihedral	2	3	**5**	
Facetted	1		**1**	

There is a wider variety of platforms than in former categories, which could be linked to a greater proportion of elongated flakes. The facetted platform belongs to the double piece cited in the scraper chapter (convex end-scraper and piece with notch); retouch occurs on all the edges including the platform zone and cuts across some facets that were apparently made prior to this flaking.

Upper face

Cortex on the upper face was retained on 25% of notched pieces; 4 are completely cortical (2 basalt and 2 trachyte), 14 others have cortical areas (6 obsidian and 8 in other materials). Apart from cortex, the upper faces often have traces of several prior removals.

Upper face	Obsidian	Other materials	Total	
Flat upper face (1 facet)	1	2	**3**	
Upper face with 2 facets	4	8	**12**	
Upper face with several facets	37	20	**57**	79%

Number of notches

Notched pieces from Gombore I have one, two or sometimes three notches.

Notches	Obsidian	Other materials	Total	
1	35	26	**61**	85%
2	6	3	**9**	
3	1	1	**2**	

Pieces with one notch are by far the most numerous. They are either clactonian notches, or notches obtained by more or less regular retouch:

Notches	Obsidian	Other materials	Total	
Clactonian	11	5	**16**	
Retouched	24	21	**45**	74%

Notches, clactonian or retouched, are either on the right or left edge, or are distal:

Notches	Obsidian	Other materials	Total
On left edge	10	7	**17**
On right edge	13	9	**22**
Distal	12	10	**22**

Finally, notches can be normal or inverse:

Notches	Obsidian	Other materials	Total	
Normal	30	19	**49**	80%
Inverse	5	7	**12**	

The illustrated piece (Fig. 46, *8*) is a good example of a normal clactonian notch on the right edge.

A partially cortical obsidian flake (Fig. 46, *5*) has a fine retouched and re-used notch on the right edge.

Pieces with two notches: Nine (6 obsidian) show some diversity in the placement of notches which can be on the same edge, on two opposing edges or one on the edge and the other on the tip.

Two notches on the same edge: There are two pieces (one of obsidian and one of trachyte). One flake of obsidian has two clactonian notches on the right edge, at least one of which was used.

On the right edge of a trachyte flake, there are two retouched notches that alternate, one normal and the other inverse, forming a kind of S.

Two notches on opposing edges: There are 5 pieces (3 on obsidian).

One small obsidian flake has two heavily retouched alternate notches: normal on the right edge, inverse on the left edge (Fig. 46, *2*).

Two quite similar pieces (one of trachyte, the other of basalt) each have two wide trimmed notches with utilization scalings on both edges.

An obsidian flake has a wide clactonian notch on the left edge and another trimmed on the right edge. Both notches converge towards the flake axis, but do not quite join.

Finally, a large very wide flake of obsidian has two clactonian notches on both edges, with the distal part trimmed as a convex end-scraper.

Two notches with one distal and the other lateral: There is one obsidian piece.

On a small flake, one notch has been made on the right edge and the other on the tip.

Pieces with three notches: 2 pieces.

One broken obsidian flake has two normal clactonian notches on the right edge and an inverse clactonian notch on the left edge. On a trachyte flake, three clactonian notches alternate on the left edge and consist of two normal notches framing an inverse notch.

Double pieces

Two obsidian convex lateral side-scrapers are associated with a notch. One convex transverse side-scraper has two clactonian notches on both lateral edges although the notches are not joined to the end-

scraper retouch. Beaks are generally formed by 1 or 2 notches. In two cases, both of obsidian, apart from wear on the beak, the notches have also been used. The hollow of the notch has many traces of utilization. Finally, two pieces with a beak, in addition to the notch that forms the beak, have a second notch, clactonian in one case, clearly retouched in the other.

An obsidian naturally backed knife, besides the used working edge opposite to the back, has a clactonian notch near the plarform end. On the whole, notches seem to have been flaked somewhat haphazardly on flake edges. However, some have been trimmed with more care by regular retouch, forming a kind of concave front. The angle formed by retouch and the ventral face (in the case of normal notches) is often close to 80° (as for end-scrapers).

The illustrated piece (Fig. 46, *5*) is a good example of a wide lateral notch and has many traces of utilization.

Denticulated pieces: 65

Raw material

Obsidian	23	(35%)
Basalt	28	
Trachyte	12	
Tuff	2	

Obsidian is less common than in the categories above.

Dimensions

Lengths of denticulated pieces range from 25 to 98 mm for obsidian, and from 28 to 105 mm for other materials, with averages of 49 and 66 mm respectively.

Dimensions	**Obsidian**	**Other materials**	**Total**	
Small	9	4	**13**	
Rather small	9	15	**24**	27%
Average	1	12	**13**	
Rather large	4	9	**13**	
Large		2	**2**	

Rather small denticulated pieces are the most common. Others are regularly distributed in various groups. Widths range between 15 and 80 mm (obsidian) with an average of 36 mm, and between 19 and 95 mm for other materials (average 49 mm).

Proportions

Proportions	**Obsidian**	**Other materials**	**Total**	
Very wide	1	2	**3**	
Wide		3	**3**	
Rather long	8	9	**17**	
Long	8	19	**27**	41.5%
Lamellar	6	9	**15**	

Proportions are evenly distributed around long pieces, whatever the raw material.

Striking platforms

Denticulates are very often on broken flakes. Only 28 pieces have kept the platform.

Striking platform	Obsidian	Other materials	Total	
Punctiform/linear	2	2	**4**	
Cortical		2	**2**	
Flat	5	17	**22**	78.5%
Dihedral				
Facetted				

The platform has been retained on only 7 obsidian denticulates (out of 23) and on half of the basalt and trachyte flaked pieces. It is usually flat.

Upper face

Among denticulated pieces, 39% have kept some cortex on the upper face. It is completely cortical in 7 cases with 1 of obsidian. The illustrated piece (Fig. 48, *4*) is a completely cortical obsidian flake (except for the platform which is flat) that is denticulate on one edge with inverse denticulations.

Among 18 denticulated pieces, 2 of which are of obsidian, areas of cortex remain either as wide cortical surfaces or smaller ones (Fig. 47, *10*, for example).

Location of denticulations

They can involve either the upper face, the ventral face, or both.

Denticulations	Obsidian	Other materials	Total	
Normal	17	32	**49**	75%
Inverse	3	6	**9**	
Alternate	2	5	**7**	

One illustrated piece (Fig. 47, *5*) has wide denticulations all over the right edge; on Fig. 42, *3* the denticulations are finer and more regular. Fig. 48, *4*, with a cortical upper face, is denticulated from this face towards the ventral face. Piece in Fig. 47, *2* has normal denticulation on one edge and alternate denticulation on the other. Moreover, denticulates can be found:

Position	Obsidian	Other materials	Total
Grouped on the right edge	4	21	**25**
Grouped on the left edge	7	8	**15**
Grouped on both edges	4	6	**10**
Grouped on the tip	3	6	**9**
Grouped on one edge and on the tip	1		**1**
Scattered on the perimeter	3	2	**5**

There does not seem to have been a preferred location, but flake edges are particularly denticulated.

Some flakes have 2 or 3 denticulations, either joined or not, while others have a completely denticulated edge.

Double pieces

An obsidian piece that is denticulated on the right edge is also an alternate burin-like beak on the left edge. An end-scraper on the tip of a trachyte flake has wide denticulations on the right edge.

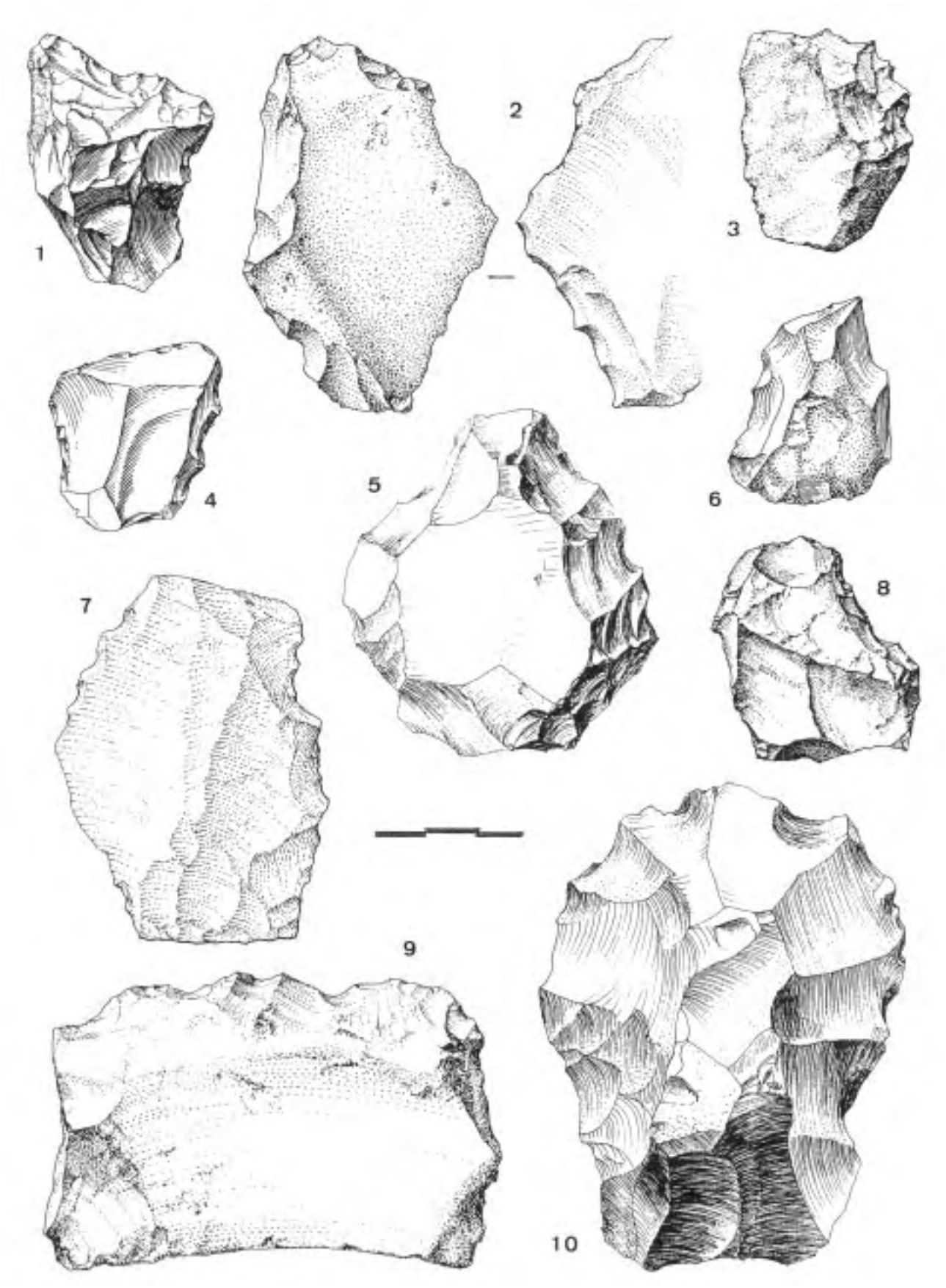

Fig. 47. Gombore I. Lithic industry from Level B. 1-8: denticulates; 9: very large flake with denticulated distal edge; 10: entirely denticulated flake. 1, 4-6, 10: obsidian; 2, 3, 7-9: basalt. *Drawings by C. Chavaillon (1, 2, 4, 6, 8), J. Jaubert (3, 7, 9) and M. Bouhey (5, 10)*

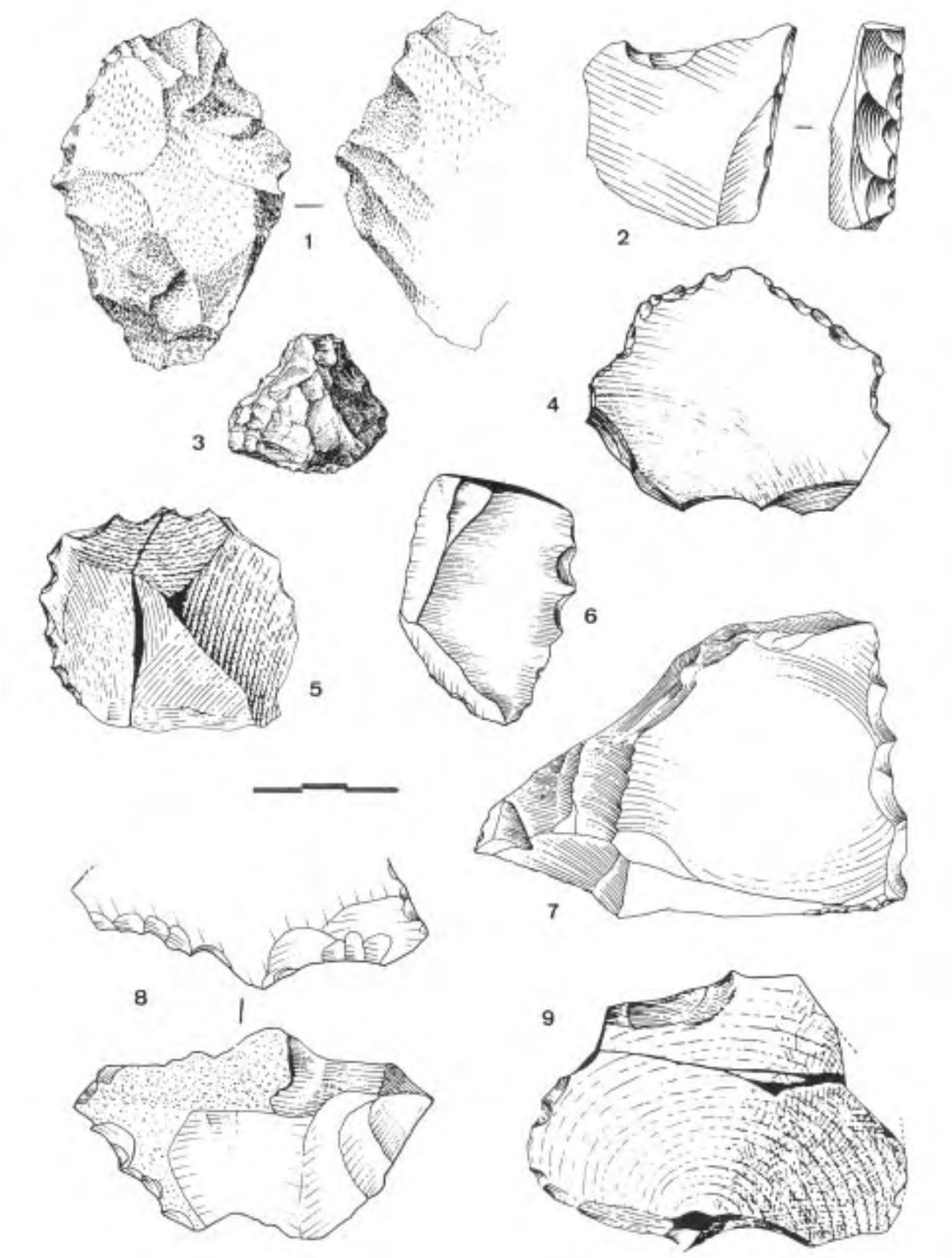

Fig. 48. Gombore I. Lithic industry from Level B. 1: directly denticulated flake on the left edge with alternating retouch on the right edge; 2: flake with abrupt retouch; 3, 5-7: denticulated flakes; 4: inverse denticulated flake; 8: very large denticulated flake on the left edge, with inverse retouch on the distal edge; 9: inverse retouched flake. 1, 3, 6, 9: basalt; 2, 4, 5, 7: obsidian; 8: trachyte. *Drawings by J. Jaubert (1), J. Chavaillon (2, 4, 6-8), C. Chavaillon (3) and J. Gire (5, 9)*

Various pieces: 52

These are retouched flakes that have not been given a particular shape. There are 52 and they can be classified according to the type of retouch:

Retouch	Obsidian	Other materials	Total
Inverse	8	14	**22**
Alternate	6	11	**17**
Abrupt	6	1	**7**
Bifacial	3	3	**6**

Obsidian and other materials are represented in normal proportions for Gombore I with 44% obsidian.

Pieces with abrupt or bifacial retouch are rarer than others.

The morphometric data will be studied before particular cases are assessed.

Dimensions

Lengths range from 19 mm for a small obsidian fragment that has some inverse retouch to 104 mm for a basalt flake that also has inverse retouch.

Dimensions	Obsidian	Other materials	Total	
Very small	1		**1**	
Small	5	2	**7**	
Rather small	8	15	**23**	44%
Average	5	6	**11**	
Rather large	3	4	**7**	
Large	1	2	**3**	

The most common are rather small pieces that are between 40 and 59 mm long.

Proportions

Proportions	Obsidian	Other materials	Total
Very wide	1	4	**5**
Wide	3	1	**4**
Rather long	4	11	**15**
Long	9	7	**16**
Lamellar	6	5	**11**
Pieces on blade		1	**1**

Proportions centre on long pieces, with a high percentage of lamellar flakes.

Striking platforms

This study deals with 29 pieces.

Striking platform	Obsidian	Other materials	Total	
Punctiform/linear				
Cortical	1	3	**4**	
Flat	7	14	**21**	72%
Dihedral	1	2	**3**	
Facetted		1	**1**	

Flat platforms are the most common.

A basalt flake, with a mostly cortical upper face and some abrupt retouch, has a facetted platform (3 facets) but the angle of the platform is 110°.

Upper face

Only 39 pieces, many of which are flake fragments, were analysed.

The upper face is completely cortical on 8 with one of obsidian (for example: Fig. 48, *2*, a flake with abrupt retouch); it is partially cortical on 10 others with 2 of obsidian. An illustrated piece (Fig. 49, *3*), of basalt, has an upper face that is three quarters cortical with inverse retouch on the left edge.

Upper face	**Obsidian**	**Other materials**	**Total**	
Flat upper face (1 facet)	2		2	
Upper face with 2 facets	4	5	9	
Upper face with several facets	13	15	28	72%

Retouch

1 - Pieces with inverse retouch: 22

Inverse retouch almost completely covers one edge in 8 cases, of which 5 are of obsidian. Twelve pieces are partially retouched (2 of obsidian, 10 in other materials).

Finally, two pieces have been retouched with wide inverse removals that seem intended to make them thinner (one of obsidian, one of trachyte). The obsidian flake has two parallel retouch flake scars, intersected by two others coming from the same section of the edge that was used as striking platform.

2 - Pieces with alternate retouch: 17

The retouch can cover the entire edge of the piece (2 obsidian and 3 other materials), as for example on the illustrated basalt piece in Fig. 49, *3*, or only a part of the edge (4, of which 2 are of obsidian).

One basalt flake shows two series of alternate retouch on both edges.

Finally, 7 pieces have retouch scattered along the edges, some normal, others inverse (2 obsidian and 5 other materials).

3 - Pieces with abrupt retouch: 7

There are only seven of which six are of obsidian. The angle formed between the retouched edge and the ventral face ranges from 80 to 90°.

On two obsidian pieces there is abrupt retouch on the left side of the piece, the right edge having been used in a way that is reminiscent of backed knives, but these are far from typical cases. Other pieces only have some abrupt retouch that is placed anywhere.

4 - Pieces with bifacial retouch: 6

Four pieces have retouch without apparent order and that is bifacial in some places.

On the other hand, one part of the right edge of an obsidian flake has been clearly retouched in the same way as a handaxe.

The evidence of another basalt flake is even clearer. The right edge is retouched alternately like that of a handaxe, but the rest of the flake remains untouched. The sinuous working edge is very worn.

Comparative analysis of pieces on flake

All 355 pieces on flake are combined for the study of this category as a whole:

SS	side-scrapers	39
ES	end-scrapers	62
B	burins	4
A	awls	8
BE	beaks	21
BK	naturally backed knives	32
N	notches	72
D	denticulates	65
V	various pieces	52

Raw material

Raw material	SS	ES	B	A	BE	BK	N	D	V	Total	%
Obsidian	18	31	1	6	15	13	42	23	23	**172**	48.4
Basalt	5	23	2	2	6	12	17	28	18	**113**	31.8
Trachyte	14	6				5	11	12	11	**59**	16.6
Lava		1					1			**2**	0.5
Tuff	2	1	1			2	1	2		**9**	2.5
Total	**39**	**62**	**4**	**8**	**21**	**32**	**72**	**65**	**52**	**355**	

The proportion of obsidian is fairly constant in comparison with other raw materials; it is higher among notched pieces (58%) and lower among denticulates (35%).

Basalt is more common than trachyte, except in the side-scrapers category. Bulbous lava and tuff are not well represented.

Dimensions

Dimensions (mm)	SS	ES	B	A	BE	BK	N	D	V	Total	%
< 20 - very small		1							1	**2**	0.5
20-39 - small	9	14	1	5	4	1	17	13	7	**71**	20.0
40-59 - rather small	10	20	1	1	4	14	23	24	23	**120**	33.8
60-79 - average	13	18		2	7	8	20	13	11	**92**	25.9
80-99 - rather large	2	6	1		1	6	4	13	7	**40**	11.2
100-150 - large	5	3	1		5	3	8	2	3	**30**	8.4

The category with the largest number is that of “rather small” pieces 40 to 59 mm long, except among side-scrapers where “average” pieces (60 to 79 mm) dominate, and among awls in which “smaller” pieces predominate (although there are only eight).

Proportions

Proportions	SS	ES	B	A	BE	BK	N	D	V	Total	%
Very wide	3	5		2	1		6	3	5	**25**	7.0
Wide	4	5	1	1	4		7	3	4	**29**	8.1
Rather long	8	8	1		4	1	17	17	15	**71**	20.0
Long	14	27		2	10	10	26	27	16	**132**	37.1
Lamellar	9	16	2	3	2	19	16	15	11	**93**	26.1
On blade	1	1				2			1	**5**	1.4

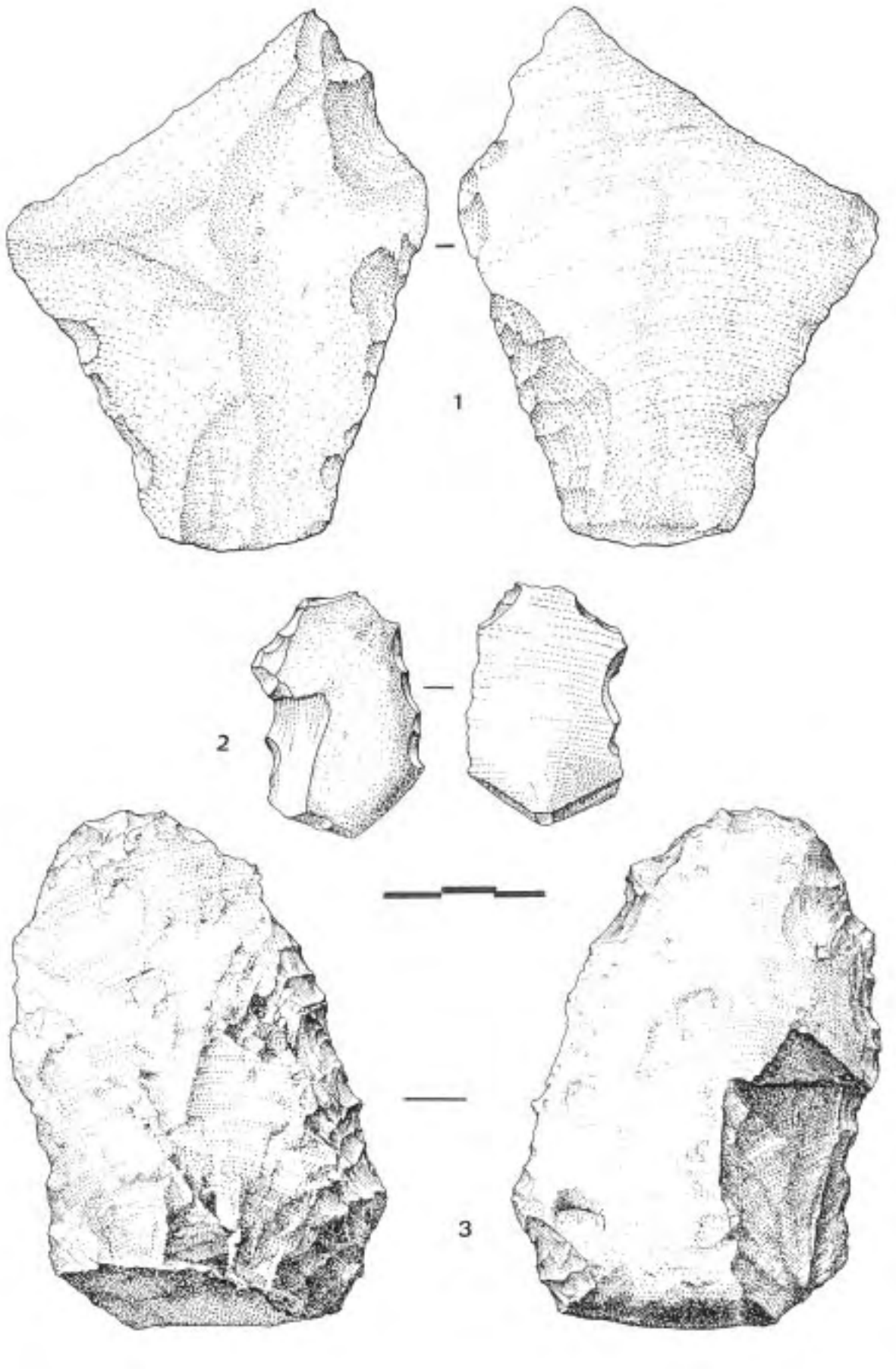

Fig. 49. Gombore I. Lithic industry from Level B. 1, 2: flakes with alternate retouch; 3: inverse retouched flake. Basalt. *Drawings by C. Chavaillon (1, 3) and J. Jaubert (2)*

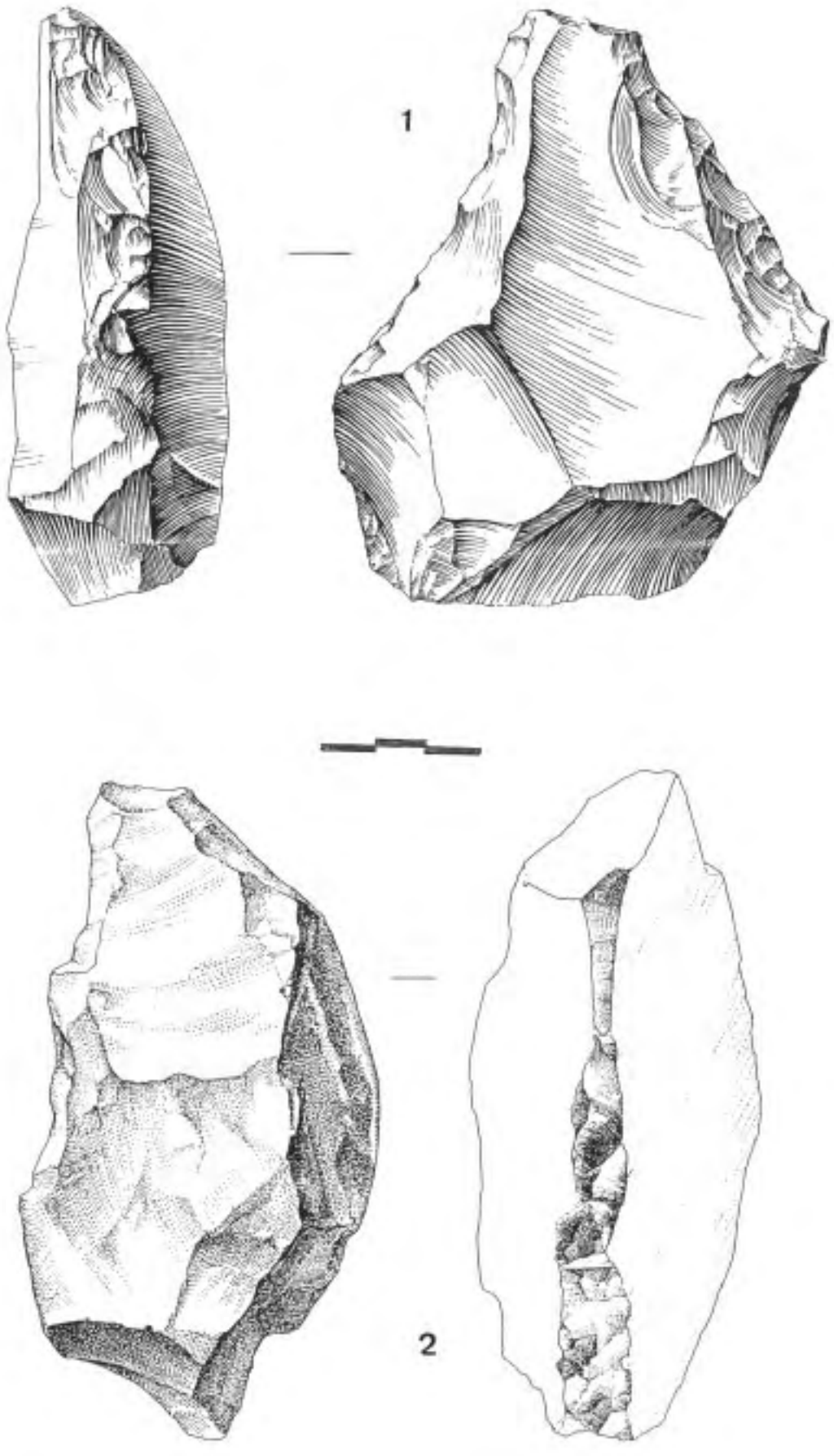

Fig. 50. Gombore I. Lithic industry from Level B. 1: borer; 2: burin. 1: obsidian; 2: tuff. *Drawings by C. Chavaillon*

Here, too, one category dominates, that of "long" pieces, except for naturally backed knives which are mainly "lamellar".

Striking platforms

Striking platform	SS	ES	B	A	BE	BK	N	D	V	Total	%
Punctiform/linear	3			2	1	3	7	4		**20**	10.8
Cortical	1	4			1	1	3	2	4	**16**	8.6
Flat	20	21			4	6	26	22	21	**130**	70.2
Dihedral		3			1	2	5		3	**14**	7.5
Facetted	2	1					1		1	**5**	2.7

Platforms are usually flat. It is notable that only 185 pieces retained a usable platform.

Upper face

The upper face of only 311 pieces could be studied as the rest were too damaged, worn or fragmentary.

About a hundred pieces have kept cortical areas or even a completely cortical face, only cut into by retouch.

Cortex	SS	ES	B	A	BE	BK	N	D	V	Total	%
Total	3	5					4	7	8	**27**	8.5
Partial	9	15		1	6	9	14	18	10	**73**	23.5

Percentages are calculated according to the total number of upper faces studied.

Percentages on the whole are similar among side-scrapers and end-scrapers but they are lower (0,5 and 19%) among pieces with notches.

Preparation of the upper face before flaking has resulted in flat upper faces that are entirely cortical or that have a negative flake scar, with two or more facets:

Upper face	SS	ES	B	A	BE	BK	N	D	V	Total	%
Flat		1	1		2	2	3	12	2	**23**	7.3
With 2 facets	2	2		1	4	8	12	9	9	**47**	15.0
> 2 facets	23	44	3	7	15	21	57	44	28	**242**	77.5

The upper face of the flakes before trimming clearly had traces of core preparation. The percentage of upper faces with several facets varies, according to the category, from 54% for "diverse" pieces to 79% for notched pieces. The composition of flake implements at Gombore I brings out the importance of end-scrapers, notched pieces and denticulated pieces. Burins and awls are rare but beaks and alternate burin-like beaks are more frequent. Side-scrapers of various types constitute 11% of the total, the most common being the lateral convex end-scraper.

Finally, it is surprising to find so many end-scrapers with high quality retouch on some of them.

Bone industry

Only two utilized bones have been observed at Gombore I. The first one (Fig. 52, *1*) is a fragment of modified bovid ribe showing possible utilization marks. The second one (Fig. 52, *2*) is a small flake cut from an unidentifiable bone.

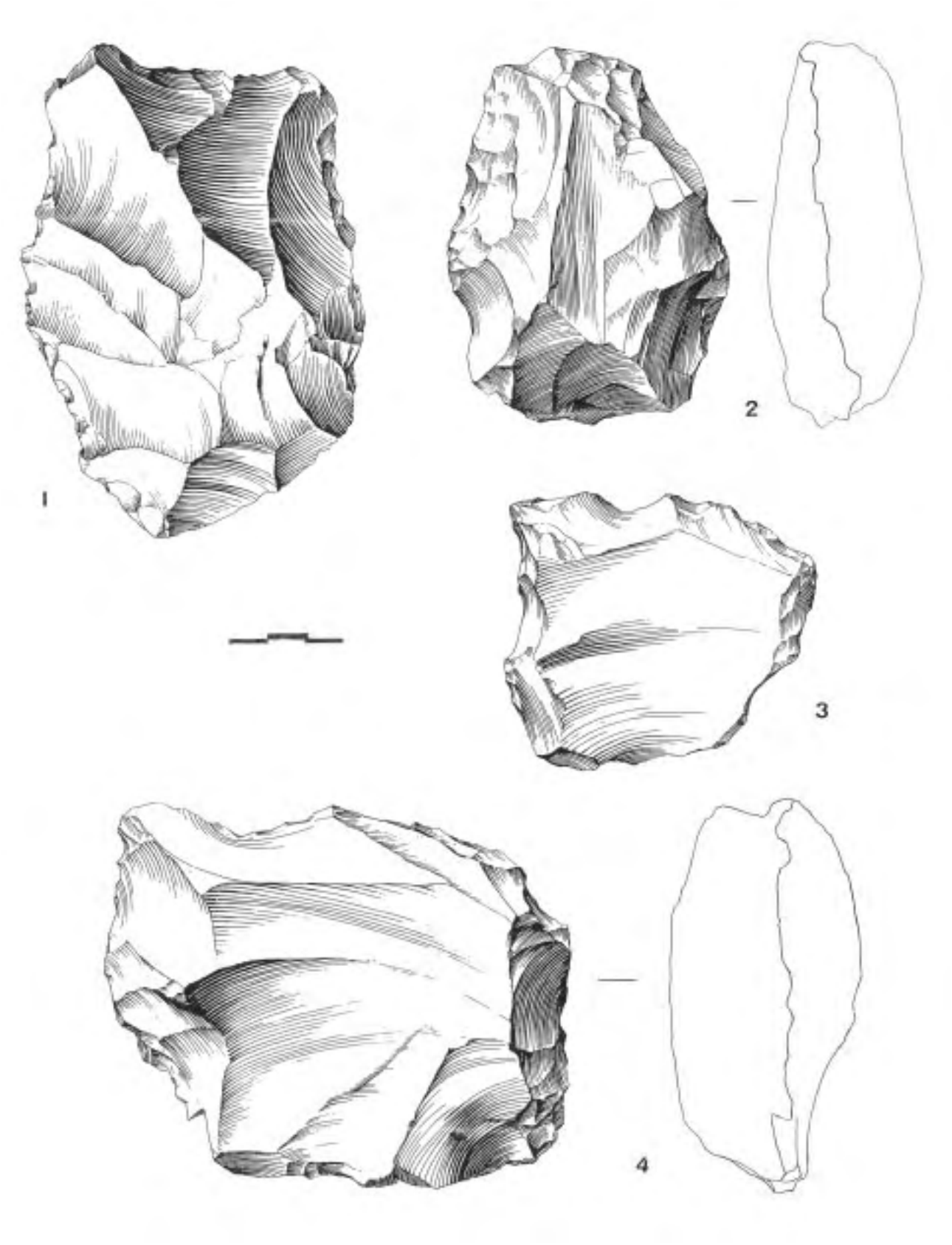

Fig. 51. Gombore I. Lithic industry from Level B. 1, 3: borers; 4 end-scraper/borer; 2: end-scraper. Obsidian.
Drawings by C. Chavaillon

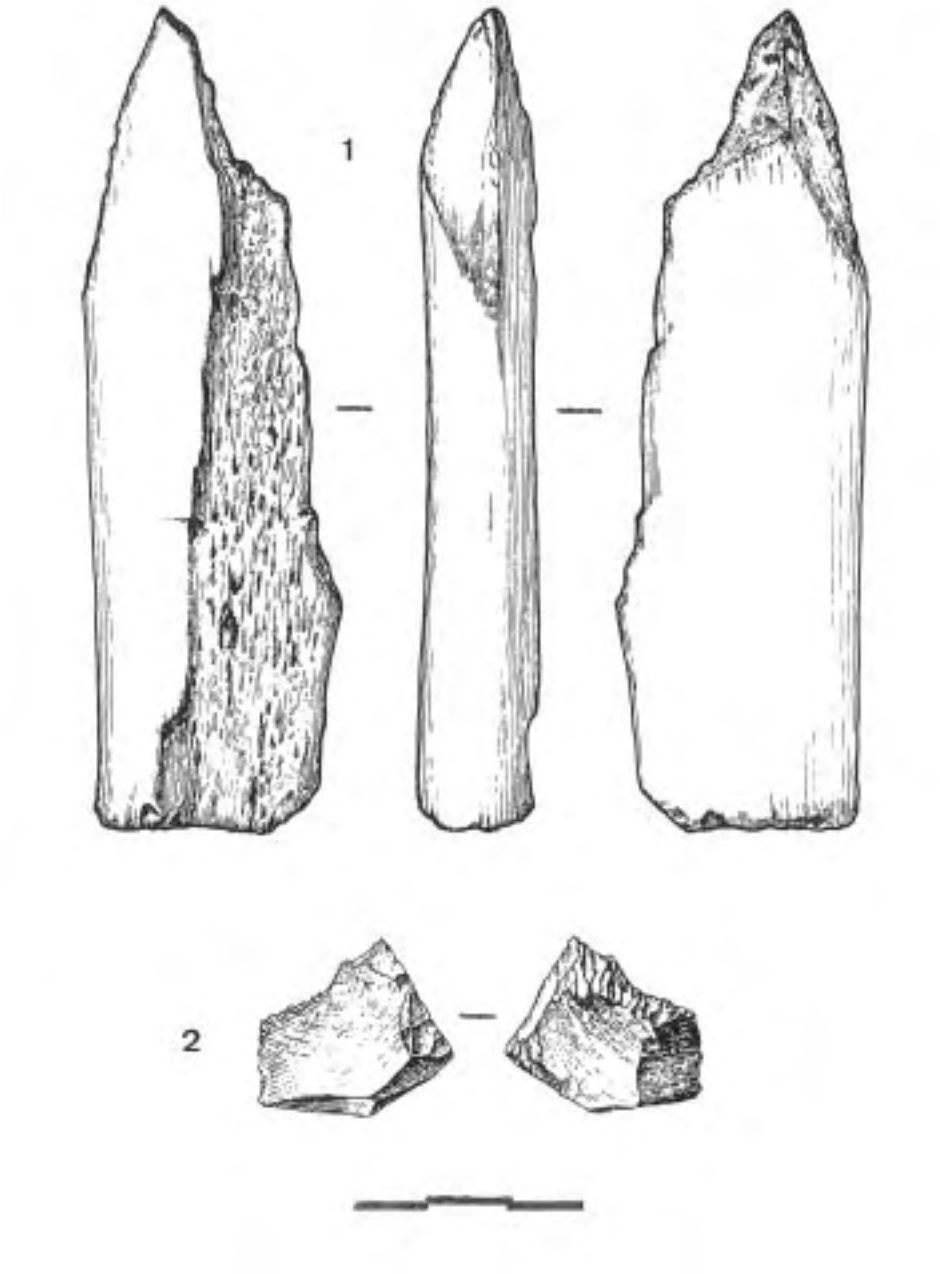

Fig. 52. Gombore I. Bone industry from Level B. 1: fragment of modified and utilized bovid rib; 2: small bone flake. *Drawings by C. Chavaillon*

Spatial distribution of tools on flake

The distribution of tools on flake is uneven over the excavated surface. They are much more numerous in the western part (from square metres 27 to 19) than in the eastern part (square metres 18 to 6).

Two zones of greater density can be seen to the west, with one to the north-west of about 19 square metres and another to the south-west of 15 square metres, and there is also a smaller zone of about 12 square metres towards the east.

Zone 1 comprises squares: H 27 to H 24
G 27 to G 22
F 27 to F 22
E 24 to E 22

That is to say, over 19 square metres there are 108 pieces with a density of 5.8 per square metre.

Zone 2 comprises squares: C 27 to C 25
B 27 to B 24
A 27 to A 24
Z 27 to Z 24

This surface of 15 square metres has 79 pieces and reaches a density of 5.3 per square metre.

Zone 3 comprises squares: G 15 to G 14
F 19 to F 15
E 19 to E 17
D 19
C 18

Over a surface of 12 square metres there are 42 pieces and the density is 3.5 per square metre.

Other sectors of the excavation have only yielded 1 or 2 pieces per square metre, with completely empty surfaces interspersed between relatively rich squares in E 25, D 24 and D 22, C 24 to C 22, B 23 to B 19, A 22, A 20 and A 14.

Towards the east of the site, squares 12 to 8 have no tools on flake over the entire width of the excavation, an area of more than 50 square metres. Neighbouring zones yielded 1 or 2 tools on flake, except for A 7 which had 3.

The study of the distribution by types (side-scrapers, end-scrapers, etc.) does not show any concentration of a particular category in the 3 richest zones; a few scattered pieces (1 or 2 per square metre) could easily belong to any group of tools.

In summary, there is definitely a western zone of the excavation that is rich in tools on flake and an eastern zone that is completely lacking in them or only has traces of them (1 per square metre).