PIERRE M. VERMEERSCH,
ETIENNE PAULISSEN and WILLEM VAN NEER

The Late Palaeolithic Makhadma sites (Egypt): environment and subsistence

Introduction

In this paper, we have assembled the three communications concerning the Makhadma sites (Qena, Upper Egypt) presented at this Symposium.

In 1980 we surveyed and evaluated the Qena area and examined the sections of the Makhadma site E6104 published by Wendorf and Schild (1976). According to these authors, the site contains a very fresh early Late Palaeolithic assemblage. In 1982 F. Wendorf kindly assigned further research on the Makhadma site E6104, which we will name further Makhadma 1, to the Belgian Middle Egypt Prehistoric Project of Leuven University.

Our 1983 campaign started with a survey of the area. Investigations in the vicinity of Makhadma 1 yielded several new Late Palaeolithic sites (Makhadma 2, 3, 4 and 5), all situated on the lower part of a scarp and characterized by a grey-black archaeological layer, features obviously missing at Makhadma 1. During the '83 and '84 campaigns our efforts focused on these sites, unknown to us outside the area, and the sites Makhadma 2 and 4 were chosen for excavation (Vermeersch 1983). In addition, several trenches were opened in the surroundings.

The physical environment, the stratigraphical position, the site characteristics, the archaeological material and the faunal remains of Makhadma 2 and 4 are treated briefly. In the last section the environment and related subsistence activities are discussed.

Physical environment

Between Wadi Qena and Wadi Makhadma, at a 10 km distance to the north, a 20 m high and rectilinear NW-SE scarp forms the contact between the Nile valley bottom (altitude: 70 - 73 m) and a higher surface to the north.

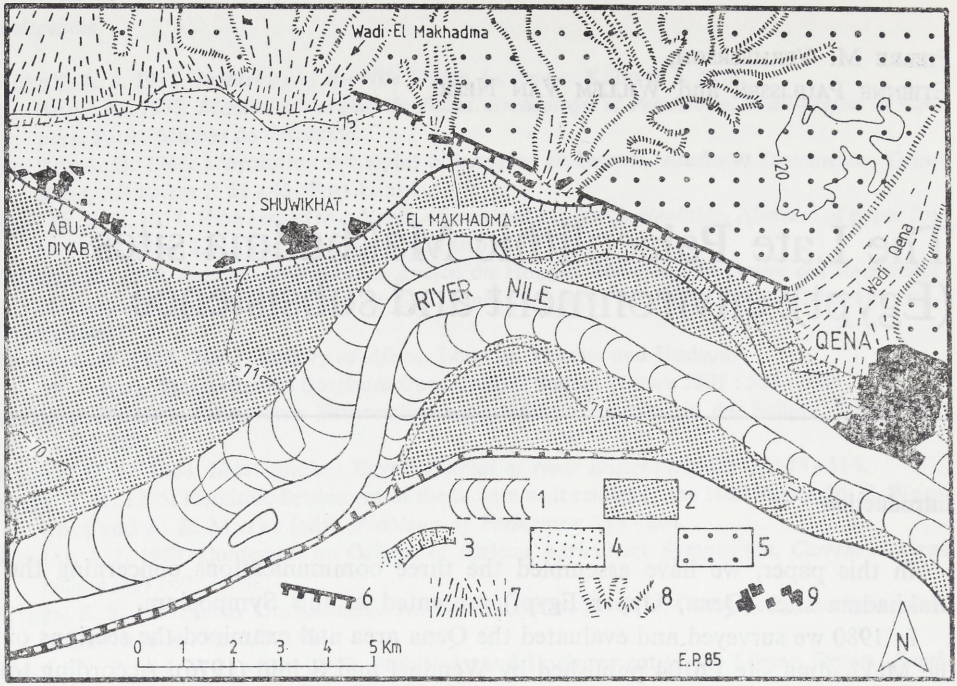

FIG. 1. Geomorphological map of the Qena-Makhadma region

1: Natural levees; *2*: Floodplain flats and basins; *3*: Abandoned Nile channel; *4*: Shuwikhat terrace; *5*: Surface above 90 m; *6*: Northern 20 m scarp of the Nile valley bottom; *7*: Important wadi fan deposits; *8*: Wadi; *9*: Town and villages.

In the Qena-Dishna area (Fig. 1) cultivation is not limited to the floodplain, but also includes the major part of a Nile Valley bottom terrace. This terrace, which we named the Shuwikhat Terrace (Paulissen and Vermeersch 1985) is well preserved in the area Makhadma-Abu Diyab just downstream of the deposits at the mouth of Wadi Qena. A fringe of former desert villages, now situated in the cultivated land, underlines the contact between the floodplain and the Shuwikhat terrace. The top of this silt terrace, originally situated at an altitude of more than 74 m, is planed off at about 72 - 73 m in the Makhadma area (Fig. 2). The terrace deposits are almost uncovered. At the out eredge however, towards the desert fringe, the Shuwikhat terrace is covered with wadi fans or slope deposits of minor importance, as is partly the case west of Makhadma in a narrow belt not yet cultivated. In the top of these slope deposits, the Late Palaeolithic industry of Makhadma 1 was recovered by Wendorf and Schild (1976).

The older surfaces, north of the 20 m scarp, are intensively dissected by wadis. It is a complex unit of Nile and wadi deposits developed at the mouth of Wadi Qena. Near Makhadma this unit is composed mainly of coarse sands – named Qena Sands by Said (1981) – covered by small hills of exotic cobbles. These hills are the inverted remnants of important accumulations in fluviatile channels eroded

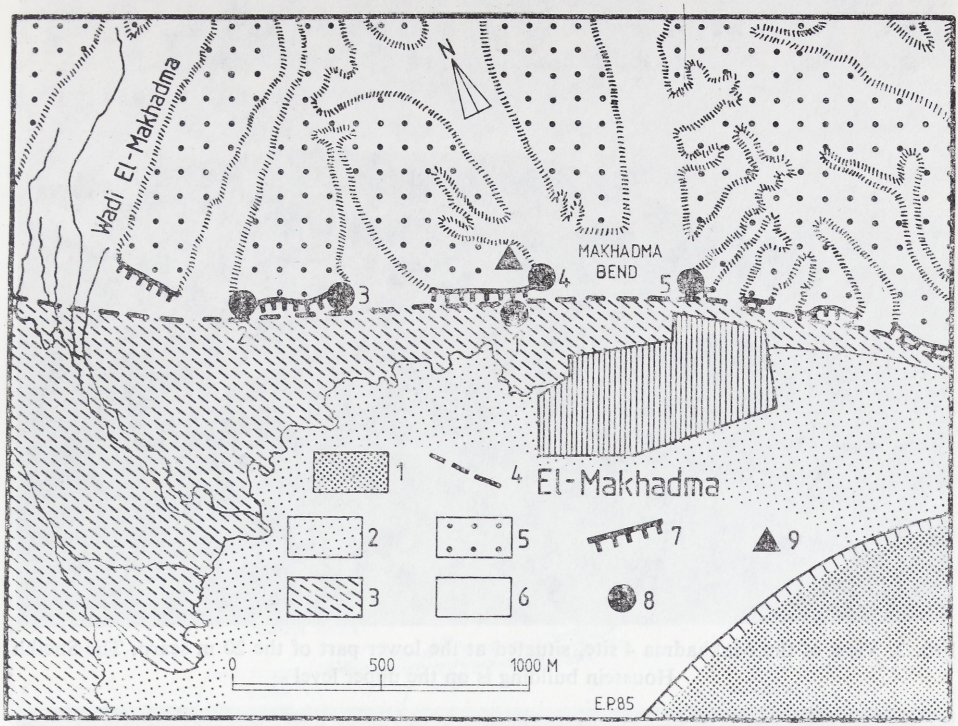

FIG. 2. Geomorphological map of the Makhadma area

1: Floodplain flat; *2*: Shuwikhat terrace planed off, silt exposed and under cultivation; *3*: Shuwikhat terrace covered with wadi fans and slope deposits; *4*: Outer limit of Shuwikhat silts; *5*: Surfaces higher than 90 m; *6*: Wadi; *7*: Northern 20 m scarp of the Nile valley bottom; *8*: Locations of the Makhadma sites; *9*: Location of the Sheikh Houssein building

in the underlying Qena Sands. The whole area is covered with a lag deposit, an admixture of cobbles and coarse sands.

As the slope deposits overlying the Late Palaeolithic Makhadma sites are of minor importance – less than 0.5 m thick and very restricted in surface – the related erosion on the higher levels must be evaluated as secondary. The physical aspect of the higher levels during Late Palaeolithic occupation was probably very similar to their present aspect, namely a rolling hill topography with nearly all the area under the sites paved with cobbles.

The Makhadma sites 2, 3, 4 and 5 are located in similar positions on the lower part of the slope near the divide between the wadi entrance and the scarp directed towards the Nile.

Makhadma 2 is situated on the Eastern divide of a local wadi very near to Wadi Makhadma, an important wadi with a large flat bottom grading with a 1% slope into a large sandy cone prograding over the Shuwikhat terrace.

Makhadma 4 (Fig. 3) is situated on the western divide with the Makhadma Bend

FIG. 3. View of the Makhadma 4 site, situated at the lower part of the 20 m scarp. The Sheikh Houssein building is on the upper level

FIG. 4. View of the Makhadma bend, eastwards from the scarp above Makhadma 4

(Fig. 4), an embayment resulting from the coalescence of different wadi bottoms and the subsequent erosion of the wadi divides. The bottom of this bend is rather flat and covered with a thin layer of wadi deposits.

The sites in their local geomorphic and stratigraphic position

The local geomorphic and stratigraphic record is figured in a catena profile (Fig. 5). We will summarize the main events from oldest to youngest.

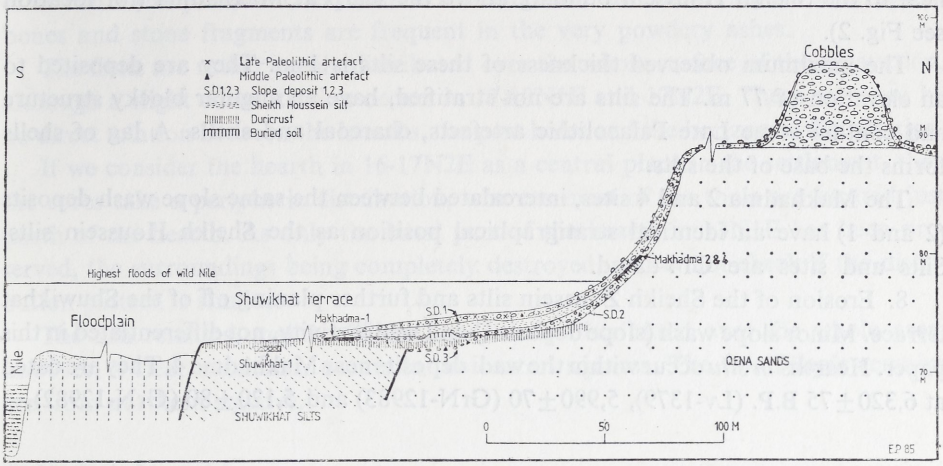

FIG. 5. General catena profile through the Makhadma area

1. Nile valley formation within older deposits, mainly the Qena Sands, resulting in the formation of a 20 m scarp at Makhadma. This history is complex but not differentiable at Makhadma.

2. Slope evolution and scarp retreat. The corresponding gravel lag contains rolled Middle Palaeolithic artefacts (slope deposit 3). This slope deposit is reworked near the scarp by slope deposit 2.

3. Nile erosion and formation of a valley wherein the Shuwikhat silts (see 4) have aggraded.

4. Aggradation of brown Nile silts, named the Shuwikhat Silts, and formation of the Shuwikhat Terrace (Paulissen and Vermeersch 1985). In the upper part of these silts we excavated a Late Palaeolithic site, Shuwikhat 1. These silts have been termed "possible Dandara" by Wendorf and Schild (1976: 116) and "Dandara" by Said (1981: 67).

5. Slope evolution and planing off of the Shuwikhat Terrace. Slope deposits contain reworked Middle and Late Palaeolithic artefacts. In top of these slope deposits (slope deposit 2), Wendorf and Schild (1976) recovered the Mahadma 1 site.

This layer grades into the lower slope deposits at Makhadma 1, 2 and 4. This lower slope wash is termed Makhadma Formation by Said (1981: 67).

6. Formation of a torrifluvent in the valley bottom and an inceptisol with ochric epipedon on the white slope deposits, only observed under Makhadma 4. Duricrust formation on top of the Shuwikhat silts, between 0.5 and 1.5 m below surface.

7. Deposition of dark calcareous Nile silts (7.5 - 10YR 5/3) to the base of the scarp and nearly in direct contact with the sites Makhadma 2 and 4. The silts have been considered as possible Sahaba by Wendorf and Schild (1976: 119). We gave these silts a local name: Sheikh Houssein Silts, according to the type location very near to the Sheikh Houssein building above the scarp at Makhadma (for location see Fig. 2).

The maximum observed thickness of these silts is 1 m. They are deposited to an elevation of 77 m. The silts are not stratified, have an angular blocky structure and contain some Late Palaeolithic artefacts, charcoal and shells. A lag of shells forms the base of the silts.

The Makhadma 2 and 4 sites, intercalated between the same slope wash deposits (2 and 1) have an identical stratigraphical position as the Sheikh Houssein silts. Silts and sites are C14-dated.

8. Erosion of the Sheikh Zoussein silts and further planing off of the Shuwikhat terrace. Minor slope wash (slope deposit 1) and wadi activity, not differentiated in this paper. Hearths *in situ* occur within the wadi deposits near Makhadma 4. They are dated at 6,320±75 B.P. (Lv-1379), 5,990±70 (GrN-12983) and 5,120±80 (GrN-12982).

The site characteristics

MAKHADMA 2

Site structures

Due to quarrying activity and erosion, less than 15 m² of this site was preserved. The excavation surface was thus limited.

On the lower part of the scarp, the in situ Qena sands are covered with a slope deposit of locally derived coarse sands, pebbles, cobbles and some rolled Middle Palaeolithic and Late Palaeolithic artefacts, distributed apparently at random. Upslope this slope deposit attains a thickness of 1 m, but thins out rapidly in the downslope direction.

The slope deposit is subdivided by the archaeological layer into 2 units. The lower slope deposit – slope deposit 2 – consists of stratified rill deposits at the base, covered by non-stratified sediments. The artefact-bearing layer, situated between an altitude of 77.0 and 78.5 m is very powdery and also contains some cobbles. The upper slope deposit – slope deposit 1 – covering the archaeological layer is very sandy and has an observed maximum thickness of 0.30 m.

Because the lower slope deposits are rich in derived terrace cobbles, it is a risky task to make the distinction between slope deposit cobbles and manuports. Nevertheless manuports certainly are present in the artefact bearing layer. Some of them are intensively rubified. There is, however, no sufficient reason for considering the cobbles as being part of a constructed pavement.

Two conical post holes could be observed. They have an upper diameter of 40 to 50 cm and have been planted to a depth of 80 cm. Two hearths were recovered: hearth 1 in 16N2E and hearth 2 in 13N1E. Both hearths consist only of an accumulation of charcoal and ashes, resting on rubified sand in a shallow pit. Only the base of hearth 2 was preserved, so that it is isolated from the archaeological layer. Burnt bones and stone fragments are frequent in the very powdery ashes.

The flints are rather evenly distributed over the whole surface of the excavation, although a slight concentration occurs in 17-18N1E and 17N2E. There seems to be no direct relation between the hearths, the post holes and the horizontal distribution.

If we consider the hearth in 16-17N2E as a central place in the settlement, then the cores take a peripheric distribution, whereas most of the tools are located just north of the hearth. As only the basal part of the hearth in 13N1E has been preserved, the surroundings being completely destroyed, we cannot check if the distribution pattern is similar.

The fish remains, mainly *Clarias*, are evenly distributed over the whole area; however, a clear maximum occurs in the central squares. The few *Tilapia* remains are from northern squares.

Archaeological material

The archaeological material collected at Makhadma 2 will be considered as belonging to a single occupation period, even if this is unlikely. However, we have no possibilities of separating the material (Table 1).

The faunal remains are listed in Table 2.

All the chert is derived from the higher terrace cobbles, which are rich in chert (about 30%). This chert is not homogeneous and different qualities are present. Upper Palaeolithic man had a clear preference for a fine grained soft-feeling chert of light brownish grey colour (5 to 7.5 YR 7/2), which makes up about 1% of the terrace cobbles. This is a good quality chert. Besides chert, other materials occasionally were utilized for flaking, such as basalt and limestone. About 2,000 artefacts have been collected during the excavation.

The single platform core type (66%) occurs most frequently. The debitage technique is very simple and consists of the removal of a primary flake, perpendicular to the long axis of the chert cobble, thus creating a single platform, which was subsequently used for blade production along the long axis of the core. Judging from the low number of core trimming pieces, a *crête* sometimes was prepared before starting blade production.

Table 1

Tool type list of Makhadma 2 and Makhadma 4

Tool types	Makh 2	Makhadma 4	
	N	N	%
1. Single end-scraper on a flake	2	6	3.57
5. Denticulated end-scraper	8	5	2.98
8. Single end-scraper on a blade	2	1	0.60
12. Single piercer		2	1.19
17. Angle dihedral burin	1		
17-18. Dihedral burin		23	13.69
19. Burin on a break	1	28	16.67
19b. Burin on a natural surface		1	0.60
19c. Multiple burin on a break		1	0.60
21. Burin on a straight normal truncation		1	0.60
23. Burin on a concave truncation		4	2.38
26. Multiple truncation burin		1	0.60
27. Multiple mixed burin	1	1	0.60
28. Core-like burin		2	1.19
44. End-scraper burin	1		
45. Pointed straight backed bladelet		2	1.19
55. Bladelet with curved backed end		6	3.58
64. Shouldered bladelet		1	0.60
66. Fragment of a backed bladelet		5	2.98
68d. Backed and truncated bladelet with retouched base		1	0.60
74. Notched flake	1	14	8.33
75. Denticulated flake	7	11	6.55
76. Notched blade or bladelet		4	2.38
77. Denticulated blade or bladelet	9	5	2.98
80. Truncated piece		21	12.50
82. Segment		2	1.19
84. Asymmetrical trapeze		3	1.79
87. Trapeze with two concave sides		1	0.60
88b. Trapeze with two convex sides		1	0.60
89. Isocele triangle		4	2.38
93. Triangle with two convex sides		1	0.60
105. Pieces with continuous retouch	not yet recorded		
106. Side scraper		2	1.19
109a. Pointed piece with unilateral proximal retouch		3	1.79
109b. Pointed piece with bilateral proximal retouch	2	3	1.79
112. Miscellaneous	1	2	1.19
Total	46	168	100.07

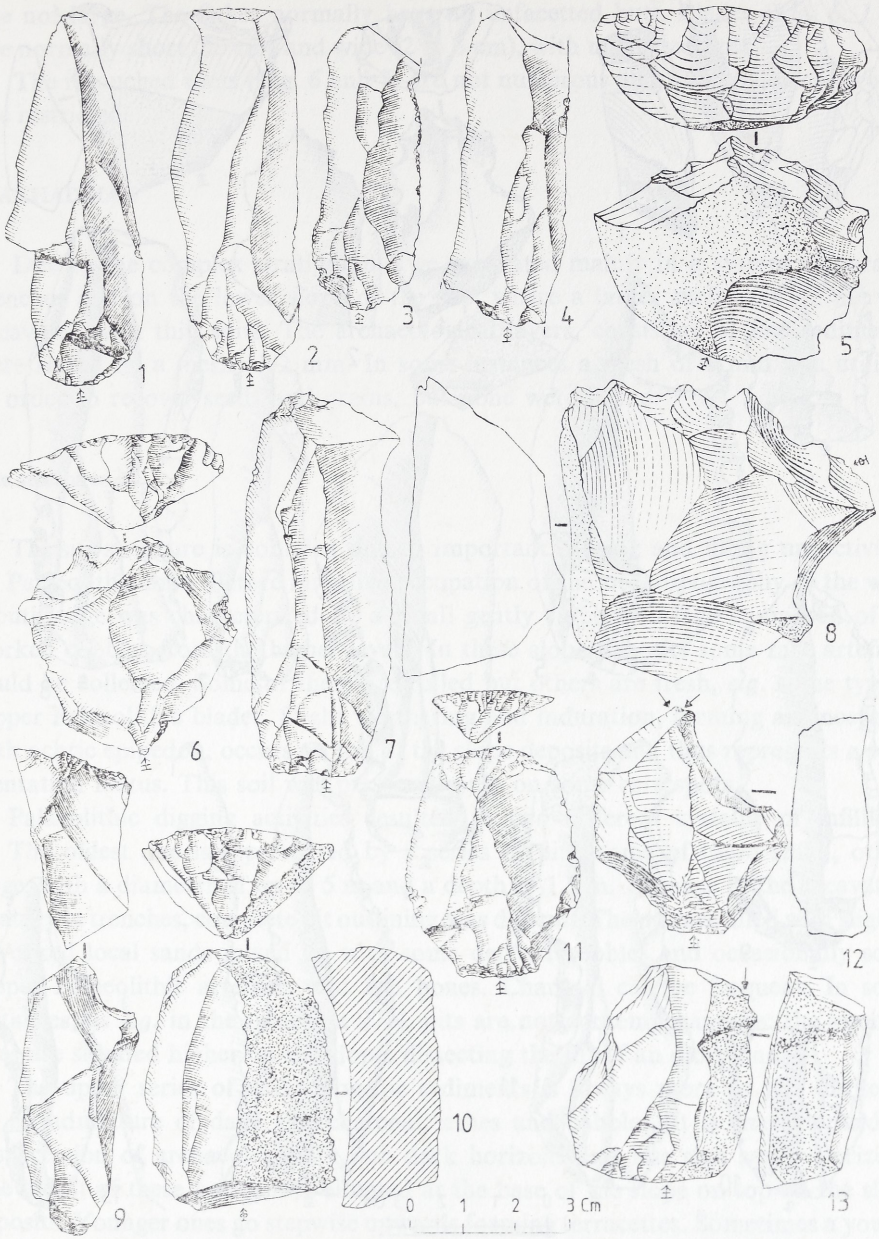

FIG. 6. Makhadma 2. Lithic assemblage

1 - 4: Blades; *5 - 11*: End-scrapers; *12, 13*: Burins

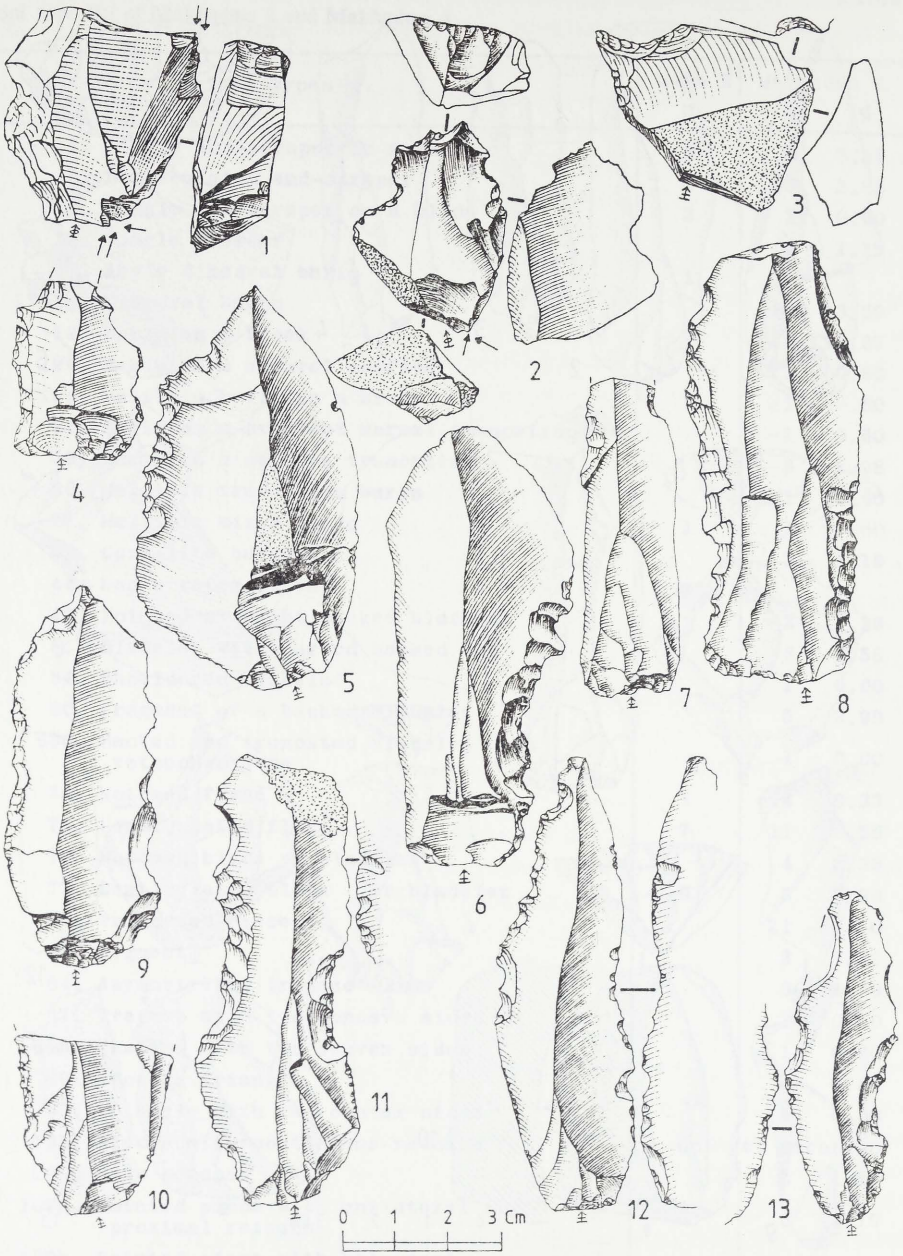

FIG. 7. Makhadma 2. Lithic assemblage

1: Burin; *2*: Scraper-burin; *3 - 13*; Notched and denticulated pieces

It is not surprising that many flakes have preserved cortex patches as the cobbles are not large. The flakes normally have an unfacetted butt. Blades (Fig. 6: *1 - 4*) are normally short (10 cm) and wide (2 to 3 cm), with unfaceted butt.

The retouched tools (Fig. 6 and 7) are not numerous and the typological groups are restricted.

MAKHADMA 4

Due to the complex stratigraphy, we excavated mainly in a system of parallel trenches and on the lower slope of the site, where a larger surface of 12 m^2 was excavated with thin spits. The archaeological layers, consisting of fine sediments, were sieved on a mesh of 2 mm. In some instances a mesh of 1 mm was utilized in order to recover seeds and grains, but none were found.

Site structures

The site structure is complex due to important digging and filling up activities by Palaeolithic man. Before intensive occupation of the site, topography of the wadi mouth edge was characterized by a small gently sloping surface composed of reworked cobbles from the higher levels. In these slope deposits some rare artefacts could be collected. Some of them are rolled but others are fresh, *e.g.* some typical Upper Palaeolithic blades. Slight weathering and induration, forming an inceptisol with ochric epipedon, occurs on top of the slope deposits and thus represents a sedimentation hiatus. This soil was preserved only on some rare spots.

Palaeolithic digging activities resulted in two different systems of infillings.

The oldest one is represented by a series of pits, some of them small, others large, with a diameter of up to 5 m and a depth of 1.5 m. Because of the excavation strategy in trenches, complete pit outlining was difficult. The pits are filled with slightly reworked local sands mixed up with some derived pebbles and occasionally some Upper Palaeolithic artefacts and fish bones. Charcoal can be frequent. In some instances, as *e.g.* in the trench at 27N, pits are not contemporaneous: the younger ones are situated higher on the slope, dissecting the fill of an older one.

The upper series of anthropogenic sediments is always more or less darkened by an admixture of dark silt, charcoal, ashes and cobbles. It is characterized by a succession of archaeologically rich dark horizons and less rich sandy horizons. The oldest of these horizons is situated at the base of the slope on top of the slope deposits. Younger ones go stepwise upwards forming terracettes. Sometimes a younger one may cut into the deposits of an older one. At the base of this grey-black layer some small holes, probably postholes, could be observed. The top of the upper series was eroded by posterior slope evolution (slope deposit 1). The present thickness of this series is certainly only part of what it was in Palaeolithic times. The eroded

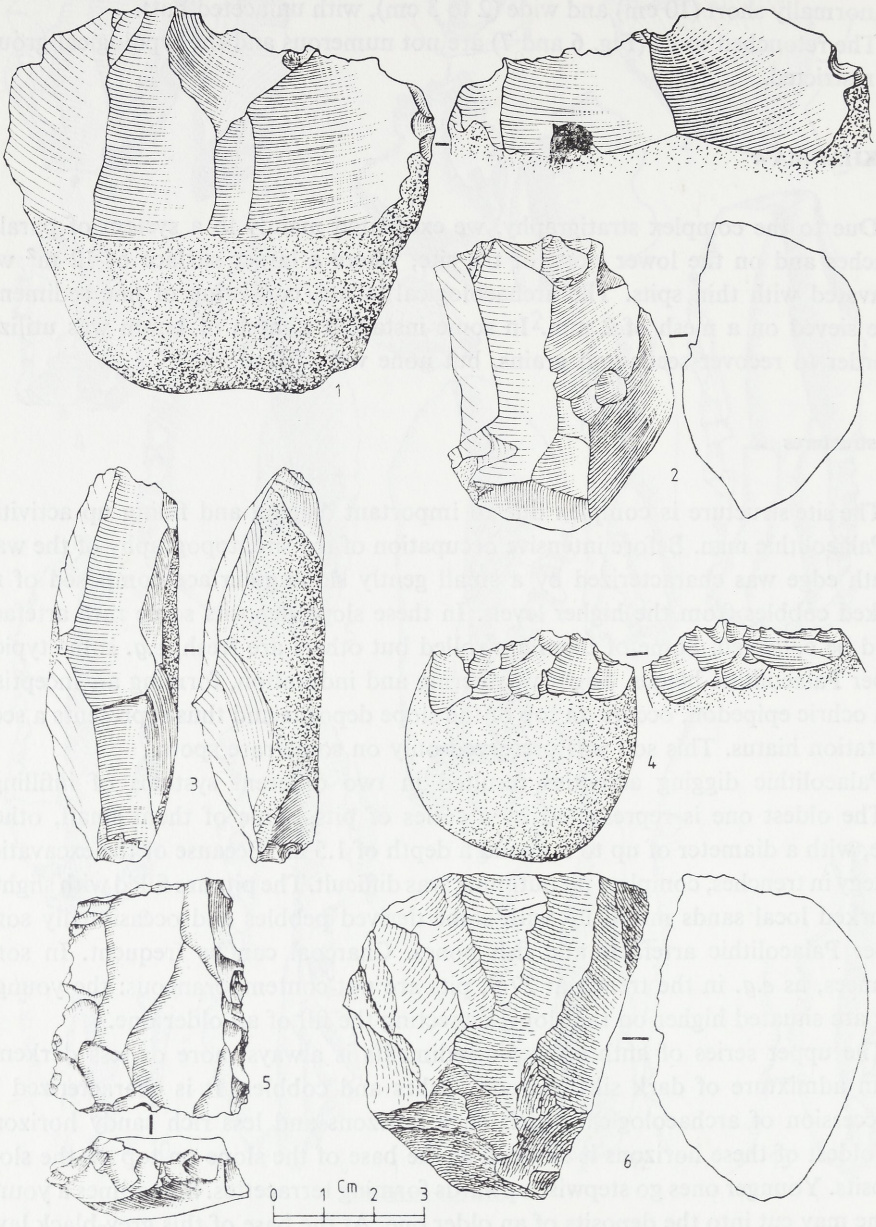

FIG. 8. Makhadma 4. Cores

black archaeological layer can be found as a slope deposit at the base of the slope, *e.g.* in the larger excavated surface. These slope deposits are rich in archaeological material, even in very fragile fish remains.

Archaeological material

As in Makhadma 2, terrace cobbles have been utilized in the debitage procedure. Artefacts are normally in a fresh state of preservation. However, some artefacts are more or less rolled. As a general rule the most intensively rolled ones can be found in the basal part of the gray-black layer, whereas the very fresh ones are to be found in the central part of that layer. Artefacts from the pits are not numerous.

The faunal remains are listed in Table 2.

Cores are made out of cobbles. The chert is of varying quality, often of light brownish gray colour. Some of the cobbles have rather fresh cortex whereas others are fully rolled.

The single platform core (Fig. 8: *2 - 6*) is the most numerous type. A *crête* was only sporadically prepared. Striking platforms are flat. As at Makhadma 2, debitage technique is very simple, consisting in removing a primary flake perpendicular to the long axis of the nodule, thus creating a single platform. The final products of the flaking strategy are mainly bladelets and elongated flakes. Core edges are not regularized, but strongly denticulated as to be comparable to some of the thick denticulated scrapers. Cortex is often present at the reverse side of the core.

Flakes and blades occur by thousands, but for the time being, a complete record is not yet available. There is, however, a general resemblance with the Makhadma 2 debitage. Blades are short and wide (L: 42.42 ± 18.6 mm; W: 16.45 ± 7.9 mm; T: 5.85 ± 4.0 mm), but sometimes of very good quality. The butt is flat.

Retouched tools (Table 1) are not numerous and the typological groups are restricted. We tried to exclude the artefacts with accidental retouches. Pieces with a continuous retouch have not been recorded in our listing.

Single end-scrapers (Fig. 9: *1 - 6, 9*) are not numerous nor are they of good quality. The burin (Fig. 9: *8, 10 - 13*; 10: *1 - 14*), accounting for 37% of the tools, is an important category. The backed bladelet group (Fig. 11: *6 - 12*) is represented by some rather atypical elements. Some of them are rather flakes than bladelets. A carefully manufactured one (Fig. 11: *7*) is a backed and truncated bladelet with retouched base. Some of the bladelets with curved backed end (Fig. 11: *3 - 5*) are similar to some of the truncations. Notches are the best represented tool category at the site. The category of truncations (Fig. 11: *10 - 30*) is an important group. Geometric microliths (Fig. 11: *31 - 40*) are rare but present. The absence of microburins and trihedral points suggests that the microburin technique has not been utilized. Segments (Fig. 11: *35, 37*), trapezes (Fig. 11: *32 - 33, 36, 40*) and triangles (Fig. 11: *31, 34, 38 - 39*) can be found. The trapezes, however, are atypical. Naturally pointed blades or bladelets can have an unilateral or a bilateral proximal retouch (Fig. 8).

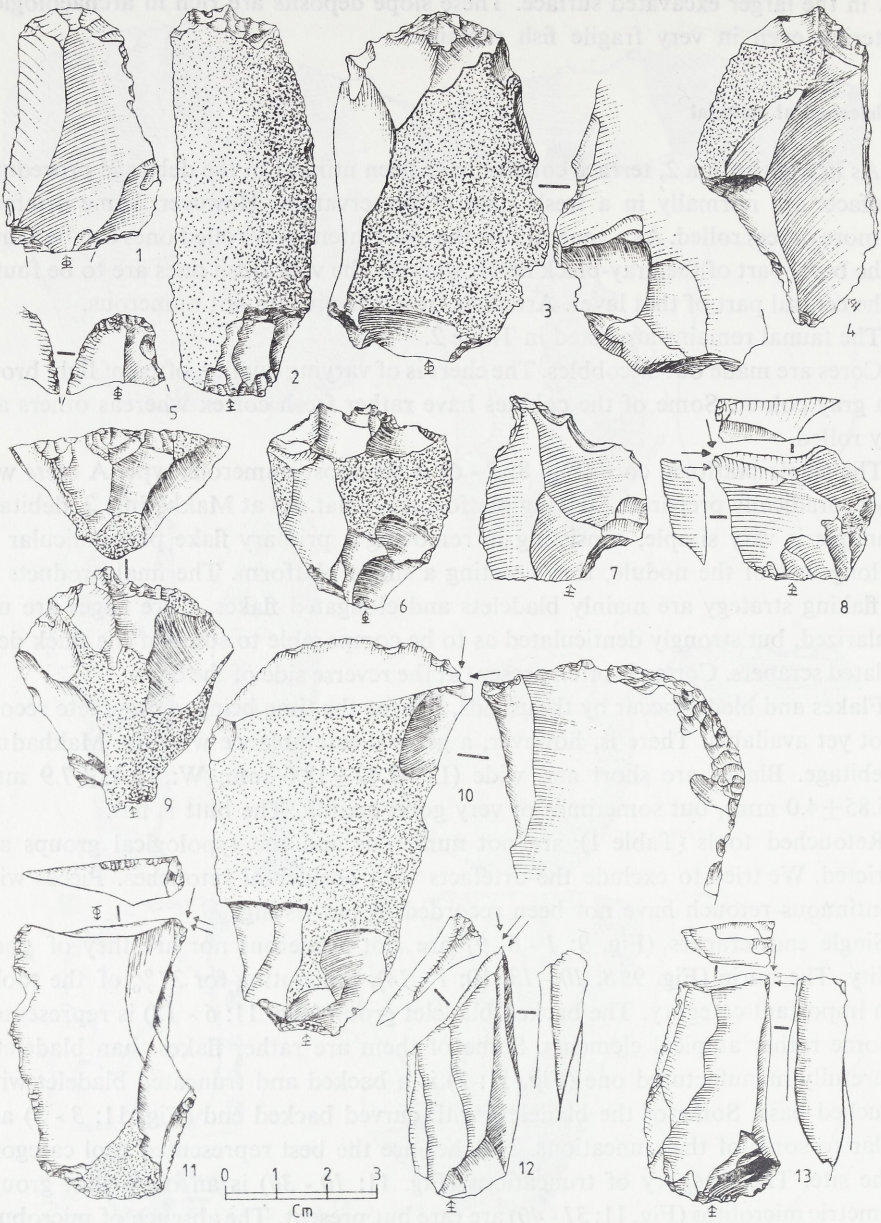

FIG. 9. Makhadma 4. Lithic assemblage

1 - 6, 9: End-scrapers; *7*: Piercer; *8, 10 - 13*: Burins

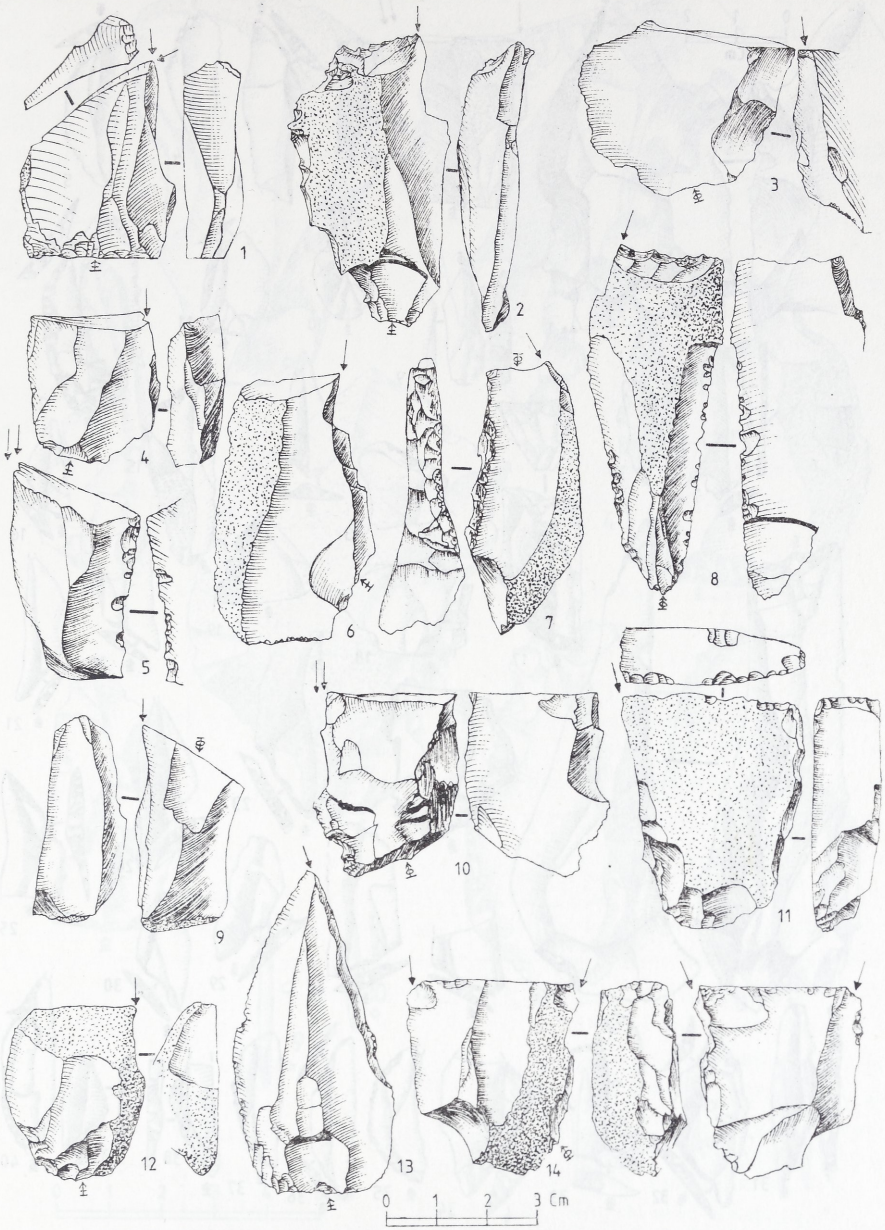

FIG. 10. Makhadma 4. Burins

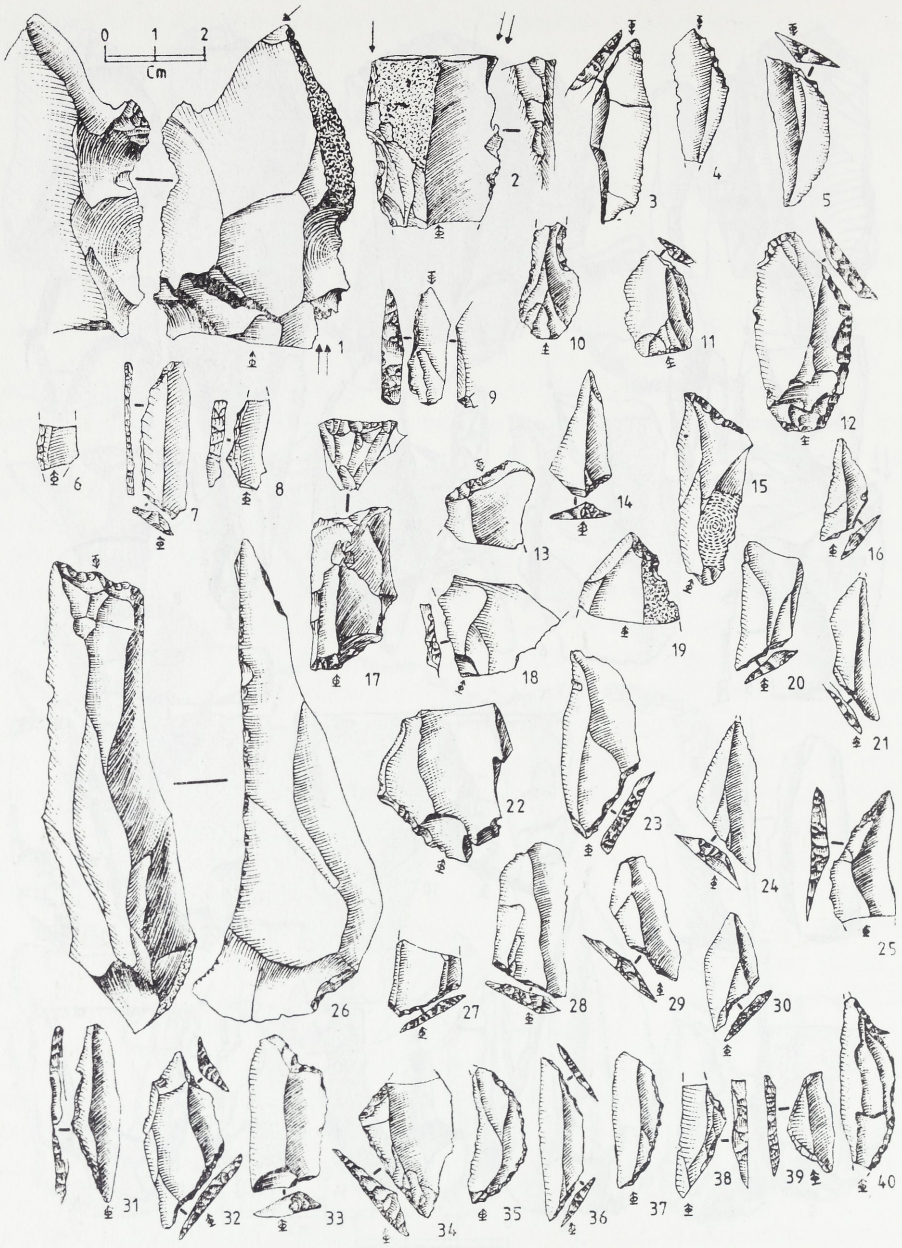

FIG. 11. Makhadma 4. Lithic assemblage

1, 2: Burins, *3 - 5*: Bladelets with curved backed end; *6 - 12*: Backed bladelets; *13 - 30*: Truncations; *31 - 40*: Geometric microliths

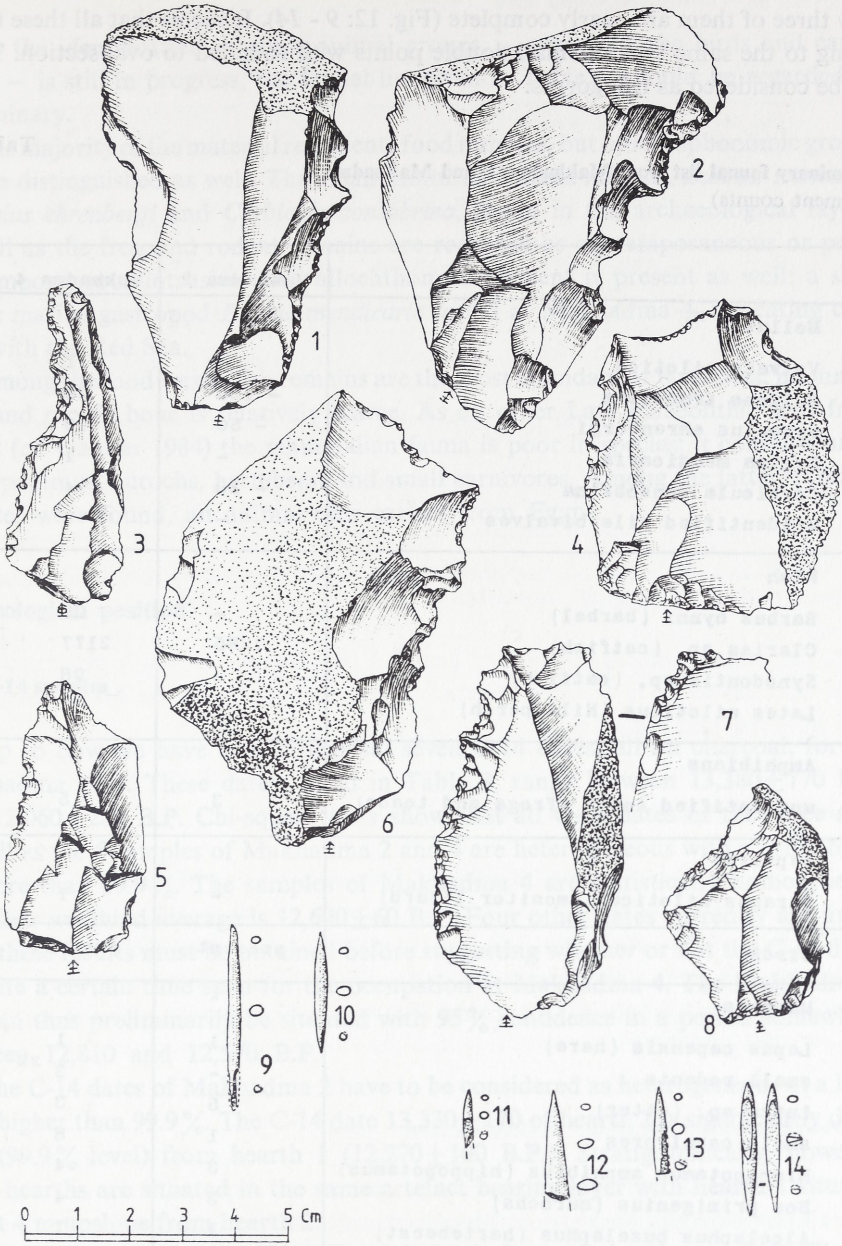

FIG. 12. Makhadma 4. Lithic and bone implements

1 - 8: Notched and denticulated pieces; *9 - 14*: Bone tools

The site yielded some bone tools which have been obtained from mammal bone. Only three of them are nearly complete (Fig. 12: *9 - 14*). It seems that all these tools belong to the same type of small double points with rounded to oval section. They can be considered as fish gorges.

Table 2

Preliminary faunal list from Makhadma 2 and Makhadma 4
(fragment counts)

	Makhadma 2	Makhadma 4
Molluscs [x]		
Valvata nilotica	-	1
Bulinus truncatus	± 100	25
Gyraulus ehrenbergi	± 50	19
Engina mendicaria	-	1
Corbicula consobrina	± 20	4
unidentified Nile bivalves	-	9
Fish		
Barbus bynni (barbel)	-	29
Clarias sp. (catfish)	1285	2177
Synodontis sp. (catfish)	-	98
Lates niloticus (Nile perch)	-	1
Amphibians		
unidentified Anura (frogs and toads)	3	5
Reptiles		
Varanus niloticus (monitor lizard)	-	1
Birds	present	present
Mammals		
Lepus capensis (hare)	1	1
small rodents	-	3 [xx]
Lutra sp. (otter)	5	3
small carnivores	1	8
Hippopotamus amphibius (hippopotamus)	3	4
Bos primigenius (aurochs)	3	4
Alcelaphus buselaphus (hartebeest)	1	7

* With the exception of 1 *Gyraulus* and 1 *Bulinus* the molluscs from Makhadma 2 are sampled in and at the base of the Sheikh Houssein silts.

** In addition to these isolated fragments, three almost complete skeletons were found.

In section „Fish" species *Tilapia* sp. should be added: 18 for Makhadma 2, and 4989 for Makhadma 4.

Faunal remains

As the identification of some animal groups – especially the birds and carnivores – is still in progress, the faunal list given in Table 2 should be regarded as preliminary.

The majority of the material represents food remains, but other taphonomic groups can be distinguished as well. The small molluscs *Valvata nilotica*, *Bulinus truncatus*, *Gyraulus ehrenbergi* and *Corbicula consobrina*, found in the archaeological layers, as well as the frog and rodent remains are regarded as contemporaneous or penecontemporaneous intrusives. An allochthonous element is present as well: a shell of the marine gastropod *Engina mendicaria* found at Makhadma 4, indicating contact with the Red Sea.

Among the food waste, fish remains are the most abundant at both sites; mammal, bird and reptile bone is relatively scarce. As on other Late Palaeolithic sites from Egypt (*cf.* Gautier 1984) the mammalian fauna is poor in species: it contains hare, hippopotamus, aurochs, hartebeest and small carnivores. Among the latter, remains of otter were found, an animal now extinct from Egypt.

Chronological position

The C-14 samples

Up to now we have at our disposal seven C-14 dates, all on charcoal, for the Makhadma sites. These dates, listed in Table 3, range between 13,380±770 B.P. and 12,060±280 B.P. Chi-square tests show that all C-14 dates of the three sites as well as the 6 samples of Makhadma 2 and 4 are heterogeneous with a probability of more than 99.9%. The samples of Makhadma 4 are statistically homogeneous and their weighted average is 12,690±60 B.P. Four other dates currently are under way; these results must be obtained before suggesting whether or not the C-14 dates indicate a certain time span for the occupation at Makhadma 4. The Makhadma 4 site can thus preliminarily be situated with 95% confidence in a period somewhere between 12,810 and 12,570 B.P.

The C-14 dates of Makhadma 2 have to be considered as heterogeneous at a level even higher than 99.9%. The C-14 date 13,330±170 of hearth 2 is significantly different (99.9% level) from hearth 1 (12,270±100 B.P.). Stratigraphically, however, these hearths are situated in the same artefact bearing layer with hearth 1 situated about 4 m upslope from hearth 2.

The C-14 date 12,060±280 B.P. of derived charcoal sieved out of the Sheikh Houssein silts at 10 m from the site fits remarkably well with the apparent age of hearth 1, so that these 2 samples can date the same event. Their average age is: 12,250±95 B.P., dating the event at a 95% confidence level between 12,450 and 12,050

Table 3

C-14 dates of the Makhadma sites

Site	C-14 dates in B.P.	Laboratory No	Provenience of charcoal
1/A *	13,380 ± 770	I-3440	from thin layer of Sheikh Houssein silts
2	12,060 ± 280	GrN-12029	sieved out from Sheikh Houssein silts
2	12,270 ± 100	GrN-12030	hearth at 17N2E
2	13,330 ± 170	GrN-12031	hearth at 13N1E
4 **	12,790 ± 170	GrN-12032	scattered fragments from 15-18N8E. Depth: 50-80 cm
4	12,570 ± 80	GrN-12033	scattered fragments from 19N5E. Depth: 70 cm
4	12,940 ± 130	GrN-12034	scattered fragments from 27N7-8E. Depth: 60 cm

* Wendorf and Schild 1976: 118.

** C-14 dates of the pits are now (1989) available: 12,410±120 (GrN-12984); 12,410±60 (GrN-12985); 12,340±70 (GrN-12936); 12,320±100 (GrN-12981).

B.P. The stratigraphical position of hearth 1 overlaying a posthole structure makes clear that this event is certainly related to the occupation of the Makhadma 2 site and its associated industry.

Datation of the Sheikh Houssein silts

The date of charcoal from the Sheikh Houssein silts at Makhadma 1 has a very large standard deviation, so that it is not possible to specify its position in relation to the dates of the other sites. The sample of derived charcoal GrN-12029 (Table 3) within the top part of the Sheikh Houssein silts at Makhadma 2 antedates of course part of this silt aggradation. It means that this aggradation continued for a while after 12,250±95 B.P.

Chronological succession of the Makhadma sites

Due to the stratigraphical position in the top of slope deposits underlying the Sheikh Houssein silt, Makhadma 1 is considered to be the oldest of the sites involved. No C-14 dates are available. The Makhadma 1 C-14 date is not situated within the archaeological site.

Makhadma 4 is preliminarily dated at 12,690±60 B.P. Dating of Makhadma 2 is hampered by the interpretation of the sample GrN-12031. If this sample age is

related directly to the occupation of the site, then the site history ranges between 13,330±170 B.P. and 12,250±95 B.P. with a discontinuous occupation over a longer period. However, if the sample age is unrelated to the occupation (burning of old wood, remnant from older occupation on the same spot), then prehistoric man lived at this spot somewhere between 12,450 and 12,050 B.P.

The available C-14 dates indicate that the Makhadma 2 and 4 were both inhabited in a time period less than a millennium between 13,000 and 12,000 B.P.

General discussion

Site characteristics and subsistence activities

The Makhadma 2 and 4 sites with gray-black archaeological deposits are middens, similar to the *escargotières* of the Maghreb, but with fish remains instead of snail shells. Most of the sediments of the black archaeological layer are of human origin. Only the sandy matrix and the cobbles are locally derived. The bones, flints and ashes are a typical midden deposit. The admixture with black silt is probably due to the frequent contact between the site and the muddy fishing grounds. From the inner structure of the black archaeological layer, it can be inferred that the midden deposits are the result of a relatively long, but not necessarily continuous occupation period.

From the faunal list it is evident that fishing must have been the main subsistence activity at both Makhadma 2 and 4. Hunting and fowling apparently were practised less intensively but the meat yield of each catch, especially of the ungulates, was much higher.

Makhadma 2 and 4 are rare examples of sites where the occupation and the corresponding behaviour of the Nile have been dated separately. The contemporaneous Nile deposits are the Sheikh Houssein silts, still aggrading posterior to 12,250± ±95 B.P. The identical stratigraphical position of sites and silts, the subsistence activities, and the location of the sites just above and beyond these well preserved deposits are considered as important additional arguments for linking sites and silt deposits.

The Sheikh Houssein silts and the "Wild Nile"

The field observations clearly show that a well marked hiatus exists between the Shuwikhat silts, containing a Late Palaeolithic site at Shuwikhat 1 and the Sheikh Houssein silts. These latter silts are related to a period with very high Nile floods, the highest in Late Palaeolithic times. The maximal flood level is at about 6 m above the floodplain and at about 4 m above the Shuwikhat Terrace.

At Makhadma these silts are dated not only by two C-14 dates (Table 3), but also by the presence of a key horizon, the so-called burned layer, dated at Kumbelat (between Qena and Luxor) at 12,500±230 (I-3424, Wendorf and Schild 1976: 102 - 104). This horizon is *in situ* at the base of the silts near Makhadma 1, within the silts near Makhadma 4 and is in derived position within the silts at Makhadma 2. In the Kom Ombo Plain, Butzer and Hansen (1968: 115) mentioned already sporadic evidence of high Nile floods (22 m above floodplain), having an averaged date of 11,940±90 B.P. (V-1446; HV-1264 and HV-1265).

The Sheikh Houssein silts, defined at Makhadma, are thus a thin layer of dark Nile silts often conserved at the outer edge of the inundated area and deposited in a stage with occasional or temporay Nile floods of exceptional amplitude, termed the "Wild Nile" by Butzer (1980: 272). From all existing evidences in the Egyptian Nile valley, this catastrophic period is dated from 12,690±60 B.P. to 11,940 ±90 B.P. The Sheikh Houssein silts can be correlated tentatively with the upper part of the Darau Member, Gebel Silsila Formation (Butzer and Hansen 1968; Butzer 1980), termed also the Sahaba-Darau Aggradation or Formation (Wendorf and Schild 1976; Said 1981; for d'scussion see Wendorf *et al.* 1979).

Environment and seasonality

The "Wild Nile" inundations were related to climatological changes in the headwaters and occured in an environment largely determined by local climatic conditions. For this stage we assume a hyperarid climate. This statement is based on following observations pointing to a lack of water activity induced by local rains. The observations are: deposition of Sheikh Houssein silts in the wadi mouths, no intercalations of wadi deposits within these silts and no rill erosion or sedimentological stratifications within the midden deposits, even on the steep slopes. The area free of inundations is thought to be a barren desert with similar geomorphological and environmental characteristics as today.

During the highest floods of the "Wild Nile" stage, and especially during its waxing phase, when terrestial life was not yet adapted to the new system, the changes in the Nile valley bottom had to be dramatic. Indeed, just prior to these events, the Nile floodplain is supposed to be situated below the actual floodplain. During the "Wild Nile" stage, with a flood height of +6 m above the modern floodplain, the inundated area extended all over the valley bottom and included the Shuwikhat Terrace so that no refuge was left for man or other mammals. Higher floods also inundated the Makhadma bend and reached the scarp. The Makhadma sites are thus situated on a safe place as close as possible to the inundated area and on the contact between extreme environments. It seems reasonable to suppose that these events directed prehistoric man towards the exploitation of greater riverine resources.

Whereas the mammalian fauna is comparable at both sites, this is not the case for the ichthyofauna. Makhadma 2 yielded almost 99% *Clarias*, but at Makhadma 4 only some 30% of the fish remains belong to this genus. *Tilapia* predominates at Makhadma 4 with some 68% of the total ichthyofauna; *Barbus*, *Synodontis* and *Lates* are scarce. In spite of their different composition, the fish faunas from both sites were taken from the former inundated area. This statement is based on biological data of the fish and on the comparison of a large number of sites along the Nile (*cf.* Van Neer, this volume). *Clarias*, *Tilapia* and *Barbus* can stay for long periods on the floodplain, since they are able to resist adverse hydrologic conditions. *Synodontis* and *Lates* are rare at Makhadma 4 and absent at Makhadma 2. These two genera often occur together in high frequencies on post-Palaeolithic sites, indicating fishing in the main channel. At Makhadma 4 only one *Lates* bone of a large adult was found: it may represent an individual taken on the floodplain during its short spawning run. The *Synodontis* are of small size and may represent young individuals trapped in residual pools.

The high frequency of *Clarias* at Makhadma 2 is typical of most Late Palaeolithic sites in Egypt and Sudanese Nubia (Van Neer, this volume). Sites with an ichthyofauna comparable to that of Makhadma 4 are rare. High frequencies of *Tilapia* are only known from sites E 81-3, E 81-4 and E 82-3 at Wadi Kubbaniya (Gautier and Van Neer 1989). At least two of these sites are situated close to a shallow basin. At Makhadma 4 the local morphology also can explain the high percentage of *Tilapia*. This genus does not dispose of accessory breathing organs and therefore requires deeper and better oxygenated water than *Clarias*. The fishing grounds near Makhadma 4 were indeed of greater extent, and small basins probably existed much longer during the declining flood season than was the case at Makhadma 2. The Makhadma Bend was indeed the first zone becoming wadable at the beginning of the postflood season. At the same time, the area accessible by man near Makhadma 2 was limited to a small strip.

At Wadi Kubbaniya it was possible to demonstrate that two major phases of fishing were present: one at the very beginning of the inundation when breeding fish occur in shallow marginal areas and a second one when the waters have receded, leaving residual ponds on the floodplain. The fish of the first category of sites are larger on the average. That they are breeding fish is also indicated by the presence of eel, a predatory species that feeds on eggs and fry. Eel is virtually absent on the Wadi Kubbaniya sites that are supposed to contain fish mainly captured later within the year when the breeding is over. The smaller average size of the fish on this second category is a result of the migration of the larger individuals into the main channel. Smaller fish migrate towards the main river later on or can stay on the floodplain until the next flood, if backwaters persist.

The high percentage of *Tilapia* at Makhadma 4 and the small size of both *Tilapia* and *Clarias* indicate that fishing must have been practised rather late within the post-flood season. For Makhadma 2 it is difficult to make similar statements as the number

of remains allowing a size estimation is low. The catfish and *Tilapia* remains from that site may theoretically come from individuals taken at the beginning of the flood season when spawning took place, or later within the year when floodwaters receded. If residual pools existed they probably were shallow and desoxygenated as indicated by the preponderance of *Clarias*.

One may wonder why the Makhadma area could be so attractive to prehistoric man during the "Wild Nile" stage. Perhaps the answer is found in the characteristics of the valley bottom and its effects on the fishing grounds, as illustrated in Fig. 13. When the valley bottom is composed mainly by the floodplain, an increase in the flood level creates only a minor increase in the inundated area. The wadable strip along the valley borders remains similar, but the global fishing conditions become adverse as it takes a longer time before the declining water level has isolated basins within the floodplain.

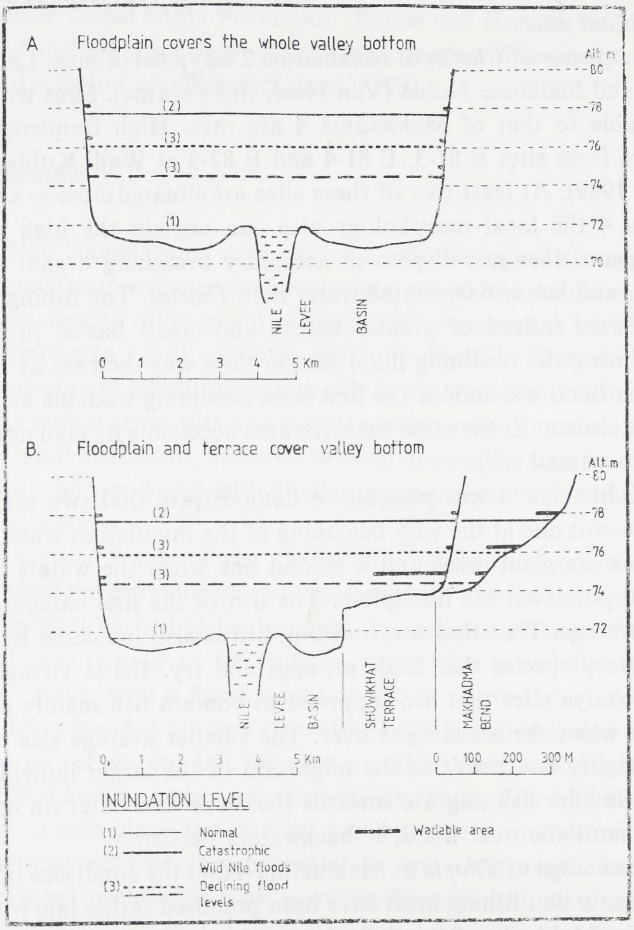

FIG. 13. The relation between the valley bottom morphology and the extent of wadable areas

When a terrace or wadi mouth is inundated in the valley bottom, as in the Makhadma area, whether or not this area remains continuously wadable depends on the flood level. In any case, with declining water level after the highest flood, some of these areas become suitable for fishing activities sooner than others.

Fishing techniques

From the foregoing it is clear that fishing must have been practised mainly when the fish were most vulnerable, namely when they occurred inshore for spawning or when they were trapped in shallow basins wadable to man. It is likely that group fishing was practised as still is the case today. Fish gorges are the only archaeological evidence that gear was used. Other techniques, however, are likely to have been practised: grasping by hand, use of striking and wounding gear. The small size of the fish makes it probable that more sophisticated gear was known as well, such as thrust baskets, nets, and scoop baskets (*cf.* von Brandt 1984). Some of the cobbles found in the Sheikh Houssein silts near Makhadma 4 may represent net weights. Baited fish gorges may have been used for the capture of both catfish and *Tilapia*. Attached in the middle to a bottomline, fish gorges are suitable for *Clarias* fishing. Set our for the night, they can capture fish effecting their daily inshore movements for feeding. Although *Tilapia* are essentially herbivorous they are easily hooked. Normally gorges are inserted lengthwise into a bait, held more or less parallel to the line. This makes it easier for the fish to swallow the bait. The gorge takes up a transverse position when the fish swims away or when the line is pulled (von Brandt 1984). In case *Tilapia* were captured with gorges, they must have been used in combination with rod and line or attached to drift lines.

Fish preparation and conservation

The fish captured in large quantities probably was not all intended for direct consumption. Traditional techniques of preparation of fish in Africa today involve sun and smoke drying and salting. The large amount of charcoal at the Makhadma sites indicates that fire was used to hasten the process of dehydratation of the fish. The simplest techniques of fish preparation with the use of fire involve spreading of the animals on piles of grass that are set on fire or by suspending the fish and making fire under them (Blache and Miton 1962). This preparation technique may have been used both at Makhadma 2 and 4; the post holes found at the former site are perhaps related to the suspension of the fish. At Makhadma 4 the charcoal production occurred on a steplike succession of terracettes. The use of shallow pits in a slope for fish smoking is known ethnographically along the Chad basin (Blache and Miton 1962). Fish may have been charred on the terracettes found at Makhadma 4 or may have been smoke dried if they were suspended above the fire.

A striking difference between Makhadma 2 and 4 lays in the presence at the latter site of large pits under the black layer. We have no indication about their function. We would suggest that the pits are contemporary with, rather than predating, the gray-black layer; the latter accumulated while the pits were in use. In such a system the pit was always higher on the slope. The existence of many pits stresses the presumption of a site utilization over a long period.

The industry

The lithic material of Makhadma 2 and 4 is characterized by the absence of the Levallois- and microburin technique. Flaking was almost always executed on single platform cores. This is rather exceptional since on most Late Palaeolithic sites opposed platform cores predominate. The burin is the most important tool type and is mostly of dihedral technique. End-scrapers and pointed blades with proximal retouch are present. The microliths of Makhadma 4 consist mainly of obliquely truncated pointed bladelets forming microlithic points and also some geometrics such as irregular trapezes and isocele triangles. It is our impression that the absence of microliths at Makhadma 2 is only due to the tool poverty of that site.

Technologically, the Makhadma 2 material is clearly Late Palaeolithic, but seems uncharacteristic. Makhadma 4, with the presence of some microliths, can be compared with the Idfuan (Wendorf and Schild 1976: 243), *e.g.* site E71K9, which, in our opinion, is rather typologically uncharacteristic because of the small inventory of tool types. According to Wendorf and Schild, the non-Levallois Idfuan appears to have considerable variations in the frequencies of certain tools. All of them share an emphasis on retouched flakes and blades, which represent half or more of the total tools, while endscrapers and backed elements are rare to absent. All of the Idfuan sites have considerable values for notches and denticulates and the frequencies of truncations are generally low. It has been related with the Ballana-Masmas aggradation around 17,400 B.P. (Wendorf and Schild 1976), which is of course much older than the Makhadma sites. Makhadma 4 differs from the Idfuan by its high frequency of truncations forming microliths.

Another possible correlation can be found within the Silsilian, where proximal truncations are frequent. The Makhadma 4 site, however, differs from the Silsilian by a high burin percentage, the presence of some geometrics, and the absence of microburins. In both complexes blades with proximal retouch occur. The Silsilian has been dated around 15,000 B.P. (Smith 1966) but more recent occurrences have also been reported (Vermeersch *et al.* 1985).

The Makhadma 4 material also has some similarities with the Afian, where truncations forming microliths and bladelets with rounded base occur. The Afian, however, is characterized by a high microburin and a low burin frequency.

Fish gorges like those of Makhadma 4 have been found at Wadi Kubbanyia E-78-8 (Wendorf and Schild. 1980: 188) around 17,000 B.P. and also in the Qarunian

around 8,000 B.P. and are thus not characteristic for a specific period or cultural group.

As stated by Roubet and Hadidi (1982) the Late Palaeolithic of Egypt is very complex. Its study is also hampered by many typologically non-characteristic sites. However, our present understanding of the Upper and Late Palaeolithic industries of the Egyptian Nile valley suggests an important synchronic variability but also an absence of diachronic evolution in the techno-complexes. This can be due to site specialisation, may be related to seasonal occupation patterns, or, more probably, it is the consequence of our poor understanding of what happened during that period. Therefore, at the present time we prefer not to correlate out Makhadma material with one of the previously defined groups in the Nile Valley.

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