Chapter 5

THE NEW EXCAVATIONS

Garrod's excavations in the outer part of the cave were thorough, she almost completely excavated Chambers I and II, partially excavated Chamber III, and in Chamber IV and V dug two test soundings to bedrock (Fig. 3).

Excavations in Chamber III were renewed in 1988 and were part of the preparations for the construction of a visitors centre planned by the Israeli Nature Reserves Authority. The idea was to level the surface layer of the chamber in an area dug by Garrod according to her own account (Figs. 3, 30), so as to lay a concrete path there and install electricity devices. Between September 1988 and February-March 1989 seven weeks of excavation were carried out. Since this area was believed to already have been excavated by Garrod, excavation strategies were adapted to stay within the demands of the developers. The result was a rather shallow excavation, encompassing no more than an area of 33sq. m in Chamber III, about 30-35m from the entrance of the cave (Fig. 30). The excavation grid was based on 1m squares, each of which was further subdivided into four 0.25sq. m units (a-d). Vertical control of the excavation was maintained through the use of 5cm spits. When distinct features were encountered, we employed three-dimensional documentation. Except for the uppermost 5-10cm, all the sediment removed during excavation was sieved under running water over a 0.2cm mesh.

The surface of the excavated area as we found it showed a marked slope from the north-east to south and west, most probably due to Garrod's excavations here. This resulted in varying excavation depths. The deepest and most complete sequence was obtained near the NE part of the excavation (Fig. 31), along squares I40 – I42, in an area which we now know had not been excavation by Garrod. At first we were unable to identify to where Garrod had extended her excavations. Later, the northern edge of Garrod's excavation was detected, as an NE-SW diagonal line in squares H42-G42 (Fig. 30). Apparently the limit lies some 5-6m to the north-west of the line Garrod's key map gives as the farthest limit of her excavation in the cave (Fig. 30). If this is correct, then the large stone in our square F41 (Fig. 30) is the one drawn by Garrod in

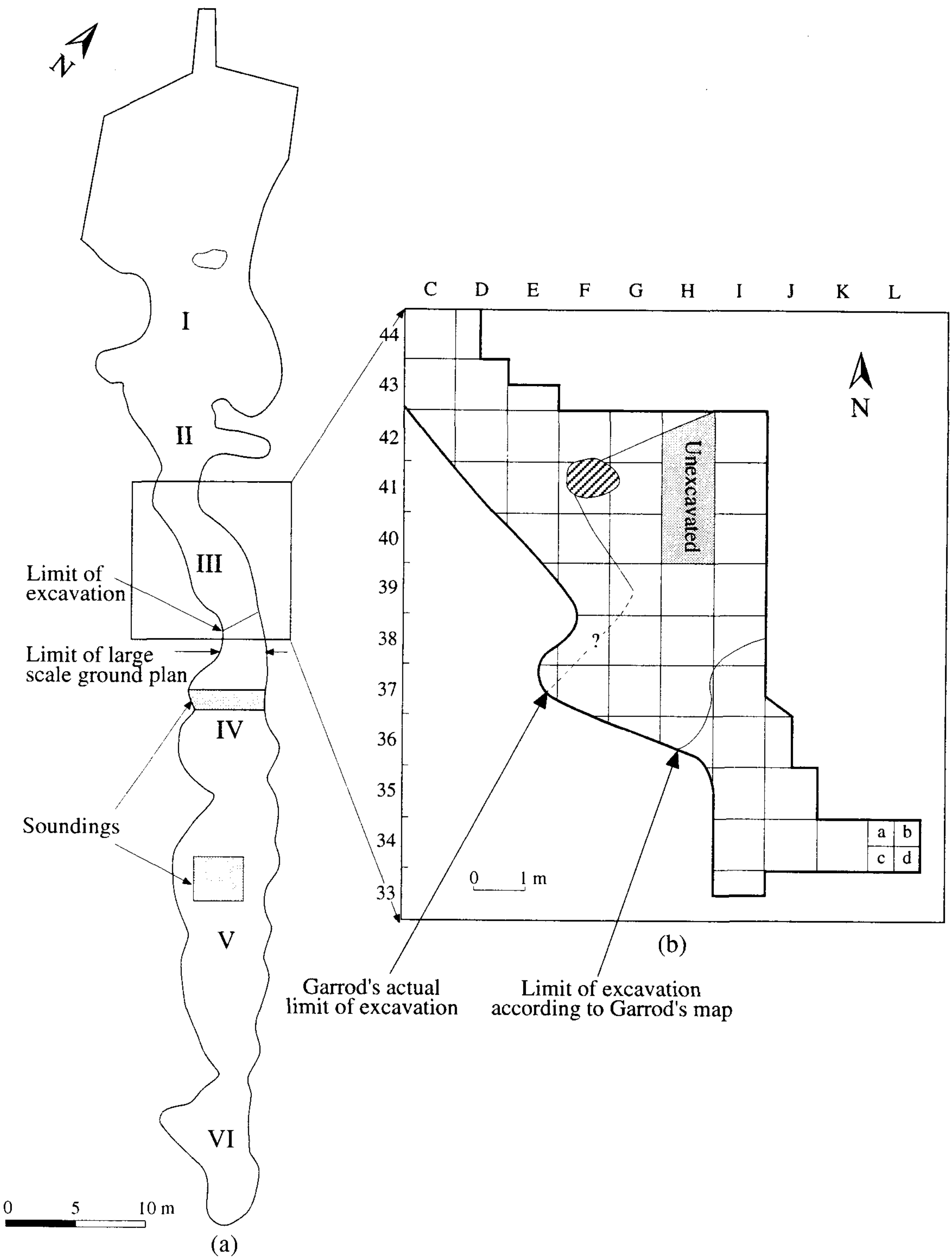


Fig. 30. (a) Garrod's key map of the cave showing the southern limits of her excavations in Chamber III, somewhat north to that of her ground plan (Fig. 3); (b) Ground plan of the recent excavations in Chamber III, indicating the northern limit of Garrod's excavations, according to our finds.

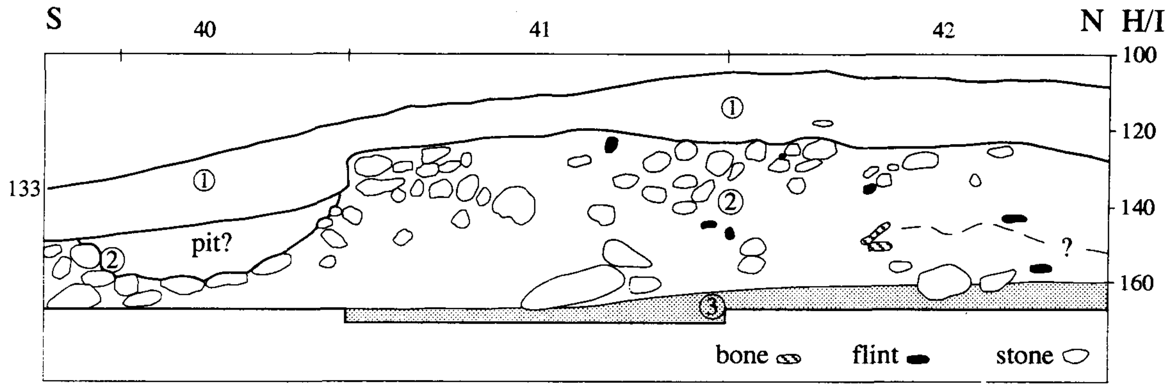


Fig. 31. The western section of squares I40-I42, at the end of the excavation.

her section along the middle part of Chamber III (Fig. 3). Further to the south and west, the situation was less clear and the exact limits of Garrod's excavations could no longer be traced. We suspect that the diagonal line that designates the excavation's limits in Garrod's key-map (Fig. 30) follows the undulating line between layers C and D1 in her ground plan of the chamber (Fig. 3). As we saw, this should be placed further to the north-west, meaning that our squares I40 to I42 were left largely unexcavated by her. In any case, the western and southern parts of Chamber III are more likely to have been susceptible to disturbances, such as collapsing due, for example, to people moving about in the cave. This is corroborated by the retrieved material which seemed rather residual in places whereas the lithics were sometimes mixed (these were therefore not processed and are not further discussed here).

Significant is that, even though the western and southern parts of the excavation are only in an initial stage, a clear line can be observed running across the middle parts of squares F40 and G39 (Figs. 30, 32). Most probably it designates the western limit of Garrod's excavation in Chamber III. Where the southern limit of her dig ought to run (Fig. 30) has as yet not been verified by our excavation.

The archaeological finds of the better preserved eastern squares I40 – I42 include Early Natufian flint, bone and groundstone implements, together with ochre fragments and a few art objects. The excavation of the underlying Upper Palaeolithic layers is at the initial stage.

Stratigraphy

The sequence at the NE part of the excavation (Fig. 31) revealed three —provisionally defined — stratigraphic units from top to bottom:

1. A light-brown soft crumbly layer, with a few limestone fragments; maximum thickness 25cm. In places this upper unit was capped by a thin (up to 5cm) reddish-brown layer with abundant bat bones. Finds include recent (20th-century) artefacts as well as Late-Neolithic – Chalcolithic to Byzantine potsherds (see below, Appendix I), flint implements and animal bones. Horizontal layers within the sections (e.g., Figs. 33,

Fig. 32. General view from the south of the western part of the excavation. The line discernible in the middle of the picture, running from the big rock in the upper part of the picture vertically along its centre, and separating the Natufian breccia (on the right; mainly in squares F40, F41, G40) from a recent fill (left), most probably represents the western limit of Garrod's excavation. Squares H40, H41, H42 (partly seen in the lower right) are not excavated.

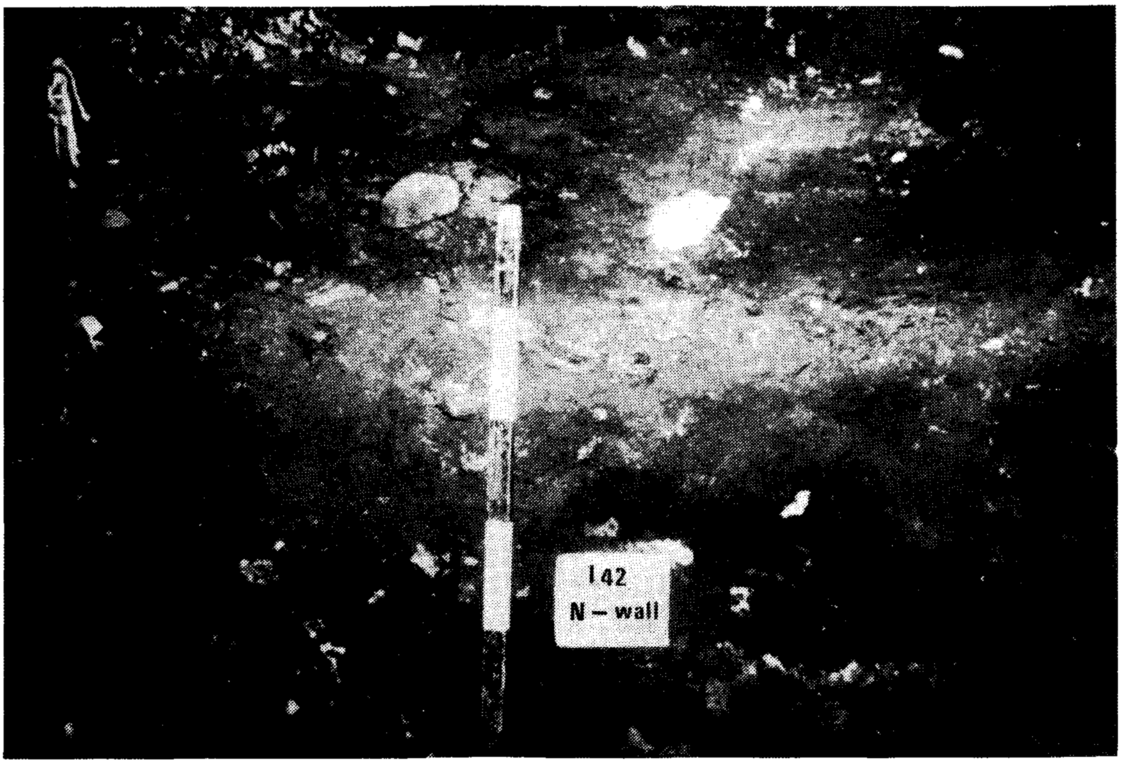


Fig. 33. The northern wall of square I42 during excavation. The lighter upper part of the Natufian layer may be a result of later migration of carbonates.

34) may imply some levelling activities in the area. They are also indicative of repeated use by shepherds (see above, Chapter 3; "Use of the Cave in the 20th Century"; Brochier et al., 1992). No distinct layers were observed during excavation, but a levelled, soft, light-grey ash layer, capped with relatively large stones and containing Roman – Byzantine potsherds, was found in the southern part of the excavation, in square I37. According to her map (Fig. 3), Garrod had probably excavated Layer A in this part of the cave, at least to some extent. If, as she claimed, she had indeed fully excavated Layer A in Chamber III, and had reached the southern limit of the chamber, none of these upper layers would have been in place. Garrod herself states that "The excavation of Layer A was brought to an end in the entrance of Chamber IV" (Garrod and Bate, 1937:8). This would also mean, in turn, that the uppermost reddish-brown layer, with the bat bones, is post Garrod's excavation.

2. A dark-brown black compact layer, with many limestone fragments, mostly eroded. Maximum depth 40cm. In places this unit could be further subdivided into an upper, lighter layer with small stones, and a lower, darker layer with less abundant but larger stones (Figs. 34, 35, 36). This was not observed in all sections and the excavation is as yet too limited to enable verification. The lighter colour of the upper layer (Fig. 33) could be the result of some carbonate enrichment due to post-depositional processes, but the possibility should not be ruled out that it represents a distinct phase. Moreover, in many places this stony layer seemed to have undergone digging and pitting activities, but it proved impossible to follow horizontally any distinct layers. A later pit had apparently disturbed the layers at the western part of square I40 (Fig. 31). Material recovered from this layer belong to the Early Natufian, with no apparent change with time, but within the faunal assemblage many recent bones, especially bats, were recovered (see below, Appendix III). No architectural features were found, apart from what seemed to be a circular arrangement of stones in squares I40-I41 (Figs. 37, 38). However, the lithic and faunal contents of this assemblage were not different from the ones found elsewhere in the dig. Large stones were discernible also in the eastern wall of square H42/c, suggesting that the northern edge of this circular arrangement could, in fact, have been part of a structure that extended further to the west. We should add that these scarce, doubtful architectural features were uncovered at the base of the Natufian layers, at a depth of some 160-165 cm. below surface.

3. A black, soft layer, with only a very few stones. About 10cm have been excavated to date so that the bottom of this unit has not yet been attained. Two levels of Upper Palaeolithic industry were exposed (Fig. 37). These have exceptionally high artefact densities, probably the result of post-depositional water deflation (Ofer Bar-Yosef, personal communication, 1988). A small block of compact breccia was found adhered to the eastern wall of square I40. We have not excavated the breccia, but based on previous observations (e.g., Garrod and Bate, 1937; O. Bar-Yosef and Vandermeersch, 1972) it is possibly of Middle Palaeolithic age.

Fig. 34. The western wall of square I42 during excavation.

Fig. 35. The western wall of square I41 during excavation. Note the layer of small, eroded stones (due to later diagenesis?) above the layer of larger, better preserved stones.

I42

I41

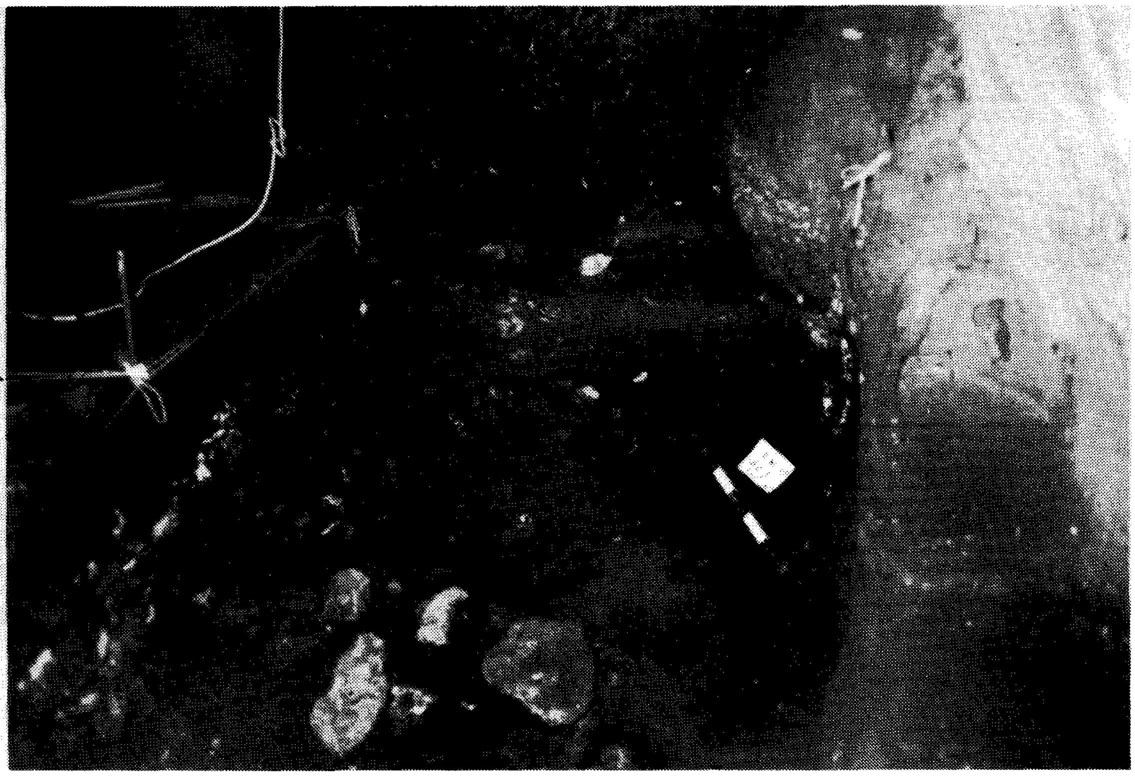


Fig. 36. General view of square I42 and the northern part of square I41, from south to north. Note the large stones at the basis of the Natufian layer in square I41, and the dark Upper Palaeolithic layer.

The Recent Material

The finds from the upper unit include potsherds, stone tools and a few bones. The pottery is represented by various types, including fragments of cooking pots, jars, bowls and many lamps (see below, Appendix I). Potsherds were found of practically all ages from the Neolithic onwards but there is a clear predominance of Late Roman – Byzantine sherds. The scarce lithic collection is mixed with material from the underlying layers, especially the Natufian. A PPNB "Tahunian" axe, together with the typical PPNA and PPNB arrowheads reported by Garrod and Bate (1937) and Ronen (1982), and the Wadi Raba pottery (see below, Appendix I) indicate that the cave was probably frequented during the Neolithic period, a possibility ignored by Garrod in her description of Layer A.

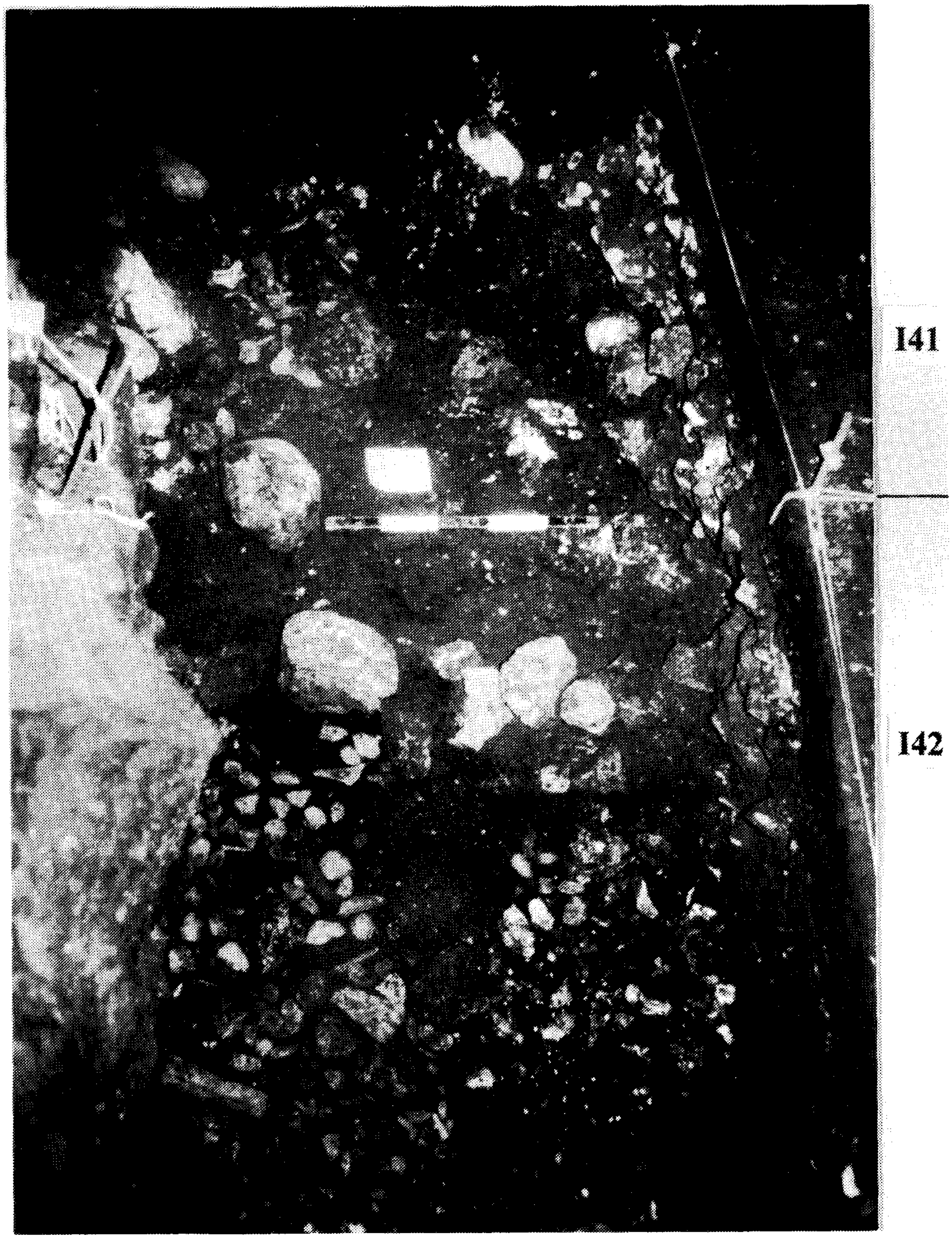


Fig. 37. General view of squares I41-I42 from the north. Note the circular arrangement of stones in square I41, and the two, densely packed Upper Palaeolithic layers in square I42.

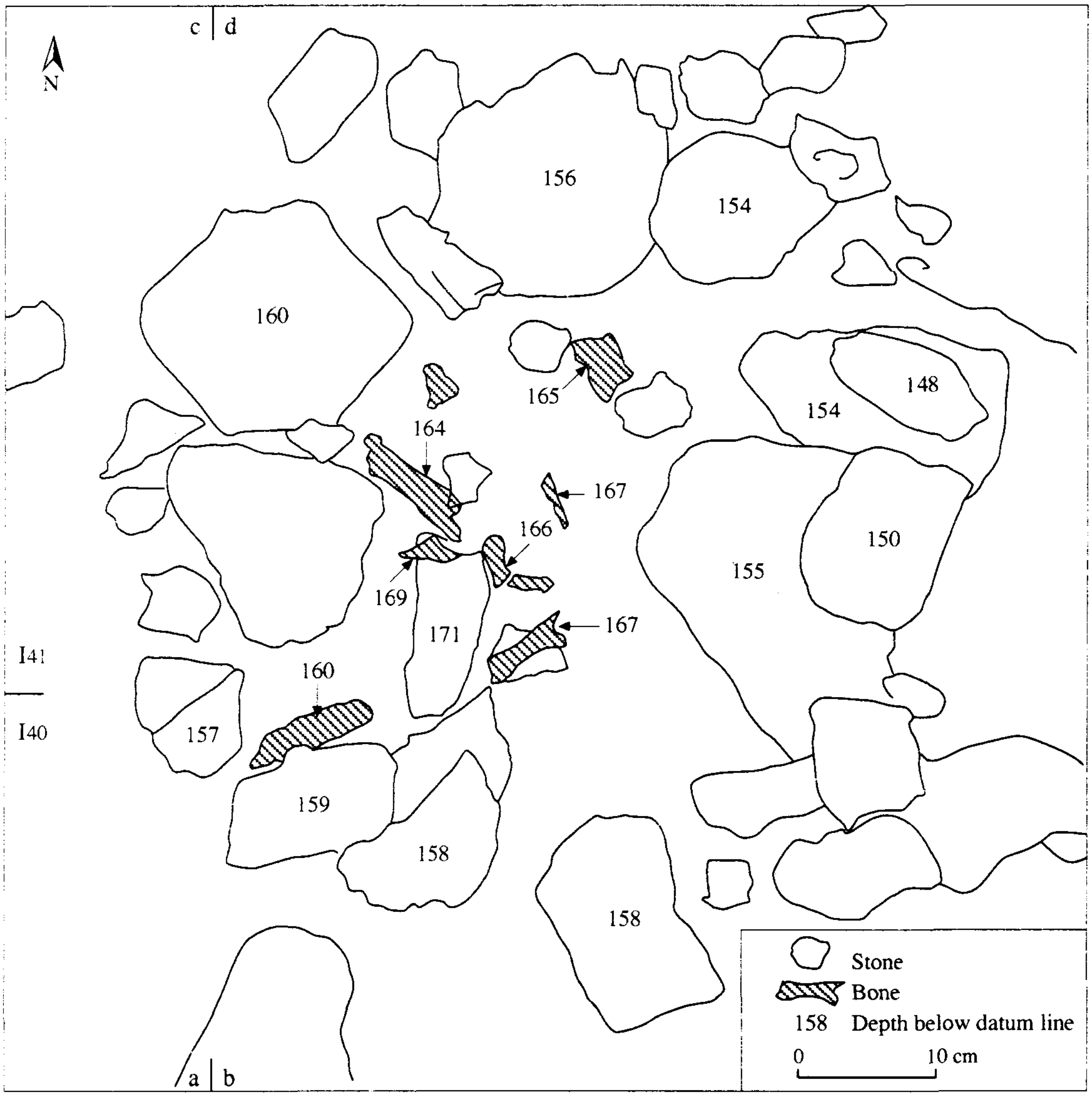


Fig. 38. The circular arrangement of stones in squares I40-I41.

The Early Natufian of Chamber III

Following Garrod's excavations in the north-western part of Chamber III it is no longer possible to gain a complete picture of the Natufian occurrence in this part of the cave. However, our research focuses on various aspects of the Early Natufian found here which we believe can contribute significantly to our understanding of the Natufian habitation in the site in general.

Dating

There are three radiocarbon dates for the Early Natufian of Chamber III, obtained by Prof. J. Vogel of the Quaternary Dating Research Unit, Pretoria (Weinstein-Evron, 1991) and Dr. I. Carmi and Mr. D. Segal of The Weizmann Institute of Science (Carmi and Segal, 1992).

The samples of charcoals gave dates of 12,950 ± 200 BP (RT-1368) for the lower part and 12,620 ± 110 BP (Pta-5435) for the middle part of the Natufian layer (Fig. 39). The dates for the upper part, 10,740 ± 200 BP and 10,680 ± 190 BP, averaging 10,708 ± 137 BP (averaging done with the OxCal Program, Stuiver and Reimer, 1993), represent two counts from the same sample (RT-1367).

The two earlier dates fall within the known range of the Early Natufian (Henry, 1989; Valla 1987). The upper dates are problematic in that they fall in the range of what is normally accepted as Late Natufian, but the excavation did not unearth artefactual evidence relating to this stage. If we rule out the possibility of contamination, then these later dates may well define the close of the Early Natufian in el-Wad. We have only one other date for the Late Natufian of el-Wad (Table 1; Belfer-Cohen, 1988), 9,795 ± 600 BP (UCLA, bone sample), which is *c.* 900 (point dates) years younger than the youngest date of the sequence discussed, with a very large standard deviation. Ten additional bone and horn-core samples from the new excavations were tested for their collagen content but this proved insufficient to make dating possible (S. Weiner, personal communication, 1992). Other available dates (on bone) for the Early Natufian of el-Wad include 11,920 ± 660 BP (UCLA) for the cave and 11,475 ± 600 BP (UCLA) for the terrace (Belfer-Cohen, 1988). Again, that they were derived from bone, that their collagen content was never measured, and that they invariably have a large standard deviation (>220 for the period between 15,000-10,000 BP; Waterbolk, 1994) practically renders them unreliable, even though they fit within the time range indicated by the recently obtained dates (Weinstein-Evron, 1991). The UCLA el-Wad dates are all from human bones, and are part of an uncompleted and unpublished PhD thesis by Ms. Sawyer (Ofer Bar-Yosef, personal communication, 1991). The el-Wad dates, together with other dates of Early Natufian contexts, are presented in Table 1. Their distribution, with one sigma, is given in Figs. 39 and 40a.

Somewhat surprisingly we do not have all that many dates for the Early Natufian and even then, many of the ones available are not very reliable (Byrd, 1994a). Among these are dates obtained by early gas-counting procedures (such as the Geochronological Laboratory (GL) and the early British Museum (BM) dates from Jericho; Waterbolk, 1987; 1994). Other dates are on bone (Waterbolk, 1994; Hedges and van Klinken,

Table 1: List of radiocarbon dates (yr BP) and calendaric ages (yr BC) for the Early Natufian. Reliable dates are marked in bold; all other dates are unreliable or with excessive sigmas (Waterbolk, 1987, 1994).

Site	**Layer**	**Radiocarbon Age (yr BP)***	**Lab. No.**	**Material**	**Calendaric Age (yr BC)****
El-Wad	Early Nat.	**12950±200**	RT-1368	Charcoal	13750-13050
"	"	**12620±110**	Pta-5435	Charcoal	13100-12650
"	"	**10680±190**	RT-1367a	Charcoal	10870-10420
"	"	**10740±200**	RT-1367b	Charcoal	10940-10480
"	B2 (cave)	11920±660	UCLA	Bone	12900-11100
"	B2 (terrace)	11475±600	UCLA	Bone	12300-10700
Kebara Cave	B	11150±400	UCLA	Bone	11600-10650
"	D	**12470±180**	OxA-2798	Bone	13000-12350
Rakefet	Early Nat.	10980±260	I-7032	Bone	11250-10650
Hayonim T.	D	**11920±90**	SMU-231	Charcoal	12110-11790
Hayonim C.	B	**11360±160**	OxA-742	Seeds	11510-11140
"	B	**12010±180**	OxA-743	Seeds	12320-11810
Eynan	III House 51	11310±880	Ly-1662	Charcoal	12600-10000
"	"	11740±570	Ly-1661	Charcoal	12500-11100
"	IV House 131	11590±540	Ly-1660	Charcoal	12300-10900
W. Ham. 27	8.1 plot XXD	**11920±150**	OxA-393	Seeds	12170-11740
"	"	**12000±160**	OxA-394	Seeds	12280-11820
"	"	**11950±160**	OxA-507	Seeds	12220-11760
Jericho	Meso I.ii	9850±240	GL-69	Charcoal	9800- 8600
"	"	10800±180	GL-70	Charcoal	10970-10580
"	"	9800±240	GL-72	Charcoal	9700- 8500
"	"	**11166±107**	P-376	Charcoal	11250-11000
"	"	**11090±90**	BM-1407	Charcoal	11160-10950
Beidha	C-01-24:4	12910±250	AA-1463	Charcoal	13750-12900
"	C-00-16:4	**12450±170**	AA-1465	Charcoal	12950-12350
"	C-01-23:4,H2	**12130±190**	AA-1464	Charcoal	12500-11900
"	C-01-24:2	10910±520	AA-1462	Charcoal	11600-10100
"	C-00-16.2	8390±390	AA-1461	Charcoal	8000 - 6700
W. Judayid	C	12090±800	SMU-805	Charcoal	13400-11200
"	C	12750±1000	SMU-806	Charcoal	14500-11800
"	C	12784±659	SMU-803	Charcoal	14100-12200

* after Weinstein-Evron (1991), Carmi and Segal (1992), Byrd (1994a) and Housley (1994).

** Calibration is based on Stuiver and Reimer, 1993.

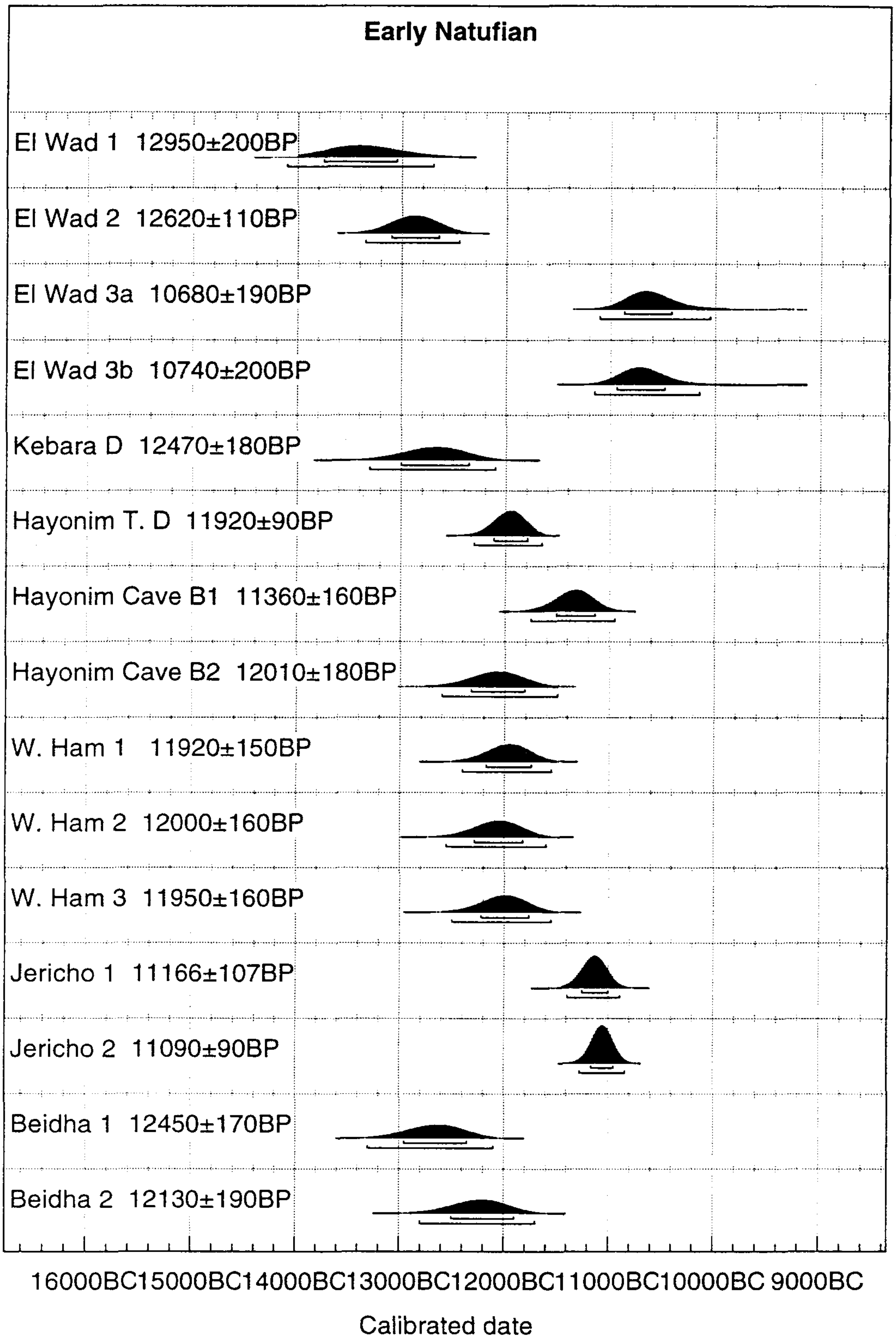
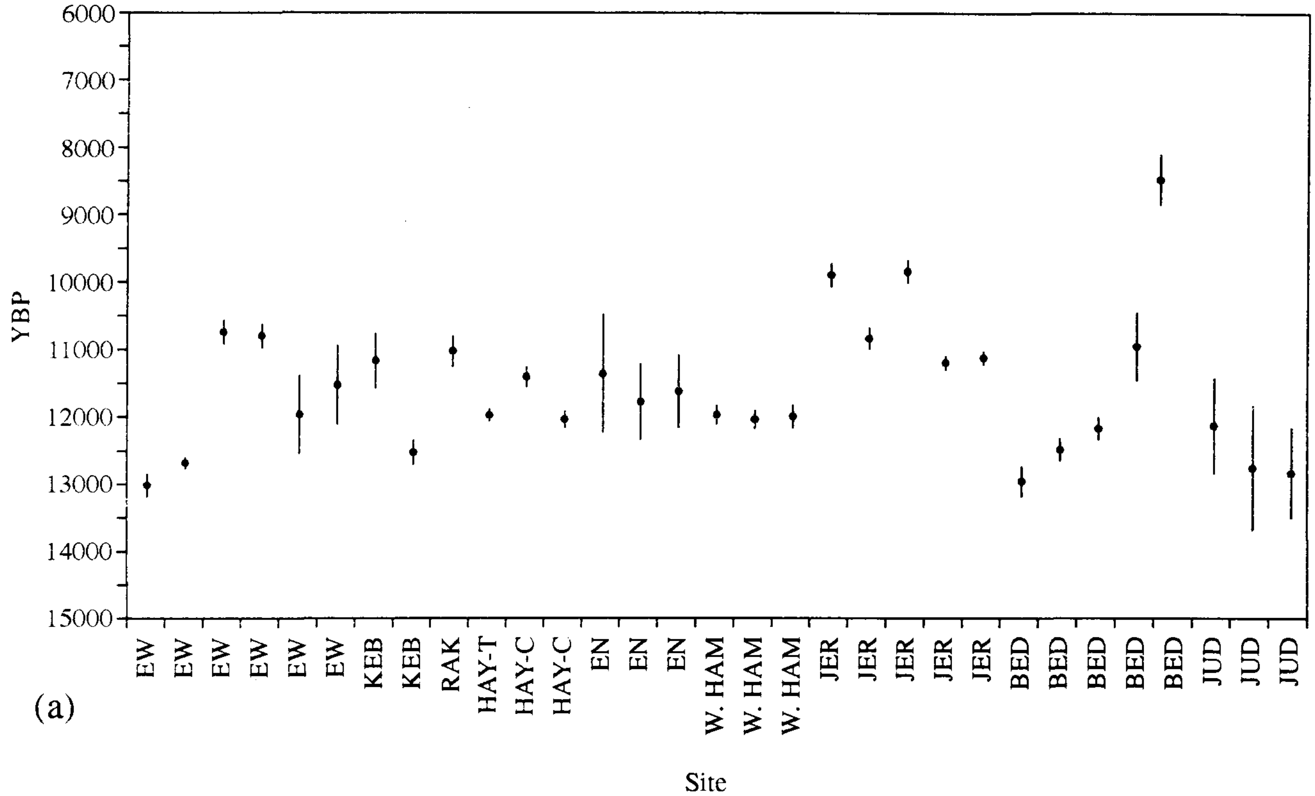
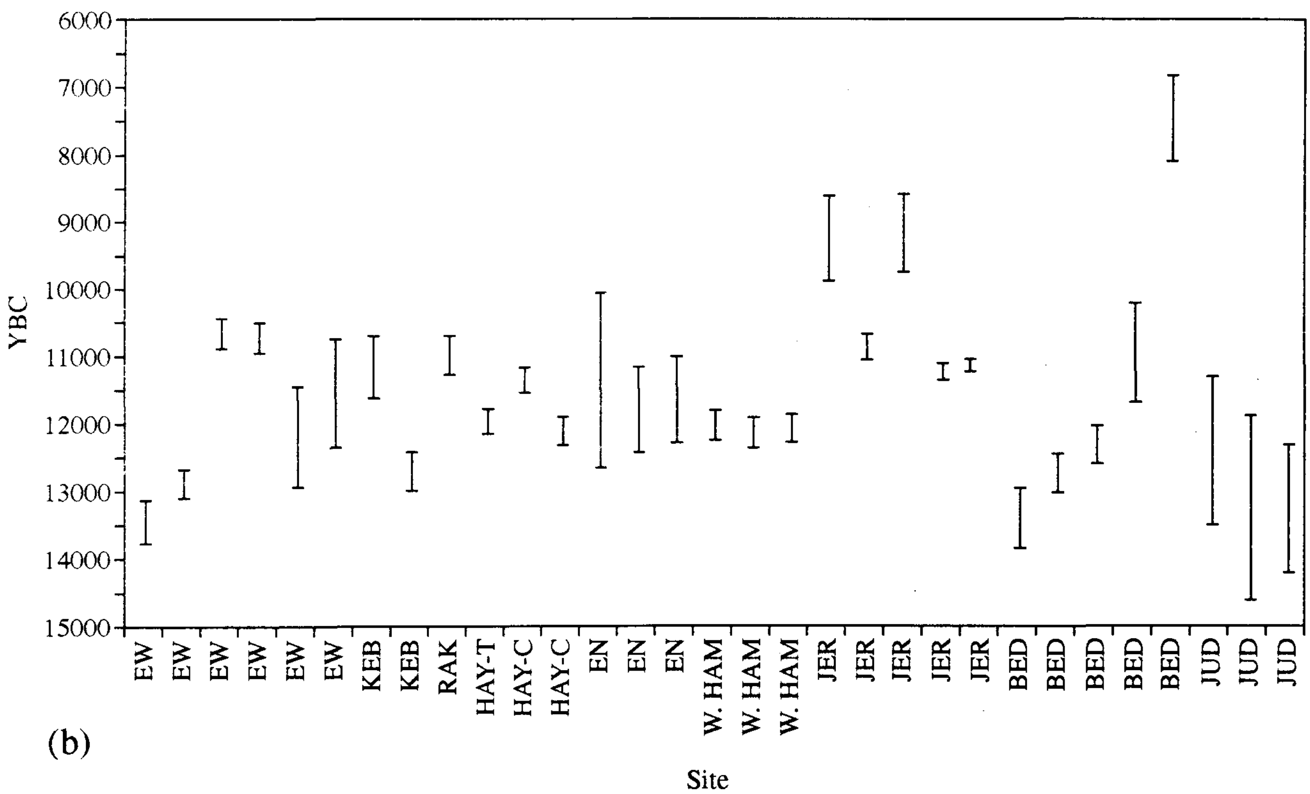


Fig. 39. Distribution and calibration of selected ^{14}C dates for Early Natufian sites. For data see Table 1. Calibration done with the OxCal program (Stuiver et al., 1993).



(a)



(b)

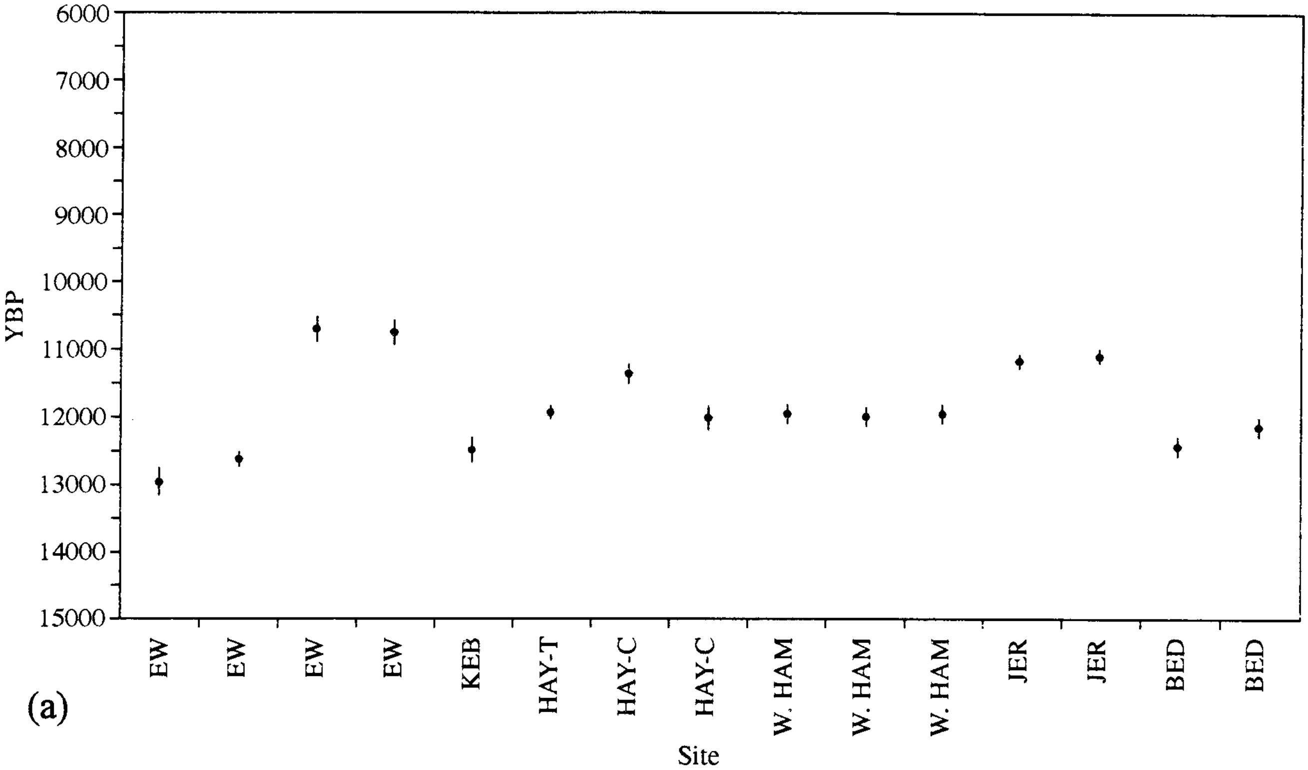
Fig. 40. (a) Distribution of radiocarbon point-dates with single sigmas for various Early Natufian sites. (b) Distribution of calendaric ages for various Early Natufian sites.

1992) and usually exhibit too large a standard deviation to be of any use (Waterbolk, 1994). The result is a rather high range of the Early Natufian dates, representing some 5750 years (Fig. 40a). If we discard the unreliable dates and excessive-sigma dates (Fig. 41a) we find that the Early Natufian dates (single sigmas) all fall within a band of some 2660 years, a significant decrease by more than half of the former, inclusive list of dates.

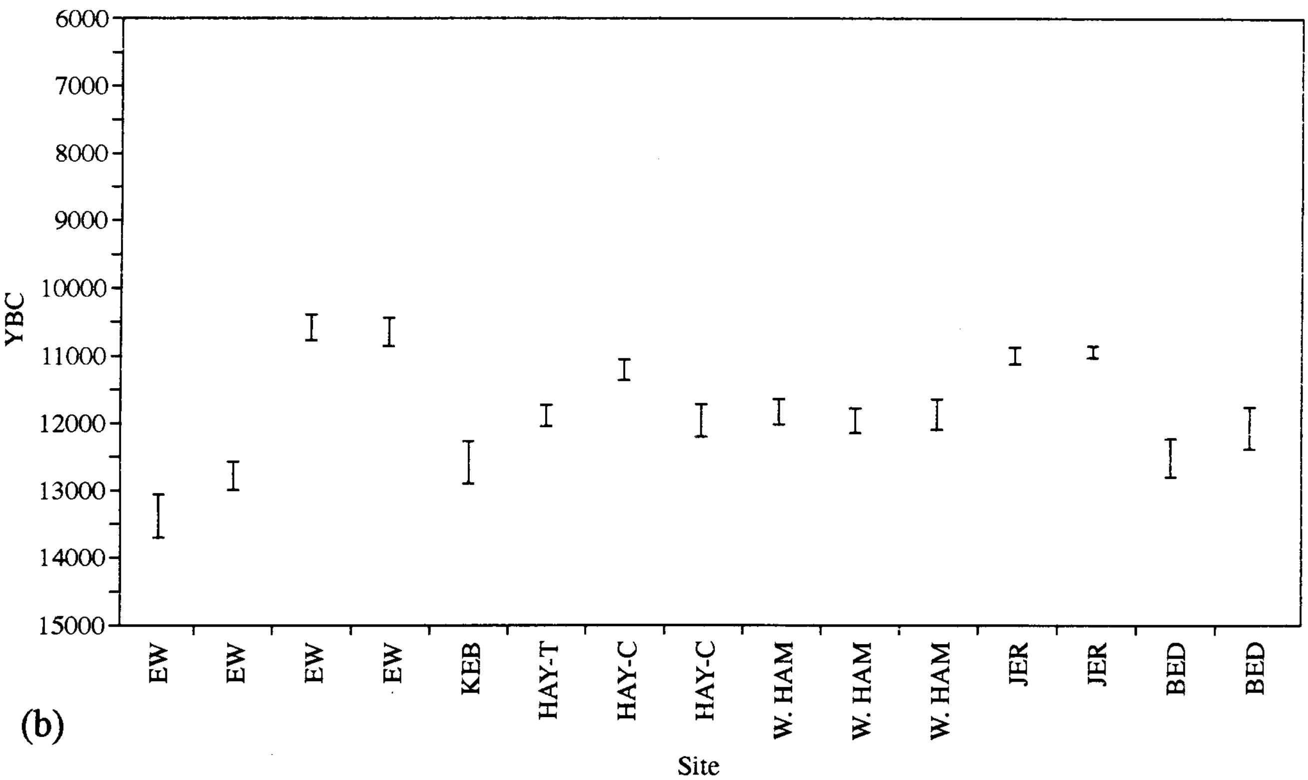
Based on the available data, it is most likely that the earlier el-Wad dates indicate the oldest occurrence of Early Natufian in northern Israel (Weinstein-Evron, 1991), i.e., considerably older than previously assumed (e.g., Valla, 1987; Henry, 1989). This probably also means that the cave was inhabited from the very beginning of the Natufian. If we go by the most recent date (*c.* 10,700 BP), Chamber III of the cave may well have been utilized throughout the whole range of the Early Natufian. Furthermore, the Early Natufian of el-Wad seems to have been of an exceptionally long duration, spanning some 2000 years. Yet, the possibility should not be ruled out of a thin, so far unidentified, Late Natufian layer, being residual or intermixed with the upper part of the Early Natufian. Other, relatively early occurrences are indicated by the dates from Kebara and Beidha. In spite of the fact that the earlier Kebara age is for a sample from layer D, which is Upper Palaeolithic, the date, for a charred human bone, is "clearly Natufian, which is more appropriate than previous estimates given to these burials by Turville-Petre" (Ofer Bar-Yosef, comment cited in Housley, 1994:59). Considering the earliest date for Beidha, even though its standard deviation slightly exceeds the "acceptable" values cited by Waterbolk (1994), both el-Wad and Beidha indicate that the beginning of the Natufian may cautiously be placed as early as *c.* 12,950 years ago, or even earlier.

In order to be able to reconstruct a calendaric chronological sequence for the various Early Natufian assemblages and, more importantly, asses their relative duration and possible overlapping periods, all the available dates for the Early Natufian have been calibrated, using the extended calibration curve recently presented by Stuiver and Reimer (1993) together with their Revised Radiocarbon Calibration Program. The results are then also used to verify the picture that emerged from conventional radiocarbon dates, according to which el-Wad exhibits the oldest and relatively most prolonged Early Natufian sequence in the Levant. It is worth noting that, even though it is generally preferable and more reliable to use the two sigmas dates (with 95.4% confidence), this has no bearing on the questions posed here.

The results are given in Table 1 and Fig. 40b. All the individual dates exhibit larger calibrated ranges than the single sigmas of their respective conventional dates. Thus, the overall range represented by the calendaric dates (*c.* 7800 years) extends by some 2050 years the range based on conventional values (5750 years). This indicates clearly that calibration has but a minor, not to say negligible, effect on the interrelationships between the various assemblages and dates or on their relative ranges: earlier dates remain early and those with large standard deviations exhibit large ranges of possible calendric dates, thus remaining less reliable. This may be because of the rather small range of the calibration curve and its constant, straight-lined, near-vertical slope during most of the period under discussion (Stuiver et al., 1993; Evin, 1995). In the later part of the period discussed, fluctuations in ^{14}C activity in the atmosphere became shorter (Stuiver et al., 1991).



(a)



(b)

Fig. 41. (a) Distribution of radiocarbon point-dates with single sigmas for various Early Natufin sites. Unreliable dates excluded. (b) The same as Fig. 40b, reliable dates only.

When the unreliable dates are excluded (Fig. 41), the range of the calendaric dates becomes more limited. It is self-evident from the slope of the calibration curve for this period that the range of reliable radiocarbon dates (2660 years) is smaller than that of their respective calibrated, calendaric ages (3330 years). Indeed the Natufian is now known to be longer than the radiocarbon timescale would have led us to believe (Evin, 1995). Once again, el-Wad exhibits the oldest ages, followed by Kebara and Beidha (Figs. 39, 41b).

In short, all calibrated dates are older than their conventional counterparts (see Fig. 42 for a joint presentation of both sets of reliable dates). The relatively small divergence between these two sets of data (maximum 578 years), as opposed to c. 800 years at, for example, 5000 BP (Pearson et al., 1983) probably indicates a period of relatively higher atmospheric ^{14}C production (e.g., Vogel, 1970; Stuiver, 1970).

The Early Natufian calibrated chronology is still "floating": only when similar procedures are carried out for other late prehistoric and protohistoric cultures, will it become possible to tie the Natufian sequence to more recent, prehistoric and historic calendaric (time) scales. But this, of course, is beyond the scope of the present study.

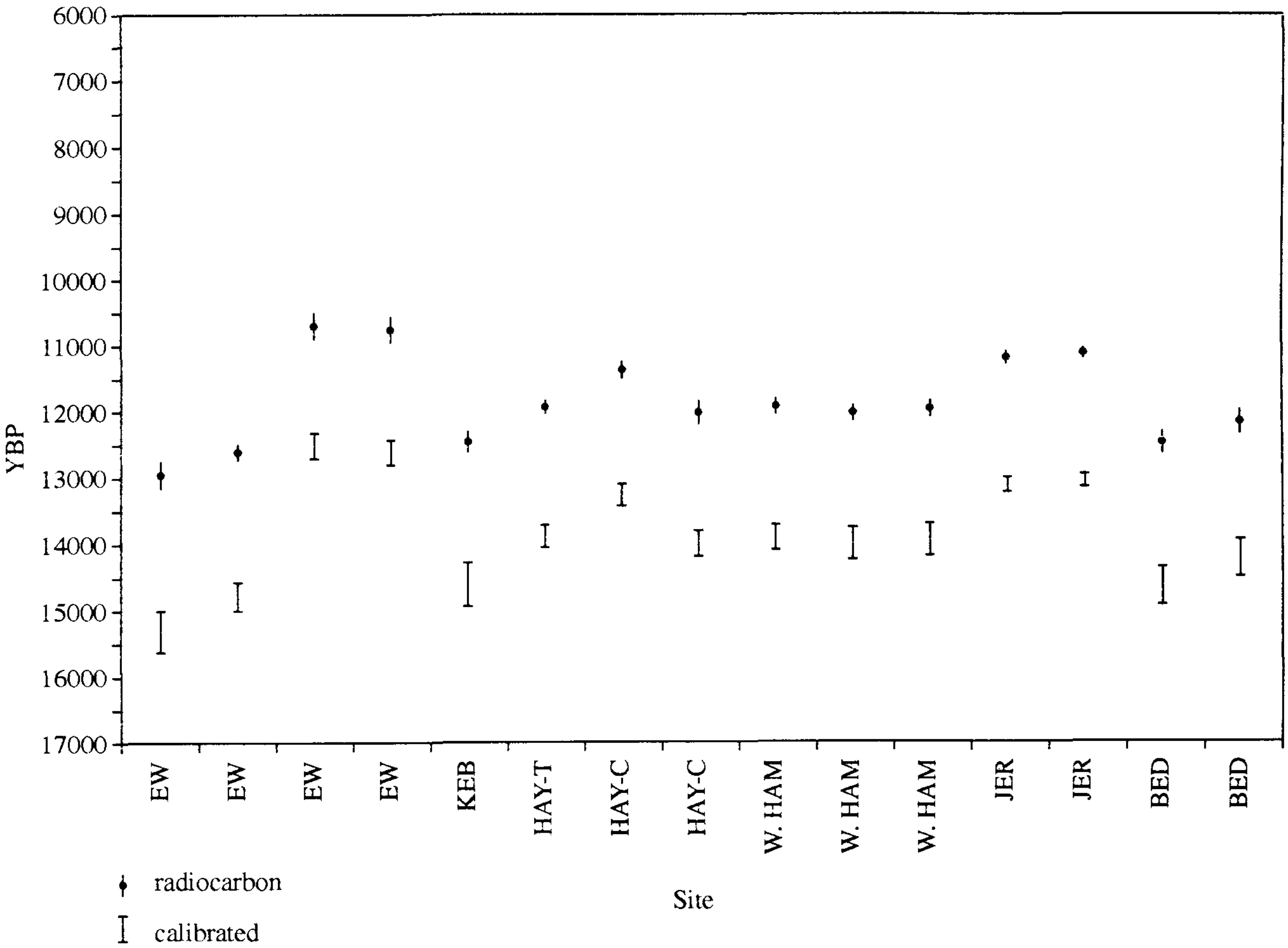


Fig. 42. Combined figure, showing radiocarbon and calibrated dates for Early Natufian sites. Reliable dates only.

The Lithic Assemblage

So as to reach at least a general picture of the lithic assemblage's characteristics and possible temporal variability, a preliminary study was carried out on a sample which included squares I40, I41 and I42. This section, from the NE portion of the excavation, has the most complete sequence recorded to date. More detailed studies and analyses pertaining to both spatial and vertical variability should be done but these will have to await further excavation.

Early Natufian

As there seems to be no apparent change with depth through the Natufian layers, in the following descriptions and discussions the finds were grouped together. The main components of the Natufian lithic assemblage are summarized in Table 2. Within the blank forms of the collection, flakes (48.8%) are clearly the most dominant. Blades (16.1%) and bladelets (17.4%) are almost equally represented. CTE (2.5%) include 51 "lame à crête", four "flanc de nucleus" and one core tablet), and primary elements make up 15.2% of the blank forms. Also found were nine burin spalls, two microburins, and 217 proximal ends of indeterminable flake/blade forms (not included in Table 2). Tools form 13.1 % of the collection (debitage, cores and tools). The core:tool ratio is 1:1. The debris include 472 chunks (8682.64gr) of raw material, many of which are burnt, and 1244.6gr of waste. Artefact density is very high (more than 2500 artefacts per cubic metre, excluding chips).

Table 2: Preliminary counts of the Natufian lithic assemblage.

DEBITAGE				BS	Mb	CORES	DEBRIS		TOOLS
flakes	blade/lets	CTE	PE				chunk (N)	chips (gram)	
1084	744	56	339	9	2	410	472	1244.6	396

Cores

In square I40-I42, 410 cores were found. Their type distribution is given in Table 3. More than half (57.3%) of the cores are with a single platform. Also abundant are double striking platform cores (29.3%). The other types are relatively rare. Many of the cores have retained at least part of the cortex (Fig. 43:1,2,4,6). The general impression is one of poor manufacturing and of an overutilization of the cores, many of which are "exhausted" bladelet (Fig. 43:5) or flake (Fig. 43:3) cores while many others exhibit signs of thermal alteration, a few bearing signs of double patination. Within the single platform cores a special core type is on a small nodule, with a longitudinal preparation of the striking platform and a few small flake scars along the resulting denticulated edge (Fig. 43:1). Blade/bladelet cores (e.g., Fig. 43:5,6,8) comprise 58% of the cores, the remaining 42% are flake cores (e.g., Fig. 43:1-4;7).

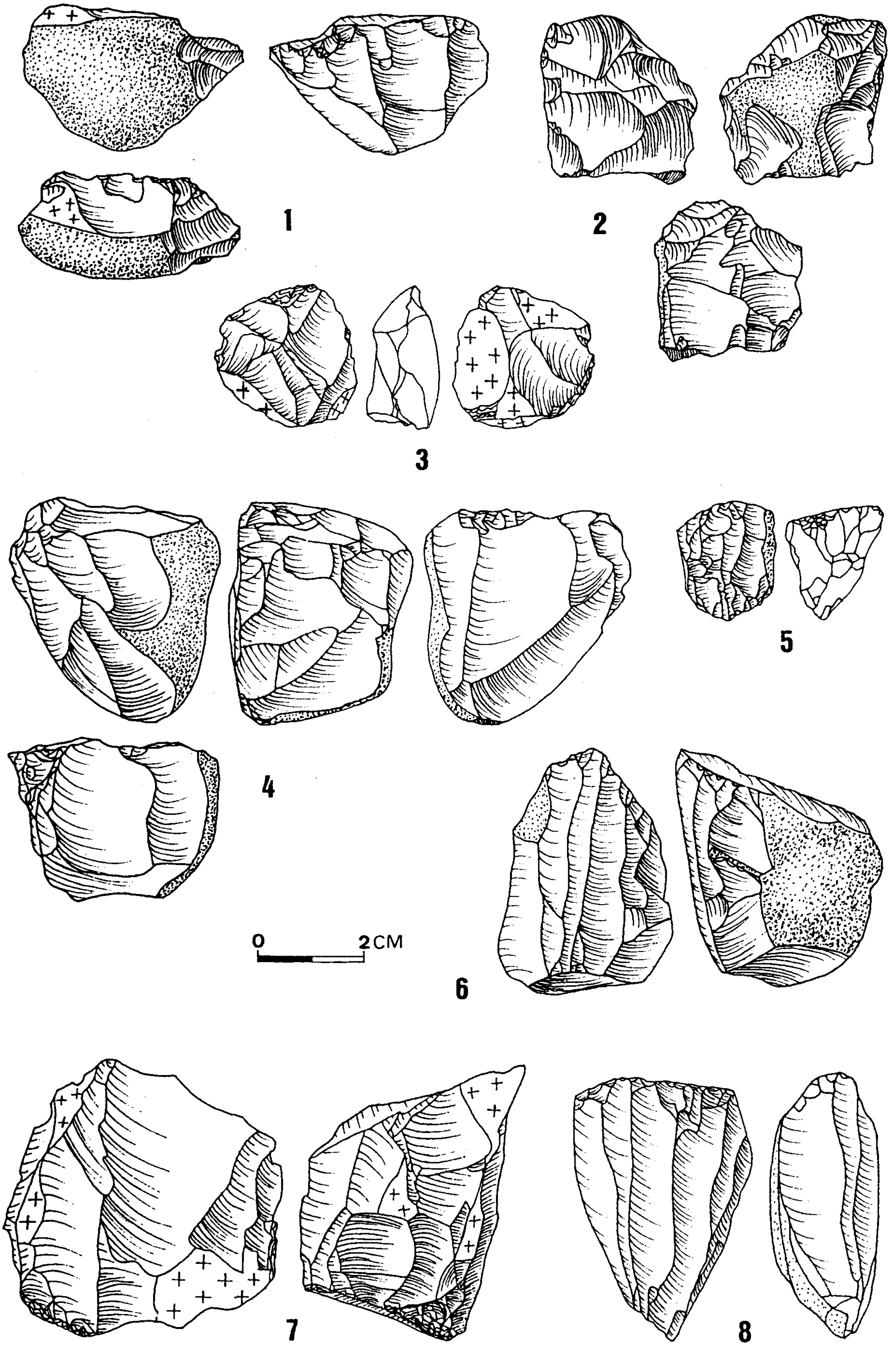


Fig. 43. Natufian cores; (+ + old patina).

Table 3: Distribution of core types.

TYPE	N	%
1 platform	235	57.3
2 platforms (at 90^0)	59	14.4
2 platforms (opposite)	61	14.9
Three platforms	20	4.9
Multiple platforms	11	2.7
Amorphous	23	5.6
Tabular flint	1	0.2
Total	410	100

Tools

The major tool classes are given in Table 4. The Natufian industry is dominated by endscrapers and burins, in almost equal percentages (24.7% and 21.7% respectively). Most of the endscrapers (58) are simple (Fig. 44: 1-3,8), with 17 of them made on small blades or flakes. A few scrapers are circular (Fig. 44:4) and others are made on thick flakes (Fig. 45:1). There are 3 double flat endscrapers (Fig 44: 5-7), two of which (Fig. 44:5-6) are made on sickle blades. The 17 carinated endscrapers are atypical and rather thin (Fig. 45:2). Double (Fig. 45:4) or nosed (Fig. 45:3) carinated endscrapers are not abundant. A special type includes slightly carinated or nosed endscrapers, made on primary flakes (Fig. 44:10). Many of these are only slightly nosed, occasionally made on the side of the flake (Fig. 44:11), and characterized by exceptionally wide working edges. This tendency to manufacture endscrapers on edges or corners of blanks appears also in a group of fine endscrapers (Fig. 44:9), usually made on bright-coloured flakes.

Many of the burins (59) are dihedral (Fig. 45:6,7), with about a third of them on break or natural surface. Seventeen burins are on oblique or concave truncations (Fig. 45:5; Fig. 46:2, 6-8). There are 11 double burins (Fig. 46:3,5) and 3 lateral carinated ones. A special burin type within the dihedral burins is made on rather small pieces of thin tabular flint (Fig. 46:1). A few of these burins are made on blanks covered with cortex on one side which, together with double patination on the other side, result in pseudo-tabular specimens (Fig. 45:8).

The awls (13) on the whole are thin and fine (Fig. 47:13), but cruder specimens do occur. The only borer is made on a bladelet, with Helwan retouch (Fig. 47:1). Among the 8 backed pieces, two are typical "Chatelperonian" knives (Fig. 47:15). One out of the eleven composite tools is a burin-awl, the others are endscraper-burin (Fig. 46:4; Fig. 47: 11-12). The endscraper-burin of Fig. 47:12 is made on a sickle blade, quite similar in form and dimensions to those of which the double endscrapers (Fig. 44:5-6) were manufactured.

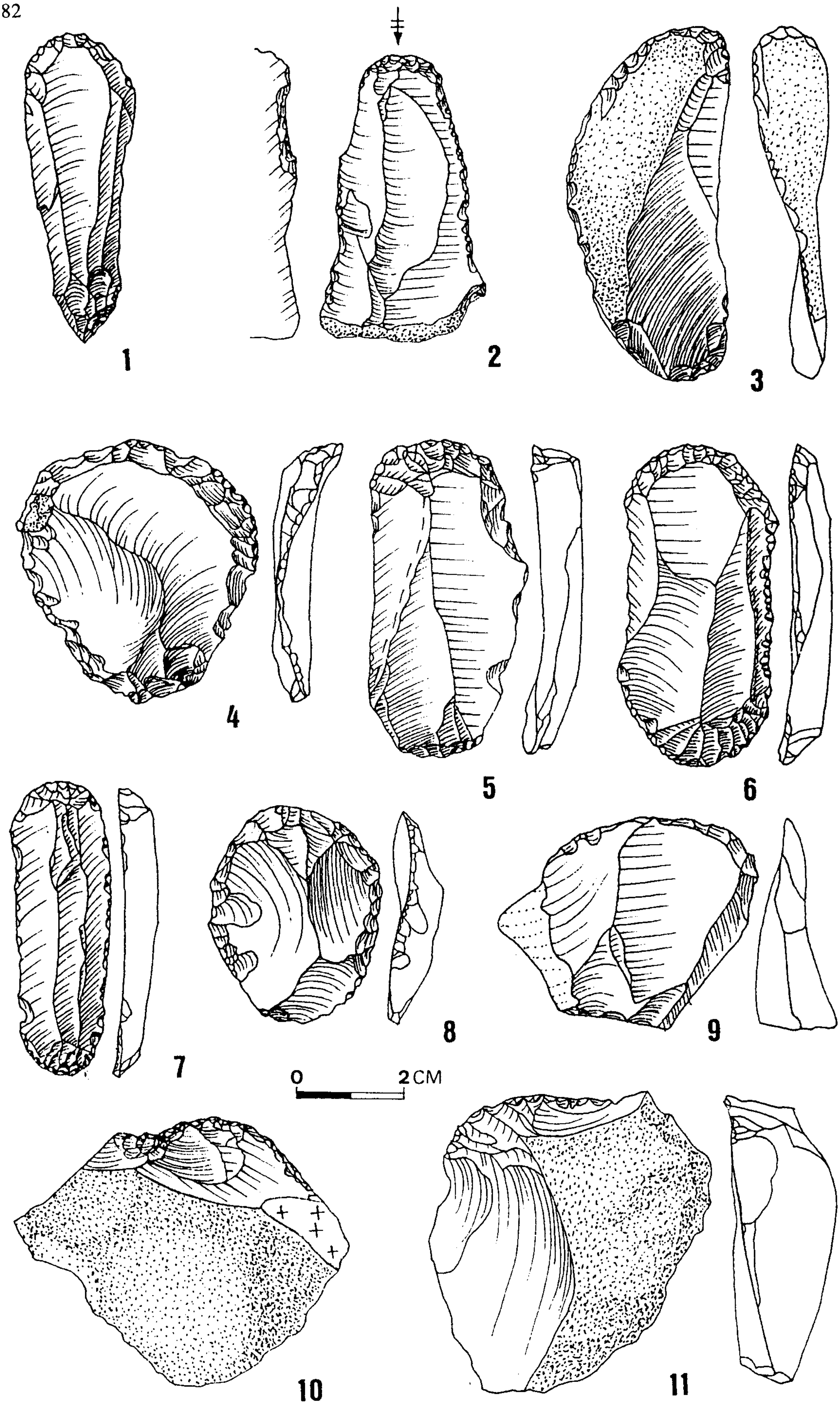


Fig. 44. Natufian endscrapers: 1-3, 8-9 simple; 4 circular; 5-7 double; 10-11 carinated; (+ + old patina).

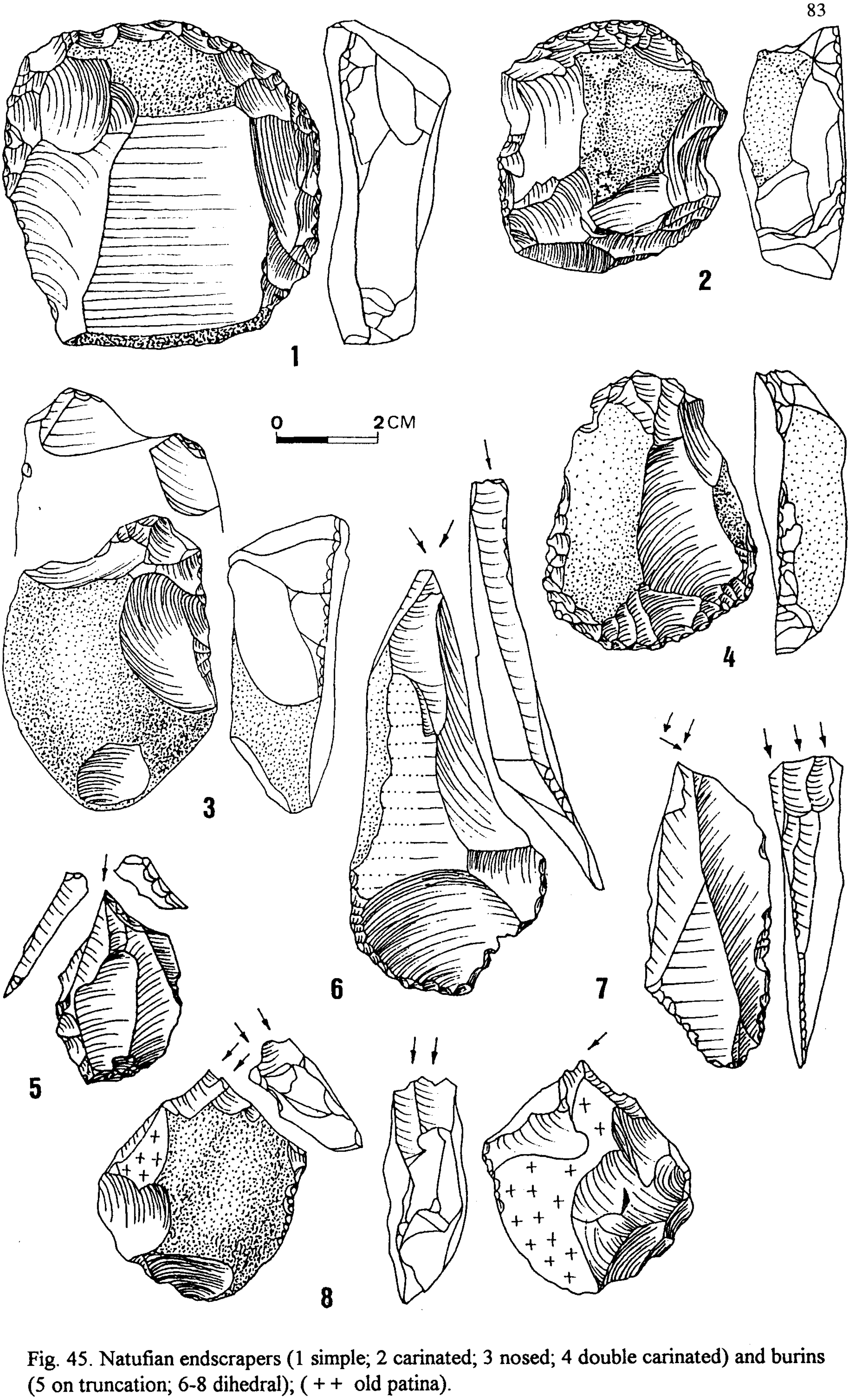


Fig. 45. Natufian endscrapers (1 simple; 2 carinated; 3 nosed; 4 double carinated) and burins (5 on truncation; 6-8 dihedral); (+ + old patina).

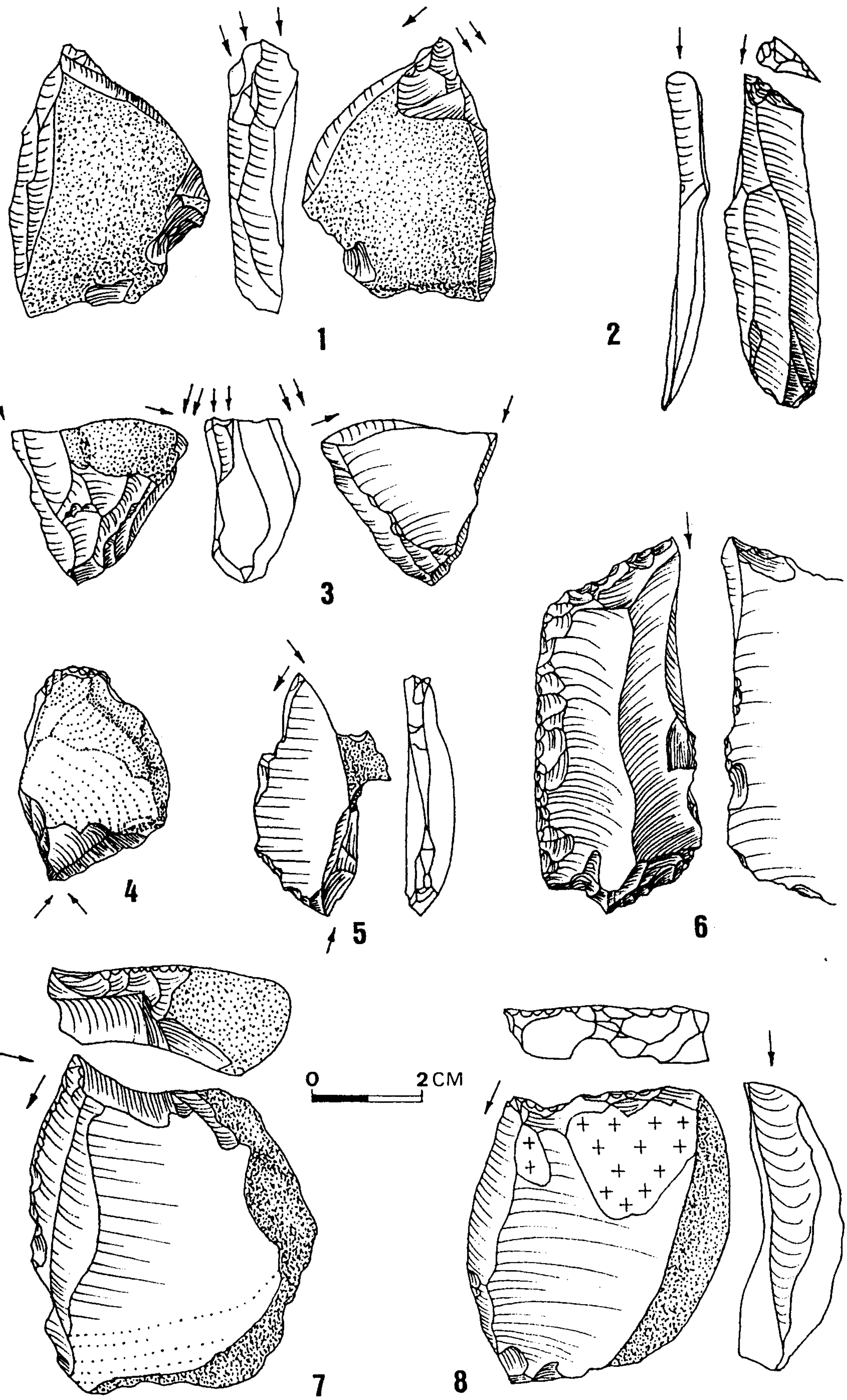


Fig. 46. Natufian burins: 1 dihedral on tabular flint; 2, 6-8 on truncation; 3, 5 double; 4 endscraper-burin; (+ + old patina).

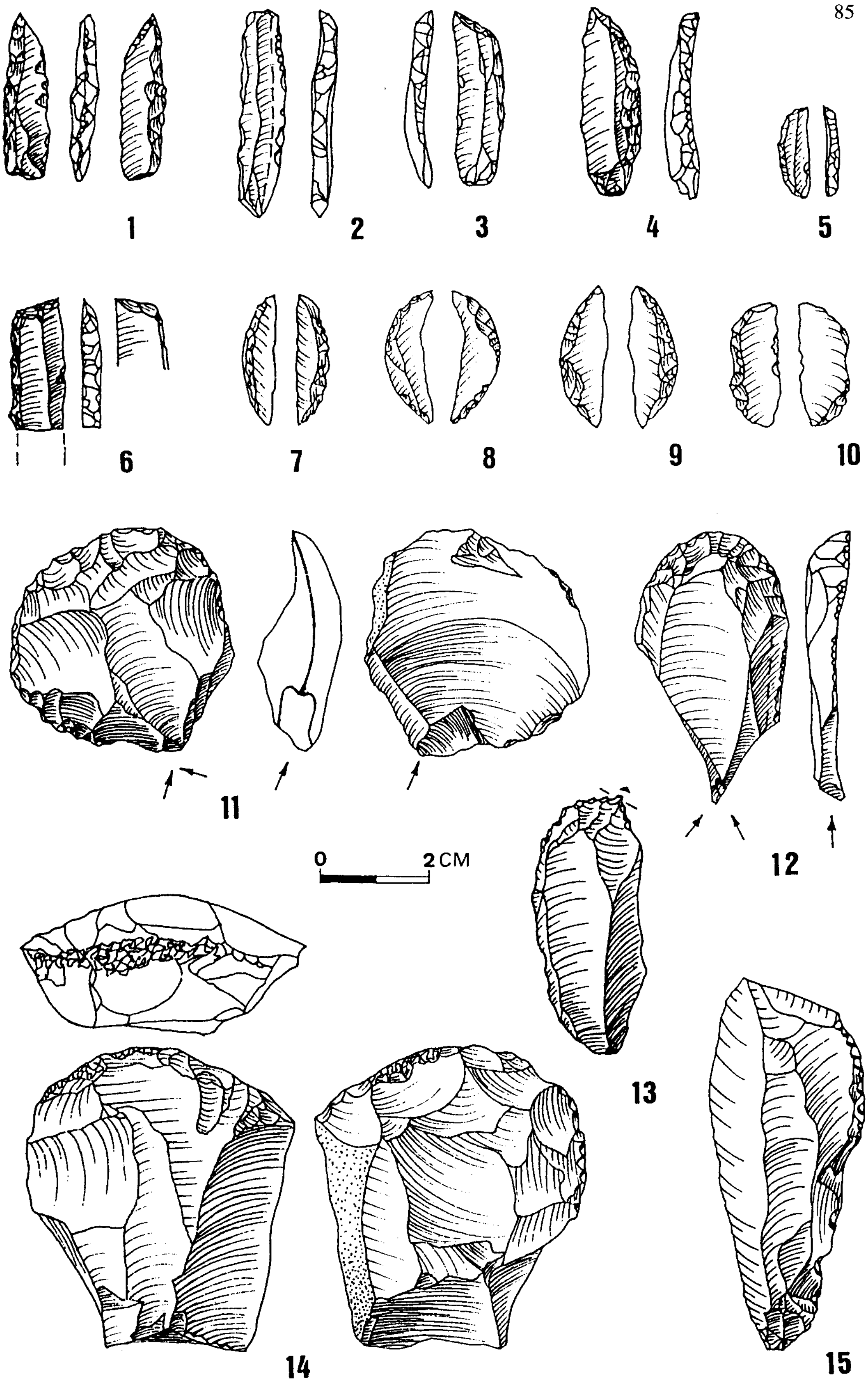


Fig. 47. Natufian tools. 1-10 microliths; 11-12 endscraper-burin; 13 awl; 14 bifacial piece; 15 "Chatelperonian" knife.

Table 4: Counts of Natufian tool classes (squares I40-I42). The typological list is after Belfer-Cohen (1988).

TOOL CLASS	N	%
Endscrapers	98	24.7
Burins	86	21.7
Awls	13	3.3
Backed pieces	8	2.0
Sickle blades	5	1.3
Truncations	8	2.0
Notches & denticulates	28	7.1
Retouched items	53	13.4
Composite tools	11	2.8
Nongeometric microliths	52	13.1
Lunates	12	3.0
Varia	22	5.6
Total	396	100

Of the 11 denticulates and 17 notches, one denticulate is massive, and three notches are on end. Seven out of the 53 retouched items are side scrapers and two are raclettes.

Of the 52 nongeometric microliths, 4 are Kebara points (Fig. 47:3). Most of the remainder are backed with fine to bipolar retouch (Fig. 47:4) with backed edges varying in shape from straight to arched. Other types occur in small quantities. Five of the 12 lunates have Helwan retouch (Fig. 47:7-10), the others are backed (Fig. 47:5) or, occasionally, are narrow with a fine retouch. Special is an item (Fig. 47:6) with a bifacially truncated distal end. Three of the sickle blades (items with traces of lustre) are on bladelets (Fig. 47:2). Three others had been turned into double endscrapers (Fig. 44:5-6) and an endscraper-burin (Fig. 47:12), and are counted as such.

Among the 22 varia, mostly heavy-duty tools, worth noting are four bifaces (Fig. 47:14) and a burin/small percussor. There is a burin on the old surface of the heavy duty scraper of Fig. 48. Seven Levallois (intrusive) artifacts complete the list of the Natufian lithic assemblage (not included in Table 4).

As indicated by the dominant blank forms, most of the tools (57%, excluding microliths) are made on flakes or other items with flake dimension (e.g., the tabular burins). For certain tool types, such as the backed pieces, sickle blades, awls and composite tools, blades were more often selected.

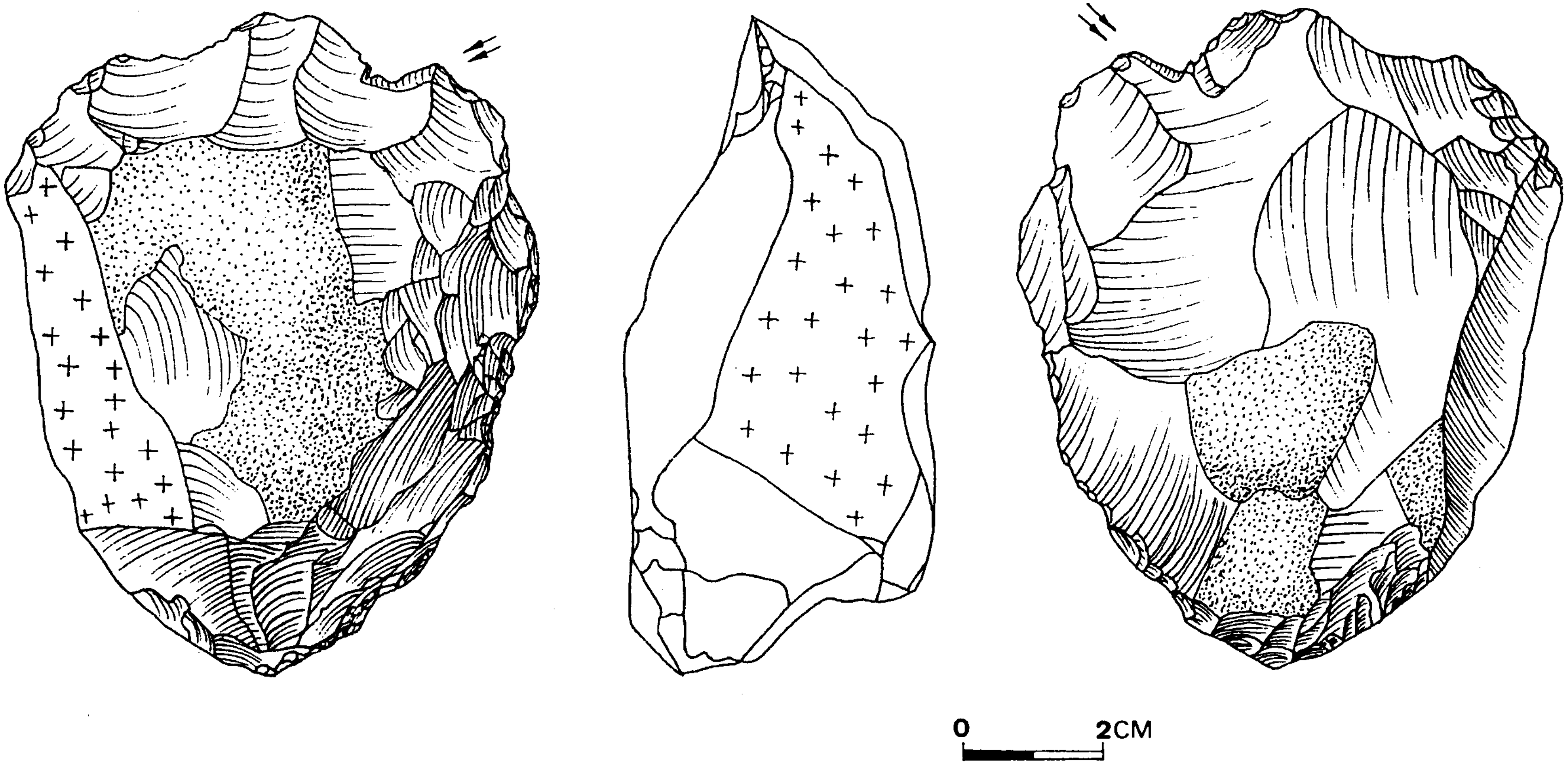


Fig. 48. Natufian heavy-duty tool; (+ + old patina).

The Upper Palaeolithic

Because, as I will show below (Chapter 8, "Conclusions"), it has an important bearing on the understanding of the Natufian occurrence in this part of the cave, the description of the Upper Palaeolithic assemblage is given here as well.

Two layers of densely concentrated finds were found underneath the Natufian layer in square I42, within a soft black clay (Fig. 37). The upper layer was somewhat richer than the lower. Finds of the two layers include 58 flakes, 14 blades, 7 bladelets, 87 cores and 68 tools (Table 5). The debris include 24 chunks of raw material (587gr) and 40gr of waste. In addition, one "lame à crête" and 5 proximal ends of indeterminable flake/blade forms were found. The cores (Table 6) are usually well made, somewhat larger than the Natufian ones, with more typical single platform blade/bladelet cores (Fig. 49). Similar to the Early Natufian, the core:tool ratio is 1.3:1.

Table 5: Preliminary counts of the Upper Palaeolithic assemblage of square I42.

DEBITAGE			CORES	DEBRIS		TOOLS
flake	blade/lets	CTE		chunk (N)	chips (gram)	
58	21	1	87	24	40	68

Table 6: Distribution of Upper Palaeolithic core types.

TYPE	N	%
1 platform	46	52.9
2 platforms at 90°	11	12.6
2 platforms (opposite)	20	23.0
3 platforms	5	5.75
Amorphous	5	5.75
Total	87	100

The tool assemblage is presented in Table 7. Endscrapers and burins are the main groups. Most of the endscrapers are simple (Fig. 50:1), and a few are double flat (Fig. 50:2). Carinated endscrapers are rare. Some of these are made on the corner of rather thin flakes and tend to be shouldered or nosed (Fig. 50:3-4,6). Several endscrapers resemble the special, wide Natufian ones, discussed above (Fig. 50:5; Fig. 51:1-2). Here, however, they seem to be better made and are not on primary flakes. Similar to the Natufian they tend to be on the side or corner of the flakes.

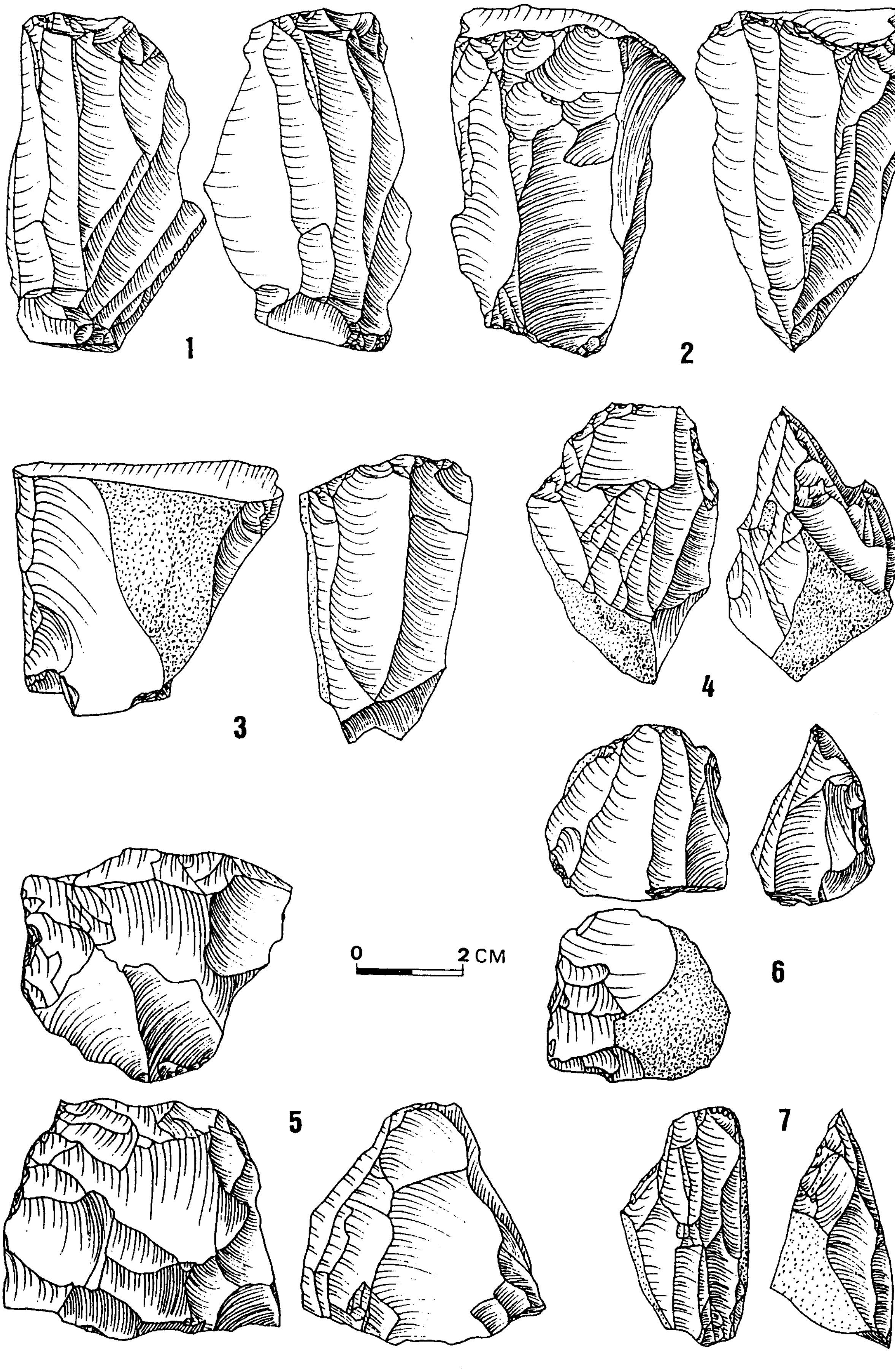


Fig. 49. Upper Palaeolithic cores.

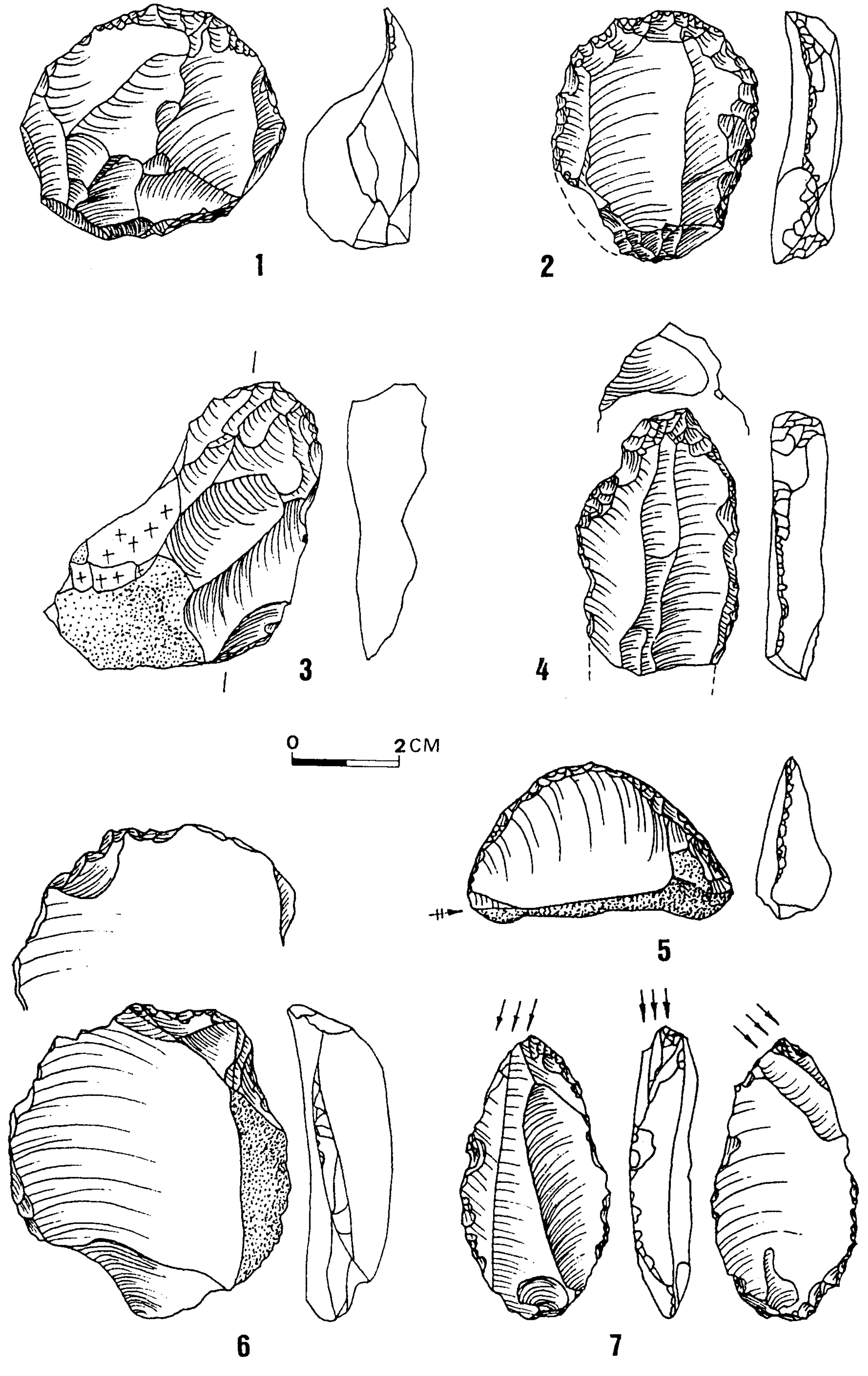


Fig. 50. Upper Palaeolithic endscrapers (1, 5 simple; 2 double; 3-4,6 shouldered/nosed) and a transversal burin (7); (+ + old patina).

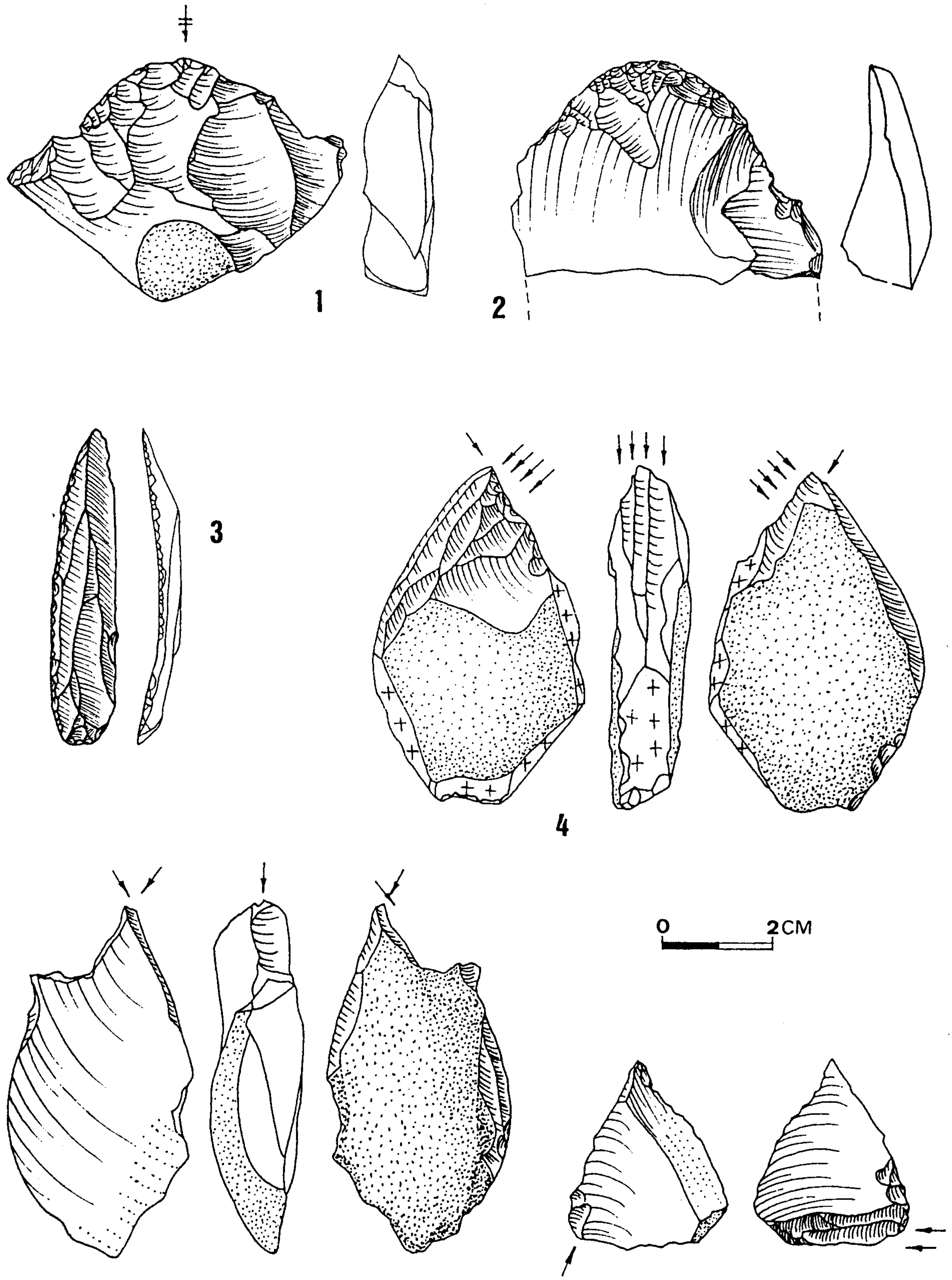


Fig. 51. Upper Palaeolithic endscrapers (1-2), el-Wad point (3) and burins (4-6);
(+ + old patina).

Most of the burins are dihedral, including a few made on tabular flint (Fig. 51:4,5). Burins on truncation are rare, and flat, sometimes transversal, burins (Fig. 50:7; Fig. 51:6) appear in fair numbers. Denticulates and notches are abundant, including quite massive ones. Also found were one el-Wad point (Fig. 51:3) and a fine, narrow nongeometric microlith.

Table 7: Counts of tool classes in the Upper Palaeolithic assemblage of square I42.

TOOL CLASS	N	%
Endscrapers	18	26.5
Burins	17	25.0
Truncations	1	1.5
Notches & denticulates	7	10.3
Retouched items	18	26.5
Composite tools	2	2.9
Nongeometric microliths	1	1.5
El-Wad points	1	1.5
Others	3	4.4
Total	68	100

In spite of the small sample, it seems that this Upper Palaeolithic assemblage does not differ considerably from the overlying Natufian layers. This is true for the typological composition and the fact that flakes were most often selected for manufacturing tools. The main difference is seen in the absence of typical Natufian elements (i.e., lunates and sickle blades) and the scarce microliths. Because of the lack of Natufian tools, on the one hand, and the abundance of endscrapers and burins, especially on flakes, on the other, these lower assemblages are defined as Aurignacian. It is worth noting that the Upper Palaeolithic tools, and especially the cores, are somewhat better made. As already mentioned, the core:tool ratios in the Upper Palaeolithic and the Natufian assemblages are similar (1.3:1).

Additional finds include one broken basalt pestle and a thin bone bipoint. Since the bipoint (Fig. 52:2) is typical Natufian (A. Belfer-Cohen, personal communication, 1995), and the pestle resembles another found within the Natufian layers (see Fig. 54:1), we considered them as intrusive from the overlying Natufian. However, the possibility that they are *in situ* should not be ruled out. Also found in these pre-Natufian layers were a few ochre fragments.

In summary, two main entities were found in the NE part of Chamber III: Early Natufian and Upper Palaeolithic. While the archaeological assemblages discussed here appear to form distinct units, some mixing may have occurred, most likely at the contacts between layers or along the cave walls. Most of the mixing would have been through the incorporation of recent materials, such as ceramics, into the Natufian, but as no Neolithic flint tools were recorded, the lithic assemblage can still be regarded as Natufian. There may also have been some mixing with the pre-Natufian layers, but this will only become clear after more, undisturbed Upper Palaeolithic layers have been excavated. Finally, the Natufian assemblage appears to be quite homogenous throughout the sequence, suggesting that mixing, if it occurred at all, remained minimal. On the other hand, given the state of the Natufian layers, some mixing *within* the Natufian is possible. The "pit" in square I40, where many recent bat bones were found (see below, Appendix III), merits further discussion. Since the archaeological material recovered here is not different from that of the other squares, it is possible that the "pit" was dug into the Natufian layer in recent times. When it was gradually refilled with material from the adjacent layers, bat bones, of bats similar to the ones that still inhabit Chamber III of the cave today, were incorporated in the sediments.

Evidently, the cultural assignment of a particular assemblage should not rest solely on the typological properties of the lithic items. For example, the Natufian endscraper-burin (Fig. 47:12) and the two Natufian endscrapers, shaped on sickle blades (Fig. 44:5-6), closely resemble Upper Palaeolithic specimens: if the retouch of the endscrapers and the burin spall had not post-dated the sickle sheen, the process could be assumed to have happened the other way around, that is, the Natufian used Upper Palaeolithic tools as blanks for modelling sickle blades.

The Natufian sample is too small to allow detailed comparisons with other Early-Natufian assemblages, but as it includes all of the techno-typological characteristics recorded from other sites (Belfer-Cohen, 1988), we may conclude that our Natufian assemblage does not vary significantly from other Natufian assemblages.

Any comparison with Garrod's Early Natufian from el-Wad is pre-empted not only by our small sample but also by the biased counts (Olszewski and Barton, 1990) Garrod and Bate (1937) presented. Yet, we can make some significant observations. The Natufian sample as analysed to date is rich in cores, many of which are amorphous, exhausted and burnt. It also contains many primary elements and broken blanks. On the other hand, it contains surprisingly low frequencies of microliths, lunates, sickle blades and borers, so typical of Garrod's Early Natufian Layer B2 in other parts of the cave (Garrod and Bate, 1937). For example, Garrod reports 1193 nongeometric microliths and 4597 lunates, including 2701 with Helwan retouch. This contrast is even more striking in view of the different retrieval methods: in spite of the careful wet sieving of the sediments of Chamber III, we recovered only a very small number of microliths. Thus, even with the differences in sample sizes, this is undoubtedly a real and not an apparent phenomenon, probably related to the spatial organization of the site (see below, Chapter 7, "Natufian Use of the Site").

Bone Artefacts

The bone tool assemblage of Chamber III is poor, including as it does only a broken, though decorated, sickle haft (Fig. Fig. 52:1; 53), a small bipoint/"gorget" (Fig. 52:2), similar to the specimens given in Garrod and Bate (1937, Plate XII, 2:11,12), and 2 broken points (e.g., Fig. 52:3). Also found were 3 polished bone fragments (R. Rabinovitch, personal communication, 1997). The sickle haft is made of a rib of a medium sized animal and is decorated in groups of parallel lines typical of the Early Natufian (Henry, 1989). A groove for the insertion of the blades was cut along one edge (Fig 52:1; the left side in Fig. 53). The point and bi-point were made by scraping the bone with flint, which is the basic Natufian technique (Campana, 1989). In addition, several bone points and pins, made of gazelle horn-cores or roe deer antlers, are illustrated by Garrod and Bate (1937, Plate XV:3).

The bone-tool assemblage in Chamber III is clearly too small to contribute in any significant way to the understanding of the bone tool industry of el-Wad. Some 185 Natufian bone points, most of them broken, are reported by Garrod, the majority of these probably deriving from the Early Natufian (Garrod and Bate, 1937). Garrod's bone industry includes also many bone awls and several bone harpoons, skin rubbers, gorgets and sickle hafts. Together with the bone art and decorative items, they represent a prolific and varied bone industry, typical of Natufian assemblages in general.

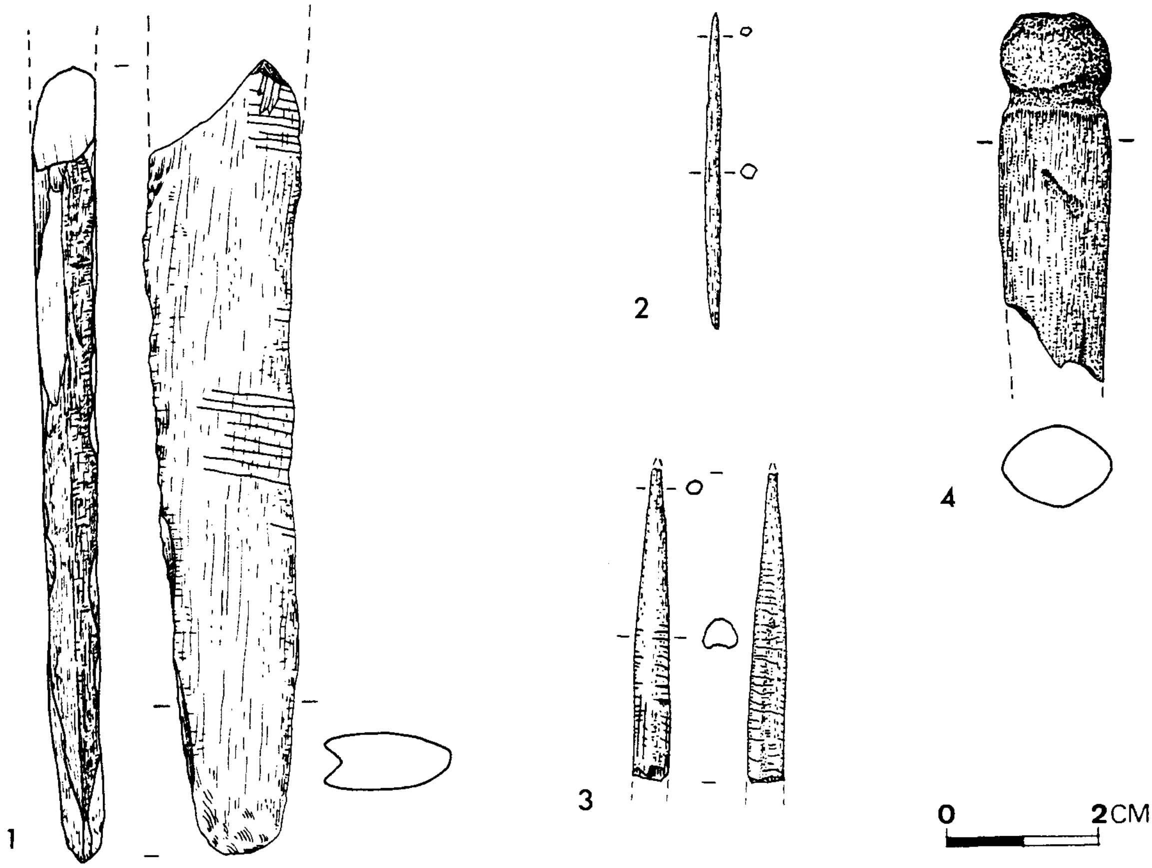


Fig. 52. Natufian bone artefacts: 1 broken point; 2 "gorget"; 3 an incised sickle haft; 4 a figurine made on a gazelle horn core.

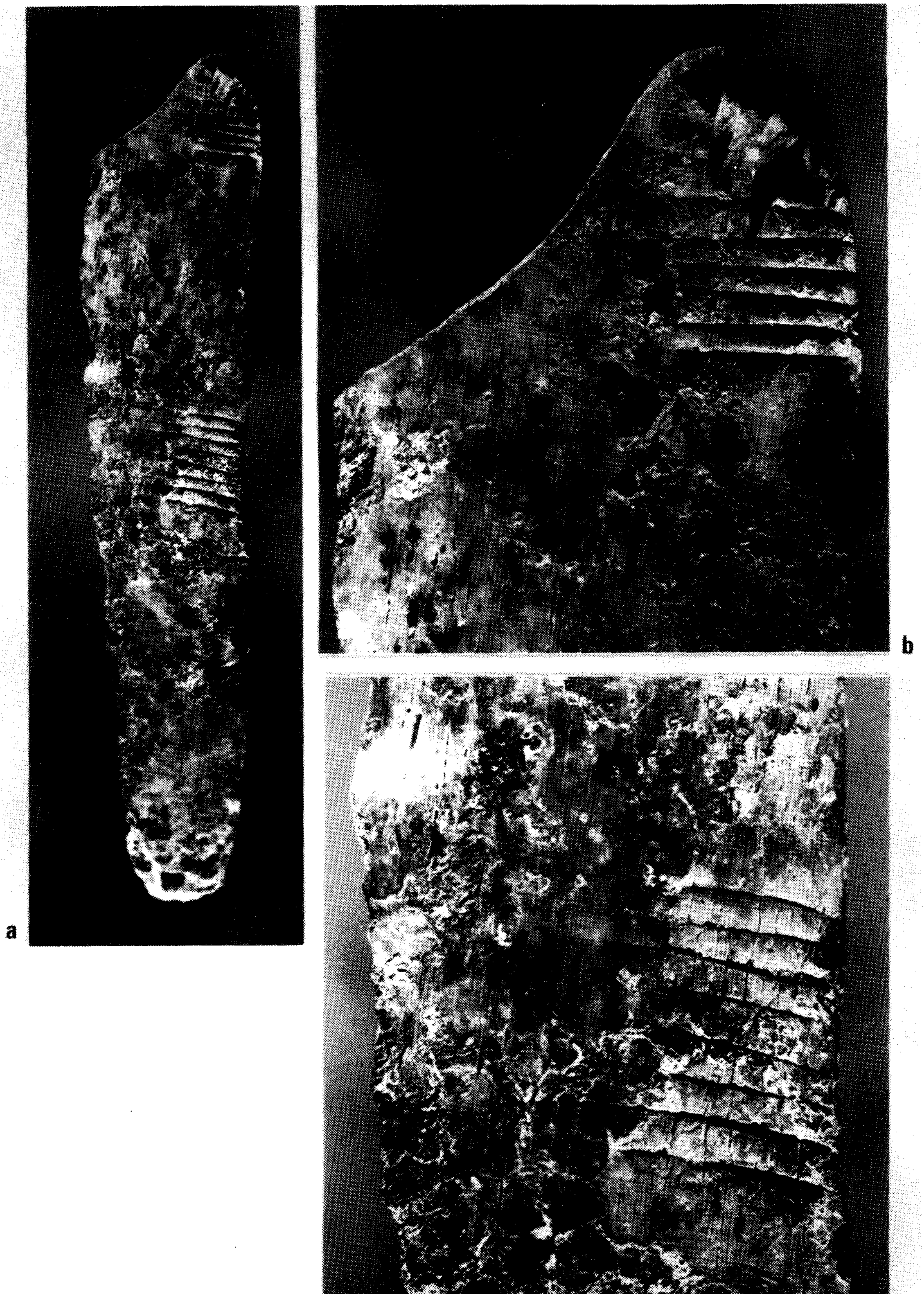


Fig. 53. The decorated sickle haft from the recent excavations at el-Wad (a); close-ups at various portions of the haft (b and c).

Ground Stone Implements

The ground stone assemblage (Table 8) comprises items chiefly made on basalt. There are only two pestles made of limestone, including an incised pestle (see Fig. 63) which was found in the surface layer. The assemblage is clearly dominated by pestles (20), of different sizes and forms (Fig. 54:1,3,5-7; Fig. 55:3), and includes two mullers (Fig. 54:2), two bowl and mortar lips (e.g., Fig. 54:4), two small pieces of mortars, three polished grinding stones (Fig. 55:1,4) and a "shaft straightener" (Fig. 55:2). Seven flint hammerstones and percussors were found as well.

Table 8: Composition of the groundstone assemblage.

TOOL TYPE	N
Pestles	20
Mullers	2
Bowls	2
Mortars	2
Grinding stones	3
Shaft straightener	1
Hammerstones	5
Total	35

Most of the pestles are broken, making it impossible to reconstruct their original lengths. In cross section, most of the pestles are either oval or circular and their diameters vary considerably. Pestles also vary in the way their working ends have been shaped. Usually these are pointed (Fig. 55:3), rounded, or with widening end (Fig. 54:1,5,7). The latter are considered to be variations on the penis shape (Belfer-Cohen, 1991b; see below Chapter 5, "Decorative and Art Objects"). One of these phallic objects (Fig. 54:7) has a radial shallow groove, similar to the one found on a phallic object made of a flint nodule (Weinstein-Evron and Belfer-Cohen, 1993). Three of the pestles have hammerstone-like ends with use-wear signs of chipping or flaking, indicative of intensive and prolonged use (e.g., Fig. 54:3,5). One pestle (Fig. 54:6), whose lower part is broken off, may have been shaped like an animal hoof similar to the specimen Garrod mentions whose "pounding end [is] shaped into a highly simplified representation of the hoof of an ungulate" (Garrod and Bate 1937: 41; Plate XV:4,2). Most of the pestles are polished, and six were stained with ochre.

Garrod also reported a large number of Natufian basalt pestles, mostly broken, which "vary a good deal in size, but the average diameter is 50 mm. to 60 mm." (Garrod and Bate, 1937:41). Oddly enough, the diameters of the pestles in our collection are rather varied. Three of the pestles Garrod found were carved, and several were stained with red ochre. The description of these "cylindrical basalt pestles" (Garrod and Bate, 1937:41) accords with the newly excavated assemblage of Chamber III. However, unlike the mortar fragments found in Chamber III, a small number of fragmentary mortars found in Garrod's Layer B are all made of limestone.

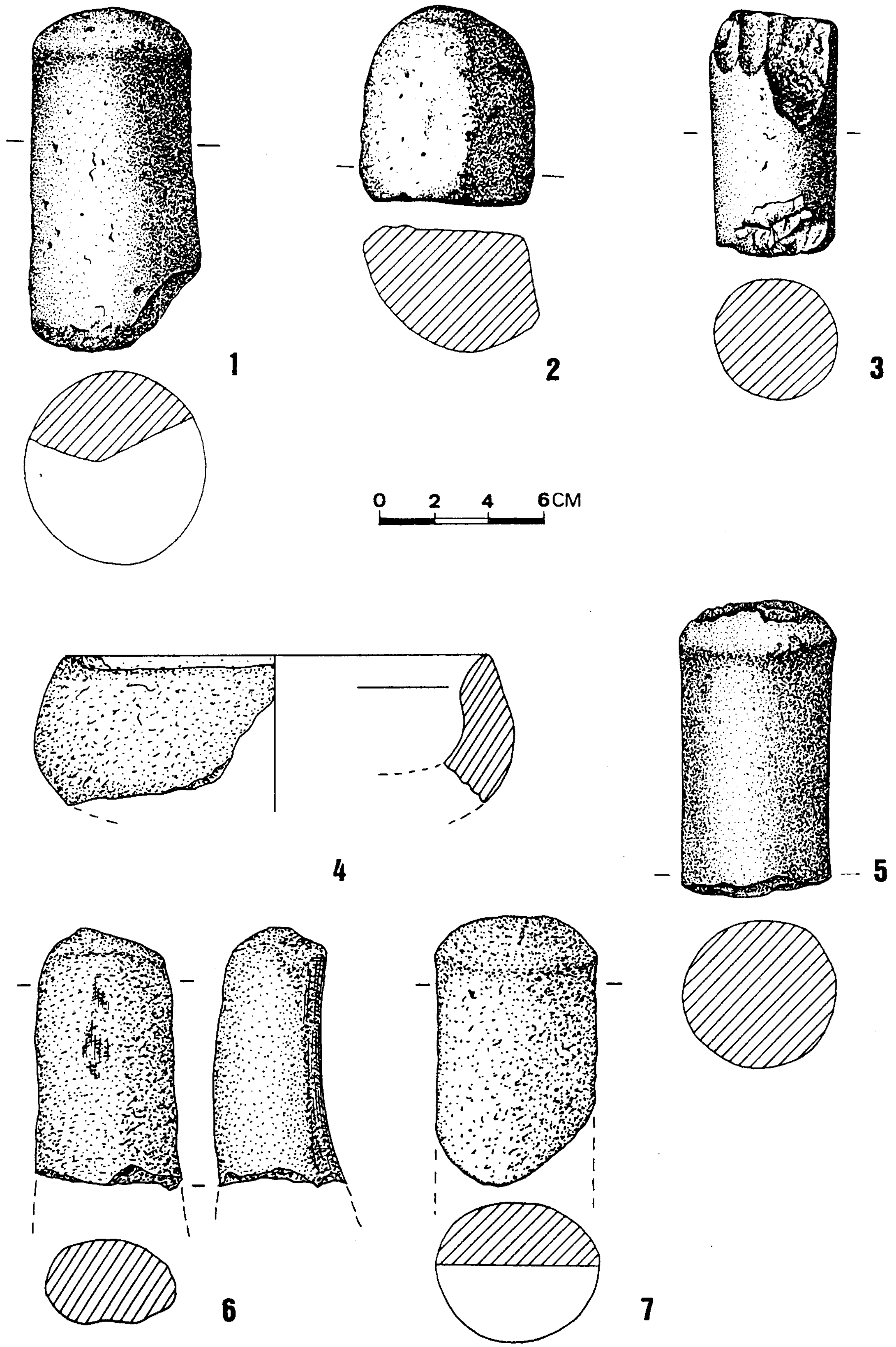


Fig. 54. Natufian basalt utensils: 1,3,5-7 pestles; 2 muller; 4 bowl lip.

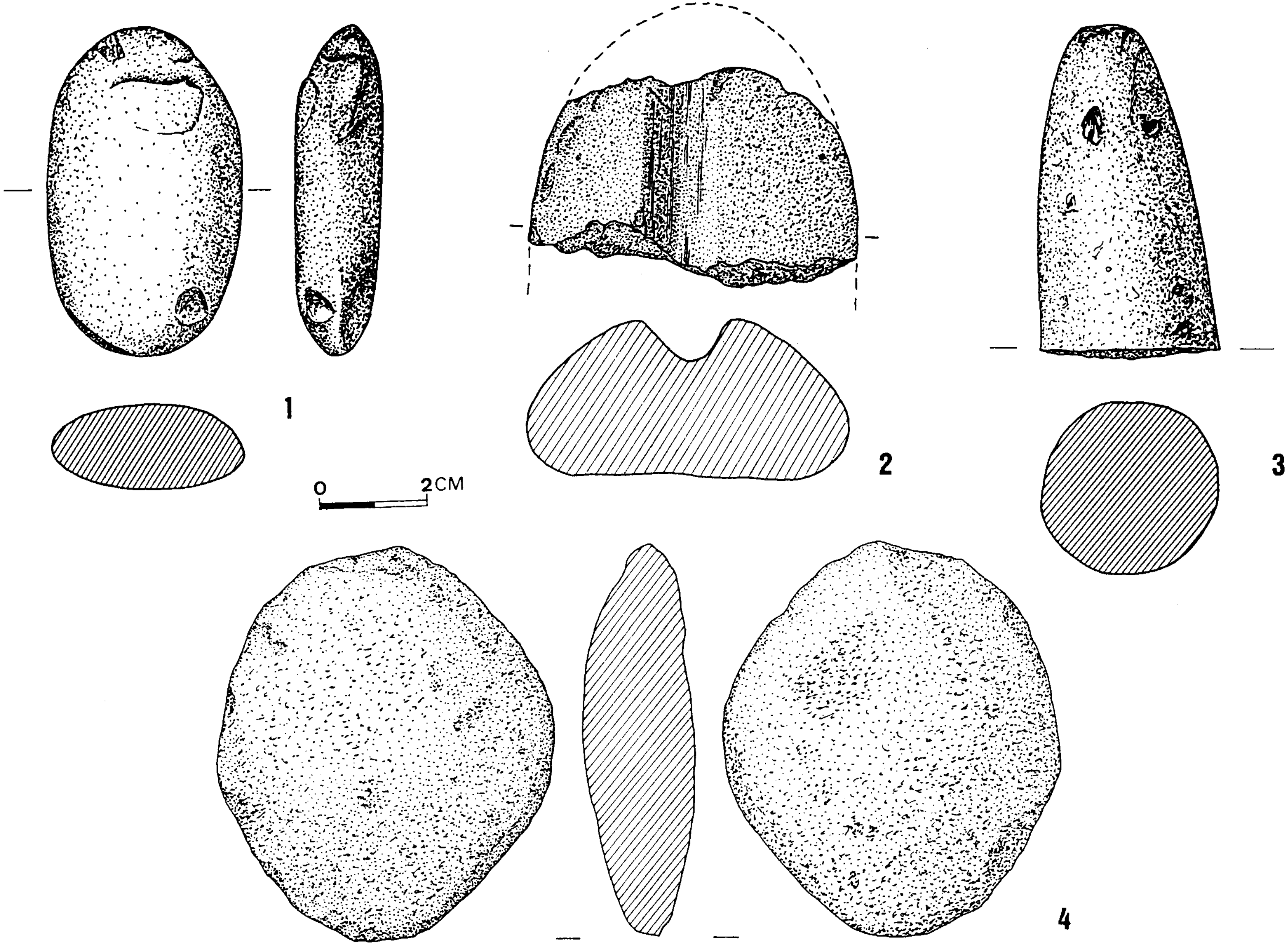


Fig. 55. Natufian basalt tools: 1,4 grinding stones; 2 shaft straightener; 3 pestle.

Decorative and Art Objects

El-Wad yielded the first prehistoric Levantine art objects ever to be found — a decorated bone sickle haft, carved in the shape of an animal's head (Fig. 56:1) and a "bâton de commandement" (Fig. 56:2), which Lambert uncovered in 1928 during his trial excavation of the site (see below, Chapter 7, "Natufian Use of the Site"). Additional decorated bone and ground stone implements, as well as items of decoration and artistic representation, were subsequently unearthed by Garrod. Together these constitute a significant element of the Natufian assemblages of the cave and the terrace. They include a variety of objects ranging from figurines through beads and pendants to decorated sickle hafts. Among the figurines Garrod included a human head made of calcite (Garrod and Bate, 1937: Plate XIII:4; Fig. 57:1) and a few phallic objects made from flint nodules (Garrod and Bate, 1937: Plate XII,2:14). While she made no mention of the exact provenance of the phallic objects, stating only that they belonged to the material derived from the Natufian Layer B, Garrod attributed the human head to the Lower Natufian.

A small number of decorative pieces and art objects were found in the recent excavations as well. They include stone "figurines", a figurine made on a gazelle horn core, a decorated bone sickle haft, an unperforated polished pendant, beads, "widening end" basalt pestles, and an incised limestone pestle.

Five stone figurines, made on flint nodules, were found in the Early Natufian layers of el-Wad (Weinstein-Evron and Belfer-Cohen, 1993). Three of the items (Fig. 57:2; Fig. 58; Fig. 59:1,2) are globular or rounded, the other two (Fig. 59:3,4; Fig. 60:1,2) elongated nodules.

The three rounded "figurines" (Fig. 58) have a central circumferential incision on their bodies (indicating the waist or neck?) and display flaking scars, together with pitting and polishing signs. The first (Fig. 58:1; Fig. 59:2) has a plano-convex shape, with signs of polishing and rubbing on the flattened side of the body. The smallest (Fig. 57:2; Fig. 58:2) is also the most elaborated of the three. It is shaped on a longitudinally broken nodule with one end bearing flaking scars and the other pitting marks, making its rounded shape more pronounced. The surface unmarked by pitting is flattened and polished. A fine, shallow, semi-circular incision (eye?) is visible to the right, where the surface is less flattened than the rest of the area, and below this two minute horizontal incisions are discernible (mouth?). The overall impression is of a schematic human face. Besides the central, circumferential incision there is a shorter, oblique incision extending from the flaked area towards the longitudinal break. The largest figurine (Fig. 58:3; Fig. 59:1) has a dozen or so vertical incisions on its upper part and some polish on its lower part.

The first elongated item (Fig. 59:3; Fig. 60:1) has circumferential incisions and polish wear on its body. Its lower end is flaked and bears several small flaking scars. The other end has an elongated, oval shape and was modified through polishing and hammering which created a fold along its outer rim and some polished and flattened surfaces above it. Later pitting marks, similar to those found on hammerstones, cover most of the surface of this end. The second elongated item is slightly thinner and longer (Fig. 59:4; Fig. 60:2) and has signs of modification on both ends, circumferential incisions on the upper and lower thirds of its body and signs of polish

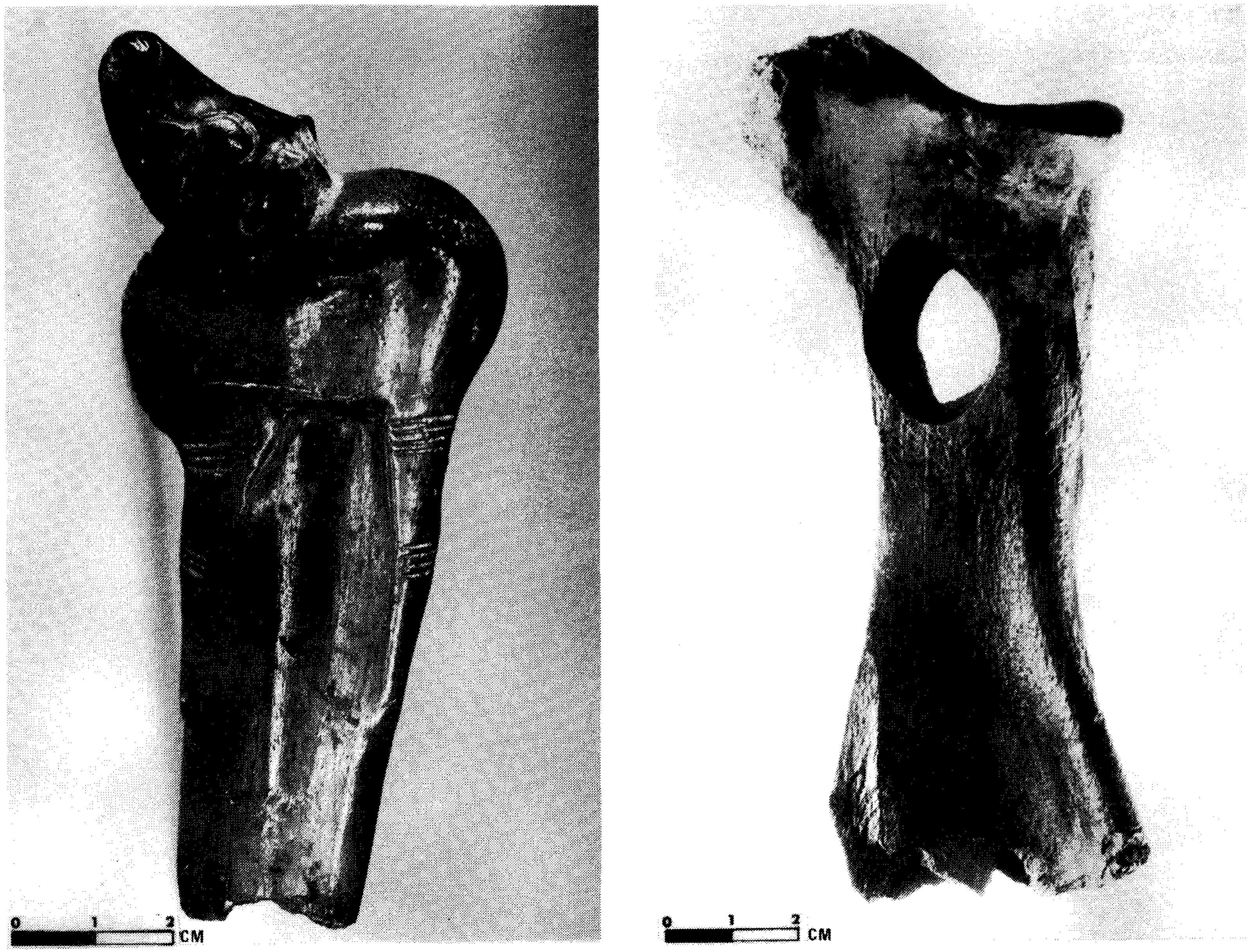


Fig. 56. The art objects uncovered by Lambert during his trial excavation in the cave: (a) carving of a young deer on a piece of long bone, probably the end of a sickle haft; (b) a pierced large bone ("bâton de commandement").

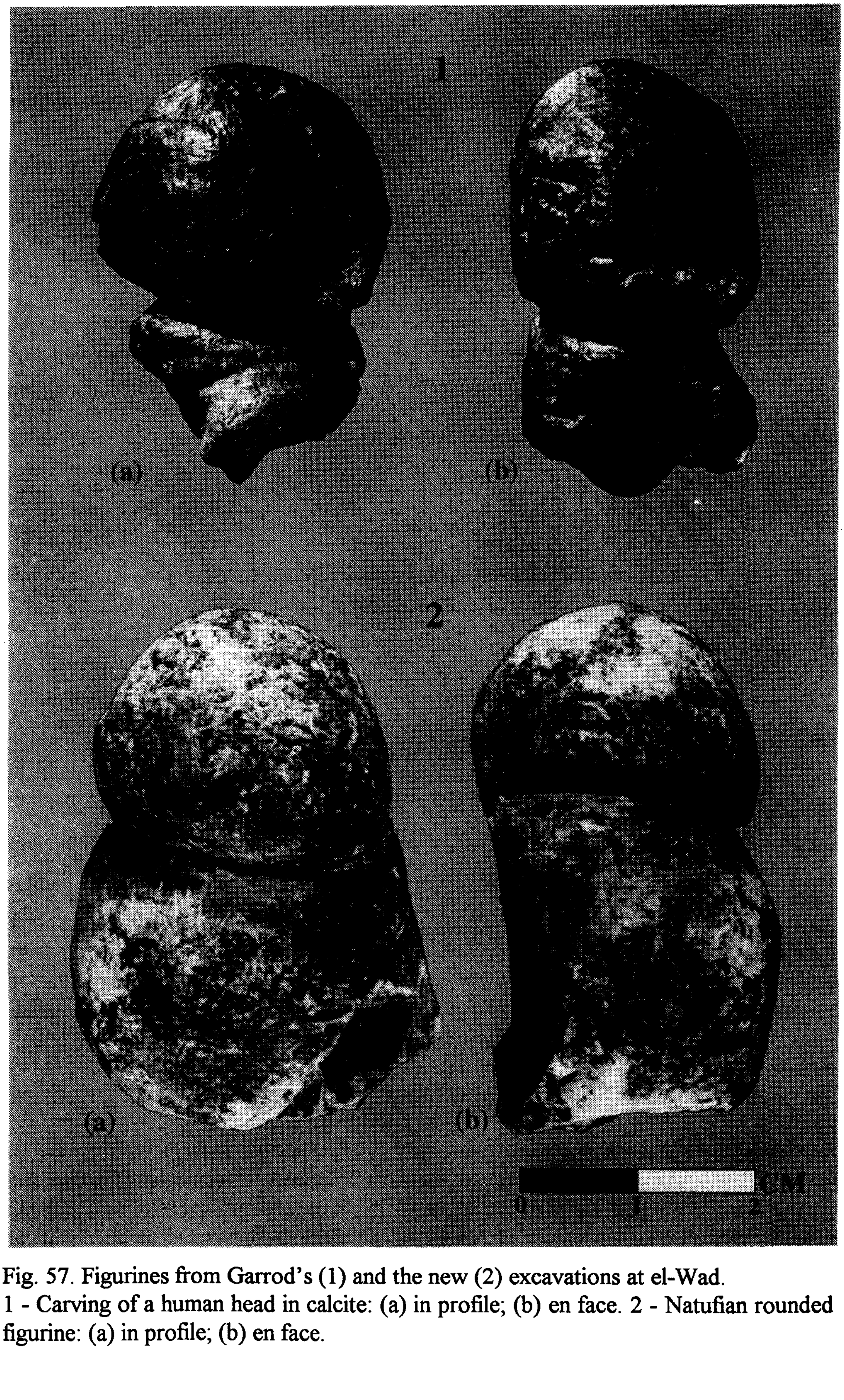


Fig. 57. Figurines from Garrod's (1) and the new (2) excavations at el-Wad.
1 - Carving of a human head in calcite: (a) in profile; (b) en face. 2 - Natufian rounded figurine: (a) in profile; (b) en face.

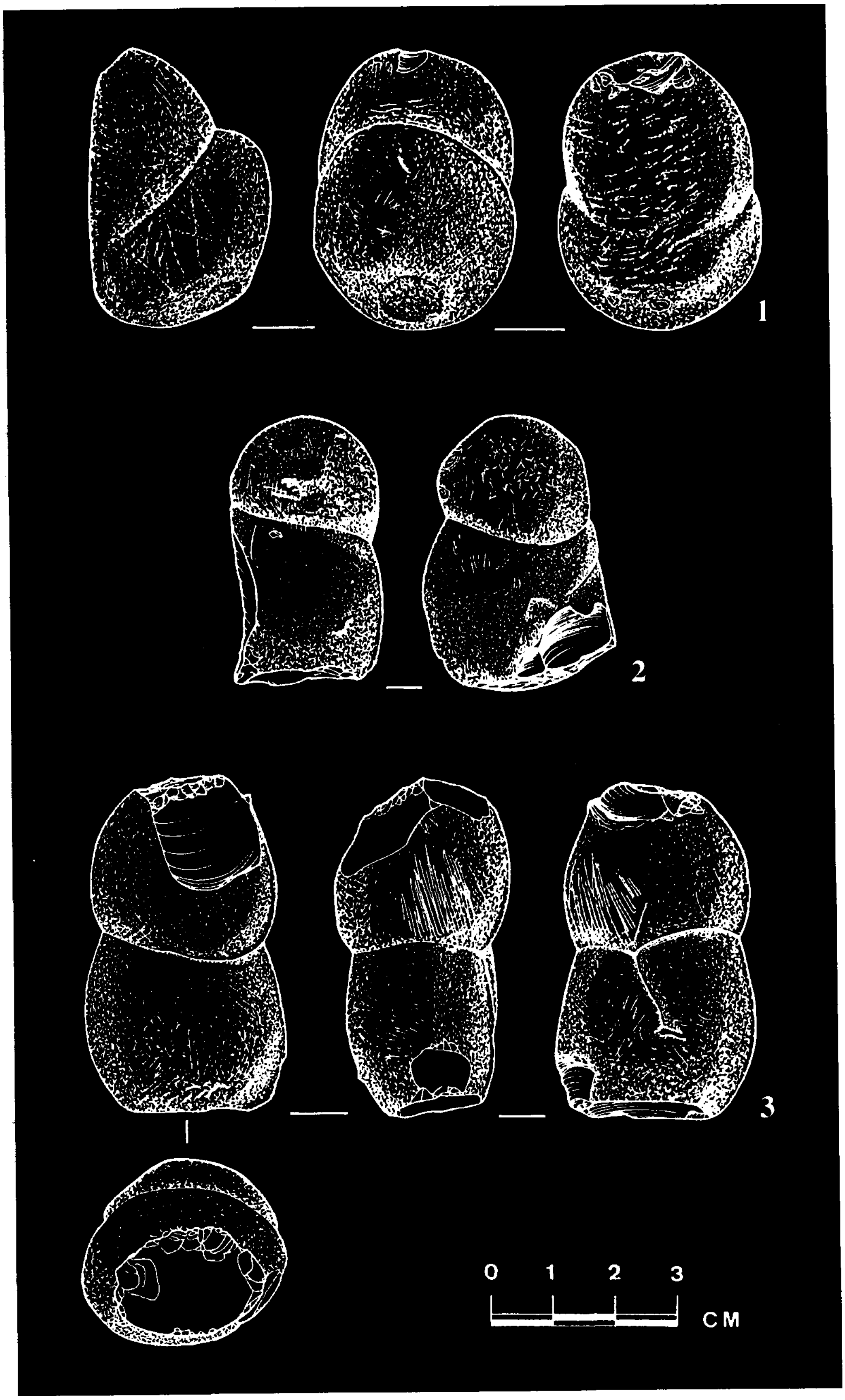


Fig. 58. Natufian rounded figurines recovered during the recent excavations at el-Wad.

Fig. 59. Rounded (1 and 2) and elongated (3 and 4) figurines from the recent excavations at el-Wad.

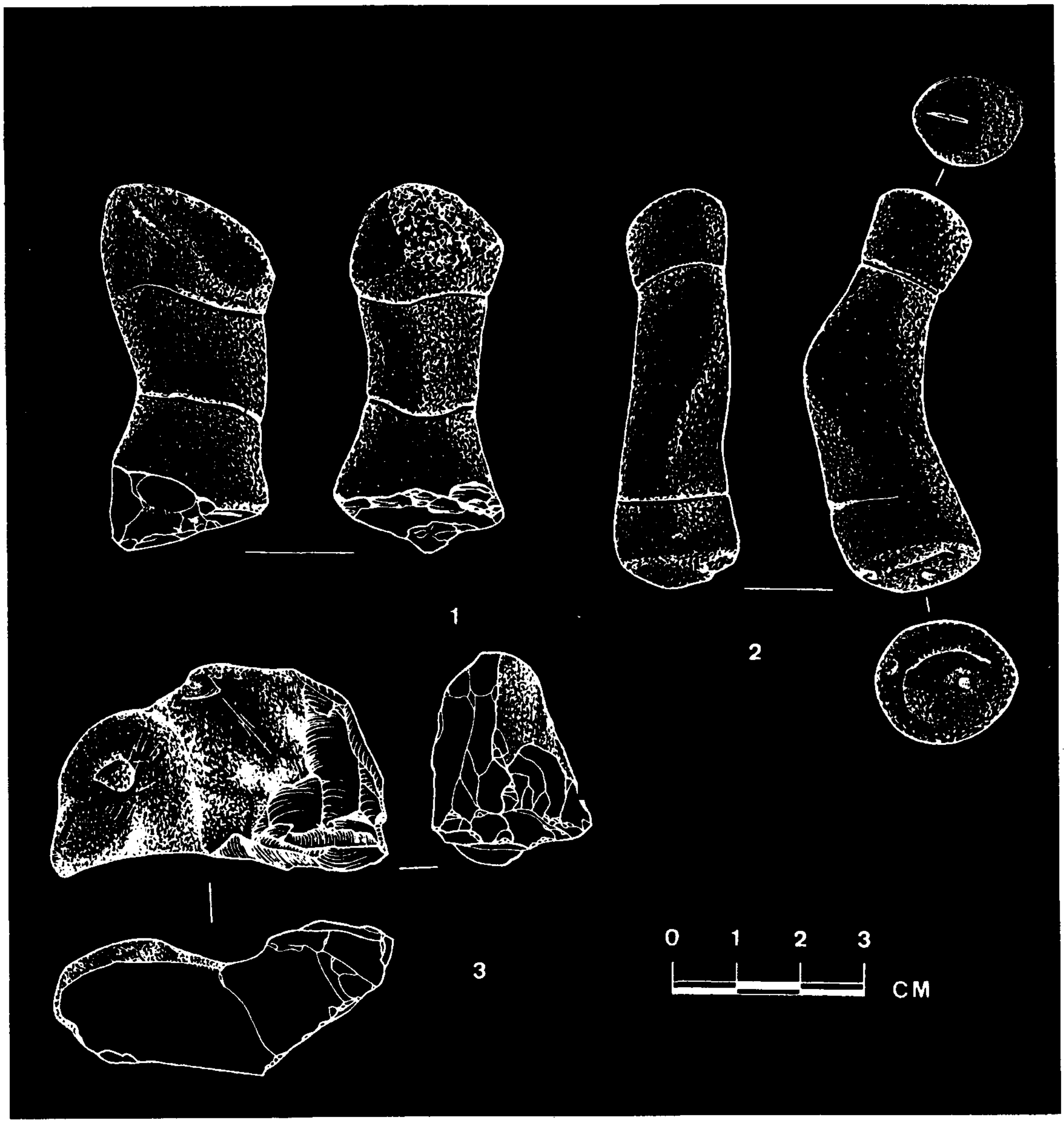


Fig. 60. Natufian figurines recovered during the recent excavations at el-Wad. 1 and 2 Phallic objects; 3 - a zoomorphic flint nodule.

wear over its entire surface. The lower end has an elongated oval shape and bears a resemblance to the distal end of a penis with a fold or thickening along the longer axis (representing the prepuce?) and a drilled hole (the urethral orifice?). The other end is more rounded, smaller in diameter and has a fine, shallow, incised groove (Fig. 59:4a) from the centre almost to the edge (vulva?).

As already mentioned, three of the basalt pestles (Fig. 54) fall into the category of the "widening-end", and thus as variations on the penis shape (Belfer-Cohen, 1991b) can be considered as decorative, symbolic items. As described, one of them (Fig. 54:7) has a radial shallow groove, similar to the one found on a flint figurine (Fig. 59:4; Fig. 60:2).

The last figurine (Fig. 52:4; Fig. 61:1a) is made on the tip of a gazelle horn core (R. Rabinovitch, personal communication, 1995). In its size, elongated shape and the circumferential thinning dividing its upper (head?) and lower parts, it largely resembles the stone figurines. The thinned area (neck?) is carved and emphasized further by an additional, fine incision (Fig. 61:1b), resembling the incisions on the flint-nodules figurine. During excavation, the lower part of the figurine was accidentally broken off and sadly was never recovered. A fine, shallow longitudinal incision (Fig. 61:1c) suggests that other body parts (legs?) may originally also have been depicted.

As already mentioned, the sickle haft (Fig. 53) is decorated with groups of parallel lines typical of the Early Natufian (Henry, 1989); similar lines were engraved on the decorated bone sickle haft uncovered by Lambert (Garrod and Bate, 1937: Plate XIII:3; Fig. 56:1). Our haft is also reminiscent of the decorated sickle haft from Hayonim (Belfer-Cohen, 1991b), in spite of the fact that the two groups of incisions here are executed in a net pattern.

Incised bone implements are relatively rare in the Levant. They increase in numbers from the Middle Palaeolithic (Davis, 1974), through the Upper Palaeolithic (Davis, 1974; Tixier, 1974) and Epi-Palaeolithic (e.g., Rabinovitch and Nadel, 1994-5 and references therein), until we reach the Natufian, which exhibits the richest and most varied bone tool assemblages (e.g., Belfer-Cohen, 1988; Campana, 1989; Stordeur, 1988, 1991), including many decorated items (Belfer-Cohen, 1991b). The purpose and meaning of the incisions are not known. Incised implements have been most commonly interpreted as decorative (e.g., Belfer-Cohen, 1991b; Noy, 1991), as calendars, quantitative records or hunting tallies (Marshack, 1972, 1997), as utilitarian (e.g., Campana, 1989, for selected items from Hayonim), or as related to group identification (O. Bar-Yosef and Vogel, 1987; Hovers, 1990).

Two beads were found in Chamber III, one a perforated bird phalanx (identified by T. Dayan) and the other a stone bead, made on green silica (Fig. 62:1). Beads made on partridge tibio-tarsus are quite common in Hayonim (Anna Belfer-Cohen, personal communication, 1997) and reported also, in small numbers, from Eynan and Erq el-Ahmar (Pichon, 1983) but the el-Wad bird phalanx bead is unique. In its general form and size, however, it is reminiscent of the many *Dentalium* shells reported by Garrod and Bate (1937). Garrod (1957), though, mentions among the pendants found at el-Wad some made from the distal end of a bird's tibio-tarsus and suggests that they had been threaded through a tiny natural foramen (see also Garrod and Bate, 1937: Plate XV1). Many perforated gazelle phalanges from el-Wad were also reported by Garrod (Garrod and Bate, 1937), together with other types of bone pendants, notably the "twin" pendants found with Homo 23 (Garrod and Bate,

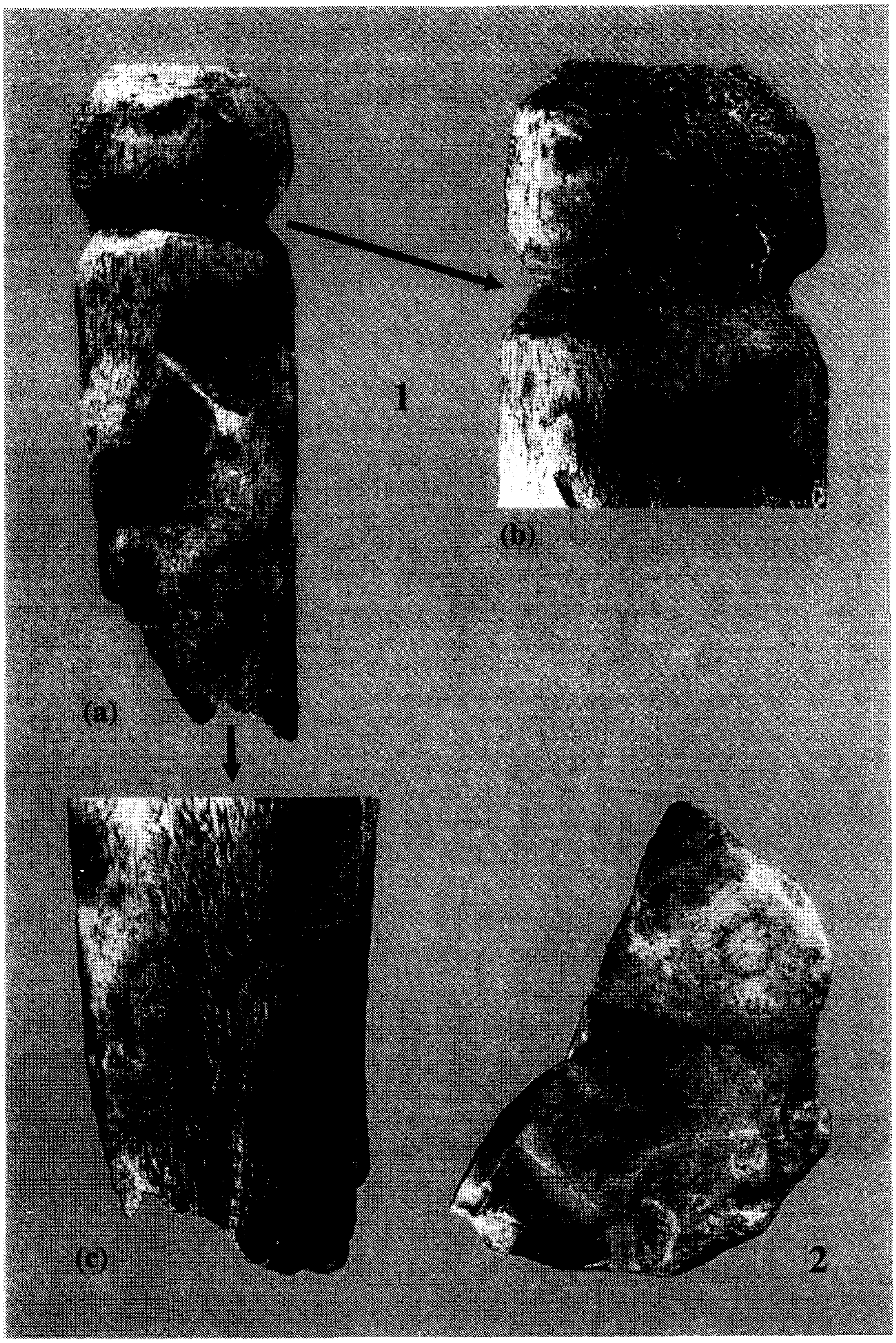


Fig. 61. Natufian figurines from el-Wad. 1 - a figurine made on a gazelle horn core (a); close-ups at various points (b and c). 2 - a zoomorphic flint nodule.

1937: Plate XIV). While they occur also in various other sites (e.g., Hayonim, Belfer-Cohen, 1988), at Eynan (Perrot, 1966) pendants of this type are quite numerous. The stone bead is similar to another one from el-Wad reported by Beck (in Garrod and Bate, 1937), which, given its "[unsatisfactory] stratigraphical position ... [was] described with the reservation that [it] may possibly not be Natufian" (Garrod and Bate, 1937:40). Three other "beads" (Fig. 62:2) are naturally eroded pieces of beachrock, typical to the coastal area of Israel (Shimon Ilani, personal communication, 1994). It may have been their particular form that attracted the Natufians because the holes in them easily suggested decorative purposes. Also found was an oval, unperforated pendant, made on a polished metapodial.

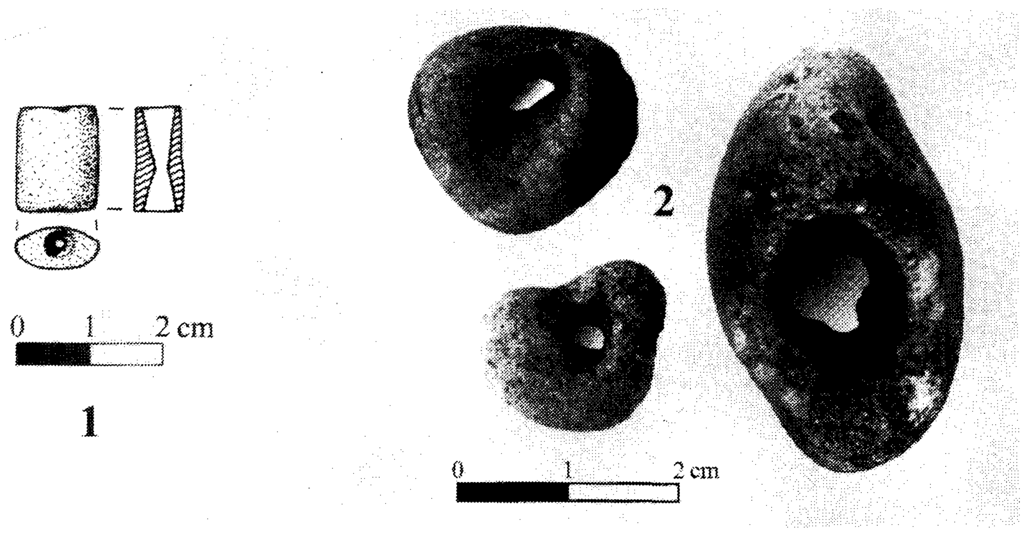


Fig. 62. A stone bead (1) and sandstone "beads" (2).

The incised limestone pestle (or chisel?) is shown in Fig. 63. The clear hammering/flaking signs along its edges indicate a rather intense use, which is also implied by the fine incisions on one of its faces (the one to the right in Fig. 63), indicating some smoothing or polishing. The other face (the left one on the drawing) exhibits a rather complex incision. It has four longitudinal lines, two virtually parallel lines in the middle, and two at either side of this composition. The design is completed by several horizontal and diagonal lines, incised at different angles. Five of these lines converge to create two somewhat rounded triangles, which share a common base, with the upper triangle being smaller than the lower one. Two other parallel, diagonal lines are incised within the upper triangle. It would, of course, be useless to try and figure out the original meaning of the depicted design, especially since we do not even know in what direction the object was held or looked upon — to suggest that this incision represents a stylized ("Modigliani") head and neck or else the lower half of a human (female?) figure is only speculation. Yet, rather than a notational sequel we do seem to have here some sort of figurative representation. Both these types of representations have been found in the Early Natufian of Hayonim (Belfer-Cohen, 1991b; Marshack, 1997). Indeed, when held horizontally the item seems to bear some similarity to the Hayonim incised "fish" (Belfer-Cohen, 1991b: Fig. 9).

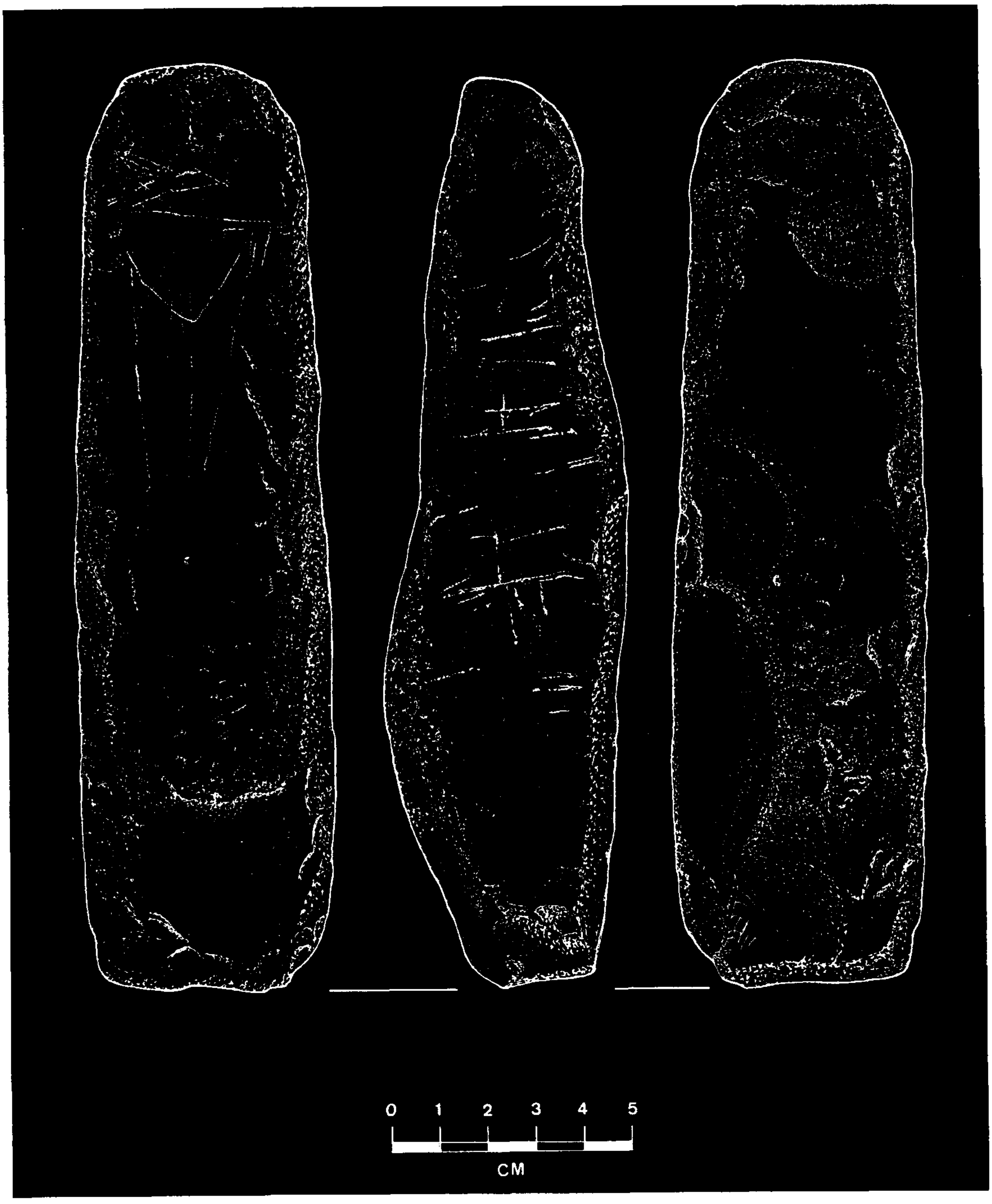


Fig. 63. An incised limestone pestle from the recent excavations at el-Wad.

Rather thick, deep and sometimes intersecting short lines were incised on one side of the pestle (Fig. 63). It is impossible to determine whether this is a notational sequel of some sort, especially as we have no known parallel. Its manner of engraving was clearly different from that of the other representations, which could indicate a different tool, a different hand or even a different time.

The provenance of the incised pestle is not clear, as it was found within the surface layer. However, similarly incised limestone items are reported from the Early Natufian layers of Kebara (Turville-Petre, 1932) and Hayonim (Belfer-Cohen, 1991b). Even Garrod describes "a single specimen made of limestone, [which] bore an incised design all over" (Garrod and Bate, 1937: 41, i.e., "phallic object"). Furthermore, most of the material incorporated in the surface Layer A is Natufian (Garrod and Bate, 1937). Thus, it appears justifiable to suggest that the newly discovered incised pestle form Chamber III of el-Wad is Natufian and most probably Early Natufian.

It is rather hard to determine with any confidence whether the recently discovered figurines represent humans in general, females or males. The phallic objects (Fig. 60:1,2) and their characteristic attributes suggest, of course, the male, but whether the rounded items (Fig. 58) should be seen as female "figurines" (Weinstein-Evron and Belfer-Cohen, 1993; Marshack, 1997), human figurines or, also, phallic objects, is more difficult to establish. Garrod reported phallic objects "made from flint nodules of suitable shape, with a circular incision made at one end to indicate the foreskin" (Garrod and Bate 1937:41; Garrod and Bate, 1937: Plate XII2:14). Phallus-shaped pestles have been recovered from various Natufian sites with ground stone assemblages (e.g., Belfer-Cohen, 1991a; Edwards, 1991) and have been unearthed in both the first (Garrod and Bate, 1937) and the recent excavations (Fig. 54) at el-Wad. Phallic objects were also reported by Turville-Petre (1932:276) from the Early Natufian layers of Kebara Cave where he found "a few flint nodules incised to represent phalli, three decorated limestone objects, perhaps stylized phalli, and a small slab of limestone incised on both faces, presumably a cult object". It is not clear whether these "phallic" flint nodules from Kebara exhibit the more slender or the more rounded of the el-Wad figurine versions. A rounded figurine from Kebara can be seen in the Rockefeller Museum in Jerusalem, but whether it is one of the objects described above is unclear.

Interestingly, most of the phallic objects from el-Wad (and possibly also from Kebara) are flint nodules with "suitable" shapes. Such natural nodules, often with circumferential incision(s) are common within the Upper Cenomanian Shamir Formation chalks (Erez, 1984). Many of these are zoomorphic (Erez, 1984:48), similar to the nodule in Figs. 60:3 and 61:2, described in detail elsewhere (Weinstein-Evron and Belfer-Cohen, 1993). Exposures of these chalks closest to our site are some 1.5-2km north-east (Karcz, 1959). Adequate flint nodules, that is those with a "potential" for certain modifications (Weinstein-Evron and Belfer-Cohen, 1993), were apparently collected by the Natufians from these exposures and brought back to the cave. The fact that the nodules are pitted only on certain areas of the body, with other parts bearing signs of polishing or incisions, excludes the possibility that they were collected from the wadi bed. Moreover, the "zoomorphic" item (Fig. 60:3) is not hammered at all, but rather had a steep carinated scraper/bladelet core shaped on it (Weinstein-Evron and Belfer-Cohen, 1993), similar to one of the phallic objects retrieved by Garrod in which "the upper end has been flaked and utilized as a steep scraper" (Garrod and Bate, 1937:41).

El-Wad is the only Natufian site which has yielded a human figurine, the carved human head recovered by Garrod (Fig. 57:1). It has, as Garrod herself puts it, "large eyes and a pointed cranium ... the most curious feature is the treatment of the eyebrows, which form a continuous bar in relief across the forehead and are carried round the sides of the head. The nose is broad and flat, the mouth barely indicated" (Garrod, 1957: 218). Our small rounded figurine (Fig. 57:2) is but a modest "imitation". Yet the eye and mouth seem to be indicated rather clearly, giving it an overall human impression. Even in profile (Fig. 57:1a, 2a) the way in which the two heads have been "portrayed" appears rather similar. Worth mentioning are a possible human head from Nahal Oren (Noy, 1991) carved on one end of a long bone, on which other end an animal head is depicted, a schematic human head in stone from Eynan (Perrot, 1966), and a "probably Natufian ... human head from Hatoula" (Ronen, 1995:484), made on a large flint nodule. The context of the Ain Sakhri figurine (Neuville, 1951), another allegedly Early Natufian human (couple?) representation, has recently been put into question (Boyd and Cook, 1993).

If the other figurines/phallic objects are regarded as human, one should also bear in mind the figurines/phallic objects from Kebara (see above). Since these two Early Natufian sites are both located in the Mount Carmel area, they may be taken to represent an Early Natufian regional tradition, similar to the "Mount Carmel [figurine] Art Tradition" that Noy (1991) has proposed for the Natufian culture as a whole. It has been suggested recently (Weinstein-Evron and Belfer-Cohen, 1993) that both the anthropomorphous figurines and the special attention paid to head decoration signify a particular interest apparent in the Early Natufian band of el-Wad. Together with the figurines/phallic objects from Kebara, they might have some wider implications.

Ochre Remains

"Ochre" is defined as "any of various natural earths containing ferric oxide, silica and alumina: used as yellow or red pigments" (Hanks et al., 1979). It has been reported from prehistoric sites perhaps as early as the Lower Palaeolithic (Wreschner, 1985). However, it is well documented in Middle Palaeolithic, Upper Palaeolithic and Epipalaeolithic sites. Ochre was probably uses for a wide range of activities, including funerary and artistic practices. In addition to these ceremonial and symbolic functions, ochre may have been used for more practical purposes, such as the dying of hides (Wreschner, 1983). In any case, it was a raw material widely used by prehistoric people.

Abundant ochre remains were found in the recently excavated Natufian layers of el-Wad (Weinstein-Evron and Ilani, 1994). Comparative analyses of these and geological iron-oxide outcrops in the Carmel area can provide valuable information regarding the Natufian mode of exploitation of natural resources.

The Archaeological Material

The archaeological ochre assemblage (Weinstein-Evron and Ilani, 1994) included 82 pieces of ochre (Fig. 64a and Table 9), ranging from 2 to 90mm in length (Fig. 65), and five ochre pebbles. In addition, 6 basalt pestles stained with ochre were found. The most common colours of the ochre fragments are shades of red, orange and brown. Four of the pestles are stained in red ochre (Fig. 64b), one in yellow and one was red stained at one end with traces of yellow at the other. The characterization of ochre fragment was achieved through detailed mineralogical and geochemical analyses Weinstein-Evron and Ilani, 1994).

Mineralogy and geochemistry

The mineralogical composition of the ochre samples was determined by X-Ray Diffraction (XRD) analyses. The analyses revealed that most of them (36.6%) are composed of haematite, a red iron oxide mineral, Fe_2O_3 (Table 9). Fifteen percent of the ochre fragments are composed of goethite, a yellow to brown iron oxide mineral, FeOOH, 8.5% have a jasperoid composition (yellow to brown iron-oxides enriched in silica) and 22% are brown to orange pieces of burnt clays. A third of the latter group are pieces of hamra, a red loam typical of the coastal plain of Israel. Some 18% of the ochre finds are quartzolites, which are silicified remains of molluscs and other faunal remains, one third of which occur in the form of pebbles. The ochre pebbles are partly covered with red and yellow iron-oxide crusts. Remains of ochre powder found on the surface and in holes of the groundstone implements are composed of haematite and goethite.

Table 9: Main composition of ochre fragments.

TYPE	N	%
Clay	18	22.0
Goethite	12	15.0
Haematite	30	36.6
Jasperoid	7	8.5
Quartzolite	15	18.0
Total	82	100.1

Larger fragments are generally of the quartzolite and haematite types (Fig. 65). Haematite-type fragments exhibit a slight bimodal size distribution. Goethite usually occurs as very small crumbs and jasperoid fragments are of medium size.

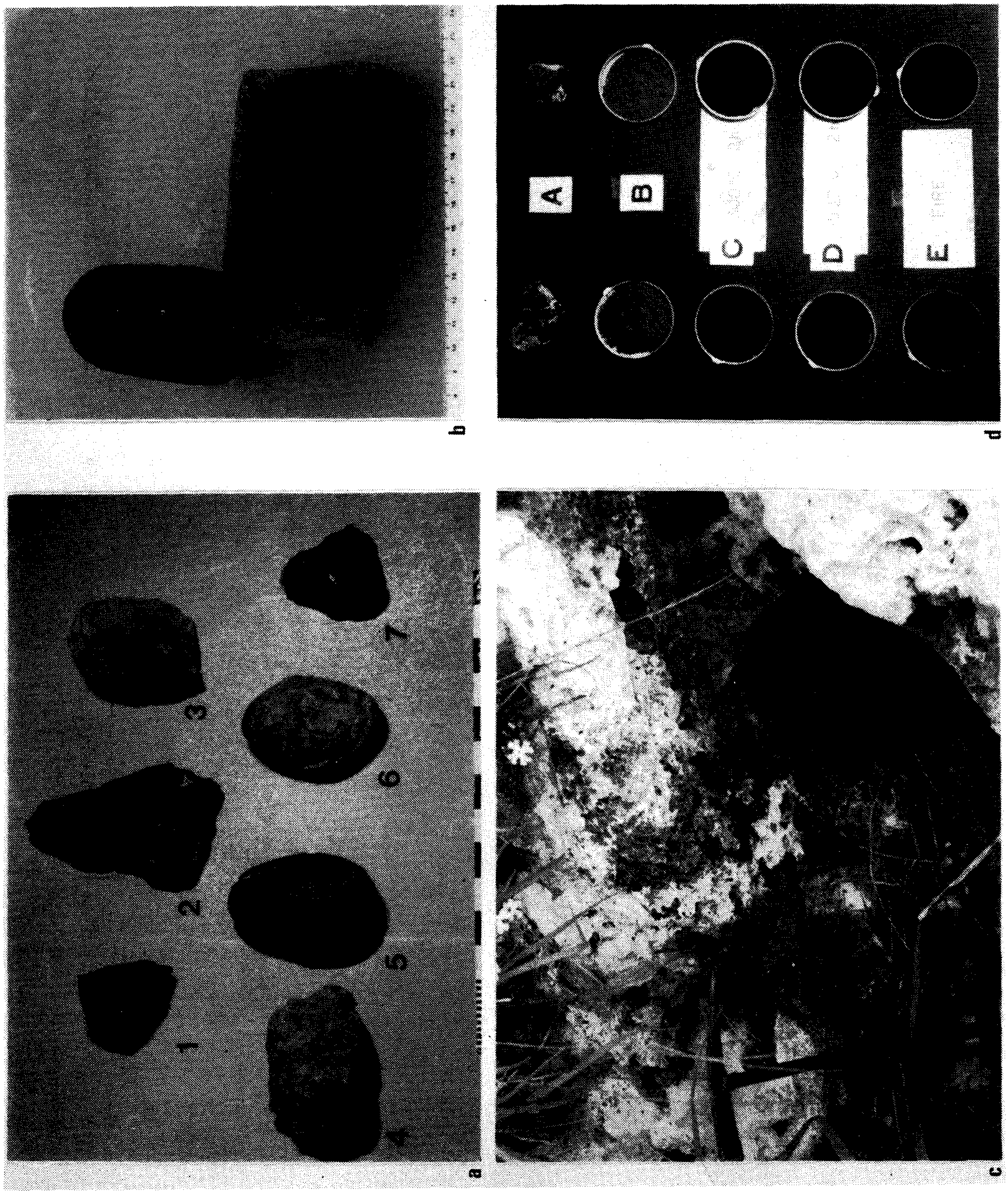


Fig. 64. El-Wad Cave and Mount Carmel iron-oxides. (a) Ochre fragments found in the Natufian layers of el-Wad: Haematite (2-3,7), goethite (4,6), jasperoid-type (1), quartzolite pebble (5); (b) red haematite staining on Natufian basalt pestles from el-Wad; (c) outcrop of iron-oxide veins, site 8: Haematite (red), goethite (yellow); (d) summary of heating and burning experiments: Goethite+Calcite (left), goethite+ haematite+calcite (right). The brighter red colour was obtained by heating goethite+ calcite powder, at 300^{0}C, for two hours.

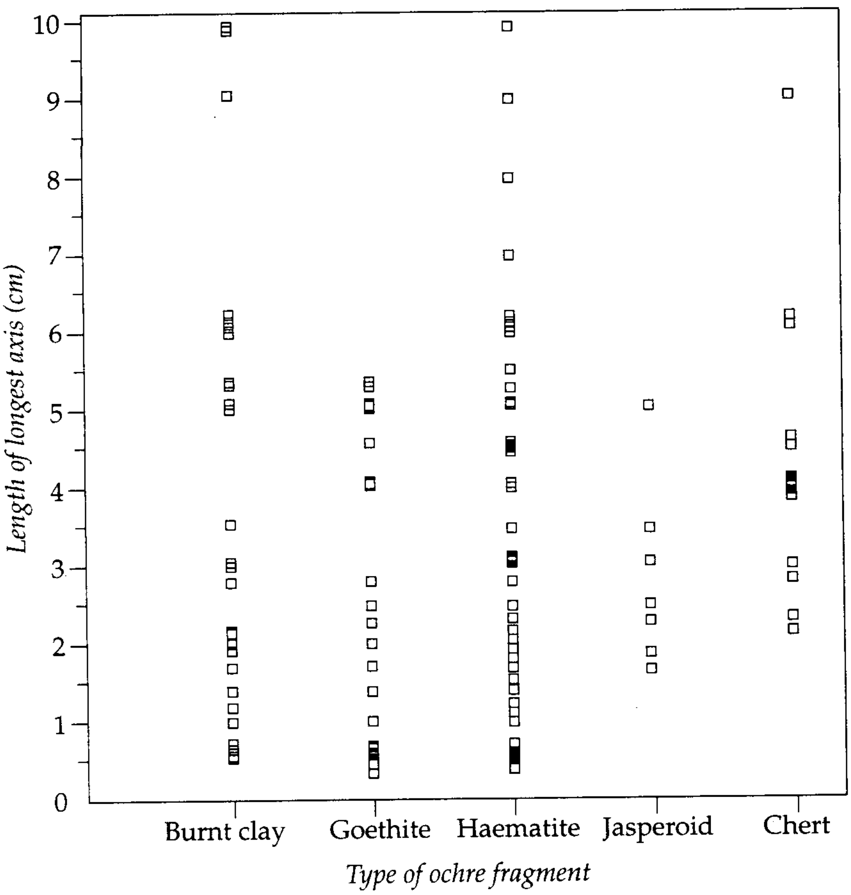


Fig. 65. Types of ochre fragments found in the el-Wad cave.

Red ochre found in a cavity on the surface of one of the basalt pestles was analysed by Scanning Electron Microscopy (SEM), equipped with Energy Dispersive Spectrometry (EDS). The analysis showed that the ground material (particles between 2 to 20 microns in size) was pure haematite with only low percentages of silica (Fig. 66).

The chemical analyses were undertaken by an Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES) technique. Results of the chemical analysis of ten ochre samples from el-Wad Cave are listed in Table 10a. Most of the analysed jasperoid-type fragments from the Natufian layers of el-Wad have high SiO_2 contents (above 36.6%) and relatively low contents of Fe_2O_3 (below 28.0%). The trace elements vary irrespective of the iron and silica contents. On the other hand, the haematite-type fragments found in the cave show high contents of Fe_2O_3 (up to 89.2%) and low contents of SiO_2 (< 7.5%). The content of As, Mo, Ni, Sb and Zn in the haematite-type fragments is high relative to that of the jasperoid type.

In order to identify the provenance of the materials used by the Natufian inhabitants of the el-Wad Cave, a geological survey of ochre outcrops in the Mount Carmel area was carried out, together with mineralogical and geochemical comparisons between geological and archaeological samples.

Table 10: Chemical compositon of iron oxides.

(a) Iron oxide fragments from the Natufian layers of el-Wad Cave, Mount Carmel

Sample No.	composition	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$CaCO_3$ (%)	$MgCO_3$ (%)	TiO_2 (%)	P_2O_5 (%)	SO_3 (%)	Ag (ppm)	As (ppm)	Ba (ppm)	Be (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)
SH36	Jasperoid	44.9	14.3	16.0	2.2	1.0	2.33	1.5	n.d.	2	50	304	1.4	14	18	232
SH37	Jasperoid	65.7	n.d.	19.4	14.0	0.4	0.01	1.6	0.1	2	80	15	0.1	8	2	121
SH41	Jasperoid	36.6	22.0	1.8	4.5	1.7	0.02	2.2	0.1	11	n.d.	144	3.6	29	2	82
SH49	Jasperoid	71.8	n.d.	17.3	5.4	0.4	n.d.	0.6	n.d.	1	55	10	0.4	9	4	268
SH56	Jasperoid	62.0	0.2	28.0	1.6	0.4	0.02	1.1	n.d.	12	50	21	0.5	7	88	43
SH59	Jasperoid	43.0	4.9	2.9	39.3	2.5	0.76	0.2	0.2	3	25	362	0.8	37	11	145
IL45	Jasperoid	36.9	0.4	58.9	0.6	1.3	0.05	0.2	n.d.	n.d.	85	90	1.1	3	14	57
IL2	Haematite	3.7	0.5	23.5	70.3	1.0	2.82	0.5	0.6	n.d.	100	70	0.4	12	7	108
IL39	Haematite	7.5	0.4	79.4	2.2	0.8	0.04	0.9	n.d.	n.d.	280	92	0.7	6	28	30
IL57	Haematite	4.9	0.3	89.2	1.1	0.4	0.04	0.1	n.d.	n.d.	60	120	1.2	28	13	16

Sample No.	composition	Cu (ppm)	Eu (ppm)	La (ppm)	Mn (ppm)	Mo (ppm)	Ni (ppm)	Pb (ppm)	Sb (ppm)	Sr (ppm)	V (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)	Total (%)
SH36	Jasperoid	127	0.8	9	175	5	210	33	0.4	88	350	7	2	250	82.3
SH37	Jasperoid	5	0.2	3	272	8	37	1	0.5	17	298	n.d.	1	95	101.2
SH41	Jasperoid	85	0.3	4	7	8	50	77	n.d.	66	33	1	1	111	68.9
SH49	Jasperoid	7	0.2	4	105	18	81	1	1.0	11	394	1	1	79	95.6
SH56	Jasperoid	3	0.5	6	45	121	77	2	1.5	13	740	1	3	231	93.4
SH59	Jasperoid	18	0.3	20	379	2	33	35	0.8	249	58	16	2	40	93.9
IL45	Jasperoid	22	2.5	22	550	8	120	14	1.5	6	501	14	2	265	98.5
IL2	Haematite	41	0.8	15	322	36	23	54	3.0	51	460	1	1	335	103.0
IL39	Haematite	27	2.0	19	220	44	270	21	3.0	18	1144	1	2	479	91.4
IL57	Haematite	n.d.	0.4	10	10	54	218	n.d.	3.5	12	1328	n.d.	3	325	96.2

(b) Iron oxide veins from Mount Carmel, Israel

Sample No.	Composition site no.*	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$CaCO_3$ (%)	$MgCO_3$ (%)	TiO_2 (%)	P_2O_5 (%)	SO_3 (%)	Ag (ppm)	As (ppm)	Ba (ppm)	Be (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)
43361	Jasperoid 3	35.8	0.1	13.0	53.0	0.4	0.03	n.d.	0.2	2	25	n.d.	0.4	3	n.d.	100
43371	Jasperoid 3	54.5	n.d.	7.2	41.5	0.2	0.01	n.d.	0.1	2	18	n.d.	0.1	1	n.d.	96
43781	Jasperoid 2	26.5	0.2	54.5	17.7	0.8	0.02	0.1	0.2	n.d.	50	2	0.5	4	25	72
48451	Jasperoid 7	68.0	0.3	27.3	3.7	0.4	0.04	0.2	n.d.	n.d.	65	11	0.9	2	16	228
45101	Haematite 5	5.0	0.4	79.2	5.5	1.0	0.04	0.3	0.2	1	400	3	1.1	26	72	62
46041	Goethite 7	1.4	0.4	14.4	67.0	22.0	0.02	0.3	0.1	n.d.	90	14	0.4	6	7	34
42511	Goethite 6	1.4	0.2	75.0	13.6	0.4	0.04	0.1	0.2	1	75	55	0.3	14	19	49
42521	Goethite 6	3.2	0.1	53.0	34.8	0.4	0.02	0.1	0.1	n.d.	80	20	0.4	9	8	15
42551	Goethite 4	2.6	0.4	27.5	65.0	0.6	0.03	0.2	0.1	n.d.	35	120	2.4	4	58	15
43341	Goethite 3	0.9	n.d.	10.2	88.6	0.4	0.01	n.d.	0.4	5	25	4	0.4	n.d	n.d.	15

Sample No.	Composition site no.*	Cu (ppm)	Eu (ppm)	La (ppm)	Mn (ppm)	Mo (ppm)	Ni (ppm)	Pb (ppm)	Sb (ppm)	Sr (ppm)	V (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)	Total (%)
43361	Jasperoid 3	n.d.	0.2	n.d.	120	26	75	n.d.	0.6	52	136	1	1	39	102.5
43371	Jasperoid 3	n.d.	0.3	n.d.	101	18	69	n.d.	0.4	58	129	0.1	1	14	103.5
43781	Jasperoid 2	22	1.6	12	99	71	124	n.d.	1.4	8	231	n.d.	2	89	100.0
48451	Jasperoid 7	n.d.	0.9	4	152	17	114	9	0.3	12	281	2	1	118	100.0
45101	Haematite 5	130	2.6	21	125	91	179	15	3.1	n.d.	723	n.d.	4	133	91.7
46041	Goethite 7	20	0.3	2	580	19	70	17	9.9	101	226	2	1	70	105.6
42511	Goethite 6	n.d.	2.5	22	210	36	50	n.d.	2.0	7	227	2	1	63	90.9
42521	Goethite 6	n.d.	1.8	13	220	57	70	n.d.	2.0	36	347	6	2	174	91.7
42551	Goethite 4	n.d.	1.3	12	940	6	140	n.d.	0.7	69	84	n.d	2	118	96.4
43341	Goethite 3	n.d.	0.3	n.d.	77	26	78	n.d.	0.6	96	121	n.d.	1	19	100.5

n.d. – not detected.

* see Fig. 68.

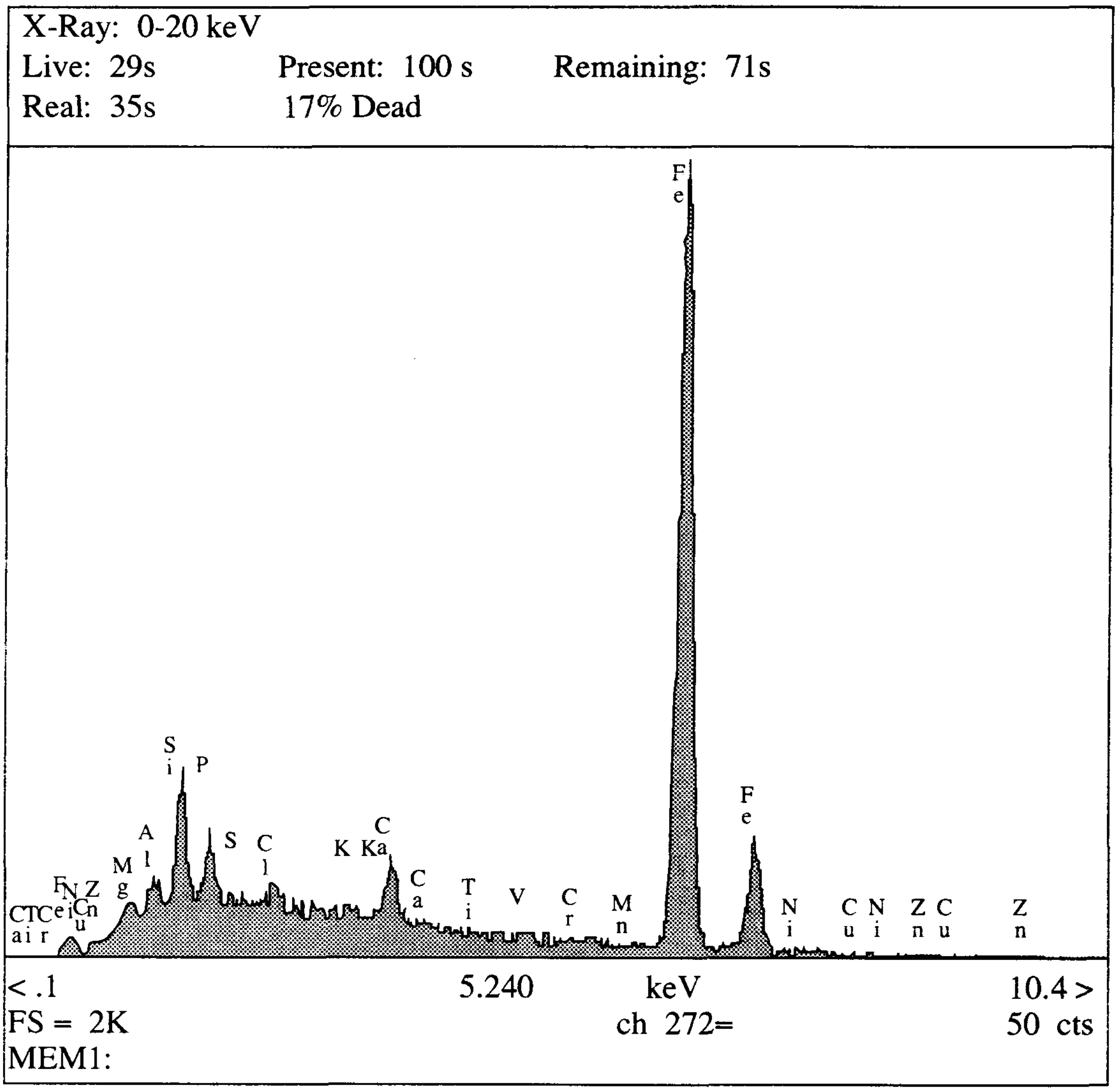


Fig. 66. SEM analysis of red ochre found on a basalt pestle at el-Wad.

Outcrops of iron oxide (ochre) veins

Eight sites of epigenetic iron-oxide mineralizations were found in the Mount Carmel area (Fig. 67), all within a range of 0.3 to 10km from el-Wad (Ilani et al., 1985; Kafri, 1986). Site No 8, the closest to the cave, was spotted only recently, and includes outcrops which are situated on the cliff overlying the cave, as well as, on the northern bank of the wadi, facing the cave.

The Mount Carmel iron-oxide mineralizations occur in Cenomanian-Turonian limestones and dolomites belonging to the Judea Group, in contact with or in close proximity to volcanic rocks (Fig. 67) interbedded with the carbonates. The volcanic rocks of Mount Carmel are mostly pyroclastics of basic composition, probably deriving from an alkaline volatile-rich magma. These pyroclastic bodies are roughly lenticular, up to 6km in length and 80m in thickness (Sass, 1980).

The iron mineralizations usually fill joints and fractures within the carbonates (Fig. 64c), along faults which put the volcanics in contact with the carbonates. These are, in fact, fissure-veins that follow the patterns of the joints along faults, mostly in a N-S direction. The iron oxides occur in veins, lenses and concretions, up to 20m from the volcanics. These veins and lenses, often discontinuous, measure between only 1 or 2m to tens of metres in length and from barely a few millimetres to 20cm in thickness. The iron oxides appear also as irregular bodies, up to some tens of centimetres in length, usually filling cavities in the carbonates which are overlain by volcanics (Rakefet Valley, site 7). In some places the iron-oxide features are associated with chert and quartzolite, emplaced in the same joints and fractures. In most cases the silica deposition preceded that of the iron oxides. According to the field relationships and the petrography, the silica and the iron emplacement is epigenetic, due to fluids flowing through the volcanics and penetrating the surrounding carbonates along faults and joints.

Pebbles of iron oxides are occasionally found in the alluvium or wadi terraces of Mount Carmel. Five such pebbles, having retained their original form and made of silicified ochre, were found in the cave (Fig. 64a).

Mineralogy and geochemistry

Samples of ochre from the Mount Carmel outcrops have been subjected to similar mineralogical (XRD) and geochemical (ICP-AES) analyses. Three main mineralogical types are found in the iron-oxide mineralizations: 1) goethite and calcite or dolomite — yellowish to brown; 2) haematite, goethite and calcite or dolomite — reddish to dark brown and yellowish; 3) silica and iron in varying proportions (SiO_2:Fe_2O_3=0.5-7.0), in association with calcite — reddish to orange and brown. These are of a jasperoid composition. Significantly, in the iron-oxide sites of the Mount Carmel area most of the surficial mineralization is composed of goethite while haematite, suitable for the extraction of red pigments, is relatively rare.

ICP geochemical analysis by an Induced Coupled Plasma (ICP) technique was conducted on ten geological ochre samples from Mount Carmel. Results of the chemical analysis are listed in Table 10b. The rock samples from the mineralization

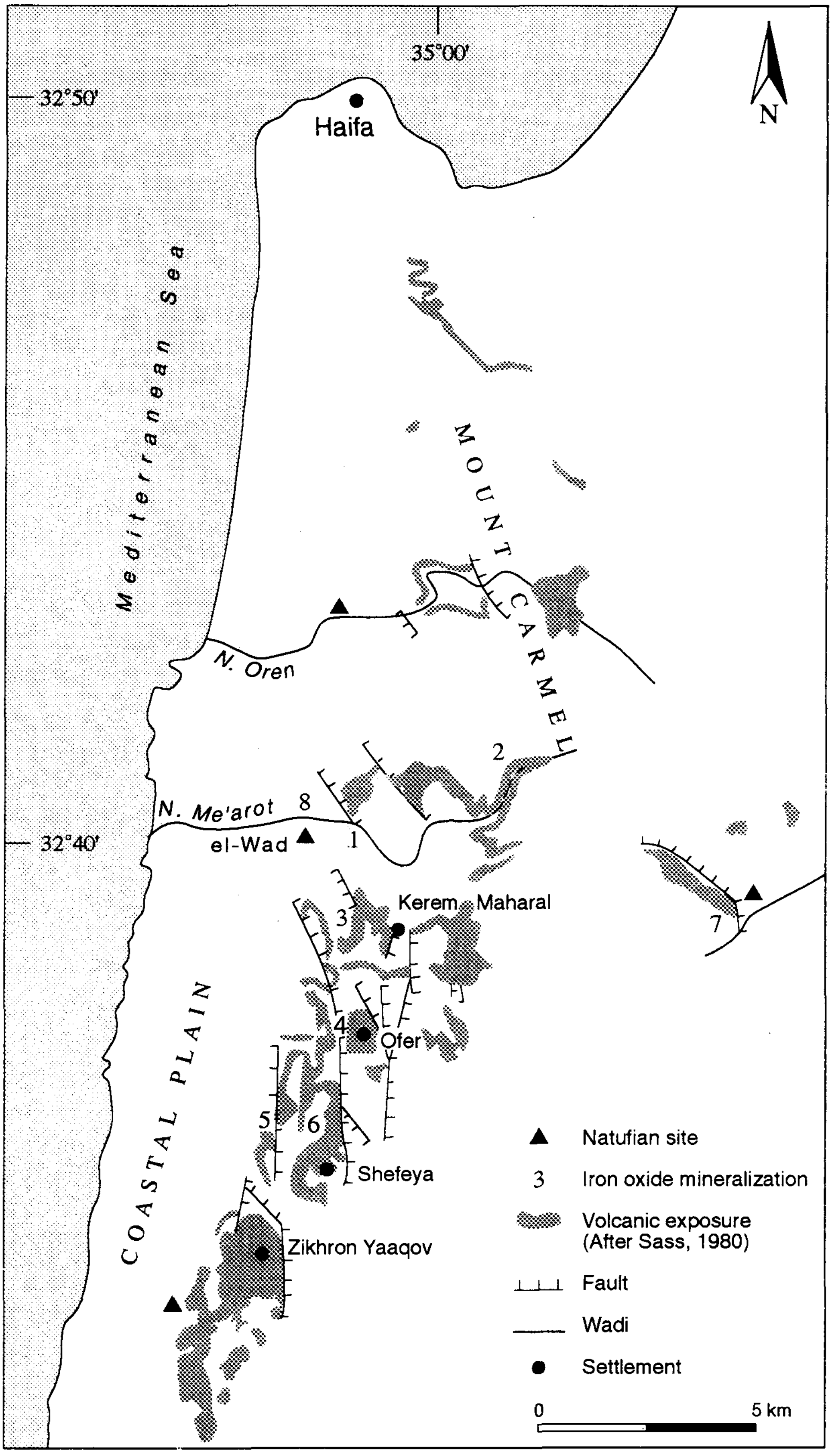


Fig. 67. Mount Carmel: location map of the volcanic outcrops and iron-oxide mineralization sites. 1. Nahal Me'arot (lower); 2. Nahal Me'arot (upper); 3. Kerem Maharal; 4. Ofer; 5. Tavasim; 6. Shefeya; 7. Rakefet Valley; 8. Nahal Me'arot (near the caves).

sites exhibit varying contents of SiO_2, Fe_2O_3 and CaO and, consequently, various contents of trace elements.

Generally, the iron mineralization sites in the Mount Carmel area and the ochre fragments from the cave are quite close from a mineralogical point of view and have a similar elemental range of contents. Fig. 68 demonstrates the close correlation of V, Zn and As in the samples from both the iron oxide veins in the mineralization sites and the ochre fragments found in the cave.

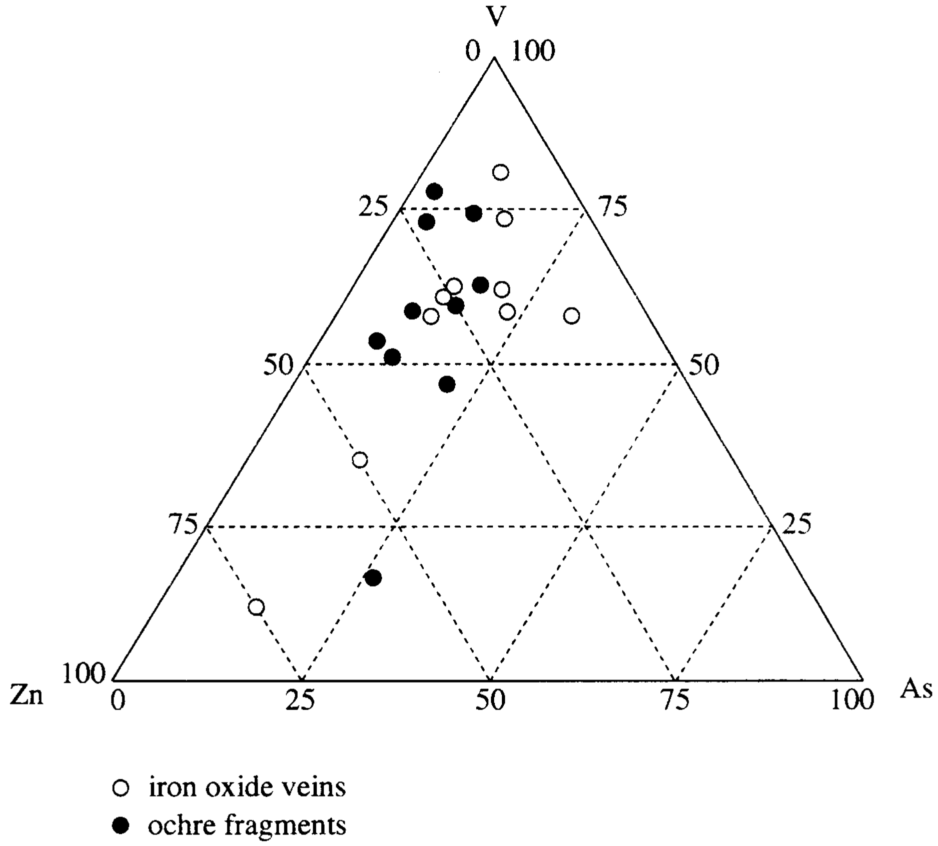


Fig. 68. Ternary diagram showing the vanadium (V), zinc (Zn) and arsenic (As) composition of the iron oxide veins and ochre fragments. x=As, y=100-V, Zn+V+As=100.

Extraction of pigments from Mount Carmel iron oxides

As we saw, most of the ochre fragments found in el-Wad are of the haematite type. However, other types are also abundant, especially goethite and jasperoid. The latter type is relatively low in iron-oxides and high in silica content. This renders it too hard to grind and too poor in iron oxides to enable the extraction of proper red pigments. Thus, the haematite and goethite found on the pestles were most probably extracted from the haematite and goethite types. Again, the red ochre powder found in a cavity on the surface of one of the basalt pestles was identified as almost pure haematite (Fig. 66).

The haematite content in the exposed iron-oxide veins of Mount Carmel is very low, goethite being by far more common. The Natufians could have produced their red colours from haematites gleaned from the veins and alluvium and then separated from the goethite and quartzolite. However, the possibility that they obtained red haematite through the heating of the more common goethite deserves further consideration. The transformation of goethite to haematite takes place at 280^0 to 400^0C (Schwertmann and Taylor, 1977).

A detailed study for the reconstruction of the possible techniques prehistoric people may have used to produce red pigments was carried out by Wreschner (1983). His experiments showed that the heating of ochre to 260-280^0C caused depletion of the hydroxides, forming red iron oxides. Most of his studies were carried out on natural clays enriched in iron oxides. The heating of such clays, whether intentional or because of natural brush-fire, produced red colours. Twenty-two percent of the ochre pieces at el-Wad are probably burnt clays. Most of these are small crumbs adhering to other burnt materials or comprising part of a breccia. It seems that these are the result of some kind of burning. In order to establish whether the goethites could have served as possible raw material for the production of red pigments (haematite), a series of heating experiments was conducted (Weinstein-Evron and Ilani, 1994) on various goethites from the Mount Carmel iron-oxide mineralizations (Fig. 64d).

Experiment No 1

A rock fragment composed of goethite and calcite from site No. 6 (Shefeya) was ground to 200 mesh (Fig. 64d, left). The colour was yellow [10.0 YR] 6/8 (Munsell Book of Colors, 1929-1942). The powder, as well as the remaining rock fragment, were heated in a closed oven at a constant temperature of 300^0C for two hours. The colour of both the yellow goethite powder and rock-fragment changed to red [10.0 R] 4/6. A XRD analysis showed that most of the goethite had been transformed to haematite.

Experiment No 2

Another rock fragment composed of haematite, goethite and calcite from the same site was ground to 200 mesh (Fig. 64d right). The colour was dark yellow to brown [10. YR] 6/6. The powder and part of the rock-fragment were heated in a closed oven at a constant temperature of 300^0C for two hours. The colour obtained was brown-violet [10.R] 3/6, less reddish than the colour obtained from goethite under similar conditions (experiment No. 1). Here, also, most of the goethite was transformed by heating into haematite.

Experiment No 3

Fresh powders, as used in experiment Nos. 1 and 2 were heated in a closed oven at a constant temperature of 500^{0}C for two hours. The colours obtained were less reddish than in experiment No. 2. The goethite powder (No. 1) obtained a reddish to brown colour [10.R] 3/6. The haematite and goethite powder (No. 2) became a darker brown-violet [10.R] 3/4. XRD analysis indicated a complete transformation of all the goethite to haematite.

Experiment No 4

Two 5X10X10cm rock fragments from site 6, one composed of goethite and calcite and the other of haematite, goethite and calcite, were burnt in an open fire of construction pine timber for two and a half hours. The surface of both fragments was burnt by the fire resulting in a black coating. This coating, apparently consisting of organic material and some magnetite, could not be removed by water or by scratching along the surface with a knife.

The burnt pieces were subsequently ground to 200 mesh. The first, goethite and calcite ochre, obtained a brownish colour [5.0 YR] 4/6, the second, haematite, goethite and calcite, a brown-red colour [10.R] 3/4. XRD analysis of the second sample showed it to consist mainly of haematite with some black magnetite produced through the heating. The mixture of red and black minerals produced a brownish colour of the burnt material.

In summary, the mineralogical and chemical compositions of the iron-oxide materials found in el-Wad and that of the iron-oxide mineralizations of Mount Carmel are similar, suggesting that local sources provided the ochre used by the Natufians of el-Wad. Ochre was probably collected from outcrops and alluvium within a distance of c. 10km from the cave, but lack of individual geochemical characteristics of the exposed iron mineralization veins prevents us from determining which of the eight sites were used by the inhabitants of el-Wad, and to what extent.

The el-Wad pestles were used for the grinding of both yellow goethite and red haematite. Goethite is the common iron oxide in the Mount Carmel mineralizations and thus readily available. Pure haematite, such as found on the pestles, is rare in outcrops. In the absence of geochemical markers it could not be established whether the haematite used by the cave dwellers was collected or manufactured by heating of goethite.

The Natufians could have produced red pigments directly from the rocks by grinding them first and improving their quality by removing the bright particles of carbonate, or the hard particles of jasperoid composition. However, manufacture by goethite heating seems easier and more efficient. The heating of goethite at 300^{0}C for two hours is enough to transform most of the yellow goethite to reddish hematite (Wreschner, 1983; Weinstein-Evron and Ilani, 1994) while over heating or direct contact with fire results in dark colours.

To avoid overheating prehistoric people could have heated the geothite either at the fringes of the hearths, where temperatures are lower, or by placing the raw material on stones lain on the hot ashes. The latter would have prevented the blackening that happens when heating the material over open fire. On the other hand, one could get rid of such a coating by burning relatively large pieces of goethite and subsequently flaking away their black surface.

The many burnt flints and bones in the Natufian layers of el-Wad indicate that fire was indeed used in the cave at the time. However, no direct evidence was found for the intentional burning of ochre. The assumption that prehistoric people may have produced red haematite by heating yellow goethite cannot be ascertained as long as no hearths containing both haematite and goethite fragments have been unearthed.

That so many fragments of quartzolite and jasperoid-type were found in the cave (27% of the ochre fragments) suggests that they are the discarded waste of raw material that was too hard to grind (more than 36% silica), but it may also be that these red stones were collected for their aesthetic value rather than for the extraction of pigments.

Organic material

A sample of the faunal assemblage from the recent excavations at el-Wad was studied by R. Rabinovitch and is given in Appendix III. Botanical remains found at the site are briefly discussed in the following pages. Both will then be placed in the general context of the Natufian use of the environment and site discussed below in Chapters 6 and 7.

Botanical remains

The relatively constant, damp conditions in the rear part of the cave contributed to the preservation of botanical material, including pollen and charcoal remains.

Pollen

Fifteen Early Natufian pollen samples were collected during the recent excavations in Chamber III of the cave, some 30-35m from the entrance. The samples, c. 50gr each, were treated with HCl to remove the carbonates. A specific-gravity separation was then carried out by a $ZnCl_2$ solution with a density of 1.9, together with sieving. After a short acetolysis, the organic residue was stained with safranin and mounted in silicone.

The NE section of the excavation yielded three of the richest samples (see Table 11). The pollen grains are well preserved. The AP includes typical Mediterranean types, mainly *Quercus calliprinos Pistacia* sp. and *Pinus halepensis*. In addition, many clumps of *Olea europaea* and especially *Tamarix* sp. pollen were found (not included in the pollen total of Table 11). Insect-pollinated plants (e.g., *Ceratonia siliqua, Crataegus* sp., *Myrtus* sp., *Cistus* sp. *Scabiosa* sp., Fabaceae (=Papilionaceae), Lamiaceae (=Labiatae), Malvaceae) are well represented within the spectra.

Table 11: Natufian pollen spectra from el-Wad Cave (after Weinstein-Evron, 1994).

Pollen Type	**Sample I40c/125**	**Sample I42b/129**	**Sample I40a/143**
Quercus	10.5	12.8	7.1
Pinus	10.5	12.6	5.5
Olea europaea	-	0.8	2.2
Pistacia	3.5	1.4	4.4
Acer	1.0	-	0.3
Arbutus	0.6	-	1.4
Crataegus	12.1	1.2	10.4
Rhamnus	-	0.6	-
Ceratonia siliqua	7.3	0.4	8.2
Styrax	0.6	-	-
Myrtus	13.7	3.3	8.2
Total AP	**59.8**	**33.1**	**47.7**
Gramineae	3.5	13.0	4.6
Compositae	4.8	3.1	8.7
Centaurea	-	-	0.5
Chenopodiaceae	1.0	0.2	1.1
Umbelliferae	2.9	5.1	8.5
Plantago	0.3	0.4	-
Ephedra	-	0.4	0.3
Malvaceae	-	4.3	-
Polygonaceae	3.5	2.5	4.1
Cruciferae	-	1.4	0.3
Dipsacaceae	0.6	14.0	4.9
Liliaceae	1.0	-	-
Asphodelus microcarpus	-	2.9	-
Papilionaceae	8.9	5.1	7.9
Labiatae	7.1	6.0	5.5
Cucurbitaceae	-	1.0	-
Sarcopoterium spinosum	0.3	1.6	0.3
Caryophyllaceae	-	-	0.3
Rubiaceae	-	-	0.5
Euphorbiaceae	2.6	2.3	1.9
Convolvulaceae	1.0	0.6	0.3
Cistaceae	0.3	2.7	1.4
Primulaceae	1.0	-	-
Ranunculaceae	1.3	-	0.8
Rutaceae	0.3	-	-
Capparis	-	-	0.5
Total Counted	**314**	**486**	**366**
Clusters (No)			
Tamarix	1	-	76
Olea europaea	-	-	9
Hydrophilous (No)			
Sparganium	-	-	14
Cyperaceae	-	1	1

Charcoals

Thirty two pieces of charcoal, 5-10mm long, were recovered in the recent excavations in el-Wad (Lev-Yadun and Weinstein-Evron, 1994). From these, cross, tangential and radial longitudinal planes were prepared, mounted on metal discs and coated with gold. The samples were studied under a Jeol JSM 840 A SEM at X20–X6,000 magnifications. The plant material was compared with wood samples from recent trees and shrubs under both a light microscope and a SEM and with published monographs on xylem anatomy (Greguss, 1955; Fahn et al., 1986; Schweingruber, 1990). A botanical survey was conducted in 1990 to find out what woody species grow today in the vicinity of the site. Wood samples for comparison were taken from various trees and shrubs in the Mount Carmel region and the nearby coastal plain.

The anatomical examination reveals that the charcoals from the Natufian layers include six woody species (Table 12; Fig. 69): *Tamarix* sp., *Quercus calliprinos, Quercus ithaburensis, Quercus* sp., *Salix* sp., probably *acmophylla, Cupressus sempervirens* and *Myrtus communis.* Two pieces of charcoal could not be identified because of their poor preservation, and for two pieces of oak (*Quercus*) charcoal and all seventeen pieces of tamarisk (*Tamarix*) charcoal, only the genus could be determined. The anatomical criteria used for the identification of the plant material are discussed in detail in Lev-Yadun and Weinstein-Evron (1994).

Table 12: Natufian wood remains from el-Wad.

TAXON	N
Cupressus sempervirens	1
Myrtus communis	1
Quercus calliprinos	10
Quercus ithaburensis	3
Quercus sp.	2
Salix (probably *acmophylla*)	4
Tamarix sp.	10
Dicotyledon	1
Total	32

The composition of the pollen and charcoal pollen indicates a typical Mediterranean environment. This holds true for both the arboreal and the non-arboreal types. A few of the arboreal species (*Quercus calliprinos, Tamarix* sp. and *Myrtus communis*) are present in both sets of data. Others are represented either in the wood sample (*Cupressus sempervirens, Quercus ithaburensis, Salix* sp.) or in the pollen spectra (*Pinus halepensis, Olea europaea, Pistacia* sp., *Acer* sp., *Arbutus* sp., *Crataegus* sp., *Rhamnus* sp., *Ceratonia siliqua, Styrax officinalis*). The latter are, by nature, wider and include more taxa.

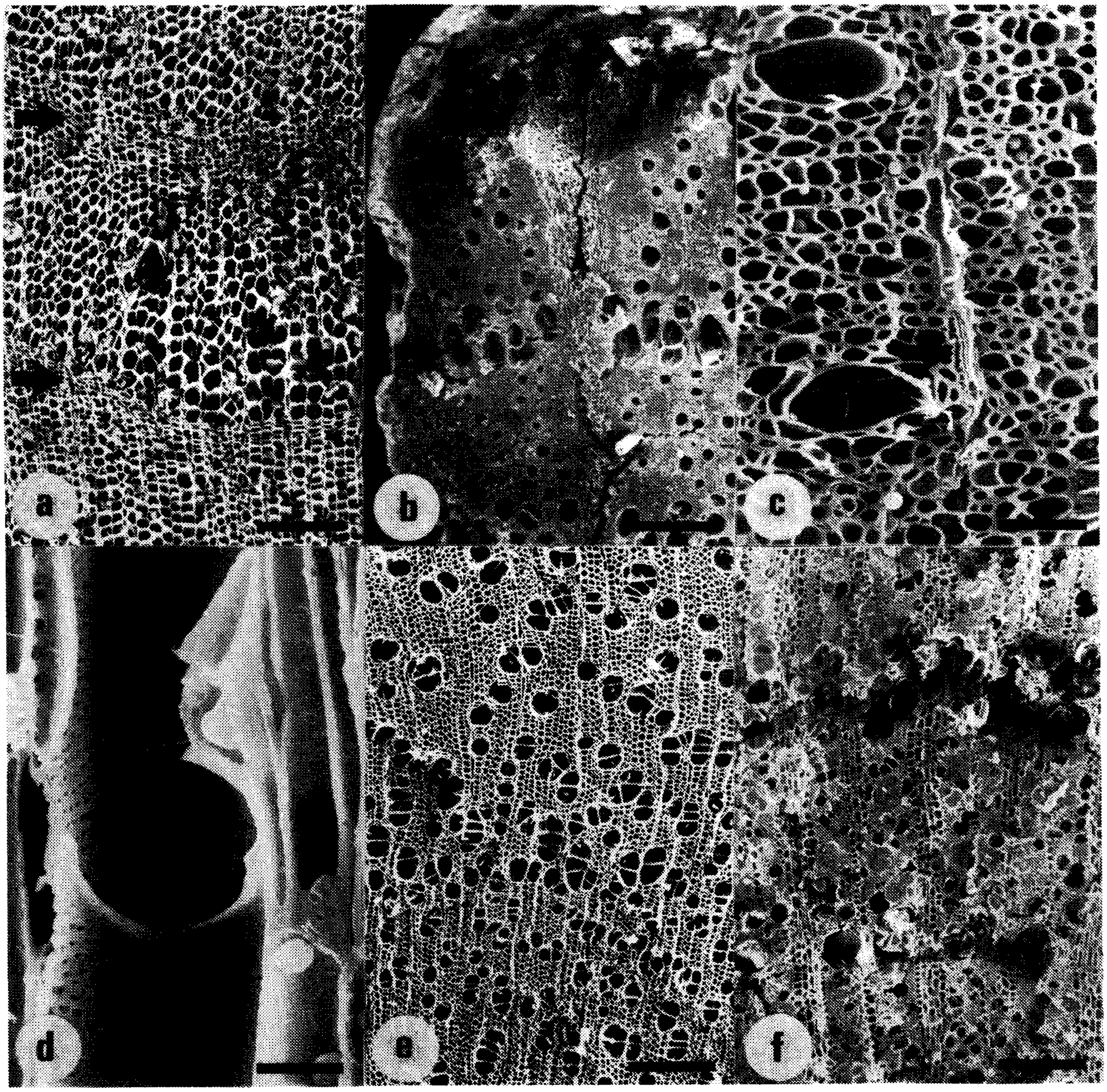


Fig. 69. Charcoal pieces from el-Wad cave as viewed in the Scanning Electron Microscope: (a) a cross section in the secondary xylem of *Cupressus sempervirens*. Two growth ring borders (arrows) are seen (bar = 100 μm); (b) a cross section in the secondary xylem of *Quercus ithaburensis*. Wide early wood vessels (arrow), dendritic pattern of late wood vessels, and a huge ray are seen (bar = 325 μm); (c) a cross section in the secondary xylem of *Myrtus communis*. Two vessels and a ray (arrow) are seen (bar = 26 μm); (d) a radial longitudinal section in the secondary xylem of *Myrtus communis*. The end wall of the vessel has a simple perforation (bar = 10 μm); (e) a cross section in the secondary xylem of *Salix* sp. showing diffuse porosity (bar = 100 μm); (f) a cross section in the secondary xylem of *Tamarix* sp. showing multiseriate rays and vessels (bar = 100 μm).

Based on the contemporary distribution of the various tree species, the remnants of woody species indicate probably that they all grew in the vicinity of the site (Lev-Yadun and Weinstein-Evron, 1994). However, their relative abundance in the site may reflect human preference.

Similarly, the location of the Natufian pollen samples in the cave — far beyond the c. 10m which is the estimated limit of pollen normally coming in through the cave entrance (Van Campo and Leroi-Gourhan, 1956; but see Coles and Gilbertson, 1994) — with the composition of the pollen spectra suggests that pollen grains were transported into the rear part of the cave mainly by its inhabitants (see also Burney and Pigott-Burney, 1993). Much of the pollen represents edible plants (e.g., *Ceratonia siliqua*, *Crataegus* sp., Malvaceae; Dafni, 1984). Significantly, pollen grains were found on leaves and fruits of various trees long after the flowering season (Weinstein-Evron et al., 1996). Lamiaceae and *Myrtus communis* may have been collected for their therapeutic, aromatic or culinary values (Zohary, 1973). Dipsacaceae and Malvaceae, characteristic of disturbed areas or ruderal plant associations, indicate possible human impact on the vegetation in the immediate environs of the cave (e.g., Dimbleby, 1985).

Even though olive pollen, for example, were found to adhere to olive leaves and fruits for long periods of time (Weinstein-Evron et al., 1996), the clusters of olive and tamarisk pollen we found most likely represent whole anthers, indicating that flowering branches were brought to the site. With their high oil content and easy availability, the young olive branches may have served as kindling material (Salman Abu Rukun, personal communication, 1992). Tamarisk branches, represented extensively among the recovered charcoals, may have been used as fuel for the fires or for other domestic purposes, such as bedding.

The el-Wad pollen samples, which are dominated by ruderal, insect-pollinated and many clusters of pollen, indicate mainly human habitation and activity. The human impact on samples collected from the rear part of the cave is but one out of a series of factors which may bias pollen assemblages from archaeological sites. A few characteristic ways in which bias is introduced have been discussed recently through the presentation of Israeli case studies (Weinstein-Evron, 1994 and references therein).

Another possible biasing factor, which has not been considered so far with reference to el-Wad, are bats. These insectivorous, cave-dwelling animals may be feeding on insects that visit entomophilous flowers (Dimbleby, 1985). Their possible contribution to the pollen spectra in the cave may be implied by the high ratios of insect-pollinated pollen.

El-Wad opens to the NW and climatic conditions in the cave are relatively cool and humid, making it especially fit for bats to dwell there (Shalmon, 1992). Hundreds of bats were still reported in surveys conducted in the 1960's (Harrison, 1964), though in a recent survey of the bat population in the cave (Shalmon, 1992) only six individuals of insectivorous bats, most probably *Myotis capaccinii*, were observed. It may well be that the bat populations in Israeli caves have been sharply reduced in recent year as a result of the intensive use of insecticides in agriculture; fruit bats, for example, which occupy the same caves as the insectivorous *Myotis*, were directly targeted for extermination when they became an agricultural pest.

Before making any attempt at regional palaeoenvironmental reconstructions, the over-representation of the local vegetation in the pollen samples needs to be given some attention. In other words, that not much change has been observed throughout the sequence — which after all may represent some 3000 years (as indicated by the range of the calibrated ^{14}C dates; see above Chapter 5, "Dating") — may be because over-representation of the local, insect pollinated plants is masking the more regional picture. Still, the types found in the samples represent plants which can be found in the area today, and therefore imply a generally Mediterranean vegetation and climate.

The same picture emerges from studies of macrobotanical remains in five other Natufian sites (Fig. 2): Abu Hureyra (Hillman, 1975; Hillman et al., 1989), Mureybet (van Zeist and Bakker-Heeres, 1986), Hayonim Cave (Hopf and O. Bar-Yosef, 1987), Azraq Basin (Garrard et al., 1988) and Wadi Hammeh 27 (Edwards et al., 1988; Edwards, 1989). The plant remains found in Natufian sites are seeds, nuts, and fruits of Mediterranean trees (Hillman, 1975; Hillman et al., 1989; van Zeist and Bakker-Heeres, 1986; Hopf and O. Bar-Yosef, 1987; Garrard et al., 1988; Edwards, 1989). They include wild almond (*Amygdalus communis* L.) nuts (Hopf and O. Bar-Yosef, 1987) and seeds of *Pistacia atlantica* Desf., *P. khinjuk* Stocks, *Celtis tournefortii* Lam., *Prunus* sp., *Mespilus germanica* L. and *Pyrus* sp. (Hillman et al., 1989). The latter also mention wood charcoal from small twigs of *Salix* sp., *Populus* sp., *Acer* sp. and *Tamarix* sp. but give no further information. Among the Israeli Natufian sites, el-Wad wood remains are the first to have been discussed (Lev-Yadun and Weinstein-Evron, 1994).

The occurrence of Mediterranean vegetation during the Early Natufian period, which was probably more humid than today, is supported by other palynological studies (e.g., Tsukada, in Bottema and van Zeist, 1981; Darmon, 1987; Leroi-Gourhan and Darmon, 1987, 1991; Baruch and Bottema, 1991; see below, Chapter 6, "Natufian Use of the Environment") In fact, as several palynological studies of the Jordan Valley have demonstrated, a Mediterranean vegetation showing fluctuations in the abundance of certain dominant species seems to have persisted in the southern Levant throughout most of the Pleistocene (see a recent review in Horowitz, 1992; Weinstein-Evron, 1990).

The same is indicated by palynological and macrobotanical studies of Levantine prehistoric sites. These assemblages range from the Lower Palaeolithic (Horowitz, 1979; Goren-Inbar et al., 1992) through the Middle and Upper Palaeolithic (Horowitz, 1979; Baruch et al., 1992; Lev, 1992; Bancroft, 1937), up to the Epipalaeolithic including the Natufian (Kislev et al., 1992; Hillman et al., 1989; van Zeist and Bakker-Heeres, 1986; Hopf and O. Bar-Yosef, 1987; Lev-Yadun and Weinstein-Evron, 1993, 1994).

The findings indicate that the Natufians in the Carmel region lived in a typical Mediterranean landscape. The various species show that three major types of habitats existed within the catchment area of the site: (1) Mediterranean forest and maquis, indicated by evergreen and deciduous oaks (*Quercus*), as well as common myrtle (*Myrtus communis*) and cypress (*Cupressus sempervirens*); (2) marshes and/or other wet habitats, characterized by tamarisk (*Tamarix* sp.) and willow (*Salix* sp.). (3) disturbed, vegetal habitats, probably in the immediate surroundings of the cave, represented by ruderal plants (Dipsacaceae and Malvaceae).

If we combine the archaeobotanical evidence with what we know of the present-day distribution of various plant formations, we may be able to arrive at a fair reconstruction of the way habitats during the Natufian were distributed.

Over Mount Carmel the vegetation would have been much the same as today's with various typical formations (*Quercus calliprinos – Pistacia palaestina*; *Pinus*; *Ceratonia siliqua – Pistacia lentiscus*) in keeping with the lithological substrate and derived soils, as well as elevation. Assuming that the cave lay between 130-140m above the Natufian sea level (see below, Chapter 6, "Natufian Use of the Environment"), the immediately adjacent vegetal formations would have included, as they do today, stands of an open park forest of *Ceratonia siliqua – Pistacia lentiscus*. The maquis of *Quercus calliprinos – Pistacia palaestina*, as well as the other types, would have been much denser than today, notably on north-facing slopes. The aeolianite ridges west of the cave could have supported a *Quercus calliprinos – Pistacia palaestina* maquis, together with *Ceratonia siliqua* and *Olea europaea*, much as the ridge west of the cave does today.

The southern, chalky flanks of Mount Carmel and Ramat Menashe probably supported an open park forest of *Quercus ithaburensis*. Similar formations are characteristic of the coastal plain hamra loams (Eig, 1933). Such soils are hardly ever exposed on the surface of the Carmel coastal plain today. The closest significant exposures which support a *Quercus ithaburensis* open park forest and where numerous Kebaran and Geometric Kebaran sites have been reported (e.g., Ronen et al., 1975; Ronen and Kaufman, 1976; Saxon et al., 1978) are near Hadera, some 25km south of the cave. Unlike the Hadera sites, in the Carmel Coastal Plain the Epipalaeolithic hamra is covered with another layer of aeolianite (Farrand and Ronen, 1974; Ronen, 1983) and is not exposed on the surface. Moreover, no Natufian sites were ever reported for this area. It seems plausible that the Kebaran sites were covered with sand soon after the end of their occupation. This sand may have been consolidated to aeolianite during the relatively humid Early Natufian. If this scenario is likely, the Carmel coastal plain, unlike the central coastal plain (Eig., 1933; M. Zohary, 1973), may not have supported any *Quercus ithaburensis* forests during the Natufian (nor, for that matter, from the Natufian onwards).