Early Natufian el-Wad Revisited

Mina Weinstein-Evron

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Cover illustrations: entrance to the el-Wad Cave.

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Preface

It is now almost 70 years ago that Dorothy A. E. Garrod carried out her pioneering investigations of the Carmel Caves (Fig. 1). In the largest of the caves, el-Wad, she unearthed a long cultural sequence, which extended from the Middle Palaeolithic to historical times (Garrod and Bate, 1937). Since this was one of the first Natufian sites to be excavated, what she found in the cave and on the terrace contributed significantly to the way Garrod was to define the Natufian culture in the Levant, as it had first been unearthed in Shukba (Fig. 2; Garrod, 1928, 1929, 1932, 1942, 1957). El-Wad has long since been considered as a main Natufian site, "base camp" or "hamlet" (e.g., Garrod, 1957; O. Bar-Yosef, 1970, 1983; O. Bar-Yosef and Goren, 1980; Henry, 1985, 1989; Byrd, 1989), stretching back to the Early Natufian, for the following reasons: the large size of the Natufian habitation found here (the actual size of which remains unknown because the greater part of the site has not yet been excavated), the occurrence of architecture (rather poorly preserved but the first to be recognized in a Natufian site), the presence of a large cemetery, rich lithic and groundstone assemblages, and the first Natufian art objects ever found anywhere. Many of these are also accepted as indicators of sedentism in a period of incipient agriculture (Garrod, 1957; O. Bar Yosef, 1983; O. Bar-Yosef and Belfer-Cohen, 1989, Belfer-Cohen, 1991a; Henry, 1989; Kaufman, 1992, to cite but a few).

El-Wad has furnished us with one of the longest and most complete Natufian sequences. The detailed description given by Garrod (Garrod and Bate, 1937) has been more recently supplemented by Valla et al. (1986), and today no discussion or research of the Natufian culture is complete without taking the site into full consideration. New data concerning its oldest occurrence — the Early Natufian — came to light during the excavations we carried out in recent years in Chamber III (Weinstein-Evron, 1993a). Some of these data are unlike anything else ever analysed for a Natufian site so far and shed important new light on the Natufian use of both the cave and the region. As such, they substantiate what we knew already but also throw into question some of the earlier assumptions. Against the background of the new information and in view of the burgeoning discussions of the Natufian habitation at the site (e.g., Gorring-Morris, 1995; Belfer-Cohen, 1995), several important aspects of Early Natufian el-Wad stand in urgent need of critical reassessment. It is such a reevaluation that forms the focus of our study.

A brief introductory chapter (Chapter 1), providing a description of the site and of previous investigations, is followed by detailed discussions of the present-day environment (Chapter 2), the use of the cave in the 20th century (Chapter 3) and of geophysical investigations carried out at the site (Chapter 4). Chapters 3 and 4, though not directly related to the Natufian habitation, are important as background for future research at el-Wad. While the former is ethnoarchaeological in nature and can contribute to a better understanding of later prehistoric cultures (e.g., Neolithic), the latter proves the potential for further excavation, of layers of as yet unknown age, within the cave.

The Early Natufian of our new excavations in Chamber III is described in Chapter 5. The characteristic cultural material (lithic, bone-tool, and groundstone assemblages) of this relatively early Natufian occurrence accords well with that described in detail by Garrod (Garrod and Bate, 1937), and our main concern here is with documentation and discussion of data (e.g., botanical materials and ochre remains) related to the mode of exploitation of the el-Wad environment by its Natufian inhabitants (Chapter 6). Chapter 7, finally, traces how the efficient exploitation of the abundant natural resources in the surrounding area, together with social and economic connections with other groups, enabled the site to develop into the large and complex Natufian site for which we know it today.

I became involved in el-Wad more or less by chance when, being chiefly engaged in palynological research, I was asked to "clean" certain areas of Chamber III so as to enable the construction there of a path for tourists. Clearly everyone involved, including myself, was convinced that these parts of Chamber III had already been dug by Garrod and therefore no longer held any true archaeological value. The results of the excavation, which I am publishing here, therefore came as a pleasant surprise: what was supposed to have been a final summing up has instead enabled us to penetrate again a bit further into the past, inspiring renewed interest in the site and its Early Natufian inhabitants.

Acknowledgements

Like our prehistoric ancestors, archaeologists go about their business in groups, even if usually only one of them gets to write up the results and draw some conclusions. Thus it is my privilege to thank a large number of friends and colleagues who, in one way or another, all took part in the revisiting of el-Wad.

First are two of my close colleagues, Avraham Ronen, for the way he helped me analyse the lithic material, and Daniel Kaufman, who participated in the excavation itself and was generous in sharing with me his thoughts on various aspects of the cultural material. Then, Milla Ohel, for his ever-ready assistance during the excavation, and Anna Belfer-Cohen, for helping me out on the lithic and art assemblages, as well as for the long hours she spent commenting on various chapters while they were still in manuscript. Yitzhak Hen, too, patiently read a final draft and gave me much useful advice. I am also grateful to Sylvia Chaim, for her painstaking work on the extraction of pollen and assistance with the palynological analyses, but even more for her friendship and support; to Salman Abu-Rukun, for his enthusiastic help throughout and for the significant contribution he was able to make to the study of the el-Wad Cave in the twentieth century; and to Udi Galili, for the eco-sounding profile he performed specifically for my research.

Help in various forms came from: Meirav Baron (sorting of the lithics), Alex Beck (detailed geophysical investigations), Simcha Lev-Yadun (study of wood remains, the photographing of plant formations, and many discussions on various aspects of the environment and its exploitation), Amots Dafni (botanical and ecological advice), Shimon Ilani (study of ochre remains from el-Wad and other sites and contribution to the understanding of the geological background and the sourcing of the various raw materials), Bobi Lang (dating of basalts), John Vogel, Israel Carmi and Dror Segal (^{14}C dating), Ezra Marcus and Dror Segal (useful remarks on dating).

Never too numerous to mention and to warmly thanks are all those who at various stages helped out in the excavation: Abu-Rukun Salman and his sons Ala and Talia, Alphasi Orly, Baron Meirav, Ben-Yishai David, Boytner Ran, Brimer Baruch, Effenberger Reinhard, Etzioni Yaron, Friedman Zaraza, Gershon Israel, Gibbor Iskandar, Kurtzbart Edna, Kurtzbart Ofra, Kushinski Gitit, Lamdan Modi, Levin Idan, Mala'achi Yechiel, Milshtein Shulamit, Nagar Anat, Ophir Ya'aqov, Oshri Aviram, Piatza Raul, Refael Ora, Sharvit Ya'aqov, Shitrit Yossi, Talmor Ronen, Tacher Ayelet, Weiner Igal, Weishoff Pnina, Yanko Liora, Yankelevitz Shalom and his sons Yachin and Boaz.

Many thanks are further due to Sophy Doroshe (the archives of the Israeli Antiquities Authority) for letting me go through the old documents of the el-Wad excavations, and for the reproduction of valuable photographs; the Israel Museum for the permission to publish Natufian art objects from its archaeological collection; Arnon Soffer for the permission to reproduce geological and vegetation maps from the Atlas of Haifa and Mount Carmel; Patrick Périn (Director of the Musée des Antiquités Nationales, Saint Germain-en-Laye) and Mme Bouron (Conservateur de la Bibliothèque, Musée des Antiquités Nationales, Saint Germain-en-Laye) for allowing me to inspect the valuable unpublished material of Dorothy Garrod; Hava Lahav, for the results of her detailed Mount Carmel vegetation survey and to Yonat Magal (the GIS unit, the Israeli Nature Reserves Authority) for the organization and reproduction of the coloured vegetation map.

For their excellent work on the drawings I owe many thanks to Elizabeth Elkin, Shoshana Mansfeld, Daphna Stern, Ofra Lazar, Zaraza Friedman, Konstantin Rybalko and Ohad Zackheim. Alexander Marshack provided the splendid photographs of the art objects and Modi Lamdan kindly supplied the photograph of the cave for the back cover.

Special thanks must go to Eviatar Nevo, whose moral support especially during some of my bleaker moments proved invaluable. With his helpful suggestions throughout on how to organize my "narrative", Dick Bruggeman did much to brighten my days at the tail end of the process.

The el-Wad excavations were supported by the Israeli Nature Reserves Authority and the Zinman Institute of Archaeology, University of Haifa. Various aspects of the research were financed by the Irene Levi Sala Care Archaeological Foundation, the Faculty of Humanities and the Research Authority of the University of Haifa.

But, of course, my greatest debt of gratitude is to Itzik, Igal and Aya, for their endurance throughout this project and for their love always.

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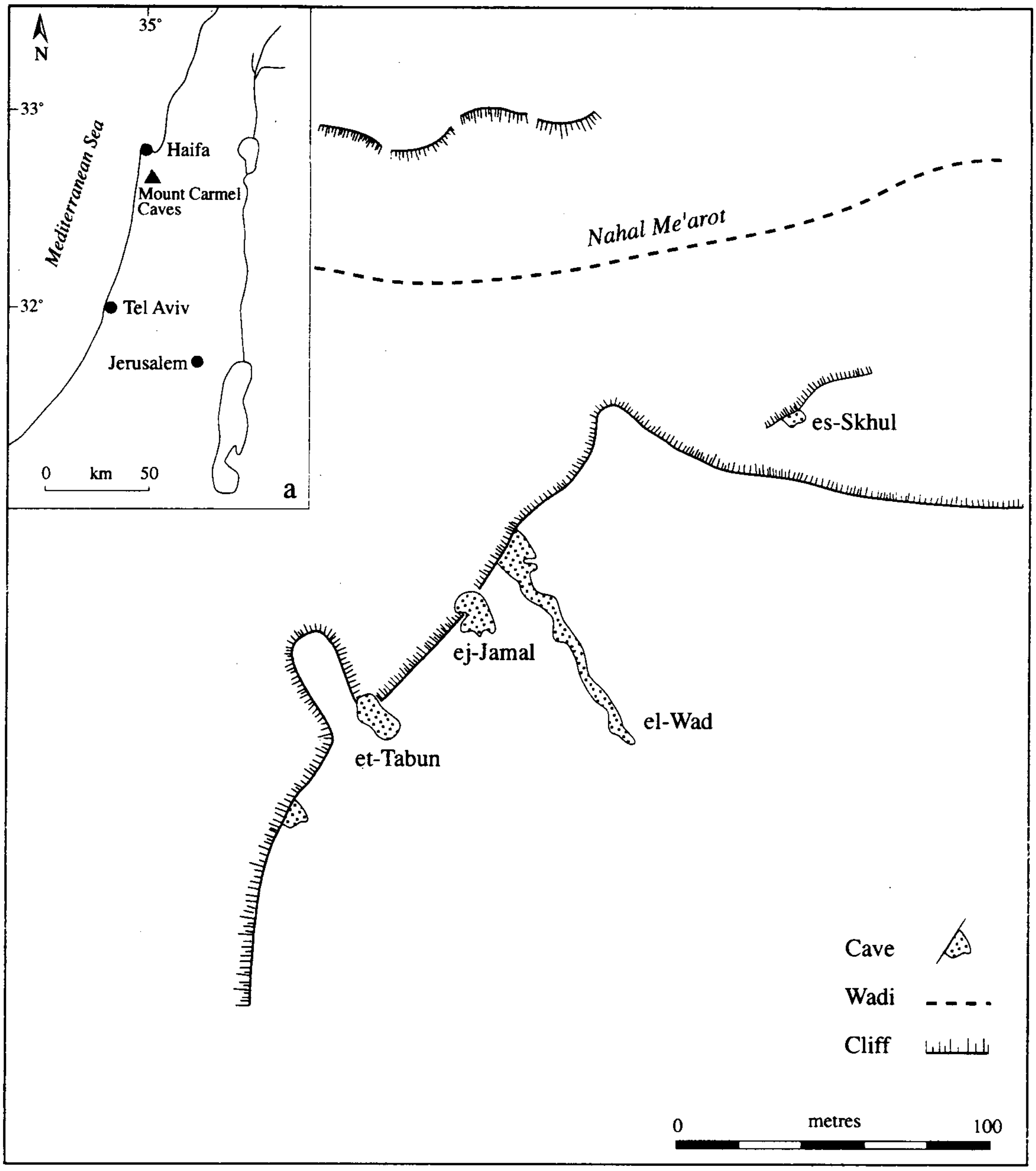


Fig. 1. Location map of the Mount Carmel caves (a), showing el-Wad as the largest of the caves within the cliff.

Chapter 1

INTRODUCTION: THE SITE

Description and First Investigations

El-Wad (Cave of the Valley) is situated on the southern escarpment of Nahal Me'arot (Valley of the Caves), together with three other caves, Tabun ("Oven"), Skhul ("Kids") and Jamal ("Camel") (Fig. 1). It faces to the NW and lies approximately 44.5m above sea level and 12.5m above the level of the coastal plain, at a point where the wadi opens out onto the coastal plain. The name el-Wad may derive from the wadi that runs below the cliff, but we also have a highly interesting remark by Lambert to the effect that "water is said to come from the tunnel at the back of the cave in winter and disappear through the cave floor (with a lot of gurgling, according to the local inhabitants)" (Lambert, 1928,3:3-4).

A big cave with a lofty roof, el-Wad covers a larger area than any of the other three caves (Fig. 3). According to Garrod's subdivision, it consists of an outer and an inner chamber (Chambers I and II) and a 71m long corridor (Chambers III-VI). In front of the cave there is a small terrace, sloping slightly downwards to a distance of 9.5m from the cave mouth. A large talus, some 45m in radius, falls steeply away from the terrace towards the plain.

Any subdivision of the cave remains subjective, inevitably reflecting the conception and, perhaps, biases of the archaeologist who excavates the site. Another way of describing the cave might start by saying that it consists of a single, large, daylit outer room (Garrod's Chambers I and II), with several niches and alcoves, which is separated by a short and rather narrow corridor (Chamber III) from an inner, darker part (Chambers IV-VI). This would also better fit Garrod's initial impression that the cave "consists of a large well-lit chamber and a long corridor, faces NW., and commands a wide view of the plain" (Garrod, 1930a:77). Of the inner chambers, Chamber V is the most spacious while Chamber VI forms the butt of the cave, with walls that are narrowing in towards the end, a floor that is irregular and rising (actually the bedrock) and a roof that curves downwards, all contributing to reducing the

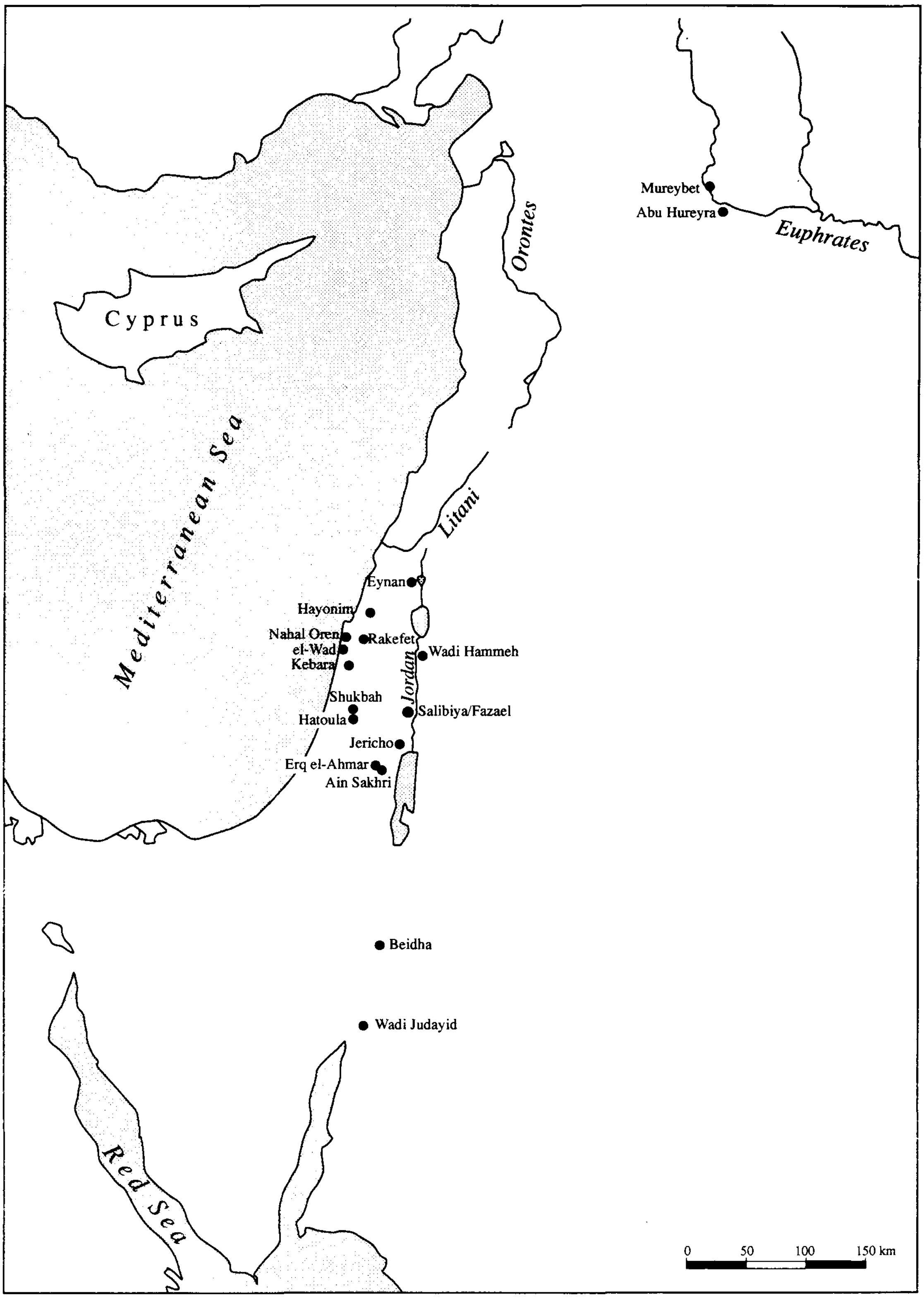


Fig. 2. Distribution of major Natufian sites in the southern Levant.

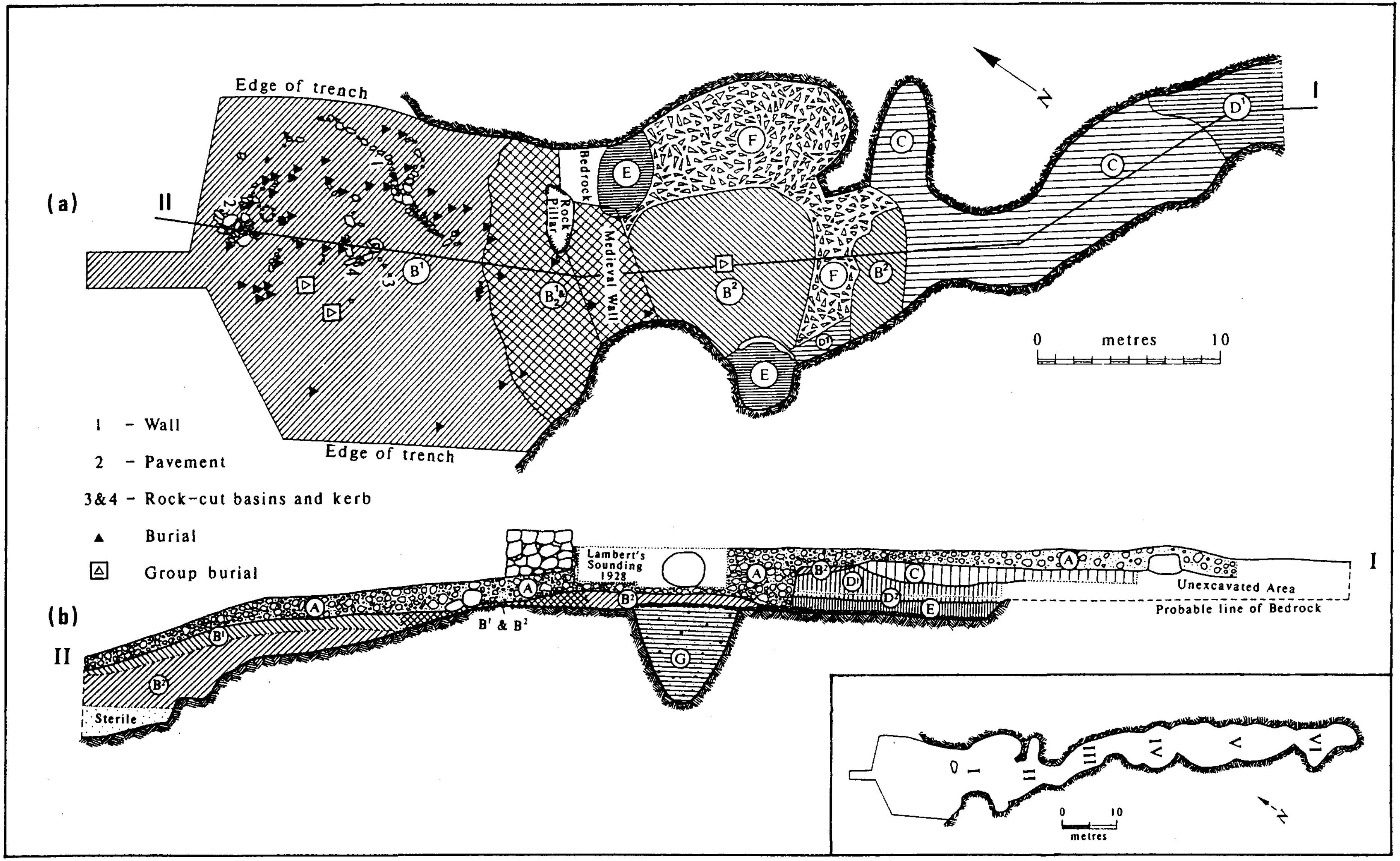


Fig. 3. Garrod's el-Wad. In the insert: key-map of the cave. The figures are the numbers of the chambers. (a) Ground plan of Chambers I-III and terrace, showing the distribution of the deposits after the removel of layer A; (b) Section I-II (for location see a). Layer A - Recent. Layer B - Natufian: B1 Late Natufian; B2 Early Natufian. C,D,E,F - Upper Palaeolithic. G - Middle Palaeolithic.

chamber's size. The main axis of the cave is NW-SE; only the axis of the connecting "corridor" (Chamber III) is WE. This, together with the narrowing of the "corridor" because of the huge masses of rock that project into it from the NE wall of the outer chamber(s), dictates the amount of daylight that enters into the inner parts of the cave and the way it spreads. Thus, daylight reaches the western part of Chamber III while its eastern part remains in the shadow. Furthermore, while the inner parts of the cave (Chambers IV-VI) are almost completely dark, some light can penetrate along the NE wall well into Chamber V. Since because of the light one tends to walk along the NE wall, one's immediate impression is that of a corridor while actually the inner part of the cave is rather spacious. Interestingly, the varied intensities of light penetrating into the different parts of the cave are clearly responsible for the distribution of blue-green algae (Cyanobacteria) in the cave (Vinogradova et al., n.d.).

Today the entrance to the cave is wide open (Fig. 4), but before excavations started this was "a well-formed lofty archway, facing NW., flanked by two roughly elliptical natural windows ... The window to the NE. of the entrance had been artificially enlarged to make a doorway ... and has a well-cut level threshold, with a door-socket on the SW. side" (Garrod and Bate, 1937:5). The entrance was partially blocked by a massive wall of rough unshaped limestone blocks (Fig. 5). While the NE window mentioned by Garrod still exists, the wall across the entrance has long since been removed and the NW window has been gradually destroyed by recent rockfalls.

Garrod assumed that both the stone wall and the NE doorway were medieval. A probable PPNB age was later suggested for the construction of the wall (Ronen, 1982), based on similar features found at the Sefunim Rock Shelter (Lamdan, 1984). The el-Wad terrace was also enclosed by a rough stone wall, but this was of recent date (Garrod and Bate, 1937).

It was Lawrence Oliphant, an English mystic and philo-Semite with a great love for the country, who first mentioned the Mount Carmel caves (Oliphant, 1886). More than a decade later the German traveller Graf von Mülinen included them in his book on the history and geography of Mount Carmel (Mülinen, 1908), noting the wall of big limestone blocks across the entrance of the largest of the caves [el-Wad], and a smaller sandstone wall in the cave's interior.

Archaeological interest in the site did not emerge until 1928. When, in 1927, the British Mandatory Government's Public Works Department initiated the Haifa Harbour Project and quarrying threatened to destroy the caves' cliff, Mr. Charles Lambert, Assistant Director of the Mandatory Department of Antiquities of Palestine, was assigned to check the cave to see whether it was worth saving.

In autumn 1928 Lambert made five soundings in el-Wad Cave, three inside and two on the terrace. Since, as Garrod has it, "the object of his work [was] simply to test the value of the site, he did not go below the surface of the Natufian layer" (Garrod and Bate, 1937:6). Nevertheless, this proved sufficient for Lambert to make some important discoveries. On the terrace, amongst stone walls and grinding implements, Lambert came upon two burials, later known to be Natufian, the first ever unearthed at Mount Carmel. Inside the cave an art object was found, the first prehistoric art ever discovered in the Near East. It was a segment of what originally had been the handle of a sickle-blade haft (Garrod and Bate, 1937) carved as "a young animal, probably a calf, standing with head thrown back, in an attitude which faintly records one of the painted

Fig. 4. The entrance to the cave today.

Fig. 5. The entrance to the cave in 1928. Lambert's trench 2 in left-centre foreground.

bisons in the cave of Altamira" (Director's report, 1928). Also found was a pierced shoulder-blade of a deer in which a large elliptical hole has been cut (and polished, possibly by use), which "recalls the *bâton-de-commandement* of the Upper Palaeolithic of Western Europe" (Garrod, 1930:77). The subsequent recognition of the caves as archaeologically important and their registration as an antiquity site were followed by six years of excavation directed, on behalf of the British School of Archaeology in Jerusalem and the American School of Prehistoric Research, by Dorothy A.E. Garrod. Palaeontological analyses were conducted by D.M.A. Bate, and the human remains were examined by T.D. McCown and A. Keith.

Garrod's Excavations

Garrod's expedition excavated el-Wad during five seasons (1929-1933). In 1929 and 1930 work was carried out both in the cave and on the terrace, but in the following years on the terrace only. What she called Chambers I and II were dug to bedrock; Chamber III was partially excavated; soundings to bedrock were made in Chambers IV and V, and the terrace and talus were dug to bedrock over an area of approximately 270 sq. m (Garrod and Bate, 1937).

At first, Garrod interpreted the sequence she found (Fig. 3) as Mousterian (Layer G), covered by three Upper Palaeolithic (layers E, D1+D2, and C), and ending with Natufian (layer B2 and B1) and Holocene (Layer A) deposits. Layer F contained a mixture of Middle Palaeolithic and Upper Palaeolithic material (Garrod, 1931). Later (Garrod, 1951) she changed her mind, now viewing layers G and F as a single cultural unit which she termed a "transitional industry" between the Middle and the Upper Palaeolithic. This she based on the composition of the lithic assemblages which included typical Middle Palaeolithic components (side scrapers and Levallois items) along with Upper Palaeolithic implements (endscrapers and burins). Emireh points, characteristic of this "transitionary industry" in Israel, were also found. Following Garrod's initial interpretation, most scholars nowadays agree that both layers represent a mixed assemblage, resulting from water activity in the cave at the onset of the Upper Palaeolithic (see, for example, O. Bar-Yosef and Vandermeersch, 1972). Water had eroded the Mousterian (G) layer's uppermost part, considerably abrading the flints that were there, resulting in a mixture of items from the lower part of the Upper Palaeolithic layers with Mousterian artefacts. Layers G-F were uncovered in Chambers I-II, up to the entrance to Chamber III, where they filled and covered deep depressions (swallow holes?) in the cave's floor.

The industry of the oldest Upper Palaeolithic ("Middle Aurignacian") Layer E, uncovered in Chambers I-II, included simple, carinated and nosed endscrapers and numerous burins, and was marked by the abundance of "fine, spiky points made on delicate blades" (Garrod and Bate, 1937:47), which Garrod named "Font Yves" and which were later termed "El-Wad" points (a term introduced by the Symposium on Levantine Typology held in London in 1969, reported in Brézillon, 1971). The finds are currently attributed to the Levantine Aurignacian culture (Upper Palaeolithic III, according to Garrod and R. Neuville's division). The industry of Layer D, uncovered in Chambers II and III, was rich in steep scrapers, nosed scrapers and burins, resembling the European Middle Aurignacian of the early 1930s. El-Wad points are rare, relative to the number found in the preceding layer. Layer D is now attributed to the Levantine Aurignacian culture (Upper Palaeolithic IV). Two sub-layers, D1 and D2, were distinguished here, based on the typology of the implements. A considerably higher percentage of retouched tools was found in sub-layer D2, their workmanship also of higher quality.

The Upper Palaeolithic of Layer C, exposed in Chambers II and III, was "marked by a very great preponderance of polyhedric burins and steep scrapers" (Garrod and Bate, 1937:41), a very extensive use of tabular flint, and a few Chatelperron points. The discrete characteristics led Garrod to name this industry she found "Atlitian", though it showed a clear affinity with the "Middle Aurignacian" of the previous layers. Layer C is currently assigned to the late Levantine Aurignacian (Upper Palaeolithic stage V).

Before embarking upon a description of the Natufian of Layer B, a few remarks concerning the sequence as constructed by Garrod are pertinent to our work. First, no complete sequence (Mousterian, Upper Palaeolithic and Early and Late Natufian layers) was ever found in any one section, as the (probably residual?) archaeological layers are unevenly distributed in the cave. For example, the Mousterian (Layer G), was found mainly in deep depressions (swallow holes?) in the bedrock (Fig. 3), usually mixed with Upper Palaeolithic remains, and its extension in the cave is thus limited. The Upper Palaeolithic (layers E, D, C) variably occurs in different areas of Chambers I-III (Fig. 3). Second, on the terrace only Natufian layers were present. These include the Early as well as the Late Natufian stages whereas in the cave only Early Natufian remains were found. Third, Natufian layers inside the cave were found only in Chambers I and II and were absent from Chamber III, where Upper Palaeolithic layers were encountered immediately beneath the upper mixed Layer A. Thus, the most complete sequence, but even there not in one section, was found in Chamber II. Interestingly, this 2.5m thick, undisturbed sequence, according to Garrod, is "more complete than any yet known in Palestine" (Garrod, 1929:221).

Garrod's Natufian

Garrod found only small patches of undisturbed sediments containing microlithic lithic industry in the cave (Fig. 3). In the outer chamber these contained a collective burial of ten skeletons in an extended position. Immediately below one of the skeletons Garrod found the second piece of prehistoric art discovered in Palestine — a small calcite pebble roughly carved into the shape of a human head. Garrod apparently believed that the decorated sickle haft discovered by Lambert originated from the same collective burial (Garrod, 1929) since "[Lambert's] sounding just reached the top of the Group Burial H. 1-10, and the carving came from the base of the trench" (Garrod and Bate, 1937: 38-39). A thin layer (Layer B2; Fig. 3), containing a microlithic lithic industry, was excavated in a small isolated area in Chamber II. The most extensive and important area is the terrace which, according to Garrod, has suffered less disturbances than those inside the cave and yielded the most notable Natufian finds. The Natufian included a few architectural remains and close to 100 burials (according to a reassessment by Belfer-Cohen et al., 1991), accompanied by a rich material culture of lithics, decorative items, bone tools, groundstone implements and a rich and varied faunal assemblage.

Garrod noticed that the microlithic industries at Shukba, excavated in 1928 (Garrod, 1928), and el-Wad were similar and she therefore argued that "as it will be convenient to have a name for this culture, I propose to call it Natufian, after the Wadi en-Natuf, where we first found it in place" (Garrod, 1929:222). Only later, after further thorough excavations on the el-Wad terrace, the seemingly homogenous Natufian deposit there could be differentiated, on typological grounds, between an early (Layer B2) and a late (Layer B1) phase.

Many of the terrace structures, including a pavement, a retaining wall and four basins cut in the rock (Fig. 3), were assigned to the Lower, Early Natufian. Similarly, the tightly flexed skeletons, of both individual and group inhumations, as well as the decorated burials, were assigned to the early phase. Bone implements and art objects were numerous in the Early Natufian. The lithics of the early phase are characterized by relatively larger lunates than those found in the later, their back predominantly made by bifacial ("Helwan") retouch. Sickle blades are plentiful, while micro-burins are extremely rare.

By contrast, the lithics of the Upper Natufian (Layer B1) are characterized by smaller lunates, with steep retouched backs, many microburins, while sickle blades are relatively rare. Bone implements and art objects, too, are rare. The burials contain only individual inhumations and are only slightly flexed, the skulls bearing no ornaments. While the chronological relationship between the terrace and the cave collective burial mentioned above could not be precisely determined, the latter were considered to be of Early Natufian age (Garrod and Bate, 1937).

In 1980-1981, limited excavations were conducted by F. Valla, of the French Archaeological Mission in Jerusalem, and O. Bar-Yosef, of the Hebrew University of Jerusalem, north-east of Garrod's terrace excavations in an area immediately adjacent to it (Valla et al., 1986). Their aim was to re-examine the stratigraphy of the Natufian layers outlined by Garrod. The excavation revealed that Layer B1 ought again to be sub-divided, in Late and Final Natufian phases. The finds of the latter phase include flint artefacts, mostly short lunates, bone tools, and stone implements. Meticulous excavation procedures and the wet sieving of sediments guaranteed that many faunal data could be recovered, which made it possible to draw conclusions regarding palaeoenvironmental conditions at the site and the Natufians' manner of exploitation of the various biotopes.

Undoubtedly, as Garrod herself had already stated, "of these [Natufian] divisions by far the richest and most interesting is the Lower Natufian, in which much use is made of bone and shells in the fabrication of tools, weapons, and ornaments. This variety of material gives us the most complete picture we posses of any Stone Age culture of the region before the Neolithic of Jericho" (Garrod, 1957:213). Furthermore, the passage from the early to the later stages "is marked by the disappearance of nearly everything which in the earlier stage gives such an impression of a varied and interesting way of life" (Garrod, 1957:224).

Chapter 2

ENVIRONMENT

Geology and Geomorphology

Mount Carmel is a structurally elevated, tilted, triangularly shaped area (Sass, 1980). It is bordered by a fault line scrap on the north-east (Fig. 6), which separates it from the Galilee, and by the Ramat Menashe (Menashe Plateau) syncline on the south-east (Fig. 7). To the west, a coastal abrasion escarpment borders a narrow coastal plain.

The total length of the mountain is about 30km, its maximum width about 25km, covering an area of 250sq. km (Inbar, 1984). El-Wad is located in the Lower, southern, Carmel (Fig. 7). The area is up to 300m high (Nir, 1980), with a rather gentle topography and a few inner valleys. Most of the area within a radius of 5km around el-Wad does not exceed an elevation of 200m (Fig. 7). The higher parts of Mount Carmel, to the north and north-east of the Lower Carmel, are more dissected, with deep valleys and cliff escarpments and a rather rough topography. The highest peak is Rom HaCarmel, 546m above msl.

The Mount Carmel lithology is composed of Cretaceous (mostly Cenomanian – Turonian) chalks, limestones and dolomites. The stratigraphic sequence, which is several hundred metres thick (Fig. 8), represents a variety of depositional facies, resulting from the unique palaeogeographic location of Mount Carmel, at the edge of a shallow platform (Bein and Sass, 1980). This variety is further reflected in soil and vegetation distribution in the area.

Karstic phenomena are common in the dolomites and crystalline limestones of Mount Carmel. At Nahal Me'arot, karstic caves were formed within a reef complex of Albian – Early Cenomanian age (the Yagur formation) (Bein and Sass, 1980). Various areas of the fossil reef are easily discernible within this complex (Figs. 9,10): the limestone reef core, which is built of mostly degraded radiolitids and chondrodonts; the fore reef talus, which is made of calcarenites and calcirudites and dips (initial dips) 25°-30° to the south-west, and the back reef, east of the reef core, which is represented by almost horizontal bedded dolomites and some biopelmicrites.

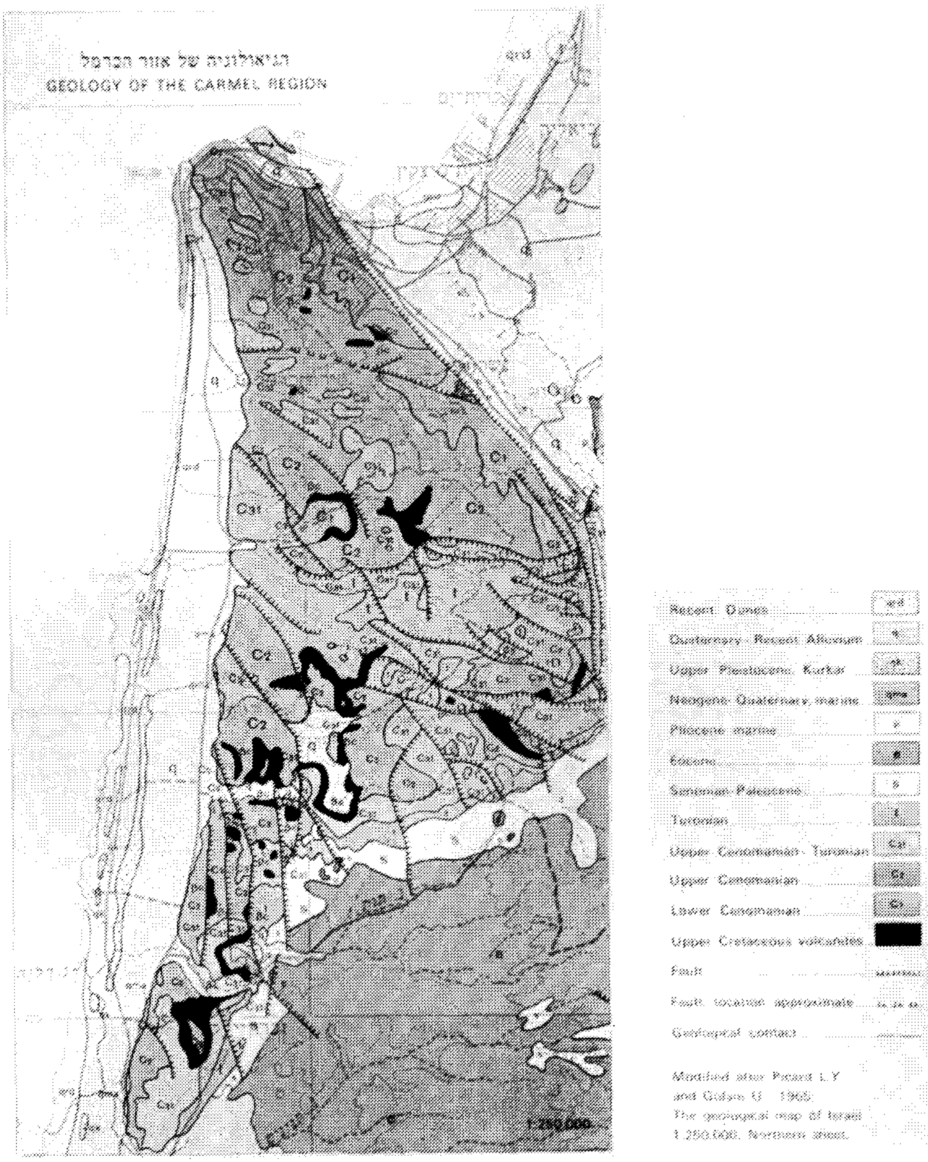


Fig. 6. Geology of the Mount Carmel region

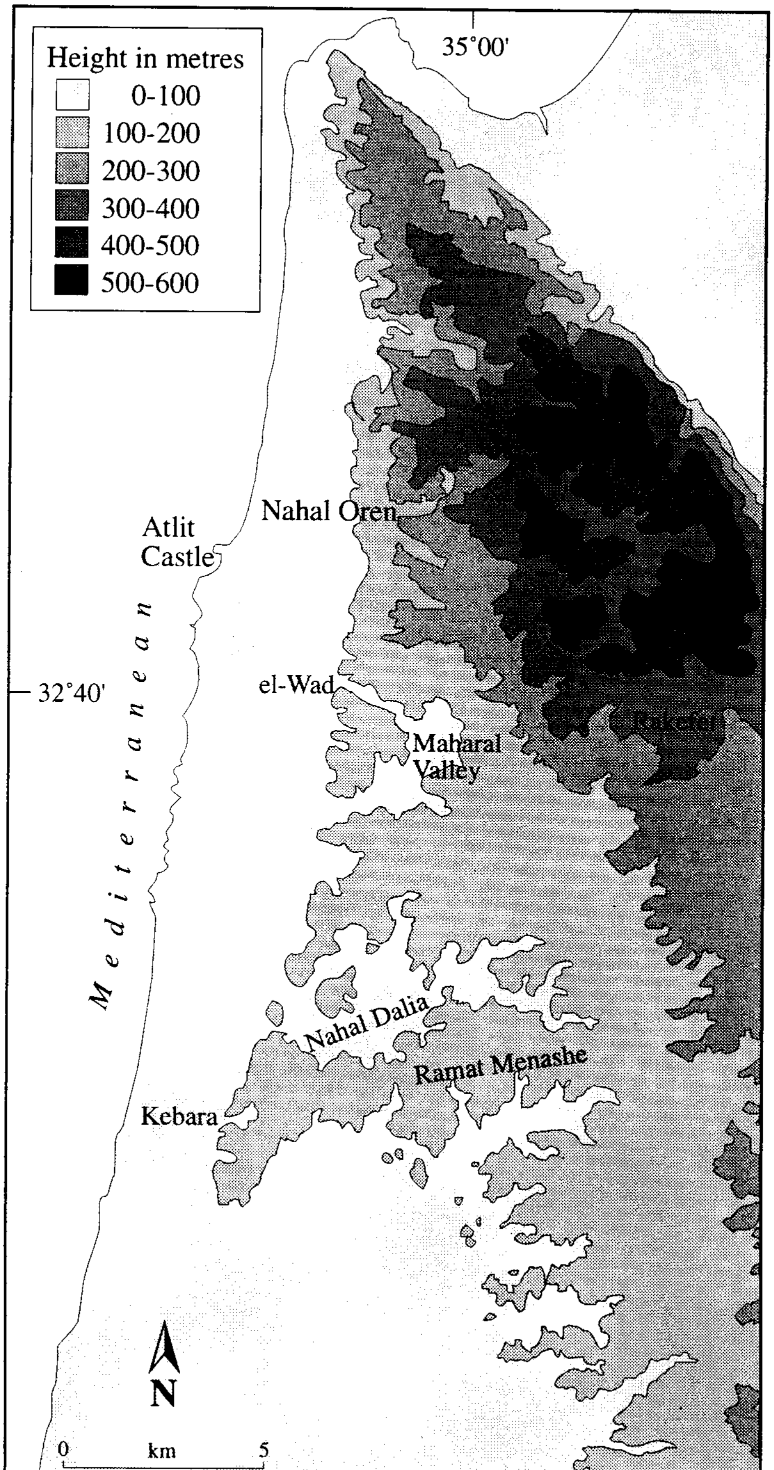


Fig. 7. Topographical map. El-Wad is situated at the southern, Lower Carmel, within a fossil reef. The Maharal Valley, east of the cave, was formed through the erosion of the rather soft, volcanic tuffs and is within easy reach (no topographical barriers).

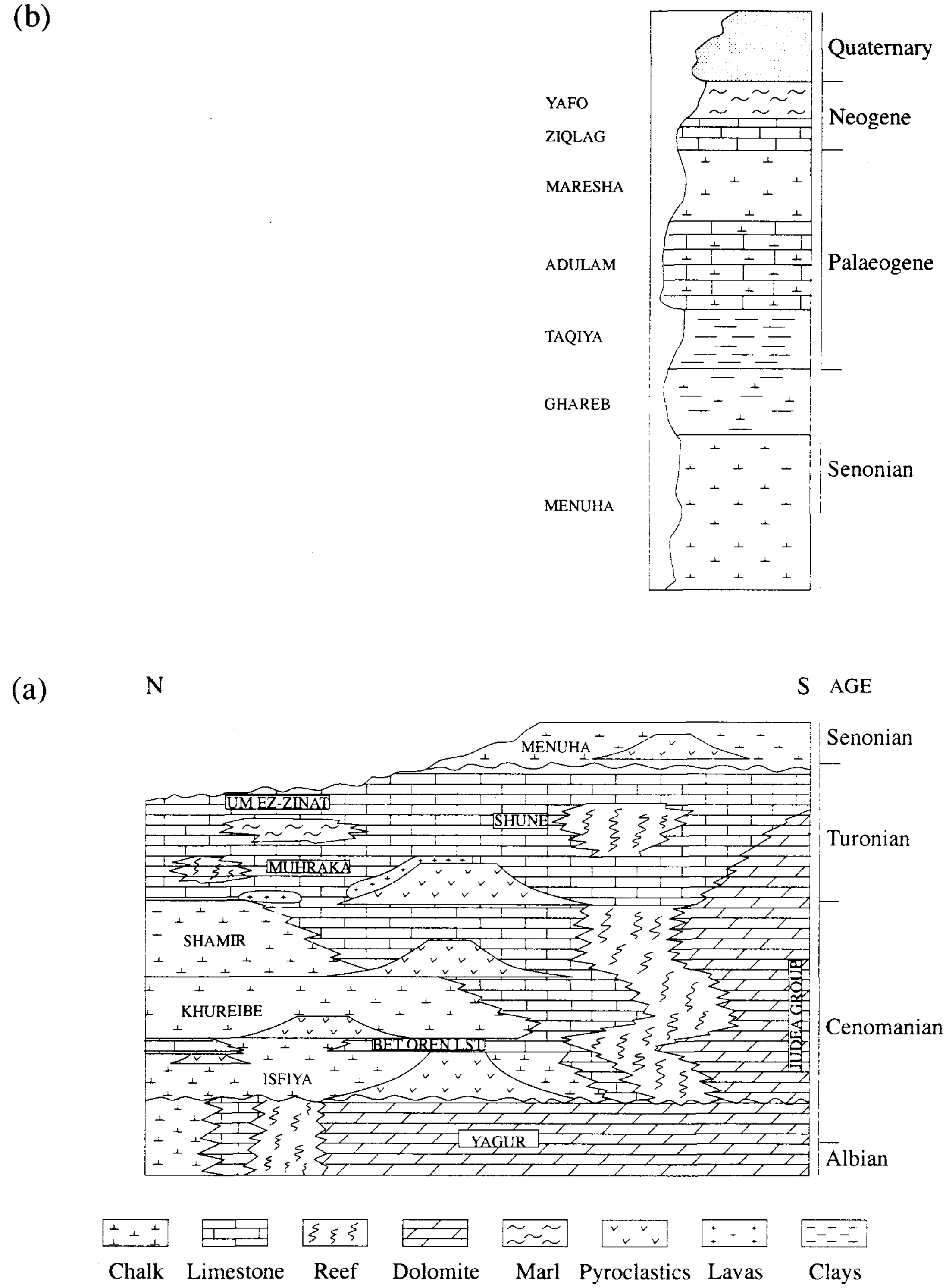


Fig. 8. Composite lithostratigraphic scheme of the Carmel region: (a) geological section of the Upper Cretaceous Judea Group; (b) columnar section of the Senonian to Quaternary sequence. Flint is abundant within the Cenomanian Shamir Formation (Karcz, 1959). Sporadic flint nodules occur in the Isfiya, Khureibe and Menuha formations (Karcz, 1959; Levy, 1995), of Cenomanian to Senonian age; flint layers also occur in the Palaeogene Adulam Formation (Levy, 1995).

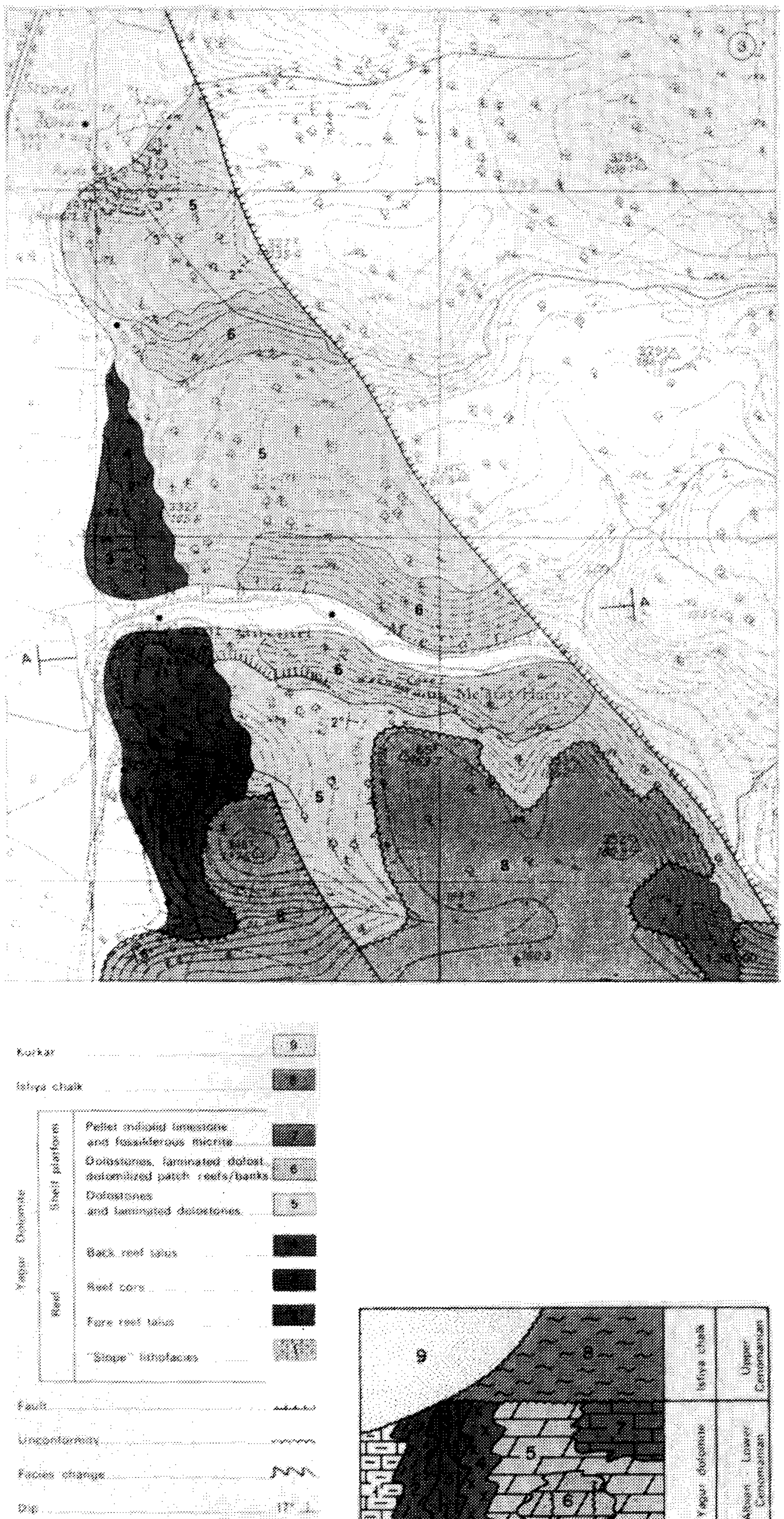
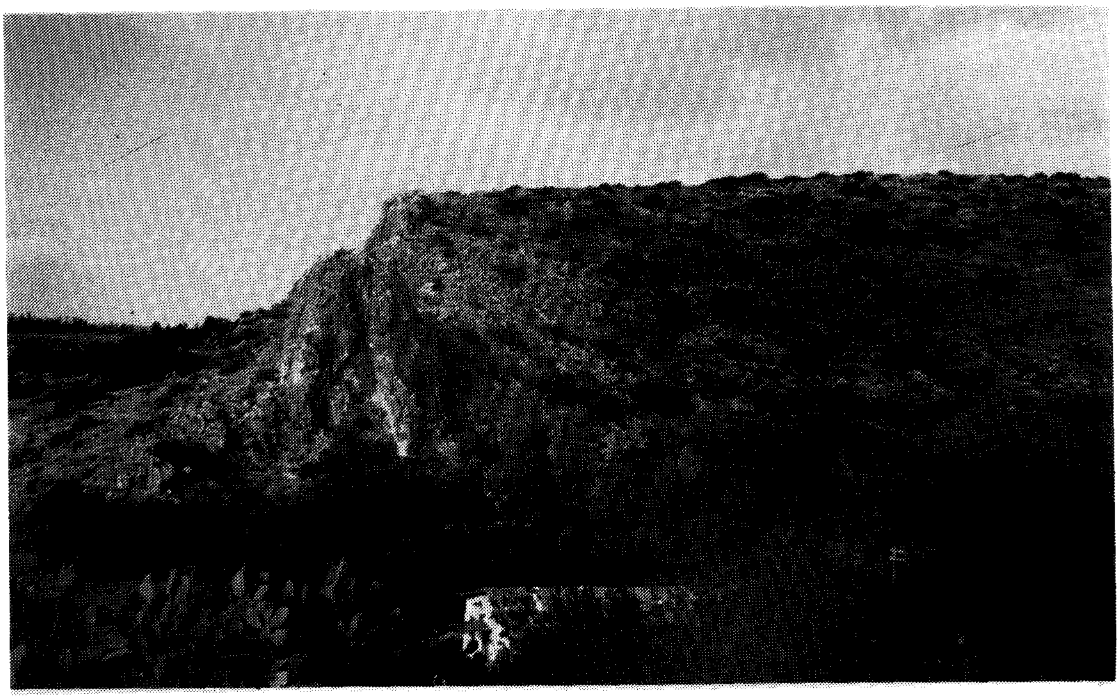


Fig. 9. The Geology of Nahal Me'arot area.

a



b

Fig. 10. The fossil reef of Nahal Me'arot: (a) An ariel view of the caves' cliff. In the foreground el-Wad, Jamal and Tabun caves, situated within the reef core, with the back reef talus at the background; (b) The fossil reef of the southern bank of Nahal Me'arot, north of the cave. Today, the reef core and especially the fore-reef calcareous talus supports many *Euphorbia dendroides* while on the dolomitic back-reef talus *Calicotome villosa* is abundant.

Volcanic rocks of Late Cretaceous (Cenomanian – Turonian) age are found mainly in the Lower Carmel (Fig. 6). They appear as lenticular bodies, mostly consisting of basic pyroclastics, which are occasionally associated with basalt lavas (Bein and Sass, 1980). Epigenetic iron oxides (Ilani et al., 1985) and manganese (Ilani et al., 1990) mineralizations occur in contact with or in close proximity to volcanic rocks within Cenomanian – Turonian limestones and dolomites of the Judea Group. Volcanic tuffs may create broad, intermontane valleys (Nir, 1980), such as the Maharal Valley, 3km to the south-east of the caves (Fig. 7).

The Carmel Coastal Plain is rather narrow (Fig. 7), about 3.5km wide at its southern part, gradually diminishing to the north, from Nahal Oren, c. 5km north of el-Wad, up to the point where the hills touch the sea (the Carmel "nose" or Haifa Cap). The region is composed of three Quaternary aeolianite (locally called *kurkar*) ridges (Fig. 6), two of which, to the north of Atlit, are presently submerged. The eastern, most continuous ridge is 20-25m high. A flat, alluvial plain, sloping from 30-40m altitude at the feet of Mount Carmel to 10-15m in the west, separates the eastern ridge from Mount Carmel (Fig. 11). Nahal Me'arot drains into the Mediterranean some 3.5km west of the cave.

Soils

Mount Carmel soils are of two main types. The reddish-brown terra rossa soils are associated with Cenomanian and Turonian limestones and dolomites. Pale rendzina soils are derived from chalks, marls and tuffs of a Lower Cretaceous to Senonian age (Singer and Rabikovitch, 1980). Colluvial soils deposited along the foothills in a narrow strip that separates the mountain from the coastal plain are derived chiefly from terra rossa and contain varying amounts of stones. Rather deep, alluvial soils occupy the major part of the Carmel Coastal Plain; sandy red loams (locally termed *hamra*) can be found on the aeolianite ridges. Commonly, a narrow strip of sand dunes occurs between these coastal hills and the sea.

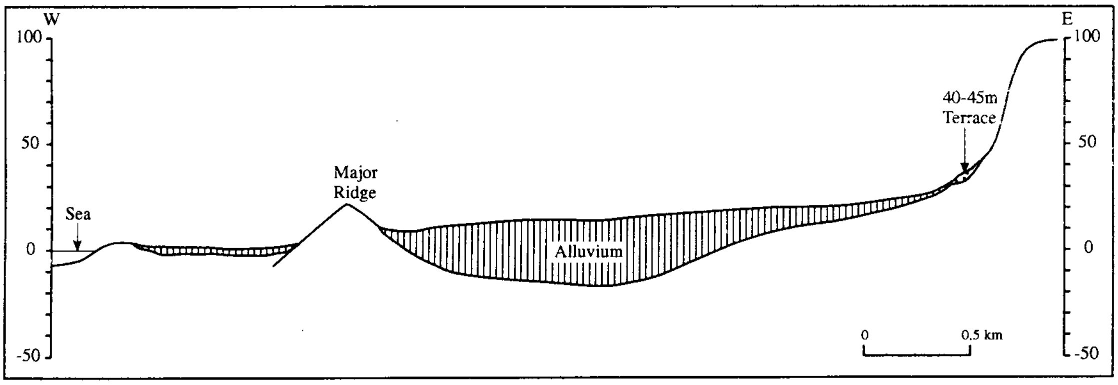


Fig. 11. Schematic section across the Carmel coastal plain in front of el-Wad.

Vegetation

Mount Carmel vegetation is primarily East Mediterranean (M. Zohary, 1980; Pollak, 1984). The distribution of the main plant formations (Fig. 12) is on the whole determined by the lithology and derived soils, but is also influenced by altitude.

The lower belt of the mountain, up to 300m., is occupied by the *Ceratonia siliqua – Pistacia lentiscus* association. (M. Zohary, 1962). This association is particularly widespread on the western parts of the mountain. It is an evergreen park forest, characterized by a high diversity of species, including trees (e.g., *Quercus calliprinos, Rhamnus palaestinus* and *Crataegus aronia*) and shrubs (e.g., *Majorana syriaca* and *Salvia fruiticosa*). A special variant, with *Olea europaea,* occurs in areas with high precipitation (more then 600mm). Stands of this association are also present on the aeolianite ridge near Atlit.

Quercus calliprinos – Pistachia palaestina maquis association is characteristic of hard limestones and dolomites and the derived terra rossa soils of the central and eastern Carmel, and among the plant associations in the area it is the most widespread. It is represented by a series of variants, with *Quercus calliprinos, Pistacia palaestina, Pistacia lentiscus, Ceratonia siliqua, Arbutus andrachne, Crataegus aronia, Rhamnus palaestinus, Cercis siliquastrum* and *Phillyrea latifolia* as the main arboreal species. The latter was apparently heavily coppiced as a preferred fuel source for charcoal production and domestic uses in the past (Naveh, 1984). In recent years it has re-established itself within the Mount Carmel Nature Reserve, where it co-dominates in many places with *Quercus calliprinos.* On the humid northern slopes and the highest elevations it includes high proportions of *Laurus nobilis* and *Quercus boissieri,* accompanied by *Pyrus syriaca* (Waizel et al., 1982). Deep, shadowed and humid cliffs and canyons support dense *Quercus calliprinos* maquis, with *Cercis siliquastrum, Melissa officinalis* and *Laurus nobilis.* Stands of *Myrtus communis* can be found in mesic habitats, especially on northern slopes.

Pine forests, the main association of which is *Pinus halepensis – Hypericum serpyllifolium,* on the whole are restricted to the soft, pale rendzina soils, derived from the chalky rock beds of the Middle Cenomanian of the Upper Carmel. Characteristic components of this association are *Thymelea hirsuta* and *Genista fasselata.* In Israel, the latter grows only in the Carmel area, where it is accompanied by *Cistus salviifolius* and *Cistus creticus* (M. Zohary, 1955, 1973). A thermophilous Tabor Oak (*Quercus ithaburensis*) open park forest is limited to the south-eastern parts of the Carmel and the Menashe Plateau. This type of forest once also covered large areas in the Sharon coastal plain, south of the Carmel coast (Eig, 1933; Karschon, 1982), remnants of which (together with *Desmostachya bipinnata,* for example) can be found today especially on hamra soils. The main components of the Carmel dwarf-shrub formations, garigue and batha, are *Sarcopoterium spinosum, Calicotome villosa, Salvia fruticosa, Cistus spp.* and *Satureja thymbra.* Exposed, rocky biotopes support many *Stachys palaestina, Micromeria nervosa, Ceterach officinarum* and *Podonosma orientalis* plants. The volcanic rocks and tuffs are covered with a sparse batha, with *Coridothymus capitatus, Calicotome villosa* and *Asphoddelus ramosus.* Hydrophilous biotopes include *Nasturtium officinale, Inula viscosa, Rubus sanguineus* and *Nerium oleander.* Large areas of Mount Carmel, as well as most of its coastal plain, are subject to cultivation and afforestation.

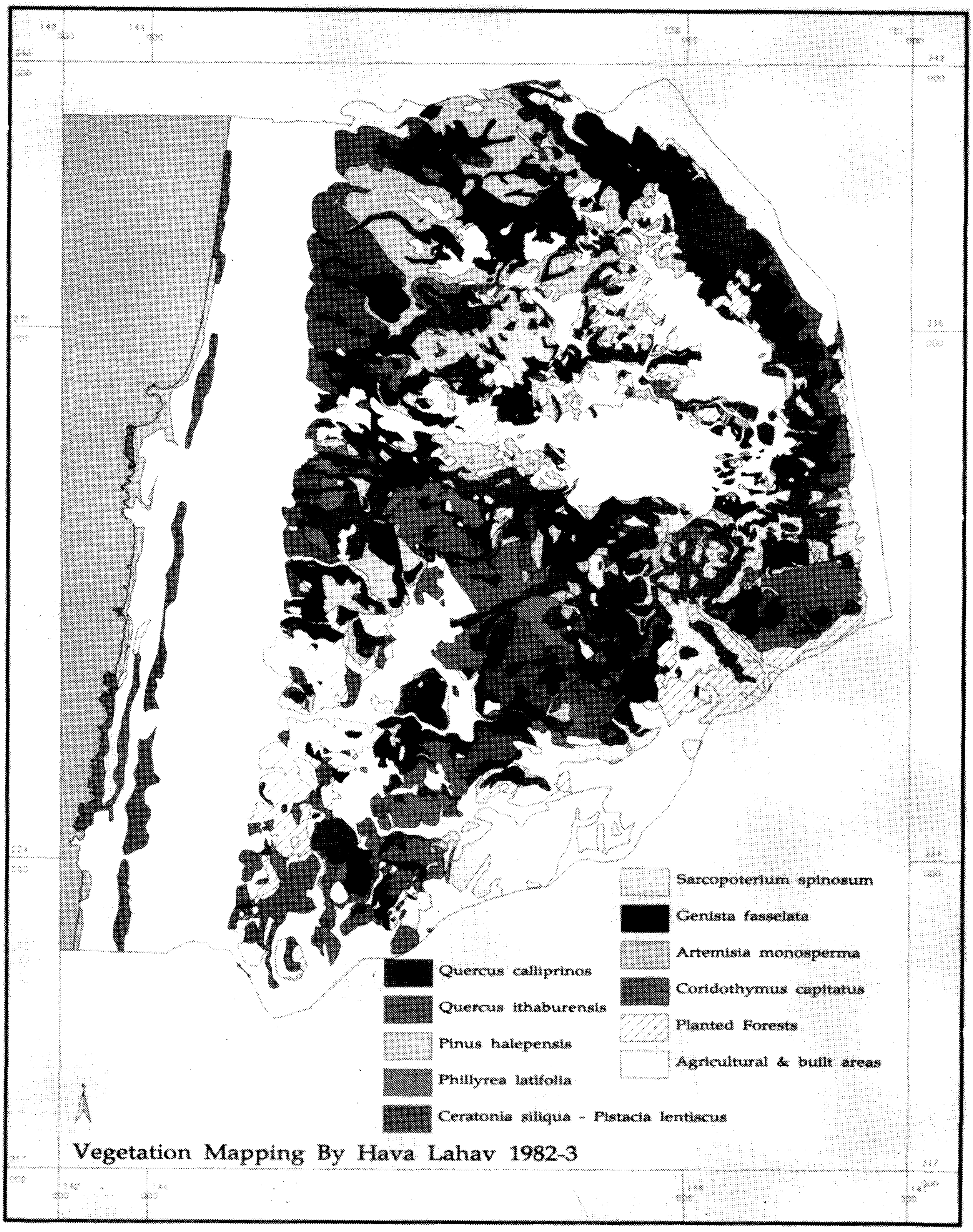


Fig. 12. Vegetation map, Mount Carmel.

The Carmel coastal plain supports vegetation types confined to sand dunes associations (mainly *Lotus creticus* and *Artemisia monosperma*), kurkar hills (*Ceratonia siliqua – Pistacia lentiscus,* with *Coridothymus capitatus, Critmum maritimum, Lavandula stoechas, Calicotome villosa,* and *Thymelaea hirsuta*), marshes (e.g., *Phragmites australis, Juncus fontanesii, Typha domingensis* and *Tamarix nilotica*) and salines (*Inula crithmoides,* Chenopodiaceae, *Tamarix tetragyna*).

Climate

Climatic conditions on Mount Carmel are temperate and are influenced by both the topography of the mountain and its proximity to the coast (Scharlin, 1980).

Average annual rainfall is 600-800mm (Katzenelson, 1967). A single rainy season extends from October to April (Fig. 13), though occasional rains may occur in September and May. Rainfall distribution depends mainly on altitude (Scharlin, 1980). The region is further characterized by heavy, localized (torrential) rains, especially at the beginning and end of the rainy season.

The mean annual temperature is 18.8°C, with a day time average of about 11.9°C in January and 28°C in August (Katzenelson, 1967). The prevailing winds are westerlies during the summer and easterlies during the winter, when strong winds are relatively common (Lomas et al., 1973). Local winds are also influenced by the mountain's special topography, i.e., high frequency of winds parallel to the mountain ridge and strong winds in wadis that cut through its western slopes (Scharlin, 1980).

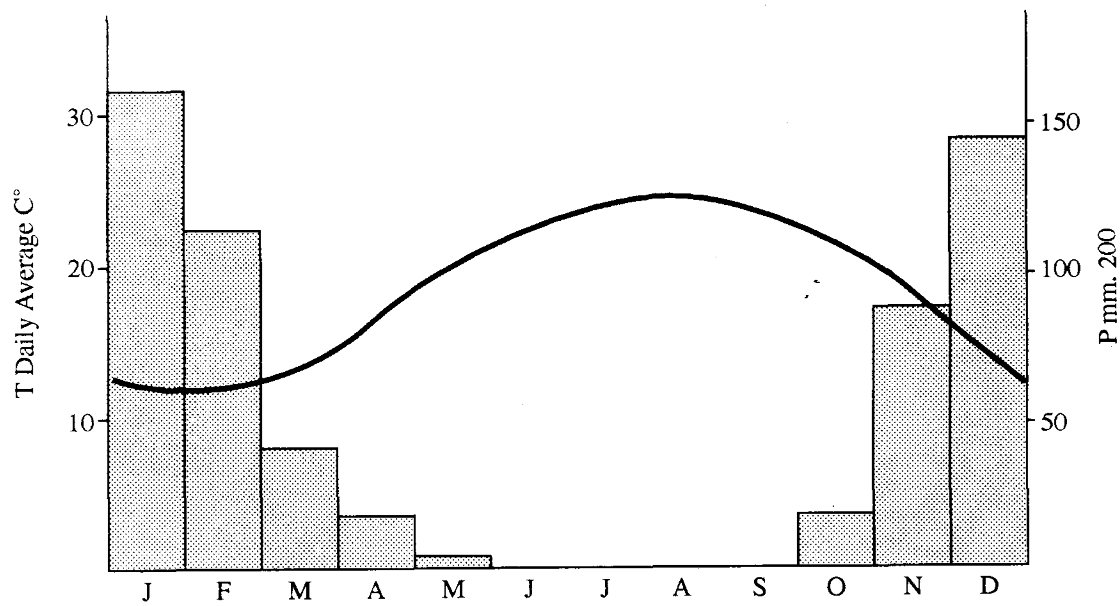


Fig. 13. Mount Carmel climatograph (Data: Israel Meteorological Services).

Chapter 3

USE OF THE CAVE IN THE 20TH CENTURY

Although not directly related to the Natufian remains at el-Wad, the following discussions may prove important for the understanding of cave-use in general and as a background for future research at the site. Significantly, our finds, together with previous observations regarding the el-Wad cultural sequence (see below, Chapter 7, "Natufian Use of the Site"), highlight the potential of the site for the recovery of later prehistoric remains, i.e., Neolithic and Chalcolithic.

El-Wad Cave seems to have been used repeatedly from prehistoric to very recent times. Following the rich Natufian assemblages, with the prominent Early Natufian, the finds indicate a scarce Neolithic-Chalcolithic occurrence, with evidence augmenting through time (see also below, Appendix I). Ceramics reveal human presence in the cave during the Bronze Age, Iron Age, and Hellenistic and Roman periods. A Greek terra-cotta figurine of Aphrodite was unearthed by Garrod, "near the entrance to the long corridor" (Garrod and Bate, 1937:29). The goddess stands on a rough pedestal, with one arm resting on an Ionic column and the other (now missing) raised above her head (also missing), and is dated to the late 4th or 3rd century BC (Iliffe, 1933). The cave's Byzantine habitation is by far the most important, as evidenced by the abundant potsherds, including many lamps. Most probably the hewed door, the stone wall at the entrance to the cave (Figs. 5,14), and the floor levelling in Chamber I, intended to "...profiter autant que possible de la protection du mur qui fermait l'entrée" (Garrod 1930b:156) and in Chamber III (see below, Chapter 5), all belong to this period, as do the long walls that ran along the lower part of the terrace and across the wadi (Fig. 15). This endeavour is probably Byzantine and part of the vast construction activity that went on in the area during that period, often associated with agricultural, wine and oil industries (Lahav and Farkash, 1986). The water cistern, basins and wine pressing installations in front of the cave and towards the south, recorded by Mülinen (1908), may also have belonged to the same period. However, it remains unclear what the exact use may have been of the cave itself throughout the years, i.e., whether it served domestic purposes, the penning of herds, or other activities.

Fig. 14. General view of the Nahal Me'arot caves at the beginning of the first excavations, 1929. Left: el-Wad; centre: Jamal; right: Tabun. Skhul, located further left, is not visible.

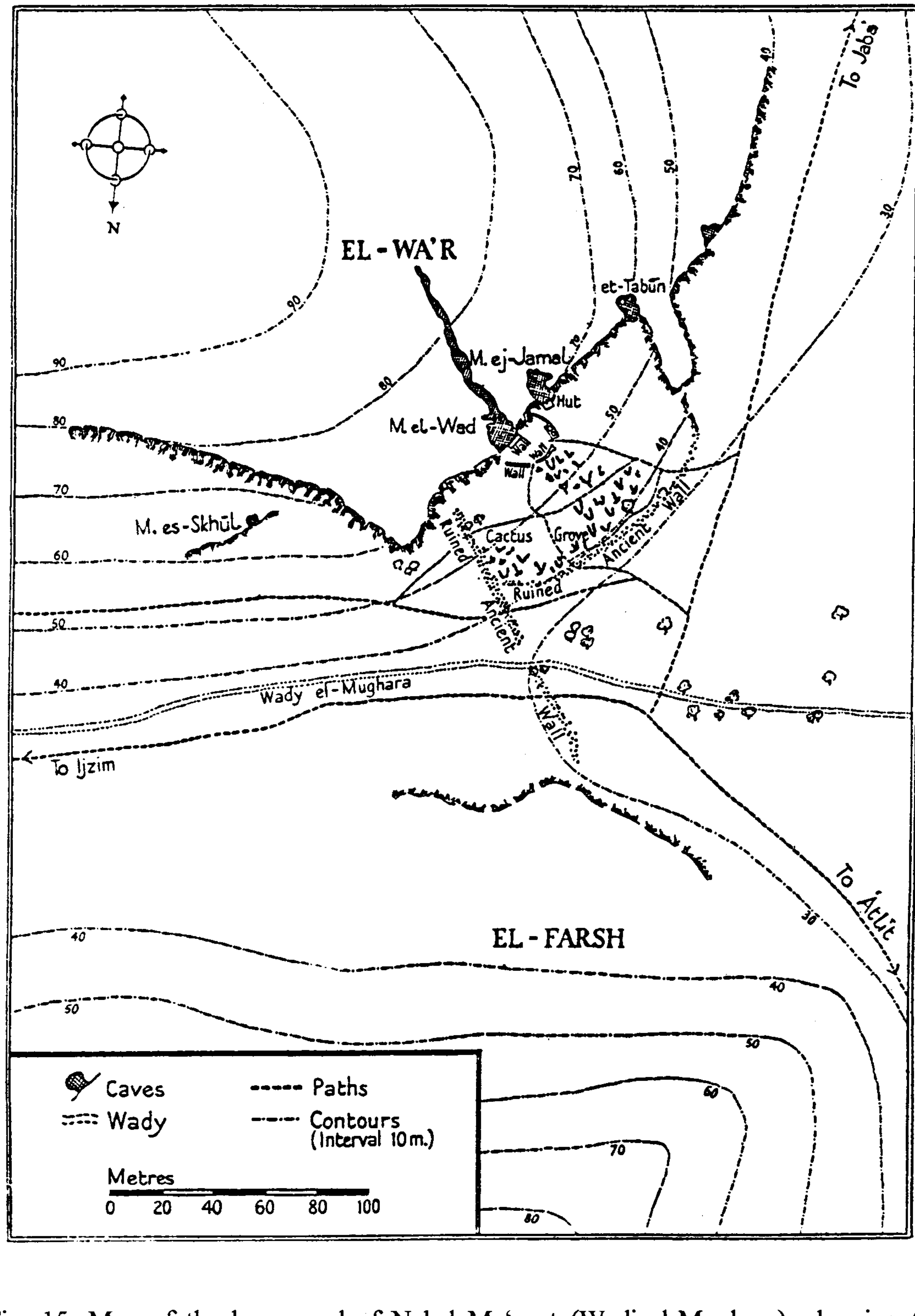


Fig. 15. Map of the lower end of Nahal Me'arot (Wadi el-Mughara), showing the position of the caves.

Clues regarding the likely uses of the cave in the past can be gleaned from data concerning the use that has been made of it in recent times. Such information can be gathered from two sources: former investigations, and interviews with people who have actually used the cave themselves. Since the sediments of the outer chambers of the cave and the higher terrace were thoroughly excavated by Garrod, no archaeological or zooarchaeological studies could be performed. There is little doubt that such studies present valuable research avenues for a comprehensive and reliable reconstruction of the mode of exploitation and subsistence strategies the inhabitants of such sites had recourse to (see, e.g., Arter, 1990). Equally unfortunate, it was impossible to conduct any sedimentological analyses, which have proved to be highly reliable in the identification of former stock-penning in sites (Brochier et al., 1992).

Former Investigations

Three types of evidence are provided by former investigations: studies on cave climate, data regarding the use of other caves in the area, and reports and indications for the use of el-Wad itself.

Cave Climate

Studies of cave climate are aimed at demonstrating the advantages of habitation in caves (Legge, 1972a; Ronen, 1984). In the past, no temperature and humidity measurements were ever carried out systematically in el-Wad, and recent development of the site for the purpose of tourism prevents detailed studies of the cave's microclimatic conditions from being performed today. Yet, the climatizing effect of the cave was acknowledged easily during our excavations in the cave in autumn (September, 1988) as well as in winter (February-March, 1989).

The — admittedly subjective — feeling of comfort the cave offers has been expressed more objectively by the results of microclimatic studies in two other Mount Carmel caves: Sefunim (Ronen, 1984) and Kebara (Legge, 1972a). In the first, measurements of temperature and humidity were taken in March 1969, in 4 measuring points extending from outside the cave to its rear part. The readings were taken over a period of 10 days, three times a day. The results (Fig. 16) indicate clearly that both temperature and humidity vary little across the entire length of the cave, but differ from the outside measurements, especially in extreme conditions (for example on March 17 and 25-26). Measurements over 24 hours in Kebara, compared with an open air site in the Haifa area (Fig. 17), indicate clearly that climatic conditions in the cave remained stable throughout the day. Regrettably, though we do have evidence of winter use of the caves (e.g., Mülinen, 1908, for Sefunim Cave), no winter measurements have been reported from Israeli sites, but here Greek sites can help us out where the climatizing properties of caves and rockshelters were demonstrated clearly (Legge, 1972a; see also Wickens, 1986 for a discussion of cave-climate properties).

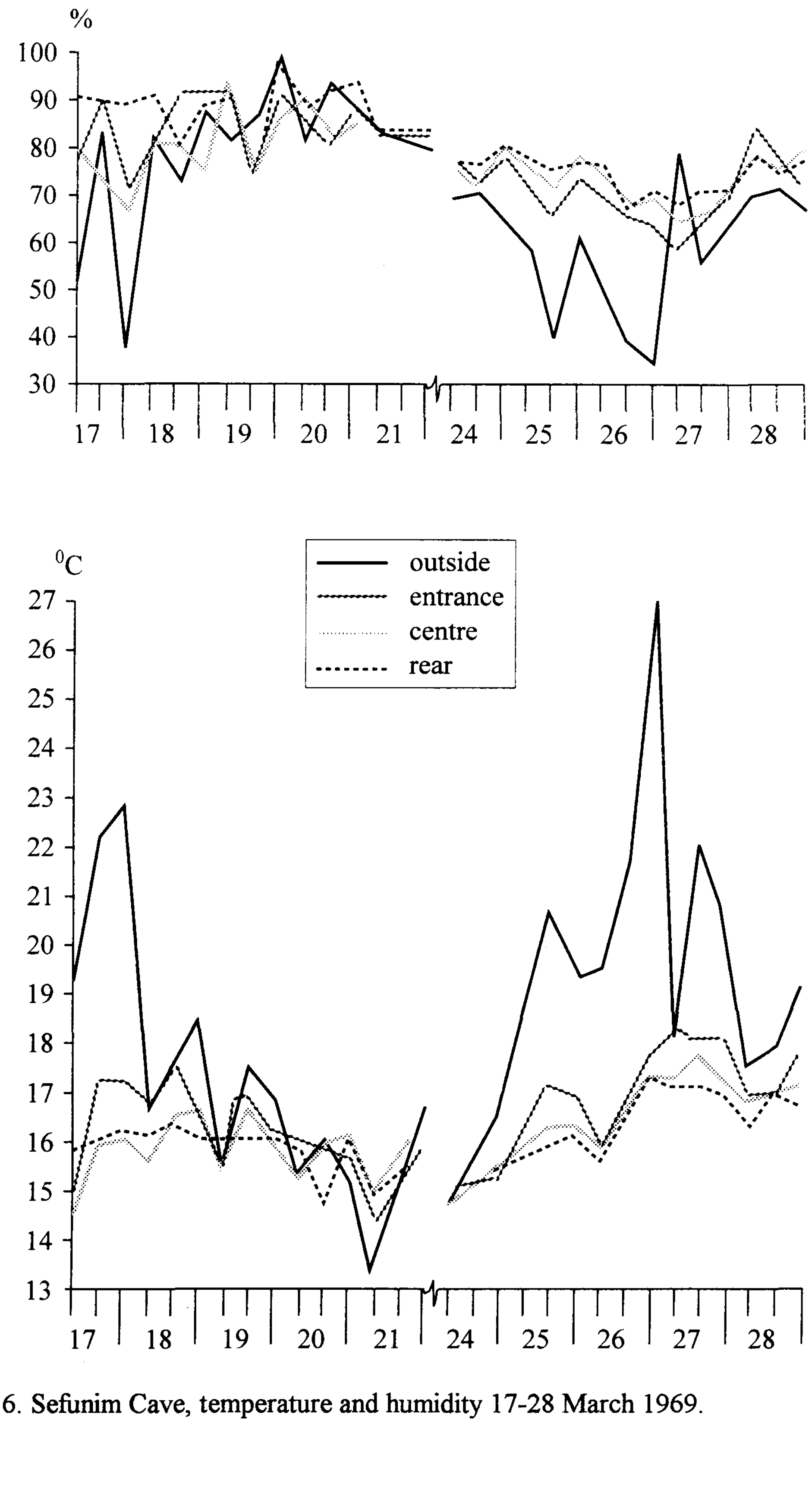


Fig. 16. Sefunim Cave, temperature and humidity 17-28 March 1969.

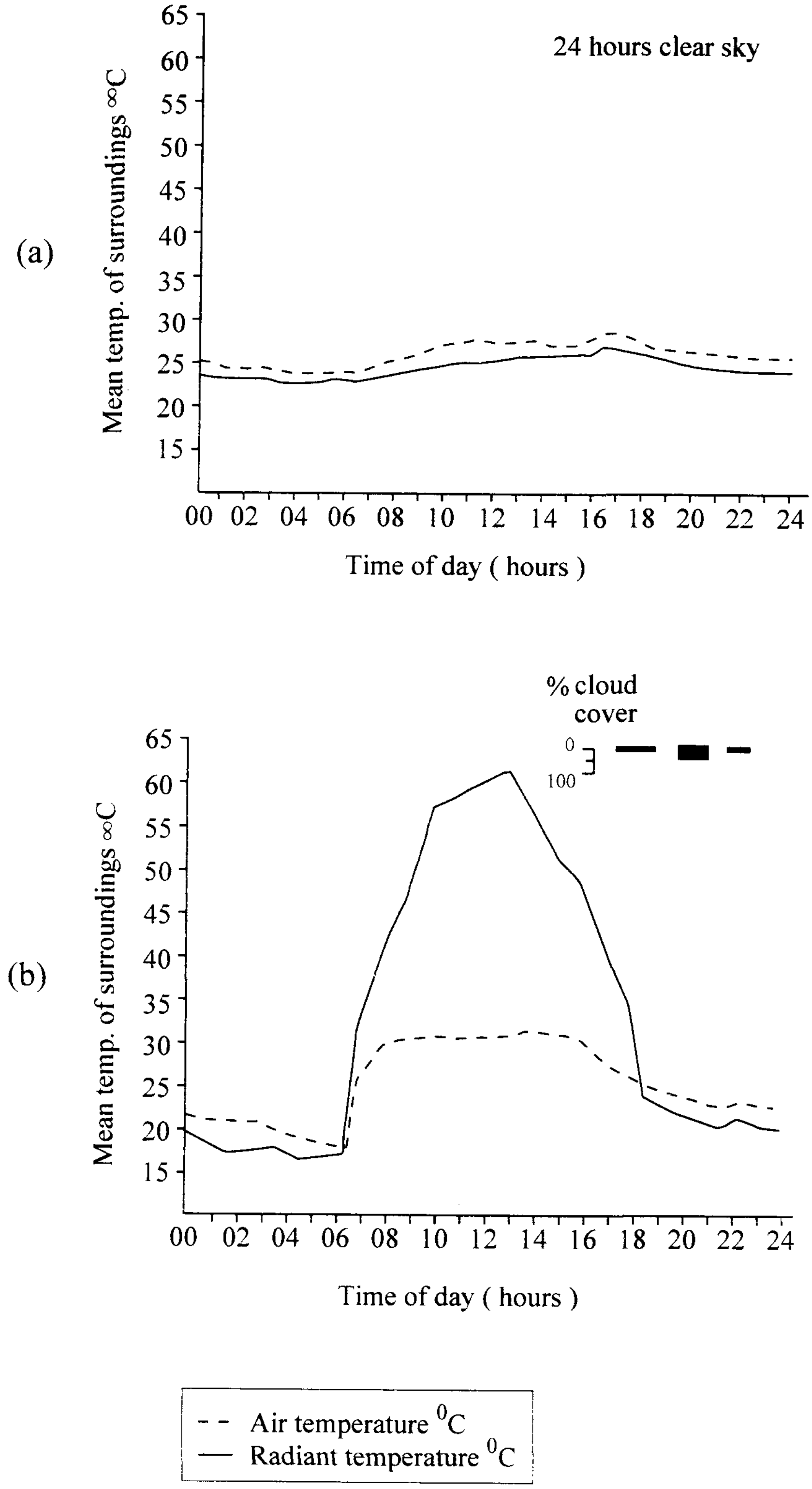


Fig. 17. (a) Radiant and air temperatures in Kebarah Cave, at rear (summer); (b) Radiant and air temperatures in the open air at sea level near Haifa (summer).

Temperature measurements were conducted in el-Wad on March 26, 1995, 10.30am, during the last day of the latest cold spell of the year. The results indicate but minor variations along the NW/SE axis of the cave, from the platform area immediately outside the cave to Chamber V at its rear (Fig. 18). However, unlike the area outside the cave, the inner chambers were clearly protected from the joint chilling effect of both low temperatures and strong winds, resulting in a markedly enhanced feeling of comfort inside the cave.

Measurements of temperature and relative humidity were carried out in August 29, 1995, at 13.30pm. Average values are given in Fig. 18. A cooling effect was felt immediately as one entered the shade of Chamber I. An even more obvious change in temperature was registered with the passage to the inner part of the cave, starting from Chamber II. However, because there was a light breeze at the entrance to the cave and the rear part of the cave was always very humid, the lower temperatures in the latter did little to give one a greater feeling of comfort.

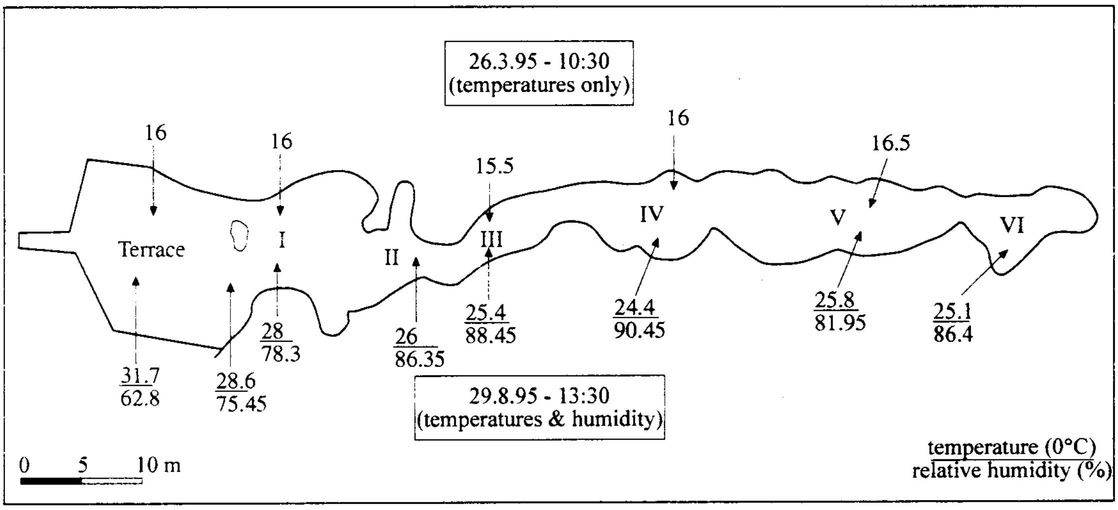


Fig. 18. Temperature (spring and summer) and humidity (summer) measurements in el-Wad.

That the cave modifies the effects of the external environment is due to the heat capacity of the enormous amounts of rock surrounding it (Legge, 1972a). These large rock masses are not subject to the short-term, daily fluctuations in temperature, and even seasonal differences in temperature are modified to a considerable degree. Legge concluded that, as long as the cave is not subjected to any excessive air exchange with the outside, the interior temperature will be higher in the winter and lower in the summer than that prevailing outside. In el-Wad, however, no meaningful differences were encountered in the low temperatures measurements, while in summer significant differences were detected in humidity as well as in temperature (Fig. 18).

The Use of Other Caves in the Area

To date no systematic studies concerning the use of caves in the Mount Carmel area have been conducted. Some indication regarding the mode of the exploitation of the Nahal Oren area by its Arab pastoral population is given by Vita-Finzi and Higgs (1970) and Higgs and Vita-Finzi (1972). A modern subsistence pattern, projected upon a suggested catchment area for the Nahal Oren cave (Fig. 19), while taking into account some distorting factors such as topography, availability of water and intrusion of neighbouring territories (idem), allows for some insight into the range and nature of exploitation and its seasonal distribution.

Nahal Oren's 5km-radius catchment area is divided into five types of terrain, according to their potential uses (Fig. 19): arable (8%), good grazing/potentially arable (7%), rough grazing (55%), seasonal marshes (27%) and negligible areas of sand dunes (3%). Whilst arable lands were probably used by the local villagers, grazing areas were exploited by goat and cattle herds based in the Nahal Oren caves. Some higher elevation grazing occurred in winter, mainly along the bed of the wadi and its tributary valleys. In summer, goats made use of the good grazing areas along the foothills, and goat as well as cattle herds were set out to graze on the seasonal green pastures in the dried-out marsh areas. Both goat and cattle herds were apparently kept in a summer corral near the Oren Cave. Altogether, summer and winter potential grazing lands cover between 85-92% of the catchment area discussed (more than a third of it good grazing lands). A rather similar distribution of potential land uses within the el-Wad catchment area (Fig. 20) would suggest a comparable pattern of exploitation.

Evidence of Recent Activities at el-Wad

Starting with the initial documentation of the cave one finds various walls, structures and secondary features mentioned, both within the cave and on the terrace. All writers report the wall of big limestone blocks across the cave's entrance (Fig. 5). Garrod describes in detail the window to the NE of the entrance, which had been artificially enlarged to make a doorway, "presumably at the time when the wall was built" (Garrod and Bate, 1937:6), with a well-cut level threshold and a door-socket on the SW side. In addition, Graf von Müllinen (Müllinen, 1908:281) noticed "the foundations of an inner gate, made of well hewn sandstone", in the early 20th-century entrance to the cave, as well as several partly built fire-places. The el-Wad terrace was enclosed by a rough stone wall of recent date (Figs. 15, 21), "built by the goatherds who kept their flocks in the cave" (Garrod and Bate, 1937:6). A similar enclosure wall, together with a small hut, existed at the entrance to the adjacent Jamal Cave (Figs. 14, 15).

El-Wad was highly regarded by the local shepherds. "The reason for this [preference] lies in the belief that she-goats here wintered produce twins and never suffer from abortion" (Director of Antiquity, 1928:7). Although, according to the same source (1928:6-7), "none of them use, or will willingly enter, the tunnel (which is supposed to be without end) there is considerable competition for the use of the cave itself for wintering their flocks of goats". This seems to accord well with his

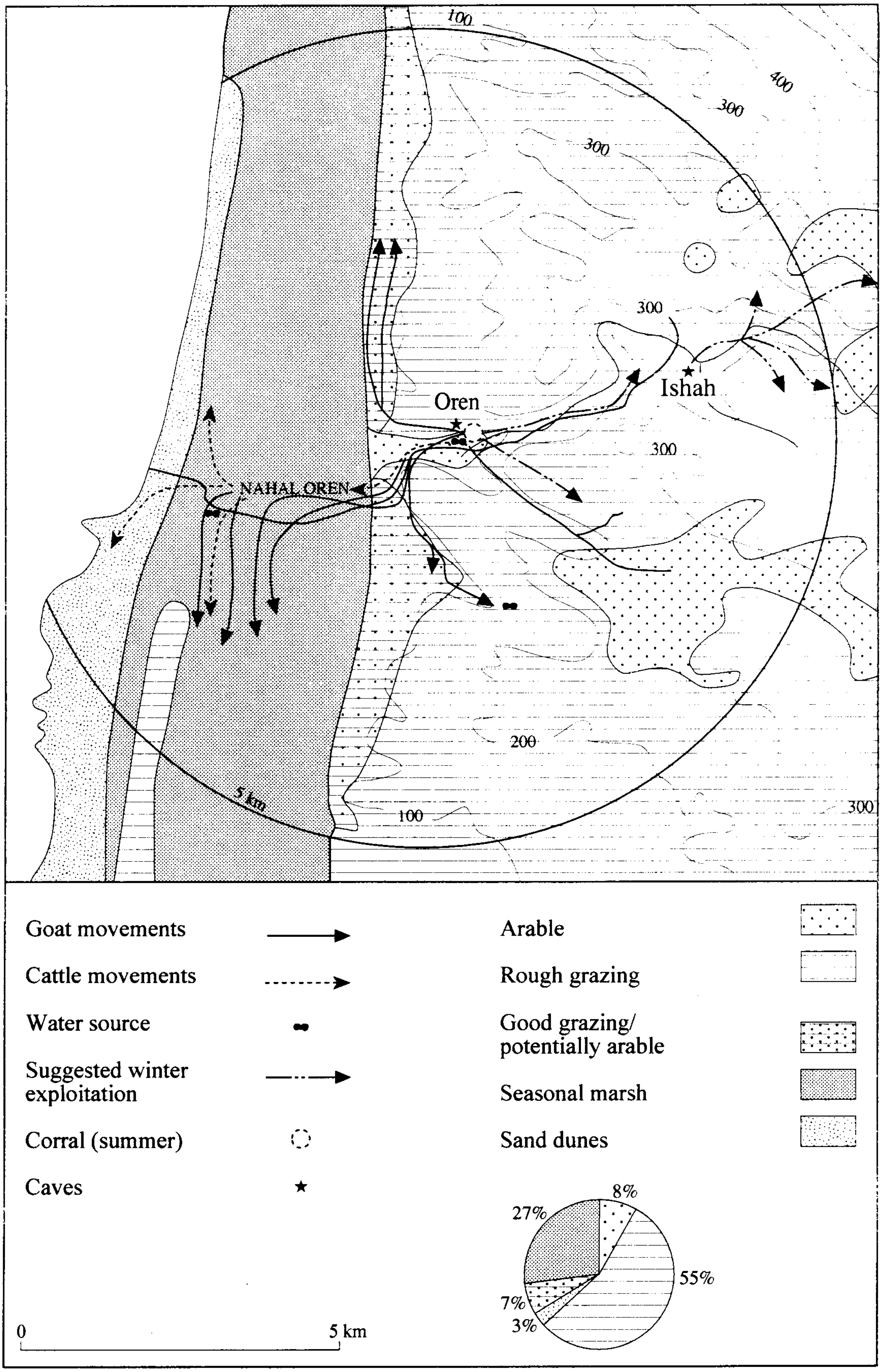


Fig. 19. Territorial analysis of Nahal Oren Cave, within a radius of 5 km, with the modern Arab, sedentary, pastoral exploitation.

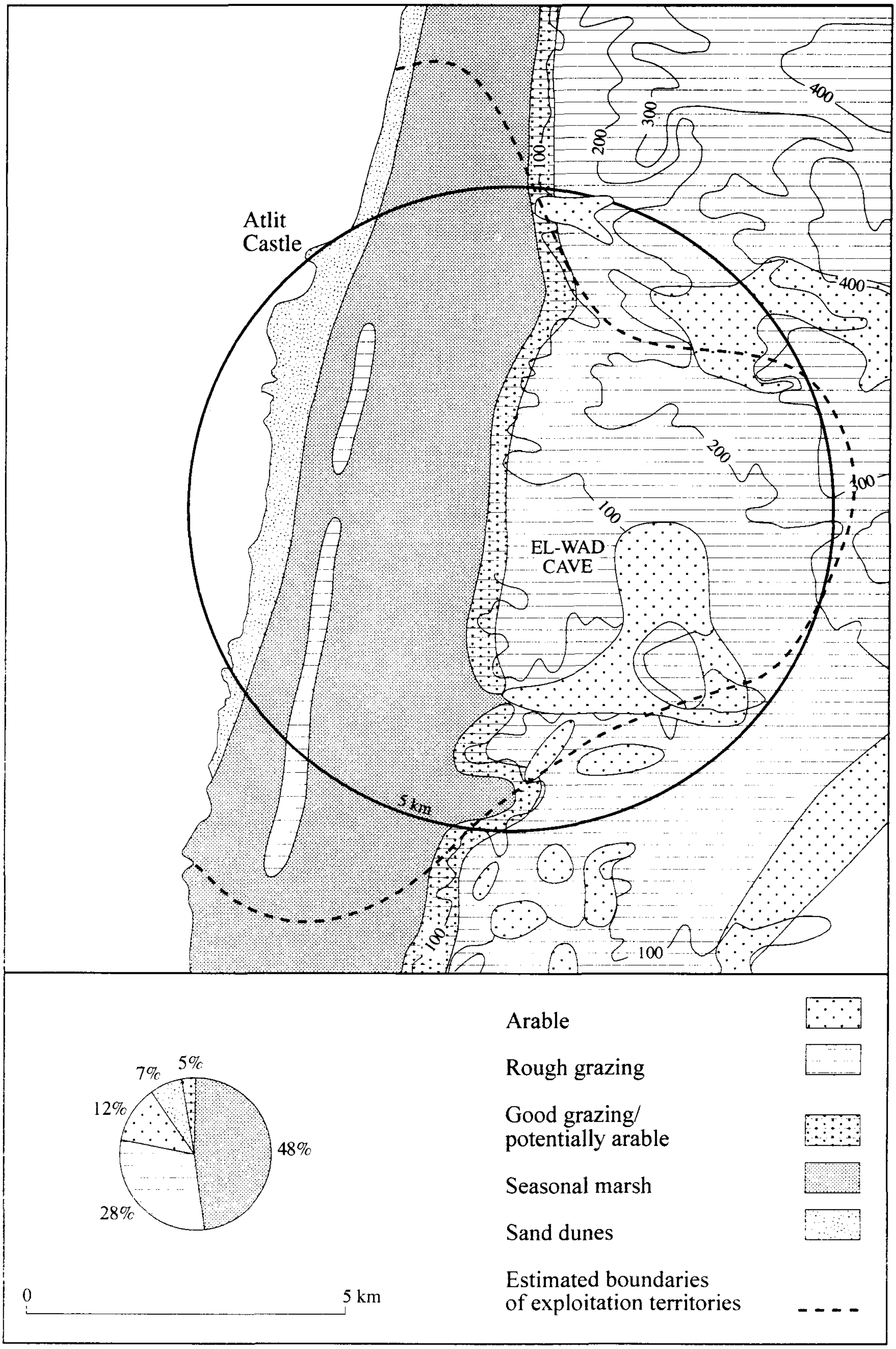


Fig. 20. Territorial analysis of el-Wad Cave, within a radius of 5 km.

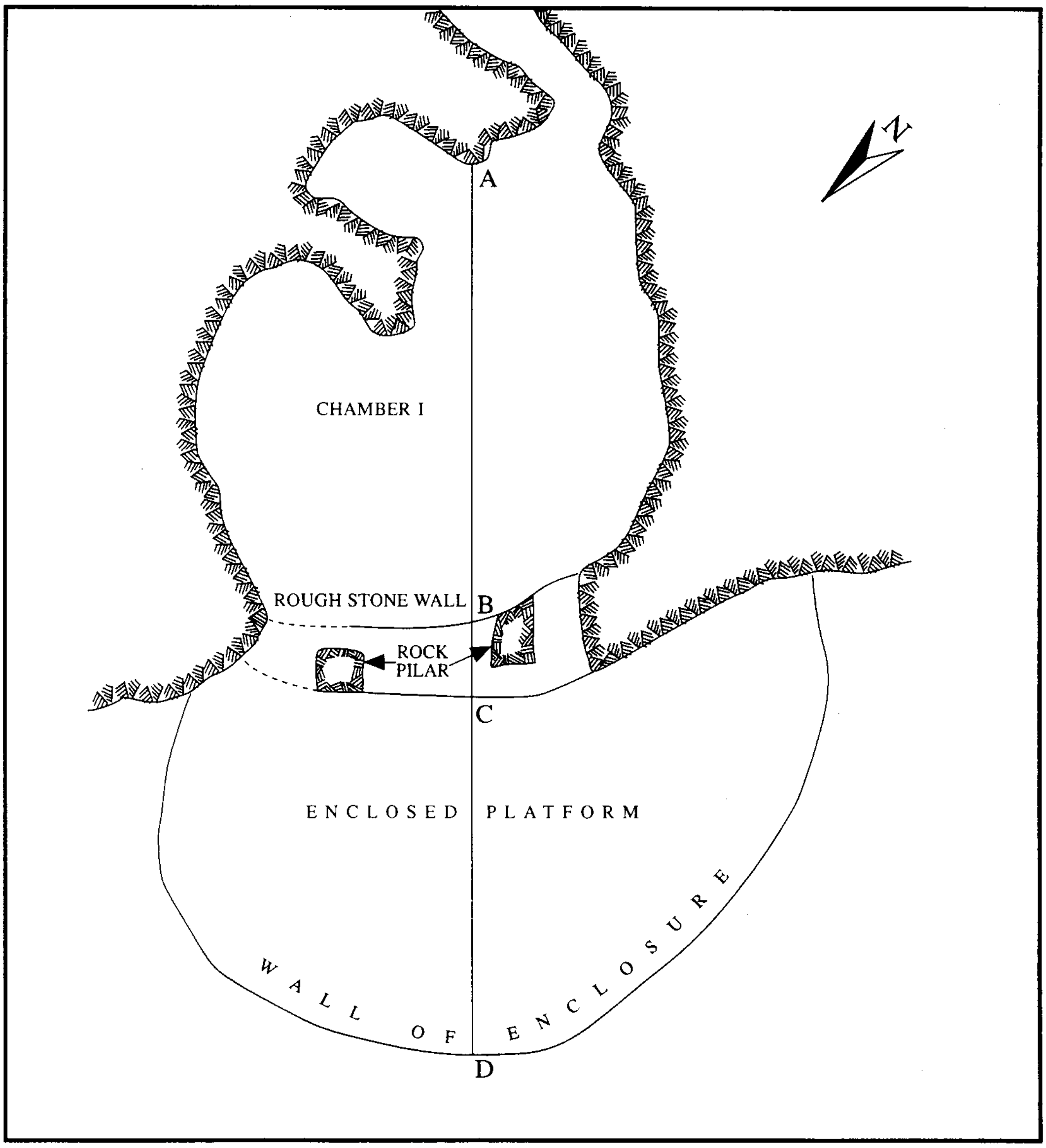


Fig. 21. Chamber I of el-Wad Cave and the enclosed terrace in front of it. Lambert's trenches 1-3 were set along the A-D line.

observation that "[t]he floor of the cave and of the tunnel is formed of stones and boulders. Among and, to some extent, over these, are, in the tunnel, bat-droppings and, in the large chamber, goat as well as bat droppings" (Director of Antiquities, 1928: 5).

Interviews

Interviewing was done by Salman Abu Rukun, over a period of a decade (1983-1993). Interviewed were seven men old enough to have been familiar with animal husbandry, herding and cave use. All of them had dwelled in caves with their herds. In some cases their ancestors had specifically used the Nahal Me'arot caves for wintering their goat herds. At the time of the interviews the men were between 61 and 95 years old. The shepherds came originally from Ijzim (Kerem Ha-Maharal), Isfiya and Daliyat al-Carmel (Fig. 22).

The questions posed focused on several major issues relating to the various aspects of the use of caves namely: suitability, ownership rules, seasonality, family participation, pasture and herd mobility. The emerging picture is summarized below.

Choice of Caves

The preferred cave is spacious, dry, located in the Lower Carmel, and with good winter pastures nearby. Good accessibility by donkeys, horses and camels is considered an important factor. The Lower Carmel, which is composed of limestone and dolomites, is bound with large, karstic caves. These are less endangered by rock falls than the caves in the upper, more chalky mountain. Their location in lower altitudes renders them warmer than caves located further up on the mountains.

A large cave made it possible to include the whole herd. Such a cave provided protection from the rains and the cold, as well as from predators. The entrance to the cave was fenced off with stones, topped with thorny branches of *Calicotome spinosa*, *Genista fasselata* and *Rhamnus palaestinus*. In many caves fences made of thorny bushes sufficed. These fences prevented the animals from dispersing and served the purpose of keeping wolves, jackals, mongooses, etc., out. A similar practice has been documented for Cretan, Greek and Sicilian stock-penning caves, for example (Faure, 1964; Wickens, 1986; Brochier et al., 1992).

Since the number of suitable caves was limited, shepherds eager to winter their flocks of goats would compete for their use. This was not necessarily won on a "first come first win" basis. Rather, aggressive fights developed on many occasions. Some territoriality seems to have existed, based on a shepherd's village of origin. Thus, the caves in Nahal Haruvim (formally known as Wadi el-Nahal), one of the up-stream tributaries of Nahal Me'arot, were used exclusively by shepherds from Ijzim, while el-Wad and the adjacent caves were used by shepherds from Jaba and El-Mazar (Fig. 22). Competition for the privilege of having their flocks winter in the cave was even stiffer because, as already mentioned, people believed it would keep the nanny-goats from miscarrying and induce them to bear twins.

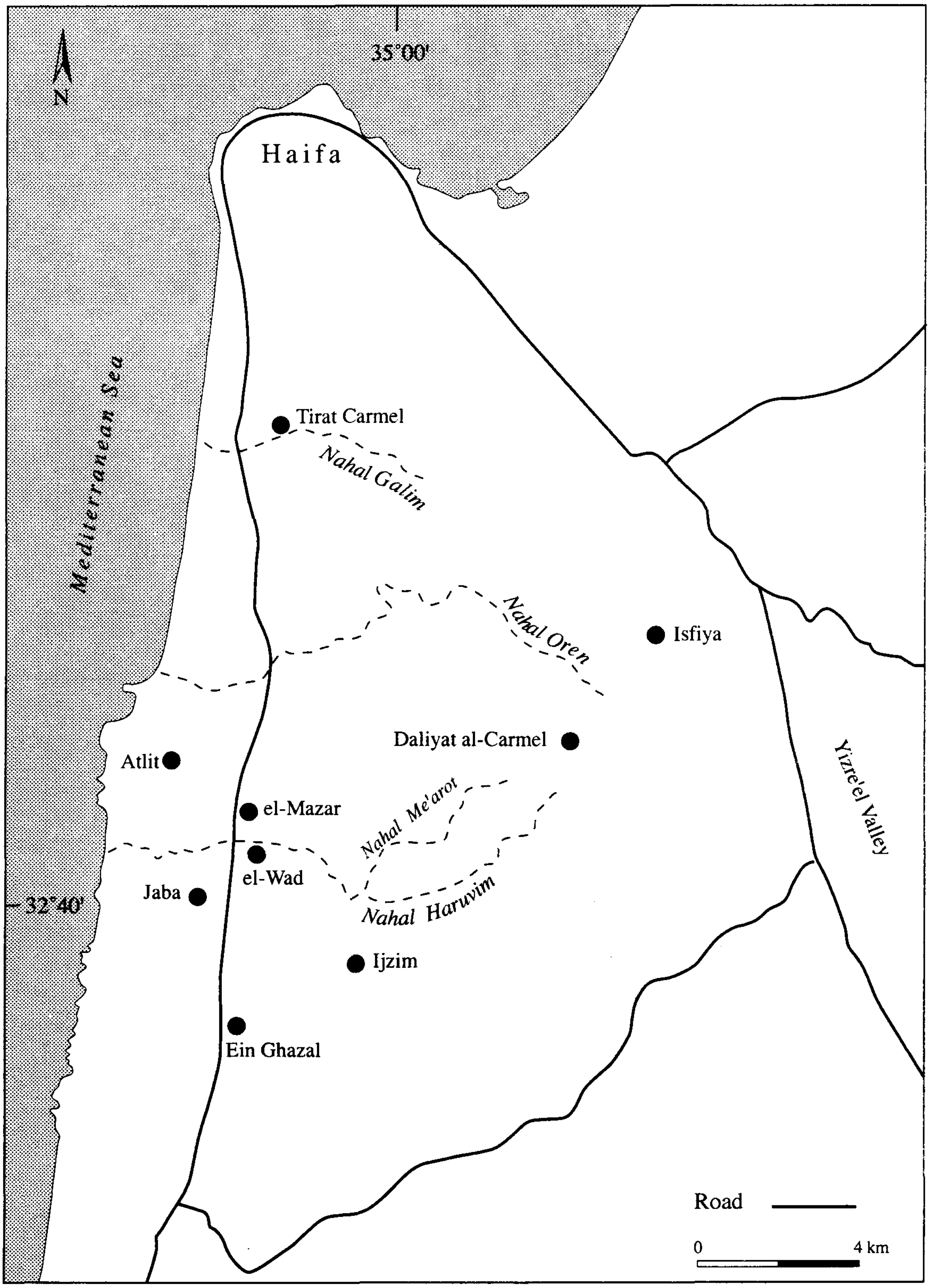


Fig. 22. Location map of villages of origin of the herdsmen.

Seasonal Occupation

The goat herds entered the caves in late October – beginning of November, i.e., soon after the first rains. Any first strike of sudden cold weather, at the end of autumn, would be critical for pregnant goats as it resulted in numerous miscarriages. The most prosperous herds were those who managed to stay in caves throughout the winter: the goats were healthier and the birth season passed without miscarriages. There was a common belief that successful herding depended on where the goats winter "and the best are the cave goats".

Usually the herds left the caves again in April. Only in rare cases did they stay in caves throughout the summer. In one case, in the Isah caves in Nahal Oren (Figs. 19, 23), such permanent habitation was made possible by water springs in the immediate vicinity. A stone building was constructed in front of the caves (Fig. 23) together with a stone enclosure at or near the cave entrance, for the summering of the herds. A similar situation existed in the Oren Cave, as late as the 1980s, whereby the goats' herd wintered in the cave itself and in the summer stayed within an enclosure, built near a hut, not far from the wadi bed (a water source). In both cases summer grazing was ensured. The herds grazed on stubble and on annuals that grow in the lowlands during summer. These summer pastures developed in areas which were covered with shallow waters in winter, creating seasonal marshes. The last Nahal Oren shepherd had two wives, one of whom stayed in a building constructed near the cave's entrance, while the other lived in the hut near the wadi bed. The stone enclosure on the high terrace of el-Wad (Figs. 15, 21) may indicate a summer stay in this cave too. In general, winter (between November and March) is the common stock-penning season in many caves within the western Mediterranean region as well (Brochier et al., 1992). Naturally, the dependency of herds on summer grazing of barley and wheat stubble is more crucial in the less favourable, more arid zones (e.g., Levy, 1983).

The Shepherd and his Family

There seems to have been no clear rule as to whether the shepherd was joined by his family. When the goatherd entered the cave with his goats only, he would built for himself a wooden cot, on an elevated spot, where he would be protected from winds and rains, but would also have a good view over the entrance to the cave. A fire-place was built near the sleeping area, and the family supplied food and clean clothing.

In cases when the goatherd was joined by his family a family tent was built near or at the entrance to the cave. A "tabun" (a traditional stone oven) or a "saaj" (a convex baking tin) was constructed, for bread baking, cooking, washing and heating. Small stone huts were occasionally built at the entrance to the cave (Fig. 14), for the storage of various working tools such as milking equipment and cooking accessories. Other small stone huts were built near the caves, for the family hens, often strengthened with an extra fence made of either barbed wire or spiky plants, for protection against wolves, jackals and mongooses.

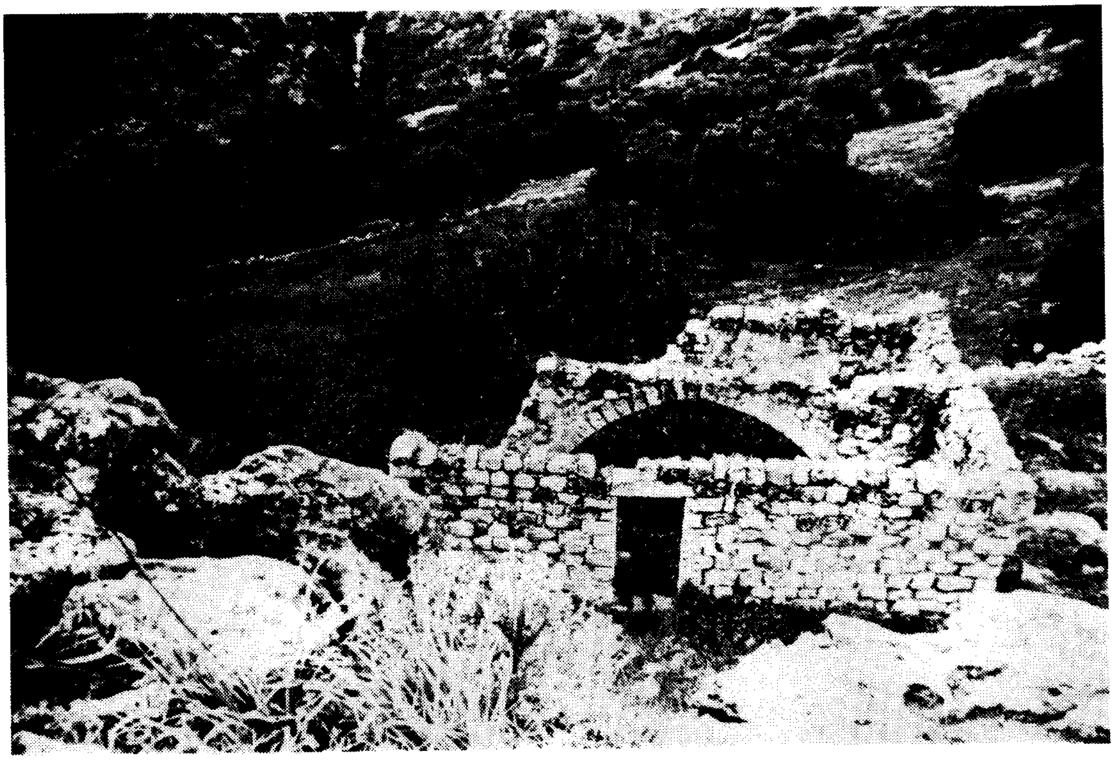


Fig. 23. Permanent stone constructions at the entrance to Isah Cave, Mount Carmel, towards the SW (above), towards the NW (below).

Fodder and Food

In winter, the herds made use of the maquis areas on the mountain, and fed on *Quercus calliprinos*, *Rhamnus* sp. and *Phyillyrea latifolia* soft leaves, and on acorns. Herds would move uphill, up to 5km from the site. In stormy days or during snow fall the goatherds gathered tree branches and brought them into the cave. Carob (*Ceratonia siliqua*) fruits were also stored in sacs to serve as staple food during the harsh winter days.

The winter of 1950 was remarkably harsh. Heavy snows prevented the shepherds from bringing food into the caves. Cold and starvation led to many deaths amongst the goats and kids, and there were many miscarriages.

Dairy products — milk, yoghurt, cheese and butter — were the main foods consumed by the shepherd and his family. When the goatherd was joined by his family, the menu was enriched with eggs and chickens, and with many gathered wild plants, e.g., *Cichorium pumilum*, *Centaurea* sp., *Gundelia tournefortii*, *Scolymus* sp., *Eryngium creticum*, *Foeniculum vulgare*, *Rumex* sp., *Malva* sp., *Reta vulgaris* and *Majorana syriaca*.

Dried dates and figs were a luxury. When alone in the cave, the men were equipped with canned foods, mainly sardines. When occasionally an injured goat would be slaughtered, the other men from the neighbouring caves were invited to come and take part in the festive meal, where sitting around the fire place they would also be given a drink of hot herbal tea, spiced with *Salvia fruticosa*, *Micromeria fruticosa* and *Satureja thymbra*.

Waste was thrown out of the cave, near the cave's entrance. Waste that could not be recycled, including empty tins and core horns, was buried near the fireplace. Such tins, some with chicken bones still inside, were unearthed in the large pit at Jamal Cave (Weinstein-Evron and Tsatskin, 1994), which was filled with goat droppings, burnt branches, potsherds, metal nails, and broken Marseilles tiles (the latter were typically used by the Jewish settlers in the area at the turn of the 19th century and the beginning of the 20th [Ben-Artzi, 1988]). Sediments from earlier, historic or late prehistoric, periods were not preserved in the cave, the archaeological sequence of which includes only Lower Palaeolithic and Middle Palaeolithic material (Weinstein-Evron and Tsatskin, 1994).

Milk Products

During the winter birth season, most of the goat milk was consumed by the newly born kids. Only in early spring, when the weaned kids were separated from their mothers, was the extra milk used for the production of cheese and butter, to be distributed and sold in the Haifa market. The milk products were carried to the markets on donkeys or camels. More than 100 camels were reported to have come in one season from the village of Ijzim alone.

The Use of Small Caves

In large enough caves, the separation between mother-goats and kids could be achieved through the construction of a fence, built of stones and covered with thistles, within the cave. Where this was not possible, the kids were transferred to another, smaller cave, the entrance of which was enclosed with a stone fence, also set off with spiky branches (*Calicotome spinosa*, *Genista fasselata* and *Rhamnus palaestinus*). Significantly, signs of recent use by goat herds were also found in a small cave in the cliff north of Nahal Me'arot (Fig. 24). Similar procedures regarding herd management were observed in the Sicilian caves (Brochier et al., 1992).

Good Pasture, Seasonality and Ranges of Herd Mobility

When it comes to ensuring grazing, animals' well-being and successful birth-giving, diversified pasture is the most adequate. Such grazing includes trees, for the leaves and fruits they provide, as well as annuals, mainly grasses and legumes. This kind of heterogeneity is found in the lower areas where the mountain meets the coastal plain (Figs. 19, 20).

Winter grazing would mainly take place not in the plain but on the mountain, where the goats could enjoy tree leaves and fruits. The herds of the lower caves, such as el-Wad, also had access to the good grazing grounds that stretched along the foothills, areas free of winter ponds and marshes but with many trees as well as annuals. The bare (Figs. 24, 25), muddy coastal plain was largely unfit for winter grazing while the mountain's arable lands were used by the villagers to grow their crops. Carob fruits, barley grains, straw and stubble were also stored for harsh winter days, when the herds were prevented from leaving the cave.

Summer grazing depended largely on cereal stubble and vegetable leaves left behind in the arable lands after the harvesting of the crops. Important grazing grounds were the muddy areas of the coastal plain which dried up in spring — the late sprouting of annuals here made for green pastures throughout the early summer. When necessary, these were enriched with tree branches and leaves the shepherds brought from the nearby maquis. The available foods enable the herds to stay in the lowlands throughout the summer. The el-Mazar, Jaba and Ein Ghazal herds roamed the coastal plain, from the Atlit area to Tirat Carmel, some 10km north of el-Wad. The Isfiya and Daliyat al-Carmel herds headed towards the Yizre'el (Escadrelon) Valley, taking advantage of the grazing areas on the north-eastern foothills. Significantly, the arable lands around the villages provided enough summer food for several herds who did not have to start roaming but could stay uplands throughout the summer too.

Interesting furthermore is that the interviewed shepherds claimed their habitual range of pastoral exploitation was some 5km from the cave, largely similar to the values suggested by Higgs and Vita Finzi (1972). Rough topographical settings, dense maquis and harsh weather conditions explained why they did not go beyond this range.

Fig. 24. A view of the Carmel Caves from the coastal plain, in 1929; the western cliff of Mount Carmel is dissected by the Valley of the Caves (Nahal Me'arot). An arrow marks the small cave north of el-Wad in which there are still signs of herdsmen use.

Fig. 25. The bare coastal plain in 1934, a view to the north. Garrod's excavations camp is at the foreground. Note the road that runs from the west towards the SE; the arrow marks a camel caravan.

In summary, el-Wad was undoubtedly one of the caves in the area that offered the best advantages. The largest of the Nahal Me'arot caves, its main use was in winter. That it was well sought after because of the warm wintering shelter it provided is indicated clearly by the nickname it has in Arabic, "el-Hammama", "the warm one". Then, also, almost mystical powers were ascribed to it, since it guaranteed the safety of the herd and there was a strong local belief that it favoured multiplication of the herd. El-Wad is located in an ecotonal setting, between the mountain, wadi and coastal plain, ideal to ensure good pastures throughout the year: winter grazing on the mountain and within the transitional belt between the mountain and the plain; summer grazing in the coastal plain. It is also located within easy reach of smaller caves, necessary when nanny-goats have to be separated from their kids. The cave is accessible from the main roads that lead to the villages of origin and to the markets where the local products could be sold (Fig. 25). Obviously, to avoid the muddy coastal plain in winter, several of the paths leading to the villages in the area passed not far from the cave (Fig. 15).

Chapter 4

GEOPHYSICAL INVESTIGATIONS

Since excavations were renewed at el-Wad in 1988, a number of geophysical investigations have been carried out whose purpose was twofold: to enable a reconstruction of the subsurface topography of the cave and to arrive at an estimate of the depth of the archaeological layers in Chamber III and in those areas of the cave that have not yet been excavated or tested, i.e., Chambers IV and V (in Chamber VI the bedrock is exposed). Two geophysical methods were employed: seismic refraction (Weinstein-Evron et al., 1991) and Ground Penetrating Radar (GPR) (Beck and Weinstein-Evron, 1997), which enabled cross-checking and validation of the data, thus making for more reliable results .

Seismic Refraction

The seismic refraction survey of el-Wad (Weinstein-Evron et al., 1991) consisted of 10 profiles (Fig. 26). Energy source was a 5kg hammer on a metal plate and receivers were 24 geophones with an internal frequency of 10Hz, arranged in 24 channels.

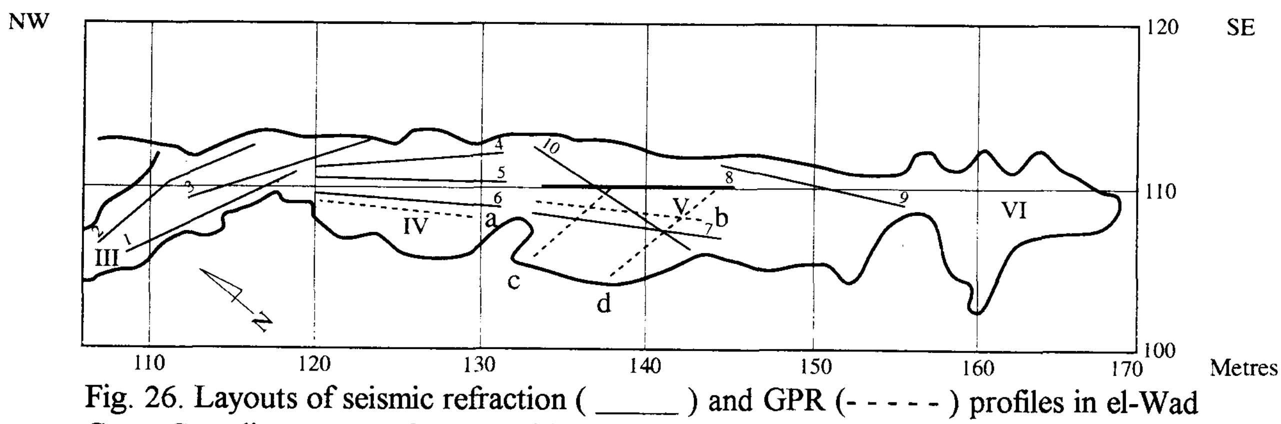


Fig. 26. Layouts of seismic refraction (_____) and GPR (- - - - -) profiles in el-Wad Cave. Coordinates are reference grid in metres.

To achieve high resolution, spacing between the geophones was kept to 0.5m. Shooting was done at both ends of the profile, i.e., where the external geophones were placed, and supplementary shooting was run at split profile configurations, where the energy was released in the centre of the profile.

Data processing was originally carried out according to the GRM method (Palmer, 1980), a procedure which guarantees reliable solutions of complex features, such as irregular configuration of seismic refractors, variable interval velocities or steeply dipping refractors. Reprocessing of the original data, using software introduced by the Institute for Petroleum Research and Geophysics (IPRG; Holon, Israel), and based on the same GRM method used before (Palmer, 1980), was done recently for selected profiles in Chambers IV and V. Both reprocessing and subsequent reinterpretation procedures have led to more reliable and refined results. These newly drawn profiles are dealt with in the following discussions. Introduced into the procedure was some basic input derived from geological and archaeological observations, such as the lithology of the underlying rock unit.

The original seismic refraction survey encountered two separate lithological layers easily distinguishable because of the varying seismic velocities that were obtained for them, the upper layer showing seismic velocities of 500 to 750m/sec, while in the second layer these range from 2140 to an anomalously high 2550m/sec. Even higher seismic velocities, exceeding 3000m/sec, were encountered at the northern edge of the surveyed part of the cave. At this stage it is difficult to determine whether these high velocities are associated with lateral lithological variation in the bedrock or with a sub-outcrop of a deeper geological layer. The slower seismic velocities in all likelihood point to unconsolidated sedimentary fill while the faster ones probably indicate bedrock.

The seismic profiles (Fig. 27) were set to measure the thickness of the upper sediment layer in three segments, corresponding to Chambers III, IV and V. The first segment (Chamber III, profile 1, Fig. 27a) is characterized by steep slopes and numerous outcrops of probable bedrock. The profiles suggest sediment thickness of less than one metre, deepening to the south, and anomalously high seismic velocities in the bedrock. The lack of readings towards the north can be explained by the fact that since this area had been excavated by Garrod only thin relics of lithified breccia were left containing archaeological remains adhered to the exposed bedrock. Moreover, that it would be difficult to interpret this segment was expected because parts of the profiles had been measured along recently excavated areas, which had somewhat distorted the natural configuration of the surface. Because of these problematics we have chosen not to reprocess the data obtained from this segment, and the profile in Fig. 27a is the original one (Weinstein-Evron et al., 1991).

The reprocessing of the second segment of the survey (Chamber IV, spread 4, Fig. 27b) enables the identification of three layers. The upper layer, 0.5m thick, with a velocity of 380m/sec, can be interpreted as consisting of loose material of unconsolidated fill. The second layer, with a seismic velocity of 1050m/sec and thickness varying between 1 to 3m, probably represents a more compacted, unconsolidated fill. At the base of the second layer lies carbonatic bedrock, the third layer, with a velocity of 2550m/sec and an irregular surface, revealing a large pit in the centre of the structure. There is a shallowing of the surface of the bedrock layer toward the interior part of the cave.

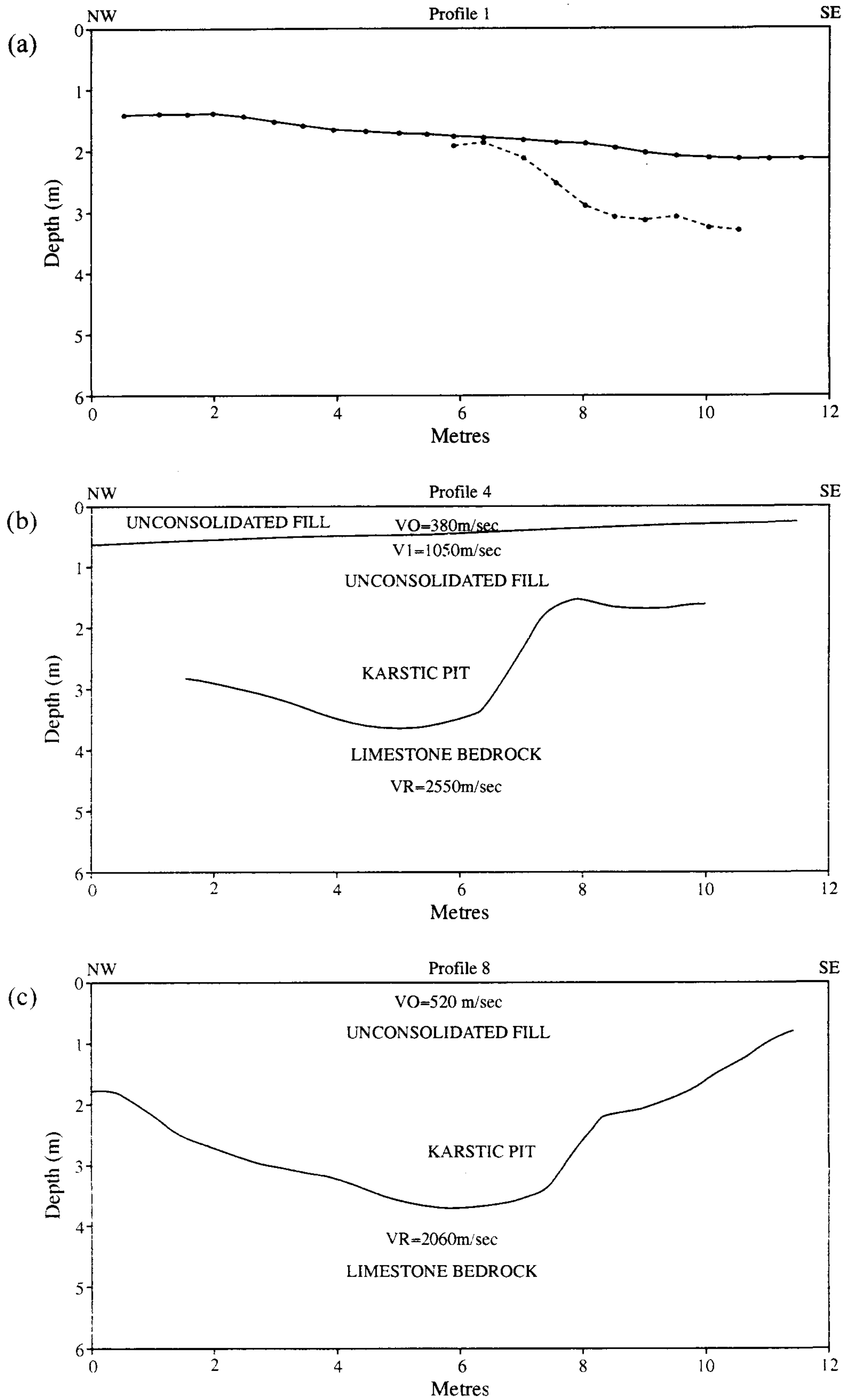


Fig. 27. Interpreted seismic refraction profiles in el-Wad Cave, showing measured depth below surface (see Fig. 26 for location): (a) represents the original interpretation (Weinstein-Evron et al., 1991); (b) and (c) are reprocessed.

The third segment surveyed is Chamber V. Profile 8 (Fig. 27c) represents this part of the corridor, showing two layers. Seismic velocity of the first layer is 520m/sec, interpreted as unconsolidated fill. The underlying bedrock shows a seismic velocity of 2060m/sec. Thickness of the sedimentary fill exceeds three metres and the microtopography of the sediment/rock contact surface seems irregular, with a large pit in the centre of the chamber. At the southern edge of the chamber measurements show a shallowing of the bedrock layer whereas further southwards the Cenomanian bedrock crops out.

Ground Penetrating Radar

In October 1994 a Ground Penetrating Radar (GPR) survey was conducted to interpret the subsurface configuration and to correlate the new findings with the results of the earlier seismic refraction surveys (original and reprocessed).

Profiles were located as close as possible to the seismic refraction profiles in Chambers IV and V (Fig. 26), but because a path (of concrete) had meanwhile been laid down for visitors, not in all cases could the exact same tracks be followed. Because the layout of the GPR profiles was restricted to the open spaces left in the relevant chambers, only Chamber IV and V could be surveyed for GPR analysis.

The GPR method is based on electromagnetic waves that are transmitted into the subsurface through an antenna. The centre frequency used in this case was 500MHz. Much like seismic refraction, electromagnetic waves are reflected from interfaces between layers. Here, however, reflections are caused by differences in the electrical properties of the layers, mainly the dielectric constant — the greater the difference the higher the amplitude of the reflection signal. The attenuation of electromagnetic waves in the subsurface is also a function of the centre antenna frequency and the conductivity of the subsurface materials: the greater the centre frequency and the conductivity the higher the attenuation of the electromagnetic signal.

The GPR survey in el-Wad consisted of four profiles each between 8 and 15m long (Fig. 26). A GSSI-10 system, with antenna frequency of 500MHz, was used. The GPR sections are presented in coloured line scan format (Figs. 28, 29), where low amplitudes are brown-red and high amplitudes are yellow-blue.

The first GPR section (Fig. 28) was carried out in Chamber IV, overlapping seismic refraction spread 6 (Fig. 26) and c. 2-4m south of spread 4. The surface is clearly marked in black-purple at the top of the section. The undulating black marker at a depth of 2-3m below surface indicates the bottom of the unconsolidated fill or the top of the bedrock. The bedrock itself is characterized by high amplitude (blue-purple) signals. As expected from the layout of the geophysical profiles, the first GPR spread (a) accords well with seismic refraction spread 6 (Weinstein-Evron et al., 1991). However, reprocessing of the seismic refraction data could be performed only on spread 4, due to the geometrical parameters of the field acquisition. Thus, this spread is used for comparing the two sets of data. The structure of the subsurface is quite similar to that indicated by the seismic-refraction spread 4 (Fig. 27b), with discrepancies no larger then 0.5-1m. The base of the pit lies at a depth of 2.5-3m, as indicated by the calculated dielectric constant value of $\varepsilon r = 9$.

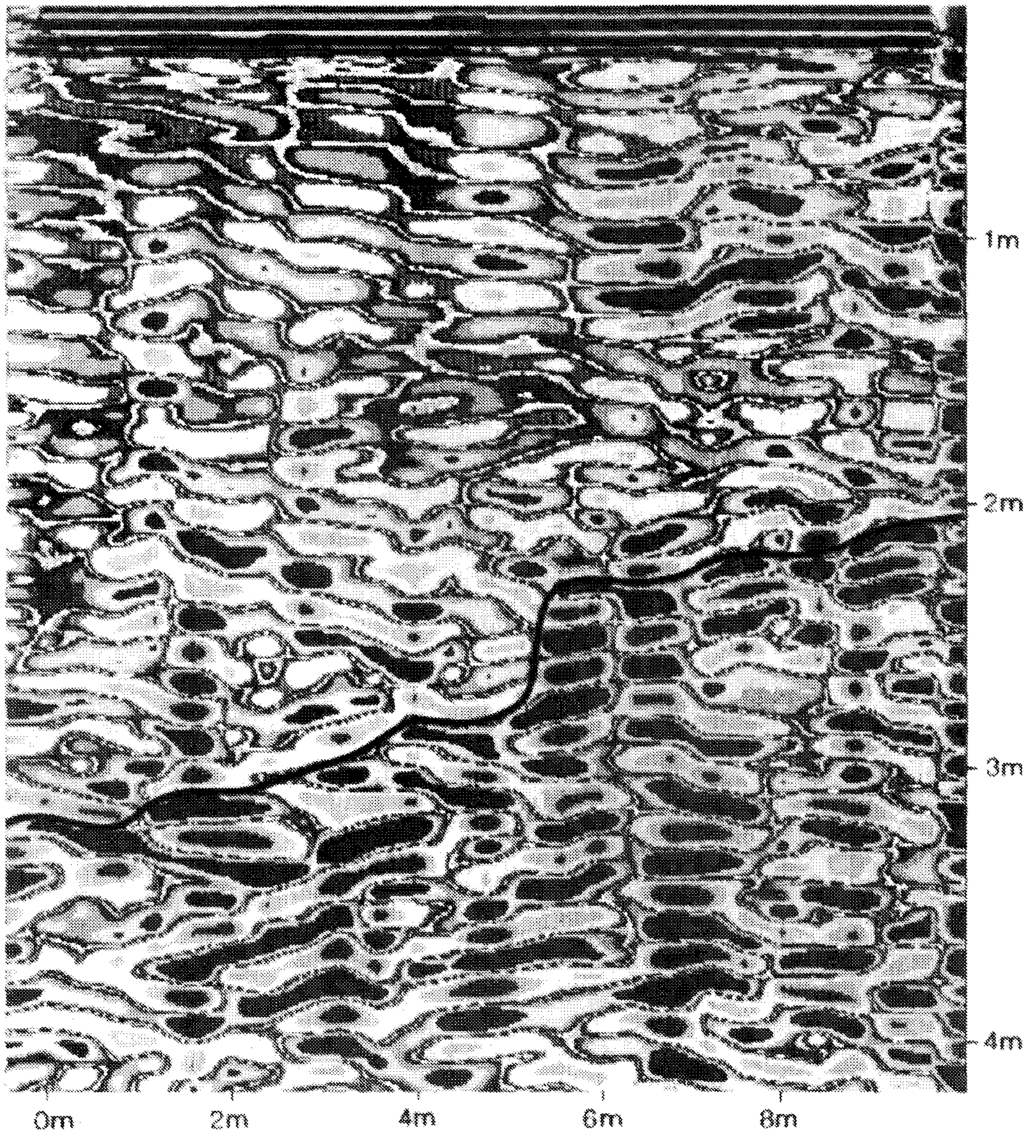


Fig. 28. GPR spread a, Chamber IV.

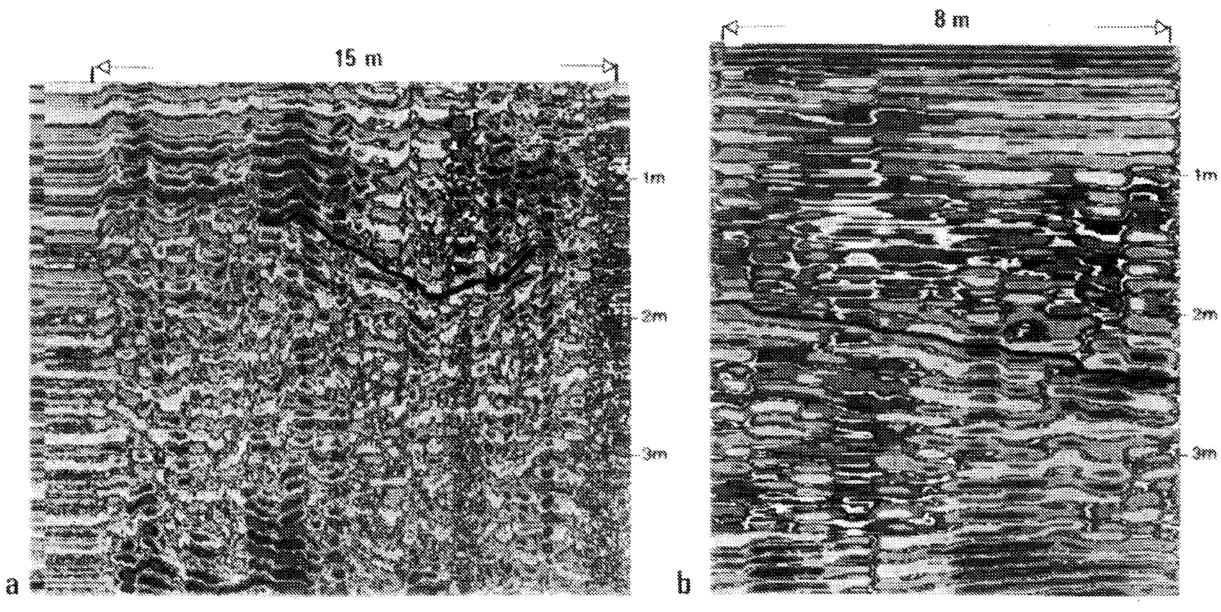


Fig. 29. (a) GPR b, Chamber V; (b) GPR spread d, Chamber V.

The second GPR section (Fig. 29a) was carried out in Chamber V. It is a NW-SE section, parallel to, and in very good concordance with, seismic refraction spread 7 (Weinstein-Evron et al., 1991). This section is compared to the reprocessed profile 8, 1-2m to the east, for the same reasons mentioned above. The black marker is interpreted as the base of the unconsolidated fill, and shows thc boundaries of the karstic pit quite clearly. The maximum depth of the bedrock surface is at 2-2.5m, about 1m less than the interface marker calculated for refraction spread 8. Such discrepancies may be explained by the 1-2m difference in the localities of the sections.

Two further GPR sections, each 8m long, were carried out in Chamber V semi-perpendicularly to the main profile (Fig. 26). The two sections exhibit very similar trends and only GPR spread d is given in Fig. 29b. These sections show dipping layers at a depth of 2-3m. The direction of the dip is W-E, indicating clearly that the structure is deepening towards the centre of Chamber V, which confirms the possible existence of a karstic pit there.

The seismic refraction survey suggests that the thickness of the sediment fill ranges between c. 0.5-3.5m. The 500-600m/sec seismic interval velocity range suggests dry, unconsolidated cave fill. On the other hand, moisture or lithification may be associated with locations where faster velocities were encountered. The more shallow deposits were found closer to the walls of the cave, while thicker layers were encountered along the axis of the cave.

A relatively shallow depression was found in the southern part of Chamber III. That there may be a pit here is also suggested by the tilting of the archaeological layers that was observed in the recent excavations. Another deepening, reaching a depth of two meters below surface, and oriented W-E, was found in Chamber IV. The most impressive pit, attaining a depth of nearly four meters, was encountered in the centre of Chamber V. Shallowing of the bedrock was measured further southwards, and the Cenomanian bedrock crops out at the southern tip of the cave (Fig. 27c).

The GPR profiles for Chambers IV and V correlate well with the seismic refraction sections of the same areas of the cave, both indicating deep pits in the two Chambers. Taking all the profiles together, the indications are of basin-shaped depressions in the two chambers. As mentioned above, the discrepancies in measurement results for the depths of the pits may be explained by the fact that the compared spreads could not be laid on the same lines exactly. The seismic refraction sections show the largest depth values probably because they were taken more in the centre of the chambers where the pits are deepest. The additional, semi-perpendicular spreads in Chamber V also indicate a dipping of layers towards the centre of the chamber.

As already mentioned, the occurrence of pits in the cave is corroborated by the occasional tilting of the archaeological layers, as brought to light by the recent excavations of Chamber III. That such pits, or swallow holes, evolved may have much to do with the karstic origin of the cave. An immense pit, at the bottom of which were two swallow holes of unequal depth, had already been unearthed in the outer chamber (Garrod and Bate, 1937: Plate III, Section VII-VIII). Similar pits or swallow-holes were found in the neighbouring Tabun (Garrod and Bate, 1937) and Jamal (Weinstein-Evron and Tsatskin, 1994) caves, and are common as well in other caves in the area, such as Kebara (Laville and Goldberg, 1989). The size of the chambers and the depth of the pits seem to be positively correlated.

The thickest sedimentary fill was found in Chamber V. Going by the results of former investigations in el-Wad and other caves, this is where we may expect to find the oldest archaeological layers, provided prehistoric people did make use of the inner parts of the cave which are immersed in almost total, perpetual darkness.

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

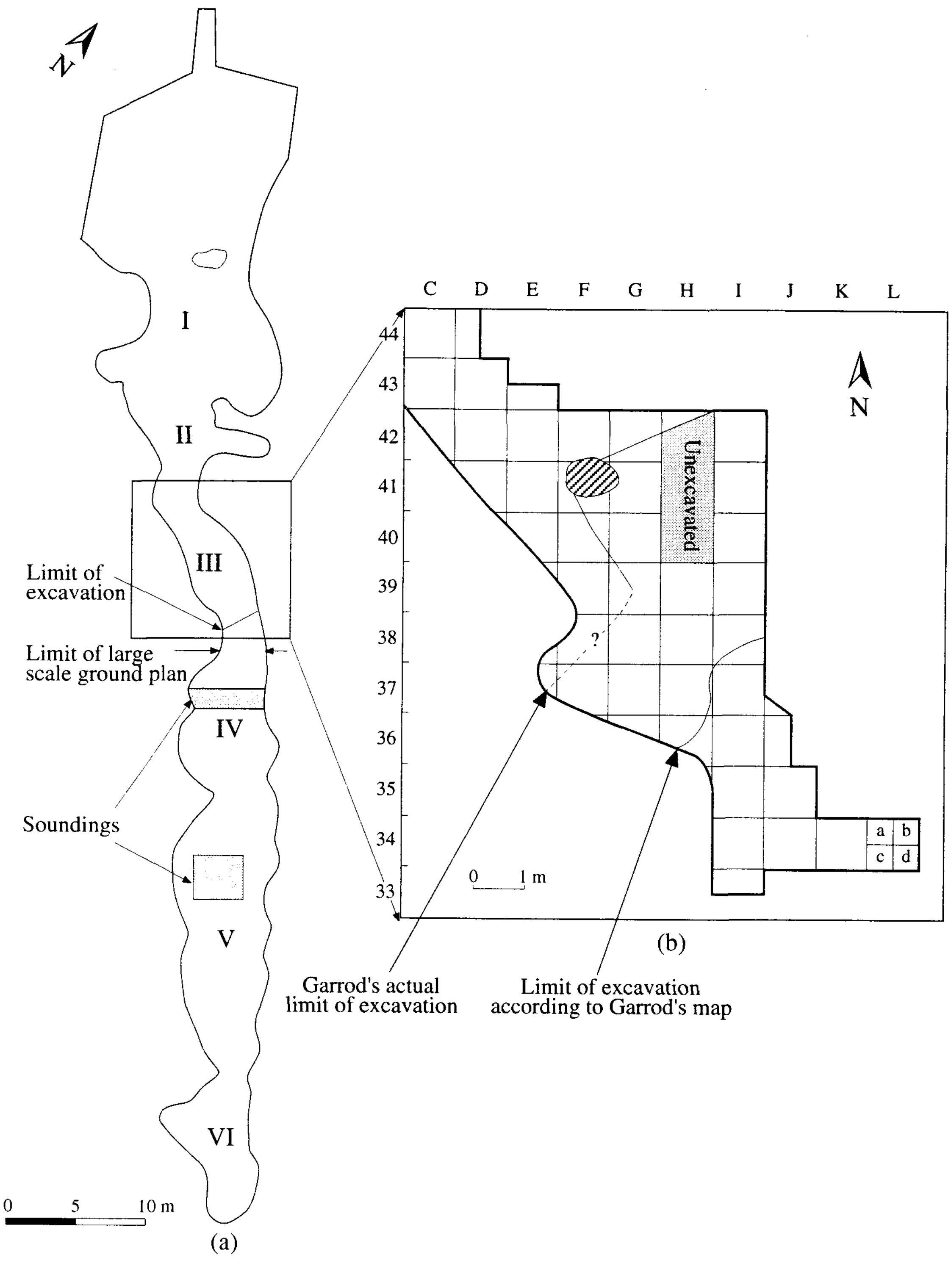


Fig. 30. (a) Garrod's key map of the cave showing the southern limits of her excavations in Chamber III, somewhat north to that of her ground plan (Fig. 3); (b) Ground plan of the recent excavations in Chamber III, indicating the northern limit of Garrod's excavations, according to our finds.

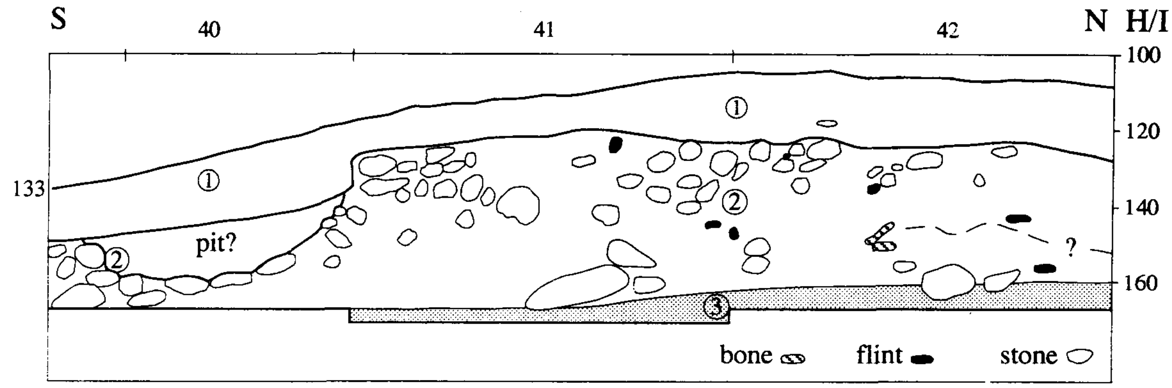


Fig. 31. The western section of squares I40-I42, at the end of the excavation.

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.

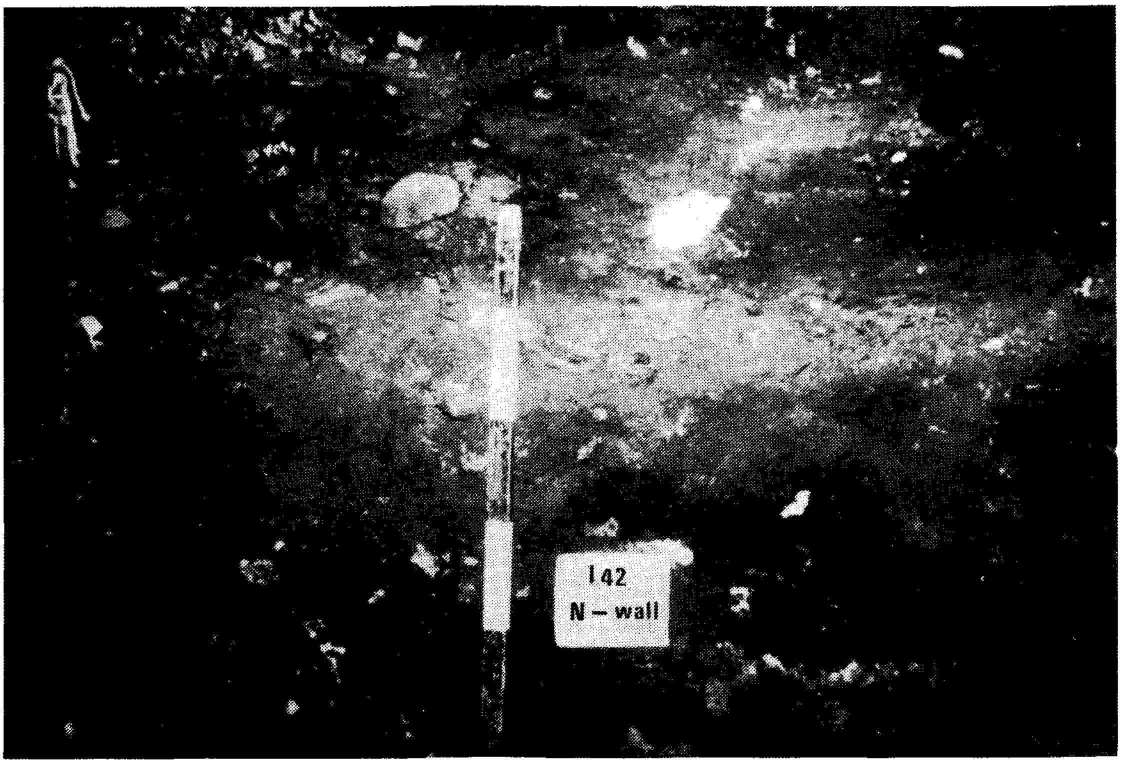


Fig. 33. The northern wall of square I42 during excavation. The lighter upper part of the Natufian layer may be a result of later migration of carbonates.

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

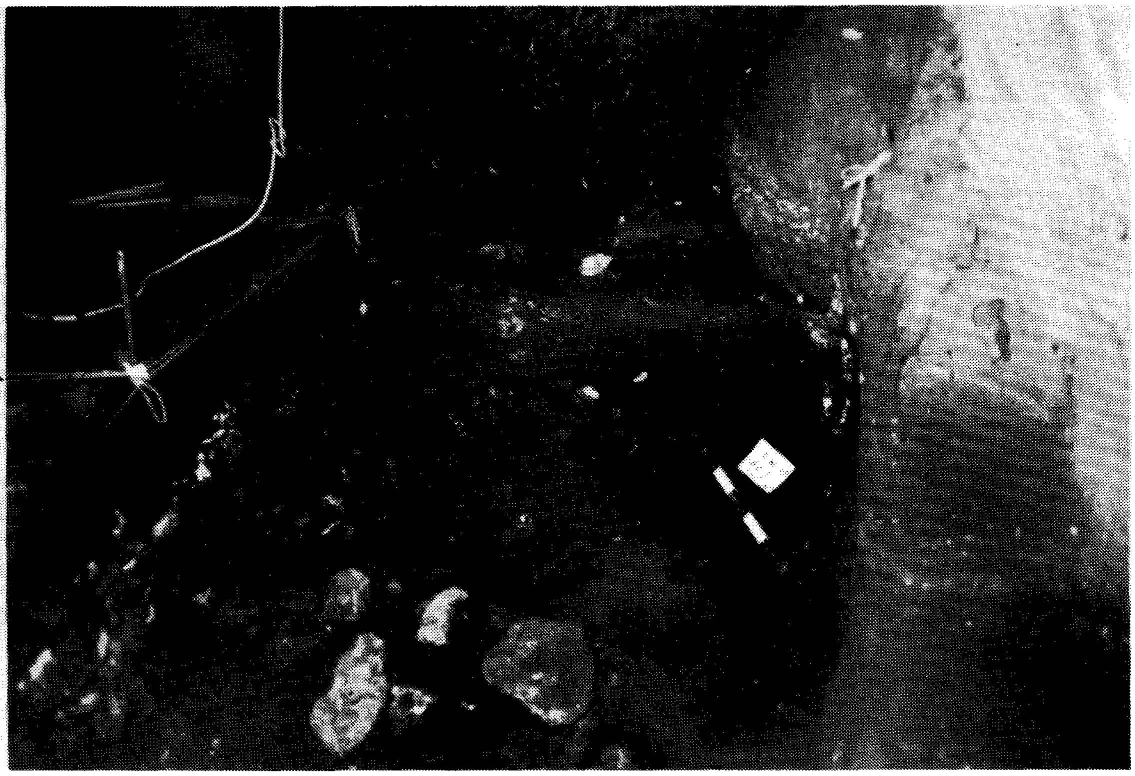


Fig. 36. General view of square I42 and the northern part of square I41, from south to north. Note the large stones at the basis of the Natufian layer in square I41, and the dark Upper Palaeolithic layer.

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.

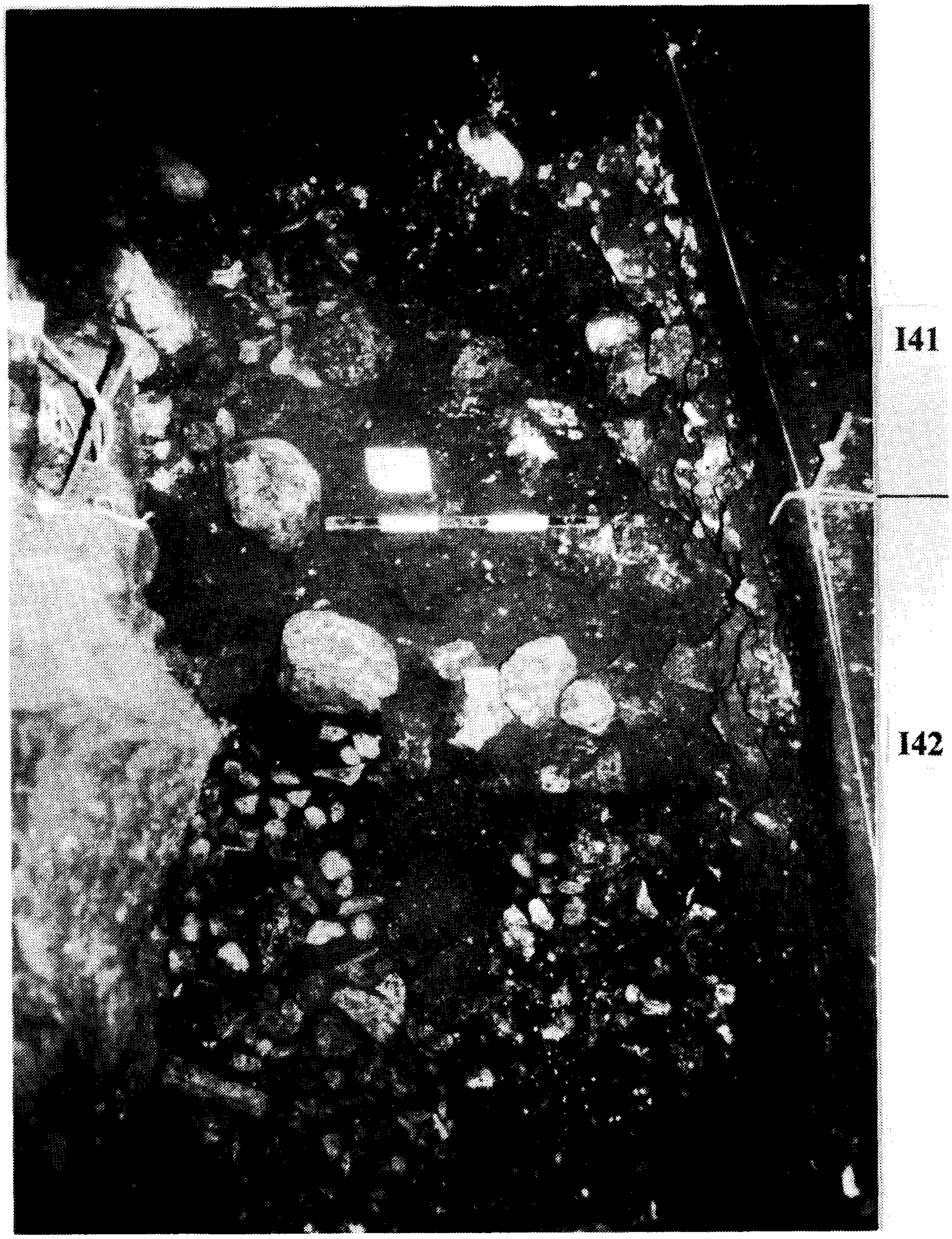


Fig. 37. General view of squares I41-I42 from the north. Note the circular arrangement of stones in square I41, and the two, densely packed Upper Palaeolithic layers in square I42.

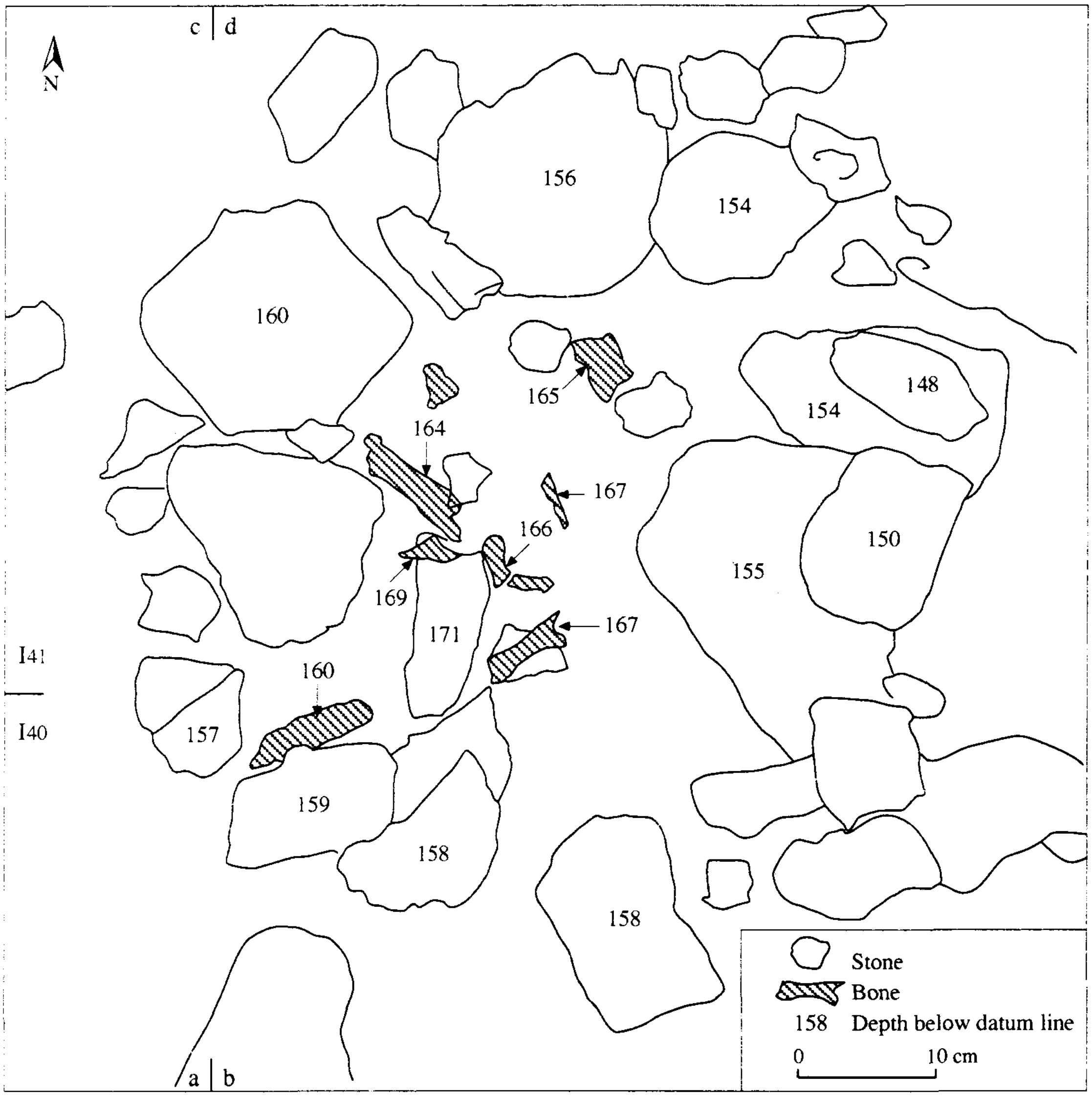


Fig. 38. The circular arrangement of stones in squares I40-I41.

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.

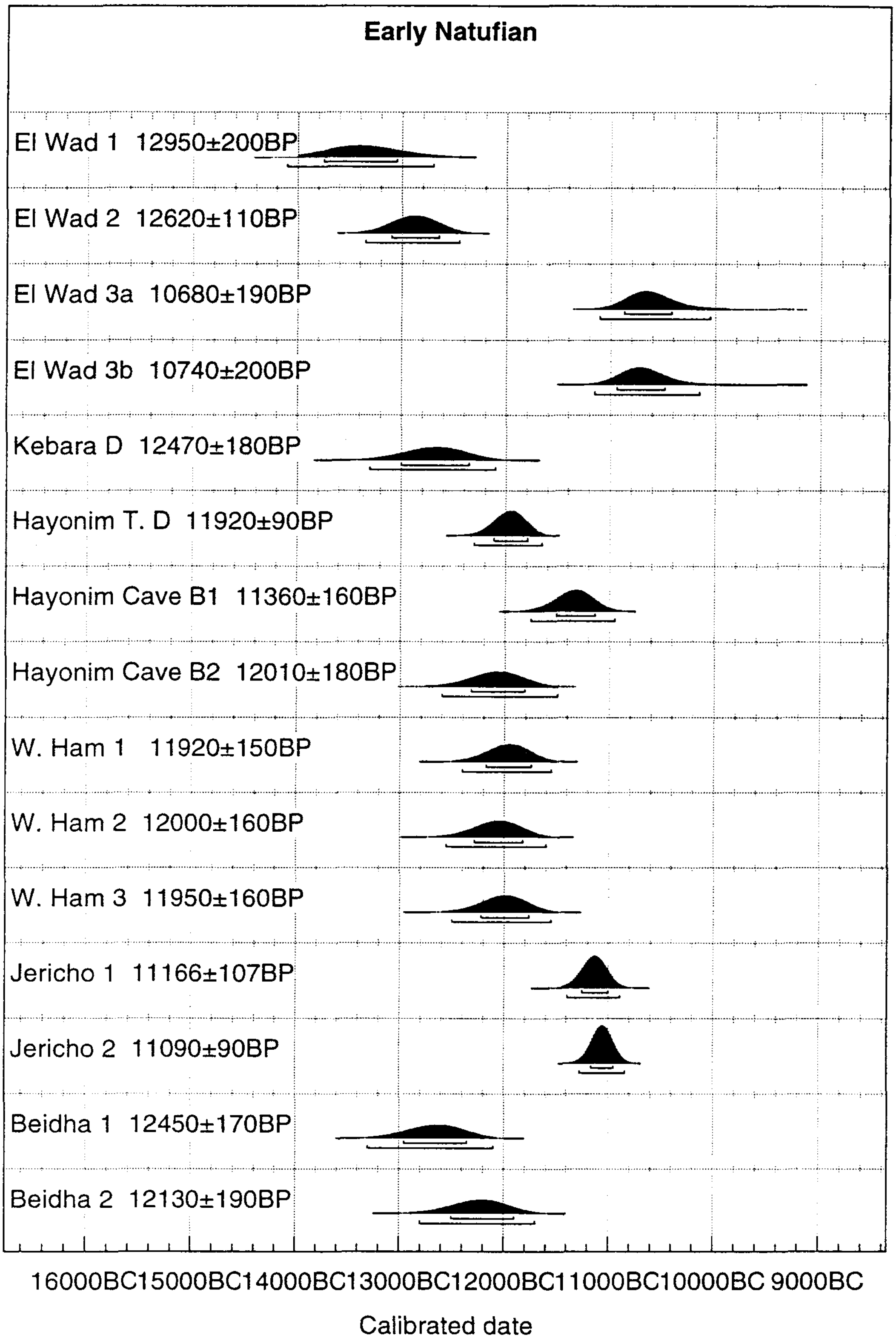
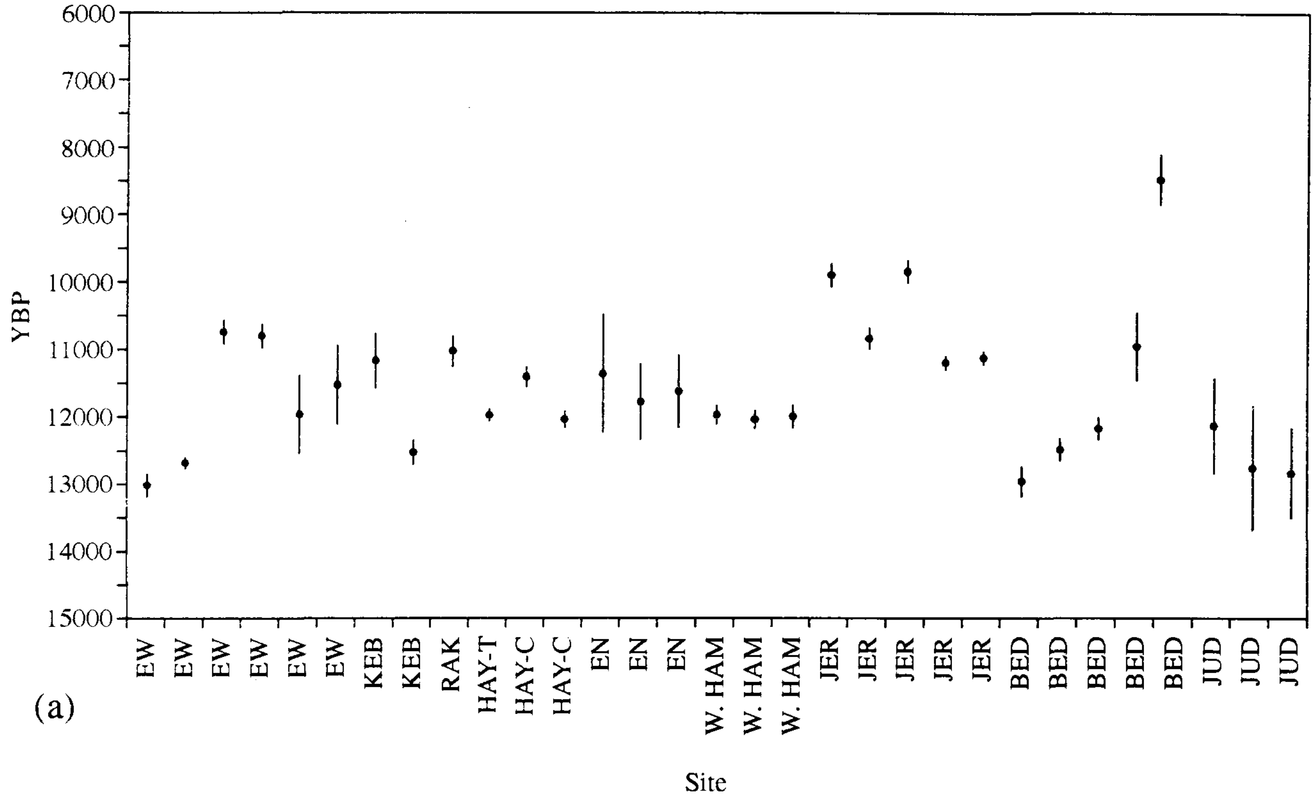
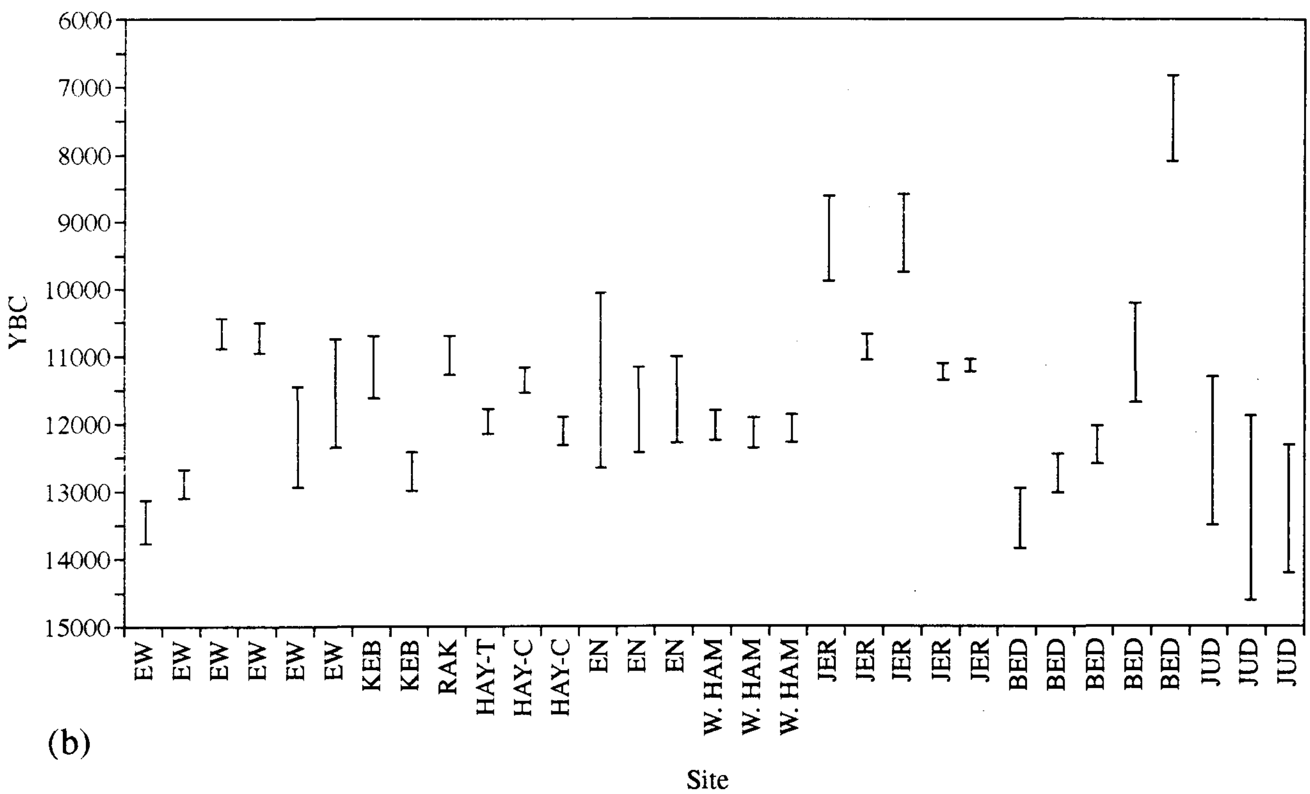


Fig. 39. Distribution and calibration of selected ^{14}C dates for Early Natufian sites. For data see Table 1. Calibration done with the OxCal program (Stuiver et al., 1993).



(a)



(b)

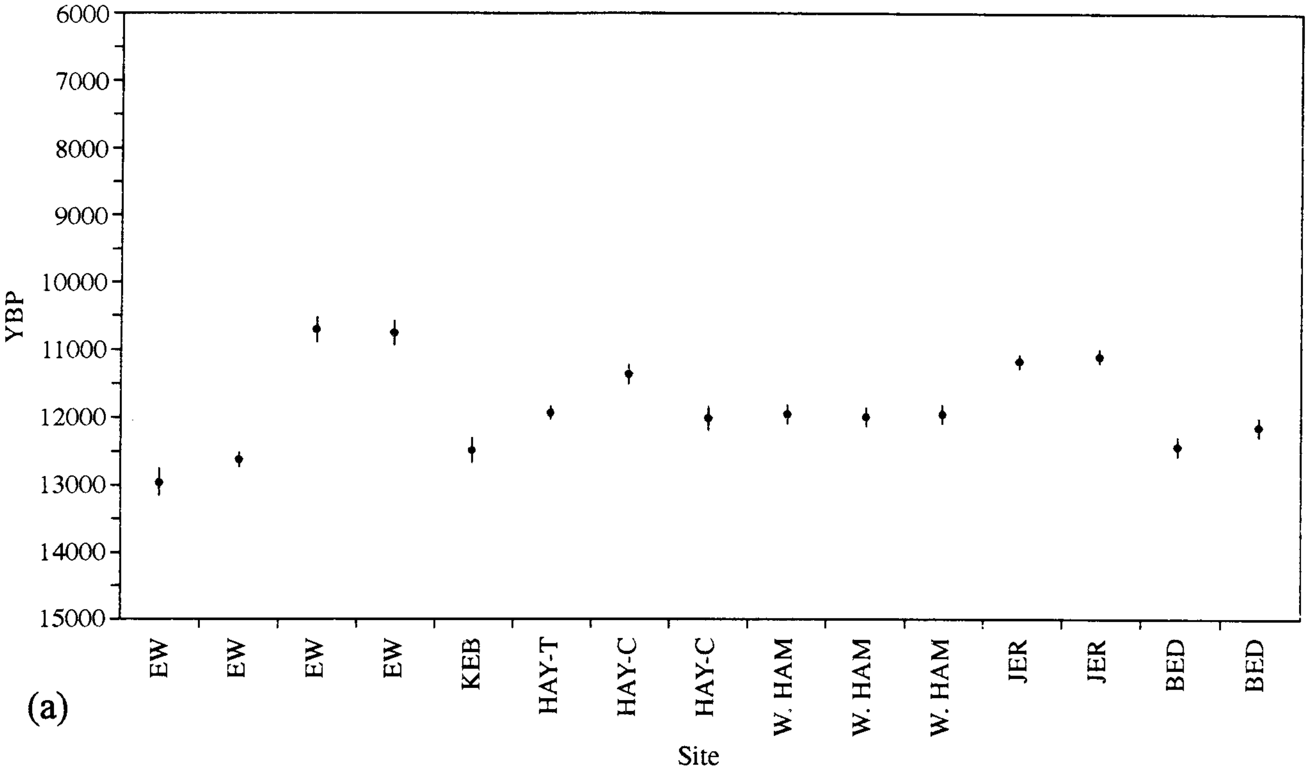
Fig. 40. (a) Distribution of radiocarbon point-dates with single sigmas for various Early Natufian sites. (b) Distribution of calendaric ages for various Early Natufian sites.

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.

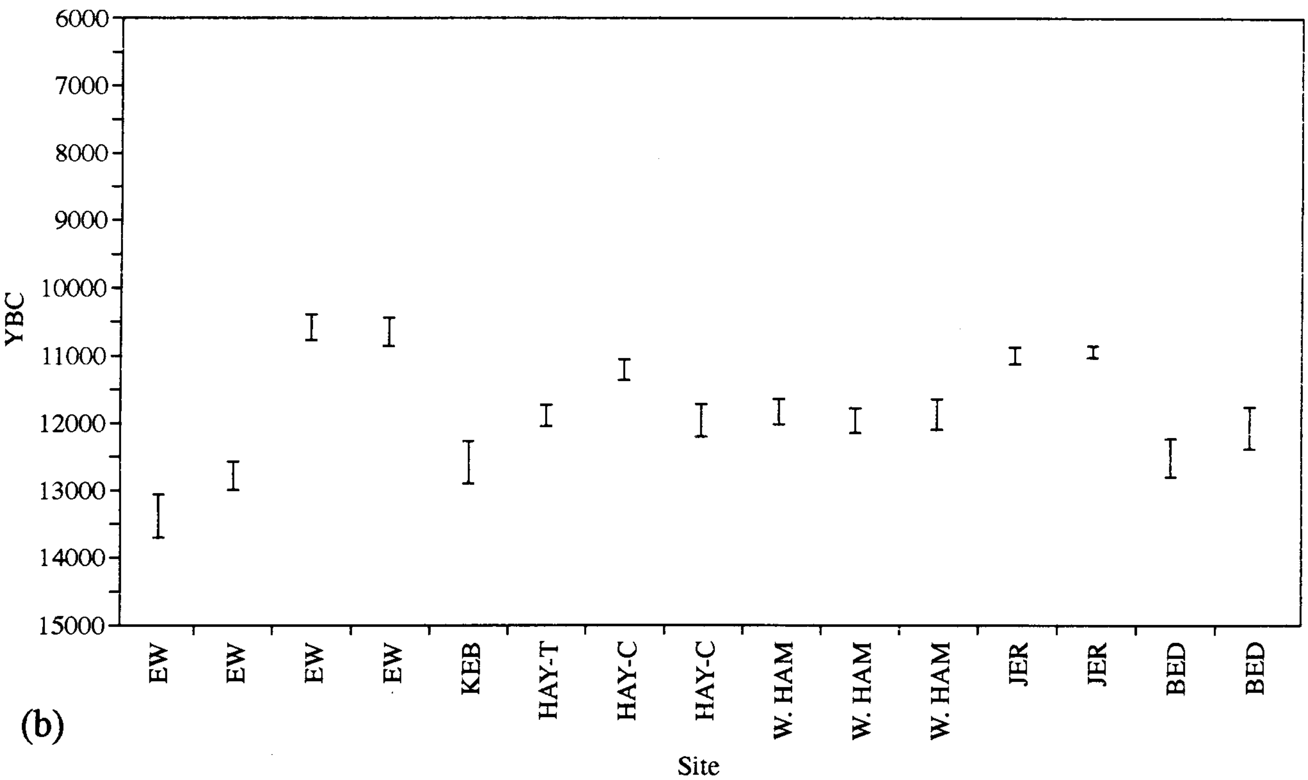
Based on the available data, it is most likely that the earlier el-Wad dates indicate the oldest occurrence of Early Natufian in northern Israel (Weinstein-Evron, 1991), i.e., considerably older than previously assumed (e.g., Valla, 1987; Henry, 1989). This probably also means that the cave was inhabited 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.

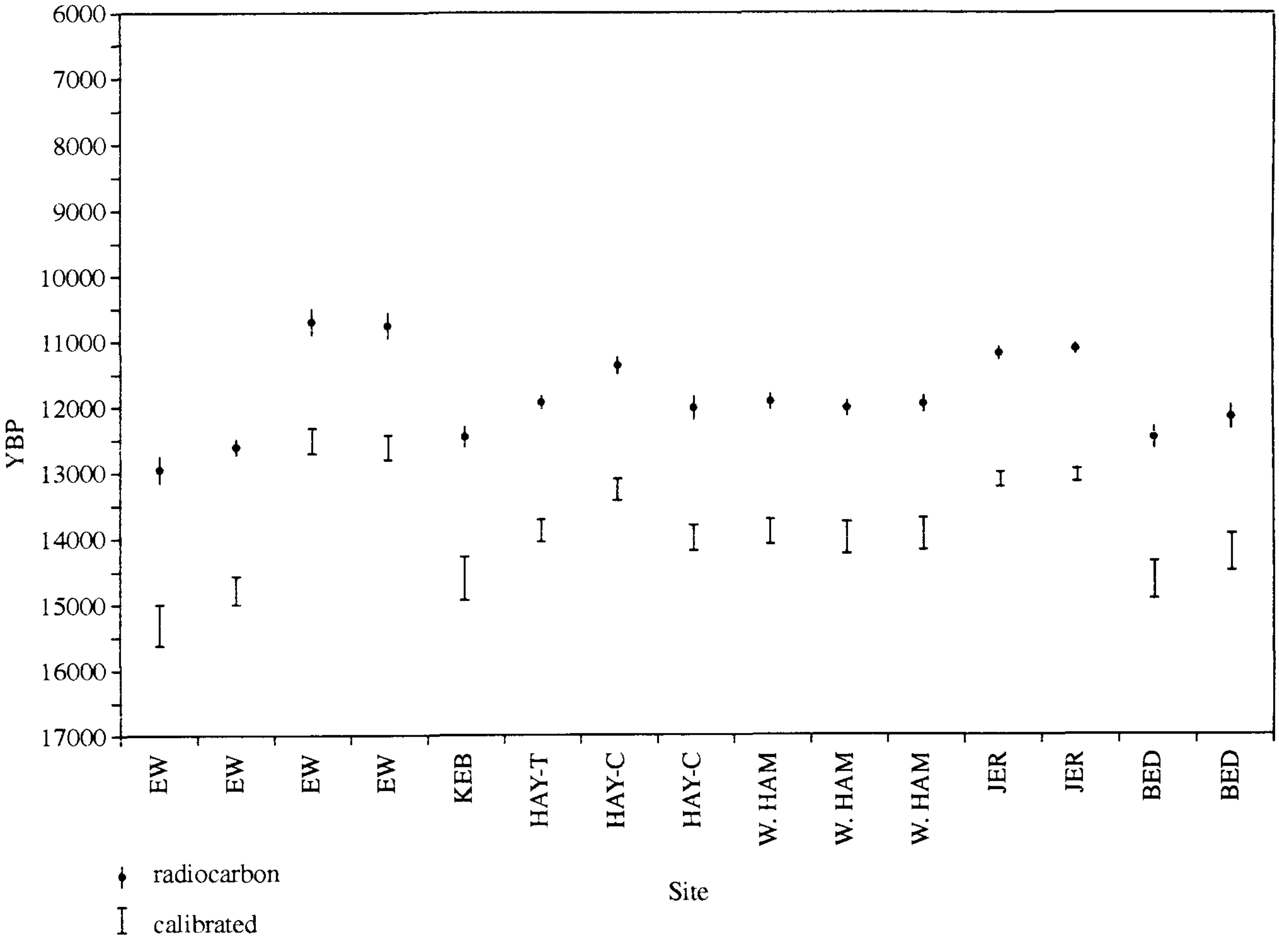


Fig. 42. Combined figure, showing radiocarbon and calibrated dates for Early Natufian sites. Reliable dates only.

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).

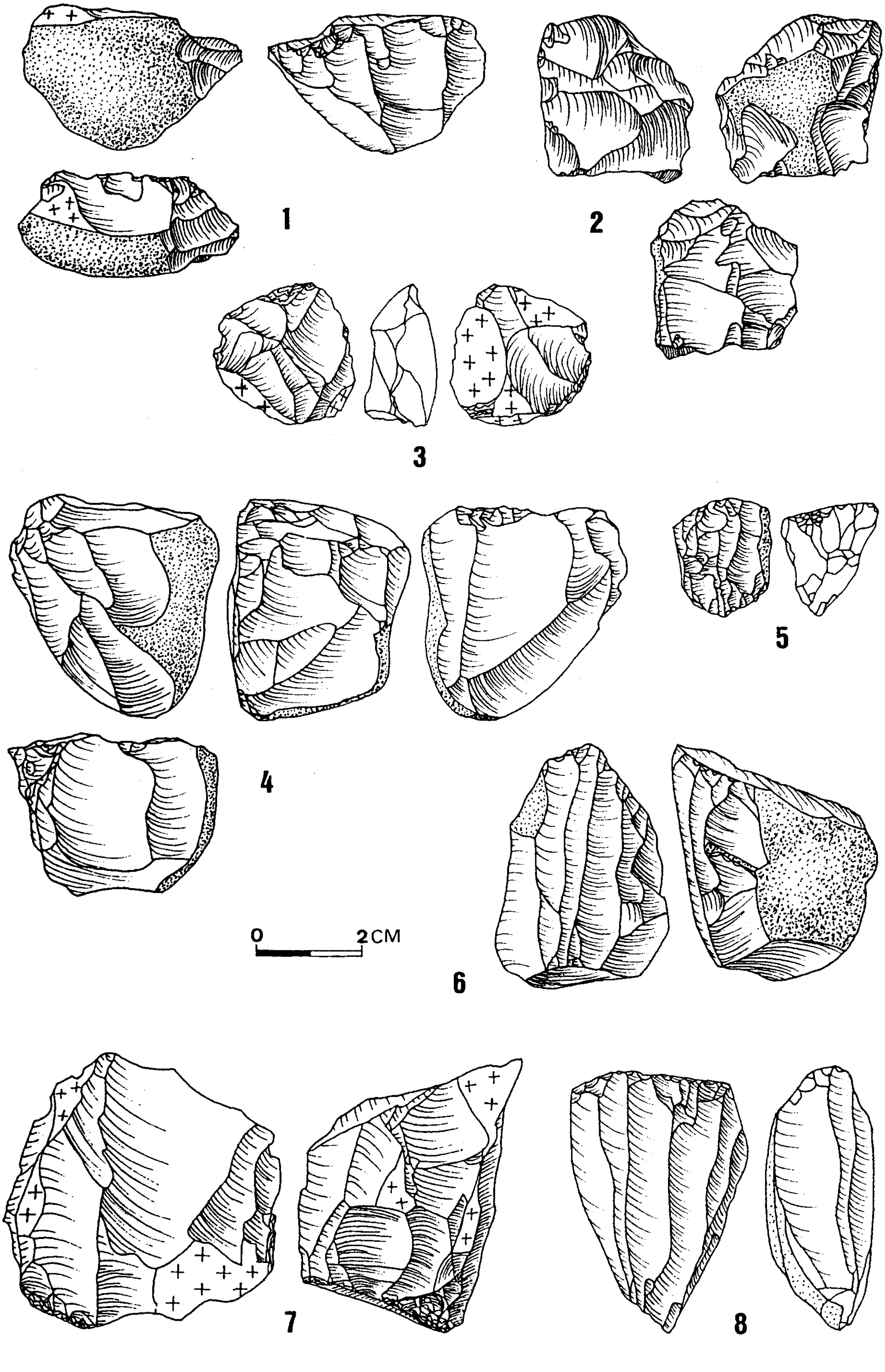


Fig. 43. Natufian cores; (+ + old patina).

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.

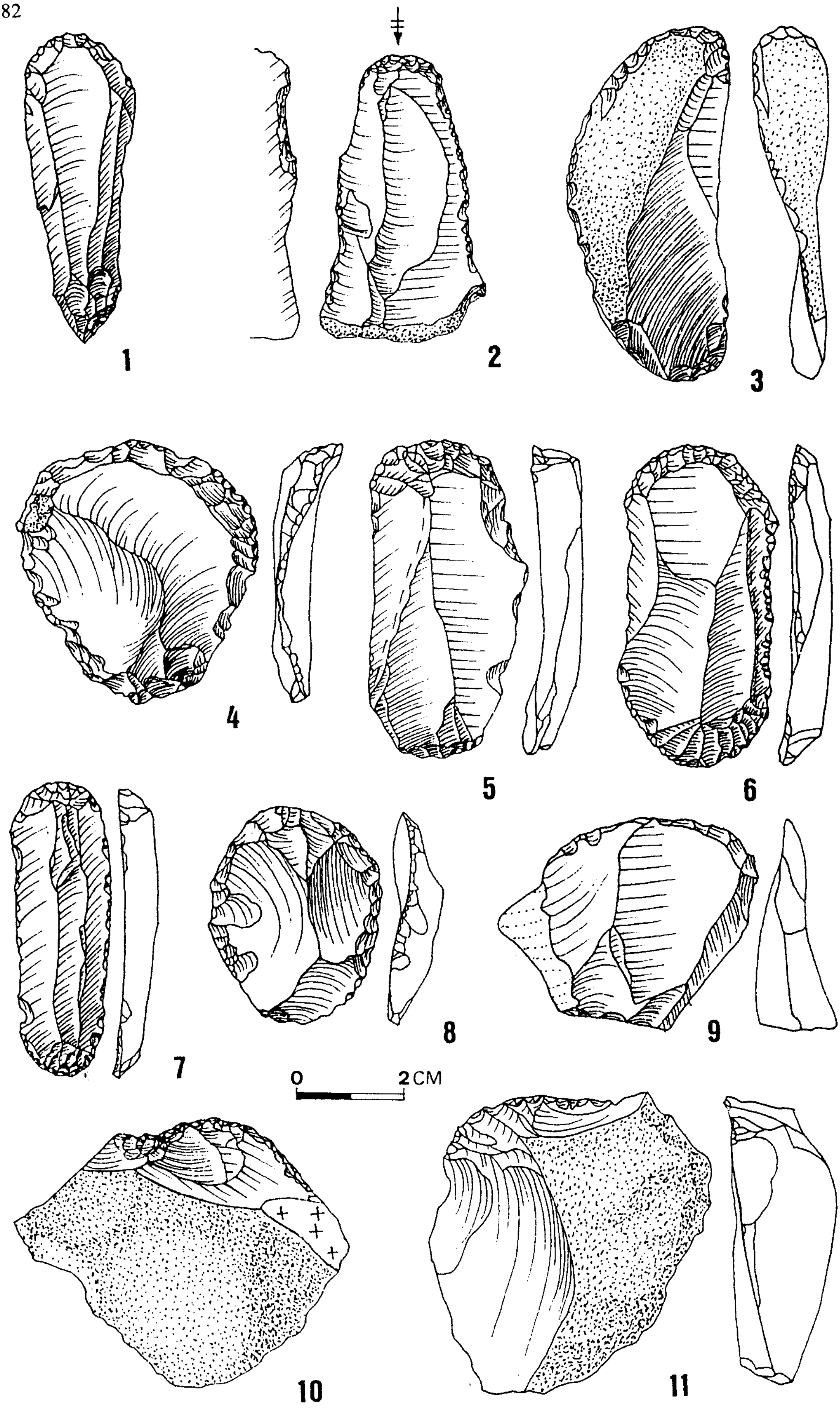


Fig. 44. Natufian endscrapers: 1-3, 8-9 simple; 4 circular; 5-7 double; 10-11 carinated; (+ + old patina).

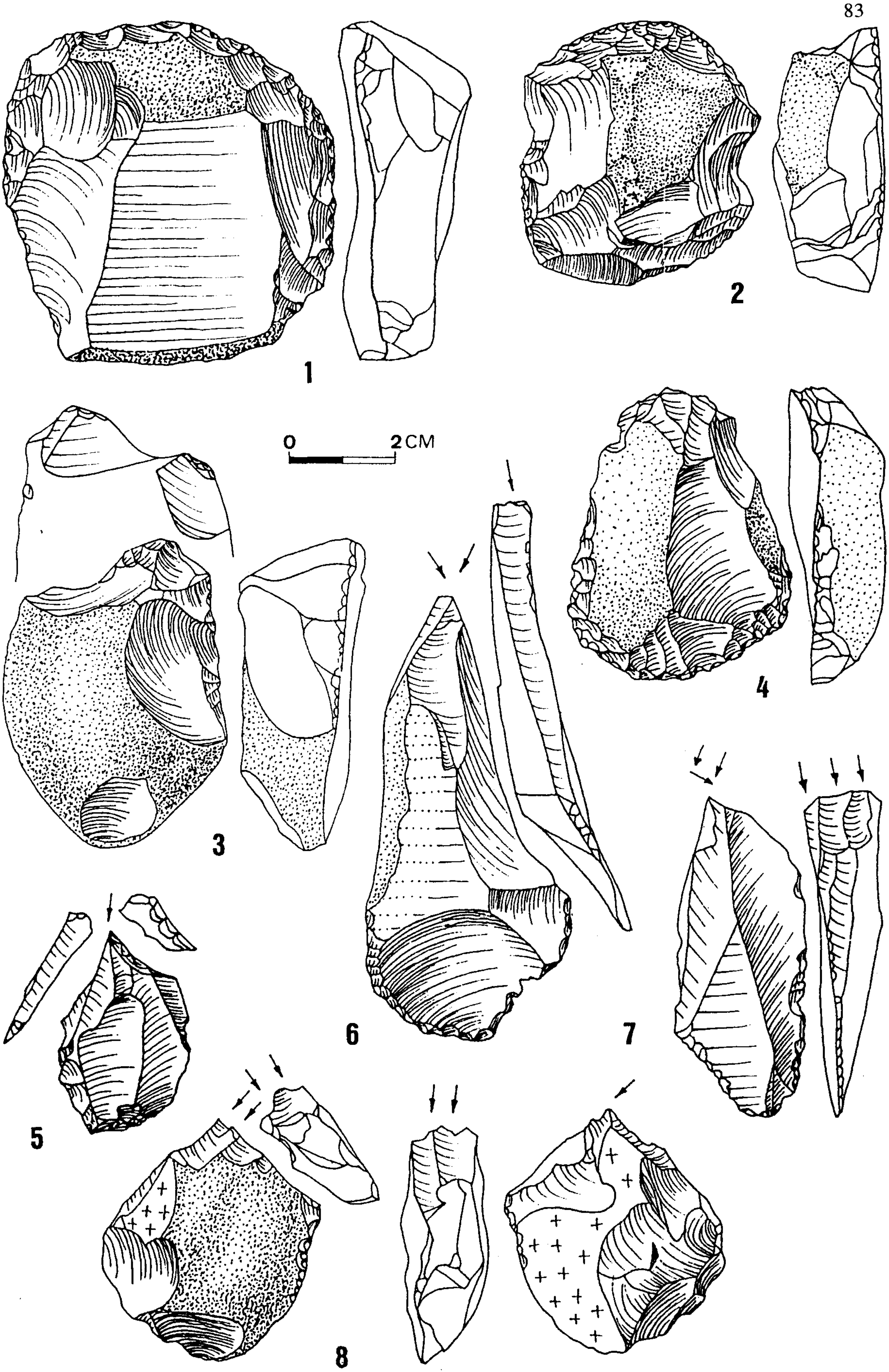


Fig. 45. Natufian endscrapers (1 simple; 2 carinated; 3 nosed; 4 double carinated) and burins (5 on truncation; 6-8 dihedral); (+ + old patina).

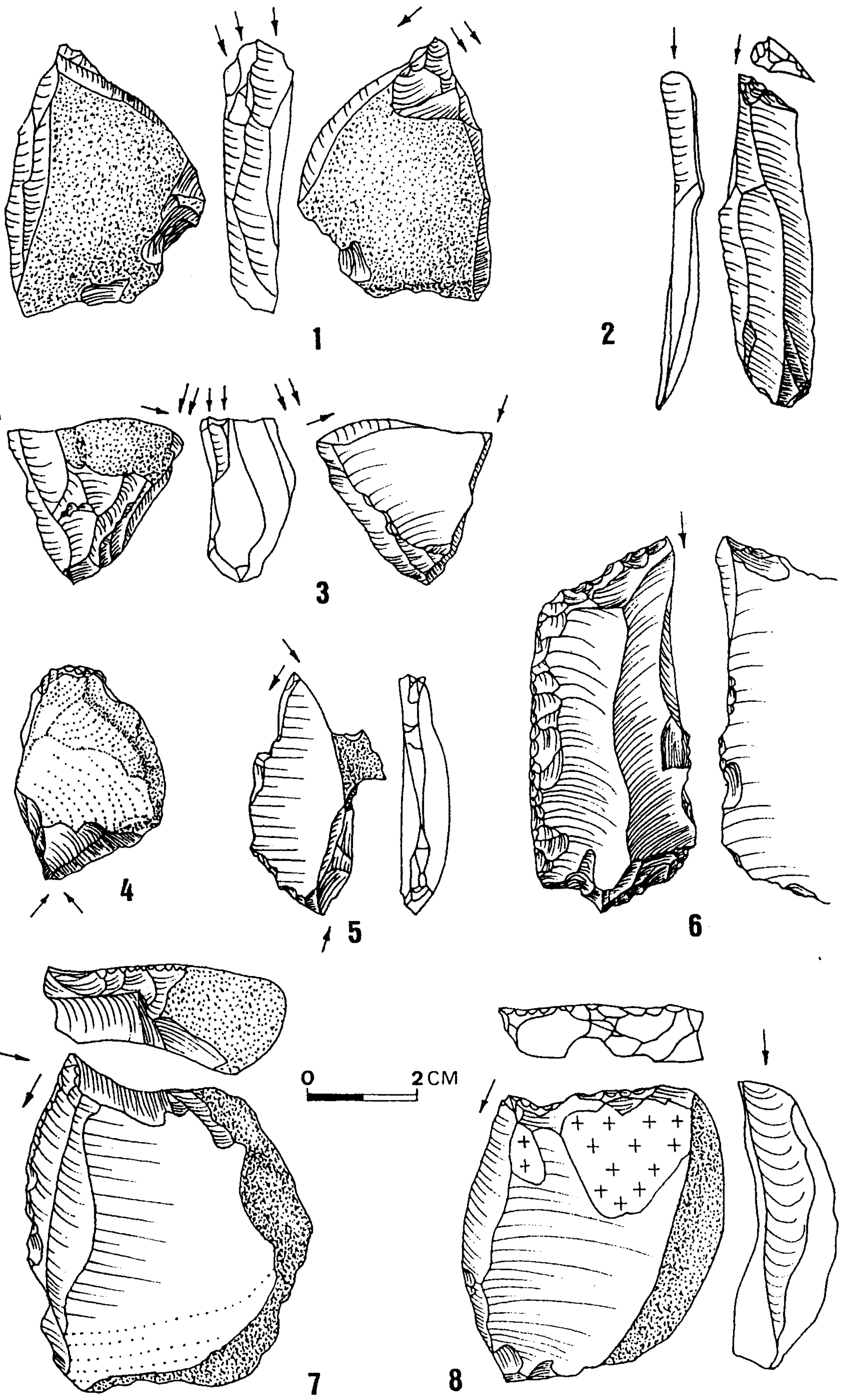


Fig. 46. Natufian burins: 1 dihedral on tabular flint; 2, 6-8 on truncation; 3, 5 double; 4 endscraper-burin; (+ + old patina).

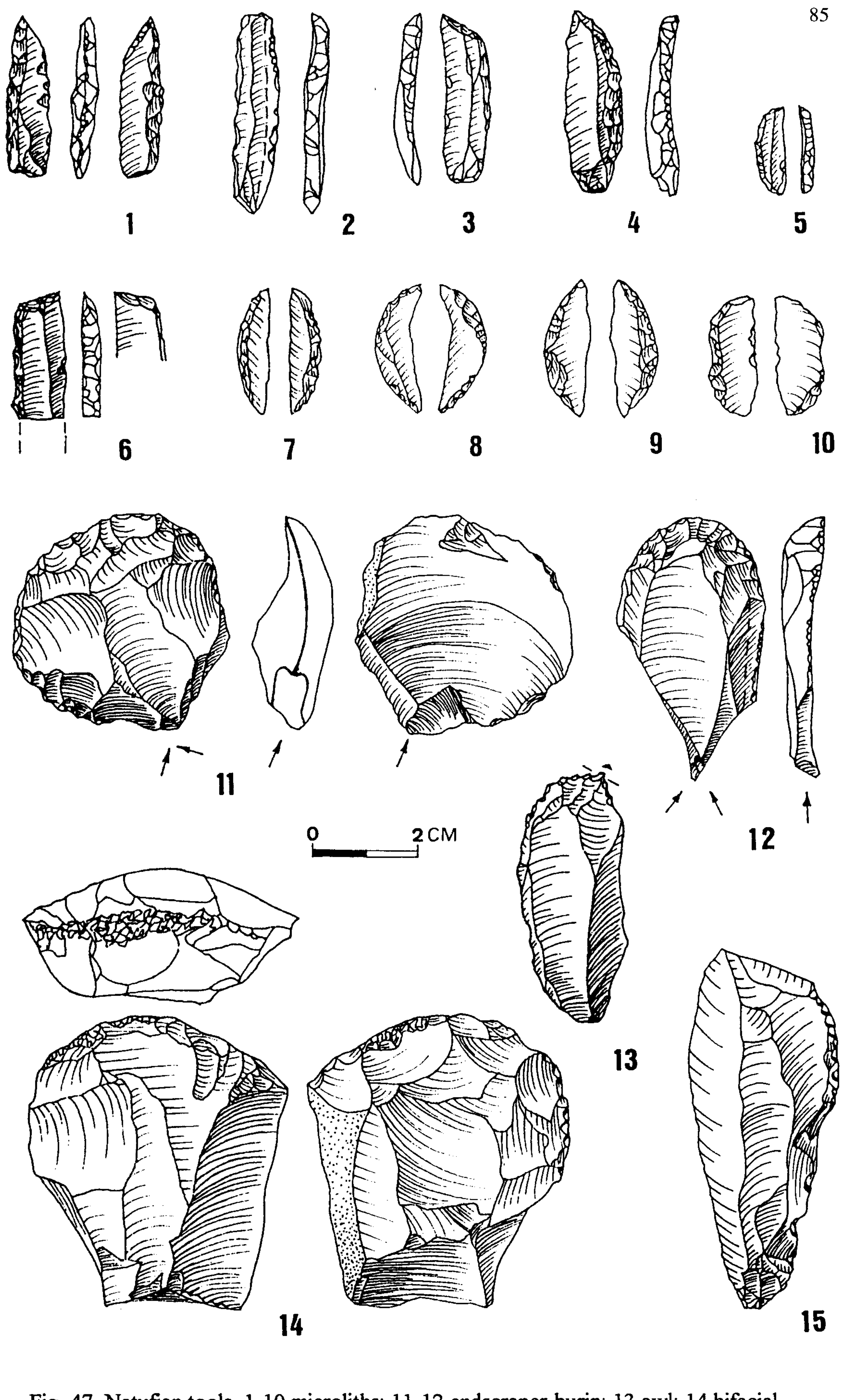


Fig. 47. Natufian tools. 1-10 microliths; 11-12 endscraper-burin; 13 awl; 14 bifacial piece; 15 "Chatelperonian" knife.

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.

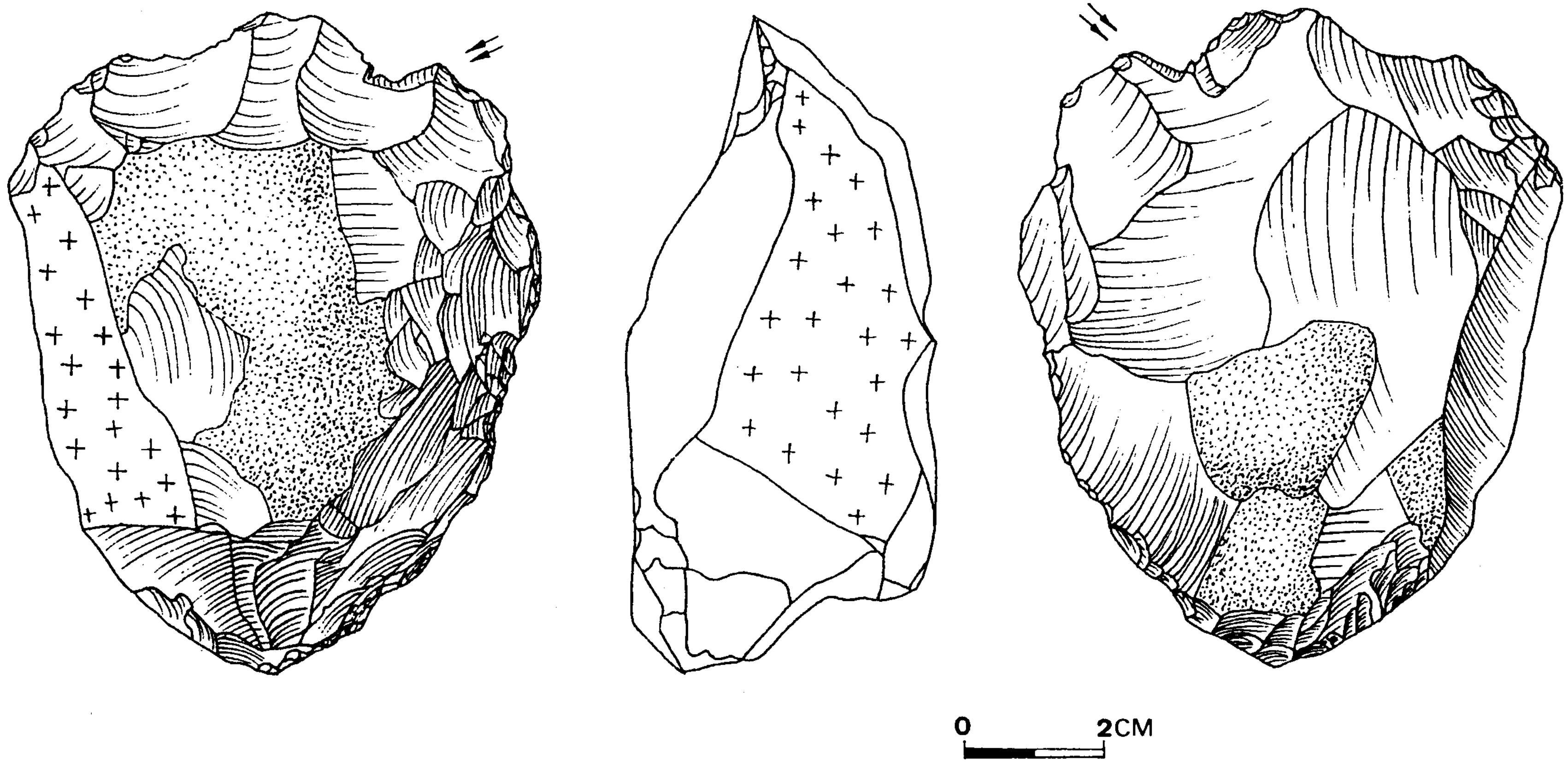


Fig. 48. Natufian heavy-duty tool; (+ + old patina).

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.

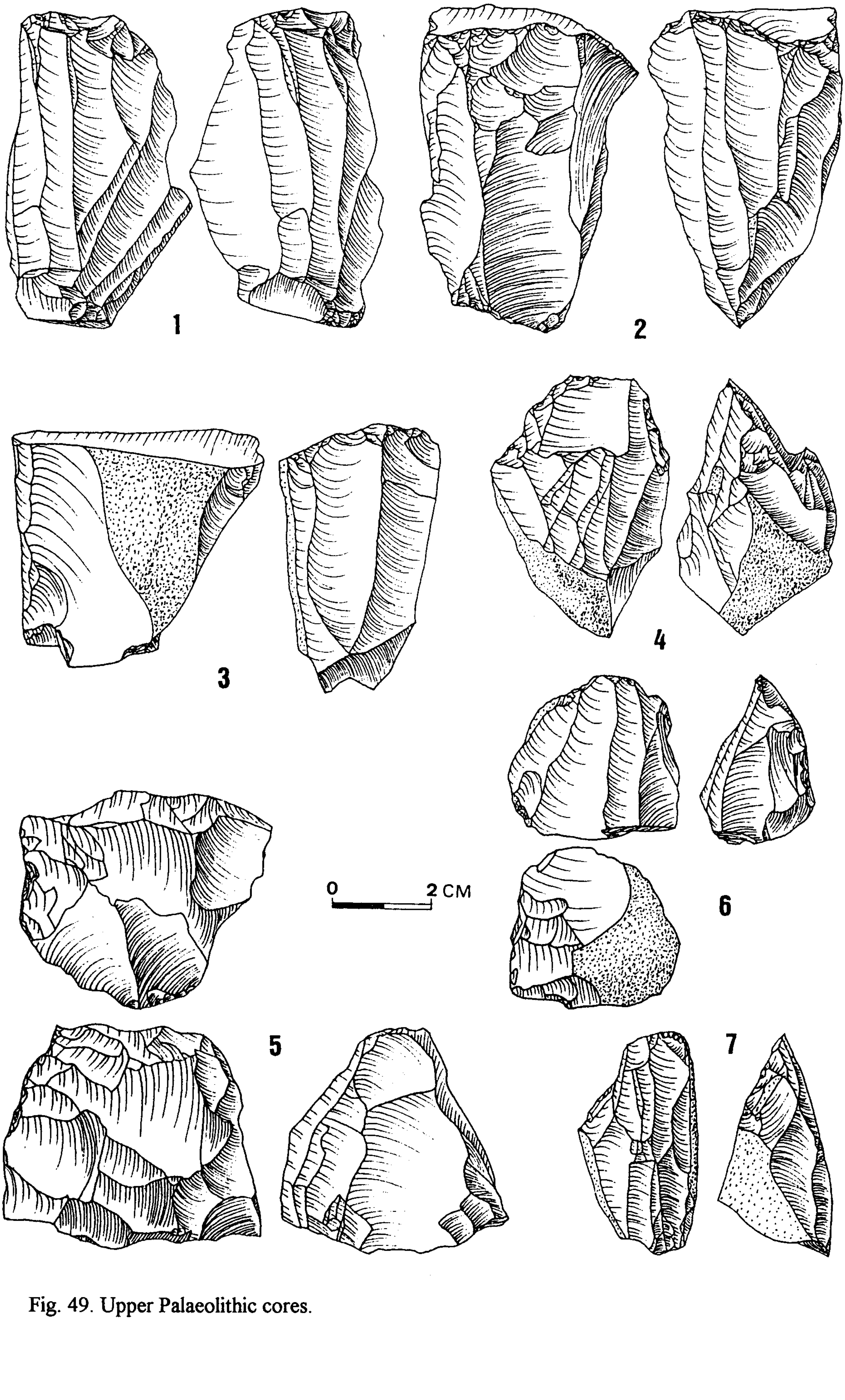


Fig. 49. Upper Palaeolithic cores.

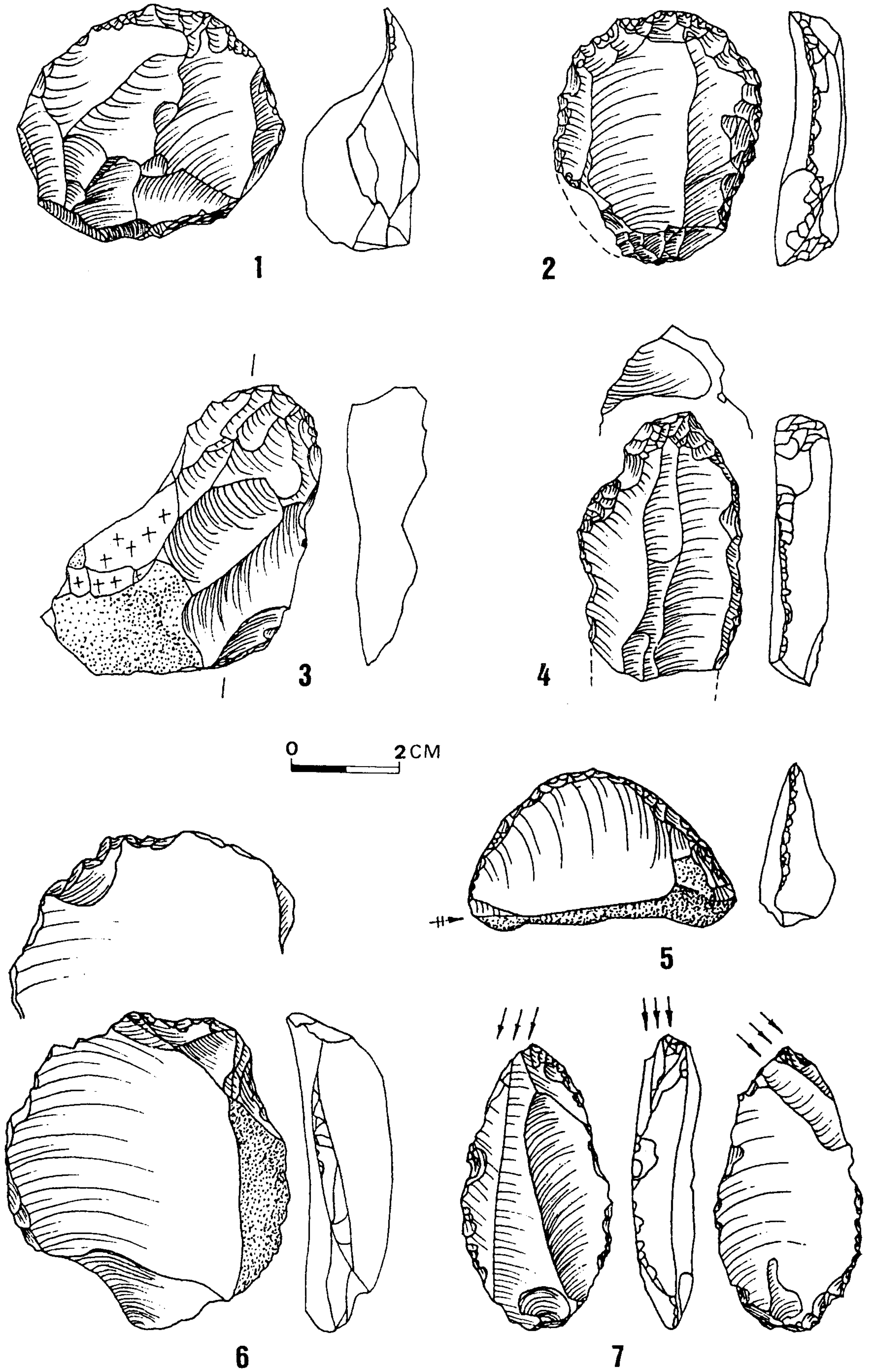


Fig. 50. Upper Palaeolithic endscrapers (1, 5 simple; 2 double; 3-4,6 shouldered/nosed) and a transversal burin (7); (+ + old patina).

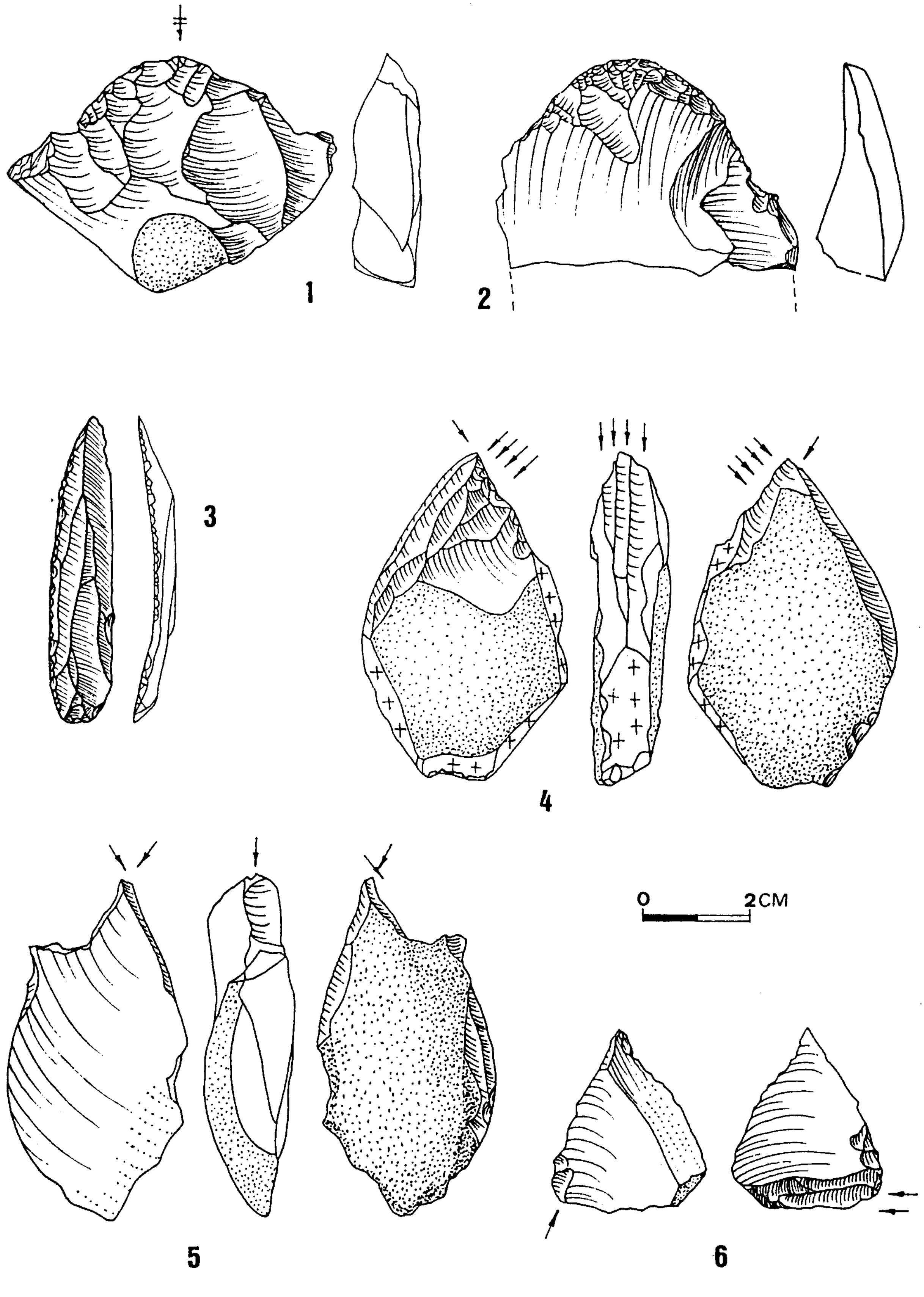


Fig. 51. Upper Palaeolithic endscrapers (1-2), el-Wad point (3) and burins (4-6);
(+ + old patina).

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.

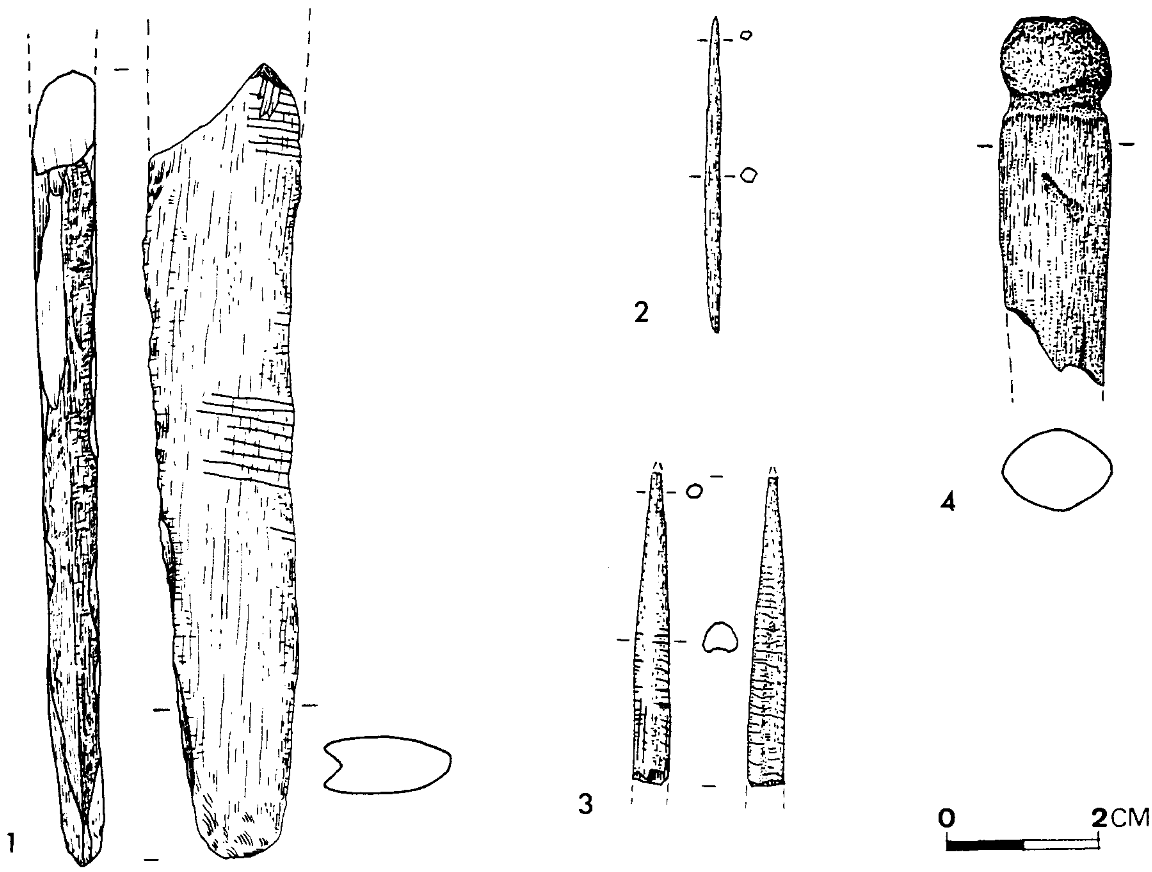


Fig. 52. Natufian bone artefacts: 1 broken point; 2 "gorget"; 3 an incised sickle haft; 4 a figurine made on a gazelle horn core.

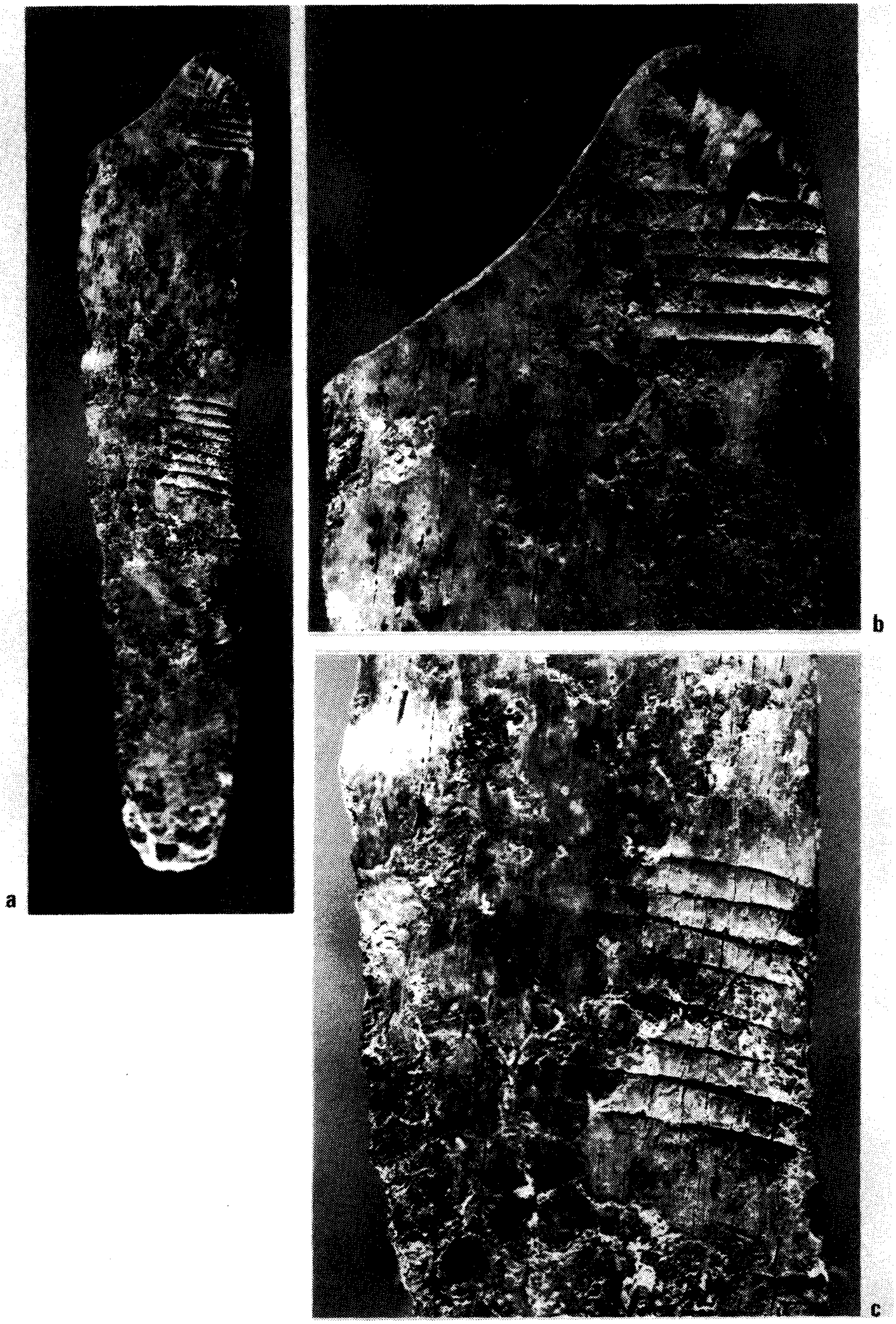


Fig. 53. The decorated sickle haft from the recent excavations at el-Wad (a); close-ups at various portions of the haft (b and c).

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.

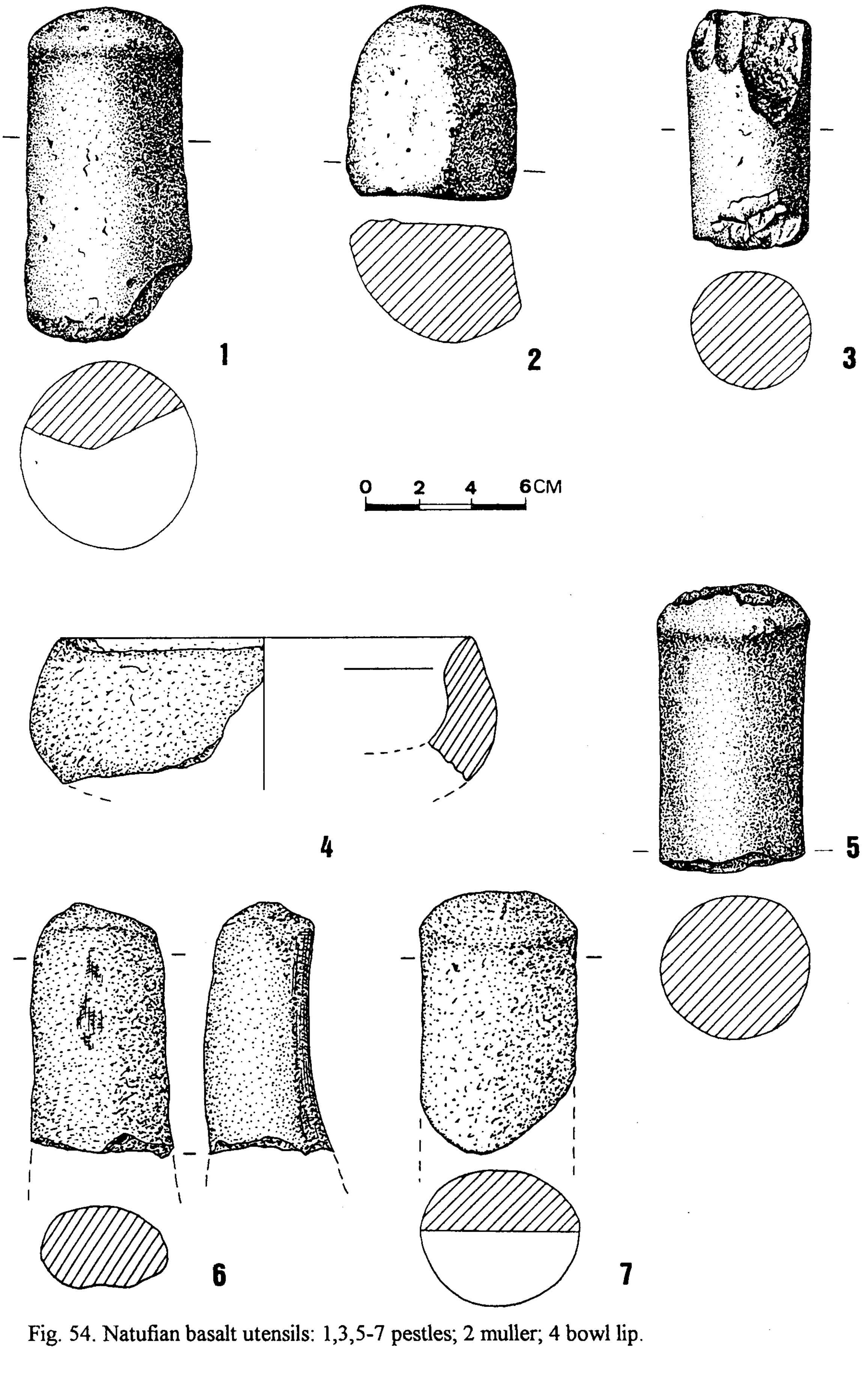


Fig. 54. Natufian basalt utensils: 1,3,5-7 pestles; 2 muller; 4 bowl lip.

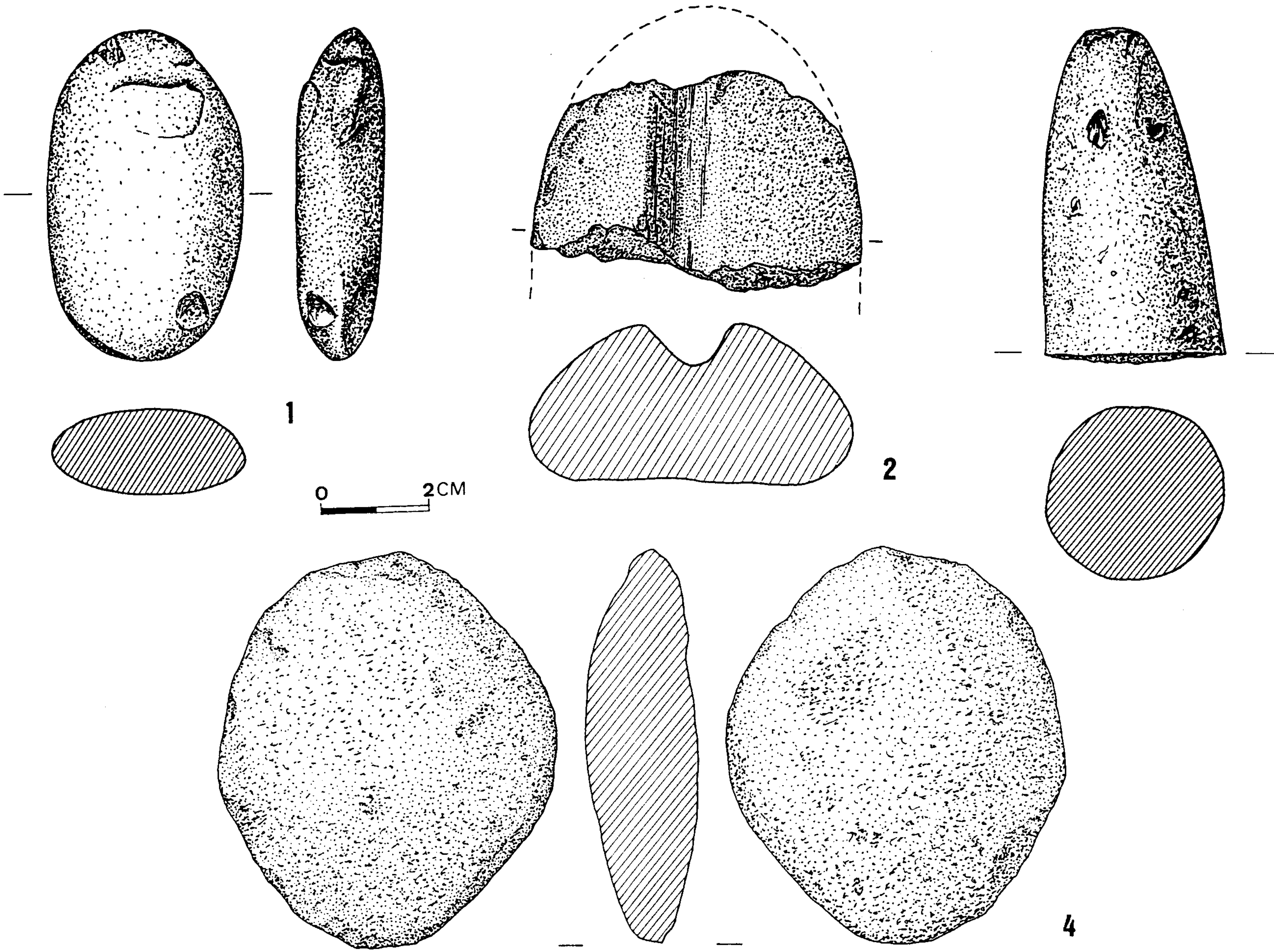


Fig. 55. Natufian basalt tools: 1,4 grinding stones; 2 shaft straightener; 3 pestle.

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

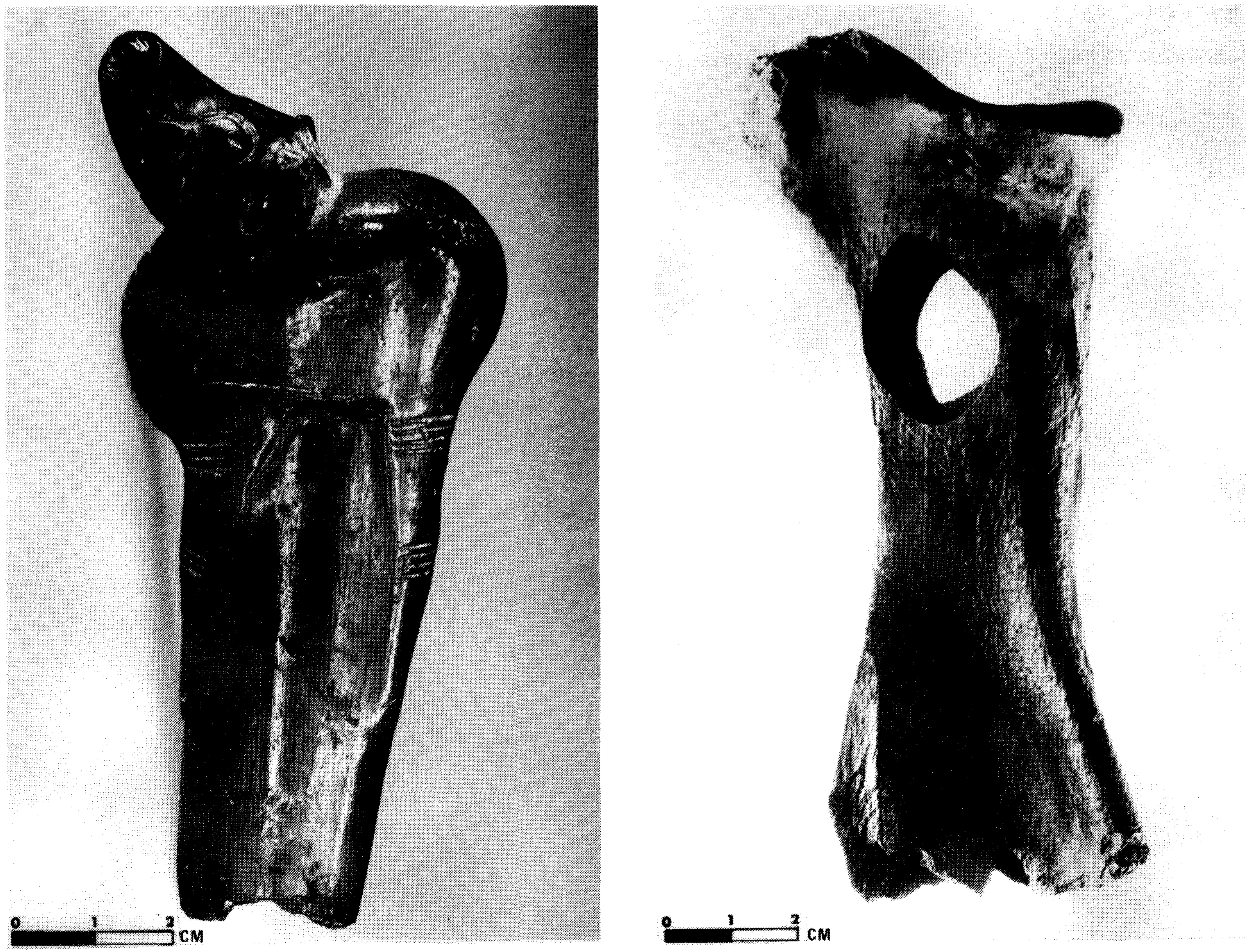


Fig. 56. The art objects uncovered by Lambert during his trial excavation in the cave: (a) carving of a young deer on a piece of long bone, probably the end of a sickle haft; (b) a pierced large bone ("bâton de commandement").

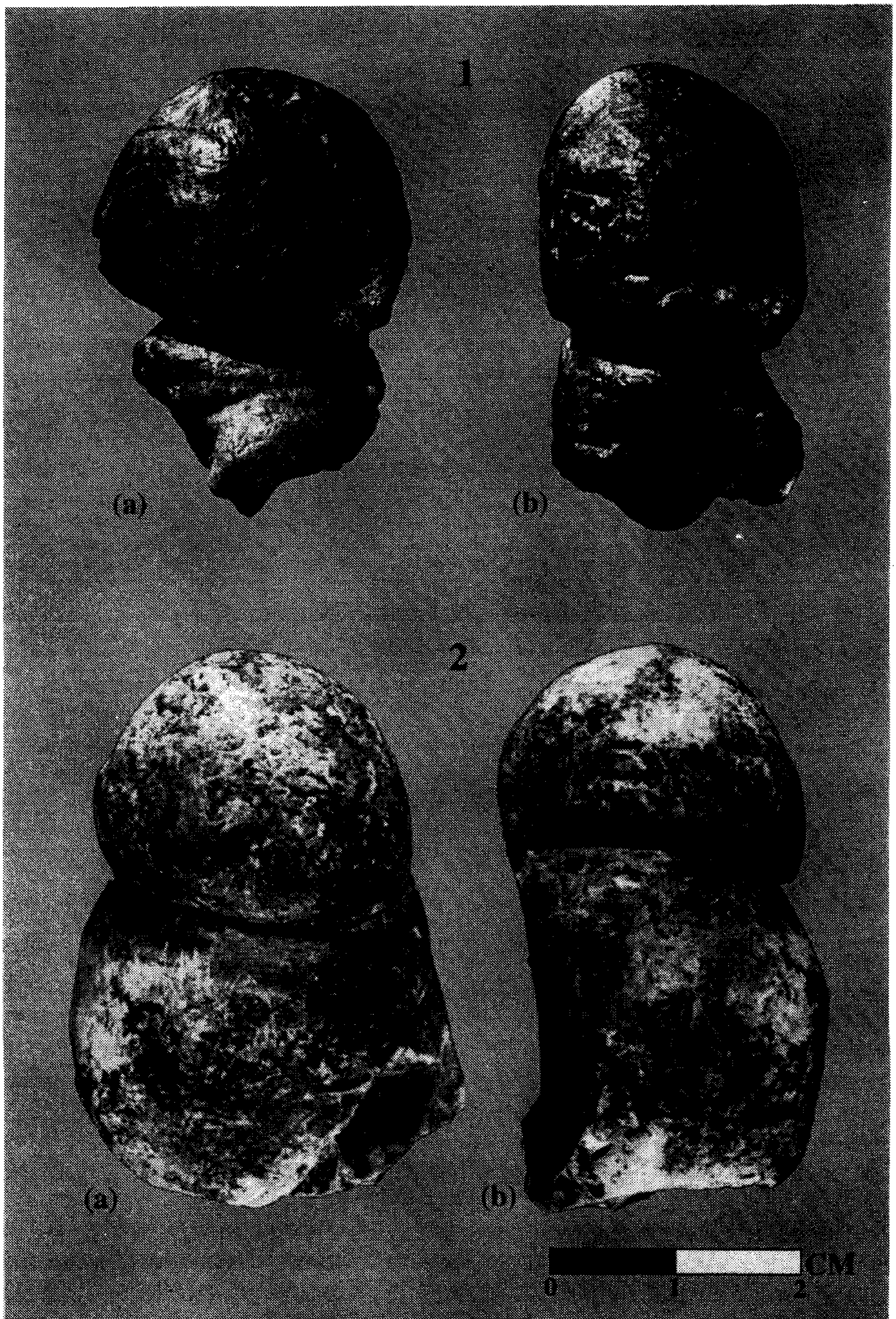


Fig. 57. Figurines from Garrod's (1) and the new (2) excavations at el-Wad.
1 - Carving of a human head in calcite: (a) in profile; (b) en face. 2 - Natufian rounded figurine: (a) in profile; (b) en face.

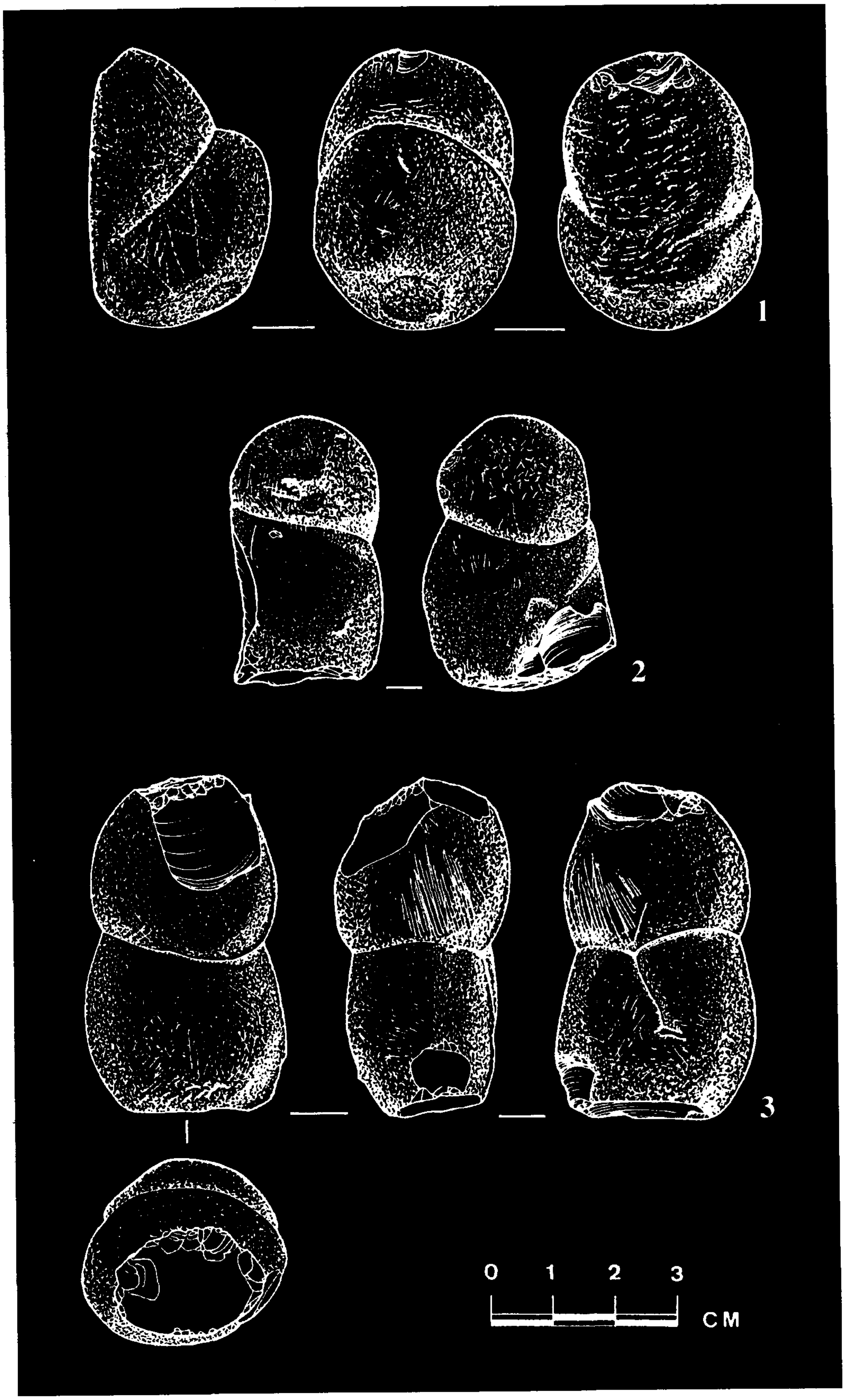


Fig. 58. Natufian rounded figurines recovered during the recent excavations at el-Wad.

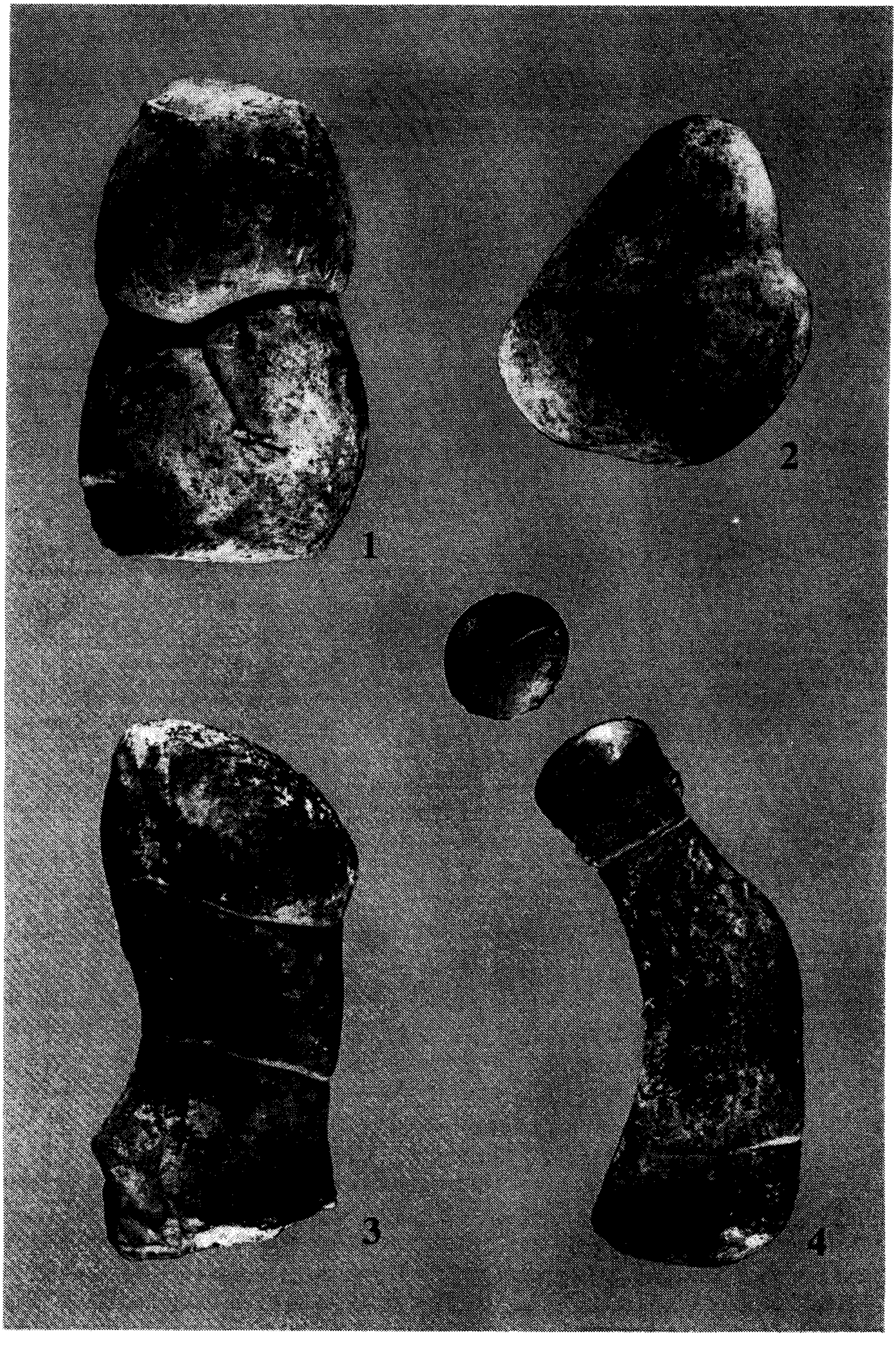


Fig. 59. Rounded (1 and 2) and elongated (3 and 4) figurines from the recent excavations at el-Wad.

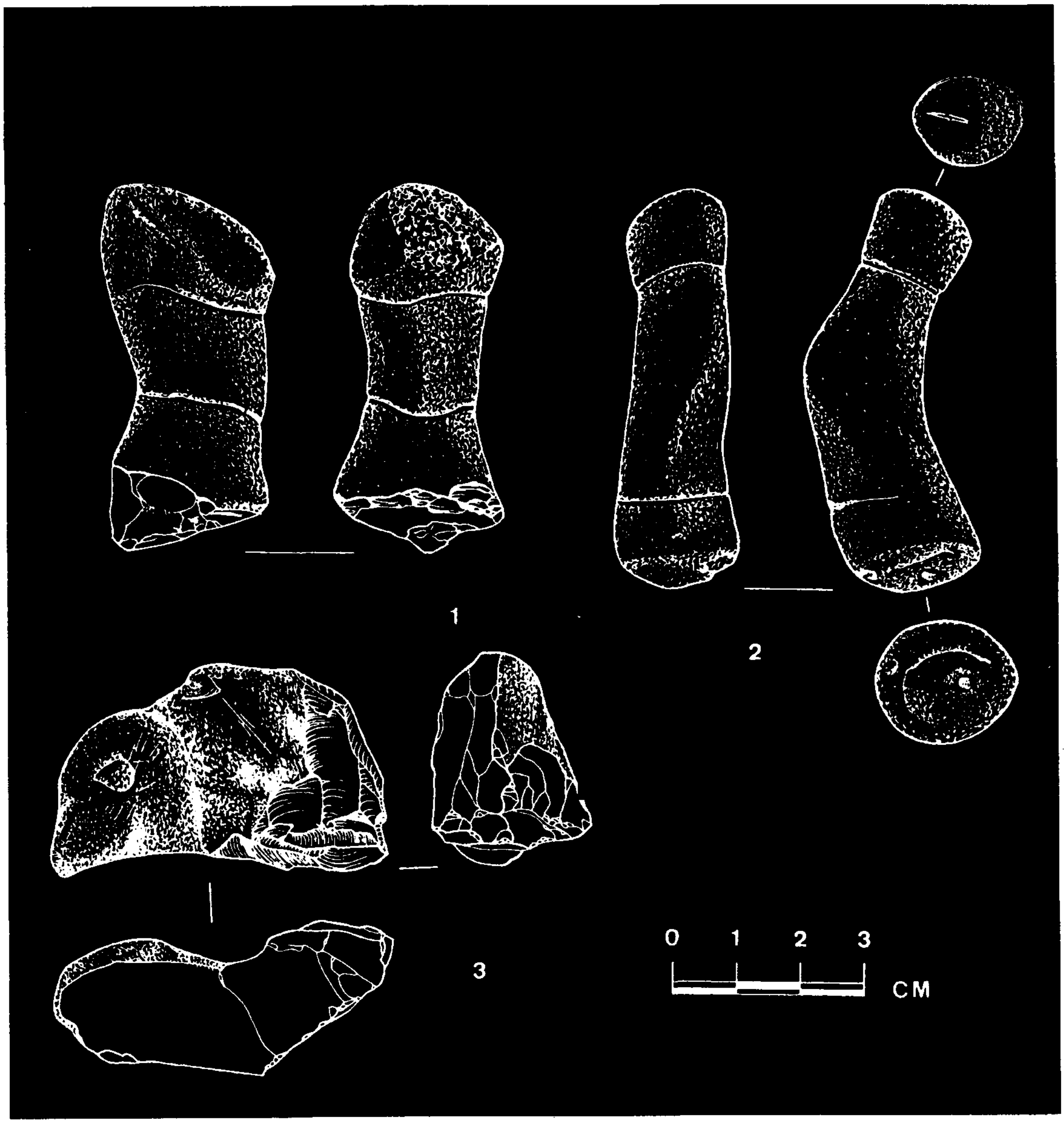


Fig. 60. Natufian figurines recovered during the recent excavations at el-Wad. 1 and 2 Phallic objects; 3 - a zoomorphic flint nodule.

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,

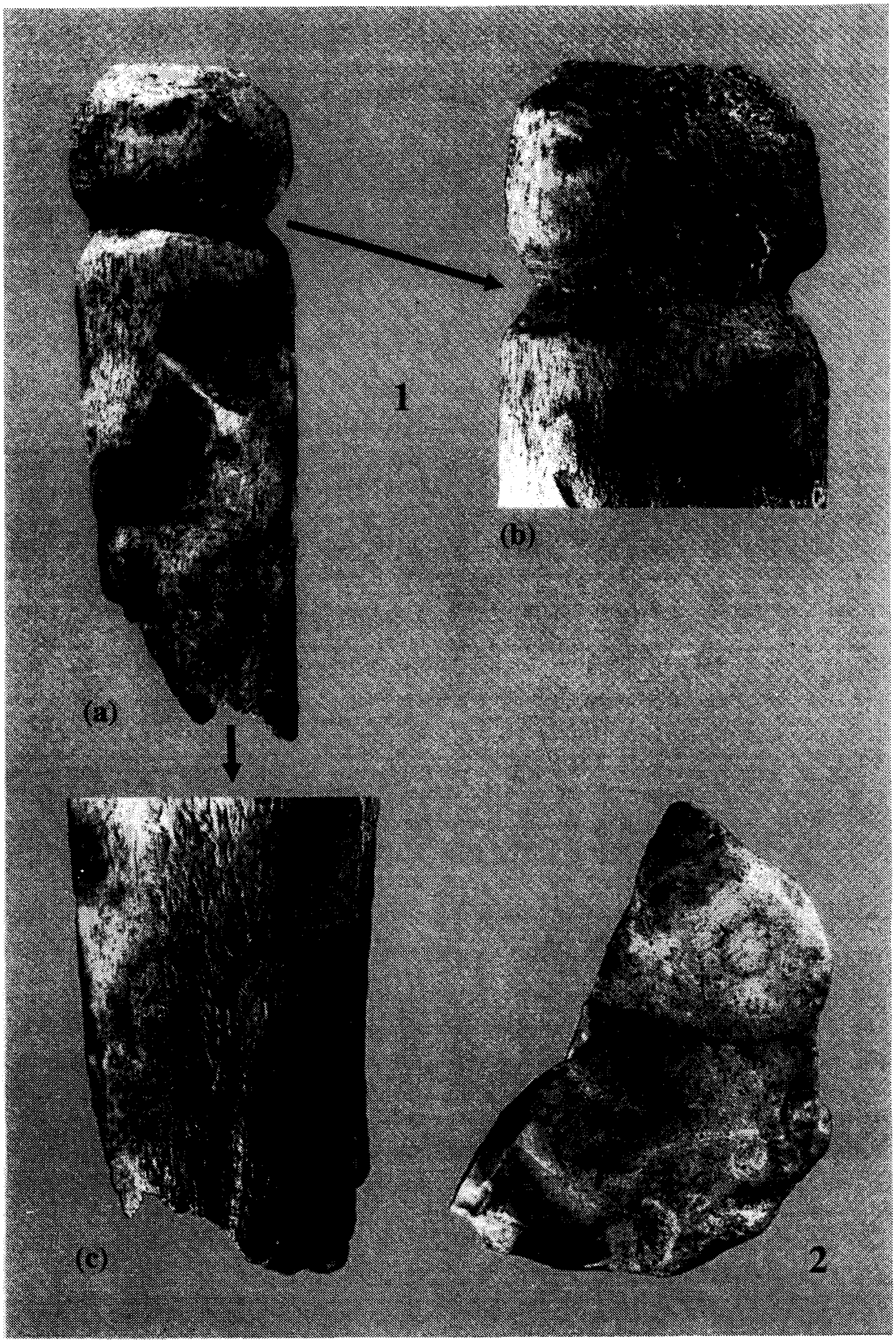


Fig. 61. Natufian figurines from el-Wad. 1 - a figurine made on a gazelle horn core (a); close-ups at various points (b and c). 2 - a zoomorphic flint nodule.

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.

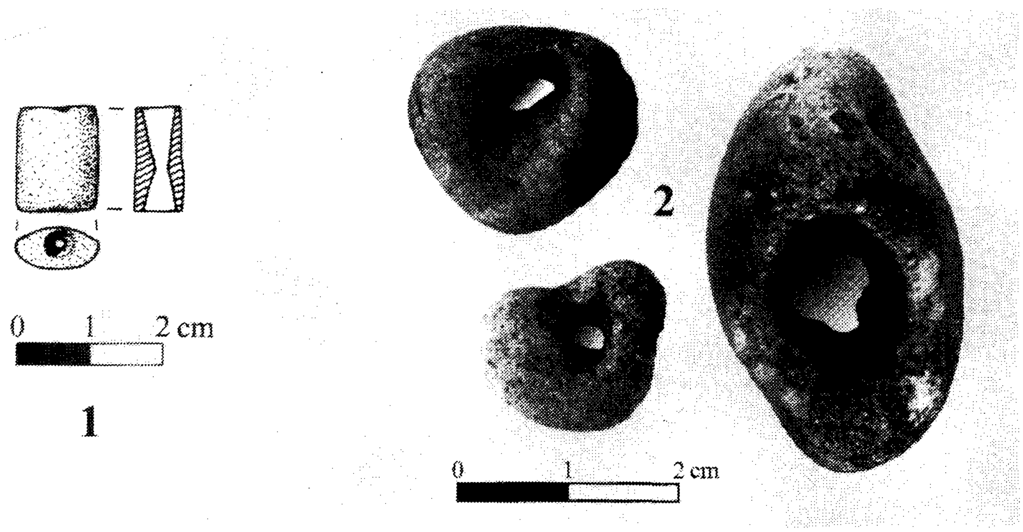


Fig. 62. A stone bead (1) and sandstone "beads" (2).

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).

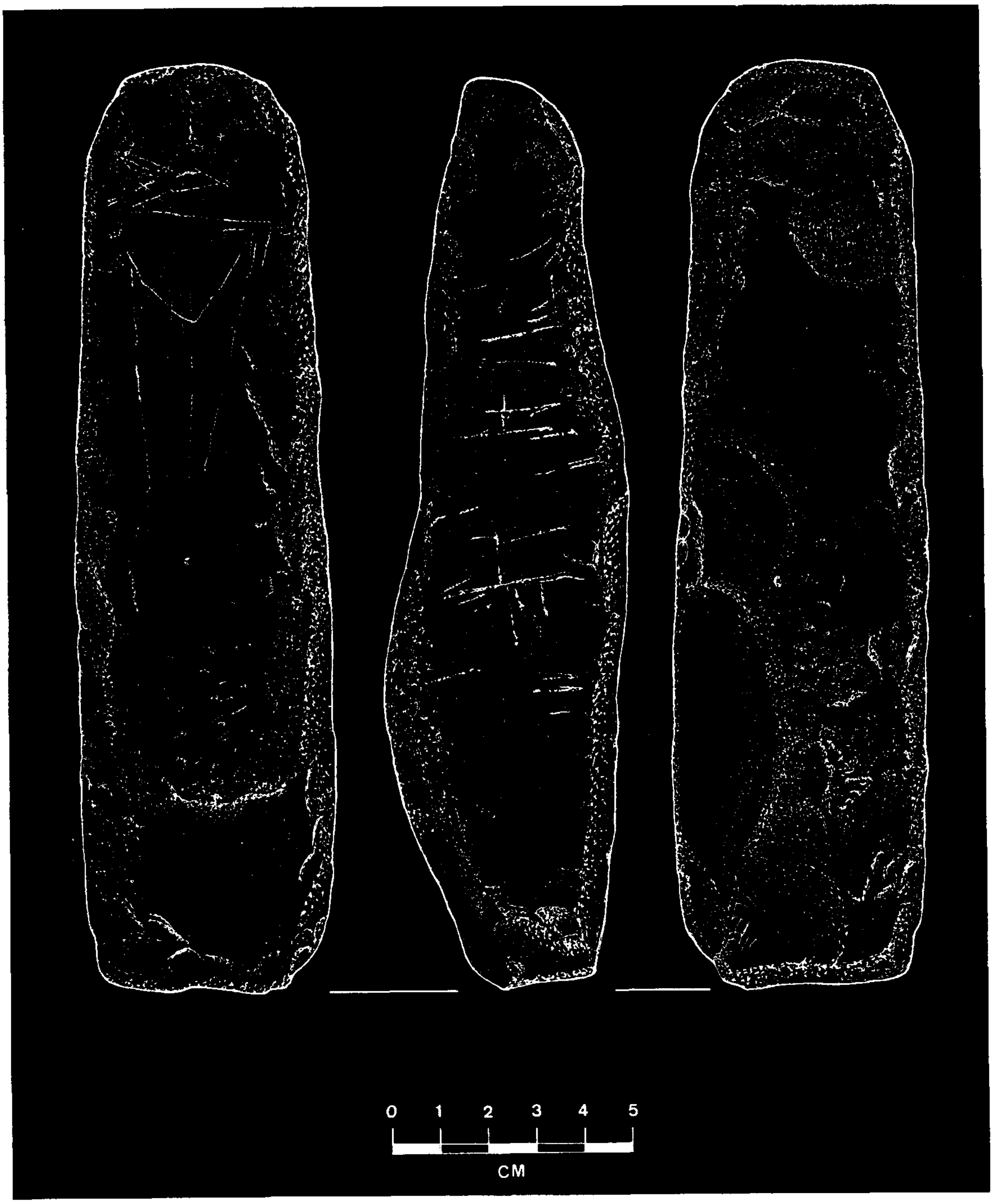


Fig. 63. An incised limestone pestle from the recent excavations at el-Wad.

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.

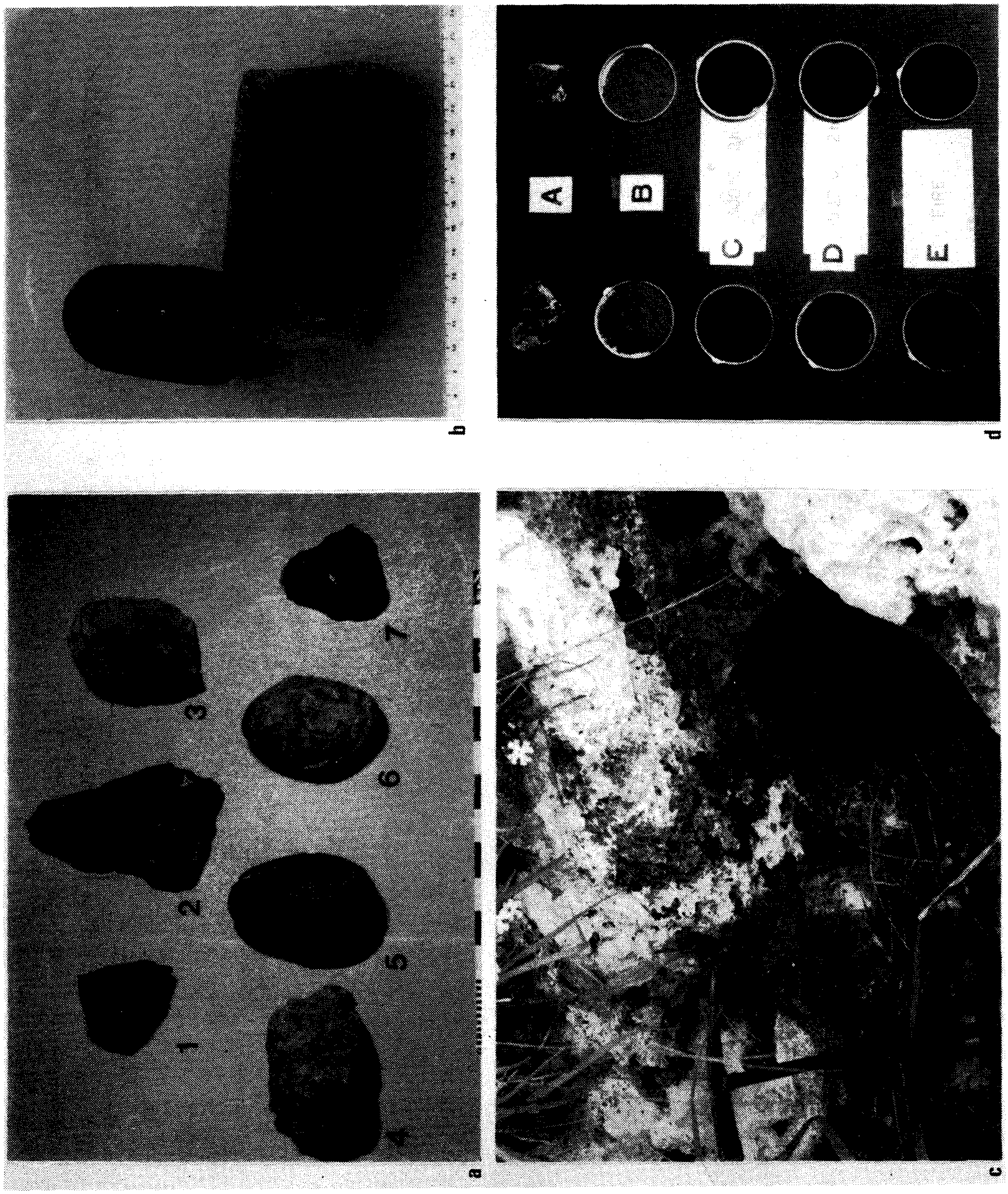


Fig. 64. El-Wad Cave and Mount Carmel iron-oxides. (a) Ochre fragments found in the Natufian layers of el-Wad: Haematite (2-3,7), goethite (4,6), jasperoid-type (1), quartzolite pebble (5); (b) red haematite staining on Natufian basalt pestles from el-Wad; (c) outcrop of iron-oxide veins, site 8: Haematite (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°C, for two hours.

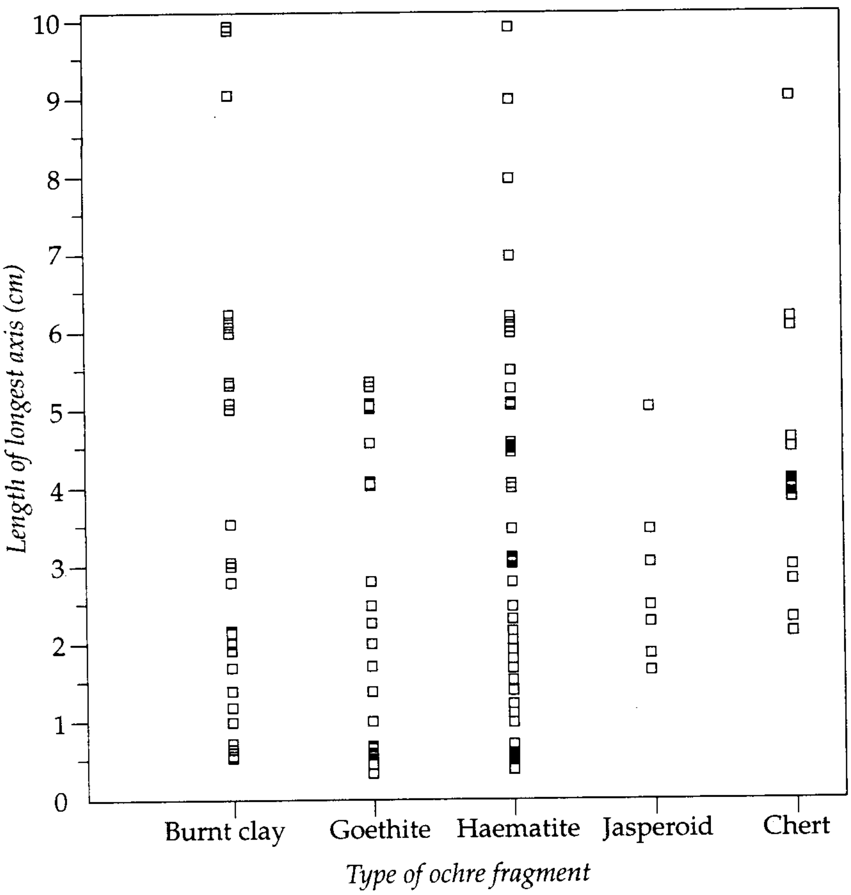


Fig. 65. Types of ochre fragments found in the el-Wad cave.

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.

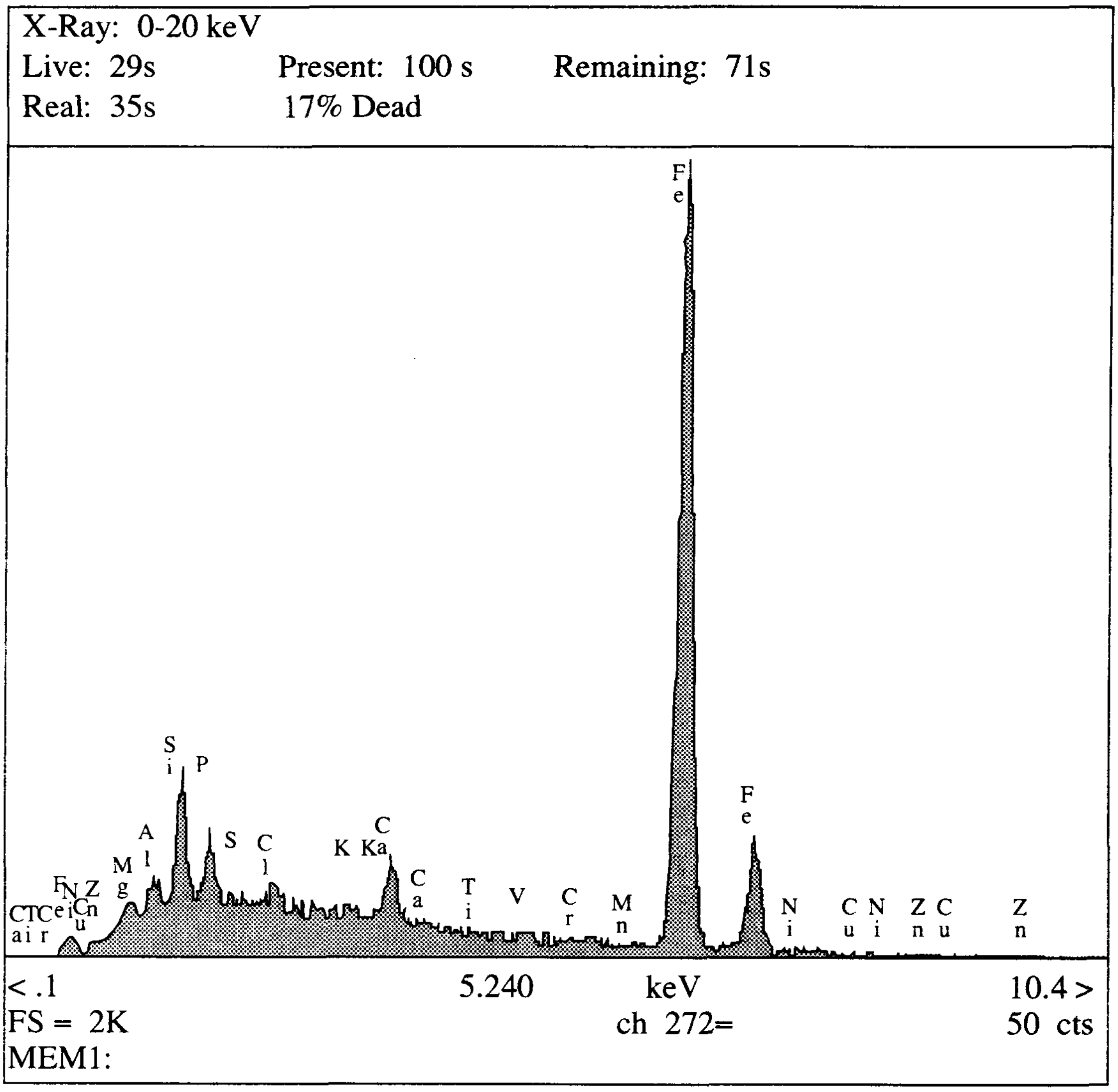


Fig. 66. SEM analysis of red ochre found on a basalt pestle at el-Wad.

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

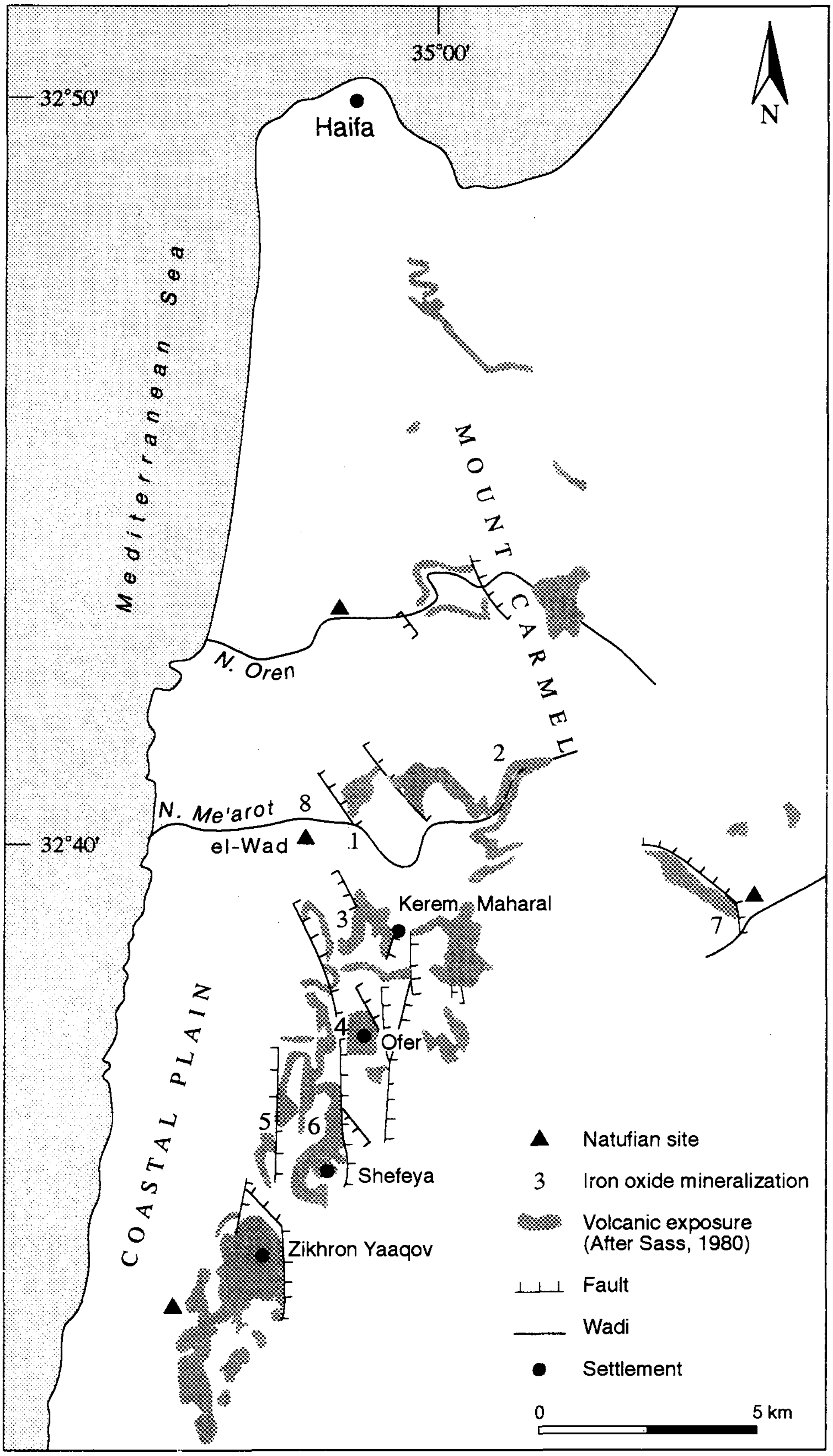


Fig. 67. Mount Carmel: location map of the volcanic outcrops and iron-oxide mineralization sites. 1. Nahal Me'arot (lower); 2. Nahal Me'arot (upper); 3. Kerem Maharal; 4. Ofer; 5. Tavasim; 6. Shefeya; 7. Rakefet Valley; 8. Nahal Me'arot (near the caves).

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.

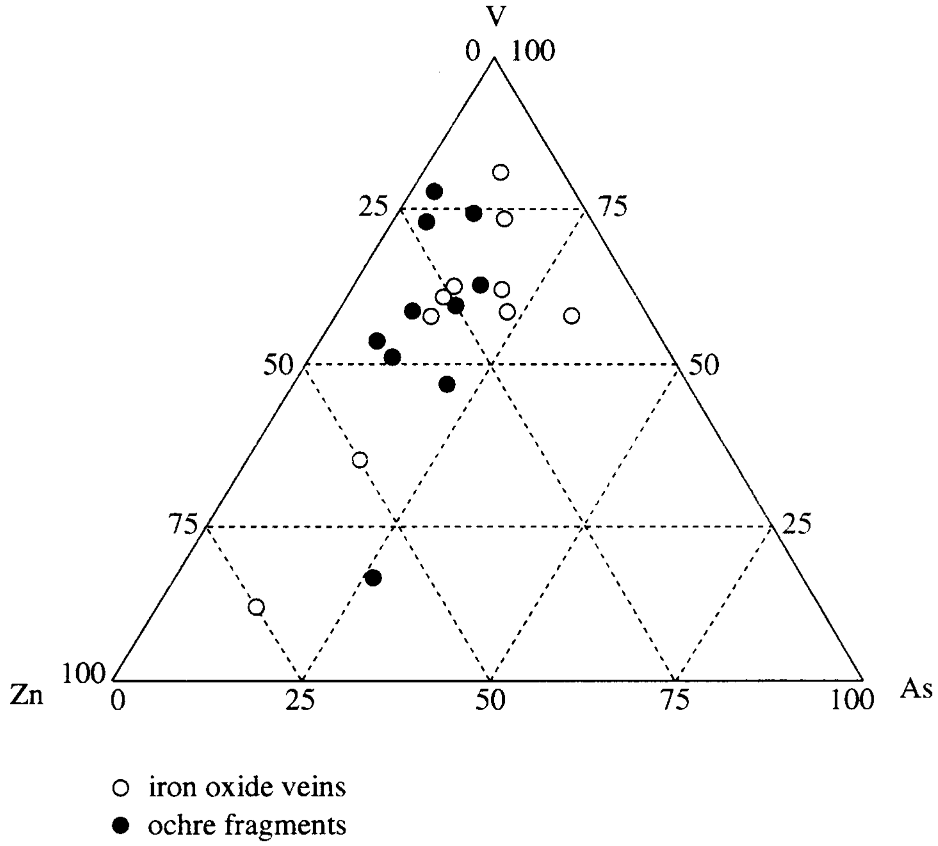


Fig. 68. Ternary diagram showing the vanadium (V), zinc (Zn) and arsenic (As) composition of the iron oxide veins and ochre fragments. x=As, y=100-V, Zn+V+As=100.

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.

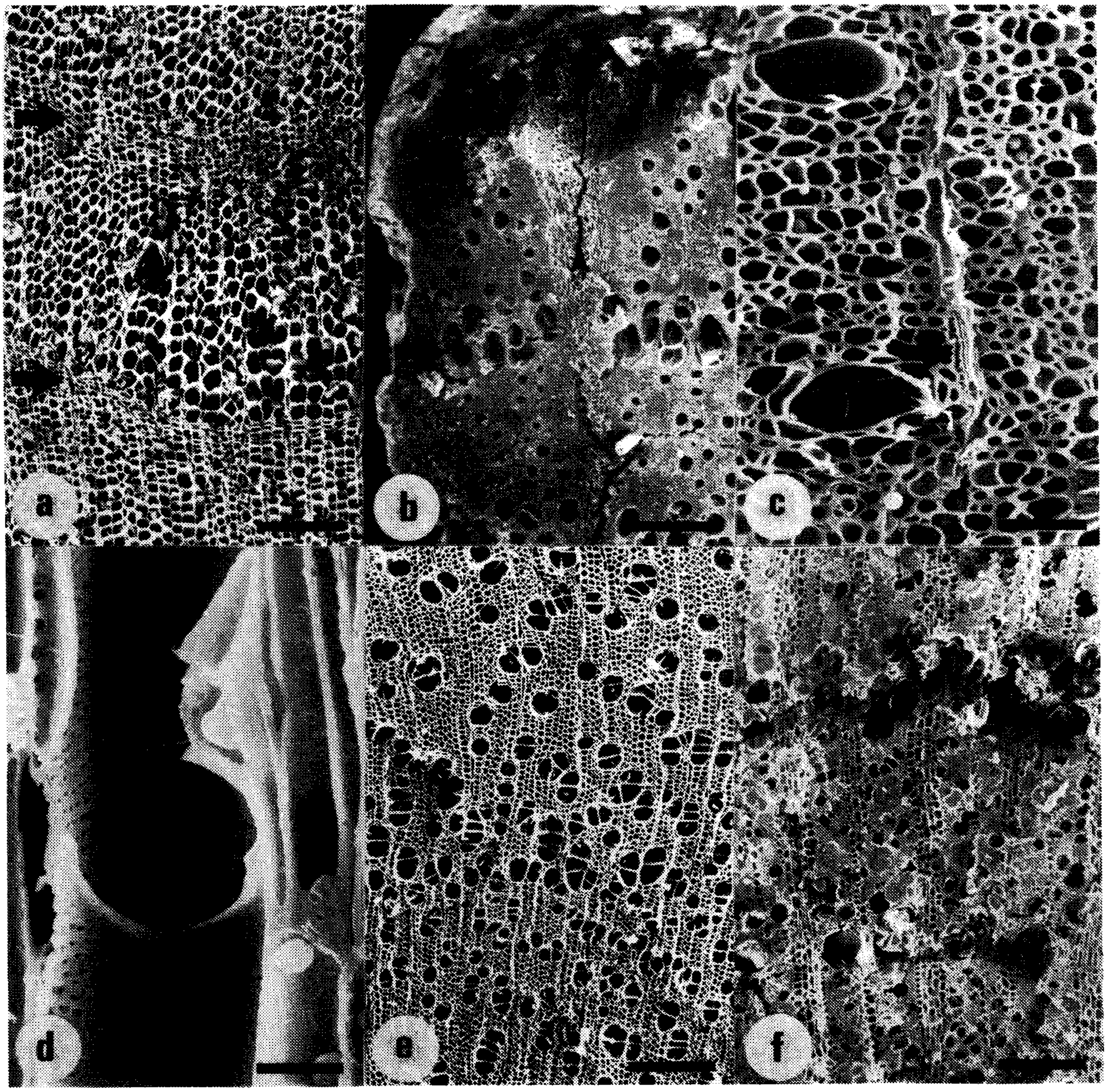


Fig. 69. Charcoal pieces from el-Wad cave as viewed in the Scanning Electron Microscope: (a) a cross section in the secondary xylem of *Cupressus sempervirens*. Two growth ring borders (arrows) are seen (bar = 100 μm); (b) a cross section in the secondary xylem of *Quercus ithaburensis*. Wide early wood 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).

Chapter 6

NATUFIAN USE OF THE ENVIRONMENT

Data concerning the use of the environment by the Early Natufian inhabitants of el-Wad can be gathered from two main sources: palaeoenvironmental studies of the Late Glacial period in the area, and direct evidence concerning the use of faunal and vegetal resources and mineral raw materials in the cave itself.

Palaeoenvironmental Studies

Palaeoenvironmental information regarding the Early Natufian, which coincides largely with the European Late Glacial, can be derived from several disciplines. The principal avenues explored in our case will be palynology and archaeobotany, geomorphology and sedimentology, and archaeozoology, while the more general information provided by the oxygen isotope curves of the eastern Mediterranean deep-sea cores will also prove useful. Because each of these disciplines has its inherent limitations, one occasionally runs up against contradictions in their interpretations, which means that in certain cases it may not be possible to arrive at a general reconstruction. The possible biases in the faunal assemblages, resulting from selective hunting, or the major gaps in the sedimentological data come readily to mind. Furthermore, analyses carried out in the various disciplines are indicative of discrete aspects of the palaeoenvironmental data. While the oxygen isotope curve can give us a general idea of changes in global temperatures, the palynological, faunal and probably also the sedimentological/ geomorphological evidence is more suitable if we want to reconstruct changes in humidity. Only rarely do such factors as changes in animal body size (Bergmann Rule: Bergmann, 1847; Mayr, 1956; Davis, 1981; Tchernov, 1979a), or peaks in *Cedrus* or the occurrence of *Utricularia* pollen (Weinstein-Evron, 1990) point to changes in temperature. Thus, we can correlate the various approaches and characterize a specific climatic fluctuation as, e.g., cold/humid or warm/humid, with some confidence only when we have sufficient absolute dates, and when the general picture is detailed enough.

Another difficulty arises from the lack of uniformity we encounter in the nature of data from different geographic regions (Fig. 70). Most of the palynological data come from the Rift Valley cores and not from the archaeological sites themselves. As for sites of northern Israel, the palaeoecological reconstructions here are based chiefly on faunal evidence whereas in the semi-arid regions, such as the Negev and Sinai, these are more often interpreted on the basis of sedimentological and geomorphological data.

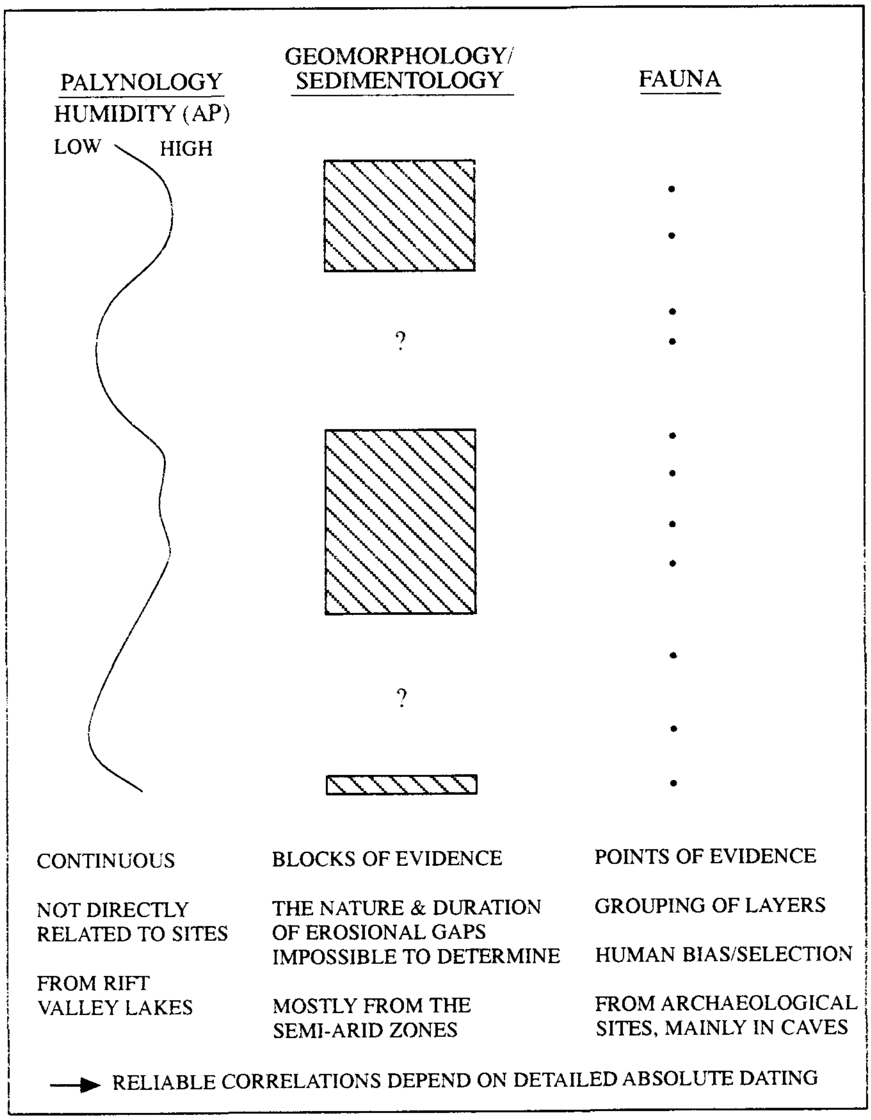


Fig. 70. Schematic representation of the nature and interpretational difficulties of data derived from various disciplines.

Also, there seem to be variations in the "coverage" the different disciplines provide. While palynological data give us more or less continuous curves (Fig. 70), only "blocks" of evidence can be extracted from the geomorphological/ sedimentological data. These "blocks" are often separated by gaps of indeterminable duration for which it is impossible to reconstruct climatological conditions and fluctuations (see also Fellner, 1995). Faunal data are the most sporadic (and probably the most biased) and can be best described as "data points", since they are usually related to specific sites or layers only. The same holds true for pollen assemblages from archaeological sites. Again, for a correlation of the different sets of data and reconstruction of palaeoenvironmental conditions for a specific site or phase to be reliable depends largely on dating.

Given the above, it is in our favour that the Natufian is relatively short: not only is it well covered by analyses of usually rich faunal assemblages, which makes their data more reliable than in earlier periods, but the general picture, too, is well known, especially because of the palynological studies that are available for this period. The latter will be discussed here in some detail, while additional, corroborative data from other disciplines will be cited in a more general way. Moreover, since we are dealing with the Natufian of el-Wad, our discussion focuses on the geographic area of present-day Israel, and information from neighbouring countries will be mentioned only in passing.

Palynology

Two distinct sets of palynological data are available: data obtained from cores in lacustrine deposits and data recovered from archaeological sites. While the former have the advantage of being better preserved and of providing us with larger sample size and greater chronological depth and continuity, the latter are on the whole more narrowly associated with a particular period and more likely to reflect only the local environment or to be biased in other ways.

A palynological sequence from the Hula covering the Natufian was recently published by Baruch and Bottema (1991). The presented Hula curve (Fig. 71) is securely dated with four uncalibrated ^{14}C dates, and can be divided roughly into three main sections. The lower part, from the base of the core to a depth of c. 14.5m (samples 11-12), is characterized by low arboreal pollen (AP) levels, mainly *Quercus ithaburensis* type (deciduous oaks) and some *Pinus*, Gramineae (Poaceae), and relatively abundant Chenopodiaceae and *Artemisia*. The middle part, from c. 14.5 - 11.5m (sample 34), exhibits high AP ratios, mainly deciduous oaks, but with a small rise in *Quercus calliprinos* (kermes oak), *Pistacia* and some *Olea*. Gramineae pollen are still the most abundant, decreasing gradually with the rise in AP. Chenopodiaceae and especially *Artemisia* exhibit pronouncedly lower ratios than before, the latter practically disappearing towards later parts of the sequence. In the upper part of the core, AP levels decrease again, with *Quercus ithaburensis* type pollen as the main element. *Pistacia* and especially *Quercus calliprinos* pollen are more abundant than in the earlier parts of the sequence. Decreases in AP values are compensated for by temporary increases in the Gramineae, with the Chenopodiaceae curve exhibiting similar trends. *Artemisia* pollen has by now disappeared almost entirely.

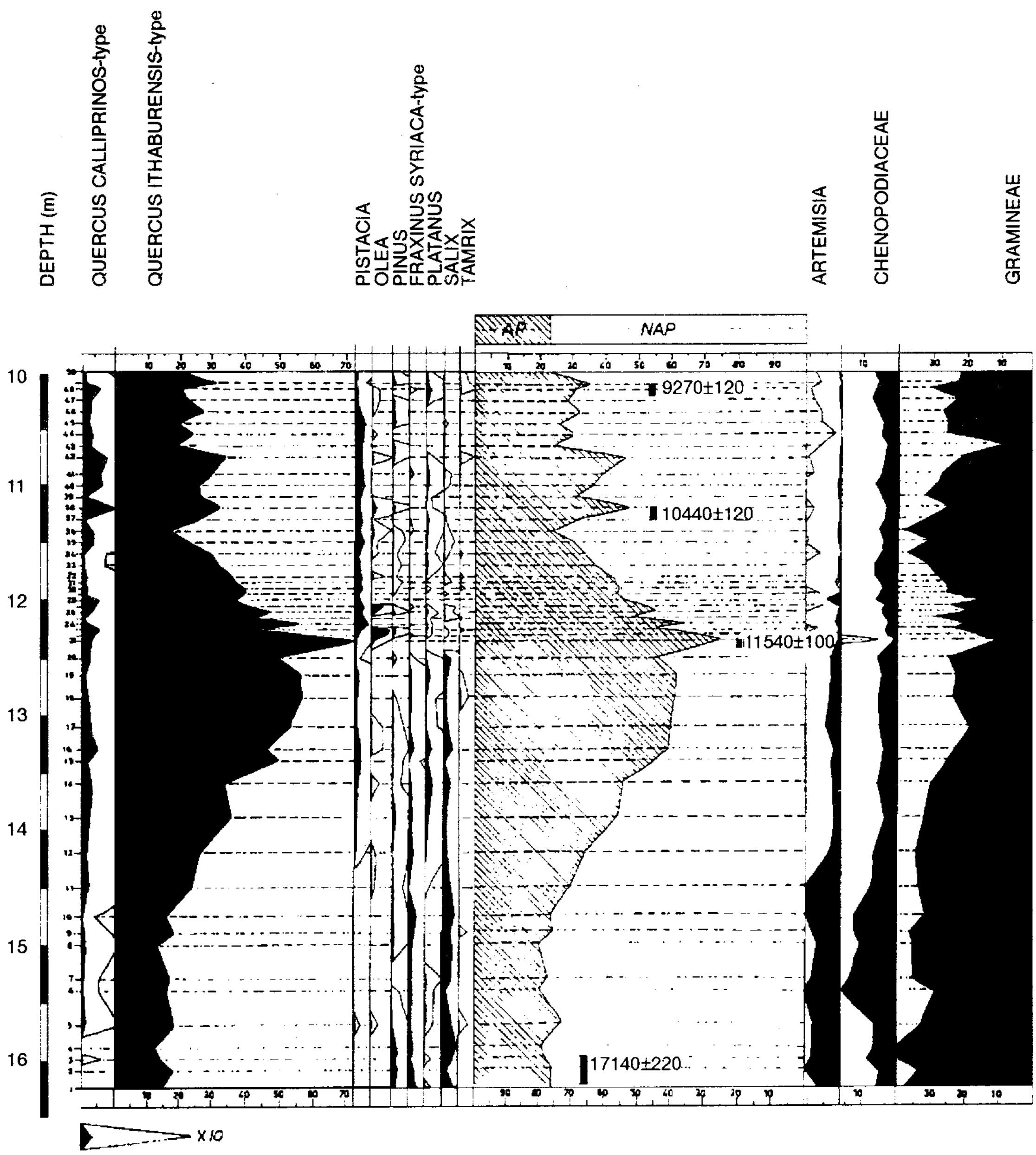


Fig. 71. Baruch and Bottema's Hula pollen diagram.

The earlier phase of Baruch and Bottema's sequence corresponds to the end of the European LGM (Pleniglacial maximum), with the driest spectra of the sequence, as evidenced by the low AP values, coupled with high values of Chenopodiaceae and *Artemisia*. That is, the climate was dry. That this time-span coincided with the Pleniglacial maximum (isotope stage 2) means that it was also cold, as the deep sea cores indicate (e.g., Ryan, 1972; CLIMAP, 1976; Thunell, 1979; Luz, 1982; Nesteroff et al, 1983; Bard et al., 1990; Broecker, 1992; Rossignol-Strick, 1993; Walker, 1995; Cheddadi and Rossignol-Strick, 1995), and as has been corroborated recently by a detailed isotope analysis of Israeli speleothems (Bar-Matthews and Ayalon, 1997). The humid Late Glacial followed, characterized by a marked increase in AP and a clear withdrawal of desert vegetation, especially the *Artemisia*. It was these favourable conditions, i.e., more humidity and warmth than in the earlier phase, that were enjoyed by the Early Natufians. A change to drier conditions came at the end of the Early Natufian and the transition to the Late Natufian. The peak of this dry phase was around 10,500 BP. Baruch and Bottema (1991) relate this dry phase to the cold, European Younger Dryas (see also Bottema, 1995). Slightly more humid fluctuations followed, but the high humidity of the Early Natufian was never regained in the period under discussion. Of course, it would be preferable to correlate the various palynological sequences in due course using calibrated rather than uncalibrated dates. Still, as we showed earlier (Chapter 5, "Dating"), this will have but a minor bearing on the relative antiquity of, and interrelationships between, Natufian sites. For example, if we calibrate the two available dates for the Natufian in Baruch and Bottema's curve (11540±100 BP and 10,440±120 BP; Fig. 71), the resulting calendaric ages (11,660-11,380 BC and 10,570-10,180 BC respectively), when related to those of Natufian sites (Table 1), are hardly such that they will influence our views regarding the palaeoecological background or the onset of specific climatic fluctuations during the "calibrated Natufian".

Significantly, the sub-division proposed here takes into account the older Hula sequence, as represented by Tsukada (Fig. 72b; see below), which suggests that the lower part of Baruch and Bottema's Hula curve should be regarded as an independent phase, coming at the end of an earlier fluctuation. In this it differs somewhat from the sub-division suggested by Baruch and Bottema (1991), who located the boundary between the two earlier sections at sample 14 (a depth of *c.* 13.5m). According to them, the resulting lower part of the sequence is characterized by gradually rising AP values and is taken to represent a mere transitional stage to the very humid, middle section.

Very similar trends are seen in an earlier analysed Hula core (Tsukada, unpublished, cited in Bottema and Van Zeist, 1981) and in a core taken from the Ghab Valley, 300km north of the Hula (Niklewski and Van Zeist, 1970). This correlation (Fig. 72) is based on a modified, chronological framework for the Ghab, earlier put forward by Weinstein-Evron (1990). In all three cores, the humid Late Glacial follows a very dry phase, with the lowest AP levels in the sequence and with many Chenopodiaceae and *Artemisia*. The latter two can be seen clearly in the new Hula (Figs. 71, 72a) and the Ghab (Fig. 72c) curves, but they are not specified in the less detailed old Hula curve (Fig. 72b). The low *Quercus calliprinos* values, and the similar trends in *Pinus*, *Pistacia* and *Olea* in the two curves, strongly suggest that they may have been contemporaneous.

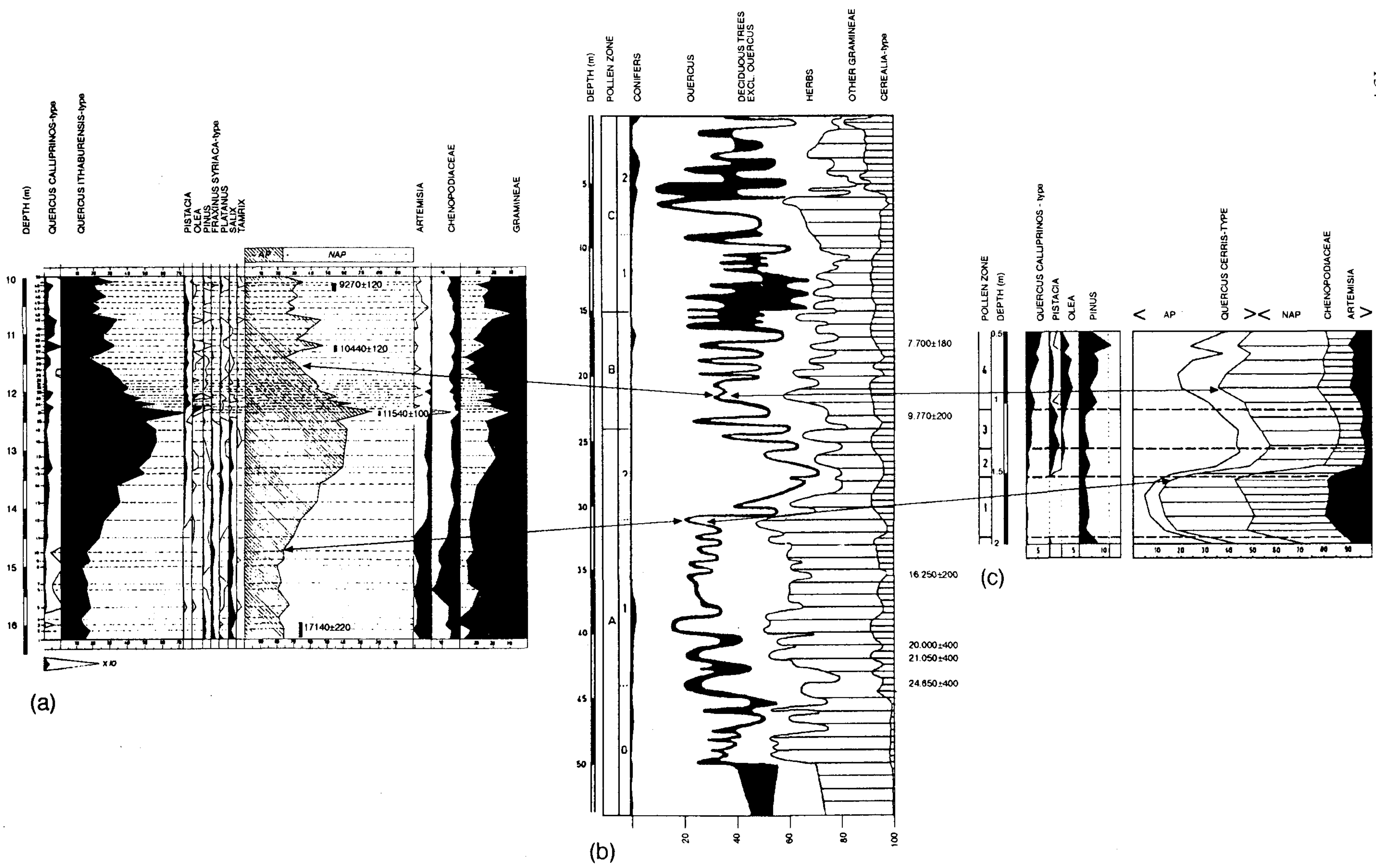


Fig. 72. Correlation of curves representing the LGM – Lateglacial sections of the Ghab (a) and Hula (b and c) palynological sequences: (a) after Baruch and Bottema (1991); (b) after Tsukada (unpublished), in Bottema and van Zeist (1981); (c) after Niklewski and van Zeist (1970) and van Zeist and Woldring (1980).

The humid Late Glacial sequence of the two sites is characterized chiefly by high values of *Quercus ithaburensis* type pollen, indicating that the forest was dominated by deciduous oaks. Unfortunately, it is impossible to distinguish palynologically between the various candidates from amongst the deciduous oak species in the region, which include *Quercus ithaburensis, Q. boissieri, Q. libani* (in the Hula area), *Q. boissieri, Q. cerris, Q. brantii* and *Q. libani* (in the Ghab area). In other words, there seems to be no ground to suggest that the most common species in the Hula was *Q. ithaburensis,* which is the most xeric (Baruch and Bottema, 1991). The long-lasting, very humid conditions could easily have encouraged rather the spread of the other deciduous oaks in the area.

A drier climate prevailed in the upper part of the sequence. AP levels are considerably lower than in the Late Glacial, and their composition in the two sites, with *Quercus calliprinos, Pinus, Pistacia* and *Olea,* indicates the occurrence of some sort of mixed maquis in the Mediterranean pyhtogeographic zone of the region.

Much the same picture emerges from palynological studies of Natufian sites (Fig. 73), especially in the Lower Jordan Rift Valley (Leroi-Gourhan and Darmon, 1987; Darmon, 1987, 1988). A long dry phase between ca. 19000-15000 BP (the LGM) was followed by a relatively humid Late Glacial, as represented by the short Early Natufian sequence of Salibiya XII. The long, increasingly drier Late to Terminal Natufian series of Salibiya I, Fazael IV and Salibiya IX ended the Natufian sequence in the area. A similar trend can be seen in the Early Natufian occupation at Wadi Judayid, southern Jordan (Emery-Barbier, 1988, 1995), where, following a short, dry phase (layer C), humid conditions prevailed (layer B). The difference between the picture derived from these archaeological sites and the clearer Hula curve can be explained by the more fragmentary nature of their data, their poor (often inadequate) dating, the possible over-representation of ruderal and disturbed habitats near the sites, and the various biases at play, especially those related to selective preservation of pollen (Weinstein-Evron, 1986, 1994). The high Asteraceae (Compositae) values in the samples indicate the importance of the latter factor (Bottema, 1975). Palynological data from two other Natufian sites, Eynan (Leroi-Gourhan, 1984) and Hayonim Terrace (Henry et al., 1981), are even more difficult to fit within the general curve (but see Leroi-Gourhan and Darmon, 1991).

Similarly, the pollen assemblages from the Early Natufian of el-Wad are most probably biased due to human activity at the site (Weinstein-Evron, 1994; see above Chapter 5, "Organic Material"). The analysed pollen samples were collected from Chamber III, i.e., the inner part of the cave, since no Natufian sediments have been preserved in the outer chambers of the cave. There is good ground to suspect, however, that pollen spectra from the outer part would have been skewed by the orientation of the opening of the cave, i.e., as the cave opens to the NW, the vegetation of the coastal plain west of Mount Carmel would have been over-represented as compared with that of the mountain itself making general palaeoenvironmental reconstruction unreliable. This phenomenon has already been discussed regarding the adjacent Tabun Cave (Horowitz 1979), as well as other sites in the area (Weinstein, 1981; Weinstein-Evron, 1994). Still, the archaeobotanical data suggest the occurrence of typical Mediterranean vegetational formations in the area,

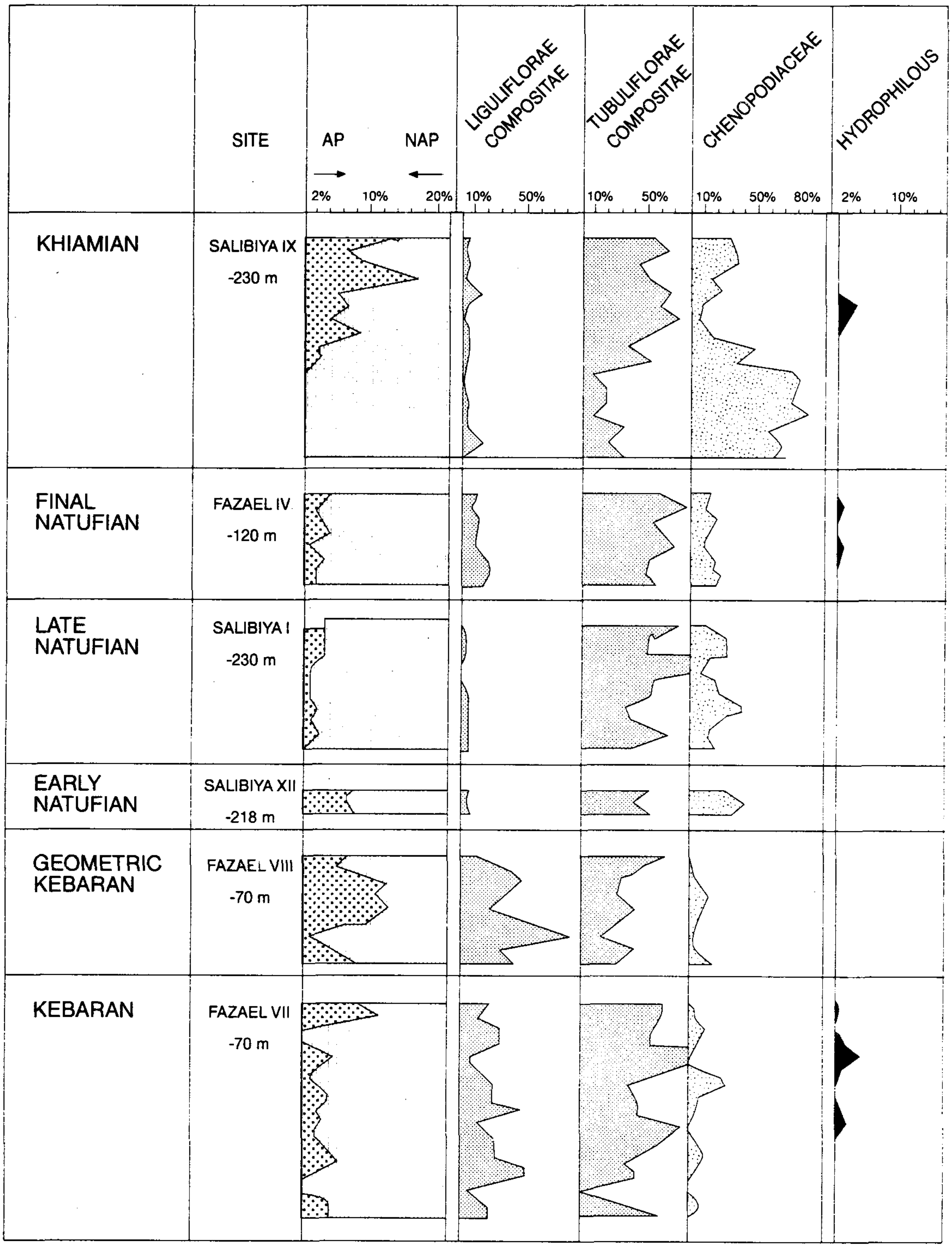


Fig. 73. Simplified pollen diagram of Fazael-Salibiya sites.

but the exact nature and extent are impossible to gauge on the basis of pollen samples from the site alone.

Geology and Geomorphology

As already mentioned, most of the available sedimentological data come from the semi-arid zones of the Levant. Here, palaeoenvironmental changes can be traced through an interpretation of geomorphological data from a series of geological sections, mainly by identifying alluvial/depositional (= humid) and colluvial/erosional (= dry) phases, and with the help of, e.g., processes such as pedogenesis and sand incursion (e.g., Besançon, 1981; Goldberg, 1977, 1981, 1986, 1994; Goldberg and O. Bar-Yosef, 1982; Goldberg and Brimer, 1983; Goring-Morris and Goldberg, 1990; Phillips, 1988; Phillips and Gladfelter, 1989; Gladfelter, 1990; Schuldenrein and Goldberg, 1981; Garrard et al., 1987, among others; see also a recent review by Sanlaville [1996] and references therein). The chronological framework arrived at depends on the presence of relatively or absolutely dated sites or artefacts. That such information is rarely available for all parts of a depositional sequence, and that the sections themselves show many gaps, means that dating successive sedimentological phases will always remain rather vague. This is particularly critical for the boundaries between phases, since here the evidence for the onset and/or end of specific conditions will often have eroded away, inevitably leading to slightly differing versions of chronological reconstructions for the same sections and processes (e.g., Fellner, 1995; Weinstein-Evron, 1993b). However, the overall picture that emerges corresponds rather well with the palynological data. A dry phase, between 22,000/20,000 and 17,000/14,500 BP, broadly coinciding with the LGM (Weinstein-Evron, 1993b), was followed by a humid Late Glacial, with a peak in precipitation between 13,000 and 11,000 BP (Baruch and Bottema, 1991).

A similar picture emerges from the isotopic analysis and dating of well-developed calcic horizons within palaeosols contained in the northern Negev loess sections (Magaritz, 1986; Goodfriend and Magaritz, 1988). The relatively humid conditions during the periods centred around 29,000 and 13,000 BP, are also related to a southward displacement of the desert boundary (Magaritz, 1986, Magaritz and Goodfriend, 1987). Further evidence for the existence of a wet period at this time comes in the form of fresh-water lacustrine sediments that can be found in the present-day desert areas of the northern Sinai (e.g., Goldberg, 1977, 1984). A similar trend is indicated by the reconstructed high Lisan Lake levels (Begin et al., 1985), but opinions still vary as to the amplitude and exact chronology of variations in lake levels (Goldberg, 1994 and references therein; Sanlaville, 1996 and references therein). An increase in the number of human occupation sites in the present-day semi-arid zones is also indicative of relatively moist conditions (Goldberg and Bar-Yosef, 1982).

That, similar to the scenario implied by the palynological evidence (Baruch and Bottema, 1991), there was a short, dry interval between c. 11,000 - 10,000 BP is here indicated by dune migration (Magaritz, 1986; Magaritz and Enzel, 1990), and by the desert boundary extending northward (Magaritz and Goodfriend, 1987), as can be gathered from, e.g., land-snail studies (Magaritz and Heller, 1980), the deposition of a thick layer of halite, recorded in boreholes in the Dead Sea area (Yechieli et al., 1993), and various data from Mediterranean (e.g., Rossignol-Strick, 1993, 1995) and Red Sea (Almogi-Labin et al., 1991) cores.

Fauna

Based on her studies in Mount Carmel showing the relative changes between *Dama mesopotamica* and *Gazella gazella* representations, Bate (1937) was the first to suggest that Natufian faunal assemblages, which are typically rich in gazelles, indicate a relatively dry climate. This is supported by the composition of microfaunal assemblages (Tchernov, 1979b). Significantly, the Natufian was then discussed "en gros", and no evidence for changing trends during this period was available. Moreover, in the case of the el-Wad Layer B assemblage, for example, some cross-site grouping was employed, and "[a]lthough no remains of *Capreolus*, *Cervus elaphus*, or *Alcelaphus* were actually present in the collection from Level B of M. Wad, specimens representing each of these species were obtained from the corresponding Level of the neighbouring cave of Kebara, and may therefore be justifiably included in the faunal assemblage of this time" (Bate, 1937: 153). When deeper Natufian sequences were studied and sub-phases and chronology were defined and refined, a significant decrease in numbers of *Dama mesopotamica* as compared to *Gazella gazella* was observed in most sites. This shift apparently coincides with the change from the Early to Late Natufian (Davis, 1982, 1987), suggesting aridification and decrease of woodland through time.

Several questions are still to be resolved regarding this apparent palaeoecological change: (1) was this apparent decrease in woodland and concomitant rise in numbers of gazelles climatically (as suggested by the palynological and other palaeoenvironmental data) or humanly induced (Garrard, 1982); (2) does it reflect demographic pressure intensified by environmental deterioration (Davis, 1982, 1987, 1991) or, (3) does it reflect selective hunting or culling, possibly even herding, of gazelles (Legge, 1972b; Davis, 1982, 1983, 1991; Cope, 1991, but see Dayan and Simberloff, 1995). The faunal evidence from the el-Wad terrace (Valla et al., 1986) seems to indicate some humidification towards the end of the Natufian, but the assemblage is too small for a reliable trend to be established. As with many other Natufian faunal assemblages, the el-Wad data exhibit a large variety of species, indicative of a wide range of habitats exploited (see also below, Appendix III).

Subsistence

Since el-Wad is located in an ecotonal setting where the slopes of Mount Carmel meet the open expanses of the coastal plain, a variety of locally available resources from different ecotypes could be exploited, including hills, mountain slopes, mountain inner valleys, the coastal plain, the wadi itself, and near-by springs. The Mediterranean sea and shore also provided raw material and food resources. This picture conforms to the model suggested by Henry (1989) for major Natufian sites, or hamlets, in general, according to which each such site enjoys a number of different habitats and proximity of important resources (i.e., wadi channel and springs, plant and animal resources, and flint), and whose integration results in a viable economy. While no springs are reported from the vicinity of el-Wad today (Inbar and Ayal, 1980), two are specified on Mandatory maps of the area (Survey of Palestine, 1942): one on the mountain, some 1.5km north-east of the cave, and another in the coastal plain, 0.8km to the south-west of the site. Much of the water from springs has been since captured and water production from new bores (Inbar and Ayal, 1980) have necessarily resulted in a lowering of the groundwater level in the area.

Over-representation of gazelles (*Gazella gazella*) among the faunal assemblages recovered from the site (Bate, 1937; Garrard, 1982; Valla et al., 1986; and see below, Appendix III) is generally seen as indication of the exploitation of local fauna, especially from the coastal plain; the good pasturing grounds that stretched along the foothills (see above, Chapter 3, "Use of the Cave in the 20th Century"), could have encouraged the grazing of gazelles. The relatively large, flat inner valleys that can be found within the Carmel area (e.g., Emeq Maharal, some 2.5km south-east of el-Wad; Fig. 7) raise the possibility that at least some of the hunted gazelles may have originated from such ecological settings (see also Bökönyi, 1982). Gazelles could also have been hunted on the Eocene hills of the southern Carmel and the Ramat Menashe area, some 5-15km to the south-east (Figs. 6, 7), with their characteristic *Quercus ithaburensis* deciduous park forest (Eig, 1933; Zohary, 1955), where they are found roaming till today (Salman Abu-Rukun, personal communication, 1997). Other animals, especially Cervidae (*Dama mesopotamica*, *Capreolus capreolus* and *Cervus elaphus*), were probably hunted in the more densely wooded Mount Carmel, or, e.g., in the forested areas of the coastal plain. The two former may also adjust to grassland and open landscapes (Putman, 1988). Together with the various deers, wild cattle (*Bos primigenius*) show that, besides open landscapes and grassland (Bökönyi, 1982), there were "localities with woods or thickets and an available [permanent] supply of water" (Bate, 1937: 154). The rodents found at el-Wad (Bate, 1937; Valla et al., 1986; below, Appendix III) also suggest the existence of more wooded areas (with e.g., *Sciurus anomalus*) alongside drier patches of open landscape (*Mesocricetus auratus*) and stands of grassland (*Microtus guentheri* and *Spalax ehrenbergi*) around the site. The latter may be a result of human activity in the immediate vicinity of el-Wad.

The Natufians of el-Wad made use of a variety of other mammals, amphibians, reptiles and birds (Valla et al., 1986; below, Appendix III), characteristic of various biotopes. That there were marshes or bodies of water is shown by the remains of *Pelobates syriacus* within the faunal assemblage (Valla et al., 1986). The use of the shore area itself is implied by the *Columbella rustica* shells found at the site (identified by D. E. Bar-Yosef), and by the occurrence of sandstone "beads" the Natufian inhabitants brought back with them (Fig. 62). Marine fish bones of littoral species (belonging to the Sparidae, Mullidae, Mugilidae and Serranidae families), together with marine shells (*Dentalium* sp., *Conus mediterraneus* and *Arcularis gibbosula*), were reported by Valla et al. (1986). While *Dentalium* shells were abundantly found at the site, and especially within the decorated burials where they "were used for making caps and circlets, and also for garters, capes, &c." (Garrod and Bate, 1937: 40), a list of some 15 other Mediterranean Mollusca species, identified by Connolly and Tomlin, is given in Bate (1937).

The ecotonal setting of the site, together with an abundance of vegetal resources, is further indicated by the botanical data (see above, Chapter 5, "Organic Material"). Both the charcoal remains (Lev-Yadun and Weinstein-Evron, 1993, 1994) and the pollen assemblages (Weinstein-Evron, 1994) suggest a local, typical Mediterranean environment, with many oaks and pistachio, and extensive use of tamarisk, most probably derived from the coastal marshes, whose existence for the period under discussion, besides the faunal evidence, is supported by ^{14}C dates for marshy clays in the Mount Carmel coastal plain (Galili and Weinstein-Evron, 1985).

Even though the same habitats and vegetal resources occur in the area today, they are only of limited use if we want to try to determine their exact distribution during the Early Natufian. Any attempt at reconstruction should take into account a good many factors, for example that the climate was more humid, that the coastal plain was wider, that the topographical setting of the cave (at *c*. 140m above msl) was different, and that there have been many thousands of intervening years of land use and abuse. Inevitably, any such attempt is bound to remain partial and tentative.

The faunal and botanical data gathered at el-Wad indicate clearly the existence of wooded areas, grassland or open park forests, as well as wadi banks and marshes, near the site. Based on geomorphological, botanical and lithological/ pedological data, it seems logical to assume that wooded areas (with *Quercus calliprinos* – *Pistacia palaestina* as the main association) covered the mountain near the cave, and probably rather densely occupied the north-facing slopes of the hills in the area (Fig. 74a,b; Weinstein-Evron, 1981; Nevo 1995), as also indicated by the Arabic term "El Wa'r" (= "thicket" or "bush") that appears on the Mandatory maps (Fig. 15). Since stands of these trees can be found today on the aeolianite ridges west of the cave, it is possible that this association was much more extended, covering larger areas of the coastal plain in front and to the north of the cave, where the plain narrows considerably (Fig. 7). Again, Arabic names for various spots in the area (Survey of Palestine, 1942) imply the occurrence of other species, typical of the Mount Carmel maquis, such as *Laurus nobilis* ("El Ghara") and *Pistacia lentiscus* ("Es Sarris"). The latter suggests that parts of these areas were covered by a more open *Ceratonia siliqua* – *Pistacia lentiscus* formation, typical of low elevations in the area today. This association would have also covered the warmer and drier hill slopes that face to the south (Fig. 74,a,c), creating a relatively open, "El Farsh" landscape (Fig. 15). The facing of slopes undoubtedly influenced differential exploitation of micro-habitats in the area. As indicated by its distribution today, *Quercus ithaburensis* park forest may have also existed not far from the cave (Fig. 12; Fig. 74d).

The Mount Carmel maquis has a large potential for vegetal resources, as indicated by a detailed botanical survey around Sefunim Cave, some 8km north of el-Wad (Naveh, 1984). Since the Sefunim area is less disturbed than Nahal Me'arot itself, results of the botanical survey carried out there may be taken to represent the el-Wad area too. Clearly, about half of the identified plant species (117 out of 237) are exploitable by humans (Table 13) either directly or indirectly, through browsers and pasturing animals.

Table 13: Exploitable plant species of the surroundings of Nahal Sefunim (after Naveh, 1984). Determination for human consumption according to Dafni (1984). Species names updated according to Feinbrun-Dothan and Danin (1991).

WOODY PLANTS					
Trees		**Shrubs**		**Dwarfshrubs**	
Arbutus andrachne	F W	*Calicotome villosa*	Fl Br W	*Cistus salviifolius*	L
Ceratonia siliqua	F! P! Br W	*Genista fasselata*	W	*Cistus creticus*	L
Cercis siliquastrum	Fl F Br W	*Pistacia lentiscus*	Br W	*Coridothymus capitatus*	L
Crataegus aronia	F Br W	*Rhamnus alaternus*	Br W	*Majorana syriaca*	L
Laurus nobilis	L Br W	*Rhamnus palaestina*	F Br W	*Melissa officinalis*	L
Olea europaea	F! Br W!	*Ruscus aculeatus*	L	*Micromeria fruticosa*	L
Phyllirea latifolia	Br W!	*Asparagus aphyllus*	Sh	*Salvia fruticosa*	L
Pinus halepensis	W	*Smilax aspera*	Sh	*Sarcopoterium spinosum*	Br W
Pistacia palaestina	F Br! W	*Tamus communis*	Sh	*Satureja thymbra*	L
Styrax officinalis	W			*Teucrium capitatum*	L
Quercus calliprinos	F Br! W				

HERBACEOUS PLANTS					
Geophytes		**Legumes**		**Miscellaneaous herbs**	
Arisarum vulgare	L	*Anthyllis tetraphylla*	P	*Alcea acaulis*	L S
Arum dioscioridis	L	*Coronilla cretica*	P	*Alcea setosa*	L S
Asphodelus ramosus	B	*Hippocrepis unisiliquosa*	P	*Anagallis arvensis*	L
Crocus hyemalis	B	*Hymenocarpos circinnatus*	S P	*Caspella bursa-pastoris*	L
Cyclamen persicum	L Fl	*Lathyrus blepharicarpus*	S P	*Convolvulus caelesyriacus*	P
Ophrys umbilicata	B	*Lotus peregrinus*	P	*Daucus carota*	R
Ophrys bornmuelleri	B	*Medicago orbicularis*	P!	*Erodium gruinum*	P
Ophrys israelitica	B	*Medicago scutellata*	P!	*Erodium moschatum*	P
Ophrys galilaea	B	*Medicago polymorpha*	P!	*Foeniculum vulgare*	L
Ophrys transhyrcana	B	*Onobrychis squarrosa*	P	*Geranium molle*	P
Orchis caspia	B	*Pisum elatius*	S L P	*Geranium purpureum*	P
Orchis galilaea	B	*Scorpiurus muricatus*	P!	*Geranium rotundifolium*	P
Orchis tridentata	B	*Tetragonolobus paleastinus*	P!	*Isatis lusitanica*	L
Serapias levantina	B	*Trifolium campestre*	P!	*Kicksia spuria*	P
Tulipa agenensis	B	*Trifolium clusii*	P	*Mandragora autumnalis*	F
		Trifolium clypeatum	P!	*Nigella arvensis*	S
Grasses		*Trifolium stellatum*	P	*Papaver carmeli*	S
Aegilops ovata	S P	*Vicia hybrida*	S P!	*Plantago cretica*	L
Brachypodium distachyon	P			*Plantago afra*	L
Andropogon distachyus	P!	**Asteraceae**		*Salvia hierosolymitana*	L
Avena sterilis	P!	*Calendula arvensis*	L P	*Salvia pinnata*	L
Bromus alopecurus	P	*Carduus argentatus*	L	*Sanguisorba minor*	L P
Bromus syriacus	P	*Carlina involucrata*	L	*Sinapsis arvensis*	L
Catapodium rigidum	P	*Catananche lutea*	P		
Dactylis glomerata	P!	*Cichorium pumilum*	L S P		
Hordeum bulbosum	S B P!	*Gundelia tournefortii*	C		
Hordeum spontaneum	S P!	*Hedypnois cretica*	P		
Hyparrhenia hirta	P	*Inula viscosa*	L C		
Lopochloa phleoides	P	*Notobasis syriaca*	P		
Phleum subulatum	P	*Rhagadiolus stellatus*	P		
Piptatherum miliaceaum	P!	*Scorzonera papposa*	B P		
Piptatherum blancheanum	P!	*Senecio vernalis*	P		
Stipa bromoides	P	*Tolpis virgata*	P		
		Thrincia tuberosa	P		

F- fruits, S-seeds, B- bulbs, corms, etc., Fl - flowers, L- leaves, Sh- shoots, R- roots, C- capitulum. P- pasture for livestock and browsers (Br). W-wood. (!- high value).

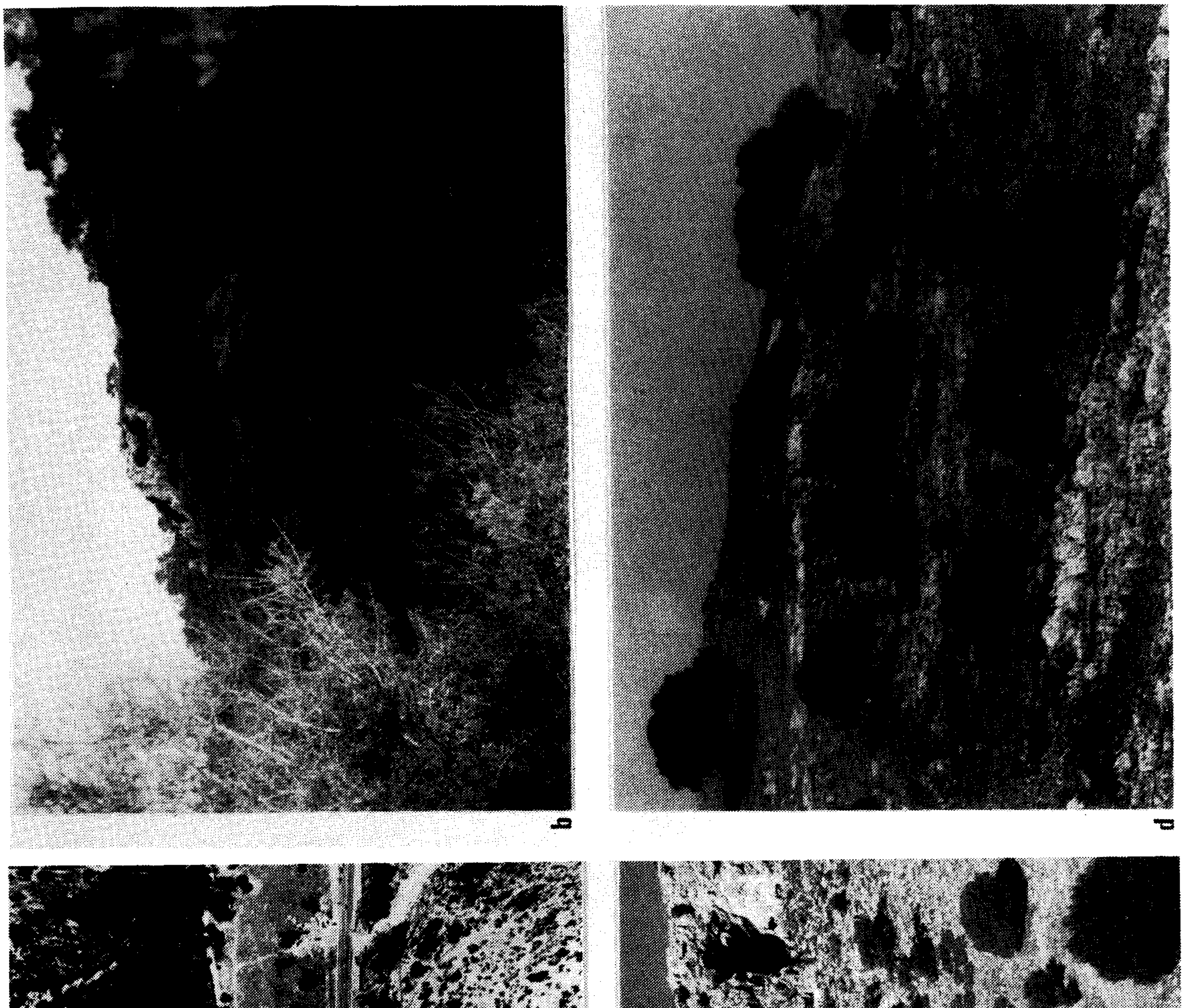


Fig. 74. Present-day plant formations in the Mount Carmel area: (a) north-facing (above) and south-facing slopes in Lower Nahal Oren: the more humid, north-facing, slope supports *Quercus calliprinos-Pistacia palaestina* maquis (b) while the drier, south-facing slope is characterized by the open landscape of the *Ceratonia siliqua – Pistacia lentiscus* association (c); (d) *Quercus ithaburensis* open park forest in the eastern Carmel; (e) freshwater marshes near Hadera, with large *Tamarix tetragyna* trees; in the water float plants of *Lemna minor*; (f) coastal kurkar ridge near Hadera, with typical dwarf shrubs of *Coridothymus capitatus*.

While Naveh (1984) regards the Nahal Sefunim vegetation as a valid representative of the natural Mount Carmel vegetation, he stresses the intensive human use for food, wood, fuel and pasture which have possibly reduced greatly "the stature of the sclerophyll phanerophytes ... by burning, cutting and browsing, especially during periods of greater population pressures, both in prehistoric and historic times" (Naveh 1984:42). He argues further that "all woody plants occurring in Nahal Sefunim surroundings and on Mt. Carmel ... are well adapted to fire by efficient regeneration mechanisms and the same is true for many, if not all, herbaceous plants" (Naveh, 1984:44), and that even the Carmel Natufian may have employed a rational use of fire, and modified their vegetation structure and composition "from natural into semi-natural and "semi-agricultural" ecotopes" (Naveh, 1984:54).

Marshes constitute an important addition to these wooded habitats. Today, marshy areas are relatively widespread in the southern Carmel and, to the south of it, in the northern Sharon coastal plain, where they are fed by fresh water springs and/or high ground waters, or occur along the coastal wadis. In many of these *Tamarix* sp. is dominant (Fig. 74e), which seems to have been the case for the Natufian as well, as indicated by the charcoal assemblages from el-Wad. Undoubtedly, marshes are an important potential source for plant and animal foods and resources, as corroborated by the impressive list of species reported for the coastal marshes of the area even today (Berliner, 1977 and references therein). In addition to some 200 hydrophilous and water-plants species, an incomplete list of some 70 animal species from these marshes (ibid.) includes Crustaceae (e.g., *Potamon potamios*), various gastropods and Bivalvia (e.g., *Unio* sp. and *Cardium edulis*), many fish (e.g., *Clarias lazera, Salaria fluviatilis, Garra rufa, Tilapia* sp., *Anguilla anguilla*), amphibians (e.g., *Rana ridibunda, Hyla arborea* and *Bufo viridis*), and various mammals (*Microtus guentheri, Lutra lutra, Herpestes ichneumon, Felis chaus, Sus scrofa*) and reptiles (e.g., *Trionyx triunguis, Mauremys caspica* and, until the turn of the century, *Crocodylus nilotica*). The rich avifaune is described in detail by, e.g., Paz (1986) and Zoaretz (1977). Eleven species of marshy habitats were reported from the Middle Palaeolithic avifauna assemblages of the nearby Kebara cave (Tchernov, 1959, 1962).

As for the area near el-Wad, such marshes probably occurred in the troughs in front of the site, east of the coastal kurkar ridge (Fig. 74f), mainly along the wadi and in areas where there was poor drainage. This is also suggested by the old maps of the area (Survey of Palestine, 1942), which indicate an alluvial (= "El Juruf") area north of the wadi course, and an "El Wa'r" ("thicket"), possibly of reeds, at the point where the wadi traverses the eastern sandstone ridge, and which presumably resulted from poor drainage. A small marsh can also be found on a British Admiralty map of the area in 1862 (Rosen, 1992), located south of the Atlit Crusader fortress. In general, the area in front and especially for the north of the el-Wad cave is relatively high and composed of colluvial sediments derived mainly from the near-by mountain, as shown by their high contents of red-brown terra rossa soils and the many limestone blocks and angular stones (Fig. 24). Artificial outlets (Nir, 1959), usually following pre-existent natural troughs (Butrimovitch, 1988), were dug through the eastern kurkar ridge in historical times to solve the problem of poor drainage of the Carmel wadis. Dark, deep alluvial soils are restricted to the low depressions. However, given the more humid climate during the Natufian, and the Late Glacial sea level rise, marshy habitats in the area would have been more widespread than today.

When reconstructing the carrying capacity of the area the importance of temporary waterbodies for the well-being of human as well as animal populations should not be underestimated (see above, Chapter 3, "Use of the Cave in the 20th Century"). Many wintering and migrant birds rely on marshes and long-lasting temporary water bodies for their food supply and, occasionally, for nesting (Paz, 1986). Several species of wintering and migrant birds were reported from e.g., the Natufian layers of Hayonim and Eynan (Pichon, 1989) and from Hatoula (Pichon, 1994).

Evaluations of Late Pleistocene-Early Holocene sea levels are based on global changes (Shackleton, 1987) and take into account local variations, especially when these are due to tectonics (e.g., Neev et al., 1987; Lambeck, 1996). The number of ways in which sea-level curves can be reconstructed, not ignoring small, local variations, is probably unlimited. For the purpose of our discussion it seems reasonable to adopt the global curve published by Fairbanks (1989), especially as it accords well with the picture suggested for Greece by Van Andel (1989, 1990). According to this curve (Fig. 75), the Early Natufian sea level lay some 100-70m below present-day msl. Given the available topographical, geological and batimetric data, the coastal plain near el-Wad was between c. 12-14km wide during this period, which, even if we allow for some variation, means that there was at least one additional aeolianite ridge (or chain of ridges) between el-Wad Cave and the Natufian Mediterranean, probably separated from the ridges more to the east by a trough where alluvial and marshy sediments accumulated over the years (Figs. 76, 77). This of course also meant a considerable increase of the available resources and an obvious greater economic potential as compared with later periods.

The wider coastal plain may have resembled the present-day Sharon plain, south of the Carmel coastal plain. If we take our cue from today's distribution, a mosaic of habitats can be envisaged for the coastal plain, each with its consumable plants (Dafni, 1980). These include the sea shore (with *Crithmum maritimum* and *Mesembryanthemum crystallinum*), wadi and marsh banks (with *Phragmites* sp., *Arundo* sp., *Nasturtium officinale*, *Apium nodiflorum*) and kurkar and hamra hills (*Quercus calliprinos, Q. ithaburensis, Ceratonia siliqua, Pistacia lentiscus*, grasses). Even when constantly available, *Crithmum maritimum* does not constitute a large supply of food and may have been used as a spicy addition only. Its importance lies, however, in its high vitamin C content (Franke, 1982). *Phragmites* and *Arundo* of the bank vegetation, on the other hand, are an important food source, as use can be made of various parts of the plant (root-stocks, pith, shoots and even capitula). Even with repeated harvesting, because of their vegetative multiplication, they supply large masses of vegetal material for use in handicraft activities (e.g., basketry, matting, weaving or net-making) which are indirectly deduced from the study of Natufian bone tools (Campana, 1989). *Nasturtium officinale* and *Apium nodiflorum* are also edible year-round.

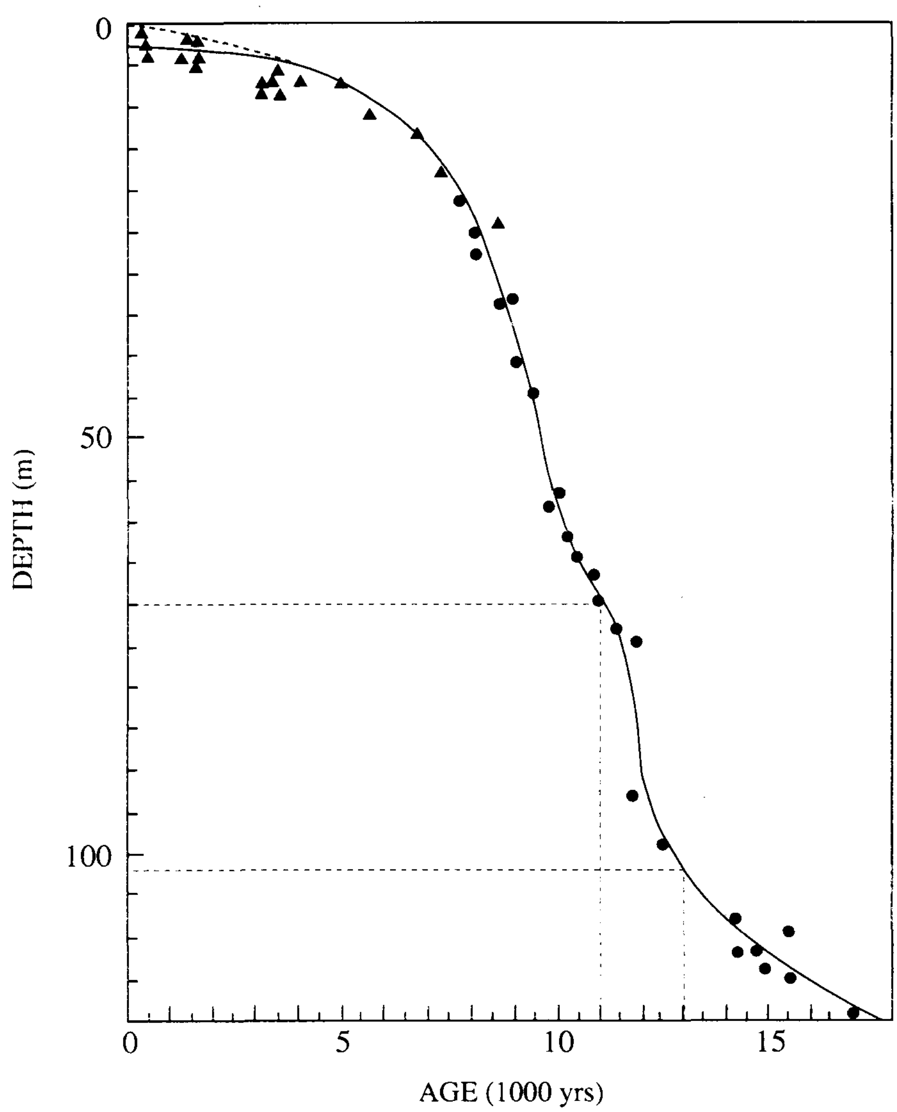


Fig. 75. A simplified Fairbanks Barbados sea level curve (Fairbanks, 1989). Circles are data from Barbados corrected for estimated uplift; triangles are data from four other islands in the Caribian (after Van Andel, 1990). During the Early Natufian, between *c.* 13,000-11,000 years BP, the sea rose by 35m.

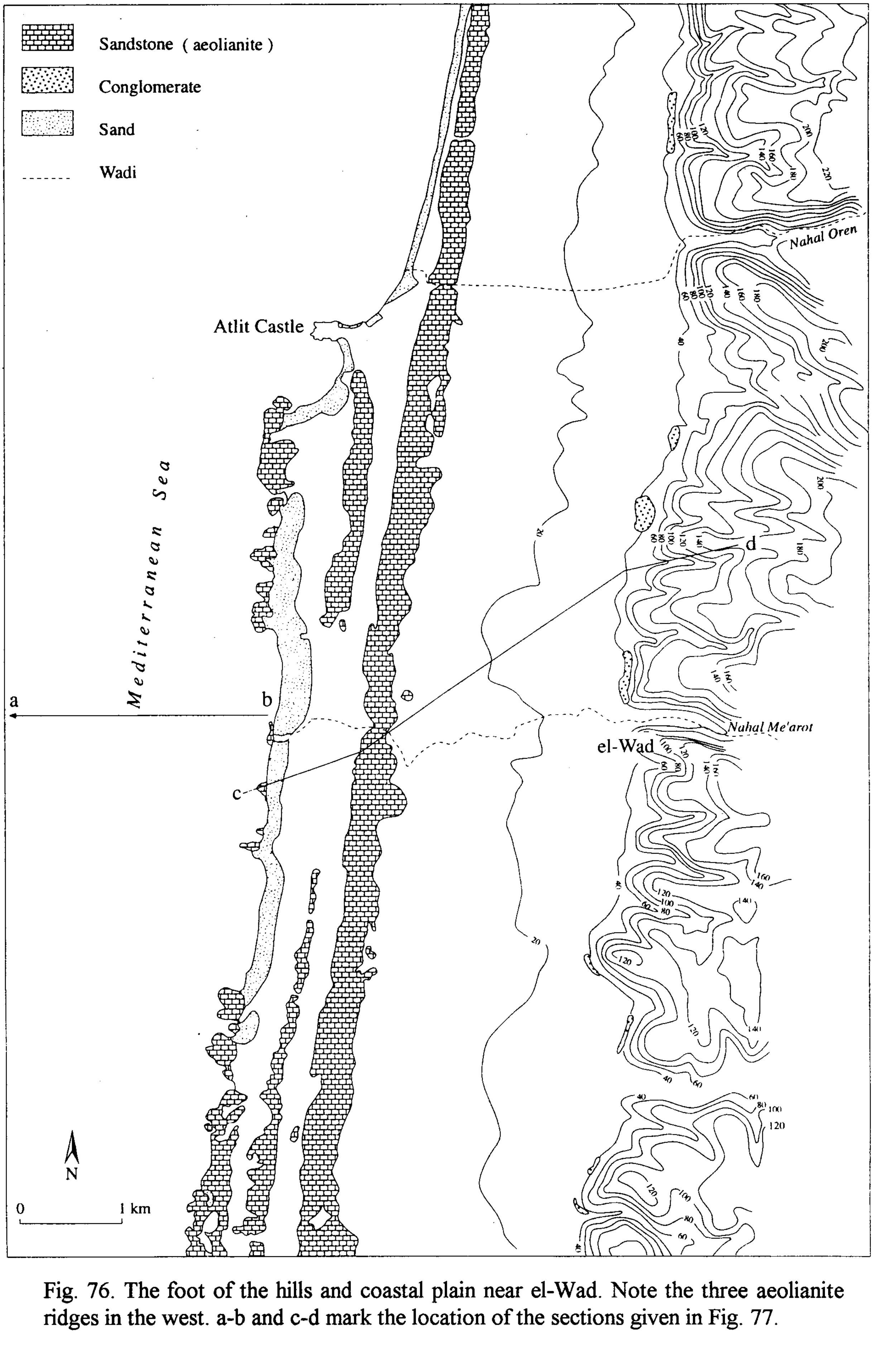


Fig. 76. The foot of the hills and coastal plain near el-Wad. Note the three aeolianite ridges in the west. a-b and c-d mark the location of the sections given in Fig. 77.

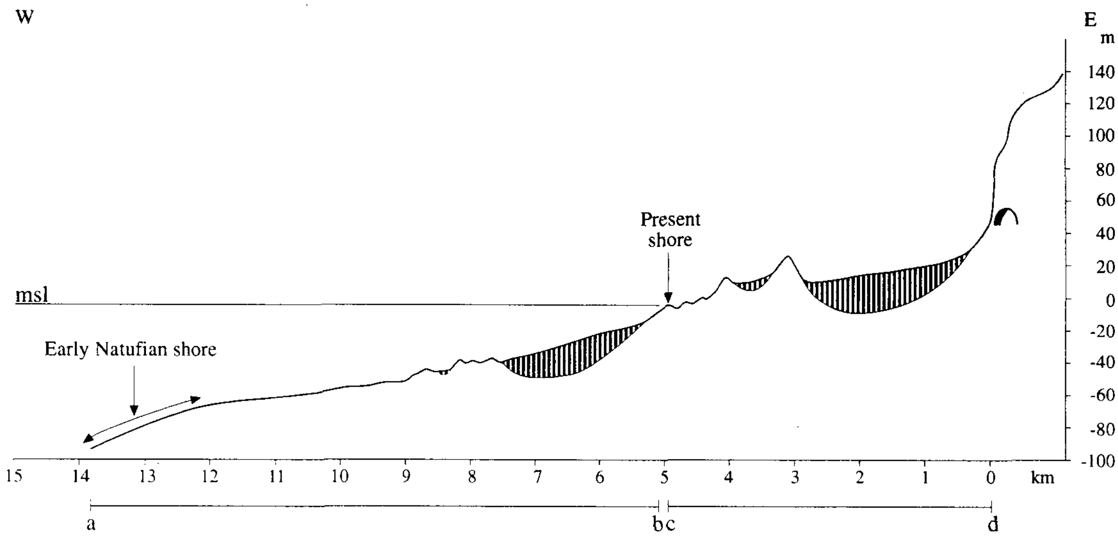


Fig. 77. Theoretical east-west section along the Carmel coastal plain in front of el-Wad Cave, during the Early Natufian. For location see Fig. 76. a-b based on batimetric maps (Survey of Israel, 1971) and complemented with the interpreted data of an eco-sounder profile effectuated by U. Galili at the mouth of Nahal Me'arot. c-d after Michaelson (1970).

The kurkar-hamra hills are another important source of vegetal food, especially *Ceratonia siliqua* and *Quercus ithaburensis* fruits. *Quercus ithaburensis* acorns were used as staple food until the turn of the century. They are better tasting than those of *Q. calliprinos*, keep well for long periods, and can be consumed roasted or ground into "porridge". *Ceratonia siliqua* fruits are also preservable, and have high contents of sugars and proteins. *Pistacia lentiscus* fruits may have been used as a secondary source of food. The apparent dominance of *Quercus calliprinos* in the archaeological charcoal assemblages of the Israeli coastal plain (Liphschitz et al., 1987) could, at least to some extent, have resulted from human bias. People may have preferred the wood of *Quercus calliprinos* for fires and building activities, and spare the *Quercus ithaburensis* since it was rich in edible acorns, which may explain the over-representation of the former in the charcoal assemblages. Ruderal plants (e.g., *Malva* sp., *Gundelia tournefortii*, *Silybum marianum*, *Notobasis syriaca*, *Urtica* sp., *Sonchus* sp., *Foeniculum* sp., *Chrysanthemum* sp.) also constitute an important element. These could be utilized from autumn to spring, but not in summer (Dafni, 1980). Malvaceae and Dipsacaceae pollen are found within the pollen spectra of the cave, indicating the possible occurrence of ruderal habitats near the site. Edible corm and bulb plants (e.g., *Crocus hyemalis, Cyclamen persicum, Asphodelus ramosus, Tulipa aegensis*, Araceae), with their various exploitable parts, can also be found in all habitats (Dafni, 1980, 1984).

Of all the formations discussed, it is the forests and the wet habitats that are especially important. The importance of wet habitats lies in the year-round availability of resources. The *Quercus ithaburensis* open forest is the richest and most varied source for plant foods (Amots Dafni, personal communication, 1996). As already mentioned, its acorns constituted a major traditional staple food in the area, available throughout the year, because of their preservability. With its open landscape and plentiful herbaceous vegetation this type of forest is especially attractive for roaming herds of gazelles, the most prominent of the animal species hunted by the Natufians.

Furthermore, wild cereals, especially wild *spontaneum* barley, are massively distributed and constitue an important annual component of open herbaceous formations, such as deciduos oak park forersts, as well as segetal, man-made habitats (D. Zohary and Hopf, 1994). An increasing reliance on plant resources, probably cereals, is indirectly inferred from the many groundstone implements, sickle blades and sickle hafts within the el-Wad Natufian material culture, as well as from dental studies (Smith, 1972, 1991; Smith et al., 1984) and strontium/calcium analysis (Sillen and Lee-Thorp, 1991) of Natufian (including el-Wad) skeletal remains.

The above theoretical discussion is supported by the analysis of Middle Palaeolithic archaeobotanical data from Kebara Cave (Lev, 1992; Baruch et al., 1992), situated 15km south of el-Wad (Figs. 2, 7) in a rather similar ecotonal setting. Only two groups of consumable plants — wood and fruits/seeds — are represented in the Kebara assemblage, and our discussion focuses on these only, since the use of other plant parts cannot be ascertained. Still, the available evidence suggests that the inhabitants of the cave exploited a large variety of vegetal resources. The most important of the seeds are large and medium-sized-seeds legumes, including *Lens* sp. and *Lathyrus* sp. (chiefly *L. cicercula*), and small grained Fabaceae. Trees are represented by many *Pistacia atlantica* shell fragments and *Quercus* sp. nut shell fragments. The other groups are much less important: the ruderal plants are represented mainly by *Mercurialis annua* and *Chenopodium murale*. The contribution of grasses, Asteraceae and other, miscellaneous herbs, is negligible. Among the wood material *Quercus* sp. (including *Quercus calliprinos* and *Quercus ithaburensis*) is the most dominant (Baruch et al., 1992). The maquis is further represented by *Crataegus* sp., possibly *Crataegus aronia.* The occurrence of *Pistacia* sp. accords with the present-day vegetation of the area. One of the specimens was of *Pistacia atlantica*, which is a typical companion of certain variants of *Quercus ithaburensis* park forests (M. Zohary, 1973). As already mentioned, its occurrence in the area is also attested to by the many shell fragments recovered (Lev, 1992).

The hydrophilous plants are represented by isolated finds of *Salix* sp. and *Ulmus* sp. *Cyperus* sp. pollen was retrieved from an hyaena coprolite (Weinstein-Evron, 1988), together with pollen of *Quercus calliprinos, Pinus* sp., *Olea europaea, Pistacia* sp., and various herbs (Poaceae, *Plantago* sp., Lamiaceae, Fabaceae, Brassicaceae and Asteraceae), which accords well with the multi-habitat picture suggested by the other archaeobotanical data.

Comparison between the archaeobotanical data of both el-Wad and Kebara and the list of present-day exploitable plants (Table 13) indicates clearly that plant resources must have been significantly richer than the archaeological evidence suggests, mainly due to selective preservation of various vegetal parts and the heavy bias towards fruits/seeds and wood. Legumes, which are an important protein source, were intensively consumed by the Kebara people (Lev, 1992).

In summary, in spite of the fragmentary evidence, the archaeobotanical and archaeozoological data, coupled with an analysis of present-day habitats, suggest that a variety of biotopes and many food resources must have been available for, and exploited by, the el-Wad Natufians, who did not "négliger aucune sorte de proie [et de nourriture végétale], même petite" (Valla et al., 1986: 37).

Procurement of Raw Material

By "raw material" we refer to any "material on which a particular manufacturing process is carried out" (Hanks et al., 1979). In its broadest sense, it includes practically all the materials the Natufian inhabitants of the site made use of, whether retrieved from various minerals (flint, basalt and ochre) or from faunal (bone, horncore, leather and hides, molluscs) and vegetal (wood, reeds) resources.

Identifying what kind of raw materials were used by prehistoric people is of crucial importance if we want to arrive at some understanding of the mode of exploitation of the environment and reconstruct the connections and interrelationships that may have existed between sites and populations, including trade ties. While evidence for earlier periods is sporadic, definite trade/exchange systems in the Levant can be attributed to the Upper Palaeolithic (Runnels and Van Andel, 1988; D.E. Bar-Yosef, 1989). Prior to the Natufian, the evidence suggests transport consisted mainly of "nonessentials", such as Mediterranean and Red Sea gastropods, the shells of which were used as ornaments (Mienis, 1977, 1987; D.E. Bar-Yosef, 1989, 1991; Reese, 1991). The long-distance transport of the latter (up to 200km in the Geometric Kebaran) may be explained by the high degree of mobility typical of hunter-gatherers, whereas long-distance exchange becomes evident with the Natufian and the first sedentary or semi-sedentary communities, *c.* 13,000-10,500 BP (D.E. Bar-Yosef, 1989). Others have argued that the widespread distribution of gastropods points to a broadening of social and economic interaction and/or the maintenance of social ties between geographically displaced groups (O. Bar-Yosef, 1990; O. Bar-Yosef and Belfer-Cohen, 1989; Henry, 1989; Kaufman, 1992). It may also be that these exchange/trade networks should be regarded as a major factor in the adoption and spread of agriculture (Runnels and Van Andel, 1988).

Determining what these interactions consisted in calls for a reconstruction of the exchange/trade networks used. Generally, such reconstructions rely on sourcing the raw materials that were exchanged. Unfortunately, apart from the above-mentioned shells and the occasional pieces of flint (Frachtenberg, 1992; Frachtenberg and Yellin, 1992; O. Bar-Yosef, 1991a; Christophe Delage, personal communication, 1997) and basalt for later prehistoric periods (e.g., Amiran and Porat, 1984; Gilead and Goren, 1989; Philip and Williams-Thrope, 1993), sourcing of mineral raw materials in the Levant is only in its very early stages.

Identifying and reconstructing the provenance and procurement of the raw material can be done in a number of ways, depending on the materials discussed. While for the characterization and consequent provenance-determination of the various mineral resources detailed geochemical and mineralogical analyses are required, other methods need to be employed for the vegetal and faunal materials. Here a reasonable "en gros" reconstruction of possible provenances can be arrived at if we are familiar with contemporary resources within the area under discussion and a detailed palaeoenvironmental reconstruction is in place.

As already argued, the Carmel area seems to have been rather self-contained as to faunal and vegetal resources. The most common plants and animal types found in the Natufian assemblages were readily available within the immediate surroundings of the cave or at least within its 5km-radius exploitation territory. The variety of habitats the area offered ensured the procurement of various animals, among them some large and small mammals, fish and turtles, as well as vegetal material such as wood, branches, reeds and straw, that could be used for constructions, as bedding and kindling materials or for the manufacturing of various tools, including containers. A growing body of indirect evidence, mainly based on wear-pattern analysis of bone implements (Campana, 1989, 1991), suggests the Natufians made widespread use of vegetal material (for instance, reeds in basketry manufacture). Thus, even if we cannot ascertain the exact provenance of the raw material used in the manufacturing of each artefact found at the site, the abundance of resources within the Carmel area makes it highly probable that they were autochthonous to the region. As already mentioned, the rare instances of allochthonous species of, e.g., molluscs of *Dentalium elephantinum* (Valla et al., 1986) and *Cypraea moneta* (Bate, 1937) were derived from the Red Sea area through some kind of trade/exchange mechanism.

Mineral raw materials included limestone and dolomite, flint, ochre and basalt. Limestone and dolomite were rarely used at el-Wad (mainly for the manufacturing of mortars; Garrod and Bate, 1937), but are readily available in an area that contains many geological calcareous formations, ranging from the Albian to the Neogene (Fig. 8). Flint was clearly the most widely used, as indicated by the rich lithic assemblage. Most of the flints used by the Natufians of Chamber III were in various shades of grey (from 10YR 7/1 to 10YR 4.5/1; Munsell, 1929-1942), followed by considerable amounts of yellowish to greyish brown (10YR 5.5/2 to 10YR 5.5/3.5) pieces. Dark grey (7.5YR 3.5/0) to veritable black (10YR 2/1), as well as red (2.5YR 4.5/2), and white (10YR 8/1-1.5) occur occasionally. The flints also differ as to homogeneity, external smoothness, translucency and whether or not they contain fossils. The Mount Carmel area is relatively rich in geological formations which contain layers or lenses of flint (Frachtenberg, 1992). These include the Cenomanian (Isfiya, Khureibe and notably Shamir) and the Turonian (Um ez-Zinat) formations (Fig. 8), outcrops of which can be found today no farther than 1.5km of the cave (Karcz, 1959; Kashai, 1966). Eocene flints are also quite at hand as they can be found in abundance along the southern limits of the mountain and in the nearby Ramat Menashe (Figs. 6, 7). In spite of this large variety of sources, it is Cenomanian flints that seem to have been the type most frequently used by the Natufians of Chamber III (Shimon Ilani, personal communication, 1996). A detailed provenance study is still under way, and exact sources of flint await identification. It was shown (Frachtenberg, 1992; Frachtenberg and Yellin, 1992; Delage, 1997) that visual inspection can serve as a preliminary step in classifying flints, and can give us a very large definition of their potential sources, but it is not sufficient for a reliable differentiation and provenance determination of flints of local facies, especially within specific geological formations or when individual artefacts are concerned.

Attempts at determining flint types and their provenance have been carried out for other Mount Carmel sites, e.g., Middle Palaeolithic Kebara (Frachtenberg, 1992) and Middle Palaeolithic to Neolithic Sefunim (Ronen, 1984). Flints originating from an area which extends from Kebara in the south to Nahal Oren in the north (= some 15km) were apparently used at the site (O. Bar-Yosef et al., 1992), alongside raw material that had originated in the Eocene Ramat Menashe, c. 4km to the east of the cave. A few specimens, made of Turonian banded flint, apparently came from further afield, that is, the more southern part of the country (the Judean Desert, the northern Arava and the Negev; Frachtenberg and Yellin, 1992), at least 120km from the site. The validity of this latter source still needs to be established by testing it against other, less remote flint sources, e.g., at the Um el-Fahem area, located only 25km from Kebara, in spite of Frachtenberg's contention that they do not to belong to the same type discussed by him (Frachtenberg, 1992).

Only minor changes through time have been shown in flint-type utilization for the Sefunim Cave, Middle Palaeolithic to Neolithic sequence (Ronen, 1984). Again, the conclusion was that the inhabitants of the site apparently used local flint sources, though their exact provenance was impossible to determine. The exception forms a rare, very distinctive Neolithic flint type, that may have originated from as far as 7km to the south of the cave, a locality where a Neolithic workshop has been identified (Ronen and Davies, 1970). A study done at Hatoula, in the Judean Shephela (Ronen et al., 1994), also indicates that the use of local resources is the most common.

No results of provenance determinations of Natufian flint assemblages have as yet been published regarding the Carmel area. Only for tabular flint, Garrod states that it "occurs abundantly, both in the limestone and weathered out on the surface, between the villages of Jeba and Ain Ghazal, two miles to the south of Wady el-Mughara" (Garrod and Bate, 1937:41). A detailed study is under way for Hayonim (Mousterian and Natufian) and for the Natufian at Eynan (Delage, 1997). For the Early Natufian of Hayonim, it could be demonstrated that for the manufacturing of certain tools the inhabitants of the site made a clear selection towards specific flint types, which are not derived from local, nearby sources, even though the latter are of good quality for flintknapping (Delage, 1997; and personal communication, 1997).

Whatever the exact sources of flint at el-Wad, it is most likely that it originated from the area around the cave. The Natufians apparently invested but little effort in collecting flint, and even less in the manufacturing of their tools, let alone their standardization, suggesting some "regression" in this regard *vis-à- vis* earlier cultures at the same location, especially the Aurignacians and the Acheulo-Jabrudians, almost as though the Natufians lacked the kind of regard for their tools as shown by these other cultures. Such form of "disrespect" can also be seen in the widespread re-use of older blanks or cores, as shown by the double-patination on numerous artifacts. The same holds true for the many tools done on primary blanks, the many exhausted cores and the use of older (Upper Palaeolithic?) endscrapers as sickle blades (see above Chapter 5, "The Lithic Assemblage"). As already mentioned, the "flint bones" used for the figurines may have originated from outcrops some 1.5-2.0km from the cave (see above, Chapter 5, "Decorative and Art Objects").

At this stage of research it is impossible to decide whether this apparent attitude of "disrespect" is cultural, i.e., could be explained by developments in other aspects of their material culture, whereby flint-tool manufacturing was somewhat left behind, with the emphasis on the fabrication of specific tools (e.g., lunates and sickle blades) and artefacts made of other raw materials (e.g., basalt, bone, hides, wood, reeds and straw). It could also have been the result of temporary difficulties in flint procurement, following some kind of environmental change (e.g., a dense vegetational cover?), or have been caused, at least partly, by a density and intensity of occupation and the larger amounts of flints used by the inhabitants of the site during a relatively short period of time. The possible impact of raw material shortage on the manufactured artefacts of other Natufian sites has been discussed, e.g., by Belfer-Cohen (1988) and Valla (1984; but see Delage, 1997). This discussion, of course, is based on my own subjective impressions of the quality of the lithic artefacts. Detailed comparative studies are required in order to verify these informations.

As for ochre, following an in-depth characterization of the archaeological samples through mineralogical and geochemical analyses (see above, Chapter 5, "Ochre Remains"), and in order to identify the provenance of the materials used by the Natufian inhabitants of the el-Wad Cave, a geological survey was conducted of ochre outcrops in the Mount Carmel area, together with mineralogical and geochemical comparisons between geological and archaeological samples (Weinstein-Evron and Ilani, 1994). Common sense dictates, again, that such sources from within the Carmel area itself had served for the procurement of raw material found at the site.

Eight sites of epigenetic iron-oxide mineralizations were found in the Mount Carmel area (Figure 67), all within a range of 0.3 to 10km from el-Wad (see above, Chapter 5, "Ochre Remains"). Based on detailed mineralogical and geochemical studies of both the archaeological ochre remains and ochre from the Mount Carmel outcrops, it has been concluded that 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 suggesting that local sources, from outcrops and alluvium within a distance of c. 10km from the cave, unidentifiable individually, provided the ochre used by the Natufians of el-Wad (Weinstein-Evron and Ilani, 1994; and see above, Chapter 5, "Ochre Remains").

Red haematite is the most common within the ochre fragments in the cave, and was also more often ground than goethite which, in turn, is the common iron oxide in the Mount Carmel mineralizations and thus more readily available. Based on our heating experiments, it has been suggested that the haematite found at the site could have been produced through controlled heating of geothite. This cannot be ascertained, however, in the absence of geochemical markers distinguishing between the collected and the heating-manufactured haematite and so long as no hearths containing both haematite and goethite fragments, in various heating stages, have been unearthed.

As already mentioned, the many fragments of quartzolite and jasperoid-type found in the cave suggest that these are the discarded waste of raw material that proved too hard to grind. It is also possible that these red stones were collected for their aesthetic value rather than for the extraction of pigments. Pieces of ochre may have been brought home, as they were found during hunting or foraging in the mountain or by more task-oriented trips to the mountain outcrops.

Basalt was another raw material widely used by the Natufians. Its exact provenance is not known. Based on geological maps of the area, it has long been held, at least for more northern sites such as Hayonim, that basalt must have originated from areas as far afield as the Lower Galilee and Mount Carmel (e.g., O. Bar Yosef, 1991a). During our iron-oxides survey in the Mount Carmel area we have located a few exposures of large, hard and unweathered basalt blocks at a distance of only 5-10km from the cave (Weinstein-Evron et al., 1995). The blocks, the largest of which attain 50cm in diameter and weigh tens to hundreds of kilograms, could easily have served as raw material for the manufacturing of utensils, including bowls and mortars. This has come as a surprise as the Mount Carmel volcanism was generally believed to include primarily tuffs, with only a few, usually weathered, basalt flows. Again, common sense rules that the available local basalts must have been used by the Natufians of Mount Carmel. Consequently, we have hypothesized that the el-Wad basalts originated from these, recently found, local Mount Carmel sources.

Detailed petrographic, mineralogical or chemical finger-printing of Levantine basalts is not available yet, in spite of the occasional chemical mapping of basalt flows (Goren-Inbar et al., 1986), and though there have been several successful attempts concerning Chalcolithic and Early Bronze groundstone implements (Amiran and Porat, 1984; Gilead and Goren, 1989; Philip and Williams-Thrope, 1993). A more straightforward way may well be to use the unique geological setting of the Mount Carmel basalts to source the archaeological implements and then to show that they originated from these local exposures.

The uniqueness of the Carmel basalts is due to their stratigraphical position. Basalts of varying ages are distributed differentially throughout the Levant. Volcanic rocks of late Cenomanian-Senonian (Upper Cretaceous) age are known only in the Mount Carmel region (Sass, 1980). While in other regions, Tertiary and Quaternary basalts are widespread (Mor, 1993), basalts of these relatively younger ages were not found on the Carmel. This suggests that through K-Ar dating of basalt implements from el-Wad and samples of locally occurring basalts it ought to be possible to determine whether the raw material used in the manufacturing of the el-Wad groundstone implements originated in the Carmel area itself. Results of the dating are summarized in Table 14.

The Mount Carmel fresh basalts yielded ages ranging between 88-77 million years (My) in accordance with their Cenomanian-Senonian stratigraphic position. The dates of the basalt tools from el-Wad, however, are of Late Tertiary to Quaternary age. This clearly excludes the nearby Mount Carmel area as the source of the raw material for these tools. That the occupants of the site ignored locally available basalts is surprising in view of the emphasis we found on the utilization of local foods and mineral resources, especially if we recall that the iron oxides used by the inhabitants of el-Wad are to be found locally in close proximity to exposures of volcanic rocks.

Table 14. K-Ar ages of Carmel basalts and basalt artefacts from el-Wad (Weinstein-Evron et al., 1995). In the cases of duplicate measurements, the value given by the measurements with the higher ^{14}Ar rad is more reliable. For the last sample, the determinations indicated (<250 My) are minimum dates and should be taken as approximations only as they are close to the laboratory limit of detection.

SAMPLE	K (%)	^{40}Ar rad (%)	AGE (My)
Fresh basalt	1.17	91	82.4±1.7
Fresh basalt	1.10	94	77.6±1.6
Fresh basalt	0.90	94	88.0±1.8
Fresh basalt	0.84	88	83.7±1.7
Basalt pestle	1.10	13	1.3±0.1
Basalt pestle	0.80	15	3.7±0.2
		6	1.6±0.3
Basalt grinding stone	0.90	6	2.6±0.5
		24	1.6±0.1
Basalt pestle	0.70	-	<0.250
			<0.250

Where, then, did the el-Wad basalts originate from? Extensive K-Ar dating of basalt occurrences in northern Israel has been carried out in a number of studies over the last two decades (Mor, 1993; Feraud et al., 1983; Heimann, 1990; Shaliv, 1991). Results of these studies help identify more specifically the possible sources of basalt utensils found at el-Wad. The nearest Late Tertiary basalts (2.5-1.8 My) can be found in the Dalton area, north-eastern Galilee (Fig. 78), some 60km from the site. Pleistocene basalts (<2My) occur in the Jordan Valley (e.g., on the western fringes of the northern Golan, Gesher Benot Ya'aqov and along the Yarmuk River) and in the northern Golan (e.g., Birket Ram). Basalts of similar or younger ages are also reported from Syria, some 80-100km away (Mor, 1993; Coleman et al., 1983). The raw material for the manufacture of the Natufian basalt tools thus originated at least 60km east of the Mount Carmel area.

The range of the K-Ar ages suggests the exploitation of different, perhaps widely spread, basalt sources, none of them local. The younger dates indicate that at least one potential source was situated at a distance of at least 60km from Mount Carmel. Alternatively, the possibility that all the basalts originated in a relatively limited area should not be ruled out, in which case one ought to look for regions in which the whole range of the measured dates can be found. The nearest locations where recent (<0.250 My) basalts occur alongside Late Tertiary/Pleistocene basalts within a relatively restricted area are to be found east of the Jordan Valley (Heimann, 1990; Mor, 1993), suggesting the material travelled some 60-100km to reach el-Wad (Fig. 78).

No basalt flakes or waste pointing to on-site manufacturing have been found at the site. Moreover, basalt blocks large enough for the manufacturing of bowls and mortars would be too heavy to carry over such long distances. This suggests that the tools were finished at or near the raw material source, probably at a site specializing in the production of such tools, and then transported to the site. The identification of potential source or sources requires comprehensive dating and sourcing of implements from other Natufian sites. Indeed, dating of basalt implements from Hayonim and Eynan (Weinstein-Evron et al., 1997, n.d.1.) indicate a similar trend, namely, a potential basalt source east of the Jordan Rift Valley. Interestingly, even today the Golan basalts are considered the best, i.e., the strongest, toughest and thus the fittest for sculpturing and for the manufacturing of tombstones, for example (Ya'aqov Mamman, personal communication, 1997).

What may have been the exact nature of these long-distance contacts, whether trade, exchange or gift making, etc., and what the underlying social and economic systems and mechanism, is yet to be determined (Weinstein-Evron et al., n.d.2). At the same time, it is not known what goods may have been traded for the basalt implements. With the easy access the occupants of el-Wad had to the Mediterranean, that shells were used in exchange is highly probable. Significantly, Mediterranean shells are abundant within both Hayonim and Eynan mollusc assemblages (Tchernov, 1974; Mienis, 1987).

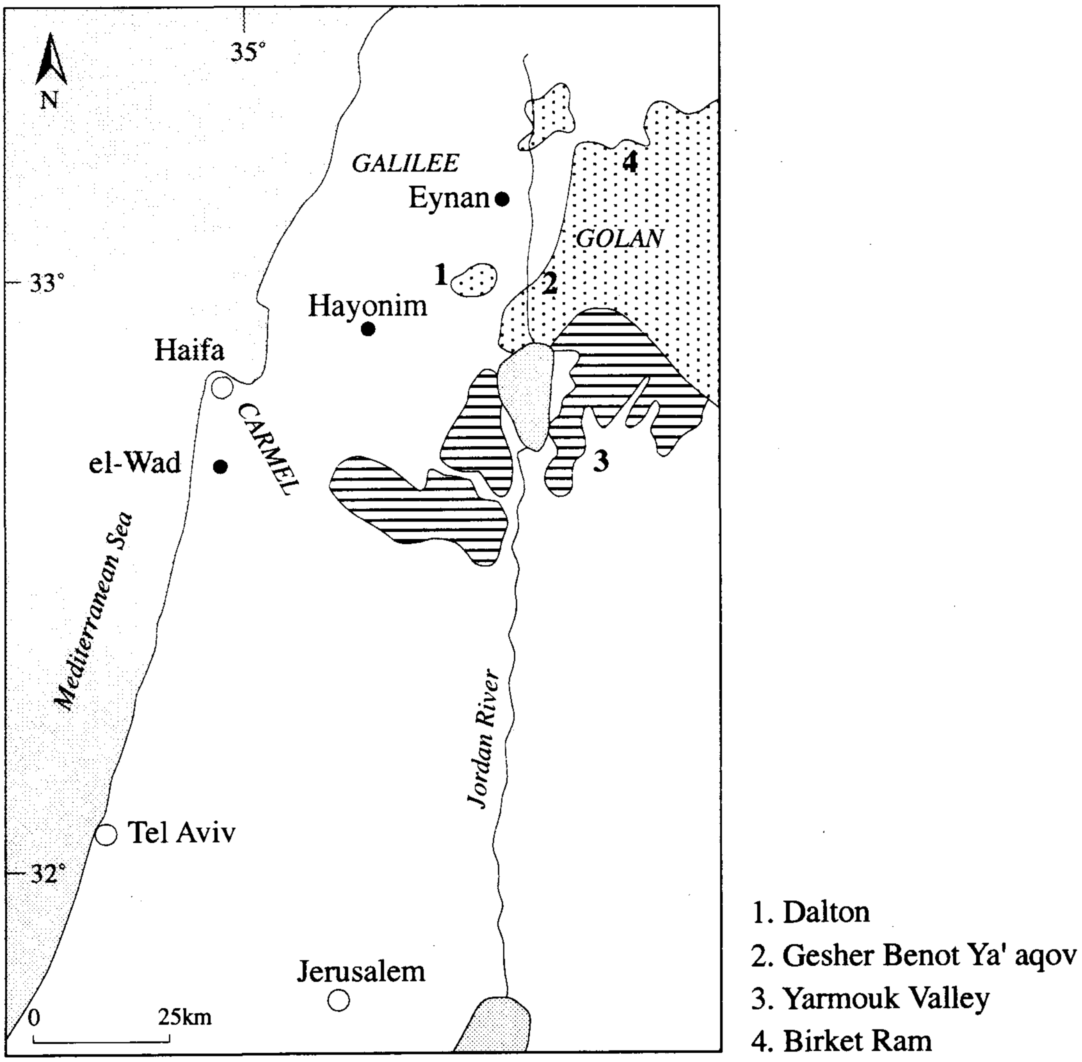


Fig. 78. Distribution of Tertiary – Quaternary basalts in the southern Levant and sites referred to in the text. Pointed areas: basalts younger than *c.* 4 My. Hatched areas: basalts older than *c.* 4 My.

Chapter 7

NATUFIAN USE OF THE SITE

A glance at the stratigraphic picture of el-Wad clearly indicates that the Natufian, especially the Early Natufian, is the most extensive layer at the site. It may also be the best preserved. It is the only culture of which there is evidence in the various parts of the site: the terrace, the outer chambers and, at the rear part of the cave, the relatively dark Chamber III. This raised the likelihood that it would be possible to identify some sort of spatial organization within the site, which, in turn, would offer us some insight into the various kinds of use the Natufian inhabitants may have made of the cave.

What we come up against almost immediately, however, are some inevitable limitations imposed, first of all, by the restricted surfacial extent of the excavations on the terrace and then also by later disturbances. Garrod excavated only the higher part of the terrace and left the vaster talus area untouched. Going by other Natufian sites, for example the Hayonim cave and terrace (O. Bar-Yosef, 1991b; Henry and Leroi-Gourhan, 1976; Valla et al., 1989; 1991), we may assume with confidence that the original el-Wad site extended far beyond the excavated area as we have it now. As for later disturbances, these were quite extensive throughout (Garrod and Bate, 1937) and, as can be clearly seen in Fig. 3, certainly affected the Natufian layers, including the Early Natufian. Disturbances were evident in Chamber III as well, where signs of later activities included, for example, the levelling of the cave's floor in the passage to Chamber IV (see above, Chapter 5, "Stratigraphy"). In fact, the entire cave floor seems to have been levelled in recent times, abutting against the medieval wall closing the entrance (Fig. 3). Garrod also remarked that "with the exception of a slight fall from SW to NE in Chamber I, and a marked rise in Chamber VI, the surface of the deposit was remarkably level all over the cave" (Garrod and Bate, 1937:5). It seems highly probable that the floor levelling (including the one observed at the rear part of Chamber III) and the wall put up to close the entrance were all part of one and the same construction activity, presumably carried out in Byzantine times.

One might add that, in a way, Lambert's trial excavation also constituted a "recent disturbance". Trench 3, in Chamber I of the cave (Fig. 3), was 7m long (Director of Antiquities, 1928) and some 2m wide. It was also deep enough to enable a detailed excavation of several, successive layers and to reach the Early Natufian burials and incorporated art objects. Together with the earlier disturbances, Lambert's sounding makes it impossible for us today to reconstruct the lay-out of architectural or other features in the cave. This is especially critical since it had apparently been laid at the very centre of the Early Natufian deposit, itself already quite limited because of later disturbances (Fig. 3). Lambert's trench is represented by the long deep "void" along Garrod's longitudinal section of the cave (Fig. 3) and, as Garrod (1930c:1) states, it "occupied a large space in this chamber". (The measures she gives [4.10mX2.30mX1.90mX2.20m] are different from those cited above, and are exactly half of those given in Plan II of the same report [Fig. 79].)

Being one of the main Early Natufian base camps, el-Wad stands out for the significance of its socio-economic position. This is due to a number of factors: its relatively large size, its rich flint industry, the great number and wide variety of ground stone utensils it contained, its rich bone-tool industry and the many decorative and artistic objects it produced. The variety, richness and density of the finds all point to intensive occupation, while the abundance of cores, blanks and waste within the lithic assemblage indicates on-site manufacturing of artefacts. High proportions of "unworked to worked material" in the Natufian assemblages are also reported by Garrod (Garrod and Bate, 1937:10). Together with the rich faunal assemblage, including bones exhibiting signs of human manipulation (see below, Appendix III) and, as Garrod puts it "Animal bones, broken for food and often burnt" (idem), all the above clearly suggests domestic or economic activities within the site.

The most distinctive feature, however, is the Natufian cemetery (Garrod and Bate, 1937) that Garrod uncovered in the outer chamber and on the terrace (Fig. 3). It included the burials of some 96 individuals (Belfer-Cohen et al., 1991). As already mentioned, the burials vary in position, number of individuals per grave, decoration and grave structure (see Garrod and Bate, 1937, for a detailed description of the graves and modes of inhumation). It is not always easy to establish the stratigraphic differentiation between Early and Late Natufian burials, but it seems that decorations can only be related to the Early Natufian burials (Garrod and bate, 1937; Belfer-Cohen, 1991a). The social stratification as earlier inferred from these burials by Wright (1978) has been questioned recently by Belfer-Cohen (1995; see also Byrd and Monahan, 1995). According to Garrod, the few structural features found on the terrace (Fig. 3), including the terrace wall and the slab pavement, together with a series of rock cut basins, were apparently related to the burial activities of the Early Natufian.

The Early Natufian finds from our recent excavations in Chamber III, at the entrance to the "corridor", indicate that this part of the cave was used for again a different purpose. Unlike the front of the cave and the terrace, where possible domestic and burial activities took place, the rear part of the cave may have served as a waste dump, as can be deduced from the composition of the flint industry found there, with its conspicuous rarity of microliths but its abundance of cores, many of which are "exhausted" and burnt. The abundance of gazelle horn cores (see below, Appendix III, Table 16), often burnt, lends further support to this view. The shepherds who used the cave in recent years had the same habit of burying horns there, as part of their non-disintegrable waste (see above, Chapter 3, "Interviews"). Gorring-Morris (1995) has suggested that, amongst other uses, Chamber III served as a repository of symbolic objects, which he based on the art objects found in this part of the cave (Weinstein-

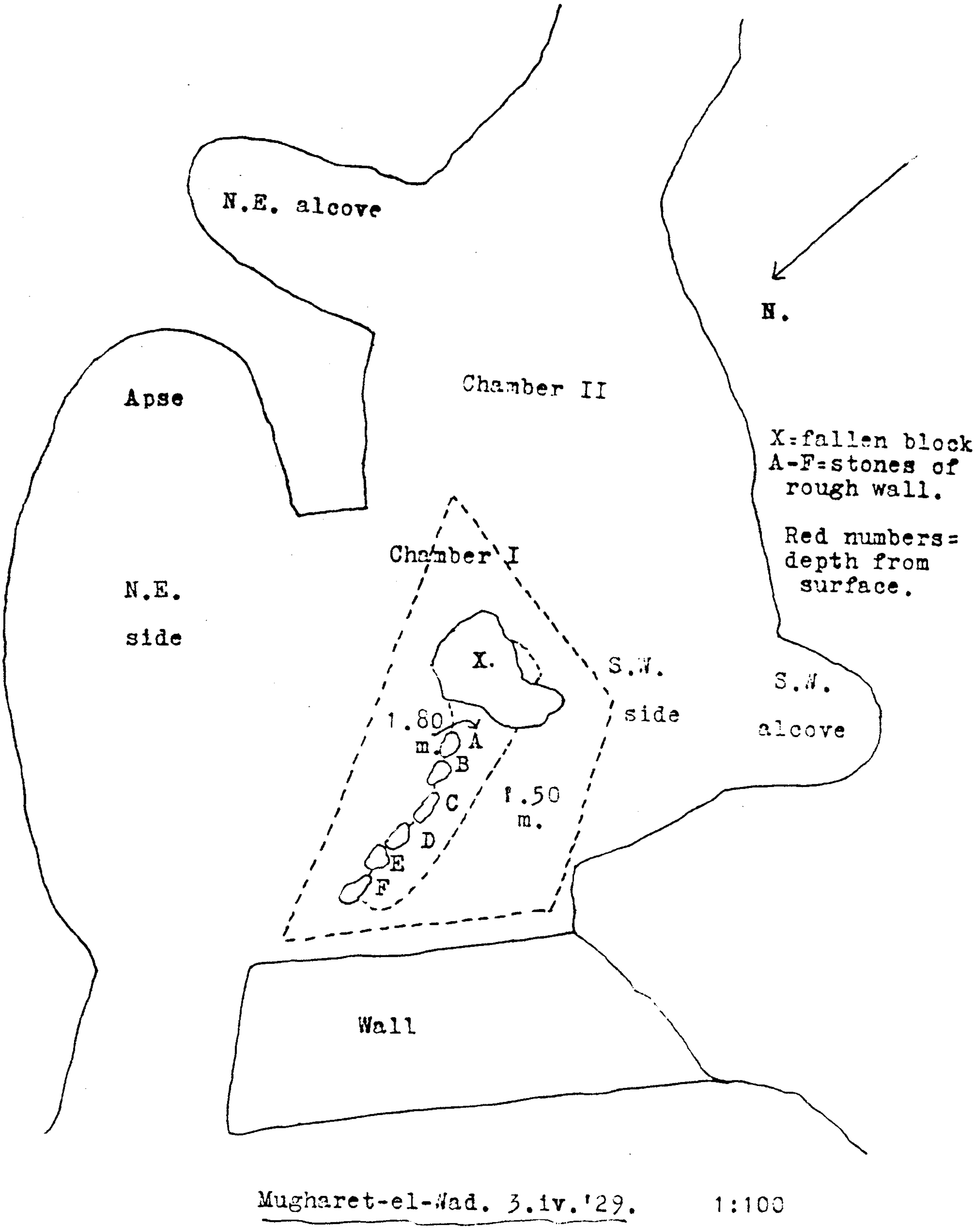


Fig. 79. Garrod's plan of the cave at the beginning of her excavations, with Lambert's Trench 3. A-F, the stones of Lambert's wall.

Evron and Belfer-Cohen, 1993, and see above, Chapter 5, "Decorative and Art Objects"). In our view, however, it is impossible to establish with certainty either whether these objects were used in Chamber III, intentionally "reposited" there, or simply dumped there as part of the general waste. That similar objects were found in Garrod's excavation in the outer parts of the site (Garrod and Bate, 1937) also seems to speak against the occurrence of a well-defined "repository" for symbolic objects in Chamber III.

So far then, according to the available data, the Natufian habitation of el-Wad can be divided roughly into three activity areas: a dwelling area in the outer chambers and possibly also on the terrace, a cemetery, mainly on the terrace and the entrance to the cave, and a dumping area in Chamber III (Weinstein-Evron, 1997).

As already mentioned, it is highly probable that the Natufian habitation of el-Wad extended much further than indicated by the excavated area, both inside the cave and on the terrace. Geophysical investigations in the cave (Weinstein-Evron, et al., 1991 and see above, Chapter 4) revealed the occurrence of rather deep, unexcavated sediments in the inner Chambers IV-VI. The "corridor" is rather spacious and could have been used for various purposes, from sleeping to ritual practices. Whether the rear part of the cave was utilized by Natufian (or other) inhabitants, to what extent, and whether these activities were such that they could have left traces in the archaeological record, is as yet unknown.

Charcoal remains and the many flint artefacts and bones which exhibit signs of thermal influence suggest the use of fire on the site. Garrod carried out no detailed mapping of hearths but she does report the occurrence of several hearths both in the cave and on the terrace, often related to burials. No hearths were encountered by us during the recent excavations. It seems unlikely that fires could be lit beyond Chamber III of the cave: attempts to keep a fire going in the rear of the cave during recent filming activities demonstrated that, since there is no proper airing in this part of the cave, there will always have been the risk of suffocation from smoke.

As for the terrace, Garrod excavated only a limited area here and concentrated her efforts on the upper part, in the area broadly delimited by a wall constructed by shepherds who had been using the cave in recent times. She noted the existence of an additional, unexcavated, area within the terrace, comprising a talus *c.* 45m in diameter, sloping sharply towards the coastal plain. In the course of excavations currently being carried out by Daniel Kaufman and the author, a Natufian wall was recently found on the terrace, some 5m NE of the area excavated by Garrod. Admittedly, "one wall does not make a village", but its discovery clearly demonstrates that the terrace has further archaeological potential and that the existence of other built features is probable. It is unlikely that the relatively straight and long "ruined ancient walls" within the talus area as illustrated by Garrod (Fig. 15) are Natufian; they certainly have no parallel in other Natufian sites. As it runs across the wadi bed, from southern to northern bank, one of these walls could have served to dam water in this part of the wadi, either permanently (prior to the recent capturing of springs) or seasonally, that could have been used for domestic purposes and for the herds belonging to the inhabitants of the cave and the area. When documented, there was already "a breach in the wall at the point where a stream runs through the valley in the rainy season" (Director of Antiquities, 1928:3). Though the age of these walls is unknown, it is tempting to relate them to the wall at the entrance of the cave, as well as to the important construction activities, often connected with wine and oil industries, which are widespread in the area (Lahav and Farkash, 1986). A small ruin and a water cistern on the terrace were also reported by Mülinen (1908).

At this point in of our speculative discourse it becomes impossible to go any further and, for example, to envisage differential use of the various parts of the site, or developments and changes through time, as has been suggested for Hayonim Cave and Terrace (O. Bar-Yosef, 1991b; Henry and Leroi-Gourhan, 1976; Valla et al., 1989) and for Eynan/Ain Mallaha (Perrot, 1966; Valla, 1991). It is also impossible to ascertain whether the layout of the Natufian settlement at el-Wad in fact included constructions in the entrance to the cave and on the terrace, as is the case, for example, at Hayonim (O. Bar-Yosef, 1991b), although the abundance of stones in Garrod's Layer A seems to speak in favour of such an assumption, as does the large amount of stones used in the "Medieval wall" that closed the cave prior to Garrod's excavation (Figs. 3,5), and which incorporated Natufian remains. Other stones may have been used by the shepherds to build walls and huts on the terrace or entrance to both el-Wad and Jamal caves. Fig. 80 shows part of Lambert's excavation in Chamber I and clearly indicates the availability of large stones in the upper layers of the cave, which could have been used for the purpose. A climatological explanation for the formation of these stony layers, to account for the widespread phenomenon in other Levantine caves, has been proposed by Ronen (1971). Significant also is Garrod's statement that Layer A on the terrace "might in fact be regarded as a disturbed Upper Natufian deposit containing a large amount of intrusive material" (Garrod and Bate, 1937:6).

Fig. 80. Lambert's Trench 3 in the cave. A Natufian construction, made of large stones, appears under a layer of medium-sized stones.

The scanty architectural remains on the terrace including the terrace wall, and the rock cut basin/mortars (originally related to the burial activity), as well as the slab-paved surfaces have been re-interpreted recently by Gorring-Morris (1995). Based on a detailed comparison with other Early Natufian sites in the Levant, Gorring-Morris has argued that the poorly preserved Early Natufian structures unearthed by Garrod represent but portions of larger and more complex architectural features. The curved "terrace" wall can be completed to form a U-shaped or circular residential structure, some 8-9m in diameter (Fig. 81:A), similar to structures from Eynan (Valla, 1981, 1988, 1991) and Wadi Hammeh 27 (Edwards, 1991, 1993). The rock-cut basin and slab pavements, together with several group (H25-26, H57, H28-32, H23, according to Gorring-Morris) and individual burials, and a stone-lined hearth are taken to represent secondary features. He argues, furthermore, that the way these are arranged within the main structure is reminiscent of internal, spatial organizations found also at the other sites. Another group burial unearthed by Garrod in Chamber I (Fig. 81:B) comprised ten individuals (H1-10), accumulated in three separate events and included two distinct hearths. It is located on the main axis of access from the cave entrance to the interior chambers, off-centre to the chamber itself. The entrance area (Fig. 81:C) and the proposed ledges (Fig. 81:D-F) formed by short terrace walls were apparently used for more sporadic, individual burials. According to Gorring-Morris, the patterning that emerges from these tentative reconstructions, in the form, nature and size of residential architecture, accords well with the evidence from the Early Natufian sites of Wadi Hammeh 27 and Eynan, indicating a high standardization of architectural concept in terms of both planning and implementation. He also argues that the envisaged site lay-out implies a spatial segregation of certain activities between the cave and terrace, with residential occupation being limited to the latter.

As convincing as these attributions are, this scenario leaves several questions unanswered. First, as shown above, the residual character of the Early Natufian deposit in Chamber I does not allow a straightforward reconstruction of the possible use(s) of this part of the cave. Second, taking the topographical data into consideration, regarding the terrace deposits, the difference in height between the rock-cut basins and the northern edge of the "residential structure" is no less than 1m, that is if we assume that the latter was found at the upper part of the Early Natufian layer (Fig. 3). If, on the other hand, this segment was uncovered deeper in the sediment (according to Garrod it was unearthed 1.2m below surface), the difference in height could have been more important. In that event, the possibility should not be ruled out that the basins and the northern end of the reconstructed wall do not represent a single architectural feature but may have belonged to different structures, built either on different topographical levels at the site, or even at different chronological stages.

In fact, other observations, too, seem to cast doubt on the contemporaneity (or even quasi-contemporaneity) of the various features within Gorring-Morris's reconstructed "residential structure". According to Garrod, several of the burials clearly predate the paved surfaces above them. H41 and H43 lay close together against the edge of the rock-platform, and immediately underneath two of the slabs which made up the pavement. Thus, as Garrod herself puts it, "It is obvious that these skeletons must already have been in place when the kerb was laid down, and this suggests that the comparable burials containing bodies with shell head-dresses, ... which lay between the rock-edge and the lower end of the trench, are older than the

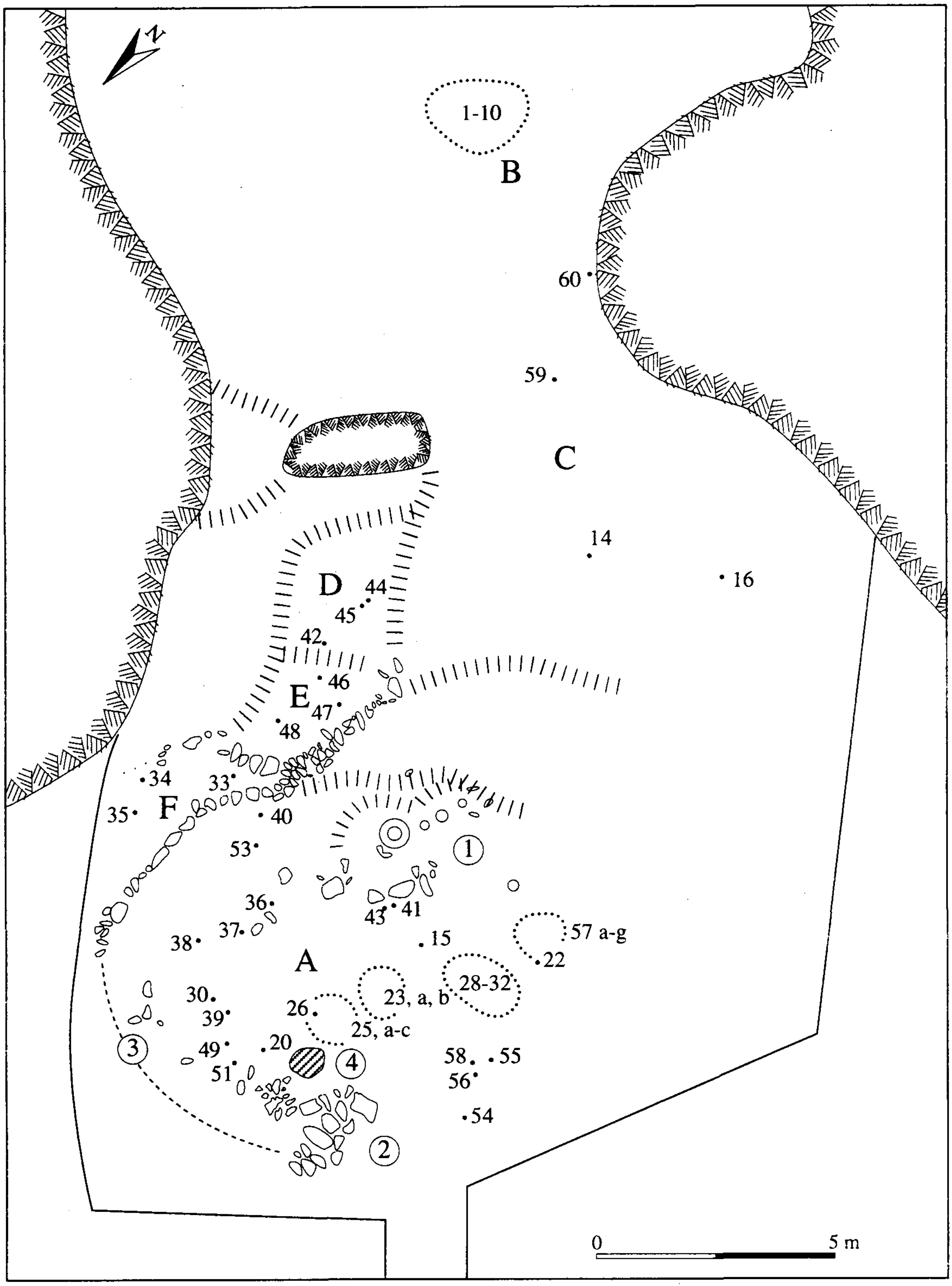


Fig. 81. Tentative re-interpretation of the Early Natufian occupation of Layer B2 on the terrace and in the cave of el-Wad based on Garrod's reports.

pavement and basins, and that if the pavement was at one time more extensive, and was afterwards destroyed, this was not done in order to admit these burials" (Garrod and Bate, 1937:17-18). Furthermore, the burials assigned by Gorring-Morris to the group burial/*cimetière* type (H23, H25, H28, H56?, H57) all came from a completely undisturbed Early Natufian deposit predating the basins and pavement, themselves of Early Natufian date (Fig. 82). "They can therefore be assigned with reasonable certainty to a fairly early stage of the Lower Natufian" (Garrod an Bate, 1937:19).

If we go by Garrod's observations, it seems highly probable that many of the terrace burials, and especially the group burials, belong to an earlier stage than the walls, basins, "kerb" and pavement. Moreover, in our view, it is not evident that the terrace wall, "kerb" and rock-cut basins, by themselves, belong to a single phase. According to Garrod, most of the stone slabs of the "kerb" were bedded in the red earth of Layer B2, which filled the trench to the NW. A few stones actually lay on the rock (Figs. 82, 83). She thus concluded that "the kerb had been made at a time when the terrace deposits covered the slope up to the edge of the rock platform, leaving the platform itself still exposed, and it is reasonable to suppose that the basins were cut at the same time, as they appear to be part of the same scheme" (Garrod and Bate, 1937:11). At least one other scenario is possible, namely that the levelled platform and rock-cut basins belong to an earlier stage than the "kerb" above them. The basins could have been associated with an early phase (or phases), such as that of the group burials. The "kerb", on the other hand, and possibly also the other pavement, could represent a later phase, either contemporaneous with or still earlier to the various walls. The "rough lump of limestone ... firmly wedged into Basin 2, and two blocks of the tabular variety into Basin 3" (Garrod and Bate, 1937:11), could have been used for the levelling of the pre-existing structures, before the kerb was laid down. If this is acceptable, then the Early Natufian sequence on the terrace can be roughly divided into two main phases: an early burial phase, probably related to the levelled platform and basins, and a later "residential" phase or phases, with the construction of paved structures and walls.

That even the architectural remains of this latter phase, may more adequately be attributed to different structures, at two to three different construction phases, represented by the northern pavement, the "kerb" and possibly also the "terrace wall", rather than to a single, large "residential structure", is further supported by the topography of the bedrock on the terrace (Figs. 81, 83). The height difference between the base of the closest wall and the levelled area near the eastern, rimmed basin is more then 50cm, with the basins and "kerb" situated at a somewhat lower step than the wall itself. This suggests again that these elevationally distinct features could easily have belonged to different construction phases. Moreover, Garrod's description of the terrace wall itself indicates two distinct modes of construction for its various parts (Fig. 84). "The lower or northern half of the wall was made up of a single row of blocks, varying roughly from 0.50m. to 0.70m. in diameter, set close together. Where the blocks were not large enough, a rough second course of smaller lumps was added to bring the average height up to 0.70m. In the upper or southern half of the wall no large blocks were used, and the many stones of irregular size and shape, piled together without regular course, had a higgledy-piggledy appearance..." (Garrod and Bate, 1937:11). In fact, the location and mode of construction of the southern part, "like that of the mortarless stone walls built by the Palestinian fellahin to-day" (idem) accords

Fig. 82. View to the NW of the excavations on the terrace, showing rock-cut basins, "kerb" and a pavement, with H.23 and H.25 *in situ*, May 1931.

Fig. 83. View to the NE of the terrace, showing rock-cut basins, "kerb", and rough stone wall. May, 1931 (The division on the stave = 0.50 m).

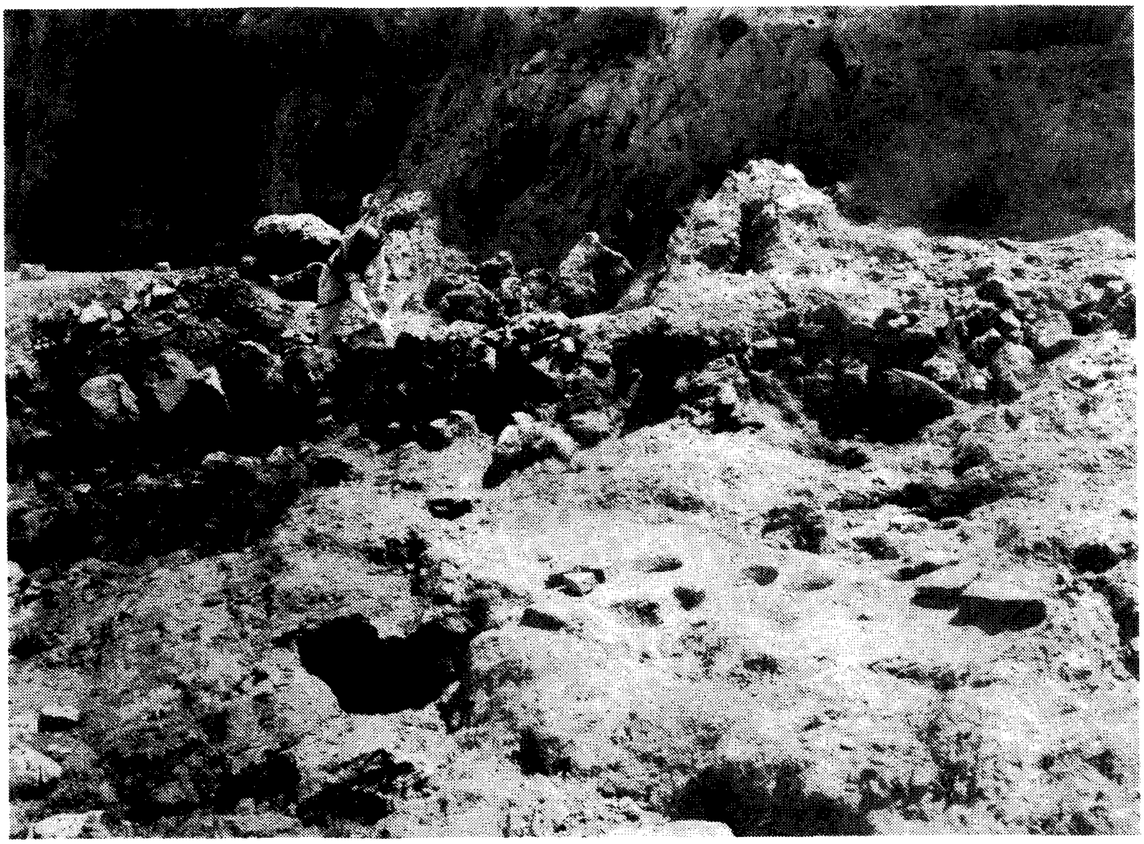


Fig. 84. A view to the SE of the terrace, showing rock-cut basins, "kerb", and rough stone wall. Note the two modes of construction of the different parts of the wall.

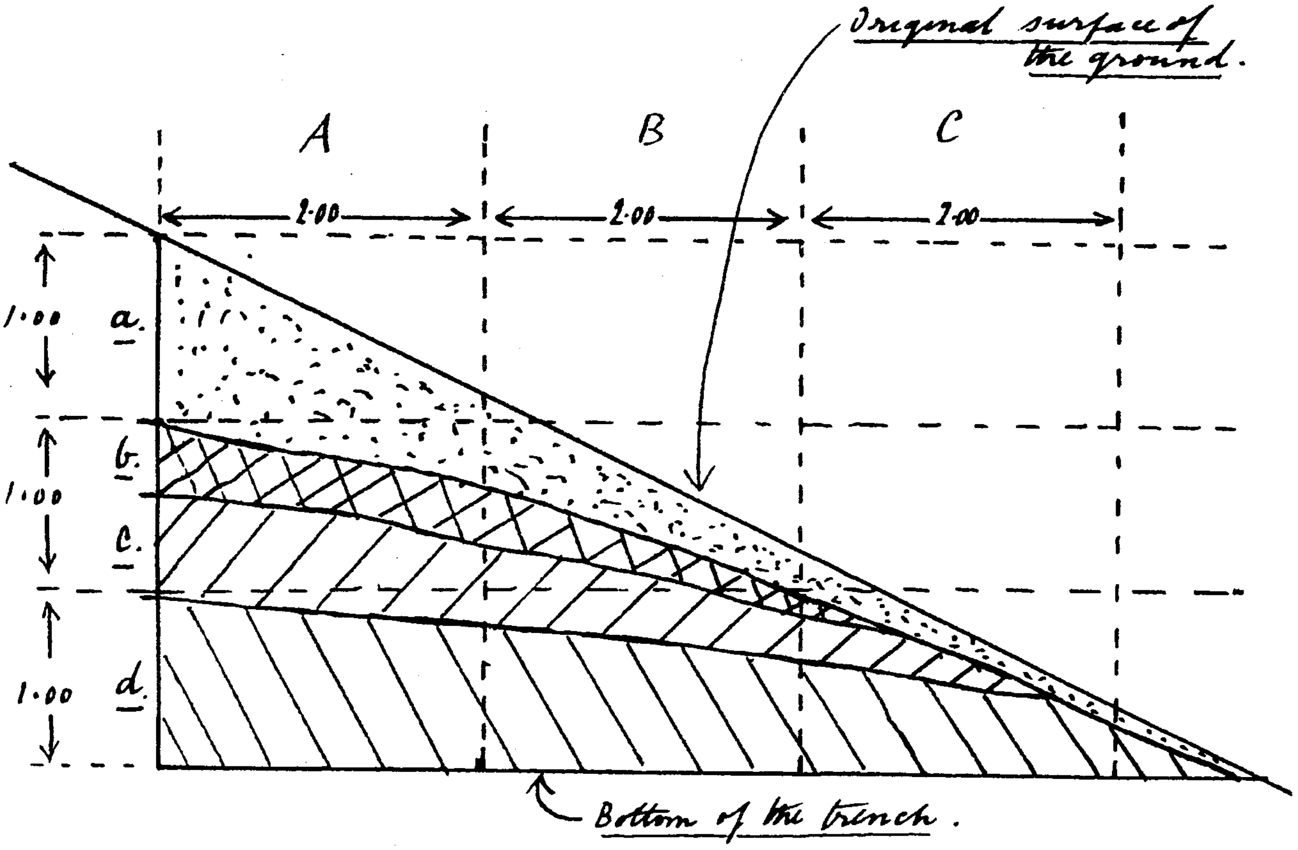
well with some kind of a terrace wall, which could have served as a basis for constructions on the higher terrace or for the protection of structures situated below it. The carefully laid stones of the northern part of the wall could have belonged to another, "residential" structure. Significantly, the northern pavement and the kerb, by themselves, clearly exhibit different modes of construction (Fig. 82).

Because of the residual nature of the architectural remains, which could have belonged to different stages of construction, reuse or amendment, any attempt at reconstructing the terrace structures in greater detail remains highly speculative. Of course, if one assumes there ever was such a thing as a Natufian "blue print", one could correlate the discussed area of Early Natufian el-Wad with similar areas within other cave sites, such as Hayonim, with its round structures, between 2-2.5m in diameter, as entrance area (O. Bar-Yosef, 1991b). As at el-Wad, they post-date an earlier phase, in which the cave seems to have been used for burial purposes, or else the preservation of structures is rather poor. A link between burial practices and basins/cup marks is also suggested by data from Hayonim (idem), as well as Eynan (Perrot, 1966; Perrot and Ladiray, 1988) and Erq el-Ahmar (Neuville, 1951).

However, there is one piece of very recent "evidence" that goes somewhat to remedy the situation, made all the more tantalising by the fact that it was summarily discarded by Garrod. Meant are the notes Lambert made during his trial excavation in the cave and on the terrace. Carefully reading through them, one cannot escape the impression that his detailed observations clearly imply the existence of Natufian "constructions". These include curved walls, paved areas, burials, hearths, and sometimes a "white limy substance" (Lambert, 1928:8). The description of the material he retrieved indicates typical Natufian flint, groundstone implements ("querns") and bone tool assemblages. Lambert seems to have been rather meticulous in the way he went about his excavation, witness his detailed descriptions and the accompanying drawings and photographs. Much of the excavated sediments were sifted, and many samples were taken for further analyses from various materials, including soil, charcoal, the "limy substance" and "lumps of red and yellow earth [ochre?]".

Lambert made five trenches, two on the ground in front of the cave, and three within the cave. Trench 1 was laid on the slope below the enclosed terrace in front of the cave, and is represented by the long, narrow, northern protrusion in Garrod's ground plan of the terrace (Fig. 3). Trench 2 was dug in the enclosed terrace near the cave (Fig. 5), along the C-D line (Fig 21). Trench 3 was laid along the A-B line, Trench 4 in Chamber II and the last sounding in Chamber VI.

Of special interest is Lambert's description of the finds from his Trench 1. The trench was initially 6 m long (Fig. 85), and was divided into three sections, A-C, from top to bottom, each two metres long. It was later extended southwards by 1m, towards the entrance of the cave. The sequence was divided into four units. The top layer (Unit a) contained "small flints" and Roman or Byzantine sherds "similar to flints and sherds found on the surface" (Lambert, 1928, 1:2; the description of each trench was numbered separately). In Unit b, the second layer, there was no late pottery, but many flints "including small crescents, and others of types found at Shukbeh" (Lambert, 1928, 1:2). This indicates that, in fact, Lambert was the first(!) to note the presence of a Natufian layer at el-Wad. The third layer, Unit c, contained many medium sized and small stones, but also a few large ones. It contained flints "of the same kinds" (Lambert, 1928, 1:2), and bone. Unit d, layer four, was characterized by large stones, flint implements and bones. For Section A, Lambert states that these "larger stones below, though rough, seemed to have been laid with some care, consideration being given to their shape; some were placed crosswise — i.e., crude headers and stretchers. There was a filling of smaller stones between the bigger ones" (Lambert, 1928, 1:4). The same was observed for Section C where "the big stones were left in place as it became evident as the work proceeded that they were not accidental but [deliberately placed] — part of a primitive construction" (Lambert, 1928, 1:3; square brackets in original). In the deeper Section A an additional feature seems to have emerged, as suggested by Lambert's description that "Under some of the larger stones ... were smaller stones which appeared to be arranged in a curve (continuing under the walls of



a. Surface soil with many small stones, flint chips, Byzantine or Roman sherds.

b. Larger numbers of small stones, with flint chips, quern stones, bone, sherds.

c. Few large (40 x 20 x 20) and more medium sized (20 x 10 x 10) stones, with small ones and flint implements and bone.

d. Large stones, with small ones between and below, flint implements and bone.

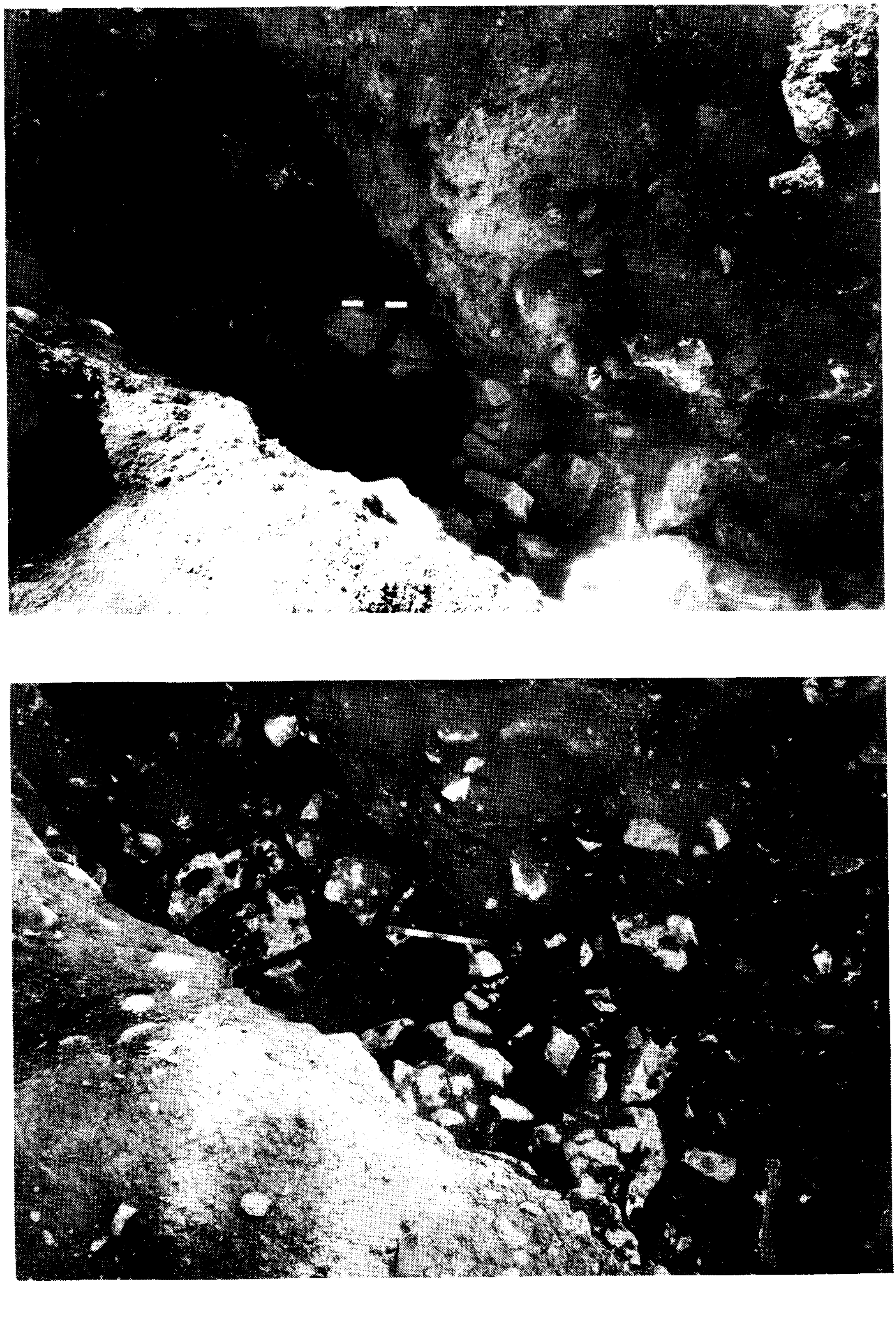
Fig. 85. Lambert's rough diagram showing a section of the stratification in his Trench 1.

the trench on either side) enclosing a small pocket of soil [see our Fig. 86] ... There were signs also of a circular arrangement ... among some of the smaller stones left in position in Section B. Here the larger stones were nearer to the surface, and in C. they were still nearer, indicating that the construction was on one plane in the parts excavated, and did not follow the present slope of the ground" (Lambert, 1928, 1: 4-5). The excavation in section C was probably not deep enough to unearth the underlying, small-stoned circular features, found in the more southern sections A and B. Lambert concludes that "It seemed better not to remove any more stones or to continue work on this trench until a clearance could be made from the top over a much larger area" (Lambert, 1928, 1:4). He reported similar "arrangements of stones" in trench 2 (Fig. 87), dug in the enclosed terrace near the cave (Fig. 5), extending some 6m northwards from a point 1m from C. on the plan (Fig. 21). The trench was about 1.5 to 2m deep. Trench 2 yielded two burials. Their exact stratigraphic position was not determined. "The arrangement of stones in trench 2. was similar to ... trench 1; but in the part of the trench where the burials were found the stones seem to be placed in a more haphazard way. The rain exposed further bones [in the side of the trench ...]. Excavation over a wider area will be necessary to clear the bones and to determine whether the layers of stones above them are undisturbed" (Lambert, 1928, 2:4; square brackets in original); large stones were placed horizontally above the first skull and at the sides.

Lambert's description not only fits well with Garrod's sequence of the terrace, but is even more detailed. Lambert divides her Layer A into two phases: historical layers (Unit a), and a "sub-recent" phase (Unit b) with no late pottery. Given the finds from the recent layer in our own excavations, the latter could have belonged to the Neolithic, Chalcolithic and probably also Early Bronze. In fact, the small crescents he mentions in his report may well represent the Final Natufian later identified by Valla et al. (1986) in the lower part of Garrod's layer A. Lambert's Unit c most probably represents Garrod's layer B1, his Unit d, with its distinct architectural features, Garrod's Early Natufian (Layer B2). An additional phase, the one with the circular arrangements of smaller stones, emerges at the bottom of Lambert's trench, which may have been Early Natufian or older still. In no place did Lambert reach bedrock. Lambert's observations are remarkably coherent and detailed, especially if we consider the swiftness with which his excavation had to be carried out. At the end of the first day of excavation, for example, Trench 1 was 2.6m, 1.6m and 1m deep in sections A, B and C respectively (Fig. 85).

The excavation of Trench 3 is described in equally minute detail (Lambent, 1928, 3). The trench was excavated along the A-B line, in Chamber I of the cave (Fig. 21), from the rough stone wall inwards. It maximum extension was 7m from point B. The trench was at first divided into two sections, A and B (section A being nearest to the point B on plan), each two metres long. Two additional sections, C and D, were added later, since "at various stages during the work it became necessary to widen and lengthen this trench" (Lambert, 1928, 3:1). In section C, at 4 metres from B, there was a large rock, probably the one marked within Lambert's sounding in Garrod's section of the cave (Fig. 3b).

The upper layer, to a depth of 20-25cm., "on and just below the surface of the cave floor" (Lambert, 1928, 3:1), contained large numbers of small stones, with some Arab and Byzantine or Roman sherds, and "some painted sherds" (Lambert, 1928,



a

b

Fig. 86. Lambert's Trench 1 showing circular arrangement of stones: (a) a general view; (b) view after rain.

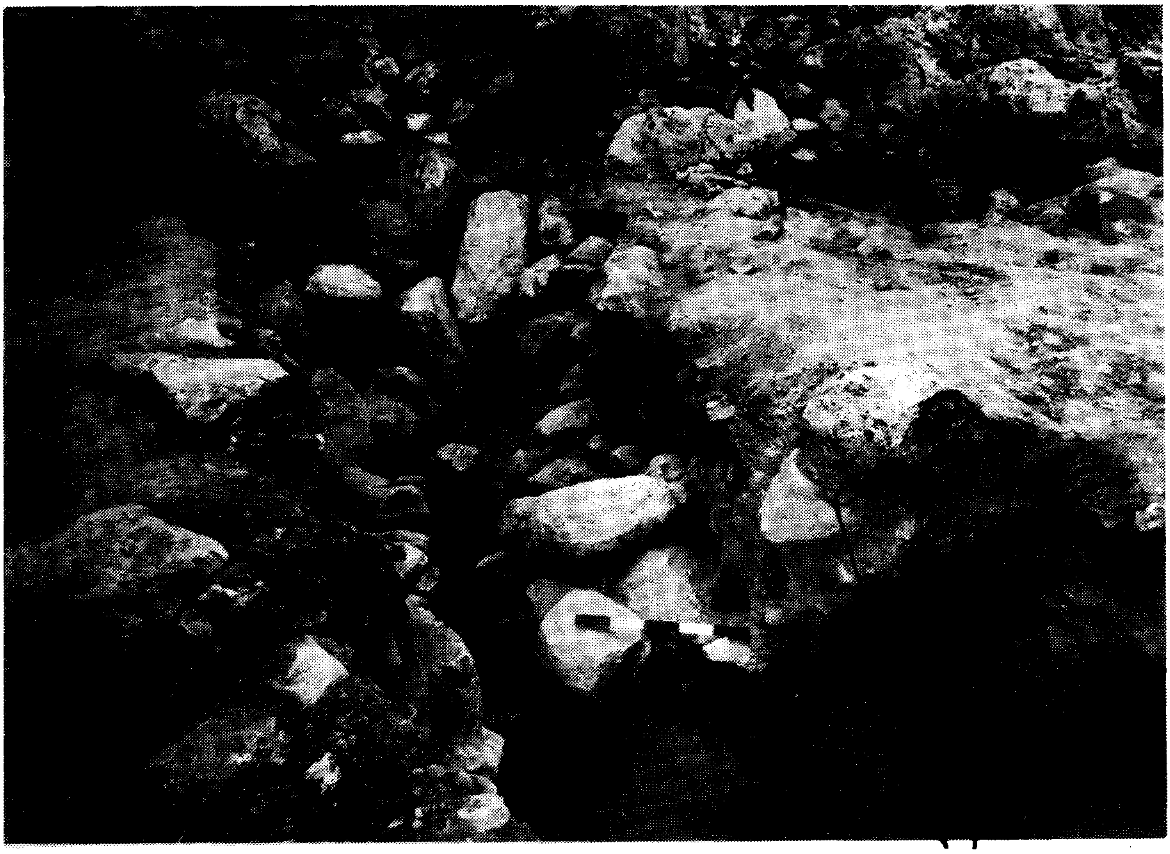


Fig. 87. Lambert's Trench 2, with the position of burials.

3:1). Below the upper 20cm., larger stones were found in section B, with under them flint implements and quern stones but no pottery. The layers below these recent levels "had the appearance of being undisturbed" (Lambert, 1928, 3:3). At 30cm below the surface, medium-sized stones, measuring 30x20x20cm, were encountered (Figs. 80, 88a). Bigger stones (65x45x45cm) occurred at 50cm below the surface (Fig. 88b). Once more Lambert states quite clearly that "the arrangement of stones was on the same lines as in trenches 1 and 2" (Lambert, 1928, 3:2). Deeper still, and separated from the arrangements of large stones by some 20cm of smaller stones, a hearth was found. It was bordered by stones (Fig. 88c), and contained blackened earth and traces of charcoal. The trench was widened to enable its exposure, whereby Lambert made sure that "before widening, the parts excavated were covered with canvas so that earth from the upper layers should not fall in" (Lambert, 1928, 3:3). The westward widening of the trench led to the exposure of a wall, most probably belonging to the phase of large stones that ran northwards in an apparently curving line towards the barrier of stones blocking the entrance to the cave (Figs. 89, 90). Surprisingly, though she does not mention it in her final report, Garrod was aware of Lambert's wall, which was left in place at the bottom of Trench 3, and she states "A row of limestone blocks ran

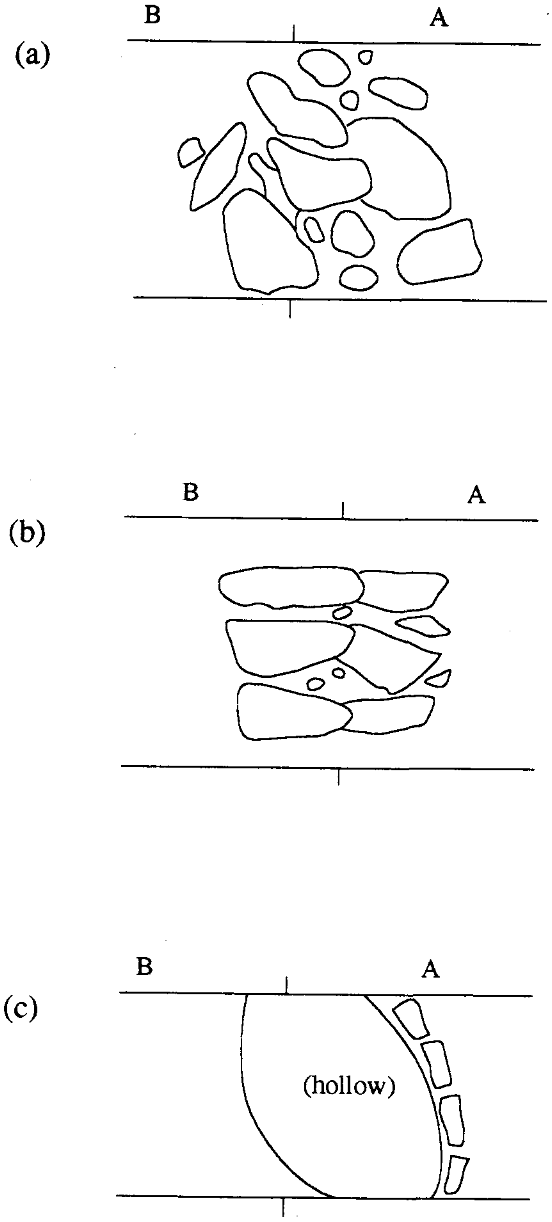
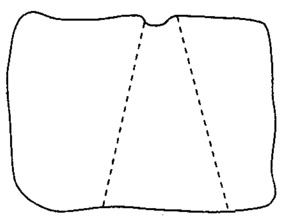


Fig. 88. Structures from Lambert's Trench 3: (a) medium sized stones; (b) large stones; (c) hearth.

Fig. 89. The Early Natufian wall in Lambert's Trench 3.

Fig. 90. The Early Natufian wall in Lambert's Trench 3. View from the west.

across it [the trench] approximately from N. to S., as though to make a rough wall or enclosure. There was no trace of a second course ... The wall ended against a large fallen block (X)" (Fig. 79; Garrod, 1930c: A1). Underneath the wall, at a depth of 1.3m, a layer of smaller stones (Fig. 91), probably similar to the one encountered further to the east, yielded "a piece of black polished bone carved in the form of a (deer's?) head" (Lambert, 1928, 3:7; Fig. 56a). "At the same level was a seam of red earth and white limy substance, of which samples were taken, running across the trench" (Lambert, 1928, 3:7). Charcoal and charcoaled earth, similar to the finds further east, were found under stones x, y (Fig. 80), with in turn "some reddish soil" underneath. Stone y (*recte* x?) "had a conical hole ground through the middle and stood with the narrower opening uppermost" (Lambert, 1928, 3:7):



Secondary use of groundstone implements was indicated also by the incorporation of a quern fragment into the wall (Fig. 89). The finds excavated in the lower parts of the trench are typical Natufian and include quern stones, bone needles, and a skull, found at a depth of 1.8 m below the surface "in what appeared to be a small circle of stones, with a quern near [to the south of it]" (Lambert, 1928, 3:9). "The first three stones in the wall (counting from the rock) were then removed ... to facilitate clearance round the skull. Under these stones there was more charcoal, red earth and whitish substance" (Lambert, 1928, 3:10; parentheses in original). Furthermore, from under the stones removed from the wall came "a large bone with a hole bored in it [the "baton de Commandement"]" (Lambert, 1928, 3:12; square brackets in original; Fig. 56b). Then the skull was removed, "loose fragments being collected and the remainder consolidated with paraffin wax ... the direction of the rest of the skeleton could not be followed without moving a large number of stones and widening the trench, which was impossible owing to the fact that the excavation had to be closed" (Lambert, 1928, 3:12). The skeleton turned out to be the first of a group of ten (H. Group 1-10) later excavated by Garrod (Garrod and Bate, 1937) who writes "Lambert had removed head, but body passed under his rough wall" (Garrod, 1930c: B17). In the third section of the trench (section C), excavation did not proceed below the layer of large stones. Two subsequent drawings of this layer, at depths of 0.9 and 1.4m, were given by Lambert (Fig. 92). They provide a detailed description of the stones, between two large rocks, practically protruding to the surface, some 90cm apart (the rock in the upper part of Fig. 92 is the one given in Fig. 3, the second rock was unearthed further east). A fragment of a "circular altar(?) of black basalt, with three legs - originally four - was found at a depth of 1.1 metres [midway between the two rocks, near the beginning of Section D]" (Lambert, 1928, 3:5; square brackets in original; Fig. 93b). It is probably a Chalcolithic chalice, intrusive from the upper layer.

Fig. 91. A layer of small stones underneath the Natufian wall, in Lambert's Trench 3. The incised sickle haft (Fig. 56:1) was discovered within the large stones of the wall.

Like the terrace, it would appear that the cave sequence contained two main Natufian construction levels: arrangements of medium-sized stones, and overlying walls built of large stones. Here, too, an additional, earlier phase emerges. This lower Early Natufian phase yielded the finest art objects found in the cave to date. In spite of these similarities, a direct correlation between the terrace and cave deposits would have been difficult to establish even during excavation, mainly because of the stone wall across the cave entrance which separated the two excavation areas and which was not dismantled until the last, 1932-1933, season (Garrod, 1934). Again, as in the terrace, the Natufian sequence of the cave was topped by two phases of recent material.

It is also worth emphasizing that, in view of Lambert's observations, the suggested depth of Garrod's Layer A in Chamber I (Fig. 3b) seems much exaggerated, and that most of it should probably be considered Natufian. Lambert's "constructions" and associated material are reported from as high as 25-30 cm. below surface, where "the layers had the appearance of being undisturbed" (Lambert, 1928:3). The depth of Trench 3 in Chamber I is 1.8 m. These observations accord well with the proposed layout of Early Natufian el-Wad, and make it reminiscent of that of Hayonim where similar structures and materials were found. As at Hayonim, Lambert's observations seem to indicate at least two construction phases within the Early Natufian: an earlier phase with relatively smaller stones in curved lines (similar to Hayonim Locus 3?), and a later stage with constructions made with more massive stones.

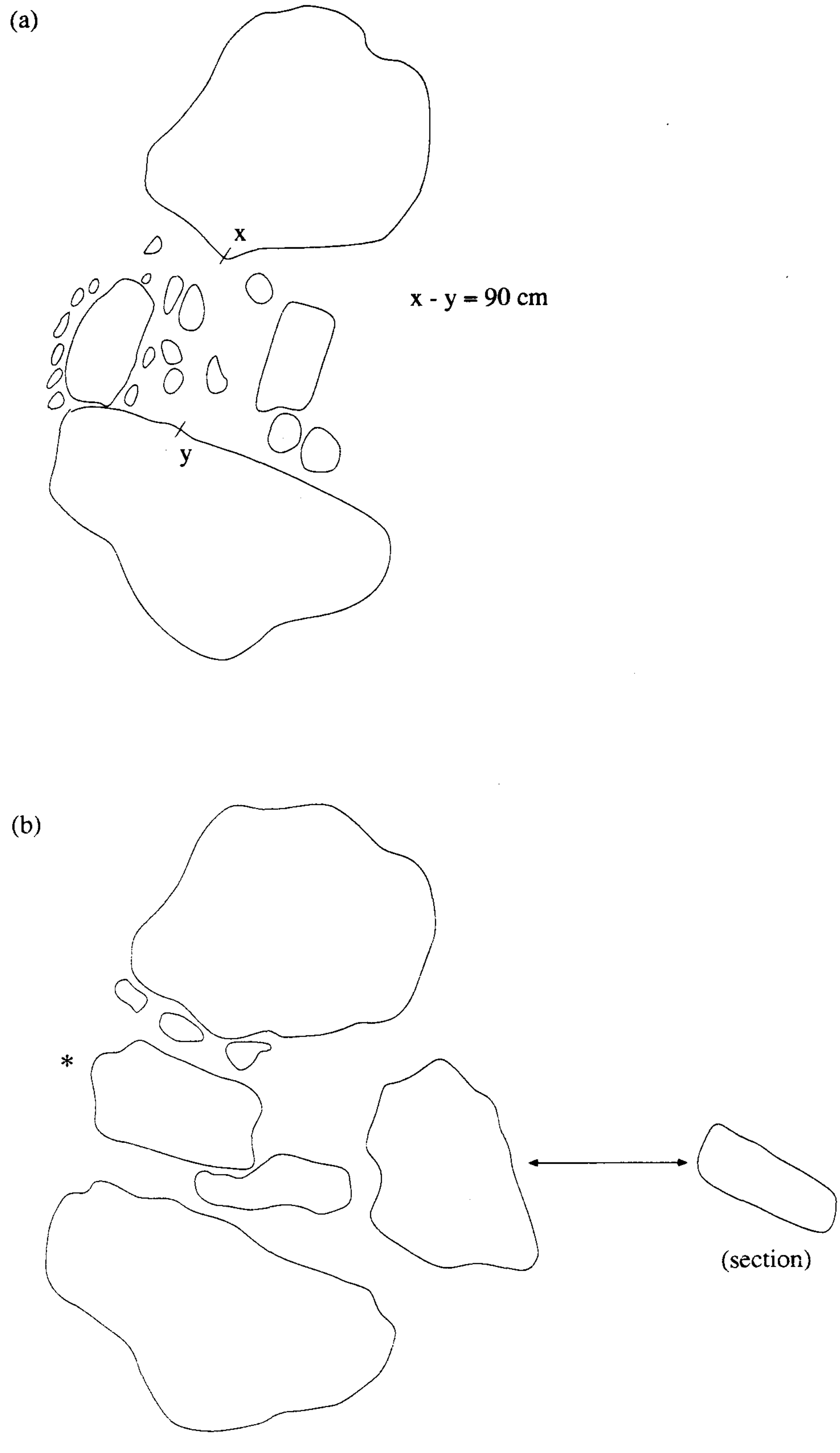


Fig. 92. Arrangements of large stones in section C of Lambert's Trench 3. The * marks the place were the "altar" (a basalt chalice?) was found, at a depth of 1.1 m.

Another observation concerns the remnants of breccia that were found on the terrace bedrock. Garrod noted that "the characteristic material of layer B was a dry red earth, growing tougher towards the base, and forming in places a thin layer of hard breccia in contact with the rock" (Garrod and Bate, 1937:10). Patches of what seems to be a thin layer of breccia were observed by us in the south-eastern, higher part of the terrace, beyond areas E, F of Fig. 81. However, we recently spotted a block of thicker breccia, containing flints and bones, east of Garrod's terrace wall, roughly on the easternmost limit of her excavation. In general appearance it resembles that of Middle Palaeolithic breccias from other caves in the area, for example Jamal Cave (Weinstein-Evron and Tsatskin, 1995), Skhul (Garrod and Bate, 1937), and from our Chamber III, but excavation is required before a specific cultural/chronological attribution can be made. Yet, if the remains are found to represent Middle Palaeolithic breccia, this may very well mean that, during Middle Palaeolithic times, el-Wad Cave extended further to the north, and was furnished with an additional, outer chamber. This hypothetical chamber probably occupied the higher part of the terrace.

If indeed such a chamber existed in Natufian times, it would certainly have influenced their use of the cave, which then also means that we shall have to reconsider our perception of el-Wad, especially as to the subdivision between its day-lit and dark portions. The existence of this additional chamber is supported by the well-developed flowstone which can be found on the higher part of the terrace, near the entrance to the cave. Such flowstone could have been formed within but not outside the cave (Mira Bar-Mattews and Avner Ayalon, personal communication, 1996).

To sum up, despite the fact that it is impossible to reconstruct exactly the layout of the Natufian settlement at el-Wad, the remains found so far, and their topographical setting, conform well to the "terraced" concept, i.e., terrace-like layout, displayed by certain other Natufian sites. Natufian settlements or villages on terraces have been found at Nahal Oren (Stekelis and Yizraely, 1963), Hayonim (Henry and Leroi-Gourhan, 1976; Valla et al. 1989) and Eynan (Perrot, 1966; Valla, 1991). In the first two, the Natufian complex included a cave, while in the latter there is no cave to occupy or use and the settlement lies on the eastern slopes of the Upper Galilee, facing the Hula Valley.

Another apparently unique characteristic of the Natufian of the Mount Carmel Caves is the use of all other caves within the same cliff. Even though el-Wad was undoubtedly the major element within this complex, slight evidence for Natufian occurrences are reported from Tabun and Skhul (Garrod and Bate, 1937) and probably also existed in Jamal (Fig. 93). We are in the dark as to the specific use of these caves, but it was probably part of the ensemble of activities carried out within the composite site. The same could probably be suggested for earlier cultures and other sites: for example, in Nahal Oren, some 5km north of Nahal Me'arot, Abu Usba Cave (Stekelis and Haas, 1952) may have formed a complex with Oren Cave (Stekelis, 1942, Stekelis and Yizraely, 1963).

The picture that emerges from this "flight of fancy" is of a rather large Natufian settlement (Figs. 93, 94) which probably included many of the typical architectural/sociological characteristics observed in other sites (for which the picture is probably incomplete also): dwelling areas in the cave and on the terrace, burial activities on the terrace and in the cave entrance, dumping area at the rear. It seems logical to suppose that Chamber III served as a dumping area only for activities performed in the cave itself with other dumping areas in existence elsewhere within the site. The other caves, higher up on the cliff and better situated as observation points, for example, were in use as well (Figs. 93, 94).

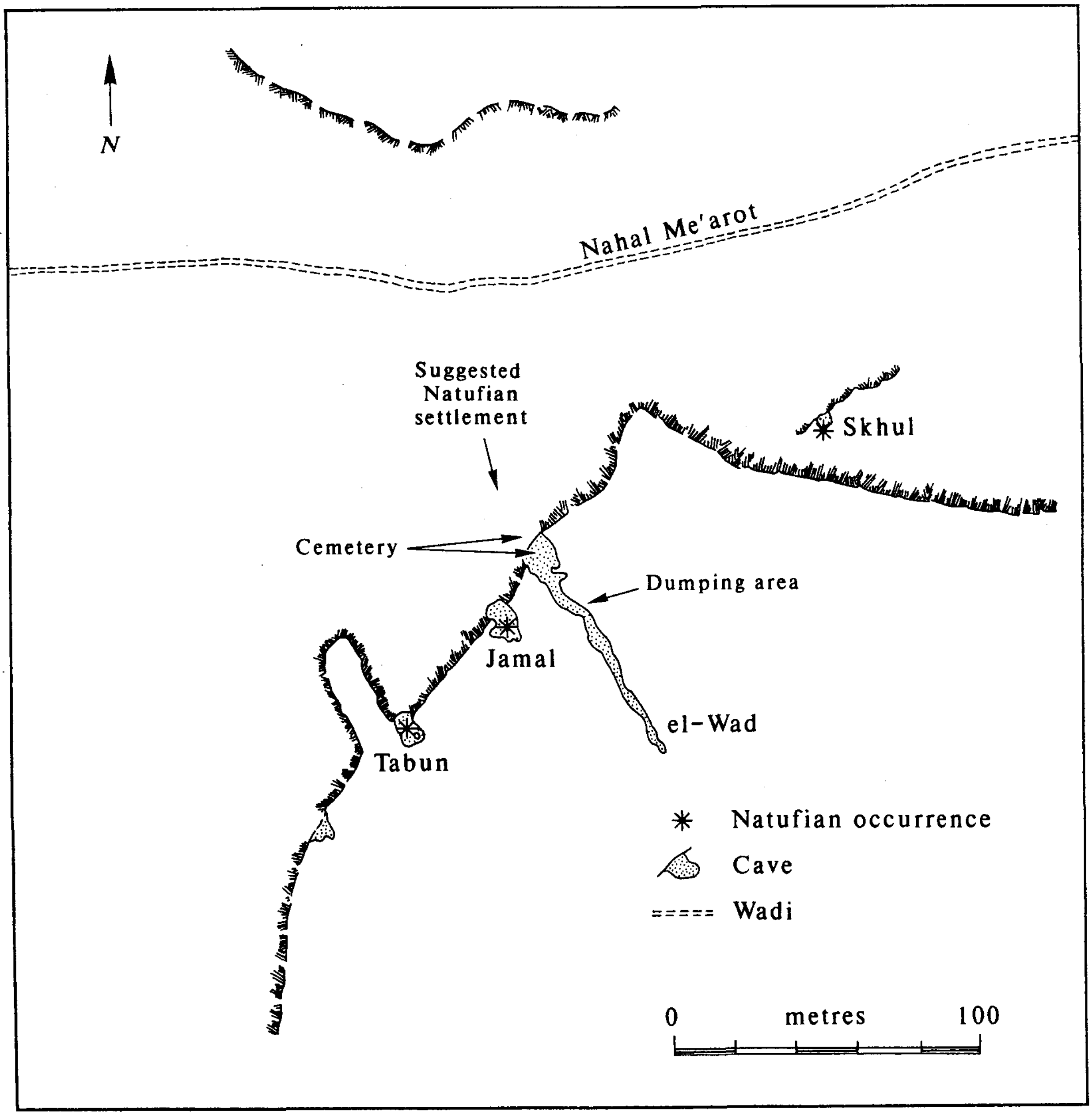


Fig. 93. A suggested general layout for the Natufian site at el-Wad.

Fig. 94. General view of the caves at the close of excavations, 1934: 1. el-Wad; 2. Jamal; 3. Tabun; 4. Natufian wall; 5. rock-cut basins

Chapter 8

CONCLUSIONS

In our discussion of the possible ways the Early Natufian habitation at el-Wad may be reconstructed, we have tried to bring together all data that could be culled from various phases of excavation and research, and from different disciplines and approaches. Important for a broadening of our understanding were comparisons with other sites, from the nearby Galilee and the Jordan Valley. The resulting picture is still far from complete, and several issues will always remain in the dark, but it appears possible to conclude that we are dealing here with a large and complex Early Natufian site that encompasses the el-Wad cave, terrace and the other caves on the same cliff. Moreover, some kind of inner organization seems to emerge, with a habitation, a cemetery, and dumping areas.

While it is obvious that the Natufian people at el-Wad knew how to make good use of the cave, that a cave was ready at hand seems to have been not an obligatory, prerequisite feature but rather a matter of convenience. As in other cases (e.g., Eynan), it is possible that the inhabitants were especially attracted by the fact that the ecotonal setting of the site meant that natural resources were easily available — the presence of a cave may simply have been a "bonus", *pace* O. Bar-Yosef and Martin (1981) who postulate an apparent "return to the caves" during the Natufian. That the el-Wad Natufians made good use of their environment is clear from the way they exploited the many different animals in the region, and possibly also a large number of plants, from various biotopes, as well as their command of the local mineral resources, especially flint and ochre. The faunal and botanical evidence suggests that this Lower Carmel site probably had a more coastal (and southern?) orientation, dictated by topographical constraints and evidenced by the abundant gazelles and the occurrence of marshy and marine species. The favourable location of el-Wad is best described by Garrod (1957: 213, citing Dorothea Bate) "... the Wady el-Mughara ... is singularly well situated for access to country of different types, mountains are near, rivers near their entry to the sea, whose undrained banks would provide swamps, and the extensive plains of Esdraelon and Jezreel, giving entry to the plain of Beisan and the Jordan Valley." As we saw, the fact that the coastal plain was considerably vaster during the Natufian, contributed significantly to the abundance of natural resources, while the "entry" to the Jordan Valley facilitated long-distance contacts with other areas.

Whether we can speak of Natufian sedentism remains a contentious issue (e.g., Perrot, 1966; O. Bar-Yosef, 1983; Tchernov, 1984, 1991, 1993a; Henry, 1985, 1989, 1994, 1995; Edwards, 1989; Byrd, 1989, 1994b; Belfer-Cohen, 1991a; O. Bar-Yosef and Belfer-Cohen, 1992; Kaufman, 1992; Lieberman, 1993a; Fellner, 1995; Valla, n.d., Valla and Khalaily, 1997), nor is it at all clear what criteria we should apply to decide how Natufian sedentism can be recognized (e.g., Edwards, 1989). Not surprisingly, we find various definitions to what the permanency of Natufian habitation may have amounted to (from intensive, multiseasonal, long-term, near-sedentary or semisedentary occupations to permanent or sedentary ones; from aggregation sites or basecamps to hamlets). The limitations within which our discussion takes place, especially the meagre evidence from the outer chambers of the cave regarding such aspects as the architectural features and environmental exploitation, make it impossible to ascertain whether el-Wad was a sedentary occupation. Still, in light of the available data and the potential of the terrace and the inner part of the cave, we have shown that el-Wad should probably be listed not among the medium sites, as suggested by O. Bar-Yosef (1983), but among the large ones. Moreover, when we add the architectural features implied by the results of Lambert's trial excavation to the various permanent features that Garrod unearthed (e.g., rock-cut basins, pavements, terrace wall), we find that the site reveals a rather complex layout. These data, together with the numerous burials (e.g., Belfer-Cohen et al., 1991), the rich and varied groundstone assemblage (e.g., Wright, 1991), the thickness of the Natufian layers and the high artefact density (Bar-Yosef, 1983), the manifestations of artistic activity (Belfer-Cohen, 1991a), all suggest that generalizations concerning sedentism, based on findings from other major Natufian sites of the Mediterranean "core area", are valid for el-Wad as well. One of these is the practically all-year-round habitation by at least part of the inhabitants. Had she been aware that the site contained more architectural features, Garrod may not have concluded that "Village life, even its simplest form, had apparently not yet begun" (Garrod, 1957:214). She did realize, however, that "At the same time the sites on Mount Carmel testify to a fairly long continuous habitation" (idem).

Besides the archaeological criteria, much of the recent arguments regarding sedentism are based on biological data, i.e., the occurrence of commensals (Tchernov, 1984, 1991, 1993a) as well as studies concerning seasonal indicators, such as the age of the hunted gazelles (Davis, 1983), the remains of certain migratory birds (Pichon, 1987), growth rings of fish vertebrae (Desse, 1987) and cementum increment of teeth (Lieberman, 1991, 1993a). While no specific data concerning the occurrence of commensals are as yet available for el-Wad, faunal studies from the recent excavations (see below, Appendix III), and especially gazelle age distribution, suggest prolonged and even year-round utilization of the site which is in line with observations based on gazelle-teeth cementum increment from the faunal assemblage of Garrod's Natufian Layer B (Lieberman, 1993a). Our palynological analyses also provided us with information on seasonality. The occurrence of clumps of olive pollen that probably had dropped from flowering branches and of myrtle pollen grains, indicates a spring/early summer habitation of the cave. Obviously, this does not necessarily mean that people were not present during the other seasons of the year — given the faunal evidence and the natural affluence of the area, there is no reason to doubt that people roamed in and around the site all year-round.

As at other sites, what remains unknown is the degree and nature of Natufian sedentism at el-Wad. Thus, we have no way of telling, for example, whether the site can be better defined as a "base camp", "aggregation site" or simply a "home". Although there were long-distance contacts, the data seem to suggest a high degree of self-sufficiency or self-containment within the area. We may also assume that within the Mount Carmel area there were less altitude-related seasonal movements than has been argued for other regions (e.g., O. Bar-Yosef and Belfer-Cohen, 1989, 1992; Henry, 1985, 1994). Such seasonal movements are often regarded as a key factor in explaining mechanisms of aggregation and dispersal (e.g., Valla, n.d.; O. Bar-Yosef and Belfer-Cohen, 1992; Kaufman, 1992). The self-containment suggested above may have had more to do with subsistence requirements than with social behaviour and choices, especially if we look at the apparent exchange/trade in basalt groundstone utensils (Weinstein-Evron et al., n.d.2), that was probably also influenced by the latter.

In all, two main archaeological entities were found in the NE part of Chamber III: Early Natufian and Upper Palaeolithic. The Natufian sample analysed to date is rich in cores but contains surprisingly low frequencies of lunates, sickle blades and awls as compared with Garrod's Layer B2 in other parts of the cave (Garrod and Bate, 1937). It was largely these differences, together with the abundance of gazelle horncores (see Appendix III, Table 16), that seem to indicate that this part of Chamber III was used for a specific activity, possibly as a waste dump, which is rather likely if we also take into consideration the special location of this area within the inner, relatively darker recesses of the cave. The broken pestles certainly seem to point in this direction. But then, again, most of the pestles Garrod found in the outer chambers were also broken (Garrod and Bate, 1937). The many gazelle horn cores, in turn, seem to imply a disposal routine similar to the one practised by the shepherds who used the cave until recent times. More surprising is the occurrence of complete well-made tools and art objects in the "dump", raising the question of why such artefacts would have been discarded. This phenomenon will remain unexplained until we have further information concerning the cultural systems in which these artefacts operated (e.g., Binford, 1972). More data, including use-wear pattern analysis, are required before we can hope to arrive at a full understanding of the function of this specific area of the cave.

The major differences between the composition of our Natufian lithic assemblage and the one Garrod unearthed in the outer chambers and the terrace may also explain, in our opinion, why she failed to identify the Natufian layer in Chamber III. Garrod indicates in her report that she had excavated the whole of Chamber III, but our finds show that this was not the case — our excavation exposed the southern limit of her excavation, making clear that she had excavated some Natufian deposits comparable to those exposed by us, to a depth of at least 40 cm.

We have defined this assemblage as Natufian on the basis of the admittedly few but typical lunates, as well as the abundant basalt tools, characteristic bone implements, and typical art and decorative objects. This definition was subsequently substantiated by the ^{14}C determinations. In fact, since the lithic assemblage (especially the dominant endscraper and burin groups), cannot be differentiated from the underlying Upper Palaeolithic assemblage of Chamber III, it is very easy to mistake them for Upper Palaeolithic. Thus, we believe that Garrod did excavate Natufian levels in Chamber III, but failed to identify them as such.

In spite of our small sample, it seems that the Upper Palaeolithic assemblage does not differ very much from the overlying Natufian layers. This is so because of its typological composition and because flakes were most often selected for tool manufacture. The main difference lies in the absence of typical Natufian elements and the scarce microliths. It is this lack of Natufian tools, on the one hand, and the abundance of endscrapers and burins, especially on flakes, on the other hand, that has led us to define these lower assemblages as Upper Palaeolithic. As already mentioned, the Upper Palaeolithic tools, and especially the cores, are somewhat better made.

The stratigraphic relationships between our Upper Palaeolithic assemblage and others previously excavated are not fully understood yet. Moreover, the small sample so far excavated made it impossible to relate it to any of Garrod's "Aurignacian" or "Atlitian" layers. What is clear, however, is that of the prevailing technological traditions at the end of the Upper Palaeolithic our assemblage can be better assigned to those with a dominant flake (O. Bar-Yosef and Belfer-Cohen, 1988) rather than blade/bladelet (e.g., Gilead, 1981; Marks, 1981; Kaufman, 1988) component.

A preliminary study of Garrod's collection in the Rockefeller Museum in Jerusalem showed that Garrod's Layer C ("Atlitian") was indeed characterized by many burins on tabular flint (Garrod and Bate, 1937). These are identical to the special dihedral burin described above (Chapter 5, "The Lithic Assemblage"), in both the Natufian (in small numbers) and Upper Palaeolithic layers of the present excavation (Fig. 46:8; Fig. 47:1; Fig. 52:4). Included in this group are typical tabular burins in which "secondary working is often confined to one or more burin-facets on a slab of flint, 5-10 mm. in thickness, with cortex on both faces" (Garrod and Bate, 1937:41), as well as burins made on secondary blanks with cortex on one side and old patina on the other. According to our counts these tabular burins form a significant component of the 160 burins of Garrod's Layer C (see also Ronen, 1976). Neither these nor the other burin types are different from our Natufian or Upper Palaeolithic burins. The difference between the analysed assemblages are again quantitative, not qualitative. The same holds true for the other tool types, especially the endscrapers. Moreover, our observations indicate that the composition of the assemblage of Garrod's Layer D1 in the Rockefeller Museum does not differ greatly from that of layer C. There, too, "tabular" burins are abundant.

There are a number of reasons to suggest that Garrod's Layer C ("Atlitian"), uncovered at the northern part of Chamber III (Fig. 3), represents either a very localized activity assemblage within the Upper Palaeolithic (Perrot, 1968) or belongs to the Early Natufian of el-Wad. These are: First, the apparent similarities between layers C and D1 as seen in the Rockefeller collection; second, the fact that Garrod excavated only a limited area of Layer C, which raises the possibility of a biased sample; and third, a scarcity of typical "Atlitian" elements in the pre-Natufian layers excavated in Chamber III to date. Finally, there are strong general similarities between the Upper Palaeolithic and Early Natufian assemblages recovered in the recent excavations.

At this stage of the research there are three possible ways to explain the relationship between the Natufian and pre-Natufian layers of el-Wad:

1) The actual sequence includes Upper Palaeolithic layer D, Upper Palaeolithic Layer C and Early Natufian (Layer B2), as described by Garrod. Thus, the "Atlitian" (Layer C) represents a separate chronological/cultural entity, as suggested originally by Garrod (Garrod and Bate, 1937).

2) Garrod's Layer C represents a specific activity zone within the cave, of Upper Palaeolithic (Layer D) age, hence the resemblance to Layer D1.

3) Garrod's Layer C should be regarded as a specific-task assemblage within the Early Natufian of el-Wad.

If alternative 2 or 3 is accepted, then there is good reason to question the use of the term "Atlitian" as either a cultural or chrono-stratigraphical taxon, at least in el-Wad, where it was first defined.

The ramifications of these possibilities are beyond the scope of the current discussion, but it is worth noting that the validity of Neuville's (1934) and Garrod's (1953) six-stage sequence of the Upper Palaeolithic, and the criteria on which this framework was formed, have been questioned before (e.g., Stekelis, 1956; Perrot, 1968; O. Bar-Yosef, 1970; O. Bar-Yosef and Vandermeerch, 1972; Marks, 1975; Ronen, 1976; Gilead, 1981). More importantly, several researchers have questioned the general applicability of a unique term "Atlitian" to assemblages attributed to the closing stages of the Upper Palaeolithic (e.g., Perrot, 1968; O. Bar-Yosef, 1970, 1973; Marks, 1975).

Our study has shown the value of additional research in what appear to be archaeologically exploited sites. Even if, as in the case of el-Wad, spatial analyses are not feasible, and the layout of the site will never be fully established, new data regarding mineral raw material procurement and faunal and botanical resources can contribute significantly to our understanding of the mode of exploitation of the environment by the inhabitants of what is a major Natufian site. Moreover, important insights can be gained into such Natufian characteristics as sedentism, trade/exchange networks and symbolic manifestations. The new absolute dates can help to define better the chronological framework of these processes.

Then also, we were able to demonstrate that one can gain a great deal of information and a better "feel" of the site from "digging" in old archives. In our case, Lambert's notes (Lambert, 1928, 1-3) and, to some extent, Garrod's recently discovered archive (Garrod, 1930b; Smith et al., 1997) have contributed significantly to our understanding of el-Wad and enabled us to substantiate the base on which previous contentions were — sometimes rather intuitively — made. Rather than defining it as a medium-sized site, with scarce architectural remains and a rich cemetery (which could, in fact, be more appropriately defined as a burial site together with some kind of cult site), el-Wad can now be better understood and described as a varied, composite, large site — all the more since we have good reason to believe it had all the architectural features that would justify ranking it as a major Natufian basecamp.

This study is, of course, not the final word. The interior parts of the cave and especially the terrace have great potential for additional finds and merit further investigation. If we wish to extend our knowledge and perspective of el-Wad we certainly need to go beyond earlier excavations that were clearly restricted to the daylit parts of the cave and the upper part of the terrace only. Given the great variety in the possible uses of caves in prehistoric and historic times (Bonsall and Tolan-Smith, 1997), not least of their darker parts, the results of our geophysical surveys, as promising as they are, show us that yet further investigations are needed if we want el-Wad to yield more of its secrets.

Appendix I

THE POTTERY OF EL-WAD

Shalom Yankelevitz*

The potsherds uncovered during the new excavations at el-Wad were collected from the entire area excavated within Chamber III, mainly from the surface layers, above the Natufian. A few potsherds were also found intermingled with the Natufian finds. Because the potsherds assemblage is clearly disturbed and mixed, and includes finds from a large variety of periods without any clear stratigraphic arrangement, the pottery will be dealt with as one ensemble. The following discussion of the main finds aims at determining during which periods the cave was in use.

Most of the potsherds represent small, sometimes rolled, body parts. Yet, about half of them (232) were identifiable, and their chronological affinity could be determined. The age distribution of the identifiable pieces is given in Table 15. The Roman-Byzantine finds dominate clearly the potsherds assemblage, followed by the Early Bronze.

The finds give us good reason to believe that the cave was used throughout the historic periods. That there are no Late Bronze Age finds is probably a matter of chance only, and can be related to both the location of the excavation in the cave and to sampling error.

The Neolithic Period (Fig. 95:1-3)

The potsherds of the Neolithic period are hand-made, generally are very crude and have been badly fired; the ware is porous. Decoration consists of white and brown slip, grass-smoothed on the outside, with red stripes on the outside. Although usually assigned to the Yarmukian Culture this type of decoration can also be found on the Wadi Raba Stage pottery (Garfinkel, 1992), as at Newe Yam (Prausnitz, 1977; Galili Ehud, personal communication, 1996) and other sites on the Carmel coastal plain (Gopher, 1993, 1995; Gopher and Gophna, 1993).

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Table 15: Age distribution of potsherds at el-Wad.

PERIOD	N
Neolithic	7
Chalcolithic	7
Chalcolithic-Early Bronze	3
Early Bronze	27
Middle Bronze II	9
Iron Age	3
Persian	3
Hellenistic	3
Roman/Byzantine	125
Middle Ages (Arab?)	12
Total	232

The Chalcolithic Period (Fig. 95:4,5)

Among the potsherds of the Chalcolithic period are a cornet fragment and a V-shaped bowl rim, which are typical to the Ghassulian Culture.

The Hadera area about 20km south of el-Wad is commonly held to be the northernmost Ghassulian Chalcolithic occurrence. Nevertheless, data from more northerly sites have been accumulating recently: Sefunim Cave (Ben-Tor, 1984), H. 'Usa (Ben-Tor, 1966; Getzov, 1991), Tell Essur (Yanai, 1996) and Peki'in (Gal et al., 1996). The evidence indicates that the culture was spread throughout the country, and el-Wad Cave fits well into the scheme.

The Early Bronze Age (Fig. 95:6)

Of only three of the potsherds was it impossible to determine with certainty whether they belong to the Chalcolithic or the Early Bronze Age, whereas 27 of the others belong to the Early Bronze without a doubt. These include EBI body sherds of well-fired, hand-made jars with flat bases, and smoothed surfaces. A large EBI site has been excavated recently at Tell Megadim, 6km NW of el-Wad (Sam Wolf, personal communication, 1994).

The Middle Bronze Age

The Middle Bronze Age is represented by finds from the Middle Bronze II, which include mainly jar body sherds. The Carmel Coast area abounds with MBII sites (Marcus, 1991), including Tell Nami (Artzy, 1991), Megadim (Broshi, 1994), and Atlit (Johnes, 1932; Raban, 1985). Based on rock engravings in the Nahal Me'arot area, it has been suggested that the Mount Carmel caves were on the main road that led from Tell Nami inland (Artzy, 1991).

The Iron Age

The Iron Age is represented by well-fired bowl and jar body sherds. Sites of this period are known from excavations at Tel Dor (Stern, 1995) and Shikmona (Elgavish, 1994) as well as from surveys in the vicinity of Kerem Maharal and Upper Nahal Oren (Olami, 1984).

The Persian Period (Fig. 96:1).

Three potsherds date from this period, all of the cylindrical neck jar type. Geopolitically the Carmel coast was an important area during the period. Among the main sites are: Shikmona (Elgavish, 1994), Megadim (Broshi, 1994), Atlit (Johnes, 1932) and Dor (Stern, 1982, 1995).

The Hellenistic Period (Fig. 96:2)

Three items belong to the Hellenistic period. They include 2 jar fragments and 1 bowl. Shikmona (Elgavish, 1994) and Dor (Stern, 1995) were the principal Hellenistic sites in the area.

The Roman-Byzantine Period (Fig. 96:3-8; Fig. 97).

A considerable number of sherds belong to this period, most of them jar sherds (Fig. 96:3-8), with a large number (19) of oil lamps (Fig. 97). This corresponds well with their occurrence in the dark part of the cave. The identifiable sherds are all Roman, but part of the other ribbed jars body sherds are undoubtedly Byzantine. Of special interest is the oil lamp in Fig. 3:3, which is assigned to the imperial lamps of the 1st-2nd century AD. It depicts a mythological scene of a male warrior holding a female by the hair and may represent some part of the Amazons' War or Perseus slaughtering the Gorgone, both common Roman scenes. Dozens of sites from this period are known in the Carmel and Carmel coast area (Kloner and Olami, 1980; Olami, 1984; Lahav and Farkash, 1986).

Medieval Period

Twelve sherds belong to the Middle Ages, mainly to the Late Arab period. The sherds are of crude manufacture, some hand-made, badly fired, straw-smoothed and usually with a lot of straw and other organic material traces in their core.

The composition of the pottery assemblage accords well with Garrod's description of the upper Layer A of the cave, which contained a mixture of archaeological material with sherds representing all the periods "from Early Bronze to modern Arab, but ribbed Byzantine ware was far the most abundant" (Garrod and Bate, 1937: 6). However, the Neolithic finds (sherds as well as flint implements) were apparently ignored by Garrod. The Late Neolithic, Wadi Raba sherds found at the cave seem to agree well with the settlement of the Carmel coast during this period (Gopher and Gophna, 1993; Gopher, 1993; Galili et al., 1997). Potsherds from historic periods were also found in the neighbouring Tabun (Garrod and Bate, 1937) and Jamal caves,

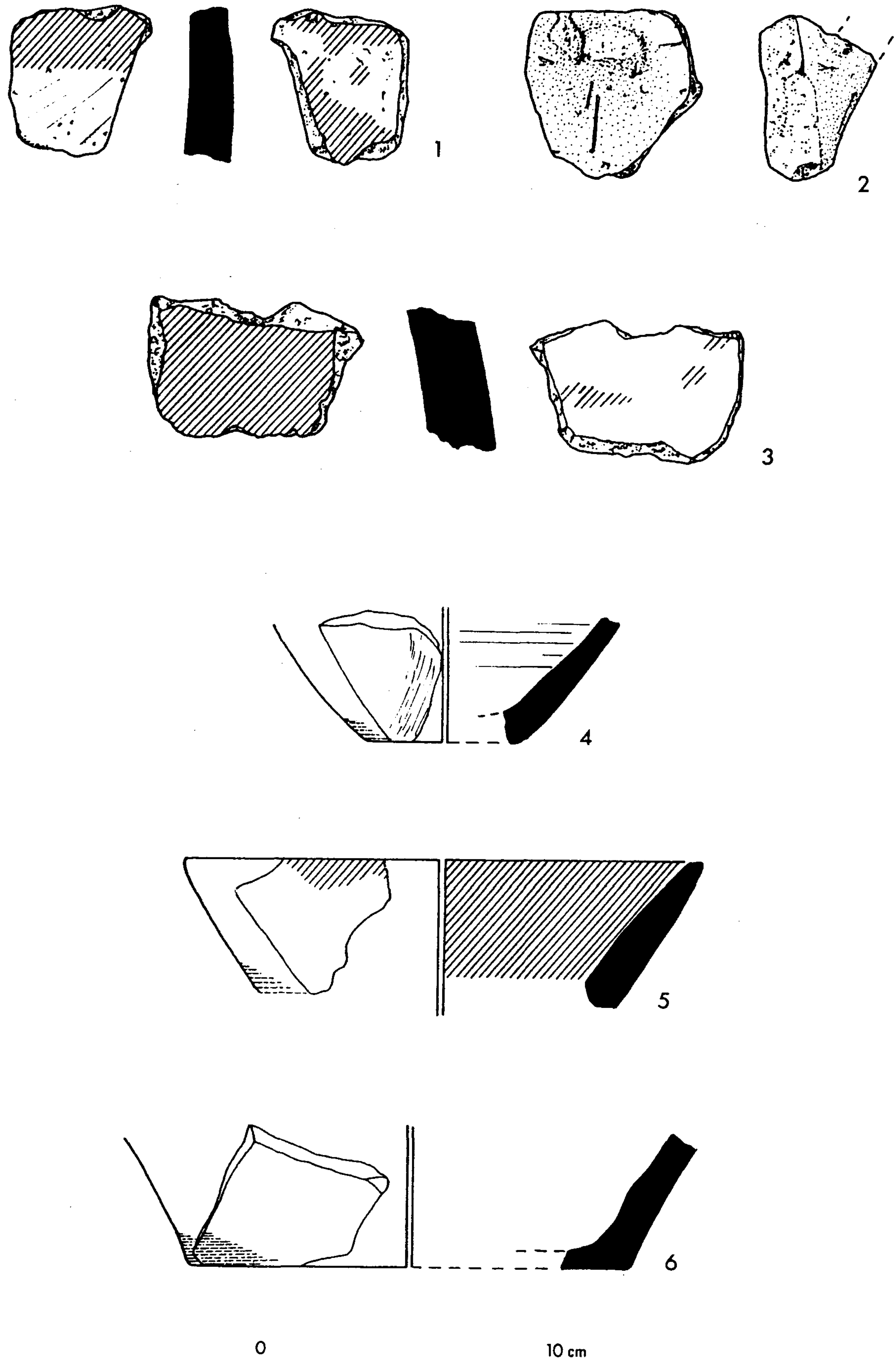

Fig. 95: Neolithic to Early-Bronze potsherds.

No.	Reg. Number	Period	Description	Parallels
1	E40a, 164-1 Bowl	Neolithic Wadi Raba Phase	Bowl: hand-made, well-fired, dark red stripe on white on outside, traces of red inside. White porous clay, smoothed on both sides. Slip colour 7.5YR4/4, slip inside 10R5/8. Clay 10YR8/3.	Garfinkel, 1992: Fig.34:9
2	G37d-128 Bowl	Neolithic Wadi Raba	Bowl knob handle: hand-made, porous, straw smoothed, medium-fired, voids of chaff or grass. Colour: surface 5YR 7/6, clay 7.5 YR 7/4..	
3	E40a, 164-2 Plate? jar	Neolithic Wadi Raba	Thick- walled plate: hand-made, brown burnished outside, red paint traces inside, many small lime grits. Slip colour 7.5 YR 5/4, clay colour 5 YR 6/6.	
4	E40b, 162-2 Cornet	Chalcolithic	Cornet: slow wheel made, well-fired, straw smoothed surface, many small lime grits + some chaff or grass voids. colour surface+clay 5 YR 7/6.	
5	E40b, 162-1 V shaped bowl	Chalcolithic	V-shaped bowl: slow-wheel made, medium-fired (black core). Red slip inside, red stripped outside rim. Many white grits + many voids of chaff or grass. Colour slip 10R 5/8 clay 7.5 YR 7/4.	Baruch, 1987: Fig. 69:2-4
6	G38,157 Jar	EBI	Jar base: hand made, well-fired, many medium sized white grits, the surface is smoothed. Colour surface + clay: 2.5 YR 6/6.	Ronen and Olami, 1978: p24, No. 9; Eisenberg, 1993: Fig. 3:15-16

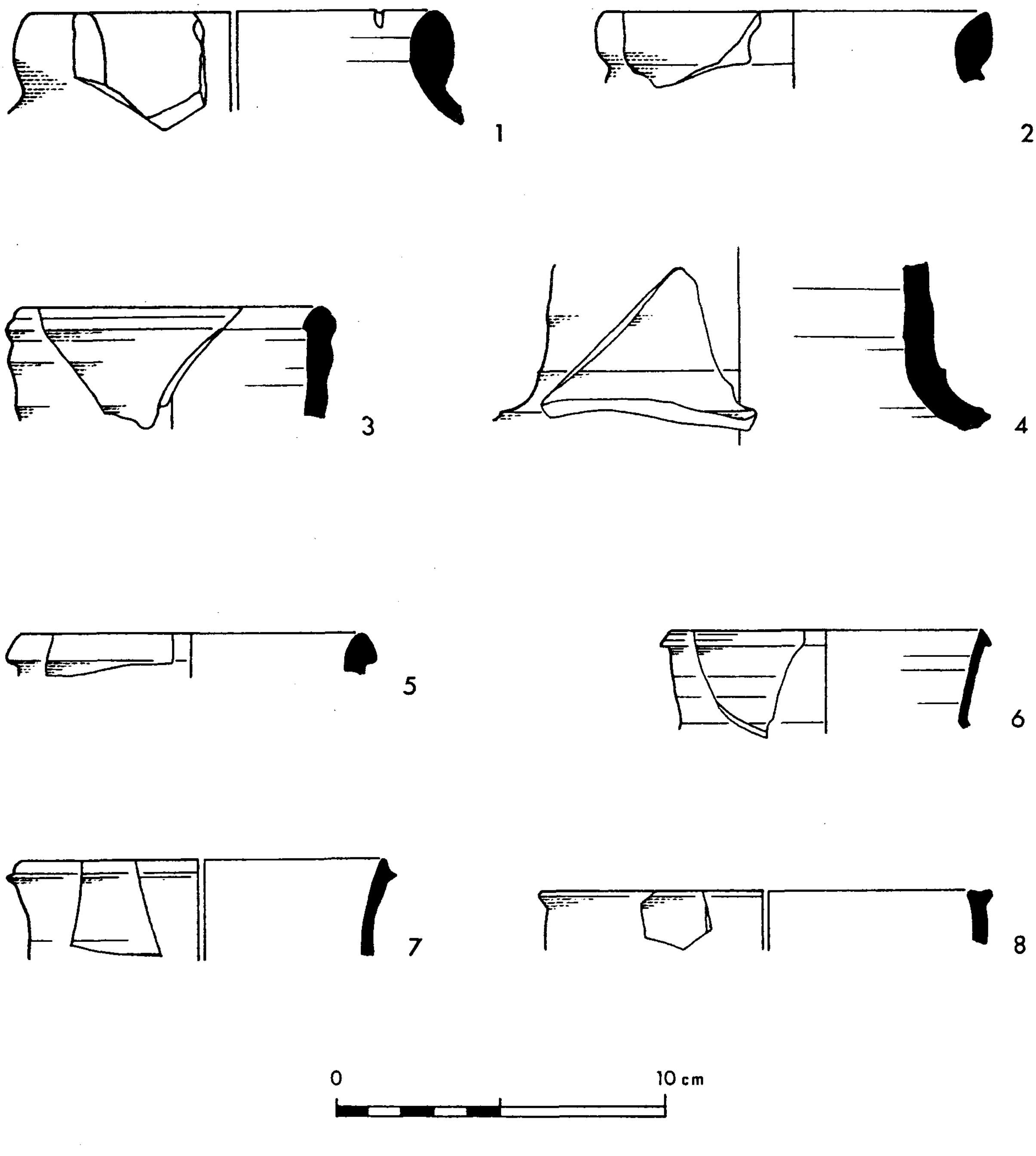

Fig. 96: Pottery of the Persian to Roman-Byzantine period.

No	Reg. Number	Period	Description	Parallels
1	I37, 133a Jar	Persian 6th-4th century BC	Jar: round thickened-rim, well-fired, mild grits. Colour: slip 2.5 YR 8/2, clay 7.5 YR 6/4,	Stern, 1995: Fig. 2; Fig. 29:6
2	I36, 130 Jar	Persian/Hellenistic	Jar: round thickened-rim well-fired, mild grits. Colour: slip 2.5 YR 8/2, clay 7.5 YR 6/4,	Stern, 1995: Fig. 6.35, 6.10.
3	I37b, 105 Jar	Roman-Byzantine 4th century AD	Jar: thickened-rim, groove underneath, very well fired, no grits. Colour: 5YR7/8,	Meyers, et al., 1976: Plate 7.20, IV.
4	H37, 119 Jar, type 1a, high neck		Jar: high neck ridge on its base, very well fired, no grits. Colour: 5YR 7/8.	Riley, 1975: Figs. 6, 8, 9.
5	G37d, 128 Jar	Roman	Jar: thin-walled, very well-fired, no grits. Colour: 5YR7/6.	Meyers, et al., 1990: Fig. D:13, Fig. K:15.
6	I37, 133 Cooking pot	Roman	Cooking pot: very thin-walled, medium-firing, few grits. Colour: 5YR4/6	Meyers, et al., 1990: Fig. U:6
7	G39a, 153 Cooking pot	Roman 250-306 AD	Cooking pot: very thin-walled, low ridge bellow the rim, bad firing, black core, no grits. Colour: 5YR 4/6	Meyers, et al., 1990: Plate CC:14.
8	I42a, 153 Cooking pot	Roman 3rd Century AD	Cooking pot: thickened everted rim, thin walled, medium fired, very small grits. Colour: 5YR 5/4	Meyers, et al., 1990: Plate Y:3, Plate AA:1. Meyers, et al., 1976: Plate 7.9 type 11.2

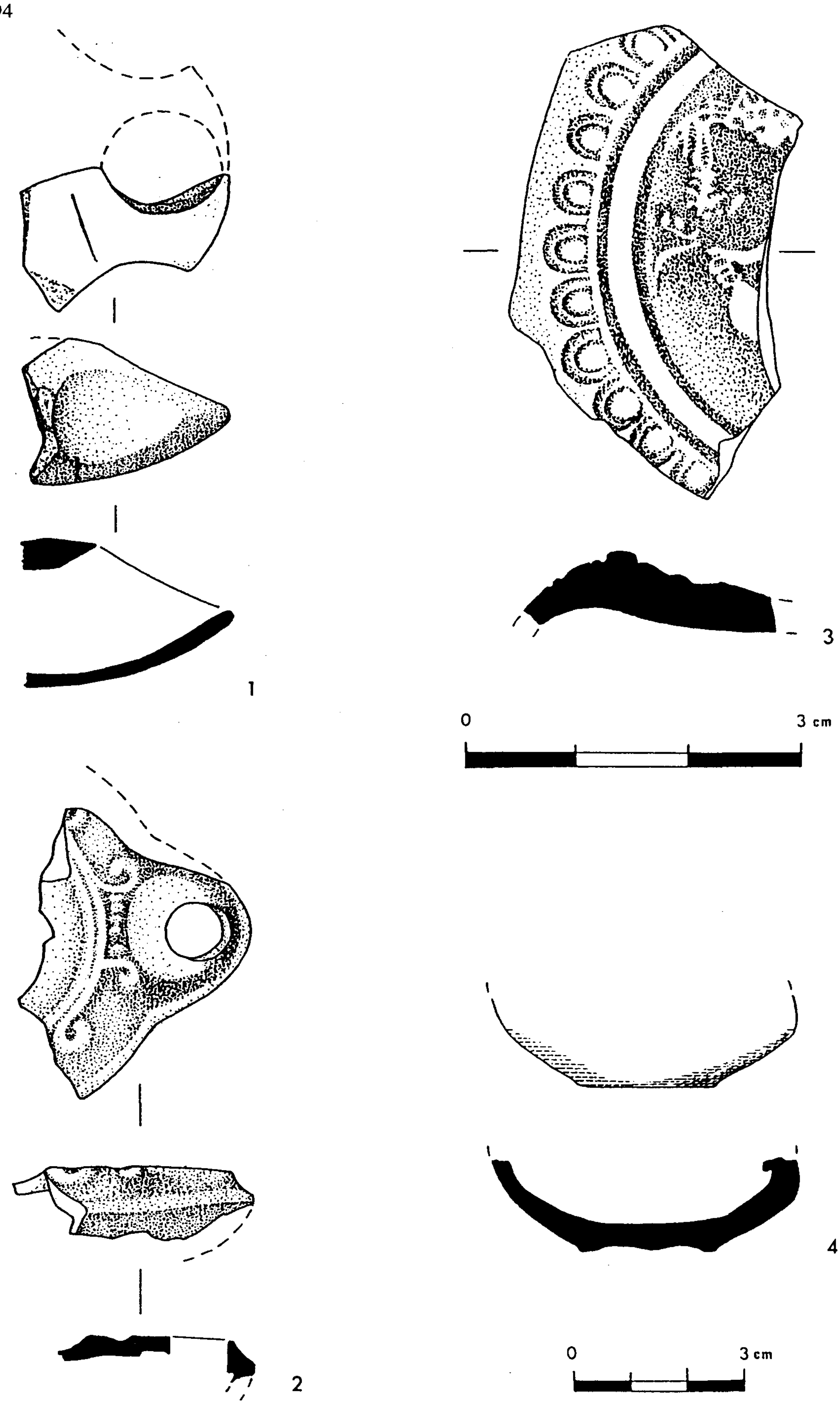

Fig. 97: Roman lamps.

No	Reg. Number	Period	Description	Parallels
1	H37b, 131	Roman 1st century BC - 1st century AD	Wheel-made Herodian lamp, Nozzle. Traces of ash. Colour: clay 5YR8/4	Rosenthal and Sivan, 1978: p. 80 and Figs. 331-334. Kahane and Ravani, 1961: pp. 136-138, variants a,b,c. Elgavish, 1962: type 5.
2	G37d,128	Roman 1st century - 2nd century AD	Imperial moulded lamp nozzle, short rounded nozzle, volutes on both sides delineate 5 dots. Colour: clay pink 5YR5/8. Red burnished 10R4/8.	Rosenthal and Sivan, 1978: pp. 85-86, Nos. 347-351. Broneer, 1930: type XXV.
3	I37g,105	Roman 1st century - 2nd century AD	Imperial moulded lamp discus fragment. Shoulder of disc decorated with "horse-shoe" pattern. In the centre of the discus - the very edge of a mithological scene. Slip colour red-brown 10R4/8, clay colour pink 5YR7/6.	As No. 2
4	I42b, 129	Late Roman	Wheel-made rounded lamp fragment, small ring base, convex body. Colour: clay pink 5YR8/4.	Rosenthal and Sivan, 1978. No. 404 and p.99. Feig, 1990: p. 74, Fig. 10:9.

as was probably the case in many of the Levantine caves. A rather similar distribution of periods, from the Chalcolithic onwards, was indicated by the pottery found at the cave of Sefunim, some 8 km north of el-Wad (Ben-Tor, 1984).

Appendix II

HUMAN REMAINS

Baruch Arensburg*

Only two human bones were found during the excavation in Chamber III: the fragments of a femur and a clavicle.

The first is a proximal part of a right femoral diaphysis, broken under the third trochander, and belonging to an adult male. The bone is highly calcified and shows ancient breaks, covered with sediment and patina.

The gluteal tuberosity of this fragment presents a medium development. In the posterior face the *linea aspera* is strong and the cortical bone thick. The total length of this femoral segment is 150mm. The maximum transverse diameter is 26.5mm, and the antero-posterior diameter is 27.5mm. The cortical bone is 6.5mm thick. The measurements of the bone and its robustisity are in the range of Mediterranean groups found in the region (Arensburg, 1973; Soliveres, 1976).

The second bone is the left clavicle of an adult woman, missing both ends (as a result of old breakages). It is covered with sediment and patina. The total length of the bone is 101mm, the transverse diameter 10mm and the antero-posterior 12mm. The conoid tubercle is small and the trapezoid line is absent.

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Appendix III

TAPHONOMICAL ASPECTS OF THE RECENT EXCAVATIONS AT EL-WAD

Rivka Rabinovich*

The study of the faunal remains at el-Wad encompasses squares I40-I42 from the NE part of Chamber III. Because of the restricted area involved and the small sample analysed, our discussion will concentrate on composition, taphonomic aspects and general palaeoenvironmental reconstructions. As with the other finds, the faunal remains will be discussed "en gros" and no finer sub-divisions will be attempted at this stage. Similarly, no spatial analyses can be carried out at this point.

There are three previous studies on the fauna of the site: Bate (1937), Garrard (1980) reexamining Bate's finds, and Valla et al. (1986). The carnivores were studied by Kurten (1965), Davis (1977), Dayan (1989, 1994) and Tchernov and Valla (1997). Because of the nature and limitations of both the old and current studies, it remains impossible to establish the contemporaneity of any of the assemblages we have and they are taken as "Natufian" merely for the sake of our general discussion.

Moreover, as the exact definition of species as well as data concerning species distribution during the Natufian in southern Levant differ from what was pertained in Garrod's days (Davis, 1981, 1983; Tchernov, 1991, 1993b), our discussion will limit itself to the genus level. When specific definitions are given they are based on Garrard's observations (Garrard, 1980; Table 5:C).

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General Taphonomic Considerations

Fauna accumulated in cave sites can give us many clues as to complex depositional and post-depositional processes. Firstly, the various species that permanently, seasonally or even just occasionally use a cave for their living space, introduce their prey animals into the cave and thus into its deposits. Main bone depositors are birds of prey (mainly owls) and carnivores, each with its own distinct prey distribution in terms of species, body parts and breakage patterns (Andrews 1990; Lyman 1994). Secondly, there are various known processes that can influence the preservation of the deposited bones, which is often selective. All such factors have to be considered before we can start reconstructing human behaviour as reflected in faunal accumulation.

The faunal assemblage found at el-Wad poses a number of problems as to the origin and nature of the accumulated bones. Most of the excavated area contained recent material. It is easy to establish whether fresh-looking bones are recent or old, going for example by colour, weight and even smell, but this becomes more difficult when such criteria are missing, especially when smaller species are concerned such as insectivores, rodents and birds. Moreover, bones of species using the cave are naturally mixed with bones from older deposits. In other words, not only should the upper layers in any cave be very carefully examined but also post-depositional agents should be cautiously identified, and materials should be keenly separated from such features as pits. This is especially true for caves such as el-Wad, not only because the site has been used by people and animals for thousands of years but also because of previous excavations (Garrod and Bate, 1937; see above, Chapter 5, "Stratigraphy"). An encouraging sign was that we found three bone parts from the same specimen that could be joined together, because it suggests that only minor spatial displacement have taken place (canid mandible – I41b 153; I42d 134; I42d 129 – No. 381, one specimen).

Highly mixed material was found in square I40 (Fig. 31), with numerous bat elements that are recent, mostly fruit bat (*Rousettus aegyptiacus*). Fruit bats roost in caves, often in colonies of up to several thousand. In the pit likely to have been in this area (see above, Chapter 5, "Stratigraphy"), recent fragile bone elements of bats, rodents, and birds were had accumulated. In squares I41-I42 there was a smaller number of recent specimens. Because of the small sample only a general analysis could be performed on the small animals, but the composition of the sample fits in well with the detailed study of the terrace excavation (Tchernov in Valla et al., 1986) where they outnumber the rest of the fauna. Rodents include mandible, maxilla and post cranial elements of *Spalax ehrenbergi*, *Meriones tristrami*, *Sciurus anomalus*, *Rattus rattus*. Insectivores included elements of *Erinaceus europaeus*, and *Crocidura russula*.

Tortoise bones of *Testudo graeca* include mainly nuchal bones, carapace parts and a few post-cranials: caracoid, scapula and femur. The carapace bony plates were broken into small pieces of up to 2cm. This might be related to natural breakage common to carapace found in other sites as well.

Both large birds (falconiformes) and small birds (passeriforms) were present, and although their species could not be defined, body part distribution was noticed. Here too, it proved quite difficult to separate recent from ancient elements — many premaxilla parts look very fresh, while post-cranials seem ancient, suggestimg that in order to distinguish between old and recent bones we need to have more to go on than looks alone (weight, smell). The most common elements were proximal parts of humerus, unidentifiable shaft parts, tarso-metatarsus and coracoid. The accumulation of larger bird bones is probably due to humans as owls tend to introduce on the whole micromammals and passeriform birds.

A few fish vertebrae and scale parts were found (NISP- 20). In a previous study of the el-Wad terrace bone fragments of small marine fishes (20-100gr.) were identified (Desse in Valla et al., 1986).

Our macrofaunal sample taken from squares I40-I42, includes 2,044 identifiable bones (NISP). Species included: gazelle (*Gazella gazella* – 49%), hare (*Lepus capensis* – 34%), fallow deer (*Dama mesopotamica* –9%), red fox (*Vulpes vulpes* – 2%) with other species represented by less than one percent (Table 16). Bone fragments that could not be defined as to species (35% of the bones) were recorded only in body size groups, from A to E, i.e., BSGA–BSGE, but these, too, reflect the relative distribution of the species, with gazelle, (BSGD –73%) being the largest and most common group followed by, in descending order, hare size (BSGE – 13%), fallow deer size (BSGB – 12%), capra size (BSGC –4%), and red deer size (BSGA –2%). Since most of the elements in the different body size groups are ribs, vertebrae or long bone splinters, these groups are important in the way they reflect the mode of deposition and processing of the animals at the cave. There were thousands of bone fragments but these proved too shattered to allow definition.

Species Distribution

Carnivora

Family Ursidae

Ursus arctos?

A part of distal radius, broken and weathered but seemingly with most of the required characteristics.

Family Canidae

Canis lupus/familiaris

About 14 fragments of teeth and post-cranials were defined as canid, probably domesticated dog (Bate, 1937; Davis and Valla, 1978; Dayan, 1994; Tchernov and Valla, 1997). Bate (1937) defined a skull part as belonging to domesticated dog (the el-Wad B specimen), although no recent dog was found to resemble this Natufian one. Parts recorded were two mandibles, lower premolar, distal humerus, ulna, scapula and phalanges (Table 16). One of the mandibles is of a foetus, its proximal ulna still unfused (it fuses during the first year). Presence of a juvenile was recorded in a tomb at Eynan (Mallaha) by Davis and Valla (1978), where the connection between a human burial and the characteristic mandible suggests domestication (ibid.).

The measurable mandible (No. 381) is of an adult, but not of an aged, specimen, as very little erosion is present on M_1. It includes the proximal part of the mandible, the area of the molars, the mandibular condyle and notch, while the coronoid process is missing. As

Table 16: El-Wad species and body part distribution.

Species	Sus	Gaz	Cer. e*	Cerv.	Dama	Capre.	Capra		Canis	Vulpus	Ursus	Meles	Martes	Lepus	BSGA	BSGB	BSGC	BSGD	BSGE
skull	2	16			2									3		10	1	19	
horn core		49					1											5	
antler				6	4														
maxilla fragment		16											1	19				3	
maxillary teeth-isolated	1	73			7					3		1		3					
maxillary teeth		9			1	1													
maxilla+mandible																			
mandible fragment	1	22			5		1		2	8			3	16	1	6		6	
mandibular teeth-isolated	1	42			18				3	1				10					
mandibular teeth		7			2		1		1	1									
isolated teeth	2	7								2				11					
atlas		5		1	2								1			1		1	
axis		1			1				1				1					1	
sternum																			
vertebrae		5			1				1	1				10	4	14		62	29
sacrum		1								1				4		1			
ribs					2					1					1	20		74	15
scapula	1	20			8		1		1	2				32	2	6		11	
humerus		34			6		2		1					37	2	1	1	5	
radius		16	2		1					3	1			21		2		9	
ulna		13	1		3				1					18				1	
radius+ulna		3														1		3	
carpals		12	2		5													2	
metacarpal	1	8	1		4									22				1	
phalange																			
phalanx 1	1	45			7				2					14				1	4
phalanx 2	4	35			5				1					14		1			1
phalanx 3		29	4		3									3					
pelvis		24			7				1					44				6	
femur	1	35			2					1			1	29	1	3		12	
tibia		27			7	1				2				69	1	4		10	2
fibula																			

tarsals		20			5					1				3	1			4	
patella	1	8	1		1					1				1				3	
calcaneum		10	1							1		1		9				1	
astragalus		14			6									6					
metatarsal		31			3		1			3				46		2		1	
metapodial	2	6			1									1				1	
sesamoid		10			2													3	
long bone splinters		1			3									4	2	14	2	274	39
Total (2044)	**18**	**654**	**12**	**7**	**124**	**2**	**7**		**15**	**32**	**1**	**2**	**7**	**449**	**15**	**86**	**4**	**519**	**90**
% of NISP	**0**	**32**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**22**	**0**	**4**	**0**	**25**	**4**

Sus - *Sus scrofa*
Gaz - *Gazella gazella*
Cer. e* - *Cervus elaphus*
Cerv. - Cervid sp.
Dama - *Dama mesopotamica*
Capre. - *Capreolus capreolus*
Capra - *Capra aegagrus*
Canis - *Canis lupus/familliaries*
Vulpes - *Vulpes vulpes*
Ursus - *Ursus arctos*
Meles- *Meles meles*
Martes - *Martes foina*
Lepus - *Lepus capensis*
BSGA - body size group A - red deer size (150 - 250kg.)
BSGB - body size group B - fallow deer size (80 - 150 kg.)
BSGC - body size group C - capra size (40 -80 kg.)
BSGD - body size group D - gazelle size (15 - 40kg.)
BSGE - body size group E - hare size (2 - 7 kg.)

already mentioned, its three parts could easily be joined. To define it, we have used some of the measurable criteria described by Dayan (1994) and Tchernov and Valla (1997) (Table 17).

Table 17: Measurements of el-Wad canids.

Number	Body part		mm
381	**Mandible**		
	Lower M1		
		length	25.98
		width	9.86
		MH	24.04
		DR	22.26
		MR	41.08
558	**Axis**		
		LCDe	56.1
365	**Humerus distal**		
		Bd	30.15
		H	11.83
1146	**Scapula**		
		GLP	32.27
		LG	21.46
		BG	21.35
		HS	
			5
556	**Phalanx first**		
		GL	27.42
		BP	9.2
		Bd	7.71
873	**Phalanx first**		
		GL	28.28
		BP	9.4
		Bd	7.72

MH = Height of the mandible behind lower M1, measured at right angles to the basal border
DR = Depth of ramus under middle lower M1, measured at the alveoles
MR = Length of molar series
LCDe = Greatest length in the region of the corpus including the dens
Bd = Greatest width of distal end
H = Height of distal end
GLP = Greatest length of glenoid region
LG = Length of glenoid cavity
BG = Width of glenoid cavity
HS = Height along the spine
GL= Greatest length
BP = Greatest width of proximal end
Bd = Greatest width of distal end

The size of the lower carnassial (M_1) is closer in size to the Kebaran specimen from Neve David, and does not differ significantly from the recent Israeli wolves (Dayan, 1994, Table 2, Fig. 2). According to Tchernov and Valla (1997, Fig. 9) it falls within the range of recent wolves, similar to a wolf that weigh 23.2 kg. The height of the mandible, measured at two points (behind M_1 – MH; and under middle M_1 – HR), falls within the range of the Desert pallipes (*Canis lupus pallipes*) for the MH (Dayan, 1994, Table 1, Fig. 4) but is smaller than the mean of the Natufian dogs, and smaller too than the recent wolves (Tchernov and Valla, 1997, Table 1), while the length of the molar series (LM) resembles recent wolves (Tchernov and Valla ,1997, Table 1). That is, the el-Wad mandible shows a reduction in the depth of the mandible ramus but not in teeth size. Tchernov and Valla (1997) mentioned that, as to the depth of the ramus under M_1, there was no change in the thickness of Natufian dogs and the Saluki dog. They also mentioned the wide variability of M_1 within the Natufian population of dogs. Significant, too, is that the size of the upper teeth of a canid (M^1), found in the previous excavation (el-Wad B specimen), does not differ from the recent wolf population (H – Dayan, 1994).

Post-cranials could only be compared with two Natufian dogs from Hayonim Terrace (HT). El-Wad distal humerus resembles the specimens from HT in their slender dimensions (Tchernov and Valla, 1997, Fig. 18). The scapula's distal articulation — glenoid cavity — is longer and wider than in the HT specimens, but smaller than in the Saluki dog. No contemporaneous fossil material was available for comparison of the axis, found to be smaller than in the Saluki dog, but this may be because of sex difference, or other related specifications. If there were changes in the skull of the Natufian dogs, a change in their axis should also be expected, even if it occurred mainly in the snout part and less in the proximal part of the mandible.

An acetabulum fragment, broken, originates from a canid, a specimen smaller than the recent Saluki dog.

The canid foetal mandible is almost complete, but is difficult to assign to a specific canid species, since we have no other specimens to compare it with. As Tchernov and Valla (1997:93) pointed out: "The amount of similarity with wild wolves among these dogs possibly reflects the amount of gene flow between commensal and wild flock ... We argue that this kind of morphology is typical to unconscious selection; no interference of people is displayed in the morphology of the Natufian dogs. This also explains the marked differences between the dogs from the different sites."

The Natufian dogs present complex changes. Though small, the fossil material does reveal variability. The mandible from el-Wad is of interest for its very large M_1. The molar row is as large as in the range of recent wolves, but the ramus is less wide, more resembling the Eynan (Mallaha) specimen (4130-188) that also has a smaller M_1 (22.8; 8.59). The few post-cranials that could be measured are in the range of the two Natufian dogs from HT, with only the scapula glenoid cavity being larger.

As it proved impossible to relate all the finds to one particular specimen, it may be that what we have here are a wild wolf (represented by the mandible) and a "Natufian domesticated dog" specimen (represented by the post-cranials). Less likely, though also worth considering is the presence of variation between the mandible and post cranials in the HT dogs (Tchernov and Valla, 1997); we might have here evidence for local Natufian dogs at el-Wad. Variation in the mandible is mainly related to the shortening of the snout and less of the proximal part (molar area). As has been suggested, body size may have changed faster than tooth size in the evolving dogs (Tchernov and Valla, 1997). We find no crowding of the molars in these specimens, but the variability along the proximal part of the mandible shows how complex these processes are.

Vulpes vulpes

Fox remains include mandible fragments, maxilla and a few post cranials, among them a baby mandible and an unfused proximal femur and radius. None of these elements were measurable and it was impossible to define the size of this particular fox, though it is known to have been larger than the recent species (Davis 1977, Davis 1981; Dayan et al., 1989).

Family Mustelidae

Meles meles

Eurasian badger – Upper tooth and calcaneum.

Martes foina

Marbled polecat – A few teeth, atlas, axis and femur, and a mandible of a young specimen.

Lagomorpha

Lepus capensis

Many bone fragments from all parts of the body of this species were found. Twenty six percent of the bones were unfused, including two foetal bones (Fig. 98). The size of the hare is larger than the recent population (Table 18). Reduction in Lepus size has been traced by Ra'anan (1980) from the Kebaran (Ein Gev), through the Natufian (Hayonim Cave B) until recent, and may be explained as a reaction to climatic change, as in Bergmann's rule, where populations of one particular species from colder regions tend to be larger than those of warmer regions (ibid.).

Larger mammals are represented by wild boar, red deer, fallow deer, wild goat, gazelle and roe deer.

Artiodactyla

Family Suidae

Sus scrofa

A few elements of wild boar, including teeth, skull fragments, phalanx and limb bones, were recovered (Table 16). Two bones are from a one-year old boar and one of a foetal specimen. These remains are too sporadic to allow further examination (Table 19).

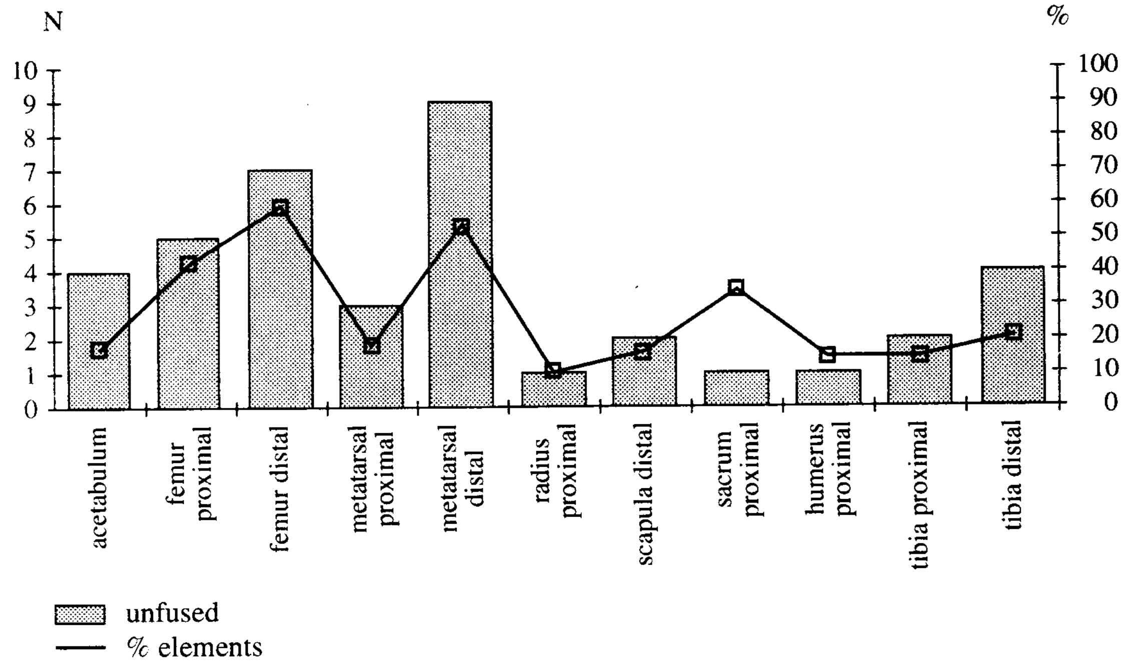

Fig. 98. El-Wad – Fusion of hare (*Lepus capensis*).

Family Cerdivae

Cervus elaphus

Several limb parts were defined on the basis of size (Table 16). Because of their fragmented nature the antler splinters were defined only as to cervid level.

Dama mesopotamica

Fallow deer are represented by various body parts: teeth, cranial and post cranials. Antlers' size suggests the presence of males, including one young male. A few unfused specimens (Table 19), including a newborn and two foetal elements were uncovered. There are only a few measurable bones which, according to the astragali, seem to originate from large specimens (cf. Davis, 1994; Rabinovich n.d.). As sex dimorphism is very pronounced in cervids, this may be related to the presence of males, although we cannot tell whether the size of fallow deer fluctuated during the Pleistocene (ibid.).

Capreolus capreolus

Only two bones of roe deer were recovered. This is not surprising since usually the smallest cervid, a solitary species, is very poorly represented in archaeological deposits.

Table 18: Measurements of el-Wad faunal material.

Number	Body part	Side		Mears 1	Mears 2	Mears 3	Mears 4
BSGA				**GL**	**GB**		
189	TAR4	R		4541	3950		
BSGD							
1014	PAT			2735	1970		
					BPC		
30	ULP				1407		
Cervus elaphus							
				Bd	**BDW**		
386	RDD	L		4481	2970		
Dama mesopotamica							
				GL	**D1**	**Bd**	
107	AS	R				2886	
475	AS	L		4428	2363	2665	
	AS	R		4342	2446	2606	
1143	AS	L		4758	2773	3101	
1362	AS	R		4227	2300	2579	
			max	4758	2773	3101	
			mean	4439	2471	2767	
			min	4227	2300	2579	
			stde	228	210	222	
			stdep	198	182	199	
				BT	**Bd**	**H**	
1384	HUMD	R		4375	4987	2318	
58	HUMD	R		4570	4916	2478	
1708	LM3	R		762	533		
				Bd	**SD**	**MCSC**	**MCLC**
61	MCD			3598	1673	1824	2344
1234	MCD			3463	1607	2349	1795
477	MTD			3430	1618	1679	2341
				GLP	**LG**	**BG**	
1782	SC	R		5186	4006	3479	
				Bd	**BW**		
1211	TBD	R		3625	3068		
Gazella gazella							
1245	UDP4	R		732	648		
276	UM1-UM3	L			3424		
1244	UM1-UM3	L		1240	1097		
440	UM3	L		856	773		
792	UM3	L		1669	1603		
1510	UM3	R		1465	1323		
379	UPR2-M3	L		1429	1351		

Number	Body part	Side		Mears 1	Mears 2	Mears 3	Mears 4
				GB	**Lad**		
1785	ATLAS				3163		
416	ATLAS			6010	5345		
148	ATLAS				2085		
448	ATLAS			5737	4945		
				Crh1*	**Crh2***		
69	DP4U	L		871	675		
550	DUP3-DUP4	R		322	398		
551	DUP4	R		412	279		
552	DUP4	L		323	299		
			min	322	279		
			mean	482	413		
			max	871	675		
			stde	263	182		
			stdep	228	158		
1340	LDP4-LM3	R		1598	1468		
380	LM2-LM3	R		1647	1602		
71	LM3	L		1927	1801		
153	LM3	R		626	471		
651	LM3	L		1229			
652	LM3	L		907	854		
1979	LM3	R		1261	1326		
555	LP4	L		800	633		
70	MANF	L		445	354		
				40*	**41***		
21	HC	R		3194	2556		
94	HC	L		2731	2210		
115	HC	R		3289	2395		
130	HC	R		2937	2235		
131'	HC	R		3480	2597		
132	HC	R		3677	2602		
133	HC	L		3579	2594		
136	HC	R		3576	2688		
182	HC	L		3083	2092		
855	HC	L		3100	2066		
1756	HC	R		3067	2376		
1781	HC	R		3316	2434		
877	HCB	R		3659	2326		
1575	HCB	R		3464	2504		
			min	2731	2066		
			mean	3297	2405		
			max	3677	2688		
			stde	290	198		
			stdep	279	191		

Number	Body part	Side		Mears 1	Mears 2	Mears 3	Mears 4
				GLP	LG	BG	
117	SC	R		2899	2179		
145	SC	R		3019	2395	2104	
977	SC	L		2900	2246		
1636	SC	L		2784	2245	1847	
1638	SCD	R			2308	1967	
			min	2784	2179	1847	
			mean	2901	2275	1973	
			max	3019	2395	2104	
			stde	96	81	129	
			stdep	83	73	105	
				BT	Bd	H	
749	HD	R		2674	2515	1423	
1150	HD	R		2545	2384	1274	
1151	HD	R		2640	2420	1335	
1218	HD	L		2675	2453	1404	
1219	HD	R		2551	2391	1278	
1400	HD	L		2323	2514	1333	
1878	HD	L		2700	2600	1495	
1984	HD	L		2371		1293	
1985	HD	L		2279	2444	1248	
120	HDD	R		2418	2602	1357	
325	HDD	R		2431	2625	1334	
643	HDD	R		2370	2538	1371	
1025	HDD	R		2697	2565	1305	
			min	2279	2384	1248	
			mean	2513	2504	1342	
			max	2700	2625	1495	
			stde	155	85	69	
			stdep	149	81	66	
				BD			
267	RDD	R		2317			
38	ULP				1546		
1641	ULP	L		1363			
				Bd			
119	FDD	L		3757			
146	FDD	R		3569			
				BD	BW		
422	TBD	L		2440	2083		
975	TBD	R		2340	1879		
1160	TBD	R		2481	1897		
1203	TBD	R		2447	2017		
1271	TBD	L		2143	1703		
1853	TBD	R		2168	1776		
2028	TBD	L		2297	1858		
			min	2143	1703		
			mean	2331	1888		
			max	2481	2083		
			stde	136	131		
			stdep	126	121		

Number	Body part	Side		Mears 1	Mears 2	Mears 3	Mears 4
				GB	**GL**		
16	TAR4			1936	1773		
1637	TAR4	L		2215	2087		
1758	TAR4	R		2074	2144		
1977	TAR4	L		2244	1998		
			min	1936	1773		
			mean	2117	2001		
			max	2215	2144		
			stde	142	163		
			stdep	123	141		
				GL	**D1**	**Bd**	
452	AS	R		2637	1453	1600	
453	AS	L				1826	
751	AS	R		2640	1482	1584	
944	AS	L		2805	1562	1748	
1351	AS	L		2993	1762	1872	
1406	AS	R		2661	1409	1432	
1757	AS	L		2953	1565	1626	
1859	AS	L		2851	1573	1700	
2005	AS	L		2721	1532	1617	
			min	2637	1409	1432	
			mean	2783	1542	1667	
			max	2993	1762	1872	
			stde	141	56	135	
			stdep	132	100	127	
				Bd	**SD**	**MCSC**	**MCLC**
1112	MCD			1923	853	1099	1430
1399	MCD			2265	1003	1651	1150
1523	MCDH				974	153	1211
			min	1923	853	153	1150
			mean	2094	943	968	1264
			max	2265	1003	1651	1430
			stde	242	80	758	147
			stdep	171	65	619	120
1520	MPDDH				941	1542	1197
				Bd	**SD**	**MCSC**	**MCLC**
421	MTD			2193	971	1261	1622
6	MTDDH				890	1123	1510
7	MTDDH				778	818	1209
463	MTDH				837	1088	1432
1310	MTDH				1075	1680	
1189	MTP	R		2123	2140		
974	MTPDH				960	1149	1493
			min	2123	778	818	1209
			mean	2158	1093	1187	1453
			max	2193	2140	1680	1622
			stde	49	472	283	153
			stdep	35	437	258	137

Number	Body part	Side		Mears 1	Mears 2	Mears 3	Mears 4
				GL	**Bd**	**BP**	
102	PH1			3846	916	1196	
152	PH1			3833	890	1149	
4	PH1D				887		
103	PH1D				904		
540	PH1P				1162		
			min	3833	887	1149	
			mean	3840	952	1173	
			max	3846	1162	1196	
			stde	9	118	33	
			stdep	7	106	24	
				GL	**Bd**	**BP**	
23	PH2			2123	778	896	
65	PH2			2306	825	963	
142	PH2			2089	778	924	
143	PH2			2083	723	845	
493	PH2			2085	916	772	
24	PH2P					871	
			min	2083	723	772	
			mean	2137	804	879	
			max	2306	916	963	
			stde	96	72	66	
			stdep	86	65	61	
				Ld	**BP**	**Ld1**	
1	PH3			2363		2361	
2	PH3			2043	1688	2047	
22	PH3			2510	1820	2944	
3	PH3P				1776		
			min	2043	1688	2047	
			mean	2305	1761	2451	
			max	2510	1820	2944	
			stde	239	67	455	
			stdep	195	55	372	
Lepus capensis							
				BT	**Bd**	**H**	
470	HD	L		924	1237		
578	HD	L		642	1073		
579	HD	R		599	1224		
678	HD	L		903	1144		
813	HD	L		925	1137	653	
814	HD	L		773	1059	587	
815	HD	R		968	1065	610	
925	HD	L		724	1069	600	
1693	HD	L		884	1156	638	
1694	HD	L		947	1175	653	
1814	HD	R		900	1150	581	
1946	HD	L		929	1148	624	
1947	HD	L		901	1095	581	
1319	HDD	L		964	1197	640	

Number	Body part	Side		Mears 1	Mears 2	Mears 3	Mears 4
1378	HDD	R		965	1100	656	
1584	HDD	R		993	1170	694	
1922	HDD	L		1064	1232	659	
1929	HDD	R		946	1133	597	
859	HDP	R			2980	2390	
			min	599	1059	581	
			mean	886	1239	744	
			max	1064	2980	2390	
			stde	123	425	457	
			stdep	119	414	441	
				RDW	**RDL**		
498	RDD	L		614	981		
1071	RDD	R		483	852		
				OLH	**OLW**		
803	ULP	L		1063	1207		
1067	ULP	L		915	1080		
				GL	**GB**		
683	AS	L		1436	722		
721	AS	L		1557	852		
1326	AS	R		1689	1165		
1921	AS	L		1460	822		
			min	1436	722		
			mean	1536	890		
			max	1689	1165		
			stde	115	191		
			stdep	100	166		
				GL	**GB**		
1821	CA	R		2768	1065		
173	CAL			3066	1233		
580	CAL	R		3188	1283		
682	CAL	L		2874	1183		
1000	CAL	R		2804	1172		
1596	CAL	R		2805	1188		
500	CALC	L		3040	1096		
			min	2768	1065		
			mean	2935	1174		
			max	3188	1283		
			stde	162	75		
			stdep	150	69		
				TDW	**TDL**		
1375	TB	R		1403	986		
497	TBD	L		1477	882		
680	TBD	L		1390	866		
998	TBD	R		1364	833		
1065	TBD	L		1428	881		
1317	TBD	R		1409	856		
1376	TBD	R		1408	871		
1553	TBD	R		1360	882		
1670	TBD	L		1352	858		

Number	Body part	Side		Mears 1	Mears 2	Mears 3	Mears 4
			min	1352	833		
			mean	1399	879		
			max	1477	986		
			stde	39	43		
			stdep	966	471		
Sus scrofa				**GL**	**GB**		
367	MC2			7359	1425		
Vulpes vulpes				**GL**	**GB**		
924	CAL	R		2540	1154		
627	CARN	R		1462			

Table 19: El-Wad – Fusion and ageing.

Fallow deer (Dama mesopotamica)	
ulna proximal	foetal
femur proximal	foetal
humerus	new born
antler	young - male
phalanx first proximal	12-14 months
femur proximal	22-24 months
metapodial distal	24 month
Teeth	
LDP2-LDP3	ca. 2 years
UDP4-UM1	ca. 2 years
4D - wear stage	3-4 years
Wild capra (Capra aegagrus)	
LDP3	<3 months
Wild boar (Sus scrofa)	
metapodial proximal	foetal
scapula distal	12 months
phalanx second	12 months
femur proximal	3-4 years
Fox (Vulpes vulpes)	
mandible	foetal
femur proximal	
radius proximal	
Canis (Canis lupus/ familiaries)	
mandible	foetal
ulna proximal	7-12 months

Family Bovidae

Capra aegagrus

Sporadic elements of wild goat were found in the assemblage, including a horn fragment.

Gazella gazella

Mountain gazelle is the most prolific species found in many south Levantine sites. According to fusion information, 37% of the bones belong to young animals (less then 18 months). There is a relatively high percentage of foetal bones (12%; Fig. 99). Most of the unfused specimens derived from bones that fuse late in the life of the animal, c. 10-18 months (Fig. 99). According to teeth eruption and wear c. one-third of the specimens are of young animals up to 1-11/2 years old (Figs. 99-101).

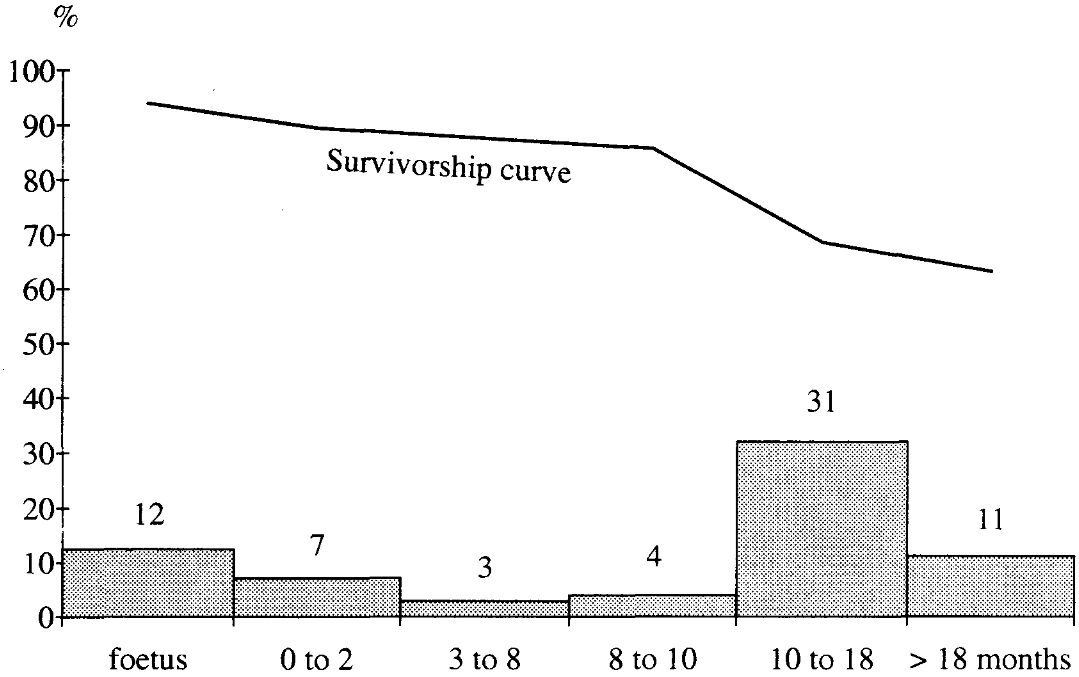

Fig. 99. El-Wad – Mortality pattern of gazelle based on epiphysis fusion.

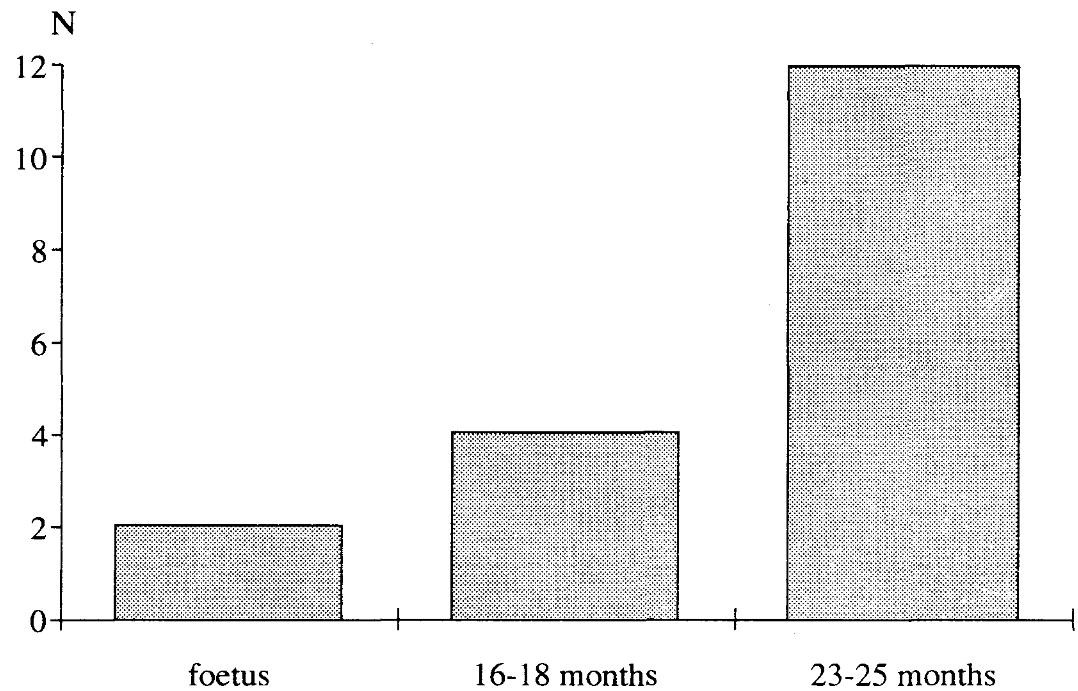

Fig. 100. El-Wad – Gazelle ageing based on teeth eruption.

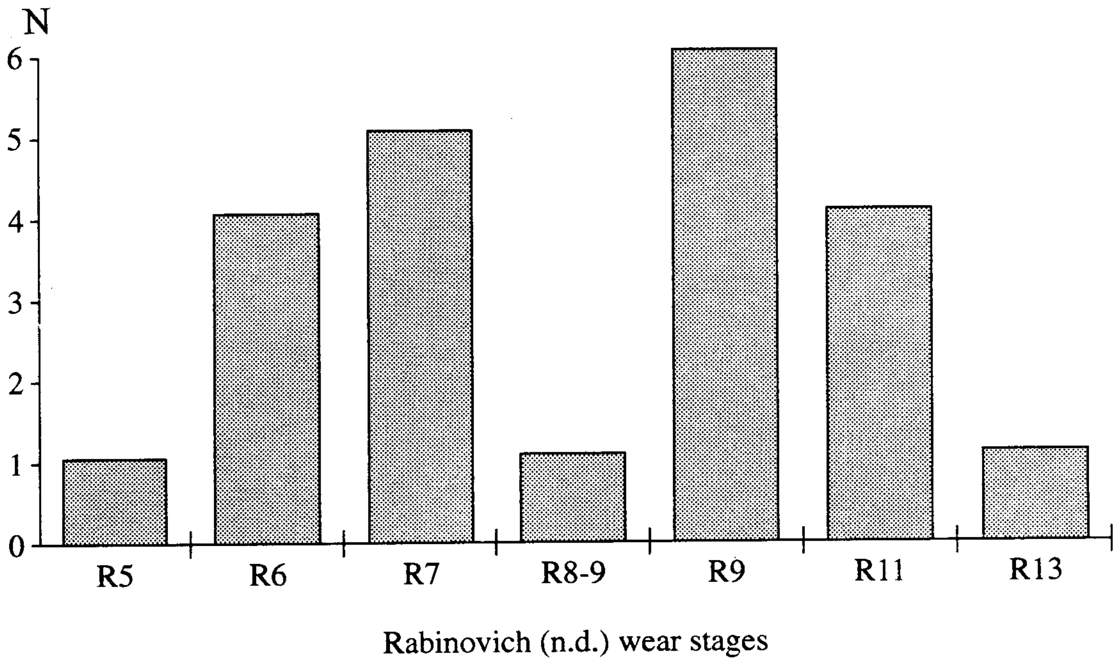

Fig. 101. El-Wad – Gazelle ageing based on wear stages (Rabinovitch, n.d.).

According to the distribution of measured bones, in comparison with the recent fauna (Horwitz et al., 1990), the distribution of male and female seems to have been equal (Table 18). The mean of the measurements is not very different from Upper Palaeolithic and Epipalaeolithic assemblages in the area (Fig. 102).

While examining the distribution of body parts, it was noticed that upper and lower limbs of both fore and hind limb are very homogeneously represented. Metacarpal are missing and may have been broken and included in the long bone splinters of BSGD. Vertebrae and ribs are also part of this body size group.

Modifications

Carnivore modifications are reflected in various aspects: relative species abundance, sex and age profile, body part distribution (e.g., head versus limbs), part of element present (proximal, shaft, distal) and surface modifications (gnawed, digested, scratches and tooth pits). In these assemblage several bones were modified by carnivores (15 – > 1%), a few bones were gnawed (3) and one had tooth pit and was burnt (Table 20), suggesting a minimal carnivore interference in the accumulation of the faunal remains.

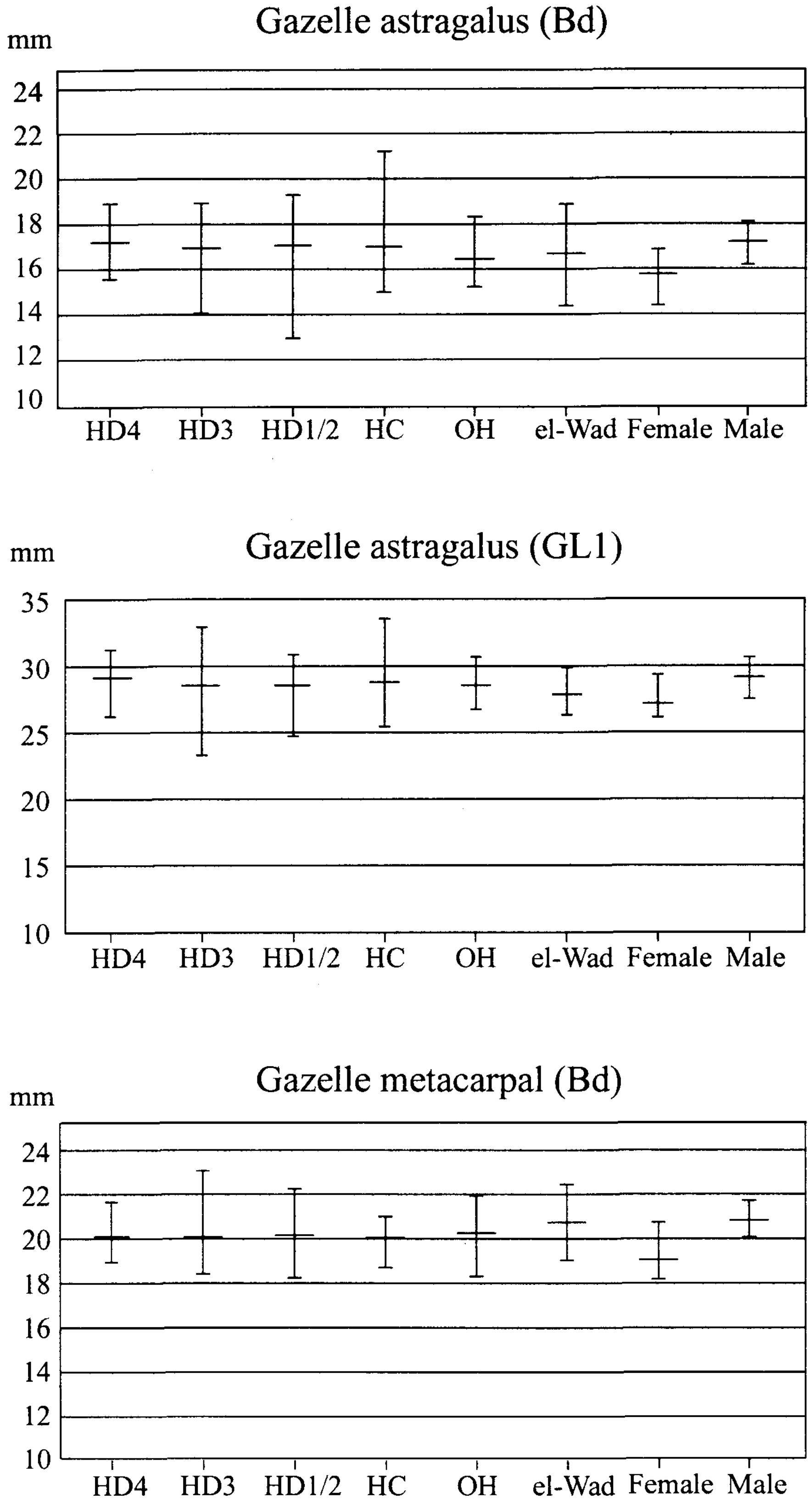

Fig. 102. Gazelle measurements (maximum, minimum and mean) of selected bones from Palaeolithic sites and recent samples. HD Hayonim D, HC Hayonim C, OH Ohalo II; data on recent gazelles from Horwitz et al., 1990.

Table 20: El-Wad – Carnivore modifications.

Species	Body part	Digested	Gnawed
Gazella gazella	astragalus	4	
	carpal	1	
	tarsal	2	
	humerus distal	1	1
	metatarsal distal	2	
	first phalanx	1	
	second phalanx	1	
	third phalanx	2	
Lepus capensis	calcaneum	1	
	Total digested	15	
Dama mesopotamica	patella		1
	first phalanx		1
BSGD	rib shaft		tooth pit

This raises the question whether any of the carnivores present at el-Wad were typical cave dwellers and bone collectors. Bears do dwell in caves but their occurrence here is doubtful and, as they are rare in the assemblage, we may exclude them as major agents. Badgers spend the day and the entire winter in burrow systems and although 75% of their diet consists of plant material, they also feed on live and dead animals. Red fox might occasionally use a den. Wolf can den in crevices that they often use year after year. If a cave was used as a den by a species we tend to find this reflected in their over-representation in the fauna. Looking at the relative distribution of the carnivore species, none of them seems to have been a typical bone collector or cave dweller.

Human modification of the fauna is reflected in the same way as carnivores modification: relative species abundance, sex and age profile, body part distribution (e.g., head versus limbs), part of element present (proximal, shaft, distal) and surface modifications (butchery marks, cut marks, extraction of marrow, hammer stone percussion), ideally leaving distinguishable patterns. Cut marks were visible on a few bones only (N=5), on long bones and scapula of gazelles and on a shaft of a long bone BSGE (probably a hare bone). Burnt elements were present on 4% (N=80 bones/specimens) of the defined fauna. A large number of identifiable burnt splinters were not included in our analysis.

The relative distribution of teeth and skull fragments was examined as against post cranials showing a distinct distribution per species (Fig. 103). A correlation is expected between the body part representation and the size of the animal. Smaller animals are easy to be brought in intact, while larger ones will be selectively introduced. Weight of Pleistocene hares can reach up to 6kg., and are therefore expected to be found complete (Yellen, 1991a, 1991b). Their cranial parts are less represented, but this may be because the skull of hares is fragile. Fallow deer and gazelle have a similar distribution of cranials and post-cranials suggesting that entire animals were brought into the cave (Fig. 103).

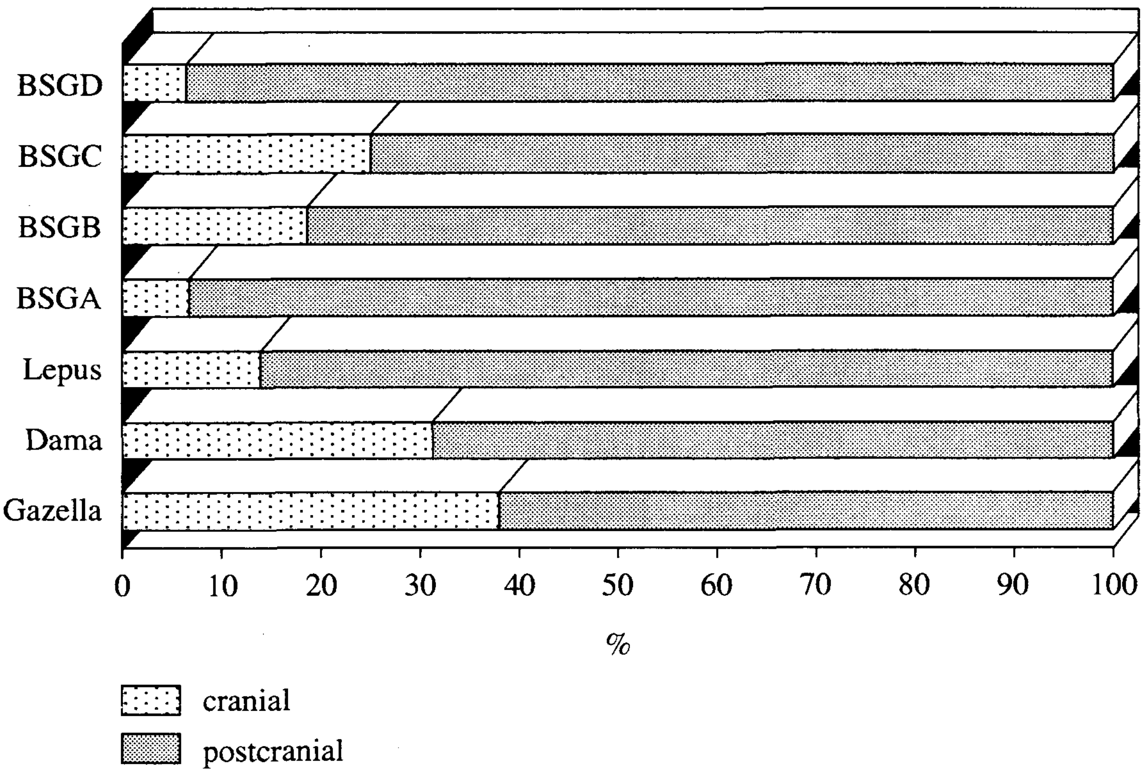

Fig. 103. El-Wad – Cranial versus post-cranial parts.

Checking relative distribution of proximal part versus distal part is another method for testing destruction mode. If both ends are similarly distributed it follows that there was very little destruction. When the two most prolific species (hare and gazelle) are examined the dominance of the distal part of most limb bones becomes clear. A difference between proximal and distal parts in the hare limbs profile is less pronounced. Proximal part of hare's radius and ulna outnumber the distal. The major contrast is noticed in the tibia part distribution, where distal ends are in the majority. As many complete hare metapodials are present, a discussion of their proximal versus distal appearance is meaningless. In all gazelle limb bones, except for metapodials, distal parts are more numerous than proximal parts (Fig. 104).

In most mammalian, proximal limb bones are more fragile than the distal ends, and since they contain more marrow, are easier to consume for carnivores and humans. In these assemblage we might assume that humans and natural weathering were the principal destructive forces (Fig. 104). Hare bones tend to remain complete after human usage or to disappear completely from an assemblage, while the robust parts of gazelles tend to be preserved. Hare bones are likely to disappear in a carnivore den due to gnawing and chewing (Andrews, 1990).

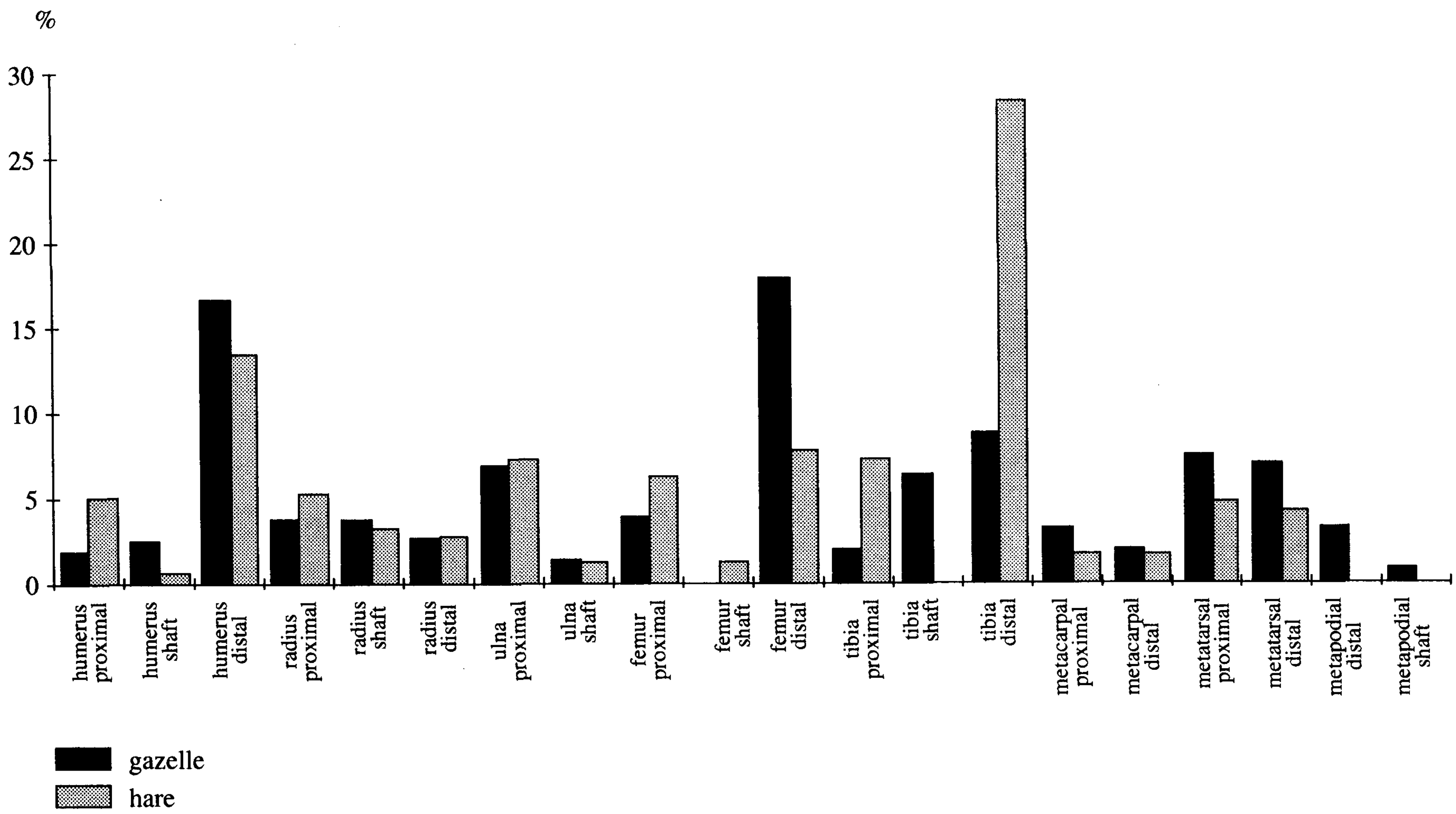

Fig. 104. El-Wad – Proximal versus distal parts of gazelle and hare.

Seasonality

Using species ageing to determine seasonality is valid mainly when a large enough sample is available to enable reconstructing an age profile. When seasonality is examined, it is essential to know the number of birth peaks per year. In the el-Wad assemblage bones exist for all mammalian species. Although the sample size per species is quite foetal small, the presence of juveniles might reflect usage of the cave by man at least during the spring (March-May), the time many mammals reproduce in the Mediterranean zone. For example, carnivores today tend to reproduce in the end of winter/beginning of spring; while the season of reproduction for foxes is late February – April; the marbled polecat reproduces in January – March. If the canids found are domesticated dogs, our clue may be the reproduction season of recent wolves, which is late February – April. It remains hard to determine to what extent these pattern could have changed during domestication.

Gazelle age distribution seems to indicate a year-round usage of the cave, as more than a third of the assemblage consists of young animals (less then 18 months). This does not necessarily mean that use of the cave was equally intensive during all seasons, also because the gazelle may have had a flexible cycle of reproduction (more than one young per year), as can be observed today (Baharav, 1974, 1983). There is a relatively high percentage of foetal bones (Fig. 99), but it remains hard to see which season they reflect.

Fallow deer age profile include a few unfused specimens (Table 19), a newborn and two foetal elements, again pointing towards spring usage of the site. The female gives birth in May – June. The females and their young move in large herds, the males gather in smaller groups.

Hares are very interesting in this respect since while they bread all year round, their cycle of reproduction is indicative of the season. Twenty six percent of the bones were unfused, including two foetal bones. A certain peak of reproduction is known from related species (Lee and Speth, n.d.), indicating an annual cycle in age distribution, including variation in foetal and young specimens. The usage of unselective hunting methods (trap, net, drive) would have led to a catastrophic age profile, including all age cohort, as in live populations. But if other methods of hunting were suggested, targeting larger specimens, it is more likely that young-adults/adults will be preferred when dealing with small mammals.

Summary

The most prolific animal in the faunal assemblage of Chamber III is the gazelle, followed by hare and fallow deer. Together they formed the main meat source for the human diet. Undoubtedly these species were introduced to the cave by people, as they do not seek out caves to live in and no carnivore behavioural pattern was observed to suggest that they were part of their prey. In other words, carnivores' relative frequency, their distribution and the characteristic bone modifications are not enough to suggest that they formed the major bone collector.

Interestingly, the three major species were processed at the site, while the sporadic nature of the other species might indicate selective introduction into the cave deposit. The same was suggested by Garrard (1980), element representation of gazelle and fallow deer in similar proportions to their preservation potential making it likely that whole carcasses were brought back to the site.

Carnivore bones were not abundant either in previous studies, nor has any proliferation been observed of one carnivore species with a varied age profile. This is largely explained by hyena and panther being rare as large species and possible bone collectors, while other species (e.g. mustelidae, canidae) are not very abundant. *Panthera pardus* is absent from the recent excavation, and is not very common in the original report (Bate, 1937, altogether two or three fragments). No hyena bones were found during the recent excavations and only two fragmentary specimens were reported from the old ones (ibid.). Hyena bones were common in the Lower Aurignacian levels of the cave (Levels E and F). Ursus is probably present in the new excavations, represented only by a part of a radius. From the Aurignacian layer three bones were defined to *U. arctos*, while a few foot bones from layers E and B were believed to be of a smaller bear (*Ursus cf. mediterraneus*) (ibid.).

The faunal assemblage of Chamber III accords rather well with that of previous studies (Bate, 1937; Garrard, 1982; Valla et al., 1986). Still, while during the old excavations several specimens of two equid species were found (a single horse tooth and several bones of *Equus hemionus*; Bate, 1937:119-220), no equid bones were recovered in the recent assemblage. Similarly, hare were not abundant in Bate's collection, and their bones fragmentary (ibid.), unlike our finds from Chamber III.

Similar to Bate's analysis and to the picture emerging from Garrard's reinterpretation, based on a sample of 1,530 bones of large mammals from el-Wad layer B (with MNI=121; Garrard, 1980, Fig. 5.4), gazelle dominates the large mammals assemblage, comprising 49% of the identified bones in Chamber III and 85% in the old studies.

Introduced by humans on a regular basis are those species that are hunted in a method which targets young adults and adults. Presence of foetal bones from most species as well as young specimens points towards the occupation of the site in the spring (March – May). Still, they are under-represented in comparison to the relative live distribution in nature during the breading season. A taphonomical process distracting the more fragile bones is possible, and happens either by humans processing foetal animals or by natural weathering. Significantly, based on the ratio between deciduous first to third molars and permanent second to fourth premolars teeth, 27% of gazelle were juveniles (Garrard, 1980), the majority of them killed when they were at an age of two months old. Several adults, killed at an advanced age, were also found. Wild boar also includes several juveniles. Sex distribution indicated roughly equal proportions of males and females in both gazelles and fallow deer remains. Both age and sex distributions according to Garrard (1980) are similar to the recent study where, even though presence of horn core (N= 20) may indicate a male bias, when other measurements are concerned the observed ranges can represent both sexes. A similar pattern was observed in most Natufian sites, where, 20-30% of the gazelles are immature (Davis, 1991). This situation changes in the Neolithic (ibid.). A larger sample is required before the possibility of a year-round accumulation can be ascertained. Significantly, however, Lieberman (1993b), based on cementum increments, suggested multiseasonal occupation for el-Wad as well as other Natufian sites.

The natural habitat reflected in the assemblage includes both open land species — gazelles, capra, hares, marbled polecat — and, not surprising given the surrounding of the site, woodlands species — fallow deer, red deer, Eurasian badger. Also found are species typical of thick woodland in mountainous regions and in low-land, like roe deer, and species of scrub and forest habitats, like wild boar.

Similar to other Natufian sites, the el-Wad faunal record is different from the previous cultural phases of the Epi Paleolithic. Although gazelle remains continue to outnumber all other ungulates, the Natufian assemblages exhibit higher proportions of juveniles (Davis, 1982, 1983, 1991), changes in body size (Cope 1993; Davis, 1983), a broadening of the faunal spectrum with animals ranging from small lizards, through turtles, to hares (Tchernov, 1991, 1993b), increase in bird remains suggesting seasonal culling (Pichon, 1991), and proliferation of commensal species during the Natufian due to longer occupation periods (Tchernov, 1984, 1993b).

The change in gazelle size at the end of the Pleistocene is, according to Davis (1981), due to climatic fluctuations but seen by Cope (1991) as a result of culling selection (but see Dayan and Simberloff, 1995). Unfortunately, the recent sample size is too small to allow for adequate testing of any of these suggestions.

Domestication of dog, another very crucial issue when it comes to the Natufian, was already observed by Bate (1937). A complex picture is revealed in the recent assemblage — while the teeth are large, the mandible is slender suggesting that body size had changed faster than the teeth in the evolving dogs. Still, the presence of canid juvenile (or foetal) in Natufian context may hint towards a domesticated species, even though, unlike at Eynan or Hayonim Terrace, it was not found in a human burial.

The Natufian period introduced new taphonomical aspects resulting from sedentism and domestication of dog. Such factors as commensal species, presence of dogs, and mode of discard are likely to change in a prolonged usage of a site. Both dogs and rodents can cause damage to bones on a very different scale. They will probably affect the "kitchen midden", the area of discard, more than any other agent, as in Hatoula were digested bones were suggested to represent dog presence (Davis, 1985).

The many standing issues regarding the extent of the faunal diversity in the Natufian, the presence of commensal species, and the proposed differential culling of gazelle, require adequate quantitative methods showing the exact distribution of species, age and sex, but surprisingly: "Very few quantitative studies have been done until now in order to show, precisely and in detail, the significant temporal augmentation in using a much larger variety of species, and the rapid increase of efforts to retrieve certain animal species of smaller sizes. Many of the Natufian sites are not yet fully and thoroughly studied qualitatively and quantitatively" (Tchernov, 1993b:191).

One of the major changes during the Natufian may have been hunting strategies as lately the occurrence of communal hunting was suggested (Campana and Crabtree, 1990), complementing other methods, such as traps or desert kites (Legge and Rowley-Conwy, 1987).

Many of the small animals (and also plants) were probably collected near the site; not requiring much time away from camp, this was probably done by females (Kelly, 1995). The noticed changes in the diet as reflected in the archaeological record during the Natufian should be reexamined in the light of changes in the gender roles in their society, often not to the advantage of the female roles.

The sample from the recent excavations at el-Wad, though small, provides us with an opportunity to examine again aspects of faunal accumulation during a period of great importance and change like the Natufian in the southern Levant and, in spite of taphonomical constrains, valuable information could be gathered regarding the mode of bone accumulation and damage. As its faunal remains point toward intensive usage but not necessarily sedentism, the role of sedentism at the site should be further examined.

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IV COLLECTION CARNET DU PATRIMOINE

Volume 20, 1997 "Découvrir la Préhistoire". Sous la direction de Marcel OTTE, Professeur à l'Université de Liège et Président de Préhistoire Liégeoise; Laurence HENRY, Archéologue et Secrétaire de Préhistoire Liégeoise. Edité par le Ministère de la Région Wallonne. Direction Générale de l'Aménagement du territoire, du logement et du Patrimoine - Division du Patrimoine 1997

Au cours de la préhistoire, toute société se constitue : l'homme et ses valeurs se forment progressivement au fil d'un temps extrêmement long. Durant quelques millions d'années apparaissent successivement notre constitution anatomique, notre langage, nos croyances, notre pensée. L'aventure se termine aux confins de l'histoire, lorsque les textes en donnent un reflet biaisé par le choix intentionnel des informations à maintenir. L'Archéologie préhistorique interroge des traces matérielles maintenues spontanément à travers les âges donc objectivement représentatives des modes de vie, des conceptions métaphysiques et des processus évolutifs propres à notre espèce. Cette si longue "histoire" fut souvent négligée par les manuels produits par des historiens orientés vers les grands faits de guerre ou d'expansion, non vers des phénomènes culturels généraux. Cette plaquette a pour vocation de pallier quelque peu cette déficience dans l'attente où les maîtres en histoire des civilisations soient aussi ceux en histoire des peuples. Réalisés par des archéologues qui se veulent historiens, cette publication invite à une réflexion généreuse et attentive sur la nature de l'homme et sa lente transformation.

LA PRÉHISTOIRE : UNE SCIENCE WALLONNE

Sollicité par la Région wallonne, cet ouvrage collectif, réalisé par l'A.S.B.L. Préhistoire Liégeoise, présente les données principales de notre patrimoine préhistorique.

Destiné à un large public et plus spécifiquement au milieu scolaire, la publication est conçue selon les grandes périodes de la préhistoire en insistant sur les caractéristiques propres à la préhistoire wallonne et sur les lieux visitables (sites et musées).

Coordonné par les deux auteurs de cette note, il constitue avant tout le fruit d'un travail d'amis passionnés de préhistoire et anciens étudiants de l'Université de Liège. Dès à présent, nous remercions vivement tous ceux qui ont particpé à cette réalisation.

Enfin, nous tenons à exprimer notre profonde gratitude à la Division du Patrimoine du Ministère de la Région wallonne et plus particulièrement à Monsieur André Matthys, Inspecteur Général, qui nous a donné l'occasion d'éditer ce fasicule dans le cadre des Journées du Patrimoine 1997 consacrées au patrimoine archéologique.

On peut légitimement considérer que la préhistoire fut née en Belgique. Vers 1820, Ph. Ch. Schmerling, Professeur à l'Université de Liège, démontre la haute ancienneté de l'homme contemporain d'animaux disparus (Engis). Dans les années 1860, Ed. Dupont (Bruxelles) établit, grâce à ses fouilles dans le Bassin mosan, la première chronologie correcte du Paléolithique supérieur européen. En 1886, M. de Puydt, J. Fraipont et M. Lohest (Liège) associent les Néandertaliens aux Moustériens et aux sépultures exhumées à Spy (Namur). En 1885, le premier "Néolithique" est découvert à Omal (Liège) par M. de Puydt et son équipe, démontrant la diffusion de la première agriculture dans nos régions.

Entretemps, les tranchées hennuyères prouvent l'importance de l'industrie minière à Spiennes (Hainaut), dès le Néolithique moyen (IV^e millénaire) et les nappes alluviales successivement taillées dans le Bassin de la Haine démontrent l'évolution des industries les plus anciennes du pays : de 500 à 100.000 ans environ (E. de Munck, D. Cahen). Plus récemment, le site de la Belle Roche (Sprimont) démontre une présence humaine, d'un style différent, dans les Ardennes et attribuée au "Pléistocène moyen Ancien", vers 500.000 ans (J.M. Cordy, Liège). Les fouilles menées à la grotte Scladina (Andenne) permettent la mise au jour des restes d'un enfant néandertalien, le mieux étudié de ce siècle en Belgique (D. Bonjean, Liège). Des fouilles aussi fructueuses ont concerné également l'Aurignacien (Trou Magrite), le Gravettien (Huccorgne) et le Mésolithique (Freyr) en collaboration entre Liège et Albuquerque (L. Strauss). Le Magdalénien fut approché par les fouilles à Chaleux (E. Teheux), Furfooz (N. Cauwe), le Trou da Somme (J.-M. Léotard). L'Arhensbourgien (8.400 ans) est désormais bien connu par les fouilles à Remouchamps menées par M. Dewez. Dernièrement, la longue séquence du Trou Walou (Trooz) illustre l'évolution complète du Paléolithique supérieur en Région wallonne (M. Dewez, M. Toussaint, E. Teheux, Chr. Draily). Durant les mêmes phases, les sites "tjongériens" de Meer (Anvers) éclairent le comportement de ces "derniers chasseurs de l'Alleröd, vers 9.000 ans (Fr. Van Noten et D. Cahen, Tervuren). Les sites mésolithiques ont entretemps livré les étonnantes découvertes de sépultures collectives (Margaux, Autours, Bois Laiterie par N. Cauwe) et celui de la station Leduc à Remouchamps montre l'organisation spatiale d'un campement de cet âge. Les remous suscités par les fouilles effectuées sur la place Saint-Lambert (Liège) sont trop connus pour en rendre davantage compte ici (M. Otte et J.-M. Léotard). De gigantesques sites du Néolithique ancien (VI^e millénaire) ont été explorés systématiquement : Darion (D. Cahen, I. Jadin); Vaux et Borset (J.-P. Caspar et J. Docquier). Ils illustrent des modes d'auto-défense et de protection, probablement liés à la présence des Mésolithiques contemporains. Une série de monuments mégalithiques furent explorés et interprétés récemment, tel l'ensemble de Wéris (Fr. Hubert, M. Toussaint), Lamseul (M. Toussaint et I. Jadin) et Gomery (N. Cauwe et M. Toussaint). Dans les Ardennes, divers sites de refuge ou d'habitat ("oppoda") et de sépulture ("tombelles") complètent le modèle de peuplement celtique de la haute Belgique (A. Cahen-Delhaye, V. Hurt et P.P. Bonenfant).

Un panorama complet de la préhistoire belge a ainsi été renouvelé totalement lors des fouilles récentes. Non seulement, il apporte des informations mises à jour, mais aussi, il facilite l'intégration de ces données dans un contexte international large où, souvent, notre pays a joué un rôle intermédiaire primordial. Ce n'est donc pas ainsi le patrimoine wallon qui y fut illustré mais bien une partie de l'histoire européenne.

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