PALEOLITHIC ARCHAEOLOGY IN THE SOUTHERN LEVANT A PRELIMINARY REPORT OF EXCAVATIONS AT MIDDLE, UPPER AND EPIPALEOLITHIC SITES IN WADI EL-ḤASA, WEST-CENTRAL JORDAN

by
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Introduction

This essay is a preliminary report of the results of the Wadi Ḥasa Paleolithic Project (WHPP), conducted at the eastern end of the wadi from September 1 until November 12, 1984. The project was designed to test by excavation sites originally discovered by Burton MacDonald's Wadi Ḥasa Survey (WHS), which took place between 1979 and 1983 (MacDonald *et al.* 1980, 1982, 1983). The immediate objectives of the WHPP were to examine the potentially most informative WHS sites ranging in time from the Middle to the Epipaleolithic in order (1) to acquire adequate samples of lithic assemblages, (2) to recover faunal, floral and other kinds of paleoenvironmental information, (3) to undertake a geomorphological study of the east Ḥasa drainage, (4) establish the beginnings of a radiocarbon chronology for west-central Jordan, and (5) map the extent of Pleistocene Lake Ḥasa, with which most of the archaeological sites are associated. Broader, long-term goals include an evaluation of Anthony Marks' (1976a, 1977, 1983a) model for paleoenvironmental change and human adaptation in the central Negev highlands, located some 100-120 km. south-west of the study area (for a complete discussion of the WHPP research design and its objectives, see Clark, 1984). Six sites were tested. All but one (WHS Site 621) had buried, stratified *in situ* deposits (Figs. 1, 2).

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GEOLOGIC AND GEOMORPHIC SETTING

by
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The geological setting of Wadi el-Ḥasa has been established as a result of two principal processes: long-term tectonism, or structural deformation, and shorter term (i.e., Quaternary) fluvial and limnic activity. The archaeological site surfaces, which span a period of *ca.* 70,000 years, correspond to various lakeshore and floodplain environments linked directly to late Quaternary climatic changes. Still, subsurface movements have affected base levels and therefore sedimentation patterns, to a significant degree. While the magnitude of these changes is difficult to gauge, the el-Ḥasa drainage empties directly into the Dead Sea Rift, the largest fault system in the Middle East. Elevations drop from a maximum of 1300 m east of the fault to -300 m to the west. The fault is located just east of eṣ-Ṣafi, some 50 km north-north-west of the study area. Downdropping of the fault may have begun as early as Eocene times *(ca.* 60 million years ago) (Bender 1974), but subsequent and protracted episodes of faulting have been documented on more regional scales. The Wadi el-Ḥasa Fault is located several kilometres north of site 784X and was responsible for the diversion of drainage flow from north to west into the Rift (see Fig. 2). The 1984 field investigations did not document any deformation structures in the Pleistocene sediments at the prehistoric sites, but localized tectonism is noted for the Rift system well into historic times (Karcz *et al.* 1977, Arieh 1967).

The study area is situated on the west side of a physiographic province known as the Mountain Ridge and Northern Highlands (Bender 1974). Regionally the bedrock sequence consists of basement Upper Pre-Cambrian to Upper Cretaceous sandstones, limestones, basalts, and unconsolidated (largely Tertiary) sediments. The basalts and unconsolidated sediments have a very patchy distribution along the wadi flanks (Donahue & Beynon n.d.). In the vicinity of the main archaeological sites, a Mesozoic bedrock sequence is most prominent and consists of a basal white sandstone overlain by a series of marine limestones and phosphorites. The limestones were a significant prehistoric resource since they contain significant quantities of flint.

It is the late Quaternary sediments, which are most visible, that have infilled the depressions formed by repeated fault and related movements. At present it is thought that Pleistocene Lake Ḥasa emerged as a self-contained basin that reached a maximum elevation of +815 m (Clark 1984). Evidence consists of a series of lacustrine marls and interdigitated fluvial sediments that are offset by extensive terraces and benches across the project area (Pl. I, 1). The marls at Wadi el-Ḥasa are quite distinctive and contain two principal facies. The first is an alternating massive and blocky to laminar sandy silt that occurs at lower elevations (<800 m) and grades into terraces of the contemporary Wadi el-Ḥasa. The second is a chemically precipitated sediment of finely laminated aragonite, calcite, and gypsum suffused with evaporites. In general, outcrops of the chemical marls either abut the bedrock valley walls or the edges of small piedmont fans emerging from the minor tributary valleys such as Wadi el-Mutadahhinat near site 618. The lacustrine terraces have been variously downcut by Wadi el-Ḥasa's divergent flows and tributaries, exposing marl sequences to heights on the order of 10 m above the valley floor (Pl. I, 1). Field investigations show that the chemical marl outcrops are best preserved at the outer flanks of the lake basin, at elevations of +800-815 m, and generally represent the highest levels attained by the lake. Late Pleistocene spring deposits, in the form of 1-2 m thick calcareous and cemented blocks known as tufas, cap the lacustrine marls at isolated locations. The fluvio-limnic sequences at el-Ḥasa are reminiscent of Pleistocene lake sequences elsewhere in the central Levant, especially in the lower Jordan Valley (Schuldenrein 1983) and the Azraq basin in eastern Jordan (Garrard *et al.* 1985). These all reflect the interaction of structural and climatic geomorphic processes.

The central feature of the site landscapes is, of course Wadi el-Ḥasa and its terraces. Across the project area the channel axis runs west by northwest and then turns sharply to the west at the el-Ḥasa fault. Valley width ranges from ca. 1 km in the vicinity of sites 1065 and 618 to 200 m near site 621 (Fig. 2). In the former area, the wadi fans out across the extensive lake plain and has incised both lacustrine marls and its own fills. Farther downstream, the channel course is contained by the steep sided limestone valley walls and a shallow width of valley fill offset by a single level terrace incised to depths of 5-6 m (Pl. I, 2). Over this northern reach of the project area the terrace was built up by alluvium consisting of stacked fluvial sediments that attest to formerly variable stream flow regimens. The profile near site 621 displays two discrete depositional cycles. The basal 2.5 m were agraded by mixed low energy alluvium and slackwater silts. The alluvium is moderately rubefied and weathered toward the top and contains translocated clays. The upper cycle is represented by banded sets of fluvial silts and sands, often laminar, indicative of episodic deposition during abrupt flooding events. These con-

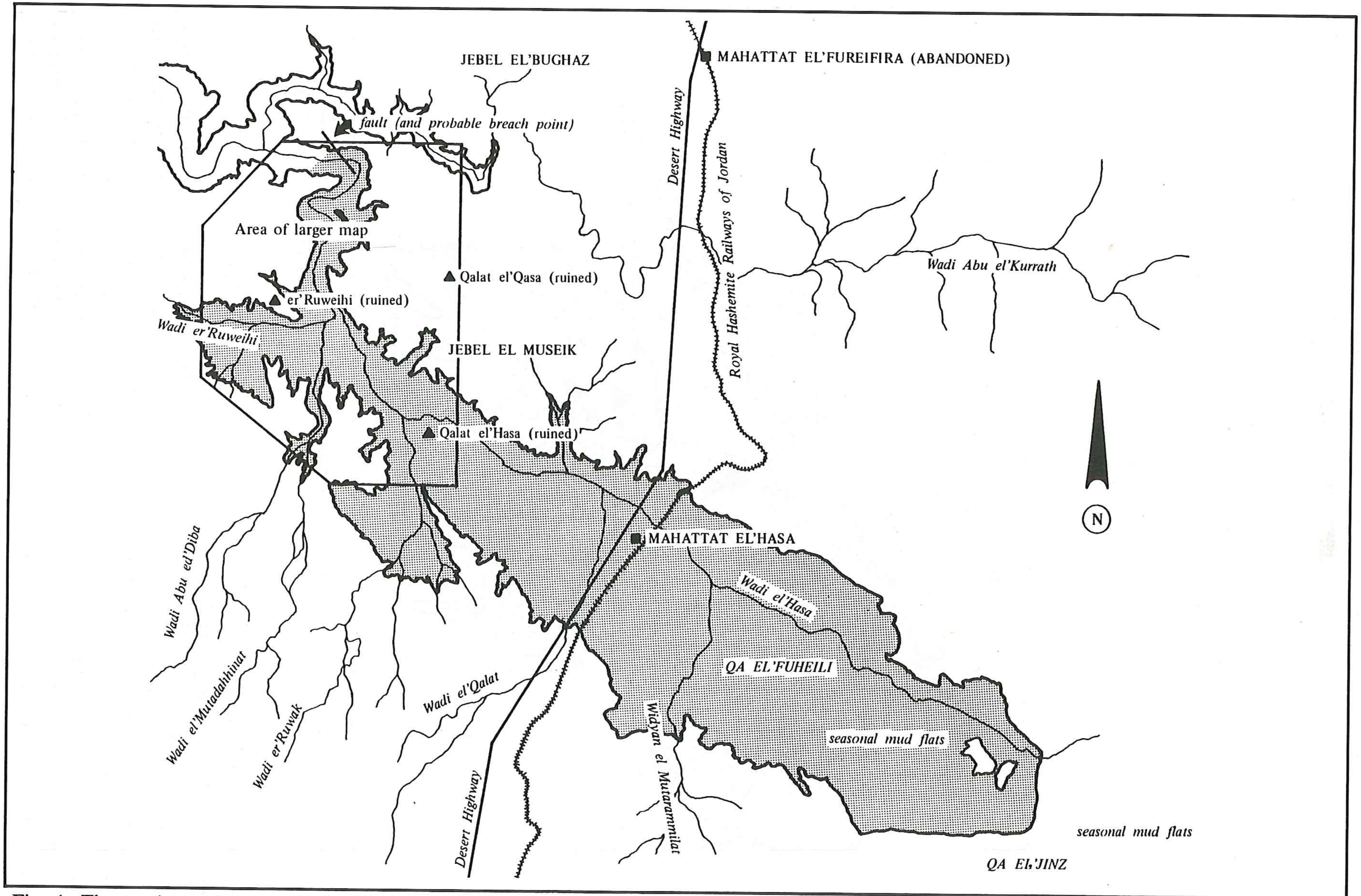

Fig. 1: The maximum former extent of Pleistocene Lake Ḥasa, determined by plotting the tops of lacustrine marls in the northwest end of the former lake bed (from Clark 1984:241).

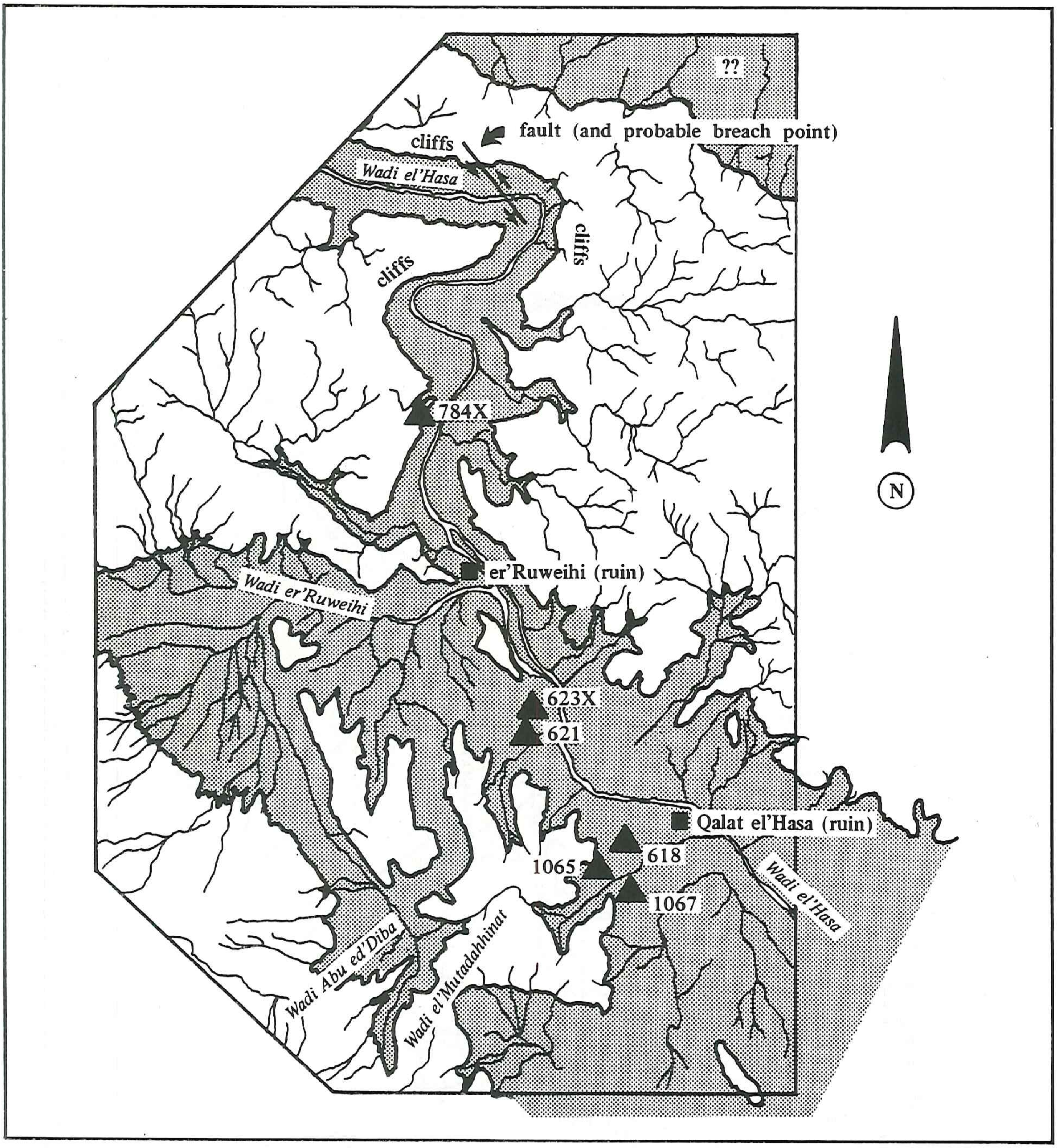

Fig. 2: Detail of the northwest end of the lake showing the locations of WHS Sites 618, 621, 623X, 784X, 1065 and 1067. Lake margin plotted at +825 m; it actually lies at about +815 m (from Clark 1984:242).

tain isolated coarse pebble and gravel stringers and are not visibly weathered.

Proceeding to the south and east, in the lake plain near sites 1065 and 618, an additional terrace is offset by 1-2 m of relief and a graded but identifiable erosional surface. Exposures of the higher terrace reveal a significantly coarser fill containing medium sands and rounded, pitted, and river-worn pebbles.

Our observations in Wadi el-Ḥasa were confined to the general site areas, but significantly, this sector of the valley has been the subject of extensive geoarchaeological exploration. Vita-Finzi (1964, 1966, Copeland & Vita-Finzi 1978) investigated the el-Ḥasa terrace system near er-Ruweiḥi to model several sets of late Quaternary archaeological site-landform correlations. The applicability of these correlations to the study area is discussed in the subsequent section on geoarchaeological observations.

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MIDDLE PALEOLITHIC SITES

by
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WHS SITE 621

Site 621 consists of a surface scatter of Middle Paleolithic artifacts distributed across two marl knolls adjacent to an ancient shoreline of the lake. The site lies at about 807-810 m, close to the estimated maximum elevation of the lake (+ 815 m) (Clark 1984). The concentrated surface scatter covers approximately 4000 m^2 and consists entirely of fresh, unrolled artifacts. An area perhaps twice as large has occasional Middle Paleolithic artifacts. The site was completely collected using a grid of 991 2 x 2 m squares. Most of the artifacts are concentrated in the northeast and southeast quadrants in a long arc that bows out to the East. The Mousterian industry appears to be eroding out of the marls at a level that corresponds in elevations to the inside of the arc. There is a thin scatter of 'Upper Paleolithic' debitage over the higher of the knolls that might be somewhat denser above the Mousterian. Mousterian artifacts occur under an oval of calcreted rubble located in the eastern part of the site. The distribution of these features, our test units, and a plot of Middle Paleolithic artifact densities is given in Figs. 3 and 4.

Test Excavations and Site Context

The text excavations at 621 determined that the artifacts occur both on the surface (and 20-30 cm below it) and, occasionally, in the marls themselves. Several Middle Paleolithic pieces, including a Mousterian point, were recovered from a bulldozer cut in the marls (Fig. 4). This suggests that nothing at 621 is really *in situ* in the narrow sense of the term, and that the artifacts and a 'background' fauna were being washed into the lake during and after formation of the marls. Since the Mousterian pieces are fresh and unrolled, and only seldom patinated, they are certainly not derived from very far (probably from the bedrock slopes immediately above where they are found, adjacent to the former lakeshore).

The abundance of Middle Paleolithic material in the arc is somewhat puzzling. We collected quite a lot of it from a *ca.* 1600 m^2 area. However, since there is little that is clearly Upper Paleolithic, and no signs of later industries, the 621 surface collection is argued to be essentially unmixed and to represent the lithic component of a slightly derived Mousterian campsite (or a series of campsites). On the basis of this line of reasoning, we undertook the following typological and technological analysis of the assemblage.

Surface Collection

Over 6000 lithic artifacts were collected from the surface of 621 (Table 1). A complete range of morphological types is present including cores, primary cortical elements, small flakes, flakes, blades, Levallois elements, tools and debris fragments. The presence of cores and of knapping debris along with various sizes and types of flakes and a large number of tools (10.9%) suggests that a complete reduction sequence took place on site. In addition, the high density of artifacts and the presence of a fairly large number of small flakes and debris fragments coupled with the fresh, sharp appearance of the artifact edges suggests that post-depositional disturbance, while obviously present, was nonetheless minimal.

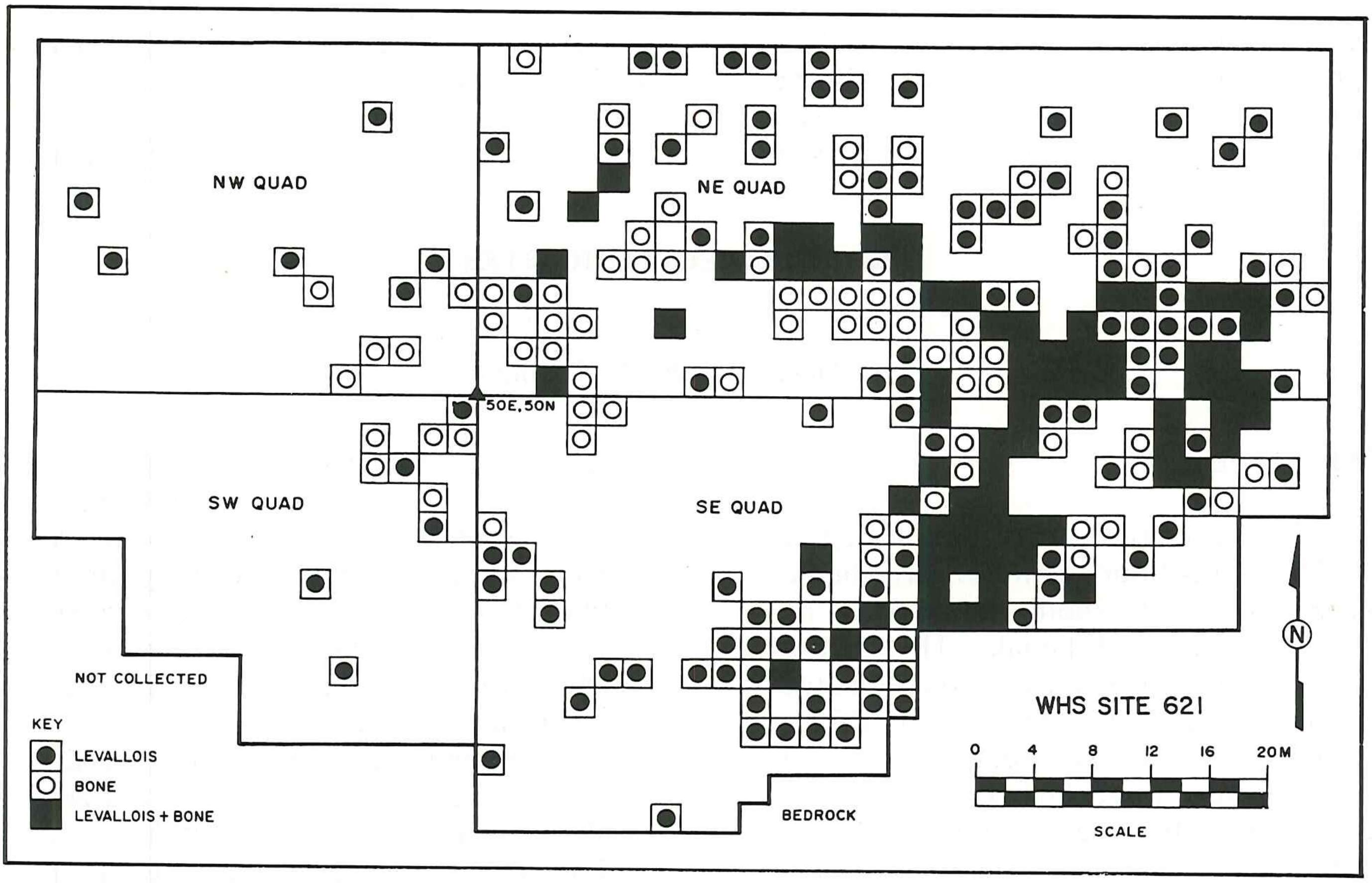

Fig. 3: WHS Site 621. Plot of the surface collection showing the distribution of Levallois elements and bone.

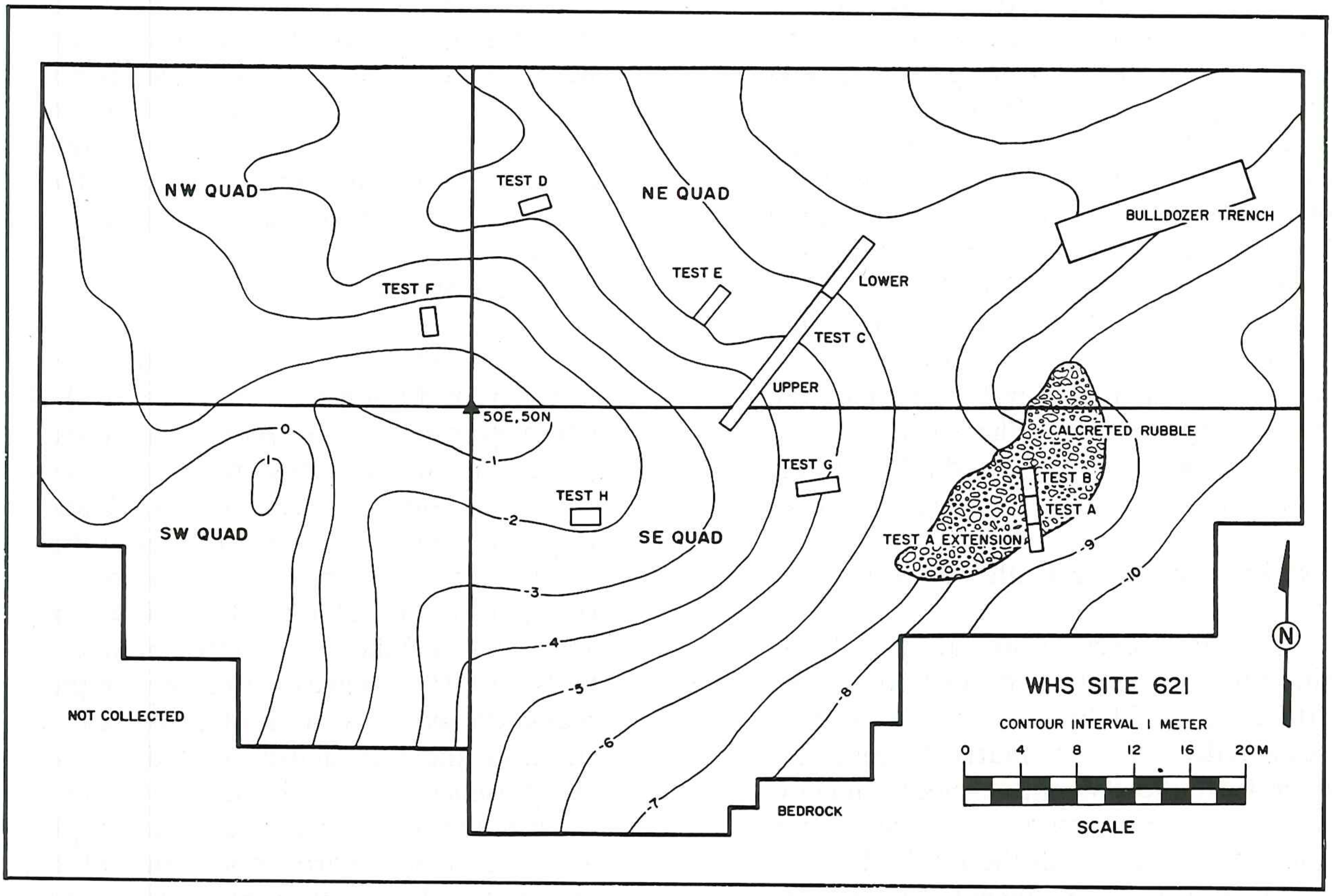

Fig. 4: WHS Site 621. Topography of the site and the locations of Tests A-G, bulldozer cut and the arc of calcreted rubble (the remains of a former spring?).

TABLE 1
SITE 621: ARTIFACT FREQUENCIES BY TYPE GROUP

Type Group	N	%
Cores	71	1.2
Primary Elements	909	14.9
Flakes	977	16.0
Prismatic Blades	1128	18.5
Levallois Elements	344	5.6
Tools (essential)	662	10.9
Flakes (>3cm)	273	4.5
Debris	1726	28.3
Total:	6090	99.9

TABLE 2
SITE 621: CORE FREQUENCIES

Type	N	%	% TG
Disk Core	9	12.7	12.7
Levallois Cores			
flake	8	11.3	
point	2	2.8	14.1
Single Platform Cores			
flake	12	16.9	
blade	8	11.3	
mixed	5	7.0	35.2
Multiple Platform Cores			
flake	11	15.5	
blade	10	14.1	
mixed	6	8.5	38.1
Total Identifiable Cores	71	100.1	100.1
Unidentified Core Frags.	69		

Core and Debitage Characteristics

The nuclei consist of disk cores, single and multiple platform flake and blade cores, Levallois flake and point cores, and 69 core fragments (Table 2). There are nearly equal percentages of single (35.2%) and multiple (38.1%) platform cores with no clear indication of a preferred method of reduction. The primary elements are mostly secondary decortication flakes (95%) with the remainder being flakes from initial decortication. The extremely small number of these last (flakes with 90-100% cortex on the exterior surface) could be indicative of raw material being brought on site already partially prepared. The bulk of the assemblage is made up of nearly equal percentages of flakes (16.0%) and prismatic blades (18.5%). There is a respectable incidence of Levallois elements with typical and atypical flakes (56.1% of the category) being slightly more numerous than regular and elongated points (43.9%). Small flakes less than 3 cm in maximum dimension make up 4.5% of the assemblage with three-quarters of this category being diminutive 'trimming' flakes and the rest bladelets. Debris makes up over one-

TABLE 3
SITE 621: RETOUCHED TOOL FREQUENCIES

No.	Tool Type	Real List N	Real List %	Essential List N	Essential List %
1.	Typical Levallois Flake	175	17.9	--	–
2.	Atyp. Levallois Flake	18	1.8	--	–
3.	Levallois Point	120	12.3	--	–
4.	Ret. Levallois Point	31	3.2	31	4.7
5.	Pseudo-Levallois Point	15	1.5	15	2.3
6.	Mousterian Point	9	0.9	9	1.4
7.	Elong. Moust. Point	5	0.5	5	0.7
9.	Straight Sidescraper	9	0.9	9	1.4
10.	Convex Sidescraper	18	1.8	18	1.8
11.	Concave Sidescraper	1	0.1	1	0.2
12-17.	Double Sidescrapers	3	0.3	3	0.4
18-29.	Other Sidescrapers	4	0.4	4	0.6
30.	Endscraper	29	3.0	29	4.4
31.	Atypical Endscraper	1	0.1	1	0.2
32.	Burin	8	0.8	8	1.2
33.	Atypical Burin	11	1.1	11	1.7
34.	Perforator	29	3.0	29	4.4
38.	Nat. Backed Knife	20	2.0	20	3.0
39.	Raclette	23	2.3	23	3.5
40.	Truncated (Bkd.) Piece	93	9.5	93	14.0
42.	Notch	96	9.8	96	14.5
43.	Denticulate	31	3.2	31	4.7
44.	Alt. Bur. Bec	5	0.5	5	0.7
47-49.	Piece w/ Alt. Retouch	20	2.0	20	3.0
51.	Tayac Point	2	0.2	2	0.3
62.	Miscellaneous	199	20.4	199	30.0
Total		975	100.0	662	100.0

TABLE 4
TYPOLOGICAL INDICES AT 621 AND OTHER SITES

Site	ILty	IRe	IIe	IIIe	IVe
Tabun IX	62.2	36.1	43.4	19.3	3.2
Rosh Ein Mor	60.6	8.6	10.8	30.4	14.3
Nahal Aqev 3	47.1	12.8	13.1	20.3	9.2
621	32.1	5.4	9.1	11.8	4.7
Kebara F	58.4	37.7	40.1	9.0	7.3
Tabun I (1-17)	64.7	31.5	31.5	13.0	7.4
Tabun I (18-26)	66.1	23.6	25.0	3.6	8.2
Tirat Carmel	8.0	26.5	26.5	22.4	22.4
Shubbabiq I-IV	43.3	25.6	29.3	15.8	15.2

quarter of the assemblage.

Retouched Pieces

The 'essential' tool index at 621 amounts to 10.9% of the assemblage (Table 3). The most frequent category is Type 62 (Miscellaneous) which consists of retouched pieces not subsumed under Types 45-49 in the Bordes typology (1961). The next most frequent types are notches (14.5%), truncated/backed pieces (14.0%), retouched Levallois points (4.7%), denticulates (4.7%), endscrapers (4.4%) and perforators (4.4%). Notches and denticulates make up 19.2% of the essential tools.

Typological Characteristics — Comparisons

Typologically, 621 does not resemble either 'early' or 'late' Levantine Mousterian sites (Table 4). The Levallois index (ILty) is moderately low (32.1) compared to the other sites examined except for Tirat Carmel, which has an exceptionally low value (8.0). The restricted scraper index (IRe) is also much lower than the other sites (5.4) but is closest to the indices of Rosh Ein Mor (8.6) and Nahal Aqev (12.8). The Mousterian index (IIe) mirrors the scraper index with the value from 621 closest to the two early Phase 1 open-air Negev sites. In contrast, the Upper Paleolithic index (IIIe) appears most similar to the late Phase 2-3 sites. The denticulate index (IVe) is similar to both Phase 1 and Phase 2-3 sites. In general, the typological indices indicate no strong similarity to either Phase 1 or Phase 2-3 Mousterian sites in the Levant.

Technological Characteristics — Comparisons

Technologically, 621 also shows similarities to both 'early' (Phase 1) and 'late' (Phase 2-3) sites (Table 5). The Levallois index (IL) is low (5.7) and most similar to Tirat Carmel (6.4), Far'ah II (4.5), Nahal Aqev (8.7) and Tor Sabiha (9.6). The faceting index (IF) is very high (69.3) along with Kebara F (71.7), Shubbabiq I-IV (65.3), Tabun IX (61.4) and Tabun I (1-17) (59.9). The restricted faceting index (IFs) shows similarities with Tabun I (18-26), Rosh Ein Mor, and Nahl Aqev. The laminar tendency (Ilam) at 621 is very high (51.3), with only Tabun IX and I (1-17) being higher (76.2, 64.2 respectively).

The 621 typological and technological indices could be those of either a Phase 1 or Phase 2-3 site and, if they indeed reflect the passage of time (which in our opinion is questionable), are not useful for chronological intepretation of the relative age of the site. Recently, however, it has been argued that the *metrical* attributes of complete blanks can be used to place Levantine Middle Paleolithic sites in a chronological order (Jelinek 1982). Metrical attribute comparisons are used in the following section to compare the 621 lithic assemblage with the two types of Mousterian commonly found in the Levant (Copeland 1975, Jelinek 1982).

Metrical Attributes of Blanks — Chronological Implications

A total of 212 complete flakes (>2.5 cm maximum dimension) were measured following the method advocated by Jelinek (1977) (i.e., *length* = point of percussion to the most distant point on the interior surface, *width* = measured at a right angle to length on the interior surface, and *thickness* = measured at the midpoint of width). Based on a detailed analysis of the Tabun sequence, Jelinek (1981, 1982) has suggested that the mean and the variance of the width:thickness ratio measured from complete flakes is a major chronological criterion with the variance considered to be the most reliable indicator of relative temporal position. A comparison of this ratio at 621 with similar ratios from Phase 1/ Tabun D and Phase 2-3/Tabun C Levantine Mousterian sites indicates an affinity with the Phase 1 sites (Table 6). The mean width:thickness ratio at 621 (4.013) is slightly lower than those from the other Phase 1 sites, but markedly lower than the corresponding means from the Phase 2-3 sites. The variance is completely within the range of the Phase 1 sites, and outside that

TABLE 5
TECHNOLOGICAL INDICES AT 621 AND OTHER SITES

Site	IL	IF	IFs	Ilam
Tabun IX	56.3	61.4	48.4	76.2
Rosh Ein Mor	14.6	54.6	34.7	19.5
Nahal Aqev 3	8.7	57.4	43.1	25.3
Tor Sabiha	9.6	41.2	---	36.9
Far'ah II	4.5	28.2	14.5	13.1
621	5.7	69.3	39.0	51.3
Kebara F	66.5	71.7	63.7	28.6
Tabun I (1-17)	36.0	59.9	50.5	64.2
Tabun I (18-26)	22.0	52.0	35.9	35.7
Tirat Carmel	6.4	35.1	28.5	14.6
Shubbabiq I-IV	41.0	65.3	56.8	13.0

TABLE 6
WIDTH:THICKNESS RATIOS FOR COMPLETE FLAKES
FROM LEVANTINE MOUSTERIAN SITES

Site	Mean	Median	Variance	N
Tabun IX	4.248	3.999	3.128	743
Rosh Ein Mor	4.436	4.111	4.236	373
Nahal Aqev 3	4.925	4.716	3.902	332
Abou Sif B	4.510	4.002	3.342	214
Abou Sif C	4.126	3.875	1.732	173
621	4.013	3.777	3.463	212
Tabun I	4.633	4.249	5.049	1377
Kebara F (3)	5.891	5.332	7.129	604
Kebara F (8)	6.293	5.668	8.166	539
Shukbah D	5.630	5.204	6.302	484
Qafzeh I	6.476	5.802	7.974	661
Qafzeh L	7.034	6.502	9.508	573

of the Phase 2-3 sites.

Another potentially significant chronological measure is the metrical characteristics of Levallois points from these assemblages. Phase 1/Tabun D sites are characterized by points which are more elongated and consequently have higher length:width ratios than Phase 2-3/Tabun B-C sites. Given the preceding width: thickness statistics, 621 would be expected to cluster with the 'early' Phase 1 sites. However, this is not the case since the mean length:width ratio for the 55 points recovered at 621 is clearly within the range of values for the 'later' Phase 2-3 sites (Table 7). The median is also in the 'late' range. In addition, only 10.9% of the points from 621 are elongated (length: width ratio >3.00), the lowest of any of the sites examined and supposedly indicative of the 'late' Phase 2-3 Mousterian.

Observations on the 621 Lithic Assemblage

The contradiction in the indices at 621 has occurred before in the Levant with the assemblage from Far'ah II in the northern Negev (Gilead & Grigson 1984). The width:thickness ratio from this site placed it in the Phase 1/Tabun D Mousterian

TABLE 7
LENGTH:WIDTH RATIOS OF LEVALLOIS POINTS
FROM LEVANTINE MOUSTERIAN SITES

Site	Mean	Median	% Elong.	N
Tabun IX	2.45	2.33	34.1	179
Rosh Ein Mor	2.41	2.39	36.4	11
Nahal Aqev 3	2.48	2.48	28.2	39
Abou Sif B	2.70	2.57	43.4	76
Abou Sif C	2.69	2.67	40.0	50
621	2.20	2.11	10.9	55
Tabun I (18-26)	2.07	2.07	14.1	35
Kebara F (3)	2.12	2.03	12.5	56
Kebara F (8)	2.07	1.91	14.3	63
Shukbah D	2.29	2.18	22.0	173
Qafzeh I	2.17	2.03	16.1	112
Qafzeh L	2.18	2.19	17.3	81

TABLE 8
SITE 621: MAMMALIAN FAUNA

Species/Part	Surface				Excavation			
	NE	NW	SE	SW	C6	E2	G2	FEL
Bos primigenius								
mandible	6(1)							
tooth frag.			1(1)	1(1)	1(1)			
Equus caballus								
mand. tooth						2(1)		
Equus hemionus/asinus								
mand. tooth	1(1)							1(1)
Equus sp. indet.								
tibia							1(1)	
phalange 1			1(1)					
mand. tooth	4(1)							
mand. frag.			1(1)					
max. tooth			2(1)					
tooth frag.		1(1)	4(1)					
Large Herbivore (Equus/Bos sized)								
pelvis frag.	1(1)							

* number bone fragments (minimum number individuals)
FEL = front end loader trench

whereas the length:width ratio of Levallois points indicated a Phase 2-3/Tabun C type Mousterian. Based on paleoenvironmental data and the calculation of sedimentation rates from absolutely dated deposits above it, Gilead (1984: 76) thinks that the Far'ah II Mousterian is late and consequently does not conform to Jelinek's expectation of thinner flakes through time (Jelinek 1982:99). However, there are no absolute dates from Far'ah II and the relative dating techniques used are coarse grained at best, leaving the age of the site unresolved.

A possible explanation for the small size and lack of elongation of the Far'ah II Levallois points could be the size and shape of the raw material utilized. The primary raw material type brought to the site consisted of wadi pebbles and small cobbles which would have imposed restrictions on the size of the flakes produced and consequently the size and degree of elongation of the Levallois points (Gilead & Grigson 1984: 74). Length and thickness can be controlled to some extent by technology, specifically by exterior platform angle and platform thickness (Dibble & Whittaker 1981). However, given a small core size, length is limited by the proportions of the raw material while thickness remains a function of technology. Thus, an 'early' Mousterian site could have 'short' Levallois points due to the characteristics of the raw material used to make them, and not because of vectored (chronological) change in technology.

A final consideration is the fact that both 621 and Far'ah II are open sites whereas the indices were primarily developed from and used on assemblages from rockshelters and caves. The exceptions, of course, are Nahal Aqev and Rosh Ein Mor which are both open sites. There is an apparent contradiction between Jelinek's original measured sample of Levallois points (which puts these two sites in Phase 1 — *cf.* Table 4) and the values calculated by Jones (1984) which indicate that these are Phase 2-3 sites. Jones (1984: 561) calculated mean length:width ratios for Levallois points from Nahal Aqev (2.19) and Rosh Ein Mor (2.01) which do not agree with those cited by Jelinek. If, upon further analysis, Jones' calculations prove to be correct, it would imply that open sites are more variable technologically than cave and rockshelter locations. Why this should be so is not clear at present, but it is becoming increasingly evident that the indices used above are not quite the panaceas for assessments of chronological order that they have sometimes been claimed to be.

Faunal Remains — Paleoenvironmental Implications

The 621 fauna are given in Table 8. There were only 28 identifiable elements, of which 18 (64.3%) were the remains of equids. Two were mandibular teeth of *Equus caballus,* and two were mandibular teeth of *Equus hemionus/asinus* (the half-ass) (Davis 1980). Both these species coexisted on the central Asian steppe in the last century (Garrard & Montague 1985). There are nine fragments of *Bos* sp. indet. The fauna indicate an open steppe or subdesert environment. Most of the osteological elements are teeth and jaw fragments. These are the most durable parts of the skeleton and their abundance is probably related to preservational factors rather than to any human agency. The absence of the remains of smaller animals might also be due to factors of preservation (Garrard & Montague 1985). Thus we cannot demonstrate a direct link between the makers of the lithic assemblage and the bone that occurs in the site. In all probability the animals remains represent a 'background fauna' of the kind that accumulates as a consequence of non-human predation in a marshy, lakeshore environment on the edge of a grassland steppe.

A Dated Chalcolithic Hearth

There is a single radiocarbon date from the site, but it does not pertain to the Mousterian component represented by the lithic industry:

7500 ± 130 BP (UA-4397)

The determination was made on a sample from an enormous *(ca.* 2.6 kg) concentration of charcoal found in a rectilinear hearth with an associated ashpit (Test C

Lower, Lev. 6, Feat. 1). The hearth was encountered at 60-70 cm below ground surface, and showed much evidence of rodent disturbance (two rodent bones were recovered from inside the hearth itself). Its configuration suggested a Chalcolithic period date, rather than any subdivision of the Paleolithic or Epipaleolithic (Olszewski 1984a). Only a handful of non-diagnostic artifacts were recovered from the excavated portion of Test C Lower, and these came primarily from rodent-disturbed contexts. Aside from the presence of the Feature 1 hearth, this unit is essentially sterile. Despite a major effort at test excavation (7 tests, labeled A-G, and a bulldozer cut), we failed to locate any convincing subsurface concentrations of artifacts that might have been the source of the surface scatter, nor did we find anything resembling an 'occupation' or 'living' surface. The industry itself shows little indication of subsequent mixing, nor of transport by geological agencies. While many of the WHS lithic sites are deflated, multicomponent 'palimpsest' deposits (see Clark *et al.* 1988), this does *not* appear to be the case at 621.

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WHS SITE 634 ('AIN DIFLA)

Site 634 comprises a small pocket of sediment preserved under a rockshelter located at *ca.* 780 m above sea level in Wadi 'Ali, a southern tributary of el-Ḥasa. It is the only one of the sites tested in 1984 not associated with Pleistocene Lake Ḥasa. The site is a remnant of a much larger rockshelter, the contents of which have mostly been removed by fluctuations in the course of Wadi 'Ali, now located some 10-12 m below it. Originally the site might have extended for as much as 150 m to the west of the preserved remnant since the rockshelter itself extends that far. The site covers about 40 m^2. The talus deposits in front of the rockshelter are about 6-7 m thick and are steeply sloped (*ca.* 35°). Due to the slope, and a paucity of vegetation cover, erosional processes continue to act on the remaining sediments.

Test Excavations

Since we had trouble locating it, 634 was only tested during the last week of the 1984 field season and the test was limited in extent. However, a good lithic sample was recovered and the presence of additional deposits was clearly documented. Two contiguous 2 x 1 m units were positioned underneath the dripline of the shelter and extended downslope for four meters, establishing a 4 x 1 m test trench (Test A) (Fig. 5). We attempted to excavate the units by 10 cm arbitrary levels following the slope of the deposits, which increased sharply from the upper to the lower unit. We were not always successful in maintaining uniform level depths (see Fig. 7, which compares the artificial and the natural stratigraphies). A depth of approximately 90 cm below the surface was attained in both units. All the excavated sediment was screened through 2 mm mesh and all visible stone and bone was saved. Columns of sediment samples were collected for sedimentological and palynological analyses (Fig. 6) (see Lindly *et al.* 1986 for a more complete discussion of the stratigraphy).

Core and Debitage Characteristics

The lithic assemblage from 634 numbers over 4000 pieces (Table 9). Recovery was excellent because of the use of 2 mm mesh screens and the relatively dry, loose consistency of the sediment. The assemblage contains a large number of small flakes (< 3 cm) (28.3%) and debris or shatter fragments (34.2%), and a relatively high incidence of primary elements (9.1%

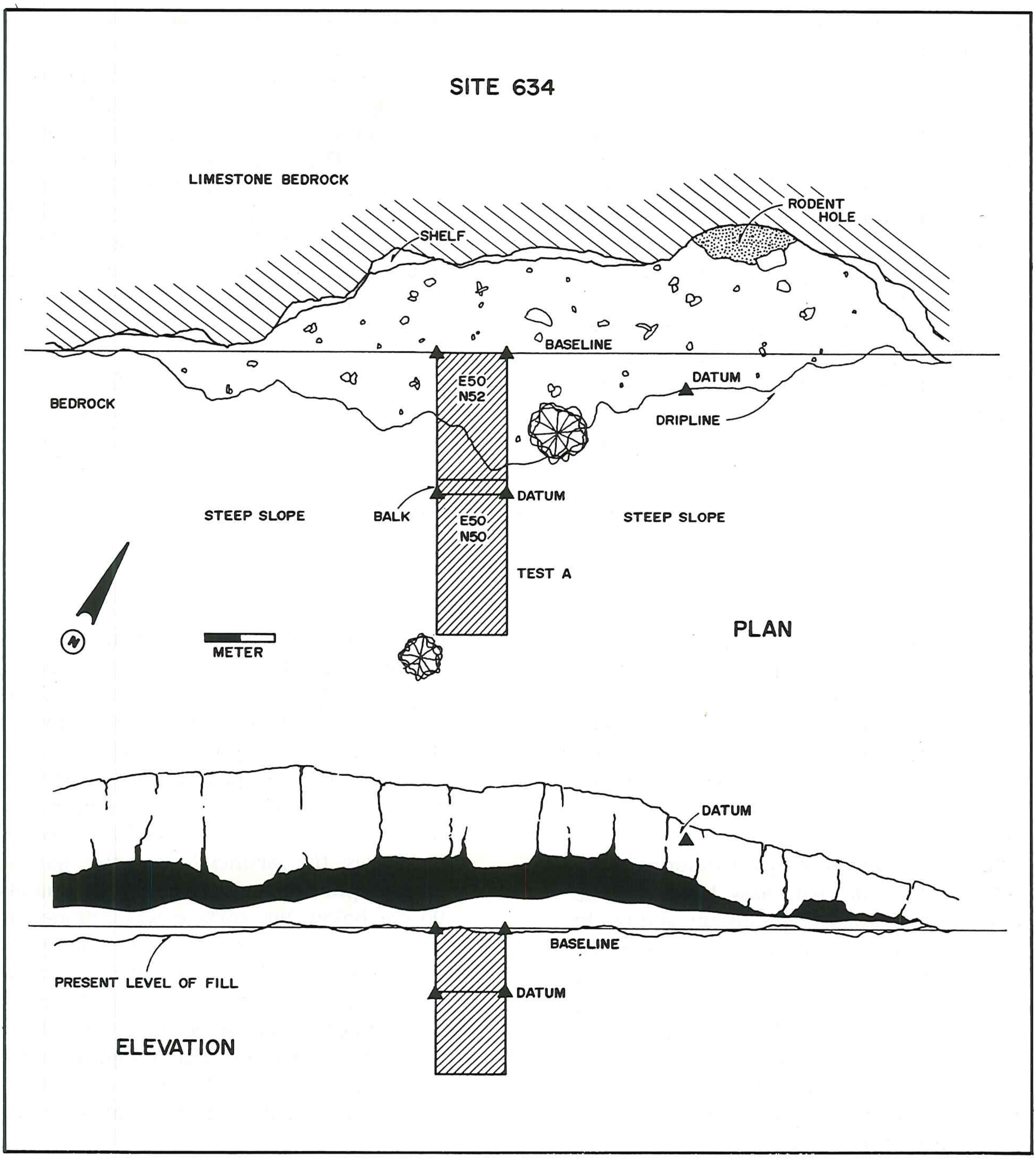

Fig. 5: WHS Site 634. Plan and elevation of the site.

— defined as flakes and blades with 10-80% cortex). Primary decortication flakes (80-100% cortex) are relatively rare, however. The complete cores recovered are principally small and 'exhausted' (Table 10). Core types include Levallois point and flake types and both single and multiple (opposed) platform flake, blade and mixed cores. There are 56 unidentifiable core fragments. The small size of the complete cores and the large number of core fragments coupled with the large number of very small flakes suggests that most of the reduction sequence occurred at the site. Only evidence for substantial amounts of primary decortication is missing. Most cores are multiple, bidirectional or opposed platform types (48.7%), followed in frequency by single platform (35.1%) and Levallois types (16.2%).

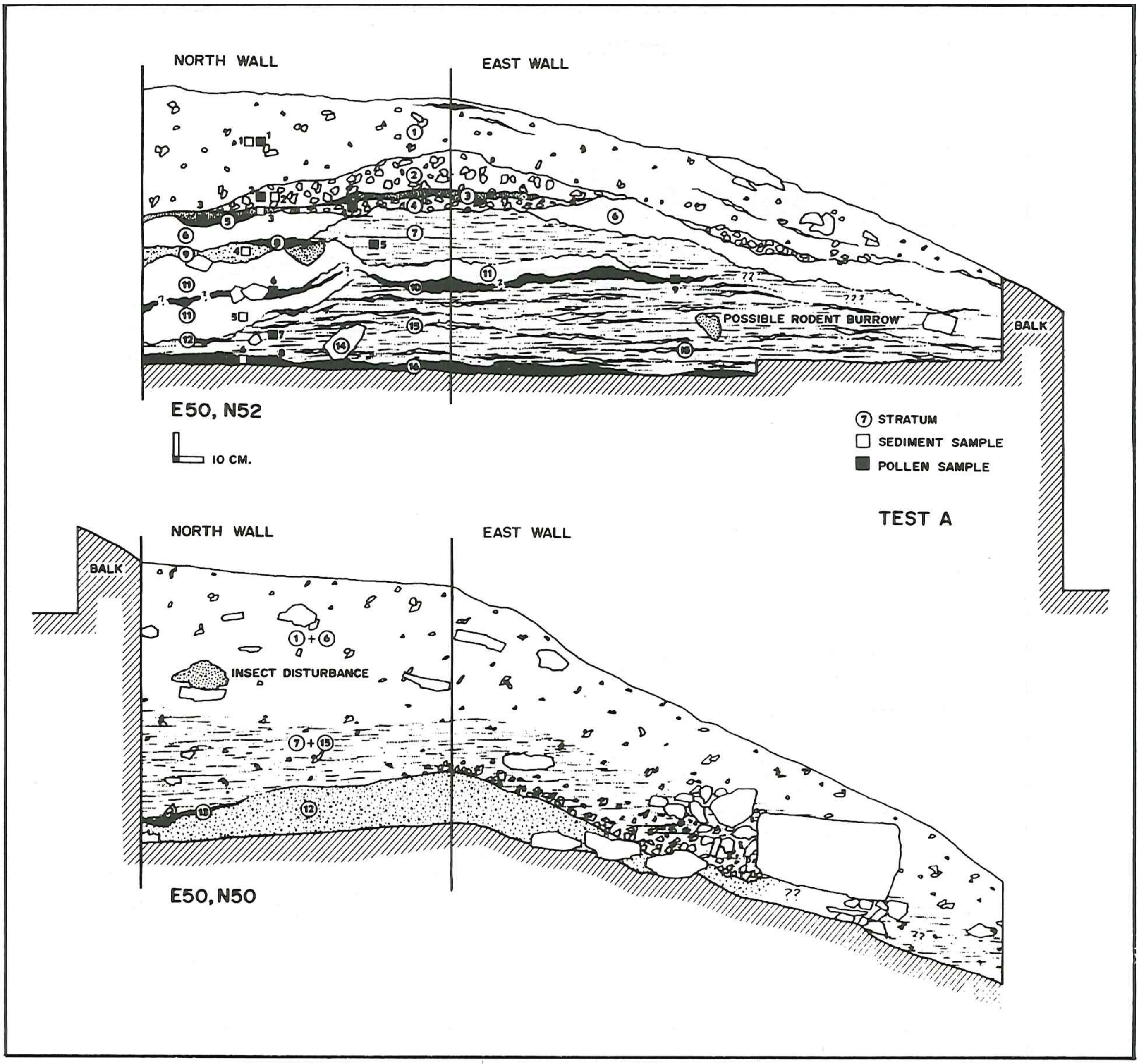

Fig. 6: WHS Site 634. The natural stratigraphy, north and east balks, Test A.

Retouched Pieces

A very low 1.9% of the assemblage consists of formal tools (Table 11). The Bordes typology is used to classify these pieces for comparative purposes. The 'real' tool count (which includes Levallois elements) is dominated by Levallois points (32.4%), many of them elongated, followed by high frequencies of atypical Levallois flakes (20.2%) and naturally backed knives (11.6%). The 'essential' type list has high frequencies of naturally backed knives (25.0%), notches (17.6%), burins (13.8%) and denticulates (8.8%). The 'naturally backed knife' category has been suggested to be more an indicator of raw material shape and the reduction sequence used than a formal tool type (Jelinek 1975:304) and as such is an expected component of a laminar industry like that of 634. There is a notable absence of sidescrapers (Types 9-29).

Large numbers of elongated Levallois points, prismatic blades and Upper Paleolithic tool types at 634 indicate a Tabun D (or Phase 1 — Abou Sif) Mousterian assemblage (Jelinek 1982:74). To examine this relationship, standard typological and technological indices were calculated for 445 complete flakes from the 634 excavation and compared to sites which contain Tabun D type industries.

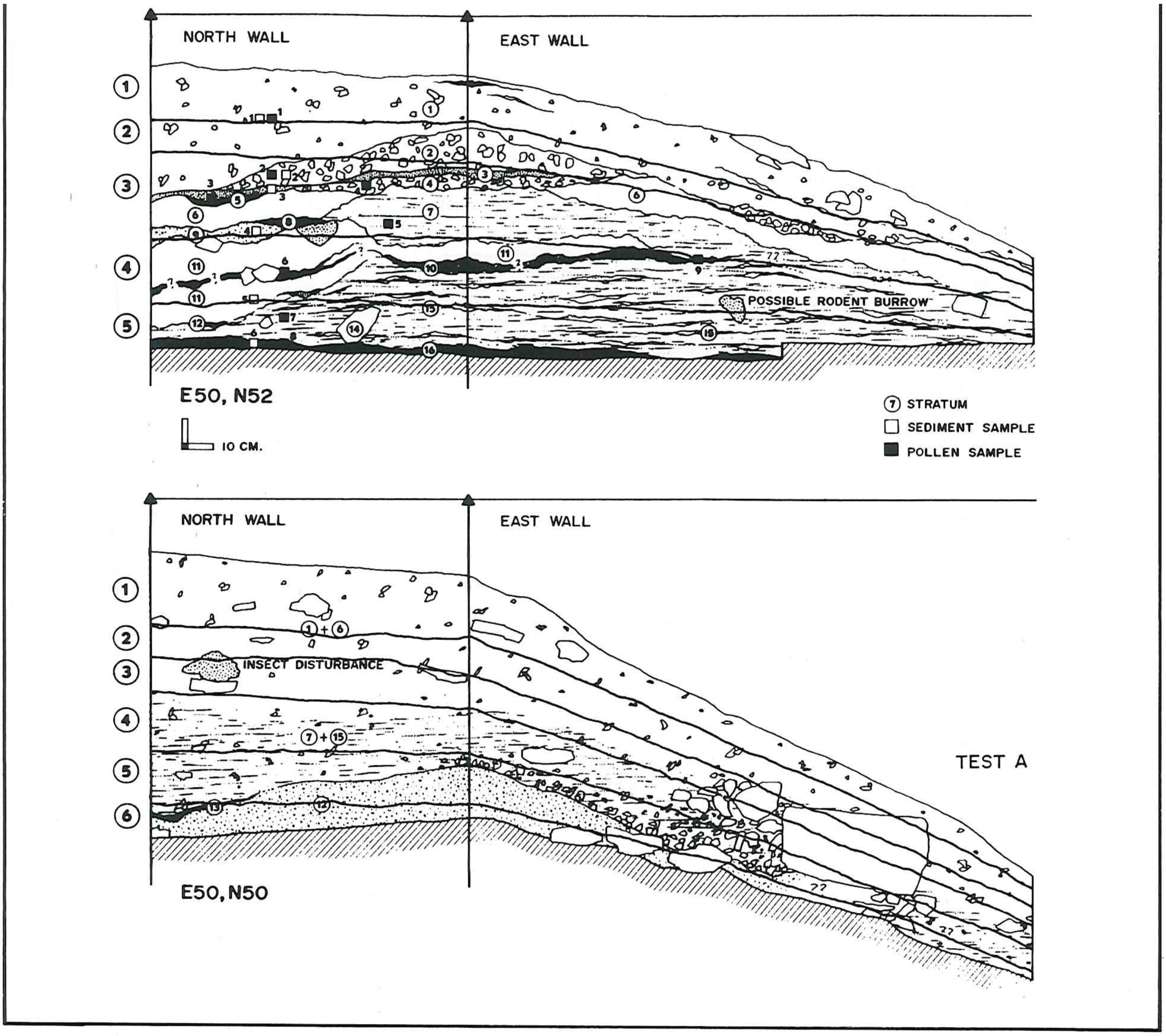

Fig. 7: WHS Site 634. A comparison of the natural stratigraphy with the arbitrary stratigraphy used in the text excavations of 1984.

Typological Characteristics — Comparisons

Table 12 compares the typological Levallois index (ILty), restricted scraper index (IRe), Mousterian (IIe), Upper Paleolithic (IIIe) and Denticulate (IVe) indices from 634 with those from Tabun Unit IX, Rosh Ein Mor and Nahal Aqev. Site 634 has a fairly high Levallois Index (54.3) which compares well with the indices from the other three sites. The restricted scraper index at 634 is zero and is thus very different from the other sites, but it is evident that there is a lot of variability among Tabun D assemblages. The Mousterian index is effectively zero and serves to underscore the complete lack of 'Mousterian' tool types at 634. This last is the major discrepancy between the 634 typological indices and those from sites considered to have *early* Tabun D type industries. However, there are sites that are argued to have *late* Tabun D type assemblages such as Ṭor Sabiḥa, Layer C (Henry 1982:425) and Boker Tachtit, Level 1 (Hietala & Marks 1981:307) that appear to show more of a correspondence with the 634 typological indices (Table 13). There are few 'late' Tabun D type sites recorded as yet, and the 'lateness' of Tor Sabiha is based solely on paleoenvironmental evidence. The comparison of typological indices from 634 with those of both

TABLE 9
SITE 634: ARTIFACT FREQUENCIES BY TYPE GROUP

Type Group	N	%
Cores	37	0.9
Primary Elements (1)	377	9.1
Flakes	727	17.5
Prismatic Blades (2)	247	5.9
Levallois Elements (3)	94	2.3
Tools (essential)	80	1.9
Flakes (>3cm)	1177	28.3
Debris	1420	34.2
Total	4159	100.1

(1) flake or blade with cortex
(2) includes "Levallois blades" (see Jelinek [1982:75], Copeland [1983] for a discussion of problems related to the definition of Levallois blades
(3) flakes + points

TABLE 10
SITE 634: CORE FREQUENCIES

Type	N	%	% TG
Levallois			
flake	2	5.4	
point	4	10.8	16.2
Single Platform			
flake	7	18.9	
blade	1	2.7	
mixed	5	13.5	35.1
Opposed Platform			
flake	6	16.2	
blade	3	8.1	
mixed	9	24.3	48.7
Total Ident. Cores	37	99.9	100.0
Unid. Core Frags.	56		

TABLE 11
SITE 634: RETOUCHED TOOL FREQUENCIES

No. Type	Real List Number	Real List %	Essential List Number	Essential List %
1. Typical Levallois Flake	2	1.1	--	
2. Atypical Levallois Flake	35	20.2	--	
3. Levallois Point	56	32.4	--	
4. Retouched Levallois Point	1	0.6	1	1.2
5. Pseudo-Levallois Point	5	2.9	5	6.3
31. Atypical End Scraper	1	0.6	1	1.2
32. Burin	11	6.4	11	13.8
34. Perforator	1	0.6	1	1.2
38. Naturally Backed Knife	20	11.6	20	25.0
40. Truncated Flakes and Blades	2	1.2	2	2.5
42. Notch	14	8.1	14	17.6
43. Denticulate	7	4.0	7	8.8
44. Alternate Flaked Tip	2	1.2	2	2.5
62. Miscellaneous	16	9.2	16	20.0
TOTAL	173	100.1	80	100.1

TABLE 12
COMPARISON OF TYPOLOGICAL INDICES FROM 634 WITH PROPOSED EARLY TABUN D TYPE INDUSTRIES

Site	ILty	IRe	IIe	IIIe	IVe
634	54.3	0.0	6.3	16.3	8.8
Tabun IX (1)	62.2	36.1	43.4	19.3	3.2
Rosh Ein Mor (1)	60.6	8.6	10.8	30.4	14.3
Nahal Aqev 3 (1)	47.1	12.8	13.1	20.3	9.2

(1) from Jelinek 1982:72, Table XV

'early' and 'late' Tabun D type assemblages clearly indicates that 634 is 'Tabun D like.' However, it is impossible to determine the chronological position of the site by typological analyses alone. Technological indices were also examined (Table 14).

Technological Characteristics — comparisons

Site 634 has a Levallois index (IL — 7.0) similar to those of Nahal Aqev (8.7), Tor Sabiha (9.6) and Far'ah II (4.5). Rosh Ein Mor has the highest Levallois index of the southern sites (14.6) and Tabun a very high index (56.3) in comparison to *all* the sites. It should be noted, however, that the Tabun index contains not only Levallois points and flakes but also prismatic blades. If prismatic blades are included in the 634 index, it increases to 25.2.

The 634 faceting index (IF — 64.7) is absolutely high compared to the other sites (esp. Far'ah II — 28.2), but is overall quite similar to the values for Tabun (61.4), Rosh Ein Mor (54.6) and Nahal Aqev (57.4). The restricted faceting index (IFs) is rather low at all the sites (and very low at Far'ah), reflecting a high proportion of dihedral (as opposed to multiple faceted) platforms. The blade index or 'laminar tendency' (Ilam) at 634 is higher than any of the southern sites (41.8) but much lower than that of Tabun IX (76.2) (Table 13). Overall, 634 resembles the southern sites

TABLE 13
COMPARISON OF TYPOLOGICAL INDICES FROM 634 WITH PROPOSED LATE TABUN D TYPE INDUSTRIES

Site	ILty	IRe	IIe	IIIe	IVe
634	54.3	0.0	6.3	16.3	8.8
Tor Sabiha Layer C (1)	39.3	6.2	6.2	9.2	12.3
Boker Tachtit Level 1 (2)	47.0	2.1	2.1	42.5	6.4

(1) calculated from Henry 1982:424, Table 3
(2) calculated from Marks and Kaufman 1983:80, Table 5.9

TABLE 14
TECHNOLOGICAL INDICES AT 634 AND OTHER SITES

Site	IL	IF	IFs	Ilam
634	7.0	64.7	34.2	41.8
Tabun Unit IX (1)	56.3	61.4	48.4	76.2
Rosh Ein Mor (1)	14.6	54.6	34.7	19.5
Nahal Aqev L.3 (1)	8.7	57.4	43.1	25.3
Tor Sabiha (2)	9.6	41.2	--	36.9
Far'ah II (3)	4.5	28.2	14.5	13.1

(1) from Jelinek 1982:72, Table XV
(2) from Henry 1982:424
(3) from Gilead 1980:56, Table 2

with respect to its Levallois index, is one of a block of four sites (Tabun, Rosh Ein Mor, Nahal Aqev) with similar faceting indices, is closest to Rosh Ein Mor in its IFs, and (along with Tor Sabiha) falls in between Tabun and the rest of the sites in regard to laminar tendency. Although there is obviously a great deal of variability in these Mousterian collections, the technological indices reinforce the typological ones, and again suggest that 634 has features that align it strongly with Tabun D or Phase 1 Mousterian sites.

Preliminary Pollen Data

The preliminary pollen identifications from 634 suggest that human use/occupation of the site coincided with a cool, *dry* interval characterised mainly by *Artemisia* (16-20%) and Chenopodiaceae (40-50%). No arboreal pollen has been identified so far. The absence of trees (riparian species at least would have been expected given the proximity of the site to Wadi 'Ali) and the chenopodia/*Artemisia* dominated NAP fraction point to more xeric conditions than would have been expected if the site pertained to the 90-60000 BP interval, a span regarded by Marks (1981, 1983b) as optimal for human habitation of the nearby central Negev highlands. This in turn implies that the site is 'late' (i.e., probably falls in the 60-50000 BP interval, when more xeric conditions prevailed over much of the southern Levant).

Faunal Remains

The 634 fauna is dominated by equids (*Equus hemionus/asinus, Equus* sp. indet.), but goat or ibex (*Capra* sp. indet.) and gazelle (*Gazella* sp. indet.) are also present. Gazelle (two late Pleistocene species) and the equids (three species) are indicators of steppe or subdesert environments and are thus consistent with the pollen data. They indicate cool, steppic or subdesertic conditions during the deposition of the lithic assemblage at 634.

Site 634 is the subject of a longer essay from which this brief report has been abstracted. For more complete information, including metrical analyses of the lithic assemblage and a comparison of the 634 paleoenvironmental data with those from the central Negev highlands, the reader is referred to Lindly *et al.* (1986).

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UPPER PALEOLITHIC SITES

by
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WHS SITE 618

Site 618 is an enormous scatter of artifacts which is distributed across and is eroding out of a series of marl fingers at the northwest end of Lake Hasa. It lies at an elevation of *ca.* 800-815 m, and intersects the highest stillstand level of the lake, which was clearly in existence during the time of occupation. The site, which covers about 12000 m^2, forms a truncated arc which extends from a bedrock outcrop about 105 m in an E/W direction, and about 110 m N/S. Artifact densities are lowest in the western quadrants of the site, and highest in the east. There is a radiocarbon-dated fossil spring located in the south-central part of the site that was active at least during the later phases of occupation (Fig. 8).

Surface Collection

The site was sampled using a stratified systematic design that produced a representative collection constituting ca. 3.3% of the surface array. Defining the site area as 104 m (E/W) x 109 m (N/S), we established 20 one-meter wide E/W transects which were divided into 10 m long units. Within each 10 m unit, two 1 m units were selected for collection using a table of random numbers. This produced 20 samples per transect and a total of 400 samples for the site surface. The small sampling fraction (3.3%) was necessitated by the sheer size of the site, and by demands on time and the workforce available for collection. The estimated number of artifacts on the site surface is about 300000 (290424).

Core and Debitage Chracteristics

The surface collection yielded some 9584 lithic artifacts of which 8377 (87.4%) consisted of debitage and primary elements (Table 15). There are almost equal frequencies of blades (33.7%) and flakes (32.9%), a substantial number of cores and core fragments (6.8%), and core renewal flakes (2.1%). The high incidence of primary elements and shatter (23.1%) clearly indicates a substantial amount of *in situ* tool preparation and reworking in what is probably the remains of a large (or series of large) basecamps. That Site 618 is a sustained locus of human occupation is borne out by a high frequency and diversity of retouched pieces (13%), and by stratified midden deposits.

Retouched Pieces

The retouched pieces number 1207 (12.6%) which is a high proportion of an Upper Paleolithic assemblage (normally retouched pieces account for less than 5%). This in itself lends support to the notion of a basecamp since a high proportion of retouched pieces would probably indicate a wide range of processing and maintenance activities. Conversely, a narrow range of tools and a redundant spectrum of tool types would suggest redundancy in site function and a restricted spectrum of activity types (Clark & Lerner 1983).

The retouched tool component is

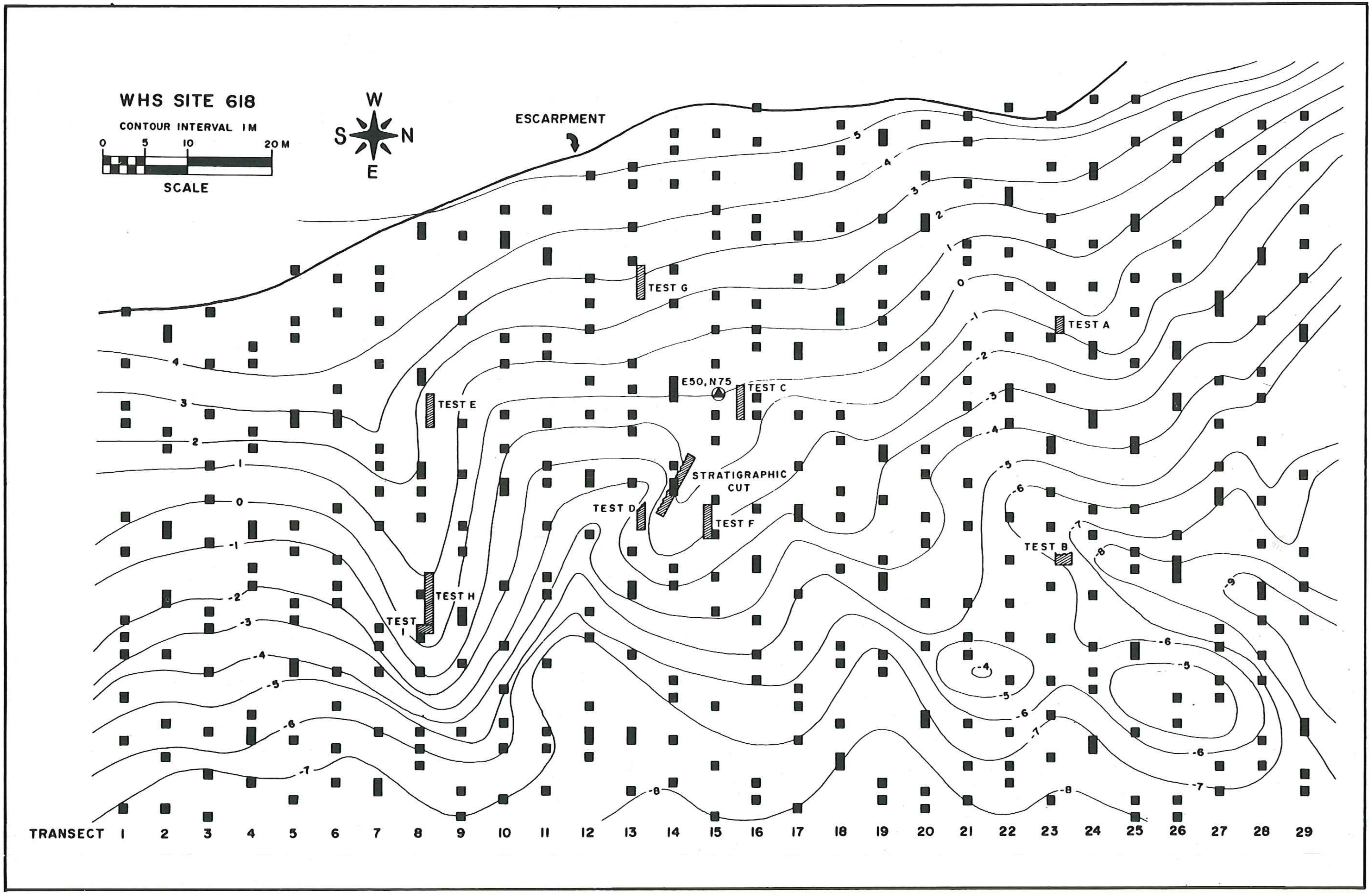

Fig. 8: WHS Site 618. Topography of the site and the locations of the surface sample units (solid black), Tests A-I and the Stratigraphic Test (hachured lines).

summarized in Table 16. The tools are generally made on large, well-executed blades, which is perhaps significant in terms of the normative culture-stratigraphic unit assignment of the site (see below). Endscrapers and burins are both represented by a wide range of morphological types, and are in proportional equilibrium (12.6%, 12.7%). There are few retouched bladelets (1.4%), which probably is a reliable datum in view of their relative scarcity in the excavated sample. As is usually the case, the retouched tools are dominated statistically by casually-made continuously retouched pieces (CRPs) (35.6%) and by notches and denticulates (17.3%). There is a substantial number of truncated elements (9.9%). There are no tanged elements, lunates or other geometrics from the surface collection, and only a very small, lacklustre heavy duty tool component (0.6%). To the extent that such things are diagnostic, there are a few Aurignacian blades, backed blades and sidescrapers (including one K'sar Akil scraper). It would be naive to argue that the surface array is *in situ* in any absolute sense. However, it lies atop buried deposits over most of the site area, and the characteristics of the surface array were used successfully to indicate the placement of excavation units.

Age of the Spring (Kebaran) Component

Site 618 was tested by the nine excavation units shown in Fig. 8. Analysis of the excavated sample (26809 pieces) is not yet complete, but preliminary results indicate general similarity between the surface and subsurface components of the main site. Tests H and I, located on the fossil spring, have produced what appears to be a Kebaran assemblage thought to postdate the main site. The Kebaran industry in Test I has been dated to 20300 ± 600 BP (UA-4395). There are no radiocarbon dates yet from the main site.

Culture-Stratigraphic Unit Assignment

In terms of a normative culture-stratigraphic affiliation, what kind of Upper Paleolithic site is 618? The answer unfortunately depends upon interpretations of patterns of Levantine Upper Paleolithic assemblage variability which are yet in a very preliminary stage. Recently both Marks (1981) and Gilead (1981) have suggested that the Levantine Upper Paleolithic prior to the Kebaran consists of two distinct 'traditions' that overlap to some extent with one another in space and time. One is the well-known Levantine Aurignacian, characterised by a dominance of endscrapers and burins made on normal flakes (less frequently on blades). The other, which Gilead has christened the Ahmarian (after 'Erq el-'Aḥmar, in the Judean Desert) is characterised by significant numbers of small blades and bladelets; retouched and backed blades, bladelets and points (>35%) and a relative scarcity of the 'classic' Aurignacian diagnostics — endscrapers and burins (<40%). The Ahmarian has been relatively well dated between 38/41000 and 17000 BP. The few radiocarbon dates associated with the Levantine Aurignacian do not antedate about 29000 BP.

There is considerable disagreement regarding not only the retouched tool components, but also the basic technological (blank production) characteristics of the two 'traditions' (cf. Marks 1981 and Gilead 1981, Marks 1983 and Henry 1982). If Marks is correct in arguing that the Levantine Aurignacian is primarily a *flake* assemblage, then, by default, Site 618 is more 'Ahmarian' than 'Aurignacian' since most of the tools are made on lamellar blanks. However, Henry (1982:428) characterises the Levantine Aurignacian as a *blade* assemblage, and Gilead (1981) is ambiguous with respect to Aurignacian blank characteristics. It could be the case that the proposed dichotomous pattern of Upper Paleolithic assemblage variation in the Levant is an oversimplification of the real situation.

Test Excavations

Test excavations on the main site intersect dark grey, highly organic silts and

TABLE 15
SITE 618: SURFACE - DEBITAGE AND CORE FREQUENCIES

Type Group	Type	N	%	% ST	% TG
Blades (>3cm):					
	blade 1DC	17	0.2		
	blade 2DC	669	8.0		
	blade 1st	473	5.6		
	blade 2nd	1193	14.2	28.0	
Bladelets (<3cm):		480	5.7		33.7
Flakes:					
	flake 1DC	41	0.5		
	flake 2DC	789	9.4		
	flake plain	1520	18.1		
	flake trim (<1cm)	413	4.9		32.9
Shatter:		1935	23.1		23.1
Core Renewal Elements:					
	CR, platform tablet	5	0.1		
	crested blade	2	0.0		
	CR, unspecified	166	2.0		2.1
Burin Spalls:		50	0.6		0.6
Levallois Elements:					
	core, blade	1	0.0		
	flake	2	0.0		
	point	6	0.1		0.1
Nuclei:					
	disk core	1	0.0		
	disk core, partial	2	0.0		
	globular core	3	0.0	0.0	
	sing. plat. blade	50	0.6		
	sing. plat. bldt.	75	0.9		
	sing. plat. flake	28	0.3		
	sing. plat. mixed	34	0.4	2.2	
	mult. plat. blade	14	0.2		
	mult. plat. bldt.	29	0.3		
	mult. plat. flake	46	0.5		
	mult. plat. mixed	84	1.0	2.0	
	core frag. unid.	218	2.6	2.6	6.8
Microburin:		1	0.0		0.0
Naturally Backed Pieces:					
	blade	28	0.3		
	flake	2	0.0		0.3
Total:		8377	100.0		100.0

TABLE 16
SITE 618: SURFACE - RETOUCHED TOOL FREQUENCIES

Type Group	Type	N	%	% ST	% TG
Endscrapers:					
	ES, simple	64	5.3		
	ES, flake	19	1.6		
	ES, atypical	20	1.7		
	ES, circular	2	0.2		
	ES, ret. blade	9	0.7		
	ES, Aur. blade	1	0.1		
	ES, dbl. flake	6	0.5		
	ES, flat nosed	1	0.1		
	ES, carinate	10	0.8		
	ES, car. atyp.	5	0.4		
	ES, microcar.	3	0.2		
	ES, rabot	2	0.2		
	ES, thk. nosed	3	0.2	1.8	
	ES/BU	5	0.4		
	ES, various	3	0.2		12.6
Burins:					
	BU on break	42	3.5		
	BU angle dih.	14	1.2		
	BU dejete dih.	13	1.1		
	BU st. dih.	13	1.1	3.4	
	BU conc. trunc.	4	0.3		
	BU lat. prep.	10	0.8		
	BU truncation	3	0.2		
	BU st. trunc.	10	0.8		
	BU conv. trunc.	2	0.2	2.3	
	BU nucleiform	4	0.3		
	BU plan	1	0.1		
	BU mult. dih.	10	0.8		
	BU mult. break	3	0.2		
	BU mult. mixed	8	0.7		
	BU mult. trunc.	4	0.3		
	BU various	13	1.1		12.7
Retouched bladelets (<3cm):					
	bldt. backed	10	0.8		
	bldt. bkd. part.	1	0.1		
	bldt. bkd. trunc.	1	0.1		
	bldt. fine ret.	3	0.2		
	bldt. trunc.	3	0.2		1.4
Continously Retouched Flakes (Pieces) and Blades:					
	CRB 1 edge	124	10.3		
	CRB 2 edges	70	5.8		
	CRP 1 edge	204	16.9		
	CRP 2 edges	31	2.6		35.6
Denticulates and Notches:					
	denticulate	34	2.8		
	notched blade	81	6.7		
	notch, Clact.	3	0.2		
	notched flake	90	7.5		
	notch/dentic.	1	0.1		17.3
Retouched Blades (>3cm):					
	Aurig. blade	2	0.2		
	blade backed	11	0.9		
	bld. bkd. part.	6	0.5		
	bld. ret. var.	1	0.1		1.7
Retouched Flakes:					
	flake backed	18	1.5		
	flk. bkd. dbl.	1	0.1		
	flk. bkd. part.	1	0.1		
	flk. ret. var.	5	0.4		2.1
Perforators and Becs:					
	bec	37	3.1		
	PF, simple	12	1.0		
	PF, various	7	0.6		4.7
Truncated Elements:					
	trunc. blade	72	6.0		
	trunc. flake	39	3.2		
	trunc. piece	8	0.7		9.9
Various Flake Tools:					
	pce. esquillee	2	0.2		
	raclette	2	0.2		
	sidescraper	7	0.6		
	biface frag.	1	0.1		
	K'sar Akil scrap.	1	0.1		
	comp. tools var.	4	0.3		1.5
Heavy Duty Tools:					
	adze, flake	1	0.1		
	grindstone frag.	2	0.2		
	hammerstone	1	0.1		
	chopper	3	0.2		0.6
Total:		1207	100.1		100.1

TABLE 17
SITE 618: TEST C STRATIGRAPHY (SOUTH WALL)

	Arbitrary Level	Natural Level (Comments)
SLIGHTLY DERIVED	1	unconsolidated yellow/tan silt ('topsoil')
	2-4	compacted whitish/brown silt; large cobbles, gravel lense W end of unit; numerous artifacts
	5	partially unconsolidated whitish/brown silt, sandy/silt; numerous artifacts
	5	very loose, unconsolidated yellow/brown silt/ sand with cobbles, gravel inclusions; bone fragments more common; numerous artifacts
MORE IN SITU	4a,6	unconsolidated whitish brown silts, sandy silts
	6-11	loose, unconsolidated yellowish brown silts, with sandy/silt lenses; gravel inclusions; high density of bone vis a vis overlying levels; artifacts horizontal in matrix
	7,8	white clay lense (S wall only)
	9	mixed white clay; loose yellowish brown silts and sandy silts
	12	bedrock

clays which appear to have formed on the marshy shore of the lake. Because of the high organic component, it should be possible to date these sediments directly. The best stratigraphic sequence occurred at Test C, where bedrock was reached over the base of the entire unit at depths ranging from 1.2 to 0.8 m below surface. A description and concordance of the Test C natural and arbitrary stratigraphies is given in Table 17. The test C stratigraphy basically represents two depositional situations. Because artifacts occur in odd positions and orientations (wedged under cobbles, vertically placed in the matrix etc.), arbitrary Levels 1-5 do not appear to be in primary contexts. The source of these fresh, unpatinated artifacts is most likely a few metres upslope, slightly south and west of their present locations. Beginning with Level 6, substantially more bone and midden debris shows up in the sample and the artifacts tend to be more horizontal in the matrix, suggesting that arbitrary Levels 6-11 might represent a more primary context than do Levels 1-5.

Faunal Remains

The excavations at Site 618 produced only 78 identifiable faunal elements, and many of these were from the spring (Test H, I). The sparse archaeological fauna resembles that of 621 (i.e., mostly teeth), and is dominated by equids (71.7%, including two mandibular teeth of *Equus hemionus/asinus),* followed by *Bos* sp. indet. (25.6%). There are single remains of a medium-sized ovicaprine and a tortoise (*Testudo* sp. indet.). The preliminary pollen results, which are characterized by frequencies of Chenopodiaceae (35-55%)

and *Artemisia* (5-30%) similar to those from nearby Site 1065, are completely devoid of arboreal species, perhaps indicating a time difference and a more xeric environment at 618 since it would be expected that pollen rains would have been similar at any given point in time between the two sites.

In sum, Site 618 appears to be the remains of a large Upper Paleolithic base-camp (or, more likely, a series of base-camps) situated on the marshy northwest shore of Lake Ḥasa, adjacent to a spring. The lake appears to have been bordered by grassy plains during the time of occupation. The main (Ahmarian?) site is probably greater than 25000 years old, based on (somewhat) similar dated assemblages in Palestine. The Kebaran spring component is substantially younger (*ca.* 20300 BP, which agrees well with other early Kebaran dates). We hope to be able to date the main site in the near future using unidentifiable bone fragments from the excavations themselves and/or the highly organic lake-margin marsh sediment samples mentioned above.

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WHS SITE 623X

by
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Site 623X is a small (*ca.* 4 m^2), isolated Upper Paleolithic knapping station located some 425 m NNE of 621. The 'X' designation is used to distinguish it from nearby WHS Site 623, a large, deflated Middle and Upper Paleolithic surface scatter (MacDonald *et al.* 1983). Site 623X was discovered in 1984 eroding out of the top of a marl knoll near the projected +815 m shoreline of the lake (Fig. 2). It was completely mapped (each piece was point-provenienced) and collected. The 967 artifacts are now in the process of being refitted on the six or seven nuclei from which they were detached (Table 18). To date, some 97 pieces have been conjoined on four cores, core fragments are being assembled and the work is continuing. The refitting indicates approximately equal numbers of bidirectional and unidirectional (pyramidal) blade cores (almost the entire collection of obvious blanks consists of pieces with blade dimensions). The 'most complete' refitted core (25+ pieces) is a multiple platform bidirectional one with evidence of several episodes of rejuvenation. In this case both flakes and blades were detached, in contrast with the other cores which show mostly blade detachments. There are very few cortical pieces in the collection (2.6%), and no primary decortication flakes or blades, suggesting that reduction in this particular instance took place on cores partially prepared elsewhere. There are very few actual core renewal elements, although at least one refitted core shows the evidence of rejuvenation just mentioned. There are no retouched tools, suggesting that the objective of reduction was simply to obtain sharp-edged blades which were used without subsequent (on-site) modification. A wide variety of raw material types brings to mind Binford's (1979) observation that lithic procurement might often have been 'embedded' in more central subsistence activities which moved foragers over wide parts of their ranges (in other words, raw material procurement was [or could be] incidental to other activities). Judging from present-day observations, purposive lithic procurement would not have been necessary in the eastern end of Wadi el-Ḥasa, where high quality flints of various types are found in profusion.

Site 623X is significant because it will allow us to reconstruct in detail one or several Upper Paleolithic reduction se-

TABLE 18
SITE 623X: ARTIFACT FREQUENCIES

Type Group	Type	N	%	% ST	% TG
Blades (>3cm):					
	blade 2DC	18	1.9		
	blade 1st	91	9.4		
	blade 2nd	388	40.1	51.4	
Bladelets (<3cm):		23	2.4		53.8
Flakes:					
	flake 2DC	7	0.7		
	flake plain	143	14.8		
	flake trim (<1cm)	157	16.2	31.7	31.7
Shatter:		126	13.0		13.0
Core Renewal Elements:					
	CR unspecified	1	0.1		0.1
Burin Spalls:		3	0.3		0.3
Levallois Elements:					
	point	1	0.1		0.1
Nuclei:					
	sing. plat. mixed	3	0.3		
	mult. plat. blade	2	0.2		
	mult. plat. mixed	1	0.1	0.3	
	core frag. unid.	1	0.1		0.7
Naturally Backed Pieces:					
	flake	6	0.6		0.6
Total:		967	100.3		100.3

quences, and to determine where these might fall in terms of the Upper Paleolithic sequences of the Avdat/Aqev area (central Negev highlands).

The Middle/Upper Paleolithic transitional site of Boker Tachtit, which has produced an excellent sample of refitted cores, has been radiocarbon dated to ca. 47000 BP ($\bar{x}$ of 4 rather problematic dates = 43628 BP). The later Upper Paleolithic is known from Boker A ($\bar{x}$ of 3 dates = 34980 BP), Boker BE ($\bar{x}$ of 7 dates = 26091 BP) and Ein Aqev ($\bar{x}$ of 5 dates = 17934 BP) (Marks 1981:343-345).

The Negev data indicate a transition from a Levallois technology to a single-platform blade technology between *ca.* 47000 and 43000 BP, with a persistence of elements (typological 'Levallois points') that, considered in isolation, appear to be the results of a Levallois reduction strategy (but are in fact casually produced from the reduction of single-platform, pyramid blade cores). After about 35000 BP, a classic Upper Paleolithic blade technology appears to be well-established and, in Marks' view, extends down in time to *ca.* 17000 BP when it overlaps with the Epipaleolithic. Over this interval the incidence of bladelets increases (although they are never entirely absent). Distinctive core reduction strategies for blades and bladelets become discernible after *ca.* 20000 BP.

It is of interest to note that both Levantine Upper Paleolithic traditions highlands. The Levantine Aurignacian, which Marks considers to be a flake-dominated assemblage in which carinated forms are common and blades poor, rare and seldom retouched, is represented in the Avdat/Aqev area by Sites G11, K9A, D29, D27A, D18, Ein Aqev, D26, Arkov and Boker C (Marks 1981:347). These sites are not dated radiometrically.

There is some possibility that we might be able to roughly date Site 623X since we have an organic sediment sample from the same knoll on which the site was found, and at approximately the same elevation. There is nothing else at 623X, so there is no way to date the site directly. It quite probably represents a 'moment frozen in time', perhaps the remains of a single episode of primary reduction. Such an array could be produced by an experienced flint knapper in 15 or 20 minutes.

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THE UPPER/EPIPALEOLITHIC TRANSITION

by
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WHS SITE 784X

Site 784X is a collapsed rockshelter located some 2.5 km upstream and slightly northwest of Sites 621 and 623X. The 'X' designation distinguishes this site from WHS Site 784, a Geometric Kebaran site located some 150 m south of 784X, and also associated with a collapsed rockshelter. The site was surface collected non-systematically because of the extreme irregularity of the area under the rockshelter remnant, now only a few meters deep. Testing 784X also proved difficult because we had to locate intact sediments amidst a jumble of enormous blocks of collapsed roof fall. Two 1 x 1 m tests (A, B) were systematically collected and then excavated to bedrock. A third test (C) was planned but never begun (Fig. 9). Test A was located upslope among the large roof fall blocks, many the size of automobiles. It sampled deposits which were originally in the main living area of the site. Test B was located to the east and slightly downslope, in an area which probably lay outside the dripline. In both cases, excavations attained a depth of about 1.5 m.

Stratigraphy

The stratigraphy exposed in Tests A and B penetrated a series of cultural deposits contained within a matrix of unconsolidated sandy silts, silts (above) and consolidated clays (below). Nine arbitrary levels of varying thickness were defined in each unit. A concordance of natural and arbitrary stratigraphic units for Test A is given in Table 19. Arbitrary Levels 1A, 2-4 are thought to represent decayed remnants of a calcreted deposit that originally adhered to the overlying roof fall blocks. Thus the artifacts recovered from these strata probably do not represent *in situ* deposits, although they have only 'travelled', so to speak, *en bloc* from a few meters upslope. The cultural materials in the light grey clay (arbitrary Levels 1, 2A, 5-8) do appear to represent *in situ* deposits. The incidence of bone (esp. long diaphysis fragments) is higher in the latter deposits, the artifacts themselves tend to be horizontal (flat) within the sediments, and there are traces of two reasonably convincing hearths and a number of pits. The radiocarbon sample comes from a hearth context (Feature 1) in Test A.

Based on the present position of the roof fall blocks, it is likely that at least two major episodes of collapse took place during the course of the human use/occupation of the rockshelter. The earliest is represented by a rough arc of boulders lying to the west and slightly above Test B, but below Test A. The second major collapse occurred later and is represented by two enormous blocks above and to the west of Test A (Olszewski 1984a).

Age of the Site

Site 784X has been radiocarbon dated to 19000 ± 1300 BP (UA-4396). Thus it lies just outside the traditionally defined temporal boundaries of the Kebaran as dated at Ein Gev 1, Nahal Oren and Rakefet Cave (19-16000 BP; $\bar{x}$ of 5 dates = 17108 BP) (Bar-Yosef 1981, Henry 1983). It falls temporally at the Upper/Epipaleolithic transition, although in terms of its lithic inventory it is somewhat 'Kebaran-like.'

Lithic Assemblage

Core and Debitage Chracteristics

Table 20 summarizes the debitage and core inventory for both the surface (which should probably be disregarded) and the excavated samples. The blade(let):flake ratio is almost 1:2 (19.7:37.9), underscoring the existence of a substantial flake technology. Both single and multiple platform flake, blade and mixed cores were recovered, and in equal frequencies (7 each). A high incidence of shatter (40.7%) points to substantial amounts of primary reduction, but there are relatively few cortical pieces (primary and secondary decortication flakes, blades), suggesting that only a part of the reduction sequence was conducted in the areas sampled, that preformed cores were being brought into the site from elsewhere, or that a decortication stage might not have been necessary (some of the flint in the region outcrops without developing a cortical rind). There are rather a lot of burin spalls (25, 0.5%), given the small area excavated. No microburins or naturally backed pieces were recovered, indicating an apparent absence of the reduction sequences of which these 'types' are byproducts.

Retouched Pieces

The retouched tool inventory is displayed in Table 21. Despite the predominance of flake debitage, the retouched pieces are dominated by retouched bladelets (40.7%), and of these, most show abrupt retouch used to back or truncate the piece. Bladelets with fine (non-abrupt) retouch are also present in some frequency (12.7%). There are no lunates and only a single 'geometric' (a quadrilateral). The hallmarks of the Upper Paleolithic, endscrapers and burins, are both present in considerable numbers, but endscrapers made on flake and blade blanks (as opposed to carinate forms) outnumber burins 2:1. Endscrapers (15.2%), continuously retouched pieces (15.2%), and serrated forms (notches and denticulates — 13.6%) are all in proportional equilibrium, and constitute a block of morphological types that are only exceeded in frequency by the retouched bladelet group. A rather diverse group of burins (7.6%) is the next most important group, followed by approximately equal numbers of backed blades (2.5%), backed flakes (1.7%), perforators (1.7%), and sidescrapers (1.7%). No heavy duty tools (grindstones, hammerstones, picks, choppers etc.) were recovered either from the surface or from the excavated samples. The lack of system in the surface collection, necessitated by the jumble of boulders that covers the site, is evident in the discrepancies between it and the excavated sample (*cf.* especially burins, retouched bladelets, truncated elements). The total retouched tool component numbers only 147 pieces (debitage:tool ratio is a very high 38:1; debitage comprises 97.4% of the assemblage). An average ratio for western European late Upper Paleolithic sites is *ca.* 20:1, indicating a greater-than-usual amount of reduction and resharpening at 784X (or the possibility of sampling error).

Because of the temporal proximity of the 784X date to the earliest Kebaran, and because Bar-Yosef (1981) has tentatively identified four regional and temporal site clusters *within* the Kebaran, it would make sense to compare Site 784X with Bar-Yosef's Clusters A and B (which are supposedly earliest). Such a comparison is planned for the future. However, it should

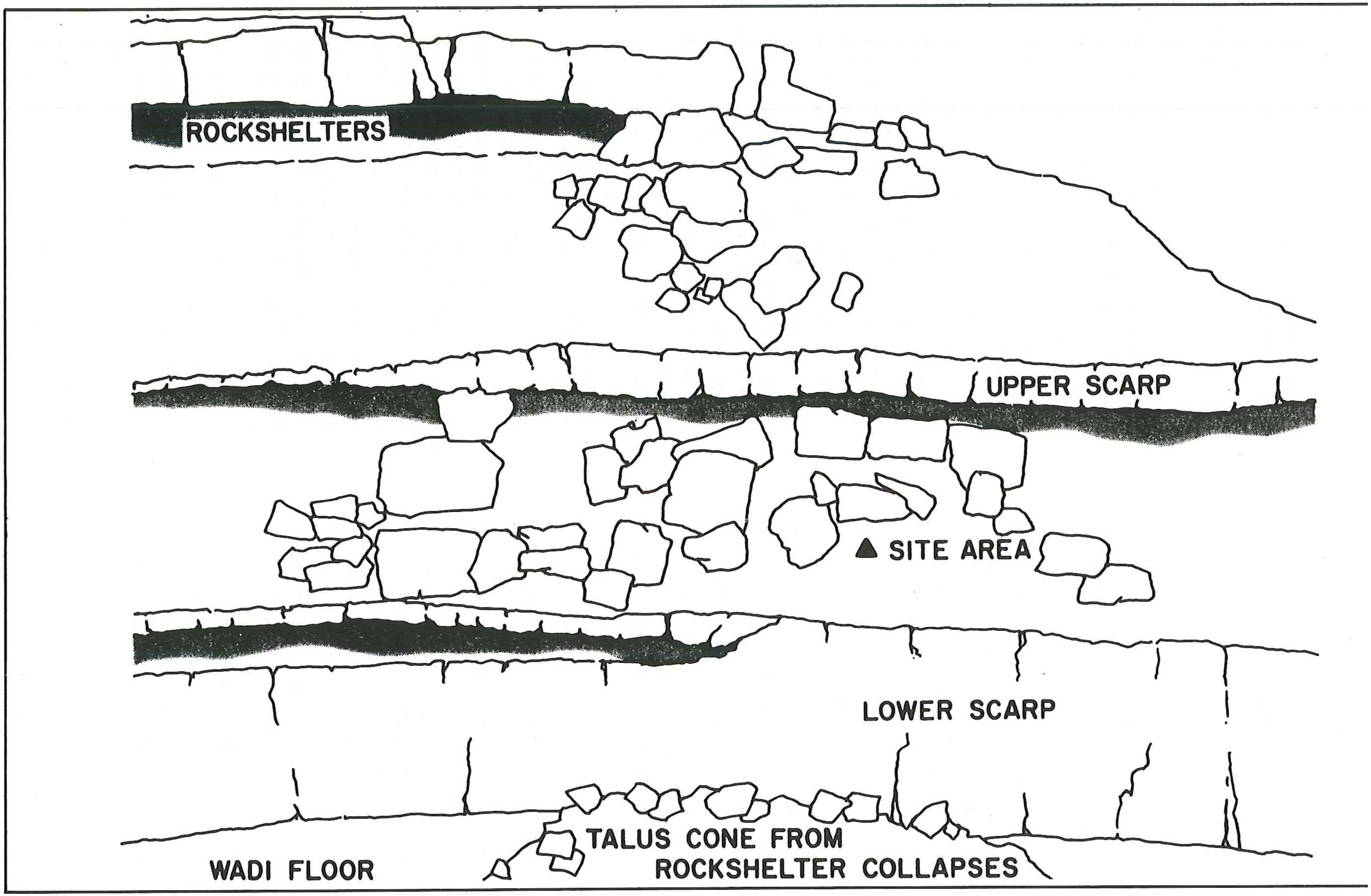

Fig. 9: WHS Site 784X. Sketch map of the site location, showing the rocky erosional spur in which the rockshelter formed and the approximate location of the collapsed rockshelter. The triangle marks the site datum. Not to scale (the largest rocks shown are about 6 m across).

TABLE 19
SITE 784X: TENTATIVE CORRELATION
OF NATURAL AND ARTIFICIAL STRATIGRAPHIES (TEST A)

Natural	Sediments	Arbitrary
1	brown calcreted clay light grey clay	1
2	tan colluvium; laminated tan silt/sand mixed	1a, 2
3	grey/brown gravelly sandy/silt	*3,4
4	light grey clay	2a, 5-8

* S part of unit only

TABLE 20
SITE 784X: DEBITAGE AND CORE FREQUENCIES

Type Group	Type	Surface N	Surface %	Surface % TG	Excavation N	Excavation %	Excavation % TG
Blades (>3cm):							
	blade 1DC	2	0.4		2	0.0	
	blade 2 DC	9	2.2		128	2.5	
	blade 1st	18	4.4		165	3.2	
	blade 2nd	10	2.5	9.5	290	5.6	11.3
Bladelets (<3cm):		29		7.2	435		8.4
Flakes:							
	flake 1DC	1	0.2		7	0.1	
	flake 2DC	16	4.0		144	2.8	
	flake plain	85	21.2		638	12.3	
	flake trim (<1cm)	68	16.9	42.3	1171	22.7	37.9
Shatter:		139		34.7	2103		40.7
Core Renewal Elements:							
	CR, unspecified	4		1.0	19		0.4
Burin Spalls:		2		0.4	25		0.5
Levallois Elements:							
	point	1		0.2			0.0
Nuclei:							
	disk core, partial				1		
	sing. plat. blade				2		
	sing. plat. bldt.	2			2		
	sing. plat. flake	1			2		
	sing. plat. mixed				1		
	mult. plat. bldt.				1		
	mult. plat. flake				2		
	mult. plat. mixed	2			4		
	core frag. unid.	11		3.7	22		0.7
Naturally Backed Pieces:							
	blade	1		0.2			
Total:		401		99.2	5164		99.9

TABLE 21
SITE 784X: RETOUCHED TOOL FREQUENCIES

Type Group	Type	Surface N	Surface %	Surface % TG	Excavation N	Excavation %	Excavation % TG
Endscrapers:							
	ES, simple	2	6.9		4	3.4	
	ES, flake	1	3.5		3	2.5	
	ES, atypical				3	2.5	
	ES, circular				1	0.8	
	ES, thumbnail				1	0.8	
	ES, ret. blade	1	3.5		1	0.8	
	ES, Aur. blade	1	3.5				
	ES, car. atyp.				2	1.7	
	ES, thk. nosed				2	1.7	
	ES/BU			17.4	1	0.8	15.2
Burins:							
	BU, on break				2	1.7	
	BU, dejete dih.				1	0.8	
	BU, lat. prep.				1	0.8	
	BU, mult. dih.				1	0.8	
	BU, mult. mixed				2	1.7	
	BU, various			0.0	2	1.7	7.6
Retouched Bladelets (<3cm):							
	bldt. backed	1	3.5		14	11.9	
	bldt. bkd. part.	1	3.5		5	4.2	
	bldt. bkd. dbl.				2	1.7	
	bldt. bkd. trunc.				4	3.4	
	bldt. fine ret.	1	3.5		15	12.7	
	bldt. quad.				1	0.8	
	bldt. micrograv.				3	2.5	
	bldt. ret. var.			10.5	4	3.4	40.7
Continuously Retouched Pieces (Flakes) and Blades:							
	CRB 1 edge	1	3.5		10	8.5	
	CRB 2 edges	2	6.9		2	1.7	
	CRP 1 edge	2	6.9		5	4.2	
	CRP 2 edges			17.3	1	0.8	15.2
Denticulates and Notches:							
	denticulate	4	13.8		4	3.4	
	notched blade	1	3.5		5	4.2	
	notch, Clact.	1	3.5				
	notched flake	1	3.5	24.3	7	5.9	13.6
Retouched Blades (>3cm):							
	blade backed	1	3.5		2	1.7	
	blade trunc.				1	0.8	
	bld. ret. var.	1	3.5	7.0			2.5
Retouched Flakes:							
	flake backed				1	0.8	
	flk. bkd. part.				1	0.8	
	flk. ret. var.	1	3.5	3.5			1.7
Perforators and Becs:							
	bec	2	6.9		1	0.8	
	PF, simple			6.9	1	0.8	1.7
Truncated Elements:							
	trunc. blade	2	6.9	6.9			0.0
Various Flake Tools:							
	sidescraper	2	6.9	6.9	2	1.7	1.7
Total:		29	100.7	100.7	118	99.9	99.9

TABLE 22
SITE 784X: FAUNA

Species/				Test A							Test B				
Body Part	Surf.	A3	A4	A5	A6	A7	A8	B1	B2	B2a	B3	B4	B5	B6	B8
Bos primigenius															
phalange 1					1(1)										
phalange 3					1(1)										
sesamoid									1(1)						
astragalus												1(1)			
Equus hydruntinus															
mandibular tooth						2(1)									
Equus sp. indet.															
scapula							3(1)								
femur												1(1)			
tibia						1(1)	1(1)								
metapodial/med.					1(1)										
phalange 1					2(1)		1(1)								
navicular						1(1)	1(1)								
cuneif./lat.+mid.							1(1)								
mandibular tooth			1(1)												
maxillary tooth						1(1)									
tooth frag.indet.		1(1)		2(1)		2(1)								1(1)	
Large Herbivore (Equus/Bos sized)															
humerus											1(1)				
Ovicaprid gen. indet.															
mandibular tooth						1(1)									
Medium Herbivore (ovicaprid sized)															
ulna											1(1)				
Gazella subgutturosa															
horn core							1(1)								
Gazella sp. indet.															
scapula									1(1)						
humerus							1(1)		1(1)					1(1)	
radius						1(1)	2(1)		2(1)			1(1)		1(1)	
ulna											1(1)				
pelvis					2(1)										
femur						2(1)	1(1)		2(1)		2(1)				
tibia							2(1)	1(1)			2(1)	1(1)	1(1)	1(1)	
malleolus											1(1)				
metacarpal	1(1)			3(1)		1(1)	2(1)							1(1)	
metatarsal				3(1)		2(1)	3(1)		2(1)						
metapodial			1(1)	2(1)	1(1)	2(1)	2(1)		5(1)		3(1)	3(1)		1(1)	
phalange 1			1(1)	1(1)		1(1)									
phalange 2					1(1)	1(1)									
astragalus					1(1)	1(1)	1(1)								
calcaneus					1(1)	2(1)									
cuneif./lat.+mid.											1(1)				
carpal or tarsal												1(1)			
mandibular tooth											1(1)	4(2)			
mandibular bone											4(1)	7(1)			
maxillary tooth					1(1)	1(1)									
horn core												1(1)			
Testudo sp. indet.															
humerus						1(1)	1(1)								
long bone frag.							1(1)								
scute						11(1)	1(1)	7(1)		1(1)					
Avifauna															
unidentified bone					1(1)										
Shark Teeth															
fossil (?)	1(1)														1(1)
Miscellaneous															
microfauna					2(?)	1(1)									

be noted that the Kebaran has a rather strongly marked lowland, coastal distribution (Bar-Yosef 1981, Henry 1983). Site 784X lies at an elevation of *ca.* 805 m. If, in normative classificatory terms, 784X is indeed a 'Kebaran' site, it is the oldest, highest, most southerly, most inland Kebaran site known to date.

Faunal Remains

Conditions of faunal preservation at 784X are the best of any of the sites tested (Table 22). One hundred sixty identifiable elements were recovered representing at least seven ungulate species, tortoise, birds and microfauna. The fauna is dominated by the remains of gazelle (*Gazella* spp. — 63.1%), of which one horn core pertains to *Gazella subgutturosa* (Harrison 1968). This is a species found in the Syrian steppe and subdesert until the latter half of the 19th century. Equid remains account for 14.4%. Two teeth of *Equus hydruntinus* have been identified — a species of 'zebra' that became extinct in the Tardiglacial. *Bos* sp. indet. limb extremities account for 2.5% of the bone count (although, if they were objects of human predation, certainly provided much more meat than any of the other species). Twenty-three carapace scutes of a tortoise (*Testudo* spp.) were also recovered (Garrard & Montague 1985). Many Jordanian Pleistocene sites have produced these remains, and it has been suggested that the carapaces might have been used as containers (Garrard pers. comm.).

The high proportions of equids and gazelle indicate a relatively xeric steppe/subdesert environment, with grassland plateaux and a few scattered trees overlooking the valley of el-Ḥasa, which must have contained either a perennial stream or an arm of the lake. Certainly the protected valley walls would have been more heavily vegetated than the surrounding plateaux, and in either case would have been characterized by relatively dense gallery forests. The remains of aurochsen point to open woodland patches in the site vicinity. The pollen has not been analyzed yet.

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EPIPALEOLITHIC SITES

by
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WHS SITE 1065

Site 1065 consists of one or several superimposed Epipaleolithic basecamps with structures (hearths, pits, fragments of walls) and midden deposits situated on a small tributary drainage of el-Ḥasa on the northwest shore of the former lake. The site is associated with a collapsed rockshelter (now devoid of sediments) and covers about 812 m^2. Cultural deposits extended to a maximum depth of 1.6 m, although on average were about 1 m thick and concentrated near the top of a moderately steep colluvial slope. The lower two-thirds of the site, while covered by a thick (*ca.* 20 cm) mantle of artifacts derived from upslope, does not contain *in situ* cultural material in the area tested. A schematic geological section is given in Clark (1984:243).

Surface Collection

Core and Debitage Characteristics

A 95% sample of the surface array was collected in the main portion of the site, which was subsequently sectioned by a 44 m trench (Fig. 10). The surface collection produced 63818 stone artifacts, of which 58518 (92%) consisted of debitage and cores (Table 23). The debitage component is characterised by almost equal numbers of blades (+ bladelets) (29.7%) and

TABLE 23
SITE 1065: SURFACE - DEBITAGE AND CORE FREQUENCIES

Type Group	Type	N	%	% ST	% TG
Blades (>3cm):					
	blade 1DC	107	0.2		
	blade 2DC	2512	4.3		
	blade 1st	4128	7.1		
	blade 2nd	5643	9.6	21.2	
Bladelets (<3cm):		4997	8.5	8.5	29.7
Flakes:					
	flake 1DC	226	0.4		
	flake 2DC	3208	5.5		
	flake plain	9674	16.5		
	flake trim (<1cm)	4877	8.3		30.7
Shatter:		20022	34.2		34.2
Core Renewal Elements:					
	CR, edge flake/blade	1	0.0		
	CR, platform tablet	10	0.0		
	crested blade	39	0.1		
	CR, unspecified	715	1.2		1.3
Burin Spalls:		377	0.6		0.6
Levallois Elements:					
	core, blade	1	0.0		
	flake	2	0.0		
	point	1	0.0		0.0
Nuclei:					
	disk core	1	0.0		
	disk core, partial	24	0.0		
	globular core	7	0.0	0.0	
	sing. plat. blade	75	0.1		
	sing. plat. bldt.	204	0.3		
	sing. plat. flake	95	0.2		
	sing. plat. mixed	88	0.2	0.8	
	mult. plat. blade	40	0.1		
	mult. plat. bldt.	65	0.1		
	mult. plat. flake	124	0.2		
	mult. plat. mixed	210	0.4	0.7	
	core frag. unid.	902	1.5	1.5	3.0
Microburin:		4	0.0		0.0
Naturally Backed Pieces:					
	blade	105	0.2		
	flake	34	0.1		0.3
Total:		58518	100.0		100.0

flakes (30.7%), a balance reflected in the core sample (3%). Unretouched bladelets account for 8.5% of the debitage total, and there are 269 single and multiple platform bladelet cores (as well as many more mixed cores from which at least some bladelets were detached). Primary elements (pieces with cortex) and core renewal flakes make up a significant 11.7% of the collection, indicating a substantial amount of *in situ* primary reduction. There were over 20000 pieces of shatter (34.2%), also usually indicative of a lot of primary reduction (although in the case of surface scatters that have baked and cooled for millennia in the desert environments of the Near East, the incidence of shatter is likely to be inflated). Only four microburins were recovered (or recognized) in the surface collection. Microburins are byproducts of (geometric) microlith manufacture resultant from the notching and subsequent snapping of a bladelet, producing a distinctive fracture pattern and scar (Bar-Yosef 1970). The production of geometric microliths by the microburin technique is most often associated with the early Natufian period (12500-11000 BP), but has been shown to occur earlier as well (Bar-Yosef 1970, Marks & Simmons 1977, Henry 1974). The fact that they are so rare in the 1065 surface array argues strongly that the site predates the Natufian period (see below).

Retouched Pieces

No less than 5300 retouched pieces were recovered in the surface collection, constituting an unusually-high 8% of the assemblage (Table 24). In and of itself, the high incidence and variety of retouched pieces suggests a basecamp situation — a concentrated locus of human actvity at which a variety of tasks were carried out by all segments of the social entity responsible for the 'site'. The retouched pieces are also quite diverse; 80 of the 92 Bordesian types are represented, and there are about a dozen additional categories not recognized in a Bordesian typology. The ratio of debitage to tools (*ca.* 20:1 as a global average for the Upper Paleolithic) is a very low 11:1 at Site 1065, more evidence in support of a basecamp locus.

When the various tool group indices are considered, we see that endscrapers are somewhat more common than burins (6.9%, 5.0%), and that there are very few carinate endscraper types (0.6%). Break burins are the most common burin category (1.6%), followed by truncation burins (1.3%). There is a substantial number and quite a diversity of multiple burins. The casually-produced, readily discarded and always numerous CRPs and CRBs account for 33.5% of the surface array. Notches and denticulates, which are also 'expedient' tools, add another 21.1%. Truncated elements make up an unusually-high 15.6% of the retouched tools, which is surprising in light of the relative scarcity of truncation burins. Most of the truncated elements are on blades. Most of the retouched pieces in general are made on lamellar blanks.

The defining characteristic of an Epipaleolithic assemblage is usually taken to be a high incidence of microliths (Bar-Yosef 1984, Henry 1983). The 1065 surface collection produced 417 (7.8%) retouched bladelets, including 80 lunates (1.5%) and a few other geometrics. Microliths are probably underrepresented in the surface collection since the site is located on a slope and small, light, easily transported artifacts would have tended to have been washed away (microliths are somewhat more common in the excavated sample). There are a few fragments of heavy duty ground stone tools (querns, hammerstones).

Different stages in the Levantine Epipaleolithic are supposedly characterized by, among other things, different kinds of microliths. Thus, the Kebaran (*ca.* 19000-14500 BP) typically has lots of backed bladelets and no or few geometrics, the Geometric Kebaran A (*ca.* 14500-12000 BP) substantial numbers of triangles, trapezes and rectangles, and the Natufian (*ca.* 12000-10200 BP) many lunates (Henry 1983, Bar-Yosef 1981). In terms of a normative culture/stratigraphic unit designation, based solely on the characteristics of the surface collection, Site 1065 is

TABLE 24
SITE 1065: SURFACE - RETOUCHED TOOL FREQUENCIES

Type Group	Type	N	%	% ST	% TG
Endscrapers:					
	ES simple	146	2.8		
	ES flake	37	0.7		
	ES atypical	41	0.8		
	ES circular	2	0.0		
	ES fan shaped	5	0.1		
	ES ogival	1	0.0		
	ES ret. blade	60	1.1		
	ES Aur. blade	7	0.1		
	ES dbl. flat	6	0.1		
	ES flat nosed	4	0.1		
	ES carinate	11	0.2		
	ES car. atyp.	10	0.2		
	ES microcar.	1	0.0		
	ES rabot	3	0.1		
	ES thk. nosed	4	0.1	0.6	
	ES/BU	15	0.3		
	ES/trunc. pce.	4	0.1	0.4	
	ES various	3	0.1		6.9
Burins:					
	BU on break	84	1.6		
	BU angle dih.	16	0.3		
	BU dejete dih.	13	0.2		
	BU st. dih.	4	0.1	0.6	
	BU conc. trunc.	11	0.2		
	BU lat. prep.	7	0.1		
	BU truncation	3	0.1		
	BU st. trunc.	39	0.7		
	BU conv. trunc.	9	0.2	1.3	
	BU nucleiform	4	0.1		
	BU plan	1	0.0		
	BU/PF	1	0.0		
	BU mult. dih.	18	0.3		
	BU mult. break	5	0.1		
	BU mult. mixed	20	0.4		
	BU mult. trunc.	13	0.2	1.0	
	BU various	20	0.4		5.0
Retouched Bladelets (<3cm):					
	bldt. backed	150	2.8		
	bldt. bkd. part.	29	0.5		
	bldt. bitrunc.	25	0.5		
	bldt. bkd. trunc.	44	0.8		
	bldt. fine ret.	30	0.6		
	bldt. Helwan ret.	3	0.1		
	bldt. quad.	4	0.1		
	bldt. trunc.	38	0.7		
	bldt. ret. var.	12	0.2		6.3
Continuously Retouched Pieces and Blades:					
	CRB 1 edge	789	14.9		
	CRB 2 edges	314	5.9		
	CRP 1 edge	535	10.1		
	CRP 2 edges	137	2.6		33.5

Type Group	Type	N	%	% ST	% TG
Denticulates and Notches:					
	denticulate	173	3.3		
	notched blade	539	10.2		
	notch, Clact.	11	0.2		
	notched flake	385	7.3		
	notch/denticulate	4	0.1		21.1
Retouched Blades (>3cm):					
	sickle bld. seg.	1	0.0		
	Aurignacian bld.	6	0.1		
	blade backed	63	1.2		
	bld. bkd. part.	11	0.2		
	bld. bkd. dbl.	6	0.1		
	bld. ret. var.	7	0.1		1.7
Retouched Flakes:					
	flake backed	18	0.3		
	flake bkd. dbl.	1	0.0		
	flake bkd. part.	5	0.1		
	flake, ret. var.	4	0.1		0.5
Perforators and Becs:					
	alt. bur. bec	6	0.1		
	bec	124	2.3		
	PF simple	152	2.9		
	PF multiple	3	0.1		
	PF various	31	0.5		5.9
Tanged Elements:					
	arrowhead	4	0.1		
	tanged point	2	0.0		
	tanged blade	4	0.1		0.2
Truncated Elements:					
	trunc. blade	641	12.1		
	trunc. flake	150	2.8		
	trunc. piece	39	0.7		15.6
Lunates:					
	lunates	80	1.5		
	other geometr.	2	0.0		1.5
Various Flake Tools:					
	piece esquillee	2	0.0		
	raclette	8	0.2		
	sidescraper	24	0.5		
	biface frag.	2	0.0		
	knife	3	0.1		
	other	25	0.4		1.2
Heavy Duty Tools:					
	flake adze	6	0.1		
	grindstone frag.	3	0.1		
	hammerstone	7	0.1		
	pick	7	0.1		0.4
Total:		5297	99.6		99.6

mainly a Kebaran site. The fact that there are some lunates might indicate the presence of a Geometric Kebaran and/or a Natufian component (but see below).

Test Excavations

The site was tested by a massive 44 m trench excavated in eight 5 x 1 m steps (and a ninth 4 x 1 m step). These steps were labeled A-I (Fig. 10). The trench passed through the approximate centre of the surface concentration, exposing the deepest midden deposits, and extended downslope where it intersected the contact between the lacustrine marls and the colluvial debris weathering off the land surfaces above the site. Steps were excavated in levels conforming to the natural stratigraphy and slope. Where complex stratigraphy was evident (Steps A, B and C), excavation levels were kept to a maximum depth of 10 cm. If a natural layer was greater than 10 cm thick, it was excavated in more than one level. All the excavated material was screened through 2 mm mesh, allowing the recovery of small lithic and faunal elements.

Stratigraphy (Steps B, C)

The best stratigraphic sequence was exposed in Steps B and C (Fig. 11). The stratigraphy exhibits a number of possible depositional phases, only some of which are likely to be directly associated with human occupation. the lowest compact light brown layer is found in both steps (Lev. 5 in B., 7 in C). It contains several hearth remnants as well as high artifact densities that decrease rapidly in the lower excavation levels. A cobble veneer in Step B, and truncated features in Step C suggest that the top of the layer was an erosional surface for some time prior to the deposition of overlying strata. A second phase of deposition is represented by grey, midden-like deposits in the upper layers of Step B (Levs. 2, 3), overlying a mixed deposit (Lev. 4). Interestingly, these sediments are most organic (i.e., grey) in the north section of the step, becoming browner (and with lower artifact counts) to the south. A cobble layer at the base of Level 3 may be indicative of another erosional surface. The upper Step C stratigraphy does not conform to that of Step B. A tentative depositional sequence correlating deposits in the two steps is given in Table 25. Color changes, changes in texture and in degree of consolidation, lithic density and feature locations suggest that occupation loci moved up and down the slope. Actual occupation loci seem to be represented by Phases B and E, while Phases C and D may be midden and trash deposits associated with these loci.

Core and Debitage Characteristics

Almost 63000 stone tools and pieces of debitage were recovered from Steps B and C alone; the total excavated sample exceeds 100000 pieces. Conclusions about the excavated sample are tentative and are based on a discussion of Steps B and C since the other excavated units are still being analyzed (see Donaldson 1986, Donaldson & Clark 1986, for more detailed reviews of the stratigraphy and the excavated lithic sample).

The debitage component is summarized in Table 26. Although specific raw material sources have not been identified yet in the Wadi el-Ḥasa area, flint cobbles of high quality are quite abundant in the present wadi bed and on its slopes. The relative abundance of local materials does not appear to have encouraged initial core reduction on the site. The low occurrence of initial reduction stages is indicated by the low frequency of primary elements (90-100% cortex) which make up less than 1% of recovered debitage in all layers, and the relatively low proportion of all cortical flakes (6.4%). Relatively low proportions of core trimming flakes and cores also support the notion that on-site core reduction was not a primary activity, at least in the areas tested.

The nearly-equal numbers of flakes and blades seen in the surface collection are replicated in the excavated sample (24.0%, 24.9%; mean ratio 1:0.94), although flakes are more common in Levs. B2 and B4, and in most levels of Step C, and much more common in Levs. C3 and

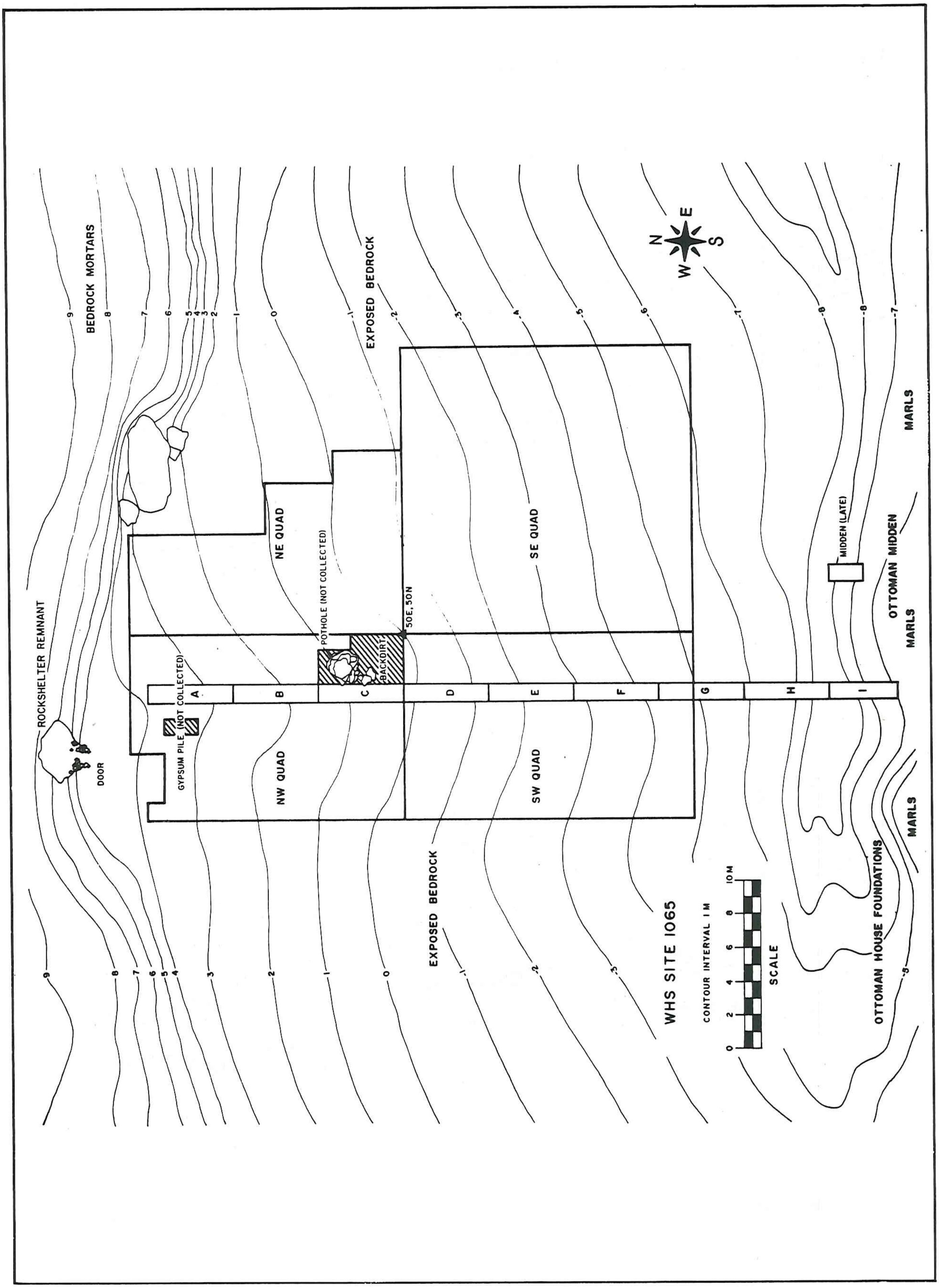

Fig. 10: WHS Site 1065. Plan of the site surface showing the general topography and the locations of Steps A-I.

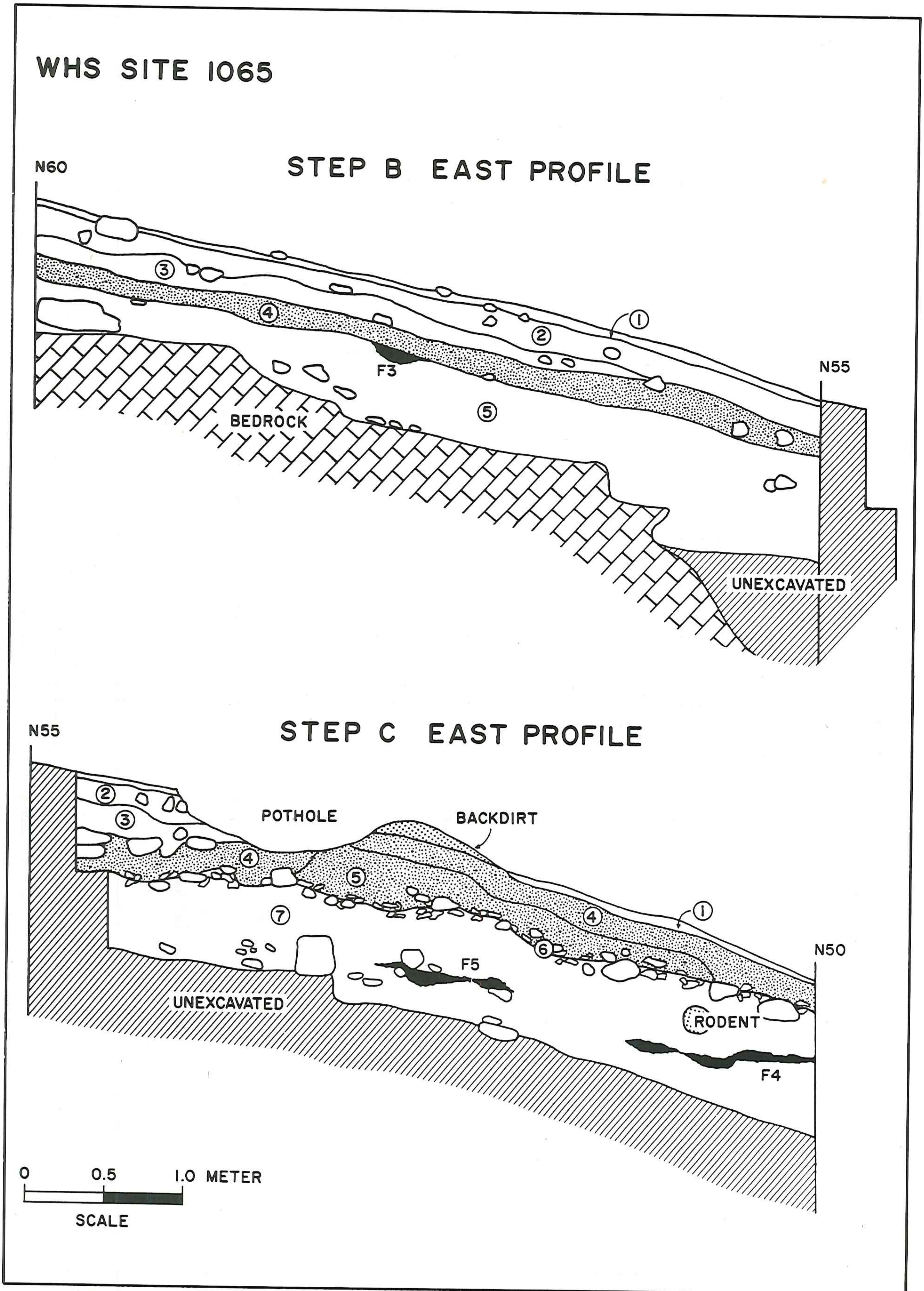

Fig. 11: WHS Site 1065. Tentative stratigraphy of Steps B and C (east profiles).

TABLE 25
SITE 1065: TENTATIVE CORRELATION
OF NATURAL AND ARTIFICIAL STRATIGRAPHIES (STEPS B,C)

Step B		Sediments	Step C	
Natural	Arbitrary		Natural	Arbitrary
1	1,1a,2	mixed surface deposits	1	1
		grey ashy intrusive	2	2
		grey intrusive	3	2
2	2,2a,4	grey midden		?4
3	2a,4	grey calcreted midden		
4	5-8	grey/brown to brown	4	3-7
		silt/sand	5	8-10
5	9-14	compact light tan silt	7	11-15

C4. Level 1 in Step B has significantly more blades, as do Levs. C5 and C7. In the remaining levels flakes and blades are in proportional equilibrium. Blades show a slight tendencey to dominate in the lowest levels of both units, perhaps indicating a heavier emphasis on blade production in the earliest occupation levels.

Shatter is even more common in the excavated sample than on the site surface (42.9% vs 34.2%). The high amount of shatter in relation to debitage in the surface layers probably reflects the exposure of these deposits to chemical and (esp.) physical weathering and other forms of erosion and disturbance. Although marked by a good deal of variability, the shatter:debitage ratios are greater than one for all of the underlying levels except C4 (0.76) which might indicate that it, too, was exposed to the elements for a long period of time.

Cores are rare in the excavated sample (0.7%) as are core trimming elements (0.5%). This could mean that primary reduction and the production of blanks was not especially important at 1065 (or at least was not emphasized in the area excavated). Core:debitage ratios indicate a relative emphasis on knapping in B1, C3, C5a and especially in C4 and C5. Exceptionally low core:debitage ratios characterize B2-4 and C2.

Retouched Pieces

The test units produced nearly 3000 retouched pieces although most categories except for microliths were relatively rare. The high incidence of microliths is probably directly related to the fact that all excavated sediments were screened. Work in western Europe on Upper Paleolithic sites has shown that recovery techniques are probably *the most significant* factor affecting microlithic assemblage composition (see, e.g., Clark & Straus 1983, Straus & Clark 1978). Thus the 1065 excavated sample might not be comparable to those from other Epipaleolithic sites where screening was not employed.

The retouched tool component from Steps B and C is summarized in Table 27. Tools from 1065 are overwhelmingly dominated by microliths (56.5%), especially backed bladelets (48.8%). There are substantial numbers of notches and denticulates (10.8%), truncated elements (8.3%) and a variety of retouched blades and flakes (14.8%). Endscrapers (usually made on blade blanks) and burins are generally poorly represented in all layers (3.8%, 2.4% respectively). Despite the significant number of truncated elements, truncation burins are rare (0.8%). Notches, denticulates and truncated pieces are relatively more common in the small col-

TABLE 26
SITE 1065: EXCAVATED SAMPLE (STEPS B,C ONLY) - DEBITAGE

Types/ Steps & Levels:	Step B L1	L2	L3	L4	L5	Step C L1	L2	L3	L4	L5	L5a	L7	Total	%
Cortical Flakes	9	111	76	106	330	62	83	34	109	300	315	254	1789	3.0
Cortical Blades	20	114	60	89	473	56	71	12	73	396	185	457	2006	3.4
Flakes	163	1045	361	794	2105	663	568	150	1415	2919	2426	2149	14758	24.9
Blades + Bladelets	249	704	388	686	2401	517	514	79	662	3458	1572	3020	14250	24.0
Core Trimming (all)	1	19	10	20	69	11	18	4	7	54	38	51	302	0.5
Other Debitage	6	29	20	7	54	22	18	-	7	67	22	92	344	0.6
Shatter	557	1224	484	1214	3460	1634	975	132	2989	5406	2936	4485	25496	42.9
Cores (all)	5	38	18	34	86	20	29	3	18	37	55	81	424	0.7
Total:	1010	3284	1417	2950	8892	2985	2276	414	5280	12637	7549	10589	59369	100.0
Ratios:														Mean
Core:Debitage	90	53	51	50	62	66	44	93	126	194	83	74		1:82
Core:Debit.+ Shat.	201	85	78	86	102	148	77	137	292	340	136	130		1:151
Flake:Blade	1.56	0.71	1.02	0.86	1.18	0.79	0.90	0.49	0.48	1.20	0.64	1.45		1:0.94
Shatter:Debitage	0.80	1.65	1.89	1.40	1.54	0.81	1.30	2.11	0.76	1.33	1.55	1.34		1:1.37

lections from the upper levels of Step C. CRBs are fairly common in most layers, while non-geometric microliths are always dominant in every layer. Geometric microliths reach their greatest proportional abundance in the middle levels of Step C, but without an accompanying decline in the frequency of non-geometric microliths.

Throughout the sequence simple endscrapers on blades dominate the endscraper category. In the lowest layers of Step C these were followed by atypical endscrapers and endscrapers on flakes, while endscrapers on retouched blades dominated in Lev. B2. In general endscrapers constituted a variable, but low frequency, tool type that cannot be used to characterize any of the levels.

Burins were even less numerous than endscrapers. Perhaps most interesting is the predominance of break burins in Levs. B2, B4 and C5a, as opposed to the primacy of truncation burins in C5. Multiple burins are rare in the site, and truncation burins outnumber dihedrals by about 2:1.

Perforators are generally uncommon and do not characterize any of the level assemblages. Multiple perforators are entirely absent while becs and simple perforators alternate in dominance. Perforators of all kinds are generally more common in earlier strata than in later ones.

Although the proportions of flakes and blades are nearly equal in the debitage sample, retouched blades outnumber retouched flakes by about 2:1. Similarly, truncated blades were recovered more often than truncated flakes, and notches and denticulates also occur most frequently on blade blanks. The selection of blade blanks for further modification is quite typical of most Epipaleolithic periods, and has been noted for sites in the Negev (e.g., Marks & Larson 1977) and southern Jordan (Henry 1982).

As noted above, microliths are taken to be characteristic of the Levantine Epipaleolithic, although they also occur (increasingly, it seems) in Upper Paleolithic contexts. When the 1065 excavated microliths are divided into geometric and non-geometric categories, differences in proportions between the levels are evident (Table 27). A series of X^2 tests for homogeneity were conducted for these tool types between each pair of levels in each step, and between levels in the two steps. Intuitively, the proportions of geometrics to microlith totals suggested that geometrics were relatively more common in the uppermost level of Step B, in Levs. 1, 4, 5 and 5a of Step C, and quite rare in the rest of the site (Table 28). These results were pretty much confirmed by the X^2 tests, which showed that Step B displayed internal homogeneity (except for Lev. 1) and that C7 was anomalous with respect to the other Step C levels, but similar to Step B, Levs. 2-5.

Factors other than the presence and frequency of certain microlith types also change through time, such as predominant retouch type, microlith width and lunate length (see, e.g., Henry 1982, Olszewski 1984b). A more detailed study of the 1065 microliths, based on a sample from Step C, was undertaken by Donaldson (1986), and will be reported in a future publication.

In summary, like the surface collection, the excavated lithic assemblage from 1065 displays many attributes characteristic of the Epipaleolithic. The debitage exhibits low proportions of cores, core trimming elements and primary cortical elements, a situation indicative of off-site primary reduction (Marks 1976b, Marks & Larson 1977). Tools are made largely on blade (and bladelet) blanks, although flakes constitute a substantial portion of the debitage. Endscrapers, perforators and burins are all relatively rare while truncations, notches and denticulates, and retouched blades make up larger parts of the tool component. This distribution of larger tool types is not unlike that recovered from Geometric Kebaran sites in the Negev (e.g., Marks 1976b) and south Jordan (Henry 1982). For 1065 as a whole, however, non-geometric microliths (esp. backed bladelets) comprise almost 50% of the total number of retouched pieces. Geometrics are present in all levels, but in appreciably smaller numbers. The number of microburins, the end-products of geometric microlith manufacture, is also quite low, suggesting that intentional use of this

TABLE 27
SITE 1065: EXCAVATED SAMPLE (STEPS B,C ONLY) - RETOUCHED PIECES

Type Group	Type	Step B L1	L2	L3	L4	L5	Step C L1	L2	L3	L4	L5	L5a	L7	N	Total %	% TG
Endscrapers:																
	ES simple	1	1	4	5	7	1	2	1	3	13	8	6	52	1.7	
	ES atypical		1			2	2			1	1	3	7	17	0.6	
	ES double			1							1	1	1	4	0.1	
	ES ogival					2					1			3	0.1	
	ES ret. blade		4		1	1	1	1		1	2	1	1	13	0.4	
	ES fan shaped				1	2								3	0.1	
	ES flake				1	1	1			2		5	4	14	0.5	
	ES flat nosed											1		1	0.0	
	ES carinate									1		1		2	0.0	
	ES car. atyp.						1							1	0.0	
	ES thk. nosed							3						3	0.1	3.8
Burins:																
	BU on break		5	1	4	2	1			1		4	2	20	0.7	
	BU st. dih.					2		1		1		1		5	0.2	
	BU dej. dih.					2								2	0.0	
	BU ang. dih.			2	1			1		1	2			7	0.2	
	BU conc. trunc.						1				4	2	2	9	0.3	
	BU conv. trunc.										1	2		3	0.1	
	BU st. trunc.				1	1					10	1		13	0.4	
	BU lat. prep.												1	1	0.0	
	BU nucleiform											1		1	0.0	
	BU mult. trunc.			1							3			4	0.1	
	BU mult. mixed							1						1	0.0	
	BU various			1			1				1	2	1	6	0.2	2.4
Microliths:																
	non-geometric	21	66	38	61	299	40	47	3	78	299	176	329	1457	48.8	
	geometric	4	5	1	4	14	9	6	3	21	81	52	29	229	7.7	56.5
Denticulates and Notches:																
	dent./notches	3	8	4	8	61	7	20	5	21	50	75	61	323	10.8	10.8
Retouched Flakes and Blades:																
	blades	1	16	11	15	29	2	15	4	9	46	66	66	280	9.4	
	flakes	2	7	5	5	21	2	12		9	37	28	34	162	5.4	14.8
Perforators and Becs:																
	perfs./becs		3	1	3	11	1	1	1	5	16	10	11	63	2.1	2.1
Truncated Elements:																
	trunc. elements	3	10	5	3	51	8	12	9	15	47	43	42	248	8.3	8.3
Various Retouched Pieces:																
	various		3	2	2	6	1	4	1	3	10	4	2	38	1.3	1.3
Total:		35	129	77	115	514	79	126	27	172	625	487	599	2985	99.6	100.0

technique was not a general characteristic of all geometric-microlith-bearing assemblages (see Henry 1974 for a discussion of microburin technique).

Age of the Site

Site 1065 has produced a series of five coherent radiocarbon determinations which span the interval from 15580 to 16900 BP (Table 29). While they indicate a late Kebaran (rather than a Geometric Kebaran) occupation, the presence of geometrics (and especially lunates) suggests that attempts to define the temporal boundaries between these supposedly sequent culture/stratigraphic units on the basis of lithic diagnostics might be premature.

Differences in tool proportions, especially those of microliths, initially suggested that more than one occupational phase is represented at 1065. Inspection of the stratigraphy indicated that a number of possible depositional episodes were present, not all of them necessarily associated with human occupation. Several possible changes in artifact content of the strata are also suggestive of different depositional episodes (e.g., the significant differences between geometric and non-geometric microlith proportions in C7 and its overlying strata). Although some differences between strata have in fact been demonstrated, there is a suggestion of considerable uniformity among all the layers so far as the lithics are concerned. Changes in the microlithic component and in the proportions of different microlith groups are apparent between levels, but they do not constitute the dramatic qualitative and quantitative changes supposedly exhibited by the different Epipaleolithic subdivisions (see esp. Bar-Yosef 1970, 1981; Henry 1982, 1983; Olszewski 1984b). Rather, the changes seem to be variations on a general theme with even metric attributes displaying a gradual change through time (Donaldson 1986).

The stratigraphy, combined with the lithic summary, suggests a series of relatively short-lived occupations at different loci on the site slope. Some strata exposed by test excavations represent *in situ* occupation remains (notably C7, B5); others represent mixed trash and colluvia derived from upslope. The long stratigraphic section thus reveals a rough temporal sequence, but with unknown parameters of variability with regard to site context.

Comparisons with Southern Levantine Geometric Kebaran and Natufian Sites

Although a Kebaran culture/stratigraphic unit assignment is indicated by the dates, the presence of geometric microliths in all levels suggests a series of Geometric Kebaran occupations. A comparison of selected 1065 level assemblages with those recovered from nearby Geometric Kebaran A and Natufian sites indicates greater similarity to the Geometric Kebaran, despite the presence of lunates at 1065 (Table 30). The amount of geographic, temporal and functional variability displayed within each of these major units or periods is not yet known, although the evidence from 1065 indicates considerable diffrences between the Negev and south Jordan assemblages. Not surprisingly, 1065 seems to be most similar to the late Geometric Kebaran A (Henry's late Hamran [1982]) assemblages of the south Jordan plateau, although the radiocarbon dates indicate a difference in time on the order of a not-insubstantial 2500 years.

Faunal Remains

Mammals

Site 1065 produced the widest range of faunal material of any of the sites investigated (241 identifiable elements, assignable to about a dozen species) (Table 31). There is also a molluscan fauna. The mammals are dominated by gazelle *(Gazella* spp.) (41.5% of the bone count), followed by equids (13.7%), *Bos* spp. (7.0%) and ovicaprines (3.3%). There are scattered remains of hare *(Lepus capensis)*, wolf *(Canis lupus)* and fox *(Vulpes vulpes)*, along with tortoise scutes (21.6% of the identifiable elements), ostrich shell

TABLE 28
SITE 1065: EXCAVATED SAMPLE (STEPS B,C ONLY) -
RATIO GEOMETRIC MICROLITHS TO MICROLITH TOTALS

	Step B					Step C						
	L1	L2	L3	L4	L5	L1	L2	L3	L4	L5	L5a	L7
Ratio:	0.16	0.07	0.03	0.06	0.045	0.18	0.11	0.50*	0.21	0.21	0.23	0.08

* only 6 microliths

TABLE 29
SITE 1065: RADIOCARBON DATES

Test/Level	Dates (BP)	C-13/ppm	Lab.No.
B, Lev. 7n, Feat. 3	15580 ± 250	-23.5	UA-4392
B, Lev. 8, Feat. 2	15860 ± 430	-20.8	UA-4394
C, Lev. 13, Feat. 5	16570 ± 380	-23.5	UA-4390
C, Lev. 13	16790 ± 340	-23.8	UA-4393
A, Lev. 5	16900 ± 500	-20.8	UA-4391

fragments, fish vertebrae, bird bones and crab claws (Garrard & Montague 1985). Nothing in the fauna would be out of place in a steppe environment, although scattered patches of open woodland are indicated by *Bos.*

The site contains a high proportion of teeth and limb extremities, which is partly due at least to preservational factors (carpals, tarsals, metapodia and phalanges are the most compact, durable bones). The body part inventory might also reflect butchering practices. Frequently in skinning an animal the limb extremites are discarded or left with the skin, since they have little nutritional value either as meat or marrow. Being compact, they might also have been utilized for industrial purposes (Garrard & Montague 1985).

Marine Gastropods — Implications for Exchange

Of the sites tested, only 1065 produced a small collection of marine shell (Table 32). These are all gastropods, and are referable to six species. They appear to have been used exclusively for ornamentation. *Conus* is found both in the Mediterranean and the Red Sea. *Arcularia* and *Columbella* are of Mediterranean origin. All others are from the Red Sea. Linear distances to the Mediterranean and the Red Sea are approximately equal (135 km, 155 km respectively). However, because of the extremely rugged topography along an E/W transect, more contact with the Red Sea would have been expected (Reese 1985). The presence of marine shell in 1065 indicates that the site participated, albeit casually and at a low level of intensity, in some kind of exchange network which made use of the natural, N/S trending topographic corridors that connect the eastern Ḥasa to the Red Sea. Some evidence of E/W exchange is also indicated by the Mediterranean species. The presence of marine shell so far inland is somewhat surprising given the age of the site.

Pollen

There is an abundant pollen sample from Steps B, C and H at 1065, although it has only been partially analyzed. All samples show substantial Chenopodia frequencies (40-50%), with Compositae ranging from 8% to 18%. Cattail *(Typha)* pollen shows up in two of the samples, indicating

TABLE 30
A COMPARISON OF TWO 1065 STEP C LEVEL ASSEMBLAGES WITH
THOSE FROM GEOMETRIC KEBARAN AND NATUFIAN SITES IN THE SOUTHERN LEVANT

Tool Groups	1065		Geometric Kebaran				Natufian		
			Negev(1)	S Jordan(2)		Negev(3)		S Jordan (2,4)	
	C7	C5	D5	J201	J202	Horesha	R.Zin	Juyadid	406
Endscrapers	3.0	3.0	10.6	3.5	5.4	2.7	7.3	1.9	2.0
Burins	1.0	3.5	1.2	0.2	1.4	12.3	10.3	0.7	-
Perforators	1.8	2.6	2.2	-	2.0	1.5	1.9	1.9	6.1
Retouched Pieces	16.7	13.7	4.3	12.6	14.8	13.7	6.7	11.7	4.1
Truncated Pieces	7.2	7.8	14.6	1.2	0.4	7.7	8.0	3.3	6.1
Notches/Denticulates	10.2	8.3	11.7	5.6	6.8	16.3	14.9	15.6	18.3
Non-Geometric Microliths	54.9	46.1	20.5	59.6	56.6	9.6	8.5	3.9	14.3
Geometric Microliths	4.8	13.4	38.2	8.9	12.3	30.3	27.0	62.3	48.9
Total Number Pieces	599	605	1044	428	203	3173	1225	154	49

(1) Marks 1976, (2) Henry 1982, (3) Marks & Larson 1977, (4) Henry 1976

TABLE 31
SITE 1065: MAMMALIAN AND OTHER FAUNAL REMAINS

Species/	Step A		Step B																Step C										Midden		
Body Part	1b	5	2a	3	4	5	6	7	7n	8	9	9s	10n	10s	11n	11s	12	13	1	6	7	8n	8s	9n	10	11	12s	13n	13s	1	2	3
Bos primigenius		1(1)																														
calcaneus		15(1)																														
tooth frag.																	1(1)															
Equus sp. indet.																																
radius						1(1)															1(1)											
femur																															1(1)	1(1)
metapod./med.																																1(1)
phalange 2		1(1)							1(1)		1(1)	1(1)				1(1)						2(1)										
phalange 3								1(1)	1(1)												1(1)											
sesamoid						1(1)																										
lunate		1(1)																1(1)														
cuneiform								1(1)				1(1)																				
magnum						1(1)																										
astragalus							1(1)								1(1)																	
cuneif./lat.mid.																																
tarsal or carpal		1(1)				1(1)																										
maxillary tooth		1(1)																														
tooth frag.	7(1)																															
Large Herbivore (Equus/Bos sized)																																
humerus																					1(1)											
metapodial																					1(1)											
Ovicaprid gen. indet.																																
pelvis																															1(1)	
phalange 1																														1(1)		
phalange 3																																1(1)
mandibular tooth																															1(1)	
maxillary tooth																															3(1)	
scapula																														1(1)		
Medium Herbivore (ovicaprid sized)																																
pelvis																						1(1)										1(1)
Gazella sp. indet.																																
scapula						1(1)																										
humerus		1(1)		1(1)																												
radius						1(1)			1(1)																					1(1)		
pelvis									1(1)																							
femur								1(1)																								
tibia					1(1)	1(1)																										
patella											1(1)																					
metacarpal		1(1)						2(1)	1(1)						1(1)	2(1)	1(1)															
metatarsal		1(1)		2(1)					3(1)		1(1)				1(1)													1(1)		1(1)		
metapodial		1(1)				6(1)		6(2)		1(1)	2(1)																					
phalange 1		2(1)				2(1)			1(1)		2(1)		1(1)			1(1)																
phalange 2					2(1)			2(1)	1(1)				2(1)			1(1)			1(1)						1(1)							
phalange 3				3(1)	1(1)	1(1)					2(1)	2(1)																				
sesamoid			1(1)	1(1)		1(1)																										
scaphoid									1(1)																							
lunate		1(1)				1(1)																										
cuneiform						1(1)																										
central				1(1)																												
magnum								1(1)																								
unciform											1(1)																					
astragalus						1(1)		1(1)	2(2)	1(1)	1(1)	1(1)																				
calcaneus		1(1)				1(1)			1(1)																							
cuneif./med.				1(1)																												
naviculo-cuboid									1(1)																1(1)							
cuneif./lat.+mid.		1(1)																														
carpal or tarsal						1(1)																										
mandibular bone																1(1)																
tooth frag.												1(1)																				
Small Herbivore (gazelle sized)																																
metapodial																							1(1)									
mandibular tooth															2(1)		1(1)													1(1)		
mandibular bone													1(1)																			
Lepus capensis																																
radius				1(1)																												
metapodial															1(1)																	
Canis lupus																																
phalange 1						1(1)																										
phalange 2																				1(1)												
Vulpes sp. indet.																																
calcaneus												1(1)																				
atlas																															1(1)	
Testudo sp. indet.																																
humerus											1(1)																					
long bone frag.																	1(1)															
scute						7(1)		2(1)	1(1)		1(1)		7(1)	2(1)		1(1)	2(1)	1(1)				4(1)	1(1)	1(1)	3(1)	15(1)	1(1)		1(1)			
Avifauna																																
unid. bone													1(1)							1(1)										3(?)		
ostrich shell																														2(?)		1(1)
Teleostomi (boney fishes)																																
unid. vertebra																														1(1)		
Crustacea																																
crab claw																														1(1)		
Miscellaneous																																
microfauna		1(1)											1(1)							1(1)					1(1)					1(1)		2(?)

TABLE 32
SITE 1065: MARINE GASTROPODS

Genus	Surf.	Step A	Step C						Step E	
		2	1	6	7	8s	11	12	1b	3
Strombus	1									
Conus		1								
Mitra				2	1			2	1	1
Arcularia					1			1		
Nerita							1			
Columbella	1									
Genus indet.			1			3	1			

a marshy lakeshore environment. In contrast to nearby (but older) Site 618, there are some arboreal species *(Salix, Quercus, Alnus)*. These are all forms indicative of the relatively humid conditions typical of Mediterranean phytogeographic associations. Willow *(Salix)* and alder *(Alnus)* are riparian genera. These observations indicate a substantially wetter paleoenvironment than that of 618, and one with more tree cover (Fish 1985).

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GEOARCHAEOLOGICAL OBSERVATIONS

by
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To this point, sedimentological descriptions have characterized the general colors and textures of the archaeological deposits at sites 618 (Table 17), 784X (Table 19), and 1065 (Table 25). Currently, detailed laboratory analyses are being evaluated on soils and sediments from these sites to identify the types of natural and cultural processes responsible for site sedimentation. The tests that have been run include total granulometry, organic matter, calcium carbonate contents, pH, and quantitative presence of key depositional and weathering elements Fe, Mn, P, K, Ca and Mg.

Perspectives on the Prehistoric Landscape

Preliminary results suggest that the occupations identified in the el-Ḥasa project area are intimately related to shifting margins of the lake and the attendant base level changes registered by tributary fills and surfaces. In general, the tributaries contain wadi flows that monitored rising and falling lake levels. This is especially evident at site 1065 where a series of alternating blocky marl and laminar fluvial facies are interdigitated in the composite aggregational sequence. The range of occupations investigated for the six sites under consideration (see Tables 29, 33) spans the time frame 70,000 to at least 16,000 BP and perhaps as late as 12,000 BP if a Natufian component can be isolated at 1065. This interval coincides with the proposed duration of the Lisan Lake in the Jordan Rift Valley, with a terminus of 16,000 BP (Begin et al. 1974, Neev & Emergy 1967) and residual pockets enduring for another 4000 years (Schuldenrein 1983, Schuldenrein & Goldberg 1981).

Site-Landform Correlations

While it is premature to postulate defacto correspondence between the Jordan Valley and el-Ḥasa sequences, the synchronous and parallel basin histories are striking. Given the generic affinities of the two systems, both bridged by common structural and climatic networks, it may be possible to generate more regional geomorphic and paleoclimatic reconstructions for the central Levant. As a first step in this process, the regional perspective enables us to reassess the initial el-Ḥasa sequence advanced over 20 years ago (Vita-Finzi 1964, 1966) and modified later (Copeland & Vita-Finzi 1978).

Vita-Finzi's earliest model for Jordan Rift Valley wadis proposed a two-cycle pattern of stream alluviation and downcutting following the disappearance of the Late Pleistocene (Lisan) Lake; terminal upper terrace aggradation dated to Upper Paleolithic times while lower terraces were built up well into the Roman period. At el-Ḥasa, the sequences were more intricate and descriptions were given for three terrace levels and four discrete fills. The uppermost terrace (Fill I) is recognized as "... 10 to 15 m high, strikingly white when seen from a distance ... (it) consists mainly of fine, highly calcareous silt... it is zoned into greys, greens and khakis..." (Vita-Finzi 1964:29). On altimetric and sedimentological grounds this description corresponds to what we have identified as the lacustrine marl (Pl. I,1). Vita-Finzi apparently considered this terrace to be the product of stream deposition, intially dating its aggradation to Middle Paleolithic times. A revised chrono-stratigraphy places terminal formation to 18,000-16,000 BP based largely on the proliferation of Kebaran artifacts in upper strata (Copeland & Vita-Finzi 1978:23).

A second terrace (Fill II) consisting of sub-angular fine gravels mixed with silt would correspond to what our study referred to as the higher, sandy terrace into which the contemporary el-Ḥasa wadi fill was incised. With 2 m of relief, distribution of the alluvium was initially noted to be highly localized, an observation borne out by our 1984 investigations. The deposition was dated to ca. 11,000-8,000 BP. Vita-Finzi's (1964) work suggested that downcutting was modest into the terrace fills.

The third terrace (Fill III) contains well-bedded silts and sands and forms the 5 m high valley floor incised by the contemporary wadi. Artifacts suggested a basal date of 10,000 BP for the onset of aggradation, while a determination of 3950 BP was obtained for upper sediments (Vita-Finzi 1964, 1966). The third terrace is the most continuous landform across the study area. It was identified by present investigations as having aggraded in two cycles (Pl. I,2). Vita-Finzi (1966) considered this terrace and fill to be highly localized to the el-Ḥasa drainage and designated the deposition as the Ḥasa Formation. Yet a fourth fill, corresponding to the Low Terrace Roman age aggradation in Jordan, was also identified but distribution is extremely spotty and of minimal concern for the prehistoric sequences.

The previous el-Ḥasa geoarchaeological reconstructions were attempted without benefit of radiometric controls. The baseline study was a generic two-tiered terrace model of aggradation and erosion that was refined for the el-Ḥasa drainage, since its hydromorphic complexity resulted in preservation of four rather than two terraces and related fills. Continuous updating of the el-Ḥasa sequence was facilitated by correlating prehistoric assemblages with the distinct alluvial units and strata within them. The present investigations draw on yet more comprehensive archaeological collections, secure site contexts, and well-dated regional fluvio-lacustrine sequences to offer alternative interpretations for el-Ḥasa landform evolution and chronology. The principal refinements are as follows:

1- The central portion of the el-Ḥasa drainage was a lake basin well into Late Pleistocene times.

2- The upper terrace (and Fill I) defines a lake level stand and contains marls diagnostic of alkaline lacustrine sedimentation.

3- Upper Paleolithic (Ahmarian) and Epipaleolithic (Kebaran) sites are associated with fluvial terraces and/or deltas prograding into the basin during a moist climatic phase that persisted to at least 16,000 BP.

4. Wadi sedimentation along the primary el-Ḥasa axis is initially registered with the aggradation of the second terrace (and Fill II) whose dating remains uncertain.

5. The contemporary wadi trough incises the first terrace whose aggradation began in early-mid-Holocene times.

These observations have obvious ramifications for the explanation of the archaeological contexts. Initially we consider the Mousterian finds the most problematic, since there is no clear articulation of artifacts and strata in open air contexts. It may be possible to establish stratigraphic correlations between rockshelter site 634 and locus 621 if and when the latter archaeological materials are more firmly assigned to a primary surface. To date, Mousterian artifacts seem to be found in gravel bands and limnic margin deposits that may relate to early periods of lake development paralleling the expansion of the nearby Lisan basin (Schuldenrein 1983). Upper Paleolithic (Ahmarian at el-Ḥasa) finds tie in with a critical period in lake history, *ca.* 25-20,000 BP. In general, drier conditions are postulated for the inland lakes (see Begin *et al.* 1974: Fig. 11) with basins shrinking. As noted, between 20,000 and 18,000 BP there was a marked return to moister conditions with Epipaleolithic sites along the Jordan Valley occurring along terraces and high surfaces flanking lake edges. The Ahmarian and Kebaran occupations at site 618 are especially instructive in this regard, since the spring tufa here was dated to 20,300±600 BP (UA-4395). Vita-Finzi (1964) early on suggested that tufas formed shortly after the erosion of the Lisan series in the Jordan Valley. Whether or not this deposit represents a desiccation trend, with lake waters retreating and leaving the spring as a residual pond, or a shift to moister conditions and spring resurgence, is unclear. It is quite possible that the spring may have been active during the lake edge to floodplain transitional settings (i.e., between 20,000 & 15,000 BP) in which case it would have been an attractive feature for both Ahmarian and Kebaran populations. Microstratigraphic resolution, involving both isolation of the two cultural strata and identification of the oxidized and reduced spring flow sediments bracketing the tufa, should help to sort out contextual problems.

The Epipaleolithic site of 1065 appears be correlated with a tributary terrace (or fans) laid down on eroded marls. While much of the buried assemblage at 1065 is contained in a colluvial matrix, field observations of the marl beds indicated a shift from chemically precipitated calcareous sedimentation at the base to laminar and sometimes blocky bedding at the top. The resurgence of alluviation may have promoted buildup of a shallow, poorly differentiated floodplain along the tributary flanks. Certainly the presence of aquatic fauna as well as *Typha* (cattail) and arboreal pollen would suggest the presence of a marshy environment, with occupants settling on the higher tributary flanks of the rock shelter overlooking the ponds and seasonal streams. The colluvium entrained the occupational debris as it was transported downslope. Similar site contexts have been documented at Wadi Fazael in the lower Jordan Valley (Bar-Yosef *et al.* 1974, Schuldenrein 1983).

Preliminary indications are that prehistoric components spanning the internal ca. 25,000-15,000 BP, and perhaps even earlier, articulate with elevations ranging between 800 & 810 m. This is a surprisingly small increment of topographic variability for over 10,000 years of geomorphic change. Moreover, all these occupations are situated on modified surfaces of the upper terrace. Our investigations suggest that this landform is underlain by a basal complex of lacustrine marls and an upper fluvio-limnic facies produced by renewed infilling of tributary wadis. The variability in sedimentology of the upper strata underscores significant paleoenvironmental dynamism during the late Paleolithic occupations, despite the seeming absence of a major erosional event. Occupations along terraces and fans and at lake margins are postulated, but more accurate landform reconstructions await syntheses of laboratory results, map reinterpretations and regional sequences.

To date, we have only addressed the Holocene (Terrace 1, 2) successions independent of the archaeological data. Investigations thus far have concentrated on the higher Paleolithic elevations. Inspection of these wadi fills does, however, lend credence to Copeland & Vita-Finzi's (1978) updated chrono-stratigraphy and the general hypothesis that the contemporary hydrography of Wadi el-Ḥasa began to evolve in the early Holocene.

J. Schuldenrein

SUMMARY

by
G. Clark

The site testing program at the eastern end of the Wadi el-Ḥasa assigned the probed sites to the Mousterian, Ahmarian, Kebaran, Geometric Kebaran and possibly Natufian time/stratigraphic units (Table 33). Site functional types ranged from probable basecamps, recognized by a diversified lithic assemblage, the presence of features and midden deposits, to a tiny, isolated Upper Paleolithic knapping station, where the cultural component probably reflected the activities of a single individual over about 30 minutes of time. Except for Site 634, a Mousterian rockshelter in Wadi 'Ali, the sites were also found on former shorelines of Pleistocene Lake Ḥasa, at about 820 m above sea level. While it is reasonable to suppose that Lake Ḥasa fluctuated in size, and in the elevation of its surface waters in response to macroclimatic change over the 50000 year span documented by the archaeological remains, we cannot precisely identify those changes yet, although we hope to be able to do so in the near future.

Environments Past and Present

The eastern end of Wadi el-Ḥasa is characterized today by Irano-Turanian vegetation and mean annual precipitation on the order of 50-100 mm (Willimott *et al.* 1964). The pollen and sediments both point to more mesic conditions than those of the present, but there is considerable evidence for variation in the moisture regimen. Probably the most mesic sites are 634 (where the pollen record is poor) and 1065. Site 634 ('Ain Difla) is on the order of 50-60000 years old, and interpretation of its paleoenvironmental record is complicated by its riparian context. Occupation there was probably associated with a relatively broad flood plain as much as 5-6 m higher than that of the present wadi bed. It is very likely that Wadi 'Ali contained a permanent watercourse at that time. The presence of two strong springs within 500 m of the cave insures a reliable year-round water supply even under present xeric conditions. Pollen indicates that the bedrock plateau into which the cave is cut was covered by a veneer of rocky soil thick enough to have supported a grassy steppe and its associated (east African) fauna.

The other site with indications of (exceptionally) mesic conditions is 1065, well dated to *ca.* 16250 BP. This was an interval marked by a series of more humid oscillations according to work in northern

Palestine and the Negev (Horowitz 1979, Goldberg 1981). This relatively humid phase seems to be indicated here as well, although the proximity of the lake might confound interpretations of the local paleoenvironment. Whereas Mediterranean phytogeographic zones expanded south and eastward at this time along the coast, this episode of moderate climatic amelioration evidently did not lead to the establishment of fully developed Mediterranean floras in the eastern Ḥasa.

The remaining sites all seem to be associated with relatively xeric steppe conditions, but since they are close to the lakeshore, the local microenvironments were wetter than would have been the case otherwise. There is a tufa formation indicative of a strong and long-lived spring at Site 618, which could account for the lengthy reoccupation of that locality. The Ḥasa paleoenvironmental evidence stops short of documenting the early Mousterian 'paradise' of Horowitz (1979) and Marks (1983) but the general drying trend seen during the later Mousterian and the Upper Paleolithic seems to be reasonably well substantiated. It is clear, though, that nothing in the pollen record indicates conditions as xeric as those of the present.

Site Functional Types

In funcational terms, the sites represent a range of activity sets related to hunting and food collection, primary reduction, the processing of kills and the maintenance of hunting and other kinds of gear. The areal extent of the site, size and diversity of the 621 lithic assemblage suggest a basecamp (or, more likely, a series of basecamps), even though it is a Middle Paleolithic site. Mousterian Site 634, with its monotonous, restricted inventory, probably represents a series of small, functionally-similar campsites where early *Homo sapiens* fabricated blanks and points (there are almost no retouched pieces). Small, informal hearths and fire lenses suggest periodic, ephemeral occupation by small hunting parties. A substantial quantity of bone, and the absence of the bones of predators, indicates a human component in the accumulation of the archaeofauna.

Ahmarian Site 623X is the only site whose functional assignment is absolutely unambiguous — an Upper Paleolithic knapping station 'occupied' by one or two hominids for less than an hour. The location of Site 784X, on the flank of the only possible NW/SE game migration route in the area, strongly suggests that one of the site functions there was that of a game lookout. The accumulation of midden debris, the large gazelle-dominated fauna, and diverse lithic assemblage also indicate that the locus served as a series of hunting camps, perhaps utilized by portions of the social entity represented by the nearly-contemporaneous basecamps at 618. Whether 784X was itself a basecamp seems doubtful, since the living area under the rockshelter overhang would have been too restricted to have accommodated large numbers of people. Sites 618 and 1065 were probably both basecamps, although separated in time by as much as 10000 years. The small Kebaran component associated with the spring at 618 probably reflects continued, casual, intermittent visits to the spring by Epipaleolithic foragers during a time late in the lake's existence when it might have become increasingly alkaline.

Concluding Remarks

In addition to more adequate publication of the WHPP sites, the challenge of future work will be to fit them into the emerging economic and demographic models being constructed to accomodate Levantine paleolithic data. The sites sampled by the WHPP span the interval during which humans evolved from unspecialized, opportunistic foragers, through stages of specialized predation involving a variety of hunting and collecting strategies, to a point when relatively mobile settlement/subsistence systems were replaced over parts of their range by relatively sedentary ones. Seen from this perspective, the appearance of domestication economies is only a final step in a continuum of human adaptation which extends back far into the Pleistocene

TABLE 33
WADI HASA PALEOLITHIC PROJECT: SUMMARY OF SITES TESTED

Site	Estimated Age (BP)	Arch. Units Represented	Area (sq.m)	Elevation (m)	Context	Assemblage Character	Midden Deposits?	Paleoenvironment	Predominant Site Functional Type(s)
621	70-50000	Mousterian	4000	810	open site, slightly derived	diverse	no	grassy steppe on lakeshore	basecamp (?) or series of basecamps
634	60-50000	Mousterian	30-40	780	rockshelter, in situ	restricted	yes	riparian microhabitat in xeric grassy steppe	limited activity site - series of hunting camps
623X	ca.25000	Ahmarian	ca.4	807	open site, in situ	very restricted	no	grassy steppe on lakeshore (?)	knapping station
784X	18-20000	Ahmarian/ Kebaran Transition	ca.75	805	rockshelter, in situ	intermediate	yes	riparian or lakeshore habitat	game lookout, series of hunting camps
618	ca.25000 ca.20000	Ahmarian (Main) Kebaran (Spring)	11500 30-50	810 810	both open sites, slightly derived, some in situ	diverse	yes	grassy steppe on lakeshore, relatively xeric	basecamp or series of basecamps
1065	ca.16250	Kebaran/ Geom. Kebaran Natufian (?)	850	810	open site, slightly derived, some in situ	diverse	yes	grassy steppe with patches of trees near lakeshore, relatively mesic	basecamps with features, architecture

(Cohen 1977, Clark 1983, Clark & Yi 1983). It is reasonable to suppose that there are pan-Levantine regularities in this process of adaptation which, if adequate data can be obtained, might become amenable to description and generalization.

Describing these things is one thing, however, and explaining them is quite another. Even the fundamental kinds of extractive processes upon which archaeologists focus much of their attention are usually very subtle and human ecological adaptations always involve the exploitation of multiple ecosystems. In order to put empirical teeth into blasé generalizations about adaptation, we will ultimately have to be able to trace the outlines of settlement/subsistence systems over particular time intervals, detect seasonal or other shifts in exploitative strategies and gain a clear understanding at an adequate level of resolution of the natural environment and how it varies spatially and temporally. Ecological systems approaches begin with the discovery of covariation between environmental and cultural variables. While knowledge of covariation is not sufficient, in and of itself, to warrant the plausibility of an explanation, it is nevertheless reasonable to assume that cultural systems (esp. those of the hunter-gatherers of interest here) are always intimately linked to regional environment. Even slight changes in that environment can have profound effects on the systems with which it is articulated (this is especially true in the Levant, with its historically precarious moisture regimen). Archaeological remains provide a record of these environmental effects if we are ingenious enough to detect and understand them. Disentangling complex, changing systems relationships between humans and their natural and social *milieux* is the principal objective of the WHPP research design.

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