PALEOLITHIC SITE PLACEMENT IN THE WADI ḤASA, WEST-CENTRAL JORDAN

by
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Introduction

From 1979 to 1983, Burton MacDonald of St. Francis Xavier University conducted an archaeological survey of the south bank of the Wadi el-Ḥasa drainage system in west-central Jordan. The survey encompassed the entire 70 km length of the wadi from its source near the Qa'el-Jinz to where it empties into the Dead Sea depression near Aṣ-Ṣafi (Fig. 1). Some 1074 sites were identified ranging in time from the Lower Paleolithic to the end of the Ottoman Empire; 542 of these were classified as Lower, Middle, Upper and Epipaleolithic and as Prepottery Neolithic, with various bracketing categories and subdivisions. The sites discussed here comprise a 41% sample (222 of 542) of the more reliable 'lithic period' survey collections. Assessments of reliability are based on marked proportional dominance of stone artifact types considered diagnostic of particular time-stratigraphic units by survey members.

At MacDonald's invitation, we analyzed the 'early' (i.e., lithic period) survey data. We sought (1) to make a preliminary descriptive statement about site size and distribution patterns over the paleolithic-to-aceramic neolithic time interval, and (2) to compare Wadi el-Ḥasa data with those from contemporary surveys in the better studied Avdat/Aqev area (C Negev highlands) and the Ras en-Naqab Basin (S Jordan Plateau) (Marks & Freidel 1977, Henry 1982). This essay summarizes major research conclusions from our analyses of the survey material, and is a condensed version of a longer, more detailed work (Coinman et al. 1986). Here we emphasize patterns characteristic of the wadi as a whole, essentially ignoring those found in its tributary drainages.

Although the survey was fairly systematic, MacDonald's efforts were not directed primarily at the lithic periods of interest here, nor were sampling designs employed to insure data sets representative of particular temporal or cultural periods, nor of topographic subdivisions of the environment. Subjective assessments were made about the reliability of the samples collected, however, which allows for some confidence in the information which serves as the basis for this discussion.

Evaluation of the survey data consisted of examining the temporal and spatial distribution of 'early' (i.e., lithic) sites by eight tributary drainage systems and areas and by the Wadi el-Ḥasa as a whole (Fig. 1). We looked at site area data by time and culture-stratigraphic unit affiliation and elevational variability in site location both within and across tributary drainages. The objective of these pattern searches was to determine whether temporal trends existed in the data, and to see whether patterns of association among environmental and topographic variables, site sizes and densities could be detected that might have meaning in behavioral terms. Identi~~fying~~ settlement-subsistence systems which corresponded to the various subdivisions of the paleolithic, epipaleolithic and aceramic neolithic allowed us to make tentative comparisons with models developed by Binford (1980), Marks and Freidel (1977) and Henry (1982, n.d.).

The data were organised by the seven time-stratigraphic analytical units used to structure the survey research. These were (1) the Lower/Middle Paleolithic (undifferentiated), (2) the Middle Paleolithic, (3) the Middle/Upper Paleolithic (combined), (4) the Upper Paleolithic, (5) the Upper/Epipaleolithic (combined), (6) the

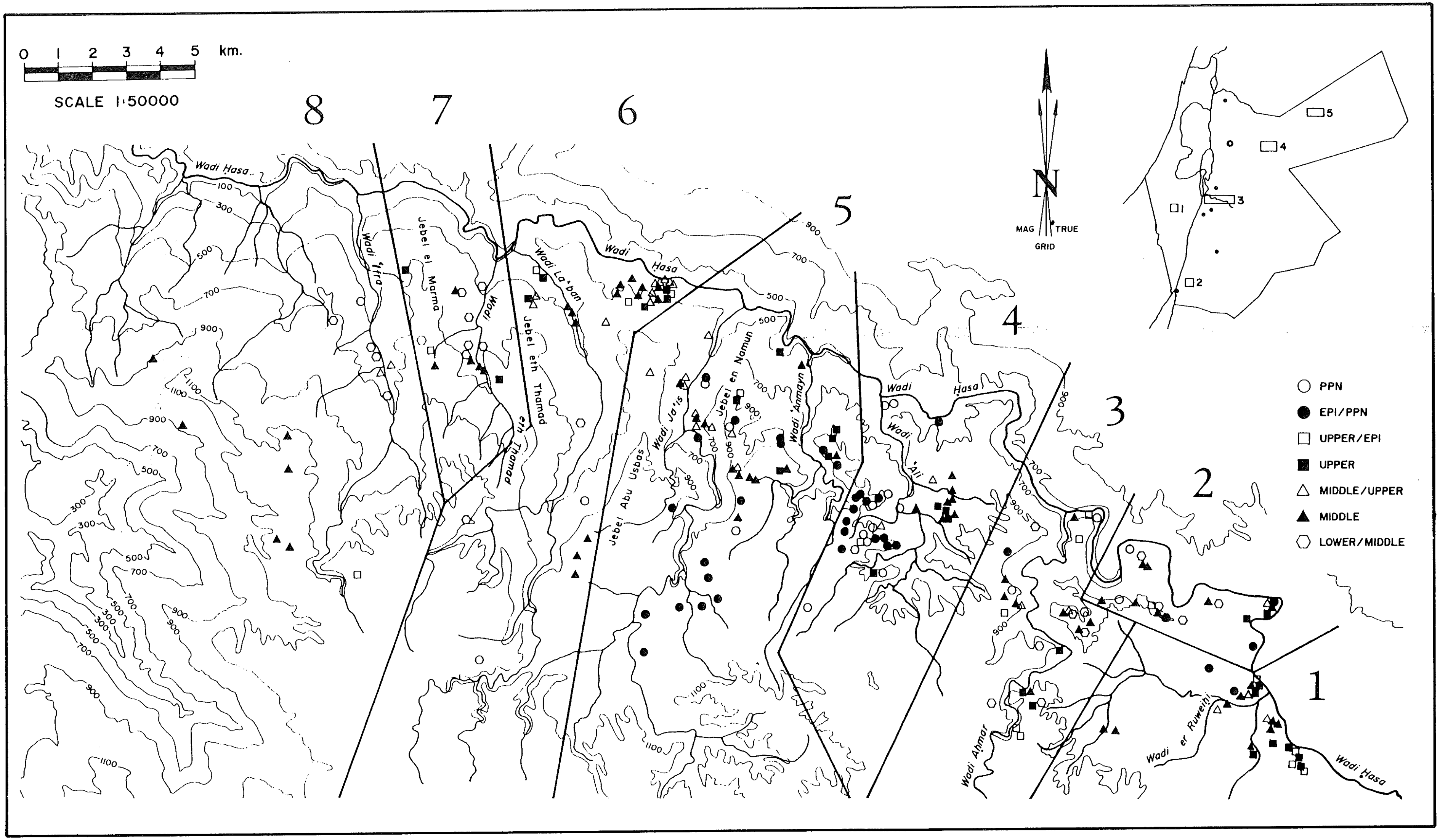

Fig. 1 Distribution of sites by culture/stratigraphic unit along the S bank of Wadi el-Ḥasa, west-central Jordan (base map courtesy of Burton MacDonald). The large numbers *on the map* indicate major tributary drainages of the Ḥasa: (1) Wadis Abu er-Riwaq/er-Ruweiḥi, (2) the Wadi Ḥasa lowlands, (3) Wadi Aḥmar, (4) Wadi ʻAli, (5) Wadis ʻAnmayn/Jaʻis, (6) Wadi el-Laʻban, (7) Wadi eth-Thamad, (8) Wadi ʻIfra. The small numbers *on the key* indicate major paleolithic survey projects: (1) Avdat/Aqev area, C Negev highlands (Marks), (2) Wadi Ḥisma/S Jordan Plateau (Henry), (3) S bank of the Wadi Ḥasa (MacDonald), (4) Al-Azraq Basin (Garrard), (5) Black Desert (Betts). Major Jordanian cities and towns are indicated by dots.

Epipaleolithic/Prepottery Neolithic (combined) and (7) the Prepottery Neolithic (PPN). Except for the Upper Paleolithic collections, which were studied independently by Clark in 1983 (Clark et al. n. d.), site classifications are those of the original survey team.

Transitional Sites

As might be expected in the case of surface collections of ancient lithic materials, these analytical categories are only rather crude temporal and developmental indicators (although it should also be noted that the survey included personnel with much prior experience in recognizing and classifying Levantine Middle, Upper and Epipaleolithic assemblages). A particular deficiency of the survey data is that it is impossible to distinguish between assemblages that are (1) truly 'transitional' (e.g., in the sense of Boker Tachtit, where a continuous record of change in an excavated assemblage documents the transition between 'Middle' Paleolithic reduction strategies, dominated by Levallois technology, and those of the early 'Upper' Paleolithic, with single platform blade cores - Marks 1983a), and those that are (2) 'mixed' or 'combined' (i.e., where collections are dominated by tool types believed to be diagnostic of two adjacent time-stratigraphic units). It is important to be able to recognise 'transitional' assemblages since they constitute 'breakpoints' in the technological subsystem that might signal changes in other aspects of human adaptation (e.g., changes in the settlement, subsistence subsystems). However, at present, 'transitions' are extremely difficult to identify even with more adequate excavated samples. To try to detect them in the Ḥasa survey data would detract from any credibility that the study might have.

In our view, the results presented here reflect typical 'early' (i.e., lithic period) survey data. They are preliminary in nature and limited in respect to detailed information on particular sites. Directed recovery of excavation data, underway since Fall 1984, will be needed to support or refute initial assessments of temporal and 'cultural' assignments and site characteristics. These are critical factors to keep in mind when temporal resolution is poor and long-term geological processes have acted to produce the 'coarse-grained' archaeological surface record observed and described by the survey (see MacDonald n. d. for the definitive work on the survey).

IDENTIFYING SETTLEMENT PATTERNS

Most hunter-gatherer settlement pattern studies have been directed towards understanding a group's adaptive relationships with (usually economic) aspects of the environment. It is assumed that hunter-gatherer adaptive strategies incorporated loci beyond a residential camp, and that variability in site size and function of contemporaneous sites might shed light on the organisation of a settlement system. The challenge in settlement pattern studies, especially those relying on survey data, is to define discrete settlement systems by establishing simultaneously site function, contemporaneity and interpretable patterns of association.

In default of unambiguous site functional data from the Ḥasa survey, site size would probably be the next best potential indicator of function (since we can control for geological disturbance to a certain extent). Because there is some indication of bimodal site distributions in elevational zones, it is possible that correlations exist between site size and elevation that can be directly related to behavior in meaningful and interpretable ways. Elevation could be strongly correlated with site function, and an examination of site size would be a preliminary step toward identifying site function associated with altitudinal variability.

Ideal Models

Simple, iconic models can express different kinds and degrees of relationship between site size and elevation (Fig. 2). These ideal models can be represented graphically by bivariate scatterplots exhibiting strong correlations along either one (Fig. 2, Models C-F) or two axes of variability (Fig. 2, Models A, B). The relationship between the two variables — site size and elevation — is different in each of the models. In Models A and B, two dichotomous relationships are present. In Model A, small sites are located at high elevations with larger sites at lower elevations; the reverse is true for Model B. In Models C-F, only one of the two variables is dichotomous — either elevation (Models C, D) or site size (Models E, F). For example, elevation is not a determining factor in Models E and F, while it does vary in Models C and D. Intersite variability is a function of size differences in Models E and F but is not a factor in Models C and D. Differentiation in site size and/or elevation is assumed to be the result of differences in site placement strategies which are themselves determined by differences in residential mobility requirements, the nature and extent of the seasonal round, time-sequenced differences in resource availability and the extent to which 'logistical'-type resource procurement (Binford 1980) was practiced.

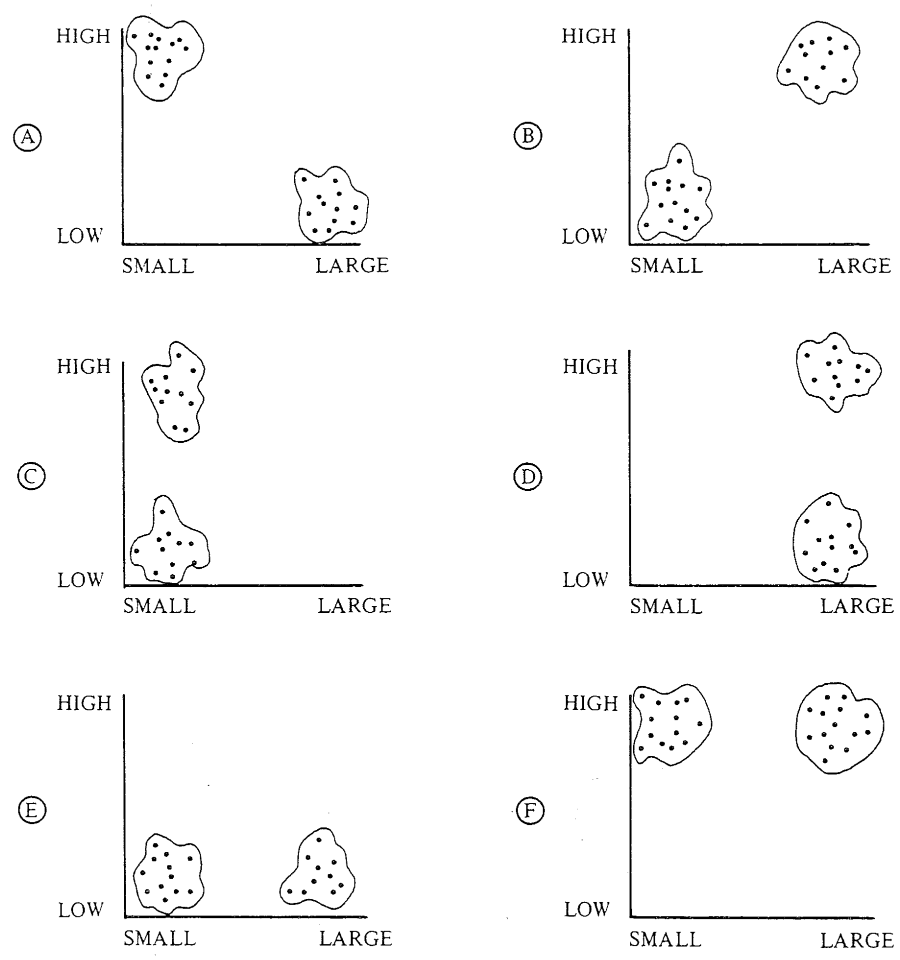

Fig. 2 Six ideal models expressing dichotomous relationships between site size and elevation.

Some expectations of the Binford and Marks Models

A comparison of the 'ideal' models with the general hunter-gatherer settlement models of Binford (1980, 1982), and the regional Levantine models of Marks and Freidel (1977, Marks 1981, 1983a) indicates that, in a topographically-differentiated environment such as the Ḥasa drainage, the illustrations (Fig. 2) express the range of systematic relationships possible between settlement locations and the environment. While elevation *per se* is not a significant factor in Binford's 'forager-collector' (1980) and site placement (1982) models (based on San Bushman and Nunamiut Eskimo groups in less topographically differentiated environments), elevational zonation is a significant determinant of site type location in the Central Negev Highlands (Marks 1981, 1983a) and on the rim of the South Jordan Plateau (Henry 1982, n.d.). In both areas, elevational variability is marked as a result of dissecting wadi systems.

In Marks and Freidel's (1977) 'radiating' settlement pattern for Early Mousterian sites in the central Negev, 'markedly different site types (have been identified) that are differentially distributed within a restricted geographic area' (Marks 1981, 1983a). Assuming contemporaneity, Models A and B would illustrate this kind of intersite variability if the sites were differentially distributed according to elevation. The larger sites would correspond to their relatively sedentary residential basecamps, while the smaller sites would represent a range of procurement and processing activities orchestrated from the residential sites. The maintenance of a radiating settlement system is argued to be directly correlated with optimal climatic conditions in the southern Levant (Marks 1981, 1983a; Goldberg 1981, Horowitz 1976, 1979) which allowed for an 'economic strategy based on local, area-intensive exploitation' (Marks 1983a:91). Base camp size and consistent intrasite spatial patterning in artifact types and densities and in the locations of features have indicated either a tendency toward sedentism or 'very consistent and briefly spaced reoccupations' (Marks 1983a:91).

Models A and B would also fit Binford's description of logistically-organized collectors in an altitudinally differentiated environment where relief would influence or even determine the locations of residential bases, field camps, stations and caches (Binford 1980). The latter three site types would be small and, like the smaller sites in the Negev, would be associated with specialized or 'target' resources. If the environment lacked significant altitudinal variability and was otherwise undifferentiated, Models E and F would be equally appropriate to both the radiating settlement pattern postulated for the Negev and the logistically organized collectors hypothesized by Binford. However only in the easternmost 5-10 km of the Ḥasa itself would this latter situation occur.

In the Binford typology, 'foragers' are contrasted with 'collectors'. Foragers use high residential mobility to 'map-on' to resources through encounter-type procurement strategies (Binford 1980:5-10). Sites created by the activities of foragers tend to be smaller and less differentiated than those of collectors. We might expect to see site patterning like that illustrated in Models C and D where sites are generally the same size but an elevational continuum is involved (which might represent 'mapping-on' to seasonally available resources). Upper Paleolithic sites in the central Negev studied by Marks and his colleagues (Marks 1976, 1977, 1983c) are described as part of a much larger 'circulating' settlement system which might have encompassed much of the southern Levant. These sites are relatively small (*cf.* above), exhibit little intersite variability in size relative to those of the Middle Paleolithic, and seem to resemble rather closely the 'forager' sites characterized by Binford (1980, 1982). As part of a larger system, the exploitation of scheduled resources through high residential mobility produces, in Marks' view, generally similar small sites and redundant site patterning. Models C and D can be interpreted to represent a foraging or circulating pattern produced by frequent, 'intra-seasonal' residential moves among elevational zones. The scale for interpreting the model is flexible to accomodate either a small system in a topographically-varied environment or a large one involving a continuum in site location in which relief is only relatively differentiated.

Some Expectations of the Henry Model

Henry's (1979, 1982, n.d.; Henry et al. 1983) research on the South Jordan Plateau has provided a local land use model that emphasizes transhumance or seasonal movement between different elevations. A transhumant strategy allows for scheduling of resource procurement via residential mobility as different seasonal resources become available in different elevational zones. Henry (n.d.) considers the transhumant model, based partly on contemporary Bedouin land use practices, to be useful in describing seasonal movement of foragers in the topographically-varied Ras en-Naqab/Wadi Ḥisma region on the edge of the South Jordan Plateau (1979, 1982; Henry et al. 1983). Transhumance of this kind is thought to have been an adaptive strategy of very great antiquity in the area. Four distinct versions of the model are presented (for the Middle and Upper Paleolithic, Epipaleolithic and Chalcolithic) that depict seasonal movement between the piedmont and the lowlands — movements that affected local group size, composition and activity patterns somewhat differently in each of these four major chronological periods. Archaeological confirmation of the model is based on variability in site size and exposure, artifact density and the permanency, number and diversity of features (Henry n.d.).

During the Middle, Upper and Epipaleolithic, grossly similar patterns of transhumance are thought to have prevailed although there are differences of degree among the three periods. The Middle and Upper Paleolithic configurations indicate larger, more permanent winter sites located at relatively low elevations — the residential bases of aggregate groups. During the summer, these groups dispersed to more transitory encampments at higher elevations in the piedmont. The Epipaleolithic pattern is similar in kind to that of the earlier periods, but large winter aggregation sites are located at lower elevations than previously, along the flanks of the Wadi Ḥisma. Summer occupation of the piedmont continues as before, with a dispersed population making temporary use of a series of small, low-density, limited activity stations with relatively specialised toolkits. This configuration is thought to be associated with wetter, cooler climatic conditions than those that prevailed during the Upper Paleolithic.

The Chalcolithic sees a complete reversal of the preexisting pattern, with large, open-air winter aggregation sites now located in high piedmont environments and small, shallow, ephemeral summer sites located at low elevations along the Wadi Ḥisma valley walls. The former are characterised by rich and diverse artifact assemblages, midden deposits (implying a degree of sedentism and/or cyclical reoccupation), pottery and architectural features. The latter have impoverished inventories mainly comprising a narrow range of flint artifacts. Henry remarks that the Chalcolithic data closely resemble those of modern (but traditional) land use practices, and imply a degree of dependence on pastoral subsistence activities, supplemented by hunting and gathering (Henry 1982, n.d.)

WADI EL-ḤASA SITE AREA DATA

Mean site area data in the Ḥasa indicated a partial trend from large to small sites over time, a pattern partly anticipated because of the probable effects of deflation on (esp.) Lower, Middle and Upper Paleolithic sites. These units have the highest mean areas (7207, 4229, 3584 m^2 respectively). The major exception is the Epi/PPN combined sample, with a mean of only 752 m^2, the smallest in the series. All of the statistics associated with the Epi/PPN sample indicate more uniformity in site size than is characteristic of any other time/stratigraphic unit (Table 1).

When (the more reliable) medians are inspected, however, evidence for a trend breaks down. Although the highest median area (2800 m^2) is again associated with the Lower/Middle Paleolithic, the Middle, Middle/Upper and Upper Paleolithic medians form a block (800, 975 and 1100 m^2) as do those for the Upper/Epipaleolithic and the Prepottery Neolithic (1500, 1650 m^2). The median area for the Epi/PPN is again very low (400 m^2). The most variable units are the Middle and Upper Paleolithic (Table 1). The modal site size is 'small' (<2500 m^2). When area data are arrayed by size classes, it is perhaps significant that all the combined samples (Lower/Middle, Middle/Upper, Upper/Epipaleolithic) have a greater-than-expected number of sites in the 5000-7500 m^2 category. The fact that they are anomalous in this regard at least lends some credibility to the original classifications of these survey data. One might expect assemblages that bracket time/stratigraphic unit boundaries to be distinct from those of periods of relative stasis.

WADI EL-ḤASA SITE ELEVATION DATA

In some contrast with the area data, Ḥasa site elevations exhibit no global trends with most values being quite similar to one another (Table 2). Exceptions are the Middle/Upper Paleolithic, when sites tended to be located at substantially lower elevations than during the rest of the sequence, and the Epi/PPN, when they were somewhat higher than average. The unanticipated thing about the site elevation data was the demonstration that three distinct kinds of patterns existed: (1) a bimodal symmetrical distribution characteristic of the Lower/Middle and Middle/Upper Paleolithic combined samples, with site clusters at 5-700 and 9-1100 meters, (2) an essentially unimodal symmetrical distribution typical of the Middle, Upper and Upper/Epipaleolithic, with sites concentrated in the 7-900 meter band, and (3) a unimodal asymmetrical configuration characteristic of the Epi/PPN and PPN periods, with the major mode at 9-1100 meters (Fig. 3).

Elevation Data within Tributary Drainages

In some fundamental sense, site elevation data from the individual tributary drainages could be more meaningful than the global data just presented because the profile of equilibrium of the Ḥasa is fairly marked, and there is (and probably always has been) a substantial topographic gradient from west to east ultimately determined by the nature of underlying geological structures (Bender 1974). When the survey area is partitioned into tributary drainages, a number of important variations in site elevation become apparent.

TABLE 1
Descriptive Statistics for Site Area by Time Periods

Periods	N	Max	Min	Mean	Med	Range	St.Dev.	St.Err.	95 % Confidence	
									–S	+S
PPN	22	15000	16	2773	1650	14984	3552	757	1199	4348
EPI/PPN	35	3600	16	752	400	3584	908	154	440	1064
UP/EPI	18	15000	36	2510	1500	14964	3545	836	747	4273
UPPER	30	48000	25	3584	1100	47975	8748	1597	318	6851
MID/UP	28	35000	75	3038	975	34925	6766	1279	414	5662
MIDDLE	66	43750	12	4229	800	43738	9082	1118	1996	6462
LOW/MID	23	30000	25	7207	2800	29975	9689	2020	3016	11397
ALL	**222**	**48000**	**12**	**3468**	**900**	**47988**	**7381**	**495**	**2492**	**4445**

TABLE 2

Descriptive Statistics for Site Elevations by Time Periods

									95 % Confidence	
Periods	**N**	**Max**	**Min**	**Mean**	**Med**	**Range**	**St. Dev.**	**St. Err.**	**–S**	**+S**
PPN	22	1198	540	844	915	658	165	35	771	918
EPI/PPN	35	1062	515	905	930	547	117	20	864	945
UP/EPI	18	1175	390	797	816	785	188	44	704	891
UPPER	30	965	385	773	803	580	164	30	712	834
MID/UP	28	950	440	680	642	510	176	33	612	748
MIDDLE	66	1200	440	816	866	760	192	24	769	863
LOW/MID	23	1100	515	792	816	585	152	32	726	857
ALL	**222**	**1200**	**385**	**806**	**856**	**815**	**178**	**12**	**782**	**829**

As one moves from east to west, site elevation patterns tend to become increasingly bimodal as the Ḥasa drainages itself becomes more deeply entrenched. This trend does not continue uninterrupted, however, as the westernmost tributary wadis (eth-Thamad, ʻIfra), although deeply dissected, are characterized by unimodal (eth-Thamad) and very weakly bimodal (ʻIfra) distributions. Figure 4 is a series of histograms of site elevation data for the tributary drainages. It illustrates the relative concentration of sites between 800 and 900 m in the drainage of the Wadis er-Ruweiḥi and Abu er-Riwaq (Drainage 1) towards progressively bimodal distributions in the Wadi ʻAli through the Wadi el-Laʻban (Drainages 4-6) (and to some extent in the Wadi ʻIfra [Drainage 8]). Elevational ranges in the western, dissected part of the wadi are more extreme. The solid line in Figure 4 indicates the elevation of the actual course of the Ḥasa and shows site elevation relative to the wadi bed itself. The dashed line indicates the maximum elevations in each of the tributary wadis. The histograms illustrate actual site locations within each drainage relative to the range of possible locations, as well as to the seasonal water resources in the Ḥasa floodplain.

Mean elevations for each drainage were also computed for comparative purposes. These statistics indicate that the Wadis eth-Thamad and ʻIfra (Drainages 6,7) have the lowest means (589, 694 m respectively), although they also have the greatest potential for elevational variability in site location. Site locations in these wadis favoured lower elevations nearer the Ḥasa, while the Wadis Aḥmar, ʻAli and Jaʻis (Drainages 3-5) have a larger proportion of sites at upper elevations and only a few sites close to the Ḥasa floodplain (means are 885, 881 and 837 m respectively). The dichotomous pattern of site elevations in these wadis, and in the adjacent Wadi el-Laʻban (Drainage 6), seems to be a significant datum, suggesting the possibility of seasonal movement and/or major temporal differences in site locations within (and possibly across) these adjacent drainages (3-6). Site locations may have varied over time in response to climatic changes affecting elevationally-determined belts of springs and vegetation associations. Topographic factors such as steep gradients and canyons found in parts of some drainages (esp. in the Wadis ʻAli, ʻAnmayn and Jaʻis) might have precluded site locations at some elevations, but in others (e.g., the Wadi el-Laʻban and at the eastern end of el-Ḥasa) no topographic features are evident that could be invoked to explain the absence of sites at certain (esp. intermediate) elevations (see Coinman et al. 1986 for further discussion of within-drainage elevation data).

BIVARIATE COMPARISONS

When size and elevation are considered together, and time is ignored, the ʻmid-

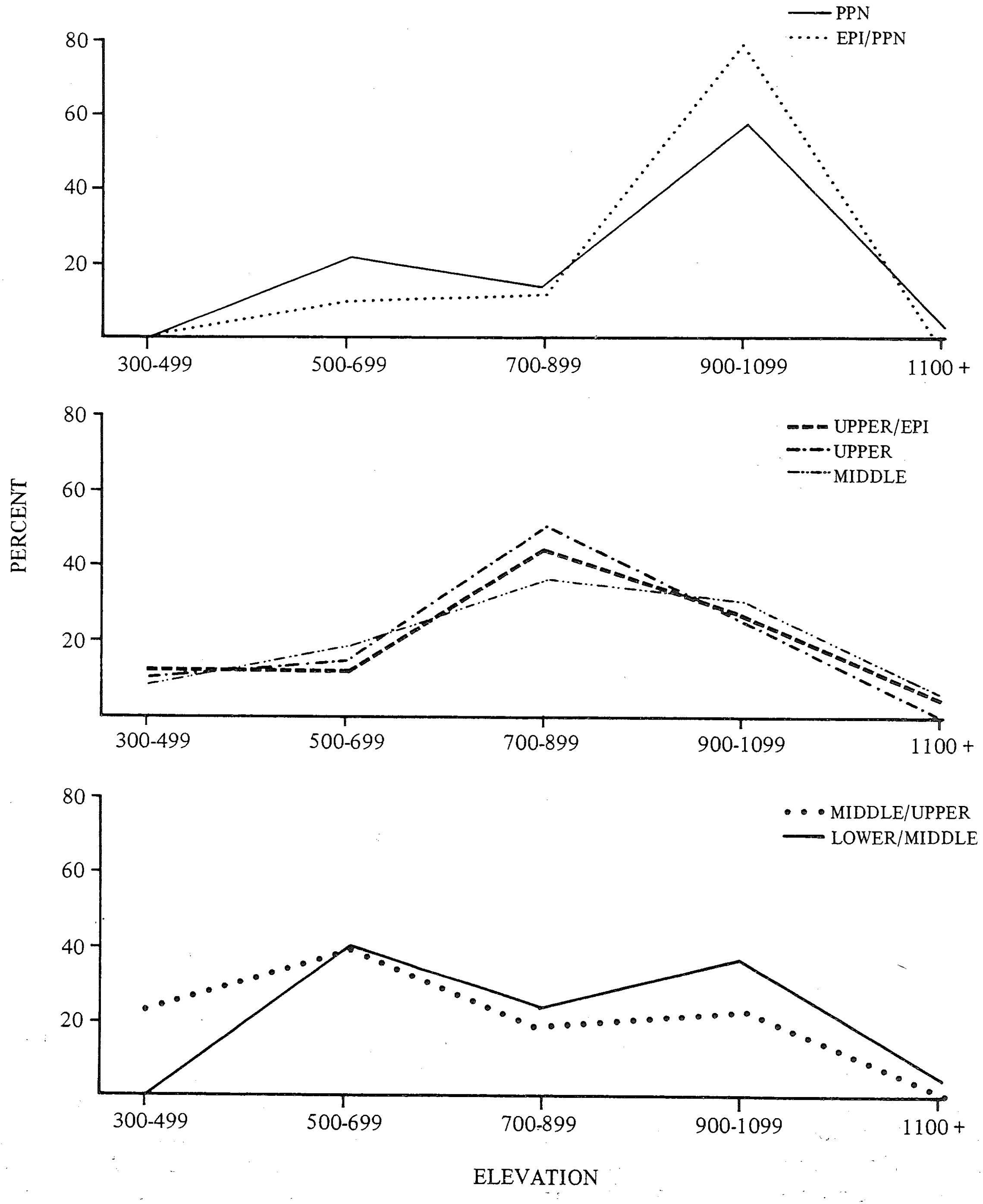

Fig. 3 Global site elevation distributions by time period. The graphs show the percentage of sites represented in each of five class intervals. Graphs of similar shape are grouped together.

dle' drainages (where relief is most marked) exhibit two contrasting patterns. In the Wadis Aḥmar and 'Ali (Drainages 3,4), the pattern most closely resembles Model F. There are many small sites and a few large ones concentrated at higher elevations. The size distribution is bimodal, but there is little differentiation in terms of elevation (although there are a few 'low' sites in both drainages). The Wadis 'Anmayn/Ja'is and el-La'ban (Drainages 5,6) show a Model C type configuration with a bimodal distribution of mainly small sites at high and low elevations.

The global bivariate scatterplots and their centroids indicated that the Middle, Upper, Upper/Epipaleolithic and PPN samples were all fairly similar to one another, being characterized by a predominance of fairly small sites at medium to high elevations (Figs. 5,6). The Lower/Middle, Middle/Upper and Epi/PPN samples were anomalous with respect to the central grouping and also different from one another.

The Lower/Middle Paleolithic sample was distinct in that site areas ranged along a conitnuum from small to very large. Since many of these sites are deflated to various degrees (MacDonald et al. 1983), some very large sites are perhaps to be expected. The fact that they are not concentrated at higher elevations seems to contradict assertions that the oldest sites in the Ḥasa drainage tend to be found on *cuestas* and ridge crests (MacDonald et al. 1983). The Middle/Upper Paleolithic sample was characterized by a predominance of fairly small sites distributed from very low to high elevations. This unit was remarkable for a virtual absence of very large sites. The Epi/PPN combined sample had large numbers of very small sites, no medium or large sites, and a strong tendency for sites to be concentrated at higher elevations than previously.

These results indicate that Wadi el-Ḥasa experienced three major shifts in settlement, and by implication adaptation, during the time intervals corresponding to the Lower/Middle, Middle/Upper and Epi/PPN transitions, when site size and elevation diverged from those which had been typical of most of the paleolithic and early neolithic. Interestingly, the Upper/Epipaleolithic sample does not deviate from the Upper Paleolithic configuration to any significant degree, implying a continuity of adaptation whatever the differences in the stone tool inventories might mean.

COMPARISONS WITH OTHER LEVANTINE MODELS

How do the Ḥasa data square with expectations under the Marks/Freidel and Henry models? Table 3 is a synopsis of the paleoclimatic sequence for the Late Pleistocene of the central Negev. It also summarizes Marks' observations about settlement pattern characteristics during the various culture/stratigraphic intervals (Clark 1984). Radiating patterns, with good site size differentiation, typify the Middle Paleolithic in the central Negev, whereas circulating patterns with smaller, more uniform sites, are characteristic of the Upper Paleolithic. The Ḥasa data resemble those of the central Negev in that a radiating pattern with good size differentiation is indicated for the Lower/Middle Paleolithic. However, the Middle *and* Upper Paleolithic in the Ḥasa are both characterized by relative uniformity in site size, while in the Negev this pattern is indicated only for the Upper Paleolithic. The Middle/Upper Paleolithic transition in the Negev marks the shift from a radiating to a circulating pattern, correlated with increased desiccation, and declines in site size, intersite variability and evidence of sedentism. The Middle/Upper Paleolithic combined sample (for it is not really a 'transition') in the Ḥasa shows mainly small, and only a single very large site — essentially an Upper Paleolithic configuration in Marks' terms. The Ḥasa Epi/PPN sample, with no large or medium-sized sites, actually conforms best to Marks' definition of a circulating pattern, at least insofar as 'fit' can be determined from the poorer-quality Ḥasa survey material. In the Negev, a circulating pattern is thought by some to be documented for the Late Natufian, whereas the Early Natufian might represent a brief return to a

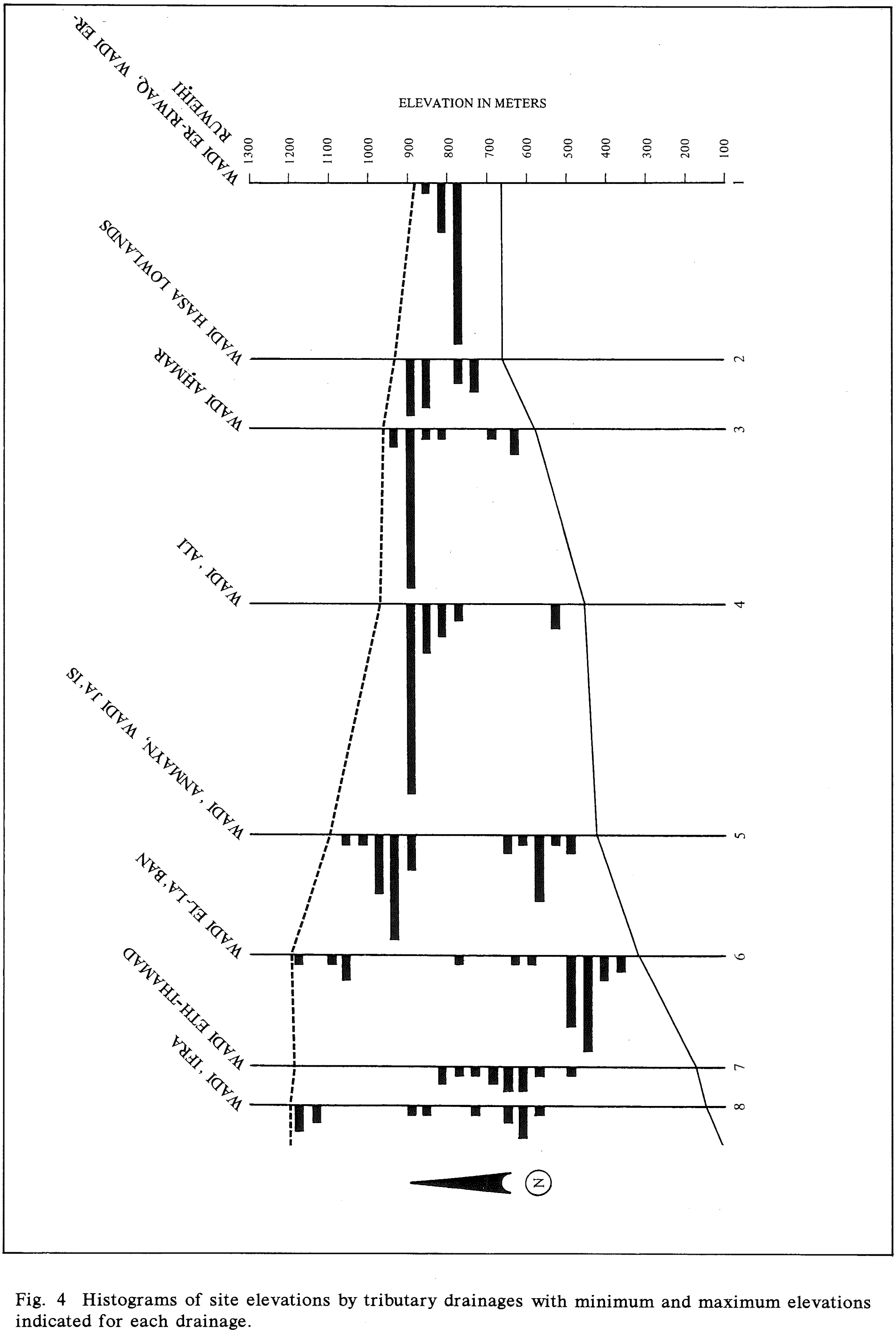

Fig. 4 Histograms of site elevations by tributary drainages with minimum and maximum elevations indicated for each drainage.

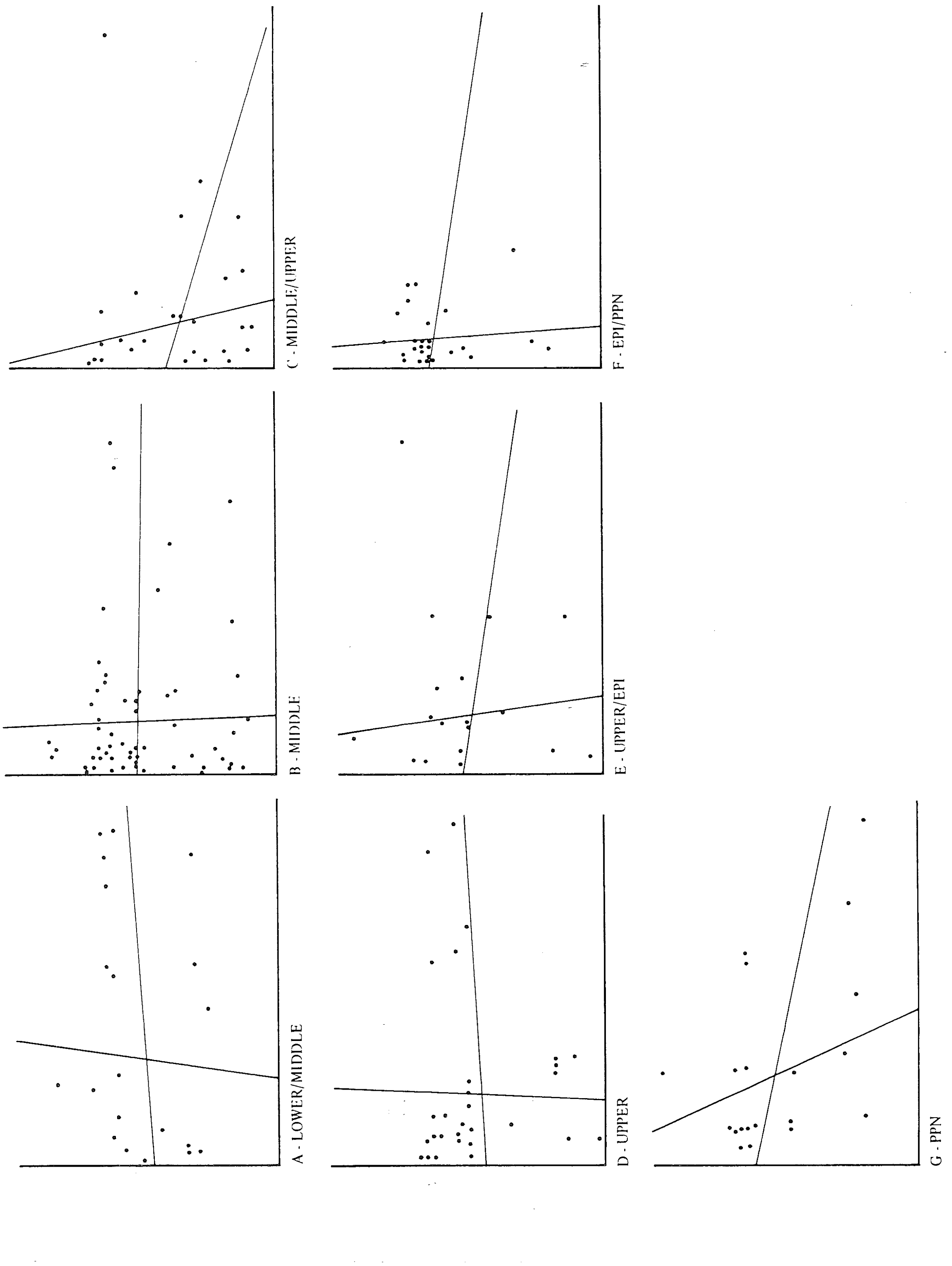

Fig. 5 Global scatterplots of site size and elevation for (a) the Lower/Middle, (b) Middle, (c) Middle/Upper and (d) Upper Paleolithic; (e) Upper/Epipaleolithic, (f) Epipaleolithic-Prepottery Neolithic, (g) Pre-pottery Neolithic.

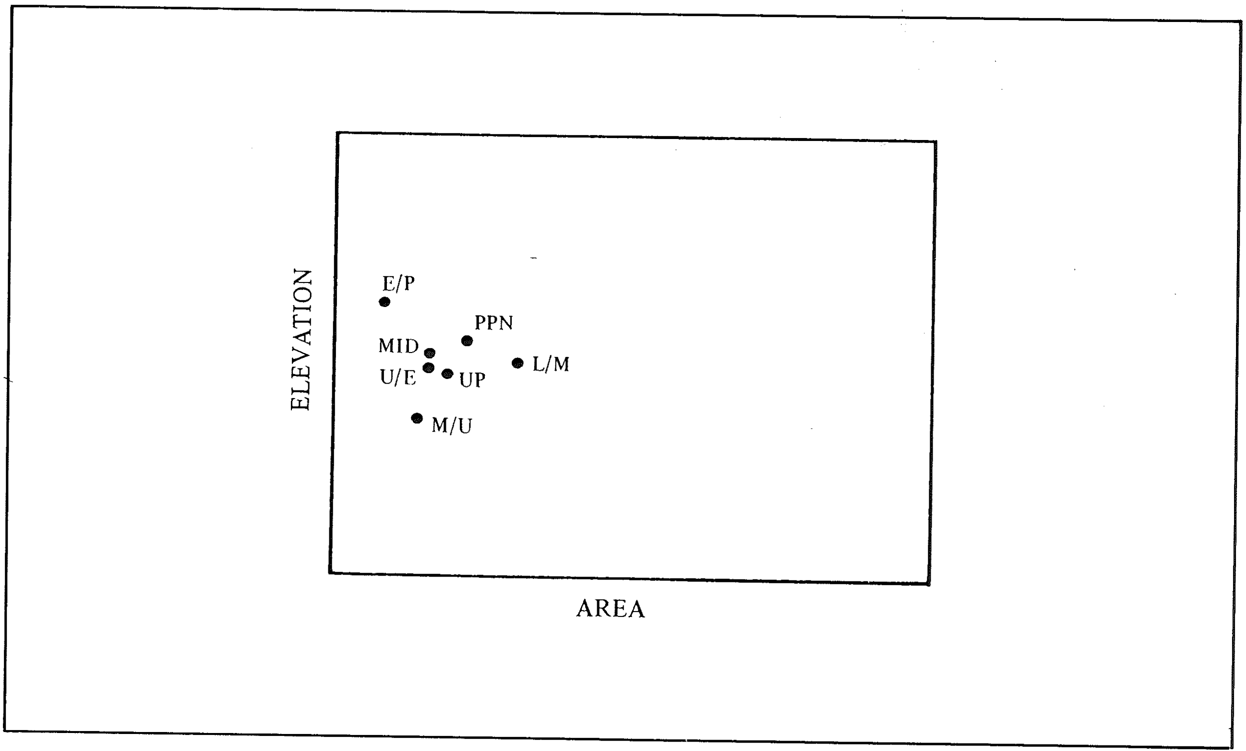

Fig. 6 Group centroids for culture/stratigraphic units (from Fig. 5).

radiating pattern correlated with a brief wetter episode after about 14000 BP (Horowitz 1976, 1979).

Henry's model of paleolithic seasonal transhumance juxtaposes (1) large, semisedentary, winter aggregation sites with diverse assemblages located at low elevations with (2) small, limited activity stations with restricted assemblages at high elevations occupied during the summer months by small dispersed groups comprising segments of the larger entities represented by the winter camps. The Chalcolithic saw an apparent reversal of this pattern, linked to the effective implementation of pastoral domestication economies. The 'modal' Ḥasa settlement pattern found during the Middle and Upper Paleolithic, and during the Prepottery Neolithic, indeed tends to replicate Henry's paleolithic model since it exhibits a predominance of fairly small sites at moderate-to-high elevations (the summer camps in the Henry model). While there are large, low sites during the Middle Paleolithic and the Prepottery Neolithic, the Ḥasa data tend to have the largest sites located at 'intermediate' to 'high' elevations, a possible response to the fact that the altitudinal gradient of the Ḥasa drainage system is not so marked as that of Henry's study area.

None of the combined assemblages fit either of Henry's models very well, but for different reasons. The Lower/Middle Paleolithic lacks a clear dichotomy in site size and elevation. The Middle/Upper and Upper/Epipaleolithic samples are both characterized by a single very large, very high site, the remainder being relatively small and continuously distributed across the elevational range. The Epi/PPN sample lacks large sites altogether; most Epi/PPN sites are high and small. Chalcolithic sites recorded by the Ḥasa survey were not included in this study, but it seems fair to say that nothing resembling Henry's Chalcolithic model (large, high winter sites; small low summer sites) showed up in the various pattern searches undertaken for this essay. If the Chalcolithic pattern is indeed one linked to pastoralism, as Henry suggests, its absence in sites predating the appearance of domestication economies is perhaps to be expected.

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TABLE 3.

TENTATIVE PALEOCLIMATIC SEQUENCE FOR THE LATE PLEISTOCENE
OF THE CENTRAL NEGEV
(FROM GOLDBERG 1973, 1979, 1981; HOROWITZ 1976, 1979)

ARCHAEOLOGICAL UNITS	SEDIMENTOLOGICAL & VEGETATIONAL CHARACTERISTICS*	AVDAT/AQEV SITES†	MACROCLIMATIC TRENDS	MARKS' (1981, 1983) SETTLEMENT PATTERN CHARACTERISTICS
EPIPALEOLITHIC-EARLY NATUFIAN [ca. 17,000 - 13,000 BP]	periodic very slightly more humid oscillations 17-12,000 BP followed by contradictory evidence: drier conditions post-13,000 BP indicated by the sediments (Goldberg 1981), wetter conditions post-14,000 BP by the pollen (Horowitz 1979); by the late Natufian (ca. 10,500 BP) a drier climate as indicated by pollen data from Rosh Zin (D-16)	D-5, Rosh Zin (D-16) D-101, Ein Aqev (D-31)	DRYING SOMEWHAT WETTER	climatic evidence equivocal; possible brief return to radiating configuration during the early Natufian, followed by circulating pattern in the late Natufian
UPPER-EPIPALEOLITHIC TRANSITION [23-22,000 - 15,000 BP]	continuation of drying trend with arboreal fraction 7% (D-34), then 3% (D-31); NAP indicates slightly wetter conditions than present; erosion beginning ca. 23,000 BP becomes marked after ca. 15,000 BP; formation of colluvial silt lenses after ca. 18,000 BP; maximum aridity ca. 16-15,000 BP	Ein Aqev (D-31) D-34	DRYING	
UPPER PALEOLITHIC [ca. 45,000 - 20,000 BP]	complex sedimentary sequence with continued alluviation characterised by the accumulation of coarse, then fine terrace gravels, sands (until ca. 27,000 BP), then silts, clayey colluvium (until ca. 20,000 BP); decline in runoff energetics over time; climate somewhat more humid (and considerably more humid 32,000-27,000 BP) until ca. 27,000 BP, when a trend toward greater aridity begins; 16% AP at D-22, D-27; climatic belts 150-200 km S of present locations	D-22, D-27a,b D-100 D-34	DRYING WETTER DRYING	circulating pattern with no significant intersite variability (i.e., more difficult to distinguish between base camps, limited activity stations); repeated reoccupation of sites (but without spatial consistency in activity area placement); more mobile settlement/subsistence system tied to increased importance in scheduling in resource procurement in a more arid environment than during the Middle Paleolithic
MIDDLE-UPPER PALEOLITHIC TRANSITION [ca. 47,000 - ca. 45,000 BP]	new cycle of alluviation with formation of terraces up to 15 m thick; somewhat drier than previously with 17% AP at D-101; NAP much the same as early Mousterian	D-101	DRY BRIEFLY SOMEWHAT WETTER?	shift to circulating pattern with trend toward increased dessication; decline in site size, intersite variability and evidence of sedentism
LATER MOUSTERIAN [ca. 65,000 - ca. 45,000 BP]	drying trend; erosion (wadi downcutting with destruction of many early Mousterian sites), consequently few sedimentary traps for later Mousterian industries		DRYING	radiating settlement/subsistence system with base camps and associated limited activity sites; base camps characterised by high artifact density, stratified deposits and the formation of middens, spatially-consistent tool kits; a relatively sedentary pattern or, alternatively, a pattern of reoccupation at regular intervals; logistical strategy possible due to optimal climatic conditions vis a vis the Upper Paleolithic
EARLY MOUSTERIAN [90,000 + - ca. 65,000 BP]	wet; formation of gravel terraces and travertines in springs; 25% AP at D-35; channel aggradation followed by colluviation; climatic belts 200-250 km S of present locations	D-35, D-15	WET	

* should be read from bottom to top

† sites not in stratigraphic order within archaeological units

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