Professor D. O. Henry
Department of Anthropology
University of Tulsa
Tulsa, Oklahoma 74104
USA

Donald O. Henry

Topographic Influences on Epipaleolithic Land-use Patterns in Southern Jordan

The discovery of a large number of Epipaleolithic sites distributed over a wide range of elevation on the southern edge of the Jordanian Plateau allows for an examination of topographic influences on prehistoric land-use practices. In arid regions such as the Near East, elevational differences play an important role in determining environmental settings due to their effects on temperature, precipitation, and evaporation regimes. These differences, in turn, appear to have induced certain patterns of land-use as reflected in the season, location, size and mobility of settlements.

Populations inhabiting topographically diverse regions generally adopt a settlement strategy of transhumance, a kind of vertical nomadism, that accommodates elevationally-linked seasonal changes in resources and creature comfort. With an annual migration through different elevational belts, groups seek to maximize their exploitation of the available resources and to optimize the comfort they experience in exposure to the elements.

The general structure of transhumance

In general, a strategy of transhumance involves certain behavioral responses to seasonal changes in the environment. These environmental changes consist of temporal (seasonal) and spatial (elevational belt) constraints on resources (i.e., water, food, fuel) and the natural elements (i.e., wind, rain, snow, temperature) affecting creature comfort. Behavioral responses to such changes include decisions about scheduling and population adjustments. Scheduling entails determining *when* a group will occupy a certain elevational belt in order to bring resources that are seasonally out-of-phase into a schedule of annual availability. Population adjustments involve meshing the population density of a group with the amounts of available resources through changes in the group's size and frequency of establishing new camps and catchments. Within an annual cycle of transhumance, segments associated with high resource densities are normally accompanied by higher group sizes and lower levels of mobility than segments found in areas of low resource density.

The modern setting: environment and behavior

The present as a key to the past is not only a basic premise of paleoecologic inquiry, but archaeological researchers increasingly have come to use modern analogs of past behavior for a better understanding of prehistory (Ascher 1961; Binford 1967, 1971, 1976; Gould 1967, 1971; Yellen 1977; Kramer 1979). Whereas contemporary data drawn from the natural and cultural settings within the south Jordan study are unlikely to have direct correlates in the past, they are likely to furnish valuable insights and generate ideas concerning prehistoric man-land relationships. Perhaps most importantly, such insights allow for the formulation of models that may be examined against independent data drawn from archaeological and paleoenvironmental contexts.

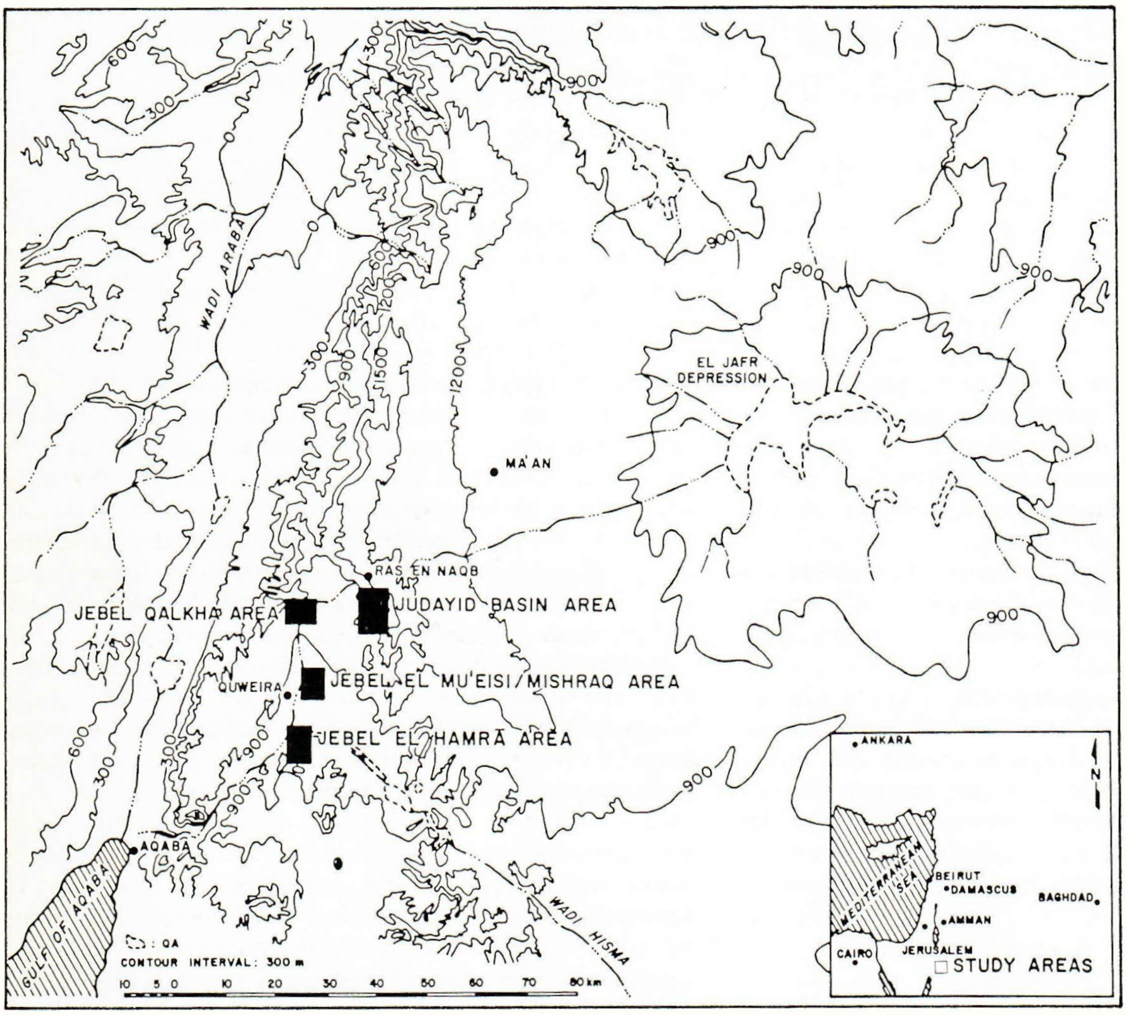
Environment

The principal environmental and meteorological characteristics of the study area near Ras en Naqb and El Quweira are related to the area's elevational diversity. Running south from the uplands of the Edom Plateau near Ras en Naqb towards El Quweira on the floor of the Wadi Hisma, one drops over 1,000 m in elevation in less than 10 km (FIG. 1). Three major physiographic units can be identified along such a transect. These units include the *uplands* of the Edom Plateau, the *piedmont* or foothills that skirt the base of the plateau's escarpment, and the *lowlands* representing the floor of the Wadi Hisma (FIG. 2). In addition to being elevationally distinct, these three units display different meteorologic patterns, environments, and topographic features.

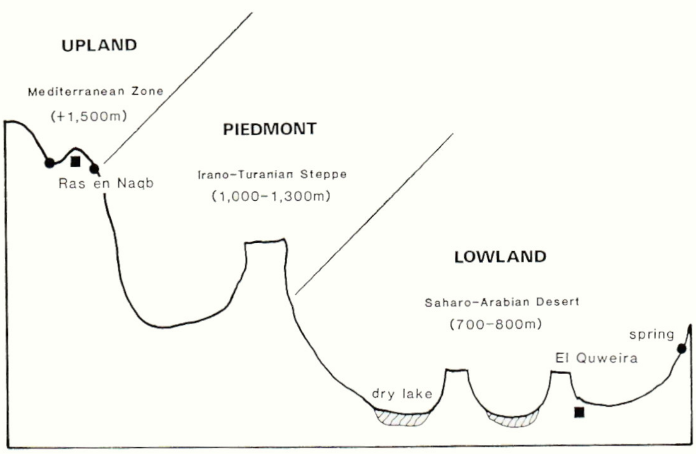
The uplands of the plateau, resting between 1,500 and almost 1,700 m above sea level, display a smoothly dissected topography of rolling hills covered with a predominantly shrub vegetation associated with a Mediterranean phytogeographic zone (Zohary 1961). The surface of the uplands is dominated by flint and limestone regoliths that occasionally veneer pockets of *terra rosa*. Limestone bedrock also is commonly exposed over large areas. Permanent surface water is available from perennial springs found where a shallow limestone aquifer is truncated within the hills and near the edge of the plateau.

The uplands, in resembling the region as a whole, receive

1. Maps showing the topography of Southern Jordan. The four study areas in the vicinity of Ras en Naqb and El Quweira furnished the archaeological evidence discussed in the paper.



2. A schematic transect of the Ras en Naqb–El Quweira area. Note the elevationally zoned environments.



90 per cent of their annual precipitation during the winter months of December, January, and February (Abu Gharbieh 1971). During the five months from May through September, the region only rarely receives measurable precipitation. Mean annual precipitation for the uplands measures between 200–350 mm. Much of the precipitation falling in the winter months is in the form of snow. Daily minimum temperatures during this period average 0° C with maximum daily temperatures averaging about 10° C. The high elevation of the uplands also significantly reduces summer temperatures with the mean daily temperatures being the coolest in the country. In July, for example, the mean daily temperature of the uplands is 20° C. The low summer temperature of the uplands is significant in that transpiraevaporation rates are reduced during the dry season thereby extending the seasonal longevity of shrubs, forbes, and grasses well beyond the point where they have died off at lower elevations.

The piedmont, resting between 1,000 and 1,300 m, flanks the escarpment of the plateau. Alluvial fans spreading from the base of the escarpment create steep, boulder strewn slopes that are frequently dissected by narrow, deeply incised wadis. Sheer faced jebels, formed by sandstone outliers, often act to create basins along the escarpment. Such basins are filled by coalesced alluvial fans and normally reveal more gentle, less rock-strewn surfaces than those common to most of the escarpment's margin. Environmentally, the piedmont is characterized by Irano-Turanian steppe vegetation found on sand and sandy-silt deposits. Drift sand and dunes occupy only only a minor portion of the piedmont.

Due to the absence of a shallow aquifer, the piedmont is without a permanent water source. Runoff from the uplands, however, insures the availability of water during the winter and early spring. Deep pools and 'kettle holes', formed in sandstone wadi beds, normally contain water throughout the winter, even during those dry years when wadis are charged only at widely spaced intervals. Precipitation within the piedmont itself is much less than that of the uplands with annual rainfall averaging between 100–200 mm.

The lower elevation of the piedmont results in temperatures that are 3–4° C higher than those of the uplands. Daily winter temperatures, for example, range from 4–14° C on the average whereas average daily summer temperatures range from 20–28° C. Although the daily temperatures of the piedmont are significantly higher than those of the uplands, the piedmont nevertheless has relatively low daily temperatures when compared to the rest of the country. As with the uplands, the low summer temperatures of the piedmont act to delay the dying-off of vegetation until late in the dry season.

The lowlands forming the floor of the Wadi Hisma represent the lowest physiographic unit within the study area with elevations ranging from 700–800 m above sea level. The Wadi Hisma forms a broad valley that is generally oriented along an east–west axis. It is bounded on the north by the piedmont of the plateau and on the south by a range of granite mountains. At its widest the Hisma is some 20–25 km wide on its western end.

The relatively flat floor of the valley contains numerous scattered dry beds of Pleistocene lakes and is occasionally punctuated by sheer walled jebels. These sandstone inselbergs rise 200–300 m above the valley floor and often attain elevations of over 1,000 m. Surface sediments within the Hisma form a mosaic of talus scree from the inselbergs and granite mountains, silty-sand of the lake beds, and extensive fields of sand dunes. The sparse plant cover of the Hisma is associated with the desert vegetation of the Saharo-Arabian phytogeographic zone.

Daily temperatures of the lowlands average some 4° C higher than the piedmont and over 6° C higher than the uplands. Winter daily temperatures average 6°–16° C and summer daily temperatures range from 24°–32° C on the average. Precipitation in the lowlands is negligible with an annual average of less than 50 mm; many years go without rainfall. Water sources are limited to springs along the Hisma's southern margin and to the lake beds which are charged for a few weeks in the winter by runoff from the uplands during abnormally wet years.

The cultural setting

Although the contemporary cultural setting of the study area is dominated by Bedouins who still basically lead a nomadic lifestyle, a variety of factors have appreciably altered their transhumant pattern as followed a century ago. In general, the overriding trend of change with regard to their settlement strategy is one of increasing sedentism.

Perhaps the two most important factors contributing to the reduction of their settlement mobility relate to the expansion of 'artificial' water sources and to the introduction of new forms of transportation. Deep wells, pipelines, holding tanks, and watertanks mounted on tractor-drawn trailers have greatly expanded the geographic and seasonal range of water sources. The impact of these artificial water sources on human settlement is particularly striking in the lowlands. Not only have these sources extended the duration of the dry season occupation of the lowlands for pastoral nomads, but the emergence and expansion of village life in the Hisma is directly tied to the development of dependable water supplies.

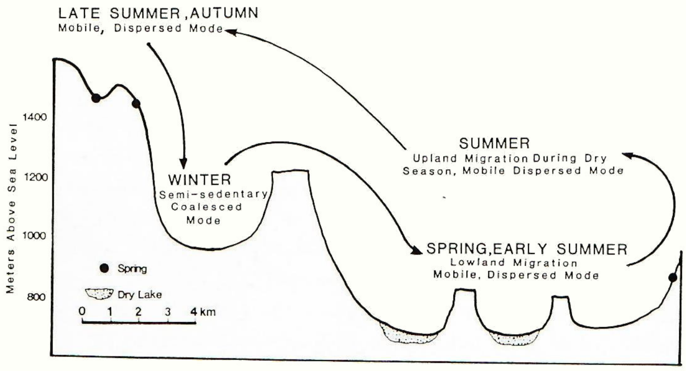
Ironically, new modes of transportation in the form of tractors, four-wheel drives, and compact pickup trucks appear to have actually reduced settlement mobility. By increasing access to distant resources these mechanical beasts of burden have acted to enlarge the resource catchments of sites and have thereby reduced the frequency by which new catchments and camp sites have to be established. The trucks and tractor-drawn trailers assist in the acquisition and movement of resources including water, fodder for livestock, fuel, and livestock ranging in size from sheep to camels.

While the introduction of new water sources and transportation modes have undoubtedly had their greatest impact upon transhumant patterns in modern times, the trend of reduced settlement mobility was initiated in historic times with the introduction of donkeys and camels as beasts of burden and with the development of cisterns, wells, and other water control-conservation devices. In defining a contemporary transhumant pattern for the study area, therefore, one should recognize that it is an ideal pattern even when considered in the context of the recent past prior to the extensive introduction of artificial water sources and powered vehicles.

Prior to the recent introduction of motorized vehicles and extensive artificial water sources, the inhabitants of the region followed an annual transhumant pattern which contained three distinct settlement segments.[1] These consisted of a late summer-autumn occupation of the uplands, a winter occupation of the piedmont, and a spring-early summer occupation of the lowlands (FIG. 3).

[1] The pattern, as presented here, is a composite picture of land-use practices that were observed in the area today and those which were reported to have taken place in 'grandfather's time'.

3. A schematic illustration of the transhumant cycle followed by the pastoral nomads of the area.



The settlement of the uplands would begin in the late summer-early autumn depending upon the severity of the dry season. At this time of year, forage for livestock will have generally died off in the lower elevations of the piedmont and in the lowlands where surface water will also have disappeared. The cooler, better watered uplands, therefore, provided an attractive grazing land and also much needed water from the perennial springs located on top of the plateau.

With the onset of winter rains and lower temperatures, groups moved to the piedmont where runoff from the rain and snow of the uplands insured available water and where more comfortable temperatures prevailed. It was during the occupation of the piedmont that settlement density reached its peak. Relative to the uplands and lowlands, the area encompassed by the piedmont forms only a small portion of the region as a whole. Thus during the winter occupation population densities reached levels well above those of the uplands or lowlands. Perhaps as a consequence of the higher levels of population density at this time, camps were larger with a greater number of tents. Where camps in the uplands and lowlands rarely contained more than 3 tents, winter camps in the piedmont generally contained 5 or more tents with some large camps containing as many as 10 tents.

Following the winter rains, the coalesced groups occupying the piedmont dispersed into smaller camp units and moved to the lowlands. It is at this time of the year that the lowlands have their best pasturage and furnish the greatest opportunity of finding surface water away from the perennial springs. Even during the wettest years, however, pasturage is sparse and water sources limited. In order to avoid overly exploiting these limited resources camp groups were small and tended to move frequently. Camps representing the winter occupation of the piedmont differed from camps occupied during other seasons in regard to size, artifact density, and the permanency and diversity of site features. In that the piedmont camps were larger and moved less frequently than those of the other season's, their associated artifact distributions covered larger areas with greater density than non-winter camps. Another important difference between the winter camps of the piedmont and the camps of other seasons rests in the frequency by which camps were reoccupied and the associated investments of energy placed in the construction of site features. Within the piedmont, both pasturage and water sources vary little in location from year to year. Given the predictability of the spatial occurrences of these resources, in conjunction with the relatively small geographic area to be occupied in the piedmont, reoccupation of the same site locus from year to year was common. The recurrent occupation of a site, and the extended length of residence during each occupation, justified the greater expenditure of effort in the construction and maintenance of site features. Rock corrals, stonewalled windbreaks, and rock structures for storage of grain, fodder, and fuel are common site features of the piedmont, but rare or absent in the upland and lowland zones.

The prehistoric setting

The inhabitants of the area, over at least the last 60,000 years, appear to have employed transhumance as a general adaptive strategy, but the specific patterns of transhumance varied dependent upon the prevailing environmental setting. For the Epipaleolithic (Early, Middle, and Late Hamran Industries), a pattern of transhumance differing markedly from the contemporary pattern is indicated. The environmental setting of the area for the period from 20,000–10,000 years ago also contrasted greatly with that associated with the area today.

Environment of the Epipaleolithic

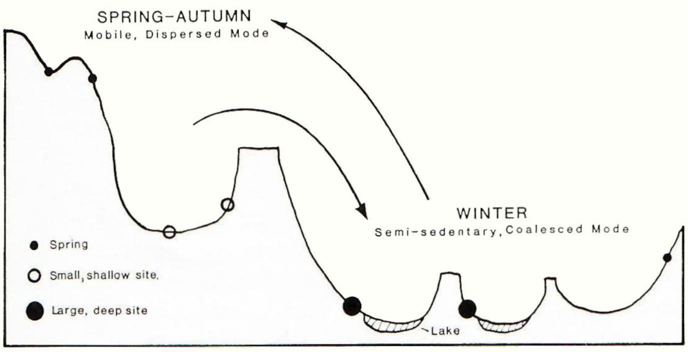
For this time-frame evidence from geomorphic and palynologic studies (Henry 1982; Henry *et al.* 1983; Henry and Turnbull 1985; Emery-Barbier, in press) points to an environmental setting that was generally more moist than that of the area today. Two dry episodes, however, appear to have punctuated this roughly 10,000 year long interval. Drier conditions are indicated for periods of 14,000–13,000 BP and after 11,000 BP.

The geomorphic expressions of these moist conditions include the filling of basins in the piedmont by coalesced alluvial fans and the oxidation of sands and formation of lakes on the floor of the Hisma. Palynological data recovered from Epipaleolithic deposits in the piedmont and from rockshelters in the Hisma provide a more precise climatic-environmental record than that furnished by the geomorphic evidence alone. Quite moist conditions (as reflected by the presence of pollen from oak, elm, walnut, and conifer) dominated the beginning (*c.* 20,000–15,000 BP) and the end (*c.* 13,000–11,000 BP) of the interval. Drier episodes persisted between 14,000–13,000 BP and after 11,000 BP as expressed by pollen indicating a dominance of steppe and desert vegetation.

Epipaleolithic transhumance

The distribution, settings, and artifact content of Hamran sites denote a transhumant pattern characterized by a winter coalesce of groups in the lowlands and summer dispersal of the population in the uplands (FIG. 4). Evidence for this pattern

4. A schematic illustration of the transhumant model proposed for the Epipaleolithic inhabitants of the area.



comes from a consistent dichotomy between sites in the lowlands and those in the piedmont as expressed in several characteristics. These include clear differences in the sizes, occupational thicknesses, exposures, artifact densities, tool-debitage-core production ratios, and tool-kit configurations between sites of those two elevational belts (TABLES 1 and 2).

The supportive data are drawn from nine sites containing fourteen assemblages. The four sites from the piedmont are single component, whereas the five sites from the floor of the Hisma are represented by culturally stratified rockshelter deposits containing ten assemblages. Before continuing with a description of these data, it should be noted that the assemblages are associated with various stages of one cultural tradition within the Epipaleolithic of southern Jordan. This tradition, represented by successive stages of the Hamran, encompassed an estimated 8,000 years (i.e., from 20,000–12,000 BP). It appears to have been restricted to southern Jordan, although general parallels are seen between the Hamran tradition and the Kebaran-Geometric Kebaran development elsewhere in the Levant (Henry 1982, 1983).

A comparison of various characteristics of the settings of the sites reveals clear differences between those of the piedmont and the lowland (TABLE 1). The piedmont sites are all small and display thin cultural deposits. They are either entirely exposed as open-air sites or have eastern exposures when located near cliff-faces. In contrast, the lowland sites are large and have thick cultural deposits. Their exposures are consistently oriented to the south and southwest. These differences are thought to reflect differences in the season and the intensity in which the camps of two zones were inhabited. The small, thin cultural deposits of the piedmont are viewed as remnants of highly transitory camps occupied by small groups. Their settings, situated in the open or with eastern exposures, are more likely to be expressions of warm than cold season occupations. The large, thick cultural deposits of the lowlands point to long term residences by relatively large groups. Their settings in rockshelters with exposures to the south and southwest are more consistent with winter occupations. Such settings would have afforded the occupants wind protection and a greater exposure to sunlight. In extending winter sunlight, the occupants would have benefited from greater warmth during the day and also at night. Investigation of these sites during the winter of 1983–84 showed an important nighttime advantage of prolonged exposure to sunlight. The dark red sandstone that forms the backwalls of the shelters absorbs heat from sunlight during the day and radiates this heat at night when the temperature begins to fall. The shelters therefore not only provided protection from wind and precipitation, but also furnished natural solar furnaces.

Unambiguous differences in artifact densities are also defined between the sites of the two zones (TABLE 1). The markedly higher cultural residue of the lowland sites is consistent with their proposed greater occupational intensities. It is also noteworthy that fixed features (i.e., petroglyphs and bedrock mortars) are found only in these lowland sites.

When turning to an examination of production ratios and tool-kit configurations, patterned variation can also be seen between assemblages of the two zones (TABLE 2). The ratios of blanks to cores and tools to cores show strong covariation. A comparison of blank to core ratios for the assemblages results in the definition of two assemblage clusters. One cluster displays relatively low blank to core ratios (ranging from some 37–60 blanks per core). *All* of the piedmont zone assemblages fall within this cluster as do some of the lowland assemblages (i.e. Group I). The other cluster (Group II) exhibits markedly higher blank to core ratios (ranging from 112–221 blanks

Table 1 A comparison of Epipaleolithic sites located in the piedmont and the lowland zones with regard to the size, thickness of cultural deposit, direction of exposure, and artifact density

	Piedmont sites					Lowland sites					
Site Number	21	22	26	31	X̄	504	520	201	202	203	X̄
Site size (M^2)	100	120	100	180	125	600	260	320	400	550	426
Cultural deposit (CM)	5	5	20	30	15	+30	30	80	60	80	56
Exposure o-open	0	0	E	E	—	SW	S	S	S	SW	—
Artifact density (.1M³)	36	13	17	19	21	341	227	228	641	37	295
Total N of artifacts	1,019	343	1,018	1,319	924	4,696	1,364	5,051	5,908	1,296	3,663

Table 2 A comparison of assemblage groups by tool classes, production ratios, and the percentages of tools to all blanks

	Piedmont				Group I Lowland				Group II Lowland			
Tool classes	Absolute range	Range	X̄	SD	Absolute range	Range	X̄	SD	Absolute range	Range	X̄	SD
Scraper	2 –14.9	12.9	8.6	5.5	1.4–12.2	10.8	4.9	4.2	3.3– 5.1	1.8	4.0	0.9
Burin	0 – 9.0	9.0	3.7	3.3	0 – 2.8	2.8	1.6	1.0	0 – 3.2	3.2	1.0	1.5
Denticulate	0 – 7.8	7.8	2.4	3.2	0 – 4.9	4.9	2.1	1.8	0 – 1.9	1.9	1.9	0.8
Notch	1.3–13.6	12.3	6.5	4.5	1.4–13.4	12.0	6.9	4.8	1.8– 5.9	4.1	3.7	1.7
Retouched Piece	7.4–63.8	56.4	46.8	23.0	5.1–32.5	27.4	14.5	11.3	4.8–16.0	11.2	9.3	5.3
Perforater	0	0	0	0	0 – 3.5	3.5	3.8	4.6	0 – 3.2	3.2	1.0	1.5
Truncation	0 –11.4	11.4	3.1	5.0	2.2– 6.0	3.8	4.5	1.5	2.6– 3.1	0.5	2.8	0.2
Back Microlith	9 –73.2	64.2	23.8	28.2	30.8–84.5	53.7	64.0	21.7	65.4–86.5	21.1	77.1	9.5
Other	0 – 2.1	2.1	0.4	0.9	0 – 0.5	0.5	2.0	0.3	0 – 1.3	1.3	0.4	0.6
Production ratios												
Blanks: 1 core	50 –60	10	53.8	4.1	37 –56	19	47.4	7.0	112–221	109	156.0	46.2
Tools: 1 core	7 –19	12	13.8	5.8	11 –30	19	17.0	7.8	24–46	20	34.8	8.4
% of Tools to all blanks	20.4%				26.4%				18.2%			

per core) and is confined to the lowlands. Interestingly, when the number of tools are compared to the data for blank production there appears to be little variability between assemblages. Of the blanks produced some 18–26 per cent were subsequently manufactured into tools. These data, therefore, point to differences in blank production efficiency, but not in tool production efficiency between sites of the piedmont and lowland zones.

A comparison of tool-kits from the various assemblages shows that the major differences occur in only two classes: retouched pieces and backed microliths (Table 2). Whereas piedmont assemblages are dominated by retouched pieces, this class is replaced by backed microliths in all lowland assemblages. While this replacement probably reflects the differences in resources and activities that existed between the two elevational belts, the specific functions of the two tool classes have not been established.

When the amount of variability in tool-kits between the three groups of assemblages are examined, the piedmont assemblages show the greatest diversity, followed by Group I and II assemblages of the lowlands. Values for 'range' and 'standard deviation' of tool-class frequencies furnish good measures of the degree of variability between the tool assemblages within each of the three groups.

How might these artifact patterns be explained in behavioral terms? I think they primarily reflect the differences in the intensity in which the sites were occupied. If, as proposed, the piedmont sites were occupied for brief periods of time (possibly only for a few days) and were infrequently reinhabited, the cores found in these sites are likely to have been used for only a few episodes of blank production. In contrast, the Group II lowland assemblages are probably representative of sites that were occupied for longer periods and experienced repeated reoccupation. The cores in these sites are likely to have experienced several episodes of blank production. In many ways the residual cores from earlier occupations would have provided a kind of 'cultural quarry' for the inhabitants of such sites. The Group I lowland occupations, resembling the piedmont sites in terms of lower blank production ratios, probably reflect temporary encampments in which cores would have experienced fewer episodes of blank production.

The different degrees of variation between tool-kits within each of the three groups is also consistent with the proposed differences in the intensities by which the sites were occupied. When inhabiting a transitory camp in the piedmont, groups are likely to have exploited a narrow range of resources, given both the temporal and spatial limits placed upon the catchments of such sites. Camps in the piedmont, therefore, probably varied significantly in regard to the resources available for exploitation and the attendant activities of procurement and processing. With such a settlement pattern a high degree of variation between tool-kits of the different camps would be expected. The longer term occupations of lowland camps, with larger temporal and spatial catchments, would have been exposed to fewer differences in resources and activities. Activities would have been less specialized and the tool-kits from these sites would have been less diverse as evidenced by the Group II lowland assemblages. Group I assemblages are thought to represent less permanent camps in the lowland as they display a moderate degree of tool-kit variability.

Summary

Even though a comparison of the transhumant patterns followed by the modern and Epipaleolithic inhabitants of southern Jordan crosscuts a major economic divide separating pastoral nomads from foragers, these patterns nevertheless show a number of remarkable parallels. The fundamental characteristic of both patterns is an asymmetric settlement cycle containing a winter segment of population coalescence associated with semipermanent camps and a much longer warm season segment of population dispersal accompanied by higher degrees of mobility. Material culture expressions of these different segments can be seen in both modern and prehistoric contexts. The sizes, cultural thicknesses, and artifact densities of camps are greater in the coalesced than the dispersed segment. Similarly, permanent features and evidence of the storage or caching of resources are more likely to be associated with coalesced than with dispersed segment camps.

Because of climatic-environmental differences, the elevational belt selected for coalescence by Epipaleolithic groups was much lower than that used by the modern inhabitants of the area. As mentioned, the piedmont zone is presently selected for winter coalescence because of the predictable supply of runoff from precipitation in the uplands and the comfortable temperature of this elevational belt. With the lower Pleistocene temperatures of Epipaleolithic times, winter encampments were established in the lowlands some 200–500 m below the piedmont zone. Selection of this lower zone for winter residence was probably induced by two factors. With the lower temperatures and perhaps increased moisture budget, winter runoff from the uplands reached the lowlands on the floor of the Wadi Hisma and charged several of the lakes; thus creating a predictable water supply for winter camps. While water undoubtedly was available at higher elevations, the depression of Pleistocene temperatures would have made such belts uncomfortably cold.

On a more general level, it would seem that modern and Epipaleolithic transhumant patterns acted to support a higher population density through increased mobility. During either time-frame, a limited part of the region would have supported a small population without the inhabitants having to resort to high levels of mobility. During most of the Holocene, the piedmont and uplands would have provided sufficient water and grazing land for a secure economy. In the Epipaleolithic, the lowlands were apparently sufficiently lush to support a year round economy. Why then should transhumant patterns emerge in which relatively unproductive land would be exploited for a portion of the year? The answer may rest in the overall increase in resources such a pattern would yield in pastoral and foraging economies. By exploiting those areas that were marginally productive during the period in which resources were available and creature comfort was acceptable, the inhabitants of the region significantly increased their total annual exploitation of resources and thereby supported higher population densities.

Bibliography

Abu Gharbieh, M. 1971. *Climatic Atlas of Jordan*. Meteorological Department, Ministry of Transport, The Hashemite Kingdom of Jordan, Amman.

Ascher, R. 1961. Analogy in archaeological interpretation. *Southwestern Journal of Anthropology* 17: 317–325.

Binford, L. R. 1967. Smudge pits and hide smoking: the use of analogy in archaeological reasoning. *American Antiquity* 32: 1–12.

—— 1971. Mortuary practices: their study and their potential. *In* Approaches to the Social Dimensions of Mortuary Practices. *Memoirs of the Society for American Archaeology*, Number 25.

—— 1976. Forty-seven trips: a case study in the character of some formation processes of the archaeological record. *In* contributions to Anthropology: the Interior Peoples of Northern Alaska. National Museums of Canada, Paper 49.

Emery-Barbier, A. (in press). Palynologie du Sud-Jordanien. *Paleorient*.

Gould, R. A. 1967. Notes on hunting, butchering, and sharing of game among Ngatatjara and their neighbors in the Western Australia Desert. *Kroeber Anthropological Society Papers* 36: 41–66.

—— 1971. The archaeologist as ethnographer: a case study from the Western Desert of Australia. *World Archaeology* 3: 143–177.

Henry, D. O. 1982. The prehistory of southern Jordan and relationships with the Levant. *Journal of Field Archaeology* 9: 417–444.

—— 1983. Adaptive evolution within the Epipaleolithic of the Near East. In *Advances in World Archaeology*, Vol. 2 (ed. Wendorff and A. Close), 99–160.

Henry, D. O., Hassan F. A., Henry, K. C. and Jones, M. 1983. An investigation of the prehistory of southern Jordan. *Palestine Exploration Quarterly* (Jan–June) 1–24.

Henry, D. O. and Turnbull, P. 1985. Natufian and Timnian sites in southern Jordan. *Bulletin of American Schools of Oriental Research* 257: 45–64.

Kramer, C. 1979. *Ethnoarchaeology*. Columbia University Press, New York.

Yellen, J. E. 1977. *Archaeological Approaches to the Present*. Academic Press, New York.

Zohary, M. 1962. *Plant Life of Palestine*. New York.