Chapter 9

Middle Paleolithic Settlement Patterns in the Levant

Liliane Meignen
CEPAM-CNRS, Sophia-Antipolis, 06560 Valbonne, France

Ofer Bar-Yosef
Dept. of Anthropology, Harvard University, Cambridge, MA 02138, USA

John D. Speth
Museum of Anthropology, University of Michigan, Ann Arbor, MI 48109-1079, USA

Mary C. Stiner
Dept. of Anthropology, University of Arizona, Tucson, AZ 85721-0030, USA

ABSTRACT

Drawing on a variety of lithic and faunal data from Hayonim, Kebara, Amud, and other well-documented sites in the Levant and adjacent areas, as well as information on numbers of sites, intensity of occupations, and internal structure of occupations, this paper explores broad changes in the nature of settlement patterns over the roughly 200,000 years of the Levantine Middle Paleolithic. The most readily visible differences between the early and late Mousterian are about numbers of people on the landscape—rates and timing of visitation and, perhaps, the sizes of the social groups present. From the point of view of site structure, we see substantive contrasts between Hayonim and Kebara caves and the successive phases of the Mousterian that they represent. Hayonim seems to be characterized by redundant, spot-specific use of domestic space, whereas Kebara displays a more rigidly partitioned and persistent spatial pattern, probably in response to higher rates of debris generation and more frequent visitation. Convincing indications of more people in the later Mousterian appear as two spatial aspects of the

archaeological record: internal differentiation in site structure during the later Mousterian and, on a geographic scale, greater numbers of sites that may also be richer in material. Our principal conclusion, best viewed at this stage as a working hypothesis, is that the changes in settlement patterns between the early and the late Middle Paleolithic reflect an increase in regional population, as well as shifts in forager mobility in response to seasonal and eventually long-term changes in resource distribution and abundance. We believe that these settlement changes are most parsimoniously accounted for by reference to a combination of demographic and paleoecological factors rather than by positing a change in the cognitive capacities of local or intrusive populations.

INTRODUCTION

It is commonplace to view the daily, seasonal, and annual mobility patterns of foragers as reflecting the distribution of resources in their territory, as well as the degree of availability, predictability, reliability, and accessibility of these resources. Social structure and mating systems are also interwoven into the spatial network of contiguous territories. The geographic position, topography, and climatic regime of the region under discussion—the Near Eastern Levant—determine the distribution and seasonality of the available resources (Zohary 1973). However, optimal exploitation depends on resource accessibility, and this is where social constraints, such as defensive territoriality by neighboring bands, could be a limiting factor. At low population densities, a region rich in resources might be adequate to meet the needs of a discrete social unit with relatively limited mobility. Under the same conditions, increasing population densities might necessitate the implementation of a very different mobility system. The diachronic sequence of the Middle Paleolithic in the Levant may indicate such a process, as suggested in the following discussion (see also Hovers 2001).

The Levant encompasses a series of topographic and climatic features with both west-east and north-south trends. The coastal plain is wider in the south and narrower along the Lebanese-Syrian and Turkish shoreline, a configuration that persisted throughout cycles of sea level fluctuations. Mountain ranges are oriented more or less parallel to the shoreline. The first or westernmost range is generally higher in the north and lower in the south. Moving eastward, next comes the Orontes-Jordan Rift Valley, which is generally less than 15 km wide. East of the Rift the major Syro-Arabian plateau descends into Mesopotamia and the Arabian peninsula. Winter rains decrease from west to east, with higher amounts in the mountains and lower amounts on the eastern plateau. The vegetation belts follow the same pattern, with Mediterranean vegetation to the west, the Irano-Turanian open oakland next, and the steppic to arid zone (Saharo-Arabian) in the east. Mediterranean vegetation dwindles in the south (the Negev), and the Irano-Turanian and the Saharo-Arabian prevail over most of the Sinai peninsula. Food and water resources are available almost all year round in the Mediterranean vegetational belt, are more seasonal in the steppic zone, and ephemeral in the arid region. The typical annual resource cycle in the Mediterranean zone involves a great abundance of seeds and fruits from February through November, and a period of stress for both plants and mammals during the winter—December through February. On the basis of these rudimentary observations, one can predict a settlement pattern with high mobility in the desert and steppic zone and less frequent movements in the Mediterranean belt.

The Middle Paleolithic period as dated currently by the Thermoluminescence (TL) and Electon Spin Resonance (ESR) techniques lasted from about 270,000/250,000 through 50,000/48,000 BP, hence almost 200,000 years (Schwarcz and Rink 1998; Valladas *et al.* 1998; Meignen *et al.* 2001b). During this period we witness evidence for climatic changes which roughly correspond to Oxygen Isotope Stages (OIS) 7, 6, 5, 4 and the early part of OIS 3. One might expect that the climatic changes that occurred over this long time interval had an impact on the environments and carrying capacity of the subregions of the Levant and therefore also impacted the mobility patterns of Middle Paleolithic humans. But it must be stressed that climatic and animal community changes in the Levant were never as striking as those in northern Europe (*e.g.*, Tchernov 1992, 1994). The most important change was the degree of humidity. The Upper Pleistocene climate was generally cooler and more humid than at present, and the contrasts between mild and drier episodes not very strong, at least along the coast. But the situation could have been quite different in the southern and eastern Levant, as shown by pollen analyses (Horowitz 1988), calcite deposits in the Negev (Avigour *et al.* 1992), and speleothems in caves (Bar-Matthews *et al.* 1998, 1999, 2000), which indicate that the woodland and steppe phytozones must have shifted frequently in this area.

Building models for Middle Paleolithic settlement patterns is far from being an easy task (Bar-Yosef 1995). As stated by Van Peer (2001), "a settlement system refers to a regional system of behavior (Binford 1983) which is archaeologically visible as a set of related, contemporaneous sites in a landscape." Operationalizing such a definition, however, poses serious methodological problems, because the degree to which the Middle Paleolithic occupations are synchronous is difficult to establish, given the poor chronological resolution of our record and the small number of sampled sites in each region. In fact, studies of settlement patterns, which have become increasingly common over the last two decades (Conard 2001, and references therein), are generally based on sites that are only broadly contemporaneous (when chronometric dates are available) and/or culturally related. This is the position adopted here, since we have compressed sites covering thousands of years into the same model.

Our studies take into account site size, intensity, duration and nature of occupation, as well as information concerning the exploitation of food resources and raw materials (Bar-Yosef 2000). Throughout, we use the concept of "*chaîne opératoire*" (Cresswell 1982; Lemonnier 1986, 1992; Boëda *et al.* 1990; Karlin *et al.* 1991), a methodological framework which helps to elucidate the nature and sequencing of technological and functional activities carried out by the Middle Paleolithic groups. It relies on the assertion that human activities are part of a dynamic system, in which the different phases of resource exploitation (acquisition, production and use/maintenance/discard of stone tools—the "reduction stream" to use the term coined by Henry [1995a]—as well as acquisition, processing and consumption of animal resources) were organized and carried out in different places and at different times, as people moved across the landscape (Geneste 1988, 1991; Henry 1989, 1995b). Identifying the portions of these exploitation sequences (mainly lithic raw material techno-economy and nature and composition of faunal assemblages) that are represented in a particular site allows us to decipher the subsistence activities that were carried out by the site's occupants, and to identify the site's function within the system of territory exploitation. Specific occupations are then examined for their internal patterning as they may relate to available resources and to the ways those resources were exploited. With this approach, different patterns of site use can be defined, and used to reconstruct reasonable, if not fully documented, settlement systems (Marks and Chabai 2001).

Needless to say, employing the known variability in land-use patterns of recent hunter-gatherers as the basis for the reconstruction of Middle Paleolithic settlement patterns is problematic. Several models of hunter-gatherer mobility and land-use strategies have been proposed, but none of these models is sophisticated enough to encompass the great diversity of changes in environment and resource distribution that must have occurred during the Late Pleistocene. Binford (1980), in a pioneering systematization of mobility patterns, defined two end points in a continuum of hunter-gatherer mobility and land-use strategies but, at the same time, acknowledged that "logistical and residential variability are not to be viewed as opposing principles . . . but as organizational alternatives which may be employed in varying mixes in different settings" (Binford 1980).

Concerning the lithic tools of Paleolithic hunter-gatherers, Kuhn (1992, 1995) has introduced a model of "technological provisioning", which is based on the assumption that the aim of any technological system is "to make tools available where and when they are needed." The concept of "provisioning" crosscuts the more familiar terms of "curation" and "expediency" (used by Binford 1977, 1979). It refers to the depth of planning in artifact production, transport and maintenance, and the strategies by which potential needs are met (Kuhn 1995:22). Modern foragers cope with anticipated demands for tools in a variety of different ways. Kuhn (1992, 1995) recognizes two principal modes of provisioning which ensure the availability of tools in advance. "Provisioning of individuals" with "personal gear" (Binford 1977, 1979) is a strategy in which people always have at least a limited toolkit in hand. Implements are manufactured, and then transported and maintained in anticipation of varied exigencies, in the form of specialized tools if specific needs have been anticipated, or as generalized tools (or even raw material in the form of cores) for more general needs. The strategy of "provisioning places" consists of supplying those places where anticipated activities will occur with necessary raw material and/or implements. This strategy requires some prior knowledge of both the timing and the probable locations of future needs. Its utility depends on residential stability, on the duration of use of habitation sites (Kuhn 1995). The relative importance of each provisioning strategy should vary with the magnitude of residential mobility. Short-duration occupations yield relatively large numbers of tools carried by individuals, while places occupied for longer periods are more likely to be mostly provisioned with raw materials. As the duration of site use increases, the large quantities of debris from manufacturing tools on site will rapidly swamp the transported toolkit, which is always less numerous (Kuhn 1995). Since mobility patterns among modern hunter-gatherers vary over the course of a year and spatially within their territory (Bamforth 1991), foragers often practiced a mixture of technological strategies (Kuhn 1992, 1995; Henry 1998), creating an archaeological record that will be very difficult to decipher.

Flexibility in human group mobility in response to changes in the local physical and social environment is assumed in the models put forward by most researchers (*e.g.*, Henry 1989, 1995a, 1998; Lieberman and Shea 1994; Kuhn 1995; Hovers 1997; Bar-Yosef 2000; Marks and Chabai 2001). With this picture in mind, in our research we simply compare the archaeological data with the global expectations deduced from ethnological models in order to identify the most plausible interpretation of site use and function in Middle Paleolithic mobility systems.

Moreover, in order to test the possibility of diachronic changes in mobility patterns, we have grouped together, in a schematic way, data collected from sites spanning tens of thousands of years. We rely heavily on patterns evident in two sites that we have studied in considerable detail (Hayonim cave for the early Middle Paleolithic; and Kebara cave for the late Middle Paleolithic). These patterns allow us to identify very general trends in forager mobility, the validity of which can then be explored further using data from other roughly contemporaneous Levantine sites. (see also application by Stiner and Kuhn 1992, on the Italian Middle Paleolithic). In painting this tentative picture, we are fully aware of the oversimplification of such a presentation and of the need for additional studies. The current paper is thus a preliminary step in what we feel is a useful direction.

EARLY MIDDLE PALEOLITHIC/LATE MIDDLE PALEOLITHIC MOBILITY PATTERNS: THE CASES OF HAYONIM AND KEBARA CAVES

Our presentation and discussion are mostly based on the results of the excavations carried out by an interdisciplinary team during the last 20 years in Hayonim and Kebara caves. From Hayonim cave we selected layer F and the base of layer E, about 180,000–215,000 years ago, and from Kebara cave, units IX to XI dated to about 57,000–60,000 years ago Each of these cases reflects different site functions and land-use patterns as will be shown below.

Hayonim Cave (Layers F and Lower E = Units 10 to 4)

Hayonim is located 13 km from the present Mediterranean coast, in Western Galilee, at an elevation of about 250 m asl, in a limestone cliff along the right bank of Nahal Meged. The cave overlooks a small valley which leads to the coastal plain.

The occupations in this cave were repetitive (units 4 to 10 are more than 3 m thick) but ephemeral, as shown by the low density of artifacts (between 200 and 320 pieces larger than 2 cm per m^3 of deposit, depending on the level), in spite of a slow rate of sedimentation. Each cubic meter accumulated over 10–15,000 years (based on the TL dates). This type of ephemeral habitation facilitated nesting by barn owls and thus most of the sediments are rich in microfauna, mainly rodents. The ephemeral character of the occupations is also expressed in the nature of the hearths, which generally are thin (in contrast to those at Kebara) when still visible to the naked eye. Micromorphological, mineralogical and phytolith analyses clearly show that the deposits are mainly anthropogenic, with remains of ashes that have been heavily trampled (Weiner *et al.* 1995, 2002; Goldberg and Bar-Yosef 1998; Albert *et al.* 2003). In fact, fireplaces had been numerous but in general were too thin to be preserved. The abundance of phytoliths of wood/bark and also leaves in the hearth sediments suggests that the main type of fuel used by Mousterian groups at Hayonim was often small branches probably derived from trees and bushes (Albert *et al.* 2003); the use of the latter is supported by the presence of minute baked clay balls seen in thin-sections of hearths, probably resulting from the uprooting of bushes (P. Goldberg, personal communication). Very likely the twigs used for fuel at Hayonim were collected in the immediate surroundings of the cave. The lack of evidence for systematic collection of fire wood from trees supports the view that the occupations were short-term and opportunistic in nature. Such opportunistic collection of fire wood, similarly linked with short-term occupations, has been described in other Middle Paleolithic sites as well (Théry-Parisot 2002; Théry-Parisot and Texier in press).

Although the intensity of occupation appears to have been low in the different units, all stages of stone tool production were carried out in the cave, employing nodules of different flint raw materials, most of which were collected within a distance of 10–15 km of the site (*i.e.*, within the probable daily foraging range). Numerous Eocene and Cenomanian outcrops of good quality raw material were available in the vicinity of the cave, most of them strictly local (less than 7 km). However, a few of the recovered artifacts testify to an origin some 20 km to the south of Hayonim (Zomet Hamovil area), and a few appear to come from distances as great as 30–40 km (Mount Carmel to the southwest, Nahal Dishon area to the northeast) (Delage *et al.* 2000). These exotic materials constitute more than 10% of the assemblage in some units. But the imported blanks were not exclusively introduced in the form of finished products. Levallois and laminar blanks were brought in, but also debitage byproducts. Thus, it seems that this nonlocal flint component should be seen as reflecting a larger exploitation territory, not as the result of a specific curation strategy.

Different core reduction strategies were used in lithic production. Throughout the sequence, a specific laminar technology aimed at the production of elongated blanks was employed, together with a form of Levallois core reduction designed to obtain short and elongated products (Meignen 1998, 2000). The former is more developed in the lower units (units 10 to 7 or layer F). Numerous diversified retouched blanks (*e.g.*, characteristic elongated retouched points or so-called

"Abu Sif points", retouched blades, sidescrapers and inversely retouched scrapers on Levallois blanks, typical burins) are present, but only in the lower units. For example, in unit 7 these elements are more abundant at the entrance of the cave than in the central area of the interior, which suggests some sort of spatial separation of activities within the site.

The analysis of the animal bones indicates low intensity exploitation of ungulates and tortoises (Stiner *et al.* 2000), pointing to low densities of human populations for much or all of the Mousterian period. Mortality patterns dominated by prime-age adults and anatomically balanced body part profiles of wild cattle (*Bos primigenius*), fallow deer (*Dama mesopotamica*), and mountain gazelle (*Gazella gazella*) clearly indicate that these game animals were obtained by hunting (Stiner this volume), and that these hominids enjoyed narrow diets rich in high-yield game types (Stiner 2001). Site-specific data for Hayonim cave indicate ephemeral occupations overall (Stiner 2005). The minimum number of individual ungulates (MNI) is consistently small in the Mousterian faunal assemblages preserved in Layer E (little to no fauna was preserved in the underlying layer F). Evidence of carnivore activity in Hayonim cave is virtually nonexistent, despite the presence of hyenas and canids in Middle Pleistocene ecosystems of the region (Tchernov 1992, 1994). Though conjectural, the lack of gnawing damage in this case may be another indication that refuse accumulation in the site was minimal and widely scattered in time, perhaps insufficient to attract large carnivores with any regularity.

In conclusion, the evidence from the lower layers in Hayonim cave (the complete sequence of tool manufacture and maintenance activities in the site, but with low densities of archaeological remains) reflects residential camps of short duration within a strategy of high mobility. This interpretation is supported by the presence of imported exotic raw materials from different directions at distances between 30–40 km. Complete on-site core reduction, together with a diversified toolkit, do not support the view that Hayonim was used primarily as a locus for highly task-specific activities. A strategy of high residential mobility would most likely occur in the Mediterranean belt when population densities were low.

Kebara Cave (Units XI to IX)

The nature of the occupations in Kebara, located close to the present-day Mediterranean coast on the western face of Mt. Carmel (Bar-Yosef *et al.* 1992), especially those in units XI–IX, were very different from those at Hayonim. Kebara's occupations were systematically repetitive over the entire 2-m-thick sequence of deposits that comprise these three units, a sequence that probably spans about 3,000 years from *ca.* 60,000 through *ca.* 57,000 years ago. Evidence of intensive human use of the cave is reflected by the paucity of small-sized rodent remains (*e.g.*, Tchernov 1996). The density of occupations is also clearly demonstrated by the large number of artifacts (1,000–1,200) per m^3 of deposit, which based on TL dates, accumulated over roughly 1,500 years. The same is true for the animal bones. The astounding "kitchen midden" (Schick and Stekelis 1977) along the north wall in Units XI–IX (see also Speth this volume) demonstrates the frequent hunting activities of the cave's occupants, and the recurrent processing of carcasses at the site (see also Speth and Tchernov 1998, 2001). Such spatial patterning at the margin of the occupation area recalls the gradual accumulation of trash along the peripheries of habitation areas observed among contemporary hunter-gatherers, a pattern that becomes increasingly apparent the longer the occupation (O'Connell 1987).

The hearths are well developed, and are often the result of numerous phases of use in the same place (Meignen *et al.* 1989, 2001a). Wood collected on the slopes of Mt. Carmel (*Quercus calliprinos*, *Q. ithaberensis*, *Crataegus* sp. and *Pistacia* sp.) was employed as the principal fuel, as shown by both charcoal and phytolith analyses (Baruch *et al.* 1992; Albert *et al.* 2000).

The mobility system in the case of Kebara was based on repetitive occupation of the same place by groups who shared the same global lithic tradition. No drastic changes in lithic technical reduction strategies can be detected across stratigraphic units XI–IX (Meignen and Bar-Yosef 1991, 1992). The same observation holds for the spatial organization of the central area in the cave. In units XI to IX there is a clear distinction between the central zone, where *in situ* fireplaces as well as flintknapping and animal processing activities occurred, and the dumping zone near the northern wall, where many of the larger debitage products and high densities of broken bones accumulated, forming what Stekelis many years ago referred to as the "kitchen midden" (Schick and Stekelis 1977; Speth this volume).

The study of the animal bones and carbonized plant remains from units XI–IX (Speth and Tchernov 2001; Lev *et al.* 2005) appears to reflect late fall, winter and spring/early summer occupations. Hunting of gazelles and fallow deer was carried out during winter and/or early spring, with male and female animals being taken in proportions broadly similar to their occurrence in wild populations (Speth and Tchernov 2001). Legume seeds, mostly various species of *Vicia* and lentils (*Lens* sp.), occur in all three layers, implying occupations of the cave in spring to early summer time, while pistachio nuts and acorn shells may indicate the presence of humans in the fall (Lev *et al.* 2005).

In units XI–IX rich faunal assemblages, mostly composed of ungulates of different sizes, result from hunting activities rather than scavenging, as demonstrated by Speth and Tchernov (1998). Differential treatment of the carcasses has been recognized, with large-sized game (red deer and aurochs) represented by elevated proportions of elements of high marrow utility, and medium- and small-sized game (fallow deer and gazelles) represented by more complete carcasses, including many elements of only moderate to low marrow utility. Transport decisions were also strongly conditioned by bulk, such that crania and pelves of the largest taxa were much less often brought to the cave than their counterparts from smaller ungulates (Speth and Tchernov 2001). Intense butchery activities, including dismembering, defleshing, and marrow extraction, as well as cooking, took place in the cave (Speth and Tchernov 2001).

All stages of lithic production were carried out inside the cave, as shown by the proportions of by-products (especially cortical products), ordinary flakes and cores (Meignen and Bar-Yosef 1991, 1992). Blocks of flint were imported from a maximum distance of 10–15 km (within the catchment area), as the nodules that were employed occur in abundance, both to the north and south of the site, in Mt. Carmel Cretaceous and Eocene formations (Shea 1991). Cores, most highly exhausted, were discarded at the site. All of these characteristics evoke a strategy of provisioning places (Kuhn 1995).

Flaking was most often done using the unidirectional convergent Levallois technique directed towards the production of triangular blanks (Meignen 1995). These blanks were rarely retouched, even though use-wear analysis demonstrates that some were repeatedly used. The tool characteristics were most often directly the result of the flaking technique, the desired morphologies of the end-products being controlled by means of the manner in which the core was shaped (Levallois blanks). As shown by the low percentage of retouched tools, the low intensity of retouching on each piece, and the observed pattern of use-wear, it is obvious that tools, with or without retouch, were not intensively utilized. In fact, few tools exhibit wear referable to prolonged use (Shea 1991). Such casual raw material exploitation, with little evidence of recycling, has been described in the context of base camps in ethnographic studies (Parry and Kelly 1987). The tools, retouched and non-retouched, were used in the cave for a series of diversified activities, including butchery (*e.g.*, dismembering, defleshing, slicing) and maintenance tasks (*e.g.*, wood working, cutting hard materials, scraping hard and medium materials, wedging or splitting). Even the retouched component of the assemblage does not demonstrate prolonged cycles of use and recycling; this category was often involved in maintenance activities, with high edge-attrition rates mostly related to wood working (Shea 1991). While Beyries (Plisson and Beyries 1998) concluded that pointed Levallois blanks were mostly multifunctional (multipurpose tools involved in butchery activities and wood working), Shea suggested that the design and the presence of impact fractures imply that they were often hafted as spear points (Shea 1988; Shea *et al.* 1998). The discovery of a broken point in a wild ass vertebra in the Middle Paleolithic site of Umm el Tlel in the El-Kowm basin in northeast Syria (Boëda *et al.* 1999) demonstrates that at least some of the Middle Paleolithic points were made as hunting devices, but were also, as with Neolithic arrowheads (Moss 1983), used in butchery activities. The same combination spear-knife is often observed in ethnographically documented hunter-gatherer groups (Oswalt 1976).

The absence of artifacts made of imported exotic raw material implies that the availability of good quality raw material from local sources was known in advance by the Mousterian occupants of the cave. This, as well as the complete reduction sequence of cores on site, the high densities of stone tools and animal bones, the numerous well-defined and often superimposed fireplaces, the development of a substantial midden along the site's northern periphery, and the redundancy of spatial patterning—all point to the conclusion that the cave was occupied by Middle Paleolithic groups on a regular and anticipated basis. In short, the occupations at Kebara during units XI–IX suggest relatively long-term encampments with formalized internal structure involving spatially differentiated activities and even human burials. The entire set of indicators tells us that the degree of residential mobility was comparatively low. The predominant lithic supply strategy in units XI–IX was the provisioning of place, the supply of raw material in the form of blocks that for the most part came from flint sources within the catchment area. The position of the cave, at the confluence of erosional gullies and adjacent to the coastal plain and the hills of Mt. Carmel, facilitated the exploitation of animal and vegetal resources from a diversity of habitats. Kebara's location is entirely compatible with its interpretation as a base camp, as such settlements are often situated at locations of compromise between widely dispersed resource concentrations (Harpending and Davis 1977; Jochim 1979; Hovers 1997). To sum, during the time of deposition of units XI–IX, Kebara functioned as a major cool-season base camp where a wide range of maintenance and extractive tasks took place, including a substantial amount of hunting in both open lowland habitats and more dissected, forested uplands.

It is worth noting a slight but intriguing change in units VIII and VI, in the later occupations of the cave. While the lithic activities appear to remain more or less the same (*i.e.*, high densities of artifacts, complete core reduction sequences *in situ*, but a more diversified Levallois production), evidence for hunting declines and is differently organized. During these later visits to the cave, either a narrower range of carcass parts, of lower average food utility, was brought back to the site, or, as seems more likely, many of the carcass parts that did make it to Kebara during these occupations were butchered and processed only to the extent necessary to prepare the higher-utility parts for transport elsewhere, leaving behind mostly lower-utility skeletal parts that had been culled and discarded. Moreover, the timing of hunting activity appears to have changed as well. Whereas in units XI–IX most hunting may have taken place during the winter and early spring, in the later Middle Paleolithic occupations, and during those of the earliest Upper Paleolithic, most hunting appears to have taken place later in the year—in the late spring or even during the warmer summer months. Thus, while the lithic data suggest the same kind of dense occupations as in units XI–IX, the faunal data point to a shift in site function and a shift in the seasonality of those activities as well. While these contrasts must still be regarded as tentative, they highlight the value of considering the lithic and faunal data together rather than as completely independent data sets.

We can now posit the question of whether the observed changes in mobility patterns hypothesized on the basis of Hayonim and Kebara simply reflect different site functions or have broader diachronic significance in the region. Unfortunately, evaluation of this hypothesis is handicapped by the limited amount of available information. Even though the data from the Levant are better than from many other geographical areas, the information is still insufficient to disclose a clear picture. But tentatively the following observations can be made.

Early Middle Paleolithic

On the whole, the limited published evidence of a few quantitative studies concerning raw material economy, occupation densities, and dating, seems to indicate that a high degree of residential mobility characterized the early Middle

Paleolithic period in the Levant. For example, in the cave of Abu Sif (Judean Desert), the low densities of lithics (suggested by Neuville 1951:54 in a footnote), the introduction of finished tools (retouched and non-retouched), and the low proportions of debitage by-products (primary flakes and especially very few cores), suggest that the occupations were short, and that most knapping activities were conducted away from the cave (Neuville 1951:54). Provisioning of individuals, based on carrying one's toolkit as personal gear, was probably the principal strategy employed by the site's inhabitants. Together with the impressive homogeneity of the toolkit, characterized by elongated retouched points together with shorter triangular tools, the former (Abu Sif points) being the most frequent, the composition of these assemblages could also evoke a task-specific location. In the laminar assemblage of Tabun IX, as described by Jelinek (1982), "the Levallois products (including blades) outnumber the non Levallois elements, a fact meaning the former's import into the site as finished blanks." This pattern may reflect short-term occupations of the cave, confirmed by low densities of artifacts (bed 39: 170 pieces per m^3, Jelinek 1977: table 2). Relatively high proportions of retouched tools, indicative of heavy blank curation, and eventually recycling, are observed in Tabun IX (19.6%, Jelinek 1982:92), Hummal Ia (*ca.* 18%, Copeland 1985), and probably in Abu Sif (Neuville 1951). These limited data, taken together, suggest a pattern of high residential mobility in which people carried over the landscape at least a limited toolkit (and see Hovers 2001).

Conversely, excavations at two large sites (Rosh Ein Mor, Nahal Aqev) as well as tests and surface collections at several smaller sites in the Negev highlands, an area rich in water sources and outcrops of good quality raw material, allowed Marks and his colleagues (Munday 1976, 1979; Marks and Friedel 1977) to propose, for the wetter periods, a relatively stable settlement/procurement pattern in which base camps (Rosh Ein Mor and Nahal Aqev) were occupied over extended periods and provisioned logistically by what they called "radiating mobility" from short-term camps (Henry 1995a). Unfortunately, the lack of preservation of faunal remains prevents us from a more detailed discussion of these Negev sites.

Late Middle Paleolithic

Not surprisingly, the late Middle Paleolithic is a richer period with many more excavated sites, and a range of site functions can be identified. The excavations at Amud cave have produced evidence for dense occupations (1,000 lithics/m^3, over 1,000–1,500/m^3 in layers B1–B2) with numerous hearths, even if not well preserved (Hovers 2001). A pattern of repeated occupations is suggested by temporal consistency in the use of designated parts of the cave as a depository for human remains (Hovers *et al.* 1995). These preliminary results are congruent with the behavior of groups moving regularly over familiar tracts of territories, the size of which allowed frequent returns to the same locale (Hovers 2001).

The intrasite patterns observed in a series of other sites of the late Middle Paleolithic (Quneitra, Farah II, Umm el Tlel) suggest relatively short encampments tied to butchery, meat-processing and initial raw-material processing. The open-air site of Quneitra, on the Golan, amidst lava flows and next to a pond, is seen as a temporary seasonal hunting camp which was repeatedly occupied within a logistical system (Goren-Inbar 1990; Hovers 1990). Located in a landscape scarce in sedimentary rocks, good quality flint could have been a critical resource for Quneitra's inhabitants. Most of the raw materials originated from distances of 10–18 km, probably beyond the daily foraging range of the site's inhabitants (Hovers 1990); part of the primary knapping of the material took place elsewhere (at the flint source or at another site). According to Hovers (1990), raw material provisioning probably required special trips (*i.e.*, procurement was probably not an "embedded" strategy); hence, once brought to the site, raw materials were intensively exploited (exhausted cores).

Farah II in the Negev is an open-air site located near water sources (Nahal Besor) and above a conglomerate rich in flint cobbles and pebbles (constituting a strictly local raw material source). It is interpreted by the authors as a short-term encampment with on-site lithic production and carcass exploitation. The main prey animals were large ungulates, possibly forming big aggregations near watering places during dry periods, and a comparatively predictable resource for people to hunt (Gilead and Grigson 1984). Hovers (1997: 246–247) suggested that at Farah II activities rather than places were provisioned, implying unanticipated tool needs, where "lithic production focused on obtaining cutting edges through knapping a large number of flakes, the shape and size of which were of little relevance." The idea of such fortuitous behavior seems contradicted both by the predictability of prey animals congregating near watering places (emphasized by the authors) and the likely predictability of the lithic resources at the site. Processing and consumption of animal resources (large ungulates) at Farah II, close to the hunting place (Gilead and Grigson 1984:89), as well as the production of a toolkit on the spot, would seem instead to suggest an expedient strategy in which "time and place of use are highly predictable so that a minimized technological effort is required" (Nelson 1991, quoted in Hovers 1997). Thus, Farah II could be considered as a residential camp in a context of high mobility (as previously indicated by Gilead and Grigson who suggested the occupation represent a duration probably not exceeding a few weeks (Gilead and Grigson 1984). While the toolkit is clearly the result of an expedient strategy, the lithic reduction strategy used by the occupants could have been more sophisticated than it seems. Levallois points, even if not numerous, are present in the site and the low ratio of Levallois products could be due to their export to other places, not surprising in a context of high residential mobility. This hypothesis of mobile end-products has also been considered by Hovers (1997: 247).

In the site of Umm el Tlel (El Kown basin), located in the present-day desertic zone (Boëda *et al.* 2001), numerous successive levels of Middle Paleolithic occupations accumulated quite rapidly in a changing environment, from steppic arid to open grassland with patches of trees, but always next to a permanent water source. The function of each occupational level varies and many appear to be logistically-based task-specific horizons. This variability is neatly expressed in the three following examples.

Layer VI3b'1 – these occupations, in a steppic environment, occurred near a lake. Meat processing for delayed consumption was the main activity as demonstrated by the transport of large numbers of high-utility parts of wild camels to the site. Intense butchery activities occurred at the site and, taking into account the large quantities of meat processed, the authors considered the hypothesis of delayed consumption as the most plausible interpretation of the observed data. Part of the toolkit was brought in as personal gear (large Levallois points and elongated blanks), completed by on-site lithic production. The site was also provisioned with raw material in the form of large flakes and small blocks that were obtained from flint outcrops that occur in the vicinity of the site (1–5 km). The duration of site use must have been relatively short as the debris of tool-manufacture using the local raw material has not overwhelmed evidence of provisioning of individuals (Kuhn 1995). Such a combination of different provisioning strategies has also been identified in other Middle Paleolithic sites such as Qafzeh (Hovers 1997) and Tor Sabiha (Henry 1995a, 1995b, 1998). Of course, it is also commonplace among modern hunter-gatherers who often prepare at least part of their toolkit in advance of use (Kuhn 1992, 1995, and references therein).

Layer VI1a0 – in this occupation, also in a steppic arid environment, the site was used as a hunting station and for primary butchery activities as shown by the abundance of low-utility body parts. It is also characterized by a very low density of stone tools ($n = 18$ in an area of 20 m^2), with few Levallois products carried into the place as personal gear. These characteristics (very low density of lithics, strategy of provisioning individuals) suggest a task-specific location.

Layer V2ba – in this layer, lithic and faunal studies point to encampments of longer duration in a quite different environment (open grassland with patches of trees). Although the densities of lithics are not very high, core reduction was done on-site from nodules already roughly shaped at the raw material outcrops more than 5 km away (a strategy of provisioning places). The toolkit, mainly Levallois flakes and points, was suitable for a diversity of activities. The tools were rarely resharpened. Animal carcasses (mostly equids and *Camelus* sp.) were brought into the site for consumption.

In the lower levels at Kebara cave (units XIII–XII), in contrast with the unit XI–IX occupations described previously, the composition of the lithic assemblage as well as the faunal remains suggest that the cave was used on a short-term basis, probably as a hunting station. Surprisingly, despite exceptionally low densities of artifacts in unit XIII, huge fireplaces have been observed in the central area. In unit XII, Neandertals introduced Levallois end-products as personal gear and completed their toolkit by on-site flintknapping. As previously described, a combination of both strategies of provisioning (provisioning of individual and place) testifies to the flexibility of Middle Paleolithic organizational behavior at Kebara.

The late Middle Paleolithic examples presented above often point to systems of low residential mobility, with some occupations resembling task-specific activity loci, others much longer-term repetitive occupations (base camps?), and some varying over time, as in the cases of the long stratigraphic sequences at Kebara and Umm el Tlel. A similar diachronic change in site occupation behavior has been observed in Qafzeh cave (Hovers 1997, 2001) during OIS 5. In southern Jordan, the available information from Tor Faraj and Tor Sabiha, two sites located along the southern edge of the Jordanian plateau, point to a combination of radiating and circulating settlement patterns (Henry 1995b). In Tor Sabiha, situated at 1,300 m asl on the plateau, the composition of the stone tool assemblage (introduction of large Levallois points as personal gear and local raw material reduction on site), together with low densities of occupation, seem to reflect "ephemeral high elevation summer camps provisioned opportunistically from resources found within their catchment" (Henry 1998:128). But the development of final processing activities (tool fabrication, maintenance and rejuvenation) could also suggest a task-specific locale. Levallois points, often considered as hunting/butchering implements, could have been imported to the site in anticipation of such specialized activities. In Tor Faraj, positioned at 900 m asl, spatially organized and repeated occupations have been documented, which often have the characteristics of base camps in a logistical strategy (provisioning of place with raw material from within and outside the site catchment; complete reduction sequence on site; Henry 1995b, 1998). But lithic densities remain low (123 to 205 /m^3; Henry 1995b: table 7.6), indicative of relatively brief occupations even if longer than in Tor Sabiha. Considering these two sites as roughly contemporaneous and in spite of the lack of fauna or plant remains, Henry (1995) interpreted Tor Faraj as winter occupations in the lowlands and Tor Sabiha as summer stations at higher elevation. In this interpretation, the topography and absolute altitude structured the nature of the mobility system.

The early Middle Paleolithic sites in the Negev, although within the steppic belt, possibly represent occupations during periods of greater precipitation when this sub-region fell within the vegetational belt of the open parkland, and not the semiarid zone. Thus, if these Middle Paleolithic occupations took place in conditions resembling those of Mt. Carmel, we may expect similar mobility patterns that range from residential through logistical strategies, and perhaps more often the combination of the two.

CONCLUSIONS

Most Levantine Mousterian sites are located within the present distribution of the Mediterranean woodland ecozone (Bar-Yosef 1995), and this belt was even more extensive during the early Upper Pleistocene (Horowitz 1979). Conversely, sites are less common in the steppic southern and eastern parts of the Levant. In our current knowledge, late Middle Paleolithic occupations are more numerous than occupations of early Middle Paleolithic age, and they often occur in multilayered sites occupied recurrently over the course of thousands of years. In addition, many late Middle Paleolithic sites also seem to be more densely occupied (*e.g.*, Kebara, Amud). Hence, the available evidence suggests either changes in mobility patterns or demographic increase or some combination of the two during the Middle Paleolithic. To date, no early Middle Paleolithic sites have been described which demonstrate an intensity and permanence of occupation comparable to what is seen in the late Mousterian sequence in Kebara cave. Admittedly, however, very few early Middle Paleolithic sites are known. Consequently, it is quite difficult to evaluate the proposed hypothesis of a change in human population size per territory from the early to the late Middle Paleolithic (see also discussion in Hovers 2001).

Nevertherless, during the onset of OIS 4, it is probable that some population increase did occur, due perhaps to a combination of local population growth and an influx of people from the Anatolian plateau (Bar-Yosef 2000). Stiner *et al.* (1999, 2000) present evidence, based on changes in dietary breadth, predator-prey computer simulation modeling, and an observed decline in mean body sizes of Late Pleistocene tortoises, that human populations in the Levant may have grown somewhat toward the end of the Middle Paleolithic, after about 55,000 years ago, thereby reopening the door to discussions of late Neandertal hunting pressure on the larger ungulates, albeit on a subtle scale if compared to later human impacts on Pleistocene environments (Stiner 2001).

Evidence for population increase is also suggested by the more numerous and diversified late Middle Paleolithic sites and the more intensive and repetitive use of the caves as described above. It is in fact possible that these changes began first during the occupation of Qafzeh cave, as proposed by Hovers (2001), namely during the early part of the Upper Pleistocene.

The Kebara faunal data provide additional though tentative evidence for demographic increase in the late Middle Paleolithic (Speth 2004). A striking feature of Kebara's faunal record is the monotonic decline of the principal larger-bodied animals – red deer and aurochs – over the entire four-meter-deep Middle Paleolithic sequence and continuing into the early Upper Paleolithic. Particularly noteworthy is the fact that this decline continues unabated across several major swings in regional paleoclimate that are clearly evident in the speleothem-based oxygen-isotope record from Soreq Cave in Israel (Bar-Matthews *et al.* 1998, 1999; Speth and Tchernov 2002). A long-term trend of similar nature is documented for the Wadi Meged faunal sequence, spanning the early Middle Paleolithic, Upper Paleolithic and Epipaleolithic from the sites of Hayonim cave and Meged rockshelter (Stiner this volume). Here, changes in ungulate prey sizes are examined from the standpoint of biomass-corrected data and indicate that large mammal communities may have been affected by human predation as early as the late Middle Paleolithic, and certainly by the early Upper Paleolithic. More robust findings on this subject in the Wadi Meged thus far come from the small game data.

In light of the Soreq Cave record, it seems very unlikely that the "phasing out" of the two largest-bodied taxa at Kebara can be attributed in any simple or direct way to changes in paleoclimate. Instead, increasing predator pressure seems to have contributed to the trend, the predator of course being the late Neandertal inhabitants of the region and/or the influx of Upper Paleolithic populations to adjoining regions (see Davis *et al.* 1988 for an earlier discussion of overhunting). Most paleoanthropologists assume, for the most part implicitly, that pre-modern human population densities in the eastern Mediterranean would have been too sparse to have had such an impact on these animals. Kebara, however, provides a few other pieces of evidence that may also point to overhunting in the later part of the Middle Paleolithic. For example, mean crown heights of the lower 4th premolars and third molars of adult gazelles increase steadily (*i.e.*, the teeth are less heavily worn) from the beginning of the sequence right into the early Upper Paleolithic indicating that, over time, Kebara's Neandertal hunters focused ever more heavily on younger adult gazelles, a possible sign of subsistence intensification. Moreover, not only were Kebara's hunters making increasing use of juvenile and young adult gazelles, prey that would have ranked lower than their prime-adult counterparts, other data such as relative skeletal completeness and the number of heads compared to postcranial parts that were transported back to the cave, suggest that the hunters had to travel longer distances to procure game, further indication of subsistence intensification during the latter part of the Middle Paleolithic.

Thus, Kebara's faunal evidence may point to overhunting of the largest mammalian taxa and intensified procurement of lower-ranked gazelles. This trend appears to be unrelated to the climatic changes that were affecting the region at the same time. Human demographic pressure, therefore, seems to have been a contributing cause. However, even if we accept a demographic explanation for the patterning, by itself Kebara does not demonstrate that the phenomenon affected the entire region. Hence, at this stage we must regard the Kebara evidence as suggestive rather than conclusive.

One may argue from the above observations that the most readily visible differences between the early and late Mousterian are about numbers of people on a landscape—rates and timing of visitation and, perhaps, the sizes of the social groups present. From the point of view of site structure, we see substantive contrasts between Hayonim and Kebara caves and the successive phases of the Mousterian that they represent. Hayonim seems to be characterized by redundant, spot-specific use of domestic space, whereas Kebara displays a more rigidly partitioned spatial pattern, probably in response to higher rates of debris generation. Finer variations in resource scheduling may also be apparent in the late Mousterian, but this is less certain due to the limitations of the Hayonim sample sizes. What indications we find of predator pressure on large mammals are subtle. The ungulate mortality evidence is suggestive but as yet unclear with respect of variation within the Mousterian. Evidence of pressure on small game resources seems clear. Convincing indications of more people in the later Mousterian appear as two spatial aspects of the archaeological record: internal differentiation in site structure during the later Mousterian and, on a geographic scale, greater numbers of sites that may also be richer in material.

Our principal conclusion, perhaps best viewed at this stage as a working hypothesis, is that the changes in settlement patterns between the early and the late Middle Paleolithic reflect an increase in regional population, as well as shifts in forager mobility in response to seasonal and eventually long-term changes in resource distribution and abundance. We believe that these settlement changes are most parsimoniously accounted for by reference to a combination of demographic and paleoecological factors rather than by positing a change in the cognitive capacities of local or intrusive populations.

REFERENCES CITED

Albert R.M., O. Bar-Yosef, L. Meignen and S. Weiner 2003. Quantitative phytolith study of hearths from the Natufian and Middle Palaeolithic levels of Hayonim Cave (Galilee, Israel). *Journal of Archaeological Science* 30: 461–480.

Albert R.M., S. Weiner S., O. Bar-Yosef and L. Meignen 2000. Phytoliths in the Middle Palaeolithic deposits of Kebara cave, Mt Carmel, Israel: sudy of the plant materials used for fuel and other purposes. *Journal of Archaeological Science* 27**:** 931–947.

Avigour A., M. Magaritz and A. Issar 1992. Pleistocene paleoclimate of the arid region of Israel as recorded in calcite deposits along regional transverse faults and in veins. *Quaternary Research* 37**:** 304–314.

Bamforth, D.B. 1991. Population dispersion and Paleoindian technology at the Allen Site. In A. Montet-White and S. Holen (Eds), *Raw Material Economies among Prehistoric Hunter-Gatherers*, pp. 357–374. Lawrence: University of Kansas.

Bar-Matthews M., A. Ayalon and A. Kaufman 1998. Palaeoclimate evolution in the eastern Mediterranean region during the last 58,000 years as derived from stable isotopes of speleothems (Soreq Cave, Israel). *Isotope Techniques in the Study of Environmental Change* (Proceedings of an International Symposium on Isotope Techniques in the Study of Past and Current Environmental Changes in the Hydrosphere and the Atmosphere), IAEA-SM-349/17. pp. 673–682. Vienna: International Atomic Energy Agency,

Bar-Matthews M., A. Ayalon and A. Kaufman 2000. Timing and hydrogeological conditions of sapropel events in the Eastern Mediterranean, as evident from speleothems, Soreq Cave, Israel. *Chemical Geology* 169: 145–156.

Bar-Matthews M., A. Ayalon, A. Kaufman and G.J.Wasserburg 1999. The eastern Mediterranean paleoclimate as a reflection of regional events: Soreq Cave, Israel. *Earth and Planetary Science Letters* 166: 85–95.

Bar-Yosef O. 1995. The Lower and Middle Paleolithic in the Mediterranean Levant: chronology, and cultural entities. In H. Ullrich (Ed.), *Man and Environment in the Palaeolithic,* pp. 247–263. (ERAUL 62). Liège: Université de Liège.

Bar-Yosef O. 1998. The chronology of the Middle Paleolithic of the Levant. In T. Akazawa, K. Aoki and O. Bar-Yosef (Eds.), *Neandertals and Modern Humans in Western Asia*, pp. 39–56. New York: Plenum Press.

Bar-Yosef O. 2000. The Middle and Upper Paleolithic in Soutwest Asia and neighboring regions. In O. Bar-Yosef and D. Pilbeam (Eds.), *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean*, pp. 107–156. Cambridge MA: Peabody Museum of Archaeology and Ethnology, Harvard University.

Bar-Yosef O., B. Vandermeersch, B. Arensburg, A. Belfer-Cohen, P. Goldberg, H. Laville, L. Meignen, Y. Rak, J.D. Speth, E. Tchernov, A.-M. Tillier and S. Weiner 1992. The excavations in Kebara cave, Mt Carmel. *Current Anthropology* 33: 497–550.

Baruch U., E. Werker and O. Bar-Yosef 1992. Charred wood remains from Kebara Cave, Israel: preliminary results. *Bulletin de la Sociėtė Botanique Francaise* 139: 531–538.

Binford L.R. 1977. Forty-seven trips: a case study in the character of archaeological formation processes. In R.V.S. Wright (Ed.), *Stone Tools As Cultural Markers*, pp. 24–36. Canberra: Australian Institute of Aboriginal Studies.

Binford L.R. 1978. *Nunamiut Ethnoarchaeology*. New York: Academic Press.

Binford L.R. 1979. Organization and formation processes: looking at curated technologies. *Journal of Anthropological Research* 35: 255–273.

Binford L.R. 1980. Willow smoke and dogs' tails: hunter-gatherer settlement systems and archaeological site formation. *American Antiquity* 45: 4–20.

Binford L.R. 1983. *In Pursuit of the Past*. London: Thames and Hudson.

Boëda E., J.-M. Geneste, C. Griggo, N. Mercier, S. Muhesen, J.-L Reyss, A. Taha and H. Valladas 1999. A Levallois point imbedded in the vertebra of a wild ass (*Equus africanus*): hafting, projectiles and Mousterian hunting weapons. *Antiquity* 73: 394–402.

Boëda E., J.-M. Geneste and L. Meignen 1990. Identification de chaînes opératoires lithiques du Paléolithique ancien et moyen. *Paléo* 2: 43–80.

Boëda E., C. Griggo and S. Noel-Soriano 2001. Différents modes d'occupation du site d'Umm el Tlell au cours du Paléolithique moyen (El Kowm, Syrie centrale). *Paléorient* 27: 13–28.

Conard N. J. 2001. Advances and problems in the study of Paleolithic settlement systems. In N. Conard (Ed.), *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age*, pp. VII–XX. Tübingen: Kerns Verlag.

Copeland L. 1985. The pointed tools of Hummal Ia (El Kowm, Syria). *Cahiers de l'Euphrate* 4: 177–189.

Cresswell R.C. 1982. Transferts de techniques et chaînes opératoires. *Techniques et Cultures* 2: 143–163.

Davis S.J.M., R. Rabinovich and N. Goren-Inbar 1988. Quaternary extinctions and population increase in western Asia: the animal remains from Biq'at Quneitra. *Paléorient* 14: 95–105.

Delage C., L. Meignen and O. Bar-Yosef 2000. Chert procurement and the organization of lithic production in the Mousterian of Hayonim cave (Israel). *Journal of Human Evolution* 38: A10–A11.

Geneste J.-M. 1988. Systèmes d'approvisionnement en matières premières au Paléolithique moyen et au Paléolithique supérieur en Aquitaine. In J.K. Kozlowski (Ed.), *L'Homme de Néandertal: La Mutation* (ERAUL 35), pp. 61–70. Liège: Université de Liège.

Geneste J.-M. 1991. Systèmes techniques de production lithique: variations techno-économiques dans les processus de réalisation des outillages paléolithiques. T*echniques et cultures* 17–18: 1–35.

Gilead I. and C. Grigson 1984. Far'ah II: a middle Palaeolithic open-air site in the northern Negev, Israel. *Proceedings of the Prehistoric Society* 50: 71–97.

Goldberg P. and O. Bar-Yosef 1998. Site formation processes in Kebara and Hayonim Caves and their significance in Levantine prehistoric caves. In T. Akazawa, K. Aoki and O. Bar-Yosef (Eds.), *Neandertals and Modern Humans in Western Asia*, pp. 107–125. New-York: Plenum Press.

Goren-Inbar N. 1990. *Quneitra: a Mousterian Site on the Golan heights* (Qedem 31). Jerusalem: Institute of Archaeology, The Hebrew University of Jersualem.

Harpending H. and H. Davis 1977. Some implications for hunter-gatherer ecology derived from the spatial structure of resources. *World Archaeology* 8: 275–286.

Henry D. 1989. Correlations between reduction strategies and settlement patterns. In D. Henry and G. Odell (Eds.), *Alternative Approaches to Lithic Analysis*, pp. 139–155. Washington D.C: Archeological Papers of the American Anthropological Association.

Henry D. 1995a. The Influence of mobility levels on Levallois point production, late Levantine Mousterian, Southern Jordan. In H.L. Dibble and O. Bar-Yosef (Eds.), *The Definition and Interpretation of Levallois Technology* (Monographs in World Prehistory 23), pp. 185–200. Madison: Prehistory Press.

Henry D.O. 1995b. *Prehistoric Cultural Ecology and Evolution. Insights from Southern Jordan.* New York: Plenum Press.

Henry D.O. 1998. Intrasite spatial patterns and behavioral modernity: indications from the late Levantine Mousterian rockshelter of Tor Faraj, southern Jordan. In T. Akazawa, K. Aoki and O. Bar-Yosef (Eds.), *Neandertals and Modern Humans in Western Asia*, pp. 127–142. New York: Plenum Press.

Horowitz A. 1979. *The Quaternary in Israel.* New York: Academic Press.

Horowitz, A., 1988. Quaternary environments and paleogeography in Israel. In Y. Yom-Tov, and E. Tchernov (Eds.), *The Zoogeography of Israel*, pp. 35–58. Dordrecht: Junk.

Hovers E. 1990. The exploitation of raw material at the Mousterian site of Quneitra. In N. Goren-Inbar (Ed.), *Quneitra: a Mousterian Site on the Golan heights* (Qedem 31), pp. 150–167. Jerusalem: Institute of Archaeology, The Hebrew University.

Hovers E. 1997. *Variability of Levantine Mousterian Assemblages and Settlement Patterns: Implications for Understanding the Development of Human Behavior*. Ph.D. dissertation, The Hebrew University of Jerusalem.

Hovers E. 2001. Territorial behavior in the Middle Paleolithic of the Southern Levant. In N.J. Conard (Ed.), *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age*, pp. 123–152. Tübingen: Kerns Verlag.

Hovers E., Y. Rak, R. Lavi and W.H. Kimbel 1995. Hominid remains from Amud cave in the context of the Levantine Middle Paleolithic. *Paléorient* 21: 47–61.

Jelinek A.J. 1977. A preliminary study of flakes from the Tabun Cave, Mount Carmel. In B. Arensburg and O. Bar-Yosef (Eds), *Moshe Stekelis Memorial Volume* (Eretz-Israel: Archaeological, Historical and Geographical Studies 13), pp. 87–96. Jerusalem: The Israel Exploration Society.

Jelinek A.J. 1982. The Middle Paleolithic in the Southern Levant, with comments on the appearance of modern *Homo sapiens*. In A. Ronen (Ed.), *The Transition from Lower to Middle Paleolithic and the Origin of Modern Man* (BAR International Series 151), pp. 57–104. Oxford: BAR.

Jochim M.B. 1979. Breaking down the system: recent ecological approaches in archaeology. In M.B. Schiffer (Ed.), pp. 77–118. *Advances in Archeological Method and Theory.* New York: Academic Press.

Karlin C., P. Bodu and J. Pelegrin 1991. Processus techniques et chaînes opératoires. Comment les préhistoriens s'approprient un concept élaboré par les ethnologues. In H. Balfet (Ed.), *Observer l'action technique: des chaînes opératoires, pour quoi faire?*, pp. 101–117. Paris: Editions du CNRS.

Kuhn S.L. 1992. On planning and curated technologies in the Middle Paleolithic. *Journal of Anthropological Research* 48: 185–213.

Kuhn S.L. 1995. *Mousterian Lithic Technology. An ecological perspective.* Princeton: Princeton University Press.

Lemonnier P. 1986. The study of material culture today: toward an anthropology of technical systems. *Journal of Anthropological Archaeolog* 5: 147–186.

Lemonnier P. 1992. *Elements for an Anthropology of Technology*. (Anthropological Paper 88). Ann Arbor: University of Michigan, Museum of Anthropology.

Lev E., M.E. Kislev and O. Bar-Yosef 2005. Mousterian vegetal food in Kebara Cave, Mt. Carmel. *Journal of Archaeological Science* 32: 475–484.

Lieberman D.E. and J.J. Shea 1994. Behavioral differences between Archaic and modern humans in the Levantine Mousterian. *American Anthropologist* 96: 300–332.

Marks A.E. and V.P. Chabai 2001. Constructing Middle Paleolithic settlement systems in Crimea: potentials and limitations. In N. Conard (Ed.), *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age*, pp. 179–204. Tübingen: Kerns Verlag.

Marks A.E. and D.A. Friedel 1977. Prehistoric settlement patterns in the Avdat/Aqev area. In A.E. Marks (Ed.), *Prehistory and Paleoenvironments in the Central Negev, Israel*, pp. 131–158. Dallas: Southern Methodist University Press.

Meignen L. 1995. Levallois lithic production systems in the Middle Palaeolithic of the Near East: The case of the unidirectional method. In H. Dibble and O. Bar-Yosef (Eds.), *The Definition and Interpretation of Levallois Technology*, pp. 361–380. Madison, WI: Prehistory Press.

Meignen L. 1998. Hayonim cave lithic assemblages in the context of the Near Eastern Middle Palaeolithic: a preliminary report. In T. Akazawa, K. Aoki and O. Bar-Yosef (Eds.), *Neandertals and Modern Humans in Western Asia*, pp. 165–180. New York: Plenum Press.

Meignen L. 2000. Early Middle Palaeolithic blade technology in southwestern Asia. *Acta Anthropologica Sinica* 19 (Supplement): 158–168.

Meignen L. and O. Bar-Yosef 1991. Les outillages lithiques moustériens de Kebara (fouilles 1982–1985): premiers résultats. In O. Bar-Yosef and B. Vandermeersch (Eds.), *Le Squelette Moustérien de Kebara 2*, pp. 49–75. Paris: Editions du CNRS.

Meignen L. and O. Bar-Yosef 1992. Middle Palaeolithic variability in Kebara Cave (Mount Carmel, Israel). In T. Akazawa, K. Aoki and T. Kimura (Eds.), *The Evolution and Dispersal of Modern Humans in Asia*, pp. 129–148. Tokyo: Hokusen-Sha.

Meignen L., O. Bar-Yosef and P. Goldberg 1989. Les structures de combustion moustériennes de la grotte de Kébara, Mont Carmel, Isräel. In M. Olive and Y. Taborin Y. (Eds.), *Nature et Fonction des Foyers Préhistoriques*, pp. 141–146. Nemours: APRAF.

Meignen L., O. Bar-Yosef, P. Goldberg and S. Weiner 2001a. Le feu au Paléolithique moyen: recherches sur les structures de combustion et le statut des foyers. L'exemple du Proche-Orient. *Paléorient* 26: 9–22.

Meignen L., O. Bar-Yosef, N. Mercier, H. Valladas, P. Goldberg and B. Vandermeersch. 2001b. Apport des datations au problème de l'origine des hommes modernes au Proche-Orient. In J.N. Barrandon, P. Guilbert and V. Michel (Eds.), *Datation*. (XXI° Rencontres Intern. d'archéologie et d'histoire d'Antibes), pp. 295–313. Antibes: A.P.D.C.A.

Meignen L., S. Beyries, J.D. Speth and O. Bar-Yosef 1998. Acquisition, traitement des matières animales et fonction du site Paléolithique moyen dans la grotte de Kébara (Israël): approche interdisciplinaire. In J.-P. Brugal, L. Meignen and M. Patou-Mathis (Eds.), *Economie préhistorique: les comportements de subsistance au Paléolithique*, pp. 227–258. Sophia-Antipolis: A.P.D.C.A.

Moss E. 1983. The functions of burins and tanged points from Tell Abu Hureira (Syria). In M.C. Cauvin (Ed.), *Traces d'utilisation sur les outils néolithiques du Proche-Orient*, pp. 143–161. Lyon: Travaux de la Maison de l'Orient.

Munday F.C. 1976. Intersite variability in the Mousterian of the Central Negev. In A.E. Marks (Ed.), *Prehistory and Paleoenvironment in the Central Negev, Israel. vol. 1*, pp. 113–140. Dallas: Southern Methodist University Press.

Munday F.C. 1979. Levantine Mousterian technological variability: a perspective from the Negev. *Paléorient* 5: 87–104.

Nelson M. 1991. The study of technological organization. In M. Schiffer (Ed.), *Archaeological Method and Theory,* pp. 57–100. Tucson: University of Arizona Press.

Neuville R. 1951. La grotte d'Abou Sif. In *Le Paléolithique et le Mésolithique de Judée* (Archives de l'IPH, vol. 24), pp. 47–60. Paris: Masson et cie.

O'Connell J.F. 1987. Alyawara site structure and its archaeological implications. *American Antiquity* 52: 74–108.

Oswalt W. 1976. *An Anthropological Analysis of Food-Getting Technology*. New York: John Wiley.

Parry W.J. and R.L. Kelly 1987. Expedient core technology and sedentism. In J.K. Johnson and T.A. Morrow (Eds.), *The Organization of Core Technology*, pp. 285–309. Boulder: Westview Press.

Plisson H. and S. Beyries 1998. Pointes ou outils triangulaires? Données fonctionnelles dans le moustérien Levantin. *Paléorient* 24: 5–24.

Schick T. and M. Stekelis 1977. Mousterian assemblages in Kebara cave, Mount Carmel. In B. Arensburg and O. Bar-Yosef, O. (Eds.), *Moshe Stekelis Memorial Volume* (Eretz-Israel: Archaeological, Historical and Geographical Studies 13), pp. 97–149. Jerusalem: The Israel Exploration Society.

Schwarcz H.P. and W.J. Rink 1998. Progress in ESR and U-Series chronology of the Levantine Paleolithic. In T. Akazawa, K. Aoki and O. Bar-Yosef (Eds.), *Neandertals and Modern Humans in Western Asia*, pp. 57–68. New York: Plenum Press.

Shea J. 1988. Spear points from the Middle Paleolithic of the Levant. *Journal of Field Archaeology* 15: 441–450.

Shea J. 1991. *The Behavioral Significance of Levantine Mousterian Industrial Variability*. Ph.D. Dissertation, Harvard University.

Shea J. 1998. Neandertal and early modern human behavioral variability. A regional-scale approach to lithic evidence for hunting in the Levantine Mousterian. *Current Anthropology* 39 (Supplement): S45–S78.

Shea J. A. Marks and J.-M. Geneste 1998. Commentaires sur l'article de H. Plisson et S. Beyries "Pointes ou outils triangulaires? Données fonctionnelles dans le Moustérien levantin". *Paléorient* 24: 5–24.

Speth J.D. 1983. *Bison Kills and Bone Counts: Decision Making by Ancient Hunters*. Chicago: University of Chicago Press.

Speth J.D. 2004. Hunting pressure, subsistence intensification, and demographic change in the Levantine late Middle Paleolithic. In N. Goren-Inbar and J.D. Speth (Eds.), *Human Paleoecology in the Levantine, Corridor*, pp. 149–166. Oxford: Oxbow Press.

Speth J.D. and E. Tchernov 1998. The role of hunting and scavenging in Neanderthal procurement strategies: new evidence from Kebara Cave (Israel). In T. Akazawa, K. Aoki and O. Bar-Yosef (Eds.), *Neanderthals and Modern Humans in West Asia*, pp. 223–240. New York: Plenum Press.

Speth J.D. and E. Tchernov 2001. Neandertal hunting and meat-processing in the Near East: evidence from Kebara Cave (Israel). In C.B. Stanford and H.T. Bunn (Eds.), *Meat Eating and Human Evolution*, pp. 52–72. Oxford: Oxford University Press.

Speth J.D. and E. Tchernov 2002. Middle Paleolithic tortoise use at Kebara Cave (Israel). *Journal of Archaeological Science* 29: 471–483.

Stiner M.C. 2005. *The Faunas of Hayonim Cave (Israel): A 200,000 Year Record of Paleolithic Diet, Demography and Society*. American School of Prehistoric Research, Cambridge, MA: Peabody Museum Press, Harvard University.

Stiner M.C. 2001. Thirty years on the "Broad Spectrum Revolution" and paleolithic demography. *Proceedings of the National Academy of Sciences USA* 98: 6993–6996.

Stiner M.C. and S.L. Kuhn 1992. Subsistence, technology, and adaptive variation in Middle Paleolithic Italy. *American Anthropologist* 94: 12–46.

Stiner M.C., N.D. Munro and T.A. Surovell 2000. The tortoise and the hare: small game use, the Broad Spectrum Revolution, and Paleolithic demography. *Current Anthropology* 41: 39–73.

Stiner M.C., N.D. Munro, T.A. Surovell, E. Tchernov and O. Bar-Yosef 1999. Paleolithic population growth pulses evidenced by small animal exploitation. *Science* 283: 190–194.

Tchernov E. 1992. Biochronology, paleoecology, and dispersal events of hominids in the southern Levant. In T. Akazawa, K. Aoki and T. Kimura (Eds.), *The Evolution and Dispersal of Modern Humans in Asia*, pp. 149–188. Tokyo: Hokusen-Sha.

Tchernov E. 1994. New comments on the biostratigraphy of the Middle and Upper Pleistocene of the southern Levant. In O. Bar-Yosef and R.S. Kra (Eds.), *Late Quaternary Chronology and Paleoclimates of the Eastern Mediterranean*, pp. 333–350. Tucson: University of Arizona.

Tchernov E. 1996. Rodent faunas, chronostratigraphy and paleobiogeography of the southern Levant during the Quaternary. *Acta Zoologica Cracov* 39: 513–530.

Théry-Parisot I. 2002. Gathering of firewood during the Palaeolithic. In S. Thiébault (Ed.), *Charcoal Analysis. Methodological Approaches, Palaeoecological Results and Wood Uses*, pp. 243–249. Oxford: Archeopress.

Théry-Parisot I. and P.-J. Texier in press. La collecte du bois de feu dans le site moustérien de la Combette (Bonnieux, Vaucluse). Implications paléoéconomiques et paléoécologiques. Approche morphométrique des charbons de bois. *Buletin de la Société Préhistorique Française.*

Valladas H., N. Mercier, J.L. Joron and J.L. Reyss 1998. GIF Laboratory dates for Middle Paleolithic Levant. In T. Akazawa, K. Aoki and O. Bar-Yosef (Eds.), *Neandertals and Modern Humans in Western Asia*, pp. 69–76. New York: Plenum Press.

Van Peer P. 2001. The Nubian complex settlement system in Northeast Africa. In N.J. Conard (Ed.), *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age*, pp. 45–63. Tübingen: Kerns Verlag.

Weiner S., S. Schiegl and O. Bar-Yosef 1995. Recognizing ash deposits in the archaeological record: a mineralogical study at Kebara and Hayonim caves, Israel. *Acta Anthropologica Sinica* 14: 340–351.

Weiner S., P. Goldberg and O. Bar-Yosef 2002. Three-dimensional distribution of minerals in the sediments of Hayonim cave, Israel: diagenetic processes and archaeological implications. *Journal of Archaeological Science* 29: 1289–1308.

Zohary M. 1973. *The Geobotanical Foundations of the Middle East*. Stuttgart: Fischer Verlag.