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The Middle Paleolithic of the East Mediterranean Levant

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This paper reviews recent developments in geochronology, archaeology, and behavioral interpretations of the Middle Paleolithic Period (ca. 47–250 Kyr) in the East Mediterranean Levant. Neandertals and early modern humans both occupied the Levant during this period. Both these hominids are associated with the Levantine Mousterian stone tool industry and similar sets of faunal remains. The Levant has long been seen as preserving evidence for the origin of modern humans out of Neandertal ancestors. Recent radiometric dates for Levantine Middle Paleolithic contexts challenge this hypothesis. Instead, they suggest the evolutionary relationships between these hominids were far more complicated. Proposed models for Neandertal and early modern human coevolutionary relationships are examined. Intense competition between Neandertals and early modern humans for a narrow human "niche" may be the context out of which the Upper Paleolithic behavioral "revolution" arose.

KEY WORDS: Levant; Southwest Asia; Middle Paleolithic; Mousterian; Neandertals; early modern humans.

INTRODUCTION

The Middle Paleolithic (MP) is often seen as a long prelude to creative "revolution" of the Upper Paleolithic (UP). Yet, recent research in the East Mediterranean Levant indicates this was a period of dynamic evolutionary change. The "Levant" refers to the region encompassing the modern states of Lebanon, Syria, Israel, and Jordan. Evidence from the Levant has long supported the hypothesis of a gradual Neandertal–modern human evolutionary

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transition. This assumption of continuity has been challenged by improvements in geochronology. Neandertals and early modern humans now appear to have been contemporaries. Recent research on the MP Period in the Levant reveals important evidence about the evolution of modern humans, Neandertal behavior and adaptations, coevolutionary relationships between early modern humans and Neandertals, and the context in which UP "modern" human behavior originated.

Dating 80–130 Kyr, the early modern human fossils from Skhul and Qafzeh caves in Israel are roughly equal in age to many "early *Homo sapiens*" fossils from Africa (Klein, 1999, pp. 398–399; Mann, 1995). While fossil and genetic evidence increasingly point to Africa as the source of modern human populations (Stringer, 2002; Stringer and McKie, 1996), the antiquity of the Skhul/Qafzeh fossils suggests that Southwest Asia may also have played an important role in modern human origins. Minimally, the occurrence of modern humans so far north at such an early date suggests an adaptive radiation and dispersal of *Homo sapiens* during later Middle Pleistocene times.

Neandertal fossils in the Levant date to 47–112 Kyr. Evidence associated with Neandertals at Levantine MP sites indicates complex subsistence strategies, settlement patterns, and social behavior (Bar-Yosef, 2000; Kaufman, 2002; Shea, 2001a). Burials and symbolic artifacts from these and other Levantine sites suggest Neandertal cognitive capacities were on a par with those of early modern humans (Bar-Yosef and Vandermeersch, 1993). The Levantine evidence challenges to the popular image of Neandertal adaptations being structurally simple and intrinsically inferior to those of modern humans (Trinkaus and Shipman, 1993).

The 90,000-year long period during which Neandertals and early modern humans were in the Levant or in adjacent parts of Eurasia and Africa is considerably longer than the overlap between Neandertals and early modern humans in any part of Europe between 30 and 40 Kyr. The possibility, indeed probability, that Neandertals and early modern humans encountered one another in the Levant has inspired considerable debate about these hominids' evolutionary relationships (Hublin, 2000). Proposed hypotheses about their relationships range from assimilation, to niche partitioning, to ecological vicarism, to competitive exclusion (Shea, 2003a,b).

The Levant currently furnishes the oldest dated evidence for the transition between Middle and Upper Paleolithic human adaptations. Long distance raw material transfers, prismatic blade technology, complex multicomponent tools, specialized subsistence strategies, and the use of exosomatic symbols, all become regular features of the Levantine record long before they appear in Eurasia or Africa (Bar-Yosef, 2002). Just as the early Holocene "Neolithic Revolution" developed from transformations of Late Pleistocene hunter–gatherer adaptations, the MP/UP transition seems to have arisen from change and variability in MP human adaptive strategies in the Levant.

This paper presents an overview of the Levantine MP archaeological record. It begins with a survey of the environmental characteristics of the Late Pleistocene Levant. Next, it discusses the major archaeological sites and summarizes our current understanding of their chronological relationships. The hominid fossil record is surveyed briefly, but this paper focuses on the archaeological evidence for behavior, settlement, subsistence, technological strategies, and social organization. Finally, the implications of the Levantine MP evidence for models of Neandertal and early modern human evolutionary relationships are examined in light of recent discoveries in Africa and Eurasia.

ENVIRONMENTAL BACKGROUND

Geology and Geography

Reflecting the collision of African and Eurasian continental plates associated with the closing of the Tethys Sea ca. 5 Myr, the geology of the Levant is complex. Its defining feature, the close juxtapositioning of temperate woodland, dry steppe, and subtropical desert, is in large part a byproduct of the northward extension of the East African Rift. When it formed, ca. 3–4 Myr, the Jordan Rift Valley split the Levant into a western coastal lowland zone and an eastern interior plateau. The Jordan Rift Valley and the Anti-Lebanon Mountains and the Palmyra Range effectively trap much of the moisture that flows into the Levant from cyclonic belts across the Mediterranean Sea (Wigley and Farmer, 1982). The better-watered western and northern parts of the Levant tend to support woodland vegetation on fertile terra rosa soils. The arid southern and interior parts of the Levant feature loess deposits and steppe-desert vegetation (Zohary, 1973).

Most of the bedrock geology of the Levant is limestone. Consequently, cave/rockshelter sites are relatively common in much of the region. Although registered MP open-air sites vastly outnumber caves/rockshelters (Tomsky, 1991), much of what is known about the MP reflects an historical focus on cave excavations. Most MP sites are located near abundant sources of flint and chert, and these raw materials dominate most MP stone tool assemblages. The basalt fields of the Golan Heights and the Nubia Sandstone country of southern Jordan are two significant exceptions to this latter generalization. In these regions, MP humans transported high quality raw materials from remote sources and employed low quality local raw materials (Goren-Inbar, 1990a; Henry, 1995a).

Levantine Climate and Climate Change

The present day climate of the Levant is classically Mediterranean, with long dry summers and cool humid winters (Blondel and Aronson, 1999). The climate of the MP was generally cooler and more humid, though the period was punctuated by episodes of extreme aridity (Cheddadi and Rossignol-Strick, 1995). The MP Period in the Levant, ca. 47–250 Kyr, spans at least two major cycles of glaciation and deglaciation corresponding to marine Oxygen-Isotope Stages (OIS) 7–4, and the first part of OIS 3 (Mercier and Valladas, 2003). The physical appearance of the Levant, its vegetation, and animal communities varied during the course of the MP.

The two most important hydrogeological effects of Late Pleistocene climate change concern the formation of Rift Valley lakes and the consequences of sea-level change. Late Pleistocene Lake Lisan, and its precursor, Lake Samra, filled much of the central and southern Jordan Rift Valley up to a maximum elevation of about −180 m below modern sea level. Deep deposits of aragonite and gypsum indicate hypersaline conditions in the south part of the lake, but diatomaceous sediments in the north suggest less saline conditions (Begin *et al.*, 1974). These lake-edge habitats along the northern shores of Lake Lisan would have supported considerable plant and animal life and attracted human settlement. Unfortunately, relatively little is known about MP adaptations around these lakes because deep alluvial deposits (the Lisan Formation) have buried the relevant landscapes.

While the northern coast of the Levant is relatively steep and was probably minimally affected by Pleistocene sea level changes, the effects on the southern Levant coast were far more pronounced. Lowered sea levels would have extended the Israeli Coastal Plain tens of kilometers west of its present position and simultaneously drawn the Nile Delta northward. These exposed areas, too, probably attracted MP human settlement, as coastlines appear to have done elsewhere (Walter *et al.*, 2000), but the evidence from any such MP coastal adaptations is now submerged. One unfortunate consequence of Pleistocene sea level changes for archaeology is that karst spring activity, particularly that associated with the Last Glacial Maximum, has disturbed cave sediments from the time of the Middle–Upper Paleolithic transition in the southern Levant (Bar-Yosef and Vandermeersch, 1972).

For most of the MP, the humid coastal lowlands of the north-central Levant supported the highest concentration of biomass. Humans living there probably experienced the least demographic effects of climate change. Extreme variation in temperature and overall lower humidity would have made the southern and interior parts of the Levant (the Sinai, southern Israel, Jordan) of marginal value for human settlement, except during episodes of increased humidity. The Sinai, southern Jordan, and the Negev/southern

Israel were probably sparsely populated peripheries of human settlement, much as they have been in historic times.

Vegetation

The vegetation of the Levant consists of three major phytozones, a Mediterranean woodland dominated by oak and terebinth (*Quercus* and *Pistachia*), an Irano-Turanian steppe dominated by wormwood (*Artemisia*) and various grasses, and a Saharo-Arabian desert with sparse vegetation (Zohary, 1973). Occurrences of Pontic-Euxine (Montane West Asian) vegetation in high mountains and Sudano-Deccan (Northeast African) flora around oases in the Jordan Valley resulted from wide displacements of plant communities by Pleistocene climate changes. Analysis of pollen from boreholes in the Jordan Valley and oceanic cores in the East Mediterranean suggest the distribution of woodland, steppe, and desert within the Levant closely followed changes in global climate (Cheddadi and Rossignol-Strick, 1995; Horowitz, 1987; Weinstein-Evron, 1987). The onset of glacial periods in the Levant is correlated with increasing arboreal vegetation, primarily oak, but also pine and cypress. Interglacial and peak glacial conditions seem to be correlated with increases in herbaceous vegetation. During dry periods, Mediterranean woodlands became restricted to lower elevations, replaced elsewhere by expansion of the Irano-Turanian steppe and desert. Wetter periods would have witnessed the expansion of the woodland southward and into higher elevations. Because of the Levant's high topographic relief, the region would have featured extensive ecotones (transition zones between woodland and steppe). Such ecotones concentrate food resources from separate ecozones into close proximity to each other, reducing search costs to potential consumers. For generalist feeders like humans, ecotones would have been particularly attractive focal points for settlement.

Fauna

The Levant's animal populations contain species from Africa, southern Asia, and Northeast Africa, reflecting 5 million years of intercontinental faunal exchanges (Tchernov, 1996). Many of the most successful Levantine fauna are ecological generalists, such as mountain gazelle (*Gazella gazella)* and boar (*Sus scrofa*), of which there are still large populations. The present-day faunal communities of the Levant are but a fraction of their Pleistocene richness and diversity. The avian fauna of the Levant remains highly diverse, largely because major migration routes cross the region. The mammalian fauna of the Levant, in contrast, is the least diverse of those ecozones in the Mediterranean region (Blondel and Aronson, 1999, p. 80). The largest species hunted by Pleistocene humans are either extinct (aurochs, steppe rhino) or survive only in other regions (elephant, hippopotamus, hartebeest, and red deer). Other large herbivores found in MP faunal assemblages survive in the Levant (e.g., ibex, wild boar, fallow deer, steppe ass); but, habitat destruction from agriculture and pastoralism have reduced them to small populations in protected refugia (Kingdon, 1990; Qumsiyeh, 1996). Habitat destruction and extirpation have also reduced the guild of large carnivores (lion, leopard, striped and spotted hyenas, and wolf) that would have been competitors with humans for prey and for animal carcasses.

THE LEVANTINE MP ARCHAEOLOGICAL RECORD

History of Research

Archaeological research on the MP of the Levant can be described in terms of three main periods, a period of initial exploration (1900–1941), a period of expansion following World War II, and the present period in which the repercussions of advances in geochronometric techniques are still being absorbed.

The "exploratory period" of Levantine MP research began at the turn of the nineteenth century, with the recognition of Paleolithic artifacts along the Lebanon coast (Zumoffen, 1900). As elsewhere in Europe, Asia, and Africa around this time, the principal objective of early Paleolithic research in the Levant was to recover human fossils and to document the succession of lithic industries. Analytical emphasis was placed on lithic "index fossils" and biostratigraphy as aids to the construction of regional chronologies. The earliest of these excavations, at Zuttiyeh Cave by Turville-Petre from 1925 to 1926, yielded a hominid cranial fragment associated with later Acheulean assemblages (Turville-Petre, 1927). Rust's 1931–1933 excavations at Yabrud Rockshelter 1 in Syria recovered a deeply stratified sequence of assemblages spanning the Lower and Middle Paleolithic periods (Rust, 1950). Neuville's excavations in the Galilee and Judean Deserts also recovered abundant Lower, Middle, and Upper Paleolithic assemblages from the sites of Qafzeh, Umm Qatafa, Abu Sif, et-Tabban, Larikba, Ghrar, Sahba, and Erq el-Ahmar (Neuville, 1951).

Of the excavations carried out during this period, Garrod's 1928–1934 research in the Wadi el-Mughara (Valley of the Caves) on Mount Carmel had the most far-reaching impact (Garrod and Bate, 1937). Excavations in Tabun, el-Wad and Skhul caves revealed a sequence of industries spanning much of the Paleolithic period in the Levant. The MP levels of Tabun and

Skhul caves preserved a rich series of human fossils (McCown and Keith, 1939). The discovery of these fossils fueled the search for additional human remains in Levantine caves, such as Kebara (Turville-Petre, 1932) and Ksar Akil (Ewing, 1947).

The resumption of research after World War II witnessed a remarkable increase in the number of excavated sites. Some of the most notable excavations during this period included renewed work at Adlun, Naamé, and Ras el-Kelb in Lebanon (Copeland and Moloney, 1998; Fleisch, 1970; Roe, 1983) excavations at Douara Cave and Jerf Ajla in Syria (Akazawa, 1988; Akazawa and Sakaguchi, 1987; Coon, 1957; Hanihara and Akazawa, 1979, 1983; Hanihara and Sakaguchi, 1978); and renewed research at Yabrud Shelter 1 (Solecki and Solecki, 1986). In Israel between 1940 and 1980, there were numerous excavations of MP cave sites, including renewed work at Tabun (Jelinek *et al.*, 1973), Amud (Suzuki and Takai, 1970), Kebara (Schick and Stekelis, 1977), Shovakh (Binford, 1966), Qafzeh (Vandermeersch, 1981), and Zuttiyeh (Gisis and Bar-Yosef, 1974). Some of the methodological innovations of this period included an increasing emphasis on recovering paleoeconomic information. Interest in paleoeconomy had the salutary effect of archaeologists increasingly conserving larger proportions of the lithic and faunal remains, and of their abandoning the practice of discarding "waste" (unretouched lithics) and "unidentifiable" bone fragments. The 1960s saw many Levantine researchers adopting Bordes' methods for describing MP industrial variability. Increased consistency in descriptions of lithic assemblages made possible studies of interassemblage variability (Binford and Binford, 1966; Crew, 1975; Munday, 1976a). Survey research, particularly in Jordan and southern Israel also increased in the 1970s–1980s, resulting in more excavations of open-air sites (Coinman, 1998; Henry, 1995c; Marks and Freidel, 1977).

During the mid-1980s, there were several important changes in Levantine MP research. The most significant development was the use of thermoluminescence (TL), electron-spin resonance (ESR), and U-series methods to date MP contexts (Bar-Yosef, 1989). In lithic analysis, the 1980s–1990s witnessed the introduction of *chaîne opératoire* analytical methodology (Meignen, 1995). The goal of *chaîne opératoire* analysis is to reconstruct the precise sequences of technical operations involved in the formation of lithic assemblages. In practical terms, this meant greater attention to variation in the attribute-states of artifacts (particularly dorsal scar patterns) and less emphasis on Bordian typology. Related methodological developments during this period include refitting studies (Volkman, 1983), lithic microwear analysis (Shea, 1989a), intrasite spatial analysis (Hietala, 1983), and micromorphological analysis of sediments (Goldberg and Bar-Yosef, 1998). As seen in recent research at Hayonim, Kebara, and Tor Faraj, field research on the MP of the Levant has become increasingly interdisciplinary in character.

Geographic Distribution of MP Sites

There are hundreds of known MP sites in the Levant (Tomsky, 1991). Of these, only about 30 sites have been the subjects of controlled archaeological excavations (Boutié, 1979; Copeland, 1975; Henry, 1998b) (see Fig. 1). Most excavated MP sites are located at lower elevations (<500 m above sea level) along the Mediterranean Coast, a distribution that reflects the many logistical difficulties in working in the desert interior. In Lebanon, caves with excavated MP levels include Keoue (Nishiaki and Copeland, 1992), Nahr Ibrahim (Solecki, 1975), Ras el-Kelb (Copeland and Moloney, 1998), Ksar Akil (Ewing, 1947; Marks and Volkman, 1986), and Adlun (Bezez Cave) (Roe, 1983). Surface occurrences of MP tools have been reported from numerous other localities along the Lebanese coast (Copeland and Wescombe, 1965). One excavated example, Naamé, preserves MP tools in breccia stratified above an interglacial fossil beach (Fleisch, 1970). MP assemblages are also exposed in a series of paleosols enclosed by fossil sand dunes on the Carmel coastal plain (Ronen *et al.*, 1999). The northern and coastal parts of Israel contain two groups of excavated MP sites. One group of these sites is located on Mount Carmel and includes the caves of Tabun, Skhul, and el Wad (Garrod and Bate, 1937; Jelinek, 1982b), Kebara (Bar-Yosef *et al.*, 1992), Sefunim (Ronen, 1984b), Misliya (Weinstein-Evron *et al.*, 2003), and Geulah (Wreschner, 1967), as well as the Tirat Carmel open-air site (Ronen, 1974). A second group, dispersed throughout the Galilee, includes the caves of Hayonim (Meignen, 1998a), Qafzeh (Vandermeersch, 1981), Zuttiyeh (Gisis and Bar-Yosef, 1974; Turville-Petre, 1927), Shovakh (Binford, 1966), and Amud (Hovers, 1998; Hovers *et al.*, 1995; Suzuki and Takai, 1970). The southernmost of these coastal caves is Shukbah (Garrod and Bate, 1942), which is located near the Wadi al-Natuf near Ramallah.

Deeply stratified MP sites are known from the interior northern Levant. These sites include Yabrud Shelter 1 (Rust, 1950; Solecki and Solecki, 1986), Douara Cave (Akazawa and Sakaguchi, 1987), Jerf Ajla (Coon, 1957; Julig *et al.*, 1999; Richter *et al.*, 2001; Schroeder, 1969), and Dederiyeh Cave (Akazawa and Muhesen, 2003; Akazawa *et al.*, 1995a,b, 1999) as well as the Umm el Tlel open-air site complex (Boëda *et al.*, 2001; Boëda and Muhesen, 1993). On the Golan Heights, a shallow, but rich deposit of lithics and faunal remains has been excavated along the southern shore of Biqat Quneitra (Goren-Inbar, 1990b).

The arid *wadis* (seasonally flooded valleys) that drain eastward into the Dead Sea contain several MP sites, most notably Abu Sif, et-Tabban, Sahba,

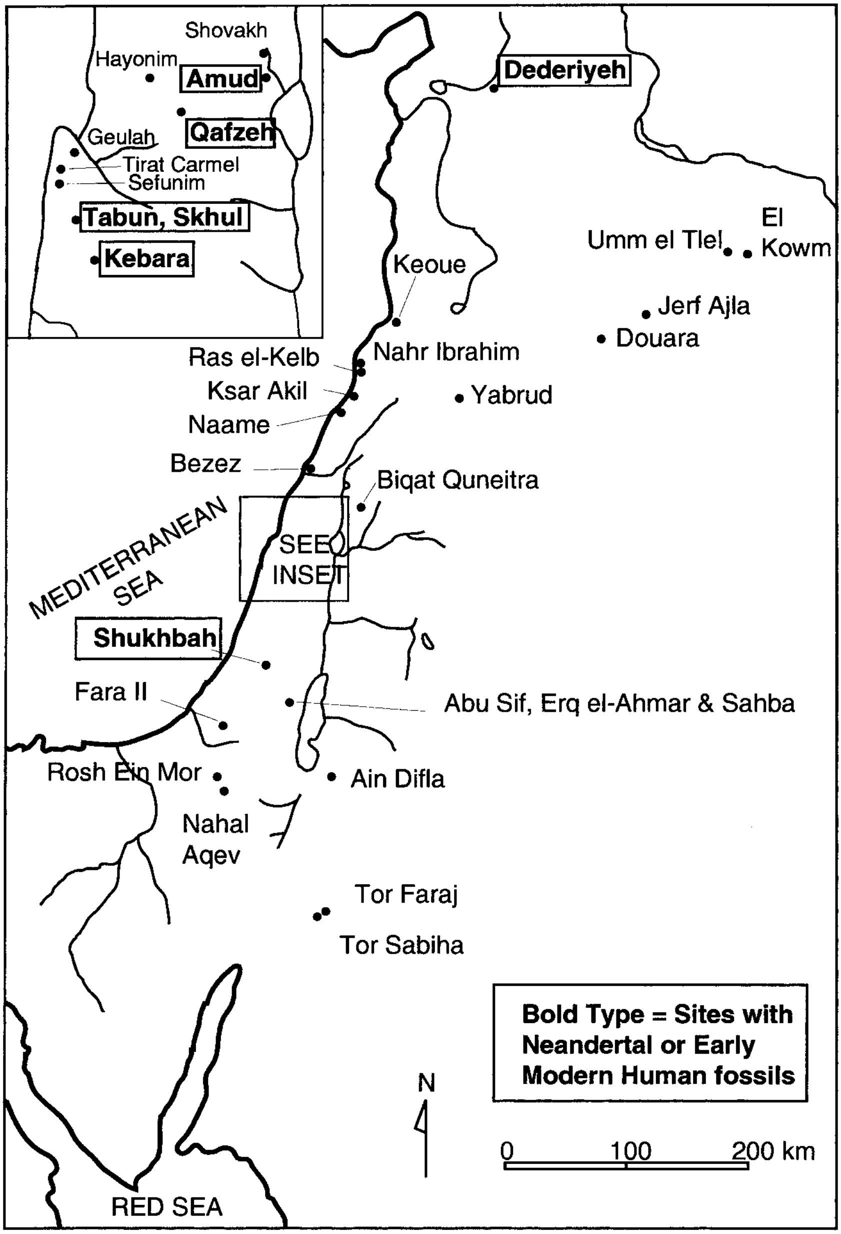

Fig. 1. Map showing key Levantine Middle Paleolithic sites discussed in the text. (Republished with permission of the American Schools of Oriental Research from Shea (2001a). Permission conveyed throught Copyright Clearance Center, Inc.)

Larikba, Ghrar, and Erq el-Ahmar. Excavations at these and other sites by Neuville (1951) revealed most of them to be shallow rockshelters with poor faunal preservation. The Nahal Zin (Central Negev) contains numerous MP sites, of which Rosh Ein Mor (D15) and Nahal Aqev (D35) are the most extensively excavated (Crew, 1976; Marks, 1981; Munday, 1976b). Further west, the site of Far'ah II preserves a rich faunal assemblage as well as refitting sets of lithic artifacts (Gilead and Grigson, 1984).

Surface occurrences of MP tools have been reported at numerous localities throughout western Jordan, but relatively few of these sites have been excavated (Henry, 1998b). In Northwest Jordan, stratified deposits of MP tools have been reported in the Jordan Valley at Ar Rasfa (Shea, 1999a), and diffuse scatters of MP tools were exposed by test excavations near Tabaqat Fahl (Macumber, 1992). Intensive surveys of the Wadi el-Hasa (West-Central Jordan) discovered stratified MP deposits in 'Ain Difla rockshelter (Lindly and Clark, 1987). Further south, the MP sites of Tor Faraj and Tor Sabiha are located in the Wadi Himsa region (Henry, 1995b, 2003). MP artifacts discovered in perilimnic sediments near al Mudawarra, suggest MP settlement sometimes extended far into the interior of the Jordanian plateau (Abed *et al.*, 2000). U-series dates placing this lake in Last Interglacial times agree well with North African evidence for episodes of increased humidity during OIS 5 (Schild *et al.*, 1992).

Overview of Recent Excavations

Several of the key MP sites furnishing important geochronological, paleontological, and archaeological evidence have not yet received monographic treatment. The following section presents short descriptions of these sites as guides to the published literature about them.

Tabun Cave

Tabun Cave is located on a bluff overlooking the western opening to the Valley of the Caves, on Mount Carmel (34°58′E/32°40′N, 60 m above sea level). Excavations directed by Jelinek were carried out at Tabun between 1967 and 1972, and resulted in a much improved, more detailed stratigraphy of the site than had been achieved by previous excavators (Jelinek, 1981, 1982a,b; Jelinek *et al.*, 1973). Garrod's Levels B and C were subdivided into 28 beds in Tabun Unit I. Reexamination of Level D revealed eight major stratigraphic units (II–IX). Of these, only Units II and IX appear to be in primary depositional context. Units III–VIII formed after the subsidence and erosion of earlier levels. These excavations recovered no hominids, and no faunal remains have been described. A preliminary description of the MP assemblages from Tabun was published in the early 1980s. (Jelinek, 1982a). Radiometric dates for the earliest MP levels of Tabun suggest the Lower–Middle Paleolithic transition in the Levant occurred after 250 Kyr (Grün and Stringer, 2000; Mercier and Valladas, 2003).

Hayonim Cave

Hayonim Cave is located in the western Galilee near the head of the Nahal Yitzhar (32°55′30″E/32°55′30″N, 250 m above sea level). Hayonim was first excavated in 1967–1979 and a second campaign of excavations was initiated in 1992. The principal MP layer of Hayonim, Level E, extends to a depth of more than 4 m. Isolated human dental, cranial, and postcranial remains of uncertain morphological affinities were recovered from this level (Arensburg *et al.*, 1990). Radiometric dates place Hayonim E in Late Middle Pleistocene times (Schwarcz and Rink, 1998), and the published description of the lithic assemblage supports this attribution (Meignen, 1998a). Preliminary accounts of Hayonim E's zooarchaeological assemblage have been published but analysis is still in progress (Stiner and Tchernov, 1998). Bar-Yosef maintains a website about the Hayonim excavation (http://www.fas.harvard.edu/~stoneage/People/hayonim.html).

Qafzeh Cave

Qafzeh Cave is located in the Wadi el-Haj (35°18′E/32°40′45″N, 220 m above sea level) on the eastern side of the Nazareth escarpment, overlooking the Jezreel Valley. The site was first excavated in 1933–1935 by Neuville and Stekelis (Neuville, 1951), and in a later campaign directed by Vandermeersch between 1965 and 1977 (Vandermeersch, 1981). Most of the MP human fossils were recovered from sediments in the "vestibule" in the front of the cave in Units XVII–XXIV. Short notes have been published on the lithic and faunal assemblages (Boutié, 1989; Hovers and Raveh, 2000; Rabinovich and Tchernov, 1995) and a monographic study is in preparation.

Kebara Cave

Kebara Cave is located on the southwest face of Mount Carmel (34°56′E/32°33′30″N, 60 m above sea level). Kebara has been the focus of several archaeological excavations (Schick and Stekelis, 1977; Turville-Petre, 1932), the most recent between 1984 and 1991 (Bar-Yosef *et al.*, 1992). Earlier excavations attributed the MP of Kebara to Level F, which has been subdivided by more recent excavations into Units VI–XIII. Stekelis' excavations discovered a Neandertal infant skeleton (KH1) and the recent excavations recovered the remains of an adult male (KH2) and numerous isolated remains (Bar-Yosef and Vandermeersch, 1991). The lithic and faunal assemblages of Kebara VI–XIII are currently being studied and prepared for publication. Dates for the MP levels of Kebara range between 45 and 65 Kyr. Kebara Units III–IV contain Initial UP assemblages dating to >44–47 Kyr (Bar-Yosef *et al.*, 1996).

Amud Cave

Amud cave is located at the top of a steep cliff in the narrow confines of the Nahal Amud (35°30′E/32°52′23″N, −110 m below modern sea level), northwest of the Sea of Galilee. Two research campaigns have taken place at Amud, the first between 1961 and 1964 (Suzuki and Takai, 1970), the second between 1992 and 1996 (Hovers *et al.*, 1995). Excavations in the principal MP stratum, Level B, have recovered numerous Neandertal remains, including those of two adults and four juveniles. Zooarchaeological remains from the earlier excavations have been published, and analysis of animal bones from the recent excavations is in progress. A short note has been published on the lithic assemblage (Hovers, 1998).

Yabrud Rockshelter 1

Yabrud Rockshelter 1 is located in western Syria (36°38′E/33°58′N, 1452 m above sea level). It has been the focus of two excavations, the first between 1931 and 1933 led by Rust, the second directed by the Soleckis in 1963–1965 (Rust, 1950; Solecki and Solecki, 1986). In Rust's stratigraphy, MP assemblages are found in Levels 2–10; however, the Soleckis' investigations suggest this stratigraphy oversimplifies a complex geological reality. The Yabrud Shelter 1 succession is significant because it spans the Lower–Middle Paleolithic transition (Waechter, 1952). Preliminary descriptions of both the MP lithics and the fauna from this site have been published (Lehmann, 1970; Perkins, 1968; Solecki and Solecki, 1995).

Umm el Tlel

Umm el Tlel is an open-air site in the El Kowm basin of western Syria at approximately E 38°40′/N 35°30′ and about 400 m.a.s.l. Umm el Tlel contains 70 MP levels in Units III–VI (Boëda and Muhesen, 1993). The best described of these are Levels IV 2βa, IV $2\gamma/\delta$a, and VI 1 a0 (Boëda *et al.*, 2001). Faunal remains from Umm el Tlel attest to intensive human predation upon large steppe dwelling species, including camel, steppe ass, and ostrich species that are otherwise rare among MP faunal assemblages. The site also contains MP/UP "Transitional" assemblages in Levels II base′ and III 2b′. The Umm el Tlel project maintains a website with up-to-date information on their research (www.mom.fr/ifapo/templates/Umm%20el%20Tlel.html).

Dederiyeh

Dederiyeh Cave is located in northwestern Syria (36°52′E/36°24′N, 450 m above sea level). Excavations at Dederiyeh began in 1993 and have identified 15 MP levels. The remains of two juvenile Neandertals have been reported from Dederiyeh Levels 3 and 11 (Akazawa and Muhesen, 2003; Akazawa *et al.*, 1995a, 1999, p. 123). The lithic assemblages have not yet been fully described. The Dederiyeh faunal assemblages are dominated by the remains of ibex (Griggo, 1998). Akazawa maintains a website summarizing recent research at Dederiyeh (www.nichibun.ac.jp/dederiyeh/).

Other MP Sites

Weinstein-Evron and colleagues initial excavations at Misliya Cave, Mount Carmel have revealed later early MP artifacts in Unit II (Weinstein-Evron *et al.*, 2003). The sediments are heavily brecciated, but chemical dissolution of the Unit II breccia is resulting in excellent recovery of faunal remains.

At Tor Faraj, in southern Jordan, a renewed campaign of excavations was undertaken during the 1990s. These excavations resulted in extensive horizontal exposure of the MP occupation in Level C and provide insights into the spatial structure of the site (Henry, 2003).

Test excavations at Ar Rasfa, Northwest Jordan, discovered MP assemblages on a promontory overlooking the outflow of the Wadi el-Yabis into the Jordan Valley (Shea, 1998a,b). Potentially, this site can shed light on human adaptations near the edges of Jordan Valley paleolakes. Refitting sets of artifacts suggest relatively little postdepositional disturbance at Ar Rasfa.

Although it does not contain MP assemblages, the site of Üçagizli in southeastern Turkey is nevertheless important for any discussion of the MP (Kuhn *et al.*, 1999, 2001). Excavations since 1997 have recovered Initial UP assemblages, a rich series of faunal remains, and shells artificially perforated for use as personal adornment. AMS radiocarbon dates for this site suggest the MP/UP transition in the Levant began around by 47 Kyr. A website (www.info-center.ccit.arizona.edu/~hatayup/index.html) describes recent research at Üçagizli.

Hominid Fossils

Ten Levantine MP sites have yielded human fossils, but only about half of them preserve remains complete enough for their morphological affinities to be identified either with Neandertals (*Homo neanderthalensis*) or early modern humans (*Homo sapiens*) (Table I). Both Neandertals and early modern humans are associated with superficially similar sets of faunal remains and lithic assemblages (Bar-Yosef, 2000; Kaufman, 1999; Lieberman and Shea, 1994; Shea, 2001a). No single level of any Levantine MP site contains the remains of both hominids.

An understanding of the Levantine MP human fossil record must take into account the history of paleoanthropological research in this region. The human remains from Tabun and Skhul were initially recognized as two different sets of fossils, Neandertal-like specimens from Tabun and more modern looking ones from Skhul (Keith, 1937). In their formal description of the fossils, however, McCown and Keith reversed this interpretation, describing the Skhul and Tabun fossils as a single population that was "in the throes of an evolutionary transition" into more specialized Neandertal and modern human types (McCown and Keith, 1939).

The recovery and description of additional hominid remains from Qafzeh, Amud, and Kebara during the 1960s–1970s was accompanied by a growing recognition that these fossils were deposited under different climatic conditions and that they probably dated to different periods (Brothwell, 1961; Higgs and Brothwell, 1961; Howell, 1959). Paralleling the growth during the 1950s–1970s of anagenetic (stagewise) models of evolutionary change in *Homo*, the Levantine sample was recast into an earlier Neandertal sample consisting of the Tabun C1, Kebara, and Amud fossils and a later early modern human one consisting of the Skhul and Qafzeh fossils (Trinkaus, 1984). Functional morphological analyses of these and other human fossils suggested the evolution of Neandertals into early modern humans reflected increased social and cultural buffering of environmental stresses (Smith, 1983; Trinkaus, 1983). Changes in the record of Levantine MP lithic industry and settlement patterns were thought to parallel this inferred transition modern behavior (Binford, 1968; Brose and Wolpoff, 1970; Jelinek, 1981). By the early 1980s, the Levant was generally regarded as providing the strongest evidence for an evolutionary transition between Neandertals and early modern humans (Brace, 1995; Trinkaus, 1986; Wolpoff, 1980, p. 304).

Table I. Hominid Fossils From Levantine MP Contexts in order of Discovery

Site and level	Years	Nature of human remains	References
Shukbah D	1928	Neandertal tooth, cranial fragments, two distal femorae, and astragalus	Keith (1931, pp. 204–208)
El Wad G	1929–33	Adult molar tooth, affinity indeterminate	McCown and Keith (1939)
Tabun B	1929–34	Numerous dental remains of all Neandertal	McCown and Keith (1939)
Tabun B/C	1929–34	Level B/C—adult female Neandertal (C1) buried with neonate (not recovered)	McCown and Keith (1939); Bar-Yosef and Callendar (1999)
Tabun C	1929–34	Level C—adult mandible (C2), numerous other isolated postcranial remains of Neandertal (?) affinities	McCown and Keith (1939); Stefan and Trinkaus (1998)
Skhul B	1931–32	Seven adults, three juveniles, all early modern humans	McCown and Keith (1939)
Qafzeh L	1933–35	Four adults (3, 5–7), two juveniles (4, 4a), all early modern humans	Vandermeersch (1981); Tillier (1999)
Kebara, Level F	1964	One fragmentary juvenile skeleton (KH1)	Smith and Arensburg (1977)
Ras el-Kelb	1959	Two teeth, affinity indeterminate	Bourke (1998)
Amud, Level B	1961–64	Two adults, two juveniles, all Neandertal	Sakura (1970)
Shovakh “lower cave earth”	1962	One molar tooth, affinity indeterminate	Trinkaus (1987)
Hayonim, Level E	1965–79	Cranial, dental, and postcranial remains of uncertain affinity	Arensburg *et al.* (1990)
Qafzeh XV–XXII	1965–77	Two adults, five juveniles, several isolated teeth, all early modern humans	Vandermeersch (1981); Tillier (1999)
Geulah A, Level B2	1967	Fragments of ulna, tibia, affinity indeterminate	Wreschner (1967)
Kebara VII–XII	1984–91	One partly-complete adult skeleton (KH2) in Level XII, numerous isolated bones and teeth throughout Levels VII–XII, all Neandertal	Bar-Yosef and Vandermeersch (1991)
Amud B	1992–96	Two juveniles, both Neandertal, numerous fragmentary remains	Hovers *et al.* (1995)
Dederiyeh Levels 11 (DH#1), 3 (DH#2)	1993–98	Two juvenile Neandertals (#1 = 10 months, #2 = 19 months)	Akazawa *et al.* (2003)

Today, models for the evolutionary relationships among these fossils range widely. A minority of researchers consider all Levantine MP humans as part of a single highly polymorphic human population that remained a single species throughout the Middle and Upper Pleistocene (Kramer *et al.*, 2001; Wolpoff, 1989, 1996, pp. 586–608). Others view them as a hybrid population living in a geographic “transition zone” between African early modern humans and Eurasian Neandertals (Simmons, 1999). A growing majority regard them as the remains of different species (Hublin, 2000; Rak, 1998; Rak *et al.*, 2002; Shea, 2003a, p. 45). Analyses of Levantine Neandertal and early modern humans postcranial remains reveal patterned differences in activities and adaptations to different temperature regimes (Churchill, 2001; Holliday, 2000; Niewoehner, 2001; Pearson, 2000a; Trinkaus, 1992; Trinkaus *et al.*, 1998; Trinkaus and Churchill, 1999). This evidence for biobehavioral differences between Neandertal and early modern humans agrees well with the results of studies of DNA recovered from European Neandertal fossils.

DNA recovered from Neandertal and European UP *Homo sapiens* fossils suggest a divergence between Neandertals and modern humans in the mid-Middle Pleistocene, ca. 500–700 Kyr, long before the appearance of Neandertals in the fossil record and before the beginning of the MP Period in the Levant (Caramelli *et al.*, 2003; Krings *et al.*, 2000). The evolutionary significance of these functional–morphological contrasts and genetic differences continue to be debated (e.g., Gutierrez *et al.*, 2002; Relethford, 2001), but there is a growing consensus among paleoanthropologists that Neandertals and early modern humans were different species (Klein, 2003). Evidence for sympatry, contact, and interbreeding between these hominids in the Levant or elsewhere remains equivocal (Hublin, 2000; Tattersall and Schwartz, 1999).

Lithic Industry

The principal MP industry of the Levant is called the “Levantine Mousterian” (see Figs. 2 and 3). Levantine, West Asian, East European, and North African MP industries share many of the same tool types and techniques, but the Levantine Mousterian differs from penecontemporaneous MP industries in adjacent regions (Crew, 1975). Levantine Mousterian assemblages’ most distinctive attribute is the use of recurrent Levallois core-reduction strategies to product triangular and subtriangular flakes (Meignen, 1995). Many Levantine Mousterian assemblages also contain truncated and facetted flakes used as cores for detaching smaller flakes (some less than 30 mm long), usually from their dorsal surfaces (Solecki and Solecki, 1970). Compared to European and West Asian Mousterian assemblages, such as those from

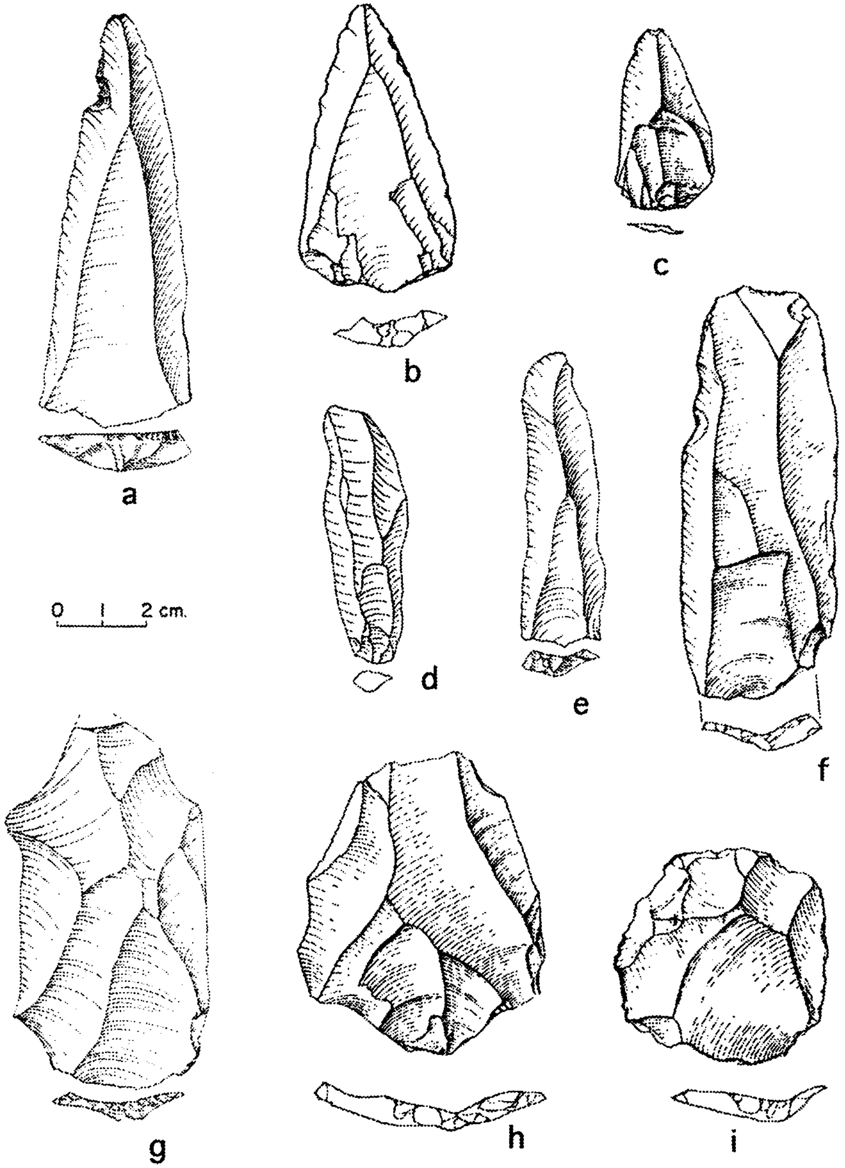

Fig. 2. Levantine Mousterian stone tools. (a–c) Levallois points; (d–f) blades; (g–i) Levallois flakes. *Sources*. (a) Rosh Ein Mor (Crew, 1976); (b) Kebara (Meignen and Bar-Yosef, 1989); (c) Qafzeh (Boutié, 1989); (d) Umm el-Tlel (Boëda, 1995); (e) Rosh Ein Mor (Crew, 1976); (f) Qafzeh (Boutié, 1989); (g) Rosh Ein Mor (Crew, 1976); (h–i) Qafzeh (Boutié, 1989). (Republished with permission of the American Schools of Oriental Research from Shea (2001a). Permission conveyed throught Copyright Clearance Center, Inc.)

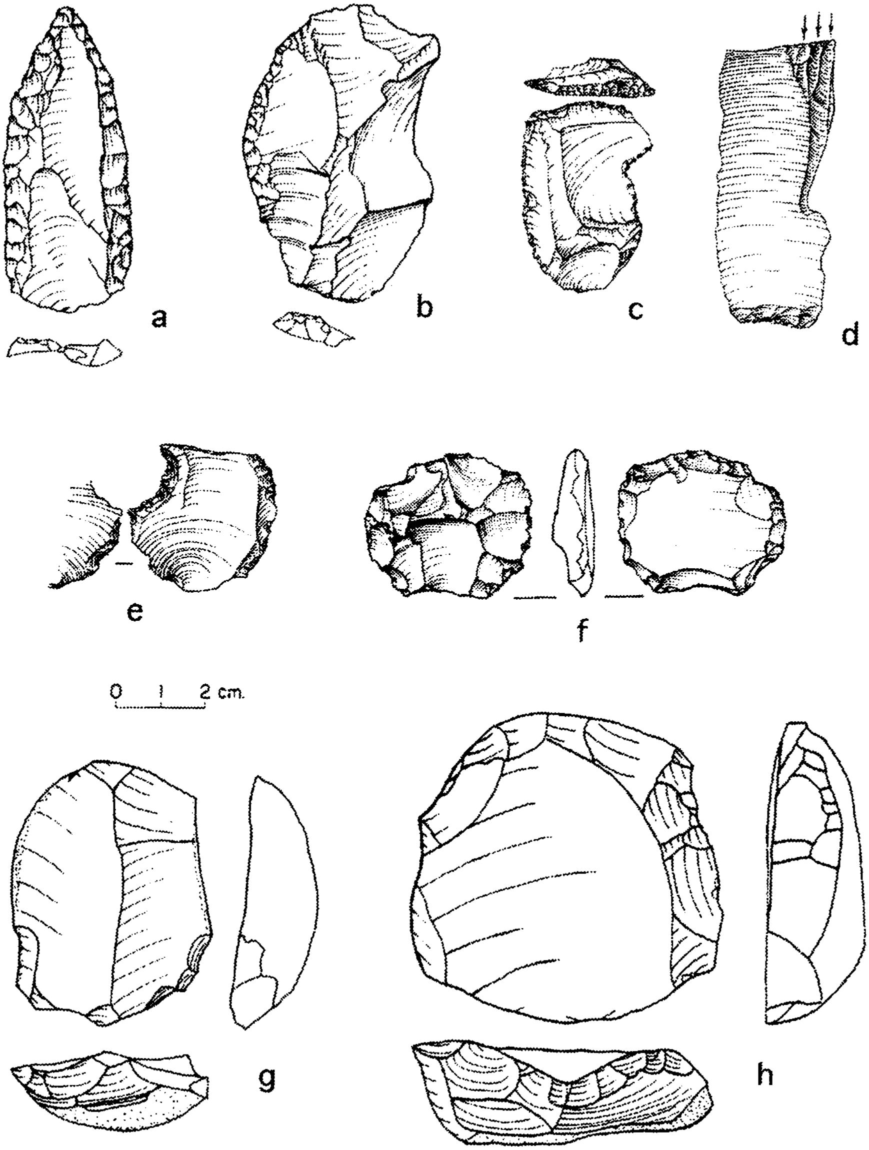

Fig. 3. Levantine Mousterian stone tools. (a) point/convergent scraper; (b) sidescraper; (c) endscraper; (d) burin on a truncated flake; (e) notch; (f) core-on-flake; (g–h) Levallois cores. *Sources.* (a–b) Kebara (Meignen and Bar-Yosef, 1989); (c–e) Rosh Ein Mor (Crew, 1976); (f) Biqat Quneitra (Goren-Inbar, 1990a); (g–h) Ar Rasfa (Shea, 1999a). (Republished with permission of the American Schools of Oriental Research from Shea (2001a). Permission conveyed throught Copyright Clearance Center, Inc.)

the Taurus, Zagros, and Caucasus, the Levantine Mousterian's most distinctive features are its relatively high proportions of Levallois debitage and the scarcity of heavily retouched scrapers (Rolland and Dibble, 1990). Bifacial foliate points, such as those known from MP assemblages in Northeast Africa and Western Asia are not found in the Levant. There are somewhat stronger similarities with some Nile Valley Mousterian assemblages, which have high percentages of Levallois tools and also lack foliates (Van Peer, 1998; Wendorf and Schild, 1992), but these are qualities shared by many "Mousterian" assemblages throughout North Africa and Western Eurasia. They do not necessarily imply an especially close cultural connection between the Levant and Nile Valley during the MP. Unfortunately, regional differences in the conventions used for describing MP assemblages makes it difficult to evaluate the similarities and differences between MP industries in the Levant and Northeast Africa (Vermeersch, 2001).

The immediate precursor of the Levantine Mousterian is the "Acheulo-Yabrudian" industry. Acheulo-Yabrudian assemblages are known from Tabun Cave Level Ea, Yabrud Rockshelter 1 Levels 11–25, Abri Zumoffen, Bezez Cave Level C, Masloukh, Zuttiyeh, Azraq C-Spring (Copeland, 2000b), and the newly discovered site of Qesem Cave (Barkai and Gopher, 1999). These assemblages differ from Levantine Mousterian ones in featuring numerous handaxes, steeply retouched scrapers, and relatively thick flakes detached without prior facetting of the striking platform (Bordes, 1977; Jelinek, 1982a). Jelinek (1982a) identifies a transition between the Acheulo-Yabrudian and Early Levantine Mousterian in Tabun Unit X, but this level appears to have been affected by subsidence and redeposition (Bar-Yosef, 1994b). Because the LP/MP transition at Tabun may reflect geological processes as well as changes in human behavior, it is not possible to use this evidence to infer either the tempo of behavioral change or to support hypotheses about regional bio-cultural continuity.

The UP "Ahmarian" industry follows the Levantine Mousterian in most parts of the Levant after ca. 38 Kyr (Bar-Yosef, 2000). Ahmarian assemblages feature a blade/bladelet technology and numerous backed knives, burins, and endscrapers. Between the Levantine Mousterian and the Ahmarian (ca. 47–38 Kyr) are a variety of "Transitional" or "Initial Upper Paleolithic" (IUP) assemblages. These assemblages typically contain evidence for both Levallois and prismatic blade production, with the latter increasing through time. Distinctive lithic artifacts that mark the IUP in the Levant include Emireh points and Umm el Tlel points (triangular flakes with basal retouch) and chamfered endscrapers, or *chamfreins* (endscrapers resharpened by an obliquely directed "tranchet" flake).

The succession of Levantine Mousterian lithic assemblages is usually described in terms of a three-phase model proposed by Copeland and modeled after the major lithostratigraphic divisions of Tabun Cave (Bar-Yosef, 1998a; Henry, 1998b; Kaufman, 1999; Meignen, 1998b). Some researchers combine Copeland's Phases 2 and 3 into a single "Later Levantine Mousterian," but retain her Phase 1 as an "Early Levantine Mousterian" (Jelinek, 1982a; Marks, 1992a; Ronen, 1979).

Table II presents a summary of major technical and typological indices for selected Levantine Mousterian assemblages from recent excavations. Compared to Mousterian assemblages from Europe and montane Western Asia, most Levantine Mousterian assemblages exhibit relatively high values for the technological Levallois index (IL) and high values for Facetting indices (IF, IFs), as well as low values for the denticulates and notches group (Bordes Group IV). Among Levantine Mousterian assemblages, Phase 1 assemblages have higher Laminar index values (I lam) and higher proportions of "Upper Paleolithic" tool types (Bordes Group III, i.e., endscrapers, burins, and perforators) than Phase 2 and Phase 3 assemblages. Phase 1 and Phase 3 assemblages share high laminar index values and high proportions of points and blades among their Levallois component. Phase 2 assemblages differ from Phase 1 and Phase 3 assemblages most obviously in having low Laminar index values and high percentages of typical Levallois flakes (and correspondingly low percentages of points and blades) among their Levallois component. Phase 2 and Phase 3 assemblages share high values for "Middle Paleolithic" tool types (Bordes Group II, sidescrapers, convergent scrapers, and transverse scrapers).

Marks (1992a) has also identified contrasting trends in typological variability among Phase 1 and Phase 2–3 assemblages. Through time, Phase 1 assemblages exhibit increasing proportions of blades and "Upper Paleolithic" tool types. Phase 2–3 assemblages exhibit increased production of flakes and "Middle Paleolithic" tools.

The attribution of a particular Levantine Mousterian assemblage to one or another Phase involves considering many lines of evidence. Usually, these variables include relative frequencies of points, blades, and flakes among the Levallois component, length/width ratios of Levallois points, and variation in the width/thickness ratios of whole flakes (Jelinek, 1982a; Meignen and Bar-Yosef, 1992). The application of *chaîne opératoire* analysis (Boëda *et al.*, 1990) is increasingly leading researchers to take into account variation in the alignment of flake scares on cores and flakes (again, primarily among the Levallois component) (Meignen, 1995, 1998a).

Among Phase 1/Early Levantine Mousterian assemblages, Levallois technology is dominated by recurrent unidirectional-parallel and bidirectional-parallel preparation. Because of the laminar aspect of the resulting debitage, width/thickness values for whole flakes from Phase 1 assemblages are relatively low (means and median values typically <5.00) (Jelinek,

Table II. Technological and Typological Variables for Key Levantine Mousterian Assemblages Listed by Phase

Assemblage (site & level)	IL	IF	IFs	I Lam	II	III	IV	%LF	%LB	%LP	N Lev	Source	Note
Phase 1													
Tabun Unit IX	56	61	48	76	43	19	3	24		34	655	Jelinek (1982)	*a*
Rosh Ein Mor	15	55	35	20	11	30	14	43	24	33	5123	Crew (1976)	
Ksar Akil XXVIIIA	12	79	57	24	22	35	16	48	9	44	105	Marks and Volkman (1986)	
Ksar Akil XXVIIIB	14	68	45	28	32	32	12	47	12	41	116	Marks and Volkman (1986)	
WHS 634/’Ain Difla	7	65	34	42	6	16	9	11		17	341	Lindly and Clark (1987)	*b*
Bezez B Unit M150	66	57	54	20	50	15	6	50	33	17	156	Copeland (1983)	
Bezez B Unit M151	69	54	46	30	46	19		43	29	28	117	Copeland (1983)	
Bezez B Unit V200	67	55	48	33	40	14	9	53	23	24	194	Copeland (1983)	
Bezez B Unit D44/G44	71	60	54	31	43	14	2	52	23	26	286	Copeland (1983)	
Nahal Aqev/D35 Level 3	9	57	43	25	13	20	9	27	32	41	612	Munday (1976)	
Phase 2													
Tabun Unit I, Beds 18–26	22	52	36	36	25	4	8	74		8	687	Jelinek (1982)	*c*
Ksar Akil Level XXVIA	30	76	63	24	73	15	3	77	23	0	57	Marks and Volkman (1986)	
Ksar Akil Level XXVIB	27	75	58	20	68	7	15	83	10	7	99	Marks and Volkman (1986)	
Ksar Akil Level XXVIIA	9	76	55	25	58	18	11	85	15	0	41	Marks and Volkman (1986)	
Ksar Akil Level XXVIIB	9	79	60	26	49	16	9	61	21	19	86	Marks and Volkman (1986)	
Qafzeh Unit XIX	60	39	31	8	4	7	9	92	7	1	125	Hovers (1997)	
Qafzeh Unit XVII	48	44	30	11	5	6	9	74	23	2	223	Hovers (1997)	
Qafzeh Unit XV	60	56	44	17	3	5	5	65	20	15	1117	Hovers (1997)	
Ras el-Kelb Rail Level D	69	69	65	21	47	2	4	78	19	3	244	Copeland (1998)	
Ras el-Kelb Rail Level C	61	61	53	10	72	3	10	83	14	3	153	Copeland (1998)	
Ras el-Kelb Rail Level B	50	50	42	18	44	16	14	70	28	2	350	Copeland (1998)	
Ras el-Kelb Tunnel Level O)	42	42	51	9	50	8	15	85	11	5	177	Copeland (1998)	
Ras el-Kelb Tunnel Level N	29	29	50	13	53	11	11	81	19	0	160	Copeland (1998)	
Ras el-Kelb Tunnel Level M	28	28	48	7	60	7	12	84	14	3	291	Copeland (1998)	
Ras el-Kelb Tunnel Level L	55	55	68	11	69	8	11	86	14	1	855	Copeland (1998)	
Ras el-Kelb Tunnel Level K	55	56	41	5	67	3	9	94	6	1	950	Copeland (1998)	
Ras el-Kelb Tunnel Level J	66	66	48	6	65	3	12	92	7	0	1461	Copeland (1998)	
Naamé Upper Level	3			3	61	7	23	85	11	4	54	Fleisch (1970); Copeland (1998)	
Naamé Lower Level	1			4	46	10	31	85	9	6	291	Fleisch (1970); Copeland (1998)	

Table II. (*Continued*)

Assemblage (site & level)	IL	IF	IFs	I Lam	II	III	IV	%LF	%LB	%LP	N Lev	Source	Note
Phase 3													
Tabun Unit I, Beds 1–17)	36	60	51	64	32	13	7	53		28	107	Jelinek (1982)	d
Kebara Level F	67	72	64	29	40	9	7					Jelinek (1982)	
Kebara Unit VII	18	58	53	12	61	7	6	74	19	7	442	Meignen and Bar-Yosef (1989)	
Kebara Unit VIII	19	59	54	11				78	17	5	134	Meignen and Bar-Yosef (1989)	
Kebara Unit IX	12	79	78	10	41	20	10	63	22	14	277	Meignen and Bar-Yosef (1989)	
Kebara Unit X	20	75	72	13	25	13	18	59	23	18	442	Meignen and Bar-Yosef (1989)	
Kebara Unit XI	23	70	64	20	28	21	11	61	31	8	740	Meignen and Bar-Yosef (1989)	
Kebara Unit XII	31	88	83	23				59	30	11	117	Meignen and Bar-Yosef (1989)	
Keoue Unit I	66	79	67	26	62	12	3	57	17	26	93	Nishiaki and Copeland (1992)	
Keoue Unit II	67	83	66	21	95	0	0	56	13	31	32	Nishiaki and Copeland (1992)	
Keoue Unit III	71	78	57	27	63	11	4	56	12	32	199	Nishiaki and Copeland (1992)	
Tor Sabiha Level C	4	38		37	3	4	18	52	12	37	93	Henry (1995)	
Tor Faraj Level C	24	50	33	17	4	8	5	19	19	62	197	Henry (1995)	
Amud Level B1	31	49	40					56	36	8	283	Hovers (1998)	
Amud Level B2	32	56	28	22				43	23	34	362	Hovers (1998)	
Amud Level B4	31	50	18	10				31	30	38	86	Hovers (1998)	
Affinities indeterminate													
Shovakh Unit I	38	61	52	14	11	15	12	36		7	427	Binford (1966)	
Shovakh Unit II	46	72	63	13	13	17	8	46		6	152	Binford (1966)	
Shovakh Unit III	40	70	61	10	16	12	17	33		2	96	Binford (1966)	
Shovakh Unit IV	40	69	61	13	12	15	11	34		4	179	Binford (1966)	
Yabrud 1 Level 2	30	53	34	14	39	11	8	12	24	65	17	Solecki and Solecki (1995)	
Yabrud 1 Level 3	29	63	47	13	23	31	9	29	18	54	28	Solecki and Solecki (1995)	
Yabrud 1 Level 4	32	61	55	14	47	9	14	35	18	48	69	Solecki and Solecki (1995)	
Yabrud 1 Level 5	22	48	44	16	12	38	32	27	18	55	22	Solecki and Solecki (1995)	
Yabrud 1 Level 6	27	61	52	4	33	12	28	62	4	34	29	Solecki and Solecki (1995)	
Yabrud 1 Level 7	21	41	32	15	19	46	21	53	26	21	38	Solecki and Solecki (1995)	
Yabrud 1 Level 8	28	64	55	36	42	31	11	28	44	28	54	Solecki and Solecki (1995)	
Yabrud 1 Level 9	7	29	28	46	9	38	52	67	17	17	6	Solecki and Solecki (1995)	
Yabrud 1 Level 10	36	48	48	17	35	12	19	20	27	53	15	Solecki and Solecki (1995)	
Tirat Carmel Excavation	6	35	28	14	26	22	22	95		13	109	Ronen (1974)	
Tirat Carmel Triangle	20	34	26	15	35	22	10	56		44	9	Ronen (1974)	

Sefunim Shelter Levels A-C	12	46	41	9	21	12	10	67	13	20	15	Ronen (1984)
Sefunim Cave Level 12	5	25	8	32				60		60	5	Ronen (1984)
Sefunim Cave Level 13	30	40	10	30				40	50	10	15	Ronen (1984)
Biqat Quneitra Area A	10	35	32	8	30	27	12	49		51	45	Goren-Inbar (1990)
Biqat Quneitra Area B	10	48	41	4	37	11	14	70		30	43	Goren-Inbar (1990)
Far'ah II	4	28	14	13	3	3	10	11	60	29	82	Gilead (1980)
Ar Rasfa	31	49		27				70	10	20	212	Shea (1999)
Summary statistics												
Mean all samples	33	57	47	20	36	15	12	57	20	21		
Mean Phase 1	39	61	46	33	31	22	9	40	23	30		
Mean Phase 2	38	56	50	14	48	8	12	81	15	4		
Mean Phase 3	34	65	55	23	41	11	8	55	22	24		
Median all samples	30	57	48	17	37	12	10	57	19	18		
Median Phase 1	35	59	47	29	36	19	9	45	23	30		
Median Phase 2	42	56	50	11	53	7	11	83	14	3		
Median Phase 3	31	65	57	21	40	11	7	56	21	26		
Variance all samples	450	235	247	177	490	101	72	501	118	335		
Variance Phase 1	854	59	59	276	265	63	23	201	78	97		
Variance Phase 2	505	264	129	80	528	23	41	79	41	26		
Variance Phase 3	454	217	347	194	753	39	33	219	58	250		

Note. IL, technological Levallois index; IF, Facetting index, IFs, strict Facetting index; I lam, Laminar index; II, Mousterian tools group; III, Upper Paleolithic tools group; IV, denticulates and notches (for definitions of these indices, see Debénath and Dibble (1994, p. 176)). %LF, Percentage of unretouched Levallois flakes; %LB, percentage of unretouched Levallois blades; %LP, percentage of unretouched Levallois points; N Lev, number of unretouched Levallois blanks upon which percentages were calculated, except where noted. In cases where different researchers have published observations on the same assemblage (e.g., Qafzeh), preference has been given to the most recent descriptions of assemblages. It should be noted that there are probably significant differences in the methods by which different researchers have tabulated these various indices and counts of Levallois artifacts. Where indices were lacking but published data have been sufficient to calculate them, I have done so, excluding unretouched Levallois artifacts from the count of "tools."

[a] Jelinek did not recognize Levallois blades as a distinct entity from prismatic blades. The count for prismatic blades ($n = 42$) is added to the denominator in calculating percentages of Levallois points and blades.

[b] Levallois blades and prismatic blades were listed together ($n = 72$) and this figure has been added to the denominator.

[c] See footnote *a*, $n = 18$ prismatic blades.

[d] See footnote *a*, $n = 19$ prismatic blades.

1982a). Examples of Phase 1 assemblages include Tabun Cave Unit X, Rosh Ein Mor (D15), Nahal Aqev (D35), ‘Ain Difla (WHS 634), Ksar Akil XXVIIIA-B, Bezez Cave Level B, Hayonim Cave Level E, Douara Cave Level IV, and probably Misliya Cave Unit II. To this list might be added Abu Sif Levels B–C, Jerf Ajla Levels B–F and Tabun Level D, but selective archaeological curation of these assemblages renders their statistical characteristics suspect.

The Levallois technology of Phase 2 assemblages is dominated by radial/centripetal modes of core surface preparation. The resulting products include many large oval “typical” Levallois flakes and pseudo-Levallois points. The resulting width/thickness ratios for whole flakes are typically rather higher than Phase 1 assemblages (means and median values >5.00). Recently excavated assemblages referable to Phase 2 include Tabun Cave Unit I Beds 18–26, Naamé (upper and lower levels), Qafzeh Level L/Units V–XXIV, Ras el-Kelb Railway Trench A–D and Tunnel Trench J–O, and Ksar Akil XXVI–XXVII, and Douara Cave Level III. Garrod’s Tabun Cave Level C can be appended to this list, but with the same reservations as expressed for including Tabun D among Phase 1 assemblages.

Those researchers who make a distinction between Phase 2 and Phase 3 assemblages do so on the basis of Phase 3 assemblages showing a greater emphasis on unidirectional-convergent core preparation (Meignen and Bar-Yosef, 1992). This method of core preparation appears particularly well suited to produce the isosceles Levallois points that are common among Phase 3 assemblages. Radial-centripetal cores also occur in these assemblages, and as a result, width/thickness ratios for whole flakes tend to be high (means and median values >5.00) (Jelinek, 1982a). Exemplary Phase 3 assemblages include those from Tabun Cave Unit I Beds 1–17, Kebara Cave Units VII–XII, Keoue Cave Units I–III, Tor Sabiha Level C, Tor Faraj Level C, Amud Cave Level B1–B4. Preliminary descriptions of the assemblages from Umm el Tlel Levels IV 2βa, IV $2\gamma/\delta$a, and VI 1 a0 also suggest affinities with Phase 3 assemblages. Selectively curated Phase 3 assemblages include those from Tabun Cave Level B, el Wad Cave Level G, Kebara Level F, and probably Shukhbah Cave Level D.

Several assemblages seem intermediate between Phases 2 and 3. These include Shovakh Units I–IV, and Dederiyeh Levels 3 & 11, and Skhul Level B. Shovakh appears genuinely intermediate, but further analysis and dating of this assemblage are needed to clarify this issue. The Dederiyeh assemblages have not yet been described sufficiently to evaluate their claimed affinities with Phase 2–3 assemblages. Garrod originally grouped Skhul B together with Tabun D in her “Lower Levalloiso-Mousterian,” but Jelinek’s metric analysis of whole flakes from that site suggested affinities with Phase 2–3 assemblages. Unfortunately, much of the Skhul B assemblage was discarded in the field and the remainder dispersed to more than a dozen different institutions. Its affinities will probably never be established with certainty.

The assemblages from Yabrud Rockshelter 1 (Levels 2–10), Tirat Carmel, Biqat Quneitra, Far'ah II, and Ar Rasfa do not seem to fit comfortably into any one of Copeland's phases. In the case of the Yabrud assemblages, this is almost certainly due to selective curation of artifacts during Rust's excavations (Solecki and Solecki, 1995). Sefunim Cave Levels 12–13, Sefunim Shelter Levels A–B, and Tirat Carmel are all small assemblages, and their unique characteristics may reflect small sample sizes. The uniqueness of the Biqat Quneitra assemblage mostly reflects the wide diversity of retouched tool types and relatively low Laminar indices in this assemblage. The two other open-air sites Far'ah II and Ar Rasfa have high whole-flake width/thickness indices. This aligns them with Phase 1 assemblages, but both lack significant numbers of elongated Levallois points.

Copeland's three-phase framework has functioned as much as an aid to chronostratigraphy as it has to the classification of MP lithic assemblages. In this, the three-phase framework works well for most coastal sites. Where assemblages belonging to more than one phase are present, they follow the Phase 1–2–3 order. The situation in the interior parts of the Levant is less clear. Stratified sequences of Levantine Mousterian assemblages at some interior sites, such as Yabrud Rockshelter 1, Jerf Ajla, Umm el Tlel, and Nahal Aqev do not follow the Phase 1–2–3 sequence precisely, while others, such as Douara Cave, apparently do.

Although the use of the term, "phase," to describe Levantine Mousterian assemblage-groups implies continuity, gradual transitions between phases are not well documented. This has led some researchers to equate these phases with stable social entities (Copeland, 1998) or distinct industrial "traditions" (Meignen and Bar-Yosef 1988). Others view the Levantine Mousterian Phases as modalities in a multivariate pattern of industrial variability ultimately reflecting the interplay of human technological strategies and land-use patterns (Clark, 2002; Shea, 2003a,b; Shea, in press). Inasmuch as MP human populations in Eurasia and Africa seem to have possessed similar technological skills and exhibited similar settlement patterns, there is no a priori reason to expect major divisions of the Levantine Mousterian to correspond to social or biological differences among human populations.

CHRONOLOGY

The earliest attempts to establish cross-correlations among Levantine MP sites depended primarily on comparisons of large mammal "index fossils" and similarities among stone tool assemblages (Garrod and Bate, 1937, p. 113; Neuville, 1934, 1951, p. 263). By mid-century, however, increased geological research in the Near East and Mediterranean basin allowed geological changes in the Levantine coastal caves to be linked to changes in sea level (Sanlaville, 1981). A geological framework developed by Farrand (Farrand, 1979) was eventually augmented by Jelinek's (1982a) comparisons of lithic assemblages to organize a regional chronological framework for the Levantine MP (Jelinek, 1982b). U-series dates for shell deposits on Mediterranean beaches, amino acid racemization dates, and radiocarbon dates obtained from MP contexts were used to attach absolute dates to the younger phases of the MP. The two key elements of this Farrand/Jelinek chronology were (1) that the MP (i.e. Levantine Mousterian) was relatively young and relatively brief, ca. 40–80 Kyr; and (2) that contexts containing early modern humans (Skhul and Qafzeh) were younger than those containing Neandertals (Tabun C, Amud B, Kebara F).

That the Farrand/Jelinek chronology for the MP Levant supported prevailing hypotheses about Neandertals' role in modern human ancestry and about population continuity in the Levant lent it considerable support (Jelinek, 1982a; Trinkaus, 1984). However, renewed excavations at Qafzeh during the 1970s revealed some discordant evidence (Bar-Yosef and Vandermeersch, 1981). The Farrand/Jelinek chronology had placed Qafzeh near the very end of the MP, ca. 50–60 Kyr (Farrand, 1979). Yet, microfaunal assemblages from that Qafzeh were more similar to those from the Acheulean deposits at Umm Qatafa and Tabun D than they were to ones from "Later Levantine Mousterian" contexts at Kebara and Tabun C (Tchernov, 1981). In addition, U-series dates of 90 Kyr were obtained for deposits bracketing a very Tabun C-like lithic assemblage at Naamé in Lebanon (Leroi-Gourhan, 1980, p. 83). Both the Qafzeh and Naamé evidence suggested a much greater antiquity for the Levantine Mousterian than implied by the Farrand/Jelinek framework.

Beginning in the mid-1980s, advances in TL, ESR, and U-series dating allowed for independent tests of the Farrand/Jelinek chronology. Table III presents a summary of published TL, ESR, and U-series dates for Levantine MP contexts (as of November 2003). Selected radiocarbon dates are included as well, although it is now clear that most radiocarbon determinations for contexts older than 45 Kyr probably express infinite ages. These new dating techniques have transformed our picture of the MP Period in the Levant (Fig. 4).

The new chronology for the Levant more than quadruples of the amount of the time encompassed by the MP, from 40–80 Kyr to >47–250 Kyr. Most of the youngest TL, ESR, and U-series dates for Levantine Lower Paleolithic assemblages and the oldest dates for Levantine MP assemblages occur

Table III. Published Radiometric Dates for Levantine MP Contexts

Context by Phase	TL	ESR EU	ESR LU	U-series	Other	Source
Phase 1						
Tabun Unit II, mean of 3	196 ± 21					Mercier and Valladas (2003)
Tabun Unit V, mean of 4	222 ± 27					Mercier and Valladas (2003)
Tabun Unit IX, mean of 3	256 ± 26					Mercier and Valladas (2003)
Tabun D, mean of 8		133 ± 13	203 ± 26	143 + 41, −28		Grün and Stringer (2000, p. 602)
Tabun D		93 ± 12	152 ± 24	110.68 + 0.88, −0.87		McDermott *et al.* (1993, p. 254)
Hayonim Upper E	150					Valladas *et al.* (1998, pp. 72–74)
Hayonim Lower E	200					Valladas *et al.* (1998, pp. 72–74)
Hayonim Central (−401 to −435 bd) mean of 3		164 ± 15	171 ± 17			Schwarcz and Rink (1998, pp. 61–65)
Hayonim Entrance (−385 to −395 bd) mean of 3		241 ± 11	257 ± 6			Schwarcz and Rink (1998, pp. 61–65)
Hayonim E				163 + 62, −40		Schwarcz *et al.* (1980, p. 160)
Misliya Cave Unit II					130 ± 33 (OSL)	Weinstein-Evron *et al.* (2003, p. 50)
Hummal Well 6b, mean of 4	128 ± 9					Bar-Yosef (1994a, p. 37)
Yabrud 1, Level 4, mean 2 ($k = 0.1$)					115 ± 17 (ESS)	Porat and Schwarcz (1991, p. 206)
Yabrud 1, Level 4, mean 2 ($k = 0.05$)					139 ± 21 (ESS)	Porat and Schwarcz (1991, p. 206)
Ain Difla Test A, Level 5	105 ± 15					Clark *et al.* (1997, p. 91)
Ain Difla Test A, Levels 12–20, mean of 4		103 ± 13	162 ± 22			Clark *et al.* (1997, p. 91)
Zuttiyeh Mousterian	106 ± 7					Valladas *et al.* (1998, pp. 72–74)
Zuttiyeh Mousterian	157 ± 13					Valladas *et al.* (1998, pp. 72–74)
Zuttiyeh chimney base				95 ± 10		Schwarcz *et al.* (1980, p. 160)
Zuttiyeh chimney base				164 ± 21		Schwarcz *et al.* (1980, p. 160)
Zuttiyeh Locus III				97 ± 13		Schwarcz *et al.* (1980, p. 160)
Rosh Ein Mor				200 +9.5, −8.7		Rink *et al.* (2003)
Douara IVB					75 (FT)	Nishimura (1979)
Ksar Akil XXXII				51 ± 4		van der Plicht *et al.* (1989)
Ksar Akil XXXII				49 ± 5		van der Plicht *et al.* (1989)

Table III. (*Continued*)

Context by Phase	TL	ESR EU	ESR LU	U-series	Other	Source
Phase 2						
Tabun C/Unit I, mean of 7	165 ± 16					Mercier and Valladas (2003)
Tabun C, mean of 8		120 ± 16	140 ± 21	135 + 60, −30		Grün and Stringer (2000, p. 602)
Tabun C, mean of 3		117.6 ± 29.3	127 ± 34.3			McDermott *et al.* (1993, p. 254)
Skhul B, mean of 6	119 ± 18					Mercier *et al.* (1993, p. 172)
Skhul B, mean of 7		80.8 ± 12.6	101 ± 17.9			Stringer *et al.* (1989, p. 757)
Skhul B, mean of 6		59.7 ± 6.3	76.7 ± 8.2	49.0		McDermott *et al.* (1993, p. 254)
Qafzeh XVII–XXIII, mean of 20	92 ± 5					Valladas *et al.* (1988, p. 615)
Qafzeh XV–XXI, mean of 16		96 ± 13	115 ± 15			Schwarcz *et al.* (1988, p. 735)
Qafzeh XIX, mean of 2		104 ± 10.5	120 ± 15	97.48		McDermott *et al.* (1993, p. 254)
Naamé Enfean II beach				90 ± 20		Leroi-Gourhan (1980, p. 83)
Naamé Naaméan beach				90 ± 10		Leroi-Gourhan (1980, p. 83)
Nahr Ibrahim, mean of 3 ($k = 0.1$)					78 ± 24 (ESS)	Porat and Schwarcz (1991, p. 206)
Nahr Ibrahim, mean of 3 ($k = 0.05$)					89 ± 28 (ESS)	Porat and Schwarcz (1991, p. 206)
Douara IIIB		77 ± 9			59.7 ± 9.3 (ENT)	Kai *et al.* (1987)
Douara IIIB			57 ± 15			Miki *et al.* (1988)
Ksar Akil XXVI				47 ± 9		van der Plicht *et al.* (1989)
Ksar Akil XXVI					43.7 ± 1.5 (C-14)	Mellars and Tixier (1989)
Phase 3						
Tabun B, mean of 7		102 ± 17	122 ± 16	104 + 33, −18		Grün and Stringer (2000, p. 602)
Tabun B		76 ± 14	85 ± 18	50.69 + 0.23, −0.23		McDermott *et al.* (1993, p. 254)
Amud B1, mean of 6	57.6 ± 3.7					Valladas *et al.* (1999, p. 265)
Amud B2, mean of 8	65.5 ± 3.5					Valladas *et al.* (1999, p. 265)
Amud B4, mean of 5	68.5 ± 3.4					Valladas *et al.* (1999, p. 265); Valladas *et al.* (1999, p. 265)
Amud B1/6–B1/7				53 ± 7		Rink *et al.* (2001, pp. 713–714)
Amud B2 mean of 4				61 ± 9		Rink *et al.* (2001, pp. 713–714)
Amud B4 mean of 2				70 ± 11		Rink *et al.* (2001, pp. 713–714)

Amud B1–B2, mean of 5					61 ± 8.6 (ETT)	Rink *et al.* (2001, pp. 713–714)
Kebara VII	51.9 ± 3.5					Valladas *et al.* (1987, p. 159)
Kebara VII, Square Q19					>44.8 (C-14)	Bar-Yosef *et al.* (1996, p. 301)
Kebara VIII	57.3 ± 4					Valladas *et al.* (1987, p. 159)
Kebara IX	58.4 ± 4					Valladas *et al.* (1987, p. 159)
Kebara X	61.6 ± 3.6					Valladas *et al.* (1987, p. 159)
Kebara X, mean of 11		60.4 ± 8.5	64.3 ± 9.2			Schwarcz *et al.* (1989, p. 657)
Kebara XI	60 ± 3.5					Valladas *et al.* (1987, p. 159)
Kebara XII	59.9 ± 3.5					Valladas *et al.* (1987, p. 159)
Tor Faraj C, mean of 3	48.0 ± 2.7					Henry (1998b, p. 27)
Tor Faraj C					69 ± 5 (AAR)	Henry and Miller (1992, p. 47)
Tor Sabiha C				31.5 ± 5		Henry (1998b, p. 27)
Tor Sabiha C					69 ± 6 (AAR)	
Umm el Tlel III2a	36 ± 2.5				34.53 ± 0.75 (C-14)	Bourguignon (1996, p. 319)
Jerf Ajla Level C, mean of 8	33.3 ± 2.3					Richter *et al.* (2001, p. 43)
Jerf Ajla C					42 ± 2.5 (C-14)	Henry and Servello (1974, p. 31)
Affinities indeterminate						
Biqat Quneitra, mean of 6		39.2 ± 4.2	54 ± 5.2			Ziaei *et al.* (1990, p. 234)
Far'ah II, mean of 6		49.1 ± 4.1	62 ± 7			Schwarcz and Rink (1998, pp. 61–65)

Notes. C-14, Radiocarbon; AAR, amino-acid racemization; ETT, ESR and thermal ionization mass spectrometric $^{230}\mathrm{T}/^{234}\mathrm{U}$; OSL, optically-stimulated luminance; ENT, ESR "Nuclear Tracks"; FT, fission track; ESS, ESR on burnt flint by signal subtraction.

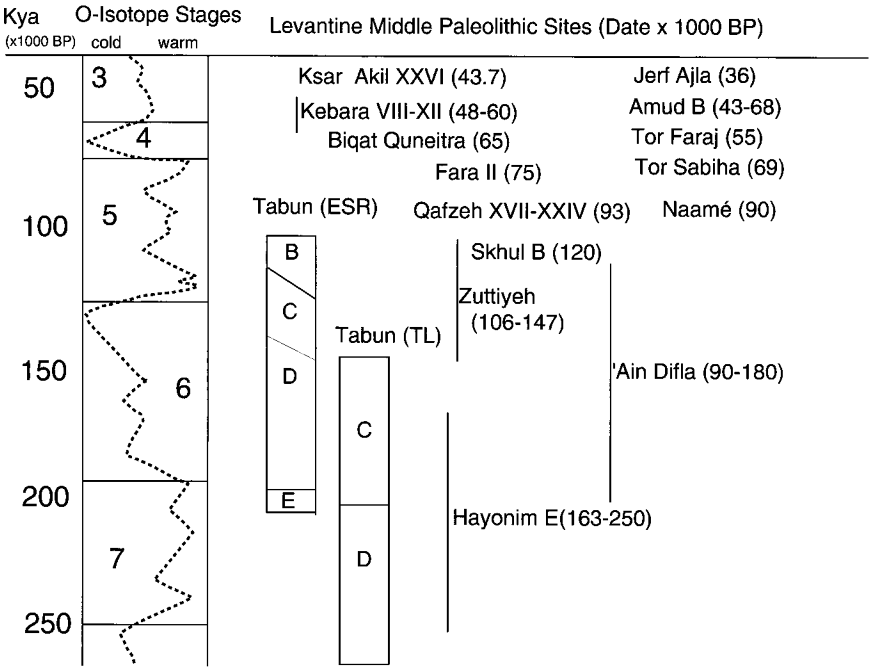

Fig. 4. Chart showing TL and ESR dates for key Middle Paleolithic sites.

around 200–250 Kyr (Barkai and Gopher, 1999; Bar-Yosef, 1998a; Mercier and Valladas, in press; Porat *et al.*, 2002). These sets of dates are more-or-less in line with dates for the Middle–Upper Paleolithic transition and Lower-Middle Paleolithic transition in Europe and Africa (Gamble and Roebroeks, 1999; Pilbeam and Bar-Yosef, 2000; Van Peer and Vermeersch, 1990).

The oldest dates for Levantine IUP assemblages and youngest dates for most Levantine MP contexts fall between 38 and 47 Kyr (Bar-Yosef, 2000). These dates are roughly the same age as various "Transitional" complexes in Eastern Europe (Kozlowski, 2000), but any such comparison is complicated by uncertainties about radiocarbon dates in this remote time range. Most of these European MP/UP contexts are dated by radiocarbon. Variation in atmospheric concentrations of ^{14}C causes erroneously young dates for contexts between 33 and 45 Kyr (Beck *et al.*, 2001). This phenomenon may create the illusion of contemporaneity between European Later MP and early UP assemblages (Conard and Bolus, 2003). TL dates for Levantine MP assemblages younger than 38 Kyr at Jerf Ajla and Umm el Tlel (Bourguignon, 1998; Richter *et al.*, 2001), on the other hand, could indicate actual "late survivals" of groups practicing MP adaptations in the northern Levant at a time when UP assemblages were being deposited at coastal sites.

Chronology and Models of MP Industrial Variability

The new dates have also made it possible to test models of the internal chronological structure of the MP and relationships between the three phases of the Levantine Mousterian. Different dating techniques produce different dates for some of the same archaeological contexts. These differences are most clearly apparent among the dates for Tabun Levels C and D, which range between 135 and 165 Kyr, and 133 and 256 Kyr, respectively. Nevertheless, examining variation in dates obtained by individual techniques generally supports the Phase 1–2–3 framework (Table IV). Although there is considerable overlap in their ranges, median dates for Phase 1 assemblages are older than those for Phase 2 assemblages. Median dates for Phase 2 assemblages are older than those for Phase 3 assemblages. The new dates affirm the validity both of Copeland's three-phase model for Levantine Mousterian industrial succession (at least in the coastal parts of the Levant) (Marks, 1992b).

The new dates also challenge the hypothesis that Phase 1 assemblages persisted in the southern and interior Levant at the same time as Phase 2–3 assemblages were being deposited in coastal sites. Marks (1983, 1992b) had argued that Phase 1 Levantine Mousterian assemblages persist up to the MP/UP transition in the southern and interior parts of the Levant, eventually developing into the IUP complexes seen at Boker Tachtit and Boker A. This argument was supported by relatively late occurrences of Phase 1 assemblages in Jordan, a U-series date of 80 ± 10 Kyr associated with the Nahal Aqev (D35) site, and by the perceived Levantine Mousterian affinities of Boker Tachtit Level 1. This hypothesis has been challenged by recent

Table IV. Summary of TL, ESR, and U-Series Dates for Contexts Associated With Levantine Mousterian Phases (Sources in Table III)

Statistics for Phases 1–3	TL	ESR EU	ESR LU	U-series
Phase 1				
Median	157	133	171	111
Range	105–256	93–241	152–257	49–200
Phase 2				
Median	119	96	115	90
Range	92–165	60–120	57–140	47–135
Phase 3				
Median	58	76	85	61
Range	33–69	60–102	64–122	32–104

research. The assemblages from Tor Faraj and Tor Sabiha were initially described as Early Levantine Mousterian (Phase 1), but their affinities have been reassigned by their excavator to Phase 3 (Henry, 1998b, p. 31). The 80 Kyr U-series date associated with Nahal Aqev (D35) is actually from the travertine of a fossil spring stratified above the site. Thus, the date of 80 Kyr is a *terminus ante quem* for D35, not an actual date for the MP occupation of D35. The final remaining pillar of support for the persistence of Phase 1 assemblages in the southern Levant hinges on the technotypological affinities of the Boker Tachtit Level 1 assemblage. Radiocarbon dates for Boker Tachtit Levels 1–4 range fall between 40 and 50 Kyr. These dates are at the outer effective range of radiocarbon dating, and could express an infinite age. The emphasis on the production of relatively short Levallois points in the Boker Tachtit Level 1 assemblage might fit as well among Phase 3 assemblages dating to 47–80 Kyr as among Phase 1 assemblages dating to more than 100 Kyr. Further research is needed to clarify this issue.

Chronology and Models of MP Human Evolution

TL, ESR, and U-series dates for contexts enclosing Neandertal and early modern human fossils have had a significant impact on models of Late Pleistocene human evolution. The first application of TL dating in the Levant occurred at Kebara Cave. Dates for contexts associated with Neandertals at Kebara ranged between 47,000 and 65,000 B.P. (Valladas *et al.*, 1987). At the time, these dates were not highly discordant with the Farrand/Jelinek MP chronology. However, the TL dates for the levels enclosing the Qafzeh humans were much greater than anticipated, averaging 92 Kyr (Valladas *et al.*, 1988). Further TL and ESR dating established that the Skhul fossils were also vastly older than predicted by the Farrand/Jelinek chronology, averaging 115 Kyr (Mercier *et al.*, 1993). Finally, the Amud Neandertals turned out to be relatively recent, ca. 50–70 Kyr (Valladas *et al.*, 1999). Estimating the ages of the fossils from Tabun C have been complicated by uncertainties about the provenance of the Tabun C1 fossil. Garrod (1937) considered it possibly intrusive from Level B, and this inference seems supported by new radiometric dates for the fossil itself (Bar-Yosef and Callendar, 1999; Grün and Stringer, 2000). The most recent ESR and U-series estimate of its age is ca. 122 ± 16 Kyr, within the range of TL and ESR dates for the Skhul fossils (Grün and Stringer, 2000, p. 610).

These dates complicate past models of human evolution in the Late Pleistocene. Long seen as a bastion for models of Neandertal–modern human evolutionary continuity, the Levantine evidence now provides a formidable challenge to those continuity models. Controversies about the age and affinities of the fossils from Tabun C remain (Bar-Yosef and Callendar, 1999; Rak, 1998; Stefan and Trinkaus, 1998), but the new dates clearly suggest that the Amud and Kebara Neandertals are far too recent for them to have been ancestors of the Skhul/Qafzeh humans.

Levantine MP Chronology: A Synthesis and Periodization

The various strands of geochronometric, paleoenvironmental, paleontological, and archaeological evidence suggest the MP Period in the Levant should be divided into three major phases, each separated by an episode of abrupt climatic change (Table V).

The Early Middle Paleolithic (EMP) lasts from approximately 250 Kyr to 128 Kyr, encapsulating much of the penultimate glacial cycle (OIS 6–7). Thus, during the EMP the climate of Levant would have a transition from relatively warmer and humid conditions associated with OIS 7 to colder and drier conditions at the peak of OIS 6 (Cheddadi and Rossignol-Strick, 1995). The archaeological sites least ambiguously dating to this period include Tabun Cave Level D/Units II–IX, Hayonim Level E, Misliya Cave Unit II, Rosh Ein Mor, and 'Ain Difla. Part of Tabun Level C may also date to this period. Microfaunal remains from these contexts share with later Lower Paleolithic assemblages a suite of "archaic" rodents that become extinct during OIS 5. These species include *Talpa chthonia*, *Ellobius fuscocapillus*, *Apodemus flavicollis*, *Allocricetus magnus*, and *Allocricetus jezreelicus* (Tchernov, 1998). Most Levantine Mousterian assemblages dating to the EMP are referable to Copeland's Phase 1. The identity of EMP human populations is unclear. Evidence from adjacent continents suggests that the earliest EMP humans in the Levant were probably either a regional variant of later Eurasian *Homo heidelbergensis* or a very early form of *Homo sapiens* (though the possibility of more than one hominid species having been present in the Levant during the EMP cannot be excluded.) Later EMP contexts, such as Tabun Level C, feature fossils with morphological affinities to *Homo neanderthalensis* (Tabun C1) and *Homo sapiens* (Tabun C2) (Rak, 1998; Stefan and Trinkaus, 1998).

The end of the EMP is marked by a rapid increase of aridity associated with the onset of the Last Interglacial (OIS 5e, 128–115 Kyr) and the extinction of many "archaic" Middle Pleistocene rodents (Tchernov, 1998).

The Mid-Middle Paleolithic (MMP) is essentially conterminous with OIS 5 (128–171 Kyr). Increasingly warm and arid conditions after 130 Kyr coincided with an immigration of new species including aurochs (*Bos primigenius)*, goat (*Capra aegagrus)*, red deer (*Cervus elaphus)*, fallow deer (*Cervus dama)*, roe deer (*Capreolus capreolus)*, wolf, (*Canis lupus)*, leopard

Table V. Periodization of the Levantine Middle Paleolithic Together With Notes on Adjacent Time Periods

Period & dates (Kyr)	Marine OIS & Levantine climate	Hominids & lithic industries	Representative archaeological contexts
Late Lower Paleolithic (250–350 Kyr)	OIS 8–7. Cold, then warmer	*Homo* sp. indet. with Late Acheulean & Acheulo-Yabrudian	Hummal Well Ib; Masloukh; Bezez Level C; Yabrud Shelter 1, Levels 11–25; Zuttiyeh; Tabun Units X–XII; Qesem Cave
Early MP (250–128 Kyr)	OIS 7–6. Warm, then colder	*Homo* sp. indet. with Phase 1 Levantine Mousterian	Douara Level IV; Hummal Well 6b; Hayonim Level E; Misliya Unit II; Tabun Units II–IX (& lower Unit I?); 'Ain Difla (WHS 634); Rosh Ein Mor (D15)
Middle MP (128–71 Kyr)	OIS 5. Initially warm and hyperarid but growing colder, more humid	Neandertals and early modern humans with Phase 2 Levantine Mousterian	Douara Level IIIB; Naamé; Nahr Ibrahim; Tabun Unit I; Skhul Level B; Qafzeh Units XVII–XXIV
Late MP (71–<47 Kyr)	OIS 4-early 3. Cold and dry.	Neandertals with Phase 3 Levantine Mousterian	Umm el Tlel Unit III2a; Jerf Ajla Level C; Biqat Quneitra; Amud B1–B4; Kebara Units VI–XII; Tor Faraj Level C; Tor Sabiha Level C; Far'ah II
Initial UP (47–32 Kyr)	Mid-late OIS 3. Cold and dry	Modern humans with early Upper Paleolithic (Emiran & Ahmarian), possible late Levantine Mousterian	Üçagizli Locus II, Level H; Umm el Tlel Unit III2a–b; Ksar Akil Levels XXV–XVI; Kebara Units III–VI; Boker Tachtit Levels 1–4; Boker A; Lagama VII & VIII; Abu Noshra I & II

(*Panthera pardus),* and lion (*Panthera leo*) (Tchernov, 1998). Of particular note among these new immigrants were African and Asian desert species, including camel (*Camelus dromedarius*), hartebeest (*Alcelaphus buselaphus*), and ostrich (*Struthio camelus*). Novel elements among the microfauna from this period include several Afro-Arabian species, such as *Arvicanthos ectos*, *Mastomys batei*, *Gerbillus dasyurus*, and *Suncus murimus*. After 115 Kyr, the MMP Levant became increasingly humid with wide fluctuations between colder and warmer conditions (Cheddadi and Rossignol-Strick, 1995; Weinstein-Evron, 1987). Archaeological contexts dating to this period include Skhul B, Qafzeh XVII–XXIV, Nahr Ibrahim, Naamé, and possibly lower parts of Tabun C/Unit I as well. Most lithic assemblages dating to the MMP are of the Phase 2 Levantine Mousterian. The Skhul/Qafzeh humans are unambiguously dated to the MMP, although recent ESR dates for the Tabun C1 Neandertal could place it in this period as well. Given the wide ranging and recurrent alternations of Levantine climates during this period, it seems reasonable to expect repeated movements of Eurasian Neandertals and African early modern humans into the region to parallel migrations of other fauna (Tchernov, 1998).

The end of the MMP is marked by a climatic punctuation, a rapid shift to full glacial conditions ca. 71–74 Kyr. It has been proposed this spike of cold, dry conditions was precipitated by atmospheric effects from the eruption of the Mount Toba (Indonesia) supervolcano (Ambrose, 1998; Rampino and Self, 1992), however, the actual magnitude of these effects are debated (Gathorne-Hardy and Harcourt-Smith, 2003; Oppenheimer, 2002).

The Late Middle Paleolithic (LMP) encompasses OIS 4 and approximately the first half of OIS 3 (ca. 71–47 Kyr). As in Europe, this appears to have been a period marked by increased cold and aridity, followed by wide climatic variability (van Andel, 2002). The contexts most reliably dated to the LMP (i.e., those dated by methods other than radiocarbon) are Kebara F/IV–XII, Amud B, Tor Faraj Level C, Tor Sabiha Level C, Biqat Quneitra, Umm el Tlel III2a, Jerf Ajla C, and Far'ah II. At several of these sites, evidence for colder conditions can be seen in an influx of European microfaunal elements, including the cricetines (*Cricetus migratorius*, *Mesocricetus auratus*) and *Myomimus roachi* (Tchernov, 1998). Most lithic assemblages dated to this period are of the Phase 3 variant of the Levantine Mousterian. Only Neandertal fossils are known from sites dating to the LMP.

The end of the LMP is correlated with a hyperarid event inferred from reductions in arboreal pollen in the Ghab and Huleh Basins (Weinstein-Evron, 1990) and in the Jordan Valley (Horowitz, 1987). This event is also reflected by erosional unconformities in the Jordan Valley Lisan Formation marking an unusually low level of the Dead Sea (−350 m below modern sea level) (Bartov *et al.*, 2002, pp. 18–19). The millennia immediately following this dry episode witnessed the first appearances of IUP assemblages with strong affinities to UP "Ahmarian" industries associated with modern human fossils in the UP levels of Qafzeh Cave (Gilead, 1991, p. 191; Ronen and Vandermeersch, 1972, p. 201) and Ksar Akil Level XVII (Bergman and Stringer, 1989, 106).

NEW PERSPECTIVES ON LEVANTINE MP BEHAVIORAL VARIABILITY

Considerable progress has been made in discovering the scope of adaptive and behavioral variability among MP humans. For convenience, a review of these developments can be structured in terms of settlement patterns, social organization, technological strategies, and subsistence adaptations.

Settlement Patterns and Land Use

While the concentration of known MP sites in the coastal lowlands is the result of historical factors in Levantine archaeological research, the woodland habitats along the Mediterranean coast and flanks of the Jordan Valley probably were the core area of MP human settlement. Ethnographic hunter–gatherers living in temperate woodlands like those in the Levant are slightly more dependent on such "gathered" foods (i.e., plants and small animals) than on larger animal prey (Kelly, 1995; see also Shea, 1998b). Their relative importance may have varied through time and space, but it seems reasonable to assume that plant foods and smaller animal prey were probably key factors in MP human settlement as well. The Mediterranean woodland and its adjacent steppe feature a wide variety of plant foods, as well as many edible small vertebrate and invertebrate species. The present-day Irano-Turanian steppe, in contrast, offers relatively few plant food resources to preagricultural human populations, and fewer still during glacial periods, when colder temperatures depressed plant productivity (Hillman, 1996). The stability of MP human populations was probably closely tethered to the distribution and productivity of Mediterranean woodlands. Marine pollen cores indicate many significant retractions of Mediterranean woodland during Late Pleistocene times (Cheddadi and Rossignol-Strick, 1995). It seems reasonable to suppose that such reductions in woodland vegetation were correlated with reductions in Levantine MP human populations as well.

What was the size of the Levantine MP human population? It is possible to formulate a rough estimate of MP human population size using data on recent human hunter–gatherer population densities (Table VI). Hunter–gatherers living in temperate woodland habitats do so at population densities

Table VI. Estimate of MP Levantine Human Populations Based on Population Densities of Ethnographic Hunter–Gatherers From Temperate Woodland Habitats

Population density per 100 km^2	Present distribution of Mediterranean Woodland (80,000 km^2)	Area enclosing all MP sites (120,000 km^2)
Minimum = 1	1048	1572
Median = 7	5760	8640
Mean = 12 (SD = 13)	9995	14992
Maximum = 38	30400	45600

Notes. Population density for groups living in habitats with effective temperatures (ET) between 14 and 18°C. Calculated from mean number of persons per 100 km^2 (except as otherwise noted below). Samples: Western United States: Modoc (4.8), Shoshone-Bannock (1.31), Tenino (18), Thompson (33.2), Shuswap (10—midpoint of range), Kutenai (2), Cour d'Alene (1.5), Sanpoil (38), Nez Perce (8.9), Umatilla (4.5), Karankawa (32—midpoint of range); Southeast Australia: Clarence Range tableands (1.8), Clarence Range slopes (5.5), Clarence Range coast (13.4). Original references in Kelly (1995, pp. 224–225).

ranging between 1 and 38 people per 100 km^2, with a median value of 7 people per 100 km^2 (Kelly, 1995, pp. 224–225). Using size estimates for the Levant ranging between 80,000 km^2 (the highly restricted present-day distribution of Mediterranean woodland) and 120,000 km^2 (a polygon enclosing all known MP sites in Lebanon, Syria, Jordan, and Israel) yields population estimates ranging between 5,760 and 8,640 people.

These figures are considerably larger than the minimum of 500 people thought necessary to constitute a stable breeding population. On the other hand, they almost certainly overestimate actual MP population. Zooarchaeological studies suggest MP humans' subsistence strategies were less effective than recent human hunter–gatherers (Klein, 2000; Stiner *et al.*, 1999). If correct, this suggests that MP human population densities must have been lower than those of ethnographic humans living in similar habitats. Small human populations living in highly circumscribed habitats like the Levant would have had a much greater risk of encountering minimum viable population thresholds than MP humans living in less circumscribed regions in adjacent parts of Africa and Western Asia/Eastern Europe. While there is a tendency for archaeologists to view the human occupation of any region as essentially continuous, there are sound biogeographic reasons to expect discontinuities in the MP settlement of the Levant (Shea, in press). Extreme reductions in the Mediterranean woodland phytozone during hyperarid episodes could have resulted in either the extinction of Levantine human populations or the temporary abandonment of much of the region.

Archaeological models of prehistoric land-use strategies are increasingly cast in terms of a continuum between "forager" and "collector" strategies (Kelly, 1995). Forager strategies involve high residential mobility, with groups of people positioning their residential sites near food sources.

Collector strategies involve stable residential sites supplied by in-bulk transport of food and other resources from distant extractive sites. Bar-Yosef (2000) has recently proposed that there was a shift from forager land-use strategies in the Early MP to collector land-use strategies in the Late MP. The relatively low densities of lithic artifacts, combined with the absence of hearths and generally poor preservation of human remains in Early MP cave sites like Hayonim E and Tabun D are consistent with a forager land-use strategy. Higher lithic densities, substantial hearths, and mortuary structures in Late MP sites, such as Kebara and Tor Faraj are thought to reflect a "collector" strategy.

Support for Bar-Yosef's settlement pattern shift hypothesis can be found in seasonality determinations from analysis of incremental structures in ungulate teeth (cementum). Working primarily with the remains of *Gazella gazella*, Lieberman (1998) was able to determine season of death for several MP sites. Early and Middle MP contexts, such as Tabun C and D, Hayonim E, and Qafzeh VII–XXIV, provide indications of single-season occupations. Later MP contexts, such as Kebara X/E–F and Tabun B, provide indications of multiseasonal use consistent with a radiating settlement pattern.

Later MP contexts provide several examples of possible extractive sites from which hypothetical Later MP residential sites would have been supplied. Tirat Carmel is located near a raw material source and is argued to have been a specialized toolmaking locality (Ronen, 1974). Unfortunately, the lack of preserved faunal remains at this site renders moot any questions about other possible site functions. The high frequencies of refitting bones with cut marks on them and relatively low frequencies of refitting stone tools at Biqat Quneitra (Goren-Inbar, 1990b) could suggest this was a specialized butchery site. Mainly on the basis of their small size and ephemeral occupations, such as Tor Sabiha and Sefunim Cave Levels 12–13 are thought to have been specialized hunters' camps (Henry, 1995a; Ronen, 1984a). Umm el Tlel Levels VI 1a0 and VI 3 b'1 contain numerous remains of camels and stone tools. The placement of stone tool cut marks on the proximal parts of long bones from these levels suggests occupations associated with hunting and butchery (Boëda *et al.*, 2001).

The fit of this model with the settlement pattern evidence is not perfect, however. Surveys of Early MP sites in the Central Negev and western Jordan reveal a bimodal distribution of site sizes, with many small sites and smaller number of large ones. This sort of bimodal site size distribution is more consistent with a collector strategy (Clark, 1998; Marks and Freidel, 1977), not the forager adaptation Bar-Yosef associates with the Early MP.

Archaeological sites are the static byproducts of dynamic land-use strategies. While it is possible that there were long-term trends in Levantine MP settlement patterns, recent human land-use strategies are widely variable and fine-tuned to variation in topography, rainfall, vegetation, prey species behavior, and human group size. There is every reason to expect MP humans' land-use strategies varied in the short term in response to these factors as well. Indeed, the wide geographic distribution of Neandertals in Western Eurasia and early modern humans in the Levant and Africa before 50 Kyr suggests both hominids were capable of adjusting their settlement patterns to local conditions and novel circumstances. With MP sites ranging from the Mediterranean coast to the mountains of southern Jordan, it is virtually certain there were a range of settlement patterns being practiced in different parts of the Levant at the same time. Our ability to identify strategic variability in land-use is complicated by a traditional focus on caves and large open-air sites and coarse-grained chronological resolution for MP contexts. Caves and large open-air sites comprise the majority of excavated MP contexts. These sites are all almost certainly palimpsests of many discrete occupations. Even with good dating, the minimum chronostratigraphic units for most Levantine MP sites span thousands, if not tens of thousands of years. Consequently, we are unable to detect shifts in settlement patterns that occur on a shorter timescale. This is important because wide and short-term variation in Late Pleistocene climate (Taylor *et al.*, 1993) is likely to have significantly altered the archaeological signature of human land-use strategies in the Levant.

Subsistence

Mediterranean woodlands contain many potential plant food resources. Plant foods probably played a prominent role in the diets of Levantine MP humans (Hovers, 2001; Shea, 1996), but relatively little is known about this dimension of their subsistence. Charred remains of *Vicia* (vetch) have been recovered from the hearths of Kebara Cave and remains of *Celtis* (hackberry) recovered from Douara and Dederiyeh. (Akazawa, 1987; Akazawa *et al.*, 1999; Bar-Yosef *et al.*, 1992) Phytoliths of cereal grasses have been recovered from MP contexts at Amud, Kebara, and Tor Faraj (Albert *et al.*, 2000; Madella *et al.*, 2002; Miller Rosen, 1995), but these residues could just as well come from bedding material as from food.

The zooarchaeological evidence for human subsistence in the MP Levant is on a somewhat more secure footing. Most Levantine MP faunal assemblages exhibit a similar range of species, but with differing modalities between sites (see Table VII and references therein). Among assemblages from coastal lowland sites in Lebanon and northern Israel, the overwhelming majority of identifiable large herbivore remains are those of five taxa, ibex/goat (*Capra ibex* and *C. aegagrus*), fallow deer, mountain gazelle,

Table VII. Large Herbivore Remains From Selected Levantine MP Contexts Expressed as Percentages of NISP (Number of Identified Specimens)

Site and level (NISP)	Hippo	Rhino	Bos	Cervus	Dama	Capreolus	Ibex	Sus	Gazella	Equids	Alcelaphus	Camel	Source
Lebanon & Northern Israel													
Ksar Akil 26–29 (2719)			20		73	2	5						Hooijer (1961, p. 57)
Ras el-Kelb A-O (1199)		2	12	1	68	1	3	8	5				Garrard (1998, p. 61)
Bezez Cave B (145)			6	1	65		1	3	25				Garrard (1982), pp. 402–403
Naamé (33)	3	9	9	12	48	3	9	3		3			Fleisch (1970, p. 90)
Kebara F (3353)			2	4	28		1	2	63	1			Davis (1982)
Tabun B (1725)			2	1	77	1	2	2	13	2			Bar-Yosef (1989, Table 7.3)
Tabun C (312)			29	5	11		5	7	40	4			Bar-Yosef (1989, Table 7.3)
Tabun D (218)			12	10	26	7	2	2	40	1			Bar-Yosef (1989, Table 7.3)
Skhul B (676)			88			2		<1		10			Bar-Yosef (1989, Table 7.3)
Qafzeh V-XV (642)		3	18	27	17	1	11	8	11	5			Rabinovich and Tchernov (1995, p. 18)
Qafzeh XVI-XXIV (296)		6	19	9	29		10	4	6	15	2		Rabinovich and Tchernov (1995, p. 18)
Shukbah D (263)			15		38		4	1	43				Garrod and Bate (1942, pp. 18–19)
Amud B (208)			6		29		1	5	58				Takai (1970, p. 54)
Hayonim E <405 bd (85)			8	13	27	5		2	45				Stiner and Tchernov (1998, p. 252)
Hayonim E >405 bd (412)			5	5	48	1	1	3	36	2			Stiner and Tchernov (1998, p. 252)
Syria & Golan Heights													
Biqat Quneitra (99)		1	43	7	8		1		11	28			Davis *et al.* (1988, p. 102)
Douara III (236)							45		28	8	1	18	Payne (1983, p. 98)
Douara IV (191)							47		46	5	1	3	Payne (1983, p. 98)
Dederiyeh 3 (111)			4			33	59	1	4				Griggo (1998, p. 756)
Dederiyeh 11 (234)						1	99						Griggo (1998, p. 756)
Umm el Tlel V2ßa (274)		4							10	63		23	Griggo (1998, p. 756)
Umm el Tlel VI1a (72)												100	Griggo (1998, p. 756)
Umm el Tlel VI3 b'1 (275)										9		91	Griggo (1998, p. 756)
Southern Israel & Jordan													
Far'ah II, L.1 (108)	1		27						1	31	37	4	Gilead and Grigson (1984, p. 82)
Far'ah II , L.2 (39)			18				3			59	15	5	Gilead and Grigson (1984, p. 82)
Rosh Ein Mor (14)			0							100			Tchernov (1976)
Ain Difla (13)			0				8		23	69			Lindly and Clark (1987)

aurochs, and *Equus* spp. (*E. caballus, E. hydruntius, E. hemionius, E. tabeti,* and *E. asinus*). Caprid remains are present in nearly every MP faunal assemblage, but they only dominate assemblages from mountainous and north Levantine sites, such as Douara and Dederiyeh. Ibex favor craggy substrates like those surrounding caves, and their predictable daily movements to and from water sources would have made them attractive targets for ambush/intercept hunting. Camel is rare in most sites, but this species appears to have been the focus of considerable hunting pressure at Umm el-Tlel (Boëda *et al.*, 2001; Griggo, 1998). Poor faunal preservation at sites in the Negev and southern Jordan precludes generalization about MP hunting strategies in this region.

If one examines the zooarchaeological evidence in terms of large mammal species' behavioral characteristics, there is geographically patterned variation in the Levantine MP record (Fig. 5). Most assemblages from Lebanon and northern Israel are dominated by territorial species and species that tend to live in or near woodlands, such as red deer, fallow deer, roe deer, boar, mountain gazelle, and hippopotamus. Species with more migratory habits and/or a preference for open country, such as steppe rhino, aurochs, camel, hartebeest, ibex, and various equids, are more common among assemblages from the interior, in Syria, southern Israel, and Jordan (see Fig. 5). Probably the most notable exception to this trend is Skhul B, whose high percentage of aurochs remains (88% of NISP) is almost certainly an artifact of differential survival during archaeological recovery (fossils were extracted from breccia by local workmen using chisels and hammers) (McCown, 1937).

Zooarchaeological analyses reconstructing specific modes of human predation have been performed on assemblages from Kebara Cave, Biqat Quneitra, Hayonim Cave, and several levels of Umm el Tlel (Boëda *et al.*, 2001; Rabinovich, 1990; Speth and Tchernov, 1998; Stiner and Tchernov, 1998). All of these assemblages exhibit some degree of carnivore disturbance, but most of the bones appear to have been processed by humans. Most of the large mammals species at Kebara (mountain gazelle, fallow deer, boar, red deer, and aurochs) feature age-mortality profiles dominated by prime-age adults, a pattern interpreted as evidence for ambush/intercept hunting strategies. The patterning of zooarchaeological evidence from Biqat Quneitra and Hayonim appears similar to that from Kebara. At minimum, the Kebara, Biqat Quneitra, and Hayonim data suggest that later MP humans preyed effectively on some large mammal species. Preferential transport and processing of high quality limbs over lower quality cranial remains at these sites argues against scavenging as a major mode of MP subsistence (Marean and Assefa, 1999).

Smaller and sedentary prey species, such as tortoise (*Testudo graeca*) are common in the MP levels of Kebara and Hayonim, but birds and small, fast moving terrestrial mammals, such as lagomorphs, do not appear to have

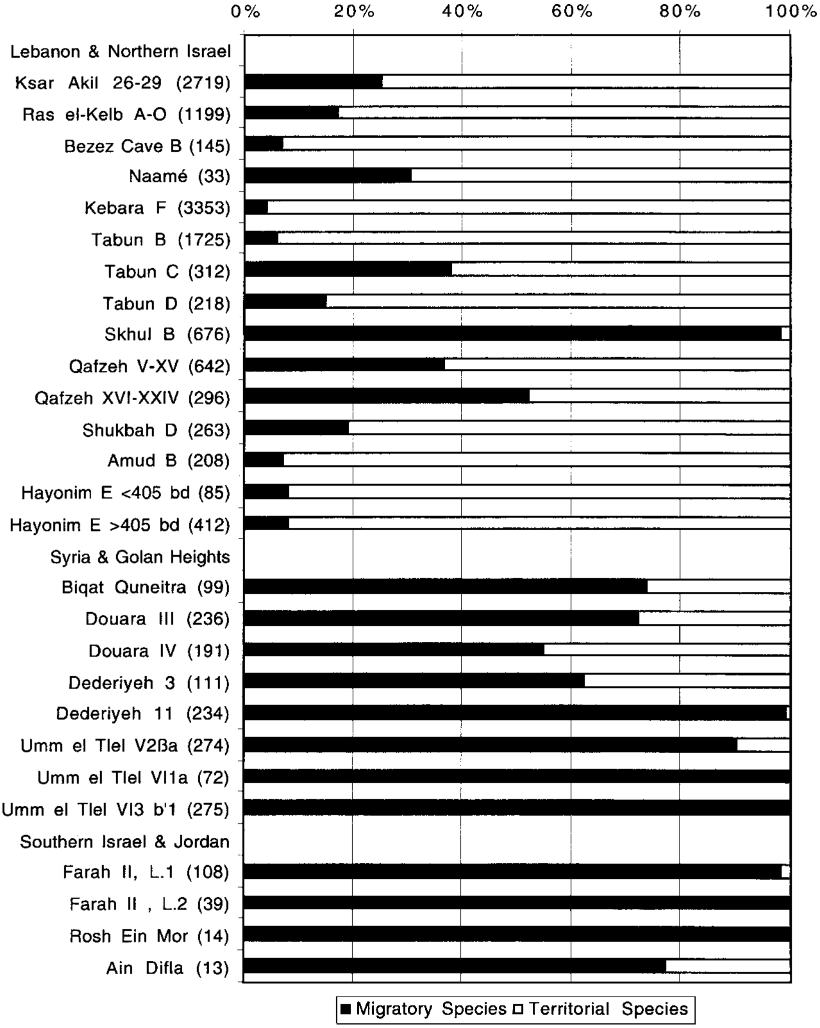

Fig. 5. Relative frequency (% NISP) of territorial/woodland vs. migratory/steppe fauna in selected Levantine MP contexts, sorted by geographic area.

been common prey items until later MP times (Stiner and Tchernov, 1998). Stiner and colleagues interpret this broadening of the prey spectrum in the Later MP as evidence for human population growth (Stiner, 2000; Stiner *et al.*, 1999). Decreases in tortoise size that are also attributed to population growth may be complicated by the effects of climate change (Speth and Tchernov, 2003).

Technology

Most Levantine MP sites are located less than 10 km from either primary or secondary sources of high quality flint/chert. This has led many researchers to assume lithic raw materials were collected in the course of daily foraging tasks. At Hayonim and Umm el Tlel, where raw material from MP sites have been traced to their sources, a small but significant proportion of each assemblage had been transported from sources more than 20 km away (Boëda *et al.*, 2001; Delage and Bar-Yosef, 2000). Tor Faraj, Tor Sabiha, and Biqat Quneitra are located more than 10–15 km from the sources of flint represented in their archaeological assemblages, and clearly some form of direct raw material procurement must have been involved in assemblage formation processes at these sites. At Biqat Quneitra, MP humans made large flakes, scrapers, and pebble-cores from local basalt outcrops, and they conserved exotic flint flakes by using them as cores (Goren-Inbar, 1990b). At Tor Faraj, they apparently transported flakes in bulk to the site from remote production sites (Henry, 1995a). At Amud and Yabrud, in contrast, they were evidently more selective, traveling long distances to collect more siliceous flints and bypassing low quality flint nodules eroding from the bedrock in front of these caves (Hovers, 1998; Solecki and Solecki, 1995). MP humans' ability to perceive variation in the quality of lithic raw materials and their ability to adjust technological strategies to compensate for this variation is paralleled in the European MP record of raw material economy (Féblot-Augustins, 1999; Gamble, 1999).

A relatively high proportion of the flakes from Levantine MP assemblages were detached with recurrent Levallois techniques. Though they do not approach the cutting-edge/mass recovery rates of later UP prismatic blade techniques, Levallois flakes have relatively high flake area/thickness ratios compared to other debitage from Lower and Middle Paleolithic assemblages (Dibble, 1997). Levallois techniques do not necessarily produce more or better tools than other techniques used by MP humans. Rather, they yield a smaller number of relatively broad flake tools with individually greater potential for curation. This suggests that the selective pressures influencing high rates of Levallois flake production in the Levant were probably ones that involving planning for prolonged tool use-lives. It might seem reasonable to infer such pressure for prolonged tool use-lives reflected increased mobility and dependence on curated "personal gear" (Kuhn, 1994), but heavily retouched tools are relatively rare in Levantine Mousterian assemblages, at least compared to Mousterian assemblages from elsewhere in Western Asia.

Microwear analysis has been performed on stone tools from Kebara, Tabun, Hayonim, Qafzeh, Tor Faraj, 'Ain Difla, Nahr Ibrahim, and Umm el

Tlel (Dockall, 1997; Plisson and Beyries, 1998; Roler and Clark, 1997; Shea, 1989b, 1991, 1995). Unretouched flakes dominate the use-worn components of probabilistically sampled assemblages from Kebara, Tabun, Hayonim, Qafzeh, and Tor Faraj (Shea, 1991). Most of the wear patterns are referable to woodworking, but wear attributable to hide scraping, processing soft plant matter, and butchery have also been observed. Surficial abrasion on the proximal ends of some tools suggests they were hafted. Support for this hypothesis has recently been found in the form of bitumen mastic adhering to stone tools from Umm el Tlel (Boëda *et al.*, 1996). In general, microwear analysis suggests Levantine Mousterian stone tool use features the same kind of weak degree of form–function correlation seen in the European Mousterian (Shea, 1989a, 1991).

One way in which Levantine Mousterian stone tool use seems to differ from the European Mousterian record is in evidence for the systematic use of stone spear points (Shea, 1997). Some Levallois points and other triangular flakes from Levantine Mousterian contexts feature distal breakage patterns comparable to those seen on ethnographic and experimental spear points (Shea, 1988). A fragment of a Levallois point was recently discovered embedded in the cervical vertebra of an equid at Umm el Tlel (Boëda *et al.*, 1999). Among ethnographic hunters, the use of stone spear points is correlated with the ambush/intercept hunting of large mammals (Churchill, 1993), a context in which sharp stone edges increase the reliability of the weapon to which they are attached (Ellis, 1997). Levallois points are more common in assemblages from the southern and interior Levant, where ecogeographic factors and the zooarchaeological record suggest there would have been more incentives for MP humans to prey systematically on large migratory terrestrial mammals (Shea, 1998b).

Recent microwear and residue analysis of East European Mousterian tools suggest spear points were used in this region as well (Hardy *et al.*, 2001). The difference between Levantine and European evidence for spear point use may be not so much a categorical distinction, as one of a degree of emphasis in technological strategies. African Middle Stone Age assemblages feature many small, thin, and symmetrical stone points that are considered likely spear points (McBrearty and Brooks, 2000; Shea, 1997), but such retouched points do not occur in Levantine Mousterian contexts.

To judge from the contents of most Levantine caves, MP humans appear to have had a relatively low "discard threshold" for their stone tools. Retouched flake tools occur in all Levantine MP assemblages, but heavily retouched scrapers are rare. Rolland and Dibble (1990, p. 488) suggest that the low frequencies of heavily retouched tools among Levantine Mousterian assemblages may reflect more extensive mobility patterns than those associated with "typical" European and West Asian Mousterian assemblages, and with the preceding Acheulo-Yabrudian Industry (in which heavily retouched tools are common). Given the abundance of flint throughout most of the area in which Levantine MP sites are distributed and the ease with which a modern flintknapper can replicate most Levantine Mousterian tools (none of which, in the author's experience, requires more than a few minutes' knapping effort), there were probably few incentives for MP humans to curate substantial quantities of stone tools.

Patches of ash deposits reported from many Levantine MP sites suggests widespread use of fire, but this evidence is particularly well documented at Kebara Cave and Tor Faraj (Henry, 1998a; Meignen *et al.*, 2000). The Kebara "combustion features" were hearths fueled by grass, brush, and wood from Tabor oak (*Quercus ithaburensis*). Micromorphological analysis of these combustion features indicates repeated firing in the same place. Both the Kebara and Tor Faraj hearths have stone tools and faunal remains distributed around them, indicating that human activity took place while the hearths were still burning. At Kebara, several hearths were built on surfaces excavated into earlier ash deposits, suggesting short intervals of time between reoccupation and reuse of the same site.

Group Size and Social Organization

The nature of Levantine MP human social organization can be appreciated only in the broadest of outlines. The actual size of face-to-face communities and of more extensive alliance networks probably varied widely through time and space, and, conceivably, between Neandertals and early modern humans. However, studies of living primate socioecology offer some potentially valuable insights into hominid group sizes. Among living primates there is an allometric relationship between brain size/body weight and social group size (Aiello and Dunbar, 1993). Using data on inferred hominid brain sizes, one arrives at group size estimate of about 150–250 individuals for both Neandertals and modern humans (both early modern humans and living humans). This is considerably larger than the effective social network size estimated for *Homo erectus* (108 individuals), but only a fraction of the size of larger social networks among recent human hunter–gatherers. These alliance and reciprocity networks can extend to 500–2500 individuals (Dunbar, 2001). A case can be made that the difference between predicted and observed effective social network size among living humans reflects our unique strategy of using fictive kinship, reinforced through the use of exosomatic symbols, to maintain extensive alliance and reciprocity networks. For Pleistocene humans living in small local groups, the adaptive advantage of participating in these networks is that they disperse otherwise high risks of local subsistence failure broadly among regional populations.

All recent human groups use exosomatic symbols to extend social networks beyond local populations (Wobst, 1977). Among primates, this is a uniquely human social strategy. The MP Levant contains numerous examples of artifacts with possible links to the use of exosomatic symbols (Table VIII), but the strongest evidence is associated with the Skhul/Qafzeh humans. At Qafzeh, a series of ochre fragments, and ochre stained stone tools are clear evidence for the production of pigments (Hovers *et al.*, 2003). The nearest known sources of ochre to Qafzeh are more than 10 km away. Shells of *Glycimerus* (a marine mollusc) also found at Qafzeh, tens of kilometers from their nearest source on the Mediterranean coast. These shells may be evidence for the use of personal adornment, but they do not appear to have been modified. At minimum, both the ochre and the shells from Qafzeh are evidence for the transport and curation of nonutilitarian objects. Interpreted more liberally, they indicate a capacity to deploy exosomatic symbols in social contexts.

Excavations at several Levantine MP sites have discovered several other kinds of possibly symbolic incised objects. An ungulate shaft fragment with a series of short linear incisions was identified among faunal remains from Kebara F (Davis, 1974). Lithic artifacts featuring repetitive linear incisions have been reported from Qafzeh XVII, Biqat Quneitra, and Ras el-Kelb (Goren-Inbar, 1990b, pp. 237–238; Hovers *et al.*, 1997; Moloney, 1998). While the lines incised on the Qafzeh and Ras el-Kelb artifacts appear unpatterned, the concentric lines on the Biqat Quneitra piece presents clear evidence for planned design (D'Errico *et al.*, 2003).

The third, and richest, category of MP symbolic evidence is human burials. The most generally accepted burials include the early modern human fossils, Skhul 1, 4, 5, and 9; Qafzeh 8–11, 13, 15; and the Neandertal fossils, Tabun C1; Kebara 1 and 2; Amud 1, 7, 9; and Dederiyeh 1 (Shea, 2001a; Tillier *et al.*, 1988). There remains a healthy skepticism about claims of MP mortuary ritual (Gargett, 1999), but complete skeletons of large mammals are so rare in Mediterranean caves as to leave little question that their burial reflect from anthropogenic processes (Belfer-Cohen and Hovers, 1992; Hovers *et al.*, 2000). In this regard, it is noteworthy that Solecki (1975) reported a fallow deer "burial" accompanied by red ochre at Nahr Ibrahim. If this is indeed an anthropogenic feature, it would suggest a complex symbolic behavior (burial of nonhuman species) not seen until later Epipaleolithic times (i.e., the dog burials of Eynan/Mallaha). If it is a natural feature, then articulated large vertebrate skeletons may not be as rare in Mediterranean caves as we suppose them to be. Unfortunately, there is not adequate documentation necessary to evaluate the Nahr Ibrahim evidence.

Table VIII. Inventory of Claimed Evidence for Levantine MP Human Symbolic Behavior

Context	Description	Interpretation	Source
Qafzeh XVII	Core fragment with repetitive linear markings	Unknown	Hovers (1997)
Biqat Quneitra	Tabular flint block with concentric elliptical incised marks	Unknown	Marshack (1996)
Ras el-Kelb Tunnel Trench Level F	Flint flake with linear incisions on the dorsal surface	Unknown	Moloney (1998)
Qafzeh XVII	Incised blocky fragment of red ochre, numerous ochre pellets, ochre-stained stone tools	Preparation of pigments, Long-distance transport (>10 km) of nonutilitarian objects.	Vandermeersch (1966); Hovers *et al.* (2003)
Qafzeh (level unspecified)	Shells of the marine mollusc, Glycimerus	Personal adornment? Long-distance (>30) transport of nonutilitarian objects.	Bar-Yosef (1992, p. 206)
Skhul B	Boar mandible under the left forearm of Skhul 5	Mortuary ritual	McCown (1937, p. 100)
Qafzeh XVII	Antlers and frontal bone of a fallow deer clasped to the upper chest of Qafzeh 11	Mortuary ritual	Vandermeersch (1970)
Amud B	Red deer maxilla on the pelvis of Amud 7	Mortuary ritual	Hovers *et al.* (1995)
Dederiyeh 11	Triangular flake on the abdomen of Dederiyeh 1 and a limestone block near its head	Mortuary ritual	Akazawa *et al.* (1995b)
Qafzeh IX	Double burial of a child (Qafzeh 10) and a young adult female (Qafzeh 9)	Mortuary ritual	Vandermeersch (1981)
Tabun B/C	Adult female Neandertal (C1) accompanied by an unrecovered neonate	Mortuary ritual	Garrod (1937)
Kebara XII	Cranium of Kebara 2 removed after burial	Mortuary ritual	Bar-Yosef *et al.* (1991)

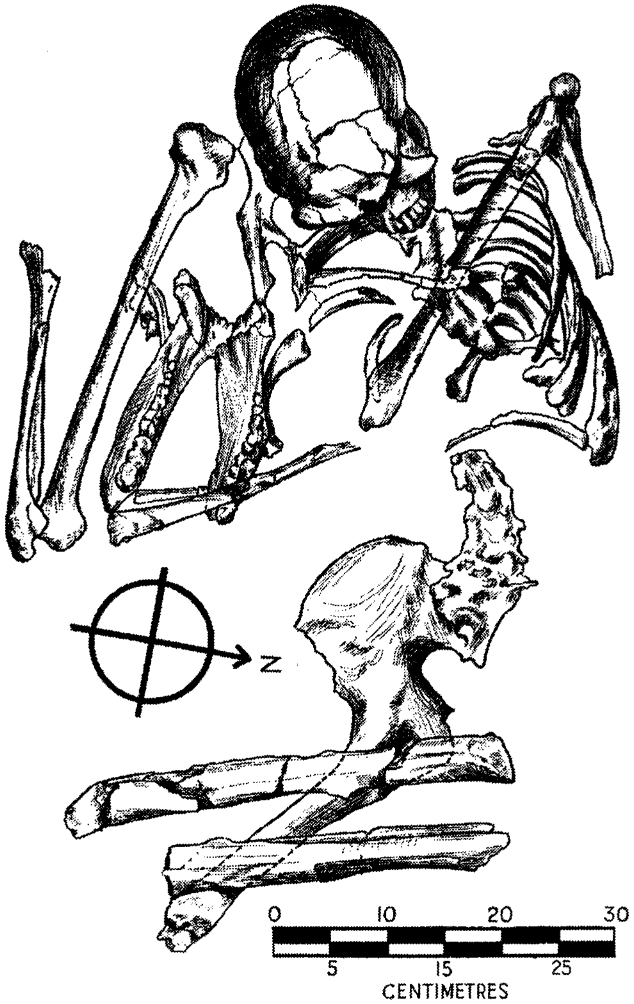

Fig. 6. Skhul 5 burial with grave goods (boar's jaw under left arm) (Garrod and Bate, 1937, Plate LII). (Republished with permission of the American Schools of Oriental Research from Shea (2001a). Permission conveyed throught Copyright Clearance Center, Inc.)

Two burials, Skhul 5 and Qafzeh 11 provide clear examples of mortuary furnishings. Skhul 5 has a boar mandible interposed between the left forearm and ribcage (McCown, 1937) (Fig. 6). Qafzeh 11 has been positioned with the antlers and frontal bone of a fallow deer clasped to its upper chest

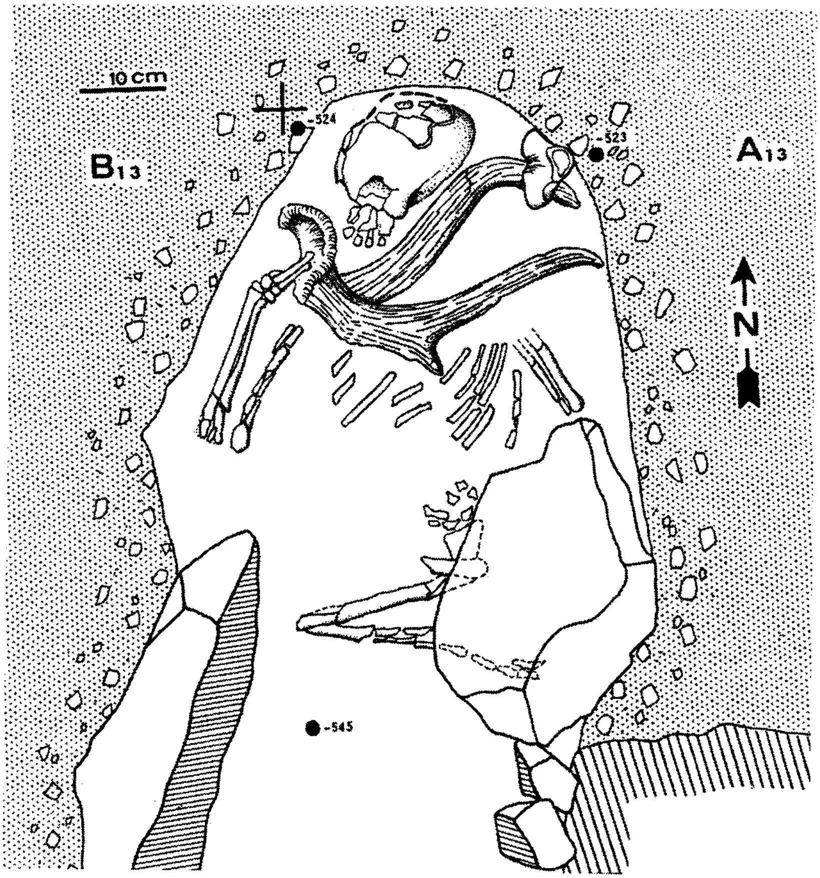

Fig. 7. Qafzeh 11 burial with grave goods (deer antler clasped to chest) (Vandermeersch, 1970). (Republished with permission of the American Schools of Oriental Research from Shea (2001a). Permission conveyed throught Copyright Clearance Center, Inc.)

(Vandermeersch, 1970) (Fig. 7). Putative grave goods associated with Amud 7 (a red deer maxilla) and Dederiyeh 1 (a stone plaque and a triangular flake) (Akazawa *et al.*, 1995b; Hovers *et al.*, 1995) are somewhat less clearly symbolic, because objects similar to the claimed mortuary furnishings occur in the sediments surrounding the skeletons (Gargett, 1999). That the skull of Kebara 2 was removed shortly after burial may also involve symbolic behavior (Tillier *et al.*, 1991). The fact that the rest of the skeleton was not disturbed makes it difficult to attribute the removal of the Kebara 2 cranium skeleton to carnivore activity.

Two examples of double burials are known. The Tabun C1 Neandertal female was accompanied by a neonate whose remains were not recovered (Garrod, 1937). In Qafzeh Level XVII, a child (Qafzeh 10) was buried in the same pit at the feet of a young adult female (Qafzeh 9) (Vandermeersch, 1981).

The Levantine MP is not unique in furnishing evidence for the social use of exosomatic symbols during MP times. Similar kinds of mineral pigments, incised artifacts, and mortuary structures have been reported from Neandertal contexts in Europe and both Acheulean and Middle Stone Age contexts in Africa (Barham, 2002; D'Errico *et al.*, 2003; McBrearty and Brooks, 2000; Mellars, 1996; Van Peer *et al.*, 2003). Like the symbolic evidence from these other regions, the striking thing about Levantine MP symbol use is its highly idiosyncratic nature. MP symbolic expressions rarely take precisely the same form in more than one archaeological context. For example, Skhul 5, Qafzeh 11, Dederiyeh 1, and Amud 7 appear to have been buried with grave goods, but each of their skeletons is positioned differently and the nature of the grave goods differs in each case. The singularity of MP symbolic expressions stands in marked contrast to those in post-MP contexts, where personal adornment, artifact decorations, and art motifs often take similar forms at sites widely dispersed in space and time. If these are reflections of ritual, the fact that they are not repetitive could suggest that they reflect unusual circumstances in which exosomatic symbols were needed, perhaps only temporarily, to extend MP humans' linguistic abilities.

The lack of patterning in symbolic evidence suggests that Levantine MP groups were probably small, with fluid membership, and composed largely of individuals who knew each other through kinship and affective relationships. The power of these affective relationships can be seen in Qafzeh 11's survival of severe cranial trauma as well as in the care given to several of the Qafzeh juveniles with severe neurocranial abnormalities (Qafzeh 19, 21), including hydrocephaly (Qafzeh 12). As Gamble has argued for Europe (1999, p. 265), aggregations of MP humans probably occurred near the intersections of habitual pathways across individual and group foraging ranges, at locations that provided shelter (caves) or fixed and predictable resources, such as springs or outcrops of high quality lithic raw material. Seasonality studies and analyses of hearths suggest that some sites were visited repeatedly, but the lack of evidence for prolonged occupations, such as storage pits, freestanding architecture, or stockpiling of raw material supplies, suggests these aggregations were relatively brief. The rare and idiosyncratic character of evidence for symbolic behavior may indicate that circumstances requiring the use of exosomatic symbols to overcome cultural/linguistic barriers were relatively uncommon in MP times.

EVOLUTIONARY ISSUES, COEVOLUTION AND DISPERSAL

Because of its association with Neandertals and early modern humans and its setting in a biogeographic corridor, the major evolutionary questions about the Levantine MP have tended to focus on two issues, relationships between Neandertal and early modern humans and the forces driving Late Pleistocene human dispersals.

Neandertal–Early Modern Human Evolutionary Relationships

In the wake of revisions to Levantine MP geochronology during the 1980s–1990s, models of Neandertal–early modern human evolutionary relationships have undergone a significant shift. Whereas previous archaeological models sought correlates for the presumed phylogenetic evolutionary relationship between Levantine Neandertals and early modern humans (e.g., Binford, 1968, 1970; Brose and Wolpoff, 1970; Clark and Lindly, 1989; Jelinek, 1982a,b; Smith, 1983; Trinkaus, 1984; Wolpoff and Caspari, 1997), recent models have focused on these hominids' possible coevolutionary relationships (e.g. Henry, 1995a; Kaufman, 1999; Rak, 1993; Shea, 2003a). The kinds of coevolutionary relationships that have been proposed include assimilation, ecogeographic vicarism, niche partitioning, and competition.

Assimilation

Kaufman (1999, 2001) sees the Levantine MP as a period of possible cultural contact and assimilation between Neandertals and early modern humans. Whether or not Neandertals and early modern humans could interbreed successfully (an issue about which this hypothesis takes no position), the ethnographic record suggests assimilation is a common outcome when different groups of humans encounter one another. Evidence cited in support for the assimilation hypothesis for the MP Levant includes (1) overlapping radiometric dates for Neandertal and early modern human fossil contexts, and (2) similarities in the archaeological record with which these fossils are associated.

Assimilation requires both Neandertals and early modern humans to have been present at the same time and in the same place. The difficulty with accepting overlapping TL, ESR, or U-series dates for separate MP contexts as evidence for contemporaneity is that these dates have very large standard errors, often thousands or even tens of thousands of years. Even if one did find remains of both hominids in the same stratigraphic level, inferring contemporaneity and the possibility of cultural assimilation would require one to time-average fossils and archaeological residues deposited over hundreds, or even thousands, of years. Thus, the evidence for the degree of sympatry necessary for assimilation to have occurred remains equivocal.

If one treats MP lithic assemblage-groups as the functional equivalent of archaeological "cultures" of more recent periods, then Neandertals' and early modern humans' association with Later Levantine Mousterian (Phases 2–3) assemblages seems to support the assimilation hypothesis. However, Paleolithic industries are not the same thing as ethnographic and archaeological cultures (Clark, 2002; Shea, in press). Whereas most ethnographic and archaeological cultures vary widely in the course of decades or centuries, MP industries persist seemingly unchanged for tens of thousands of years. Secondly, archaeological cultures are defined on the basis of multiple lines of evidence, including mortuary rituals, architecture, stylistic variation in multiple media, and they are only *assumed* to be rough proxies for self-conscious social groups. MP industries are defined primarily in terms of lithic typological and technological variation. Among such simple tools as compose most Levantine Mousterian assemblages, there is an intrinsically high probability of design convergence. Levantine Neandertals and early modern humans stone tools may look similar because the people who made them faced similar needs for simple stone tools and responded to those needs by calling upon evolutionarily primitive technological abilities (Shea, 2003a, p. 46; 2003b, pp. 177–178). The resulting similarity of their lithic industries is a kind of "lithic homoplasy." Accepting Neandertals' and early modern humans' association with these industries as proof of culture contact and assimilation involves a high risk of a Type 2 statistical error, accepting a null hypothesis of "no difference" due to inadequate information.

Ecogeographic Vicarism

Rak (1993) and others (Bar-Yosef, 1988) have argued that the alternation of Neandertal and early modern human fossils in Levantine caves reflects vicarism, climatically driven shifts in these humans' otherwise mutually exclusive geographic distribution. The Skhul/Qafzeh humans' presence in the Levant 80–130 Kyr is seen as a northward dispersal of African early modern humans during a relatively warm period. Neandertals' appearance in the Levant between 50 and 70 Kyr is thought to reflect population displacement resulting from the rapid onset of glacial conditions during Marine OIS 4 (65–75 Kyr). Both these inferred population movements are correlated with the immigration of African and Eurasian micromammals (Tchernov, 1998). As ecological vicars, Neandertals and early modern humans would rarely have found themselves in the same place at the same time. This inference is exactly congruent with these hominids' mutually exclusive stratigraphic distribution in Levantine sites.

Currently, the only evidence that can be marshaled against the vicarism hypothesis is new ESR and U-series dating of the Tabun C1 fossil. The preferred date, 112 Kyr, would place this Neandertal in the Levant during the relatively warm period of OIS 5, at roughly the same time as the Skhul B fossils. Such rough chronological equivalence does not prove contemporaneity, but it is enough to raise questions about the environmental determinism of the vicarism model. Both Neandertals and early modern humans were large omnivorous mammals distributed across many different ecozones in Eurasia and Africa, respectively. It seems unrealistic to envision them driven into and out of the Levant *en masse* solely by climate changes of a sort to which both species had been exposed for tens of thousands of years previously. No other large mammals living in the Late Pleistocene Levant exhibit a vicarious relationship to each other like that proposed for Neandertals and early modern humans.

Niche Partitioning

Species that would otherwise compete for the same resources in a given environment sometimes partition their originally broad ecological niche into more specialized niches. Henry (1995a) has proposed a kind of "niche partitioning" model for the MP Levant in which Neandertal settlement focused on Mediterranean woodlands and early modern human settlement focused on the Irano-Turanian steppe. Henry argues modern humans' origins in tropical Africa may have led them to focus their MP occupation of the Levant on steppic habitats. MP assemblages from sites in southern Jordan reveal behavior patterns that resemble those of recent human hunter–gatherers.

The principal theoretical objection to the niche partitioning model concerns equation of preadaptation with preference. Early modern humans may have been preadapted to warm, arid climates, but there is little reason to suppose they preferred to live in arid steppes when more food-rich habitats were available nearby in Mediterranean woodlands. Indeed, the large mammals (and presumed human prey) from Skhul and Qafzeh are overwhelmingly those of woodland-dwelling species, such as red deer, fallow deer, gazelle, and aurochs. The same is true of faunal assemblages associated with Neandertals at Tabun, Kebara, Amud, and Dederiyeh. Of all the faunal assemblages associated with human fossils, those most dominated by steppe species are associated with the Dederiyeh Neandertals. There is thus far no evidence that early modern humans' abilities to inhabit arid steppes were in any way superior or inferior to those of Neandertals.

A further objection to the niche partitioning model concerns its specific prediction of differences in hominid behavior. Most ethological cases of niche partitioning among larger mammals involve differences in subsistence. Strontium/calcium ratios for Levantine Neandertal and early modern human fossils (Skhul 9, Qafzeh 4, Tabun C1) suggest these hominids had essentially similar diets (Schoeninger, 1982). Studies of dental microwear thus far also fail to reveal dietary differences among Levantine MP humans (Perez-Perez *et al.*, 2003, p. 507). While there is much that we do not know about Levantine MP human subsistence from archaeological residues, what we do know is not yet sufficient to support a model of niche partitioning.

Competition

The competitive exclusion principle in ecology holds that species requiring similar food sources will compete with each other when their geographic ranges overlap. The similar archaeological record associated with Neandertals and early modern humans in the Levant suggests these hominids occupied ecological niches that were very similar, if not effectively identical. Many researchers accept that there was competition between Neandertals and early modern humans in Europe around the Middle–Upper Paleolithic transition, but the hypothesis that they competed with each other in the MP Levant has received relatively less attention (Shea, 2001a,b, 2003a,b). Levantine Neandertals and early modern humans were, in effect, large social predators living in a geographically circumscribed habitat bounded by ocean to the West, by desert to the South and East, and by mountains to the North. Among social predators now living in circumscribed habitats competitive encounters involve high risks of injury and mortality (Van Valkenburgh, 2001). Competitive encounters between (and among) Neandertals and early modern humans may have been violent as well, although the archaeological record is silent on this issue. Taking the evidence at face value, with minimal evidence for sympatry between Neandertals and early modern humans, competition between them may have been largely indirect, with each group trying to outdo the other in exploiting those habitats at the margins of their geographic ranges. The actual areas jointly occupied and exploited by Neandertals may have been quite small, short-lived, and thus intrinsically unlikely to leave a fossil or archaeological record of such "coexistence." Nevertheless, small advantages in foraging efficiency played out over thousands of years, may have been sufficient to affect the demographic stability of MP human populations (Zubrow, 1989).

One of the interesting implications of the competition hypothesis is that the behavioral capacities that enabled modern humans to competitively displace Neandertals throughout Western Eurasia around 30–47 Kyr may not have been present among the Skhul/Qafzeh humans. Even though such early modern humans were present in the coastal lowlands of the Levant 80–130 Kyr, no modern human fossils occur in the Levant until UP times. Only Neandertal fossils are known from Levantine MP sites dating to 47–80 Kyr. If the absence of early modern human fossils from these contexts reflects their genuine absence from the region, then this could suggest the Skhul/Qafzeh humans and their immediate descendants lacked the behavioral capacities that enabled subsequent modern humans to compete successfully against Neandertals (Shea, 2003b).

Late Pleistocene Human Dispersals and Adaptive Radiations

Reflecting the Levant's role as a major biogeographic corridor, the second main set of evolutionary questions about the Levantine MP focus on hominid dispersals.

Why were MP humans unable to disperse into Eurasia beyond the Levant? The Late MP (47–71 Kyr) seems to have witnessed a long delay in the movement of *Homo sapiens* populations into the rest of Eurasia. Whether this delay involved movements into all of Eurasia or just western Eurasia is not yet clear. Early modern humans appear to have reached remote parts of eastern New Guinea and southern Australia by 35–40 Kyr (Mulvaney and Kamminga, 1999). It is conceivable that early modern human populations were already dispersing eastward along the Indian Ocean coast by 80 Kyr (Kingdon, 1993), but a poor paleoanthropological record for the Arabian Peninsula and South Asia for this time period prevents us from testing this hypothesis (Kennedy, 2000).

The delay in modern human dispersals into Europe is somewhat more clearly a "real" phenomenon. The earliest reliably dated modern human fossils in Europe date to 32–36 Kyr and are associated with early UP Aurignacian industries (Churchill and Smith, 2000). The earliest dated occurrences of the Aurignacian are not associated with any human fossils, but many archaeologists attribute the authorship of these earlier Aurignacian assemblages to modern humans on the strength of technotypological similarities with later Aurignacian assemblages.

Two factors have been implicated in the long delay of modern human dispersal into Eurasia. Both, ultimately, are related to coping with cold. Klein (1998) argues that the challenges of adapting to colder temperatures required organizational changes in modern human society of which early modern humans were not capable. The success of later modern human populations is attributed to the spread of neurological mutation allowing more complex social configurations. This hypothesis is supported by the discovery of a recent (<200 Kyr) point mutation of the *FOXP2* gene, a mutation that is linked to precise control of orofacial muscles, language production, speech recognition (Enard *et al.*, 2002). It has also been argued that Neandertal adaptations to cold climates were so effective that early modern humans were unable to make inroads into their territory until the onset of wide, short-term variation in climate during OIS 3 (D'Errico and Goñi, 2003; Shea, 2003b).

Did Neandertals expand beyond the Levant into Africa? The Later MP Period in the Levant is the high water mark of Neandertal dispersal. No Neandertal fossils are known from any African site. Some older references describe North African MP human fossils as "Neanderthaloid," particularly Jebel Irhoud, Haua Fteah, and Mugharet el-Aliya (Howell, 1984, p. 137), but all these are now generally regarded as early forms of *Homo sapiens* (Hublin, 2000, p. 159; Klein, 1999, p. 400; McBrearty and Brooks, 2000, p. 481). Inasmuch as colder conditions during OIS 4 seem to have allowed Neandertals to establish themselves in the Levant, it remains unclear why they were not able to expand their geographic range further south, following Mediterranean woodlands into North Africa. Many of the other large carnivore species found in the Late Pleistocene Levant (lion, wolf, leopard, and hyena) also persisted in North Africa until recently (Kingdon, 1990; Qumsiyeh, 1996). The halt in Neandertals' southward dispersal around 47–80 Kyr remains an enigma.

The most likely point of entry for Neandertals into Africa would have been the Nile Delta and the Lower Nile Valley. Unfortunately the MP record of northern Egypt is poorly known. No MP sites are known north of 29°N latitude (Wendorf and Schild, 1992). The only clue we have about the identity of these Nile Valley MP populations is a modern humans burial from Taramsa Hill in southern Egypt dating to around 55 Kyr (Vermeersch *et al.*, 1998). But, given the diversity of hominids associated with the Levantine Mousterian, it is difficult to justify extrapolating the identity of all Nile Valley MP humans from Taramsa Hill alone. Even if one were to assume all Nile Valley MP humans were modern humans like the Taramsa Hill fossil, there is no evidence these populations were any better equipped to resist Neandertal adaptive radiation than the Skhul/Qafzeh humans were. This issue can only be solved by the recovery of additional fossils and excavation of MP archaeological sites in Northeast Africa.

What changes in modern human behavior allowed modern humans to disperse into Eurasia after 47 Kyr? The end of the MP Period in the Levant witnessed a rapid evolutionary "reversal of fortune" for the Neandertals. Within 15,000 years, between 30 and 45 Kyr, a species that had evolved and thrived in some of the harshest environments ever occupied by primates became extinct throughout their range, replaced by modern humans equipped with UP adaptations. The close geographic and chronological correlation between changes in human behavior reflected in the Middle/Upper Paleolithic transition, modern human dispersal into Eurasia after 40 Kyr, and Neandertal extinction, suggest a possible causal link between these events. The Levant appears to have been the first region in which humans practicing UP adaptations replaced Neandertals practicing MP ones. Levantine IUP behavioral innovations provide clues to modern humans' subsequent adaptive success. Projectile weaponry and personal adornments are two such important IUP behavioral innovations. Both became universal features of human adaptation to the present day, long outlasting other UP innovations, and both can be linked to structural changes in human social organization.

To many researchers, recent discovery of seemingly aerodynamically streamlined wooden javelins from the Middle Pleistocene site of Schöningen in Germany (Theime, 1997) suggests much earlier projectile use. However, published photographs of at least one of these spears suggest their diameter at 20 mm from their tip (25 mm) is considerably greater than the diameters of ethnographic thowing spears (mean = 11 mm, SD = 3, $n = 17$) and rather closer to the dimensions of ethnographic thrusting spears (mean = 20 mm, SD = 5, $n = 7$) (data from Oakley *et al.*, 1977, pp. 24–28).

In the Levant, as in Europe, the earliest clear evidence for "true" projectile weaponry, specialized streamlined lithic and bone weapon armatures, dates to the IUP. Initial UP contexts at Ksar Akil and other Levantine sites contain aerodynamically streamlined stone and bone points, some of which feature impact damage like that seen on ethnographic and experimental projectile points (Bergman, 1981; Bergman and Newcomer, 1983; Newcomer, 1984, 1987). Among ethnographic weapon armatures, the tip cross-sectional area of a stone point ([0.5 Width] × Thickness) is an accurate guide to the weapon system on which it is deployed (Hughes, 1998). Ethnographic spearthrower dart tips and arrowheads typically have cross-sectional area (TCSA) values less than 1 cm^2. Table IX lists TCSA values for ethnographic arrowheads, dart tips, and a series of Levantine MP and UP stone points. Although there is considerable variability, Levallois points from Late Levantine Mousterian contexts have TCSA values larger than those for ethnographic projectile points. This suggests that when they were used as weapon armatures, Levallois points were probably used to tip thrusting spears, not projectile weapons. Stone artifacts from Initial and Early UP contexts in the Levant, such as Emireh points, Ksar Akil Points, Unifacial Points, and El Wad points exhibit mean TCSA area values within the range of ethnographic projectile points.

One advantage of using projectile weapons as subsistence aids is that by minimizing risk of injury, projectile weapons enable human hunters to

Table IX. Tip Cross-Sectional Areas (TCSA) in cm^2 of Various Ethnographic Weapon Armatures and Hypothetical Levantine MP and Initial UP Stone Points

Site & level & artifact type	TCSA	*SD*	*n*	Source
Ethnographic controls				
Thrusting spear points	3.10		3	Hughes (1998, Table IV)
Throwing spear points	2.10		33	Hughes (1998, Table IV)
Spearthrower dart tips	0.67		18	Hughes (1998, Table IV)
Arrowheads	0.47		105	Hughes (1998, Table IV)
Later Levantine Mousterian (47–75 Kyr)				
Tor Faraj Level C Levallois points	1.13	0.57	142	D. Henry, unpublished data
Kebara Unit IX Levallois points	1.38	0.78	87	L. Meignen and O. Bar-Yosef, unpublished data
Kebara Unit X Levallois points	1.29	0.71	121	L. Meignen and O. Bar-Yosef, unpublished data
Kebara Unit XI Levallois points	1.32	0.67	63	L. Meignen and O. Bar-Yosef, unpublished data
Kebara Unit XII Levallois points	1.43	0.62	24	L. Meignen and O. Bar-Yosef, unpublished data
Initial Upper Paleolithic (38–47 Kyr)				
Ksar Akil XXI–XIV Levallois points	0.90	0.41	19	C. Bergman, unpublished data
Various Lebanese sites Emireh Points	1.43	0.94	36	Copeland (2000a)[a]
Boker Tachtit Levels 2-3 Emireh Points	0.98	0.27	11	Marks and Kaufman (1983)[b]
Early Upper Paleolithic (20–38 Kyr)				
Ksar Akil XVI–XXI Unifacial points	0.60	0.21	21	C. Bergman, unpublished data
Ksar Akil XVI–XXI Ksar Akil Points	0.39	0.20	65	C. Bergman, unpublished data
Ksar Akil IX–XIII El-Wad points	0.12	0.05	55	C. Bergman, unpublished data

[a] Measurements of points illustrated in Copeland (2000a) and corrected for scale.
[b] Measurements of points illustrated in Marks and Kaufman (1983) and corrected for scale.

attack larger and more dangerous prey than would otherwise be the case (Churchill, 1993). The windfall returns to individual hunters or small groups of hunters using effective projectile weaponry against large terrestrial mammals would have been powerful incentives for them to form extensive reciprocity networks reinforced through the use of exosomatic symbols, particularly symbols in durable media. Among recent humans, personal adornments broadcast symbolically encoded information about social identity (gender, rank, ethnicity, etc.) in ways that can transcend local cultural and linguistic differences that are obstacles to cooperation (Wobst, 1977). The use of durable media for this purpose is significant, because high labor costs involved in producing these artifacts makes it difficult to sham membership in a symbolically reinforced social network by producing expedient imitations of the signifying artifacts. Extensive alliance networks among small groups have tremendous adaptive potential, because they allow the risk of subsistence failure and personnel loss to be dispersed throughout the cooperating network. Absent such risk, individual humans would have few incentives to incur the costs (reciprocity obligations) entailed in joining these networks. During times of high subsistence risk, however, humans participating in such networks would have had tremendous competitive advantages over individuals living in smaller autonomous groups.

MP humans occasionally produced objects of personal adornment. In the Levant, the earliest evidence for the systematic production of objects of personal adornment dates to IUP times. Excavations at Üçagizli Cave in southeastern Turkey recovered evidence for the systematic production of perforated marine shells dating to ca. 45 Kyr (Kuhn *et al.*, 2001). Many Early UP sites from the southern Levant preserve similar objects to those found at Üçagizli (Gilead, 1995, p. 135). The considerable amount of labor involved in carving shell for this purpose, suggests a fundamental shift in the role that personal adornment, and by implication reciprocity networks, played in human society.

A theoretical connection between effective projectile technology and the formation of stable alliance networks (Bingham, 2000) provides important insights into the end of the Levantine MP and subsequent modern human dispersal into Eurasia. One significant limiting factor in alliance networks is the problem of "cheaters," individuals who take the benefits of belonging to the alliance without sharing the risks or costs. In the absence of effective projectile technology, it is difficult to deter cheating as a strategic option because individuals who try to punish cheaters face high risks of injury. By allowing the credible threat of lethal force from a distance, projectile technology dramatically lowers the risk of injury to coalition "enforcers" and removes a significant obstacle to the formation of large, stable, and extensive alliance networks. The increased evidence for personal adornment and projectile technology in the Initial UP of the Levant may signal a shift from small social networks reinforced primarily through biological kinship and affective relationships to larger regional networks reinforced through language, symbol, formal rules, and the (implicit) threat of coalitionary killing. The organizational capacities for coalitionary killing appear to be evolutionary primitive among hominoids (Wrangham, 1999); but, evidence for attempts to stabilize regional coalitions through the use of exosomatic symbols is associated with only two hominids, Neandertals and early modern humans. Interestingly, the earliest evidence for this strategy occurs in precisely that part of the world where these hominids' geographic ranges overlap, and where ecogeographic factors suggest competition between them would have been most intense (Shea, 2003a,b).

Increased use of projectile technology and personal adornments in the context of regional alliance networks may have played a key role in the spread of the UP, the dispersal of modern humans, and the extinction of the Neandertals. Groups using projectile weapons to attack large mammals would have had incentives (such as depleted local game populations) to extend their foraging ranges into the territories of neighboring groups who did not use this technology. This would have been a risky strategy, increasing potential conflicts with other groups, but the risk could have been underwritten by the risk-takers' ability to fall back on reciprocity arrangements with other individuals in their alliance networks. Understandably, any group of individuals adopting this "expansionist" strategy would have created selective pressure for other groups to adopt projectile weaponry and to array themselves in symbolically reinforced alliance networks.

Much recent discussion of the Middle–Upper Paleolithic transition in Western Eurasia has assumed that only modern humans were able to construct such alliance networks. Indeed, the strongest evidence for them comes from later UP contexts associated with modern humans (Gamble, 1999). Yet, European Neandertals are associated with some "Transitional" and early UP assemblages featuring evidence of personal adornment and probable projectile weapon armatures (Chatelperron points, Uluzzian microliths) (D'Errico *et al.*, 1998). It has recently been proposed that these associations reflect an independent transition to behavioral modernity among Neandertals (D'Errico, 2003).

While there is no reason to doubt Neandertals possessed the capacity for more complex social and economic behavior than is apparent from most European Mousterian contexts, the timing of their "behavioral revolution" raises questions about its causal mechanisms. As human adaptations go, the European Mousterian was extraordinarily stable, and by implication, successful. Yet, between 35 and 45 Kyr, some Neandertals began creating archaeological assemblages suggesting behavioral strategies elsewhere associated with early modern humans. These transformations of European Mousterian contexts, which had served Neandertals well for more than a 100,000 years, did not occur in a vacuum, but rather at precisely the point in time when modern humans had returned to the Levant and when they were beginning to disperse into Europe. I suggest that the appearance of symbolic artifacts, projectile weapons, and other trappings of "behavioral modernity" in European MP/UP transitional industries reflects intensified competition, both among later Neandertal populations and between Neandertals and early modern humans.

The flashpoint for this intensified competition was the Levant corridor. The "human niche" in the Levant is a small and narrow one, one for which intraspecific competition must have been fierce, and interspecific competition fiercer still. If the combination of symbolically reinforced alliance networks and projectile weapon use, both emergent behavioral components of the Levantine IUP, enabled modern humans to displace Neandertals from the Levant, there would have been every conceivable evolutionary incentive for modern humans to have pushed this advantage north and westward, into Europe.

As with the diffusion of agricultural out of the Southwest Asia in early Holocene times (Bar-Yosef, 1998b), or, more recently, the spread of firearms and horses into the interior of North America, the effects of novel modern human UP adaptive strategies are likely to have caused behavioral changes far in advance of actual population movements. Intensified competition and population dislocations along the Neandertal "frontier" with modern humans are likely to have had destabilizing effects on other Neandertal populations. Faced with effective competition from UP modern humans, it seems only reasonable to expect Neandertals' strategic response to have included similar behaviors, such as exosomatic symbol use and projectile weaponry. I argue that the behavioral changes associates with certain late Neandertal populations were not an independent "behavioral revolution," but convergent cultural evolution, structurally similar to that which had occurred between Neandertals and early modern humans during the MP Period in the Levant. As in the Levant, the subsequent biological replacement of Neandertals by modern humans probably did not reflect deep contrasts in these hominids' behavioral and adaptive abilities, or technological contrast of the sort that characterized European colonial expansions of recent centuries (Diamond, 1997; Graves, 1991), but rather minor differences in these hominids' abilities to pursue similar strategies near each other over the course of thousands of years (Zubrow, 1989).

Ultimately, however, modern human populations did physically disperse into Europe. The archaeological record thus far only hints of actual migrations. Some of the earliest "Bohunician" UP assemblages of Southeastern Europe have numerous technotypological similarities to Levantine Initial UP assemblages, such as those from Boker Tachtit (Tostevin, 2000). Our meager, yet growing, knowledge about the IUP of Anatolia will doubtless shed light on cultural connections between Southeast Europe and the Levant (Kuhn, 2002).

Currently, the major explanations for the success of modern human dispersal after 40–50 Kyr focus on population pressure among African early modern human populations (Bar-Yosef, 2002; McBrearty and Brooks, 2000), and neurological changes in modern humans' capacity for complex behavior (Klein, 1999; Klein and Edgar, 2002; Shea, 2003b). Although the increasing representation of small prey species in Later MP, IUP, and UP zooarchaeological assemblages has been interpreted as evidence for population increase (Stiner *et al.*, 1999), more recent studies of these assemblages suggest it may be difficult to sort out the effects of population growth from those resulting from climate change (Speth and Tchernov, 2003). Though currently framed as alternatives, the neural mutation and population growth hypotheses are not mutually exclusive. Sorting out which of these changes occurred first, as well as their possibly interdeterminate relationships to each other, and the role these changes played in competition between early modern humans an rival hominid species, such as the Neandertals, all remain formidable challenge for future paleoanthropological research.

CONCLUSION

The MP archaeological record for the Levant provides new insights into modern human origins, variability in Neandertal adaptations, early modern human and Neandertal evolutionary relationships, and the context for the origins of "modern" behavior in the Middle/Upper Paleolithic transition.

Did the Skhul/Qafzeh humans evolve in the Levant out of later *Homo heidelbergensis* populations? Some interpretations of the Lower Paleolithic Zuttiyeh fossil support this hypothesis (Vandermeersch, 1989, p. 162), but more, and more complete, fossil remains from Early MP contexts are needed before we can answer this question. Absent archaeological evidence for a migration of early modern humans out of Africa during the Early MP, the presence of early modern humans ca. 80–130 Kyr, suggests that the Levant was part of a broader region of modern human origins and initial dispersal that encompassed much of Africa. The recent discovery of somewhat older early modern humans at Herto in the Middle Awash Valley, Ethiopia (White *et al.*, 2003), and better dating of the Omo Kibish fossils (Leakey *et al.*, 1969; Shea *et al.*, 2002) will doubtless clarify the evolutionary relationships between African and Levantine late Middle Pleistocene human populations. It is important that we keep an open mind about continuity between the Skhul/Qafzeh humans and later Levantine populations. The gap in the Levantine record for modern humans' presence in region between 40 and 80 Kyr could indicate that the Skhul/Qafzeh humans were an evolutionary dead end with no post-MP descendants (Shea, 2003a, p. 181). The UP human populations of the Levant and Europe may be descended from modern human populations who arrived in the Levant after 40–50 Kyr.

Much of our knowledge about Neandertal behavior and adaptation is based on their archaeological record in Europe (Hoffecker, 2002; Mellars, 1996). But, Europe is a geographic cul-de-sac. The isolation of human populations in Europe by cycles of Middle Pleistocene glaciation is probably one of the main reasons Neandertals evolved in the first place (Howell, 1952). Neandertals appear to have been supremely well-adapted to the temperate woodlands and cold steppes of Western Eurasia (Churchill, 1998). Isotopic analysis of Neandertal bones (Bocherens and Drucker, 2003) and studies of their zooarchaeological record (Gaudzinski and Turner, 1999; Marean and Assefa, 1999; Stiner, 1994) suggest Neandertals were the apex predators of their ecosystems, in effect, "wolves with knives." As is often the case, however, the long-term evolutionary success of a species is determined not so much by adaptations in the core area of its geographic range, but rather at the periphery, where it faces novel evolutionary challenges and competition from other species (Eldredge and Gould, 1972). In the Levant, Later MP Neandertal adaptations apparently involved a significant measure of economic intensification. Multiseasonal site occupations, a broadening of the subsistence base to include small, elusive prey, and bulk production of stone spear points all paint a picture of economic intensification, of a society (like the Red Queen's subjects in Lewis Carrol's *Alice in Wonderland*) always running faster just to stay in one place. Neandertals appear to have been fairly successful in pursuing this strategy between 47 and 80 Kyr. There is no evidence that any other hominid population gained a foothold in the Levant during this time; but, ultimately, the Neandertals' failure to disperse through the Levant into the Old World Tropics sealed their fate.

The MP Period in the Levant lasted more than 150,000 years. The coevolutionary relationships between Neandertals and early modern humans undoubtedly varied widely during this period. As models for the entire MP, however, vicarism and competition are most strongly supported by the archaeological and fossil records. Assimilation and niche partitioning are not demonstrably false, but they require assumptions about Neandertal and early modern human reproductive behavior and habitat preferences that are not yet independently verifiable. There is no conclusive evidence for interbreeding between Neandertals and early modern humans in the Levant, although this observation must be tempered by several considerations. First, nobody knows exactly what form physical evidence of such interbreeding would take. (Thus the controversial nature of claims about the Neandertal ancestry of certain European early UP fossils (Churchill and Smith, 2000; Duarte *et al.*, 1999; Tattersall and Schwartz, 1999; Trinkaus *et al.*, 2003).) Hybrids of living mammal species are neither perfectly intermediate between their parents, nor are they a patchwork quilt of ancestral autapomorphies (Tattersall and Schwartz, 1999). Secondly, the Skhul/Qafzeh humans retain archaic morphologies that, when compared to Neandertals, may risk mistaking shared primitive features for evidence of gene flow (Pearson, 2000b). Third, the early UP human fossil record for the Levant is relatively sparse, making it difficult to test for Neandertal ancestry in the immediate aftermath of the MP (Smith, 1995). Finally, although we have no recent analog for hybrids among different human species, the technological variability that both Neandertals and early modern humans exhibit during MP times suggests that their association with superficially similar lithic assemblages need not be seen as evidence for a shared culture (Shea, in press). These similarities probably reflect convergence, expressions of technological abilities shared broadly among Middle Pleistocene hominids being applied to similar needs for tools (Shea, 2003b). In this, Levantine prehistory sounds a cautionary note to Europe, that the named lithic industries that populate the early UP record may not correspond to significant social or biological divisions among human populations (Clark, 2002).

The transition between the Late MP and Initial UP in the Levant marks the earliest appearance of some significant "modern" human behavior patterns that are shared universally among UP and post-UP populations. The most obvious and ubiquitous of these derived modern behaviors include consistent use of projectile weaponry and exosomatic symbols. Symbolic artifacts and projectile weapons were apparently used intermittently by MP human populations in Africa and Eurasia, but the MP/UP transition in the Levant marks a significant change in the *consistency* with which evidence for these behaviors appears in the archaeological record. It is probably reasonable to see the early timing of the MP/UP transition in the Levant as related to competition between Neandertals and early modern humans; however, the period 30–50 Kyr, poses many difficulties for accurate dating of archaeological contexts. As we have seen in recent transformations of the Levantine MP record, improved chronology is an essential first step in unraveling the complex relationships between Neandertals and early modern humans at this crucial juncture in both hominids' evolutionary history.

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