J.-M. Le Tensorer, R. Jagher & M. Otte (eds.). *The Lower and Middle Palaeolithic in the Middle East and Neighbouring Regions*.
Basel Symposium (May 8-10 2008).
Liège, ERAUL 126, 2011, p. 169-182.

THE ARCHAEOLOGY OF AN ILLUSION: THE MIDDLE-UPPER PALEOLITHIC TRANSITION IN THE LEVANT

John J. SHEA
Anthropology Department, Stony Brook University, NY 11794-4364 USA, John.Shea@sunysb.edu

Introduction

Transitions are popular metaphors for change in prehistory. Levantine prehistorians favor transition scenarios because they assert the relevance of the evidence from a relatively small geographic region to central narrative of human origins. The Levant's small size, geographic circumscription and limited carrying capacity make turnovers far more likely explanations for evolutionary change among Pleistocene hominin populations. This paper asserts that the MP-UP "Transition" in the Levant was not a transition. It was a turnover event in which *Homo sapiens* populations dispersing out of Africa replaced Neandertal populations whose numbers had been reduced below viable levels by abrupt onset of cold dry conditions between 45-52 ka.

The Middle-Upper Paleolithic (MP-UP) Transition is often described as a watershed event, even a "human revolution" (Bar-Yosef 2002; Mellars 2007; Gamble 2007). Throughout Europe and Western Asia between 35-45 ka, Middle Paleolithic archaeological assemblages associated with Neandertals were supplanted by Upper Paleolithic assemblages associated with *Homo sapiens*. The Upper Paleolithic is the point at which many uniquely human behavioral universals begin to appear consistently in the archaeological record. These include art, symbol, personal adornment, visual metaphor, musical instruments, specialized subsistence technologies, domestic architecture, advanced pyrotechnology, broad-spectrum subsistence, systematic division of labor and extensive exchange networks.

The MP-UP Transition in the Levant is the earliest of the various MP-UP "transitions" in Western Eurasia and North Africa. Around 45/47 ka, stratigraphically-superposed lithic assemblages from numerous Levantine sites shift from laminar Levallois core reduction to prismatic blade core reduction. This shift has been documented throughout the Levant, at Ksar Akil Rockshelter (Lebanon), Umm El Tlel (Syria), Boker Tachtit (Israel), and Tor Fawwaz and Tor Sadaf (Jordan), Üçagilzi Cave (Turkey) and other sites (Belfer-Cohen & Goring-Morris 2003). That the same distinctive artifact-types (chamfrein end-scrapers, Emireh points) continue to be made over the course of this technological shift is accepted as evidence for cultural continuity, and by implication biological continuity among toolmaking populations (Neuville 1934; Howell 1959; Garrod 1962; Binford 1968; 1970; Copeland 1975; Marks 1983; Clark & Lindly 1989; Bar-Yosef 1992, 1993, 1996, 2000; Belfer-Cohen & Goring-Morris 2003).

This paper challenges the central assumption of evolutionary continuity during the MP-UP Transition in the Levant. It argues that the MP-UP Transition was not a "transition". Rather, it was a "turnover event" in which African *Homo sapiens* populations dispersed into the region replacing Neandertal precursors. The turnover appears to have been climatically-driven, the result of sharp downturns in temperature and rainfall precipitating Neandertal extinction. Behavioral changes among *Homo sapiens* populations may also played an important role (Shea 2007a). The use of complex, stone- and bone-tipped projectile weaponry to construct a broader ecological niche may have been among the most important of these changes.

Background: Transitions and Turnovers

A transition is a behavioral change within a single evolving hominin lineage. Assemblages from the starting point of a transition differ from those at its end and both are separated by assemblages that can be arranged into a series of intermediate chronological stages. This definition of a transition does not exclude possible gene flow from other evolving hominin lineages or recursive patterns of behavioral change, but there must be evolutionary continuity between the authors of the assemblages at opposite ends of sequence for it to be a transition. Most of the major "revolutions" in the recent human past, the Neolithic, Urban, and Industrial Revolutions, were actually transitions.

The polar opposite of a transition is a "turnover event". In a turnover event, one of two contemporary species replaces the other in a broadly equivalent ecological niche. The processes of replacement and the timescale involved can vary; but, the irreducible character of a turnover event is that at its conclusion there are no survivors of the replaced population. Turnovers are a consequence of extinction. There have been few real turnover events in recent human history. Most cases of "genocide" among recent humans are not turnover events, because there

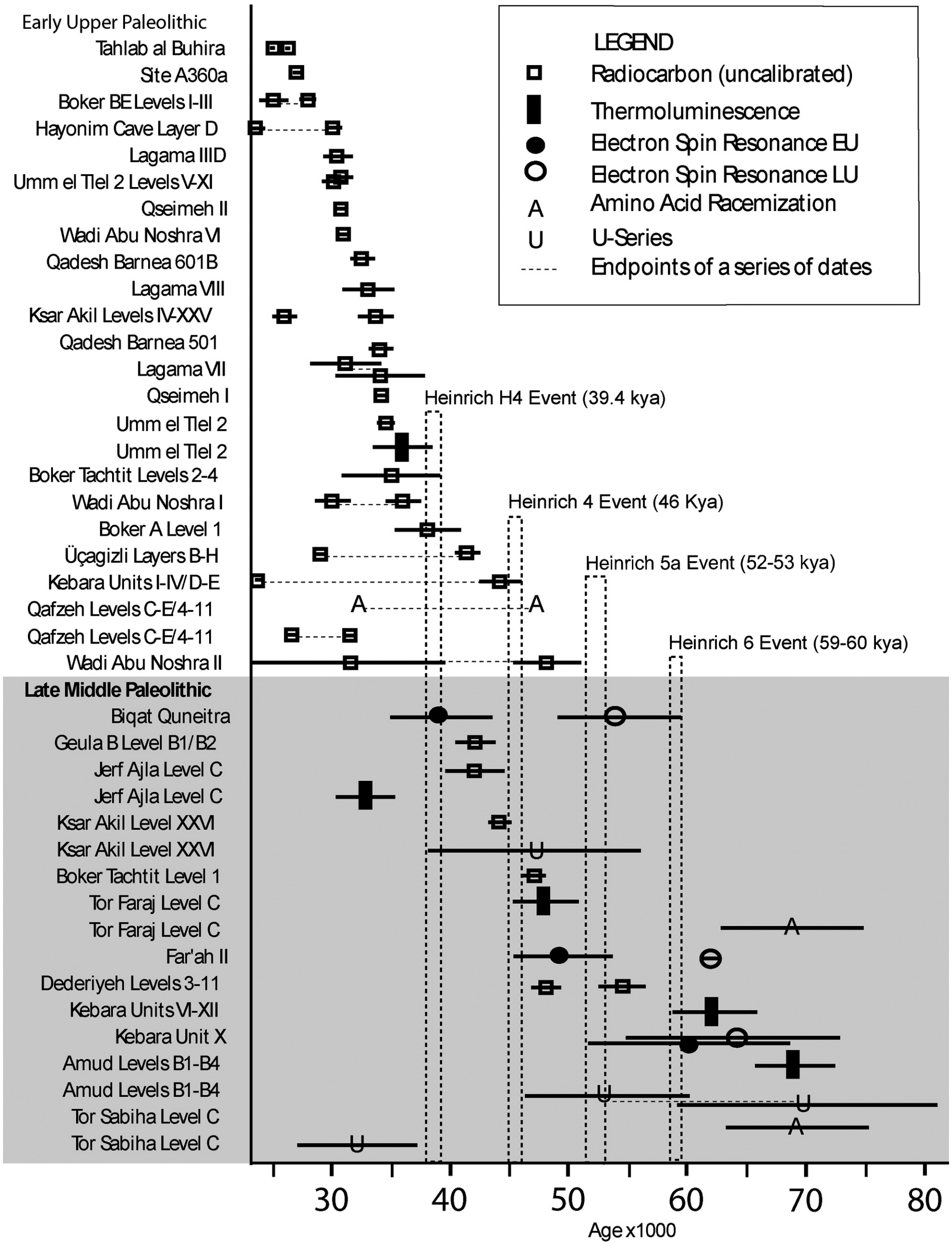

Figure 1 - Geochronology of Levantine Early Upper Paleolithic and Later Middle Paleolithic Periods. For original dates and references, see Shea (2007a, 2003) and (Goring-Morris & Belfer-Cohen 2003). Note: Radiocarbon dates are uncalibrated.

are nearly always survivors of the targeted population. More numerous examples of turnover events involving human populations involve human domesticates, commensals, and other "invader species" replacing indigenous flora and fauna (Crosby 1986).

As metaphors for change in prehistory, transitions are by far more commonly invoked than turnover events. The reasons for this popularity include (1) the perception that turnovers are unusual, and (2) subjective factors favoring transitions over alternative explanations. The lack of recent cases of turnover events in human history fosters the assumption that extinctions and turnover events were rare in the course of human evolution as well. This assumption overlooks the large population, wide local genetic diversity, global geographic distribution and other technological and social factors that insulate recent human populations from the effects of rapid climate change. Many of these insulating factors are consequences of the agro-pastoral adaptations developed over the last 12,000 years. Pleistocene humans had no such insulation from extinction. Our species insulation from climatically-forced extinction is an evolutionary novelty.

A second set of factors involve careerism. Transition implies continuity and continuity implies relevance to human evolution. Research on ancestral individuals commands far more interest than research on evolution's "dead ends". No one ever lost a job, was refused an excavation permit, or had a grant declined for arguing that the archaeological record of their chosen geographic region was vital to the central narrative of human evolution. As scientists, we know preservation does not favor ancestral individuals. We also know that fossils and archaeological assemblages created by non-ancestral individuals preserve just as well (or poorly) as those left behind by ancestral individuals. The "doublethink" this situation creates is especially problematical in Levantine prehistory *["Doublethink" is a term coined by George Orwell in his dystopian novel, 1984. It refers to the ability to simultaneously accept two contradictory ideas]*. Smaller regions and biogeographic corridors are less likely settings for long-term evolutionary continuity among large mammals than larger regions, if only for reasons of sample error alone. Thus, in a small region like the Levant one is likely to find mismatches between actual evolutionary turnover events and archaeological models casting those changes as transitions. This paper contends that this is precisely what has happened in past archaeological models of the MP-UP Transition in the Levant.

The principal archaeological periods involved in the MP-UP Transition in the Levant are the Later Middle Paleolithic (LMP) and the Early Upper Paleolithic (EUP). For recent overviews of both periods, see Shea (2003, 2007a) and Belfer-Cohen and Goring-Morris (2003). Both periods have reasonably well-dated archaeological records, although the availability of radiocarbon dating makes the chronology of the EUP somewhat more secure than that of the LMP (fig. 1).

Later Middle Paleolithic assemblages come from contexts dating to between 45-75 ka. The best documented of these contexts include Amud Cave Levels B1-4, Boker Tachtit Level 1, Biqat Quneitra, Dederiyeh Cave Levels 3-11, Far'ah II, Geulah Cave B Level B1/B2, Jerf Ajla Cave Level C, Kebara Cave Units VI-XII, Ksar Akil Rockshelter Level XXVI, Shovakh Cave "Lower Cave Earth", Shukhbah Cave Level D, Tor Faraj Rockshelter Level C and Tor Sabiha Rockshelter Level C. LMP lithic assemblages exhibit frequent use of recurrent unidirectional-convergent core preparation to detach triangular and subtriangular flakes (or "points"). These assemblages also feature variable proportions of cores and débitage from radial-centripetal core reduction. Prismatic blade production is evident, but it is rare and follows a different set of procedures and "volumetric conception" of core geometry than blade production in EUP assemblages. Most LMP assemblages feature both large and small Levallois points, as well as sidescrapers and naturally-backed knives (fig. 2). No carved bone/antler tools are known from LMP contexts.

Early Upper Paleolithic assemblages date to at least 28-47/45 ka. The best documented EUP sites include Boker A Level 1, Boker BE Levels I-III, Boker Tachtit Levels 2-4, Hayonim Cave Layer D, Kebara Cave Units I-IV/Levels D-E, Ksar Akil Rockshelter Levels IV-XXV (phase III-VII), Lagama IIID, VII, and VIII, Qadesh Barnea 501 and 601B, Qafzeh Cave Levels C-E/ 4-11, Qseimeh I and II, Site A360a, Thalab al Buhira, Üçagizli Cave Layers B-H, Umm el Tlel 2 Levels V-XI, Wadi Abu Noshra I, II, and VI. Numerous other assemblages are assigned to the EUP on the basis of their lithic typology and/or their geological context. Most EUP lithic assemblages feature prismatic blade and bladelet cores. Laminar débitage is common. EUP assemblages show less emphasis on Levallois core reduction and more prismatic blade production than LMP assemblages. Retouched tools types made on elongated flakes or blades, such endscrapers, burins, and backed knives, are common (fig. 3). Emireh points, Umm el Tlel points, and chamfrein endscrapers are thought to be index fossils for the earliest or "Initial" Upper Paleolithic. EUP assemblages are subdivided into named industries, including the "Initial Upper Paleolithic", "Ahmarian", "Levantine Aurignacian" and a fourth unnamed flake-based industry, on the basis of variation in retouched tool types and the relative frequencies of blades and bladelets. A variety of carved bone/antler implements and perforated shells and teeth assumed to be personal adornments have been recovered from EUP contexts.

The geographic range and floral/faunal associations of LMP and EUP sites are broadly similar, consisting mainly of species endemic to the Mediterranean woodland and its ecotone with the Irano-Turanian steppe. The most ubiquitous large mammal taxa in these assemblages include wild cattle (aurochs), horse, red deer, fallow deer, ibex, wild boar, and gazelle. Gazelle are somewhat more common in EUP assemblages than in LMP ones, but faunal assemblages from both periods exhibit wide variability (Rabinovich 2003). There is a trend towards increasing exploitation of smaller prey (birds, rodents, lagomorphs, and tortoises) in EUP assemblages (Stiner 2006).

LMP archaeological contexts from Amud, Dederiyeh, Geulah, Kebara, Shovakh, and Shukhbah contain hominin fossils. All of them are either Neandertals, or they are too fragmentary to allow attribution to species. Human fossils from EUP contexts include the burials from Ksar Akil (one of which has been lost), two sets of cranial remains from Qafzeh, fragmentary remains from Hayonim Level D, and ten isolated dental remains from Üçagizli. All of these fossils are attributed to *Homo sapiens*, except for one tooth from Üçagizli preliminarily described as "Neanderthaloid". Most physical anthropologists are deeply skeptical about species-level attributions of isolated teeth.

At this juncture, it is important to stress that this paper is not questioning arguments about evolutionary continuity within either the LMP or the EUP. This paper is solely concerned with the question of evolutionary continuity between the LMP and the EUP.

Problems with the MP-UP Transition as a Transition

Describing the shift from LMP to EUP as a "transition" made sense when the archaeological and hominin fossil records seemed to indicate a parallel process of biological and cultural evolution, but this is no longer the case. Since the mid-1980s, U-series, TL, and ESR dating have shown that Levantine *Homo sapiens* fossils from Skhul and Qafzeh are older than their putative Neandertal ancestors. These early dates were controversial, but they were eventually confirmed by several independent dating methods (Millard 2008). The relevant aspects of the paleontological record are briefly summarized below.

Few hominin fossils are known from contexts dating to 130-400 ka. The most complete of these, Zuttiyeh, shows no Neandertal autapomorphies. It resembles *Homo sapiens* only in terms of primitive morphologies shared by *Homo sapiens* and African *Homo heidelbergensis* (Rak 1993). As such, they are no more clearly ancestral to us than they are to Neandertals.

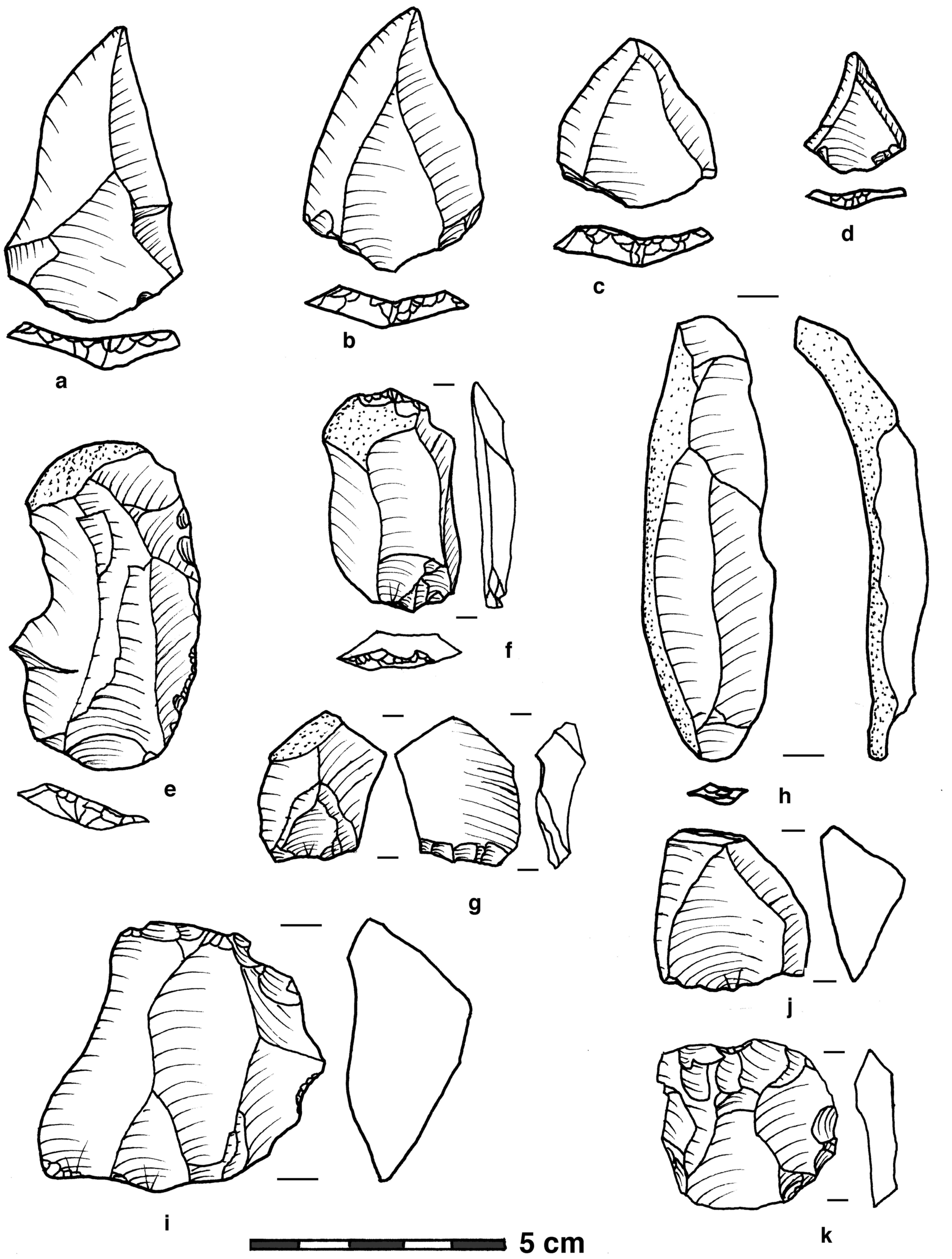

Figure 2 - Levantine Later Middle Paleolithic Artifacts. a-d. Levallois points, e. retouched Levallois flake, f-g. truncated-facetted pieces, h. naturally backed blade, i-j. unidirectional convergent Levallois core, k. discoidal core. Source: Kebara Cave Units VII-XII.

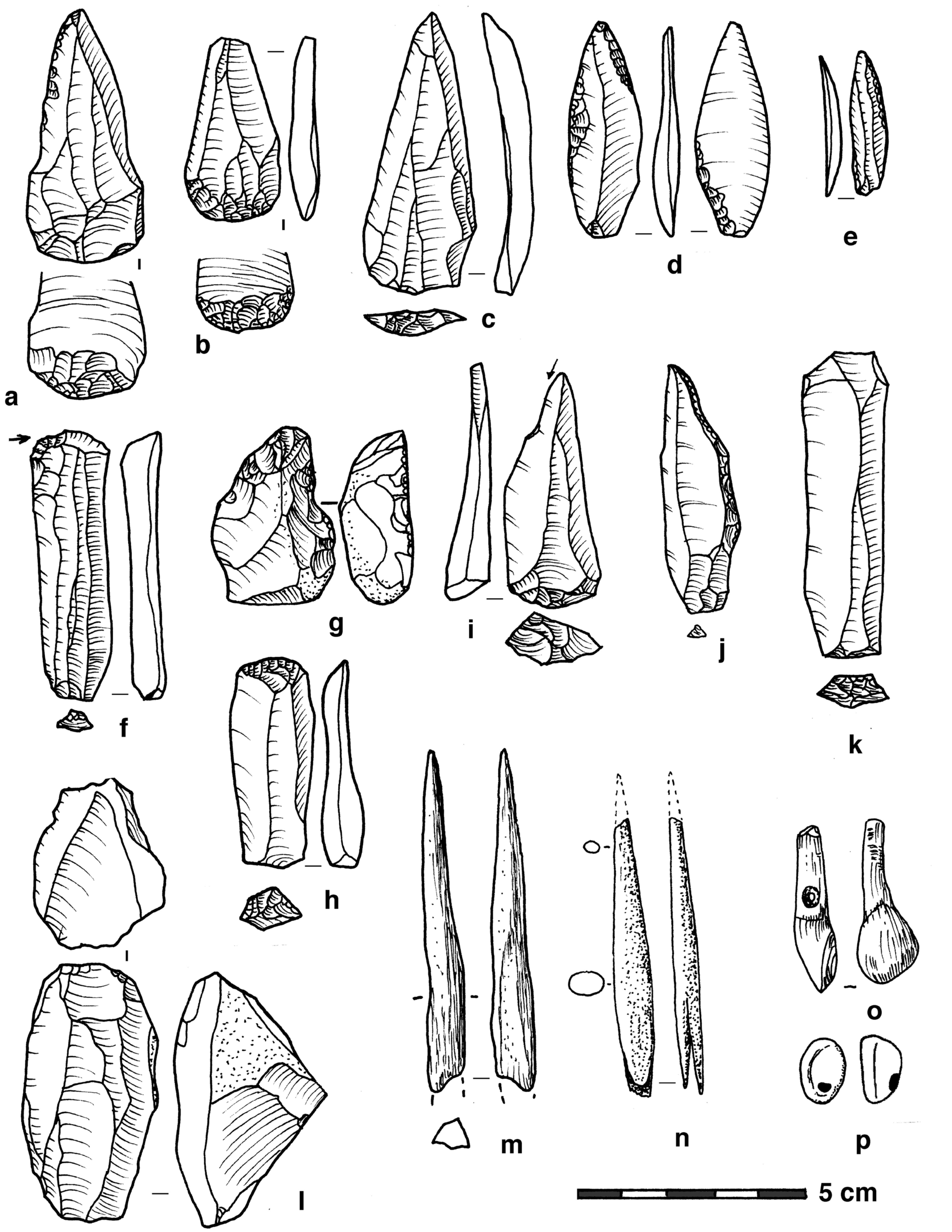

Figure 3 - Levantine Early Upper Paleolithic Artifacts. Early UP tools associated with Homo sapiens at Ksar Akil and other UP sites. Descriptions: a-b. Emireh points, c. Umm el Tlel point, d. Ksar Akil point, e. El Wad point, f. chamfrein endscraper, g. carinated endscraper/core, h. endscraper on blade, i. burin, j. backed blade, k. prismatic blade, l. prismatic blade core, m-n bone/antler points, o. perforated deer tooth, p. perforated Nassarius shell. Sources: a. Qafzeh Level E, b. Boker Tachtit Level 1, c. Umm el Tlel Unit II Base, d,f,h-l. Ksar Akil Levels XXV-XVI, e,g,m, o. Hayonim Level D, n. Kebara Unit I-II, p. Üçagizli Level H.

The early Upper Pleistocene fossil record shows early *Homo sapiens* present in "last interglacial" times (*sensu lato*, i.e., Marine Isotope Stage [MIS] 5), ca. 75-130 ka. This timing agrees well with speleothem evidence from the Negev suggesting wetter conditions ca. 100-130 ka that would have facilitated early human dispersals from Africa to the Levant (Vaks *et al.* 2007). The most recent radiometric dates for the Tabun C1 fossil suggests Neandertals were present in early in MIS 5 as well (Grün *et al.* 2005). The uncertainties surrounding the stratigraphic provenance of this fossil and others from the 1930s excavations in Tabun preclude viewing them as evidence of actual sympatry between Neandertals and *Homo sapiens* (Bar-Yosef & Callendar 1999; Shea 2003). No other Levantine site dating to early MIS 5 has yielded Neandertal fossils.

During the onset of glacial conditions during MIS 4 and early MIS 3 (45-75 ka) only Neandertal fossils are known from Levantine contexts (e.g., Tabun, Kebara, Amud, Dederiyeh, Shukhbah). No *Homo sapiens* fossils are known from Levantine sites dating to this period.

From 35-45 ka onwards to the present day only fossils of *Homo sapiens* have been recovered from Levantine archaeological contexts. That there is no gap in the fossil record for this period longer than a few thousand years suggests *Homo sapiens* occupation of the region has been more-or-less continuous since at least 35 ka.

What the MP-UP Transition in the Levant was NOT

Much has been written about what the MP-UP Transition was or what it reflected. It is now actually a lot easier to say what the MP-UP Transition in the Levant was not.

The MP-UP Transition in the Levant did not have anything to do with the origin of *Homo sapiens*. The earliest known *Homo sapiens* fossils come from Ethiopian contexts dating to 160-195 ka in the Lower Omo Valley Kibish Formation and the Bouri Formation near Herto, Middle Awash Valley (McDougall *et al.* 2005; White *et al.* 2003). These fossils' archaeological associations are broadly analogous to Eurasian Middle Paleolithic assemblages (Levallois core technology, lanceolate bifaces, neither blades nor microliths)(Clark *et al.* 2003; Shea *et al.* 2007).

The MP-UP Transition in the Levant did not have anything to do with the initial dispersal of our species out of Africa. Nearly a dozen fossils universally recognized as early forms of *Homo sapiens* are known from at least two sites in northern Israel, Skhul and Qafzeh, that date to 80-130 ka (Shea & Bar-Yosef 2005).

The MP-UP Transition in the Levant did not have anything to do with the origin of "modern" human behavior (by which most archaeologists mean the derived features of the European Upper Paleolithic). Two of the Skhul and Qafzeh hominins are buried with grave goods, and there is evidence from both sites for both the use of mineral pigments and personal adornments in the form of perforated marine shells (Shea 2007a). In fact, evidence for nearly all of the purported hallmarks of "behavioral modernity" are known from African contexts prior to 50 ka (McBrearty & Brooks 2000; McBrearty 2007; Willoughby 2007; Barham & Mitchell 2008).

The MP-UP Transition was not good news for the Neandertals. Neandertal fossils last appear 42 ka at Geulah Cave B (Arensburg 2002). This date is younger than or broadly equivalent to the oldest dates for EUP assemblages, but it is also a date obtained for a context that was profoundly disturbed by carnivore activity. To assume Neandertals were present in evolutionarily significant numbers in the Levant after 45 ka requires one to make more than the minimum number of assumptions about the hominin fossil record.

The MP-UP Transition in the Levant did not involve an evolutionary transition among Levantine hominins, either solely among *Homo sapiens* or between *Homo sapiens* and Neandertals. *Homo sapiens* fossils are absent from Later Middle Paleolithic contexts dating to between 45-75 ka. The Skhul/Qafzeh humans appear to have been an evolutionary "dead end", that the succumbed to the rapid cooling and desertification of the region ca. 75 ka (Shea & Bar-Yosef 2005; Shea 2007b). One cannot rule out the possibility that some *Homo sapiens* populations were present in the Levant at this time but in numbers too low to achieve paleontological visibility (Hovers 2006), but inasmuch as it equally well accommodates both the presence and absence of data, neither is it clear how one could falsify this "invisibility hypothesis".

McCown and Keith (1939) originally proposed that the Levant was a transition zone in which interbreeding occurred between Neandertals and *Homo sapiens* populations. This argument still retains some support today (Simmons 1999; Kramer *et al.* 2001; Eswaran 2002). Nevertheless, conclusive evidence for such interbreeding remains elusive. While it is conceivable that early Neandertals and the Skhul/Qafzeh humans interbred (Holliday 2000; Trinkaus 2007), there is no evidence that strongly compels one to accept this interpretation of the evidence to the exclusion of other hypotheses. Nor is there evidence for actual sympatry between these hominins immediately prior, during, or after the MP-UP Transition. In this respect, the Levantine evidence is exactly consistent with the overwhelming majority of genetic, morphological, and geochronometric evidence now available indicating Neandertals and *Homo sapiens* were different species who were rarely, if ever, sympatric and between whom gene flow was of negligible evolutionary consequence (Hublin & Pääbo 2006).

Was the Transition Actually a Turnover Event?

The most parsimonious reading of the Levantine hominin fossil record is that the period 35-45 ka witnessed a turnover event. Levantine Neandertals became extinct and were replaced by *Homo sapiens* populations who dispersed into the Levant from elsewhere, most likely from East Africa. This hypothesis makes no assumptions about what manner of coevolutionary relationships may have existed among these hominins in earlier times. As outlined below, the hypothesis of a turnover event is consistent with what we can plausibly infer about how rapid climate change affected hominin demography in the Levant. It is consistent with our growing understanding of the relationship between environmental change and human evolution in Africa. Lastly, it explains the available evidence better than alternative arguments about biological and cultural transitions.

Claims that some recent humans possess DNA traceable to Neandertal ancestors, as the result of interbreeding between Neandertals and early *Homo sapiens* have to be treated skeptically. The most recent such claim by Green and colleagues (2010) identifies the Levant between 60-100 Ka as the most likely time and place for such interbreeding. But, if one examines the references cited, it is clear that it does so based on interpretations of the archaeological record! The circularity of this reasoning is obvious. Alternative explanations for the seeming introgression of "Neandertal DNA" into *Homo sapiens* must be falsified before such hypotheses are accepted.

Any hypothesis relating the MP-UP Transition to an evolutionary turnover event has to explain (1) the mechanism by which the replaced population became extinct, (2) the cause of their extinction, (3) the geographic source of the successor population, and (4) why the successor population dispersed into the former range of the replaced population.

The Mechanism of Extinction

The ultimate cause of extinction is the reduction of a population below the minimum number necessary to reproduce itself (Gilpin & Soulé 1986). Demographers and ecologists use the term "population sink" for regions in which populations of a given species persistently drop below sustainable levels. There are compelling reasons to believe that the Levant became a hominin population sink many times during the Pleistocene.

Estimating the preagricultural human population of the Levant involves making some necessarily simplifying assumptions about habitat preferences, and population densities (see Shea 2007b). Most faunal remains from LMP and EUP sites are those of species endemic to Mediterranean habitats (i.e., woodland, batha, garigue, and the woodland-steppe ecotone). The Mediterranean woodland offers far greater density and diversity of food resources to preagricultural humans than any other SW Asian habitat (Blondel & Aronson 1999). Consequently, it makes sense to model Paleolithic hominin demography in terms of change in this Mediterranean woodland phytozone. Mediterranean habitats currently comprise 80,000 km² in Lebanon, Syria, Israel, Jordan, and the Palestinian territories. Pollen spectra from the Jordan Valley and foraminifera from the East Mediterranean sea floor indicate that today's warm, humid conditions are exceptional, and that Mediterranean ecozones were less extensive under cooler, drier Upper Pleistocene conditions (Cheddadi & Rossignol-Strick 1995; Almogi-Labin *et al.* 2004). One can base a preagricultural human population estimate on the current extent of Mediterranean habitats, but the results will likely err on the high side. Such estimates, for example, would not take into account topography, watershed, and other terrain effects on primary productivity and carrying capacity.

The best models for preagricultural human population size in the Levant are ethnographic hunter-gatherers living in temperate woodlands. There are two major published sources for temperate woodland hunter-gatherer population density figures (Binford 2001; Kelly 1995), and both yield concordant results. Among mostly Western North American and Aboriginal Australian groups surveyed by Kelly, the median population density is 7.2 people per 100 km². The minimum is 1.3 people per 100 km². It is probably safest to frame estimates of population size as a range of values between the median and minimum figures. Even so, estimates derived from ethnographic population density figures will also likely be overestimates. Recent human hunter-gatherers deploy specialized extractive technologies that leave detectable traces in the Holocene archaeological record (Kuhn & Stiner 2001). None of these technologies are reliably and consistently documented for Levantine contexts prior to 50 ka.

Population density per 100 km²	25% Present (20,000 km²)	50% Present (40,000 km²)	75% Present (60,000 km²)	Present (80,000 km²)
1	200	400	600	800
2	400	800	1200	1600
3	600	1200	1800	2400
4	800	1600	2400	3200
5	1000	2000	3000	4000
6	1200	2400	3600	4800
7	1400	2800	4200	5600
8	1600	3200	4800	6400

Table 1 - Estimates of Levantine hominin populations obtained by multiplying various population densities against differing extensions of contemporary Mediterranean woodland habitats.

Multiplying population density figures ranging from 1 to 8 persons per 100 km² against a geographic range from 25-100% of the present Mediterranean woodland yields values for the total Levantine population ranging from an unrealistically low of 200 to a maximum of 6400 (tab. 1). The most generally accepted estimate for a human minimum viable population (MVP) is 500 reproducing individuals (Wobst 1974). Yet, a MVP of 500 is unrealistically low for a region like the Levant, one that is elongated North-South and divided topographically East-West by the Lebanon Mountains and the Jordan Rift Valley. A more realistic MVP would probably be around 2000 individuals, with at least 500 people living in four topographically-distinct subregions (Lebanon and northern Israel, southern Israel and the Sinai, Syria, and Jordan).

The results of this simulation suggest that it would not have taken much to drive Levantine hominin populations to extinction. A reduction in the Mediterranean woodlands to 25% of its present extent would have turned the Levant into a population sink. The effects of such a reduction would not have been evenly distributed geographically within the region. In the event of a sudden downturn in rainfall and temperature, the southern Levant would have been impacted first and most severely (Enzel *et al.* 2008). Surviving hominin populations would have persisted longest in areas with the highest rainfall, at lower elevations along the Mediterranean Coast in the northern Levant and in the foothills of the Taurus-Zagros Mountain Range.

The Cause of Extinction

Is there evidence for reductions in humidity and temperature in the East Mediterranean sufficient to cause drastic reductions in human population around 45 ka? Isotopic analysis of speleothems from Soreq and Peqiin caves in Israel show rapid short-term shifts in temperature and rainfall over the last 100,000 years (Almogi-Labin *et al.* 2004; Bar-Matthews *et al.* 2000; McGarry *et al.* 2004). The timing of these events is closely correlated with global patterns of climate change (Burroughs 2005). Change in rainfall in the Upper Pleistocene Levant was driven by shifts in oceanic circulation patterns in the North Atlantic. During "Heinrich Events", when this circulation slowed, Europe froze and the Levant grew colder and drier (Bond & Lotti 1995; Bartov *et al.* 2003). The period 44-50 ka witnessed rapid and substantial shifts in global and local climate. Sharp decreases in temperature and humidity were followed by wide short-term variability. These are exactly the conditions one would expect to reduce Levantine hominin populations heavily dependent on resources in Mediterranean woodlands. The absence of *Homo sapiens* fossils from contexts dating 45-75 ka probably reflects a regional extinction event associated with a previous sharp temperature and humidity decrease ca. 75 ka. Contrasting signals of wetter conditions detected at many coastal caves are likely local phenomnena, reflecting hydrostatic spring activity during times of lowered sea level.

Neandertals seem to have been doing well in the Levant up to 45 ka. There is no clear evidence that they were in any trouble, ecologically or evolutionarily. Yet, the interval between 45-50 ka would have posed new challenges. This period encapsulates the H5 and H5a North Atlantic Heinrich Events, rapid shifts to colder conditions (Bond & Lotti 1995; Rashid *et al.* 2003). The H5a event was unusual in both its magnitude and its long duration (Andrews 1998). Speleothems from Soreq and Peqiin caves register sharp increases in 13C and 18O around 45-50 ka, indicating rapid and significant reductions in temperature and rainfall. These carbon and oxygen isotopic increases are paralleled by oxygen-isotope values for foraminifera in East Mediterranean sediment cores (Bar-Matthews & Ayalon 2003). Speleothem and foraminifera isotopic data suggest rainfall in the coastal lowlands of the Levant plummeted to less than 200 mm (vs. 500 mm today) and average temperatures declined to 12-13°C (vs. 20°C today) (McGarry *et al.* 2004). A rapid decrease in the level of the Lisan paleo-lake during this period shows colder temperatures and increased aridity in the interior southern Levant (Bartov *et al.* 2003; Haase-Schramm *et al.* 2004). A correlated decline in regional terrestrial productivity is evident in increased pollen from steppe-desert taxa in marine sediment cores from the eastern Mediterranean (Cheddadi & Rossignol-Strick 1995; Almogi-Labin *et al.* 2004). In the microfaunal record for this period, cold-tolerant mice, voles, and hamsters, replace thermophilous species, such as gerbils and African grass rats (Tchernov 1998). All this evidence points to an abrupt and sustained drop in terrestrial productivity ca. 45-50 ka.

H5's cold, dry conditions probably retracted Neandertal settlement to woodland refugia along the Mediterranean coast. Evidence for over-hunting deer and gazelle at Kebara Cave (Speth & Clark 2006) is evidence for precisely the kind of resource stress one would expect to see among hominins beginning to run up against the limited subsistence options such refugia presented to them. Levantine Neandertals probably dwindled to extinction shortly after 45 ka.

Geographic Source of the Successor Population

Africa, and particularly East Africa, is currently the leading candidate for the ultimate source of the Levant's EUP human populations. East Africa's fossil record preserves strong support for an inferred morphological transition between *Homo heidelbergensis* (a.k.a. *H. rhodesiensis*) and *Homo sapiens* around 160-195 ka (Trinkaus 2005, Rightmire 2008). The Hofmeyr fossil, coming southernmost Africa, dating to 36 ka, and nearly indistinguishable from European Upper Paleolithic humans clearly points north, to East Africa, as the likely source of western Eurasia's *Homo sapiens* populations (Grine *et al.* 2007).

Studies of living human genetic variation consistently show greater variation among African populations, evidence for our species greater antiquity on that continent (Pearson 2004; Weaver & Roseman 2008). Among living humans, distance from East Africa strongly and accurately predicts local genetic diversity (Prugnolle *et al.* 2005), further narrowing the geographic locus of human origins on the African Continent. The estimated date at which African and Eurasian *Homo sapiens* genetic lineages diverged from one another ca. 65 ka (Kivisild 2007) immediately precedes the appearance of EUP assemblages in the Levant. Analysis of human linguistic variability also points towards our species recent origin in East Africa (Ehret *et al.* 2004).

The Levant is connected to East Africa by a major biogeographic corridor, the Nile River and the Afro-Arabian Rift Valley. Tracing human dispersal from the Levant back to East Africa involves the least number of untestable assumptions about human origins and the biogeographic factors that influenced their dispersal (Lahr & Foley 1998). It is possible that humans dispersed to the Levant from the Mediterranean Coast of North Africa, or from the Arabian Peninsula, but the ultimate source of those populations was almost certainly East Africa.

Why the Successor Population Dispersed

Dispersal is usually driven by population increase. Recent studies of equatorial African paleoclimate suggest an ecological basis for inferring a rapid growth among East African human populations immediately prior to the MP-UP Transition in the Levant. Analysis of sediment cores from Lake Malawi reveal pollen and isotopic evidence for overall drier conditions and a series of acute and long-lasting megadroughts in Subsaharan Africa between 75-130 ka (Cohen *et al.* 2007). These megadroughts likely concentrated human populations into those parts of Africa with persistently high rainfall and vegetation cover. The most likely such regions close to the Levant include the Ethiopian Highlands, the headwaters of the Nile and the flanks of the East African Rift Valley (Cowling *et al.* 2008). After 75 ka, when humid conditions returned, the Continent's carrying capacity increased, and human populations undoubtedly increased as well. The period 45-75 ka probably saw Africa steadily "filling up" with humans, increased intra-specific competition, and greater incentives for geographic dispersal, both within the Continent and beyond it. The Levant would have been an attractive destination for such dispersal, because *Homo sapiens* populations migrating in that direction would not have been competing against dense populations of conspecifics. Evidence that by 50 ka the Northeast African *Homo sapiens* populations were persisting in desert habitats (Wendorf & Schild 1996) suggests they possessed the skills necessary to disperse into Levant across its desertic southern periphery. The distances involved are not all that great. In fact, the entirety of the Sinai Peninsula would easily fit within the annual range of recent African arid-zone hunter-gatherers, like the !Kung San (Lee 1979).

Dispersal Out of Africa: Assumptions vs. Evidence

Is there archaeological evidence for the inferred dispersal of African *Homo sapiens* into the Levant around 45 ka? The simple answer to this question is "yes", but it is a different kind of evidence from what archaeologists are accustomed to seeking.

None of the diagnostic artifact-types of the Levantine EUP are present in large numbers and at earlier dates in either North or East African contexts. For this reason, most archaeologists who have considered the "Out of Africa" dispersal hypothesis with respect to the MP-UP Transition in the Levant have reached a negative verdict (Marks 1992; Bar-Yosef 2000; Vermeersch 2001). The problem with this approach to the lithic evidence is that it places great emphasis on interpreting variability among a category of evidence, stone tools, whose formation processes we do not fully understand. Stone tools from separate contexts may resemble one another because of a cultural connection between their authors or because of convergent selective pressures on stone tool design. Stone tools made by the same person may differ in response to raw material availability, to particular needs for tools, to transport decisions, and any number of other factors. Without adequate, much less robust, middle-range theory to sort out these possible sources of lithic variability the lithic record can easily send a "false negative" signal about human dispersal (Tostevin 2007).

Such false negative findings are demonstrable in two other well-documented cases of Late Pleistocene continental-scale dispersal, those to New Guinea and Australia after 45 ka and to the New World after 13 ka. In both cases, the dispersing *Homo sapiens* populations littered their new habitats with lithic assemblages that differ from those in those parts of Asia from which these dispersals are thought to have originated (Meltzer 1993; Mulvaney & Kamminga 1999). Expecting humans dispersing from Africa to retain that continent's traditions of stone tool production thousands of years later in the Levant contradicts nearly everything that is known about the flexible relationship between social identity and ethnographic material culture (Hodder 1982). There is no reason to assume Pleistocene human cultural identities were more rigidly linked to tool production strategies than among recent humans.

A more productive approach for testing the African dispersal hypothesis would be to trace the distribution of archaeological evidence for behavioral strategies uniquely associated with recent *Homo sapiens*. This is not an easy task. Our species exhibits an extraordinary capacity for behavioral variability, one that is almost certainly the result of strong and sustained selective pressure from very early stages in our evolution (Potts 1998). The particular archaeological "signatures" of many uniquely human activities likely vary widely through space and time. Nevertheless, it is sometimes possible to cut through the clutter of typological variability to track change and variability in the underlying technology.

The use of complex projectile weaponry is a behavioral strategy that is universal among historic and ethnographic human populations (Knecht 1997), and it appears to be associated solely with *Homo sapiens* in the paleoanthropological record (Shea 2006). As used here, the term "complex projectile weaponry" refers to weapon-systems such as the bow and arrow and spear-thrower and dart that combine low-mass penetrating weapons with high-speed delivery systems. Heavy, slow moving weapons like hand-cast spears and thrusting spears are excluded by this definition. Unlike hand-cast spears and non-piercing weapons (boomerangs, throwing sticks, etc.) projectile weapons are light, allowing a single hunter to carry many of them at the same time. They fly quickly, allowing them to be used on small, fast-moving targets as well as larger stationary ones. They retain energy longer in flight, allowing them to be used against larger dangerous prey, or other humans, with less risk of injury (Churchill 1993; Yu 2006). In a word, projectile weaponry is niche-broadening technology. Its underwrites one of the most distinctive derived features of Eurasian (indeed all) human adaptations after 50 Kya, our broad and flexible ecological niche. Like no other subsistence adaptation, complex projectile technology makes *Homo sapiens* the quintessential ecological generalist, and in evolutionary competition, generalists always beat specialists.

The mechanical constraints under which projectile weapons perform offer a route to identifying the durable components of projectile weapon systems in spite of the wide local and regional morphological variability. The most durable remains of projectile weapons are stone weapon tips. (Bone was used in many parts of the world as well, but its preservation is subject to taphonomic bias.) Studies of ethnohistoric North American stone arrowheads and dart tips suggest that such weapon armatures can be discriminated from other pointed stone tool types by wear patterns, mass, and tip cross-sectional area (TCSA)(Shea 2006). Of these, TCSA data can be recovered from the broadest range of archaeological points. A study of stone points from a wide range of African contexts dating to more than 50 ka revealed small numbers of artifacts in nearly every sample whose TCSA values overlapped with those of the ethnohistoric projectile points (Shea 2009). These data suggest that even though projectile technology was not the sole factor driving the production of these points, stone tipped projectile weapons were being produced in North, East, and South Africa before 50 ka. Subsequent studies of wear patterns and residues on these points and on backed pieces from additional African contexts have since affirmed the widespread use of projectile technology by African *Homo sapiens* between 50-100 ka (Shea & Sisk 2010). This finding suggests African humans developed complex projectile weapons as a strategy for diversifying their

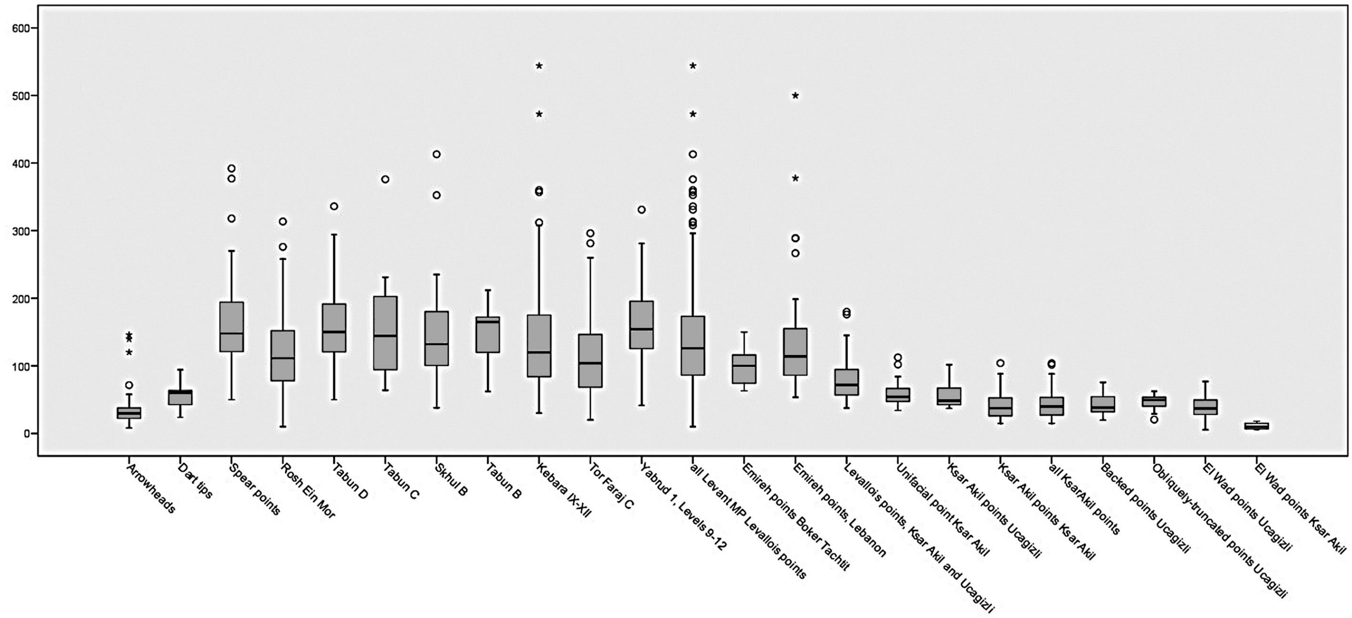

Figure 4 - Tip Cross-Sectional Area (TCSA) Values in mm² for hafted ethnohistoric North American arrowheads and dart tips, experimental thrusting spear points compared to Levantine Middle and Upper Paleolithic points. For original data, see Shea (2006).

ecological niches, possibly intensifying their use during the period of Late Pleistocene megadroughts. It is only reasonable to assume that this technology spread geographically as African populations increased along with wetter conditions after 75 ka.

If this hypothesis is correct, then durable evidence for projectile weaponry should appear in the Levant after 45 ka in contexts directly or indirectly associated with *Homo sapiens*. This is exactly the pattern one sees in the Levantine archaeological record. Samples of retouched and unretouched Levallois points from Levantine Middle Paleolithic contexts (n = 749 artifacts) show TCSA values consistently higher than those of ethnohistoric projectile points (fig. 4). There is no chronological trend in these data towards lower TCSA values, nor are the TCSA values from contexts associated with *Homo sapiens* fossils from Qafzeh significantly different ($p < .01$) from those associated with Neandertals. Pointed stone artifacts from Levantine EUP contexts (mostly Ksar Akil points, El Wad points) exhibit mean TCSA values that do not differ significantly from ethnohistoric projectile points. This evidence supports the inferred dispersal of African humans equipped with projectile technology into the Levant after 45 ka. The exact nature of this projectile technology remains unknown. Inasmuch as the spearthrower is virtually unknown from African ethnographic contexts, we cannot reject the hypothesis that the first *Homo sapiens* who entered the Levant after 45 ka did so carrying bows and arrows. (Emireh points, a point type that has been cited most often as evidence for continuity between LMP and EUP assemblages, exhibit high TCSA values, suggesting they were probably used in a manner more similar to the Middle Paleolithic Levallois points than to EUP projectile points.)

Stone points with TCSA values equivalent to known projectile points occur in European Early Upper Paleolithic assemblages, but not in Middle Paleolithic ones (Shea 2006). This and the Levant evidence are consistent with increasing evidence that what most distinguished *Homo sapiens'* adaptations in Europe and Western Asia was a wide ecological niche and an unprecedented degree of social networking among the populations (O'Connell 2006; Marean 2007; Stiner & Kuhn 2006). Projectile weaponry demonstrably plays a key role in recent human niche construction and social relations. Accepting the hypothesis that projectile weaponry enabled human survival in Africa and dispersal from that continent involves no greater leap of faith than any other inference about the past derived from uniformitarian principles.

The weak evidence for the use of complex projectile weaponry by Neandertals and by the Levant's Middle Paleolithic *Homo sapiens* population is puzzling. It is possible that our habit of referring to the Skhul/Qafzeh fossils as early "modern" humans underestimates significant biological differences between them and Upper Paleolithic *Homo sapiens* populations.

Conclusion

There is a long tradition in Levantine prehistory of describing change in terms of the metaphor of transition (see papers in Levy 1995; Bar-Yosef 1998). This is neither surprising nor unique to the Levant. Transitions imply continuity and continuity implies centrality and relevance to human origins and evolution. Regionalism, nationalism, careerism, and many other factors furnish strong incentives to describe change in prehistory in terms of transition. Yet, there are also compelling reasons to be skeptical about claims regarding prehistoric transitions. The most obvious one is that such claims are neither biogeographically nor evolutionarily realistic. Not all regions are equally likely places for long term continuity in hominin evolution. The smaller the region, the less likely it is to have been a locus for such continuity among large mammals (MacArthur & Wilson 1967). Continuity is even less likely among small populations of large mammals during periods of rapid climate change (Cardillo *et al.* 2005). When climates change, big mammals move, unless their movements are constrained by geography, competition, or predation. The dwindling populations of rhinos, elephants, gorillas, and other endangered species today living in game preserve refugia are sad proof of truth of this principle. Bounded by mountains, oceans and deserts, the Pleistocene Levant posed similar challenges to hominin survival to those currently faced by many of the world's large nonhuman mammal species. If this interpretation of the evidence is correct, then the events of 45-50 ka may have been but the most recent of many turnover events in the Levant Paleolithic prehistory. While there appears to be a consensus that the Levantine Upper Paleolithic period was not marked by turnover events, the lithic evidence for this assumption rests on the same shaky ground as that cited in support of the MP/UP Transition.

Contemporary archaeology draws on both humanistic and scientific epistemologies. Predictably, current debate about the MP-UP Transition contains a mixture of arguments and hypotheses. Most archaeological models invoking transitions and continuity in the Paleolithic record are arguments in the humanistic tradition. They are not hypotheses. They do not specify the mechanisms of continuity in terms of interpretive models derived from middle-range research. We can only explain past human behavior to the extent that we understand present-day sources of behavioral variability and use that understanding to generate hypotheses about the formation processes of the archaeological record. Continuity inferred from similarities among stone tools might reflect ancestor-descendant relationships, gene flow, culture contact, diffusion, convergent behavioral evolution, some other mechanism, or a combination of mechanisms. Unless the precise mechanism underlying the inferred continuity is specified and test criteria for rejecting that mechanism are made explicit, it is impossible to prove arguments about prehistoric transitions wrong. This does not make these continuity/transition arguments more likely to be correct; it just removes them from the arena of serious scientific debate. Science advances by the refutation of hypotheses, not by the mere repetition of arguments.

In presenting this "Out of Africa" explanation for the MP-UP Transition in the Levant, this paper is intended to be provocative. In current debate about this event, turnovers in hominin populations and dispersal from Africa are all too often dismissed because a robust, testable model incorporating these evolutionary mechanisms has not been proposed. Consequently, the "Out of Africa" hypothesis that is rejected in much recent debate about Levantine prehistory is a weakened, watered-down, "straw man" version of an hypothesis that actually explains the MP-UP record much better than competing arguments about transitions and continuity. There are at least four ways to prove the turnover hypothesis proposed here wrong:

• Finding shared derived morphological features (synapomorphies) between LMP and EUP hominins would show evolutionary continuity across the proposed turnover event.

• Showing abrupt climate change (specifically, temperature and humidity reduction comparable to that associated with Heinrich 5 and 5a) had no detectable effect on Middle Paleolithic hominin settlement, subsistence and demography would challenge the proposed role for climate change in the extinction of the Levantine Neandertals.

• Tracing EUP behavioral innovations or hominin populations to elsewhere in Eurasia would contradict their proposed African origin.

• Discovering evidence for widespread complex projectile weapon use in Eurasian Lower or Middle Paleolithic contexts would contradict the proposed role for projectile technology in *Homo sapiens'* dispersal into Eurasia after 45 ka.

Acknowledgements

I thank Jean-Marie Le Tensorer, Dorota Wojtczak, Thomas Hauck and Daniel Schuhmann for inviting me to this conference. The final draft of this paper profited immeasurably from discussions at the Basel Symposium. I also thank Gil Tostevin and two anonymous reviewers for comments on earlier drafts of this paper. I thank Reto Jagher for editorial guidance. All opinions expressed and any errors of fact are my sole responsibility.

References

Almogi-Labin A., Bar-Matthews M. & Ayalon A. (2004) - Climate Variability in the Levant and Northeast Africa during the Late Quaternary Based on Marine and Land Records. In: N. Goren-Inbar & J. Speth (eds.), *Human Paleoecology in the Levantine Corridor*. Oxford, Oxbow Books, p. 117-134.

Andrews J.T. (1998) - Abrupt changes (Heinrich events) in late Quaternary North Atlantic marine environments: a history and review of data and concepts. *Journal of Quaternary Science* 13:3-16.

Arensburg B. (2002) - Human Remains froim Geula Cave, Haifa. *Bulletin et Mémoires de la Société d'Anthropologie de Paris* (n.s.) 14:141-148.

Bar-Matthews M. & Ayalon A. (2003) - Climatic Conditions in the Eastern Mediterranean during the Last Glacial (60-10 ky) and their Relations to the Upper Palaeolithic in the Levant as inferred from Oxygen and Carbon Isotope Sytematics of Cave Deposits. In: A. Goring-Morris & A. Belfer-Cohen (eds.), *More Than Meets the Eye: Studies on Upper Palaeolithic Diversity in the Near East*. Oxford, Oxbow Books, p. 13-18.

Bar-Matthews M. Ayalon A., Kaufman A., Wasserburg G.J. (2000) - The Eastern Mediterranean paleoclimate as a reflection of regional events: Soreq Cave, Israel. *Earth and Planetary Science Letters* 166:85-95.

Bar-Yosef O. (1992) - Middle Palaeolithic Chronology and the Transition to the Upper Palaeolithic in Southwest Asia. In: G. Brauer & F. Smith (eds.), *Continuity or Complete Replacement: Controversies in Homo sapiens Evolution*. Rotterdam, Balkema Press.

Bar-Yosef O. (1993) - The Role of Western Asia in Modern Human Origins. In: M. Aitken, C. Stringer, P. Mellars (eds.), *The Origin of Modern Humans and the Impact of Chronometric Dating*. Princeton, Princeton University Press, p. 132-147.

Bar-Yosef O. (1996) - The Middle/Upper Paleolithic Transition: A View from the Eastern Mediterranean. In: E. Carbonell & M. Vaquero (eds.), *The Last Neandertals, The First Anatomically Modern Humans: A Tale about Human Diversity. Cultural Change and Human Evolution: The Crisis at 40 KA BP*. Barcelona, Grafiques Lluc, p. 79-94.

Bar-Yosef O. (1998) - On the Nature of Transitions: the Middle to Upper Palaeolithic and Neolithic Revolutions. *Cambridge Archaeological Journal* 8:141-163.

Bar-Yosef O. (2000) - The Middle and Early Upper Paleolithic in Southwest Asia and Neighboring Regions. In: O. Bar-Yosef & D. Pilbeam (eds.), *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean*. Cambridge MA, Peabody Museum of Archaeology and Ethnology, Bulletin 8:107-156.

Bar-Yosef O. (2002) - The Upper Paleolithic Revolution. *Annual Review of Anthropology* 31:363-393.

Bar-Yosef O. & Callendar J. (1999) - The woman from Tabun: Garrod's doubts in historical perspective. *Journal of Human Evolution* 37:879-885.

Barham L. & Mitchell P. (2008) - *The First Africans: African Archaeology from the Earliest Toolmakers to Most Recent Foragers*. New York, Cambridge University Press.

Bartov Y., Goldstein S.L., Stein M., Enzel Y. (2003) - Catastrophic arid episodes in the Eastern Mediterranean linked with North Atlantic Heinrich events. *Geology* 31:439-442.

Belfer-Cohen A. & Goring-Morris A.N. (2003) - Current Issues in Levantine Upper Palaeolithic Research. In: A. Goring-Morris & A. Belfer-Cohen (eds.), *More Than Meets the Eye: Studies on Upper Palaeolithic Diversity in the Near East*. Oxford, Oxbow Books, p. 1-12.

Binford L.R. (2001) - *Constructing Frames of Reference: An Analytical Method for Archaeological Theory Building Using Hunter-Gatherer and Environmental Data Sets*. Berkeley, University of California Press.

Binford S.R. (1968) - Early Upper Pleistocene Adaptations in the Levant. *American Anthropologist* 70:707-717.

Binford S.R. (1970) - Late Middle Paleolithic Adaptations and Their Possible Consequences. *Biosciences* 20:280-283.

Blondel J. & Aronson J. (1999) - *Biology and Wildlife of the Mediterranean Region*. New York, Oxford University Press.

Bond G.C. & Lotti R. (1995) - Iceberg discharges into the North Atlantic on millennial time scales during the last glaciation. *Science* 267:1005-1009.

Burroughs W.J. (2005) - *Climate Change in Prehistory: The End of the Reign of Chaos*. Cambridge, Cambridge University Press.

Cardillo M., Mace G.M., Jones K.E., Bielby J., Bininda-Emonds O.R.P., Sechrest W., Orme C.D.L., Purvis A. (2005) - Multiple Causes of High Extinction Risk in Large Mammal Species. *Science* 309:1239-1241.

Cheddadi R. & Rossignol-Strick M. (1995) - Eastern Mediterranean quaternary paleoclimates from pollen isotope records of marine cores in the Nile cone area. *Paleoceanography* 10:291-300.

Churchill S.E. (1993) - Weapon Technology, Prey Size Selection, and Hunting Methods in Modern Hunter-Gatherers: Implications for Hunting in the Palaeolithic and Mesolithic. In: G. Peterkin, H. Bricker, P. Mellars (eds.), *Hunting and Animal Exploitation in the Later Paleolithic and Mesolithic of Eurasia*. Washington D.C., American Anthropological Association, p. 11-24.

Clark G.A. & Lindly J. (1989) - Modern Human Origins in the Levant and Western Asia: The Fossil and Archeological Evidence. *American Anthropologist* 91:962-985.

Clark J.D., Beyenne Y., Wolde Gabriel G., Hart W.K., Renne P.R., Gilbert H., Defleur A., Suwa G., Katoh S., Ludwig K.R., Boisserie J.-R., Asfaw B., White T.D. (2003) - Stratigraphic, chronological and behavioural contexts of Pleistocene Homo sapiens from Middle Awash, Ethiopia. *Nature* 423:747-752.

Cohen A.S., Stone J.R., Beuning K.R.M., Park L.E., Reinthal P.N., Dettman D., Scholz C.A., Johnson T.C., King J.W., Talbot M.R., Brown E.T., Ivory S.J. (2007) - Ecological consequences of early Late Pleistocene megadroughts in tropical Africa. *Proceedings of the National Academy of Sciences* 104:16422-16427.

Copeland L. (1975) - The Middle and Upper Palaeolithic of Lebanon and Syria in the light of recent research. In: F. Wendorf & A. Marks (eds.), *Problems in Prehistory: North Africa and the Levant*. Dallas, SMU Press, p. 317-350.

Cowling S.A., Cox P.M., Jones C.D., Maslin M.A., Peros M., Spall, S.A. (2008) - Simulated glacial and interglacial vegetation across Africa: implications for species phylogenies and trans-African migration of plants and animals. *Global Change Biology* 14:827-840.

Crosby A.W. (1986) - *Ecological Imperialism: The Biological Expansion of Europe, 900-1900*. Cambridge, Cambridge University Press.

Ehret C., Keita S.O.Y., Newman P. (2004) - The origins of Afroasiatic. *Science* 306:1680-1681.

Enzel Y., Amit R., Dayan U., Crouvi O., Kahana R., Ziv B., Sharon D. (2008) - The climatic and physiographic controls of the eastern Mediterranean over the late Pleistocene climates in the southern Levant and its neighboring deserts. *Global and Planetary Change* 60:165-192.

Eswaran V. (2002) - A Diffusion Wave out of Africa: The Mechanism of the Modern Human Revolution? *Current Anthropology* 43:749-774.

Gamble C. (2007) - *Origins and Revolutions: Human Identity in Earliest Prehistory*. New York, Cambridge University Press.

Garrod D.A.E. (1962) - The Middle Palaeolithic of the Near East and the Problem of Mount Carmel Man. *Journal of the Royal Anthropological Institute* 92:232-259.

Gilpin M.E. & Soulé M.E. (1986) - Minimim viable populations: Processes of species extinction. In: M. Soulé (ed.), *Conservation Biology: The Science of Scarcity and Diversity*. Sunderland MA, Sinauer Associates, p. 19-34.

Goring-Morris A.N. & Belfer-Cohen A. (2003) - *More Than Meets the Eye: Studies on Upper Palaeolithic Diversity in the Near East*. Oxford, Oxbow Books.

Green RE, *et. al.* (2010) - A Draft Sequence of the Neandertal Genome. *Science* 328(7 May):710-722.

Grine F.E., Bailey R.M., Harvati K., Nathan R.P., Morris A.G., Henderson G.M., Ribot I. & Pike A.W.G. (2007) - Late Pleistocene Human Skull from Hofmeyr, South Africa, and Modern Human Origins. *Science*, 315:226-229.

Grün R., Stringer C., McDermott F., Nathan R., Porat N., Robertson S., Taylor L., Mortimer G., Eggins S., McCulloch M. (2005) - U-series and ESR analyses of bones and teeth relating to the human burials from Skhul. *Journal of Human Evolution* 49:316-334.

Haase-Schramm A., Goldstein S., Stein M. (2004) - U-Th dating of Lake Lisan (late Pleistocene dead sea) aragonite and implications for glacial east Mediterranean climate. *Geochimica et Cosmochimica Acta* 68:985-1005.

Hodder I. (1982) - *Symbols in Action: Ethnoarchaeological Studies of Material Culture*. Cambridge, Cambridge University Press.

Holliday T.W. (2000) - Evolution at the Crossroads: Modern Human Emergence in Western Asia. *American Anthropologist* 102:54-68.

Hovers E. (2006) - Neanderthals and Modern Humans in the Middle Paleolithic of the Levant: What Kind of Interaction? In: N. Conard (ed.), *Neanderthals and Moderns Meet, Tübingen*. Kerns Verlag, p. 65-85.

Howell F.C. (1959) - Upper Pleistocene stratigraphy and early man in the Levant. *Proceedings of the American Philosophical Society* 103:1-65.

Hublin J.-J. & Pääbo S. (2006) - Neandertals. *Current Biology* 16:R113-R114.

Kelly R.L. (1995) - *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Washington D.C., Smithsonian Institution Press.

Kivisild T. (2007) - Complete MtDNA Sequences - Quest on 'Out of Africa' Route Completed? In: P. Mellars, K. Boyle, O. Bar-Yosef, C. Stringer (eds.), *Rethinking the Human Revolution*. Cambridge UK, McDonald Institute for Archaeological Research Monographs, p. 219-232.

Knecht H. (1997) - The history and development of projectile technology research. In: H. Knecht (ed.), *Projectile Technology*, New York, Plenum, p. 3-36.

Kramer A., Crummett T.L., Wolpoff M.H. (2001) - Out of Africa and into the Levant: Replacement or admixture in Western Asia. *Quaternary International* 75:51-63.

Kuhn S.L. & Stiner M.C. (2001) - The Antiquity of Hunter-Gatherers. In: C. Panter-Brick, R. Layton, P. Rowley-Conwy (eds.), *Hunter-Gatherers: An Interdisciplinary Perspective*. Cambridge UK, Cambridge University Press, p. 99-142.

Lahr M.M. & Foley R.A. (1998) - Towards a theory of modern human origins: Geography, demography and diversity in recent human evolution. *Yearbook of Physical Anthropology* 41:137-176.

Lee R.B. (1979) - *The !Kung San: Men, Women and Work in a Foraging Society*. Cambridge, Cambridge University Press.

Levy T.E. (1995) - *Archaeology of Society in the Holy Land*. New York, Facts on File.

MacArthur R.H. & Wilson E.O. (1967) - *Theory of Island Biogeography*. Princeton NJ, Princeton University Press.

Marean C.W. (2007) Heading North: An Africanist Perspective on the Replacement of Neanderthals by Modern Humans. In: P. Mellars, K. Boyle, O. Bar-Yosef, C. Stringer (eds.), *Rethinking the Human Revolution*. Cambridge UK, McDonald Institute for Archaeological Research Monographs, p. 367-382.

Marks A.E. (1983) - The Middle to Upper Paleolithic Transition in the Levant. In: F. Wendorf & A. Close (eds.), *Advances in World Archaeology*. New York, Academic Press, p. 51-98.

Marks A.E. (1992) - Upper Pleistocene Archaeology and the Origins of Modern Man: A View from the Levant and Adjacent Areas. In: T. Akazawa, K. Aoki, T. Kimura (eds.), *The Evolution and Dispersal of Modern Humans in Asia*. Tokyo, Hokusen-Sha, p. 229-251.

McBrearty S. (2007) - Down with the Revolution. In: P. Mellars, K. Boyle, O. Bar-Yosef, C. Stringer (eds.), *Rethinking the Human Revolution*. Cambridge UK, McDonald Institute for Archaeological Research Monographs, p. 133-152.

McBrearty S. & Brooks A.S. (2000) - The Revolution That Wasn't: a New Interpretation of the Origin of Modern Human Behavior. *Journal of Human Evolution* 39:453-563.

McCown T.D. & Keith A. (1939) - *The Stone Age of Mt. Carmel, Volume 2: The Fossil Human Remains from the Levalloiso-Mousterian*. Oxford, Clarendon Press.

McDougall I., Brown F.H., Fleagle J.G. (2005) - Stratigraphic placement and age of modern humans from Kibish, Ethiopia. *Nature* 433:733-736.

McGarry S., Bar-Matthews M., Matthews A., Vaks A., Schilman B., Ayalon A. (2004) - Constraints on hydrological and paleotemperature variations in the Eastern Mediterranean region in the last 140 ka given by the [delta]D values of speleothem fluid inclusions. *Quaternary Science Reviews* 23:919-934.

Mellars P. (2007) - Rethinking the Human Revolution: Eurasian and African Perspectives. In: P. Mellars, K. Boyle, O. Bar-Yosef, C. Stringer (eds.), *Rethinking the Human Revolution*. Cambridge UK, McDonald Institute for Archaeological Research Monographs, p. 1-14.

Meltzer D.J. (1993) - Pleistocene Peopling of the Americas. *Evolutionary Anthropology* 1:157-169.

Millard A.R. (2008) - A critique of the chronometric evidence for hominid fossils: I. Africa and the Near East 500-50 ka. *Journal of Human Evolution* 54:848-874.

Mulvaney J. & Kamminga J. (1999) - *Prehistory of Australia*. Washington D.C., Smithsonian Institution Press.

Neuville R. (1934) Le Préhistorique de Palestine. *Revue Biblique* 43:237-259.

O'Connell J.F. (2006) - How did modern humans displace Neanderthals? Insights from hunter-gatherer ethnography and archaeology. In: N. Conard, *Neanderthals and Modern Humans Meet*? Tübingen, Kerns Verlag, p. 43-64.

Pearson O.M. (2004) - Has the Combination of Genetic and Fossil Evidence Solved the Riddle of Modern Human Origins? *Evolutionary Anthropology* 13:145-159.

Potts R. (1998) - Variability Selection and Hominid Evolution. *Evolutionary Anthropology* 7:81-96.

Prugnolle F., Manica A., Balloux F. (2005) - Geography predicts neutral genetic diversity of human populations. *Current Biology* 15:R159 - R160.

Rabinovich R. (2003) - The Levantine Upper Paleolithic Faunal Record. In: A. Goring-Morris & A. Belfer-Cohen (eds.), *More Than Meets the Eye: Studies on Upper Palaeolithic Diversity in the Near East*. Oxford, Oxbow Books, p. 33-48.

Rak Y. (1993) - Morphological variation in Homo neanderthalensis and Homo sapiens in the Levant: a biogeographic model. In: W. Kimbel & L. Martin (eds.), *Species, Species Concepts, and Primate Evolution*. New York, Plenum, p. 523-536.

Rashid H., Hesse R., Piper J.W. (2003) - Evidence for an Additional Heinrich Event between H5 and H6 in the Labrador Sea. *Paleoceanography* 18:1-15.

Rightmire G.P. (2008) - Homo species in the Middle Pleistocene: Hypodigms, Variation, and Species Recognition. *Evolutionary Anthropology* 17:8-21.

Shea J.J. (2003) - The Middle Paleolithic of the East Mediterranean Levant. *Journal of World Prehistory* 17:313-394.

Shea J.J. (2006) - The origins of lithic projectile point technology: evidence from Africa, the Levant, and Europe. *Journal of Archaeological Science* 33:823-846.

Shea J.J. (2007a) - Behavioral Differences between Middle and Upper Paleolithic Homo sapiens in the East Mediterranean Levant: The Roles of Intraspecific Competition and Dispersal from Africa. *Journal of Anthropological Research* 64:449-488.

Shea J.J. (2007b) - The Boulevard of Broken Dreams: Evolutionary Discontinuity in the Late Pleistocene Levant. In: P. Mellars, K. Boyle, O. Bar-Yosef, C. Stringer (eds.), *Rethinking the Human Revolution*. Cambridge UK, McDonald Institute for Archaeological Research Monographs, p. 219-232.

Shea J.J. (2009) - The Impact of Projectile Weaponry on Late Pleistocene Human Evolution. In: J.-J. Hublin, & M. Richards (eds.) *The Evolution of Hominid Diets: Integrating Approaches to the Study of Palaeolithic Subsistence*. New York, Springer, p. 187-197.

Shea J.J. & Bar-Yosef O. (2005) - Who Were the Skhul/Qafzeh People? An Archaeological Perspective on Eurasia's Earliest Modern Humans. *Journal of the Israel Prehistoric Society* 35:449-466.

Shea J.J., Fleagle J.G., Assefa Z. (2007) - Context and Chronology of early Homo sapiens fossils from the Omo Kibish Formation, Ethiopia. In: P. Mellars, K. Boyle, O. Bar-Yosef, C. Stringer (eds.), *Rethinking the Human Revolution*. Cambridge UK, McDonald Institute for Archaeological Research Monographs, p. 153-162.

Shea J.J. & Sisk M.L. (2010) - Complex Projectile Technology and Homo sapiens Dispersal into Western Eurasia. *PaleoAnthropology* 2010:100-122.

Simmons T. (1999) - Migration and Contact Zones in Modern Human Origins: Baboon Models for Hybridization and Species Recognition. *Anthropologie* 37:101-109.

Speth J.D. & Clark J.L. (2006) - *Hunting and overhunting in the Levantine Late Middle Palaeolithic*. Before Farming, 3, Article 1.

Stiner M.C. (2006) - *The Faunas of Hayonim Cave, Israel: A 200,000-Year Record of Paleolithic Diet*. Demography, and Society, Cambridge MA, Peabody Museum Press.

Stiner M.C. & Kuhn S.L. (2006) - Changes in the Connectedness and Resilience of Paleolithic Societies in Mediterranean Ecosystems. *Human Ecology* 34:693-712.

Tchernov E. (1998) - The Faunal Sequences of the Southwest Asian Middle Paleolithic in Relation to Hominid Dispersal Events. In: T. Akazawa, K. Aoki, O. Bar-Yosef (eds.), *Neandertals and Modern Humans in Western Asia*. New York, Plenum, p. 77-90.

Tostevin G.B. (2007) - Social Intimacy, Artefact Visibility and Acculturation Models of Neanderthal-Modern Human Interaction. In: P. Mellars, K. Boyle, O. Bar-Yosef, C. Stringer (eds.), *Rethinking the Human Revolution*. Cambridge UK, McDonald Institute for Archaeological Research Monographs, p. 341-358.

Trinkaus E. (2005) - Early Modern Humans. *Annual Review of Anthropology* 34:207-230.

Trinkaus E. (2007) - European early modern humans and the fate of the Neandertals. *PNAS* 104:7367-7372.

Vaks A., Bar-Matthews M., Ayalon A., Matthews A., Halicz L., Frumkin A. (2007) - Desert speleothems reveal climatic window for African exodus of early modern humans. *Geology* 35:831-834.

Vermeersch P.M. (2001) - 'Out of Africa' from an Egyptian point of view. *Quaternary International* 75:103-112.

Weaver T.D. & Roseman C.C. (2008) - New Developments in the Genetic Evidence for Modern Human Origins. *Evolutionary Anthropology* 17:69-80.

Wendorf F. & Schild R. (1996) - The Middle Paleolithic Settlement System in the Eastern Sahara. In: N. Conard & F. Wendorf (eds.), *Middle Palaeolithic and Middle Stone Age Settlement Systems*. Forli, Italy, ABACO Edizione, p. 305-312.

White T.D., Asfaw B., DeGusta D., Gilbert H., Richards G., Suwa G., Howell F.C. (2003) - Pleistocene Homo sapiens from Middle Awash, Ethiopia. *Nature* 423:742-747.

Willoughby P.R. (2007) - *The Evolution of Modern Humans in Africa: A Comprehensive Guide*. New York, Altamira.

Wobst H.M. (1974) - Boundary conditions or paleolithic social systems: A simulation approach. *American Antiquity* 39:303-309.

Yu P.-L. (2006) - From Atlatl to Bow and Arrow: Implicating Projectile Technology in Changing Systems of Hunter-Gatherer Mobility. In: F. Sellet, R. Greaves, P. Yu, (eds.), *Archaeology and Ethnoarchaeology of Mobility*. Gainesville FL, University Press of Florida, p. 201-220.