Chapter 8
Behavioral and Cultural Origins of Neanderthals: A Levantine Perspective

Naama Goren-Inbar

Abstract The proceedings of the conference "150 years of Neanderthal discoveries – early Europeans: continuity and discontinuity" reflect the current state of the art as regards Neanderthals and their material culture in the Old World. The present contribution will focus on selected aspects of the world that predated the Neanderthals and their contemporaries. It draws mainly on data deriving from the meeting point of Africa and Eurasia (the Levantine Corridor) and focuses on the aspects that are most relevant for broadening our knowledge of the cultural background and evolution of the Neanderthals and early modern humans.

In order to better understand Neanderthal material culture and associated behavior, the archaeological remains should be viewed in conjunction and perspective with insights from an earlier period, namely the Lower Paleolithic. The issues addressed here include the first appearances of particular technological inventions pertaining to Mousterian/Middle Paleolithic technologies, the abilities of humans to learn, accumulate and share knowledge of their environment and its exploitation modes, as well as mobility patterns, migrations and colonization events.

Discoveries pertaining to Neanderthal populations in Europe have always been received with excitement and much scientific and lay interest. Over the years, many scholars have viewed these hominins as archaic and primitive creatures of limited abilities (and see discussion in Berman 1999; Speth 2004). Although recent opinion is subtler in its expression of this view of Neanderthal capabilities, the consensus on those of earlier hominins remains resolutely dismissive. Regrettably, this stance has resulted in the disregard of abundant data that suggest a strong correlation between ancient and modern behavioral patterns.

The Middle to Upper Paleolithic transition (with emphasis on the European record) and the disappearance and replacement by modern humans of the Neanderthals have been topics of extensive research. In contrast, although the transition from the Lower Paleolithic to the Middle Paleolithic occurred at ca. 250–300 ka across the whole of the Old World (e.g., Clark 1982a, b, 1988; Mercier et al. 2007; Tryon and McBrearty 2002, 2006; Tryon et al. 2005; Jaubert 2000–2001:157; Moncel 1995, 2005; but see Beaumont and Vogel 2006), it has been rather succinctly addressed and far less thoroughly investigated. This analytical bias towards the earlier period is no doubt partly due to its less direct involvement with our own species, but also a reflection of the absence of long uninterrupted sequences, taphonomic disturbances at the sites, lack of suitable dating methods, and meager publication in respect of the later period discussed here.

Yet despite all of the above, the available data indicate a continuity of hominin behavioral traits from the Lower to the Middle Paleolithic in diverse behavioral domains. Hominins of both periods share fundamental traits such as the ability to identify and occupy specific (favorable) landforms, the preference for specific ecological niches and habitats (e.g., Tuffreau et al. 1997; Roberts and Parfitt 1999; Pope 2002), successful exploitation of diverse resources and continuous survival in a given territory for a long period. Furthermore, hominin behavioral patterns that emerged during pre-Neanderthal times were later adopted, elaborated upon and widely distributed. These phenomena are evident in both the domains of planning and implementation. It will suffice to mention here the "domestication" and exploitation of fire (at Gesher Benot Ya'aqov (GBY), Alperson-Afil and Goren-Inbar 2006; Alperson-Afil et al. 2007; the complex modes of raw material acquisition and its transportation (e.g., at 'Ubeidiya, Bar-Yosef and Goren-Inbar 1993; at GBY, Madsen and Goren-Inbar 2004; at Tabun Cave, Verri et al. 2004, 2005); the emergence of species-specific targeting as a mode of game exploitation, indicating elaboration of hunting modes, weapons and efficient game processing (at Qesem Cave: Gopher et al. 2005; Lemorini et al. 2006 and at GBY: Rabinovich et al. 2008) and the presence, albeit rare, of non-utilitarian objects (a bead made of crinoid, GBY Goren-Inbar et al. 1991 and a figurine found at Berekhat Ram: Goren-Inbar 1986).

Of great interest, due to its high archaeological visibility, is the realm of stone tool production. It is in this domain that

N. Goren-Inbar (✉)
The Hebrew University of Jerusalem, Mount Scopus, Jerusalem 91905, Israel
e-mail: goren@cc.huji.ac.il

S. Condemi and G.-C. Weniger (eds.), *Continuity and Discontinuity in the Peopling of Europe: One Hundred Fifty Years of Neanderthal Study*, Vertebrate Paleobiology and Paleoanthropology, DOI 10.1007/978-94-007-0492-3_8, © Springer Science+Business Media B.V. 2011

particular aspects of the technologies characterizing the Neanderthal era are first observed in the Lower Paleolithic. Among these technologies are the Levallois flaking system, the soft hammer technique and the systematic production of blades. While all are widely represented in the Middle Paleolithic (MP) assemblages (and those of the Middle Stone Age [MSA]), and considered to some extent to be the hallmark of the MP, their origins are deeply rooted within the Lower Paleolithic and the Early Stone Age (ESA) material culture and technological sphere of knowledge.

Keywords Lower Paleolithic • Middle Paleolithic • Lithic technology

The Levallois Flaking System[1]

The entire record of the Eurasian MP and that of the MSA of Africa portrays technologies that have been first identified for earlier times – the Lower Paleolithic and in the ESA. Two technological modalities are particularly associated with these MP/MSA chrono-cultural units: those that exhibit Levallois characteristics and those that do not. While the MP Levantine record is characterized solely by the Levallois flaking system, classified as "Typical Mousterian" (after Bordes 1981), the European record is evidently much more diverse (Jaubert 2000–2001, with references for the last decade). However, particular technologies that are an integral part of these methods made their first appearance during much earlier times.

The Levallois flaking system has been mentioned in the context of the Levantine Acheulian by several researchers (Neuville 1951; Garrod and Bate 1937) and in syntheses of the Lower Paleolithic in the Levant and beyond (Bar-Yosef 1994; Clark 1975; Goren 1981). However, detailed accounts of the Levallois component of most of these LP assemblages have never been reported. Clearly, the dominance of surface sites as opposed to the small number of well-excavated sites hindered the establishment of a solid database as well as secure chronological assignment. The latest analyses of Acheulo-Yabrudian and Yabrudian assemblages from Tabun Cave (Gisis and Ronen 2006) as well as those deriving from Qesem Cave (Barkai et al. 2006; Gopher et al. 2005; Lemorini et al. 2006) did not yield Levallois products. This lack of evidence is inconclusive, as an absence of the Levallois flaking system from some of the sequences cannot be considered, as is frequently done (e.g., Gisis and Ronen 2006), an indication of a much later first appearance of the Levallois flaking system. Gopher et al. suggested: "Radial flake production at Qesem Cave appears to have been limited and opportunistic and we are quite confident that the Levallois concept and method are not represented in the Qesem Cave assemblages" (2005: 73). As the Acheulo-Yabrudian is the latest phase of the Lower Paleolithic, this view actually calls for the first appearance of the Levallois flaking system in the Middle Palaeolithic and its Levantine Mousterian occurrences.

Yet the Acheulian site of Berekhat Ram demonstrates a fully fledged Levallois component. Cores and flakes as well as flake tools recovered on site are typical products of the Levallois system (Goren-Inbar 1985). Given the frequent similarity in form of Levallois and handaxe manufacturing flakes, the sheer variety of Levallois products discovered within a clearly Acheulian assemblage, such as that of Berekhat Ram, rules out the possibility that the two have been confused.

As the Berekhat Ram site is older than 233 ka (Feraud et al. 1983), it seems that the first appearances of the Levallois technique are much earlier than generally assumed. Clearly, the Berekhat Ram assemblage demonstrates a fully developed Levallois flaking system with a large variety of the typical recurrent and preferential methods (Goren-Inbar 1985, figs. 5, 6, 14, 15).

When dealing with the question of Levallois antiquity, we have to integrate fragmentary data derived from different sites and distant geographical sources, despite obvious drawbacks, due primarily to the lack of dated Acheulian entities and sequences. Furthermore, there are preliminary indications for the development of the Levallois flaking system in Lower Paleolithic times, identifiable through the exploitation of specific morphologies (see below) that are prerequisites for the production of Levallois items, an extremely long process that required both skill (technology) and complex mental abilities.

A genuine Levallois flaking system does not appear in sub-Saharan Africa prior to 250 ka (e.g., McBrearty and Tryon 2005, 2006; Tryon 2003; Tryon and McBrearty 2002, 2006; but see Beaumont and Vogel 2006), which is the age of the early MSA (eMSA). However, if the production in the Final Acheulian of large predetermined flakes for the modification of bifacial tools is considered a variant of the Levallois method (and see explanations in the references above), then the first dated East African Levallois occurrence is assumed to have taken place between 285 and 509 ka in the Acheulian of the Kapthurin Formation in Kenya (ibid., and references therein). Despite the plethora of African Late and Final Acheulian sites and lithic assemblages, these cultural phases are generally poorly dated; the importance of the Kapthurin Formation data lies in their illustration of the potential of the African sequences.

Giant cores that exhibit centripetal scar patterning have been considered to represent the initial evolutionary phase of the Levallois method (i.e., Paddayya et al. 2006; Tryon and McBrearty 2006 and references therein). They are usually associated with the production of large flakes that were modified into handaxes and cleavers. While the technological

[1] In this paper I use Hovers's nomenclature of "Levallois flaking system" (in press) in order to avoid unnecessary confusion with regard to the Levallois terminology, defined as "method", "technology" and (frequently in English-language publications) "technique."

life-history of the handaxes is usually difficult to reconstruct due to the obliteration of earlier stages of modification by the sequential shaping of these tools, cleavers frequently bear scar patterns that could associate them with some of the observed large scars on the giant cores. If giant cores bearing other traits similar to the Middle Paleolithic Levallois flaking system (such as continuous acute-angle working edges and minimal preparation of the surface opposed to that of the débitage surface, which is observable in the small modifying scars) are accepted as the first appearance of this technique, then there is a case for suggesting that a more ancient origin should be attributed to the system.

The rich Acheulian horizons of GBY not only contain Levallois elements, but occur above the Brunhes-Matuyama boundary, thus dating the site to MIS 18–20 (Goren-Inbar et al. 2000; Feibel 2004). The presence of Levallois traits at such an early period may be an indication of the advanced mental and technological skills of the hominins responsible for the assemblage's manufacture (Madsen and Goren-Inbar 2004; Goren-Inbar and Saragusti 1996). This discovery is of particular significance since the age of the site is earlier than the early Levallois of Africa. Yet, it seems that the lack of archaic African evidence is most probably a result of poor dating rather than actual absence of lithic evidence. Further research is necessary in order to attempt to differentiate between scar patterning resulting from the application of the classical Levallois flaking system and that derived from various modification stages of bifacial tools. At GBY, as elsewhere, a possible key to identifying the existence of "genuine," fully intentional Levallois flaking lies within the component of small cores and blanks (Fig. 8.1). One should conclude that the Levallois flaking system is indeed a methodological and technological invention of a much greater antiquity than has previously been assumed.

It is quite obvious that archaeological data will continue to accumulate, changing dynamically the current low resolution as a consequence. Thus, the recent assignment of the Levallois flaking system in Europe to 300 ka (e.g. Tuffreau et al. 1997; for other areas in France, see Moncel 1999, 2003; Turq, personal communication, 2006; White et al. 2006) is but a single illustration of the fact that this system is much more archaic than previously perceived and that it predates the earliest recorded Neanderthal presence in Eurasia.

Cores on Flakes

As early as Pliocene times (2.34 ma ago), the splitting of individual stone nodules into several segments and subsequent utilization of the flaked material as cores were practiced (e.g., Delagne and Roche 2005). During the Middle Paleolithic the ability to exploit convex surfaces of "secondary products" (the ventral faces of flakes) as cores became a well-established trait of the Mousterian tool kit, a relatively common feature of assemblages of the Levant and across the Old World (e.g., Goren-Inbar 1988; Hovers 2007). In light of this, the observational skills and ability needed to exploit convex surfaces in order to produce predetermined flakes of different sizes are argued here to be traits of great antiquity. These were pivotal in the acquisition of the Levallois flaking system, the roots of which can be observed in the Acheulian. Acheulian assemblages from a wide geographical range have produced handaxes that were exploited as cores and from which large flakes were removed, thus destroying the symmetry of the item and most probably its original function. The exploitation of the convex surface of the handaxe necessitated a technological expertise that shares several characteristics with the Levallois flaking system.

The archaeological data indicate that the presence of cores on flakes was common in the Levantine Acheulian. They are known from sites as early as GBY but appear in larger quantities elsewhere, particularly towards the end of the Acheulian (e.g. the Amudian of Qesem Cave: Gopher et al. 2005).

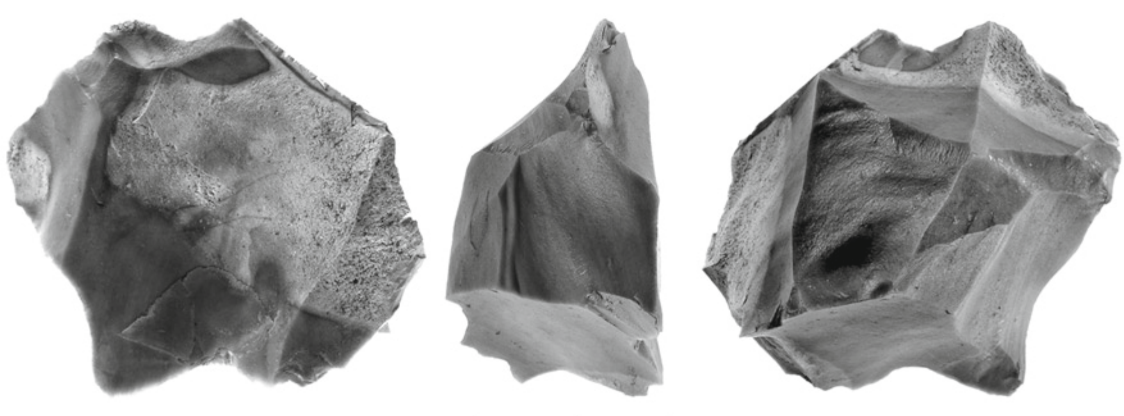

Fig. 8.1 A small flint Levallois core from GBY (scale = 2 cm)

An increase in the use of convex surfaces is expressed in the exploitation and utilization of ventral faces of flakes on the one hand and the use of handaxes as cores on the other (DeBono and Goren-Inbar 2001). The latter has been reported recently from the excavations of the Acheulian open-air site of Revadim, where it was observed on 67% of the handaxes (Marder et al. 2006), and from the Acheulo Yabrudian assemblages of the Tabun and Misliya Caves (Gisis and Ronen 2006; Zaidner et al. 2006, respectively).

Soft Hammer Technique

The earliest Levantine evidence for the use of the soft hammer technique was discovered at GBY. It is expressed in the large quantity of *éclats de taille de bifaces*, small flakes resulting from the last stages of biface modification. Further evidence is available from typical features that are associated with the use of the soft hammer, which include particular crushing of the proximal area (dorsal face) adjacent to the striking platform as well as high frequencies of lipped striking platforms (Sharon and Goren-Inbar 1999; Goren-Inbar and Sharon 2006). The characteristic shallow scars resulting from the soft hammer technique are observed on many bifaces from the site. One should also mention a fragment of antler bearing damage signs typical of those created during experimental knapping (Fig. 8.2). These indications are further supported by even more conclusive finds from the younger Acheulian site of Boxgrove, dated to 0.5 ma, which supplied indications of the soft hammer technique in the form of microscopic flint flakes embedded in the antler surfaces that were used as a percussor (Pitts and Roberts 1997).

Evidence for the application of the soft hammer technique can therefore be demonstrated in the production of bifacial tools during the later phases of the Levantine Acheulian. Although it may have been used in a subsequent period for the production of specific types of scraper, there are no available studies clearly demonstrating its existence, despite the great potential of the Acheulo-Yabrudian and Yabrudian assemblages. Examination of the Middle Paleolithic European assemblages reveals ample evidence for the production of bifaces by the soft hammer technique (i.e., Soressi 2002). There is also a growing body of data indicating that this particular technique was applied during the modification of flakes (i.e., retouch) into Quina scrapers (Delagne and Jaubert, personal communications, 2006), and some indications from assemblages currently under study for the production of blanks, a mode that was to become widely common during the European Upper Paleolithic.

Systematic Blade Production in Lower Paleolithic Times

Systematic blade production was first recognized in the prehistoric record of the Levant in the 1920s, being identified by Garrod and by Rust (Garrod and Bate 1937; Rust 1950). Despite the advanced excavation methods, the secure stratigraphic contexts and the fact that the phenomenon recurred itself in different sites in this region (Syria, Lebanon, Israel), some scholars

Fig. 8.2 A damaged cervid (*Dama*?) antler from GBY (*left*) and an experimental antler percussor that was used to replicate basalt bifacial tools (scale divisions in cm)

Fig. 8.3 A sample of blades from the excavations of Qesem Cave

continuously doubted the integrity of the assemblages and refused to accept their assignment to the Lower Paleolithic (Bordes 1977). The systematic production of blades was apparently regarded as a marker of advanced abilities and thus outside the repertoire of non-modern hominins (Garrod 1962).

Recently acquired data demonstrate that blade production in the Lower Paleolithic was a systematic technological procedure, and much more common than previously thought. The latest discoveries in the Levant originate from excavations at Qesem Cave (coastal plain, Israel). These investigations have yielded unprecedented evidence of systematic blade production (Barkai et al. 2005; Gopher et al. 2005; Lemorini et al. 2006), representing a lengthy tradition documented in an extensively dated sedimentary sequence of some 7.5 m thickness (Barkai et al. 2003, 2006; Gopher et al. 2005) (Fig. 8.3).

It is of interest to note that the onset of the Middle Paleolithic in the Levant is characterized by the systematic production of blades. The Levantine record has furnished assemblages of similar technological as well as typological characteristics, although they were differently named (i.e., "Abu Zif", "Tabun D", "Humalian"; Meignen 1994 and references therein), all assigned to ca. 250–200 ka and stratigraphically underlying the long Mousterian sequences (Mercier et al. 2007, and references therein). Early dates for systematic blade production in Africa are known from the sequence at the Kapthurin Formation, Kenya (Tryon and McBrearty 2002, 2006). Beaumont and Vogel (2006) suggest much older age estimations for blade production of South African sites and consider its first appearance within the time range of the Late Acheulian. Evidently, the scarcity of other laminar assemblages in this continent is related to the poor resolution of the archaeological record rather than to an absence of know-how and technological abilities among the ESA hominins.

Adaptation, Mobility, Diffusion and Colonization

The processes involved in the colonization of the Old World are fundamental to understanding the behavior of Neanderthals and their contemporaries. In particular, the ability to survive, exploit and adapt in different ecological niches and under different environmental conditions provides some of the most attractive topics of research concerned with the Neanderthal world. Examination of the geographical distribution of Middle Paleolithic cultural entities in Eurasia indicates very widespread dispersion over large territories, evidenced through the spread of the Levallois flaking system and associated lithic traditions. This distribution is much more extensive (i.e., in the number of occurrences and territories) than any of its typo-technological predecessors.

The ways in which Neanderthals and other contemporaneous groups related to the Levantine environments are understood in part from repeated occupations of sites (mainly caves) and from their distribution in the landscape. Repeated occupation of the same sites in the Levant differs markedly from that in Europe, in that Levantine sites demonstrate greater similarity at the same site than between sites. The differences and similarities in tool kits and in the nature of the occupations at the sites are hypothesized by some to result from particular mechanisms of territorial behavior and demographic changes (e.g., Hovers 2009, 2001; Meignen et al. 2006; Wallace and Shea 2006), from functional behavior related to acquisition of raw material (e.g., Vermeersch 2002), and from social structure and behaviors that are assumed to reflect seasonal changes in the size of the paleocommunity throughout the year cycles (Marks 1992). While task-specific sites existed during the Lower Paleolithic (i.e., quarries in the Levant: Barkai et al. 2006 and elsewhere:

Paddayya et al. 2006; Potts et al. 1999; Sampson 2006; kill sites: Goren-Inbar et al. 1994), the data on the geographic distribution of these earlier sites are very limited. However, they seem to reflect a large array of variability, most probably stemming from reasons similar to those mentioned above in relation to the behavior of the Neanderthals. These sites are located in different regions and ecological niches (from Western Europe to the Far East). The diffusion, migration or colonization mechanisms that enabled hominins to expand into these varied habitats and to behave in ways that resulted in these characteristic sites are under continuous debate. Several issues are central to this debate: (1) How many colonization episodes (waves) took place before the emergence of Neanderthals and modern humans? (2) What were the main dispersal routes? (3) What was the material culture possessed by hominins at the time of any particular sortie?

Hominin behavior in a given region is entirely dependent on recognition and knowledge of the potential subsistence resources. Examination of the Levantine record indicates that the Acheulian hominins had the ability to occupy remarkably diverse landscapes (Fig. 8.4). The distribution of sites clearly reflects the hominins' comprehensive knowledge of the terrain of the Levantine Corridor, as they are distributed throughout a variety of landforms, habitats and paleoclimatic zones. The Acheulian extensive occupation of the Levantine Corridor is but an initial chapter in the extremely prolonged duration of human exploitation of this area (Goren-Inbar and Speth 2004).

Central to this region is the close proximity of Lower Paleolithic sites to freshwater resources, including areas that are currently arid (i.e., the paleo-Lake Zihor: Ginat et al. 2003; Goren-Inbar et al. in preparation). It is evident that dependence on water sources (ancient lakes, riverbeds and springs: Por 2004) necessitated and dictated a particular mode of behavior (Bar-Yosef 1994; Gilead 1970), and that the distribution of sites in close proximity to these sources

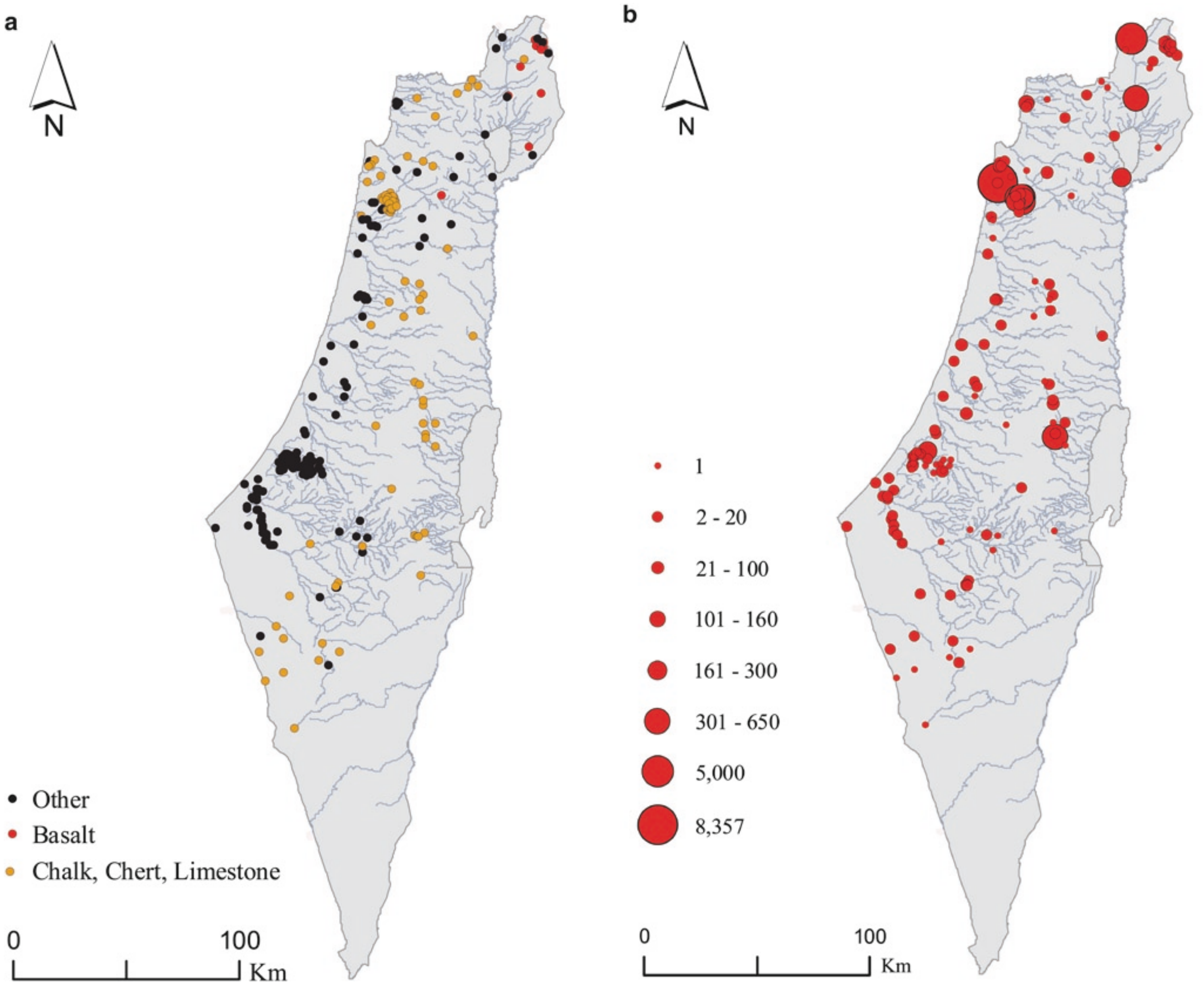

Fig. 8.4 Distribution map of Acheulian occurrences (sites and find spots); (**a**) on bedrock map; (**b**) according to the frequency of handaxes

is indicative of a thorough knowledge of the landscape and its optimal exploitation. This aspect of behavior underwent a major change during the Middle Paleolithic in Eurasia, when extensive occupations are less dependent upon proximity to water bodies and hence much more extensive than previously recorded.

In-depth knowledge of the environment in antiquity is also expressed through its exploitation for subsistence purposes. The paleobotany study at GBY, for example, yielded a unique opportunity on the one hand to examine the plants that existed during the paleoclimate oscillations of MIS 18–20, and on the other hand to gain an insight into the edible plant components of the lake-edge depositional sequence. The analysis of the wood fragments, fruits and seeds provided direct evidence of the paleo-vegetation of the early Lower Paleolithic Levant. Analyses of the organic material revealed a typical Mediterranean vegetation, which mirrors that of present-day natural habitats in the area, with an additional rich assemblage of submerged and lakeshore vegetation (Goren-Inbar et al. 2001, 2002, 2004; Melamed 1997, 2003). These finds indicate a wealth of edible species (fruits, grains, rhizomes, etc.), which permit greater resolution of the modeling of Acheulian subsistence, diet and behavior in this region. It further provides additional insight into the diversity of the exploitable sources and the depth of knowledge that enabled Acheulian hominins to effectively exploit these seasonal landscapes.

The behavioral system that concerns stone artifacts involves an intricate network of acquisition, selection, multi-stepped production and transportation of various items to focal points on the landscape. Although little is known of the functional aspects of the artifacts, patterns similar to those described above, though more limited, have been reported for the Acheulian of Europe (Lhomme et al. 2000) and are widely documented for the Middle Paleolithic in the context of Neanderthal behavior.

Some newly acquired Levantine data allow a better understanding of additional aspects of mobility, primarily those concerning transportation of raw material and artifacts. Previously published data on Lower Paleolithic hominin behavior were mainly concerned with raw material acquisition of particular rock types, sizes and shapes, transportation into the sites and a variety of other properties. These are only some aspects of the much wider realm of hominin mobility strategies. Mobility patterns seem to have become more extensive and complex along the Pliocene and Pleistocene time trajectory and may indicate quite a high degree of sophistication expressed in foresight and behavioral complexity.

We were recently able to demonstrate that extensive mobility to and from the sites took place at the Acheulian occupations of GBY. This mobility is expressed in the transportation of different raw materials into the archaeological horizons and involves the introduction of particular clast sizes, including basalt, flint and limestone that are not an integral component of the local sedimentary sequence (Goren-Inbar et al. 2000). In addition to this type of import, it was further demonstrated that there was active selection of raw material such as that expressed in the basalt archive at the site (basalt slabs of particular morphology and density and their various end products). This enables traits such as shape, size and quality of the imported objects to be more accurately identified (Madsen and Goren-Inbar 2004). The study of the basalt items further demonstrated that some of the basalt blocks (the giant cores) were introduced to the site, while others were exploited elsewhere and only the derived roughouts or nearly finished tools (handaxes and cleavers) were imported to the site.

It appears that each of the Acheulian sites in the GBY sequence reveals a different scenario of lithic inventories, although typologically and technologically they all belong to the same Acheulian tradition (ibid.). Despite these differences, there is a common denominator: the behavioral complexity that has emerged from analyses of mobility patterns is a recurring characteristic. The pattern discussed above is clearly more complex than the one identified at the earlier site of ʻUbeidiya, where the basalt bifaces (handaxes, trihedrals, quadrihedrals and picks) were introduced to the site as nearly finished tools, with only minimal additional knapping taking place on site (Bar-Yosef and Goren-Inbar 1993).

A similar pattern can be observed in the flint component of the Acheulian assemblages from GBY (Goren-Inbar and Sharon 2006; Sharon and Goren-Inbar 1999). Clearly, what is documented is only a small fraction of a complex web of movement of raw materials and artifacts at various stages of manufacture in and out of each site (Goren-Inbar and Sharon 2006). The identification of particular mobility patterns is extremely informative, as they suggest repeated movements within a given territory and extensive/in-depth knowledge of the area.

Recent studies of Acheulian sites in Europe, both on the continent and in England, have resulted in the identification of complex mobility patterns similar to those described above for GBY. These were identified, among others, through detailed refitting analyses (Hallos 2005; Pope 2002). The results contribute much to the understanding of behavioral traits and confirm that the high mobility identified at earlier times in the Levant prevailed in Europe at later times.

Acquiring a better understanding of mobility patterning is fundamental in any attempt to enlarge the scope of our knowledge of diffusion and colonization. Thus, when attempting to reach this objective, one should aim to utilize the most trustworthy evidence and avoid data that have not been subjected to rigorous investigation, particularly in terms of geology, paleontology and stratigraphical integrity.

A wealth of knowledge on archaeological sites and the geographical distribution of prehistoric cultures in the Old World has been accumulated over the last 150 years, since the discovery of the first Neanderthal. It is our scholarly goal to formulate additional hypotheses and examine previous postulated ones based on the currently available data, preferably pristine data. It is invalid at the present state of knowledge to consider fragmentary and selected topics (e.g., skeletal remains, paleontological assemblages, and scanty or unsound archaeological data) in order to gain further understanding of diffusion and colonization processes, as has recently been done (e.g., the lithics of ʻErq el-Ahmar or the age of the ʻUbeidiya Formation as in Dennell and Roebroeks 2005). Recent discussion of the impressive hominin skeletal finds from Dmanisi has raised the question as to whether this represents a permanent or transient colonization. Attempting to describe hominin behavioral abilities at Dmanisi, the authors suggested: "but there is no certainty that hominins managed to colonize this region on a long-term basis. Indeed it seems likely that many of the earliest dispersals from Africa into Eurasia resulted in occupations that were ephemeral, and the Early Pleistocene record does not document any continuity of populations through southern Asia to the Far East (Dennell 2003). The distribution of the first colonists to cross this landscape (the dynamics of such populations in respect to environmental change, and the extent of gene exchange among parapatric groups are entirely unknown." (Rightmire et al. 2006:139). This view clearly overlooks and contradicts extensive archaeological evidence from two geological formations in Israel, which demonstrate the abilities of hominins to colonize territories in the Early Pleistocene and occupy them for a **very long duration**. While only a segment of these formations are exposed, each of them reveals a scenario of repeated hominin occupations in lake-margin environments. The older ʻUbeidiya Formation is of Early Pleistocene age (Eisenman et al. 1983; Tchernov 1986), while the younger Benot Yaʻakov Formation (BYF) is dated to the Early and Middle Pleistocene and assigned to MIS 18–20 (Feibel 2001, 2004; Goren-Inbar et al. 2000). While each of these two depositional sequences is located in a different segment of the Dead Sea Rift, **the estimated duration of each is considered to be some 100 kyr** (Feibel 2004). At both formations a very long sequence of occupations is documented: the ʻUbeidiya Formation has so far yielded over 70 different sites (Bar-Yosef and Goren-Inbar 1993; Shea and Bar-Yosef 1998), while at GBY over 13 sites were excavated (Goren-Inbar 2004; Goren-Inbar et al. 2000). Due to the fragmentation of both formations by prolonged tectonic activity of the Dead Sea Transform and the minimal and highly fragmentary size of the outcrops, it is impossible to demonstrate that the two archaeological localities (formations), situated in two adjacent Dead Sea Rift basins, were **continuously** or periodically occupied beyond the 100 kyr of the known data. Indeed, a series of core drillings to a depth of ca. 80 m that were carried out at the GBY site failed to reach the base of the BY Formation (Goren-Inbar 2004). These drillings furnished geological and archaeological data indicating that the sequence is much longer than previously assumed. Similarly, while ʻUbeidiya is indeed younger than the Dmanisi record, it should be noted that the 1.4 ma Member Fi (Eisenmann et al. 1983), which yielded most of the archaeological horizons, is only one segment of the sedimentary record of the ʻUbeidiya Formation (Bar-Yosef and Goren-Inbar 1993). The Levantine data reflect an entirely different scenario than the one suggested above. Early hominins could and did colonize new territories and these occupations were prolonged, as indicated below.

While the entire extent of the Benot Yaʻakov and ʻUbeidiya Formations is unknown, it seems most likely that the Levantine Corridor was continuously occupied by hominins with different cultural traditions. The particular origin of each of the traditions can be traced back to Africa, as they differ morphotechnologically from one another (Goren-Inbar and Saragusti 1996; Saragusti and Goren-Inbar 2001). The presence of two distinctly different traditions is viewed as reflecting different African dispersals. The generally low resolution of the very early archaeological record in the Levantine Corridor may mask additional evidence testifying to additional sorties.

The mobility pattern is crucial for understanding processes of diffusion and colonization. The available data illustrate the problematic nature of archaeological resolution, a difficulty that is pertinent to all archaeological periods but is of greater amplitude where Lower Paleolithic sites are concerned, due to the impact of natural processes affecting them over a much longer time span. Yet, the archaeological records of both Acheulian sites clearly illustrate the colonization of two distinct Acheulian episodes within the Levantine Corridor. ʻUbeidiya is definitely not an outlier due to its great age, as was recently suggested by Foley and Lahr (2003: 114). On the contrary, it is in full accord with many other assemblages that are classified in Africa as "Developed Oldowan" and share the same cultural inventories, some of the faunal components and the overall age. Furthermore, it contributes extensively to a better understanding of the mechanism of diffusion, as it is currently viewed. When repeated visits to the same locality are considered together with high levels of mobility, and such a trend is repeated at archaeological sites in different geographical regions, there is reason to suggest an incremental pattern of diffusion (see terminology in Bar-Yosef and Belfer-Cohen 2001). Such findings support the argument for a slow dispersal rate as suggested by Anton and Swisher (2004).

The control of fire is considered to be one of the most important cultural innovations in hominin lifestyle (Goren-Inbar et al. 2004; Alperson-Afil et al. 2009). Evidence from GBY provides strong evidence for the presence of hearths in the archaeological layers, thus attesting to the ability of hominins to control fire as early as MIS 18. Furthermore, additional evidence currently under investigation indicates that this ability may have existed at a much earlier date at the site. Needless to say, such a cultural tool may have been fundamental in facilitating hominin dispersal and furthering their ability to cope in increasingly seasonal environments. This evidence, the oldest in Eurasia, is chronologically followed by evidence from various Acheulian sites in the Levant (i.e., Tabun Cave: Garrod and Bate 1937) and most recently by the newly recovered burned bone data from Qesem Cave (Lemorini et al. 2006). Clearly, the extensive and rich evidence for the use of fire at these Middle Paleolithic sites testifies to its importance amongst both Neanderthals and modern humans. The roots of this important aspect of paleobehavior are embedded in the Lower Paleoloithic and supported by the presence of hearths at the site of Beeches Pit, England (Gowlett 2006; Gowlett et al. 2005; Hallos 2005).

In summary, the Lower Paleolithic Levantine record, though segmented, indicates that predetermination expressed in the use of the Levallois flaking system and systematic blade production existed long before the appearance of the Neanderthals. These findings, and the large volume of the evidence, clearly refute some current terminologies that attempt to characterize pre-Neanderthal cultural entities by lumping the diverse cultural occurrences into a few classes – the "Modes" (Carbonell et al. 1999; Clark 1961; Foley 1996; Foley and Lahr 1997, 2003; Lahr and Foley 1998). We have demonstrated above that particular technological inventions characterizing the Middle Paleolithic and Middle Stone Age originated and achieved their full forms in earlier times – during the Lower Paleolithic and Early Stone Age. Furthermore, their coexistence in earlier times rules out the attempts to use each of these traits as an independent indicative marker for particular time segments in human cultural history. Taking the above into consideration, it is evident that attempting to differentiate the various dispersals Out of Africa on the basis of these "markers" and their possible cultural significance is of questionable value.

The review of the pre-Neanderthal archaeological data presented above demonstrates that some of the current schemes of dispersal modes are misleading, as they do not consider the wealth of newly acquired data and thus mask some major prehistoric inventions on the one hand and blur their diffusions on the other. Indeed, there is some awareness of the effect that the suggested schemes are faulty, as expressed by Foley and Lahr (2003: 113) "there are continuities between them". But this awareness is insufficient and the continuous use of Modes I to IV, and hence the lumping together of cultural innovations and apparent behaviors that are clearly of archaic nature, is extremely misleading.

We have described in this article the great similarity in abilities – both cognitive and cultural – between hominins predating modern humans and Neanderthals, based mainly on newly acquired data concerning selected aspects that existed during the Lower Paleolithic and ESA. Clearly, the similarities are more extensive during the later phases of the Lower Paleolithic than those observed in the Pliocene African sites. This similarity is revealed through a wide array of multidisciplinary studies, adding to the growing scope of our understanding of the Neanderthals and their contemporaries. It seems that the current state of research requires the formulation of additional questions that will attempt to achieve a better and more precise definition of the domains in which the abilities of Lower Paleolithic hominins differ from those of the Neanderthals.

In a recently published article Tryon and McBrearty (2006: 492) described their findings of the transition between the Early Stone Age to the Middle Stone Age: "Combined evidence from the tools and flake production methods suggest an incremental and mosaic pattern of change in hominin adaptive strategies during the Acheulian–MSA transition." In this study, we have similarly demonstrated that in the Levantine Corridor, and at earlier times, such phenomena are discernible. It seems that modern human abilities, both mental and technological, evolved quite early in time and changed at different rates. In order to gain additional and thorough understanding of modern behavior, it is mandatory to enlarge our knowledge of the cultural entities that are assigned to the Early and Middle Pleistocene times. Comparative study of behavioral traits of archaic hominins and the data pertaining to the Neanderthal era will enable us to explore aspects of cultural and non-cultural evolutionary traits. It will further contribute to the abundant attempts to decipher the evolutionary tempo of the cultural, behavioral and mental abilities of different hominin taxa, and hence enable us to understand ourselves better.

Acknowledgements I would like to thank the organizers of this conference, and in particular S. Condemi, for inviting me to take part in this important celebration of 150 years since the first Neanderthal discovery. This paper was written during a sabbatical year in Cambridge. Clare Hall College and the Department of Biological Anthropology, University of Cambridge, provided excellent facilities. M. Lahr and R. Foley excelled in their hospitality at the new Leverhulme Centre for Human Evolutionary Studies (LCHES), Cambridge.

Thanks are due to N. Alperson-Afil for the production of Fig. 8.4, and to G. Laron for the photographs of Figs. 8.1 and 8.2; Fig. 8.3 was photographed by P. Shrago and permission to use it was generously given by R. Barkai and A. Gopher. E. Hovers commented on and corrected the text, and A. Belfer-Cohen contributed thoroughly in both extended comments and many editorial aspects to the present version. V. Ling's talent made this contribution significantly easier to read.

References

Alperson-Afil, N., & Goren-Inbar N. (2006). Out of Africa and into Eurasia through controlled use of fire: Evidence from Gesher Benot Ya'aqov, Israel. *Archaeology Anthropology & Ethnology of Eurasia, 28*, 63–78.

Alperson-Afil, N., Richter, D., & Goren-Inbar, N. (2007). Phantom hearths and controlled use of fire at Gesher Benot Ya'aqov, Israel. *PaleoAnthropology, 2007*, 1–15.

Alperson-Afil, N., Sharon, G., Zohar, I., Biton, R., Melamed, Y., Kislev, M. E., Ashkenazi, S., Rabinovich, R., Werker, E., Hartman, G., & Goren-Inbar, N. (2009). Spatial orgnaization of hominins activities at the Acheulian Gesher Benot Ya'aqov, Israel. *Science, 326*, 1677–1680.

Antón, S. A., & Swisher, I. C. C. (2004). Early dispersals of Homo from Africa. *Annual Review of Anthropology, 33*, 271–296.

Barkai, R., Gopher, A., Lauritzen, S. E., & Frumkin, A. (2003). Uranium series dates from Qesem Cave, Israel, and the end of the lower Palaeolithic. *Nature, 423*, 977–979.

Barkai, R., Gopher, A., & Shimelmitz, R. (2005). Middle pleistocene blade production in the Levant: An Amudian assemblage from Qesem Cave, Israel. *Eurasian Prehistory, 3*(2), 39–74.

Barkai, R., Gopher, A., & LaPorta, P. C. (2006). Middle Pleistocene landscape of extraction: Quarry and workshop complexes in northern Israel. In N. Goren-Inbar & G. Sharon (Eds.), *Axe age: Acheulian tool-making from quarry to discard* (pp. 7–44). London: Equinox.

Bar-Yosef, O. (1994). The lower paleolithic of the near East. *Journal of World Prehistory, 8*(3), 211–265.

Bar-Yosef, O., & Belfer-Cohen, A. (2001). From Africa to Eurasia. *Quaternary International, 75*, 19–28.

Bar-Yosef, O., & Goren-Inbar, N. (1993). *The lithic assemblages of 'Ubeidiya*. Jerusalem: Institute of Archaeology, Hebrew University.

Beaumont, P. B., & Vogel, J. C. (2006). On a timescale for the past million years of human history in central South Africa. *South African Journal of Science, 102*, 217–228.

Berman, J. C. (1999). Bad hair days in the Paleolithic: Modern (re)construction of cave man. *American Anthropologist, 10*(2), 288–304.

Bordes, F. (1977). Que sont le Pré-Aurignacien et le Iabroudien? In B. Arensburg & O. Bar-Yosef (Eds.), *Moshe stekelis memorial volume* (pp. 49–55). Jerusalem: Israel Exploration Society.

Bordes, F. (1981). Vignt-cinq ans après: le complexe mousterién revisité. *Bulletin de la Société Préhistorique Française, 78*, 77–87.

Carbonell, E., Mosquera, M., Rodríguez, X. P., Sala, R., & Made, J. V. D. (1999). Out of Africa: The dispersal of the earliest technical systems reconsidered. *Journal of Anthropological Archaeology, 18*, 119–136.

Clark, G. (1961). *World prehistory: In new perspectives*. Cambridge: Cambridge University Press.

Clark, J. D. (1975). A comparison of the Late Acheulian industries of Africa and the Middle East. In K. W. Butzer & G. L. Isaac (Eds.), *After the Australopithecines: Stratigraphy, ecology and culture change in the middle Pleistocene* (pp. 605–659). Chicago: Aldine.

Clark, J. D. (1982a). The transition from Lower to Middle Palaeolithic in the African continent. In A. Ronen (Ed.), *The transition from lower to middle Palaeolithic and the origin of modern man* (pp. 235–255). BAR International Series 151, Oxford.

Clark, J. D. (1982b). The cultures of the Middle Palaeolithic/Middle Stone Age. In J. D. Clark (Ed.), *The Cambridge history of Africa, from the earliest times to c. 500 BC* (pp. 248–341). Cambridge: Cambridge University Press.

Clark, J. D. (1988). The Middle stone age of East Africa and the beginnings of regional identity. *Journal of World Prehistory, 2*(3), 235–305.

deBono, H., & Goren-Inbar, N. (2001). Note on a link between Acheulian and Levallois technologies. *Journal of the Israel Prehistoric Society, 31*, 9–23.

Delagnes, A., & Roche, H. (2005). Late Pliocene hominid knapping skills: The case of Lokalalei 2 C, West Turkana, Kenya. *Journal of Human Evolution, 48*, 435–472.

Delagnes, A., & Ropars, A. (Eds.). (1996). *Paléolithique Moyen en Pays de Caux (Haute-Normandie): Le Pucheuil, Etoutteville – deux gisements de plein air en milieu loessique*. Paris: Éditions de la Maison des Sciences de l'Homme.

Dennell, R. (2003). Dispersal and colonisation, long and short chronologies: How continuous is the Early Pleistocene record for hominids outside East Africa? *Journal of Human Evolution, 45*, 421–440.

Dennell, R., & Roebroeks, W. (2005). An Asian perspective on early human dispersal from Africa. *Nature, 438*, 1099–1104.

Eisenmann, V., Ballesio, R., Beden, M., Faure, M., Geraads, D., Guerin, C., & Heintz, E. (1983). Nouvelle interpretation biochronologique des grands mammifères d'Ubeidiya, Israël. *Geobios, 16*(5), 629–633.

Feibel, C. S. (2001). Archaeological sediments in lake margin environments. In J. K. Stein & W. R. Farrand (Eds.), *Sediments in archaeological contexts* (pp. 127–148). Salt Lake City: University of Utah Press.

Feibel, C. S. (2004). Quaternary lake margins of the Levant Rift Valley. In N. Goren-Inbar & J. D. Speth (Eds.), *Human paleoecology in the Levantine corridor* (pp. 21–36). Oxford: Oxbow Books.

Feraud, G., York, D., Hall, C. M., Goren, N., & Schwarcz, H. P. (1983). $^{40}Ar/^{39}Ar$ age limit for an Acheulian site in Israel (sample site: Berekhat Ram). *Nature, 304*(5923), 263–265.

Foley, R. (1996). The adaptive legacy of human evolution: A search for the environment of evolutionary adaptedness. *Evolutionary Anthropology, 4*(2), 194–203.

Foley, R., & Lahr, M. M. (1997). Mode 3 technologies and the evolution of modern humans. *Cambridge Archaeological Journal, 7*(1), 3–36.

Foley, R., & Lahr, M. M. (2003). On stony ground: Lithic technology, human evolution, and the emergence of culture. *Evolutionary Anthropology, 12*, 109–122.

Garrod, D. (1962). The Middle Palaeolithic of the Near East and the problem of Mount Carmel Man. *The Journal of the Royal Anthropological Institute of Great Britain and Ireland, 92*(2), 232–259.

Garrod, D. A. E., & Bate, D. M. A. (1937). *The stone age of Mount Carmel: Excavation at Wadi Mughara*. Oxford: Oxford University Press.

Gilead, D. (1970). *Early Paleolithic cultures in Israel and the Near East*. Ph.D. thesis, Hebrew University, Jerusalem.

Ginat, H., Zilberman, E., & Saragusti, I. (2003). Early Pleistocene lake deposits and lower Paleolithic finds in Nahal (Wadi) Zihor, southern Negev desert, Israel. *Quaternary Research, 59*, 445–458.

Gisis, I., & Ronen, A. (2006). Bifaces from the Acheulian and Yabrudian layers of Tabun Cave, Israel. In N. Goren-Inbar & G. Sharon (Eds.), *Axe age: Acheulian tool-making from quarry to discard* (pp. 137–154). London: Equinox.

Gopher, A., Barkai, R., Shimelmitz, R., Khalaily, M., Lemorini, C., Hershkovitz, I., & Stiner, M. (2005). Qesem Cave: An Amudian site in central Israel. *Journal of the Israel Prehistoric Society, 35*, 69–92.

Goren, N. (1981). The Lower Palaeolithic in Israel and adjacent countries. In P. Sanlaville, & J. Cauvin (Eds.), *Préhistoire du Levant* (pp. 193–205). C.N.R.S. Colloque 598, Lyon.

Goren-Inbar, N. (1985). The lithic assemblages of Berekhat Ram Acheulian site, Golan Heights. *Paleorient, 11*(1), 7–28.

Goren-Inbar, N. (1986). A figurine from the Acheulian site of Berekhat Ram. *Mitekufat Haeven, 19*, 7–12.

Goren-Inbar, N. (1988). Too small to be true? A reevaluation of cores on flakes in Levantine Mousterian assemblages. *Lithic Technology, 17*(1), 37–44.

Goren-Inbar, N. (2004). The Gesher Benot Ya'aqov Acheulian Site – The environment and behavior of early/middle Pleistocene Settlers in the Hula Valley. In A. P. Derevianko & T. I. Nokhrina (Eds.), *Arkheologiya i paleoekologiya Evrasii [Archaeology and Paleoecology of Eurasia]* (pp. 267–278). Novosibirsk: Institute of Archaeology and Ethnography SB RAS Press.

Goren-Inbar, N., & Saragusti, I. (1996). An Acheulian biface assemblage from the site of Gesher Benot Ya'aqov, Israel: Indications of African affinities. *Journal of Field Archaeology, 23*, 15–30.

Goren-Inbar, N., & Sharon, G. (2006). Invisible handaxes and visible Acheulian biface technology at Gesher Benot Ya'aqov, Israel. In N. Goren-Inbar & G. Sharon (Eds.), *Axe age: Acheulian tool-making from quarry to discard* (pp. 111–135). London: Equinox.

Goren-Inbar, N., & Speth, J. D. (Eds.). (2004). *Human paleoecology in the Levantine Corridor*. Oxford: Oxbow Books.

Goren-Inbar, N., Lewy, Z., & Kislev, M. E. (1991). The taphonomy of a Jurassic bead-like fossil from an Acheulian occupation at Gesher Benot Ya'aqov. *Rock Art Research, 8*(2), 133–136.

Goren-Inbar, N., Lister, A., Werker, E., & Chech, M. (1994). A butchered elephant skull and associated artifacts from the Acheulian site of Gesher Benot Ya'aqov, Israel. *Paleorient, 20*(1), 99–112.

Goren-Inbar, N., Feibel, C. S., Verosub, K. L., Melamed, Y., Kislev, M. E., Tchernov, E., & Saragusti, I. (2000). Pleistocene milestones on the Out-of-Africa corridor at Gesher Benot Ya'aqov, Israel. *Science, 289*, 944–974.

Goren-Inbar, N., Sharon, G., Melamed, Y., & Kislev, M. (2001). Nuts, nut cracking, and pitted stones at Gesher Benot Ya'aqov, Israel. *PNAS, 99*(4), 2455–2460.

Goren-Inbar, N., Werker, E., & Feibel, C. S. (2002). *The acheulian site of Gesher Benot Ya'aqov: The wood assemblage*. Oxford: Oxbow Books.

Goren-Inbar, N., Alperson, N., Kislev, M. E., Simchoni, O., Melamed, Y., Ben-Nun, A., & Werker, E. (2004). Evidence of hominin control of fire at Gesher Benot Ya'aqov, Israel. *Science, 304*, 725–727.

Gowlett, J. A. J. (2006). The early settlement of northern Europe: Fire history in the context of climate change and the social brain. *Comptes Rendus Palevolution, 5*, 299–310.

Gowlett, J. A. J., Hallos, J., Hounsell, S., Brant, V., & Debenham, N. (2005). Beeches Pit: Archaeology, assemblage dynamics and early fire history of Middle Pleistocene site in East Anglia, UK. *Eurasian Prehistory, 3*(2), 3–38.

Hallos, J. (2005). "15 minutes of fame": Exploring the temporal dimension of Middle Pleistocene lithic technology. *Journal of Human Evolution, 49*, 155–179.

Hovers, E. (2001). Territorial behavior in the middle Paleolithic of the Southern Levant. In N. J. Conard (Ed.), *Settlement dynamics of the middle Paleolithic and middle stone age* (pp. 123–152). Tübingen: Kerns Verlag.

Hovers, E. (2007). The many faces of cores-on-flakes: A perspective from the Lavantine Mousterian. In S. McPherron (Ed.), *The identification and study of alternative core technologies*. Cambridge Scholarly Press, Cambridge.

Hovers, E. (2009). *The organization of Mousterian Lithic technology*. Oxford University Press, Oxford.

Jaubert, J. (2000–2001). Les sociétés du Paléolithique Moyen en France: Principaux de ces dix dernières années. *Zephyrus, 53–54*, 153–175.

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

Lemorini, C., Stiner, M. C., Gopher, A., Shimelmitz, R., & Barkai, R. (2006). Use-wear analysis of an Amudian laminar assemblage from the Acheuleo-Yabrudian of Qesem Cave, Israel. *Jounal of Archaeological Science, 33*, 921–934.

Lhomme, V., Connet, N., & Chaussé Chaussé, C. (2000). Essai d'interprétation du site Paléolithique Inférieur de Spoucy 1 (Yonn). *Gallia Préhistoire, 42*, 1–44.

Madsen, B., & Goren-Inbar, N. (2004). Acheulian giant core technology and beyond: An archaeological and experimental case study. *Eurasian Prehistory, 2*(1), 3–52.

Marder, O., Milevski, I., & Matskevich, Z. (2006). The handaxes of Revadim Quarry: Typo-technological considerations and aspects of intra-site variability. In N. Goren-Inbar & G. Sharon (Eds.), *Axe age: Acheulian tool-making from quarry to discard* (pp. 223–242). London: Equinox.

Marks, A. E. (1992). Typological variability in the Levantine Middle Paleolithic. In H. L. Dibble & P. A. Mellars (Eds.), *The middle Paleolithic: Adaptation, behavior and variability* (pp. 127–141). Philadelphia: University of Pennsylvania Museum Press.

McBrearty, A., & Tryon, C. (2006). From Acheulian to Middle Stone Age in the Kapthurin Formation, Kenya. In E. Hovers & S. L. Kuhn (Eds.), *Transitions before the transition: Evolution and stability in the middle Paleolithic and middle Stone Age* (pp. 257–277). New York: Springer.

Meignen, L. (1994). Paléolithique moyen au Proche-Orient: le phénomène laminaire. In S. Révillion & A. Tuffreau (Eds.), *Les industries laminaires au Paléolithique moyen* (pp. 125–159). Paris: Éditions CNRS.

Meignen, L., Bar-Yosef, O., Speth, J. D., & Stiner, M. C. (2006). Middle Paleolithic settlement patterns in the Levant. In E. Hovers & S. L. Kuhn (Eds.), *Transitions before the transitions: Evolution and stability in the middle Paleolithic and middle Stone age* (pp. 149–169). New York: Springer Science + Business Media, Inc.

Melamed, Y. (1997). *Reconstruction of the landscape and the vegetarian diet at Gesher Benot Ya'aqov archaeological site in the lower paleolithic period*. M.Sc. thesis, Bar-Ilan University, Ramat Gan.

Melamed, Y. (2003). *Reconstruction of the Hula valley vegetation and the Hominid vegetarian diet by the lower Palaeolithic botanical remains from Gesher Benot Ya'aqov*. Ph.D. thesis, Bar-Ilan University, Ramat Gan.

Mercier, N., Valladas, H., Froget, L., Joron, J.-L., Reyss, J.-L., Weiner, S., Goldberg, P., Meignen, L., Bar-Yosef, O., Belfer-Cohen, A., Chech, M., Kuhn, S.L., Stiner, M.C., Tillier, A.-M., Arensburg, B., Vandermeersch, B., (2007) Hayonim Cave: A TL-based chronology for this Levantine Mousterian sequence. *Journal of Archaeological Science, 34*, 1064–1077.

Moncel, M.-H. (1995). Contribution à la connaissance du Paléolithique moyen ancien (antérieur au stade isotopique 4): l'example de la Vallée de l'Ardèche et de la moyenne Vallée du Rhône (France). *Préhistoire Européenne, 7*, 81–109.

Moncel, M.-H. (1999). Les assemblages lithiques du site Pleistocène moyen d'Orgnac 3 (Ardèche, Vallée du Rhône, France). Université de Liège, ERAUL, Liège.

Moncel, M.-H. (2003). L'exploitation de l'espace et la mobilité des groupes humains au travers des assemblages lithiques à la fin du Pléistocène moyen et au début du Pléistocène supérieur. La Moyenne Vallée du Rhône entre Drôme et Ardèche. BAR International Series 1184, Oxford.

Moncel, M.-H., Moigne, A.-M., & Combier, J. (2005). Pre-Neandertal behaviour during isotopic stage 9 and the beginning of stage 8. New data concerning fauna and lithics in the different occupation levels of Orgnac 3 (Ardèche, South-East France): Occupation types. *Journal of Archaeological Science, 32*, 1283–1301.

Neuville, R. (1951). *Le Paléolithique et Mésolithique du désert de Judée*. Paris: Archives de l'Inst. de Paléont.

Paddayya, K., Jhaldiyal, R., & Petraglia, M. D. (2006). The Acheulian quarry at Isampur, Lower Deccan, India. In N. Goren-Inbar & G. Sharon (Eds.), *Axe age: Acheulian tool-making from quarry to discard* (pp. 45–73). London: Equinox.

Pitts, M., & Roberts, M. (1997). *Fairweather Eden: Life in Britain half a million years ago as revealed by the excavations at Boxgrove*. London: Century.

Pope, M. I. (2002). *The significance of Biface-Rich assemblages: An examination of behavioural controls on Lithic assemblage formation in the lower Paleolithic*. Ph.D. Thesis. University of Southampton, Southampton.

Por, D. F. (2004). The Levantine waterway, riparian archaeology, paleolimnology, and conservation. In N. Goren-Inbar & J. D. Speth (Eds.), *Human Paleoecology in the Levantine Corridor* (pp. 5–20). Oxford: Oxbow Books.

Potts, R., Behrensmeter, A. K., & Ditchfield, P. (1999). Paleolandscape variation and early Pleistocene hominid activities: Members 1 and 7, Olorgesailie formation, Kenya. *Journal of Human Evolution, 37*, 747–788.

Rabinovich, R., Gaudzinski, S., & Goren-Inbar, N. (2008). Systematic butchering of fallow deer (*Dama*) at the early Middle Pleistocene Acheulian site of Gesher Benot Ya'aqov (Israel). *Journal of Human Evolution, 54*, 134–149.

Rightmire, G. P., Lordkipanidze, D., & Vekua, A. (2006). Anatomical descriptions, comparative studies and evolutionary significance of the hominin skulls from Dmanisi, Republic of Georgia. *Journal of Human Evolution, 50*, 115–141.

Roberts, M. B., & Parfitt, S. A. (1999). *Boxgrove: A middle Pleistocene Hominid site at Eartham Quarry, Boxgrove,West Sussex*. London: English Heritage.

Rust, A. (1950). *Die Höhlenfunde von Jabrud (Syrien)*. Neumünster: Karl Wachholtz.

Sampson, C. G. (2006). Acheulian quarries at hornfels outcrops in the upper Karoo region of South Africa. In N. Goren-Inbar & G. Sharon (Eds.), *Axe age: Acheulian tool making from quarry to discard* (pp. 76–107). London: Equinox.

Saragusti, I., & Goren-Inbar, N. (2001). The biface assemblage from Gesher Benot Ya'aqov, Israel: Illuminating patterns in "Out of Africa" dispersal. *Quaternary International, 75*, 85–89.

Sharon, G., & Goren-Inbar, N. (1999). Soft percussor use at the Gesher Benot Ya'aqov Acheulian site? *Mitekufat Haeven, 28*, 55–79.

Shea, J. J., & Bar-Yosef, O. (1998). Lithic assemblages from new (1988–1994) excavations at Ubeidiya: A preliminary report. *Mitekufat Haeven, 28*, 5–19.

Soressi, M. (2002). Le Moustérien de tradition acheuléenne du sud-ouest de la France. Discussion sur la signification du faciès à partir de l'étude comparée de quatre sites: Pech-de-l'Azé I, Le Moustier, La Rochette et la Grotte XVI. Université de Bordeaux I, Bordeaux.

Speth, J. D. (2004). News flash: Negative evidence convicts Neanderthals of gross mental incompetence. *World Archaeology, 36*(4), 519–526.

Tchernov, E. (1986). *Les mammifères du Pleistocène inférieur de la Vallée du Jordain à Oubeidiyeh*. Paris: Association Paléorient.

Tryon, C. A. (2003). *The Acheulian to Middle Stone Age transition: Tephrostratigraphic context for archaeological change in the Kapthurin Formation, Kenya*. Ph.D. dissertation, University of Connecticut, Storrs.

Tryon, C. A., & McBrearty, S. (2002). Tephrostratigraphy and the Acheulian to Middle Stone Age transition in the Kapthurin Formation, Baringo, Kenya. *Journal of Human Evolution, 42*, 211–235.

Tryon, C. A., & McBrearty, S. (2006). Tephrostratigraphy of the Bedded Tuff Member (Kapthurin Formation, Kenya) and the nature of archaeological change in the later Middle Pleistocene. *Quaternary Research, 65*, 492–507.

Tryon, C. A., McBrearty, S., & Texier, P.-J. (2005). Levallois lithic technology from the Kapthurin Formation, Kenya: Acheulian origin and Middle Stone Age diversity. *African Archaeological Review, 22*(4), 199–229.

Tuffreau, A., Marcy, K.-L., & Tuffreau, A. (1997). Land-use and site function in Acheulean complexes of the Somme Valley. *World Archaeology, 29*(2), 225–241.

Vermeersch, P. M. (Ed.). (2002). *Palaeolithic quarrying sites in upper and middle Egypt*. Belgium: Leuven University Press.

Verri, G., Barkai, R., Bordeanu, C., Gopher, A., Hass, M., Kaufman, A., Kubik, P., Montanari, E., Paul, M., Ronen, A., Weiner, S., & Boaretto, E. (2004). Flint mining in prehistory recorded by *in situ* produced cosmogenic 10Be. *Proceedings of the National Academy of Sciences, 101*(21), 7880–7884.

Verri, G., Barkai, R., Gopher, A., Hass, M., Kubik, P. W., Paul, M., Ronen, A., Weiner, S., & Boaretto, E. (2005). Flint procurement strategies in the late lower Palaeolithic recorded by *in situ* produced cosmogenic ^{10}Be in Tabun and Qesem Caves (Israel). *Journal of Archaeological Science, 32*, 207–213.

Wallace, I. J., & Shea, J. J. (2006). Mobility patterns and core technologies in the middle Paleolithic of the Levant. *Journal of Archaeological Science, 33*(9), 1–17.

White, M., Scott, B., & Ashton, N. (2006). The Early middle Palaeolithic in Britain: Archaeology, settlement history and human behaviour. *Journal of Quaternary Science, 21*(5), 525–541.

Zaidner, Y., Druck, D., & Weinstein-Evron, M. (2006). Acheulo-Yabrudian handaxes from Misliya Cave, Mount Carmel, Israel. In N. Goren-Inbar & G. Sharon (Eds.), *Axe age: Acheulian tool-making from quarry to discard* (pp. 243–266). London: Equinox.