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THE CHRONOLOGY OF THE LEVANTINE MIDDLE PALAEOLITHIC PERIOD IN RETROSPECT

ANALYSE RÉTROSPECTIVE DE LA CHRONOLOGIE DU PALÉOLITHIQUE MOYEN AU LEVANT

Ofer BAR-YOSEF [1], Liliane MEIGNEN [2]

ABSTRACT

During the last 20 years, in the context of new interdisciplinary research projects in the Near East, significant changes have emerged in our ideas about the origin and early evolution of Modern Humans. Most of these changes are the result of the development and application of dating techniques such as TL and ESR but no less have the advent of lithic technological studies contributed refinements in the classical tripartite scheme of the Levantine Middle Palaeolithic. The aim of this paper is to explore in retrospect the various proposals for dating the archaeological deposits in which human fossils have been recovered. New hypotheses based on the recent dating are presented radiometric ignoring certain ambiguities.

Keywords: settlement, chronology, Upper Pleistocene, Mousterian, radiométric datation, TL, ESR.

RÉSUMÉ

Durant les 20 dernières années, le développement de programmes de recherches interdisciplinaires au Proche-Orient, s'appuyant en particulier sur les nouvelles méthodes de datation, principalement en TL et ESR, ont considérablement changé notre perception de l'origine et des débuts de l'évolution des Hommes modernes. Les études en technologie lithique ont par ailleurs permis de nuancer les schémas « culturels » classiquement adoptés pour cette région. Cet article propose un bilan des hypothèses longtemps défendues par les différents spécialistes sur la base des données de chronologie relative (données biostratigraphiques et géologiques) ; il expose les nouvelles interprétations obtenues à la lueur des données radiométriques mais fait également référence aux problèmes encore non résolus.

Mots-clés *: peuplement, chronologie, Pléistocène supérieur, Moustérien, datations numériques, TL, ESR.*

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INTRODUCTION

The Levantine human fossils are known to the scientific world and the public since the first discovery of F. Turville-Petre in Zuttiyeh cave in Wadi Amud in 1925. However, the ensuing projects by D. Garrod in Mt. Carmel, R. Neuville and M. Stekelis in Qafzeh cave near Nazareth, uncovered a large number of Middle Palaeolithic skeletal remains. Further, since the 1960s additional discoveries in Qafzeh, Amud, Kebara and Dederiyeh caves increased the sample size of this population. At the same time these fossils were and are still at the center of lively palaeo-anthropological debates. There are four issues at stake: the biological origins of what seems to have been different populations, disagreements concerning the classification of the available fossils, their ages, and the inter- and intra- relationships between the different fossils and the Mousterian industries.

For all these purposes, dating the hominids of the Levant, in a region located at the inter-continental crossroads of Eurasia and Africa, is of crucial importance. The current wealth of molecular and nuclear genetic evidence points to sub-Saharan Africa as the origin of modern humans. This population, whether or not defined as Cro-Magnon, dispersed at least in part through southwestern Asia, into Eurasia (*e.g.*, Harpending *et al.,* 1998). It is in the latter continent they encountered the Neanderthals, a local population that evolved in Europe at least since 300 Ka. or before, and was well-adapted to the variable environments and climatic fluctuations. Hence, the relationship between the two populations is a subject for intensive research and contradictory explanatory models (*e.g.*, Zilhão and d'Errico, 1999).

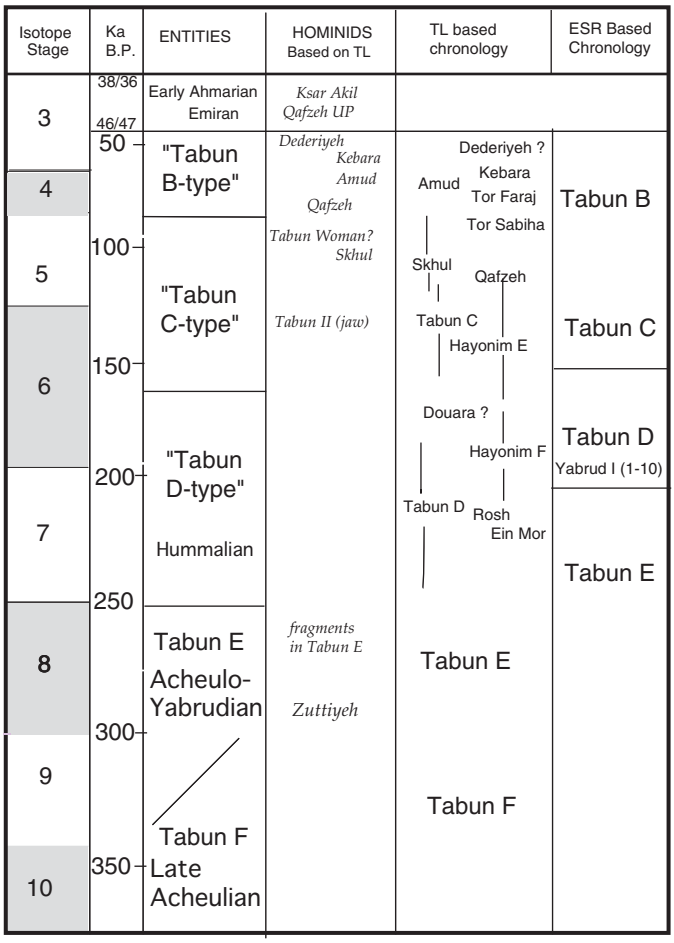
The aim of this paper is to explore in retrospect the various proposals for dating the archaeological deposits in which the Levantine human fossils were incorporated. Only lately has direct dating of the fossils provided more direct information although not necessarily a final resolution to the chronological ambiguities. We will not linger on issues related to the classification of the skeletal relics and only briefly mention the lithic industries.

Figure 1 summarizes the currently available TL and ESR chronology (updated version from Bar-Yosef, 1998), while taking into account additional dates and potential errors as expressed recently in several cautionary remarks (*e.g.*, Schwarcz and Rink, 1998; Millard and Pike, 1999; Grün and Stringer, 2000).

The relative chronological limits of the Middle Palaeolithic are defined on the basis of the lithic industries. It is worth mentioning that in the past the Acheulo-Yabrudian was considered part of this sequence (Jelinek, 1982a, b; Copeland and Hours, 1983). Currently we view the Middle Palaeolithic as a synonym for the Mousterian industries. When we examine how the Mousterian was originally dated we find out that Quaternary geologists and prehistorians investigating Southwest Asia have commonly used the European chrono-cultural scheme. For many years the equation of the "Middle

Palaeolithic" with the "Würm Glaciation" (OIS 5d-2), and the "pre-Mousterian" and "Late Acheulian" with the "Riss Glaciation and the Riss-Würm Interglacial" (OIS 10-5[e]), crippled the geo-chronological interpretations of Levantine cave sequences. The result was the adoption of a short time span of the Mousterian.

Today the industry referred to as "Tabun D-type", including Hummalian, is thought to represent the older portion of the Middle Palaeolithic sequence. The end of the period is marked by the appearance of the earliest Upper Palaeolithic assemblages known as Early Upper Palaeolithic (EUP) or Initial Upper Palaeolithic (IUP). Based on several radiocarbon dated assemblages and their core reduction strategies, the onset of the IUP is considered as 47-45 Ka. BP (*e.g.*, Marks, 1993; Bar-Yosef *et al.,* 1996; Bar-Yosef, 2000). Hence, (*fig. 1)* demonstrates that the length of the Middle Palaeolithic lasted more than 200,000 years. During this period, modern humans moved "out of Africa". It is also the time when several of the cultural features that later signified the IUP first appeared (McBrearty and Brooks, 2000; d'Errico and Nowell, 2000).



THE CULTURAL ATTRIBUTION OF THE HUMAN FOSSILS

The relationship between the hominids and the industries in western Europe has been quite clear for over a hundred years. Neanderthals were and are still found in typical Middle Palaeolithic contexts while Cro-Magnons seemed to characterize layers of Upper Palaeolithic age. Only in the 1980s was there the realization that the Chatelperronian, originally considered as an early Upper Palaeolithic entity, was produced by the local Neanderthals. The discoveries in Saint-Césaire and Arcy-sur-Cure, disrupted the simplified past correlations between industries and the human morpho-types. This was followed by questions related to the non-perishable expressions of "modernity" and the meaning of this term.

Interestingly, the situation in the Levant was more complex starting in the 1930s. The possibility of a certain co-existence between two populations was already recognized by T.D. McCown and D. Garrod while digging in Skhul and Tabun caves (for historical survey see Bar-Yosef and Callander, 1999). In their final analysis McCown and Keith (1939) reviewed the particular features of all Mt. Carmel fossils, and grouped them under the term *Paleanthropus palestinensis*. However, the variability among these hominids, and the suite of modern morphological characteristics, led to the revised definition of the entire group as "proto-Cro-Magnons" (Howell, 1951, 1958, 1959). Furthermore, additional discoveries in Qafzeh cave supported this interpretation (Vandermeersch, 1981). The fact that these anatomically modern humans were the bearers of the Mousterian industries did not escape the attention of researchers. Indeed, in order to reconcile the morphological resemblance to "modern fossils" with their Mousterian stone artifacts, they were chronologically attributed to the period immediately prior to the Upper Palaeolithic. The commonly proposed date for these fossils was 50-40,000 years ago (*e.g.*, Trinkaus, 1984).

The Levantine Mousterian, as noted by many researchers, is quite variable. As the longest and most complete stratigraphy, the Tabun sequence serves as a model for MP lithic technological variability, the 3 entities (Tabun B type, Tabun C type and Tabun D type) representing different phases in a chronological scale suitable for the Levant (Copeland, 1975; Ronen, 1979; Jelinek, 1982a, b; Bar-Yosef, 1992a, b, 1994). During lively debates, several researchers have called into question the chronological significance of these different entities, while others accepted their reality. The position against a temporal tripartite sequence depends on the argument of possible contemporaneity of the different facies (Copeland, 1981, 1983; Meignen, 1990; Marks, 1988). Others stressed the technological variability that could have been the reflection of variable adaptative strategies (Munday, 1979; Marks, 1988; Lieberman and Shea, 1994).

The research of the two last decades and the increase in the number of well-published and dated lithic assemblages demonstrated that the overall picture is more

complex. The advent of technological studies has shown that a wider range of variability of reduction strategies was adopted by Middle Palaeolithic groups than previously thought; this variability is expressed not only in the presence of several modalities within the Levallois concept, as previously recognized by Hours, Copeland and Aurenche (1973), but also in different debitage concepts (Marks, 1993; Marks and Monigal, 1995; Meignen, 1994, 1998a, 2000; Boëda, 1995; Goren-Inbar, 1990).

The oversimplification of the tripartite scheme does not fully fit with the diversity recorded in the Levantine Middle Palaeolithic. As established by Boëda (1994), the Levallois method comprises an internal variability expressed in the morphologies of the end products (flakes, blades, and points), and in the different reduction processes ("preferential" and "recurrent" methods; by unidirectional, bidirectional, or centripetal flaking). Due to its internal structure the unique feature of the Levallois method, regardless of the chronological position of a given assemblage, is the capacity to produce a non-monotonous standardized series of blanks, with a wide array of different products, which thus differs from the monotonous standardized series of blades known in the Upper Palaeolithic production. Several of these Levallois variants were always used concurrently by the makers of the same lithic assemblages, in different combinations leading prehistorians to identify schematically each assemblage by the most dominant pattern of the end-products and the flaking method. The intra-assemblage technical variability could be expressed also by the use of different modes of Levallois flaking successively on the same core as exemplified by the assemblages from Zobiste (Baumler, 1988), Keoue, and Kebara (Meignen and Bar-Yosef, 1992). Additionally, in some Levantine Middle Palaeolithic assemblages, different core reduction strategies were aimed at the production of almost fully developed blades. This means that the concept of blade production through the Laminar method, was already part of the Middle Palaeolithic technological body of knowledge, and could have been later adopted during the Upper Palaeolithic (Meignen, 2000; Bar-Yosef and Kuhn, 1999).

The complexity of the Middle Palaeolithic technical traditions expressed in these lithic assemblages is hardly mirrored in the simplified model based on the Tabun cave sequence. Consequently, several researchers recently questioned it "as a catalogue encompassing all the Levantine Middle Palaeolithic technological variants" (Hovers, 1998; Goren-Inbar and Belfer-Cohen, 1998; Meignen, 1998a; Gilead and Grigson, 1984).

In sum, the present state of research concerning lithic studies and radiometric dating indicates the following results.

The assemblages characterized by the production of elongated blanks, commonly called "Tabun D type", are the earliest Middle Palaeolithic complex. They are stratigraphically located at the base of the Middle Palaeolithic sequence in multi-layered sites (*e.g.*, Tabun IX, Yabrud, Hayonim Lower E and F, Douara IV), and dated between roughly 180-260,000 years (OIS 7-8) in TL chronology (Mercier *et al.,* 1995; Valladas

et al., 1998). The Negev sites such as Rosh Ein Mor and Nahal Aqev were originally identified as late Mousterian age ca. 80 Ka. (Schwarcz *et al.,* 1979). Recent dating by U-series on ostrich eggshell gave an age of around 210 Ka. for Rosh Ein Mor (Marks and Schwarcz, 1999). The dating of Nahal Aqev is still open to revision. No human remains were found associated with the various assemblages, in spite of their distribution from El-Kowm basin in the north, through the Mediterranean hilly ranges to the Negev in the south.

The main feature of these assemblages is the notable proportion of elongated blanks, frequently retouched into points. In some cases, such as in Hayonim cave Lower E and F, Abu Sif and Rosh Ein Mor, short Levallois blanks, often of triangular shape, are also present. Upon examination and review, the lithic products indicate a strategy of blade production aimed at producing elongated, narrow and thick blades, with triangular or trapezoidal cross-sections, together with thinner and wider pieces. The cores, whether uni- or bi-directional, represent different volumetric configurations. In Hayonim and in Rosh Ein Mor, two different core reduction strategies (the Laminar and Levallois methods) were practiced in the production of the same assemblage (Meignen, 1998a, b, 2000; Marks and Monigal, 1995). In fact, blade production is rarely exclusive during the Middle Palaeolithic, except when the Laminar method is the only one used such as in Hummal Ia (Boëda, 1995). The diversity of core reduction strategies within the so-called "Tabun D type" industries is thus more significant than previously thought.

When most of the assemblages characterized by the dominance of oval-rectangular short blanks, so-called "Tabun C-type", were dated such as in Qafzeh, Skhul, Naamé, Hayonim upper E, they fall between 92 Ka. and 170 Ka., with the majority during OIS 5. The main exception is Quneitra, dated to 53,900 +/- 5,900 years based on the ESR analysis of the enamel of 5 cattle teeth (Ziaei *et al.,* 1990). In addition the lithic assemblages are also considered as having particular traits (Goren-Inbar, 1990).

The industries of the above-mentioned sites were recorded in detail at Qafzeh cave (Boutié, 1989; Hovers, 1997; Hovers and Raveh, 2000) characterized by the production of subovalar and subquadrangular flakes, sometimes of large dimensions, struck from Levallois cores through centripetal and/or bi-directional exploitation. Triangular points appear in small numbers and in definite horizons, such as in layer XV in Qafzeh. Similar assemblages include Tabun I 18-26 (layer C in Garrod's excavations), Skhul layer B, Ras el Kelb (Copeland, 1998), Naamé (Fleisch, 1970), as well as Ksar' Akil XXVI (Marks and Volkman, 1986), Hayonim Cave layer Upper E, (Meignen, 1998b). As it currently seems to be the case, the fossils in Skhul and Qafzeh were buried in deposits containing this type of lithic assemblages.

Another group of industries, so-called "Tabun B-type", are currently known from Kebara (Meignen and Bar-Yosef, 1991; Bar-Yosef *et al.,* 1992; Meignen, 1995), Amud (Hovers *et al.,* 1995; Hovers, 1998), Tor Faraj, and Tor Sabiha (Henry, 1995, 1998). It

comprises assemblages dominated by the production of subtriangular short blanks, mainly flakes and points, often removed from unidirectional convergent Levallois cores. The range of variability within the modes of flaking and the products of this group is fairly wide, expressed specifically in the special morphologies of the subtriangular products. In Kebara units IX-X, in Tor Faraj and in Tabun I 1-17 (layer B in Garrod's excavations), typical products, although not necessarily the most frequent, are the broad-based Levallois points, commonly seen with the typical *chapeau de gendarme* striking platform. In Kebara IX-X, they often display the special "Concorde" tilted profile when viewed from the side (Meignen and Bar-Yosef, 1991; Meignen, 1995). In Amud and Tor Sabiha, a somewhat different way of reducing the unidirectional convergent cores (Meignen, 1998a) resulted in narrower and more elongated triangular flakes called "leaf shaped flakes (Watanabe, 1968; Meignen, 1995; Hovers, 1998; Henry, 1995).

Blades do occur in these assemblages, generally in low frequencies, although sometimes reaching up to 25% of the blanks (Kebara unit XII; Amud B1). Similar "Tabun B-type" assemblages occur in Bezez B (Meignen and Bar-Yosef, 1992 *contra* Copeland, 1983, 1975), Sefunim (Ronen, 1984), layer H at Erq el Ahmar (Neuville, 1951), possibly in Dederiyeh (Akazawa *et al.,* 1999), and Ksar' Akil XXVIII (Meignen and Bar-Yosef, 1992 *contra* Marks and Volkman, 1986).

Besides the dominant unidirectional core reduction, centripetal exploitation is present, with a slight increase in the upper part of the Kebara sequence (unit VII-VIII) (Meignen and Bar-Yosef, 1991; Meignen, 1995), and eventually even more in Ksar' Akil XXVII. However, as the dominant feature of this industry remains essentially the production of long narrow flakes by unidirectional convergent mode of flaking, one may suggest, as did Copeland (1975), that this industry could have been the technological forerunner to the transition to the bladey Initial Upper Palaeolithic (Meignen, in prep.). Such a claim would mean that the technical shift was first expressed in the Levant, although one of us suggested an alternative geographical core area (Bar-Yosef, 2000).

The human fossils incorporated with the "Tabun B-type" industry are those of Kebara, Amud, one of the Dederiyeh fossils, and probably the woman from Tabun (known as C1; for arguments, see Bar Yosef and Callander, 1999, and for discussions of the dating: Meignen *et al.,* 2001). Generally, these fossils were classified as Western Asian Neanderthals.

On the basis of the available dates, these industries are grouped between 70/60 to 45,000 years (Kebara, Amud, Tor Faraj; see *fig. 1*; Meignen *et al.,* 2001, for references). In our present state of knowledge, they could be roughly contemporaneous with Quneitra, Nahal Aqev and Farah II.

In conclusion, the following points should be stressed:

– The core reduction strategies producing mostly elongated blanks by various methods, are generally of early age during the Middle Palaeolithic (180-260 Ka.). In

spite of the evidence for this type of flaking no long-term process favoring the increase of blade production has been observed.

– The assemblages dominated by the Levallois centripetal/bidirectional recurrent method are less developed in the Levant than in Western Europe. They are mostly grouped during the end of OIS 6 and OIS 5, during which they are linked with anatomically Modern Humans in Qafzeh and Skhul. Only the site of Quneitra is an exception.

– The numerous assemblages sharing the dominance of the subtriangular short blank production by unidirectional convergent Levallois debitage are late in the Mousterian, dated to between 70 and 45 Ka., and when known, were produced by local Neanderthals. Only the sequence of Ksar' Akil is an exception: the flake production of the Levallois centripetal mode dominates the latest assemblage prior to the "MP/UP transition" layers (Marks and Volkman, 1986) while the "Tabun B type" industry in this site is earlier (Meignen and Bar-Yosef, 1992).

The long sequence of Tabun cave, even if it seems to be the most complete one in the area, does not represent the full range of the Mousterian core reduction strategies encountered in the Levant. In particular, the recently demonstrated variability of concepts of debitage aimed at obtaining the same kind of products, the blades, are not presented in this global scheme. Since these production methods are considered technical choices and socially meaningful (Lemonnier, 1976, 1983) in this case, the model does not make allowances for the bulk of the information on technical traditions. The current state of research gives a rough picture of the chronological frame for the already recognized technological entities. If some chronological groupings are identifiable on the basis of our present data base, there are already too many exceptions and the number of well dated sites is too small for using the presently available industries as chronological "markers".

PALAEOCLIMATE, RELATIVE AND RADIOMETRIC CHRONOLOGY

The common practice of the day, before the introduction of radiometric dating techniques, was to correlate sites and assemblages within a palaeontological as well as a palaeoclimatic sequence. The elements employed for such correlations were faunal lists (mostly microfauna) as well as the climatic interpretations of the sediments in each site.

Dating the Middle Palaeolithic sequence by employing the traditional method of comparing faunal assemblages, was advanced by G. Haas and E. Tchernov (Haas, 1972; Tchernov, 1981, 1992, 1994).

By comparing the presence, extinction, temporary disappearance and appearance of the indicative microvertebrates, Tchernov originally proposed to use the following criteria: a) the presence and absence of primitive archaic forms (long disappeared from the global record); b) species extinct in the Levant but present elsewhere; c) arrival of new species; d) temporal penetration and regression of species; e) evolution of endemic forms; f) range of variability within the same species, and g) the influence of human occupation on the quantitative presence of certain species.

The main difficulty was the uneven preservation in the lower levels at Tabun and the small sample size affected the frequency of rare species. The oldest assemblage was derived from the Upper Acheulian layers at Oumm Qatafa cave (Judean Desert) and served as the baseline. All other available Mousterian assemblages were included in his analysis.

One of the markers was the presence in Oumm Qatafa of both *Lagomys sp*., a primitive hare and *Rattus haasi*, a south Asian rat, globally extinct and therefore considered an archaic form. *Allocricetus jesreelicus*, a cold steppe hamster, is also an extinct form. *Mastomys batei*, a commensal African rat like the house-mouse in the Levant, and *Arvicanthis ectos*, another African rat, are present in Tabun F, E and Qafzeh XIX-XXIV. An additional argument for Qafzeh's old age was the presence of an early form of *Myomimus roachi qafzensis*, an Euro-Asian dormouse, still present in Turkey and Russia.

The species missing from the Qafzeh records was the field mouse *Apodemus flavicollis* that lives on trees and two kinds of hamsters (*Allocricetus magnus* and *Meoscricetus auratus*). The appearance of the modern grey hamster is noted only in Hayonim lower E and Tabun C. The sporadic presence of the European mole (*Talpa chtonia*) is also unexplainable satisfactorily. The appearance and disappearance of the desertic rough-tailed gerbil (*Gerbillus dasyurus*) was considered as indicating the expansion and retraction of arid environments. The first conclusion by Tchernov was that the Qafzeh assemblage was either earlier or in partial contemporaneity with Tabun D.

Further revisions enabled Tchernov (1994) to replace the Qafzeh assemblage between Tabun D and Tabun C. Other Mousterian collections, such as Kebara, and Geula cave were attributed to the late Mousterian. The adoption of TL and ESR dates helped to resolve the controversies regarding the relative age of these assemblages.

The late Middle Pleistocene and Upper Pleistocene sequence was composed based on geomorphological investigations of Syrian fluvial terraces, the Lebanese shorelines, and intermontane valleys, as well as the formations in the Jordan Valley in Israel and Jordan. Incorporation of data from both inland and coastal localities was attempted more than once (*e.g.*, Horowitz, 1979; Farrand, 1979; Sanlaville, 1981, 1998; Besançon, 1981; Besançon *et al.,* 1988; Copeland, 1998; Bar-Yosef, 1992a, b; Goldberg, 1994; Henry, 1986, 1997; Tchernov, 1981, 1988, 1992, 1994).

The Lebanese coast, where the mountains descend directly into the sea, provides a series of sites that are directly linked to the Pleistocene marine stratigraphy. Coastal abrasion with episodal and sporadic depositional events left a series of clear-cut marine terraces, dunal accumulations and beach-rocks. Sanlaville's detailed studies (Sanlaville, 1977, 1981) defined a sequence of marine terraces of both transgressive and regressive character. Most relevant are those ranging in altitude between 8 and 20 m above sea-level, named Enfean I and II and Naamean. Generally Enfean II and Naamean shorelines contained Mousterian industries. Only the Enfean II shoreline deposits contained the *Strombus bubonius Lmk*., a West African mollusk species that usually designates the Tyrrhenian faunas in the Mediterranean basin. This Senegalese species, penetrated the Western Mediterranean during OIS 7 but could have been present in Lebanon at the time of OIS 5e. Strombus never reached the southern Levant due to the dominant sandy environment of its shoreline. There instead, the Tyrrhenian fauna is represented by *Marginopora sp.*, a foraminifera that inhabits warm sea water, probably not more than 30 m deep. Sandy deposits that contain this species and identified in Mt. Carmel between the 6 m and the 45 m beaches, were tentatively correlated with Tyrrhenian shorelines of the Western Mediterranean (Horowitz, 1979).

Enfean I and Enfean II shorelines were uncovered inside and in front of the caves of Ras el-Kelb, as well as Bezez and Abri Zurnoffen, near Adlun (Roe, 1983). A transgressive shoreline deposit without Strombus shells was identified at Abri Zumoffen. This 12 m beach is overlaid by Acheulo-Yabrudian lithic assemblages, including Amudian. Although it was assigned to the Enfean II on the sole basis of altimetric considerations, it has been suggested to re-date it to post-Enfean I (Bar-Yosef, 1992a), which today would possibly correlate with the Tabun cave layer E to OIS 9.

The geological studies in Tabun cave, which lies 45 m above sea level, went through major revisions in recent years due to the new set of TL dates (Mercier *et al.,* 1995; Ronen *et al.,* 1999). The site's stratigraphy (Jelinek, 1982a, b; Farrand 1979, 1982, 1994) which contains the "Tayacian/Tabunian", Upper Acheulian, Acheulo-Yabrudian, and Mousterian, was originally thought to stretch from the Last Interglacial to OIS 3. Other proposals to view the early portion of the sequence as much older were rejected (Farrand, 1994). With the new TL dates it now seems that the Tabun sequence is much longer than ever imagined.

The Negev Mousterian sites have so far provided very few clues for their chronology although on typological grounds it seems that Rosh Ein Mor would be included within the "Tabun D-type" industry (Munday, 1979; Marks and Monigal, 1995). Some assemblages from Ramat Avdat could have been manufactured by the "Tabun B-type" knappers, a proposal supported by the U-series dates of fossil travertines in Ain Aqev area (Schwarcz *et al.,* 1979).

Other possible climatic correlations include the dry and cold conditions of Stage 4 that were probably responsible for the lowering of the water table and the erosion in the main chamber of Kebara cave (Bar-Yosef *et al.,* 1992). This was followed by the rather rapid accumulation of Mousterian layers approximately 4.5-5 m thick, rich in hearths, bones, charcoal and lithic artifacts currently dated to 65/60-48 Ka. by TL and ESR. In Unit XII an almost complete skeleton of an adult male, classified as a Neanderthal, was uncovered in 1983 (Arensburg *et al.,* 1985; Rak and Arensburg, 1987) although a different interpretation was later offered (Arensburg and Belfer-Cohen, 1998). The lithic analysis (Meignen and Bar-Yosef, 1991) indicates that the assemblages of Kebara are similar to the industry of Tabun layer B and probably to Amud cave as well as Tor Faraj and Tor Sabiha, two rock-shelters, located in the hilly area of southern Jordan, and dated to about 70 Ka. (Henry and Miller, 1992; Henry, 1998).

In wadi terraces in the Negev and elsewhere, the erosional phase which followed the accumulation of the gravelly unit indicates arid conditions (Goldberg, 1986) during 75-65 Ka. In Nahal Besor, the site of Farah II (Gilead and Grigson, 1984; Gilead, 1988), which is embedded in silts, suggests that the return to somewhat wetter (and possibly cold) conditions took place before the beginning of the Upper Palaeolithic. This is also indicated by the deposits that underlie Boker Tachtit. The lithic industry from Fara II is made of cobbles and shaped by predominantly unidirectional convergent core reduction.

Finally, no clear evidence for a major climatic break marks the onset of the Upper Palaeolithic. This could be because we are unable to accurately place the time of the transition or boundary between the two techno-complexes.

In conclusion, establishing the chronology through the relative Quaternary stratigraphy did not succeed in determining the length of time of the Mousterian in the Levant. The chronological concepts derived from the European accepted notions affected the conclusions reached by various investigators. Moreover, ambiguities in the dating techniques, congenitally presented by Jelinek (1992), demonstrated a chaotic situation. In brief, every investigator could adopt the chronology as suitable to his or her purposes.

The progress made in TL and ESR techniques finally heralded the method of dating the Levantine fossils.

THE DATING REVOLUTION

The first steps toward a new chronology were taken in the course of the Kebara cave excavations that were carried out from 1982 through 1990. The TL dates (Valladas *et al.,* 1987) of a Mousterian sequence of some 4.5 m thick indicated a range from 60 ± 3 Ka. (in Unit XII) to 48.3 ± 3.5 Ka. (in Unit VI). Most importantly it placed the

Neanderthal burial at around 59.9 ± 3.5 Ka. ESR dates (Schwarcz *et al.,* 1989) on gazelle teeth from Unit X suggested an Early Uptake (EU) of 60.0 ± 6 Ka. and a Linear Uptake (LU) of 64 ± 4 Ka.

During the same years the human fossil bearing layers at Qafzeh were also dated by TL (Valladas *et al.,* 1988). Layer XXIII-XVII produced an average age of 92.0 ± 5 Ka. (and a range of 107 ± 9 through 85 ± 7 Ka.). Similarly ESR dates in Qafzeh (Schwarcz *et al.,* 1988) averaged as 96 ± 13 Ka. (EU) and 115 ± 15 (LU). Uranium series on the same samples (McDermott *et al.,* 1993) simply confirmed the previous readings and suggested that ESR Early Uptake is probably more accurate than Linear Uptake.

Dating museum collections opened another avenue for dating. ESR dates from Tabun cave (Grün *et al.,* 1991; Grün and Stringer, 2000), and TL date from Skhul (Mercier *et al.,* 1993) prolonged the entire chronology of the Mousterian. But the striking change was brought by the TL dates for the Tabun sequence (Mercier *et al.,* 1995). While the ESR readings indicated that the Mousterian began around 200 Ka. the TL dates demonstrated an earlier age around 270/250 Ka. The difference between the two sets of dates could have resulted from the higher concentration of uranium in the sediments attached to the teeth taken from the museum collections and underestimates of the amount of humidity in the deposits (Meignen *et al.,* 2000).

The age determinations at Tabun are now supported by the TL dates from Hayonim cave as well as the ESR readings (*e.g.*, Valladas *et al.,* 1998; Schwarcz and Rink, 1998). Fig. 1 exhibits the new chronology with the location of the hominids. The attribution of the woman from Tabun to the later Mousterian industry is based on reanalysis of the conceptual framework of D. Garrod, T.D. McCown and A. Keith at the time of the discovery (Bar-Yosef and Callander, 1999).

More recently, TL dates from Amud cave (Valladas *et al.,* 1999) supported the observation that the site contains an industry generally similar to Kebara, as well as Neanderthal remains. Thus except for the ambiguities involved in the position and age of the Tabun woman, all human relics identified as Neanderthals were contemporary with the "Tabun B-type" industry. Hence, in addition to the possible southern migration of Neanderthals from Anatolia or other northern areas into the Levant, we should keep in mind that an earlier incursion could have occurred. If the final analysis of the human remains from Karain cave demonstrates their European affinities, the presence of this population at a much earlier time than the Last Interglacial should be considered.

CONCLUSIONS

Interestingly, with the new chronology, previous geomorphological observations receive a new chronological meaning. For example, the presence of the "Tabun C-type" industry above the Strombus shoreline in Lebanon indicates an age during the Last Interglacial, or a time range from OIS 5e through OIS 5a (ca.130-75 Ka. B.P.) This affirmation supports the observations made already by L. Copeland (1981). If this conclusion gains further evidence it means that the Strombus fauna penetrated into the eastern Mediterranean only during the latest phase of the Tyrrhenian.

Another example for the implications of the new chronology is the dating of the Acheulo-Yabrudian entity to an earlier period within the Middle Pleistocene, before ca. 250 Ka. This implies that the fragmentary skull from Zuttiyeh is older than previously perceived, and could be ca. 350 Ka. In addition, the full sequence in Tabun cave is much older than previously thought (Mercier *et al.,* 2000).

As for the Mousterian industries, questions related to the continuous use of essentially the same lithic production method, the Levallois concept (even with a clear amount of recorded variability) are being now raised. The continuity of the behavioural patterns as expressed in the material culture over tens of thousands of years should motivate us to search for the social explanations of these phenomena. By stressing the existence of technical variability within each of these entities, without being able to measure and compare its nature and degree to other phenomena in other regions or later periods, we still remain at the level of basic observations. Hence, when writers who are not fully versed in the archaeological record of the Levant summarize the current situation, they still view the various human fossils as producing exactly the same industries. The lithic studies presently available have shown that technological differences in the morphology of the end-products and the *façon de faire* have been observed, but the level of technical knowledge involved is similar. Perhaps the differences in the lithic assemblages between these people were more subtle, and instead of looking for a positive correlation between human morphological types and a particular industry, as done in the past, one should examine the variability as expressing the social conditions and even differences in the social structure of the basic human group.

In sum, the new chronology of the Mousterian in the Levant opened up a host of new questions, which are not solely related to the date of the fossils, or evidence for past migrations, but also in the need for further explanations related to the prehistoric social arena.

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