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COMPARISONS AND THE CASE FOR INTERACTION AMONG NEANDERTHALS AND EARLY MODERN HUMANS IN THE LEVANT

Summary. *There is good reason to believe that both archaic and anatomically modern humans occupied south-west Asia at the same time. On the assumption that this was indeed the case, this paper attempts to draw comparisons between the Neanderthals and their modern contemporaries and to examine the possibilities of interaction between the two.*

South-west Asia is the only region in the world where two biologically distinct hominids are associated with the Middle Palaeolithic. Thus, the region provides a unique opportunity to make direct comparisons between archaic hominids, notably the Neanderthals, and early representatives of anatomically modern humans. The primary question to be dealt with here is whether these two populations, defined on the basis of their morphological characteristics, also varied with regard to their cultural and behavioral adaptations. In addition, as will be seen, there is a strong possibility that both of the groups occupied the region simultaneously rather than in an alternating fashion, and this provides the opportunity to consider the question of possible interactions between them. In order to deal with these issues it is first necessary to present a brief overview of the Levantine Middle Palaeolithic with regard to assemblage types, chronology and hominid associations.

ASSEMBLAGE TYPES

The cave of Tabun on Mount Carmel, with its deeply stratified sequence, has long been used as the type site for classifying Mousterian assemblages. The terminology follows the stratigraphic nomenclature set out by Garrod (Garrod and Bate 1937) resulting in three types of Mousterian assemblages: Tabun D type Mousterian, Tabun C type Mousterian and Tabun B type Mousterian. Because these fall within a stratigraphic sequence from oldest (Layer D) to youngest (Layer B), they are often referred to as phases within the Mousterian (e.g. Copeland 1975 who proposed Phases 1 through 3 modeled on Tabun Layers D through B respectively). However, as will be outlined below, because some of them may actually overlap in time, there may be good reason to adhere to the view proposed some years ago (Hours *et al*. 1973) and use the term facies rather than phase for the different assemblage groups. Since there is a strong possibility that at least two of the groups represent separate, partially parallel traditions within the Mousterian, it is proposed here to refer to each of the three groups as distinct cultural entities.

OXFORD JOURNAL OF ARCHAEOLOGY 20(3) 219–240 2001

More recently, there have been attempts to classify the assemblages through analyses of the '*chaîne opératoire*' or operational sequence of core reduction (Bar-Yosef and Meignen 1992; Meignen 1995; Meignen and Bar-Yosef 1988, 1991, 1992). This classification, which correlates closely with the Tabun types, sees two major groups. One incorporates those assemblages that are characterized by Levallois *récurrent* centripetal methods, similar to those found in Layer C of Tabun. The other, dominated by Levallois *récurrent* unidirectional methods, is further subdivided into two subgroups, one corresponding to Layer D of Tabun and the second to Layer B.

In the Tabun D type assemblages, the predominant technology is one of unidirectional and some bidirectional core reduction with little, if any, classic radial core preparation. Elongated blanks characterize these assemblages and the numerous blades generally have parallel or converging edges. Levallois points are also elongated with length/width indices approaching 2.5:1. Complex platform preparation and faceting is rare. Typologically, points always form an important component of the tool kit and Upper Palaeolithic types, such as endscrapers and burins, also appear in significant quantities (Bar-Yosef 1994; Bar-Yosef and Meignen 1992; Marks 1981a, 1988, 1992a). In addition to Tabun, this group includes sites such as Rosh Ein Mor and Nahal Aqev (Marks 1981a), Ain Difla (Lindly and Clark 1987), Abu Sif (Neuville 1934, 1951) and Hayonim Lower E (Bar-Yosef 1995; Meignen 1995, 1998) among others.

The Tabun C assemblages, as noted, are those described as based on Levallois *récurrent* centripetal methods. Blanks tend to be relatively large and ovoid in shape, having been struck from radially prepared Levallois cores. Blades occur in low frequencies and the few Levallois points that appear tend to be short and broad. As expected with the radially prepared cores, there is a high incidence of platform faceting. The most common tools are typical Mousterian types, especially a wide variety of sidescrapers, while Upper Palaeolithic types and Levallois points are noted by their scarcity (Bar-Yosef 1994; Marks 1988). Examples of sites of this type besides Tabun Layer C are Skhul (Garrod and Bate 1937), Qafzeh (Boutié 1989) and Hayonim Upper E (Meignen 1998) in addition to sites in Lebanon such as Ksar Akil XXVI (Meignen 1995), Naame, Ras el Kelb and Nahr Ibrahim (Copeland 1975).

With the Type B assemblages there is, again, an emphasis on unilateral core reduction methods. In contrast to the technique of Type D assemblages with their on-axis parallel removals, these are characterized by high frequencies of convergent removals. It has been suggested that this represents a very specific reduction process and is best described as a unidirectional convergent *récurrent* method (Meignen 1995; Meignen and Bar-Yosef 1988, 1991). The blanks produced through this procedure are generally short, broad and triangular in shape resulting in high frequencies of Levallois points. These points have low length/width indices and their maximum width is at the base. Well-pronounced *chapeau de gendarme* striking platforms are also a distinguishing characteristic of these points. Radial preparation of cores often accompanies the unidirectional and bidirectional procedures of these assemblages. Retouched and unretouched Levallois points are an important component of the tool assemblage as is a variety of sidescrapers and other typical Middle Palaeolithic tools. An Upper Palaeolithic element is also relatively common. This type of assemblage is now well documented at Kebara (Bar-Yosef and Meignen 1992; Meignen 1995; Meignen and Bar-Yosef 1988, 1991) and, in addition to the Layer B of Tabun, other examples are found at Amud (Ohnuma 1992; Hovers 1998), Keoue Cave in Lebanon (Nishiaki and Copeland 1992) and Ksar Akil XXVIII (Meignen 1995). The assemblages from Tor Faraj and Tor Sabiha (Henry 1995) in southern Jordan, originally placed within the Tabun D type of assemblages have recently been reassigned to the Type B group (Henry 1998).

CHRONOLOGY

The Near East has produced some of the most surprising and controversial dates for the Middle Palaeolithic and its associated hominids. The application of techniques such as thermoluminescence (TL), electron spin resonance (ESR) and uranium series at the important hominid-bearing sites such as Kebara, Tabun, Qafzeh, Skhul and Amud have, in many ways, revolutionized the thinking of the antiquity and duration of the Middle Palaeolithic. The fact that some of the sites have been dated by more than one technique has produced corroborative information and confirmation for what, at one time, were thought to be aberrant determinations.

Kebara is perhaps the best example for which the various dating techniques seem to correlate quite well. The first determinations were made by Valladas *et al*. (1987) through TL of burned flints from Layers VI through XII, the lowest of which contained the Neanderthal burial. Subsequently, ESR determinations were made on tooth enamel of gazelle teeth from Layer X (Schwarcz *et al*. 1989). Finally, Porat *et al*. (1994) applied ESR to the same burned flint samples as used by Valladas *et al*. (1987). The results are presented in Table 1.

For the TL dates, Valladas *et al*. (1987) note that there is no systematic variation with depth for Layers X to XII indicating frequent occupation of the cave around 60,000 years ago. Layer VII is somewhat younger than the underlying layers but the authors feel, given the errors in the dates, that it can not be stated definitely that there was an occupational hiatus between Layers VIII and VII. In fact, drawing on the stratigraphic evidence from the cave, they argue for a very rapid rate of accumulation from Layers XII to VII. Layer VI is quite young in comparison to the other dates and it is possible that the samples dated were in secondary position due to erosion in the cave. Considering the experimental errors of the dates, it is safe to say that the two series of ESR determinations, including those based on both early uptake (EU) and linear uptake (LU) models, correspond well with the TL dates (Schwarcz *et al*. 1989; Porat *et al*. 1994). The burial, then, can be dated to approximately 60,000 years ago while the Mousterian sequence at this site continues to 50,000 years ago.

Turning to Qafzeh, with the recognition that the fossil hominids from this site were of modern anatomy, it was generally thought that they dated relatively late in the Middle

TABLE 1
Radiometric age (kyr) determinations for Kebara[a]. The ages are the averages for each level

Level	TL Burned Flint	ESR Burned Flint	ESR Tooth Enamel
VI	48.3 ± 3.5	53.9 ± 4.6	
VII	51.9 ± 3.4	66.7 ± 6.0	
VIII	57.3 ± 4.0	58.2 ± 5.4	
IX	58.4 ± 4.0		
X	61.6 ± 3.6		60 ± 6.0 (EU[b] 64 ± 6.0 (LU)[b]
XI	60 ± 3.5	65.1 ± 5.1	
XII	59.3 ± 3.5	58.9 ± 5.5	

[a] Ater Porat *et al*.
[b] EU is for early uptake model and LU is for linear uptake model.

Palaeolithic sequence, ca. 40–50,000 years ago (Trinkaus 1984) and this was supported on the grounds of archaeological evidence (Jelinek 1982). The first indication that they may have been considerably older, at least greater than 85,000 years, came from studies of biostratigraphy of microfauna (Bar-Yosef and Vandermeersch 1981; Tchernov 1988, 1994). Confirmation for a greater antiquity for the Mousterian of this cave has now come from TL, ESR and U-series determinations. The TL dates of burnt flints from Levels XVII through XXIII range from 85,000 to 105,000 years (Valladas *et al*. 1988). There is no systematic variability with depth when experimental errors are taken into consideration, supporting the geological evidence of very rapid sediment accumulation. The average date for all layers together is 92,000 ± 5,000. ESR determinations on tooth enamel (Schwarcz *et al*. 1988) from layers XV to XXI are very close to the TL dates. Here, they range from 73.7 to 119 kyr (EU) and between 89.1 to 143 kyr (LU) with respective means of 96 ± 13 kyr and 115 ± 15 kyr. Even though the EU dates overlap with the TL dates and the LU determinations are only slightly older, the authors feel that the average based on the LU model gives a more reliable age estimate. However, as they state, there is reason to consider a U-uptake history intermediate between the EU and LU profiles which 'would also give ages that overlap the error limits on the TL age' (Schwarcz *et al*. 1988: 736).

Further confirmation of the TL dates, which also tend to support the EU age estimates, was obtained from U-series analyses of two tooth enamel samples taken from Level XIX (McDermott *et al*. 1993) which were also used in the analysis done by Schwarcz *et al*. (1988). Comparisons between the ESR and U-series dates are presented in Table 2. It is noteworthy that the 368DE sample provided essentially equivalent U-series and EU ages. For the second sample the U-series date is slightly younger than that for EU but it is still within the error for that average. In sum, all three techniques place the Mousterian of Qafzeh at around 92,000 years ago.

The same three techniques have been applied to the hominid-bearing Layer B of Skhul Cave. In this case, however, the results are less clear-cut than in the previous examples. This is due in part to the fact that the cave fill was completely removed by the original excavators thus precluding the possibility of carrying out precise dosimetry. The first attempt to date this site was done by Stringer *et al*. (1989) through ESR of two bovid teeth. The resulting EU dates ranged from 54.6 to 101 kyr with an average of 81 ± 15 kyr while the LU determinations, between 77.2 to 119 kyr averaged 101 ± 12 kyr (Table 3). It can be seen in this table that there are some discrepancies between the two teeth, a point that will be returned to below.

Subsequently, six samples of burnt flint were analyzed through TL (Mercier *et al*. 1993). These gave dates ranging from 99.4 to 166.8 kyr which averaged 119 ± 18 kyr and which agree to some degree with the LU model ESR dates. McDermott *et al*. (1993) analyzed the same two samples studied by Stringer *et al*. in addition to three other teeth from Layer B.

TABLE 2
Comparisons of U-series and ESR dates (kyr) from Qafzeh, Layer XIX[a]

Sample	U-Series	ESR	
		EU	LU
371EN	88.6 ± 3.2	103.19 ± 19	125 ± 22
368DE	106 ± 2.4	105 ± 02	115 ± 08

[a] After McDermott *et al*. 1983.

TABLE 3
Early uptake (EU) and linear uptake (LU) ESR ages (kyr) for Skhul, Layer B[a]

Sample	EU	LU
521a	88.1 ± 17.9	102.0 ± 22.7
521b	86.1 ± 13.1	102.0 ± 18.1
521c	94.9 ± 15.6	109.0 ± 20.5
521d	101.0 ± 19.0	119.0 ± 25.1
522a	68.0 ± 5.4	98.3 ± 10.6
522b	73.0 ± 7.0	99.9 ± 12.4
522c	54.6 ± 10.3	77.2 ± 15.7
Average	81 ± 15	101 ± 12

[a] After Stringer *et al.* 1989.

Their results, compared to the ESR determinations, are presented in Table 4. For sample 521, the U-series and EU determinations are in accordance. In addition, the U-series date for sample 522 is considerably younger than those obtained through ESR. The duplicated runs of sample 856 match well with the EU estimates while the two 854 samples are also younger than the EU determinations, but not by the same order of magnitude when comparing sample 522. The implication is that there may be some danger in averaging the ESR dates since, as McDermott *et al.* (1993) argue, it may be that two faunal stages are present at the site. This idea was originally suggested by McCown and Keith (1939). They noted the possibility of stratigraphic variability between the burials with one group of hominids (3, and 6–10) being earlier than a second group (1, 4 and 5). It seems, then, that part of the occupation at Skhul can be dated to at least 100,000 years ago, if not a bit earlier, but one should not discount the possibility that the cave was utilized at a much later date, perhaps around 50,000 years ago.

Since Tabun, with its very long sequence (Garrod and Bate 1937; Jelinek 1982; Jelinek *et al.* 1973), is often used as the key site for drawing correlations, its chronology is of critical importance but, unfortunately, it is proving the most difficult to date as the various techniques do not always provide corroborating determinations. Determinations were first made through ESR (Grün *et al.* 1991) and the results for the Mousterian levels of the cave are presented in Table 5. While there are considerable differences between the LU and EU dates (the former are anywhere from 17% to 20% older than the latter) the LU determinations were considered to be the more reliable estimates in this particular study.

McDermott *et al.* (1993) suggest that it is the EU dates which most likely represent the true ages of the various levels. This is based on what they see as strong correlations between

TABLE 4
Comparisons of U-series and ESR dates (kyr) from Skhul, Layer B[a]

Sample	U-series	ESR	
		EU	LU
521DE	80.3 ± 0.6	88 ± 13	102 ± 18
522EN	40.4 ± 0.2	68 ± 05	98 ± 11
854DE	41.4 ± 0.4	55 ± 05	65 ± 05
854EN	43.0 ± 0.5	55 ± 05	65 ± 05
856DE(1)	43.5 ± 0.1	46 ± 05	66 ± 05
856DE(2)	45.5 ± 0.7	46 ± 05	66 ± 05

[a] After McDermott *et al.* 1993.

TABLE 5
Average early uptake (EU) and linear uptake (LU) ESR ages (kyr) for the Mousterian layers of Tabun Cave[a]

Layer	EU	LU
B	86 ± 11	103 ± 16
C	102 ± 17	119 ± 11
D	122 ± 20	166 ± 20

[a] After Grün *et al*. 1991.

TABLE 6
Comparisons of U-series and ESR dates (kyr) from Tabun Cave[a]

Layer/Sample	U-series	ESR	
		EU	LU
B/550DE	590.7 ± 23	76 ± 14	85 ± 18
C/552DE	105.4 ± 2.5	111 ± 30	113 ± 31
C/551DE	101.7 ± 1.3	121 ± 29	134 ± 36
C/551DE	97.8 ± 0.4	121 ± 29	134 ± 36
D/556EN	110.7 ± 0.9	93 ± 12	152 ± 24

[a] After McDermott *et al*. 1993.

their U-series dates and those based on the early uptake ESR dates (Table 6). According to these authors, the dates for the samples from Layers C and D are well within the error ranges for the ESR determinations based on EU. They offer no explanation for the discrepancy in the Layer B dates.

More recently Mercier *et al*. (1995) have dated the Tabun sequence with TL of burnt flints resulting in dates that vary considerably from those provided through other means (Table 7). The dates are shown in this table with regard to Jelinek's (1982; Jelinek *et al*. 1973) stratigraphic column and their correlations to Garrod's layers. These dates are exceptionally older than any of those determined by ESR or U-series and essentially push the beginning of the Mousterian sequence from Layer D into Oxygen Isotope Stage 8 with Layer C falling toward the end of Stage 7.

Within this context, mention should be made of a site from the El-Kowm region of Syria, Hummal (Copeland 1985; Copeland and Hours 1983; Hours 1983). This assemblage, referred to as the Hummalian, is found within a stratigraphic sequence similar to Layer D of Tabun, between Yabrudian and Type C Mousterian horizons. The industry, like that of Tabun D, is characterized by a blade technology and the production of elongated points but the Levallois technique is absent. Three TL determinations from this layer gave an average date of

TABLE 7
Average TL dates for the Mousterian levels at Tabun Cave[a]

Jelinek's Unit	Garrod's Layer	Age
I	C	171 ± 17
II	D/C	212 ± 22
V	D/C	244 ± 28
IX	D	263 ± 27

[a] After Mercier *et al*. 1995.

104 ± 9 kyr that is in agreement with the dates given by McDermott *et al*. (1993) for Layer D of Tabun.

Another hominid-bearing site that has been dated is Amud. The first ESR analyses (Grün and Stringer 1991) yielded dates of 42 ± 3.0 kyr (EU) and 49 ± 4.0 and 50 ± 4.0 kyr (LU). These are somewhat problematic in that the precise provenance of the samples is not known. Moreover, these are in contrast to recently obtained TL dates (Valladas *et al*. 1999) which indicate that the entire sequence in the cave encompasses a range of 70,000 to 50,000 years and the layers containing the Neanderthal remains average to approximately 57,000 years ago.

There are a few other dated assemblages. The Mousterian site of Quneitra, located in the Golan Heights, has provided an average linear uptake ESR date of 53.9 ± 5.9 kyr (Ziaei *et al*. 1990). In addition, two assemblages from southern Jordan, Tor Faraj and Tor Sabiha, have been dated through amino acid racemization (AAR) on ostrich egg shell to 69 ± 6.0 kyr (Henry and Miller 1992). Th/U determinations on the same samples gave two aberrant dates (ca. 30,000 years) and one, 62.4 ± 14 kyr, which is in agreement with the AAR dates while three TL determinations on burned flint gave results of 43.8 ± 2, 47.5 ± 3 and 52.8 ± 3 kyr (Henry 1988). Together, the dates range from 44–69 kyr and have an average of ca. 55,000 years. Also from Jordan is Site 634 (Ain Difla) that contains a Middle Palaeolithic sequence of greater than two meters depth. A TL date of 105,000 ± 15,000 has been reported for the top of the sequence (Schuldenrein and Clark 1994). In addition, four ESR dates from this site (Clark *et al*. 1997) have yielded an EU range of 88.3 ± 11.5 to 114.9 ± 14.2 kyr with an average of 102.9 ± 12.9 kyr and an LU range of 142.8 ± 20.7 to 185.6 ± 26.6 kyr with an average of 162.2 ± 18.2 kyr (LU). The combined dates give an overall range of 90 to 180 kyr. The site of Nahal Aqev in the central Negev has been indirectly dated. Artifact-bearing travertines in the vicinity of the site were dated through U-series and gave a probable age of 80 ± 10 kyr for the Mousterian occupation of the Negev (Schwarcz 1979, 1980). Finally, mention should be made of recently obtained dates for Layer E of Hayonim Cave (Bar-Yosef 1998; Schwarcz and Rink 1998; Valladas *et al*. 1998). The lower part of this layer, with a Tabun D type of industry, has provided average ESR dates of 241 ± 11 (EU) and 257 ± 6 (LU) kyr while the upper part, with an assemblage like that of Tabun C, gave average dates of 164 ± 15 (EU) and 171 ± 17 (LU) kyr. Thermoluminescence dating of burned flint yielded averages of ca. 200,000 and 150,000 years for the lower and upper portions respectively.

It is an understatement to say that there are discrepancies in these dates, discrepancies that lead to several scenarios of interpretation. One approach to be taken is that proposed by McDermott *et al*. (1993) who see strong correlations between early uptake ESR dates and those derived from U-series. There is some merit to such an approach since such correlations tend to validate and confirm the dates. This would place the Tabun D assemblage in Oxygen Isotope Stage 5. On the assumption that the TL and ESR dates for Ain Difla and the U-series determinations for Nahal Aqev are reliable, the implication is that the Type D Mousterian lasted for a considerable time continuing into stage 4 to approximately 80,000 years ago. The Type C Mousterian, as seen in Layer C of Tabun, Qafzeh and Skhul also appears in stage 5 around 100,000 years ago but has a considerably shorter span, also ending near 80,000 years ago. The fact that these two groups of industries are at least partially contemporaneous is of significance and is counter to some other interpretations. Bar-Yosef (1994), for example, has proposed using the sequence from Tabun as a basis for correlation with other sites. On this basis he argues that the Negev assemblages should be viewed as contemporaneous with Tabun

D because of the similarities between the lithic assemblages, leading to the suggestion that sites such as Rosh Ein Mor and Nahal Aqev should fall within stage 6 or 8 (Bar-Yosef 1992, 1995). There seems no reason, however, to reject totally the later dates for the Negev and Jordanian sites and that contemporaneity between two cultural traditions should be seen as a viable interpretation of the available information. It is generally accepted that this part of the world saw at least two parallel traditions during the Upper Palaeolithic (Gilead 1981, Marks 1981b), the Ahmarian and the Aurignacian, and it seems reasonable to expect a similar picture for the Middle Palaeolithic. If very early radiometric dates for the Negev sites were to be obtained at some point in the future, then Bar-Yosef's proposal would seem to be the more acceptable.

Another approach would be to accept the very early TL dates for Tabun and place the beginning of this sequence into stage 8. This would mean that the temporal range for this kind of industry would be extended considerably, again on the assumption that the Negev dates are correct. This scenario, too, would call for some level of contemporaneity between the D and C types of Mousterian. There is at least one major reservation, though, which makes accepting this approach difficult. It is only at Tabun where the discrepancies between TL and ESR dates are of such an order of magnitude. At no other site dated through both techniques have there been differences of close to 100,000 years. At the same time, these early determinations cannot be rejected out of hand because similar dates have recently been reported for the lower part of Layer E of Hayonim Cave, which also contains a Tabun D type assemblage (Bar-Yosef 1998; Valladas *et al*. 1998).

Mention has yet to be made of the Type B Mousterian as represented at Layer B of Tabun, Kebara, Quneitra, Amud, Tor Faraj and Tor Sabiha. Except for Tabun, these sites are strong evidence that this type of assemblage is the latest Middle Palaeolithic manifestation in the region, more or less bridging stages 4 and 3 of the oxygen isotope record. This would mean that it does not really overlap with the other two assemblage groups. The difficulty lies in the placement of Layer B of Tabun. The ESR dates would place it within the same range as Qafzeh, Skhul, and Ain Difla, and only slightly younger than Layer C of Tabun. This, again, may indicate contemporaneity between the three types of assemblages. On the other hand, the single U-series date from this level is more in line with the Kebara and other similar lithic assemblages suggesting that this layer, too, belongs to the later part of the sequence.

In spite of the numerous dates available and attempts at cross-validation through the application of multiple techniques, it is not yet possible to say that the chronological framework for the Middle Palaeolithic of the Levant is well established. There do seem to be enough consistencies, however, to state that the relative chronological placement of the three cultural entities is fairly well set. Even if the sequence does begin somewhere during stage 8, the Types D and C Mousterian would still partially overlap and it would not be an overwhelming surprise if such early dates were found for Type C assemblages. Establishing the initial appearance of the Mousterian in this region, then, is of major concern as is further verification of existing dates. Clearly, there is a need to refine the techniques employed and search for explanations why, in some cases, relatively strong correlations can be found between them while in others the deviations between them are so great that they tend to negate each other.

HOMINID ASSOCIATIONS

Given this general cultural/chronological framework, the issue to be dealt with now is where to fit the various fossil hominids into the picture. Perhaps it is best to begin with what, for the present, is definite. To date, there are no human remains, neither Neanderthals nor early moderns, associated with the Type D Mousterian assemblages. Even this absence of data raises some interesting scenarios. If the more conservative dating scheme is accepted, then it is possible that either or both of the known hominids of the period were responsible for this group of assemblages. On the other hand, if the assignment of these assemblages to stage 8 should be confirmed, the possibility of early moderns being present would be negated: this simply pre-dates the appearance of anatomically modern humans anywhere in the world by some 150,000 years. It is worth noting here that technologies emphasizing blade production are known from the Middle Palaeolithic of Europe (Conard 1990; Cook 1989; Otte 1990; Revillion and Tuffreau 1994) first appearing in stage 6 and being especially well documented in stage 5. Chronologically, these do not approach the early Tabun dates but they considerably pre-date the appearance of anatomically modern humans in Europe.

When considering those sites and assemblages that have yielded hominid remains, the situation is more complex. Some, such as Bar-Yosef (1994), have proposed correlations that would attribute Neanderthals to Type B assemblages and anatomically moderns to Type C assemblages. This is based on the association of Neanderthals at Kebara and Amud (Type B) and of early moderns at Skhul and Qafzeh (Type C). There is some merit in such a proposal for it offers a possible explanation for the technological variability seen between the two assemblage groups. On the assumption that anatomically differing populations would exhibit varying behaviors, it could be expected that each would manipulate raw materials and derive production strategies according to their own needs and preferences.

The question is how well this proposed correlation holds up and, once again, it is Tabun that presents difficulties. The finds from Layer C of the cave (McCown and Keith 1939) include the Tabun I partial female skeleton, the Tabun II complete mandible, a femoral shaft (Tabun III) and wrist and hand bones (Tabun IV–VI). The debate centers on the Tabun I skeleton, not on its recognition as a Neanderthal, rather with regard to its stratigraphic placement. Garrod (Garrod and Bate 1937) assigned it to Layer C but stated that, because it was near the top of the layer, it could well be intrusive from the overlying Layer B, an interpretation most recently presented by Bar-Yosef and Callender (1999). Jelinek (Jelinek *et al*. 1973), has argued that this same skeleton could have originated in Layer D. Jelinek's thinking was based on the fact that the Skhul assemblage was similar to that from Layer C of Tabun. Since the former was associated with anatomically modern humans, and on the assumption that Neanderthals preceded anatomically modern humans, then Tabun I must predate both the Skhul and Layer C assemblages. Historically, then, this particular find has been moving within the Mousterian sequence of the cave. A very possible solution has been offered by Trinkaus (1993a) who has examined the right hand and wrist bones, Tabun IV–VI. In that they are essentially mirror-images of the same left hand bones from Tabun I, the indication is very strong that the skeleton does, indeed, belong to Layer C.

The Tabun II mandible is also controversial. In this case, there is no argument regarding its provenance and it definitely belongs within Layer C. However, there are those (McCown and Keith 1939: Stefan and Trinkaus 1998; Trinkaus 1983, 1987, 1993a) who see this specimen as representing a Neanderthal while others (Quam and Smith 1998; Rak 1998) argue that it more closely resembles the Skhul/Qafzeh hominids and should be classed with them. There is also no debate concerning the location of the femoral shaft that is quite definitely that of a Neanderthal (Trinkaus 1976). More recently, a premolar with typical Neanderthal features has been reported from this same layer (Jelinek 1992).

Considering the femur, the tooth and, more significantly Trinkaus' arguments, there is no doubt that Neanderthals are definitely associated with a Type C assemblage. The uncertainty regarding the taxonomic placement of the mandible presents another dilemma. Classifying it as that of a Neanderthal would add further confirmation to the above statement. If, on the other hand it does represent an anatomically modern human, then there would be a strong argument for contemporaneity between the two populations. In addition, regardless of their stratigraphic position, this scenario would also provide the only cave in which the two types of hominid occur together within a Mousterian context. In all other cases, only one or the other is present. Finally, it is worth noting that, according to Garrod's (Garrod and Bate 1937) description, the mandible is only some 85 centimeters below the skeleton so it is not likely that there is a great difference in their ages given the available radiometric dates.

At this stage it does not seem possible to assign particular hominids specifically to a particular type of assemblage. So far, it is only Neanderthals that are associated with the Type B assemblages but, as argued above, they can also be attributed to the Type C Mousterian, together with anatomically modern humans. This, together with the radiometric chronology, would strongly indicate at least partial temporal overlap, if not full contemporaneity, between the two populations.

There is another solution to the problem of associating hominids and assemblages. This is based on the idea that, rather than dealing with two distinct populations, all of the Levantine Middle Palaeolithic hominids belong to one, very heterogeneous population (Arensburg and Belfer-Cohen 1998). If this is the case, then the technological and typological differences would be the result of a degree of cultural variability within a biological population, exactly as is the case for modern hunter-gatherers.

COMPARISONS

In a recent review of the evidence (Kaufman 1999) it was argued that the cultural adaptations of Levantine Middle Palaeolithic hominids were, in every sense, fully modern and there was no possibility to characterize their behaviors as archaic or proto-cultural. Comparisons between Neanderthals and anatomically modern human through evaluation of lithic technology, subsistence strategies, mobility patterns, burial customs and symbolic behavior showed few, if any, major behavioral differences between them. Such a conclusion, however, varies with the assumption that biologically distinct groups would exhibit varying cultural adaptations. Even though the archaeological data do not reflect this, there is osteological evidence that does indicate variability in the ways the two groups were adapting to their surroundings.

Most of these data have been compiled by Trinkaus (1976, 1983, 1984, 1992, 1993b) who has drawn comparisons between the two on the basis of morphological characteristics such as scapular breadth, radial curvature, ulnar articulations, femoral neck angles and femoral shaft robusticity and shape. These traits are not, according to Trinkaus, genetically determined but they are highly plastic. Morphological variability within each is the result of the levels of stress and mechanical load during stages of development and not once adulthood had been achieved. In other words, the morphological comparisons provide information on varying degrees of locomotor and manipulative activity levels of juveniles and young adolescents that reflect behavioral differences. The general conclusions drawn from these comparisons is that the late archaic Neanderthal children were subjected to more constant and higher levels of stress and mechanical load than were anatomically modern humans. At the same time, 'it is likely that adult activity levels contrasted only in relatively subtle ways between these two groups' (Trinkaus 1993b: 408–409).

How can this variability be explained? A clue may be found in a recent ethnographic study (Hawkes *et al*. 1995) dealing with children's roles in foraging amongst mobile hunter-gatherers. The research centered on Hadza children with comparisons made to !Kung children. It was found that Hadza children, from an age of about 3–4 years, take a very active part in daily foraging activities, both near their camps and at some distance from them. They regularly accompanied adults on forays of 10–15 km on a daily basis. !Kung youngsters, on the other hand, participate little, if at all, in the acquisition of food until they are well into their teens. The variability is partially explained in terms of the kinds and availability of resources as well as the returns gained from the varying resources so that the differences between the two groups reflect diverse cultural adaptations to specific environmental conditions. It would be interesting to see if morphological traits, such as those studied by Trinkaus, covary with these two subsistence strategies. It would not be expected that the same ranges of variability seen between Neanderthals and moderns, but some level of differentiation would strongly support Trinkaus' conclusions. In any case, while not specifically mentioned in Hawkes *et al*., there is an implication that different things were expected of children in each of the cultures, lending credence to the very reasonable suggestion that the differences between Neanderthals and early moderns 'may well lie more in the social organizational sphere than in the archaeologically-more-visible technological and subsistence patterns' (Trinkaus 1993b: 411). In this regard, if the argument presented by Arensburg and Belfer-Cohen (1998) is accepted, we are seeing here another form of cultural variability within a single biological population in addition to the technological and typological variability referred to earlier.

In this same paper Trinkaus (1993b) offers another explanation related to differentials in duration of occupation at sites inhabited by members of each group. Analyses of micromammalian faunal assemblages (Tchernov 1984, 1991, 1998) showed much higher frequencies of commensal rodents at Qafzeh than at Middle Palaeolithic sites with associated Neanderthals such as Kebara or Tabun. Their relatively high frequencies at Qafzeh indicate longer periods of occupation at this site. The conclusion is that the occupants of Qafzeh, and by association Skhul, were considerably less mobile on a daily basis than were the archaic hominids of Kebara and Tabun.

Drawing on Trinkaus' studies, Lieberman and Shea (1994) have offered another explanation for the observed morphological variability that also involves concepts of mobility and settlement. The model they present incorporates earlier works on seasonality (Lieberman 1993) and lithic assemblages (Shea 1988, 1989). The analysis of tooth cementum increments from samples of gazelle, red deer, fallow deer and aurochs allow estimates of the season during which the animals were hunted. On this basis it was found that the occupations at some sites (Tabun C and Qafzeh XVI–XXI) were of relatively short, single-season duration while others (Tabun B and Kebara VII–X and Qafzeh XV) indicated multi-season occupations. The analysis of the assemblages was specifically intended to provide a measure of the dependency on hunting done from the various sites. This was determined through comparing the frequencies of impact fractures on tools and the ratios of Levallois points to other Levallois elements. The highest incidence of impact fractures and points occurred at Kebara IX–XII, Tabun B and Qafzeh XV, while such implements were less well represented at Tabun C and Qafzeh XVII–XXIV.

There is an apparent correlation, then, between hunting intensity and duration of occupation, with considerable more hunting taking place from multi-season sites. This leads to the suggestion that multi-season camps were part of radiating or logistically organized systems while the single season sites indicate a system of circulating, residential mobility. Finally, Lieberman and Shea attempt to correlate fossil hominids with this dichotomy and place the Neanderthals within a logistical system and anatomically modern humans within a circulating system. They suggest that the reduced mobility levels that characterize logistical systems would require 'significantly higher daily expenditures of effort to acquire less predictable resources such as game' (Lieberman and Shea 1994: 319) and that this is reflected in the documented morphological variability. More frequent and greater reliance on hunting amongst the archaic humans would result in higher levels of stress and subsequent muscular hypertrophy. Since they characterize a circulating system as being more energetically efficient, they contend that anatomically modern humans spent less time and expended less energy in the pursuit of nutrition.

There are some general parallels between the Trinkaus' model and that proposed by Lieberman and Shea but, more importantly, there are some significant contrasts. For example, there is agreement that the data from the lower levels of Qafzeh are suggestive of lower levels of energy expenditure. However, they arrive at this conclusion on very different grounds. Recall that Trinkaus, drawing on the micromammalian assemblages, argues for a long-lasting occupation that would result in reduced mobility thus indicating that a radiating or logistically organized system is the more efficient. This is in direct opposition to the reasoning presented by Lieberman and Shea who argue that the same layers at Qafzeh are associated with circulating mobility that, for them, is the most energy efficient. Part of the problem here is with the seeming lack of correspondence between the seasonality data obtained from the analysis of cementum intervals and those from the micromammals (Tchernov 1984, 1991). The former is phrased in terms of seasonality while the latter refers to duration of occupation. It could be expected that the multi-season pattern is the result of numerous, short-term reoccupations in the cave throughout the year while a single season occupation could be of considerable duration. An additional paradox is the interpretation regarding energy efficiency when comparing the two systems of mobility. There is no agreement as to which requires greater expenditure on a regular daily basis resulting in higher levels of stress.

This is not meant to negate the existence of different kinds of settlement systems in the Middle Palaeolithic. There is archaeological evidence for them (Kaufman 1999, and references therein) and for a mix of the two strategies. This has also been documented ethnographically (Binford 1980) and applies to Qafzeh, as well. Recalling that Layer XV of Qafzeh was seen by Lieberman and Shea as representing a less mobile setting, then it must be assumed that, for some reason, mobility patterns shifted through time. As there is no evidence for Neanderthals at this site, this shift must be attributed to anatomically modern humans who were able to utilize both levels of mobility when needed.

Other questions arise concerning the Lieberman/Shea hypothesis. One of these relates to their inclusion of Tabun Layer B in their study. The problem here is that this layer may not represent an occupation. Jelinek (Jelinek *et al*. 1973) noted that during the time of deposition of this layer, the chimney of the cave had achieved its full dimensions making the cave much less suitable for habitation. He argues that the site had shifted function and had become a hunting station, with animals being driven into the chimney. This certainly corresponds with the fact that the lithic assemblage from Layer B has the highest frequencies of points and impact fractured tools (Lieberman and Shea 1994) and that the faunal assemblage is heavily dominated (> 75%) by fallow deer (Garrard 1982; Garrod and Bate 1937). That hunting took place here throughout the year is highly probable but this does not mean that people were living in the cave for extended periods at this time. If this is the case, it would counter those arguments (Bar-Yosef and Callander 1999) that the Neanderthal burial in Layer C is intrusive from Layer B.

Finally, there are problems in correlating hominid taxa with contrasting mobility strategies (Belfer-Cohen 1993; Trinkaus 1993a). For example, at least some, if not all of the hominid remains from Layer C of Tabun can be classified as Neanderthals. However, the faunal and lithic characteristics, according to Lieberman and Shea have all the hallmarks of an adaptive strategy corresponding to anatomically modern humans. This would lend credence to the idea that any of the hominids could very well have used either or both of these two systems in varying mixes. Therefore, there is no possibility to assign a particular hominid group to any of those sites from which no human remains have been recovered.

So, is there a cultural/behavioral explanation for the morphological variability that distinguishes between archaic and early modern humans? The conflicting evidence and approaches presented above would indicate that we have yet to resolve this problem and that the solution is not necessarily to be found with direct reference to subsistence and procurement strategies or patterns of mobility. Bar-Yosef (1993: 134) has made the observation that the bio-mechanical differences between the two groups 'resulted from activities not registered in the archaeological record.' For the moment, it seems that Trinkaus' (1993b: 411) statement referred to earlier that the key is to be found in the realm of social organization within the framework of subsistence activities is supported by the comparisons drawn between the Hadza and !Kung.

INTERACTIONS

With regard to the question of interactions, there is no question that both early modern and archaic hominids were present during the long Middle Palaeolithic period in the Levant and the possibility of them coming into contact must be taken into account. One point to be stressed is that at all those sites from which hominids have been found, the remains were of one population or the other. The notable example is Layer C of Tabun where there is a continuing debate over the taxonomic placement of the isolated mandible (Trinkaus 1983, 1987, 1993a; Rak 1998). The apparent pattern is one suggesting some degree of separation, at least to the point that burial places were not shared. There is no reason to assume that Neanderthals were burying their dead in sites occupied by early moderns, or the reverse, and it seems reasonable to infer that the burials represent the living populations of each site. A degree of segregation regarding some cultural behaviors does not necessarily imply complete isolation. As an illustration, we can return to the three industrial variants or facies recognized within the Levantine Middle Palaeolithic. It was shown earlier that each tended to emphasize rather specific technological orientations but, at the same time, there were common elements amongst them. Further, the chronological evidence strongly suggests that there was at least partial contemporaneity between the Types D and C, on the one hand, and some overlap between Types B and C. The point is that those common technological characteristics could very well have been the result of the movement of ideas and even materials between different groups. It must be emphasized that this does not prove or disprove that the interactions took place between the two hominid taxa involved because of the lack of correlation between taxa and assemblage types. There is simply no way of knowing if communication was, or was not, restricted to those of similar appearance. The fact that the manufacturers of the Type D assemblages are unknown further complicates this issue. The available information from the region does not yet allow for a resolution of this problem.

However, there are intriguing bits of evidence and ideas from Europe that may shed light on the Levantine situation. These relate to the chronological overlap (Bischoff *et al*. 1989; Cabrera and Bischoff 1989; Harrold 1989; Leroyer 1983; Mercier *et al*. 1991; Otte 1990) between the Châtelperronian and the early Aurignacian and the occurrence of items of personal decoration in each. There are those who would explain away this phenomenon as simply a case of acculturation with the Neanderthals adopting a number of cultural concepts and behaviors from their culturally advanced Aurignacian neighbors (DeMars and Hublin 1989; Farizy 1990; Harrold 1989; Mellars 1989; Stringer and Gamble 1993; and see Allsworth-Jones 1990 for similar arguments concerning central and eastern Europe). Mellars (1989: 376), for example, in rejecting the possibility that items of personal adornment were spontaneous innovations of the Châtelperronians, argues that their appearance implies 'at least *some* form of social or cultural interaction between the Aurignacian and Châtelperronian populations' (italics in original). Unfortunately, we do not yet know who those Aurignacians were, as skeletal remains from the earliest phase of this period are lacking (Gambier 1989; Frayer and Wolpoff 1993; Wolpoff 1994). While later stages of this period are associated with anatomically modern *Homo sapiens*, this does not automatically mean that those of the early stage were more biologically evolved than their Châtelperronian counterparts. Wolpoff (1994: 99) has suggested that there is a real potential for future discoveries of Neanderthals in early Aurignacian contexts, since anatomically modern remains have never been associated with this period. If the early Aurignacian was the handiwork of late Neanderthal groups, then the distinction between this lithic tradition and the Châtelperronian is indicative of technological variability and adaptive flexibility being exhibited by a single biological population (Kaufman 1999).

Allsworth-Jones (1990), on the other hand, makes a very strong argument of contemporaneity between the Szeletian of eastern Europe and the early Aurignacian together with an equivalent overlap of their respective hominid remains, Neanderthals and moderns. He suggests that, like the Châtelperronian and probably the Uluzzian of Italy, the 'Szeletian was the product of an acculturation process at the junction of the Middle and Upper Palaeolithic' (Allsworth-Jones 1990: 235).

There are, then, indications for interaction and communication between Neanderthals and their contemporaries in Europe. In this regard, though, mention must be made of a recent reassessment of Châtelperronian and Aurignacian chronologies (d'Errico *et al*. 1998; Zilhão and d'Errico 1999). These authors argue that the Châtelperronian preceded the Aurignacian and that there was no overlap between the two. This would lend credence to the argument that the Neanderthals associated with the Châtelperronian had attained a fully modern level of cultural and cognitive development without input from anatomically modern hominids (Kaufman 1999). This further supports the argument made above that there is a strong basis to argue that the cultural adaptations of both of the Levantine Middle Palaeolithic hominid groups could be considered as fully modern (Kaufman 1999), indicating no differences with regard to mental and cognitive capabilities.

On the assumption that the notion of social and cultural interaction is correct, possibly for Europe and more likely for the Levant, must it also be assumed that the exchange of ideas flowed in one direction only? Could not the early Aurignacians (assuming they were indeed anatomically moderns) have adopted some of the concepts of personal adornment from the Neanderthals of the Châtelperronian? Could not the early anatomically modern humans of the Levant acquire ideas of technology and burial customs from their Neanderthal counterparts? Most anthropological definitions of acculturation note that cultural traits are passed in both directions, even when one group is dominant (Howard and Dunaif-Hattis 1992) and, as correctly noted by Graves, acculturation 'suggests a sociocultural level of recognition and that the two populations had similar cognitive capacities' (1991: 525). In this regard, Harrold's (1989: 702, Table 33.8) comparisons of the Châtelperronian and Early Aurignacian are of relevance. Coloring materials are more abundant in Châtelperronian assemblages and they contain types of incised stone and pendants that are not found in the Aurignacian. In that these latter items are unique, they cannot be viewed as the products of borrowing. Further, as Bednarik (1992) and Marshack (1988) have shown, there are examples of objects likely to have served as items of personal decoration dating well into the Middle Palaeolithic, indicating a tradition of long history. While these items are relatively rare, there seems no reason to reject them out of hand; it may well be that their relative scarcity and uniqueness are what bestowed value and significance on such objects (Kaufman 1999). In this regard, it is worth recalling that Bordes (1972) was able to demonstrate technological and typological continuity between the Châtelperronian and its Middle Palaeolithic predecessors. If these Neanderthals were capable of passing on and varying their lithic traditions, then they were just as able to pass on other cultural traditions and there is no need to argue that these traits were simple emulations of Aurignacian behaviors.

It seems, then, that there is every possibility for cultural interaction between biologically differing groups. Significantly, for the case of southwest Asia, such interactions would have fulfilled an essential adaptive role. Again, on the assumption that Neanderthals and anatomically modern humans were sympatric species, they would have been in competition for available resources placing each at risk. However, social interactions would have allowed for the establishment of reciprocal obligations with mutual reciprocity serving to guarantee access to resources and reducing risk (Cashdan 1983; Root 1983; Wiessner 1982a, b). It must be remembered that we are dealing here with large-brained, intelligent hominids that exhibited fully modern modes of cultural behavior (Kaufman 1999). There seems no reason to reject the notion that, rather than competing with each other, they were fully capable of cooperating in order to ensure mutual survival. This seems even more likely if we accept the hypothesis of one single biological population as presented by Arensburg and Belfer-Cohen (1998).

One further scenario concerning interactions must be considered. Let us assume that Rak (1998) and Quam and Smith (1998) are correct in assigning the Tabun C mandible to anatomically modern humans. In addition to confirming contemporaneity between them, it would enhance those arguments for interaction between the two populations. In this case it would mean that, not only were ideas and technological concepts being exchanged, but there was intercommunal movement of people and some fluidity in group composition. Certainly, additional co-occurrences of the two hominid types in a single context are required to verify this, but it must be taken as a distinct possibility.

This, in turn, raises one further question. If people were moving about, were they also exchanging genes in addition to the material and behavioral aspects of their culture? This is a debate of long standing, centering on the question of whether or not modern genotypes are the result of a Neanderthal contribution. If interbreeding did take place and viable offspring were produced then the Neanderthals and their partners would have to be considered as members of the same biological species. Unfortunately, there is no consensus of opinion regarding this question, with genetic studies resulting in interpretations which differ from those derived from analyses of the skeletal materials.

Recently, Krings *et al*. (1997) concluded that the Neanderthals were genetically distinct from modern humans. In this study a mitochondrial DNA (mtDNA) sequence was successfully extracted from the Neanderthal bones discovered in Germany in 1856. Comparisons showed that the Neanderthal sequence lay well outside the range of modern human mtDNA variability, indicating that for this part of the modern genetic makeup there was no possibility for a Neanderthal contribution: all of which supports the notion of separate and distinct species.

On the other hand, there is the recently discovered skeleton of a child found within an Upper Palaeolithic context in Portugal (Duarte *et al*. 1999). The skeleton is exceptional in that it exhibits a unique mosaic of both archaic and modern traits. The authors conclude that such a combination of morphological characteristics can best be explained through admixture between early modern humans and Neanderthals. They further stress that the child was not the result of a rare Neanderthal/early modern union but the descendant of extensively admixed populations, implying a long history of hybridization.

CONCLUSIONS

If the notion of biological incompatibility between Neanderthals and anatomically modern humans is accepted, it may explain in part the degree of isolationism noted above for the Levant, at least as far as the exclusive use of caves is concerned. However, it does not negate the possibility of other kinds of interaction between the two hominid types, particularly with regard to the establishment of systems of reciprocity. Alternatively, if one accepts the possibility of biological compatibility, the case for social interaction becomes even stronger and provides support for inter-group movement as suggested for the case of human remains from Tabun Layer C.

In sum, several scenarios have been suggested which may describe and explain the morphological variability and possible interactions between two hominid taxa. For the moment, since it is yet impossible to fully confirm or refute any of them, all must be viewed as viable options.

Acknowledgements

I wish to thank my colleagues Mina Evron and Avraham Ronen for their constructive comments on an earlier version of this manuscript. Also, part of the research for this paper was carried out while on sabbatical at the Department of Anthropology, University of New Mexico and my appreciation is given to all members of the department for their hospitality and interest in the project. Partial funding was provided by the Zinman Institute of Archaeology and the Research Authority of Haifa University.

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