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PEOPLE OF THE HOLY LAND FROM PREHISTORY TO THE RECENT PAST

Patricia Smith

For approximately the first million years of settlement, the archaeological record for Israel shows that people were hunters and foragers, with limited technological resources, and needing a high degree of physical fitness and strength for survival. The climatic changes occurring during the Middle and Upper Pleistocene modified selective pressures operating on the human populations of Israel and surrounding regions. Marked shifts occurred in the distribution of African versus Asiatic biotypes and the human populations may have moved with them. If early hominids did not retreat south in response to cold spells, they would have had to cope with changing food resources and increased seasonality in their availability. Climatic change would also have affected the ability of these early hominids to survive. Many of the long-term physiological and morphometric adaptations favorable to survival in a hot climate are disadvantageous in a cold climate. Under such conditions both population movement and the development of new adaptive strategies may have occurred. Indeed, it has been suggested that the early Mousterian populations of Israel did not, in fact, adapt to changing climatic conditions, but migrated as did many of the other mammals. According to the proponents of this hypothesis, population replacement rather than evolutionary trends *in situ* account for the phenotypic changes recorded in the Mousterian of Israel.

The technological explosion that began in the Upper Paleolithic was associated in Israel with a marked change in subsistence strategies, causing a major shift in dietary adaptations and behavior. Hunting patterns changed, partly in relation to the changing biotype and partly in relation to new technologies. Grinding stones, querns and mortars appearing in Kebaran and Natufian sites are indicative of new ways of preparing food. The advent of agriculture and animal domestication in the Neolithic, produced a further shift in the pattern and intensity of selective pressures, that accelerated in response to the new developments of the Chalcolithic and recent periods. The characteristics that make a successful hunter are not necessarily those that make a successful farmer, tradesman or statesman. Deficiencies in body size and physical fitness are less critical for survival, and can be compensated for by improved technology, the use of pack animals and servants or slaves.

The development of agriculture and animal domestication in the Neolithic, greatly modified the relative quantity and availability of food staples utilized, while the introduction of pottery at the end of this period facilitated new methods of food preparation, and specifically the preparation of soft, boiled foods. These changes further modified selective pressures affecting human populations. However, the advantages of a more reliable food supply were partially offset by the associated increase in disease rates. The aggregation of large numbers of people in permanent or semi-permanent settlements facilitated the spread of disease. The absence of adequate methods of sewage and garbage disposal resulted in an increase in pests as well as contamination of water supplies. Use of stored foods meant greater susceptibility to infection through food spoilage or contamination from pests, as well as a reduction in its vitamin content. Husbandry involving closer contact with animals, increased the risk of infection from animal-borne disease, while milk consumption exposed people to tuberculosis and brucellosis. This scenario of changing environmental pressures constitutes some of the selective pressures operating on the Holocene populations of Israel. However, Israel has also been the scene of repeated migrations, that have contributed to admixture and/or population replacement at various times. The evolutionary trends that have taken place in the populations of Israel, in relation to changing adaptations, need to be examined critically and distinguished from change through gene-flow in all periods.

Population diversity and microevolutionary trends

This synopsis of the prehistoric and historic populations of Israel will focus on two main topics: first, the extent of population diversity in the Middle Paleolithic, and second, microevolutionary trends and population displacement associated with changing adaptations and cultures in the Epipaleolithic to recent periods. Two groups of hominids, one identified as Neandertals and

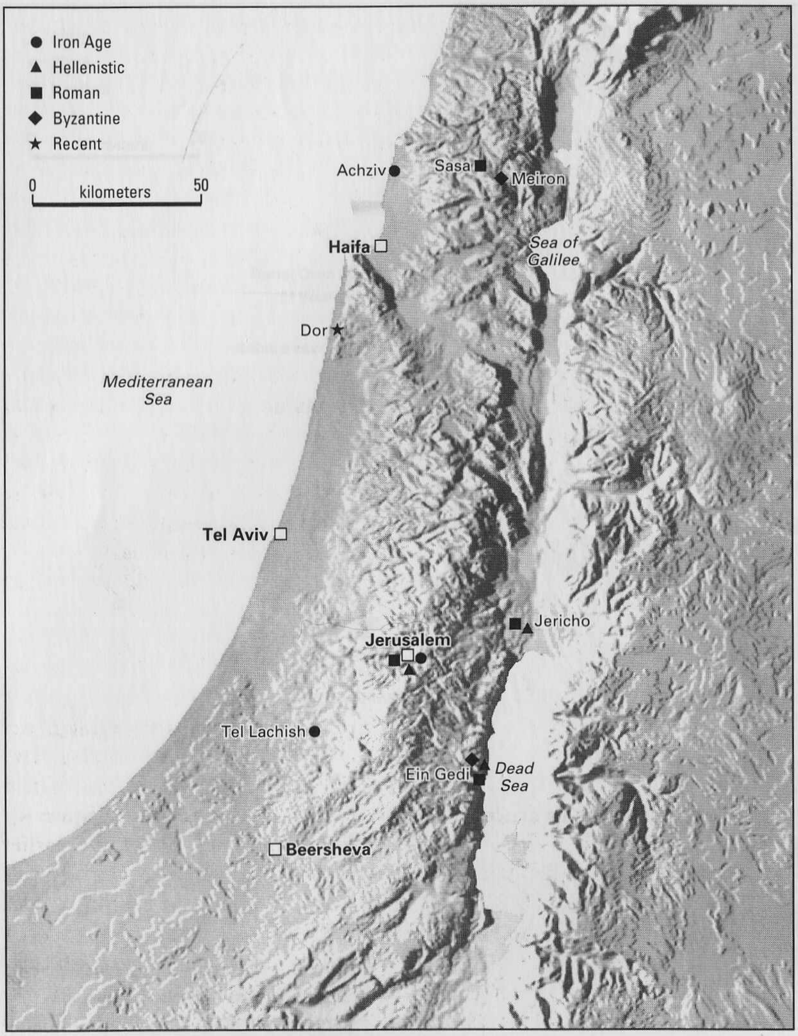


Figure 4 Map showing Iron Age to recent sites with human remains referred to in text

been practiced at Jericho, and Strouhal (1973) reported that one of the plaster skulls examined by him showed evidence of *intra vitum* head moulding. However, most of the illustrations provided by Kurth and Rohrer-Ertl (1981) show clearly that considerable post-mortem deformation had taken place in the Jericho skulls.

Stature in PPNB samples appears to have been similar to that of the Natufians, although the PPNB specimens from Abu Gosh and Beisamoun appear to have been more robust than even the largest Natufians (Arensburg et al. 1978, Soliveres 1978). At Jericho, Kurth and Rohrer-Ertl (1981: 449) report on male stature in the PPNA as 167 cm and in the PPNB as 171 cm. Male stature in the terminal phase of the PPNB at Ain Ghazal (Rollefson's PPNC) was reported as 170.8 cm (Kafafi et al. 1990; Rollefson and Simmons 1985; and Rollefson et al. 1985: 108, Schulz (1987) and Schulz and Scherer (1991) described the terminal PPNB sample from Basta as gracile. The specimens from Basta and Ain Ghazal also appear to have more dental disease – especially calculus and caries – than those from the PPNA or early PPNB sites previously described.

People in the Neolithic also show an increased frequency of ante-mortem tooth loss from severe dental attrition in comparison with the Natufians. Since this condition increases with age, this means either that people lived longer or that the diet became more abrasive (probably from increased carbohydrate consumption) between the Natufian and Neolithic periods. Evidence for such a change in diet between the Mesolithic and Neolithic populations of Abu Hureyra in Syria has now been published by Molleson and Jones (1991), based on SEM studies of tooth wear.

The differences in stature and skeletal robusticity within the Neolithic may also be related to differences in environmental stress and changing lifestyles. Dental hypoplasia, which is one estimate of environmental stress, is present in less than 50 per cent of Natufians and PPNB samples, affected over 90 per cent of the PPNA sample from Hatoula, and appears to increase again towards the end of the PPNB. If the situation at Hatoula proves to be reflected at other PPNA sites, this may indicate a temporary increase in environmental stress in the initial stages of plant domestication, followed by a temporary amelioration of conditions in the earlier phases of the PPNB through the addition of other crops such as legumes, and the beginning of herding. The findings from Basta and Ain Ghazal suggest, however, that the improvement was temporary, and that by the end of the PPNB the quality of life of most people was deteriorating. Recent excavations at Lod, Neveh Yam and Nahal Zohoriya have yielded PN skeletons that are now being analyzed. The results will show if the poor health suggested for the terminal PPNB continued into the PN.

The Chalcolithic and Early Bronze Age: proto-urban and early urban communities

The Chalcolithic–EBI provide the earliest population samples of fully fledged farming communities yet published from Israel. Like the earlier periods discussed, this is again a period of transition in which societies increased in complexity and size, and in which regional differences may have become ever more pronounced (Levy, this volume).

Statistical data presented here for the Chalcolithic and EBI, are based on specimens from Ben Shemen (Lacombe 1980), Nahal Mishmar (Haas and Nathan 1973), Jericho (Kurth and Rohrer-Ertl 1981), Megiddo (Hrdlicka 1938), and unpublished specimens from Arad, Gilat, Shiqmim, Horvat Hor and Wadi Maqoch, shown in Figure 3. In contrast to the earlier periods, where skeletal remains were concentrated in the Northern part of the country, many of these sites are from the Judean desert and Negev. However, preliminary studies have shown that they resemble both the Chalcolithic sample from Byblos on the Lebanese coast described by Ozbek (1974) and the Early Bronze I–II samples from Bab-edh-Dhra in Jordan described by Krogman (1989). This suggests that there were no major genetic differences between populations living in different parts of Israel and those on its northern and eastern borders at this time.

The urbanized populations of the EBII and EBIII are poorly represented by human skeletal remains. In addition to the small sample from Tel Erani, studied by Ferembach (1961b), some EBIII specimens were found at Lachish, but were pooled with the Middle Bronze Age series from the same site for analysis (Giles 1958). The situation with regard to skeletal remains is somewhat better for the EB1V. Sites with human remains examined for this study include Jebel Qaaqir, Givon, Nahal Refaim and Efrat (see Figure 3).

Stature shows little or no change between the Natufian and Chalcolithic to EB periods, averaging 168 cm in males and 155 cm in females. Head form also shows little alteration in shape, but a slight reduction in size (see Table 1 p. 70; Plate 7). Mandibular dimensions decease slightly, but the main difference seen is in tooth size (Figure 6). Tooth size in the Chalcolithic-EBI sample is significantly smaller than that of the Natufians or Neolithic samples in bucco-lingual dimensions, and decreases even further in the EBIV (Figure 6). Dental hypoplasia reached an exceptionally high level in the Chalcolithic, affecting some 90 per cent of individuals studied. These data suggest an exceptionally high level of environmental stress in infancy and childhood. It has not yet been determined to what extent this was diet-related, or reflects an increase in disease load in the wake of increased sedentism and population density. The frequency of dental hypoplasia decreases slightly in the EBIV, suggesting some amelioration of environmental stress at this time.

Middle Bronze populations: the evidence for population displacement

Most of the MBII samples that have been studied are dated to the MBIIB or MBIIC. Specimens studied here are derived from Efrat, Nahal Refaim, Tel Dan, Ganei HaTa'arucha, Megiddo, Sasa and Hazor (see Figure 4). They show significant differences from all of the earlier populations in this region in craniofacial characteristics. In the MBII samples the head is shorter and wider, with a high rounded skull and shorter broader face and nose than in any of the earlier or most of the later populations inhabiting Israel. Statistically significant differences are present in five out of the seven measurements shown in Figure 5, and the direction of change found differs from that to be expected as the result of microevolutionary trends or environmental factors affecting growth and development. The MBII samples studied here then represent an intrusive group, and their characteristics suggest that they originated from a damper and/or more temperate climate than that of Israel. Determination of their exact point of origin is now planned, using DNA analysis.

Late Bronze to recent populations: cultural diffusion versus migration

From the MBII to recent periods the archaeological and written records suggest very rapid change as well as considerable admixture. Space limitations preclude a detailed discussion of all the population samples associated with the different cultures identified, but a brief overview is presented here. For the Late Bronze Age

Table 1 Cranial measurements for human populations in different periods in the Holy Land

	Basion–nasion length			Porion–bregma height			Biasterion width			Cranial length			Cranial breadth		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
Mousterian	—	—	—	2	114.5	—	2	127.0	—	2	199.0	—	2	145.5	—
Natufian	4	97.5	8.1	27	114.5	9.6	3	109.0	6.0	27	191.6	8.3	26	135.7	6.6
Neolithic	—	—	—	*2*	*115.5*	*1.0*	—	—	—	*9*	*183.2*	*8.2*	*11*	*146.9*	*8.3*
Chalcolithic	5	96.6	2.8	15	116.4	6.8	10	106.2	6.8	22	186.5	5.8	21	136.8	5.1
MBI	10	102.7	4.8	12	120.8	7.0	12	108.7	8.3	15	186.9	7.8	13	136.1	4.9
MBII	5	104.4	2.8	3	126.0	5.1	7	112.0	4.0	7	183.7	3.9	7	139.5	5.6
Iron															
Achziv	4	102.7	1.7	4	116.5	0.5	5	116.0	4.1	5	189.2	3.9	5	141.8	5.4
Jerusalem	—	—	—	—	—	—	—	—	—	*5*	*181.4*	—	*4*	*135.0*	—
Lachish	26	101.0	3.8	—	—	—	—	—	—	322	184.5	5.8	327	136.8	5.1
Hellenistic–Roman															
Samaritan	25	100.2	5.7	20	116.4	4.0	21	109.1	6.4	22	181.9	6.2	22	136.8	4.4
Jewish	9	96.2	8.2	8	113.1	7.6	13	115.8	9.3	18	182.2	8.4	19	143.8	4.6
Ottoman	17	105.1	4.0	17	118.4	5.1	17	109.8	3.8	18	183.6	5.4	17	140.0	5.8

	Basion–bregma height			Nasal breadth			Nasal height			Minimum frontal width			Nasion–prosthion height		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD
Mousterian	—	—	—	2	29.0	—	2	54.0	—	2	102.0	—	—	—	—
Natufian	9	138.9	8.0	3	24.0	3.6	2	47.5	0.7	23	96.7	6.1	3	68.6	4.0
Neolithic	—	—	—	*3*	*25.3*	*1.5*	*3*	*48.0*	*4.5*	*8*	*103.3*	*7.9*	*5*	*68.8*	*5.4*
Chalcolithic	13	133.0	5.1	17	25.1	1.8	15	51.8	3.7	20	91.9	3.7	10	69.1	6.2
MBI	11	134.7	9.7	12	22.8	1.2	12	49.8	12.7	14	94.5	4.0	13	68.7	3.6
MBII	5	141.2	4.2	8	23.7	2.2	8	49.1	1.5	7	102.7	16.7	7	61.8	6.3
Iron															
Achziv	4	132.7	4.0	3	25.6	2.0	4	50.0	1.1	3	96.3	5.5	1	67.0	—
Jerusalem	—	*132.7*	—	—	—	—	—	—	—	*8*	*97.1*	—	*5*	*68.0*	—
Lachish	268	133.8	5.0	26	25.0	1.5	26	52.8	3.2	319	95.5	4.2	98	70.1	4.3
Hellenistic–Roman															
Samaritans	20	130.6	4.9	10	25.0	1.3	10	50.1	2.5	21	93.4	6.4	9	66.5	3.0
Jewish	13	128.2	7.9	9	24.3	1.9	8	50.7	3.0	20	98.9	8.7	6	67.5	5.0
Ottoman	17	137.2	5.6	18	24.0	2.1	20	53.2	3.5	17	97.9	4.0	17	69.4	7.9

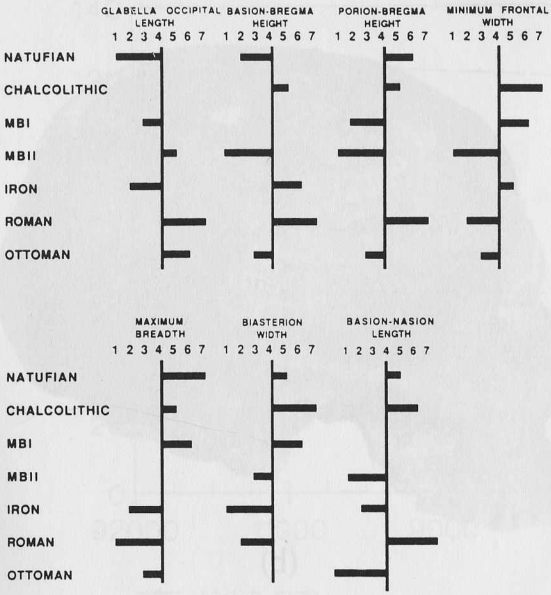


Figure 5 Deviation of different measurements from the common mean (vertical line) are shown as horizontal lines on a scale from 1 to 7. Deviations to the left indicate values smaller than the mean; deviations to the right indicate values larger than the mean. The absence of a horizontal line indicates that the sample mean and group mean were identical

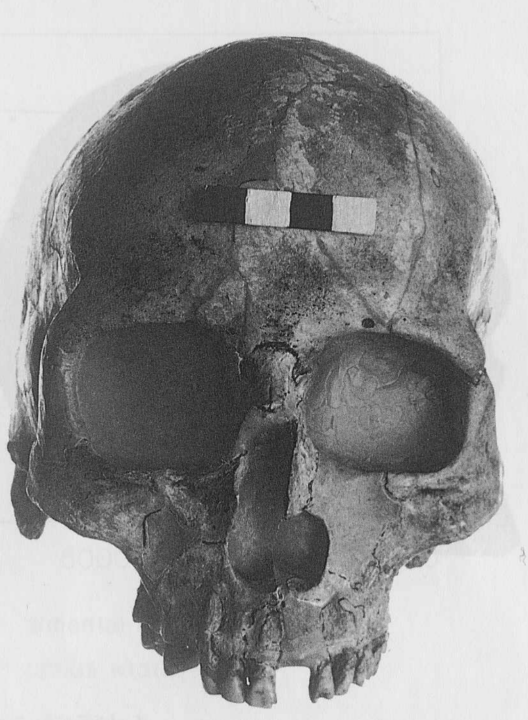


Plate 6 Frontal view of skull from Eynan (Natufian)

there are a few specimens from Megiddo (Hrdlicka 1938) and Tel Dan (Arensburg 1973) that appear to be intermediate in physical characteristics between the MBII and the Iron Age Phoenicians from Achziv. They are, however, too few for detailed analysis and were omitted from the statistical calculations.

The Iron Age is represented by Phoenicians from Achziv (Smith et al 1993), a small sample of First Temple Jews from Jerusalem (Arensburg and Rak 1985) and the large Iron Age sample from Lachish (Risdon 1939). The Iron Age Phoenicians from Achziv most closely resemble the Late Bronze Age sample from Megiddo, followed by the MBII samples, whereas Iron Age Lachish more closely resembles the 'core' population represented both by the pre-MBII populations and by the more recent Arab population. The First Temple Jews from Jerusalem appear to lie between the two, but the sample is too small for rigorous statistical analysis (Plate 8).

For the Hellenistic, Roman and Byzantine periods there are skeletal remains of Jews from sites ranging from the Judean desert in the South to Sasa and Meiron in the North. Of the numerous publications on these populations, that of Arensburg et al. (1981) is the most detailed. Sites with human remains measured for this study are shown in Figure 4. In addition, there is a Samaritan sample from a late Hellenistic site at Wadi Daliya (Wadi ed Daliyeh; Krogman 1974). The Wadi Daliya sample was remeasured for this study and some of the measurements are shown in Table 1. They have remarkably small, narrow heads and most closely resemble the local Arab population. In contrast, the combined Jewish Hellenistic-Byzantine group are, like the MBII sample, an outlier group, characterized by relatively short, broad skulls and faces. They differ from other populations of historic periods discussed here who are characterized by relatively narrow heads and long faces. The distinctive features of the Jewish population from Israel from the Hellenistic through to the Byzantine Period were also commented upon by Arensburg et al (1981). They differ markedly from the Samaritan skulls from Wadi Daliya, which are exceptionally small, but fit into the general shape pattern of the core population and are intermediate between Iron Age Lachish and the Arab population from the Ottomon period.

Conclusions

The data presented above indicates that major evolutionary changes have taken place in the past populations of Israel. The depth of our understanding of the factors associated with these changes is constrained both by the samples available for analysis and our ability to reconstruct their lifestyles. Thus, the morphology of the earliest populations in this region is still unknown and the 'Galilee' skull

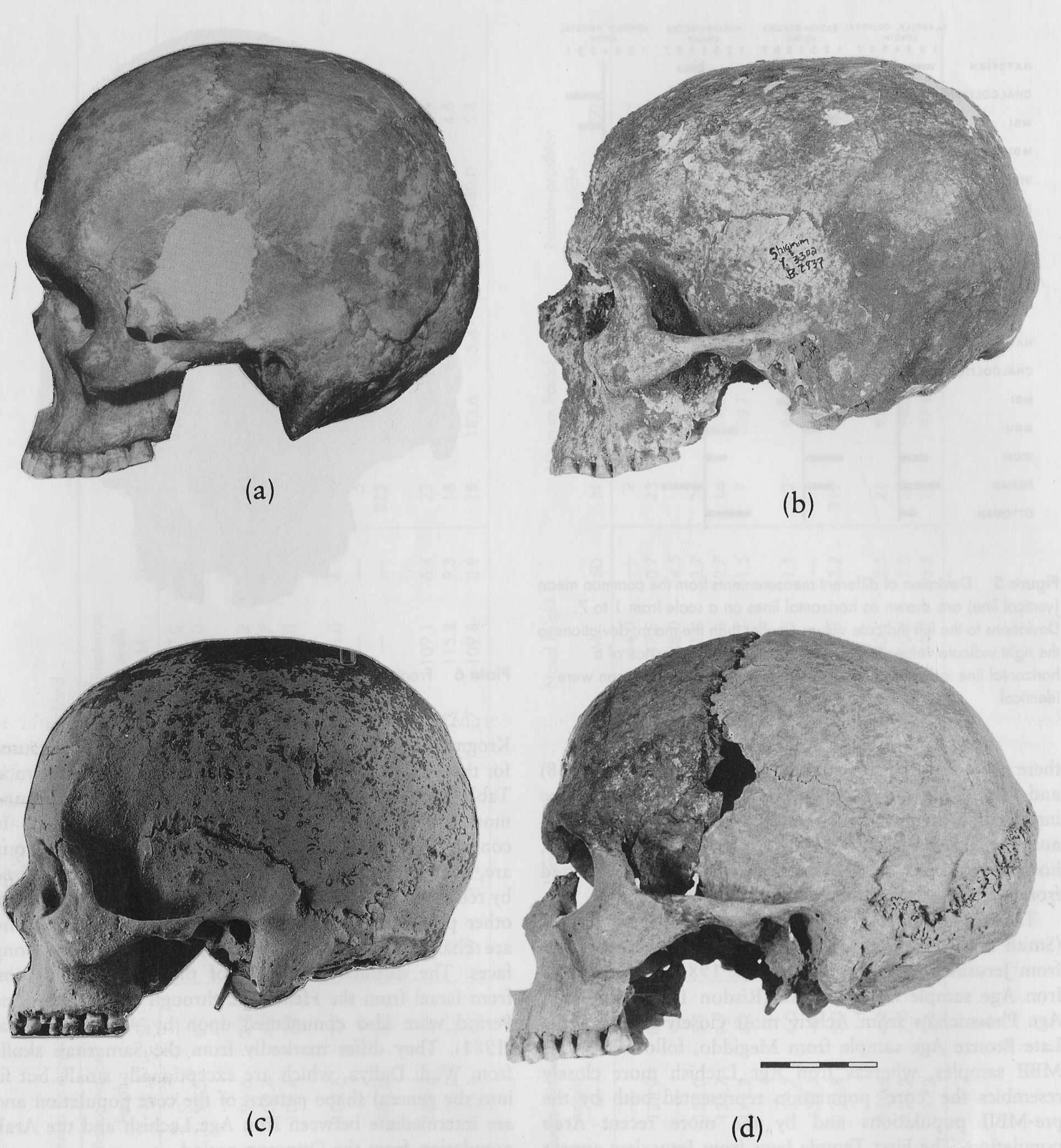


Plate 7 Lateral view of skulls: a) Natufian from El Wad; b) Chalcolithic skull from Shiqmim; c) EBIV skull from Jebel Qa'aqir: d) EBI skull from Kabri. Not all to same scale

provides only a tantalizing glimpse of the peoples associated with the Acheulean culture. The Mousterian samples, while more numerous, are still too few in time and space to provide a detailed record of the evolutionary changes and interactions that led to the emergence of the Upper Paleolithic populations. There are still numerous unanswered questions regarding the relationship of Neandertals and *Homo sapiens sapiens* Mousterian hominids in Israel and those elsewhere in the world. In spite of these deficiencies, the Mousterian hominids do provide a starting point from which to estimate the pattern and rate of change that has occurred in different skeletal parameters.

Stature is at its maximum in the early *Homo sapiens*

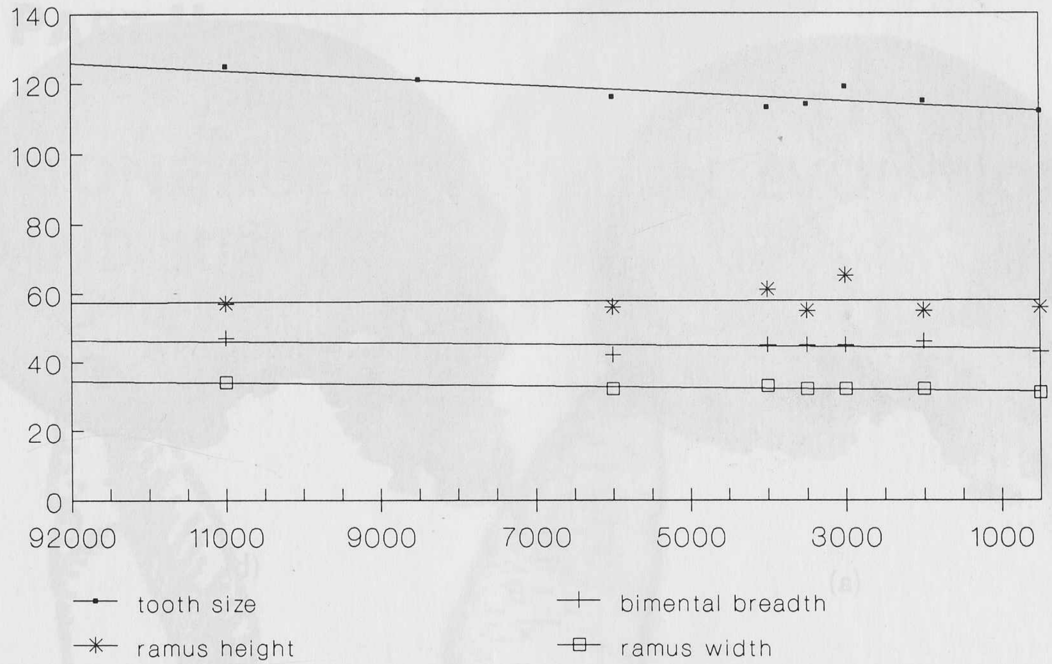


Figure 6 Diachronic trends in the mandible and tooth size for the samples described in Table 1

sapiens from Skhul and Qafzeh (180 cm in males), while from the Kebaran to recent periods it averages 168 cm in males, with only slight fluctuations. This reduction in stature is generally associated with increased environmental stress that acted to depress growth. However, the plasticity of the available gene pool has been drastically demonstrated by the marked secular trend in stature in modern Israeli populations.

Unlike the change in stature, the changes in head form – especially in head length, facial height and bizygomatic breadth – continue through to the Early Bronze Age. They result in decreased head length and increased head height so that the skull has become more globular. However, head length and head width ratios change only slightly so that most of these early Holocene populations remain dolichocranic. Figure 5 shows the extent of differences in morphometric characteristics of the skull in populations from different periods in Israel, in relation to the pooled mean of all samples studied. As can be seen, the Natufian, Chalcolithic and EBIV samples group together and separate out from the much more heterogeneous samples from the MBII and later periods. The changes occurring in the mandible are similar in timing and extent to those that have occurred in the skull. Size and robusticity decreased markedly between Mousterian and Upper Paleolithic populations. In later periods, the Natufian mandible with a broad ramus and acute gonal angle, was replaced by a thinner ramus with an obtuse gonal angle and thinner corpus. However, the only parameter to show continued reduction until the present time is tooth size (Figures 5 and 6). From the MBII to recent periods, there is considerable fluctuation in all other parameters discussed above. Between the Natufian and the MBII it is possible to trace unidirectional microevolutionary trends in the skull, mandible and teeth. From the MBII onward, there are numerous fluctuations in all measurements, suggesting greater heterogeneity in the peoples inhabiting Israel and masking, to a greater or lesser extent, evidence of microevolutionary trends in the skull and mandible, although tooth size continues to reduce.

The extent and timing of changes in the skull, mandible and teeth have not all taken place at the same time, and in some periods, notably in the MBII and Roman-Byzantine periods, a sudden change and apparent reversal has taken place in cranial but not dental parameters. The long-term trends can be related to long-term selective pressures, that have acted to reduce skeletal robusticity and tooth size, whereas the sudden changes seen in MBII and Jewish populations indicate the introduction of a different population group. Smith (1989c, 1991) and Smith et al. (1984) have proposed that the pattern of microevolutionary change that characterizes the Israeli sequence, can be related to increased levels of environmental stress in Holocene populations following the adoption of agriculture.

Obviously, many more samples are needed before any

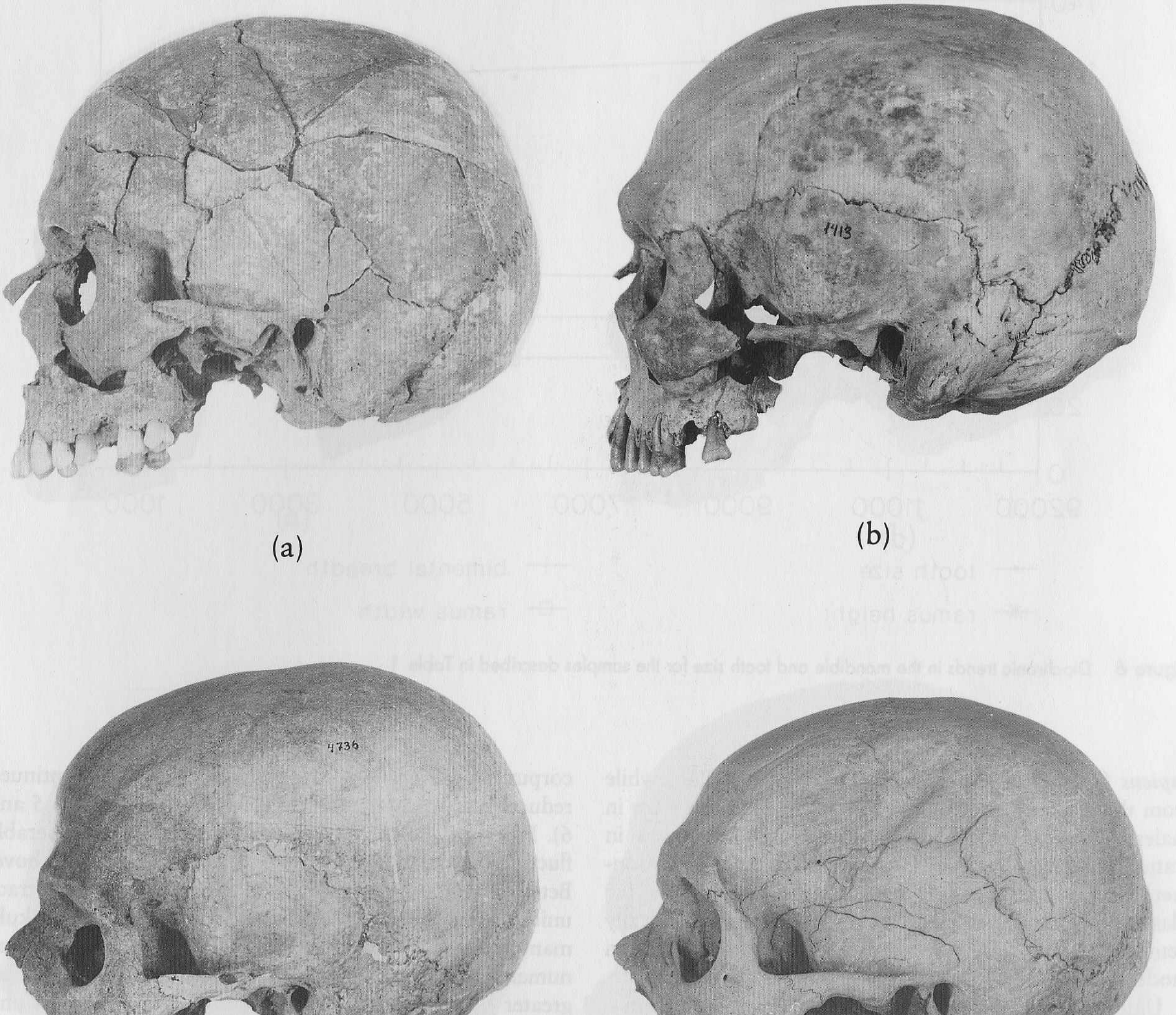


Plate 8 Lateral view of skulls: a) MBIIB from Sasa; b) Late Hellenistic skull from Ein Gedi; c) Iron Age skull from Achziv; d) Arab skull from Dor. Not all to same scale

attempt can be made to map the full extent and pattern of regional and temporal diversity within Israel, or the connections between populations in Israel and neighboring countries. Hopefully, the additional samples will become available through continued excavations. At the same time the new techniques available such as c-t scan imaging and DNA analysis of fossil bone, will improve the scope of research and enable the anthropologist both to ask new questions and to answer old ones with a degree of reliability undreamt of in the past.

one considered the prototype of Upper Paleolithic Cro-Magnon *Homo sapiens sapiens*, have been found in Mousterian contexts in Israel. This contrasts with the situation elsewhere in the world, where there is no evidence of the coexistence of both types. In Europe all hominids found in association with Mousterian industries are of the Neandertal type. In Africa all hominids associated with the equivalent Middle Stone Age industries are considered early examples of *Homo sapiens sapiens*. Thermoluminescence and ESR dates suggest that *Homo sapiens sapiens* in Israel antedated most if not all of the Neandertals there by some 30,000 years. This raises the question of the nature of the relationship between them, and between them and later populations in the region – a question that is crucial for our understanding of the origins of modern humans.

The second topic dealt with here is the extent and pattern of change in the populations of Israel over the past 12,500 years, and its relation to shifting environmental pressures and population movements. Although it lies on the periphery of the fertile crescent, archaeological investigations have made Israel one of the richest sources of information on the social, cultural and technological changes associated with the advent of plant and animal domestication in the Neolithic. The wealth of skeletal remains from the Natufian to recent periods provides an unequaled diachronic series for the investigation of microevolutionary trends. During this critical period a revolution occurred not only in the external environment of people, but also in their internal environment as food resources and methods of food preparation changed. In addition to the changes in physical activity, degree of mobility and skills associated with these innovations, population size began to increase. This increase in fecundity, imposed an additional burden that specifically affected women. More frequent childbirth meant increased metabolic demands on women, in order to cope with pregnancy and lactation, as well as greater investment in childcare. The increased group size and degree of sedentization, adoption of new foods and methods of food preparation, affected stress levels, specifically in relation to nutrition and disease. Increased trade and warfare also contributed to changes in the genetic make-up of the populations, so that the biological record helps to identify the faces behind the contrasting cultures and religions for which we have written records, and to differentiate between cultural diffusion and population change.

The earliest inhabitants of Israel

Lower and Middle Pleistocene Hominids

Numerous Lower Pleistocene and Middle Pleistocene sites have been found in Israel (Bar-Yosef 1980, 1992 and in this volume; Goren, this volume) but only very fragmentary human remains have yet been identified and few of them are in good stratigraphic contexts (Figure 1). At 'Ubeidiya the earliest levels have been dated to *ca.* 1.4 million years BP and two pieces of parietal bone and one temporal fragment were uncovered by a bulldozer, and two teeth – an upper lateral incisor and third molar – were found during the excavations carried out there between 1960 and 1963. Tobias (1966) described these fragments as indistinguishable from those of recent populations and chemical tests have confirmed that they are younger than the associated Cromerian fauna (Molleson and Oakley 1966).

An early date has also been claimed for three crania found in association with handaxes and other Acheulean implements as surface finds near kibbutz Hazorea (Anati and Haas 1967). However, since the crania resemble those of recent *Homo*, and show no archaic characteristics, their attribution to the Acheulean must be considered dubious. It is hoped that they will be dated directly in order to establish their provenience.

Other finds, while still fragmentary, do however demonstrate the presence of archaic hominids in Israel during the Middle Pleistocene. At Gesher Benot Ya'akov, two femur shafts mixed in with the faunal collections from the site, were identified as human (Geraards and Tchernov 1983). Once again their provenience is unclear, but they were found in association with faunal remains characteristic of the Terminal-Middle Pleistocene and they exhibit the thick shafts characteristic of early *Homo*. Other human remains from Middle Pleistocene deposits in Israel are a tooth and femur shaft from Tabun E (McCown and Keith 1939) that, in size and shape, fall within the range known for archaic *Homo* elsewhere.

The partial skull from the Zuttiyeh cave, also known as 'The Galilee Skull' (Keith 1927), provides more specific information on the morphology of early *Homo* in Israel. It may be between 250,000 and 300,000 years old (Bar-Yosef 1992). It comprises the frontal bone, small portions of both nasal bones, the frontal process of the right maxilla, part of the right sphenoid and zygoma. Primitive features include thick brow ridges and extreme width of the greater wing of the sphenoid (Plate 2). However, as recognized by Keith (1927), the Galilee skull also has a number of neanthropic features. These include a bulging and relatively high forehead giving a frontal angle of 62.5° (it is 65° in Tabun 1 and 55° in Gibraltar), high flat maxilla and slender zygomatic process. In his 1927 paper, Keith identified the cranium as female, because of its neanthropic characteristics, but after examining the Mount Carmel finds, McCown and Keith (1939: 256) concluded that the Galilee skull was probably that of a male. Its neanthropic characteristics were attributed to the fact that it was more advanced along the evolutionary scale than European hominids of the same period and very similar to

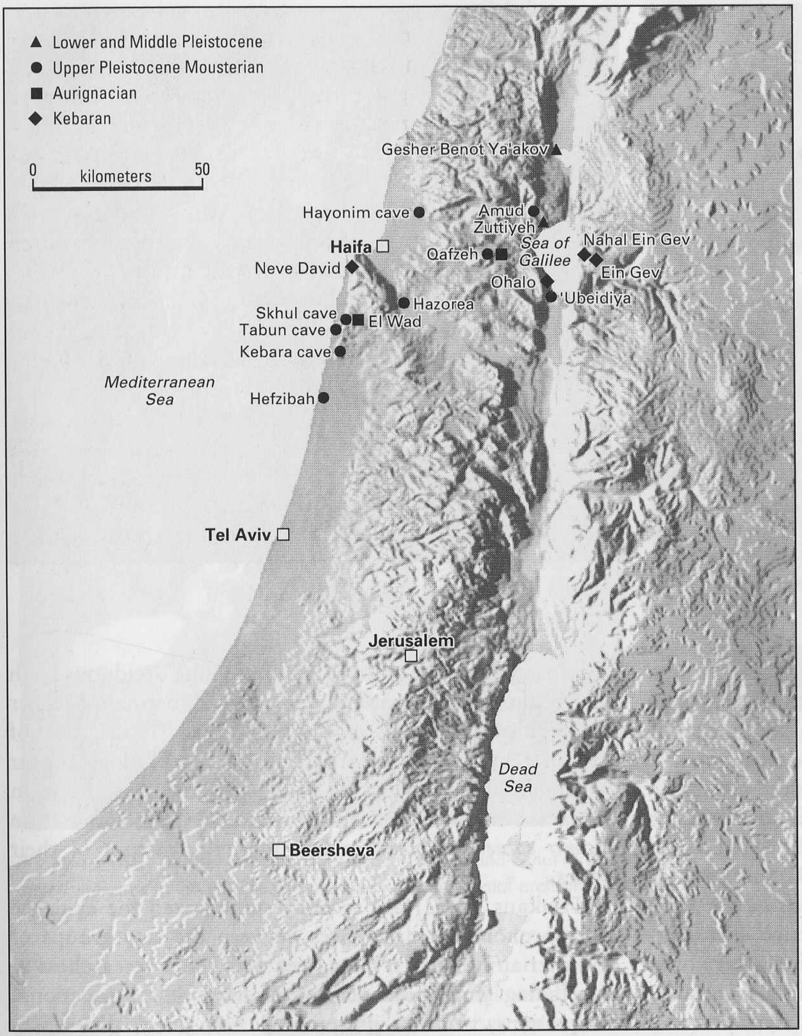


Figure 1 Map showing Pleistocene sites with hominid remains

the Mount Carmel skulls, especially Skhul IX. In a more recent study Vandermeersch (1981a) suggested that the Galilee skull was ancestral to early *Homo sapiens sapiens* represented at Skhul and Qafzeh. Suzuki (Suzuki and Takai 1970: 189) and Trinkaus (1992), however, considered Zuttiyeh as possibly ancestral to Neandertals, but emphasized that any attempt to classify it could only be tentative since it is so incomplete.

Upper Pleistocene Hominids

The Mousterian

For the period *ca.* 150,000–50,000 BP, the number of well-preserved fossil hominids that have been excavated in Israel is exceptionally large. All were found in caves or rock shelters located in the North of Israel (see Figure 1). They include 10 partial skeletons and additional fragmentary remains from Skhul (McCown and Keith 1939), one individual, a second mandible and isolated teeth from Tabun (McCown and Keith 1939), a minimum of 14 individuals from Qafzeh (Vandermeersch 1981b; Tillier 1989), two individuals and isolated bones and teeth from Wadi Amud (Suzuki and Takai 1970; Rak et al. 1992), two individuals and numerous teeth from Kebara Cave (Bar-Yosef and Vandermeersch 1991; Smith and Arensburg 1977; Smith and Tillier 1989) and isolated bones and teeth from Hayonim Cave (Arensburg et al. 1990).

The specimens from Skhul and Qafzeh have been dated to around 92,000 BP (Schwarcz et al. 1988 and 1989) and have been generally classified as *Homo sapiens sapiens*. Those from Amud and Kebara have been dated to *ca.* 58,000 BP (Valladas et al. 1987) while layer C from Tabun, in which both the female skeleton (C I) and male mandible (C II) were found, may date to as early as 150,000 BP (Grün and Stringer 1991; Grün et al. 1991).

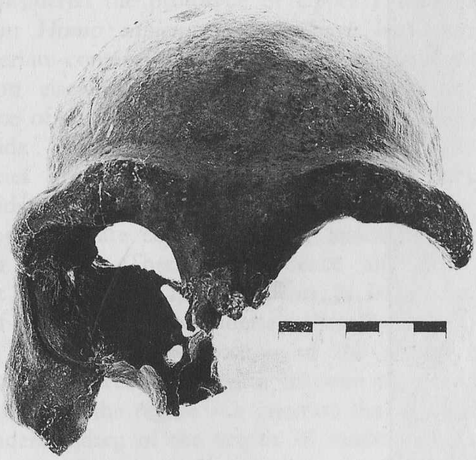


Plate 2 Frontal view of the Galilee skull

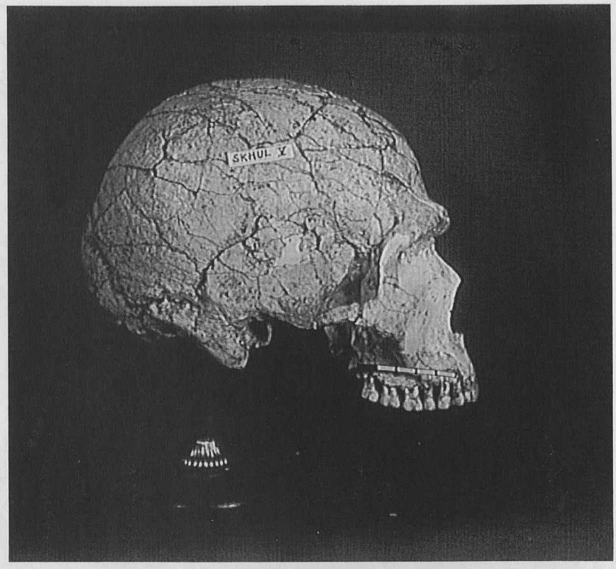


Plate 3 Lateral view of Skhul V skull

The hominids from the Tabun, Amud, Kebara and Hayonim caves show many similarities to Mousterian hominids from Iraq and Europe, and are generally classified with them as *Homo sapiens neandertaliensis*.

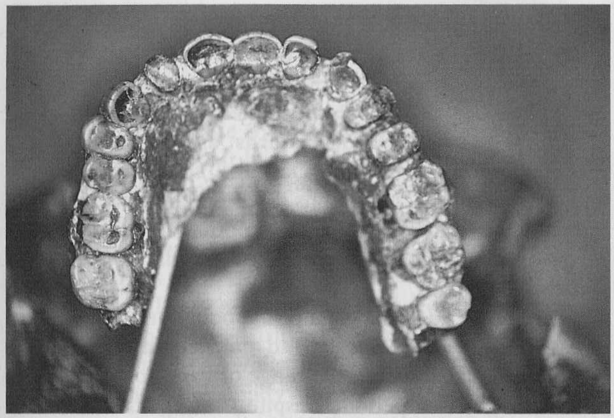
The recognition of two different hominid groups in Mousterian context in Israel can be traced back to McCown and Keith (1939). Writing of the Tabun and Skhul specimens, McCown and Keith (1939) refer to them as different 'breeds' of humanity, 'but breeds of the same stock' (1939: 265). Discussing the distinctive characteristics of the Tabun woman they state, 'We find it very hard to believe that these are mere individual anomalies; they have all the appearance of intrinsic structures of morphological value' (1939: 373).

The distinctive morphometric features of the Tabun female have now been identified in the Amud, Hayonim and Kebara specimens, but not in the hominids from Qafzeh who resemble those from Skhul (Plates 3 and 4a–b). They include details of cranial form and orbital torus development; angle formed between the cheekbones and maxilla; angle formed by the cranial base; relation of the mandible to the maxilla; mandibular angle; anterior posterior dimensions of the alveolar bone and dental morphology. In the postcranial skeleton the most distinctive feature is pelvic form and, specifically, the dimensions of the pubic element that is flattened caudo-cranially in the Neandertal group. Other major differences include the morphology of the limb bones (Plate 5) and bones of the extremities, that suggest differences in muscle development and function between the two groups of hominids.

Many of these differences result from very early divergence in developmental pathways, that are genetically determined. A good example of this is the significant difference present in the morphology of the deciduous teeth that begin development early *in utero* (Zilberman, Skinner and Smith 1992), while according to Tillier (1992), most of the differences in head shape and facial morphology appear in childhood (Tillier 1992). Current studies now in progress further suggest that Neandertals also differ from *Homo sapiens sapiens* in the internal structure of their bones.

Trinkaus (1992) has recently summarized the evidence for morphometric differences between the two groups of Mousterian hominids. He agrees with other researchers in concluding that these differences may reflect functional adaptations, and so presumably behavioral differences between them, despite the similarities in lithic assemblages and diet suggested by the archaeological record.

The provenience of all these specimens, except for those from Tabun, is good. At Tabun however, Garrod (Garrod and Bate 1937: 61–64) was uncertain as to whether the Tabun female found in level C was contemporary with these deposits or intrusive from level B. The skeleton was found 35 cm below the surface of C, in an area where the distinction between the two levels was poor. The male mandible from Tabun was found at a lower level, some 1.2 m beneath the surface of C. While the Tabun C male mandible could be accommodated within a generalized early *Homo* lineage, the Tabun female is very definitely Neandertal and similar to the Kebara Neandertal. If the Tabun female is indeed over 150,000 years old, then she would predate any Neandertal yet known, and we would have to assume biological stasis for the 100,000 years that would then separate her from the other Neandertals in Israel. Direct dating of the Tabun human remains is necessary to resolve this issue.



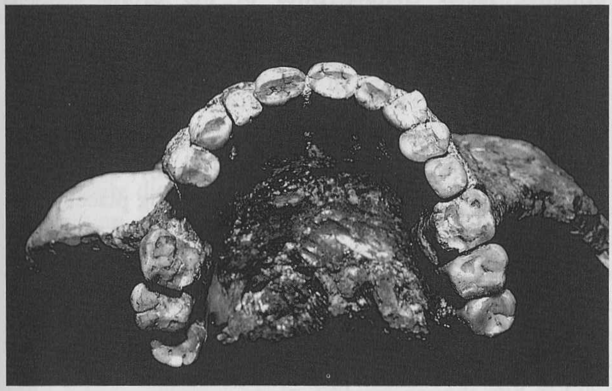


Plate 4a–4b Upper dental arch of Tabun CI (4a) and Skhul IV (4b): note difference in length/breadth dimensions of the dental arch and incisors

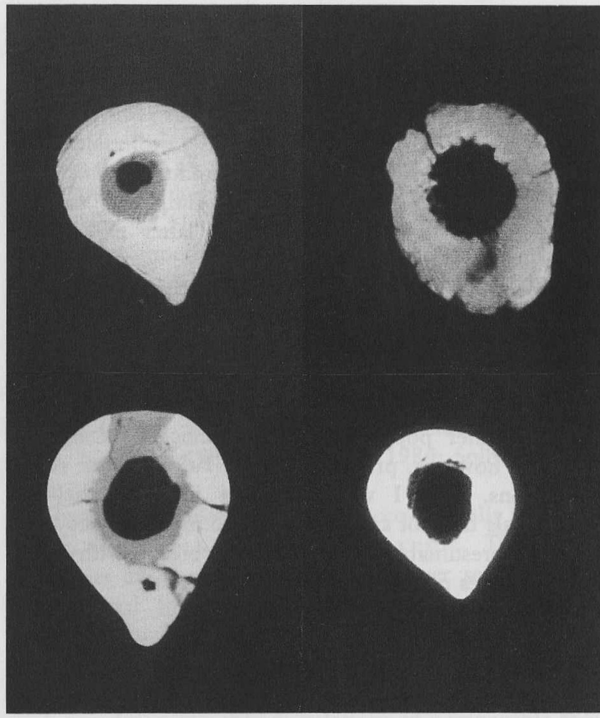


Plate 5 Cross-section of femurs seen on c-t scan

At the present time there are two schools of thought regarding the genetic relationship of the two groups of hominids. Many see the Amud-Tabun-Kebara-Hayonim group as part of a widespread Western Asian Neandertal group present also in Iraq and in the Crimea (Trinkaus 1983) and related more closely to European Neandertals than to the Skhul-Qafzeh hominids in both skeletal and dental traits (Stringer et al. 1984; Smith 1989a; Trinkaus 1983, 1992; Vandermeersch 1992). Other researchers such as Arensburg (1991) and Corrucini (1992) have emphasized the similarity of the two groups. The issue is complicated by the fragmentary nature of many of the specimens. For McCown and Keith (1939) the anatomy of the pelvis, hand and foot bones, and teeth were the most distinctive features of the Tabun female. These features are shared by Amud and Kebara, and Neandertals from Europe and Western Asia (Endo and Kimura p. 313 in Suzuki and Takai 1970; Rak 1991; Trinkaus 1983). They are not present in any of the specimens from Skhul or Qafzeh in which these parts of the skeleton are represented, not even in Skhul IX, whose very incomplete cranium shows a number of primitive features (McCown and Keith 1939; Suzuki and Takai 1970; Corrucini 1992).

Israel is the only place where remains of both Neandertals and *Homo sapiens sapiens* have been found in association with Mousterian artifacts. However, there is no evidence of simultaneous presence, much less of interbreeding between the two groups described here, since they are separated by over 30,000 years and appear to be associated with different climatic conditions. It is, theoretically, conceivable that the Israeli Neandertals were descended from the local Skhul-Qafzeh and/or Galilee prototypes. However, a more plausible and parsimonious explanation for the replacement of early *Homo sapiens sapiens* in Israel by Neandertals was proposed by Vandermeersch (1981b) and elaborated upon by Bar-Yosef (1992). Vandermeersch (1981b) proposed that the Neandertals in Israel represented the southern advance of European Neandertals following their retreat from Europe during cold phases of the last glaciation, and is related to the observed climatic and faunal changes that took place in the region. At the same time, the *Homo sapiens sapiens* populations in Israel moved south to Africa, so the two were not in direct contact for any length of time. Trinkaus's studies of limb proportions and estimates of body mass in Mousterian hominids give some support for this hypothesis, with the Neandertals having relatively short extremities and greater body mass which would give them an advantage in cold weather (Trinkaus 1983, 1992).

But if the Tabun specimens really do date to *ca.* 150,000 BP, other possibilities must be considered. These include the possibility of displacement of an early local Neandertal population in Israel by early *Homo sapiens sapiens* as they migrated out of Africa in a warm phase; evolution *in situ* of early *Homo sapiens sapiens* to a Neandertal form, or the sumultaneous presence of Neandertal and sapiens populations in Israel throughout the latter part of the Upper Pleistocene.

Sites with late Mousterian and transitional industries are known, especially in the Negev and Sinai (Bar-Yosef 1992), but they have yielded no human skeletal remains. There is then no skeletal evidence to show how long the Neandertals survived in Israel or their possible contribution to later populations. No specifically Neandertal traits are, however, present in Upper Paleolithic or recent populations. This I would suggest indicates that the Neandertals did not contribute to the modern gene pool, and so presumably did not interbreed with early representatives of *Homo sapiens sapiens.*

The Aurignacian and Kebaran

Aurignacian and Kebaran sites with human remains, like those of earlier periods in Israel, are located in the northern third of the country (see Figure 1). Fragmentary Upper Paleolithic remains were found at Qafzeh by Neuville and Stekelis in 1933 and briefly described in Vandermeersch (1981b: 26). They comprise the frontal bone and part of the nasal bones of an adult male and two fragments of a mandible (H. 2). Teeth and fragmentary bones have also been found in the Aurignacian deposits at El Wad and Kebara (McCown and Keith 1939) and more recently at Hayonim (Arensburg et al. 1990). However, the most complete skeletal remains from the Upper Paleolithic are those from the early Kebaran (*ca.* 19,000 BP). They comprise a female from Nahal Ein Gev, on the eastern shore of the Sea of Galilee (Arensburg 1977), and at least four partial skeletons from Ohalo on the southwest shores of the Sea of Galilee (Nadel and Hershkovitz 1991, Hershkovitz et al. 1992). Additional remains dating to circa 13,000 BP have been recovered from Ein Gev I (Arensburg and Bar-Yosef 1973), Newe David (Kaufman 1989) and Hefzibah (Ronen et al. 1975).

The human remains from Ohalo have not yet been described in detail, but preliminary observations by Hershkovitz (1992) on the male skeleton indicate that this specimen was similar to the Natufians in morphometric characteristics, but resembled European Upper Paleolithic CroMagnons, especially in orbital configuration and degree of robusticity. The same applies to the cranial features of the female from Nahal Ein Gev (Arensburg 1977), although her postcranial skeleton appears to have been extremely gracile, even in relation to the more recent Natufian females. The male frontal from Qafzeh, whose exact age is unknown, is long and only slightly curved, and looks somewhat more primitive than the Ohalo skull. It has marked superciliary eminences, measuring some 16 mm in height, that fan out above the central portion of the orbits, and are directed upwards and outwards. The mandibular fragments from Qafzeh 2 consist of the right and left sides of the corpus and molar teeth. Corpus thickness at M1–M2 and molar tooth size lie within the range of values found at Ohalo, and molar tooth size is similar.

Morphometric parameters of the bones and teeth found in Aurignacian context at El Wad and Kebara can similarly be accommodated within the range of variation known for the later Natufian period. Despite the retention of some primitive facial characteristics of the orbital region, discussed in Arensburg (1977), Upper Paleolithic and Kebaran skeletons so far known from Israel resemble the Epipaleolithic Natufians in stature, head form and tooth size.

The paucity of human skeletal remains for the Early Upper Paleolithic in Israel, precludes any attempt at directly analyzing the extent of change taking place in this dynamic period. However, the fossil record for Europe and North Africa provides two different models against which to evaluate the probable rate of change in the Israeli Upper Paleolithic sequence. In Europe, marked changes occurred between the Early and late Upper Paleolithic, with late Upper Paleolithic and Mesolithic populations significantly shorter, with smaller teeth and jaws than those of the early Upper Paleolithic populations (Frayer 1984). In North Africa, however, little change seems to have occurred over the same period. Ibero-Maurasian Epipaleolithic populations from Taforalt and Afalou were as tall as early Upper Paleolithic Europeans with even larger jaws and teeth, reminiscent of those of Skhul and Qafzeh. In the Nile Valley, represented by Wadi Halfa and Jebel Sahaba, large bodied and large toothed robust populations survived until as recently as some 7000 years ago (Smith 1979, 1988).

The similarity present between the Kebaran populations of Israel and the Late Upper Paleolithic populations of Europe in stature, head form and tooth size, suggests that they may have been exposed to similar selective pressures. The observed reduction in tooth and body size and robusticity in European Upper Paleolithic populations has been related to changing selective pressures associated with new behavioral and dietary adaptations that occurred towards the end of the Pleistocene (Frayer, 1984). The archaeological evidence suggests that even more drastic changes in technology and food staples occurred in the Israeli Upper Paleolithic sequence (Bar-Yosef 1980; Belfer-Cohen 1991: Goring-Morris this volume). The stability of North African and Nile Valley populations may, in turn, reflect the lack of major changes in subsistence strategies in these regions.

The advent and consequences of agriculture: Terminal Pleistocene and Holocene populations

The Natufians provide a good starting point from which to study the changes that have taken place in the populations of Israel as hunting and foraging activities were replaced by farming, pastoralism, the development of urban societies and increased trading. These changes were associated with marked shifts in selective pressures operating on populations. The characteristics needed for success in hunting are not necessarily those most advantageous in farming or herding, while minor genetic differences can affect not only the ability to utilize new foods but also disease susceptibility. It is not then surprising that marked microevolutionary changes have taken place in the populations of Israel, even within the relatively brief time span represented by the past 12,500 years.

Arensburg (1973) suggested that the Natufians and their descendants formed a 'core' population in Israel that could be traced down to recent periods, but was added to, or temporarily displaced at certain times. I have adopted his assumption as my working hypothesis in this analysis of Natufian to recent populations from Israel. The provenience of the specimens studied is given in Figures 2–4. Unfortunately, the number of specimens available for analysis varies from period to period, and some samples were too small for reliable analysis. Descriptive statistics for cranial measurements in different periods and cultures are shown in Table 1 and their relative distance from one another is plotted in Figure 5. Some estimate of the extent of diachronic trends in the teeth and jaws can be seen in Figure 6 (see p. 73). Between the Mousterian and Natufian periods, head size, jaw size and tooth size reduce. From the Natufian to recent period, tooth size reduces more than any other parameter studied here. In order to identify the presence of 'outlier' groups and the significance of the differences between them and the core population, two tests were employed. One provided a robust test for the comparison of samples of unequal size (Brown and Forsythe (1974a, 1974b); one provided for the simultaneous comparison of a number of samples (the Bonnferonni test described in Miller 1981). Except for basion-bregma height, which may be affected by environmental factors, all variables chosen were those considered to have a high component of hereditability. A detailed summary of the evidence for this is given in Keita (1988).

Natufian populations

The most dominant feature of the Natufian period is the increasing reliance placed on foraging, with cereals gaining ever increasing importance in the diet. This adaptation affected behavior as well as nutrition. Three distinct phases of the Natufian have been recognized on the basis of the archaeological findings (see Bar-Yosef and Valla 1991, Belfer-Cohen 1991; Valla, this volume, for detailed summaries of the archaeological evidence) and human remains have been found at numerous sites (see Figure 2). At El Wad, Hayonim and Eynan, the human remains date to all phases of the Natufian. At Kebara and Erq el Ahmar they appear to be restricted to the lower phase, and at Hatoula, Nahal Oren and Shukbah they date to the upper phase (Valla 1987).

The Natufians are characterized by low to medium stature, large, low, dolichocranic (long and narrow) skulls; short, broad faces, short mandibles with wide rami, an anteriorly flattened dental arch and marked alveolar prognathism (Plate 6; Arensburg 1973; Crognier and Dupouy-Madre 1974; Ferembach 1961a, 1977; Keith 1934, McCown 1939; Smith et al. 1984; Soliveres 1988; Vallois 1936).

The teeth are relatively broad bucco-lingually with large lingual tubercles and Carabelli's cusps. The second premolars and both the upper and lower second molars are reduced mesio-distally. Lower second molars are generally four cusped (<90 per cent) and upper second molars have reduced or missing hypocones. In addition, there is a high frequency of congenitally missing third molars, relative to other populations of comparable tooth size, especially at Hayonim (Smith 1991). Since congenital absence of third molars is an inherited condition, the high prevalence at Hayonim is evidence for consanguinity between the people buried there. Belfer-Cohen et al. (1991) correctly state that the incidence of third molar agenesis at Hayonim is similar to that found in modern small-toothed populations. However, it must be remembered that the frequency of congenital agenesis is inversely related to tooth size. The incidence of agenesis in Natufians from other sites, or indeed from populations with similar tooth size to the Natufians, averages less than 5 per cent compared to the 21 per cent at Hayonim.

Intersite differences and diachronic trends in the Natufians are relatively few. Ferembach (1961a) reported that the Natufians from Eynan had larger skulls and mandibles and were taller than Natufians from other sites. She postulated that this was due to nutritional differences between Eynan and other sites. Soliveres (1988) has now analyzed the entire series from Eynan, and her results confirm those of Ferembach's earlier study. Head length at Eynan appears to be slightly greater than at El Wad or Hayonim, and mandibles are slightly larger. Stature estimates at Eynan were also reported by her and by Belfer-Cohen et al. (1991) as greater than those of Hayonim, El Wad or Nahal Oren. This conclusion should, however, be regarded with caution as there were intact femora from only two individuals at this site. The additional estimates were derived from femur shafts – and the error of estimate involved is several centimeters.

Smith (1989b, 1991) suggested that most of the

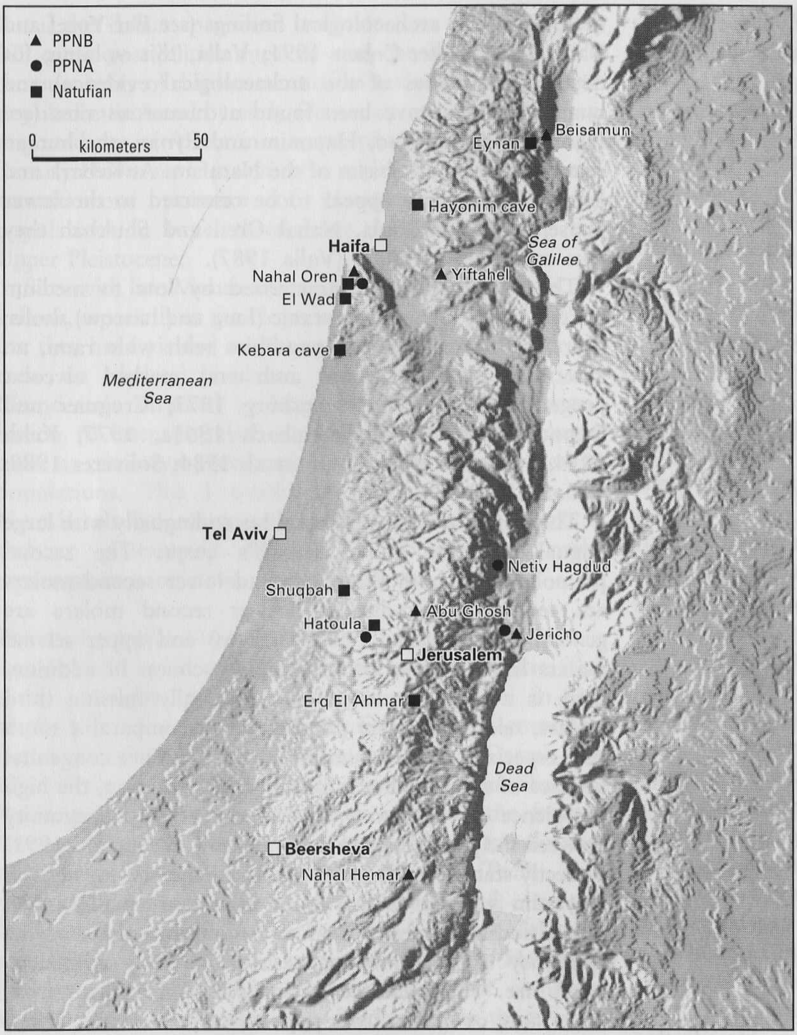


Figure 2 Map showing Natufian and Neolithic sites with human remains referred to in text

available measurements from Eynan may have been derived from skeletons from the earliest phase of the Natufian, so that the apparent intersite differences might be due to diachronic trends within the Natufian. The paper by Soliveres (1988) confirms that indeed most of the measurable specimens from Eynan do date to the earliest phase, but they still appear to be larger than early Natufian specimens from Hayonim and El Wad. The largest Natufians appear to be those from Erq el Ahmar and Eynan, followed by Hayonim and El Wad and finally by Shukbah and Nahal Oren. The first group have the longest largest skulls and mandibles, the second group have rounder skulls and mandibles with short thick ascending rami, and the third group are the most gracile.

Between and within sites, the only significant diachronic trend that can be traced is a reduction in ramus width and increase in dental disease over time (Smith 1991). Both appear to be related to changes in the diet, indicating a shift to more cariogenic foods that require less vigorous chewing. This finding is corroborated by the archaeological evidence in the form of number of grinding implements, sickle blades and remains of cereals.

Neolithic populations

Considerable differences in adaptations are present between the various phases of the Neolithic (10,300–6500 BP), and between contemporaneous sites in different ecological zones. Sites with published human remains are, however, few. Specimens from Israel, the West Bank and Jordan discussed here include, from north to south Yiftahel (Hershkovitz et al. 1986), Horvat Galil (Hershkovitz and Gopher 1988), Beisamoun (Ferembach 1978; Soliveres 1978), Nahal Oren and Abu Gosh (Arensburg et al. 1978) Hatoula, Jericho (Kurth and Rohrer Ertl 1981) Nativ Hagdud (Belfer-Cohen et al. 1990), Ain Ghazal (Kafafi et

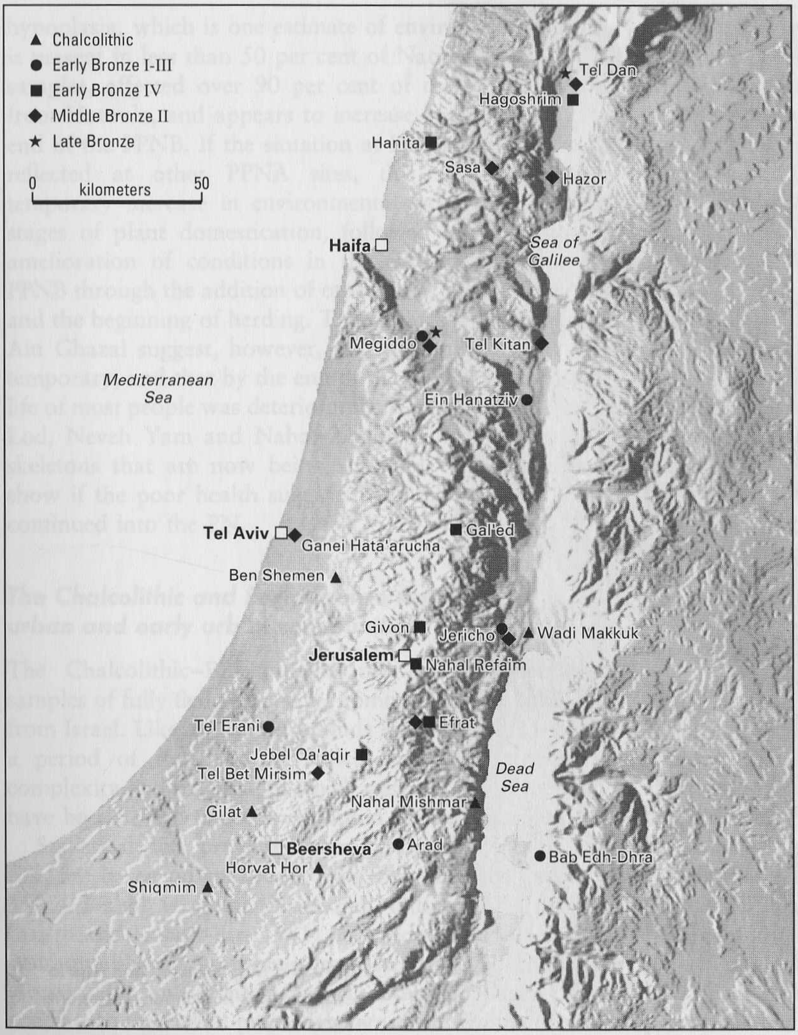


Figure 3 Map showing Chalcolithic and Bronze Age sites with human remains referred to in text

al. 1990; Rollefson and Simmons 1985; Rollefson et al. 1985), Nahal Hemar (Arensburg and Hershkovitz 1988) and Basta (Schulz 1987, Schulz and Scherer 1991). Most of these specimens are fragmentary and cranial sample sizes available were too small for detailed statistical analysis. They are, therefore, excluded from the plots shown in Figure 5. For the mandibles and teeth, sample sizes are larger and the Neolithic values for these variables are included in Figure 6.

For the PPNA there is one skull from Jericho for which measurements have been published by Kurth and Rohrer-Ertl (1981). An additional PPNA skull from Hatoula is now being studied and there are some jaw fragments with teeth from Hatoula and Netiv Hagdud (Belfer Cohen et al. 1990). The PPNA skull from Jericho is long and narrow and falls within the range of measurements seen in the Natufian. The Hatoula skull most closely resembles that from El Wad. The PPNA mandibles from Hatoula are gracile, and tooth size slightly smaller than in the Natufians.

The PPNB specimens span some 1500 years but the skeletal finds are too fragmentary for evaluation of diachronic trends in this dynamic period that is associated with animal domestication. The PPNB crania from Nahal Hemar, Abu Gosh and the plaster skulls from Jericho and Beisamoun, appear to be shorter and broader than those of the Natufians. Facial measurements are available for very few specimens and are extremely variable. They suggest a more elongated face than that characteristic of the Natufians and this is substantiated by comparison of the mandibles. These tend to be longer with greater ramus height than is characteristic of the Natufians. At the present time sample sizes are too small for definite conclusions, but the underwater excavations being carried out by U. Galili at Atlit and Neve Yam may change this picture. Kurth and Rohrer-Ertl (1981) suggest that head moulding may have