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Human Origin Sites and the World Heritage Convention in Eurasia

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Human Origin Sites and the World Heritage Convention in Eurasia

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The case of Mount Carmel: the Levant and Human Evolution, future research in the framework of World Heritage

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Introduction

The Mount Carmel Caves in Israel are undoubtedly among the most famous prehistoric sites in the world. Figuring prominently in all relevant textbooks dealing with human evolution (for example, Klein, 2009; Stringer, 2011), the site has been recently inscribed as a World Heritage Site. The caves are located *c.* 20 km south of Haifa (32° 40′ 12′ N; 34° 57′ 55′ E), on the southern cliff of Nahal Me'arot/Wadi el-Mughara (within the Nahal Me'arot Nature Reserve), where it opens to the coastal plain and comprises four natural caves (Figure 1, from west to east): Tabun, Jamal, el-Wad and Skhul. Formed within one of the most completely exposed fossilised rudist reefs in Israel (Bein and Sass, 1980), together they represent a cultural and natural heritage site of significant global interest. The archaeological layers exposed at the site bear witness to a long sequence of human evolution through the major stages of the Stone Age and exhibit the roots of our cultural and evolutionary diversity.

Heritage values

The unique significance of the Mount Carmel Caves is best expressed through criterion (iii) and (v) that express its Outstanding Universal Values (OUVs) (Weinstein-Evron et al., 2012a).

Long cultural continuum and changes in ways of life

The long cultural sequence exposed at the four caves that make up the site extends from the Lower Palaeolithic to the present day (Garrod and Bate, 1937), representing at least half a million years of human evolution (Figure 2). Documented within this long sequence are some of the most significant developments in human evolution in terms both of cognition and culture. One is the early (Middle Palaeolithic) existence of the intentional burial of the dead (McCown, 1937; McCown and Keith, 1939). Significantly, Skhul cave is among the world's first burial sites demonstrating evidence of ritual burial as early as *c.* 100,000 years ago (Grün et al., 2005). Another issue is the transition from nomadic hunter-gatherers to complex, sedentary communities and the adaptations they were developing which led soon afterwards to the advent of agricultural societies. This is best expressed at el-Wad Cave and Terrace where thick accumulations attributed to the Natufian culture were unearthed (Garrod and Bate, 1937; Weinstein-Evron, 2009).

The importance of the site's long sequence was fully acknowledged following Garrod's excavations (Garrod and Bate, 1937), as conveyed by the statement made by C. N. Johns, the excavator of the nearby Athlit Crusader castle:

> **Of the caves to be seen from the road, the lowest [el-Wad] and highest [Tabun] prove to have been inhabited by early man over long periods, the highest first, the lowest last; but the occupation of the latter commenced before the former was abandoned, hence the two caves together give a continuous range of human occupation [...] It is rare to find such a range of 'industries' as we have found in these caves, layer upon layer, in such depth and with such a variety of skeletal remains, animal and human.' (Johns, 1947: 70).**

The four main periods represented in the Mount Carmel caves site are the Lower Palaeolithic, the Middle Palaeolithic, the Upper Palaeolithic and the Epipalaeolithic (Figure 2). Holocene finds, from the Neolithic to the historical periods, are also present in the site but are less dominant. Thus, the site has long been recognized as a yardstick for the study of the prehistory of the southern Levant.

The Lower Palaeolithic period is best represented at Tabun Cave (Figure 4), with some occurrences at Jamal and possibly also at Skhul (Figure 2). The earliest lithic assemblage in Tabun Layer G was defined by Garrod as Tayacian (Garrod and Bate, 1937).

This small assemblage encompasses a few hand axes and flakes and was later ascribed to the Acheulean, but its exact character is still unknown. The Acheulean industry of Tabun Layer F is characterized by the presence of hand axes and scrapers and constitutes one of the rare occurrences of this culture in a cave site in the Levant (Goren-Inbar, 1995).

An impressive and long Acheulo-Yabrudian sequence, presenting seven metres of archaeological accumulations, was found in Layer E containing all the characteristic facies of this unique Levantine culture: Acheulean, Yabrudian and Amudian (Jelinek, 1990). Tabun Cave is one of the very rare sites where all three industries were found (Copeland, 2000). While the lithic assemblage ascribed to the Yabrudian facies is dominated by thick scrapers and some hand axes, within the Acheulean facies hand axes are well represented; the Amudian facies, found in one-metre thick accumulations at the top of Layer E, is typically a blade-oriented industry (Garrod and Bate, 1937; Jelinek, 1990; Shimelmitz, 2009). In this regard, it is worth mentioning Jelinek's suggestion that the entire Lower Palaeolithic of Tabun Cave should be regarded as a single cultural sequence (coined the *Mugharan Tradition*) based on the similarities in lithic technology (Jelinek, 1982a, b).

The Middle Palaeolithic is represented by a long Mousterian cultural sequence characterized by the widespread use of Levallois technique at Tabun Cave, the later part of which a Neanderthal burial was uncovered, and at Skhul Cave with its ten burials of early modern humans (or Early Anatomically Modern Humans; EAMH). Meagre evidence was also uncovered at the bottom of the el-Wad Cave sequence. The Tabun sequence is the only one in the Levant where the three main variants of this cultural complex were unearthed, designated Tabun D, Tabun C and Tabun B type industries, differentiated by their techno-typological characteristics, constituting the key sequence for the Middle Palaeolithic of the Levant (Garrod and Bate, 1937; Jelinek, 1982a; Copeland, 1975; Bar-Yosef, 1998; Figure 4; Table 1). Jelinek (1982b) delineated the general breakdown of the various assemblages, while Shimelmitz and Kuhn (2013) have recently studied the Tabun D industry in more detail.

The Upper Palaeolithic was found only at el-Wad Cave. The lithic assemblages here were attributed to the Levantine Aurignacian and provided essential data for delineating the Upper Palaeolithic sequence of the Levant (Garrod and Bate, 1937; Weinstein-Evron, 1998; Belfer-Cohen and Goring-Morris, 2003). The Epipalaeolithic period is represented only by the Natufian (*c.* 15,000-11,500 years BP), a culture of complex hunter-gatherers on the threshold of agriculture that culminates the prehistoric sequence.

Human evolution

A large number of human fossil remains have been found at three of the four caves and adjoining terraces of Nahal Me'arot. These can be roughly separated into three groups. At Tabun Cave, the complete skeleton of a Neanderthal woman, known as 'The Woman from Tabun' was discovered by Dorothy D. A. E. Garrod in the 1929 to 1934 excavation (Garrod and Bate, 1937).

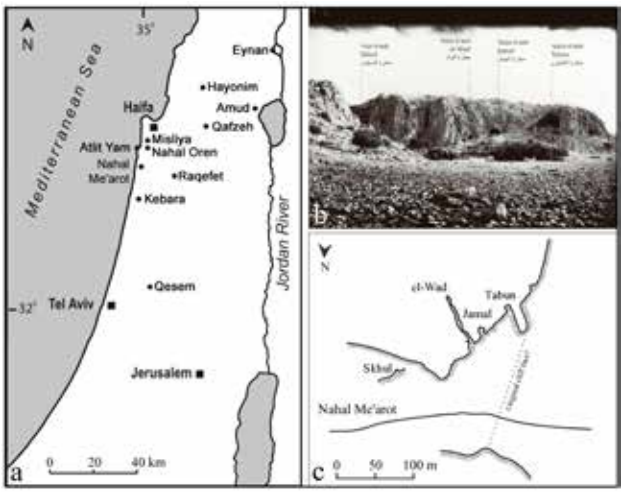

Figure 1.The site: a) location map; b) general view of the caves at the beginning of the first excavations in 1929 (Courtesy Israel Antiquities Authority); c) plan of cliff and caves (after Garrod and Bate, 1937, Plate I).

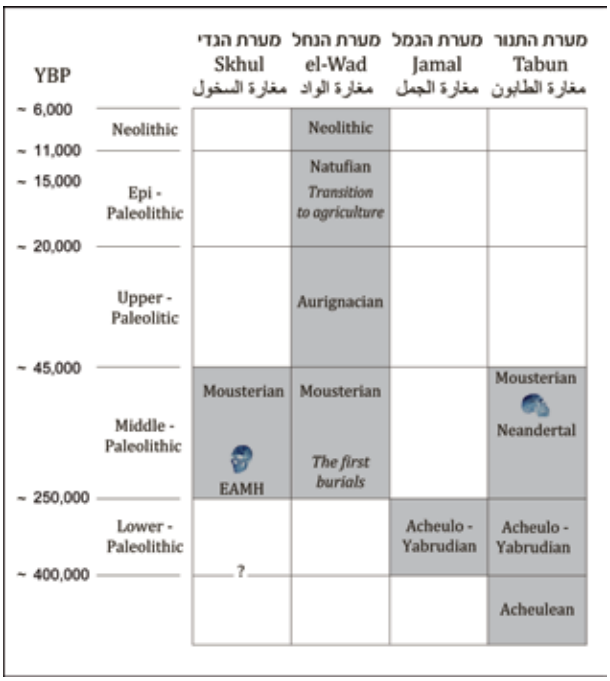

Figure 2.Schematic cultural and chronological framework of the caves.

Table 1. The current suggested chronology of Mousterian industries in the Levant (after Bar-Yosef, 1998: Figure 2).

Isotope stage	Ky BP		Entities	TL-based chronology	Hominins
3		UP	Ahmarian Emiran		Ksar Akil Qafzeh
	50	Middle Paleolithic	Tabun B type	Amud, Kebara T. Faraj, Quneitra Dederiyeh	Dederiyeh Kebara, Amud Tabun I?
4					
5	100		Tabun C type	Qafzeh Skhul	Qafzeh Skhul Tabun I?
6	150			Hayonim E (Upper)	Tabun II (jaw)
7	200		Tabun D type	Negev sites Hayonim E (Lower)	
	250			Misliya	Misliya
8		Lower Paleolithic			
9	300		Acheulo-Yabrudian	Tabun E Misliya Qesem	Qesem
10	350				

Table 2. A composite stratigraphic diagram of the Natufian occupation at el-Wad (after Weinstein-Evron et al., 2013: Figure 10).

Current Excavation	Former Excavations					
	Lambert		Garrod		Valla & Bar Yosef	Weinstein-Evron
Terrace	Terrace	Cave	Terrace	Cave	Terrace	Cave
Historic periods	Late Ceramic		A		A	A
Chalcolithic PPNA-PPNB	Early Ceramic			A		
Final Natufian?					Final Natufian	
Late Natufian			B1 Late Natufian		Late Natufian	Residual Late Natufian
Early Natufian (Late / Middle / Early)			B2 Early Natufian	Early Natufian	Early Natufian	Early Natufian

At Skhul, 11 skeletons of early modern humans were uncovered by Theodore McCown between 1929 and 1934 (McCown, 1937; McCown and Keith, 1939). While most Levantine Neanderthals are currently dated to *c.* 50-60,000 years BP (Table 1) and the dating of the Tabun remains is still enigmatic, the Skhul skeletons are dated to *c.* 80,000-120,000 years BP (Grün et al., 2005). The third and largest group of human remains (at present numbering over 110 individuals) was unearthed in the Natufian cemeteries of el-Wad (Garrod and Bate, 1937; Weinstein-Evron et al., 2007; Weinstein-Evron, 2009).

The presence of both early modern humans and Neanderthals in the same cave complex is exceptional. It is important to emphasize that in the southern Levant the securely dated Neanderthals are later than early modern humans (in Western Europe, where early modern humans are absent, Neanderthals are succeeded by fully modern humans). The occurrence of these two human types within one geographical region and the same Middle Palaeolithic cultural complex, the Levantine Mousterian, is unmatched anywhere in the world. The caves of Mount Carmel represent the southern extremity of the Neanderthal range (also found at Amud and Kebara caves; Table 1) as well as the northernmost known remains of early *Homo sapiens*, which are mostly found in Africa (Figure 5). This situation is unique to the Nahal Me'arot site and as such, is of outstanding significance to the study of human dispersals and evolution (for example, Henry, 2003; Klein, 2009). Significantly, recent DNA studies suggest that, given the timescale of the split between non-Africans and sub-Saharan hominins (Fu et al., 2013), this is also the most likely place where Neanderthals and early modern humans first met and interbred, thus accounting for the 1 to 4% of Neanderthal genes present in non-African humans (Green et al., 2010); this may have been followed by additional admixtures such as with the Denisovans (Stoneking and Krause, 2011; see also Lohse and Frantz, 2014 and references therein). Both fossil human types are key specimens in the debate concerning the demise of Neanderthals and the origin of *Homo sapiens*, as summarized in, for instance, Klein (2009). Together with Qafzeh Cave in the Lower Galilee (some 35 km east of Mount Carmel: Figure 1; Vandermeersch, 1981). Skhul exhibits the earliest ritual burials discovered to date, sometimes including grave goods, as well as collections of marine mollusks and ochre (McCown, 1937; Vanhaeren et al., 2006; Bar-Yosef Mayer et al., 2009; d'Errico et al., 2010; Salomon et al., 2012).

The Natufian remains are significant for the data they provide concerning demographics, pathologies and ways of life (for example, Bachrach et al., 2013) of these local groups on the threshold of agriculture. Important insights into symbolic and religious aspects of this culture are offered by the rich and varied artistic manifestations, as well as the varying burial modes and the wealth of associated artefacts and decorations found within the burial contexts.

Palaeoenvironmental reconstructions

The many palaeoenvironmental fluctuations registered in the site's geological and anthropogenic, as well as the zooarchaeological and palaeobotanical sequences (Bate, 1937; Jelinek et al., 1973; Weinstein-Evron, 1994), have been related to both regional and global climatic changes (Jelinek, 1982a, b) that encompass fluctuations in humidity, as evidenced by changes in the rich faunal and floral assemblages and sea-level fluctuations.

Multi-disciplinary research, strengthened by studies of present-day parallels, highlights the various palaeoenvironmental changes and their relationship with the main sociocultural processes and human impact on ancient environments (for instance, Jelinek, 1982a; Jelinek et al., 1973; Bar-Oz, 2004; Lev-Yadun and Weinstein-Evron, 2005; Weissbrod et al., 2005; Weissbrod et al., 2013; Weinstein-Evron et al., 2013a).

Natufian el-Wad: the transition from nomadic hunter-gatherers to complex, sedentary communities

The Natufian site of el-Wad Cave and Terrace, the paragon of this unique Levantine entity, was the first Natufian base camp to be explored within the culture's Mediterranean 'core area'. The culture was largely defined by Garrod, following her 1929-1933 excavations at the site (Garrod, 1932; Garrod and Bate, 1937; Belfer-Cohen, 1991; Bar-Yosef, 2002; Weinstein-Evron, 2009). The length and extent of the excavations at el-Wad (both cave and terrace) make this one of the most intensively excavated Natufian sites, which has yielded rich assemblages of material culture including hundreds of thousands of flint items, dozens of stone tools made mainly of basalt, numerous bone tools, art and decorative items, ochre, as well as a wealth of vertebrate remains and mollusks (Garrod and Bate, 1937; Weinstein-Evron and Ilani, 1994; Weinstein-Evron et al., 2007; Bar-Oz et al., 2004; Weissbrod et al., 2005; Yeshurun et al., 2013, 2014a; Rosenberg et al., 2012). This key site incorporates the complete Natufian sequence – from its earliest appearance to its final stages, documenting the transition from hunter-gatherers to sedentary communities on the threshold of agriculture (Garrod, 1957; Weinstein-Evron, 2009; Weinstein-Evron et al., 2007; Weinstein-Evron et al., 2013b). As characteristic of large semi-sedentary or sedentary Natufian hamlets, the site displays stone-built architecture, rock-cut installations and numerous graves (Figure 3).

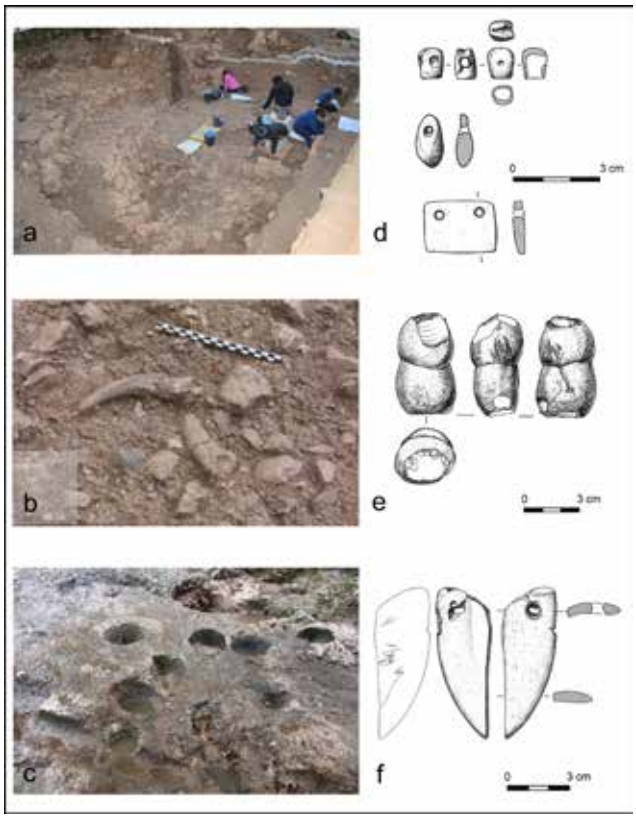

Figure 3. Natufian el-Wad (after Weinstein-Evron et al., 2012a). a) Round structure during excavation; b) living floor with gazelle horns; c) rock cut basins; d) bone beads/pendants; e) human figurine; f) bone implement (a, b, c photo by R. Yeshurun; d) after Weinstein-Evron et al., 2007: Figure 16; e) after Weinstein-Evron, 1998: Figure 58; f) after Weinstein-Evron et al., 2007: Figure 17).

The Natufian cemeteries of el-Wad contain more than 110 individuals, interred in a variety of burial modes (Garrod and Bate, 1937; Weinstein-Evron, 2009). This is one of the richest and most diverse Natufian burial grounds ever found, testimony to the complex social organization of the last hunter-gatherer society and the various adaptations it underwent prior to the adoption of agriculture (for example, Wright, 1978; Byrd and Monahan, 1995). In many respects, the extensive Natufian occupation of the site signals the transition from Palaeolithic to Neolithic ways of life, from plant gathering and animal hunting to cultivation and herding.

History of research

The outstanding archaeological value of the site of Nahal Me'arot was first realized in 1928. The government of the British Mandate over Palestine had decided to construct a new deep-water harbour at Haifa, for which the cliffs of Wadi el-Mughara were considered a potential quarry. As the Department of Antiquities was already aware of the potential historic significance of the area due to the plain visibility of the caves themselves and the 'flints and flakes in large numbers [which] cover the slopes' (Richmond, 1928), Charles Lambert, Assistant Director, was dispatched to investigate the site. Three weeks of trial excavations at el-Wad Cave during November 1928 yielded a wealth of flint and bone implements, querns, beads, stone structures and human remains (Weinstein-Evron, 2009). The most striking find was a bone sickle haft, carved in the shape of a young animal, which was the first example of Stone Age art to be published from the Near East. As a result of this first sounding, the British School of Archaeology in Jerusalem together with the American School of Prehistoric Research concentrated their efforts on the Wadi el-Mughara caves and embarked on seven seasons of excavation from 1929 to 1934, headed by Garrod and McCown. It was in these formative years that Garrod established the cultural yardstick, which provided the general chrono-stratigraphic framework for the prehistory of the Levant (Garrod and Bate, 1937). Dorothy M. A. Bate constructed the first

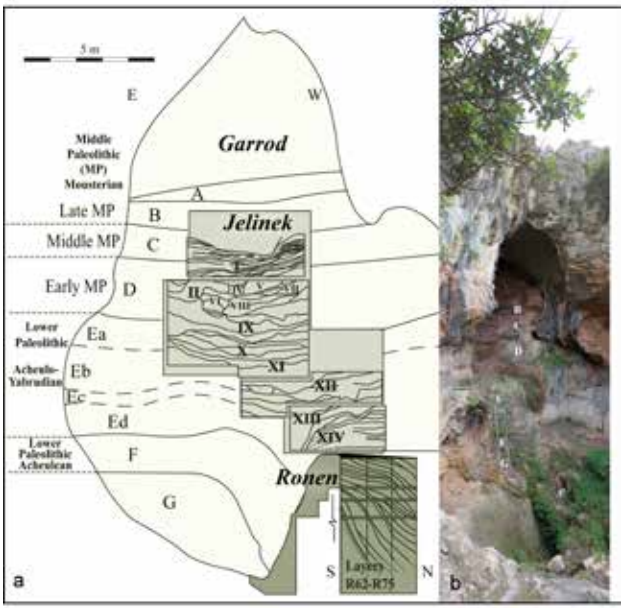

Figure 4.The archaeological sequence of Tabun Cave: a) scale of excavations by Garrod, Jelinek and Ronen (after Shimelmitz et al., 2014a: Figure 1); b) sequence of layers at the central part of the cave (photo by A. Ronen). G-F, Acheulian; E, Acheulo-Yabrudian (Mugharan); D-B, Mousterian.

palaeoenvironmental curve ever drawn for any prehistoric site in the world (Bate, 1937).

In the years that have elapsed since the onset of excavations at the site, it has been subject to continuing scientific exploration and research. Worth noting are Jelinek's (University of Arizona) and Ronen's (University of Haifa) excavations at Tabun (Jelinek, 1982a, b; Jelinek et al., 1973; Ronen et al., 2011; Figure 4). The extended history of research at el-Wad includes a trial excavation on the terrace (Valla et al., 1986) and the ongoing excavations of Weinstein-Evron and colleagues in the cave and on the terrace (Weinstein-Evron, 1998; Weinstein-Evron et al., 2007, 2013b; Figure 6). Jamal Cave was examined, too, and was found to yield Acheulo-Yabrudian lithics older than *c.* 220,000 years (Weinstein-Evron and Tsatskin, 1994; Weinstein-Evron et al., 1990a; Zaidner et al., 2005).

Archaeological, anthropological and environmental investigations at the site are among the earliest systematic, multidisciplinary studies carried out. Historically, the excavation and analysis methods have always incorporated all major scientific breakthroughs and advanced technologies in the archaeological sciences and have thus been at the forefront of archaeological practices. This is best expressed by numerous publications dealing with the site, which appears as a key site for studying the chrono-cultural sequence of the Levant and the global scheme of human evolution in most textbooks.

Natural and environmental values

Nahal Me'arot/ Wadi el-Mughara, with its rudist reef and the multiple caves within it, is a natural landmark clearly visible from the coastal plain, which parallels its western slopes and is of regional geological significance (Bein and Sass, 1980). This reef, a typical Upper Jurassic – Lower Cretaceous era phenomenon, is formed by rudist bivalve mollusks. A geological phenomenon

Figure 5.Overlap of Neanderthal and Early Anatomically Modern Humans approximate ranges (based on Klein, 2009: Figure 6.1).

unique in its size and exposure throughout the Middle East, it provides important insights into the geological history of the area and the formation processes of its caves.

Situated on the low western slopes of the mountain (Figure 7), the caves provide an expansive view of the coastal plain and Mediterranean Sea to the west and a large variety of environmental settings. Incorporating the Mediterranean maquis, the nearby stream bed, coastal fresh water and saline marshes, and the coast itself, these rich settings provided the essential subsistence resources for the prehistoric inhabitants of the region. Because of this ecotonal setting (Figures. 7, 8), the site is crucial for an in-depth understanding of various biotopes, the changes they underwent over time and their relationships to human-environment sustainable development, bio-diversity management and ecological conservation.

Past and ongoing research

Like prehistoric and anthropological research at large, since the first multi-disciplinary excavations and until today, research at the site of Nahal Me'arot has been subjected to ever-growing detailing and fine-tuning of the body of evidence, both through additional excavation and revisiting of old data and archives. Their synergic effect results in an increasingly more comprehensive reconnaissance of various aspects of this important sequence, as well as the defining of new research goals. Naturally, the ongoing research benefits from similar undertakings in other Levantine sites (and beyond), but in this report I will focus mainly on the research carried out at the site itself.

The classic sequence of Tabun cave was researched through renewed excavations by Jelinek (1982a) and Ronen (Ronen et al., 2011) resulting in a considerably more detailed stratigraphy (Figure 4) and chronology (for instance, Grün et al., 2005; Mercier and Valladas, 2003), as well as the geoarchaeological and palaeoenvironmental picture (Jelinek et al., 1973; Weinstein-Evron, 1994). With developing scientific techniques, various aspects of technological developments (Shimelmitz, 2009), palaeoenvironments (Tsatskin, 2000; Tsatskin et al., 1995) and human exploitation of the site (for example, Albert et al., 1999), were also elaborated. The temporal and taxonomic attribution of the various human remains was repeatedly reconsidered, in accordance with various models of human evolution in the Middle Palaeolithic, where the site plays a major role (Jelinek 1982b; Bar-Yosef and Callander, 1999; Rak, 1998; Kaufman, 1999, 2002; Stringer, 2011; Ronen 2012).

At el-Wad, renewed excavation projects were conducted repeatedly from 1981 (Figure 6; Valla et al., 1986; Weinstein-Evron, 1998; Weinstein-Evron et al., 2007; Weinstein-Evron et al., 2013b) with additional fine-tuning of the stratigraphy. Uniquely for this site, further detailing of the initial data was also achieved through a careful revisiting of the raw field-notes of both Garrod, the principal excavator of the site and Charles Lambert (Weinstein-Evron, 2009). Lambert conducted the trial excavation at the site in 1928 and his major contribution to the delineation of its stratigraphy and the unveiling of the Natufian culture was unacknowledged before. As clearly apparent from Table 2, his picture of the Natufian layer at el-Wad was much more complete than the one later published by Garrod, better conveying the narration and complexity of the Natufian culture at the site. Largely based on his observations, and together with a reinterpretation of Garrod's unpublished notes and various publications, an intercalation between construction and burial phases could be put forward, and several Natufian activity areas were identified during the main Early Natufian construction phase at the site (Figure 9).

An additional area is currently being excavated by Weinstein-Evron, Kaufman and Yeshurun in the north-eastern part of the terrace (Figure 9). The comprehension of its general picture, exhibiting a well-built curvilinear wall (Wall I), minimally 9 m in diameter, encompassing various smaller installations, such as Structure II (Figure 10a; Yeshurun et al., 2013, in press; Weinstein-Evron et al., 2013b) clearly benefits from the insights obtained through the detailed archival study and from the evidence unearthed at other sites, mainly in the Natufian 'core-area' (for instance, Valla, 1988; Hardy-Smith and Edwards, 2004). However, it is augmented considerably by the detailed mode of excavation and data-gathering and the in-depth taphonomic study of the faunal data. Thus, for the Early Natufian architectural complex defined by Wall I, various activity areas could be identified (Figure 10a; Yeshurun et al., 2013, 2014a). Preliminary results of phytolith analysis also seem to help differentiate between various site features (Portilo et al., 2010) and contextualizing other types of data is ongoing (for example, Rosenberg et al., 2012; Weissbrod et al., 2012, 2013). Significantly, the repeated nature of the Natufian habitation at the site was demonstrated through the super-position of at least nine living floors inside the Wall I complex (Figure 10b; Yeshurun, 2011, 2014, 2014a, b). The prolonged habitation at the site and its varying nature were also supported by a detailed dating programme (Weinstein-Evron et al., 2012b) coupled with a thorough FTIR study in order to determine the environmental factors that influenced the preservation of material for 14C dating of the site (Eckmeier et al., 2012). Significantly, the detailed dating and its careful contextual analysis helped support previous suggestions such as those regarding the stratigraphic affiliation of specific burials. It was demonstrated that no human remains can be linked to the Wall I architectural complex, enhancing the clear spatio-temporal separation between cemeteries and dwellings at the site (Weinstein-Evron, 2009).

The many Natufian burials and large skeletal assemblage were the subject of archaeological and anthropological research relating to both demographic and sociocultural aspects of this complex society (Garrod and Bate, 1937; Hershkovitz and Gopher, 1990; Belfer-Cohen, 1995; Byrd and Monahan, 1995; Bocquentin, 2003). The thorough archive study (Weinstein-Evron, 2009) indicated that the extant anthropological collection and resulting publications are clearly biased towards the group and decorated burials of the Early Natufian. Our recent excavations at the north-eastern part of the terrace somewhat remedy the situation regarding the Late Natufian of the site. A restricted burial area was unearthed containing 10 graves, with 15 burials (Figure 11), comprising the largest assemblage of Late Natufian burials unearthed at the site to date (Weinstein-Evron et al., 2007; Weinstein-Evron, 2009). Its placing indicates some spatial arrangement of activities at the site even within the limited area excavated. Thanks to careful excavation and documentation an unprecedented number of children were unearthed, while similar burials may have been overlooked in other parts of the site (Weinstein-Evron, 2009). The anthropological and palaeopathological study of the remains (Bachrach et al., 2013) provides important insights into the life-ways of these late hunter-gatherers.

Insights into mode of subsistence of the Natufian inhabitants of the site were primarily obtained through archaeozoological studies. These highlight the high diversity of exploited biotopes and animal types, including ungulates, small mammals, reptiles, birds, fish and mollusks (for instance Bar-Oz et al., 2004; Weissbrod et al., 2012; Yeshurun et al., 2009, 2014a; Weinstein-Evron et al., 2007). Understanding site layout and function depends on both the reconstruction of its extent and its inner-organization. While detailed spatial analysis of the various data is essential for the latter, geophysical research has also proven instrumental in drawing up the eastern boundary of the Natufian site on the el-Wad Terrace. Based on a geo-electric survey (Weinstein-Evron et al., 2003a) it could be demonstrated that this in fact lay very near the Late Natufian burial locale, no more than 5 m to its east, towards the wadi bed. Together with the observed, limited spatial expansion of the burials, this may indicate that at least for this part of the site and this cultural phase, graves were dug at the edge of the settlement.

Future research in the framework of World Heritage

Future research should of course involve more of the same in-depth analyses conducted today, preferably encompassing additional sites or layers, with the introduction of yet more sophisticated research venues. Entailing an impressive list of Outstanding Universal Values (OUVs), the site can easily anchor a Prehistoric Mount Carmel serial nomination, within which

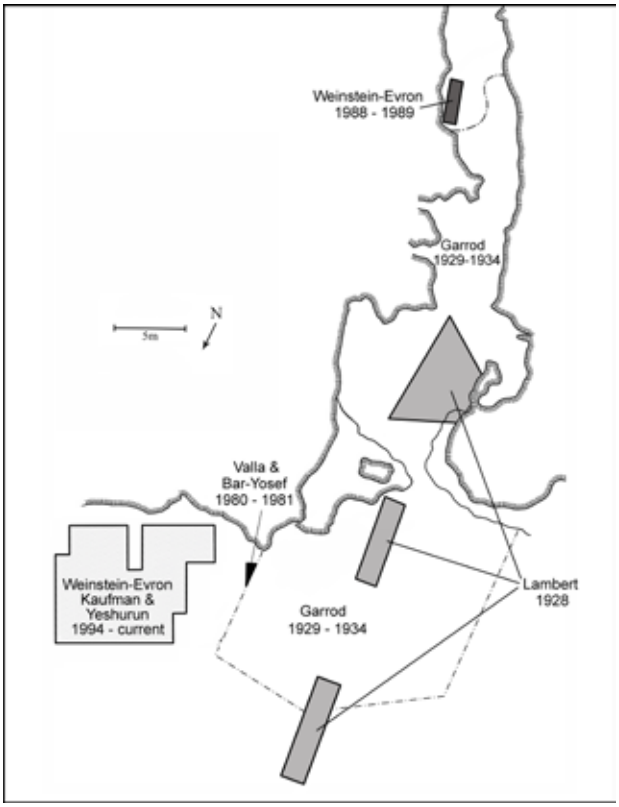

Figure 6.History of excavations at el-Wad Cave and Terrace (after Weinstein-Evron et al., 2013b: Figure 1).

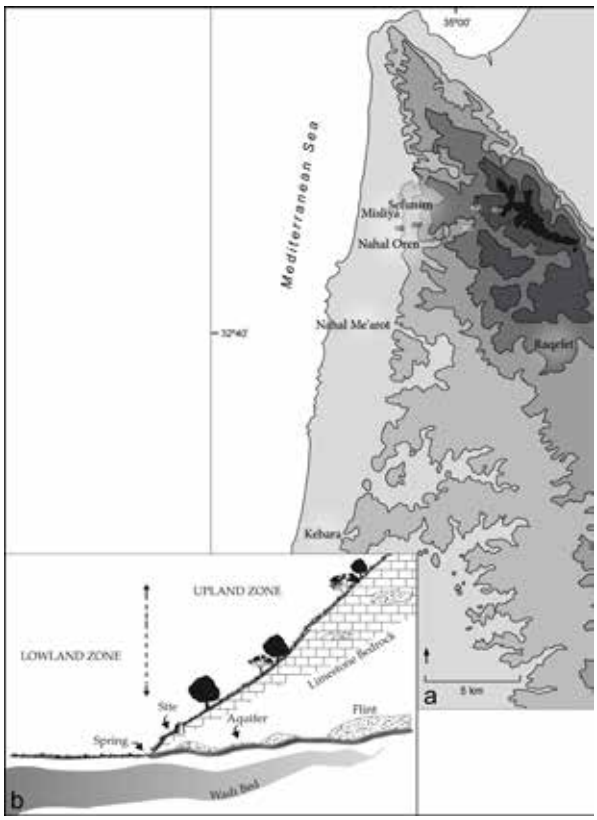

Figure 7.Topographic map of Mount Carmel (a) with (b) schematic illustration of a typical ecotonal setting of sites mainly located along the western cliff of the mountain (after Henry, 1989: Figure 7.2).

numerous other sites, exhibiting shorter sequences but equally demonstrating the various thematic OUVs, can be readily incorporated (for example, Sanz, 2009). Such thematic serial nominations (for example, Neanderthal/EAMH spheres; the Natufian) can be later widened to encompass the entire Levant and beyond. The easily defined geographic limits of the mountain and the fact that large parts of it are contained within either a natural park and/or a biosphere reserve makes it even more easily achievable.

For the early part of the sequence, Misliya cave, the only other site on Mount Carmel that contains both late Lower Palaeolithic (Acheulo-Yabrudian) and Early Middle Palaeolithic remains (Table 1) easily comes to mind. The site, located 7 km north of Nahal Me'arot in a similar setting, is important for the dating of the transition between these two periods, which marks a distinct technological and possibly also population change (Valladas et al., 2013; Zaidner and Weinstein-Evron, 2014). The rich faunal assemblage further contributes to an in-depth reconnaissance of human subsistence strategies and palaeoenvironments (Yeshurun et al., 2007; Yaroshevich et al., in press). Placed within a similar setting to Tabun cave (Figure 7), where faunal remains are rarely preserved, the observed patterns can be utilized to create a more reliable picture for the region as a whole and help reconstruct settlement patterns of its various groups (Yeshurun et al., 2007; Zaidner and Weinstein-Evron, 2014). The site also contains an impressive series of *in situ* heaths. Their study is still underway, but it can certainly benefit from those conducted for the later Middle Palaeolithic hearths of both Tabun and Kebara caves (Albert et al., 1999, 2012). Significantly, a detailed micromorphological study, coupled with phytolith analysis suggests the occurrence of bedding, as yet the earliest documented (Weinstein-Evron et al., 2012c). Additional studies of this nature still hold great promise to our understanding of prehistoric site-use and ways of life (Mentzer, 2012 and references therein). The later part of the Middle Palaeolithic is best represented in Kebara Cave, with its impressive Neanderthal remains (Arensburg et al., 1989; Bar-Yosef and Vandermeersch, 1991; Bar-Yosef and Meignen, 2007). Besides its importance for the understanding of the relationships between Neanderthals and early modern humans, it helps establish the faunal-based subsistence and climatic sequence well into the later Middle Palaeolithic and the Upper Palaeolithic (Speth, 2012, 2013; Speth and Tchernov, 2007).

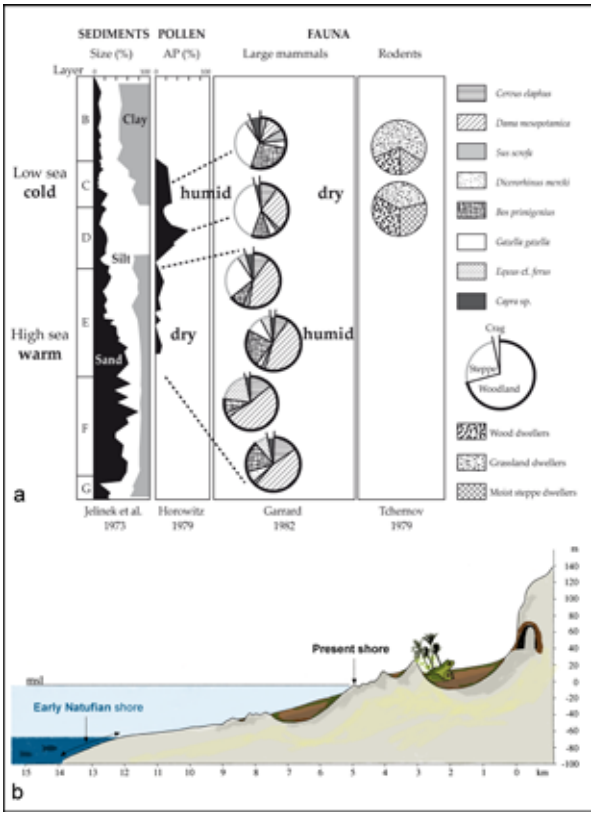

Figure 8.Changing sea-levels along the Mount Carmel sequence and their relationship with changing landscape, climates, vegetation and wildlife. a) At Tabun Cave, narrowing coastal plain as a result of sea transgression (warm period, increased sand input) is characterized by a dry climate (based on palynological data). The seemingly humid climate implied by the composition of the faunal assemblage may be a product of biasing hunting selection (after Weinstein-Evron, 1994: Figure 4). b) during Early Natufian times the coastal plain in front of the caves was located 7-9 km westward from the current one, supporting a variety of marshy and coastal biotopes (after Weinstein-Evron, 1998: Figure 77).

Kebara Cave also nicely ties in the Natufian sphere. El-Wad is the only Natufian site on the mountain that exhibits the full Natufian sequence and is thus considered a major base camp of this culture, paralleling only Hayonim Cave and Terrace (Bar-Yosef, 1991; Valla, 2012) and Eynan (Perrot, 1966; Perrot and Ladiray, 1988; Valla, 1991, 1995). During the Early Natufian it is accompanied by Kebara, where a rich burial complex was discovered in the early days of research (Turville-Petre, 1932). During the Late Natufian, Nahal Oren may have constituted another important hamlet (Stekelis and Yizraely, 1963; Noy et al., 1973) while at Raqefet Cave mostly burial activities were documented (Nadel et al., 2012a, 2013). Each site has its specific characteristics and contributes significantly to our understanding of Natufian ways of life and symbolic realms. Together they may constitute parts of a more comprehensive 'pan-Carmel' Natufian system (Weinstein-Evron, 2009). The relationships among the components of this system and with other regions still remain an intriguing issue for future research (for example, Weinstein-Evron et al., 1999b, 2001; Bar-Yosef and Belfer-Cohen, 1999). When raw material provenance is concerned (Weinstein-Evron et al., 1999b) such studies can benefit from thorough geological mapping and dating (Ilani et al., 2001) coupled with detailed geochemical analyses and finger-printing (Gluhack and Rosenberg, 2013). Benefiting from all available, updated scientific techniques, nothing can replace the keen eye of the archaeologist in the field, as recently reinforced by the unique unearthing of vegetal imprints in mud veneer coating of several Natufian graves at Raqefet Cave (Nadel et al., 2013).

Settlement-pattern reconstruction and landscape archaeology can benefit from old and advanced analyses, as well as from updated syntheses of topographic, geomorphic, vegetational and climatic data (for example, Olami, 1984). Naturally, detailed archaeobotanical, zooarchaeological and

geoarchaeological data can help elucidate points in time and space that can be incorporated into a palaeoenvironmental curve of changing landscapes, biotopes and temporal palimpsests. Data from the later part of the sequence (for instance, the Natufian) are much more varied and detailed, and the increasingly better-dated sequences can help clarify such notions as the relationships between climate and cultural changes at, for example, the ending phases of this culture (for opposing views regarding the impact of the Younger Dryas see, for example, Bar-Yosef and Belfer-Cohen, 2002; Lev-Yadun and Weinstein-Evron, 2005 and references therein). The lower part of the sequence and especially the Lower Palaeolithic is much less known in this regard, because of the paucity of sites and the low preservation of organic materials. The rare occurrence of Lower Palaeolithic sites, essentially in caves (Tabun, Jamal, Misliya), may indicate that the ancient Lower Palaeolithic landscape had been eroded from the top of the mountain and its upper slopes. Occurrences of Lower Palaeolithic finds in talus underlying those with Middle Palaeolithic remains (Weinstein et al., 1975) may indicate repeated processes of erosion and down-sloping. Significantly, the many patches of Middle Palaeolithic breccias, habitually found at some distance below extant cliffs, mainly across the western slope of the Mountain, but also within some wadi channels (Olami, 1984) attest to a previously much extended cave-system heavily utilized by the Middle Palaeolithic inhabitants of the mountain. Reconstruction of the rate and tempo of the cliff back-cutting still requires detailed modelling that needs to take into account the underlying bedrock, the possible rate of uplifting (Zviely et al., 2009) and the physical properties of every site. Being probably non-linear, it can be sometimes anchored at certain, well-established points in time. In the case of Misliya Cave, for example, the last major collapse of the cave occurred during the Early Middle Palaeolithic habitation of the cave (Weinstein-Evron et al., 2012c). In Nahal Me'arot, the first postulated major roof collapse must have occurred after the Lower Palaeolithic habitation at Tabun, with other episodes during the Middle Palaeolithic following. As suggested by the geoarchaeological data, the last collapse that resulted in the chimney formed in the ceiling of the inner chamber of the cave, likely occurred at the end of the Middle Palaeolithic occupation of the site (Jelinek et al., 1973). Whether the face of the cliff had once been connected in a straight line with that of the southern bank of the wadi (Figure 1c) and together these had undergone similar processes of cliff retreat cannot be ascertained. Clearly, however, Tabun Cave originally may have had three chambers (as suggested by Garrod and Bate, 1937: Plate XXX). An additional chamber was postulated for el-Wad cave as well, based on the form of the cliff, the sharp westward descending bedrock and flowstone deposition immediately outside the present entrance to the cave (Weinstein-Evron, 1998).

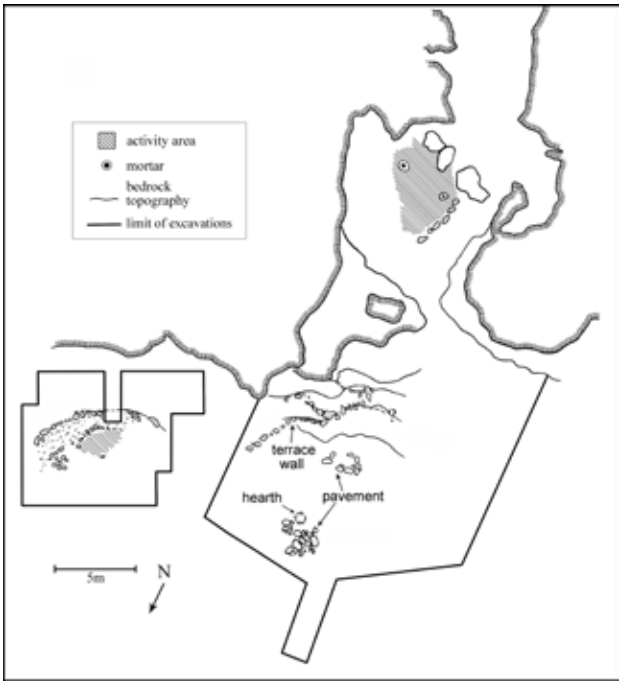

Figure 9. Plan of main construction elements of Late Early Natufian (LEN) el-Wad (after Weinstein-Evron et al., 2013b: Figure 6).

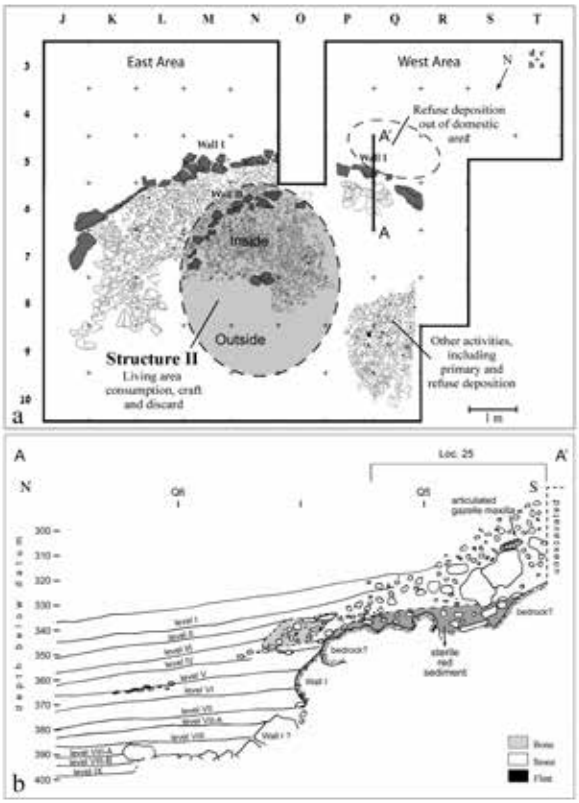

Figure 10. Currently unearthed Late Early Natufian features at the north-eastern part of the el-Wad Terrace. a) Plan of the main architectural features. Note the 'domestic' (Structure II) and 'non-domestic' refuse deposition (Locus 25) areas (after Yeshurun, 2014a: Figure 7). b) Composite section of Locus 25, Wall I and associated Levels (after Yeshurun, 2011: Figure 2.13).

As the caves are the result of prolonged karstic processes, deciphering their structure and the evaluation of the potential for further excavation, while avoiding unnecessary damage to these valuable sites should preferably resort to remote sensing. Geophysical studies have already proven reliable in assessing site extent, depth of archaeological layers and identification of specific features (Weinstein-Evron et al., 2003a) and are recommended prior to the initiation of additional excavations.

An additional issue of major importance for Mount Carmel and the Mediterranean Levant as a whole is the establishment of a detailed, continuous, well-dated palaeoenvironmental 'master sequence', at one key location. This can be achieved through a thorough isotopic research, similar to the ones conducted for other Levantine caves (Bar-Mathews et al., 1997, 2003), but using a local, long-term speleothem, as recently suggested for the one located in the back chamber of Sefunim Cave (Kandel and Shimelmitz, 2013), that may represent the last 300,000 years (Ronen, 1984).

Such a palaeoclimatic sequence can also provide the natural framework for a long cultural sequence, composed of the caves located nearby, practically within the same reefall cliff and together representing a sequence almost as long as that of the classical sequence at Nahal Me'arot (Figure 2). This composite sequence starts with Misliya Cave, with its Acheulo-Yabrudian and Early Middle Palaeolithic remains (Weinstein-Evron et al., 2003b) and continues with Sefunim Cave, set within a nearby wadi, some 0.5 km to the north-east of Misliya (Figure 7), whose sequence includes Late Middle Palaeolithic, Upper Palaeolithic, Epipalaeolithic and Pre-Pottery Neolithic remains (Ronen, 1984; Kandel and Shimelmitz, 2013). Sefunim is easily reached both from the wadi-bed north of Misliya and from a small plateau-like area above both caves. The nearby western face of Mount Carmel encompasses various other collapsed caves (Olami, 1984), some appearing as residual breccias, with mainly Middle Palaeolithic remains. Worth noting is the unique Middle Palaeolithic open air site in Nahal Sefunim (Lamdan, 1984) that probably constituted part of the same Late Middle Palaeolithic sociocultural system as the nearby Sefunim Cave.

Any such palaeoenvironmental curve can also be observed against the background of ongoing lithic research, especially that related to technological aspects of the various assemblages, as the one currently underway regarding the long sequence of industries at Tabun Cave. The strength of examining patterns of change throughout the sequence of Tabun Cave was already demonstrated by Garrod (1956) and more precisely by Jelinek (1977, 1982b). These, however, represent but a small fraction

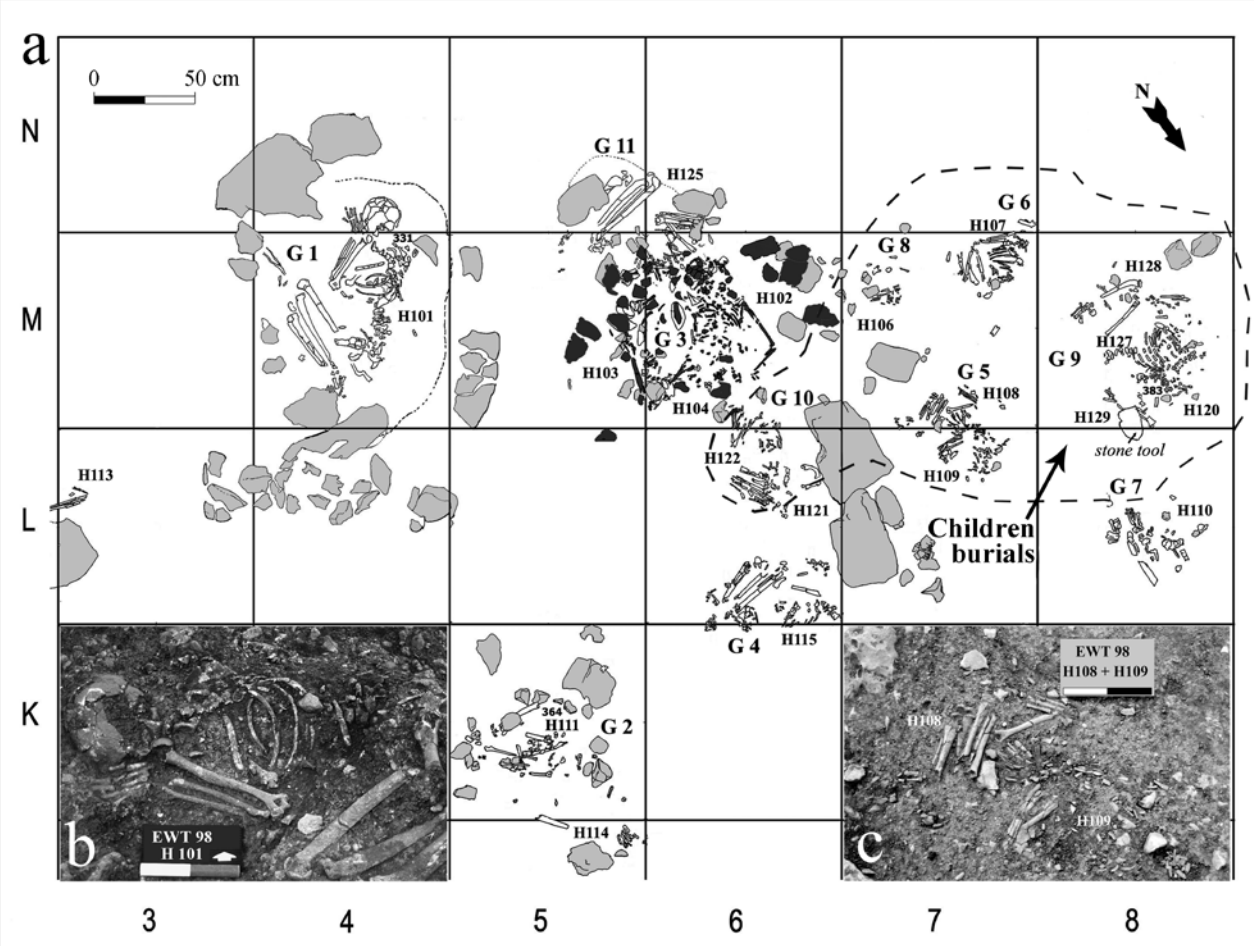

Figure 11: Late Natufian burials from the north-eastern terrace (after Weinstein-Evron et al., 2013b: Figure 12). a) plan of burials, with H101 (b) and the double burial of H108-109 (c). (b, c photo by D. Kaufman).

of the potential embedded in this long key-sequence. Our current study of Tabun Cave uses the material unearthed from both Jelinek's and Ronen's excavations which together create a 16 m long sediment sequence encompassing *c.* 100 distinct superimposed archaeological layers (Shimelmitz, in press; Shimelmitz et al., 2014a). In order to examine the evolution of technology and behaviour, more than 25 assemblages from this sequence were studied employing updated procedures of lithic analysis. This ongoing research will help shed new light on several research key-issues, such as the transition from the Acheulean to the Acheulo-Yabrudian, the reasons beyond the variability within the Acheulo-Yabrudian, the increased use of predetermined technologies (Shimelmitz et al., 2014b) and the Levallois technology in particular along the sequence, as well as the transition from the Lower Palaeolithic to the Middle Palaeolithic, now set around 250,000 years ago (Valladas et al., 2013).

Following the Early Natufian complex base-camp at el-Wad, during the later part of the Natufian, Nahal Me'arot seems to have lost its central role that passed to Nahal Oren, *c.* 3 km northward, with its impressive Late Natufian to Pre-Pottery and Pottery Neolithic sequence (Stekelis and Yizraely, 1963). It may have formed part of a Late Natufian site complex (Weinstein-Evron, 2009; Nadel et al., 2012b); during Neolithic times, it was accompanied by several other sites located along the wadi (Olami, 1984), on the enclosing slopes and cliffs (for example, Stekelis, 1942) and within a series of now submerged sites along the Carmel coast, dating from the PPNC to the Pottery Neolithic, (for instance, Galili et al., 1993, 1997). The location of such an impressive number of Neolithic sites (albeit of various phases) along the west to east transect of Nahal Oren may indicate some kind of elevation-biotope-economy-related settlement system. The onset of agriculture is still elusive in the Mount Carmel area, perhaps to some extent due to the incomplete data retrieved from the old excavations at the main site of Nahal Oren. Moreover, opinions still vary whether it started in parallel at different locations (for example, Riehl et al., 2013; Willcox, 2013) that may have included the Mount Carmel area with its stands of wild cereals (Zohary et al., 2012) or was a result of one event, in a rather restricted area (Lev-Yadun et al., 2000; Abbo et al., 2010, 2012) the influence of which later dispersed to the Near East as a whole, as well as to Europe and beyond. Significantly, the series of submerged Neolithic sites along the Carmel coast exhibits a unique preservation of botanical remains (wood, seeds, fruits) that, against the background of extensive archaeological, archaeozoological and anthropological/palaeophatological research can considerably enhance our understanding of the various social and economic processes involved (for instance, Galili et al., 1997; Hershkovitz et al., 1991). This impressive series of sites in fact represents the early Mediterranean agro-pastoral-fishing villages (Galili et al., 2002). Through it one can practically follow the stages in the onset of the domestication of plants and animals, and hence the adaption of agriculture in the region. It can thus constitute an important epilogue to the story of prehistoric Mount Carmel, with a significant OUV in its own right.

While archaeological, anthropological and palaeoenvironmental research at the sites deepens, much thanks to the introduction of micro-archaeological techniques, the use of more evolved nano archaeological methods, such as isotopic and DNA research is still called for (for example Brown and Brown, 2011). DNA research may help highlight a variety of demographic issues, especially those concerned with transitions between different cultural phases and whether or not these involved human migration and various degrees of admixture between new-comers and local groups. For example, literature abounds with research concerning the dispersion of agriculture into Europe (for instance, Haak et al., 2010; Fu et al., 2012), but analyses of Mount Carmel populations are still lacking. Ancient DNA of Natufian populations can help decode the nature of the transition between earlier Epipalaeolithic cultures and the Natufian. Specifically, if this transition is considered a real departure from former ways of life, such studies can show whether the Natufian revolution involved the arrival of new human groups and from where, much as they have shed important light on the origin and possible contact of the first agriculturalist in Europe (Pinhasi et al., 2012 and references therein). At el-Wad and probably at other sites as well, such studies can help discern whether collective or near-by burials, such as the ones unearthed by us at the north-eastern part of the terrace (Figure 11), belong to specific families (for a similar notion based on pathological criteria see Smith, 1973), thus contributing to the understanding of the underlying social structure (for example, Wright, 1978). Contact between human groups, now reconstructed based on movement of raw materials (Weinstein-Evron et al., 1999b, 2001; Bar-Yosef Mayer et al., 2013) or stylistic motives (Bar-Yosef and Belfer-Cohen, 1999) can be thus more securely established and this will contribute significantly to our understanding of Natufian settlement patterns on Mount Carmel and beyond.

Similarly, isotopic research of human and animal bones may help reconstruct their dietary and ecological niches (for instance, Lee-Throp et al., 2003; Al-Bashaireh and Al-Muheisen, 2011; Hartman, 2012) including anthropogenic niches, such as around sedentary Natufian hamlets (Tchernov, 1993; Yeshurun et al., 2009). Coupled with residue analysis, they can augment our knowledge of the relative contribution of faunal and vegetal foods at important stages of the adaption of agriculture. Plant isotopic research has also proven reliable in reconstructing past climatic changes and provenance of plant resources (Fiorentino et al., 2008, 2012). Detailed analyses of vegetal remains are still wanting in the southern Levant (Asouti and Fuller, 2013), but starch analysis has clearly demonstrated the crucial role of wild cereals in the subsistence of Epipalaeolithic groups in our region (for example, Nadel et al., 2012c; for the potential of such analyses for earlier periods see Hardy et al., 2012). The use of vegetal and other raw materials can be also perceived through detailed use-wear analysis (for instance, Lemorini et al., 2006; Weinstein-Evron et al., 2007; Groman-Yaroslavski, 2012). With in-depth charcoal and phytolith research (for example, Lev-Yadun and Weinstein-Evron, 1994; Portillo et al., 2010; Rosen, 2010) all these venues together can highlight the still poorly

comprehended role of vegetal food that, as much as animal resources, may have held an important role in the far-reaching social transformation of the agricultural revolution (for example, Zeder, 2008; Asouti and Fuller, 2013 and references therein; Hayden et al., 2013 and references therein).

Conclusion

The Mount Carmel Caves at Nahal Me'arot/Wadi el-Mughara constitute an important heritage site of human cultural and biological evolution within the background of palaeoecological changes, the recent history of cave use and the history of archaeological, palaeoenvironmental and palaeontological research. They have been the subject of multi-disciplinary research since the late 1920s and ever since the first groundbreaking exploration at the site and the establishment of this remarkable Levantine sequence, the research of the caves is characterized by increasingly in-depth studies of various cultural, biological, environmental and chronological aspects, and fine-tuning of the evidence.

Future research should consider preserving this important site while zooming in on additional facets (for instance, isotopic and DNA research), which will shed further light on the various evolutionary processes registered in its unique sequence. Broadening the research sphere to include numerous other prehistoric sites on Mount Carmel may significantly enhance our reconnaissance of specific periods or features that fit nicely into the caves 'ladder of progress' (McCown, 1943), while preserving this valuable World Heritage Site.

Acknowledgements

Like our prehistoric ancestors, archaeologists go about their business in groups, even if usually only one of them gets to write up the results and draw some conclusions. Thus it is my privilege to thank my faithful colleagues, especially from the Zinman Institute of Archaeology, the University of Haifa, who participated in the excavations and in sharing thoughts about various aspects of the research, during our long-time endeavour of the prehistoric exploration of the Mount Carmel caves: Daniel Kaufman, Alexander Tsatskin, Guy Bar-Oz, Reuven Yeshurun, Lior Weissbrod, Avraham Ronen, Silvia Chaim, Israel Hershkovitz, Dani Nadel, Noga Bachrach, Daniel Rosenberg, Alla Yarushevitch, Iris Groman-Yaroslavsli, Yossi Zaidner and Ron Shimelmitz.

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