

The Levantine Aurignacian: a closer look

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ABSTRACT This paper presents the results of a detailed study of lithic assemblages throughout the Levant that have been labeled “Levantine Aurignacian”, within both the Mediterranean woodlands and the marginal zone. A review and comparison of these assemblages is presented in this paper according to comparable, relevant artifactual criteria and attributes. These assemblages can be grouped

at the broader classification of complex/lineage, but are divided into three industries.

The differences between these industries are explained within a framework of chronological trends reflecting intensified exploitation of certain subsistence strategies, as a response to the combined effects of demographic pressure and climatic deterioration at the end of the Upper Paleolithic.

Introduction

The Levantine Aurignacian has not received the same long history of attention afforded to the European Aurignacian. Nor does it produce the same heated discussion as seen in Europe, primarily because the Levantine Aurignacian is, for the most part, disassociated with the issue of archaic versus modern humans. The appearance of modern humans antedates the Levantine Aurignacian, and indeed the Middle-to-Upper Paleolithic technological shift by tens of thousand years (Valladas et al., 1987; Vandermeersch and Bar-Yosef, 1988). Further, the earliest Upper Paleolithic entity is not the Levantine Aurignacian, but rather a local industry termed the Ahmarian. The Levantine Aurignacian arrives later, and appears to co-exist with the Ahmarian for at least a few thousand years.

Although the attention that it receives pales in comparison with that seen in Europe, the Levantine Aurignacian remains one of the most disputed topics in the Upper Paleolithic of this region. The major issues surrounding the Levantine Aurignacian are its identification and defining characteristics, its geographical distribution, and its relationship with other Upper Paleolithic industries, including the European Aurignacian. Originally defined on the basis of its similarity with Europe, the Levantine Aurignacian remains an entity with unclear boundaries and characteristics. Researchers are divided between those who suggest a refined definition of the Levantine Aurignacian, on the basis of close similarities with the French Aurignacian (Bar-Yosef and Belfer-Cohen, 1988, 1996; Belfer-Cohen and Bar-Yosef, 1981, 1999; Belfer-Cohen, 1994), and those who prefer a broader definition that encompasses most assemblages that produce flakes, thick blades, and twisted bladelets (Gilead, 1981; Marks, 1981). Most of the disagreement is centered on whether or not Levantine Aurignacian assemblages are restricted to a small strip of Mediterranean woodlands in northern Israel and Lebanon, or if they are also found within the steppe and desert regions of the marginal zone.

This paper presents the results of a detailed study of lithic assemblages throughout the Levant that have been labeled “Levantine Aurignacian”, within both the Mediterranean woodlands and the marginal zone. A review and comparison of these assemblages is presented in this paper according to comparable, relevant artifactual criteria and attributes. These assemblages can be grouped at the broader classification of complex/lineage, but are divided into three industries, on the basis of their lithic reduction sequences. The differ-

ences between these industries are explained within a framework of chronological trends reflecting intensified exploitation of certain subsistence strategies, as a response to the combined effects of demographic pressure and climatic deterioration at the end of the Upper Paleolithic.

Background

Two traditions are broadly recognized in the Levantine Upper Paleolithic: the Ahmarian and Levantine Aurignacian. The Ahmarian is a local industry, representing the first full-fledged blade/bladelet Upper Paleolithic entity. It is found directly after the terminal Middle Paleolithic technologies in the region, and appears to have evolved there (Marks, 1983). The term “Ahmarian” was first introduced by Anati (1963, p. 119), and subsequently adopted by Gilead (1981, p. 339), who applied it to the “blade-bladelet” assemblages in the Negev and Sinai. The Ahmarian was defined by both Gilead (1981) and Marks (1981), as a stone tool assemblage with an elaborate blade-bladelet technology and a tool-kit composed mainly of retouched and backed blades, as well as el-Wad points. Endscrapers are commonly found, although in relatively low frequencies, while burins are generally rare.

Dorothy Garrod (1937) was the first to recognize and define an Aurignacian industry in the Levant. In her earlier writings, Garrod (1937) believed that the continuous sequence from Levalloiso-Mousterian, through the Emiran, and into the Aurignacian at such caves as el-Wad and el-Emireh supported a Levantine origin for the Aurignacian industry. Garrod soon changed her mind, however, and the original home of the Aurignacian shifted to Europe. She later postulated that an Aurignacian cultural diffusion occurred from its home in Europe into southwest Asia (Garrod, 1953).

She recognized the following index fossils, present in both the Levant and in Europe: nosed and carinated scrapers, beaked and prismatic burins, and leaf-shaped points. Shared technology included the use of thick blanks and profuse secondary retouch. Garrod (1953) also noted some differences, such as the lack of strangled blades and the paucity of large blades with Aurignacian retouch in the Levant. Further differences included higher frequencies of carinated scrapers and burins, and lower frequencies of bone tools in the Levant (Garrod, 1953). She postulated that cultural diffusion must have occurred between the Levant and Europe, which was thought to be the homeland of the Aurignacian (Garrod, 1953).

Ofer Bar-Yosef coined the term ‘Levantine Aurignacian’ in 1969 at the Wenner Gren Symposium in London, during a group discussion with François Bordes, who saw close similarities between Level X at Ksar Akil (Lebanon) and the Aurignacian of Font-Yves (France), on the basis of typological indices (burins, scrapers, and points) (Wenner Gren Symposium, 1969; Bergman, 1987, p. 8). The Levantine Aurignacian was divided into three phases (A, B, and C) on the basis of the sequence at Ksar Akil. Phase A was more blade-oriented than the subsequent phases, and included numerous retouched blades and bladelets (el-Wad points). Phase B is characterized by a rise in Aurignacian elements, such as nosed and shouldered scrapers, carinated pieces, and bone tools (Copeland, 1975). Phase C saw a rise in burin indices, as well as prismatic bladelet cores.

Within the “two-tradition” framework of Marks and Gilead, the unilinear scheme of Neuville and Garrod was abandoned for a more dynamic framework that postulated two Upper Paleolithic traditions, the Levantine Aurignacian and the Ahmarian, which to some extent overlap spatially and temporally. The two-tradition framework departed from the ideas up to that point on a number of issues. The Levantine Aurignacian was expanded both spa-

tially, to the southern marginal zone, and temporally, to the very end of the Upper Paleolithic, judging from the late dates at Ein Aqev (Marks, 1976b). Also, the two traditions were defined largely on the basis of technological attributes, deemphasizing typological indices and index fossils that were the focus up to that point. In the two-tradition framework, the Levantine Aurignacian came to be broadly defined by a blank production aimed at producing flakes and a tool-kit dominated by endscrapers and burins, especially carinated and nosed varieties.

The problem

The Levantine Aurignacian is not clearly understood today, because there are unresolved, competing ideas about what it represents. Researchers of this subject can be divided into two camps. On one side of the debate, the most outspoken members are Ofer Bar-Yosef and Anna Belfer-Cohen, who have maintained Dorothy Garrod's original definition and conception of the Levantine Aurignacian. Like Garrod, they believe that the Levantine Aurignacian represents a cultural migration or diffusion, or a "social network" that spread to the Levant from its European homeland (Bar-Yosef and Belfer-Cohen, 1988, p. 36). In this scenario, the Levantine Aurignacian should share a striking similarity to the French Aurignacian, with specific typological markers such as an elaborate bone/antler tool industry, nosed and shouldered scrapers, thick keeled scrapers, and blades with Aurignacian retouch.

The other position is represented by the two-tradition framework, which was proposed independently by Anthony Marks and Isaac Gilead. Their framework expanded the definition, geographic scope, and temporal scale of the Levantine Aurignacian. The definition was expanded to include assemblages that did not meet all of the typological requirements of the classic perspective, and the Levantine Aurignacian was expanded spatially, to the steppe/desert areas, and temporally, to the terminal Upper Paleolithic. Marks is the most vociferous proponent of this position, giving reasons why he feels it provides a more accurate framework than the other approach. Marks (2003) argues that Bar-Yosef and Belfer-Cohen's definitional criteria include artifacts that can only be found in settings with good preservation (i.e., bone and antler tools). Because most of the sites in the desert/steppe area are open air, where there is poor organic preservation, Marks claims that a Levantine Aurignacian would never be found outside of a cave or rockshelter using such a refined definition. Marks asserts that by ignoring assemblages that do not possess a host of typological elements, one might exclude useful information, such as ephemeral sites within the settlement pattern of a single group, which could be recognized through their shared, underlying technology. In other words, the entire array of Aurignacian tools may not be needed at every locality, and the possibility exists that small desert sites may exist which do not have bone and antler tools and nosed scrapers for reasons of preservation and function, but yet might be recognizable through a shared, underlying technology.

One of the reasons why this issue remains unresolved is a basic confusion of what the Levantine Aurignacian represents. While Garrod and others who have followed her lead have clearly associated the Levantine Aurignacian with a prehistoric culture, possibly from western Europe, there has been confusion about what Marks and Gilead refer to as a "tradition". Marks (2003) has since addressed the confusion and inconsistency surrounding the concept of a tradition, and explicitly defined a new framework. In this framework, the Levantine Aurignacian is attributed to the scale of industry, which is more refined than Marks's original conception of a tradition. According to Marks (2003), an industry is characterized by one or

more closely related lithic reduction strategies that produced comparable clusters of blank forms, regardless of activities performed or raw-material used, and a technological consistency or developmental change across time and space. Tools also contribute to industrial classification, but in a technological sense. An industry should exhibit a patterned blank selection for retouched tools, and in the kinds of retouch applied to those tools (Marks, 2003).

Marks has provided a testable classificatory framework for his perception of the Levantine Upper Paleolithic. Bar-Yosef and Belfer-Cohen (1988) also acknowledge the utility of technology, and have devised a testable hypothesis. Noting the dissimilarity between the Levantine Aurignacian cave assemblages in the Mediterranean woodlands and open air assemblages in the marginal zone, such as a lack of bone tools and decorative objects in the marginal zone, they considered the possibility that such differences were governed by: 1) site formation processes (e.g., taphonomic processes or duration of occupation), or 2) separate cultural-technological concepts between these two areas. They suggested that reconstructing the core reduction strategies and tool selection for both areas could test these possibilities, because while tool form might be influenced by nature and habitation type, core reduction strategies should remain constant within the Levantine Aurignacian.

Now the stage is set to resolve some of the ambiguities surrounding the Levantine Aurignacian. We are armed both with a classificatory scheme, and an agreement among researchers about how to compare assemblages to determine if they belong within the same classificatory scale. To this end, this study seeks to reconstruct the reduction strategies of the relevant assemblages, using a consistent and detailed method of analysis that will allow direct comparison. With some understanding of the reduction sequences, it is possible to classify the assemblages at the scale of lineage and industry, and then identify potential sources of this variability, such as developmental changes revealed through chronological information, or adaptive responses to environmental and/or demographic stress, as reflected in technological strategies. In short, the groundwork has not yet been laid to allow us to clearly conceive the Levantine Aurignacian. Before addressing broader issues such as the migration or diffusion of early modern human culture, it is necessary to identify the precise nature of the archaeological remains, and how they pattern on a local scale.

Methodology

Assemblages were sampled from the Mediterranean woodlands (Ksar Akil XIII-VI, Hayonim D, Sefunim 8), the Jordan Valley (Fazael IX and Nahal Ein Gev I), and the Negev Highlands (Ein Aqev, D27A, Arkov, Har Horesha I, G11, and K9A) (Fig. 1). This sample encompasses most of the Upper Paleolithic, from ca.30 000 BP to ca.20 000 BP. Some Jordanian assemblages that were previously questionable, such as WHS 618C (Coinman, 1993), Tor Fawaz (J403) and Jebel Humeima (J412) (Coinman and Henry, 1995), were excluded from this study because they were subsequently determined to be Ahmarian in nature (Kerry, 1997; Williams, 2003a), or too undiagnostic to fit into a known category (Kerry and Henry, 2003; Williams, 2003a).

Ksar Akil is by far the most intensively occupied Upper Paleolithic site known in the Levant, with the deepest stratigraphy, with some 23 meters of rich cultural deposits spanning the Middle and Upper Paleolithic. It is situated at the edge of the coastal plain north of Beirut, adjacent to the Lebanese Mountains (Wright, 1951). The rockshelter has been excavated numerous times, beginning in the early part of last century. The most representative surviving artifact samples are derived from the excavations of the Boston College team in the 1930s

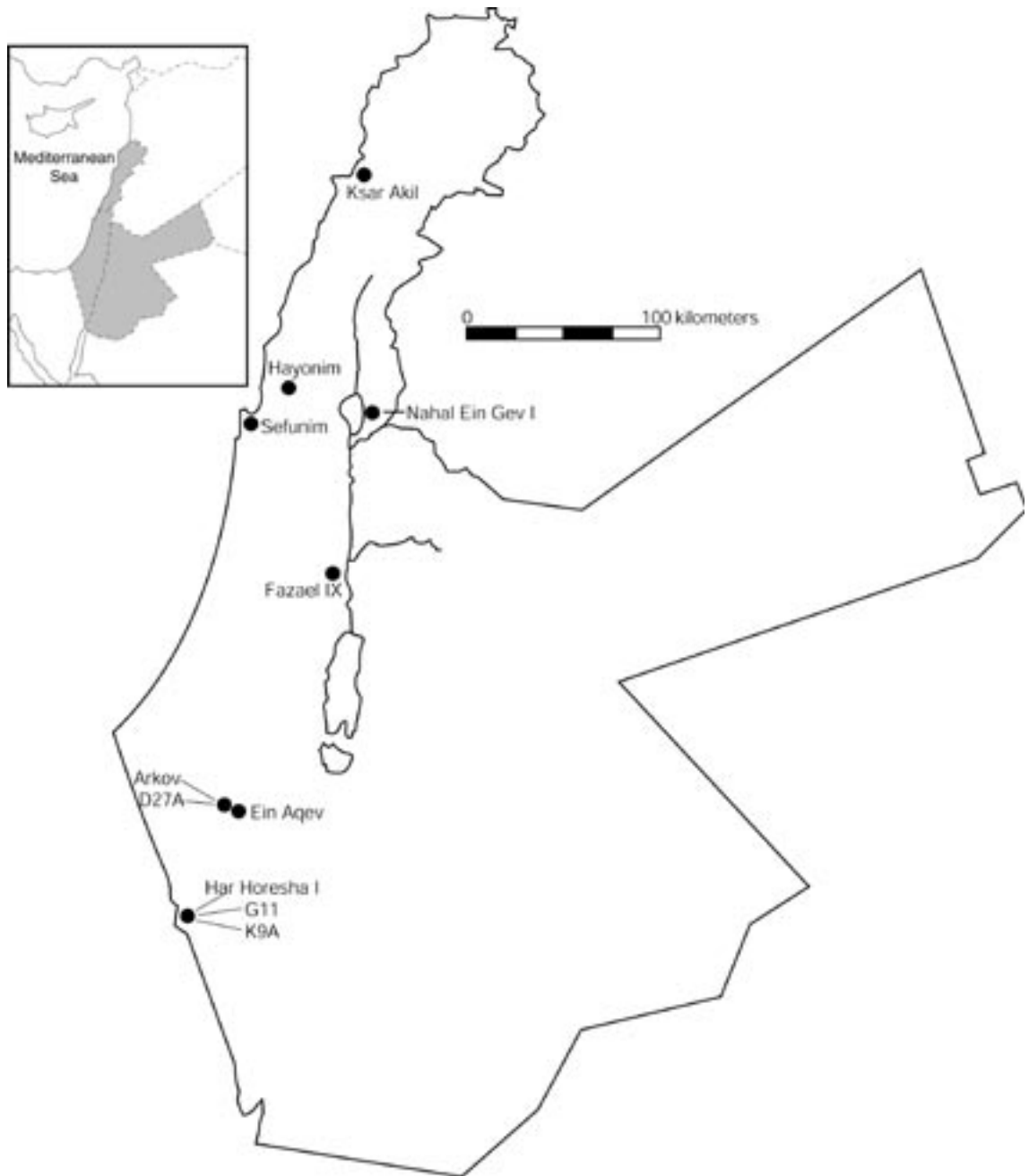


FIG. 1 – Map of the Levant, revealing sites in sample.

and 1940s, which were analyzed in this study. Although the 1937 material has previously been analyzed and published in detail by C. Bergman (1987), the 1947 material remains unpublished. The Levantine Aurignacian levels (XIII-VI) from both seasons were sampled in this study.

The addition of the 1947 material adds important new information about the sequence as a whole. Particularly, blades and bladelets were a much more prominent aspect of the technology throughout these levels than what was previously known from the 1937 season material, a tendency that was observed in Tixier's more recent excavations (Tixier and Inizan, 1981). Apparently, the 1946-47 seasons seem to be a more representative sample than the

1936-37 seasons (see Williams, 2003a). For this reason, only the artifacts from the 1946-47 seasons are used in the following analyses.

Two other assemblages were sampled in the Mediterranean woodlands, in the Galilee and Mt. Carmel regions of Israel: Hayonim D and Sefunim 8. The cave of Hayonim has provided a wealth of cultural material from the Middle Paleolithic through to the Natufian, excavated in a massive project by Ofer Bar-Yosef during the 1980s and 1990s. Aurignacian layers were found inside the major frontal chamber in Stratum D, a layer of light colored grayish loam, 35-45 cm thick, of which 15 m² was excavated (Belfer-Cohen and Bar-Yosef, 1981). The Aurignacian deposits at Hayonim represent three successive temporary occupations, yet full recovery and good preservation provided a wealth of information, replete with lithic and bone artifacts, hearths, architecture, ornaments, and art objects.

The cave of Sefunim is situated on a dry watercourse, which drains from Mount Carmel into the Mediterranean about 10 km from Haifa. Directed by Ronen, excavations at the cave during the 1960s-1970s revealed cultural horizons spanning from the Mousterian to the Chalcolithic. Layer 8 yielded the largest assemblage of Sefunim, and was characterized by a flake technology and typical Aurignacian tools. Ronen (1984, p. 102, 107) also characterized Layers 9-10 as "Levantine Aurignacian", but due to a small sample in Layer 9 and apparent mixing with the underlying Mousterian horizon in Layer 10, only Layer 8 was studied.

Two assemblages were also sampled within the Jordan Valley: Fazael IX and Nahal Ein Gev I. Wadi Fazael IX was excavated under the direction of O. Bar-Yosef during part of a larger project in the Lower Jordan Valley (Goring-Morris, 1980). Wadi Fazael is a steep, rock-walled valley with bedrock floors, draining the eastern slopes of the Samarian Hills between the Dead Sea and the Beth Shan Valley.

Six of the assemblages considered for this study are located in the Central Negev Highlands, within two study areas: the Avdat/Aqev, and the Har Harif Plateau. Ein Aqev (D31) occurs in the Nahal Aqev, and consists of 60 cm of stratified cultural deposits, which date to the end of the Upper Paleolithic (ca. 17 500 BP) (Marks, 1976b). This open air site revealed abundant lithic artifacts, which were classified as a Levantine Aurignacian assemblage on the basis of a toolkit dominated by carinated scrapers and burins, as well as numerous Dufour bladelets. Ein Aqev represents one of the only sites in the Central Negev that was still largely *in situ* at the time of excavation, both geologically and archeologically (Marks, 1976b, p. 227). It is located 250 m downstream from the present perennial spring of Ein Aqev, within the top of the western side of an Upper Paleolithic terrace at an elevation of 390 m asl.

Situated on the Divshon Plain, two sites, Arkov (D22) and D27A, are characterized by large surface and, in some cases, partially *in situ* artifact concentrations that were spread over large areas on fine eolian deposits (Marks and Ferring, 1976).

Also sampled were three sites collected atop the Har Harif plateau, at an elevation of 980 m asl (Larson and Marks, 1977; Belfer-Cohen and Goring-Morris, 1986). G11, K9A, and Har Horesha I each were characterized by surface lithics covering a large area, apparently moved by extensive deflation and sheetwash.

Sampling procedures were tailored to the overall goals of the research and the idiosyncrasies of the sites (Table 1). In an attempt to control for intra-assemblage patterning, horizontally random samples were taken from the large assemblages. When dealing with stratified assemblages at a single site, each level was sampled separately.

Only complete artifacts were selected for detailed study. Because attribute relationships are focal aspects of the research design, the use of broken pieces would exclude examination of numerous attributes. Complete tools on a broken blank (e.g., an endscraper on a distal seg-

ment of a blade) were tabulated only on the basis of type class and the characteristics of the broken blank (i.e., proximal, distal, lateral).

The methodology was designed to provide an accurate representation of the Levantine Aurignacian reduction sequence, from raw material acquisition and core reduction, to core maintenance and blank production, and finally to tool manufacture and maintenance. According to the most frequently cited characteristics (Garrod, 1953; Belfer-Cohen and Bar-Yosef, 1981, 1999; Gilead, 1981; Marks, 1981; Belfer-Cohen and Goring-Morris, 1986; Bergman and Goring-Morris, 1987; Marks and Ferring, 1988; Coinman, 1990; Belfer-Cohen, 1995), the Levantine Aurignacian is defined by specific technological attributes (carination, thick blade blanks and Aurignacian retouch), in addition to specific typological attributes at the class and type levels (thick and steep scrapers, nosed and shouldered scrapers, multifaceted burins, el-Wad points and bone/antler tools). The methodology was created with these characteristics in mind, proceeding from a basic division of class types, to more detailed information about blank types and scar patterns and, finally, to metric measurements of various characteristics and attributes (Williams, 2003a). Only lithic artifacts were included in the study, because they are consistently present in adequate numbers in all studied assemblages. Unfortunately, bone/antler tools and decorations are incomparable among the sampled assemblages and had to be excluded from these analyses, because of the relatively poor organic preservation in areas such as the Negev.

This study deals with technological and typological data at two levels: the artifact type and the attribute class and state. Each assemblage is initially separated into three categories: debitage, cores, and tools, following Marks (1976a). After identifying the appropriate artifact class, various criteria and attributes are recorded for each piece (Fig. 2).

Of particular importance in this methodology is the subcategory of “carinated pieces”, which includes both cores and tools in traditional typologies (Fig. 2). The treatment of carinated lithic implements in this study attempts to avoid some of the problems that arise when using typologies that include carinated tools. Many efforts have been made to classify carinated artifacts in western Europe and the Near East. The term “carinated scraper” was first used by Breuil (1906, p. 340), who defined this tool on the basis of the convex shape of the contour, i.e., the profile of the working edge, and the thickness of the blank. The earliest classifications of carinated burins (Noone, 1934, p. 478; Bouyssonie, 1948, p. 16) also emphasized the convex, or keeled shape of the burin spalls, visible in their profile. De Sonneville-Bordes and Perrot (1954, p. 332) defined a carinated endscraper as an “endscraper made on a

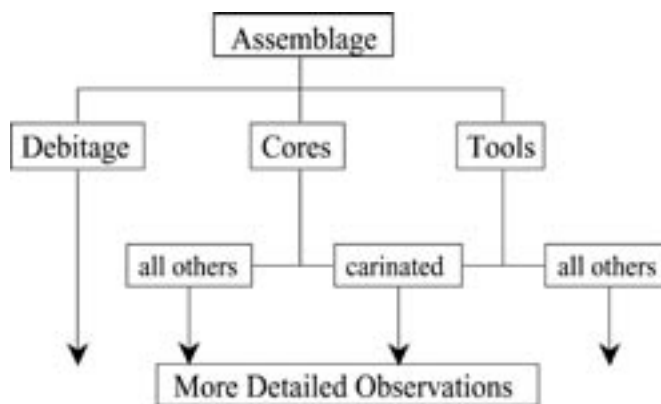


FIG. 2 – Method of dividing each assemblage into analyzable units.

thick flake having a profile of an inverted keel; the scraper front is made by lamellar retouch which may be wide and short or narrow and long”.

Since the inclusion of carinated tools in lithic typologies, archeologists have struggled to define the boundaries between carinated burins, carinated scrapers, and cores. Some have proposed the term “core-tools” to deal with the intermediate forms (e.g., the “core-like burin” of Sonneville-Bordes and Perrot, 1956, p. 412), while others such as F. Bordes argued against tool-core hybrids, stating that an artifact “is a core or a scraper, not both” (quoted in Bergman, 1987, p. 12). Recognizing the impracticality of distinguishing many carinated tools from cores, Goring-Morris (1980, p. 45-46) eliminated a number of carinated tool types on Bar-Yosef’s type list (1970, p. 18-19) and re-classified them as cores, reserving the terms “carinated burin” and “carinated scraper” to implements on flake blanks. Bergman (1987, p. 12) further reduced the number of carinated tools in his typology for Ksar Akil by using Goring-Morris’s restriction to artifacts produced on flakes (or blades), in addition to combining the carinated burin and scraper classes into one tool type: “carinated pieces.”

Similarly, the methodology used in this study attempts to avoid making arbitrary distinction between carinated scrapers, carinated burins, and bladelet cores, which can result in major tool class discrepancies that reflect the preferences of the individual archeologist more than reality. The approaches of Goring-Morris and Bergman, however, were not directly adopted in this study. While restricting carinated artifacts to secondary blanks is useful because it avoids making an arbitrary cutoff between carinated artifacts and bladelet cores on blocks of raw material, there is no reason to suspect that secondary blanks could not have also been used as cores. So we are faced with the same impasse, trying to distinguish between cores and supposed tools on secondary blanks. To avoid this problem, all carinated pieces are taken out of the type list entirely, and examined according to a set of detailed attributes (Fig. 2). Carinated pieces are thus identified on the basis of their technique of manufacture, rather than on the basis of their presumed function.

Within the relevant literature (Bardon and Bouyssonie, 1906, p. 402; Breuil, 1906, p. 60; de Sonneville-Bordes and Perrot, 1954, p. 332; Brézillon, 1971, p. 235-236; Marks, 1976a, p. 380-381; Ferring, 1976, p. 216; Bergman, 1987, p. 12-13; Belfer-Cohen and Goring-Morris, 1986, p. 55; Demars and Laurent, 1989, p. 44, 52), these are the most frequently cited characteristics of carination: invasive, steep retouch with bladelet-dimension removal scars on a thick blank; a removal surface with a keel-shaped profile; convergent retouch; and twisted removal scars. Although most researchers would agree that all of these are common characteristics of carinated implements, none of these characteristics by itself must be present for an artifact to be considered carinated. The criteria used to identify carination in this study are the following, all of which must be present for an implement to be considered carinated: a removal surface with a keel-shaped profile; three or more removals possessing bladelet dimensions; at least two twisted removals; and convergent to semi-convergent retouch (a natural result of twisted removals). While twisted removals are rarely used as a necessary attribute of carination, it is deemed important in this study to restrict carination to a specific kind of reduction sequence, which sets it apart from typical bladelet manufacture found throughout the Upper Paleolithic and Epipaleolithic (e.g., the Ahmarian reduction sequence, which involves the production of primarily non-twisted debitage). Using these criteria, carination includes both secondary blanks and cores/chunks. It is suggested that carinated implements, by their nature, are potentially tools and/or bladelet cores, and as a result it is regarded more appropriate to apply the same method of analysis to all carinated implements before further divisions. It should be noted that this methodology does not ignore important characteristics of carinated implements, such as whether the blank is a chunk/core or a flake/blade, as these and other attributes are recorded after the artifact is put into the “carinated” category.

Chronology of the assemblages

Many of the assemblages used in this study have been radiometrically dated, and together span nearly the entire duration of the Upper Paleolithic, from the earliest fully-fledged blade technologies at the beginning of the Upper Paleolithic some 40 000 years ago, to the latest manifestations of this period at around 19 000-17 000 BP.

Dating and correlating Ksar Akil

Unfortunately, only one direct radiocarbon date was obtained from the Boston College excavations at Ksar Akil, and this was taken from the upper Mousterian levels (GrN-2579, 43 750 ± 1500 BP; Vogel and Waterbolk, 1963). Later excavations by Tixier, however, provide a suite of reliable radiometric dates from the Upper Paleolithic sequence (Mellars and Tixier, 1989). Although Tixier's excavations were directly adjacent to Ewing's, precise correlations between the Boston College collections and those by Tixier are difficult for a number of reasons. One reason is that three datum-points were used: 80.9 m asl by Ewing (1947), 75 m asl by Wright (1951, 1960), and 76 m asl by Tixier and Inizan (1981). Further, Tixier's grid was slightly offset from that of Ewing (less than 5 degrees). Lastly, Tixier used much more refined levels, often identifying natural stratigraphic levels of only a few centimeters in thickness, as opposed to the Boston College's use of large geological units, sometimes exceeding 1 m in thickness.

Nevertheless, broad comparisons can be made based on various lines of evidence. A rough correlation has already been performed by Copeland (in Bergman, 1987, p. vii), who used the heights above sea level published by both authors, while also accounting for the slope and the different grid angles. For the most part, this study, which includes the 1947 material that was excavated adjacent to Tixier's sondage, confirms Copeland's correlations, with minor modifications. A correlation between the levels/phases excavated by the Boston College team and Tixier was performed on the basis of technological and typological characteristics, as well as the discrepancy in slope between the geological levels and the archeological layers at Ksar Akil, identified in this study. It was discovered in this study that the technological characteristics of the 1937 season are consistently found in lower levels in the 1947 season, according to the labels given by the Boston College team (Levels XIII-VI). The Boston College team excavated in broad geological levels, and it is apparent from this study that the geological levels are somewhat offset from the cultural layers, a phenomenon noted by Tixier (1970) during his excavations. Specifically, the cultural layers seem to have a steeper slope southwards than the geological levels. Given that using the original level designations provides misleading information, Bergman's phase divisions have been adopted. Based on his analysis of Levels XIII-VI from the 1937 material, Bergman (1987) designated three phases for these levels — 3 through 6. The first two phases were identified by Azoury's (1971) study of the earliest Upper Paleolithic material (levels XXV-XXI and XX-XV, respectively). Based on Bergman's descriptions of these phases, and the correlation between the 1937 and 1947 material in this study, it was possible to assign Bergman's phase designations to the 1947 material. An additional Phase 7 was identified in this study, in the 1947 material at a stratigraphically higher position than Bergman had access to in the 1937 material.

Table 2 displays the correlation between the 1937 and 1947 seasons, as well as how these compare to Tixier's levels and phases, with the associated dates. This correlation follows that provided by Copeland (in Berman, 1986, p. vii), and includes the 1947 material, which was

closer to Tixier's excavations. This proposed correlation is of course open to question, given the natural difficulty of linking archeological entities that were excavated decades apart.

Dating the remaining assemblages

As revealed in Fig. 3, the dated assemblages in this study span the period between ca. 32 000 and 18 000 BP, with a possible break around 22 000-25 000 BP. The oldest assemblage is Ksar Akil Phase 4, which averages 30 000 BP, while the youngest assemblages are Ein Aqev and Fazael IX, both falling about 18 000 BP.

There appears to be two sub-sets of dates from Hayonim D. The break between these two clusters of dates is large enough to warrant the separation of the entire suite of dates from Hayonim D into two groups: early and late. The early dates average around 29 000, while the later dates average around 21 000 BP. It seems probable that the late dates are intrusive, from unrelated activities known to have taken place in the cave at a later period (Bar-Yosef, 1991).

Many of the assemblages in this study are undated. Yet they can be tentatively grouped into certain time frames on the basis of their technological relationship with dated assemblages. Sefunim 8, for example, is very similar technologically to Hayonim D and Ksar Akil Phase 5, and the logical assumption is that the occupation at Sefunim dates to this earlier period (30 000-25 000), rather than later with assemblages which it has little in common with, such as Ein Aqev and Fazael IX, which average around 18 000 BP. Similarly, the undated assemblage of Nahal Ein Gev I can be tentatively grouped together with the dates from Fazael IX, because the assemblages are nearly identical.

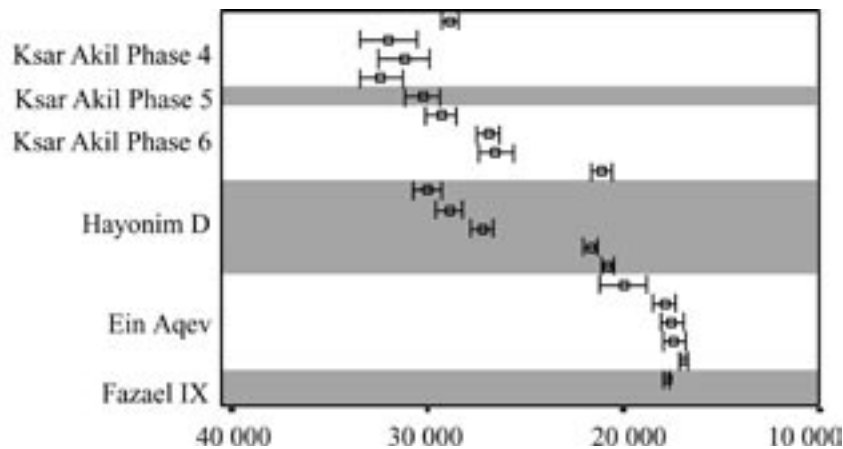


FIG. 3 – Radiocarbon dates for the sampled assemblages.

Paleoenvironment of the sampled assemblages

Given that some of the assemblages in this study have been dated, it is possible to reconstruct the paleoenvironmental conditions during their occupation. A good representation of the paleoenvironments for the Levant is provided by combining various lines of evidence, including pollen cores (Weinstein-Evron, 1990), geomorphological evidence from Upper Pleistocene sediments by Besançon (1981), Sanlaville (1981), and Goldberg (1981, 1986; Goldberg and Bar-Yosef, 1982), deep-ice cores (Mayewski et al., 1994; Petit et al., 1997, 1999) and

various isotopic studies (Gat, 1981; Luz, 1982; Issar and Gilead, 1986; Martinson et al., 1987; Goodfriend and Margaritz, 1988; Rossignol-Strick, 1993). The following reconstruction is a result of these studies.

Prior to 75 000 BP, the early Middle Paleolithic was one of the wettest periods of the Upper Pleistocene and Holocene (Gilead, 1991). This is evidenced by an intensive deposition of conglomerates, breccias, and travertines (Goldberg, 1981) and high-moisture plants represented in the pollen spectra from Tabun D (Horowitz, 1979, p. 250-253) and the Negev Mousterian sites (Horowitz, 1976).

A very dry period followed during the late Middle Paleolithic, which correlates mainly with the early part of isotope Stage 3 (Shackleton and Opdyke, 1973, Table 3). The southern Levant shows evidence for a dry period beginning around 60 000 BP, when the thick gravelly deposits of the early Middle Paleolithic were truncated by erosion during the late Middle Paleolithic (Bar-Yosef, 1989, p. 602-603). This event caused a depositional hiatus between the Middle and Upper Paleolithic sediments when the former was disconformably overlain by fine-grained, mostly Upper Paleolithic, sediments (Gilead, 1991; Horowitz, 1979, p. 250-253).

The climate remained relatively dry between 45 000 and 32 000 BP during the later part of isotope Stage 3 (Horowitz, 1989). This period includes the Middle to Upper Paleolithic transition and the early Upper Paleolithic. Regional variations appear to exist for this general trend. For example, a palynological sample from Boker Tachtit suggests a dry climate in the southern Levant (Horowitz, 1983), whereas a wetter phase in the caves of the Mediterranean core zone is evidenced by large-scale alluviation during the early Upper Paleolithic occupations (Bar-Yosef and Vandermeersch, 1972). Temperatures were relatively cool with warmer fluctuations.

To summarize these various lines of evidence, the humid conditions during the early Middle Paleolithic began to turn drier around 60 000 BP. This drying trend continued throughout the Middle Paleolithic and early part of the Upper Paleolithic. Around 40 000 BP, during the transitional period from the Mousterian to the early Upper Paleolithic, the climate was basically cold and dry throughout the Levant. A climatic amelioration began ca. 32 000 BP, marked by notably wetter conditions. Corresponding broadly to the early isotope Stage 2, this period became the most humid of the Levantine Upper Paleolithic. While the temperature during this period was cool compared to today's standards, there were several global fluctuations between warm and cold between ca. 40 000 and 23 000 BP, according to $^{18}\text{O}/^{16}\text{O}$ records in the GISP2 deep-ice core (Mayewski et al., 1994), after which cooler temperatures subsisted until the end of the Pleistocene. Around 20 000 BP the climate again turned drier and that tendency continued until around 14 500 BP, when the climate became more hospitable for human habitation.

To consider how the dated assemblages relate to global temperature changes, data from the GISP2 deep-ice core was used. Because ice-core paleoclimatic data are recorded on a calendrical time-scale, it was necessary to convert the uncalibrated ^{14}C dates of the assemblages used in this study. To perform this calibration, CalPal (Cologne Radiocarbon Calibration & Paleoclimatic Research Package) was used (Weninger et al., 2002). Fig. 4 displays the results of this calibration, together with the deep-ice core paleoclimatic proxies. The gradient shaded area within the lower portion of Fig. 4 represents the general precipitation levels during this period; the darker shaded areas represent more precipitation. The precipitation follows the broad trends outlined above, and does not represent a precise, measurable level of precipitation, as these levels apparently varied throughout the Levant. The shaded area only represents the general trend of a peak in precipitation around 32-30 000 BP.

The majority of sites in this sample seem to have been occupied during warmer and wetter phases, particularly within the period between 28-32 000 cal BC. GISP2 ice core data

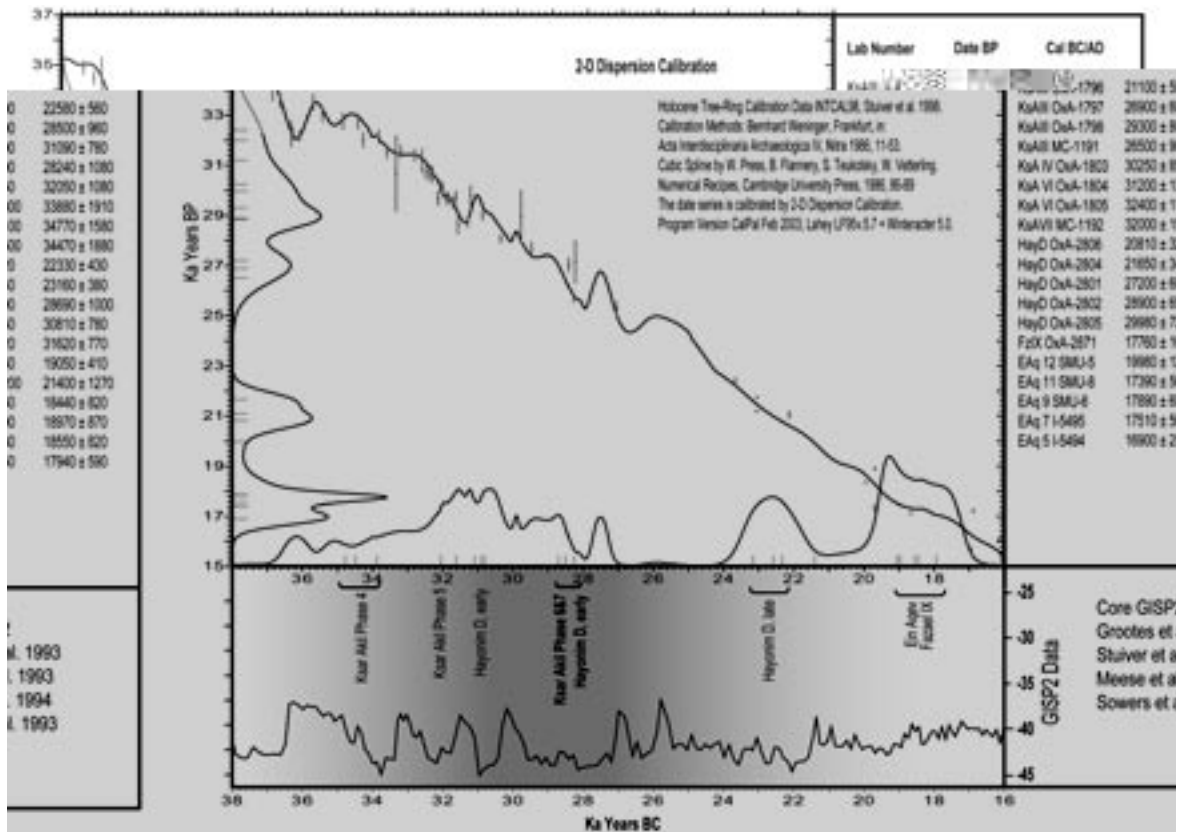


FIG. 4 – Calibrated radiometric dates for sampled assemblages, with paleoclimatic proxies.

suggest that several warm peaks are associated with this period (Groottes et al., 1993), and various local paleoenvironmental data suggest notably wetter conditions during this period (Goldberg, 1986, p. 239; Weinstein-Evron, 1990; Gilead, 1991). Notable exceptions to warm-wet climate occupations are Ein Aqev and Fazaal IX, which fall within the cold phase of the record. The late dates at Hayonim D are found just at the boundary of the warmer peak around 23 000 cal BC, and the beginning of the cold phase. Given the tentative correlation for the Ksar Akil dates, and the general spread of the Hayonim “early” dates, it is impossible to associate any of these assemblages with a particular spike in the $^{18}\text{O}/^{16}\text{O}$ records. Therefore, the most meaningful trend in Fig. 4 is the association Ksar Akil Phases 5-7 and Hayonim D with the climatic amelioration around 30 000 years ago, and the occupations at Ein Aqev and Fazaal IX during the cold and dry conditions during the late Pleistocene.

Results

A goal of this study was to eliminate some of the ambiguity surrounding the Levantine Aurignacian by taking all of the assemblages that have been called by this name and analyzing them on equal terms to determine how they compare among themselves, and to the broader Upper Paleolithic.

The classification of assemblages in this study follows schemes put forward by Henry (1989a, p. 81-89) and Marks (2003). In short, this scheme uses four archeological fields of data, ordered from broad to specific: complex/lineage, industry, phase/facies, and assemblage. The assemblage is the most spatially- and temporally-refined unit that can be identified

at any given archeological site, and forms the basic comparative unit for the higher-order classificatory scales. A complex, or lineage, is defined on the basis of a broad level of technological affinity, recognized as similar methods of blank reduction. An industry is defined by more specific technological attributes (e.g., metric parameters and frequency ranges), and activity-independent typological criteria such as tool blank selection and type of retouch. Phase/facies criteria are highly specific, such as a highly distinctive retouch type that in all probability would not occur independently at different locales or during different periods. It is clear that among the sampled assemblages in this study, there are no elements of the lithic assemblages that are sufficiently distinctive to allow identification at the scale of phase/facies. There are no technological characteristics that were solely restricted to a certain geographic region within the study area, or to a small time frame within this sample. There is not enough resolution to allow the identification of a phase/facies, which might even hold true for the entire Levantine Upper Paleolithic.

A possible exception to this generalization is the Ksar Akil scraper, which is found right around 25 000 BP at three sites with seemingly similar technologies: Ksar Akil Levels IV and V of the 1947 excavations (Ewing, 1947), Boker BE Levels III-VI (Jones et al., 1983), and Thalab al-Buhira (Coinman, 2000). The distinctiveness of the Ksar Akil scraper, coupled with technological similarities and seemingly tight chronological resolution, appears to represent a subdivision or phase of the larger Ahmarian. The Ahmarian, however, is not the focus of this study.

Most of the assemblages in this sample belong to a single complex/lineage, which is characterized broadly as a flake-oriented technology. While blades and bladelets were produced at some of these assemblages, sometimes in large numbers, the technology, on the whole, is oriented toward relatively thick blanks that are less than twice as long as they are wide.

While a flake technology is important at most of the sampled assemblages, blade and bladelet production was also present, and was practiced in earnest at a few of the assemblages. It is necessary to consider carinated items when discussing core technology for the sampled assemblages. That carination is related to twisted bladelet production is becoming more apparent as this issue is further researched.

The strategies used to produce flakes are generally related among these assemblages, while other aspects of the technology (e.g., bladelet production) vary considerably. Also, typological characteristics are divergent within this group of flake technologies. The impact of carination on core technology is apparent in Fig. 5. When carinated items are placed in the bladelet core category (graph B), the core inventory of assemblages with significant carination indices are markedly influenced. In particular, the relative proportion of bladelet cores is increased. Given the evidence supporting carination as a means of producing twisted bladelets, and the definition of carinated items used in this study, it is reasonable to consider graph B in Fig. 5 as a more accurate representation of core technologies. When carinated items are considered in the bladelet core percentages, the assemblages cluster into three broad groups, represented by bladelet-rich core technologies at the top of the tripolar graph, and two other groups characterized by fewer bladelet cores and higher percentages of flake cores. Arkov is excluded from any grouping because of the extreme paucity of cores other than carinated items in this assemblage.

Two of the sampled assemblages can not be considered flake technologies as a result of their blade-bladelet oriented reduction sequences: Ksar Akil Phases 3 and 4. Ksar Akil Phase 3 is characterized by habitual production of blades and twisted bladelets, with the use of a reduction sequence unlike the others in this sample. Ksar Akil Phase 4 is characterized by blade and bladelet production, with many more incurvate profiles than the preceding period, and a large percentage of el-Wad points. In many ways, Ksar Akil Phase 4 resembles the Early Ahmarian

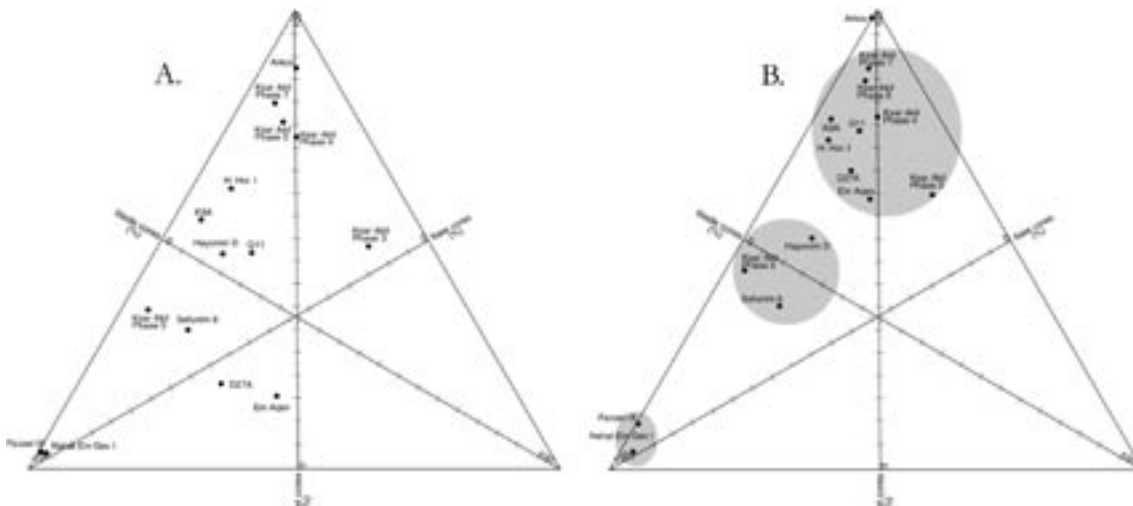


FIG. 5 – Tripolar graphs: (A) - Core scar pattern frequencies, excluding carinated items. (B) - Scar pattern frequencies, cores and carinated items (twisted bladelet cores).

industry of the southern Levant. Ksar Akil Phases 3 and 4 fall squarely within the “Leptolithic” complex described by Marks (2003), and as a result, will not be further considered in this study (for detailed information about these assemblages, see the study in Williams, 2003a).

Using the information from various analyses, such as scar pattern complexity, blank profile, and length-width ratios (Williams 2003a), some generalizations can be made about the reduction sequences for the sampled assemblages (Table 7). Most assemblages have multiple reduction strategies, where flakes were produced with one strategy, and blades and/or bladelets were produced with another strategy. There are only two assemblages with a single reduction strategy (Fazael IX and Nahal Ein Gev I), which was solely oriented toward flake manufacture. Of the blade-bladelet producing reduction strategies, one was geared toward the manufacture of incurvate blanks, while the other produced blanks with twisted profiles.

Fig. 6 displays how the assemblages were classified in this study, and the major characteristics of each classificatory unit. Providing a list of criteria and attributes that does justice to the classificatory scheme is difficult. Nevertheless, the most pertinent criteria are listed in Fig. 6 in some cases with the representative range of variability among the sampled assemblages. The ranges listed do not represent precise exclusionary break points, but rather show what is typical for a particular complex or industry. Indeed, some of the assemblages in this sample fall outside the given ranges, but for known reasons (Williams, 2003a).

At one time or another, all of the assemblages listed in the flake-oriented complex/lineage in Fig. 6 have been called Levantine Aurignacian. These assemblages, however, can be divided into three industries. Marks (2003) recognized all of the reduction strategies of the flake-oriented complex/lineage within his discussion of the Levantine Aurignacian. Noting the difficulties of using published information to compare assemblages, he tentatively grouped all of the flake-oriented assemblages sampled in this study within a single industry because each of them seemed to possess all of the identified reduction strategies. In contrast, this study found that all of these assemblages do not share the same reduction strategies, and they can be divided into three industries, each with their own specific characteristics.

We are now faced again with the ongoing debate between various researchers: what is and what is not Levantine Aurignacian? Is it useful to classify these industries under a broader Levantine Aurignacian heading, possibly defining geographic sub-regions, or temporal ranges, or is it more productive to reserve this title for a particular industry that is more fundamentally

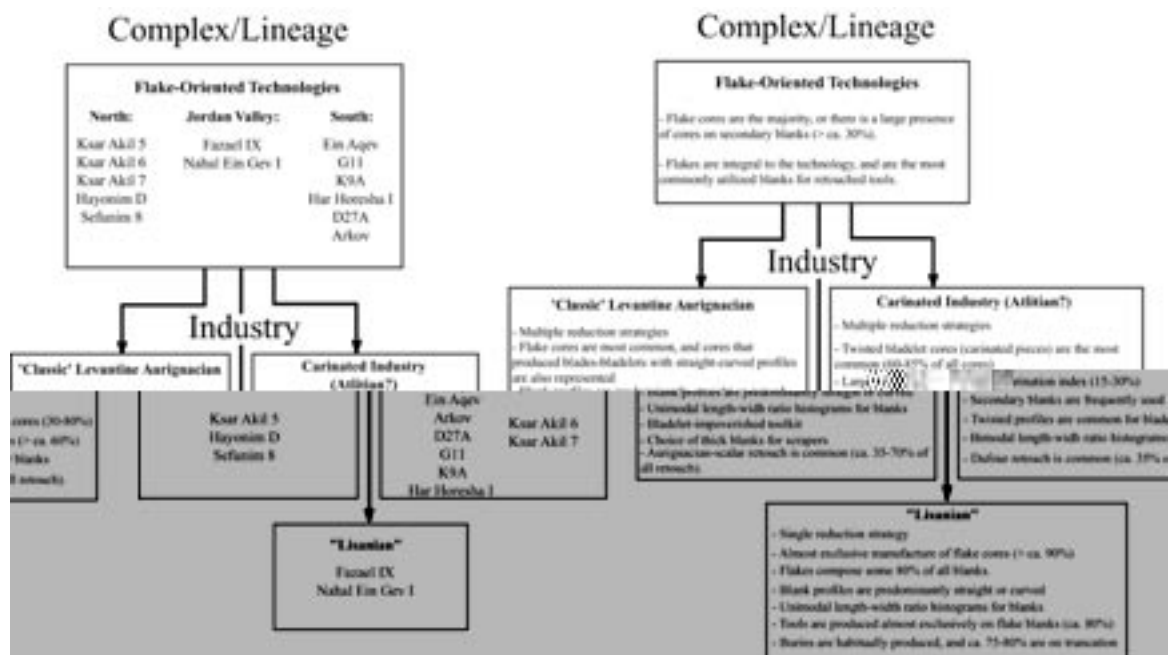


FIG. 6 – Classificatory scheme for the sampled assemblages, and the characteristics and criteria of each classificatory unit.

Aurignacian than the others? It seems that the title “Aurignacian” has somehow been awarded an intrinsic value, probably by virtue of its application to assemblages throughout the Near East and Europe, and the implied association with an early modern human culture, spread throughout the Old World through diffusion or migration. The problem with this scenario is that in the Levant, the Aurignacian arrives some five to ten thousand years later than the Initial Upper Paleolithic, which itself exhibits all of the features of the Upper Paleolithic behavioral complex, including bone tools and ornaments (Kuhn, 2003). Thus the utility of the Levantine Aurignacian, as Kuhn (2003) rightly remarks, is not some implicit notion of behavioral superiority, but rather how it is found in areas so far apart as southwest France and the eastern Mediterranean. Such a question is beyond the scope of this study, which is concerned with how to classify and explain the identified industrial variability within the Levant.

Both the classificatory framework provided by Marks (2003), and the hypothesis provided by Bar-Yosef and Belfer-Cohen (1988) have been tested in this study, revealing that, firstly, the questioned assemblages do not belong to a single industry, and secondly, that the dissimilarity between the “classic” Levantine Aurignacian assemblages in the Mediterranean woodlands and the remaining assemblages in the marginal zone are a result of different core reduction strategies, rather than site formation processes.

We know that there is a Levantine Aurignacian in the Mediterranean Woodlands, which in this study occurs at Ksar Akil Phase 5, Hayonim D, and Sefunim 8. These assemblages bear some resemblance to the classic Aurignacian from Europe, particularly southwest France, including thick nosed and shouldered scrapers, Aurignacian blades, and even split-based antler points and art (Bar-Yosef and Belfer-Cohen, 1988). As detailed below, we also know that toward the end of the Upper Paleolithic, assemblages are found with some Aurignacian characteristics, but possessing a fundamentally different core reduction strategy, aimed at the habitual production of twisted bladelets, or “carinated” reduction, as it is defined in this study. These differences indicate that the classic Levantine Aurignacian and the carinated assemblages are two, distinct industries, but the question remains, should the term Aurignacian also be applied to the cari-

nated industry, noting perhaps a temporal or geographic distinction? “Early” and “Late” Levantine Aurignacian might be used, but at this point, a developmental link between the two industries has not been clearly demonstrated. Perhaps the best way to proceed with the classification is to search for previous terminology applied to similar entities.

There has been a division of the Levantine Aurignacian before, based on the sequence at Ksar Akil. It was divided into Levantine Aurignacian A, B, and C at the London Conference (1969), corresponding to Phases 3-4, 5, and 6-7 in this study, respectively. Using this framework, the industry represented by Ksar Akil Phase 5, Hayonim D, and Sefunim 8 could be termed “Levantine Aurignacian B”, and the industry represented by Ksar Akil Phases 6-7, Ein Aqev, and the remaining carinated assemblages in the Negev could be termed “Levantine Aurignacian C”. This author is hesitant to use the London Conference classification, however, because in a separate study (Williams, 2003a), Ksar Akil Phase 4 was found to resemble the local Ahmarian industry more than any Levantine Aurignacian assemblage. The resemblance of Ksar Akil Phase 4 to the Ahmarian was also noted by Bergman (1987, p. 146), thus casting doubt on the utility of the term “Levantine Aurignacian A”. Kebara Levels I-II have also been compared to the “Levantine Aurignacian A” (Bar-Yosef and Belfer-Cohen, 1996), but recent analyses indicate very different reduction sequences at Kebara I-II and the corresponding levels at Ksar Akil (Williams, 2003a).

The participants at the London Conference also agreed to abandon the term “Atlitian”, first proposed by Garrod (1937), and use instead “Levantine Aurignacian C. Given that “Levantine Aurignacian A” seems to be a problematic term, perhaps we should return to Garrod’s terminology, applying the term “Atlitian” to the “Levantine Aurignacian C” material. In fact, the term “Atlitian” has not been abandoned entirely, and it has recently been revived by Belfer-Cohen and Goring-Morris (2003), in their outline of Upper Paleolithic entities. This study is largely in agreement with Belfer-Cohen and Goring-Morris, with the exception of the “Atlitian” category. They noted the poor fit of some assemblages within this category, particularly Fazael IX and Nahal Ein Gev I, which are “quite different” than el-Wad C — the type site for the Atlitian (Belfer-Cohen and Goring-Morris, 2003, p. 8).

Garrod first defined the Atlitian at el-Wad cave, Level C (Garrod and Bate, 1937, p. 41-44). She noted that Level C at el-Wad bore some resemblance to the underlying Aurignacian level (D), which she believed to be European in origin. But Level C was sufficiently distinctive from the Aurignacian to warrant its own name (Atlitian) which she believed was “a specialised development of the Aurignacian, so far unknown outside Palestine.” (Garrod 1953, p. 20). Atlitian assemblages were “less elaborate” than the Aurignacian (i.e., fewer tools with profuse retouch and less tool diversity), and steep or carinated scrapers and burins became the predominant tools, as opposed to rostrate scrapers with projecting noses in the Aurignacian (Garrod, 1953). Furthermore, microliths make their first appearance. It is important to note that many of Garrod’s polyhedral burins and steep scrapers would have been classified as carinated pieces and bladelet cores in this study, judging from the artifact illustrations (Garrod and Bate, 1937, Plates XVI and XVII), and that a large microlithic component was almost certainly missed without some of the more advanced excavation techniques that developed after Garrod’s time.

All things considered, Garrod’s Atlitian appears to be similar to the carinated industry identified in this study, with some obvious exceptions (e.g., Châtelperon points). Ksar Akil Phase 6, Fazael IX, and Nahal Ein Gev I have all been compared to the Atlitian, based on the presence of burins on truncation. But this study has revealed that the underlying technology is considerably different between Ksar Akil Phase 6 on the one hand, and Fazael IX and Nahal Ein Gev I on the other. While burins on truncation are found at Ksar Akil Phase 6, these tools were produced habitually at Fazael IX and Nahal Ein Gev I, to the virtual exclusion

of anything else, within a technology geared solely for a single purpose — the production of thick flakes for burin manufacture. In contrast, Ksar Akil Phase 6 is characterized by a carinated technology, particularly lateral carinated pieces, and shares more in common with the other carinated technologies in this study, such as Ein Aqev.

Therefore, the term “Atlitian”, if it were to be used, seems more appropriate for the carinated industry in this study, or the “Unnamed flake-based entities” identified by Belfer-Cohen and Goring-Morris (2003, p. 8). It is impossible to say with certainty that el-Wad C is part of the same industry as the carinated technologies in this study, because there is no complete collection from Garrod’s excavations at el-Wad. This author did have the occasion to look at a portion of the collection from el-Wad C at the Peabody Museum. No detailed analysis was performed because of the incomplete nature of the collection, but it did bear some resemblance to the carinated technologies in this sample, most notably the presence of carinated pieces and dihedral burins. Nevertheless, we may never know the exact nature of Garrod’s Atlitian, and it is a problematic term, given its uncertainty. As a result, the term “carinated industry” will be used in this study, and a tentative association is made with the Atlitian, until we know with more certainty Garrod’s perception of this industry.

Finally, a new name is proposed for Fazael IX and Nahal Ein Gev I: Lisanian. Given their apparent association with the settings of the prehistoric Lake Lisan, and their very distinctive lithic assemblages, it seems fitting to provide Fazael IX and Nahal Ein Gev I with an equally distinctive and refined name. Other researchers have repeatedly compared these assemblages to the Atlitian, but this study has revealed a reduction sequence sufficiently distinct as to warrant a separate name. At present, it seems that the Lisanian reduction sequence is as different from assemblages such as Ksar Akil Phase 6 as it is from the Levantine Aurignacian.

The following is a description of the industries identified in this study.

The Levantine Aurignacian industry

This industry is characterized by multiple reduction strategies designed to produce each of the following: flakes, blades, and bladelets. Flakes and blades are the most predominant blanks. Flakes are produced on globular cores, which typically have more than one platform and orientation. Sefunim 8 is an exception, where most flake cores are single platform varieties. These cores produced thick flakes that were used primarily in the production of scrapers, which are characteristically thick and shouldered or nosed.

Bladelets are generally rare, and appear to represent activity-specific episodes, such as the “kitchen midden” at Hayonim D (Belfer-Cohen and Bar-Yosef, 1981). At Hayonim D, the bladelet cores appear to represent small versions of blade cores, which were used to produce the characteristic blades that were sometimes made into tools with Aurignacian-scalar retouch, the dominant method of retouch (generally greater than 50% of all retouch). Both the blade and bladelet cores are typically single platform, with little in the way of treatment, and are typically conical shaped.

Blades and bladelets are almost exclusively incurvate in profile, and there is an associated near absence of carinated pieces. The exception to this paucity of bladelets is Ksar Akil, where bladelets are relatively abundant throughout the sequence. Also, twisted bladelets are relatively common throughout — a phenomenon also noted by Bergman (2003). In this case, it is important to note the general trend within the sequence at Ksar Akil, where Phase 5 produces distinctly fewer twisted debitage than the preceding or succeeding phases (Table 8). When compared to the plethora of twisted profiles/carination in Phases 6-7, the numbers are

very minor in Phase 5. In addition, the broad geological levels excavated at Ksar Akil most probably led to mixing of cultural layers in the excavated levels. The carinated pieces in Phase 5, therefore, could represent some mixing from Phase 6, judging from their increased presence in the upper sub-levels. Twisted bladelets and carinated pieces are also present in moderate numbers at Sefunim 8. If these pieces are *in situ* and are not derived from a more recent layer above 8, they might represent the introduction of a new technology within an otherwise non-carinated sequence of reduction.

One of the more diagnostic properties of the Levantine Aurignacian industry is the use of thick blanks for scrapers. Not only does this industry exhibit a larger mean scraper bit thickness than the remaining industries, but also apparently thicker blanks were preferentially chosen for use as scrapers. Table 9 presents the mean scraper bit thickness (i.e., working edge length) for all scrapers in all assemblages. It is clear that the Levantine Aurignacian exhibits the largest mean value for this measurement. It is worth examining if thick scrapers in all of the assemblages represent extensive resharpening, or a preference to produce thick scrapers. Support for the second scenario (a preference for thick scrapers) is provided by Table 10, which shows the largest discrepancy between debitage blank thickness and scraper blank thickness in the Levantine Aurignacian. This industry was not producing the thickest flakes, but scrapers were produced on considerably thicker flakes than what is represented in the debitage — a difference that exceeds all other industries.

Another diagnostic element of this industry is the use of Aurignacian-scalar retouch. Unlike the non-invasive nibbling most commonly practiced in the other industries, the majority of retouch in the Levantine Aurignacian industry is distinct in its invasiveness onto the face of the blank.

The Carinated industry

Most of the Negev assemblages in this study, as well as Phases 6-7 at Ksar Akil, are characterized by a technology oriented toward the production of twisted bladelets via carination (twisted bladelet removal). An important conceptual break separates this industry from all others. Carinated technologies in this sample produce a subset of final products (bladelets) in a two-step process involving the manufacture of a thick flake, and then the use of that flake as a core for the manufacture of twisted bladelets. This interrelationship between flakes and bladelets does not consistently exist within any of the other industries. Rather, there is a discontinuity between flakes and bladelets in the other industries.

This industry utilizes multiple reduction strategies to produce two primary blank subsets: flakes and twisted bladelets. Flakes were used both as tools and as cores, as described above. Burins and scrapers were produced from the flakes, and the relative proportion of these tools among the assemblages in this industry appears to represent activity-specific episodes. Burins are typically dihedral varieties, and scrapers are typically simple endscrapers. Retouch is typically non-invasive, typically of the Dufour variety. Also, Aurignacian-scalar retouch is rare.

The most characteristic aspect of this industry is the use of secondary blanks for the production of twisted bladelets (i.e., lateral carination). This is a novel approach to bladelet manufacture within this sample, and is clearly visible in Table 11, which displays the type of blanks used for bladelet manufacture. Typical bladelet cores are produced on primary blanks (chunk/cores), and presumably reduced from blocks of raw material and reduced in a single process. Bladelets produced from secondary cores, however, involves a two-stage process, where a blank is first removed from a primary core, and then the secondary blank (usually a

thick flake) is used as a core itself to remove smaller bladelets. This usually involves carination, due to the tendency of bladelet removals to twist around the edge of a blank.

The assemblages of the carinated industry are plainly visible in Table 11 by the leap in the percentage of secondary blanks for bladelet manufacture. The carinated assemblages are typically above 30%, while the remaining assemblages fall around 20%.

While all assemblages in this industry have carination in common, there is some variability among the assemblages. Arkov does not fit comfortably within the group, as it exhibits some uncommon characteristics. Namely, the carinated pieces are often very large, and were produced on tabular raw material, which may account for some of the irregularities. There is a paucity of flake cores, which might relate to an incomplete sample. Nevertheless, Arkov shares enough affinity with the carinated industry to tentatively be considered as such.

It should also be noted that K9A has come under scrutiny (Belfer-Cohen et al., 1991), for its possible misidentification as an Upper Paleolithic assemblage. The collection from K9 was originally divided into two separate groups (A and B), on the basis of differential raw material (flint and chalcedony) in what were thought to be two overlapping concentrations of artifacts — flint was assigned to the Upper Paleolithic and chalcedony to the Epipaleolithic “Negev Kebaran” or “Ramonian” (Larson and Marks, 1977). Since this time, differential raw material usage has been observed at exclusively Epipaleolithic assemblages from the Negev, which purportedly look similar to the K9 complex (Belfer-Cohen et al., 1991; Marder, 1994). However, the analyses of this study indicate that the reduction strategies at K9A share the same industrial affiliation with the other carinated assemblages in the Negev. K9A is particularly similar to the neighboring sites of G11 and Har Horesha I on the Har Harif plateau. It will be interesting to know if such a degree of technotypological affinity exists at Epipaleolithic sites such as Nahal Neqarot (Belfer-Cohen et al., 1991), when detailed information is published.

The Lisanian industry

Fazael IX and Nahal Ein Gev I are certainly distinctive in the sampled assemblages as the only single reduction strategy oriented solely toward flake production. Flakes were produced in great abundance, to the virtual exclusion of blades and bladelets, and they were habitually used for the manufacture of burins on truncation. The simplicity of this reduction strategy was consistently revealed in a number of analyses (Williams, 2003a). The habitual production of flake cores is reflected in Fig. 5. These cores are not particularly large, and are globular in shape, often with more than one platform and numerous flaking surfaces. Blank types reflect a flake technology, with broad, thick flakes being predominant. The tool kit is heavily dominated by burins on truncation (80.9% and 74.9% of total burins at Fazael IX and Nahal Ein Gev I, respectively).

Discussion

With the assemblages set within a classificatory framework, it is now possible to search for what might be influencing the perceived similarities and differences among the assemblages. The first avenue of inquiry involves potential influence of environmental conditions on the material record. Lithic technology might be closely related to social entities, yet the resolution of the existing archeological record during this period is not sufficient to allow conclusions to be drawn about social entities. The highest resolution this study was able to discern from the lithic artifacts was industrial variability. Certainly social/cultural issues must

be sought at the phase/facies level. So it is necessary to work with the information at hand. An attempt is made here to search for broad relationships between technology and the environment. Because there are over 20 000 years to work with in the Upper Paleolithic, perhaps there is some chance that relationships could be found, at least at a very large scale.

In the broadest sense, the Upper Paleolithic period experienced two major climatic regimes: a warmer and more humid period from its onset, up until around 24 000 BP, when the climate turned cold and dry. The first climatic regime during the early and mid-Upper Paleolithic witnessed several oscillations between warmer and cooler temperatures, while the final Upper Paleolithic seems to exhibit more climatic stability: cold and dry (Fig. 4). The broadest association that might be made with technological change is the increased production of microliths (bladelets) during this period. The Dufour bladelets produced in the carinated industry contrast sharply with the Levantine Aurignacian, where microliths are generally rare. Perhaps it is no coincidence that the dates of this broad industrial variability correspond to the extreme periods of each climatic regime: a climatic optimum at 30-35 000 BP, and the most severe portion of the cold-dry phase, at around 17-20 000 BP.

There is evidence that twisted bladelets were curated extensively throughout the Central Negev Highlands (Williams, 2003b). This is evidenced at sites such as Arkov and D27A where hundreds of carinated pieces/twisted bladelet cores are found, but twisted bladelets are virtually absent. These sites are all situated on plateaus near raw material outcrops, and appear to represent ephemeral episodes of twisted bladelet production, where the cores were left and the twisted bladelets were carried away. If the bladelets were removed by Upper Paleolithic people rather than by nature, then the carinated assemblages on the plateaus of the Negev Highlands appear to represent gearing-up episodes where cores were reduced and the twisted bladelets were carried away. Such a scenario seems to suggest ephemeral camps within a mobile settlement system. Another possibility is that the bladelets were used within the general vicinity for utilization of local resources, and thus did not necessarily represent groups traversing great distances. In this latter scenario, perhaps Ein Aqev can be considered less ephemeral than the other carinated industries up on the plateaus, even a base camp of sorts, judging from its much greater artifact density, larger size, and greater level of activities represented (including large limestone blocks carried into the site, a large firepit, comparatively rich faunal remains, Mediterranean shells, ochre, and ground stone).

Nevertheless, mobility is suggested at Ein Aqev at varying scales. On a smaller scale, the presence of steppic mammals such as *Equus hemionis* (onager) in the faunal inventory suggests that game procurement also took place somewhat far afield. Also on a local scale, the presence of two basalt groundstone artifacts suggests trips to the closest basalt outcrop, at Giv'at Ga'ash some 30 km to the southeast in Maktesh Ramon (Bar-Am and Shalem, 1983). On a larger scale, the presence of Mediterranean shells suggests either trading networks, or that the Mediterranean coast was included within the range of movement for the people who inhabited Ein Aqev. Ein Aqev is situated 54 km from the coast as the crow flies, and foot passage to the coast entails moving some 75 km along winding wadi beds to avoid sheer cliff ascents and descents.

Given this evidence, as well as independent studies (e.g., Henry, 1987; Almeida, 2000), carinated technologies are well-suited for a mobile settlement pattern, which traditionally has been considered to be most advantageous during periods of diminishing resources resulting from dry and/or cold climatic conditions. The first carinated industries, however, occurred before the cold-dry phase at the Terminal Upper Paleolithic. Carinated technologies appear as early as Phase 3 at Ksar Akil, and are found in earnest in Phases 6-7, around 26 000 BP, just after the Levantine Aurignacian industry. It is indeed too simplistic to correlate microliths at

Ksar Akil with cold-dry conditions, as bladelets occur throughout the Upper Paleolithic sequence, both before and after Phase 6. What can be said about Ksar Akil is that increased microlithization occurred throughout the Upper Paleolithic sequence, with a brief hiatus in Phase 5. Judging from Tixier's (1974) publication, bladelets became increasingly smaller and more prolific in the layers above those analyzed in this study (post-30 000 BP).

Unfortunately, the more recent levels above Ksar Akil Phase 7 were not analyzed in this study. Judging from Tixier's publications (1974), twisted bladelet manufacture begins fading around 27 000 BP as curved bladelets become more common, and by 25 000 BP, there is an Ahmarian industry present, complete with the micro-denticulated Ksar Akil scrapers, seen at sites with the exact same date in the Negev (Boker BE) and in Jordan (Thalab al-Buhira), as described earlier.

The period around 25 000 years ago appears to represent a brief period of climatic amelioration, when Ahmarian industries proliferated throughout the Levant, occupying both the Mediterranean woodlands and the deserts, down to Jordan and the Negev. The assemblages of Boker BE II in the Negev and Thalab al-Buhira in the Wadi Hasa are so similar to each other that they appear to represent the exact same group of people, exploiting similar environments. It is no coincidence, then, that each provides the same dates, as well as the closest thing in the Upper Paleolithic to a type fossil: the Ksar Akil scraper, which is also found at Ksar Akil with a similar technology and the same date. Thus it seems that up to 25 000 BP we are witnessing pulses of groups, following the expansion of resources into marginal areas during periods of climatic improvement.

The impact of the deteriorating climatic conditions after 25 000 years ago can be seen in the archeological record. First, there are no dated sites between 25 000 and 22 000 BP (Phillips, 1994). When sites begin reappearing, they display increasing specialization in bladelet manufacture. This is exemplified by the Late Ahmarian industry on one hand, and the carinated industry on the other. The Late Ahmarian industry appears to be relatively common within the marginal zone, given the presence of identical assemblages in the Negev and west-central Jordan (e.g., Ein Aqev East and Ain al-Buhira), and when equated with Goring-Morris's "Mazraqa", a different term for the same industry, it apparently is spread from the Sinai up through the Rift Valley and into Lebanon and Syria (Goring-Morris, 1995). It is important to note that fully-fledged microlithic technologies were present since the beginning of the Upper Paleolithic, with the Early Ahmarian, which has been shown with detailed refitting to be an elegant, efficient, and redundant method of producing bladelets (Davidzon, 2002; Monigal, 2003). There is still, however, a general trend of increasing microlithization within the Ahmarian itself, indicated through increasingly small bladelet manufacture in the Late Ahmarian (e.g., Goring-Morris et al., 1998)

A framework where technologies produce ever-smaller microliths toward the end of the Upper Paleolithic as a response to deteriorating climatic conditions cannot be applied in a sweeping fashion across the study area for a number of reasons. The main reason is that Fazael IX and Nahal Ein Gev I, which are roughly contemporaneous with Ein Aqev, are both very large, blocky flake technologies, where blades are almost non-existent. These two assemblages form an industry that appears to represent a specialized adaptation to a lake setting. Fazael IX and Nahal Ein Gev I were occupied at the maximum extent of Lake Lisan and both appear to represent specialized adaptations to this particular setting.

At its maximum extent, Lake Lisan covered some 320 km from north to south, forming a connection between the modern water bodies of The Sea of Galilee and the Dead Sea. It is somewhat problematic to correlate assemblages with high lake levels, because there were large fluctuations over the course of a few thousand years. Apparently, there were repeated

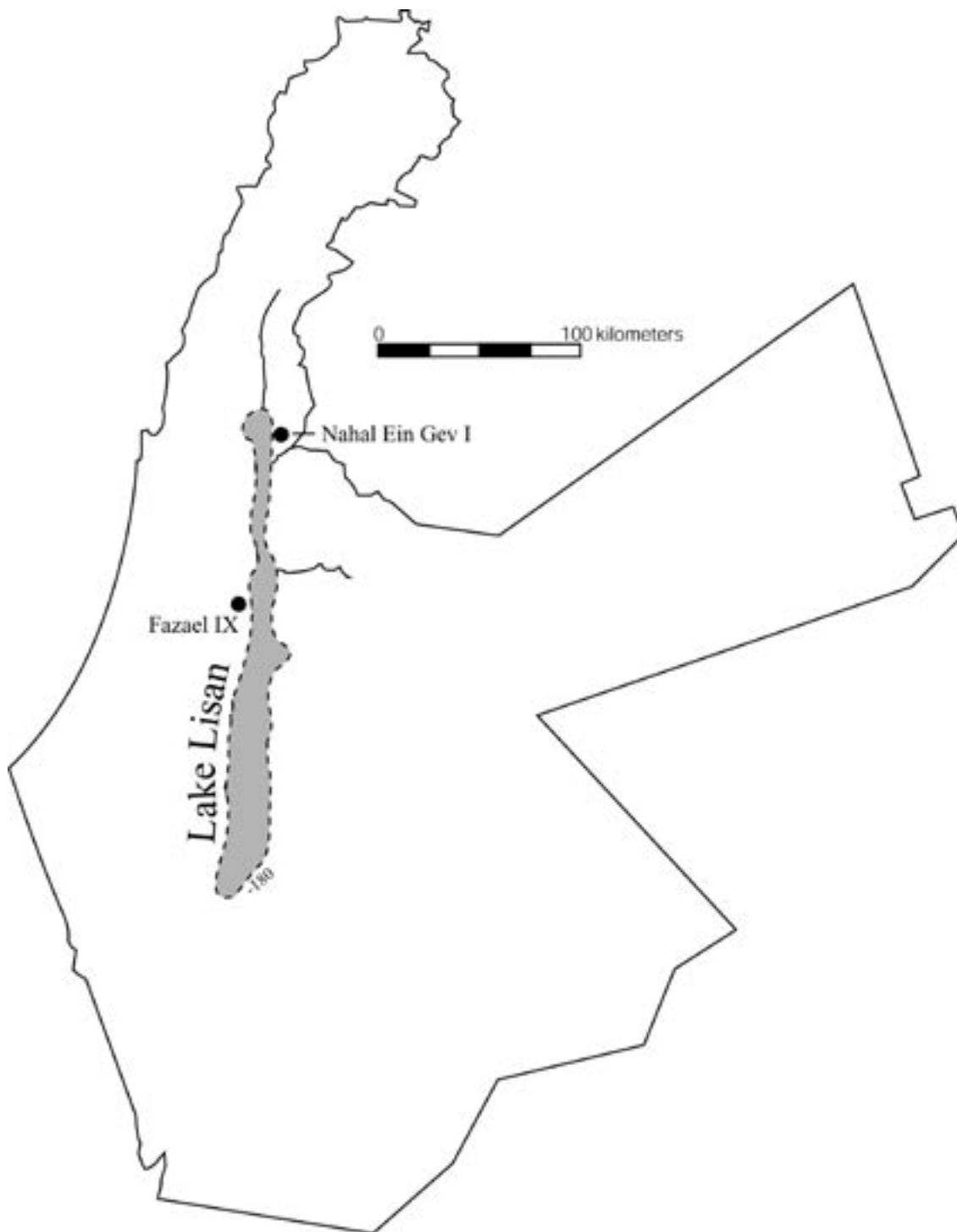


FIG. 7 – Lake Lisan between ca.20 000 and 17 000 BP, at -180 m below sea level, and the location of the Lisanian industry sites in relation to the lake.

termination/refilling episodes for Lake Lisan, where the lake would separate into two bodies, equivalent to the modern Sea of Galilee and Dead Sea, only to refill and combine again into a single lake after a couple thousand years. Lake Lisan certainly terminated around 23 000 years ago, when Ohalo II was occupied on the southern coast of the Sea of Galilee, at an elevation of 212 m below sea level. This site has been soundly dated from huge quantities of recovered charred material, providing a calibrated date of ca.23 000 BP (Nadel et al., 1995, 2001).

This date coincides with a low lake level postulated by Begin et al. (1985). Apparently, Lake Lisan refilled by 20 500 BP, then terminated again quite rapidly about 17 000 BP as a result of subsidence of the Dead Sea and Lake Kinneret basins, combined with a continued drying trend. The lake again returned to its former level about 15 000-14 000 BP, where it remained for about 2500 years before dropping to an all-time low of -700 m below sea level during the Younger Dryas (Neev and Hall, 1977; Begin et al., 1985).

Mediterranean. In short, Stiner's model reveals that dietary breadth expanded in response to demographic packing at the onset of the Upper Paleolithic, evidenced by the steady increase of small game exploitation.

There is ample evidence that intensification was taking place on a large scale during the Terminal Upper Paleolithic. The specialized occupations at Fazael IX and Nahal Ein Gev I, for example, appear to be taking advantage of the lake setting, which included not only larger land mammals (gazelle, wild cattle, fallow deer, and fox) but also waterfowl, crab, and terrestrial molluscs (Goring-Morris, 1980). Further to the south, Ein Aqev is comparatively rich in faunal remains, including ibex, gazelle, onager, as well as some smaller animals such as hare, hardun, and ostrich (Tchernov, 1976), indicating the exploitation of numerous animals from various environments.

Probably the best example of intensification during the Terminal Upper Paleolithic is Ohalo II. This was a camp on the present-day Sea of Galilee that was occupied ca. 23 000 BP (calibrated), during a low lake level similar to that of today (Nadel, 2002; Nadel et al., 1995, 2001). Because it was submerged for most of its post-occupational history, it provides a unique example to observe a Paleolithic camp in a near-pristine state of preservation. Huge quantities of fish, bird, mammal, and rodent bones were found at the site, as well as the remains of a fishing net. Thus Ohalo II presents a perfect example of an intensified subsistence strategy utilizing numerous species of small animals that are harder to catch, or require a novel technology, while providing a more stable food source than larger prey. Of particular importance is evidence for technological innovations (nets) to exploit a new resource (fish). Also, botanical remains indicate that the occupants were eating numerous wild plants, including local cereals (wheat and barley), and various fruits (Kislev et al., 1992). The lithic assemblage at Ohalo has been classified as early Epipaleolithic, with some aspects of a Terminal Upper Paleolithic assemblage (Nadel, 2003).

A relevant model for this study is one developed by Stiner (2001; Stiner et al., 1999) dealing with small animal exploitation and population growth pulses. When Stiner's model is used as a backdrop against these data, a number of interesting patterns emerge. As Stiner suggests, when there are local shortages in high-ranked resources, one solution is to turn to more abundant but more costly or less nutritionally valuable foods. For much of the Upper Paleolithic, this option was perhaps more viable than another option, moving to another location with the high-ranked resources. This apparently occurred to some extent during the early and middle portion of the Upper Paleolithic, particularly when compared to the Middle Paleolithic. This is clear from the research of Stiner et al. (1999) at various caves throughout the eastern Mediterranean. When viewed at a somewhat smaller temporal scale in this study, it is evident that the other option was also practiced: moving to another location with high-ranked resources. This occurred during periods of climatic amelioration, most notably around 35-30 000 BP, and again around 25 000 BP, when Early Ahmarian groups occupied the Negev and Sinai along with the expansion of resources sustained by warmer and wetter conditions. In support of Stiner's model, it appears that during various phases of less-desirable climatic conditions, the marginal zone was largely vacant, suggesting that people chose to restrict their subsistence to resources within a particular area (in this case, the Mediterranean phytogeographic zone), while avoiding adjacent and less-productive areas.

Before the onset of unfavorable climate during the final Upper Paleolithic, it seems that risk was alleviated by diversifying subsistence to all available resources within a given environmental niche and/or by spreading-out within that niche during times of abundance. At the onset of a new climatic regime around 24 000 BP, apparently the same strategy of intensification within traditionally productive areas was attempted. The marginal zone was evacuated, and

assemblages are only found in higher-resource areas, such as Ksar Akil and possibly in unique oasis settings such as Uwaynid 18 in eastern Jordan (Garrard and Gebel, 1988, p. 326). Nevertheless, intensification can only take you so far. Given increased external pressure (e.g., demographic and/or environmental), at some point resource diminution will reach a point where a given number of people will be forced to expand their area of exploitation to get the same amount of food, even if this entails expanding into marginal areas. This is apparently what happened beginning around 23 000 BP, when populations expanded throughout the study area, including the marginal area. Associated with this territorial expansion was a proliferation of microlithic technologies, from the Late Ahmarian/Mazraqa, to the carinated industry identified in this study. Also, a uniquely non-microlithic strategy was found around Lake Lisan, indicating that microlithization was not the only viable option. Further, it appears that this period witnessed not only an expansion of people into new territory, but also increased mobility within groups. In other words, they did not expand into a new area and then live there year-round. Rather, they included adjacent areas within a large settlement pattern of increased mobility.

All of the available evidence suggests that the occupants at Ein Aqev were either trading extensively with non-local groups, or more likely, that their settlement pattern was large enough to at least reach the Mediterranean coast. There is, however, an exception to a highly mobile settlement pattern during this period. Botanical and faunal evidence from Ohalo II indicates a year-round occupation (Nadel et al., 1995, 2001). This was almost certainly allowed by the abundant resources available at this particular location, particularly fish. Other areas, it seems, were less productive year-round, and required greater mobility to procure adequate food.

During the early and middle part of the Upper Paleolithic, better climate allowed the population pressure of prehistoric groups to be offset by intensifying already-existing subsistence strategies. Thus, mobility was not increased in some cases, and probably was even decreased during this early period. In other cases, populations expanded into new areas with climatic amelioration, following resources. When the climate shifted for the worse after 25 000 BP, the resulting stress on the system produced a threshold event, where populations were forced cover a larger area to procure the same resource return. Marginal areas such as the Negev springs and even the highland plateaus were occupied even during this cold and dry phase. Apparently, for the first time in the Upper Paleolithic, people moved into the marginal zone during a period of undesirable climate. It is this switch in behavior that suggests environmental pressures necessitated the expansion of exploited territory, as intensification and demographic pressure may have reached their limits.

Conclusions

The goals of this study were two-fold: to resolve some of the ambiguity in the Levantine Aurignacian by directly comparing the reduction sequences of relevant assemblages, and to search for what influenced any perceived variability in the assemblages that have been named “Levantine Aurignacian”. Although the exact nature of the Levantine Aurignacian is far from fully known, hopefully this study has resolved some of the existing ambiguities. At the very least, it is apparent that the assemblages under question can indeed be divided into three industries, based upon demonstrable differences in their reduction strategies. At a broad level, these differences seem to reflect intensified subsistence in response to climatic deterioration after 25 000 years ago. Unfortunately, the Upper Paleolithic chronology in the Levant is rather vague. Promising new research in places such as Kebara Cave (Bar-Yosef et al.,

1992), the Wadi Hasa (Coinman, 2003) and Ohalo II (Nadel, 2003) are providing some of this much-needed chronometric precision, but the dates for the Upper Paleolithic as a whole are still far from clear. Nevertheless, there is a clear association between a major climatic shift for the worse after 25 000 BP, and microlithization/intensification afterwards that is exemplified by assemblages such as Ein Aqev and the other Negev assemblages in this study. It is also interesting to observe that, in this sample, microlithization was not the only option for intensification. For example, the Lisanian industry is characterized by a blocky flake technology, which habitually produced burins on truncation. These burins were perhaps related to bone/antler tool manufacture, judging from the relatively abundant bone tools at Fazael IX (Goring-Morris, 1980). The importance of the Lisanian within this model of intensification is the proposed exploitation of a lake setting at the end of the Upper Paleolithic.

Perhaps with continued research we will soon be able to address some of the larger issues, such as the relationship between the Aurignacian of Europe and the Levant, and possible diffusion of early modern human culture. The “classic” Levantine Aurignacian at Ksar Akil Phase 5, Hayonim D, and Sefunim 8 in this study is largely thought to bear the most resemblance to the Aurignacian of western Europe, based on various stone tools and bone/antler tools (Bar-Yosef and Belfer-Cohen, 1988, 1996; Belfer-Cohen, 1994; Belfer-Cohen and Bar-Yosef, 1999). Hopefully other papers in this volume will allow a more detailed comparison than was previously possible. Assuming the Levantine Aurignacian is directly related to the European Aurignacian, we are presented with a host of research questions unique from those of Europe. The Aurignacian is not the emblem of behavioral modernity in the Levant, as it appeared well after the Ahmarian — a local Upper Paleolithic industry. As Kuhn (2003) correctly expressed, the relevant research questions include why the Aurignacian spread so far, and if not, why it was reinvented thousands of kilometers apart. Also, we are faced with the question of whether the Levantine Aurignacian left the same way it came, or if it stayed and developed into some of the later entities, such as the carinated industry. The model outlined in this study of intensification as a result of climatic deterioration at the end of the Upper Paleolithic provides a potential reason for this broad industrial variability. With any luck, further research will allow some of the specifics in the questions above to be resolved.

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TABLE 1

General information for each collection, including sampling procedures.

<i>Collection</i>	<i>Location</i>	<i>Site Type</i>	<i>Total Debitage (n)</i>	<i>Total Cores (n)</i>	<i>Total Tools (n)</i>	<i>Sampling Procedure</i>	<i>Total Artifacts Sampled</i>
Ksar Akil XIII-VI, 1936-37	London	rockshelter	unknown	640	13 974	C	4703
Ksar Akil XIII-VI, 1946-47	Cambridge, MA	rockshelter	unknown	unknown	unknown	C	6569
Hayonim D	Jerusalem	cave	5174	298	844	A ²	1123
Sefunim 8	Haifa	cave	713	126	199	A ²	635
Nahal Ein Gev I	Jerusalem	open air	unknown	120	447	B	835
Fazael IX	Jerusalem	open air	5242	25	684	A ¹	856
Ein Aqev (D31)	Dallas	open air	8981	272	1287	B	669
Arkov (D22)	Dallas	open air	3463	227	314	A ²	481
D27A	Dallas	open air	1967	115	457	A ²	501
K9A	Dallas	open air	2446	171	222	A ²	453
G11	Dallas	open air	2164	226	266	B	615
Har Horesha I	Jerusalem	open air	5283	107	757	C	384

A1 - Random sample ofdebitage from all units in each level (or surface), all cores and tools.

A2 - Alldebitage from randomly sampled units in each level; all cores and tools.

B - Alldebitage from randomly sampled units in each level (or surface); cores and tools in sampled units only.

C - A combination of two or more of the above strategies

TABLE 2

The correlation between each season in the Boston College excavations at Ksar Akil, and a broad correlation of these with Tixier's levels.

<i>Phase</i>	<i>Boston College</i> 1937-1938	<i>1947-1948</i>	<i>Tixier</i> 1969-1975	<i>Date BP</i>
	<i>Levels</i>	<i>Levels</i>	<i>Levels</i>	<i>Mean</i>

TABLE 3

Radiocarbon dates for the sampled assemblages.

		Date BP	±	Lab Number	Reference
Ksar Akil Phase 4	(Tixier's VII)	32 000	1 500	MC-1192	Mellars and Tixier, 1989
	(Tixier's VI)	31 200	1 300	OxA-1804	Mellars and Tixier, 1989
		32 400	1 100	OxA-1805	Mellars and Tixier, 1989
Ksar Akil Phase 5	(Tixier's IV)	30 250	850	OxA-1803	Mellars and Tixier, 1989
Ksar Akil Phase 6	(Tixer's III)	29 300	800	OxA-1798	Mellars and Tixier, 1989
		26 900	600	OxA-1797	Mellars and Tixier, 1989
		26 500	900	MC-1191	Mellars and Tixier, 1989
		21 100	500	OxA-1796	Mellars and Tixier, 1989
	Hayonim D	29 980	720	OxA-2805	Bar-Yosef, 1991, p. 85
	Hayonim D	28 900	650	OxA-2802	Bar-Yosef, 1991, p. 85
	Hayonim D	27 200	600	OxA-2801	Bar-Yosef, 1991, p. 85
	Hayonim D	21 650	340	OxA-2804	Bar-Yosef, 1991, p. 85
	Hayonim D	20 810	320	OxA-2806	Bar-Yosef, 1991, p. 85
	Ein Aqev 12		19 980	1,200	SMU-5
Ein Aqev 9		17 890	600	SMU-6	Marks, 1976, p. 230
Ein Aqev 7		17 510	560	I-5495	Marks, 1976, p. 230
Ein Aqev 11		17 390	560	SMU-8	Marks, 1976, p. 230
Ein Aqev 5		16 900	250	I-5494	Marks, 1976, p. 230
Fazael IX		17 760	160	OxA-2871	Hedges et al., 1992, p. 342

TABLE 4

Blank types among debitage.

	Flake		Blade		Bladelet		Primary Element		CTE		burin spall	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Ksar Akil Phase 5	67	25,2	108	40,6	68	25,6	1	0,4	20	7,5	2	0,8
Ksar Akil Phase 6	98	9,1	280	26,0	616	57,1	10	0,9	68	6,3	6	0,6
Ksar Akil Phase 7	51	10,5	137	28,3	266	55,0	4	0,8	24	5,0	2	0,4
Hayonim D	266	53,8	35	7,1	77	15,6	90	18,2	16	3,2	10	2,0
Sefunim 8	111	36,6	74	24,4	37	12,2	59	19,5	22	7,3		
Nahal Ein Gev I	188	68,4	22	8,0	8	2,9	42	15,3	4	1,5	11	4,0
Fazael IX	211	48,1	14	3,2	35	8,0	47	10,7	4	0,9	128	29,2
Arkov	121	45,5	50	18,8	27	10,2	31	11,7	37	13,9		
D27A	14	17,1	26	31,7			28	34,1	14	17,1		
Ein Aqev	68	32,5	42	20,1	49	23,4	29	13,9	21	10,0		
G11	132	55,5	38	16,0	9	3,8	48	20,2	11	4,6		
K9A	133	55,0	40	16,5	25	10,3	32	13,2	12	5,0		
Har Horesha I	75	57,3	9	6,9	9	6,9	24	18,3	14	10,7		

TABLE 11

Bladelet core blanks among sampled assemblages, including traditional bladelet cores and carinated pieces.

		Primary (chunk/core)		Secondary blank		Total
		n	%	n	%	
Levantine Aurignacian	Ksar Akil Phase 5	63	77,8%	18	22,2%	81
	Hayonim D	29	78,4%	8	21,6%	37
	Sefunim 8	44	80,0%	11	20,0%	55
Carinated Industry	Ksar Akil Phase 6	389	72,3%	149	27,7%	538
	Ksar Akil Phase 7	48	66,7%	24	33,3%	72
	Arkov	25	43,1%	33	56,9%	58
	D27A	16	21,1%	60	78,9%	76
	Ein Aqev	11	34,4%	21	65,6%	32
	G11	45	60,8%	29	39,2%	74
	K9A	35	66,0%	18	34,0%	53
	Har Horesha I	20	57,1%	15	42,9%	35
Lisanian	Nahal Ein Gev I	1	–	1	–	2
	Fazael IX	1	–	1	–	2

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