

# Exploring “*the great wilderness of prehistory*”: The Chronology of the Middle to the Upper Paleolithic Transition in the Northern Levant

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**Abstract:** *Establishing a reliable chronological framework to describe the timing, migration routes and cultural affiliation of the earliest fully anatomically and behaviorally modern humans arriving in southwest Asia, and eventually in Europe, is crucial to understanding the earliest Upper Paleolithic but has proven hugely challenging to achieve. This is due to the often poor organic preservation from hot and arid environments, and the difficulties in radiocarbon dating near to the limit of the method. One of the main archaeological correlates for the presence of modern humans along the northern Mediterranean Rim, one of the two putative migration paths into Europe, is the sudden appearance of beads made of deliberately perforated marine shells. These are thought to represent body ornaments and reflect symbolic behavior. Some of the largest assemblages of such material appear in the Middle East, at the key sites of Ksar Akil (Lebanon) and Uçağızlı (Turkey). In the present paper, the use of such beads as a chronological marker for the Middle to Upper Paleolithic transition is described. In addition to presenting newly obtained chronometric data from the two sites, and the statistical analysis of these results using Bayesian methods, the previous chronology for the wider Levant is discussed, and the paper concludes with an updated chronological framework and remarks on it.*

**Keywords:** Northern Levant, Neandertals, anatomically modern humans, Middle Paleolithic, Upper Paleolithic, transition, dating

## Die Chronologie des Übergangs vom Mittel- zum Jungpaläolithikum in der nördlichen Levante

**Zusammenfassung:** Um das früheste Jungpaläolithikum verstehen zu können, ist es unerlässlich, einen verlässlichen chronologischen Rahmen zu erarbeiten. Nur so lassen sich der Ankunftszeitpunkt und die Wanderrouten der frühesten voll anatomisch modernen Menschen rekonstruieren, die, aus Afrika kommend, Südwestasien und schließlich auch Europa erreichten. Und nur so lässt sich auch ermesen, welche kulturellen Hinterlassenschaften diese Menschen zu welcher Zeit mit sich führten. Es hat sich jedoch als höchst schwierig erwiesen, dieses Ziel zu erreichen. Ein Grund dafür ist die oftmals schlechte Erhaltung datierbarer organischer Materialien in heißen und ariden Umgebungen, ein anderer liegt in den Schwierigkeiten bei der Radiokohlenstoffdatierung in Zeiträumen nahe an der Messbarkeitsgrenze dieser Methode.

Einer der wichtigsten archäologischen Hinweise auf die Anwesenheit moderner Menschen entlang des nördlichen Mittelmeerrandes, in einem Gebiet, in dem sich eine ihrer möglichen Einwanderungsrouten nach Europa befindet, ist das plötzliche Auftreten absichtlich durchlochter Meeresschnecken. Es ist anzunehmen, dass diese durchlochten Meeresschnecken als Körperschmuck getragen wurden und dass mit ihnen symbolische Inhalte übermittelt wurden. Einige der wichtigsten Fundinventare mit solchen Schmuckobjekten finden sich im Nahen Osten. Sie stammen insbesondere von den Fundstellen Ksar Akil im Libanon und Uçağızlı in der Türkei.

Im vorliegenden Beitrag wird die Nutzung solcher Schmuckschnecken als chronologischer Meilenstein für den Übergang vom Mittel- zum Jungpaläolithikum dargestellt. Dies ist möglich, seit die Autorin Verfahren entwickelt hat, die bisher kaum datierbaren Schneckengehäuse mit der Radiokohlenstoffmethode zu datieren. Damit werden ganz neue Alterseinschätzungen für die beiden genannten Fundplätze sowie die statistische Analyse der Ergebnisse unter Anwendung Bayesianischer Methoden ermöglicht. Im Zusammenhang mit der Präsentation der Neudatierungen wird die bisherige Chronologie für das Gebiet der Levante und ihrer Nachbargebiete diskutiert. Den Abschluss bildet die Vorlage eines auf den neuesten Stand gebrachten Chronologierahmens.

**Schlagwörter:** Nördliche Levante, Neandertaler, anatomisch moderne Menschen, Mittelpaläolithikum, Jungpaläolithikum, Übergang, Datierung

## Introduction

The transition from a Neandertal-dominated western Eurasia to a continent in which anatomically and behaviorally modern humans (AMH) were the sole inhabitants marks one of the biggest transformations ever witnessed in this vast region. After several decades of intense research, heated debate and vigorously expressed opinions, our comprehension of the period changes fast. To a large extent, modern analytical techniques and their application to Paleolithic remains have helped to build a much greater understanding of the period known as the Middle to Upper Paleolithic transition.

Chronometric dating, and in particular, the application of advanced AMS radiocarbon dating, has proved an invaluable tool in contributing to solving key questions, such as the timing of Neandertal extinction, the first appearance of fully anatomically modern humans in Europe and the Levant, the time of overlap – if any – which would support interbreeding and acculturation scenarios, and finally the development of sophisticated and symbolic behaviors.

In 1960, H. Movius wrote about the Middle to Upper Paleolithic transition in the first volume of ‘Current Anthropology’, and said that “*Time alone is the lens that can throw it into focus*” (Movius 1960). At the time, establishing a reliable Paleolithic chronology was considered to be extremely difficult, if not impossible to achieve. In the same year, in his Nobel Prize acceptance lecture, W. F. Libby admitted the difficulties in determining whether radiocarbon dating was reliable when applied to old samples: “...we had to go into the great wilderness of prehistory to see whether there were elements of internal consistency which would lead one to believe that the method was sound or not...” (Libby 1960).

We have come a long way since, and Libby’s prehistoric wilderness has steadily been explored. By the 1980s, with significant developments in the instrumentation used in radiocarbon dating (e.g. introduction of Accelerator Mass Spectrometry) and increased levels of precision in the measurements, important research was being conducted into ways of removing carbonaceous contaminants from dated samples. In the subsequent decades, this field of pretreatment chemistry has been greatly advanced, with special attention given to old samples (>25 ka). New material-specific techniques were designed and developed, such as the ultrafiltration of bone collagen (Brown et al. 1988; Bronk Ramsey et al. 2004), the cleaning of charcoal with ABOx-SC (Bird et al. 1999; Santos et al. 2003; Higham et al. 2009), and the dating of compound-specific biomarkers that promise contaminant-free dates (Marom et al. 2012). In addition, improved statistical tools, such as Bayesian analysis, used in the modelling of the results (Bronk Ramsey 2009) and a new calibration curve for correcting radiocarbon determinations older than 26 ka cal BP (Reimer et al. 2009) allow more reliable results for Pleistocene-aged material.

## Archaeological background

The demise of Neandertal populations in Eurasia and the diaspora of anatomically modern humans (AMH) from an unknown source, although not demonstrably linked, are broadly contemporaneous and mark a key period in human evolution. After a long and relatively stable (but not monotonic) Middle Paleolithic, significant changes in human innovation became sharply manifest in the archaeological record of Europe and adjacent

areas. These changes mark the start of the Upper Paleolithic, and have been traditionally equated with a biological and cultural shift.

One of the main distinctions in the lifestyle of the anatomically modern newcomers is the regular appearance of personal ornaments and portable and stationary art, evidence for which is found all across Eurasia. Beads, in particular, are commonly produced and recovered at early AMH sites. Neandertals do not appear to have made or used similar beads. This does not mean that Neandertals could not or did not have symbolic culture, nor does it mean that they did not use objects beyond their conventional meaning and beyond the realms of the tangible world in order to transmit very specific and culturally-encoded information. The abundance of pigments (d'Errico et al. 2010; but see Roebroeks et al. 2012) and evidence for the use of feathers (Peresani et al. 2011; Finlayson et al. 2012; Morin and Laroulandie 2012) could indicate the inherent capacity of Neandertals to use symbols. Sadly, Neandertal means for expressing and materializing abstract thinking do not often survive in the archaeological record, and hence suggestions for a distinct and well-defined Neandertal symbolic culture prior to the arrival of modern humans (or other symbolically-engaged human groups) in Eurasia, cannot be confidently validated. The use of shells by Mousterian Neandertals for the production of ornaments (e.g., Peresani et al. 2013) or as objects of unidentified use (Zilhão et al. 2010) remains controversial and such cases tend to be rare in the record.

On the contrary, the early use of symbols by AMH is not questioned; in fact, it is exactly this expression of symbolic thinking that defines them as behaviorally modern. Modern humans exploit durable varieties of natural materials (marine shell, animal teeth and bone, stone varieties) to obtain highly-standardized end-products. In most cases, a well-defined operational strategy leads to the standardization of these symbolic media. Ornaments must have been used for various purposes, e.g. in order to differentiate individuals or groups in social and economic terms, adorn one's body and/or attire and convey shared knowledge amongst members carrying similar traditions (d'Errico et al. 2003; Vanhaeren 2005; Stiner et al. 2013).

Several so-called "transitional" technocomplexes (e.g., Uluzzian in Italy and Greece, Bachokirian in the Balkans, Initial Upper Paleolithic [IUP] contexts in the Levant), and most prominently, the classic early Upper Paleolithic contexts (Protoaurignacian and Early Aurignacian in Europe, Early Ahmarian in the Levant) contain various numbers of beads of high specification and aesthetic appeal. More than 150 bead types have been described from early Upper Paleolithic (Aurignacian) contexts in Europe and the Near East (e.g., Vanhaeren and d'Errico 2006). The Uluzzians have used several shell types and bird bones for making beads. Châtelperronian ornaments mainly consist of animal teeth, but a small number of shell beads have also been attributed to such contexts.

It is worth mentioning that the assemblages associated with AMH (Uluzzian, IUP, Aurignacian, Ahmarian) show a significant difference in size and quality of pieces when compared to any ornamental assemblage traditionally attributed to Neandertals (e.g., Châtelperronian, late Mousterian of Fumane and Aviones). In the former case, personal ornaments are significantly more numerous, as well as more varied and technologically standardized. There are significant differences between what is observed in the archaeological record of Neandertal and AMH ornamental assemblages, both in qualitative (e.g. ephemeral *versus* long-lasting materials) and quantitative terms (occasional, localized

use – imitation-sparked? – of a dozen objects *versus* regular and extensive production and use of comparable pieces, amounting to several thousand objects so-far). Such an important distinction cannot be attributed simply to site locality or character, local conditions or preferential preservation; instead it bears important clues to understanding the long-lasting behavioral differences between the two human groups.

Between 2006 and 2011, in the framework of a doctoral research project at the University of Oxford (Douka 2011a), a systematic attempt was undertaken by the author to directly date early Upper Paleolithic personal ornaments. The study concerned specifically ornaments made on marine shell from sites across Mediterranean Europe. The objective was to shed further light on the Middle to Upper Paleolithic transition in this region, where reliable chronologies for the period had proven exceptionally challenging to establish due to the absence of appropriate materials for dating. Shell beads were a suitable alternative. Unlike other organic materials, they survive well and are often abundant in early Upper Paleolithic sites across the Mediterranean Rim, and, most importantly, they are strongly linked to past human activities.

In the present paper, I will explore the use of shell beads in the southeastern Mediterranean during the Middle to Upper Paleolithic transition, and their current use as a chronological marker for the period. In addition to presenting newly obtained data from two sites: Ksar Akil (Lebanon) and Üçağızlı (Turkey) (Fig. 1), I will discuss the previous chronology for the wider region (interchangeably referred to as the Levant or the Near East) and will conclude the paper with an updated chronological framework and remarks on it.



**Fig. 1:** Location of the two studied sites, Ksar Akil and Üçağızlı, in Lebanon and Turkey, respectively.

## The Middle to Upper Paleolithic transition in the Near East

Since the beginnings of prehistoric research at the turn of the 19<sup>th</sup> and throughout the 20<sup>th</sup> century, the Levant, at the crossroads of three continents and in close proximity to diverse ecosystems, has assumed particular paleoanthropological significance. Its importance was verified by the early discovery of several deeply stratified sequences at sites such as et-Tabun at the Mount Carmel, Kebara, Hayonim, Ksar Akil and Yabrud 1 (for references see Shea 2003) and a number of fossil remains, including both Neandertals and *Homo sapiens* (archaic and fully modern).

Currently, most scenarios revolving around the Out of Africa and Into Eurasia theory include the Near East as a midpoint, and for some others it represents a source of origin for the first modern humans prior to entering Europe (e.g., Mellars 2006; Bar-Yosef 1998, 2000). The association of Middle Paleolithic assemblages with both Neandertals and archaic modern humans in the region at around 70-130 ka, led to the formulation of several suggestions. Amongst others, researchers see the Levant as the place where (i) an initial strand of archaic modern humans arrived through the Nile or Arabia, after leaving Africa at around 100 ka; (ii) Neandertals and modern humans co-existed producing undifferentiated Middle Paleolithic lithic industries; (iii) Neandertals and modern humans first interbred; (iv) Neandertals eventually substituted archaic modern humans, whose early lineage was wiped away; or, finally, as the place where (v) those early archaic modern humans producing Middle Paleolithic tools did not become extinct but instead contributed to the much later, Upper Paleolithic, colonization of Europe ~40-50,000 years ago.

Sadly, these various scenarios cannot be tested due to the lack of a detailed regional chrono-stratigraphic framework for the period. Although the record is relatively rich, poor preservation of organic material, as well as the lack of comprehensive dating projects have made it difficult to obtain good and reliable chronologies as the basis of archaeological argument.

## Associated technocomplexes

### Mousterian

The Middle Paleolithic in the Near East is currently synonymous with the Mousterian, and its beginnings are often set to coincide with the first occurrences of Mousterian assemblages around 250,000 years ago (Hovers 2009). The much earlier Acheulo-Yabrudian entity is probably related to the transition from the Lower to the Middle Paleolithic and therefore not discussed here. The local Mousterian can be found in several variants with distinct characteristics, such as the Zagros-Taurus Mousterian and the Levantine Mousterian – previously known as Levallois-Mousterian. The Levantine Mousterian is quite variable and has been subdivided in a tripartite system (Phase 1-2-3) based on major lithostratigraphic divisions of the sequence in Tabun Cave (Tabun D-C-B) respectively (Bar-Yosef 1998). Its distinctive feature is the use of Levallois core-reduction strategies to produce triangular and sub-triangular flakes resulting in high percentages of Levallois debitage, low percentages of retouched tools and a variable frequency of pointed artifacts (Meignen and Bar-Yosef 1989; Marks 1990; Lieberman and Shea 1994;



Meignen 1995, 2012). This near exclusive use of the Levallois flaking system in the Levant, with emphasis on unidirectional flaking and the production of elongated convergent Levallois blanks<sup>1</sup>, contrasts the diversity of technical systems observed in the rest of Europe during the same period (Meignen 2012). A synopsis of the Middle Paleolithic in the Levant can be found in Shea (2003).

The Levantine Mousterian has been linked both to Neandertals and archaic forms of modern humans. Yet, after the modern-like fossils from Qafzeh and Skhul, all other skeletal remains that have been recovered in Near Eastern Mousterian contexts belong to Neandertals.

### Initial Upper Paleolithic

In 1951, in one of the earliest comprehensive attempts to discuss the transition from the Middle to Upper Paleolithic in the Near East, Dorothy Garrod identified an intermediate “transitional” industry occurring between the late Levantine Mousterian and the typical blade-dominated assemblages of the Levantine Upper Paleolithic (Garrod 1951). She called this technocomplex ‘Emiran’, after the Palestinian site (El Emireh) in which it was first found by Turville-Petre (Garrod 1951, 1955). Neuville (1934) had identified similar transitional assemblages, which he called ‘Phase I’ in his six-phase unilinear system of industrial evolution, while Ewing described a similar situation in Ksar Akil (Lebanon). This he called Châtelperronian, with direct analogy to its European counterpart (Ewing 1947). In Ksar Akil, the thickness of these intermediate layers (about 2.5-3 m) ruled out the possibility of mixing of two different lithic traditions, the late Mousterian and the classic Upper Paleolithic (Ewing 1947). In recent years, the term Emiran (and Châtelperronian) has been abandoned in an effort to detach from it a strongly intermediate character and phylogenetic relationships with preceding or successive technocomplexes (Kuhn 2003). It is slowly being replaced by the term Initial Upper Paleolithic (or IUP) (Bar-Yosef and Kuhn 1999; Kuhn et al. 1999, 2009; Kuhn 2003; but see Marks 2003 and Leder 2013 for a different approach).

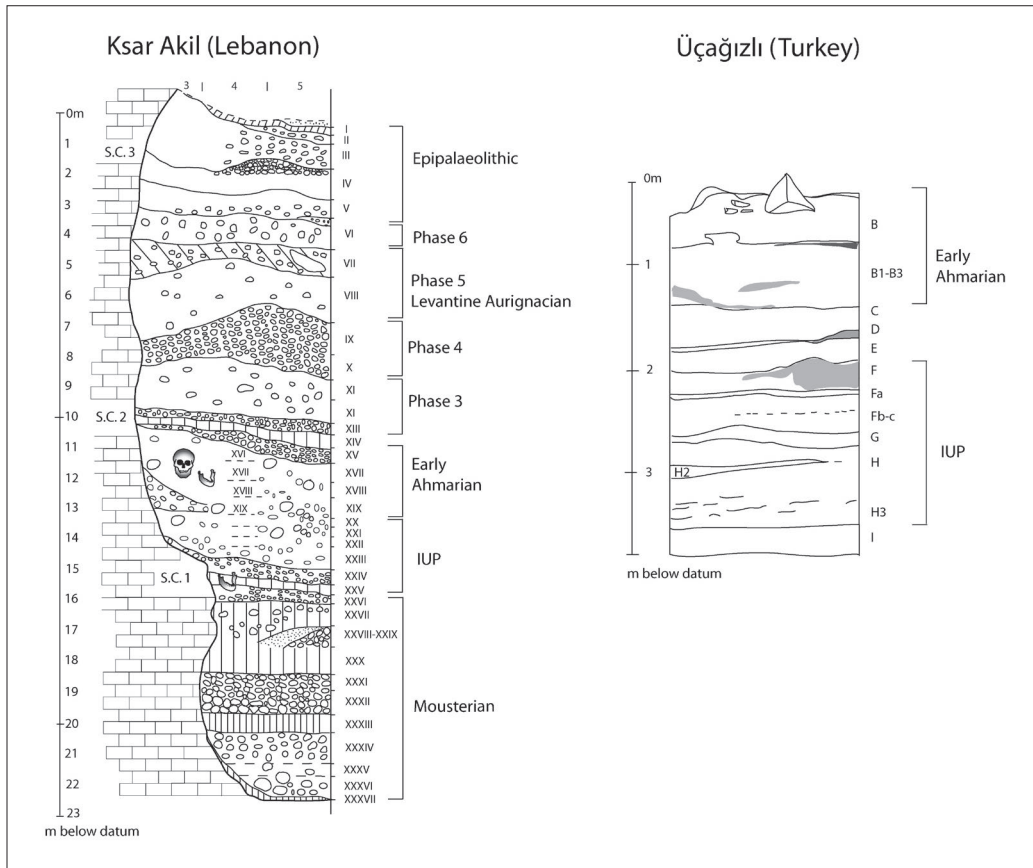
While the integrity of the IUP has been questioned on the basis of post-depositional disturbance by Bar-Yosef and Vandermeersch (1972), subsequent studies reintroduced the concept (Marks 1983; Azoury 1986) and identified more than one variant in undisturbed or minimally disturbed contexts, such as in Umm el-Tlel, Boker Tachtit, Ksar Akil, and Üçağızlı (Fig. 2).

The IUP is the first post-Middle Paleolithic technocomplex in the Levant, and for Copeland (2003) the earliest Upper Paleolithic industry, rather than an artificial mixture of Middle and Upper Paleolithic tool-types. As the same researcher has suggested (Copeland 1975), the transition in the Levant appears to occur “on the same piece of flint”, during which Middle Paleolithic technological strategies are used to produce Upper Paleolithic tools. Kuhn (2003) and Kuhn et al. (2009) see the IUP as a typical Upper Paleolithic *sensu lato* industry, utilizing Levallois-like methods for blade production.

The IUP is a multifaceted entity with internal typological and technological characteristics, temporal trends, and two ‘type fossils’: the Emireh point (Levallois, triangular

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1 Unidirectional flaking does not apply to the “Middle” Levantine Mousterian, e.g. at Qafzeh.



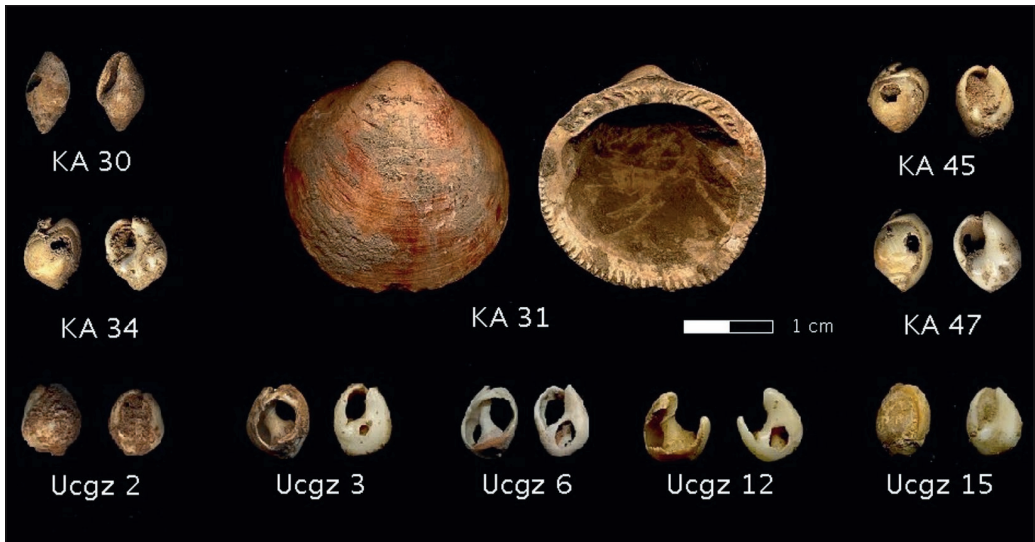
**Fig. 2:** Stratigraphic sequences of Ksar Akil and Üçağızlı. Redrawn from Ewing (1947) and Kuhn et al. (2009).

flakes with basal retouch resulting in thin proximal end; Copeland 2000) and the chanfrein endscraper (chamfered pieces or simply chamfers, i.e. flakes and blades of which the distal end is removed by the detachment of a flake perpendicular to their long axis; Garrod 1951; Newcomer 1970; Azoury 1986; Marks 1990; Ohnuma and Bergman 1990; Bar-Yosef 2000; Kuhn 2003). Lately, Umm el Tlel points were added to this inventory (Shea 2008).

In addition to the type fossils, IUP assemblages are characterized by “essentially Upper Paleolithic inventories of retouched tools (*burins, endscrapers, and retouched blades*) sometimes with a significant number of Middle Paleolithic types (*sidescrapers and broad points*). They demonstrate a dominant blade production from core reduction strategies following the Levallois and/or Laminar (*volumetric*) concepts. Most of the blades (frequently with convergent edges) are wide, not very regular, with faceted platforms, and indicate still the use of hard hammer technique in large proportion. In some cases, systematic bladelet production has been described with “alternating” production and/or specific reduction strategies” (Meignen 2012). Given the numerous Upper Paleolithic features of

the lithic toolkit, as well as the presence of bone points and perforated shells, especially in its more evolved stages in Ksar Akil and Üçağızlı (Fig. 3), the IUP technocomplex is now seen as a long-lasting archaeological entity rather than a feeble transitional phase.

The IUP has been identified in a small number of sites in Lebanon, Palestine, Israel, and southern Jordan, including el-Wad, Emireh, Kebara, Abu Halka, Raqefet, Tor Sadaf,



**Fig. 3:** Examples of the dated shell specimens. The majority belong to *Nassarius gibbosulus/circumcinctus*, apart from KA 30 (*Columbella rustica*) and KA 31 (*Glycymeris cf. insubrica*).

Umm el-Tlel, BokerTachtit, Ksar Akil, and Üçağızlı (Goring-Morris and Belfer-Cohen 2003 and papers therein). Similar assemblages have been found over a broader area, from the Altai Mountains (Derevianko et al. 2000) to northeast Asia (Brantingham et al. 2001) and as far as northwest China (e.g. Shuidonggou Localities 1 and 2) (Brantingham et al. 2001; Li et al. 2013) while technological parallels have been drawn between the IUP and the Bohunician of Central Europe (Kozłowski 1990; Demidenko and Usik 1993; Tostevin 2003).

The origin of the IUP is still disputed, mainly due to stratigraphic discontinuities in sites where the industry has been found (Copeland 2003). Several scholars think that it evolves directly from the local (Early) Levantine Mousterian (Garrod 1951, 1957; Gilead 1991; Fox 2003), some see it as a northeastern African tradition (Bar-Yosef 2000) while others fail to find a direct antecedent of the industry in the Near East (e.g. Marks and Volkman 1986; Tostevin 2003). In Ksar Akil and Umm el Tlel there is an erosional disturbance between late Mousterian and first IUP layers, in Boker Tachtit and Abu Halka no Mousterian exists previously, while in Kebara there is a large gap since the late Mousterian is only followed by the early Ahmarian, and no IUP is identified there. Leaving aside the issue of its antecedents, the IUP is normally linked to subsequent Upper Paleolithic assemblages, particularly the Ahmarian, which is often found above it (Azoury 1986; Bergman 1987; Gilead 1991; Gladfelter 1997; Bar-Yosef 2000; Fox and Coinman 2004; Shea 2008).



Very few human remains are associated with IUP layers. Notable examples include the “Neandertaloid” maxilla from Ksar Akil level XXV, which metrically falls well within the range of *Homo sapiens* and is very likely to belong to a modern human specimen (see discussion in Douka et al. 2013) and several teeth from Üçağızlı which have been tentatively ascribed as belonging to *Homo sapiens* individuals (Güleç et al. 2007; Kuhn et al. 2009 and <http://web.arizona.edu/~hatayup/humanremains.htm>). This limited set of fossil remains does not allow secure attribution of the IUP to a single human type, but the general consensus is that it is most likely to be an industry produced by AMH.

### Early Upper Paleolithic

In the Levant, two classic Upper Paleolithic traditions cover the last stage of MIS 3 (40,000-25,000 BP): the Early Ahmarian and the Levantine Aurignacian. This ‘two-tradition model’ (Gilead 1981; Marks 1981, 1993) replaced Neuville’s (1934) unilinear sequence for the evolution of the Levantine Upper Paleolithic. Flake predominance is characteristic of the Levantine Aurignacian assemblages, while a high proportion of blades lead some to diagnose an assemblage as Early Ahmarian (but caution is advised by Belfer-Cohen and Goring-Morris 2003; Marks 2003).

Stratigraphically, both entities are found above terminal Mousterian or IUP layers, and, when they co-exist at the same site, the Ahmarian always underlies the ‘classic’ Levantine Aurignacian phase. However, if the available chronological data were taken into account, the Levantine Aurignacian and Ahmarian would seem to overlap for several thousand years in the regions where they occur (Belfer-Cohen and Goring-Morris 2003). Whatever the case, it seems that there is a general paucity of Ahmarian and Levantine Aurignacian sites in comparison with the larger number of Middle Paleolithic sites found in the Levant (Gilead 1991).

### Early Ahmarian

The Early Ahmarian, a term proposed by Anati (1963) and adopted by Gilead (1981), is the first classic Upper Paleolithic industry extensively distributed throughout the southern, central and northern Levant. Typologically, Early Ahmarian assemblages are characterized by an overwhelming dominance of blades and bladelets among both the tools and the debitage (>30-40%), and low to medium quantities of endscrapers and burins (<40%) (Gilead 1981). The el-Wad (previously Font-Yves) point, once regarded as a *fossile directeur* of Garrod’s Levantine Aurignacian industries (Garrod 1957), is now associated primarily with the Early Ahmarian tradition (Belfer-Cohen and Goring-Morris 2003).

The Early Ahmarian phase was subdivided into a northern facies, with sites in the northern Levant (e.g. Ksar Akil and Üçağızlı, Kebara, Qafzeh and Yabrud), and a southern facies with early (37-30 ka BP) and late (27-25 ka BP)<sup>2</sup> assemblages in semi-arid locations in the Negev, Jordan and Sinai.

2 In this article “(ka) BP” refers to uncalibrated radiocarbon ages, while “(ka) cal BP” or “(thousand) years ago” refers to calendar years Before Present. When only “ka” is used, ages of various chronometric methods may have been described, usually beyond the <sup>14</sup>C limit (e.g. OSL, U-series) and which do not require calibration.

The Late Ahmarian, originally viewed as a continuity of the Early Ahmarian phase, is now thought to be a late Upper Paleolithic techno-typological complex occurring after the Levantine Aurignacian and falling within the Upper-to-Epipaleolithic transition (Belfer-Cohen and Goring-Morris 2003). Although similar patterns exist between the Early and Late Ahmarian phases and a basic continuity remains identifiable (Marks 2003), there are almost no el-Wad points or Aurignacian elements in this late sub-phase.

The nature of the transition from the IUP to the Ahmarian, whether gradual or abrupt, and its relation to environmental and demographic changes, is still unclear. For some scholars, the transition is autochthonous to the Levant (Marks 1990) while others see it as evidencing population dispersals out of Africa and into the Levant (e.g., Bar-Yosef 2000).

### Levantine Aurignacian

It has been argued that the Middle to Upper Paleolithic transition in the Near East is completed only with the appearance of the Levantine Aurignacian (Belfer-Cohen and Goring-Morris 2003). Yet, this industry has not received the same attention as the European Aurignacian, mainly because it is not linked with the issue of the biological shift from Neandertals to modern humans (Williams 2006).

The Levantine Aurignacian is a later Upper Paleolithic tradition featuring, in contrast to the Ahmarian and the European Aurignacian, a flake-based technology (Williams 2006) which contains various percentages of blades and bladelets, and the *lamelle Dufour* usually comprising the only bladelet tool. A predominance of flakes, thick and steep endscrapers and multifaceted burins (possibly cores for Dufour bladelet production) are considered to be distinctive characteristic of the industry, as is the presence of nosed and shouldered carinated pieces, bone points, pierced teeth and shell beads (Gilead 1991; Belfer-Cohen and Goring-Morris 2003; Williams and Bergman 2010). Carination, thick blanks for blades and scrapers and Aurignacian retouch also define the technological attributes of the Levantine Aurignacian (Williams 2006).

Copeland (1975) divided the industry into three phases that she termed Levantine Aurignacian A, B and C (renaming Neuville's Phase III, IV and V and Garrod's Antelian I, II and Atlelian, respectively). Phase A has a strong blade orientation and includes retouched blades and bladelets, el-Wad points and flat-faced carinated burins; Phase B is rich in typical Aurignacian elements, such as nosed and shouldered scrapers, carinated pieces, el-Wad points and bone tools; and Phase C is characterized by bladelets, numerous prismatic burins, and carinated scrapers (Copeland 1975; Belfer-Cohen and Goring-Morris 2003; Williams 2006; Williams and Bergman 2010). Yet, it has become more and more obvious in recent decades that not all elements of the industry are present at each site (Williams and Bergman 2010).

The Levantine Aurignacian may represent an assortment of various localized industries, temporally distinct and spatially restricted to the Mediterranean coastal zone (Goring-Morris and Belfer-Cohen 2006), or also found within the steppe and desert regions of the marginal zone (Marks 2003; Williams 2006). Such assemblages occur in the north and central Mediterranean Levant in sites including, among others, Ksar Akil, Hayonim, Sefunim, Kebara, Yabrud.

In terms of origins, opinions vary. Some suggest that it emerged in the region as a result of local evolution (Tixier and Inizan 1981; Mellars and Tixier 1989) and, in particular, out of the local Early Ahmarian (Garrod 1937; Goring-Morris 1987; Marks and Ferring 1988), or that it arrived as an intrusion from western Europe or Asia; hence the close similarities to the French Aurignacian (Garrod 1957; Belfer-Cohen and Goring-Morris 2003; Bar-Yosef 2006).

For a recent discussion the reader is referred to Williams and Bergman (2010) who use the term “Levantine Aurignacian” only for Phase 5 (levels VIII-VII of 1937-38 and Xb-IXc of 1947-48) of Ksar Akil, which they see as intrusive in the sequence, failing to identify any clear ties to what came before or after.

## Revised chronological framework for the northern Levant

The underlying hypothesis supporting this research was that if the occurrence of personal ornaments in the form of shell beads around the Mediterranean is taken as proxy of the presence of AMH, then direct radiocarbon dating of these beads can provide significant information on the expansion of modern populations in Europe along – what Mellars (2006) termed – the southern Mediterranean route.

### Sites and material under study

Only two Levantine sites have yielded numerous examples of shell beads available for dating: Ksar Akil and Üçağızlı. For a history of research in each site the reader is referred to Ewing (1947), Bergman (1987), and Douka et al. (2013) for Ksar Akil, and for Üçağızlı to Kuhn et al. (2009).

Ksar Akil in central Lebanon contains 23 m of cultural deposits and an unparalleled Middle and Upper Paleolithic sequence (Fig. 2a). Three major archaeological phases have been identified (Ewing 1947; Azoury 1986; Bergman 1987): (i) a Middle Paleolithic phase in levels XXXVII–XXVI, assigned to the Levantine Mousterian; (ii) an IUP phase in levels XXV–XXI/XX, also referred to as “Ksar Akil Phase A” or “Phase 1”; (iii) a typical Upper Paleolithic phase in levels XX/XIX–top, subdivided in an Early Ahmarian facies (“Ksar Akil Phase B” or “Phase 2”) in XX/XIX–XV, an intermediate assemblage comprising both Aurignacian and Ahmarian elements (“Levantine Aurignacian A” in levels XIII–IX or “Phase 3” in levels XIII–XI), Classic Aurignacian levels (“Levantine Aurignacian B” in levels VIII–VII, or “Phase 4” in levels X–IX and “Phase 5” in levels VIII–VII); later Paleolithic levels predating the LGM (“Levantine Aurignacian C”, VII/VI–V), and finally Kebaran layers (IV–top).

Üçağızlı in southwest Turkey has yielded a 3 m-deep stratigraphic sequence that is divided into eight layers, designated I to B from bottom to top (Fig. 2b). The sequence documents the transition between from an IUP technological system to the Early Ahmarian. Assemblages from layers B, B1-B4, and C are typically Ahmarian in character; layers F, Fa, Fb/Fc, G, H, H2/H3, and I fall within the IUP. Layers C/D, D, and E are more difficult to characterize due to the low number of artifacts, but they appear closer to the Ahmarian than to the IUP (Kuhn et al. 2009).

Ksar Akil has yielded abundant molluscan remains. Altena Van Regteren (1962) and Inizan and Gaillard (1978) mention about 2,200 marine shells – about 2000 from the Ewing excavations and 200 from those of Tixier – belonging to 45 molluscan species. *Nassarius gibbosulus*, *Columbella rustica*, *Osillinus turbinatus*, and *Glycymeris* sp. are the most abundant throughout the sequence. Ewing (1949) also mentions thousands of shells of *Patella* sp. and *Trochus* sp. assumed to have been collected for food consumption. These have not been identified in the current collection raising the possibility that

Sample	OxA	<sup>14</sup> C	±	Level / Sq. / Depth in m below datum	Genus/Species [δ <sup>13</sup> C‰]	Calibrated (95.4%)	
						from	to
Charc.	19194	30250	170	8ac=VI	Not identified	35110	34580
KA 4	20875	30640	160	VIII / G 3-4 / -6.75	<i>Nassarius gibbosulus</i>	35090	34550
KA 9*	20022	37210	230	IX / G 4 / -8	<i>Glycymeris</i> sp.	42150	41270
KA 11	20023	30360	140	IX / E 4-F 4 / -8.1	<i>Nassarius gibbosulus</i>	34960	34070
KA 15	25585	34550	250	X / F 3 / -8.1	<i>Nassarius gibbosulus</i>	40050	38480
KA 16	20024	35520	200	XII / E 4 / -10	<i>Nassarius gibbosulus</i>	40940	39350
KA 17	20876	35020	240	XV / F 4 / -10.4	<i>Nassarius gibbosulus</i>	40400	38820
KA 18	22665	36040	240	XVI / F 3 / -10.7	<i>Nassarius gibbosulus</i>	41410	40170
KA 30	X-2342-57	28130	110	XVII / F 3 / -10.9	<i>Columbella rustica</i> [-5.1]	32270	31380
KA 31	20877	36270	240	XVII / F 3 / -10.9	<i>Glycymeris</i> sp.	41560	40410
KA 27	22269	35390	250	XVII / F 3 / -10.9	<i>Acanthocardia</i> sp.	40860	39100
KA 25	20487	33930	220	XVII / F 3 / -10.9	<i>Nassarius gibbosulus</i>	38880	37380
KA 29	25652	33300	230	XVII / F 4 / -11.25	<i>Columbella rustica</i>	38760	37200
KA 22	20486	35780	240	XVII / F 4 / -11.25	<i>Nassarius gibbosulus</i>	41200	39610
KA 37	X-2338-8	33760	210	XVIII / E 4 / -11.55	<i>Columbella rustica</i>	38760	37200
KA 34	25653	34830	240	XVIII / E 4 / -11.55	<i>Nassarius gibbosulus</i>	40220	38700
KA 35	20488	34230	210	XVIII / E 4 / -11.55	<i>Nassarius gibbosulus</i>	39250	37660
KA 38	22664	35510	240	XIX / F 4 / -11.7	<i>Nassarius gibbosulus</i>	40980	39280
KA 39	X-2361-14	32960	160	XIX / F 4 / -11.7	<i>Columbella rustica</i>	37580	36530
KA 41	20879	35010	240	XX / F 4 / -12.65	<i>Nassarius gibbosulus</i>	40390	38810
KA 45	20025	36390	210	XXI / E 4 / -12.95	<i>Nassarius gibbosulus</i>	41630	40560
KA 49	25655	30890	160	XXII / F 4 / -13.7	<i>Columbella rustica</i>	36270	34890
KA 47	20880	34940	200	XXII / F 4 / -13.7	<i>Nassarius gibbosulus</i>	40260	38790
KA 48	22667	34320	190	XXII / F 4 / -13.7	<i>Nassarius gibbosulus</i>	39410	37910
KA 51	20489	36790	270	XXIII / E 4 / -14.5	<i>Nassarius gibbosulus</i>	41960	40950
KA 51	20490	37430	320	XXIII / E 4 / -14.5	<i>Nassarius gibbosulus</i>	42380	41320
KA 54*	X-2361-17	33810	180	XXVIII / F 5 / -16.55–75	<i>Ostrea</i> sp. [-3.4]	38770	37330
KA 54*	X-2344-23	35900	400	XXVIII / F 5 / 16.55–75	<i>Ostrea</i> sp. [-2.6]	41480	39440
KA 54	20491	39310	330	XXVIII / F 5 / 16.55–75	<i>Ostrea</i> sp.[1.6]	43830	42520
KA 55	25656	39530	330	XXVIII / F 5 / 16.55–75	<i>Ostrea</i> sp.[1.0]	44280	43020

**Table 1:** New radiocarbon determinations from Ksar Akil. The differentiation between *Nassarius gibbosulus* or *Nassarius circumcinctus* was not always possible due to the preservation state of the shells; here they are all tentatively ascribed to the former species. The δ<sup>13</sup>C value is also given when this was unusual for marine shells, therefore indicating either some degree of meteoric diagenesis or other technical issues. In the case of KA 54, the last determination is the most reliable and in agreement with KA 55, probably belonging to the same bivalve. The three determinations marked with an asterisk were not used in the modelling since they are most certainly problematic (see Douka et al. 2013).

some of the invertebrate remains never left Lebanon. Permission was sought from the Naturalis Museum (The Netherlands) to directly date a number of specimens from the malacofaunal collection of Ksar Akil. Twenty-six shells were obtained (some of which are shown in Fig. 3), producing 30 new radiocarbon determinations (some specimens were dated twice) (Table 1).

The molluscan assemblage from Üçağızlı is equally impressive (Kuhn et al. 2001). About 2,000 ornamental shells, perforated and not, have been identified across the excavated layers B–I. Almost all beads are made from the shells of marine and freshwater molluscs, mostly gastropods (Stiner 2003; Kuhn et al. 2009). Besides the ornamental assemblage, abundant food shellfish remains (over 2,200 specimens of *Monodonta* sp. and *Patella* sp.) were also found at the site. Samples for dating were provided by Profs. S. Kuhn and M. Stiner (University of Arizona), co-directors of the excavation. Eight samples were dated, some of which are shown in Fig. 3. These come from IUP (F–H) and Early Ahmarian (B–D) levels of the site.

### **New radiocarbon determinations and Bayesian statistical analysis**

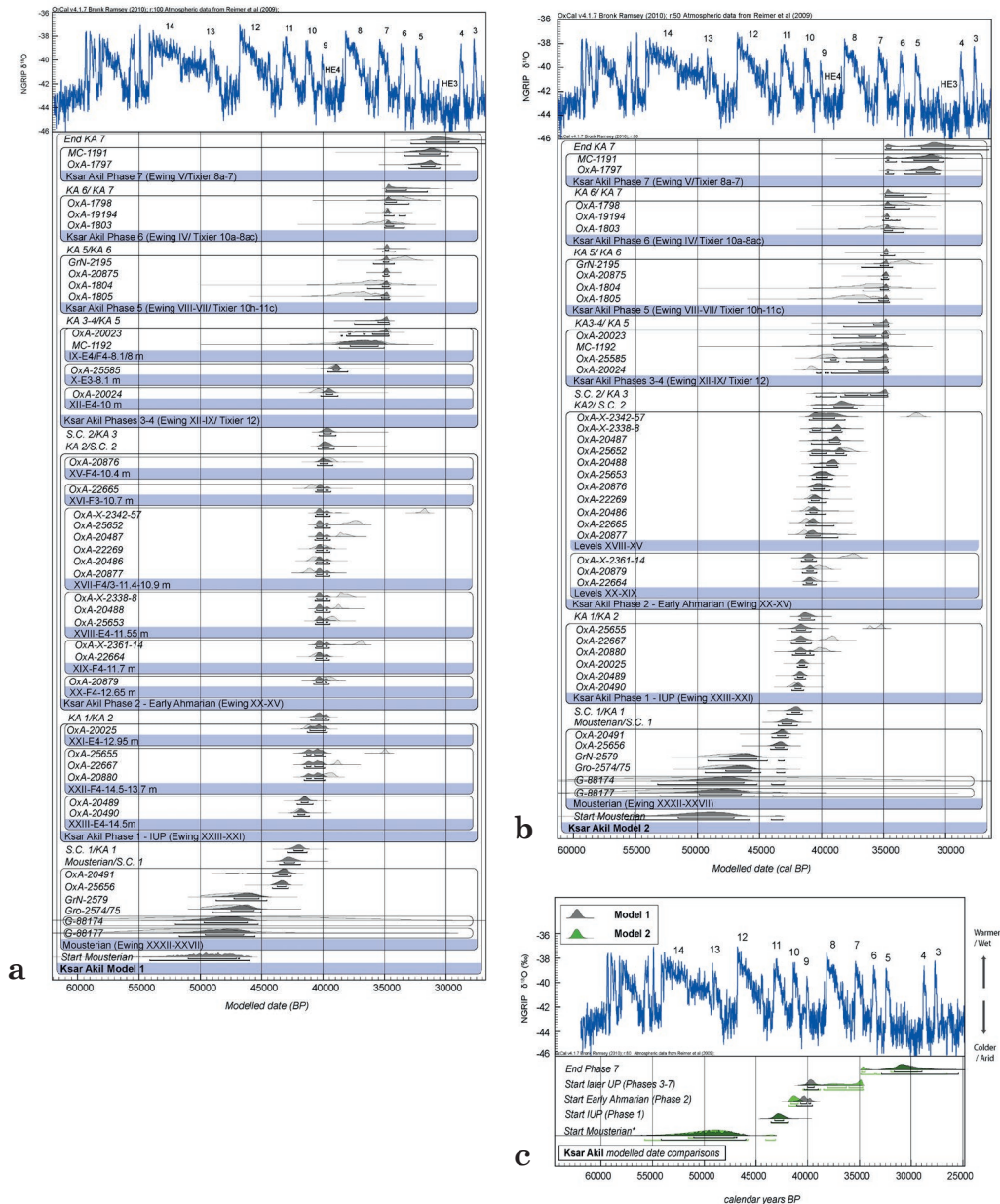
The new radiocarbon determinations from Ksar Akil have been reported recently by Douka et al. (2013). Despite the large suite of new determinations, variations within the sequence are apparent. The discrepancies are thought to derive from contextual problems, as well as horizontal and lateral misalignment of the cultural horizons in different excavation squares, similar to the ones outlined by Williams and Bergman (2010) for the upper part of the sequence. The new results on shells span from 39.5 ka BP/44–43 ka cal BP for the late Mousterian level XXVIII to about 30 ka BP/35–34 ka cal BP for the Levantine Aurignacian level VIII (Phase 5 of Williams and Bergman 2010) (Table 1).

In order to evaluate the series of new results, the Bayesian statistical approach was used and the calibrated determinations were analyzed in two different models: one based on the levels the dated samples derive from, and one where most individual levels were combined within five broad techno-typologically distinct phases and the results grouped therein (Fig. 4a, b). Bayesian methods allow the formal incorporation of stratigraphic and relative sequence. Along with the calibrated radiocarbon likelihoods, information on breaks in the sequence or the nature of the succession of archaeological levels can be added to modify the way the deposition may have been influenced in the past (Bronk Ramsey 2009).

The second model built for Ksar Akil is more flexible and best reflects the sedimentary evolution of the site. For example, it allows for a certain degree of material movement through levels found in close proximity and minimizes contextual discrepancies, which are consistent with the findings of Williams and Bergman (2010). It also incorporates most available data with less statistical outliers (Douka et al. 2013). A comparison of both models is shown in Fig. 4c.

The antiquity of the earlier basal Mousterian levels of Ksar Akil cannot be established but if previous determinations are to be trusted, it must have certainly started before 50 ka and ended at around 43.5–42.5 thousand years ago. The Mousterian was replaced by the IUP soon after; the latter lasted for a couple of millennia until 41–40 thousand years ago. The Early Ahmarian starts at around the same time and it seems to end at





**Fig. 4:** Bayesian modelling for the old and new determinations from Ksar Akil. (a) Bayesian Model 1. Initial Bayesian plot with the new dates, as well as previously obtained determinations. The model is structured around individual layers and phases. Of the 39 determinations, 11 are flagged as outliers. (b) Bayesian Model 2. Second modelling iteration containing the same determinations as before. Here, individual layers are grouped together within broad industrial phases. Of the 39 determinations, 9 outliers are identified. (c) Comparison of the two models. For a description of the results see also Douka et al. (2013).

some point between 39-37.5 thousand years ago. After a possible hiatus, the Levantine Aurignacian phases start. It is worth mentioning here that the new results obtained for the uppermost dated level (VIII) are very comparable to previous determinations from charcoal and shell samples collected from analogous contexts during Tixier's excavations at the site in the 1970s. In fact, a charcoal sample from Tixier's level 8ac previously dated at 29 ka BP (OxA-1798: 29300 ± 800 BP; Mellars and Tixier 1989) was re-dated in Oxford and produced a more precise but statistically identical date (OxA-19194: 30250 ± 170 BP) when a harsher and more reliable decontamination method (ABOx) was applied to the sample.

In Üçağızlı, eight new radiocarbon dates were obtained on *Nassarius gibbosulus* shells, most of which were transformed into beads. The ages span between 36-33 ka BP/41-37 ka cal BP (Table 2). Those from the middle part of the sequence (OxA-19758, OxA-X-2318-50, OxA-19759, OxA-19760) are statistically identical. Six of the eight determinations are consistent and conform to the stratigraphic information available for the provenance of the beads; two determinations, however, appear old despite coming from the uppermost part of the Ahmarian sequence (layer B). The possibility that some material is re-deposited from older sediments in the site may be an explanation, although post-depositional mixing does not seem to affect other types of material nearly as much. Given the mineralogical integrity of the shells, it is perhaps possible that the two samples were semi-fossilized (i.e. long dead) at collection in the prehistoric period. Indeed, one of the two *Nassarius* shells shows clear evidence of death by animal predation. In any case, the two 'old' shells are within the overall span of the shell determinations obtained from Üçağızlı and do not significantly influence the chronology of the site.

Sample	OxA	<sup>14</sup> C	±	Layer /Depth in cm below datum	Species	Calibrated (95.4%) from to	
Ucgz 2	X-2338-55	36270	240	B/ 90-100	<i>Nassarius gibbosulus</i>	41560	40410
Ucgz 3	21116	35240	260	B1-B3 / 95-100	<i>Nassarius gibbosulus</i>	40670	38940
Ucgz 6	19842	33230	180	D / 184-190	<i>Nassarius gibbosulus</i>	38380	36670
Ucgz 8	19758	34080	180	F / 210-215	<i>Nassarius gibbosulus</i>	38970	37590
Ucgz 9	X-2318-50	34300	800	Fc / 226-235	<i>Nassarius gibbosulus</i>	40770	36800
Ucgz 10	19759	34540	180	G / 265-270	<i>Nassarius gibbosulus</i>	39650	38520
Ucgz 12	19760	34050	170	H / 285-290	<i>Nassarius gibbosulus</i>	38930	37580
Ucgz 15	20628	36320	270	H3 / 300-305	<i>Nassarius gibbosulus</i>	41630	40410

**Table 2:** New radiocarbon determinations from Üçağızlı.

Initial calibration of the previously published dates from Üçağızlı confirmed the wide scattering of the results. All layers fell before into the same broad age ranges between 45-35 ka cal BP (Fig. 5a). After obtaining the new results, all available determinations, new and previous, were modeled and analyzed using Bayesian statistics. Fig. 5b shows the new modeled chronology. It demonstrates the effect that the addition of the new radiocarbon dates and the treatment of the sequence with the Bayesian statistical approach had on the chronological framework of the site.

This new chronological framework for Üçağızlı suggests that the IUP (layers I-F) started at the site between 45-43,000 years ago and lasted until about 39-38,000 years ago, while the Ahmarian occupation (layers C, B and possibly D and E) started between

38.5-37 ka cal BP (95.4%) and was relatively short-lived, ending at some point around 36,000 years ago.

### Previous chronological framework

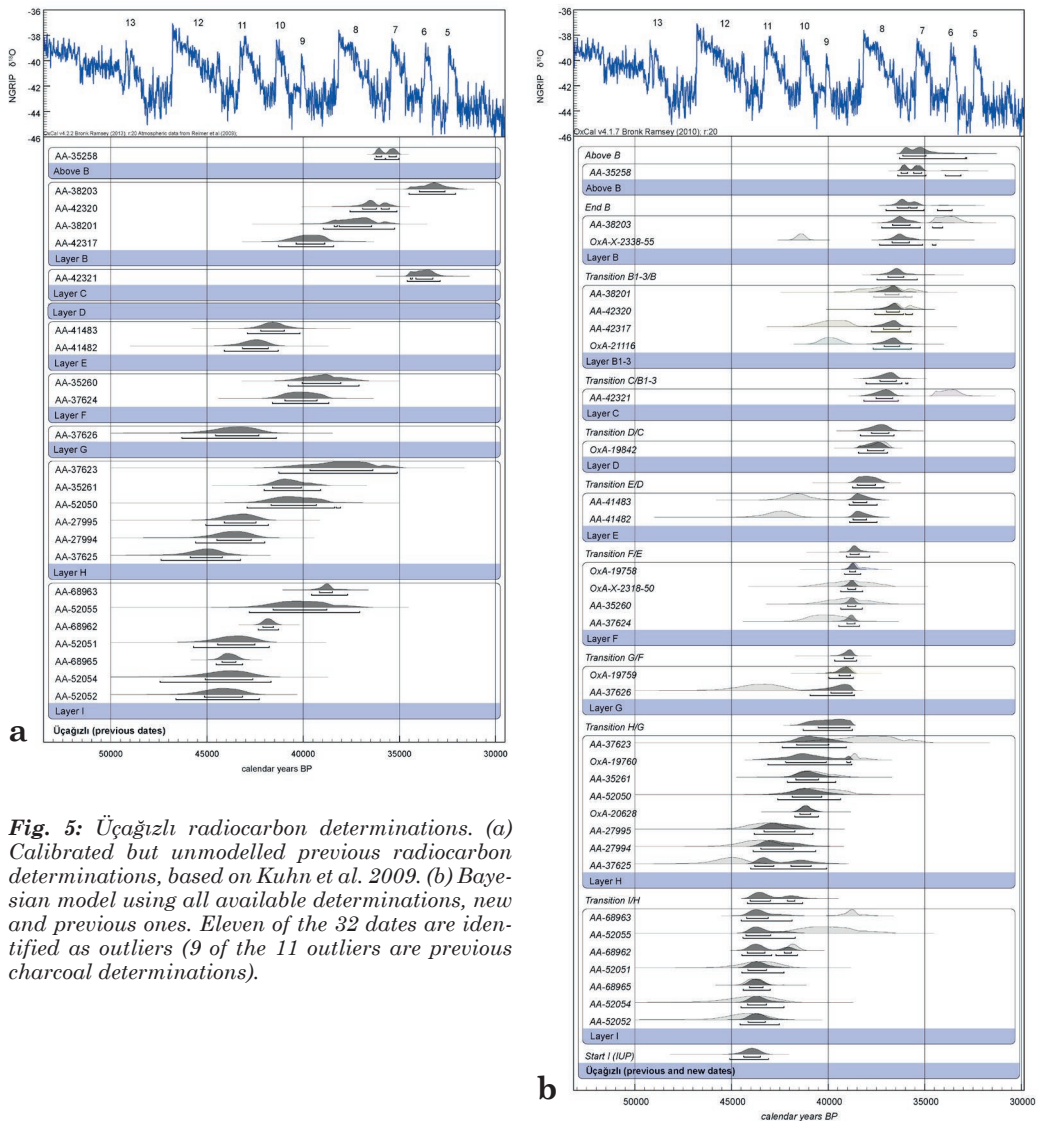
The earliest dated evidence for IUP assemblages comes from the open-air site of Boker Tachtit (Marks 1983). Four conventional radiocarbon determinations are available. These are charcoal samples from basal level 1 (SMU-580:  $47284 \pm 9048$ ; SMU-259:  $46930 \pm 2420$ ; SMU-184:  $>45570$ ; GY-3642:  $>34950$  BP), a transitional level thought to exhibit Mousterian affinities (Fig. 4). These ages are surprisingly old and while technological re-examination of the lithic material from Boker Tachtit was recently conducted (Tostevin 2003) no effort has been made – to my knowledge – to reproduce or add to these original dates, which have in the meantime become central in the discussion of the transition in the Levant. At the same site, uppermost level 4 is normally compared to IUP levels XXV–XXI of Ksar Akil and I–G of Üçağızlı. Level 4 is associated with a single date (SMU-579:  $35055 \pm 4100$  BP) (Marks 1983) on a charcoal sample from which humates could not be extracted, therefore probably a minimum age (Fig. 6). Shea (2003) hints at the possibility that the Boker Tachtit assemblage might even be much older ( $>50$ -100 ka). From a radiocarbon point of view, all samples were treated with less rigorous methods than the ones currently used for similar material. Old methodologies are now known to produce minimum ages for Paleolithic-aged samples due to incomplete removal of contaminants. It is hoped that the new planned excavations at Boker Tachtit will enable new dates with improved preparative techniques to be obtained and elucidate the picture.

In Umm El Tlel (Syria), the level III2a' is also attributed to the IUP and has been dated at  $36500 \pm 2500$  with TL on burnt flint and at  $34530 \pm 890$  BP (Gif-93216) with AMS dating (Boëda et al. 1996) (Fig. 6).

No direct dates existed for the IUP levels XXI–XXV of Ksar Akil but previous results from the underlying Middle Paleolithic levels (GrN-2579:  $43750 \pm 1500$ ; Gro-2574/75:  $44400 \pm 1200$  BP) broadly placed the transition at around 44 ka BP at the site, or as early as 50 ka BP (Mellars and Tixier 1989).

Finally, in Üçağızlı, layers F–I are attributed to the IUP and have been associated with 16 radiocarbon dates on charcoal (F: AA-35260:  $34000 \pm 690$ , AA-37624:  $35020 \pm 740$ ; G: AA-37626:  $39100 \pm 1500$ ; H, H2, H3: AA-37623:  $33040 \pm 1400$ , AA-52050:  $35500 \pm 1200$ , AA-35261:  $35670 \pm 730$ , AA-27995:  $38900 \pm 1100$ , AA-27994:  $39400 \pm 1200$ , AA-37625:  $41400 \pm 1100$ ; I: AA-52055:  $35100 \pm 1400$ , AA-52051:  $39200 \pm 1300$ , AA-52054:  $39700 \pm 1600$ , AA-52052:  $40200 \pm 1300$ , AA-68963:  $33874 \pm 271$ , AA-68962:  $36915 \pm 335$ , AA-68965:  $39817 \pm 383$  BP) (Kuhn et al. 2009). Despite this large number of dates in the IUP layers, the chronology appears problematic because of wide variation in ages and a lack of a clear temporal trend within the sequence (Kuhn et al. 2009).

A larger dataset of determinations are available for the Early Ahmarian. The earliest dates ( $\sim 42 \pm 2$  ka BP) are reported from Kebara Unit IV (Rebollo et al. 2011), however much younger dates are the norm, as shown in Fig. 7.

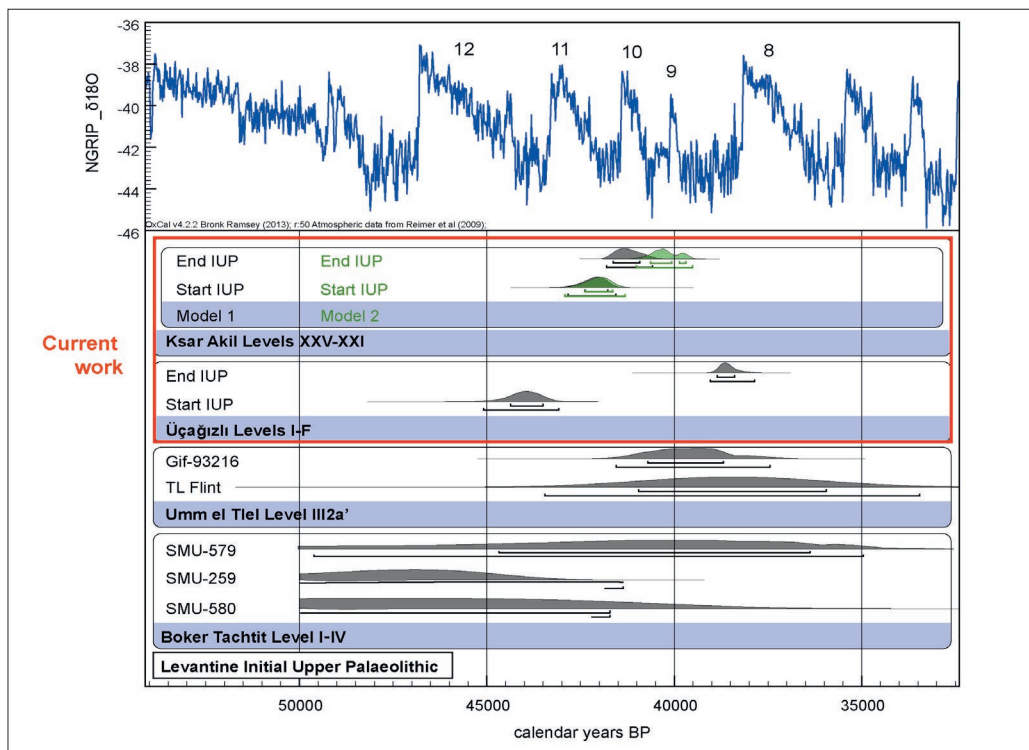


**Fig. 5:** Üçağızlı radiocarbon determinations. (a) Calibrated but unmodelled previous radiocarbon determinations, based on Kuhn et al. 2009. (b) Bayesian model using all available determinations, new and previous ones. Eleven of the 32 dates are identified as outliers (9 of the 11 outliers are previous charcoal determinations).

No radiocarbon dates existed for the Early Ahmarian part of the sequence in Ksar Akil. In Üçağızlı, layers B and B1–B4 assigned to the Ahmarian tradition (Kuhn et al. 2009) were associated with four radiocarbon dates on shell and charcoal (B, B1–B4: AA-38203:  $29130 \pm 380$ , AA-42320:  $31900 \pm 450$ , AA-38201:  $32670 \pm 760$ , AA-42317:  $34580 \pm 620$  BP). The intermediate layers, E and C, fixed between the IUP and the Early Ahmarian, are difficult to attribute to either of the industries. It seems however, according to the excavators, that these two layers are more closely related to the Ahmarian. Three radiocarbon determinations existed for levels C and E (AA-42321:  $29060 \pm 330$ , AA-41483:  $36560 \pm 790$ , AA-41482:  $37870 \pm 920$  BP).

Several determinations exist for other Ahmarian sites; the calibrated ranges are shown in Fig. 7. The actual determinations can be found in Appendix I in Goring-Morris and Belfer-Cohen (2003).

There are nine contexts attributed to the Levantine Aurignacian with associated chronometric data. The calibrated probability distributions are shown in Fig. 8 here; the actual dates can be found in Appendix I of Goring-Morris and Belfer-Cohen (2003) and site-specific reports (e.g., Lengyel et al. 2006).



**Fig. 6:** Calibration of the currently published dates from IUP contexts in the Levant, as well as the generated start and end boundaries (modelled probability distribution functions) for the IUP phase in Ksar Akil and Üçağızlı. The latter stem from the Bayesian treatment of all determinations at each site (Figs. 4 and 5). The determinations from the other sites can be found at Goring-Morris and Belfer-Cohen (2003) and <http://context-database.uni-koeln.de>.

In Ksar Akil, ~20 determinations from the classic Upper Paleolithic (“Levantine Aurignacian”) levels were available before our work and spanned between 32-21 ka BP (Douka 2011a). The vast majority come from the later Upper Paleolithic levels of Tixier’s excavations (Mellars and Tixier 1989) while a small number was produced on samples collected in 1959 and submitted to the Groningen Laboratory (Vogel and Waterbolk 1963).

Based on the previous determinations, the Aurignacian appeared to be roughly contemporaneous with the Ahmarian even though, at the sites where both occur, the latter always precedes the former stratigraphically.



## Discussion

The new chronostratigraphic framework for the two key Levantine sites allows some new insights to be drawn from the Middle to Upper Paleolithic transition in the Near East as well as the appearance of personal ornamentation.

The IUP and Ahmarian layers from Ksar Akil produced results between 37.5-35 ka BP and 35-32 ka BP, respectively. In Üçağızlı, the IUP ranges from 39-35 ka BP (although we note two earlier determinations) while the Early Ahmarian layers were dated between 34-31 ka BP. The IUP in Üçağızlı seems to precede that at Ksar Akil, despite the significant similarities between the lithic assemblages. However there is a wide degree of overlap between the calendar age ranges. In Ksar Akil, the early manifestation of the IUP phase may lie in the lowermost, undated IUP layers XXV–XXIV or be completely absent from the site. A different explanation may lie to the fact that the charcoal samples of Üçağızlı are indeed most representative of the true age of the IUP, in which case the shell bead dates may be responsible for a “shorter chronology”.

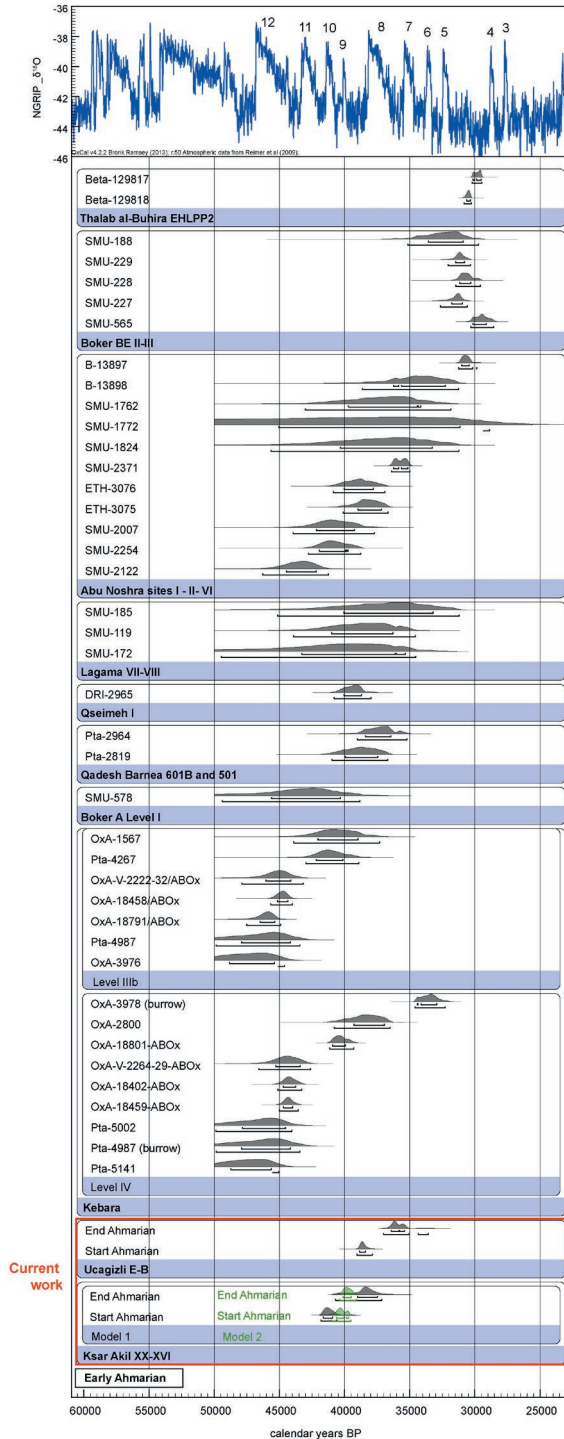
At the moment the most parsimonious explanation is that the IUP industry in the northern Levant appears at around 39 ka BP or about 43,000 years ago, and possibly slightly earlier. This age estimate is comparable to the evidence from other industries of Europe described as ‘transitional’ but containing evidence of modern human behavior, beads, and a distinctive lithic toolkit, different to the one from the preceding Mousterian levels.

In Fig. 6, the new data are compared to a small number of dates available from IUP assemblages in the Negev (Boker Tachtit) and Syria (Umm El Tlel). These dates are particularly imprecise and do not add much to the overall discussion, other than the fact that the determinations from Boker Tachtit are extremely old. The dates from Umm El Tlel are later and compare well with the “evolved” stages of the IUP both in Ksar Akil and Üçağızlı.

The subsequent industrial phase at both sites, the Early Ahmarian, dates to between 35-33 ka BP (38.5-37 ka cal BP) in Üçağızlı. This is marginally later than in Ksar Akil, where it had already replaced the IUP by 36 ka BP (~41 ka cal BP). The Ahmarian, often considered the first true Upper Paleolithic industry in the region, seems therefore to be directly contemporaneous to the earliest Aurignacian of Europe. In Üçağızlı, the Ahmarian ends at around 31 ka BP (or 36-35 ka cal BP). Whilst there is no identified Levantine Aurignacian there, in Ksar Akil the latter technocomplex appears between 31-30 ka BP (or 37-35 ka cal BP). This is consistent with its higher position in the upper layers of the stratigraphy, where it follows a depositional hiatus and possible abandonment of the site, marked by Stone Complex 2.

If we are to consider these ‘classic’ Upper Paleolithic phases (Early Ahmarian and Levantine Aurignacian) from Ksar Akil and Üçağızlı within their broader context, the chronological framework becomes fuzzy and imprecise.

In Fig. 7, all available dates from Early Ahmarian Levantine assemblages are plotted together. The dates from Kebara are considerably older than those from any other site, and are difficult to explain. At most northern Levantine sites the Ahmarian dates to ~ 40-35 ka cal BP, while at Boker BE and Thalab al-Buhira the dates tightly cluster



**Fig. 7:** Calibration of the currently published dates from Early Ahmarian contexts in the Levant, as well as the generated start and end boundaries (modelled, not measured ages) for the technocomplex in Ksar Akil and Uçagizli. The latter stem from the Bayesian treatment of all determinations at each site (Figs. 4 and 5). The determinations from the other sites are taken from Goring-Morris and Belfer-Cohen (2003), Rebollo et al. (2011), and <http://context-database.uni-koeln.de>.

at 30 ka cal BP. There may be, however, techno-typological issues relevant to the assessment of these sites as Early Ahmarian.

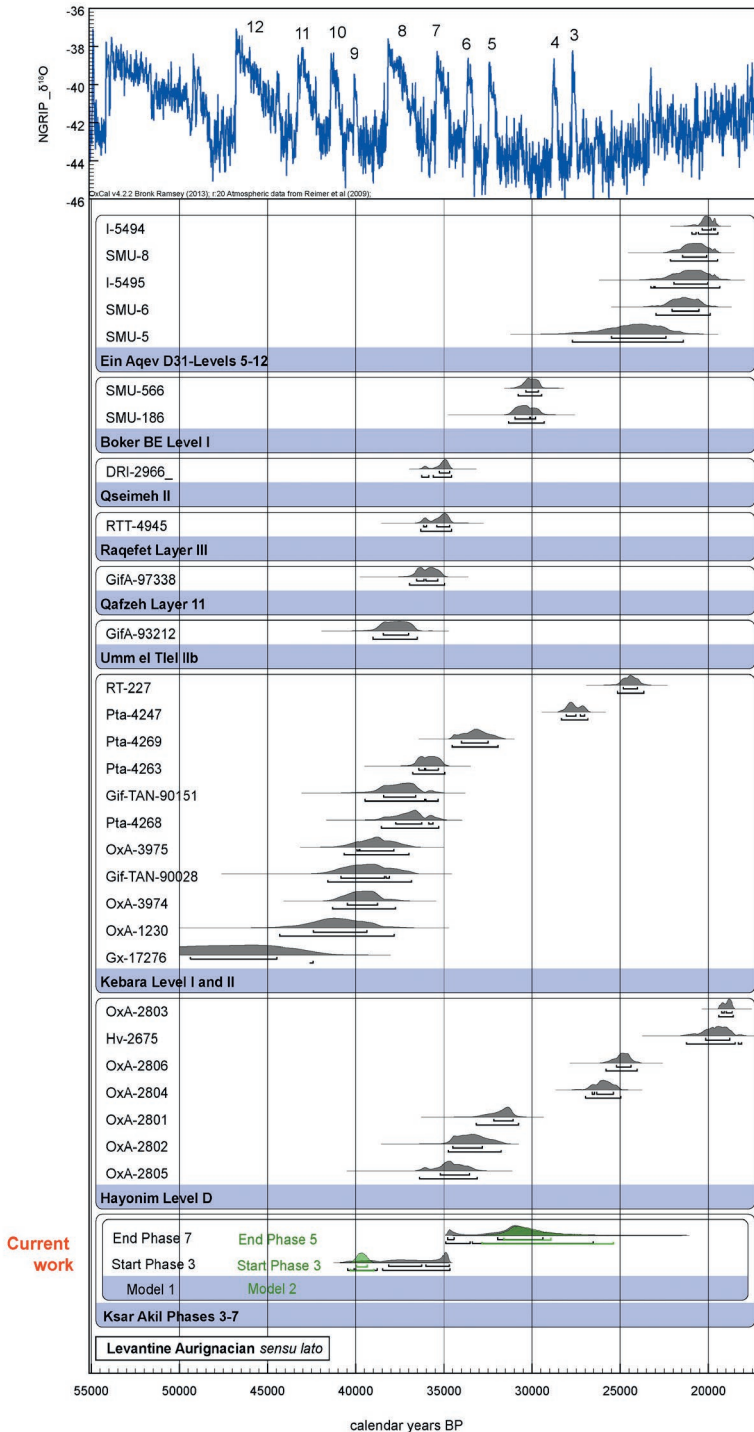
Available determinations from Levantine Aurignacian contexts in the wider Near Eastern region, including the new chronology for Ksar Akil, are plotted in Fig. 8. Again, as with the current framework pertinent to the Levantine IUP and Early Ahmarian assemblages, there is great variation. The majority of the dates were measured in the early 1970s, some were even amongst the first archaeological measurements at the then newly-established laboratories. Experience with several re-dates of old material at the ORAU has shown that the majority of these early determinations should be now considered unreliable, and often minimum ages.

Two clusters of dates appear to define the current chronological framework for the Levantine Aurignacian. The youngest – and possibly less reliable – group consists of determinations from Kebara, Hayonim and Ein Aqev which are in the range of 20-15 ka BP. Those from Kebara (Pta-4247 and RT-227) have been questioned on reasons of contextual integrity (Bar Yosef and Belfer-Cohen 1981; Bar-Yosef et al. 1996) and so have the ones from Hayonim Cave (Hedges et al. 1992). These are now considered Kebaran intrusions. The Ein Aqev evidence, although internally consistent, requires further re-examination.

The second earlier cluster suggests that the Levantine Aurignacian starts at 40 ka cal BP and lasts until about 32/30 ka cal BP. The dates that push the start boundary of the phase back are mainly the early dates from Kebara and a couple of new determinations from Ksar Akil (OxA-20022 and OxA-20024 in particular) which appear too old. The latter were most certainly due to old shells being collected from the local beach (Douka 2011b). If a ~40 ka cal BP start is valid, then the Ahmarian and the Aurignacian develop in parallel. This has been suggested repeatedly (see Marks 2003 for detailed discussion) but stratigraphic evidence does not support such a development.

If the data from Kebara are set to one side, then the European Aurignacian 0 (= Protoaurignacian) phase, which is normally compared to the Early Ahmarian (Goring-Morris and Belfer-Cohen 2003; Zilhão 2007), predates it or, at best, they are comparable in age. The Levantine Aurignacian started later, after 35 ka BP/40 ka cal BP, as suggested by the corpus of the recently produced dates in Ksar Akil, Raqefet, and Umm El Tlel, as well as the majority of the Kebara determinations for levels I and II. The data suggest that the Levantine Aurignacian phase may coincide at both ends with the classic facies of the Aurignacian in Europe (Early Aurignacian or Aurignacian I).

These aforementioned observations have a great bearing on our understanding of the spread and internal evolution of the Aurignacian phenomenon across the Mediterranean. One thing should not be overlooked: beyond the all-inclusive 'Aurignacian' heading, there are major techno-typological differences between the Aurignacian assemblages across regions of Europe and the Levant.

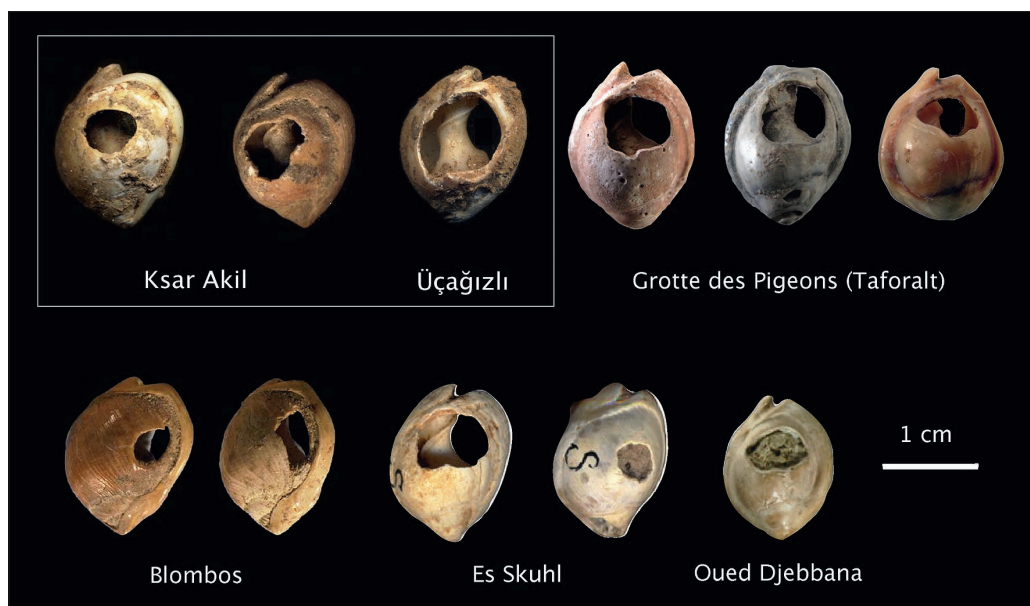


**Fig 8:** Radiocarbon determinations for the Levantine Aurignacian phase, including the generated start and end boundaries (modelled, not measured ages) for the phase in Ksar Akil and Uçağızlı. The determinations from other sites can be found in Goring-Morris and Belfer-Cohen (2003), Lengyel et al. (2006), and at <http://context-database.uni-koeln.de>.

## Production of Paleolithic beads in southeastern Mediterranean

The earliest occurrences of beads in the Levant have been reported from Mousterian level B of Es-Skhul (~100 ka; Vanhaeren et al. 2006) and Mousterian levels XXI-XIV of Qafzeh (~90 ka; Bar Yosef Mayer et al. 2009) in Israel. None of these beads have been directly dated and their age is assumed to be old based on their context. Pierced shells are not found in the Levant until beads re-appear in large number and technological consistency in the IUP levels of Ksar Akil and Üçağızlı. Some of the earliest IUP examples were dated here at 37.5 ka BP/42.3-41.3 ka cal BP (Ksar Akil level XXIII) and 36.2 ka BP/41.6-40.4 ka cal BP (Üçağızlı level H) although it is very likely that the earliest examples at both sites were not dated. Even so, the earliest beads are not expected to be older than 1-2 millennia at most.

The shells of a particular genus, that of *Nassarius gibbosulus/ circumcinctus*, are the most common in the two Levantine sequences. This selection mirrors the preferential exploitation of an almost identical, yet smaller in size, shell species (*Nassarius kraussianus*) by archaic modern humans in southern Africa (e.g., Blombos Cave) as well as the use of *Nassarius gibbosulus/ circumcinctus* in North Africa (e.g., Taforalt) around 100-70 ka ago (Fig. 9). The reasons behind the selection of the distinct basket-shaped shells of *Nassarius gibbosulus/ circumcinctus/ kraussianus* are not clear and cannot be explained on the biogeography of the molluscan assemblages alone. Instead, the use

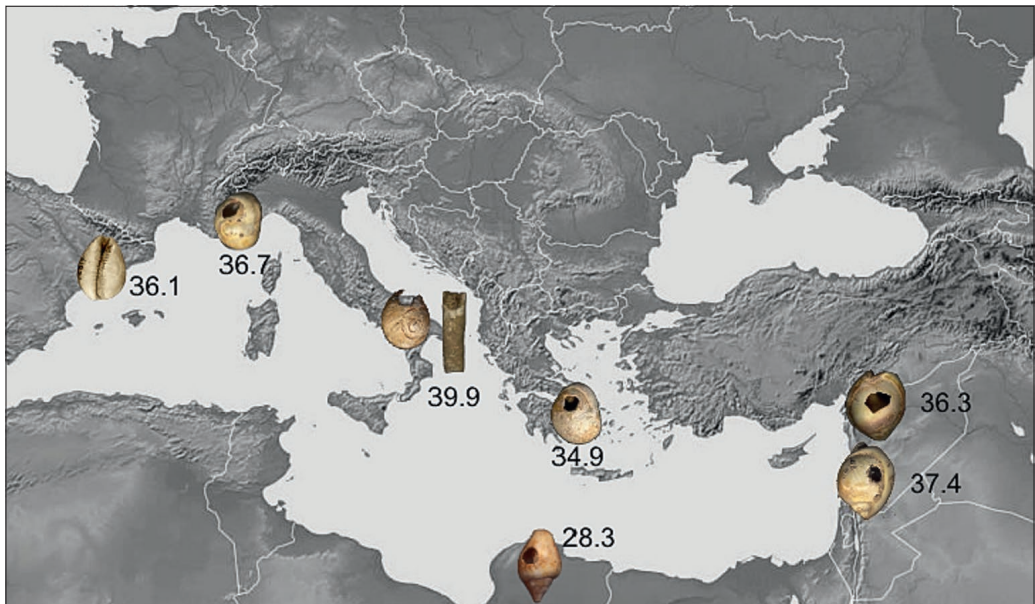


**Fig. 9:** Examples of the Levantine shell beads dated here are compared to shell ornaments made on the same or closely related species (*Nassarius gibbosulus/ circumcinctus/ kraussianus*) from much earlier (archaic) modern human sites in Morocco (Grotte des Pigeons/Taforalt), South Africa (Blombos Cave), Israel (Es-Skhul) and Algeria (Oued Djebbana). The African beads have never been directly dated, but the contexts they come from date to ~80 ka BP or before. Shell pictures on the first row are taken by the author, those on the second row are from d'Errico et al. (2005) and Vanhaeren et al. (2006).



of almost identical shells across huge geographic and temporal scales and completely different ecological niches may imply a strong cultural tradition and symbolic linkage between archaic modern humans evolving and leaving Africa and the first modern humans settling the Near East tens of thousands of years later.

Comparison of the new bead determinations from the Near East with other direct  $^{14}\text{C}$  determinations of shell beads from Early Upper Paleolithic Mediterranean contexts (e.g., Riparo Mochi: Douka et al. 2012; Franchthi Cave: Douka et al. 2011; Abric Romaní: Camps and Higham 2012) reveals a remarkable synchrony in the emergence and standardization of the phenomenon of shell ornamentation in the Near East, northern Italy and Spain (Fig. 10). The observed synchronous appearance of beads across the entire Mediterranean basin, although currently limited in a small number of sites, forms an important basis for future re-assessments of the hypotheses revolving around the start, expansion and modes of production of body ornamentation and, by extension, the development of “fully *sapiens* symbolic behavior” across Paleolithic Eurasia. It should be noted that older directly-dated beads, those from the Uluzzian site of Cavallo (Benazzi et al. 2011) (Fig. 10), predate the Aurignacian ornaments, and this is in accordance to stratigraphic correlation at the respective sites. In addition, in some cases the dated beads do not necessarily correlate with the earliest dates from a particular context: for example, in Üçağızlı some charcoal radiocarbon determinations are older than the dated shell beads, while in Haua Fteah the earliest dated shell beads are found much later than the start of the Dabban (Douka et al. in press).



**Fig. 10:** Map illustrating the location of shell ornaments across the Mediterranean basin and their ages, after direct  $^{14}\text{C}$  dating at Oxford. Starting from bottom right and anticlockwise the beads come from: Haua Fteah (Libya), Ksar Akil (Lebanon), Üçağızlı (Turkey), Franchthi (Greece), Cavallo (southern Italy), Mochi (northern Italy) and Abric Romaní (Spain).

The use of shell beads increases throughout the evolved stages of the Upper Paleolithic and Epi-Paleolithic in the Near East (Bar-Yosef Mayer 2005) and the production of highly standardized ornamental pieces does not cease since; if anything, shell ornaments become more abundant in the Natufian and Neolithic contexts of the broader Near East.

## Concluding remarks

The results described in this paper demonstrate that marine shell has great potential in building site chronologies and providing meaningful results for dating the Middle to Upper Paleolithic transition, as well as the earliest appearance of Upper Paleolithic personal ornaments in Europe and the Levant. One of the most important conclusions to be drawn from the re-dating of Ksar Akil and Üçağızlı is that the new chronostratigraphic framework is not substantially older than the chronologies obtained from the western Mediterranean, but appears roughly contemporaneous with them. While the Levant appears an obvious route in and out of Africa, there is little evidence for substantial human and animal migrations in the Pleistocene (Goren-Inbar and Speth 2004 and papers therein) despite the expectation that this region ought to be early in the dispersal process. The region appears to be more similar to a *cul-de-sac*, rather like southern Iberia, southern Greece or even Atlantic Europe, and not a center for the emergence of early Upper Paleolithic industries. However, vital work remains to be done to add more strength to this conclusion. Clearly, even after current efforts, the chronology for the Middle to Upper Paleolithic transition in the Levant lacks precision. There remains an urgent need to revisit and (re-)date more Levantine sequences, especially the southern ones, and determine, for example, whether very old IUP dates (~47 ka BP) from Boker Tachtit and the also old Ahmarian dates (~42 ka BP) from Kebara are robust and reproducible. Such antiquity is not supported by the results obtained here from Ksar Akil and Üçağızlı, but there is no reason to believe that either of the recently dated sites should preserve the earliest evidence for the IUP or Ahmarian traditions.

Clearly the last word has yet to be written on the shift from the Middle to Upper Paleolithic and the establishment of fully modern humans in the key Levantine region. It is hoped that the new radiocarbon determinations presented here will stimulate further research by encouraging the applications of most up-to-date scientific methods to the archaeological record of the region.

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