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ARTICLES

Archeology and the Dispersal of Modern Humans in Europe: Deconstructing the "Aurignacian"

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Few would now dispute the reality of a major dispersal of anatomically and genetically modern human populations across Europe and western Asia centered broadly within the period from ca. 45,000 to 35,000 BP in terms of conventional radiocarbon dating, or between ca. 47,000 and 41,000 BP in terms of the most recent calibration of the radiocarbon timescale.[1] This can be supported equally from the direct skeletal evidence recovered from European and Near Eastern sites and from the closely similar conclusions drawn from studies of both the mitochondrial and Y-chromosome DNA evidence in modern European populations.[2–4] How far these new anatomically and genetically modern populations may or may not have interbred with the preceding Neanderthal populations in the different regions of Europe remains a matter of lively debate.[2,5,6] But the reality of this modern human population dispersal itself is now almost universally accepted.

Since it is inconceivable that any population dispersal of this kind would not bring with it certain new behavioral and technological patterns derived ultimately from beyond Europe, there has always been a direct challenge to archeologists to identify the underlying cultural and technological "signatures" of this population dispersal within the documented archeological records of Europe and western Asia. A frequent response to this question has been to identify the modern human "colonization" phenomenon at least broadly with the geographical dispersal of so-called "Aurignacian" technologies. I myself have supported this correlation on several occasions.[7–15] However, the literature over the past two decades has revealed increasing disagreements, ambiguities, and frankly outright confusions over exactly how we employ the concept of "Aurignacian" technology, threatening to throw the whole of the archeological debate over the distribution and dispersal of modern behavioral patterns into virtual interpretative and terminological chaos. A plethora of publications over the past few years reflects this situation only too clearly.[9,11,16,17]

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The primary aim of the present paper is therefore to attempt to clarify these historical and geographical confusions over the varying concepts of "Aurignacian" technology as an essential step toward clarifying the broader picture of the archeological evidence of modern human dispersals across Europe. As we shall see, there is now fairly general agreement that in the past "Aurignacian" has been applied in far too liberal a fashion to refer to very different technological and cultural patterns, which clearly need to be more sharply separated and differentiated. In my view, the most productive and positive approach to this question is not to attempt to apply exact, hard-and-fast limits to these different terminological and conceptual entities since, in cultural and technological terms, it is *a priori* unlikely that strict technological boundaries between several of the component demographic entities could have existed, in both spatial and chronological terms. My approach is simply to identify some of the most sharply characterized and clearly defined components or "nodes" in this spectrum of technological and cultural variation and to employ these essentially as templates against which the overall range of technological and cultural variation within the different regions of Eurasia can be assessed. Since it is now clear that many of the terminological and conceptual confusions in this field stem ultimately from the historical development of research in the different regions of Eurasia, I will attempt to set the discussion primarily within an historical context. Despite all the confusions and disagreements over the past twenty years, I suspect, perhaps optimistically, that at least the central components of what follows will now be accepted by at least the majority of current specialists working within this field. In later sections I will look at the evidence for the potential origins of these technological patterns and how far they can be reliably associated with specifically anatomically "modern" as opposed to "archaic" human populations.

"CLASSIC" AURIGNACIAN

The original definition of the Aurignacian was of course a specifically French concept, based on the type-site of Aurignac in the lower Pyrenees, excavated by Louis Lartet in 1860.[18] Even if, by modern standards, the excavation procedures were less than ideal, there is general agreement that the assemblage excavated from Aurig-

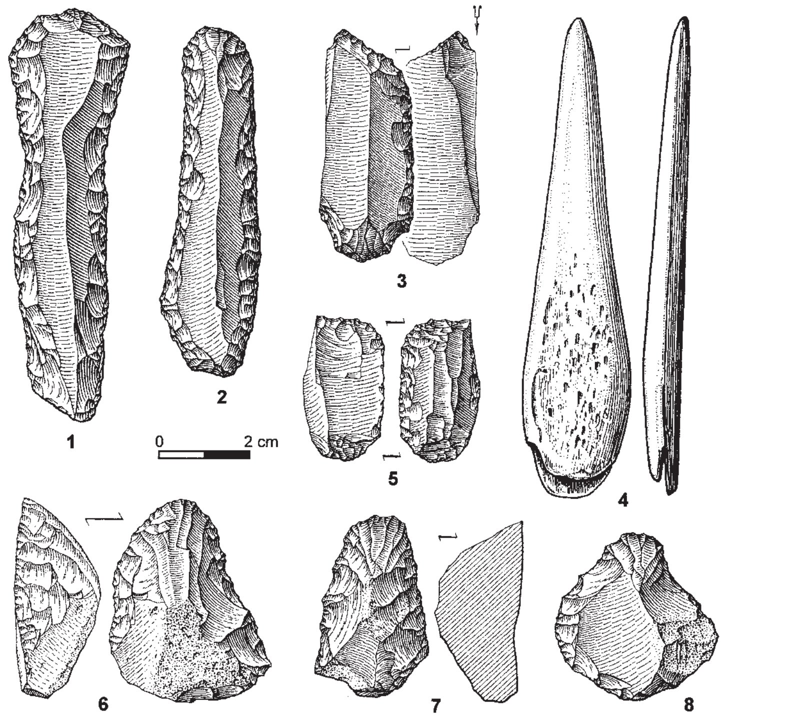

Figure 1. Characteristic tool types of the "classic" early Aurignacian ("Aurignacian I") industries in southwest France. 1, 2: Edge-retouched Aurignacian blades; 3: Combined truncation burin and end scraper; 4: Split-base antler point ("pointe d'Aurignac"); 5: Scaled piece; 6, 7: Carinate scrapers; 8: Nosed scraper.

nac conforms to what Denis Peyrony,[19] Denise de Sonneville-Bordes,[20] and others subsequently defined as "Aurignacian I" or, in some of the more recent French literature, simply as "Aurignacian ancien."[21,22] The original, classic *"fossile directeur"* of this assemblage has always been seen as the so-called split-base point, which, significantly, was generally referred to as the "pointe d'Aurignac" (Fig. 1).[21,23]

Subsequent research in France by Peyrony,[19] de Sonneville-Bordes,[20] Delporte,[24] and others has shown that the lithic assemblages associated with the split-base "pointe d'Aurignac" are for the most part both highly distinctive and, with some minor, essentially quantitative variations in the relative frequencies of end scrapers and burins, relatively homogeneous in composition: the traditional assemblages of the "Aurignacian I" type, as represented at La Ferrassie layer F, Abri Castanet, Abri Pataud levels 11–14, and many other sites in western France.[22,24,25] Apart from the split-base (mostly antler) points, the most diagnostic features of these industries are high frequencies of thick carinate or, more rarely, nosed scrapers shaped by means of distinctive fluted micro-bladelet retouch, combined with varying frequencies of extensively edge retouched "Aurignacian blades" (*lames Aurignaciennes*) often showing relatively invasive, overlapping retouch, and sometimes approaching the strangulated blade form (Fig. 1). Other forms such as scaled pieces and truncations are often common in these industries. Curiously, in view of the abundance of bone and antler working generally associated with these industries, typical burin forms are generally sparse in these assemblages and in some of the apparently earliest industries, such as those from Abri Castanet, La Ferrassie, and the Abri Pataud layer 14, are virtually lacking.[20,25]

The manufacture of typical carinated and nosed scrapers clearly involved the use of a microbladelet technology for the shaping of the distinctively fluted ends of the pieces, and bladelets produced in this process, are relatively common in at least some of these sites, as in the recent excavations at the Abri Castanet (R. White, personal communication). However, in the typical Aurignacian I industries these rarely show any retouch on either margin and rarely, if ever, fall into the distinctive "lamelle Dufour" form.[20,22] The potential functions of the carinate and nosed forms, whether intentional scrapers or conceivably small bladelet cores, are currently debated, and the question of the potential uses of the unretouched bladelets produced in manufacturing these forms has still to be resolved.[22,26] The absolute ages of these classic Aurignacian I industries have now been determined by many radiocarbon measurements to between ca. 35,000 and 33,000 (uncalibrated radiocarbon years) BP, and seem to coincide broadly with the very cold Heinrich Event 4 as reflected in the deep-sea core climatic records.[27–31] (Note that all radiocarbon dates are cited in uncalibrated terms unless indicated otherwise.)

Clearly, if we are looking for a definition of the "classic" Aurignacian, then the typical "Aurignacian I" or "Aurignacian ancien" assemblages of western France must be seen as the classic expression of this concept in both an historical and type-site taxonomic sense. When conceived and defined in these terms, there is now fairly general agreement that industries conforming fairly closely to this classic Aurignacian pattern can be recognized over large areas of western, central, and eastern Europe, and even extending into certain areas of the Near East (Fig. 2).[9,12,32,33] Of course there are certain local variations on this theme, reflected for example in the relative frequencies of nosed versus carinate scrapers, different burin types, and Aurignacian blades in the different regions. But the linking features of high frequencies of fluted carinate forms, various forms of edge-retouched blades and, above all, the esoteric split-base bone and antler points can be traced in a broad, apparently continuous arc extending across large areas of western, central, and eastern Europe and (especially in central and eastern Europe), adhering fairly closely to the areas adjacent to the Danube valley and its tributaries; such as Vogelherd, Geissenklösterle, and Hohle Fels in Germany and Wil-

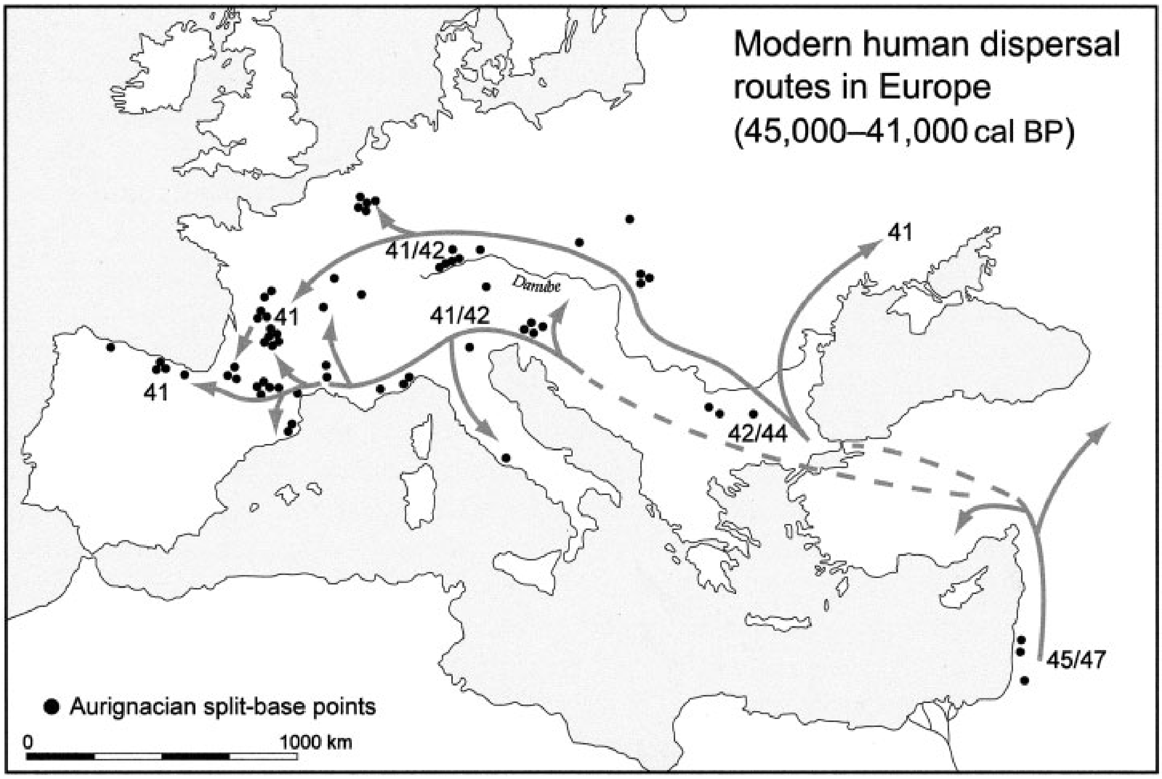

Figure 2. Map showing the inferred dispersal routes of anatomically modern populations across Europe, represented respectively by the "classic" Aurignacian industries, mainly along the Danube valley, and the Fumanian ("Proto-Aurignacian") bladelet industries along the Mediterranean coast. Patterns of dispersal across Turkey are at present uncertain due the lack of well-documented sites. The figures indicate the earliest radiocarbon dates for the industries in different regions expressed in terms of thousands of years BP, calibrated in terms of the recent "NotCal04" calibration curve[1] (Fig. 7). Note the contrast between these dates and the uncalibrated radiocarbon ages plotted in Figure 3 of an earlier article in Evolutionary Anthropology.[106] The distribution of split-base bone and antler points is also shown, although these are not necessarily associated with the adjacent age estimates.

lendorf in Austria, among others.[9,12,32]

What has not always been so clearly recognized among European scholars is the remarkably close correspondence of several industries within the Near Eastern zone of Israel, Lebanon, and parts of Syria to this essentially classic Aurignacian pattern. Early workers such as Neuville,[34] Garrod,[35] and others made this point explicitly in relation to the lithic industries from Kebara, El Wad, Yabrud, and elsewhere. The same point was made equally emphatically by François Bordes based on his own studies of the Near Eastern industries. In 1968, for example, he commented, "Certain levels in these deposits are so close to the French Aurignacian . . . that it may be questioned whether a separate name for them is desirable. Layer 10 at Ksar Akil in particular is definitely Aurignacian."[33] These comments are even more significant since they were based entirely on the character of the lithic industries from the Near Eastern sites and before the recovery of the associated bone and antler inventories recently recovered from Hayonim, Kebara, and elsewhere. More recently, fully classic specimens of split-base bone or antler points have been recorded from at least three of the Near Eastern sites: Kebara, Hayonim, and El Quseir (Fig. 4).[36,37] The best documented radiocarbon dates for these sites are those of ca. 34,000–36,000 BP for the early Aurignacian level, associated with two specimens of split-base points, in the recent excavations at the Kebara Cave.[37,38] These dates are broadly similar to those of the earliest Aurignacian I levels in the French sites. As an illustration of extraordinary continuities in technological patterns over a broad geographical area extending from northwestern Spain through to northern Israel, a distance of over 4,000 km, this distribution of the essentially classic Aurignacian lithic and bone technologies is difficult, if not impossible, to parallel during any of the later stages of the Upper Paleolithic sequence in Eurasia.

"PROTO-AURIGNACIAN" BLADELET TECHNOLOGIES

In my own view, the greatest single source of confusion in recent studies of the European Aurignacian has come from the inclusion under this term of a group of at least partially contemporaneous but technologically clearly different assemblages, which have generally been referred to under the rubrics of "Proto-Aurignacian," "Archaic Aurignacian," or sometimes "Aurignacian O."[9,22,39–42] The geographical distribution of these industries is concentrated very largely, though not exclusively, along the Mediterranean coastline of Europe, extending from northeastern Italy to northern Catalonia and then via the Pyrenees to the Atlantic coast of northern Spain. The best documented sites at present are those of Grotta Fumane in Venetia, Riparo Mochi in Liguria, Esquicho Grapaou, Tournal and other sites in southeastern France, L'Arbreda in Catalonia, Isturitz and Gatzarria in the French Pyrenees, and Cueva Morín in Cantabria.[22,39–46]

These industries do share at least one feature in common with the classic Aurignacian technologies, the use of finely controlled techniques for the removal of small bladelets from either nodules or thick flakes. But in the case of the Mediterranean industries, these bladelets are produced predominantly from distinctive single-platform prepared core forms with a characteristically sharp angle between the striking platform and the main face of the core. This is very different from the techniques used in the shaping of the carinate and nosed scraper forms in the classic Aurignacian industries.[22,39–41] The majority of these bladelets in the Mediterranean assemblages are much larger than those encountered in the classic Aurignacian and have relatively straight, as opposed to curved or twisted, profiles. The single most distinctive feature of the industries, however, is the deliberate retouching of these small- to medium-sized bladelets into a series of highly distinctive "lamelle Dufour" and "Font Yves" forms, usually shaped by means of fine, semi-abrupt retouch applied either to the ventral face of the bladelet (inverse retouch) or alternately to both the ventral and dorsal surfaces (alternate retouch) (Fig. 3).[22] Arguably the most distinctive types are the so-called Font Yves forms, in which the retouch extends to the distal tip of the bladelet to define a clear, sharp point. The functions of these retouched bladelet forms is still debated, but there seems to be an increasing consensus that they served in some way as hafted segments of multi-component hunting missiles, probably attached by resin to wooden hafts.[22] Frequencies of these retouched bladelet forms frequently rise as high as 50%–80% of the total retouched tool component in recently excavated assemblages such as those from the Grotta Fumane, Riparo Mochi, and Cueva Morín.[22,39,41,43,46]

As noted, recent excavations at the Abri Castanet, Abri Pataud, Roc de Combe, and elsewhere have confirmed that these large Dufour and Font Yves bladelet forms, together with the associated distinctive bladelet-core techniques, are not a component of the classic early Aurignacian industries of western France. They clearly represent a separate technological component of the Mediterranean industries.[22] How far certain other distinctively "Aurignacian" types, such as typical nosed and carinated scrapers or heavily edge-retouched blades, can be identified within the Mediterranean bladelet industries is perhaps more debatable, but it seems clear that in at least the majority of the bladelet industries these are both less frequent and generally much less typical than in the classic Aurignacian industries.[22,39–41] Where classic split-base bone or antler point forms have been found in the Mediterranean sites, these seem invariably to be stratified immediately above the principal levels with the bladelet industries as, for example, at Grotta Fumane, Riparo Mochi, Gatzarria, L'Arbreda, Isturitz, and, further to the north, Le Piage in the Lot.[9,22,42] A further esoteric feature of many of the bladelet assemblages is the occurrence of large numbers of carefully selected and deliberately perforated marine shells, especially gastropod forms such as *Cyclope* and *Homolapoma*, although of course this may reflect simply the relative proximity of the majority of the sites to the Mediterranean coast.[22,41,47] Even more interesting are the red-painted human and animal-like figures painted on limestone blocks recently reported from the basal levels of the Fumane site.[40]

Assessed in purely technological and typological terms, it seems, at best, highly debatable how far these Mediterranean bladelet assemblages can be linked directly with the "classic" Aurignacian industries of western France and elsewhere. For this reason, it seems to me both taxonomically unjustified and potentially seriously misleading to lump all these industries together within the broadly "Aurignacian" term. Any attempt to link these industries directly with the classic Aurignacian would imply certain assumptions about potential genetic or technological relationships between the two groups of industries which, at present, lie largely within the realm of hypothesis and speculation, as opposed to demonstrable archeological observations. If only to avoid endless debates over terminology in which hypothetical interpretative scenarios become inextricably intertwined with the terminology employed, I suggest that it would be much better to separate out the bladelet technologies under an entirely separate name, for which I have already suggested the term "Fumanian,"[48] based on what is presently the most clearly isolated, well-studied, and fully published occurrence of these industries in the Mediterranean region.[39,40,42] Future discussions of the genetic, cultural, and chronological relationships of these industries can then be pursued without any danger of inadvertently assuming many critical features of the significance of these technologies, which still remain to be clarified on the basis of the hard archeological data.

BACHO KIRIAN

This term was introduced by Janusz Kozlowski[49] in 1982 to designate the industry excavated from layer 11 of the Bacho Kiro cave in eastern Bulgaria. In his original publication, Kozlowski[49] emphasized three aspects of the industry. First, its clearly Upper Paleolithic character, marked by the clear dominance of blade over flake technology; the presence of typical end scrapers, burins, and edge-retouched blade forms; the apparent absence of distinctively Mousterian tool types; and the presence of two typical perforated animal-tooth pendants. Second, the sharp contrast between this industry and the immediately underlying Mousterian industry, emphasized by the use in the Bacho Kirian of almost entirely nonlocal flint resources introduced from sources at least 100 km from the site, as opposed to purely local sources in the Mousterian level. To him, this suggested that the Bacho Kirian was an entirely intrusive phenomenon, probably introduced by new populations deriving from further to the east. Third, the presence of several types that were strongly reminiscent of Aurignacian forms, such as thick, steeply worked end scrapers and blades with invasive, Aurignacian-like retouch. These features, combined with the very early date of >43,000 BP secured on a large charcoal sample collected from a hearth at the base of the Bacho Kirian levels, led Kozlowski to suggest the Bacho Kirian could well represent an industry directly ancestral to the ensuing Aurignacian industries in the Balkan region.[9,49,50] Although this has tempted some later workers to assimilate the Bacho Kirian industry directly into the broader, pan-European Aurignacian tradition, it should be recalled that Kozlowski himself was initially commendably cautious of this interpretation and wisely chose to allocate the industry provisionally to a taxonomically separate Bacho Kirian group.

Research since 1982 has served to modify this situation in significant ways. Tsanova and Bordes[51] have recently challenged the whole notion of a distinctively "Aurignacian" element in the Bacho Kirian technology and suggested that some of the techniques of blade production in the industry have more in common with so-called Levallois techniques of blade production, including the use of hard-hammer flaking and the presence of facetted striking platforms. Similar comments have been made by Zilhao and d'Errico[11] who, in terms of their own special concepts of the Eurasian Aurignacian, wish to exclude the Bacho Kirian from any directly ancestral role in the formation of the European Aurignacian.

Kozlowski himself has reacted to these comments in a more positive vein by integrating the data from Bacho Kiro with that from the more recently excavated site of Temnata, some 140 km to the northwest.[52] Briefly, Kozlowski has argued that the more detailed sequence of early Upper Paleolithic industries documented in the excavations at Temnata strongly suggest the emergence of the Bacho Kirian from an immediately preceding industry (from level VI of Trench TDII), which to him shows close analogies with the earliest Upper Paleolithic industries in the Near Eastern region, specifically those of the so-called Emiran group as documented at sites such as Boker Tachtit in southern Israel,[53] Üçağizli in eastern Turkey,[54] and Ksar Akil in the Lebanon,[55] as well as with some of the "Bohunician" industries from the adjacent Czech Republic.[56,57] Kozlowski has argued further that the immediately overlying levels at Temnata contain a sequence of three closely superimposed assemblages (from layer 4 of Trench TDI). These assemblages, he says, not only show strong affinities to the original Bacho Kirian industry from Bacho Kiro, but also reveal a clear and progressive increase in the occurrence of several distinctively Aurignacian-like tool forms, including especially a range of typical carinate and nosed scraper forms.[52] To him, all of this strongly supports the original hypothesis of a gradual *in-situ* evolution of essentially Aurignacian technology within the Balkan region from industries closely related to the Near Eastern Emiran and Ahmarian technologies.

In the light of all this new evidence, Kozlowski and Otte were led to propose in 2000 that the original Bacho Kirian concept could well be integrated directly into the subsequent development of the classic Aurignacian in central and eastern Europe, and on this basis proposed to describe these industries as essentially "Pre-Aurignacian" in a taxonomic and technological sense.[9] But clearly, introduction of the newly defined "Pre-Aurignacian" term conflicts with some earlier usages of this term to refer to the very early "Amudian" blade industries from Tabun and Yabrud, now known to date from at least 300,000 BP,[37,58] and adds a further element of potential confusion to usage of the all-embracing "Aurignacian" term.

THE LEVANTINE AURIGNACIAN

It is probably fair to say that whatever confusions have arisen over the use of the term "Aurignacian" in Europe fade almost into insignificance when compared with those that have plagued the use of this term to the Near Eastern industries from Israel, Syria, Lebanon, Iran, and elsewhere.[17,36,59,60] As noted earlier, the notion that many of the industries from this region bear a striking resemblance to those of the classical Aurignacian from sites in western and central Europe has been a commonplace of the Near Eastern literature since the 1930s.[33–35] The recent discoveries of classic split-base bone points at the sites of Hayonim, Kebara, and El Quseir in Israel[36,37] have only confirmed in a particularly graphic way what had long been recognized from the character of the lithic industries themselves (Fig. 4).

The subsequent confusions have arisen mainly from the varying classifications of the long sequence of preceding early Upper Paleolithic industries, especially those from the 18 meter-deep sequence recorded in the excavations by Ewing and Docherty[61] at the site of Ksar Akil on the Lebanese coast. The two basal components of this sequence, in levels 25–14, are clearly earlier than any part of the Aurignacian sequence in the Near East and have been divided into two principal stages: "Ksar Akil Phase A" or "Emiran," in levels 25–21 and the overlying "Ksar Akil Phase B," now generally referred to as "Ahmarian," in levels 20–14. Both of these assemblages are typically Upper Paleolithic in terms of the range of the associated tool forms (end scrapers and burins, together with a range of perforated seashell ornaments) but with a higher component of typical blade technology in the Ahmarian than in the preceding Emiran levels. The base of this early Upper Paleolithic sequence, directly overlying a succession of typically late Mousterian industries,[62,63] is dated by age-depth extrapolations from overlying radiocarbon measurements to around 45,000–50,000 BP.[64] These dates are broadly similar to those for the earliest Emiran industries from the open-air site of Boker Tachtit in the Negev desert of southern Israel.[53,64]

The confusions have arisen mainly over the classification and terminology of the sequence of 7 meters of rich industries recorded between these earlier Emiran/Ahmarian industries and the essentially classic Aurignacian industry from levels 6 and 7, dated directly by both conventional

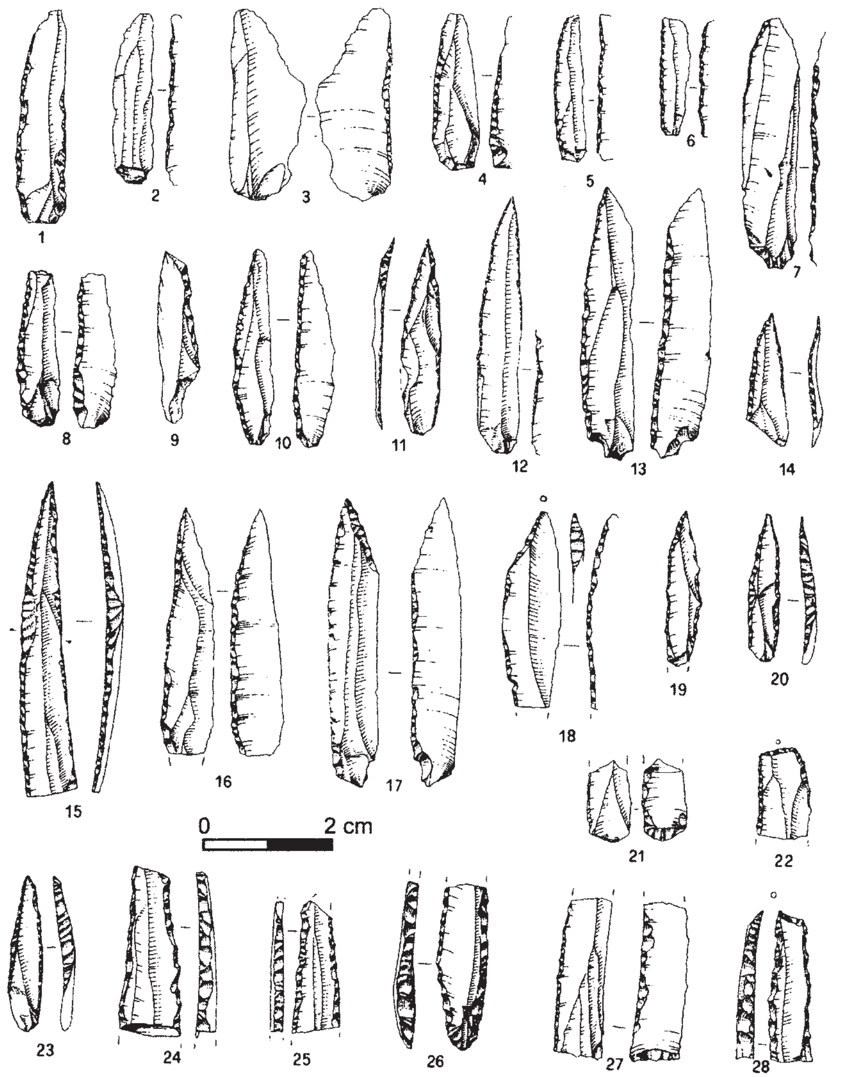

Figure 3. Finely retouched bladelets from the Fumanian ("Proto-Aurignacian") levels of the Fumane Cave, northeast Italy. Numbers 11, 12, 15, 20, 23 are "Font-Yves" points; numbers 1–8 are "Dufour" bladelets. The rest are broken or intermediate forms. Note the presence of either "inverse" or "alternate" retouch on the dorsal and ventral faces of many of the pieces. After Bartolomei and coworkers.[39]

and accelerator radiocarbon measurements to ca. 31,000–32,000 BP.[64] The initial classification of these industries, proposed at a major conference on the terminology of the Near Eastern industries in London in 1969, classified the whole of this 7-meter sequence (levels 13 to 6) as formally "Levantine Aurignacian," subdivided into the three subphases of "Levantine Aurignacian A, B, C."[59,62] As noted, the final (Stage C) levels showed the most classic Aurignacian features, although with a clear predominance of flake over blade technology. The underlying levels of the Aurignacian A and B were characterized by much higher levels of blade technology and, in most levels, especially layers 10–11, included large numbers of carefully retouched small bladelet forms comprising what, in European terms, would be described as "lamelles Dufours." These occurred together with more sharply pointed forms that, in European terminology, would be described as "Font Yves" (or "Krems") points, but which in the preexisting Near Eastern literature had generally been referred to as "El Wad points" following the excavations by Dorothy Garrod at El Wad on Mount Carmel (Fig. 5).[62,66] In all the earlier excavations by Garrod and others these small retouched bladelet forms had invariably been found immediately below the more classic Aurignacian industries, as at El Wad and Kebara, and generally seen, as at Ksar Akil, as marking the initial episode of the overall Aurignacian sequence in the Near Eastern region.[67]

A subsequent detailed analysis of the whole of the long Levantine Aurignacian sequence at Ksar Akil was undertaken by Christopher Bergman on the collections at the London Institute and published as a major monograph in 1987.[62,66,68] Basically, this endorsed the three-phase development of the industries between levels 13 and 6 of Ewing's section, emphasizing the presence of typical Aurignacian elements, especially nosed and carinate forms, together with some edge-retouched Aurignacian blades, not only in the uppermost (Stage C) part of the sequence but also in most, if not all, of the underlying levels.[62,68] However, Bergman left open the possibility that the three phases of the "Levantine Aurignacian" at Ksar Akil could reflect essentially separate occupational episodes, possibly reflecting some movement of populations into and out of the region.[68]

Studies of the question of Aurignacian technologies in the Near Eastern region over the past 20 years have led to a categorical rejection of this three-phase division of the so-called Levantine Aurignacian based on the Ksar Akil sequence. Commencing with two influential papers by Gilead[69] and Marks[70] in 1981, it has been argued that the term "Levantine Aurignacian" should be reserved exclusively for the uppermost part of the Ksar Akil sequence (the former Levantine Aurignacian C), and that all of the preceding levels should be grouped instead within the newly defined concept of the "Ahmarian" tradition. That tradition was also held to embrace most if not all of the immediately underlying assemblages that had previously been included within the broader division of "Ksar Akil B."[36,69–71] All of the recent publications have stressed that this distinction is based primarily on the character of the primary flaking strategies rather than the morphology of the retouched tools, and that the definition of the Aurignacian should

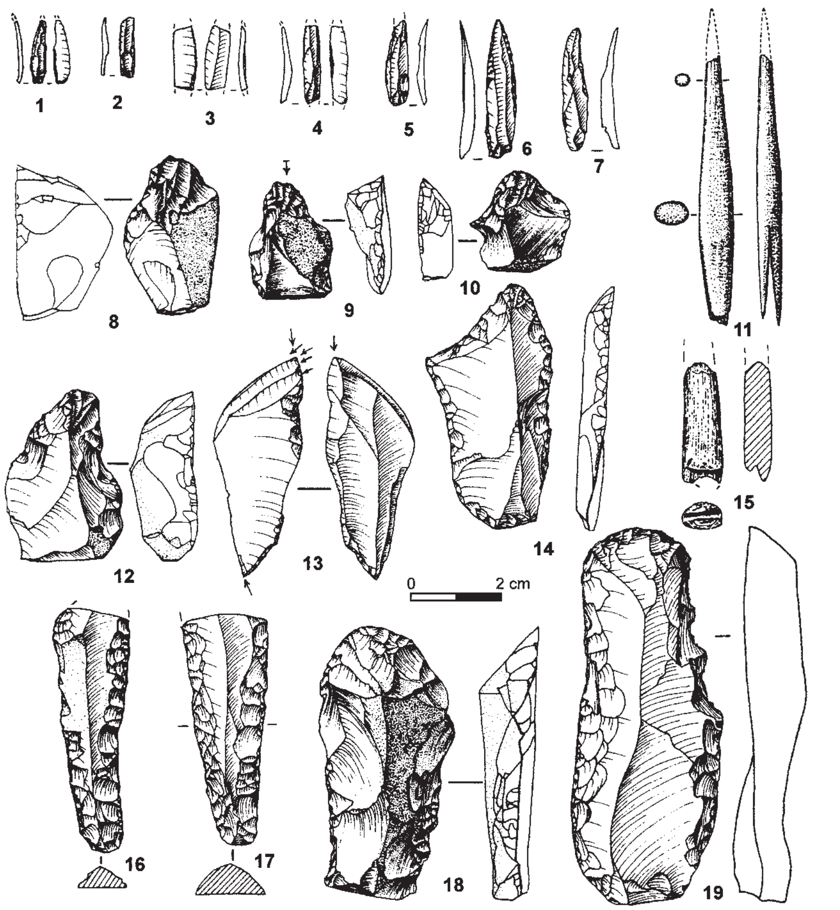

Figure 4. Typical "Levantine Aurignacian" industry from the Hayonim cave, Israel, showing a range of forms closely similar to those of the "classic" Aurignacian in western and central Europe (see Fig. 1). Numbers 11 and 15 are split-base bone points (number 15 from Kebara cave). After Bar-Yosef.[37]

be based strictly on the dominance of flake as opposed to blade-based technologies.[36,60,71] All of the preceding blade-based technologies have therefore now been assimilated into the long-lasting "Ahmarian" tradition, including the assemblages from levels 9–11 at Ksar Akil, which included large numbers of small, retouched Dufour and Font Yves ("El Wad") bladelet forms (Fig. 5). Finally, it has been claimed that the same blade-based Ahmarian tradition in some way persisted alongside the technologically intrusive Aurignacian industries within the Levantine region and may have survived as an essentially continuous, discrete technological tradition within this region until at least 20,000 BP.[17,36,37,71]

How far this new, highly restricted definition of the Levantine Aurignacian can be supported in taxonomic terms could clearly be debated, especially since it appears to put an overwhelming emphasis on the purely technological (flake versus blade) aspects of the industries as opposed to the more conventional typological criteria traditionally used to define the Aurignacian concept.[59,60] (Certainly the classic "Aurignacian I" industries within the southwestern French region are heavily blade-dominated.[20,22]) Nevertheless, the new terminology now seems to have been adopted almost as a matter of doctrine by the majority of recent workers in the Near Eastern region (see papers in Goring-Morris and Belfer-Cohen[17]). I have discussed these issues at length here since they do illustrate in a particularly graphic way some of the historical contradictions and potential confusions that have emerged in use of the concept of "Aurignacian" technology in recent studies of the Eurasian Upper Paleolithic.

THE ORIGINS OF AURIGNACIAN TECHNOLOGY

If the Aurignacian in some way represents the archeological signature of the dispersal of anatomically modern populations over at least the central and western parts of Europe, as is now fairly widely agreed,[7–15] then the question of the cultural and demographic origins of this technology becomes one of the most significant issues in current studies of modern human origins in Eurasia. There has of course been a plethora of literature on this topic over the past fifty years, which can hardly be said as yet to have arrived at anything approaching a consensus.[9,11,16,51,52] If we concentrate on what I have here defined as the classic form of the Aurignacian, however, two main models have been debated, which may in fact have more in common than has been generally recognized.

The first model, as discussed, is that the classic form of the Aurignacian took shape essentially in southeastern Europe, probably centered in the Balkans.[9,49,50,52] The two sites that are central to this viewpoint are Bacho Kiro and Temnata in northern Bulgaria, a short distance to the south of the Danube valley. As already noted, Kozlowski originally argued in 1982 that the so-called Bacho Kirian industry from level 11 at Bacho Kiro showed certain apparently Aurignacian-like features in the form of steep, fluted end scrapers and a series of blades with Aurignacian-like edge retouch.[49] Following criticisms of this diagnosis,[51] Kozlowski has recently argued strongly that in the more recent excavations at Temnata, some 140 km to the northwest of Bacho Kiro, one can apparently observe an *in-situ* evolution directly from a typical Bacho-Kirian-like assemblage to a succession of three later assemblages in levels A, B, and C of layer 4 in Trench TD I showing increasingly typical Aurignacian elements, especially carinated and nosed scraper forms.[9,52,72] According to the available dates, the time range of this succession seems to span the period from ca. 43,000 BP, for the base of layer 11 at Bacho Kiro, to ca. 37,000 BP in the later levels at Temnata, followed by an essentially classic Aurignacian with at

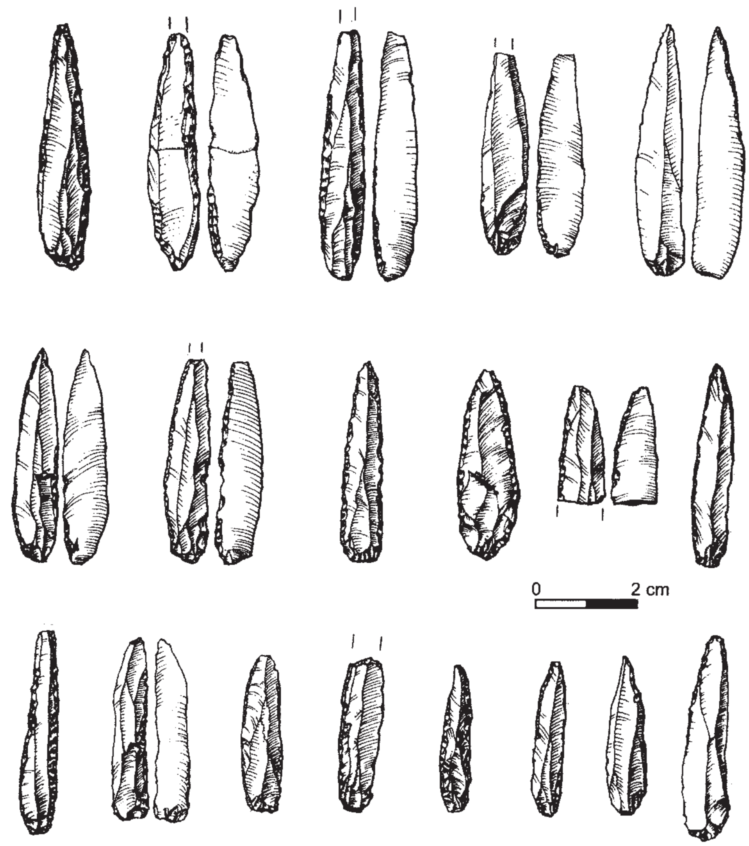

Figure 5. Retouched bladelets from levels 9–11 at Ksar Akil (Lebanon), showing a range of typical "El Wad" (i.e., "Font-Yves") points and related forms, many with inverse or alternate retouch on the dorsal and ventral faces. The pieces derive from levels immediately underlying the typical Levantine Aurignacian industries from levels 6 and 7 at Ksar Akil. After Bergman.[62]

least one split-base bone point in level 9 at Bacho Kiro.[49,50,52] Recently Kozlowski[52] has pursued this model further, suggesting that the origin of the basal Bacho Kirian levels at both Bacho Kiro and Temnata could well lie in the immediately preceding, so-called Transitional industry recovered from layer VI in Temnata Trench TDII, which he now sees as having strong similarities to the succession of Emiran and immediately succeeding Ahmarian assemblages recorded at Ksar Akil and other sites (Boker Tachtit, Erq el Ahmar, Üçağizli, and so on) in the Levant.[54] If this model is valid, then of course it would derive the whole of the gradually emerging Aurignacian technology within the Balkans ultimately from the initial Upper Paleolithic succession in the Near East, presumably associated with some form of western expansion of early anatomically modern human populations from the latter areas broadly within the time from ca. 47,000–43,000 BP.

The second model that has been debated for the origin of Aurignacian technology is located further to the east within the Near Eastern region itself, based on the long succession of early Upper Paleolithic industries recovered from the 18-meter-deep succession at Ksar Akil.[13,64,68,73] As noted, the original analysis of the Ksar Akil sequence presented at the London conference in 1969 attributed the whole of the material from levels 13–6, spanning a total depth of 7 meters, to what was designated formally as "Levantine Aurignacian" and divided into three successive phases of "Levantine Aurignacian A, B, and C."[59,62] More recent workers in this region have tended to apply a much more restricted definition of the Levantine Aurignacian notion, which would confine this entity entirely to the final ("Levantine Aurignacian C") episode of the Ksar Akil sequence, based essentially on the slightly esoteric premise that the Levantine Aurignacian should be defined as strictly a flake-based, as opposed to blade-based, technology.[17,37,59,60] Viewed in these terms, they see the Levantine Aurignacian as a strictly intrusive phenomenon within the Near Eastern region, probably originating, as Kozlowski argued, within the Balkans and perhaps driven back into the Levantine area by the onset of very cold conditions around 36,000 BP.[36,37]

In this context, however, it should be recalled that several other workers have argued for much greater technological continuities within the Ksar Akil sequence itself, as of course the original three-phase definition of the Levantine Aurignacian at the London conference had originally implied. In his detailed analysis of the Ksar Akil sequence, Bergman[62] repeatedly emphasized the presence of typical nosed and carinated scraper forms in all of levels 13 to 6, and commented that "another significant feature is the presence of several assemblages (levels 13-9) which are blade and bladelet based with varying percentages of Aurignacian tools. This facies is known at a few other sites in the Northern Levant and may suggest that the Levantine Aurignacian initially developed out of the local blade-based cultures"[67] (p. 136). The same point had been made earlier by Copeland.[59] In 1988, Marks and Ferring[73] echoed this observation: "With respect to an early Ahmarian-Levantine Aurignacian developmental sequence, the best evidence again comes from Ksar Akil, where in levels 13 through 9 there is a marked trend towards increasing Aurignacian elements within a basically Ahmarian technology"[73] (p. 68). The possibility of a gradual emergence of distinctively Aurignacian technology within the early Upper Paleolithic sequence at Ksar Akil and other sites in the Levantine region was therefore raised repeatedly in the earlier literature, despite its apparent rejection by many of the later workers in this region.

Interestingly, all of these observations on the early Upper Paleolithic sequence at Ksar Akil and other Near Eastern sites could in fact be seen to harmonize fairly closely with the recent arguments advanced by Kozlowski[52] concerning the apparent evolution of Aurignacian technology within the Balkan region. If, as Kozlowski argues, the initial phase of the Upper Paleolithic sequence in the Balkans, as represented by the so-called Transitional industry recovered from Temnata TDII layer VI, does in fact derive from the dispersal of basically Emiran populations from the Near Eastern region, then one could potentially see the overall pattern of technological development within both the Balkans and the northern Levantine areas as following a broadly similar pattern. How far this would imply continuing demographic or social exchanges between the two regions is an interesting point for speculation, which is currently hampered by the virtual lack of well-documented and fully published early Upper Paleolithic sites from the intervening region of Turkey, with the notable exception of Karain in southwest Turkey.[9] But, in any event, the evidence from both the Bulgarian and the Near Eastern sites could be seen in several important respects as reinforcing each other in suggesting an original source area for the ensuing classic Aurignacian technologies located broadly within this wider southeast European and Near Eastern zone. As Kozlowski[52] has pointed out, the recent suggestion by Zilhão and d'Errico[11] (p. 344–345) that the formation of the classic European Aurignacian could represent an almost "instantaneous" event at ca. 36,500 BP, with the sudden emergence of a range of distinctive new stone tool forms, the appearance of idiosyncratic split-base points and other bone types, and the explosion of personal ornaments, is perhaps not the most economical hypothesis from the evidence at present to hand.

ORIGINS OF THE BLADELET TECHNOLOGIES

One final aspect of the early Upper Paleolithic succession in the Near Eastern region has a potentially equally important bearing on the overall patterns of dispersal of early modern populations across Europe. This relates to the origins of what I have discussed in the preceding sections under the heading of "Mediterranean Proto-Aurignacian technologies," or what I now prefer to designate as Fumanian industries.[48] As discussed, these are distributed mainly along the Mediterranean coastline of Europe, extending from at least northeastern Italy, via Mediterranean France and the Pyrenees, to the Atlantic coast of northwestern Spain. They are characterized by high frequencies of small, lightly retouched bladelet forms of the so-called "lamelle Dufour" and "Font Yves" types (Fig. 3). As noted, these generally show relatively few if any classic Aurignacian forms such as nosed and carinated scrapers and heavily edge-retouched Aurignacian blades. They are clearly distinct from the classic, early Aurignacian technologies distributed mainly in the areas further to the north and west, though in fact the two technologies do overlap to some extent in both southern France and Austria, where the bladelet industries sometimes underlie industries with split-base bone or antler points. The origin of these Fumanian bladelet technologies has never been clearly identified. The industries clearly appear as an abrupt break with the immediately preceding Mousterian industries along the Mediterranean coast as, for example, at the Grotta Fumane and Riparo Mochi in northern Italy and Cueva Morin in Northern Spain. They are generally assumed to represent a dispersal of new populations across this region from further to the east.[7,9,15,39,42] The question, then, is where, in these more eastern regions, might one look for an origin of these highly distinctive bladelet technologies?

The most probable answer, in my view, lies once again within the Near Eastern region.[14,15,48] Two observations in particular are central to this suggestion. First, as noted, it is now clear that many of the industries that directly underlie the classic flake-based Levantine Aurignacian technologies within the Near Eastern region do, in fact, include high frequencies of these small retouched bladelet forms. These fall into the same two broad categories of large "Dufour" forms, often shaped by means of inverse retouch on the ventral as opposed to the dorsal faces, and more sharply pointed "Font Yves" or "El Wad" forms. These bladelet types are particularly frequent in the so-called "Levantine Aurignacian B" assemblages from levels 9–11 at Ksar Akil[62,66] and occur in a similar stratigraphic position at several other Israeli sites such as Kebara and El Wad.[35,38,67] Equally, if not more relevant in this context, is the industry excavated by Marks from the open-air site of Boker A in the Negev desert of southern Israel.[74,75] This assemblage is massively dominated by these retouched bladelet forms, of both the larger Dufour and pointed Font Yves or El Wad types, which are similarly shaped in many cases by retouch on the ventral as opposed to dorsal faces (Fig. 6). At Boker A and elsewhere, these bladelets were produced from specialized cores apparently similar to those documented in the European Mediterranean bladelet assemblages, and are again associated with end scrapers, burins, and other characteristically Upper Paleolithic forms that could rarely, if ever, be described as classic Aurignacian forms.[74,75] Finally, there are strong indications that the Near Eastern bladelet technologies are either of the same age as or slightly earlier than the similar bladelet industries on the Mediterranean coast. From Boker A there is a radiocarbon date of 37,920 ± 2810 BP, which was said by the laboratory most probably to indicate a true radiocarbon age of ca. 39,000 BP.[76] The analogous bladelet industries from levels 9–11 in the Ksar Akil sequence must date from a broadly similar age, estimated on the basis of extrapolated age estimates from radiocarbon measurements of the overlying levels at between 35,000 and 38,000 BP.[64] Still further to the east, broadly similar industries appear to be represented at the so-called Baradostian sites such as Warwasi, Yafteh, and Shanidar in Iran and Iraq, which Olszewski and Dibble[77] have described as representing a "Zagros Aurignacian," and which again appear to date within the range of ca. 36,000–40,000 BP.[77–79] By comparison, the most reliable radiocarbon dates for the analogous bladelet industries along the Mediterranean coast and in

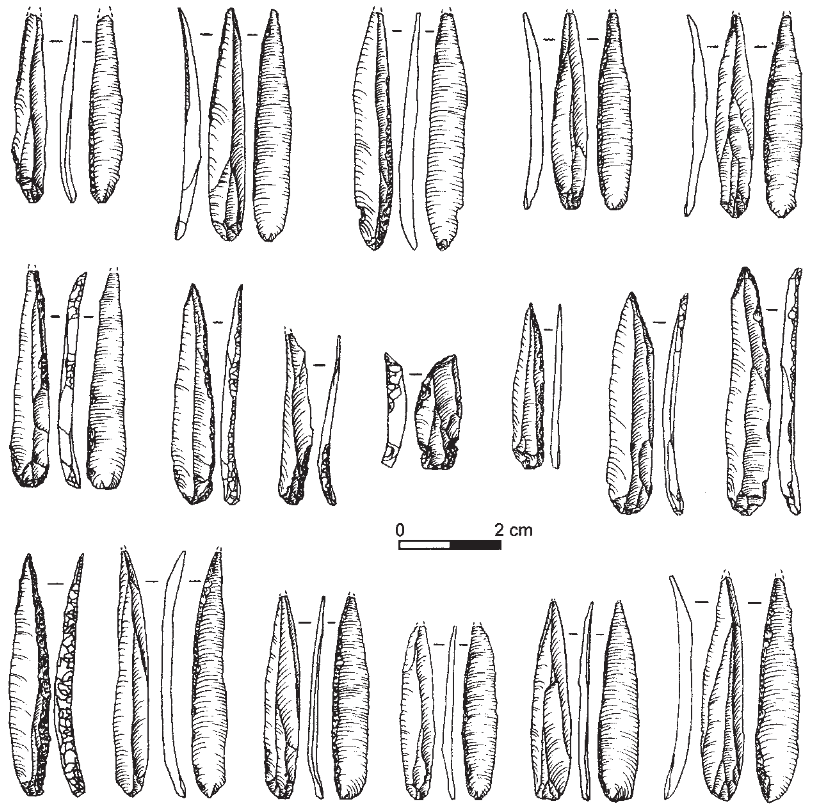

Figure 6. Retouched bladelets from the site of Boker A in the Negev desert (southern Israel) showing a range of inversely retouched "El Wad points" and related forms, closely similar to those from levels 9–11 at Ksar Akil (Fig. 5) and Mediterranean Fumanian sites (Fig. 3). The site is radiocarbon dated to ca. 38,000–39,000 BP. After Marks.[53]

northern Spain seem to lie within the range from ca. 38,000 to 36,000 BP as, for example, at Fumane, El Paina, Isturitz, Árbreda, and Cueva Morin.[22,28,39,40,45] I suggest, therefore, that these Near Eastern bladelet technologies could well represent the immediate source of the highly distinctive Fumanian/Proto-Aurignacian industries along the Mediterranean coastline of Europe, reflecting the dispersal of new populations across this region, which was largely, if not entirely, separate from that reflected by the dispersal of the "classic" Aurignacian technologies via the Danube valley, and subsequently into the northern and western zones of Europe (Fig. 2).[9,12,15,48] The lack of these industries from the intervening zone of southern Turkey represents an obvious gap in this geographical distribution, but one which can hardly be taken too seriously in view of our virtual ignorance of early Upper Paleolithic technologies in most parts of Turkey.[9]

One interesting implication of this scenario is that the appearance of so-called Aurignacian-like technologies within the classic southwestern French region was probably a two-phase phenomenon, reflected by the presence of both the "classic" early Aurignacian technologies at sites such as Abri Castanet, Abri Blanchard, La Ferrassie, and Abri Pataud, and the presence in at least one site, Le Piage layer K, in the Lot region, of typically Mediterranean-style "Fumanian" bladelet technologies. The industry from layer K at Le Piage, currently under excavation by J.-G. Bordes, seems to be in most, if not all respects, closely similar to those on the Mediterranean coast.[22,80] By contrast, the classic "Aurignacian I" industries show much closer analogies to industries from southern Germany and northern Austria, as at Das Geissenklösterle, Vogelherd, and Willendorf II layer 3, with many radiocarbon dates significantly earlier than those in the French sites. These dates extend back to ca. 37,000–39,000 BP at das Geissenklösterle, Keilberg-Kirche, and Willendorf, as compared to at most 35,000–36,000 BP in western France.[12,22,28,81] As further support for this model one might also note the occurrence of many worked ivory artifacts in some of the French sites, including the ivory basket-shaped beads from Abri Castanet and elsewhere, the flattened ivory perforated plaque from layer 11 at the Abri Pataud[25] and, above all, the idiosyncratic, curved ivory "bandeaux" forms from the Abri Castanet, La Ferrassie, and elsewhere,[83] all strongly reminiscent of some of the perforated ivory artifacts from Vogelherd and Geissenklösterle in southern Germany.[12,25,32,82,83]

The recent excavations at Geissenklösterle and elsewhere have shown that the large-scale working of mammoth ivory was a major feature of these German early Aurignacian sites.[12,82] Equally, if not more significant, is the fact that the French Aurignacian I industries seem to appear in this region at precisely the time when we know that climatic conditions were becoming much colder, associated at least broadly with the period of Heinrich Event 4 in the deep-sea core climatic records.[27,31] A movement from central Europe directly toward the west and south at this time seems to be largely predictable in climatic and ecological terms, if only to avoid the onset of extremely severe winters in the more continental regions of central Europe.[84,85] According to this model, the apparent northward movement of the Mediterranean bladelet industries into southwestern France would likely have occurred shortly before this time, as strongly suggested by the presence of the typical bladelet industry from Le Piage (layer K) immediately underlying the typically Aurignacian I industries from levels G–J at this site.[22,80] The new excavations currently in progress at Le Piage, as well as those at Isturitz in the western Pyrenees,[46] will, it is hoped, shed further light on this question.

THE AURIGNACIAN AND THE DISPERSAL OF ANATOMICALLY MODERN HUMANS

What relevance, if any, does the "Aurignacian" have for the dispersal of anatomically and behaviorally modern populations across Europe? The answer, in my view, may well be fairly straightforward. The most critical single discovery is that of the so-called Egbert skeleton from Ksar Akil excavated by Ewing, clearly embedded in brechiated deposits within level 17 of his stratigraphy.[61,62] According to the detailed analysis by Bergman and Stringer,[86] this is unquestionably a fully modern human in both cranial and postcranial terms. The skeleton was in the form of a burial (apparently associated with parts of a second skeleton), associated with what would now be termed a typical Ahmarian industry in level 17[37] and overlain by the full sequence of at least 7 meters of succeeding "Levantine Aurignacian" industries in levels 13–6. In radiocarbon terms the skeleton must date from at least 40,000 BP, and conceivably from as early as 45,000 BP.[64] This find alone is sufficient to demonstrate that fully anatomically modern populations were present in the Near Eastern region well before the appearance of the long ensuing sequence of Aurignacian-like technologies within this region.

Although finds of human skeletal remains in direct association with Aurignacian technologies are notoriously scarce in all parts of Europe, the available finds are entirely consistent with the conclusion that these industries were similarly associated with characteristically modern populations.[15,87,88] The best dated association between Aurignacian industries and human remains are those of at least five individuals from the Mladeč cave in the Czech Republic, recently dated by direct radiocarbon measurements on the skeletal remains themselves to at least 31,000–32,000 BP,[89] and perhaps closer to 34,000–35,000 BP on the basis of dating of closely associated stalagmite formations.[90] Further to the west there is a typically modern, if very robust human jaw from the basal Aurignacian level at Les Rois in the Charente,[91] which, on the basis of dating of similar industries in other southwest French sites, must similarly date in the region of 32,000–34,000 BP[15] and a recently reported find from La Quina (Charente) dated to ca. 32,000 BP.[6] Bailey and Hublin[88] have recently shown that the series of human teeth recovered from the early Aurignacian levels at Brassempouy in the Pyrenees are unmistakably anatomically modern on the basis of their distinctive cusp patterns, with associated ^{14}C measurements of around 33,000–34,000 BP.[92] Churchill and Smith (p. 61, 102)[87] have argued that the fragmentary human jaw recovered from the much earlier Bacho Kirian levels (ca. 40,000–43,000 BP) at Bacho Kiro are most probably anatomically modern rather than Neanderthal in form. Finally, we have the recent find of at least three robust but typically anatomically modern individuals from the Peştera cu Oase cave in Romania, dated directly on the bones to ca. 35,000–36,000 BP.[93] Although not associated directly with archeological material, these finds are entirely within the chronological and geographical range of the earlier Aurignacian in southeastern Europe.

Unfortunately, we have at present no human remains associated directly with the Proto-Aurignacian/Fumanian bladelet industries from the Mediterranean coastal zone except for a single, apparently modern human tooth from Riparo Bombrini in northwest Italy[94] and the enigmatic "pseudomorph" human burial excavated in association with the typically bladelet-dominated industry at Cueva Morín on the Cantabrian coast.[43] If this is indeed the burial of an anatomically modern individual, as the large size of the body, estimated at ca. 185–195 cm, suggests,[43] then we also can presumably associate these technologies with anatomically modern populations. This could be supported further by the arguments outlined earlier for the apparent origins of these bladelet technologies within the earlier part of the long "Levantine Aurignacian" succession at Ksar Akil and elsewhere, directly overlying the anatomically modern Egbert skeleton from the immediately preceding Ahmarian levels.[86] As I have discussed elsewhere,[15] all of these observations tend to support the model of two separate routes of dispersal of anatomically modern populations across Europe, one primarily along the Danube valley associated with the spread of the "classic" Aurignacian and the other along the Mediterranean coast represented by the bladelet-dominated Fumanian industries,[7,9,37] both deriving from the hypothetically ancestral Emiran and Ahmarian populations within the east Mediterranean Levantine region (Fig. 2). Whether the origins of these populations should be traced even further to the east, conceivably into the Zagros region or even Central Asia, as Otte and Kozlowski[78] have suggested, is at present one of the central questions in current studies of modern human origins in Eurasia.[95]

DISPERSAL PATTERNS OF MODERN HUMANS IN EUROPE

From the various patterns discussed, we can now perhaps begin to reconstruct a more sophisticated model for the overall pattern of dispersal of anatomically and behaviorally modern populations across Europe. If we focus on what we might call the northern or Danubian route, we can perhaps envisage an essentially two-phase dispersal process, commencing in the Near East with the development of the Emiran and immediately ensuing Ahmarian technologies, which, on the basis of the dates for Boker Tachtit and Ksar Akil, had clearly emerged in this region by at least 45,000–47,000 BP and could well extend back to around 50,000 BP.[37,72,74] We know from the Egbert skeleton from Ksar Akil that at least the later stages of this sequence, from ca. 43,000 BP, were associated with typically anatomically modern populations.[86] According to the evidence advanced by Kozlowski,[52] Bar-Yosef,[37] Tostevin,[96] Svoboda,[56] and others, these populations seem to have expanded via Turkey to southeastern Europe by around 43,000 BP, as represented by the Bacho Kirian levels at Bacho Kiro, the similar levels at Temnata, and the closely related Bohunician technologies from the Czech Republic.[52,57] Within southeastern Europe and perhaps also in the adjacent areas of the Levant, as reflected in the Ksar Akil sequence, it seems that these technologies developed more explicitly "classic" Aurignacian features in the form of typical carinated and nosed scrapers and edge-retouched Aurignacian-like blades.[52]

A second stage in the dispersal process seems to have taken these more

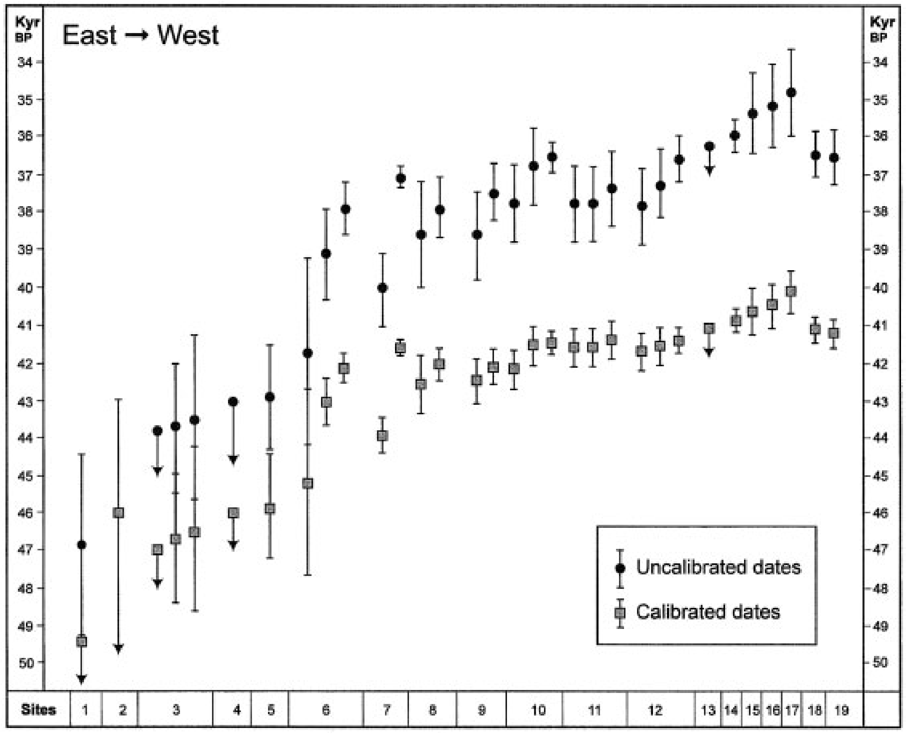

Figure 7. Radiocarbon dates for early Aurignacian, "Proto-Aurignacian" (Fumanian), and apparently ancestral Bacho Kirian, Ahmarian, and Emiran technologies across Europe and the Near East. The sites are arranged from east to west. The dates are plotted in terms of the original uncalibrated radiocarbon measurements (upper: circular symbols) and the calibrated versions of the dates (lower: square symbols), based on the recent "NotCal04" calibration curve.[1] Note that only the oldest dates from each region are plotted, on the assumption that these are likely to be least affected by contamination by more recent carbon.[1] Owing to the shape of the calibration curve, the standard deviations (1 s.d.) on the calibrated dates are smaller than those on the uncalibrated dates. The sites plotted are as follows: 1: Boker Tachtit (Israel); 2: Ksar Akil (Lebanon); 3: Kebara (Israel); 4: Bacho Kiro (Bulgaria); 5: Bohunice (Czech Republic); 6: Willendorf II (Austria); 7: Grotta Fumane (Italy); 8: El Paina (Italy); 9: Keilberg-Kirche (Germany); 10: Geissenklöstlerle (Germany); 11: l'Arbreda (Spain); 12: Abric Romaní (Spain); 13: Châtelperron (France); 14: La Rochette (France); 15: Abri Caminade (France); 16: Abri Castanet (France); 17: Roc de Combe (France); 18: Isturitz (France); 19: Cueva Morín (Spain). For sources of dates, see references.[11,12,22,28,37–40,42,45,46,84,97] The date range shown for Ksar Akil is based on age/depth extrapolation from overlying radiocarbon measurements.[64] The dates from El Castillo (Spain) with currently disputed archeological and skeletal associations[11] have been omitted.

"classic" Aurignacian technologies westward along the Danube valley into central Europe, where they are best represented at sites such as Willendorf in lower Austria and das Geissenklösterle and Keilberg Kirche in southwest Germany, with radiocarbon dates centering on ca. 37,000–39,000 BP.[12,81,97] The final dispersal of the classic Aurignacian technologies into western France is currently dated to around 35,000–37,000 BP, as at the sites of Châtelperron, Abri Castanet, La Ferrassie, and La Rochette[28,84] (Fig. 2).

Two further aspects of this demographic and technological dispersal scenario are of particular interest here. In the first place there are strong reasons for thinking that the dispersal northward and westward of the early Aurignacian populations was closely associated with two major eposides of climatic warming, referred to as interstadials GIS 11 and GIS 10 in the Greenland ice cores, dated to between ca. 36,000 and 38,000 BP, and probably associated with the Hengelo interstadial in the Netherlands.[1,27–30,98] These were clearly major events in climatic terms, marked by a temperature rise of at least 5°–8°C, and leading to a replacement of essentially open tundra or steppe-like vegetation in western Europe by at least partially wooded conditions.[85,98,99] For populations originating in the warmer and more forested regions of southeastern Europe, this would inevitably have made a process of demographic dispersal toward the north and west much easier to achieve, perhaps amounting to little more than what I have referred to in earlier papers as "surfing the ecological tide."[14,27] Climatic modeling studies by Barron and coworkers[99] suggest that both summer and winter temperature isotherms during this period probably shifted by around 1,000 km from east to west, closely paralleling the dispersal of the earliest Aurignacian populations from central Europe to western France. In other words, a major population dispersal westward at this time would be not merely plausible, but arguably largely predictable in ecological and demographic terms. The earlier warm episode of GIS 12 may have facilitated the earlier expansion from the Near East to southeast Europe between ca. 43,000 and 45,000 BP.[30]

The second, even more significant pattern that has emerged from recent research is that when we translate the available raw radiocarbon dates into calibrated, calendrical terms, this pushes the absolute age of the main Aurignacian dispersal across Europe back by several thousand years (Fig.

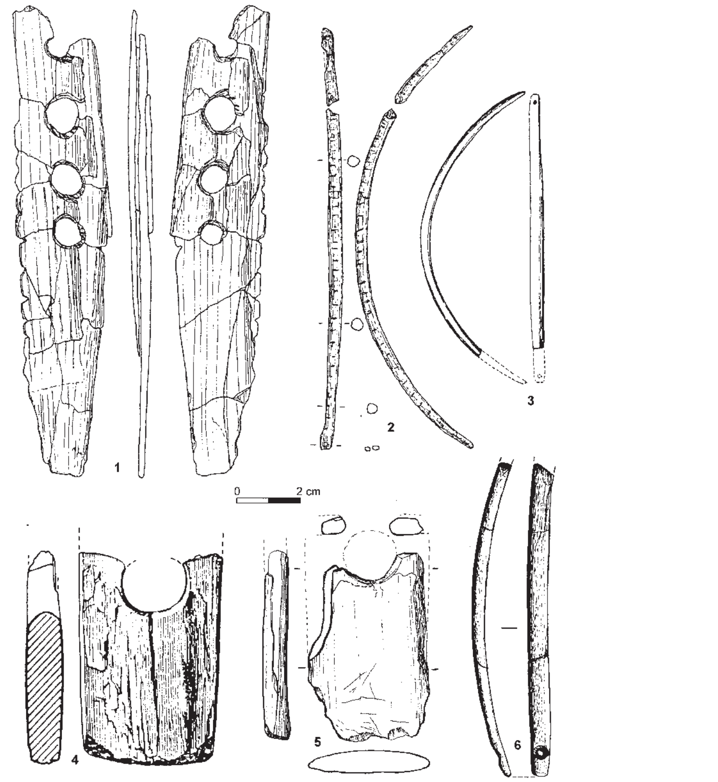

Figure 8. Early Aurignacian mammoth ivory artefacts from sites in southern Germany (1, 2, 5) and southwestern France (3, 4, 6). Nos 1, 2 das Geissenklösterle layer III; 3 Abri Castanet; 4 Abri Pataud layer 11; 5 Wildscheuer layer III; 6 Abri Blanchard.[32,82,83]

7).[1] Until recently, the exact pattern of divergence of radiocarbon dates from true calendar years within the 30,000–40,000 year range remained highly controversial, with the suggestion of potentially massive and erratic oscillations in the ^{14}C content of the atmosphere, which could have caused equally erratic fluctuations and even major reversals in radiocarbon age measurements by up to 8,000 years.[100,101] Happily, two new and tightly constrained calibration curves over this time range have been published during the past 18 months, based on the radiocarbon dating of a long sequence of deep-sea sediments from the Cariaco basin near Venezuela[102] and a series of directly paired ^{14}C and high-resolution uranium/thorium measurements on fossil coral samples from Barbados and elsewhere.[103] These indicate that the erratic oscillations in the radiocarbon time scale suggested by some earlier calibration curves, such as those from Lake Suigetsu in Japan, and the dating of some cave stalagmite formations in the Bahamas, were largely if not entirely spurious.[100,101] They also show that the rapid increase in the ^{14}C content of the atmosphere over the 30,000–40,000-year period means that the relative precision and resolution of radiocarbon dating over this time range is actually significantly better that in other, adjacent parts of the age scale. A measured difference of 2,000 years in radiocarbon measurements over this time range translates into an actual difference of only around 1,500 years in absolute calendrical terms.[1]

If we apply this new calibration curve to the available dates for the earliest dated occurrences of Aurignacian and related technologies across Europe, this produces the pattern shown in Figure 7. Owing to the shape of the calibration curve, we can now see that the dispersal of Aurignacian technologies across central and western Europe, from the Balkans to western France, occupies an actual period of only around 5,000 years, from ca. 46,000 to 41,000 cal. BP, as compared to a period of over 7,000 years (ca. 43,000 to 36,000 BP) in terms of the original, uncalibrated radiocarbon dates. Evidently, the dispersal of anatomically modern populations across eastern, central, and western Europe was a more rapid process than previously envisaged (Fig. 2). None of this is surprising, since hunter-gatherers are inherently mobile in their habits, and the demographic dispersal from east to west would have been greatly facilitated by the major climatic ameliorations around this time. From the available dates it seems that the broadly synchronous dispersal of the bladelet-dominated (Fumanian/Proto-Aurignacian) technologies along the Mediterranean coastal zone was equally rapid, reaching northeastern Italy by ca. 38,000 BP and northwestern Spain by at least 36,500 BP in uncalibrated radiocarbon terms[22,39,40,45] or ca. 42,000 BP and 41,000 BP, respectively, in calibrated calendar years (Figs. 2, 7). These two routes of dispersal are closely similar to those of the earliest Neolithic communities across Europe, between ca. 10,000 and 6,000 (calibrated) BP.[104]

When seen in these terms, the striking uniformities in many aspects of the "classic" Aurignacian technologies extending from the Atlantic coast of western Europe to at least the northern parts of the Near East become easier to understand. Even so, it would clearly be unrealistic to expect to find identical technological patterns across this region. If we assume that any process of population dispersal would inevitably be a progressive, multi-stage phenomenon, then we would expect to observe not only the effects of technological and cultural change over time during the dispersal process, but also a process of progressive adaptation to the changing environments across central and western Europe. This would be combined with the cumulative effects of repeated cultural and technological founder effects as relatively small population units progressively expanded from east to west.[95,105] These effects would subsequently become amplified as the individual population units gradually settled into the different geographical provinces across Europe and developed their own particular trajectories of cultural and technological development[10,12]—what

I have referred to elsewhere as cultural "intensification."[106] To find that the early Aurignacian populations of southern Germany developed significantly different styles of figurative and abstract art and varying patterns of personal ornaments from those found in western France should hardly come as any surprise.[12,32,106,107]

EXCHANGE

It is interesting to ask how far we can detect any patterns of cultural or technological exchange between the earliest dispersing populations of modern humans across the different regions of Europe. Much of the essential research in this area still remains to be done, although there are already some indications of apparently significant patterns. Within the southwestern French region, for example, we can already document what appear to be some very clearly defined patterns of exchange of perforated bead forms manufactured from steatite and other soft stones between the Perigord region and sites on the northern flanks of the Pyrenees, as at Isturitz and Brassempouy some 300 km to the south.[22,46,108] High-quality Bergerac flint from the Dordogne region was transported in the opposite direction, from the Perigord to the French Pyrenees.[22] Equally, if not more striking, is the presence in many of the earliest southwest French sites of various species of perforated marine shells, which must have originated from the Mediterranean coast of southeastern France.[47] Since identical forms of perforated shell beads occur abundantly in the typical Fumanian bladelet assemblages along the French and Italian Mediterranean coasts[22,41,47] it is tempting to suggest that these could reflect direct social and economic exchanges between these two populations. Similar long-distance distribution or exchange of Mediterranean shells is recorded from the site of Krems in Austria, some 400 km to the northeast of the Mediterranean coast.[32] Clearly, more research into these questions is urgently needed. But it is already clear that when some of the longstanding historical confusions over the various concepts of "Aurignacian" technology have been cleared away, a fairly robust pattern of early modern human dispersal across Europe is now beginning to emerge.

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