

HUMAN ADAPTATIONS TO THE REFORESTATION OF THE SOUTH COAST OF THE BAY OF BISCAY: 13,000-9000 RADIOCARBON YEARS AGO

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Abstract

The period from Bölling through Preboreal saw the oceanic Vasco-Cantabrian region of northern Spain and extreme southwestern France pass from the rigorously cold conditions of Oldest Dryas with mainly open vegetation to more temperate conditions with increasingly wooded landscapes culminating in the dense, mixed deciduous, climax forests of the Atlantic period. As glaciers retreated and ultimately disappeared from the Picos de Europa, Cantabrian Cordillera and western Pyrenees, the sea level rose, eventually creating the estuaries and bays that would become so important to human survival during the Mesolithic in this region. Considering that this period only covered some four millennia, the environmental changes were dramatic and relatively abrupt. In contrast to general similarities in the vegetation records of Gascony, the Basque Country and Cantabria-Asturias, there are significant differences in archeofaunas across the Pleistocene-Holocene transition between the two sides of the western Pyrenees: reindeer-domination followed by red deer colonization in the north versus continuity of red deer domination in the south, always with ibex in steep, rocky habitats and an increase through time in woodland-specialized species in both areas, as bison was extirpated and horse at least became much rarer. Against this backdrop, humans struggled to survive, as attested by the transformation of the Upper Magdalenian into the Azilian, with simplification of a continuing technological tradition but an apparently radical break in the symbol system that had supported the long-standing ideology of Tardiglacial hunting societies. The final rupture of the Magdalenian world came - not coincidentally - at the end of the Preboreal as the forests closed in on what now would become Mesolithic foragers, mainly concentrated along the Boreal shore.

Introduction

One of the most densely populated regions of Europe during the Würm Upper Pleniglacial and Tardiglacial (isotope stage 2) was the south coast of the Bay of Biscay, specifically the narrow strip stretching from central Asturias in the west to the Basque Country (Euskalherria) in the east, a distance of about 400 km along the 43rd parallel. Bounded to the south by the Picos de Europa, Cantabrian Cordillera and western Pyrenees, this distinctive natural region is separated from the mesetas of Old Castile and from the Mediterranean environments of the Ebro River basin by the cordilleran crestline whose passes often exceed 1000 m above present sea level. It is separated from the vast Aquitaine plain of southwestern France by the Adour River and its major tributaries, the western Pyrenean "Gaves". Because of its rugged, montane relief and its long, moderately indented coast, the Vasco-Cantabrian region was favored in prehistoric times by a great variety of terrestrial and aquatic animals inhabiting closely spaced habitats. During the Last Glacial Maximum (i.e., in Solutrean times) human subsistence was intensified through both a broadening of the spectrum of exploited resources and the development of highly specialized means for hunting a few key medium/large-size ungulate species (e.g. Straus 1992a). In the steep, rocky hill and mountain habitats of the entire region, ibex and chamois were hunted from specialized sites.

In the valleys and narrow and discontinuous coastal plain of northern Spain, red deer were killed in drives and sur-

rounds, while in southern Gascony, reindeer were slaughtered. Apparently ecological vicars, these two cervids were almost geographically mutually exclusive, with a Pleniglacial and Tardiglacial boundary corresponding to the Pyrenean border between Spain and France. Only during periods of "population boom" in southern France (particularly in Dryas I-II) did reindeer invade red deer "territory" in significant numbers - at 16 Magdalenian sites all the way west to central Asturias, but especially in the Spanish Basque Country (Altuna 1996). (Similarly, except for 6 foot bones that could even have been humanly transported attached to a hide and left at Abautz in Navarra [Altuna & Mariezkurrena 1996a], the saiga antelope - a fairly frequent early Magdalenian game species in southwestern France - "stopped" at the Pyrenees. In addition, there was either a minor incursion of reindeer or human transport of reindeer antler as raw material across the eastern Pyrenees into northern Catalonia in Magdalenian times [Canal & Carbonell 1989:346]). In contrast, only with warming conditions, particularly in Alleröd, could red deer begin to make inroads in reindeer territory north of the Basque Pyrenees.

While the archeological record in Cantabrian Spain, with its narrow, steep continental shelf, documents extensive use of marine molluscs, anadromous and ocean fish, beginning around 20 kya (see Straus 1992a, with references), the surviving sites in the extreme southwestern corner of France testify to heavy subsistence dependence on bison, horses, saiga antelopes and especially reindeer (see Delpech 1983, 1989). However, the broader, shallower

nature of the continental shelf off the present coast of the Aquitaine means that any evidence of possible coastal resource exploitation there would have been lost as a result of postglacial transgression. Nonetheless, numerous late Magdalenian sites along the northern flanks of the Pyrenees have yielded abundant evidence of salmon fishing.

What happened to the finely tuned adaptive systems of late Last Glacial Vasco-Cantabria and Gascony with the severe, rapidly fluctuating climatic and vegetational changes of the end of the Pleistocene is the subject of much recent paleoenvironmental, paleontological and prehistoric research. The purpose of this note is to examine the records of environmental change and of human response by way of resource exploitation at a number of recently published sites, where interdisciplinary studies have provided radiocarbon control, pollen analyses and detailed zoo-archeological data, as well as modern studies of archeological materials. The time frame is the period conventionally attributed to Bölling, Dryas II, Alleröd, Dryas III and Preboreal (13-9 kya, uncalibrated) - a time of rapid deglaciation in the region's mountain chains. (Use of the classic pollen zone designations originally developed in northwestern Europe is of course fraught with problems of resolution and time lags, but it nonetheless continues to be the standard in southwestern Europe, despite significant recent challenges such as Sanchez Goñi's [e.g., 1994] dismissal of Dryas II in at least the Cantabrian region.) This study is meant to complement a number of recent syntheses of the Tardiglacial and early Postglacial prehistory of the region (e.g., Fernández-Tresguerres 1980; González Sainz 1989; Clottes 1989; Straus 1992a) and to add environmental and resource details to a series of studies of synchronic adaptational differences between Cantabria and Gascony and of diachronic adaptive changes between the Tardiglacial and early Postglacial (e.g., Aura *et al.* 1996; Straus 1983, 1986, 1991a,b, 1985, 1992b, 1995a, 1996). The aim is to refine the controlled comparison of adaptive systems across space and time at the critical boundaries between southern and mid-latitude western Europe and between glacial and interglacial conditions.

Such an approach is made possible by the existence of monographic or other substantial publications of a series of archeological sites with full analyses and with levels pertaining to part or most of this critical time, in a west to east transect along the south coast of the Bay of Biscay (a.k.a. Cantabrian Sea or Gulf of Gascony). These are Los Azules Cave (Fernández-Tresguerres 1980) and La Riera Cave (Straus & Clark 1986) in Asturias, El Juyo Cave (Barandiarán *et al.* 1987) and Rascaño Cave (González Echegaray and Barandiarán 1981) in Cantabria (ex-Province of Santander), Ekain Cave (Altuna & Merino 1984) and Erralla Cave (Altuna *et al.* 1985) in Guipúzcoa, Abautz Cave (Utrilla 1982) and Zatoya Cave (Barandiarán & Cava 1989) in Navarra, Abri Duruthy (Arambourou 1978) and Abri Dufaure (Straus 1995b) in Les Landes on the edge of the French Basque Country. Ancillary information from partially published sites (e.g., Berroberria in Navarra, Urtega in Guipúzcoa and Arenaza in Vizcaya) is also of use in compiling a detailed record of

changing environments across the Pleistocene-Holocene transition (see Sanchez Goñi 1994), but other sites lacking significant pollen sequences, faunal data or radiocarbon dates are not included here.

Aspects of Environmental Change

Table 1 presents summary data on pollen and faunal percentages from radiocarbon-dated sites. (At La Riera, as has been much debated, it is possible, on the basis of conflicting dates, to choose either an "old" or a "young" chronology. The 10,340 BP date from Level 23 is probably too young however, as recently confirmed by a corrected 12,800 date on marine shell from lumped levels 21/23 obtained by Craighead [1999] and as originally discussed by Straus & Clark [1986]). These data document the reforestation of the region in the period from Bölling through Preboreal. It should be noted that even during the Upper Pleniglacial, limited stands of trees may have survived in sheltered, well-exposed and watered locations in Cantabrian and Pyrenean valleys, although the arboreal pollen spectra are composed mainly of pines, that, because of notorious pollen over-production and long-distance transport, may not in reality have been either abundant or strictly local trees. The modest climatic ameliorations prior to and within Dryas I (i.e., Lascaux, Angles and Prebölling), strenuously contested by Sanchez Goñi (e.g., 1990, 1994), may be manifested by the appearance of trace quantities of pollen from thermophile arboreal taxa that might be indications of the refugium character of these southerly mountains (e.g., Boyer-Klein 1984; Leroi-Gourhan 1986, 1994). During the Tardiglacial and early Postglacial, a general increase in hazel (*Corylus*) pollen is typical in diagrams throughout this region. Along with pine, it is a major constituent of the AP (arboreal pollen) percentages given in Table 1. Because of pine's unusual over-representativeness in pollen spectra and possible non-local nature, an "AP minus pine %" has been calculated. The percentage of oak (*Quercus*) pollen has also been given, as an indicator of rising temperatures (while recognizing that a variety of different species may be represented). Oak is often accompanied by limited quantities of other thermophile deciduous arboreal taxa in these sites (e.g., *Alnus*, *Betula*, *Tilia*, *Salix*, *Ulmus*, *Buxus*, *Juglans*) that generally increase through time into the Postglacial. (Note that most of the pollen percentages in Table 1 are approximate estimates scaled from published diagrams).

In addition to the sites listed in Table 1, the following pieces of relevant but partial information can be gleaned from the literature. At Berroberria Cave (110 m a.s.l., 18 km from the present shore), the relevant levels are E (late Middle Magdalenian, dated to 13,270±220 BP), D inferior (Final Magdalenian, dated to 11,900±130, 11,750±300 and 11,600±220 BP), and D superior (Azilian, dated to 10,160±410 BP). During this time, the AP swung from c. 30% to c. 20% to 70% in D inferior (presumably Alleröd), back down to c. 8% and finally c. 25% in D superior (presumably Dryas III and transition to Preboreal). Almost all of the arboreal pollen are of pine, however, with only traces of oak and hazel throughout (Boyer-Klein

1984; Sanchez Goñi 1994). At Urtiaga Cave (130 m a.s.l., 1.5 km from the present shore), the relevant levels from the old stratigraphic section of J.M. de Barandiarán, which has been recently refreshed by J.A. Múgica, are E & D inferior (Final Magdalenian), D superior & C (Azilian). The old radiocarbon dates are problematic and may be too young (see below). The pollen diagram shows a very dramatic change from virtually non-existent AP percentages in Level E and D inferior to a steadily rising AP (up to at least 25%) in Level C, which is when oak and hazel appear in the spectrum (Sanchez Goñi 1990, 1994). At Arenaza Cave (c. 200 m a.s.l., 10 km from the present shore) the relevant levels are VI (undated Magdalenian), V-VI (undated Azilian), III (Azilian, 10,300±180 BP), and II (Epipaleolithic: base without geometric microliths, 9600±180 BP; top with geometric microliths, undated) (Arias & Altuna 1999). The pollen analysis shows an AP of c. 20% in Level VI. This plunges to c. 10% and below (down to almost 0% in a couple of samples) in the Azilian levels. There are traces of hazel, oak, walnut and alder however in the Magdalenian and early Azilian levels. The AP rebounds in Epipaleolithic Level II (up to c. 40%), with a large proportion of oak, plus a spike of boxwood (Isturiz & Sanchez Goñi 1990).

Among the Cantabrian sites, one fact that stands out is great variability in terms of arboreal pollen, probably reflecting both microhabitat variation and variable exposure to winds transporting allochthonous pollen grains. In general, however, arboreal pollen are still relatively scarce until Preboreal times, but even then pine is often dominant - especially at Abauntz and Zatoya, sites actually located to the south of the Cordillera, in the upper Ebro drainage of northern Navarra. The two French sites, Duruthy and Dufaure, are small, adjacent rockshelters with large talus deposits along the base of the south-facing Pastou cliff. The cliff borders the Gave d'Oloron river at the southern edge of the vast Aquitaine Basin on the edge of the Basque hill country. In this very different environment (far more open, less coastal and with more gentle relief), arboreal pollen are generally more abundant, particularly in Alleröd times, perhaps reflecting local gallery woodlands between the cliff and the river. Nonetheless, these two Gascon sequences show the same trends as the Cantabrian sites, with a significant increase in thermophile taxa (including *Quercus*) in late Alleröd and Preboreal.

Controversy exists concerning the "visibility" or even "existence" of Dryas II in the Bay of Biscay region. But there is no doubt that Alleröd was separated from Preboreal by a short but marked climatic downturn in Dryas III (e.g., Sanchez Goñi 1994; Turner & Hannon 1988; Watts 1986; Duplessy *et al.* 1981; Laville *et al.* 1983), although pollen diagrams from archeological sites that clearly show it are still relatively few in this region. One of the exceptions is Berroberría, which is (barely) on the Navarra side of the borders with the coastal French Basque province of Labourd and the Spanish Basque province of Guipúzcoa, and actually in the valley of the Nivelle River which drains across the international boundary toward the Atlantic. At this site the AP % - composed almost entirely of pine - falls to around 6% in an Azilian

level dated to 10,160±410 BP (Boyer-Klein 1984; González Sainz 1989). AP declines are also seen in the pollen spectra from the lower parts of Azilian levels 3 and 2 at Dufaure (Marguerie & Paquereau 1995) and Duruthy (Paquereau 1978), respectively, as well as in Azilian level 28 at La Riera (Leroi-Gourhan 1986 - although this is not how she interprets it chronologically).

It appears that, from refugia in the Iberian Peninsula and in protected Pyrenean valleys, deciduous trees spread in limited quantities into favorable habitats during the climatic moderation of Bölling-Alleröd. They were then severely stressed during Dryas III, but strongly rebounded in Preboreal, with the appearance of the first real woodlands, at least at lower altitudes. The extent of forestation in Bölling-Alleröd may have been highly variable from area to area, ranging from open prairies dotted with thickets to open woodlands dotted with clearings. The contrast with very rigorous Pleniglacial conditions was nevertheless quite marked, even if dense, mixed oak-deciduous forests were not to cover the region until well into the Holocene *sensu stricto*.

Ungulates and Environments

Table 1 also lists the relative frequencies (based on numbers of identified specimens) of roe deer (*Capreolus*), boar (*Boar*) and reindeer (*Rangifer*) among the ungulate faunas of the same radiocarbon-dated sites. It is assumed that these are animals that were killed by Upper and Epipaleolithic hunters, and thus may not exactly mirror natural frequencies in the environment. (As yet there are few dated natural taphoceneses in the region that would allow us to control for "background" faunal compositions [but see Clot & Evin 1986; Altuna 1984]). Indeed, the existence of highly specialized strategies and tactics for mass hunting of red deer, reindeer and ibex in this region may mean that boar and roe deer are somewhat under-represented in these percentages. Reindeer, of course, is a classic cold climate species, but one which can to a great extent determine its specific habitat at any season by means of extensive long-distance and/or altitudinal migrations (see discussion in Spiess 1979, with references). It seems to have been restricted substantially from occupying Last Glacial Cantabrian Spain by the massive presence of another similar cervid, red deer, also a species with a high degree of dietary and habitat flexibility (see Straus 1981, with references). Red deer is by no means restricted to temperate woodland habitats, although it is not an arctic species. Its "invasion" of the territory of France in late Tardiglacial and early Postglacial times was partly a result of the abandonment by or extirpation of reindeer. Boar and roe deer, on the other hand, are true dwellers of temperate deciduous woodlands (e.g., Corbet 1966). Their presence in archeological deposits is a good indicator of the local existence of at least substantial thickets.

At La Riera the percentages of boar and especially roe deer remains track the rise in arboreal pollen percentages rather well. Rascaño is a specialized mountain ibex-hunting site, so the absence of roe and scarcity of boar there may not only be due to the scarcity of trees.

Similarly, Abauntz, at a high altitude, was a specialized chamois-hunting site, exposed essentially to pine pollen deposition. The early appearance of *Sus* at El Juyo is not surprising, given the site's low elevation on the relatively broad coastal plain around the city of Santander, full of sheltered microhabitats such as dolinas, southern ridge slopes, stream valleys, etc. But boar is quite rare in the sites of Guipúzcoa - the high percentage in Ekain Level II being an artifact of a very small ungulate sample size (29 identifiable remains). This may be due to the extreme steepness of the terrain around Ekain and Erralla. At Duruthy and Dufauere, boar and roe deer also clearly increase in concert with the growth of local woodlands and warming climates.

In mountainous regions such as Cantabrian Spain, the percentages of caprines would seem to have little value as environmental indicators, since these regions would have had common and good habitats for rock-adapted ibex and chamois under any climatic conditions, although snow and mountain glaciers would have forced even the now high-dwelling ibex to lower elevations. In their natural state, chamois would easily have inhabited lowland woods, as well as slopes.

One of the interesting anomalies of a region with extreme mosaic habitats such as Vasco-Cantabria, is the late Tardiglacial (Upper Magdalenian) co-existence of both arctic and temperate species. At La Riera, Ekain and Erralla small numbers of positively identified reindeer remains have been found in the same archeological levels as remains of roe deer (and sometimes boar). This is also the case at the equally modern excavation of Tito Bustillo (Asturias) in slightly older (Dryas I *sensu lato*) deposits (Altuna 1976), as well as in earlier excavations at the Navarrese site of Zatoya, the Vizcayan sites of Lumentxa and Santimamiñe (Castaños cited by Altuna & Mariezkurrena 1996b) and the Guipuzcoan sites of Lezetxiki, Aitzbitarte, Ermitia and especially Urtiaga (Altuna 1972). At the latter site, near Ekain and Erralla and in contrast to most other Vasco-Cantabrian sites where reindeer is present in only trace quantities, 226 remains of roe and 24 of boar are associated with 46 of reindeer and 1002 of red deer in Upper Magdalenian Level D, whose top has been originally dated to 10,280±190 BP (Altuna 1972), although there are now two new dates of c. 11,500 BP from unspecified depths within Level D (Sanchez Goñi 1994). The base of this Urtiaga level is said to have few arboreal pollen, while the top of D and overlying C show a marked increase in AP (9-31%), including *Quercus* (Sanchez Goñi 1990, 1994; see above). The fact that Level D was 1 m thick, however, obviously poses a problem, since the deposit could represent a significant amount of time (as suggested by the radiocarbon dates). Reindeer is absent from Azilian Level C (dated problematically to 8700±170 BP), when cold, drier conditions had been replaced by more temperate, humid ones. The seemingly discordant co-occurrence of reindeer, roe deer and even boar suggest how complex the refugium habitats of Vasco-Cantabrian Spain were in the Tardiglacial.

Another interesting observation concerns the process of replacement of reindeer by red deer in extreme

southwestern France. This could be detailed by analyzing the faunal composition of Stratum 4 (30-70 cm thick) at Dufauere in four stratigraphic subdivisions (Altuna & Mariezkurrena 1995). This deposit (composed of man-made cobblestone pavements) is - like its larger homologue (Couche 3) at adjacent Duruthy - well dated by radiocarbon, sedimentology and palynology to Alleröd. By the time of formation of these levels, humans with Upper Magdalenian technology had become specialized in the slaughter of reindeer (probably at river crossings near the strategic Pastou cliff) and were heavily exploiting a remnant Pyrenean herd already cut off from the broader reindeer population that was in the process of abandoning much of the territory of what is today France (see Delpech 1983, 1989). In Dufauere, the early part of Stratum 4 has an overwhelming predominance (70%) of reindeer remains among its ungulate assemblage, but with the passage of time, as climate warmed and open areas shrank through the course of Alleröd, red deer began their incursion into the area of the Adour basin in southern Aquitaine. Beginning at 15% in lower Stratum 4 (and only 7.7% in underlying Stratum 5 - late Dryas I), the percentage of red deer rises to 20% and finally to 37.2% at the top of Stratum 4, where it nearly equals reindeer (42.6%) in terms of numbers of remains (and, being a somewhat larger cervid, possibly actually exceeding it in terms of meat weight). The trend continues in the Azilian level (Stratum 3 - whose base was formed in Dryas III and top in Preboreal): red deer makes up over 80% of the ungulate remains. But, surprisingly, as in the pencontemporaneous level at Duruthy (Couche 3), there were still a few reindeer left in the vicinity of the Pastou cliff to be killed in Azilian times. These survivors - reminiscent of the woodland caribou of southern Canada in terms of their habitat - may have been behaving more like the much less gregarious, more sedentary roe deer than like their highly mobile, herd-dwelling, open-country ancestors. This remnant of the Pyrenean herd finally went extinct *in situ* - perhaps "helped" to its demise by human hunters in Preboreal.

The rise of red deer at the expense of reindeer at the Pastou sites is correlated with an increase in boar and roe deer. While the latter two ungulates clearly increased because of increased temperature and forestation, the substitution of reindeer by red deer may at least in great part have been linked to the changing dynamics of inter-specific competition between these two medium-large size cervids. While both were capable of living in either woodlands or open country (and both do in the modern world), reindeer held an advantage (and held the territory) in southern France as long as - by their vast numbers - they could largely exclude red deer (and vice versa for red deer in Cantabrian Spain). Nevertheless, a combination of rising temperatures and intensive human predation seem to have terminally weakened the reindeer's hold in southern Aquitaine by late Alleröd times.

Conclusions : The Cultural Response

Against the backdrop and probably because of the fluctuating, staged, but ultimately final reforestation of the south

coast of the Bay of Biscay and the attendant shifts in fauna, especially in southern Aquitaine, the lithic and osseous technologies of "the Magdalenian" changed into those of "the Azilian"--a sort of simplified "Epi-Magdalenian". Gone now was the "raison d'être" for the integrated cybernetic, educational and ideological systems specifically related to making a living under often brutal glacial conditions in open environments. Thus, one sees a rapid change in "artistic" creation in the terminal Magdalenian (with the last AMS-dated cave paintings in Cantabria being between 12-11 kya at various sites in Monte Castillo [Moure & González Sainz 2000], roughly contemporary with or slightly older than the last classic Magdalenian portable art objects [González Sainz 1988]) to the simply painted and engraved cobbles and geometrically marked bones of the Azilian - and the end of representational cave wall decoration.

The striking fact about the cultural transition between the Magdalenian and Azilian in the two sectors of the greater Biscayan region - Gascony and Vasco-Cantabria - is that in the former, it co-occurred with a major shift in principal game species (from reindeer to red deer), while in the latter, there was no such radical shift in prey. To be sure, horses and bison respectively decreased or were extirpated in northern Spain, but the main ungulate food resources - red deer and ibex - survived and remained plentiful. Even if - as networked participants in a wider western European cultural world of shared ideology - Magdalenian Cantabrians had "bought into" the symbolic importance of horse and bison - the dominant species represented in cave art there as in France, despite their apparently very secondary role in local subsistence - their iconography rather suddenly became completely anachronistic and untenable in the newly wooded landscapes of Alleröd. It seems to me that the main change in the natural world that may be seen as "explaining" the Magdalenian-Azilian cultural change was reforestation. It was probably the new conditions of hunting smaller groups of tame (or solitary animals) in fairly dense forests that necessitated not only changes in hunting weaponry, strategy and tactics, but also in activity and social organization, band size and education/training rooted in collectively held ideologies. The same red deer hunted on open grasslands and heaths in glacial-age Cantabria, would be hunted very differently in the forests of the same region or of Gascony in postglacial times. Stalking and decoying of individual animals may have tended to replace drives and surrounds of deer bands or herds. Bow and arrow may have tended to replace spear, javelin and atl-atl. Ironically there may have been more similarities between the ways in which Cantabrian and Gascon "Magdalenians" respectively hunted red deer and reindeer, than between the ways in which "Magdalenians" and "Azilians" hunted either reindeer or red deer in the two parts of the region. Thus, while reforestation may not have been strictly the sole cause for the replacement of reindeer by red deer in Gascony, it may have been the ultimate cause for the strong technological convergence between the "Azilian" phenomenon there and in Vasco-Cantabria. Naturally, in this case at least, such technological convergence was abetted by geograph-

ical contiguity and an undoubtedly dense network of social contacts among human groups along the whole region (if for no other reason than to find mates in the linear, physically confined, montane, coastal situation of Vasco-Cantabria and in the situation of the western Pyrenees area which was relatively isolated from northern Aquitaine by the dunefields and marshes of Les Landes). Given some basic anatomical, size and behavioral similarities between the chief game animals, it was perhaps not species per se that was the important variable governing technological and social change, but the conditions in which those game lived and under which humans had to procure them, that led to the development of the "Azilian" system from the widespread "Magdalenian" base. Of course, in retrospect, it was to be a "stop-gap" effort, as the even denser deciduous forests of Boreal times, beginning c. 9000 BP clearly brought a replacement of the Azilian (i.e., many Epimagdalenian aspects of its technology, art, subsistence and settlement pattern) by such Mesolithic cultural manifestations as the Asturian and other unnamed coastal midden site clusters, as well as the Basque geometric microlith complex.

These speculative remarks, following on some solid documentation of the course of reforestation and faunal change at the close of the Last Glacial in the south coastal regions of the Bay of Biscay, will require further investigation. They are offered to help develop a theoretical perspective on the empirical reality of the cultural changes that archeologists have summarized when describing the advent of "the Azilian". Appearing at different times (sometimes as early as Alleröd, sometimes as late as Preboreal (e.g., Straus 1985), "the Azilian" does not represent a change of "people". Nor does it simply involve a change in "mental templates". It does seem to suggest a "retooling" of old ways (technological, social, ideological) to deal with a fast-developing environmental situation. This conservative readjustment may not have been enough, for soon one sees a much more profound change in many regions of Europe - the development of simple macrolithic or true geometric microlithic, "Mesolithic" technologies, sometimes (but not along the southern Bay of Biscay) found at large, (semi-) sedentary settlements with structures and cemeteries. This represented more of a "revolution" in some respects than did the "Azilian", which was in reality an attempt to continue "Magdalenian" ways - albeit in generally smaller bands with simpler lithic and bone artifacts, and with reduced variety, visibility and complexity of "artistic" creations. *Sic transit gloria mundi!*

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script for his journal, *Préhistoire Européenne*.

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Abbreviations: CIMAM: Centro de Investigación y Museo de Altamira, Monografías (Santander & Madrid); SPFM: Société Préhistorique Française, Mémoires (Paris); TPN: Trabajos de Prehistoria Navarra (Pamplona); ARP: Anthropological Research Papers (Tempe); ERAUL: Etudes et Recherches Archéologiques de l'Université de Liège (Liège); BAR: British Archaeological Reports.

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Table 1 : Tardiglacial radiocarbon dates, arboreal pollen and ungulate bone percentages from Vasco-Cantabrian and Gascon sites.

Site, Level, Altitude		%							
Distance from Sea		Date BP	1SD	AP	Pinus	Quercus	Sus	Capreolus	Rangifer
La Riera: 30m, 2km									
23	UM	10,340	560	7	4	0	0.2*	0.5*	0.2*
		12,620	300						
		12,800	110						
24	UM	10,890	430	5-15	4-8	0-2	0	2.8	0.6
		11,480	75						
25	UM						0	12.0	0
26	UM	11,450	85	45	38	0	0.3	7.2	0
27 lower	AZ	10,990	70	22	18	0	1.9	5.3	0
		12,270	400						
27 mid	AZ			18	13	3			
27 upper	AZ	10,630	120	10	10	0	2.0	4.8	0
28	AZ	8,830	90	13	12	1	2.4	14.6	0
29 lower	AS	8,650	300						
29 total	AS			53	51	4	0	6.0	0
29 upper	AS	6,500	200						
Los Azules: 125m, 14km									
3 e/d	AZ	10,400	90						
3d upper	AZ	9,540	120	44	27	1			
3b	AZ			37-65	15-30	0-5			
3a	AZ	9,430	120	31-42	24-41	0-3			
3 total	AZ						Abundant	Rare	0
Rascaño: 275m, 19km									
2.3	UM	12,896	137	7	5	0			
2 total	UM						0.3	0	0
2.1	UM	12,282	164						
1.3	AZ	10,486	90	11	11	0			
1 total	AZ						0.6	0	0
1.2	AZ	10,558	244	18	16	2			
El Juyo: 55m, 5km									
4	MM	13,920	240	4-14	2-7	0-1	0.1	2.7	0
Ekain: 90m, 7km									
VI b	UM	12,050	190	7	2	0	0	0.7	0
VI a	UM			7-20	1-4	0	0	1.2	4.7
V	AZ			4	3	0	0	1.1	0
IV	AZ	9,460	185	3-13	1-5	0-2	0	7.9	0
III	AZ			10-13	9-10	0	1.1	1.1	0
II	AZ	9,540	210	17	14	1	34.5	0	0
Erralla: 230m, 10km									
III base	UM	12,310	190	29-31	2-7	0-1			
III mid	UM			20-31	7	1-2			
III upper	UM			14-26	6-9	0-1			
III-I total	UM						0	1.1	1.5
II	UM			21-35	4-7	0-2			
I	UM?			32	19	2			
Zatoya: 900m, 70km									
II lower	UM	11,840	240	8-25	2-10	0-1	4.6	0	0.2
II mid	AZ	11,480	270	27-42	13-30	0			
II upper	AZ	11,620	360				17.8	4.0	0
Abauntz: 700m, 42km									
D	AZ	9,530	300	58-96	4-9	0-2	0	0	0

Duruthy: 30m, 36km									
4 lower	MM	13,840	210	10-23	3-11	0			
4 total	MM						0	0	25.1
4 upper	MM	13,510	220	26-40	9-18	0-3			
3'	UM			17-26	7-16	0-1	0	0	23.9
3 lower	UM	11,300	1130TL	33-46	23-39	0-3			
3 total	UM						0.01	0.03	71.7
2	AZ			23-50	7-40	0-3	3.2	3.2	24.2
Dufaure: 35m, 36km									
5 upper	MM	12,990	270	17-40	2-18	0-1	0.2	0.6	46.7
		12,690	230						
4 lower	UM	12,260	400	28	17	1	0	0	70.1
4 mid-low	UM	12,030	280	30	20	2	0.1	0.6	65.2
4 mid-up	UM	11,750	300	30	23	2	0.4	1.5	64.2
4 upper	UM	10,910	220	40	30	3	0.5	2.8	42.6
3 lower	AZ	10,310	270	28-40	17-30	2-3	1.4	6.3	3.5
3 upper	AZ	9,810	100						
		9,750	110	50	42	7	1.1	11.0	2.5
		9,600	290						

*: La Riera Levels 21-23 combined

MM: Middle Magdalenian; UM: Upper Magdalenian; AZ: Azilian; AS: Asturian

Sources:

La Riera: Straus & Clark 1986; Leroi-Gourhan 1986; Altuna 1986

Los Azules: Fernández-Tresguerres 1980; López 1981

El Rascaño: González Echegaray & Barandiarán 1981; Boyer-Klein 1981; Altuna 1981

El Juyo: Barandiarán et al. 1987; Boyer-Klein & Leroi-Gourhan 1987; Klein & Cruz-Urbe 1987

Ekain: Altuna & Merino 1984; Dupré 1984; Altuna & Mariezkurrena 1984

Erralla: Altuna et al. 1985; Boyer-Klein 1985; Altuna & Mariezkurrena 1985

Zatoya: Barandiarán & Cava 1989; Boyer-Klein 1989; Mariezkurrena & Altuna 1989

Abauntz: Utrilla 1982; López 1982; Altuna & Mariezkurrena 1982

Duruthy: Arambourou 1978; Paquereau 1978; Delpech 1978

Dufaure: Straus 1995b; Marguerie & Paquereau 1995; Altuna & Mariezkurrena 1995