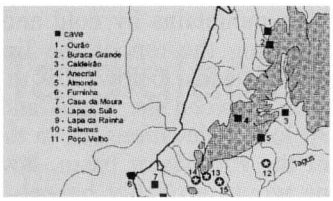

The Paleolithic settlement of Portuguese Estremadura after the last glacial maximum

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ABSTRACT

Available paleoenvironmental indicators suggest an early development of the temperate forest in the limestone hills and plateaus beginning no later than ca. 16.000 BP. As a result, faunal resources underwent significant changes: alpine species and horse disappeared from the assemblages recovered at cave sites, which are almost entirely made up of red deer and rabbits. Material culture was also significantly transformed: Magdalenian lithic tool-kits became miniaturized, and were manufactured in the framework of lithic production systems characterized by a more exhaustive exploitation of flint cores. As a result, the structural composition of lithic assemblages became more homogeneous, and the functional differentiation of sites became less apparent. The extent to which these changes may have been related to possible changes in settlement-subsistence strategies is currently unknown.

El món mediterrani després del Pleniglacial (18.000-12.000 BP),
(J.M. Fullola & N. Soler, eds.),
Sèrie Monogràfica, 17,
Museu d'Arqueologia de Catalunya - Girona,
Girona, 1997, pp. 233-242.

CLIMATE AND ENVIRONMENT

Dias (1985) and Rodrigues et al. (1991) have studied the late Quaternary evolution of the northern part of the Portuguese continental platform. According to them, during the last glacial maximum, the coast line would have been located somewhere between 130 and 140 m below modern sea level. During the first part of the deglaciation of the North Atlantic Ocean, between 16.000 and 13.000 BP, the 100 m isobath would have been attained. After that, between 13.000 and 11.000 BP, sea level would have risen rapidly to -40 m. The transgression continued until ca. 5.000 BP, when present day levels were attained, although the Dryas III event (11.000-10.000 BP) is associated with a lowering of the sea level from -40 m to -60 m.

Based on the evidence from Charco da Candeeira (located at an elevation of about 1.400 m), lacustrine deposits at Serra da Estrela, where a mountain glaciation developed during the last glacial maximum (Daveau, 1971), began to accumulate before 12.000 BP (Van der Knaap & Van Leeuwen, 1991). It is likely, therefore, that the chronology of the deglaciation in the Portuguese mountains was similar to that in northwestern Spain, where, according to Turner and Hannon (1988), melting of the glaciers would have been completed, or nearly completed, between 16.000 and 14.500 BP.

In the littoral fringe, the environmental conditions of the Bølling/Allerød interstadial (13.000-11.000 BP) seem to be fully interglacial, sea surface temperatures off the Portuguese coast being practically identical to present (Bard et al. 1987). Based on palynological data from peat bogs, Mateus & Queirós (1993) date from this period the formation of the *Pinus pinaster* forest that, in early Holocene times, is known to be covering the coastal dune fields accumulated during the last glacial maximum. Anthracological data (Figueiral, 1993) from the Magdalenian levels radiocarbon dated to between 12.500 and 11.000 BP at the multi-component open air site of Cabeço de Porto Marinho, indicate that, by then, the sandy soils of the Rio Maior basin would have been covered by *Pinus pinaster/pinea* pine woods. Charcoal from the same levels also includes mediterranean taxa (*Arbutus unedo*, *Olea europaea*, *Quercus suber*, deciduous *Quercus*), suggesting that the adjacent limestone slopes of the Serra de Candeeiros would already have been recolonized by the temperate forest.

These patterns are in a marked contrast with those derived from the analysis of charcoal from last glacial maximum deposits (fig. 1). In the Late Gravettian and Proto-Solutrean levels of Cabeço de Porto Marinho and Lapa do Anecrial, heather and pine are the only species represented. At the latter site, some 350 m above modern sea level, the trees are *Pinus sylvestris*, indicating that alpine and subalpine vegetation communities, expelled from the high mountains by cold and aridity, were now covering the top of the limestone mountains and plateaus, below 700 m, of the littoral region between the Tagus and Mondego Rivers. At lower elevations, as in the sandy interfluves of the Rio Maior basin, however, the landscape would probably be one of extensive heath lands punctuated by stands of maritime pine (*Pinus pinaster*).

Paleoecological analysis of layer Eb from Gruta do Caldeirão, accumulated throughout the Magdalenian, suggests, however, that the recolonization by the temperate forest of those limestone massifs may have begun well before the Bølling/Allerød interstadial: probably around 16.000 BP, if not slightly before. Land snails are characteristic of forested or semi-forested biomes, and *Cepaea nemoralis* is present (Callapez, 1992). Among the rodents (fig. 1), *Terricola duodecimcostatus*, *Apodemus sylvaticus* and *Eliomys quercinus* account for 91% of the remains, and the steppic species that occur in the underlying pleniglacial deposits are now absent (Póvoas et al. 1992). Neither alpine species (*Capra ibex* and *Rupicapra rupicapra*), nor those that prefer open landscapes (*Bos primigenius* and *Equus caballus*), both types being well represented in the Solutrean levels, were found in the Magdalenian large herbivore fauna; instead, such temperate forest dwellers as *Castor fiber*, *Capreolus capreolus* and *Sus scrofa* are now present (Zilhão, 1992).

Data on the evolution of sea surface temperatures are compatible with this hypothesis of an early temperate forest development. According to Bard et al. (1987), in the winter, off the coast of Sines, such temperatures would have been of about 12° C (that is, only 3° C lower than present) in a period immediately before 14.500 BP. This is confirmed by the summer temperatures calculated by Duplessy et al. (1992), in the same core, for a period immediately after the last glacial maximum. Analysis of the variation in the sodium content of the sediments in the Caldeirão sequence (fig. 1) shows that, after an absolute minimum at the top of the Solutrean sequence, a maximum of oceanic influence occurs during the deposition of layer Eb, where observed values are even higher than those obtained for the levels accumulated during the late Holocene (Cruz, 1993). It is possible that this amelioration in temperature and humidity, and its geomorphological effects on land, may have been responsible for the pattern of marked discontinuities separating Solutrean and Magdalenian deposits known in all the relevant cave sequences of Portuguese Estremadura (Lapa do Suão, Gruta do Caldeirão, Buraca Grande). These lacunae span the 18.000-16.000 BP period, after which sedimentation begins again, but at a much slower rate. No contexts dated to this period of two millennia are known in the open air record either, and there is strong evidence at such sites as Carneira that important erosional episodes occurred after the Solutrean.

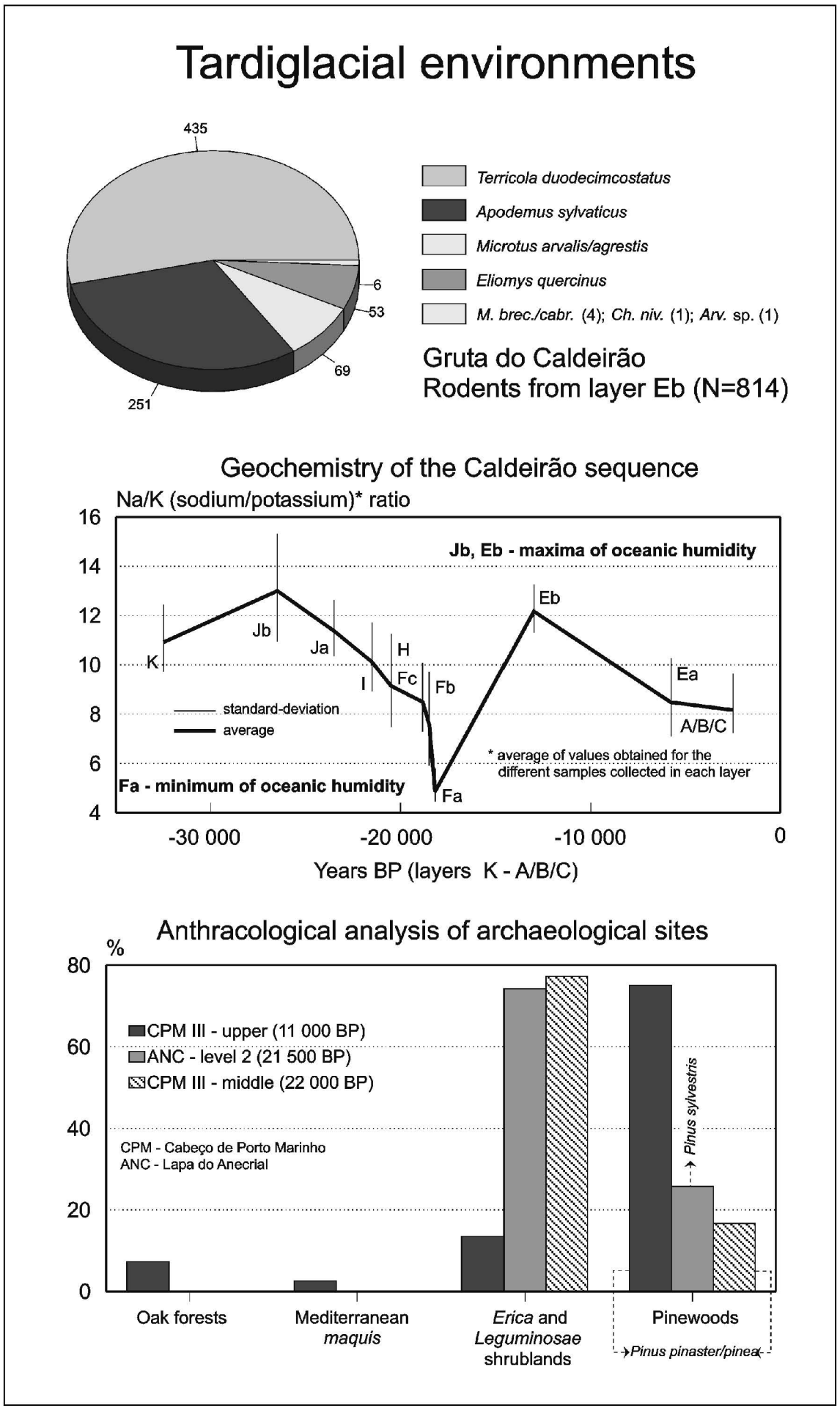

Fig. 1
Paleoenvironmental indicators for the Portuguese Magdalenian. Top: species composition of the rodent fauna from Gruta do Cladeirão (layer Eb). Middle: diachronic variation of oceanic influence in the area around Gruta do Caldeirão, measured as a function of the Na/K ratio in the sediments. Bottom: anthracological data for the last glacial maximum at ca. 350 m above modern sea level (Lapa do Anecrial) and at ca. 80 m above modern sea level (Cabeço de Porto Marinho) and, also, for the Bølling/Allerød interstadial at the latter site.

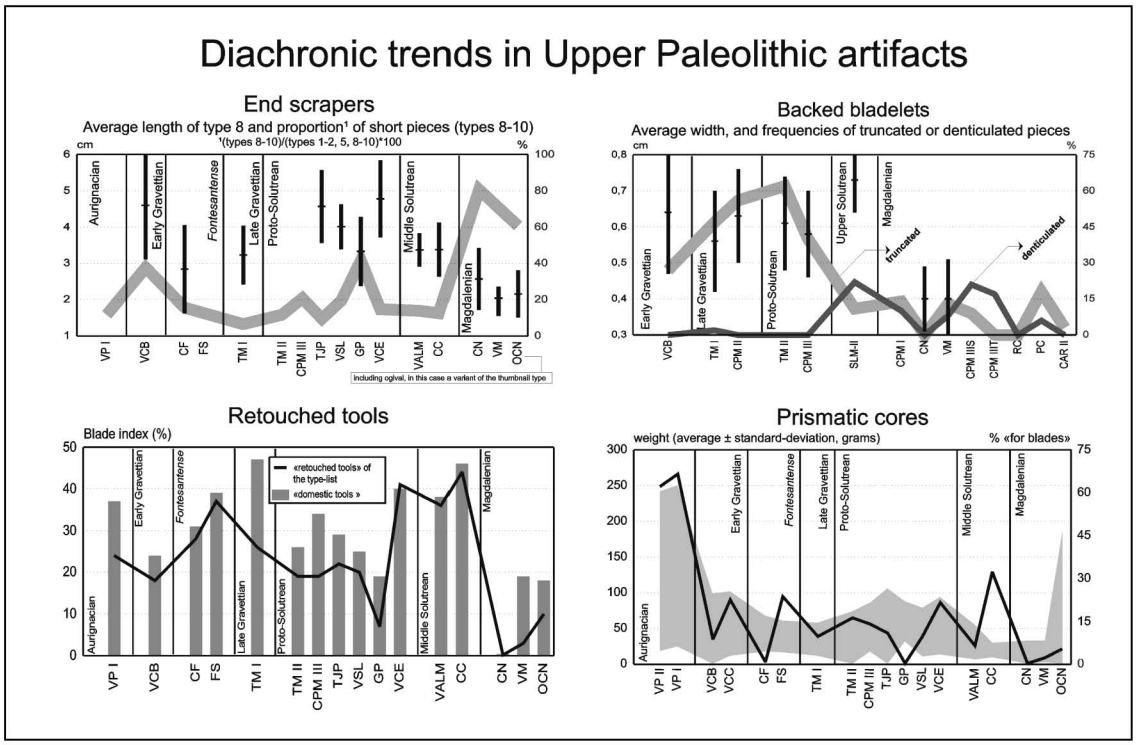

Fig. 2
Overall characteristics of Magdalenian lithic assemblages. Top left: short pieces represent much higher percentages of the end scrapers, and are smaller. Top right: backed bladelets are narrower, backed and truncated pieces being far less frequent, while backed and denticulated pieces are important in the Upper Magdalenian. Bottom left: the percentage of retouched tools that are made on blades decreases, although such a decrease is less marked when only "domestic tools" (see text for definition) are considered. Bottom right: cores are abandoned at much smaller sizes, and the percentage of those that bear scars of blade extraction is negligible.

Data from the ocean record also indicate, however, that the 16.000-10.000 BP period may not have been climatically stable. According to Bard et al. (1987), sea surface temperatures off Sines, in the period between 14.500 and 12.500 BP, came back down to values identical to those that, according to Duprat (1983), existed around 18.000 BP: ca. 4° C. The extent to which this marked drop affected the environmental conditions on land cannot be evaluated at present. The low resolution of the Caldeirão Magdalenian levels does not enable us to stratigraphically differentiate this period, which, on the other hand, corresponds to another lacuna in the open air record, which may relate to geomorphological processes determined by that cold oscillation (the many Magdalenian contexts so far excavated at Cabeço de Porto Marinho all date to before 15.000 BP or after 12.500 BP). As for the continental effects of the Dryas III crisis, when sea surface temperatures again suffered a marked drop (to 6° C in the winter, off Sines, ca. 10.400 BP, Bard et al. 1987), no paleoenvironmental data have yet been derived from the few sites known, so evaluation of those effects is also precluded by lack of the relevant information.

It is conceivable that these two crises caused temporary reversals in the trend towards a temperate climate and vegetation that, at low altitudes, seems to have been well under way already by 16.000 BP. In the present state of our knowledge, however, there is no indication that such was the case. From a long-term historical perspective, and for comparative purposes, it would seem, therefore, that the period between 16.000 and 10.000 BP may be considered as an environmentally coherent block of time that can be contrasted with that before 18.000 BP: in Portuguese Estremadura, open landscapes inhabited by a variety of large and medium sized herbivores predominated in the latter; more wooded landscapes, with less varied and less abundant faunal resources, characterized the former. In the following sections, we will attempt an analysis of the extent to which this change affected human behavior and may have been responsible for the specific aspects of the Portuguese Magdalenian's material culture and adaptation.

MATERIAL CULTURE, SETTLEMENT AND SUBSISTENCE

The chrono-stratigraphic lacuna that corresponds to the 18.000-16.000 BP period makes it very difficult to know how lithic industries evolved in immediately post-Solutrean times. However, several clues (namely, the very small backed and shouldered points recovered at the base of the Magdalenian levels excavated at Caldeirão) suggest that this period may have witnessed the development of a stone technology very similar to the Solutreo-gravettian of southeastern Spain.

Several contexts, however, have already been dated to between 16.000 and 15.000 BP (table I). In the open air, bone is not preserved, and the paucity of cave sites means that, so far, not many bone tools have been found. At Caldeirão, they differ from those found in earlier deposits in that flattened cross-sections are predominant among sagaie points (Zilhão, 1995). This is in good accord with observations reported by Aura (1984-85) on the Magdalenian of Parpalló, where bone points are

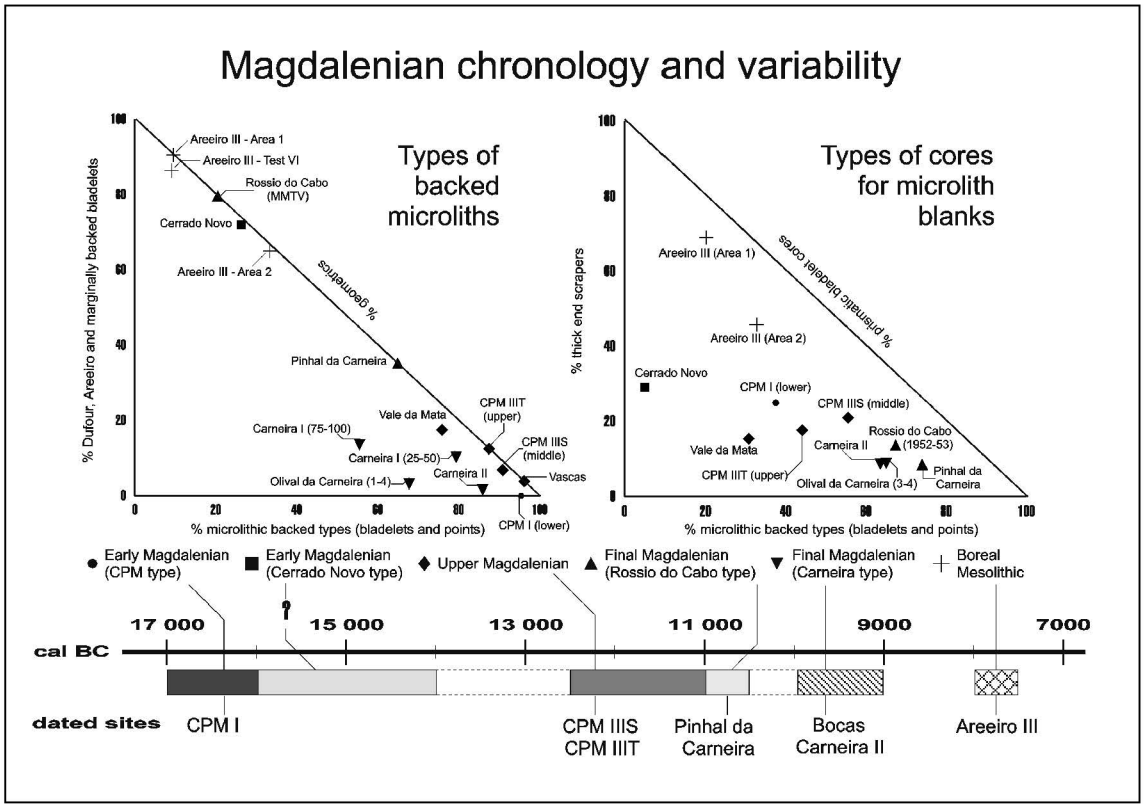

Fig. 3
Chronological variability in the Magdalenian. Early Magdalenian (CPM type) and Upper Magdalenian lithic assemblages have balanced proportions of the three bladelet core types, but differ in that the microliths of the former are almost entirely made up of backed bladelets, while those of the latter are much more diverse, including numerous backed points and denticulated backed bladelets, as well as small amounts of geometrics and marginally retouched bladelets. Final Magdalenian core assemblages are dominated by burins, but the Rossio do Cabo type differs from the Carneira type in the composition of microlith assemblages: dominated by marginally retouched bladelets in the former, and by thick backed points and geometrics in the latter. The industry recovered at Cerrado Novo shares with the Boreal Mesolithic assemblages from Areeiro III the paucity of burins and the dominance of marginally retouched bladelets, but differs in that prismatic cores, not thick end scrapers, are preferred for bladelet extraction, as well as in the presence of significant amounts of "Vascas scrapers", not found at the latter site; Cerrado Novo type assemblages are thus thought to correspond to the Parpalló, "Early Magdalenian type B".

TABLE I
Rio Maior Magdalenian sites
Accepted radiocarbon dates (a)

Site (b)	Level	Material	Lab number	Age BP	Age cal BC (2s)	Sample type
CPM I	Lower	Charcoal	ICEN-542	15,820 ± 400	17,668-15,970	Hearth
CPM I	Lower	Charcoal	SMU-2015	16,340 ± 420	18,483-16,442	Scattered
CPM II	Middle	Charcoal	SMU-2476	15,410 ± 195	16,778-15,953	Hearth
CPM IIIS	Lower	Charcoal	SMU-2668	14,050 ± 850	16,700-12,471	Scattered
CPM IIIS	Lower	Charcoal	WK-3127	15,040 ± 210	16,458-15,526	Scattered
CPM IIISW	Lower	Charcoal	WK-3126	16,180 ± 290	17,879-16,526	Scattered
CPM VI	Lower	Charcoal	SMU-2634	15,420 ± 180	16,763-15,992	Scattered
Bocas I	*Fundo*	Bones	ICEN-901	10,110 ± 90	10,251-9056	Old excavation
Bocas I	0+	*Bos primigenius*	ICEN-900	9880 ± 220	10,262-8462	Old excavation
Bocas I	1 (c)	*Cerastoderma* sp.	ICEN-903	10,260 ± 70 (d)	9726-9013	Old excavation
CPM I	Upper	Charcoal	SMU-2011	11,680 ± 60	11,923-11,463	Scattered
CPM I	Upper	Charcoal	ICEN-687	12,220 ± 110	12,744-11,960	Scattered
CPM II	Upper	Charcoal	SMU-2637	11,110 ± 130	11,359-10,805	Scattered
CPM III	Upper	Charcoal	ICEN-545	11,160 ± 280	11,744-10,566	Scattered
CPM IIIS	Middle	Charcoal	ICEN-689	11,810 ± 110	12,169-11,518	Hearth
CPM IIIT	Upper	Charcoal	ICEN-690	10,940 ± 210	11,337-10,472	Hearth
CPM VI	Middle	Charcoal	SMU-2636	10,160 ± 80	10,302-9136	Scattered
Pinhal da Carneira	4	Charcoal	SMU-2635	10,880 ± 90	11,050-10,647	Hearth

(a) after Bicho (1993), Marks *et al.* (1994) and Zilhão *et al.* (1995); calibration after Stuiver and Reimer (1993)
(b) CPM = Cabeço de Porto Marinho
(c) although labeled as being from level 2, the sample dated probably comes from the shell-midden in level 1
(d) after correction for the reservoir effect, through the subtraction of 360±35 years (Soares 1989), the radiocarbon age of this sample becomes 9900±80 BP, this value having been used for the calibration

numerous. Overall, lithic artifacts also seem to be typologically and technologically very close to those found at that site, suggesting that the Portuguese industries from this time period can be considered as part of the same Magdalenian technocomplex.

The raw-material of choice is flint, which tends to be locally acquired, as is testified by the fact that the percentages of quartz and quartzite (generally used, particularly the latter, in the framework of expedient flaking strategies) tend to become higher as the distance of

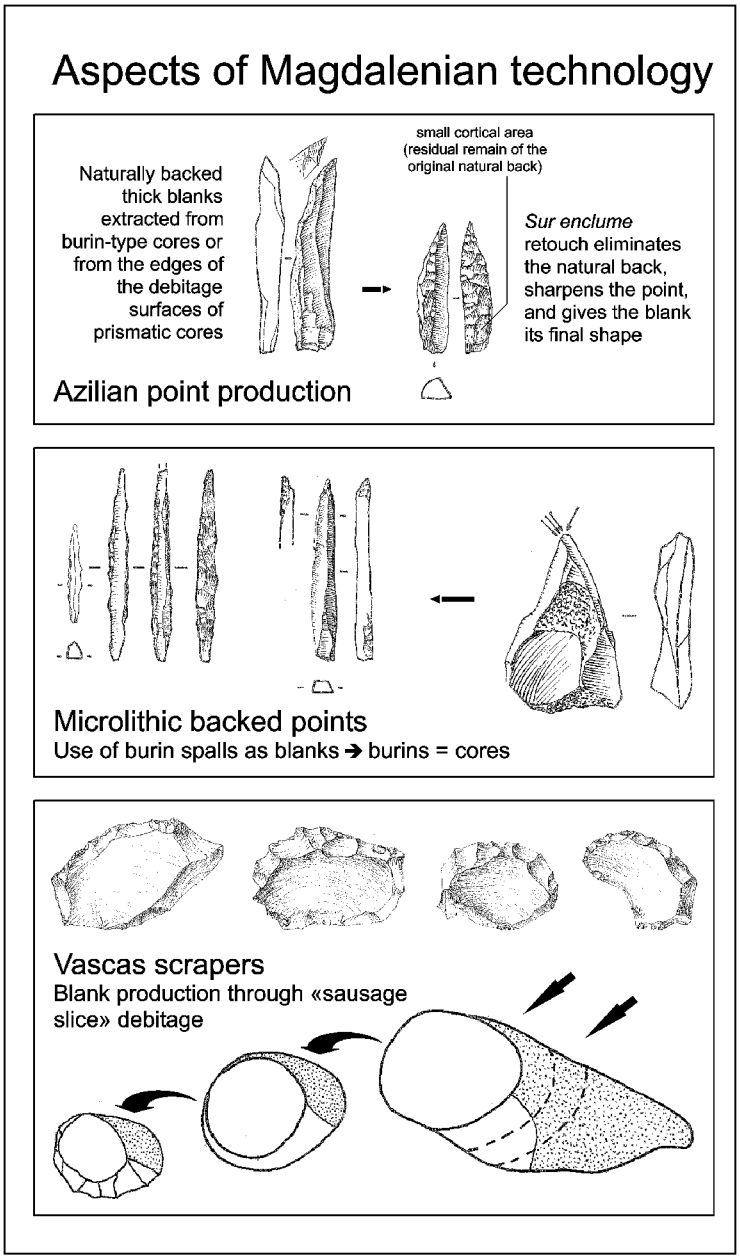

Fig. 4
Aspects of Magdalenian technology. Top and middle: backed point production. Bottom: chaîne opératoire of the "Vascas scrapers".

sites to the flint sources increases. By comparison with previous time periods, the use of flint in the Portuguese Magdalenian, as a whole, is characterized by (fig. 2):

– *An exhaustive exploitation of cores;*

core reduction strategies oriented towards the production of flake and bladelet blanks;

– *Smaller-sized retouched tools;*

a greater diversity of microliths in the later stages, including geometrics, new point types and denticulated backed bladelets.

Internal diachronic variation seems to be oriented along two axis (fig. 3): the technology of bladelet production (through prismatic, "burin", or "thick end scraper" core types); and the typology of microlithic tool assemblages (backed bladelets and points, marginally retouched bladelets, geometrics). The reasons why burins and thick end scrapers should be considered cores have been exhaustively discussed elsewhere (Zilhão, 1995). As regards the former, proof of the validity of this interpretation has been obtained by refitting studies of several "Aurignacian V/Proto-Solutrean" contexts (Zilhão et al., 1994). As regards the latter, the interpretation is supported by the frequent use of "burin spalls" as blanks for microlithic point production (fig. 4).

Combining this variation with the chronometric data obtained for recently excavated contexts in the Rio Maior area (table I), it is possible to discriminate the five industrial phases presented in table II and figure 3 (Zilhão, 1995). The assemblage excavated at Cerrado Novo in the 1950's has not been chronometric dated, and the similar assemblage from Vascas was differentiated from a mixed collection. An approximate chronology for this phase can be derived, however, from the striking similarity (notably, the abundance of "Vascas scrapers", fig. 4) that exists between these assemblages and those from the stratigraphic units of Parpalló used by Aura (1989) to define his "Early Magdalenian type B".

The nature of Middle Magdalenian industries cannot be assessed at present, given the stratigraphic lacuna that occupies the corresponding time range at Cabeço de Porto Marinho, and the fact that, so far, no individualized contexts dated to between 15.000 and 12.500 BP have been identified at other sites. A decorated bone tool from Buraca Grande, however, was recently dated directly, through radiocarbon Ams, to ca. 13.000 BP (Aubry and Moura, personal communication). Therefore, this hiatus is not the result of a hypothetical interruption in the human settlement of the region. As suggested in the preceding section, the explanation for this phenomenon should be sought, instead, in the taphonomical domains of site formation and site visibility.

Synchronic variation also exists. A case in point is the difference that exists between Rossio do Cabo and Pinhal da Carneira in the frequencies of backed bladelets versus marginally retouched bladelets. It cannot be excluded, however, that this variation may result from the use of slightly different classification criteria by the two analysts who counted each assemblage (Zilhão, 1995, for the former; Bicho, 1992, for the latter). Another example is the marked internal differentiation of Upper Magdalenian assemblages in the amount of microlithic tools they contain. At Cabeço de Porto Marinho, for instance, the ratio "microliths:domestic tools" (the latter including thin end scrapers, borers, burins on non-cortical blade/bladelet blanks, retouched blades, notches, denticulates, side scrapers and Vascas scrapers) is always below 0.5; at Vale da Mata, on the Cambelas coast, however, the same ratio has a value of 6 (fig. 5).

A similar phenomenon can be observed in earlier Upper Paleolithic industries that also have among their weaponry a component armed with retouched microliths. When classified using lithic indicators of function, contexts belonging to those industries cluster in

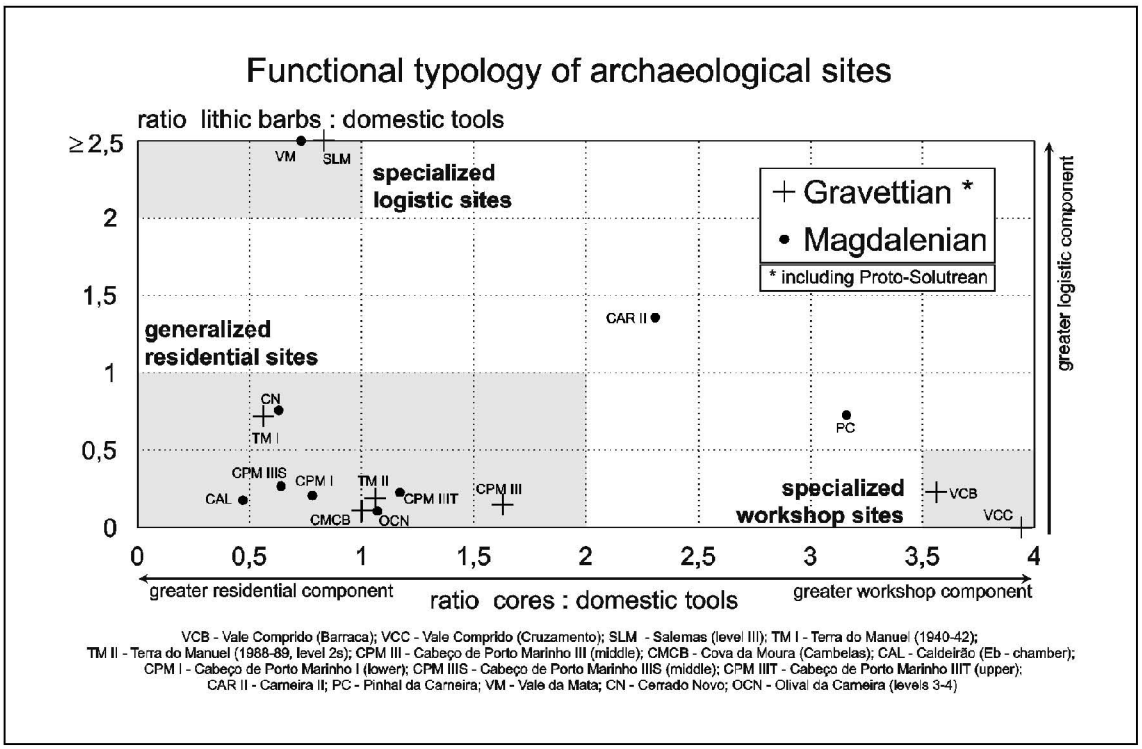

Fig. 5
Upper Paleolithic site function as measured by the structural composition of lithic assemblages (only those industries characterized by the production of retouched microliths were considered). The fact that intermediate assemblages are known in the Magdalenian suggests a lesser degree of inter-site functional differentiation, perhaps as a result of the adoption of a more forager oriented settlement-subsistence strategy. It is also possible, however, that this greater homogeneity is instead related to the overall changes in lithic production, from systems essentially based on the circulation of blanks and tools to systems essentially based on the circulation of cores.

TABLE II
Portuguese Magdalenian
Chronology, sites and industrial variability (after Zilhão 1995)

Phase	Sites	Industrial characteristics
Early Magdalenian (CPM type) 17-16 ky cal BC	Cabeço de Porto Marinho, Caldeirão	quartzite is an important raw-material the several bladelet core types occur in similar proportions backed bladelets comprise more than 90% of the microliths, and pointed types are unknown
Early Magdalenian (Cerrado Novo type) 16-14 ky cal BC	Cerrado Novo, Vascas	burins are nearly absent marginally retouched bladelets comprise more than 90% of the microliths, microlithic backed points being unknown side scrapers (often inverse) are abundant, and associated with «Vascas scrapers» (Fig. 4)
Upper Magdalenian 12.5-11 ky cal BC	Buraca Grande, Cabeço de Porto Marinho, Caldeirão, Picareiro, Vale da Mata, Vascas, Suão	the several bladelet core types occur in similar proportions backed bladelets and a large diversity of backed points, the latter often made on «burin spalls» (Fig. 4), comprise more than 90% of the microliths
Final Magdalenian (Rossio do Cabo type) 11-10.5 ky cal BC	Pinhal da Carneira, Rossio do Cabo	bladelet core assemblages are largely dominated by burins no side scrapers marginally retouched bladelets are more than one third of the microliths, which also include a diversity of backed points
Final Magdalenian (Carneira type) 10-9 ky cal BC	Bairrada, Bocas, Carneira, Olival da Carneira, Vasca	debitage includes production of blades in significant amounts bladelet core assemblages are largely dominated by burins geometrics (trapeze and segments) represent more than 10% of the microliths, and are associated with thick Malaurie and Azilian points, often made on «burin spall» blanks (Fig. 4)

three well-differentiated groups (fig. 5):

– Specialized workshop sites, with very high values of the ratio "cores:domestic tools" (where the former also include burin-type cores, "thick end scrapers", and splintered pieces).

– Specialized logistic sites, with high values of the ratio "microliths:domestic tools".

– Generalized residential sites, where the first ratio is less than 2 and the second less than 1, that is, where cores, domestic tools, and microliths, occur in balanced proportions.

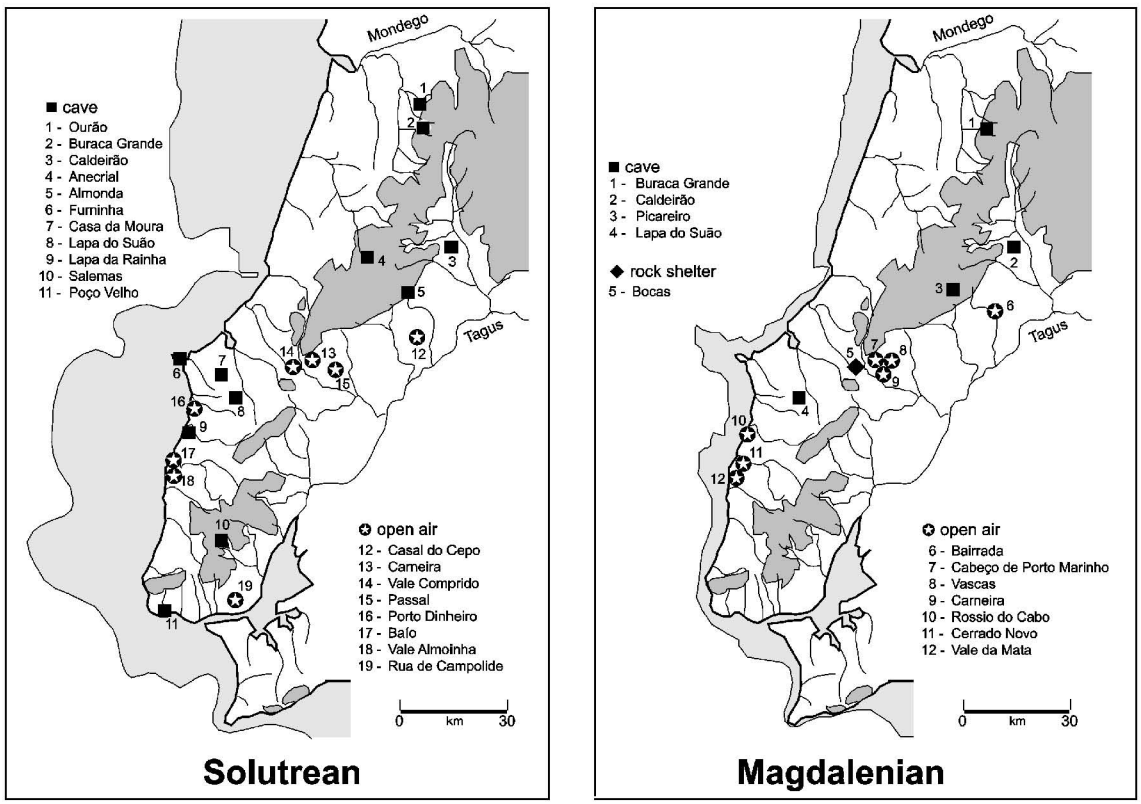

Fig. 6
Distribution of archaeological sites dated to the last 10.000 years of the Paleolithic. The rise in sea level has allowed for the preservation of sites closer to the extant coast line than was the case during the Solutrean. Unlike those from Cantabrian Spain, however, Portuguese Early and Upper Magdalenian occupations located at distances of between 10 and 25 km of the sea do not show any signs of a marked increase in the exploitation of aquatic resources. In Portuguese Estremadura, evidence for such an increase is not found in the archaeological record until ca. 10.000 BP.

In the Magdalenian, however, assemblages with intermediate values are known, such as those from Pinhal da Carneira and Carneira II (fig. 5). Therefore, when dealing with these later Upper Paleolithic assemblages, one has the impression of facing a continuous variation, the functional discrimination of sites being somewhat arbitrary and biased by the still very small number of contexts available for analysis.

The distribution of sites in the landscape, on the other hand, does not seem to differ significantly from that known in previous times (fig. 6). Although the rise in sea level has allowed the preservation of sites closer to the extant coast line than was the case in, for instance, the Solutrean, those sites do not contain any evidence that the exploitation of aquatic resources had by then become a strong component of subsistence practices. Actually, such evidence does not seem to appear until ca. 10.000 BP, when shell-middens begin to accumulate, not only along the coast, as is the case with Pedra do Patacho, in Alentejo (Soares & Silva, 1993), but also very far inland, as is the case with the Casal do Papagaio cave (Arnaud & Bento, 1988). The latter, occupied during Pre-Boreal times, was some 40 km away from the extant coast, and contained large amounts of both marine and estuarine shell-fish. Such a feature, by contrast, was notably absent from cave sites (such as Lapa do Suão), as well as from open air settlements (such as Rossio do Cabo, Cerrado Novo and Vale da Mata) that were occupied during the Magdalenian, that is, during a time when their distance to the extant coast oscillated between 10 and 25 km only.

MECHANISMS OF CHANGE AND REGIONAL CONTEXT

The changes in subsistence that are found when comparing the Magdalenian to earlier Upper Paleolithic periods, therefore, may have been related essentially to the modifications in the availability of terrestrial resources caused by the post-16.000 BP climatic amelioration. Meat procurement came to rely almost exclusively on the hunting of red deer (*Cervus elaphus*) and rabbits (*Oryctolagus cuniculus*), and it is likely that plant foods became more important. It is also conceivable that this change in the resource base may have entailed a modification in settlement-subsistence strategies, which may have become more forager oriented, as opposed to hypothetically more collector oriented strategies used in Solutrean times. Until more paleoeconomic data and seasonality analyses are obtained, however, this hypothesis will remain almost impossible to test.

Such a change could represent a good explanation for the differences observed between Magdalenian and earlier Upper Paleolithic periods in the functional typology of archaeological sites, as measured by the lithic indicators used in figure 5. Another way of looking at the problem, however, would be that of correlating those differences with changes in the economics of flint. As figure 2 well illustrates, Magdalenian industries are essentially characterized by their miniaturized tool-kits, allowing for a more thorough exploitation of cores. The dimensions at discard of the latter are, therefore, much smaller than before but, on the other hand, it is also true that smaller volumes are needed to ini-

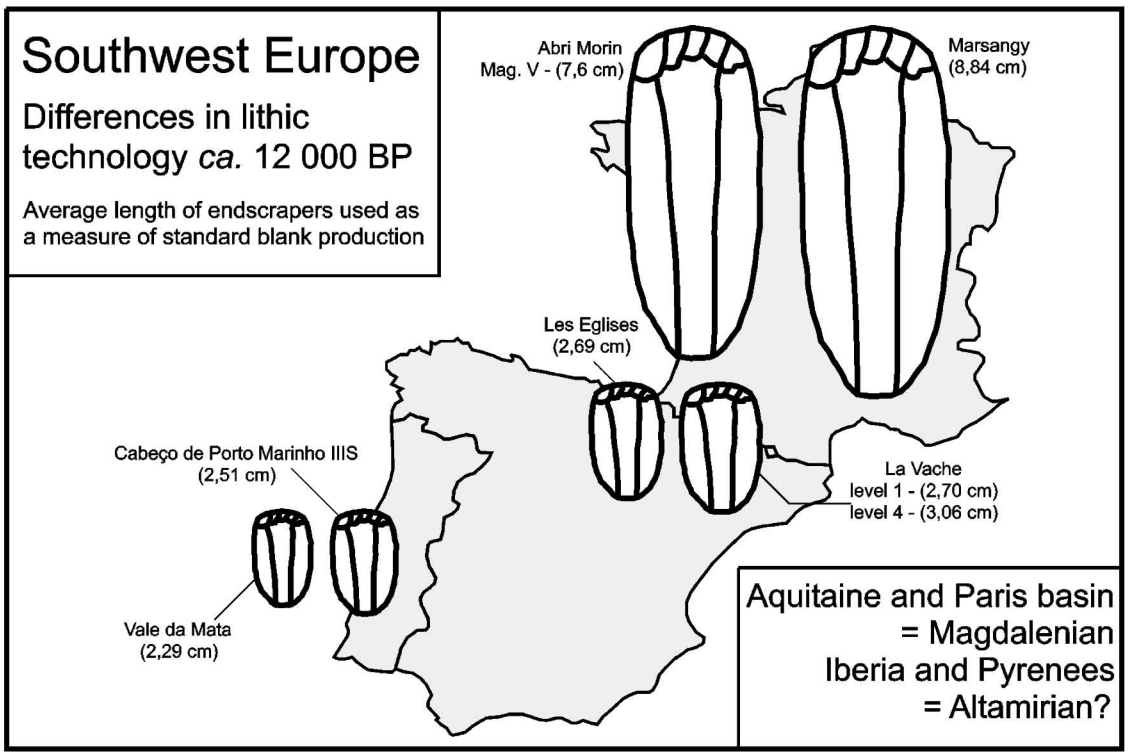

Fig. 7
Geographical patterning in the late Upper Paleolithic industries of southwestern Europe. Although sharing the same combination of bone points and microliths, Iberian and Pyrenean assemblages differ at the basic technological level from those to the north: the former are oriented towards the production of flake/bladelet blanks since ca. 16.000 BP, while the latter are still based on the production of large blades as late as 12.000 BP.

tiate blank production. In such a situation, it makes sense that raw-material is circulated between sites preferentially as prepared cores or unflaked volumes, and that blanks for bladelet tools are extracted only when required, and for immediate consumption. As a consequence, production activities will take place even at logistic sites where, in the framework of a Solutrean-type stone economics, only imported blanks and tools would have been introduced.

Therefore, the apparent change from well differentiated types of sites in the Solutrean and before to a situation where, from the point of view of lithic production, sites seem to form a more homogeneous group and represent points along a continuum of variation, may have more to do with the adoption of a new tool-kit entirely based on miniaturized lithic components than with changes in settlement-subsistence strategies ultimately determined by climatic and environmental change. That a similar trend towards miniaturization is observed in other Upper Paleolithic regional trajectories, as is the case in the Pyrenees (Clottes, 1989), where the timing of climatic events and the nature of the resource base were very different from those documented in Portugal, also suggests that such, indeed, may be the case. This does not mean that the advent of the Magdalenian should be considered as an entirely cultural process where natural selection had no bearing. Instead, what this indicates is that we should probably consider it as the end result of a long term selective pressure for the optimization of group mobility: a miniaturized tool-kit makes it easier to take decisions on where groups should position themselves in a given territory, at least in regard to the constraints placed on those decisions by the requirements of raw-material procurement.

On the other hand, a consideration of the variability in Magdalenian lithic production across western Europe shows that a process of raw-material economization similar to that found in Portugal does not begin, in many regions, until the very end of the Pleistocene. Using end scraper size as a measure of standard blank production, it is quite clear that, ca. 12.000 BP, both the Aquitaine and the Paris basin, for instance, are still occupied by groups manufacturing traditional Upper Paleolithic tool-kits based on large blade blanks (fig. 7). This might be used, of course, as an argument in favor of correlating open environments with large blade based tool-kits, and forest environments with miniaturized flake/bladelet based tool-kits. Given the observations mentioned above, however, it would seem more reasonable and more productive, although beyond the scope of this paper, to investigate the foundations of such a distinction in the differences that may have existed in the scale of mobility, itself possibly related with raw-material size and distribution, with the nature of the subsistence resources, and with the extension and orientation of social and cultural networks.

This distinction also highlights the ambiguity that exists in the use of the term Magdalenian to refer to all late European Upper Paleolithic industries with bone tools and microliths. At the basic level of lithic technology, upon which Paleolithic taxonomy should be grounded, it would seem from figure 7 that Iberian and French Pyrenean industries are quite separate from those to the north (although the pattern clearly needs confirmation from currently unavailable technological and metric data on the Spanish sites). The possibility of grouping them under a different technocomplex designation, for instance that of Altamirian, would also seem, therefore, worthy of further consideration.

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