THE UPPER PALEOLITHIC OF THE RIO MAIOR BASIN (PORTUGAL). PRELIMINARY RESULTS OF A 1987-1993 PORTUGUESE-AMERICAN RESEARCH PROJECT

by

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Abstract: The Rio Maior basin has been a well known center of Upper Paleolithic settlement, since the time of M. Heleno's excavations in the area. New field work and analysis of the unpublished old collections made it possible to obtain a basic chronostratigraphic framework for the Gravettian/Proto-Solutrean transition, and for the Early and Later Magdalenian. Aurignacian and Gravettian sites are also known, but the Solutrean and Middle Magdalenian seem to be absent or rare. Geomorphological processes connected with the climatic oscillations evidenced by diverse paleoenvironmental indicators may be responsible for some of this, but the issue requires further investigation.

Resumo: Desde os trabalhos levados a cabo na região por M. Heleno que o povoamento paleolítico da bacia de Rio Maior tem sido um facto bem conhecido. A realização de novas escavações e o estudo das colecções antigas, que permaneciam por publicar, tornou possível a obtenção de um quadro crono-estratigráfico para o período da transição do Gravettense ao Proto-Solutrense e para o Magdalenense antigo e superior. Há também sítios do Aurignacense e do Gravettense, mas o Solutrense e o Magdalenense médio parecem não existir ou ser raros na região. Embora a questão continue por esclarecer, é possível que a razão de ser desta situação resida em processos geomorfológicos relacionados com as oscilações climáticas postas em evidência por diversos indicadores paleoambientais.

Palavras-chave: Paleolítico Superior. Rio Maior. Cronoestratigrafia.

1. INTRODUCTION

The importance of the Rio Maior basin for Portuguese Upper Paleolithic studies was first brought to light by the results of M. Heleno's mid-century excavations in the area. Carried out in the periods between 1935 and 1943, and 1952-53, this work remained essentially unpublished, except for very summary

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discussions in two papers where its implications for broader historical or archaeological issues were addressed by Heleno (1944, 1956).

The collections from those excavations were stored in Lisbon's National Museum of Archaeology, of which Heleno was the director for three decades. It was not until 1982, however, that their inventory and analysis were actually undertaken, originating several preliminary publications (Zilhão 1984, 1985, 1988, 1993). In conjunction with data from excavations at the new site of Gruta do Caldeirão (Tomar), and from a few other cave sites excavated and published by the Geological Survey of Portugal since the mid-19th century, this work also made possible the production of a new synthetical perspective of the Solutrean (Zilhão 1987, 1990, 1991).

The results obtained made it clear that a more rigorous evaluation of the Rio Maior collections required a new investigation of the archaeology and the geology of the area. All the more so since any records or field books that may have been kept by Heleno's foremen have subsequently become unavailable, if not entirely lost. Therefore, a collaborative research project, with the aim of obtaining such an evaluation and, through discovery and excavation of more sites, contribute to the basic task of building a chronostratigraphic framework for the Portuguese Upper Paleolithic, was begun in 1987 by J. Zilhão and A. E. Marks. Its field component was completed in 1993, and some results are already available (Bicho 1991, 1992, 1993; Figueiral 1993; Marks 1993; Marks *et al.* 1994).

Here, we will expand on these preliminary publications and will try to present a first overview, since the completion of the project, of its achievements regarding the Upper Paleolithic of the region. Therefore, evidence collected by the project but relating to the Middle Paleolithic, or to a time post-10,000 BP, will not be considered.

A list of all Rio Maior Upper Paleolithic sites from which excavated evidence has been obtained can be found in Table 1. They are all open air, except for Bocas, which is a stratified rock-shelter, and their location is presented in Fig. 1. Table 2 contains a selection of the radiocarbon dates obtained that, on present evidence, are thought to provide a reliable assessment of the age of the archaeological contexts with which they are associated.

2. GEOLOGICAL BACKGROUND

The Rio Maior basin is a depression filled with mainly sandy sediments originally accumulated in Plio-Pleistocene times. Fluvial shaping of the landscape has produced a pattern of deeply incised drainages separated by interfluves that, on average, are some 20 to 30 m above the present day valley bottoms.

TABLE 1
The Upper Paleolithic of Rio Maior
Sites and components

Site	Period	Observations
Areeiro I	Magdalenian	Single component site excavated in 1987. Located at the edge of a very large and extensive sand pit that had already destroyed most of it prior to excavation. Burning and forestry (plantation of pine and eucalyptus) caused deep post-depositional disturbance.
Arneiro	Upper Paleolithic Solutrean ?	Excavated by Heleno in 1942-43, at a time when the sediments were already deeply disturbed by the plantation of vines. As at Passal (see below), most artifacts are likely correspond to a Chalcolithic workshop for the production of foliates, although an attribution of some of the latter to the Solutrean cannot be entirely excluded. The early Upper Paleolithic is represented by rolled blades and cores.
Bocas	Later Magdalenian	Deeply stratified rock shelter excavated by Heleno in 1936-38. The three bottom levels (*Fundo*, 0 and 1) contained similar «Carneira-type» artifact assemblages and gave statistically identical radiocarbon dates.
Cabeço de Porto Marinho	Late Gravettian Proto-Solutrean Earlier Magdalenian Later Magdalenian	Stratified multi-*locus* and multi-level site excavated in 1987-94. One possible mousterian and several post-paleolithic (Epipaleolithic, Early Neolithic, Chalcolithic and Bronze Age) occupations have also been identified. Most levels contain features and seem to be archaeologically *in situ*, although some vertical displacement of artifacts often precludes the establishment of rigid stratigraphic boundaries.
Carneira	Upper Solutrean Later Magdalenian	Multi-locus site. Carneira I was originally excavated by Heleno in 1952-53, and Olival da Carneira, excavated in 1991, corresponds to the eastern end of that area, not affected by the old excavations. Carneira II, excavated in 1987-89, contained a similar Magdalenian assemblage, but none of the Solutrean artifacts found in the other two *loci*. The Magdalenian at Pinhal da Carneira, excavated in 1989-91, is earlier and different, both in typology and in technology.
Casal do Felipe	Fontesantian	Single component site completely excavated by Heleno in 1940-42.
Estrada da Azinheira	Early Gravettian	Extensive spread of artifacts, with a strong workshop component, excavated in 1990-91. Buried in shallow sands, it was deeply affected by post-depositional processes, mainly burning.
Gato Preto	Proto-Solutrean	Concentration of artifacts, with fireplace, excavated in 1987-89. Contained in a very thin horizon, it probably corresponds to a single, and short, episode of occupation. Although archaeologically *in situ*, there is some indication that smaller sized materials may have been washed away.
Passal	Upper Paleolithic Solutrean	Excavated by Heleno in 1942-43, at a time when the sediments were already deeply disturbed by the plantation of vines. Referred to as Solutrean, most of the artifacts actually represent residues from a Chalcolithic workshop for the production of foliates. There are rolled early Upper Paleolithic materials in the collections from the old excavations. Testing in 1988 showed that such artifacts could only have come from the fluviatile terrace that constitutes ground surface throughout most of the area. Secure evidence of Solutrean is represented by two patinated Parpalló points.
Picos	Late Gravettian ?	Small site, deeply disturbed by roots of large pine trees, excavated in 1991. It is not yet known to what extent the collection is representative.
Quartel dos Bombeiros	?	Close to Gato Preto, it was excavated in 1992. Cultural affinities are problematic in the current state of analysis of the artifact assemblages.

TABLE 1 (continued)

Site	Period	Observations
Quinta do Sanguinhal	Gravettian	Small remnant of what seems to be a single component site, almost entirely destroyed by construction. Excavated in 1991–92, it yielded an assemblage that permitted several core reconstructions, indicating that the material originally corresponded to an archaeologically *in situ* occupation.
Quintal da Fonte	Upper Paleolithic Upper Solutrean	Site investigated (tested or surface collected) by Heleno in 1943. The collection consists of a patinated Upper Paleolithic assemblage, including a patinated Solutrean shouldered point.
Sancada	?	Low density artifact scatter in the vicinity of Vascas, tested in 1991 with the unfulfilled hope that it would provide a control (and explanation) for the mix of periods represented in the latter. Artifacts collected suggest accumulation of the deposits throughout late Upper Paleolithic or Epipaleolithic times.
Terra do José Pereira	Proto–Solutrean	Single component site excavated by Heleno in 1940–42. A small similar assemblage was also recovered at the adjacent site/locus designated by Heleno as Terra do Xavier.
Terra do Manuel	Late Gravettian Proto–Solutrean	Excavated by Heleno in 1940–42. New work in 1988–89 allowed the identification, and investigation, of an adjacent area, unaffected by his work, where a stratified sequence of Late Gravettian/Proto–Solutrean age was excavated. At least two components, but most likely three, are represented in the collections from both episodes of excavation.
Tocas	Gravettian	Stratified site downslope from Estrada da Azinheira, excavated in 1992–93. At the base, there is a level of rolled material similar to that recovered at that site. Overlying it, but separated by sterile deposits, is a level of fresh material, extremely dense, suggesting the operation of sorting processes.
Vale de Porcos	Aurignacian	Single component site excavated by Heleno in 1952–53. In the mid–1970's, the GEPP (*Grupo para o Estudo do Paleolítico Português*) discovered an adjacent area — Vale de Porcos II — that had just been deep ploughed for the plantation of eucalyptus. Its contents were the object of thorough surface collection, yielding an assemblage with a workshop component even stronger than that of the original site.
Vale Comprido–Barraca	Early Gravettian	Single component site excavated by Heleno in 1939–42. Exact relocation was possible, and the collections bore labels that enabled clear separation from the proto–solutrean site located downslope (Vale Comprido – Encosta).
Vale Comprido–Cruzamento	Early Gravettian	Single component site excavated in 1988–89. Shallow buried archaeological level, partly destroyed by dirt road. The whole area was bulldozed and deep ploughed in 1990 for the plantation of eucalyptus.
Vale Comprido–Encosta	Proto–Solutrean Lower Solutrean ? Middle Solutrean ?	Excavated by Heleno in 1939–42. The collection should be attributed almost entirely to the Proto–Solutrean. Artifacts indicating a later age may represent either a mixture of different *loci* or the existence of a cultural stratigraphy that went unnoticed at the time of excavation.
Vales	Proto–Solutrean	Excavated by Heleno in 1938–39. It probably corresponds to a *locus* of the site excavated in 1940–42 as «Terra do Manuel».
Vascas	Aurignacian ? Gravettian ? Proto–Solutrean ? Magdalenian	Excavated by Heleno in 1952–53. The collection contains a mixture of artifacts from different time periods, among which early Upper Paleolithic and Magdalenian components are readily recognizable. Recent changes in the topography of the area make it difficult to evaluate the original nature and condition of the site.

TABLE 2
Rio Maior sites
Accepted radiocarbon dates

Site (a)	Level	Material	Lab number	Age BP	Sample type
Late Gravettian/Proto-Solutrean/«Aurignacian V»					
CPM III	Lower	Charcoal	ICEN-541	21,080 ± 850	Scattered
CPM III	Lower	Charcoal	SMU-2475	22,710 ± 350	Scattered
CPM III	Lower	Charcoal	ICEN-428	23,050 ± 750	Scattered
Terra do Manuel	2s	Charcoal	ETH-6038	21,770 ± 210	Scattered (AMS)
Earlier Magdalenian					
CPM I	Lower	Charcoal	ICEN-542	15,820 ± 400	Hearth
CPM I	Lower	Charcoal	SMU-2015	16,340 ± 420	Scattered
CPM II	Middle	Charcoal	SMU-2476	15,410 ± 195	Hearth
CPM IIIS	Lower	Charcoal	SMU-2668	14,050 ± 850	Scattered
CPM IIIS	Lower	Charcoal	WK-3127	15,040 ± 210	Scattered
CPM IIISW	Lower	Charcoal	WK-3126	16,180 ± 290	Scattered
CPM VI	Lower	Charcoal	SMU-2634	15,420 ± 180	Scattered
Later Magdalenian					
Bocas I	*Fundo*	Bones	ICEN-901	10,110 ± 90	Old excavation
Bocas I	0+	*Bos primigenius*	ICEN-900	9,880 ± 220	Old excavation
Bocas I	1 (b)	*Cerastoderma* sp.	ICEN-903	10,260 ± 70 (c)	Old excavation
CPM I	Upper	Charcoal	SMU-2011	11,680 ± 60	Scattered
CPM I	Upper	Charcoal	ICEN-687	12,220 ± 110	Scattered
CPM II	Upper	Charcoal	SMU-2637	11,110 ± 130	Scattered
CPM III	Upper	Charcoal	ICEN-545	11,160 ± 280	Scattered
CPM IIIS	Middle	Charcoal	ICEN-689	11,810 ± 110	Hearth
CPM IIIT	Upper	Charcoal	ICEN-690	10,940 ± 210	Hearth
CPM VI	Middle	Charcoal	SMU-2636	10,160 ± 80	Scattered
Pinhal da Carneira	4	Charcoal	SMU-2635	10,880 ± 90	Hearth

(a) CPM – Cabeço de Porto Marinho
(b) although labeled as being from level 2, the sample dated most certainly belongs to the shell-midden in level 1
(c) 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

Geological and geomorphological work carried out on and off archaeological sites has allowed the discrimination of three important periods in the history of sedimentation in the basin between the Würm interstadial and the end of the Pleistocene. Terrace formation before the last glaciation maximum is documented by the presence of rolled early Upper Paleolithic artifacts in fluviatile deposits at Arruda dos Pisões. Solutrean and later prehistoric artifacts in the same area, although often recovered from disturbed deposits, always bear a totally different surface appearance, indicating that they were geologically *in situ* or had only suffered very short displacement. Their accumulation, therefore, must have taken place after the process of terrace formation in the area had come to an end.

During the last glacial maximum, sea level on the Portuguese coast dropped to between -130 and -140 m (Dias 1985; Rodrigues *et al.* 1991). As a result, the

base level of the Tejo was lowered, prompting deep incision of the valleys of its tributaries, namely, the Maior. Terraces formed during the previous period were exposed as fluviatile beaches and made available for human occupation, as is documented at the Late Gravettian and Proto-Solutrean site of Terra do Manuel. At the same time, denudation of the slopes by deteriorating climatic conditions allowed for erosion and for eolian or colluvial redeposition of silts and sands that buried those occupation surfaces and preserved them as archaeological levels.

Little is yet known of the certainly complex geomorphological history of the area during the Tardiglacial, but there are a few indications that erosion was very active at certain moments. One such erosional episode, taking place right after 18,000 BP, may have been responsible: (a) for the low density of finds that characterized the Upper Solutrean occupation excavated at Olival da Carneira, indicating post-depositional scattering by a low energy agent, and (b) for the archaeological hiatuses in all the sequences so far excavated in the different *loci* of the stratified site of Cabeço de Porto Marinho, where Late Gravettian or Proto-Solutrean levels were found in direct contact with overlying Early Magdalenian deposits. A second episode must have taken place right after 10,000 BP, as is indicated by the sorting processes that affected the Final Magdalenian levels of Olival da Carneira, where the great majority of artifacts were contained in small discontinuous pockets with extremely high densities of finds. Patinated and displaced Upper Paleolithic artifacts were also found in a level underlying the Boreal Mesolithic occupations at Areeiro III, and may represent another manifestation of the same erosional episode.

The archaeological consequences of these processes are obvious, since they represent the most important control on the visibility, degree of preservation, and present day geographical distribution, of sites. Those dating from the early Upper Paleolithic, for instance, have been found only in the interfluves, buried in shallow sediments that offered little protection against disturbance. This does not mean that the valley bottoms were not occupied at the time. Rather, it is a result of the fact that those surfaces are now gone, and the corresponding sites gone with them.

On the other hand, sites from the beginning of the last glacial maximum are the most numerous, and occur in many different settings. Again, this does not mean that human occupation of the area was more important by then. Rather, it is a result of the fact that many opportunities for covering of those occupations by sediments existed, and that their deep burial enabled them to resist more successfully to subsequent destruction by natural or anthropic agencies.

3. PALEOENVIRONMENTS

In the preceding section, we suggested a pattern of higher sedimentation rates in last glacial maximum sites, and related it with deteriorated climatic conditions. Independent confirmation of the prevalence of such conditions at that time is provided by the results of the analysis of charcoal collected in the deposits excavated at Cabeço de Porto Marinho (Table 3). In the Late Gravettian or Proto-Solutrean levels, pine is the only tree represented and, together with heather, almost exclusively dominates the assemblages. This indicates an open landscape, as reconstructed, based on pollen data from deep sea cores, by Mateus e Queirós (1993). These authors suggest that, after 25,000 BP, the association of *Pinus sylvestris* and *Artemisia* steppe would have descended from the high mountains and plateaus to cover the lesser elevations of littoral central Portugal where, at lower altitudes, heath shrub lands with stands of maritime pine (*Pinus pinaster*) would have covered the interfluves.

Analysis of the earlier Magdalenian levels has not yet been completed, so it is not possible to evaluate the rhythm and the extent to which this picture began to change after 18,000 BP. By 12,500 BP, and possibly even earlier, however, it

TABLE 3
Cabeço de Porto Marinho (Rio Maior)
Anthracology of Upper Paleolithic levels in *loci* I, II, III and IIIS

	III lower Late Gravettian		III middle Late Gravettian		I upper Late Magdalenian		II upper Late Magdalenian		III upper Late Magdalenian		IIIS middle Late Magdalenian	
	N	%	N	%	N	%	N	%	N	%	N	%
Arbutus unedo					1	0,6	1	0,6	3	0,7	1	0,2
Cistus sp.							2	1,3	2	0,5	1	0,2
Erica arborea			41	36,0					13	3,1	1	0,2
Erica sp.			4	3,5			1	0,6	3	0,7	5	1,2
Fraxinus angustifolia									5	1,2	1	0,2
Leguminosae	1	0,5	3	2,6					25	6,0	6	1,5
Leg. t. *Cytisus scoparius*			3	2,6					4	1,0	1	0,2
Leg. t. *Ulex* sp.									7	1,7		
Olea europaea var. *sylvestris*							2	1,3	5	1,2	1	0,2
Pinus pinaster/pinea	192	93,2	8	7,0	148	88,6	127	80,4	228	54,5	338	83,7
Pinus sp.	11	5,3	3	2,6	13	7,8	8	5,1	61	14,6	19	4,7
Pine cone							1	0,6				
Quercus deciduous					1	0,6	7	4,4	7	1,7	5	1,2
Quercus t. *ilex*							2	1,3	13	3,1	1	0,2
Quercus suber					2	1,2			7	1,7	6	1,5
Quercus sp.									1	0,2	3	0,7
Rhamnus alaternus/Phillyrea									1	0,2		
Rosaceae Pomoidea					4	3,5						
Indeterminable	2	1,0	48	42,1	2	1,2	7	4,4	33	7,9	15	3,7
TOTAL	206		114		167		158		418		404	

is quite clear that full interglacial conditions were already established. Pine woods covered the sandy soils of the basin, where the site is located, while the several taxa from the mediterranean oak forest represented in the assemblages from the Upper and Final Magdalenian levels (Table 3) can be interpreted as a pale reflection of the vegetation covering the nearby limestone slopes of the Serra dos Candeeiros. Major paleosoil development is also a feature of the extant deposits excavated at Cabeço de Porto Marinho.

This reconstruction is compatible with available data on sea surface temperatures. According to Bard *et al.* (1987), essentially modern values are observed between 12,500 and 11,000 BP. However, the Dryas III episode is very well marked, with a drop to values of 4°C in the winter (that is, to last glacial maximum levels) off the coast of southern Portugal, *ca.* 10,400 BP. Due to lack of data, it is as yet not possible to evaluate the impact this episode may have had on the paleoenvironments of the Rio Maior area.

4. CULTURAL STRATIGRAPHY

The Rio Maior data base was of paramount importance in two recent dissertations bearing on the Upper Paleolithic of Portugal (Bicho 1992; Zilhão 1995). The following summary will be based on that work. Zilhão (1995) will be used for the early Upper Paleolithic and the Solutrean. However, there is some degree of disagreement between these two authors on Magdalenian systematics and on how industrial variability in this time range should be explained, largely to be attributed to the still preliminary stage of analysis of the huge amounts of relevant material collected during the 1987-1993 project. In this discussion, therefore, those issues will be avoided, and, as regards the Magdalenian, our intent will be that of focusing solely on the broader aspects of patterning permitted by the available chronological framework.

The only Aurignacian site known is that of Vale de Porcos (some possibly Aurignacian material also exists at Vascas, but the assemblage recovered there by Heleno is mixed, and it is difficult, therefore, to evaluate its significance). The industry recovered at Vale de Porcos is characterized by a strong workshop component and, typologically, it is dominated by burins, which suggests a late chronology. Debitage is oriented towards the production of large blades, and is prepared, as a rule, by careful abrasion of the platform. Bladelets are obtained from prismatic cores as well as from the numerous «burins», mostly carinated or busked, although dihedral and on truncation types are also well represented. A different facies, comprising very small assemblages almost entirely made up of Dufour bladelets belonging to the Dufour subtype of Demars and Laurent (1989),

has been found at cave sites outside the Rio Maior area, namely at Pego do Diabo, north of Lisbon, where it was dated to *ca.* 28,000 BP (Zilhão 1995). It seems likely that this differentiation is of a functional nature and that both facies are contemporaneous.

The Early Gravettian is represented at Estrada da Azinheira, Vale Comprido-Barraca and Vale Comprido-Cruzamento. At the latter site, a TL date of *ca.* 28 000 BP was obtained that, in spite of the large standard deviation, can be taken as confirmation of the chronostratigraphic classification of these assemblages. Blade debitage is not prepared, and is largely a byproduct of the setting up of cores for the production of narrow blade or wide bladelet blanks destined for transformation in backed points. An important proportion of such blanks, however, is certainly extracted from the abundant «burins» on truncation, often multiple and *plan* (Fig. 2). As was the case with the local Aurignacian, these sites have a strong workshop component, and are probably complementary to the known cave occupations of the same period (Zilhão 1995). At Salemas, a site located north of Lisbon, for instance, the small artifact assemblage from the (probably early) Gravettian level III was overwhelmingly dominated by microlithic and bone points (Roche *et al.* 1962).

The assemblage excavated by Heleno at Casal do Felipe belongs to a phase that has also been identified at Fonte Santa, a new open air site near Torres Novas excavated in 1989-90. It has not yet been possible to date it, but several lines of evidence suggest an age of *ca.* 23,000 years. The type-fossil of this Fontesantian facies, which is unknown in the other culture regions of the Upper Paleolithic of Southwestern Europe (Zilhão 1988), is the bilaterally backed, symetrical, Casal do Felipe point (Fig. 3). Blade production is geared towards the production of blanks for these lithic projectile tips. Their width varies between 10 and 15 mm, and is always prepared by abrasion, originating slender, regular products, with lipped platforms. On present evidence, the Fontesantian seems to correspond to a complete lithic production system and, therefore, to a stage of the Portuguese Upper Paleolithic culture-stratigraphic sequence. However, until an absolute chronology is firmly established, the possibility that it might instead represent a functional facies of the Late Gravettian cannot be ruled out entirely. An important element of continuity between both types of assemblages is the fact that, in the latter, after the core is appropriately set up and enters a phase of mainstream blank production, an extractive technology identical to that of the Fontesantian is used.

The Late Gravettian is represented by the collection from Heleno's 1940-42 excavations at Terra do Manuel and by the base of the «lower cultural level» of the sequence excavated in *locus* II of Cabeço de Porto Marinho (Fig. 4). It shares many typological characteristics with the Proto-Magdalenian or Perigordian VII of Southwestern France, particularly in the production of large amounts of backed

and truncated bladelets, the use of burins made on slender blade blanks, and the modification of cutting edges through «proto-magdalenian retouch» (Bosselin 1991). Available chronometric data for the sequences excavated at the two Rio Maior sites suggest that these moments of the Portuguese and French sequences also share a similar chronology; that is, *ca.* 22,000 BP.

The transition to the Solutrean takes place between 22,000 and 21,000 BP. Assemblages from this time period seem to show a high degree of polymorphism. Therefore, in certain specialized contexts, particularly when a single and short occupation episode is represented, these transitional industries may appear under a number of different functional poses. It is very likely that one such pose is that represented by the open air site of Gato Preto, where the typological predominance of carinated and nosed scrapers might be taken to indicate «aurignacian» affinities. Instead, it would seem more logical to understand these assemblages as representing something similar to the French «Aurignacian V». As it was demonstrated elsewhere (Zilhão *et al.* 1994), such industries, particularly that excavated at Laugerie-Haute, do not represent complete lithic production systems. Rather, they should be interpreted as representing nothing more than one of the technological components, related to the production of lithic barbs from thick «scrapers»/cores, that is present in the different industries of the Late Gravettian/ /Proto-Solutrean/Lower Solutrean transition.

Several lines of evidence suggest that, in Portugal, the Proto-Solutrean may be subdivided in two different stages. The first, represented by level 2s of the 1988-89 excavations at Terra do Manuel, by the upper part of the «lower cultural level» in *locus* II of Cabeço de Porto Marinho, and by the «middle cultural level» of *locus* III of the same site, is characterized by the deliberate choice of quartz for the production of unretouched bladelet barbs, extracted from both prismatic cores and thick «scrapers» (Fig. 4). Backed and truncated bladelets are still present but in small amounts, and Vale Comprido points seem to make their first and very rare appearance in the archaeological record. In the second stage, the use of quartz decreases, backed and truncated bladelets disappear entirely, and Vale Comprido points are numerous. The latter correspond to a lithic projectile tip made on convergent blade blanks extracted from prismatic and pyramidal cores with a hard hammer technology (Fig. 3). Given the thick butts of such blanks they had to be modified by retouch to enable hafting. The method used in this case was the dorsal thinning of the platform, making the recognition of the type difficult when edges and tip remain unretouched, as is often the case. Similar artifact types have been variously described as «levallois points» or «mousteroïd points» in different French assemblages attributed to the Proto-Solutrean (Smith 1966; Combier 1967).

No Lower Solutrean assemblages have so far been recognized, but such an industrial component may once have been represented at Vale Comprido - Encosta.

The sites located in the village of Arruda dos Pisões, namely Arneiro and Passal, were once thought to represent Middle Solutrean occupations (Heleno 1956; Zbyszewski *et al.* 1977; Zilhão 1987). As was recently demonstrated (Zilhão 1995), however, most of the foliates recovered there actually correspond to residues related to the operation of Chalcolithic workshops. Nonetheless, some indisputable patinated pieces are clearly of Solutrean age, as is the case with the two barbed and tanged points recovered by Heleno at Passal. The 1987-1993 project could only identify and partially excavate another occurrence dating to this period: that contained in the basal fluviatile deposits of the sequence exposed at Olival da Carneira, where the typology of the points indicates an Upper Solutrean of both franco-cantabrian and mediterranean affinities (Fig. 5). Therefore, although well represented elsewhere in Portugal, almost always in caves, Middle and Upper Solutrean occupations are virtually non-existent in the open air record of the Rio Maior area. No satisfactory explanation has yet been found for this, but geomorphological processes, particularly erosion, may play an important role.

A large majority of the Upper Paleolithic archaeological contexts presently known in the basin date to the Magdalenian, and most were excavated in only two sites: Cabeço de Porto Marinho and Carneira. Here, as in the Portuguese Magdalenian as a whole, blade blanks are extremely rare, and can be entirely non-existent in some cases. Therefore, debitage and tools are almost entirely made up of flake and bladelet blanks. At the end (that is, *ca.* 10,000 BP, in the facies identified at both Bocas and Carneira), however, blade debitage seems to reappear, and the overall appearance of the assemblages is again «Gravettian-like». Even then, however, the other correlates of this major change in core reduction strategies are still apparent: small sized end scrapers, many of which of the thumbnail type; important and diverse microlithic tool-kits; exhaustive exploration of flint volumes, abandoned at sizes much smaller than any time before.

Radiocarbon dating of the several Magdalenian components excavated at Cabeço de Porto Marinho shows a clustering in two time periods, separated by a large hiatus: the first is between 16,000 and 15,000 BP; the second is between 12,500 and 11,000 BP. Preliminary work suggests that the two clusters differ in several aspects of technological or typological relevance: quartzite is more important as a raw material in the earliest; microlithic tools are more diverse in the latest, and include pointed types, which are not known before 15,000 BP; side scrapers, often made by inverse retouch, are very abundant in the earlier assemblages, in which «Vascas scrapers» (Zilhão 1995), analogous to raclettes, are also to be found in fair numbers. Overall, these assemblages seem broadly similar to those dated between 16,000 and 12,000 BP in the rest of Iberia (Straus and Clark 1986; Aura 1989, 1992; Marks 1995).

Two assemblages are dated after 11,000 BP: the middle level of locus VI of

Cabeço de Porto Marinho has not yet been analyzed; Pinhal da Carneira is characterized by the large numbers of burins and by the fact that marginally backed bladelets, generally of very small size (10 to 15 mm long), are very abundant. Assemblages dated around 10,000 BP, besides being characterized by the above mentioned technological particularities, also contain new microlith types: Azilian and Malaurie points, and trapeze (Fig. 6). The closest parallel for these terminal Paleolithic industries seems to be found in the Laborian complex of the Périgord (Bordes 1984).

5. CONCLUSIONS

Results reported above make it clear that the 1987-1993 research project accomplished its main goals. Excavations at Carneira, Passal, Vale Comprido and Terra do Manuel provided invaluable information on the nature of the old collections from those sites, making it possible to use them in a controlled way. The discovery and extensive excavation of Cabeço de Porto Marinho gave, for the first time, a possibility of sound inquiry into the chronology and variability of the Portuguese Magdalenian's lithic assemblages. Survey, testing and excavation of other smaller or less important sites showed that Heleno's work had been far from exhausting the potential of the Rio Maior basin for Upper Paleolithic studies. A lot remains to be done, and the pace at which modern industrial activities (construction, forestry and sand quarrying) are revolving the landscape, makes it urgent that continued and systematic work is pursued in the area.

Analysis of charcoal from Cabeço de Porto Marinho is unfinished, as is work on the geoarchaeology of the basin. When completed, these lines of evidence will enrich the already important contribution of the project to the study of the paleoenvironmental background of the Portuguese Upper Paleolithic. Settlement studies based on systematic survey, and provenience studies based on the distribution of flint sources, now near completion, will also contribute to a better understanding of how hunter-gatherer groups adapted to the way climate and resources changed over time between the beginning of isotope stage 2 and the end of the Pleistocene.

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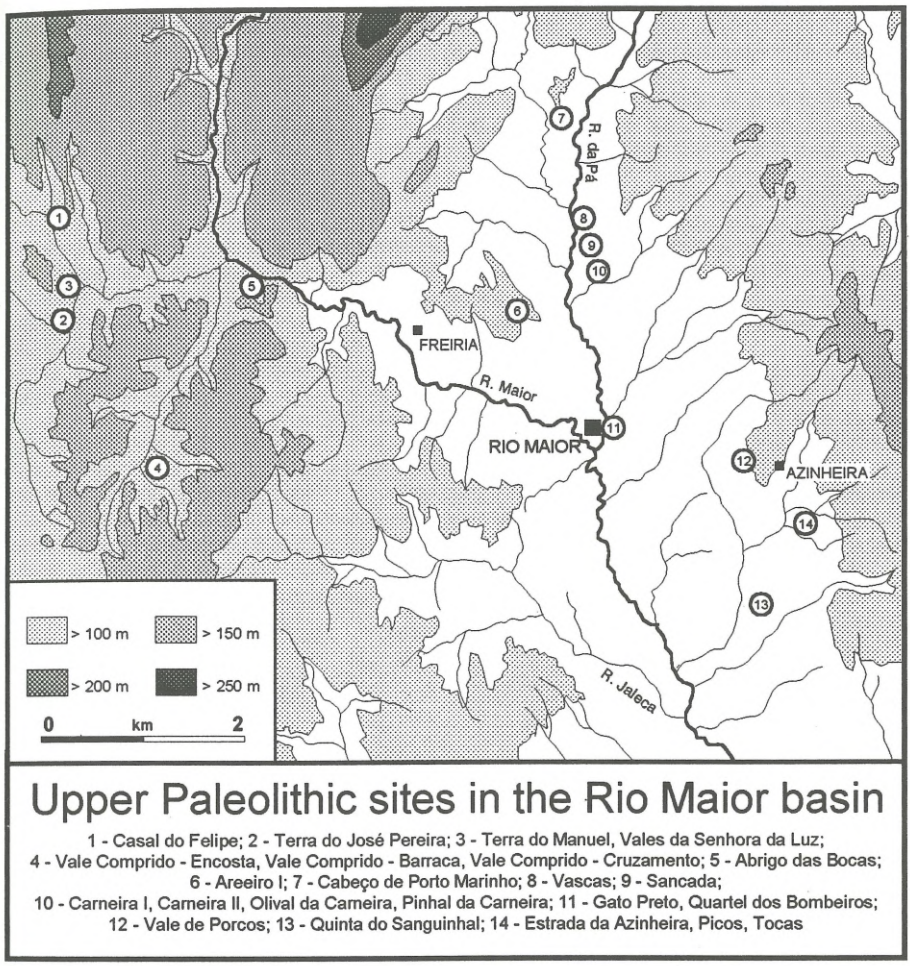

Upper Paleolithic sites in the Rio Maior basin

1 - Casal do Felipe; 2 - Terra do José Pereira; 3 - Terra do Manuel, Vales da Senhora da Luz; 4 - Vale Comprido - Encosta, Vale Comprido - Barraca, Vale Comprido - Cruzamento; 5 - Abrigo das Bocas; 6 - Areeiro I; 7 - Cabeço de Porto Marinho; 8 - Vascas; 9 - Sancada; 10 - Carneira I, Carneira II, Olival da Carneira, Pinhal da Carneira; 11 - Gato Preto, Quartel dos Bombeiros; 12 - Vale de Porcos; 13 - Quinta do Sanguinhal; 14 - Estrada da Azinheira, Picos, Tocas

Fig. 1 — Location of excavated sites (see Table 1 for chronology and comments). The Chalcolithic workshops with some rolled or patinated Upper Paleolithic material known at Arneiro and Passal are some 6 km ESE of Azinheira, in the village of Arruda dos Pisões.

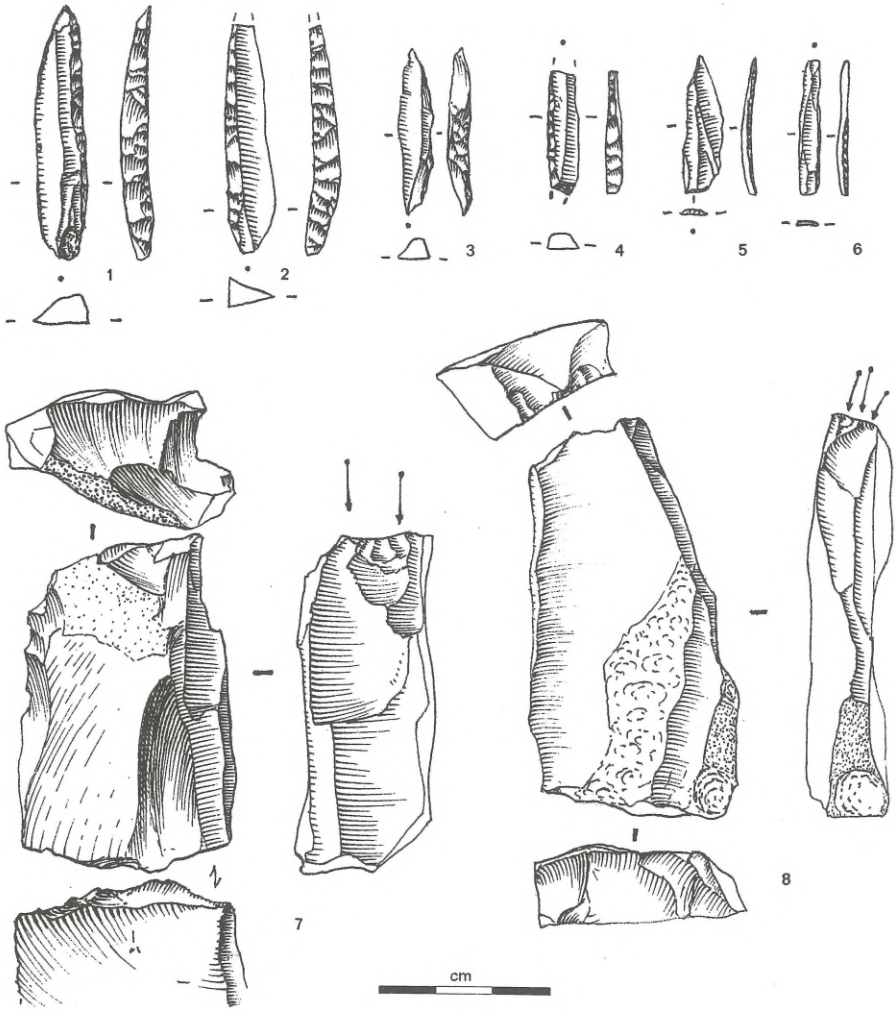

Fig. 2 — Early Gravettian artifacts from Estrada da Azinheira.

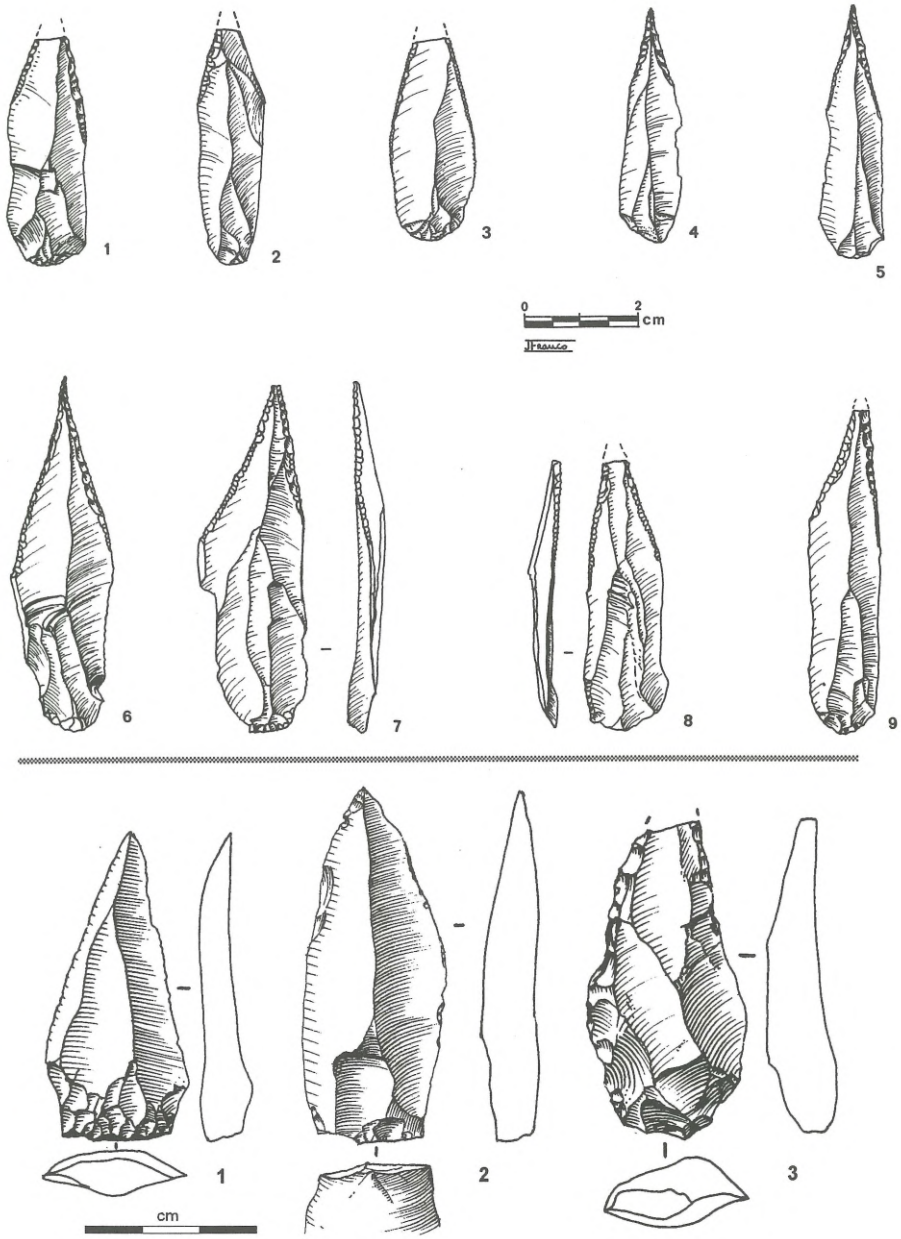

Fig. 3 — Diagnostic point types of the Fontesantian (above, from the site of Casal do Felipe) and the Proto-Solutrean (below, from the site of Vale Comprido - Encosta).

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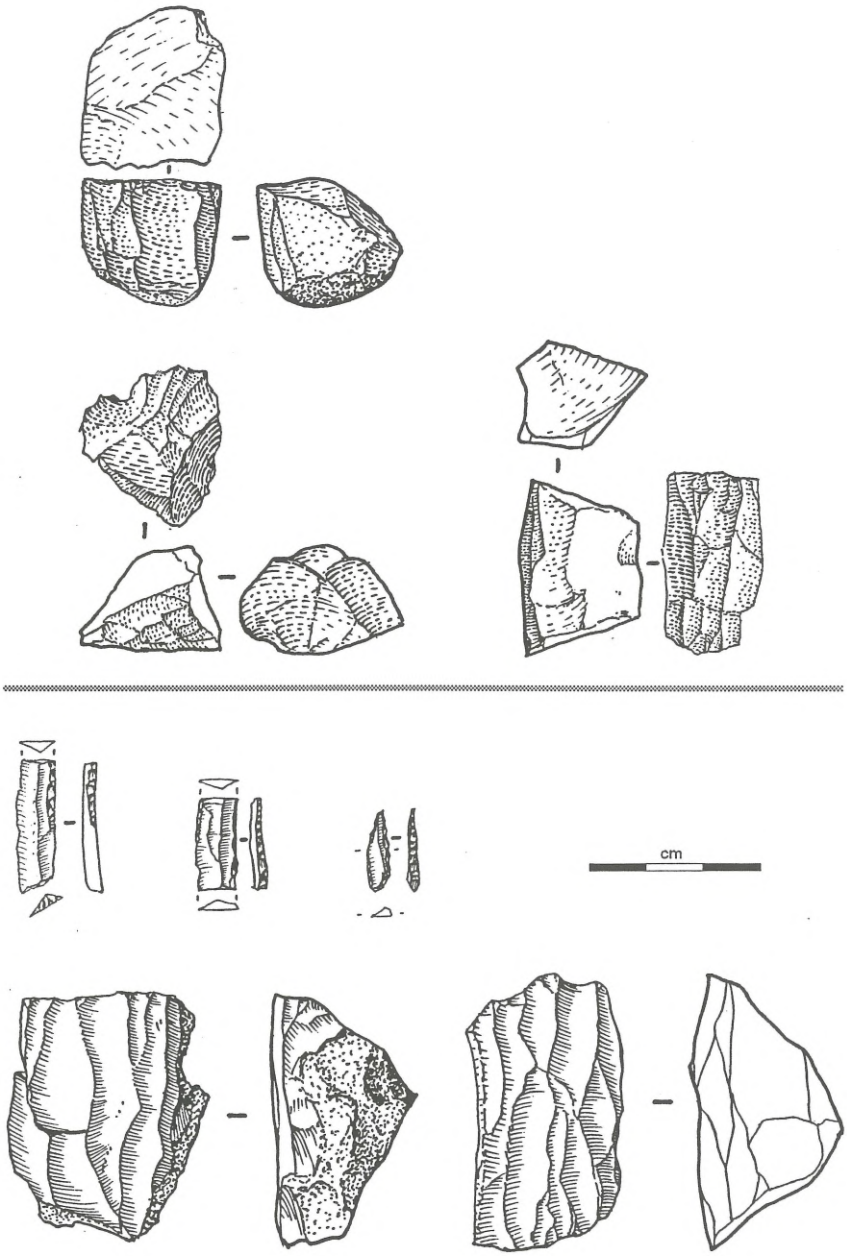

Fig. 4 — Late Gravettian (below, all flint) and Proto-Solutrean (above, all quartz) artifacts from *locus* II of Cabeço de Porto Marinho.

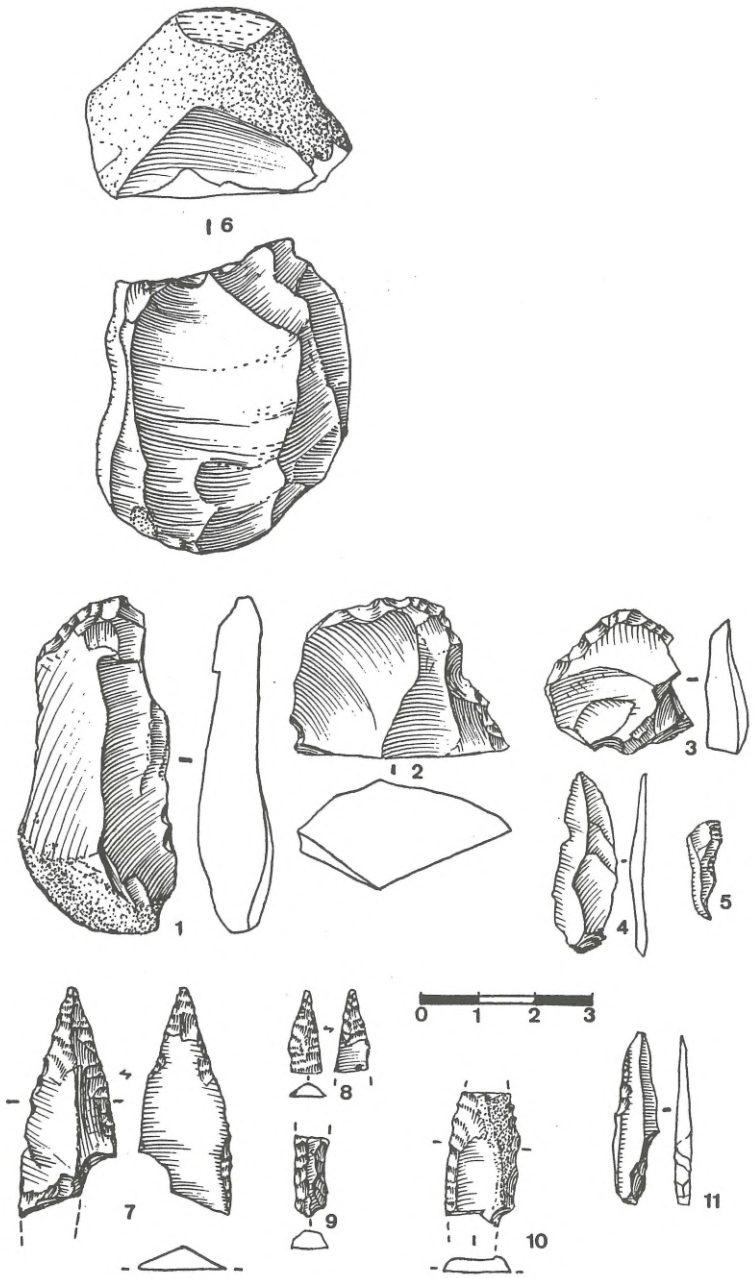

Fig. 5 — Upper Solutrean artifacts from Olival da Carneira.

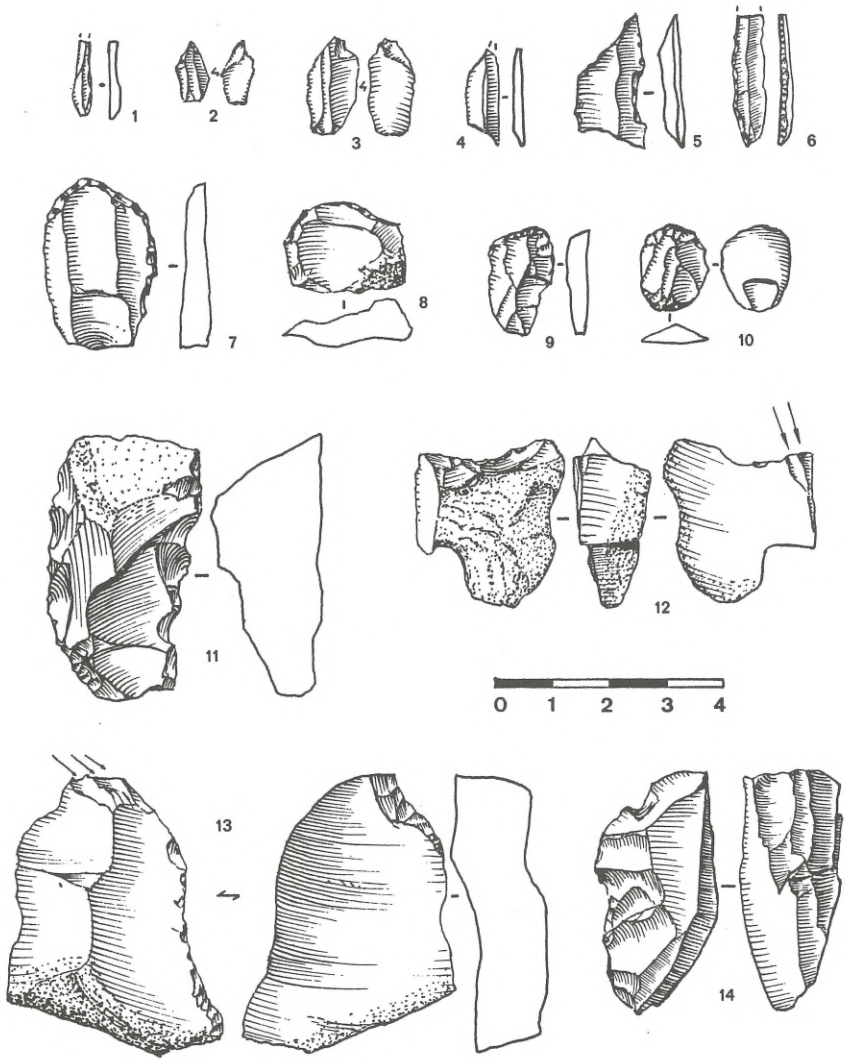

Fig. 6 — Final Magdalenian artifacts from Olival da Carneira.