M. Otte (dir.), *La Spiritualité*.
Actes du colloque de la commission 8 de l'UISPP (Paléolithique supérieur), Liège, 10-12 décembre 2003.
Liège, ERAUL 106, 2004, p. 71 à 80.

SHELL ORNAMENTS, BONE TOOLS AND LONG DISTANCE CONNECTIONS IN THE UPPER PALEOLITHIC OF SOUTHERN PORTUGAL

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Abstract

Very little was known from the Upper Paleolithic of southern Portugal until very recently. A few sites were discovered during the last decade and one of them, Vale Boi (Algarve), yields shell ornaments, bone tools and clear evidence of long distance connections between Algarve, Central Portugal and the Spanish Levant. Raw materials and ideas moving across the southern coast of Iberia seem to suggest differences in the cultural systems relative to Central Portugal and greater similarities with the Spanish Levant.

Personal ornaments are among the most important indicators of "modern" or Upper Paleolithic culture. As Kuhn *et al.* (2001:7641) stated, they mark an important step in the evolution of human behavior, although ornaments were occasionally produced by Neandertals as well. Body ornaments are extremely rare in Mousterian occupations (Marshack 1989), however, and their associations often are equivocal due to stratigraphic disturbance (e.g., Chase & Dibble 1987; Kuhn *et al.* 2001; Vanhaeren & d'Errico 2002). Pendants of different materials, however, are associated to Neandertals within the Chatelperronian of Southwestern France and Northern Spain (Zilhão & d'Errico 1999; d'Errico *et al.* 1998).

Body ornamentation, like art, is a phenomenon that may indicate a significant change in the cognitive abilities of early humans and the emergence of modern behavior, because it is rare or absent among Mousterian humans, including Neandertals (Kuhn *et al.* 2001:7645). Such communication may convey ideas of social identity, group membership, gender, age or perhaps ethnicity seen through stylistic aspects of the material culture (e.g., Wiessner 1983; Sackett 1972, 1992). The important aspect of this form of communication - which according to Soler Mayor (2001:367) can be called "visual communication" - is the premise that the "visual display of personal information through ornaments, clothing or other media most often targets strangers or infrequently encountered individuals" (Kuhn *et al.* 2001:7645). Thus, the use of such items, and the specific technology to produce them, would be more important in areas where there was the need to mark the difference between populations, either between species (i.e., Neandertals with Chatelperronian and Modern Humans with Aurignacian if one prefers this species-level taxonomic separation of the Neandertals) or between groups of the same species.

Of course, this same concept can be applied to investigate relationships and ideological connections between human groups during various phases of the Upper Paleolithic. Similar technological traits for producing ornaments, as well as repeated characteristics of personal decoration, can be used to link human groups across wide areas, such as the Iberian Peninsula. This hypothesis is tested through a comparison of data recovered from the Upper Paleolithic and Early Neolithic site of Vale Boi in Algarve, Portugal, and sites located in the Estremadura, Central Portugal, and from the Spanish Mediterranean coast. The results suggest stronger long distance connections between Algarve and the Mediterranean than with the Portuguese Atlantic area.

The Upper Paleolithic background: sites from Estremadura, Central Portugal

Portuguese Upper Paleolithic research has been carried out in Central Portugal since the late 19th century (Bicho 1994; Marks *et al.* 1994; Zilhão 1995), and there are over 100 sites or

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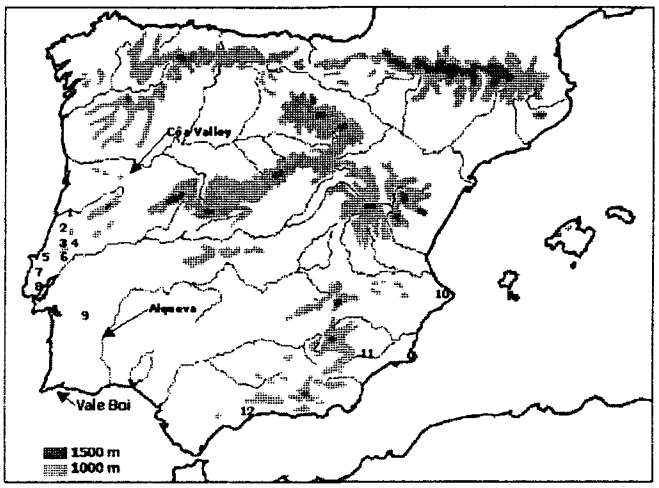

Figure 1. Map of Iberia with location of sites referred in text. 1: Buraca Grande and Buraca Escura; 2: Lagar Velho; 3: Anecrial and Picareiro; 4: Caldeirão; 5: Casa da Moura and Suão; 6: Bocas; 7: Lapa da Rainha; 8: Salemas and Pego do Diabo; 9: Escoural; 10: Parpalló, Beneito and Los Cendres; 11: Ambrosio; 12: Nerja.

archaeological levels known in the area, ranging from Early Gravettian to Late Magdalenian. Only in the last decade have other Portuguese areas become the focus of systematic research, such as the Côa Valley, the Alqueva region in inland Alentejo, and the Algarve. With the exception of Algarve, the two dozen or so Upper Paleolithic sites that contain preserved faunal remains are located in Estremadura, from the Lisbon peninsula to the area of Coimbra, northern limit of central Portugal (fig. 1).

The Upper Paleolithic of Portugal presents some interesting characteristics that seem to isolate it from the rest of the Iberian Paleolithic, including a clear tendency for a flake technology and the seemingly rare presence of bone technology. Another isolating factor, at least for central Portugal, is the lack of art, in contrast to the northeastern region of Portugal, where the Côa valley preserves a very important open air rock art complex. Also striking is the late persistence of the Middle Paleolithic in Portugal, possibly as late as 27,000 bp radiocarbon years; the first unequivocal Upper Paleolithic occupations are dated to c. 26,500 bp (radiocarbon years). Some authors doubt the Aurignacian exists in Portugal (Bicho 2000), although Zilhão (1995, 2002) defends the presence of the Aurignacian for a short period between 28 and 26,000 bp.

The more important Upper Paleolithic sites are those excavated in the 1980's and 1990's, from which just a few ornaments and bone tools have been recovered, namely the caves of Caldeirão, Picareiro, Anecrial, Buraca Escura, Suão, and Pego do Diabo. In addition to the recently excavated sites, the caves of Salemas and Casa da Moura, and Bocas Rockshelter also yielded artifacts of bone and shell, but these sites were excavated in the late 19th century and in the first half of the 20th century.

There is also the recently published Rockshelter of Lagar Velho, where a Gravettian child burial was excavated, and the remains are argued to be the example of hybridism between Neandertals and Modern Humans (Duarte *et al.* 1999; Zilhão & Trinkaus 2002).

Caldeirão cave has a long sequence starting at least in the final Middle Paleolithic, some 30,000 years ago, and ending with a Medieval occupation. There are important Gravettian, Solutrean and Magdalenian deposits, although no distinctive single occupational level was found at the site (Zilhão 1995). The Upper Paleolithic deposits of Caldeirão Cave are dated between c. 26,500 and 10,000 bp and contain large amounts of lithic materials and faunal remains, shells (for both ornamental and dietary functions), as well as bone tools.

Picareiro cave is a small cavern some 540 meters a.s.l. that contains Gravettian and Magdalenian occupations, overlain by Mesolithic, Early Neolithic and Bronze age deposits (Bicho *et al.* 2003a). The fauna is composed of rabbit, medium sized herbivores (mostly red deer and wild boar), as well as aquatic resources such as fish (probably sardine) and edible shellfish (clams, mussels and cockles). In addition there are also a few perforated shells interpreted to be ornaments, made from *Cerastoderma*, *Nassarius*, and the freshwater gastropod *Theodoxus fluviatilis*.

Anecrial is another small cave a few kilometers from Picareiro with Gravettian, Proto-Solutrean and Solutrean occupations dated between 23,500 and 21,500 bp; the Solutrean level is not yet radiocarbon dated. The faunal preservation is very good at this site, and a few *Littorina obtusata* shells were found (Zilhão 1995; Vanhaeren & d'Errico 2002).

Buraca Escura is a cave located near Coimbra and contains a Paleolithic sequence of Mousterian, Gravettian, and Proto-Solutrean layers (Aubry *et al.* 2001). An interesting aspect of this site is the relatively low number of artifacts compared with the faunal remains. The faunal assemblage is characterized by a significant number of carnivore species and carnivore bones.

A similar situation is observed at Pego do Diabo cave (Valente 2000). This is a small limestone cavity north of Lisbon with Middle and Upper Paleolithic occupations. Based on the presence of Dufour bladelets and a C14 date of c. 28,000 bp, Zilhão has argued the presence of an Aurignacian horizon at this site (Zilhão 1995). The dates of 18,000 bp for the Mousterian level and 2,500 and 23,000 bp for the so-called Aurignacian, as well as the presence of Roman and modern ceramics through the entire sequence, indicates that the site has suffered redeposition. This mixing is probably due to carnivore disturbance and to the Roman occupation of the cave. There is, however, one bone point, probably of Gravettian age.

The cave of Suão was never the object of a full report.

It was excavated in the early 20th century and again starting in 1963. The few short reports on the cave point to the presence of Magdalenian and Epipaleolithic occupations, overlain by more recent prehistoric levels. Zilhão's (1995) recent re-evaluation of some of the materials indicates that some of the Magdalenian levels may, in fact, be Solutrean. Although the cave is fairly rich in artifacts made from skeletal materials, these have never been published in detail. Unfortunately, there has been no study of the numerous ornaments found in Suão and, thus, this material will not be considered here.

The Rockshelter of Lagar Velho is one of the most important Paleolithic sites in Portugal. This is due to the presence of a child burial, as well as a long sequence of natural and anthropogenic levels dating from the early Gravettian to the Solutrean. Faunal preservation is very good, and there are large amounts of skeletal materials in most levels. Some ornaments were recovered from both the burial and other occupations, and a fragment of a bone point was found in mixed deposits, possibly coming from the Late Gravettian occupation.

The site of Vale Boi

The site of Vale Boi was discovered in 1998 during survey work in the Algarve (Bicho 2003; Bicho *et al.* 2003b), which targeted Pleistocene sand dunes and terraces and limestone outcrops. In Western Algarve, Jurassic limestone runs east to west, crossing most of the region at fairly low elevations, usually barely reaching 100 meters a.s.l. Presently, this Jurassic stratum forms the edge of the Atlantic and extends no more than 500 meters inland. The limestone is exposed by river cutting, with valleys running north-south, sometimes along geologic faults and creating small rock-shelters along the way. Small caves can be found in the coastal cliffs, sometimes a hundred meters above the sea.

Vale Boi is located in one of these river valleys. This valley is defined by a series of limestone exposures, some 30 to 50 meters above the alluvial plain. One of those exposures slopes gently down to the alluvial plain, forming a series of steps partly covered by Pleistocene sediments and likely corresponding to the old terraces of the small Vale Boi River. When the site was discovered, its surface was covered by lithic artifacts, bone and shell fragments, an exposed Magdalenian occupation in the process of being eroded away.

Testing of the site of Vale Boi began in 2000 with two 1 m² test pits, designated respectively G25 and Z27, and located some 20 meters apart, half way between the cliff and the alluvial plain (fig. 2). The test pits were placed in some of the flatter areas of the slope, based on the idea that those would be the likely areas where the archaeological levels were better preserved. Initially the team had low expectations about the site preservation because so much material lay exposed on the surface. However, an archaeological deposit about 1.4 m thick was encountered in G25, with early Gravettian, Late Gravettian, Proto-solutrean, Early Solutrean, Late Solutrean and Early Magdalenian components. Lithic artifacts and fauna are spread more or less evenly throughout the sequence, with no sterile layers in between. Below this is over a meter of sediment containing scarce lithic materials and bones, possibly of Mousterian age. Three AMS dates for this sequence come from the middle of the Gravettian c. 24,500 bp (tabl. 1), the end of the Solutrean at 17,600 bp, and the beginning of the Proto-Solutrean that, due to the low N%, 18,500 bp should be considered a minimum date only. The material recovered from the Z27 test pit is Late Gravettian with a date of 22,500 bp. It is over a meter thick and is as rich as G25.

Since 2001, two areas have been opened next to these two units, expanding the horizontal area of the excavation to 12 m². Five other test pits have been started. In these we find well-defined archaeological levels, corresponding to Gravettian, Solutrean, Mesolithic and Early Neolithic occupations. Total horizontal extent of the site size is estimated to be

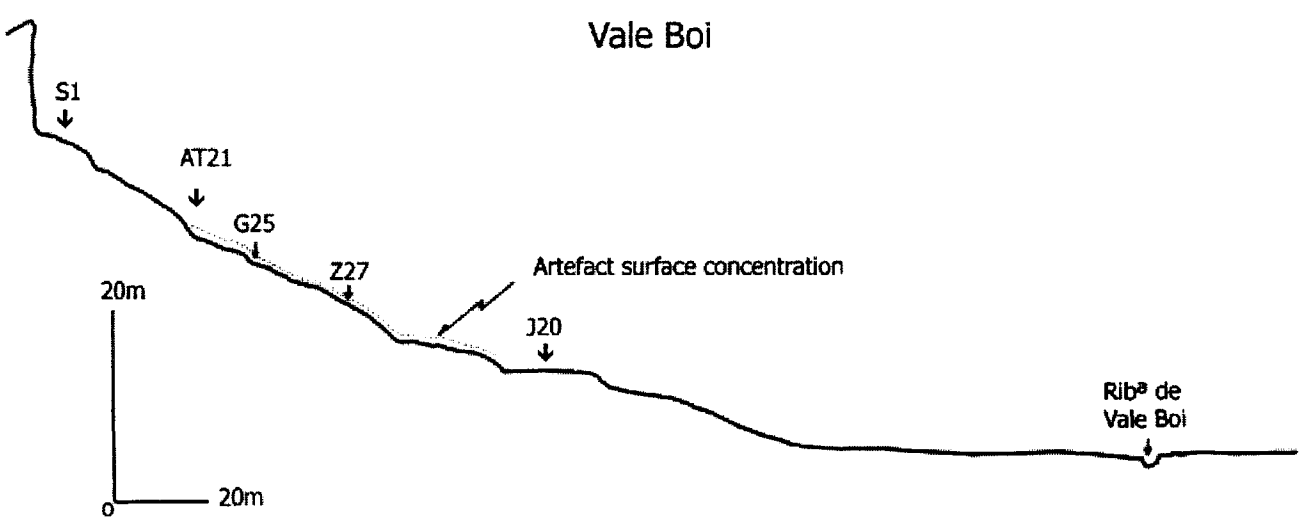

Figure 2. Simplified cross-section of the Vale Boi valley, with the location of test pits.

Level	Period	Lab Code	Material	dC13	Result
G25.4	Upper Solutrean	Wk-12131	bones	-20.0± -.2	17,634±108
G25.10	Proto-solutrean	Wk-12130	bones	-20.0±.2	18,406±164*
Z27.8	Late Gravettian	WK-13686	bones	-19.7±.2	22,469±233
G25.18	Early Gravettian	Wk-12132	charcoal	-23.6± -.2	24,300±205

* since the % N (.18) of this sample was too low, result should be considered a minimum age.

Table 1. AMS dates from Vale Boi.

Spit	Culture*	% Stone**	% Bone	% Shell	Total kg
1-3	early Magdalenian	84	16	0	1.690
4-7	Solutrean	82	18	<1	10.622
8-9	proto-Solutrean	68	30	2	10.429
10	late Gravettian	73	25	2	6.595
11-15	Gravettian	80	19	1	22.631
16-25	Gravettian	59	37	4	19.284

* Culture assignments are preliminary.
**The majority of heavy stone material is fire-cracked rock and/or stone anvils.

Table 2. Weight (kg) percentage distributions for archaeological materials from G25 test pit.

Common name	Latin name	Comments
common limpet	*Patella vulgata*	Modern distribution W Medit. to N Atlantic
china limpet	*Patella ulyssiponensis*	
mussel	*Mytilus edulus/galloprovincialis*	
scallop	*Pecten maximus*	
carpet venus clam	*Ruditapes decussatus*	
rabbit	*Oryctolagus cuniculus*	
fox	*Vulpes* sp.	Almost certainly *V. vulpes*
lynx	*Felis pardina?*	Large-bodied, probably Spanish lynx
bird	indet. Aves	Species undetermined, medium-sized
red deer	*Cervus elaphus*	
wild cattle	*Bos primigenius*	
ibex	*Capra* sp.	Probably *C. pyrenaica*, large-bodied
wild pig	*Sus scrofa*	
horse	*Equus caballus*	Small-bodied type
wild ass	*Equus* sp.	Subgenus *Asinus*, possibly *E. hydruntinus*

Table 3. List of animal taxa identified in the Vale Boi 2000-2001 faunal samples.

roughly 6,000 m², and more than 100,000 artifacts, bones and shells have been recovered thus far.

The results from the G25 and Z27 test pits indicate the presence of middens. Here the fauna makes up about 40% of the weight of the archaeological material recovered (tabl. 2). Some refitting was carried out for the larger shells and some of the bone points, indicating that the deposit has suffered very little disturbance. This is supported by the presence of a wide range of sizes of the lithic materials, ranging from many small chips (smaller than 5 mm) to large artifacts weighing over 1 kg, and the presence of faunal remains in anatomical position.

The mammalian fauna (tabl. 3) includes the remains of red deer (*Cervus elaphus*), two small equids (*Equus caballus* and possibly an asine equid), wild goat (*Capra* sp.), aurochs (*Bos primigenius*), wild boar (*Sus scrofa*), and rabbit (*Oryctolagus cuniculus*). The relative frequencies of these species change through time, probably due to changes in the distance to the coast with reduced sea level during the LGM (Stiner 2003a; Bicho *et al.* 2003). In addition to these prey species, there are scant remains of lynx (*Felis pardina*?) and fox (*Vulpes* sp.).

Marine shells are abundant in the Gravettian deposits. The species represented associate with rocky shores as well as

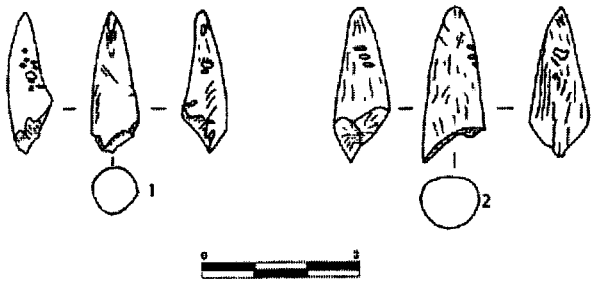

Figure 3. Bone points from Bocas rockshelter.

sandy bottoms. The shell assemblages are composed mostly of rock-dwelling limpets (two different species of *Patella*), but mussels (*Mytilus*), cockles (*Cerastoderma edule*) scallops (*Pecten maximus*), and clams (*Venerupis decussata*) are also present. The frequency of shells drops after the Proto-solutrean, and they are completely absent from the early Solutrean. The species discussed so far almost certainly represent food debris. Rare small shells instead served as ornaments, specifically the small, colorful marine gastropod known as *Littorina obtusata*.

Stiner's recent analysis of the faunal material from the two test pits indicates frequent exploitation of quick small game (rabbits) in addition to littoral shellfish, and heat-in-liquid grease rendering from medium and large ungulate bones (Stiner 2003a). This evidence points to expanding dietary breadth and intensification in carcass processing techniques starting in the early Gravettian.

Bone tools and ornaments

Bone tools are rare in the Portuguese Paleolithic. They have been the focus of two papers, one by Chauvière (2002) on the materials from Caldeirão cave, and another by Cardoso and Gomes (1994) on the sagaies from various Portuguese sites. In both cases, the research considered all types of worked bone, whereas we wish to address only the presence of projectile bone tools.

The very low numbers of bone tools, projectile or otherwise, from Central Portugal does not appear to be the consequence of poor preservation conditions; although the extent of skeletal preservation varies among sites, many preserve fauna in large quantities, and some of these materials are in very good condition. The lack of bone tools more likely reflects cultural characteristics of the Upper Paleolithic hunter-gatherers of central Portugal.

Only a few fragments of bone projectile weapons were recovered from these sites (tabl. 4) and most of them are broken apical fragments, usually less then 3 cm long. The mesial and basal fragments are, in general, less well preserved than the tips. Some of the tips found in Late Magdalenian deposits are made of antler (fig. 3); these are polished and pointed, although not very sharp, sometimes heated, probably to har-

Sites	Chronology	Excavated area (m²)	Complete	Apical frag.	Proximal and mesial frag.	Total
Pego do Diabo	Early UP	12	-	1	-	1
Casa da Moura	Gravettian	160	2	3	3	8
Salemas	Gravettian	45	1	2	-	3
Total	**Gravettian**	**217**	**3**	**6**	**3**	**12**
Caldeirão	Solutrean	26	-	4	1	5
Escoural	Solutrean	?	1	1	-	2
Salemas	Solutrean	45	1	-	1	2
Lagar Velho	Solutrean?	9?	-	1	-	1
Lapa Rainha	Solutrean	?	-	2	-	2
Buraca Grande	Solutrean?	?	1	3	4	8
Total	**Solutrean**	**>70**	**3**	**11**	**6**	**20**
Bocas	Magdalenian	30?	-	2	-	2
Buraca Grande	Magdalenian	?	1	-	-	1
Caldeirão	Magdalenian	26	-	1	4	5
Picareiro	Magdalenian	31	-	2	-	2
Suão	Magdalenian	?	-	-	1	1
Total	**Magdalenian**	**>90**	**1**	**5**	**5**	**11**
Vale Boi	Gravettian	7	3	4	5	12
Vale Boi	Solutrean	9	-	1	1	2

Table 4. Bone points from Portuguese sites.

den the tip. One of the artifacts found in Bocas is decorated with three oblique lines on the side of the tool. Some artifacts may not be projectile points at all, since they exhibit slight curvature relative to their main axis.

There are only a few complete or fairly complete bone points from central Portugal. These are from old excavations, with the exception of the Magdalenian sagaie from Buraca Escura in the Coimbra region.The morphology is similar in all cases with long, more or less parallel sides. There seem to be two groups of sagaies based on overall dimensions, one group between 15 and 18 cm long, and a second group less than 10 cm. Their maximum diameter is between 8 and 13 mm. Their tips have round cross-sections, while the bases are usually flattish. In the cases where the outside (natural) surface of the bone is retained, the cross-section of the mesial area is circular or oval. In the specimens where the spongy area of the mesial section has been exposed and partially polished, the cross-section tends to be flat. The base is always thinned, although not pointed, usually starting at about a third of the total length of the projectile. About half these artifacts are slightly decorated on one side, with parallel lines, frequently oblique, and transversally placed in relation to the main axis of the artifact.

Three complete Gravettian projectiles have been recovered from Vale Boi so far, and only one follows this general typology (fig. 4). It was found in several pieces in two adjacent units (G25 and G24) that date to c. 24,500 bp. Its length is more than 14 cm (the tip is missing) with a round cross-section 8.5 mm in diameter. The two other examples are very different. One is a double pointed, symmetrical type slightly over 6 cm in length, less than 6 mm in diameter, with a circular cross-section. There are similar artifacts in Nerja cave, near Málaga, interpreted as fish gorges (Aura & Pérez Herrero 1998). The third sagaie is about 85 mm long, with a broken tip, suggesting an impact fracture. The diameter increases towards the base, reaching its maximum at about one tenth of its length, where it terminates in a robust pointed base. The cross-section is also circular, with a maximum diameter of about 10 mm.

The bone point fragments from Vale Boi seem to form

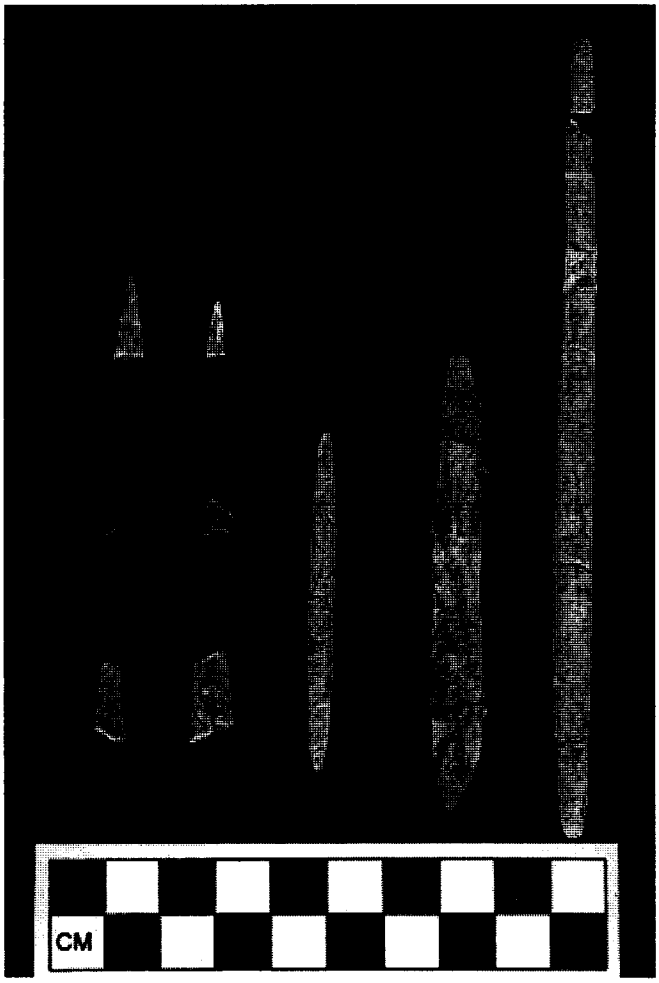

Figure 4. Vale Boi bone points.

two different groups. One, present from the Gravettian to Solutrean times, possesses thin tips and the mesial fragments are similar to those found in the sites of Central Portugal. The other group, coming only from the Gravettian deposits, is composed of thick and robust fragments and these seem quite different from those found in the Estremadura sites. In terms of bone tool frequencies, there seem to be two phases at Vale Boi. The first, corresponding to the Gravettian, is marked by a high incidence of bone projectiles. A second phase, probably starting in the Proto-solutrean and continuing through to the Magdalenian, seems to have involved very little use of bone technology, at least at this site. This phase better resembles the situation in Central Portugal, where bone technology was scarcely used.

The shell and teeth ornaments are frequent in Portuguese Upper Paleolithic sites (tabl. 5). These are mainly pendants, made by different technologies. The shell pendants are perforated near the lip of the shell, and the perforations are usually less than 5 mm in diameter and tend to be oval in shape, based on a detailed study by Vanhaeren and d'Errico (2002) on the *Littorina obtusata* shells from Caldeirão, Lagar Velho, and Anecrial. In addition, there are also two studies on the shells from Caldeirão, one focusing the artifacts

Sites	Chronology	Excavated area (m²)	*Littorina ob.*	Other shell species	Perforated red deer canine	Other ornamental teeth	Total ornaments	Pendents/Sq. meter
Lagar Velho	Grav. burial	2	2	-	4	-	6	3
Caldeirão	Gravettian	5	-	1	-	-	1	0.2
Lagar Velho	Gravettian	37	2	-	3	-	5	0.1
Total	**Gravettian**	**44**	**4**	**1**	**7**	**-**	**12**	**0.3**
Caldeirão	Proto-solutrean	7	1	1	-	-	2	0.3
Buraca Escura	Proto-Solutrean	24	-	-	3	1	4	0.2
Total	**Proto-solutrean**	**31**	**1**	**1**	**3**	**1**	**6**	**0.2**
Caldeirão	Solutrean	26	20	6	2	-	28	1.1
Buraca Grande	Solutrean	60?	?	?	1	-	1	?
Lagar Velho	Solutrean	2?	1	-	-	-	1	.5?
Anecrial	Solutrean	6	4	-	-	-	4	0.7
Total	**Solutrean**	**>35**	**5**	**-**	**3**	**-**	**8**	**<.2**
Caldeirão	Magdalenian	26	8	17	-	-	27	1
Picareiro	Magdalenian	31	-	4	-	-	4	0.1
Total	**Magdalenian**	**56**	**8**	**21**	**-**	**-**	**29**	**0.5**
Vale Boi	Gravettian	6	21	-	1	2	24	4
Vale Boi	Proto-solutrean	7	11	-	-	-	11	1.6
Vale Boi	Solutrean	7	6	-	-	1	7	1

Table 5. Perforated shells and tooth pendants from Portuguese Upper Paleolithic sites.

(Chauvière 2002) and the other dealing with problems related to the paleobiology and paleogeography of the marine and fresh water mollusks (Callapez 2003).

A wide variety of shells from both riverine and marine environments were used by the Paleolithic people at Caldeirão. These were *Theodoxus fluviatilis* and *Unio* sp. from fresh- or brackish water habitats, and *Littorina obtusata*, *Aporrhais pespelicani*, *Hinia reticuluta*, *Anadara diluvii*, and *Acanthocardia tuberculata* from the Atlantic coast. In addition to the species noted from Caldeirão cave, *Cerastoderma edule* and *Nassarius reticulatus* also occur in Picareiro cave.

Vanhaeren and d'Errico's study of the *Littorina obtusata* from Lagar Velho, Caldeirão, and Anecrial yield interesting results on the significance of their presence, links between the Gravettian burial and the regional Gravettian, patterns of cultural choice and of technological aspects of production. Vahaeren and d'Errico assume that the body ornaments coming from the burial are able to reflect, by such characteristics as raw material, color, species, shape and size, aspects of the material and symbolic culture of the mourners. In addition to an analysis of color and shell length, and width of the first spiral whorl in modern and archaeological specimens, they observed the characteristics of perforation, including technique, maximum and minimum perforation diameter, and the location of the use wear. According to Vanhaeren and d'Errico (2002:169) and based on a series of studies (Dautzenberg & Fischer 1914; Smith 1974; Reid 1996), there are at least eight color morphs in *L. obtusata*. Most of these color morphs cannot be isolated in terms of their shape or size of the shell. The exceptions are the *citrina* and *fusca* groups, where the first is clearly smaller than the second. The importance of distinguishing between the color morphs is that the colors could have been the decisive element to choose certain shells on the coastal strip. The analysis carried out by Vanhaeren and d'Errico demonstrated a statistically significant difference between the archaeological specimens from Estremadura and the citrina color morph group; no such difference is found for the fusca cluster. On the European coast, the most common color morphs are fusca and olivacea, the larger sized shells. The authors argue that the pattern seen in the archaeological assemblages is due to humans' selective preference for certain colors, since the bias in the archaeological ornament assemblages, and thus the pairing of size/color may reflect symbolic and social markers. Strong color and shape preferences are widely apparent in Mediterranean shell ornaments, some aspects of which adhere strongly to local variations in mollusk community structure (e.g. preferences for certain taxa and trophic groups), but other preferences such as general form and size seem to transcend the changes in material culture that archaeologists use to distinguish Upper Paleolithic phases (Stiner 1999, 2003b).

The site of Vale Boi contains ornaments made on shells (fig. 5) from *L. obtusata* and *L. mariae* (also known as *fabalis*), a very similar shell and easily mixed with the *obtusata* species. The *L. mariae* shells in nature are, on average, smaller than the *obtusata*, and they tend to be yellowish in color. A total of 27 shells from Vale Boi have been analyzed thus far (4 Solutrean, 9 Proto-solutrean, and 14 Gravettian). About half of the specimens from the Gravettian deposits display dimensions outside of the fusca range; two are within the citrina range while one of the larger (fusca) shells is not perforated. Thus the tendency during the Gravettian at Vale Boi may have been to use citrina and reticulata shell types (yellow and yellow with darker reticulation), apparently contrasting to the homogenous assemblage from Central Portugal for the same period (fig. 6). This pattern may, however, be due to the

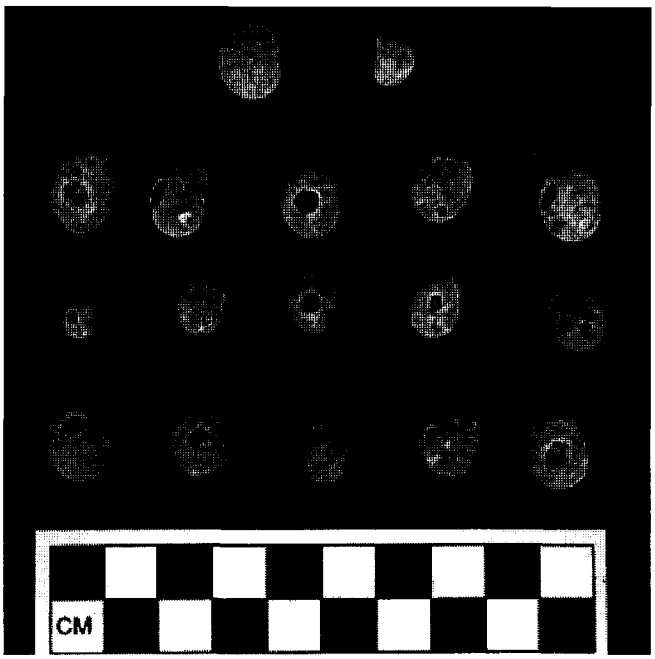

Figure 5. Littorina shells from Vale Boi.

fact that most specimens within the smaller sized group for this period are *L. mariae*. Thus, the pattern may result from a higher species availability of *mariae* then of *obtusata*.

During the Proto-solutrean the pattern seems to have lost some of its importance since the majority of the shells fall within the range of the fusca color and are mostly of *L. obtusata* species (fig. 7), although the samples available for comparison are too small to evaluate statistically. During the Solutrean the pattern observed thus far is exclusive use of large sized shells probably corresponding to the fusca color morph, consistent with what is found for archaeological sites from Portuguese Estremadura (fig. 8).

The tooth pendants from Central Portugal are, with one exception, made on red deer canines. A total of 11 specimens are reported from Buraca Escura, Buraca Grande, Caldeirão, and Lagar Velho. The teeth from the latter two sites, analyzed by Vanhaeren and d'Errico (2002) come from stags and hinds and represent a wide diversity of age classes. Another tooth pendant, an incisor of a bovid, is from Buraca Escura (Aubry *et al.* 2001) and seems to have been produced and used in a manner similar to that for perforated red deer canines. Tooth pendants are more common in the Gravettian than in the later cultural phases; and there are no tooth pendants known for the Magdalenian.

There are four tooth pendents found in Vale Boi thus far. Three tooth pendants, respectively from the Gravettian and Solutrean deposits, were made from the incisors of red deer. They are not pierced but rather were affixed to cord via a fine groove encircling the root tip. In the two cases where the crown is unbroken, the tooth is characterized by heavy occlusal wear, indicating that they originated in an old animal.

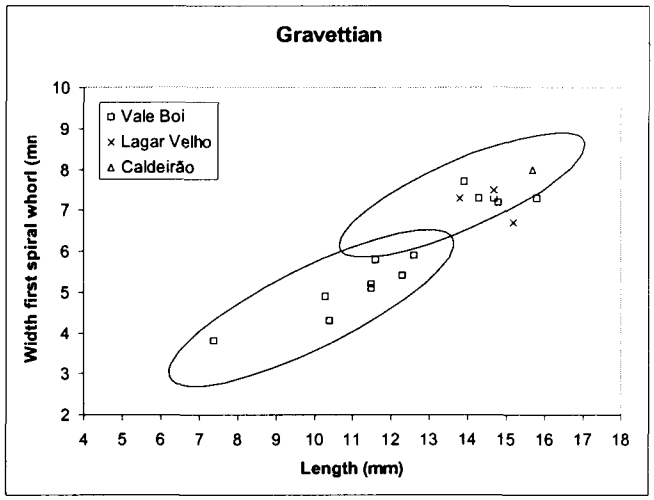

Figure 6. Graph with length and width of spiral whorl of Gravettian shells.

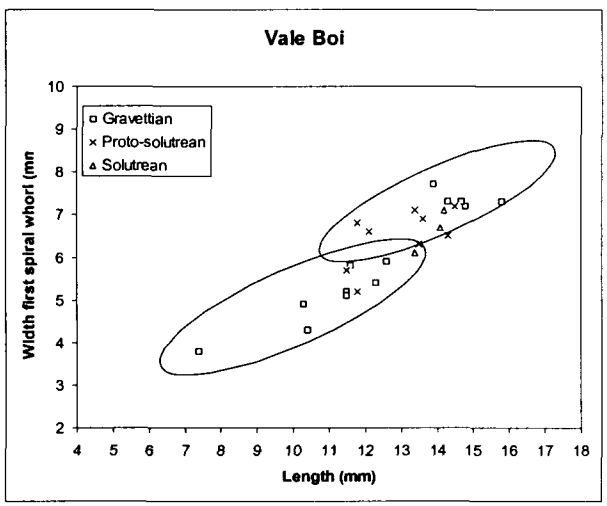

Figure 7. Graph with length and width of spiral whorl of Vale Boi shells.

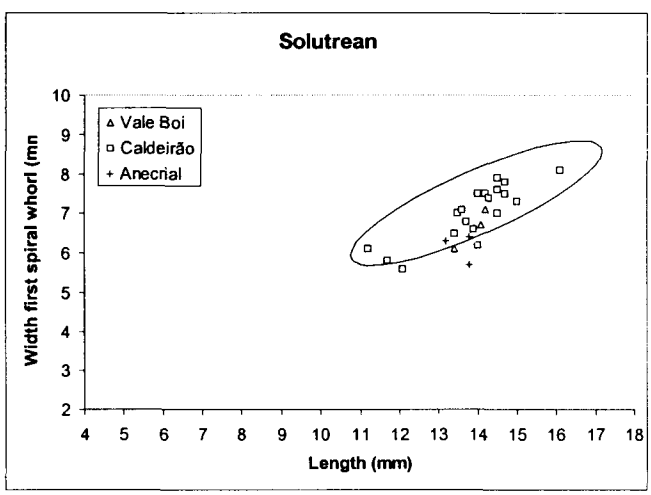

Figure 8. Graph with length and width of spiral whorl of Solutrean shells.

The suspension technique and type of teeth used differ from those tooth pendants found in Estremadura. The last ornament found in Vale Boi is a pendent made on a red deer canine (fig. 9), although no enamel is left on the specimen. The pendent is polished and pierced. It was found in the Gravettian deposits dating to c. 22,500 bp. There are no similar specimens known in Portugal since all examples of red deer perforated canines found in Estremadura are completely covered by dentine. There is a possible similar specimen found in Cova Beneito, South of Valencia, in an Upper Paleolithic deposit of unknown age (Soler Mayor 2001:372).

Archaeological significance of the observed patterns

In Vale Boi the use of perforated shells is common, while other types of ornaments are rare. No red deer canine pendants have been found, and the method of suspending red deer incisors is distinctive.

Bone projectile technology is also frequent in Vale Boi, although mostly in the earlier periods. The bone projectile technology is marked by the presence of two general types (thin and thick projectiles). The use of shells of *Littorina obtusata*, probably of yellow and yellow mottled colors, as body ornaments is also noteworthy. Preliminary evidence therefore appears to isolate the Algarvian site of Vale Boi from the Gravettian of Central Portugal. In the latter region bone tools are rare, fewer shell beads were used, but there was a strong emphasis on tooth ornaments (>60%). In the Proto-solutrean, the difference between Vale Boi and the Estremaduran sites may not be as strong, but the samples available for comparison are still quite small. The first signs of similarity between the two areas nonetheless appear to be in the Solutrean, including a decrease in the frequency of shell beads. The size of the shells is now completely within the range of the fusca color morph, just at it is in the shell ornaments assemblages from Estremadura, and there is a decline in the importance of projectile bone technology in Vale Boi during this period.

The data from the so-called Spanish Levantine coast, stretching from Valencia to Gibraltar, derives from a series of Upper Paleolithic sites, including Nerja, Parpalló, Ambrósio, Beneito, and Los Cendres. The data on bone technology and body ornaments is partially studied and organized in a series of publications (Soler Mayor 2001; Aura 1995; Aura & Pérez Herrero 1998; Cotino Villa & Soler Mayor 1998). The general pattern found at these sites, independently of their chronology, is a high frequency of bone projectile tools, perforated shells with a preference for small sizes (Soler Mayor 2001:376), and the near absence of tooth ornaments (none in the Gravettian, 8 specimens in the later periods in contrast to a few hundred shell ornaments).

The data presented above suggest stronger cultural connections between the Gravettian of Vale Boi and that of the Mediterranean Spain, less to the sites of Central Portugal.

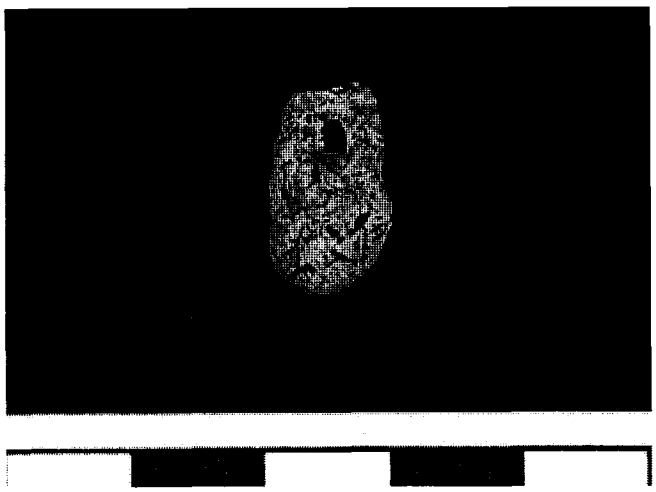

Figure 9. Pendant made on a red deer canine.

After the Proto-solutrean there is a general convergence with the patterns found in Portuguese Estremadura. Other artifactual data also point to cultural affinities between Vale Boi and the Valencian coast (Bicho *et al.* 2003b). The first similarity is simply the importance of marine shellfish in human diets, specifically limpets, from very early on (Stiner 2003a; Aura 1995; Serrano *et al.* 1998); the second similarity concerns the designs of the Solutrean points from Vale Boi, which are similar both in size and morphology to the weaponry found in the Valencian region (Bicho *et al.* 2003b).

In conclusion, it seems likely that the Gravettian population of Vale Boi had certain stylistic characteristics that connected them with the early Upper Paleolithic groups of the Mediterranean coast. These traits were rather different from the traits observed in the Portuguese Estremadura. There is some evidence of contact or interaction with the second area, however, with respect to the Vale Boi lithic raw materials, some of which clearly came from Estremadura. If these differences can be interpreted as social markers during the Gravettian, they seemed to fade away by the Solutrean. The connection with the Valencian region, however, was still strong during the Solutrean, as the morphology of the projectile points indicates. Perhaps the ornamental elements of southern Portuguese sites represent distinct social and symbolic markers and correspond in some way to land use territories in Iberia. In the present study, they allowed a tentative diachronic map of the social influence of different hunter-gatherer groups that can be tested as the data from Algarve continue to accumulate. The areas occupied by distinct human groups probably changed with time, depending in part upon paleoenvironmental changes and the regional paleogeography in southern Iberia.

Bibliography

AUBRY T., BRUGAL J.-Ph., CHAUVIÈRE F.-X., FIGUEIRAL I., MOURA M., PLISSON H., (2001) - Modalités d'occupations au Paléolithique supérieur dans la grotte de Buraca Escura (Redinha, Pombal,

Portugal). *Revista Portuguesa de Arqueologia* 4(2):19-46.

AUBRY T. & MOURA H., (1994) - Paleolítico da Serra de Sicó. *Trabalhos de Antropologia e Etnologia* 34(3-4):43-60.

AURA E., (1995) -*El Magdaleniense Mediterráneo: La Cova del Parpalló (Gandia, Valencia)*. Valencia: Diputación Povincial de Valencia.

AURA E. & PÉREZ HERRERO C., (1998) - Micropuntas dobles o anzuelos? Una propuesta de estudio a partir de los materiales de la Cueva de Nerja (Málaga). *In*: J. Sanchidrián Torti & M. Simón Vallejo (eds.), *Las Culturas del Pleistoceno Superior en Andalucia*. Nerja: Patronato de la Cueva de Nerja, p. 339-348.

BICHO N., (1994) - The end of the Paleolithic and the Mesolithic in Portugal. *Current Anthropology* 35(4):664-674.

BICHO N., (2000) - Paleolithic Occupation and Environment of Central and Southern Portugal during Isotopic Stages 2 and 3. *In*: P. Vermeersch & J. Renault-Miskovsky (eds.), *European Late Pleistocene Isotopic Stages 2& 3: Humans, their Ecology and Cultural Adaptations*. Liège: ERAUL 90:43-56.

BICHO N., (2003) - A importância dos recursos aquáticos na economia dos caçadores-recolectores do Paleolítico e Epipaleolítico do Algarve. *Xelb* 4:11-26.

BICHO N., STINER M., LINDLY J., FERRING C.R., CORREIA J., (2003a) - Preliminary results from the Upper Paleolithic site of Vale Boi, southwestern Portugal. *Journal of Iberian Archaeology* 5:51-66.

BICHO N., HAWS J., HOCKETT B., MARKOVA A., BELCHER W., (2003b) - Paleoecologia e Ocupação Humana da Lapa do Picareiro: resultados preliminares. *Revista Portuguesa de Arqueologia* 6(2):49-81.

CACHO C. & RIPOLL S., (1988) - Industria óssea. *In*: S. Ripoll (ed.), *La Cueva de Ambrosia (Almeria, Spain) y su posicion cronoestratigráfica en el Mediterraneo Ocidental*. Oxford: BAR, vol. II, p. 400-415.

CALLAPEZ P., (2003) - Moluscos marinhos e fluviais do Paleolítico Superior da Gruta do Caldeirão (Tomar, Portugal): evidências de ordem sistemática, paleobiológica e paleobiogeográfica. *Revista Portuguesa de Arqueologia* 6(1):5-15.

CARDOSO J. & GOMES M., (1994) - Zagaias do Paleolítico Superior de Portugal. *Portugalia* (Nova Série) 15:7-31.

CHASE P. & DIBBLE H., (1987) - Symbolic behaviour in the Middle Paleolithic: a review of current evidence and interpretations. *Journal of Anthropological Archaeology* 6:263-296.

CHAUVIÈRE F., (2002) - Industries et parures sur matières dures animales du Paléolithique supérieur de la grotte de Caldeirão (Tomar, Portugal). *Revista Portuguesa de Arqueologia* 5(1):5-28.

COTINO VILLA F. & SOLAR MAYOR B., (1998) - Ornamento sobre malacofauna: una perspectiva regional. *In*: J. Sanchidrián Torti & M. Simón Vallejo (eds.), *Las Culturas del Pleistoceno Superior en Andalucia*. Nerja: Patronato de la Cueva de Nerja, p. 301-324.

D'ERRICO F., ZILHÃO J., JULIEN M., BAFFIER D., PELLEGRIN J., (1998) - Neanderthal acculturation in Western Europe? A critical review of the evidence and its interpretation. *Current Anthropology* 39:S1-S44.

DUARTE C., MAURÍCIO J., PETTITT P., SOUTO P., TRINKAUS E., PLICHT H., ZILHÃO J., (1999) - The early Upper Paleolithic human skeleton from the Abrigo do Lagar Velho (Portugal) and modern human emergence in Iberia. *PNAS* 96:7604-9609.

FULLOLA J., (1985) - Les pièces à ailerons et pédoncule comme élément différentiel du Solutréen ibérique. *In*: M. Otte (ed.), *La signification culturelle des industries lithiques*. Oxford: BAR, p. 339-352.

MARSHAK A., (1989) - Early hominid symbol and evolution of the human capacity. In: P. Mellars (ed.), *The Emergence of Modern Humans*, p. 457-498.

KHUN S., STINER M., REESE D., GÜLEÇ E., (2001) - Ornaments of the earliest Upper Paleolithic: New insights from the Levant. *PNAS* 98(13):7641-7646.

MARKS A., BICHO N., ZILHÃO J., FERRING C.R., (1994) - Upper Paleolithic Prehistory in Portuguese Estremadura: preliminary results. *Journal of Field Archaeology* 21(1):53-68.

SACKETT J., (1972) - Style, Function and Artifact Variability in Paleolithic Assemblages. *In*: C. Renfrew (ed.), *The explanation of Culture Change*. Duckworth, London, p. 317-328.

SACKETT J., (1992) - Style and Ethnicity in Archaeology: the Case for Isochrestism. *In*: M. Conkey & C. Hastorf (eds.), *The use of style in Archaeology*. Cambridge University Press, Cambridge, London, New York, p. 32-43.

SERRANO F., GUERRA-MERCHÁN A., LOZANO-FRANCISCO M., VERA-PELÁEZ J., (1998) - Los restos alimentarios de malacofauna de los homínideos del Pleistoceno Final y Holoceno de la Cueva de Nerja (Málaga, España). *In*: J. Sanchidrián Torti & M. Simón Vallejo (eds.), *Las Culturas del Pleistoceno Superior en Andalucia*. Nerja: Patronato de la Cueva de Nerja, p. 359-380.

SOLER MAYOR B., (2001) - Adorna, imagen y comunicación. *In*: V. Villaverde (ed.), *De Neandertales a Cromañones. El inicio del poblamiento humano en las tierras valencianas*. Valencia: Universitat de València, p.367-376.

STINER M., (1999) - Trends in Paleolithic mollusk exploitation at Riparo Mochi (Balzi Rossi, Italy): food and ornaments from the Aurignacian through Epigravettian. *Antiquity* 73(282):735-754.

STINER M., (2003a) - Zooarchaeological evidence for resource intensification in Algarve, southern Portugal. *Promontoria* 1:27-61.

STINER M., (2003b) - "Standardization" in Upper Paleolithic Ornaments at the Coastal Sites of Riparo Mochi and Üçagizli Cave. *In*: J. Zilhão & F. d'Errico (eds.), *The Chronology of the Aurignacian and of the Transitional Technocomplexes: Dating, Stratigraphies, Cultural Implications*. Lisbon: Instituto Português de Arqueologia, Trabalhos de Arqueologia 33:49-59.

VALENTE M., (2000) - *Arqueozoologia e Tafonomia em contexto paleolítico. A Gruta do Pego do Diabo*. Unpublished Master Thesis, Faculdade de Letras, Universidade de Lisboa.

VANHAEREN M. & D'ERRICO F., (2002) - The body ornaments associated with the burial. *In*: J. Zilhão & E. Trinkaus (eds.), *Portrait*

of the Artist as a Child. The Gravettian Human Skeleton from the Abrigo do Lagar Velho and its Archaeological Context. Lisboa: IPA, p. 154-186.

VILLAVERDE V., (1994) - Le Solutréen de faciès ibérique: caractéristiques industrielles et artistiques. *In*: *Le Solutréen en Péninsule ibérique*. Mâcon: Musée Départamental de Solutré, p. 11-29.

WIESSNER P., (1983) - Style and social information in Kalahari San projectile points. *American Antiquity* 49:253-276.

ZILHÃO J., (1995) - *O Paleolítico Superior da Estremadura Portuguesa*. Unpublished Ph.D. dissertation, Faculdade de Letras, Universidade Clássica de Lisboa.

ZILHÃO J., (2002) - O Paleolítico Superior português 30.000 anos depois. *Arqueologia e História* 54:41-56.

ZILHÃO J. & F. D'ERRICO F., (1999) - The chronology and taphonomy of the earliest Aurignacian and its implications for the understanding of Neandertal extinction. *Journal of World Prehistory* 13:1-68.

ZILHÃO J. & TRINKAUS E. (eds.), (2002) - *Portrait of the Artist as a Child. The Gravettian Human Skeleton from the Abrigo do Lagar Velho and its Archaeological Context*. Lisboa: IPA.