NOT ONLY FOOD

2ND MEETING OF THE ICAZ ARCHAEOMALACOLOGY WORKING GROUP

SANTANDER (SPAIN) FEBRUARY 19TH-22ND, 2008

ABSTRACTS & FIELD TRIPS GUIDEBOOK

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Foreword

The 10th ICAZ Conference was held in Mexico City in 2006. At the end of the session dedicated to Archaeomalacology, organized by Dr. Canan Cakirlar and Dr. Victoria Stosel, the Archaeomalacological Working Group met to decide where and when the Second Meeting of the Group would take place. Out of the different proposals, ours was finally the one that was accepted with the greatest enthusiasm.

In this way, three years after the First Meeting of the Archaeomalacology Working Group, which was held in Gainesville (USA), the Second Meeting took place in Santander.

Ever since the preparations for the Working Group Meeting began, the idea of the reunion was welcomed enthusiastically by the *Instituto Internacional de Investigaciones Prehistóricas de Cantabria* (IIIPC), by the University of Cantabria and by the *Consejería de Cultura, Turismo y Deporte* of the Government of Cantabria.

The Meeting, held from February 19th to 22nd, included two days of scientific sessions at the University of Cantabria (*Escuela Superior de Marina Civil*) and two field trips. This book is intended to be used as a guide for those trips, but it may also be considered a general introduction to the exploitation of marine resources at archaeological sites. Three texts about archaeological sites (El Toralete and Cuevas del Mar shell middens, Tito Bustillo Cave, the rock art site of Peña Tu and Altamira Cave) are also included.

It is an act of justice and a pleasure to acknowledge the Institutions and persons that contributed to the success of this Meeting, and particularly to the field trips and to the edition of this book. In the first place, the institutions that supported it: *Consejería de Cultura, Turismo y Deporte* of the Government of Cantabria, University of Cantabria and *Instituto Internacional de Investigaciones Prehistóricas de Cantabria*. We are also grateful to the *Ayuntamiento de Santander*, which received the participants at the Meeting at the Royal Palace of La Magdalena. The field trips would have not been possible without the valuable help of the *Consejería y*

Turismo of the Government of the Principality of Asturias, and the staff at the sites of Tito Bustillo, Peña Tu and Altamira; the *Museo Regional de Prehistoria y Arqueología de Cantabria* and the *Museo Marítimo del Cantábrico*. The closing ceremony of the Meeting was held at the latter museum.

Our special thanks to the generosity of several colleagues who shared their time and experience explaining their field research *in situ* to the participants: Dr. Mikel Fano (El Toralete and Cuevas del Mar) and Pablo Arias Cabal (Peña Tu). And finally, our special thanks to some people without whom this Meeting would have not been possible: César González Sainz, Mikel Fano, Roberto Ontañón Peredo and Rodrigo de Balbín Behrmann, authors of some of the texts in this book; Peter Smith, who translated the Spanish originals into English; but also Carla Cifrián, Miriám Cubas, Marián Cueto, Cristina García-Moncó, Moncho Gelabert who were of most valuable assistance in the organisation of the Meeting and the fieldtrips.

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ARTICLES

Not only food: Marine, Terrestrial and Freshwater Molluscs in Archaeological Sites.

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The invertebrate remains most commonly encountered at archaeological sites are those of the phylum Mollusca. This Phylum is divided into eight classes, three of which are usually found in the archaeological record: Gastropoda (snails), Bivalvia (bivalves) and Scaphopoda (tusk shells). All three have an external skeleton, the shell, made of calcium carbonate.

Most of the molluscs that are recovered in archaeological deposits were gathered on the sea-shore (gastropods, bivalves and scaphopods), but terrestrial gastropods are also common and to a lesser extent also fresh water species (gastropods and bivalves). These were collected on the banks of rivers, springs and lakes.

Food

The earliest evidence of the exploitation of molluscs by modern humans is in relation with their use as food. The oldest testimony to the gathering of marine molluscs comes from the deposit at Pinnacle Point, on the southern coasts of South Africa, and goes back to MIS6. There, remains mainly of the bivalve *Perna perna* were found in Level LC-MSA Lower, dated by OSL to 164 ±12 kyr (Marean *et al.* 2007).

However, the systematic exploitation of molluscs took place much later, in the transition from the Pleistocene to the Holocene. This systematic exploitation is surely related to the evolution of coastal environments and geological processes (Oyuela-Caycedo 1996)

Thus, for example, in the case of Cantabrian Spain, shell middens or *concheros* are characteristic deposits of that period. These are large accumulations of marine and terrestrial molluscs, which in the east of the region of Asturias (Asturian shell middens) are made up mainly of two gastropod species: *Patella* sp., and *Osilinus lineatus* (Fano Martínez 1998) **(Fig. 1, left)**.

In addition, and possibly after the end of the Pleistocene, terrestrial gastropods were added to the diet of hunter-gatherer groups, and their *escargotieres* are found at sites located throughout the Mediterranean region, and also in other parts of our planet (Lubell 2004).

In South America, archeological research conducted at Quebrada Jaguay in south coastal Peru demonstrated that Paleoindian-age people of the Terminal Pleistocene (about 11,100 to 10,000 BP) made use of molluscs as food (Sandweiis *et al.* 1998). Other early evidence of shellfish exploitation is dated between 8000 BP - 5000 BP and was found at coastal sites in Ecuador (Meggers *et al.* 1965; Stahl 2003; Stothert 1985), Colombia (Angulo 1988; Bischof 1966; Oyuela-Caycedo 1996; Reichel-Dolmattoff 1965, 1985; Santos & Ortiz 1986; Stahl & Oyuela-Caycedo 2007) and Brasil (Roosevelt *et al.* 1991; Suguio 1993; Willey 1971). In North and Central America shell mounds dated between 9000-5000 BP are found in many areas including north west Mexico (Voorhies 2004), the Pacific Coast of North America (Lightfoot 1993), California (Glassow 1992), Florida (Widmer 1989), Texas (Ricklis 1995), Alaska (Browman 1996) and Panama (Borgogno & Linares 1980; Hansell 1983; Willey *et al.* 1954) **(Fig. 1, right)**.

Figure 1. Left: Asturian pick with shell midden remains adhered to it; Right: Archipelago de las Perlas shell midden, Panamá, associated with Cubitá pottery (500 BC).

Data on the cultivation of marine molluscs goes back to the Roman Empire, when there is evidence, for example, that oysters were cultivated, as has been recorded at *Virunum* (Carinthia, Austria) and dated approximately between 300 and 400 AD (Galik *et al.* 2006). In the case of the mussel *(Mytilus galloprovincialis)*, its cultivation has been documented on the Biscay coast as far back as the 13th Century BC (Yonge 1984).

Regarding the cultivation of terrestrial molluscs, according to Pliny, the earliest evidence also dates to the Roman period (Elmslie 1984).

Pendants

As shells are not very hard (hardness: 3 on the Mohs scale) they make easy raw material to be transformed into suspended objects of adornment. In order to put these objects in suspension, they were usually perforated, but notches were also used (Álvarez Fernández 2006; Bar-Yosef Mayer 2008; Taborin 1993).

The earliest dated evidence of the manufacture and use of shell beads comes from North Africa. A total of 13 perforated gastropods belonging to the species *Nassarius gibbosulus* were found in levels ascribed to the Middle Stone Age (MSA) at Grotte des Pigeons (Taforat, Morocco) dated to about 82,000 $BP_{TL\ /\ ESR\ /\ U\text{-}series}$ (Bouzouggar *et al.* 2007). Two *Nassarius gibbosulus* beads reported from layer B at Es-Skuhl (associated with the burials of Anatomically Modern Humans) as well as one of the same species at Oued Djebbana (Aterian), in Algeria (Vanhaeren *et al.* 2006), are probably as old as ca. 100ka BP. **(Fig. 2, right)**. However, this antiquity is controversial due to the largely unknown chronology of the Aterian and doubts as to the age of layer B at Skuhl (Zilhão 2007).

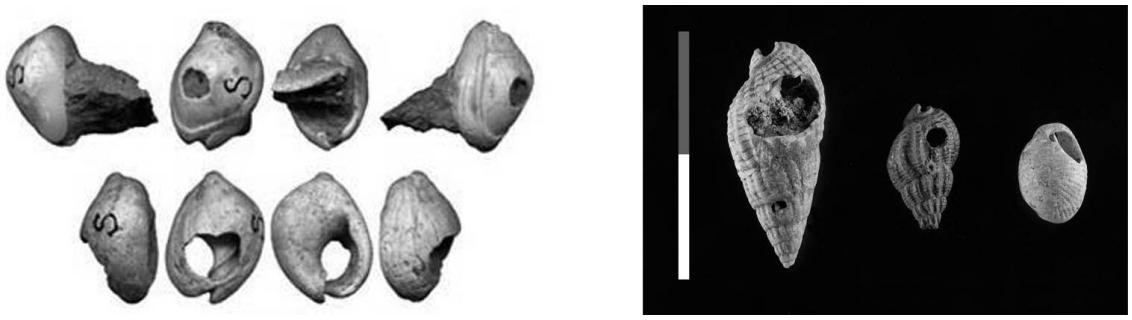

Figure 2. Left: Perforated *Nassarius gibbosulus* beads from Es-Skuhl; Right: Perforated marine shells from the Upper Magdalenian levels at La Garma A (Omoño, Cantabria, Spain): *Nassarius reticulatus*, *Nassarius incrassatus* and *Trivia* sp.

Therefore, Anatomically Modern Humans were the only hominids to manufacture suspended objects of adornment. Early *Homo sapiens* were the likely producers of shell beads not only at sites in Africa and the Near East. They are also responsible for the first shell beads identified in Europe which are attributed to the Protoaurignacian and Aurignacian technocomplexes (Álvarez-Fernández & Jöris 2008). From the beginnings of the Upper Palaeolithic, beads made from Atlantic and Mediterranean shells are found at great distances from either coast (sometimes over 500km away). This is a clear indication of the existence of long-distance relationships that suggest a

strongly interwoven social fabric, facilitated by communication along the river valleys (Álvarez Fernández, 2006; in press) **(Fig. 2, left)**.

In western Europe, pearls made from valves of the Cardiidae family become particularly important in the Neolithic period (Álvarez Fernández, in press).

The long distance contacts referred to above have been noted in other periods and regions. For example, shells of the fresh water bivalves *Arpartharia* and *Mutela* from the River Nile and its tributaries, have been recovered in different burials and shrines in Greece, Tunisia, Turkey and Palestine, from the Natufian period to the Byzantine age (Reese *et al.* 1986).

In America, early evidence of the use of molluscs as raw material for adornments by hunter-gather societies is found in sites in North and South of the continent. For example, two pieces of purple olive shell *(Olivella biplicata)* possibly represent bead-making debris, produced by Santa Barbara Channel peoples in North America (Erlandson *et al.* 1999). Holocene artifacts found within the Dasy Cave rockshelter sediments include a "bead-maker's kit" containing purple olive *(Olivella biplicata)* shell bead blanks, shell fishhook blanks, small chert bladelets and bladelet drills used in bead-making (Erlandson *et al.* 1996).

In Colombia at the site called Tequendama, a site near present-day Bogotá and dated around 9000 BP were found two beads made of freshwater molluscs were found in a burial context (Correal and Vam der Hamen 1971).

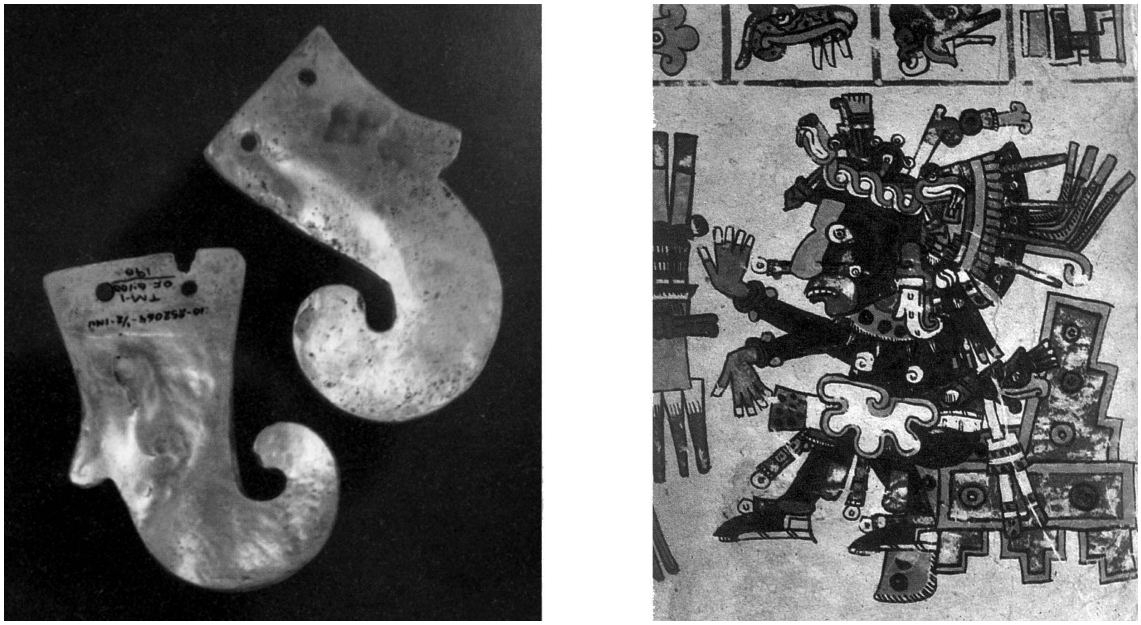

Figure 3. Left: Ear-rings *(epcalotli)* found in the excavations at the Great Temple at Tenochtitlan. Right: The god Quetzalcóatl with this type of ear-ring in the Borgia Codex.

As well as beads, it has been seen in Mesoamerica that shells were used to make large pendants, chest adornments, ear-rings, bracelets, etc., like those found at the Great Temple at Tenochtitlan, where their position on the body has been represented in various graphic sources (Suárez Diez 2004) **(Fig. 3).**

Adornments from Archaic archaeological sites on the Caribbean Coast and lowlands that date between 5900-2900 BP are the evidence of the use of marine shell as raw material. Some of these sites were found in the Antilles (Davis 1982; Moravetz, 1999), Colombia, Ecuador, (Archila 1993; Oyuela-Caycedo 1993; Legros 1992; Reichel-Dolmatoff 1965; Reichel-Dolmatoff & Reichel-Dolmatoff 1956; Stahl & Oyuela-Caycedo 2007; Oyuela-Caycedo & Bonzani 2005; Stothert 1985) and Panama (McGimsey 1956).

These shell jewellery was used by the Elite as prestigious objects. Artefacts made from Spondylus and Conus shells were often interred with high status individuals in Moche burials in Peru (Hill 1998). In Andean societies the Andes, nacreous pearl oyster (Pinctada or Pteria shells) was associated with lightness, brightness and royalty (Mester 1990).

The Manufacture of Artefacts

The first evidence of the use of shell material as raw material for the manufacture of artefacts has been found in Mediterranean Europe and is attributed to the Mousterian period (at Moscerini, etc.), and consequently, made by the Neanderthal groups. Here shells of different bivalves (e.g. *Callista chione*) have been recorded, made into implements by means of percussion retouch around their edges (Stiner 1994) **(Fig. 4, left)**.

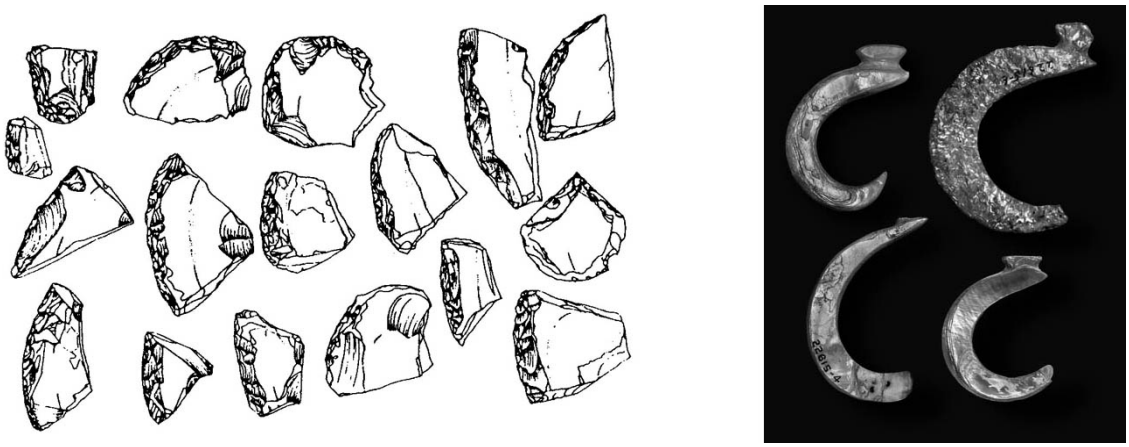

Fig. 4. Left: Side-scrapers made from *Callista Chione* valves at Moscerini. Right: Shellfishhook from a californian site.

In the case of Asia, artefacts made from the opercula of *Turbo marmoratus* have found at Golo Cave (Gebe Island, Indonesia) between 32,000-28,000 BP (Szabó *et al.* 2007). However, none of these examples of artefacts have been studied further, by examining the wear marks of their use or by residue analysis, in order to determine how they were used by human groups. In the case of Europe, the first clear evidence is not until the Neolithic, e.g. at Grotte Champrafaud, in France (Vigié 1987).

In America, early shellfish-gatherers who produced Valdivia pottery on coastal Ecuador, used fishhooks made of shell (Meggers *et al.* 1965) and Pre-Columbian inhabitants of Monsu, an Archaic archaeological site in Colombia, elaborated adzes on *Strombus* gasteropod (Reichel-Dolmatoff 1985). Fishhooks made of shell were also found in California (Heizer, 1949), **(Fig. 4, right)**.

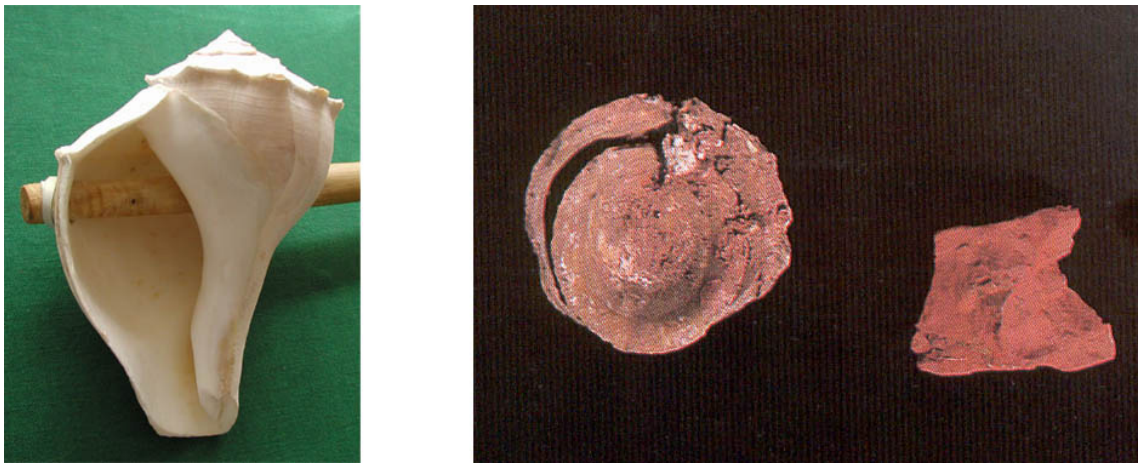

Figure. 5. Left: Calusa shell hammer; Right: *Patella vulgata* with remains of ochre (Photo by Pedro Saura)

Paleoindian and Archaic shell tools were also found in a unique underwater site in Florida called Little Salt Spring (Clausen *et al.* 1979) and the early inhabitants of the Antilles (4,000 BP) developed a characteristic shell tool assemblage that includes gouges, plates, cups, tips and hammers (Keegan 1994) **(Fig. 5, left)**.

Bivalve shells were also used as spoons. For examples at the Islamic site at La Almagra (Huelva, Spain) *Pecten* sp. valves were found affected by fire and worn along their ventral edges (Bernáldez & Bernáldez, 2005).

Shells were already in use as containers in the Upper Palaeolithic. For example, specimens of *Glycymeris* sp. have been found with remains of ochre at Skhul (Bar-Yosef Mayer 2005a). In the Solutrean level at Altamira Cave (Spain) some twenty specimens of *Patella vulgata* with abundant remains of different shades of ochre powder inside them were found in the course of H. Breuil and H. Obermaier's excavations (Álvarez-Fernández, in prep.) **(Fig. 5, right)**.

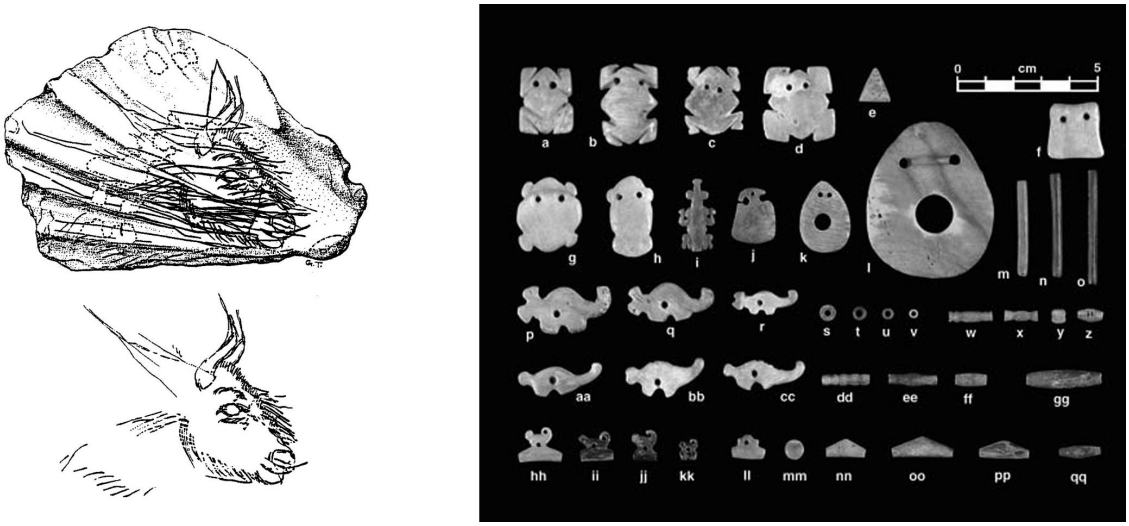

Figure 6. Left: Le Mas d´Azil. Engraved valve; Right: Beads and ear-rings made from *Spondylus*, found at the site of Cerro Juan Díaz (Panamá).

Also in the Upper Palaeolithic, shells were used as a surface on which to produce works of art. The most characteristic example is the *Pecten maximus* valve engraved with the figure of a bison, from the Magdalenian levels at the French site of Le Mas d´Azil (Margerie 1996) **(Fig. 6, left)**.

Figure 7. Left: Jericho, PPNB. Human head made with clay and shells; Right: Great Temple, Mexico. Sacrificial knife with shell incrustations representing teeth and an eye.

The production of animal sculptures is a characteristic of many Central American cultures. Some outstanding examples are the objects made from *Spondylus* sp. valves, found in Panama.

Evidence of sites where shell ornaments were produced has been identified in the Americas. Shell workshops has been documented in Panama at Cerro Juan Diaz site where were founds small bifacial chipped wedges and shell remains and unfinished shell pendants dated around 1,400 BP (Mayo & Cooke 2005) **(Fig. 6, right)**. At inland archaeological sites associated to Guangala phase (2,000 BP-1,000 BP) in Ecuador were found evidence of dense worked Spondylus and Pinctada *mazatlanica* shells and chert drills (Masucci 1995).

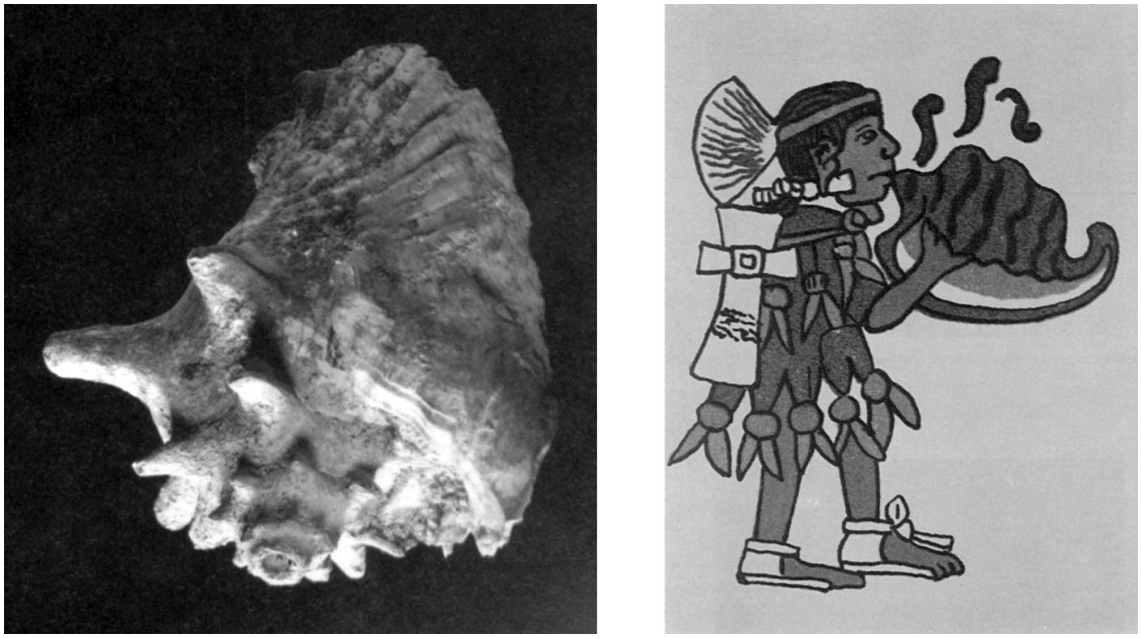

Figure 8. Left: Trumpet made from a gastropod of the *Strombus gigas* species from the Great Temple at Tenochtitlan. Right: Musician playing a trumpet of this kind, represented in the *Magliabechi Codex*.

In Maya elite residences of the site of Aguateca, Guatemala (approximately 1,130 BP), recent archaeological research has revealed that elite households were involved in the production and the manufacture of bone and shell artifacts using stone tools (Emery & Aoyama 2007).

On other occasions, shells were used as incrustations to form the eyes of sculptures. For example, at the PPNB at Jericho human heads were found that had been shaped in clay, and one of them had two *Cypraea* shells inlaid in it to represent the eyes (Kenyon 1957) **(Fig 7, left)**. In other cases, the surfaces of stone tools were decorated, producing an anthropomorphic appearance, like the example found at the Great Temple (Suárez Diez 2004) **(Figure 7, right)**.

Shells have also been used as musical instruments in many cultures. Some important examples are the trumpets made from *Strombus gigas* by the Mexicans. These were often decorated with different engraved or painted motifs, and are cited in many written sources. They were used in sacrifices and ceremonies **(Fig. 8)**

Figure 9. Left: Shiloh cemetery, Cedar Key, Florida. Photo: Irv Quitmyer; Right: *Pecten maximus* specimen.

Other decorative uses of mollusc shells range from the decoration of graves, such as those at the Shiloh cemetery, in USA, decorated with whole specimens of *Mercenaria mercenaria* **(Fig. 9, left)**, to the *Pecten* sp. valves carried by the pilgrims who travelled on the St James' Way to Santiago de Compostela **(Fig. 9, right)**.

Shells and Pottery production

Different species of Bivalvia and Gastropoda shells have been used in pottery production in different ways.

One example is the use of certain parts of the shells of *Cerastoderma* sp. (umbos, ventral margin) and *Collumbella rustica* (apex) to decorate the surfaces of pottery before firing, as has been recorded in the early Neolithic in the western Mediterranean (e. g. cardial Neolithic at L'Or in Valencia (Bernabeu 1989) **(Fig. 10, left)**, or in the case of the first species cited, in the impressed Neolithic at Giovanna Piano (Pianosa Island, Italy) (Tozzi & Weiss 2001).

Also in the Neolithic, the shells of certain bivalves were used to smooth the surface of vessels, as has been recorded at French sites like Diconche (*Ruditapes decussatus* and *Callista chione* shells) (Dupont 2006). Similarly in Neolithic contexts, crushed shells are found as inclusions (intentional or otherwise) in pottery fabrics (de Andrés *et al.* 1993).

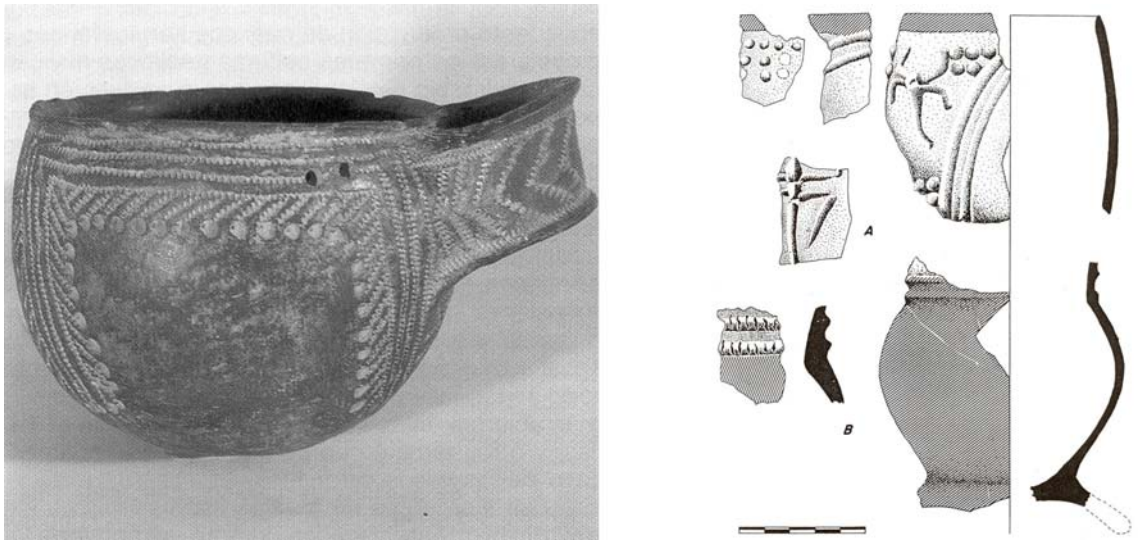

Figure 10. Left. Cardial pottery from L´Or; Right: Pottery with Culebra type shell inclusions, associated with Cubita pottery (Panamá, 500 BC).

The beginning of the Early Formative in the Americas (5,000-3,000 BP) is signalled by the appearance of simple pottery vessels, typically in the form of *tecomates*, or gourd-shaped, rimless vessels. Some of these vessels were found at coastal shell middens and inland sites in Colombia, Ecuador, Costa Rica and Panama, and they display wavy edge shell edge stamping (Reichel-Dolmatoff 1956, 1985; Hoopes 1994; Cooke 1995; Legros 1992; Willey *et al.* 1954) **(Fig. 10, right)**.

Shells used in Construction

At Near East sites, especially during the Late Bronze and Iron Ages, shells were embedded in floors, apparently to improve drainage. For example, at Lachish, a site located about 30km from the Mediterranean coast, over 5000 whole and fragmented shells of the Cardiidae y Glycymerididae family were found, with signs of marine erosion on their surfaces (Bar-Yosef Mayer 2005b).

At other sites, shells have been used to produce lime for making plaster. For instance, caustic lime made from freshwater snail shells *(Pachylus* sp.*)* is used to soften maize kernels by the modern Lacandon Maya. J. D. Nations (1979) proposes that snail shells may also have served the Ancient Mayas as a source of lime.

Mortar, plaster and stucco were used in Mesoamerica from Classic to Postclassic periods (200 AC to 1,500 BC) to construct public and ceremonial buildings. This materials were a mixture of sand, earth, shells, and limestone. Slabs were joined by mortar and a thin, lime- based wash or

stucco was used to cover the surfaces of the structures. Plaster was used to covered the floor surfaces (Mathews 2001; Matos Moctezuma 1985).

Textile Dyes & Pigments

In the Mediterranean (mainly in the Aegean), crushed or broken *Murex* shells have been recovered in great quantities from archaeological contexts dated from the Early Bronze Age (e. g. Cosmos, in Crete island) to the later Roman period. This suggests that shells like *Murex trunculus*, *Murex brandaris* and *Thais haemastoma* were used to produce purple (blue and violet colours) for dyeing textiles (Rusillo 2005). In some cases, pottery sherds with purple dye residues have been reported (Karmon & Spanier 1988).

The study of rock art and ethnographic accounts in California determine that Chumash people (5,000-7,000 BP) use burnt shell to obtain white pigments (Scott and Hyder 1993).

Shell Money

Cowries were used as money during the Bronze Age in China. It has been shown that *Cypraea moneta* specimens from the Maldive Islands were used as currency in different parts of the world (China, Thailand, Japan, Bengal and West Africa) since the 9th Century BC. They only fell into disuse in the 19th Century AD (Moreno Feliú 1991) **(Fig. 11)**.

Figure 11: Ghana steel 20-cedis coin, dated 1991, depicting a cowrie shell of the type formerly used as money in the region.

Another example of the use of shells as currency comes from North America. *Dentalium* was used as money by North American Indians for 2,500 years. They were harvested by the Ehattesaht and Quatsino people,

on the west coast of Vancouver Island and were acquired by Indians on the west coast and in the interior of the continent (Sioux, etc.) (Nuytten 1993).

Archaeological, ethnohistorical, and ethnographic evidence from the Orinoco Basin (Venezuela) suggests that *quirípa* strings or shell beads were used as objects during the pre-Columbian times in both ceremonial transactions and, to a lesser degree, in negotiate among the Indians. Many groups with different levels of social organization were involved in the manufacture and exchange of beads. Those beads were manipulated and exchanged principally by chiefly elites (Gassón 2000).

In the Antilles, Boomert (1987: 37) considered shell beads as primitive valuables used in the sphere of ceremonial exchange. This archaeologist suggests the existence of two independent spheres of exchange, one located in the East Antilles, based on green-polished stones, and the other in the Northwest Antilles, based on shell beads.

At the present time, mollucs shells are used in many various ways, and are collected on coasts practically all over the World. However, shells from archaeological shell midden deposits are also used as economic resources, in agriculture (e. g. as fertilizer), in construction (e. g. sea walls, roads) and in commerce (lime industry) (Ceci 1984).

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The exploitation of the Bay of Biscay by Mesolithic Societies in Cantabrian Spain

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After the scarce evidence recorded in recent middle Palaeolithic and early upper Palaeolithic contexts in Cantabrian Spain, Solutrean sites show a significant increase in the exploitation of marine environments, with the presence of molluscs and fish from estuary situations. In the late glacial period, shell-middens have been recorded, and fishing appears to have been an important activity among late Palaeolithic societies, marine species being caught by the late Magdalenian. However, it was in the Mesolithic when marine resources were exploited with greater intensity, and in fact shell-middens are the most common type of site during this period, especially in the western sector of Cantabrian Spain (Fano 2007a). However, we know our knowledge of marine resource exploitation through time in Cantabrian Spain is incomplete because of several factors. One of these is the question of sea level change. It is certain that the Flandrian transgressive episode affected the late glacial coast, and today we do not know many coastal Magdalenian sites. The Mesolithic archaeological record was also affected. In fact, the data available suggest that some shells middens must have been laid down at a time when sea level was at a lower lever than the present. It is also important to take into account the type of sites which are preserved. For instance, in the case of the first Cantabrian settlers only few in situ sites are known, so our knowledge about these human societies is in general quite low. In the same way, the intensity of the research into the different periods and areas along the region has been unequal. So these and other factors must be considered when we try to assess the role marine resources played through time.

Sources of information on Mesolithic hunter-gatherers

There exists a clear disproportion between the different sectors of Cantabrian Spain regarding the intensity of research on the Mesolithic. This unequal intensity of research means that, at least in part, the quantity and quality of information about the period varies along the length of the

region. On the eastern coast of Asturias, over 50km long, more than a hundred shell middens are known. The number of sites of this type recorded on the coast of Cantabria is also very high, but in most cases the available information comes from superficial observations. Unlike the coast of Cantabria and Asturias, few Mesolithic middens have been found along the Basque coast.

In a large number of cases, the archaeological excavations at Mesolithic sites were carried out at an early stage. This is the case of Vega del Sella's pioneering work on the "Asturian" (1923) –a term coined by Hugo Obermaier in 1916 and which is still in use to refer to the Mesolithic sites in Asturias and western Cantabria. However, we can draw on a relatively large number of sites that have been examined or dug in recent decades, and which have provided or are going to provide high quality information about the use of marine resources by Mesolithic societies. As regards the record in Asturias, we can mention La Riera, La Llana, Mazaculos, Los Canes, Arangas, Poza l'Egua, as well as a series of middens where trial excavations have been carried out recently. In Cantabria, the most important sites are in the lower Asón and Agüera valleys: El Perro, La Fragua and La Trecha. To these we can add some of the sites belonging to La Garma archaeological zone, such as La Garma A. Regarding the Basque sites, we can mention the recent work in Pico Ramos, in Kobeaga II, in J3 and in Santimamiñe (Fano 2007b) **(Fig. 1)**.

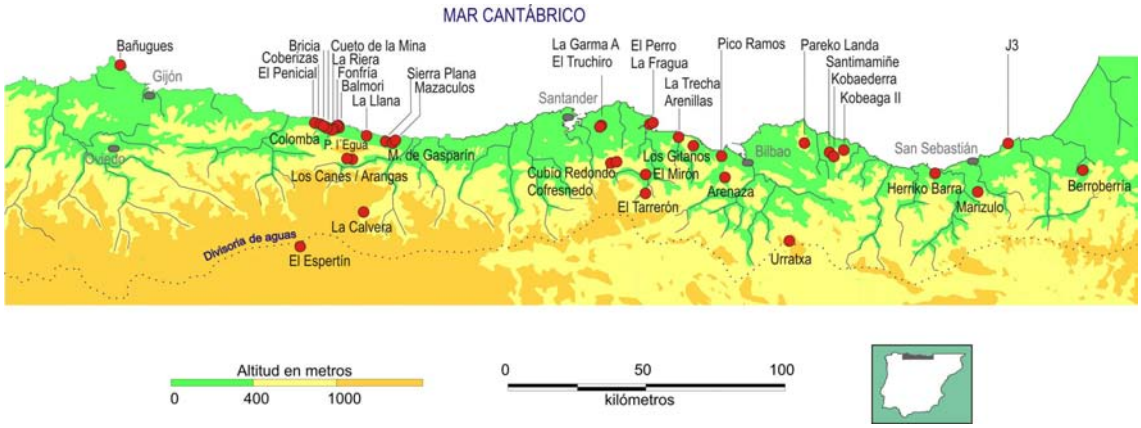

Fig. 1: Main archaeological sites excavated in Cantabrian Spain with layers attributed to the Mesolithic and/or to the Early Neolithic.

But so far, few quantitative archaeozoological studies have been made based on large-scale samples. For the marine malacofauna we already have some quantitative analyses, although not always with the same amount of detail. We also have some information about mollusc gathering patterns, thanks to isotopic analysis ($^{16}O/^{18}O$) carried out on samples of *Osilinus lineatus* (Deith & Shackleton 1986). Besides this, we have some data from the analysis of growth bands on samples of *Patella* (Craighead 1995; Bailey

& Craighead 2004). Both types of analysis show that the shellfish were gathered mostly in autumn and winter, or at least, that is when they were taken to the caves.

The information on fishing activity is rather more limited. In this case there is an evident sampling problem, owing to the methods of the old excavations, combined with the state of conservation of most shell-middens, which are heavily calcited **(Fig. 2)**; this circumstance makes it difficult to recover fragile materials, like fish remains, and very few ichthyological studies have been made in the region (Menéndez de la Hoz *et al.* 1986; Roselló 1990).

Fig. 2: Shell midden of El Alloru (Balmori, Llanes, Eastern Asturias).

Approaches developed

The marine resources found in the Mesolithic deposits of Cantabrian Spain have been primarily considered as food resources, and their role in the diet of post-glacial hunter-gatherers in the region has been a recurring topic in the bibliography. The importance of this type of resource to the diet has been evaluated from different points of view. One of these has been the population pattern, assuming that the activities related with subsistence

determine to a large degree the distribution of settlements in the territory. A non-shoreline location of shell-middens **(Fig. 3)** has been used as an argument in favour of the idea that these marine resources were a secondary element in the diet of the post-glacial hunter-gatherers.

The transport of certain coastal resources, like molluscs, would limit movements to a certain extent (see Davidson & Bailey 1984) but we should not ignore the fact that, in spite of the life-cycles of the species and a possible over-exploitation, we are talking about "reliable" resources. That is, it was a form of gathering in one determined environment, and therefore, there could not be many factors that the inter-tidal gatherers had to take into account, apart from the tide and the state of the sea. It was also an activity in which, in principle, the gatherers knew what the result of their work would be, and equally knew the distance from the settlement to the sea. It is clear that a hunter did not have these advantages.

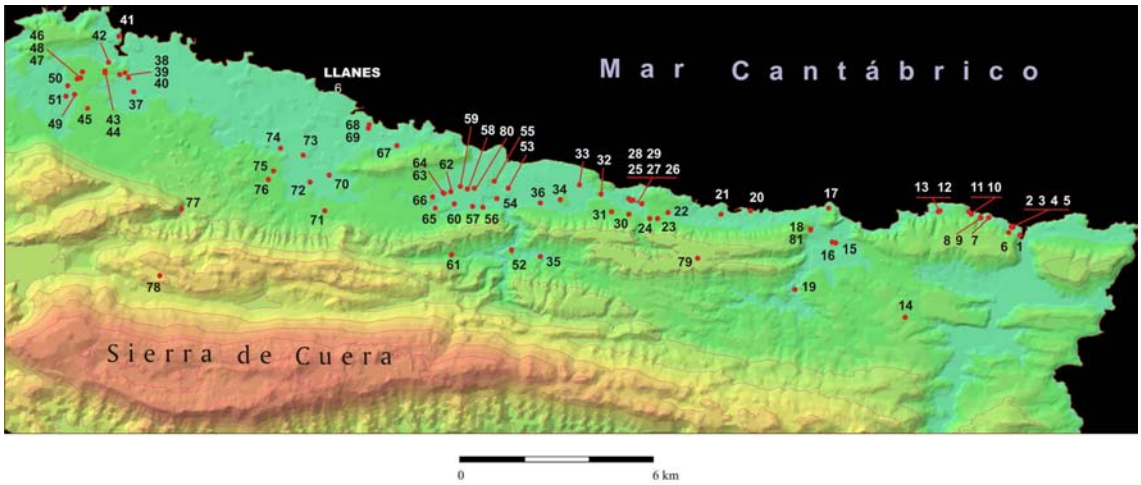

Fig. 3: Mesolithic population in a sector of the eastern coast of Asturias.

So far, tool assemblages have provided hardly any information about the role played by marine resources in the diet of Mesolithic societies in Cantabrian Spain. It is a fact that the shell-middens – and especially the Asturian middens – are characterised by the near or total absence of lithic or bone assemblages. Yet it is also true that no analyses have been carried out, unlike in other regions where they have been able to identify, for example, the lithic tools used to process fish (Clemente & García, in press).

In fact, in Cantabrian Spain, the debate has focused almost entirely on the function of the Asturian pick, the "fossil guide" of the Asturian and a relatively common tool in the shell-middens **(Fig. 4)**. In the early stages of research it was called a "shell-fishing pick" and it was thought that its use was for collecting limpets. Other possible uses were suggested in later works but even today we cannot be certain about the exact use of this tool,

although the evidence exists to suppose that the use of this instrument was linked to the exploitation of marine resources (González Morales 1982).

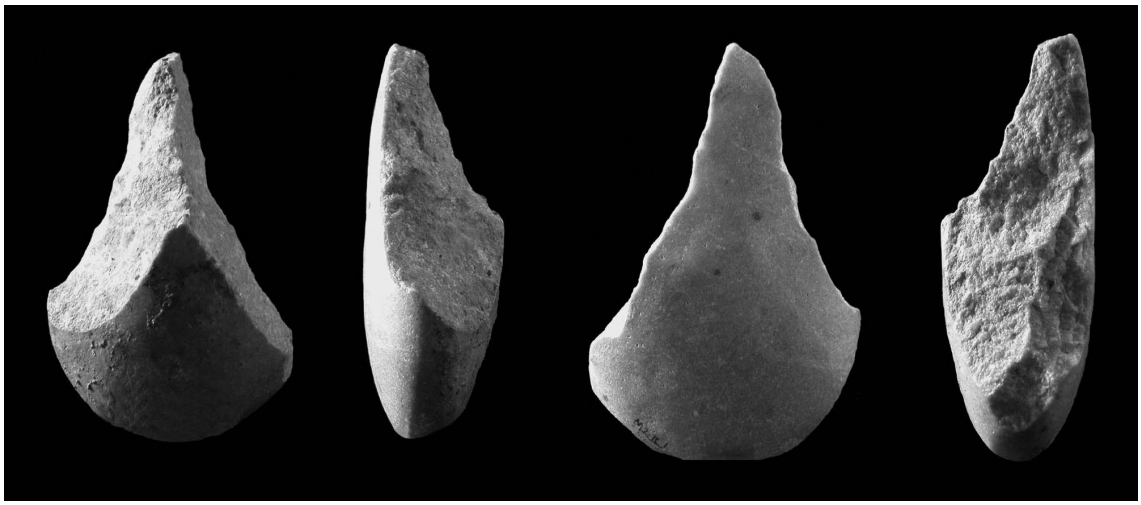

Fig. 4: "Asturian" pick from Mazaculos II (La Franca, Ribadedeva, Eastern Asturias) (photo M. R. González Morales).

Special attention has also been paid to a type of artefact made out of bone; a double pointed shape, either with a central notch or slightly curved, considered as a "double pointed fish hook". This technical innovation has been interpreted as an indicator of the change that occurred during the Mesolithic in the way of approaching the activity of fishing (González Morales 1982; Fernández 2001). It appears that the "hunting of fish" with harpoons, which is efficient in rivers, gave way to a more suitable technology for exploiting the marine environment.

Despite the recent publication of new collections of land animal remains, it is still difficult to assess the relative contribution of each type of food to the diet. In this sense, it is also important to bear in mind that our knowledge about the use of plants for food is even scarcer (Zapata 2000). Therefore, in the last few years, attempts have been made to obtain "direct" information about the food consumed by Mesolithic groups by carrying out stable isotope analysis (^{13}C and ^{15}N) of the collagen from some human remains. So far we have data from four adults buried in Cueva de Los Canes, as well as from the human remains found in shell-middens preserved in the caves of Poza l'Egua, Colomba and J3 (Arias 2005-2006).

The results currently available reveal a clear difference between the individuals in Los Canes, whose samples give ^{13}C values of between –20 ‰ and –19 ‰ and for ^{15}N of about 8 ‰, which corresponds to a diet rich in proteins with a terrestrial origin, and the remains found in the middens, with higher values of ^{13}C (–17 to –15 ‰) and also of ^{15}N (11-13 ‰), indicating a mixed terrestrial-marine protein diet. Without doubt, it is extremely interesting to ask what social behavioural patterns induced the

individuals buried in Cueva de Los Canes, to fail to exploit a food resource that at that time formed part of the diet of the coastal Mesolithic groups, as evidenced by the shell-middens and the first stable isotope analyses. Los Canes is located on the southern slopes of Sierra de Cuera, but only 11 km away from the coast (in a straight line); no more than 5 hours' walking distance.

But the sea was not only a source of edible resources for the Cantabrian Mesolithic societies. The marine environment also provided other resources not directly linked to subsistence (Álvarez-Fernández 2006). Research has given special attention to those marine resources (particularly certain species of gastropods) used as raw materials to make objects of personal adornment during the upper Palaeolithic and especially in the Magdalenian. Equally, other types of uses cannot be ruled out, as is suggested by the specimens of food species which had been collected already dead, but the information available for this is even scarcer. Several Mesolithic sites throughout the region have yielded objects of adornment manufactured from sea shells but paradoxically, the number of examples known is slightly higher in the neighbouring Ebro valley, *i.e.* in a region much further from the sea. Two factors can explain, at least in part, the scarcity of examples in Cantabrian Spain: The preservation problems of many Mesolithic deposits make it difficult to recover delicate objects, such as artefacts made from small-sized gastropods, like *Trivia* sp.; and the lack of specific research on the topic.

The data available

At the moment, the best known activity is shell fishing, owing to the large volume of remains of molluscs, crustaceans and echinoderms preserved in the region's Mesolithic sites. The Asturian shell-middens include limpets (mainly *Patella vulgata* and *Patella intermedia*) and topshells (*Osilinus lineatus*), as well as mussels (*Mytilus galloprovincialis*). This shows that the shell gathering took place mostly in areas with a rocky sea-bed, which are very common in the inter-tidal zones of the coast of Asturias. Remains of crustaceans and other marine invertebrates such as sea urchins (*Paracentrotus lividus*) have been recorded to a lesser extent.

The archaeo-malacological studies available for sites on the eastern coast of Cantabria also indicate that rocky shores were predominantly exploited, with a significant presence of limpets, above all of *Patella intermedia* when the species belonging to the *Patella* genus have been determined, topshells (*Osilinus lineatus*) and mussels (*Mytilus galloprovincialis*). In much smaller proportions, species corresponding to sandy or muddy sea beds have been found, like clams (*Tapes decussatus*). Equally, oysters (*Ostrea edulis*) are relatively common; these bivalves

preferentially occupy areas with a soft seabed. Crustaceans, like *Balanus* sp., are also present, and in one case (La Fragua) *Paracentrotus lividus* has been recorded.

A greater contrast with the Asturian shell middens is found in the Basque Country, in the midden at Cueva de Santimamiñe, where there is a clear predominance of oysters (*Ostrea* sp.) and clams (*Ruditapes* sp.), and a modest presence of molluscs belonging to rocky shores, like limpets (*Patella* sp.) and topshells (*Monodonta* sp.). This appears to be the result of the exploitation of the estuary of Urdaibai, near Santimamiñe. The biotopes where shell gathering was carried out in Asturias were quite different and, consequently, so were the species found in the sites of that part of the region. In contrast, the site of Kobeaga II, which is less than 6km away from Santimamiñe in a straight line, shows a clear predominance of the genus *Patella*. This shows that a different shore was being exploited, probably located in the inter-tidal zones of the most easily reached bays from the site.

The abundance of shell middens is without doubt proof of the idea that during the Mesolithic, in comparison with earlier periods, there was a noticeable increase in the use of marine resources. Some sequences, with occupations beginning in the late glacial period, such as those in La Fragua and El Perro, equally show this fact. However, as is the case of sites in other parts of the Iberian Peninsula, the increase in shell gathering displayed by the sequences in the sites in the lower Asón valley can be related with the progressive approach of the sea to the settlements.

Other observations of a more specific nature, such as those referring to the exact gathering areas within the inter-tidal zone, or the variation in size of some of the species collected, have also been presented as proof of an intensified exploitation of the marine environment. For example, the increasing frequency of *Patella intermedia* in comparison with earlier periods, as can be seen in certain sequences such as those at La Riera, Poza l'Egua and La Fragua **(Fig. 5)**, has been linked to a widening of the resource gathering area.

In contrast with the most common species during the Palaeolithic, *Patella vulgata*, which tends to be found in estuaries and sheltered areas, *Patella intermedia* occupies relatively wave-beaten zones. By using the sample from La Riera, Ortea (1986) suggested that the start of the exploitation of more exposed areas, leading to the appearance of species like *Patella intermedia* in the archaeological record, could have been a solution to a growing demand for food caused by demographic increases.

However, the analysis of variables such as the age of the specimens of *Patella vulgata* collected, whose mean is hardly affected by the reduction in size of these gastropods, according to data from level 28 at La Riera, or the climatic preferences of each species, seriously questions the link established

between a reduction in the frequency of *Patella vulgata* and the supposed over-exploitation of the malacological resources (Bailey & Craighead 2004).

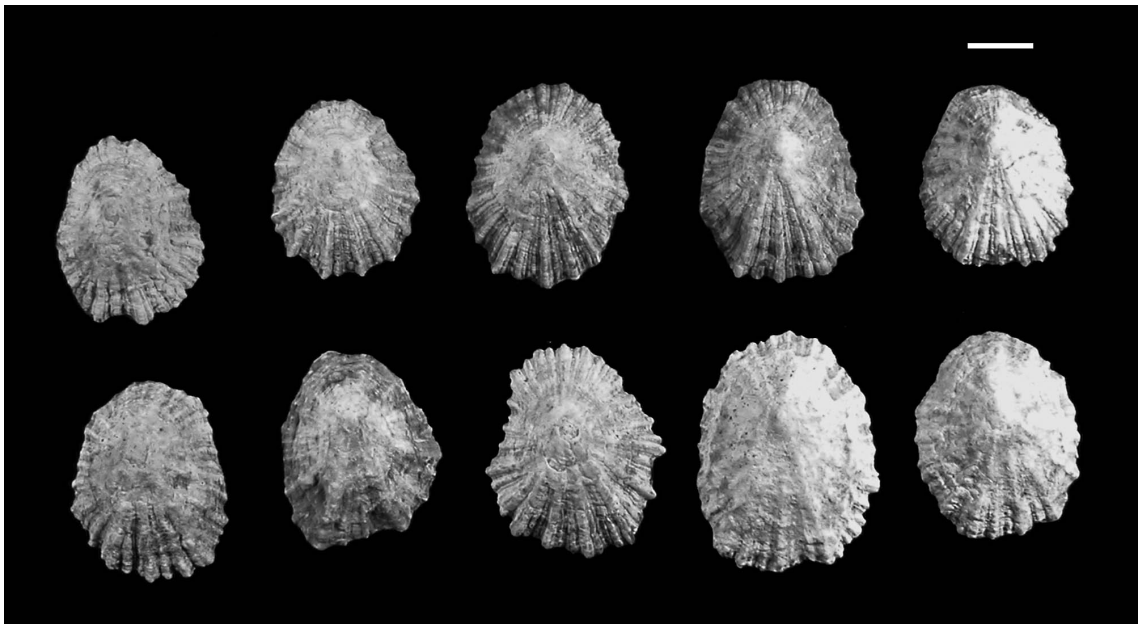

Fig. 5: *Patella intermedia* from the Mesolithic layer of La Fragua (Santoña, Cantabria) (photo F. I. Gutiérrez Zugasti).

It is true that the recent study of the Mesolithic level at La Fragua by Gutiérrez Zugasti (2006) has shown that *Patella vulgata* **(Fig. 6)** is even overtaken in frequency by *Patella ulyssiponensis*, a species that lives in even more wave-beaten zones than *Patella intermedia*. However, this is not the usual pattern, and in general the more exposed species do not appear to have been exploited more assiduously in the Mesolithic. Evidence for this is the habitual scarcity or absence in shell middens of species like the barnacle (*Pollicipes cornucopia*).

The decrease in size of specimens of *Patella vulgata* throughout the sequence at La Riera has also been related to a growing intensification in the gathering of coastal resources (Clark & Straus 1986, 355, 365), but other factors could have affected the reduction in size of these gastropods, such as variations in sea surface temperatures (Bailey & Craighead 2004). Recently, the same reduction has been seen at Poza l'Egua (Arias, Fdez.-Tresguerres et al. 2007); however not only in the change from Level A, probably Azilian in age, to the Mesolithic layers, but also differences have been noted within the Mesolithic midden, with examples of a smaller size in the upper layer. In this case, the hypothesis of over-exploitation is strengthened, but to be confirmed greater chronological precision is required. In fact, if there was a long period of time between the Mesolithic layers, the decreasing size of *Patella vulgata* could be related to a variation in certain conditions on the coast (exposure, fall in the volume of nutrients, etc.).

Regarding fishing activity, the most significant fact is the increase, in comparison with preceding periods, in the capture of marine species. In fact, despite the lack of data in absolute terms, the available information suggests that the marine environment was exploited more intensively during the Mesolithic. In this respect, the presence of new open-water species, absent from the archaeological record until then, is significant. Some of these are the sardine (*Sardina pilchardus*), the anchovy (*Engraulis mordax*) and the jurel (*Trachurrus trachurrus*). With all certainty, the capture of sardines and anchovies requires the use of nets, but we have no definite evidence of their use.

Fig. 6: *Patella vulgata* from the Mesolithic layer of La Fragua (Santoña, Cantabria) (photo F. I. Gutiérrez Zugasti).

Mesolithic fishers also caught species preferring rocky coasts, *e.g.* sea bass (*Dicentrarchus labrax*) and some of the *Labridae* family; estuaries, *e.g.* the *Sparidae* family; and rivers, *e.g.* trout (*Salmo trutta fario*). For the Mesolithic we have no information about the exploitation of a strictly oceanic environment, and we only have a small number of remains of hake (*Merluccius merluccius*) for the whole of the Upper Palaeolithic. The same can be said of marine mammals, whose remains, *e.g.* of seals and other species such as sperm whale, are found in small numbers at various upper Palaeolithic sites (Fernández 2001, Corchón *et al.* in press). Another revealing fact about changes in fishing activity, also noted by R. Fernández (2001), is the coincidence in time of the disappearance of the harpoon, which was common in the late Magdalenian and the Azilian, and the significant drop in the size of captures in the Mesolithic.

As we indicated above, little information is available about the marine resources exploited for purposes different from that of food, but we know that different gastropod species were collected on beaches, *i.e.* out of their natural habitat and after their death. Proof of this is the appearance of them having been eroded by the sea. Without mentioning all examples found, we can quote the collection and use as objects of adornment, after being perforated, of *Nassarius reticulatus*, *Trivia* sp., *Littorina obtusata*, *Littorina fabalis*, *Naticidae* family, *Callista chione* and *Columbela rustica.* Unworked examples of some of these species, especially *Nassarius reticulatus,* are found in many of the Mesolithic sites that have been studied. It is likely is that they are the raw material, gathered on beaches, for the manufacture of objects of adornment (Álvarez-Fernández 2006).

As occurs in the case of late glacial societies, this type of object formed part of the cultural values of Mesolithic societies. A good example of this could be the presence of numerous perforated shells (above all of *Trivia* sp.) around and behind the head and body of one of the individuals buried in Cueva de Los Canes, which was interpreted as the remains of a necklace and/or the adornments on a garment, perhaps a cape or blanket (Arias & Álvarez-Fernández 2004).

Without doubt, the find of this kind of evidence at a mountain site, relatively far from the sea like Los Canes, is extremely interesting. But the presence of personal adornments made from sea shells is even more significant when the finds are made at sites much further from the coast such as those in the upper Ebro valley, *i.e.* on the other side of the Cantabrian watershed. Examples, among more recent contributions, are known at the Mesolithic settlements of Kampanoste and Mendandia in the province of Álava, located 100km from the Cantabrian Sea, where we find one of the most common species in the settlements of Cantabrian Spain, *Nassarius reticulatus* (Alday 2004, 2005; Álvarez-Fernández 2006). As is also indicated by other kinds of archaeological evidence, this fact proves the existence of relationships between the Mesolithic societies located on each side of the watershed.

Conclusions

After the end of the Palaeolithic, post-glacial societies exploited the Cantabrian Sea with greater intensity. The existence of shell middens, which are very common in the Mesolithic, are good proof of this fact, while novelties in fishing activity are evidence for a clear interest in exploiting the marine environment in a more systematic way. In any case, the first stable isotope analyses carried out on human remains found in shell middens confirm that the sea was not the only source of food. On the contrary, just as the population patterns and archaeozoological observations have shown, terrestrial sources of food, like the meat of ungulates, particularly red deer

in the case of Asturian deposits, played a determinant role in the diet of these post-glacial societies. The contribution of wild plant products must have been vital too, although the present data is too limited to be able to assess their importance in the diet adequately. As well as the fish and shellfish obtained for food (perhaps seasonally in the case of the latter), Mesolithic groups collected shells on beaches and made them into objects of adornment. Their presence at sites a long distance from the coast, as in the Ebro valley, where we find no food related species, tells us that they must have been objects with a specific value within those societies.

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PROGRAM OF THE MEETING

●Tuesday, 19 February

Venue: Salón de Actos, Escuela Técnica Superior de Náutica (University of Cantabria), Calle Gamazo 1, Santander, Spain.

Morning

9.00. Registration

10.00. Inauguration

10.30. Opening Lecture

Pablo ARIAS
Director of the Instituto Internacional de Investigaciones Prehistóricas de Cantabria (IIIPC)

Altamira, and much more!
An overview of the Prehistory of Cantabrian Spain

11.30. Coffee Break

12.00. Oral Communications

12.00-12.15.
Katerina DOUKA, Robert E. M. HEDGES & Thomas F. G. HIGHAM
Radiocarbon dating of shell carbonates: a new approach for the dating of the Middle-to-Upper Palaeolithic Transition

12.20-12.35
Daniella E. BAR-YOSEF MAYER & Bernard VANDERMEERSCH
Ochre covered shells from Qafzeh cave: evidence for the modern behaviour of modern humans

12.40-12.55
Bárbara AVEZUELA
The personal ornaments of la Peña de Estebanvela (Segovia-Spain) made on molluscs

13.00-13.15
Jorge MARTÍNEZ, Joel CASANOVA & Rafael MORA
Lost in the mountain?: marine shells and social networks in the Southern Pyreenes

13.20-13.35
Pablo ARIAS; Miguel A. FANO; Ángel ARMENDARIZ; Esteban ÁLVAREZ-FERNÁNDEZ; Marián CUETO; Raquel FERNÁNDEZ; María Dolores GARRALDA; Carmen MENSUA; Joan S. MESTRES; Luis C. TEIRA
Recent reseach in Mesolithic shell middens of Eastern Asturias (Spain)

13.40 Discussion

14.00. Lunch break

Afternoon

15.30. Oral Communications

15.30-15.45
F. Igor GUTIÉRREZ & Manuel GONZÁLEZ-MORALES
New data on Asturian shell midden sites: the caves of La Llana and Mazaculos II (Asturias, Northern Spain)

15.50-16.05
Zhanna ANTIPUSHINA
Analysis of malacofauna remains from archaeological sites on Adak Island, Aleutian Islands

16.10-16.25
Darko KOMŠO & Preston T. MIRACLE
Mesolithic sea and freshwater perforated snails from Istria, Croatia

16.30-16.45
Karen HARDY
Shells in Scotland. Use of shells as raw material for tools and jewellery in Mesolithic Scotland

16.45-17.00. Coffee Break

17.00-17.15
David LUBELL, Mary JACKES, Meredith L. FABER & Crayton J.YAPP
Land snail stable isotopes and the Capsien Typique-Capsien Supérieur Transition in Eastern Algeria

17.20. Discussion

19.30. Santander Mayor´s Reception
Venue: Palacio de la Magdalena

•Wednesday, 20 February

Venue: Salón de Actos, Escuela Técnica Superior de Náutica (University of Cantabria), Calle Gamazo 1, Santander, Spain.

Morning

9.00. Oral Communications

9.00-9.15.
Jesús F. JORDÁ, J. Emilio AURA, C. MARTÍN & Bárbara AVEZUELA:
Archaeomalacological remains from the Upper Pleistocene – Early Holocene record of "Vestíbulo" of Nerja Cave (Málaga, Spain)

9.20-9.35
Dustin WHITE
Holocene molluscan successions in the Lake Baikal region, Siberia – reconstructing a Neolithic landscape

9.40-9.55
Rena VEROPOULIDOU
Purple-dye production in the Bronze Age Aegean: the evidence from mainland Greece and the islands

10.00-10.15
Alfredo CARANNANTE
Non food-related shells in the Bronze Age industrial centre of Pyrgos-Mavroraki (Cyprus)

10.20-10.35
Arati DESHPANDE-MUKHERJEE:
Dietary use of marine molluscs between the third and second millennium BC at coastal Harappan settlements in Gujarat, India

10.40-10.55
Ademar EZZUGHAYYAR, Muhammad ZAWAHRA & Hamed SALEM:
Molluscan fauna from site 4 of Tell Jenin (Northern West Bank –Palestine).

11.00- 11.30 Coffee Break

11.30-11.45
Gregory CAMPBELL:
Oysters ancient and modern: methods used to compare shell shape in modern and late roman flat oysters (Ostrea edulis) from Southern England

11.50-12.05
Catherine DUPONT
An industrial exploitation of oysters during the Middle Ages at Beauvoir-sur-Mer (France)

12.10-12.25
Juan Carlos HERNÁNDEZ, Eduardo MESA, Juan Francisco NAVARRO & Gustavo GONZÁLEZ
Archaeological shell mounds and shellfish gathering on La Gomera island (Canary Islands, Spain)

12.30-12.45
Cheryl CLAASSEN
Shells, Caves & Snakes

12.50-13.05
Isabel C. RIVERA
The shells of Punta Candelero: palaeoenvironmental evaluation of anthropogenic shell deposits in a Saladoid Coastal Site in Puerto Rico, and its implications for coastal habitat availability

13.10-13.25
Andrea GUÍA
Where the sea invades to the desert: forms of utilization of the mollusks in the Upper Gulf of California, Mexico

13.30 Discussion

14.00. Lunch Break

Afternoon

15.30. Oral Communications

15.30-15.45
Romina SILVESTRE, Natacha BUC & Daniel LOPONTE
What about shells? Experimentation and functionality of shell artifacts in The Paraná´s Wetland, Argentina

15.50-16.05
Eugenia VILLARMARZO
Mollusk exploitation in the Atlantic Coast of Uruguay

16.10-16.25
Diana Rocío CARVAJAL
Mollusks at a purported fishing camp: Cueva de Los Vampiros, Central Pacific Panama

16.30-16.45
Ermengol GASSIOT, Ignacio CLEMENTE & Virginia GARCÍA
Archaeomalacology and paleoeconomy. The shell middens into the prehistoric subsistence practices in the Caribbean Coast of Nicaragua (1400 CalBC To 1000 CalAD)

16.45-17.00 Coffee break

17.00-17.15
Emiliano Ricardo MELGAR
The manufacturing techniques of the Oliva pendants at Xochicalco, Morelos

17.20-17. 35
Hervé MONTERROSA & Reyna Beatriz SOLÍS
Malacological materials of the archaeological area in Pezuapan, Guerrero, Mexico

17.40-17.55
Reyna Beatriz SOLÍS & Guadalupe MARTÍNEZ
The specialized production of shell objects in Teopantecuanitlan, Guerrero, Mexico.

18.00-18.15
María de Lourdes GALLARDO, Emiliano Ricardo MELGAR & Hortensia DE VEGA
The shell garment of Oxtankah, Quintana Roo, mexico: a proposal of its analysis and restoration.

18.20- 18.35
Pedro LÓPEZ & Emiliano Ricardo MELGAR
Exploitation of shells at El Cuyo, Campeche, Mexico

18.40-18.55
Ilean Isel ISAZA & Patricia A. McAnany
Social uses of shell ornaments: a comparative study from the Maya Area and Central Panama

19.00-19.15
Cheryl CLAASSEN
The US Freshwater Shell Button Industry 1891-1950

19.20 Discussion

●Thursday, 21 February

Field Trip 1

Morning

7.30 Trip to Asturias

○ 8.45. El Toralete (Santiuste, Asturias), Mesolithic Shell-Midden

○ 10.00.Cuevas de El Mar (Nueva de Llanes, Asturias), Mesolithic Shell-Midden

○ 11.00/11.30. Tito Bustillo (Ribadesella, Asturias), Palaeolithic Rock Art

13.30 Lunch Break

Afternoon

16.00. Trip to Asturias: Peña Tu (Site and Interpretation Place)

○ Peña Tu (Puertas de Vidiago, Asturias), Postpalaeolithic Rock Art.

●Friday, 22 February 2008

Field Trip 2

Morning

8.15 Trip to Santillana del Mar

○ 9.00. Altamira cave (Replica of the famous Chamber of the Paintings)

○ Altamira Museum (Permanent exhibition)

○ 11.30. Medieval village of Santillana del Mar

14.00 Lunch Break

Afternoon

16.30/17.00- Museo Marítimo del Cantabrico, Santander city

19.00 Closure of the Meeting

Venue: Sala Naos. Museo Marítimo del Cantábrico. Calle San Martín de Bajamar, S/N Santander.

21. 30 Banquet dinner

Venue: Restaurante del Museo Marítimo del Cantábrico. Calle San Martín de Bajamar, S/N Santander.

MEETING ABSTRACTS
IN ALPHABETICAL ORDER

Hala ALARASHI

SHELL BEADS IN THE PREPOTTERY NEOLITHIC B IN CENTRAL LEVANT: NOTE ABOUT THE CYPRAEIDAE OF TELL ASWAD (DAMASCUS, SYRIA)

Tell Aswad is one of the few archaeological sites dated to the Prepottery Neolithic B found in the Central Levant. More than 190 pieces of ornaments were collected during the excavations which were carried out between 2000 and 2006. The beads are generally made in stone or from hard animal tissues. Regarding the latter category, different species of mollusks were used (40 beads). Although precise taxonomical identification is still needed, 8 families were recognized: *Cypraeidae*, *Conidae*, *Neritidae*, *Unionidae*, *Dentaliidae*, *Nassaridae*, *Littorinidae* (?) and *Muricidae*. Our observations presented in this study deal particularly with the cowries.

At Tell Aswad, the cowrie beads show a high diversity of types contrary to the elements belonging to other families. For the cowries, at least two processes of transformation of the natural shape of the shells were distinguished. These processes imply different techniques such as abrasion, engraving and hole drilling by circular movement.

What were the main types and techniques used for making cowrie beads during the Neolithic period in the Near East? And what kind of information can offer the study of the material from Tell Aswad in this context?.

In order to analyse these questions, a short synthesis about the Near East will be exposed in this work as well as the typology and the distinct techniques for the cowrie bead making observed at this site, for a little known region till now: the Central Levant.

Esteban ÁLVAREZ-FERNÁNDEZ & Juan Carlos CASTRO

SHELLS IN THE MIDDLE AGES: ARCHAEOMALACOLOGICAL REMAINS FROM THE WALL OF PONTEVEDRA CITY (GALICIA, SPAIN)

Very few studies of marine malacological remains found in medieval contexts have been made for archaeological sites in Northern Spain. This poster presents the results of the research carried out on archaeomalacological evidence recovered during the archaeological excavation of a section of the medieval wall in the city of Pontevedra, in 2004-5. The wall was built in the second half of the 15th Century. All the remains came from different accumulations located in a stratum interpreted as the city rubbish-dump, on the banks of the River Lérez. This would have been previous to the construction of the excavated section of wall, whose foundation ditch cuts through it. It must therefore have formed in the first half of the 15th Century at the latest, and probably also during the 14th Century. The most abundant remains belong to *Ostrea edulis*. There is also a significant number of specimens of *Ruditapes decussatus* and *Cerastoderma glaucum*, and to a lesser

extent, of *Littorina littorea* and *Mytilus galloprovincialis*. As well as the taxonomic classification, taphonomic and morphobiometric studies have been undertaken.

Esteban ÁLVAREZ-FERNÁNDEZ, Pablo ARIAS, Marián CUETO, Cristina GARCÍA-MONCÓ & Roberto ONTAÑÓN

ARCHAEOMALACOLOGICAL EVIDENCE IN THE LOWER GALLERY OF LA GARMA (OMOÑO, CANTABRIA, SPAIN)

The Lower Gallery of La Garma shelters one of the most important Late Palaeolithic deposits in Europe. Its original entrance was blocked by a collapse at the end of the Upper Pleistocene, allowing an exceptional preservation of Middle Magdalenian floors (ca. 14500 cal BC) on the surface of the cave. In this communication the remains of marine molluscs found in Zone IV are presented. The archeomalacological evidence documented in that sector of the cave will be compared with those from Zone I (where the Pleistocene entrance was located) and the Middle Magdalenian layers of a cave nearby (La Garma A). The distribution of species in those areas suggests that the molluscs found in the latter (probably a living area) were collected as food, whereas those found in Zone IV are probably related to personal ornament and other aspects of the symbolic realm.

Zhanna ANTIPUSHINA

ANALYSIS OF MALACOFAUNA REMAINS FROM ARCHAEOLOGICAL SITES ON ADAK ISLAND, ALEUTIAN ISLANDS

We attempt to reconstruct the dynamic of palaeoenvironmental conditions from archaeological sites on Adak Island, Aleutian Islands, based on analysis of mollusk remains. The samples of this study come from two shell middens excavated by members of the Western Aleutian Archaeological and Palaeobiological Project (WAAPP), lead by Dr. West (University of Kansas). Radiocarbon analysis showed that the first shell midden, situated near Clam lagoon, was formed from the end of the sixth millennium to the beginning of the fourth millennium BC. This shell midden is the oldest archaeological site found on Adak Island. Analysis of shell remains shows that mollusk taxonomic composition changed significantly during the existence of this ancient settlement. A decrease of epifaunal remains (*Mytilus trossulus* and chitons) and increase of infaunal remains (*Clinocardium nuttallii*, *Spusula polynima*, *Saxidomus giganteus*, *Mya* sp.) is evident in the deposits. It is possible that the intertidal zone of Clam lagoon was rockier at the end of sixth millennium BC. After that the rocky area decreased and the sandy ground began to dominate, the curtailment of rocky area was the result of sea level decrease.

The second shell midden, situated near Sweeper Cove, was formed from the 8th to the 19th centuries AD. The remains of epifaunal mollusks dominate and are the evidence of rocky substrate of the intertidal zone of Sweeper Cove during the 8th to the19th centuries AD. Analysis of the mollusk taxonomic composition allows us to

distinguish two periods in the development of this shell midden. A warmer period was characteristic from the middle of the 11th till the 15th centuries, and from the middle of the 16th till the 19th centuries because of some thermophile species found in the layers are not typical for this region, (i.e. *Nucella heyseana*). The period from the 15th till the middle of the 16th centuries was colder, arctic-boreal species (*Littorina aleutica*, *Onoba aurivilli, Puncturella longifissa*) were more abundant in this layer.

Pablo ARIAS, Miguel A. FANO, Ángel ARMENDARIZ, Esteban ÁLVAREZ-FERNÁNDEZ, Marián CUETO, Raquel FERNÁNDEZ, María Dolores GARRALDA, Carmen MENSUA, Joan S. MESTRES & Luis TEIRA

RECENT RESEARCH IN MESOLITHIC SHELL MIDDENS OF EASTERN ASTURIAS (SPAIN)

The eastern coast of Asturias (North Spain) is one of the classic areas of the European Mesolithic. This paper presents the preliminary results of a programme of fieldwork conducted between 2000 and 2003 in order to sample a series of shell-middens attributed to the Asturian period (local coastal Mesolithic). This research has improved the definition of malacological assemblages in the area. In addition, a large collection of *Osilinus lineatus* shells have been dated; and preliminary data has been obtained for the determination of the ΔR factor on this part of the Atlantic coast of Europe. At the same time, stable isotope analysis ($\delta^{13}C$ and $\delta^{15}N$) of the collagen from human remains found at some of the sites has provided more objective information about the use made of the marine environment by Mesolithic societies in western Cantabrian Spain.

Álvaro ARRIZABALAGA, Esteban ÁLVAREZ-FERNÁNDEZ & María José IRIARTE

FIRST EVIDENCE OF ARCHAEOMALACOLOGICAL REMAINS IN THE BASQUE COUNTRY (SPAIN): MARINE SHELLS AT LEZETXIKI

In this paper we study marine shells recovered at Lezetxiki, a site with different levels ascribed to the Middle Palaeolithic-Upper Palaeolithic transition. The Middle Palaeolithic level (Level IVc) has yielded Muricidae gastropods. At the Early Upper Palaeolithic, a valve fragment of *Ostrea* sp. and a fragment of *Spondylus* sp., possibly *S. gaederopus*, have been found in Level III. *S. gaederopus* now lives on the shores of the Mediterranean Sea, and has never occurred at the Cantabrian coast. Its presence in this deposit is result of long distance contacts between hunter-gatherer groups in Cantabrian Spain and the Mediterranean area. Finally, we discuss the role played by molluscs in Europe during the Middle-Upper Palaeolithic transition.

LAURA HARUTYUNOVA, N. MANASERYAN, I. GABRIELYAN, M. MARDJANYAN & R. HARUTYUNYAN

MOLLUSKS ON BONE REMAINS FROM HOLOCENE DEPOSITS OF THE LAKE SEVAN BASIN

Mollusks remains associated to natural bone deposits from the Holocene are concentrated on the north-western coast of Lake Sevan, near the village of Akhkala (Ayrivank monastery). This site is situated along the wave-cut zone up to Noraduz cape and has a length of 500m and width of 50 to 60m. Early archaeological work indicated that these Early Holocene layers are related to paleo-fluvial sedimentation. These layers contained animal bones lying on diagonal bands of sand. The vertebrate species of this 'faunal complex' is diverse and includes: red deer (*Cervus elaphus*), wolf (*Canis lupus*), fox (*Vulpes vulpes*), wild boar (*Sus* sp.), horn cores of the small cavicornia (ovis /capra). Bovidae skulls and horn axes dominate these layers.

Ten mollusk species are found on these bone remains (skull, horn trunks, femurs, etc.) and embedded in a grey silty- sandy rock sediment and sandy streaks: *Valvata piscinalis (Muller,1774); Bithynia troscheli* (Paasch,1842)*; Lymnaea stagnalis (Linnaeus, 1758); Lymnaea stagnalis var.goktchana* (Mousson,1873)*; Lymnaea auricularia* (Linnaeus,1758)*; Lymnaea ovata* (Draparnaud,1805)*; Planorbis carinatus* (Muller,1774)*; Planorbis planorbis* (Linneaus, 1758)*; Gyraulus leavis* (Alder,1378) and *Euglesa casertana* (Polli,1791). Some of these species*, Bithynia troscheli* and *Planorbis carinatus*, are glacial relics.

Bárbara AVEZUELA

THE PERSONAL ORNAMENTS OF LA PEÑA DE ESTEBANVELA (SEGOVIA-SPAIN) MADE ON MOLLUSCS

The site of La Peña de Estebanvela is situated on the South edge of the Duero river basin in contact with the Central System. This rock shelter offers a sequence attributed to the Middle-Late Magdalenian. Its ornamental collection is made up of five species of marine molluscs, one of freshwater mollusc and three red deer atrophied canines, all of them perforated. Using an experimental program we present a technological study of the perforations made on the molluscs. Furthermore, we try to go beyond the taxonomic and technological descriptive analyses in order to assess which could have been the relationship of the groups who lived in La Peña de Estebanvela with the coasts.

Daniella E. BAR-YOSEF MAYER & Bernard VANDERMEERSCH

OCHRE COVERED SHELLS FROM QAFZEH CAVE: EVIDENCE FOR THE MODERN BEHAVIOUR OF MODERN HUMANS

Qafzeh cave, the site where "anatomically modern humans" were first defined, yielded archaeological evidence for the modernity of the humans living there.

Dated to 92k bp, the site contained, not only skeletal remains, flint tools and animal bones, but also sea shells and ochre lumps, as well as other grave goods. The shells that were positioned below the human remains, were brought from the Mediterranean, at about 30 km away. All the complete *Glycymeris* bivalves were naturally perforated. Some included traces of having been strung, and a few had ochre residues on them. The shells join other evidence from the site that together are strong indicators for the modern behavior of the modern humans of Qafzeh.

Víctor BEJEGA, Eduardo GONZÁLEZ, Natividad FUERTES & Carlos FERNÁNDEZ

ANALYSIS OF SHELL MIDDENS FROM AN IRON AGE SITE: O NEIXÓN (A CORUÑA, NORTHWEST OF SPAIN)

On the course of archaeological excavations carried out at Castro Grande de O Neixón (Boiro, A Coruña), a site used in recent years, a section of a ditch was uncovered and revealed various materials associated to the Iron Age. These are several deposits of organic garbage characterized by the high proportion of shells. The analysis of these remains allows us to evaluate the utilisation of marine resources during Iron Age. The main shell species used at this site were taken in the nearest available habitats.

Eloísa BERNÁLDEZ, Esteban GARCÍA & María BERNÁLDEZ

INDIRECT DETECTION OF CHANGES IN SEVILLE POPULATION STUDYING SIZE CHANGES IN OYSTERS

Human ancient rubbish dumps are evidence of human uses of natural resources and territory. These structures have never been important for citizens, in fact they are an untouched record of history when methodology is appropriate it is possible to study the tank and their contents.

The city of Seville has a vast archaeological record; in fact, here we can find structures of the 7th century B.C. It is very usual to find organic rubbish such as rubbish dumps, religious offer places or a quarry to construct buildings.

We have 283 oyster (*Ostrea edulis* Linnaeus, 1758) shells from four different archaeological sites of Seville: Reales Atarazanas, Cabildo, Castillo de San Jorge and Plaza de la Encarnación. We measured the shells and observed changes in their size between the 14th and 18th centuries. We compared these results with demographic changes at this time and observed a link between demography and size changes in shells.

Eloísa BERNÁLDEZ, Mª del Carmen LOZANO, José Luís VERA, Felipe VÁZQUEZ, Esteban GARCÍA, José Luís GOLLLONET, Laura EXPOSITO, Aurora OCAÑA, María BERNÁLDEZ, Miguel GAMERO & Ana VELA

BIOSTRATINOMY OF NATURAL SHELL HEAPS: DIFFERENCES BETWEEN THESE HEAPS AND HUMAN HEAPS IN ARCHAEOLOGICAL SITES

We can find shell heaps in coastal archaeological sites. Scientists usually think that these deposits are always human product. In our opinion, these heaps could be produced after people had left this place and may have a natural origin. Taphonomic studies and biostratinomic analyses in archaeological sites and actual beaches show us that other processes can form these heaps. We study composition and structure of the tanathocoenosis on the Espigón beach (Huelva).

Gregory CAMPBELL

OYSTERS ANCIENT AND MODERN: METHODS USED TO COMPARE SHELL SHAPE IN MODERN AND LATE ROMAN FLAT OYSTERS (*OSTREA EDULIS*) FROM SOUTHERN ENGLAND

Recognition of two distinct shapes in shells of flat oyster (*Ostrea edulis* L.) from late 3rd-4th Century AD Winchester, south central England, prompted comparison with modern *O. edulis* samples by methods which define shell shape objectively for this species. All oysters were orientated within the shell in a consistent manner regardless of size, shape, location or period; this orientation is probably unique to this species, and forms a useful framework for the analysis of this notoriously variable shell. Relative proportions of the nacreous lining were more consistent means of comparison than proportions based on the whole shell. Some proportions were consistent regardless of shape or location, but were different between periods. Archaeological shells changed abruptly during growth from a range of shapes to a single shape, arguing for oyster management in late Roman England.

Alfredo CARANNANTE

MUREX SHELLS AND STOVES: PURPLE-DYE INDUSTRY SHELL WASTE RECYCLING IN THE BRONZE AGE AEGEAN? THE MINOAN MONASTIRAKI (CRETE, GREECE) PARADIGM

A large number of highly fragmented murex shells were found associated to a stove with lime in the Minoan Palace of Monastiraki (Central Crete). Crushed murex shell middens are generally indicated as evidence of purple-dye production. The location of Monastiraki, situated in an inner region of Crete, at 350 metres upon sea level and, approximately, at 25 kilometres by the coast suggests the recycling of purple-dye industry shell waste in Minoan Crete. This hypothesis may help to interpret in different way other similar contexts in Aegean Bronze Age sites.

Alfredo CARANNANTE

NON FOOD-RELATED SHELLS IN THE BRONZE AGE INDUSTRIAL CENTRE OF PYRGOS-MAVRORAKI (CYPRUS)

Several shells come from the Bronze Age industrial centre of Pyrgos-Mavroraki (Cyprus). Here metallurgy, textile industry, perfume industry and oil and wine production are well documented but any food processing and consumption is attested. Most of the archaeomalacological record pertains to ornamental use of shells as beads or as raw material but also musical instruments and furniture elements are detectable.

Diana Rocío CARVAJAL

MOLLUSKS AT A PURPORTED FISHING CAMP: CUEVA DE LOS VAMPIROS, CENTRAL PACIFIC PANAMA

Aquatic resources such as mollusks are, and have been a vital supply for the economy of pre-Columbian societies.

For my ongoing PhD dissertation, I excavated the upper and more recent deposits of Cueva de los Vampiros site located on the Central Pacific coast of Panama. These stratified deposits which began to accumulate around 2200 BP, have abundant and biologically diverse remains of mollusks, crustaceans, and fish. This paper focuses the taxonomic and taphonomic aspects of mollusks remains. The aim of this paper is to summarize some general aspects of mollusk use at Cueva de los Vampiros.

Cheryl CLAASSEN

SHELLS, CAVES & SNAKES

For at least 9000 years humans carried bivalves into caves and rockshelters of the eastern US. Rather than simply food debris for travellers seeking temporary shelter, mythology and context indicate that bivalves and gastropods where used to symbolize babies in the night sky, deposited as part of thanksgiving rites, and used for eating by menstruating women who retreated to rock shelters.

Cheryl CLAASSEN

THE US FRESHWATER SHELL BUTTON INDUSTRY 1891-1950

The US freshwater shell button industry began in 1891 and ended in the 1950s but was a descendant of a much older European shell button industry. Shells were harvested from hundreds of rivers engendering skirmishes over the beds and

occassionally giving rise to pearl rushes. Some species were favored over others for their cutablity and for their size. The quantities of shells harvested and the size of individual beds are detailed. Button blanks were either cut locally or shells were shipped to factories in Muscatine, Iowa where the blanks were finished and either sold in mass or sold to the retail trade as carded buttons. Ultimately the high loss of product in the production process and then the high loss in washing machines led to the triumph of the Japanese plastic button.

Arati DESHPANDE-MUKHERJEE

DIETARY USE OF MARINE MOLLUSKS BETWEEN THE THIRD AND SECOND MILLENNIUM BC. AT COASTAL HARAPPAN SETTLEMENTS IN GUJARAT, INDIA

Faunal studies from Harappan sites in Gujarat, datable between the third and second millennium BC have so far provided considerable insights into the subsistence economy of the Gujarat Harappans. While major focus has been on the dietary contribution of terrestrial mammals, very little is known about aquatic animals like fish and mollusks. Among these are mollusks in particular whose role in Harappan shellworking is well established now but their use as a food resource still remains unascertained.

In recent years identification of edible marine mollusks at coastal sites in Gujarat does hint at their probable dietary use during Harappan times. This paper attempts to examine the dietary use of mollusks in the light of the available evidence. Marine shells recovered from the site of Kuntasi and Shikarpur were subjected to a detailed analysis along with ethnographic observations on present-day shellfish gathering on the Indian west coast. Additional shell evidence from a few other sites was used as a comparison for arriving to an overall picture of mollusk exploitation patterns along the Gujarat coast. Besides a dietary contribution, the recovered shell data has provided useful insights into the coastal environments during the Harappan period.

Katerina DOUKA, Robert E.M. HEDGES & Thomas F. G. HIGHAM

RADIOCARBON DATING OF SHELL CARBONATES: A NEW APPROACH FOR THE DATING OF THE MIDDLE-TO-UPPER PALAEOLITHIC TRANSITION

Marine shell carbonates are often considered problematic for radiocarbon dating. Problems most often identified include the reservoir effect (the difference between atmospheric and marine 14C activities), the calibration of the radiocarbon age and the need to be converted to a calendar date, or others such as the hard-water effect and the old “shell” problem. However, the assessment of the material’s preservation state, in chemical and physical terms, is most possibly the key

parameter that one should take into account when proceeding with chemical pre-treatment prior to shell dating.

We present some new approaches for the radiocarbon dating of marine carbonates in RLAHA (University of Oxford). The protocol includes effective pre-treatment and rigorous screening that, respectively, reduce the effect of secondary carbonate contamination and help us determine, with confidence, whether or not the marine shells have been diagenetically altered and therefore are suitable for dating.

Finally we discuss the application of this new approach to the dating of the Middle to Upper Palaeolithic transition, with the future aim to shed light on two broadly coinciding processes: the Neanderthal extinction and the dispersal of Anatomically Modern Humans along the Mediterranean rim.

Catherine DUPONT

AN INDUSTRIAL EXPLOITATION OF OYSTERS DURING THE MIDDLE AGES AT BEAUVOIR-SUR-MER (FRANCE)

Large amounts of the flat oysters *Ostrea edulis* dated from the Middle Ages are frequently recovered in Vendée along the French Atlantic facade. Some of these oyster´s deposits are genuine hills more than two meters high. This gigantic aspect and the presence of connected valves have led archaeologists to interpret these deposits as natural accumulations. Several archaeologists and biologists have examined attentively the one of Saint-Michel-en-L'Herm since the beginning of the 19th century to prove its anthropic origin.

But most of these oyster deposits are less known. In spite of their large dimensions they remain invisible in the landscape. They are located under the current ground where villages have been built above the heaps of oysters.

One of them, located in the village of Beauvoir-sur-Mer was recently excavated. This oyster's deposit is 160 meters long, 20 to 25 meters wide and one to two meters high. The first aim of our study was to determine if the oyster was the only species represented in the shell-midden. With that in mind, we sample this deposit and sieved it. More than thousand valves of these oysters were studied. Only a few of them have a hole. The biometric analysis of these features and their position allows us to define the origin of these perforations. The biometric analysis of the valves linked to the observation of the opening marks gives information on the technique used to gather the bivalve. The associated fauna inform about the exploited territory. It allows us to discuss the viability of this gathering activity in the long term.

But these large deposits of flat oysters raise another question. What did people do with all these oysters? The characteristics of the deposit underline the specialization of the activity, the nature of which we will discuss.

Alicia ESTRADA, José Miguel TEJERO, Joseph Maria FULLOLA, Xabier MANGADO, Mari Angels PETIT, Raúl BARTROLI & Xavier ESTEVE

FROM THE MEDITERRANEAN SEA TO THE RIVER SEGRE: PERFORATED SHELLS FROM MAGDALENIAN LEVELS OF PARCO's CAVE (ALÒS DE BALAGUER, LLEIDA, SPAIN)

Discovered in 1974, Parco's Cave has been the object of intensive and systematic excavations by the team from Seminari d'Estudis i Recerques Prehistòriques (SERP) of the University of Barcelona since 1987. In this paper, we will present and discuss these studies of perforated shells obtained from the Upper Magdalenian level (N. II).

To date, more than 30 of these pieces have been identified. Among these fragments found on the site, we distinguish the presence of exclusively fluvial species, such as *Teodoxus fluviatilis*, as well as exclusively marine species, such as *Homalopoma sanguineum* and *Cyclope neritea* – both being strictly of Mediterranean origins. While the origin of the former raises no question whatsoever since their catchments were done from the nearby river Segre, the procurement of marine gastropods, however, which has been identified so far exclusively in Cantabrians sites could suggest the possibility of a new doorway through the Ebro Basin, thereby strongly pointing to the possibility of a new way between the Mediterranean Basin and the Cantabrian area other than the commonly known North Pyrenean corridor. Here, we shall also report on the taxonomical, technological as well as the Geographical Information System (GIS) data of perforated shells found at the Parco's Cave.

Ademar EZZUGHAYYAR, Muhammad ZAWAHRA & Hamed SALEM

MOLLUSKAN FAUNA FROM SITE 4 OF TELL JENIN (NORTHERN WEST BANK –PALESTINE)

Site 4 of Tell Jenin covers many strata from Late Neolithic to Recent Past. Tell Jenin was the first archaeological site excavated in the Area of West Bank (Palestine) by Birzeit University.

The molluskan fauna accumulated during the Bronze Age shows a dominance of freshwater and landsnails over the Mediterranean shells. The "construction" phase (occupation) contain many more specimens than the "destruction" ones (abandonment) in each studied stratum of the site. This archaeomalacological study identifies palaeoclimatic variations in the prehistoric times.

It also reflects the different patterns of trade exchange, food sources, and the use of mollusks as artifacts, including their use as ornaments, in traditional and ritual activities by the population of the site.

Miguel Angel FANO & Esteban ÁLVAREZ-FERNÁNDEZ

MAGDALENIAN MARINE SHELLS FROM EL HORNO CAVE (RAMALES DE LA VICTORIA, CANTABRIA, NORTH OF SPAIN)

The aim of this poster is to present the available information about the intensity and method used to exploit malacological resources provided by the Bay of Biscay by Magdalenian groups at El Horno Cave. The location of the site in the upper Asón Valley, far from the coast, gives a specific weight to the malacological record within the analysis of the population dynamics of the societies being studied. In the case of El Horno, hardly any evidence has been found that the malacological resources were used as food, but in contrast, they were used to make personal ornaments.

Carlos FERNÁNDEZ & Natividad FUERTES

SHELL TRADE AND CONSUMPTION DURING ROMAN AGE AT *ASTURICA AUGUSTA* (LEÓN, SPAIN)

We present a study of malacological remains from Roman levels at *Asturica Augusta*. Most of those remains are marine origin. Our analysis evaluate the importance of this type of resource to the Roman population's diet and provide us with information of the nourishing habits of the upper social classes. In addition to their dietary use, there are some shells that have been used as ornaments.

Asturica Augusta - in the interior of the Iberian Peninsula – was integrated into a commercial network that linked this city with the coast. Thanks to transportation and preservation systems, this commercial network reached the nutritional demand of the elite inhabitants of this city.

María de Lourdes GALLARDO, Emiliano Ricardo MELGAR & Hortensia DE VEGA

THE SHELL GARMENT OF OXTANKAH, QUINTANA ROO, MEXICO: A PROPOSAL OF ITS ANALYSIS AND RESTORATION

The aim of this paper is to demonstrate the existence of a Maya nacreous shell garment by analyzing more than 1600 shell objects of a tomb from Oxtankah, near Chetumal City in Quintana Roo, México. We showed the different techniques employed on this pieces (taxonomical identification, typology based on shape and function, and technological analysis with experimental archaeology and Scanning Electron Microscopy). Also, we compared the design of different garments from hundreds of images from 32 Mayan archaeological sites and the Calakmul reddish shell garment, appreciating in almost all of them the same semicircular B-shape. Finally, we showed how we restored the garment and proposed other ones based on the drawings of some Mayan burial offerings.

Ana GARCÍA & Jordi MARTINELL

STUDY OF THE MARINE MALACOFAUNA COLLECTED IN THE ANCIENT NEOLITHIC THE CAVET SITE (CAMBRILS, TARRAGONA)

The study of marine shells collected from El Cavet site (Cambrils, Spain) has been conducted on the basis of their conchiological characteristics. The material studied is represented by a total of 13 species, among gastropods and bivalves. In the case of gastropod species, three of them have proved to be the most common in El Cavet: Gibbula turbinoides, Columbella rustica and Cerithium vulgatum. These species are also very common in other Neolithic sites of the Iberian Peninsula. The main anthropic uses of the shells inferred in this site are food, personal ornamentation and craftsmanship. In any case, not all species were used for everything, and some of the collected have not shown any attributes that enable infer any usefulness.

Ermengol GASSIOT, Ignacio CLEMENTE & Virginia GARCÍA

ARCHAEOMALACOLOGY AND PALEOECONOMY. THE SHELL MIDDENS INTO THE PREHISTORIC SUBSISTENCE PRACTICES IN THE CARIBBEAN COAST OF NICARAGUA (1400 calBC TO 1000 calAD)

Still no so well known in many areas, shellmiddens are a common trait in the archaeological record from the Caribbean. Ten years of intensive archaeological researches in the littoral lowlands around the Pearl Lagoon and the Bluefields Bay into the Atlantic Coast of Nicaragua provide abundant data on littoral sites, most of which with shellmiddens. This permits to construct an archaeological sequence of 3,500 years of occupation, with an intense exploitation of aquatic mollusks that has continuity. With the exception of the prehistoric village of Karoline (400 calBC to 350 calAD) and a few handfuls of sites in the Bluefields Bay, the shellmiddens are conformed quite merely by the medium fresh water bivalve *Polymesoda solida*. In spite this apparent homogeneity in the shellmiddens, the exploitation of mollusks undergoes notable changes through time.

This paper presents the patterns that undergo the exploitation of mollusks across all the archaeological sequence. First, the taxonomy of shells is detailed, linking these data to the remaining evidences of subsistence at different sites. Second, the formation process of the shellmiddens is hypothesized, on the basis of their internal stratification, the ethology of the different species of shells and the inferred practices of collection. Third, it is exposed too the use of the shells as raw material, shown both in the necklace beads and in use wear analyses of lithic tools. Finally, the paper concludes with an economic analysis of the exploitation of mollusks as a subsistence practice. Different patterns of collection are presented for the different species from the confrontation of archaeological data (counting and measuring of shells, stratigraphy of the shellmiddens, etc.) with the ethnographical ones. On the basis of these patterns, the traditional assumption of the mollusks as a "*low rank resource*" is revised, especially for these taxa that were mass collected.

Eduardo GONZÁLEZ, Víctor BEJEGA, Laura LLAMAZARES & Carlos FERNÁNDEZ

MARINE SHELL EXPLOITATION AT SAN CIBRAO SITE (LUGO, NORTHWEST OF SPAIN)

Recent discoveries of shell remains and other materials were found during various construction works at San Cibrao's beacon located on a small peninsula (Cervo, Lugo). These findings are associated to a Roman maritime settlement, a fort on a hill, similar to those previously found at the Cantabrian sea sector of Lugo province.

Sampling and posterior analysis of these remains allows us to evaluate the importance of mollusks for the diet of an indigenous-type population during Roman times.

Gustavo GONZALEZ, Eduardo MESA, Alberto BRITO, Gustavo PEREZ, Jacinto BARQUIN & Bertila GALVAN

DISTRIBUTION OF THE *PATELLA CANDEI* (D´ORBIGNY) IN THE CANARY ISLANDS AND ITS SUPPOSED EXTINCTION IN PRE-HISPANIC TIMES

We will analyze the distribution in the Canary Islands of the limpet *Patella candei* (d´Orbigny 1840). This limpet is considered in the national catalogue of threatened species as an endangered one. Nowadays it only has bad preserved populations in the south and south eastern areas. Until now this populations have been considered as a relic after its extinction in the rest of the islands. The previous fact would be a consequence of intensive shell-fish exploitation since prehistoric times. The results of this study were obtained from an exhaustive sampling of the entire islands´ coast and from the revision of shells from aboriginal shell-fish gathering in the archaeological record.

After all studies we can see that, at least since the period of the first human settlements in the Canary Islands, the distribution of this limpet was similar to the present one. We must discard its extinction in the other islands as a direct consequence of the intensive exploitation. In the pre-Hispanic deposits of Fuerteventura, *Patella candei* was very common in shell middens and maintains its population nowadays. On the other hand, from the study of 41 sites in the rest of the islands only four of these limpets were found in the shell middens of Tenerife and Lanzarote. In the last 30 years only 3 *Patella candei* specimens have been found alive outside Fuerteventura and they belong to the typical morphotype of the Wild Islands.

Andrea GUÍA

WHERE THE SEA INVADES TO THE DESERT: FORMS OF UTILIZATION OF THE MOLLUSKS IN THE UPPER GULF OF CALIFORNIA, MEXICO

Diverse species of mollusks live in the Gulf of California. They were used in various ways by the ancient inhabitants of the Baja California peninsula. This is demonstrated by the numerous shell middens located along the coastline, which resulted from the collection of these organisms by the human groups that lived in the region. Studying the middens reveals to us the species that were most commonly used for food, the ways in which the animals' meat was acquired, and the preferences for certain species as raw materials for manufacturing artifacts. Archaeological investigations carried out by INAH-BC make clear the importance of murex snails (primarily *Hexaplex nigritus*) and several species of clams as fundamental to the groups' survival. Also sites in the interior of the peninsula are examined and where there are found species of freshwater mollusks that were used to make ornaments. This study is one of the first projects into the region in which the species that compose the middens are described. In the present lecture, an attempt is made to describe and discuss mollusk exploitation and the means of subsistence for the ancient inhabitants of Baja California.

F. Igor GUTIÉRREZ & Manuel GONZÁLEZ-MORALES

NEW DATA ON ASTURIAN SHELL MIDDEN SITES: THE CAVES OF LA LLANA AND MAZACULOS II (ASTURIAS, NORTHERN SPAIN)

Throughout the 20th Century research on Mesolithic shell midden sites in northern Spain have focused predominately on the Asturian chronocultural period (≈ 9000 - 6000 BP). However, the last twenty years has seen a decline in the archaeological investigation of the Asturian period, while research in Mesolithic shell midden sites has increased in other areas of northern Spain, such as eastern Cantabria and the Basque Country. In spite of the large amount of research conducted on the Asturian shell middens during the past century, only a few detailed archaeomalacological analyses have been carried out. In this paper, I present the results of the archaeomalacological analyses from the Asturian shell midden sites of La Llana (Andrín, Asturias) and Mazaculos II (La Franca, Asturias). These new data are used to address both mollusk exploitation patterns as well as to compare these results to established data from previous mollusk research on the Asturian.

Karen HARDY

SHELLS IN SCOTLAND. USE OF SHELLS AS RAW MATERIAL FOR TOOLS AND JEWELLERY IN MESOLITHIC SCOTLAND

Scotland has thousands of miles of coastline and numerous prehistoric sites. Many of Scotland's Mesolithic sites lie near or adjacent to the coast and shell middens abound. Most of the shells in these middens appear to be related to food however in

certain sites such as Sand, near Applecross, a range of evidence for shells as jewellery and as raw material for tools has emerged. The Mesolithic in Scotland does not have a particularly rich material culture and these exciting results will be presented and placed in the wider context of similar artefacts from the Scottish Mesolithic and Neolithic.

Juan Carlos HERNÁNDEZ, Eduardo MESA, Juan Francisco NAVARRO & Gustavo GONZÁLEZ

ARCHAEOLOGICAL SHELL MOUNDS AND SHELLFISH GATHERING ON LA GOMERA ISLAND (CANARY ISLANDS, SPAIN)

We present the preliminary results of the project: "Superficial Study of the archaeological shell middens of La Gomera (2006-2008)". The remarkable level of conservation at La Gomera island´s coastline, where these archaeological units are located, has allowed their study. Firstly, the work consisted of an exhaustive compilation of spatial information of the existing shell middens on the island. On the other hand, with the purpose of successfully obtaining data and looking for elements to interpret these shell middens, a series of interviews were conducted within neighbours and average sailors in the entire island to ages between the 60 and 95 years. Also the archaeomalacological remains deposited in the Insular Archaeological Museum coming from excavations, archaeological surveys and donations made between 1974 and nowadays were revised. This information permit to understand the role developed by shell gathering between the old Gomeros and evaluated these shell middens by their patrimonial interest as well their scientific potentiality.

María José IRIARTE, Álvaro ARRIZABALAGA, Francisco ETXEBERRIA & Lourdes HERRASTI

SHELL MIDDEN PEOPLE IN NORTHERN IBERIA. NEW DATA FROM THE MESOLITHIC ROCK SHELTER OF J3 (BASQUE COUNTRY, SPAIN)

In the course of a sondage dug in the rock shelter of J3, in the Jaizkibel mountains (at the north-western tip of Guipúzcoa), the body of a adult man was located buried inside a shell midden. This shell midden had not been disturbed and presented internal stratigraphy features. In any case, the outer edge of the shell midden does show some interesting interdigitation with the adjacent habitational layers, with evidence of different stages of occupation. Within the shell midden itself, under the individual buried there, it was possible to observe layers without any ceramics, whereas the layers covering said individual included ceramic fragments. This individual has been dated to 8,300 BP and therefore corresponds to a Mesolithic context.

Ilean Isel ISAZA & Patricia A. MCANANY

SOCIAL USES OF SHELL ORNAMENTS: A COMPARATIVE STUDY FROM THE MAYA AREA AND CENTRAL PANAMA

Shell, both marine and freshwater, is one of the most common raw materials used for the crafting of personal ornamentation. Retrieved from the cosmologically charged watery depths, shell is relatively easy to work with. Globally and throughout time, shell has been highly sought after and often is cited as an item of value in exchange networks and pre-state spheres. Interpretation of archaeological patterns indicates that shell ornaments can provide significant insights into the construction of social identities. During the presentation of this paper we will use examples from two cultures in Central America: the Maya from Mesoamerica and Gran Coclé from Central Panama where large samples of shell ornaments where found in pre-Classic and Classic period burials, particularly those of children and adult females.

Jesús F. JORDÁ, J. Emilio AURA, Carlos MARTÍN & Bárbara AVEZUELA

ARCHAEOMALACOLOGICAL REMAINS FROM THE UPPER PLEISTOCENE – EARLY HOLOCENE RECORD OF "VESTÍBULO" OF NERJA CAVE (MÁLAGA, SPAIN)

At the final stages of the Upper Pleistocene and the Early Holocene, a strong stratigraphic series was placed on the access of Nerja Cave ("Vestíbulo"). This serie was distinguished by the evidence of major human activities throughout the human occupation of the cave (*ca.* 30.000 - 6.000 years cal. BP). This series represents one of the broadest archaeological records on the Western Mediterranean area at this age, and it is the technological evidence of various cultural assemblages of the prehistoric sequence (Gravetian, Solutrean, Magdalenian, Mesolithic and Neolithic). The technological remains are not the only evidence found, an important amount of vegetal and animal remains related to human activities in the cave have been also found. Among the remains, stands out the abundant presence of remains of marine and continental mollusks: 76 taxa and more of 135.000 remains (80 kg of shells) of Gastropoda, Scaphopoda, Bivalvia and Cephalopoda. Surpasses the important presence of mollusks used for food, but others also were used as ornaments, and finally some species are introduced in the cave accidentally by men and those inhabit in these karstic zones.

Darko KOMŠO & Preston T. MIRACLE

MESOLITHIC SEA AND FRESHWATER PERFORATED SNAILS FROM ISTRIA, CROATIA

Perforated shells figure prominently in discussions of exchange systems and body ornamentation during the Mesolithic in Europe. In this paper we discuss assemblages of perforated snail shells recovered from recent excavations of

Mesolithic sites in Istria, Croatia. The most numerous species is *Columbella rustica*, and recent experiments and observations on the assemblage from Šebrn Abri suggest that larger-sized shells were selected and that perforations were made quickly and expediently using a punching technique. A much larger assemblage of perforated shells was recovered from Pupićina Cave, and alongside *Columbella* (dominant in the assemblage) there are also perforated shells from freshwater taxa. The significance of the Pupićina perforated shell assemblage is examined in light of other evidence of site use, as well as within the context of the Late Upper Palaeolithic and Mesolithic of Istria and the surrounding region.

Sonia Laura LANZELOTTI

CHARACTERISTICS OF MOLLUSK EXPLOITATION IN THE NORTHERN PATAGONIAN COAST (ARGENTINA)

A methodology to study malacological resource exploitation in the northern patagonian coast of Argentina is proposed. The goal is to contribute to the knowledge of human use of coastal areas during Mid-Late Holocene at a regional scale. It is assumed that the combination of several resources generates redundant occupation of particular places. Thus, we analyze the relative importance of mollusks exploitation in relation with other littoral resources.

Density and distribution of shell middens are shown, as well as the characteristics of the mollusk species recovered in excavations (e.g. diversity, density, laterality, state of preservation, intertidal/subtidal provenience, allometric measure, etc.), detailing the presence of other evidences recovered among valves (remains of crustaceans, fishes, marine and terrestrial mammals, birds, egg shells, charcoal and lithic artifacts).

Finally, some ways for exploring changes in the exploitation of mollusks and possible causes during the span these shell middens involve (*ca.* 4000 a 700 years BP) are proposed.

Pedro LÓPEZ & Emiliano Ricardo MELGAR

EXPLOITATION OF SHELLS AT EL CUYO, CAMPECHE, MEXICO

During the 2006 and 2007 underwater fieldwork at El Cuyo, Campeche, a pre-Columbian Mayan seaport, the archaeologists had been recovered a rich shell assemblage. The taxonomical identification allowed us to know the different environments exploited by the ancient Maya. Also, the comparison of the archaeological specimens with the modern ones showed us that the former shells were bigger in size than the modern ones, probably as a result of the overexploitation of these marine resources by the modern fishermen.

M. Carmen LOZANO & José Luis VERA

PALAEOBIOGEOGRAPHY RECONSTRUCTION OF *MODIOLUS LULAT* (DAUTZENBERG, 1891) (BIVALVIA, MYTILOIDA) OBTAINED FROM MOLLUSK'S RECORD IN FENICIAN-PUNIC CITIES AND THANATOCOENOSIS AT HOLOCENE BEACHES

Modiolus lulat (Dautzenberg, 1891) is a specie of Mytiloida (Mollusca, Bivalvia) living in West Africa from Senegal to Angola and Cabo Verde Islands. It has been cited as fossil in Dakar Quaternary (Senegal). *Modiolus lulat* has been confused in the bibliography with *Mytilus edulis* and *M. galloprovincialis.*

It has cited in Alborán Sea (West Mediterranean) and recently in Málaga, the only point in Europe where there are living specimens and cited. *Modiolus lulat* is not cited in the archaeology record neither in European coasts, so we think that this specie colonized Alboran Sea and Lusitanian (Cádiz province, Southern Spain) recently, possible at the terminal Holocene.

The authors have collected living specimens of *M. lulat* in the thanathocoenosis of beach in some stations of Málaga province: El Morche, Misoricordia (Málaga town), Calaburra (Mijas), Cabo Pino (Marbella), Punta de la Plata, Arena Beach (Estepona); and Sardina beach (San Roque, Cádiz).

Lozano-Francisco studied the sea resources of Fenician-Punic populations of Camposoto (San Fernando, Cádiz) (century VI B.C.). She reported eight valves of *Modiolus lulat* excellently preserved with their original coloration (deep red-pinkish). This is the first mention of this rare specie in the zooaarchaeological record in Europe, which was identified before as *Mytilus edulis* (Linné, 1758).

With *Modiolus lulat*, the Fenician-Punic populations of Camposoto exploited also 32 species of mollusks, one crab (Crustacean) and five species of fishes, mainly for food. Mollusks were complete (with both valves), these are: *Glycymeris glycymeris* (Linné, 1758), *Glycymeris insubrica* (Brocchi, 1814), *Mytilus edulis* (Linné, 1758), *Pecten* sp., *Chlamys (Chlamys) varia* (Linné, 1758), *Chlamys (Proteopecten) glabra* (Dillwyn, 1817), *Anomia epphipium* Linné, 1758, *Ostrea edulis* Linné, 1758, *Acanthocardia* sp., *Rudicardium tuberculatum* (Linné, 1758), *Eastonia rugosa* (Helbling, 1779), *Ensis minor* (Chenu, 1843), *Ruditapes decussatus* (Linné, 1758), *Venerupis corrugata* (Gmelin, 1791), *Patella caerulea* Linné, 1758, *Patella rustica Linné, 1758, Monodonta lineata* (Da Costa, 1778), *Charonia lampas lampas* (Linné, 1758), *Bolinus brandaris brandaris* (Linné, 1758), *Trunculariopsis trunculus trunculus (Linné, 1758), Thais (Stramonita) haemastoma* (Linné, 1766), *Nassarius reticulatus* (Linné, 1758), *Bittium reticulatum* (Da Costa, 1778), *Hidrobia ulvae* (Pennant, 1777), *Hidrobia ventrosa* (Montagu, 1803), *Hydrobia* sp., *Caracollina lenticula* (Michaud, 1831), *Rumina decollata* (Linné, 1758), *Cecilioides acicula* (Müller, 1774), *Theba pisana* (Müller, 1774), *Ferrussacia acicula* (Müller, 1774), *Sepia officinalis* Linné, 1758, Decapoda sp., *Myliobatis aquila* (Linné, 1758), *Lophius piscatorius* Linné, 1758, Sparidae sp., *Merluccius merluccius* (Linné, 1758), *Thunnus thynus* (Linné, 1758). Some small marine gastropods such as Hidrobia o *Bittium* were interpreted as part of the sand or sediment from the beach.

In conclusion, taxonomic and ecologic studies of the archaeological record are the keys to know the paleobiogeography and taxonomy of the marine mollusks, especially when they are occupying areas in the past where do not live recent in Mediterranean area. This conclusion is extrapolated to fresh water and continental mollusks.

David LUBELL, Mary JACKES, Meredith L. FABER & Crayton J. YAPP

LAND SNAIL STABLE ISOTOPES AND THE CAPSIEN TYPIQUE-CAPSIEN SUPERIEUR TRANSITION IN EASTERN ALGERIA

Excavations in the 1970s at two stratified Capsian escargotières in the Télidjène Basin, eastern Algeria, revealed a Capsien typique-Capsien supérieur sequence dated ca. 9500 to 6500 calBP. Geoarchaeological analyses of the deposits and zooarchaeological studies, especially of the abundant land snail assemblages, suggest a change from wetter to drier environmental conditions coinciding with the transition from Capsien typique to Capsien supérieur. New studies of the stable isotope composition of Helix melanostoma shells from one of these sites, Aïn Misteheyia, as well as of live/recent samples of the same species collected near the site in 1973, show measured values of δ18O that correspond with the decrease observed in the Greenland ice cores at 8200 calBP. Values for δ13C are consistent with a snail diet of predominantly C3 organic matter throughout the sequence, and this is being verified using studies of phytoliths from the same deposits. Analyses now in process of land snail shell samples from the second site, Kef Zoura D, where variations in land snail assemblages were used to reconstruct the stratigraphic sequence, are expected to demonstrate a similar scenario. In this paper, we will combine data from all studies, but especially those of the land snails, to show that the cultural/technological shift from earlier (typique) to later (supérieur) varieties of the Capsian, was related to environmental changes brought on by the Abrupt Early to Mid-Holocene Climatic Transition (EMHT), also known as the 8200 calBP event.

Ruth MAICAS

MORE THAN FOOD, BEADS AND SHELL TOOLS IN LATE PREHISTORY: SPANISH SOUTHEAST

Current reviews point out the bromatologic role of malacological remains and their increase attribution as ornaments in prehistoric societies. Beads and other ornamental objects are very common components of archaeological assemblages in Mediterranean Late Prehistory, but they are not the exclusive production in shell materials in our sites.

This paper discusses objects from the Siret collection in the Museo Arqueológico Nacional (Madrid, Spain). We would like to emphasize, among other topics, the role of a pioneer in Spanish Archaeology, Luis Siret, as regards malacological studies:

some analysis and experimental works made by him at the end of XIX century are presented here.

The study of malacological material collected from Neolithic and Chalcolitic sites documented in Vera Basin (Almería, Spain) is revised in this paper. More than 2,600 objects were made of shell. Personal ornaments, such as beads and pendants, compose the main group, although we have also identified a small assemblage of tools. An interesting point is the existence of shell materials in the inland, far from the sea. Shell objects are evidenced in 30 of 35 burials documented in the Alto Almanzora, being frequently the main component of grave-goods. Shell industry was studied in order to learn artefact's functionality of these assemblages in Neolithic and Chalcolithic societies. Moreover, this other kind of objects, prepared as utilitarian tools (i.e. small pots), has shown a different perspective for their social value.

Jorge MARTÍNEZ, Joel CASANOVA & Rafael MORA

LOST IN THE MOUNTAIN? MARINE SHELLS AND SOCIAL NETWORKS IN THE SOUTHERN PYREENES

In the past few years, Mediterranean carved marine shells (particularly *Collumbella rustica*) have been profusely mentioned at the south Pyrenees and Ebro valley Mesolithic sites. Some scholars argued this gastropod allows identifying long distance social networks that articulate a common cultural Post-glacial landscape. In this presentation we will introduce the marine carved shells evidence found in the south-eastern Pyrenees sites of Santa Linya, Balma Guilanyà, Sota Palou and Font del Ros, that included a wide temporal range, from the end of Paleolithic to Early Neolithic. The characterization of these assemblages in the geographic, crono-climatic and crono-cultural context of the Pyrenees sites permit to visualize the radical transformations that affected the technical, social and cultural spheres of the hunter-gatherer lifestyle from the late Pleistocene to the Holocene. These data can evaluate if these ornaments describe patterns of cultural change and if the pertinence to consider them like Post-glacial social network tracers in the south Pyrenees and Ebro Valley.

Emiliano Ricardo MELGAR

THE MANUFACTURING TECHNIQUES OF THE OLIVA PENDANTS AT XOCHICALCO, MORELOS

At the Epiclassic (AD 600-900) site of Xochicalco, in the Western Valley of Morelos, México, archaeologists had been recovered a lot of Oliva pendants, some of them forming necklaces in the offerings inside the main structures. Through the experimental archaeology and the analysis of the traces of manufacture with optic microscopy (OM) and scanning electron microscopy (SEM), I could identify the different tools and techniques employed in their production. Surprisingly, each pendant presented different technologies, despite that they were part of the same

necklace and offering. Probably, they were produced by different working groups or shell workshops, because in the later stages of the site, the shell objects presented a strong standardization of their manufacture.

Eduardo MESA, Bertila GALVÁN & Gustavo GONZÁLEZ

ARCHAEOMALACOLOGICAL STUDIES IN PREHISTORIC CONTEXTS IN TENERIFE (CANARY ISLANDS, SPAIN)

We will present a synthesis of the malacological studies made in different prehistoric contexts in Tenerife (middle of the first millennium B. C. (s. IV-II) until the 15th century A. D.). These contexts are the result of the first occupation of the islands by bereber populations from northern Africa. The first seashell´s taxonomical identifications from prehistoric sites of the island were made at - the 70´s decade of the 20th century. But it is mostly in the 90´s when a theoretical and methodological change occurs as far as the study of this kind of findings. This new approach implies an advance on the past hypothesis that deals with shell-fish gathering as a complementary activity. They have been now replaced by a new approach that deepens in the importance and development of this activity inside the productive process between these populations.

Hervé MONTERROSA & Reyna Beatriz SOLÍS

MALACOLOGIC MATERIALS OF THE ARQUEOLOGICAL AREA IN PEZUAPAN, GUERRERO, MEXICO

During the season 2005-2007 in the area of Pezuapan, located in Chilpancingo city, Guerrero, there were recovered various malacological materials of marine and freshwater origin. These mollusks correspond to the Epi-classic (AD 600-900) and early Post-classic (AD 900-1150) periods. The material presents a diversity of species that indicates the relationships of this area with settled groups in the Pacific Ocean shores, surely following the beds of the main rivers like Balsas, Huacapa, and Papagayo. Finally, this study is a pioneer in a not well known archaeological area such as the Chilpancingo valley and Guerrero in general.

Mònica OLIVA

TECHNOLOGY, PRODUCTION AND USE OF MALACOLOGICAL ORNAMENTS AND TOOLS IN THE PREHISTORIC SITE OF CAN ROQUETA (BARCELONA, SPAIN).

This poster shows preliminary typological, technological and spatial analyses of shell ornaments from the site of Can Roqueta near Barcelona, Spain. Can Roqueta is situated at 15 km from the city of Barcelona, in a platform over Ripoll River

which has a long and wide valley with - diverse paleoecological and water resources. The site is dated between the 5th-4th millennium BC (Ancient Neolithic) to the Middle Age. The artifacts analyzed in this study are associated to the beginning of the second millennium BC (Early Bronze Age). Most of the ornaments are made of shell but other raw materials were also used. These shell ornaments were founded in funerary contexts, pit storage and habitation areas. The analyses determine the variety of shell species chosen by ancient people in the area, their use, production and the manufacture of ornaments. With the help of experimental archaeology and traceology techniques, we try to established how those ornaments were made, which techniques were used, how much time they may spent elaborating these objects and what were their finally use.

Mònica OLIVA & Riker YLL

THE USE OF MARINE SHELLS IN CINGLE VERMELL AND ROC DEL MIGDIA, TWO PREHISTORIC SITES IN WESTERN MEDITERRANEAN: A PRELIMINARY APPROACH

This poster presents the results of a preliminary study of malacological materials at the archaeological sites of Roc del Migdia and Cingle Vermell. This first approach determines the variety of shell species chosen by ancient people settle in the area and try to discern their use.

Early excavations at the Roc del Migdia reported human occupation from Upper Palaeolithic until Bronze-age. There are few contemporary archaeological sites in the immediate area with the exception of the Cingle Vermell with evidence for Mesolithic occupation. The sites are included in the multidisciplinary project *Evolució de les Ocupacions Humanes des del Paleolitic al Neolitic a la Vall de Sau (Osona).*

Both rock shelters, Cingle Vermel and Roc del Migdia are located at 15 km east of the city of Vic (Barcelona province) in north eastern Catalonia. The sites lay at the base of a cliff at 650 meters of altitude in the Sau Valley. The Sau Valley´s slopes support helm oak woodland and lies near the intersection of distinct climatic influences. These ecological conditions create a zone with a wide range of different biological communities that have potential as human food resources. Because of this ecological richness, this zone has had a considerable attraction to prehistoric populations with an economy based on hunting and gathering. One of the resources documented were marine shells. These remains are represented by few ornaments and fragmented shells appeared in the occupation levels. These ornaments were made in species like *Nassa*, *Trivia* and *Cyclope*. Most of the shell ornaments described present one or two perforations using different techniques and have small size.

Roberto ONTANÓN & Esteban ÁLVAREZ-FERNÁNDEZ

FIRST DATA ON MARINE MOLLUSC EXPLOITATION DURING THE NEOLITHIC IN CANTABRIAN SPAIN: LOS GITANOS CAVE (MONTEALEGRE, CASTRO URDIALES, CANTABRIA, SPAIN)

Mollusc shells from the archaeological site of Los Gitanos Cave largely correspond to the Patelloidea family. Due to their good preservation, it is possible to identify four different gastropod species: *Patella vulgata*, *Patella rustica*, *Patella intermedia* and *Patella ulyssiponensis.* Gastropods such as, *Osilinus lineatus* is also abundant, while other species of gastropods and bivalves are less represented (*Gibbula umbilicalis*, *Mytilus* sp., etc). In this paper we study the evolution in the consumption of molluscs through the Neolithic sequence in this archaeological deposit.

Isabel C. RIVERA

THE SHELLS OF PUNTA CANDELERO: PALAEOENVIRONMENTAL EVALUATION OF ANTHROPOGENIC SHELL DEPOSITS IN A SALADOID COASTAL SITE IN PUERTO RICO, AND ITS IMPLICATIONS FOR COASTAL HABITAT AVAILABILITY

This essay evaluates a shell assemblage from Punta Candelero, a Saladoid site located in the south portion of Puerto Rico's eastern coast, in the Caribbean Sea. Given the different possible ways in which shells are incorporated to archaeological contexts, this assemblage has been classified as an anthropogenic shell deposit, differentiating it from middens or other shell accumulations. Analysis of the shell assemblage reflects the foraging strategies of the inhabitants of the site, exploiting all the locally available coastal habitats, including rocky shores, soft bottoms and sandy beaches. The importance of the exploitation of riparian environments seems to be much greater than anticipated given the abundant presence of *Neritina* sp.

Antonio José RODRÍGUEZ, Antoni CANALS, Palmira SALADIÉ & Ana GARCÍA

UPPER PALEOLITHIC SHELL ORNAMENTS FROM SALA DE LAS CHIMENEAS, MALTRAVIESO CAVES, CÁCERES (SPAIN)

In this work we carried out taxonomic, technological and traceologic studies of two perforated shells: *Littorina obtusata* and *Patella vulgata* recovered from the Sala de las Chimeneas, inside of Maltravieso caves site, Cáceres (Spain).

The presence of both species is frequent in Paleolithic contexts and common in Epi-Paleolithic contexts but rare in later chronologies, especially for *L. obtusata.* The techniques of perforation and utilization of shell pendants have been characterized by traceologic and morphometric studies. These Caceres Complex ornaments were compared to other Upper Paleolithic sites in the Portuguese Tajo's Basin.

Cristina SAN JUAN & Pascal FOUCHER

MARINE SHELL BEADS FROM THE GRAVETTIAN AT GARGAS (CENTRAL PYRENEES, FRANCE): CULTURAL AND TERRITORIAL MARKERS

Gargas Cave (Aventignan, Haute-Pyrénées) is a reference site for the Gravettian period in Europe because of its exceptional parietal art and rich archaeological strata. The excavations carried out in the late 19th Century and early 20th Century showed that the deposit covered a wide chronological range: Mousterian, Chatelperronian, Aurignacian and Gravettian. A new series of excavations was commenced in 2004 with the aim of establishing a detailed stratigraphic sequence that would be more precise than the schematic profile proposed by E. Cartailhac and H. Breuil in their studies of 1911-1913. At the same time, a further objective has been to carry out the first palaeo-environmental study of the deposit.

The Gravettian levels discovered in the recent excavations (dated by C14-AMS to between 27,000 and 25,000 BP) have yielded lithic and bone assemblages that are characteristic of the middle Gravettian with *Noailles* burins, which has confirmed the initial attribution of the level. It has also been possible to recover new archaeological material, in particular a series of 17 personal ornaments made from marine shell beads, including a dozen examples with the perforation intact. The identified species are: *Littorina obtusata, Littorina littorea, Patella vulgata, Nucella lapillus, Trivia europea, Neritina fluviatilis*, *Neritina picta* and *Pirenella plicata*. These are Atlantic gastropods that are often found in Gravettian deposits in south-west France or fossil shells from lower Miocene beds (*faluns*) in Aquitaine. Most of the potential sources are located at distances of 150 or 250km from the cave, on the Basque coast and in the middle and lower valleys of the Adour and Gave de Pau. These areas coincide with the sources used for the supply of the most common allochthonous flint at Gargas. This information is of great significance in terms of the directions of movements and the cultural space of Gravettian populations in the Central Pyrenees.

Romina SILVESTRE, Natacha BUC & Daniel LOPONTE

WHAT ABOUT SHELLS? EXPERIMENTATION AND FUNCTIONALITY OF SHELL ARTIFACTS IN THE PARANÁ´S WETLAND, ARGENTINA

This presentation is based on three main characteristics of the late Holocene archaeological deposits located on the Paraná's wetland (Pampean Region, Argentina): low availability of lithic raw materials, a contrasting great abundance of bone tools and an overwhelming quantity of malacological remains. In previous works, we exposed the technological scenario of our study area discussing that lithic and bone technology functioned in a complementary fashion. In this paper we consider the possibility that mollusk shells had been used as an alternative raw material, that is, as a third part of this integrated technological system given their high availability and low procurement costs.

As a starting point, we explore the functional possibilities of shells as raw material. For this reason, we developed an experimental program that involved both the extraction of base forms and their use as artifacts as well. We used them as natural edges for varied tasks such as cutting, scraping and sawing hard materials, mainly bone and antler. But also we tested the capabilities of lithic raw material for the formalization of malacological tools such as *tembetás* (ornament items used by ethnographic groups in northern Argentina).

Results can be briefly summarized as follows:

Processes of micropolish formation on shells can be equated with those produced on lithic materials, although differential sharpness introduces some variation. Moreover, we can differentiate bone cut marks made by mollusk shells from those made by lithic edges (U-shaped vs. V-shaped, respectively). In sum, shells can undergo different tasks efficiently, but we also recognize the difficulty of identifying the artifacts on the archaeological record, especially after taphonomic processes. However, these results point out that we must consider mollusk shells as a source of raw material in our study area and as an important option within the technological strategies of hunter-gatherers during late Holocene times.

Reyna Beatriz SOLÍS & Guadalupe MARTÍNEZ

THE SPECIALIZED PRODUCTION OF SHELL OBJECTS IN TEOPANTECUANITLAN, GUERRERO, MÉXICO

In the area of Teopantecuanitlan, located in the east-center region of Guerrero, it has been recovered the most ancient and abundant shell collection correspondent to the Mesoamerican Formative period (1200-600 BC). Most of this material comes from the Pacific Ocean shores and in less quantity from the Mexican Gulf and of rivers on the slope of the Pacific Ocean. There has been identified: non modified mollusks, pieces in process of work and finished objects. Through the use of experimental archaeology and the observation of the various modifications with optical microscopy (OM) and scanning electron microscopy (SEM), it was possible to deduce the techniques and tools used for its production, which should have been concentrated in one or in a few workshops controlled by the rulers of the site.

José Luís VERA, M. Carmen LOZANO, María Dolores SIMÓN, Miguel CORTÉS & Julián RAMOS

THE TUSK-SHELLS (SCAPHOPODA, MOLLUSCA) IN THE ARCHAEOZOOLOGICAL RECORD OF MÁLAGA PROVINCE (SPAIN): SYNTHESIS AND PREHISTORIC OUTCROPS

Molluscs were obtained by humans from Upper Paleolithic, Epipaleolithic, Neolithic and Calcolithic contexts of Nerja Cave, Mina Hole and Humo Complex (Málaga), specially tusk-shells (Scaphopoda, Mollusca) which were utilized as ornaments. Similar artefacts arranged in collars are found in every cave in Malaga province. These tusk-shells are strongly polished on the outside and scratched

inside. Tusk-shells were obtained by human populations on the thanathocoenosis of beaches, near of caverns (Humo Complex, Mina Hole), and far away of cavern (Nerja Cave).

Fossil tusk-shells (Pliocene) obtained in Upper Paleolithic and Neolithic contexts from Mina Hole are exceptional findings. Molluscs excavated in Mina Hole have been compared, measured and identified with fossil and recent tusk-shells from Tertiary age (Miocene and Pliocene) of Andalusia, Catalonian (Spain) and Italian basins deposited in MMPE. This is an important collection of reference in Spain to study scaphopods and mollusks from prehistoric outcrops. We have found scaphopods fossils (Miocene to Pliocene) *Dentalium sexangulum* Gmelin, 1790 and *D. inaequale* Bronn, 1831. These two species are bigger than recent European scaphopods and both are buried in marine Pliocene sediments in Málaga basin, near of Mina Hole. These species of the genus *Dentaliun* are extinguished since Upper Pliocene (Gelasien).

The Quaternary species identified in Prehistoric outcrops of Málaga province are *Antalis inaequicostatum* (Dautzenberg, 1891), *Pseudantalis rubescens* (Deshayes, 1825) and *Antalis vulgare* (Da Costa, 1778). These shells might be collected dead by humans in the thanathocoenosis of beach. Nowadays, these shells are frequent in the littoral of western Mediterranean Sea.

Ester VERDÚN

MOLLUSKS AS SEDIMENTARY COMPONENTS. ANOTHER PERSPECTIVE OF ANALYSIS

The study of shell middens through representative and significant sedimentary samples from every stratigraphic subunit, gives us a different approach to archaeological sites. The statistical study of the components of each sedimentary sample shows spatial differences in the site Túnel VII (Tierra del Fuego, Argentina). This is a shell midden located at the coast of the Beagle Channel. It was occupied in the last decades of the 19th century by the Yamana, a hunter-fisher- gatherer society that lived along the Beagle Channel until the arrival of the European expeditions. There are some chronicles and ethnographic testimonies of Yamana occupation. The spatial differences observed in this site, give information about the activities carried out in the settlement and about the use of the shells as building material.

Rena VEROPOULIDOU

PURPLE-DYE PRODUCTION IN THE BRONZE AGE AEGEAN: THE EVIDENCE FROM MAINLAND GREECE AND THE ISLANDS

The use and importance of purple-dye are well documented in Geometric and Classical Greece and the earliest evidence of purple-dye production in the Aegean comes from Crete and dates to the end of the Middle Minoan period, in the 18th cent BC. Archaeological data, however, related to prehistoric purple-dye production

and use is generally insufficient since early excavations collected only a sample of shells, if at all. Furthermore, interpretations which are strongly influenced by the testimonies of the large scale chemical industry of Roman times often discredit the existing meager evidence on prehistoric purple-dye production.

Recent research indicates that the production of the dye is also feasible on a much smaller, even on a domestic scale. Adopting this point of view, the discussion here examines data from Bronze Age sites in mainland Greece and the Aegean islands with the aim to identify evidence of the activity. Special attention is directed to two mainland Bronze Age sites, which suggest the existence of small scale purple-dye production. The data from the recent excavations of the settlements of Thessaloniki Toumba and Mitrou, in Northern and Central Greece respectively, are presented as case studies. The results of the analysis of all shell specimens are presented, with a particular emphasis on the hundreds of purple-supplying seashells found fragmented in the Middle and Late Bronze Age layers of the two sites and their archaeological context.

Eugenia VILLARMARZO

MOLLUSK EXPLOITATION IN THE ATLANTIC COAST OF URUGUAY

In 1996 the first shell midden site was discovered in the Atlantic Coast of Uruguay (Locality of La Esmeralda, Rocha). This site presents three structures composed of valves of coquina clam (*Donax hanleyanus*, Bivalvia, Donacidae), as well as other mollusks, animal bones, lithic remains and sediments.

This paper presents the results of the archaeomalacological study of Excavation I carried out at the Structure A. This structure was dated at 3.300 BP.

We identified ten bivalves and gastropods species, both marine and freshwater. Some of these species are food remains while others are intrusive. The study analyses the relative importance of each species in the sample, biometric characteristics and taphonomic issues in order to generate site formation hypotheses.

Dustin WHITE

HOLOCENE MOLLUSCAN SUCCESSIONS IN THE LAKE BAIKAL REGION, SIBERIA – RECONSTRUCTING A NEOLITHIC LANDSCAPE

This paper reviews recent multidisciplinary research investigating Holocene molluscan successions in the Lake Baikal region of Siberia and their significance to archaeological and palaeoecological reconstructions.

Archaeological data from the area demonstrate two distinct phases of greater socio-economic complexity, evidenced by the use of large formal cemeteries, increased sedentism and resource intensification dating to the Early Neolithic and Late

Neolithic-Bronze Age periods, separated by a c. 1000-year interval in which large mortuary sites are entirely absent. Results further suggest that groups on either side of this Middle Neolithic discontinuity differed in subsistence strategies, diet, mobility patterns and genetic affiliation. Causal explanations for these pre- and post-hiatus cultural changes remain unresolved however. Data presented here examines this developing model of Neolithic-Bronze Age prehistory within the context of shifting climatic and environmental conditions across the Lake Baikal region during the Holocene.

Recent fieldwork has focused on the study of high-resolution floodplain biostratigraphic records, in particular the palaeoecological significance of radiocarbon dated pedogenic profiles developed within both alluvial and aeolian sedimentary environments and the associated fossil sequences of terrestrial and freshwater molluscs. The malacological data recovered to date comprise well over 100,000 shells representing over 53 species and are the most detailed yet reported from the entire eastern Palaearctic. These results, together with other published proxy records from the region, provide the framework both to reconstruct the climate and environmental context of Holocene culture change in the Lake Baikal area and to evaluate the hypothesis that regional palaeoecological variability was a contributing factor in reconfiguring both the Neolithic landscape and the bio-cultural profile of resident boreal hunter-gatherer populations.

Miguel Angel ZUBIMENDI

THE USE OF ARCHAEOMALACOLOGICAL FAUNA AS INSTRUMENTS IN PATAGONIA (ARGENTINA)

The Patagonian region represents the southernmost tip of the American continent, and was the last landmass colonized by humans at 12.000 or 13.000 B.P. Hunter-gatherer populations lived in this region since the end of Pleistocene and during the Holocene. They exploited available resources, especially guanacos in the interior areas, and sea lions and shellfish from the coast.

Few thousands years after the initial settlement, there is evidence of the exploitation of malacological resources for food. Freshwater shellfish have been exploited since 9.000 BP, while marine molluscs began to be heavily consumed two thousands years later.

The archaeology of Patagonia documented a large number of sites with evidence of an intense exploitation of shellfish for consumption over the past 4,000 years with a greater emphasis on central sector. Few instruments made of molluscs have been identified, mostly shellbeads and containers for liquids and paints.

Recent investigations of the Patagonian coast study not only the role of shellfish in the diet of the aboriginal peoples but also archaeomalacological remains as raw materials for tools. The purpose of this paper is deepened on the use of mollusc as raw material for tools in Patagonia (Argentina).

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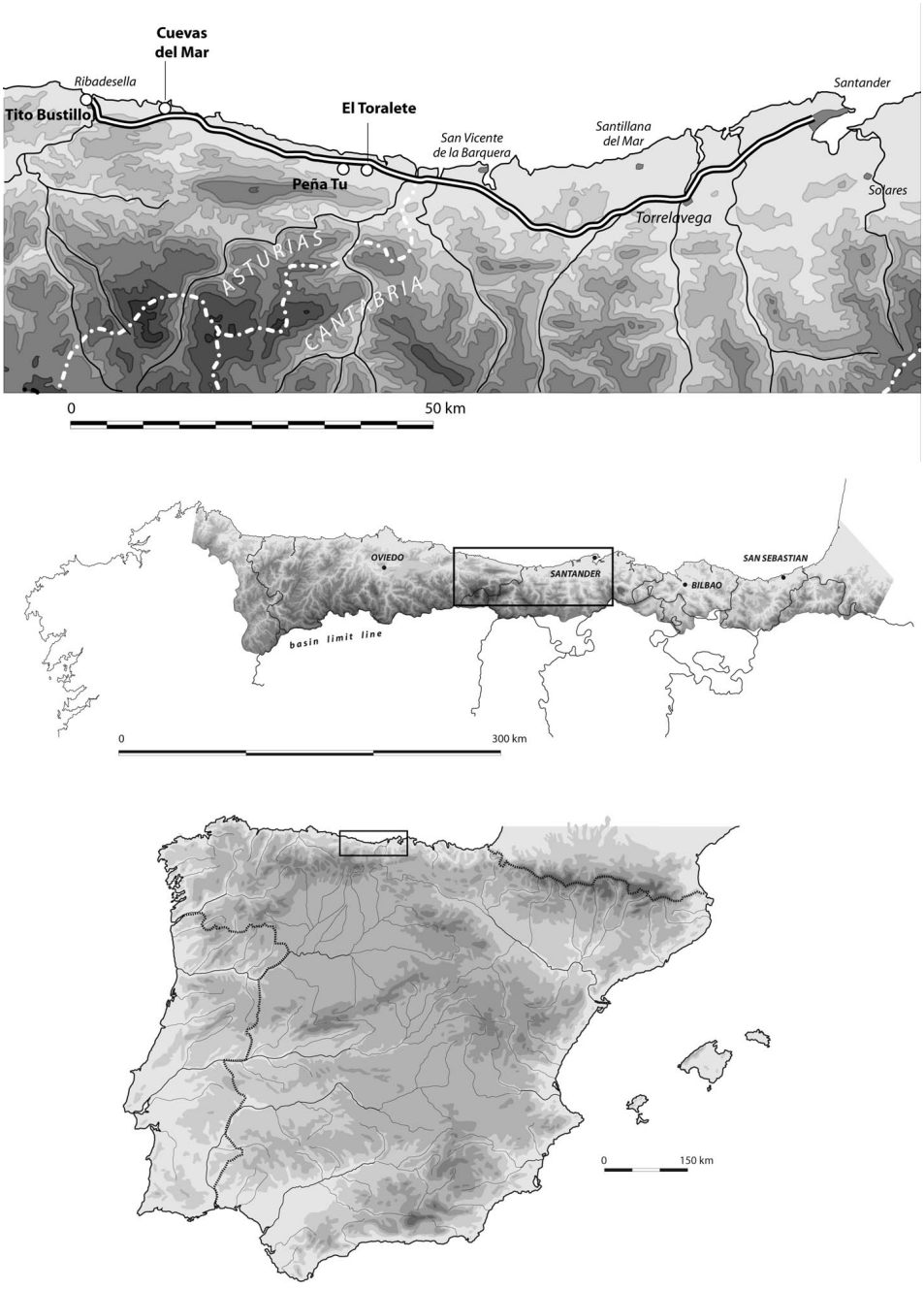
FIRST FIELD TRIP:

SHELL MIDDENS, TITO BUSTILLO CAVE & PEÑA TU.



Asturias shell middens: the cases of El Toralete and Cuevas de El Mar (Asturias)

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It was Count Vega del Sella, one of the pioneers of Cantabrian Prehistory, who initiated the systematic study of the "Asturian" (Vega del Sella 1923). This term, coined by Hugo Obermaier in 1916, is still commonly used to refer to the Mesolithic of the western Cantabrian coast. Research on this period in this part of the region has been particularly intense; following Profesor Jordá's research in the 1950s, several doctoral theses in the 1970s, 80s and 90s have chosen the study of the Asturian record as their central theme (Fano 2007a).

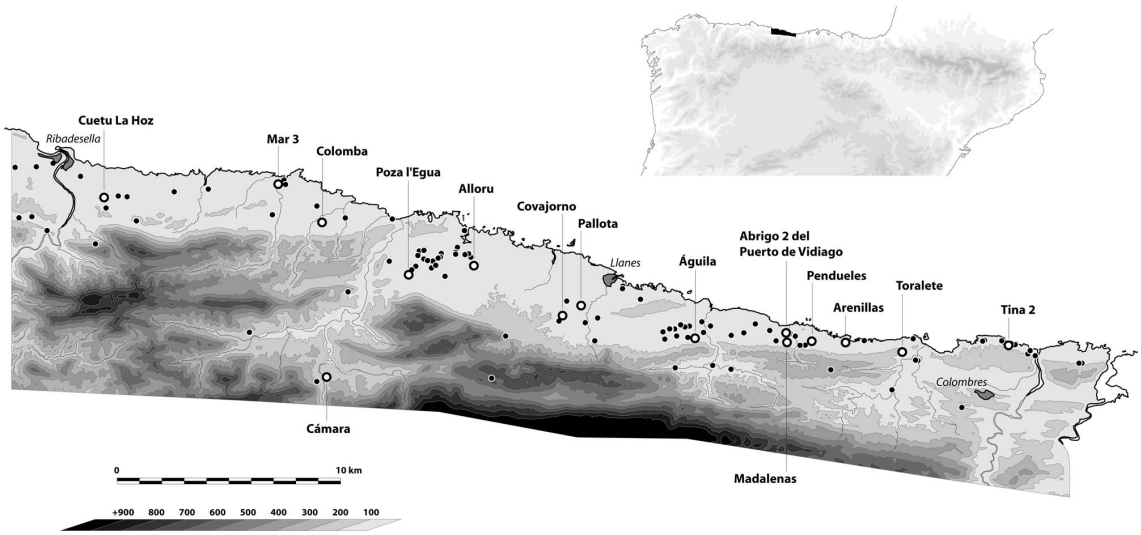

Figure 1: Location of Asturias shell-middens in the east of Asturias, indicating the sites included in the Sampling Programme carried out between 2000 and 2003.

In fact, a great deal of archaeological fieldwork has been carried out on the shell-middens, but most of this took place in the early stages of archaeological research, or affected very small surface areas. Of the recent excavations, since the 1970s, only one definitive publication is available, for

La Riera (Straus & Clark 1986). However, it was the study of Mazaculos which made possible a qualitative step forwards in the understanding of the Asturian record, owing to the conservation of intact, non-cemented levels, over a considerable surface area (González Morales 1982, 1995). More recent fieldwork that can be mentioned includes the Sampling Programme in Asturian middens, carried out between 2000 and 2003 (Arias, Fano *et al.* 2007) **(Fig. 1).**

Asturian shell middens are only partially conserved and are always located in caves and rock shelters. From the 9th to the 6th millennium cal BC, this is practically the only type of archaeological site we find in this part of Cantabrian Spain. Asturian deposits in eastern Asturias consist of limpets (mainly *Patella vulgata* and *Patella intermedia*) and topshells (*Osilinus lineatus*), as well as mussels (*Mytilus galloprovincialis*). Remains of crustaceans and other marine invertebrates such as sea urchins (*Paracentrotus lividus*) have been recorded to a lesser extent. Mammal remains are usually present too, with a predominance of red deer (*Cervus elaphus*). Another characteristic of this type of deposit is the scarce, impoverished nature of its industry, both lithic and bone. In the lithic assemblage, implements made from cobbles, basically Asturian picks and quartzite cobbles, predominate.

El Toralete Cave

El Toralete Cave is situated at Santiuste (Llanes, Asturias), about 750m to the west of the beach at La Franca. The first bibliographic reference to the site appeared in M.R. González Morales' doctoral thesis (1982). The remains of a thick Asturian midden are cemented to the roof and walls of this small cave. The section adhered to the roof is 9m long and the remains reach a height of 2m above the present-day floor, suggesting that the original shell-midden completely filled the cave during the Mesolithic.

El Toralete formed part of the Sampling Programme in Asturian middens mentioned above, and was sampled in 2000 and 2001. Three samples were taken of the cemented shell-midden, with a total weight of 5.298kg **(Fig. 2)**. Sample No. 1 (COT774) was taken from the top of the midden. Sample No.2 (COT775) was taken a short distance from the first and at a lower level (6.3cm). Sample No. 3 (COT776) also came from the top of the deposit. In this case, it was collected from the remains of the midden cemented to the northern cave wall, and at a lower level (33.3cm) than the position of the other two samples. In general terms, the series of dates that was obtained **(Table 1)** is not incoherent with the relative chronology of the samples, as it seems logical to suppose that the deeper part of the cave was filled first.

Site	Sample nº	Method	Material	Lab No.	Date BP	Cultural attribution
C. del Mar III	Shell midden (1)	C14 conv.	*Osilinus lineatus*	UBAR-794	5610 ± 100	Neolithic?
El Toralete	Shell midden (2)	C14 conv.	*Osilinus lineatus*	UBAR-777	7060 ± 80	Mesolithic
El Toralete	Shell midden (1)	C14 conv.	*Osilinus lineatus*	UBAR-776	7680 ± 50	Mesolithic
El Toralete	Shell midden (3)	C14 conv.	*Osilinus lineatus*	UBAR-780	7890 ± 80	Mesolithic

Table 1. Radiocarbon Dates from Cuevas del Mar y El Toralete.

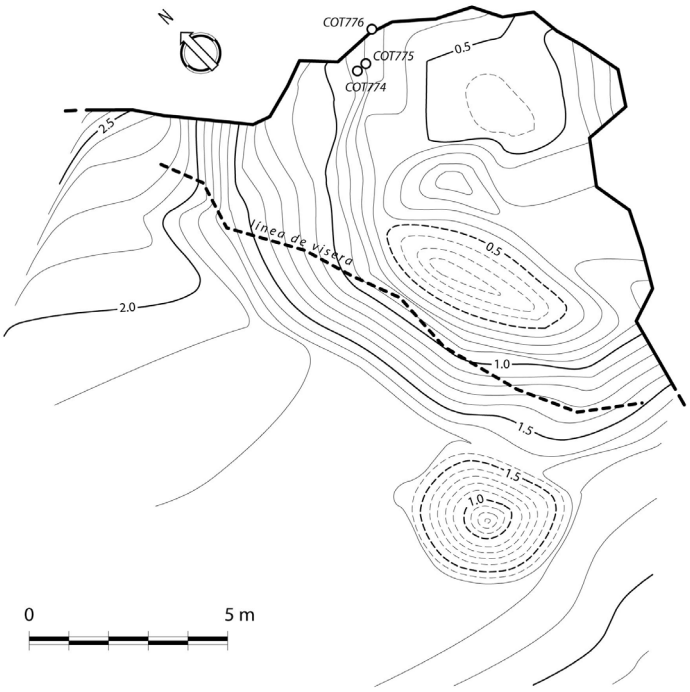

Figure 2: Survey of El Toralete Cave, marking the points where the samples were extracted.

Out of all the shell middens that were sampled, El Toralete has the highest density of mammal remains (26.05 remains/kg). The remains that could be identified at species level include red deer, roe deer, ovi-caprine and wild boar (M. Cueto, personal communication). There is a minimal presence of ichthyological remains; only three, which could not be identified taxonomically. Among the molluscs, the predominance of *Osilinus lineatus* (MNI: 275), compared with the *Patella* genus (MNI: 218), is surprising. This circumstance is not usual in Asturias middens, although it is also true that, for technical reasons, areas with a high density of *Osilinus lineatus* were specifically selected during the sampling programme. In any case, the molluscs recovered from the samples at El Toralete are the typical ones found at Asturian sites, in this case with a very low presence of mussel (*Mytilus galloprovincialis*). The samples also provided specimens of the

echinoderm *Paracentrotus lividus*, another of the coastal resources usually consumed by Mesolithic societies in the region. A modest presence of terrestrial gastropods includes *Cepaea nemoralis*.

Cuevas del Mar

Cuevas del Mar is cited in the bibliography at an early stage. In his monograph on Cueto de la Mina –one of the "great" Paleolithic sites in Asturias– Count Vega del Sella (1916) indicated the existence of a series of small caves, by the River Nueva, near the mouth of the river on the beach of Cuevas del Mar, at Nueva de Llanes. This is scarcely 2 km from the palace where Vega del Sella lived. The author mentioned the existence of "remains of Asturian deposits", i.e. remains of shell-middens similar to those he had already examined at other sites on the eastern coast of Asturias, such as Fonfría and Mazaculos among others.

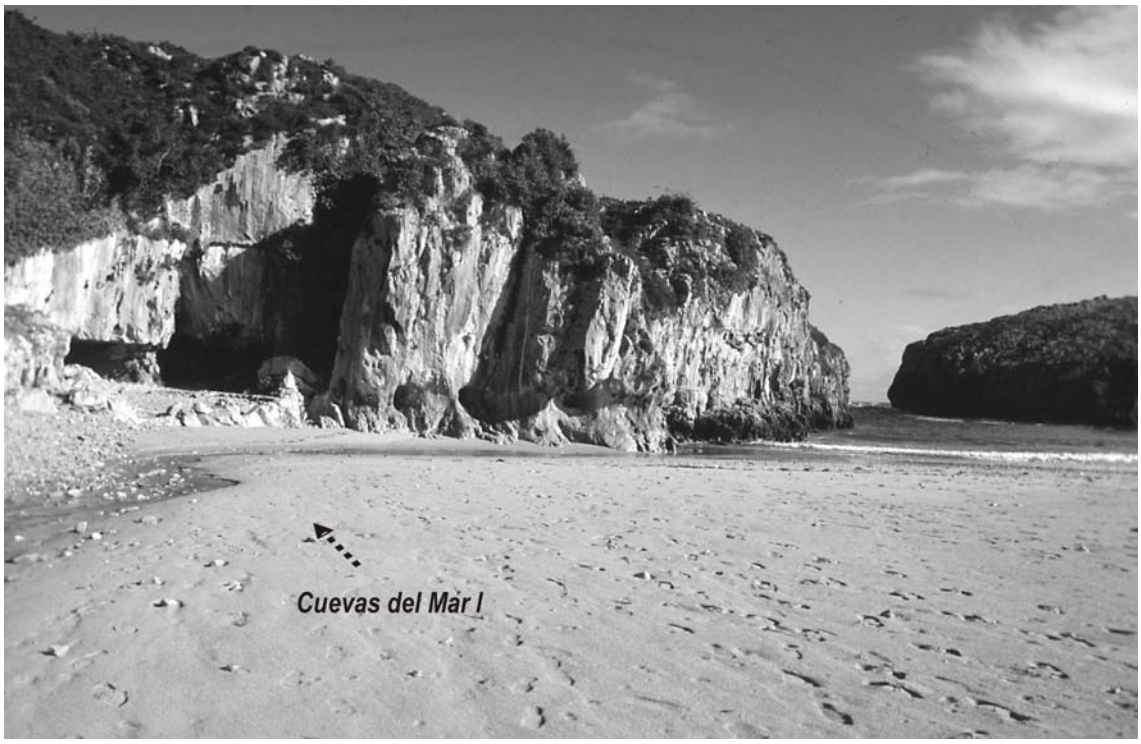

Figure 3: Location of the shell midden in Cuevas del Mar I.

In 1969, the area was revised by G. A. Clark (1976). He refers to the presence of eight caves around the mouth of the River Nueva. The North American archaeologist mentioned that remains of Asturian shell middens were preserved in at least two of the caves. When he inspected the sites, Clark found that one of them, situated at the base of a small limestone cliff next to the beach of Cuevas del Mar, had been turned into a small summer restaurant **(Fig. 3)**. It seems that the action of the sea had ruined this

improvised business, as the cave was flooded occasionally by the tides. This flooding no doubt contributed to the erosion of the Asturias shell midden inside the cave, and of which only a few remains calcited to the walls has been preserved.

M.R. González Morales included this information in his above mentioned thesis in the 1980s, and made similar observations about other Asturian middens in the Council of Llanes. In Cueva de la Silluca he noted remains of the calcited shell midden in a passage which flooded at high tide. In the cave of Río Purón he verified that the remains of a midden that had become cemented and later eroded, was partially covered by a sandy sedimentary deposit by the river near the cave, which was affected by the tides and located less than 1m in height below the midden. The scholar related these observations with variations in sea level, and pointed out that these deposits must have formed at a time when sea level was at a lower altitude than at the present time. In consequence, González Morales (1982) suggested the probable existence of more sites, now submerged on the coastal platform.

Indeed, although the continental platform off the Northern Spanish coast is small, and marine regressions and transgressions are therefore modest, especially in comparison with other European regions, the effects of the Flandrian transgression cannot be ignored. In the Holocene, the rise in sea level may not have resulted in the loss of large areas of territory, but the flooding of coastal areas and the accumulation of large amounts of sediment in the lower valleys, caused by the alterations to the marine base level, have brought about the loss of part of the archaeological record. We do not know how many Mesolithic deposits have disappeared, but we possess one significant fact: more than half (over 65%) of the Asturian shell-middens located within a distance of one kilometre from the coast are situated less than 500m from the present shore-line. This allows us to propose, as a reasonable hypothesis, that quite a large number of sites existed in the strip of coast affected by the marine transgression. At the same time, we have no precise information about the position of settlements relative to the former shore, and this circumstance could make a significant difference to our inferences about such aspects as population patterns and forms of subsistence of the Mesolithic societies.

In the early 1990s, in the course of the preparation of the archaeological register for the Llanes district, C. Pérez (1992) identified remains of Asturian shell middens in three caves, which he called respectively Cuevas del Mar I, II and III. Cuevas del Mar I is the one shown in **figure 3**. Cuevas del Mar II is a small cave situated near the tunnel, about 150m before the beach. It has few remains of a midden, in which only *Patella* can be recognised, calcited to the walls in the exterior rock shelter, and *Osilinus* on the cave floor. The site of Cuevas del Mar III is located by a stream bed and is formed by three small caves which are interconnected,

with hardened remains of Asturian middens visible in their entrances. Only Cuevas del Mar III was included in the cited Programme of Sampling.

In 2001, a single sample of calcited midden with a weight of 4.393kg was collected. In this case, the sample was much less rich in archaeological material than those taken at El Toralete, with only 4.78 mammal remains per kilogram. Remains of red deer and wild boar are among the few items that could be identified (M. Cueto, personal communication). No ichthyological remains were found, and the mollusc collection is also very small, with the presence of the usual species: mainly *Osilinus lineatus* and different *Patella* species.

The date of the sample **(Table 1)** places the deposit in a period when food production was already implanted in the north of the Iberian Peninsula. It should also be taken into account that the nature of the material that was dated (*Osilinus lineatus*) will have increased the age of the radiocarbon determination. At the same time, the sample came from the lower part of the midden, and although it has been badly eroded by the nearby stream, it can probably be confirmed that the deposit continued forming after the time of the date that has been obtained. This is interesting in at least two ways: it contributes to palliating the existing lack of archaeological information in the western sector of Cantabrian Spain about the period immediately following the Asturian; and it provides new evidence about continuity in the use of marine resources after the Mesolithic (Fano 2007b), which has been clearly seen in other sequences such as Kobaederra, Los Gitanos or La Garma A, among other sites in northern Spain.

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Tito Bustillo Cave (Ribadesella, Asturias)

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Introduction

The original entrance to this cave, used in the Palaeolithic, is in the village of Ardines, Ribadesella; and its coordinates are: Long. 01 23' 10" W, Lat. 43 27' 35" N., Alt. 30m (IGC, 1:50,000, sheet No. 31, Ribadesella) (**Fig. 1**).

The cave was discovered in 1968, when it was first explored by Torreblanca Speleological Society, from Asturias. Tito Bustillo is the name of a club member who died in another Asturian cave a few days later. This cave was dedicated to his memory, and it has been called by this name since then, although the local name for the upper entrance of the system is Pozu'l Ramu, or Pozu la Cerezal. It was this upper entrance that led to the discovery of the lower cave, and it was the only way into it until 1970.

Many publications have been produced about the cave since the discovery, taking into account the interest of both the cave art ensemble and the cultural remains. The first excavations were carried out by M. A. García Guinea in 1970. Systematic archaeological research in the cave began in 1972 under the supervision of A. Moure Romanillo; and the study of the parietal art was undertaken in 1974 by R. de Balbín Behrmann and A. Moure Romanillo. More recently, R. de Balbín Behrmann and J. J. Alcolea González have re-started the research, within a project aiming to assess Ardines Hill as a whole, where Tito Bustillo is without doubt the most important site. Scholars who have published studies of the art ensemble include M. Mallo, M. Pérez, F. Jordá, M. Berenguer, A. Beltrán, M. Almagro and M. A. García Guinea; as well as the present authors.

Since we re-commenced the study of Tito Bustillo in 1999, we have aimed to carry out a full analysis of the site, and the surrounding area which puts it into context and defines it, as we understand that the population and the artistic production in the area were not restricted to the

cave, but were distributed throughout Ardines Hill. They were organized around a large and varied population, occupying at the same time some ten caves, related physically and culturally among each other.

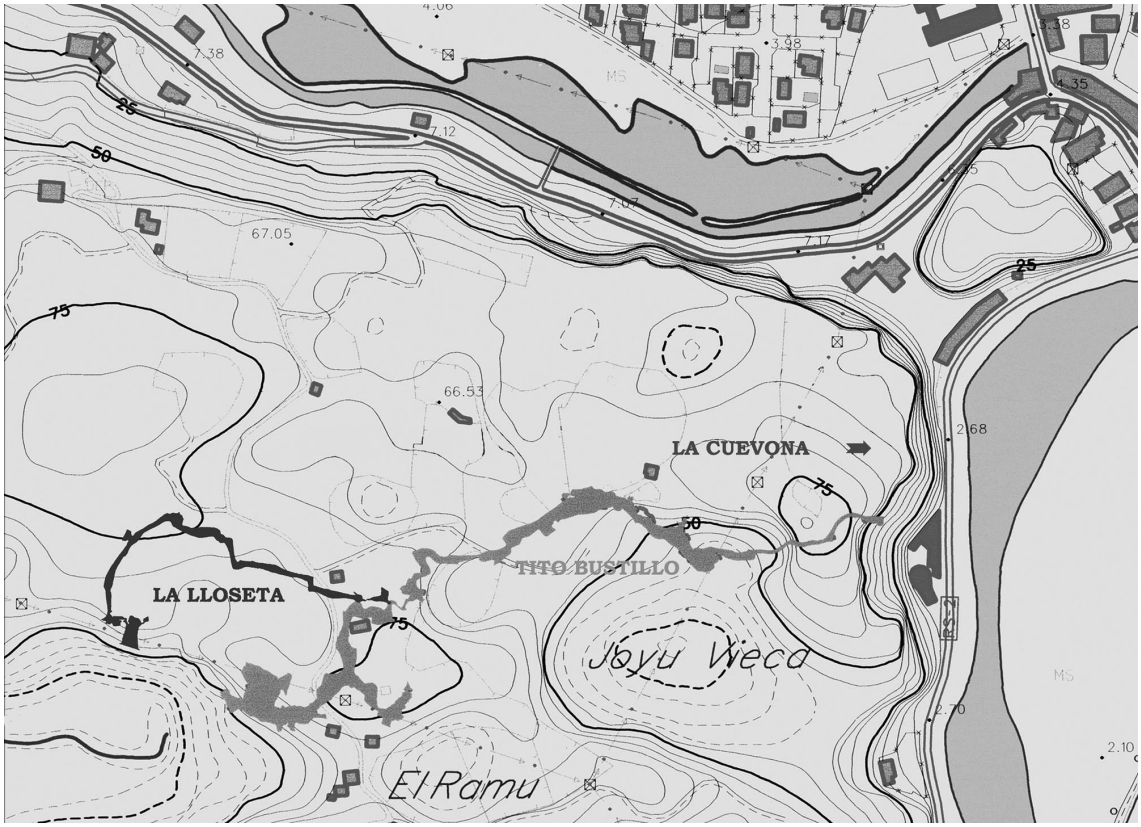

Figure 1. View of the map of Ardines hill with the location of the main caves.

Times have changed since we first studied the art at Cueva de Tito Bustillo in the 1970s. We can no longer understand this habitat as isolated in each one of the caves and we must propose an understanding that relates some sites with others and interpret the relationships. Only from this perspective will an assessment of the group of Ardines sites be established with the dimension it had in the past.

The excavations carried out by both García Guinea and Moure took place mainly in the large chamber that is the continuation of the old entrance, and which we call Ensemble XI. Apart from a sondage in the area near the collapse, almost all the work was centred on a sector surrounded by large fallen blocks and the limestone wall, in an area near the entrance. The radiocarbon determinations obtained by Moure vary between 15,400 ± 300 and 12,850 ± 90 BP. Both García Guinea and Moure, in collaboration with González Morales, at different times carried out excavations at the foot of the main panel of polychrome paintings. From this work radiocarbon dates of between 14,340 ± 309 and 12,890 ± 530 BP were obtained.

García Guinea excavated below the main panel in 1970, where he found a stratigraphy with 4 levels that could correspond to the Magdalenian and Solutrean. He did not follow any of the known recording systems, and established *a posteriori* several areas with different irregular surfaces, as he apparently followed the areas with the greatest concentrations of artefacts. He left the materials *in situ*. They were gathered in 1984, during the work carried out by Moure and González Morales, who drew up a square grid and a distribution plan.

Moure excavated in the habitation area in Ensemble XI where he found two levels: the first belonging to the late Magdalenian, divided into 1a, 1b and 1c; and the second to the Magdalenian without specifying further, with abundant organic material and hearths *in situ*. Some of these were simple and had not been prepared, whereas others were in the base of a hollow, or surrounded by quartzite cobbles or low stone walls. A large amount of pigment was found on the floor, either in fragments or within limpet shells. Tools for breaking up ochre were also recovered. This technological evidence can be related with preparing the raw material for the production of the paintings. It should also be pointed out that a natural source of pigment exists within Ensemble XI itself, and this was used to produce the paintings in the cave and surely for many other uses. A large number of portable art objects were recovered too, and great thematic continuity can be seen in these.

During the archaeological work that has taken place since 1990, we have carried out a sondage in the interior area, some 50m to the north of A. Moure's excavations; and we have begun another in the vestibule of the disconnected passage. Further excavations were undertaken in the Main Gallery of the cave, near to Ensemble VI, where a group of contours découpés in the shape of horse's heads were found, and also in the Gallery of the Anthropomorphs, in the intermediate shaft. This work has been accompanied by surveying, drawing plans and documenting the art.

Indeed, one of our priorities was to conclude the documentation of the parietal art. Despite a large number of preliminary publications, this research had been interrupted at the end of the 1980s which meant that it had never been completed. We therefore began a review of the interior of the cave, following the route around the different ensembles, according to our own classification, starting with number I, which is located near the artificial entrance that was made for tourist visits, and at the opposite end of the cave to the entrance used in the Palaeolithic.

Since A. Moure's first publications, the whole useful area in Cueva de Tito Bustillo has been organized in representative groups from the graphic point of view; i.e. the decorated areas are denominated in a numerical series from I to XI, starting by the modern tourist entrance. This distribution was effective, although it is now somewhat limited; new finds have been made

and the ensembles that had been defined are now larger. We are now much closer to the total decoration than to the decoration in independent ensembles. The general conservation is deficient, but what has survived is enough to be able to affirm this decorative totality (**Fig. 2**).

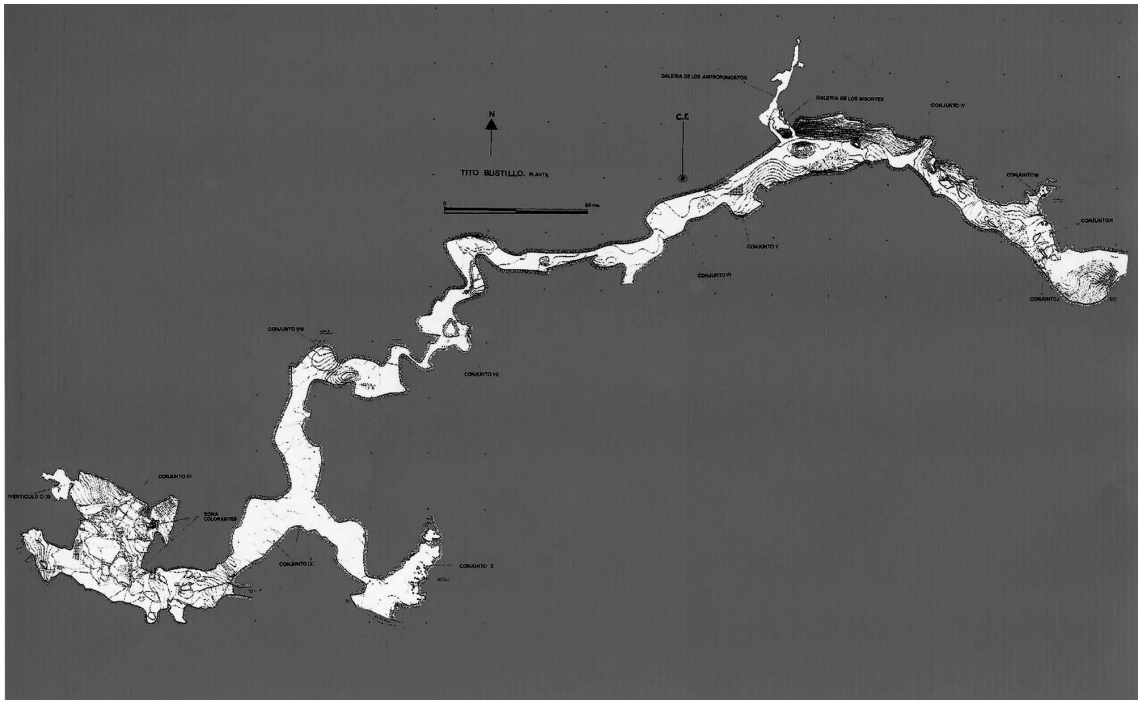

Figure 2. Plan of Cueva de Tito Bustillo.

Ensemble I

This is located in the eastern-most part of the cave, at the end of the artificial access tunnel. We have established a rather different relationship between the different panels that have been published, among other reasons, because many more figures exist than were known at the time of the publications. The side walls of the passage leading towards the collapse separating the cave from La Cuevona have numerous remains of paintings in a very poor state of conservation. The large pile of mud which appears at the end of the collapse is mostly of anthropic origin and must have accumulated when the artificial tunnel was excavated, although we have no references, plans or descriptions of this building work.

The ensemble can be divided into two parts. The southern wall has a large group of engravings and some remains of paintings, with a lower area with painted signs, engravings of animals and signs, and some red marks. The second part of the ensemble consists of paintings, in the form of long signs and finger-marks, as well as a painting that completes the natural

form of a bison. All this second part is on large boulders in the central part of the Main Gallery.

Ensemble II

This follows on immediately from Ensemble I, and on occasions overlaps it, as the separation that we have made between them does not reflect the reality of exact limits.

It consists of only a few remains of colour, some of which, on the lower part of several broken stalagmites, announce the nearby Small Chamber. There are also remains of painted signs, but the situation of this ensemble in the passage has been greatly altered by the tourist visits, so that the remains should be considered as residual. In any case, it is a group previous to Ensemble III and an important part of it is explained by that relationship.

Figure 3. Main figures in the chamber of the vulvae or ensemble III.

Ensemble III

This is one of the most characteristic groups in Cueva de Tito Bustillo, because of its special female sexual meaning. Its contents are well-known and have been widely-published (**Fig. 3**). However new figures that have been discovered recently are less well-known, such as two female

profiles, with the frontal sex in their medial part, which use prominences in the rock to emphasis the breasts. They are very similar to another female figure located in the lower, older part of the Main Panel.

At the rear of the Small Chamber, within the Main Gallery in the cave, another group of signs appears to mark its end. Next to them, and slightly above, some finger-marks apparently announce the existence of another group of depictions, which can only be located at the end of a ramp in this area.

Ensemble IV

This group is centred on a number of "laciform" depictions, that is, signs in the form of a bow or loop. They may be connected with the painted sexual symbols in the previous ensemble, among other possibilities. Remains of paintings can be seen in all the surrounding area.

Ensemble V

Of all the groups of art being described in Tito Bustillo, this is surely the most heterogeneous, as it is arranged around part of the main gallery, on both sides of it. Its definition is therefore topographical and it commences with an area of calcite flowstone next to Ensemble IV, and stalagmite columns that ring with a musical note when struck, and which have partially been painted in red.

Within this ensemble, several sub-groups have been discovered during our research in the cave.

Gallery of the Bison

The longitudinal axis of Tito Bustillo, its Main Gallery, is intersected along its length by several side-passages, of different sizes, which meet in the main passage and which possess their own organisation and decoration. The chamber forming Ensemble III, the Chamber of the Vulvae, was one of them.

Within Ensemble V, on the right-hand, or northern, side of the passage, an oval opening with a polygonal background, with the shape of the female sex, is painted in red around its outline and in the background. This opening is two metres above the general floor level in the Main Gallery, and to its left a horse has been painted in a brown colour-wash.

Penetrating through the female sex, in a narrow and difficult passage, a narrow passage 10m long is painted along its length with figures representing bison, signs and some horses. The final part is dry and dusty, with a maximum width of less than two metres, and has some quite large figures on its walls, drawn several times to emphasise their outlines. The general state of conservation is poor.

The roof of the narrow lower passage has a low space, full of red pigment, through which a normal-sized adult cannot squeeze, although it connects with another small passage in the next area, the Gallery of the Anthropomorphs.

This passage conforms a small space, with average figures and a concept of total decoration. However, its conservation is worse than other parts of the cave.

Figure 4. Female anthropomorph in Ensemble V.

Gallery of the Anthropomorphs

This is the next side-passage after the Gallery of the Bison, with a more complex series of tunnels, connecting with the former gallery along a narrow passage that slopes up, where each successive step upwards is marked by red dots and stains. It is longer, about 30m, and its access is equally at a high level above the Main Passage, about two metres away from the former gallery.

The first part slopes up steeply, with red marks along its length, including figures in this colour, such as a bison at the top of the climb. The passage becomes more or less flat, and contains large stones on several levels, covered by large amounts of ochre.

A shaft is reached to the north of this area; it is about four metres deep with a circular base closed off on the northern side by an accumulation of stones forming an artificial wall. On the other side of the wall, a long chamber has a calcite crest decorated with several lines and dots, as well as three anthropomorphic figures in an excellent state of conservation (**Fig. 4**). A tube shaped passage leads off on the right, and after being interrupted twice by artificial accumulations of calcite slabs, ends in a narrow angular area, also decorated.

There are more figures in this area, as well as the anthropomorphs, such as animals and signs. Among the animal-signs, a snake has been picked in the rock, and this is the main decoration in the first shaft.

We excavated in this area in the seasons of 2001 and 2002. In the shaft we found a large accumulation of burnt bones and limestone, together with charcoal and remains of pigment. A C14 AMS determination of 32,990 ± 450 BP was obtained here, and although this is not directly related with parietal depictions, it is at least an indication of human presence and activity in this part of the cave at that time.

The rest of Ensemble V displays several decorations, such as a negative image of a hand on the left, or south, side of the passage next to two stalactites painted in red. This was the figure that initially characterised the ensemble, although now its contents have been increased considerably.

A palaeontological excavation was carried out opposite this hand, image by Ana Pinto, who found numerous remains of bear, apparently not in anatomical connection, and older than the Upper Palaeolithic.

The contours découpés

A little further on, on the right-hand wall, on a ledge 4m above the floor of the gallery, in 2001 we found an intentional deposit of four contours découpés in the form of horse's heads. These are some of the most important examples of portable art discovered in the cave. The discovery was made during our exploration of the Main Gallery, in the course of a small excavation, and these four classical contours découpés, each of them eight centimetres long, were covered in red pigment (**Fig. 5**).

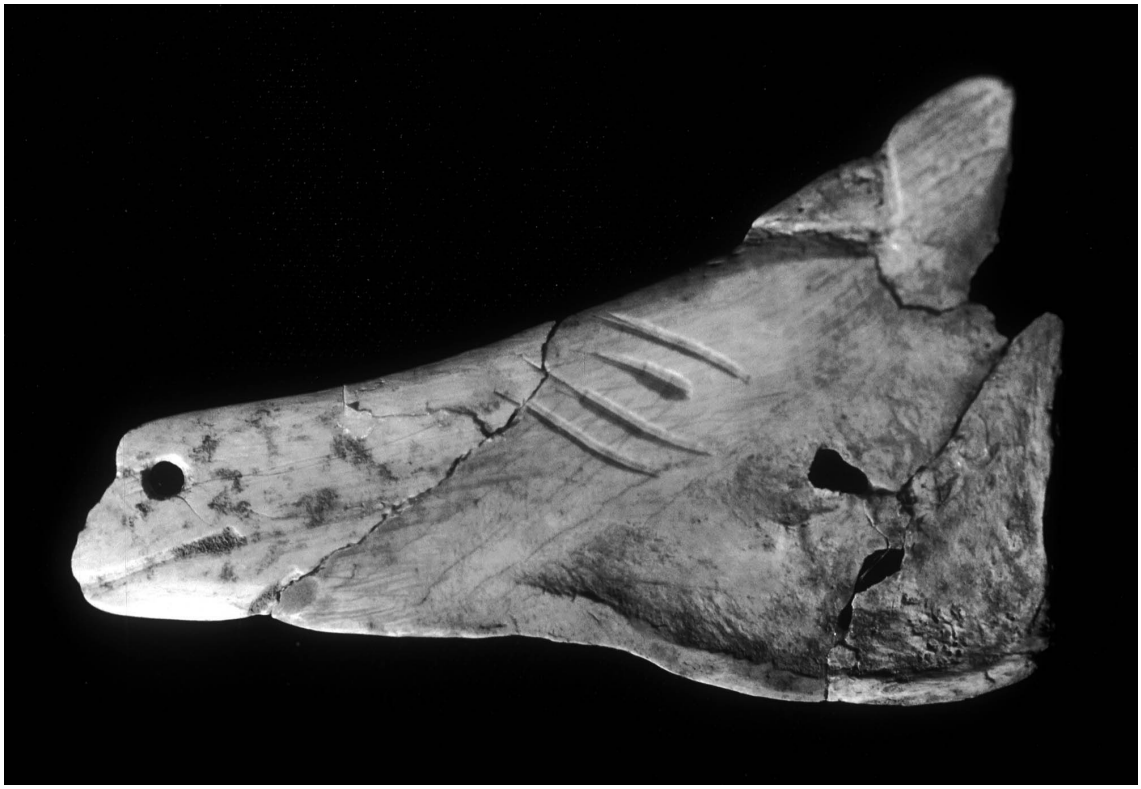

Figure 5. *Contour découpé* in Ensemble V.

Ensemble VI

This ensemble commences immediately beyond the area where the contours découpés were found. It is arranged around a niche in the wall of the Main Gallery and consists of several fine engravings that appear to represent signs, and a painted finger-mark. Before and after this group, signs in the form of a grille are indicators of its presence. All this area and the surrounding passage is decorated with red and black paintings, with animal figures and signs, including quite large stags, horses and claviforms, on the roof of the passage.

The state of conservation of the latter figures is poor, and we are taking infra-red photographs of them in order to determine their condition. Once again the figures are evidence of the total decoration of the cave, of which unfortunately little now remains.

Ensemble VII

This group contains one of the few engravings of a cetacean that are known in Palaeolithic art, in a side-passage to the left of the Main Gallery. It is at a high level on the wall, and is not seen in the tourist visit to the cave as this part is not illuminated or prepared for visitors. It is in a narrow part of the passage, where the roof is painted in red.

This small passage has other animal and human figures, e.g. an extremely well-engraved anthropomorph. In addition, there are paintings and naturalistic engravings of horses, made with a finger-tip on a soft clay surface at the end of the passage.

If we consider all the depictions found before Ensemble VIII as belonging to this Ensemble VII, then we have to include some new figures that have been discovered in the Main Gallery, such as a horse depicted vertically with its head turned backwards, painted in red with a black outline.

In the course of the narrower and wider areas of the Main Gallery, before Ensemble VIII is reached, more remains of red and black paintings can be seen, in the form of stags and other animals. Some stalagmites were painted red, and the bones of a carnivorous animal can also be seen.

Ensemble VIII

The importance and spectacular character of this group have made it worthy of a specific publication. It is in another small side-passage, on the right of the Main Gallery and oblique to it, and it contains the series of animal engravings that have given the ensemble its name: the Gallery of the Horses.

It is a double passage, with a lower level on the right and an upper level on the left, where the main panel, with its excellent engravings, can be found. They represent horses in different positions, sizes and movements, accompanied by a large bull, a plantigrade and a reindeer at the end (**Fig. 6**). Again, this panel cannot be visited, because of the small size of the passage, although the engravings are some of the most beautiful in the cave.

Figure 6. Detail of one of the figures in the Gallery of the Horses.

The lower passage on the right, with a more circular shape and lower ceiling, contains some finger engravings on clay surfaces adhered to the rock wall. Most of this clay has fallen down, and this passage must surely have held a large panel of finger engravings.

Outside this small space called Gallery of the Horses, both opposite it and in the continuation of the right-hand wall, red stains and dots can be seen.

Ensemble IX

This group is in a section of the Main Gallery, between the area with the main panel and the passage leading to the habitat area, with the archaeological deposit at the old entrance to the cave.

It is found on the left-hand side of the Main Gallery and begins on the corner of the junction mentioned above, with a composite quadrangular sign. A little further on, the same wall has a polychrome horse, with the same conventions and violet colour as many of the figures in the main panel.

We have examined this area in the our latest research, and we have found remains of large figures, painted over the composite quadrangular sign, on a large vertical rock, as well as other remains of paintings near the horse.

Opposite this central part of Ensemble IX, at its end before the slope to the old entrance, a small high level passage contains figurative paintings in a poor state of conservation, mainly in red tones.

Ensemble X

This is the main panel in Cueva de Tito Bustillo, holding most of the figures in the cave, and the central point in the site. It has been the attention of specialised publications, despite which the possibilities for a review of its contents are still open, simply because of the large number of figures represented in the panel and their complexity.

The decorated area is on the right-hand side of the chamber, in the centre and on the left side, and it is the remains of decoration on a larger scale. The general conservation is deficient, especially the larger figures on the walls and ceiling.

The deepest part is covered by white calcite deposits, stalagmites and water, as the cave is still active from the karst point of view. However, figures can be seen, such as a large engraved horse, most of which is covered by white calcite. Paintings can also be identified, and remains of pigment on the floor are of the same type as was used on the walls.

Both the central part of the panel and its right-hand side are covered by red staining, which we originally interpreted as intentional, produced to wipe out underlying figures. We have now re-interpreted this stain, so that part of it had that function but the rest is made up of deteriorated red figures, painted perhaps several thousand years before the main polychromes.

Among these figures, many of them large in size, are a female anthropomorph like the one in the Chamber of the Vulvae, large felines, bison and horses. These abundant figures are evidence of an earlier phase of decoration of which we know little.

On the right-hand side, the colouring that we once interpreted as red stains has now equally been broken down into figures in red, together with others covered by layers of calcite, also belonging to earlier times.

At the far right of the main panel, nearest the access for visitors, another continuous red coat of paint is made more intense because of the

high humidity in that area. Within this, some black lines can be recognised that we have now succeeded in identifying as corresponding to a megaceros, a good representative of the first artistic phases in the Palaeolithic cycle.

The most important and most recent figures in the panel, horses and reindeer, are found in its most prominent parts, and also in a miniature repetition on right-hand wall, near the entrance to the main panel and which we have called XD (**Fig. 7**).

Figure 7. Pair of reindeer in the Main Panel.

Ensemble XI

The area between the junction and the habitation deposit can be considered as Ensemble XI, and it was the entrance to the cave in Palaeolithic times (**Fig. 8**). As it was the former living area, excavations were carried out in the 1970s, and the only examples of parietal art that were recognised were red stains and a kind of bovine painted in black and red. In a complex area like this, with large collapsed blocks everywhere, some further remains of red paint were identified but not published, as they did not seem to correspond to the last paintings in the cave, or the first if we enter the cave as the prehistoric occupants did (**Fig. 9**).

Figure 8. View from the interior of the deposit at the Palaeolithic entrance.

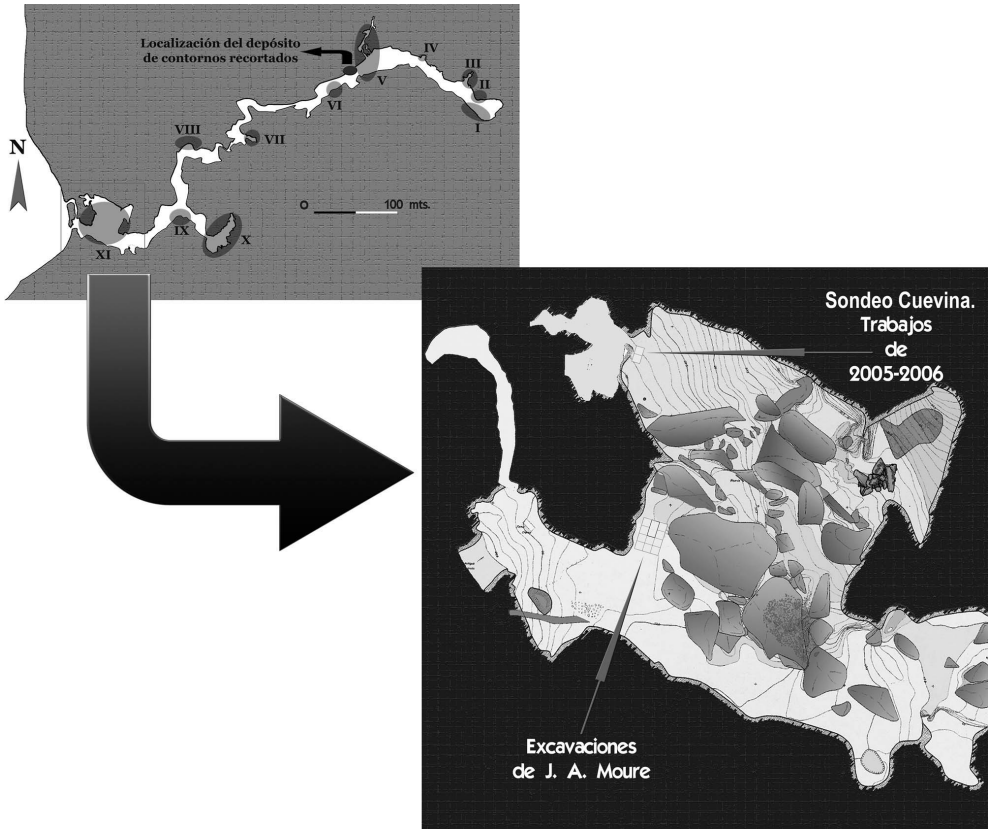

Figure 9. Plan with the position of Ensemble XI together with the other main ensembles in Cueva de Tito Bustillo.

The discoveries in our latest research are more abundant and better. In the first place, some of the blocks probably collapsed during a similar episode to the one at La Cuevona, before the artists entered Cueva de Tito Bustillo. These blocks were used for different purposes, among others as a surface for figures and as a deposit for pigment. Red-violet pigment was recovered in the area and it was even broken into pieces and deposited over wide areas. The walls in Ensemble XI were painted and engraved, occasionally at considerable heights above floor level. The conservation of the paintings is not good, but they can be recognised as far as the collapse that blocked the prehistoric entrance.

Figure 10. General view of the Chamber of the Bison.

This collapse took place after the Palaeolithic, after a human body had been deposited in the foetal position. This body has been dated by radiocarbon to between 7590 and 7480 calBC (2 sigma). Probably orogenic movements made the large blocks fall from the ceiling, and they landed upon those that had been lying on the floor since before the chamber was decorated. At the same time, the old passage that led into the cave in Ensemble XI, at least on its western side, was separated by the block it contains, producing a partition that was later covered by calcite. This original vestibule contains a layer of calcite 75cm thick which we are excavating, and below this, a fertile Palaeolithic deposit is comparable with one that was studied during the excavations in the 1970s.

Beyond the habitation deposit, in the area with the painted bovine, a piece of limestone was found that had been shaped into the form of a bison,

which therefore accompanied the one on the wall (**Fig. 10**). Abundant remains of paint can be seen on this block and the adjacent ones. Other interesting remains are also seen on the high walls situated above the blocks, including figures over three metres long. This is therefore an area that we did not know very well, and whose contents are now understood to be much richer than we previously imagined.

At the north-west end of the ensemble, a small cave was almost blocked by surface sediments in Palaeolithic times; it contains some poorly-conserved paintings of animal figures and signs. The archaeological deposit in front of it is also being excavated, and it has yielded an important collection of portable art, comparable with that recovered during A. Moure's excavations in the 1970s.

Ardines Hill

As stated above, our research is focused on Cueva de Tito Bustillo, but this has not made us forget that this cave belongs to Ardines Hill, an inter-related area throughout Prehistory, full of caves and cultural remains. Only as examples, we shall describe some the most important caves and points of reference on the hill.

Cueva de Les Pedroses is near the top of the hill, very near El Cierru, Pandu and Cuetu. Further east, and located over the passages in Tito Bustillo, are Pozu'l Ramu, the entrance that used when the cave was discovered, La Lloseta, El Tenis and La Cuevona. We know that more caves existed in the past, but for different reasons they are not accessible at the present time. A panel with incomplete paintings was known in the first cave mentioned, but in a recent examination we have explored other passages near the entrance and beyond the main panel, where remains of parietal art can still be identified.

La Cuevona is located above the modern entrance to Tito Bustillo, and it is reached through the access tunnels to the cave. It is a large cavern, especially in its central chamber, and it contains a prehistoric deposit with a shell-midden. Some remains of parietal decoration are very faded.

Cueva de El Cierru is near Les Pedroses, and contains a good Upper Palaeolithic deposit, which was excavated by F. Jordá. The levels range from the Aurignacian to the Epipalaeolithic and include an interesting Magdalenian shell-midden.

Cueva de Lloseta was named by F. Jordá, who excavated the site. It is above Tito Bustillo and connects with the cave. The upper chamber, where the excavations took place, holds Magdalenian and Epipalaeolithic deposits. We have studied the lower passage; as well as an interesting human cranium, it contains an important parietal assemblage that we have

recently published, and which demonstrates the relationship between this site and the others in the same hill.

With this summary we have tried to show briefly the reality of Tito Bustillo, as it cannot in any circumstances be separated from the evidence at the other sites in Ardines Hill. We now know that the caves on the left bank of the *ría* at Ribadesella were occupied at the same time during thousands of years. It is no longer possible to understand the behaviour of its inhabitants without putting the cave in its context, without realising that the prehistoric community was much more complex and numerous than we had realised before, and was probably organised as a whole. The Palaeolithic population of Tito Bustillo does not exist, but rather the Palaeolithic population of Ardines Hill.

The main residence and meeting place would have been Tito Bustillo; the cave could be accessed through its open entrance, or through inter-connecting cave passages which would also be a means of communication for its inhabitants. The occupants at Ardines in the Upper Palaeolithic would do many things together; they would meet and extract large amounts of pigment with which to paint and to paint themselves. They would compose musical sounds using the conditions of the cave and its walls; act in areas with constructed walls representing animal figures and anthropomorphs at the same time. They would decorate places with the female sex, and do the same with the opposite sex, with a dedication and abundance until now unknown in Palaeolithic art.

Our Palaeolithic ancestors knew the interior passages of underground Ardines perfectly well, and moved through them easily and with confidence, marking the passage ways, as in the Galleries of the Bison and the Anthropomorphs, or leaving objects of great beauty, like the contours découpés. These were not primitive beings, fearful of the mysteries of the depths, but skilled cave dwellers, who knew the caves well and organised their total decoration.

Tito Bustillo was decorated fully and many times, throughout its length, in the main galleries and the side-passages, in chambers and corridors, since the early Upper Palaeolithic at least until its end. It was the centre of this area of population. The social group that lived at Ardines was connected along the whole Sella valley, and left signs of their presence from the Palaeolithic till after its conclusion, from the times of most intense cold until that age finished for ever. They adapted to the changing climate and landscape and left us abundant evidence of their idea of the world, through paintings, engravings and sculptures. They speak to us with all the means at their reach, with a language we do not understand yet, but which we certainly aim to understand.

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Peña Tu (Puertas de Vidiago, Asturias)

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The rock art site of Peña Tu is the most relevant and best known example of schematic art in Cantabrian Spain. It was discovered by Count Vega del Sella and E. Hernández-Pacheco in 1913, and since it was first published (Hernández-Pacheco *et al.* 1914) it has become the main reference point in the study of post-Palaeolithic art in the north of the Iberian Peninsula.

It was included by H. Breuil in the first volume of his major work on schematic rock art in the peninsula (1933) and has since been analysed by other prehistorians, like E. Anati (1968a, 1968b), M. Almagro Basch (1972) and M. Almagro Gorbea (1972, 1993). Until 1981, however, there was no detailed and up-to-date study of the site; this was carried out by P. Bueno Ramírez and M. Fernández-Miranda (1981), and has acted as a basis for all later approaches.

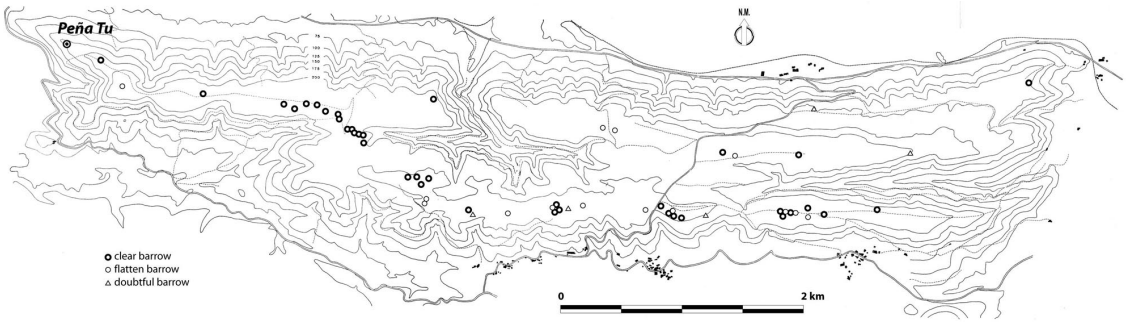

Figure 1. Location of Peña Tu and the megalithic monuments of Sierra Plana de La Borbolla (after Pérez & Arias 1979)

The panel with artistic depictions is situated in a hollow on the eastern face of a large rock outcrop which stands out as an isolated block at the western end of Sierra Plana de Vidiago or La Borbolla, 165 m above sea level and only a few kilometres from the coast **(Fig. 1)**. The decorated area, which is very poorly preserved, is 4 m wide and 1.3 m high. Two parts can be distinguished: the right hand side, occupied by an idoliform figure

accompanied by a weapon (both engraved and painted in red) and an anthropomorph as well as other figures all painted in the same colour, and the left, where several patterns produced with different techniques are in a row.

The idoliform is 112 cm high and 64 cm wide, and consists of three concentric rectangles which finish in an arch at the top of the figure **(Fig. 2)**. The spaces between the two outer lines are occupied by zigzags or transversal lines which appear to frame the whole depiction. The inside of the figure is differentiated into an upper semicircular part, with two concentric arches which surround two identical circles arranged side by side, reminiscent of ocular patterns; and a lower rectangular zone, subdivided by six horizontal lines in superimposed bands which seem to contain parallel vertical lines. This idol was produced by combining two complementary techniques. Most of its lines were engraved with wide and shallow lines, often filled with paint, and paint alone was used in some other parts.

A metallic weapon is depicted to the left of the idol, next to its upper half. This is a dagger or sword, engraved with the same technique as the idol. It consists of the hilt, the blade, and at its base, five dots painted in an arch, as if they were nails or rivets. There are several more dots on either side of the weapon, and below it an anthropomorph, all of them done in paint.

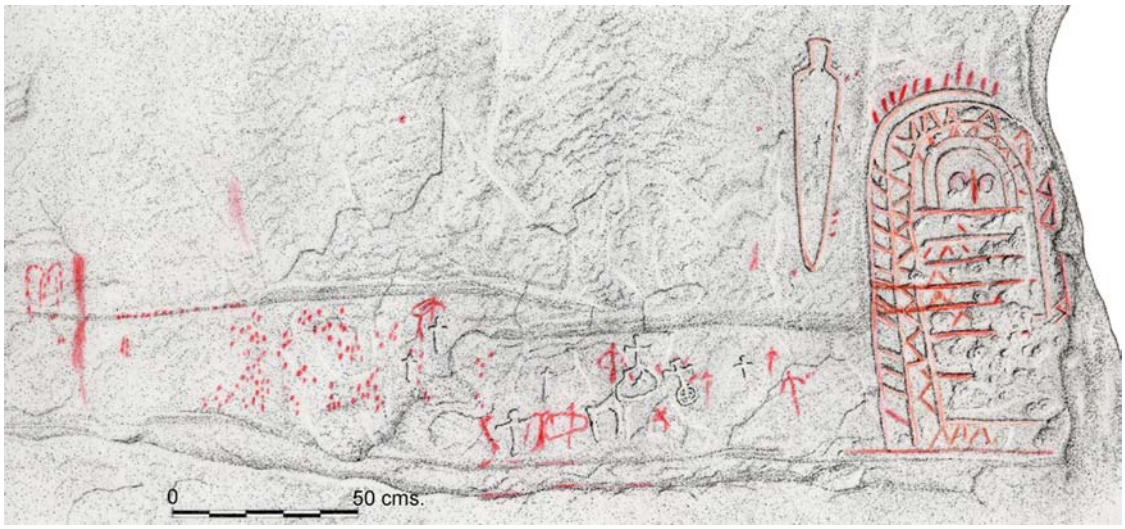

Figure 2. Pannel of Peña Tu (after Barroso et al., 2007)

On the left of the panel there are three designs painted in red, and others picked in the rock, superimposed over the paintings, arranged more or less in a row. From right to left, the first figures are a group of four anthropomorphs in red; one of them is apparently shown in movement and is probably carrying a stick, superimposed over a badly deteriorated anchoriform. To the left, a number of vertical lines could be further

anthropomorphs. Over these there are picked figures of anthropomorphs, cruciforms and a possible zoomorph. Beyond these, there is another group of painted anthropomorphs, anchoriforms and cruciforms, next to some very faint lines of paint, over which there are two picked cruciforms. Further left, a large number of painted dots appear to be arranged in curved lines. The last group is apparently formed by paintings of anthropomorphs, dots and a possible zoomorph. When this panel was first interpreted, not one, but two zoomorphs could be seen here. They were diffuse and incomplete and one of them, according to Breuil (1933: 40) owing to "une excroissance dorsale, a pu porter un cavalier."

This panel has been ascribed chrono-culturally in several different ways, although the time period involved has not varied very much, and is situated in the early Bronze Age. They have all been based in the classification of the weapon depicted (depending on the type of hilt), and it is given as accepted that it is contemporaneous with the idoliform it accompanies.

The discoverers of Peña Tu include it in what was then known as the "Copper Age", and compared the weapon with several daggers from the south-east of Spain and Portugal, some of which came from Argaric sites (Hernández-Pacheco *et al*. 1914). The idoliform figure was related with several Portuguese stelae, with megalithic art in different regions and with the decorated plaques from Portuguese dolmens. The parallels established have been taken up by the other researchers studying this site, as a central part of their reasoning. The discoverers accept the synchronic association between the idol, dagger and painted anthropomorphs, which would be the key to dating similar schematic figures in other, less specific contexts, such as "the paintings of the last phase in the Cavern of El Castillo at Puente Viesgo (Santander)" (Hernández-Pacheco *et al*. 1914: 23).

In different articles published in 1968, E. Anati established the basic chrono-cultural interpretation of the engraved drawings at Peña Tu, following the historical-cultural and diffusionist theories in vogue at that time. The Italian prehistorian considered that the combination of idol and weapon represented the meeting of two "ideological-religious currents", one coming from the south and west of the peninsula and reflected in the occulted idols in megalithic sites, and the other from the south of France and north of Italy, responsible for menhir-statues. This conjunction of idols and weapons had a meaning that was not only thematic, but also stylistic and chronological. It formed a style and also a figurative phase or cycle, which situated this complex in the north of the peninsula between the "Eneolithic and the start of the Bronze Age". Regarding the weapon depicted, Anati identified it with long daggers or swords of the late bell-beaker period, and this comparison was to dominate in later chrono-cultural considerations of the depictions.

Four years later, M. Almago Basch published the stela at Tabuyo del Monte (in the north of the province of León). This is the closest parallel, together with the engraving on Sejos II in Cantabria, that is known for Peña Tu, as regards the idol typology and association with a weapon. He showed that the anthropomorphic figure is related to the decorated plaques in dolmens in the west of the peninsula, mostly of late chronology (Almagro Basch 1972: 105) and is quite comparable with Peña Tu and with the idol at Hernán Pérez VI (Cáceres). These were considered together with other anthropomorphic figures on engraved stelae in the south-west, which date to the late Bronze Age (Almagro Basch 1972: 112).

In his study of the sword from Guadalajara, M. Almagro Gorbea includes the weapon at Peña Tu in the same class of arm, within his type I, "perhaps variant C" (short swords with triangular blade and rivets). These are dated in the middle Bronze Age, "although it is not impossible that they could be older" (Almagro Gorbea 1971: 70-71).

Recently, the same archaeologist has established a typology of anthropomorphic stelae in the Iberian Peninsula (Almagro Gorbea 1993). This systematisation includes the depiction at Peña Tu in group B, of "feminine" stelae, to be more exact, in sub-group B-1, of "menhir-stelae with idoliform depictions", together with the examples at Sejos and Tabuyo del Monte, which he attributes to "the bell-beaker culture and early Bronze Age" (Almagro Gorbea 1993: 133).

P. Bueno and M. Fernández-Miranda (1981) consider that Peña Tu is a religious manifestation rooted in megalithic tradition, and situate it in "a date between the chronological limits established for Phase A of El Argar culture" (Bueno and Fernández 1981: 465). This attribution is based primarily on the weapon depicted on the left of the idol, which they consider is a dagger linking the bell-beaker hafting tradition - a tang - with the later technique - rivets. They also consider that there are close parallels between this steliform figure and that on the stone at Tabuyo del Monte, which can equally be related with plaque-idols in the peninsula, and associated with a dagger they believe to be similar and a halberd assignable within the Carrapatas type, belonging to the start of the early Bronze Age and an "Atlantic" cultural environment.

As representations in which idols are associated with bell beaker-tradition weapons and elements corresponding to the early Bronze Age, Peña Tu and Tabuyo are placed in Phase III, with a date of around 1800 BC, of the evolution of anthropomorphic stelae in the north of the Peninsula, proposed by Bueno *et al*. (1985). A very similar chronology - 2000 to 1800 BC - is proposed some years later by P. Bueno, who again gives as a reason the mixture of bell-beaker and "Argaric" elements existing in the weapons depicted (Bueno 1990: 106).

R. de Balbín provides a new interpretation (1989), by suggesting a hypothesis which is of interest because it breaks with earlier theories. This archaeologist introduces a radical innovation in the interpretation of the decorated panel, and raises doubts about whether the depictions and techniques appearing in it can be contemporaneous (these doubts are compounded by the deterioration and recent alterations suffered by the rock surface). Balbín concludes that "nothing allows us to affirm that the depictions are coetaneous, and they could have been produced successively from the idol to the dots and painted anthropomorphs, to the figure of the dagger, which could have been done without the nails" (Balbín 1989: 31). The explicit idea that leads Balbín to suggest this series of artistic expressions in the panel, where until this moment the different designs and techniques were considered synchronic, is the context of the idoliform image in a megalithic environment (the site is located within an area of monuments, including tumular structures), whose chronology is clearly older than that of the metal weapon by its side. The date of the idol is in the 3rd millennium BC, in common with similar figures on decorated plaques in the Alentejo area, which are not accompanied with arms, and also the examples in Cantabria at Garabandal or Sejos I. These form an early phase of this type of anthropomorphic figures in the north and centre of the peninsula, and are directly related with the "Megalithic culture" (Balbín & Bueno 1993: 52).

An opinion in disagreement with this reasoning has been expressed by L. C. Teira in his publication about the idol at El Hoyo de la Gándara (1992), which includes a dissertation on the chronology of anthropomorphic idols in Cantabrian Spain. This article discusses both the evolution of anthropomorphic stelae proposed by Bueno *et al*. (1985) and Balbín's theory explained above. Teira believes that it is more appropriate to take into account, above all else, the great iconographic affinity in the assemblages, whose attributes - especially the weapons - suggest a date at the start of the Bronze Age (also see Teira & Ontañón 2000). He therefore rejects, because of their inconsistency, the arguments in favour of a long chronology, such as the considerations about the hafting methods used in the arms (tangs and rivets) - contaminated from a modern point of view and "professionally deformed" - and the fact of the presence or absence of these, or the idea of a temporal disconnection between the techniques of engraving and painting, which could be affected by questions of differential conservation.

Finally, it is possible to put this panel into the context of a number of assemblages of schematic art in the north of the peninsula. They are all practically identical in their conventions and even in their size, and cover a rather small area in the centre of Cantabria (idols of Sejos and San Sebastián de Garabandal), Asturias (Fresnéu, Picu Berrubia) and the north of León province (stela of Tabuyo del Monte). The existence of this group, with a clear personality of its own, is proof of close cultural connections among these regions at the beginning of the Bronze Age.

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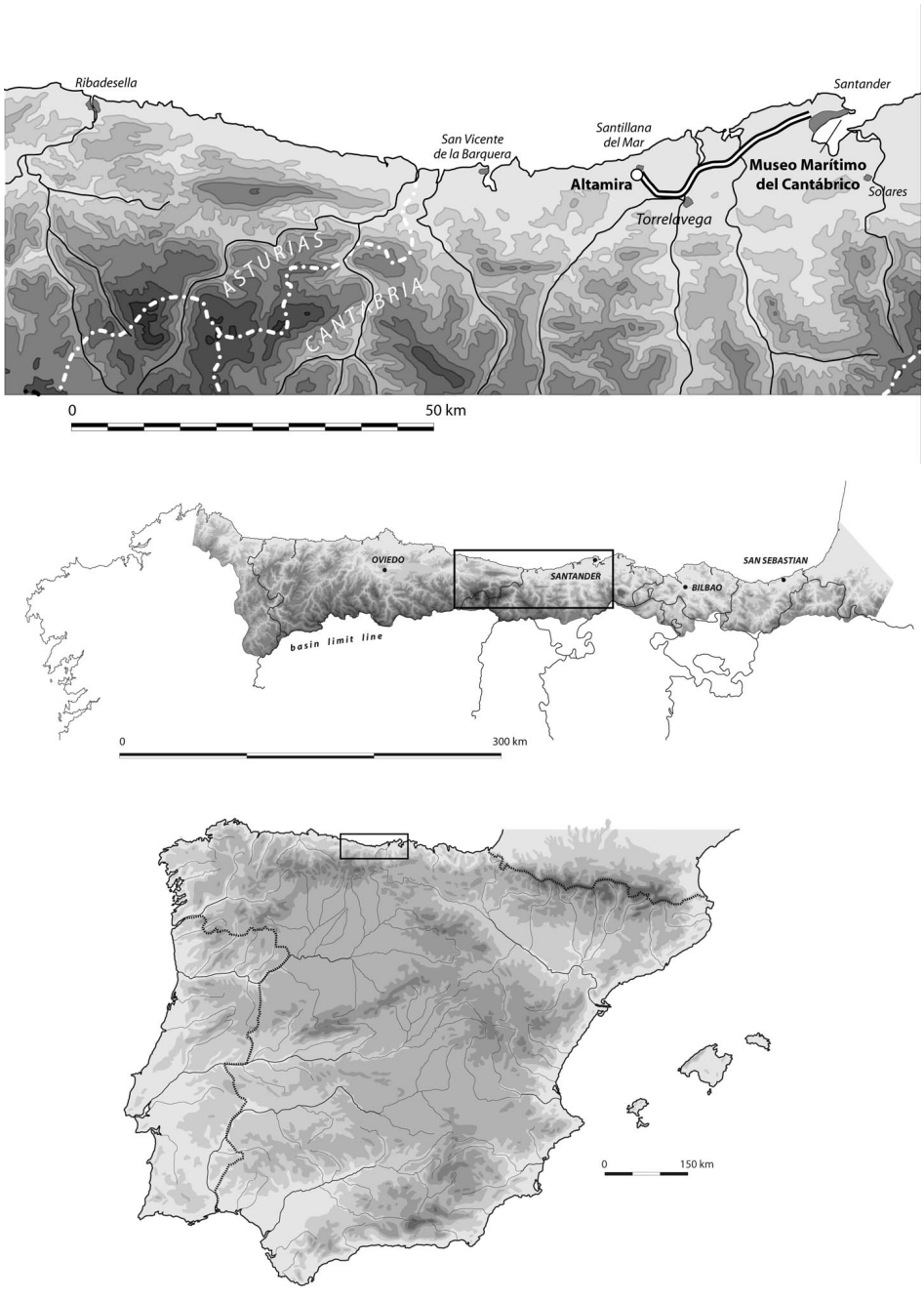
SECOND FIELD TRIP:

MUSEO DE ALTAMIRA, SANTILLANA DEL MAR & MUSEO MARÍTIMO DEL CANTÁBRICO



Altamira Cave (Santillana del Mar, Cantabria)

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IIIPC (Santander)

Although a hundred and twenty-five years have gone by since Marcelino Sanz de Sautuola discovered this cave art ensemble, and over a hundred decorated caves, in Cantabrian Spain alone, have been discovered since then, Altamira remains the example par excellence of Palaeolithic cave art. Its polychrome bison certainly constitute one of the most amazing creations in all western prehistory. Both circumstances – the first Palaeolithic cave art ensemble to be studied, and the exceptional conservation and quality of its art – have made this site into a cultural point of reference of the first order, and also a kind of battlefront where different interests and scientific approaches converge.

1. Location and Archaeological Context

Cueva de Altamira is situated about two and a half kilometres to the south-west of the town of Santillana del Mar. Its entrance is very near the top of a low limestone hill, just 161m above sea level, in a dominating position over the surrounding land. From this place, as its name indicates (Altamira could be translated as "high view"), there are wide panoramas over the regional territory, especially an area of karst to the west and the north, where the coastline is, about 5km away at the present time, or towards the valley of the River Saja, hardly two kilometres to the south.

This area of the Cantabrian *Marina*, relatively open terrain that could easily be crossed by herds of ungulates and groups of hunters, was used with certain intensity by Upper Palaeolithic human groups (ca. 37,000-11,500 BP). In fact, the archaeological site of Altamira is not an isolated case, but rather the icing on the cake. In a radius of ten kilometres around the cave many other Palaeolithic settlements are known, in some cases with parietal decoration, even if they are much less spectacular. Thus, we can find the caves of Las Aguas (Novales) and El Linar (La Busta) to the west of Altamira, La Clotilde (Santa Isabel de Quijas) by the River Saja in the south, Cueva de Cudón in the east, across the River Besaya, and also Cueva de Sovilla up-river, at the entrance to Buelna valley. Simple Upper Palaeolithic deposits

are even more abundant in the area, usually habitat sites. They include the caves of La Peña de Caranceja, Cualventi, Gurugú and La Pila, among others. This relative archaeological wealth must be a pale reflection of the original situation, or of the total sum of remains left behind by human groups in the Upper Palaeolithic. But it is all we have to obtain an idea of the life of the primitive communities in our land.

2. Description of the Cave

The entrance of Cueva de Altamira faces north-northeast, at just over 160m above sea level. It leads to a relatively straightforward cave nearly 300m long. It is especially significant that it is formed in Cretaceous limestone strata (Cenomanian-Turonian), about 1m thick, alternating with thin beds of clay, and generally in a horizontal position. The formation of vertical fissures and the fracture and collapse of blocks of limestone are more common features in Altamira than in other caves formed in thicker beds of limestone or with more oval cross-sections. This permanent structural instability has its implications in a very angular and broken longitudinal development, in passages and chambers with rectangular cross-sections, with flat roofs and vertical walls, sometimes offering overhanging surfaces, whose vertical faces and horizontal steps were used by the artists.

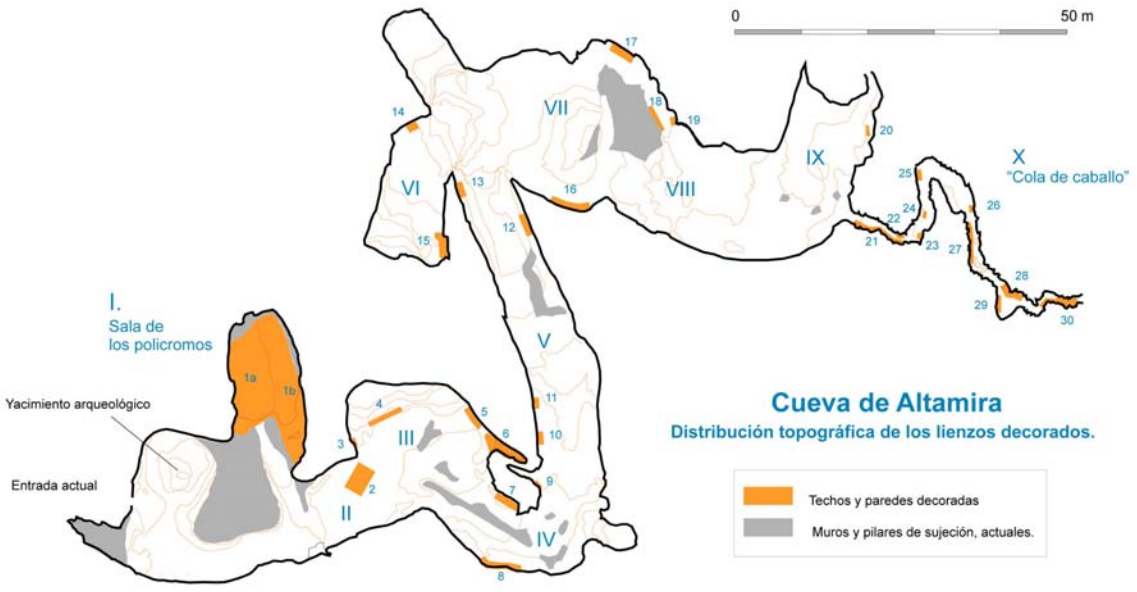

Figure 1. Plan of the Cave of Altamira

On the other hand, this orthogonal shape has resulted in great instability, especially in the areas that are more exposed to changes in temperatures, near the entrance. As a result, the excavations in the vestibule have been able to define different phases in the collapse of large limestone

blocks, which has occurred throughout the history of the cave. The main episodes frame the Palaeolithic anthropic occupations stratigraphically. They are located below the occupation level of Solutrean chronology (ca. 21,000-17,000 BP), and finally they partly seal the following early Magdalenian level (ca. 16,000-14,200 BP). The latter episode of collapse took place during middle or late phases of the Magdalenian. It made the entrance smaller and more difficult, and possibly made the vestibule a less attractive place for a habitat. As time passed, the blockage at the entrance was consolidated by carbonate concretion, and with it, Cueva de Altamira was slowly forgotten.

In addition, the instability to which we have referred may have been increased by dynamiting at a nearby quarry (before the paintings had been discovered) and possibly by the work carried out to lower the floor in the Hall of the Polychromes or, at the present, by any building work that could affect the limestone beds in which the cave has formed. This instability has made it necessary to take action to preserve the cave. The main work, in the 1920s, consisted of building large pillars and supporting walls to prop up the roof in different parts of the cave (see the plan in **Fig. 1**). The most important supports, between the vestibule and the decorated chamber, artificially separated these two spaces which had originally been united.

3. The exploration of Altamira

It seems that the cave had been known to the local people of Santillana and Vispieres since 1868. Don Marcelino Sanz de Sautuola, a restless scholar, naturalist and archaeologist, studied it between 1875 and 1879, and he discovered and correctly interpreted the Palaeolithic deposit in the entrance. Here he found abundant tools in stone, bone and antler, charcoal, and remains of the animals and shellfish consumed on the site, and which were similar to the kind of material recovered from French caves. He also spotted some black drawings on the cave walls, although he did not think much about them at first. In 1879, his daughter Maria accompanied him on one of his visits, and discovered the large bison painted in red and black on the roof at the back of the entrance vestibule, which was very low above the floor in this part of the cave. This discovery was the start of great events. Sautuola began the study of the art, and soon decided to publish his results. In a memorable booklet printed in 1880, he proposed the Palaeolithic age of the paintings and the deposit, which would be synchronic (Sanz de Sautuola 1880; Madariaga de la Campa 1976). As is well known, this was in complete contradiction with the established concept people then had of primitive societies and evolution, and started a bitter controversy, which we cannot go into now. This only ended in the first years of the twentieth century, when the accumulation of evidence from sites in the Dordogne and French Pyrenees forced not only the acceptance of the Palaeolithic chronology of the paintings in Altamira, but also the most transcendental point in the discussion: the full aesthetic and intellectual capacity of populations that were "primitive" technically and

economically, whether they were Palaeolithic hunters or modern societies. The controversy had great scientific significance and has often been described. The basic information about the discussion appears in the works of B. Madariaga (1976; 2000); while more recent, and recommendable, assessments have been made by E. Palacio (2002) and M. R. González Morales and O. Moro (2002).

Figure 2. Sketch of the figures on the ceiling at Altamira, by H. Breuil (Breuil & Obermaier 1935: 36. fig. 3).

At the beginning of the century, the French prehistorians, E. Cartailhac and H. Breuil (the latter was just beginning his fascinating career in Prehistory), travelled to Santillana and made a full, detailed study of Altamira. Their documentation and analysis of the cave art, aimed at proving its Palaeolithic age, and at comparing it with the art of modern primitive people, was completed with the results of the excavations carried out by Alcalde del Río, an important local researcher who was then beginning his collaborations with Breuil (Cartailhac & Breuil 1906; Alcalde del Río 1906).

Despite this, the fundamental study of Altamira is the volume published by H. Breuil and H. Obermaier three decades later, in 1935. It had a great deal of novelties in comparison with the previous work of 1906, for example in the drawings and measurements, which were a consequence of the improved facilities for copying and lighting, as the floor below the polychromes had been lowered. Together with more adequate financing, this allowed more exhaustive documentation and the correction of some errors in the first book, both in the stratigraphic order of the figures in certain panels (the superimposition of different figures was one of the main ways in which the parietal art could be put in chronological order), and in the copies made of

some of the figures themselves. Furthermore, it included the results of new excavations undertaken in the vestibule by Obermaier in 1924 and 1925, which completed the results obtained by Alcalde del Río.

Opinions about Altamira, regarding the chronology and order of the cave art, were changed substantially by the publication of A. Leroi-Gourhan's synthesis (1965). Although this prehistorian was not in possession of specific and detailed documentation on the cave, and his study has striking omissions and great overall simplification, he proposed an older age for the polychrome animals. In this way, for Leroi-Gourhan, the bison on the famous ceiling, the technical and expressive apogee of the Upper Palaeolithic, need not necessarily belong to its final stages, as Breuil had thought. Instead, based on analogies between rock art and portable art, he proposed that they had been painted in the early or middle Magdalenian (or in his Styles III - IV). This older date has been ratified by the absolute radiocarbon determinations obtained for the polychromes since 1992.

Since the 1960s, a large number of summaries of the fieldwork carried out in the first third of the century have been published. These include impressions, reinterpretations and up-dates (and to which the present essay might be added), but they contain hardly anything of a comparable standard to those first monographs. The most interesting contributions have been the studies of the last passage in the cave (Zone X, see the plan in **Fig. 1**), which contains a large number of figures, made by L. G. Freeman and other prehistorians, the new digs carried out in the vestibule by the same researcher and J. González Echegaray, the radiocarbon dating of the cave art and the deposit, and the splendid photographs of the art recently published (Freeman, *et al.* 1987; Freeman & González Echegaray 2001; Valladas, *et al.* 1992; Moure Romanillo, *et al.* 1996; Saura *et al.* 1998; Múzquiz 1988). But this large number of publications cannot disguise the current lack of knowledge we have about Altamira. Breuil's fieldwork, excellent for its day, is simply not good enough at the present time. In fact, just limiting ourselves to the documentation of the art, we can point out that there are many figures in Altamira that have never been published, other animal figures that were described in publications have not been reproduced in drawings, and even the documentation of the main ceiling is limited to the more visible and spectacular figures, with partial reproductions of each figure. Finally, the available survey has been designed to show the building work in the cave and the paths through it, rather than to illustrate the areas used and chosen by its Palaeolithic explorers and their working conditions.

4. Palaeolithic occupations at Altamira

If, for a moment, we leave aside the large composition of polychrome animals, the rest of the archaeological record inside Altamira is quite conventional and relatively similar to the assemblages at other decorated

caves or archaeological sites in the region. The walls and ceilings inside the cave contain a large number of engravings, black paintings and others in red, yellow and violet, representing animals and anthropomorphic beings, abstract signs and non-figurative images. Similarly, at the cave entrance, within daylight, a deposit was formed with the remains of human occupation that were especially frequent between approximately 19,000 and 14,000 years ago, in the Magdalenian and Solutrean periods. In this lapse of time, the parietal art inside the cave was produced, or at least most of it, as researchers are not unanimous on this point, as we shall see below.

The different excavations carried out in the vestibule have therefore been able to distinguish two occupation levels corresponding to late phases of the Upper Palaeolithic. The oldest, the Solutrean layer (a period dated in Cantabrian Spain between 21,000 and 16,500 BP), contained a great deal of flint and quartzite tools; the hunting points made with flat retouch, and a concave or notched base, are especially characteristic. There were also deer antler spearheads; monobevelled, bi-pointed assegaies with central flattening, and other bone artefacts. Among these, the most interesting are four perforated pendants made from bone plaquettes and decorated with lateral engraved marks. A bone from this level has been dated to 18,540 ± 320 BP, a date which fits in perfectly well with our knowledge of the Solutrean period.

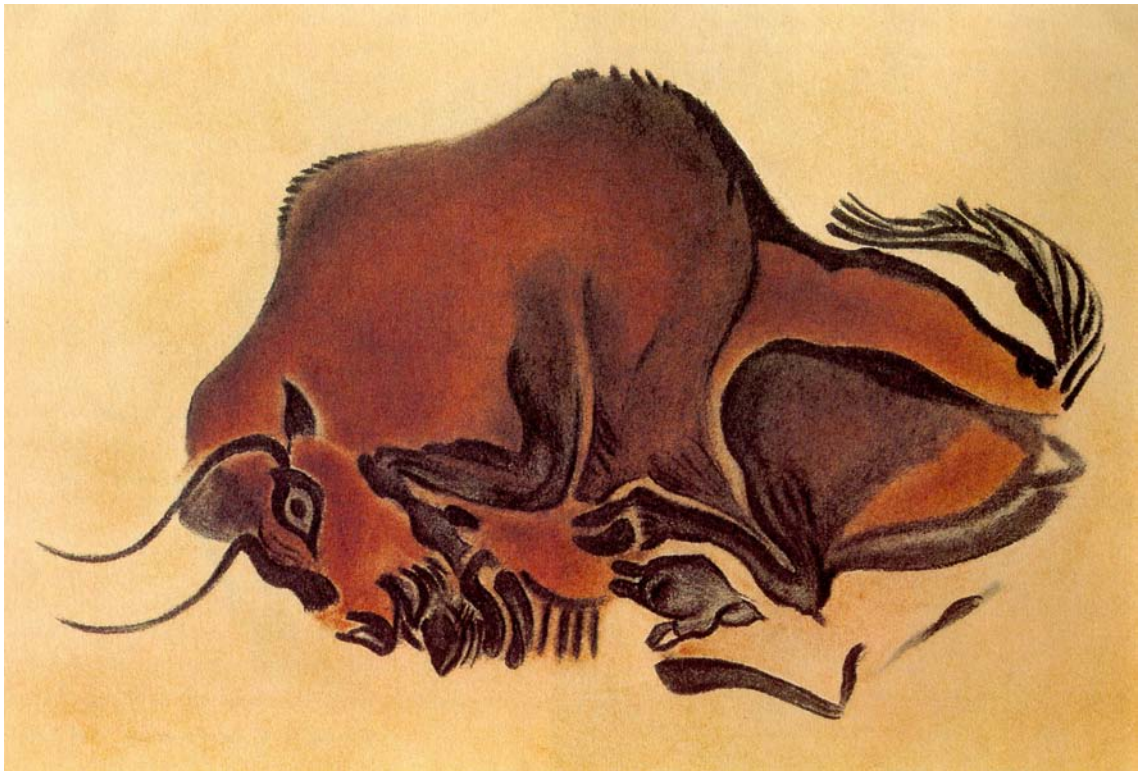

Figure 3. Reproduction made of the polychrome bison on the ceiling, made by H. Breuil. These magnificent copies, although owing much to his interpretation, defined the public image of the art during much of the 20th Century
(Breuil & Obermaier 1935, lamine XXVII).

The early Magdalenian layer had a much more abundant bone and antler assemblage, as is usual in this period. The tools included assegaies with a quadrangular section and monobevelled base, perforated needles, spatulas, pendants made from horse and aurochs teeth, and many stone scrapers, burins and backed bladelets. This layer has been dated by C14 several times, with results between 15,910 ± 230 and 13,900 ± 700 BP. A scapula with an engraved deer was dated by accelerator mass spectrometer to 14,480 ± 250 BP. These scapulae, which often have striated hind's heads, are very similar to some of the parietal engravings inside the cave. The date, therefore, means that these examples of portable art can be attributed to the early Magdalenian, as at El Castillo, El Juyo or the Asturian cave of El Cierro, thus overcoming the doubts caused by their position in the area of contact between the Solutrean and Magdalenian layers in Altamira (Straus 1983; Utrilla Miranda 1981; Altuna & Straus 1976; González Sainz 1993; Álvarez Fernández 2001).

Human activity was not limited to the area with daylight in vestibule, as the distribution of paintings and engravings already makes clear. Interesting artefacts have been found on the cave floor in different places inside. The most important was a fragment of a perforated antler staff, with several engraved figures of chamois, and which was found in the Hall of the Polychromes. A number of borers, a fragment of spatula, and a tube made from a cut bird's bone, were found in the Main Gallery. Even more surprising was the discovery of three flat *Pecten* shells, i.e. the opposite of the concave shell used for drinking by medieval pilgrims. They were perforated next to their hinge, and hidden under a block about half way along the cave passage (Álvarez Fernández 2001).

A discussion, which still has not reached a conclusion, is based on determining whether the human occupations were limited to the periods mentioned above – Solutrean and early Magdalenian – or other older occupation existed. In the case of Altamira, this doubt is caused by the excavation difficulties in the vestibule, which have to avoid the large limestone blocks that have collapsed at different times, so that it is very difficult to dig any deeper into the deposit. This problem is the reason why we still cannot be certain whether pre-Solutrean occupations took place or not. This, in turn, leads to different chronological proposals for the paintings on the walls and ceiling inside the cave. It is important to point out now that the archaeologist responsible for the most important excavations (H. Obermaier, in the 1920s) expressed in unmistakeable terms his belief in older occupations in the vestibule, which he attributed to the "Aurignacian" because of the find of some "Font-Robert blades", a lithic implement that is now considered as characteristic of the Gravettian period (between 27,000 and 21,000 BP in Cantabrian Spain). In their 1935 report (Breuil & Obermaier 1935: 196), they noted that *"it is probable that other Palaeolithic layers, especially of Aurignacian age, are found below [the Solutrean layer], as paintings and engravings of that period are found inside the cave"*. A similar

statement is made on page 36. This stylistic argument is completed by H. Obermaier's note (1929: 9-11), where he offers as proof the find of some "Font-Robert blades". Although this publication is difficult to locate, it is reproduced in the documentation provided by B. Madariaga de la Campa (1972: 243-245). In our opinion, we believe that Obermaier's observation, often forgotten, is quite feasible. Above all, because among the parietal art in the cave (even though most of the figures are indeed of Solutrean or early Magdalenian age), some depictions appear to belong to a much earlier style, just as Breuil and Obermaier claimed.

The human groups who occupied Altamira, coinciding with the coldest moments of the Upper Palaeolithic, lived from the hunting of red deer, and occasionally bison or aurochs, or animals of rocky terrain such as ibex and chamois. Their diet was complemented by birds, fish, and very rarely, by seal, and the gathering of diverse products, which included marine molluscs. The gathering of sea food on the coast, which would then have been noticeably further away, and the return to the cave with limpets (*Patella vulgata*) and winkles (*Littorina littorea*) became more important in the early Magdalenian.

5. Graphic Activity: An Assessment of the Parietal Art

The best overall study of Altamira, published by Breuil and Obermaier in 1935, differentiated ten topographic areas along the 300m length of the cave. Cave art is found in all of them, from the rear of the entrance vestibule to the final narrow passage. However, the artists did not distribute the decoration at random throughout those areas, but were particularly interested in enclosed areas, the chambers and side-passages with only one entrance and no way out. Thus, they worked most intensely at the back of the vestibule, which had a relatively independent chamber with a flat roof on its left-hand side (Zone I), as well as in a chamber on a lower level, on the left, half-way along the cave (Zone VI, or *Hoya*, The Pit), or in other narrow side-passages. Finally, and again quite intensely, they decorated the final passage, where it is necessary to stoop and crawl (Zone X, or *Cola de Caballo*, The Horse's Tail). In fact the Zones I and X contain over 95% of the cave art in Altamira, which we shall now briefly review.

The Hall of the Paintings, or of the Polychromes, or Zone I. The rear of the vestibule, a large, low-roofed chamber on the left-hand side, out of the reach of daylight, is the location for the famous ceiling painted with polychrome animals and many other examples of cave art. Today, this hall is separated from the vestibule by a wide wall holding up the roof, built in 1922, and besides, the floor has been partially dug out so that the paintings can be seen more easily.

The hall is 18m long, and about 8 or 9m wide. The original height of the roof was between 2m at the entrance and 1.10m at the back. All the paintings and engravings known in this chamber were produced on the ceiling, which must have been difficult, especially considering the size of the polychrome animals, which in some cases are nearly two metres long.

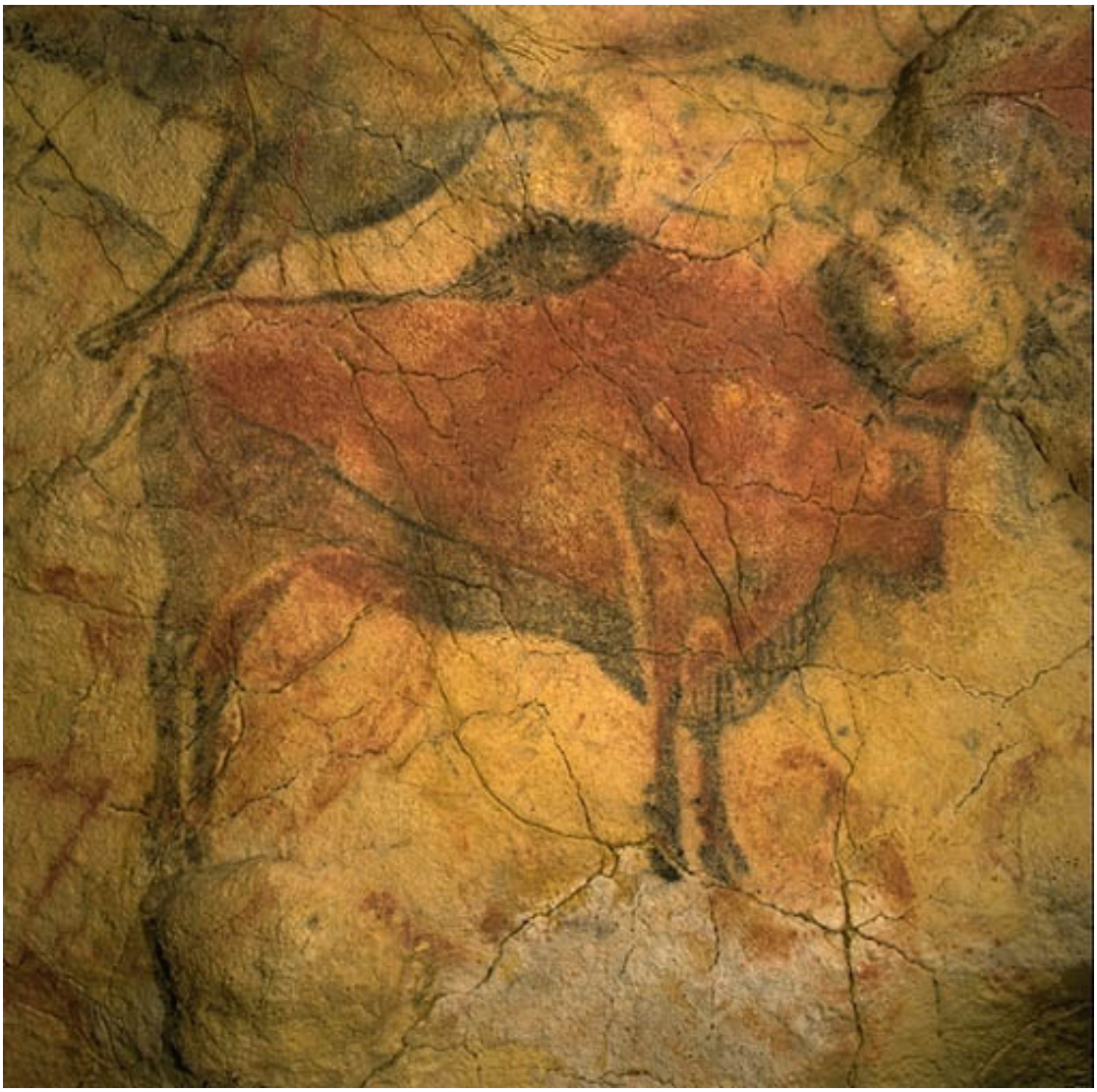

Figure 4. Bison on the large ceiling (photo by P. Saura)

These animals, painted in different tones of red and black, and often engraved too, are the best known figures in Altamira and we shall start our descriptions with them. There are about twenty large figures of a type of bison that was the ancestor of the modern day European bison, situated above all on the left of the ceiling (zone 1a on the plan), although a few poorly-conserved examples are found at the front and right (zone 1b on the plan), separated from the others. A smaller number of hinds and horses were represented with the same technique, but the wild boar that have sometimes

been identified are rather doubtful (at least one of them is really a leaping bison, with the characteristic horns and beard).

The techniques with which these paintings were produced are relatively more complex than usual for Palaeolithic art. The animals' outlines were drawn in black or engraved with a burin, before the colours were applied: reddish ochre combined with black or, in the case of some bison, only in the latter colour. The pigment was applied directly with the hand, with brushes and pieces of animal skin and occasionally with colouring "pencils". The outlines were emphasised and drawn more precisely with multiple engraved lines, which were also used to indicate details such as the eyes, horns that are always fine and systematically in correct perspective, the snout and hoofs. Equally, engraving was used to define the limbs and separate planes at different depths. In order to achieve volume and shape, as well as colour shading and ordering anatomical elements in different planes – horns, limbs, ears… - parts of the interior of the body were washed and scraped in different ways. With the same aim, prominences in the ceiling (the base of one of the limestone strata in which the cave had formed) were cleverly used by adjusting some of the figures to these positive volumes, and fissures and steps in the rock were used systematically to line up with different parts of the animals' outlines or internal morphology. The result, a large group of animals in different shades of red, circled in black and engraving, standing out extraordinarily from the yellowish colour of the rock, produces a profound effect on visitors who enter the chamber and turn a light towards the ceiling.

The animals were painted in very different positions and postures: standing up and bellowing, resting and turning their heads back, trotting and jumping, or just standing still. They seem to be figures isolated from one another, without any obvious relationships amongst each other. However, the homogeneity in technique, style, and to a certain extent size, of the polychrome paintings, or the fact that the outlines of the animals seem to fit together like pieces in a jigsaw puzzle, has led many researchers to consider it as a synchronic assemblage, the work of a single artist, or perhaps of several artists working closely together, and this seems reasonable (Apellániz Castroviejo 1983; Múzquiz 1988; *cf.* Alcalde del Río 1906: 17-18; Cartailhac & Breuil 1906: 75). Nevertheless, it is likely that not all the bison on the ceiling are synchronic, and therefore some of them need to be segregated. The recent radiocarbon determinations, although they still have certain problems in their interpretation, show that most of the animals, including the largest and truly polychrome ones, were produced some time between 14.900 and 14.100 BP, towards the end of the early Magdalenian period. But two smaller bison, shaped in black and engraved, facing one another, may be later, and produced between 13.600 and 13.100 BP (Moure Romanillo *et al.* 1996: 297-301). The differences in techniques, size and perspective that can be seen between these two small bison and the truly polychrome figures, had already been pointed out by the main researchers at Altamira. However, taking into account that

they are less realistic and finished figures, they were believed to be a little older than the polychromes (Breuil & Obermaier 1935: 59), in a too rigid application of the formal evolutionism that prevailed at that time. The results of the radiocarbon determinations were able to segregate the production of each type of bison, but placed the simpler figures in a more recent time.

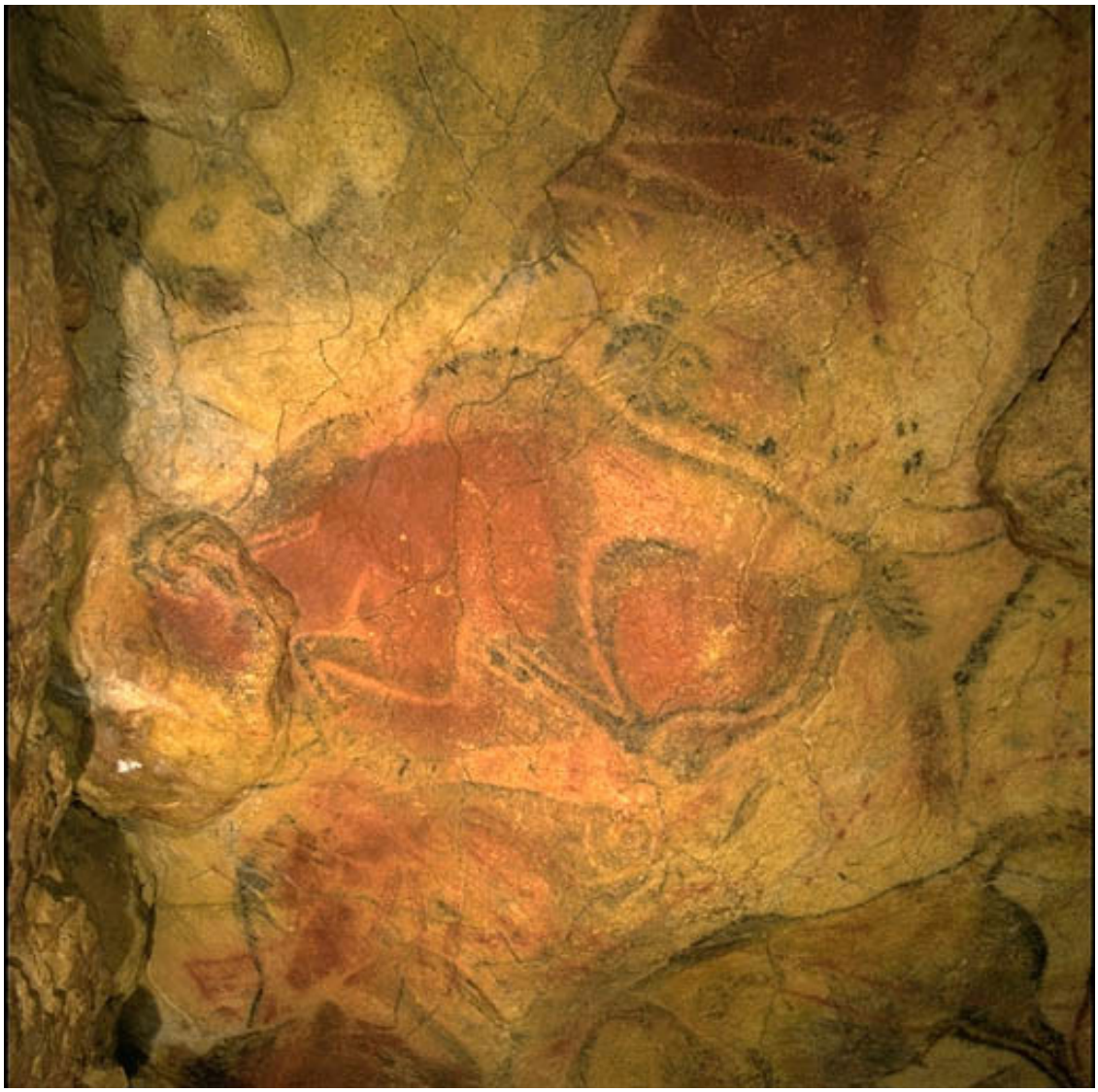

Figure 5. Bison turning its head (photo by P. Saura)

Numerous interpretations of the whole composition have been made, since that of Max Raphaël, above all of later structuralist prehistorians, as well as more recent naturalistic interpretations which explain it as a simple herd of bison in the rutting season (Raphaël 1986; Leroi-Gourhan 1965: 270-272; Freeman 1978; Freeman & González Echegaray 2001). We must remember, however, that Palaeolithic people never saw the ceiling as we do – the lighting and the height of the floor have changed – nor consulted a sketch of the ensemble like the illustrative and explanatory one published in 1906

and systematically reproduced since then. To obtain a mental image of the relative positions of the larger bison and horses, of the hinds, acephalous animals and the other supposedly complementary figures, must have been extremely difficult for the Palaeolithic visitors who were not involved in the decoration of the ceiling. An additional problem for the overall interpretation of the composition of *preserved* polychromes lies in the possible loss of information.

Figure 6. "Claviform" signs situated near the polychrome figures on the ceiling in Altamira (photo by P. Saura)

It is not only striking that some similar bison figures are isolated at the front-right of the chamber but that – as the archaeologists who knew Altamira before the construction of supports for the ceiling in the 1920s warned (Breuil & Obermaier, 1935: 35): *"It is probable that in prehistoric times the painted*

ceiling extended further towards the entrance, which would be located further out than it is today; but the process of the progressive collapse of this area of the cave has often caused the beds of rock to fall to the cave floor".

It is also worth stressing, lastly, that the skill displayed in the depiction of the bison, the consummate expression of force and strength they evoke, often makes us forget their highly conventional character. These bison are simply a version, of extremely high quality, of an iconographic scheme that was used widely in western Europe in the Magdalenian period, repeated time and time again on portable objects or in more modest parietal ensembles.

Figure 7. Archaic depiction of a horse on the right of the ceiling. Superimposed on it can be seen the head of a bison in black, in a more recent style (photo P. Saura)

The polychrome bison, and these other monochrome figures possibly added later (which apparently occupy free spaces and assuming the pre-existing main composition), are in fact just the last great art to be produced on the roof, which had been profusely decorated before. Below the bison, and in better view in lateral areas of the hall, we can see a large number of painted and engraved animal figures and signs, seemingly of quite diverse age within the Upper Palaeolithic. In brief, we can find a large number of animals in red, produced with wide linear outlines or in colour-wash. They

include a group of horses in a clearly pre-Magdalenian style, with small heads, short limbs and large bellies (**Figure 7**). Superimposed on the horses there are several negative hand images in violet and two positive hands in red. Above the red figures there are also black figures, in a Magdalenian style. Equally, red claviform signs are very common, as there are more than forty examples, similar to those in the Gallery B of La Pasiega, as well as "grilles", and over seventy "comet" shaped signs, formed by series of converging engraved lines. The polychrome animals are superimposed on all these series of depictions. Finally the ceiling has great numbers of engravings of animals and anthropomorphs, which mix human and animal characteristics. These appear both above and below the different paintings, and the most interesting are hind's heads with striated bands marking their chin and chest. There is also an exceptional figure of a stag bellowing, opposite the head of an ibex. Although the stag does not seem to be wounded, it reminds one immediately of similar animals in Peña Candamo, El Buxu, Gallery B in La Pasiega and Cueva Grande in Otañes where, as at Altamira, the stag faces the depiction of an ibex.

In reality, the precise definition of these series of depiction, both from the technical and the formal and stylistic points of view, and their sequential ordering on the ceiling, is one of the tasks which still has not been concluded satisfactorily. Despite this, the multiple superimpositions of figures observed by Breuil in different places in the hall, together with examples in smaller panels at El Castillo, La Pasiega and Peña Candamo, formed one of the most important foundations for the chronological order that he proposed for Palaeolithic parietal art in the Cantabrian region.

* Zones II to V. These sectors are located in more or less open and comfortable passages, occasionally with small side-passages. In Zone II, sections of wall covered with a layer of clay were used to draw in the clay with fingers or blunt-tipped objects, and a bovine's head can be recognized among the lines of a composition five metres long (No.2 on the plan). These walls continue with abstract engravings of sinuous, intertwining lines, and some animals. A few black animal paintings are found too, with relatively different stylistic conventions.

A little further inside the cave, in Zone III, a corroded calcite flowstone was used for two large, deeply-engraved figures of horses and other less clear motifs (No.4 on the plan). Beyond the flowstone, a few animals, which were finely engraved or painted in black, are normally isolated figures.

At the back of Zone III, on its left-hand side, a narrow side-passage has on its walls and roof all the red abstract signs which are known in the interior passages of Altamira (No. 6 on the plan, **Fig. 8**). They are four oval signs, subdivided into three fields, and a band nearly two and a half metres long with scaliform designs, as well as other quite faded signs. This relative hiding-away of abstract signs is a well-known feature in Cantabrian

Palaeolithic art, with the clearest examples being in Cueva del Castillo, La Pasiega and La Peña de Candamo

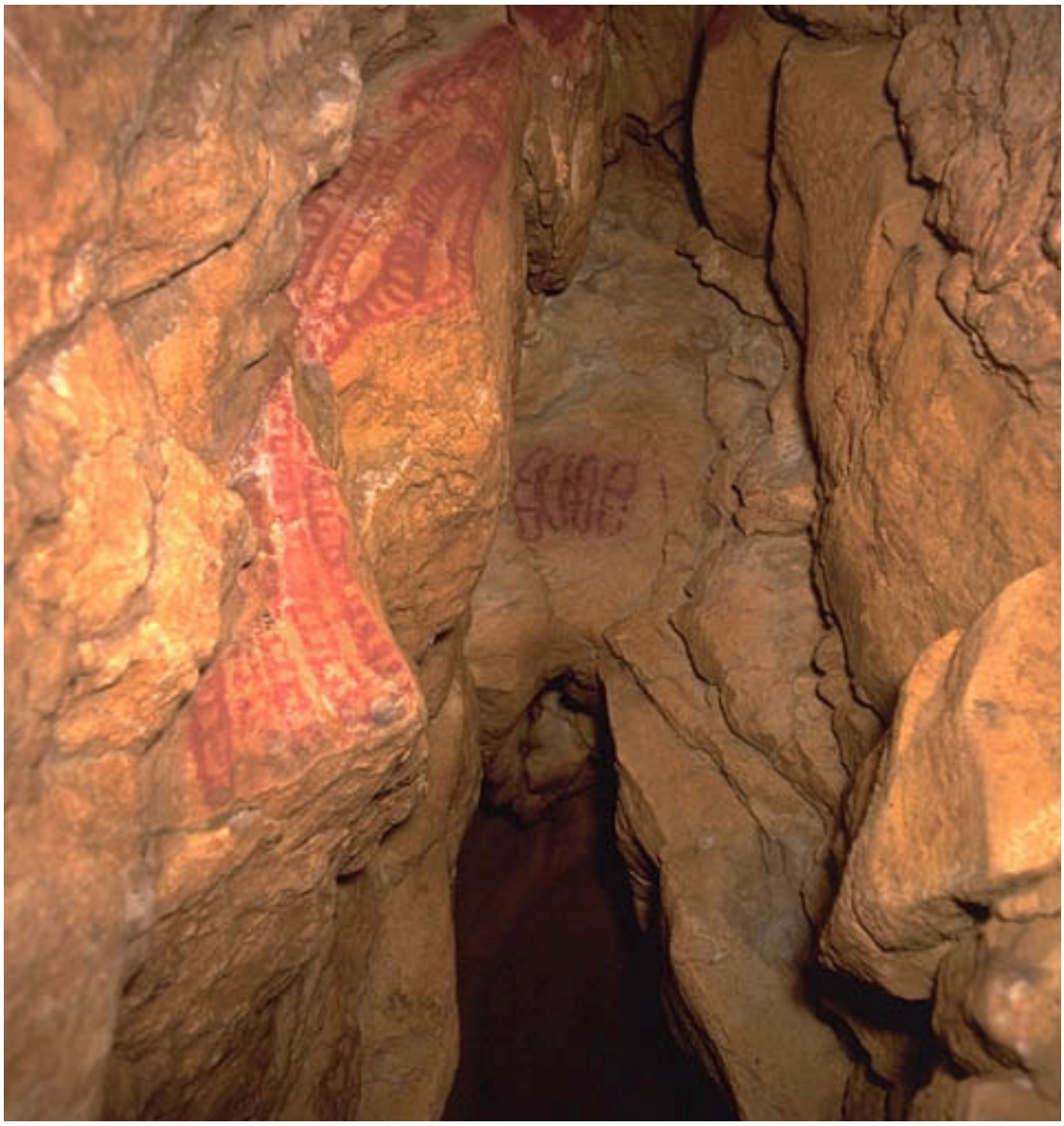

Figure 8. Group of abstract signs in a narrow side passage in Zone III (No.6 on the plan). In the photograph, taken from floor level, some "scaleriform" signs can be seen, painted at the base of a rock projections, and several oval signs at a lower level (photo by P. Saura)

The opposite wall has a series of cornices with good vertical sections of wall. These have a series of hinds and stags (at least nine figures) and a horse, engraved with fine lines, and occasionally with bands of striated lines (No. 8 on the plan). This concentration of engravings of hinds, little known, is similar to the one at the end of Zone X in Altamira and in other caves in the centre of Cantabrian Spain. These engravings of hinds and, more rarely, stags, conventionally represented were sometimes drawn in groups in specific

panels, separated from the rest of the decorated area (there are similar concentrations to the ones in Zones IV and X in Altamira (Nº 8 and 30 on the plan), in the sector B7 at La Pasiega, on the walls on the right of the *"Great Hall"* at El Castillo and its continuation in the passage to the Second Chamber, as well as in chambers Ie and If in the Lower Gallery at La Garma).

Figure 9. Hind's head drawn on the edge of a rock projection, which acts as the line of its chin. It is located in Zone VI (Nº 15 on the plan) and was dated by C14-AMS to 15,050 ± 180 BP (photo by P. Saura)

On other occasions these striated engravings accumulate on more complex panels, where they are found overlying or underlying other figures (Zone I in Altamira, main panel in Zone X in Tito Bustillo, Sector C3 in La Pasiega, panels at the start of the "Gallery of the Hands" in El Castillo). These same figures of hinds, so characteristic of the Magdalenian period in the centre of

Cantabrian Spain, are found in other caves with smaller numbers of parietal depictions, like Los Emboscados, las Aguas and Cobrantes. In their portable versions, always on scapulae, they have been recovered from the deposit in Altamira as well as at El Castillo, El Cierro, El Juyo and El Pendo.

In more open corridors, through Zones IV and V, we can find a few figures painted in black or engraved, but no important compositions. The most interesting at the start of Zone IV are blocks of limestone with simple engravings of animals, like horses and an anthropomorph, drawn before the blocks fell to the floor. Or a magnificent whole hind engraved on the left wall with repeated lines around its outline and striated bands in its head and chest (Nº 7 on the plan). A black line below the hind was recently dated to 14,650 ± 140 BP. A little further on, we come to more engravings of an aurochs and a bison, and black paintings of a possible feline and other animals.

Figure 10. Composition of very stylised ibex figures in Zone VI (Nº 15 on the plan) (photograph by P. Saura)

* Hall VI. This is a large side chamber, which is reached by descending a flowstone slope, hence its usual name, "The Pit". At the bottom, both walls have panels of art. They include representations of two very stylized ibex, in a similar composition to figures at the rear of Gallery C in La Pasiega, although

the latter are technically rather more complex **(Fig. 10)**. A hind's head is very simple but quite expressive (**Fig. 9**), and a third ibex in black is badly deteriorated (Nº 15 on the plan). At the start of this hall, there is a black outline of a bison (Nº 14 on the plan). They are relatively coherent figures stylistically, and the date obtained for the hind, of about 15,050 BP, can be applied to the others also.

* Zones VII to IX. After the Pit, we reach a couple of chambers with many collapsed blocks and calcite reconstruction. There are few depictions in this part of the cave. In fact, they tend to become rarer as we leave the sectors nearest to the entrance, until they become abundant again in the very last passage, Gallery X. In chambers VII-IX, we can only see non-figurative black marks, a few rare intercrossing engravings of horses, and at the end an indeterminate quadruped painted in black.

Figure 11. Group of signs painted in black in "The Horse's Tail" (Zone X, Nº 27). A sample taken from several of them was dated by C14-AMS to 15,440 ± 200 BP (photograph by P. Saura)

* Gallery X, or "The Horse's Tail". In contrast, the narrow, winding final passage in Altamira, about 50m long, harbours a large number of black paintings and engravings and even a few remains of red paint. Five of the most important black paintings are quadrilateral signs of the Cantabrian type, some of which are divided into three parts, with lines ordered like steps inside the sign, while some also have an enlargement of their longest side. Another three, smaller, quadrilateral signs are associated with them, and these have series of lines radiating outwards from their perimeter, and so are of a less conventional type than the first (**Fig. 11**). This composition of signs was dated by C14-AMS to 15,440 ± 200 BP.

In the same way, several "masks" are surprising figures in this last passage. They are natural rock forms which were animated by the addition of eyes, nostril or mouth painted in black. Exactly the same idea has been recognized in other masks in Cueva del Castillo and in the Lower Gallery at La Garma. Besides these, there are black paintings of animals, such as a horse in a rather archaic style, and non-figurative marks, and above all engravings of bison and a horse, some ibex, and hinds particularly. Indeed, the end of the passage has perhaps the most important group of striated hind's heads, and also stags, in the whole cave (Nº 30 on the plan).

6. Structure of contents and chronology

At present, it is very difficult to make an even remotely accurate inventory of the themes represented in Altamira, both because of the volume and complexity of the ensemble and because the studies published and available are by no means exhaustive nor systematic. González Echegaray's study of 1978 is still the most indicative, and this established a minimum of 141 clearly identifiable animals: 37 bison, 35 cervids, mostly hinds, 33 horses, 24 caprids (including a chamois), 7 aurochsen, 2 or 3 possible carnivores (a highly dubious wolf and felines proposed by Breuil), possibly 2 mammoths, and a deer with wide antlers, which has sometimes been identified as an elk, although the presence of this animal in Cantabrian Spain is merely hypothetical. There are also several negative and positive hand images, at least 9 engraved anthropomorphs, and several "masks". Regarding the signs, of which there are well over a hundred, the most important are the claviforms and the comb or grille shaped signs, in red, and the "huts" or "comets" made up of converging striated lines. These are all found in the Hall of the Paintings, while the rest of the cave has the oval and scaliform signs in red, in the central passages, and the black quadrangular signs with a pointed protuberance or a fringe, in the "Horse's Tail". It is worth noting, and perhaps relevant chronologically, that these different types of signs only appear in certain areas of the cave, and are not repeated in different places. Their high relative abundance is, however, usual in the central part of the Cantabrian

region, where there is also a high proportion of abstract signs in the caves of La Pasiega, El Castillo, Chimeneas and Las Aguas, etc.

As we have seen, Altamira displays practically the whole range of cave art techniques, except sculpture and bas-relief. But they are not distributed regularly or uniformly throughout the cave. The Hall of the Polychromes is completely different from the rest of the cave, as here all the techniques are found (except perhaps engraving on soft clay). Away from this hall, red paintings are very rare, as the only ones are the signs in the side-passage in Zone III, and a few remains of figures in the Horse's Tail, and of course polychromes do not exist anywhere else in the cave. The animal paintings in black, of different stylistic conventions, and the engravings including those with striated lines, are dispersed more homogeneously throughout practically all the decorated areas.

Regarding the chronological attribution and order of all these figures, practically all prehistorians agree that it is highly likely that occupation of the cave, as reflected in the habitation deposit, and the decoration of walls and ceilings, coincided within the same span of time. The art would have been produced, either at different times during the periods of occupation, with a gradual accumulation of different compositions and isolated figures, or within a reduced time-span.

The first problem lies in deciding whether at Altamira human occupations existed before the period well-documented stratigraphically, and dated between 19,000 and 14,000 years ago. We have already expressed our inclination to accept Obermaier's proposal, and consider it is probable that occupations existed, at least during the Gravettian period (from about 27,000 years ago). This does not imply that we should re-accept, in the same terms, Breuil's opinion that the cave art in Altamira is divided between the Aurignacian and late Magdalenian, but we do believe that the ensemble at Altamira covers a long chronology, and is like a palimpsest, as we shall see below.

The second problem consists of determining the degree of synchronicity or diachronicity of the art ensemble. In contrast with Breuil and Obermaier's idea that a succession of isolated figures and some compositions (such as the polychromes) accumulated over a very long time period, in the 1960s structuralist researchers reduced the period during which the art was produced considerably. For Leroi-Gourhan it was clear that all the black figures were relatively synchronic, and corresponded to later moments of his Style III, which he believed could be dated in the Solutrean or early Magdalenian. He situated the art in the Hall of the Polychromes in the Magdalenian III-IV, which included the polychrome animals and the claviform signs, but without referring to the red horses, hands, lines of red dots and huts or comets, which certainly do not seem to be of the same period. The engravings, present throughout the cave, would correspond to different

moments during the cave's occupation in the Solutrean and early Magdalenian, and some of them in the Horse's Tail might even belong to the late Magdalenian.

In recent years, different scholars have stressed this short chronology, based on the concentration of radiocarbon determinations obtained for the paintings within the limits of the early Magdalenian period, and some not too convincing parallels between the iconographic composition of different zones of the cave. In this way, the decoration of Altamira would have taken place in a short period of scarcely two millennia in the early Magdalenian or Magdalenian III (Bernaldo de Quirós 1991; Moure Romanillo & Bernaldo de Quirós 1995), or in two moments: the first in an old phase of the early Magdalenian (red horses, claviforms, etc.) and a more recent stage of the same period (polychromes, black paintings and some engravings) (Freeman & González Echegaray 2001: 63).

Although this is not the place to discuss the chronology at too much length, it can be adduced that above-mentioned concentration of radiocarbon dates is logical, taking into account that only figures painted in black with charcoal have been dated, and these are all of a relatively similar style, as Leroi-Gourhan already pointed out. But red paintings cannot be dated by C14-AMS, and these must be quite older, judging by their style, by their position beneath figures in Magdalenian style in the Hall of the Polychromes, and by the absolute dates that have been obtained for red paintings at other sites. In our opinion, the large number of figures and the relatively different topographic locations of technical procedures in the cave, are arguments in favour of a long temporal distribution. Although these are not decisive reasons, in both aspects Altamira differs from what is usually found at Cantabrian cave art ensembles that are generally considered synchronic (such as Chimeneas, Monedas and Covalanas), which have a much lower number of depictions and greater technical (and certainly stylistic) homogeneity. In contrast, they bring Altamira in line with ensembles of which nobody questions their chronological depth (such as El Castillo, La Pasiega, the Lower Gallery at La Garma, La Peña de Candamo and, now initial inaccuracies have been overcome, Tito Bustillo).

Therefore, the possibility that the cave was occupied in pre-Solutrean times, as Obermaier suggested, and that at the same time, some examples of cave art were produced inside the cave, cannot be ruled out. Based on merely stylistic considerations, possible examples of older figures are the red paintings at the rear of the main panel, the hands, and the simple engravings on the collapsed blocks in Zone IV. However, most of the art known in Altamira corresponds to the time of the occupations, whose remains are still to be found in the vestibule, and they were probably produced during the Solutrean, and certainly more abundantly and with greater assiduity during the early Magdalenian (between 16,500 and 14,000 years ago). And it is clear that there are figures later than the early Magdalenian. At least, the smaller

bison on the main panel were produced about 13,600 or 13,100 BP, according to the radiocarbon determinations, which corresponds to the middle Magdalenian in the region.

Altamira was a reference point for Palaeolithic populations in Cantabrian Spain during long periods of the Upper Palaeolithic. It was not, especially in the early Magdalenian, just another cave. The size and spectacular appearance of its iconographic assemblage suggest a diversity of functions much greater than is seen at other sites in the region belonging to the same period. Despite this, we should not be dazzled by its singularity, which has increased with the passage of time and is especially strong at present. Other caves with similar compositions of polychrome animals must have existed (like the few examples we know at caves such as Tito Bustillo and Ekain) because, among other reasons, the high level of skill seen in the reproduction of conventional motifs could hardly have been achieved at the first attempt.

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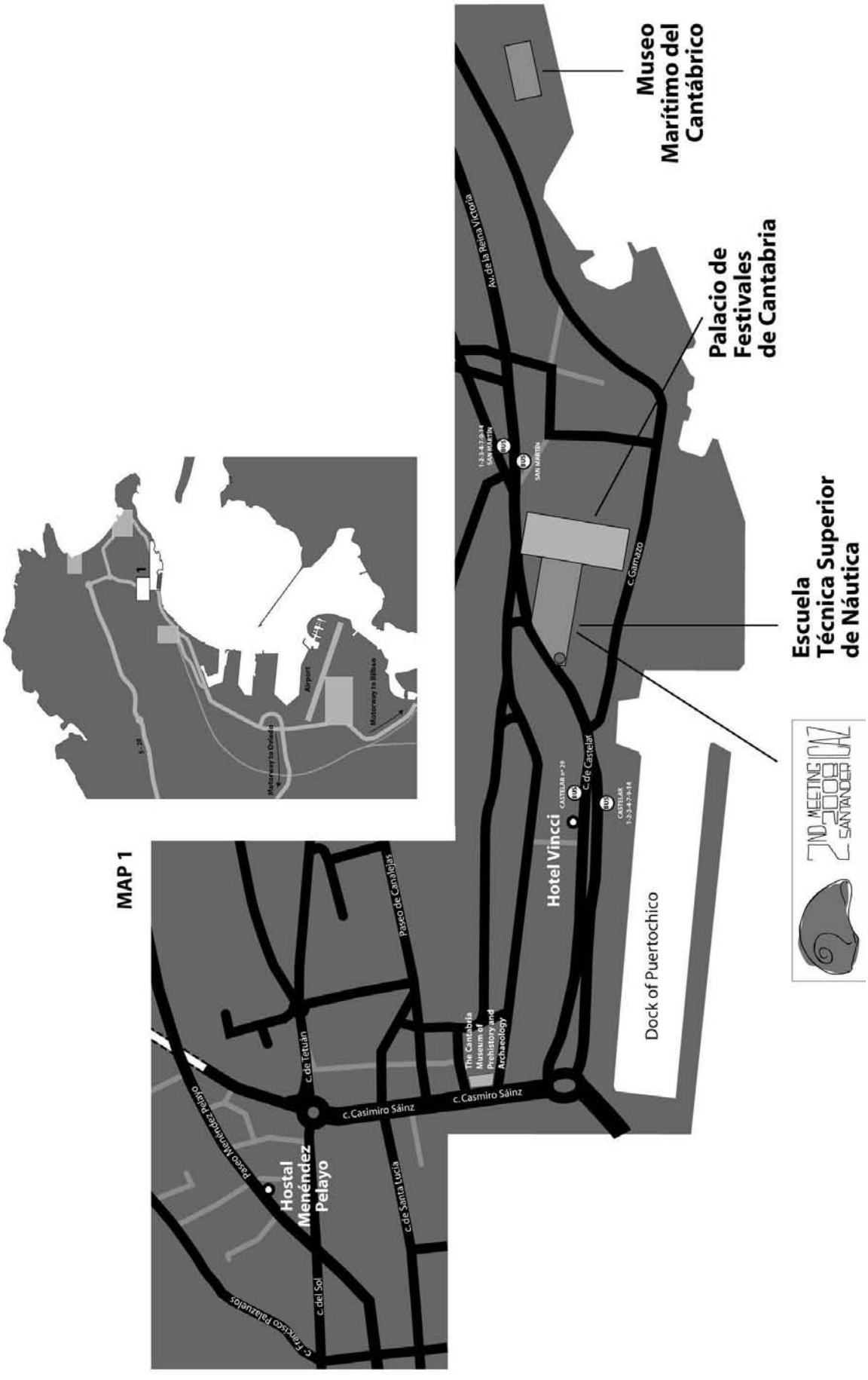
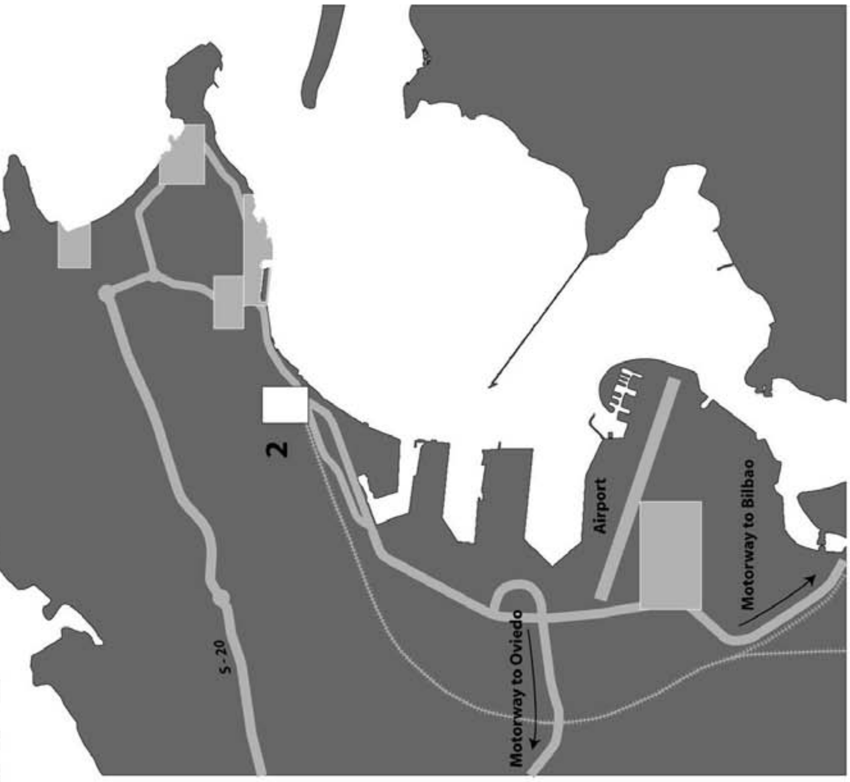
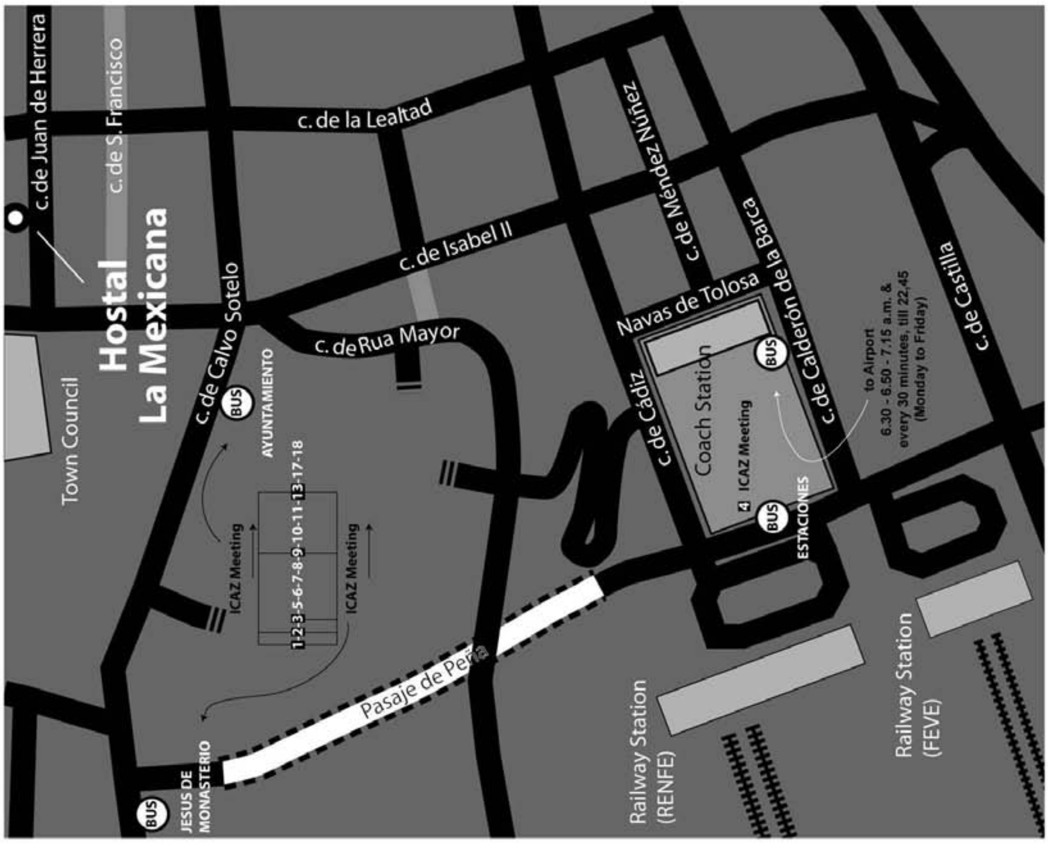
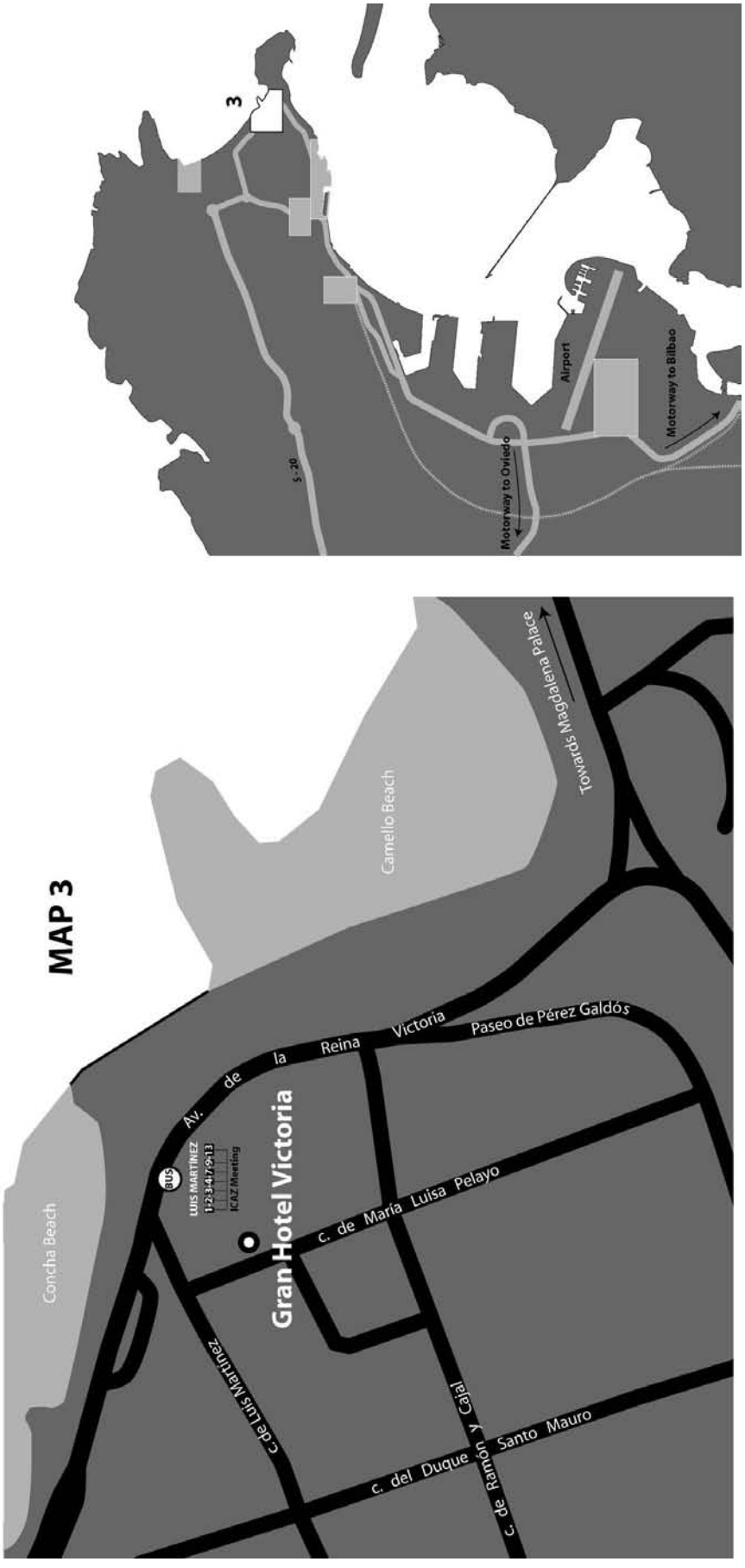
MAPS

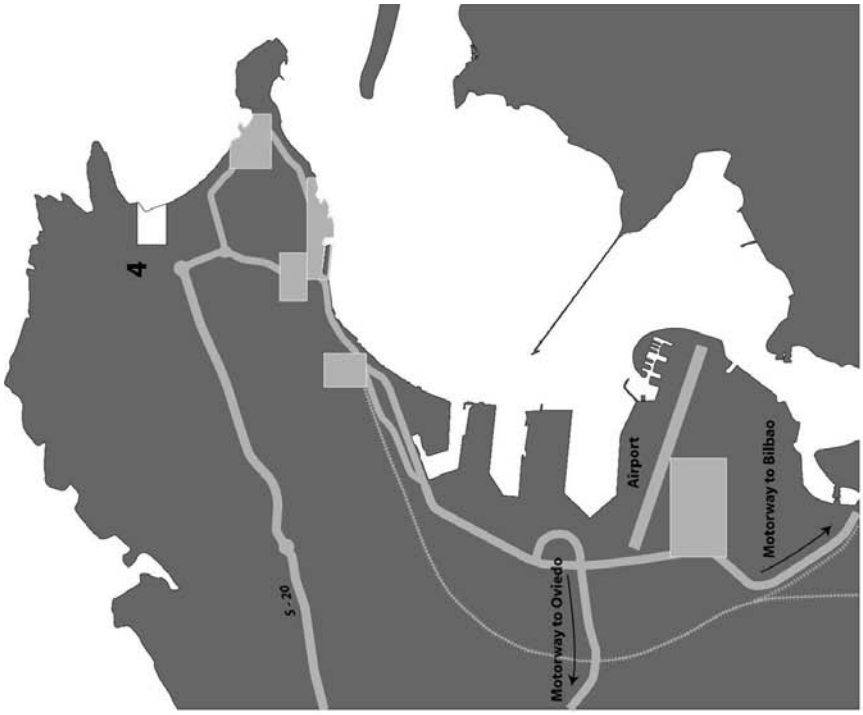

MAP 1
Museo Marítimo del Cantábrico
Palacio de Festivales de Cantabria
Escuela Técnica Superior de Náutica
Av. de la Reina Victoria
c. Gamazo
c. de Castelar
Hotel Vincci
Dock of Puertochico
Paseo de Canalejas
c. de Tetuán
c. Casimiro Sáinz
c. Casimiro Sáinz
The Cantabria Museum of Prehistory and Archaeology
Paseo Menéndez Pelayo
Hostal Menéndez Pelayo
c. de Santa Lucía
c. del Sol
c. Francisco Palazuelos
Airport
Motorway to Bilbao
Motorway to Oviedo
S-20
1
2ND. MEETING 2008 SANTANDER ICAZ

MAP 2


2
S - 20
Airport
Motorway to Oviedo
Motorway to Bilbao


c. de Juan de Herrera
c. de S. Francisco
Hostal La Mexicana
Town Council
c. de la Lealtad
c. de Isabel II
c. de Calvo Sotelo
c. de Rua Mayor
c. de Méndez Nuñez
Navas de Tolosa
c. de Cádiz
c. de Calderón de la Barca
c. de Castilla
Coach Station
ICAZ Meeting
BUS
AYUNTAMIENTO
ESTACIONES
JESUS DE MONASTERIO
1-2-3-5-6-7-8-9-10-11-13-17-18
to Airport
6.30 - 6.50 - 7.15 a.m. &
every 30 minutes, till 22.45
(Monday to Friday)
Pasaje de Peña
Railway Station (RENFE)
Railway Station (FEVE)


3
S - 20
Motorway to Oviedo
Airport
Motorway to Bilbao
MAP 3
Camello Beach
Towards Magdalena Palace
Av. de la Reina Victoria
Paseo de Pérez Galdós
Gran Hotel Victoria
LUIS MARTÍNEZ
1-2-3-4-7-9-13
ICAZ Meeting
c. de María Luisa Pelayo
Concha Beach
c. de Luis Martínez
c. del Duque
c. de Ramón y Cajal
Santo Mauro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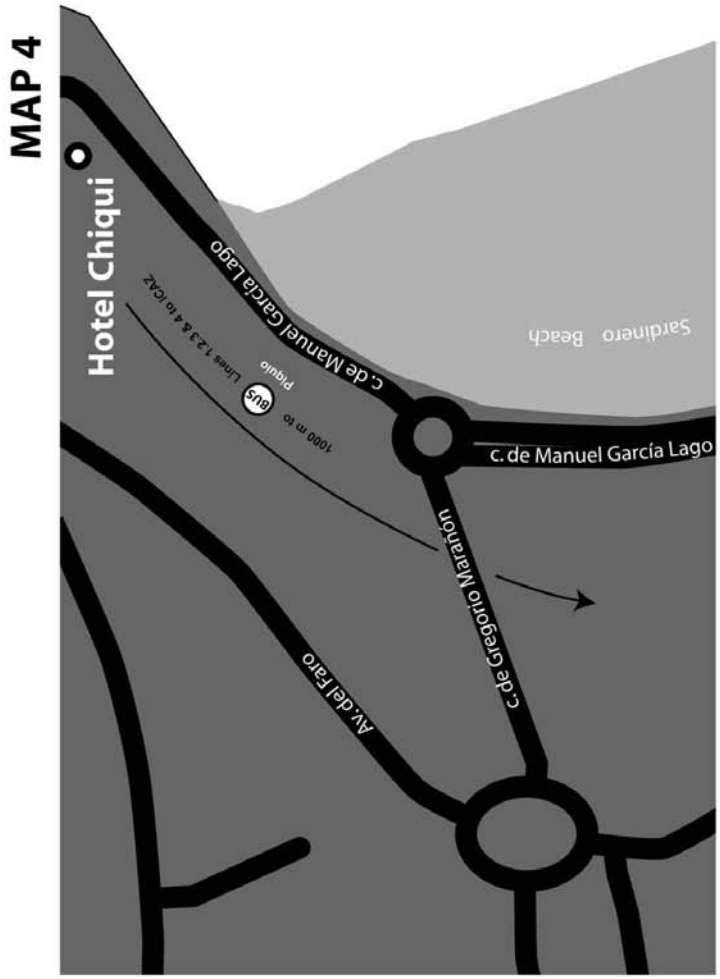
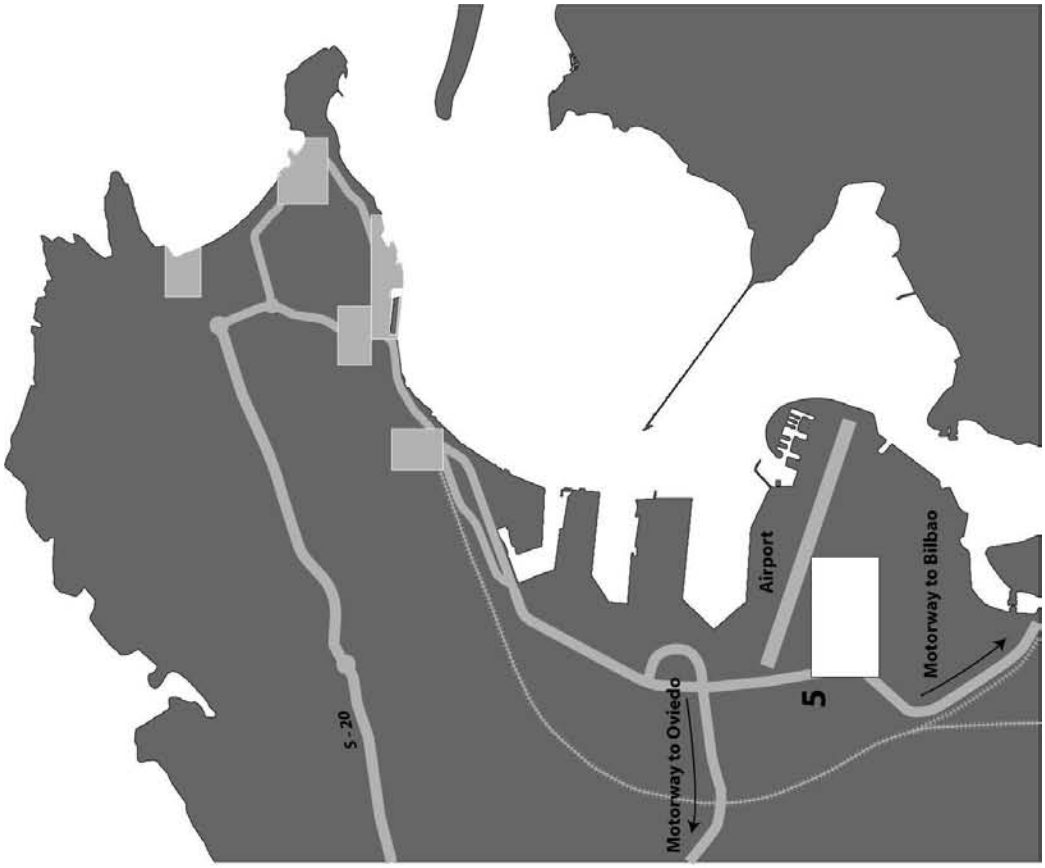
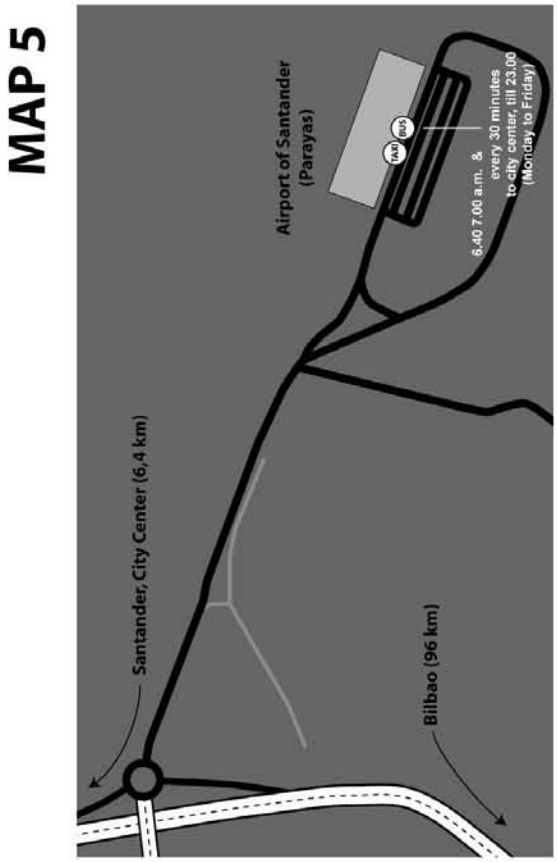
S - 20
Motorway to Oviedo
Airport
Motorway to Bilbao


MAP 4
Hotel Chiqui
c. de Manuel García Lago
Sardinero Beach
Lines 1,2,3 & 4 to CAZ
1000 m to
BUS
Pigüeo
c. de Manuel García Lago
c. de Gregorio Marañón
Av. del Faro


S - 20
Motorway to Oviedo
5
Airport
Motorway to Bilbao


MAP 5
Airport of Santander
(Parayas)
6.40 7.00 a.m. &
every 30 minutes
to city center, till 23.00
(Monday to Friday)
Santander, City Center (6,4 km)
Bilbao (96 km)