



Written in Bones

**Studies on technological
and social contexts
of past faunal skeletal remains**

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The barnacles: A new species used to make a Gravettian suspended object from Nerja Cave (Málaga, Spain)

The Cave of Nerja is situated in the Southern Mediterranean coast of Spain, in the province of Málaga. Its stratigraphy goes from the Upper Pleistocene to the Early Holocene – between 30 ky and 3 ky cal BP – and is one of the most important archaeological and paleobiological records of the Western Mediterranean zone in this period. This sequence contains Gravettian, Solutrean, Magdalenian, Epipalaeolithic, Neolithic and Chalcolithic levels.

In this work we present one suspended object from Nerja Cave. This object is made on the plate of a large goose barnacle (*Pollicipes pollicipes* (Gmelin, 1790) and belongs to the oldest levels of *Sala del Vestíbulo* (one of the three chambers of the site). These levels are clearly attributed to the Gravettian and the piece comes from the systematic archaeological excavations directed by Professor Francisco Jordá Cerdá between 1982 and 1987.

Keywords: body ornaments, suspended object, goose barnacle, Upper Palaeolithic, Gravettian, Western Mediterranean.

As we know, the purpose of the Worked Bone Research Group is to improve communication between individuals studying worked animal hard tissues (especially bone, antler and ivory) with a special emphasis on archaeological finds. In this paper we present one newly documented suspended object made on a worked animal hard tissue. This object

is made on the plate of a large goose barnacle from Nerja Cave (Málaga, Spain) and is attributed to the oldest levels of the site, to the Gravettian. Its identification can extend the list of species and raw materials used to make suspended objects in the Upper Palaeolithic, applying a simple technique for its suspension.

Nerja Cave

The Cave of Nerja is situated on the Southern Mediterranean coast of Spain, in the province of Málaga on the northern coast of the Alborán Sea (Fig. 1:1). The cave is located in the area that bridges the high relief zone of the Sierra de Almirajara and the shoreline, which lies at 158 meters below sea level and is about a thousand meters from the current coastline.

The cave was discovered in 1959 and has a vast subterranean system, however, the archaeological deposits are found only in the most external halls (Fig. 1:2). These galleries formed a large rock shelter while occupied by human groups, but the area is now partly filled in with sediment. The chambers of archaeological interest are Torca, Mina, and the Vestíbulo (Fig. 1:3).

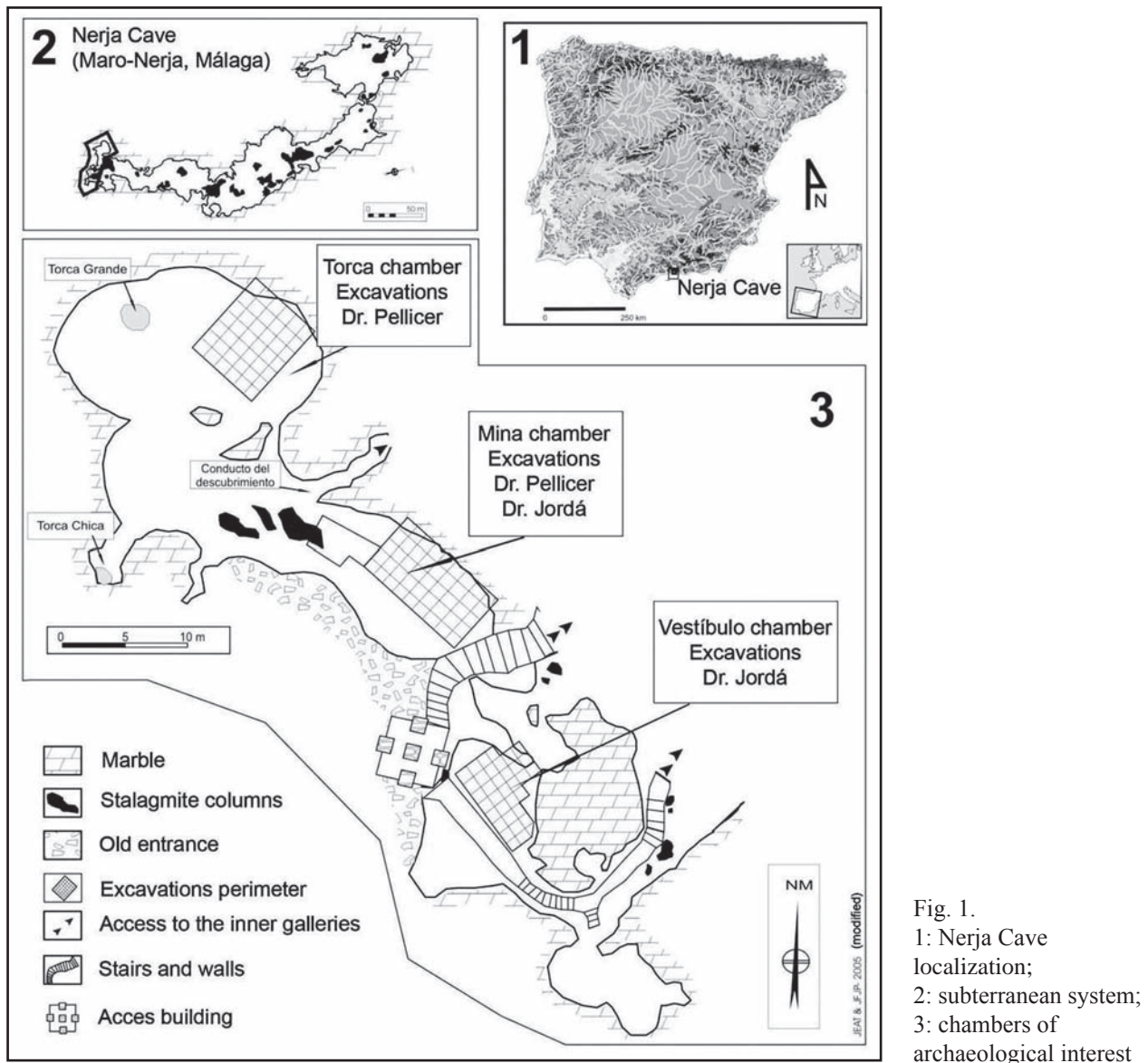


Fig. 1.
1: Nerja Cave localization;
2: subterranean system;
3: chambers of archaeological interest

The stratigraphy goes from the Upper Pleistocene to the Early Holocene – between 30 ky and 3 ky cal BP – (Jordá Pardo, Aura Tortosa 2006) and is one of the most important archaeological and palaeobiological records of the Western Mediterranean zone for this period. The sequence contains Gravettian, Solutrean, Magdalenian, Epipalaeolithic, Neolithic and Chalcolithic levels (Fig. 2).

Archaeological work done at the site by different teams in each of the different chambers allows us to have an unbroken archaeological sequence that has

been reported in a vast scientific literature concerning artefactual, vegetal and faunal remains associated with anthropogenic activities at the site. About a hundred species of invertebrates (Gastropoda, Scaphopoda, Bivalvia, Cephalopoda, Crustacea and Echinoidea) and more than a hundred species of vertebrates – including fish, reptiles, birds and mammals, and the contemporary human species – have been documented. An extensive bibliography can be consulted in a recent publication (Aura Tortosa *et al.* 2010).

The Gravettian levels of the Nerja Cave vestíbulo chamber

The known stratigraphic sequence of Nerja Cave starts with the phase of Nerja 1 that contains the Gravettian levels (NV 13, NV 12 and NV 11). This unit has a thickness of 120 cm. and lies over a spe-

leothen (Fig. 2). The three levels that compose this unit are made up of orange-red sands, with non-introduced local cobbles and all have the same texture and are also characterized by the presence of carbonate

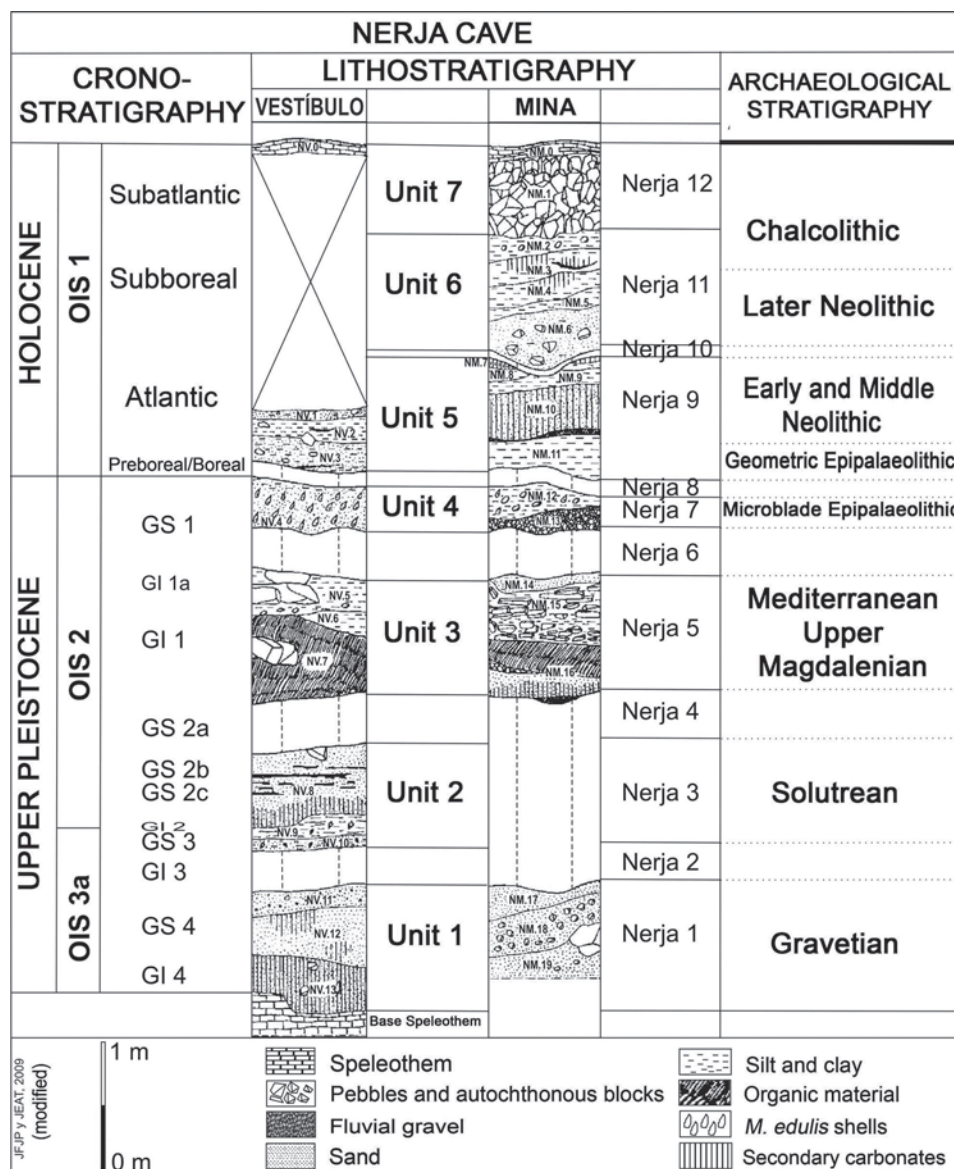


Fig. 2. Nerja Cave stratigraphy

concretions. This sedimentary make-up is due to the action of surface run-off currents, generally flowing planarly, but occasionally cutting down into channels. (Jordá Pardo, Aura Tortosa 2009). In the base level (NV 13) some macro-mammal remains were found in anatomical position, which could indicate low energy sedimentation. In the same base level remains of *Crocota crocuta spelaea* coprolites announce the absence of humans in the cavity during the first period of sedimentary registry (Arribas Herrera *et al.* 2004).

For this period we have 6 dates obtained from radiocarbon dating (Jordá Pardo, Aura Tortosa 2006). Only 3 dates are made by AMS carbon dating, are considered valid (Table 1). After calibration, these dates situate Unit 1 (NV 13, NV 12, NV 11) at 30,180 to 28,550 calibrated years before present (BP) (Jordá Pardo, Aura Tortosa 2008, 2009).

The vegetal remains from these levels consist of pinecone and pine nut charcoal (*Pinus pinea*) which

increases consistently in quantity as dates advance in years. The same tendency toward greater accumulations is seen with marine molluscs (*Patella* sp., *Patella caerulea*, *Osilinus* sp., *Osilinus turbinatus*, *Mytilus edulis*, *Cerastoderma edule*, *Ruditapes* sp. and *Pecten* sp. in addition to the *Littorina obtusata* and *Dentalium* sp. that appear transformed into personal ornaments) that unlike in the rest of levels, is less that the presence of continental gastropods (*Iberus alonensis* –introduced as food-, *Iberus marmoratus*, *Rumina decollata*, *Sphinterochilla cariosula hispanica*, *Hydrobia* sp. and the freshwater gastropod *Theodoxus fluviatilis*, manufactured into personal ornaments) (Jordá Pardo *et al.* 2010).

The mammalian osseous remains are distributed among 7 species: *Capra pyrenaica*, *Cervus elaphus*, *Equus ferus*, *Bos* sp., *Rupicapra rupicapra* and two carnivores, *Felis silvestris* and *Lynx* sp. In the base level (NV XIII) juvenile remains of *Bos* sp. and

Equus sp. with carnivores' teeth marks, an extremity of red deer and the coprolites of *Crocota crocota spelaea* are also present. *Oryctolagus cuniculus* is very abundant with a bigger anthropogenic contribution than that of carnivores and birds of prey. Finally there is also the presence of *Testudo hermanni* remains (Aura Tortosa *et al.* 2010).

These Gravettian levels of the Vestíbulo are of low density in lithic and bone artifacts. The identified flint is good quality and was used to produce

narrow laminar blanks of medium-large size. These are the most employed blanks used to produce lithic industries that contain the main gravettian lithics groups: scrapers, burins, truncated blades, tools with abrupt or crushed retouch and microblade technologies (Aura Tortosa *et al.* 2006).

The worked bone industry group is made up of 10 objects: four are debris from osseous tool manufacture while the rest are undecorated gracile points with circular cross-sections. (Aura Tortosa *et al.* 2010).

The Gravettian personal ornaments from Nerja Cave

The Nerja Cave personal ornaments collection contains eleven pieces along with two other gastropods, that, although fragmented so that the perforation area is gone, conserve some traces of manufacture, and in any case, their presence in the deposit cannot be due to introduction to the site as food. The used raw material, with the exception of the goose barnacle and one fox perforated canine, is the molluscs. The selected species are two gastropods, *Littorina obtusata* and *Theodoxus fluviatilis*, and one escaphopod, *Dentalium* sp. The gastropod *Littorina obtusata* is represented by three units that are conserved complete; perforations are on the back near the outer lip and differ in form, surely due to the length of use, since the specimen that has the more regular perforation is, as well, the one with less use wear. *Theodoxus fluviatilis* is represented by two whole individuals and a fragment; the perforations are located in the back and the wearing down of its lips has erased the preparation wear traces completely. Two of these have thermal alterations. Of the three *Dentalia*, two were sawn and snapped at the point of the natural aperture.

Theodoxus fluviatilis is a freshwater mollusc (Fechter, Falkner 1993; Lindner 2000) and *Dentalium* sp. could be gathered on the beaches closest to the cave. However, *Littorina obtusata*, at the present, only proliferates on Atlantic coast. Thus, there is some debate about the origin on this species when found in Mediterranean sites. There are two possible explanations. On one hand, it is possible that in cold periods Mediterranean waters were colonized by typically Atlantic species (Álvarez-Fernández 2006; Taborin 1993). By now is known that during the period in question, the temperature of the sea surface on the Alborán Sea was between 10°C and 14°C, with occasional temperatures under 10°C – the minimal temperature of the entire sequence of Nerja Cave – in the last cold episode of the isotopic phase OIS3a (Cacho *et al.* 2001); this would propitiate the mentioned colonisation.

The second possibility would raise the question of long distance contacts. It is well demonstrated that the circulation of this kind of object was not rare during the Upper Palaeolithic (Álvarez-Fernández 2001, 2002, 2007). Both situations, then, are plausible, but we do not have sufficient data to support either argument.

The barnacles

A barnacle is a type of arthropod belonging to infraclass *Cirripedia* in the subphylum *Crustacea*. Essentially there are two basic types: sessile forms (Order *Sessilia*) typified by the “acorn” barnacles of the suborder *Balanomorpha* (balanes) and stalked or pedunculate forms (Order *Pedunculata*) typified by the goose barnacles. The exemplar from Nerja Cave corresponds to the second type. Barnacles are exclusively marine.

The body of stalked barnacles consists of a flexible, tough stalk, the peduncle, and a capitulum at the free end of the stalk. The body is almost always covered by a series of calcareous or chitinous plates. Between the larger principal plates that compose the

capitulum, we can distinguish the *terga* and *scuta* (in pairs and symmetrical) and the *carina* (Fig. 3) The form of the *scuta* and *terga* allow for the production of modern comparative collections, permitting us to orientate and side them. The *rostrum*, the *subcarina* and the other lateral plates are more difficult to identify in archaeological contexts because of their smaller dimensions. In this way, as with other archaeozoological specialties, we can weigh the total specimens, count them to establish the number of individual specimens (NISP) and calculate the minimal number of individuals (MNI). This kind of systematic study has recently been employed at sites where goose barnacles were consumed at the

Neolithic sites of Cueva de los Gitanos de Montealegre (Cantabria, Northern Spain: Álvarez-Fernández *et al.* 2010) and Zafrín (Congreso Island, Chafarinas Islands, Spain-North African shore: Álvarez-Fernández 2010) or at the Iron Age Site of Port Blanc (Höedic Island, Morbihand, France: Dupont *et al.* 2008).

Presently, in the Mediterranean Sea stalked barnacles that have plates over the peduncle are represented by the Lepadidae and Scalpellidae families (Relini 1987). The peduncle may be more or less developed and the number of calcareous or chitinous plates is variable.

Members of Lepadidae family have a capitulum with 5 plates and their dimensions vary from 1 to 12 cm. They live attached to floating objects in the intertidal zone or affixed to big marine animals: sharks, turtles, mammals etc. (Luchesi 2006).

Two genus of Lepadidae are present at the Mediterranean Sea – Conchoderma and Lepas. Morphologically, Lepas, is the only one with a similarity to the archaeological piece from Nerja. There are 4 species of Lepas in the Mediterranean Sea, two (*Lepas anserifera* (Linnaeus 1767) and *Lepas pectinata* (Spengler 1851) have radial stria in their plates and the other two (*Lepas anatifera*: Linnaeus 1767) and *Lepas hilli* (Leach 1818) have smooth plates or thin striae (Relini 1987). The exemplar from Nerja does not have radial striae so among the options the only one that could be valid is *Lepas anatifera*, as the biggest in the genus can have a capitulum that reaches 5 cm at most. However, the plates of *Lepas anatifera* are translucent and the *carina* is longer overall than that of Nerja.

The Scalpellidae family is currently represented in the Mediterranean Sea by two species belonging

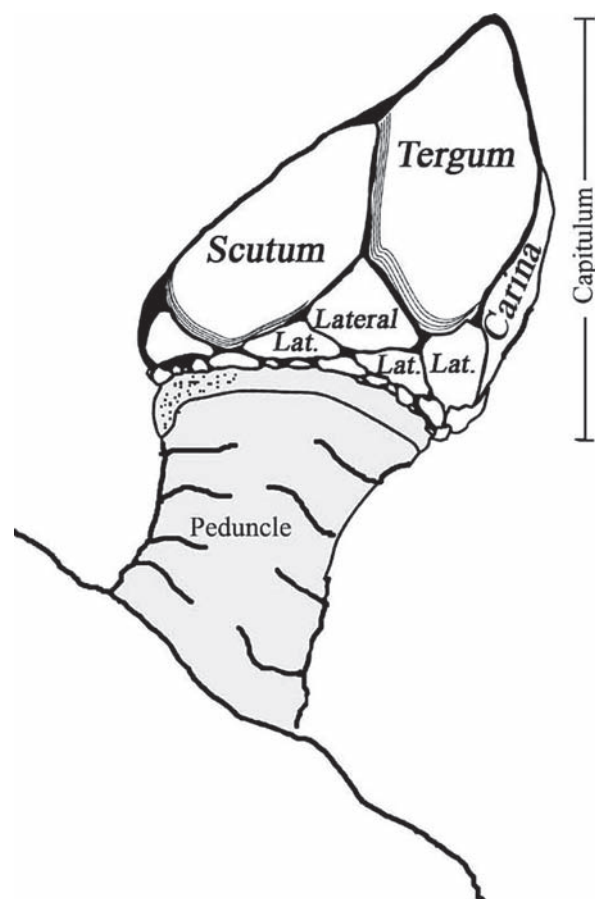


Fig. 3. *Pollicipes pollicipes* main plates

to two different genera: *Pollicipes pollicipes* (Gmelin 1790) and *Scalpellum scalpellum* (Linnaeus 1767). The latter always live at depths below 50 meters.

Other species cited occasionally for the Strait of Gibraltar as *Arcoscalpellum atlanticum* (Gruvel,

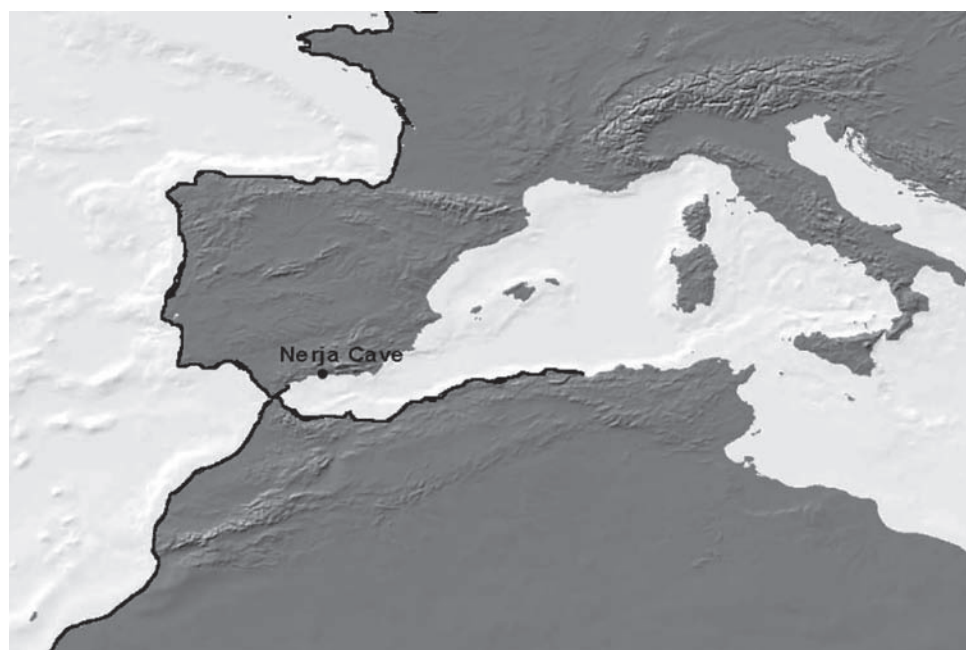


Fig. 4. Current biogeographical distribution of *Pollicipes pollicipes*

1900) or *Arcoscalpellum michelotianum* (Seguenza 1876) are of small dimensions and inhabit depths exceeding 1000 meters (Hoek 1883; Young 2002).

Pollicipes pollicipes (Gmelin 1790) is, at the moment, the option that could be considered as possible species attribution for the plate of Nerja.

Pollicipes pollicipes (“Percebe” in Spanish) or goose barnacle has at least 18 plates. Between these plates *scutum*, *tergum* and *carina* are much bigger than the secondary ones (Fig. 3). Goose barnacles can reach today a size of 12 cm (capitulum+peduncle) (Barnes 1996, 2009).

Pollicipes pollicipes inhabit shallow waters and live in the coasts in erosive settings exposed to the beating of waves, at the base of rocky cliffs. They can attach to rocks that are subject to heavy waves. The groups develop in the tide ecosystem and are often found alongside mussels, limpets and balanes. In their natural

setting these barnacles tend to be found in groups or extended upon each other in bunches. The younger specimens tend to affix themselves to older individuals.

This species can be harvested by hand, either scraping the rock or with the aid of a hammer or burin tool. The difficulty in collecting these shellfish lies mainly in the slope of the cliffs and in the danger of crashing waves in the zone. Unlike other crustaceans that lack a peduncle, the part of the goose barnacle that is eaten is the internal peduncle, which should be cooked. In Spain, it is a highly valued shellfish and brings a high market price, leading to the farming of these barnacles in France and Morocco.

The current biogeographical distribution of *Pollicipes pollicipes* runs along the Atlantic coast of Europe, Strait of Gibraltar and North Africa, from the north of Bretagne to Senegal with a more minimal presence on the Algerian and Moroccan coasts (Fig. 4).

The goose barnacle personal ornament from Nerja Cave

The personal ornament presented here comes from the systematic archaeological excavations directed by Professor Francisco Jordá Cerdá between 1982 and 1987 in the Cave of Nerja.

This Gravettian suspended object from Nerja Cave is made on the plate of a stalked barnacle. This plate is called the *carina* and is one of the three biggest plates of the goose barnacle. The measurement of the piece is 26 mm long, 13 mm wide and 7 mm thick: this is a goose barnacle with considerable dimensions (Fig. 5). No species of stalked barnacles known from today has so large resemblance.

The comparison between different goose barnacle *carina* plates (maximum length and width) from a modern reference collection from Islares (Cantabria, Spain: Álvarez-Fernández *et al.* 2010) and archaeological pieces from the Neolithic sites of Zafrín and Los Gitanos de Montealegre shows that the archaeological ones are larger than the contemporary ones. The exemplar recovered at Nerja is even bigger (Fig. 6). We are certain that this barnacle was selected for its size.

The *carina* plate has been transformed with two drilled notches on the internal face where we have also identified use-polish on the notched borders. This



Fig. 5. Gravettian suspended object from Nerja Cave made on the *carina* plate of a large goose barnacle

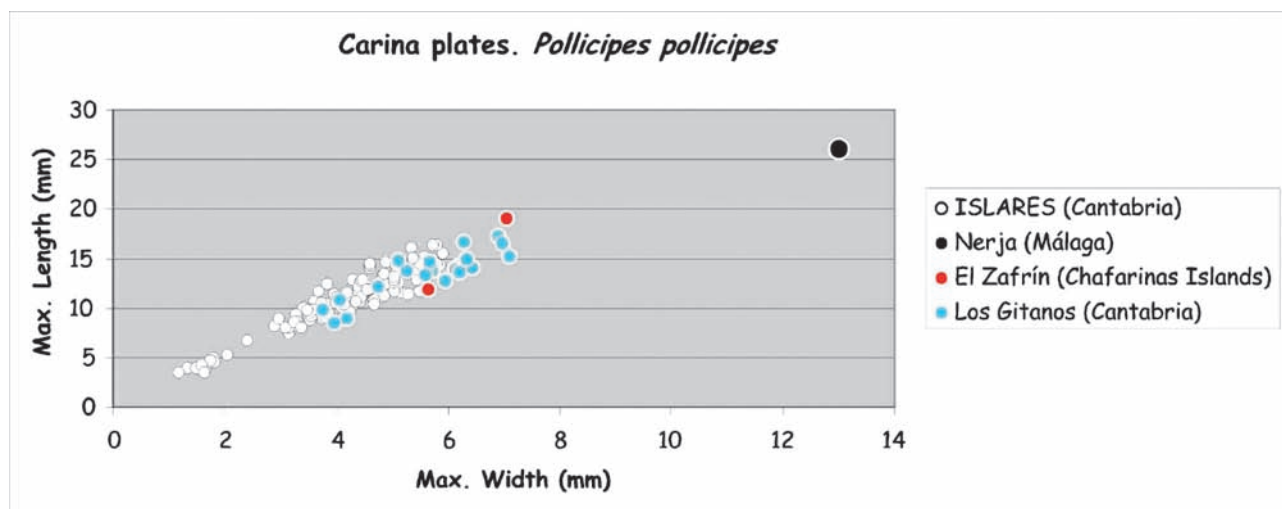


Fig. 6. Comparison between different goose barnacle *carina* plates (maximum length and width) from a modern reference collection from Islares (Cantabria, Spain) and archaeological pieces from the Neolithic sites of Zafrín and Los Gitanos de Montealegre



Fig. 7. Drilled lateral notches on the internal face of the *carina* plate with use-polish on the notched borders

indicates that the manner in which this piece was suspended or sewn was by passing a line through the two notches, which served to hold down the line (Fig. 7).

We can also see that the modification of this object of personal adornment was not limited only to the production of these two notches. Prior to perforation, the plate was abraded in order to enhance the overall form. We have identified various series of multi-directional overlapping striae that result from multi-directional abrasion (Fig. 8). Finally, we note overall polishing, which may have been produced through use.

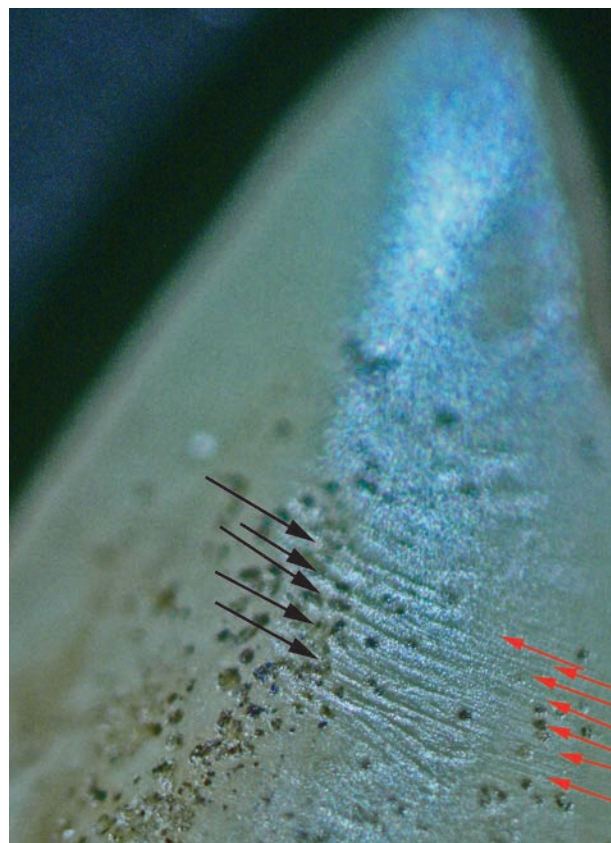


Fig. 8. Series of multi-directional overlapping striae resulting from multi-directional abrasion

Archaeological evidence of goose barnacles

The first mention of pedunculate cirripedes in archaeological sites refers to the species *Pollicipes cornucopiae* (Leach 1824), the same species as *Pollicipes pollicipes*, in the Mousterian site of Lapa de Santa Mar-

garida (Arrabida, Portugal: Pais, Legoinha 2000). Although these goose barnacles are associated with other archaeological finds their anthropogenic origin has not been demonstrated (Álvarez-Fernández *et al.* 2010).

In the Upper Palaeolithic *Pollicipes pollicipes* has been documented in the Gravettian levels of Vale Boi (Algarve, Portugal: Bicho *et al.* 2010; Manne, Bicho 2009). As in the case of Lapa de Santa Margarida, the minimal presence of this kind of species (3 plates in this case) and association with other molluscs, especially *Mytilus* sp. and *Patella* sp., leads us to think that their presence at the site is unintentional

since barnacles in their natural setting are displaced by limpets and mussels, who compete for space.

The first archaeological evidence of goose barnacle exploitation as a food consists of use documented during the Mesolithic and, more notably, in Neolithic sites of Cantabrian Spain, west and southwest Portugal and a couple of Mediterranean sites on north African shores (Álvarez-Fernández *et al.* 2010).

Conclusions

Thus, this artifact constitutes the oldest archaeological modification of the stalked barnacle (possibly *Pollicipes pollicipes*) plate known to date from an archaeological context. It is also the first personal ornament identified in this raw material.

The data that exist today about Gravettian exploitation of marine resources are not very abundant. In Nerja Cave, the use of this kind of resources becomes common starting in the Magdalenian and Epipalaeolithic. Bioclimatic changes and essentially eustatic oscillations have served to explain the chronological limit in which this exploitation starts (hunting, fishery and gathering of marine species) with the tardiglacial transgression and the approach of the coastline to the site (Aura Tortosa *et al.* 2002, 2009). However, at the first moments of occupation, the period to which the personal ornament belongs, marine resources didn't have as much importance, as the shoreline was 5-6 km away, a short distance, compared to the 25 km where flint used at the site was picked up (Aura Tortosa *et al.* 2001).

At this point we cannot be sure whether the piece discussed here could have come from the coasts closest to the site of Nerja, as it has not been established whether *Pollicipes pollicipes* was present in these seas at that time. The closest *Pollicipes pollicipes* today

are about 100-150 km away. In any case, it is certainly possible that the object arrived at the site of Nerja by way of exchange with other groups, either through the movement of objects, individuals, or entire groups of people, since we know that during the Upper Palaeolithic the transfer of many kinds of goods took place on a much grander scale. It is necessary to emphasize the presence of marine molluscs transformed into personal ornaments not only in deposits located near the Atlantic or Mediterranean coasts, but in the European continent. Atlantic and Mediterranean ornaments could appear in French Dordogne region sites, but also in European deposits located many kilometers from the Mediterranean coasts (Álvarez-Fernández 2007; Taborin 1993).

The size of the piece in of itself indicates something of its singular value. Even though in general the archaeological specimens are significantly larger than the modern examples, the goose barnacle from Nerja was selected specifically for its large size.

Finally, we should keep in mind that the identification of goose barnacle remains in archaeological sites has just started; the small dimensions of the species and the difficulty in identifying it are the primary reasons for the rarity of its identification and analysis.

Table 1. Nerja Cave radiocarbon dates of the gravettian levels: laboratory code, type of sample, radiocarbon date, calibrated years before present (BP) with a 95% certainty level – CalPal2005-SFCP (Weninger and Danzeglocke: 2006) – the maximum statistical probability likely and first published appearance of the date

CODE	SAMPLE	C14 BP	C14 CAL BP	REFERENCE
GifA-102.023	<i>Pinus</i> charcoal	24730±250	30400-29160	(Jordá Pardo and Aura Tortosa 2008)
BETA-189080	<i>Pinus cf. Pinea</i> charcoal	24200±200	29730-28410	(Jordá Pardo and Aura Tortosa 2006)
BETA-131576	<i>Pinus</i> charcoal	24480±110	30100-28940	(Arribas Herrera <i>et al.</i> 2004)

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