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Bone or shell? Using ED-XRF to determine the nature of prehistoric ornaments

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ABSTRACT

When determining the nature of prehistoric ornaments, the degree of transformation can play an important role, as occasionally the technical traces (as polishing or smoorthing) applied to define the morphology of the desired object can substantially modify the original surface. When this occurs, it is sometimes difficult to determine the nature of the object. In this paper a protocol to quickly and easily distinguish between shell and bone materials in a non-destructive manner is presented. Both elements were frequently used during prehistory to make personal ornaments. After a first analysis with a stereoscopic microscope and a basic morphological description to observe the degree of standardization of the selected objects, energy dispersive X-ray fluorescence (ED-XRF) was applied to determine chemical components. To test the validity of this protocol, the study focused on the analysis of discoidal beads and V-perforated buttons whose nature, in some cases, had already been noted using macroscopic methods. Prehistoric ornaments analysed were recovered at three archaeological sites of NE Iberia: Tutes de Menús Cave (Béixec, Montellà i Martinet, Lleida, Spain), Espluga Negra Cave (Vilanova de Meià, Lleida, Spain) and Ànimes Cave (Matadepera, Barcelona, Spain).

1. Introduction

Prehistoric ornaments found in the archaeological record have always been analysed not only for their nature, but also because of their symbolism for past societies. Recent studies have revealed that personal ornaments made from shells were first used by groups from the Near East, North Africa and Sub-Saharan Africa, with some examples from the Middle Stone Age (d'Errico et al., 2009). In Eurasia it is during the Late Mousterian and Chatelperronian that first evidences of personal ornaments made from shells or bones appeared (Zilhão et al., 2010; Caron et al., 2011). From the early Upper Palaeolithic, the symbolic manifestations increased exponentially, with recent published examples of personal shell ornaments found in Iraqi Kurdistan (Hunt et al., 2017) and personal stone ornaments (ivory and soapstone beads) from southern France and northern Spain (Heckel, 2017).

Studies concerning the analysis of prehistoric personal ornaments in Western Europe have mostly focused on morphological, technological and typological characterizations (Álvarez Fernández, 2006; Barciela, 2008; Barciela, 2006; Barge, 1992; Oliva, 2015; Pascual-Benito, 1998; Taborin, 1974; Taborin, 2004) and only a few attempts to determine the nature of ornaments using archaeometric techniques have been made. Archaeometric studies based on the definition and characterization of the nature of prehistoric personal ornaments have mostly been carried out on lithic artefacts, such variscite or steatite (Oliva, 2015; Dominguez-Bella and Boveda, 2011; Odriozola, 2015). Nevertheless, and mostly due to the destructive character of some analytical techniques or the long analysis-time when using non-destructive procedures, few samples are selected when analysing the mineralogical or chemical nature of prehistoric ornaments (Oliva, 2015; Mangado et al., 2015).

Concerning the nature of prehistoric ornaments, shells, bones, teeth, antlers and stone are the most represented materials appearing in the

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archaeological record. Nevertheless, we should assume that other perishable resources as wood, vegetable fibres and seeds could also have been used, despite the fact they have not been found because of their perishable nature, except some well-preserved exceptions, as la Draga in Spain (Oliva, 2015) or La Marmotta in Italy (Fugazzola Delpino and Pessina, 1999). When determining the nature of prehistoric ornaments, the degree of transformation can play an important role, as sometimes the polish applied to define the morphology of the desired object can substantially modify the original surface. This is the case in some shell ornaments that have completely lost their original surface comprising the ribs, which naturally appear on the dorsal face of some species. When this occurs, it is sometimes difficult to determine if the ornament was created using a shell that has completely lost its original morphology or if a bone or other material was used.

In this paper we present a methodological protocol to distinguish between shell and bones and thus determine the origin of prehistoric ornaments. After a first analysis with a stereoscopic microscope and a basic morphological description to observe the degree of standardization of the selected objects, geochemical methods were used to determine the chemical components. To prove the validity of the established protocol, several prehistoric ornaments from three different archaeological sites of NE Iberia were analysed, using both samples whose nature had already been observed and those yet to be defined.

2. Archaeological and chronological background

The three archaeological sets used to prove the validity of this analytical protocol were selected. They were all located in NE Iberia (Catalonia, Spain). The first was recovered from the Catalan Pyrenees (Tutes de Menús Cave -Béixec, Montellà i Martinet, Cerdanya-), the second from the central Prepyrenean region (Espluga Negra Cave -Vilanova de Meià, La Noguera-) and the third from the Prelitoral Mountain Chain of the province of Barcelona (Ànimes Cave -Matadepera, Vallès Occidental-) (Figs. 1 and 2) (see Table 1).

2.1. Tutes de Menús Cave (Béixec, Montellà i Martinet, Lleida, Spain)

The archaeological site of Tutes de Menús Cave is located at 1273 m asl in the Catalan Pyrenean region, in the upper Segre river basin, in the Cerdanya valley, 121 km from the current shoreline measured in a straight line. The site has recently been excavated as part of *The middle and upper Segre basin during the prehistory* project. The archaeological works have brought to light a burial site used repeatedly from the Late Neolithic-Chalcolithic to the Bronze Age, according to the typological adscription of the recovered materials (e.g. pottery and ornaments) (Oms et al., 2016a).

The preservation of the archaeological remains (any anatomical connection or well-preserved larger bones as skulls were identified) leads us to believe that the cavity was frequently used as a burial place where past human remains were regularly cleaned from the main space. Nevertheless, a rock-pavement that served as the base to place human remains was well preserved and documented during the excavation works. It represents a space of c. 3 m wide per 4 m deep that seems to have been enclosed by some natural block rock appearing in the front of the cavity. At 4 m deep from the entrance, where the rock-pavement stops, a large block deliberately placed vertically separates an interior area 1.5 m width and 1.5 m deep. The excavation of this space revealed that any human remains were preserved in primary position, since evidences found were moved from the external area by a badger that occupied the space recently. The anthropological analysis of bone remains, as well as some radiocarbon dating to determine the chronology, are in progress and will be published shortly.

2.2. Espluga Negra Cave (Vilanova de Meià, Lleida, Spain)

This site is located in the Catalan Prepyrenean region, in the Montsec Mountain Range, at 1180 m asl, at 128 km in a straight line to the current shoreline. The cave consists of two separate units. Firstly, there is a shelter of a maximum length of about 12 m with a maximum width of 7 m. Then, through a small tunnel of 1 m we reach a small room (Room I) of 7 m^2.

As part of *The middle and upper Segre basin during the prehistory* project, two archaeological seasons were recently developed in the cavity with the aim of determining the degree of preservation of the archaeological remains and to establish, if possible, a stratigraphic sequence. The excavation was focused on Room I, as the absence of archaeological remains in the rock shelter area was noted after a preliminary survey. The absence of anatomical connections and larger

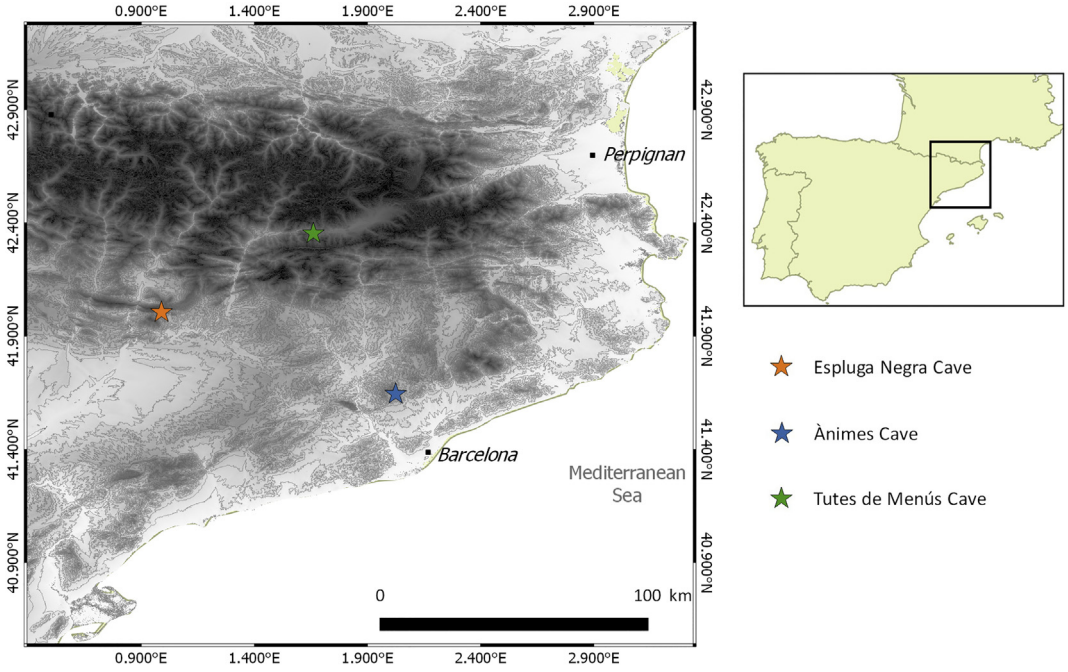

Fig. 1. Location of the archaeological sites where the prehistoric ornaments were recovered.