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Different parts of the same plants. Charcoals and seeds from Cova de les Cendres (Alicante, Spain)

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ABSTRACT

The analysis of archaeobotanical macroremains from Cova de les Cendres (Teulada-Moraira, Alicante, Spain) allows a better understanding of the dynamic of the vegetation during the Upper Palaeolithic in the region. The anthracological sequence shows that *Pinus* type *nigra*/*sylvestris* dominates in the area during the Upper Palaeolithic, while more open formations of *Juniperus* and Fabaceae spread in Upper Solutrean and Early-Middle Magdalenian. The carpological analysis that has been carried out in the Middle Magdalenian level has brought to light different species of *Juniperus* (*J. sabina, J. communis* and *J. oxycedrus*). This information indicates that during the period, Cova de les Cendres had similar bioclimatic conditions to those currently prevailing in the Iberian summits of the supramediterranean belt. New ^{14}C dates obtained from *Juniperus sabina* and *Buglossoides* cf. *arvensis* seeds as well as from charcoal fragments of *Ephedra* sp., presented in this paper, prove the existence of steppe landscapes during the Late Glacial.

1. Introduction

In the archaeological sediments different parts of the same plants can be found: seeds, leaves, rhizomes, roots, wood, pollen, phytoliths, etc (Aura et al., 2002; Cacho et al., 2012; Bergadá et al., 2013; Burjachs et al., 2016). Their analysis improves our knowledge on how human groups used the vegetal resources during Prehistory and how the vegetation has changed since. Usually, the different remains are analysed and interpreted independently by different researchers, sometimes lacking the desired precision. In the Iberian Peninsula there are only a few Upper Palaeolithic sites that combine both charcoal and seeds analyses (Badal, 2001; Aura et al., 2005; Allué et al., 2010). However, combining anthracology and carpology is essential, since we can obtain more information and improve the interpretation of the archaeobotanical remains. In this sense, this work expects to highlight the potential of this combination for a better understanding of the archaeobotanical record of Cova de les Cendres and the paleoenvironmental conditions prevailing during Magdalenian period.

The aims of this paper are, at first, to present the anthracological data from the Magdalenian levels of Cova de les Cendres (Badal and Carrión, 2001), as well as the first results of seed analysis from Middle Magdalenian level. Secondly, the importance of combining the data of both charcoal and seeds analyses in the interpretation of the palaeoenvironment is being highlighted. For example, with wood anatomy, it is possible to discriminate pines with different ecological requirements (e.g. *Pinus brutia*/*halepensis* to *Pinus nigra*/*sylvestris*), but the homogeneous anatomical structure of *Juniperus* prevents its identification to species level. On the contrary, *Juniperus* seeds can be identified at this level. Identification to the species level of the highest possible number of taxa provides high-resolution ecological information. The amalgamation of the information extracted from these analyses gives the opportunity for a more accurate interpretation of the uses of the available vegetal resources of Upper Palaeolithic hunter-gatherers. Thus, combining the information of both assemblages allows for achieving a more complete and accurate reconstruction of the landscape surrounding the archaeological site. Finally, some seeds and charcoals previously identified have been dated, in this way we can define climatic and vegetation changes at the coast of Alicante.

2. Regional setting

Cova de les Cendres (Teulada-Moraira, Alicante, Spain) is a spacious cavity of approximately 600 m^2 with a wide south-east

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facing opening. It is located on the Moraira headland (38° 41′ 10″ N, 00° 09′ 09′ E) at about 45 m.a.s.l. on a limestone cliff of the Late Cretaceous, just on the present coastline (Fig. 1a–c).

The current bioclimatic conditions are dry thermomediterranean, with a mean annual temperature of 17 °C. The landscape is characterized by a disturbed shrubland on impoverished soils, dominated by *Rosmarinus officinalis*, followed by *Erica multiflora*, *Cistus albidus*, *Coronilla juncea*, *Anthyllis cytisoides*, *Thymus vulgaris* and *Ulex parviflorus*. Some uncommon elements grow there, such as *Lavandula dentata* and *Ephedra distachya*. In addition, some species characteristic of maquis vegetation sporadically appear such as *Olea europaea* var. *sylvestris*, *Pistacia lentiscus*, *Quercus coccifera* and *Chamaerops humilis*.

The site was already known since the early 20th century. Archaeological excavations on the Holocene layers of the site have been carried out from 1981 to 1995 under the supervision of Dr. J. Bernabeu Aubán (Bernabeu and Molina, 2009), while the Pleistocene levels were excavated under the guidance of Dr. V. Villaverde Bonilla immediately after (Villaverde et al., 2010). The paleolandscape results from the Neolithic to the Bronze Age have been already published (Badal et al., 1994; Bernabeu and Molina, 2009).

The archaeological works in Palaeolithic levels combine a survey, in A-17 and B-17 trenches, which aimed to the better understanding of the sequence as well as to determine the depth of the deposit, and the excavation of a larger area in sectors A and B (Fig. 1d).

The Upper Palaeolithic sequence of Cova de les Cendres is one of the most complete sequences in the Spanish Mediterranean region. Eight superimposed levels of Upper Palaeolithic have been identified, dated to the Magdalenian, Solutrean and Gravettian periods, and the bottom of the sequence has not been reached yet. A short description of the archaeological strata of the sequence from lowest to the highest layers is given below (Villaverde et al., 2010, 2012; Villaverde and Román, 2012).

The sedimentary stages XV and XVI correspond to Gravettian. Radiocarbon dates from these strata suggest that the occupations took place between 21,230 ± 80 BP and 25,850 ± 260 BP (25,057-31,266 cal BP) (Villaverde et al., 2010), while radiocarbon dates from level XIV place it in Upper Gravettian or Lower Solutrean. Lithic and bone industry found at level XIII are characteristic of Upper Solutrean. Before the deposition of the aforementioned level (XIII), a strong erosive process, linked to water flow, took place. This event affected even the top of the Gravettian levels and it could explain the lack of evidence of anthropic occupations in Middle or Lower Solutrean.

Regarding the Magdalenian levels, level XII is dated between 16,480 and 19,340 cal BP, while Early and Middle Magdalenian occupations have been documented (Table 1). Microlaminar group dominates the lithic assemblage of this stage, followed by end scrapers. Level XI is attributed to Upper Magdalenian and is dated between 15,410 and 16,810 cal BP. The lithic assemblage is characterized by a predominance of a diversified microlaminar group and an equal representation of end scrapers and burins. Among the bone industry, harpoons stand out (Román and Villaverde, 2011; Villaverde et al., 2012). No occupations have been documented in level X. Level IX has been dated in 12,470 ± 100 BP (15,250-14,410 cal BP), at the end of Upper Magdalenian, when the bone industry is less abundant while end scrapers stand out.

3. Material and methods

The excavation area of Cova de les Cendres is 20.5 m^2 and is divided in 1 m^2 trenches (Fig. 1d), which are subdivided to 25 cm x 25 cm squares. During the excavation, the sediments are extracted in 5–10 cm thick artificial layers, which follow the natural level. This method was adopted in order to achieve a greater

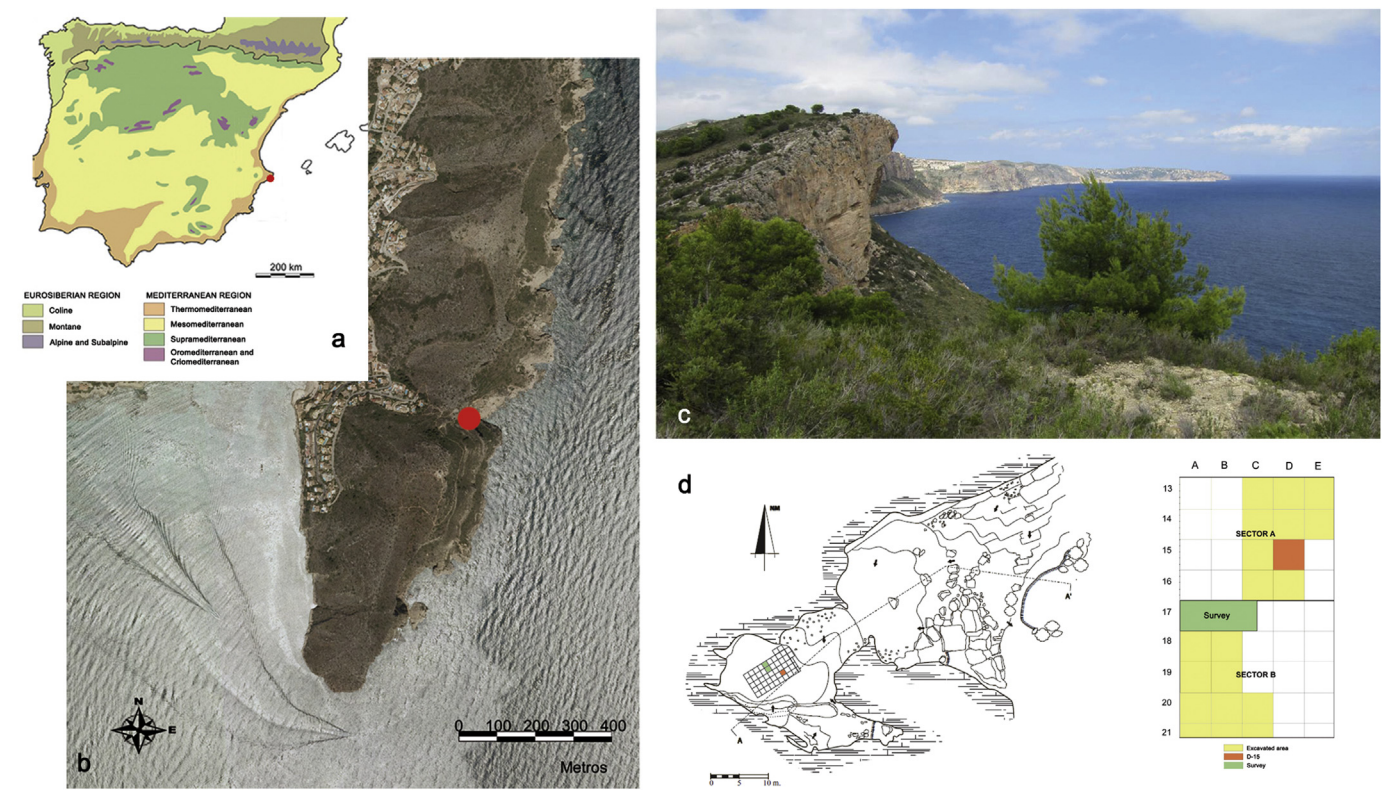

Fig. 1. Geographical location of Cova de les Cendres (a, b, c) and plan of the cave with the excavation area (d).

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