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First reconstruction of the dietary traits of the Mediterranean deer (*Haploidoceros mediterraneus*) from the Cova del Rinoceront (NE Iberian Peninsula)

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ABSTRACT

This article presents the results of the reconstruction of the paleodietary traits in the Mediterranean deer (*Haploidoceros mediterraneus*) from the MIS 5 site of Cova del Rinoceront in the NE of the Iberian Peninsula. This medium-sized deer species has a poor fossil record in Europe, and only four localities have reported remains. This study is the first approach to the dietary traits of this genus. Our data reveal that *H. mediterraneus* had mixed feeding traits, with clear tendency toward leaf browsing, similar to the extant fallow deer (*Dama dama*). We also report a probable phenomenon of competitive exclusion between *H. mediterraneus* and *D. dama* at all localities where the presence of *H. mediterraneus* has been reported so far (Cova del Rinoceront, PRERESA, Igue des Rameaux, and Lunel-Viel).

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1. Introduction

Haploidoceros mediterraneus is a peculiar medium-sized deer with scarce occurrence. It is reported in the Pleistocene fossil record and geographically limited to an area at the southwest of Europe (Croitor et al., 2008; Sanz et al., 2014; van der Made and Mazo, 2014-2015) (Fig. 1A). The most remarkable characteristic of this deer is the large two-pointed antlers, an unusual morphology distinguished mainly by one sickle-shaped beam that curves backward and sideward and a long frontal tine (Fig. 1G). These antlers are larger and weightier compared to other similar-sized deer. This rare antler shape could be suggestive of a degree of specialization. As can be expected, this antler simplification cannot be explained as an adaptation of a mountainous habitat because postcranial proportions point out that it was a generalized deer closer to a saltatorial runner (Croitor et al., 2008).

Hitherto it has only been identified in four sites in southwestern Europe. In the south of France, this genera has been recovered in two Late Middle Pleistocene sites (~MIS 7–9), where it has been described for the first time, Lunel-Viel (Hérault) and the nearby site of Igue des Rameaux (Tarn-et-Garonne) (Bonifay, 1967; Rouzaud et al., 1990; Noury, 1997; Croitor et al., 2008). Recent works in the Iberian Peninsula have also documented this taxon at the Cova del Rinoceront (Barcelona) (Sanz et al., 2014) and PRERESA (Madrid) (van der Made and Mazo, 2014-2015), providing a longer time span for the genera at least until MIS 5 (early Upper Pleistocene). The absence of *H. mediterraneus* at younger sites suggests that extinction could be occurred at the beginning of the Last Glacial period, at least in the Iberian region.

Dietary habits of *H. mediterraneus* are unknown. Croitor et al. (2008), based on the dental morphology (i.e., advanced molarization of the lower P4 and the reduced length of the premolar series), suggested an adaptation to a hard forage, which is typical of an arid climate. Moreover, the *H. mediterraneus* specimens found at Lunel-Viel and Igue des Rameaux are associated with both forested and open landscape taxa (Rouzaud et al., 1990; Fosse, 1996; Croitor et al., 2008).

This work provides the first inference on dietary traits and habitat of *H. mediterraneus* and other associated ungulates from Cova del Rinoceront based on tooth mesowear and microwear analyses. Furthermore, based on ecofactual evidence from Cova del Rinoceront, we provide a discussion on the palaeoenvironmental reconstruction and some considerations about the presence of *H. mediterraneus*.

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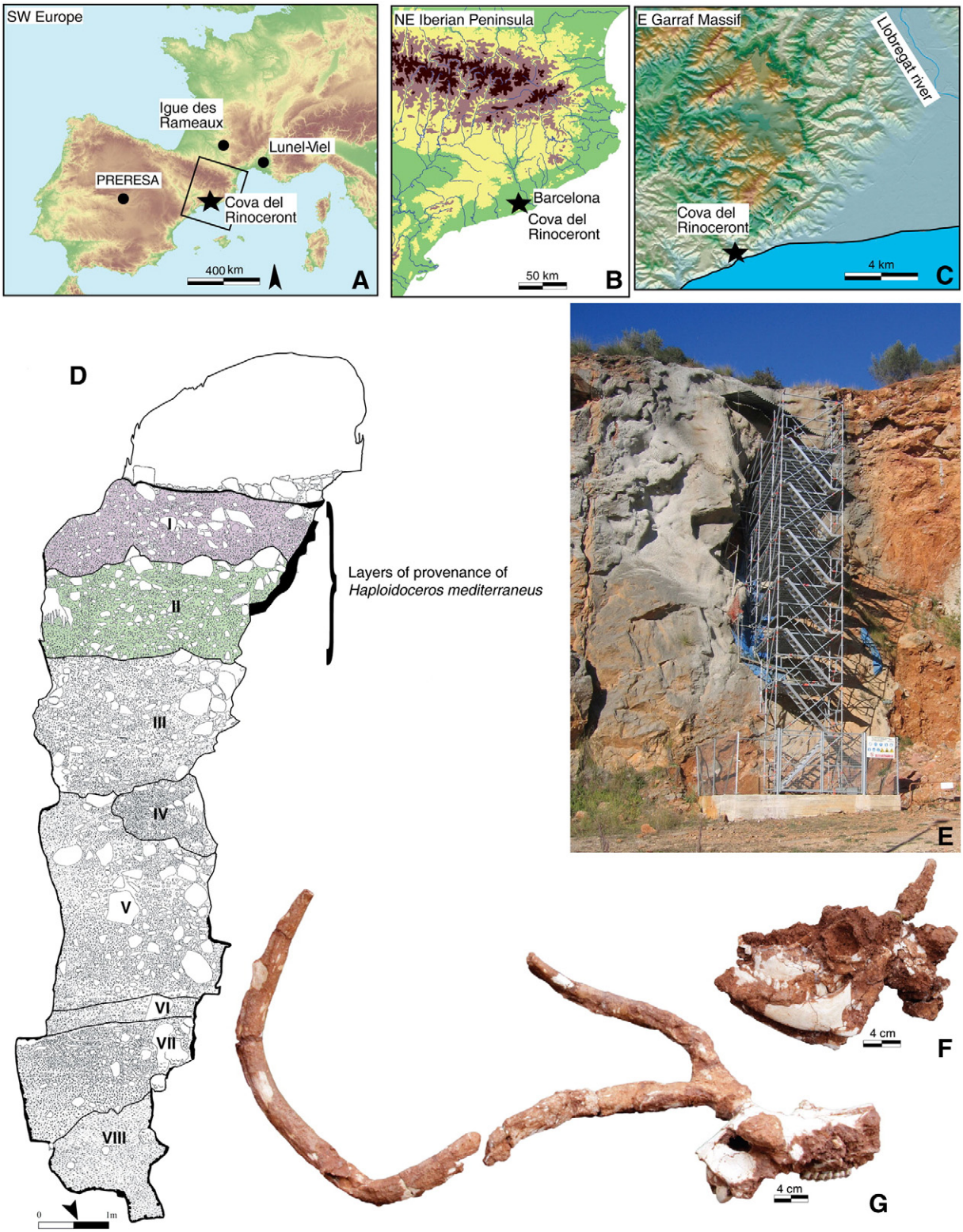

Fig. 1. (1) Location of the sites where *Haploidoceros* remains were identified. (2–3) Location of Cova del Rinoceront in the northeast of Iberian Peninsula. (4) Stratigraphic profile with *Haploidoceros mediterraneus* provenance. (5) Cova del Rinoceront after restoration with scaffold access. (6) *H. mediterraneus* juvenile skull. 7: *H. mediterraneus* adult skull.

2. Site description

2.1. Cova del Rinoceront

Cova del Rinoceront (41°16′24.92″N, 1°57′39.18″E, 25 m a.s.l.) is located in the Garraf Massif, in the municipality of Castelldefels (20 km to the southwest of Barcelona), only 1 km inland from the extant coastline (Fig. 1A–C). The original morphology of the site is unknown, as a significant part of it was destroyed by quarrying, which exposed the sedimentary fill along a vertical N–S section (Fig. 1D and E).

The exposed stratigraphy has a thickness of 11 m and a width of between 1.5 and 3 m. The sequence is contained within three main

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