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On the ecological context of the earliest human settlements in Europe: Resource availability and competition intensity in the carnivore guild of Barranco León-D and Fuente Nueva-3 (Orce, Baza Basin, SE Spain)

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ABSTRACT

With an age of ~1.4 Ma, the Early Pleistocene archaeopaleontological sites of Barranco León and Fuente Nueva-3 (Orce, Baza Basin, SE Spain) provide the oldest evidence on human presence in Western Europe, including the finding of a deciduous tooth of *Homo* sp., huge lithic assemblages of Oldowan tradition and abundant cut-marks on large mammal bones. Here we use a mathematical approach based on Leslie matrices to quantify for the large mammal species preserved at the sites the biomass of primary consumers available, the distribution of meat resources among the secondary consumers and the competition intensity within the carnivore guild. The results obtained show a community of large mammals with a high diversity of secondary consumers that would satisfy slightly less than half of their dietary requirements under optimal ecological conditions. In the case of *Homo* sp., and considering that flesh resources were obtained through the scavenging of ungulate carcasses, the model indicates that the ecosystems of the basin could hold 10–14 individuals per 100 km^2 during a year, a value that is close to the mean population density of recent hunter-gatherers. These density estimates decrease slightly when a mixed hunting-scavenging strategy is considered and even more in the case of a strict hunting behavior. In addition, the value of the species competition index obtained for *Homo* sp. is among the lowest of the carnivore guild. These results suggest that the hominin populations that inhabited Southeast Spain during the Early Pleistocene behaved more as opportunistic scavengers than as active predators.

1. Introduction

During the last decades, increasing evidence indicates that the genus *Homo* dispersed out of Africa during the late Early Pleistocene (Calabrian, Late Villafranchian). However, a number of issues related to this dispersal event are still subject to debate and controversy, including the chronology of the first human settlements in Western Europe, the dispersal route(s), the technocultural developments of this early human population, the continuity of the initial peopling of Europe, and the ecological context and climatic conditions in which the dispersal event took place (Dennell and Roebroeks, 1996, 2005; Arribas and Palmqvist, 1999; Carbonell et al., 1999, 2008, 2010; Bar-Yosef and Belfer-Cohen, 2001; Dennell, 2003; Antón and Swisher, 2004; Martínez-Navarro, 2004, 2010; Rook et al., 2004; Nikitas and Nikita, 2005; Palombo and Mussi, 2006; Agustí et al., 2009; Moncel, 2010; Palombo,

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2010; Dennell et al., 2011; Jiménez-Arenas et al., 2011a, 2011b; Toro-Moyano et al., 2011, 2013; Bermúdez de Castro and Martinón-Torres, 2013; Bermúdez de Castro et al., 2013; Muttoni et al., 2013, 2015; Rolland, 2013; Barsky et al., 2015; Rodríguez et al., 2015a, 2015b; Palmqvist et al., 2016).

In this paper, our main goal is to test the availability of animal resources for the hominin populations that inhabited the Baza Basin (SE Spain; García-Aguilar and Palmqvist, 2011) during the late Early Pleistocene, which remains and evidence of anthropic activity have been documented in two archaeopaleontological sites of this sedimentary basin that are located in the vicinity of the town of Orce, Barranco León (BL-D) (Espigares, 2010; Toro-Moyano et al., 2013) and Fuente Nueva-3 (FN-3) (Espigares et al., 2013) (Fig. 1). The age of these sites has been estimated by biostratigraphy and using the combined U-series/ESR dating method in 1.43 ± 0.38 Ma for BL-D and in 1.19 ± 0.21 Ma for FN-3, respectively (Duval et al., 2012; Toro-Moyano et al., 2013), and there is also a recent age estimate of 1.50 ± 0.31 Ma for FN-3 derived from cosmogenic nuclides (Álvarez et al., 2015). Given these age estimates and according also to biostratigraphic considerations (e.g., *Sus* ex. gr. *scrofa*, which marks the beginning of the Epivillafranchian biochrone, is first recorded at level TE9 of Atapuerca Sima del Elefante, dated by cosmogenic nuclides to 1.22 ± 0.16 Ma, but is absent from both BL-D and FN-3; Martínez-Navarro et al., 2015), the Late Villafranchian sites of Orce preserve the oldest evidence of human presence in Western Europe (see reviews in Martínez-Navarro et al., 1997, 2014; Arribas and Palmqvist, 1999, 2002; Palmqvist et al., 2005, 2014, 2016; Jiménez-Arenas et al., 2011b; Espigares et al., 2013; Toro-Moyano et al., 2013).

The evidence of human presence from these sites includes the finding of a human deciduous, lower first molar tooth at BL-D (Toro-Moyano et al., 2013) and huge lithic assemblages of Old-owan (i.e., Mode 1) tradition at both localities that include flint flakes, cores and limestone percussion tools (Palmqvist et al., 2005; Toro-Moyano et al., 2009, 2011; Barsky et al., 2015) as well as abundant cut-marks on large mammal bones (Espigares et al., 2013; Toro-Moyano et al., 2013). In fact, taphonomic analysis of the faunal assemblage unearthed from FN-3 has provided evidence

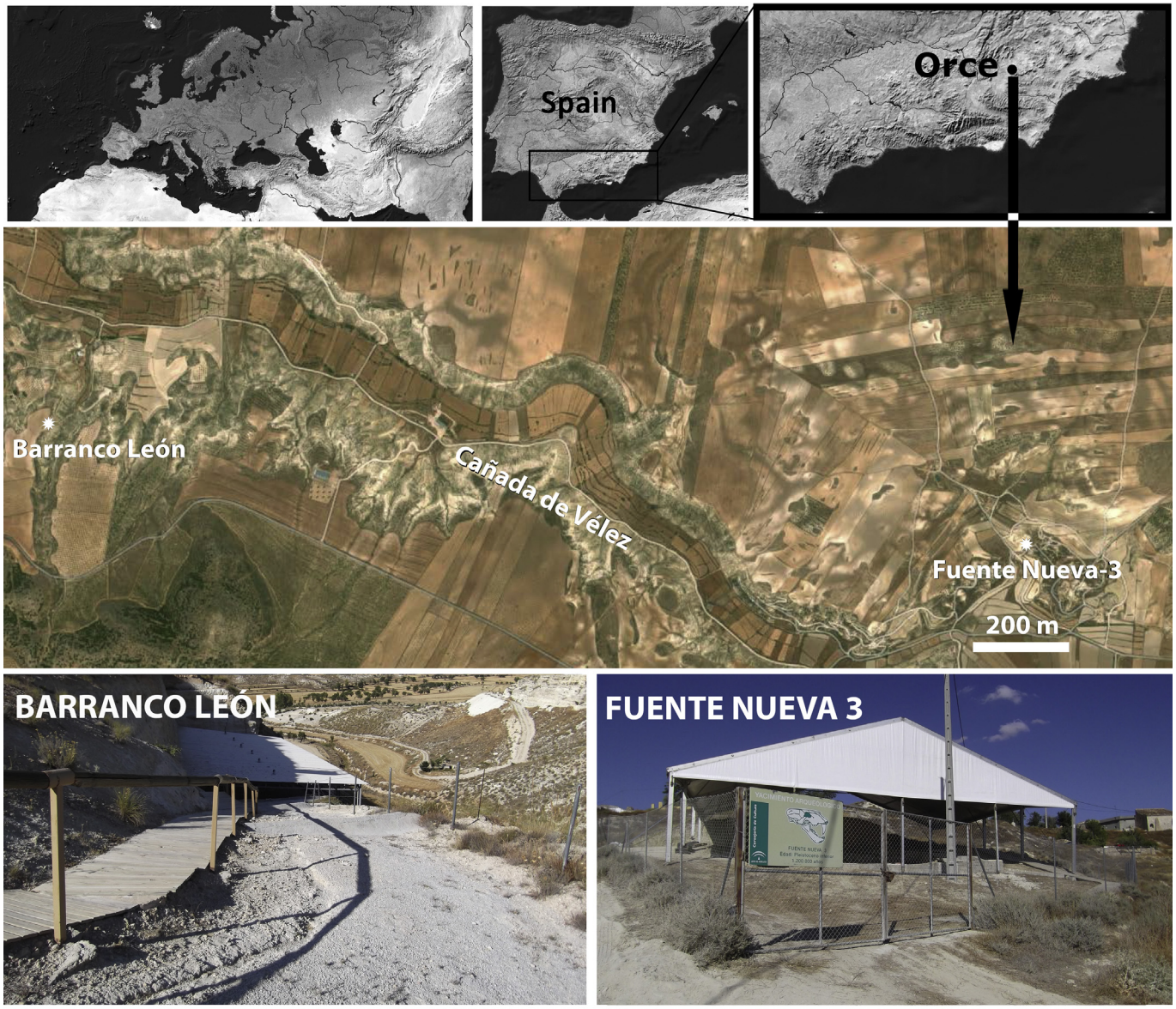

Fig. 1. Geographic location of the Orce sites, Barranco León (BL-D) and Fuente Nueva-3 (FN-3) in the Baza Basin (SE Spain).