



Who brought in the rabbits? Taphonomical analysis of Mousterian and Solutrean leporid accumulations from Gruta do Caldeirão (Tomar, Portugal)

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ABSTRACT

In the Iberian Peninsula, leporids, and specifically rabbits, play a key role in the understanding of hunter-gatherer economies. They appear to have been especially important in the Tardiglacial, when large numbers of small prey animals and of the European rabbit (*Oryctolagus cuniculus*) in particular, are a ubiquitous feature of faunal assemblages from archaeological sites. Since a large number of non-human predators can also contribute to the formation of such assemblages, the ability to discriminate between bones accumulated by humans and by other kinds of predators is a key prerequisite to their interpretation. On the basis of systematic actualistic studies carried out on modern leporid remains produced by mammalian terrestrial carnivores, nocturnal and diurnal raptors, and humans, we identified diagnostic taphonomic indicators of the different predators. In this paper, the patterns observed on the modern material are applied to the taphonomical analysis of two archaeological samples of rabbit and hare remains from Mousterian and Solutrean layers of Gruta do Caldeirão, a cave site located in Central Portugal. Our results suggest that Eagle Owl (*Bubo bubo*) were mainly responsible for the Mousterian accumulations, whilst the Solutrean ones were most likely the result of human activity. These data support the notion that, in Iberia, significant reliance on rabbits does not become a feature of subsistence strategies until later Upper Palaeolithic times.

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1. Introduction

The Iberian Peninsula is the homeland of the European rabbit (*Oryctolagus cuniculus*). Their remains constitute the most abundant taxon in many Middle and Upper Palaeolithic and Epipalaeolithic archaeological sites from this geographical region. Since Iberia and their associated faunas were less affected by the large-scale changes in climate experienced by northern Europe during the Pleistocene (Bicho, 1994; Straus, 1991; Zilhão, 1990) small mammals such as the rabbit have probably been abundant and readily available to prehistoric hunters for many thousands of years. In keeping with this, Palaeolithic leporid hunting in the Iberian Peninsula has received considerable attention in the past few years. Where Portugal is concerned, rabbit hunting during this period has been discussed by Brugal (2006), Haws and Valente (2001), Hockett and

Bicho (2000), Hockett and Haws (2002), Manne and Bicho (2009), Rowley-Conwy (1992) and Valente (2004).

Archaeological studies (Aura et al., 2002, 2009; Hockett and Bicho, 2000; Hockett and Haws, 2002; Stiner et al., 1999, 2000; Villaverde et al., 1997) have shown that rabbits yield important information about changes in subsistence practices, mobility patterns and demographic trends. Specifically, human diets are claimed to have undergone a radical transformation toward a reliance on smaller prey and in particular on the European rabbit during the transition from the Pleistocene to the Holocene (Hockett and Haws, 2002; Jones, 2004, 2006). This trend is revealed by the presence on rabbit bones from this period of cut marks and other evidence of anthropogenic modification (Aura et al., 2002; Cochard and Brugal, 2004; Hockett and Haws, 2002; Manne and Bicho, 2009; Pérez Ripoll, 1992, 1993, 2001, 2004, 2006; Rodríguez-Hidalgo et al., 2011; Villaverde et al., 1997).

Against this background, the acquisition and consumption of rabbits in pre-Upper Palaeolithic times remains a controversial issue. If the systematic use of resources offered by small-sized animals is limited to the Upper Palaeolithic, as argued by many (Aura et al., 2002; Cochard and Brugal, 2004; Hockett and Haws,

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2002; Lupo and Schmitt, 2002; Martínez Valle, 2001; Pérez Ripoll, 2001; Villaverde et al., 1997), then such a subsistence strategy can be explained in behavioural terms and exclusively linked to anatomically modern humans. However, the human consumption of rabbits has been documented also in Middle and early Upper Pleistocene sites of Iberia, where numerous examples of the routine exploitation of aquatic birds, marine molluscs, tortoises and seals by Neanderthals and their ancestors also exist (Antunes, 2000; Blasco, 2008; Blasco and Fernández Peris, 2009; Blasco Sancho, 1995; Fernández-Jalvo and Andrews, 2000; Martínez Valle, 1996; Montes, 1993; Sanchís Serra, 2008; Stringer et al., 2008; Zilhão et al., 2010). These observations have led others (Zilhão, in press) to link the leporid spike apparent in the later Upper Palaeolithic of Iberia to environmental availability, site function and demography rather than behaviour (as explanations linking the exploitation of leporids to the emergence of "behavioral modernity" are hard to reconcile with the fact that, in Mesolithic assemblages from the same regions, a decline to Middle Palaeolithic values succeeds the Tardiglacial spike; Aura et al., 2009).

The origin, anthropic or other, of the studied rabbit remains is a key issue underlying this debate, as rabbits are an important source of food for a large number of non-human predators (Delibes and Hiraldo, 1981). Terrestrial carnivores and diurnal and nocturnal birds of prey are regular visitors to caves and rock-shelters where their prey leftovers and pellets or scats, containing digested bone fragments, may accumulate. Thus, in order to understand human subsistence activities in the past it is essential to establish how a given leporid assemblage was accumulated: by humans, by other predators, or as a palimpsest of anthropogenic and non-anthropogenic contributions.

With such an aim, we have been carrying out over the last years systematic actualistic studies on modern leporid remains originated by mammalian terrestrial carnivores, nocturnal and diurnal raptors and humans (Lloveras et al., 2008a, 2008b, 2008c, 2009, in press) in order to identify the corresponding taphonomic signatures. The observed patterns were applied to the analysis of archaeological leporid remains from Mousterian layers of the Arbrede cave site (North-East Spain), and led us to conclude (a) that medium-sized carnivores (namely, Fox, Iberian Lynx, and Wild Cat) were the agents involved and (b) that the cave functioned at that time as a carnivore den only intermittently occupied by humans (Lloveras et al., 2010). Here, we apply the same methodological approach to two other Iberian archaeological samples of rabbit and hare remains, from the Mousterian and Solutrean layers of the Gruta do Caldeirão, a cave site located in Central Portugal (Table 1; Fig. 1).

2. Archaeological context

Gruta do Caldeirão (39° 38' 54" N; 8° 24' 54" W) opens to the south on a side valley of a limestone canyon cut by the Nabão River, a tributary of the Tagus, some 7 km north of the city of Tomar. Excavated over ten field seasons carried out between 1979 and 1988, the site corresponds to a narrow, meandering karstic gallery where three different areas were concerned by the field work: outside the extant drip-line (the exterior); squares K/O-13/15 (the corridor); and squares N/S-8/15 (the back chamber) (Fig. 2). The >6 m-thick stratigraphic sequence exposed spans Mousterian, Early Upper Palaeolithic, Solutrean, Magdalenian and Early Neolithic levels, capped by a surficial deposit (levels A/B/C and D) significantly disturbed by badger burrowing and containing human burial remains from the Copper, the Bronze and the Iron Ages as well as isolated finds from the Roman, Medieval and Modern Eras (Zilhão, 1992, 1997).

The surficial deposit, a dark brown to black cave earth deposit very rich in organic matter, was thoroughly excavated across most

of the site, but the stratigraphy of the Early Holocene and Upper Pleistocene fill can be observed in two baulks left in the more interior area of the cave at the end of the 1988 field season (Fig. 3). From bottom to top, this fill is comprised of three main blocks:

- at the base, levels Q–L, which yielded few artifacts of Middle Paleolithic technology and abundant remains of large carnivores, namely hyenas; these levels are of fine, predominantly silty-clayey texture, and the bone finds made therein feature extensive manganese staining, while the limestone clasts additionally present significant interior corrosion, suggesting temporary waterlogging of the deposits throughout the time of deposition;
- in intermediate position, levels K–Fa, separated from underlying level L and from overlying level Eb by marked erosive discontinuities and containing remains of Middle (in level K) and Upper Palaeolithic (in levels Jb–Fa) human occupations that significantly increase in density towards the top, especially so in levels H–Fa, which contained diagnostic Middle and Upper Solutrean stone tools; this deposit is a compact, reddish, clayey sand with varying amounts of large blocks and, in square P11, featured two major episodes of stalagmitic crust formation, one covering (and cementing) level H, the other at the top of level Fa; the available results (Zilhão, 1997) date level Jb (OxA-5542) to $26,020 \pm 320$, level I (OxA-1942) to $22,900 \pm 380$, level H (OxA-2511 and OxA-1939) to $20,530 \pm 270$ and $19,900 \pm 260$, and level Fc (OxA-2510) to $18,840 \pm 200$ ^{14}C BP; the result for level Jb provides a *terminus ante quem* for the site's Mousterian, which must at present be considered undated, as the result of $27,600 \pm 600$ ^{14}C BP (OxA-1941) obtained for the upper part of level K could not be replicated when re-dating of archived material from that sample was attempted with ultrafiltration pretreatment but failed due to low yield (Rachel Wood, personal communication, 2010), indicating that it should be treated as a minimum age only;
- at the top, levels Eb–Ea are a brown-red to light brown looser sandy deposit where Ea, spatially restricted to the back

Table 1
Composition (spatial and stratigraphic provenience) of the two leporid assemblages from Gruta do Caldeirão analyzed in this paper.

Mousterian sample			Solutrean sample		
Square	Layers	Spits	Square	Layers	Spits
P11	K	K3, K4, K5	P11	Fb	F10
	L	L1, L2, L3, L4		Fb/Fc	H1
	M	M1, M2	P12	Fa	F4, F5
	N	N1, N2, N3		Fb	F11
O	O1		Fb/Fc	F13	
P12	K	K4, K5, K6, K7, K8, K9	P13	H	H1, H2
		J7, J8		I	H3
P13	K	K2, K3, K4, K5		I	I1, I2
		K1 14/9	P14	Fa	F2, F3, F4, F5, F6, F7
P14	K	K1		Fb	F8, F9, F10, F11
O12	K	K1		Fc	F9, F11, F12, F13, F14, F15
O13	K	K1			
		J6	O12	H	H1, H2
	K1	I		I1, I2, I3	
O14	K	J6		H	H2, H3
		K1		I	I3, I4
			O13	H	H1, H2
				I	I1, I2
			O14	Fb	F9
				Fc	F11, F13
				H	H1, H2
				I	I1, I2
			N14	H	H1, H2
				I	I2, I3

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