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Bears and humans, a Neanderthal tale. Reconstructing uncommon behaviors from zooarchaeological evidence in southern Europe

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ABSTRACT

Cave bear (*Ursus spelaeus*), brown bear (*Ursus arctos*), and Neanderthals were potential competitors for environmental resources (shelters and food) in Europe. In order to reinforce this view and contribute to the ongoing debate on late Neanderthal behavior, we present evidence from zooarchaeological and taphonomic analyses of bear bone remains discovered at Rio Secco Cave and Fumane Cave in northeast Italy, an extended geographic area north of the Adriatic Sea. The remains from both caves come from layers dated to 49-42 ky cal. BP, and suggest close interactions between humans and bears, with data not only limited to the association of Mousterian lithic artifacts with numerous bear remains, but also the detection of clearly preserved traces of human modification such as cut and percussion marks, which enable a reconstruction of the main steps of fur recovery and the butchering process. Examples of Neanderthal bear exploitation are extremely sporadic in Europe, and Grotta Rio Secco and Grotta Fumane can be considered rare cases of remain accumulations generated by the human predation of bears of varied age classes during or near the end of hibernation. All of this evidence suggests that bears had a strategic role in the nomadic economy of Neanderthal hunting groups.

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1. Introduction

From the Middle to the Upper Pleistocene, humans and bears coexisted and cohabitated in a good part of Europe. This is demonstrated by numerous findings of plantigrade remains in association with artifacts, interpreted over the course of the 20th century to demonstrate both the hunting of these carnivores and the accumulation of their bones following natural deaths in contexts that also indicate anthropic frequentations (Fedele, 1968; Jéquier, 1975; Hille and Rabeder, 1986; Tillet, 1997; Le Tensorer, 1998; Tillet and Bernard-Guelle, 1998; Fosse et al., 2002; Auguste, 2003; Bona et al., 2007; Torres et al., 2007; Cvetković and Dimitrijević, 2014; Bocherens et al., 2014; Fourvel et al., 2014). However, the taphonomic history of these faunal assemblages within caves is very complex and has only been refined in the last 20 years by microscopic and taphonomic investigative techniques, accompanied by reviews of the materials excavated in the early to middle of the last century that have shown that between these large carnivores and Neanderthals, a consolidated and probably "symbiotic" interactive relationship was established (Koby, 1951; Kurtén, 1976; Fosse et al., 2002; Stiner, 1998; Auguste, 2003). The ecological and etological characteristics shared by humans and ursids (*Ursus arctos* and *Ursus spelaeus*) were not, in fact, insignificant. Besides adopting prey acquisition and related alimentary regime strategies, they shared habitat types and shelters, which were utilized for hibernation and protection, especially of the youngest (Turner, 1992, 1994; Arribas and Palmqvist, 1999; Hemmer, 2000; Brugal and Fosse, 2004), whose distribution and density is equally a regulating factor within species assemblages that can live in territorial or family communities. Human and bear interactions are particularly observed in Europe throughout the

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Upper Pleistocene, with abundant ursid populations and numerous Mousterian frequentations attested by archaeological finds in caves and shelters (Petram et al., 2004; Bona et al., 2007; Diedrich, 2012; Viranta and Grandal d'Anglade, 2012). In terms of contributing factors to the overall interaction, climatic conditions had greater impact in respect to the more temperate regions, which were differentiated by environments, types of vegetation, geological substrates, and by populations and the structure of ursid communities (Turner, 1995). Lastly, the quality of the fossil record and the level of archaeozoological and taphonomic research must also be considered.

The sizes of *Ursus arctos* and *Ursus spelaeus*, averaging 260 and 600 kg, respectively, are markedly different, but their eto-ecological behaviours are very similar. With a longer life span among the carnivores (20–30 years), these ursids were adapted to temperate-cold climes, preferring semi-forested vegetation, and could live in groups or individually, moving through a territory estimated to between 100 and 1,000km2 for females and males, respectively, (Caloi et al., 1997; Couturier, 1954; Jakubiek, 1993; Brugal et al., 2001; Brugal and Fosse, 2004; Torres et al., 2007). The dimensions of the ursid groups, their structural stability, and the size of their populations are in most cases strongly influenced by the presence of water, which determines the choice of a suitable place of refuge, the abundance of herbivorous prey, and even, for mothers and young, the orientation of slopes (S, S-E), fundamental to the micro-climatic conditions in the critical phases of hibernation.

If one talks of taphonomy and archaeozoology in relation to the ursids, it is impossible not to take into consideration the theory of the "Bear Cult," which was widely diffused in the first half of the 20th century by Emil Bächler (Bächler, 1920–1921, 1923, 1940), who hypothesized the existence of a culture unique to the Alps, associated to the Riss-Würm Interglacial: the "Palaeolithic" or "Alpine Mousterian." This "culture" was associated with a specialized hunting of young cave bears that was practiced in the summer at highland sites where, in addition to bear remains, bone tools and lithic industries were identified at the time, often described as Quina Mousterian type. The true "Bear Cult," "Cave Cult," and/or "Cult of Hunting and Sacrifice" (Bächler, 1920–1921) is manifested through the presumed deposition or replacement of cave bear long bones and crania. These theories or hypotheses saw undeniable comparisons in archaeological evidence from Germany, Austria, Hungary, Slovenia, and Croatia (Pacher, 2003). Decades later, the theory of the "Bear Cult" was totally abandoned by challenging the origin and anthropic modification of bear remains (Koby, 1943, 1951, 1953; Kurtén, 1976; Fosse et al., 2002; Stiner, 1998; Auguste, 2003).

However, aside from the discussed practice of burying human remains in association with brown bear bones as funerary goods at Le Régourdou in France (Cavanhié, 2009–2010), many examples linking Neanderthals and bears are now known thanks to the discovery of lithic tool cut-marks on the surfaces of ursid bones from recently excavated sites or from review of ancient excavation materials. At Taubach, the systematic destruction of 80% of the brown bear canines (Kurtén, 1976), based on the current state of knowledge, cannot be explained by the vague term "symbolic," as in the majority of cases it is "utilitarian." The main difficulty, then, lies in evaluating the degree active hunt against scavenging. The hypotheses of carcass manipulation at the bears' natural place of death seems plausible for the Mousterian: evidence for such behavior has been observed in Belgium at Goyet and Scladina caves (Germonpré and Sablin, 2001; Germonpré and Hämäläinen, 2007; Abrams et al., 2014), in France at Regourdou (Cavanhié, 2009–2010; Bonifay et al., 2007), in Germany at Geißenklösterle, Hohle Fels and Balve Cave (Kitagawa et al., 2012; Münzel, 1997; Münzel and Conard, 2004b; Münzel et al., 2011; Kindler, 2012), in Austria at Salzofen Cave (Ehrenberg, 1958–59, cited by Armand et al., 2004), in Poland at Nietoperzowa (Wojtal, 2007; Wojtal et al., 2015), in Slovenia at Divje Babe (Turk, 1997, 2014), in Serbia at Pešturina Cave (Majkić et al., 2017), in Montenegro at Crvena Stijena (E. Morin personal communication) and in Italy at Caverna delle Fate, Madonna dell'Arma, Ciota Ciara, Badalucco, Le Manie, and Sant'Agostino (Stiner, 1994; Valensi and Psathi, 2004; Quilès, 2003, 2004; Buccheri et al., 2016) (Fig. 1, Table 1). In light of these findings, it is thus possible to distinguish two principal European regions of Neanderthal ursid exploitation from OIS6 to OIS-3: one in north-central Europe (Germany, France, and Belgium), and one in the central-eastern Mediterranean (northern Italy and the Balkans) (Fig. 1, Table 1).

Within a framework that addresses rather fragmented and patchy taphonomic evidence, this work seeks to reinforce this view through the presentation of two cave contexts, Rio Secco Cave (Grotta de Rio Secco) and Fumane Cave (Grotta di Fumane) in the Italian Alps (Supplementary Information), which are geographically distant but chronologically related, and that provide several distinct Neanderthal frequentations that attest to the systematic and consolidated exploitations of bears (*Ursus arctos* and *Ursus spelaeus*) (See Fig. 2).

2. The use of cavities by bears

"Bear sites" are characterized by a percentage of bear remains within caves or shelters equal to 80–99% of the total recovered bones (Quilès, 2004), "charriage a sec" (Koby, 1941, 1943; Andrews and Turner, 1992) on the bone surface, traces of frequentation (including claw marks and polishing of the cave walls), and/or the presence of "bear earth," rich in phosphate nodules derived from the decomposition of their carcasses (equaling 10–17 kg of phosphate per individual). Bear caves can be divided into "bear hibernation den" and "cave/shelter den." These attributions are secondary to the function of the cave and the identity of its occupants: bear (male adults or females with cubs and young), carnivore, or man (Quilès, 2004). Other parameters include the representative indexes of bone destruction and the proportions of axial skeletons. In the "bear hibernation den," the appendicular skeleton will be strongly represented, in some cases with intact skeletons recovered in anatomical connection. The "cave/shelter den", however, is characterized by a major percentage of bone destruction and dispersal due to continuous trampling over a lesser occupational duration.

The ratio of cave bear remains to other animals in bear sites and the ratio of cave bear to brown bear remains appears to be 10:1, if not higher (Quilès, 2004). Both the cave bear and modern bears appear to be long-lived animals with a low reproductive success that rarely confers to their respective populations a high density. This is due to factors of an ecological order, such as trophic capacity, living space, infant mortality rate, and, in modern populations, human disturbances, either direct or indirect. According to studies carried out in North America, females grizzly give birth on average every two to three years, and individuals of both sexes, at a ratio of 1:1, are considered fertile at around the age of four to five years (Craighead et al., 1974). Females are fertile until the age of 18 and the number of cubs born is usually one or two, rarely three or four. The mating period for European brown bears is around the months of May and July, while the American grizzly mates between June and August. The gestation period varies from seven to eight months. At birth, which takes place between January and March in various species (during the wintering), the cubs weigh 250–400g, about 1/500 of the female's weight. The bear spends the cold season sheltered in refuges (dens) in semi-hibernation, a torpor produced by a more or less prolonged state of sleep induced by low

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