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Spotted hyena and steppe lion predation behaviours on cave bears of Europe – ?Late Quaternary cave bear extinction as result of predator stress

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Cave bears hibernated in caves all over Eurasia (e.g. Rabeder et al., 2000) including alpine regions using mainly larger caves for this purpose. Late Quaternary spotted hyenas Crocuta crocuta spelaea instead occupied mainly areas close to the cave entrances as their dens (Diedrich and Žák 2006, Diedrich 2010). The largest predator, the steppe lion Panthera leo spelaea was only a sporadic cave dweller (Diedrich 2007b, 2009b). His presence and its remains from caves all over Europe can be recently explained best as result of imported carcasses after killing by their largest antagonists, the Late Quaternary spotted hyenas. In some cases the kill might have happened in the hyena den cave itself during the theft of prey remains by lions (Diedrich 2009a). Another reason of their remains in caves of Europe is the hunting onto the herbivorous cave bears, especially during hibernation times, when megafauna prey was less available in the open environments (Diedrich 2009c). These lion remains from caves of Europe, nearly all of which were from adult animals, provide evidence of active predation by lions onto cave bears even in medium high alpine regions (Diedrich 2009b, in review). Lion skeletons in European cave bear dens were therefore often found amongst originally articulated cave bear skeletons or scattered cave bear remains and even close to their hibernation nests (Diedrich et al. 2009c, in review). Not only lions fed on cave bears documented mainly by the large quantities of chewed, punctured and crushed cave bear long-bones; even damaged skulls reveal that hyenas scavenged primarily on cave bear carcasses which were mainly responsible for the destruction of their carcasses and bones (Diedrich 2005, 2009d). Predation and scavenging on cave bears by the two largest Late Quaternary predators C. c. spelaea and P. l. spelaea explains well the large quantity of fragmented cave bear bones over all European caves in low to medium high mountainous elevations, whereas in high alpine regions the leopard Panthera pardus seem to have used the ecological niche of the absent hyenas (Diedrich 2009d, in review a). At open air sites cave bear scavenging by the largest Late Quaternary predators were proven, too (Diedrich 2006, 2009e). The predation stress caused by the three main and largest Late Quaternary predators seem to have provided cave bears to hibernate often deeply in many European caves, and here especially in larger and longer cave systems (e.g. Diedrich et al 2009, in review, Diedrich and Moldovan 2010) to protect themselves against the largest Quaternary predators. In conflicts with those large felids must have been killed by adult cave bears, which explains why those predator carcasses remained as complete skeletons or as partly disarticulated ones even deep in caves all over Europe which were finally not scavenged by the herbivorous cave bears (Diedrich in review). In such cave bear den caves the amount of lion bones generally take only 1-3% of the total bone amount being highly dominated by cave bear bones (Diedrich 2009c, in review). Lions and hyenas seem to have focussed onto the hunt of cave bears all over Europe, especially with the reduction of the biomass in the open environments at the maximum cold period during around 26.000-24.000 BP (Solutrean). The slow extinction of their largest prey was an important motor of the predation pressure onto cave bears. This might be one reason for the cave bear extinction in the final Late Quaternary (early Late Weichselian, maximum cold period) at least in northern Europe, but it seem to have happened in a combination of climatic change, and also human impact (cf. Diedrich, this volume).

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