Geophysical Research Abstracts
Vol. 12, EGU2010-2124, 2010
EGU General Assembly 2010

Disappearance of the last lions and hyenas of Europe in the Late Quaternary – a chain reaction of large mammal prey migration, extinction and human antagonism

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In the Eemian to Early/Middle Weichselian (Late Pleistocene), when the Scandinavian and Alpine Glaciers were still small, and northern Germany under mammoth steppe to taiga palaoenvironment conditions, Late Quaternary steppe lions were well distributed in northern to central Germany, whereas generally all over Central Europe bones and rarely articulated skeletons were found less at open air but mainly at cave sites (Diedrich 2007a, 2008a-b, 2009a-b, 2010a-c, k, in review a-b; Diedrich and Rathgeber in review). A similar distribution, but more dense, is reported for the Late Quaternary Ice Age spotted hyenas (Diedrich 2005, 2006, 2007b-c, 2008a, c, 2010f-j, in review c-d, Diedrich and Žák 2006). The last lions of northern Europe were thought to have reached into the final Magdalénan (cf. Musil 1980). This can be not concluded with a restudy of the bone material from the Late Magdalenian (V-VI) Teufelsbrücke stone arch site near Saalfeld (Thuringia, Central Germany) and many other Magdalenian stations (open air and caves) in northern to central Germany (Münsterland Bay, Sauerland Karst, Harz Mountain Karst, Thuringian Karst). None of those sites yield remains of final Upper Pleistocene spotted hyenas or steppe lion bones anymore, nor in the few preserved Late Magdalenian mobile art can those be recognized in those regions. The last lion remains seem to reach into the Aurignacian or possibly into the Early Gravettian (early Late Weichselian) documented especially at the cave bear den, hyena den and overlapping Neandertalian to Modern human camp site Balve Cave (Sauerland Karst, cf. archaeology in Günther 1964) where still a mammoth fauna is documented for that time (Diedrich 2010a). The last and by archaeological layers dated hyena remains were also found in the Balve Cave and are from the Late Middle Palaeolithic cave site reaching a maximum Aurignacian age documenting an overlapping of hyena den and human camp site use (Diedrich 2010a, b). In northern Germany there are no records of indirectly dated hyena and lion remains being younger then even Aurignacian/Early Gravettian (35.000-28.000 BP). Those largest Late Quaternary predators must have got extinct in northern Germany with the Late Weichselian/Wuermian extending Skandinavian Glacier, which reached northern Europe between Hamburg and Berlin its maximum extension about 24.000 BP (Skupin et al. 1993). The two largest predators of the Late Quaternary of Europe seem to have been well represented in the Gravettian and up to Magdalénian Late Palaeolithic of southern Europe, in which mainly lions, but only rarely hyenas are well documented within the cave and mobile art (e.g Breuil 1952, Begouen and Clottes 1987, Chauvet et al. 1995, Diedrich and Rathgeber in review, Diedrich 2005). Hyenas and lions must have been represented in the Gravettian, Early and Middle and possibly even ?Late Magdalenian in southern Europe, which must have resulted from a southern migration of those predators during the Late Weichselian/Wuermian together with the megafauna and humans. The disappearance of hyenas and lions also correlate with the extinction of mammoth and woolly rhinoceros in northern Germany. The large mammals such as elephants and rhinoceroses were highly important for hyenas and lions during the Late Quaternary. Hyenas had a systematic scavenging strategy on both large prey which was even "transferred" until today compared to modern spotted hyenas and lions of Africa (Diedrich 2010d, e, in prep). Where those Late Quaternary giant mammals such as woolly mammoth and woolly rhinoceros were absent in middle mountainous regions (e.g. Sauerland Karst, Harz Mountain Karst, Bohemian Karst, Thuringian Karst) those had to kill other medium sized animals such as horse or steppe bison and those in larger amounts (Diedrich 2008, 2010c). Woolly rhinoceros and woolly mammoth seem to be not known in northern Germany after Aurignacian/?Early Gravettian times (Sauerland Karst and Münsterland Bay, Harz Mountain Karst) such as humans (archaeology cf. Günther 1988) but there are also lacking radiocarbon dating series or new excavations. Humans must have been in antagonism to the large predators about their prey and also their Late Palaeolithic

sanctuaries - the large caves especially in southern Europe, in which they left thousands of animal figurations mainly during the Gravettian to Late Magdalenian periods (e.g. Breuil 1952, Begouen and Clottes 1987, Chauvet et al. 1995). Therefore the extinction reason of the largest predators of the Late Quaternary seems to be a complex combination of climate change with resulting maximum glacier extension which finally caused a southern directed megafaunal migration and reduction of the available caves and habitat areas in general. Finally in those southern European regions a higher competition about larger caves as cave bear hibernation places, hyena den sites and human settlement/sanctuary sites must have happened. Therefore an active hunt onto lions and hyenas can not be excluded nor be proven well yet, even if there are finds of necklesses in Europe from Late Palaeolithic ages made of mainly carnivore teeth including rare lion and hyena teeth, which might have been only collected. The resettlement of the northern European region by humans and a reduced "reindeer fauna" and its main and largest predators such as wolves and wolverines after the maximum glacier extension in the middle Late Weichselian started not before the Late Magdalenian (Magdalénian V: e.g. Perick Caves, Martins Cave – Sauerland Karst; Rübeland Caves – Harz Mountain Karst, Teufelsbrücke stone arch – Thuringian Karst). Humans occupied at that post-maximum glaciation time many caves in the Sauerland Karst region and even at open air sites in the Münsterland Bay or central Germany (cf. Bosinski 1987, Günther 1988). Within this Late Magdalénian V-VI times in the record of ten thousands of bones from more then 100 sites no hyena or lion remains are recorded anymore in northern and central Germany, such as cave bears.

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