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A Late Pleistocene to Holocene succession of leporid species in the southern Vienna Basin (Austria)

Une succession d'espèces de léporidés du Pléistocène supérieur à l'Holocène dans la partie méridionale du bassin de Vienne (Autriche)

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ABSTRACT

The new archaeological and palaeontological site of Smrcka Lorenz-Abris yielded three different leporid species in stratigraphical sequence, mirroring the effect of environmental changes and the influence of humans in this area. *Lepus timidus* is a species with a wide Late Pleistocene distribution, but disappeared in the Vienna Basin at the end of the Pleistocene. *Lepus europaeus* appeared in the Holocene and became dominant in lower altitudes in Austria. Interspecific competition as well as anthropogenic and natural environmental changes are the main factors that caused this replacement. At Smrcka Lorenz-Abris, *L. europaeus* became dominant around 7000 a BP. This site yielded the last evidence of a mountain hare in the Vienna Basin, with a preserved lower jaw that was dated to be from around 14,000 a BP. The most recent immigrant is *Oryctolagus cuniculus*, which was introduced to Austria, and only found in the upper parts of the section.

Mots clés :
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RÉSUMÉ

Le nouveau site archéologique et paléontologique de Smrcka Lorenz-Abris a fourni trois espèces différentes de léporidés dans la colonne stratigraphique, reflétant l'effet des changements environnementaux et l'influence de l'Homme dans cette région. *Lepus timidus* est une espèce à vaste distribution au Pléistocène supérieur, mais qui a disparu dans le bassin de Vienne à la fin du Pléistocène. *Lepus europaeus* est apparu à l'Holocène et est devenu dominant aux basses altitudes en Autriche. Une compétition interspécifique, ainsi que les changements environnementaux naturels ou dus à l'Homme, sont les principaux facteurs de ce remplacement. À Smercka Lorenz-Abris, *L. europaeus* est devenu dominant autour de 7000 a BP. Le site a produit la denière évidence d'un lièvre de montagne dans le bassin de Vienne, avec une mâchoire inférieure conservée, qui a été datée d'environ 14,000 a BP. Le plus récent immigrant est *Oryctolagus cuniculus*, qui a été introduit en Autriche et que l'on trouve seulement dans les parties hautes de la coupe.

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1. Introduction

1.1. The fossil record of leporids in Austria

Before the Pliocene, only ochotonids such as *Eurolagus*, *Amphilagus*, or *Prolagus* are known from Austria (Angelone and Veitschegger, 2015; Prieto et al., 2012 and references therein; Prieto et al., 2014). The first appearance of modern leporids in Europe was in the Late Miocene (Flynn et al., 2014 and references therein), and the first known leporid from Austria is *Hypolagus petenyii* ("*H. beremendensis beremendensis*") from Middle Pliocene fissure fillings (Deutsch-Altenburg 9, 20, 21; MN 16; ca. 3.0–2.5 Ma old) (Čermák, 2009; Döppes and Rabeder, 1997; Fladerer and Reiner, 1996a). This species evolved into, or was replaced by, the Early Pleistocene *Hypolagus brachygnathus*, which survived until the beginning of the Middle Pleistocene (Čermák, 2009; Fladerer and Reiner, 1996a). The first species of the genus *Lepus* may have appeared in the Middle Pleistocene in Austria. A *Lepus* sp. ("*L. terraerubrae*") inhabited the Early to Middle Pleistocene steppes of eastern Austria. This species, however, has not yet been properly described (Döppes and Rabeder, 1997; Fladerer, 1984).

Finds of *Lepus timidus* occur rather frequently in Late Pleistocene sediments in eastern Austria (Fig. 1) and the oldest dated evidence of this species are from the Salzofenhöhle (Styria), about 54,000–31,200 a BP, and from the Peggauerwandhöhle (Styria), about 42,400–22,600 a BP (Döppes and Rabeder, 1997; Fladerer, 1994; Pittioni, 1980). So far, the oldest occurrence of *L. timidus* in Lower Austria around the Vienna Basin is from the Late Palaeolithic locality Alberndorf 1 with radiocarbon dates of around 28,500 and 26,900 a BP (Jöris et al., 2010). The most recent evidences for fossil mountain hares in Austria so far are from the Merkensteinhöhle (Lower Austria), with an age of 13,000–10,000 a BP, and from the Teufelslucke near Eggenburg (Lower Austria), with an age of 13,000–7,000 a BP. The relative age of both caves, however, is based on the micromammal assemblages (e.g., *Dicrostonyx*) (Fig. 1) (Döppes and Rabeder, 1997).

So far the most reliable oldest evidence of the European hare, *Lepus europaeus*, in Austria is from the Knochenhöhle near Kapellen (Styria), where one specimen of *L. europaeus* was found among several hundred of *L. timidus*. A ^{14}C age of a mountain hare from the same layer dated back to about 14,000 a BP (Fladerer and Reiner, 1996b).

Oryctolagus cuniculus is endemic on the Iberian Peninsula, as well as southern France, and was introduced to Austria in the late Middle Ages around the 15th century (Spitzenberger, 2001). Newer evidence from eastern Austria (canabae legionis, Vindobona) suggests an earlier introduction, within the Roman period, but the temporal origin of these specimens still needs to be verified (Czeika, 2005).

1.2. The Smrcka Lorenz-Abris

The archaeological and palaeontological site of Smrcka Lorenz-Abris (about 380 m above sea level) is located in the Höllgraben, a small valley close to the village Enzesfeld-Lindabrunn in the southern part of the Vienna Basin (47°54′43″N, 16°10′10″E). This village is at the western margin of the southern Vienna Basin, about 35 km southwest from Vienna (Fig. 1). The Smrcka Lorenz-Abris is a single cliff in an artificial *Pinus nigra* forest on the southern hillside of the Höllgraben (Neitz, 2013). The cliff is built by cemented coarse grained gravels which were deposited by rivers during the Late Miocene (Pannonian), 11.6–10.5 Ma, and mainly consists of transported Alpine rubble (Wessely, 2006). The sediments under the Smrcka Lorenz-Abris and the surrounding talus were formed during Late Pleistocene and modern times. This sediment mainly consists of the eroded rubble from the cliff. Archaeological evidence, based on the recovery of stone tools (Neitz, 2013),

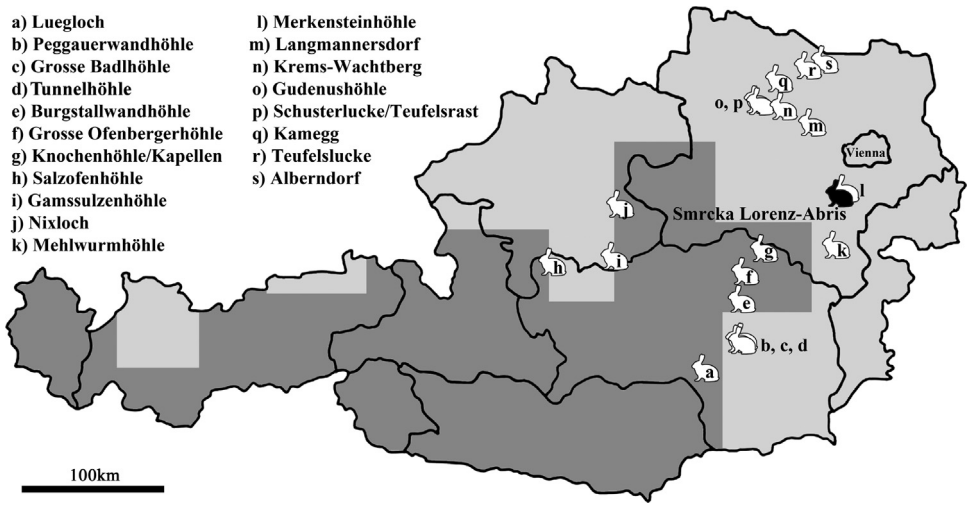

Fig. 1. Late Pleistocene findings of *Lepus timidus* in Austria (after Döppes and Rabeder, 1997). The dark grey area represents the modern distribution of the mountain hare in Austria (IUCN, 2008). The black hare icon indicates the position of the Smrcka Lorenz-Abris.
Fig. 1. Découvertes de *Lepus timidus* du Pléistocène supérieur en Autriche (d'après Döppes et Rabeder, 1997). La zone en gris foncé correspond à la distribution moderne du lièvre de montagne en Autriche (IUCN, 2008). L'icône représentant un léporidé noir indique la position de Smrcka Lorenz-Abris.