

## First Holocene record of the Alcathoe bat *Myotis alcathoe* in an Austrian cave

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Milchram M. & Bürger K. 2020. First Holocene record of the Alcathoe bat *Myotis alcathoe* in an Austrian cave. Biodiversität und Naturschutz in Ostösterreich - BCBEA 5/2: 80–83.

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Online seit 12 Dezember 2020

### Abstract

The Alcathoe bat *Myotis alcathoe* is a rare bat species which is spread throughout deciduous forests in Eastern Austria. Here, we present the finding of a cranium in the “Ritzlkesselhöhle” (cadastral number 1815/400) in Lower Austria, which is the first cave record of this species in Austria.

**Keywords:** temperate bats, cave, cryptic species, whiskered bat complex, Lower Austria

### Zusammenfassung

**Erster holozäner Nachweis der Nymphenfledermaus *Myotis alcathoe* in einer Höhle in Österreich.** Die Nymphenfledermaus *Myotis alcathoe* ist eine seltene Fledermausart, die in Ostösterreich vor allem in Laubwäldern zu finden ist. Wir berichten hier über den ersten Nachweis in einer Höhle in Österreich, einen Schädel Fund aus der Ritzlkesselhöhle (Katastrernummer 1815/400) in Niederösterreich.

Most temperate bat species use caves for swarming and hibernation due to constant climatic conditions and little disturbance (Dietz et al. 2016). In Austria, 16 of the 28 listed species are regularly found in caves (Spitzenberger & Bauer 2001, Bürger 2011, 2016) and many monitoring schemes are based on hibernation monitoring. Some species, however, are difficult to identify visually which complicates these monitoring schemes. For instance, the cryptic whiskered bat species complex consists of four species (Whiskered bat *Myotis mystacinus*, Brandt’s bat *M. brandtii*, Steppe whiskered bat *M. davidii*, and the Alcathoe bat *M. alcathoe*; see Dietz et al. 2016) in Central Europe, which are often impossible to identify without handling the bat. Handling hibernating bats, however, is not justified, because it poses the risk of awakening them. This again results in great energy loss and reduces the bats’ chance of surviving the winter period (Boyles 2017, Speakman et al. 1991). Thus, cryptic species are treated as species complex when they are found at hibernation sites. To detect those species in caves, skeletal remains of dead individuals allow identifying them to species level.

Since the first record of the *M. alcathoe* in Austria (Spitzenberger et al. 2008), the species has been found in several regions of Eastern Austria, mostly in old deciduous stands (Hüttmeir et al. 2010, Reiter et al. 2015). All findings have been recorded outside the hibernation period and cave findings have been missing, although several specimens have been captured at cave entrances during autumnal swarming (Gebhardt et al. 2016, Reiter et al. 2015). This, and since both living individuals and skeletal remains of *M. alcathoe* have been found in many underground sites in Europe (e.g. Sachanowicz et al. 2012, Vierhaus 2012) the species might use caves for hibernation. However, evidence for *M. alcathoe* within an Austrian cave was missing until now.

The cave “Ritzlkesselhöhle” (1425 m asl) is located close to the wilderness area “Dürrenstein” within the Natura 2000 site “Ötscher-Dürrenstein” (Site Code: AT1203A00) in Lower Austria. The landscape is characterised by subalpine vegetation of the northern limestone Alps. Dominant tree species are the mountain pine (*Pinus mugo*), the Norway spruce (*Picea abies*) and the European larch (*Larix decidua*). The cave is 701 m long with an altitude difference of 163 m and two entrances. The upper

entrance is a shaft of 2 m in diameter and more than 30 m deep which ends up in the roof of the "Pyramidenhalle" (Fischer et al. 2017).

In July 2013 three living individuals of the whiskered bat species complex were observed during a cave expedition. One skull of the Greater Mouse-eared bat *Myotis myotis* was found. In October 2014, two other skeletal parts were collected in the "Pyramidenhalle", of which one was identified as a cranium of *M. alcaethoe*. Collections were conducted under permission from the nature conservation department of Lower Austria (RU5-BE-517/005-2013).

We took measurements of the cranium (Condylbasal length - Cbl, braincase breadth - Bb, braincase height - Bch, width across the zygomatic arches - Zyg, length of the upper toothrow from the canine to the third molar - CM<sub>3</sub>, and the least width at the postorbital constriction - LPW) using a measuring eyepiece (Fig. 1). Cranial data of *M. alcaethoe* are scarce and existing measurements overlap with *M. mystacinus* (see Vierhaus 2012). Thus, we focused on qualitative traits following Vierhaus (2012) and Dietz & Dietz (2015) to identify the cranium. Dental characteristics were typical for *M. alcaethoe* (Fig. 2) and the lacrimal foramen was located at the edge of the orbit, which is a reliable identification criterion for *M. alcaethoe* (Vierhaus 2012).

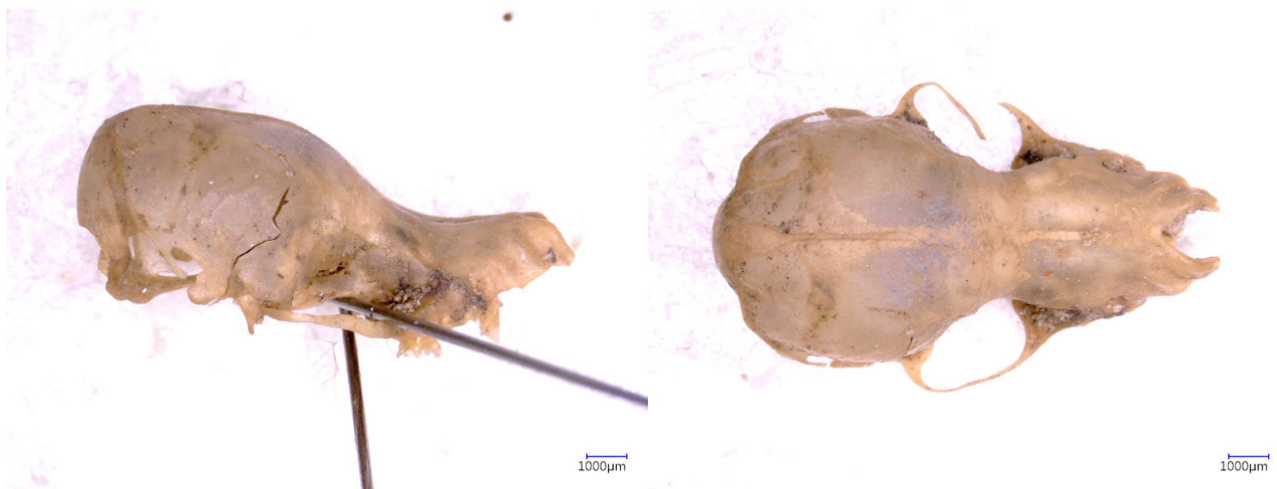


Fig. 1: Lateral and dorsal view on the cranium of *M. alcaethoe* with the typical concave shape of the frontal region and following measurements: Cbl 12.3 mm, Bb 6.2 mm, Bch 5.0 mm, Zyg 17.9, CM<sub>3</sub> 4.9 mm, LPW 3.2 mm (for abbreviations we refer to the main text).

The cranium was found at a higher altitude than previous records of *M. alcaethoe* in Austria. So far, the species has been found mostly in lower regions up to 945 m asl (Reiter et al. 2015). In Bulgarian caves, *M. alcaethoe* was recorded at altitudes up to 1450 m (Niermann et al. 2007) within habitat structures similar to the subalpine Ötscher-Dürrenstein region. Thus, *M. alcaethoe* seems to use caves outside its preferred foraging habitats (old deciduous stands).



Fig. 2: On the left a frontal view on the teeth of *M. alcathoe*. The Cingular cusp of the  $P^4$  and the Paraconuli on the  $M^2$  are clearly visible (black arrows). On the right a detailed view on the  $M^1$  and its Paraconulus (black circle).

We show that *M. alcathoe* uses or used caves in Austria similar to other locations in Europe. Since there are no summer records of *M. alcathoe* within the region (Fischer 2016, Knoll et al. 2016), and we do not know the exact age of the cranium, we cannot confirm it as a current element of the local bat fauna. Mist netting at the cave entrances during autumnal swarming could reveal if *M. alcathoe* is still present within the region.

#### Acknowledgements

We thank the Working Group on Karst and Caves of the Natural History Museum Vienna (NHMW) for their support in all respects and the University of Natural Resources and Life Sciences for granting access to the microscope we used to take pictures of the cranium. We also thank the Mammal collection of the NHMW for providing reference specimens. We also would like to give special thanks to the caving expedition group (C. Gegenhuber, T. Gundacker, E. Herrmann & W. Labaky), especially Walter Fischer, who discovered the cave and was driving force for its exploration.

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