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## Review of the Late Pleistocene Soricidae (Mammalia) fauna of the Vaskapu Cave (North Hungary)

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(with 2 figures, 2 tables and 1 plate)

The summary of the Late Pleistocene Soricidae remains of the North Hungarian Vaskapu Cave II and VII localities is given in the present paper. Five species (*Sorex alpinus* SHINZ, 1837, *Sorex minutus* LINNAEUS, 1766, *Sorex araneus* LINNAEUS 1758, *Crocidura russula* HERMANN, 1780 and *Crocidura suaveolens* PALLAS, 1811) were identified in the fauna. The species composition of the shrew assemblage indicates cold climate with diversified ecotypes in the mountain surroundings, with forests and open grasslands as well. Also the new location (in the Stratigraphical Collection of the Department of Paleontology and Geology at the Hungarian Natural History Museum) with definitive inventory numbers of the formerly published Vaskapu fossils is present here.

### Introduction

The first report of the Late Pleistocene fauna of the Vaskapu Cave was given by Kadič and Mottl (1938). János Hír and Lukács Mészáros collected another fossil sample from Vaskapu II locality, of which Soricid species were published by MÉSZÁROS (1999). The further excavations carried out by L. Mészáros, M. Kázmér, I. Szente, A. Virág and A. Sóron yielded more shrew remains, with new species. A review of the shrew assemblage, with its palaeoecological implications, was required, because of the new results (Fig. 1).

MÉSZÁROS (1999) mentioned 3 *Sorex* species (*S. alpinus*, *S. minutus*, and *S. araneus*) from the Vaskapu II site. In contrast, two additional taxa (namely *Crocidura russula* and *Crocidura suaveolens*) are reported here. Only the soricid elements of the fauna are present in this paper. For the complete presentation of the Vaskapu fissure system and its microvertebrate assemblage see the article published in the present volume by VIRÁG et al. (2013).

### Material and method

Because of the not definitive inventory, the material described and figured by MÉSZÁROS (1999) was mentioned only with “working numbers”. At present all the Vaskapu findings are stored in the Stratigraphical Collection of the Department of Palaeontology and Geology at the

Hungarian Natural History Museum, Budapest. The detailed data and the catalogue numbers of the old and the new Soricidae material are given in Tabs 1-2. Morphological terms in Pl. 1 are used after REUMER (1984).

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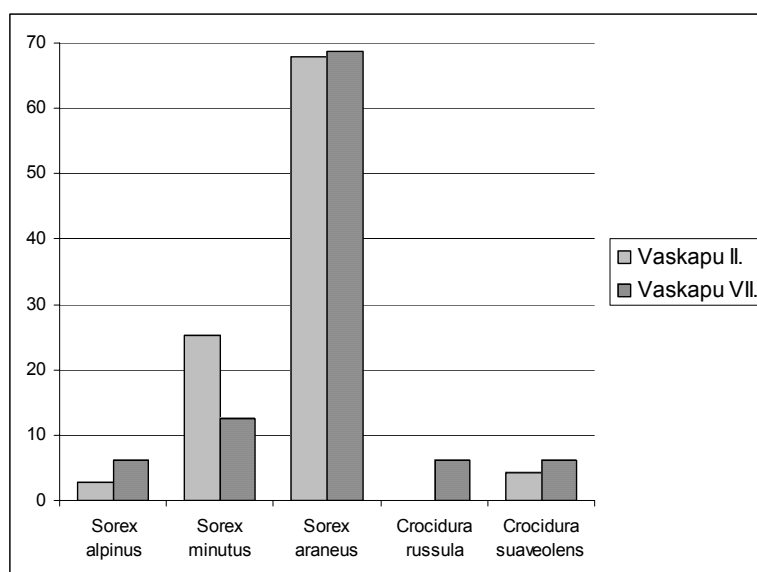


Figure 1. Species composition of the Vaskapu Soricidae faunas (% of the specimens)

## Systematic review

Shrews have dilambdodont molars and elongated lower incisors, usually with a variable number of low cusplets along the edge of the latter. A dark red pigmentation is often present on the top of the dental cusps in the case of the group Soricinae (see on Pl. 1, Fig. 1-3), while Crocidurinae have white teeth, because they lack the aforementioned pigment. In the case of the latter group, the dorsal edge of the lower incisor is rather smooth, with traces of cusplets only (see on Pl. 1, Fig. 4 and 5).

### *Subfamily Soricinae*

According to RZEBIK-KOWALSKA (1995), the Soricinae forms (pigmented toothed shrews), especially genus *Sorex* are adapted colder environment, than the Crocidurinae. They prefer wet, wooded environments to the open grasslands. Since they live in cold regions, they are characterized higher metabolic levels and average body temperature, than Crocidurinae.

Genus *Sorex* LINNAEUS, 1758

*Sorex alpinus* SHINZ, 1837

- 4 specimens from the Vaskapu II and 1 from the Vaskapu VII site.

*Sorex minutus* LINNAEUS, 1766

- 36 specimens from the Vaskapu II and 2 from the Vaskapu VII site (Pl. 1 Figs 1-2)

*Sorex araneus* LINNAEUS, 1758

- 96 specimens from the Vaskapu II and 11 from the Vaskapu VII site (Pl. 1 Fig. 3)

### *Subfamily Crocidurinae*

This subfamily (Crocidurinae or white-toothed shrews) contains mainly tropical forms. They differ from Soricinae mainly in their preferences, concerning humidity. They are adapted to more arid conditions than are Soricinae (RZEBIK-KOWALSKA 1995).

Genus *Crocidura* WAGLER, 1862

*Crocidura russula* HERMANN, 1780

- 1 specimen from the Vaskapu VII site (Pl. 1 Fig. 4)

*Crocidura suaveolens* PALLAS, 1811

- 6 specimens from the Vaskapu II and 1 from the Vaskapu VII site (Pl. 1 Fig. 5)

## Palaeoecological conclusions

On the basis of the shrew fauna (with many *Sorex araneus* and *Sorex minutus* findings, and the occurrence of the Alpine shrew, *Sorex alpinus* in

the sample), MÉSZÁROS (2003) raised the idea of the presence of an "Alpine ecotope" in the higher areas of the Bükk Mountains during the time of the

sedimentation of the Vaskapu Cave layers. This ecological change could be caused by the cold climate in the Pilisszántó Horizon (Late Würm). He supposed that there could be occurred open mountain vegetation in the Bükk Plateau, somewhat higher than the studied locality, which could be situated in the pine forest zone. The model is in agreement with the taphonomical observations of SÓRON & VIRÁG (2009), according to which the remains were transported to the plateau at the top of the Vaskapu VII locality by a stream from a somewhat higher area with both forest and open vegetation. The fossil ecosystem, which was determined in the Bükk

Mountains, was very similar to the recent communities of the European high mountains (MÉSZÁROS 2004). This view is not refuted by the new *Crocidura* findings in the locality (Fig. 2). MÉSZÁROS (2011) studied recent sedimentations of similar samples to the fossil ones in the high mountain ecosystems (Eastern Austria, Rax Alps.) Comparison of the fossil and recent samples supported the hypotheses, that the Vaskapu localities actually represent an Alpine ecosystem. Although *Crocidura* species usually indicate some warmer and more arid climate than *Sorex* ones, however, the forms mentioned here rarely occur in the open mountain vegetation of the Rax Plateau.

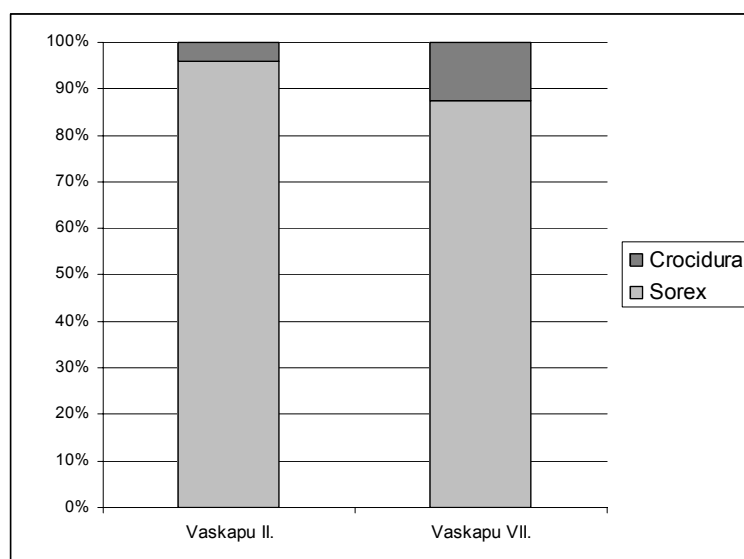


Figure 2. Generic composition of the Vaskapu Soricidae faunas (% of the specimens)

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Table 1. New location of the Vaskapu II. Soricidae material in the Stratigraphical Collection of the Department of Palaeontology and Geology at the Hungarian Natural History Museum.

| Catalogue number | Material   | Collected by                          | First report in  | Figured in               |
|------------------|--|---------------------------------------|------------------|--------------------------|
| VK2.S.1.         | <i>Sorex alpinus</i><br>left mandible fragment                       | Hír and Mészáros (1994)               | Mészáros<br>1999 | Mészáros 1999,<br>fig. 4 |
| VK2.S.2.         | <i>Sorex minutus</i><br>right mandible                               | Hír and Mészáros (1994)               | Mészáros<br>1999 | Mészáros 1999,<br>fig. 3 |
| VK2.S.3.         | <i>Sorex minutus</i><br>left mandible                                | Hír and Mészáros (1994)               | Mészáros<br>1999 | This paper               |
| VK2.S.4.         | <i>Sorex minutus</i><br>right maxillary fragment                     | Hír and Mészáros (1994)               | Mészáros<br>1999 | -                        |
| VK2.S.5.         | <i>Sorex minutus</i><br>16 mandible fragments and lower teeth        | Hír and Mészáros (1994)               | Mészáros<br>1999 | -                        |
| VK2.S.6.         | <i>Sorex araneus</i><br>left mandible                                | Hír and Mészáros (1994)               | Mészáros<br>1999 | Mészáros 1999,<br>fig. 1 |
| VK2.S.7.         | <i>Sorex araneus</i><br>right maxillary fragment                     | Hír and Mészáros (1994)               | Mészáros<br>1999 | Mészáros 1999,<br>fig. 2 |
| VK2.S.8.         | <i>Sorex araneus</i><br>45 mandible fragments and lower teeth        | Hír and Mészáros (1994)               | Mészáros<br>1999 | -                        |
| VK2.S.9.         | <i>Sorex araneus</i><br>20 maxillary fragments and upper teeth       | Hír and Mészáros (1994)               | Mészáros<br>1999 | -                        |
| VK2.S.10.        | <i>Sorex alpinus</i><br>3 mandible fragments                         | Kázmér, Mészáros and<br>Szente (2002) | This paper       | -                        |
| VK2.S.11.        | <i>Sorex minutus</i><br>12 mandible fragments and lower teeth        | Kázmér, Mészáros and<br>Szente (2002) | This paper       | -                        |
| VK2.S.12.        | <i>Sorex minutus</i><br>3 maxillary fragments and upper teeth        | Kázmér, Mészáros and<br>Szente (2002) | This paper       | -                        |
| VK2.S.13.        | <i>Sorex araneus</i><br>13 mandible fragments                        | Kázmér, Mészáros and<br>Szente (2002) | This paper       | -                        |
| VK2.S.14.        | <i>Sorex araneus</i><br>1 maxillary fragment and 1 upper tooth       | Kázmér, Mészáros and<br>Szente (2002) | This paper       | -                        |
| VK2.S.15.        | <i>Crociodura suaveolens</i><br>5 mandible fragments and lower teeth | Kázmér, Mészáros and<br>Szente (2002) | This paper       | -                        |
| VK2.S.16.        | <i>Crociodura suaveolens</i><br>right maxillary fragment             | Kázmér, Mészáros and<br>Szente (2002) | This paper       | -                        |
| VK2.S.17.        | <i>Sorex minutus</i><br>right mandible fragment                      | Sóron and Virág 2005-<br>2009         | This paper       | -                        |
| VK2.S.18.        | <i>Sorex minutus</i><br>right maxillary fragment                     | Sóron and Virág 2005-<br>2009         | This paper       | -                        |
| VK2.S.19.        | <i>Sorex araneus</i><br>15 mandible fragments and lower teeth        | Sóron and Virág 2005-<br>2009         | This paper       | -                        |
| VK2.S.20.        | <i>Crociodura suaveolens</i><br>left mandible fragment               | Sóron and Virág 2005-<br>2009         | This paper       | -                        |

Table 2. New location of the Vaskapu VII. Soricidae material in the Stratigraphical Collection of the Department of Paleontology and Geology at the Hungarian Natural History Museum.

| Catalogue number | Material  | Collected by                       | First report in | Figured in |
|------------------|---|------------------------------------|-----------------|------------|
| VK7.S.21.        | <i>Sorex alpinus</i><br>right mandible fragment         | Kázmér, Mészáros and Szente (2002) | This paper      | -          |
| VK7.S.22.        | <i>Sorex minutus</i><br>left mandible                   | Kázmér, Mészáros and Szente (2002) | This paper      | This paper |
| VK7.S.23.        | <i>Sorex minutus</i><br>right mandible fragment         | Kázmér, Mészáros and Szente (2002) | This paper      | -          |
| VK7.S.24.        | <i>Sorex araneus</i><br>left mandible                   | Kázmér, Mészáros and Szente (2002) | This paper      | This paper |
| VK7.S.25.        | <i>Sorex araneus</i><br>10 mandible fragments and teeth | Kázmér, Mészáros and Szente (2002) | This paper      | -          |
| VK7.S.26.        | <i>Crocidura russula</i><br>left mandible               | Kázmér, Mészáros and Szente (2002) | This paper      | This paper |
| VK7.S.27.        | <i>Crocidura suaveolens</i><br>right mandible           | Kázmér, Mészáros and Szente (2002) | This paper      | This paper |

## Plate 1

1. *Sorex minutus* (VK2.S.3.) left mandible in lingual view from the Vaskapu II site.
2. *Sorex minutus* (VK7.S.22.) left mandible in buccal view from the Vaskapu VII site.
3. *Sorex araneus* (VK7.S.24.) left mandible in buccal view from the Vaskapu VII site.
4. *Crocidura russula* (VK7.S.26.) left mandible in buccal view from the Vaskapu VII site.
5. *Crocidura suaveolens* (VK7.S.27.) right mandible in buccal view from the Vaskapu VII site.

## Abbreviations:

**c** = caninus;  
**i** = incisivus;  
**m** = molaris;  
**maf** = mandibular foramen;  
**mef** = mental foramen;  
**p** = praemolaris;  
**pang** = processus angularis;  
**pcond** = processus condyloideus;  
**pcor** = processus coronoideus.

Plate 1

