Introduction

Fossil and subfossil findings of ursids are relatively frequently found in individual Slovak sites, which are dated to the period from the Middle Miocene to the beginning of the Holocene. However, their presence is especially restricted into caves and karst fissures only. The oldest findings of bear fossil remains from Slovak caves have already been known as "dragon bones" in the Middle Ages (SCHMIDT, 1970).

So far, findings of representatives of the both ursid subfamilies Hemicyoninae and Ursinae have been described from more than 70 sites in the territory of Slovakia. Generally, approximately 16 fossil and subfossil ursid taxa are known: Hemicyon sansaniensis LARTET, 1851; Hemicyon cf. sansaniensis LARTET, 1851; Hemicyon goeriakensis (TOULA, 1884), Ursus breviriinus (HOFMANN, 1887); Ursus thibetanus mediterraneus (FORSYTH MAJOR, 1872); Ursus thibetanus cf. mediterraneus (FORSYTH MAJOR, 1872); Ursus deningeri REICHENAU, 1904; Ursus cf. deningeri REICHENAU, 1904; Ursus spelaeus ROSENMÜLLER et HEINROTH, 1794; Ursus cf. taubakensis (RODE, 1931); Ursus arctos ssp. LINNÉ, 1758; Ursus arctos priscus GODFUSS, 1822; Ursus arctos cf. priscus GODFUSS, 1822; Ursus arctos arctos LINNÉ, 1758; Ursus sp.; and Ursidae gen. et spec. indet. (cf. Ursus minimus DEVÉZE et BOUILLÉ, 1827). This article yields comprehensive view on their distribution in the Slovak territory of the Western Carpathians in both time and space.

Chronostratigraphic and geographic distribution of ursids in Slovakia

Findings of the oldest representatives of the Ursidae in the territory of Slovakia come from sediments dated to Middle Miocene (Middle to Late Badenian). They belong to two subfamilies - Hemicyoninae and Ursinae.

ZAPFE (1950) described Hemicyon sansaniensis (and/or H. cf. sansaniensis) from a karst fissure of Devinska Nová Ves - Stockerau limestone pit locality (Neudorf - Spalte) (Fig. 1A, Tab. 1), which is filled by terrestrial sediments of the Middle Badenian (Astaracian, MN 6a) (FEJFAR, 1997). However, after GINSBURG (1999), this ursid species was only extended in the territory of Western Europe (France and Spain, MN 5b - 6), whereas the approximately equally large species H. goeriakensis lived in the territory of Central Europe during the MN 6 - 9 period. Thus, it is not out of the question that ZAPFE’s findings also belong to this taxon. Otherwise, Stockerau limestone pit will represent the easternmost occurrence of the species H. sansaniensis.

Fossil findings of Hemicyon goeriakensis, originally mentioned by THENIUS (1952) as H. sansaniensis, have been found in the Late Badenian off-shore marine sands of Sandberg site (Astaracian, MN 6b - 7/8) (Fig. 1A, Tab. 1). During this period, H. goeriakensis also spread into Western Europe, where together with giant Dinocyon thenardi JOURDAN, 1861 replaced H. sansaniensis (GINSBURG, 1999).

Ursus breviriinus is next ursid species found in the territory of Slovakia. After GINSBURG (1999), it is one of the oldest representatives of the subfamily Ursinae. The stratigraphic distribution of this species moves from MN 4 to MN 6. ZAPFE (1950) describes this as wolf large ursid from the fissure in Stockerau limestone pit too (Fig. 1, Tab. 1). Findings, mentioned by THENIUS (1952) from Sandberg, probably also belong to this taxon. However, it is not out of the question that Sandberg remains can belong to next species of Ursavus (e. g. U. primaevus (GAILLARD, 1899), which fossils come from sediments of MN 7 - 9, or U. intermedius VON KOENIGSWALD (MN 6 az MN 7) (GINSBURG, 1999), mentioned by ERDBRINK (1953) from Germany).

None fossil ursid findings from the Late Miocene to the Early Pliocene are known from Slovakia to date. However, the presence of the Early Pliocene Ursus boecki SCHLOSSER, 1899 in Hungary do not exclude a possibility of the existence of this or other forms of early representatives of Ursus in the territory of Slovakia. Also, the presence of other populations with obscure progressive characters in the subsequent Plio-Pleistocene period can be assumed (SCHMIDT, 1970). This assumption was con-
Fig. 1. Findings of ursids in the territory of Slovakia (A - findings of Hemicyoninae, B - findings of Ursinae).


<table>
<thead>
<tr>
<th>Taxon</th>
<th>Number of Sites</th>
<th>MN/WQ range</th>
<th>Europe</th>
<th>Slovakia</th>
<th>References</th>
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<tbody>
<tr>
<td>Hemicynus (cf.) sansamieresi Lartet, 1851</td>
<td>1</td>
<td>MN 5b - 6</td>
<td>MN 6a</td>
<td></td>
<td>Zapf, 1950</td>
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<tr>
<td>Hemicynus insignis (Toula, 1884)</td>
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<td>MN 9 - 10</td>
<td>MN 6b - 7b</td>
<td></td>
<td>Grabštejn, 1999</td>
</tr>
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<td>Ursus brevifemur (Hoffmann, 1877)</td>
<td>2</td>
<td>MN 4 - 5</td>
<td>MN 6 - 7b</td>
<td></td>
<td>Therien, 1952</td>
</tr>
<tr>
<td>Ursidae gen. et spec. indet. (cf. Ursus minisimus Debréz &amp; Bouillet, 1827)</td>
<td>1</td>
<td>MN 16 - 17</td>
<td>MN 16a</td>
<td></td>
<td>Zapf, 1950</td>
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<tr>
<td>Ursus (cf.) deningeri Reichenau, 1904</td>
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<td>MQ 1</td>
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<td>Horacek &amp; Loze, 1987, 1988</td>
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<td>Ursus spelaeus Rosenmüller et Hennebrock, 1794</td>
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<td>MQ 2 - MQ 3</td>
<td>MQ 2</td>
<td></td>
<td>Musá, 1996 Sabol, 1999</td>
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<tr>
<td>Ursus arctos (cf.) priscus Gadow, 1822</td>
<td>2</td>
<td>MQ 2 - MQ 3</td>
<td>MQ 2</td>
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<td>Sabol, 1999</td>
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<td>Ursus arctos arctos Linne, 1758</td>
<td>7</td>
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<td>Holocene</td>
<td></td>
<td>Ambroz, 1990 Hoz, 1951</td>
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<tr>
<td>Ursus arctos ssp.</td>
<td>9</td>
<td>MQ 2 - Holocene</td>
<td>MQ 2 - Holocene</td>
<td></td>
<td>Fejfar &amp; Sery, 1964 Skutil, 1938 Volko-Starohorsky, 1929</td>
</tr>
</tbody>
</table>

Tab. 1. Distribution of ursids in the Slovak territory of the Western Carpathinas.

firmed, when ursid front premolar (P1 or p3) has been found during new research of Hajnáčka I site (Villafranchian, MN 16a) (Fig. 1, Tab. 1). Probably, this tooth (determined for the present as Ursidae gen. et spec. indet. only) belongs to Ursus minimus DEVÉZE et BOUILLET, 1827, which is one of the typical representatives of European Late Pliocene mammalian faunas (Late Ruscinian - Vilanian).

During the Plio-Pleistocene and the Early Pleistocene, Ursus thibetanus mediterraneus (and/or U. thibetanus cf. mediterraneus) lived in the Slovak territory of the Western Carpathians. It is probably close relative of recent U. thibetanus, which represents a relict of small bears from the Late Pliocene to the Early Pleistocene (ERD-Brink, 1953). Fossil findings of this taxon are
known from several sites in the Mediterranean area, whence migrated into Central European territory during warmer periods. Its remains have been found in sites Írany (Late Villafranchian - Early Biharian) (FEJFAR, 1960, 1963), Gombasek 1 (Early Cromerian) (FEJFAR, 1961; HORÁČEK & LOZEK, 1988), and Vceláre 3 (Vilanian/Biharian) (KERNÁTSOVÁ, 1994) (Fig. 1, Tab. 1).

_Urus deningeri_ REICHENAU, 1904 was relatively spread in Europe during the Early to Middle Pleistocene. This problematic descendant of _U. etruscus_ belongs to the so-called "deningeri-group", including chronological and morphological different populations and subspecies, or species resp. (MUSIL, 1969). So far, its fossils are mentioned from 4 localities - Vceláre (Early Pleistocene) (HOLEC, 1986), Honce (Early Pleistocene) (HORÁČEK & LOZEK, 1987), Gombasek 1 (Early Cromerian) (HORÁČEK & LOZEK, 1988), and Skalka (older phase of Late Biharian) (LOZEK & HORÁČEK, 1984). Findings of _U. etruscus gombaszoegensis_, described by KRETZOI in 1938 from Gombasek, belong probably to the species _U. deningeri_ too (TORRES, pers. comm.) (Fig. 1, Tab. 1). On the basis of findings in the Hundsheim Mts. (ZAPFE, 1946), SCHMIDT (1970) also assumed the presence of this species in the Little Carpathians Mts. However, fossils of Deningeri bear have not been found here to date.

Cave bear - _Ursus spelaeus_ achieved the largest distribution from all ursids found in the Slovak territory of the Western Carpathians. Hereby, it is the most frequently occurring fossil bear during the Pleistocene of Slovakia (Fig. 2). Its fossil remains are known from more than 60 sites dated from the Middle to Late Pleistocene (Fig. 1, Tab. 1) (SABOL, in press). The stratigraphical oldest findings of cave bears come from base sediments of the Jasov Cave in southern Slovakia. Their age was determined to the period from the end of the Warthe (Rakyteovce Glacial in the Tatra Mts.) to the beginning of the Last Glacial (Strbské pleso Glacial in the Tatra Mts.) (LOZEK et al., 1957). However, it is not excluded that cave bears have already been present in the territory of the Western Carpathians during the Middle Pleistocene. Cave bears achieved the largest distribution in the next period of the Late Pleistocene, especially during the Weichselian. The last populations of cave bears died out in the territory of Slovakia gradually in the time between 10,000 to 15,000 BP (SCHMIDT, 1970), when atypical lesser individuals (e. g. from the Bear Cave under Sivy hill) still lived together with relatively large ones. Some skulls of these large individuals are longer than 50 cm (e. g. from the Bear Cave in the Slovensky raj Mts.)! Probably, this part of Slovakia represented one of the last refuges of relatively large cave bears in Central Europe during changing environment in the time of the end of the Pleistocene and the beginning of the Holocene.

Big arctoid bear is rarely occurring in the Slovak territory of the Western Carpathians during the Eemian. Its fossil remains have been described as

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_Fig. 2. Proportional expression of the number of Slovak sites, where fossil and subfossil osteological remains of ursids have been found._

54
**Ursus cf. taubachensis** (RODE, 1931) from Certová pec Cave (MUSIL, 1996) and karst fissure in the travertine pit Besenová – "Báná" (Fig. 1, Tab. 1). This bear taxon was especially spread in Central Europe during the Eemian and the beginning of the Last Glacial. It probably migrated into the Western Carpathians area from the South, whence expanded northward during warmer periods (MUSIL, 1996).

Besides Taubach bear, other relatively giant arctoid bear **Ursus arctos priscus** (and/or **U. arctos cf. priscus**) lived in the Slovak territory during the Last Glacial. It was especially spread in mountain areas of Central Slovakia. Its findings have been found in the sites Vazec Cave, Lísková Cave, Vyvieranie Cave, Kupcovie izbička Cave, and probably in the Okno Cave (SABOL, 1999) (Fig. 1, Tab. 1). However, this as grizzly large fossil brown bear died out in Europe together with cave bears at the end of the Pleistocene too.

With the beginning of the Holocene, the recent European brown bears (**Ursus arctos arctos**) appear in the Slovak territory of the Western Carpathians. Their presence is the result of some migration waves of brown bears from the southern Europe, probably from the Balkan Peninsula, whence they migrated northward during warmer periods (MUSIL, 1996). Fossil findings of this recent ursid taxon from the Lukác Abyss (southeastern Slovakia), which belong among the oldest remains, are the evidence of that (Fig. 1, Tab. 1). Original distribution of recent European brown bears in the territory of all Europe is only insular in recent Western Europe, and mountains of Central and Northern Slovakia represent a western boundary of their continuous distribution in Eurasia today. However, subfossil (or fossil resp.) remains from the Silická Brezová (HOKR, 1951), Bear Cave near Ruzín (AMBROS, 1990), Líscia Cave in the Little Carpathians Mts., Bear Cave – Huciaky, Klenovec, and Sipová Cave are the evidence of their larger distribution in Slovakia. It also is not out of the question that findings, described only as **Ursus arctos ssp.** from the Jasov Cave (VOLKO-STARKOVSKY, 1929), N III Cave in the Tatras Mts. (FEJFAR & SEKYRA, 1964), Lucívná (SKUTIL, 1938), Nová éra Cave (HOLEC, pers. comm.), Belianska Valley, Cervená Magurka Cave, Pod Úplazom Cave, Psie diery Cave, and Moldava Cave, belong to representatives of the subspecies **U. arctos arctos** (Fig. 1, Tab. 1).

**Conclusions**

Fossil and subfossil remains of ursids are relatively frequently found in the territory of Slovakia, especially in the Late Pleistocene sediments. So far, approximately 79 sites are known in Slovakia, where findings of 10 to 16 ursid taxa have been found in sediments dated from the Middle Miocene to the Holocene. Most of fossils (mainly cave bears) come from the Late Pleistocene cave sediments, which have especially been deposited during the Last Glacial period. Also, ursid have been represented rarely frequently in the last as from the view point of paleopopulation amount so from the view point of taxa number during single geological periods. Thus, paleontological findings yield new information important not only for geology, but also for biology. The better knowledge of the paleobiocenosis composition and environment in the last is a result of that.

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**References**


