A STUDY OF SUCCESIONAL PROCESSES ON TRAVERTINES IN THE HORNÁDSKA KOTLINA VALLEY (SLOVAK REPUBLIC) ON THE BASIS OF MOLLUSCS (*Mollusca*)

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Abstract

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Travertines, as mostly Quaternary sediments, are a significant object for the study of the successional processes of plant and animal communities. In the Hornádska kotlina valley there are several different-aged travertine sites whose genesis is known, but the molluscan fauna has not been complexly assessed until now. This paper presents results on the succesional stages of mollusc communities in eight of the most significant travertine sites – Baldovce (Kamenec), Dreveník, Kozia hora, Ostrá hora, Pažica, Sivá Brada, Sobocisko and Spiš castle hill. These localities are also important due to the presence of several rare and endangered mollusc taxa such as *Clausilia dubia ingenua, C. d. carpatica, Chondrula tridens eximia, Vertigo angustior, Pupilla alpicola, P. triplicata, P. sterri, Helix lutescens* etc.

Key words: Mollusca, travertines, ecosozoology, succession, Hornádska kotlina valley, Slovakia

Introduction

Molluscs are animals with calcareous shell (excluding slugs), which protect their body against negative natural factors and, in special cases, against predators. Their habitat is main source of the components which are necessary for shell creation. That is why molluscs are very sensitive to the content of $CaCO_3$ in their habitat. From this point of view, there are favourable habitat conditions in the south-eastern part of the Hornádska kotlina valley, mainly in the following localities: Dreveník, Spišský hradný vrch, Sivá Brada, Pažica,

Sobocisko, Ostrá hora and Kozia hora. There are relatively sufficient malacozoological data from constituent geological periods. Kovanda (1971) summarized the data on malacofauna and travertin evolution of these localities in a monograph about Quaternary limestones of former Czechoslovakia. On the other hand, there are poor data about recent malacofauna. Unfortunately, the passing of V. Lučivjanská on September 28th 1993 (Šteffek, 1996) was the main reason that her data about molluscs of these sites have not yet been published. We hold V. Lučivjanská in high regard and we would like to present the results of her research in combination with data obtained 10–15 years ago.

Materials and methods

Standard methods were used during this research (sampling of travertines and manual picking of shells). Dry samples were sieved through sieves of different mesh size and individual shells were colected.

The majority of the presented data is adapted from the database of Dr. V. Lučivjanská (1981–1988), recent data (1987–2002) were gained by the co-authors. Zoological nomenclature follows the papers of Falkner et al. (2001) and Šteffek, Grego (2002).

The explanations for abbreviations – **E – ecoelement** [sensu Lisický, 1991]:
1 forest species – silvicolae • SI, SI(p)
2 predominant forest species • SI(AG), SIth, SI(HG)
3 species of forest wetlands • SIh
4 steppe species – stepicolae • ST, STp, ST(SI)
5 species of open ground area – patenticolae • PT, PTp, PT(SI), SS
6 xerophilic species – xericolae • XR
7 mesophilic species – agricolae • AG, AGp, SIp
8 hygrophilic species – hygricolae • HG
9 species of wetlands – ripicolae • RP
10 aquatic species • RV (rivicolae), SG (stagnicolae), PD (paludicolae), FN (fonticolae)
h (hygrophilic), **p** (petrophilic), **th** (thamnophilic)
$\sum$ – total species/specimen

Recent knowledge about malacofauna of the studied area

The first data of fossil malacofauna of **Dreveník** were published in Petrbok (1926, 1927, 1931, 1935, 1936, 1937). Ložek (1964b) compiled genesis and age of the Spiš travertines. Sporadic data of some recent mollusc species can be found in the contributions of Brabenec (1954), Hudec (1964), Ložek (1958, 1963), Mácha (1985), Petrbok (1932), Vostál (1983) and Šteffek (1994). J. Brabenec and V. Hudec described a new subspecies, *Clausilia dubia ingenua*, with a sparse-rib shell structure in the locality of Dreveník (Hudec, Brabenec, 1963). The taxons of the genus *Clausilia* with sparse-rib shell structure within the whole area of Slovakia were evaluated in a monograph of Hudec (1967). Kholová et al. (1980), Ložek (1955, 1956, 1964a, 1973), Koreň, Šteffek (1996) and Lisický (1991) were concerned with the recent malacofauna of Dreveník. In 1967 T. Weisz studied molluscs of Dreveník, the Spišský hrad castle and Sivá Brada hill. His data were published in Lučivjanská and Šteffek (1991). Šteffek realised a detailed study of the molluscs of Dreveník in 1987 (Šteffek, 1988). The occurrence of the *Pupilla bigranata* reported by Ložek (1954) is improbable. In this paper all published and unpublished data of the malacofauna of Dreveník, including the unpublished data of Šteffek from 1995, are presented.

Recent malacofauna of the **Spišský hradný vrch** hill was first described in Brabenec (1954); other data were published in Ložek (1956, 1958) and Šteffek (1988). Some of the above-mentioned malacozoologists studied this site, but their data have not been published. Šteffek collected molluscs from the vicinity of the Spišský hradný

vrch hill in 1991, 1993, 1995 and 1997; Grego took one sample of molluscs from a burned area in 2002. Their data are included in this contribution.

Malacofauna of the **Sivá Brada** is not well known when compared to previous localities. Petrbok (1926, 1936) and Ložek (1955) mainly published data of fossil malacofauna, while recent data about the occurrence of *Helix lutescens* were recorded by Ložek (1958). In 1962, S. Mácha performed field research of this locality, but only information about the occurrence of *Deroceras sturanyi* was published (Hudec, 1970). Detailed data about the mollusc community of the Sivá Brada, together with vegetation characteristics, are in the paper of Šteffek, Barlog (1991). There, data gained in 1991, 1993 and 1995 are included with emphasis on the re-evaluation of the boundaries of the National Nature Reserve Sivá Brada.

The malacofauna of **Pažica** was studied only by Ložek (1958), Lučivjanská (1986, unpubl.) and Šteffek (1993, unpubl.) The unpublished data are presented and included in this paper.

Knowledge on mollusc diversity of **Baldovce**, **Kozia hora**, **Ostrá hora** and **Sobocisko**, which were collected by Lučivjanská in 1986 and 1988, have not yet been published. The data from these sites are unique, except of those dealing with the occurrence of *Helix lutescens* in Kamenec (Baldovce), the Ostrá hora and Sobocisko (Ložek, 1958).

Results

Scientific summary of recorded malacofauna

There are 88 recent mollusc species, including 1 subspecies, within the travertine sites of the Hornádska kotlina valley. This assemblage represents about 30% of all mollusc species known from Slovakia. With respect to the relative small area of this region, a very high diversity of malacofauna can be attributed to these sites. The species are listed according to Šteffek and Grego (2002); for each species the areotypes (choroelements) and ecoelements (sensu Lisický, 1991) are defined, localities of occurrence and abbreviation of the names of authors of published papers (bbc – J. Brabenec, grg – J. Grego, hdc – V. Hudec, kpv – V. Lučivjanská-Kroupová, lzk – V. Ložek, mch – S. Mácha, sff – J. Šteffek, vst – Z. Vostál) are added. Unpublished data are printed in bold.

GASTROPODA

Aciculidae

Platyla polita (W. H a r t m a n n, 1840). Central European; 1 SI; Dreveník (**sff**), Spišský hradný vrch (**kpv**)

Hydrobiidae

Bythinella austriaca (F r a u e n f e l d, 1857). East-Alpine-Carpathian; 10 FN; Spišský hradný vrch – subfossil (**kpv**)

Valvatidae

Valvata cristata O. F. M ü l l e r, 1774. Palearctic; 10 PD; Baldovce (**kpv**)

Lymnaeidae

Galba truncatula (O. F. M ü l l e r, 1774). Holarctic; 10 SGPD(-t); Baldovce (**kpv**), Sivá Brada (sff)

Planorbidae

Anisus leucostoma (M i l l e t, 1813). Palearctic; 10 PDt; Baldovce (**kpv**)

Anisus septemgyratus (R o s s m ä s s l e r, 1835). East-European-West-Siberian; 10 PD; Sivá Brada **(sff**)

Bathyomphalus contortus (L i n n a e u s, 1758). Palearctic; 10 SGPD; Sivá Brada (**sff**)

Carychiidae

Carychium minimum O. F. M ü l l e r, 1774. Euro-Siberian; 9 RP; Baldovce (**kpv**), Dreveník (**sff**), Sivá Brada (sff)

Carychium tridentatum (R i s s o, 1826). European; 8 HG; Dreveník (sff)

Succineidae

Succinella oblonga (D r a p a r n a u d, 1801). Euro-Siberian; 8 HG; Baldovce (**kpv**), Pažica (**kpv)**, Sivá Brada (**kpv,** sff)

Succinea putris (L i n n a e u s, 1758). Euro-Siberian; 9 RP; Baldovce (**kpv**)

Cochlicopidae

Cochlicopa lubrica (O. F. M ü l l e r, 1774). Holarctic; 7 AG; Baldovce (**kpv**), Pažica (**kpv)**, Sivá Brada (**sff)**

Cochlicopa lubricella (R o s s m ä s s l e r, 1834). Holarctic; 6 XR; Dreveník (bbc, **kpv,** sff), Pažica (**kpv**, **sff**), Ostrá hora (**kpv**), Sivá Brada (**kpv,** sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**)

Orculidae

Sphyradium doliolum (B r u g u i è r e, 1792). Central European-Meridional; 1 SI; Dreveník (bbc, **kpv,** sff), Spišský hradný vrch (**kpv**)

Valloniidae

Acanthinula aculeata (O. F. M ü l l e r, 1774). West-Palearctic; 1 SI; Dreveník (**kpv**), Spišský hradný vrch (**kpv**)

Vallonia costata (O. F. M ü l l e r, 1774). Holarctic; 5 PT(SI); Baldovce (**kpv**), Dreveník (bbc, **kpv,** sff), Kozia hora (**kpv**), Ostrá hora (**kpv**), Pažica (**kpv,** sff), Sivá Brada (**kpv,** sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Vallonia excentrica S t e r k i, 1893. Holarctic; 5 PT; Dreveník (**kpv,** sff), Kozia hora (**kpv**), Ostrá hora (**kpv**), Pažica (**kpv**), Sivá Brada (**kpv, sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Vallonia pulchella (O. F. M ü l l e r, 1774). Holarctic; 5 PT; Baldovce (**kpv**), Dreveník (bbc, **kpv,** sff), Kozia hora (**kpv**), Ostrá hora (**kpv**), Pažica (**kpv**, Sivá Brada (**kpv,** sff), **sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Pupillidae

Pupilla alpicola (C h a r p e n t i e r, 1837). Alpine-Carpathian; 9 RP; Baldovce (**kpv**), Sivá Brada (**kpv,** sff)

Pupilla muscorum (L i n n a e u s, 1758). Holarctic; 5 PT; Dreveník (brb, **kpv**, sff), Kozia hora (**kpv**), Ostrá hora (**kpv**), Pažica (**kpv**, **sff),** Sivá Brada (sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Pupilla triplicata (S. S t u d e r, 1820). Central European-Meridional; 4 ST; Dreveník (bbc, **kpv,** lzk, sff), Sivá Brada (sff), Ostrá hora (**kpv**), Pažica (**kpv, sff**), Spišský hradný

vrch (**kpv**, **sff**). This species is presented in Ložek (1954, 1955) and Brabenec (1954) as *Pupilla bigranata* (R s s m.), which occurs in the Western Europe (France).

Pupilla sterri (V o i t h, 1840). Palearctic; 4 ST; Pažica (**sff**), Spišský hradný vrch (**sff**)

Pyramidulidae

Pyramidula pusilla (V a l l o t, 1801). Mediterranean-Alpine; 4 STp; Dreveník (bbc, **kpv,** sff), Ostrá hora (**kpv**), Pažica (**sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Chondrinidae

Chondrina arcadica clienta (W e s t e r l u n d, 1883). Alpine-Southeast European; 4 STp; Dreveník (bbc, **kpv,** sff), Ostrá hora (**kpv**), Pažica (**sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Chondrina tatrica L o ž e k, 1948. West-Carpathian; 4 STp; Dreveník (**kpv, sff**)

Granaria frumentum (D r a p a r n a u d, 1801). Central European-Meridional (fossil.); 4 ST; Dreveník (**kpv**), Spišský hradný vrch (**kpv**)

Vertiginidae

Columella edentula (D r a p a r n a u d, 1805). Holarctic; 8 HG; Dreveník (**kpv**)

Truncatellina cylindrica (A. F é r u s s a c, 1807). European; 5 PT; Baldovce (**kpv**), Dreveník (**kpv,** sff), Ostrá hora (**kpv**), Pažica (**kpv, sff**), Sivá Brada (sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Truncatellina claustralis (G r e d l e r, 1856). Central European-Meridional; 4 ST(SI); Dreveník (sff)

Vertigo alpestris A l d e r, 1838. Palearctic; 7 SIp; Dreveník (**kpv,** sff), Sivá Brada (**sff**)

Vertigo angustior J e f f r e y s, 1830. European; 8 HG; Baldovce (**kpv**), Sivá Brada (sff)

Vertigo antivertigo (D r a p a r n a u d, 1801). Palearctic; 9 RP; Baldovce (**kpv**), Sivá Brada (sff)

Vertigo pusilla O. F. M ü l l e r, 1774. European; 1 SI; Dreveník (**kpv,** sff), Sivá Brada (**sff**), Sobocisko (**kpv**), Spišský hradný vrch (**sff**)

Vertigo pygmaea (D r a p a r n a u d, 1801). Holarctic; 5 PT; Baldovce (**kpv**), Dreveník (**kpv,** sff), Sivá Brada (**kpv,** sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Vertigo substriata (J e f f r e y s, 1833). Central-East European; 8 HG; Dreveník (sff)

Enidae

Chondrula tridens tridens (O. F. M ü l l e r, 1774). Pontic-Meridional; 4 ST; Dreveník (**kpv,** sff), Kozia hora (**kpv**), Ostrá hora (**kpv**), Sivá Brada (sff)

Chondrula tridens eximia (R o s s m ä s s l e r, 1835). Pontic-Meridional; 4 ST; Dreveník (bbc), Sivá Brada (mch), Spišský hradný vrch (**kpv**, lzk, mch, sff)

Merdigera obscura (O. F. M ü l l e r, 1774). European; 1 SI; Spišský hradný vrch (**kpv**, **sff**)

Clausiliidae

Balea perversa (L i n n a e u s, 1758). Atlantic; 7AGp; Spišský hradný vrch (**sff**)

Balea biplicata (M o n t a g u, 1803). Moetic-Central European; 2 SI(AG); Dreveník (**sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Balea stabilis (L. P f e i f f e r, 1847). Carpathian; 1 SI; Spišský hradný vrch (**kpv**, **sff**)

Clausilia dubia dubia D r a p a r n a u d, 1805. Central European; 7 SIp; Dreveník (**kpv, sff**), Sobocisko (**kpv**), Spišský hradný vrch (**sff**)

Clausilia dubia carpatica B r a n c s i k, 1888. West-Carpathian; 7 SIp; Dreveník (bbc, sff). This subspecies was published in Ložek (1963) as **Clausilia grimmeri** A. Schm.

Clausilia dubia ingenua H u d e c & B r a b e n e c, 1963. West-Carpathian; 1 SIp; Dreveník (bbc, hdc, **kpv,** lzk, mch, sff, vst), Spišský hradný vrch. (**kpv**). This subspecies is presented as *Clausilia grimmeri* (L. P f f r.) in Ložek (1955) and Brabenec (1954); it was described as single species in Hudec & Brabenec (1963).

Clausilia pumila succosa A. S c h m i d t, 1857. Baltic-Dacian-Central European; 3 SIh; Sobocisko (**kpv**)

Cochlodina cerata (R o s s m ä s s l e r, 1836). Carpathian; 2 SIth; Dreveník (**kpv,** sff), Spišský hradný vrch (**kpv**)

Cochlodina laminata (M o n t a g u, 1803). European; 1 SI; Dreveník (bbc, **kpv, sff**), Spišský hradný vrch (**kpv**, **sff**)

Cochlodina orthostoma (M e n k e, 1828). Baltic-Dacian-Central European; 1 SI; Dreveník (bbc, **kpv,** sff, vst), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Lacinaria plicata (D r a p a r n a u d, 1801). Central European; 7 SIp; Baldovce (**kpv**), Dreveník (bbc, **kpv,** sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Ruthenica filograna (R o s s m ä s s l e r, 1836). Baltic-Dacian-Central European; 1 SI; Dreveník (**kpv,** sff), Spišský hradný vrch (**kpv**)

Vestia gulo (E. A. B I e l z, 1859). Carpathian; 3 SIh; Baldovce (**kpv**), Spišský hradný vrch (**sff**)

Vestia turgida (R o s s m ä s s l e r, 1836). Carpathian; 3 SIh; Baldovce (**kpv**)

Punctidae

Punctum pygmaeum (D r a p a r n a u d, 1801). Palearctic; 7 AG; Baldovce (**kpv**), Dreveník (**kpv,** sff), Pažica (**kpv),** Sivá Brada (**sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**)

Patulidae

Discus rotundatus (O. F. M ü l l e r, 1774). Central-West European; 2 SI(AG); Dreveník (**kpv**)

Discus perspectivus (M e g e r l e v o n M ü h l f e l d, 1816). Peripannonian; 1 SI; Dreveník (sff)

Pristilomatidae

Vitrea contracta (W e s t e r l u n d, 1871). European; 7 AG; Dreveník (sff), Spišský hradný vrch (**sff**)

Vitrea crystallina (O. F. M ü l l e r, 1774). European; 2 SI(HG); Baldovce (**kpv**), Dreveník (**kpv, sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**)

Vitrea diaphana (S. S t u d e r, 1820). Alpine-Meridional; 1 SI; Dreveník (bbc, **kpv,** sff)

Vitrea subrimata (R e i n h a r d t, 1871). Alpine-Meridional; 1 SI; Dreveník (**kpv**)

Vitrea transsylvanica (C l e s s i n, 1877). Carpathian; 1 SI; Dreveník (**kpv**). Sobocisko (**kpv**)

Euconulidae

Euconulus fulvus (O. F. M ü l l e r, 1774). Holarctic; 7 AG; Baldovce (**kpv**), Dreveník (**kpv,** sff), Sobocisko (**kpv**),Spišský hradný vrch (**kpv**, **sff**)

Gastrodontidae

Zonitoides nitidus (O. F. M ü l l e r, 1774). Holarctic; 9RP; Baldovce (**kpv**)

Oxychilidae

Aegopinella minor (S t a b i l e, 1864). Mediterranean-Central European; 2 SIth; Dreveník (hdc, **kpv,** sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Aegopinella pura (A l d e r, 1830). European; 1 SI; Baldovce (kpv), Dreveník (**kpv,** sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**)

Mediterranea depressa (S t e r k i, 1880). Central-Southeast European; 1 SI; Dreveník (bbc, **kpv,** sff), Spišský hradný vrch (**sff**)

Mediterranea inopinata (U l i č n ý, 1887). Balkan-Subcarpathian; 4 ST; Dreveník (brb, **kpv**, lzk, **sff**), Ostrá hora (**kpv**), Pažica (**sff**), Sivá Brada (**sff**), Sobocisko (**kpv**), Spišský hradný vrch (**sff**)

Morlina glabra (R o s s m ä s s l e r, 1835). Central-Southeast European; 2 SI(AG); Dreveník (bbc, **kpv,** sff), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Nesovitrea hammonis (S t r ö m, 1765). Palearctic; 7 AG; Baldovce (**kpv**), Dreveník (**kpv**)**,** Pažica (**kpv**)**,** Sivá Brada (**sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Cellariopsis deubeli (A. J. W a g n e r, 1914). Carpathian; 1 SI; Baldovce (**kpv**), Dreveník (**kpv,** sff), Spišský hradný vrch (**kpv**)

Vitrinidae

Vitrina pellucida (O. F. M ü l l e r, 1774). Palearctic; 7 AG; Baldovce (**kpv**), Dreveník (bbc, **kpv,** sff), Ostrá hora (**kpv**), Pažica (**kpv, sff**), Sivá Brada (**kpv, sff**), Sobocisko (**kpv**), Spišský hradný vrch (**sff**)

Limacidae

Lehmannia marginata (O. F. M ü l l e r, 1774). European; 1 SI(p); Dreveník (**kpv**)

Agriolimacidae

Deroceras laeve (O. F. M ü l l e r, 1774). Holarctic; 8 HG; Sivá Brada (**sff**)

Deroceras praecox W i k t o r, 1966. Sudet-West Carpathian; 3 SIh; Spišský hradný vrch (**kpv**)

Deroceras reticulatum (O. F. M ü l l e r, 1774). Eurychoric; 7 AG; Pažica (**kpv**), Spišský hradný vrch. (**kpv**)

Deroceras sturanyi (S i m r o t h, 1894). European; 8 HG; Sivá Brada (hdc)

Arionidae

Arion fuscus (O. F. M ü l l e r, 1774). European; 2 SI(AG); Spišský hradný vrch (**kpv**)

Bradybaenidae

Fruticicola fruticum (O. F. M ü l l e r, 1774). European; 2 SI(AG); Baldovce (**kpv**), Dreveník (bbc, **kpv,** sff), Spišský hradný vrch (**kpv**)

Hygromiidae

Euomphalia strigella (D r a p a r n a u d, 1801). Central-East European; 5 SS; Baldovce (**kpv**), Dreveník (**kpv,** sff), Pažica (**kpv**)**,** Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Xerolenta obvia (M e n k e, 1828). Pontic; 4 ST; Dreveník (**kpv,** sff), Kozia hora (**kpv**), Ostrá hora (**kpv**), Pažica (**kpv**, **sff**), Sivá Brada (**sff**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Monachoides incarnatus (O. F. M ü l l e r, 1774). Central European; 1 SI; Spišský hradný vrch (**kpv**)

Monachoides vicinus (R o s s m ä s s l e r, 1842). Carpathian; 3 SIh; Dreveník (**kpv**)

Pseudotrichia rubiginosa (R o s s m ä s s l e r, 1838). Euro-Siberian; 9 RP; Baldovce (**kpv**), Sivá Brada (**sff**), Spišský hradný vrch (**kpv**)

Trichia lubomirskii (Ś l ó s a r s k i, 1881). West-Carpathian; 7 AG; Spišský hradný vrch (**kpv**, **sff**)

Helicidae

Cepaea vindobonensis (C. P f e i f f e r, 1828). Pontic-Pannonian; 4 ST(SI); Baldovce (**kpv**), Dreveník (**kpv**, **sff**), Ostrá hora (**kpv**), Sobocisko (**kpv**), Spišský hradný vrch (**kpv**, **sff**)

Causa holosericea (S. S t u d e r, 1820). Alpine; 1 SI; Dreveník (**sff**)

Faustina faustina (R o s s m ä s s l e r, 1835). Carpathian; 1 SI; Baldovce (**kpv**), Dreveník (**kpv,** sff), Spišský hradný vrch (**kpv**, sff)

Helix lutescens R o s s m ä s s l e r, 1837. Pericarpathian; 4 ST; Baldovce – Kamenec (**kpv**, lzk), Dreveník (**kpv,** lzk, sff), Kozia hora (**kpv**), Ostrá hora (**kpv**, lzk), Pažica (**kpv,** lzk, **sff**), Sivá Brada (**kpv,** lzk, sff), Sobocisko (**kpv**, lzk), Spišský hradný vrch (**kpv**, lzk, **sff**).

Isognomostoma isognomostomos (S c h r ö t e r, 1784). Central European; 1 SI; Dreveník (**kpv, sff**), Spišský hradný vrch (**kpv**)

Malacofauna of studied localities

The localities are evaluated according to mollusc diversity, and mollusc species are listed in the tables.

BALDOVCE (KAMENEC)

Localities:

a) reed vegetation near a mineral water bottle filling station, 24.4.1988 (lgt. V. Lučivjanská), 19.7.2005 (lgt. J. Šteffek)

b) willow trees near a mineral water bottle filling station, 24.4.1988 (lgt. V. Lučivjanská), 19.7.2005 (lgt. J. Šteffek)

This locality is not a typical travertine site. But, there is a strong influence of mineral water which is forming in the travertine pile of the Sivá Brada. In a wet depression, a calcareous fen with layers of alms and travertines was created (Kovanda, 1971; Ložek, 1958). The vegetation is composed mainly of sedge and reed, with willow shrubs at the edge. This site is very important because of the occurrence of the relict species *Pupilla alpicola*, which was a common species at the end of the late Glacial (Ložek, 1965). The distribution area of this species has been fragmented due to climate changes from the beginning of the recent period and due to recent meadow drainage. In the surroundings of Baldovce *Pupilla alpicola* occurs in a high population density together with other hygrophilous species (Table 1). In willow vegetation,

Vestia gulo and *Fruticicola fruticum* are more frequent together with some forest species (e.g. *Faustina faustina*). The occurrence of *Valvata cristata* is very important, since it is rare in the Hornádska kotlina valley. It is only the third record of this species from central and eastern Slovakia. From the nature conservation point of view, the ecosystems of wet meadows of Baldovce are very valuable, especially because of their persisting relict character.

T a b l e 1. Mollusc species in the surroundings of Baldovce.

E	Species	Localities a	b
1.	*Cellariopsis deubeli*	-	1
	Faustina faustina	-	4
2.	*Aegopinella minor*	-	1
	Fruticicola fruticum	69	86
	Vitrea crystallina	-	2
3.	*Vestia gulo*	-	189
	Vestia turgida	18	-
4.	*Cepaea vindobonensis*	-	1
	Helix lutescens	48	35
5.	*Euomphalia strigella*	3	14
	Truncatellina cylindrica	1	-
	Vallonia costata	558	10
	Vallonia pulchella	110	6
	Vertigo pygmaea	60	-
7.	*Cochlicopa lubrica*	103	35
	Euconulus fulvus	6	-
	Lacinaria plicata	-	10
	Nesovitrea hammonis	20	-
	Punctum pygmaeum	20	-
	Vitrina pellucida	8	-
8.	*Succinella oblonga*	41	5
	Vertigo angustior	15	-
9.	*Carychium minimum*	8	-
	Pseudotrichia rubiginosa	19	6
	Pupilla alpicola	122	3
	Succinea putris	18	9
	Vertigo antivertigo	1	-
	Zonitoides nitidus	35	50
10.	*Anisus leucostoma*	3	-
	Galba truncatula	1	-
	Valvata cristata	-	1
	Limacidae (dorsal discs)	4	1
Σ		**23+1/1291**	**19+1/469**

SIVÁ BRADA

Localities:
a) surroundings of springs, 24.5.1986 (lgt. V. Lučivjanská)
b) upperparts with xeroterm biotopes, 29.5.1987 (lgt. J. Šteffek)
c) surroundings of springs, 23.6.1991 (lgt. J. Šteffek)
d) surroundings of spring with south exposure, 8.9.1993 (lgt. J. Šteffek)
e) grass vegetation with west exposure, 8.9.1993 (lgt. J. Šteffek)
f) the foot of travertine site on the east side, 11.3.1995 (lgt. J. Šteffek)
g) calcareous swamps on the west side, 29.5.1987 (lgt. J. Šteffek)

T a b l e 2. Mollusc species of the Sivá Brada travertines.

E	Species	Localities a	b	c	d	e	f	g
1.	*Vertigo pusilla*	-	-	-	1			
4.	*Cepaea vindobonensis*	-	-	-	3	-	-	-
	Chondrula t. tridens	-	-	2	13	2	-	-
	Helix lutescens	52	10	2	6	-	29	1
	Mediterranea inopinata	-	-	-	-	-	1	-
	Pupilla triplicata	1	8	12	8	5	3	-
	Xerolenta obvia	-	-	2	14	3	2	-
5.	*Pupilla muscorum*	49	60	87	100	11	23	1
	Truncatellina cylindrica	-	39	96	56	9	25	-
	Vallonia costata	43	57	167	130	13	72	1
	Vallonia excentrica	4	-	5	3	-	1	-
	Vallonia pulchella	21	19	19	23	5	14	14
	Vertigo pygmaea	1	10	14	22	4	2	4
6.	*Cochlicopa lubricella*	12	18	25	10	7	7	
7.	*Cochlicopa lubrica*	-	12	-	15	1	-	1
	Nesovitrea hammonis	-	-	-	1	-	10	-
	Punctum pygmaeum	-	-	-	2	2	-	-
	Vertigo alpestris	-	-	-	-	2	-	-
	Vitrina pellucida	10	-	-	1	-	2	-
8.	*Deroceras laeve*	-	-	-	-	-	2	2
	Succinella oblonga	3	9	-	18	3	-	2
	Vertigo angustior	-	1	-	5	2	3	13
9.	*Carychium minimum*	-	-	-	-	-	-	4
	Pseudotrichia rubiginosa	-	-	-	-	-	-	1
	Pupilla alpicola	-	-	12	-	4	11	11
	Vertigo antivertigo	-	-	-	-	-	-	38
10.	*Anisus septemgyratus*	-	-	-	-	-	-	1
	Bathyomphalus contortus	-	-	-	-	1	-	-
	Galba truncatula	-	-	-	-	-	-	7
Σ		**10/196**	**11/243**	**12/443**	**18/431**	**16/74**	**16/207**	**15/101**

The Sivá Brada is the only „living" travertine site in the Hornádska kotlina valley. This locality is very suitable for the study of mollusc communities in relation to the travertine`s age and on different phases of vegetation succesion (Ložek, 1964b). A similar situation was described from the Buzgovské lúky meadows in the Ipeľská pahorkatina Hills (Lučivjanská, 1993).

Mollusc diversity of this locality (Table 2) is low from a quantitative and qualitative point of view. An isolated occurrence of *Succinella oblonga* in surroundings of springs and open travertine habitats without vegetation was recorded. Patenticolae species and *Mediterranea inopinata* prefer dry and sunny biotopes with low grass vegetation. In the bushes and damp depressions with thick soil layer and lush vegetation, we can find *Helix lutescens, Cepaea vindobonensis, Xerolenta obvia* and *Chondrula tridens tridens*. *Vertigo angustior, Vertigo antivertigo, Pupilla alpicola* and *Deroceras laeve* appear in calcareous swamps at the foot of the travertine site Sivá Brada. Also, the most northerly occurrence of *Anisus septemgyratus* and *Bathyomphalus contortus* in Slovakia (Lisický, 1991) was recorded from this site. In accordance with the data mentioned above, the Sivá Brada is an important locality for xerotermophilous and wetland mollusc species of the Hornádska kotlina valley (Buday, 1983; Tatarko, 1990).

PAŽICA

T a b l e 3. Mollusc species of the Pažica travertines.

E	Species	Localities a	b	c
4.	*Chondrina arcadica clienta*	-	-	18
	Helix lutescens	18	32	13
	Mediterranea inopinata	-	-	1
	Pupilla triplicata	-	3	1
	Pupilla sterri	-	-	11
	Pyramidula pusilla	-	-	14
	Xerolenta obvia	1	2	14
5.	*Euomphalia strigella*	23	-	-
	Pupilla muscorum	25	6	1
	Truncatellina cylindrica	1	-	10
	Vallonia costata	47	25	19
	Vallonia excentrica	3	-	-
	Vallonia pulchella	21	10	4
6.	*Cochlicopa lubricella*	-	8	14
7.	*Cochlicopa lubrica*	10	-	-
	Deroceras reticulatum	2	-	-
	Nesovitrea hammonis	4	-	-
	Punctum pygmaeum	3	-	-
	Vitrina pellucida	6	7	-
8.	*Succinella oblonga*	6	-	-
Σ		**14/170**	**8/93**	**13/117**

Localities:

a) northern exposure – pine forest and rock-faces of quarry, 24.5.1986 (lgt. V. Lučivjanská)
b) southern exposure – pine forest, meadows and shelfs, 24.5.1986 (lgt. V. Lučivjanská)
c) travertine shelfs, 8.9.1993 (lgt. J. Šteffek)

Pažica (490–522 m) represents a travertine site in the middle phase of destruction, mainly due to stone mining. The mollusc community of warm and open southern slopes is similar to that of the Sivá Brada travertines. The occurrence of further xerotermophilous species (*Pupilla sterri, Pyramidula pusilla, Chondrina arcadica clienta*), including mesophilous and steppe species (Table 3), was recorded from this site. The species *Nesovitrea hammonis, Deroceras reticulatum* and *Succinella oblonga* prefer mostly wet habitats.

DREVENÍK

Localities:

a) western exposure – vegetation of abandoned sites near old quarry, 21.5.1987 (lgt. V. Lučivjanská)
b) western exposure – forest on the foot of travertine site, 21.5.1987 (lgt. V. Lučivjanská)
c) western exposure – rocks and debris forest below the top of travertine site, 21.5.1987 (lgt. V. Lučivjanská)
d) western exposure – rock-rim on the peak of Dreveník, 21.5.1987 (lgt. V. Lučivjanská)
e) south-western exposure – xeroterm slope below the peak of Dreveník, 21.5.1987 (lgt. V. Lučivjanská)
f) south-western exposure – rocks, 21.5.1987 (lgt. V. Lučivjanská)
g) southern exposure – steppe with rocks, 21.5.1987 (lgt. V. Lučivjanská)
h) eastern exposure – rock city, 1.6.1976 (lgt. V. Lučivjanská)
i) eastern exposure – rock city, 6.8.1981 (lgt. V. Lučivjanská)
j) eastern exposure – rock city, 21.5.1987 (lgt. V. Lučivjanská)
k) grass vegetation of the plateau on the peak of Dreveník, 21.5.1987 (lgt. V. Lučivjanská)
sff) species found by J. Šteffek (1987, 1988, 11.3.1995, 11.7.1995)

The Dreveník locality is well known as the oldest Pliocene travertine site from Slovakia, with massive travertine blocks at the edge. This locality is in an advanced stage of destruction, especially due to stone mining.

One of the very interesting species found here is the west-central European species *Discus rotundatus*, which has a natural distribution area ending near the river Topľa. The eastern slope of Dreveník constitutes the northeast boundary of the distribution area of the West-Carpathian endemite *Chondrina tatrica*. Although Petrbok (1926) mentioned a fossil loessial finding of the xerotermophilous *Granaria frumentum*, which is extinct on the Dreveník travertines and the Spišský hradný vrch travertines; Ložek (1955) questioned this finding. In the rough rubble habitats the boreo-alpine species *Vertigo alpestris* as well as *Truncatellina claustralis* and *Vertigo substriata* occur. The slopes of the southern

T a b l e 4. Mollusc species of the Dreveník travertines.

E	Species	Localities a	b	c	d	e	f	g	h	i	j	k	sff
	Acanthinula aculeata	-	3	-	-	-	-	-	-	-	-	-	-
	Aegopinella pura	-	2	7	-	-	-	1	1	-	-	-	+
	Causa holosericea	-	-	-	-	-	-	-	-	-	-	-	+
	Cellariopsis deubeli	-	-	6	1	-	-	-	4	5	4	-	+
	Cochlodina laminata	-	2	3	-	-	-	-	-	-	-	-	+
	Cochlodina orthostoma	-	-	226	5	10	4	29	8	7	105	-	+
	Discus perspectivus	-	-	-	-	-	-	-	-	-	-	-	+
	Faustina faustina	-	-	85	7	-	-	-	-	3	27	-	+
1.	*Isognom. isognomostomos*	-	-	2	-	-	-	-	-	-	-	-	+
	Lehmannia marginata	-	-	1	-	-	-	-	-	-	-	-	-
	Mediterranea depressa	-	-	-	1	-	-	-	2	-	-	-	+
	Ruthenica filograna	-	-	16	-	-	-	-	-	4	3	-	+
	Aphyradium doliolum	-	-	1	-	-	-	-	-	1	12	-	+
	Vertigo pusilla	-	8	-	-	-	-	1	-	-	3	-	+
	Vitrea diaphana	-	-	2	-	-	-	-	-	3	2	-	+
	Vitrea subrimata	-	-	-	-	-	-	-	-	-	3	-	-
	Vitrea transsylvanica	-	-	-	-	-	-	-	-	-	1	-	-
	Aegopinella minor	-	1	3	-	-	-	-	-	-	-	-	+
	Balea biplicata	-	-	-	-	-	-	-	-	-	-	-	+
	Cochlodina cerata	-	-	5	-	-	-	-	28	3	3	-	+
2.	*Discus rotundatus*	-	-	-	-	-	-	-	-	-	1	-	-
	Fruticicola fruticum	-	-	20	1	1	-	-	1	-	5	-	+
	Morlina glabra	-	-	5	-	-	-	-	6	-	8	-	+
	Vitrea crystallina	-	-	1	-	1	-	-	-	-	-		+
3.	*Monachoides vicinus*	-	-	1	-	-	-	-	-	-	-	-	-
	Cepaea vindobonensis	1	-	-	-	5	-	-	4	6	4	-	+
	Chondrina arcadica clienta	-	-	15	12	2	-	59	82	565	47	-	+
	Chondrina tatrica	-	-	-	-	-	-	-	3	-	-	-	+
	Chondrula tridens tridens	-	-	-	-	6	-	-	1	1	-	1	+
	Chondrula tridens eximia	-	-	-	-	-	-	-	-	-	-	-	+
4.	*Granaria frumentum*	-	-	-	-	-	-	-	-	-	-	1?	-
	Helix lutescens	11	1	-	-	5	-	3	4	-	-	3	+
	Mediterranea inopinata	-	-	-	-	-	-	-	2	-	1	-	+
	Pupilla triplicata	-	-	6	-	5	-	75	4	1	116	-	+
	Pyramidula pusilla	-	-	18	-	-	-	13	8	3	70	-	+
	Xerolenta obvia	-	-	-	-	-	-	2	-	38	-	-	+
	Euomphalia strigella	2	2	10	-	3	-	-	-	1	-	-	+
	Pupilla muscorum	-	-	-	1	3	-	1	6	-	20	-	+
	Truncatellina claustralis	-	-	-	-	-	-	-	-	-	-	-	+
5.	*Truncatellina cylindrica*	3	-	71	-	3	-	2	3	-	23	-	+
	Vallonia costata	2	-	37	2	11	-	219	31	1	193	1	+
	Vallonia excentrica	-	-	-	-	-	-	1	7	-	8	-	+
	Vallonia pulchella	1	-	24	2	8	-	23	8	-	55	3	+
	Vertigo pygmaea	-	-	1	-	-	-	1	-	-	-	-	+
6.	*Cochlicopa lubricella*	-	-	1	2	7	-	19	5	6	37	-	+
	Clausilia dubia dubia	-	-	6	-	-	-	-	15	17	78	-	+
	Clausilia dubia carpatica	-	-	-	-	-	-	-	-	-	-	-	+
	Clausilia dubia ingenua	-	6	26	2	1	10	92	9	-	-	-	+
	Euconulus fulvus	-	4	5	-	1	-	-	-	-	1	-	+
7.	*Laciniaria plicata*	-	-	57	20	-	17	-	2	17	97	-	+
	Nesovitrea hammonis	-	2	-	-	-	-	-	2	6	-	-	-
	Punctum pygmaeum	-	7	7	1	-	-	2	-	-	-	-	+
	Vertigo alpestris	-	1	-	-	-	-	-	-	-	1	-	+
	Vitrea contracta	-	-	-	-	-	-	-	-	-	-	-	+
	Vitrina pellucida	-	1	-	-	2	-	2	2	1	6	-	+
	Carychium tridentatum	-	-	-	-	-	-	-	-	-	-	-	-
8.	*Columella edentula*	-	1	-	-	-	-	-	-	-	-	-	+
	Vertigo substriata	-	-	-	-	-	-	-	-	-	-	-	-
9.	*Carychium minimum*	-	-	-	-	-	-	-	-	-	-	-	+
∑		**6/20**	**14/41**	**30/869**	**13/57**	**16/69**	**3/31**	**18/646**	**26/248**	**20/169**	**29/1453**	**5/9**	**50/-**

exposure are represented by the occurrence of numerous populations of the rare petrophilous subspecies *Clausilia dubia ingenua*, whose distribution is restricted to only a few localities within Slovakia (Hudec, 1967). A similar situation occurs with the distribution of the West-Carpathian subspecies *Clausilia dubia carpatica*. The habitats of this species are situated on the slopes of eastern and western part of the Dreveník travertines. This site is also considered to be the east-southern boundary of the distribution area of the alpine species *Causa holosericum* in Slovakia.

The Dreveník travertines are representatives of the malacocoenoses of travertines (Table 4). Communities of xerotermophilous habitats, steppe and forest habitats, malacocoenoses of sunny and shade rocks and of debris forest are typical for this site.

From the malacozoological viewpoint this locality is characterized by a mixture of xerotermophilous and mountain elements. Also, the zoogeographical boundaries of several mollusc species run through this site.

OSTRÁ HORA

Locality:

a) western exposure – grass vegetation with rocks, 22.5.1986 (lgt. V. Lučivjanská)

The mollusc community of the Ostrá hora travertines is composed mainly of xerotermophilous and steppe species (*Chondrina arcadica clienta, Pyramidula pusilla*). The occurrence of *Mediterranea inopinata* is of high importance. The Dreveník, Ostrá hora and Sobocisko travertines are the northern-most sites of this species in Slovakia. The assemblage of Ostrá hora site is representative of a xerotermophilous mollusc community with *Chondrula tridens tridens, Pupilla triplicata* and *Mediterranea inopinata* (Table 5).

KOZIA HORA

Locality:

a) eastern exposure – xerophilous meadow, 22.5.1986 (lgt. V. Lučivjanská)

The mollusc diversity of the Kozia hora travertines is influenced by its eastern location. *Chondrula tridens tridens* was recorded here only with low population density; *Pupilla triplicata* and *Mediterranea inopinata* have not yet been recorded from this site. In comparison with the previous site, the stony habitats are less frequent, which is the main reason that the malacocoenoses of the Ostrá hora travertines are not distinctly xerotermophilous (Table 6).

T a b l e 5. Mollusc species of the Ostrá hora travertines.

E	Species	a
4.	*Cepaea vindobonensis*	16
	Chodrina arcadica clienta	4
	Chondrula tridens tridens	10
	Helix lutescens	19
	Mediterranea inopinata	2
	Pupilla triplicata	39
	Pyramidula pusilla	1
	Xerolenta obvia	13
5.	*Pupilla muscorum*	19
	Truncatellina cylindrica	27
	Vallonia costata	43
	Vallonia excentrica	2
	Vallonia pulchella	21
6.	*Cochlicopa lubricella*	18
7.	*Vitrina pellucida*	3
Σ		**15/237**

T a b l e 6. Mollusc species of the Kozia hora travertines.

E	Species	a
4.	*Chondrula tridens tridens*	1
	Helix lutescens	2
	Xerolenta obvia	40
5.	*Pupilla muscorum*	3
	Vallonia costata	7
	Vallonia excentrica	1
	Vallonia pulchella	6
Σ		**7/60**

SPIŠSKÝ HRADNÝ VRCH

Localities:

a) western exposure – grass slope below the castle, 22.5.1986 (lgt. V. Lučivjanská)

b) southern exposure – grass slope below the castle, 22.5.1986 (lgt. V. Lučivjanská)

c) eastern exposure – grass slope with rocks and bush below the castle, 22.5.1986 (lgt. V. Lučivjanská)

d) northern exposure – grass slope below the castle, 22.5.1986 (lgt. V. Lučivjanská)

e) northern exposure – castle rock-hills and debris, 22.5.1986 (lgt. V. Lučivjanská)

f) castle courts and vegetation of abandoned sites in the castle ruins, 22.5.1986 (lgt. V. Lučivjanská)

sff) foot of the castle wall and calcareous rock-faces, 23.6.1991, 8.9.1993, 11.3.1995, 7.6.1997 (lgt. J. Šteffek)

The Spišský hradný vrch locality is represented by the following characteristics (Table 7):

- the occurrence of some important mollusc species with rare distribution in Slovakia was recorded here. There are numerous populations of *Chondrula tridens eximia, Clausilia dubia ingenua, Clausilia dubia dubia*. The Spišský hradný vrch locality is one of the eastern-most sites of *Balea perversa* and *Deroceras praecox;*
- the Spišský hradný vrch site is a typical travertine cone with grass vegetation. The slopes (except for those with northern exposure) are inhabited by mollusc communities with the steppe species *Chondrula tridens eximia*, whereas in habitats of the northern slopes xerotermophilous species except *Pupilla triplicata* are missing (Table 7, compare a, b, c, d). In comparison with other habitats, the slope with eastern exposure is represented by the highest diversity of hygrophilous and mountain mollusc species;
- the mollusc community of the northern slope is a good example of malacocoenoses influenced by the relief formation. There is a vast number of hygrophilous mollusc species in the detritus of the castle rock-hills, together with xerotermophilous species (*Pupilla triplicata*) in the dry parts of stony habitats. The diversity of this northern site is only about 50% of the diversity of differently exposed slopes; also, the abundance of specimens is around 15 times lower;
- the ruins of the Spišský hrad castle are one of the eastern-most sites of the west-carpathian endemic species *Trichia lubomirskii* distribution area in Slovakia. A numerous population of *Helix lutescens*, which is not widely distributed within the other habitats of the Spišský hradný vrch travertines, has been recorded here.

T a b l e 7. Mollusc species of the Spišský hradný vrch travertines.

E	Species	Localities a	b	c	d	e	f	sff
1.	*Acanthinula aculeata*	-	-	-	-	2	-	-
	Aegopinella pura	-	-	18	-	-	-	-
	Balea stabilis	-	-	-	-	1	-	+
	Cellariopsis deubeli	-	-	3	-	-	-	-
	Cochlodina laminata	-	-	-	-	1	-	+
	Cochlodina orthostoma	-	-	-	58	205	-	+
	Faustina faustina	-	-	-	-	1	10	+
	Isognomostoma isognomostomos	-	-	-	-	1	-	-
	Mediterranea depressa	-	-	-	-	-	-	+
	Merdigera obscura	-	-	3	-	-	-	+
	Monachoides incarnatus	-	-	16	-	-	-	-
	Platyla polita	-	-	1	-	-	-	-
	Ruthenica filograna	-	-	-	-	9	-	-
	Sphyradium doliolum	-	-	-	-	1	-	-
	Vertigo pusilla	-	-	-	-	-	-	+
2.	*Aegopinella minor*	-	-	2	-	6	-	+
	Arion fuscus	-	-	-	-	-	5	-
	Balea biplicata	-	-	1	-	-	-	+
	Cochlodina cerata	-	-	-	-	1	-	-
	Fruticicola fruticum	-	-	-	-	2	-	-
	Morlina glabra	-	-	2	-	16	2	+
	Vitrea crystallina	-	-	1	-	-	-	-
3.	*Deroceras praecox*	-	-	1	-	-	-	-
	Vestia gulo	-	-	-	-	-	-	+
4.	*Cepaea vindobonensis*	-	1	-	-	-	-	+
	Granaria frumentum	1	-	-	-	-	-	-
	Chondrina arcadica clienta	-	-	4	1	104	-	+
	Chondrula tridens eximia	2	23	48	-	-	-	+
	Helix lutescens	1	-	5	-	-	53	+
	Mediterranea inopinata	-	-	-	-	-	-	+
	Pupilla sterri	-	-	-	-	-	-	+
	Pupilla triplicata	-	-	-	-	32	-	+
	Pyramidula pusilla	2	-	7	1	20	-	+
	Xerolenta obvia	4	2	3	-	-	-	+
5.	*Euomphalia strigella*	119	2	13	4	-	2	+
	Pupilla muscorum	-	5	1	2	3	-	+
	Truncatellina cylindrica	1	6	25	-	116	-	+
	Vallonia costata	9	45	53	15	51	-	+
	Vallonia excentrica	-	-	8	1	-	-	+
	Vallonia pulchella	9	12	46	4	105	-	+
	Vertigo pygmaea	-	9	1	-	1	-	+
6.	*Cochlicopa lubricella*	-	-	1	3	6	-	
7.	*Balea perversa*	-	-	-	-	-	-	+
	Clausilia dubia dubia	-	-	-	-	-	-	+
	Clausilia dubia ingenua	-	-	-	-	85	-	+
	Deroceras reticulatum	-	-	1	-	1	4	+
	Euconulus fulvus	-	-	-	-	2	-	+
	Laciniaria plicata	-	-	-	10	430	234	+
	Nesovitreaa hammonis	3	-	15	5	-	-	+
	Punctum pygmaeum	-	1	2	-	-	-	-
	Trichia lubomirskii	-	-	-	-	-	7	+
	Vitrea contracta	-	-	-	-	-	-	+
	Vitrina pellucida	4	9	4	-	2	-	+
9.	*Pseudotrichia rubiginosa*	-	-	6	-	-	-	-
10.	*Bythinella austriaca*	-	-	1	-	-	-	-
	∑	**11/155**	**11/115**	**29/292**	**11/104**	**26/1604**	**8/317**	**37/-**

SOBOCISKO

Localities:

a) southern exposure – xerotermophilous meadow and abandoned holes of travertine quarry, 24.4.1988 (lgt. V. Lučivjanská)

b) northern and west exposure – pine forest, 24.4.1988 (lgt. V. Lučivjanská)

c) northern exposure – canyon in pine forest, rock-faces, debris, 24.4.1988 (lgt. V. Lučivjanská)

The Sobocisko site is composed of old Pleistocene travertines in an intermediate stage of destruction. Cracks of the slope with northern exposure are filled with soil; on the joint planes there

T a b l e 8. Mollusc species of the Sobocisko travertines.

E	Species	Localities a	b	c
1.	*Aegopinella pura*	-	-	1
	Cochlodina orthostoma	-	-	4
	Vertigo pusilla	1	-	-
	Vitrea transsylvanica	1	-	-
2.	*Aegopinella minor*	17	-	-
	Balea biplicata	1	-	-
	Morlina glabra	-	2	53
	Vitrea crystallina	-	1	-
3.	*Clausilia pumila succosa*	-	-	5
4.	*Cepaea vindobonensis*	36	9	10
	Chondrina arcadica clienta	-	-	47
	Helix lutescens	110	77	27
	Mediterranea inopinata	-	-	3
	Pyramidula pusilla	-	-	95
	Xerolenta obvia	20	3	10
5.	*Euomphalia strigella*	3	26	23
	Pupilla muscorum	1	2	9
	Truncatellina cylindrica	29	130	12
	Vallonia costata	41	88	50
	Vallonia excentrica	-	-	2
	Vallonia pulchella	78	45	5
	Vertigo pygmaea	3	9	2
6.	*Cochlicopa lubricella*	3	-	34
7.	*Clausilia dubia dubia*	-	-	3
	Euconulus fulvus	16	39	71
	Laciniaria plicata	-	-	895
	Nesovitrea hammonis	-	-	10
	Punctum pygmaeum	12	20	23
	Vitrina pellucida	6	12	16
	Limacidae (dorsal plates)	3	1	4
Σ		**17/381**	**15/464**	**24/1414**

are high rock-faces with joints. The south slope is covered with sparse vegetation, with only a thin soil layer, and a lot of open travertine habitats without vegetation. This is main reason why a lot of differencies occur between mollusc diversity of slopes with northern and southern exposure. The xerotermophilous and steppe mollusc community of the southern sites of the Sobocisko travertines are very similar to molluscs of the Sivá Brada travertines (Table 8). Mollusc species which prefer high moistness in the environment occur especially in the canyons and forests of the northern part, but we have found termophilous species there too. *Clausilia pumila succosa*, characterized by sporadic occurrence within Slovakia has been recorded here.

Comments on protection of the travertines of the Hornádska kotlina valley

The travertines of the Spišské Podhradie surroundings are the largest and most important travertine sites in Slovakia, because of numerous different evolutionary stages – from newly formed sites (the Sivá Brada travertines), „mature" sites (the Pažica travertines) to those in the old and destructed stage (the Sobotisko travertines, the Spišský hradný vrch travertines, the Dreveník travertines).

Malacocoenoses of travertine sites are very specific because of favourable environmental conditions. There are much considerable differency between the mollusc diversity of travertine sites and other sites within the Hornádska kotlina valley. A vast number of xerotermophilous species like *Pupilla triplicata, Pupilla sterri, Mediterranea inopinata, Chondrula tridens eximia*, is limited to this type of biotope. On the other hand, hygrophilous and mountainous species prefer the aforested canyons. The calcareous swamps in travertine surroundings constitute optimal biotopes for some relict species (*Pupilla alpicola*). In the Hornádska kotlina valley some biotopes still occur which provide a more or less stable environmental condition characterized by the occurrence of a mollusc community not distinctly altered since the end of the Last Glacial age. The springs of the Sivá Brada travertines are not as profitable as during the Glacial, what was probably caused by the „living travertines" of Spiš. Unfortunately, there are other negative factors, especially building activities, which have a negative impact on the mollusk assemblages of the travertine sites. It is our responsibility to preserve and to protect these sites (e.g. wet meadows in the surroundings of Baldovce, the Sivá Brada travertines).

From the environmental point of view, the Dreveník travertines are a negative example of travertine destruction. Despite the fact that it is a National Nature Reserve well known across Europe, the Dreveník travertines are highly influenced by human activities (especially stone-mining). The threat to this locality is magnified by the fact that the Dreveník travertines constitute the border of distribution areas of some western elements (*Discus rotundatus, Balea perversa*), eastern elements (*Cellariopsis deubeli*), southern elements (*Mediterranea inopinata, Helix lutescens, Granaria frumentum, Pupilla triplicata, Chondrula tridens eximia*) and some carpathian endemic species (*Trichia lubomirskii, Deroceras praecox*), which occur together within this single locality. Unfortunately, the Dreveník travertines and other similar localities are still under strong negative human influence and there is a high probability that these significant and interesting sites will be destroyed in the near future.

Conclusion

On the basis of the results of a detailed mollusc study of the travertines of the Hornádska kotlina valley we can formulate several general conclusions:

1. The travertines of the Spišský hradný vrch are the only travertine sites in former Czechoslovakia where we can study all stages of travertine evolution together with the representative vegetation and animal communities.
2. Mollusc communities of travertine sites are very specific, often conservative and relict, with a mixture of xerotermophilous and mountainous elements.
3. Travertine sites offer attractive environmental conditions for xerotermophilous species of meadow and rock biotopes, as well as of forest biotopes.
4. There is a positive correlation between the age of travertine loads and species richness of mollusc assemblages. This is most presumably related to the absence of direct active travertine formation. This is clearly obvious in the case of recent active travertine springs, where the mollusc assemblages are considerably poorer when compared to the assemblages of older travertine sediments.

In the study area, a total of 88 mollusc taxons have been recorded. This paper presents the first information about 37 recent mollusc species from these localities.

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