

Terrestrial gastropods of the Upper Pannonian in the northern part of the Danube basin

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Abstract. The paper addresses to the terrestrial gastropods found in the Upper Pannonian sediments, intersected in the borehole PID-1, drilled at the eastern margin of the Považský Inovec Mts., near the Orešany village. 26 *Gastropoda* species are described.

The terrestrial gastropods in question were found together with the fresh water species, indicating that these represented an allochthonous component in this community. They were washed down from the nearby coast. On the basis of paleoecological requirements of each gastropods species it is possible to state that the hydrophilous species prevailed, while the forest species are less and the xerophilous are the least frequent species.

The fauna in the sediments of the PID-1 borehole may be correlated with the fauna of the Eichkogel locality, found in the Austrian part of the Vienna Basin and with the Őcs locality from the Hungarian part of the Pannonian Basin.

Key words: Pannonian basin - Danube basin - Upper Pannonian - terrestrial gastropods - paleoecology

Introduction

Sediments of the Upper Pannonian (sensu RÖGL et al. 1993) rarely contain fauna which could be used for stratigraphic purposes.

In the past, 2 important Upper Pannonian localities were evaluated. The first of them is Eichkogel (stratotype of the Pannonian H zone), found in the Austrian part of the Vienna Basin, the second one is Őcs from the Hungarian part of the Pannonian Basin.

The locality Eichkogel has been evaluated several times (SCHLOSSER 1907, WENZ-EDLAUER 1942, PAPP 1951 and LUEGER 1981). The locality Őcs was similarly the object of interest of the following authors: LÖRENTHEY (1911), HALAVATS (1911), SOÓS (1934), BARTHA (1954) and SCHLICKUM (1978, 1979).

The first occurrence of Upper Pannonian fauna (zone H) in the Slovak part of the Pannonian Basin has been found at the eastern margin of Považský Inovec Mts., near the village Orešany, in the borehole PID-1

(FORDINÁL 1994). In sediments from this borehole, abundant fauna of terrestrial and freshwater gastropods has been found.

The aim of this paper is to evaluate in detail terrestrial gastropods from Upper Pannonian sediments from the borehole PID-1.

The systematic classification is based on works of LUEGER (1981) and STOJASPAL (1990).

Paleoecology

The terrestrial gastropods studied were found in the borehole PID-1 along with freshwater ones, indicating that terrestrial gastropods are an allochthonous component of the communities. They were washed down from the nearby coast into the shallow part of the freshwater lake. Based on a study of paleo-ecologic requirements of individual species of terrestrial gastropods it is possible to reconstruct the character of the shore area.

Terrestrial gastropods found in sediments from the borehole PID-1 may be classified, in accordance with LUEGER (1981), in the following groups:

1. hydrophilous, shore species: *Carychium* (*Saraphia*) *pachychilus* SANDBERGER, *Vertigo* (*Vertigo*) *callosa* (REUSS), *V. (Vertilla) oecensis* (HALAVATS), *Succinea* (*Succinella*) *oblonga* DRAPARNAUD, *Tropidomphalus* (*Mesodontopsis*) *doderleini* BRUSINA.

2. forest species: *Acicula* (*Acme*) *edlaueri* SCHLICKUM, *Argna* (*Argna*) *suemeghyi* (BARTHA), *Acantinula trochulus* (SANDBERGER), *Discus* (*Discus*) *pleuradrus* (BOURGUIGNAT), *Semilimax intermedius* (REUSS), *Clausilia* (*Clausilia*) *strauchiana* NORDSIECK.

3. probably xerophilous species living in open areas: *Vallonia subpulchella* (SANDBERGER), *Strobilops pappi* SCHLICKUM and *Fortuna clairi* SCHLICKUM-STAUCH.

Dominant in the samples investigated were hydrophilous species, less abundant were forest and the least abundant xerophilous species.

On the basis of above data it may be stated that the shore of the freshwater lake was damp (swamps?). This environment was replaced at a greater distance

from the shore by forest environment, in which there were probably open areas with xerophilous fauna.

Interregional correlation

The terrestrial gastropod fauna from Orešany, from the borehole PID-1, stratigraphically classified as the Pannonian zone H (FORDINÁL 1994) may be correlated with the localities Eichkogel (stratotype locality of the Pannonian zone H) from the Austrian part of the Vienna Basin and the locality Öcs from the Hungarian part of the Pannonian Basin.

Comparing the occurrences of various species of terrestrial gastropods on the above three localities (Tab. 1) it may be stated that most species determined in the borehole PID-1 (22 out of 26, i.e. 84.6%) are common with the locality Eichkogel (LUEGER 1981) and 16 (61.5%) with the locality Öcs (BARTHA 1954, SCHLICKUM 1978, 1979, LUEGER 1981).

The situation as far as the occurrences of the genus *STROBILOPS* is concerned is interesting. Of the three species described in the borehole PID-1, the species *S. pappi* SCHLICKUM is common with the locality Eichkogel and *S. pachychila* SOOS with the locality Öcs.

Systematic part

Class Gastropoda

Subclass Prosobranchia

Order Mesogastropoda

Family Acmidae

Genus *Acicula* HARTMANN, 1821

Subgenus *Acme* HARTMANN, 1821

Acicula (Acme) edlaueri SCHLICKUM, 1970

(Tab. I, Fig. 1)

1954 *Pupula limbata* (REUSS) - BARTHA: p. 175, Tab. 1, Fig. 8-10

1970 *Acicula (Acicula) edlaueri* n. sp. - SCHLICKUM: p. 86, Abb. 4

1978 *Acicula (Acicula) irenae* n.sp. - SCHLICKUM: p. 246, Tab. 18, Fig. 2

1981 *Acme (Acme) edlaueri* (SCHLICKUM) - LUEGER: p. 11, Tab. 1, Fig. 16a-b

Material: 80 specimens

Description: SCHLICKUM (1970) p. 86

Dimensions: Tab. I, Fig. 1; height = 2.74 mm, width = 1.1 mm

Occurrences: Orešany, borehole PID-1 (9.8-10.0 m, 10.0-10.4 m, 13.0-13.1 m, 22.0-22.1 m, 28.7-28.8 m, 32.0-32.3 m, 36.0-36.1 m, 36.5-36.6 m)

Stratigraphic and geographic distribution: This species occurs in the Pannonian H zone in Austria (Eichkogel, Richardshof) and in the Upper Pannonian in Hungary (Öcs)

Subclass *Pulmonata*

Order *Archaeopulmonata*

Family *Ellobiidae*

Genus *Carychium* O. F. MÜLLER, 1774

Subgenus *Saraphia* RISSO, 1826

Carychium (Saraphia) pachychilus SANDBERGER, 1875

(Tab. I, Fig. 2)

1875 *Carychium pachychilus* SANDB. - SANDBERGER: p. 715, Tab. 27, Fig. 12

1981 *Carychium (Saraphia) pachychilus* SANDBERGER - LUEGER: p. 14, Abb. 1, Tab. 1, Fig. 5-8, 9a-b, 10 (cum syn)

Material: 1100 specimens

Description: LUEGER (1981) p. 14

Dimensions: Tab. I, Fig. 2 height = 1.83 mm, width = 0.73 mm

Occurrences: Orešany, borehole PID-1 (4.0-4.2 m, 9.8-10.0 m, 10.0-10.4 m, 13.0-13.1 m, 22.0-22.1 m, 28.7-28.8 m, 32.0-32.3 m, 36.0-36.1 m, 36.5-36.6 m)

Stratigraphic and geographic distribution: The above species is known from zones B/C (Leobersdorf), D (Leobersdorf), E (Vösendorf), G/H (Velm), H (Eichkogel, Richardshof) of the Austrian Pannonian and from the Upper Pannonian of Hungary (Rudabánya, Öcs)

Order *Stylommatophora*

Family *Vertiginidae*

Subfamily *Truncatellinae*

Genus *Negulus* O. BOETTGER, 1889

Negulus gracilis GOTTSCHICK-WENZ, 1919

(Tab. I, Fig. 3-4)

1967 *Negulus suturalis gracilis* GOTTSCHICK u WENZ - SCHÜTT: p. 204

1981 *Negulus suturalis gracilis* GOTTSCHICK u WENZ - LUEGER: p. 18, Tab. 2, Fig. 2a-b

Material: 27 specimens

Description: LUEGER (1981) p. 18

Dimensions: Tab. I, Fig. 3; height = 1.73 mm, width = 0.83 mm

Occurrences: Orešany, borehole PID-1 (13.0-13.1 m, 22.0-22.1 m, 32.0-32.3 m, 36.0-36.1 m, 36.5-36.6 m)

Stratigraphic and geographic distribution: The occurrences of this species are known from the Sarmatian (Stenheim, Hollabrunn), from zones B/C (Leobersdorf) and H (Eichkogel) in the Austrian Pannonian.

Remarks: The quoted taxon I mention in the sense of STOJASPAL (1990) as species

Subfamily *Vertigininae*

Genus *Vertigo* O. F. MÜLLER, 1774

Subgenus *Vertigo* s.str.

***Vertigo (Vertigo) callosa* (REUSS, 1852)**

(Tab. I, Fig. 5)

- 1875 *Pupa collosa* REUSS - SANDBERGER: tab. 24, fig. 19
 1911 *Pupa callosa* REUSS - HALAVATS: p. 60, Tab. 3, Fig. 9
 1942 *Vertigo (Vertigo) callosa callosa* (REUSS) - WENZ-EDLAUER: p. 89
 1956 *Vertigo (Vertigo) callosa* (REUSS) - BARTHA: p. 518, Tab. 3, Fig. 18-19
 1967 *Vertigo (Vertigo) callosa* (REUSS) - SCHÜTT: p. 206, Abb. 8
 1981 *Vertigo (Vertigo) callosa* (REUSS) - LUEGER: p. 20, Tab. 2, Fig. 3.5

Material: 100 specimens

Description: LUEGER (1981) p. 20

Dimensions: Tab. I, Fig. 5, height = 1.5 mm, width = 1.03 mm

Occurrences: Orešany, borehole PID-1 (9.8-10.0 m; 10.0 - 10.4 m; 13.0 - 13.1 m; 22.0 - 22.1 m; 28.7 - 28.8 m; 32.0 - 32.3 m; 36.0 - 36.1 m; 36.5 - 36.6 m)

Stratigraphic and geographic distribution: This species is known from the Upper Oligocene in Germany (Hochheim), Lower Miocene of Bohemia (Tuchovice), zone H of the Pannonian in Austria (Eichkogel) and Upper Pannonian of Hungary (Öcs, Várpalota, Tab).

Subgenus *Vertilla* MOQUIN-TANDON, 1885

***Vertigo (Vertilla) oecsensis* (HALAVATS, 1911)**

(Tab. I, Fig. 6)

- 1911 *Pupa oecsensis* n.sp. - HALAVATS: p. 60, Tab. 3, Fig. 10
 1942 *Vertigo (Vertilla) angustior oecsensis* (HALAVATS) - WENZ-EDLAUER: p. 90, Tab. 4, Fig. 10
 1956 *Vertigo angustior oecsensis* (HALAVATS) - BARTHA: p. 518, Tab. 3, Fig. 20-21
 1959 *Vertigo angustior oecsensis* HALAV. - BARTHA: p. 79, Tab. 15, Fig. 9-10
 1981 *Vertigo (Vertilla) angustior oecsensis* (HALAVATS) - LUEGER: p. 22, Tab. 2, Fig. 8-9

Material: 110 specimens

Description: LUEGER (1981) p. 22

Dimensions: Tab. I, Fig. 6 height = 1.73 mm, width = 0.96 mm

Occurrences: Orešany, borehole PID-1 (4.0-4.2 m, 9.8-10.0 m, 10.0-10.4 m, 13.0-13.1 m, 22.0-22.1 m, 28.7-28.8 m, 32.0-32.3 m, 36.0-36.1 m, 36.5-36.6 m)

Stratigraphic and geographic distribution: Occurrences of the above species are known in the Sarmatian in Austria, in zones D (Leobersdorf), E (Vösendorf), G/H (Velm), H (Eichkogel) of the Pannonian in Austria and from the Upper Pannonian of Hungary (Öcs, Várpalota)

Remarks: The quoted taxon I mention in the sense of STOJASPAL (1990) as species

Family Chodrinidae

Genus *Gastrocopta* WOLLASTON, 1778

Subgenus *Albinula* STERKI, 1892

***Gastrocopta (Albinula) acuminata* (KLEIN, 1846)**

- 1959 *Gastrocopta (Albinula) acuminata* (KLEIN) - BARTHA: p. 80, Tab. 15, Fig. 6
 1976 *Gastrocopta (Albinula) acuminata acuminata* (KLEIN) - SCHLICKUM: p. 10
 1981 *Gastrocopta (Albinula) acuminata acuminata* (KLEIN) - LUEGER: p. 23, Tab. 2, Fig. 10

Material: 130 specimens

Description: LUEGER (1981) p. 23

Occurrences Orešany, borehole PID-1 (9.8-10.0 m, 10.0-10.4 m, 13.0-13.1 m, 22.0-22.1 m, 36.0-36.1 m, 36.5-36.6 m)

Stratigraphic and geographic distribution: The species is known in Europe from the Badenian to the Upper Pannonian

Remarks: The quoted taxon I mention in the sense of STOJASPAL (1990) as species

***Gastrocopta (Albinula) larteti* (DUPUY, 1850)**

(Tab. II, Fig. 1)

- 1942 *Gastrocopta (Albinula) acuminata larteti* (DUPUY) - WENZ-EDLAUER: p. 91, Tab. 4, Fig. 11
 1979 *Gastrocopta (Albinula) acuminata larteti* (DUPUY) - SCHLICKUM: p. 408, Tab. 23, Fig. 3
 1981 *Gastrocopta (Albinula) acuminata larteti* (DUPUY) - LUEGER: p. 24, Tab. 2, Fig. 11

Material: 25 specimens

Description: LUEGER (1981) p. 24

Dimensions: Tab. II, Fig. 1, height = 2.58 mm, width = 1.84 mm

Occurrences: Orešany, borehole PID-1 (10.0-10.4 m, 22.0-22.1 m, 32.0-32.3 m, 36.0-36.1 m)

Stratigraphic and geographic distribution: Occurrences of this species were found in all of the Miocene.

Remarks: The quoted taxon I mention in the sense of STOJASPAL (1990) as species

Subgenus *Sinalbinula* PILSBRY, 1916

***Gastroconpta (?Sinalbinula) infrapontica* WENZ, 1927**

(Tab. I, Fig. 7)

- 1959 *Gastrocopta fisidens infrapontica* WENZ - BARTHA: p. 79, Tab. 15, Fig. 2
 1979 *Gastrocopta (Sinalbinula) fisidens infrapontica* WENZ - SCHLICKUM: Tab. 23, Fig. 6
 1981 *Gastrocopta (?Sinalbinula) fisidens infrapontica* WENZ - LUEGER: p. 27, Tab. 2, Fig. 20-21

Material: 10 specimens

Description: LUEGER (1981) p. 27

Dimensions: Tab. I, Fig. 7, height = 2.5 mm, width = 1.25 mm

Occurrences: Orešany, borehole PID-1 (10.0-10.4 m, 13.0-13.1 m, 36.5-36.6 m)

Stratigraphic and geographic distribution: The species is known from the Badenian to the Upper Pannonian in Austria and Hungary

Remarks: The quoted taxon I mention in the sense of STOJASPAL (1990) as species

Family Pupillidae

Genus *Argna* COSSMANN, 1899

Subgenus *Argna* s.str.

Argna (Argna) suemeghyi (BARTHA, 1956)

(Tab. II, Fig. 2)

1956 *Agardia suemeghyi* n.sp. - BARTHA: p. 519, Tab. 4, Fig. 3-4

1959 *Agardia suemeghyi* BARTHA - BARTHA: p. 81, Tab. 15, Fig. 17

1978 *Argna oppoliensis* (ANDREAE - SCHLICKUM: p. 252, Tab. 19, Fig. 10

1981 *Argna (Argna) suemeghyi* (BARTHA) - LUEGER: p. 32, Tab. 3, Fig. 9, 10-11

Material: 50 specimens

Description: BARTHA (1956) p. 519

Dimensions: Tab. II, Fig. 2, height = 3.06 mm, width = 1.24 mm

Occurrences: Orešany, borehole PID-1 (13.0-13.1 m, 22.0-22.1 m, 36.0-36.1 m, 36.5-36.6 m)

Stratigraphic and geographic distribution: The species is known from zones G/H (Velm) and H (Eichkogel, Richrdshof) of the Pannonian in Austria and from the Upper Pannonian of Hungary (Tab. Öcs).

Family Valloniidae

Subfamily Valloniidae

Genus *Vallonia* RISSO, 1826

Vallonia subpulchella (SANDBERGER, 1875)

(Tab. II, Fig. 3)

1875 *Helix (Vallonia) subpulchella* SANDBERGER - SANDBERGER: p. 544, Tab. 29, Fig. 3a-c

1959 *Vallonia subpulchella* (SANDBERGER) - BODA: p. 739, Tab. 37, Fig. 1

1981 *Vallonia subpulchella* (SANDBERGER) - LUEGER: p. 33, Tab. 3, Fig. 13a-c

Material: 30 specimens

Description: LUEGER (1981) p. 33

Dimensions: Tab. II, Fig. 3, width = 2.48 mm, height = 1.42 mm

Occurrences: Orešany, borehole PID-1 (10.0-10.4 m; 22.0-22.1 m; 28.7-28.8 m; 32.0-32.3 m; 36.0-36.1 m; 36.5-36.6 m)

Stratigraphic and geographic distribution: Occurrences of this species are known from the H zone of the Austrian Pannonian (Eichkogel), Sarmatian and Upper Pannonian of Hungary (Öcs).

Subfamily Acanthinulinae

Genus *Acanthinula* BECK, 1847

Acanthinula trochulus (SANDBERGER, 1875)

(Tab. II, Fig. 6)

1875 *Pupa (Modicella) trochulus* SANBERGER - SANDBERGER: p. 601, Tab. 29, Fig. 25a-b

1907 *Pupa (Modicella) trochulus* SANDBERGER - TROLL: p. 76

1921 *Acanthinula trochulus* (SANDBERGER) - WENZ: p. 31

1981 *Acanthinula trochulus* (SANDBERGER) - LUEGER: p. 34, Tab. 3, Fig. 14

Material: 2 specimens

Description: LUEGER (1981) p. 34

Dimensions: Tab. II, Fig. 6; height = 1.8 mm, width = 1.8 mm

Occurrences: Orešany, borehole PID-1 (22.0-22.1 m)

Stratigraphic and geographic distribution: This species is known from zones D (Heilsamer Brunnen at Leobersdorf) and H (Eichkogel) of the Austrian Pannonian..

Subfamily Strobilopsinae

Genus *Strobilops* PILSBRY, 1893

Subgenus *Strobilops* s.str.

Strobilops (Strobilops) costata (CLESSIN, 1877)

(Tab. III, Fig. 2)

1915 *Strobilops (Str.) costata* (SBG. emend CLESSIN) - WENZ: p. 79, Tab. 4, Fig. 15a-c, 16a-c

1961 *Strobilops (Strobilops) costata* (CLESSIN) - STEKLOV: p. 4, Abb. 2-4

1966 *Strobilops (Strobilops) costata* (CLESSIN) - STEKLOV: p. 171 Tab. 5, Fig. 99-100

1967 *Strobilops (Strobilops) costata* (CLESSIN) - SCHÜTT: p. 213, Abb. 15

Material: 67 specimens

Description: STEKLOV (1966) p. 171

Dimensions: Tab. III, Fig. 2, height = 1.5 mm, width = 2.6 mm

Occurrences: Orešany, borehole PID-1 (13.0-13.1 m, 22.0-22.1 m, 36.0-36.1 m)

Stratigraphic and geographic distribution: Occurrences of this species are known from the Upper Miocene in Germany (Undorf), Poland (Oppeln) and the Fore-Caucasian region.

Notes: The genus *Strobilops* occurred in Europe from the Eocene, its greatest development was reached in the Miocene and at the end of Pliocene it died out. At present there are known 19 species of this genus. They occur in SE Asia (China, Japan, Korea), on Philippines and on the American continent (from SE provinces of Canada to Venezuela, NE part of Brasil and on the Galapagos Islands (STEKLOV, 1961).

***Strobilops (Strobilops) pachychila* Soós, 1955**

(Tab. III, Fig. 1)

1934 *Strobilops tiarula* SBGR. - Soós: p. 196

1955 *Strobilops tiarula pachychilus* Soós n.v. - BARTHA-Soós: p. 65, Tab. 5, Fig. 11-13

1959 *Strobilops tiarula pachychilus* Soós - BARTHA: Tab. 15, Fig. 12, 14

1978 *Strobilops (Strobilops) pachychila* Soós - SCHLICKUM: p. 409, Tab. 23, Fig. 8

Material: 15 specimens

Description: BARTHA-Soós (1955), p. 65

Dimensions: Tab. III, Fig. 1, height = 1.6 mm, width = 2.2 mm

Occurrences: Orešany, borehole PID-1 (22.0-22.1 m, 36.0-36.1 m, 36.5-36.6 m).

Stratigraphic and geographic distribution: Up to now, the species has been known only from the Upper Pannonian of Hungary (Öcs).

***Strobilops (Strobilops) pappi* SCHLICKUM, 1970**

(Tab. III, Fig. 3)

1970 *Strobilops (Strobilops) pappi* n.sp. - SCHLICKUM: p. 84, Abb. 2-3

1981 *Strobilops (Strobilops) pappi* SCHLICKUM - LUEGER: p. 36, Tab. 4, Fig. 1a-c

Material: 150 specimens

Description: SCHLICKUM (1970) p. 84

Dimensions: Tab. III, Fig. 3, height = 1.17 mm, width = 1.87 mm

Occurrences: Orešany, borehole PID-1 (4.0-4.2 m; 9.8-10.0 m; 10.0-10.4 m; 13.0-13.1 m; 22.0-22.1 m; 28.7-28.8 m; 32.0-32.3 m; 36.0-36.1 m; 36.5-36.6 m)

Stratigraphic and geographic distribution: This species occurs in zones D (Leobersdorf), E (Vösendorf), G/H (Velm) a H (Eichkogel, Richardshof) in Austria.

Suborder *Heterurethra*

Family *Succineidae*

Genus *Succinea* DRAPARNAUD, 1801

Subgenus *Succinella* MABILLE, 1870

***Succinea (Succinella) oblonga* DRAPARNAUD, 1881**

1964 *Succinea (S.) oblonga* DRAPARNAUD, 1801 - LOŽEK: p. 230, Tab. 12, Fig. 7-9

1975 *Succinea (Succinella) oblonga* DRAPARNAUD - SCHLICKUM: p. 58, Tab. 5, Fig. 29

1980 *Succinea (Succinella) oblonga* DRAPARNAUD - SCHLICKUM - GEISERT: p. 234, Tab. 13, Fig. 23

1981 *Succinea (Succinella) oblonga* DRAPARNAUD - LUEGER: p. 38, Tab. 4, Fig. 13-14

Material: 1 specimen

Description: LOŽEK (1964) p. 230

Occurrences: Orešany, borehole PID-1 (22.0-22.1 m)

Stratigraphic and geographic distribution: Occurrences of this genus in Europe are known from the Pannonian to the Recent.

Suborder *Sigmuretha*

Superfamily *Enodontacea*

Family *Enodontidae*

Subfamily *Punctinae*

Genus *Punctum* MORSE, 1864

Subgenus *Punctum* s.str.

***Punctum (Punctum) propygmæum* ANDREAE, 1904**

(Tab. II, Fig. 4)

1942 *Punctum (Punctum) pygmæum* (DRAPARNAUD) - WENZ - EDLAUER: p. 92

1975 *Punctum (Punctum) propygmæum* ANDREAE - SCHLICKUM: p. 59, Tab. 5, Fig. 30

1981 *Punctum (Punctum) pygmæum propygmæum* ANDREAE - LUEGER: p. 39, Tab. 4, Fig. 4a-c, 5a-

Material: 10 specimens

Description: LUEGER (1981) p. 39

Dimensions: Tab. II, Fig. 3, height = 0.9 mm, width = 1.73 mm

Occurrences: Orešany, borehole PID-1 (10.0-10.4 m; 36.0-36.1 m)

Stratigraphic and geographic distribution: The species occurs in the Upper Miocene of Europe.

Remarks: The quoted taxon I mention in the sense of STOJASPAL (1990) as species

Subfamily *Discinae*

Genus *Discus* FITZINGER, 1833

Subgenus *Discus* s.str.

***Discus (Discus) pleuradrus* (BOURGUIGNAT, 1881)**

1875 *Patula euglyphoides* SANDB. - SANDBERGER: p. 583, Tab. 29, Fig. 1

1907 *Patula euglyphoides* SANDB. - TROLL: p. 73

1967 *Discus (Discus) pleuradrus pleuradrus* (BOURGUIGNAT) - SCHÜTT: p. 213, Abb. 16

1981 *Discus (Discus) pleuradrus* (BOURGUIGNAT) - LUEGER: p. 40, Tab. 4, Fig. 6a-c, 7

Material: 40 specimens

Description: LUEGER (1981) p. 40

Occurrences: Orešany, borehole PID-1 (9.8-10.0 m; 13.0-13.1 m; 22.0-22.1 m; 32.0-32.3 m; 36.0-36.1 m; 36.5-36.6 m)

Stratigraphic and geographic distribution: This species occurs in the Upper Miocene (Sansan - type locality) of France, in the Badenian, Sarmatian (Stenheim, Hollabrunn, Oberdorf), in zones B/C of the Pannonian (Lanzendorf, Leobersdorf), D (Leobersdorf), E (Vösendorf), G/H (Velm), H (Eichkogel) in Austria and in the Upper Pannonian of Hungary (Öcs).

Superfamily Zonitacea

Family Vitrinidae

Subfamily Vitrininae

Genus *Semilimax* AGASSIZ, 1845***Semilimax intermedius* (REUSS, 1852)**

1954 *Daudebardia* cf. *praecursor* ANDREAE - PAPP-THENIUS: Tab. 4, Fig. 12

1981 *Semilimax intermedius* (REUSS) - LUEGER: p. 41, Tab. 5, Fig. 1a-b, 2-3

Material: 3 specimens

Description: LUEGER (1981) p. 41

Occurrences: Orešany, borehole PID-1 (13.0-13.1m; 36.0-36.1 m)

Stratigraphic and geographic distribution: Occurrences of this species are known in Europe from the Eggenburgian to the Upper Pannonian.

Subfamily Zonitinae

Genus *Oxychilus* FITZINGER, 1833Subgenus *Oxychilus* s.str.***Oxychilus (Oxychilus) procellarius* (Jooss, 1918)**

1934 *Oxychilus (Oxychilus) procellaria* JOOSS - Soós: p. 197

1942 *Oxychilus (Oxychilus) procellarium* (JOOSS) - WENZ - EDLAUER: p. 93

1981 *Oxychilus (Oxychilus) procellarium* (JOOSS) - LUEGER: p. 46, Tab. 6, Fig. 2a-c

Material: 580 specimens

Description: LUEGER (1981) p. 46

Occurrences: Orešany, borehole PID-1 (4.0-4.2 m; 9.8-10.0 m; 10.0-10.4 m; 13.0-13.1 m; 22.0-22.1 m; 28.7-28.8 m; 32.0-32.3 m; 36.0-36.1 m; 36.5-36.6 m)

Stratigraphic and geographic distribution: The species is known from the Lower Miocene (Morsingen), Sarmatian (Stenheim) the zones B/C (Leobersdorf), D Leobersdorf, H (Eichkogel) of the Pannonian of Austria and from the Upper Pannonian of Hungary (Öcs).

Family Subulinidae

Genus *Fortuna* SCHLICKUM-STRAUCH, 1972***Fortuna clairi* SCHLICKUM-STRAUCH, 1972**

(Tab. II, Fig. 5)

1970 *Rumina seringi* (MICAUD) - SCHLICKUM: p. 87, Fig. 7-9 (non 5-6)

1972 *Fortuna clairi* n.sp. - SCHLICKUM-STRAUCH: p. 72, Fig. 3-4

1975 *Fortuna clairi* SCHLICKUM-STRAUCH - SCHLICKUM: p. 63, Tab. 6, Fig. 43

Material: 20 specimens

Description: SCHLICKUM - STRAUCH (1972) p. 72

Dimensions: Tab. II, Fig. 5, height=3.4 mm, width=1.7 mm

Occurrences: Orešany, borehole PID-1 (4.0-4.2 m; 13.0-13.1 m; 22.0-22.1 m; 32.0-32.3 m; 36.0-36.1 m; 36.5-36.6 m)

Stratigraphic and geographic distribution: Up to now, occurrences of this species have been known from the zone H of the Pannonian in Austria (Eichkogel) and the Pliocene of Germany.

Family Clausillidae

Subfamily Phaedusinae

Genus *Nordsieckia* TRUC, 1972***Nordsieckia pontica* LUEGER, 1981**

(Tab. II, Fig. 9)

1981 *Nordsieckia fischeri pontica* n.ssp. - LUEGER: p. 50, Tab. 7, Fig. 7, 8a-c, 9-12

1981 *Nordsieckia pontica* LUEGER - NORDSIECK: p. 81, Tab. 9, Fig. 32-33

Material: 20 specimens

Description: LUEGER (1981) p. 50

Occurrences: Orešany, borehole PID-1 (13.0-13.1 m; 22.0-22.1 m; 36.0-36.1 m; 36.5-36.6 m)

Stratigraphic and geographic distribution: This species occurs in zones B/C (Leobersdorf) E (Vösendorf) G/H (Velm), H (Eichkogel, Richardshof) of the Pannonian in Austria.

Subfamily Clausiliinae

Genus *Clausilia* DRAPARNAUD, 1805Subgenus *Clausilia* s.str.***Clausilia (Clausilia) strauchiana* NORDSIECK, 1972**

(Tab. II, Fig. 8)

1972 *Clausilia strauchiana* n.sp. - NORDSIECK: p. 172, Tab. 10, Fig. 19-23, Abb. 3-4

1981 *Clausilia (Clausilia) strauchiana* NORDSIECK, 1972 - LUEGER: p. 51, Tab. 7, Fig. 14a-b

Material: 3 specimens

Description: NORDSIECK (1972) p. 172

Occurrences: Orešany, borehole PID-1 (13.0-13.1m)

Stratigraphic and geographic distribution: The species is known from the zone H of the Pannonian of Austria (Eichkogel) and the Pliocene of Germany.

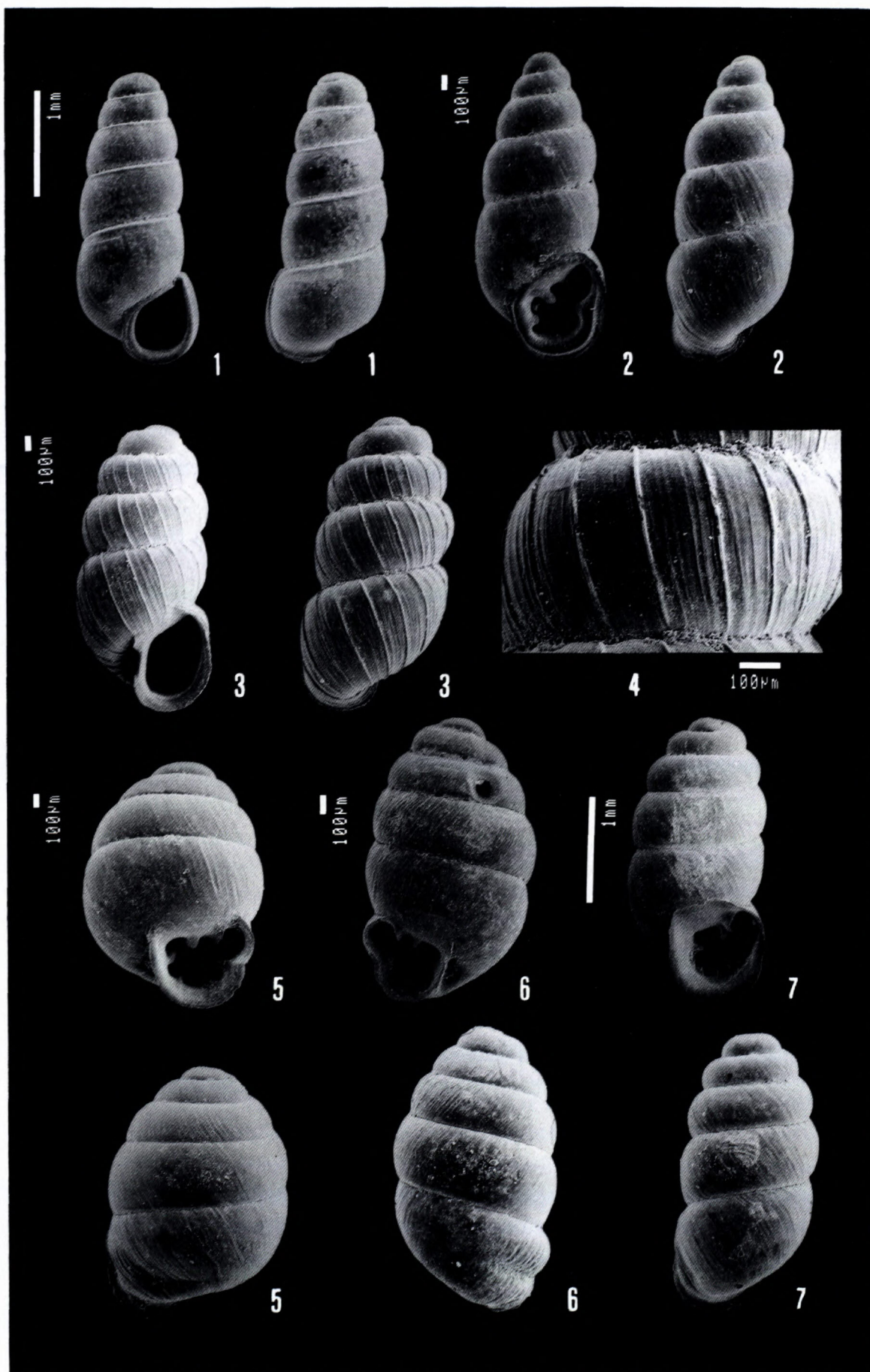
Subfamily Campylaeina

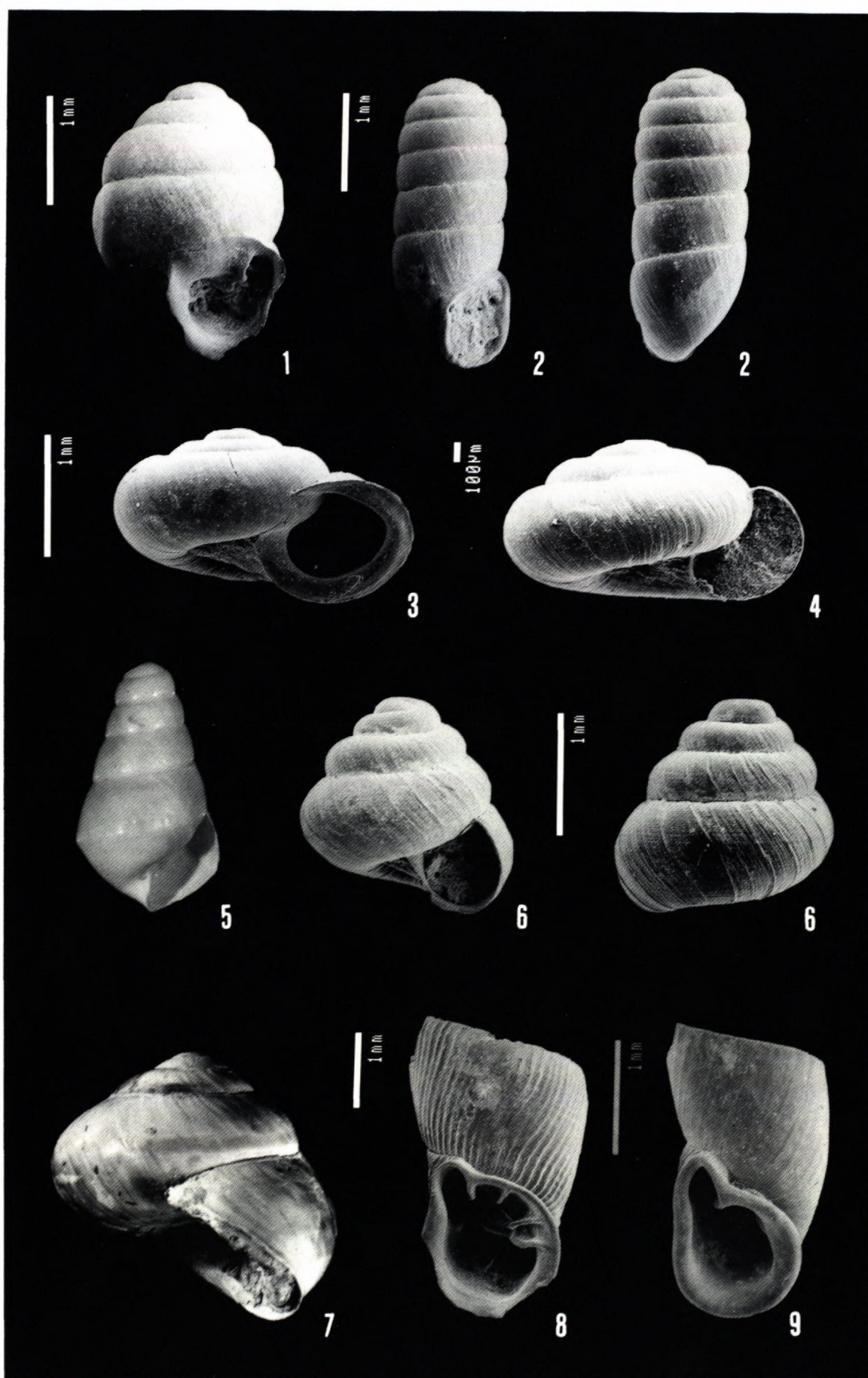
Genus *Tropidomphalus* C.R. BOETGER, 1908Subgenus *Mesodontopsis* PILSBRY, 1895***Tropidomphalus (Mesodontopsis) doderleini***

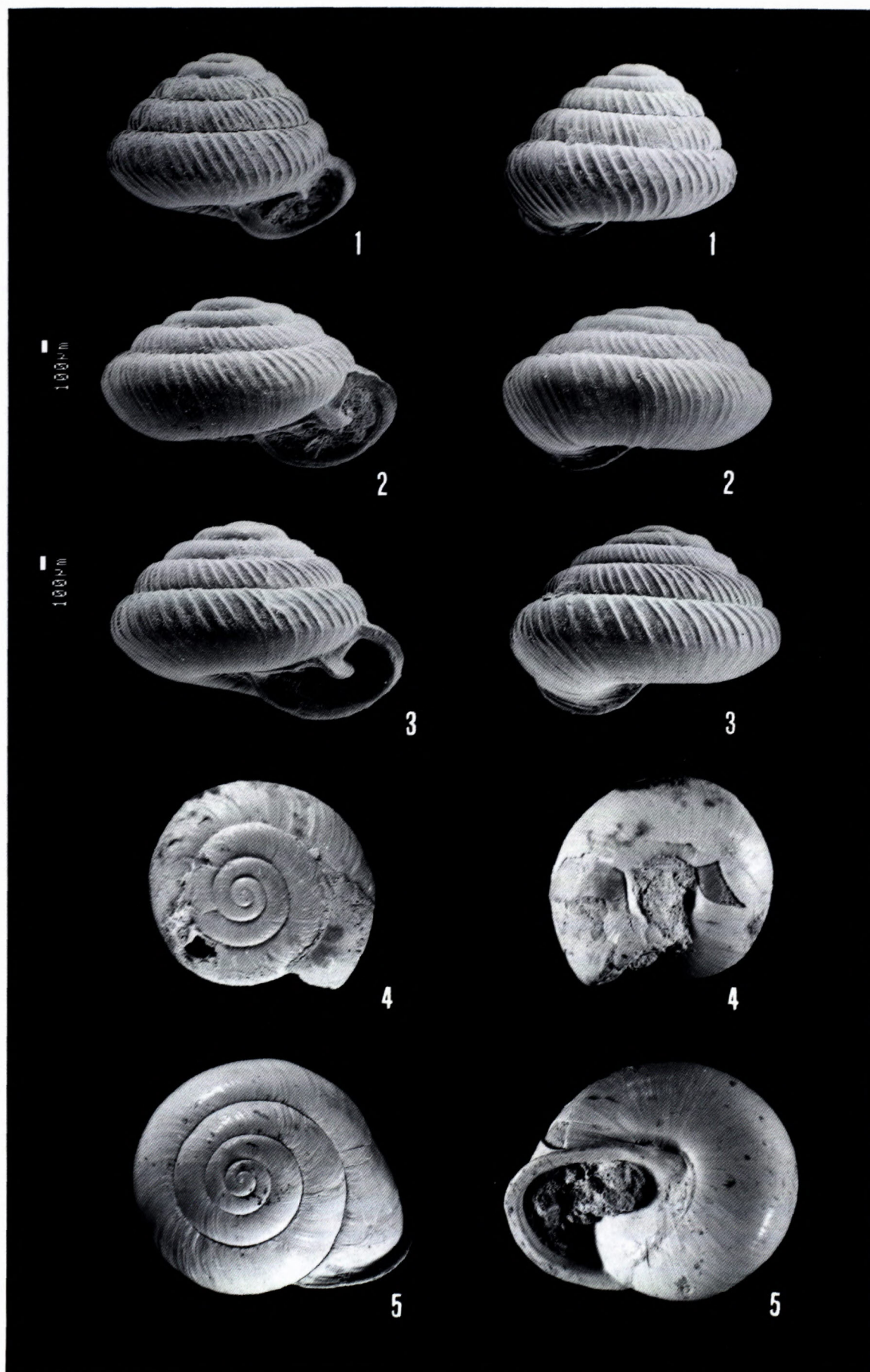
(BRUSINA, 1897)

(Tab. III, Fig. 5)

1897 *Helix (Tacheocampylea) Doderleini* BRUS. n.sp. - BRUSINA: p. 1, Tab. 1, Fig. 1-2







- 1955 *Tacheocampylea* (*Mesodontopsis*) *doderleini* (BRUSINA) - BARTHA: p. 310
 1956 *Tacheocampylea* (*Mesodontopsis*) *doderleini* (BRUSINA) - BARTHA: p. 520
 1959 *Tacheocampylea* (*Mesodontopsis*) *doderleini* BRUSINA, 1897 - BARTHA: p. 82, Tab. 16, Fig. 1, 6
 1973 *Mesodontopsis doderleini* (BRUSINA 1897) - SCHLICKUM - STRAUCH: p. 161, Abb. 3, 9-14
 1981 *Tropidomphalus* (*Mesodontopsis*) *doderleini* (BRUSINA) - LUEGER: p. 61, Tab. 10, Fig. 5, Tab. 11, Fig. 2-6

Material: 4 specimens

Description: LUEGER (1981) p. 61

Dimensions: Tab. III, Fig. 5, height = 20.0 mm, width = 35.4 mm

Occurrences: Orešany, borehole PID-1 (32.0-32.3 m; 36.0-36.1 m; 36.5-36.6 m)

Stratigraphic and geographic distribution: Summarised in detail in SCHLICKUM-STRAUCH (1973). Pannonian of zones G-H.

Notes: This species was found also in the Western Carpathians (in the Danube Lowland), at the village Gbelce (former Kőbőkút). It was classified as *Helix* (*Flemicla*) *robusta* REUSS (HORUSITZKY, 1898). It has been classified as *Tacheocampylea* (*Mesodontopsis*) *doderleini* (BRUSINA) by WENZ (1923).

Genus *Helicigona* RISSO, 1826

Helicigona wenzii SOOS, 1934

(Tab. III, Fig. 4)

- 1934 *Helicigona* (*Helicigona*) *WENZII* n.sp. - SOÓS: p. 201, Fig. 12,
 1981 *Helicigona wenzii* SOOS - LUEGER: p. 66, Tab. 8, Fig. 9a-c, 10a-c, Tab. 16, Fig. 8

Material: 1 exemplár

Description: LUEGER (1981) p. 66

Dimensions: Tab. III, Fig. 4, height = 5 mm, width = 12 mm

Occurrences: Orešany, borehole PID-1 (36.0-36.1 m)
 Stratigraphic and geographic distribution: The species occurs in zone F of the Pannonian in Austria (Götzendorf) and in the Upper Pannonian of Hungary (Fonyód, Öcs, Várpalota).

Genus *Klikia* PILSBRY, 1895

Subgenus *Apula* C.R. BOETTGER, 1909

Klikia (*Apula*) *goniostoma* (SANDBERGER, 1875)

- 1875 *Helix* (*Fruticola*) *goniostoma* SANDB. - SANDBERGER: p. 702, Tab. 32, Fig. 12
 1979 *Apula* (*Steklovía*) *goniostoma* (SANDBERGER) - SCHLICKUM: p. 411, Tab. 23, Fig. 9
 1979 *Apula* (*Steklovía*) *halavatsi* n.nom. - SCHLICKUM: p. 412, Tab. 23, Fig. 10
 1981 *Klikia* (*Apula*) *goniostoma* (SANDBERGER) - LUEGER: p. 68, Tab. 10, Fig. 3a-c

Material: 1 specimen

Description: LUEGER (1981) p. 68

Occurrences: Orešany, borehole PID-1 (22.0-22.1 m)

Stratigraphic and geographic distribution: Occurrences of this species are known from zones G/H (Ebergassing, Velm, Gols, Angern), H (Eichkogel) of the Pannonian in Austria and from the Upper Pannonian of Hungary (Öcs, Nagy Vaszony, Várpalota, Tab, Balatonszentgyörgy).

Subfamily: *Helicinae*

Genus *Cepaea* HELD, 1837

Subgenus *Cepaea* s.str.

Cepaea (*Cepaea*) *etelkae* (HALAVATS, 1925)

(Tab. II, Fig. 7)

- 1907 *Helix* (*Tachea*) cf. *hortensis* MÜLLER - TROLL: p. 74
 1934 *Cepaea sylvestrina etelkae* HALAV. - SOÓS: p. 202
 1955 *Cepaea sylvestrina etelkae* HALAV. BARTHA: p. 311
 1959 *Cepaea sylvestrina etelkae* (HALAVATS) - BARTHA: p. 82, Tab. 16, Fig. 3-4
 1981 *Cepaea* (*Cepaea*) *etelkae* (HALAVATS) - LUEGER: p. 72, Tab. 13, Fig. 1a-c, 2a-c, Tab. 14, Fig. 1a-c, 2a-c, 3a-c, 4a-c, 5-6, 7a-c

Material: 4 specimens

Description: LUEGER (1981) p. 72

Dimensions: Tab. II, Fig. 7, height = 19.2 mm, width = 24.4 mm

Occurrences: Orešany, borehole PID-1 (13.0-13.1 m; 32.0-32.3 m; 36.0-36.1 m)

Stratigraphic and geographic distribution: Occurrences are known from zone B/C to zone H in Austria and from the majority of Upper Pannonian localities in Hungary.

Conclusions

In sediments from the borehole PID-1, stratigraphically classified as the Pannonian zone H (FORDINÁL 1994) there have been described 26 species of terrestrial gastropods. The list of species known from the above borehole has been extended to include *Acanthiula trochulis* (SANDBERGER), *Strobilops costata* (CLESIN), *S. pachychila* SOOS, *Clausilia strauchiana* NORDSIECK, *Helicigona wenzii* SOOS.

On the basis of paleoecological requirements of different terrestrial gastropod species (LUEGER 1981) it may be stated that during the Pannonian zone H, humid climate (swamps?) existed on the shores of the lake, which was at a greater distance from the shore replaced by forest environment, in which there were probably open areas with xerophilous fauna.

The fauna of terrestrial gastropods from Orešany, from the borehole PID-1, has been compared with the localities Eichkogel (84.6% of species in common) and Öcs (61.5%).

Tab. 1 Occurrence of individual species of terrestrial gastropods at the Eichkogel, Öcs and Orešany localities

Druh	Eichkogel Lueger 1981	Öcs	Orešany PID-1
<i>Acicula edlaueri</i>	+	+	+
<i>Carychium pachychilus</i>	+	+	+
<i>Negulus gracilis</i>	+		+
<i>Vertigo callosa</i>	+	+	+
<i>Vertigo suevica</i>	+		
<i>Vertigo oecensis</i>	+	+	+
<i>Truncatellina suprapontica</i>	+		
<i>Gastrocopta acuminata</i>	+	+	+
<i>Gastrocopta larteti</i>	+	+	+
<i>Gastrocopta nouletiana</i>	+	+	
<i>Gastrocopta infrapontica</i>	+	+	+
<i>Gastrocopta ferdinandi</i>	+		
<i>Gastrocopta serotina</i>	+		
<i>Abida schuebleri</i>	+		
<i>Pupilla rathi</i>	+		
<i>Argna suemeghyi</i>	+	+	+
<i>Vallonia costata</i>	+		
<i>Vallonia subpulchella</i>	+	+	+
<i>Acanthinula trochulus</i>	+		+
<i>Strobulops costata</i>			+
<i>Strobulops pachychila</i>		+	+
<i>Strobulops pappi</i>	+		+
<i>Ena</i> sp.	+		
<i>Succinea oblonga</i>			+
<i>Succinea</i> sp.	+		
<i>Punctum propygmæum</i>	+		+
<i>Discus pleuradrus</i>	+	+	+
<i>Semilimax intermedius</i>			+
<i>Helicodiscus roemeri</i>	+		
<i>Perpolita disciformis</i>	+		
<i>Aegopinella orbicularis</i>	+		
<i>Oxychilus procellarius</i>	+	+	+
<i>Cecilioides aciculella</i>	+		
<i>Fortuna clairi</i>	+		+
<i>Nordsieckia pontica</i>	+		+
<i>Clausilia strauchiana</i>	+		+
<i>Leucochroopsis kleini</i>	+		
<i>Helicigona wenzi</i>			+
<i>Klikia trolli</i>	+		
<i>Klikia goniostoma</i>	+	+	+
<i>Klikia magna</i>	+		
<i>Tropidomphalus richarzi</i>	+		
<i>Tropidomphalus doderleini</i>	+	+	+
<i>Helicigona wenzi</i>			+
<i>Cepaea etelkae</i>	+	+	+

Explanations to Plates I-III

Plate I

- Fig. 1 *Acicula (Acme) edlaueri* SCHLICKUM PID-1 36,5-36,6 m
 Fig. 2 *Carychium (Saraphia) pachychilus* SANDBERGER PID-1 13,0-13,1 m
 Fig. 3 *Negulus gracilis* GOTTSCHICK-WENZ PID-1 13,0-13,1 m
 Fig. 4 Detail of the sculpture of last but one whorl of the *Negulus gracilis* test (fig. 3)
 Fig. 5 *Vertigo (Vertigo) callosa* (REUSS) PID-1 36,5-36,6 m
 Fig. 6 *Vertigo (Vertilla) oecensis* (HALAVATS) PID-1 36,5-36,6 m
 Fig. 7 *Gastrocopta (?Sinalbinula) infrapontica* WENZ PID-1 22,0-22,1 m

Plate II

- Fig. 1 *Gastrocopta (Albinula) larteti* (DUPUY) PID-1 22,0-22,1 m
 Fig. 2 *Argna (Argna) suemeghyi* (BARTHA) PID-1 22,0-22,1 m
 Fig. 3 *Vallonia subpulchella* (SANDBERGER) PID-1 10,0-10,4 m
 Fig. 4 *Punctum (Punctum) propygmæum* ANDREAE PID-1 6,0-36,1
 Fig. 5 *Fortuna clairi* SCHLICKUM-STRAUCH PID-1 22,0-22,1 m
 Fig. 6 *Acanthinula trochulus* (SANDBERGER) PID-1 22,0-22,1 m
 Fig. 7 *Cepaea (Cepaea) etelkae* (HALAVATS) PID-1 36,0-36,1m, magn. 2,3x
 Fig. 8 *Clausilia (Clausilia) strauchiana* NORDSIECK PID-1 13,0-3,1 m
 Fig. 9 *Nordsieckia pontica* LUEGER PID-1 13,0-13,1 m

Plate III

- Fig. 1 *Strobulops (Strobulops) pachychila* SOOS PID-1 22,0-2,1 m
 Fig. 2 *Strobulops (Strobulops) costata* (CLESSIN) PID-1 13,0-13,1 m
 Fig. 3 *Strobulops (Strobulops) pappi* SCHLICKUM PID-1 22,0-22,1 m
 Fig. 4 *Helicigona wenzi* SOOS PID-1 36,0-36,1 m, zv. 3,6x
 Fig. 5 *Tropidomphalus (Mesodontopsis) doderleini* (BRUSINA) PID-1 32,0-32,3 m, magn. 1,4x

Photographs in Table III, Fig. 4 and 5 were made by C. Michaliková in Fig. 7, in Table II the author of this paper. The remaining photographs were made by the 3SM-840 electron microscope, installed at the Dionýz Štúr Institute of Geology in Bratislava, operated by K. Horák.

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