Arch. Molluskenkunde | **133** | (1/2) | 1–57 | 5 figs., 11 plates | Frankfurt am Main, 31.12.2004

Synopsis of the Late Miocene mollusc fauna of the classical sections Richardhof and Eichkogel in the Vienna Basin

(**Austria, Pannonian, MN 9-MN11**)

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Abstract

The Eichkogel and Richardhof sections represent two important reference faunas for the reconstruction of the Late Miocene continental mollusc faunas. New investigations with strong focus on the micro-vertebrate assemblages of the Pannonian in the Vienna Basin by G. DAXNER-HÖCK (NHMW) allow a rather precise dating of the Vallesian to Early Turolian faunas into the mammal zones MN 9 (samples Richardhof RH A/2, RH A/7), MN 10 (samples Richardhof Rh 1, Rh 3, Rh 5) and MN 11 (Eichkogel). The increase in material and the improved stratigraphic resolution of the formerly intermingled faunas - aside from the fact that the already published taxa are partly hidden in various papers dealing with special taxonomic problems - motivated us to produce a critical synopsis of the knowledge of these faunas. For the first time, the protoconch features are also documented for many of the discussed species. In total, 84 mollusc taxa are known from the sections. Of these, 71 are recorded from the Eichkogel section and 58 from the Richardhof section. *Pseudamnicola hoeckae* nov. sp., *Granaria moedlingensis* nov. sp., *Janulus austriacus* nov. sp. and *Klikia* (*Apula*) *vindobonensis* nov. sp. are introduced as new species.

Keywords: Late Miocene, Pannonian, Vallesian, Early Turolian, non-marine molluscs, Vienna Basin, Lake Pannon.

Kurzfassung

Die terrestrischen und limnischen Molluskenfaunen der Fundpunkte Eichkogel und Richardhof sind bedeutende Referenzfaunen des späten Miozäns in Mitteleuropa. Durch neue Untersuchungen der Aufschlüsse im Rahmen eines „Kleinsäuger-Projektes“ von G. DAXNER-HÖCK (NHMW) konnte zahlreiches Material geborgen werden und eine präzise Datierung der Faunen vorgenommen werden. Die oftmals als zeitgleich beurteilten Faunen umspannen tatsächlich eine Zeitspanne von rund 2 Millionen Jahren. Die ältesten Proben vom Richardhof (RH A/2, RH A/7) entsprechen der Säugetierzone MN9 (Vallesium). Weitere Proben vom gleichen Fundpunkt (Rh 1, Rh 3, Rh 5) wurden als MN 10 datiert, während der Eichkogel Säugerfaunen der Zone MN 11 (Turolium) erbrachte. Durch diese Einstufung erweisen sich die beiden Faunen als exzellente „Anker“ für die Korrelation weiterer miozäner und pliozäner kontinentaler Molluskenfaunen. Von den 84 Taxa der Gesamtfauna lassen sich 71 am Eichkogel nachweisen, während 58 Arten am Richardhof festgestellt werden konnten. Viele dieser Arten - insbesondere die Protoconche - werden erstmals abgebildet. *Pseudamnicola hoeckae* nov. sp., *Granaria moedlingensis* nov. sp., *Janulus austriacus* nov. sp. und *Klikia* (*Apula*) *vindobonensis* nov. sp. werden als neue Arten beschrieben.

Schlüsselwörter: Spätes Miozän, Pannonium, Vallesium, Turolium, terrestrische - limnische Mollusken, Wiener Becken, Pannonischer See.

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Introduction

The investigated material derives from an excavation campaign by the Museum of Natural History in Vienna under the leadership of Gudrun DAXNER-HÖCK. The aim of these efforts was to obtain a full dataset on the micromammal fauna of the Mammal Zones MN 9 to MN 11 in the environments surrounding Lake Pannon. As a „bycatch", thousands of terrestrial and aquatic molluscs became available from sieve samples. In the literature the newly studied sections were often considered to be approximately of the same age and have usually been treated as Pliocene The actual dating based on the mammal zones as illustrated in textfigure 1 documents the huge gap of about 2 ma between the faunas of Richardhof and those from the Eichkogel section.

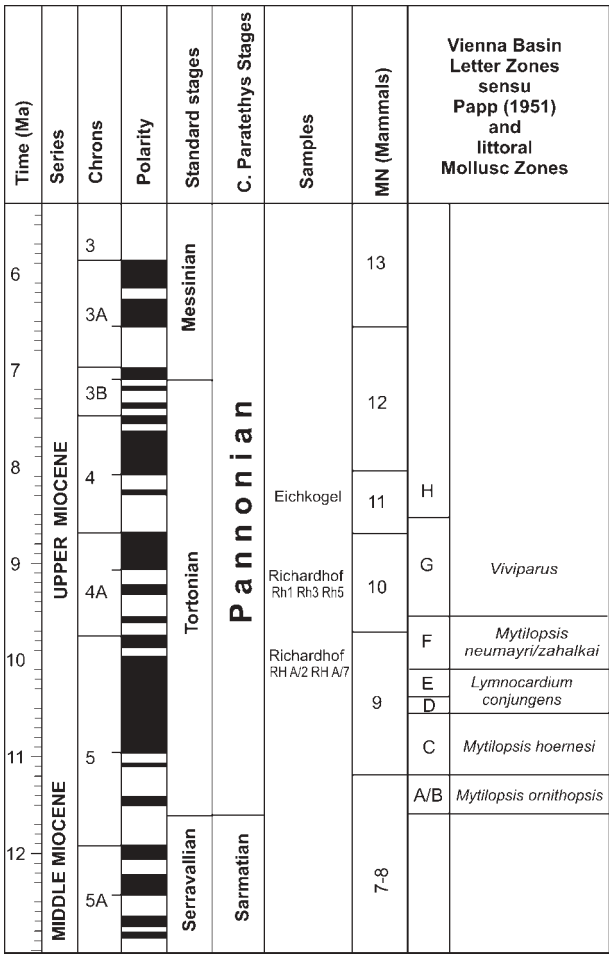
In the late 20 th century, especially the vertebrate fauna from the Eichkogel section was focused upon by scientists such as WEINFURTER (1950), ZAPFE (1951), RABEDER (1970), and DAXNER-HÖCK (1970, 1972 a, 1972 b, 1975). PAPP (1951 a) reported on the Characeae gyrogonites; the frequent decapod remains, which are otherwise extremely rare in Pannonian deposits, were studied by BACHMAYER & PRETZMANN (1971).

The position of the localities Richardhof and Eichkogel is presented in textfigures 2 and 3. In textfigure 3 the log Richardhof is presented for the first time; the most important samples and characteristic lithologies are indicated.

The mollusc faunas from the Eichkogel and Richardhof sections near Mödling in Lower Austria have experienced a long history of investigations. This began with CŽJŽEK (1849), KARRER (1859), FUCHS (1870 a), and SCHLOSSER (1907). The basal monographs of HÖRNES (1856) and SANDBERGER (1874, 1875) also mentioned some few molluscs from the Eichkogel section. More detailed studies followed by WENZ (1928), WENZ & EDLAUER (1942), PAPP (1953) and LUEGER (1981). Finally, STOJASPAL (1990) gave a list of the taxa described from the Pannonian Zones F-H of the Vienna Basin. Moreover - as an important reference fauna - the Eichkogel material was frequently mentioned in several papers dealing with Miocene and Pliocene mollusc faunas (e.g. SCHLICKUM 1970 a, 1976 and STRAUCH 1977).

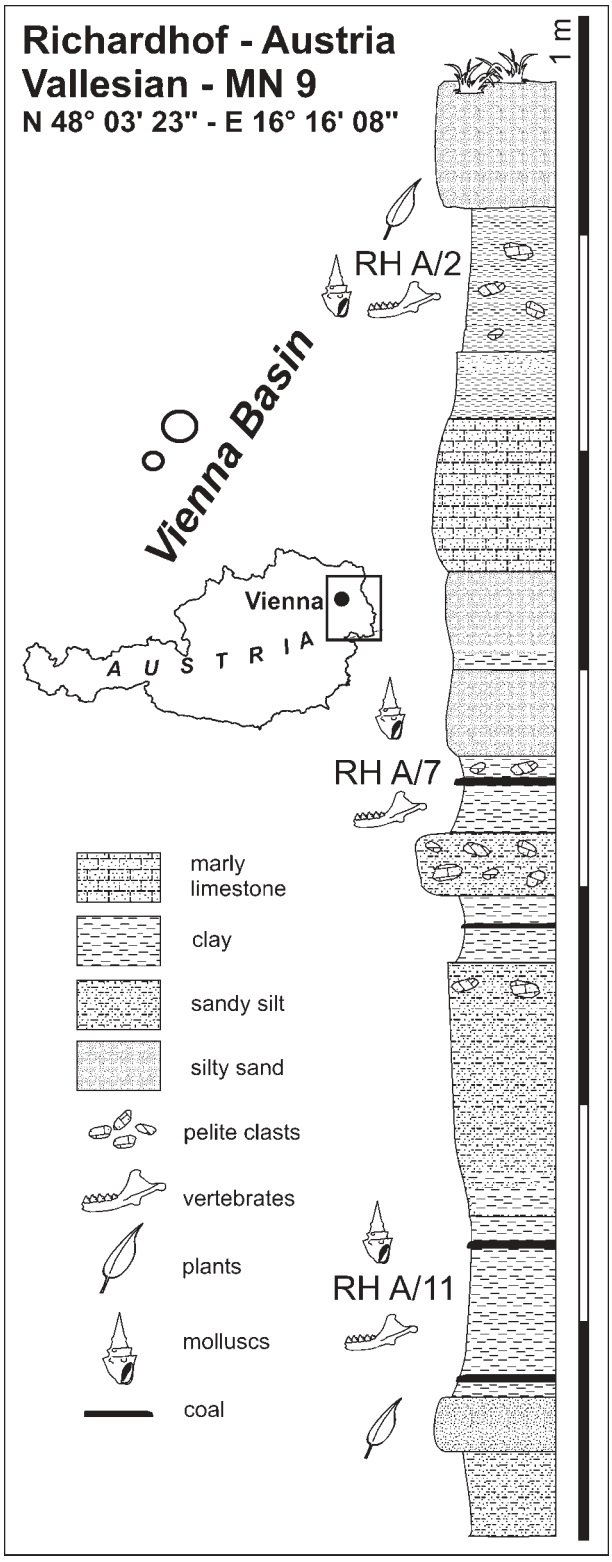
Despite the number of systematic papers, no detailed description of the geological setting of the Eichkogel and Richardhof area is available until now. Brief discussions of the geology of the Eichkogel section by RICHARZ (1921), SCHAFFER (1907, 1942) or KÜPPER. & BOBIES (1927) were by no means sufficient.

The very similar lithofacies and the very close position led most workers to treat the section Richardhof as synchronous with the better known Eichkogel section. Thus it was assigned to the Pannonian „zone" H by PAPP (1951 b, 1953), LUEGER (1981, 1985), and STOJASPAL (1990).



Textfigure 1: Chronostratigraphy and biostratigraphy of the Pannonian in the Vienna Basin with the position of the investigated samples. Biostratigraphy modified from MAGYAR & al. (1999); the use of *Mytilopsis* in the names of the mollusc biozones instead of *Congeria* follows the revision of NUTTALL (1990). The Serravallian/Tortonian boundary is drawn according to the suggestions of LIRER & al. (2002) and HILGEN & al. (2000). The Richardhof and Eichkogel sections, formerly considered as more or less synchronous, span a time of approximately 2 ma based on the datings of the mammal faunas.

A more recent dating into the mammal zone MN 10 of some samples from the Richardhof section was presented by DAXNER-HÖCK (1996). These samples correspond to the samples RH 1, RH 3 and RH 5 in this paper. Furthermore, the mammal fauna of the Turolian Eichkogel section was dated as MN 11 by DAXNER-HÖCK (1996). An excavation campaign during summer 2001 at the Richardhof by the Museum of Natural History Vienna under the leadership of GUDRUN DAXNER-HÖCK tremendously increased the material. Due to the large quantities of sediment that had to be washed for micro-mammal in-



Textfigure 2: Geological map of the investigation area. Pannonian deposits are preserved here as erosional relics on small fault zones along the margin of the Vienna Basin.

vestigations, thousands of gastropods could be collected from the residue. In addition, these efforts allowed an additional dating into the mammal zone MN9 of the samples RH A/2, RHA/7, thus documenting a range from the MN 9 to MN 10 for the Vallesian Richardhof section. Most taxa documented herein for the Richardhof section derive from the samples RH A/2 and RH A/7.

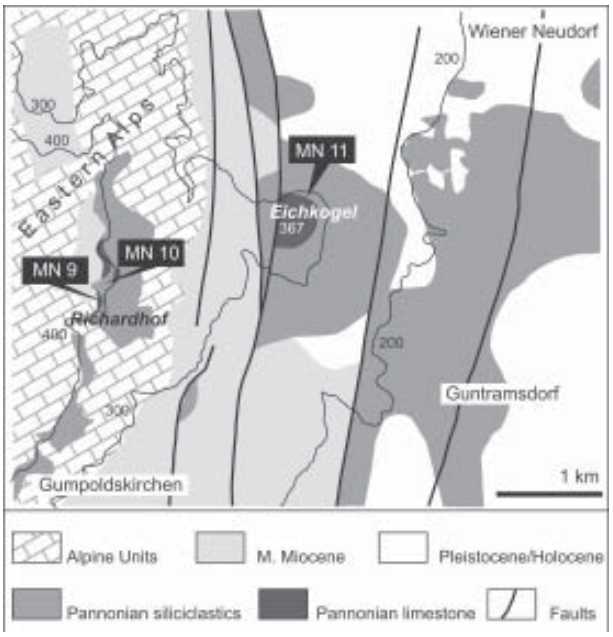
Paleoecology

Up to now, the marly facies of the Upper Pannonian along the margins of the Vienna Basin have been dated to the Pannonian „zone“ H (sensu PAPP 1951 b) based primarily on lithological considerations. Only the well-studied Eichkogel fauna represented the tie point for this vague and in fact self-deceiving correlation. As documented now by the dating by DAXNER-HÖCK (pers. comm.), this conspicuous litho- and biofacies occurred at least from the mammal zone MN 9 up to zone MN 11 (Vallesian to Lower Turolian), covering at least the ecostratigraphic mollusc „zones“ F to H of PAPP (1951 b) and probably also upper parts of „zone E“.

The faunas of both sections are strongly predominated by lacustrine species among the aquatic taxa, with *Bithynia, Anisus* and *Planorbarius* as characteristic snails. Among the terrestrial gastropods, woodland inhabitants predominate (see appendix). Although these woodland inhabitants achieve only a rather small percentage of 50 % of the total terrestrial species, the bulk of individuals represent this ecological group: *Zonites schaireri, Discus pleuradrus, Oxychilus, Aegopinella, Klikia* and *Tropidomphalus*. Additionally, more open area communities and meadows might be indicated at both sections by taxa such as *Vallonia* and *Cepaea*. Inhabitants of moist habitats were *Vertigo callosa* and *Carychium.* By contrast, xerothermic elements such as *Granaria* and *Truncatella* are documented by few specimens only.

The conspicuous ecological conditions are also reflected in the dense populations of *Potamon* (*Potamon*) *ibericum* - a brachyuran which is unknown from Lake Pannnon environments, whilst it was extremely successful in the marginal freshwater lakes. At both investigated sections the occurrence of *Potamon* (*P.*) *ibericum* coincides with that of *Melanopsis fuchsi* HANDMANN, which documents a very striking predation pressure based on numerous healed fractures of the body whorl. Although, molluscivore fishes such as cyprinids cannot be excluded as predators, it seems more likely that the fractures evidence a *Potamon-Melanopsis* relationship. The pattern of scars is highly reminiscent of that described by RUST (1997) for *Melanopsis* cf. *impressa* and *Esperania* cf. *acicularis* from the Pliocene of the northern Aegean Sea. These could be related to the decapod *Liocarcinus* sp.

The low influx by typical Lake Pannon fauna is easily explained by the fact that the vast lake retreated from the Vienna Basin during the Late Pannonian. Thus, a fringe of freshwater lakes probably established along the margin of the Eastern Alps after the maximum expansion of Lake Pannon during „zone“ E. This fringe profited



Textfigure 3: Composite log of the Richardhof section (MN 9) based on field data of H.P. SCHMID and G. HÖCK. The about 7 m thick section comprises mainly sandy silt and silty clay. Most illustrated specimens from Richardhof derive from sample RH A/2 in the top of the section. The smaller insert indicates the position of the sections within the Vienna Basin along the eastern margin of the Calcareous Alps.

from the withdrawal during the Late Pannonian and successively covered the topographically deeper tectonic marginal blocks parallel to the basin's axis.

Discussion and Biostratigraphy

A total of 84 species are documented for both sections (see appendix). Of these, 58 are found at Richardhof and 71 at Eichkogel. Only 13 species (~15 %) are unique to the Richardhof fauna, and 26 species (~31 %) are recorded only from the Eichkogel. Of the 84 recorded taxa, 29 represent aquatic species and 55 terrestrial gastropods. Splitting the fauna into these two guilds documents rather similar percentages of species that are unique to each section. Hence, 11 aquatic species (~38 %) are restricted to the Eichkogel and 4 (~14 %) to the Richardhof. Among the terrestrial species, 15 (~27 %) are recorded only from the Eichkogel and 11 (~20 %) from the Richardhof.

This difference in the total numbers of documented species is easily explained by the much longer investigation history of the Eichkogel deposits, leading to an „overcomplete" documentation compared to the less exploited Richardhof. Furthermore, the material from Richardhof derives from a single section, whereas the Eichkogel fauna was collected for centuries in various strata and sections. The different compositions therefore probably partly reflect a sampling effect and thus reduce the expectations from a biostratigraphic perspective.

However, some species do seem to bear some biostratigraphic significance. Among the species which are restricted in the Vienna Basin to the Vallesian zone MN9 are *Archaeozonites laticostatus* (SANDBERGER) and *Janulus austriacus* nov. sp. Similarly, *Pomatias conicum* (KLEIN) is unknown from Austrian localities younger than the Richardhof section (MN 9). In contrast, the otherwise mainly Pliocene *Fortuna clairi* appears in the Turolian fauna of the Eichkogel but is missing in the older Richardhof samples.

Within the aquatic fauna, the obvious differences in composition are most probably ecologically triggered and should not be used for biostratigraphy. An exception might be *Prososthenia sepulcralis* (NEUMAYR & PAUL), which seems to be an index for the ecostratigraphic mollusc „zone" F in the Vienna Basin. However, the poor data on the exact dating of the non-Austrian occurrences renders a decision difficult if *Prososthenia sepulcralis* is confined to this level.

Conclusions

The dating implies rather steady conditions on the hinterland of the Vienna Basin adjacent to Lake Pannon throughout the Late Pannonian spanning a time of about 2 ma (textfig. 1). Small-scaled „satellite-lakes" formed under more or less stagnant conditions. Pure freshwater settings clearly prevailed, whilst any influence by the highly aberrant water chemistry of Lake Pannon was missing. Therefore, the characteristic Lake Pannon melanopsids and congerias could not penetrate into the freshwater habitat. Elements of swift riverine settings such as *Unio atavus, Tinnyea escheri* or any theodoxids are completely missing in the fauna of the Richardhof and Eichkogel sections, indicating very low riverine influence. The investigation area along the eastern termination of the Calcareous Alps was obviously in a rather protected position. The huge deltaic complex in the northern Vienna Basin, which was fed by the drainage system of the Molasse Basin, did not affect the more southern Eichkogel region (compare the paleogeographic map in SAUER & al. 1992). Similarly, the two southern drainage systems close to Baden and Wiener Neustadt reconstructed by SAUER & al. (1992) based on drilling data, could not reach the fringe of swampy lakes. The gradual back stepping of Lake Pannon from the Vienna Basin towards the Pannonian Basin system during the „zones" F to H supported this development and allowed the basinward shift of the facies belt from the more marginal and topographically higher Richardhof to the younger, more basinward and topographically lower Eichkogel.

Systematics

The systematic arrangement of the investigated taxa follows the suggestions of the CLECOM-project (FALKNER & al. 2001, BANK & al. 2001).

The investigated material derives from the Museum of Natural History in Vienna (Mollusc collection: NHMWM, Paleontological-Geological collection: NHMWG), the Institute of Paleontology, University of Vienna (collection Papp: PA) and the private collection of the second author (collection Binder: BI).

Bivalvia LINNAEUS 1758

Veneroida ADAMS & ADAMS 1856

Sphaeriidae DESHAYES 1855

Pisidium PFEIFFER 1821

Pisidium personatum MALM 1855

Pl. 1, Figs. 1-3

1942 *Pisidium? priscum*, – WENZ & EDLAUER: 95 (non EICHWALD 1830)
1972 *Pisidium personatum*, – KUIPER: 128, figs. 11-12

Material: Eichkogel (NHMWG); Richardhof RH A/2 (NHMWG).

Description: Small-sized fragile shells with oval outline. Rounded margins without marked angles. Umbones subcentral, slightly shifted posteriorly, broad. Surface sculpture consisting of weak lines of growth; internal surface with a dense, irregular pattern of shallow pores. Hinge plate narrow but distinct; cardinal tooth of right valve weak and slightly cleft; lateral teeth elongated, well developed.

Remarks: The identification follows strictly KUIPER (1972) who has studied material from the Eichkogel section.

This is the sole bivalve of the investigated freshwater deposits aside from some unidentifiable fragments of unionids mentioned by WENZ & EDLAUER (1942) from the Eichkogel section. The fragile shells are frequently detected in the sieve samples, but due to the delicate structure most specimens became fractured during the washing procedure. KUIPER (1972) already recognised this species from the Eichkogel section, whereas WENZ & EDLAUER (1942) seem to have erroneously described these shells as *Pisidium priscum* EICHWALD. However, all specimens from the Sarmatian and Pannonian of the Vienna Basin which were introduced by HÖRNES (1862) as *Pisidium priscum* (EICHWALD 1830) differ markedly in their much larger size and the strongly elongate, nearly trigonal outline. The same holds true for the specimens identified as *Pisidium priscum* (EICHWALD) by NEUMAYR & PAUL (1875) from the Pannonian of Croatia.

Sphaeriids from the Pannonian Zones B-F of Lower Austria were also introduced by LUEGER (1979) and SCHULTZ in RÖGL & al. (1993) as *Pisidium amnicum* (MÜLLER 1774). Modern representatives of this species as described by LOŽEK (1964) differ from the species present in the Richardhof fauna in their robust, more elongate shells and the large size. Another Pannonian sphaeriid bivalve was detected by LUEGER (1979) in the Eisenstadt-Sopron Basin (Austria) and affiliated to the modern *Sphaeridium rivicola* (LAMARCK 1818). Again, the large size (up to 20 mm) and the marked sculpture of growth lines of *Sphaeridium rivicola* allow a clear separation from the shells from Richardhof.

Extant representatives of *Pisidium personatum* are recorded by LOŽEK (1964) from springs and swamps. The species is able to settle moist but almost terrestrial settings.

Gastropoda CUVIER 1795

Architaenioglossa HALLER 1890

Aciculidae GRAY 1850

Acicula HARTMANN 1821

Acicula edlaueri (SCHLICKUM 1970)

Pl. 1, Figs. 4-5, 6

1970 *Acicula* (*Acicula*) *edlaueri* SCHLICKUM: 86, fig. 4
1978 *Acicula* (*Acicula*) *irenae* SCHLICKUM: 246, pl. 18, fig. 2
1981 *Acme* (*Acme*) *edlaueri*, – LUEGER: 11, pl. 1, figs. 16 a-16 b
1996 *Acicula* (*Acme*) *edlaueri*, – FORDINÁL: 6, pl. 1, fig. 1
1996 *Acicula edlaueri*, – STWORZEWICZ & SOLTYS: 72, fig. 9

Material: Eichkogel (NHMWG), Richardhof RH A/2, RH A/7 (NHMWG)

Description: High and moderately convex protoconch of about 1.5 whorls with sunken initial part, resulting in a hemisperical outline. Surface glossy and completely smooth. Transition to the teleoconch indistinct, therefore the diameter can only be approximated at about 0.48 mm. Four high, weakly convex teleoconch whorls with typical prosocline, narrow, carved axial grooves occurring in irregular distances. Convexity usually most prominent in the anterior third of the whorl. Drop-shaped aperture with narrow posterior angulation and concave columella. Some specimens separate a very narrow adsutural band which is also carved by the axial grooves.

Remarks: As already discussed by LUEGER (1981) the synchronous *Acicula irenae* SCHLICKUM 1978 from Öcs in Hungary can hardly be distinguished from *Acicula*

edlaueri. Differences in the convexity of the whorls and the shape of the apical part as mentioned by SCHLICKUM (1978) are also observed within the Richardhof population. Only the sculpture of the Hungarian shells seems to be less developed compared to the Austrian ones. The species is present in both investigated sections Richardhof and Eichkogel and was also recorded from the Upper Pannonian of Slovakia by FORDINÁL (1996). However, shells from the MN 4 of Poland described by STWORZEWICZ & SOLTYS (1996) from Belchatów in Poland extend the range of this species back to the Early Miocene. We follow the suggestions of the CLECOM-Project (BANK & al. 2001) that *Acme* HARTMANN 1821 has to be treated as synonym of *Acicula* HARTMANN 1821.

Viviparidae GRAY 1847

Viviparus MONTFORT 1810

Viviparus loxostomus (SANDBERGER 1875)

Pl. 1, Fig. 15

1856 *Paludina concinna*, – HÖRNES: 581, pl. 47, fig. 17 (non SOWERBY 1813)
1875 *Paludina loxostoma* SANDBERGER: 691, pl. 31, figs. 21-21 a
1903 *Vivipara Semseyi* HALAVÁTS: 43, pl. 1, figs. 11-12
1942 *Viviparus* cf. *semseyi*, – WENZ & EDLAUER: 82
1953 *Viviparus* (*Viviparus*) *loxostomus*, – PAPP: 106, pl. 3, figs. 17-19
1990 *Viviparus loxostomus*, – STOJASPAL: 655, pl. 1, fig. 1

Material: Eichkogel (NHMWG)

Description: Depressed egg-shaped shells with 4 rapidly increasing, moderately convex teleoconch whorls. A very weak angulation between base and flank of the body whorl and more or less incised spiral grooves on the external part of the base are most characteristic for this species.

Remarks: *Viviparus loxostomus* was recorded only from the Eichkogel section but is missing in the Richardhof samples, although it is known from the Vienna Basin throughout the „zones“ F to H. HÖRNES (1856) and SANDBERGER (1875) referred to specimens from Moosbrunn („zone“ F). Specimens from Moosbrunn tend to produce slightly more convex body whorls with a very indistinct spiral sculpture, whereas shells from the Eichkogel display a more pronounced sculpture.

The Hungarian *Viviparus semseyi* (HALAVÁTS 1903) is obviously conspecific. It agrees in shape, size and ornament, representing the morphotype which predominates at the Eichkogel section.

Neotaenioglossa HALLER 1892

Melanopsidae ADAMS & ADAMS 1854

Melanopsis FÉRUSSAC 1807

Melanopsis fuchsi HANDMANN 1882

Pl. 1, Figs. 12-12

1882 *Melanopsis Fuchsi* HANDMANN: 556
1887 *Melanopsis* (*Homalia*) *Fuchsi*, – HANDMANN: 13, pl. 1, fig. 6
1942 *Melanopsis* (*Melanopsis*) *entzi*, – WENZ & EDLAUER: 84, pl. 4, fig. 3 (non BRUSINA 1902)
1953 *Melanopsis fuchsi*, – PAPP: 151, pl. 12, figs. 38-40
1959 *Melanopsis fuchsi*, – BARTHA: 74, pl. 6, figs. 1-5
1985 *Melanopsis fuchsi*, – PAPP: 286, pl. 34, figs. 30-33

Material: Eichkogel (NHMWG), Richardhof RH A/2, RH A/7 (NHMWG)

Description: Slender, medium-sized, elongate egg-shaped shell with 5 teleoconch whorls. The spire whorls are hardly convex, separated by weakly incised sutures. Convexity increases on body whorl. Shell surface glossy, nearly smooth aside from dense lines of growth. An indistinct angulation may occasionally occur along the spire whorls. Inner lip feebly swollen, narrow, and well demarcated from the base. Narrow, slightly bent siphonal canal. The colour ornament consists of narrow-spaced, axially arranged, orange zigzag lines. If these lines are crowded they may join and form a dense net-like pattern.

Remarks: *Melanopsis fuchsi* is the predominating *Melanopsis* in all samples from Richardhof. It displays the highest percentage of predation scars among all species recorded from the Eichkogel and Richardhof. PAPP (1953, 1985) emphasized that *Melanopsis fuchsi* was probably an inhabitant of riverine/lacustrine settings, which avoided the Lake Pannon environments.

This species is reminiscent of *Fagotia acicularis* FERUSSAC, which is recorded by LUEGER (1979) from the Lower Pannonian of Lower Austria. The higher and more convex body whorl, the resulting wider aperture and the much shorter posterior canal of *Melanopsis fuchsi* prevent confusion between the two forms.

The specimens from the Vienna Basin were variously compared and identified with *Melanopsis entzi* (BRUSINA 1902). PAPP (1953) and MÜLLER & SZÓNOKY (1990) even discussed *Melanopsis entzi* BRUSINA to be a synonym of *Melanopsis fuchsi* HANDMANN. In contrast to the usually ornamented *Melanopsis entzi*, the Austrian shells lack any conspicuous nodes or ribs. Moreover, the slender shape differs distinctly from the *Melanopsis entzi*. Thus we reject the identification of WENZ & EDLAUER (1942).

Melanopsis bouei sturii FUCHS 1873

Pl. 1, Fig. 14

1873 *Melanopsis Sturii* FUCHS: 21, pl. 6, figs. 18–19
1953 *Melanopsis bouei sturii*, – PAPP: 146, pl. 12, figs. 15-17
1954 *Melanopsis sturi*, – BARTHA: 176, pl. 2, figs. 5-7
1985 *Melanopsis bouei sturi*, – PAPP: 322, pl. 34, figs. 22-23
1990 *Melanopsis sturi*, – STOJASPAL: 652, pl. 1, fig. 6

Material. Eichkogel (NHMWG), Richardhof RH A/2 (NHMWG)

Remarks: Differs distinctly from *Melanopsis fuchsi* in its strong ornamentation of spiny nodes on the body whorl. The whorls develop a concave sutural ramp; the aperture is slightly narrower and the inner lip is broader. The color ornament consists of less densely spaced zigzag lines which are often disintegrated into large dots and speckles. *Melanopsis bouei sturi* is a very rare species at the Richardhof section, where it is found in the sample RH A/2. In contrast, it is frequently found at the Eichkogel section.

Pomatiidae NEWTON 1891

Pomatias STUDER 1789

Pomatias conicum (KLEIN 1853)

Pl. 1, Figs. 7-11

1853 *Cyclostoma conicum* KLEIN: 217, pl. 5, fig. 14
1954 *Pomatias conicus conicus*, – PAPP & THENIUS: 21, pl. 3, fig. 7
1981 *Pomatias conica*, – LUEGER: 10, pl. 1, figs. 11-12, pl. 6, fig. 3
2002 *Pomatias conicus*, – HARZHAUSER & KOWALKE: 70, pl. 10, figs. 6-8

Material: Richardhof Rh 1, RH A2/7 (NHMWG, Coll. BI.)

Description: The species was recently described by HARZHAUSER & KOWALKE (2002) with special emphasis on protoconch features. The conical shell has 5 strongly convex teleoconch whorls; the diameter of the penultimate whorl corresponds to that of the last one. Aperture nearly circular.

Sculpture consists of prominent spiral ridges crossed by weaker axial ribs; the wide interspaces become narrower on the base.

Remarks: The extant relative *Pomatias elegans* (MÜLLER 1774) is a moderately xerothermophilic species in mixed woods but appears also along rivers and lake sides and between screes (CRISPINO & ESU 1995; KERNEY & al. 1979). For example, *Pomatias elegans* was found by the second author in open wood and between rocks close to Lake Doberdon, near Trieste (Italy). *Pomatias conicum* is one of the most frequent species at the Richardhof section and its habitat was probably in the neighbourhood of the pond. Correspondingly, HARZHAUSER & KOWALKE (2002) counted more than 80 specimens per square metre in marshland deposits of Eastern Austria. Input from the hinterland was poor within these layers and most species recorded by HARZHAUSER & KOWALKE (2002) seem to have derived from the marshland environments.

The species is commonly recorded from the circum-Paratethyan environments from the Sarmatian up to the Pannonian. Its stratigraphical youngest occurrence is documented from the Richardhof section, whereas it is apparently absent from the Eichkogel section.

Bithyniidae TROSCHEL 1857

Bithynia LEACH 1818

Bithynia jurinaci (BRUSINA 1884)

Pl. 2, Figs. 8-11

1884 *Bythinia Jurinaci* BRUSINA: 31
1902 *Bythinia jurinaci*, – LŐRENTHEY: 243, pl. 14, fig. 5, pl. 16, fig. 6
1942 *Bulimus* (*Bulimus*) *jurinaci*, – WENZ & EDLAUER: 84
1978 *Bithynia* (*Bithynia*) *jurinaci*, – SCHLICKUM: 247, pl. 18, figs. 4-5
1997 *Bithynia jurinaci*, – FORDINÁL: 269, pl. 3, fig. 10

Material: Eichkogel (NHMWG), Richardhof RH A/2, RH A/7, Rh 1 (NHMWG)

Description: Small-sized shells with glossy surface. Protoconch poorly separated from teleoconch, consisting of less than one, rather loosely coiled whorl; diameter about 0.55 mm. A very weak spiral striation appears on its initial cap. Despite the vast variability in outline, a large, subspherical, inflated body whorl which contrasts with the small, rather slender spire of 3-4 moderately convex whorls is characteristic. Aperture wide, nearly circular with weak, rounded angulation in the posterior part; strongly oblique. Inner lip well demarcated from body whorl, forming a shallow, slit-like umbilicus.

Remarks: One of the most frequent gastropods at the Richardhof section. Shells and opercula are ubiquitous elements in the sieve samples. *Bithynia jurinaci* is a typical species in Pannonian lacustrine deposits of the Vienna Basin. Own observations in Lower Pannonian deposits of the Northern Vienna Basin (Hollabrunn-Mistelbach Formation, Pannonian Zone B/C) suggest that the species – though found in various freshwater settings – favoured especially calm conditions and *Ceratophyllum* meadows.

Hydrobiidae TROSCHEL 1857

Hydrobia HARTMANN 1821

Hydrobia pseudocornea (BRUSINA 1902)

Pl. 2, Figs. 21-22

1902 *Hydrobia? pseudocornea* BRUSINA: pl. 10, figs. 18-20
1902 *Hydrobia? pseudocornea minor* BRUSINA: pl. 10, figs. 21-26
1942 *Hydrobia* (*Hydrobia*) *pseudocornea*, – WENZ & EDLAUER: 83
1953 *Hydrobia testulata* PAPP: 113, pl. 7, figs. 2-4
1954 *Hydrobia pseudocornea minor*, – BARTHA: 188
1990 *Hydrobia testulata*, – STOJASPAL: 652

Material: Eichkogel (NHMWG), Richardhof RH A/2, RH A/7 (NHMWG)

Description: Small-sized shells with 4-5 teleoconch whorls, ranging between 2.5 and 4 mm in height. Low conical protoconch of about 1.5 convex whorls with a diameter of about 0.35 mm. The teleoconch whorls are strongly convex, rapidly increasing in width, separated by deeply incised sutures. Umbilicus slit-like but moderately broad and deep, often partly covered by the slightly reflected inner lip. Outer lip rarely preserved, glossy, slightly expanded.

Remarks: The separation of two syntopic subspecies of *Hydrobia pseudocornea* based only on vague differences in size as introduced by BRUSINA (1902) is hardly acceptable. If both taxa are united, the separation of *Hydrobia testulata* PAPP becomes obsolete. PAPP (1953) stated that the specimens from the Eichkogel section are stockier than *Hydrobia pseudocornea minor.* In fact, all specimens illustrated in BRUSINA (1902) - aside from the slender figure 21 - correspond in shape to the Austrian shells. Correspondingly, STOJASPAL (1990) already doubted the validity of *Hydrobia testulata* and discussed this species to be only a synonym of *Hydrobia pseudocornea* (BRUSINA).

Pseudamnicola **PAULUCCI 1878**

Pseudamnicola hoeckae nov. sp.

Pl. 2, Figs. 14-17

1953 *Pseudamnicola* (*Pseudamnicola*) *minima*, – PAPP: 117, pl. 7, fig. 10 (non LŐRENTHEY 1902)

Derivatio nominis: in honour of Gudrun DAXNER-HÖCK who initiated this study.

Locus typicus and Stratum typicum: Richardhof (sample RH A/2) close to Mödling in Lower Austria (Vienna, Basin); marls deposited in a Pannonian (Upper Miocene) swampy lake adjacent to Lake Pannon – mammal zone MN9.

Holotype: the specimen illustrated on plate 2, figure 16/17 - NHMW Inv. 2003z0005/0019, dimensions: height: 1.79 mm, width: 1.24 mm

Paratype: the specimen illustrated on plate 2, figure 14/15 - NHMW Inv. 2003z0005/0018, dimensions: height: 1.57 mm, width: 1.26 mm

Description: Small-sized shell of up to 2 mm height. Protoconch consisting of 1.2 convex whorls of 0.27 mm diameter, ornamented with a dense pattern of wrinkles which yield a hammered surface. Transition to teleoconch coincides with the onset of the teleoconch sculpture. This is formed by numerous, dense, rounded axial threads with intercalations of 1-3 secondary threads on the earliest part of the teleoconch. Later whorls are smooth; only few specimens tend to form thread-like lines of growth close to the aperture. Teleoconch formed by about 2.5 rapidly increasing, strongly convex whorls with deeply incised sutures. Aperture elongate oval, with slight posterior angulation. Outer lip thin and moderately reflected; inner lip strongly reflected and attached to the base in its posterior part. Shallow, slit-like, rather broad umbilicus.

Remarks: The sculpture of the protoconch clearly reveals this species to be a *Pseudamnicola.* Recently the protoconch of the Late Sarmatian *Pseudamnicola immutata* (HÖRNES 1856) was described by HARZHAUSER & KOWALKE (2002). Another *Pseudamnicola* protoconch was documented earlier by FINGER (1997), who reported *Pseudamnicola pseudoglobulus* (D'ORBIGNY 1852) from the Middle Miocene of the Steinheim Basin. Both display the characteristic groove-ridge pattern. The Pannonian species from the Richardhof section differs from both in its bulbous initial part and the characteristic adsutural groove.

Among the 19 species from Pannonian deposits of Central and South-eastern Europe assigned to *Amnicola* (=*Pseudamnicola*) by WENZ (1926), only *Pseudamnicola dokici* (BRUSINA 1902) and *P. brusiniana* (PAVLOVIC 1903) are reminiscent in outline (cf. PAVLOVIC 1908, KORPÁS-HÓDI 1983). Both differ either in their higher spire or the less convex whorls. *Pseudamnicola proxima* (FUCHS 1870 c), which is also recorded from the Vienna Basin, might be related but lacks the deeply incised sutures. Even the more reminiscent high-spired morphotypes of *P. proxima* described by LŐRENTHEY (1902) are distinguished by the distinctly less convex whorls.

This new species was probably already detected at Leobersdorf (Lower Pannonian) by WENZ (1920 a) as *Pseudamnicola* cf. *torbariana* (BRUSINA 1902), which he described to differ from the type in its less flattened sutural part of the whorls. The shells from the Lower Pannonian of the Vienna Basin, referred to as *Pseudamnicola minima* (LŐRENTHEY 1902) by PAPP (1953), are undoubtedly conspecific with *Pseudamnicola hoeckae*. „*Hydrobia* (*Pannonia*) *minima*" in LŐRENTHEY (1902) differs considerably in its reticulate sculpture and the strongly detached aperture.

Prososthenia **NEUMAYR 1869**

Prososthenia sepulcralis (NEUMAYR & PAUL 1875)

Pl. 2, Figs. 13

1875 *Hydrobia sepulcralis* „PARTSCH" NEUMAYR & PAUL: 76, pl. 9, fig. 14
1897 *Prososthenia sepulcralis*, – BRUSINA: 18, pl. 9, figs. 5-6, 13-14, 36-39
1953 *Prososthenia sepulcralis sepulcralis*, – PAPP: 116, pl. 7, fig. 8
1956 *Prososthenia sepulcralis sepulcralis*, – BARTHA: 590, pl. 3, fig. 12
1990 *Prososthenia sepulcralis*, – STOJASPAL: 656, pl. 1, fig. 5

Material: Richardhof RH A/2 (NHMWG).

Description: Slender shell with 4-5 smooth teleoconch whorls. Protoconch smooth, poorly demarcated;

earliest part bulbous but depressed, passing into a strongly convex whorl. Early spire whorls are convex and very low, whereas later whorls are hardly convex and increase in height. Maximum width of these whorls is in the anterior quarter. Sutures appear as narrow and shallow incisions. Aperture slightly oblique, elongate egg-shaped with weak posterior angulation and slightly thickened lips. Inner lip separated by continuous narrow slit. An indistinct spiral groove appears sometimes on the penultimate whorl, separating the adapical third of the whorl. Additional grooves may occur on the body whorl.

Remarks: This species is recorded for the first time from the Richardhof section. There it is restricted to the oldest samples (RH A/2), which are dated into the mammal zone MN 9. Otherwise, *Prososthenia sepulcralis* is restricted in Austrian basins to the „zone" F of Moosbrunn, Sollenau, and Haslau (PAPP 1953, STOJASPAL 1990).

Hauffenia **POLLONERA 1898**

Hauffenia simplex (FUCHS 1870)

1870c *Valvata simplex* FUCHS: 535, pl. 21, figs. 4-6
1942 *Valvata* (*Valvata*) *simplex* var. WENZ & EDLAUER: 83
1978 *Hauffenia simplex*, – SCHLICKUM: 247, pl. 18, fig. 3

Material: Eichkogel (NHMWM).

Remarks: The morphology of this species ranges from nearly planspiral to moderately trochospiral. WENZ & EDLAUER (1942) referred to the high-spired morphotype when describing their „*Valvata* (*Valvata*) *simplex* var." from the Eichkogel. This extreme intraspecific variability in spire height within the genus *Hauffenia* is also documented by ESU & GIROTTI (1974) for *Hauffenia minuta* (DRAPARNAUD 1805) from the Plio-Pleistocene of Italy. *Hauffenia simplex* is variously recorded from the Eichkogel section but was not detected in our samples.

Emmericiidae BRUSINA 1870

Emmericia BRUSINA 1870

Emmericia canaliculata BRUSINA 1870

Pl. 2, Figs. 18-20

1870 *Emmericia canaliculata* BRUSINA: 933
1874 *Emmericia canaliculata*, – BRUSINA: 58, pl. 4, figs. 5-6
1897 *Emmericia canaliculata*, – BRUSINA: 21, pl. 7, figs. 22-24
1953 *Emmericia canaliculata*, – PAPP: 124
1954 *Emmericia* sp. PAPP & THENIUS: 92
1990 *Emmericia canaliculata*, – STOJASPAL: 652, pl. 1, fig. 5

Material: Richardhof Rh 1, RH A/2, RH A/7 (NHMWG).

Description: Small-sized, stout conical, glossy shells of about 4-5 mm height. Protoconch low, depressed; no marked transition towards the teleoconch recognisable. Deep, broad sutures between the earliest protoconch and the following whorl. Teleoconch of 4 to 4.5 convex whorls separated by deep sutures. Subcircular aperture with distinct posterior angulation which sometimes passes into a narrow, shallow posterior canal. Columellar lip adherent but distinct; outer lip slightly thickened, expanded in a reflected, collar-like structure. Narrow, slit-like umbilicus.

Remarks: The internal furrow close behind the aperture as emphasised by ESU & GIROTTI (1974) and KADOLSKY (1993) to characterise *Emmericia* BRUSINA 1870 and *Choerina* BRUSINA 1882 (syn. *Zilcheuchilus* SCHLICKUM 1965) is only very weakly developed in the Austrian shells. Consequently, the corresponding swelling on the external shell surface is poorly developed. Thus the generic affiliation of this species is based on the flattened protoconch (cf. ESU & al. 2001) and the extremely bent external lip which is typical within the Emmericiidae.

Nystia dehmi SCHLICKUM 1978, which was also described as *Emmericia pliocenica* by BARTHA (1954, 1959) from Öcs in Hungary, is probably a synonym (pers. comm. ESU).

Ectobranchia FISCHER 1884

Valvatidae GRAY 1840

Valvata GRAY 1840

Valvata helicoides STOLICZKA 1862

Pl. 3, Figs. 1-3, 4-5

1862 *Valvata helicoides* STOLICZKA: 535, pl. 17, fig. 5
1944 *Valvata* (*Valvata*) *helicoides*, – JEKELIUS: 116, pl. 43, figs. 1-3
1953 *Valvata* (*Valvata*) aff. *simplex simplex*, – PAPP: 109, pl. 4, figs. 1-3 (non FUCHS 1870 c)
1979 *Valvata* (*Valvata*) *helicoides*, – SCHLICKUM: 407, pl. 23, fig. 1
1998 *Valvata* (*Valvata*) *helicoides*, – FORDINÁL: 296, pl. 1, fig. 3

Material: Richardhof RH A/2, RH A/7 (NHMWG)

Description: Small-sized, advolute shell with 2-3 rapidly increasing, evenly rounded whorls. Protoconch of about 1 whorl hardly demarcated from the teleoconch. Its sculpture consists of a dense pattern of moderately broad spiral ribs which are axially connected by slightly weaker bridges. This characteristic pattern is much stronger on the apical side of the shell. Correspondingly, the spiral ribs are only developed on the apical part of the earliest teleoconch whorl but are absent on the base.

Shell surface smooth except for straight to weakly opisthocline lines of growth. Aperture subcircular; a slight strangulation of the body whorl close to the aperture may occur.

Remarks: Despite the extremely flat, nearly planorbid habitus of the shells, the characteristic pattern of the protoconch reveals the species as valvatid (cf. RIEDEL 1993). It is the most common valvatid at the Richardhof section and is also documented from Rumania and Hungary. The species appears in the Vienna Basin already during the Pannonian Zone C (PAPP 1953). The type specimen from the Pannonian of Hungary described by STOLICZKA (1862) develops distinct angulations on the upper and lower part of the whorls. Specimens from Rumania described by JEKELIUS (1944) document a considerable variability concerning the strength of these angulations, leading also to nearly equally rounded shells. Finally, the shells from Öcs in Hungary introduced by SCHLICKUM (1979) and from the Richardhof section usually lack the angulations but develop well-rounded whorls.

Valvata oecsensis SOÓS 1934

Pl. 3, Figs. 9-10, 11

1903 *Valvata helicoides*, – HALAVÁTS: 38, pl. 3, fig. 1 (non STOLICZKA 1862)
1934 *Valvata* (*Valvata*) *simplex öcsensis* SOÓS: 189, fig. 1
1942 *Valvata* (*Valvata*) *öcsensis*, – WENZ & EDLAUER: 83, pl. 4, figs. 1-2
1953 *Valvata* (*Valvata*) *öcsensis*, – PAPP: 109, pl. 4, figs. 12-13
1959 *Valvata simplex öcsensis*, – BARTHA: 162, pl. 4, figs. 7-9
1978 *Valvata* (*Valvata*) *oecsensis*, – SCHLICKUM: 246, pl. 18, figs. 1
1990 *Valvata* (*V.*) *oecsensis*, – STOJASPAL: 651, pl. 1, fig. 2
1998 *Valvata* (*Valvata*) *oecsensis*, – FORDINÁL: 296, pl. 1, fig. 2

Material: Eichkogel (NHMWG).

Description: Small-sized, depressed, nearly discoidal shells with 3-4 mm diameter comprising 2.5 teleoconch whorls. Protoconch consists of about 0.75 whorls with a diameter of about 0.38 mm. It is ornamented with spiral ribs connected by very dense, strongly opisthocyrt axial ridges. Towards the very apex this pattern blends into a somewhat reticulate ornamentation, whereas the spiral sculpture becomes dominant in later stages of growth. The transition into the teleoconch is indicated by the onset of distinct axial threads. Soon after, a prominent keel appears which separates a broad, almost flat sutural ramp that is negatively inclined towards the suture. A corresponding weaker keel is developed along the base. Umbilicus deep, wide; aperture circular aside from two indistinct angulations caused by the keels.

Remarks: This *Valvata* was found only at the Eichkogel but is absent in the Richardhof samples. Nevertheless, its range is recorded by STOJASPAL (1990) to last from the „zone“ F to „zone“ H. The sculpture of the slightly smaller protoconch and of the very early teleoconch of the extant *Valvata tricarinata* (SAY 1817) as illustrated by RIEDEL (1993) is highly reminiscent of this form. The species was separated by SOÓS (1934) from *Valvata bicincta* (FUCHS 1870 c) based on its larger size.

Valvata subgradata LŐRENTHEY 1902

Pl. 3, Fig. 6

1902 *Valvata subgradata* LŐRENTHEY: 283, pl. 20, figs. 9 a-c
1953 *Valvata* (*Cincinna*) *subgradata*, – PAPP: 110, pl. 5, fig. 1

Material: Eichkogel (NHMWG).

Description: Only a single specimen which was already described by PAPP (1953) is available. Very large sized *Valvata* of 4.5 mm diameter. Moderately high conispiral shell with about 3 rapidly increasing whorls. A weak keel separates a weakly convex sutural ramp from the convex flank and base which are ornamented with several weak spiral threads. Protoconch not preserved.

Remarks: This *Valvata*, too, is only known from the Eichkogel but was not detected in the Richardhof samples. Until know it is apparently restricted to the „zone“ H in the Vienna Basin.

Valvata wenzi PAPP 1953

Pl. 3, Figs. 7-8

1953 *Valvata* (*Atropidina*) *wenzi* PAPP: 110, pl. 4, figs. 4-5

Material: Eichkogel (NHMWG).

Description: A very small-sized *Valvata* of hardly 2 mm diameter. The spire barely emerges from the body whorl. Protoconch of less than 1 whorl; its earliest part is covered by a weak groove-ridge pattern which fades out towards the teleoconch. The latest part of the protoconch displays flat spiral threads which are best developed close to the anterior suture. This spiral sculpture continues on to the early teleoconch where it is immediately crossed by axial threads. Later, the 2 teleoconch whorls develop only a pattern of narrow spaced axial threads. Sutures deep; aperture circular with faint posterior angulation. The extremely broad and deep umbilicus which leaves all foregoing whorls visible is characteristic for the species.

Remarks: The illustrated specimen differs from the holotype in its even less elevated spire and the slightly narrower umbilicus. It derives from the collection PAPP, now stored in the NHMW, and was already identified by PAPP. STOJASPAL (1990) mentions this species as an endemic from the Eichkogel section.

Its overall shape is reminiscent of a *Hauffenia* (POLLONERA 1898) and reminds one of the synchronous *Hauffenia simplex* (FUCHS). However, its valvatid protoconch and the weak spiral sculpture of the early teleoconch differs considerably from the early shells of *Hauffenia* as documented by HAASE (1993) for the extant *Hauffenia kerschneri* (ZIMMERMANN 1930).

Valvata obtusaeformis LŐRENTHEY 1906

1906 *Valvata* (*Cincinna*) *obtusaeformis* LŐRENTHEY: 174, pl. 3, fig. 20
1953 *Valvata* (*Cincinna*) *obtusaeformis*, – PAPP: 110, pl. 3, figs. 20-22, pl. 5, fig. 2
1959 *Valvata obtusaeformis*, – BARTHA: 162, pl. 4, figs. 4-6
1990 *Valvata* (*Cincinna*) *obtusaeformis*, – STOJASPAL: 651, pl. 1, fig. 3

Remarks: The species was mentioned from the Eichkogel section by STOJASPAL (1990) but was not be detected during the current study.

Pulmonata CUVIER in BLAINVILLE 1814

Lymnaeidae RAFINESQUE 1815

Stagnicola JEFFREYS 1830

Stagnicola bouilleti (MICHAUD 1855)

Pl. 1, Figs. 1-2

1855 *Lymnea bouilleti* MICHAUD: 53, pl. 4, figs. 7-8
1907 *Limnaeus* cfr. *Bouilleti*, – SCHLOSSER: 772, pl. 17, figs. 31-32
1970 a *Stagnicola* (*Stagnicola*) *bouilleti*, – SCHLICKUM: 89, figs. 1-4, 5-11

Material: Eichkogel (NHMWG), Richardhof RH A/2 (NHMWG)

Remarks: The medium-sized, slender lymnaeid was discussed in detail by SCHLICKUM (1970 a), who also illustrated a specimen from the Eichkogel section. Due to the sampling method, only fragments of the early spire whorls are preserved. *Stagnicola bouilleti* appears in the Late Miocene (Pannonian) and is a frequent species during the Pliocene.

Radix MONTFORT 1810

Radix aff. ***cucuronensis*** (FONTANNES 1878)

Pl. 2, Figs. 3-4

1928 *Radix* (*Radix*) *cucuronensis deydieri*, – WENZ: 9 (non? FONTANNES 1878)
1990 *Radix deydieri*, – STOJASPAL: 652 (non? FONTANNES 1878)

Material: Richardhof RH A/2 (NHMWG).

Remarks: The generic affiliation is uncertain but is based on the rapidly increasing second whorl. This feature was also stressed by RIEDEL (1993) as difference between recent juveniles of *Radix auriculata* and those of *Lymnaea stagnalis*. The single fragmentary specimen from the Richardhof section is reminiscent of the Pliocene *Radix cucuronensis* (FONTANNES 1878: 529, pl. 6, figs. 9-10) [note that *Radix deydieri* (FONTANNES) is a synonym according to WENZ (1923)]. Nevertheless, the juvenile specimen of *Radix cucuronensis* from the Upper Miocene to Lower Pliocene of Spain illustrated by BANDEL & al. (2000) differs considerably in its more numerous and higher spire whorls. Thus an identification of the Viennese specimen as *Radix cucuronensis* (sensu BANDEL & al. 2000) can be excluded.

The younger *Radix lytostomopsis* (BRUSINA 1902) as redescribed by STEVANOVIC (1978) from the latest Pannonian of Serbia might be another related species. It develops a very similar spire and agrees fully in the oblique but straight columella but differs distinctly in its well-rounded posterior part of the aperture and the broad shelf-like adsutural part of the body whorl. *Radix paucispira* (FUCHS 1870 b) forms an even broader shelf and its semicircular aperture is even wider. The specimen differs also from the Sarmatian *Radix zelli* (HÖRNES 1856), which develops a higher spire with higher and less convex early teleoconch whorls. However, in respect to the morphological variability of extant *Radix* species, it is difficult to compare the fragmentary Pannonian specimen reliably with other Late Miocene species.

Galba SCHRANK 1803

Galba halavatsi WENZ 1923

Pl. 2, Figs. 5-7

1903 *Limnaea minima* HALAVÁTS: 54, pl. 3, fig. 13 (non SOWERBY 1816)
1923 *Galba* (*Galba*) *halavatsi* WENZ: 1367
1942 *Galba* (*Galba*) *halavatsi*, – WENZ & EDLAUER: 86

Material: Richardhof RH A/2 (NHMWG)

Description: Small-sized, moderately slender shell with 4-5 whorls, separated by distinct sutures. Drop-shaped aperture with well-rounded extended base and broad lips. Columellar lip bent, somewhat extending to the base. A marked, slightly angulated concavity of the columella is characteristic.

Remarks: The species is commonly found in the sieve samples from the Richardhof section. Due to the sampling method most specimens are either fractured or, if undamaged, juvenile. The rather stout shell and the convexity of the spire whorls distinguish even juveniles clearly from the syntopic *Stagnicola bouilleti*.

Galba halavatsi is also recorded from the Upper Pannonian of Öcs (Hungary).

Physidae FITZINGER 1833

Aplexa FLEMING 1820

Aplexa cf. ***subhypnorum*** GOTTSCHICK 1920

Pl. 2, Fig. 12

1920 *Aplexa subhypnorum* GOTTSCHICK: 116, pl. 6, figs. 9 a-b
1927 *Aplexa* cf. *subhypnorum*, – WENZ: 48, pl. 2, fig. 7
1959 *Aplexa subhypnorum*, – BODA: 638, pl. 37, figs. 5-6
1959 *Aplexa subhypnorum*, – BARTHA: 182, pl. 14, fig. 14
1998 *Aplexa subhypnorum*, – FORDINÁL: 297

Material: Richardhof RH A/2 (NHMWG).

Description: A single juvenile specimen of about 1.8 mm height is preserved; rather slender, sinistral shell with about 2 moderately convex whorls with obtuse apex; narrow, impressed sutures. Shell surface smooth except for weak growth lines which are best developed close to the posterior suture. Elongate aperture with marked posterior angulation. Strong concavity along columella; inner lip bent and slightly thickened.

Remarks: Up to now this genus was recorded in the Vienna Basin only from the Lower Pannonian. The juvenile specimen allows no clear identification with the rather large-sized species described by GOTTSCHICK (1920) from Steinheim in Germany. The same problem arose already for WENZ (1927), who had also just one juvenile shell from Leobersdorf (Lower Austria). That shell measures about 3 mm in height and consists of one additional whorl compared to the new shell from Richardhof. Aside from these features both shells agree well in shape and are most likely conspecific.

Aplexa subhypnorum is recorded throughout the Sarmatian and Pannonian of Hungary, Austria and Slovakia. Furthermore, FORDINÁL (1998) mentions the species also from the Ukraine.

Planorbidae RAFINESQUE 1815

Planorbarius DUMÉRIL 1806

Planorbarius mantelli (DUNKER 1848)

Pl. 5, Figs. 1-4

1848 *Planorbis Mantelli* DUNKER: 159, pl. 21, figs. 27-29
1856 *Planorbis pseudoammoneus*, – HÖRNES: 607, pl. 49, fig. 25 (non SCHLOTHEIM 1820)
1907 *Planorbis* aff. *Heriacensis*, – SCHLOSSER: 771, pl. 27, figs. 36-37 (non FONTANNES 1875)
1953 *Planorbis cornu mantelli*, – SAUERZOPF: 50, pl. 1, figs. 1-2
1976 *Planorbarius cornu mantelli*, – SCHLICKUM: 7, pl. 1, fig. 19
1990 *Planorbarius mantelli*, – STOJASPAL: 653, pl. 2, fig. 1
1990 *Planorbarius heriacensis*, – STOJASPAL: 653 (non FONTANNES 1875)

Material: Eichkogel (NHMWG), Richardhof RH A/2, RH A/7 (NHMWG)

Description: Moderately large-sized planorbid of up to 15-18 mm diameter. Whorls rapidly increase, covering about 20 % of the preceding one; somewhat inflated, strongly convex with the maximum convexity along the middle of the upper shell side. Protoconch formed by an inflated initial cap and about 0.8 embryonic whorls, ornamented by an extraordinary spiral pattern of weak pits, producing a punctuated surface. Sculpture of the teleoconch formed by indistinct, irregular, narrow-spaced spiral threads crossed by lines of growth which become most prominent close to the sutures. The strength of this early spiral sculpture declines soon but may be preserved as faint sculpture on the external side of adult shells. Umbilicus deep but earliest whorls are covered.

Remarks: The protoconch allows a clear affiliation with the planorbid genus *Planorbarius*, differing considerably from the strongly striate *Gyraulus* protoconch and the poorly ornamented *Planorbis* protoconch (cf. GORTHNER 1992). The species seems to be closely related to the extant *Planorbarius corneus* (LINNÉ 1758). The protoconch of *Planorbarius corneus* as described and illustrated by GORTHNER (1992) and RIEDEL (1993) corresponds fully in its characteristic punctuation. However, it lacks the inflated initial part as recorded for *Planorbarius mantelli*.

Distribution and synonyms are exhaustively documented by WENZ (1923).

Planorbarius thiollierei (MICHAUD 1855)

1855 *Planorbis thiollierei* MICHAUD: 56, pl. 4, figs. 9-11
1942 *Planorbarius thiollierei*, – WENZ & EDLAUER: 86
1998 *Planorbarius thiollierei*, – FORDINÁL: 297, pl. 2, fig. 5

Remarks: This large-sized species is commonly found in the Pannonian of the Vienna Basin and the Eisenstadt-Sopron Basin and is mentioned in the literature from the Eichkogel. From the Richardhof section, however, it is apparently absent.

Anisus STUDER 1820

Anisus confusus SOÓS 1934

Pl. 4, Figs. 7-10

1907 *Planorbis* (*Anisus*) *matheroni*, – SCHLOSSER: 770, pl. 17, figs. 29-30 (non FISCHER & TOURNOUER 1873)
1934 *Anisus* (*Anisus*) *confusus* SOÓS: 194, fig. 5
1942 *Anisus* (*Anisus*) *confusus*, – WENZ & EDLAUER: 86
1953 *Planorbis* (*Anisus*) *confusus*, – SAUERZOPF: 53, pl. 2, figs. 1 a-c
1998 *Planorbis confusus*, – FORDINÁL: 297, pl. 1, fig. 4

Material. Eichkogel (NHMWG), Richardhof RH A/2, RH A/7 (NHMWG)

Description: Small to medium-sized planorbid of up to 7 mm diameter. The nearly planspiral, convex whorls are weakly overlapping. Maximum diameter close to the lower side of the shell. External side of shell sometimes slightly flattened; rarely even a weak concavity may be developed in adult shells. Initial part of the protoconch ornamented with a hammered surface which gradually passes into a wide-spaced striation towards the teleoconch.

Remarks: The species is very common at both investigated localities but is also found in the Eisenstadt-Sopron Basin (SAUERZOPF 1953). Aside from Öcs in Hungary, this typical Late Pannonian species is also recorded from Slovakia by FORDINÁL (1998).

Odontogyrorbis LŐRENTHEY 1906

Anisus (*Odontogyrorbis*) *krambergeri* (HALAVÁTS 1903)

Pl.4, Figs. 3-6

1903 *Planorbis Krambergeri* HALAVÁTS: 56, pl. 3, fig. 3
1907 *Planorbis* (*Gyrorbis*) *Mariae*, – SCHLOSSER: 769, pl. 17, figs. 27-28 (non MICHAUD 1862)
1942 *Anisus* (*Odontogyrorbis*) *krambergeri*, – WENZ & EDLAUER: 86
1953 *Planorbis* (*Odontogyrorbis*) *krambergeri krambergeri*, – SAUERZOPF: 53, pl. 3, figs. 1 a-d
1953 *Planorbis* (*Odontogyrorbis*) *krambergeri angustigyratus* SAUERZOPF: 54, pl. 3, figs. 2 a-c
1978 *Anisus* (*Anisus*) *krambergeri*, – SCHLICKUM: 250, pl. 18, fig. 8
1990 *Anisus* (*Anisus*) *krambergeri*, – STOJASPAL: 652, pl. 1, fig. 8
1990 *Anisus* (*Anisus*) *mariae*, – STOJASPAL: 652 (non MICHAUD 1862)
1990 *Anisus* (*Odontogyrorbis*) *angustigyratus*, – STOJASPAL: 652
1990 *Anisus* (*Odontogyrorbis*) *krambergeri*, – STOJASPAL: 652
1998 *Anisus krambergeri*, – FORDINÁL: 297, pl. 1, fig. 5

Material: Eichkogel (NHMWG), Richardhof RH A/2, RH A/7, Rh 1 (NHMWG)

Description: Small-sized shells of up to 3.8 mm diameter which are characterised by their 3-5 strictly evolute whorls, which hardly increase in width. Protoconch of 0.75 whorls, maximum diameter 0.38-0.40 mm with regular spiral threads which are most prominent along the external quarter of the whorl, whereas the upper and lower sides of the whorls are poorly ornamented. Close to the transition to the teleoconch the threads disintegrate into narrow-spaced, spirally connected granules. Transition to teleoconch marked by a weak rim. Teleoconch whorls nearly flat on the lower side and moderately convex on the upper side. Flanks of adult species sometimes slightly concave. Sutures impressed and narrow, but slightly wider along the protoconch and the early part of the first teleoconch whorl. Aperture oblique, subquadratic. Fully grown shells may produce three to four swollen teeth close to the aperture along each „side“. Usually the one at the inner lip and its opponent are stronger than those on the dorsal and ventral side.

Remarks: The species was also described by SCHLOSSER (1907) as *Planorbis mariae* MICHAUD 1862. STOJASPAL (1990) seems to have referred to this citation when mentioning *Anisus mariae* in his list of the taxa from Eichkogel. However, as already emphasised by SCHLICKUM & PUISSÉGUR (1978), the French Late Pliocene to Pleistocene *Anisus mariae* is restricted to Western Europe and differs from *Anisus krambergeri* in the even less increasing diameter of the whorls (see SCHLICKUM 1975 and SCHLICKUM & PUISSÉGUR 1978 for descriptions and illustrations of *Anisus mariae*).

SAUERZOPF (1953) introduced the name „*Planorbis* (*Odontogyrorbis*) *krambergeri angustigyratus* n. ssp.“ as new subspecies of *Anisus krambergeri krambergeri* based on the higher number of narrow whorls. Both morphologies are well represented at the sections Eichkogel and Richardhof as well as at Öcs. Their protoconch size and sculpture are identical. Transitions between the extreme morphologies are frequent. Thus a separation of two sympatric subspecies should be rejected. The specimens illustrated in pl. 4, fig. 5 represent typical representatives of *Anisus krambergeri* whereas pl. 4, fig. 3 corresponds to the *angustigyratus*-morph of SAUERZOPF (1953).

The status of *Odontogyrorbis* as subgenus of *Anisus* based on the strange teeth in the aperture follows ZILCH (1959).

Armiger HARTMANN 1840

Armiger subptychophorus (HALAVÁTS 1903)

Pl. 4, Figs. 1-2

1903 *Planorbis subptychophorus* HALAVÁTS: 56, pl. 3, fig. 4
1942 *Gyraulus* (*Gyraulus*) *subptychophorus*, – WENZ & EDLAUER: 87
1953 *Planorbis* (*Gyraulus*)*subptychophorus*, – SAUERZOPF: 54, pl. 10, figs. 4 a-c
1990 *Gyraulus subptychophorus*, – STOJASPAL: 653, pl. 1, fig. 9
1998 *Armiger subptychophorus*, – FORDINÁL: 297, pl. 2, fig. 3

Material: Eichkogel (NHMWG), Richardhof (NHMWG).

Description: Small protoconch of less than 0.5 whorls; maximum diameter 0.2 mm; width of initial cap about 0.07 mm. The initial cap is smooth and followed by a strongly striate embryonic shell. These striae consist of slightly wavy spiral threads, much narrower than the intervening spaces but externally narrowing. Transition to the teleoconch distinctly marked by the abrupt vanishing of spiral ornamentation. Teleoconch whorls moderately increasing in width, ornamented only with strongly opisthocline lines of growth. In more or less regular distances these lines of growth become more prominent, producing pseudo-ribs. The external side of the shell is often slightly concave between these pseudo-ribs, causing the very characteristic shape of this species.

Remarks: *Armiger subptychophorus* is rarely represented in the investigated samples of the Richardhof section. In contrast, numerous shells in the collection of the NHMW witness its abundance at the nearby, but Turolian, Eichkogel section. Generally, *Armiger subptychophorus* is a common species in the Pannonian Basins complex during the Late Pannonian.

Gyraulus CHARPENTIER 1837

Gyraulus cryptornatus (SAUERZOPF 1953)

Pl. 5, Figs. 8-9

1953 *Planorbis* (*Gyraulus*) *cryptornatus* SAUERZOPF: 56, pl. 10, figs. 4 a-c

Material: Eichkogel (NHMWG)

Description: Small-sized shell of less than 2 mm diameter. Protoconch poorly preserved, displaying characteristic „*Gyraulus* striae". The whorls overlap considerably on the upper side, which is moderately convex with sloping flanks, terminating in a very weak, rounded keel. Lower side less convex, nearly flat. The sculpture consists of strongly opisthocline threads formed by the growth lines. Along the suture of the early teleoconch these threads grade into irregular radial wrinkles. The generally weak sculpture vanishes nearly completely on the lower side.

Remarks: A rare species that is recorded only from the Eichkogel. It might have been frequently overlooked in other faunas due to its inconspicuous features.

Bathyomphalus CHARPENTIER 1837

Bathyomphalus moedlingensis (SAUERZOPF 1953)

1953 *Planorbis* (*Bathyomphalus*) *mödlingensis* SAUERZOPF: 66, pl. 4, figs. 4 a-c

Remarks: The species was detected by SAUERZOPF (1965) as a rare element at the Eichkogel. A second occurrence was mentioned by FORDINÁL (1998) from Čel'adince in Slovakia. No additional material could be found during the recent excavations.

Segmentina FLEMING 1818

Segmentina loczyi (LŐRENTHEY 1906)

Pl. 5, Figs. 5-7 a

1906 *Planorbis* (*Segmentina*) *loczy* LŐRENTHEY: 119, pl. 2, fig. 18
1953 *Planorbis* (*Segmentina*) *loczyi loczyi*, – SAUERZOPF: 64, pl. 4, figs. 2 a-c
1998 *Segmentina loczyi*, – FORDINÁL: 299, pl. 2, fig. 1-2

Material: Eichkogel (NHMWG)

Description: Protoconch covered by well-defined spiral threads along the adapertural part of the whorl. Adapical part with less distinct spiral sculpture. The spiral threads pass into delicate spirals of very dense but disconnected, slightly axially elongated tiny nodes. Teleoconch characterised by a depressed hemispherical shape and a strongly involute upper side of the shell. Lower side with weakly convex whorls which slope towards the deep and narrow umbilicus. Surface glossy and smooth.

Remarks: The species is recorded from the Eichkogel section and from Slovakia (FORDINÁL 1998).

Segmentina filocincta (SANDBERGER 1875)

1875 *Planorbus* (*Segmentina*) *filocinctus* SANDBERGER: 714, pl. 27, figs. 10-10 c
1942 *Segmentina* – WENZ & EDLAUER: 88 (cf. *S. filocincta* SANDBERGER)
1953 *Planorbis* (*Segmentina*) aff. *filocinctus*, – SAUERZOPF: 64, pl. 4, figs. 1 a-c
1998 *Segmentina filocincta*, – FORDINÁL: 299, pl. 2, fig. 4

Remarks: Differs from *Segmentina loczyi* in its smaller size and the less inflated whorls. Additionally, its whorls are slightly less involute. The species is recorded from the Eichkogel section and from Slovakia (FORDINÁL 1998).

Acteophila DALL 1885

Carychiidae JEFFREYS 1830

Carychium O.F. MÜLLER 1772

Carychium sandbergeri HANDMANN 1887

Pl. 6, Figs. 1-2, 11, 14

1887 *Carychium Sandbergeri* HANDMANN: 46
1977 *Carychium* (*Saraphia*) *sandbergeri*, – STRAUCH: 167, pl. 16, figs. 36-38
1978 *Carychium* (*Saraphia*) *sandbergeri*, – SCHLICKUM: p. 248, textfig. 1
1981 *Carychium* (*Saraphia*) *pachychilus*, – LUEGER: 14, pl. 1, figs. 5-8, 9-10 (non SANDBERGER 1875)
1996 *Carychium pachychilus*, – FORDINÁL: 6, pl. 1, fig. 2 (non SANDBERGER 1875)

Material: Eichkogel (PA, NHMWG), Richardhof RH A/2, RH A/7, Rh 1 (NHMWG).

Description: Fusiform shell with slightly tumid whorls. Bulbous, smooth protoconch. Surface of the teleoconch covered by curved ribs. Thickened outer lip; inner lip thickened, well defined, attached to base in its posterior half. Prominent, oblique parietal fold; knob-like columellar and palatal teeth. The affiliation with the subgenus *Saraphia* is based on the feebly undulating internal parietalis (see pl. 6, fig.11).

Remarks: The lumping of *Carychium sandbergeri* with *Carychium pachychilus* as proposed by LUEGER (1981) was rejected by STWORZEWICZ (1999 a). The slender outline and the weaker sculpture of *Carychium sandbergeri* are typical. Furthermore, the faint axial threads described by STWORZEWICZ (1999 a) from *Carychium pachychilus* are unknown from *Carychium sandbergeri*.

Carychium geisserti SCHLICKUM & STRAUCH in SCHLICKUM 1978

1978 *Carychium* (*Saraphia*) *geisserti* SCHLICKUM & STRAUCH in SCHLICKUM: p. 249, pl. 18, fig. 7, textfig. 2

Material: Eichkogel (NHMWG)

Remarks: According to SCHLICKUM (1978), *Carychium geisserti* differs from *Carychium sandbergeri* in its strong sinus of the parietal fold and the smooth shell surface. LUEGER (1981, 1985) rejects it as valid species and treats it as a synonym of his *Carychium pachychilus*. In fact, smooth shells are rather rare, whereas densely ornamented shells predominate. Due to the rather solid sediment it is nearly impossible to expose the columellar apparatus and the status of most specimens remains doubtful.

Carychium geisserti might merely represent a hybrid of *Carychium sandbergeri* and *Carychium berthae.*

Carychium berthae (HALAVÁTS 1903)

Pl. 6, Fig. 3, 4

1903 *Pupa Berthae* HALAVÁTS: 60, pl. 3, fig. 12
1942 *Carychiopsis berthae*, – WENZ & EDLAUER: 85, pl. 4, fig. 5
1977 *Carychium* (*Carychiopsis*) *berthae*, – STRAUCH: 161, pl. 14, figs. 21-22, pl. 18, fig. 57, pl. 20, fig. 80
1981 *Carychium* (*Saraphia*) *pachychilus*, – LUEGER: 14, 15: Abb 1 b (non SANDBERGER 1875)

Material: Eichkogel (PA, NHMWG), Richardhof. Rh 1, RH A 2 (NHMWG)

Description: Relatively broad shell with gently convex whorls. Aperture with thick reflected margin and prominent palatal denticle on the outer lip, columellar fold and weaker parietal lamella. The internal parietalis displays a double flexure and resembles the parietalis of *Carychium pachychilus* SANDBERGER (see pl.6, fig. 3).

Remarks: In the paleontological literature there are two interpretations concerning the species of the genus *Carychium*. On the one hand, *Carychium sandbergeri* and *Carychium berthae* are considered as different species (see STRAUCH 1977, STWORZEWICZ 1999 a). On the other hand, LUEGER (1981) suggests that the features of both taxa may appear in various combinations, thus hindering a clear separation. We follow the opinion of STWORZEWICZ (1999 a), and treat both taxa as different species. A typical feature of *Carychium berthae* seems to be the relatively thinner aperture, the stout outline and high body whorl.

However, the occurrence of intermediate morphologies such as represented by the specimen illustrated on plate 6, figure 4 indicates that the status of these taxa is still poorly solved and calls for a detailed study of this group.

Stylommatophora SCHMIDT 1855

Succineidae BECK 1837

Succinea DRAPARNAUD 1801

Succinea sp.

1981 *Succinea* sp. LUEGER: 37, pl. 4, fig. 12
1990 *Succinea primaeva* STOJASPAL: 653

Remarks: LUEGER (1981) documented a fragment of a *Succinea* from the Eichkogel.

Argnidae HUDEC 1965

Argna COSSMANN 1889

Argna oppoliensis (ANDREAE 1902)

Pl. 6, Figs. 12-13

1902 *Coryna oppoliensis* ANDREAE: 16, fig. 8 a
1956 *Agardhia oppoliensis* var. *turrita*, – BARTHA: 518, pl. 4, figs. 2, 5
1959 *Agardhia oppoliensis* var. *turrita*, – BARTHA: 81, pl. 15, figs. 23
1978 *Argna oppoliensis*, – SCHLICKUM: 252, pl. 19, fig. 10
1981 *Argna* (*Argna*) *suemeghyi*, – LUEGER: 32, pl. 3, figs. 9-11 (non? BARTHA 1956)
1990 *Argna suemeghyi*, – STOJASPAL: pl. 2, fig. 3 (non? BARTHA 1956)
1996 *Argna* (*Argna*) *suemeghyi*, – FORDINÁL: 8, pl. 2, fig. 2 (non? BARTHA 1956)

Material: Eichkogel (NHMWG), Richardhof RH A/2 (NHMWG).

Description: Very high, cylindrical shell with spherical apex. Some shells even narrow slightly towards the aperture. Protoconch extremely low, smooth, nearly flat; hardly demarcated from the teleoconch.

Height of whorls increases after the third teleoconch whorl. Correspondingly, the convexity decreases towards the slightly flattened body whorl. Number of whorls of fully grown shells ranges from 6 to 7. Shell surface smooth aside from weak, prosocline lines of growth.

Body whorl with weak concavity close to the aperture and subconical base. Aperture elongated with straight lips and well-rounded basal part. Lips reflected, forming a continuous collar. A weak palatal swelling is frequently developed; a second sharper palatal plication is sometimes formed deep in the aperture. A marked parietal plication and a distinct columellar fold may occur. Deep umbilicus.

Remarks: There is considerable confusion about this species in the literature. Occurrences from the Eichkogel section were introduced as *Argna oppoliensis* (ANDREAE) by SCHLICKUM (1978) and as *Argna suemeghyi* (BARTHA) by LUEGER (1981, 1985). The latter author stated that *Argna suemeghyi* differs in its two palatal folds from *Argna oppoliensis*. In contrast, SCHLICKUM (1978), who compared the Eichkogel specimens with the type material from Opole in Poland, recognised two palatal structures. Our material from Eichkogel witnesses a broad variability concerning all apertural features, indicating that minor differences in the palatal sculpture should not be overevaluated. *Argna suemeghyi* (BARTHA), if a valid species at all, displays strongly incised sutures, a more convex and somewhat strangled penultimate whorl.

Argna oppoliensis is a rare species at Richardhof but was frequently collected at the Eichkogel section. It is a widespread species during the Late Pannonian of Austria, Hungary and Slovakia but is also recorded from the Pannonian Zone E of the Vienna Basin (LUEGER 1981). Its first occurrence reaches back to the Middle Miocene of Opole in southern Poland.

Strobilopsidae WENZ 1915

Strobilops PILSBRY 1893

Strobilops* (*Strobilops*) *pappi SCHLICKUM 1970

Pl. 7, Figs. 4-6

1954 *Strobilop*s sp. PAPP: 21, pl. 4, figs. 10 a-c
1970 *Strobilops* (*Strobilops*) *pappi* SCHLICKUM: 84, figs. 2-3
1981 *Strobilops* (*Strobilops*) *pappi*, – LUEGER: 36, pl. 4, figs. 13 a-c
1985 *Strobilops* (*Strobilops*) *pappi*, – LUEGER: 351, pl. 45, figs. 4-6
1996 *Strobilops* (*Strobilops*) *pappi*, – FORDINÁL: 9, pl. 3, fig. 3

Material: Eichkogel (PA, NHMWG), Richardhof RH A/2 (NHMWG)

Remarks: A very common species at the sections Richardhof and Eichkogel. The genus is probably represented by 2 different species - *Strobilops pappi* and *Strobilops pachychila*. According to LUEGER (1981, 1985), *Strobilops pachychila* differs in its slightly more inflated shape and the thickened lips. We are unable to state significant differences in the general shapes. Instead, the parietal folds might justify a separation. *Strobilops pappi* develops a large fold that is nearly perpendicular to the axis. In contrast, this fold is weaker in *Strobilops pachychilus* and is rather perpendicular to the base of the shell (see also illustrations in FORDINÁL 1996). Finally, the axial ribs of *Strobilops pachychilus* tend to pass to the base, whereas the base of *Strobilops pappi* is poorly ornamented.

Strobilops* (*Strobilops*) *pachychila SOÓS 1955

Pl. 7, Fig. 7-8

1955 *Strobilops tiarula pachychilus* SOÓS in BARTHA & SOÓS: 65, pl. 5, figs. 11-13
1979 *Strobilops* (*Strobilops*) *pachychila*, – SCHLICKUM: 409, pl. 23, fig. 8
1996 *Strobilops* (*Strobilops*) *pachychila*, – FORDINÁL: 9, pl. 3, fig. 3

Material: Richardhof Rh 1; RH A/2 (NHMWG).

Remarks: See *Strobilops* (*Strobilops*) *pappi* SCHLICKUM. *Strobilops pachychila* is also recorded from the Upper Pannonian of Öcs in Hungary and Oresany in Slovakia.

Valloniidae MORSE 1864

Vallonia RISSO 1826

Vallonia subpulchella (SANDBERGER 1874)

Pl. 6, Figs. 5-6

1874 *Helix* (*Vallonia*) *subpulchella* SANDBERGER: 544, pl. 29, figs. 3 a-c
1981 *Vallonia subpulchella*, – LUEGER: 33, pl. 3, figs. 13 a-c
1996 *Vallonia subpulchella*, – FORDINÁL: 8, pl. 2, fig. 3
2002 *Vallonia subpulchella*, – HARZHAUSER & KOWALKE: 76, pl. 10, figs. 1-2

Material: Eichkogel (PA), Richardhof RH A 2 (NHMWG)

Remarks: The species was recently described by HARZHAUSER & KOWALKE (2002) from the Upper Sarmatian of Austria. This common species was unknown until now from the Richardhof section. It differs from *Vallonia subcyclophorella* (GOTTSCHICK) – which is co-occurring at the Eichkogel section – in its smooth surface that lacks any ribs.

Vallonia subcyclophorella (GOTTSCHICK 1911)

1911 *Helix* (*Vallonia*) *subcyclophorella* GOTTSCHICK: 503, pl. 7, figs. 2, 2 a-b
1981 *Vallonia costata*, – LUEGER: 33, pl. 3, figs. 12 a-12 c (non MÜLLER 1774)
1996 *Vallonia subcyclophorella*, – GERBER: 150

Material: Eichkogel (PA).

Remarks: This species was usually identified as *Vallonia costata* (MÜLLER) in the Austrian Pannonian literature. However, the even more crowded and narrow ribs require an affiliation with *Vallonia subcyclophorella* (see GERBER 1996 for a detailed description). *Vallonia subcylophorella* is a very rare species in the Vienna Basin. Among 33 valloniid specimens from the Eichkogel section, all represented *Vallonia subpulchella*.

Acanthinula trochulus (SANDBERGER 1874)

Pl. 7, Figs. 1-3

1874 *Pupa* (*Modicella*) *trochulus* SANDBERGER: 601, pl. 29, figs. 25-25 b
1981 *Acanthinula trochulus*, – LUEGER: 34, pl. 3, fig. 14
1996 *Acanthinula trochulus*, – FORDINÁL: 8, pl. 2, fig. 6

Material: Richardhof RH A/2 (NHMWG).

Description: Small-sized trochiform shells with 3.5 convex teleoconch whorls separated by deep sutures. The maximum convexity coincides with a very faint angulation along the middle of the whorls. The initial part of the protoconch is covered by a dense groove-ridge pattern, causing a hammered surface. This ornament passes soon into a pattern of narrow-spaced spiral threads which fade out during the first teleoconch whorl. The sculpture of the adult shell consists of prosocline axial threads intercalated by several weaker secondary threads. Aperture oblique terminating in thin, slightly reflected lips. Umbilicus narrow.

Remarks: The species is rare at both investigated sections; the illustrated specimen is thus the first completely preserved shell from Austria. Its documented range along the shores of Lake Pannon lasts from „zone" D to „zone" H (LUEGER 1981, FORDINÁL 1996).

Pupillidae TURTON 1831

Gibbulinopsis GERMAIN 1919

Gibbulinopsis (***Gibbulinopsis***) ***rathi*** (SANDBERGER 1874)

1874 *Pupa* (*Pupilla*) *Rathi* SANDBERGER: 504, pl. 25, fig. 26
1981 *Pupilla* (*Gibbulinopsis*) *rathi*, – LUEGER: 30, pl. 3, fig. 4

Description: Sinistral shell with cylindrical shape; surface covered by oblique threads.

Remarks: The species has only been recorded from the Eichkogel but could not be detected during own excavations.

Leiostyla LOWE 1852

Leiostyla (***Leiostyla***) ***austriaca*** (WENZ 1920)

1920 *Lauria austriaca* WENZ: 28
1981 *Leiostyla* (*Leiostyla*) *austriaca*, – LUEGER: 31, pl. 3, figs. 5-8

Description: Oviform to subcylindrical shell with distinct ribs. Aperture with weak parietalis and a distinct angularis.

Remarks: This species has only been recorded from the Eichkogel but could not be detected during own excavations.

Chondrinidae STEENBERG 1925

Granaria HELD 1837

Granaria schlosseri (COSSMANN 1908)

1907 *Pupa* (*Vertigo*) *oviformis* SCHLOSSER: pl. 17, fig. 5 (non MICHAUD 1838)
1908 *Pupa schlosseri* COSSMANN: 257
1923 *Abida schlosseri*, – WENZ: 946
1981 *Abida schuebleri*, – LUEGER: 29, pl. 3, figs. 2-3 (non KLEIN 1846)

Material: Eichkogel (NHMWM).

Remarks: There are only fragments of this species in the collection from the Eichkogel. The identification is based on 2 well-preserved specimens from other Pannonian localities of the Vienna Basin (e.g. Reipersbach). LUEGER (1981) erroneously identified his specimen from the Eichkogel as *Abida schuebleri* (KLEIN 1846), but *Granaria schuebleri* develops flat whorls and bears a prominent angularis (see MAILLARD 1892). The dimensions of the specimen described by LUEGER (1981) correspond fully to those of the specimen illustrated by SCHLOSSER (1907), which he introduced as *Pupa oviformis*. This name turned out to be pre-occupied and thus COSSMANN (1908) proposed *Pupa schlosseri* as the new name.

Granaria moedlingensis nov. sp.

Pl. 9, Figs. 3-4

Derivatio nominis: after the town Mödling (Lower Austria), which is close to the Richardhof section

Locus typicus and Stratum typicum: Richardhof (sample RH A/2) close to Mödling in Lower Austria (Vienna, Basin); marls deposited in a Pannonian (Upper Miocene) swampy lake adjacent to Lake Pannon. – mammal zone MN9 (sample RH A/2).

Holotype: the specimen illustrated on plate 9, figure 3-4 - NHMW Inv. 2003z0005/0073, dimensions: height: 6 mm, diameter: 3.4 mm

Description: Subcylindrical shell with conical apex and 7 strongly convex whorls. Body whorl feebly contracting. Sculpture consisting of regular, prosocline threads. Somewhat triangular aperture with moderately thickened outer lip. Prominent angularis, blunt, oblique parietalis and 2 well-developed columellar folds. Weak infrapalatalis, prominent anterior palatalis and less marked posterior palatalis. A distinct axial swelling appears close to the outer lip. Slit-like umbilicus. The columellar folds are restricted to the columallar area but do not reach the inner lip (see pl.9, fig. 4), which allows a separation from the genus *Abida* (cf. GITTENBERGER 1973).

Remarks: Only this single specimen is available. However, the set of characters clearly documents a new species. *Granaria schlosseri* (COSSMANN) is distinguished clearly by its less cylindrical outline, the weaker sculpture, and the aperture which lacks the prominent angularis and displays only 2 palatal structures. *Granaria costata* (LUEGER) develops a less delicate sculpture and lacks the conspicuous convexity of the whorls.

Granaria schuebleri (KLEIN) differs considerably in the flat whorls, the less cylindrical outline and the hardly developed upper palatalis (cf. *Granaria schuebleri* from Steinheim in FINGER 1998: pl. 8, fig. h). The Middle Miocene *Granaria noerdlingensis* (KLEIN) and *Granaria antiqua* (ZIETEN), too, display nearly flat whorls. The new species is reminiscent of the Pliocene to Recent *Granaria frumentum* (DRAPARNAUD) concerning shape and sculpture. A difference, however, is the fourth palatal fold of the extant species.

Like most of its Recent relatives, *Granaria moedlingensis* might have preferred open and rocky habitats.

Vertiginidae FITZINGER 1833

Truncatellina LOWE 1852

Truncatellina suprapontica WENZ & EDLAUER 1942

Pl. 5, Figs. 7-8

1942 *Truncatellina suprapontica* WENZ & EDLAUER: 88, pl. 4, fig. 8
1979 *Truncatellina suprapontica*, – SCHLICKUM: 407, pl. 23, fig. 2
1981 *Truncatellina strobeli suprapontica*, – LUEGER: 19, pl. 2, fig. 1
1985 *Truncatellina strobeli suprapontica*, – LUEGER: 347, pl. 44, fig. 4

Material: Richardhof RHA 2 (NHMWG)

Description: Only a single spire fragment was found in sample RH A/2 from Richardhof. The flat protoconch is formed by about 1.4 convex whorls; initial part hardly emerging, with broad, somewhat loose groove-ridge pattern which becomes dense along the adapical suture but vanishes on the flanks during growth. Towards the termination of the protoconch this sutural sculpture grades into axially arranged, irregular ridges. The following whorl is marked by the onset of axial ribs and by a considerable increase of diameter, causing a slightly stepped outline of the early spire. Spire whorls bulgy, low, convex with prominent, strictly prosocline axial ribs. Aperture described by SCHLICKUM (1979) and LUEGER (1981).

Negulus BOETTGER 1889

Negulus gracilis GOTTSCHICK & WENZ 1919

Pl. 6, Figs. 9-10

1919 *Negulus suturalis gracilis* GOTTSCHICK & WENZ: 9, pl. 1, figs. 12-13
1981 *Negulus suturalis gracilis*, – LUEGER: 18, pl. 2, figs. 2 a-2 b
1996 *Negulus gracilis*, – FORDINÁL: 6, pl. 1, figs. 3-4

Material: Richardhof RH A 2 (NHMWG)

Description: Large-sized protoconch of 1.25 convex whorls with moderately incised sutures and a very characteristic hammered, regularly wrinkled surface sculpture. Its diameter ranges between 0.48 and 0.5 mm. Teleoconch consists of 3-4 whorls. Spire whorls strongly convex with the maximum convexity slightly adapically of the median line. Sutures strongly incised. Body whorl less convex, rather high with slightly flattened flank. Aperture elongate ovoid with somewhat reflected inner lip. Narrow, slit-like umbilicus. Entire teleoconch ornamented with thin, widely spaced but prominent prosocline axial ribs and much weaker, densely spaced secondary ribs in the interspaces. Height up to 2 mm.

Remarks: Although originally introduced as a subspecies of *Negulus suturalis* (SANDBERGER), the Pannonian shells differ considerably in their higher aperture and the less convex, sometimes even somewhat flat flanks of the body whorl. Thus a specific separation from the chiefly Early Miocene *Negulus suturalis* seems to be justified. The species appears already during the Early Sarmatian (SCHÜTT 1967) and is common throughout the Pannonian of Austria, Slovakia, and Hungary. In Austria it was found at the sections Richardhof and Eichkogel. An additional occurrence is recorded by LUEGER (1981) from the Lower Pannonian of Leobersdorf (Vienna Basin).

Vertigo MÜLLER 1773

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

Pl. 8, Figs. 5-6

1852 *Pupa callosa* REUSS: 30, pl. 3, fig. 7
1942 *Vertigo* (*Vertigo*) *callosa callosa*, – WENZ & EDLAUER: 89
1981 *Vertigo* (*Vertigo*) *callosa*, – LUEGER: 20, pl. 2, figs. 3-5
1996 *Vertigo callosa*, – FORDINÁL: 7, pl. 1, fig. 5

Material: Eichkogel (PA, NHMWG), Richardhof RH A/2 (NHMWG).

Description: Low protoconch of slightly more than one weakly convex, smooth whorl. The transition to the teleoconch is indistinct, indicated by the successive onset of the adult sculpture of weak, densely spaced axial threads. Shell subspherical, stout; whorls weakly convex. The aperture is heart-shaped with a slight palatal concavity. Two prominent parietal and angular teeth are opposed by two slightly stronger palatal teeth.

Remarks: SCHLOSSER (1907) described specimens from the Eichkogel as *Vertigo* aff. *myrmido* (MICHAUD), a citation which was reproduced by STOJASPAL (1990). At least the specimen fig. 7 of SCHLOSSER (1907) is clearly a *Vertigo callosa*. Found at both sections. According to LUEGER (1981) the species appears already in the Late Oligocene and extends to the Late Pannonian.

Vertigo (***Vertigo***) ***protracta suevica*** GOTTSCHICK & WENZ 1919

1919 *Vertigo* (*Alea*) *protracta suevica* GOTTSCHICK & WENZ: 21, pl. 1, figs. 40-41
1981 *Vertigo* (*Vertigo*) *protracta suevica*, – LUEGER: 21, pl. 2, figs. 14-15

Material: Eichkogel (NHMWM)

Remarks: There are only two specimens from the Eichkogel described by LUEGER (1981). The shell is smaller than *Vertigo callosa* and it lacks the palatal incision. The species was recently described in detail by STWORZEWICZ (1999 b).

? ***Vertigo*** (***Vertigo***) ***moedlingensis*** WENZ & EDLAUER 1942

1942 *Vertigo* (*Vertigo*) *pusilla mödlingensis* WENZ & EDLAUER: 89, pl. 4, fig. 9
1981 *Vertigo* (*Vertigo*) *pusilla moedlingensis*, – LUEGER: 22

Remarks: This species was introduced by WENZ & EDLAUER (1942) from the Eichkogel. As emphasised by LUEGER (1981) the type material is lost and it was not possible to detect this species again.

Vertilla MOQUIN-TANDON 1856

Vertigo (***Vertilla***) ***oecsensis*** (HALAVÁTS 1903)

Pl. 8, Figs. 1-4

1903 *Pupa oecsensis* HALAVÁTS: 60, pl. 3, fig. 10
1942 *Vertigo* (*Vertilla*) *angustior öcsensis*, – WENZ & EDLAUER: 90
1981 *Vertigo* (*Vertilla*) *angustior oecsensis*, – LUEGER: 22, pl. 2, figs. 8-9
1985 *Vertigo* (*Vertilla*) *angustior oecsensis*, – LUEGER: 348, pl. 44, figs. 8-10
1996 *Vertigo* (*Vertilla*) *oecsensis*, – FORDINÁL: 7, pl. 1, fig. 6

Material: Eichkogel (NHMWG, PA), Richardhof Rh 1, RH A/2 (NHMWG)

Description: A common shell at both sections which can be recognised easily by the sinistral coiling. The protoconch consists of about one whorl with a very weak groove-ridge pattern. The surface is covered by strong prosocline (sinistral!) lines of growth which decrease towards the aperture. A marked groove in the middle of the whorl characterises the last quarter of the body whorl. The oblique parietalis and the broad angularis are distinct.

Gastrocoptidae PILSBRY 1918

Gastrocopta WOLLASTON 1878

Sinalbinula PILSBRY 1916

Gastrocopta (***Sinalbinula***) ***ferdinandi*** (ANDREAE 1902)

Pl. 8, Figs. 12-14

1902 *Leucochilus ferdinandi* ANDREAE: 18, fig. 9
1942 *Gastrocopta* (*Sinalbinula*) *fissidens infrapontica*, – WENZ & EDLAUER: 92 (non WENZ 1927)
1967 *Gastrocopta* (*Sinabinula*) *ferdinandi*, – SCHÜTT: 207, Abb. 11
1981 *Gastrocopta* (*Sinalbinula*) *obstructa ferdinandi*, – LUEGER: 26, pl. 2, fig. 13
1981 *Gastrocopta* (*?Sinalbinula*) *fissidens infrapontica*, – LUEGER: 27 (in parte)

Material: Eichkogel (PA, NHMWG)

Description: Cylindrical shell with conical top and strongly convex whorls. Spherical aperture with wide, continuous lips, attached to the base in the parietal area. Parietalis and angularis distinctly united; oblique columellaris and knob-like basalis.

Remarks: One specimen from the Eichkogel (NHMWM) is mentioned as *Gastrocopta fissidens infrapontica* WENZ by LUEGER (1981). This specimen lacks the incision between parietalis and angularis which is typical for the *Gastrocopta fissidens* group and has to be treated *as Gastrocopta ferdinandi*. Correspondingly, *Gastrocopta fissidens infrapontica* described by WENZ & EDLAUER (1942) from the Eichkogel might rather represent a poorly preserved *Gastrocopta ferdinandi.* The occurrence of *Gastrocopta fissidens infrapontica* at the Eichkogel section is therefore doubtful.

Gastrocopta (***Sinalbinula***) ***nouletiana*** (DUPUY 1850)

Pl. 8, Figs. 9-11

1850 *Pupa nouletiana* DUPUY: 309, pl. 15, fig. 6
1942 *Gastrocopta* (*Sinalbinula*) *nouletiana gracilidens*, – WENZ & EDLAUER: 91 (non SANDBERGER 1874)
1942 *Gastrocopta* (*Sinalbinula*) *nouletiana nouletiana*, – WENZ & EDLAUER: 91
1981 *Gastrocopta* (*Sinalbinula*) *nouletiana*, – LUEGER: 25, pl. 2, figs. 16-19, 22
1990 *Gastrocopta* (*Sinalbinula*) *nouletiana*, – STOJASPAL: 653

Material: Eichkogel (PA, NHMWG), Richardhof RH A 2 (NHMWG)

Description: Ovate shell with strongly convex whorls. Triangular to spherical aperture with weak infraparietalis, one columellar fold, and two palatal teeth; parietalis and angularis are united to a characteristic incised tooth. The basalis is often reduced to a weak swelling.

Remarks: This species is very abundant at the Eichkogel section but rare in the samples from Richardhof. Similar specimens from Poland and Germany are described by STWORZEWICZ (1999 b) and FINGER (1998).

Specimens from the investigation area identified as *Gastrocopta serotina* LOŽEK by LUEGER (1981) are probably conspecific with *Gastrocopta nouletiana*. The much younger *Gastrocopta serotina* is well distinguished by its aperture, which displays a wide, circular margin that is well detached from the body whorl (see LOŽEK 1964, BINDER 1977).

Albinula STERKI 1892

Gastrocopta (***Albinula***) ***edlaueri*** (WENZ 1920)

Pl. 8, Figs. 7-8

1920 *Leucochilus edlaueri* WENZ: 30, Abb. 3
1981 *Gastrocopta* (*Albinula*) *edlaueri*, – LUEGER: 24, pl. 2, fig. 12

Material: Richardhof RH A/2 (NHMWG)

Description: Conical shell with moderately convex whorls, covered with distinct prosocline axial ribs; triangular aperture with wide basal groove (see also MANGANELLI & GIUSTI 2000: pl. 8, figs. 7-8).

Remarks: This species is recorded for the first time from the Upper Pannonian, but is a very rare element. Other Austrian occurrences derive from Lower Pannonian deposits of Leobersdorf in Lower Austria and from the Sarmatian of Styria (LUEGER 1981).

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

Pl. 8, Figs. 15-20

1846 *Pupa acuminata* KLEIN: 75, pl. 1, figs. 19 a-b
1942 *Gastrocopta* (*Albinula*) *acuminata larteti* (DUPUY) – WENZ & EDLAUER: 91, pl. 4, fig. 11
1981 *Gastrocopta* (*Albinula*) *acuminata acuminata,* – LUEGER: 23, pl. 2, fig. 10
1981 *Gastrocopta* (*Albinula*) *acuminata larteti,* – LUEGER: 24, pl. 2, fig. 11
1996 *Gastrocopta* (*Albinula*) *larteti,* – FORDINÁL: 7, pl. 2, fig. 1
2000 *Gastrocopta* (*Albinula*) *acuminata,* – MANGANELLI & GIUSTI: 60, pl. 1, figs. 1-6, pl. 2, figs. 1-7

Material: Eichkogel (NHMWG, PA), Richardhof RH A 2 (NHMWG)

Description: Stout conical shell with dense axial sculpture of delicate, prosocline striae. Ovoid aperture with marked parietal callus; large, incised tooth formed by the united angularis and parietalis; tiny, thin columellar fold; knob-shaped basalis and two palatal teeth.

Remarks: The similarities of the aperture features of the typical *Gastrocopta acuminata* with the stout specimens formerly referred to as *Gastrocopta larteti* (DUPUY) is obvious (see pl.7, fig.15, 18). A separation of these morphs as two different species is therefore rejected for the herein studied specimens.

Gastrocopta acuminata is abundant at the Eichkogel section but rather rare in the Richardhof samples.

Enidae WOODWARD 1903

Ena TURTON 1831

Ena sp.

1981 *Ena* sp. LUEGER: 37, pl. 4, fig. 8

Remarks: A fragment of an *Ena* sp. was described by LUEGER (1981) from the Eichkogel.

Clausiliidae GRAY 1855

Nordsieckia TRUC 1972

Nordsieckia pontica LUEGER 1981

Pl. 9, Fig. 1

1981 *Nordsieckia fischeri pontica* LUEGER: 50, pl. 7, figs. 7-12
1981 *Nordsieckia pontica,* – NORDSIECK: 81, pl. 9, figs. 32-33
1996 *Nordsieckia pontica,* – FORDINÁL: 10, pl. 2, fig. 9

Material: Eichkogel (NHMWG, PA), Richardhof RH A2 (NHMWG)

Remarks: Fragments consisting of the aperture and parts of the body whorl of this species, which has its type locality at Eichkogel, are also rarely found in samples from Richardhof. The simple aperture is characterised by a prominent upper lamella. A thorough description of this species was given by LUEGER (1981) and NORDSIECK (1981). *Nordsieckia pontica* appears in the Lower Pannonian of Leobersdorf and reaches to the „zone“ H in the Vienna Basin.

Clausilia DRAPARNAUD 1805

Clausilia strauchiana NORDSIECK 1972

1972 *Clausilia strauchiana* NORDSIECK: 172, pl. 10, figs. 19-23, textfigs. 3-4
1981 *Clausilia strauchiana,* – LUEGER: 51, pl. 7, figs. 14 a-b

Remarks: This Clausiliidae is only mentioned from the Eichkogel by LUEGER (1981).

Macrogastra HARTMANN 1841

Macrogastra nov. sp.

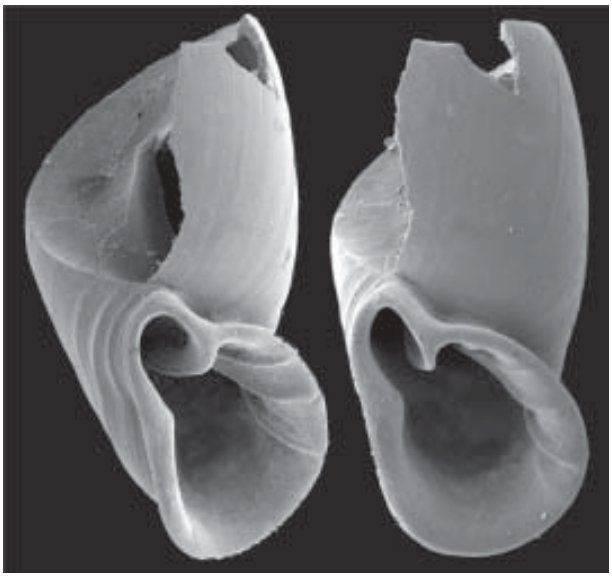
Textfig. 4

Unfortunately, the only available specimen, illustrated on textfig. 4, was destroyed during the SEM procedure. Therefore we cannot designate a holotype. However, at least the information should not be lost by neglecting the species.

Description: Sinistral shell with smooth surface except for few distinct axial ribs close to the aperture. Subspherical to elliptical aperture, detached from the last whorl with thickened and reflected lip. Deep sinulus; separated by a prominent parietal lamella extending deep into the shell. Bifid columellar fold with two branches; two short folds in the interlamellar area. Below the columellar lamella an oblique subcolumellar fold appears. Outer lip with palatal callus and a curved lunella. Short, slit-like umbilicus. Dorsal part of the shell convex without elevation or depression. Height of aperture: 1.3 mm.

Remarks: Among the modern representatives, *Macrogastra plicatula* (DRAPARNAUD 1801) is reminiscent but does not display the conspicuous subcolumellar lamella.

Macrogastra voesendorfensis and *Macrogastra vindobonensis*, described by PAPP & THENIUS (1954), differ distinctly concerning the less separated sinulus. The French *Macrogastra loryi* (MICHAUD) as described by MICHAUD (1862) and TRUC (1972) is reminiscent. TRUC (1972) emphasised the variability of its interlamellar folds (1-3) and SCHLICKUM (1975) and NORDSIECK (1972) documented a narrow groove along the basal margin of the aperture. *Macrogastra schlickumi* (NORDSIECK 1972) and *Macrogastra sessenheimensis* (NORDSIECK 1974) differ either in their high aperture or the subcolumellar



Textfigure 4: *Macrogastra* nov. sp. from the section Richardhof (RH A/2). The shell was destroyed during handling and cannot serve as type specimen.

fold which is invisible in front view. *Macrogastra multistriata* NORDSIECK 1981 lacks the interlamellar. *Macrogastra densestriata* (ROSSMÄSSLER 1836) is distinguished by its more spherical aperture (cf. NORDSIECK 1976). Finally, the new *Macrogastra* differs from all other described species by its prominent axial ribs.

Triptychiidae WENZ 1923

Triptychia SANDBERGER 1874

Triptychia sp.

Material: Richardhof RH A/7 (NHMWG).

Description: Only 2 fragments are available; the surface of the early 2.5 whorls is nearly smooth, later characteristic ribs appear. An identification of the fragments at the species level is impossible.

Ferussaciidae BOURGUIGNAT 1883

Cecilioides FÉRUSSAC 1814

Cecilioides (***Cecilioides***) ***aciculella*** (SANDBERGER 1874)

Pl. 9, Figs. 8-11

1874 *Caecilianella aciculella* SANDBERGER: 595, pl. 29, fig. 15
1976 *Cecilioides* (*Cecilioides*) *aciculella*, – SCHLICKUM: 19, pl. 5, fig. 68
1981 *Cecilioides* (*Cecilioides*) *aciculella*, – LUEGER: 49, pl. 7, fig. 1
1998 *Cecilioides aciculella*, – FINGER: 50, pl. 12, fig. I

Material: Richardhof RH A/2 (NHMWG)

Description: Large-sized, globular protoconch with weakly convex initial part and nearly invisible sutures, causing a subspherical dome. Teleoconch features are exhaustively described by LUEGER (1981).

Remarks: The species was already mentioned by SCHLICKUM (1976) from the Eichkogel section. It appears frequently at both investigated sections; the sampling method with a caterpillar and the consolidated marly sediment exclude a contamination with the very reminiscent extant *Cecilioides acicula* (MÜLLER 1774). It differs from the Recent species in its even more slender shell, the slightly higher body whorl and the globular protoconch.

Cecilioides aciculella appears already during the Badenian. It is common during the Sarmatian at Hollabrunn (Austria) and in the synchronous deposits at Steinheim (Germany). Recently, it was also found at St. Margarethen in Austria (this species was unfortunately not included in the study of that fauna by HARZHAUSER & KOWALKE, 2002). From the Pannonian of Austria it is only known from Richardhof and Eichkogel.

Subulinidae FISCHER & CROSSE 1877

Fortuna SCHLICKUM & STRAUCH 1972

Fortuna clairi SCHLICKUM & STRAUCH 1972

Pl. 9, Figs. 12-13

1970 *Rumina seringi*, – SCHLICKUM: 87 pars, fig. 5 (non MICHAUD 1862)
1972 *Fortuna* sp. SCHLICKUM & STRAUCH: 73, fig. 5
1981 *Fortuna clairi* n. ssp. LUEGER: 49, pl. 7, fig. 2
1996 *Fortuna clairi*, – FORDINÁL: 10, pl. 2, fig. 5

Material: Eichkogel: NHMWG, Richardhof RH 2 A (NHMWG)

Remarks: Specimens from the Eichkogel section were already discussed by SCHLICKUM (1970), who erroneously identified them as the Pliocene *Fortuna seringi* (MICHAUD). Later, SCHLICKUM & STRAUCH (1972) recognised the mistake and separated three species of *Fortuna* – *F. seringi*, *F. clairi*, and *Fortuna* sp. – of which the latter referred to the specimens from Austria. According to SCHLICKUM & STRAUCH (1972) and SCHLICKUM (1975), *Fortuna clairi* exhibits an apical angle ranging between 29-30 °. The specimens from the Pliocene of the coal mine Fortuna in Germany and from the Eichkogel were separated by SCHLICKUM & STRAUCH (1972) based on the obtuse apical angle of 33-34 ° and the broad apex as *Fortuna* sp. Indeed, the Eichkogel specimens witness a tendency to produce rather broad shells compared to the French Pliocene specimens as illustrated in SCHLICKUM (1975). However, some Pannonian shells such as that documented by FORDINÁL (1996) from the Danube Basin in Slovakia display low apical angles (31 °) and do not differ significantly from *Fortuna clairi*.

Only 10 specimens could be found, all of which lack the body whorl and the aperture. Thus, a separation as

subspecies as suggested by LUEGER (1981) is rejected for the present due to the poor state of preservation.

Oleacinidae ADAMS & ADAMS 1855

Pseudoleacina WENZ 1914

Pseudoleacina eburnea (KLEIN 1853)

Pl. 9, fig. 2

1853 *Glandina* (*Achatina*) *eburnea* KLEIN: 213, pl. 5, fig. 10
1907 *Oleacina eburnea*, – TROLL: 70
1981 *Pseudoleacina* (*Pseudoleacina*) *eburnea*, – LUEGER: 55, pl. 7, figs. 15-16

Material: Richardhof RH A 2 (NHMWG)

Description: 1 fragment of 8 mm height consisting of a strongly elongate ovate, moderately convex body whorl and a fragmentary penultimate whorl. Characteristic are the drop-shaped aperture with the extremely acute posterior angulation and the slightly incised sutures.

Remarks: This species was unknown from the Richardhof but was already detected in synchronous deposits of Velm (LUEGER 1981). According to LUEGER (1981), *Pseudoleacina eburnea* appears already during the Sarmatian of southern Germany. In the Vienna Basin it is commonly found in Lower Pannonian deposits. The specimens from the Richardhof and Velm sections are the latest occurrences in the Vienna Basin.

Punctidae MORSE 1864

Punctum MORSE 1864

Punctum propygmaeum (ANDREAE 1904)

1904 *Punctum propygmaeum* ANDREAE: 6, fig. 4
1942 *Punctum* (*Punctum*) *pygmaeum*, – WENZ & EDLAUER: 92 (non DRAPARNAUD 1801)
1981 *Punctum pygmaeum propygmaeum*, – LUEGER: 39, pl. 4, figs. 4-5
1998 *Punctum propygmaeum*, – FINGER: 46, pl. 10, figs. G-I

Remarks: This species was variously documented from the Eichkogel but could not be detected during own investigations.

Helicodiscidae BAKER 1927

Helicodiscus MORSE 1864

Helicodiscus roemeri (ANDREAE 1902)

Pl. 9, Figs. 5-6

1902 *Hyalinia* (*Gyralina*) *roemeri* ANDREAE: 9, fig. 3
1942 *Gyralina roemeri*, – WENZ & EDLAUER: 93, pl. 4, fig. 12
1979a *Helicodiscus* (*Helicodiscus*) *roemeri*, – SCHLICKUM: 69, fig. 3
1981 *Helicodiscus* (*Helicodiscus*) *roemeri*, – LUEGER: 39, pl. 7, figs. 3-4

Material: Richardhof RH A/2 (NHMWG)

Description: Small-sized, discoidal shell with flat spire and broad umbilicus. The diameter of the whorls increases only very slowly; sutures incised. Sculpture consists of conspicuously regular spiral ribs with rounded backs, which are crossed by much weaker lines of growth.

Remarks: *Helicodiscus roemeri* is a rare species at both investigated sections. It appears in the Vienna Basin during the Pannonian „zone" C (LUEGER 1981) but displays its first occurrence already in the Middle Miocene, when it is recorded from Opole in southern Poland (ANDREAE 1902).

Patulidae TYRON 1866

Discus FITZINGER 1833

Discus pleuradrus (BOURGUIGNAT 1881)

Pl. 7, Figs. 9-11

1881 *Helix pleuradra* Bourguignat: 53, pl. 3, figs. 67-72
1942 *Gonyodiscus* (*Gonyodiscus*) *pleuradra pleuradra*, – WENZ & EDLAUER: 93
1967 *Discus* (*Discus*) *pleuradrus*, – SCHÜTT: 213, Abb. 16
1976 *Discus* (*Discus*) *pleuradra*, – SCHLICKUM: 12, pl. 2, fig. 37
1981 *Discus* (*Discus*) *pleuradrus*, – LUEGER: 40, pl. 4, figs. 6-7

Material: Eichkogel (NHMWG); Richardhof RH A/2, Rh 1 (NHMWG)

Description: A small-sized shell of 2-4 mm diameter; discoidal shape with low, somewhat stepped spire. Broad, bulgy protoconch with rather wide whorl compared to the narrow initial part of the teleoconch. Short axial folds appear along the posterior suture but do not reach the back of the protoconch (see pl. 8, fig. 11). Adult shell ornamented with prominent, dense, rather regular, prosocline axial ribs. These become weaker and slightly sigmoidal on the base. Umbilicus broad and very deep. A faint angulation may occur along the flank of the body whorl. Aperture wide, subcircular if not angulated; its posterior termination coincides more or less with the median line of the foregoing whorl.

Remarks: There is some confusion of this species with representatives of *Janulus* (LOWE 1852). SCHLICKUM (1978; 1979) reported two species of *Janulus* from Öcs in Hungary which were later considered by LUEGER (1981) to be mere synonyms of *Discus pleuradrus*. The comparatively broader umbilicus, the evenly convex whorls and the shape of the aperture seem to support the generic identification at least of the herein reported specimens and of that illustrated by LUEGER (1981) from the Pannonian of Austria. Especially the axial ribs of the base which

are emphasised by SCHLICKUM (1979) to characterise *Discus* are always developed in these specimens, although some variability in strength is observed.

According to LUEGER (1981), *Discus pleuradrus* is recorded in the Austrian Basins from the Badenian to the Late Pannonian.

Gastrodontidae TYRON 1866

Janulus LOWE 1852

Janulus austriacus nov. sp.

Pl. 7, Figs. 12-15

Derivatio nominis: after Austria.

Locus typicus and Stratum typicum: Richardhof (sample RH A/2) close to Mödling in Lower Austria (Vienna Basin); marls deposited in a Pannonian (Upper Miocene) swampy lake adjacent to Lake Pannon. – mammal zone MN9.

Holotype: the specimen illustrated on plate 7, figure 14 - NHMW Inv. 2003z0005/0060, dimensions: height: 1.75 mm, diameter: 3.14 mm

Paratypes: the specimens illustrated on plate 7, figures 12 and 13: fig. 12 - NHMW Inv. 2003z0005/0058, dimensions: height: 1.35 mm, diameter: 2.47 mm; fig. 13 - NHMW Inv. 2003z0005/0059, dimensions: height: 1.99 mm, diameter: 3.64 mm

Description: Discoidal shells with narrowly coiled, high whorls. Protoconch comprises 1.2 moderately convex whorls, bearing numerous faint axial threads along the adapical suture (see pl. 8, fig. 15). Teleoconch of 3.25 whorls develops regular, narrow-spaced, prosocline axial ribs which fade out along the flanks (number of ribs ~82-bodywhorl, ~71-penultimate whorl). The weakly convex flank slopes towards the also poorly rounded base, which is ornamented close to the umbilicus with few irregular axial folds and grooves. Umbilicus narrow and deep; foregoing whorls are almost completely covered by the body whorl.

Remarks: This species is missing in all previous reports on the mollusc fauna of the sections Richardhof and Eichkogel and was probably intermingled with the superficially similar *Discus pleuradrus* (BOURGUIGNAT 1881). The generally smaller *Discus pleuradrus* differs distinctly in its wider umbilicus, the wider and evenly rounded whorls; its protoconch develops a more convex whorl and lacks the numerous adsutural axial threads but develops few, broad axial folds. Finally, its base bears axial ribs.

A highly reminiscent species is *Janulus angustiumbilicatus* SACCO from the Pleistocene of Italy (SACCO 1897). The holotype illustrated by FERRERO MORTARA & al. (1984) displays several differences from *Janulus austriacus*. These are the slightly narrower umbilicus and the steep, distinctly less convex body whorl. The flanks of *Janulus angustiumbilicatus* form an angle of 55 ° whereas this angle ranges around 45 ° in *Janulus austriacus*. The axial ribs of the Italian species diverge in an angle of 29-30 ° from the vertical line whilst *Janulus austriacus* displays axial ribs with an angle of 34 °. Finally, the number of axial ribs (69-bodywhorl, 67-penultimate whorl) is lower in *Janulus angustiumbilicatus*. These morphological differences, the geographic separation and the much younger age of *Janulus angustiumbilicatus* support the separation on the species level.

Janulus olisipponensis (ROMAN 1907) from the Pliocene of the Tagus Basin in Portugal is also very similar. However, it can be excluded to be conspecific with the Austrian species based on the higher number of whorls (5 teleoconch whorls) and the convex and elevated anterior part of the aperture. Furthermore, its axial ribs do not reach down to the flanks.

The Middle Miocene *Janulus supracostatus* (SANDBERGER 1874) sensu SCHLICKUM (1976) is reminiscent and might represent the Badenian ancestor of *Janulus austriacus*. It differs sufficiently due to the increasing width of the whorls and the more oblique prosocline axial ribs. Its flanks are more or less perpendicular to the axis and well rounded. In contrast, the Austrian species displays strongly oblique flanks and a much narrower aperture. The also Middle Miocene *Janulus striatus* (EICHWALD 1830) differs in its low number of blunt axial ribs (about 30 on the body whorl) and the extremely narrow umbilicus (see „*Helix striata*“ in EICHWALD 1853). *Janulus gottschicki* (JOOSS 1912) from Steinheim differs in its smaller size (max. 2.7-2.9 mm diameter), the even steeper flanks and especially in the presence of two teeth in the outer lip. *Janulus moersingensis* JOOSS 1918 sensu SCHLICKUM (1976) from the Middle Miocene differs in its broader whorls and the considerably convex flanks; additionally, *J. moersingensis* is characterised by the increasing distance between the axial ribs during growth. In contrast, this distance stays quite similar in the shells from the Richardhof section. Again, the broad and well rounded aperture differs strongly from that of *Janulus austriacus*.

Janulus moersingensis JOOSS sensu SCHLICKUM (1978) and *Janulus joossi* SCHLICKUM 1979 display axial ribs on the base and develop a broader umbilicus (both specimens are identified as *Discus pleuradrus* by LUEGER 1981). *Janulus germainae* SCHLICKUM & GEISSERT (1980: 237) from the Pliocene of Sessenheim is clearly distinguished by its perspectivic umbilicus and the well rounded aperture.

Zonitoides LEHMANN 1862

Zonitoides schaireri SCHLICKUM 1978

Pl. 11, Figs. 17-18

1978 *Zonitoides* (*Zonitoides*) *schaireri* SCHLICKUM: 255, pl. 19, fig. 15

1981 *Zonitoides schaireri*, – LUEGER: 47, pl. 5, fig. 6

Material: Richardhof RH A/2 (NHMWG)

Description: Very low conical shell with 3-5 slowly increasing whorls with incised sutures. Protoconch flat with spirally arranged pits. These soon pass into spiral grooves. Thus the delicate spiral sculpture consisting of faint spiral grooves, mentioned by LUEGER (1981) for the base, covers the entire shell in well-preserved specimens. This sculpture is only visible in SEM-photos but hardly recognisable under the light microscope. Umbilicus deep, moderately narrow.

Remarks: This rare species was known only from Öcs in Hungary (SCHLICKUM 1978) and from Velm in Austria (LUEGER 1981) and is documented for the first time from the Richardhof section.

Oxychilidae HESSE 1927

Oxychilus FITZINGER 1833

Oxychilus procellarium (JOOSS 1918)

Pl. 11, Figs.19

1918 *Hyalinia procellaria* JOOSS: 289
1981 *Oxychilus* (*Oxychilus*) *procellarium*, – LUEGER: 46, pl. 6, figs. 2 a-c

Material: Eichkogel (NHMWG)

Description: Moderately increasing whorls with deep, concave grooved sutures.

Nesovitrea COOKE 1921

Nesovitrea disciformis (LUEGER 1981)

Pl. 11, Figs. 14-15

1981 *Perpolita disciformis* LUEGER: 44, pl. 5, figs. 5 a-c

Material: Eichkogel (NHMWG, PA), Richardhof Rh 1, RH A/2, RH A/7 (NHMWG)

Description: Small-sized, nearly discoidal shells of up to 4 mm diameter. Flat, weakly convex protoconch, poorly demarcated from the teleoconch. Faint spiral threads appear close to the abapical suture. Surface smooth aside from very weak, prosocline lines of growth. Aperture slightly oblique, well rounded with thin lips. Umbilicus moderately wide, reaches to the protoconch.

Remarks: LUEGER (1981) reports *Nesovitrea disciformis* from the Lower Pannonian of Leobersdorf and the Upper Pannonian of Velm.

Aegopinella LINDHOLM 1927

Aegopinella reussi (HÖRNES 1856)

Pl. 11, fig. 5-7

1856 *Planorbis Reussi* HÖRNES: 609, pl. 49, fig. 26
1907 *Hyalinia Reussi*, – SCHLOSSER: 767, pl. 17, fig. 10
1981 *Aegopinella orbicularis*, – LUEGER: 45, pl. 6, figs. 4-6 (non KLEIN 1846)
1990 *Aegopinella orbicularis*, – STOJASPAL: 654 (non KLEIN 1846)
1990 *Oxychilus reussi*, – STOJASPAL: 654

Material: Eichkogel (NHMWG), Richardhof Rh 1 (PA, NHMWG)

Description: Discoidal shell of 4.5 whorls with distinctly increasing body whorl, flat spire and deep, wide umbilicus. Shallow sutures. Surface covered by indistinct axial ribs; spiral threads poorly preserved.

Remarks: The species is distinguished from *Aegopinella orbicularis* (KLEIN) by its smaller size and differs from the reminiscent *Oxychilus procellarium* by its narrow sutures (see illustrations in BARTHA 1959 and LUEGER 1981). *Aegopinella reussi* was detected at both sections; additionally, it was described as *Aegopinella subnitens* (KLEIN) from Öcs in Hungary by SCHLICKUM (1978).

Milacidae ELLIS 1926

Milax GRAY 1855

Milax sp.

1942 *Milax* (*Milax*) *fonyódensis*, – WENZ & EDLAUER: 94, pl. 4, figs. 14-15
1981 *Milax* sp. LUEGER: 47, pl. 5, figs. 11-12
1990 *Milax fonyodensis*, – STOJASPAL: 654

Material: Eichkogel, Richardhof

Remarks: Several specimens from both investigated sections. As discussed by LOŽEK (1964) even extant species are hard to identify based solely on the plates. Investigations on the variability of modern species are still missing. Due to the varying morphologies of the studied calcareous plates we refrain from distinguishing „biological species“.

Zonitidae MÖRCH 1864

Aegopis FITZINGER 1833

Pontaegopis LUEGER 1981

Archaeozonites (***Pontaegopis***) ***laticostatus*** SANDBERGER 1885

Pl. 11, fig. 1-4

1885 *Archaeozonites laticostatus* SANDBERGER: 393
1981 *Aegopis* (*Pontaegopis*) *laticostatus*, – LUEGER: 43, pl. 6, figs. 1 a-c, pl. 7, figs. 5-6

Material: Richardhof RH A/2 (NHMWG, PA)

Remarks: The species was affiliated with the genus *Aegopis*, but the recent *Aegopis* develops a reticulate sculpture on the whorls and displays a smooth base. In contrast, *Archaeozonites laticostatus* bears prominent ribs on the entire surface (see pl.10, fig. 2). *Archaeo-*

zonites laticostatus is documented from the Pannonian „zones“ D-F of the Vienna Basin and the Eisenstadt-Sopron Basin but is missing in the „zone“ H of the Eichkogel section.

Vitrea FITZINGER 1833

Vitrea procrystallina steinheimensis GOTTSCHICK 1920

Pl. 11, Figs. 11-13

1920 *Vitrea* (*Vitrea*) *procrystallina steinheimensis* GOTTSCHICK: 37
1981 *Vitrea* (*Vitrea*) *procrystallina steinheimensis*, – LUEGER: 42, pl. 5, figs. 4, 7

Material: Richardhof Rh 1, RH A/2 (NHMWG)

Remarks: *Vitrea procrystallina procrystallina* (ANDREAE 1902) is highly reminiscent and differs only in its more pronounced angulation of the whorls. Generally, the specimens from Richardhof are poorly angulated but some specimens develop a faint shoulder. Thus the separation of both types on species level as proposed by STOJASPAL (1990) can hardly be maintained. Correspondingly, SCHLICKUM (1976) treated the Middle Miocene representatives from Zwiefaltendorf (Germany) as conspecific with those from the Lower Pannonian of Leobersdorf (Austria). Maybe both taxa represent only a succession of chrono-subspecies from the Badenian to the Pannonian. The subspecies is known from the Sarmatian to the Late Pannonian. In Austria it was recorded by LUEGER (1981) from Leobersdorf, Inzersdorf and Richardhof but is unknown from the younger Eichkogel fauna.

Vitrinidae FITZINGER 1833

Semilimax STABILE 1859

Semilimax cf. ***intermedius*** (REUSS 1852)

Pl. 9, fig. 7

1852 *Vitrina intermedia* REUSS: 11, Pl. 1, fig. 4
1981 *Semilimax intermedius*, – LUEGER: 41, pl. 5, figs. 1-3

Material: Richardhof RH A/2 (NHMWG)

Remarks: The illustrated fragment of 2.4 mm diameter shows a flat, smooth protoconch that does not emerge from the strongly expanding spire whorl. Other fragments document some variability in the convexity of these earliest parts of the shells; correspondingly, the suture ranges from slightly incised to nearly absent. The vast stratigraphic range of this species from the Eggenburgian to the Pannonian suggests that there might be several species intermingled within this taxon. However, the poor, fragmentary preservation of the specimens from the Richardhof section allows no further discussion on the status of the species.

Vitrina DRAPARNAUD 1801

? ***Vitrina suevica*** SANDBERGER 1874

?1874 *Vitrina Suevica* SANDBERGER: 602, pl. 29, figs. 27-27 b

Remarks: *Vitrina suevica* SANDBERGER 1874 is mentioned by STOJASPAL (1990) from the Richardhof without any description, illustration or reference. The species was not detected during our investigations.

Limacidae LAMARCK 1801

Limax LINNAEUS 1758

Limax spp.

Pl. 9, Figs. 14-15

1942 *Limax* sp. WENZ & EDLAUER: 93, pl. 4, fig. 13
1981 *Limax* sp. LUEGER: 48, pl. 5, figs. 9 a-c

Material: Richardhof RH A/2, Rh 1; Eichkogel: PA, NHMWG

Remarks: Several specimens from both investigated sections which derive at least from two species. *Limax* plates predominate compared to the rarer *Milax* plates. As already stated for *Milax*, we avoid distinguishing „species“ based on the varying morphologies of the calcareous plates.

Hygromiidae TYRON 1866

Leucochroopsis BOETTGER 1908

Leucochroopsis kleini (KLEIN 1846)

Pl. 11, Figs. 8-10

1846 *Helix Kleini* KLEIN: 69, pl. 1, fig. 8
?1907 *Helix* (*Fructicola?*) *mödlingensis* SCHLOSSER: 765, pl. 17, figs. 19-21
1981 *Leucochroopsis kleini*, – LUEGER: 57, pl. 15, fig. 6, pl. 16, fig. 6

Material: Eichkogel (PA, NHMWG)

Description: Small protoconch; narrow conical spire and wide, angulated body whorl with strongly convex base. Periphery with rounded keel. The surface of the shell is covered by a weak, reticulate sculpture; delicate ribs formed by growth lines may occur on the body whorl. Umbilicus covered by the reflected columellar lip.

Remarks: SCHLOSSER (1907) introduced „*Helix mödlingensis*“ as new species based on steinkerns from the Eichkogel section. All these specimens lack all relevant features which would justify an identification on the species level. *Helix mödlingensis* is therefore considered to be a nomen dubium. However, as already discussed by LUEGER (1981) some steinkerns correspond to *Leucochroopsis kleini* in shape and size and could tentatively be assigned to this species.

Helicidae RAFINESQUE 1815

Tropidomphalus PILSBRY 1895

Mesodontopsis PILSBRY 1895

Tropidomphalus (***Mesodontopsis***) ***doderleini*** (BRUSINA 1897)

1897 *Helix* (*Tacheocampylea*) *Doderleini* BRUSINA: 1, pl. 1, figs. 1-2
1981 *Tropidomphalus* (*Mesodontopsis*) *doderleini*, – LUEGER: 61, pl. 10, figs. 5 a-5 b, pl. 11, figs. 2-6
1996 *Tropidomphalus* (*Mesodontopsis*) *doderleini*, – FORDINÁL: 10, pl. 3, figs. 1-2

Material: Eichkogel (PA)

Remarks: Mentioned by LUEGER (1981) from the Eichkogel, but absent at the older Richardhof section. Several aperture fragments in the sieve samples from Eichkogel might derive from this species. Steinkerns from the limestone facies of the Eichkogel section are present in the old collection of the NHMW. These were identified as „*Helix doderleini*" already by WENZ during a visit in Vienna. One of the numerous fragments displays the characteristic callus of the aperture.

Pseudochlorites BOETTGER 1908

Tropidomphalus (***Pseudochlorites***) ***richarzi*** (SCHLOSSER 1907)

Pl. 10, Figs.1-5

1907 *Helix* (*Iberus*) *Richarzi* SCHLOSSER: 760, pl. 17, figs. 9, 11
1907 *Helix* (*Campylaea*) *Toulai* SCHLOSSER: 761, pl. 17, figs. 18, 26
1981 *Tropidomphalus* (*Pseudochlorites*) *richarzi*, – LUEGER: 60, pl. 12, figs. 1-3

Material: Eichkogel (PA), Richardhof (PA), Rh 1, Rh 5, RH A/2 (NHMWG)

Description: Until now no representative of this genus was recorded from the locality Richardhof. Typically, parts of the body whorl with the basal part of the aperture are preserved. These exhibit a broad and deep umbilicus which is partly hidden by a strongly reflected lip with wide, smooth and flat termination. Characteristic are the ribs on the surface. Well-preserved fragments display weak, slightly spirally elongated pits and papillae. Juvenile shells bear a characteristic pattern of elongated granules which are loosely axially arranged (see pl. 10, fig. 5). Only the initial part of the protoconch is smooth. A similar sculpture was described by TRUC (1971) for *Tropidomphalus* (*Pseudochlorites*) *mollonensis* TRUC from the Upper Miocene of France. Despite the similarity, both sculptures can be clearly distinguished by the elongation and axial arrangement of the granules in *T. richarzi*.

Remarks: The specimens introduced by SCHLOSSER (1907) as *Helix Toulai* turned out to be subadult and/or damaged representatives of *Tropidomphalus richarzi*. The protoconch of *T. richarzi* is smaller than the protoconch of *T. depressus* WENZ. Two steinkerns in the paleontological collection of the NHMW determined as „*Cepaea reinensis* (GOBANZ)" represent rather a *Tropidomphalus*. This identification is based on the flat outline of the steinkern, the convexity of its whorls, and the deep sutures. These features allow a clear separation from „*Cepaea reinensis*", which in fact has to be treated as a *Holcotachea* (see BINDER 2002).

Klikia PILSBRY 1895

Klikia (***Klikia***) ***trolli*** LUEGER 1981

Pl. 10, Figs. 14-16

1981 *Klikia* (*Klikia*) *trolli* LUEGER: 68, pl. 10, figs. 1 a-c
1985 *Klikia* (*Klikia*) *trolli*, – LUEGER: 359, pl. 48, figs. 10-12

Material: Eichkogel (PA), Richardhof Rh 1, RH A/2 (NHMWG)

Description: Depressed globular shell with narrow whorls and deeply incised sutures. Characterised by its strongly oblique aperture which allows a clear separation from the otherwise reminiscent *Klikia kaeufeli* WENZ. Basal part of lip bears a broad swelling. Umbilicus open, moderately narrow and deep, narrowed by the thick inner lip. The protoconch is covered by blunt, axially arranged, elongated, disrupted papillae which grade into a dense pattern of net-like papillae within the first teleoconch whorl (see pl. 10, fig.16). The sculpture declines towards the late teleoconch and is also weaker on the base.

Apula BOETTGER 1909

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

Pl. 10, Figs. 6-9

1875 *Helix* (*Fruticicola*) *goniostoma* SANDBERGER: 702, pl. 32, fig. 11
1981 *Klikia* (*Apula*) *goniostoma*, – LUEGER: 68, pl. 10, figs. 3 a-c
1990 *Klikia* (*Apula*) *goniostoma*, – STOJASPAL: 654, pl. 2, fig. 4

Material: Eichkogel (PA, NHMWG)

Description: Medium-sized, low conical shell with depressed spire (diameter: 11-15 mm). Sutures impressed; aperture formed by evenly thickened, somewhat reflected lips. Umbilicus shallow, often strongly narrowed by the inner lip. The protoconch is glossy and delicate (see pl. 10, fig. 9). Early teleoconch whorls bear weak granules. The surface of the other whorls is covered by small papillae.

Remarks: The species was not found at Richardhof but is common at the Eichkogel section. It is generally

restricted to the Upper Pannonian of Austria, Slovakia, and Hungary.

Klikia* (*Apula*) *vindobonensis nov. sp.

Pl. 10, Figs. 10-13 a

1927 *Klikia coarctata steinheimensis*, – WENZ: 46, pl. 2, fig. 4 (non JOOSS 1918)

1981 *Klikia* (*Apula*) *coarctata steinheimensis*, – LUEGER: 69; pl. 10, fig. 4 (non JOOSS 1918)

Derivatio nominis: after Vindobona, the Roman name of Vienna

Locus typicus and Stratum typicum: Leobersdorf in the south of Baden in Lower Austria, fine sand of the Pannonian „zone" D (Upper Miocene).

Holotype: the specimen from Leobersdorf illustrated on plate 10, figs. 10-12 NHMW 2003z0005/0083, dimensions: height: 8.4 mm; diameter: 11.1 mm

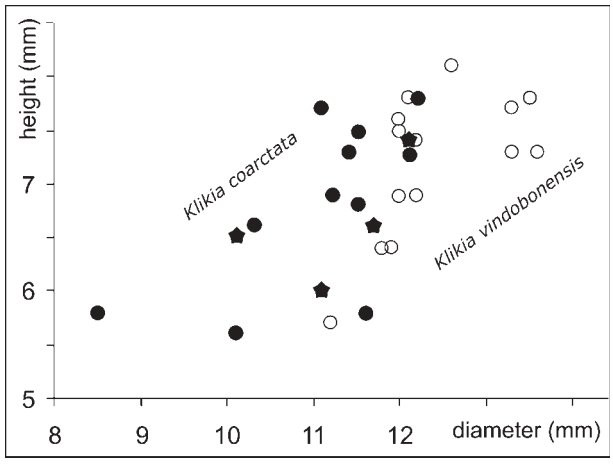
Paratype: the specimen illustrated on plate 10, figs. 13-13 a from Richardhof (NHMW 2003z0005/0084), dimensions: diameter: 5.68 mm; further material: 13 specimens from Leobersdorf (NHMW 2003z0005/0083 a)

Material: Leobersdorf (NHMWG), Richardhof Rh 1, RH A/7 (NHMWG, PA),

Description: Depressed shell with slightly elevated spire. About 4 moderately convex teleoconch whorls with incised sutures. Large, blunt and sac-like protoconch of 1.25 whorls with characteristic axial ribs. These ribs are also developed on the early teleoconch but disappear soon within the moderately increasing first teleoconch whorl and become replaced by densely spaced papillae.

The umbilicus is narrow, but not fully covered. Extralabial depression close to the aperture; outer lip only slightly thickened and weakly reflected, forming a narrow collar. Elongate, somewhat oblique aperture, due to the sloping adapical part of the body whorl.

Remarks: WENZ (1927) and LUEGER (1981) identified conspecific shells from Leobersdorf as *Klikia coarctata steinheimensis* JOOSS. This species was described by JOOSS (1918) as a flat and smooth variation of *Klikia coarctata* (KLEIN), without any illustration. Otherwise, MILLER (1900) published a figure of a flat *Klikia coarctata* from Steinheim, which corresponds well to the description of *Klikia coarctata steinheimensis*. In any way, the specimens from Leobersdorf and Richardhof distinctly differ from both *Klikia coarctata coarctata* and *Klikia coarctata steinheimensis.* Material from Mörsingen and Zwiefaltendorf (Germany), stored in the collection of the NHMW, support the separation based on following features: the protoconch of *Klikia vindobonensis* is blunt; its whorls are more rapidly increasing, resulting in a broad body whorl. In contrast, *Klikia coarctata* develops narrower whorls. The outline of *Klikia vindobonensis* is more flat and not depressed-globose like *Klikia coarctata* and the new Late Miocene species is generally larger than the Middle Miocene one (see also textfigure 5). The most important difference, however, are the conspicuous ribs of *Klikia vindobonensis* which are absent or very weak in all available specimens of *Klikia coarctata*. The umbilicus of *Klikia coarctata* is covered whereas *Klikia vindobonensis* displays a narrow umbilicus. In contrast, *Klikia goniostoma* (SANDBERGER) and especially *Klikia kaeufeli* WENZ have a much wider umbilicus. Further, *Klikia goniostoma* develops one more whorl and the lip is thicker and strongly reflected. *Klikia trolli* LUEGER, too, develops a wide umbilicus and differs strongly in its globose outline.



Textfigure 5: Diagram showing dimensions of *Klikia coarctata* (KLEIN) [black circles = Mörsingen, Germany; black stars = Zwiefaltendorf, Germany) and *Klikia vindobonensis* nov. sp. (white circles = Leobersdorf, Austria). Despite a „mixing area" a general difference in size is evident between both species.

Similar shells from the Pannonian of Hungary have been introduced by BARTHA (1959) as *Helicigona pontica* (HALAVATS), but according to the opinion of LUEGER (1981) and in contrast to SCHLICKUM (1979) this species is a synonym of *Klikia goniostoma*. Specimens from Öcs and Nagy Vaszony in the collection TROLL (NHMWG) which have been investigated during this study support this interpretation.

Steklovia SCHLICKUM & STRAUCH 1972

Klikia* (*Steklovia*) *magna (LUEGER 1981)

1981 *Klikia* (*Steklovia*) *magna* LUEGER: 71, pl. 3, figs. 3 a-c, pl. 16, fig. 7

Remarks: The large-sized, somewhat flattened species with a narrow umbilicus was reported by LUEGER (1981) from the Eichkogel section.

Cepaea HELD 1838

Cepaea etelkae (HALAVÁTS 1923)

Pl. 11, Fig. 20-21

1923 *Helix* (*Tachaea*) *Etelkae* HALAVÁTS: 403, pl. 14, figs. 7 a-b
1981 *Cepaea etelkae*, – LUEGER: 72, pl. 13, figs. 1-2, pl. 14, figs. 1-7
1985 *Cepaea etelkae*, – LUEGER: 361, pl. 47, figs. 4-6
1990 *Cepaea etelkae*, – STOJASPAL: 654, pl. 2, fig. 5
1996 *Cepaea etelkae*, – FORDINÁL: 11, pl. 2, fig. 7

Material: Eichkogel (PA), Richardhof RH A/2 (NHMWG)

Remarks: A common shell at both sections. Completely preserved shells, however, are rare due to the sampling method. The species appears in the Vienna Basin at least during the Early Pannonian and can be traced up to the Late Pannonian in Austria and Hungary (LUEGER 1981).

Cepaea sp.

1928 *Cepaea christoli*, – WENZ: 9 (non MATHERON 1842)
1990 *Cepaea christoli*, – STOJASPAL: 654 (non MATHERON 1842)

Material: NHMWM

Remarks: WENZ (1928) mentions several steinkerns of a helicid from Eichkogel which he identified as *Cepaea christoli* (MATHERON). One of these steinkerns, determined as *Cepaea christoli*, is stored in the NHMWM. This specimen has a conoid spire like *Cepaea vindobonensis* and displays a blunt keel on the body whorl. In contrast, *Cepaea christoli* is globular (cf. MATHERON 1842: pl. 33, figs. 22-23), thus differing considerably from the Austrian species. The poor preservation prevents from any reliable identification.

Acknowledgements

This work is part pf the FWF-projects P-13745 Bio and P-15724. Financial support was provided by the OSKAR & FRIEDERIKE ERMANN Fonds zur Förderung der Erdwissenschaften am Naturhistorischen Museum – many thanks. Thanks to ANDREAS KROH, ALEXANDER LUKENEDER, and THOMAS SUTTNER for the SEM photos and to ALICE SCHUMACHER (NHMW) for the macro-photos. Many thanks to DANIELA ESU (Rome) and ORTWIN SCHULTZ (NHMW) for their kind help and discussions. We are greatly indebted to GUDRUN DAXNER-HÖCK (NHMW) for providing most of the investigated material.

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Manuscript submitted: 03.02.2003
Revised manuscript accepted: 01.04.2004

Appendix

Occurrence of the species at both investigated sections (R – Richardhof, E – Eichkogel); Assumed preferred ecological requirements according to data in LOŽEK (1964), KERNEY & al. (1979), FECHTER & FALKNER (1989), and LUEGER (1981) (a/l - aquatic lacustrine, a/f – aquatic fluviatile, H – watersides and very humid biotopes, W – woodland, O – open habitats, x – xerothermic).

	documented species	**R**	**E**	**a/l**	**a/f**	**H**	**W**	**O**
1	*Pisidium personatum* MALM	+	+	+	+			
2	Unionidae indet.		+		+			
3	*Acicula edlaueri* (SCHLICKUM)	+	+				+	
4	*Viviparus loxostomus* (SANDBERGER)		+	+	+			
5	*Melanopsis fuchsi* HANDMANN	+	+	+	+			
6	*Melanopsis bouei sturii* FUCHS	+	+	+	+			
7	*Pomatias conicum* (KLEIN)	+				+	+	
8	*Bithynia jurinaci* (BRUSINA)	+	+	+	+			
9	*Hydrobia pseudocornea* (BRUSINA)	+	+	+				
10	*Pseudamnicola hoeckae* nov. sp.	+		+				
11	*Prososthenia sepulcralis* (NEUMAYR & PAUL)	+		+	+			
12	*Hauffenia simplex* (FUCHS)		+					
13	*Emmericia canaliculata* BRUSINA	+	+	+	+			
14	*Valvata helicoides* STOLICZKA	+	+	+				
15	*Valvata oecsensis* SOÓS		+	+				
16	*Valvata subgradata* LŐRENTHEY		+	+				
17	*Valvata wenzi* PAPP		+	+				
18	*Valvata obtusaeformis* LŐRENTHEY		+	+				
19	*Stagnicola bouilleti* (MICHAUD)	+	+	+				
20	*Radix* aff. *cucuronensis* (FONTANNES)	+	+	+				
21	*Galba halavatsi* WENZ	+	+	+				
22	*Aplexa* cf. *subhypnorum* GOTTSCHICK	+		+				
23	*Planorbarius mantelli* (DUNKER)	+	+	+				
24	*Planorbarius thiollierei* (MICHAUD)	+	+	+				
25	*Anisus* (*Odontogyrorbis*) *krambergeri* (HALAVÁTS)	+	+	+				
26	*Anisus confusus* SOÓS	+	+	+				
27	*Armiger subptychophorus* (HALAVÁTS)	+	+	+				
28	*Gyraulus cryptornatus* (SAUERZOPF)		+	+				
29	*Bathyomphalus moedlingensis* (SAUERZOPF)		+	+				
30	*Segmentina loczyi* (LŐRENTHEY)		+	+				
31	*Segmentina filocincta* (SANDBERGER)		+	+				
32	*Carychium sandbergeri* HANDMANN	+	+			+	+	
33	*Carychium geisserti* SCHLICKUM & STRAUCH		+			+	+	
34	*Carychium berthae* (HALAVÁTS)	+	+			+	+	
35	*Succinea* sp.	+	+			+		
36	*Argna oppoliensis* (ANDREAE)	+	+				+	
37	*Strobilops* (*Strobilops*) *pappi* SCHLICKUM	+	+					+
38	*Strobilops* (*Strobilops*) *pachychila* SOÓS	+	+					+
39	*Vallonia subpulchella* (SANDBERGER)	+	+					+
40	*Vallonia subcyclophorella* (GOTTSCHICK)		+					+
41	*Acanthinula trochulus* (SANDBERGER)	+	+				+	
42	*Gibbulinopsis rathi* (SANDBERGER)		+					X
43	*Leiostyla* (*Leiostyla*) *austriaca* (WENZ)	+						
44	*Granaria moedlingensis* nov. sp.	+						+
45	*Granaria schlosseri* (COSSMANN).	+	+					+
46	*Truncatellina suprapontica* WENZ & EDLAUER	+	+					+
47	*Negulus gracilis* GOTTSCHICK & WENZ	+	+					
48	*Vertigo*(*Vertigo*) *callosa* REUSS	+	+			+		
49	*Vertigo* (*Vertigo*) *protracta suevica* GOTTSCHICK & WENZ		+					
50	*Vertigo* (*Vertigo*) *moedlingensis* WENZ & EDLAUER		+					
51	*Vertigo* (*Vertilla*) *oecsensis* (HALAVÁTS)	+	+			+		
52	*Gastrocopta* (*Sinalbinula*) *ferdinandi* (ANDREAE)		+					
53	*Gastrocopta* (*Sinalbinula*) *nouletiana* (DUPUY)		+					+
54	*Gastrocopta* (*Albinula*) *edlaueri* WENZ	+	+					
55	*Gastrocopta* (*Albinula*) *acuminata* (KLEIN)	+	+					

	documented species	R	E	a/l	a/f	H	W	O
56	*Ena* sp.		+				+	
57	*Nordsieckia pontica* LUEGER	+	+					
58	*Clausilia strauchiana* NORDSIECK		+				+	
59	*Macrogastra* nov. sp.	+						
60	*Triptychia* sp.	+	+					
61	*Cecilioides* (*Cecilioides*) *aciculella* (SANDBERGER)	+	+					X
62	*Fortuna clairi* SCHLICKUM & STRAUCH		+					
63	*Pseudoleacina eburnea* (KLEIN)	+				+	+	
64	*Punctum propygmaeum* (ANDREAE)		+				+	+
65	*Helicodiscus roemeri* (ANDREAE)	+	+					X
66	*Discus pleuradrus* (BOURGUIGNAT)	+	+				+	
67	*Janulus austriacus* nov. sp.	+						
68	*Zonitoides schaireri* SCHLICKUM	+					+	
69	*Oxychilus procellarium* (JOOSS)		+				+	
70	*Nesovitrea disciformis* (LUEGER)	+	+				+	+
71	*Aegopinella reussi* (HÖRNES)	+	+				+	
72	*Milax* sp.	+	+				+	
73	*Archaeozonites* (*Pontaegopis*) *laticostatus* SANDBERGER	+					+	
74	*Vitrea procrystallina steinheimensis* GOTTSCHICK	+					+	
75	*Semilimax* cf. *intermedius* (REUSS)	+	+				+	
76	*Limax* spp.	+	+				+	+
77	*Leucochroopsis kleini* (KLEIN)		+				+	
78	*Tropidomphalus* (*Mesodontopsis*) *doderleini* (BRUSINA)		+				+	+
79	*Tropidomphalus* (*Pseudochlorites*) *richarzi* (SCHLOSSER)	+	+				+	
80	*Klikia* (*Klikia*) *trolli* LUEGER	+	+				+	+
81	*Klikia* (*Apula*) *vindobonensis* nov. sp.	+					+	
82	*Klikia* (*Apula*) *goniostoma* (SANDBERGER)	+	+				+	
83	*Klikia* (*Steklovia*) *magna* (LUEGER)		+			+	+	
84	*Cepaea etelkae* (HALAVÁTS)	+	+					+

Plate 1
scale bar corresponds to 1 mm

Figs. 1–3. *Pisidium personatum* MALM 1855.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0001-2003z0005/0003)

Figs. 4–6. *Acicula edlaueri* (SCHLICKUM 1970).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0004-2003z0005/0005)
Fig. 6 shows protoconch of Fig. 4

Figs. 7–11. *Pomatias conicum* (KLEIN 1853).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0006-2003z0005/0008)
8–9) opercula, Figs. 10–11: protoconch

Figs. 12–13. *Melanopsis fuchsi* HANDMANN 1882.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0009 a+b)

Fig. 14. *Melanopsis bouei sturii* FUCHS 1873.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0010)

Fig. 15. *Viviparus loxostomus* (SANDBERGER 1875).
Eichkogel – MN11 (NHMW 592/1964)

Plate 1

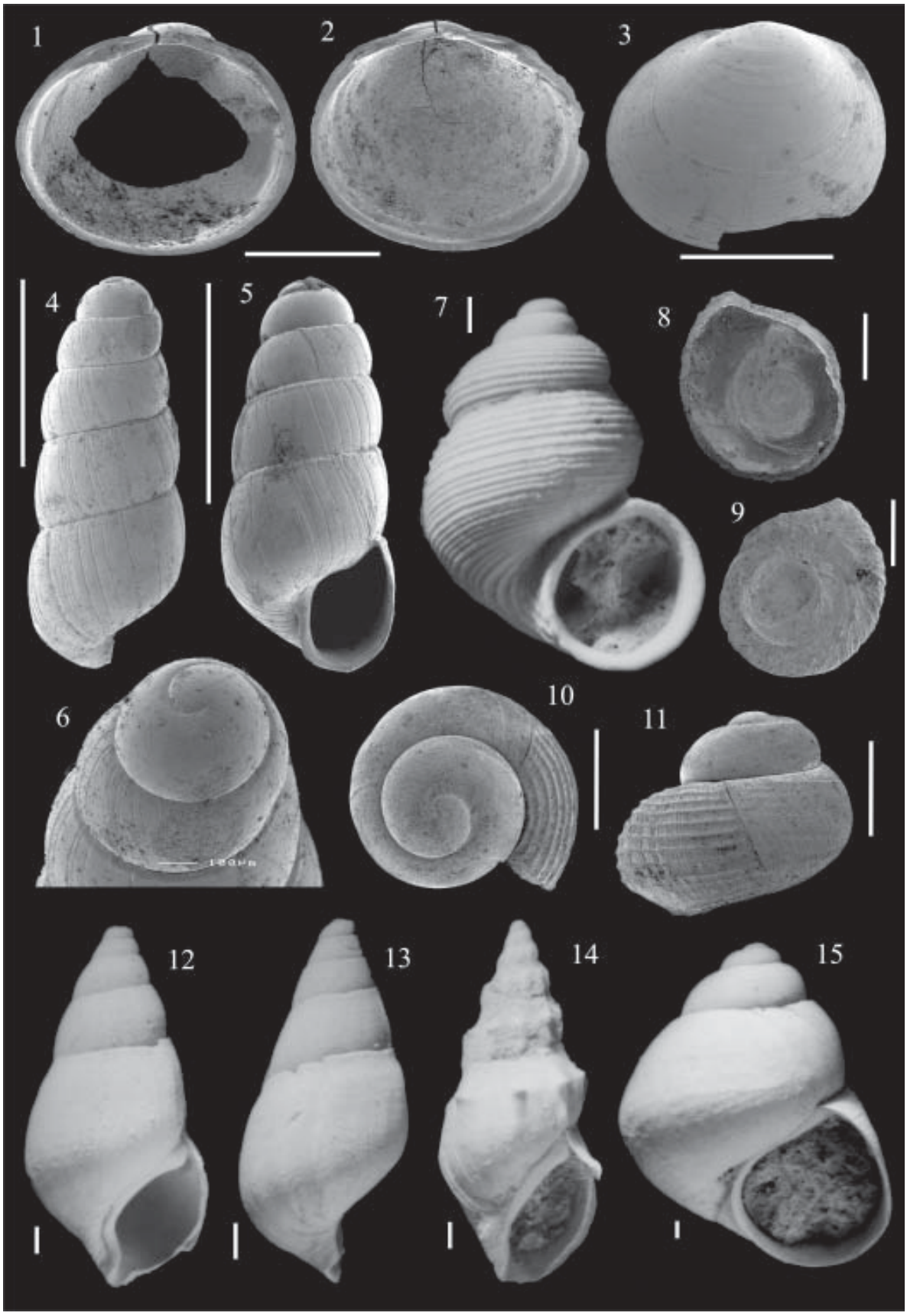

Plate 2
scale bar corresponds to 1 mm

Figs. 1–2. *Stagnicola bouilleti* (MICHAUD 1855)
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0011)

Figs. 3–4. *Radix* aff. *cucuronensis* (FONTANNES 1878)
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0012)

Figs. 5–7. *Galba halavatsi* WENZ 1923
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0013 a+b)

Figs. 8–11. *Bithynia jurinaci* (BRUSINA 1884)
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0014-2003z0005/0015)
(Figs. 10–11: opercula)

Figs 12. *Aplexa* cf. *subhypnorum* GOTTSCHICK 1920.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0016)

Fig. 13. *Prososthenia sepulcralis* (NEUMAYR & PAUL 1875).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0017)

Figs. 14–17 *Pseudamnicola hoeckae* nov. sp.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0018-2003z0005/0019)
14–15) paratype - NHMW 2003z0005/0018, Fig. 15 shows protoconch of Fig. 14
16–17) holotype - NHMW 2003z0005/0019, Fig. 17 shows protoconch of Fig. 16

Figs. 18–20 *Emmericia canaliculata* BRUSINA 1870.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0020-2003z0005/0021), Fig. 20 shows protoconch of Fig. 19

Figs. 21–22 *Hydrobia pseudocornea* BRUSINA 1902
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0022)

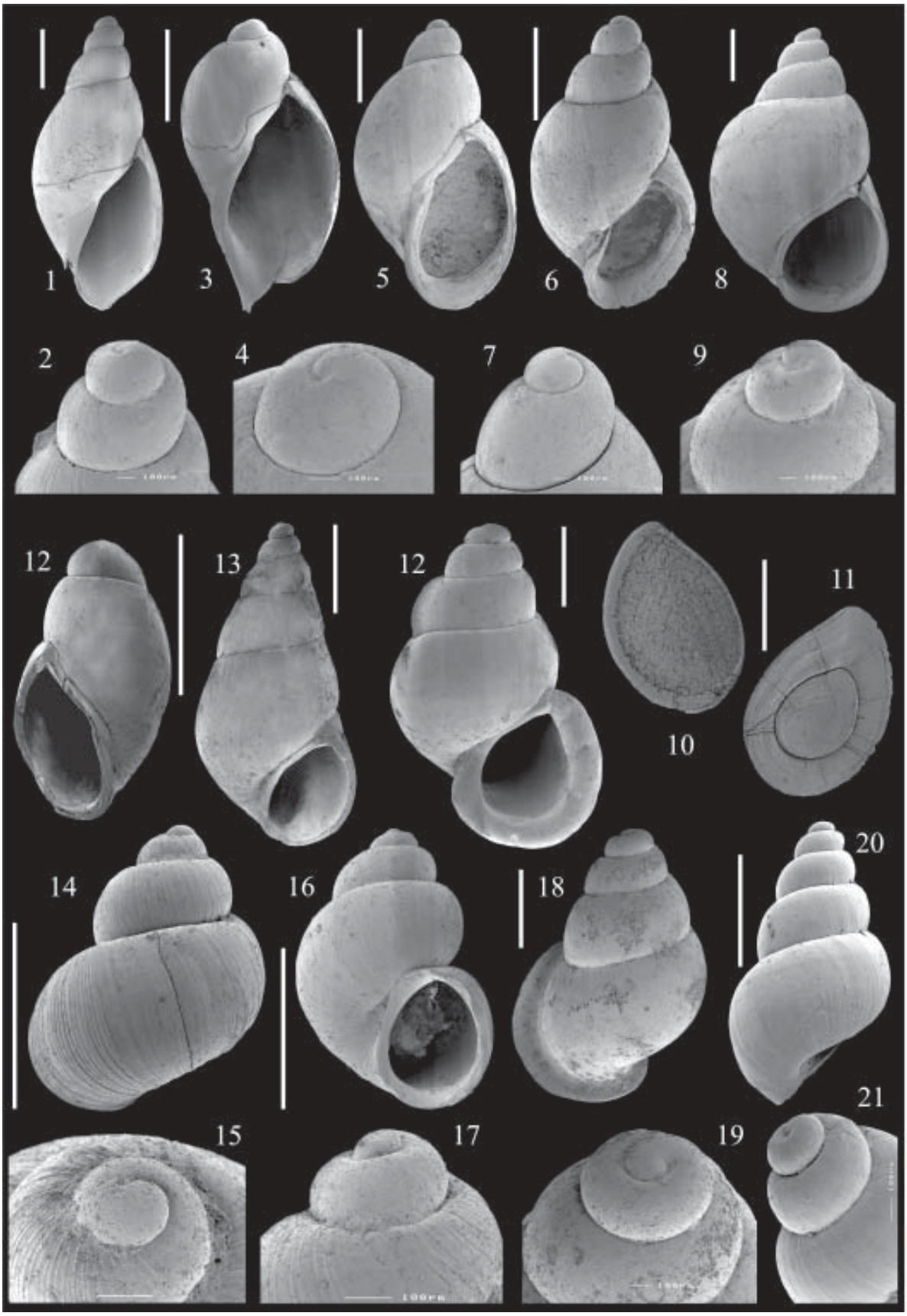
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Plate 3
scale bar corresponds to 1 mm

Figs. 1–5. *Valvata helicoides* STOLICZKA 1862.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0023-2003z0005/0025), Fig. 4 shows protoconch of Fig. 1, Fig. 5 shows protoconch of Fig. 2.

Fig. 6. *Valvata subgradata* LŐRENTHEY 1902.
Eichkogel – MN11 (NHMW 2003z0005/0026)

Figs. 7–8. *Valvata wenzi* PAPP 1953.
Eichkogel – MN11 (NHMW 2003z0005/0027), Fig. 8 shows protoconch of Fig. 7

Figs. 9–11. *Valvata oecsensis* SOÓS 1934.
Eichkogel – MN11 (NHMW 2003z0005/0028-2004z0005/0029), Fig. 9 shows protoconch of Fig. 10

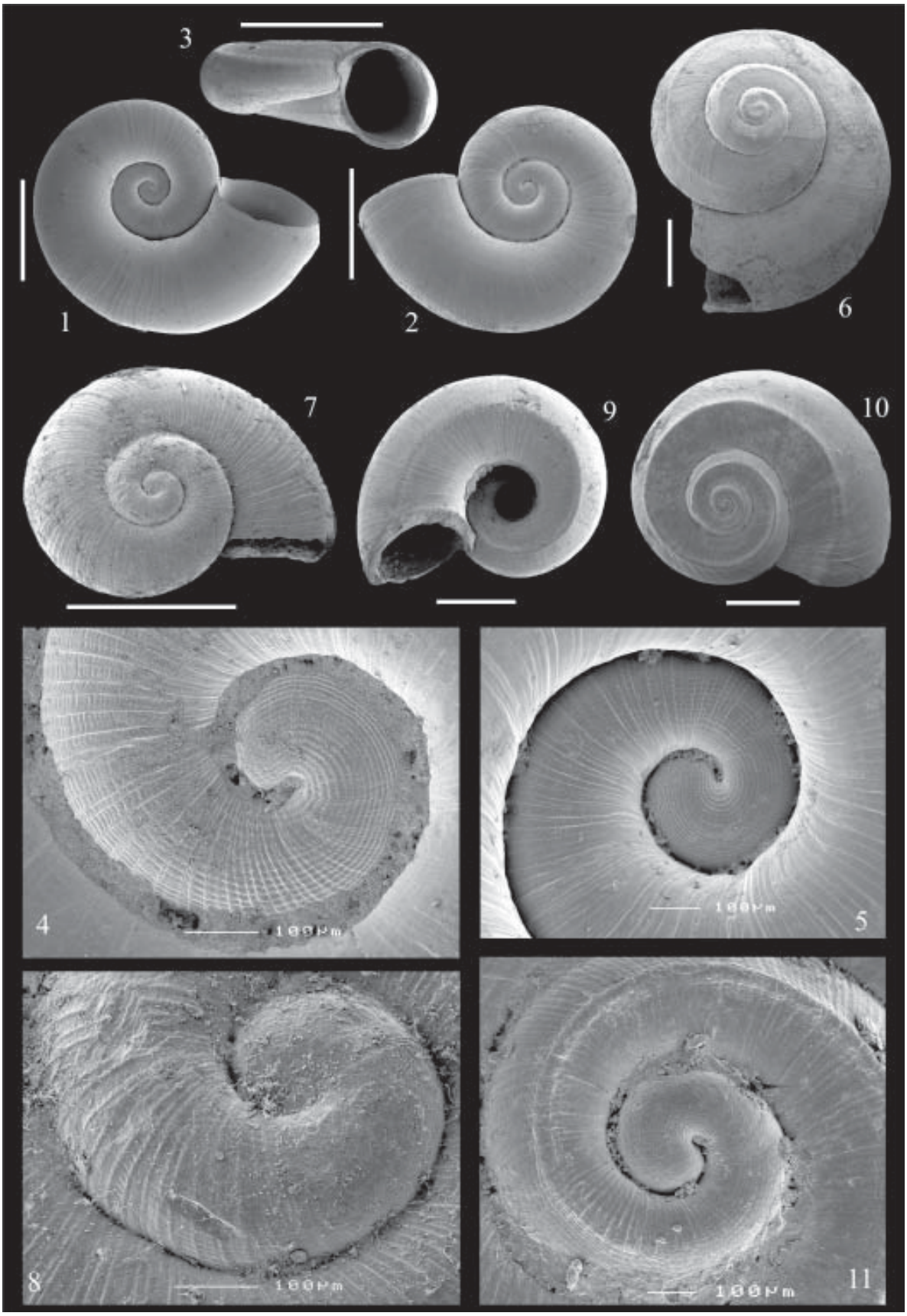
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Plate 4
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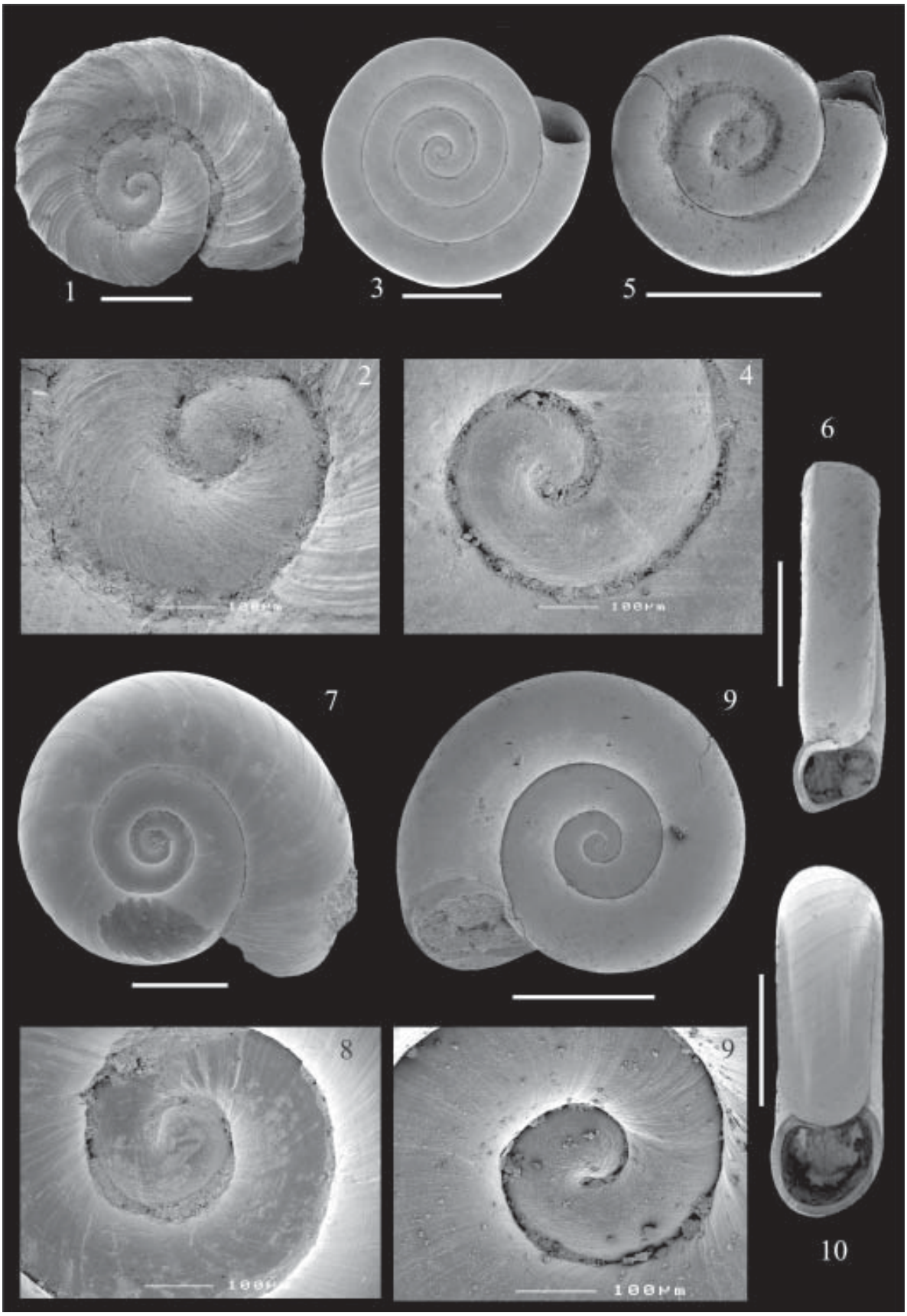
Figs. 1–2. *Armiger subptychophorus* (HALAVÁTS 1903).
Eichkogel – MN11 (NHMW 2003z0005/0030)

Figs. 3–6. *Anisus* (*Odontogyrorbis*) *krambergeri* (HALAVÁTS 1903).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0031-2003z0005/0033), Fig. 4 shows protoconch of Fig. 3

Figs. 7–10. *Anisus confusus* SOÓS 1934.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0034-2003z0005/0036), Fig. 8 shows protoconch of Fig. 7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Figs. 1–4. *Planorbarius mantelli* (DUNKER 1848)
1–3) Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0037-2003z0005/0038), Fig. 3 shows protoconch of Fig. 1
4) Eichkogel – MN11 (NHMW 1974/1680/421)

Figs. 5–7 a. *Segmentina loczyi* (LŐRENTHEY 1906)
Eichkogel – MN11 (NHMW 2003z0005/0039-2003z0005/0040)
Fig. 5 shows protoconch of Fig. 6

Figs. 8–9. *Gyraulus cryptornatus* (SAUERZOPF 1953)
Eichkogel – MN11 (NHMW 2003z0005/0041-2003z0005/0042)


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Plate 6
scale bar corresponds to 1 mm

Figs. 1–2, 14. *Carychium sandbergeri* HANDMANN 1887
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0043-2003z0005/0044), Fig. 14 shows protoconch of Fig. 1

Figs. 3–4. *Carychium berthae* (HALAVÁTS 1903).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0045-2003z0005/0046)

Figs. 5–6. *Vallonia subpulchella* (SANDBERGER 1874).
Richardhof (RH A/7) – MN9 (NHMW 2003z0005/0047-2003z0005/0048)

Figs. 7–8. *Truncatellina suprapontica* WENZ & EDLAUER 1942.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0049)

Figs. 9–10. *Negulus gracilis* GOTTSCHICK & WENZ 1919.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0050)

Fig. 11. *Carychium sandbergeri* HANDMANN 1887.
Eichkogel – MN11 (NHMW 2003z0005/0051)

Figs. 12–13. *Argna oppoliensis* (ANDREAE 1902).
Eichkogel – MN11 (NHMW 2003z0005/0052)

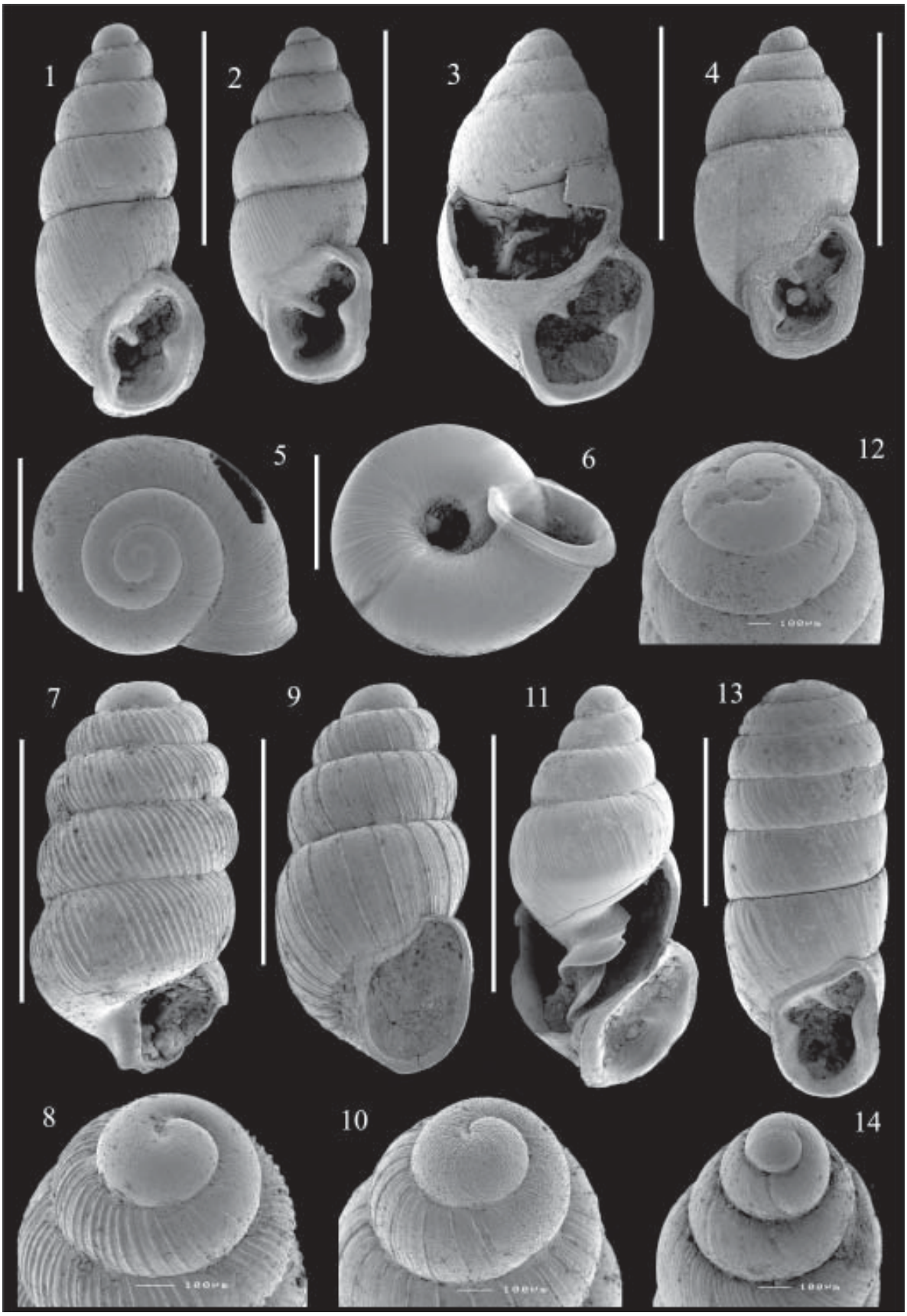
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Plate 7
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Figs. 1–3. *Acanthinula trochulus* (SANDBERGER 1874).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0053)

Figs. 4–6. *Strobilops pappi* SCHLICKUM 1970.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0054-2003z0005/0055)

Figs.7–8. *Strobilops pachychila* SOÓS 1955.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0056-2003z0005/0057)

Figs. 9–11. *Discus pleuradrus* (BOURGUIGNAT 1881).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0061-2003z0005/0062)

Figs. 12–15. *Janulus austriacus* nov. sp.
12) paratype (NHMW 2003z0005/0058)
13) paratype (NHMW 2003z0005/0059)
14) holotype (NHMW 2003z0005/0060), Fig. 15 shows the protoconch of the holotype; all Richardhof (RH A/2) – MN9

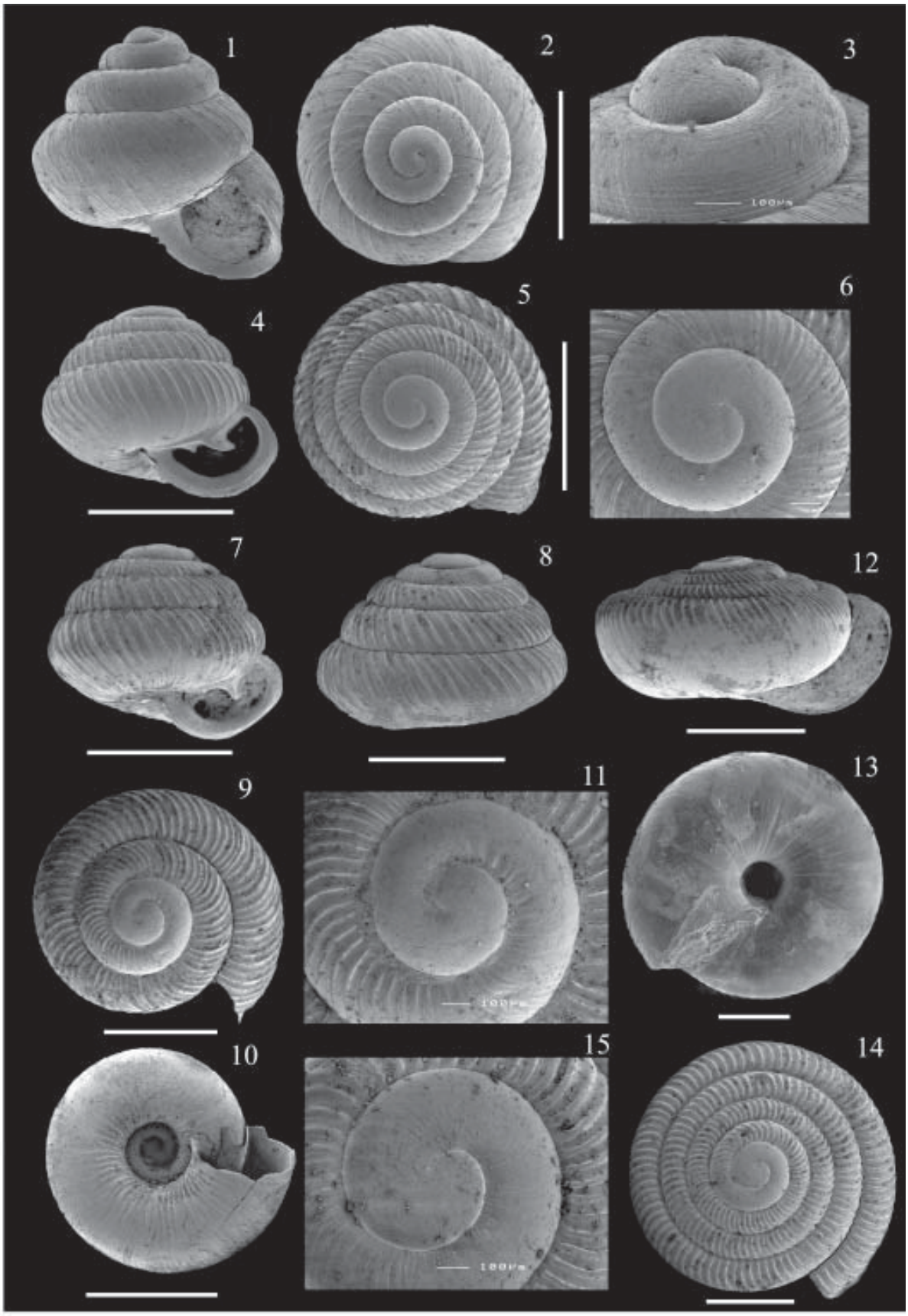
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Plate 8
scale bar corresponds to 1 mm

Figs. 1–4. *Vertigo* (*Vertilla*) *oecsensis* (HALAVÁTS 1903).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0063-2003z0005/0064), Fig. 4 shows protoconch of Fig. 3

Figs. 5–6. *Vertigo* (*Vertigo*) *callosa* (REUSS 1852).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0065)

Figs. 7–8. *Gastrocopta* (*Albinula*) *edlaueri* (WENZ 1920).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0066)

Figs. 9–11. *Gastrocopta* (*Sinalbinula*) *nouletiana* (DUPUY 1850).
Eichkogel – MN11 (NHMW 2003z0005/0067)

Figs. 12–14. *Gastrocopta* (*Sinalbinula*) *ferdinadi* (ANDREAE 1902).
Eichkogel – MN11 (NHMW 2003z0005/0068)

Figs. 15–20. *Gastrocopta* (*Albinula*) *acuminata* (KLEIN 1846).
Eichkogel – MN11 (NHMW 2003z0005/0069-2003z0005/0070)

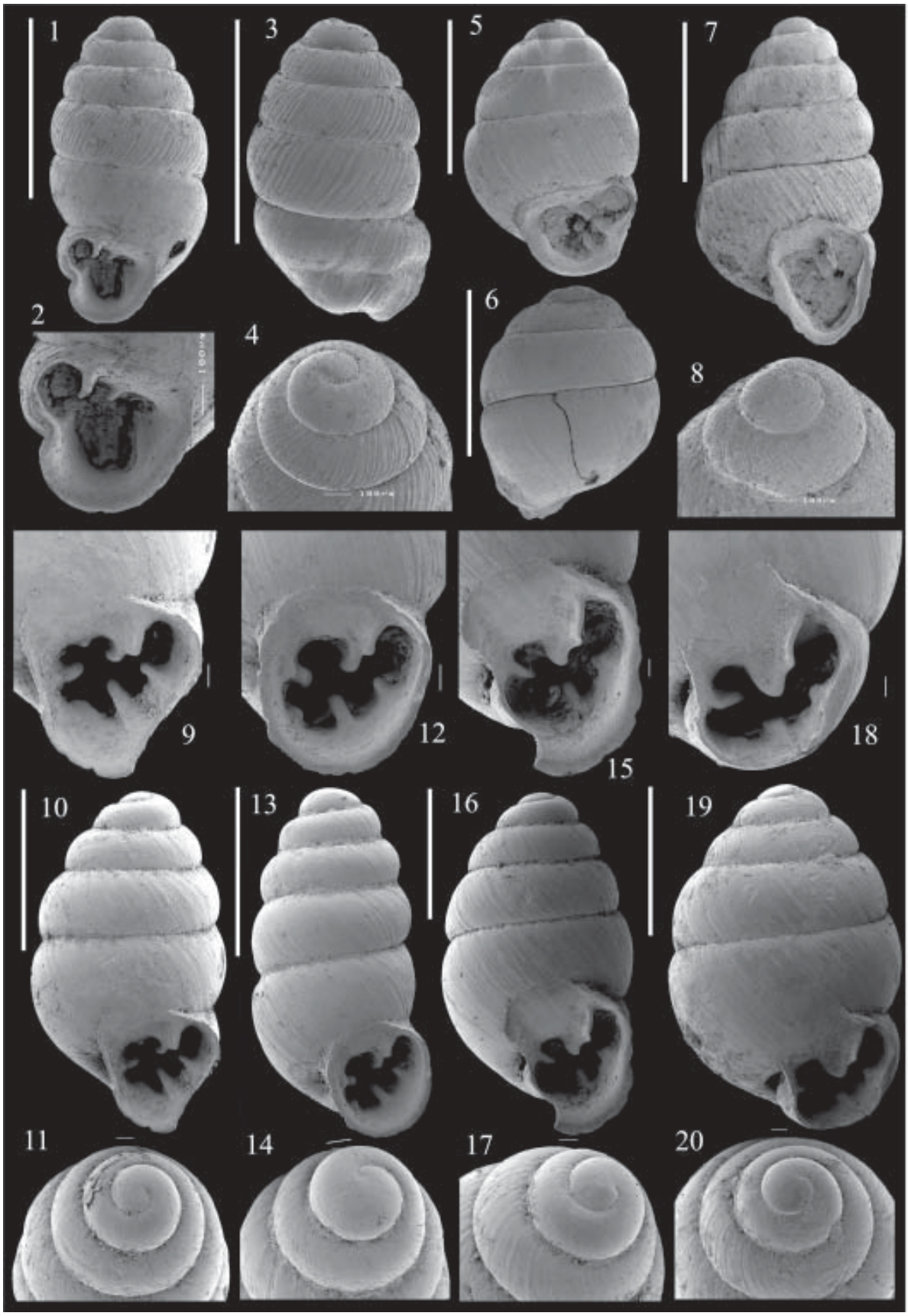
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Plate 9
scale bar corresponds to 1 mm

Fig. 1. *Nordsieckia pontica* LUEGER 1981.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0071)

Fig. 2. *Pseudoleacina eburnea* (KLEIN 1853).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0072)

Figs. 3–4. *Granaria moedlingensis* nov. sp.
Holotype, Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0073)

Figs. 5–6. *Helicodiscus roemeri* (ANDREAE 1902).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0074)

Fig. 7. *Semilimax* cf. *intermedium* (REUSS 1852).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0075)

Figs. 8–11. *Cecilioides aciculella* (SANDBERGER 1874).
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0076-2003z0005/00077), Fig. 9 shows protoconch of Fig. 8, Fig. 11 shows protoconch of Fig. 10

Figs. 12–13. *Fortuna clairi* SCHLICKUM & STRAUCH 1972.
Eichkogel – MN11(NHMW 2003z0005/0078)

Figs. 14–15. *Limax* sp.
Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0079 a+b)

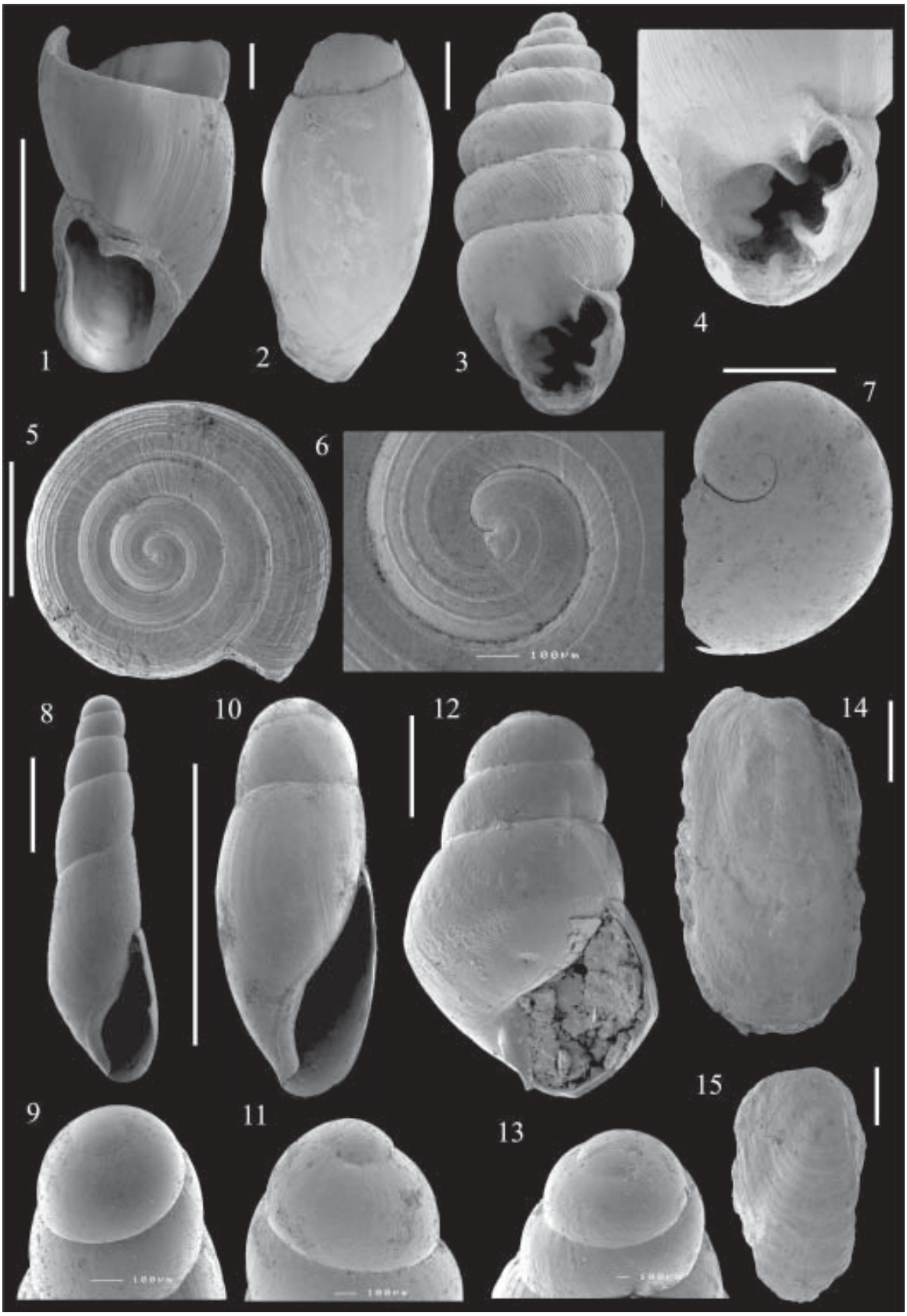
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Plate 10
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Figs. 1–5. *Tropidomphalus* (*Pseudochlorites*) *richarzi* (SCHLOSSER 1907).
1–3) Richardhof Rh 5 – MN10 (NHMW 2003z0005/0080)
4–5) Richardhof HH A/2 – MN9 (NHMW 2003z0005/0081)

Figs. 6–9. *Klikia* (*Apula*) *goniostoma* (SANDBERGER 1875).
6–8) Eichkogel – MN11 NHMW 1974/1680/419
9) Richardhof (RH A/2) – MN9 (NHMW 2003z0005/0082)

Figs. 10–12. *Klikia* (*Apula*) *vindobonensis* nov. sp.
Holotype Leobersdorf – Pannonian „zone“ D (NHMW 2003z0005/0083)

Figs. 13–13a. *Klikia* (*Apula*) *vindobonensis* nov. sp.
Paratype Richardhof – RH A/2 MN9 (NHMW 2003z0005/0084)

Figs. 14–16. *Klikia* (*Klikia*) *trolli* LUEGER 1981.
Richardhof – RH A/2 MN9 (NHMW 2003z0005/0085)

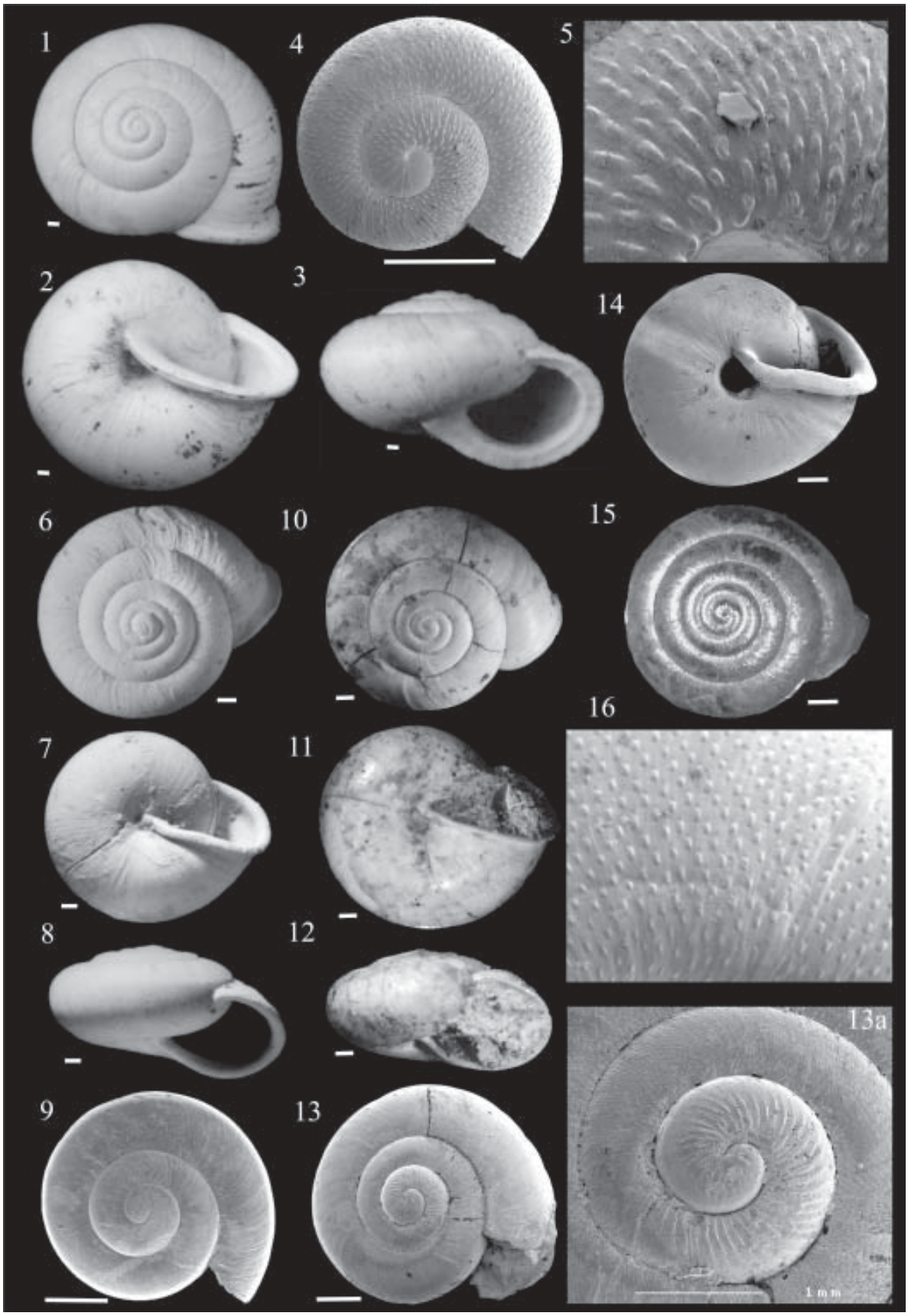
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Plate 11
scale bar corresponds to 1 mm

Figs. 1–4. *Archaeozonites* (*Pontaegopis*) *laticostatus* SANDBERGER 1875.
Richardhof – MN9? (NHMW 2003z0005/0086)

Figs. 5–7. *Aegopinella reussi* (HÖRNES 1856).
Richardhof – MN9? (NHMW 2003z0005/0087)

Figs. 8–10. *Leucochroopsis kleini* (KLEIN 1846).
8) Eichkogel – MN11 (NHMW 2003z0005/0088)
9–10) Eichkogel – MN11 (NHMWM 2003z0005/0088 a)

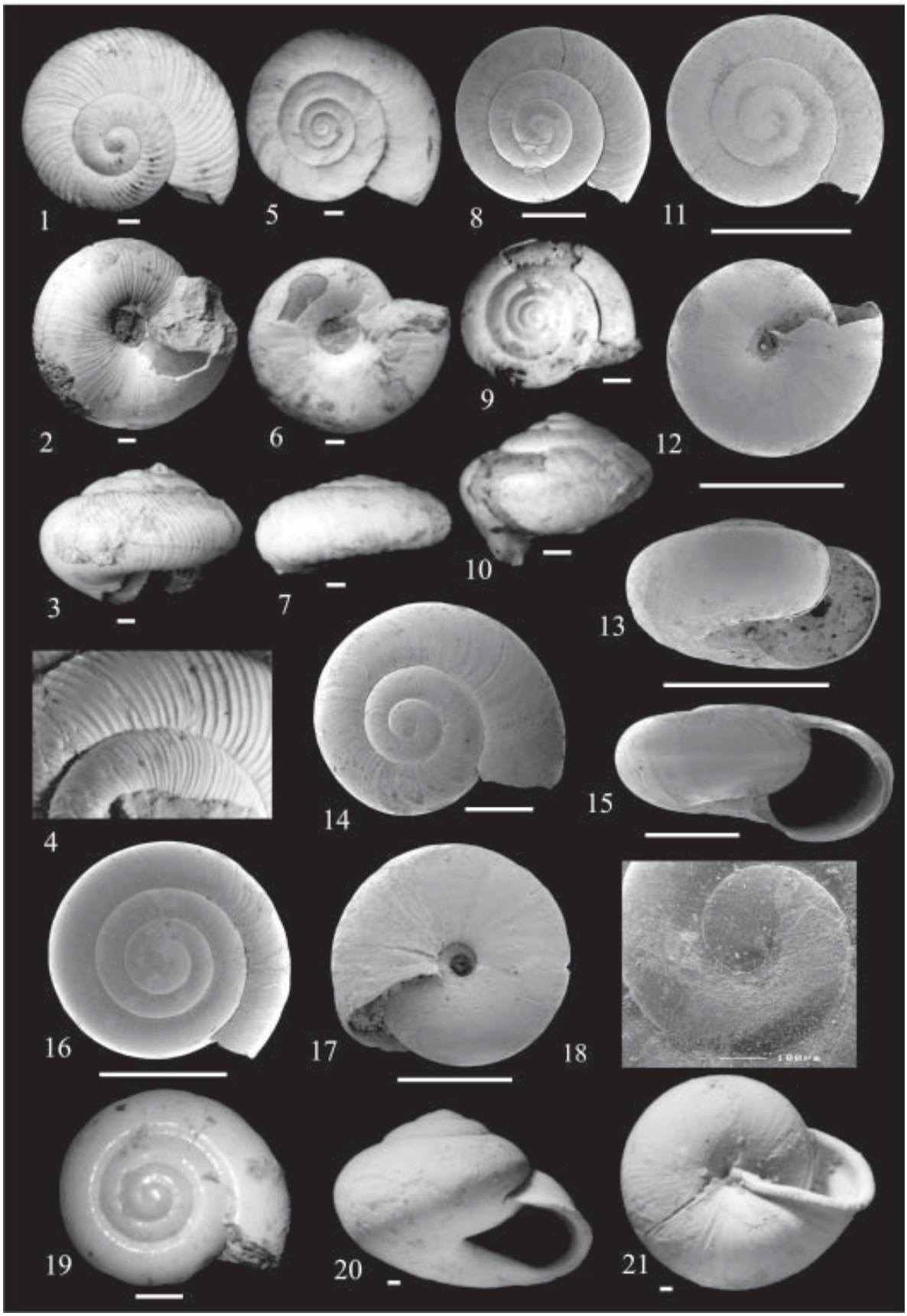
Figs. 11–13. *Vitrea procrystallina steinheimensis* GOTTSCHICK 1920.
Richardhof – RH A/2 MN9 (NHMW 2003z0005/0089-2003z0005/0090)

Figs. 14–15. *Nesovitrea disciformis* LUEGER 1981.
Richardhof – RH A/2 MN9 (NHMW 2003z0005/0091)

Figs. 16–18. *Zonitoides schaireri* SCHLICKUM 1978.
Richardhof – RH A/2 MN9 (NHMW 2003z0005/0092-2003z0005/0093), Fig. 18 shows protoconch of Fig. 16

Fig. 19. *Oxychilus procellarium* (JOOSS 1918).
Eichkogel – MN11 (NHMW 2003z0005/0094)

Figs. 20–21. *Cepaea etelkae* (HALAVÁTS 1923).
Eichkogel – MN11 – NHMW 1974/1680/424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