

## Survey of the Nassariid Gastropods in the Neogene Paratethys

(Mollusca: Caenogastropoda: Buccinoidea)

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### Abstract

Nassariidae (Neogastropoda, Buccinoidea) are typical molluscs in the marine and marine-brackish Miocene deposits of the Eurasian Paratethys Sea. Furthermore, they are among the few gastropod taxa that managed to pass the water chemistry crisis at the Badenian/Sarmatian boundary. However, the changed conditions of the Sarmatian led to a severe decline of the Nassariinae whereas the Dorsaninae seem to have occupied the vacant ecological niches formerly filled by Nassariinae and Cylleninae. About 98 species names are available in the literature regarding Nassariinae IREDALE 1916. These refer to Middle Miocene (Badenian) occurrences mainly. Of these only 46 are considered herein to represent valid species. Distinctly less manifold are the Cylleninae BELLARDI 1882 that are recorded with about 10 species of the genera *Cyllene* and *Cyllenina*. The third subfamily Dorsaninae COSSMANN 1901 is represented by the genera *Duplicata* and *Akburunella* representing about 45 species. The protoconch morphology of representatives of the three subfamilies is described for the first time, inferences regarding the embryogenesis and larval ecology and systematic implications are discussed. *Nassarius jansseni* nov. sp., *Nassarius schultzi* nov. sp. and *Duplicata ermanni* nov. sp. are introduced. This paper gives a critical overview of most Miocene Paratethyan nassariid gastropods but does not claim to be a revision of this complex group.

**Keywords:** Nassariidae, Central Paratethys, Eastern Paratethys, Neogene, early ontogeny.

### Zusammenfassung

Nassariidae (Neogastropoda, Buccinoidea) sind typische Mollusken der marinen und brackischen Ablagerungen aus dem Miozän des eurasischen Paratethys Meeres. Sie zählen zu den wenigen Gastropoden, die die Krise im Wasserchemismus an der Wende vom Badenium zum Sarmatium (im mittleren Miozän) überstanden. Die veränderten Bedingungen im Sarmatium führten jedoch zu einem deutlichen Rückgang der Nassariinae. Die somit frei gewordenen ökologischen Nischen wurden durch Vertreter der Dorsaninae und Cylleninae besetzt. An die 98 nominale Arten der Nassariinae IREDALE 1916 finden sich in der Literatur. Diese repräsentieren mehrheitlich Formen des mittleren Miozäns (Badenium). Nur 46 dieser Taxa werden hier als gültige Arten anerkannt. Dem gegenüber sind die Cylleninae BELLARDI 1882 wesentlich artenärmer und werden durch 10 Arten der Gattungen *Cyllene* und *Cyllenina* vertreten. Die dritte Subfamilie Dorsaninae COSSMANN 1901 mit den Gattungen *Duplicata* und *Akburunella* umfasst rund 45 Arten. Zum ersten Mal wird die Morphologie der Protoconche aller drei Subfamilien beschrieben. Embryogenese, larval Ökologie und Systematik werden unter Berücksichtigung dieser Daten diskutiert. *Nassarius jansseni* nov. sp., *Nassarius schultzi* nov. sp. und *Duplicata ermanni* nov. sp. werden als neue Arten eingeführt. Diese Arbeit versucht, einen kritischen Überblick über die miozänen paratethyalen Nassariiden Gastropoden zu schaffen, stellt aber keine Revision dieser komplexen Gruppe dar.

**Schlüsselwörter:** Nassariidae, Zentrale Paratethys, Östliche Paratethys, Neogen, frühe Ontogenie.

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## Introduction

More than 200 nominal taxa of nassariid gastropods are described from the Neogene of the Paratethys Sea. Herein, we try to evaluate the status of most of these nassariids but do not present a revision of that group. Several rare and/or dubious taxa will remain unchecked.

The investigation history started with the almost simultaneous contributions by ANDRZEJOWSKI (1830, 1833), DUBOIS DE MONTPEREUX (1831), EICHWALD (1829, 1830, 1839) and PUSCH (1837). Later, the famous monograph by HÖRNES (1852) laid a foundation stone on the knowledge of this difficult group in the Central Paratethys. Soon after HOERNES & AUINGER (1882) recognised several inefficiencies and enlarged the inventory greatly by introducing a vast number of new species. BELLARDI (1882) published his monograph on the Northern Italian nassariids introducing large numbers of new taxa but also offering first illustrations of many already described Neogene Mediterranean species. Of course, these unfortunate coincidences in publication dates caused several synonyms.

In the following 120 years all subsequent authors dealing with Paratethyan nassariids referred to many of these taxa. However, none of them ever studied the holotypes or syntypes in the collection of the Museum of Natural History in Vienna (NHMW). Descriptions in German language and the rather interpretative drawings of many species handicapped the investigations for many workers. These difficulties resulted in an often incorrect treatment of the „HOERNES & AUINGER - species“ in the literature. In the same way the supraspecific determination of most taxa is in a state of total chaos. The genera *Buccinum*, *Hinia*, *Hima*, *Nassa*, *Phrontis*, *Zeuxis* and *Uzita* were used for Paratethyan species throughout history as vague, exchangeable terms. In recent years CERNOHORSKY (1984) and ALLMON (1990) emphasized the difficulties in estimating the validity of the European Neogene nassariids. Finally, ALLMON (1990) in his contribution on the American *Bullia* group even concluded that most of the European „*Dorsanum*“ should be treated as something else. Thus, a review of the taxa introduced by HÖRNES (1852), HILBER (1879), HOERNES & AUINGER (1882), and SCHAFFER (1912) supported by modern SEM techniques is urgently needed. Furthermore, these methods allow a thorough discussion of the protoconch morphologies and the early ontogenetic development of most taxa. A new methodological effort in bringing order into the generic affiliation especially of the Cylleninae and Dorsaninae is attempted.

Many species that were first described in HÖRNES (1852), HILBER (1879), and HOERNES & AUINGER (1882) are based on older collection labels, which were written by the curators PARTSCH, AUINGER, and HÖRNES. This resulted in the often used authorship „PARTSCH in HÖRNES

Time (Ma)	Chronos	Polarity	Series	Mediterranean Stages	Central & Western Paratethys Stages	Eastern Paratethys Stages	
5.3	C3A		Upper Miocene	Messinian	Pontian	Pontian	
	C3B			Tortonian	Pannonian	Maeotian	
	C4					Khersonian	
	C4A					Bessarabian	
11.6	C5		Middle Mio.	Serravallian	Sarmatian <small>Mactra Z. Ervilia Z. Mohrenstermia Z.</small>	Volhynian	
	C5A			Langhian	Badenian <small>U. Wielicien L.</small>	Konkian	
	C5AB					Karaganian	
	C5AC			Chokrakian			
	C5AD			Tarkhanian			
	C5B			Burdigalian	Karpatian	Kotsakhurian	
	C5C				Ottngangian		
	C5D				Eggenburgian	Sakarauiian	
	C5E			Lower Miocene	Aquitanian	Egerian	Karadzhalgian
	C6						
	C6A						
	C6AA						
	C6B						
23.8							

**Fig. 1:** Stratigraphic correlation chart of the standard scale with the Central Paratethys and the Eastern Paratethys; modified after RÖGL (1998), STUDENCKA & al. (1998) and HARZHAUSER & al. (2003) and references therein.

1856“ „AUINGER in HILBER 1879“, and „HÖRNES in HOERNES & AUINGER 1882“. None of these taxa are based on any valid description or illustration of the alleged „authors“ and are rejected herein in accordance with the rules of the IRZN. The authorship is therefore passed to the authors of the monographs.

### Stratigraphical background and sources

The herein described material derives mainly from the collection of the Museum of Natural History in Vienna (NHMW in the following). Most of the specimens were already collected during the 19<sup>th</sup> and 20<sup>th</sup> centuries and were the foundation stone for the monographs of HÖRNES (1852) and HOERNES & AUINGER (1882).

The material covers a succession from the Lower Miocene regional stages Eggenburgian (~Lower Burdigalian), Ottngangian („middle“ Burdigalian), and Karpatian (~Upper Burdigalian) to the Middle Miocene regional stages Badenian (~Langhian to Lower Serravallian) and Sarmatian (~Upper Serravallian) (fig. 1). During the Pannonian which corresponds roughly to the Mediterranean Tortonian all marine molluscs became extinct in the Central Paratethys and thus no nassariids are documented from that interval. Tortonian marine taxa variously referred to in the literature (e.g. STRAUZ 1966, ZELINSKAYA & al. 1968, BAŁUK 1970, ADAM & GLIBERT 1976) are a bad heritage from the er-

**Table 1:** The most important localities considered.

Middle-Upper Miocene	
Bessarabian	Jenikale, Akburun — Krim/Ukraine Kischeneu — Moldavia
Middle Miocene	
Sarmatian (Upper Serravallian) — <i>Maetra</i> Zone	Wiesen — Austria
Sarmatian (Upper Serravallian) — <i>Ervilia</i> Zone	Nexing, Hauskirchen, Hautzendorf, Wiesen — Austria Břilovice — Czech Republic
Sarmatian (Upper Serravallian) — <i>Mohrensternia</i> Zone	Grinzing/Vienna, Hollabrunn — Austria Baden, Enzesfeld, Forchtenau, Gainfarn, Grund, Marz, Steinabrunn, Niederleis, Pöls/Wildon, Sooß, St. Florian, Vöslau — Austria Hrusovany — Czech Republic Devínska Nova Ves (Devin) — Slovakia Várpalota, Hidas, Herend — Hungary
Badenian (Langhian — Lower Serravallian)	Lăpuşiu de Sus (=Lapugy), Coşteiu de Sus (=Kostej), Bujtur — Romania Korytnica — Poland
Lower Miocene	
Karpatian (Upper Burdigalian)	Stetten/Korneuburg, Weinsteig, Kleinebersdorf, Niederkreuzstetten — Austria
Ottangian (Middle Burdigalian)	Ottang — Austria
Eggenburgian (Lower Burdigalian)	Maria Dreieichen — Austria

roneous correlation of the Middle Miocene Badenian stage with the Upper Miocene Tortonian of the Mediterranean area dating back to the 19<sup>th</sup> century (see HARZHAUSER & al.

2003 for further discussion). When Lake Pannon became installed in the former Central Paratethys area, the Sea was restricted to the Eastern Paratethys.

## Discussion

Palaeobiogeographically the investigated taxa are part of the fauna of the Paratethys Sea. This vast inland sea developed at the Eocene/Oligocene boundary in the north of the alpidic mountain chains – see RÖGL (1998) for a detailed outline of the Paratethys history and its correlation with circum-Mediterranean events. Despite its complex history, the Paratethys shared many taxa with the adjacent Mediterranean Sea. Among the nassariids, too, several species are common to both biogeographic areas. As emphasised by HARZHAUSER & al. (2002) the percentage of shared gastropod taxa between the Mediterranean and the Paratethys was very high during the Karpatian and Badenian when broad marine connections allowed a fair faunistic exchange. Obviously, this stands in contrast to the rather high number of Central Paratethys-endemics among the nassariids as documented in this paper. However, in respect to the still poorly known nassariid fauna of the Lower to Middle Miocene Mediterranean the „endemics“ are probably rather a matter of investigation than of biogeography. Additionally it has to be kept in mind that the corresponding Mediterranean nassariid fauna is nearly exclusively based on the old

and poorly illustrated monographs of BELLARDI (1882) and SACCO (1904). This handicap was slightly reduced by the re-illustration of several type-species of BELLARDI (1882) by FERRERO MORTARA & al. (1981). Nevertheless, the overwhelming part of these species derives from Pliocene or Tortonian deposits, whereas the bulk of the Paratethyan species is of Middle Miocene age. Therefore we mainly stick to the Central Paratethys occurrences, but refrain from interpreting the endemismrate of the Badenian fauna, when broad marine connections to the Mediterranean Sea contradict such a seemingly autochthonous evolution.

Nevertheless, nassariids seem to bear a tendency to produce rather local species in short time. This is best documented by the number of endemics only known within the Paratethys from the Polish-Ukrainian foredeep. There, species such as *Nassarius podolicus* (HOERNES & AUINGER), *Nassarius zborzewskii* (ANDRZEJOWSKI) arose from the widespread *Nassarius dujardini-schoenni* stock. This evolution was probably triggered by the position of this basin which suffered various disconnections from the other basins of the Central Paratethys, leading to the

formation of evaporites during the Wielician phase of the Badenian.

In the Eastern Paratethys the nassariids witness an obviously geodynamically controlled development. Generally the pre-Sarmatian assemblages of the Eastern Paratethys are considerably less diverse than their „western“ counterpart. Only 16 taxa are described by ZHIZHENKO (1936) and ILJINA (1993) from the Tarkhanian to Konkian strata. The more or less normal marine Tarkhanian and Chokrakian stages are characterised by several species which are also common in the Badenian of the Central Paratethys. Even those species which are probably endemics seem to be rooted in „western“ species stocks such as *Nassarius dujardini* (DESHAYES) or *Nassarius volhynicus* (ANDRZEJOWSKI). This flair vanishes abruptly during the Karaganian salinity crises. A single, endemic species is reported by ILJINA (1993) from this brackish phase. Afterwards, during the Konkian the nassariid fauna is still reduced. However, of the 4 documented species 3 are conspecific with Central Paratethyan taxa showing hardly any endemism. A closer look shows that one of these species – *Nassarius zborzewskii* (ANDRZEJOWSKI 1830) – is only reported from the Polish-Ukrainian foredeep but is unknown from the Pannonian Basins system. Obviously, the connection of the Polish-Ukrainian foredeep to the other Central Paratethys basins was hampered whereas a seaway to the Eastern Paratethys allowed some migration.

At the Badenian/Sarmatian boundary the Nassariinae declined in the entire Paratethys with very few surviving taxa. Only *Nassarius coloratus sarmaticus* (LASKAREW 1903) and *Nassarius kulensis* (KOJUMDIEVA 1969) managed to pass the boundary in the Polish-Ukrainian-Bulgarian foredeep. Both are seemingly restricted to the Volhynian and are unknown from other Central Paratethys basins.

A second major phase of endemic evolution is documented for the Sarmatian when *Duplicata*, ZHIZHENKO in KOLESNIKOV 1939 as the main survivor of the manifold Badenian nassariids experienced a conspicuous radiation. PAPP (1954) already referred to the low morphologic variability of *Duplicata duplicata* during the *Mohrensternia* Zone and emphasized the increase in plasticity during the *Ervilia* Zone. Of the 12 taxa described by PAPP (1954) from the Sarmatian of the Vienna Basin, only two are known from the initial Sarmatian *Mohrensternia* Zone. Eleven are documented from the *Ervilia* Zone, of these eight are restricted to that zone. The diversity again drops considerably in the *Maetra* Zone when only four taxa occur.

Generally, the Sarmatian bloom of the Dorsaninae seems to be a twofold story. Whilst *Duplicata* experiences its build-up phase during the Volhynian of the Eastern Paratethys and the *Ervilia* Zone in the Central Paratethys, the second Sarmatian genus *Akburunella* flourishes slightly later during the Bessarabian.

*Akburunella* was introduced by KOLESNIKOV (1935) for a group of Sarmatian nassariids which are endemic to the Paratethys. The origin can be traced back to the Lower Sarmatian Volhynian, when *Akburunella akburunensis* (ANDRUSOV 1906), *Akburunella triformis* (d'ORBIGNY 1844), and *Akburunella leioconcha* (ANDRUSOV 1927) occurred in the Eastern Paratethys. The genus experiences its heyday finally during the Bessarabian in the so-called *Cryptomaetra* Beds. About 12 suddenly appearing species of *Akburunella* document a considerable radiation right before its extinction at the boundary to the Khersonian. In the western part of the Paratethys this conspicuous evolution is not documented since this area was already covered by Lake Pannon when the Bessarabian fauna flourished in the Eastern Paratethys.

### Early ontogenetic development of the gastropods

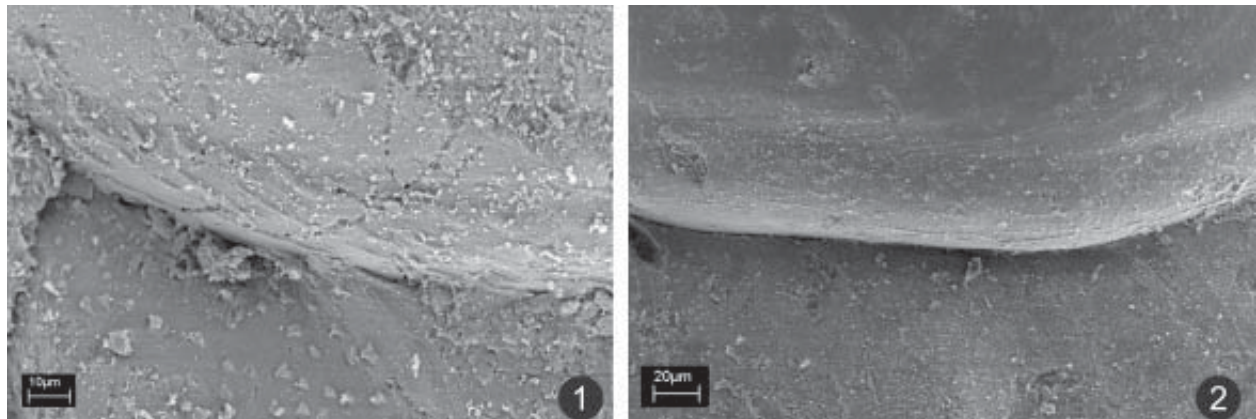
Two modes of early ontogenetic development, which are reflected in the protoconch morphology, occurred in the investigated taxa – for terminology and measurements of protoconchs see also SHUTO (1974) and KOWALKE (1998, and cited literature):

Indirect development, i.e. hatching of veliger larvae after embryonic development within the egg capsule (cf. THORSON 1950, SHUTO 1974, JABLONSKI & LUTZ 1983, JABLONSKI 1986). In this case the embryonic shell comprises about one whorl measuring about 0.2 mm in maximum diameter. The moment of hatching is usually reflected by a thickened rim of the shell, indicating the thickened apertural margin of the veliger ready to hatch. During the subsequent free larval stage an additional larval shell is built, which usually consist of 2–2.5 whorls. This shell reflects a planktotrophic veliger stage during

that the larva feeds on phytoplankton. The subsequent teleoconch is secreted after metamorphosis during the benthic life. It is usually well distinguished from the protoconch by different sculpture.

In case of the different mode of direct development a larval stage is absent, thus miniature adults directly hatch from the egg-masses. In this case the embryonic shells comprise 1–1.5 whorls measuring more than 0.5 mm in maximum diameter. Embryonic development is often supported by nurse-eggs and -embryos nutrition, indicated by bulbous embryonic shells and a rapid increase of the diameter of the embryonic shell (see also SHUTO 1974).

Only two of 29 herein investigated Nassariinae species known with regard to their protoconch morphology were characterised by direct development. Most of the species had protoconchs comprising 3–3.5 whorls re-



**Fig. 2:** Microsculpture of Nassariinae protoconchs - (1) *Nassarius subasperatus* (BOETTGER 1906) from Niederleis/Austria and (2) *Nassarius schroeckingeri* (HOERNES & AUINGER 1882) from Co $\le$ teiu de Sus/Rumania. A secondary sculpture of four spiral rows of longitudinal tubercles in the visible part of the whorls characterises the spiral keels of the larval shells of the Nassariinae. These ornaments may be connected to spiral threads.

flecting planktotrophic development. The embryogenesis was not very yolk-rich, as indicated by considerably small initial cap-like onsets usually measuring 0.03–0.06 mm in width. In case of indirect development the larval shell comprises 2–2.5 whorls, which points to a shorter larval stage of probably few weeks (cf. THORSON 1961, WEBBER 1977, SCHELTEMA 1977, 1978). Sculpture of the investigated Nassariinae protoconchs is variable. 1–2 more or less distinct spiral cords may occur on the visible part of the larval shells. A very constant characteristic is the secondary sculpture on these spiral cords (fig. 2). These are sculptured by four spiral rows of longitudinal tubercles that may be connected to spiral threads. This feature occurred in species of the genera *Nassarius*, *Naytiopsis* and *Profundinassa*. The morphology of the transition from the protoconch to the teleoconch is generally variable: straight or sinuous thickened rims occur as well as indistinct transitions with successive onset of adult sculpture.

In case of planktotrophic development Dorsaninae may show similar protoconch morphology. A difference is the smaller protoconch of *Duplicata haueri*, which comprises only 2.25 whorls. The first whorl is char-

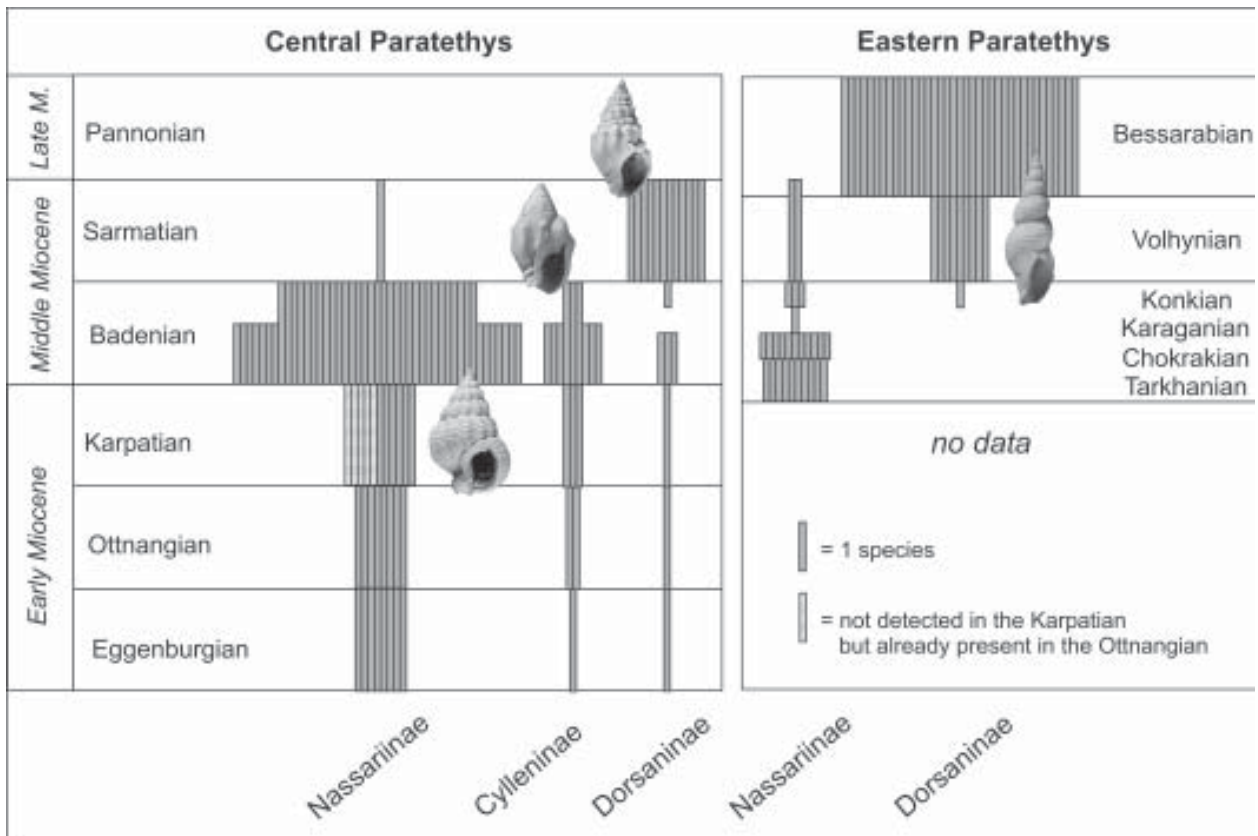
acterised by a rapid increase of diameter of the embryonic shell. This points to a more yolk-rich embryogenesis compared to that of the investigated Nassariinae. The genus *Akburunella* is only known by direct developers, which differ from direct developing *Duplicata duplicata* by bulbous embryonic shells with considerably larger initial cap-like onsets measuring more than 0.35 mm in width. This indicates a very yolk-rich embryogenesis most probably supported by nurse-egg nutrition. This mode differs from „breeding“, i.e. retaining miniature adults within the female’s body as described for some Recent Nassariinae by CERNOHORSKY (1984 b), in comprising only slightly more than one embryonic whorl, which furthermore is sharply demarcated from the teleoconch.

The cyllenine species *Cyllenina ternodosa* represents a direct developer, which could be distinguished from directly developing Nassariinae and Dorsaninae by its considerably smaller embryonic shell, reflecting a less yolk rich embryogenesis. Cylleninae with planktotrophic larval development (see CERNOHORSKY 1984 b: Figs. 169–173) were characterised by protoconch-angles less than 60° and lacked any spiral sculpture, thus could be differentiated from Nassariinae and Dorsaninae.

## Conclusions

The data summarized in fig. 3 impressively document the early Middle Miocene bloom in diversity of taxa during the Badenian of the Central Paratethys and to a lesser degree during the Tarkhanian and Chokrakian of the Eastern Paratethys. Within the Central Paratethys the three subfamilies are recorded by a rather constant number

of taxa throughout the Early Miocene. The Nassariinae always range about 8–10 species whereas the Cylleninae and Dorsaninae are distinctly less manifold, comprising only 1–3 species each. This picture changes dramatically during the Early Badenian (Langhian) when the Nassariinae rise to 45 species within the Central Paratethys.



**Fig. 3:** Stratigraphical distribution of Nassariinae, Cylleninae and Dorsaninae in the Central Paratethys compared with the distribution of the Nassariinae and Dorsaninae in the Eastern Paratethys. Note the Sarmatian take over by Dorsaninae after the severe decline of Nassariinae in both biogeographic entities.

Correspondingly the Cylleninae experience the acme during the Early Badenian being documented by at least eight species. For both groups the Late Badenian brings about some slowdown of radiation. This development is mirrored in the faunas of the Eastern Paratethys. There, the lower Middle Miocene Tarkhanian and Chokrakian stages reflect a maximum of nassariid diversity which collapses during the Karaganian crises. Afterwards, the Konkian stage which corresponds to the Upper Badenian of the Central Paratethys could not regain the loss.

Two factors may account for the peak in diversity in Early Badenian/Tarkhanian-Chokrakian assemblages of the Paratethys. The first is that the knowledge on Early Miocene mollusc faunas in the Paratethys is hampered by a taphonomic bias. Most documented faunas suffered from dissolution and well-preserved aragonitic shells are rare. In contrast, the Badenian assemblages are usually excellently preserved allowing a fair estimation of the entire shelly fauna. This might lead to underestimations of the Early Miocene diversities. Nevertheless, the Badenian bloom is also witnessed in calcitic bivalves which are less prone to taphonomic bias (cf. HARZHAUSER & al. 2003). Hence, a second factor is supposed to have triggered the overall trend. HARZHAUSER & al. (2003) related this Early Badenian bloom with the Langhian climatic opti-

um. This is supported by the northward migration of thermophilic taxa from the Mediterranean area into the Paratethys at that time. Consequently, the subsequent decline in diversity during the Late Badenian/Konkian might simply reflect the climatic deterioration.

Parallels in development can still be observed in the Early Sarmatian in both parts of the Paratethys. A severe drop in the Nassariinae is reflected in both, the Central and Eastern Paratethyan faunas. Only one representative of *Nassarius* passes the Badenian/Sarmatian boundary, and two cross the Konkian/Volhynian boundary. The Early Sarmatian bloom of the Dorsaninae - mainly contributed by *Duplicata* - is also rather homogeneous in both biogeographic areas. 12 species appear in the Central Paratethys and nine are documented from the Eastern Paratethys. Finally, with the establishment of Lake Pannon in the Central Paratethys the faunas drift apart. In the Eastern Paratethys *Akburunella* seized its change and attains a unique diversity during the Bessarabian.

The trigger of these developments and successions is difficult to reveal. However, a closer look to the early ontogeny shows that the majority of all investigated Nassariinae (93 %) display indirect development with a shorter planktotrophic larval stage of few weeks. This is in strong contrast to 0 % indirect development in the

investigated Sarmatian Dorsaninae. Indeed it is possible to state some pre-adaptation for direct development within the Eggenburgian to Badenian Dorsaninae. Although the pre-Sarmatian *Duplicata haueri* still experienced indirect development, it is already characterised by a more yolk-rich embryogenesis compared to that of the Nassariinae. With the dawn of the Sarmatian, representatives of the genus switch towards direct development, as documented by *Duplicata duplicata*. No lecithotrophic larval development is documented. Finally, the preference to yolk-rich embryogenesis culminates in the Bessarabian with the genus *Akburunella* which was most probably even supported by nurse-egg nutrition.

Obviously, the tendency to renounce planktotrophy and to focus on a yolk rich embryogenesis turned out as

competitive advantage in the Sarmatian fauna. In reverse, this development might hint to some kind of planktoncrises during the Early Sarmatian, which hampered the success of indirect developing nassariids.

Reliable data for the much rarer Cylleninae are only available for the Central Paratethys. There, few species contribute in enormous masses of specimens to the littoral and estuarine assemblages of the Karpatian and Early Badenian. Aside from the Early Badenian diversity, a second radiation of the genus *Cyllenina* took place during the Early Pliocene warming in the Mediterranean Sea (cf. BELLARDI 1882). Thus, *Cyllenina* seems to be a rather thermophilic genus and its Early Badenian bloom could best be correlated with the Langhian climatic optimum.

## Systematic Descriptions

### Buccinoidea RAFINESQUE 1815

#### Nassariidae IREDALE 1916

The Nassariidae represent a family of small to larger marine and brackish water Neogastropoda, which occurred in Palaeocene times and today worldwide settle in a broad variety of intertidal to deeper water habitats of the tropics to temperate provinces, with a particular abundance of taxa within the Indo-Pacific (CERNOHORSKY 1984 b). The family is divided into the Nassariinae, Cylleninae and Dorsaninae.

Nassariids comprise fusiform slender to broad ovate shells that consist of up to 8 teleoconch whorls, which are sculptured by more or less prominent axial and spiral striae, cords, ribs or grooves. The sculptural elements may form a reticulate pattern forming nodes in the points of intersection, which may be elongated to short spines. Sculpture may also be reduced in some taxa. The aperture usually bears distinct anterior and posterior canals. A corded siphonal fasciole is present. It is often thickened by heavy callus pads and varices and may be denticulate. The corneous operculum is usually thin and may be marginally serrated. The protoconch consists of up to four rounded to cylindrical whorls that may be smooth or spirally keeled. In case of planktotrophic development larval shells of representatives of Nassariinae and Dorsaninae usually bear 1–2 more or less distinct median to suprasutural spiral keels and up to three additional keels on the abapical half of the larval whorls, which are usually covered by the succeeding whorls and thus only visible in veliger shells (see also BANDEL & al. 1997, RIEDEL 2000). The protoconchs of Cylleninae are smooth aside from growth lines. Indirect and direct development occurred in both fossil and recent species.

Even the thorough revision of the genus *Nassarius* by CERNOHORSKY (1984 a, b) did not result in a clear separation and differentiation of the various subgenera. As stated by CERNOHORSKY (1984 b) several extant species of the Indo-Pacific might be affiliated with one or another subgenus. Correspondingly, it was impossible to assign the herein studied species convincingly to subgenera, based on conchological features only. Therefore, we refrain from using subgenera within *Nassarius* although some species obviously witness a relationship with species from the modern Mediterranean fauna. Thus, e.g. *Nassarius spectabilis* (NYST 1843) and *Nassarius subprismaticus* (HOERNES & AUINGER 1882) might best be fixed within *Uzita* ADAMS & ADAMS 1853 with the type species *Nassarius (Uzita) migus* (BRUGUIÈRE 1792). *Nassarius daciae* (HOERNES & AUINGER 1882) and *Nassarius vulgatissimus* (MAYER 1860) stand close to *Hima* LEACH in GRAY 1852 with the type species *Nassarius (Hima) incrassatus* (STROEM 1768). The complex and variable *Nassarius striatulus* (EICHWALD 1829) group is very reminiscent of *Gussonea* MONTEROSATO 1912 with the quite similar *Nassarius (Gussonea) semistriatus/elatus* group. Others suggest closer relationships with taxa of the modern Indo-West Pacific fauna. *Nassarius jansseni* nov. sp. and *Nassarius illovensis* (HOERNES & AUINGER 1882) exhibit more similarities with Indo-Pacific representatives of *Niotha* ADAMS & ADAMS 1853 and *Zeuxis* ADAMS & ADAMS 1853 than with any modern Mediterranean species.

#### Nassariinae IREDALE 1916

##### *Nassarius* DUMÉRIL 1806

Type species: *Buccinum arcularia* LINNAEUS 1758 – Recent, Indo-Pacific.

*Nassarius sturi* (HOERNES & AUINGER 1882)

Pl. 1, Fig. 2

- 1882 *Buccinum* (*Leiodomus*) *Sturi* HOERNES & AUINGER: 120, pl. 14, figs. 33–36  
 1906 *Nassa* (*Liodomus*) *sturi*, – BOETTGER: 23  
 1958 *Hinia* (*Uzita*) *sturi*, – BEER-BISTRICKY: 69  
 1958 *Hinia* (*Uzita*) *sturi*, – SIEBER: 149  
 2002 *Hinia sturi*, – HARZHAUSER: 105, pl. 8, figs. 11–12

**Description:** Elongated, medium-sized shells of 6–7 teleoconch whorls and strongly incised sutures. Spire whorls flat to moderately convex, sculptured by blunt, rounded axial ribs. These fade out within the last spire whorl. Body whorl well rounded with indistinct, wide spaced spiral threads in its posterior third and several narrow spiral grooves on the base. Thin outer lip with numerous, weak internal lirae; inner lip narrow, thin, smooth except for an occasionally developed weak columellar swelling. A moderate varix appears close to the aperture. The corroded conical protoconch comprises approximately three moderately rounded whorls. Sculpture consists of remains of a spiral cord just above the abapical suture. The transition to the teleoconch is distinct, indicated by a thickened rim of the shell and by the onset of the adult sculpture.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage. ALLMON (1990: 22) referred to this species as „*Cyllenina*“ *sturi*, thus erroneously placing it into the *Cylleninae*.

**Distribution:** The species appears in the Karpatian of the Korneuburg Basin (HARZHAUSER 2002). During the Badenian it is a rather rare species, known from Romania and the Vienna Basin.

*Nassarius schroeckingeri* (HOERNES & AUINGER 1882)

Pl. 1, Fig. 1, Pl. 6, Figs. 3–4

- 1882 *Buccinum* (d. *Caesia*) *Schröckingeri* HOERNES & AUINGER: 132, pl. 14, figs. 31–32  
 1906 *Nassa* (*Caesia*) *schroeckingeri*, – BOETTGER: 27

**Description:** Small to medium-sized, biconical ovate shell of 5 teleoconch whorls. Spire whorls nearly flat with orthocline blunt, rounded axial ribs which fade out on the body whorl. Axial ribs are crossed by spiral ribs on the earliest two teleoconch whorls, resulting in a rather regular rectangular cancellate pattern. Strength of spiral sculpture decreases soon. Later whorls display a conspicuous adsutural spiral groove which may separate a slightly pointed adapical portion of the axial ribs. A second, weaker spiral groove often appears close to the anterior suture. Base and siphonal fasciole are ornamented by several spiral threads. Varix close to the aperture. Outer lip with internal lirae; inner lip smooth, narrow, and slightly expanding in the parietal area.

The conical protoconch has 3.25 moderately rounded whorls measuring 0.82–0.83 mm in height and 0.76–

0.77 mm in maximum diameter. The apical angle amounts 75–80°. The embryonic shell consists of 0.9 inflated whorls measuring 0.06 mm in the width of the initial cap and 0.19–0.2 mm in maximum diameter. It is terminated by a thickened rim of the shell. The larval shell is sculptured by two abapical spiral cords just above the abapical suture. These cords bear a sculpture of four very fine rows of longitudinal tubercles, which may be connected to fine spiral threads. The last quarter whorl of the protoconch is characterised by closely spaced growth lines. The protoconch is terminated by a slightly sinuous thickened rim of the shell.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage.

The weak parietal tooth mentioned by HOERNES & AUINGER (1882) is only rarely developed and might better be termed a short, thin plication. HOERNES & AUINGER (1882) discussed the morphological similarity of this species with *Nassarius sturi* (HOERNES & AUINGER 1882). This is a surprising comment, since *Nassarius schroeckingeri* differs strongly in several features. Its teleoconch is constantly smaller and develops one teleoconch whorl less. Its sculpture is much more pronounced and the sutural grooves are unknown from *Nassarius sturi*. The shell from the Upper Badenian of Slovakia described by SVAGROVSKÝ (1960) as *Nassarius schroeckingeri* lacks any spiral sculpture. Its identification is therefore doubtful.

**Distribution:** Only known from the Badenian of Romania.

*Nassarius styriacus* (HILBER 1879)

Pl. 1, Figs. 3–4, Pl. 6, Figs. 10–12

- 1879 *Buccinum styriacum* „AUINGER“ HILBER: 12, pl. 2, figs. 1 a–c  
 1882 *Buccinum* (i. *Hima*) *styriacum*, – HOERNES & AUINGER: 139, pl. 13, figs. 34–35  
 1938 *Nassa styriaca*, – FRIEDBERG: 126, textfig. 38  
 1966 *Nassa* (*Tritia*) *styriaca*, – STRAUZ: 314, pl. 37, figs. 38–42  
 1966 *Hinia* (*Uzita*) *styriaca*, – KÓKAY: 60, pl. 8, figs. 21–22  
 1982 *Hinia* (*Hinia*) *retusata* SVAGROVSKÝ: 394, pl. 3, fig. 3  
 1997 *Hinia* (*Hinia*) *styriaca*, – BAŁUK: 11 in parte, pl. 4, figs. 4–5, non 2–3 [= *Nassarius intersulcatus* (HILBER 1879)]

**Description:** Small-sized, conoidal shells with weakly convex to flat spire whorls. Sculpture consists of 14–20 strong, orthocline to slightly prosocline axial ribs with smooth, rounded backs. Spiral sculpture is only developed in the interspaces between the axial ribs, consisting of weak spiral grooves. Only rare specimens do also develop an adsutural spiral groove, incising the axial ribs. Sutures incised. Moderately wide aperture with narrow, slightly detached columellar lip. Outer lip thickened in a varix-like swelling but thinning towards the very end of the aperture. Up to five teeth in outer lip



of strongly varying strength. Columellar lip with strong concavity. Its parietal part bears a usually weakly developed tooth. Anterior part with one strong tooth and a terminal fold. A broad anterior notch is present. The parietal edge of the aperture is pointed.

The protoconch has slightly more than three moderately rounded whorls measuring 0.6–0.61 mm in height and 0.68–0.69 mm in maximum diameter. The protoconch-angle amounts 75°. The embryonic shell comprises one rounded whorl. It measures 0.04–0.05 mm in the width of the initial cap-like onset and 0.19 mm in maximum diameter. Irregular growth lines are visible on the last quarter whorl of the embryonic shell. It is terminated by a thickened rim. The larval shell appears to be smooth aside from indistinct growth lines. In the course of the last 0.2 larval whorls growth lines are crowded and thickened growth lines slightly sinuous in course indicate the transition to the adult shell.

**Remarks:** Morphology and dimensions of the protoconch are indicative of an indirect development including a free planktotrophic larval stage.

The Upper Badenian „*Hinia retusata* SVAGROVSKÝ 1982“ is rather slender and develops only moderately convex whorls. Similar morphs are already present in populations of *Nassarius styriacus* in the Lower Badenian of the Styrian Basin. The separation of the Slovakian shells as separate species is therefore based on weak ground and rejected herein.

**Distribution:** The species is common throughout the Badenian of the Central Paratethys, being described from Poland, Austria, and Hungary.

#### *Nassarius intersulcatus* (HILBER 1879)

- 1879 *Buccinum intersulcatum* HILBER: 12, pl. 2, fig. 2  
 1882 *Buccinum* (b. *Hima*) *intersulcatum*, – HOERNES & AUINGER: 137, pl. 15, fig. 22  
 1966 *Hinia (Uzita) intersulcata*, – KÓKAY: 61, pl. 8, fig. 23  
 1997 *Hinia (Hinia) styriaca*, – BAŁUK: 11 in parte, pl. 4, figs. 2–3 (non HILBER 1879)  
 ?1966 *Hinia (Uzita) borelliana acutispira*, – KÓKAY: 61, pl. 9, fig. 1 (non SACCO 1904)  
 ?1966 *Hinia (Uzita) borelliana brevispira*, – KÓKAY: 61, pl. 9, fig. 2 (non SACCO 1904)

**Remarks:** Sculpture very similar to *Nassarius styriacus* (HILBER 1879). Therefore, BAŁUK (1997) suggested both taxa to be conspecific. Nevertheless, in our opinion the species is well distinguished by its elongated shape, the convex spire whorls and the higher number of axial ribs (ranging from 21–24 instead of 14–20). A weak spiral incision close to the posterior suture usually crosses the axial ribs. A further difference is the deeper concavity of the columella of *Nassarius styriacus*.

KÓKAY (1966) introduced the names *Hina (Uzita) borelliana acutispira* (SACCO) and *Hinia (Uzita) borelliana brevispira* (SACCO) – described by SACCO (1904) from the Upper Miocene (Messinian) of the Mediterr-

anean – for two poorly preserved shells from the Badenian of Hungary. The smooth axial ribs, the convex whorls, and the typical spiral grooves in the interspaces between the ribs are strongly reminiscent of *Nassarius intersulcatus*.

**Distribution:** The rare species is only known from the Lower Badenian of Austria and Poland and from the Badenian of Herend in Hungary.

#### *Nassarius adae* (BOETTGER 1902)

- 1902 *Nassa (Hima) adae* BOETTGER: 22  
 1906 *Nassa (Hima) adae*, – BOETTGER: 29  
 1934 *Nassa (Hima) adae*, – ZILCH: 256, pl. 16, fig. 5  
 1960 *Nassa adae*, – SVAGROVSKÝ: 93, pl. 11, fig. 1–3  
 1964 *Nassa adae*, – SVAGROVSKÝ: 80, pl. 17, fig. 3  
 1982 *Hinia (Hinia) adae propinqua* SVAGROVSKÝ: 394, pl. 3, fig. 4  
 1997 *Hinia (Hinia) adae*, – BAŁUK: 8, pl. 4, fig. 6

**Remarks:** This species is reminiscent of *Nassarius styriacus* (HILBER) and might represent an ontogenetic stage of *Nassarius styriacus*. Aside from the smaller size, *Nassarius adae* always develops flat whorls and is characterised by the abrupt angulation of the base. SVAGROVSKÝ (1982) tried to separate an Upper Badenian chrono-subspecies based on a slightly more slender shape. These Slovakian shells range well within the intraspecific variability and its status as a valid subspecies should be rejected.

**Distribution:** Occurrences of this species are only reported from the Lower Badenian of Poland and Romania and from the Upper Badenian of Slovakia. A further but doubtful shell from the Badenian of Bulgaria was introduced by KOJUMDIEVA & STRACHIMIROV (1960).

#### *Nassarius macrodon auingeri* (HOERNES & AUINGER 1882)

Pl. 1, Fig. 5, Pl. 6, Figs. 5–6

- 1882 *Buccinum* (d. *Nassa*) *Auingeri* „M. HOERNES“ HOERNES & AUINGER: 122, pl. 14, figs. 23–24  
 1882 *Nassa Auingeri*, – BELLARDI: 90, pl. 6, fig. 3  
 1906 *Nassa auingeri*, – BOETTGER: 23  
 1960 *Nassa (Hinia) auingeri*, – KOJUMDIEVA & STRACHIMIROV: 178, pl. 44, fig. 14  
 1985 *Amyclina auingeri*, – ATANACKOVIC: 152, pl. 34, figs. 7–8  
 1997 *Amyclina auingeri*, – BAŁUK: 18, pl. 5, figs. 7–8

**Description:** Egg-shaped, stout shell. Coalescing whorls with narrow but slightly canaliculate suture. Earliest teleoconch sculptured by a more or less well developed cancellate pattern formed by 4–5 spiral ribs which are crossed by straight to opisthocyrt axial ribs. This sculpture fades out quickly. Last spire whorl smooth except for an adsutural groove. A second groove may be developed close to the anterior suture. Body whorl with adsutural groove and several furrows on the base. Aper-

ture wide; outer lip thickened, bearing blunt teeth. Expanding, reflected columellar lip with parietal tooth and weak dentations. Siphonal canal short, deeply incised.

The low conical protoconch comprises 3.25 moderately rounded whorls measuring 0.87–0.88 mm in height and 0.95–0.96 mm in maximum diameter. The apical angle amounts 95°. The first whorl measures 0.08–0.09 mm in the width of the initial cap-like onset and 0.2–0.21 mm in maximum diameter. A transition from the embryonic shell to the larval shell is not preserved. The second whorl bears a sculpture of an abapical spiral cord, which is sculptured by indistinct threads and tubercles. This sculpture persists all over the larval whorls. The transition from the protoconch to the teleoconch is indistinct, indicated by the successive onset of the adult sculpture.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage.

ADAM & GLIBERT (1974) treat the Middle Miocene Paratethyan species as synonymous with the Upper Miocene to Pliocene *Nassarius macrodon macrodon* (BRONN 1831). However, all available Middle Miocene species are constantly smaller and develop a stockier shell than the Pliocene *Nassarius macrodon macrodon*. The spire whorls of the latter are higher and the sculpture may even reach to the body whorl. Therefore we do not consider both taxa as fully conspecific although a very close relationship is obvious. Nevertheless, the subspecies concept followed herein might turn out to represent only a succession of the chrono-subspecies *Nassarius macrodon auingeri* (HOERNES & AUINGER 1882) > *Nassarius macrodon reconditum* (MAYER 1873) > *Nassarius macrodon macrodon* (BRONN 1831), which then have to be united in a single taxon.

Note that ADAM & GLIBERT (1974) have not seen any specimens from the Badenian of the Central Paratethys and that their literature-based comparison is partly handicapped by the erroneous correlation of the Middle Miocene Paratethyan deposits with the Upper Miocene Tortonian. BELLARDI (1882) referred to the already published paper of HÖRNES & AUINGER (1882), who thus have to be treated as the authors of this taxon.

According to ADAM & GLIBERT (1974) the recent *Nassarius macrodon recidivus* (VON MARTENS 1876) is a deep water species. This corresponds excellently to the occurrences of the herein described fossil species, which is usually confined in Austria to the pelitic sediments of the Vienna Basin.

**Distribution:** *Nassarius macrodon auingeri* (HOERNES & AUINGER) is described from the Badenian of the Czech Republic, Austria, Romania, Bulgaria, Poland, and Bosnia. It seems to be rooted in the Early Miocene of the Mediterranean, where it is mentioned by BELLARDI (1882) from the Burdigalian of the Colli Torinesi.

*Nassarius kostejanus* (BOETTGER 1902)

Pl. 1, Fig. 6

- 1852 *Buccinum corniculum*, – HÖRNES: 156, pl. 13, fig. 5 (non OLIVI 1792)  
 1877 *Nassa laevisissima*, – BRUSINA: 375 (non BRONN 1831)  
 1882 *Buccinum* (f. *Nassa*) *Laevisissimum*, – HOERNES & AUINGER: 123, pl. 15, fig. 21 (non BRONN 1831)  
 1902 *Nassa laevisissima* var. *kostejana* BOETTGER: 19  
 1934 *Nassa laevisissima kostejana*, – ZILCH: 225, pl. 16, fig. 1  
 1997 *Amyclina kostejana*, – BÆLUK: 19, pl. 5, fig. 6

**Description:** Shell up to 16 mm in length, elongate-ovate with pointed spire. Spire whorls nearly flat; suture simple. Body whorl with hardly convex flank passing abruptly into the base. Surface smooth except for a not always developed adsutural groove. Base covered by numerous shallow grooves. Outer lip thin; only fully grown specimens develop about 11 weak denticles inside the thin outer lip. Siphonal canal short, wide. Inner lip narrow, smooth with conspicuous and very characteristic concavity close to the canal.

**Remarks:** As shown by BÆLUK (1997), the homonym „*Nassa laevisissima* BRUSINA“ non BRONN requires a new name for the species from the Badenian of Poland, Romania and Austria. The next available name was introduced by BOETTGER (1902) for a variety *kostejana*, which he separated based on the smaller size, the less developed angulation of the base and the weaker basal sculpture. The same variations can be observed in populations from the Vienna Basin and do not justify a separation on the species level. Therefore the name *Nassarius kostejanus* is adopted herein as valid.

**Distribution:** The species is common in pelitic sediments of the Badenian in the entire Central Paratethys. It probably preferred offshore environments.

*Nassarius schultzi* nov. sp.

Textfigs. 4/a–c, 6/a–b

- 1875 *Buccinum subquadrangulare*, – HOERNES: 349, pl. 11, figs. 8–10 (non MICHELOTTI 1847)  
 1882 *Buccinum* (d. *Niotha*) *subquadrangulare*, – HOERNES & AUINGER: 126, in parte (non MICHELOTTI 1847)  
 1965 *Hinia* (*Uzita*) *subquadrangularis*, – HÖLZL: 270, pl. 4, fig. 6  
 1973 *Hinia* (*Uzita*) *subquadrangularis*, – STEININGER & al.: 425, pl. 7, figs. 1–2 (non MICHELOTTI 1847)  
 1998 *Hinia* (*Uzita*) *subquadrangularis*, – SCHULTZ: 66, pl. 26, fig. 17 (non MICHELOTTI 1847)

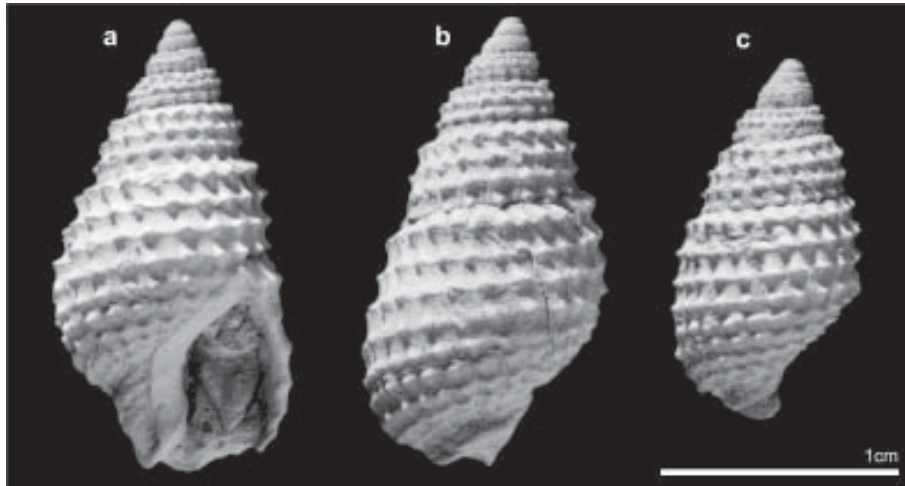
**Locus typicus:** Ottnang/Schanze in Upper Austria  
**Stratum typicum:** Ottnangian (Lower Miocene) sublittoral marly silt (so-called „Schlier“)

**Derivatio nominis:** in honour of Dr. Ortwin SCHULTZ, curator at the Natural History Museum Vienna, who started his career as collector in the Miocene of Upper Austria

**Holotype:** the specimen illustrated as textfig. 4/a–b; Inv. NHMW A724

**Paratype:** the specimen illustrated as textfig. 4/c; Inv. NHMW 1854/23/8

**Description:** High, smooth protoconch of 2.25 moderately convex whorls. Teleoconch starts with weak



**Figs. 4a–c:** *Nassarius schultzi* nov. sp. a–b: holotype from Ottnang (Austria) NHMW A724; c: paratype from Ottnang (Austria) NHMW 1854/23/8

axial threads which soon grade into blunt axial ribs. Within the first teleoconch whorl a row of small nodes is separated from the ribs along the adapical suture; soon after the ribs disintegrate into 3 rows of nodes. Spire whorls with nearly flat flanks and a moderately convex, elongated body whorl; spire outline somewhat stepped. Sculpture consists of very prominent spiny nodes arranged into spiral rows. 4 rows of nodes appear on the penultimate whorl increasing up to 9 rows on the body whorl. The axial arrangement into oblique axial ribs is less distinct; the body whorl displays 19–23 of these axial rows. Elongated ovoid aperture; slightly concave columella. Inner lip smooth except for some granules in the very posterior part, reflecting the external sculpture of the preceding whorl. Smooth inner lip and thin outer lip lacking distinct plications. Twisted canal.

**Remarks:** The Paratethyan specimens were usually identified as *Nassarius subquadrangularis* (MICHELOTTI 1847) although already BELLARDI (1882) doubted that the specimens from Ottnang in Upper Austria are conspecific with the Italian species. *Nassarius subquadrangularis* (MICHELOTTI) as described and illustrated by BELLARDI (1882: 127, pl. 8, fig. 10) differs considerably in its much more convex whorls. It develops 28–30 axial ribs along the body whorl (instead of 19–23) and displays 5 spiral rows of nodes on the last spire whorl and 12 rows on the body whorl (instead of 9). The inaccuracy in determination may be explained by the somewhat idealized drawings in HOERNES (1875). Due to the sedimentcover between the nodes, the artists underrated the depth of the sutures and the nodes are drawn too weak (see also the figure in SCHULTZ 1998: 66, pl. 26, fig. 17 which represents the holotype before cleaning).

This new species was lumped with a Middle Miocene (Badenian) species which is described herein as *Nassa-*

*rius jansseni* nov. sp. (for discussion of morphologic differences between both species see below).

**Distribution:** The species appears in the Ottnangian in the Molasse Basin and is only known from Ottnang/Schanze in Upper Austria and from Bavaria.

*Nassarius jansseni* nov. sp.

Pl. 1, Fig. 7, Textfigs. 5/a–d, 6/c–e

1882 *Buccinum* (*d. Niotha*) *subquadrangulare*, – HOERNES & AUINGER: 126 in parte, pl. 15, fig. 13 (non MICHELOTTI 1847)

1906 *Nassa* (*Niotha*) *subquadrangularis*, – BOETTGER: 25 (non MICHELOTTI 1847)

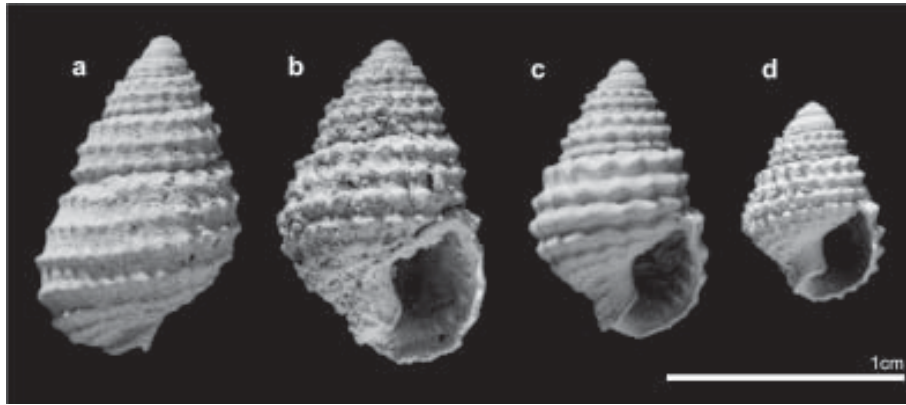
**Locus typicus:** Hrusovany in the Czech Republic  
Stratum typicum: nearshore sand of the Badenian stage (Middle Miocene)

**Derivatio nominis:** in honour of Dr. Ronald JANSSEN, curator at the Naturmuseum Senckenberg. Due to his critical comments this species was recognised as new.

**Holotype:** the specimen illustrated as fig. 7 on plate 1; Inv. NHMW 1861/12/62

**Paratypes:** the specimens from Hrusovany illustrated as textfigs. 5 a, 5 b, 5 d; Inv. NHMW 1866/28/1

**Description:** Medium-sized shells (most 11–15 mm) with flat to hardly convex whorls and impressed sutures. Spire whorls develop 3 spiral threads, increasing to 7–8 on the body whorl. Crossed by indistinct, straight axial ribs. Intersection points culminate in conspicuous spiny nodes. Rather small, ovoid aperture with weak posterior notch. Twisted columella with narrow terminal fold. Short slightly bent canal; plump siphonal fasciole which is separated from the base by a weak rim. Inner lip smooth except for some granules in the very posterior part, reflecting the external sculpture of the preceding whorl. Outer lip thickened close to the aperture and thin



**Figs. 5a–d:** *Nassarius jansseni* nov. sp. a, b, d: three paratypes from Hrusovany (Czech Republic); Inv. NHMW 1866/28/1; c: Orlau/Moravská Ostrava (Czech Republic); Inv. NHMW 1849

at its very termination; with 7–10 plications of strongly variable strength.

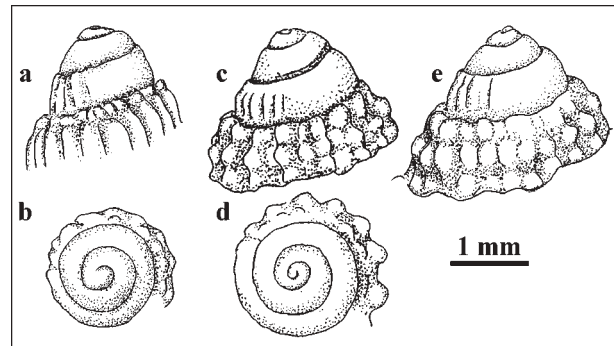
The broad conical protoconch comprises 3 to 3.25 moderately rounded whorls. Sculpture consists of an indistinct sutural spiral cord. It is sharply demarcated from the early teleoconch by a thickened rim which is not sinuous in course. The early teleoconch sculpture starts with weak axial threads which soon disintegrate into 3 rows of nodes.

**Remarks:** The protoconch is indicative of an indirect development including a free planktonic larval stage.

This rare species was frequently identified as „*Nassa subquadrangularis* MICHELOTTI 1847“. It clearly differs from that species by the fewer number of spiral ribs, whereas *Nassarius subquadrangularis* bears 12 spiral ribs on the body whorl and 5 on the spire whorls (BELLARDI 1882). In addition, the strongly convex whorls of *Nassarius subquadrangularis* and the granulated columellar plate of *Nassarius jansseni* allow a distinct separation of both species.

In the Paratethys area the species was always intermingled with the Lower Miocene *Nassarius schultzi* nov. sp. The latter differs considerably in its elongated shape, larger size, high body whorl, and the even more spiny nodes. Its protoconch is higher and consists of only 2.25 whorls; the early teleoconch sculpture consists of axial ribs with an adsutural row of small nodes instead of 3 rows of blunt nodes. Furthermore, the protoconch of *Nassarius schultzi* nov. sp. lacks the weak sutural spiral cord of *Nassarius jansseni* nov. sp.

*Nassarius raricostatus* (SACCO 1890) [described as *Nassa subquadrangularis* var. *raricostata* SACCO 1890: 110; illustrated in SACCO 1904: 69, pl. 16, fig. 34] is superficially similar. It differs from *Nassarius jansseni* nov. sp. in its more convex whorls and the spirally elongated nodes. Further it develops up to 5 spiral-rows of nodes along the spire whorls which consequently bear weaker nodes. Even BELLARDI (1882: 127) when intro-



**Figs. 6:** Comparison of the protoconchs of *Nassarius schultzi* nov. sp. and *Nassarius jansseni* nov. sp. 6a–b: protoconch of *Nassarius schultzi* nov. sp.; holotype from Ottnang (Austria) NHMW A724; 6c–e: protoconch of two specimens of *Nassarius jansseni* nov. sp. from Hrusovany (Czech Republic); c–d: with distinct sutural cord; e: with nearly absent cord; both specimens Inv. NHMW 1866/28/1

ducing *Nassa subquadrangularis* var. A. (= *Nassarius raricostatus*) noted several differences with the specimen from Hrusovany which has been described as *Buccinum subquadrangulare* by HOERNES & AUINGER (1882) (= *Nassarius jansseni* nov. sp.). Hence, the Italian shell is less robust, has a wider aperture with a broader anterior part, a thin lip and the columella develops a regular, continuous concavity.

**Distribution:** The species is only known from the Badenian of Romania (Lăpuşiu de Sus) and the Czech Republic (Hrusovany, Zidlochovice, Orlau/Moravská Ostrava).

#### *Nassarius pauli* (HOERNES 1875)

Pl. 1, Fig. 8

1875 *Buccinum Pauli* HOERNES: 348, pl. 11, figs. 5–7

1882 *Buccinum* (f. *Niotha*) *Pauli*, – HOERNES & AUINGER: 126, pl. 13, fig. 22

- 1904 *Nassa Pauli*, – SACCO: 69, pl. 16, fig. 33.  
 1973 *Hinia (Uzita) pauli*, – STEININGER & al.: 425, pl. 6, figs. 12–13

**Description:** 3–4 weakly convex spire whorls. Moderately, wide spaced, opisthocyrt axial ribs of sub-triangular cross-section, which grade into up to 25 sigmoidal ribs on the body whorl. Crossed by 13–14 weaker, broad, flat spiral ribs, separated by shallow, narrow grooves. The last spire whorl displays 4–5 of these spirals. Intersection points develop strong beads. The adsutural, posterior row of beads is distinctly stronger and may pass into very short, obtuse nodes. Aperture corresponds to that of *Nassarius illovensis* (see below). Broad, short, plump siphonal fasciole.

The low conical protoconch has 3.5 rounded, rapidly increasing, apparently smooth whorls measuring up to 1.2 mm in maximum diameter and 0.8 mm in height. The first whorl measures 0.07 mm in the width of the initial cap-like onset and 0.23–0.25 mm in maximum diameter. The transition to the teleoconch is indistinct, indicated by a slightly thickened rim on the shell which is not sinuous in course.

**Remarks:** The protoconch of *N. pauli* is indicative of an indirect development including a free planktotrophic veliger stage. *N. pauli* differs from the probably related *Nassarius illovensis* (HOERNES & AUINGER 1882) distinctly by the much stronger adsutural row of beads, the rather triangular and wider spaced axial ribs and by the larger protoconch comprising half a whorl more.

Some relationship can be suggested with *Nassarius perpulchra* (BELLARDI 1882), which differs mainly in its more elongated shape but corresponds well in its sculpture (compare *Nassarius perpulchra* in FERRERO MORTARA & al. 1981).

**Distribution:** In the Paratethys the species is only known from the Ottnangian of Austria and Bavaria. Additionally, probably conspecific shells were described by SACCO (1904) from the Langhian of the Colli Torinesi (Monte Cappuccini).

#### *Nassarius signatus* (HÖRNES 1852)

Pl. 1, Fig. 9

- 1852 *Buccinum signatum* „PARTSCH“ HÖRNES: 142, pl. 12, figs. 7 a–b  
 1882 *Buccinum (e. Niotha) signatum*, – HOERNES & AUINGER: 126  
 ?1956 *Nassa (Niotha) signata*, – CSEPREGHY-MEZNERICS: 406, pl. 7, figs. 38–39  
 ?1966 *Nassa (Tritia) signata*, – STRAUZ: 316, pl. 38, fig. 26

**Description:** Small to medium-sized shells hardly exceeding 8–10 mm in height. Stocky to moderately elongated shape; large body whorl and weakly convex spire whorls. These bear opisthocyrt, narrow spaced axial ribs passing into 25–28 sigmoidal ribs on the body whorl. Spiral sculpture formed by indistinct spiral ribs on early whorls which grow into broad regular spiral

ribs with flat backs on later whorls, producing a more or less cancellate pattern. The posterior tips of the axial ribs are slightly incised by a weak spiral constriction and terminate in small nodes.

Aperture narrow, adapically pointed; thick outer lip with 5–6 blunt teeth of which the middle one is usually most prominent. Columellar lip reflected, well developed but weakly expanding. A hardly concave to straight posterior part with two strong teeth is separated from the short anterior part by a deep concavity. Close to the blunt terminal fold a second fold may appear, usually of equal strength. The corroded, low conical, step-like protoconch comprises about 3.5 whorls. Sculpture consists of a sutural spiral cord. The transition to the teleoconch is indistinct, indicated by the successive onset of the adult sculpture.

**Remarks:** The protoconch of *N. signata* from the Badenian of Vöslau is indicative of an indirect development including a free planktotrophic larval stage. The species displays a remarkable convergence with *Nassarius pauli* (HOERNES 1875) concerning the sculpture. A separation of both species, however, is obvious in respect to the characteristic dentation of the columellar lip of *Nassarius signatus*. Furthermore the adsutural spiral keel of the protoconch of *Nassarius signata* is absent in *Nassarius pauli*.

The Hungarian shells assigned to *Nassarius signatus* by CSEPREGHY-MEZNERICS (1959) and STRAUZ (1966) lack the prominent adsutural spiral rib and develop slightly more convex whorls. From the descriptions and illustrations it is hard to decide if these specimens are conspecific with the herein presented shells.

**Distribution:** A rare species which is mainly known from the Badenian of Austria, the Czech Republic and Romania.

#### *Nassarius illovensis* (HOERNES & AUINGER 1882)

Pl. 1, Figs. 11–12

- 1882 *Buccinum (g. Niotha) illovense* HOERNES & AUINGER: 127, pl. 13, figs. 23–24  
 1960 *Nassa (Hinia) illovense*, – KOJUMDJEVA: 176, pl. 44, fig. 9  
 ?1973 *Hinia (Uzita) proavia pluricostata*, – STEININGER & al.: 426, pl. 7, fig. 3 (non SACCO 1904)  
 1981 *Hinia (Hinia) illovensis*, – SVAGROVSKÝ: 147, pl. 47, figs. 1–4

**Description:** Medium-sized shells (most 11–15 mm), moderately robust of about 5 teleoconch whorls. Numerous, narrow, slightly opisthocline axial ribs, crossing the weaker but equally spaced spiral ribs (35–40 axial ribs and about 20 spirals on the body whorl). Intersection points slightly beaded. The posterior, adsutural beaded spiral rib is usually stronger than the others, thus causing a weakly stepped spire. The interspace to the next spiral rib is often wider than those between all other spiral ribs.

Aperture ovoid, wide with posterior notch. Outer lip thin with a characteristic, strong anterior tooth close to

the short and broad siphonal canal. 6–10 much weaker internal striae cover the outer lip. Columellar lip, thin, narrow, well demarcated from the base; smooth except for an indistinct, narrow terminal fold bordering the canal. The corroded protoconch comprises three whorls. It is sharply demarcated from the early teleoconch.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage. STEININGER & al. (1973) presented 2 shells from the Ottnangian of Hungary as *Hinia proavia pluricostata* (SACCO) emphasising its relationship with *Nassarius illovensis*. Alleged differences in shape and axial ribbing mentioned by these authors are also observed in Badenian populations of *Nassarius illovensis* and do not justify a separation. However, the apertures of the Lower Miocene shells are unknown which hampers a distinct identification.

In Upper Badenian specimens such as those described by SVAGROVSKÝ (1981) from Slovakia, the axial ribs are strongly disintegrated in hardly connected beads.

**Distribution:** The rare species is known from the Badenian of Marz in the Eisenstadt-Sopron Basin (Austria), Devín (Slovakia), Bulgaria, and Romania. Its earliest occurrence might be represented by shells from the Ottnangian of Várpalota in Hungary.

*Nassarius notterbecki* (HOERNES & AUINGER 1882)

Pl. 1, Fig. 13

- 1882 *Buccinum* (*d. Hima*) *Notterbecki* HOERNES & AUINGER: 137, pl. 13, figs. 37–38  
 1911 *Nassa Notterbecki*, – FRIEDBERG: 92, pl. 5, figs. 14–15  
 1960 *Nassa (Hinia) notterbecki*, – KOJUMDIEVA & STRACHIMIROV: 177, pl. 44, fig. 12  
 1966 *Nassa (Tritia) notterbecki*, – STRAUZ: 315, pl. 37, figs. 12–13  
 1985 *Hinia (Uzita) notterbecki*, – ATANACKOVIC: 156, pl. 34, figs. 17–18  
 1997 *Hinia (Hinia) notterbecki*, – BAŁUK: 9, pl. 3, fig. 8

**Description:** Small-sized, considerably robust, ovoid shells with slightly cyrtocoid spire. Conspicuous cancellate sculpture of beaded, prominent, straight axial ribs which are crossed by somewhat weaker spiral ribs. 4–6 spiral ribs occur on the last spire whorl; the body whorl bears 10–11 spirals and 15–21 axial ribs.

Aperture wide rounded with short but well demarcated siphonal canal. Outer lip terminates in a varix-like swelling with about 6 teeth. Of these the second posterior one and the anterior most one are always the most prominently developed. Inner lip forms a very narrow columellar plate. Sculpture consists of an obligatory parietal fold, 2–4 teeth and a weak terminal fold. Siphonal fasciole arises distinctly from the base. The corroded protoconch consists of one rounded whorl. The transition to the early teleoconch is indistinct, indicated by the successive onset of the adult sculpture.

**Remarks:** The protoconch of *N. notterbecki* from the Badenian of Grund is indicative of a direct development which hatching of crawling young.

**Distribution:** A widespread Central Paratethys species which is known from the Badenian of Austria, Romania, Poland, Bulgaria, and Bosnia.

*Nassarius lapugyensis* (HOERNES & AUINGER 1882)

Pl. 1, Figs. 14–15

- 1852 *Buccinum incrassatum*, – HÖRNES: 148, pl. 12, fig. 16 (non MÜLLER 1766)  
 1882 *Buccinum* (*c. Hima*) *granulare*, – HOERNES & AUINGER: 137 (non BORSON 1820)  
 1882 *Buccinum* (*g. Hima*) *Lapugyense* HOERNES & AUINGER: 138, pl. 13, fig. 39  
 1906 *Nassa (Hima) subgranularis* BOETTGER: 28  
 1906 *Nassa (Hima) lapugyensis*, – BOETTGER: 28

**Description:** High-spined, medium-sized elongated shells of 4–5 teleoconch whorls. Evenly convex whorls with incised sutures. Rounded, straight, regular axial ribs (20–22 on the body whorls) crossed and sculptured by up to 9 weaker spiral ribs of rectangular cross section. Outer lip with several indistinct teeth; thickened by a conspicuous varix. Adult shells develop a distinct tooth close to the canal. Inner lip thin, very narrow, and smooth except for a more or less prominent parietal tooth and a terminal fold. The corroded protoconch has three small whorls. It is sharply demarcated from the early teleoconch by a slightly thickened rim of the shell which is not sinuous in course.

**Remarks:** The protoconch of *N. lapugyensis* from the Badenian of Lăpugiu de Sus is indicative of an indirect development including a free planktotrophic veliger stage. The specimen from the Vienna Basin illustrated in HÖRNES (1852) and referred to as *Nassa (Hima) subgranularis* by BOETTGER (1906) differs from *Nassarius lapugyensis* only in its elongate shape. A second specimen from Baden in Austria, however, fully corresponds to the holotype of *Nassarius lapugyensis* in shape, sculpture, and protoconch features. A specific separation is therefore impossible. The variability in shape and size was already stated by BOETTGER (1906) who also discussed the possibility that *Nassarius subgranularis* might turn out to be identical with *Nassarius lapugyensis*.

BEER-BISTRICKÝ (1958) treats the species erroneously as synonymous with *Nassarius notterbecki* (HOERNES & AUINGER 1882). It differs from *Nassarius notterbecki* distinctly in its convex spire whorls and the elongated shape. Its spiral sculpture consists rather of threads and its columellar lip lacks the teeth. Finally, *N. notterbecki* is one of the few directly developing species.

**Distribution:** Restricted to the Badenian of the Central Paratethys.

*Nassarius hochstetteri* (HOERNES & AUINGER 1882)

Pl. 1, Fig. 18

- 1882 *Buccinum* (*e. Hima*) *Hochstetteri* HOERNES & AUINGER: 138, pl. 13, fig. 41  
 1906 *Nassa* (*Hima*) *hochstetteri*, – BOETTGER: 27  
 1985 *Hinia* (*Uzita*) *hochstetteri*, – ATANACKOVIC: 154, pl. 35, figs. 11–12

**Description:** Small-sized, stocky egg-shaped shells with large body whorl. Rounded, strong axial ribs predominate the sculpture (13–16 on the body whorl); spiral ribs are weak and are most prominent in the interspaces between the axial ribs. An indistinct constriction close to the posterior suture separates a somewhat more prominent adapical part of the axial ribs. Usually, these posterior tips are feebly swollen and reach into the interspaces of the axial ribs of the preceding whorl, resulting in a scalloped suture.

Weak varix close to the aperture; indistinct posterior notch; siphonal canal very short. Outer lip bears several internal lirae. Inner lip reflected, with conspicuous concavity and smooth except for an occasional parietal tooth. The corroded protoconch consists of 3.5 moderately rounded whorls. The protoconch is sharply demarcated from the early teleoconch by a slightly thickened rim of the shell. The onset of the teleoconch is indicated by the formation of the adult sculpture.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage. A close relationship to *Nassarius notterbecki* (HOERNES & AUINGER 1882) as discussed by BEER-BISTRICKÝ (1958) has to be rejected. The smooth inner lip and the numerous and fine internal lirae of the outer lip allow a very distinct separation of the species. Furthermore, the sculpture of both species differs strongly: whilst the axial ribs of *Nassarius hochstetteri* tend to touch the preceding whorl across the suture, the ribs of *Nassarius notterbecki* always fade out at the suture.

**Distribution:** The species was described by HOERNES & AUINGER (1882) from the Badenian of the Vienna Basin and the Eisenstadt-Sopron Basin. Later it was also recorded from the Badenian of Romania and Bosnia.

*Nassarius daciae* (HOERNES & AUINGER 1882)

Pl. 1, Fig. 10

- 1882 *Buccinum* (*f. Hima*) *Daciae* HOERNES & AUINGER: 138, pl. 13, fig. 42  
 1981 *Hinia* (*Tritonella*) *daciae*, – SVAGROVSKÝ: 149, pl. 47, fig. 5  
 1997 *Hinia* (*Hinia*) *daciae*, – BAŁUK: 8, pl. 3, fig. 6  
 ?1906 *Nassa* (*Nassa*) *daciae* var. *rejecta* n. BOETTGER: 27  
 ?1934 *Nassa* (*Hima*) *daciae rejecta*, – ZILCH: 256, pl. 16, fig. 3  
 ?1997 *Hinia* (*Hinia*) *daciae*, – BAŁUK: 8, pl. 3, figs. 4–5  
 ?2003 *Nassarius daciae*, – ZŁOTNIK: 363, fig. 3, E–F

**Description:** Small-sized, elongated, often with cyrtconoid spire. Spire whorls nearly flat to moderately

convex; sutures incised. A characteristic feature is that the last spire whorl displays its maximum diameter close to the anterior suture.

Axial ribs rounded, somewhat swollen, forming more or less continuous lines with the axial ribs of the following whorl; 14–16 of these ribs occur on the body whorl. Weaker spiral ribs cause a cancellate pattern on early spire whorls, whereas the spiral sculpture is reduced on later whorls. Thickened outer lip with varix and 4–5 blunt teeth. A strong parietal fold produces a false posterior canal. Columellar lip slightly reflected, with weak terminal fold; rarely it may also develop one or two granules.

The corroded protoconch comprises 1.5 inflated whorls. The transition to the teleoconch is sharp, indicated by the onset of the adult sculpture.

**Remarks:** The protoconch of *N. daciae* from the Badenian of Lăpugiu de Sus is indicative of a direct development with hatching of crawling young. In the illustration of HOERNES & AUINGER (1882, pl. 13, fig. 14) the spiral sculpture is extremely overemphasised. This error probably gave rise to the confusion of the frame of this taxon. Although there is some variation concerning the sculpture and the height/width ratio even in the type material from Lăpugiu de Sus, none of the specimens develops the distinct spiral ribs and the evenly convex whorls of the shells illustrated by ZILCH (1934), BAŁUK (1997) and ZŁOTNIK (2003). Furthermore the strict axial arrangement of the ribs is not evident in these specimens. These shells seem to represent a separate species which should be named *Nassarius rejecta* (BOETTGER 1906).

A quite similar species is *Nassarius aldrovandii* (BELLARDI 1882) from the Lower Pliocene of Italy (see FERRERO MORTARA & al. 1981).

**Distribution:** A rare species which is recorded only from the Lower Badenian of Rumania and the Upper Badenian of Slovakia.

*Nassarius bittneri* (HOERNES & AUINGER 1882)

Pl. 1, Figs. 16–17

- 1882 *Buccinum* (*h. Hima*) *Bittneri* HOERNES & AUINGER: 139, pl. 13, fig. 43  
 1906 *Nassa* (*Hima*) *bittneri*, – BOETTGER: 28  
 ?1956 *Nassa* (*Hima*) *franzenausii* CSEPREGHY-MEZNERICS: 405, 447, pl. 7, figs. 32–33  
 ?1966 *Nassa* (*Tritia*) *franzenausii*, – STRAUZ: 315, pl. 37, figs. 10–11

**Description:** Elongated, high-spired shells with moderately convex whorls and incised sutures. The characteristic sculpture consists of wide-spaced, rather sharp, straight axial ribs (about 13 on the body whorl) which are crossed by spiral cords of rectangular cross-section (3–4 cords on the last spire whorl). The intersection points often grade into pointed nodes. Varix close to the aperture, but thin outer lip. 6–7 apertural lirae and a more prominent tooth close to the canal. Columellar lip moderately expanding and usually detached from base;

smooth except for the parietal tooth, a weak terminal fold and some, rarely developed granules deep inside the aperture. The corroded protoconch has three moderately rounded whorls. It is sharply demarcated from the teleoconch by a slightly thickened rim of the shell, which is not sinuous in course.

**Remarks:** The protoconch of *N. bittneri* from the Badenian of Niederleis is indicative of an indirect development including a free planktotrophic larval stage. The holotype chosen by HOERNES & AUINGER (1882) represents a rather stout shell, whereas most of the specimens from Niederleis in Austria are more slender.

*Nassarius franzenau* (CSEPREGHY-MEZNERICS) is based on a single specimen from the Badenian of Hungary. STRAUSZ (1966) suggests that it might be an aberrant representative of the *Hinia notterbecki*-group. According to the aperture it could also represent a freak specimen of *Nassarius bittneri*.

***Nassarius doliolum* (EICHWALD 1830)**

Pl. 2, Figs. 1–3

- 1830 *Nassa doliolum* EICHWALD: 223  
 1831 *Buccinum obliquatum*, – DUBOIS DE MONTPEREAUX: 26, pl. 1, figs. 6–7  
 1833 *Nassa bistriatum* ANDRZEJOWSKI: 439, pl. 13, fig. 4  
 1848 *Buccinum Rosthorni* „PARTSCH“ HÖRNES in ČŽŽEK: 17, nr. 151  
 1852 *Buccinum Rosthorni*, – HÖRNES: 140, pl. 12, figs. 4–5  
 1853 *Buccinum doliolum*, – EICHWALD: 168, pl. 7, fig. 5 a–b  
 1879 *Buccinum collare* HILBER: 7, pl. 1, fig. 6  
 1879 *Buccinum tonsura* HILBER: 8, pl. 1, fig. 8  
 1882 *Buccinum (a. Tritia) Rosthorni*, – HOERNES & AUINGER: 140  
 1882 *Buccinum (c. Tritia) Hilberi* HOERNES & AUINGER: 141, pl. 13, figs. 10–11  
 1882 *Buccinum (b. Tritia) collare*, – HOERNES & AUINGER: 141, pl. 13, fig. 8  
 1882 *Buccinum (d. Tritia) tonsura*, – HOERNES & AUINGER: 142, pl. 13, fig. 16  
 1906 *Nassa (Tritia) tonsura*, – BOETTGER: 22  
 1906 *Nassa (Tritia) collare*, – BOETTGER: 29  
 1914 *Nassa Rosthorni*, – FRIEDBERG: 64, pl. 4, figs. 1–2  
 1950 *Nassa rosthorni*, – MEZNERICS: 51, pl. 3, fig. 4  
 1958 *Hinia (Uzita) rosthorni rosthorni*, – BEER-BISTRICKÝ: 61, pl. 2, fig. 14  
 1960 *Nassa (Uzita) rosthorni*, – KOJUMDIEVA & STRACHIMIROV: 180, pl. 44, fig. 19  
 1966 *Nassa (Tritia) rosthorni*, – STRAUSZ: 321, pl. 38, figs. 22–31  
 1985 *Hinia (Uzita) rosthorni*, – ATANACKOVIC: 154, pl. 35, figs. 3–6  
 1997 *Hinia (?Uzita) rosthorni*, – BÆLUK: 17, pl. 1, figs. 9–12  
 1998 *Hinia (Hinia) rosthorni*, – SCHULTZ: 66, pl. 26, fig. 16

**Description:** Large-sized, plump; most specimens 17–30 mm. Whorls number seven to eight. Large, inflated body whorl and evenly convex spire whorls. Entire teleoconch covered by strong spiral ribs of rectangular cross-section, separated by slightly narrower grooves with flat bottom. Sometimes two spiral ribs may

join on adult whorls, being separated by a distinctly narrower groove. Simple, distinct sutures. Oblique axial ribs produced by rounded swellings may appear in each population. Strength of the prosocline lines of growth increases distinctly towards the aperture. Columella with narrow, well defined terminal columellar fold. Inner lip expanded, with well developed border and plications. Of these a string, elongated, posterior tooth is obligatory. Strength and number of further columellar granules and teeth varies considerably. Usually the strongest sculpture appears in the anterior half of the aperture. The body whorl contracts rapidly into a short, deflected canal, forming a conspicuous concavity of the base. Rarely a weak, posterior carina is developed along the siphonal fasciole. Outer lip thin with about 12–15 strong internal striae. The very end of the outer lip thins out and is unsculptured.

**Remarks:** The species was introduced at least three times under different names. The name „*Buccinum Rosthorni*“ was first mentioned by HÖRNES (1848) as a nomen nudum in a simple list. Later, HÖRNES (1852) correctly described and illustrated this species. As author he referred to PUSCH, who but had only written this name on a label in the collection. Nevertheless, EICHWALD (1830) already gave a valid description of this taxon and named it „*Nassa doliolum*“, although the illustration was given much later (EICHWALD 1853). Three years later ANDRZEJOWSKI (1833) introduced „*Nassa bistriatum*“ for the same species, describing a shell with a pronounced tendency to split the primary ribs. FRIEDBERG (1911) was aware of this synonymy and considered all the mentioned taxa to represent a single species. However, since there was nothing like the IRZN at that time, he did not accept the priority of *doliolum* but chose the younger synonym of HÖRNES (1852), as did all subsequent authors.

*Buccinum collare* HILBER 1879 differs only in the slight adsutural constriction but agrees in all other sculptural and apertural features with *Nassarius doliolum* (EICHWALD). Even the „splitter“ HOERNES & AUINGER (1882) already doubted the validity of this taxon and discussed the close resemblance with *Nassarius rosthorni*. In the same way *Buccinum Hilberi* HOERNES & AUINGER 1882 seems to be conspecific with *Nassarius rosthorni*. These shells are smaller than typical representatives of *Nassarius doliolum* and differ in their tendency to produce axial swellings. This feature, however, is also documented at scattered specimens from typical populations of *Nassarius doliolum* from Gainfarn in Austria, where few specimens develop a strong axial ribbing, thus being fully identical with „*Buccinum Hilberi*“

*Nassarius doliolum* experienced a development from smaller, axially sculptured shells towards large-sized, predominately spirally sculptured morphotypes during the Badenian. Obviously, the *collare*-, *hilberi*-, *tonsura*-morphotypes have their acme in the Lower Badenian (Langhian), documented by the occurrences in Pöls in Austria or Lăpugiu de Sus in Rumania. This develop-



ment culminates in the giant-sized specimens of the Middle Badenian of Gainfarn or Enzesfeld in Austria.

**Distribution:** Ubiquitous and frequent during the Badenian in the entire Central Paratethys.

*Nassarius supernecostatus* (HOERNES & AUINGER 1882)

Pl. 1, Figs. 19–20

- 1882 *Buccinum* (*e. Tritia*) *supernecostatum* HOERNES & AUINGER: 142, pl. 13, figs. 12–15  
 1882 *Buccinum* (*f. Tritia*) *Petersi* HOERNES & AUINGER: 143, pl. 13, figs. 17–18  
 1958 *Hinia* (*Uzita*) *rosthorni supernecostata*, – BEER-BISTRICKÝ: 62

**Description:** The corroded low conical protoconch has slightly more than 2.5 whorls. It is terminated by a well developed but fractionated sinusigera notch.

**Remarks:** The protoconch of *N. supernecostatus* is indicative of an indirect development including a free planktotrophic larval stage. This taxon is obviously very closely related if not conspecific with *Nassarius doliolum* (EICHWALD 1830). BAŁUK (1997) even treated both species as synonyms and HOERNES & AUINGER (1882), too doubted the validity of their „*Buccinum Petersi*“ which in any way is a synonym of *Nassarius supernecostatus*.

The shells differ from *Nassarius doliolum* only in the elongate outline and the higher spire. Furthermore they develop strong axial ribs on the spire whorls and especially on the last spire whorl. In contrast, the aperture corresponds fully to that of *Nassarius doliolum*, although the plication of the columellar lip varies extremely from smooth to strong. Correspondingly, the shell thickness ranges from thin (specimens from the Lower Badenian of Grund in Austria and Lăpugiu de Sus in Rumania) to solid (shells from Hidas in Hungary). Indeed, the validity of this species is very doubtful, but the small number of specimens renders a decision difficult.

**Distribution:** The species is only known from the Badenian of Austria, Romania and Hidas. At least the typical *supernecostatus* sensu HOERNES & AUINGER (1882) is restricted to Lower Badenian deposits.

*Nassarius toulai* (HILBER 1879)

Pl. 2, Fig. 4

- 1879 *Buccinum Toulai* „AUINGER“ HILBER: 9, pl. 1, figs. 9–10  
 1882 *Buccinum* (*g. Tritia?*) *Toulai*, – HOERNES & AUINGER: 143 in parte, pl. 13, fig. 19, [non 20–21 = *Nassarius korytnicensis* (BAŁUK 1997)]  
 1906 *Nassa* (*Tritia*) *toulai*, – BOETTGER: 29  
 1966 *Nassa* (*Tritia*) *toulai*, – STRAUSS in parte: 318, pl. 38, figs. 8–9  
 1973 *Hinia* (*Uzita*) *toulai*, – STEININGER & al.: 426

**Description:** Small to medium-sized (7–10 mm) stocky, robust shells of 4 to 5 teleoconch whorls. Strongly convex, inflated body whorl and moderately convex

spire whorls. Simple, incised sutures. Sculpture consists of elevated rounded triangular, straight to hardly opisthocyrt axial ribs (18 on the body whorl), separated by interspaces of equal or slightly larger width. Spiral ribs weaker, flat, separated by very narrow grooves. Up to 12 of these spirals cover the body whorl; 5–6 occur on the last spire whorl. Aperture short, wide with short siphonal canal. Outer lip thickened, bearing 5 blunt teeth in its anterior  $\frac{3}{4}$ . A well developed parietal tooth appears close to the weak posterior notch. A strong concavity separates a smooth, nearly straight posterior part of the columellar lip from a shorter anterior one, which develops 3 conspicuous teeth. Columellar plate distinct and broad. The corroded protoconch has approximately three rounded whorls. It is sharply demarcated from the early teleoconch.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage. As already recognised by BAŁUK (1997), the specimens from Poland which were erroneously identified by HOERNES & AUINGER (1882, pl. 13, figs. 20–21) as *Buccinum Toulai* bear little in common with their species. It differs in its elongated shape, the less thickened outer lip, the rather smooth anterior part of the columellar lip, the weaker and narrow columellar plate and the reticulate sculpture.

**Distribution:** The species is a rare element of the Badenian fauna in the Central Paratethys. A doubtful occurrence in the Ottnangian of the Bavarian Molasse Basin was mentioned by HÖLZL in STEININGER & al. (1973). BAŁUK (1997) established *Hinia korytnicensis* as new species for the shells described as „*Buccinum Toulai*“ by HOERNES & AUINGER (1882) from Korytnica. Most of the mentioned occurrences of the latter species from the Badenian of Poland are therefore doubtful.

*Nassarius korytnicensis* (BAŁUK 1997)

- 1882 *Buccinum* (*g. Tritia?*) *Toulai* „AUINGER“ HOERNES & AUINGER: 143 in parte, pl. 13, figs. 20–21  
 1911 *Nassa toulai*, – FRIEDBERG: 89, pl. 5, figs. 9–11  
 1997 *Hinia* (*Hinia*) *korytnicensis* BAŁUK: 12, pl. 2, figs. 5–6

**Remarks:** See remarks for *Nassarius toulai* (HOERNES & AUINGER 1882) and BAŁUK (1997).

**Distribution:** The species is only described from the Lower Badenian of Poland.

*Nassarius coloratus* (EICHWALD 1830)

Pl. 2, Fig. 5

- 1830 *Buccinum coloratum* EICHWALD: 222  
 1852 *Buccinum reticulatum*, – HÖRNES: 151, pl. 12, fig. 18 (non LINNAEUS 1758)  
 1853 *Buccinum coloratum*, – EICHWALD: 164, pl. 8, fig. 1  
 1856 *Buccinum coloratum*, – HÖRNES: 668, pl. 12, fig. 18  
 1860 *Buccinum vindobonense* MAYER: 421, pl. 5, fig. 2  
 1882 *Buccinum* (*h. Tritia*) *vindobonense*, – HOERNES & AUINGER: 145

- 1906 *Nassa (Tritia) vindobonensis*, – BOETTGER: 30  
 1911 *Nassa colorata*, – FRIEDBERG: 81, pl. 5, figs. 1–2  
 1911 *Nassa vindobonensis*, – FRIEDBERG: 83, pl. 5, fig. 3  
 1928 *Nassa colorata* EICHWALD – FRIEDBERG: 583  
 ?1960 *Nassa (Phrontis) colorata* var. *vindobonensis*, – KOJUMDIEVA & STRACHIMIROV: 181, pl. 45, fig. 1  
 1966 *Nassa (Phrontis) vindobonensis*, – STRAUZ: 324, pl. 39, figs. 1–5  
 1970 *Nassa colorata*, – BAŁUK, pl. 12, figs. 10–11  
 1981 *Nassa colorata*, – KRACH: 70, pl. 20, figs. 9–12  
 1985 *Hinia (Hinia) colorata vindobonensis*, – ATANACKOVIC: 153, pl. 34, figs. 13–16  
 1993 *Nassarius (Hinia) coloratus*, – ILJINA: 94, pl. 12, figs. 16–18  
 1998 *Hinia (Hinia) colorata vindobonensis*, – SCHULTZ: 66, pl. 26, fig. 14

**Description:** Robust, medium- to large-sized shells with slightly stepped spire and flat to moderately convex spire whorls. Early spire whorls display very broad, straight-prosocline axial ribs which are intersected by a characteristic spiral groove in the posterior third. This groove holds on to the body whorl in most specimens. Additional weaker spiral furrows and spiral threads may appear on later spire whorls. Body whorl bears 14–20 blunt prosocline or sigmoidal axial ribs; its spiral sculpture is very variable, bridging nearly smooth shells with almost cancellate ones. Generally, however, the spiral and often also the axial sculpture are reduced on the body whorl. Aperture with swollen, thick columellar plate; outer lip thickened bearing 5–8 internal lirae. Posterior notch present but narrowed by the heavy columellar callus. Inner lip concave with subordinate dentations in the anterior half. Bulgy siphonal fasciole, occasionally forming a shallow pseudo umbilicus with the reflected lip.

**Remarks:** The Polish specimens were traditionally described as *Nassarius coloratus* whereas the „southern“ specimens were generally termed *Nassarius vindobonensis* (MAYER 1860). This separation was supported by the poor drawing of *Nassarius coloratus* in EICHWALD (1853). The Polish specimens of *Nassarius coloratus* illustrated by BAŁUK (1970) and KRACH (1981), however, do not differ at all from the shells from the Vienna Basin, to which HÖRNES (1852) and HÖRNES & AUINGER (1882) referred to.

See also *Nassarius poelsensis* (HILBER 1879) for further discussions. *Nassarius coloratus sarmaticus* is an at least closely related or conspecific species which was described from the Sarmatian of the Polish-Ukrainian foredeep by LASKAREW (1903) and FRIEDBERG (1911). It is one of only two representatives of the Nassariinae which crossed the Badenian/Sarmatian boundary in the Central Paratethys.

**Distribution:** The species is described from the Badenian of the entire Central Paratethys and from the Tarkhanian, Chokrakian and Konkian of the Eastern Paratethys (ILJINA 1993). As *Nassarius coloratus sarmaticus* (LASKAREW) it is also documented from the Sarmatian of the Polish-Ukrainian foredeep.

### *Nassarius neugeboreni* (HOERNES & AUINGER 1882)

Pl. 2, Fig. 6

- 1882 *Buccinum (k. Tritia) Neugeboreni* HOERNES & AUINGER: 147, pl. 13, figs. 27–28  
 1955 *Nassa Korobkowi* MOISESCU: 146, pl. 12, figs. 16–17, 20–21  
 ?1966 *Hinia colorata neugeboreni*, – KÓKAY: 60, pl. 8, figs. 18–19

**Remarks:** At the first glance *Nassarius neugeboreni* (HOERNES & AUINGER) differs hardly from *Nassarius coloratus* (EICHWALD 1830). It was introduced by HOERNES & AUINGER (1882) for shells from Lăpugiu de Sus in Romania which differ from *Nassarius coloratus* in their higher spire and the more convex body whorl. This would be a poor reason to separate these taxa. However, the earliest spire whorls of *Nassarius neugeboreni* develop a sculpture completely different from *Nassarius coloratus*. Instead of broad, rather blunt axial ribs with the typical adsutural spiral groove, the spire whorls of *Nassarius neugeboreni* display wider spaced, higher axial ribs which are crossed by several regular spiral ribs, causing a somewhat rectangular pattern.

Therefore both species are well distinguished and even subspecific treatment as suggested by KÓKAY (1966) has to be rejected.

Aside from the type specimens a large number of shells from Lăpugiu de Sus are stored in the collection of the NHMW. These witness a broad variability in sculpture of the body whorl and document that the illustrated specimens of HOERNES & AUINGER (1882) are rather weakly sculptured.

**Distribution:** Common in the Lower Badenian of Romania. The identification of the specimens from the Badenian of Hungary reported by KÓKAY (1966) is unchecked.

### *Nassarius poelsensis* (HILBER 1879)

Pl. 2, Figs. 7–8

- 1879 *Buccinum Pölsense* „AUINGER“ HILBER: 9, pl. 1, fig. 11  
 1882 *Buccinum (i. Tritia) Pölsense*, – HOERNES & AUINGER: 146, pl. 13, figs. 25–26  
 1954 *Nassa (Caesia) pölsensis*, – CSEPREGHY-MEZNERICS: 42, pl. 5, figs. 10–11, 17–18

**Description:** Very robust, medium- to large-sized, rather cylindrical shells (height: 16–20 mm); 6–7 teleoconch whorls and slightly stepped spire. No protoconch preserved. Spire whorls weakly convex to nearly flat. Sculptured by blunt, very strong, rounded, straight prosocline axial ribs 18–21 on the body whorl. Spiral sculpture of up to 13 weaker ribs usually only in the inter-spaces between the axial ribs. A spiral furrow close to the posterior suture separates an indistinct, slightly swollen adsutural band of the axial ribs (only occasionally developed). Aperture with distinct posterior notch. Outer lip thickened with 5–6 sharp internal lirae. Thick columellar

plate; the columellar lip bears a more or less developed parietal fold and three dentations close to the canal of strongly varying strength.

**Remarks:** At first glance the species is strongly reminiscent of *Nassarius coloratus* (EICHWALD 1830). Thus, ILJINA (1993) suggested that these taxa might be conspecific. Consistent differences are the strong axial sculpture of the early whorls and the typical sculpture of the body whorl of *Nassarius poelsensis* and the obligatory adsutural spiral furrow of *Nassarius coloratus*. Nevertheless the separation of both species is still somewhat doubtful; the final decision will depend on additional material of *Nassarius poelsensis*.

STRAUSZ (1966) erroneously treated this species as subspecies of *Nassarius toulai* (HILBER 1879), a mistake which is probably rooted in the inaccurate illustration in HÖRNES & AUINGER (1882). Both species bear little in common; main differences are the larger size and extremely robust shell of *Nassarius poelsensis*, its flattened spire whorls and the stepped spire. Furthermore, the columellar lip of *Nassarius toulai* develops three characteristic teeth and a distinct parietal tooth, whereas *Nassarius poelsensis* always displays a much weaker sculpturing of the inner lip.

**Distribution:** The species is known from the Badenian of Austria, Hungary and Romania.

*Nassarius striatulus* (EICHWALD 1829)

Pl. 2, Figs. 8–14

- 1829 *Buccinum striatulum* EICHWALD: 297, pl. 5, fig. 7  
 1839 *Buccinum striatulum*, – EICHWALD: 17  
 1853 *Buccinum striatulum*, – EICHWALD: 166, pl. 7, fig. 2  
 1852 *Buccinum semistriatum*, – HÖRNES: 145, pl. 12, figs. 9–10 (non BROCCHI 1814)  
 1852 *Buccinum costulatum*, – HÖRNES: 145, pl. 12, figs. 11–12 (non BROCCHI 1814)  
 1864 *Buccinum Hoernesii* MAYER: 76  
 1882 *Buccinum (a. Zeuxis) restitutianum*, – HOERNES & AUINGER: 127, pl. 14, figs. 6–13  
 1882 *Buccinum (b. Zeuxis) Hoernesii*, – HOERNES & AUINGER: 128, pl. 14, figs. 16–18  
 1882 *Buccinum (e. Caesia) inconstans* HOERNES & AUINGER: 133, pl. 14, figs. 1–5  
 ?1904 *Nassa (Telasco) restitutensis* var. *tauromontis* SACCO: 72, pl. 16, figs. 62 a–c  
 1911 *Nassa hoernesii*, – FRIEDBERG: 84, pl. 5, fig. 5  
 1960 *Nassa (Hinia) restitutiana*, – KOJUMDGIEVA & STRACHIMIROV: 288, pl. 44, fig. 5  
 1960 *Nassa (Hinia) restitutiana* var. *hoernesii*, – KOJUMDGIEVA & STRACHIMIROV: 175, pl. 44, figs. 6–7  
 1966 *Nassa (Tritia) inconstans*, – STRAUZ: 317, pl. 37, figs. 18–21  
 1966 *Nassa (Tritia) restitutiana*, – STRAUZ: 321, pl. 38, figs. 10–11  
 1966 *Nassa (Tritia) restitutiana*, – STRAUZ: 321, pl. 38, figs. 12–13  
 1974 *Nassarius hoernesii*, – ADAM & GLIBERT: 33, pl. 4, figs. 6–8, textfig. 8

- 1974 *Nassarius restitutianus*, – ADAM & GLIBERT: 36, pl. 1, fig. 7, pl. 4, fig. 9, textfig. 9  
 1974 *Nassarius inconstans*, – ADAM & GLIBERT: 65  
 1997 *Hinia (Telasco) restitutiana*, – BAŁUK: 14, pl. 2, figs. 7–11  
 1998 *Hinia (Hinia) restitutiana restitutiana*, – SCHULTZ: 66, pl. 26, fig. 15  
 2003 *Nassarius restitutianus*, – ZŁOTNIK: 363, figs. 3, M–N

**Description:** Elongated ovoid, medium-sized shells with moderately convex whorls and deep sutures. Slightly opisthocyrte or even weakly sigmoidal, rounded, blunt axial ribs which are intersected by spiral ribs. These are very narrow-spaced on spire whorls, but become wider spaced on the body whorl. A conspicuous spiral furrow is usually developed close to the posterior suture, separating an adsutural band of slightly more prominent and rarely even pointed nodes. There is also a strong tendency to reduce the axial sculpture towards the body whorl, resulting in rather smooth late teleoconchs. These shells lack the pointed nodes but do always develop the axial sculpture on early whorls.

Aperture elongated ovoid; moderately thin outer lip with numerous internal lirae. Columellar lip thin, hardly reflected, bearing a distinct parietal plication. Much weaker teeth or folds may occur in the strongly concave anterior part. The short canal is well separated by a terminal fold of the columellar lip and a strong tooth on the outer lip.

**Remarks:** All authors dealing with this species argued that the two extreme morphotypes - traditionally termed *Nassarius restitutianus* (FONTANNES 1879) for shells with strong axial sculpture and *Nassarius hoernesii* (MAYER 1864) for those with strongly reduced ornament - are bridged by transitional morphologies. This is fully confirmed by the rich material from the Vienna Basin and the Transylvanian Basin in the collection of the NHMW. Despite the considerable different morphologies of the endpoints a separation on the species level seems to be on weak ground. Following the conclusions of ADAM & GLIBERT (1974) that the Paratethyan Middle Miocene specimens are not conspecific with the Pliocene *Nassarius restitutianus* (FONTANNES) we have to look for the next available name. This is usually considered to be „*Buccinum Hoernesii* MAYER 1864“, but this name was already preoccupied by ZITTEL (1862) for an Eocene species from Hungary. Therefore the next available well established name is *Buccinum inconstans* HOERNES & AUINGER 1882. If a separation of the smooth shelled specimens turns out to be justified the next available name for this species would be *Nassarius irritans* (BOETTGER 1906). However, the oldest but totally neglected name for this species was already given by EICHWALD (1829). Later, EICHWALD (1839, 1853) emphasised the striking similarity of his „*Buccinum striatulum*“ with the Middle Miocene specimens of the Vienna Basin, which have been erroneously referred to as „*Buccinum semistriatum*“ and „*Buccinum costulatum*“ in the literature.

**Distribution:** Ubiquitous in the Badenian of the Central Paratethys. The probably conspecific specimens described by SACCO (1904) as var. *tauromontis* derive from the synchronous Mediterranean section Monte dei Cappuccini close to Torino in Italy (Langhian according to FERRERO MORTARA & al. 1981 and PAVIA pers. comm.).

*Nassarius banaticus* (BOETTGER 1902)

Pl. 2, Figs. 15–16

- 1882 *Buccinum* (c. *Zeuxis*?) *semistriatum*, – HOERNES & AUINGER: 129 partim, pl. 14, figs. 21–22  
 1896 *Nassa* (*Zeuxis*) *semistriata*, – BOETTGER: 58  
 1902 *Nassa* (*Zeuxis*) *banatica* BOETTGER: 20  
 1902 *Nassa* (*Zeuxis*) *altera* BOETTGER: 21  
 ?1902 *Nassa* (*Zeuxis*) *crux* BOETTGER: 26  
 1906 *Nassa* (*Zeuxis*) *banatica*, – BOETTGER: 25  
 1906 *Nassa* (*Zeuxis*) *altera*, – BOETTGER: 25  
 1934 *Nassa* (*Zeuxis*) *banatica*, – ZILCH: 257, pl. 16, fig. 7  
 1934 *Nassa* (*Zeuxis*) *altera*, – ZILCH: 257, pl. 16, fig. 8  
 ?1934 *Nassa* (*Zeuxis*) *crux*, – ZILCH: 257, pl. 16, fig. 9

**Description:** Elongated ovoid shell with moderately convex spire whorls, well rounded, slightly inflated body whorl and incised sutures. Sculpture strongly reduced, surface glossy. Several spiral grooves appear on the early teleoconch becoming weaker towards the body whorl. Only the base bears several flat, hardly raised spiral ribs. A spiral furrow close to the posterior suture is usually slightly more prominent. Aperture with weak varix-like swelling; outer lip thin, numerous internal lirae. Columellar lip thin, slightly reflected, usually hardly expanding without sculpture. Siphonal canal short, adjoined by a thin terminal fold and a slightly stronger anterior tooth of the inner lip. The corroded protoconch consists of 3.5 moderately rounded whorls. The demarcation to the teleoconch is not sharp, indicated by the successive onset of the adult sculpture.

**Remarks:** The protoconch of *N. banaticus* from Lăpugiu de Sus is indicative of an indirect development including a free planktotrophic veliger stage. This species is probably often intermingled with *Nassarius striatulus* (EICHWALD 1829). Specimens of that species with strongly reduced sculpture are strongly reminiscent of *Nassarius banaticus*. Differences are the glossy and thin shell of *N. banaticus*, the less impressed sutures, and the constant absence of axial sculpture even on early teleoconch whorls. Within the specimens from Lăpugiu de Sus in Romania there are several specimens which document the ability of the species to produce also a broad parietal callus. These shells do not differ considerably from the synchronous and syntopic *Nassarius crux* (BOETTGER 1902). Therefore we doubt the validity of the latter species.

**Distribution:** This rarely documented species is only known from the Lower Badenian of Romania.

*Nassarius grateloupi* (HÖRNES 1852)

Pl. 2, Fig. 17

- 1852 *Buccinum Grateloupi* HÖRNES: 141, pl. 12, fig. 6  
 1882 *Buccinum* (d. *Zeuxis*?) *Grateloupi*, – HOERNES & AUINGER: 130  
 1971 *Nassa rosthorni*, – CSEPREGHY-MEZNERICS: 29, pl. 11, figs. 29–30 (non HÖRNES 1852)  
 1974 *Nassarius grateloupi*, – ADAM & GLIBERT: 43, pl. 1, fig. 6, pl. 5, fig. 2, textfig. 13  
 1997 *Hinia* (?*Uzita*) *grateloupi*, – BAŁUK: 17, pl. 1, figs. 7–8

**Description:** Medium- to large-sized, broad ovoid shell with convex spire whorls and slightly inflated body whorl. The entire shell including the siphonal fasciole is covered by a very regular pattern of up to 30 narrow-spaced axial ribs of sub-rectangular cross-section. Axial sculpture is only developed on the 2–3 spire whorls, consisting of rounded, not well-defined axial ribs. Rarely few axial swellings may occur on the body whorls close to the aperture. Outer lip thin with 15–20 regular internal lirae. Columella convex in the parietal area and moderately convex anteriorly. Posterior notch narrow. Inner lip smooth except for a parietal plication and the weak terminal fold. A shallow, indistinct axial groove may occur posterior to the terminal fold. The corroded protoconch consists of 3.5 moderately rounded whorls. The protoconch is sharply demarcated from the early teleoconch by a slightly thickened rim which is not sinuous in course.

**Remarks:** The protoconch of *N. grateloupi* from the Badenian of Baden is indicative of an indirect development including a free planktotrophic larval stage. Differs from the similar *Nassarius doliolum* (EICHWALD 1830) in its smaller size and the smooth inner lip.

**Distribution:** The species is known from the Badenian of Austria, Hungary and Poland.

*Nassarius badensis* (HÖRNES 1852)

Pl. 2, Fig. 18

- 1852 *Buccinum badense* „PARTSCH“ HÖRNES: 143, pl. 12, figs. 8 a–b  
 1882 *Buccinum* (e. *Zeuxis*?) *badense*, – HOERNES & AUINGER: 130  
 ?1882 *Nassa badensis*, – BELLARDI: 131, pl. 8, fig. 17  
 1906 *Nassa* (*Zeuxis*) *badensis*, – BOETTGER: 25  
 1960 *Nassa* (*Hinia*) *badensis*, – KOJUMDIEVA & STRACHIMIROV: 176, pl. 44, fig. 9  
 1966 *Nassa* (*Tritia*) *badensis*, – STRAUZ: 322, pl. 38, figs. 32–33  
 1974 *Nassarius badensis*, – ADAM & GLIBERT: 41, pl. 1, fig. 5, pl. 5, fig. 1, textfig. 12  
 1985 *Amyclina badensis*, – ATANACKOVIC: 152, pl. 34, figs. 11–12

**Description:** Medium- to large-sized, ovoid shells with convex spire whorls, deeply incised sutures and a slightly inflated body whorl. The entire shell bears up to 30 narrow-spaced, low spiral ribs. These are slightly wider spaced close to the adapical suture, where occasionally a deeper spiral furrow may occur. The subordinate axial sculpture consists of very characteristic

faint laminae which are only developed in the narrow interspaces between the spiral ribs, producing a „punctuated“ sculpture. The corroded protoconch comprises three moderately rounded whorls measuring about 0.8 mm in height and in maximum diameter. It is sculptured by remains of a strong sutural spiral cord. The demarcation of the protoconch to the early teleoconch is not sharp, indicated by the successive onset of the teleoconch sculpture.

**Remarks:** The protoconch of *N. badensis* from Vöslau is indicative of an indirect development including a free planktotrophic larval stage. The species is very reminiscent of *Nassarius grateloupi* (HÖRNES 1852). Only a careful examination reveals the differences which seem to support a separation of both taxa on the species level. *Nassarius grateloupi* develops an axial sculpture on the earliest two or three teleoconch whorls, whereas *Nassarius badensis* displays only spiral ornaments. The interspaces between the spiral ribs are smooth in *Nassarius grateloupi*, but covered with characteristic axial laminae in *N. badensis*. The parietal callus of *Nassarius badensis* is more prominent; its columellar lip may sometimes bear granules or plications but the parietal tooth of *Nassarius grateloupi* is never developed in *N. badensis*.

The most convincing feature for a separation of these species is the protoconch which is broad, stout and rapidly increasing in *N. badensis* and slender, high spired in *N. grateloupi* (see also ADAM & GLIBERT 1974).

**Distribution:** Common in the Badenian of the southern Central Paratethys, described from Austria, Bosnia, Hungary, Romania and Bulgaria.

*Nassarius vulgatissimus* (MAYER 1860)

Pl. 2, Fig. 19

- 1860 *Buccinum vulgatissimum* MAYER: 215, pl. 5, fig. 6  
 1882 *Buccinum* (c. *Caesia*) *vulgatissimum*, – HOERNES & AUINGER: 132, pl. 14, figs. 29–30  
 1906 *Nassa* (*Caesia*) *vulgatissima*, – BOETTGER: 26  
 1966 *Nassa* (*Tritia*) *vulgatissima*, – STRAUZ: 316, pl. 38, figs. 1–2  
 1974 *Nassarius vulgatissimus*, – ADAM & GLIBERT: 55, pl. 5, figs. 10–11, textfig. 16  
 1997 *Hinia* (*Hinia*) *vulgatissima*, – BAŁUK: 12, pl. 3, fig. 3

**Description:** Medium-sized, fusiform shells consisting of 5–6 fairly convex teleoconch whorls, separated by simple sutures. Axial ribs of subtrigonal cross-section narrower, than the interspaces between cover the entire shell; the body whorl bears 16–18 of these ribs. These are crossed by regular spiral threads (7–9 on the last spire whorl); the intersections may be slightly pointed on early whorls.

Aperture simple; thin strongly reflected inner lip with a parietal plication and a narrow terminal fold; outer lip with numerous sharp internal lirae. Siphonal canal considerably long. The corroded protoconch consists of three rounded whorls, which are sharply demarcated from the early teleoconch.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage.

The affiliation of the specimens from the Paratethys with *Nassarius vulgatissimus* (MAYER 1860) is uncritically adopted as we have not seen the French type material.

**Distribution:** Described from the Badenian of Poland, Hungary, Austria and Romania. According to ADAM & GLIBERT (1974) it appears also in the Miocene of France.

*Nassarius spectabilis* (NYST 1843)

Pl. 2, Fig. 20, Pl. 3, Fig. 1

- 1843 *Buccinum spectabilis* NYST: 577  
 1852 *Buccinum prismaticum*, – HÖRNES: 146, pl. 12, figs. 13–14 (non BROCCHI 1814)  
 1882 *Buccinum* (a. *Caesia*) *limatum*, – HOERNES & AUINGER: 130, pl. 13, figs. 2–7 (non CHEMNITZ 1786)  
 1906 *Nassa* (*Caesia*) *limata*, – BOETTGER: 26 (non CHEMNITZ 1786)  
 1958 *Hinia* (*Uzita*) *limata*, – BEER-BISTRICKÝ: 60, pl. 2, fig. 13 (non CHEMNITZ 1786)  
 1960 *Nassa* (*Hinia*) *limata*, – KOJUMDJEVA & STRACHIMIROV: 177, pl. 44, fig. 11 (non CHEMNITZ 1786)  
 1966 *Nassa* (*Tritia*) *limata*, – STRAUZ: 312, pl. 37, figs. 22–23 (non CHEMNITZ 1786)  
 1973 *Hinia* (*Uzita*) *limata*, – STEININGER & al.: 424, pl. 6, fig. 11 (non CHEMNITZ 1786)  
 1976 *Nassarius spectabilis spectabilis*, – ADAM & GLIBERT: 41, pl. 2, fig. 4, pl. 5, fig. 10  
 1985 *Hinia* (*Uzita*) *limata*, – ATANACKOVIC: 157, pl. 35, figs. 9–10 (non CHEMNITZ 1786)  
 1997 *Hinia* (*Uzita*) *limata*, – BAŁUK: 15, pl. 2, figs. 1–2 (non CHEMNITZ 1786)  
 1998 *Hinia* (*Uzita*) *clathrata*, – SCHULTZ: 66, pl. 26, fig. 18 (non BORN 1778)  
 2003 *Nassarius limatus*, – ŻŁOTNIK: 363, fig. 3, K–L (non CHEMNITZ 1786)

**Description:** Broad conical shell with short spire whorls, and large, inflated body whorl. The apical angle varies considerably from slender (30 °) to stocky (40 °). Blunt, rounded straight to slightly sigmoidal axial ribs, crossed by a very regular pattern of weaker spiral ribs. Thick outer lip with short, well developed internal lirae. Columellar lip strongly concave; weak parietal plication and distinct terminal fold; slightly expanding on base and detached from siphonal fasciole. The corroded protoconch has three whorls, which are sharply demarcated from the early teleoconch.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage. GLIBERT (1976) attempted to bring order to the species group which they termed the *Nassarius clathratus* group. According to their revision the Middle Miocene species of the Central Paratethys, which was usually assigned to *Nassarius prismaticus* (BROCCHI 1814) or *Nassarius lima* (DILLWYN 1817<sup>1</sup>) represents *Nassarius spectabilis* (NYST 1843). A comparison of the protoconchs of Viennese and

Romanian representatives with those illustrated by ADAM & GLIBERT (1976) seem to support this decision. The protoconch of *Nassarius lima* is very depressed, whereas that of *N. prysmaticus* is extremely slender. Both types differ from that of the herein discussed Paratethyan specimens, which develop a moderately high, multispiral protoconch corresponding to that of *Nassarius spectabilis* illustrated by ADAM & GLIBERT (1976).

Generally, the Paratethyan species is smaller than the Pliocene *Nassarius prysmaticus* which may attain up to 36 mm in height (see holotype in PINNA & SPEZIA 1978). In contrast, the variability in shape and ornamentation of *Nassarius prysmaticus* as documented by ADAM & GLIBERT (1976) renders a convincing separation difficult. A rather consistent feature seems to be the lack of a prominent sculpture of the inner lip.

**Distribution:** The earliest occurrence was described from the Ottnangian of Bavaria by HÖLZL in STEININGER & al. (1973). During the Badenian the species becomes an ubiquitous element in the Central Paratethys and occurs also in the Eastern Paratethys during the Tarkhanian and Chokrakian (ILJINA 1993). During the Middle Miocene *Nassarius spectabilis* (NYST) is also common in the Loire Basin, the Gironde and the Bretagne (ADAM & GLIBERT 1976).

*Nassarius subprismaticus* (HOERNES & AUINGER 1882)

Pl. 3, Fig. 2

- 1882 *Buccinum* (b. *Caesia*) *subprismaticum* HOERNES & AUINGER: 131, pl. 13, fig. 1  
 1958 *Hinia* (*Uzita*) *subprismatica*, – BEER-BISTRICKÝ: 61  
 1960 *Nassa* (*Hinia*) *subprismatica*, – BALDI: 68, pl. 2, fig. 6  
 ?1967 *Nassarius brugnonis*, – ADAM & GLIBERT: 15 in parte, pl. 4, fig. 1 (non BELLARDI 1882)  
 1997 *Hinia* (*Uzita*) *subprismatica*, – BAŁUK: 16, pl. 2, fig. 3  
 2002 *Hinia subprismatica*, – HARZHAUSER: 104, pl. 8, fig. 9

**Description:** Very broad conical, large-sized shell of 6 low, broad, strongly convex teleoconch whorls. Protoconch destroyed in all available specimens.

Aperture subspherical with thick, strongly dentated outer lip and a considerably concave columellar lip bearing a prominent parietal fold, a more or less developed terminal fold and several plications and granulations.

**Remarks:** HOERNES & AUINGER (1882) separate the shells from the Badenian of the Vienna Basin from *Nassarius prysmaticus* (BROCCHI 1814), based on the idealised illustration in BROCCHI (1814). Thus they erroneously mention a weaker dentation of the outer lip, a narrower canal, a less expanding columellar lip and more convex whorls as features to distinguish their species from the Italian Pliocene *Nassarius prysmaticus*. The re-illustration of the type specimen by PINNA & SPEZIA (1978) proof that none of these characters allows any separ-

ation. Thus the validity of *Nassarius subprismaticus* based on rather superficial features such as the more numerous axial ribs and the more inflated body whorl is very doubtful. A weak difference can be stated for the tendency of *Nassarius prysmaticus* to produce slightly pointed axial ribs which is completely missing in the Badenian shells.

This species was variously discussed to be conspecific with the Upper Miocene *Nassarius brugnonis* (BELLARDI) (BALDI 1960, BAŁUK 1997). Following the re-illustration of the type material from the Tortonian of Italy in FERRERO-MORTARA & al. (1981), *Nassarius brugnonis* differs distinctly in its low spire, the moderately convex whorls and the weak apertural sculpture. The same differences can be deduced from the illustration of another Italian *Nassarius brugnonis* by ADAM & GLIBERT (1976: pl. 4, fig. 2). In contrast, the French specimen illustrated by ADAM & GLIBERT (1976: pl. 4, fig. 1) as *Nassarius brugnonis* fully corresponds to *Nassarius subprismaticus*.

Differs from *Nassarius spectabilis* (NYST 1843) clearly in its stout shell, the rather inflated whorls, and the conspicuous sculpture of the columellar lip.

**Distribution:** The rare species is recorded from the Badenian of Austria, Hungary and Poland. Its first occurrence was recently described by HARZHAUSER (2002) from the Karpatian of the Korneuburg Basin in Austria.

The poorly understood relationship within the *Nassarius prysmaticus* group renders an interpretation of the distribution of the various taxa difficult.

*Nassarius expectatus* (BAŁUK 1997)

- 1997 *Hinia* (*Uzita*) *expectata* BAŁUK: 16, pl. 2, fig. 4

**Remarks:** This extremely stout shell which is characterised by its twisted canal, the broad and convex but very low whorls and the varix-like axial ribs. It seems to be close to the *Nassarius subprismaticus* – *Nassarius spectabilis* group. However, it is hard to decide from the considerably low numbers of known specimens if this species is valid or if it is based on 2 single freak specimens.

**Distribution:** Mentioned by BAŁUK (1997) from the Lower Badenian of Poland.

*Nassarius pupaeformis* (HOERNES & AUINGER 1882)

Pl. 3, Fig. 3

- 1882 *Buccinum* (l. *Tritia*) *pupaeforme* HOERNES & AUINGER: 147, pl. 13, fig. 36  
 1906 *Nassa* (*Tritia*) *pupiforme*, – BOETTGER: 22  
 1954 *Nassa* (*Phrontis*) *pupaeformis palatina* STRAUSS: 29, pl. 4, fig. 90  
 1966 *Nassa* (*Phrontis*) *pupaeformis*, – STRAUSS: 326, pl. 39, figs. 6–7

◀◀ <sup>1</sup>see CERNOHORSKY (1984: 50) for discussion on *Nassarius lima* (DILLWYN) versus *Nassarius limata* (CHEMNITZ)

- 1966 *Nassa (Phrontis) pupaeformis palatina*, – STRAUZ: 326, pl. 39, figs. 12–16  
 1973 *Hinia senilis*, – STEININGER & al.: 424, pl. 6, fig. 10 (non DODERLEIN 1862)  
 1985 *Hinia (Hinia) pupaeformis palatina*, – ATANACKOVIC: 154, pl. 34, figs. 9–10

**Description:** Small-sized, elongated shell of 4–5 teleoconch whorls. Spire slightly stepped; spire whorls flat; body whorl subcylindrical. Aperture elongated with strong posterior angulation. Outer lip with 7–8 distinct internal lirae. Inner lip smooth, hardly reflected strongly concave. The most characteristic feature is the sculpture consisting of very narrow, incised, spiral grooves (three on spire whorls, 7–10 on body whorl) which cover the entire shell down to the siphonal fasciole. Axial sculpture considerably weaker, formed by broad rib-like swellings, which are most prominent close to the posterior suture. Only the earliest two spire whorls display a pronounced axial sculpture. The protoconch consists of 2.5–3 corroded whorls. It is sharply demarcated from the early teleoconch.

**Remarks:** The protoconch of *N. pupaeformis* from Lăpugiu de Sus is indicative of an indirect development including a free planktotrophic larval stage. STRAUZ (1954) established the subspecies „*Nassa pupaeformis palatina*“ based on the lower number of spiral grooves on the body whorl, the pronounced axial sculpture and the stockier shape. In 1966 STRAUZ already remarked that it is hardly possible to divide his „subspecies“ from the type due to the transitional specimens. Indeed, the separation on a subspecies level can not be maintained. On the one hand the features mentioned by STRAUZ (1954, 1966) to separate his *palatina* represent rather the intra-specific variability of the species. Furthermore, the stronger axial sculpture that he was missing in the type specimens is a matter of a slightly misleading drawing in HOERNES & AUINGER (1882). On the other hand both – the type species as well as the alleged subspecies – appear synchronously and syntopically at Várpalota in Hungary.

A specimen from the Ottnangian of Várpalota in Hungary was erroneously assigned to the Upper Miocene, Mediterranean *Nassarius senilis* (DODERLEIN) by KÓKAY in STEININGER & al. (1973), which differs in its considerably shorter spire.

**Distribution:** *Nassarius pupaeformis* appears already in the Ottnangian. After a Karpatian gap it is recorded again from the Badenian of Bosnia, Hungary, and Austria.

*Nassarius serraticosta* (BRONN 1831<sup>2</sup>)

Pl. 3, Figs. 4–6, Pl. 6, Figs. 1–2

- 1831 *Buccinum serraticosta* BRONN, 23

- 1852 *Buccinum serraticosta*, – HÖRNES: 147, pl. 12, fig. 15  
 1882 *Buccinum (a. Hima) serraticosta*, – HOERNES & AUINGER: 136  
 1879 *Nassa serraticosta*, – FONTANNES: 65, pl. 5, fig. 8  
 ?1906 *Nassa (Hima) striaticosta* BOETTGER: 27  
 ?1934 *Nassa (Hima) striaticosta*, – ZILCH: 256, pl. 16, fig. 2  
 1966 *Nassa (Tritia) serraticosta*, – STRAUZ: 313, pl. 37, figs. 14–17  
 1985 *Hinia (Uzita) serraticosta*, – ATANACKOVIC: 155, pl. 34, figs. 19–20  
 1993 *Nassarius (Hinia) serraticosta serraticosta*, – ILJINA: 93, pl. 12, figs. 4–5  
 1997 *Hinia (Hinia) serraticosta*, – BAŁUK: 10, pl. 3, figs. 1–2  
 ?1997 *Hinia (Hinia) striaticosta*, – BAŁUK: 11, pl. 4, fig. 1

**Description:** Small-sized, stocky-fusiform shells with strongly convex spire whorls and impressed, slightly wavy sutures. 12 broad, blunt, rounded orthocline to slightly prosocline axial ribs predominate the sculpture. These are crossed by a closely spaced, regular pattern of up to 20 spiral ribs or threads. Thick varix close to aperture. Outer lip robust with about 8 distinct internal lirae and a prominent terminal tooth. Columellar lip well defined, narrow with strong parietal tooth but otherwise smooth. Short, strongly twisted canal. A very characteristic feature is the short, bulgy siphonal fasciole which lacks any axial sculpture but is demarcated from the base by a very strong rim. The conical protoconch comprises 3.5 moderately rounded whorls measuring 0.51 mm in height and 0.73 mm in maximum diameter. The protoconch-angle amounts 75°. The first whorl measures 0.03–0.04 mm in the width of the initial cap-like onset and 0.18–0.19 mm in maximum diameter. The transition from the embryonic shell to the larval shell is not evident. The second whorl is sculptured by a broad abapical cord just above the abapical suture, which persists all over the larval shell. The transition of the larval shell to the teleoconch is indicated by closely spaced thickened growth lines, which are slightly sinuous in course. The onset of the teleoconch is indicated by the abrupt formation of the adult sculpture.

**Remarks:** The protoconch morphology is indicative of a direct development including a free planktotrophic larval stage. See BAŁUK (1997) for discussion on the relationship with *Nassarius catulloi* (BELLARDI 1882).

*Nassarius striaticosta* (BOETTGER 1906) represents most probably a synonym of this variable species. Shape and aperture corresponds fully to that of *Nassarius serraticosta*. Differences in the number of the spiral ribs as described by BOETTGER (1906) are obviously a mistake as already figured out by BAŁUK (1997).

BOETTGER (1906) compared this species with *Nassarius subasperatus* (BOETTGER 1906) emphasising the close resemblance. This statement is surprising since the

<sup>2</sup>Note that *serraticosta* is a feminine compound noun and thus cannot be transferred to *serraticostus* as might be erroneously deduced from the masculine genus name]

latter species is quite different concerning the extremely broad and low axial ribs. *Nassarius striaticosta* differs also by the convex spire whorls, whereas *Nassarius subasperatus* develops hardly convex whorls.

**Distribution:** A widespread species during the Badenian in the entire Central Paratethys. In the Eastern Paratethys, the species is mentioned by ILJINA (1993) during the Tarkhanian and Chokrakian.

*Nassarius striaticosta* is seemingly restricted to Lower Badenian deposits of the Central Paratethys, known from Poland and Romania.

***Nassarius subasperatus* (BOETTGER 1906)**

Pl. 3, Figs. 7–8, Pl. 6, Figs. 13–14

1882 *Buccinum* (*k. Hima?*) *asperatum*, – HOERNES & AUINGER: 139, pl. 13, fig. 40 (non COCCONI 1873)

1906 *Nassa* (*Hima*) *subasperata* BOETTGER: 29

1934 *Nassa* (*Hima*) *subasperata*, – ZILCH: 256, pl. 16, fig. 4

**Description:** Small-sized, biconical shell with coalescing whorls, separated by weakly impressed sutures. The four teleoconch whorls are covered by ten densely spaced, regular spiral ribs with flat backs and very narrow interspaces (18–23 on the body whorl). These are crossed by 10–12 wide spaced, straight to slightly sigmoidal axial furrows, causing a spirally elongated rectangular pattern. Siphonal fasciole is devoid of axial sculpture and bears only spiral ribs. Aperture simple; occasionally a varix is developed; thickened outer lip with 14 internal lirae. Columellar lip thin, narrow, with indistinct parietal plication.

The conical protoconch has 3.5 moderately rounded whorls measuring 0.8 mm in height and in maximum diameter. The protoconch-angle amounts 88°. The embryonic shell comprises one smooth whorl measuring 0.04–0.05 mm in the width of the initial cap-like onset and 0.17–0.18 mm in maximum diameter. The embryonic shell is terminated by a thickened rim on the shell. The larval shell is sculptured by a broad abapical cord just above the abapical suture. This cord is characterised by four spiral rows of very fine longitudinal tubercles. The last quarter whorl of the protoconch bears closely spaced, thickened growth lines. The protoconch is terminated by a thickened rim, which is slightly sinuous in course. The onset of the teleoconch is indicated by an abrupt formation of the adult sculpture.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage. It differs from the protoconch of *Naytiopsis karreri* with similar protoconch dimensions by the presence of the prominent spiral cord sculpturing the larval shell.

The described specimens were erroneously assigned to *Nassarius asperata* (COCCONI 1873) by HOERNES & AUINGER (1882). According to the description and illustration of *Nassarius asperata* in BELLARDI (1882), the Italian species differs in its elongate shape and the quadrangular sculpture. Correspondingly, *Nassarius fischeri*

(BELLARDI 1882), which agrees in surface sculpture, differs in its elongated shape and the weak ornamentation of the aperture.

**Distribution:** This species is only known from the Lower Badenian of Austria, the Czech Republic, and Romania.

***Nassarius dispar* (BOETTGER 1902)**

1902 *Nassa* (*Niotha*) *dispar* BOETTGER: 20

1934 *Nassa* (*Niotha*) *dispar*, – ZILCH, 257, pl. 16, fig. 10

**Distribution:** Only known from the Lower Badenian of Romania.

***Nassarius dujardini* (DESHAYES 1844)**

Pl. 3, Figs. 9–10, Pl. 6, Figs. 15–16

1844 *Buccinum Dujardini* DESHAYES in LAMARCK: 211

1852 *Buccinum mutabile*, – HÖRNES: 154 partim, pl. 13, fig. 2! (non LINNAEUS 1766)

1856 *Buccinum Dujardini*, – HÖRNES: 668 partim

1882 *Buccinum* (*Niotha*) *Dujardini*, – HOERNES & AUINGER: 124, pl. 15, fig. 12.

1925 *Arcularia dujardini*, – COSSMANN & PEYROT: 187, pl. 3, figs. 124–126

1952 *Nassa* (*Nassa*) *dujardini*, – GLIBERT: 333, pl. 9, fig. 9

1958 *Hinia* (*Hinia*) *dujardini dujardini*, – BEER-BISTRICKY: 56, pl. 2, fig. 12

1958 *Hinia* (*Hinia*) *dujardini longitesta* BEER-BISTRICKY: 57

1960 *Nassa* (*Phrontis*) *dujardini*, – KOJUMDIEVA & STRACHIMIROV: 338, pl. 40, figs. 1–4

1966 *Nassa* (*Phrontis*) *dujardini*, – STRAUZ: 338, pl. 40, figs. 1–4

1970 *Nassa schoenni dujardini*, – BAŁUK: 118, pl. 12, fig. 12

1997 *Sphaeonassa dujardini*, – BAŁUK: 6, pl. 1, figs. 4–6

2002 *Sphaeronassa dujardini*, – HARZHAUSER: 103, pl. 8, fig. 3

2003 *Nassarius dujardini*, – ZŁOTNIK: 363, fig. 3, A–B

**Description:** Medium-sized shell with large ovoid body whorl and moderately high spire of weakly convex, coalescing whorls, separated by slightly impressed sutures. Shell surface smooth except for some spiral grooves on the base and weak axial ribs on the earliest 1–3 teleoconch whorls which may bear subordinate spiral ribs.

The outer lip develops about seven strong dentations, of these usually the middle 2–3 teeth are most prominent. Bulgy siphonal fasciole with rather sharp back, separated by a distinct rim from the base.

The protoconch has three slightly rounded whorls measuring 0.58–0.59 mm in height and 0.62–0.63 mm in maximum diameter. The protoconch-angle amounts 65°. A broad abapical cord just above the abapical suture appears in the course of the second whorl. This cord bears secondary sculpture of four spiral rows of elongated tubercles or threads. The transition to the teleoconch is indistinct, indicated by the successive onset of the adult sculpture.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic lar-



val stage. The species is reminiscent of *Nassarius schoenni* (HOERNES & AUINGER). Differences are the ovoid body whorl and the pointed, less stepped spire of *Nassarius dujardini*. The bulgy shoulder of *Nassarius schoenni* is absent in *Nassarius dujardini* and the early spire whorls of the latter lack spiral ribs.

**Distribution:** *Nassarius dujardini* arrives in the Central Paratethys already during the Early Miocene, when it is also known from the NE Atlantic. It is ubiquitous in the Badenian of the Central Paratethys and is also documented from the Middle Miocene of the Loire Basin (GLIBERT 1952).

***Nassarius schoenni* (HOERNES & AUINGER 1882)**

Pl. 3, Figs. 11–12

- 1882 *Buccinum (Niotha) Schönni* HOERNES & AUINGER: 125, pl. 15, figs. 18–20  
 1882 *Buccinum* (b. *Niotha*) *Telleri* HOERNES & AUINGER: 125, pl. 15, fig. 11  
 1911 *Nassa Schönni*, – FRIEDBERG: 78, pl. 4, figs. 16–18  
 1952 *Nassa schoenni*, – GLIBERT: 335, pl. 9, fig. 10  
 1958 *Hinia (Hinia) coarctata telleri*, – BEER-BISTRICKÝ: 58  
 1967 *Arcularia (Arcularia) schoenni*, – TEJKAL & al.: 202, pl. 11 B, fig. 11  
 1970 *Nassa schoenni schoenni*, – BAŁUK: 118, pl. 12, fig. 13  
 1996 *Sphaeonassa schoenni*, – BAŁUK & RADWANSKY, pl. 1, fig. 1  
 1997 *Sphaeonassa schoenni*, – BAŁUK: 7, pl. 1, figs. 1–3  
 2002 *Sphaeronassa schoenni*, – HARZHAUSER: 103, pl. 8, fig. 4  
 2003 *Nassarius schoenni*, – ZŁOTNIK: 363, fig. 3, C–D

**Description:** Ovoid, medium-sized shells with pointed and slightly stepped spire. The earliest 2–3 teleoconch whorls bear a pattern of blunt, swollen axial ribs crossed by narrow-spaced, regular spiral ribs. This sculpture vanishes on later whorls, which are smooth and glossy except for 2–4 basal grooves and weak lines of growth. Body whorl subcylindrical, inflated with bulgy shoulder, several indifferent axial swellings and a thick swollen varix close to the aperture. Aperture elongated, pointed; columella evenly concave. Thick parietal callus and reflected, well defined inner lip; smooth aside from a weak terminal fold. Thick outer lip with about 9 strong internal lirae and a terminal tooth. Canal deeply incised, very short. Bulgy siphonal fasciole demarcated from the base by a strong rim and deep wide spiral groove. The corroded protoconch consists of about 2.5 rounded apparently smooth whorls. It is not sharply demarcated from the teleoconch.

**Remarks:** The protoconch is indicative of an indirect development including a planktotrophic larval stage. The three rather poorly preserved specimens from the Badenian of Forchtenau in Austria introduced as *Buccinum Telleri* by HOERNES & AUINGER (1882) range well within the intra-specific variability of *Nassarius schoenni*.

**Distribution:** *Nassarius schoenni* appears in the Karpatian of the Central Paratethys. During the Badenian it becomes an ubiquitous species found in enormous

masses. The first occurrence of this species was mentioned by KÓKAY in STEININGER & al. (1973) as *Arcularia dujardini* (DESHAYES) from the Ottnangian of Várpalota in Hungary. [Note that the specimen illustrated by GLIBERT (1952) derives from Vöslau in Austria and not from the Loire Basin.]

***Nassarius edlaueri* (BEER-BISTRICKÝ 1958)**

Pl. 2, Figs. 13–14

- 1852 *Buccinum miocenicum*, – HÖRNES: 153 partim, pl. 12, figs. 22 a, b (non MICHELOTTI 1847)  
 1879 *Buccinum obliquum* HILBER: 12, pl. 2, fig. 3  
 1882 *Buccinum (Uzita) obliquum*, – HOERNES & AUINGER: 135, pl. 13, fig. 33  
 1911 *Nassa obliqua*, – FRIEDBERG: 79, pl. 4, figs. 19–20  
 1958 *Hinia (Hinia) edlaueri* BEER-BISTRICKÝ: 55, pl. 2, fig. 11  
 1967 *Hinia (Hinia) edlaueri*, – TEJKAL & al.: 202, pl. 11 B, figs. 6–7  
 1973 *Hinia edlaueri*, – STEININGER & al.: 424  
 1993 *Nassarius (Phrontis) edlaueri*, – ILJINA: 86, pl. 11, figs. 9–13  
 2002 *Sphaeronassa edlaueri*, – HARZHAUSER: 104, pl. 8, figs. 5–7

**Remarks:** Aside from its bulgy axial ribs covering the spire and body whorl, it differs from *Nassarius schoenni* in its less inflated body whorl, the higher spire and the absent or only occasionally developed spiral ornamentation of the earliest teleoconch. It is highly questionable if these features, which are quite variable in the Badenian populations of *Nassarius schoenni*, justify a separation as a valid species. The corroded protoconch also does not show significant differences as it consists of 2.5 rounded whorls as in *N. schoenni* of about identical size. The sharp demarcation from the early teleoconch may indicate a difference compared to the protoconch of *N. schoenni*, which is not sharply demarcated from the teleoconch. But this character is not very significant, because it could also depend on the bad preservation of the early ontogenetic shells. *Nassarius edlaueri* is ubiquitous in the brackish water influenced littoral environments of the Karpatian but also in synfacial environments of the Lower Badenian (e.g. Pöls in the Styrian Basin). These populations are often adjoined by *Nassarius schoenni*, bridged by transitional morphs. In the normal marine, sublittoral settings of the Badenian it is absent but replaced by *Nassarius schoenni*. It thus seems that *Nassarius edlaueri* is a mainly Lower Miocene morphotype of *Nassarius schoenni*, documenting a shift in sculpture from high spired shells with irregular bulgy ribbing to low spired, spherical ones with reduced sculpture.

This taxon was variously considered to be synonymous with *Nassarius basteroti* (MICHELOTTI 1847) by PEYROT (1925), GLIBERT (1952), and BEER-BISTRICKÝ (1958). This species, however, differs considerably in its inflated, convex body whorl and the typical, deeply incised spiral grooves between the axial ribs.

**Distribution:** *Nassarius edlaueri* experiences its acme during the Karpatian of the Central Paratethys and is ubiquitous at that time in the Austrian Korneuburg Basin. According to KÓKAY in STEININGER & al. (1973), BEER-BISTRICKÝ (1958), and STRAUZ (1966) the species is also recorded from the Ottnangian of Hungary and from the Badenian of Poland and Hungary. In the Eastern Paratethys the species is described by ILJINA (1993) from the Tarkhanian, Chokrakian, and Konkian.

***Nassarius podolicus* (HOERNES & AUINGER 1882)**

Pl. 3, Figs. 15–16

- 1882 *Buccinum* (c. *Nassa*) *podolicum* HOERNES & AUINGER: 122, pl. 13, figs. 30–31  
 1882 *Buccinum* (*Nassa*) *Podolicum*, – HILBER: 4

**Description:** Medium-sized, moderately robust shells with high, stepped spire of weakly convex whorls and inflated body whorl. Axial sculpture of irregular, swollen ribs appears on early whorls and may occasionally also be present on the body whorl. 2–3 spiral grooves may be developed on the posterior part of the body whorl; up to four additional ones appear on the base. Outer lip only slightly thickened with about 9–10 internal lirae. Siphonal fasciole bulgy, rounded, forms a false umbilicus with the narrow columellar lip.

**Remarks:** Differs from the resembling *Nassarius schoenni* and *Nassarius dujardini* in its thinner shell, the spiral grooves, the moderately thickened outer lip, and the much weaker internal lirae. Additionally, the columellar lip is less swollen and lacks a strong parietal callus.

The shells identified by FRIEDBERG (1911: pl. 4, figs. 10–12) as *Nassarius podolicus* differ considerably in their thick shell, the absence of spiral ornamentation of the body whorl, and the convex base which lacks the neck of *Nassarius podolicus*. These shells represent rather members of the *Nassarius coarctatus/volhynicus* group.

**Distribution:** The species seems to be restricted to the Badenian of the Polish-Ukrainian foredeep.

***Nassarius zborzewskii* (ANDRZEJOWSKI 1830)**

Pl. 3, Fig. 17

- 1830 *Nassa Zborzewskii* ANDRZEJOWSKI: 96, pl. 4, fig. 4  
 1830 *Nassa tumida* EICHWALD: 223  
 1837 *Nassa Zborzewskii*, – PUSCH: 123, pl. 11, fig. 7  
 1853 *Buccinum tumidum*, – EICHWALD: 170, pl. 7, fig. 6  
 1882 *Buccinum* (a. *Nassa*) *Zborzewscii*, – HOERNES & AUINGER: 121, pl. 13, fig. 29  
 1882 *Buccinum* (b. *Nassa*) *Tietzei* HILBER in HOERNES & AUINGER: 122, pl. 15, fig. 23  
 1882 *Buccinum* (*Nassa*) *Tietzei*, – HILBER: 3, pl. 1, fig. 4  
 1882 *Buccinum* (*Nassa*) *Zborzewskii*, – HILBER: 3, pl. 1, fig. 5  
 1911 *Nassa Zborzewskii*, – FRIEDBERG: 66, pl. 4, figs. 3–4  
 1911 *Nassa Zborzewskii* var. *plicata* FRIEDBERG: 69, textfig. 19  
 1993 *Nassarius* (*Phrontis*) *zborzewskii*, – ILJINA: 88, pl. 11, figs. 20–23

**Description:** Elongated ovoid shell with pointed spire. Spire whorls display rather flat flanks but often develop a considerable convexity close to the posterior suture. Body whorl strongly convex but rapidly contracting towards the canal. A slight angulation, sometimes adjoined by a weak keel may segregate a narrow sutural ramp. Early whorls with cancellate sculpture, which fades out at least on the last spire whorl. Body whorl decorated by spiral grooves, being most prominent close to the suture and along the base. Broad outer lip with heavy dentation, internally swollen and additionally strengthened by a strong terminal varix. Columellar lip lacks a marked parietal callus but becomes very broad in its anterior half covering even the siphonal fasciole.

**Remarks:** The more or less distinct angulation and keel of the body whorl and the spire height were variously considered to distinguish *Nassarius tumidus* (EICHWALD) from *Nassarius zborzewskii* (ANDRZEJOWSKI) and *Nassarius tietzei* HILBER in HOERNES & AUINGER). A separation of these taxa based solely on these highly variable features seems to be very artificial.

**Distribution:** Only known from the Badenian of the Polish-Ukrainian foredeep. The species is also recorded from the Konkian of the Eastern Paratethys by ILJINA (1993) witnessing some faunal exchange between both bioprovinces at that time.

***Nassarius volhynicus* (ANDRZEJOWSKI 1830)**

- 1830 *Nassa volhynica* ANDRZEJOWSKI: 97, pl. 4, fig. 5  
 1830 *Nassa coarctata* EICHWALD: 223  
 1831 *Buccinum mutabile*, – DUBOIS DE MONTPÉREUX: 26, pl. 1, figs. 30–31 (non LINNAEUS 1766)  
 1837 *Nassa volhynica*, – PUSCH: 122  
 1853 *Buccinum coarctatum*, – EICHWALD: 171, pl. 7, fig. 7  
 1911 *Nassa coarctata*, – FRIEDBERG: 70, pl. 4, fig. 5  
 1911 *Nassa coarctata* var. *elongata* FRIEDBERG: 72, textfig. 21  
 1911 *Nassa podolica*, – FRIEDBERG: 74, pl. 4, figs. 10–12

**Remarks:** Judging from the illustrations of *Nassa volhynica* in ANDRZEJOWSKI (1830), *Nassa coarctata* in EICHWALD (1853) and *Buccinum mutabile* in DUBOIS DE MONTPÉREUX (1831) all these authors referred to the same species. A fact that was already recognised by PUSCH (1837). It is unclear which of the two competing names *Nassa coarctata* and *Nassa volhynica* gains priority. EICHWALD (1853) uses his names from 1830 and indicates the names proposed by ANDRZEJOWSKI (1830) as synonyms. In contrast, PUSCH (1837) considers *Nassa volhynica* to be the valid name – probably because of the first available illustration in ANDRZEJOWSKI (1830). FRIEDBERG (1928) and POŻARYSKA & al. (1977), too, accept the priority of the taxa of ANDRZEJOWSKI (1830).

The relation of this species to *Nassarius schoenni* is unclear. A difference might be the even more globular shape of *Nassarius volhynicus* and the evenly rounded whorls which lack the indistinct axial swellings of *Nassarius schoenni*. A very close relation of these species,

however, is obvious and their separation is somewhat dubious. Thus, BAŁUK (1870) treated the taxon as subspecies of *Nassarius schoenni* (HOERNES & AUINGER).

**Distribution:** Only described from the Badenian of the Polish-Ukrainian foredeep. The shells mentioned by BEER-BISTRICKÝ (1958) from the Badenian of the Vienna Basin are undoubtedly representatives of *Nassarius schoenni* (HOERNES & AUINGER).

***Nassarius hungaricus* (MAYER 1873)**

- 1873 *Buccinum hungaricum* MAYER: 149, pl. 6, fig. 5  
 1966 *Nassa (Tritia) hungarica*, – STRAUZ: 320, pl. 38, figs. 15–25, pl. 78, fig. 17

**Remarks:** This species was extensively discussed by STRAUZ (1966) who mentioned it from the Lower Badenian of Várpalota in Hungary.

***Nassarius eichwaldi* (FRIEDBERG 1911)**

- 1911 *Nassa Eichwaldi* FRIEDBERG: 96, pl. 5, fig. 17 [non textfig. 26, = *Nassarius striatulus* (EICHWALD 1829)]

**Remarks:** A species of unclear affinity was introduced by FRIEDBERG (1911) as *Nassa Eichwaldi* referring to a specimen illustrated by EICHWALD (1853: pl. 7, fig. 3) as *Buccinum costulatum*. The shell illustrated by FRIEDBERG (1911: pl. 5, fig. 17) differs considerably from the figure in EICHWALD (1853). Furthermore, FRIEDBERG (1911: 97, textfig. 26) erroneously re-illustrated a wrong figure of EICHWALD (1853).

The species mentioned by FRIEDBERG (1911) and ZELINSKAYA & al. (1968) is probably restricted to the Badenian of the Polish-Ukrainian foredeep.

***Nassarius cerithiformis* (HILBER 1879)**

Pl. 3, Fig. 18

- 1879 *Buccinum cerithiforme* „AUINGER“ HILBER: 15, pl. 2, fig. 8.  
 1882 *Buccinum (Leiodomus) cerithiforme*, – HOERNES & AUINGER: 119, pl. 15, figs. 14–17.  
 1882 *Nassa Sotterii* BELLARDI: 64, pl. 4, fig. 16  
 1906 *Dorsanum cerithiiforme*, – BOETTGER: 30  
 1910 *Buccinum cerithiforme* var. *longa* VETTERS: 144  
 1910 *Buccinum cerithiforme* var. *crassa* VETTERS: 144  
 1928 *Dorsanum cerithiforme*, – FRIEDBERG: 580, pl. 37, figs. 32–34.  
 1958 *Dorsanum (Dorsanum) cerithiforme cerithiforme*, – BEER-BISTRICKÝ: 51.  
 1958 *Dorsanum (Dorsanum) cerithiforme brevior* BEER-BISTRICKÝ: 52, pl. 1, fig. 8.  
 1971 *Bullia (Dorsanum) cerithiforme*, – CSEPREGHY-MEZNERICS: 29, pl. 11, fig. 20  
 1981 *Nassa sotterii*, – FERRERO-MORTARA & al.: 106, pl. 25, figs. 9 a–9 b  
 1997 *Dorsanum cerithiforme*, – BAŁUK: 21, pl. 5, fig. 9.  
 2001 *Dorsanum cerithiforme*, – HARZHAUSER: 107, pl. 8, fig. 10

**Description:** Very slender shells of 5–7 moderately convex whorls and deeply incised, slightly wavy sutures.

A smooth sutural band appears in the posterior quarter of the whorls, separated by a strongly incised furrow. Anterior to this furrow, the whorls bear axial ribs which usually fade out towards the penultimate whorl, resulting in a rather smooth body whorl and last spire whorl. Up to 6 spiral grooves appear on the base. Siphonal fasciole bordered by a distinct, rather sharp rim.

The species displays considerable intraspecific variability concerning the strength of the axial and spiral ornamentation. Especially the latter feature bridges shells with nearly smooth surface with those with full sculpture.

**Remarks:** The variability of this species is best documented by the number of variation-names such as *longa*, *crassa* or *brevior* introduced by VETTERS (1910) and BEER-BISTRICKÝ (1958). BELLARDI (1882) when describing his „*Nassa Sotterii*“ from the Upper Miocene of Borelli in Italy doubted that the specimens illustrated in HOERNES & AUINGER (1882) as *Buccinum cerithiforme* are conspecific with the type of HILBER (1879). The re-investigation of the discussed specimens from the Styrian Basin and the Vienna Basin, however, proofed the identification. The features claimed by BELLARDI (1882) to distinguish the specimens, such as the more or less elongated shell, range all within the intraspecific variability.

Differences in the aperture of *Nassarius sotterii* and *Nassarius cerithiformis* as mentioned by BELLARDI (1882) are due to the partly destroyed outer lip of the Austrian specimens illustrated by HOERNES & AUINGER (1882). Thus it is quite questionable if *Nassarius sotterii* (BELLARDI 1882) is a valid species, or if it rather represents an Upper Miocene to Pliocene *Nassarius cerithiformis*. Lower Miocene representatives from the Karpatian of Austria are rather stocky in shape compared to the elongated shells of the Badenian. This shift from stocky to elongated shells would thus result in the slender shape of the Upper Miocene *Nassarius sotterii*.

**Distribution:** In the Central Paratethys the species is first recorded in the Karpatian, when it is commonly found in marine deposits of the Korneuburg Basin (HARZHAUSER 2002). In the Lower Badenian (Langhian) *Nassarius cerithiformis* is a typical constituent of the Austrian Grund Formation and is ubiquitous in the Styrian Basin. According to HOERNES & AUINGER (1882), CSEPREGHY-MEZNERICS (1971), and BAŁUK (1997) the species appears also in Badenian of Romania, Hungary, and Poland.

*Nassarius sotterii*, which is probably synonymous with *Nassarius cerithiformis*, is described from the Upper Miocene and Pliocene of Northern Italy.

***Naytiopsis* THIELE 1929**

**Type species:** *Buccinum granum* LAMARCK 1822 – Recent, Mediterranean Sea.

**Remarks:** *Naytiopsis* differs from *Nassarius* (*Nassarius*) by its stocky ovoid teleoconch shape and by smooth adult whorls. *Nassarius (Telasco)* (H. and A. ADAMS

1853) with the Recent Mediterranean type species *Buccinum cuvieri* PAYRAUDEAU 1826 is similar, but differs by its more elongated shell outline, remaining spiral sculpture on the body whorl, heavy callus and by strong dentition of the outer lip (see CERNOHORSKY 1984: pl. 20, figs. 1–15).

*Naytiopsis karreri* (HOERNES & AUINGER 1882)

Pl. 3, Fig. 19, Pl. 6, Figs. 7–9

- 1882 *Buccinum* (e. *Nassa*) *Karreri* HOERNES & AUINGER: 123, pl. 14, figs. 25, 27–28, fig. 26?  
 1906 *Nassa explorata* BOETTGER: 23  
 1906 *Nassa hypertropha* BOETTGER: 24  
 1934 *Nassa explorata*, – ZILCH: 255, pl. 16, fig. 98  
 1934 *Nassa hypertropha*, – ZILCH: 255, pl. 16, fig. 99

**Description:** Small-sized, stocky, ovoid shells. Coalescing whorls separated by simple, incised sutures. Early spire whorls develop up to ten weak spiral ribs which soon fade out. In the same way up to 12 occasionally occurring blunt, rounded axial ribs vanish within the spire whorls. Body whorl large, smooth except for few spiral furrows on the base and several varices close to the aperture, resulting from growth interruptions. Aperture with well rounded basal part; moderately thin outer lip with up to 20 faint internal lirae; only fully grown specimens develop a flat varix. Inner lip glossy, strongly reflected but hardly demarcated, forms a thin enamel covering of the base. Distinct terminal fold but otherwise smooth columellar lip, which is strongly concave close to the fold in most specimens. Deeply incised siphonal notch but extremely short canal. The parietal portion of the aperture is pointed.

The conical protoconch comprises 3.25 moderately rounded apparently smooth whorls measuring 0.92–0.93 mm in maximum diameter and 0.85 mm in height. The protoconch-angle amounts 80–85°. The first whorl measures 0.05–0.06 mm in the width of the initial cap-like onset and 0.19–0.2 mm in maximum diameter. A transition from the embryonic to the larval shell is not preserved. The transition from the larval shell to the teleoconch is indistinct, indicated by the successive onset of the adult sculpture.

**Remarks:** Protoconch dimensions are indicative of an indirect development, including a free planktotrophic larval stage.

There are superficial similarities with *Nassarius auingeri* (HOERNES & AUINGER), but the latter can be distinguished easily by its blunt apertural teeth.

The species displays considerable variability in shape and size as well as in the extent and strength of the sculpture. The specimens from Bujtur (Romania) are rather stout and small, whereas those from Forchtenau (Austria) and Lăpugiu de Sus (Romania) develop slender and stout shells and range from 6 to 10 mm in height. Thus, the extreme splitting as practiced by BOETTGER (1906) who separates *Nassarius explorata* and *Nassa-*

*rius hypertropha* from *N. karreri* is doubtful. BOETTGER (1906) himself discussed the possibility that his *N. explorata* is probably only a variety of *Naytiopsis karreri*.

BOETTGER (1906) emphasized that the specimen from Forchtenau (Austria) illustrated by HOERNES & AUINGER (1882: pl. 14, fig. 26) is not conspecific with *Naytiopsis karreri*. Indeed, the specimen is larger and the columellar lip does not expand to the base. Nevertheless, the single specimen allows no clear decision and a separation as new species is impossible; maybe it is just a freak specimen of *Naytiopsis karreri*.

**Distribution:** A rare species only known from the Badenian of the Vienna Basin and from Romania.

*Profundinassa* THIELE 1929

**Type species:** *Nassa babylonica* WATSON 1882 – Recent, Indo-Pacific.

**Remarks:** *Profundinassa* differs from *Nassarius* by its angulate whorls, long spire and short aperture. The arrangement of prominent spiral cords or spiny nodules with the sutures is a typical feature of the genus (see CERNOHORSKY 1884: 173, pl. 36, figs. 1–12).

*Profundinassa fuchsi* (KOENEN 1872)

Pl. 4, Figs. 1–2, Pl. 7, Figs. 9–10

- 1852 *Buccinum turbinellus*, – HÖRNES: 150, pl. 12, fig. 17 (non BROCCHI 1814)  
 1872 *Nassa Fuchsi* KOENEN: 59  
 1882 *Buccinum* (m. *Tritia*?) *turbinellus*, – HOERNES & AUINGER: 148 (non BROCCHI 1814)  
 1958 *Hinia (Uzita) turbinella*, – BEER-BISTRICKÝ: 66 (non BROCCHI 1814)

**Description:** Elongated, small-sized (5–8 mm) shell with flat spire whorls, moderately convex body whorl and slightly stepped spire. Sharp, wide-spaced axial ribs are crossed by much weaker spiral ribs or threads which sometimes are strongly reduced on the body whorl. A characteristic spiral furrow close to the adapical suture separates a row of pointed tips of the axial ribs. The specimen presented by HÖRNES (1852) displays only a weak spiral sculpture, whereas nearly all other specimens from Niederleis and Forchtenau in Austria have a much stronger ornamentation.

Aperture elongated; outer lip bears several distinct, sharp internal lirae; inner lip with strong parietal tooth and a second one in the anterior part of the columella. Weak plications or granulations may appear along the columellar lip. The transition to the short siphonal canal is clearly marked by a prominent tooth on the outer lip and the narrow terminal fold on the columellar lip.

The low conical protoconch has 3.5 moderately rounded whorls measuring 1.22 mm in height and 1.33 mm in maximum diameter. The protoconch-angle amounts 75–80°. The first whorl measures 0.05–0.06 mm in the

width of the initial cap-like onset and 0.22–0.23 mm in maximum diameter. The transition from the embryonic to the larval shell is not preserved. In the course of the second whorl two abapical spiral cords are visible which persist all over the protoconch-whorls. The lower abapical cord just above the suture is stronger developed and bears subordinated sculpture of four spiral threads which may disintegrate in spiral rows of longitudinal tubercles. The protoconch is terminated by a thickened rim of the shell.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage. It differs from the similar protoconch of *Nassarius schroeckingeri* by its considerably larger size.

The species is rarely reported and was usually intermingled with the Middle to Upper Miocene *Profundinassa turbinella*. The holotype of „*Buccinum turbinellus* BROCCHI 1814“ was re-illustrated by ROSSI RONCHETTI (1951–1956, fig. 120) and PINNA & SPEZIA (1978: pl. 13, fig. 3) and offers several obvious differences which prevent from a lumping of both taxa. Despite the convergent development of the sculpture: *turbinella* differs by the oblique and shorter aperture and by the unsculptured columellar lip.

The slight anterior strangulation of the spire whorls of some *P. turbinella* is never developed in the Austrian shells. BELLARDI (1882: 123) doubted that the Viennese specimens are conspecific with the Italian species and compared them with *Profundinassa inaequalis* (BELLARDI 1882) [figured in FERRERO MORTARA & al. 1981]. This species, too, is a poor candidate for the identification of the Austrian shells, due to its ovoid body whorl and the coalescing spire whorls. In fact, KOENEN (1872) already recognised the differences between *P. turbinella* from the Miocene of the North Sea Basin and the species from the Vienna Basin described by HÖRNES (1852) and thus introduced *Nassa Fuchsi* as new name. Later this name was erroneously assigned to specimens from the North Sea Basin whereas the connection to the Paratethys became lost in the literature (see MOSTAFAVI 1979 and JANSSEN 1984 for further discussion upon the North Sea species).

BELLARDI (1882) described several species which are reminiscent of the Paratethyan species. These are especially the Tortonian „*Nassarius*“ *diadematus* (BELLARDI 1882), „*Nassarius*“ *exsculptus* (BELLARDI 1882), and „*Nassarius*“ *ringens* (BELLARDI 1882). Although these younger species agree largely in surface sculpture and the large, low protoconch they all differ in the ornamentation or shape of the aperture. *N. ringens* forms a deep concavity of the columellar lip (see FERRERO MORTARA & al. 1981) whilst *N. exsculptus* and *N. diadematus* lack the teeth of the columellar lip.

**Distribution:** The earliest occurrence in the Central Paratethys derives from the Karpatian of the Korneuburg Basin in Austria. During the Badenian this characteristic species is only known from the Vienna Basin, where it

appears in several Lower Badenian sections in fair numbers. Reported occurrences from the Miocene of the North Sea Basin are rejected by MOSTAFAVI (1979).

#### Dubious species mentioned from the Central Paratethys

The following taxa are described by HÖLZL (1958) and STEININGER & al. (1971) from the Eggenburgian of the Central Paratethys. The preservation of these shells is rather poor, the aperture is usually damaged. Thus the validity and status of the species is doubtful.

*Nassarius angustus* (HÖLZL 1958) - HÖLZL 1958: 244, pl. 20, figs. 16–16 a

**Remarks:** Only known from the Eggenburgian of Bavaria.

*Nassarius badensis praecursor* (HÖLZL 1958) - HÖLZL 1958: 238, pl. 20, fig. 14

**Remarks:** Only known from the Eggenburgian of Bavaria. The information on the aperture of this shell is too poor to decide about its affiliation.

*Nassarius girundicus* (PEYROT 1927) - STEININGER & al. 1973: 401, pl. 10, figs. 7–8

**Remarks:** Known from the Eggenburgian of Slovakia. There are considerable differences in the sculpture of the body whorl of the Slovakian species compared to that of *Nassarius girundicus* (PEYROT) from the Lower Miocene of France. It is therefore unlikely that they are conspecific.

*Nassarius facki* (KOENEN 1872) - HÖLZL 1958: 239, pl. 20, fig. 13

**Remarks:** Described from the Eggenburgian of Bavaria.

*Nassarius bocholtensis* (BEYRICH 1854)

**Remarks:** This species was not illustrated by HÖLZL (1958). It is the only record of this species which was otherwise restricted to the Miocene of the North Sea Basin.

*Nassarius fortocostatus* (HÖLZL 1958) - HÖLZL 1958: 241, pl. 20, fig. 15

**Remarks:** Only known from the Eggenburgian of Bavaria. There are some similarities with *Nassarius hochstetteri* (HÖRNES & AUINGER 1882).

*Nassarius lineolatus* (GRATELOUP 1834)

**Remarks:** This species was not illustrated by HÖLZL (1958); the aperture is unknown in all Bavarian species.

*Nassarius* cf. *incommodans* (PEYROT 1927)

**Remarks:** According to HÖLZL (1958) he based this name only on steinkerns.

*Cylleninae* BELLARDI 1882

The *Cylleninae* comprise the genera *Cyllene* GRAY in GRIFFITH and PIGEON 1834, which is known by fossils from the Miocene and Pliocene of Europe and Asia and which is today distributed over West-Africa and the tropical Indo-West Pacific (CERNOHORSKY 1984 b) and *Cyllenina* BELLARDI 1882 which occurred in the Miocene and Pliocene of Europe.

*Cylleninae* comprise small to medium sized solid shells, which are characterised by large elongated body whorls and short spires. Sculpture consists of prominent axial ribs and subordinated spiral threads. The elongate aperture bears heavy columellar and parietal callus pads. A distinct sutural groove is present. The subfamily is well distinguished from the Nassariinae and Dorsaninae by the protoconch morphology: The protoconch-angle amounts less than 60° and the larval shell does not show any sculptural pattern aside from growth lines (see also planktrophic protoconchs of Recent Indo-Pacific *Cylleninae* as figured by CERNOHORSKY 1984: Figs. 169–173), whereas the protoconch angle is larger than 60° in Nassariinae and Dorsaninae, where also frequently spiral cords occur, sculpturing the larval shells.

*Cyllene* GRAY in GRIFFITH & PIGEON 1834

Type species: *Cyllene owenii* GRAY in GRIFFITH & PIGEON 1834 - Recent, West Africa.

*Cyllene desnoyersi* (BASTEROT 1825)

Pl. 4, Fig. 3

- 1825 *Nassa desnoyersi* BASTEROT: 50, pl. 2, fig. 13  
 1837 *Nassa Desnoyeri*, – PUSCH: 124  
 1852 *Buccinum lyratum*, – HÖRNES: 152, pl. 12, fig. 19 (non LAMARCK 1822)  
 1882 *Buccinum (Cyllene) lyratum*, – HOERNES & AUINGER: 148 (non LAMARCK 1822)  
 1904 *Cyllene Desnoyersi*, – SACCO: 106, pl. 14, figs. 50–52  
 1927 *Cyllene Desnoyersi*, – PEYROT: 166, pl. 4, figs. 9–14  
 1952 *Cyllene (Cyllene) desnoyersi turonica*, – GLIBERT: 347, pl. 10, fig. 12  
 1984 *Cyllene desnoyersi desnoyersi*, – CERNOHORSKY: 219  
 1997 *Cyllene (Cyllene) desnoyersi*, – BAŁUK: 19, pl. 5, figs. 1–3  
 2001 *Cyllene desnoyersi*, – LOZOUET & al.: 61, pl. 26, figs. 11 a–b

**Description:** Ovoid, robust shell with pointed spire. Spire whorls bear a row of knobby nodes along the anterior suture and develop a concavity posterior to these nodes. Sutures slightly wavy, grooved. Body whorl with narrow and usually strongly concave sutural ramp. Shoulder marked by blunt axially elongated nodes, which often form distinct axial ribs or axial swellings. The sutural ramp and the base may bear several spiral threads. Thick outer lip with 10–14 distinct, thin internal lirae. Anal canal narrow, incised reaching to the suture. Siphonal canal narrow, strongly reflected and deeply incised.

Anterior half of columella with well defined callus and occasionally developed plications. Siphonal fasciole with oblique spiral cord.

CERNOHORSKY (1984 a) divides the lineage leading from the European Neogene to the Recent West African species into three chrono-subspecies *Cyllene desnoyersi desnoyersi* (BASTEROT) > *Cyllene desnoyersi turonica* (PEYROT) > *Cyllene desnoyersi lamarcki* (CERNOHORSKY).

**Distribution:** The species arises already during the Aquitanian in France (LOZOUET & al. 2001) and is commonly found in Burdigalian deposits of the Mediterranean and the NE Atlantic. In the Central Paratethys *Cyllene desnoyersi* appears during the Badenian. It is found as rare species across this bioprovince from Romania in the south to Poland in the North. After a considerable gap in record the species appears again in the Mediterranean Lower Pliocene (BELLARDI 1882). This points to a re-immigration from an eastern Atlantic distribution area which might be linked to the Early Pliocene climatic optimum.

**Remarks:** The specimens from the Badenian of the Vienna Basin document some variability in the strength of the axial sculpture which is sometimes more or less obsolete.

*Cyllenina* BELLARDI 1882

Type species: *Buccinum ancillariaeforme* GRATELOUP 1834 –Upper Burdigalian of the Aquitaine (France), St.-Jean-de-Marsacq (dating according to LOZOUET 1998).

The genus is characterised by its conspicuous parietal callus which is often not fully covered by the following whorls. Thus a more or less narrow rim, bulge or band appears close to the suture – the so-called *Cyllenina* band. The whorls are generally only moderately convex, the body whorl is often subcylindrical or conical. Sculpture is dominated by nodes. Aside from the base, the shells lack any spiral ribs or threads.

*Cyllenina ancillariaeformis* (GRATELOUP 1834)

Pl. 4, Figs. 4–7

- 1834 *Buccinum ancillariaeforme* GRATELOUP: 212.  
 1840 *Buccinum ancillariaeforme*, – GRATELOUP, pl. 36, fig. 3  
 1847 *Nassa miocenica* MICHELOTTI: 205, pl. 17, fig. 1  
 1852 *Buccinum miocenicum*, – HÖRNES: 153 (partim), pl. 12, fig. 21  
 1882 *Buccinum* (c. *Uzita*) *miocenicum*, – HOERNES & AUINGER: 135, pl. 13, fig. 32  
 1882 *Cyllenina ancillariaeformis*, – BELLARDI: 162, pl. 10, figs. 17 a–b  
 1911 *Cyllene ancillariaeformis*, – FRIEDBERG: 106, textfigs. 28–29  
 1966 *Cyllene (Cyllenina) ancillariaeformis*, – STRAUSS: 338, pl. 37, figs. 6–7

**Description:** Medium-sized robust shells with acute, pointed spire and cylindrical body whorl. The

hardly convex early spire whorls bear a row of nodes close to the anterior suture. On later spire whorls a very characteristic, bulgy spiral swelling is intercalated between the suture and this row of nodes. The bulge is caused by the conspicuous parietal swelling which is not fully covered by the following whorl. Sculpture of body whorl consists of a row of blunt nodes along a weak shoulder. The nodes may pass into axial swelling or may be strongly reduced. Outer lip moderately thin with several internal lirae. Columellar lip dominated by the knobby parietal callus but narrow and reflected below. Prominent, sharp, oblique spiral cord borders the inconspicuous siphonal fasciole.

**Remarks:** This is the type species of the genus *Cyllenina* BELLARDI 1882. Due to the poor illustration by GRATELOUP (1840) MICHELOTTI (1847) introduced the synonym *Nassa miocenica*, to which many authors dealing with Paratethyan gastropods referred to.

**Distribution:** In the Paratethys this species is only known from the Badenian of Austria, Hungary, and Poland whereas it is recorded from the Upper Burdigalian to the Tortonian of France and the Tortonian of Northern Italy (PEYROT 1928, BELLARDI 1882).

***Cyllenina hontensis* (CSEPREGHY-MEZNERICS 1956)**

- 1956 *Nassa (Uzita) hontensis* CSEPREGHY-MEZNERICS: 405, pl. 7, figs. 24–25  
 1966 *Cyllene? (Cyllenina?) hontensis*, – STRAUZ: 339, pl. 37, figs. 8–9

**Remarks:** The species is based on a single, not well preserved shell from Szob in Hungary. It is probably rather a freak specimen of *Cyllenina nodosocostata* or *Cyllenina ancillariaeformis*.

***Cyllenina suessi* (HOERNES & AUINGER 1882)**

Pl. 4, Fig. 8

- 1882 *Buccinum (Cominella) Suessi* HOERNES & AUINGER: 117, pl. 15, figs. 6 a, b  
 1958 *Dorsanum (Dorsanum) suessi*, – BEER-BISTRICKÝ: 48, pl. 1, figs. 6 a, b  
 1967 *Dorsanum baccatum*, – KÓKAY: 86 (non BASTEROT 1825)  
 1973 *Dorsanum (Dorsanum) baccatum*, – STEININGER & al.: 422, pl. 6, fig. 9 (non BASTEROT 1825)  
 1998 *Bullia (Bullia) suessi*, – SCHULTZ: 66, pl. 26, fig. 11  
 2002 *Dorsanum suessi*, – HARZHAUSER: 106, pl. 8, fig. 18

**Description:** Large-sized, elongate ovate shell with acuminate spire. Very characteristic sculpture of two rows of 10–12 large, blunt, rounded nodes; one adsutural row is adjoined by a second one coinciding with a slight shouldering of the whorls. Between both rows a narrow, concave sutural ramp is developed. 3–4 spiral ribs appear on the base being separated by a distinct spiral groove from the narrow but prominent rim terminating the siphonal fasciole. Aperture elongate, wide with indistinct, narrow posterior canal. Columella

smooth except for the twisted terminal fold. Outer lip probably thin; columellar lip indifferent in the parietal part and thin and narrow in the anterior part. *Cyllenina* band rarely developed and always very narrow.

**Remarks:** The separation from the resembling *Duplicata? baccata* (BASTEROT 1825) (sensu PEYROT 1927) from the Lower Miocene of France is based on the lower spire, the absence of the delicate spiral threads on the sutural ramp of *Duplicata? baccata*, the shorter siphonal canal and the rounded cord of the siphonal fasciole whereas *D. baccata* develops a very sharp rim. The strict, hardly varying sculpture and shape as well as the already mentioned cord allow also a clear separation from *Duplicata haueri*.

**Distribution:** *Cyllenina suessi* experiences its acme in the Karpatian but appears also in the Lower Badenian. Its earliest occurrence was mentioned by HÖLZL (1973) from the Ottnangian of Bavaria. Generally, it is only described from the Central Paratethys.

***Cyllenina grundensis* (HOERNES & AUINGER 1882)**

Pl. 4, Figs. 9–10

- 1852 *Buccinum miocenicum*, – HÖRNES: 153 (partim), pl. 12, fig. 20 (non MICHELOTTI 1847)  
 1882 *Buccinum* (c. *Cominella?*) *Grundense* HOERNES & AUINGER: 118, pl. 15, fig. 9  
 1882 *Buccinum* (d. *Cominella?*) *bohemicum* HOERNES & AUINGER: 119, pl. 15, fig. 10  
 1958 *Dorsanum (Dorsanum) grundense*, – BEER-BISTRICKÝ: 48  
 1958 *Dorsanum (Dorsanum) bohemicum*, – BEER-BISTRICKÝ: 49  
 1966 *Dorsanum nodosocostatum grundense*, – STRAUZ: 337, pl. 37, fig. 1 (non *Buccinum Grundense* HOERNES & AUINGER 1882)

**Remarks:** This large-sized species is quite similar to *Cyllenina suessi* (HOERNES & AUINGER 1882). It differs in its ancillariid outline which is caused by the absence of the sutural ramp of *Cyllenina suessi* and by the convex to hardly concave base of *Cyllenina grundensis*. The shells lack any nodes but display axial ribs formed by blunt swellings. These are well developed on late spire whorls but fade out towards the base of the body whorl. A bulgy adsutural band caused by the parietal callus of the foregoing whorls – the *Cyllenina* band – is well developed.

*Buccinum bohemicum* HOERNES & AUINGER 1882 is based on a subadult, rather small sized shell. At the section Grund all available shells are adult and of more or less the same size due to the sorting. Thus the small shell from Bohemia seems to have deduced HOERNES & AUINGER (1882) to create the new name.

**Distribution:** The species is only known from the Badenian of Austria, Hungary, and the Czech Republic.

***Cyllenina neumayri* (HOERNES & AUINGER 1882)**

Pl. 4, Figs. 11–12

- 1882 *Buccinum* (b. *Cominella*) *Neumayri* HOERNES & AUINGER: 118, pl. 15, figs. 7–8

- 1958 *Dorsanum (Dorsanum) neumayri*, – BEER-BISTRICKÝ: 48, pl. 1, fig. 7  
 1998 *Bullia (Bullia) neumayri*, – SCHULTZ: 66, pl. 26, fig. 12

**Description:** Very slender, medium-sized shell with high spire and an apical angle of about 30°. Spire whorls bear a prominent median row of up to 10 axially elongated nodes and a second weaker row of beads at the posterior suture. A slight concavity between these spiral sculpture elements passes into a distinct sutural ramp on the short body whorl. Elongate aperture with thin outer lip. Columellar lip thin poorly defined in the parietal region but reflected and slightly detached in the anterior part. The terminal columellar fold is separated by a narrow groove from a second weak spiral plication. Siphonal fasciole with sharp spiral cord. The sutural *Cyllenina* band is only weakly developed and is most prominent on early spire whorls.

**Remarks:** There are some superficial similarities with the *Duplicata haueri*-group in shape and sculpture. A separation of *Cyllenina neumayri* is obvious from the characteristic plication close to the terminal columellar fold, the even more slender shell and the shorter body whorl. Further, the siphonal canal of *Cyllenina neumayri* is less twisted. Thus the suggestion of SCHAFFER (1912: 146) to treat *Cyllenina neumayri* as subspecies or variation of *Duplicata haueri* has to be rejected.

**Distribution:** The species was described by HOERNES & AUINGER (1882) from the Lower Badenian Grund Formation in Austria where it appears in considerable numbers. The occurrence of this species in the Burdigalian of Northern Italy as suggested by BELLARDI (1882: 171) is unchecked.

#### *Cyllenina echinata* (HÖRNES 1852)

Pl. 4, Figs. 13–14

- 1852 *Buccinum echinatum* HÖRNES: 159, pl. 13, figs. 12–13  
 1882 *Buccinum (Hebra) echinatum*, – HOERNES & AUINGER: 136  
 1958 *Dorsanum (Dorsanum) echinatum*, – BEER-BISTRICKÝ: 50  
 1967 *Dorsanum (Dorsanum) echinatum*, – TEJKAL & al., S. 201, pl. 11 B, figs. 3–5  
 2002 *Dorsanum echinatum*, – HARZHAUSER: 105, pl. 8, figs. 16–17

**Description:** Slender ovoid shell with pointed spire and large body whorl. The characteristic sculpture consists of pointed nodes. These appear in two spiral rows on the penultimate whorl and increase to 3–4 rows on the body whorl; axially they are arranged in 9–13 rows. Early spire whorls lack spines but develop axially elongated, rounded nodes along the anterior suture.

Aperture elongated, pointed in the posterior part and with wide canal. Outer lip moderately thick, bearing about 5–7 internal lirae. Inner lip reflected, well developed in the anterior part but indistinct and hardly demarcated towards the base. Siphonal fasciole terminated by narrow, strong rims. The posterior rim is strongly separated from the base by a deep spiral incision.

**Remarks:** BELLARDI (1882) discussed the relation of *Cyllenina echinata* with his *Cyllenina bicoronata* and *C. subumbilicata*. Both species differ considerably by the well developed inner lip but much more by their sculpture which lacks the spines.

**Distribution:** *Cyllenina echinatum* is restricted to the Karpatian and Lower Badenian of the Central Paratethys. It experiences a considerable optimum during the Karpatian and becomes a rare and ancillary species in Lower Badenian deposits of the Austrian Grund Formation. A dubious occurrence from the Lower Badenian of Poland was described by BAŁUK (1997).

#### *Cyllenina nodosocostata* (HILBER 1879)

Pl. 4, Figs. 15–16

- 1879 *Buccinum nodoso-costatum* HILBER: 428, pl. 2, figs. 4–6  
 1882 *Buccinum* (b. *Uzita*) *nodosocostatum*, – HOERNES & AUINGER: 134, pl. 15, figs. 3–5  
 1966 *Dorsanum nodosocostatum*, – STRAUZ: 335, pl. 36, figs. 19–23  
 1990 „*Cyllenina*“ *nodosocostata*, – ALLMON: 22

**Description:** Medium-sized, robust shells with slightly stepped spire and higher, subcylindrical body whorl. Early spire whorls bear two spiral rows of nodes which are usually axially united into densely spaced ribs. The adapical nodes are slightly more prominent and tend to form a weak, bulgy shoulder of the body whorl. This bears slightly sigmoidal to weakly oblique axial ribs. Occasionally a shallow incision separates the posterior tips of the ribs. On the base the axial ribs become weaker and are incised by 3–5 spiral grooves and spiral threads. Outer lip thin, rarely with internal lirae and with shallow „stromboid“ notch. Inner lip with prominent parietal callus, anteriorly well defined and reflected. Very sharp and well developed oblique cord bordering the fasciole.

**Remarks:** There are some superficial similarities with *Cyllenina ancillariaeformis* (GRATELOUP 1834) in its overall shape. Nevertheless the species are well distinguished by the sculpture of the early spire whorls. The densely spaced axial ribs or axially blended nodes of *Cyllenina nodosocostata* are absent in *C. ancillariaeformis*. Additionally, the axial ribs of the body whorl of *C. nodosocostata* are replaced by blunt axial swellings or even only by a single row of nodes in *C. ancillariaeformis*. Last not least the prominent sutural bulge of *Cyllenina ancillariaeformis* is unknown from *C. nodosocostata*.

**Distribution:** A common species of the Lower Badenian in Austria, Hungary

#### *Cyllenina uniseriata* (KÓKAY 1973)

- 1973 *Dorsanum (Dorsanum) nodosocostatum uniseriatum* KÓKAY in STEININGER & al.: 423, pl. 6, figs. 7–8

**Remarks:** Differs in its extremely stepped spire and the bulgy shoulder from all other Paratethyan nassa-



riids. However, without these features it would not differ at all from *Cyllenina grundensis* (HOERNES & AUINGER 1882). Thus, as already discussed by KÓKAY in STEININGER & al. (1973) a close relationship between these species is likely - maybe *Cyllenina uniseriata* is the Early Miocene ancestor of the Badenian species.

The taxon was originally introduced as a subspecies of *Cyllenina nodosocostata* (HILBER 1879). That species differs considerably in size (smaller), shape (less inflated body whorl, relatively shorter spire) and sculpture (axial ribs on early spire whorls). Therefore any closer relation between *Cyllenina uniseriata* and *C. nodosocostata* has to be rejected.

**Distribution:** Only known from the Ottnangian of Várpalota in Hungary.

***Cyllenina ternodosa* (HILBER 1879)**

Pl. 4, Figs. 19–20

- 1852 *Buccinum Haueri* HÖRNES: 159, pl. 13, fig. 11 (non MICHELOTTI 1847)  
 1879 *Buccinum ternodosum* HILBER: 15, pl. 12, fig. 7  
 1882 *Buccinum (Hebra) ternodosum*, – HOERNES & AUINGER: 136, pl. 15, figs. 1–2  
 1912 *Buccinum (Hebra) ternodosum*, – SCHAFFER: 145, pl. 51, fig. 7  
 1958 *Dorsanum (Dorsanum) ternodosum*, – BEER-BISTRICKÝ: 49  
 1966 *Dorsanum nodosocostatum ternodosum*, – STRAUZ: 336, pl. 36, figs. 16–18  
 1967 *Dorsanum (Dorsanum) ternodosum*, – TEJKAL & al., S. 201  
 1973 *Dorsanum (Dorsanum) ternodosum*, – STEININGER & al.: 422, pl. 6, fig. 4  
 2002 *Dorsanum ternodosum*, – HARZHAUSER: 106, pl. 8, fig. 15

**Description:** Small- to medium-sized shells with stepped, rarely even cyrtocoid spire and narrow, subcylindrical to elongate-ovoid body whorl. Spire whorls bear two rows of knobby nodes close to the sutures, separated by a narrow constriction. An additional third row of nodes may appear on the body whorl. Axially, these nodes are arranged into 10–12 rows. A characteristic band of about 2 mm width is formed on the base. It is bordered by a shallow groove below the third spiral row and a weak cord close to the siphonal fasciole. The slightly raised band may be separated into two or three ribblets by weak furrows. Aperture narrow, elongate, strongly narrowed in its posterior termination by a swollen parietal callus. Outer lip thin; occasionally few denticles are developed deep inside the aperture.

The protoconch is not well preserved. It comprises about 1.25 rounded whorls measuring 0.46 mm in height and in maximum diameter. The transition to the teleoconch is indistinct.

**Remarks:** The protoconch is indicative of a direct development with hatching of crawling young. STRAUZ (1966) treated *Cyllenina ternodosa* as subspecies of *C. nodosocostata* (HILBER 1879). Aside from the different shape and sculpture of the early spire whorls this point

of view has to be rejected in respect to the completely different sculpture of the base.

Another dubious species was introduced by STRAUZ (1966) as *Dorsanum nodosocostatum schreteri* nom. nov. According to STRAUZ (1966) these stout shells are linked with typical representatives of *Cyllenina ternodosa* by transitional morphs. Hence it would represent an aberrant *C. ternodosa*.

**Distribution:** The species appears during the Eggenburgian of Austria. Scattered occurrences are also recorded for the Ottnangian (STEININGER & al. 1973); it experiences its acme during the Karpatian but survives also into the Badenian.

***Cyllenina dorsaniformis* (SVAGROVSKÝ 1960)**

- 1960 *Nassa (Hinia) dorsaniformis* SVAGROVSKÝ: 91, 143, pl. 10, figs. 1–11, pl. 11, figs. 5–7  
 1970 *Nassa dorsaniformis*, – BALUK: 143

**Remarks:** The species is reminiscent of the Sarmatian *Duplicata duplicata* group but differs in its parietal callus and the adsutural spiral rows of knobby nodes decorating the early spire whorls. These features are more similar to *Cyllenina nodosocostata* (HILBER 1879) or *C. ternodosa* (HILBER 1879). Nevertheless, its stout, convex body whorl and the resulting broad aperture prevent from a lumping of these species. Furthermore, it lacks the basal sculpture of *Cyllenina nodosocostata*.

**Distribution:** Known from the Upper Badenian of Slovakia and Poland.

**Dorsaninae COSSMANN 1901**

The subfamily comprises small to medium sized elongated moderately thin shells. Sculpture consists of more or less developed axial ribs and subordinated spiral threads. Sculpture is often reduced. The body whorl is usually large, characterised by a wide aperture with a well rounded outer lip. The columellar and parietal portion are only moderately thickened by a callus. A broad basal notch and a slit like slightly pointed posterior canal is present.

According to CERNOHORSKY (1984 b) the subfamily is documented by 4 fossil and 5 Recent genera. Fossils united within the genus *Desorinassa* NUTTALL and COOPER 1973 range back to the Palaeocene of Europe. This genus has also been reported from the Eocene of Alabama (CERNOHORSKY 1984 a). Recent genera of the Dorsaninae are distributed in the bioprovinces of South America, West-Africa and the Indian Ocean.

***Duplicata* ZHIZHENKO in KOLESNIKOV 1939**

**Type species:** *Duplicata duplicata* (SOWERBY 1832) from the Sarmatian of Styria in Austria.

**Remarks:** Miocene representatives of *Duplicata* have traditionally been assigned to *Dorsanum* GRAY 1847. Indeed, it seems to be closely related to *Dorsanum* GRAY 1847 with the sole living species *Dorsanum miran* (BRUGUIÈRE 1789). The separation is mainly based on consistent differences in the sculpture. Whereas *Dorsanum* displays glossy shells with strongly reduced axial sculpture on early spire whorls and a smooth body whorl, *Duplicata* produces strong axial sculptures down to the body whorl and develops an adsutural row of nodes. Additionally, shouldering and sutural ramp, frequently formed in *Duplicata*, is missing in *Dorsanum* s.s. The protoconch of *Dorsanum miran* is comparatively slender and smooth (ALLMON 1991: Pl. 6, figs. 5–8), whereas it is broad low conical in *Duplicata* in case of planktotrophy and bears spiral sculpture on the larval shell (see below). *Duplicata* differs from *Cyllenina* (BELLARDI 1882) by the inconspicuous parietal area which lacks the knobby swelling of *Cyllenina*. Consequently the *Cyllenina*-band is absent in *Duplicata*.

***Duplicata haueri* (MICHELOTTI 1847)**

Pl. 5, Figs. 1–4

- 1847 *Buccinum Haueri* MICHELOTTI: 204, pl. 17, figs. 3 a–b  
 1852 *Buccinum baccatum*, – HÖRNES: 156, pl. 13, fig. 9 (non BASTEROT 1825)  
 1882 *Buccinum* (a. *Uzita*) *Haueri*, – HOERNES & AUINGER: 133  
 1904 *Dorsanum Haueri*, – SACCO: 73, pl. 17, figs. 1–2  
 1912 *Buccinum (Dorsanum) Haueri excellens* SCHAFFER: 146, pl. 51, figs. 1–3  
 1912 *Buccinum (Dorsanum) Haueri scalata* SCHAFFER: 146, pl. 51, figs. 4–5  
 1912 *Buccinum (Dorsanum) Haueri sub-suessi* SCHAFFER: 147, pl. 51, fig. 6  
 1958 *Dorsanum (Dorsanum) haueri excellens*, – BEER-BISTRICKÝ: 47, pl. 1, figs. 5 a–f  
 1958 *Dorsanum (Dorsanum) haueri scalata*, – BEER-BISTRICKÝ: 47  
 1958 *Dorsanum (Dorsanum) haueri sub-suessi*, – BEER-BISTRICKÝ: 48  
 ?1958 *Bullia (Dorsanum) aquense*, – HÖLZL: 234 (non GRATELOUP 1847)  
 ?1958 *Bullia (Dorsanum) aff. baccata*, – HÖLZL: 235 (non BASTEROT 1825)  
 1958 *Bullia (Dorsanum) haueri*, – HÖLZL: 236, pl. 20, fig. 11  
 ?1958 *Bullia (Dorsanum) intermedia* HÖLZL: 237, pl. 20, figs. 12–12 a  
 1971 *Dorsanum (Dorsanum) haueri excellens*, – STEININGER & al.: 400, pl. 10, fig. 10  
 2002 *Dorsanum haueri excellens*, – HARZHAUSER: 106, pl. 8, fig. 13

**Description:** Medium- to large-sized, elongate ovate shells displaying a vast variability concerning size, shape and sculpture. Typically, early spire whorls develop a posterior row of granules or nodes separated from a usually more prominent anterior row of nodes. This sculpture may range from distinct nodes via axially elongated nodes to regular axial ribs covering about 2/

3 of the spire whorl height. A slightly concave sutural ramp forms between these spiral elements. The posterior row of nodes holds on to the body whorl and is only rarely reduced. In contrast the second row – coinciding with a shoulder of the body whorl – is strongly variable and often gives rise to blunt axial ribs reaching to the base. 3–4 spiral threads are restricted to the base, whereas no spiral cords, threads or furrows are developed on the spire or body whorls. Elongate, pointed aperture with thin outer lip, moderately defined inner lip with weak parietal expansion and narrow but distinct terminal fold. Occasionally some plications appear in the middle of the outer lip. Siphonal fasciole limited by a sharp, prominent cord.

The protoconch comprises 2.25 rounded whorls measuring 0.5 mm in height and in maximum diameter. The first whorl is rapidly increasing in diameter. It measures 0.04 mm in the width of the initial cap-like onset and 0.24 mm in maximum diameter. A thin suprasutural spiral cord, which may disintegrate to a spiral row of tubercles, occurred in the course of the second whorl. The protoconch is terminated by a thickened rim of the shell.

**Remarks:** The protoconch is indicative of an indirect development including a free planktotrophic larval stage. When describing this species MICHELOTTI (1847: 205) already referred to specimens from Austria which he had received from Franz von HAUER from the collection of the Geological Survey Vienna.

Later, BELLARDI (1882) intermingled this species with a representative of *Cyllenina* and described them as „Variation A“ and „Variation B“. For these specimens the names *Cyllenina paucicostata* (SACCO 1890) and *Cyllenina subecostata* (SACCO 1890) are available whereas the original specimen has to be treated as *Duplicata haueri* (MICHELOTTI 1847).

The morphologic plasticity of this species is well expressed by three variation names introduced by SCHAFFER (1912). Within the large number of species which are available from the Eggenburgian section Maria Dreieichen in Austria, from where SCHAFFER (1912) described his variations, all transitions between these forms are represented. Thus we reject a subspecies concept for this species. The range of variation concerning outline and sculpture corresponds fully to that of the Sarmatian *Duplicata duplicata* (SOWERBY 1832).

**Distribution:** *Duplicata haueri* occurs in the Eggenburgian of Austria and Bavaria and in the Burdigalian of Northern Italy. Its latest undoubted representatives are described by HARZHAUSER (2002) from the Karpatian of the Austrian Korneuburg Basin. Some poorly preserved shells from the Lower Badenian of the Styrian Basin may be a hint towards some Middle Miocene relic populations.

***Duplicata duplicata* (SOWERBY 1832)**

Pl. 5, Figs. 5–10, Pl. 7, Figs. 11–12

- 1831 *Buccinum baccatum*, – DUBOIS DE MONTPEREUX: 28, pl. 7, figs. 24–25 (non BASTEROT 1825)

- 1832 *Buccinum duplicatum* SOWERBY in SEDGWICK & MURCHINSON: 420, pl. 39, fig. 14  
 1883 *Buccinum (Cominella) Höllesense* HANDMANN: 166  
 1883 *Buccinum nodulosum* HANDMANN: 167  
 1932 *Buccinum janitor* KOLESNIKOV: 67, pl. 1, figs. 1–5  
 1932 *Buccinum janitor sokolovi* KOLESNIKOV: 68, pl. 1, figs. 6–9  
 1932 *Buccinum duplicatum*, – KOLESNIKOV: 75, pl. 1, figs. 30–35  
 1932 *Buccinum duplicatum longinquum* KOLESNIKOV: 81, pl. 1, figs. 36–38  
 1932 *Buccinum opinabile* KOLESNIKOV: 84, pl. 2, figs. 17–22  
 1932 *Buccinum opinabile trabale* KOLESNIKOV: 85, pl. 2, figs. 23–25  
 1935 *Buccinum duplicatum*, – KOLESNIKOV: 243, pl. 29, figs. 7–9  
 1935 *Buccinum opinabile*, – KOLESNIKOV: 247, pl. 29, figs. 24–26  
 1954 *Dorsanum duplicatum duplicatum*, – PAPP: 51, pl. 8, figs. 1–5, 8–10  
 1954 *Dorsanum opinabile opinabile*, – PAPP: 52, pl. 8, figs. 11–13  
 1954 *Dorsanum opinabile trabale*, – PAPP: 53, pl. 8, figs. 6–7  
 1954 *Dorsanum duplicatum gradaria*, – PAPP: 52, pl. 8, figs. 21–23  
 ?1958 *Dorsanum (Dorsanum) duplicatum voeslauensis* BEER-BISTRICKÝ: 51, pl. 1, fig. 9  
 1959 *Dorsanum duplicatum duplicatum*, – BODA: 719, pl. 30, figs. 1–3  
 1969 *Dorsanum (Duplicata) duplicatum duplicatum*, – KOJUMDGIEVA: 104, pl. 35, figs. 8–11  
 1971 *Dorsanum duplicatum duplicatum*, – SVAGROVSKÝ: 381, pl. 67, figs. 1–14  
 1971 *Dorsanum opinabile opinabile*, – SVAGROVSKÝ: 386, pl. 68, figs. 3–6  
 1971 *Dorsanum opinabile trabale*, – SVAGROVSKÝ: 389, pl. 68, figs. 7–9  
 1974 *Dorsanum duplicatum duplicatum*, – PAPP: 350, pl. 9, figs. 1–6  
 1992 *Dorsanum duplicatum*, – SCHÜTT: 170, pl. 2, fig. 42.  
 1998 *Bullia* („*Dorsanum*“) *duplicatum gradaria*, – SCHULTZ: 130, pl. 59, fig. 12

**Description:** Medium-sized, robust, elongate ovate shells with pointed spire and moderately convex, somewhat subcylindrical body whorl. The sculpture of the spire whorls consists of an adsutural row of nodes and a second row of usually strongly axially elongated nodes to ribs in the anterior 2/3 of the whorls. The height of this part of the whorls increases on the latest spire whorls which then display straight, flat flanks, posterior bordered by a distinct concavity.

The posterior row of nodes holds on to the body whorl whereas the anterior row grades into straight to sigmoidal axial ribs. These are extremely variable in shape and density ranging from few blunt ribs to numerous fine to nearly obsolete riblets. The posterior tips of the ribs may occasionally form a weak shoulder of the body whorl, although in most shells the sutural knobs roughly coincide with the maximum diameter.

Aperture elongated with pointed posterior part and moderately long, twisted siphonal canal. The columella is smooth except for a strong terminal fold. Outer lip thin, rarely few, weak internal lirae are developed. Inner

lip indistinct in the posterior part but well developed and slightly detached in the anterior half. Siphonal fasciole broad, bulgy, bordered by a very prominent, sharp oblique cord. This cord, the narrow but reflected anterior part of the columellar lip, and the raised terminal fold may form a distinct frame of the fasciole.

Especially weathered shells exhibit a narrow, slightly depressed fasciolar band on the base.

The protoconch consists of slightly more than one bulbous whorls. It measures 0.56–0.6 mm in height and in maximum diameter. The apical angle amounts 55°. The first whorl measures 0.2–0.22 mm in the width of the initial cap-like onset and 0.5–0.54 mm in maximum diameter. Closely spaced not sinuous growth lines and a following thickened rim are terminating the protoconch.

**Remarks:** The protoconch is indicative of a direct development with hatching of crawling young.

The Sarmatian *Duplicata* lineage seems to be rooted in species which are closely related with *Duplicata haueri*. Both taxa bear similarities in teleoconch morphology, but are easily distinguished by their protoconch morphology. *D. duplicata* represents a direct developer, while *D. haueri* is characterised by a larval shell, reflecting a planktotrophic development. A difference in teleoconch characters are the spiral threads or ribs on the base of *Duplicata haueri*, which are rarely developed in *Duplicata duplicata*. Only *Duplicata gradaria* (KOLESNIKOV 1932) tends to develop these basal spiral ribs, too. The status of this species, which is usually considered to be a subspecies or variety of *Duplicata duplicata* is unclear, since we did not see the type specimens. However, some basal grooves or threads appear seldom within typical populations of *Duplicata duplicata* and thus these elements may rather represent some kind of atavism. Another clear difference is the hardly visible, slightly depressed spiral band on the base of *Duplicata duplicata*.

In any way *Duplicata duplicata* can be traced back to the prae-Sarmatian fauna as it is recorded from Konkian deposits by KOLESNIKOV (1932) as *Buccinum janitor sokolovi*. BEER-BISTRICKÝ (1958), too, described this species from the Badenian as a new chrono-subspecies *Dorsanum duplicatum voeslauensis* from Vöslau and Grund in Austria. Nevertheless, since it was impossible to collect any further material, these shells might have been mislabelled Sarmatian specimens of *Duplicata duplicata*.

Specimens with high numbers and densely spaced axial ribs and inflated body whorl are usually termed *Dorsanum opinabile* (KOLESNIKOV 1839) in the literature. *Dorsanum opinabile trabale* (KOLESNIKOV 1932) differs by a less segregated adsutural row of nodes and a slender body whorl. The latter is a clear transition to the always syntopic and synchronous *Duplicata duplicata*. As there is no clear feature to maintain the separation of the mentioned taxa we consider them to represent various morphs of a single, rather polymorph species as already suggested by KOJUMDGIEVA (1969).

The extreme endpoint of this morphologic plasticity towards the „*trabale* – morph“ is documented by the extraordinarily slender shell described by PAPP (1954: 54, pl. 7, fig. 25) as *Dorsanum corbianum pseudobaccatum* (KOLESNIKOV). The same morph was described by HANDMANN (1883) as *Buccinum (Cominella) Höllesense*.

*Buccinum duplicatum gradaria* KOLESNIKOV 1932 was introduced by KOLESNIKOV (1932, 1935) for specimens with spiral ribs on the anterior part of the body whorl. At least the shells from the Austrian Sarmatian identified as *Dorsanum duplicatum gradaria* by PAPP (1954) are only large, slender specimens of *Duplicata duplicata* and do not represent a valid subspecies.

**Distribution:** The most widespread Sarmatian nassariid species. It appears in the Eastern Paratethys during the Konkian and flourishes in the entire Paratethys in the Sarmatian (*Mohrensternia*-Zone and Volhynian). In the Eastern Paratethys it holds on even to the Bessarabian and it is one of the few nassariids which are still frequently found in the *Mactra*-Zone of the Central Paratethys.

#### *Duplicata dissita* (EICHWALD 1830)

Pl. 5, Figs. 11–12

- 1830 *Buccinum dissitum* EICHWALD: 222  
 1831 *Buccinum dissitum*, – DUBOIS DE MONTPÉREUX: 28, pl. 1, figs. 22–23  
 1844 *Buccinum Douthinae* d'ORBIGNY: 462, pl. 3, figs. 20–21  
 1852 *Buccinum baccatum*, – HÖRNES: 156 (partim), pl. 13, fig. 6 (non BASTEROT 1825)  
 1935 *Buccinum dissitum*, – KOLESNIKOV: 250, pl. 31, figs. 7–9  
 1935 *Buccinum torpidum* KOLESNIKOV: 267, pl. 31, figs. 31–32  
 1940 *Buccinum latesulcum* SIMIONESCU & BARBU: 112, pl. 3, figs. 39–40  
 1954 *Dorsanum dissitum*, – PAPP: 53, pl. 8, figs. 14–15  
 1954 *Dorsanum torpidum*, – PAPP: 53, pl. 8, figs. 19–20  
 1959 *Dorsanum duplicatum dissitum*, – BODA: 720, pl. 30, figs. 5–7  
 1959 *Dorsanum opinabile opinabile*, – BODA: 720, pl. 30, figs. 10–11, pl. 31, figs. 1–2  
 1969 *Dorsanum (Duplicata) dissitum*, – KOJUMDGIEVA: 106, pl. 35, figs. 16–17, pl. 36, fig. 1  
 1969 *Dorsanum (Duplicata) torpidum*, – KOJUMDGIEVA: 107, pl. 36, figs. 7–9  
 1971 *Dorsanum dissitum*, – SVAGROVSKÝ: 391, pl. 68, figs. 10–14  
 1971 *Dorsanum torpidum*, – SVAGROVSKÝ: 395, pl. 69, figs. 1–4  
 1974 *Dorsanum dissitum*, – PAPP: 350, pl. 9, figs. 7–9  
 1974 *Dorsanum torpidum*, – PAPP: 351, pl. 9, figs. 16–17

**Description:** Medium-sized, robust shell with rather short spire and broad, large body whorl with prominent shoulder. This is formed by a row of axially elongated nodes or ribs and a moderately concave sutural ramp which is bordered by a second row of usually weaker adsutural nodes. The convex-conical body whorl contracts evenly. Aperture wide; outer lip thin; columellar lip indistinct aside from its thin, narrow, reflected anterior half. Here, the columella may be slightly flattened

or even weakly concave. Siphonal fasciole identical with that of *Duplicata duplicata*.

**Remarks:** Aside from its broad, stocky body whorl it differs from *Duplicata duplicata* in its wider and distinctly less pointed aperture.

*Duplicata torpida* (KOLESNIKOV 1932) was described by KOLESNIKOV (1932) and KOJUMDGIEVA (1969) from the Bessarabian. SVAGROVSKÝ (1971) and PAPP (1954) used this name also for older specimens from the *Ervilia* Zone of Austria and Slovakia. The separation of the latter specimens from *Duplicata dissita* is highly artificial. Furthermore, the typical Bessarabian representatives of *Duplicata torpida* as illustrated and described by KOJUMDGIEVA (1969) and KOLESNIKOV (1932) seem to be nothing more than a late morphotype of *Duplicata dissita*, characterised by a rather plump shape and reduced sculpture.

**Distribution:** The species appears during the *Ervilia* and *Mactra* Zone of the Central Paratethys. In the Eastern Paratethys it is also recorded from the Volhynian but holds on up to the Bessarabian.

#### *Duplicata ermanni* nov. sp.

Pl. 5, Figs. 13–14

- 1969 *Dorsanum (Duplicatum) subspinosum*, – KOJUMDGIEVA: 112, pl. 38, fig. 1 (non SINZOV 1892)

**Locus typicus:** Wiesen in Burgenland/Austria.

**Stratum typicum:** silty sand of the Sarmatian *Mactra* Zone in the Eisenstadt-Sopron Basin.

**Derivatio nominis:** in honour of Oskar and Friederike ERMANN (Vienna) who are generous sponsors of the earth sciences at the Natural History Museum in Vienna.

**Holotype:** the specimen illustrated as fig. 13 on plate 5; Inv. NHMW 2002z0093/0018

**Paratype:** the specimen illustrated as fig. 14 on plate 5; Inv. NHMW 2002z0093/0019

**Description:** Medium- to large-sized robust shells of 6–7 teleoconch whorls. Spire high, pointed; body whorl rapidly enlarging, broad and strongly convex. Early spire whorls are convex and bear axial ribs which are intersected by thin furrows. Later whorls are angulated; the ribs disintegrate into two axially elongated nodes anterior to the angulation whereas a concave sutural ramp and an adsutural spiral row of nodes - often united into a bulgy rim - follows adapically. All nodes tend to unite into spiral cords within the penultimate and body whorl. Two of these spirals separated by a narrow and weak spiral groove meet along the angulation and form very characteristic „intersected“ spiny nodes. Body whorl covered by about 7 spiral cords. Anterior canal wide; aperture evenly ovoid. Outer lip thin; columellar lip thin, reflected and well defined.

**Remarks:** This species was intermingled with the younger, Bessarabian *Duplicata subspinososa* (SINZOV 1892) by KOJUMDGIEVA (1969) which differs by its steep, flat sutural ramp, the less acute apical angle, and the cylindrical body whorl. Furthermore it lacks the bulgy rim at the

suture. The Bessarabian *Duplicata kishinevensis* (KOLESNIKOV 1832) is also slightly reminiscent of the Austrian species but differs in its smooth shell surface. The characteristic sculpture of the early spire whorls separates the species distinctly from the *Duplicata duplicata-dissita* group. The Bessarabian *Duplicata ignobilis* (KOLESNIKOV 1932) which develops also spines along its shoulder differs in its depressed shape, the high and strangled spire whorls and the abruptly contracting body whorl.

**Distribution:** Found in the Sarmatian (*Mastra* Zone) of Wiesen in the Austrian part of the Eisenstadt-Sopron Basin. KOJUMDIEVA (1969) published another occurrence from the Baurenian horizon of Bulgaria – an only slightly younger or even synchronous interval, which she introduced as connection between the Volhynian and the Bessarabian stages.

#### *Duplicata corbiana* (d'ORBIGNY 1844)

Pl. 5, Figs. 16–17

- ?1833 *Buccinum propinquum*, – ANDRZEJOWSKI: 440, pl. 1, fig. 1 (non SOWERBY 1832)  
 ?1844 *Buccinum corbianum* d'ORBIGNY: 464, pl. 3, fig. 25  
 ?1935 *Buccinum corbianum*, – KOLESNIKOV: 262, pl. 31, figs. 12–14  
 1954 *Dorsanum corbianum corbianum*, – PAPP: 54, pl. 8, figs. 16–18  
 1974 *Dorsanum corbianum corbianum*, – PAPP: 351, pl. 9, figs. 20–22  
 1998 *Bullia* („*Dorsanum*“) *corbianum corbianum*, – SCHULTZ: 130, pl. 59, fig. 13

**Remarks:** We refer only to the specimens from the Sarmatian of the Vienna Basin. These specimens display some allometric growth resulting in a high and pointed spire which is followed by a rather inflated, short body whorl. The broad body whorl and the high spire remind on a transition between the morphologies of *Duplicata dissita* and *Duplicata duplicata*. Its larger size of the teleoconch would hardly justify to distinguish this species from *Duplicata duplicata*. Only the much larger, multi-whorled protoconch reflects a quite different planktonic larval development and seems to support the separation.

**Distribution:** *Duplicata corbiana* appears during the Volhynian of the Eastern Paratethys where it is still found in Bessarabian deposits. In the Central Paratethys it seems to be restricted to the Lower Sarmatian *Ervilia* Zone.

#### *Duplicata mitraeformis* (SIMIONESCU & BARBU 1940)

- 1940 *Buccinum mitraeforme* SIMIONESCU & BARBU: 122, pl. 6, figs. 104–105

**Description:** Extremely slender, solid shell with axial sculpture on early spire whorls. Spiral grooves

produce 4–6 flat spiral ribs which become the dominant sculpture towards the body whorl. A median angulation separates a slightly concave sutural ramp from an almost flat, negatively oblique flank. Only the shot body whorl is convex, terminating in a low, rather small aperture with posterior angulation and wide canal. Inner lip broad, well defined. Distinct cord on siphonal fasciole.

**Remarks:** The shell derives from the Sarmatian (*Ervilia* or *Mastra* zone) of Wiesen in the Austrian Eisenstadt-Sopron Basin. Although thousands of nassariid shells have been collected at that locality, this species is only recorded by a single specimen. The small and comparatively narrow aperture and the absence of any ad-sutural sculpture allow a clear separation from slender morphs of *Duplicata duplicata*. The spiral sculpture, the solid shell and the broad inner lip distinguish this specimen well from slender representatives of *Akburunella*.

**Distribution:** This rare species appears already during the *Ervilia* or *Mastra* Zone in the Central Paratethys. In the Eastern Paratethys it seems to be absent during the Volhynian but appears during the Bessarabian when it is recorded from Rumania by SIMIONESCU & BARBU (1940).

#### *Duplicata superabilis* (KOLESNIKOV 1932)

- 1935 *Buccinum superabile* KOLESNIKOV: 248, pl. 30, figs. 1–3  
 1935 *Buccinum superabile marcida* KOLESNIKOV: 249, pl. 30, figs. 6–7  
 1935 *Buccinum superabile luxuriosa* KOLESNIKOV: 249, pl. 30, figs. 4–5  
 1971 *Dorsanum marcidum*, – SVAGROVSKÝ: 396, pl. 69, fig. 5  
 1971 *Dorsanum seminovale*, – SVAGROVSKÝ: 393 in parte, pl. 69, figs. 6–7

**Remarks:** The inflated and weakly sculptured shells from the Vienna Basin identified as *Dorsanum seminovale* (KOLESNIKOV) by SVAGROVSKÝ (1971: pl. 69, figs. 6–7) are probably conspecific with *Duplicata superabilis* (KOLESNIKOV 1932) but have little in common with the strongly ornamented *Duplicata seminovalis*.

**Distribution:** The species appears in the *Ervilia* Zone of the Vienna Basin and the Volhynian of the Eastern Paratethys.

#### *Duplicata* cf. *seminovalis* (KOLESNIKOV 1932)

- ?1935 *Buccinum seminovale* KOLESNIKOV: 246, pl. 29, figs. 19–21  
 1971 *Dorsanum seminovale*, – SVAGROVSKÝ: 393 in parte, pl. 69, fig. 9

**Remarks:** The single shell from the Sarmatian of the Vienna Basin illustrated by SVAGROVSKÝ (1971, pl. 69, fig. 9) might represent an untypical specimen of *Duplicata seminovalis*. The strange sculpture of well defined and spirally arranged nodes and the subordinate spiral sculpture of the base differ markedly from the typus of KOLESNIKOV (1932).

**Distribution:** The species appears in the *Ervillea* Zone of the Vienna Basin and the Volhynian of the Eastern Paratethys.

***Duplicata miranda* (KOLESNIKOV 1932)**

- 1935 *Buccinum mirandum* KOLESNIKOV: 247, pl. 29, figs. 22–23  
 1971 *Dorsanum mirandum*, – SVAGROVSKÝ: 394, pl. 69, figs. 8  
 1974 *Dorsanum mirandum*, – PAPP: 353, pl. 10, fig. 4

**Remarks:** A rare species in the Central Paratethys which is only recorded by SVAGROVSKÝ (1971) from the northern Vienna Basin.

**Distribution:** The species appears in the *Ervillea* Zone of the Vienna Basin and in the Volhynian of the Eastern Paratethys.

**„*Dorsanum*“ *exageratum* PEYROT 1927**

- 1927 *Dorsanum gradatum* nov. sp. var. *exagerata* PEYROT: 160, pl. 1, figs. 40–42  
 1997 *Dorsanum exageratum*, – BAŁUK: 21, pl. 5, fig. 10

**Distribution:** Described by BAŁUK (1997) from the Lower Badenian of Poland. Originally, the name was established by PEYROT (1927) for a species from the Burdigalian of the Aquitaine.

**„*Dorsanum*“ *cibori* BAŁUK 1997**

- 1997 *Dorsanum cibori* BAŁUK: 21, pl. 5, fig. 7

**Distribution:** Described by BAŁUK (1997) from the Lower Badenian of Poland.

***Akburunella* KOLESNIKOV 1935**

**Type species:** *Nassa akburunensis* ANDRUSSOV 1906 – Sarmatian, Russia, Eastern Paratethys.

**Remarks:** *Akburunella* differs from *Duplicata* by its slender and less robust shells. The protoconchs of *Akburunella* spp. differ by their considerably larger size. The genus occurs in the Lower Sarmatian of the entire Paratethys but experiences its acme during the Bessarabian of the Eastern Paratethys. It is thus a Sarmatian endemism of the Paratethys.

***Akburunella akburunensis* (ANDRUSSOV 1902)**

Pl. 5, Fig. 18, Pl. 7, Figs. 14–15

- 1902 *Nassa akburunensis* ANDRUSSOV: 494, pl. 9, figs. 24–25  
 1932 *Buccinum akburunense*, – KOLESNIKOV: 14, pl. 5, figs. 1–5.  
 1935 *Akburunella akburunensis*, – KOLESNIKOV: 273, pl. 32, figs. 1–3  
 1943 *Dorsanum (Akburunella) akburunensis*, – WENZ: 1505, fig. 4211 a, b

- 1969 *Dorsanum (Akburunella) akburunense akburunense*, – KOJUMDIEVA: 113, pl. 37, figs. 14–16

**Description:** Small- to medium sized slender shells. The early 2 spire whorls are convex, later whorls develop an angulation slightly anterior to the median line. Concavity of the sutural ramp decreases towards the short body whorl. Moderately wide-spaced axial ribs of extremely variable strength. Spiral threads cross the axial ribs of the early whorls; later they may cause a distinct cancellate pattern or may also fade out completely.

The protoconch consists of slightly more than one bulbous whorl. It measures 1.14 mm in height and 1 mm in maximum diameter. The protoconch-angle amounts 47°. The initial cap-like onset measures 0.36–0.37 mm in width. The last quarter whorl is characterised by closely spaced growth lines and a slightly thickened rim terminating the protoconch.

**Remarks:** The protoconch is indicative of a direct development with hatching of crawling young. Several taxa such as *Akburunella stavropolenis* (KUDRIAVTZEVA 1928), *Akburunella enikalensis* (KOLESNIKOV 1932), or *A. sequax* (KOLESNIKOV 1932) are probably only morphotypes of *A. akburunensis*, reflecting the considerable variability in sculpture and to a lesser degree also of shape.

**Distribution:** *Akburunella akburunensis* is a widespread species throughout the Volhynian and Bessarabian of the Eastern Paratethys. Its westernmost occurrence is known from Bulgaria.

***Akburunella verneuilii* (d'ORBIGNY 1844)**

Pl. 5, Fig. 19, Pl. 7, Figs. 16–17

- 1844 *Buccinum Verneuilii* d'ORBIGNY: 465, pl. 4, figs. 1–2  
 1932 *Buccinum verneuilii*, – KOLESNIKOV: 98, pl. 3, figs. 21–22  
 1935 *Buccinum verneuilii*, – KOLESNIKOV: 258, pl. 30, figs. 24–27  
 1940 *Buccinum verneuilii*, – SIMIONESCU & BARBU: 119, pl. 3, figs. 58–60, pl. 4, fig. 109, textfig. 121 b

**Description:** Moderately slender shell of up to 7 teleoconch whorls. Body whorl and late spire whorls display a conspicuous increase in width. These are separated in a distinct, low-angled sutural ramp, a narrow median part with more or less flat flanks parallel to the axis and a strangled anterior part. Several weak spiral ribs appear which disintegrate in spirally elongated nodes. Sculpture generally most prominent close to the angulation. Ovoid aperture with concave columella, evenly rounded outer lip and well defined siphonal canal.

The conical protoconch comprises 1.25 bulbous apparently smooth whorls. It measures 1.1 mm in height and 0.9–0.91 mm in maximum diameter. The first whorl measures 0.52 mm in the width of the initial cap-like onset and 0.79–0.8 mm in maximum diameter. Growth lines are visible on the last quarter of the protoconch. The transition to the teleoconch is indistinct, indicated by the successive onset of the adult sculpture.

**Remarks:** The protoconch is indicative of a direct development with hatching of crawling young. The dimensions of the protoconch indicate a yolk-rich embryogenesis, probably supported by nurse-eggs.

The species is reminiscent of *Akburunella akburunensis* (ANDRUSOV 1902) but differs in its slender shape, the less evenly convex anterior part of the spire whorls, the subordinate axial sculpture and by its considerably larger embryonic shell, but smaller initial cap-like onset.

**Distribution:** The species is restricted to the Bessarabian of the Eastern Paratethys. Alleged occurrences of this species from the Lower Sarmatian of the Vienna Basin refer to *Akburunella moldavica* (SIMIONESCU & BARBU 1940) and *A. kolesnikovi* (SIMIONESCU & BARBU 1940).

***Akburunella jacquemarti* (d'ORBIGNY 1844)**

Pl. 5, Fig. 20

- 1844 *Buccinum Jacquemarti* d'ORBIGNY: 466, pl. 4, figs. 3–5  
 1875 *Buccinum duplicatum Hoernesii Jacquemarti*, – SINZOV: 49, pl. 4, fig. 5  
 1935 *Buccinum jacquemarti*, – KOLESNIKOV: 256, pl. 30, figs. 17–20  
 1940 *Buccinum jacquemarti*, – SIMIONESCU & BARBU: 121, pl. 3, figs. 66–67, textfig. 126 c  
 1969 *Dorsanum (Duplicata) jacquemarti*, – KOJUMDGIEVA: 111, pl. 37, figs. 12–13

**Remarks:** The slender shell is characterised by its adsutural rim of slightly spirally elongated nodes. A second row of nodes appears along the angulation of the whorls, usually accompanied by a weaker secondary spiral of nodes. The axial sculpture consists rather of indistinct, oblique swellings than of well defined axial ribs.

*Akburunella jacquemarti* is distinguished from the similar *Akburunella kolesnikovi* (SIMIONESCU & BARBU 1940) by its less strangled spire whorls and the distinctly weaker and less wide spaced nodes along the shoulder. The also somewhat reminiscent *Akburunella verneuillii* (d'ORBIGNY 1844) is distinguished by the prominent spiral sculpture below the shoulder and by the low sutural ramp.

**Distribution:** The species is only known from the Bessarabian when it is widespread in the Eastern Paratethys as far west as Romania and Bulgaria.

***Akburunella fraudulentum* (KOLESNIKOV 1932)**

Pl. 7, Fig. 1

- 1932 *Buccinum fraudulentum* KOLESNIKOV: 105, pl. 4, figs. 15–18  
 1935 *Buccinum fraudulentum*, – KOLESNIKOV: 265, pl. 31, figs. 24–27  
 1940 *Buccinum fraudulentum*, – SIMIONESCU & BARBU: 109, pl. 3, figs. 29–30  
 1954 *Dorsanum fraudulentum*, – PAPP: 56, pl. 7, fig. 27  
 1969 *Dorsanum (Duplicata) fraudulentum*, – KOJUMDGIEVA: 109, pl. 36, figs. 13–14  
 1974 *Dorsanum fraudulentum*, – PAPP: 353, pl. 10, fig. 5

**Remarks:** A single specimen from the Vienna Basin is the sole record of this otherwise Bessarabian species from the *Ervilia* Zone of the Central Paratethys. Its slender shell, the slight angulation in the middle of the whorls, the indistinct axial ribs correspond fully to the specimens described by KOLESNIKOV (1932, 1935) and allow no separation. *Akburunella akburunensis* (ANDRUSOV 1902) is less slender and develops lower and more convex whorls.

**Distribution:** The species appears in the *Ervilia* Zone of the Vienna Basin. During the Bessarabian it is well documented from Rumania, Bulgaria and Moldavia.

***Akburunella triformis* (KOLESNIKOV 1932)**

Pl. 7, Fig. 2

- 1935 *Buccinum triformis peltax* KOLESNIKOV: 241, pl. 29, figs. 1–2  
 1935 *Buccinum triformis tesovensensis* KOLESNIKOV: 242, pl. 29, figs. 3–4  
 1935 *Buccinum triformis dubitabilis* KOLESNIKOV: 242, pl. 29, figs. 5–6  
 1940 *Dorsanum triformis*, – SIMIONESCU & BARBU: 117, pl. 3, fig. 55  
 1944 *Buccinum verneuillii*, – JEKELIUS: 89, pl. 25, figs. 1–18 (non d'ORBIGNY 1844)  
 1954 *Dorsanum verneuillii*, – PAPP: 55 (non d'ORBIGNY 1844)  
 1954 *Dorsanum triformis triformis*, – PAPP: 55, pl. 7, fig. 26, pl. 8, fig. 25  
 1969 *Dorsanum (Akburunella) triformis triformis*, – KOJUMDGIEVA: 113, pl. 38, figs. 4–6

**Description:** Thin, high-spired, slender shells of 6–7 teleoconch whorls. Sutural ramp deeply to moderately concave. Spire whorls convex, anteriorly strangled with prominent, sometimes slightly sigmoidal axial ribs. The posterior tips of these axial elements may pass into a spiral row of nodes close to the suture. One to four thin, sharp spiral threads appear on the spire whorls. Usually two threads closely below the shoulder are most prominent and narrow-spaced. Further spiral threads may cover the body whorl and the base; often the spiral sculpture fades out towards the aperture. Body whorl well rounded, rapidly contracting towards the short, bent siphonal canal. Outer lip very thin; columellar lip hardly developed, only in the anterior half it may develop a thin, narrow enamel-like covering. Terminal fold extremely thin. Siphonal fasciole weak, bordered by a hardly raised cord.

**Distribution:** The species appears already during the Volhynian in the Eastern Paratethys and holds on to the Bessarabian. In the Central Paratethys it is only known from the *Ervilia* Zone of the Vienna Basin.

***Akburunella moldavica* (SIMIONESCU & BARBU 1940)**

Pl. 7, Fig. 3

- 1852 *Buccinum verneuillii*, – HÖRNES: 158, pl. 13, fig. 10 (non d'ORBIGNY 1844)

- 1874 *Buccinum duplicatum* var. *Verneuilii*, – HOERNES: 34, pl. 2, fig. 3 (non d'ORBIGNY 1844)  
 1935 *Buccinum duplicatum-verneuilii*, – KOLESNIKOV: 253, pl. 30, figs. 11–13  
 1940 *Buccinum moldavicum* SIMIONESCU & BARBU: 118, pl. 3, figs. 56–57, textfig. 121 a  
 1969 *Dorsanum (Duplicata) moldavicum*, – KOJUMDGIEVA: 10, pl. 37, figs. 5–7

**Description:** Small-sized shells with pointed spire, moderately angulated spire whorls and broad body whorl. Sutural ramp slightly concave and steep. Broad axial ribs with narrow interspaces cover the teleoconch. Indistinct spiral threads and grooves disintegrate the axial ribs in weak nodes. Occasionally the nodes along the shoulder of the body whorl may grade into low, spiny nodes. Broad and poorly defined siphonal canal. Siphonal fasciole inconspicuous bordered by a reduced cord.

**Remarks:** The Lower Sarmatian shells from the Vienna Basin, which were already described by HÖRNES (1852) differ from the Bessarabian representatives in their lower spire, the broader body whorl and rather regular sculpture. Furthermore, the angulation of the spire whorls is close to the anterior suture in the Lower Sarmatian shells whereas most Bessarabian shells develop rather high spire whorls – aside from few exceptions such as the specimen illustrated by KOLESNIKOV (1935: pl. 33, fig. 13).

**Distribution:** The species arises in the Lower Sarmatian *Mohrensternia* Zone of the Vienna Basin and is unknown from the Central Paratethys in overlying strata. In the Eastern Paratethys it is a common species in the Bessarabian of Bulgaria, Romania, and Moldavia.

***Akburunella kolesnikovi*** (SIMIONESCU & BARBU 1940)

Pl. 7, Figs. 7–8, 18–19

- 1874 *Buccinum duplicatum* var. *Verneuilii*, – HOERNES: 85 in parte, pl. 2, fig. 6 (non d'ORBIGNY 1844)  
 1875 *Buccinum duplicatum-hörnesi* SINZOV: 47, pl. 4, fig. 4  
 1932 *Buccinum duplicatum-hörnesi*, – KOLESNIKOV: 4, pl. 3, figs. 15–17  
 1935 *Buccinum duplicatum hörnesi*, – KOLESNIKOV: 255, pl. 30, figs. 14–16  
 1954 *Dorsanum duplicatum hoernesii*, – PAPP: 54, pl. 8, fig. 24  
 1940 *Buccinum kolesnikovi* SIMIONESCU & BARBU: 120, pl. 3, figs. 61–63  
 1969 *Dorsanum (Duplicata) kolesnikovi*, – KOJUMDGIEVA: 110, pl. 37, figs. 8–9  
 1992 *Buccinum duplicatumhoernesii*, – SCHÜTT: 170, pl. 2, fig. 39

**Description:** Slender, elongate shell of 4–6 teleoconch whorls. A marked angulation appears in the middle of the whorls; sutural ramp flat or weakly concave. Sculpture of two spiral rows of broad nodes; one row coincides with the angulation, a second weaker one is developed on the strangled anterior part of the whorl. Close to the adapical suture an indistinct bulge is occasionally developed. Body whorl short well rounded; low, ovoid aperture and well defined siphonal canal.

The protoconch has slightly more than one bulbous whorl measuring 1.05–1.1 mm in height and 0.91–0.92 mm in maximum diameter. The protoconch-angle amounts 55°. The initial cap-like onset measures 0.4 mm in width. Indistinct spiral threads are visible on the last quarter whorl of the protoconch, where also growth lines appear. The protoconch is terminated by a slight thickening of the shell.

**Remarks:** The protoconch is indicative of a direct development with hatching of crawling young.

The name „*Buccinum kolesnikovi*“ was introduced by SIMIONESCU & BARBU (1940) to replace the variously preoccupied name „*Buccinum hörnesi*“ which would result from pushing the variation name *Buccinum duplicatum hörnesi* SINZOV 1875 on the species level.

**Distribution:** The species arises already in the *Maetra* Zone of the Eisenstadt-Sopron Basin. During the Bessarabian it becomes a common species in the Eastern Paratethys.

***Akburunella renovata*** (KOLESNIKOV 1932)

Pl. 7, Fig. 4

- 1875 *Buccinum verneuilii* var. *striatulum*, – SINZOV: 46, pl. 4, fig. 11 (non EICHWALD 1853)  
 1932 *Buccinum renovatum* KOLESNIKOV: 100, pl. 3, figs. 25–28  
 1935 *Buccinum renovatum*, – KOLESNIKOV: 260, pl. 30, figs. 29–31  
 1940 *Buccinum renovatum*, – SIMIONESCU & BARBU: 123, pl. 6, figs. 106–107

**Description:** One of the most slender representatives of *Akburunella*. The whorls are moderately high and evenly convex with the maximum diameter close below the median line. Spire whorls covered by 4–5 weak, narrow spaced, rounded spiral ribs; the posterior adsutural part of the whorls is usually nearly smooth. Faint axial threads appear on the late spire whorls and the body whorl. Aperture elongate ovoid; siphonal canal long, twisted and reflected with narrow but distinct terminal fold.

**Distribution:** Known from the Bessarabian of Romania and Moldavia.

***Akburunella scalaris*** (ANDRUSSOV 1902)

Pl. 7, Fig. 5

- 1902 *Nassa scalaris* ANDRUSSOV: 492, pl. 9, figs. 3–5  
 1928 *Buccinum scalaris*, – KUDRIAVTZEVA: 16, pl. 2, figs. 3–5  
 1928 *Buccinum scalaris caucasicum* KUDRIAVTZEVA: 16, pl. 2, figs. 6–7  
 1932 *Buccinum scalare*, – KOLESNIKOV: 123, pl. 5, figs. 56–59  
 1935 *Akburunella scalaris*, – KOLESNIKOV: 281, pl. 32, figs. 37–39

**Description:** A slender elongate shell with keeled whorls. A second sharp spiral rib appears anteriorly to the keel. Occasionally, secondary spiral ribs are developed along the anterior suture and on the slightly concave sutural ramp. Weaker, wide spaced axial ribs



cross the spiral elements and cause a broad, rectangular pattern.

**Remarks:** The sculpture is rather unique within the genus *Akburunella*. Only *Akburunella multicostata* (KUDRIAVTZEV 1928) is reminiscent in the sharp spiral ribs but lacks a keel and develops a less slender shell.

**Distribution:** The species is restricted to the Bessarabian of the Eastern Paratethys.

*Akburunella leiococha* (ANDRUSSOV 1927)

Pl. 7, Fig. 6

1932 *Buccinum leiococha*, – KOLESNIKOV: 124, pl. 5, figs. 45–48

1935 *Akburunella leiococha*, – KOLESNIKOV: 282, pl. 32, figs. 43–45

**Description:** Rather stocky *Akburunella* with hardly convex whorls and weakly incised sutures. Large

body whorl passes abruptly into the concave base. Shell surface smooth.

**Remarks:** The also smooth *Akburunella nefanda* (KOLESNIKOV 1932) and *A. repuerasco* (KOLESNIKOV 1932) differ considerably in their higher spire and the strongly convex whorls.

**Distribution:** Restricted to the Bessarabian of the Eastern Paratethys.

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## Appendix 1

**Nassariids of the Eastern Paratethys:** Middle Miocene nassariids of the Eastern Paratethys after ZHIZHCENKO (1936), ILJINA (1993), KUDRIAVTZEV (1928), KOJUMDGIEVA (1969) and KOLESNIKOV (1932, 1935).

<i>Nassarius tamanensis</i> (DAVIDASCHVILI 1932)	Tarkhanian
<i>Nassarius urupicus</i> SARYTSHEVA in ILJINA 1993	Tarkhanian
<i>Nassarius amarus</i> (ZHIZHCENKO 1936)	Chokrakian
<i>Nassarius contusus</i> (ZHIZHCENKO 1934)	Chokrakian
<i>Nassarius dujardini</i> (DESHAYES 1844)	Chokrakian
<i>Nassarius miocenaobliquus</i> (SCHWETZ 1912)	Chokrakian
<i>Nassarius „limatus</i> (CHEMNITZ)“	Tarkhanian — Chokrakian
<i>Nassarius „restituanus</i> (FONTANNES 1879)“	Tarkhanian—Chokrakian
<i>Nassarius serraticosta serraticosta</i> (HÖRNES 1852)	Tarkhanian-Chokrakian
<i>Nassarius serraticosta claudus</i> (ZHIZHCENKO 1936)	Tarkhanian — Chokrakian
<i>Nassarius scrobiculatus</i> (ZHIZHCENKO 1936)	Tarkhanian — Chokrakian
<i>Nassarius karaganicus</i> ZHIZHCENKO in ILJINA 1993	Karaganian
<i>Nassarius coloratus</i> (EICHWALD 1830)	Tarkhanian — Chokrakian, Konkian
<i>Nassarius coloratus sarmaticus</i> (LASKAREV 1903)	Volhynian
<i>Nassarius edlaueri</i> (BEER-BISTRICKÝ 1958)	Tarkhanian — Chokrakian, Konkian
<i>Nassarius zborzewskii</i> (ANDRZEJOWSKI 1830)	Konkian
<i>Nassarius kulensis</i> (KOJUMDGIEVA 1969)	Volhynian
<i>Duplicata neutra</i> (KOLESNIKOV 1932)	Konkian
<i>Duplicata bessarabica</i> (SIMIONESCU & BARBU 1940)	Bessarabian
<i>Duplicata corbiana</i> (d'ORBIGNY 1844)	Volhynian — Bessarabian
<i>Duplicata daveluina</i> (d'ORBIGNY 1844)	Bessarabian
<i>Duplicata dissita</i> (DUBOIS DE MONTPEREUX 1831)	Volhynian — Bessarabian
syn.: <i>D. iassiensis</i> (SIMIONESCU & BARBU 1940), <i>D. latesulca</i> (SIMIONESCU & BARBU 1940), <i>D. torpida</i> (KOLESNIKOV 1932)	
<i>Duplicata duplicata</i> (SOWERBY 1829)	Volhynian — Bessarabian
syn.: <i>D. duplicata omnivaga</i> (KOLESNIKOV 1932), <i>D. opinabilis</i> (KOLESNIKOV 1932), <i>D. opinabilis trabalis</i> (KOLESNIKOV 1932), <i>D. pseudoduplicata</i> (SIMIONESCU & BARBU 1940)	
<i>Duplicata globosa</i> (SIMIONESCU & BARBU 1940)	Bessarabian
syn.: <i>D. duplicatumhaueri</i> (SINZOV 1875)	
<i>Duplicata ignobile</i> (KOLESNIKOV)	Bessarabian
syn.: <i>D. duplicatumhoernesii</i> (SINZOV 1875) in parte	
<i>Duplicata kishinevensis</i> (KOLESNIKOV 1932)	Bessarabian
syn.: <i>D. pauli</i> (COBALESCU 1883), <i>D. gricevensis</i> (KOLESNIKOV 1932)	
<i>Duplicata miranda</i> (KOLESNIKOV 1932)	Volhynian
<i>Duplicata mitraeformis</i> (SIMIONESCU & BARBU 1940)	Bessarabian
<i>Duplicata nasuta</i> (KOLESNIKOV 1932)	Bessarabian
<i>Duplicata orgeevensis</i> (KOLESNIKOV 1932)	Bessarabian

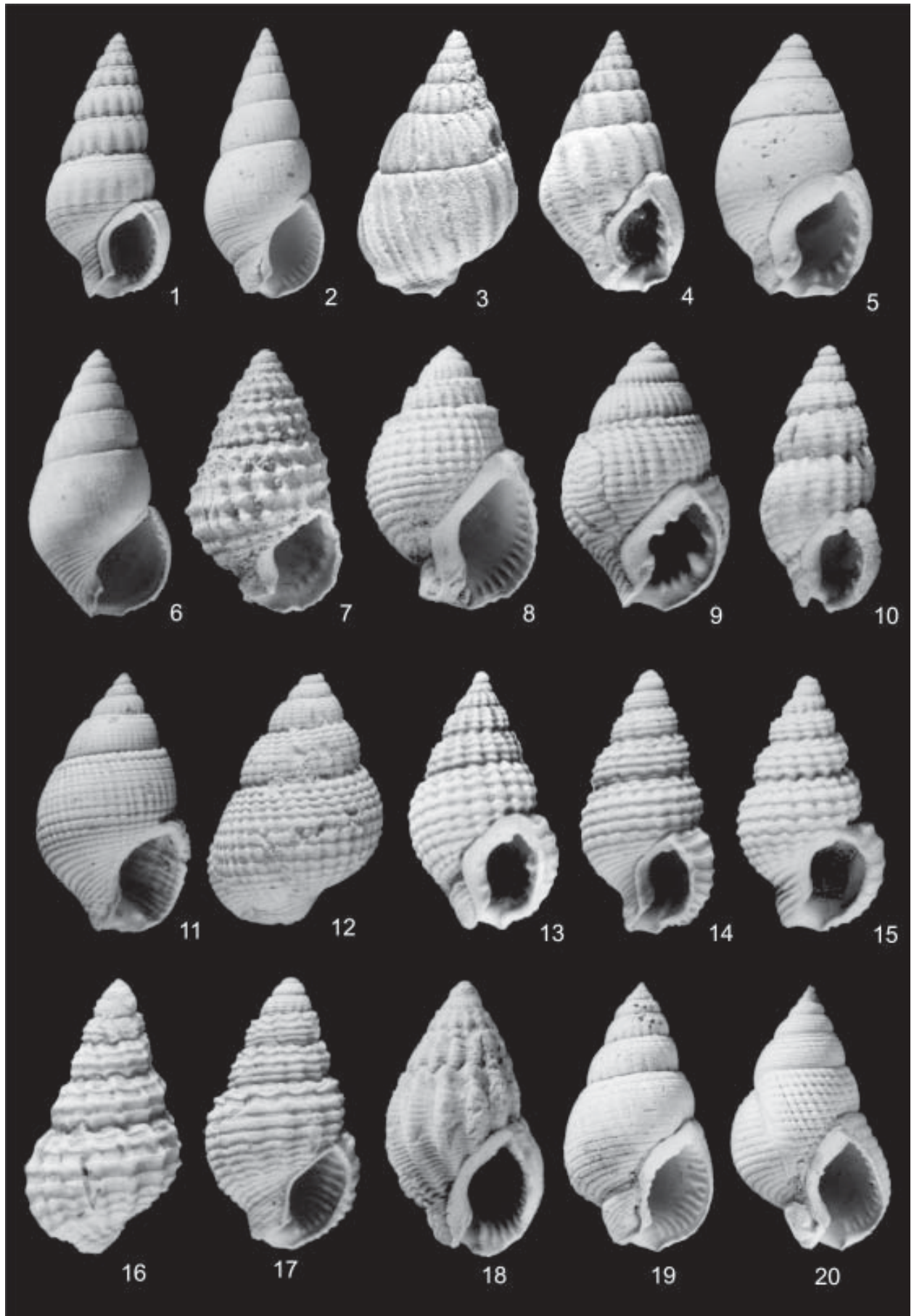
**Nassariids of the Eastern Paratethys (cont.)**

<i>Duplicata parva</i> (SIMIONESCU & BARBU 1940)	Bessarabian
<i>Duplicata pseudobaccata</i> (KOLESNIKOV 1932)	Bessarabian
<i>Duplicata seminovialis</i> (KOLESNIKOV 1932)	Volhynian
<i>Duplicata superabilis</i> (KOLESNIKOV 1932)	Volhynian — Bessarabian
syn.: <i>D. superabilis marcida</i> (KOLESNIKOV 1932), <i>D. superabilis luxuriosa</i> (KOLESNIKOV 1932), <i>D. lymnaeiformis</i> (KOLESNIKOV 1932)	
<i>Duplicata subspinosa</i> (SINZOV)	Bessarabian
<i>Akburunella akburunensis</i> (ANDRUSOV 1902)	Volhynian — Bessarabian
? syn.: <i>Akburunella stavropolensis</i> (KUDRIAVTZEV 1928)	
<i>Akburunella bosporana</i> (ANDRUSOV 1902)	Bessarabian
<i>Akburunella egorlykensis</i> (KOLESNIKOV 1932)	Bessarabian
<i>Akburunella elegans</i> (SIMIONESCU & BARBU 1940)	Bessarabian
<i>Akburunella fraudulenta</i> (KOLESNIKOV 1932)	Bessarabian
<i>Akburunella impexa</i> (KOLESNIKOV 1932)	Bessarabian
<i>Akburunella inflata</i> (SINZOV 1912)	Bessarabian
syn.: <i>Akburunella carabinica</i> (KUDRIAVTZEV 1928), <i>A. praedo</i> (KOLESNIKOV 1935)	
<i>Akburunella jacquemarti</i> (D'ORBIGNY)	Bessarabian
<i>Akburunella pseudogracilis</i> (KOLESNIKOV)	Bessarabian
<i>Akburunella kolesnikovii</i> (SIMIONESCU & BARBU 1940)	Bessarabian
syn.: <i>A. duplicata-hoernesii</i> (SINZOV 1875)	
<i>Akburunella leioconcha</i> (ANDRUSOV 1927)	Volhynian - Bessarabian
<i>Akburunella maturatis</i> (KOLESNIKOV 1932)	Bessarabian
<i>Akburunella moldavica</i> (SIMIONESCU & BARBU 1940)	Bessarabian
syn.: <i>A. duplicata-verneuilii</i> (SINZOV 1875)	
<i>Akburunella multicostata</i> (KUDRIAVTZEV 1928)	Bessarabian
<i>Akburunella nefanda</i> (KOLESNIKOV 1932)	Bessarabian
<i>Akburunella renovata</i> (KOLESNIKOV 1932)	Bessarabian
<i>Akburunella repuerasco</i> (KOLESNIKOV 1932)	Bessarabian
<i>Akburunella seminuda</i> (KOLESNIKOV 1832)	Bessarabian
syn.: <i>A. verneuilii striatula</i> (SINZOV 1875)	
<i>Akburunella scalaris</i> (ANDRUSOV 1902)	Bessarabian
<i>Akburunella triformis</i> (KOLESNIKOV 1932)	Volhynian — Bessarabian
<i>Akburunella tscharnozskii</i> (KUDRIAVTZEV 1928)	Bessarabian
<i>Akburunella verneuilii</i> (d'ORBIGNY 1844)	Bessarabian
syn.: <i>A. verneuilii semifera</i> (KOLESNIKOV 1935)	

## Plate 1

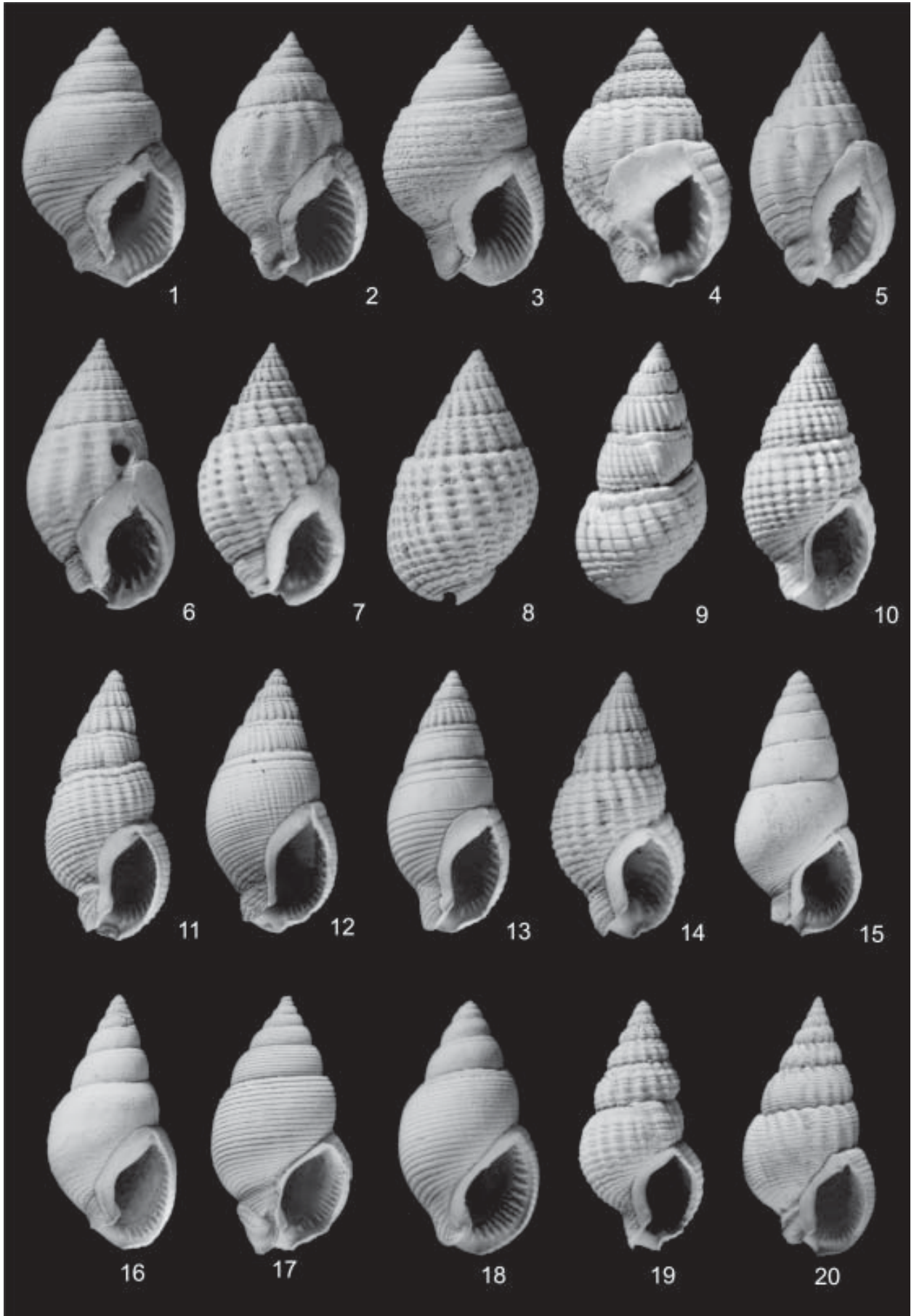
- Fig. 1. *Nassarius schroeckingeri* (HOERNES & AUINGER 1882). Rumania, Lower Badenian, Coateiu de Sus. Inv. NHMW 1869/1/682, height: 12 mm.
- Fig. 2. *Nassarius sturi* (HOERNES & AUINGER 1882). Lăpugiu de Sus – Rumania, Lower Badenian, syntype, Inv. NHMW 1858/43/22, height: 16.3 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 33)).
- Figs. 3–4. *Nassarius styriacus* (HILBER 1879).  
 3) Styria/Austria, Lower Badenian, Pöls. Syntype, Inv. NHMW 1949/5/12, height: 7.7 mm (illustrated in HILBER (1879: pl. 2, fig. 1)).  
 4) Styria/Austria, Lower Badenian, Pöls. Inv. NHMW 1949/5/12, height: 7.9 mm.
- Fig. 5. *Nassarius macrodon auingeri* (HOERNES in HOERNES & AUINGER 1882). Czech Republic, Badenian, Drnowitz. Syntype, Inv. NHMW 1864/1/450, height: 8.3 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 23)).
- Fig. 6. *Nassarius kostejanus* (BOETTGER 1902). Lower Austria, Badenian, Baden. Inv. NHMW 1846/37/164, height: 9.8 mm (illustrated as *Buccinum corniculum* in HÖRNES (1852: pl. 13, fig. 5)).
- Fig. 7. *Nassarius jansseni* nov. sp. Czech Republic, Badenian, Hrusovany. Holotype, Inv. NHMW 1861/12/62, height: 14.7 mm.
- Fig. 8. *Nassarius pauli* (HOERNES 1875). Upper Austria, Ottnangian, Ottnang –Inv. NHMW 1854/23/9, height: 11.5 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 22)).
- Fig. 9. *Nassarius signatus* (HÖRNES 1852). Lower Austria, Badenian, Vöslau. Inv. NHMW 1874/24/31, height: 8.8 mm.
- Fig. 10. *Nassarius daciae* (HOERNES & AUINGER 1882). Rumania, Lower Badenian, Lăpugiu de Sus. Syntype, Inv. NHMW 1854/35/1288, height: 7.4 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 42)).
- Fig. 11. *Nassarius illovensis* (HOERNES & AUINGER 1882). Burgenland/Austria, Badenian, Marz. Inv. NHMW 1866/40/115, height: 12.3 mm.
- Fig. 12. *Nassarius illovensis* (HOERNES & AUINGER 1882). Burgenland/Austria, Badenian, Marz. Inv. NHMW 1866/40/115, height: 11.7 mm.
- Fig. 13. *Nassarius notterbecki* (HOERNES & AUINGER 1882). Lower Austria, Lower Badenian, Grund. Inv. NHMW 1850/2/20, height: 8.6 mm.
- Figs. 14–15. *Nassarius lapugyensis* (HOERNES & AUINGER 1882).  
 14) Rumania, Lower Badenian, Lăpugiu de Sus. Syntype, Inv. NHMW 1860/40/85, height: 7.8 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 39)).  
 15) Lower Austria, Badenian, Baden. Inv. NHMW 1846/37/147, height: 7.8 mm, a specimen of the suite which HÖRNES (1852) erroneously described as *Buccinum incrassatum* (MÜLLER) and to which BOETTGER (1906) referred to as *Nassa subgranularis*.
- Figs. 16–17. *Nassarius bittneri* (HOERNES & AUINGER 1882).  
 16) Lower Austria, Badenian, Niederleis. Inv. NHMW 1863/15/646, height: 6.8 mm.  
 17) Lower Austria, Badenian, Niederleis. Syntype, Inv. NHMW 1863/15/646, height: 7.5 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 43)).
- Fig. 18. *Nassarius hochstetteri* (HOERNES & AUINGER 1882). Lower Austria, Badenian, Niederleis. Inv. NHMW 1866/1/830, height: 8.6 mm.
- Figs. 19–20. *Nassarius supernecostatus* (HOERNES & AUINGER 1882).  
 19) Rumania, Badenian, Lăpugiu de Sus. Syntype, Inv. NHMW 1859/42/10, height: 25 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 13)).  
 20) Hungary, Lower Badenian, Hidas. Inv. NHMW 1870/33/60, height: 24 mm (illustrated as „*Buccinum Petersi*“ in HOERNES & AUINGER (1882: pl. 13, fig. 18)).





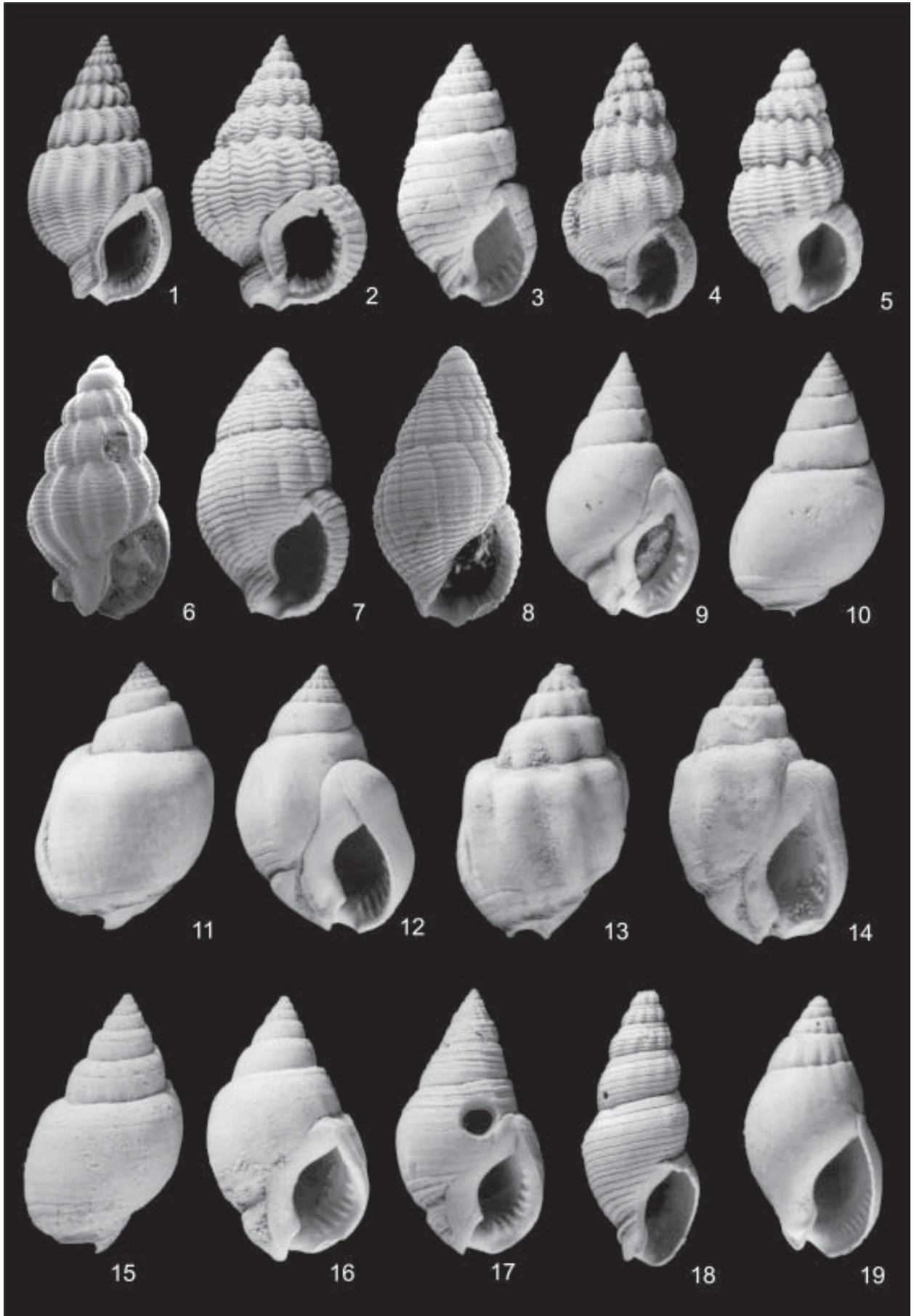
## Plate 2

- Figs. 1–3. *Nassarius doliolum* (EICHWALD 1830).  
 1) Styria/Austria, Lower Badenian, Pöls. Inv. NHMW 1949/5/10, height: 19.5 mm (illustrated as „*Buccinum collare*“ in HILBER (1879, pl. 1: 6)).  
 2) Rumania, Lower Badenian, Lăpugiu de Sus. Inv. NHMW 1866/40/262, height: 20.5 mm (illustrated as „*Buccinum hilberi*“ in HOERNES & AUINGER (1882: pl. 13: 11)).  
 3) Lower Austria, Badenian, Gainfarn. Inv. NHMW 1846/37/154, height: 30.5 mm (illustrated in HÖRNES (1852, pl. 12, fig. 4)).
- Fig. 4. *Nassarius toulai* (HOERNES & AUINGER 1882). Styria/Austria, Lower Badenian, Pöls. Syntype, Inv. NHMW 1861/1/251, height: 10.7 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 19)).
- Fig. 5. *Nassarius coloratus* (EICHWALD 1830). Lower Austria, Badenian, Enzesfeld. Inv. NHMW 1846/37/140, height: 20 mm (illustrated in HÖRNES (1852: pl. 12, fig. 18)).
- Fig. 6. *Nassarius neugeboreni* (HOERNES & AUINGER 1882). Rumania, Lower Badenian, Lăpugiu de Sus. Syntype, Inv. NHMW 1870/33/62, height: 21.5 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 27)).
- Figs. 7–8. *Nassarius poelsensis* (HILBER 1879).  
 7) Styria/Austria, Lower Badenian, Pöls. Inv. NHMW 1861/1/245, height: 19.3 mm.  
 8) Rumania, Lower Badenian, Lăpugiu de Sus. Inv. NHMW 2002z0093/000, height: 18.5 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 25)).
- Figs. 9–14. *Nassarius striatulus* (EICHWALD 1829).  
 9) Austria/Burgenland, Badenian, Ritzing. Inv. NHMW 1848/3/14, height: 21.1 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 1)).  
 10) Austria/Burgenland, Badenian, Ritzing. Inv. NHMW 1848/3/14, height: 20.7 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 4)).  
 11) Rumania, Lower Badenian, Lăpugiu de Sus. Inv. NHMW 2002z0093/0002, height: 14.5 mm.  
 12) Rumania, Lower Badenian, Lăpugiu de Sus. Inv. NHMW 2002z0093/0003, height: 15.8 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 13)).  
 13) Lower Austria, Badenian, Möllersdorf. Inv. NHMW 1846/37/149, height: 15.7 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 16)).  
 14) Hungary, Badenian, Szobb. Inv. NHMW 1847/46/14, height: 11.6 mm
- Figs. 15–16. *Nassarius banaticus* (BOETTGER 1902).  
 15) Rumania, Lower Badenian, Coateiu de Sus. –Inv. NHMW 1869/1/680, height: 14.3 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 22)).  
 16) Rumania, Lower Badenian, Lăpugiu de Sus. Inv. NHMW 1854/35/122, height: 15.6 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 21), referred to as *Nassa altera* by BOETTGER (1902)).
- Fig. 17. *Nassarius grateloupi* (HÖRNES 1852). Lower Austria, Badenian, Baden. Syntype, Inv. NHMW 1846/37/151, height: 17.5 mm (illustrated in HÖRNES (1852: pl. 12, fig. 6)).
- Fig. 18. *Nassarius badensis* (HÖRNES 1852). Lower Austria, Badenian, Baden. Inv. NHMW 2002z0093/0004, height: 17 mm (probably the syntype illustrated in HÖRNES (1852: pl. 12, fig. 8)).
- Fig. 19. *Nassarius vulgatissimus* (MAYER 1860). Lower Austria, Badenian, Baden. Inv. NHMW 1846/37/147, height: 15.5 mm.
- Fig. 20. *Nassarius spectabilis* (NYST 1843). Lower Austria, Badenian, Gainfarn. Inv. NHMW 1847/37/146, height: 20.5 mm.



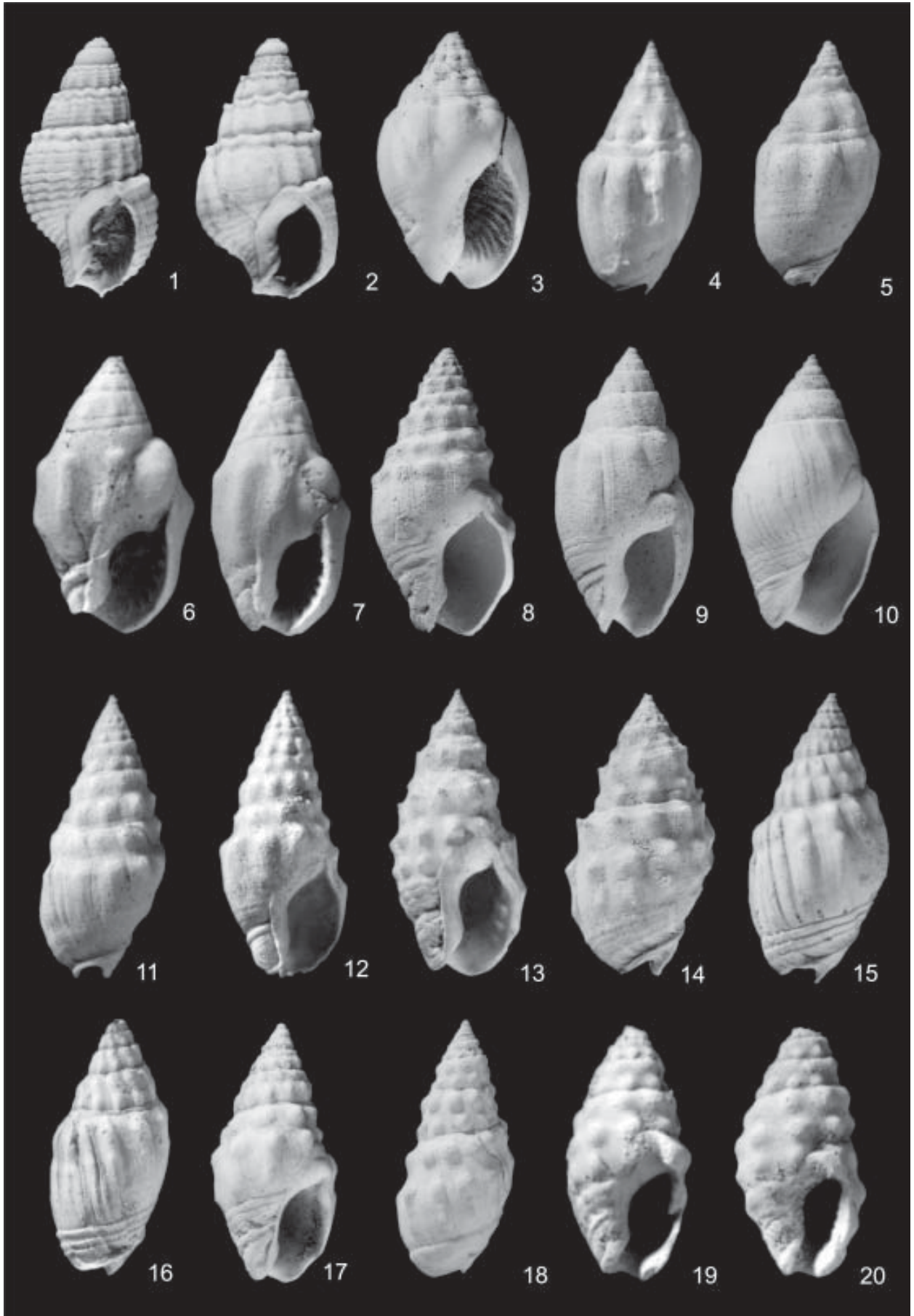
## Plate 3

- Fig. 1. *Nassarius spectabilis* (NYST 1843). Rumania, Lower Badenian, Lăpugiu de Sus. Inv. NHMW 1876/11/19, height: 21 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 6)).
- Fig. 2. *Nassarius subprismaticus* (HOERNES & AUINGER 1882). Austria/Burgenland, Badenian, Forchtenau. Syntype, Inv. NHMW 1859/45/294, height: 24.5 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 1)).
- Fig. 3. *Nassarius pupaeformis* (HOERNES & AUINGER 1882). Rumania, Lower Badenian, Lăpugiu de Sus. Syntype, Inv. NHMW 1867/11/21, height: 6.2 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 36)).
- Figs. 4–6. *Nassarius serraticosta* (HÖRNES 1852).  
 4) Austria/Vienna, Badenian, Grinzing. Syntype, Inv. NHMW 186/50/779, height: 8.2 mm (illustrated in HÖRNES (1852: pl. 12, fig. 15)).  
 5) Lower Austria, Badenian, Baden. Inv. NHMW 1869/1/167, height: 6.4 mm.  
 6) Rumania, Badenian Bujtur. Juvenile, Inv. NHMW 2002z0093/0005, height: 3.77 mm.
- Figs. 7–8. *Nassarius subasperatus* (BOETTGER 1906).  
 7) Lower Austria, Badenian, Niederleis. Inv. NHMW 1865/1/618, height: 6.4 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 40)).  
 8) Lower Austria, Badenian, Niederleis. Inv. NHMW 2002z0093/0006, height: 5.25 mm.
- Figs. 9–10. *Nassarius dujardini* (DESHAYES 1844).  
 9) Lower Austria, Badenian, Gainfarn. Inv. NHMW 1855/45/406, height: 14.8 mm.  
 10) Lower Austria, Badenian, Gainfarn. Inv. NHMW 1855/45/406, height: 14.7 mm.
- Fig. 11–12. *Nassarius schoenni* (HOERNES & AUINGER 1882).  
 11) Lower Austria, Badenian, Baden. Inv. NHMW 1850/9/6, height: 13.5 mm.  
 12) Lower Austria, Badenian, Baden. Inv. NHMW 1850/9/6, height: 14.7 mm.
- Figs. 13–14. *Nassarius edlaueri* (BEER-BISTRICKY 1958).  
 13) Lower Austria, Karpatian, Niederkreuzstetten. Inv. NHMW 1969/42/5, height: 10.6 mm.  
 14) Lower Austria, Karpatian, Niederkreuzstetten. Inv. NHMW 1969/42/5, height: 14 mm.
- Figs. 15–16. *Nassarius podolicus* (HOERNES & AUINGER 1882).  
 15) Poland, Badenian, Glinsko. Syntype, Inv. NHMW 1858/45/436, height: 13.6 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 31; note the much weaker axial sculpture compared to the drawing)).  
 16) Poland, Badenian, Glinsko. Syntype, Inv. NHMW 1858/45/436, height: 14.5 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 30)).
- Fig. 17. *Nassarius zborzewskii* (ANDRZEJOWSKI 1830). Poland, Badenian, Tarnopol. Inv. NHMW 1949/5/16, height: 24 mm (illustrated in HOERNES & AUINGER (1882: pl. 13, fig. 29)).
- Fig. 18. *Nassarius cerithiformis* (HOERNES & AUINGER 1882). Lower Austria, Lower Badenian, Grund. Syntype, Inv. NHMW 1859/38/118, height: 10.3 mm (illustrated in HOERNES & AUINGER (1882: pl. 15, fig. 14)).
- Fig. 19. *Naytiopsis karreri* (HOERNES & AUINGER 1882). Austria/Burgenland, Badenian, Forchtenau. Syntype, Inv. NHMW 1859/37/121, height: 9.3 mm (illustrated in HOERNES & AUINGER (1882: pl. 14, fig. 25)).



## Plate 4

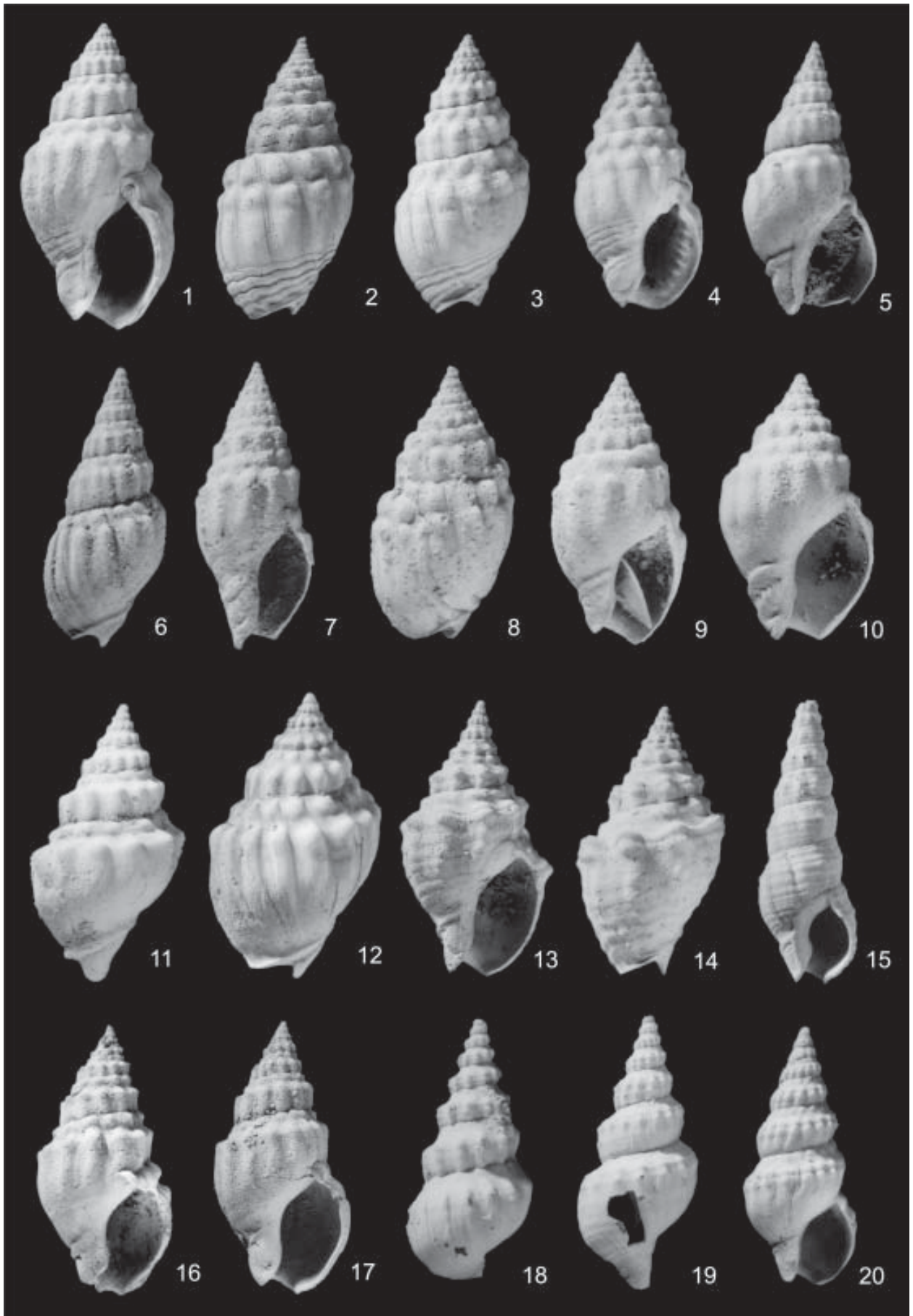
- Figs. 1–2. *Profundinassa fuchsi* (KOENEN 1872).  
 1) Lower Austria, Badenian, Niederleis. Inv. NHMW 1863/15/644, height: 8.3 mm.  
 2) Lower Austria, Badenian, Baden. Holotype, Inv. NHMW 1846/37/146, height: 6.3 mm (illustrated in HÖRNES (1852: pl. 12, fig. 17) as „*Buccinum turbinellus*“).
- Fig. 3. *Cyllene desnoyeri* (BASTEROT 1825). Lower Austria, Badenian, Enzesfeld. Inv. NHMW 1846/37/158, height: 19.0 mm (illustrated in HÖRNES (1852: pl. 12, fig. 19)).
- Figs. 4–7. *Cyllenina ancillariaeformis* (GRATELOUP 1834).  
 4) Austria/Vienna, Badenian, Pötzleinsdorf. Inv. NHMW 1846/37/142, height: 17.0 mm (illustrated in HÖRNES (1852: pl. 12, fig. 21)).  
 5) Austria/Vienna, Badenian, Pötzleinsdorf. Inv. NHMW 1846/37/142, height: 15.0 mm.  
 6) Austria/Vienna, Badenian, Pötzleinsdorf. Inv. NHMW 1846/37/142, height: 18.0 mm.  
 7) Austria/Vienna, Badenian, Pötzleinsdorf. Inv. NHMW 1846/37/142, height: 15.3 mm.
- Fig. 8. *Cyllenina suessi* (HOERNES & AUINGER 1882). Lower Austria, Lower Badenian, Grund. Syntype, Inv. NHMW 1851/2/18, height: 28.5 mm (illustrated in HOERNES & AUINGER (1882: pl. 15, fig. 6)).
- Figs. 9–10. *Cyllenina grundensis* (HOERNES & AUINGER 1882).  
 9) Lower Austria, Lower Badenian, Grund. Syntype, Inv. NHMW 1850/2/19, height: 27 mm (illustrated in HOERNES & AUINGER (1882: pl. 15, fig. 9)).  
 10) Czech Republic, Badenian, Rudelsdorf. Inv. NHMW 1859/10/8, height: 17.5 mm (illustrated as „*Buccinum bohemicum*“ in HOERNES & AUINGER (1882: pl. 15, fig. 10)).
- Figs. 11–12. *Cyllenina neumayri* (HOERNES & AUINGER 1882).  
 11) Lower Austria, Lower Badenian, Grund. Inv. NHMW 2002z0093/0007, height: 20.5 mm.  
 12) Lower Austria, Lower Badenian, Grund. Inv. NHMW 2002z0093/0008, height: 20.7 mm.
- Figs. 13–14. *Cyllenina echinata* (HÖRNES 1852).  
 13) Lower Austria, Karpatian, Kleinebersdorf. Syntype, Inv. NHMW 1846/37/136, height: 21 mm.  
 14) Lower Austria, Karpatian, Kleinebersdorf. Syntype, Inv. NHMW 1846/37/136, height: 17.3 mm.
- Figs. 15–16. *Cyllenina nodosocostata* (HILBER 1879).  
 15) Styria/Austria, Lower Badenian, Pöls. Syntype, Inv. NHMW 1861/1/287, height: 15.3 mm (illustrated in HILBER (1879: pl. 2, fig. 4)).  
 16) Austria/Styria, Badenian, Wildon. Inv. NHMW 2002z0093/0009, height: 20.8 mm.
- Figs. 17–20. *Cyllenina ternodosa* (HILBER 1879).  
 17) Austria/Styria, Lower Badenian, Gamlitz. Syntype, Inv. NHMW 1949/5/14, height: 11.1 mm (illustrated in HILBER (1879: pl. 2, fig. 7)).  
 18) Lower Austria, Karpatian, Kleinebersdorf. Inv. NHMW 1846/37/135, height: 18.3 mm.  
 19) Lower Austria, Karpatian, Niederkreuzstetten. Subadult, Inv. NHMW 1861/2/84, height: 7.0 mm.  
 20) Lower Austria, Karpatian, Niederkreuzstetten. Subadult, Inv. NHMW 1861/2/85, height: 10.3 mm.



## Plate 5

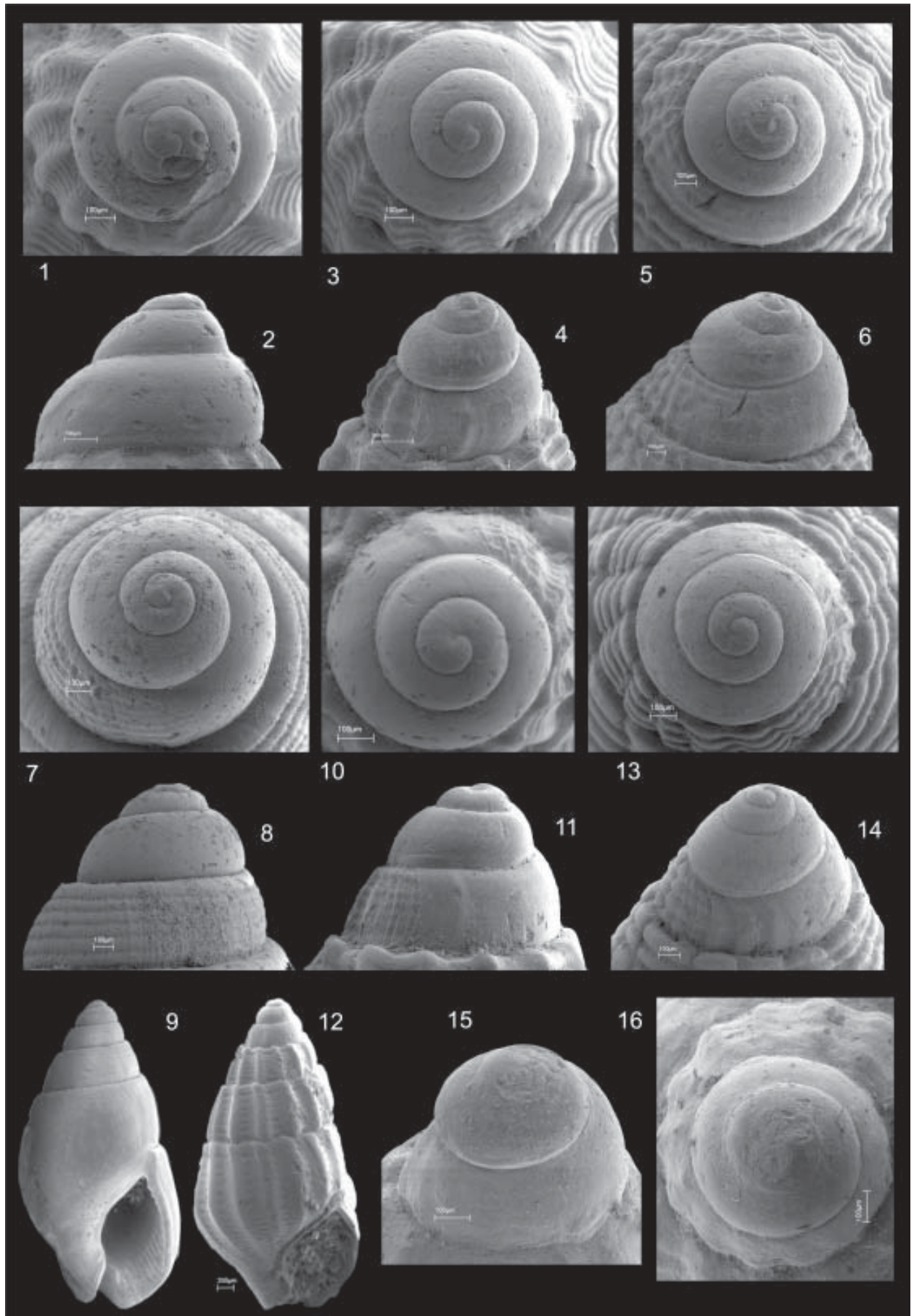
- Figs. 1–4. *Duplicata haueri* (MICHELOTTI 1847).  
 1) Lower Austria, Eggenburgian, Maria Dreieichen. Inv. NHMW 1989/86, height: 28 mm (illustrated as *Buccinum (Dorsanum) Haueri sub-suessi* in SCHAFFER (1912: pl. 51, fig. 6)).  
 2) Lower Austria, Eggenburgian, Maria Dreieichen. Inv. NHMW 1989/85/2, height: 17 mm (illustrated as *Buccinum (Dorsanum) Haueri scalata* in SCHAFFER (1912: pl. 51, fig. 5)).  
 3) Lower Austria, Eggenburgian, Maria Dreieichen. Inv. NHMW 1989/84/1, height: 19 mm (illustrated as *Buccinum (Dorsanum) Haueri excellens* in SCHAFFER (1912: pl. 51, fig. 1)).  
 4) Lower Austria, Eggenburgian, Maria Dreieichen. Inv. NHMW 1989/84/1, height: 17 mm.
- Figs. 5–6. *Duplicata duplicata* (SOWERBY 1832) „*trabalis*-morph“.  
 5) Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Inv. NHMW 2002z0093/0010, height: 17.3 mm.  
 6) Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Inv. NHMW 2002z0093/0011, height: 16.6 mm.
- Figs. 7–9. *Duplicata duplicata* (SOWERBY 1832).  
 7) Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Inv. NHMW 2002z0093/0012, height: 27 mm (illustrated in PAPP (1954: pl. 8, fig. 23)).  
 8) Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Inv. NHMW 2002z0093/0013, height: 16.5 mm (illustrated in PAPP (1954: pl. 8, fig. 5)).  
 9) Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Inv. NHMW 2002z0093/0014, height: 14.9 mm.
- Fig. 10. *Duplicata duplicata* (SOWERBY 1832) „*opinabilis*-morph“. Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Inv. NHMW 2002z0093/0015, height: 18 mm.
- Figs. 11–12. *Duplicata dissita* (EICHWALD 1830).  
 11) Lower Austria, Sarmatian/*Ervilia* Zone, Hautzendorf. Inv. NHMW 2002z0093/0016, height: 22 mm (illustrated in PAPP (1954: pl. 8, fig. 20)).  
 12) Lower Austria, Sarmatian/*Ervilia* Zone, Hautzendorf. Inv. NHMW 2002z0093/0017, height: 16.8 mm.
- Figs. 13–14. *Duplicata ermanni* nov. sp.  
 13) Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Holotype, Inv. NHMW 2002z0093/0018, height: 24 mm.  
 14) Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Paratype, Inv. NHMW 2002z0093/0019, height: 22.5 mm.
- Fig. 15. *Duplicata mitraeformis* (SIMIONESCU & BARBU 1940). Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Inv. NHMW 2002z0093/0020, height: 17.5 mm.
- Figs. 16–17. *Duplicata corbiana* (d'ORBIGNY 1844).  
 16) Austria/Burgenland/, Sarmatian/*Ervilia* Zone, Wiesen. Inv. NHMW 2002z0093/0021, height: 27.5 mm.  
 17) Czech Republic, Sarmatian/*Ervilia* Zone, Bilovice. Inv. NHMW 2002z0093/0022, height: 30 mm.
- Fig. 18. *Akburunella akburunensis* (ANDRUSSOV 1902). Krim/Ukraine, Bessarabian, Akburun. Inv. NHMW 2002z0093/0023, height: 16.5 mm.
- Fig. 19. *Akburunella verneuilii* (d'ORBIGNY 1844). Moldavia, Bessarabian, Kischenew. Inv. NHMW 2002z0093/0024, height: 26 mm.
- Fig. 20. *Akburunella jacquemarti* (d'ORBIGNY 1844). Moldavia, Bessarabian, Kischenew. Inv. NHMW 2002z0093/0025, height: 17.8 mm.





## Plate 6

- Figs. 1–2. *Nassarius serraticosta* (HÖRNES 1852). Rumania, Badenian, Bujtur. Inv. NHMW 2002z0093/0026.
- Figs. 3–4. *Nassarius schroeckingeri* (HOERNES & AUINGER 1882). Rumania, Lower Badenian, Co<teiu de Sus. Inv. NHMW 1869/1/682.
- Figs. 5–6. *Nassarius macrodon auingeri* (HOERNES in HOERNES & AUINGER 1882). Czech Republic, Badenian, Drnowitz. Inv. NHMW 1864/1/450
- Figs. 7–9. *Naytiopsis karreri* (HOERNES & AUINGER 1882). Rumania, Badenian Bujtur. Inv. NHMW 2002z0093/0027, height: 6.18 mm.
- Figs. 10–12. *Nassarius styriacus* (HILBER 1879). Rumania, Badenian Bujtur. Inv. NHMW 2002z0093/0028, height: 3.72 mm.
- Figs. 13–14. *Nassarius subasperatus* (BOETTGER 1906). Lower Austria, Badenian, Niederleis. Inv. NHMW 1865/1/618.
- Figs. 15–16. *Nassarius dujardini* (DESHAYES 1844). Lower Austria, Badenian, Steinabrunn. Inv. NHMW 2002z0093/0029.



## Plate 7

- Fig. 1. *Akburunella fraudulenta* (KOLESNIKOV 1932). Lower Austria, Sarmatian/*Ervilia* Zone, Hautzendorf. Inv. NHMW 2002z0093/0030, height: 13.3 mm (illustrated in PAPP (1954: pl. 7, fig. 27)).
- Fig. 2. *Akburunella triformis* (KOLESNIKOV 1932). Lower Austria, Sarmatian/*Ervilia* Zone, Hautzendorf. Inv. NHMW 2002z0093/0031, height: 18 mm (illustrated in PAPP (1954: pl. 7, fig. 26)).
- Fig. 3. *Akburunella moldavica* (SIMIONESCU & BARBU 1940). Austria/Vienna, Sarmatian/*Mohrensternia* Zone, Gaudenzdorf. Inv. NHMW 1846/37/139, height: 14.7 mm.
- Fig. 4. *Akburunella renovata* (KOLESNIKOV 1932). Moldavia, Bessarabian, Kischenew. Inv. NHMW 2002z0093/0032, height: 24.2 mm.
- Fig. 5. *Akburunella scalaris* (ANDRUSSOV 1902). Krim/Ukraine, Bessarabian, Akburun. Inv. NHMW 2002z0093/0033, height: 10.7 mm.
- Fig. 6. *Akburunella leiiconcha* (ANDRUSSOV 1927). Krim/Ukraine, Bessarabian, Jenikale. Inv. NHMW 2002z0093/0034, height: 11.7 mm.
- Figs. 7–8. *Akburunella kolesnikovi* (SIMIONESCU & BARBU 1940).  
 7) Lower Austria, Sarmatian/*Ervilia* Zone, Hautzendorf. Subadult, Inv. NHMW 2002z0093/0035, height: 9.0 mm (illustrated in PAPP (1954: pl. 8, fig. 24)).  
 8) Moldavia, Bessarabian, Kischenew. Subadult Inv. NHMW 2002z0093/0036, height: 15.9 mm.
- Figs. 9–10. *Profundinassa fuchsi* (KOENEN 1872). Lower Austria, Badenian, Niederleis. Inv. NHMW 2002z0093/0037.
- Figs. 11–12. *Duplicata duplicata* (SOWERBY 1832). Austria, Vienna. Inv. NHMW 2002z0093/0038.
- Fig. 13. *Cyllenina ternodosum* (HILBER 1879). Lower Austria, Karpatian, Kleinebersdorf. Inv. NHMW 1846/37/135.
- Figs. 14–15. *Akburunella akburunensis* (ANDRUSSOV 1902). Krim/Ukraine, Bessarabian, Akburun. Inv. NHMW 2002z0093/0023.
- Figs. 16–17. *Akburunella verneuili* (d'ORBIGNY 1844). Moldavia, Bessarabian, Kischenew. Inv. NHMW 2002z0093/0024.
- Figs. 18–19. *Akburunella kolesnikovi* (SIMIONESCU & BARBU 1940). Austria, Sarmatian, Vienna. Inv. NHMW 2002z0093/0039

