

New Muricidae (Neogastropoda) faunas from the Middle Miocene of Hungary

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Új, magyarországi középső-miocén Muricidae (Neogastropoda) faunák

Összefoglalás

Jelen tanulmány a badeni (kora-középső-miocén) Középső-Paratethys gastropoda-diverzitásának pontosabb ismeretéhez járul hozzá hét Muricidae-összlet bemutatásával. A több mint 50 fajt tartalmazó anyag a badeni Pannóniai-medence északi és nyugati részéből, a Börzsöny, a Bakony és a Mecsek hegységéből származik. Bánd kora-badeni faunája különleges figyelemre tarthat igényt egy faj, a *Janssenia echinulata* (PUSCH) szokatlan gyakorisága miatt. Mecsekpölösken a *Favartia suboblunga* (D'ORBIGNY), míg Hidas térségében egy középső-badeni feltárás faunájában az *Ocinebrina confluens* (EICHWALD) faj jelenik meg más lelőhelyekhez képest tömeges előfordulásban. Néhány ritka species szélesebb ösföldrajzi elterjedése mellett nyolc faj: *Bolinus brandaris torularius* (LAMARCK), *Dermomurex scalaroides* (BLAINVILLE), *Pterynotus pseuderinaceus* (BOETTGER), *Ocinebrina landaui* KOVÁCS, *Pteropurpura friedbergi* (COSSMANN & PEYROT), *Phyllocoma michelottii* (BELLARDI), *Coralliophila sacyi* (COSSMANN & PEYROT), *C. serraticincta* BALUK, valamint egy trophonine nemzetség, a *Pterynopsis* új magyarországi előfordulása dokumentálható a vizsgált anyag alapján. Egy új faj, *Ocinebrina bertai* n. sp. is bevezetésre kerül a bándi középső-miocén lelőhelyről.

Tárgyszavak: miocén, badeni, Muricidae, Középső-Paratethys, Pannóniai-medence

Abstract

The aim of this paper is to contribute to a better understanding of the actual diversity of the Early – Middle Badenian (Langhian; middle Miocene) gastropods from the Central Paratethys. This will be attempted by presenting seven Muricidae assemblages including more than 50 species from the northern and western part of the Pannonian Basin System (Börzsöny, Bakony and Mecsek Mts, Hungary). The Early Badenian fauna of Bánd (Bakony Mts) is of special interest due to its marked abundance of *Janssenia echinulata* (PUSCH); the fauna of Mecsekpölöske (Mecsek Mts) is characterised by the unusual dominance of *Favartia suboblunga* (D'ORBIGNY), while the Middle Badenian fauna from Locality 2 at Hidas (Mecsek Mts) includes a mass occurrence of *Ocinebrina confluens* (EICHWALD). Extended geographical range of some rare species is also documented. Furthermore, eight species: *Bolinus brandaris torularius* (LAMARCK), *Pterynotus pseuderinaceus* (BOETTGER), *Dermomurex scalaroides* (BLAINVILLE), *Ocinebrina landaui* KOVÁCS, *Pteropurpura friedbergi* (COSSMANN & PEYROT), *Phyllocoma michelottii* (BELLARDI), *Coralliophila sacyi* (COSSMANN & PEYROT), *C. serraticincta* BALUK, and a trophonine genus: *Pterynopsis* are recorded as new in Hungary. A new species, *Ocinebrina bertai* n. sp. is also designated from the Middle Miocene locality of Bánd.

Keywords: Miocene, Badenian, Muricidae, Central Paratethys, Pannonian Basin System

Introduction

The aim of this paper is to examine the actual gastropod diversity and palaeogeographical distribution in the Middle Miocene Pannonian Basin by revision of the family Muricidae. Previous papers (KOVÁCS 2018a, KOVÁCS et al. 2018)

have already described the highly diverse muricid assemblage of Letkés (W Börzsöny Mts, N Hungary). Now — beside a new record from Letkés — the muricid materials of W Hungary are presented from newly collected mollusc assemblages in the Bakony Mts (Bánd), and in the Mecsek Mts (Mecsekpölöske, Kisbattyán, Hosszúhetény, Hidas,

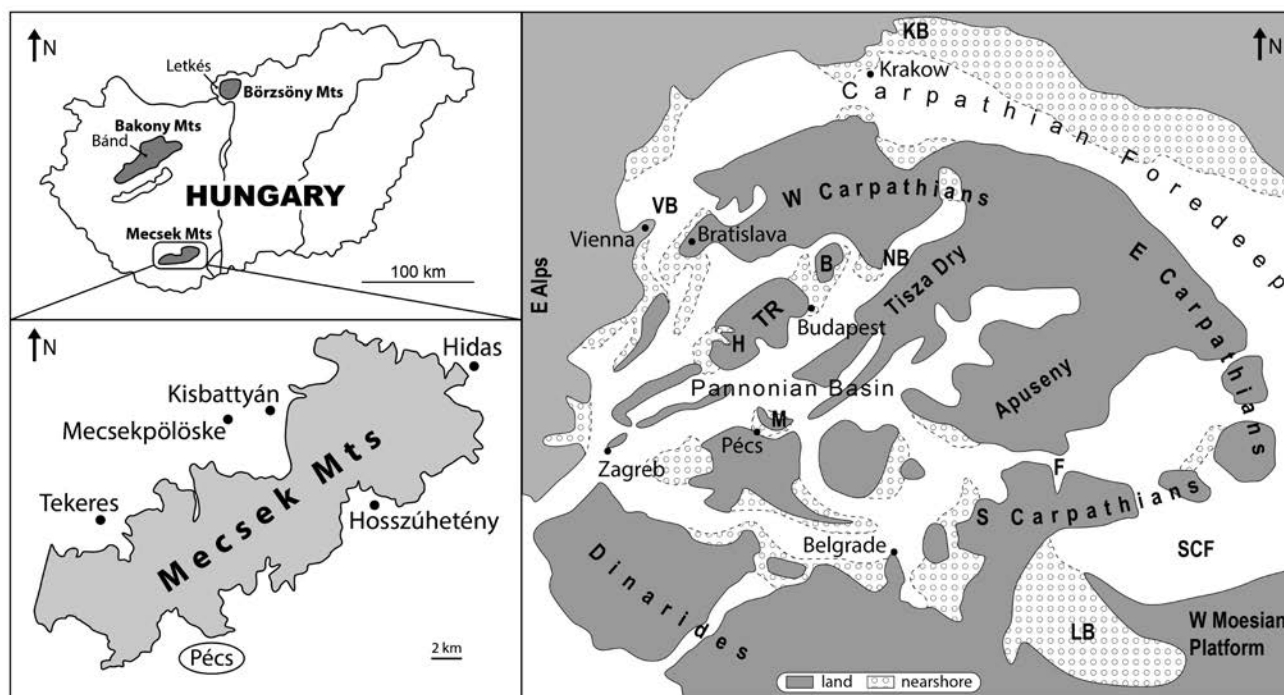


Figure 1. Early Badenian fossiliferous sites mentioned in the text, and their locations in the Central Paratethys. (B – Börzsöny Mts, F – Fáget Basin, H – Herend Basin, KB – Korytnica Basin, LB – Lom Basin, M – Mecsek Mts, NB – Nógrád Basin, TR – Transdanubian Range, SCF – South Carpathian Foredeep, VB – Vienna Basin) (modified from HAAS 2012 and SANT et al. 2019)

I. ábra. A szövegben említett középső-miocén ősmaradvány-lelőhelyek, és ősföldrajzi helyzetük a kora-badeni Középső-Paratethys területén

and Tekerés) (Figure 1). Thus new data are offered for the geographical range and diversity of the family in the Middle Miocene Central Paratethys. The outstanding richness of certain gastropod groups (e.g. Buccinidae, Cypraeidea, Tonnoidea, Ficoidea, Conoidea and Siphonarioidea) in the region was the result of the immigration of thermophilic molluscs from the Mediterranean during the Mid-Miocene Climate Optimum (HARZHAUSER et al. 2003).

The Early Badenian locality of Letkés (Börzsöny Mts) was thoroughly discussed by KOVÁCS & VICIÁN (2014, 2018). Deposits of the Lower Badenian Pécsszabolcs Formation are rich in molluscs, and gastropods were described by CSEPREGHY-MEZNERICS (1956), HARZHAUSER & LANDAU (2016), HARZHAUSER et al. (2017) and VICIÁN et al. (2017).

The geological background of the small Herend Basin was dealt with by KÓKAY (1966, 2006), and DUDKO et al. (1992). During the Early Badenian transgression, the sea formed a narrow embayment in the mountains; the Lower Badenian succession consists of paludal-lacustrine to shallow marine sediments of approx. 300 m thickness. Fossiliferous localities near Bánd and Herend have yielded rich Badenian invertebrate assemblages; marine molluscs were described by KÓKAY (1966), STRAUZ (1966), FEHSE & VICIÁN (2004), DULAI (2005), VICIÁN et al. (2017) and KOVÁCS (2018b).

The Mecsek Mts is an isolated mountainous range in SW Hungary built up of different Permian and Mesozoic rocks, during the Miocene this range was an island surrounded by a largely shallow sea. Over the last 150 years the geological

and stratigraphical properties of the area have been studied in numerous papers (BÁLDI et al. 2002). The diverse lagoonal, coastal and nearshore Badenian facies (Budafa Sandstone, Hidas Brown Coal, Lajta Limestone and Tekerés Schlier formations) were recently discussed by SEBE et al. (2015) and SELMECZI (2015). The Lower Badenian deposits investigated herein represent the lower part of the Lajta Limestone Formation, locally referred to as “Pécsszabolcs Limestone”. It is “a mixture of basal breccias and conglomerates, glauconitic sand(stone)s, bioclastic limestones and mollusc-, echinoidea- and bryozoa-bearing calcareous sands and silts” of 30–50 m thickness (SEBE et al. 2015), it was deposited in the nearshore to littoral zones. The Middle Badenian Hidas Brown Coal Formation represents a brackish-water brown coal, mollusc-bearing marl of 100–150 m thickness and it “comprises clayey, xylithic brown coal seam-bearing rocks (lignite, clayey lignite, huminitic clay) which are situated between the underlying and overlying marine formations” (SELMECZI 2015). The gastropod faunas of this region are poorly known and there are only two monographs which contain detailed analyses of Badenian molluscs: CSEPREGHY-MEZNERICS (1950) dealt with the Hidas area, while BOHN-HAVAS (1973) investigated mainly assemblages from drill cores. With the exception of Tekerés, the localities described herein in the Mecsek Mts have so far not been discussed in the literature. A comprehensive investigation of the newly collected gastropods in the studied assemblages is still in progress, only the muricid species are documented in the present paper.

Materials and methods

The specimens investigated herein are stored in the collections of (i) the Mining and Geological Survey of Hungary (MGSH), (ii) the Hungarian Natural History Museum (HNHM), Budapest, and (iii) in the private collections of Tibor BERTA (Veszprém), László NÁDAI (Budapest), Tamás NÉMETH (Balatonkenese), László SÖVÉR (Bonyhád) and Zoltán VICIÁN (Budapest) (Hungary). The Muricidae taxonomy is discussed in the recent literature; the suprageneric classification given in this paper provisionally follows MERLE et al. (2011), LANDAU et al. (2007, 2013) and HOUART (2018). The comprehensive works of BAŁUK (1995, 2006), HARZHAUSER (2002), KOVÁCS et al. (2018) and KOVÁCS (2019) were also used for taxonomical revision. 21 taxa of special interest are described systematically. The figured specimens belong to private collections except *Figure 2* (see later) and *Plate I/29*. Abbreviation: shell length (SL) in mm.

Localities and faunas

Börzsöny Mts: Letkés

The locality is situated about 400 m to the east of Letkés village (47.888319° N, 18.784647° E). The deposits — re-sedimented beds of limonitic marly sand with andesite rock fragments, andesitic tuff and eroded colonial coral blocks — represent the Lower Badenian Pécszabolcs Formation that was deposited in littoral–sublittoral zones. The macrofauna shows a mixture of taxa deriving from different biotopes. The Muricidae was described in detail by KOVÁCS (2018a) and KOVÁCS et al. (2018), this material is completed herein with a newly collected specimen from the private collection of VICIÁN that represents a new record in the Paratethys: *Phyllocoma michelottii*. The muricid assemblage of Letkés with 54 species is one of the richest in the Paratethys.

Bakony Mts, Herend Basin: Bánd

The materials studied herein were collected from Locality 28 (KÓKAY 1966), 250 m south-east of the village church of Bánd (47.121087° N, 17.786770° E) in artificial trenches. The deposits — mollusc- and coral-bearing grey clay and clayey sand of approx. 2 m thickness with thin fine-grained yellow sand layers — represent the Lower Badenian Pécszabolcs Formation. The colonial coral remains — as well as the rich brachiopod, polyplacophoran, gastropod and bivalve materials — indicate intertidal to sublittoral zones, and a patch reef environment (DULAI 2007).

Four collections were examined: 1. The assemblage containing ten muricids described by KÓKAY (1966) from “Excavation 28” (stored in the MGSH); 2. A large material collected by KÓKAY in 1984 from the same excavation (HNHM); 3. The material listed by BERTA & NÉMETH (2004); 4. The gastropod assemblage of more than 10,000 specimens — including approx. 7000 muricid specimens —

collected by NÉMETH in 2017. Based on this large volume of materials, it was possible to identify 38 species (*Table I*).

The most significant feature of the assemblage is the extreme abundance of the ergalataxine *Janssenia echinulata* (more than 5600 specimens). The appearance of other rare ergalataxines — *J. spinosa* and *Morula (Habromorula) austriaca* — and the frequent occurrence of *M. bellardii* are also remarkable. The most abundant examples in the subfamily Muricinae are *Hexaplex (Trunculariopsis) austriacus* (= *Murex gavardanensis* in KÓKAY 1966), *Chicoreus (Triplex) borni*, and *Homalocantha heptagonata*. In the Aspellinae one rare species occurs: *Aspella emmae*. The dominance of *Muricopsis cristata* in the Muricopsinae is common in Middle Miocene Paratethyan localities, however, the respective occurrences of *Murexsul typhioides*, *Favartia absona* and *F. czjzeki*, as well as the abundance of *F. (Pygmaepteris) transsylvanica* can be considered remarkable. In the Ocenebrinae the abundance of *Ocenebrina kojumdgievae* and *Vitularia linguabovis* is also significant. Two specimens of the extremely rare *Ceratostoma subaustriacus* were found. A new species, *Ocenebrina bertai* n. sp. has also been designated from the locality (see later *Figure 2*). The Typhinae and Coralliophilinae are under-represented. One specimen of *Typhinellus labiatus* (*Plate I/29*, collected by KÓKAY in 1984), and one specimen of *Tripterotyphis tripterus* are all that represent the subfamily Typhinae. (The latter has been recorded only at Letkés in Hungary.) Although colonial corals and vermetids are common in the assemblage, only three coralliophilines — *Coralliophila burdigalensis*, *C. sacyi* and *Leptoconchus jaegeri* — occur sporadically. *Muricodrupa? styriaca* was recorded by KÓKAY (1966) at Bánd but is missing from the newly collected material.

Mecsek Mts: Mecsekpölöske

The geology and stratigraphy of the Mecsekpölöske region were examined earlier by STRAUZ (1928), and CHIKÁN (1991). The Lower Badenian deposits represent the Pécszabolcs Limestone. Muricids have not been recorded in this region. The newly discovered locality is located 1 km east of the village, in a ravine on the western side of the Nagy Hill (46.22311° N, 18.22904° E). Three collections were examined: the mollusc assemblage collected by the staff of the HNHM and the respective private collections of NÉMETH and SÖVÉR.

Alternating layers of mollusc-bearing limestone and dark yellow sandy clay of approx. 3 m thickness were excavated in the locality. The mollusc shells in the clay are very well-preserved, while the limestone benches contain poorly preserved internal molds. In the Muricidae the abundance of *Purpurellus cyclopterus*, *Aspella subanceps*, *Murexsul sandbergeri* and *Favartia suboblunga*, as well as the appearance of rare species such as *Pterynotus pseuderrinaceus*, *F. absona*, *Coralliophila gracilispira* and *C. serraticincta* are noteworthy. The Muricidae species of the locality are shown on *Table I*. The muricid faunal com-

Table I. Muricidae species of the investigated Early Badenian assemblages.**I. táblázat.** Muricidae-fajok a vizsgált kora-badeni összletekben. E – Középső-Paratethysre jellemző endemikus faj

Subfamily Muricinae	E	Illustration	B	M	K	H	Hh	T
<i>Bolinus brandaris torularius</i> (LAMARCK, 1822)		Plate I/1–3				12	1	
<i>Bolinus submuticus</i> (GRATELOUP, 1845)		Plate I/4–5	2					1
<i>Bolinus subtorularius</i> (HOERNES & AUINGER, 1885)	x	KÓKAY l.c., pl. 7/18–19	12		1			
<i>Hexaplex (Trunculariopsis) austriacus</i> (TOURNOUÉR, 1875)		Plate I/6–9	211		2	23	2	
<i>Chicoreus (Triplex) aquitanicus</i> (GRATELOUP, 1833)		Plate I/10			1		17	
<i>Chicoreus (Triplex) borni</i> (HÖRNES, 1853)	x	Plates I/11–14	126	2			26	
<i>Purpurellus cyclopterus</i> (MILLET, 1865)		Plate I/15–16	16	54	9			
Subfamily Aspellinae								
<i>Aspella emmae</i> (BOETTGER, 1902)		Plate I/17–18	4					
<i>Aspella subanceps</i> (D'ORBIGNY, 1852)		Plate I/19–20		56				
<i>Dermomurex (D.) distinctus</i> (CRISTOFORI & JAN, 1832)		Plate I/21–22	3					
<i>Dermomurex (D.) scalaroides</i> (BLAINVILLE, 1826)		Plate I/23–24		2	1			1
<i>Dermomurex (Triatella) jani</i> (DODERLEIN, 1862)			1					
<i>Dermomurex (Dermomurex) sp.</i>		Plate I/25–26		1				
Uncertain subfamily								
<i>Homalocantha heptagonata</i> (BRONN, 1831)			24					
<i>Pterynotus (P.) pseuderinaceus</i> (BOETTGER, 1902)	x	Plate I/27–28		1				
Subfamily Typhinae								
<i>Typhis (Hirtotyphis) horridus</i> (BROCCHI, 1814)								1
<i>Typhinellus labiatus</i> (CRISTOFORI & JAN, 1832)		Plates I/29, II/1–2	1	2		15		
<i>Siphonochelus fistulosus</i> (BROCCHI, 1814)		Plate II/3–4						31
<i>Tripterotyphis tripterus</i> (GRATELOUP, 1833)		Plate II/5–6	1					
Subfamily Muricopsinae								
<i>Muricopsis (Muricopsis) cristata</i> (BROCCHI, 1814)		KÓKAY l.c., pl. 7/20	317	76				
<i>Subpterynotus graniferus</i> (MICHELOTTI, 1841)		Plate II/7–8	1					
<i>Murexsul sandbergeri</i> (HÖRNES, 1856)		Plate II/9–11		56				
<i>Murexsul typhioides</i> (MAYER, 1869)		Plate II/12–13	2					
<i>Favartia (F.) absona</i> (CRISTOFORI & JAN, 1832)		Plate II/14–15	5	2				
<i>F. (F.) czjzeki</i> (HOERNES & AUINGER, 1885)		Plate II/16–17	1					
<i>F. (F.) suboblonga</i> (D'ORBIGNY, 1852)		Plate II/18–19		228	4			
<i>F. (Pygmaepterys) transsylvanica</i> (HOERNES & AUINGER, 1885)	x	Plate II/20–21	43					
Subfamily Ocenebrinae								
<i>Ocenebrina boeckhi</i> (HOERNES & AUINGER, 1885)	x	Plate II/22–23			1			
<i>Ocenebrina credneri</i> (HOERNES & AUINGER, 1885)	x		96					
<i>Ocenebrina dertonensis</i> (BELLARDI, 1873)		Plate II/26	3				61	
<i>Ocenebrina grundensis</i> (HOERNES & AUINGER, 1885)	x	KÓKAY l.c., pl. 8/2	1					
<i>Ocenebrina kojumdgievae</i> (BA UK, 1995)	x	Plate II/27–30	162					
<i>Ocenebrina landaui</i> KOVÁCS, 2019		Plate III/1–2	5					
<i>Ocenebrina bertai</i> n. sp.	x	Figure 2.	3					
<i>Ocenebrina sp.</i>		Plate III/3–4	3					
<i>Ocenebra vindobonensis</i> (HÖRNES, 1853)		Plate III/5–7					740	
<i>Hadriana mioincrassata</i> (SACCO, 1904)		Plate III/8–9	7			88		
<i>Jaton sowerbyi</i> (MICHELOTTI, 1841)		Plate III/10–14	80				15	
<i>Pteropurpura friedbergi</i> (COSSMANN & PEYROT, 1924)		Plate III/15–16						36
<i>Ceratostoma subaustriacus</i> (STOJASPAL, 1978)	x	Plate III/17–18	2					
<i>Vitularia linguabovis</i> (BASTEROT, 1825)		Plate III/19–20	132			2	190	
Subfamily Trophoninae								
<i>Pterylopsis sp.</i>		Plate IV/1–2			1			
Subfamily Ergalataxinae								
<i>Orania cheilotoma</i> (HOERNES & AUINGER, 1890)			14					
<i>Janssenia echinulata</i> (PUSCH, 1837)		Plate IV/3–10	5.600	3		3	31	
<i>Janssenia spinosa</i> (KOJUMDGIEVA, 1960)	x	Plate IV/11–12	93					
<i>Cathymorula exilis</i> (HÖRNES, 1852)		Plate IV/13–14	25			4	11	

Table I. Continuation

I. táblázat. Folytatás

Subfamily Ergalataxinae	E	Illustration	B	M	K	H	Hh	T
<i>Morula (M.) bellardii</i> (HOERNES & AUINGER, 1890)		Plate IV/15–16	51					
<i>M. (Habromorula) austriaca</i> (HOERNES & AUINGER, 1882)	x	Plate IV/17–18	8					
<i>Muricodrupa? styriaca</i> (Hilber, 1879)	x	KÓKAY l.c. pl. 8/1	2					
Subfamily Coralliophilinae								
<i>Coralliophila burdigalensis</i> TOURNOUÉR, 1874		Plate IV/22–23	14					
<i>Coralliophila gracilispira</i> BOETTGER, 1906	x	Plate IV/24		2				
<i>Coralliophila sacyi</i> (COSSMANN & PEYROT, 1924)		Plate IV/25–26	1					
<i>Coralliophila serraticincta</i> BA UK, 1995	x	Plate IV/27–29		2				
<i>Leptoconchus jaegeri</i> BOETTGER, 1906	x	Plate IV/30–31	2					

B – Bánd, M – Mecsekpölöske, K – Kisbattyán, H – Hidas, Locality 1, Hh – Hosszúhetény, T – Tekeres, E – Central Paratethyan endemic species.

position is of special interest given that some of the species are unknown or very rare at other Badenian sites in the Pannonian Basin.

Kisbattyán

The geology and stratigraphy of the Kisbattyán region were treated by STRAUZ (1928) and HÁMOR (1970). The Lower Badenian deposits represent the Pécsszabolcs, the Budafa and the Tekeres formations. The locality studied herein was discovered by SÖVÉR in 2010, it is located 800 m north-west of the village in a ravine (46.23327° N, 18.25653° E). The deposits and the mollusc fauna are very similar to that of the Mecsekpölöske locality. The excavation contains alternating beds of limestone and dark yellow sandy clay layers. For the present study private collections of NÉMETH and SÖVÉR were examined. The Muricidae species of the locality are shown on Table I. The muricid fauna shows low diversity but the appearance of *Ocinebrina boeckhi* and *Pterylopsis* sp. specimens are noteworthy.

Hidas

The geology and stratigraphy of the classical Hidas region have been dealt with by numerous papers (for research history see BOHN-HAVAS 1973, and SELMECZI 1987 with additional references). The Badenian deposits represent the Pécsszabolcs, the Budafa, the Hidas and the Szilágy Formations. Middle Miocene gastropod assemblages were described e.g. by CSEPREGHY-MEZNERICS (1950), STRAUZ (1966), and BOHN-HAVAS (1973); these authors identified only five muricid species from the region.

The gastropod materials examined herein came from artificial trenches in a small ravine in a forest area 350 m south-east of the village (46.25075° N, 18.50690° E). Until this paper these localities have never been studied in the literature; the Lower Badenian Locality 1 was discovered by NÉMETH and SÖVÉR in 2013, while the Middle Badenian Locality 2 was first recognised by NÉMETH in the same year. In Locality 1 shallow marine deposits of 2 m thickness were exposed, the clayey sand represents the Pécsszabolcs Lime-

stone. The deposits are very rich in gastropods. Within the Muricidae *Bolinus brandaris torularius*, *Hexaplex (Trunculariopsis) austriacus* and *Hadriana mioincrassata* are abundant. The muricid species are given in Table I. Most of the species also occur in other small localities in the vicinity or can be collected on the ploughed land at the eastern side of the village. The appearance of *B. brandaris torularius* deserves special mention as the species has never been recorded in the Central Paratethys. The size of the *T. labiatus* shells in this assemblage is slightly larger than at other Pannonian Basin sites. Locality 2 is a small trench approx. 80 m south of Locality 1. Clayey sand of 90 cm thickness was exposed between thin lignite layers; the brackish water deposits represent the Middle Badenian Hidas Brown Coal Formation. The gastropod fauna shows low diversity with the mass occurrences of *Vitta tuberculata* (SCHRÉTER), *Granulolabium nodosoplicatum* (HÖRNES), *Gibborissoia varicosa* (BASTEROT), *Tritia schoenni* (HOERNES & AUINGER) and *Ocinebrina confluens* (EICHWALD). *Alvania* sp., *Rissoina* sp., *Terebralia lignitarium* (EICHWALD) and *Cyllenina ancillariaeformis* (GRATELOUP) appear sporadically. Similar mollusc assemblages without *O. confluens* were earlier recorded from the Hidas area by FÖLDI (1966).

Hosszúhetény

The geology and stratigraphy of the Hosszúhetény region were treated by STRAUZ (1950), SOMOS & KÓKAY (1960), and HÁMOR (1970). The Lower Badenian deposits represent the Pécsszabolcs, the Budafa and the Hidas formations. From the vicinity only one muricid species was recorded by STRAUZ (1950). The locality studied herein is located 600 m south of the village (46.13676° N, 18.35458° E). Lower Badenian clayey sand of 2.5 m thickness was excavated by artificial trenches, the deposit represents the Pécsszabolcs Fm. The layers are rich in mollusc shell remains and fragments of colonial corals. For the present study the respective private collections of NÉMETH and SÖVÉR were examined.

The muricid fauna (Table I) is unique in the Pannonian

Basin. Representatives of the subfamily Ocenebrinae predominate with an abundance of *Ocenebra vindobonensis vindobonensis* and *Vitularia linguabovis*. The latter species shows a similar frequent occurrence in the Muricidae fauna of Bánd, but in that fauna *O. vindobonensis* is replaced by the closely allied *Ocenebrina kojumdgievae*. The specimens of *Jaton sowerbyi* in the Hosszúhetény assemblage are characterized by moderate morphological variability in height of the spire.

Tekeres

The geology and stratigraphy of the Orfű–Tekeres region were dealt with by CHIKÁN (1991) and BÁLDI et al. (2002). The Lower Badenian deposits represent the Pécszabolcs Member and the Tekeres Formation. The locality studied herein is located 100 m east of the Herman Ottó Lake in the forest (46.17449° N, 18.13063° E). It was discovered by NÉMETH in 2010, and described first by BOSNAKOFF (2013). Clayey sand of 180 cm thickness was excavated by artificial trenches, the deposit belongs to the Pécszabolcs Member. The macrofauna is very rich in Early Badenian invertebrate and vertebrate fossils. Two collections were examined: the mollusc assemblage collected by the staff of the HNHM, and the private collection of NÉMETH.

The Muricidae is characterised by a very low diversity with only five species (Table I). The material is of special interest due to the occurrence of the subfamily Typhinae. A single specimen of *Typhis (Hirtotyphis) horridus* and the abundance of *Siphonochelus fistulosus* are noted, both species being very rare in other Badenian sites of Hungary. In addition, *Pteropurpura friedbergi* is reported for the first time in Hungary. It is known only in this assemblage but its occurrence is frequent. Similar gastropod faunal compositions with the co-occurrence of *T. (H.) horridus*, *S. fistulosus*, *P. friedbergi* and the rare cancellariid *Perplicaria mioquadrata* (SACCO) (recorded herein at Tekeres) are known only in the Făget Basin (SW Romania) and the Lom Basin (Vidin–Pleven Region, Bulgarian part of the South Carpathian Foredeep, KOJUMDIEVA 1960).

Systematic Palaeontology

Clade Neogastropoda WENZ, 1938
 Superfamily Muricoidea RAFINESQUE, 1815
 Family Muricidae RAFINESQUE, 1815
 Subfamily Muricinae RAFINESQUE, 1815
 Genus *Bolinus* PUSCH, 1837

Bolinus brandaris torularius (LAMARCK, 1822)
 (Plate I, figs 1–3)

1822 *Murex torularius* — LAMARCK, p. 576.
 2013 *Bolinus brandaris torularius* (LAMARCK) — LANDAU et al., p. 144, pl. 21, fig. 1 (*cum syn.*)
 2018 *Murex (Bolinus) subtorularius* HÖRNES & AUINGER — JANEČEK, p. 59, pl. 6, fig. 3.

2019 *Bolinus brandaris torularius* (LAMARCK) — LANDAU et al., p. 4, pl. 1, figs 1–3 (*cum syn.*)

Remarks: The species is distinguishable from *B. subtorularius* (HÖRNES & AUINGER) — which is common in the Early Badenian of the Pannonian Basin (KOVÁCS et al. 2018) — by subquadrangulate last whorl, two rows of well-developed spines on the last whorl, and spiny siphonal canal. The specimen illustrated by JANEČEK (2018) as *M. (B.) subtorularius* actually represents *B. brandaris torularius*, it came from an Early Badenian mollusc assemblage of Lomnička (Czechia, Moravian part of the Carpathian Foredeep). The two records confirm a wide geographical range of the species in the Central Paratethys.

Distribution: Middle Miocene–Pleistocene. Middle Miocene: NE Atlantic (France), Central Paratethys (Czechia; Hungary: this paper), Proto-Mediterranean Sea (Turkey).

Subfamily Aspellinae KEEN, 1971
 Genus *Aspella* MÖRCH, 1877

Aspella subanceps (D'ORBIGNY, 1852)
 (Plate I, figs 19–20)

1852 *Ranella subanceps* — D'ORBIGNY, p. 77.
 2007 *Aspella subanceps* (D'ORBIGNY) — LANDAU et al., p. 21, pl. 6, fig. 9 (*cum syn.*)
 2011 *Aspella subanceps* (D'ORBIGNY) — MERLE et al., p. 206, text-fig. 71/F, pl. 157, figs 1–3.
 2018 *Aspella subanceps* (D'ORBIGNY) — KOVÁCS et al., p. 116, fig. 4/A–C.

Remarks: Two *Aspella* species are known in the early Badenian Central Paratethys: *A. subanceps* (D'ORBIGNY), and *A. emmae* (BOETTGER). *A. emmae* (Plate I/17–18) — which is known in the Făget Basin (Romania), Korytnica Basin (Poland) and the N Pannonian Basin (North Hungarian Mountains) — differs from *A. subanceps* by paucispiral protoconch and smooth shell surface. *A. subanceps* is very rare in the Pannonian Basin: beside Mecsekpölöske where it is abundant, only one specimen was recorded in the Early Badenian gastropod assemblage of Letkés.

Distribution: Early–Middle Miocene. Middle Miocene: NE Atlantic (France), Central Paratethys (Austria, Hungary, Poland, Romania).

Genus *Dermomurex* MONTEROSATO, 1890
 Subgenus *Dermomurex* (*Dermomurex*)

Dermomurex (Dermomurex) scalaroides (BLAINVILLE, 1829)
 (Plate I, figs 23–24)

1829 *Murex scalaroides* — BLAINVILLE, p. 131, pl. 5A, figs 5–6.
 non 1960 *Aspella (Aspella) scalaroides* (BLAINVILLE) — KOJUMDIEVA, p. 148, pl. 40, fig. 7 [= *Dermomurex (Triatella) jani* (DODERLEIN, 1862)]
 2007 *Dermomurex (Dermomurex) scalaroides* (BLAINVILLE) — LANDAU et al., p. 22, pl. 6, fig. 1 (*cum syn.*)
 2016 *Dermomurex (Dermomurex) scalaroides* (BLAINVILLE) — CEULEMANS et al., p. 38, pl. 1, fig. 5.

Remarks: The species is recorded herein for the first time in Hungary. It differs from *D. (D.) distinctus* (CRISTOFORI & JAN) (Plate I/21–22) — which is common in the Early Badenian Central Paratethys — in morphology by slender shell and weakly developed spiral sculpture. It also differs from the trivariate *D. (Triatella) jani* (DODERLEIN) by numerous varices on the last whorl (KOVÁCS et al. 2018).

Distribution: Middle Miocene – Recent. Middle Miocene: NE Atlantic (France), Proto-Mediterranean Sea (Italy), Central Paratethys (Hungary: this paper).

Dermomurex (Dermomurex) sp.
(Plate I, figs 25–26)

Remarks: The specimen from the muricid assemblage of Mecsekpölöske lacks the protoconch, possesses five rounded teleoconch whorls, ovate aperture with dentate outer lip, weakly developed spiral sculpture of flat, narrow P1, P2, P4 primary cords, slightly stronger P3 and P5 primary cords, and four varices on the last whorl. Its morphology differs from that of the common *D. (D.) distinctus* by less developed spiral sculpture, from *D. (T.) jani* by the presence of more varices, and from *D. (D.) scalaroides* by slender shell with higher spire. The most closely allied form in size and overall morphology is the *D. (D.) cf. tenellus* (MAYER) illustrated by MERLE et al. (2011, pl. 165/10) from the Early Miocene of the Aquitaine Basin. However, the specific beaded spiral ornamentation cannot be observed on the specimen figured herein.

Uncertain subfamily (see HOUART 2018 with additional references)
Genus *Pterynotus* SWAINSON, 1833
Subgenus *Pterynotus (Pterynotus)*

Pterynotus (Pterynotus) pseuderinaceus (BOETTGER, 1902)
(Plate I, figs 27–28)

1902 *Murex (Pteronotus) pseuderinaceus* — BOETTGER, p. 28.
1934 *Murex (Pterynotus) pseuderinaceus* BOETTGER — ZILCH, p. 251, pl. 15, fig. 76.
2019 *Pterynotus (Pterynotus) pseuderinaceus* (BOETTGER) — KOVÁCS, p. 117, figs 13–14.

Remarks: The small specimen figured here possesses an eroded protoconch, 4.5 shouldered teleoconch whorls, an ovate aperture, smooth lips within, and a curved, open siphonal canal. The sculpture consists of primary spiral cords (P) (P1–P2 on the spire whorls, P1–P4 on the last whorl), and axial sculpture of four varices on the spire whorls, and three varices on the last whorl. The morphology contributes to the diagnosis of subgenus *Pterynotus (Pterynotus)* (trivariate shell with foliaceous varices, lack of anal notch, generally not spiny spiral sculpture, weakly developed denticles on the outer lip, smooth inner lip) (MERLE et al. 2011). However, the characteristic spiral sculpture with numerous fine cords is absent on the available specimens.

P. (P.) pseuderinaceus is recorded herein for the first

time in Hungary. It is a poorly known species having hitherto been documented only in its type locality, Coșteiu de Sus (Făget Basin, SW Romania). The congeneric *P. (P.) granuliferus* (GRATELOUP) differs in larger size and in morphology by less developed spiral cords on the early spire whorls, and rounded varices.

Distribution: Middle Miocene: Central Paratethys (Hungary: this paper, Romania)

Subfamily Muricopsinae RADWIN & D'ATTILIO, 1971
Genus *Murexsul* IREDALE, 1915

Murexsul typhioides (MAYER, 1869)
(Plate II, figs 12–13)

1869 *Murex typhioides* — MAYER, p. 83, pl. 3, fig. 6.
1995 *Aspella (Aspella) typhioides* (MAYER) — BAŁUK, p. 219, pl. 25, fig. 5 (*cum syn.*)
2018 *Murexsul typhioides* (MAYER) — KOVÁCS et al., p. 120, figs 5/K, L, 6A–C.

Remarks: The taxonomy and morphology of *M. typhioides* were discussed by KOVÁCS et al. (2018). The species was assigned to *Aspella* by BAŁUK (1995), however, the latter genus differs by bivariate morphology. *M. typhioides* is a rare species, and in Hungary it is known only in the Early Badenian gastropod assemblages of Bánd and Letkés.

Distribution: Early – Middle Miocene. Middle Miocene: NE Atlantic (France), Central Paratethys (Hungary, Poland).

Genus *Favartia* JOUSSEAUME, 1880
Subgenus *Favartia (Favartia)*

Favartia (Favartia) suboblonga (D'ORBIGNY, 1852)
(Plate II, figs 18–19)

1852 *Murex suboblongus* — D'ORBIGNY, p. 73.
2007 *Favartia suboblonga* (D'ORBIGNY) — LANDAU et al., p. 46, text-fig. 12, pl. 12, figs 5–8 (*cum syn.*)
2016 *Favartia suboblonga* (D'ORBIGNY) — CEULEMANS et al., p. 40, pl. 1, figs 8–9.
2018 *Favartia (s.s.) suboblonga* (D'ORBIGNY) — KOVÁCS et al., p. 121, fig. 5/Q–T (*cum syn.*).

Remarks: Three *Favartia* species occur in the Early Badenian of the Central Paratethys: *F. (F.) absona* (CRISTOFORI & JAN), *F. (F.) czjzeki* (HOERNES & AUINGER) [= *Murex (Muricidea) collega* BOETTGER, 1906] and *F. (F.) suboblonga* (D'ORBIGNY). *F. suboblonga* differs from *F. absona* (Plate II/14–15) in morphology by higher spire and rounded varices, and from *F. czjzeki* (Plate II, figs 16–17) by broader shell. The species is widespread but generally rare in the Central Paratethys. Its dominance in the muricid fauna of Mecsekpölöske (Table I) with 47% is unusual compared to other Paratethyan Middle Miocene sites.

Distribution: Early Miocene – Middle Pliocene. Middle Miocene: NE Atlantic (France), Central Paratethys (Austria, Hungary, Poland, Romania, Slovakia).

Subfamily Ocenebrinae COSSMANN, 1903

Genus *Ocenebrina* JOUSSEAUME, 1880

Ocenebrina confluens (EICHWALD, 1853)
(Plate II, figs 24–25)

1853 *Murex confluens* — EICHWALD, p. 192, pl. 8, fig. 11.

1950 *Tritonalia* (*Hadriania*) aff. *miocrassata* — CSEPREGHY-MEZNERICS, p. 48, pl. 2, fig. 19.

1968 *Murex confluens* EICHWALD — ZELINSKAYA et al., p. 185, pl. 44, figs 5–6.

1971–1972 *Tritonalia confluens* EICHWALD — CSEPREGHY-MEZNERICS, p. 27, pl. 10, fig. 6.

1994 *Murex confluens* EICHWALD — IONESI & NICORICI, pl. 3, fig. 7.

2006 *Purpura* (*Tritonalia*) *confluens* (EICHWALD) — BAŁUK, p. 209, pl. 13, figs 1–3 (*cum syn.*)

non 2010 *Murex* (*Tritonalia*) *confluens* (EICHWALD) — JOVANOVIĆ, text-fig. 1.2 (= ? *Murexsul* sp.)

Remarks: As this species lacks well-developed varices typical of genus *Ocenebra*, here it is assigned to *Ocenebrina*. Only one specimen was recorded by CSEPREGHY-MEZNERICS (1950) from the Mecsek Mts (Hidas area). In the newly discovered Middle Badenian Locality 2 at Hidas, *O. confluens* (represented by more than 1000 specimens) is one of the most abundant species in the gastropod assemblage. The intraspecific variability is not typical of the local *confluens* material: the specimens are closely allied to the type in size and morphology but slightly differ by open siphonal canal similarly to the example figured by BAŁUK (2006, pl. 13, fig. 1). The specimen presented by JOVANOVIĆ (2010, text-fig. 1.2) is characterised by different morphological features, it represents another taxon.

Distribution: Middle Miocene: Central Paratethys (Hungary, Poland, Romania, Ukraine).

Ocenebrina kojumdgievae (BAŁUK, 1995)
(Plate II, figs 27–30)

1966 *Tritonalia vindobonensis* (HÖRNES) var. — KÓKAY, p. 57, pl. 8, fig. 6.

1995 *Purpura* (*Tritonalia*) *kojumdgievae* nom. n. — BAŁUK, p. 228, pl. 30, fig. 8.

2017 *Ocenebrina kojumdgievae* (BAŁUK) — VICIÁN et al., p. 60, pl. 3, fig. 3 (*cum syn.*)

Remarks: The abundance of *O. kojumdgievae* in the gastropod assemblage of Bánd is noteworthy as the species is usually very rare at other Badenian fossiliferous sites. It differs from the similar *Ocenebra vindobonensis vindobonensis* (HÖRNES) in morphology by broad shell, lower spire and rounded varices. The co-occurrence of the latter species and *O. kojumdgievae* recorded by BAŁUK in the Korytnica Basin (Poland) is not typical of the Pannonian Basin localities. The *kojumdgievae* material at Bánd is characterised by moderate intraspecific variability in the strength of the spiral sculpture.

Distribution: Middle Miocene: Central Paratethys (Austria, Bulgaria, Hungary, Poland, Romania).

Ocenebrina landaui KOVÁCS, 2019

(Plate III, figs 1–2)

2018 *Ocenebrina* cf. *recognita* BAŁUK — KOVÁCS et al., p. 123, fig. 7/G-H.

2019 *Ocenebrina landaui* n. sp. — KOVÁCS, p. 129, figs 51–55.

Remarks: *Ocenebrina landaui* appears in the clayey sand layers of Locality 28 of Bánd. The species is similar in size and morphology to *O. recognita* BAŁUK but differs in sculpture by labral tooth and well-developed secondary cords. It is also distinguishable from *O. grundensis* (HOERNES & AUINGER) on the bases of its higher spire, labral tooth and sharper spiral cords. The species is widely distributed in the Badenian Central Paratethys: it was described at Coșteiu de Sus (Romania), and it is also documented here in the gastropod assemblage of Letkés.

Distribution: Middle–Late Miocene: Middle Miocene: Central Paratethys (Romania, Hungary: this paper), Proto-Mediterranean Sea (Turkey).

Ocenebrina bertai n. sp.

(Figure 2)

urn:lsid:zoobank.org:act:A627F7BE-7A63-42B2-A262-3B7E6C2E34AB

Holotype: PAL 2019.246.1., HNHM, Department of Palaeontology and Geology, SL 19 (Figure 2).

Type strata and locality: Middle Miocene (Lower Badenian) yellow sand, Locality 28, Bánd, Hungary.

Derivation of name: In honour of the collector: Tibor BERTA (Veszprém, Hungary).

Material: holotype (HNHM), and two additional specimens in Collection Berta.

Diagnosis: An *Ocenebrina* species with biconic shell, worn paucispiral protoconch, five shouldered teleoconch whorls, ovate aperture, dentate outer lip, short, open siphonal canal, well-developed primary cords and fine secondary cords, broad, rounded axial ribs.

Description: Biconic shell of medium size, worn paucispiral protoconch. Teleoconch of five shouldered whorls, suture shallow, undulating. Last whorl 79% of the total length. Aperture ovate, outer lip slightly thickened, six denticles within (D1–6, D3 splitted). Anal notch slightly developed, columellar lip thin and smooth, siphonal canal open, short and straight. Spiral sculpture of strong and rounded primary cords, 11 on the last whorl, and finer secondary cords. Axial sculpture of broad and rounded ribs, seven on the last whorl.

Remarks: Based on general morphology the new species is assigned to *Ocenebrina*. The genus shows a remarkable variability in the Badenian Central Paratethys but similar forms with broad biconic shell are unknown in the literature. *O. crassilabiata* (HILBER) differs in larger size, stronger varices, and well-developed denticles, while *O. grundensis* and *O. landaui* possess rounded teleoconch whorls and sealed canal. *O. striata* (EICHWALD) is a closely allied spe-

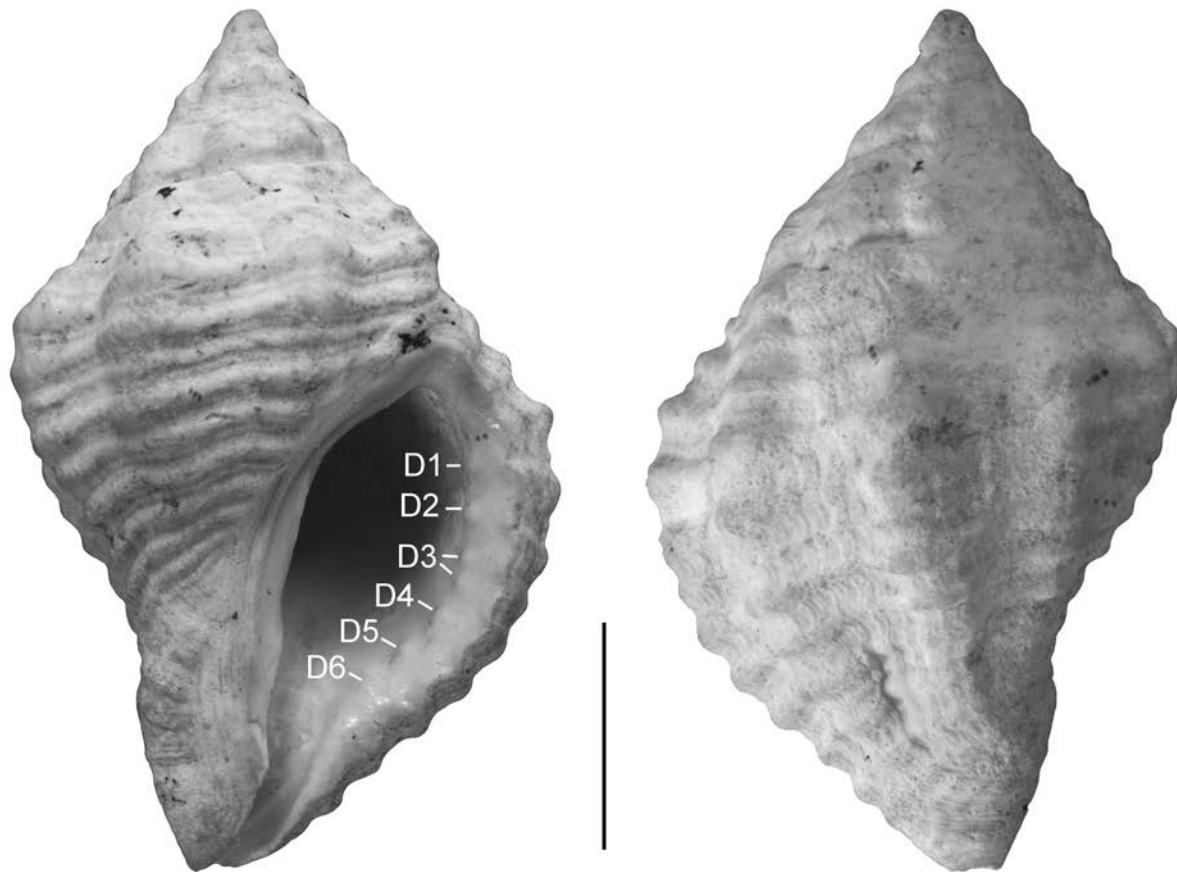


Figure 2. *Ocinebrina bertai* n. sp. Holotype, SL 19, Scale bar 5 mm
2. ábra. *Ocinebrina bertai* n. sp. Holotípus, hossz: 19, Méretvonal: 5 mm

cies in overall form but characterised by slender shell and higher, usually gradate spire. The *Ocinebrina* sp. specimens (Plate III/3–4) in the same assemblage are distinguishable by somewhat stronger varices, presence of pseudoumbilicus, and different sculpture with regularly alternating primary and secondary cords.

The material came from a yellow sandy layer of 40 cm thickness under- and overlaid by clayey sand of marine origin. *Ocinebrina* sp. and *O. bertai* n. sp. were associated with abundant specimens of *Terebralia lignitarum* (EICHWALD), and genera *Vitta* and *Granulolabium*; the assemblage is typical of the lagoon paleoenvironment.

Genus *Ocenebra* GRAY, 1847

Ocenebra vindobonensis vindobonensis (HÖRNES, 1853)
 (Plate III, figs 5–7)

- 1853 *Murex Vindobonensis* — HÖRNES, p. 252, pl. 25, fig. 17 only.
 1943 *Murex granuliferus* GRATELOUP — STRAUSZ, pl. 3, figs 9, 15
 [non *Pterynotus granuliferus* (GRATELOUP, 1833)]
 2016 *Ocenebra vindobonensis vindobonensis* (HÖRNES) —
 LANDAU et al., p. 224, pl. 1, fig. 4 (cum syn.)
 2018 *Ocenebra vindobonensis vindobonensis* (HÖRNES) —
 KOVÁCS et al., p. 123, fig. 7/I, J.

Remarks: This species is not rare in the Early Badenian

localities of Hungary but extremely abundant in the mollusc assemblage of Hosszúhetény where more than 700 specimens were collected. The specimen identified by STRAUSZ (1943) as *M. granuliferus* from the neighbouring Pécsvárad area differs in morphology from *Pterynotus granuliferus* (GRATELOUP), it actually represents *O. vindobonensis vindobonensis*. The studied specimens show moderate intraspecific variability in the development of the sculpture.

Distribution: Early – Middle Miocene. Middle Miocene: Central Paratethys (Austria, Bulgaria, Czechia, Hungary, Poland, Romania, Slovakia), Proto-Mediterranean Sea (France, Turkey).

Genus *Pteropurpura* JOUSSEAUME, 1880

Pteropurpura friedbergi (COSSMANN & PEYROT, 1924)
 (Plate III, figs 15–16)

- 1924 *Murex friedbergi* — COSSMANN & PEYROT, 98.
 non 1966 *Purpura (Tritonalia) delbosiana friedbergi* COSSMANN &
 PEYROT — SYMEONIDIS, p. 279, pl. 57, figs 4–5 [= *Pteropurpura delbosiana* (GRATELOUP, 1845)]
 1968 *Murex friedbergi* COSSMANN & PEYROT — ZELINSKAYA et al.,
 p. 186, pl. 44, figs 7–8.
 1995 *Murex (Tubicauda) friedbergi* COSSMANN & PEYROT —
 BALUK, p. 212, pl. 22, figs 6–8 (cum syn.)
 2016 *Murex friedbergi* COSSMANN & PEYROT — WYSOCKA et al.,
 text-fig. 11/C.

2019 *Pteropurpura friedbergi* (COSSMANN & PEYROT) — KOVÁCS, p. 132, figs 59–60.

Remarks: Although the species is widely distributed in the Early Badenian Central Paratethys, it is recorded here for the first time in Hungary. *P. friedbergi* appears only in the locality of Tekeres in the Hungarian part of the Pannonian Basin and is relatively common in the mollusc assemblage. The specimen illustrated by SYMEONIDIS (1966, pl. 57, figs 4–5) from the Miocene of Crete (Greece) represents *P. delbosiana* (Grateloup), it differs from *friedbergi* in larger size and in morphology by strong labral varix, and lack of spines on the siphonal canal.

Distribution: Middle Miocene: Central Paratethys (Austria, Bulgaria, Hungary: this paper, Poland, Romania, Ukraine).

Genus *Ceratostoma* HERRMANNSEN, 1846

Ceratostoma subaustriacus (STOJASPAL, 1978)
(Plate III, figs 17–18)

1978 *Jaton* (*Ceratostoma*) *subaustriaca* nom. nov. — STOJASPAL, p. 335.

2017 *Ceratostoma subaustriacus* (STOJASPAL) — VICIÁN et al., p. 269, pl. 2, figs 13–14.

2018 *Ceratostoma subaustriacus* (STOJASPAL) — KOVÁCS et al., p. 125, fig. 7/P–S.

Remarks: *C. subaustriacus* is the sole representative of the genus in the Early Badenian assemblages of the Paratethys and is extremely rare. It is only known from three localities: beside the two specimens recorded herein at Báánd, six specimens were documented at Grund (Austria) by HÖRNES (1853), and two specimens were described at Letkés by VICIÁN et al. (2017). The scarcity may be explained by the fact that the Recent *Ceratostoma* is confined to the temperate zone, while the Mid-Miocene Climate Optimum resulted in a tropical phase in the Early Badenian Central Paratethys.

Distribution: Middle Miocene: Central Paratethys (Austria, Hungary)

Subfamily Trophoninae COSSMANN, 1903

Genus *Pterynopsis* VOKES, 1972

Pterynopsis sp.
(Plate IV, figs 1–2)

Remarks: The poorly preserved specimen in the Kisbattyán assemblage is characterised by high, conical, gradate spire with 3.5 preserved spire whorls, subangulate shoulder, ovate aperture, foliated and dentate outer lip, smooth columella, straight and open siphonal canal, six varices on the second preserved spire whorl, three varices with P1 spine on the penultimate and last whorls, and two prosocline intervarical axial ribs. These morphological features correspond to the main characteristics of genus *Pterynopsis* (VOKES 1972). One species, *P. badensis* (NYST, 1881) [= *P. tortuosus*

(SOWERBY) in the older literature] is known from the Paratethys in Austria, Poland, Romania, Slovakia and Ukraine (BISKUPIČ 2016). However, the specimen figured herein is closer in size and morphology to *P. subcontabulata* (MILLET, 1854) from the Late Miocene – Pliocene NE Atlantic region (see CEULEMANS et al. 2016, pl. 2, figs 2–4), the two intervarical ribs appear on the specimen illustrated on the website of the Muséum national d'Histoire naturelle (Paris [https://science.mnhn.fr/institution/mnhn/collection/f/item/a57350]), but the poor state of preservation precludes exact determination. The genus is recorded in Hungary for the first time.

Subfamily Ergalataxinae KURODA, HABE & OYAMA, 1971

Genus *Janssenia* LANDAU, HARZHAUSER, İSLAMOĞLU & SILVA, 2013

Janssenia echinulata (PUSCH, 1837)
(Plate IV, figs 3–10)

1837 *Ricinula echinulata* — PUSCH, p. 140, pl. 11, fig. 27.

1882 *Purpura* (*Stramonita*) *haemastomoides* — HOERNES & AUINGER, p. 151.

1966 *Thais* (*Stramonita*) *haemastomoides* HOERNES & AUINGER — STRAUZ, p. 282, text-fig. 129.a, pl. 35, figs 13–15, pl. 64, fig. 1.

1995 *Thais* (*Stramonita*) *echinulata* (PUSCH) — BALUK, p. 222, pl. 27, figs 5–6.

2013 *Stramonita haemastomoides* (HOERNES & AUINGER) — LANDAU et al., p. 155, pl. 23, fig. 4 (*cum syn.*)

2013 *Janssenia echinulata* (PUSCH) — LANDAU et al., p. 157, pl. 23, figs 7–8 (*cum syn.*)

2018 *Janssenia echinulata* (PUSCH) — KOVÁCS et al., p. 126, fig. 8/O–Q.

Remarks: This species is extremely abundant in the gastropod assemblage of Báánd. The investigated specimens are characterised by strong intraspecific variability in height of the spire, strength of the spiral rows of tubercles and development of the columellar folds. The large amount of material available made it possible to review the taxonomic validity of *Stramonita haemastomoides* (HOERNES & AUINGER). The *J. echinulata* specimens investigated herein show remarkable differences in the strength of the columellar folds (visible only on 60% of the material); the very weak development of the folds was also emphasized by LANDAU et al. (2013). The material of HÖRNES (1852: 167) was quite small, so it is plausible that the unfolded type of *haemastomoides* (HÖRNES, 1852, pl. 13, fig. 18, designated by HOERNES & AUINGER 1882: 151) — that possesses an identical morphology with *echinulata* but folds — in fact represents *echinulata*. According to LANDAU et al. (2013: 155) all Paratethyan *haemastomoides* that are recorded in the literature represent *J. echinulata*. However, only four *haemastomoides* specimens were listed by the authors from Turkey, and the illustrated specimen (l.c., pl. 23, fig. 4) seems to fit within the variability of *J. echinulata*. Consequently, it is the arrangement of BALUK (1995) which is accepted herein, and *haemastomoides* is regarded as the junior synonym of *echinulata*.

From a palaeoecological point of view *J. echinulata* may be compared to the Pliocene–Recent *Stramonita haemastoma*

(LINNAEUS) as they are closely allied in size and morphology. The latter species occurs in both tropical and warm temperate water areas, and is typical of rocky littoral habitats where it can occur with a density of hundreds of specimens/m² (RILOV et al. 2001). *S. haemastoma* is a predator of bivalves (ostreoids, mytiloids), gastropods (limpets, vermetids) and cirripedes. It seems plausible that *J. echinulata* occupied the same habitat in the Badenian sea. The remains of possible prey (bivalves and vermetids) are common in the fossil assemblage of Bánd (e.g. the *Vermetus* material is over-represented compared to other Badenian localities).

Distribution: Middle Miocene: Central Paratethys (Austria, Bosnia, Bulgaria, Hungary, Poland, Romania, Slovakia, Slovenia), Proto-Mediterranean Sea (Turkey).

Genus *Phyllocoma* TAPPARONE CANEFRI, 1880

Phyllocoma michelottii (BELLARDI, 1873)
(Plate IV, figs 19–21)

1873 *Ranella michelottii* — BELLARDI, p. 275, pl. 15, fig. 22.
2001 *Phyllocoma michelottii* (BELLARDI) — LOZOUET et al., p. 59, pl. 24, fig. 7 (*cum syn.*)

Remarks: The type of this species from the Middle Miocene of the Torino Hills (Italy) is a fragmentary specimen (BELLARDI 1873, pl. 15, fig. 22). The specimen presented here from the Letkés assemblage possesses an anterodorsally depressed shell, two varices per whorl and a well-developed spiral sculpture. It agrees well in size and morphology with the materials presented by LOZOUET et al. (1993, 2001) from the Early Miocene of France. *P. michelottii* differs from *Daphnellopsis tournouëri* LOZOUET, LEDON & LESPORT, 1993 (recorded by KOVÁCS et al. 2018 from Hungary) in higher spire and different sculpture. This extremely rare species is documented for the first time in the Paratethys. (The classification of the genus is discussed in the literature, see VERMEIJ & CARLSON 2000 and HOUART 2018.)

Distribution: Chattian – Middle Miocene. Middle Miocene: Proto-Mediterranean Sea (Italy), Central Paratethys (Hungary: this paper).

Subfamily Coralliophilinae CHENU, 1859

Genus *Coralliophila* H. ADAMS & A. ADAMS, 1853

Coralliophila burdigalensis TOURNOUËR, 1874
(Plate IV, figs 22–23)

1874 *Coralliophila burdigalensis* — TOURNOUËR, p. 296, pl. 9, fig. 6.
2001 *Coralliophila burdigalensis* (TOURNOUËR) — LOZOUET et al., p. 60, pl. 25, figs 1–10 (*cum syn.*)
2018 *Coralliophila burdigalensis* TOURNOUËR — KOVÁCS et al., p. 129, fig. 9/F–I.
2019 *Coralliophila burdigalensis* TOURNOUËR — KOVÁCS, p. 137, figs 71–76.

Remarks: Up until now very little has been known about genus *Coralliophila* in the Miocene Paratethys. However, the new records (BALUK 2006, KOVÁCS et al. 2018, this paper) demonstrate a higher diversity and a wider geographical

distribution of the genus than was recognized before. *C. burdigalensis* is characterized by a highly variable shell morphology (LOZOUET & RENARD 1998). The species is widespread in the Central Paratethys, occurring in the Lower Badenian deposits of Bánd and Letkés (Pannonian Basin), and Coșteiu and Lăpugiu (Făget Basin). *C. gracilispira* BOETTGER differs in morphology by slender shell and higher spire (Plate IV/24); *C. sacyi* (COSSMANN & PEYROT) has a noticeably different sculpture; *C. biconica* BOETTGER possesses flat spire whorls and numerous axial ribs (ZILCH 1934, pl. 15, fig. 83); *C. serraticincta* BALUK has a broader shell and gradate spire. *C. burdigalensis* is associated mainly with Faviidae colonial corals that are abundant in the clayey sand deposits of Bánd (OOSTERBAAN 1990).

Distribution: Chattian – Middle Miocene. Middle Miocene: Central Paratethys (Hungary, Romania).

Coralliophila sacyi (COSSMANN & PEYROT, 1924)
(Plate IV, figs 25–26)

1924 *Purpura (Stramonita) Sacyi* nov. sp. — COSSMANN & PEYROT, p. 247, pl. 14, figs 51–52.
1998 *Coralliophila sacyi* (COSSMANN & PEYROT) — LOZOUET & RENARD, p. 175, fig. 3.1–4.
2006 *Coralliophila* sp. — BALUK, p. 210, pl. 13, fig. 9.

Remarks: This rare species is closely allied to *C. burdigalensis* in size but differs in morphology by shouldered whorls, well-developed sculpture of strong primary and weak secondary cords, and marked, narrow axial ribs. *C. sacyi* is typical of the Early Miocene of France, but sporadically occurs in the Middle Miocene of the Central Paratethys as well. The species is a new record in Hungary.

Distribution: Chattian – Middle Miocene. Middle Miocene: Central Paratethys (Hungary: this paper, Poland).

Coralliophila serraticincta BALUK, 1995
(Plate IV, figs 27–29)

1995 *Coralliophila (Coralliophila) serraticincta* — BALUK, p. 231, pl. 27, fig. 10.

Remarks: The specimens presented herein correspond to the holotype in morphology. The species is distinguishable from the similar *C. burdigalensis* and *C. gracilispira* by biconic shell, lower spire, subangulate whorls and narrower aperture. *C. biconica* differs by flat spire whorls and finer spiral cords. *C. serraticincta* is recorded for the first time in the Pannonian Basin.

Distribution: Middle Miocene: Central Paratethys (Poland, Hungary: this paper).

Genus *Leptoconchus* RÜPPELL, 1834

Leptoconchus jaegeri BOETTGER, 1906
(Plate IV, figs 30–31)

1906 *Leptoconchus jaegeri* ROLLE — BOETTGER, p. 36.
1934 *Magilus jaegeri* BOETTGER — ZILCH, p. 252, pl. 15, figs 85–86.
2018 *Leptoconchus jaegeri* BOETTGER — KOVÁCS et al., p. 130, fig. 9/P–V.

Remarks: *Leptoconchus* is a very rare genus in the Early Badenian assemblages of the Central Paratethys, and *L. jaegeri* is the only species that has hitherto been known from the Făget Basin (Romania) and Letkés (Pannonian Basin). The specimen figured herein from Bánd slightly differs from the holotype with its sculptured early whorls; it is quite similar to the Letkés material (KOVÁCS et al. 2018, fig. 9/V).

Distribution: Middle Miocene: Central Paratethys (Hungary, Romania).

Conclusions

In the present paper six newly collected Early Badenian and one Middle Badenian Muricidae assemblages are examined. 38 species are documented from Bánd (Herend Basin) (KÓKAY 1966, this paper); the material represents a moderately diverse muricid assemblage that is typical of the Central Paratethys. Similar alpha diversity was recorded in the Korytnica Basin (Poland, BAŁUK 1995, 2006), in the Lom Basin (NW Bulgaria, KOJUMDIEVA 1960, NIKOLOV 1994), and in the Vienna Basin (e.g. Gainfarn, Bad Vöslau, Steinebrunn, Austria, HOERNES & AUINGER 1879–1891). A higher diversity (more than 50 species) is known only in two regions (Făget Basin, Romania, KOVÁCS 2019; Letkés, N Pannonian Basin, KOVÁCS et al. 2018). Noteworthy features in the fauna include (i) the dominance of *Janssenia echinulata* (PUSCH), (ii) the abundance of *Favartia (Pygmaeptyris) transsylvanica* (HOERNES & AUINGER), *Ocinebrina kojumdgievae* (BAŁUK) and *Morula* (s.s.) *bellardi* (HOERNES & AUINGER), and (iii) the appearances of the rare *Ceratostoma subaustriacus* (STOJASPAL) and *Coralliophila sacyi* (COSSMANN & PEYROT). 12 species are endemic in the Paratethys (Table I), the endemic ratio is 31% in the Bánd assemblage. A similar endemicity was observed in the assemblages of Letkés (28%) and the Făget Basin (approx. 30%). From Letkés a new Paratethyan record, *Phyllocoma michelottii* (BELLARDI) is presented.

Until now not much has been known about the muricids of the Mecsek region; in fact, only six species were described earlier. Based on newly collected materials 31 species are recorded herein, six of them are new records in

Hungary: *Bolinus brandaris torularius* (LAMARCK), *Ptery-notus pseuderinaceus* (BOETTGER), *Ocinebrina landaui* KOVÁCS, *Pteropurpura friedbergi* (COSSMANN & PEYROT), *Dermomurex scalaroides* (BLAINVILLE), and *Coralliophila serraticincta* BAŁUK. Genus *Ptery-nopsis* is also recorded for the first time in Hungary. The muricid faunas of the Mecsek Mts are generally characterised by low diversity. Some species are known only in this region in Hungary, others — such as *Murexsul sandbergeri* (HÖRNES), *Favartia* (s.s.) *suboblonga* (D'ORBIGNY), and *Ocenebra vindobonensis vindobonensis* (HÖRNES) — are present in an unusual abundance. This paper also documents the extended geographical range of numerous rare species. Five species represent Paratethyan taxa, the endemic ratio is 16% in the Mecsek assemblage.

The respective occurrences of more than 80 muricid species in the Early Badenian Pannonian Basin System is confirmed by (i) a taxonomic review of the previous literature — especially the monograph of the Miocene gastropods of Hungary (STRAUSZ 1966), (ii) revisions of museum collections (KOVÁCS 2019), and (iii) analyses of newly collected mollusc assemblages (KOVÁCS et al. 2018; this paper).

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- Manuscript received: 25/09/2019

Plate I — I. tábla

- Figs 1–2. *Bolinus brandaris torularius* (LAMARCK), SL 53 (1.2×), Hidas.
- Fig. 3. *Bolinus brandaris torularius* (LAMARCK), SL 32 (1.5×), Hidas.
- Figs 4–5. *Bolinus submuticus* (GRATELOUP), SL 29 (1×), Bánd.
- Figs 6–7. *Hexaplex (Trunculariopsis) austriacus* (TOURNOUËR), SL 59 (1×), Bánd.
- Figs 8–9. *Hexaplex (Trunculariopsis) austriacus* (TOURNOUËR), SL 48 (1×), Hidas.
- Fig. 10. *Chicoreus (Triplex) aquitanicus* (GRATELOUP), SL 65 (1×), Hosszúhetény.
- Figs 11–12. *Chicoreus (Triplex) borni* (HÖRNES), SL 58 (1×), Bánd.
- Figs 13–14. *Chicoreus (Triplex) borni* (HÖRNES), SL 48 (1×), Hosszúhetény.
- Figs 15–16. *Purpurellus cyclopterus* (MILLET), SL 34 (1.3×), Mecsekpölöske.
- Figs 17–18. *Aspella emmae* (BOETTGER), SL 8 (4×), Bánd.
- Figs 19–20. *Aspella subanceps* (D'ORBIGNY), SL 10 (3×), Mecsekpölöske.
- Figs 21–22. *Dermomurex (Dermomurex) distinctus* (CRISTOFORI & JAN), SL 25 (1.6×), Bánd.
- Figs 23–24. *Dermomurex (Dermomurex) scalaroides* (BLAINVILLE), SL 12 (3×), Kisbattyán.
- Figs 25–26. *Dermomurex (Dermomurex) sp.*, SL 10.4 (3×), Mecsekpölöske.
- Figs 27–28. *Pterynotus (Pterynotus) pseuderinaceus* (BOETTGER), SL 8 (6×), Mecsekpölöske.
- Fig. 29. *Typhinellus labiatus* (CRISTOFORI & JAN), SL 18 (2×), Bánd.

Scale bars/Méretvonalak: 5 mm for Figs 1–16, 21–22, 29; 1 mm for Figs 17–20, 23–28.

Plate II — II. tábla

- Figs 1–2. *Typhinellus labiatus* (CRISTOFORI & JAN), SL 25 (1.6×), Hidas.
- Figs 3–4. *Siphonochelus fistulosus* (BROCCHI), SL 10.5 (3×), Tekeres.
- Figs 5–6. *Tripterotyphis tripterus* (GRATELOUP), SL 9 (3.5×), Bánd.
- Figs 7–8. *Subptyernotus graniferus* (MICHELOTTI), SL 56 (1×), Bánd.
- Fig. 9. *Murexsul sandbergeri* (HÖRNES), SL 27 (1.8×), Mecsekpölöske.
- Figs 10–11. *Murexsul sandbergeri* (HÖRNES), SL 34 (1.5×), Mecsekpölöske.
- Figs 12–13. *Murexsul typhioides* (MAYER), SL 10 (3.5×), Bánd.
- Figs 14–15. *Favartia (Favartia) absona* (CRISTOFORI & JAN), SL 12 (3×), Bánd.
- Figs 16–17. *Favartia (Favartia) czjzeki* (HOERNES & AUINGER), SL 8.5 (4.5×), Bánd.
- Figs 18–19. *Favartia (Favartia) suboblonga* (D'ORBIGNY), SL 15 (3×), Mecsekpölöske.
- Figs 20–21. *Favartia (Pygmaeptyeris) transsylvanica* (HOERNES & AUINGER), SL 14.5 (3×), Bánd.
- Figs 22–23. *Ocinebrina boeckhi* (HOERNES & AUINGER), SL 27 (2×), Kisbattyán.
- Figs 24–25. *Ocinebrina confluens* (EICHWALD), SL 18 (2×), Hidas (Locality 2).
- Fig. 26. *Ocinebrina dertonensis* (BELLARDI), SL 25 (1.6×), Hosszúhetény.
- Figs 27–28. *Ocinebrina kojumdgievae* (BALUK), SL 33 (1.6×), Bánd.
- Figs 29–30. *Ocinebrina kojumdgievae* (BALUK), SL 36 (1.6×), Bánd.

Scale bars/Méretvonalak: 5 mm for Figs 1–2, 7–11, 22–30; 1 mm for Figs 3–6, 12–21.

Plate III — III. tábla

- Figs 1–2. *Ocenebrina landaui* KOVÁCS, SL 21 (2×), Bánd.
 Figs 3–4. *Ocenebrina* sp., SL 18 (2×), Bánd.
 Fig. 5. *Ocenebra vindobonensis vindobonensis* (HÖRNES), SL 29 (1.5×), Hosszúhetény.
 Figs 6–7. *Ocenebra vindobonensis vindobonensis* (HÖRNES), SL 35 (1.5×), Hosszúhetény.
 Figs 8–9. *Hadriania mioincrassata* (SACCO), SL 35.5 (1.2×), Hidas.
 Figs 10–11. *Jaton sowerbyi* (MICHELOTTI), SL 53 (1.2×), Bánd.
 Figs 12–13. *Jaton sowerbyi* (MICHELOTTI), SL 47 (1.2×), Hosszúhetény.
 Fig. 14. *Jaton sowerbyi* (MICHELOTTI), SL 38 (1.2×), Hosszúhetény.
 Figs 15–16. *Pteropurpura friedbergi* (COSSMANN & PEYROT), SL 33 (2×), Tekeres.
 Figs 17–18. *Ceratostoma subaustriacus* (STOJASPAL), SL 81 (1×), Bánd.
 Figs 19–20. *Vitularia linguabovis* (BASTEROT), SL 74 (0.9×), Hosszúhetény.

Scale bars/Méretvonalak: 5 mm

Plate IV. — IV. tábla

- Figs 1–2. *Pterylopsis* sp., SL 21 (2×), Kisbattyán.
 Figs 3–4. *Janssenia echinulata* (PUSCH), SL 23 (1.3×), Bánd.
 Figs 5–6. *Janssenia echinulata* (PUSCH), SL 32 (1.3×), Bánd.
 Fig. 7. *Janssenia echinulata* (PUSCH), SL 32 (1.3×), Hosszúhetény.
 Fig. 8. *Janssenia echinulata* (PUSCH), SL 53 (1.3×), Bánd.
 Figs 9–10. *Janssenia echinulata* (PUSCH), SL 48 (1.3×), Bánd.
 Figs 11–12. *Janssenia spinosa* (KOJUMDGIEVA), SL 23 (2×), Bánd.
 Figs 13–14. *Cathymorula exilis* (HÖRNES), SL 32 (1.3×), Hosszúhetény.
 Figs 15–16. *Morula (Morula) bellardii* (HOERNES & AUINGER), SL 9 (4×), Bánd.
 Figs 17–18. *Morula (Habromorula) austriaca* (HOERNES & AUINGER), SL 20 (2×), Bánd.
 Figs 19–21. *Phyllocoma michelottii* (Bellardi), SL 23 (2×), Letkés.
 Figs 22–23. *Coralliophila burdigalensis* TOURNOUËR, SL 9 (4×), Bánd.
 Fig. 24. *Coralliophila gracilispira* BOETTGER, SL 9 (4×), Mecsekpölöske.
 Figs 25–26. *Coralliophila sacyi* (COSSMANN & PEYROT), SL 10.5 (3×), Bánd.
 Fig. 27. *Coralliophila serraticincta* BALUK, SL 6 (4.5×), Mecsekpölöske.
 Figs 28–29. *Coralliophila serraticincta* BALUK, SL 10.2 (4×), Mecsekpölöske.
 Figs 30–31. *Leptoconchus jaegeri* BOETTGER, SL 14.5 (2.7×), Bánd.

Scale bars/Méretvonalak: 5 mm for Figs 1–14, 19–21, 2 mm for Figs 15–18, 22–31.

Plate I — I. tábla

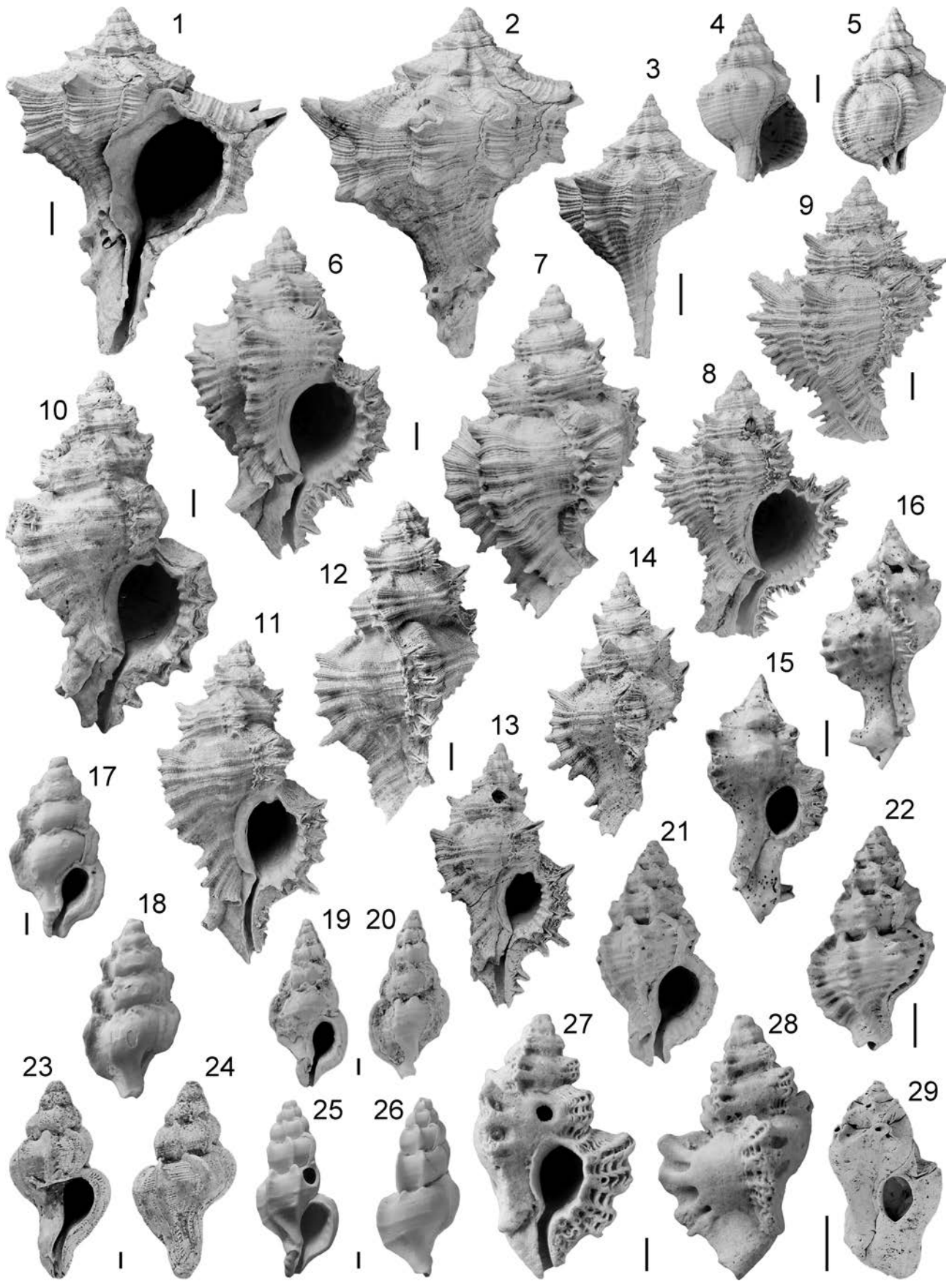


Plate II — II. tábla

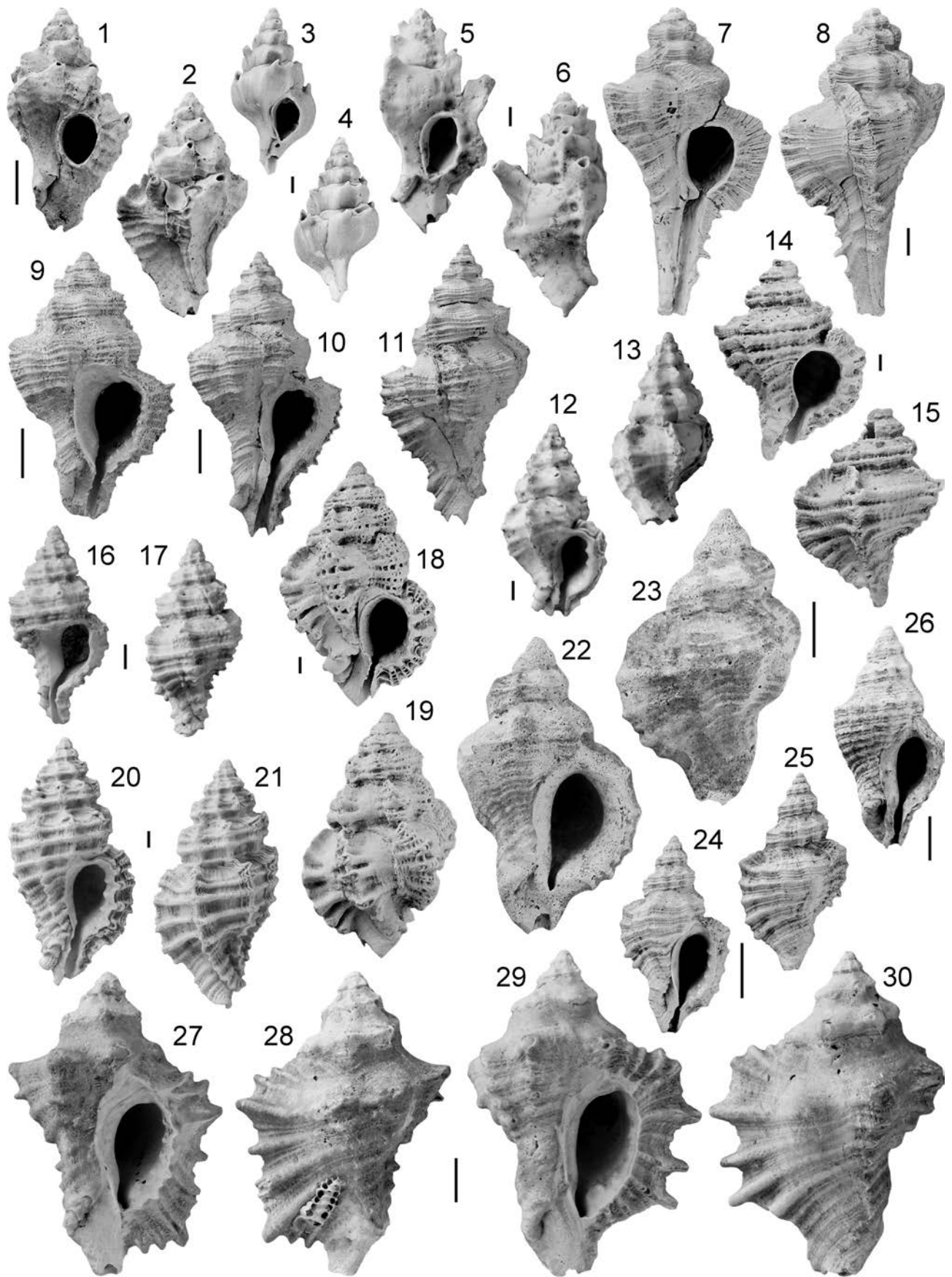


Plate III — III. tábla

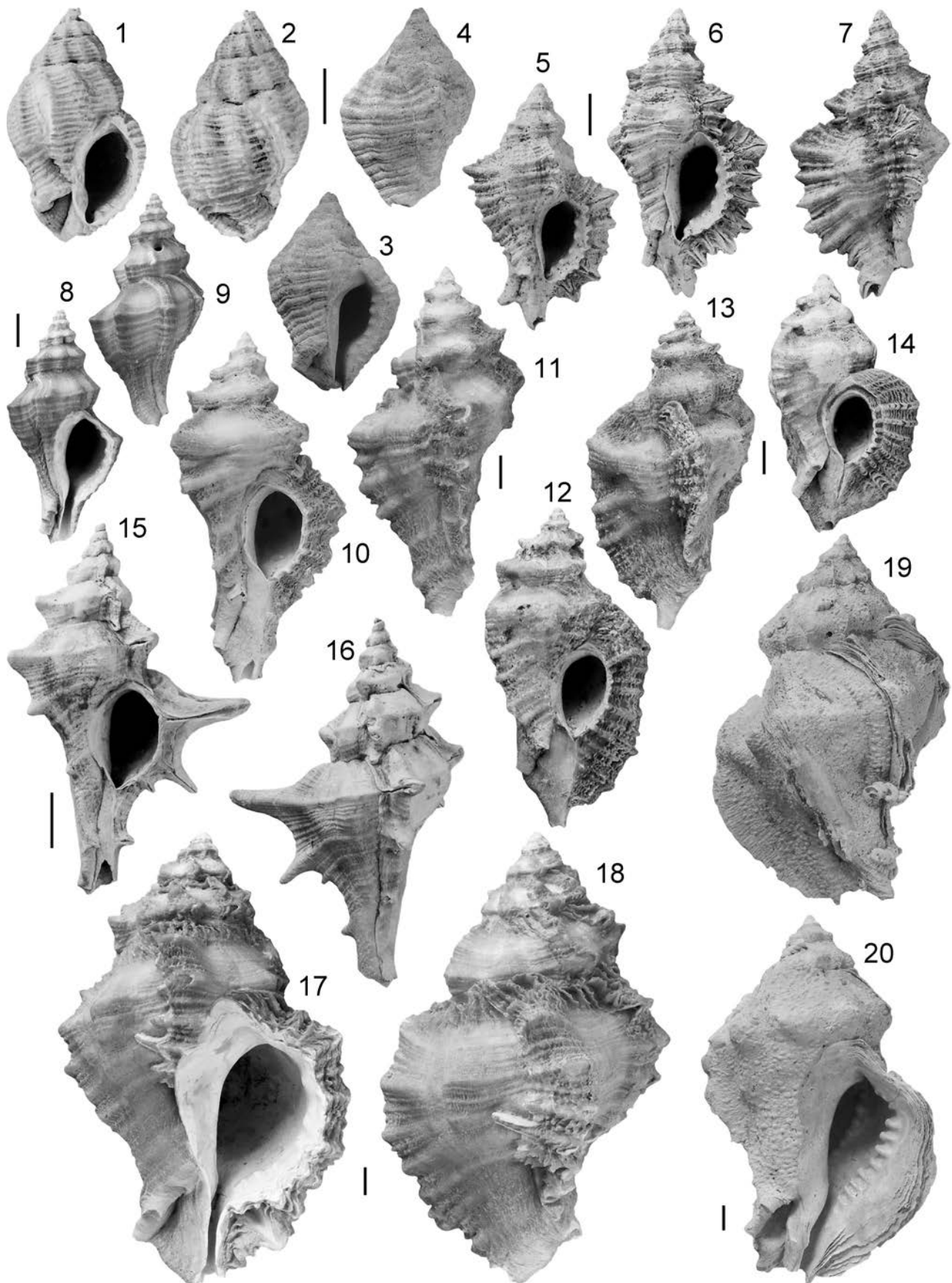


Plate IV — IV. tábla

