

## **Conoidea (Neogastropoda) assemblage from the Lower Badenian (Middle Miocene) deposits of Letkés (Hungary), Part II. (Borsoniidae, Cochlespiridae, Clavatulidae, Turridae, Fusiturridae)**

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### *Conoidea (Neogastropoda) fauna Letkés alsó badeni (középső miocén) üledékeiből, II. rész (Borsoniidae, Cochlespiridae, Clavatulidae, Turridae, Fusiturridae)*

#### Összefoglalás

Tanulmányunk Letkés (Börzsöny hegység) középső miocén gastropoda-faunájának ismeretéhez járul hozzá öt Conoidea-család (Borsoniidae, Cochlespiridae, Clavatulidae, Turridae, Fusiturridae) 41 fajának leírásával és ábrázolásával. A közismert lelőhely agyagos, homokos üledékei a Lajtai Mészke Formáció alsó badeni Pécsszabolcsi Tagozatát képviselik, és – ma már kijelenthető – Magyarország leggazdagabb badeni tengeri molluszkanyagát tartalmazzák. A jelen tanulmányban vizsgált Conoidea-fauna néhány nagyon ritka faj [pl. *Cochlespira serrata* (BELLARDI), *Clavatula sidoniae* (HOERNES & AUINGER) stb.] újabb előfordulásának igazolása mellett a tudományra nézve öt új faj bevezetését is lehetővé tette: *Clavatula hirmetzli* n. sp., *Clavatula santhai* n. sp., *Clavatula szekelyhidiae* n. sp., *Perrona harzhauseri* n. sp., *Perrona nemethi* n. sp. A kutatás során a vonatkozó korábbi magyarországi szakirodalom revízióját is elvégeztük. A Magyar Természettudományi Múzeum miocén gastropoda-gyűjteményének vizsgálata alapján szükségesnek látszik a Pannon-medencéből leírt Conoidea-fajok közül három taxonómiai revíziója: a *Clavatula nogradensis* CSEPREGHY-MEZNERICS, 1953 a *Clavatula granulata* (MÜNSTER in GOLDFUSS, 1841) junior szinonimája, a *Clavatula (Surcula) krenneri* CSEPREGHY-MEZNERICS, 1953 a *Fusiturris emiliae* (HOERNES & AUINGER, 1891) junior szinonimája és a *Clavatula (Surcula) nodosa borsodensis* CSEPREGHY-MEZNERICS, 1969 a *Clavatula orientoromana* BÁLDI, 1960 junior szinonimája. Új kombinációk: *Acampptogenotia praecedens* (BELLARDI, 1877) nov. comb., *Perrona letkesensis* (CSEPREGHY-MEZNERICS, 1953) nov. comb., *Fusiturris emiliae* (HOERNES & AUINGER, 1891) nov. comb., *Fusiturris intermedia* (BRONN, 1831) nov. comb., *Fusiturris reevei* (BELLARDI, 1847) nov. comb.

*Tárgyszavak: középső miocén, badeni, Pannon-medence, Letkés, Neogastropoda, Conoidea*

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#### Abstract

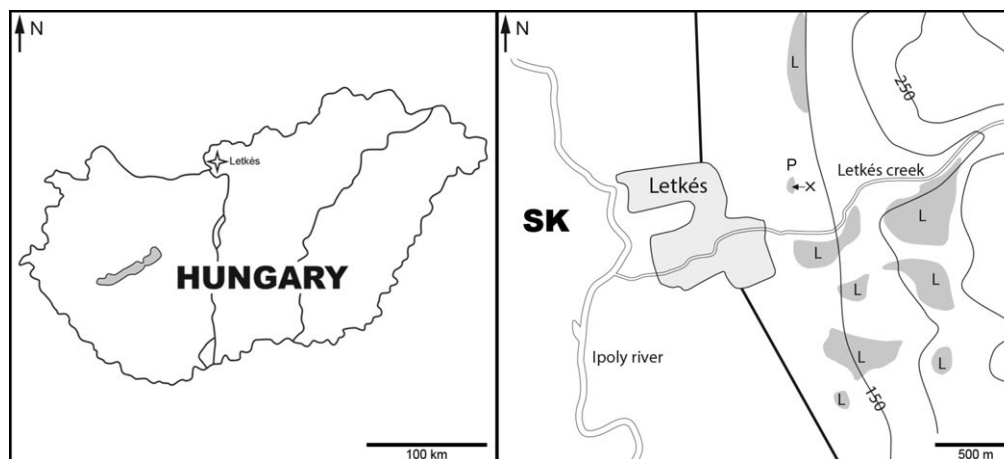
Five conoidean families (Borsoniidae, Cochlespiridae, Clavatulidae, Turridae, Fusiturridae) are described from the early Badenian (early Middle Miocene) gastropod assemblage of Letkés (N Pannonian Basin, Hungary). The clayey sand deposits of the locality represent the Pécsszabolcs Member of the Lajta Limestone Formation and contain the richest Badenian fossil marine mollusk assemblage in Hungary. 41 conoidean species are recorded and illustrated. Furthermore *Clavatula hirmetzli* n. sp., *Clavatula santhai* n. sp., *Clavatula szekelyhidiae* n. sp., *Perrona harzhauseri* n. sp. and *Perrona nemethi* n. sp. are described as new for science. *Clavatula nogradensis* CSEPREGHY-MEZNERICS, 1953 is a junior synonym of *Clavatula granulata* (MÜNSTER in GOLDFUSS, 1841); *Clavatula (Surcula) krenneri* CSEPREGHY-MEZNERICS, 1953 is a junior synonym of *Fusiturris emiliae* (HOERNES & AUINGER, 1891); *Clavatula (Surcula) nodosa borsodensis* CSEPREGHY-MEZNERICS, 1969 is a junior synonym of *Clavatula orientoromana* BÁLDI, 1960. New combinations include: *Acampptogenotia praecedens* (BELLARDI, 1877) nov. comb.; *Perrona letkesensis* (CSEPREGHY-MEZNERICS, 1953) nov. comb.; *Fusiturris emiliae* (HOERNES & AUINGER, 1891) nov. comb.; *Fusiturris intermedia* (BRONN, 1831) nov. comb.; and *Fusiturris reevei* (BELLARDI, 1847) nov. comb.

*Keywords: Middle Miocene, Badenian, Pannonian Basin, Letkés, Neogastropoda, Conoidea*

## Introduction

The aim of this paper is to review the early Badenian (early Middle Miocene) occurrence of five conoidean families (Borsoniidae BELLARDI, 1875; Cochlespiridae POWELL, 1942; Clavatulidae GRAY, 1853; Turridae H. ADAMS & A. ADAMS, 1853; Fusiturridae ABDELKRIM et al. 2018) in the gastropod assemblage of Letkés (N Pannonian Basin, Central Paratethys). The present work is the second part of the Conoidea research in the studied section; the Conidae

private collections of Tamás HIRMETZL (Fót, Hungary), Tamás NÉMETH (Balatonkenese, Hungary), and the authors. Taxonomy and morphological terminology follow BOUCHET et al. (2011), LANDAU et al. (2013), and ABDELKRIM et al. (2018). As numerous species presented herein have been discussed in the literature, beside revision of previous Hungarian literature only the most informative works are cited. Miocene palaeogeographical ranges of the studied species are shown on *Table I*. Abbreviation: shell length (SL) and shell width (SW) in mm.



**Figure 1.** Location, and the Lower Badenian marine deposits at Letkés. P - Pécsszabolcs Member of the Lajta Limestone Formation *sensu lato* (L), X - locality (Modified from: <https://map.mbfisz.gov.hu/fdt100>)

**I. ábra.** Alsó badeni üledékek Letkés térségében. Lajtai Mészkö Formáció *sensu lato* (L), Pécsszabolcsi Tagozat (P), X - lelőhely (<https://map.mbfisz.gov.hu/fdt100> alapján)

*sensu lato* material was analyzed in an earlier study (KOVÁCS & VICIÁN 2014). Beside the Letkés collection of the Hungarian Natural History Museum, a newly-collected material was also investigated.

Letkés is a well-known Middle Miocene fossiliferous site in the W Börzsöny Mts (N Hungary) (*Figure 1*); numerous papers have treated its rich invertebrate records (see KOVÁCS & VICIÁN 2021 with additional references). As a result of the research considered in this paper 41 conoidean species are described and four of these are recorded for the first time in the Pannonian Basin: *Acamptogenotia praecedens* (BELLARDI), *Clavatula eleonora* (HOERNES & AUINGER), *C. juliae* (HOERNES & AUINGER), and *C. sidoniae* (HOERNES & AUINGER). Five new species are designated: *Clavatula hirmetzli* n. sp., *Clavatula santhai* n. sp., *Clavatula szekelyhidiae* n. sp., *Perrona harzhauseri* n. sp., *Perrona nemethi* n. sp.

## Material and methods

All specimens investigated in this paper came from the gastropod assemblage of Letkés. They are stored in the Hungarian Natural History Museum (HNHM, Budapest), in the Naturhistorisches Museum (NHMW, Vienna), and in the

## Systematic Palaeontology

Clade Neogastropoda WENZ, 1938  
Superfamily Conoidea FLEMING, 1822  
Family Borsoniidae BELLARDI, 1875  
Genus *Acamptogenotia* ROVERETO, 1899

*Acamptogenotia praecedens* (BELLARDI, 1877)  
nov. comb. (Plate I, figs 1–4)

1891 *Pleurotoma (Pseudotoma) praecedens* BELLARDI var. – HOERNES & AUINGER, p. 369, pl. 34, fig. 4, pl. 49, fig. 5.  
2003 *Genota (Pseudotoma) praecedens* (BELLARDI) – BAŁUK, p. 56, pl. 9, fig. 8 (*cum syn.*).

**Material:** 28 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 51 mm.

**Remarks:** Based on morphological similarities between *Acamptogenotia intorta* (BROCCHI) and *Pseudotoma praecedens*, BELLARDI's species is placed within genus *Acamptogenotia*. It differs from *A. intorta* – recorded by STRAUZ (1966) in the Middle Miocene Pannonian Basin – in lower spire and well-developed shoulder spines. *Acamptogenotia praecedens* is a new record in this region.

**Table I.** Miocene palaeogeographical ranges of the studied conoidean species**I. tábla.** A tanulmányban tárgyalt fajok miocén kori ősföldrajzi elterjedése

Species	Central Paratethys	Proto-Mediterranean Sea	NE Atlantic	North Sea Basin
<i>Acamptogenotia praecedens</i>	Austria, Hungary, Poland, Ukraine	Italy	? France (E)	
<i>Aphanitoma pecchiolii</i>	Hungary	Italy (L)		
<i>Asthenotoma festiva</i>	Austria (E-M), Bosnia, Hungary, Poland, Slovakia, Ukraine	Italy (L)		
<i>Asthenotoma tuberculata</i>	Austria, Czechia, Hungary, Poland, Romania	Italy (L)		
<i>Bathytoma cataphracta</i>	Austria (E-M), Bulgaria, S Germany (E), Hungary (E-M), Poland, Romania, Slovenia, Ukraine	Greece (M-L), Italy (E-L), Spain (L), Turkey (E-M)	France (E-M), Portugal (L)	
<i>Genota elisae</i>	Albania, Austria (E-M), Bulgaria, Czechia, Hungary, Poland, Romania, Slovakia (E-M), Slovenia, Ukraine		France	
<i>Genota valeriae</i>	Albania, Austria, Bulgaria, ? S Germany (E), Hungary, Poland, Romania			
<i>Microdrillia teretiaeformis</i>	Austria, Bulgaria, Czechia, Hungary, Poland	Turkey		the Netherlands (E-M), N Germany
<i>Cochlespira serrata</i>	Austria, Bulgaria, Hungary, Romania	Italy		
<i>Clavatula amaliae</i>	Austria, Hungary, Poland, Romania, Slovakia			
<i>Clavatula camillae</i>	Hungary, ? Bulgaria, Poland, Romania, Slovakia, Slovenia			
<i>Clavatula eleonorae</i>	Austria, Hungary, Poland			
<i>Clavatula granulatacineta</i>	Austria, Bosnia, Bulgaria, Czechia, S Germany (E) Hungary, Poland, ? Serbia, Slovakia, Slovenia		France (E-M)	
<i>Clavatula hirmetzli</i> n. sp.	Hungary		Portugal (L)	
<i>Clavatula juliae</i>	Hungary, Poland, Romania			
<i>Clavatula olgae</i>	Bulgaria, Czechia, Hungary, Poland, Romania, Slovakia, Slovenia	Turkey		
<i>Clavatula polonica</i>	Austria, Hungary, Poland, Romania			
<i>Clavatula santhai</i> n. sp.	Hungary, Romania			
<i>Clavatula schreibersi</i>	Austria (E-M), Czechia, Hungary, Romania, Serbia, ? Ukraine	Italy (L)		
<i>Clavatula sidoniae</i>	Hungary, Romania			
<i>Clavatula suturalis</i>	Austria (E-M), Bulgaria, Croatia, Hungary, Poland, Romania, Slovenia, Ukraine			
<i>Clavatula veronicae</i>	Croatia, Hungary, ? Poland, Romania			
<i>Clavatula szekelyhidiae</i> n. sp.	Hungary			
<i>Perrona descendens</i>	Albania, Austria (E-M), Bulgaria, Czechia, Hungary (E-M), Poland, Romania, Slovenia	Italy (E-L), Spain, Turkey	France (E-M), Portugal (M-L)	
<i>Perrona harzhauseri</i> n. sp.	Hungary			
<i>Perrona inedita</i>	Hungary	? Greece (M-L), Italy (E), Spain (L), Turkey		
<i>Perrona letkesensis</i>	Hungary			
<i>Perrona nemethi</i> n. sp.	Hungary			
<i>Perrona semimarginata</i>	Austria (E-M), Bulgaria, Czechia, Hungary (E-M), Romania, Slovenia	Italy (L)	France (E-L), Portugal (L)	N Germany
<i>Perrona taurinensis</i>	Croatia, Hungary	? Greece (M-L), Italy (E), Turkey		
<i>Turricula dimidiata</i>	Austria (E-M), Bosnia, Bulgaria, ? Czechia, Hungary, Romania, Slovakia (E), ? Ukraine	Greece, Italy (M-L)	France (M-L)	
<i>Turricula inermiformis</i>	Hungary			
<i>Gemmula badensis</i>	Austria, ? Czech, Hungary	Italy (L), Turkey		
<i>Gemmula coronata</i>	? Albania, Austria (E-M), Bulgaria, ? Czechia, ? S Germany (E), Hungary, Poland, Romania, ? Slovakia, ? Ukraine	Italy (L), Turkey		
<i>Gemmula denticula</i>	Hungary, ? Bulgaria, ? Poland	Spain, ? Italy	France (E-L)	
<i>Gemmula trifasciata</i>	Austria, Bulgaria, Czechia (E-M), Hungary, ? Slovakia	Italy		
<i>Turris vermicularis</i>	Austria, Bulgaria, Hungary, Romania	Italy	France (E-L)	N Germany, the Netherlands (E)
<i>Unedogemmula annae</i>	Albania, Austria (E-M), Bulgaria, Czechia (E-M), Hungary, Poland, Romania, Slovakia, Ukraine	? Greece (L)		
<i>Fusiturris emiliae</i>	Austria, Hungary			
<i>Fusiturris intermedia</i>	Albania, Austria, Bulgaria, Hungary, Poland, Romania	Italy (M-L), Spain (L)	Portugal (L)	
<i>Fusiturris reevei</i>	Austria, Bulgaria, Croatia, Czechia, Hungary, Poland, Romania, Slovakia	Greece (M-L), Italy (L)		

E - Early Miocene, L - Late Miocene. Ranges restricted to the Middle Miocene (M) without indication.

E - kora miocén, L - késő miocén. A középső miocénre (M) korlátozóó elterjedés jelölés nélkül.

Genus *Aphanitoma* BELLARDI, 1875

*Aphanitoma pecchiolii* BELLARDI, 1877  
(Plate I, figs 5–6)

- v 1969 *Aphanitoma pecchiolii* (BELLARDI) – CSEPREGHY-MEZNERICS, p. 97, pl. 6, fig. 17.  
1981 *Aphanitoma pecchiolii* BELLARDI – FERRERO MORTARA et al., p. 85, pl. 15, fig. 11.  
2002 *Aphanitoma pecchiolii* (BELLARDI) – VERA-PELÁEZ, p. 189, pl. 2, figs A–B, pl. 17, figs G–H.

*Material:* 5 specimens in private collections of the authors, max. SL 12 mm.

*Remarks:* *Aphanitoma pecchiolii* differs from *A. labelum* BELLARDI & MICHELOTTI by having a somewhat more slender shell, and different sculpture with more widely-spaced, weaker axial ribs. *Aphanitoma acutoplicatula* SACCO – recorded by CSEPREGHY-MEZNERICS (1953) in the Pannonian Basin – is distinguished by its paucispiral protoconch (JANSSEN 1972).

Genus *Asthenotoma* HARRIS & BURROWS, 1891

*Asthenotoma festiva* (HÖRNES, 1854)  
(Plate I, figs 7–8)

- v 1953 *Asthenotoma pannus* – CSEPREGHY-MEZNERICS, p. 15, pl. 3, figs 3–7 (non BASTEROT).  
1966 *Asthenotoma ornata festiva* DODERLEIN (in HÖRNES) – STRAUZ, p. 431, pl. 19, fig. 15, pl. 20, figs 1–2.  
1972 *Asthenotoma pannus* BASTEROT – CSEPREGHY-MEZNERICS, p. 33, pl. 16, fig. 23.  
1997 *Asthenotoma festiva* (HÖRNES) – GATTO, p. 42, pl. 1, figs 9–10, pl. 2, figs 1–7 (*cum syn.*).  
2003 *Asthenotoma festiva* (HÖRNES) – BAŁUK p. 51, pl. 16, figs 1–6 (*cum syn.*).

*Material:* 1 specimen in private collection of the authors, SL 11.6 mm.

*Remarks:* The juvenile specimen figured herein possesses a slender, fusiform shell with six slightly rounded teleoconch whorls and protoconch of approx. 1 3/4 eroded whorls. The Burdigalian *Asthenotoma pannus* (BASTEROT) (see LOZOUET 2017, pl. 1, figs 19–22) is a closely allied species in morphology but differs by multispiral protoconch and stronger axial ribs. *Asthenotoma festiva* was erroneously interpreted as a subspecies of *A. ornata* (DEFRANCE) by STRAUZ (1966) the latter being a Late Miocene – Pliocene species. Only one specimen occurs in the studied assemblage but the species is abundant in the sandy onshore deposits at the neighboring locality of Szob (CSEPREGHY-MEZNERICS 1956).

*Asthenotoma tuberculata* (PUSCH, 1837)  
(Plate I, figs 9–12)

- 1854 *Pleurotoma Heckeli* – HÖRNES, p. 371, pl. 39, fig. 20.  
1997 *Asthenotoma tuberculata* (PUSCH) – GATTO, p. 39, pl. 1, figs 1–8, pl. 7, fig. 1 (*cum syn.*).  
2003 *Asthenotoma tuberculata* (PUSCH) – BAŁUK, p. 52, pl. 16, figs 7–10 (*cum syn.*).

*Material:* 8 specimens in private collections of the authors, max. SL 22 mm.

*Remarks:* *Asthenotoma tuberculata* was recorded in borehole material at Várpalota (KÓKAY 1957) but it was neither described nor illustrated in Hungary. This species is distinguished from *Asthenotoma festiva* (HÖRNES) by its tuberculate sculpture. The taxonomy of the species, as well as the identity of *Pleurotoma heckeli* HÖRNES and *A. tuberculata* (PUSCH) was discussed by GATTO (1997).

Genus *Bathytoma* HARRIS & BURROWS, 1891

*Bathytoma cataphracta* (BROCCHI, 1814)  
(Plate I, fig. 13)

- v 1953 *Moniliopsis (Bathytoma) cataphracta orientalis* n. subsp. – CSEPREGHY-MEZNERICS, p. 16, pl. 3, figs 19–20.  
v 1953 *Moniliopsis (Bathytoma) cataphracta dertogranosa* SACCO – CSEPREGHY-MEZNERICS, pl. 3, figs 21–22.  
1966 *Moniliopsis (Bathytoma) cataphracta* BROCCHI – STRAUZ, p. 428, pl. 18, figs 11–15.  
v 1966 *Moniliopsis (Bathytoma) cataphracta orientalis* CSEPREGHY-MEZNERICS – STRAUZ, p. 429, pl. 19, figs 1–6.  
1973 *Bathytoma cataphracta* (BROCCHI) – BÁLDI, p. 317, pl. 49, fig. 6.  
2013 *Bathytoma cataphracta* (BROCCHI) – LANDAU et al., p. 256, pl. 42, fig. 14 (*cum syn.*).  
2016 *Bathytoma cataphracta* (BROCCHI) – KOVÁCS & VICIÁN, pl. 5, fig. 9.

*Material:* 56 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 50 mm.

*Remarks:* This Late Oligocene – Pliocene species is highly variable in shell morphology. Its taxonomical revision was arranged by BAŁUK (2003), and LANDAU et al. (2013) and numerous subspecies were synonymized including CSEPREGHY-MEZNERICS's taxa from the Badenian Pannonian Basin.

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

*Genota elisae* (HOERNES & AUINGER, 1891)  
(Plate I, figs 14–15)

- 1966 *Genota ramosa elisae* HOERNES & AUINGER – STRAUZ, p. 448, pl. 22, figs 8–15.  
v 1972 *Genota ramosa elisae* HOERNES & AUINGER – CSEPREGHY-MEZNERICS, p. 33, pl. 16, fig. 31.  
2003 *Genota (Genota) elisae* (HOERNES & AUINGER) – BAŁUK, p. 54, pl. 18, figs 7–9 (*cum syn.*).

*Material:* 14 specimens in private collections of HIRMETZL and the authors, max. SL 43 mm.

*Remarks:* Here the taxonomical arrangement of BAŁUK (2003) is followed, and *Genota elisae* is regarded as a characteristic Central Paratethyan species. It is closely allied in size and morphology to *Genota ramosa* (BASTEROT) but differs by higher spire and finer sculpture which bears fewer weakly-developed tubercles on the shoulder.

*Genota valeriae* (HOERNES & AUINGER, 1891)  
(Plate I, fig. 16)

- 1943 *Genota valeriae* HOERNES & AUINGER – BANDAT, p. 337, pl. 2, fig. 17.  
v 1953 *Genota valeriae* HOERNES & AUINGER – CSEPREGHY-MEZNERICS, p. 18, pl. 2, figs 30–31.  
2003 *Genota valeriae* HOERNES & AUINGER – BALUK, p. 55, pl. 18, figs 4–6 (*cum syn.*).

*Material:* 1 specimen in private collection of the authors, SL 34 mm.

*Remarks:* *Genota valeriae* is also a Central Paratethyan species. It differs from the common *Genota elisae* by more slender shell and finer sculpture with weakly-developed axial ribs.

Genus *Microdrillia* CASEY, 1903

*Microdrillia teretiaeformis* JANSSEN, 1972  
(Plate I, figs 17–18)

- 1960 *Asthenotoma crispata* – BÁLDI, p. 85, pl. 3, fig. 7 (non DE CRISTOFORI & JAN).  
2003 *Microdrillia crispata* – BALUK, p. 52, pl. 17, figs 5–7 (*cum syn.*) (non DE CRISTOFORI & JAN).  
2013 *Microdrillia teretiaeformis* A.W. JANSSEN – LANDAU et al., p. 259, pl. 43, fig. 3, pl. 70, fig. 4 (*cum syn.*).

*Material:* 5 specimens in private collections of the authors, max. SL 10 mm.

*Remarks:* Protoconchs of the specimens recorded as *Microdrillia crispata* in the Central Paratethys are characterized by subangulate whorls with widely-spaced axial riblets while the Pliocene *M. crispata* (DE CRISTOFORI & JAN) has rounded protoconch whorls (DELLA BELLA & SCARPONI 2007, LANDAU et al. 2013). The Paratethyan records represent *M. teretiaeformis* JANSSEN. The Letkés material is close to the specimens illustrated by BALUK (2003) and LANDAU et al. (2013), although slight differences appear in the sculpture of the last whorl with broader spiral cords.

Family Cochlespiridae POWELL, 1942

Genus *Cochlespira* CONRAD, 1865

*Cochlespira serrata* (BELLARDI, 1877)  
(Plate I, figs 19–20)

- 1966 *Surcula serrata* HÖRNES (in BELLARDI) – STRAUZ, p. 417, pl. 17, fig. 4.  
1972 *Clavatula (Surcula) serrata* M. HÖRNES – CSEPREGHY-MEZNERICS, p. 32, pl. 16, figs 10–11.

*Material:* 1 specimen in private collection of the authors, SL 13.8 mm.

*Remarks:* *Cochlespira serrata* is a rare element of the Badenian gastropod assemblages in the Pannonian Basin. The species differs from the similar *Cochlespira subserrata* (BOETTGER) being larger in size with a higher spire, less

prominent, coronate carina, and the presence of spiral cords on the lower half of the last whorl (see LANDAU et al. 2013: 276).

Family Clavatulidae GRAY, 1853

Genus *Clavatula* LAMARCK, 1801

*Clavatula amaliae* (HOERNES & AUINGER, 1891)  
(Plate I, figs 21–25)

- 1958 *Clavatula (Clavatula) asperulata asperulata* – ŠVAGROVSKÝ, pl. 1, fig. 7 *only* (non LAMARCK)  
1958 *Clavatula (Clavatula) amaliae* HOERNES & AUINGER – ŠVAGROVSKÝ, p. 12, pl. 2, fig. 4  
v 1960 *Clavatula amaliae* (HOERNES & AUINGER) – BÁLDI, p. 81, pl. 3, fig. 3.  
1966 *Clavatula asperulata laevigata* var. *amaliae* (HOERNES & AUINGER) – STRAUZ, p. 407, pl. 16, figs 3–4.  
2003 *Clavatula sophiae* – BALUK, pl. 3, fig. 11 *only*.

*Material:* 27 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 72 mm.

*Remarks:* The *Clavatula amaliae* material in the Letkés assemblage is characterized by moderate morphological variability. The shells of the specimens figured herein are somewhat more slender than the type (HOERNES & AUINGER 1891, pl. 44, figs 1–2), and bear less-developed spiral cords on the subsutural ramp. *Clavatula amaliae* differs from the abundant *C. suturalis* in shell shape and sculpture. The misinterpretation of the NE Atlantic *Clavatula asperulata* (LAMARCK) in the Central Paratethyan literature was discussed by BALUK (2003).

*Clavatula camillae* (HOERNES & AUINGER, 1891)  
(Plate I, figs 26–27)

- v 1954 *Clavatula camillae* (HOERNES & AUINGER) – CSEPREGHY-MEZNERICS, p. 51, pl. 7, figs 6–7.  
1966 *Clavatula camillae* HOERNES & AUINGER – STRAUZ, p. 405, pl. 15, fig. 15.  
non 1968 *Clavatula (Clavatula) camillae* (sic!) (HOERNES & AUINGER) – HINCULOV, p. 147, pl. 37, fig. 3 (= *Clavatula santhai* n. sp.)  
1973 *Clavatula camillae* (HOERNES & AUINGER) – BOHN-HAVAS, p. 1065, pl. 6, fig. 8.  
2003 *Clavatula camillae* (HOERNES & AUINGER) – BALUK, p. 33, pl. 1, figs 1–3 (*cum syn.*).

*Material:* 4 specimens in private collections of HIRMETZL and the authors, max SL 43 mm.

*Remarks:* *Clavatula camillae* is typical of the Central Paratethys. The specimens illustrated by STEIN et al. (2016, pl. 57, figs 4–6) as *Clavatula camillae* from the North Sea Basin differ in sculpture from the types (HOERNES & AUINGER 1891, pl. 43, figs 12–13), they represent *C. boreointerrupta* KAUTSKY. The specimen illustrated by HINCULOV (1968, pl. 37, fig. 3) also differs from the type of *Clavatula camillae* (HOERNES & AUINGER l.c.) in morphology by its more slender shell and different spiral sculpture, it represents *Clavatula santhai* n. sp.

*Clavatula eleonorae* (HOERNES & AUINGER, 1891)  
(Plate I, figs 28–29)

2003 *Clavatula eleonorae* (HOERNES & AUINGER) – BALUK, p. 33, pl. 3, figs 6–9 (*cum syn.*).

*Material*: 1 specimen in private collection of the authors, SL 34 mm.

*Remarks*: *Clavatula eleonorae* is a new record in the Hungarian part of the Pannonian Basin. The specimen figured herein is a good example of the variability of the clavatulids. It agrees in size and overall morphology with the types (HOERNES & AUINGER 1891, pl. 45, figs 1–3) but differs by slightly broader last whorl with somewhat higher concave portion, slightly more prominent spines and less twisted siphonal canal. The spiral threads are reduced to the suprasutural fourth of the whorls, they are very weak (not visible on the photo), and the concave mid-whorl bears only axial growth lines. *Clavatula spinosa* (GRATELOUP) is a similar form (PEYROT 1931, pl. 6, fig. 34) but possesses a higher spire and has different spiral sculpture on the last whorl. The most closely allied specimen was illustrated by BALUK (2003, pl. 3, fig. 8).

*Clavatula granulaticincta* (MÜNSTER in GOLDFUSS, 1841)  
(Plate I, figs 30–32)

v 1953 *Clavatula granulaticincta* (MÜNSTER) – CSEPREGHY-MEZNERICS, pl. 1, figs 23–24.

v 1953 *Clavatula granulaticincta angelae* (HOERNES & AUINGER) – CSEPREGHY-MEZNERICS, p. 10, pl. 1, figs 27–28.

v 1954 *Clavatula nogradensis* n. sp. – CSEPREGHY-MEZNERICS, p. 51 [141], pl. 7, fig. 13.

1966 *Clavatula granulaticincta* (MÜNSTER) – STRAUZ, p. 407, pl. 16, fig. 11.

1966 *Clavatula granulaticincta angelae* (HOERNES & AUINGER) – STRAUZ, p. 408, pl. 16, fig. 12.

2003 *Clavatula granulaticincta* (MÜNSTER) – BALUK, p. 36, pl. 6, figs 1–3 (*cum syn.*).

*Material*: 18 specimens in private collection, max. SL 40 mm.

*Remarks*: The species is characterized by moderate morphological variability. *Clavatula granulaticincta angelae* (HOERNES & AUINGER) bears an almost identical sculpture as the type of *C. granulaticincta* but differs by its slightly longer siphonal canal. The holotype of *Clavatula nogradensis* CSEPREGHY-MEZNERICS (HNHM, M.61.4366) represents a juvenile *C. granulaticincta* specimen (a similar example: Plate I, fig. 30), so *C. nogradensis* is regarded as a junior synonym of *C. granulaticincta*.

*Clavatula juliae* (HOERNES & AUINGER, 1891)  
(Plate II, figs 1–2)

2003 *Clavatula juliae* (HOERNES & AUINGER) – BALUK, p. 35, pl. 7, figs 1–5 (*cum syn.*).

*Material*: 1 specimen in private collection of the authors, SL 37 mm.

*Remarks*: The species is a new record in the Pannonian Basin. *Clavatula juliae* is very rare, and only a few specimens were recorded in the literature from two regions: the Fäget and the Korytnica basins. It differs from the congeners by having a somewhat biconic, broad shell with a strong and oblique spiral cord on the siphonal canal.

*Clavatula cf. olgae* (HOERNES & AUINGER, 1891)  
(Plate II, figs 3–4)

1954 *Clavatula interrupta* – STRAUZ, pp. 33, 67, pl. 4, fig. 78 (non BROCCHI).

non 1954 *Clavatula olgae* – CSEPREGHY-MEZNERICS, pl. 7, fig. 14 [= *Clavatula veronicae* (HOERNES & AUINGER, 1891)].

1966 *Clavatula interrupta* – STRAUZ, p. 403, pl. 14, fig. 24, pl. 15, fig. 1 (non BROCCHI).

? 1966 *Clavatula interrupta* – STRAUZ, pl. 14, figs 25–26.

2013 *Clavatula olgae* (HOERNES & AUINGER) – LANDAU et al., p. 286, pl. 48, figs 2–6, pl. 50, fig. 8 (*cum syn.*).

*Material*: 2 fragmentary specimens in private collection of the authors, max. SL 21 mm.

*Remarks*: The fragmentary specimen figured herein is similar to *Clavatula olgae* (HOERNES & AUINGER) in size and morphology (shouldered whorls; tripartite sculpture of spire whorls with a moderately elevated, striate subsutural band, a finely striate, concave mid-portion, and an elevated, tuberculate suprasutural band; and strong, granular spiral cords on the last whorl). However, due to the absence of the whole aperture and the siphonal canal, an open nomenclature is used. The juvenile specimen figured by CSEPREGHY-MEZNERICS (1954, pl. 7, fig. 14) as *Clavatula olgae* has a very slender shell and it represents *C. veronicae* (HOERNES & AUINGER).

*Clavatula orientoromana* BÁLDI, 1960 is similar in shell shape but differs in spiral sculpture. A comparison was made of the holotypes of *Clavatula orientoromana* (HNHM, M.60.147) and *C. (Surcula) nodosa borsodensis* CSEPREGHY-MEZNERICS, 1969 (HNHM, M.70.619). The two specimens are almost identical in morphology, the small differences mentioned by CSEPREGHY-MEZNERICS (1969) fit within the intraspecific variability, so CSEPREGHY-MEZNERICS's taxon is a junior synonym of that of BÁLDI.

*Clavatula polonica* (PUSCH, 1837)  
(Plate II, figs 5–7)

v 1953 *Clavatula asperulata* – CSEPREGHY-MEZNERICS, pl. 1, figs 19–20 (non LAMARCK).

1966 *Clavatula asperulata* – STRAUZ, pl. 15, fig. 17 *only* (non LAMARCK).

v 1969 *Clavatula asperulata tortonica* PEYROT – CSEPREGHY-MEZNERICS, p. 95, pl. 6, fig. 11.

2003 *Clavatula polonica* (PUSCH) – BALUK, p. 36, pl. 1, figs 1–8, pl. 2, figs 1–8 (*cum syn.*).

*Material*: HNHM, INV 2021.14.1.; 22 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 64 mm.

*Remarks:* The species is widely distributed in the N Pannonian Basin. *Clavatula polonica* is highly variable in morphology, but generally characterized by a broad, rounded last whorl bearing a prominent spiral row of spiny tubercles on its shoulder and generally two tuberculate spiral cords below. The specimens figured herein correspond to that illustrated by BAŁUK (2003, pl. 1, fig. 7).

*Clavatula schreibersi* (HÖRNES, 1854)  
(Plate II, figs 8–9)

- v 1954 *Clavatula schreibersi* (HÖRNES) – CSEPREGHY-MEZNERICS, p. 50, pl. 6, figs 24–27.  
1958 *Clavatula (Clavatula) schreibersi* (M. HOERNES) – ŠVAGROVSKÝ, p. 14, pl. 3, figs 7–9.  
1960 *Clavatula schreibersi szokolysensis* nov. var. – STRAUZ, p. 351 [354], pl. 20, fig. 2.  
1966 *Clavatula schreibersi* (HÖRNES) – STRAUZ, p. 409, pl. 16, figs 5–8 (*cum syn.*).  
2002 *Clavatula schreibersi* (HÖRNES) – HARZHAUSER, p. 118, pl. 10, fig. 16 (*cum syn.*).

*Material:* HNHM, INV 2021.10.1.; and 11 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 42 mm.

*Remarks:* The species differs from its congeners mainly by its strongly-developed sculpture consisting of tuberculate sub- and suprasutural bands and marked spiral cords. Primary spiral cords are granular on the lower half of the last whorl.

*Clavatula sidoniae* (HOERNES & AUINGER, 1891)  
(Plate II, figs 10–11)

- 1891 *Pleurotoma (Clavatula) sidoniae* nov. form – HOERNES & AUINGER, p. 339, pl. 43, fig. 3.

*Material:* 1 specimen in private collection of the authors, SL 25.4 mm.

*Remarks:* *Clavatula sidoniae* is a new record in the Pannonian Basin. It is extremely rare, and is represented only by the type specimen from Lăpuş de Sus (Făget Basin, SW Romania). *Clavatula sidoniae* is characterized by lirae within the outer lip. A photo of the type was studied (by courtesy of Mathias HARZHAUSER); the specimen figured here corresponds in size and morphology. *Clavatula interrupta palatina* STRAUZ has a broader shell, while the Serravallian *C. labiolirata* LANDAU et al. differs by its shallower subsutural groove and different spiral sculpture. The size and sculpture of *Clavatula sidoniae* show some resemblance to the representatives of the Recent genus *Paraclavatula*.

*Clavatula suturalis* (ANDRZEJOWSKI, 1833)  
(Plate II, figs 12–18)

- 1960 *Clavatula sublaevigata* n. sp. – BÁLDI, p. 80, pl. 3, fig. 1.  
1966 *Clavatula asperulata suturalis* ANDRZEJOWSKI – STRAUZ, p. 407, pl. 15, fig. 22, pl. 16, figs 1–2 (*cum syn.*).  
v 1969 *Clavatula asperulata susannae* HOERNES & AUINGER – CSEPREGHY-MEZNERICS, p. 94, pl. 6, figs 1–2.

- 2003 *Clavatula laevigata* (EICHWALD) – BAŁUK, p. 35, pl. 7, figs 7–10 (*cum syn.*).  
2003 *Clavatula suturalis* (ANDRZEJOWSKI) – BAŁUK, p. 39, pl. 8, figs 1–8 (*cum syn.*).  
2011 *Clavatula suturalis susannae* (HOERNES & AUINGER) – KATONA et al., pl. 1, fig. 7.

*Material:* HNHM, M.62.889.1–4., M.62.890.1–2., INV 2021.11.1–13.; 200 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 60 mm.

*Remarks:* *Clavatula suturalis* is the most abundant *Clavatula* species in the gastropod assemblage of Letkés. The specimens are characterized by moderate variability in size and sculpture. According to TUCKER (2004) *Clavatula laevigata* (EICHWALD) is conspecific with *C. suturalis*. The material studied herein confirms this arrangement. In the present study no recognition could be made of the distinctive morphological differences between the two species which were discussed by BAŁUK (2003). The illustrated specimens (BAŁUK 2003, pl. 7, figs 7–10: *C. laevigata*; pl. 8, figs 1–8: *C. suturalis*) are closely allied in morphology but are the size of adults. According to BAŁUK's data and figures, there is only 1–2% difference between the W/L ratio of *suturalis* (35.8–43%) and *laevigata* (36.6–41.3%). Moreover, BAŁUK's specimens display moderate differences in spiral sculpture in both groups. In the Letkés assemblage the size of adult shells (with at least eight teleoconch whorls) ranges between 42–55 mm. *Clavatula sublaevigata* BÁLDI and *C. susannae* HOERNES & AUINGER are junior synonyms of *C. suturalis* (see BAŁUK 2003).

*Clavatula veronicae* (HOERNES & AUINGER, 1891)  
(Plate II, figs 19–20)

- 1954 *Clavatula olgae* – CSEPREGHY-MEZNERICS, pl. 7, fig. 14.  
1966 *Clavatula doderleini veronicae* HOERNES & AUINGER – STRAUZ, p. 411, pl. 16, figs 13–14.  
1966 *Clavatula veronicae* HOERNES & AUINGER – KÓKAY, p. 64, pl. 9, fig. 17.  
? 2003 *Clavatula veronicae* (HOERNES & AUINGER) – BAŁUK, p. 39, pl. 4, figs 9–10.

*Material:* 6 specimens in private collections of the authors, max. SL 21.3 mm.

*Remarks:* Six small clavatulid species were introduced by HOERNES & AUINGER (1891) from Central Paratethyan assemblages. *Clavatula veronicae* differs from its congeners by its more slender shell, its wide, spiny and nearly horizontal subsutural ramp, and sculpture of marked, dense spiral cords and fine, dense axial riblets. The broad specimens illustrated by BAŁUK (2003, pl. 4, figs 9–10) differ from the types (HOERNES & AUINGER 1891, pl. 46, figs 11–14) by a well-defined spiral cord at mid-height of the spire whorls, this material is closer to *Clavatula granulatinata* in morphology. The small, slender specimen illustrated by CSEPREGHY-MEZNERICS (1954, pl. 7, fig. 14) differs from *C. olgae* in morphology, it represents *C. veronicae*.

*Clavatula hirmetzli* n. sp.

(Plate II, figs 21–26, Plate III, figs 1–2)

1867 *Pleurotoma granulato-cincta* – PEREIRA DA COSTA, pl. 26, fig. 14 (non MÜNSTER in GOLDFUSS).*Holotype*: HNHM, PAL 2021.1.1. (Plate II, figs 22–23).*Paratype 1*: HNHM, PAL 2021.2.1. (Plate II, fig. 26).*Paratype 2*: HNHM, PAL 2021.3.1. (Plate III, figs 1–2).*Paratype 3*: NHMW 2021/0002/0001 (Plate II, fig. 21).*Type strata and locality*: Lower Badenian (Middle Miocene) clayey sand (Pécsszabolcs Member of the Lajta Limestone Formation), Letkés, Hungary.*Derivation of name*: In honour of Tamás HIRMETZLI, fossil shell collector (Fót, Hungary).*Material*: Holotype, paratypes 1–3, and 4 specimens in private collections of NÉMETH and the authors, max. SL 57 mm.*Diagnosis*: Medium-sized *Clavatula* species with nine teleoconch whorls, gradate spire, subangulated last whorl and moderately long siphonal canal. Tripartite spire whorls with swollen, beaded to spinous sub- and suprasutural bands, concave part between. Spiral threads on whole shell, strong, granular spiral cords on last whorl, deep, U-shaped anal sinus.*Description*: Medium-sized, broad shell, protoconch absent. Teleoconch of ten whorls with impressed suture. Early spire whorls bear slightly swollen, beaded subsutural and suprasutural bands, and a concave part between with dense, raised, curved axial ribs. Last whorl 66% of the total height, aperture ovate. Anal sinus U-shaped, wide, deep with apex placed on mid subsutural ramp. Columella smooth, siphonal canal moderately long, open, slightly curved, sculptured by granular spiral cords, narrow pseudumbilicus. Spiral sculpture of fine, dense spiral threads on the whole shell, small spines on subsutural band and on shoulder on the 7–9 teleoconch whorls, axial sculpture of strong growth lines. Bimarginate last whorl bearing swollen and spiny subsutural band, concave, striate subsutural ramp, sharp, tuberculate to spiny shoulder, oblique, flat lateral wall below the shoulder, base constricted. The oblique wall sculptured by four well-developed, irregular primary cords, fine secondaries between; on adult shells these cords crossed by raised growth lines producing a crowded, granular ornamentation.*Remarks*: *Clavatula hirmetzli* n. sp. is characterized by poorly-sculptured spire whorls but a richly ornamented, bimarginate last whorl, its appearance shows some resemblance to the Recent *Clavatula bimarginata* (LAMARCK). The Late Miocene specimen figured by PEREIRA DA COSTA (1867, pl. 26, fig. 14) as *Clavatula granulato-cincta* differs from its type by broader shell, longer siphonal canal and reduced spiral sculpture on spire whorls. Although this specimen has a slightly shorter siphonal canal, it is considered as a representative of *C. hirmetzli* n. sp. The Middle Miocene *Clavatula ligeriana* (PEYROT) specimen illustrated by GLIBERT (1953, pl. 3, fig. 8/b) is similar in size and morphology but is distinguished by its more slender shell, higher, conical spire, stronger spiral threads, and weakertubercles and spines. The most closely allied form is the Badenian *Clavatula interrupta vitalisi* STRAUZ from Várpalota (Pannonian Basin) (see STRAUZ 1966, pl. 15, figs 2–3) but it differs by less gradate spire, more rounded last whorl bearing much broader spiral cords, broader aperture, and shorter siphonal canal.*Clavatula santhai* n. sp.

(Plate III, figs 3–6)

1968 *Clavatula (Clavatula) camilae* (sic!) – HINCULOV, p. 147, pl. 37, fig. 3 (non HOERNES & AUINGER)*Holotype*: HNHM, PAL 2021.20.1. (Plate III, figs 5–6).*Type strata and locality*: Lower Badenian (Middle Miocene) clayey sand (Pécsszabolcs Member of the Lajta Limestone Formation), Letkés, Hungary.*Derivation of name*: In honour of József SÁNTHA, owner of the Middle Miocene Malom-kert locality at Szob (Hungary).*Material*: Holotype, and 1 specimen in private collection of the authors, max. SL 37 mm.*Diagnosis*: Medium-sized *Clavatula* species with elongated, fusiform shell, ten teleoconch whorls, tripartite spire whorls, last whorl with strong nodes on shoulder and granulated spiral cords on abapical part, short siphonal canal, deep anal sinus.*Description*: Medium-sized, fusiform shell, protoconch missing. Teleoconch of ten whorls, suture deep, undulating. Last whorl shouldered, approx. 60% of the total height. Aperture ovate, columella smooth, siphonal canal short, sculptured by spiral cords. Broad, deep anal sinus with apex placed mid subsutural ramp. Tripartite spire whorls with swollen, tuberculate suprasutural band, spiny subsutural band and a concave part between. This part bears only growth lines on the holotype, while two weak spiral threads appear on the other specimen (Plate III, figs 3–4). Last whorl bears 18 well-developed nodes on the shoulder, the rounded part below is sculptured by strong growth lines and five granulated primary cords with secondaries between.*Remarks*: *Clavatula santhai* n. sp. differs from *C. gradata* (DEFRANCE) by its more slender shell, and different sculpture, from *C. boreointerrupta* (KAUTSKY) by development of the sub- and suprasutural bands, and spiral sculpture, from *C. szekelyhidiae* n. sp. by swollen sutural bands and lack of strong spiral cords on spire whorls, while from *C. orientoromana* BALDI by shorter siphonal canal and much stronger spiral cords. *Clavatula boreoromana* (KAUTSKY) is a closely allied form but is distinguished by less swollen and non-spiny subsutural band, slightly longer siphonal canal, and weaker, non-granulated spiral cords on last whorl. The specimen illustrated by HINCULOV (1968, pl. 37, fig. 3) from the Mehadia Basin (Romania) differs from *Clavatula camillae* (HOERNES & AUINGER) by its more slender shell and different spiral sculpture; it agrees with the new species described herein in morphology, and is regarded as a representative of *Clavatula santhai* n. sp.



*Clavatula szekelyhidiae* n. sp.  
(Plate III, figs 7–10)

*Holotype*: HNHM, PAL 2021.19.1. (Plate III, figs 9–10).  
*Paratype 1*: NHMW 2021/0002/0002 (Plate III, figs 7–8).

*Type strata and locality*: Lower Badenian (Middle Miocene) clayey sand (Pécsszabolcs Member of the Lajta Limestone Formation), Letkés, Hungary.

*Derivation of name*: In honour of Orsolya SZÉKELYHIDI, fossil shell collector (Csömör, Hungary)

*Material*: Holotype, Paratype 1, and 3 specimens in private collections of HIRMETZL and the authors, max. SL 65 mm.

*Diagnosis*: Medium-sized *Clavatula* species with elongated shell, ten teleoconch whorls, concave late spire whorls, last whorl with spiny shoulder, short siphonal canal, shallow anal sinus, sculpture of strong spiral cords and weakly-developed axial riblets.

*Description*: Medium-sized, fusiform shell, protoconch missing. Teleoconch of ten whorls, suture shallow, undulating. First three spire whorls possess three spiral rows of fine tubercles, the suprasutural row being the strongest. The following whorls become concave, sculptured by a fine, spiny subsutural spiral cord, sharp, slightly projected suprasutural spiral cord and ten moderately-developed cords between. Last whorl approx. 60% of the total height. Aperture ovate, columella smooth, siphonal canal short, sculptured by primary and secondary spiral cords, broad pseudo-umbilicus. Shallow anal sinus with apex placed mid subsutural ramp. Axial sculpture of fine, sharp riblets. Last whorl bears small spines on shoulder, flattened lateral wall below with three strong primary spiral cords and a projected, tuberculate cord abapically.

*Remarks*: *Clavatula szekelyhidiae* n. sp. differs from its Badenian congeners by its wide and shallow anal sinus. The spiral sculpture is somewhat similar to that of *Clavatula granulata* but the latter has a broader shell with lower spire and shorter siphonal canal, and it bears a specific granular spiral cord at mid-whorl formed by much deeper and narrower U-shaped anal sinus. The Middle – Late Miocene *Clavatula saubrigiana* (GRATELOUP) is also a closely allied form in size and morphology but is distinguishable by its more slender shell, higher spire, finer spiral cords, less spiny suprasutural nodes, and deeper anal sinus.

Genus *Perrona* SCHUMACHER, 1817

*Perrona descendens* (HILBER, 1879)  
(Plate III, figs 11–14)

- v 1954 *Clavatula (Perrona) vindobonensis* PARTSCH – CSEPREGHY-MEZNERICS, p. 52, pl. 7, fig. 1.
- v 1954 *Clavatula (Perrona) vindobonensis nodosa* n. subsp. – CSEPREGHY-MEZNERICS, p. 52, pl. 7, figs 8–9, 11–12.
- 1966 *Clavatula jouanneti vindobonensis* PARTSCH – STRAUZ, p. 400, pl. 14, figs 5–14.
- 1966 *Clavatula jouanneti descendens* HILBER – STRAUZ, p. 401, pl. 14, figs 15–16.
- v 1966 *Clavatula (Perrona) vindobonensis nodosa* MEZNERICS – KÓKAY, pl. 9, fig. 18.

- v 1966 *Clavatula (Perrona) descendens* HILBER – KÓKAY, pl. 9, fig. 19.
- v 1972 *Clavatula (Perrona) vindobonensis* PARTSCH – CSEPREGHY-MEZNERICS, p. 32, pl. 16, fig. 1.
- v 1972 *Clavatula (Perrona) jouanneti descendens* HILBER – CSEPREGHY-MEZNERICS, p. 32, pl. 16, figs 2–3.
- 1973 *Clavatula (Perrona) jouanneti* (DES MOULINS) – BOHN-HAVAS, p. 1062, pl. 6, fig. 11.
- 1973 *Clavatula (Perrona) jouanneti descendens* (HILBER) – BOHN-HAVAS, p. 1063, pl. 6, fig. 10.
- 2002 *Perrona jouanneti vindobonensis* (PARTSCH in HÖRNES) – HARZHAUSER, p. 121, pl. 11, figs 5–6.
- 2003 *Perrona (Perrona) descendens* (HILBER) – BAŁUK, p. 40, pl. 9, figs 1–7 (*cum syn.*).
- 2013 *Perrona descendens* (HILBER) – LANDAU et al., p. 290, pl. 49, figs 8–9, pl. 50, fig. 13 (*cum syn.*).

*Material*: HNHM, INV 2021.13.1–3.; 252 specimens in private collections of HIRMETZL, NÉMETH, and the authors, max. SL 32 mm.

*Remarks*: The diagnosis of *Perrona*, as well as the well-established separation of genera *Clavatula* and *Perrona* has been discussed e.g. by SPADINI & MANGANELLI (2010). Following LANDAU et al. (2020) clavatulid species with much reduced sculpture are assigned to genus *Perrona*.

*Perrona descendens* is the most abundant *Perrona* species in the studied assemblage. It is characterized by moderate morphological variability in concavity of whorls, and in sculpture. The swollen subsutural band is smooth or nodular on different specimens or sculptured by fine spiral grooves on the shell (see Plate III, figs 11–12). The difference from *Perrona jouanneti* (DESMOULINS) was noted by LANDAU et al. (2013). The specimens recorded in the literature as *Perrona vindobonensis* PARTSCH bears fine spiral grooves on spire whorls, on the last whorl below the swollen subsutural band and on the base. In our opinion this feature is not a *differentia specifica* but fits within the morphological variability of *Perrona descendens*. This problem was not mentioned by BAŁUK (2003) but both striate and smooth shells were illustrated.

*Perrona inedita* (BELLARDI, 1877)  
(Plate III, figs 15–16)

- v 1972 *Clavatula (Perrona) oliviae* – CSEPREGHY-MEZNERICS, pl. 15, fig. 25 (non HOERNES & AUINGER)
- 2013 *Perrona inedita* (BELLARDI) – LANDAU et al., p. 29, pl. 49, figs 10–11 (*cum syn.*).
- 2019 *Perrona inedita* (BELLARDI) – CARDENAS et al., fig. 7/f.

*Material*: 1 specimen in private collection of the authors, SL 53.5.

*Remarks*: *Perrona inedita* is a rare record in the Middle Miocene Central Paratethys. The specimen (HNHM, M.70.599) illustrated as *Clavatula oliviae* by CSEPREGHY-MEZNERICS (1972) from the Bükk Mts (N Hungary) differs from its types (HOERNES & AUINGER 1891, pl. 47, figs 13–16) which are characterized by a more slender shell, rounded last whorl, more broadly channeled portion of the whorls, and non-tuberculate suprasutural band on late teleoconch

whorls. The specimen from Borsodbóta also represents *Perrona inedita*.

*Perrona letkesensis* (CSEPREGHY-MEZNERICS, 1953)  
nov. comb. (Plate III, fig. 17)

v 1953 *Clavatula letkesensis* n. sp. – CSEPREGHY-MEZNERICS, p. 13, pl. 2, figs 13–14.

*Material*: Holotype (HNHM, M.61.4373).

*Remarks*: Based on its reduced sculpture the species is assigned herein to genus *Perrona*. It is represented only by the fragmentary type specimen which was collected at Letkés but the exact locality was not recorded by CSEPREGHY-MEZNERICS (1953). *Perrona letkesensis* is characterized by a smooth shell bearing convex early teleoconch whorls with a narrow and low spiral keel at midheight. The keel disappears on the late whorls which bear a narrow, slightly swollen subsutural band, a concave portion below, and a rounded suprasutural part on the lower third. The closely allied *Perrona semimarginata* (LAMARCK) and *P. lydiae* (HOERNES & AUINGER) differ by concave early teleoconch whorls.

*Perrona semimarginata* (LAMARCK, 1822)  
(Plate III, fig. 18)

v 1969 *Clavatula (Perrona)* cf. *borsoni* (BASTEROT) – CSEPREGHY-MEZNERICS, p. 97, pl. 6, fig. 3.

1973 *Clavatula (Perrona) semimarginata* (LAMARCK) – BOHN-HAVAS, p. 1063, pl. 6, fig. 9.

? 1985 *Clavatula semimarginata* – FÓZY & LEÉL-ŐSSY, pl. 3, fig. 7.

1998 *Clavatula (Perrona) semimarginata* (LAMARCK) – MIKUŽ, p. 81, pl. 6, fig. 4.

2002 *Perrona semimarginata* (LAMARCK) – HARZHAUSER, p. 120, pl. 11, fig. 9 (*cum syn.*).

*Material*: 1 fragmentary specimen in private collection, SL 21 mm.

*Remarks*: The fragmentary specimen with smooth teleoconch whorls represents *Perrona semimarginata*. The similar *Perrona oliviae* (HOERNES & AUINGER) is distinguishable by its sculptured early teleoconch whorls.

*Perrona taurinensis* (BELLARDI, 1877)  
(Plate III, figs 19–20)

v 1953 *Clavatula* cf. *oliviae* – CSEPREGHY-MEZNERICS, p. 13, pl. 2, figs 15–16 (HNHM, M.62.896) (non HOERNES & AUINGER) (refigured by STRAUZ 1966, p. 401, pl. 14, fig. 17).

1957 *Clavatula* cf. *taurinensis* MAYER – PAVLOVSKY, pl. 2, fig. 3.

non 1966 *Clavatula taurinensis* – STRAUZ, p. 403, pl. 14, figs 20–23 (= *Perrona nemethi* n. sp.)

2009 *Clavatula taurinensis* MAYER – ZUNINO & PAVIA, pl. 2, fig. 5.

2013 *Perrona taurinensis* (BELLARDI) – LANDAU et al., p. 291, pl. 50, figs 1–2, 15, pl. 82, fig. 13.

*Material*: HNHM, M.62.896, INV 2021.9.1–2.; 20 specimens in private collections of NÉMETH and the authors, max. SL 54 mm.

*Remarks*: The specimens illustrated herein correspond to the type (BELLARDI 1877, pl. 6, fig. 10), and the specimen

figured by ZUNINO & PAVIA, pl. 2, fig. 5 in size and morphology. The species is similar to *Perrona oliviae* (HOERNES & AUINGER) in channeled spire whorls, but differs by its shorter siphonal canal, narrower channeled portion of the whorls, tuberculate suprasutural band on late teleoconch whorls and prominent spiral cords on the lower part of the last whorl.

*Perrona harzhauseri* n. sp.  
(Plate III, figs 21–29)

*Holotype*: HNHM, PAL 2021.24.1. (Plate III, figs 21–22). *Paratype 1*: NHMW, 2021/0002/0005 (Plate III, fig. 23). *Paratype 2*: NHMW, 2021/0002/0006 (Plate III, fig. 26). *Paratype 3*: HNHM, PAL 2021.25.1. (Plate III, figs 27–28). *Paratype 4*: NHMW, 2021/0002/0007 (Plate III, fig. 29). *Paratype 5*: HNHM, PAL 2021.26.1. (Plate III, fig. 25). *Paratype 6*: NHMW, 2021/0002/0008 (Plate III, fig. 24). *Paratypes 7–9*: HNHM, PAL 2021.27.1., PAL 2021.28.1., PAL 2021.29.1.

*Type strata and locality*: Lower Badenian (Middle Miocene) clayey sand (Pécsszabolcs Member of the Lajta Limestone Formation), Letkés, Hungary.

*Derivation of name*: In honour of Mathias HARZHAUSER, palaeontologist, Naturhistorisches Museum, Wien.

*Material*: Holotype, paratypes 1–9; 65 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 56 mm.

*Diagnosis*: *Perrona* species with medium-sized, fusiform shell, two smooth protoconch whorls, ten teleoconch whorls. Tripartite sculpture of smooth, broad sub- and suprasutural bands and a smooth, narrow median band. Slightly rounded last whorl, ovate aperture, smooth columella, moderately long, twisted siphonal canal. Wide, deep, U-shaped anal sinus, with apex on mid-whorl band.

*Description*: Medium-sized, fusiform shell with elongated spire. Protoconch of two smooth, slightly rounded whorls (Plate 3, fig. 25), the teleoconch boundary is marked by a slightly concave axial riblet. Teleoconch of ten whorls, suture shallow. The first two-three teleoconch whorls bear three spiral rows of tubercles, from the third-fourth whorl the rows become smooth bands forming a tripartite sculpture with broad sub- and suprasutural bands and a narrow and low median band. Last whorl approx. 56% of the total height, slightly rounded, constricted at base, and sculptured by three strong spiral cords abapically. Aperture ovate. Anal sinus U-shaped, wide, deep with apex placed on mid-whorl band. Columella smooth, siphonal canal moderately long, twisted, sculptured by strong spiral cords. Axial sculpture of fine growth lines.

*Remarks*: *Perrona harzhauseri* n. sp. is characterized by a specific smooth, low, narrow band at the apex of the anal sinus. The most closely allied species is the Late Miocene – Early Pliocene *Perrona villarrasensis* VERA-PELÁEZ & LOZANO-FRANCISCO but it differs by its somewhat broader shell.

*Perrona nemethi* n. sp.

(Plate III, figs 30–32, Plate IV, figs 1–3)

1966 *Clavatula taurinensis* – STRAUZ, pl. 14, figs 20–23 (non BELLARDI).

*Holotype*: HNHM, PAL 2021.21.1. (Plate III, figs 30–31). Paratype 1: NHMW, 2021/0002/0003 (Plate IV, figs 1–2). Paratype 2: NHMW, 2021/0002/0004 (Plate IV, fig. 3). Paratype 3–4: HNHM, PAL 2021.22.1, PAL 2021.23.1. Paratype 5: Coll. Tamás NÉMETH (Plate III, fig. 32). Paratype 6: Coll. VICIÁN.

*Type strata and locality*: Lower Badenian (Middle Miocene) clayey sand (Pécsszabolcs Member of the Lajta Limestone Formation), Letkés, Hungary.

*Derivation of name*: In honour of Tamás NÉMETH, fossil shell collector (Balatonkenese, Hungary).

*Material*: Holotype, paratypes 1–6; 20 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 42 mm.

*Diagnosis*: *Perrona* species with medium-sized, fusiform shell. High, conical spire, protoconch missing. Nine teleoconch whorls, rounded last whorl, ovate aperture, long siphonal canal. Moderately deep, U-shaped anal sinus. Spire whorls with smooth to gently beaded subsutural and tuberculate suprasutural bands, with a smooth, channeled mid-portion between. Suprasutural tubercles disappear on the penultimate whorl. Axial sculpture of fine growth lines.

*Description*: Medium-sized, fusiform shell with high, conical spire, protoconch not preserved. Teleoconch of nine whorls, suture shallow. Early spire whorls bear slightly swollen, smooth to gently beaded subsutural and tuberculate suprasutural bands, with the mid-portion smooth and channeled between. Suprasutural tubercles weaken abapically, and disappear on the penultimate whorl, the channel becomes shallower on late spire whorls. Last whorl 66% of the total height, rounded, constricted at base, aperture ovate. Anal sinus U-shaped, wide, moderately deep with apex placed in mid-whorl channel. Columella smooth, siphonal canal long, open, straight, sculptured by widely-spaced spiral cords. Spiral sculpture of suprasutural row of tubercles, and both the subsutural and the suprasutural bands bear fine spiral threads crossing the tubercles. Two well-defined, granular spiral cords on last whorl at base with finer threads between them. Axial sculpture of fine growth lines. The species is characterized by slight morphological variability in shell width.

*Remarks*: Based on reduced sculpture, the new species is assigned to genus *Perrona*. *Perrona semimarginata* (LAMARCK) has a larger shell, smooth early teleoconch whorls and subangulated last whorl at base. *Perrona pretiosa* (BELLARDI) differs by its shorter siphonal canal, and smooth last whorl; *P. seminuda* (BELLARDI) is a similar form but is distinguishable by its more slender shell with regularly spaced spiral cords on the last whorl; *P. emmae* (HOERNES & AUINGER) is a broader form with shorter

siphonal canal; *P. bouillei* (PEYROT) has a more elongated shell with narrower and deeper mid-whorl channel on the spire; *P. kowalewskii* (BALUK) bears more deeply channeled whorls without tuberculation; while *Clavatula helwerdae* CEULEMANS, VAN DINGENEN & LANDAU is a larger form with broader last whorl and different spiral sculpture. The specimens figured by STRAUZ from Letkés (1966, pl. 14, figs 20–23) as *Clavatula taurinensis* differs from the type (BELLARDI 1877, pl. 6, fig. 10) by their broader shell and weakly-sculptured last whorl, they represent *Perrona nemethi* n. sp.

Genus *Turricula* SCHUMACHER, 1817*Turricula dimidiata* (BROCCHI, 1814)

(Plate IV, figs 4–6)

- v 1953 *Clavatula (Surcula) dimidiata* BROCCHI – CSEPREGHY-MEZNERICS, p. 12, pl. 4, figs 13–14.
- 1966 *Surcula dimidiata* BROCCHI – STRAUZ, p. 413, pl. 17, figs 6–9 (*cum syn.*).
- v 1972 *Clavatula (Surcula) dimidiata* BROCCHI – CSEPREGHY-MEZNERICS, p. 33, pl. 15, figs 15, 20.
- ? 2003 *Turricula (Surcula) dimidiata* (BROCCHI) – BALUK, p. 42, pl. 10, figs 1–4 [= ? *Turricula neugeboreni* (HÖRNES, 1854)]
- 2003 *Comitas dimidiata* (BROCCHI) – SCARPONI & DELLA BELLA, p. 36, pl. 6, figs 32–35 (*cum syn.*).

*Material*: 6 specimens in private collections of NÉMETH and the authors, max. SL 23 mm.

*Remarks*: *Turricula dimidiata* is a rare element of the Letkés gastropod assemblage. The species differs from the similar *Turricula neugeboreni* (HÖRNES) – recorded in the Pannonian Basin by CSEPREGHY-MEZNERICS (1972, p. 32, pl. 15, figs 16, 21) – by its more slender and elongated shell bearing sharper keel with more widely-spaced, flattened nodes.

*Turricula inermiformis* (CSEPREGHY-MEZNERICS, 1969)

(Plate IV, fig. 7)

- v 1960 *Turricula (Surcula) laurae* – BÁLDI, p. 79, pl. 2, fig. 15 (non HOERNES & AUINGER)
- v 1969 *Clavatula (Surcula) inermiformis* n. sp. – CSEPREGHY-MEZNERICS, p. 96, pl. 6, figs 6–7.
- v 1972 *Clavatula (Surcula) inermiformis* CSEPREGHY-MEZNERICS – CSEPREGHY-MEZNERICS, p. 32, pl. 16, figs 14–16.

*Material*: 1 specimen in private collection of NÉMETH, SL 21 mm.

*Remarks*: *Turricula inermiformis* differs from *T. dimidiata* by its broader shell and stronger spiral sculpture. The species is closely allied to the extremely rare *Turricula laurae* (HOERNES & AUINGER) in size and morphology but is distinguishable by its more concave subsutural slope, less prominent keel, more widely-spaced nodes, more rounded last whorl, and weaker spiral and axial sculpture.

Family Turridae H. ADAMS & A. ADAMS, 1853

Genus *Gemmula* WEINKAUFF, 1875

*Gemmula badensis* (R. HOERNES, 1875)

(Plate IV, figs 8–10)

v 1953 *Clavatula (Surcula) trifasciata* – CSEPREGHY-MEZNERICS, p. 11, pl. 2, figs 1–4 (non HÖRNES).

1966 *Pleurotoma badensis* – STRAUSS, p. 420, pl. 18, figs 1–2.

v 1972 *Clavatula (Surcula) badensis* R. HOERNES – CSEPREGHY-MEZNERICS, p. 32, pl. 16, figs 4–5.

2013 *Gemmula badensis* (R. HOERNES) – LANDAU et al., p. 293, pl. 51, fig. 3 (*cum syn.*)

*Material:* HNHM, M.62.892, M.62.893.1-12, and 32 specimens in private collections of the authors, max. SL 24 mm.

*Remarks:* The species shows slight morphological variability in its subangulate to rounded last whorl and sculpture. The specimens illustrated by STRAUSS (1966, pl. 18, figs 1–2), and CSEPREGHY-MEZNERICS (1972, pl. 16, figs 4–5) bear widely-spaced, strong tubercles on the carina. The material studied herein has denser tuberculation and is more similar to the specimens figured by CSEPREGHY-MEZNERICS (1953, pl. 2, figs 1–4) from Letkés as *trifasciata*, and LANDAU et al. (2013, pl. 51, fig. 3) from Turkey. *Gemmula carolinae* (HOERNES & AUINGER) – recorded in Hungary by CSEPREGHY-MEZNERICS (1969) – is distinguishable by its lower placed and more prominent keel.

*Gemmula coronata* (MÜNSTER IN GOLDFUSS, 1841)

(Plate IV, figs 11–12)

1841 *Pleurotoma coronata* MÜNSTER – MÜNSTER in GOLDFUSS, p. 21, pl. 171, fig. 8.

1856 *Pleurotoma coronata* MÜNSTER – HÖRNES, p. 683, pl. 52, fig. 9.

1891 *Pleurotoma coronata* var. *Lapugyensis* – HOERNES & AUINGER, p. 295, pl. 37, figs 11–13.

non 1904 *Pleurotoma coronata* MÜNSTER – SACCO, p. 41, pl. 11, figs 27–28.

? 1904 *Pleurotoma coronata* var. *profundesuturata* – SACCO, p. 41, pl. 11, fig. 33.

1954 *Pleurotoma coronata* MÜNSTER – FRIEDBERG, p. 577, pl. 37, figs 5–6.

1954 *Turris (Gemmula) coronata* MÜNSTER – GLIBERT, p. 7, pl. 2, fig. 4.

1960 *Pleurotoma (Pleurotoma) coronata* MÜNSTER in GOLDFUSS – KOJUMDGIEVA, p. 193, pl. 46, fig. 10.

v 1960 *Turris coronata* (Münster) – BÁLDI, p. 78.

non 1961 *Turris (Gemmula) coronata* – BÁLDI et al., p. 105, pl. 4, fig. 14 (= ? *Unedogemmula* sp.).

? 1966 *Pleurotoma trifasciata* – STRAUSS, p. 419, pl. 17, figs 16–17 only (non HÖRNES)

v 1972 *Clavatula (Gemmula) coronata* MÜNSTER – CSEPREGHY-MEZNERICS, p. 32, pl. 16, fig. 8.

1974 *Pleurotoma coronata* MÜNSTER – URBANIAK, pl. 12, fig. 11.

non 1973 *Turris (Gemmula) coronata* – BÁLDI, p. 314, pl. 46, fig. 11 (= ? *Unedogemmula* sp.).

2013 *Gemmula coronata* (MÜNSTER in GOLDFUSS) – LANDAU et al., p. 294, pl. 51, fig. 4.

2014 *Gemmula coronata* (MÜNSTER in GOLDFUSS) – HARZHAUSER et al., p. 97, pl. 4, figs 8–10.

*Material:* 4 fragmentary specimens in private collections of the authors, max. SL 15.2 mm.

*Remarks:* The specimens in the Letkés assemblage are provisionally assigned to *Gemmula coronata* (MÜNSTER in GOLDFUSS) as the species needs a taxonomical revision (see TUCKER 2004). A morphological revision is also necessary because quite different specimens were illustrated in the literature under the name *coronata* MÜNSTER. The type (GOLDFUSS 1841, pl. 171, fig. 8) and specimens in HÖRNES (1856) and HOERNES & AUINGER (1891) are characterized by relatively broad shells with prominent, strongly tuberculate keel at mid-whorls. Similar forms were illustrated e.g. by FRIEDBERG (1954), GLIBERT (1954), KOJUMDGIEVA (1960), CSEPREGHY-MEZNERICS (1972), and LANDAU et al. (2013). It was SACCO who first presented much more slender shells with much lower keels (1904, pl. 11, figs 27, 28, 30, 32; non fig. 33). This wide interpretation was accepted e.g. by CSEPREGHY-MEZNERICS (1953), and BAŁUK (2003). SACCO's specimen on 1904, pl. 11, fig. 27 markedly differs from the type of *coronata*, and is more similar to *Gemmula denticula* (BASTEROT) in morphology but may not be conspecific; it probably represents a new species. *Gemmula coronata* was erroneously synonymized under *G. trifasciata* (HÖRNES) by STRAUSS (1966), these two species obviously differ in morphology. The Egerian (Late Oligocene – Early Miocene) specimens recorded by BÁLDI et al. (1961) and BÁLDI (1973) markedly differ from the type by their very low keels; they probably represent an *Unedogemmula* species. The Letkés specimen figured herein is close to that illustrated by LANDAU et al. (2013, pl. 51, fig. 4).

*Gemmula denticula* (BASTEROT, 1825)

(Plate IV, figs 13–15)

1931 *Pleurotoma (Hemipleurotoma) denticula* (BASTEROT) – PEYROT, p. 88., pl. 8, figs 20–21.

v 1953 *Clavatula (Surcula) coronata* – CSEPREGHY-MEZNERICS, p. 10, pl. 2, figs 9–12 (non MÜNSTER in GOLDFUSS).

1954 *Turris (Gemmula) denticula* BASTEROT – GLIBERT, p. 5, pl. 2, fig. 1.

? 2003 *Gemmula coronata* – BAŁUK, pl. 12, figs 1–4 (non MÜNSTER in GOLDFUSS).

2017 *Gemmula denticula* (BASTEROT) – LOZOUET, p. 77 pars, pl. 35, figs 10–15.

*Material:* HNHM, M. 62.895.; 110 specimens in private collections of HIRMETZL and the authors, max. SL 22.

*Remarks:* *Gemmula denticula* differs from the similar *G. coronata* by its slightly more slender shell with higher spire and somewhat shorter siphonal canal, and different spiral sculpture. The subsutural ramp is lower, and nearly horizontal above the shoulder. The broad and less prominent keel bears two somewhat laterally flattened spiral cords divided by a narrow and shallow spiral groove. *Gemmula denticula* is the most abundant species of the genus in the studied assemblage.

*Gemmula trifasciata* (HÖRNES, 1854)  
(Plate IV, figs 16–19)

- 1854 *Pleurotoma trifasciata* HÖRNES – HÖRNES, p. 354, pl. 38, fig. 17.  
v 1953 *Clavatula (Surcula) rotata subrotata* – CSEPREGHY-MEZNERICS, p. 11, pl. 2, figs 5–8 (non D'ORBIGNY).  
v 1960 *Turris trifasciata* (HÖRNES) – BÁLDI, p. 77.  
non 1961 *Turris (Gemmula) trifasciata* (M. HÖRNES) – BÁLDI et al., p. 106, pl. 4, fig. 15 (refigured by BÁLDI 1973, p. 314, pl. 46, fig. 7).  
? 1966 *Pleurotoma trifasciata* HÖRNES – STRAUZ, p. 419, pl. 17, fig. 15 only.  
1967 *Turris (Turris) cf. trifasciata* (M. HÖRNES) – TEJKAL et al., p. 206, pl. 11B, fig. 19.  
? 1972 *Clavatula (Surcula) trifasciata* M. HÖRNES – CSEPREGHY-MEZNERICS, p. 32, pl. 15, figs 17, 27.

**Material:** HNHM, M. 62.891.1-2; 4 specimens in private collections of the authors, max. SL 23.

**Remarks:** The specimens studied herein are closely allied to the type of *Gemmula trifasciata* (HÖRNES 1854, pl. 38, fig. 17) in size and morphology. The species bears a less prominent tuberculate keel than that of *Gemmula coronata*, and the keel is subdivided into three parts by two narrow spiral cords. *Gemmula denticula* is distinguishable by a more slender shell, while *G. badensis* has a slightly broader shell which bears much finer spiral cords. The specimen illustrated by CSEPREGHY-MEZNERICS (1953, pl. 2, figs 5–8) as *subrotata* differs in morphology from the material of PEYROT (1931, pl. 8, figs 81–83) by its somewhat broader shell, shorter siphonal canal, less prominent keel, and different spiral sculpture. The Egerian (Late Oligocene – Early Miocene) specimen recorded by BÁLDI et al. (1961) and BÁLDI (1973) differs from the type in morphology and represents another species. [A taxonomical revision of *Gemmula trifasciata* (HÖRNES) is in progress – Mathias HARZHAUSER pers. com.]

Genus *Turris* BATSCH, 1789

*Turris vermicularis* (GRATELOUP, 1832)  
(Plate IV, figs 20–21)

- 1969 *Turris vermicularis* GRATELOUP – CSEPREGHY-MEZNERICS, p. 97, pl. 6, fig. 10.  
1998 *Turris (Turris) vermicularis* GRATELOUP – SCHULTZ, p. 30, fig. 14.

**Material:** HNHM, INV 2021.12.1–7.; more than 450 specimens in private collections of HIRMETZL, NÉMETH and the authors, max. SL 60 mm.

**Remarks:** *Turris vermicularis* is generally uncommon in the Pannonian Basin localities but it is one of the most abundant species in the turrinid assemblage of Letkés.

Genus *Unedogemmula* MACNEILL, 1960

*Unedogemmula annae* (HOERNES & AUINGER, 1891)  
(Plate IV, figs 22–23)

- v 1953 *Turris annae* HOERNES & AUINGER – CSEPREGHY-MEZNERICS, p. 14, pl. 2, figs 24–25.

- 1966 *Pleurotoma annae* HOERNES & AUINGER – STRAUZ, p. 421, pl. 18, figs 3–5.  
v 1972 *Turris annae* HOERNES & AUINGER – CSEPREGHY-MEZNERICS, p. 33, pl. 16, figs 24–25.  
2003 *Gemmula annae* (HOERNES & AUINGER) – BALUK, p. 45, pl. 12, figs 5–9 (*cum syn.*).  
2015 *Gemmula annae* (HOERNES & AUINGER) – POPA et al., p. 20, pl. 6, fig. 7.

**Material:** HNHM, M.62.901; 5 specimens in private collections of the authors, max. SL 21.

**Remarks:** The supraspecific arrangement of the species has been discussed in the literature. Based on protoconch morphology *annae* was assigned to genus *Unedogemmula* by LANDAU et al. (2013).

Family Fusiturridae ABDELKRIM et al., 2018  
Genus *Fusiturris* THIELE, 1929

*Fusiturris emiliae* (HOERNES & AUINGER, 1891) nov. comb.  
(Plate IV, figs 24–25)

- 1891 *Pleurotoma (Surcula) emiliae* nov. form. – HOERNES & AUINGER, p. 302, pl. 38, fig. 4.  
v 1953 *Clavatula (Surcula) krenneri* n. sp. – CSEPREGHY-MEZNERICS, p. 13, pl. 2, figs 17–18.

**Material:** HNHM, M.61.4299; 1 fragmentary specimen in private collection, SL 20.2 mm.

**Remarks:** The supraspecific classifications of three Miocene “*Surcula*” species (*emiliae* HOERNES & AUINGER, *intermedia* BRONN and *reevi* BELLARDI) have been discussed in the literature. As their morphology corresponds to the revised diagnosis of *Fusiturris* (ABDELKRIM et al. 2018) all three are assigned to this genus in the present paper. *Fusiturris emiliae* shows some resemblance to *F. aquensis* (GRATELOUP) in size and weak axial sculpture but differs by its lower spire and slightly more rounded spire whorls. *Fusiturris intermedia* has longer siphonal canal and shouldered whorls. The size and morphology of the holotype of “*Clavatula*” *krenneri* CSEPREGHY-MEZNERICS (HNHM, M.61.4299) are identical with that of *Fusiturris emiliae*, so *krenneri* is regarded as a junior synonym.

*Fusiturris intermedia* (BRONN, 1831) nov. comb.  
(Plate IV, figs 26–29)

- 1966 *Surcula intermedia* BRONN – STRAUZ, p. 415, pl. 17, fig. 13.  
2003 *Turricula (Surcula) intermedia* (BRONN) – BALUK, p. 43, pl. 10, figs 9–10 (*cum syn.*).  
2003 *Comitas intermedia* (BRONN) – SCARPONI & DELLA BELLA, p. 37, figs 36–37, 53 (*cum syn.*).  
2019 *Turricula intermedia* (BRONN) – CARDENAS et al., fig. 7/e.

**Material:** 2 fragmentary specimens in private collections, max. SL 25.4 mm

**Remarks:** *Fusiturris intermedia* is similar to *F. aquensis* and *F. emiliae* but is distinguished by its longer siphonal canal.

*Fusiturris reevei* (BELLARDI, 1847) nov. comb.  
(Plate IV, figs 30–31)

1950 *Clavatula (Surcula) reevei* BELLARDI – CSEPREGHY-MEZNERICS, p. 59, pl. 2, fig. 16.

1966 *Surcula reevei* BELLARDI – STRAUZ, p. 417, pl. 17, fig. 14.

2003 *Turricula (Surcula) reevei* (BELLARDI) – BAŁUK, p. 43, pl. 10, figs 5–7 (*cum syn.*).

**Material:** HNHM, INV 2021.8.1–2.; 17 specimens in private collections, max. SL 33.

**Remarks:** Protoconchs are preserved only on *Fusiturris reevei* specimens from the fusiturrid material of Letkés. These protoconchs are multispiral with smooth, rounded whorls.

### Conclusion

The present paper is the second contribution to the analysis of the superfamily Conoidea in the early Badenian (early Middle Miocene) gastropod assemblage of Letkés (N Pannonian Basin, Hungary). It focuses on describing species belonging to Borsoniidae, Cochlespiridae, Clavatulidae, Turridae, and Fusiturridae. Based on newly-collected material and revision of museum collections more than 1350 conoidean specimens of these families were investigated, and 41 species are presented herein. The alpha diversity is generally high at the locality as it yielded a partly reworked mollusk assemblage of different palaeocommunities. Other gastropod families or superfamilies have been described from the locality (Conidae – KOVÁCS & VICIÁN 2014, HARZHAUSER & LANDAU 2016; Tonnoidea and Ficoidea – KOVÁCS & VICIÁN 2018; Muricidae – KOVÁCS et al. 2018; Cancellariidae – KOVÁCS & VICIÁN 2021; or the Buccinoidea and Cypraeoidea – research in progress) and, similarly to these, the diversity of the Clavatulidae (23 species) is the highest in the Hungarian part of the Pannonian Basin (for comparison see KÓKAY 1966, STRAUZ 1966, BOHN-HAVAS 1973). Furthermore, the clavatulid assemblage is similar in composition to the faunas known from the Făget Basin (Romania) and the Korytnica Basin (Poland) (see BAŁUK 2003). The rich material enabled five

new species to be designated: the endemic *Clavatula santhai* n. sp., *C. szekelyhidiae* n. sp., *Perrona harzhauseri* n. sp., *P. nemethi* n. sp. and *Clavatula hirmetzli* n. sp. that shows wider stratigraphic and geographic ranges. High endemism is typical of the Clavatulidae (LANDAU et al. 2020); in the material of Letkés 14 clavatulids (61%) are known only in the Central Paratethys (*Table I*). Diversities of the Turridae (6 species) and the Fusiturridae (3 species) are also relatively high. Four conoidean species are recorded for the first time in Hungary: *Acamptogenotia praecedens* (BELLARDI), *Clavatula eleonora* (HOERNES & AUINGER), *C. juliae* (HOERNES & AUINGER), and *C. sidoniae* (HOERNES & AUINGER). The extended geographical distributions of rare taxa such as *Aphanitoma pecchiolii* BELLARDI, *Asthenotoma tuberculata* (PUSCH), *Cochlespira serrata* (BELLARDI) or *Turricula inermiformis* (CSEPREGHY-MEZNERICS) are also documented.

### Authorship contribution statement

Zoltán KOVÁCS: conceptualization, project administration, writing, editing, visualization.

Zoltán VICIÁN: investigation, resources, review.

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**Plate I – I. tábla**

- Figs 1–2. *Acamptogenotia praecedens* (BELLARDI), SL 51 (1×)  
 Figs 3–4. *Acamptogenotia praecedens* (BELLARDI), SL 22 (1.5×)  
 Figs 5–6. *Aphanitoma pecchiolii* BELLARDI, SL 13 (4×)  
 Figs 7–8. *Asthenotoma festiva* (HÖRNES), SL 11.6 (2.8×)  
 Figs 9–10. *Asthenotoma tuberculata* (PUSCH), SL 22 (2×)  
 Figs 11–12. *Asthenotoma tuberculata* (PUSCH), SL 15 (3×)  
 Fig. 13. *Bathytoma cataphracta* (BROCCHI), SL 35 (1.2×)  
 Figs 14–15. *Genota elisae* (HOERNES & AUINGER), SL 36 (1.5×)  
 Fig. 16. *Genota valeriae* (HOERNES & AUINGER), SL 34 (1.5×)  
 Figs 17–18. *Microdrillia teretiaeformis* JANSSEN, SL 9.7 (5×)  
 Figs 19–20. *Cochlespira serrata* (BELLARDI), SL 13.8 (4×)  
 Figs 21–23. *Clavatula amaliae* (HOERNES & AUINGER), SL 70 (1×)  
 Figs 24–25. *Clavatula amaliae* (HOERNES & AUINGER), SL 47 (1×)  
 Figs 26–27. *Clavatula camillae* (HOERNES & AUINGER), SL 43 (1.2×)  
 Figs 28–29. *Clavatula eleonora* (HOERNES & AUINGER), SL 34, (1.5×)  
 Fig. 30. *Clavatula granulatocincta* (MÜNSTER in GOLDFUSS), SL 27 (1.6×)  
 Figs 31–32. *Clavatula granulatocincta* (MÜNSTER in GOLDFUSS), SL 40 (1.4×)

**Plate II – II. tábla**

- Figs 1–2. *Clavatula juliae* (HOERNES & AUINGER), SL 37 (1.4×)  
 Figs 3–4. *Clavatula* cf. *olgae* (HOERNES & AUINGER), SL 21 (2×)  
 Fig. 5. *Clavatula polonica* (PUSCH), SL 36 (1.4×)  
 Figs 6–7. *Clavatula polonica* (PUSCH), SL 63 (1×)  
 Figs 8–9. *Clavatula schreibersi* (HÖRNES), SL 40 (1.2×)  
 Figs 10–11. *Clavatula sidoniae* (HOERNES & AUINGER), SL 25.4 (2.2×)  
 Fig. 12. *Clavatula suturalis* (ANDRZEJOWSKI), SL 49 (1.2×)  
 Figs 13–14. *Clavatula suturalis* (ANDRZEJOWSKI), SL 43 (1.2×)  
 Figs 15–16. *Clavatula suturalis* (ANDRZEJOWSKI), SL 41 (1.2×)  
 Figs 17–18. *Clavatula suturalis* (ANDRZEJOWSKI), SL 31 (1.5×)  
 Figs 19–20. *Clavatula veronicae* (HOERNES & AUINGER), SL 21.2 (2.2×)  
 Fig. 21. *Clavatula hirmetzli* n. sp., Paratype 3, SL 47.2, SW 21.3 (1.3×)  
 Figs 22–23. *Clavatula hirmetzli* n. sp., Holotype, SL 51, SW 24 (1.3×)  
 Figs 24–25. *Clavatula hirmetzli* n. sp., Coll. NÉMETH, SL 57, SW 25 (1.3×)  
 Fig. 26. *Clavatula hirmetzli* n. sp., Paratype 1, SL 34.2, SW 16.6 (1.4×)

**Plate III – III. tábla**

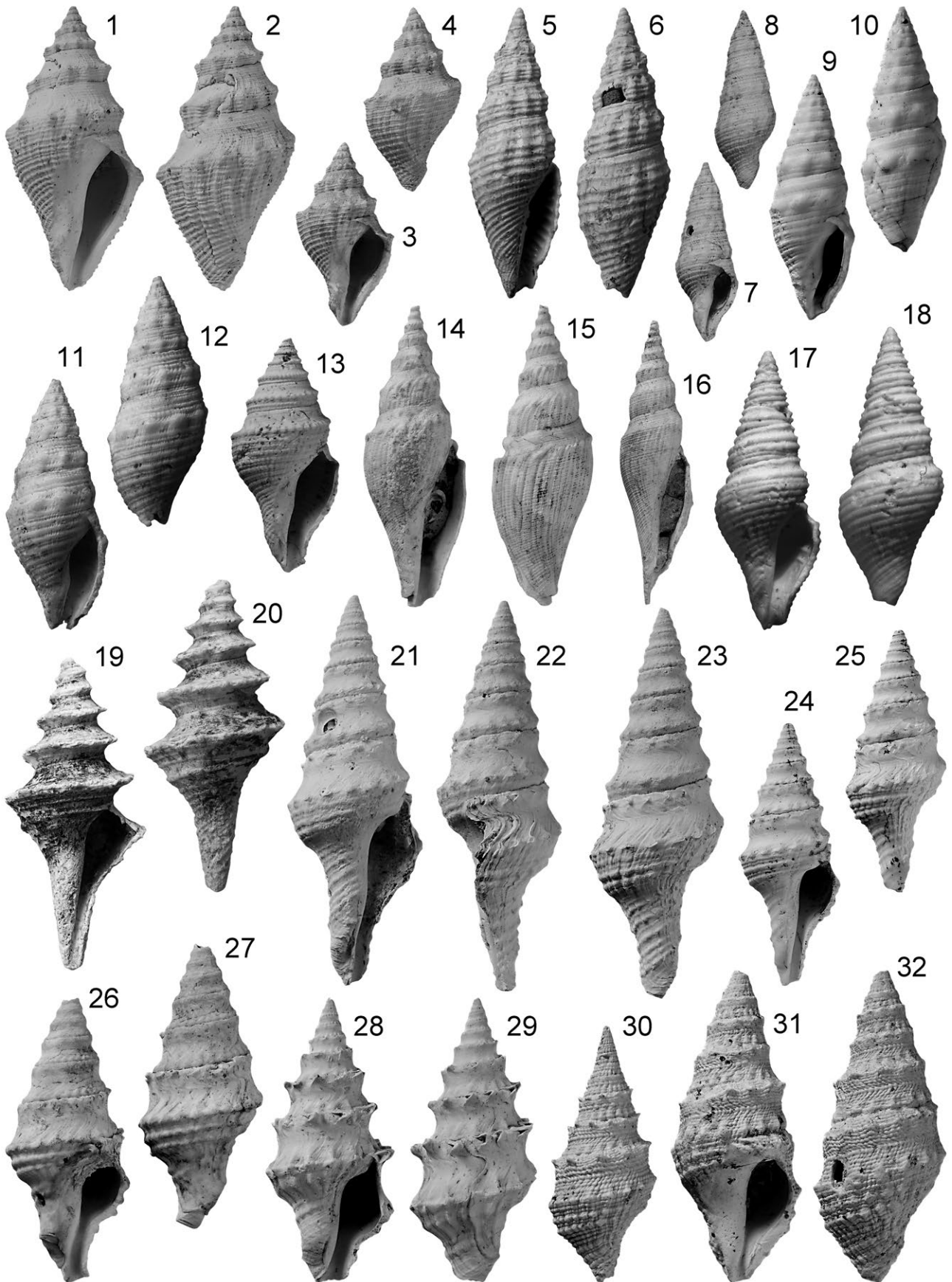
- Figs 1–2. *Clavatula hirmetzli* n. sp., Paratype 2, SL 32.8, SW 16.8 (1.3×)  
 Figs 3–4. *Clavatula santhai* n. sp., Coll. KOVÁCS, SL 28.5, SW 10.6 (1.4×)  
 Figs 5–6. *Clavatula santhai* n. sp., Holotype, SL 37, SW 13.5 (1.3×)  
 Figs 7–8. *Clavatula szekelyhidiae* n. sp., Paratype 1, SL 53.5, SW 19.4 (1.3×)  
 Figs 9–10. *Clavatula szekelyhidiae* n. sp., Holotype, SL 65, SW 25.6 (1.2×)  
 Figs 11–12. *Perrona descendens* (HILBER), SL 30 (1.4×)  
 Figs 13–14. *Perrona descendens* (HILBER), SL 30 (1.4×)  
 Figs 15–16. *Perrona inedita* (BELLARDI), SL 53.5 (1×)  
 Fig. 17. *Perrona letkesensis* (CSEPREGHY-MEZNERICS), Holotype, HNHM, M.61.4373, SL 41.4 (1.2×)  
 Fig. 18. *Perrona semimarginata* (LAMARCK), SL 21 (1.8×)  
 Fig. 19. *Perrona taurinensis* (BELLARDI), SL 40 (1.2×)  
 Fig. 20. *Perrona taurinensis* (BELLARDI), SL 54 (1×)  
 Figs 21–22. *Perrona harzhauseri* n. sp., Holotype, SL 54, SW 16.5 (1.2×)  
 Fig. 23. *Perrona harzhauseri* n. sp., Paratype 1, SL 52, SW 16.6 (1.2×)  
 Fig. 24. *Perrona harzhauseri* n. sp., Paratype 6, SL 27.6, SW 9.6 (1.2×)  
 Fig. 25. *Perrona harzhauseri* n. sp., Paratype 5 (SL 21.7, SW 7.6), protoconch and first teleoconch whorl (16×)  
 Fig. 26. *Perrona harzhauseri* n. sp., Paratype 2, SL 50, SW 15.5 (1.2×)  
 Figs 27–28. *Perrona harzhauseri* n. sp., Paratype 3, SL 50, SW 16 (1.2×)  
 Fig. 29. *Perrona harzhauseri* n. sp., Paratype 4, SL 51, SW 15 (1.2×)  
 Figs 30–31. *Perrona nemethi* n. sp., Holotype, SL 36, SW 12.4 (1.5×)  
 Fig. 32. *Perrona nemethi* n. sp., Paratype 5, Coll. NÉMETH, SL 32.6, SW 12.2 (1.5×)

**Plate IV – IV. tábla**

- Figs 1–2. *Perrona nemethi* n. sp., Paratype 1, SL 25, SW 10 (2×)  
Fig. 3. *Perrona nemethi* n. sp., Paratype 2, SL 41, SW 15.4 (1.2×)  
Figs 4–5. *Turricula dimidiata* (BROCCHI), SL 22.4 (2.3×)  
Fig. 6. *Turricula dimidiata* (BROCCHI), SL 18.2 (2.2×)  
Fig. 7. *Turricula inermiformis* (CSEPREGHY-MEZNERICS), SL 21 (2.4×)  
Fig. 8. *Gemmula badensis* (R. HOERNES), SL 22.5 (2.6×)  
Figs 9–10. *Gemmula badensis* (R. HOERNES), SL 23.4 (2×)  
Figs 11–12. *Gemmula coronata* (MÜNSTER in GOLDFUSS), SL 15.2 (3.4×)  
Figs 13–14. *Gemmula denticula* (BASTEROT), SL 21.4 (2.3×)  
Fig. 15. *Gemmula denticula* (BASTEROT), HNHM, M.62.895., SL 20.6 (2.5×)  
Figs 16–17. *Gemmula trifasciata* (HÖRNES), SL 19.7 (2.2×)  
Figs 18–19. *Gemmula trifasciata* (HÖRNES), SL 22.3 (2.2×)  
Figs 20–21. *Turris vermicularis* (GRATELOUP), SL 50 (1×)  
Figs 22–23. *Unedogemmula annae* (HOERNES & AUINGER), SL 17.5 (2.3×)  
Figs 24–25. *Fusiturris emiliae* (HOERNES & AUINGER), SL 20.2 (2.3×)  
Figs 26–27. *Fusiturris intermedia* (BRONN), SL 20.4 (2.2×)  
Figs 28–29. *Fusiturris intermedia* (BRONN), SL 25.4 (2.2×)  
Figs 30–31. *Fusiturris reevei* (BELLARDI), SL 33 (1.7×)

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Plate I – I. tábla



**Plate II – II. tábla**

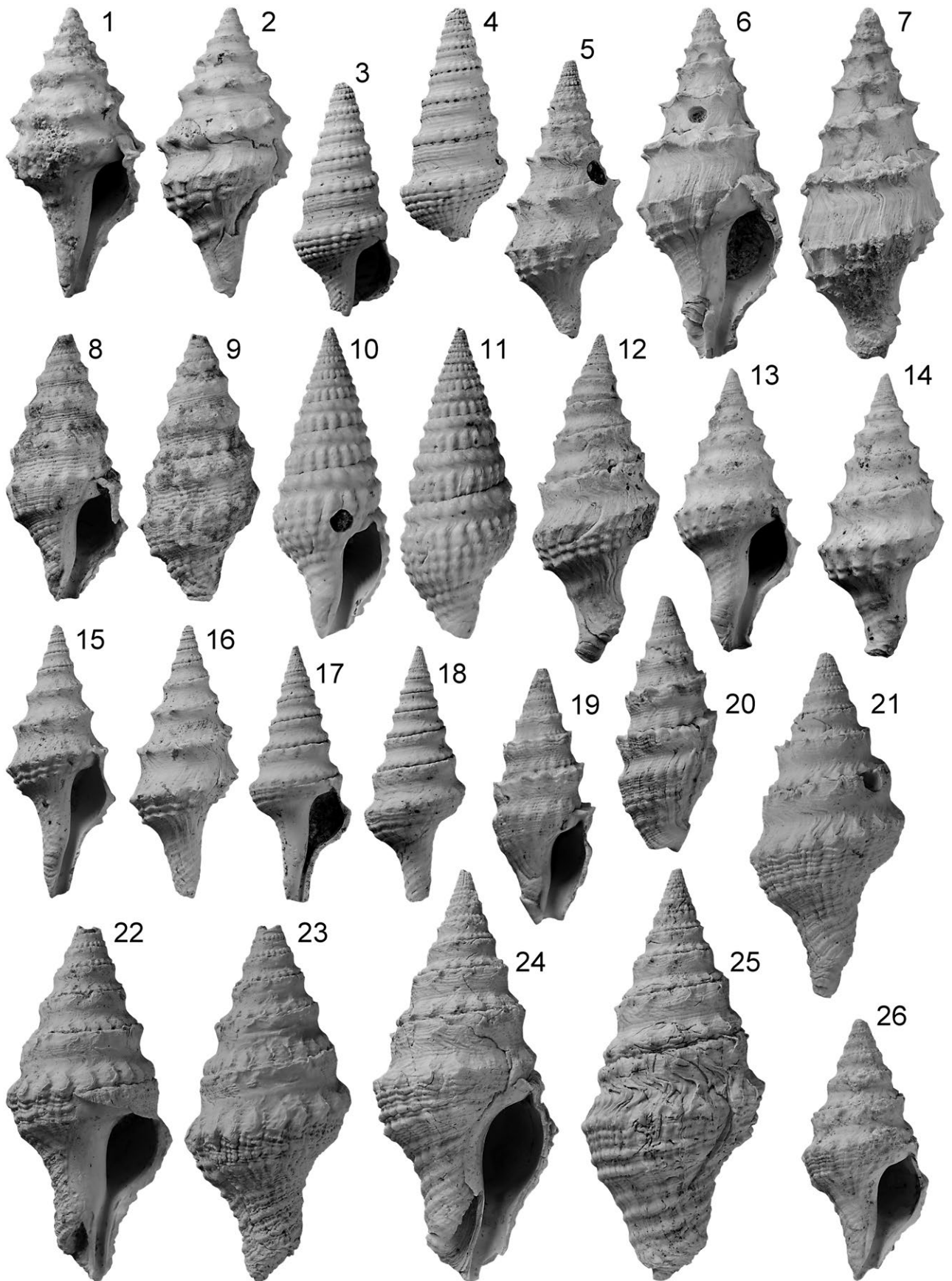
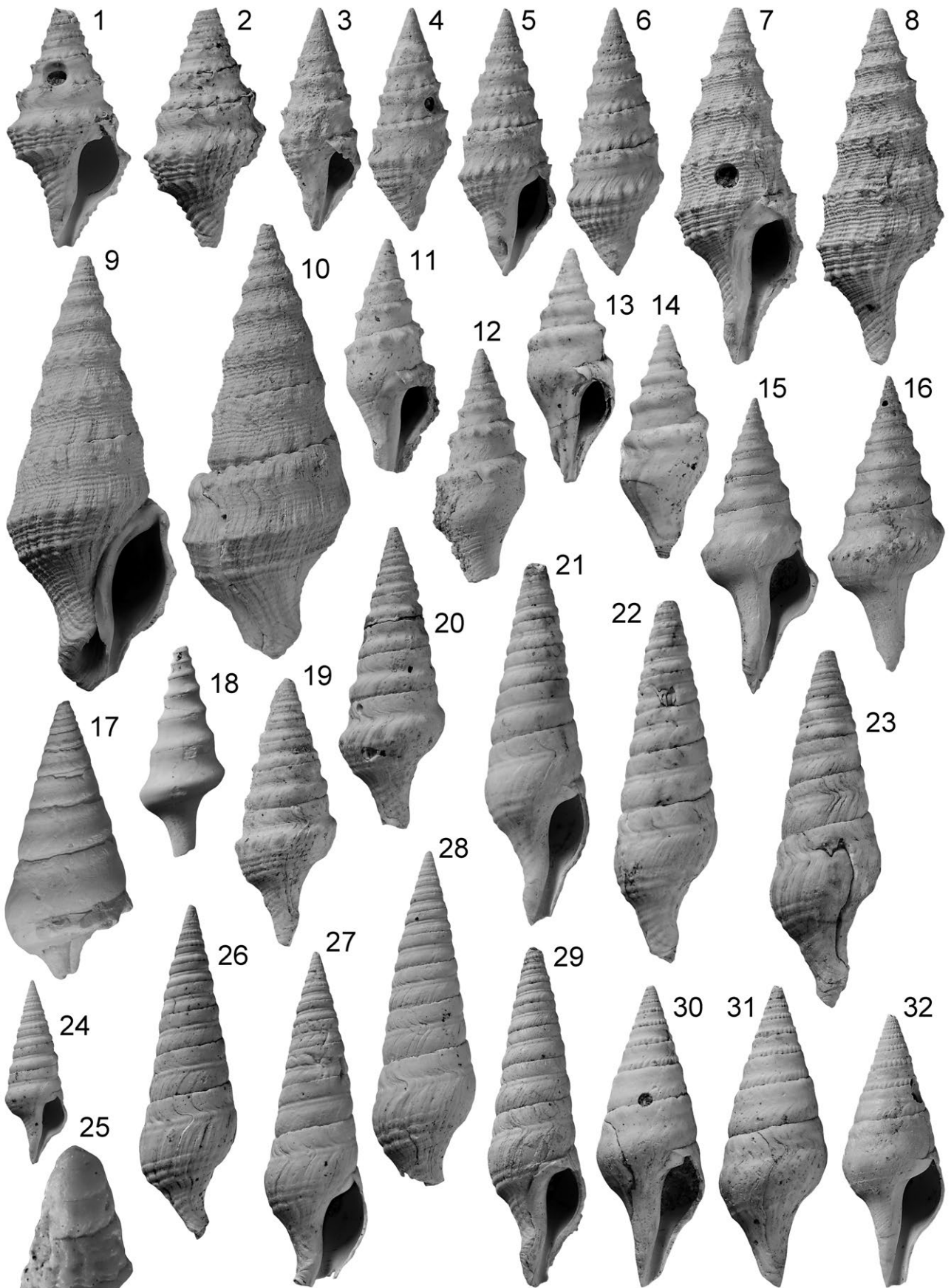


Plate III – III. tábla



## Plate IV – IV. tábla

