Magyarhoni Földtani Társulat
Földtani Közlöny
Hungarian Geological Society

154/4, 395–422., Budapest, 2024

DOI: 10.23928/foldt.kozl.2024.154.4.395

Ladinian ammonoids from the Balaton Highland (Hungary) I. Nemesvámos

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Ladin ammoniteszek a Balaton-felvidékről. I. Nemesvámos

Összefoglalás

Nemesvámos (régi nevén Vámos) a Balaton-felvidék régóta ismert ladin ősmaradvány-lelőhelye, amely már a klaszszikus „Balaton-monográfia" tanulmánysorozatában is szerepel (Diener 1899, Frech 1903). A falutól NyDNy-ra húzódó, Gyűrtető nevű gerinc földtani felépítését Laczkó (1911) írta le részletesen, és ábrázolta földtani szelvényén. A vonulat Katrabóca nevű D-i részén lévő felhagyott mészkőfejtők vörös mészkövéből (a „vámosi márványból") hosszú faunalistát közölt. Lóczy (1913) csak érintőlegesen említette a lelőhelyet, a terület földtani felépítését azonban olyan pontosan ábrázolta földtani térképén (Lóczy 1920) – feltehetően Laczkó felvétele alapján –, hogy ahhoz a későbbi kutatások sem tudtak érdemi új ismereteket hozzátenni. Ezt követően a lelőhelyről újabb őslénytani adatokat csak a Balaton-felvidék legutóbbi földtani térképezéséhez kapcsolódó OTKA-program keretében megvalósult kutatások szolgáltattak (Vörös 1998). Az elmúlt évek gyűjtései során újabb gazdag cephalopoda-, csiga- és kagylófauna került elő a vörös mészkőből (Buchensteini Formáció), amelynek vizsgálata pontosítja a ladin emelet biosztratigráfiai tagolását és korrelációját más alpi területek rétegsorával, továbbá adatokat szolgáltat az üledékképződési környezet jellegére is.

Nemesvámos és Veszprémfajsz környéke a Litéri-feltolódástól É-ra lévő pikkelyhez tartozik (*1. ábra*), ahol a középső triász képződményekből felépülő Ny–K-i csapású vonulatot (Som-hegy, Gyűr-hegy, Király-hegy, veszprémfajszi Kálvária-hegy) alpi gyűrt szerkezetek alkotják (*2. ábra*). A felszínre bukkanó legidősebb triász képződmény az alsó anisusi karbonátrámpán létrejött Iszkahegyi Mészkő. Fölötte az ugyancsak rámpán képződött Megyehegyi Dolomit következik, amelyet az északi pikkelyre általában jellemző, viszonylag kis vastagságú, bitumenes dolomit képvisel. A középső–felső anisusi emeletet a mélyebb medencében lerakódott Felsőörsi Mészkő alkotja, amelyet a Katrabócán mélyült Nemesvámos Nos–2 fúrás viszonylag jelentős vastagságban harántolt (*3. ábra*). Fölötte néhány méter vastag, mészkő-betelepülésekkel tagolt vulkáni tufa (Vászolyi Formáció), majd arra a ladin Buchensteini Formáció pados, kovás, tűzköves mészkő és fölötte a világosszürke, részben dolomitosodott Füredi Mészkő következik. Az erre települő sekélytengeri dolomit, a Gémhegyi Formáció alsó, Kádártai Dolomit Tagozata a karbonátplatform progradációját jelzi a karni elején (Budai & Haas 1997, 2014; Budai et al. 1999b; Budai & Vörös 2006).

A középső triász sorozatból álló vonulat egy ÉNy–DK-i csapású eltolódás mentén karni képződményekkel érintkezik Nemesvámos környékén (*2. ábra*). Balácapusztánál a Veszprémi Márga Formáció és a Gémhegyi Dolomit platformkarbonátjának (Kádártai és Sédvölgyi Tagozat) összefogazódása figyelhető meg, míg Nemesvámos Ny-i részét (Gyűr-hegy) a karni emelet felső részét képviselő Sándorhegyi Formáció és Fődolomit alkotja.

A Katrabóca II. jelű szelvényt 1995–96-ban Budai T., Csillag G., Dosztály L., Szabó I. és Vörös A. tárta fel, és gyűjtötte be az ősmaradványait rétegenként. A 10 méter hosszúságú szelvény 25 rétegének és faunájának rövid leírását Vörös (1998) munkája tartalmazza. Az utóbbi években Bercsényi M. és Pintér Zs. amatőr gyűjtők újra feltárták a lelőhelyet. Csapásirányban kiszélesítették az árkolást (*7. ábra*), és hatalmas mennyiségű ősmaradványt (elsősorban ammoniteszeket) gyűjtöttek a legdúsabban faunás rétegekből, megtartva a korábbi rétegszámozást (*4. ábra*). Az újonan gyűjtött ladin (longobárd) ammoniteszanyag mintegy 450 példányból áll; ebből 117 példány volt fajra meghatározható; közülük 68 példányt ábrázolunk ebben a dolgozatban (*I. táblázat, I–XI. tábla*). A 13. rétegen belül lencsésen megjelenő csiga–kagyló kokvína (*5. ábra*) a vázak tenger alatti átülepítésével és gyors cementációjával keletkezhetett. Ugyancsak üledékmozgásokra utal a 11. és 12. réteg szerkezete; az itt megjelenő, gazdag *Arpadites*-együttes nagy része töredékes, és a példányok kaotikusan helyezkednek el. A leggazdagabb faunát adó 9. rétegben a nagy méretű, vas–mangánoxiddal bevont *Protrachyceras*ok rétegződéssel párhuzamos elrendeződése nyugodt, lassú, kondenzált üledékképződésre utal.

Az új gyűjtések jelentősen bővítették a katrabócai Ammonoidea-fauna rendszertani összetételét; az ebben a dolgozatban röviden ismertetett 23 taxon közül 9 új a helyi faunára nézve. Másrészt az új adatok lényegében alátámasztották a Katrabóca II. szelvény korábban kialakított biosztratigáfiai tagolását.

Tárgyszavak: ammonitesz, ladin, biosztratigráfia, üledékképződési környezet

Abstract

Recent collecting from the classic fossil site of Katrabóca at Nemesvámos (northeastern part of the Balaton Highland) yielded a well-preserved Ladinian (Longobardian) fossil assemblage from the red nodular limestone of the Buchenstein Formation. The ammonite material consists of about 450 specimens; of these, 117 specimens could be identified as species; 68 of them are presented in this paper. A special phenomenon is the lenticular bivalve and gastropod coquina in Bed 13, which may have been formed by submarine redeposition and rapid cementation of the shells. The sedimentary structures of Beds 11 and 12 also indicate redeposition; most parts of the rich *Arpadites* assemblage contain fragmented shells and the specimens have a chaotic orientation. The richest ammonite assemblage was found in Bed 9 where the bedding-parallel arrangement of the large Protrachyceras shells and their iron-manganese oxide coating indicate low sedimentation rate and related condensation. The new collection significantly expands the taxonomic composition of the Katrabóca ammonoid fauna; within the 23 briefly described taxa of this paper nine are new at the locality.

Keywords: Ammonite, Ladinian, biostratigraphy, sedimentary environment

Introduction, previous studies

The first geological study in the vicinity of Nemesvámos was performed by LACZKÓ (1911) who gave a very detailed description of the Triassic stratigraphy and the structure of the area (pp. 77–83). LÓCZY (1913) only briefly mentioned this area in his monograph; however, his geological map (LÓCZY 1920) clearly shows the characteristic compressional structures (e.g., synclines and anticlines) of the northern thrust sheet along the Litér thrust.

Within the framework of the last detailed mapping project of the Balaton Highland, the Nemesvámos area was also re-surveyed (BUDAI et al. 1999a,b). The ammonoid fauna collected bed by bed from the Ladinian sequence of small, abandoned quarries at Katrabóca was published by VÖRÖS (1998).

During the past few years, a new exploration was performed at the Katrabóca II site by amatour collectors (co-authors of this paper) and a rich, well-preserved cephalopod assemblage was collected, which also contains previously unknown forms. In this paper we present these new palaeontological results and their biostratigraphic context, and some new considerations for the interpretation of the sedimentary environment.

Geological setting

The Nemesvámos area is situated close to the southern rim of the Veszprém Plateau, which belongs to the northeastern part of the Balaton Highland. The Balaton Highland forms the southeastern limb of the SW–NE oriented syncline structure of the Transdanubian Range where the most decisive compressional Alpine structure, the Litér thrust occurs (*Figure 1*).

The Nemesvámos area belongs to the northern thrust sheet along the Litér thrust where the folded Middle Triassic formations form small syncline and anticline structures (*Fig-*

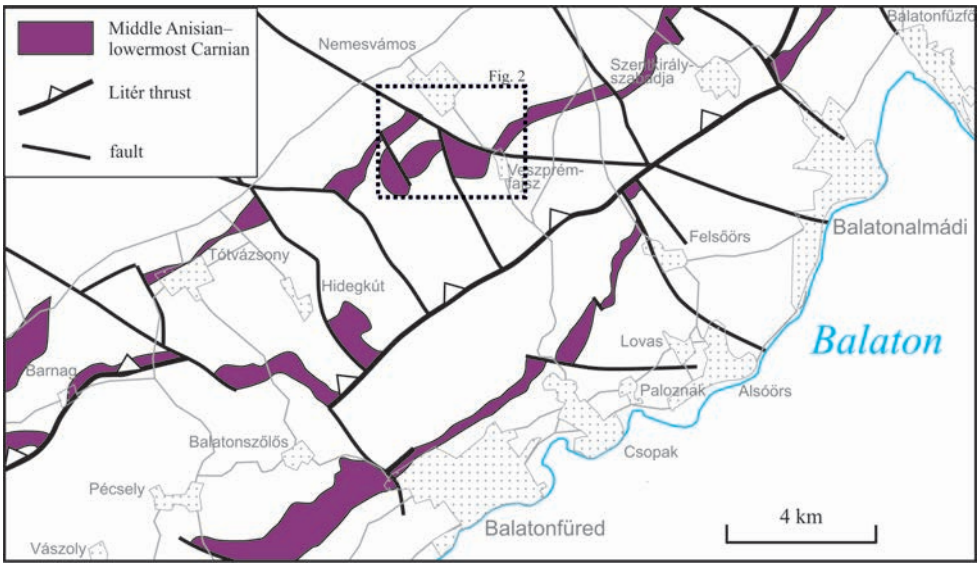

Figure 1. Simplified Pre-Cenozoic geological map of the Balaton Highland (after BUDAI et al. 1999a) showing the extension of the middle Anisian to lowermost Carnian basin succession (Felsőörs, Vászoly, Buchenstein and Füred Formations) and the position of the geological map in *Figure 2* (rectangle)

1. ábra. *A Balaton-felvidék egyszerűsített prekainozoos földtani térképe (BUDAI et al. 1999a nyomán) a középső anisusi - legalsó karni medence kifejlődésű képződmények (Felsőörsi, Vászolyi, Buchensteini és Füredi Formáció) elterjedésének feltüntetésével. A négyszög a* 2. ábrán *szereplő földtani térkép helyzetét mutatja*

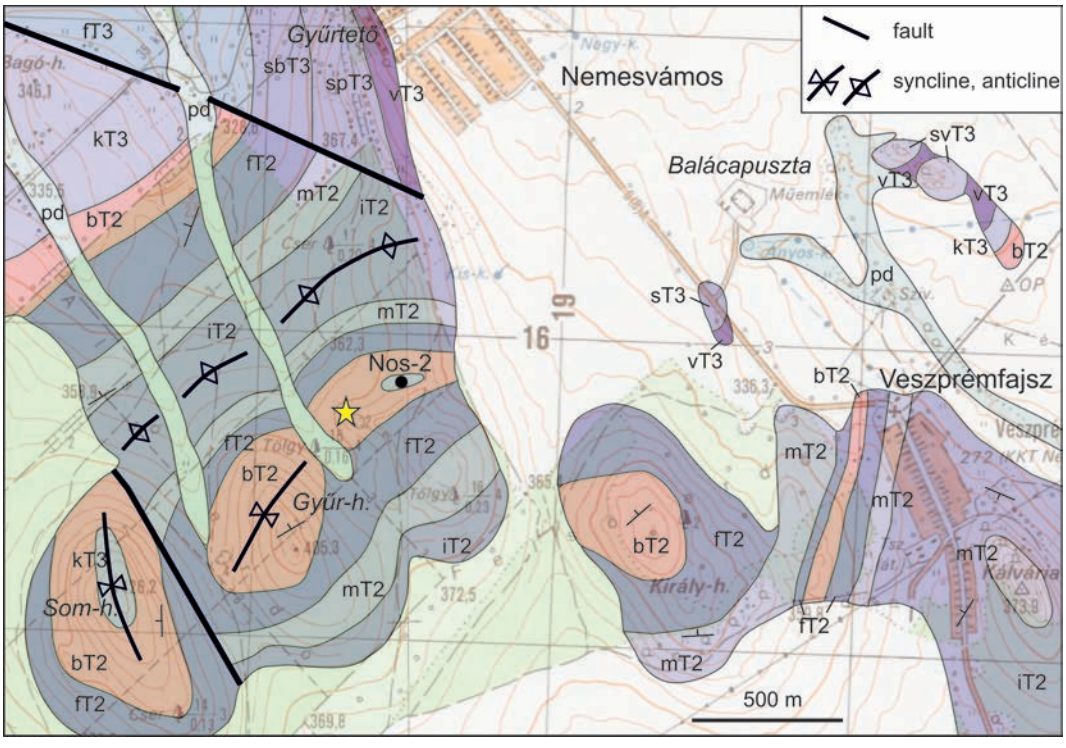

Figure 2. Geological map of the area between Veszprémfajsz and Nemesvámos (after Budai et al. 1999a) showing the location of the Katrabóca II fossil site (yellow asterisk) and the Nemesvámos Nos-2 drill core. Uncoloured part of the map area is covered by Quaternary sediments, pd: valley fill sediments

Abbreviations of the Triassic formations: lower Anisian: iT2 – Iszkahegy Limestone Fm; mT2 – Megyehegy Dolomite Fm; middle–upper Anisian: fT2 – Felsőörs and Vászoly Fm; Ladinian: bT2 – Buchenstein Fm; Carnian: kT3 – Füred Fm and Kádárta Mb (Gémhegy Dolomite Fm); vT3 – Veszprém Fm; svT3 – Sédvölgy Mb (Gémhegy Dolomite Fm); sT3 – Sándorhegy Fm; spT3 – Pécsely Mb (Sándorhegy Fm); sbT3 – Barnag Mb (Sándorhegy Fm); fT3 – Fődolomit Fm

2. ábra. *Veszprémfajsz és Nemesvámos környékének földtani térképe (Budai et al. 1999a nyomán), a Katrabóca II lelőhely (sárga csillag) és a Nemesvámos Nos-2 fúrás helyének feltüntetésével. A térkép területének színezetlen része kvarter üledékekkel fedett, pd: száraz völgyek kitöltése. Megjegyzés: Laczkó (1911) és Lóczy (1920) földtani térképén a Király-hegy Hegyesgyűr néven szerepel*

Alsó anisusi: iT2 – Iszkahegyi Mészkő F.; mT2 – Megyehegyi Dolomit F.; középső–felső anisusi: fT2 – Felsőörsi és Vászolyi F.; ladin: bT2 – Buchensteini F.; karni: kT3 – Füredi F. és Kádártai T. (Gémhegyi Dolomit F.); vT3 – Veszprémi F.; svT3 – Sédvölgyi T. (Gémhegyi Dolomit F.); sT3 – Sándorhegyi F.; spT3 – Pécselyi T. (Sándorhegyi F.); sbT3 – Barnagi T. (Sándorhegyi F.); fT3 – Fődolomit

ure 2). The oldest exposed rock units of the area belong to the lower Anisain carbonate ramp succession of the Balaton Highland. The dark grey, even bedded, laminated bituminous limestone of the Iszkahegy Formation is widespread at Veszprémfajsz. It is overlain by the relatively thin (few tens of metres), bituminous, bedded dolomite of the Megyehegy Formation, which caps the Kálvária Hill of Veszprémfajsz.

The middle to upper Anisian of the area is made up by the hemipelagic basin succession of the Felsőörs Formation, which was penetrated in a relatively large thickness by the Nemesvámos Nos–2 drill core at Katrabóca (*Figure 3*). The dip of the Anisian succession is around 20°. The lower part of the formation consists of dark grey bituminous laminated clayey dolomite and limestone (16 m), characterized by rhythmic alternation of light and dark laminae. It is overlain by a poorly stratified marl and nodular limestone (89 m) with a laminated marl intercalation (2.8 m). The uppermost part of the formation is made up of laminated, siliceous, tuffitic limestone (2 m). Laczkó (1911: 78–79) mentioned a rich fossil assemblage from this formation at Gyűrtető, containing typical ammonoids of the Balatonicus and Trinodosus Zones.

In the core of Nemesvámos Nos–2 (*Figure 3*), the overlying light green volcanic tuff of the Vászoly Formation (6 m) contains a few siliceous limestone intercalations with a thickness of 20-30 cm. This formation is unexposed on the surface.

The Ladinian Buchenstein Formation comprises bedded, nodular, siliceous cherty limestone. In the core of Nemesvámos Nos–2 (*Figure 3*), the dip of the Ladinian strata is around 30°. The 11.7-m-thick lower part of the formation consists of yellowish grey limestone with brownish grey chert nodules. Upsection the chert content decreases while the colour of the rock progressively changes to red. In the upper part of the formation (6 m), the nodular limestone alternates with dark red marl layers and a few greenish tuff intercalations also occur. The bedded limestone of the formation was mined in several small quarries at Gyűrtető and at the nearby Som Hill from where Laczkó (1911: 79–80) gave a long list of fossils, including ammonite *Celtites epolensis,* which proves late Ladinian age of the uppermost layers.

The lower part of the overlying Carnian succession is made up of light grey, microcrystalline dolomitized limestone (6 m) in the core of Nemesvámos Nos–2 (*Figure 3*).

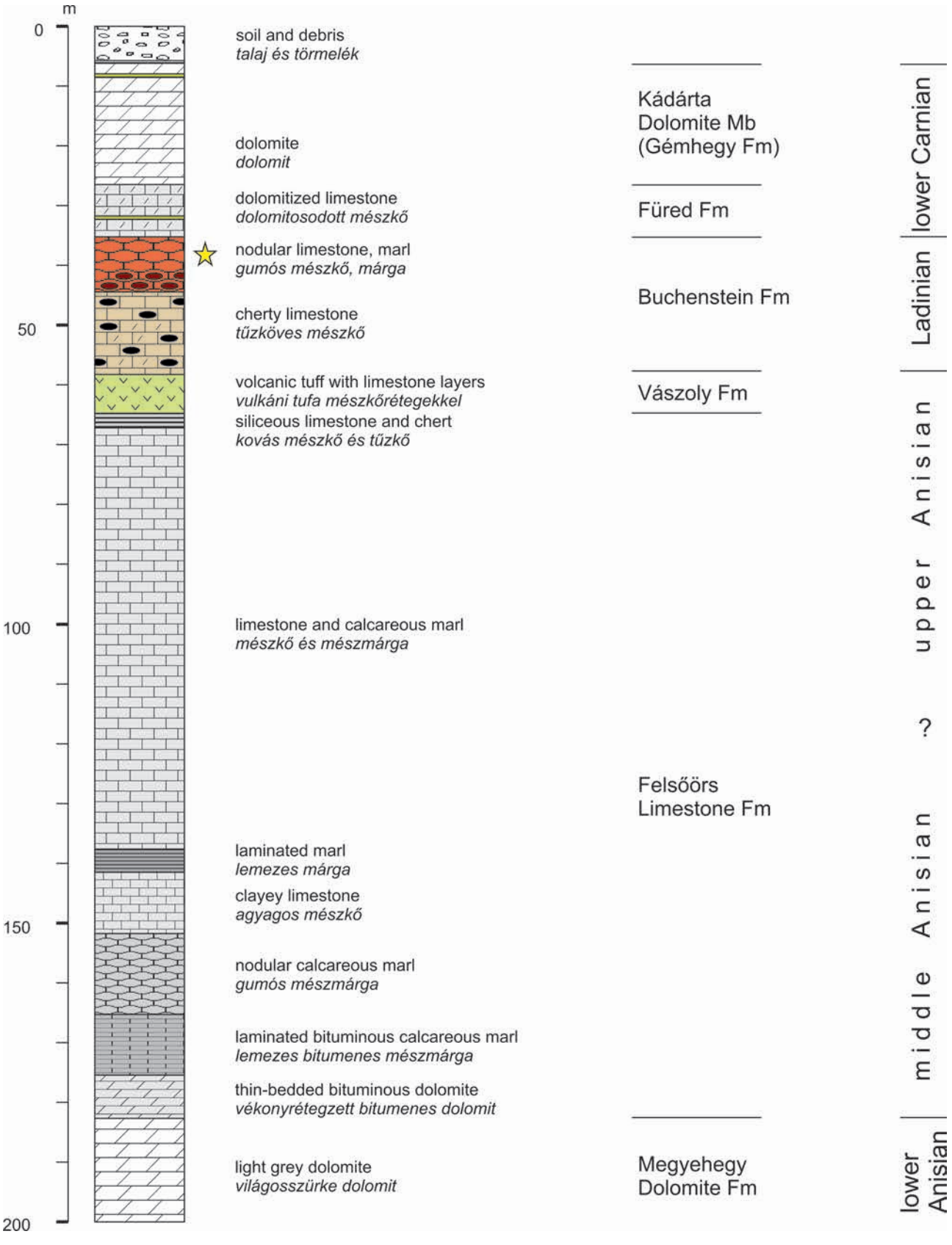

Figure 3. Stratigraphic column of the Nemesvámos Nos-2 drill core showing the penetrated thickness of the formations (corrected thickness data are mentioned in the text). Yellow asterisk shows the stratigraphic position of the Katrabóca II fossil site (see *Figures 4* and *7*)

3. ábra. *A Nemesvámos-2 fúrás rétegoszlopa a képződmények fúrt vastagsági adataival (a dőléssel korrigált vastagságértékek a szövegben szerepelnek). A sárga csillag a Katrabóca II. lelőhely rétegtani helyzetét mutatja (*4. *és* 7. ábra*)*

This was classified as the „füred limestone" by Böckh (1872: 125) and later by Laczkó (1911: 81) in the description of Gyűrtető. The youngest part of the Triassic succession of the core comprises light grey dolomite with a few-cm-thick tuff layer (Gémhegy Formation, Kádárta Member). This dolomite caps the Som Hill and the Bagó Hill west of Nemesvámos (*Figure 2*).

The W–E oriented Middle Triassic range of the Som Hill, Gyűr Hill, Király Hill and Kálvária Hill at Veszprémfajsz is in contact with Carnian formations to the NE along a strike-slip fault, running from NW to SE (*Figure 2*). At Balácapuszta the Carnian basin succession (Veszprém Formation) is interbedded with various parts of the coeval platform carbonate sequences (Kádárta and Sédvölgy Members of the Gémhegy Dolomite Formation). The Gyűrtető at the western part of Nemesvámos is made up of the upper Carnian succession of the Sándorhegy Formation and the overlying Fődolomit Formation.

Material

Katrabóca II section

This section was excavated and sampled in detail by T. Budai, G. Csillag, L. Dosztály, I. Szabó and A. Vörös in 1995–96; the results were published by Vörös (1998). The nearly 10-metres-long trench exposed 25 layers (Vörös 1998, figs 19, 20). The lowermost ten, violet-red, nodular limestone layers did not yield noteworthy fossils. Here we illustrate only the middle portion of the section (*Figure 4*), which was exposed in the past few years (coordinates: 47°02'22.0"N, 17°52'17.5"E).

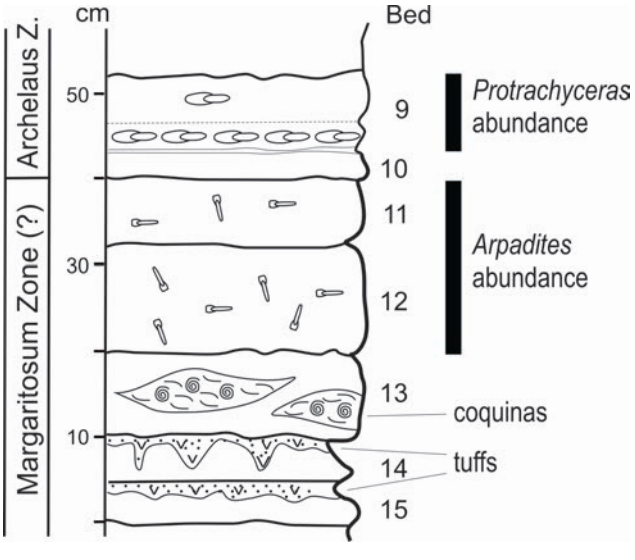

Figure 4. Stratigraphic column and tentative biostratigraphical subdivision of the newly exposed Longobardian part of the Katrabóca II section with the indication of some important sedimentary features and the ammonoid abundances

4. ábra. *A Katrabóca II. szelvény újragyűjtött longobárd szakaszának rétegoszlopa és biosztratigráfiai tagolása néhány fontosabb szedimentológia bélyeg és az ammoniteszdúsulások feltüntetésével*

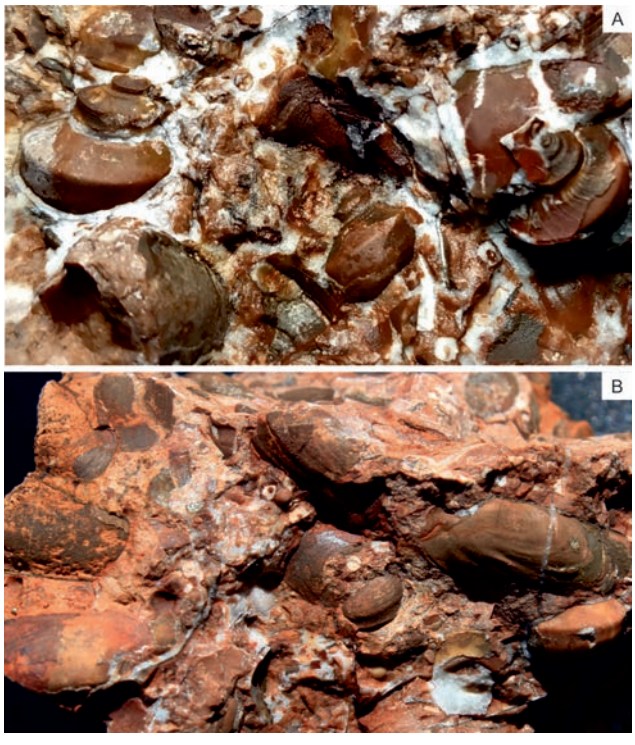

Figure 5. Coquina of the Katrabóca II section (Bed 13) containing 5–10-mm-sized gastropods (A) and 25-mm-sized bivalves (B). Crinoid ossicles are also common

5. ábra. *Kokvina a Katrabóca II szelvényben (13. réteg). A) 5–10 mm méretű csigák; B) 25 mm nagyságú kagylók tömeges megjelenésével. Krinoidea-vázelemek szintén gyakoriak*

Beds 14 and 15 comprise greenish, biotitic tuffaceous material; the first noteworthy ammonoids (*Arpadites* spp.) were found here. In Bed 13, lenses of gastropod–bivalve coquina cemented by sparry calcite were encountered. The fossils found in the coquina lenses are almost intact (*Figure 5*), even some parts of the stem of crinoids are preserved (*Figure 6*). The next crinoidal limestone layers (Beds 10–12) are characterized by mass accumulation of *Arpadites* specimens in a chaotic arrangement, with the presence of numerous species of the genus. The most remarkable layer (Bed 9) of the locality occurs above a ferro-manganese crust. The lower horizon of this layer yielded the richest ammonoid assemblage in the section. The brownish-red, pure micritic limestone enclosed a great number of well-preserved, ferro-manganese encrusted ammonoids, arranged sub-parallel with the bedding. There is a change in the composition of the fauna; the predominant Arpaditinae are substituted by large Protrachyceratinae and globose Arcestidae. Higher upwards, the micritic limestone succession does not contain any noteworthy ammonoid.

The main microfacies types of the studied section are illustrated in *Figure 6*. The gastropod-bivalve coquina exhibits a coarse grained biosparite and biomicrite (grainstone to packstone) fabric (*Figure 6A–C*), whereas the majority of the limestone layers of the section can be classified as biomicrite (wackestone) with fragments of thin-shelled bivalves, embryonic ammonoids and calcified radiolarians (*Figure 6D–F*).

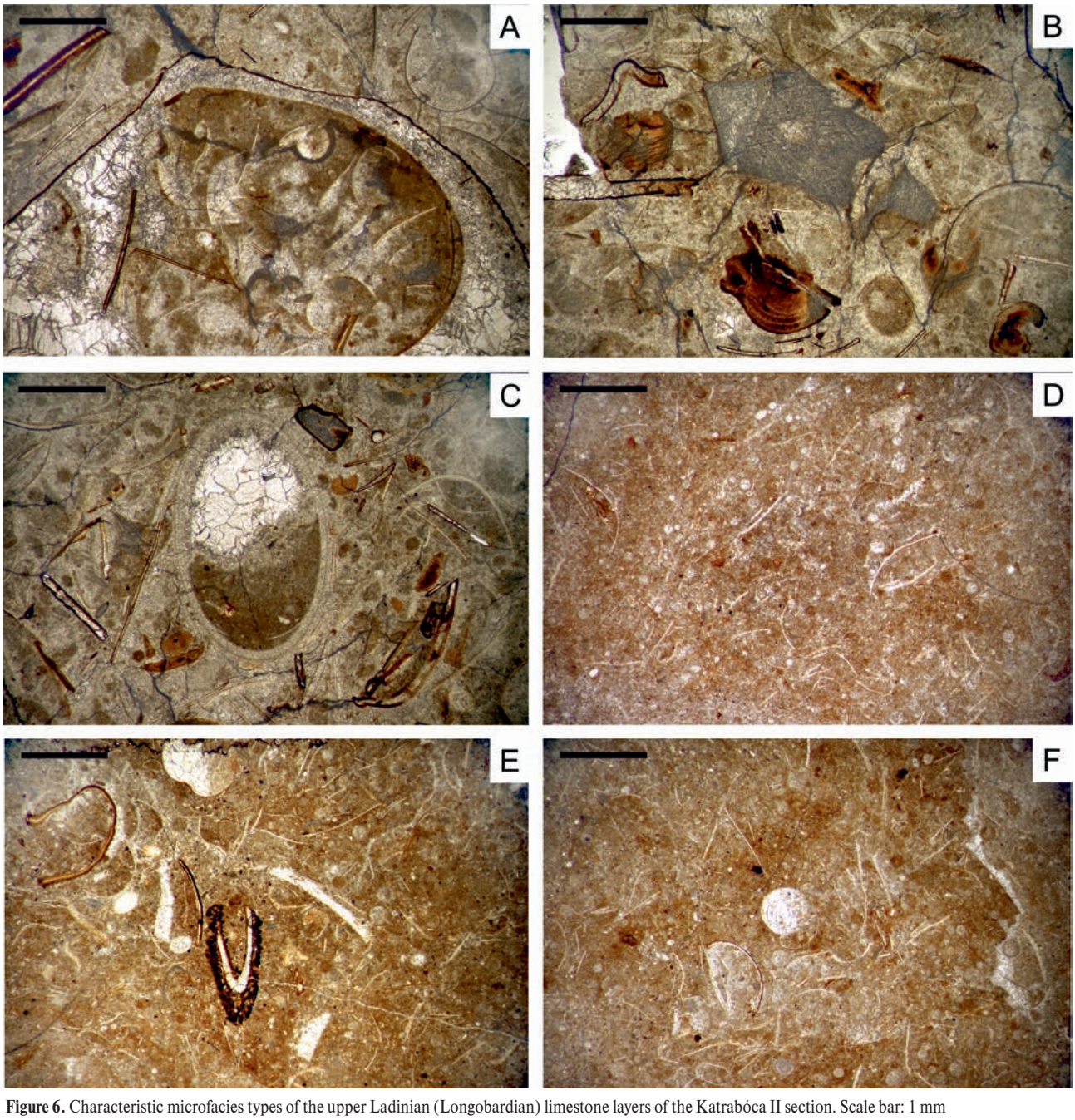

Figure 6. Characteristic microfacies types of the upper Ladinian (Longobardian) limestone layers of the Katrabóca II section. Scale bar: 1 mm

A–C: Coarse grained biosparite and biomicrite (grainstone to packstone) from Bed 13. A) Thick gastropod shell lined with ferruginous coating, replaced by secondary spar and filled with biomicrite. B) Bioclasts lined and encrusted with ferruginous coatings; pentagonal crinoid ossicle in the center. C) Various bioclasts enveloped by ferruginous coatings; geopetal structure in an orthocone cephalopod (?) shell, partly filled with micrite. D) Biomicrite (wackestone) from Bed 12, with fragments of thin-shelled bivalves and calcite-filled moulds of radiolarians (small calcitic spots). E) Biomicrite (wackestone) from Bed 9, with ferro-manganese encrusted bioclasts and an embryonic ammonoid (top center). F) Biomicrite (wackestone) from Bed 9, with fragments of thin-shelled bivalves and calcite-filled moulds of radiolarians (embryonic ammonoid in the center)

6. ábra. *A Katrabóca II. szelvény felső ladin (longobárd) mészkőrétegeinek jellemző mikrofáciesei. Lépték: 1 mm*

A–C: Durva szemcséjű biopátit és biomikrit a 13. rétegből. A) Másodlagos kalcittal kitöltött, vastag gastropoda-héj vasas bevonattal és biomikrit kitöltéssel. B) Vasas bevonatú és bekérgezésű bioklasztok; a középen egy ötszögletű krinoidea nyéltag. C) Vasas bevonatú és bekérgezésű bioklasztok; a középen geopetális szerkezet egy részben mikrittel kitöltött egyenes házú fejlábú (?) váz belsejében. D) Biomikrit a 12. rétegből, „filamentumokkal" és kalcitosodott radiolaria-vázakkal. E) Biomikrit a 9. rétegből, vas-mangános bekérgezésű bioklasztokkal és egy embrionális ammonoideával (felül középen). F) Biomikrit a 9. rétegből, „filamentumokkal" és kalcitosodott radiolaria-vázakkal (középen egy embrionális ammonoidea)

The new collections

The recent collecting activity by amateur collectors (M. BERCSÉNYI and Zs. PINTÉR) yielded abundant fossils from the Buchenstein Formation in the Katrabóca II section. They expanded the abandoned pit and attempted to trace and follow the most fossiliferous layers along the strike (*Figure 7*), keeping the original numbering of beds used and published by VÖRÖS (1998). Ammonoids were found in the greatest number (~450 specimens); other, mostly orthocone cephalopods and one brachiopod were also encountered. Remarkable mass accumulations of gastropod and bivalve specimens were found in Bed 13 (*Figure 5*).

Figure 7. The new excavations in the Katrabóca II section in 2023
7. ábra. *A Katrabóca II. szelvény új feltárása 2023-ban*

Results

A comprehensive taxonomical analysis of the invertebrate fauna is not the intention of the present paper. Our goal is to provide comprehensive information on this large and extraordinarily well-preserved ammonoid material. Therefore, we selected the most representative specimens from the large ammonoid collection: 117 ammonoid specimens were identified on species level; 68 of these are illustrated by photographs (*Plates I–XI*). Most of the figured ammonoids came from layers 9, 11, 12 and 14 (*Table I*); further two illustrated specimens were found loose. The studied material represents a very diverse assemblage and considerably broadens the taxonomical spectrum of the late Ladinian (Longobardian) ammonoid fauna of the Katrabóca locality.

Table I. Occurrence and specimen numbers of ammonoid taxa of the Katrabóca II section
I. táblázat. *Az ammonoidea-taxonok előfordulása és példányszámai a Katrabóca II. szelvényben*

List of taxa *A taxonok listája*	Bed No. *Rétegszámok*			
	9	**11**	**12**	**14**
	Specimens *Példányszámok*			
Megaphyllites obolus Mojsisovics, 1882	1		2	
Epigymnites cf. *ecki* (Mojsisovics, 1882)	1			
Epigymnites sp.	2		1	
Proarcestes subtridentinus (Mojsisovics, 1875)	3			
Proarcestes boeckhi Mojsisovics, 1875	2	1		
Protrachyceras archelaus (Laube, 1869)	2	1		
Protrachyceras sp., aff. *archelaus* (Laube, 1869)	3			
Protrachyceras cf. *pseudoarchelaus* (Böckh, 1872)	1			
Protrachyceras sp., aff. *gredleri* (Mojsisovics, 1882)	3			
Protrachyceras cf. *margaritosum* (Mojsisovics, 1882)	1			
Protrachyceras longobardicum (Mojsisovics, 1882)	1			
Protrachyceras steinmanni (Mojsisovics, 1882)	3			
Protrachyceras ladinum (Mojsisovics, 1869)	6			
Arpadites arpadis (Mojsisovics, 1870)		2	4	
Arpadites szaboi (Böckh, 1872)		4	4	
Arpadites telleri Mojsisovics, 1882			1	
Arpadites cinensis Mojsisovics, 1882			1	
Arpadites cf. *bracki* Fantini Sestini, 1994			1	1
Arpadites cf. *dichotomus* Fantini Sestini, 1994			1	
Anolcites sp., aff. *recubariensis* (Mojsisovics, 1882)	1			
Anolcites laczkoi Diener, 1899	2			
Anolcites sp., aff. *laczkoi* Diener, 1899	5			
Monophyllites wengensis (Klipstein, 1843)	5			
Sum *(összesen)*	42	8	15	1

Cephalopod taxa in systematic order

Order Ceratitida HYATT, 1884
Superfamily Megaphyllitoidea MOJSISOVICS, 1896
Family Megaphyllitidae MOJSISOVICS, 1896
Megaphyllites MOJSISOVICS, 1879

Megaphyllites obolus MOJSISOVICS, 1882
(Plate I, Figures 2–4)

1882 *Megaphyllites obolus* E. v. MOJSISOVICS – MOJSISOVICS, p. 192, pl. LIII, figs 3–5.

We illustrate three specimens of this very small and smooth ammonoid. The gently compressed conch with arched venter resembles the Jurassic *Phylloceras* but its umbilicus is always completely occluded. *Megaphyllites obolus* was previously recorded but not figured from Katrabóca (VÖRÖS 1998).

Superfamily Pinacoceratoidea MOJSISOVICS, 1879
Family Gymnitidae WAAGEN, 1895
Epigymnites DIENER, 1916

Epigymnites cf. *ecki* (MOJSISOVICS, 1882)
(Plate I, Figure 7)

1882 *Gymnites Ecki* E. v. MOJSISOVICS – MOJSISOVICS, p. 238, pl. LX, fig. 3.

This large, strongly compressed specimen with moderately narrow umbilicus is identified as *Epigymnites ecki* on the basis of a weak row of flat nodes in the middle of its lateral part, visible on the partially preserved shell surface. A poorly preserved and incomplete specimen of this species was previously illustrated from Katrabóca (VÖRÖS 1998).

Epigymnites sp.
(Plate I, Figures 1, 5, 6)

One larger and two small specimens with very narrow umbilicus seem to belong to this genus, but the absence of any ornamentation on their lateral part does not allow the specific identification. The shell material of the larger specimen (*Plate I, Fig. 1*) was partly removed and the cleaned surface revealed some phylloid lobes supporting the attribution to *Epigymnites*.

Superfamily Arcestoidea MOJSISOVICS, 1875
Family Arcestidae MOJSISOVICS, 1875
Proarcestes MOJSISOVICS, 1893

Proarcestes subtridentinus (MOJSISOVICS, 1875)
(Plate I, Figures 8, 9; Plate II, Figure 1)

1875 *Arcestes subtridentinus* E. v. MOJSISOVICS – MOJSISOVICS, p. 91, pl. LVIII, fig. 20.

The large, globose, smooth ammonoids, mostly as internal moulds, occurre in great number at Katrabóca; however, their generic attribution to *Proarcestes* or *Joannites* is often problematic. The chief distinction between these two genera lies in their suture lines: straight with triangular saddles in *Proarcestes*, and anteriorly curved with bifid saddles in *Joannites*. In the case of our specimens, the suture lines are not visible; so we used another character, the shape of the constrictions (the radial grooves on the internal mould), which are simply prorsiradiate in *Proarcestes*, while strongly projected on the ventral margin at *Joannites* (see MOJSISOVICS 1882). Therefore our specimens belong to *Proarcestes*. The weak flared ribs appearing on the venter of the body chamber of the specimen on *Plate I, Fig. 8* prove the identification as *P. subtridentinus*. This species was previously reported but not figured from Katrabóca (VÖRÖS 1998).

Proarcestes boeckhi (MOJSISOVICS, 1875)
(Plate II, Figures 2–4)

1875 *Arcestes Böckhi* E. v. MOJSISOVICS – MOJSISOVICS , p. 91, pl. LVIII, fig. 21.

One of our specimens (after the removal of the material substituting the original shell) nicely shows the suture lines with triangular saddles, characteristic of *Proarcestes*. The very globose, almost spherical shape seems to prove the identification as *P. boeckhi*, which is one of the most globose late Ladinian species of *Proarcestes*. The similar species of *P. pannonicus* (MOJSISOVICS, 1870) differs by its fewer constrictions. *P. boeckhi* was not previously reported from Katrabóca.

Superfamily Trachyceratoidea HAUG, 1894
Family Arpaditidae HYATT, 1900
Subfamily Protrachyceratinae TOZER, 1980
Protrachyceras MOJSISOVICS, 1893

Protrachyceras archelaus (LAUBE, 1869)
(Plate III, Figures 1–3)

1869 *Trachyceras Archelaus* LAUBE – LAUBE, p. 74, pl. XL, fig. 1.

This is one of the biggest and most strongly ornamented species of the genus *Protrachyceras*, and the index species of the Archelaus Zone. The ribbing and nodosity are more or less in equilibrium. The ventral furrow is deep and wide. The umbilicus is rather wide for the genus; the whorls have regularly six rows of nodes. It was previously recorded and illustrated from Katrabóca (VÖRÖS 1998).

Protrachyceras sp., aff. *archelaus* (LAUBE, 1869)
(Plate IV, Figures 1, 3, 4)

It is very similar to *Protrachyceras archelaus* in lateral ornamentation, but its venter and the ventral furrow are significantly narrower. Its whorl section is high trapezoidal in contrast to the almost quadrangular whorl of *P. archelaus*. A specimen of this taxon was illustrated from Katrabóca (VÖRÖS 1998, pl. XV, fig. 5) wrongly under the name *P. archelaus*.

Protrachyceras cf. *pseudoarchelaus* (Böckh, 1872)
(Plate IV, Figure 5)

1872 *Trachyceras pseudoarchelaus* n. sp. – Böckh, p. 165, pl. X, fig. 15.

It is somewhat more compressed than the *Protrachyceras archelaus* and has a little narrower umbilicus. The true diagnostic difference is that the ribbing is very strong and the nodes are subordinate. Although our specimen shows these characters, it is not perfectly similar to the type specimen of *P. pseudoarchelaus*; therefore, here we have to express the ambiguity with the use of "cf.". A poorly preserved fragment of this species was previously figured from Katrabóca (Vörös 1998).

Protrachyceras sp., aff. *gredleri* (Mojsisovics, 1882)
(Plate III, Figures 4–6)

1882 *Trachyceras Gredleri* E. v. Mojsisovics – Mojsisovics, p. 117, pl. XXXIV, fig. 7.

Wide umbilicus, very coarse ornamentation, with strong ribs and only five rows of nodes characterize this taxon. One of our specimens with good preservation (*Plate III, Fig. 4*) even possesses the original spines (regularly broken off from other specimens). The last whorl of the same specimen seems to be injured: the ventral furrow is displaced from the plane of symmetry. Our specimens show the basic morphological features of *Protrachyceras gredleri*. This species was described by Mojsisovics (1882: 117) from the Archelaus Zone, but recently Mietto et al. (2018: 249) pointed out that the original specimen of *P. gredleri* came from a much higher level (Neumayri or Regoledanus Subzone). Therefore, here we only indicate the relationship with the use of open nomenclature. Our specimens stand closer to the smaller specimen figured by Mojsisovics (1882, pl. XXXIV, fig. 7), though the inner whorls of the larger specimen (l.c., pl. XVII, fig. 7a) also show similar characters. A similar form was illustrated from Katrabóca (Vörös 1998, pl. X, fig. 4).

Protrachyceras cf. *margaritosum* (Mojsisovics, 1882)
(Plate IV, Figure 2)

1882 *Trachyceras margaritosum* E. v. Mojsisovics – Mojsisovics, p. 127, pl. LXXXII, fig. 1.

This species is characterized by extremely numerous lateral nodes and rather strongly projected ribs. Our specimen seems to correspond well with these criteria: it has nine rows of nodes, it is rather compressed, and has relatively narrow umbilicus. It was not previously reported from Katrabóca.

Protrachyceras longobardicum (Mojsisovics, 1882)
(Plate V, Figure 3)

1882 *Trachyceras longobardicum* E. v. Mojsisovics. – Mojsisovics, p. 126, pl. XVIII, figs 4, 5; pl. XX, fig. 1; pl. XXI, fig. 5.

This rather large species is characterized by narrow umbilicus, compressed shape, eight rows of nodes and a well-developed, narrow and sharply incised (v-shaped) ventral groove. The lateral rows of nodes are equidistantly spaced. *Protrachyceras longobardicum* was previously reported and illustrated from Katrabóca (Vörös 1998).

Protrachyceras steinmanni (Mojsisovics, 1882)
(Plate IV, Figure 6; Plate V, Figures 1, 2)

1882 *Trachyceras Steinmanni* E. v. Mojsisovics – Mojsisovics, p. 109, pl. LXXXI, figs 10, 11.

This taxon differs from other *Protrachyceras* species by its rather weak ornamentation with somewhat falcoid, prorsiradiate ribs and seven rows of nodes. The special character of the lateral parts is the rather wide space between the umbilical nodes and the next three rows of nodes, which are divided by another wider space from the ventral rows of nodes. *P. steinmanni* was not previously reported from Katrabóca.

Protrachyceras ladinum (Mojsisovics, 1869)
(Plate V, Figures 4–6; Plate VI, Figures 1–3;
Plate VII, Figure 1)

1869 *Ammonites (Trachyceras) Archelaus* Laube – Mojsisovics, p. 130, pl. II, fig. 2.

This was the most frequently encountered *Protrachyceras* species in our material and yielded the largest specimens. The relatively compressed conch of *P. ladinum* has a deeply incised ventral groove flanked by elevated rows of pointed nodes. The lateral part is embroidered with seven rows of nodes arranged on weak and almost straitght ribs. One fragment (*Plate V, Fig. 4*) preserved the colour of the nacreous layer. This species was previously recorded and illustrated from Katrabóca (Vörös 1998).

Subfamily Arpaditinae Hyatt, 1900
Arpadites Mojsisovics, 1879

Arpadites arpadis (Mojsisovics, 1870)
(Plate 7, Figures 2–7)

1870 *Ammonites Arpadis* Mojs. nov. sp. – Mojsisovics, p. 109, pl. V, fig. 6.

This is the type species of the genus *Arpadites*, described very early by Mojsisovics (1870) from Vörösberény, under the name "*Ammonites Arpadis*". The conch is very evolute with subrectangular whorl secion. The ornamentation consists of rather strong, almost straight ribs on the inner whorls; the ribbing gradually changes to be finer and denser on the body chamber. The middle of the venter is bicarinate, flanked with two shallow grooves and two ventral rows of the pointed terminations of the lateral ribs. This arrangement may be termed as quadricarinate venter. This species was previously recorded and illustrated from Katrabóca (Vörös 1998).

Arpadites szaboi (Böckh, 1872)
(Plate VIII, Figures 1–8)

1872 *Ammonites Szabói* n. sp. – Böckh, p. 170, pl. X, figs 16, 17.

Arpadites szaboi, described by BÖCKH (1872) from Szentantalfa, shares the general shape of the conch with *A. arpadis*, though the degree of evolution is more variable. The ribbing is much finer, even on the inner whorls, and tends to be more projected. The venter of *A. szaboi* is narrower and the quadricarinate nature is less pronounced due to the weaker rows of the ventral terminations of the ribs. Poorly preserved fragments of this species were previously illustrated from Katrabóca (VÖRÖS 1998).

Arpadites telleri MOJSISOVICS, 1882
(Plate IX, Figures 1, 5)

1882 *Arpadites Telleri* E. v. MOJSISOVICS – MOJSISOVICS, p. 59, pl. XXVII, figs 10–15.

This species is characterized by a relatively compressed and less evolute conch with bicarinate venter. The lateral ornamentation consists of definite, straight ribs marked lateral nodes even in juveniles. In adult specimens the ribs bear strong umbilical, lateral and ventral nodes. *Arpadites telleri* was recorded but not illustrated from Katrabóca (VÖRÖS 1998).

Arpadites cinensis MOJSISOVICS, 1882
(Plate IX, Figure 2)

1882 *Arpadites cinensis* E. v. MOJSISOVICS – MOJSISOVICS, p. 56, pl. XXVI, figs 5–15.

The species seems closely related to *Arpadites telleri*, but differs in having only one marked, umbilical row of nodes. The weak ribbing of the inner whorls fades ventrally on the body chamber. This species was not previously recorded from Katrabóca.

Arpadites cf. *bracki* FANTINI SESTINI, 1994
(Plate IX, Figures 3, 4)

1994 *Arpadites bracki* sp. n. – FANTINI SESTINI, p. 262, pl. 11, figs 13, 14.

This species seems to stand close to *Arpadites cinensis*, in the strong umbilical nodes and the ventrally fading ribbing, but the whole ornamentation is much stronger. Particularly the massive ribs on the inner whorls are remarkable, in contrast to the fine ribbing of *A. cinensis*. *A. bracki* was not previously recorded from Katrabóca.

Arpadites cf. *dichotomus* FANTINI SESTINI, 1994
(Plate IX, Figure 6)

1994 *Arpadites dichotomus* sp. n. – FANTINI SESTINI, p. 263, pl. 11, figs 9, 10.

Arpadites dichotomus may belong to a small-sized, less evolute group of *Arpadites* species, together with the above described two taxa. But, except for the row of umbilical nodes, its ornamentation is remarkably weak and consists of projected, gently sigmoidal dense ribs, regularly bifurcating at the umbilical nodes. Intercalatory ribs are also frequent. This species was reported with uncertainty but not illustrated from Katrabóca (VÖRÖS 1998).

Family Trachyceratidae HAUG, 1894
Anolcites MOJSISOVICS, 1893

Anolcites sp., aff. *recubariensis* (MOJSISOVICS, 1882)
(Plate IX, Figure 7)

1882 *Trachyceras recubariense* E. v. MOJSISOVICS – MOJSISOVICS, p. 114, pl. VII, fig. 1.

This specimen is rather similar to that figured by VÖRÖS (1998, pl. IX, fig. 3) under the name *Eoprotrachyceras* cf. *recubariense*, from Öskü, from the Curionii Zone, and which was attributed to their new genus *Falsanolcites* by RIEBER & BRACK (2004). Without going into details of the complex taxonomical problem raised by these authors, it is important to note that RIEBER & BRACK defined *Falsanolcites* as stratigraphically restricted to the Curionii Zone. Since our specimen came from the Archelaus Zone, it may not belong to *Falsanolcites* but rather to *Anolcites*. On the other hand, in spite of the morphological similarity, it may not belong to the species *A. recubariensis* (allegedly restricted to the uppermost horizon of the Curionii Zone; see VIDAKOVIĆ et al. 2023). Therefore, here we indicate only the possible relationship with that species with the use of "aff." This taxon was not previously reported from Katrabóca.

Anolcites laczkoi DIENER, 1899
(Plate IX, Figures 8, 9)

1899 *Anolcites Laczkói* nov. sp. – DIENER, p. 13, pl. I, fig. 7.

This moderately compressed species has rather narrow umbilicus and rounded venter with a very narrow and shallow median groove. The lateral ornament consists of numerous, simple ribs starting from weak umbilical nodes; the number of ribs increases ventrally by bifurcation and insertion. It was described by DIENER (1899) from Katrabóca, and was repeatedly found there and illustrated (VÖRÖS 1998) under the name *Protrachyceras* ? *laczkoi*. This tentative generic attribution was forced by the ambiguity in the interpretation of the genus *Anolcites.* The ambiguity was largely cleared up after the survey by RIEBER & BRACK (2004). Although our species differs from the type of the genus by its narrower umbilicus, its place in *Anolcites* seems to be the best.

Anolcites sp., aff. *laczkoi* DIENER, 1899
(Plate IX, Figures 10, 11; Plate X, Figures 1, 2;
Plate XI, Figure 1)

This species is very similar to *Anolcites laczkoi* in general shape and the narrow and shallow ventral groove but significantly differs in its lateral ornament. The umbilical nodes are very strong and give way to ribs which are bifurcated or inserted by secondary ribs toward the venter. The most diagnostic difference from *A. laczkoi* is the appearance of three rows of distinct nodes in the outer two-third of the lateral flank. This taxon was not previously reported from Katrabóca.

Order Phylloceratoidea ZITTEL, 1884
Family Ussuritidae HYATT, 1900
Monophyllites MOJSISOVICS, 1879

Monophyllites wengensis (KLIPSTEIN, 1843)
(Plate XI, Figures 2–6)

1843 *Ammonites Wengensis* – KLIPSTEIN, p. 120, pl. VI, fig. 11.

These very frequent specimens of the ammonoid fauna at Katrabóca can easily be recognized even in small fragments by the fine, projected, thread-like capillation on the shell of the outer whorls. The rather evolute specimens expose that, in contrast to the smooth outer whorls, the inner whorls bear strong varices. Decorticated specimens reveal the elements of the very peculiar and distinctive phylloid suture lines. *Monophyllites wengensis* was previously reported and illustrated from Katrabóca (VÖRÖS 1998).

Discussion

The recently collected ammonoid material support the previous biostratigraphical results (VÖRÖS 1998), particularly the attribution of the fauna of Bed 9 to the Archelaus Zone. In the past few decades the zonal subdivision of the upper Ladinian (Longobardian) has changed: the former Gredleri Zone was replaced by the Margaritosum Zone and the Archelaus Zone was divided into a lower, Longobardicum and an upper, Neumayri Subzone (MIETTO et al. 2018, VIDAKOVIĆ et al. 2023). With the application of this zonal scheme, the age of our Bed 9 can be restricted to the Longobardicum Subzone of the Archelaus Zone. It is tempting to attribute the *Arpadites*-dominated underlying Beds 11–14 to the Margaritosum Zone, as it was implicitly done by VÖRÖS (1998), at that time using the name "Gredleri Zone". However, it may be debated because of the occurrence of the zonal index species *Protrachyceras margaritosum* in Bed 9 (see *Table I*). The apparent contradiction may be solved in two ways: (1) *P. margaritosum* was a long ranging species passing up to the lower part of the Archelaus Zone; (2) Bed 9 contains a strongly condensed ammonoid fauna of the Margaritosum Zone and the Longobardicum Subzone of the Archelaus Zone. The sedimentary characters of Bed 9 do not contradict to the latter explanation.

The whole sedimentary succession at Katrabóca, dominated by well-bedded, partly nodular micritic limestone (a "Triassic Rosso Ammonitico"), suggests a stable, quiet, deeper marine depositional environment in a more or less starved basin as it is also indicated by the ostracod assemblage (MONOSTORI & TÓTH 2013). The odd phenomenon in this picture is the intercalation of the coarse grained coquina lenses implying rapid accumulation of shells of fossils that were alien to the local environment. The epibenthic gastropods and bivalves did not prefer the muddy substrates and did not occur in other layers of the section. Short-distance transport of shells is suggested by the partly excellent preservation of the fossils. This points to a closely located special environment, favourable for the gastropod–bivalve community, most probably the existence of a short-lived hard bottom in the neighbourhood. We may speculate on the creation of a local elevation providing the hard surfaces advantageous for the epibenthic animals. Extensional tectonic movements might produce several metre scale steep faults dissecting the bottom into subsided and relatively elevated segments. Along the fault planes the deeper, consolidated part of the underlying sedimentary complex might emerge and appear as submarine elevation with rocky scarps. Evidence for a phase of extensional tectonics and accompanying volcanism here and in the wider area (e.g., Litér) was provided by BUDAI et al. (2001) and by PÁLFY et al. (2003). These events were dated to the Gredleri Zone (now Margaritosum Zone), i.e. exactly coeval with the formation of the coquina lenses at Katrabóca.

In addition to the coquinas, some other sedimentary features (e.g., the chaotic arrangement of partly broken *Arpadites* specimens) in Beds 11 and 12 suggest gravitational mass transport of semi-consolidated deposits to their place of accumulation. The mixing of faunal elements can not be excluded either. After filling up of the local depressions, the bottom topography equalized, and the regular deposition of the micritic limestones resumed. The abundance and horizontal orientation of the ferro-manganese encrusted ammonoids in Bed 9 indicate the sudden decrease of sedimentation rate, leading to condensation.

Sedimentary features and fossil assemblages of the coquina lenses of the red Ladinian limestone refer to relatively uplifted position of the sedimentary environment within the Buchenstein basin in the surroundings of Nemesvámos. This can be interpreted with the proximity of a coeval submarine high or a platform. Occurrence of ornamented bairdiaceans in the bathyal ostracod assemblage (MONOSTORI & TÓTH 2013) confirms this interpretation. The Budaörs Platform was likely not far from this part of the Ladinian basin as the Buchenstein Formation is intercalated with and is overlain by shallow marine carbonates (dolomites) at Balácapuszta and north of it (BUDAI et al. 1999a). A similar situation is known in the western Carnic Alps (BRACK et al. 2007) where the slope of the Bivera/Clapsavon Platform is draped by the red nodular, ammonite rich, condensed Clapsavon Limestone. This also contains bivalves and crinoids, while neptunian dykes point to synsedimentary tectonism. The ammonite assemblage of the Clapsavon Limestone is (TOMMASI 1899), however, somewhat older than that of the Buchenstein Formation at Katrabóca (Curionii vs. Archelaus Zone).

One of the most remarkable features of the ammonoid fauna of Katrabóca is the great abundance and diversity of the *Arpadites* assemblages in Beds 11–12. It is noteworthy that two of the species (*A. dichotomus, A. bracki*) were also described by FANTINI SESTINI (1994) from the Esino Limestone. Further two species (*A. telleri, A. cinensis*) also came originally from the "Esinokalk", according to MOJSISOVICS (1882), who reported from the same formation *A. arpadis* and *A. szaboi*, as well. Although the latter two species were

originally described from red basinal limestones from the Balaton Highland, their occurrence in the platform carbonate Esino Limestone seems to be significant and has palaeoecological implications. The explanation of the episodic and mass appearance of *Arpadites* species in the basinal area of Katrabóca probably lies in their immigration from the coeval Budaörs Platform.

Conclusions

A recent collecting activity yielded abundant material, mainly ammonoids from the Buchenstein Formation in the Katrabóca II section. This new collecting expanded the taxonomical spectrum of the late Ladinian (Longobardian) ammonoid fauna of the locality: within the briefly described 23 taxa of this paper 9 are new for the locality.

The new ammonoid material supports the previous biostratigraphical results of VÖRÖS (1998) remarkably well, particularly the attribution of the diverse *Protrachyceras* fauna of Bed 9 to the Archelaus Zone. The assignment of the *Arpadites*-dominated underlying Beds 11–14 to the Margaritosum Zone is tentative.

The lenticular bivalve and gastropod coquina in Bed 13 may have been formed by short-distance submarine redeposition and rapid cementation of the skeletons. The sedimentary structure of Beds 11 and 12 also indicates redeposition; most parts of the rich *Arpadites* assemblage contain fragmented shells and the specimens show a chaotic orientation. After the gravitational sediment transport the bottom topography equalized, and the regular deposition of the muddy carbonate sediments resumed (Bed 9). Here, the abundance and bedding-parallel orientation of the ferro-manganese encrusted ammonoids indicate decrease of sedimentation rate, leading to condensation.

Many species of the diverse *Arpadites* fauna were originally described from carbonate platform or peri-platform facies (Esino Limestone; see FANTINI SESTINI 1994). Their presence in the deeper basinal sediments of Katrabóca suggests the proximity of the coeval Budaörs Platform.

Acknowledgements

The authors are indebted to J. HAAS and J. BLAU, reviewers of the manuscript for their constructive suggestions. The present study was partly supported by the NKFIH FK 134229 grant.

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Manuscript received: 24. 04. 2024.

Plate I – I. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. BERCSÉNYI and Zs. PINTÉR. All figures are in natural size. The specimens are kept in the private collections of M. BERCSÉNYI (Nyúl, prefixed by BM) and Zs. PINTÉR (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), BERCSÉNYI M. és PINTÉR Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat BERCSÉNYI M. (Nyúl, BM jelzettel) és PINTÉR Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Epigymnites* sp.; BMEpsp-3; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
2. *Megaphyllites obolus* MOJSISOVICS, 1882; BMMeob-1; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
3. *Megaphyllites obolus* MOJSISOVICS, 1882; BMMeob-2; Katrabóca II, Bed 12, Margaritosum Zone (?); a: lateral view, b: ventral view.
4. *Megaphyllites obolus* MOJSISOVICS, 1882; BMMeob-3; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
5. *Epigymnites* sp.; BMEp-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
6. *Epigymnites* sp.; BMEp-1; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
7. *Epigymnites* cf. *ecki* (MOJSISOVICS, 1882); PZsEpec-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
8. *Proarcestes subtridentinus* (MOJSISOVICS, 1875); PZsProasu-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
9. *Proarcestes subtridentinus* (MOJSISOVICS, 1875); PZsProasu-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.

Plate II – II. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. BERCSÉNYI and Zs. PINTÉR. All figures are in natural size. The specimens are kept in the private collections of M. BERCSÉNYI (Nyúl, prefixed by BM) and Zs. PINTÉR (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), BERCSÉNYI M. és PINTÉR Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat BERCSÉNYI M. (Nyúl, BM jelzettel) és PINTÉR Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Proarcestes subtridentinus* (MOJSISOVICS, 1875); BMProasu-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
2. *Proarcestes boeckhi* MOJSISOVICS, 1875; PZsProabo-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
3. *Proarcestes boeckhi* MOJSISOVICS, 1875; PZsProabo-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view. Specimen polished to demonstrate the suture lines. *A lóbavonalak feltárása érdekében polírozott példány*.
4. *Proarcestes boeckhi* MOJSISOVICS, 1875; BMProabo-1; Katrabóca II, Bed 11, Margaritosum Zone (?); a: lateral view, b: ventral view.

Plate III – III. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. BERCSÉNYI and Zs. PINTÉR. All figures are in natural size. The specimens are kept in the private collections of M. BERCSÉNYI (Nyúl, prefixed by BM) and Zs. PINTÉR (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), BERCSÉNYI M. és PINTÉR Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat BERCSÉNYI M. (Nyúl, BM jelzettel) és PINTÉR Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Protrachyceras archelaus* (LAUBE, 1869); BMPrar-1; Katrabóca II, Bed 11, Margaritosum Zone (?); a: lateral view, b: ventral view.
2. *Protrachyceras archelaus* (LAUBE, 1869); BMPrar-4; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
3. *Protrachyceras archelaus* (LAUBE, 1869); BMPrar-3; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
4. *Protrachyceras* sp., aff. *gredleri* (MOJSISOVICS, 1882); BMPrgr-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
5. *Protrachyceras* sp., aff. *gredleri* (MOJSISOVICS, 1882); PZsPrgr-1; Katrabóca II, Bed 9 (?), Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
6. *Protrachyceras* sp., aff. *gredleri* (MOJSISOVICS, 1882); BMPrgr-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.

Plate IV – IV. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. Bercsényi and Zs. Pintér. All figures are in natural size. The specimens are kept in the private collections of M. Bercsényi (Nyúl, prefixed by BM) and Zs. Pintér (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), Bercsényi M. és Pintér Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat Bercsényi M. (Nyúl, BM jelzettel) és Pintér Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Protrachyceras* sp., aff. *archelaus* (Laube, 1869); PZsPracar-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
2. *Protrachyceras* cf. *margaritosum* (Mojsisovics, 1882); BMPrma-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
3. *Protrachyceras* sp., aff. *archelaus* (Laube, 1869); BMPracar-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
4. *Protrachyceras* sp., aff. *archelaus* (Laube, 1869); BMPracar-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
5. *Protrachyceras* cf. *pseudoarchelaus* (Böckh, 1872); BMPrps-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
6. *Protrachyceras steinmanni* (Mojsisovics, 1882); BMPrst-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.

Plate V – V. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. Bercsényi and A. Vörös. All figures are in natural size. The specimens are kept in the private collections of M. Bercsényi (Nyúl, prefixed by BM) and in the collection of the Department of Palaeontology and Geology, Hungarian Natural History Museum (Budapest, prefixed by M.).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), Bercsényi M. és Vörös A. gyűjtése. Az ábrák természetes nagyságúak. A példányokat Bercsényi M. magángyűjteménye (Nyúl, BM jelzettel), valamint a Magyar Természettudományi Múzeum Őslénytani és Földtani Tárának gyűjteménye (Budapest, M. jelzettel) őrzi.

1. *Protrachyceras steinmanni* (Mojsisovics, 1882); BMPrst-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
2. *Protrachyceras steinmanni* (Mojsisovics, 1882); BMPrst-3; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
3. *Protrachyceras longobardicum* (Mojsisovics, 1882); BMPrlo-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
4. *Protrachyceras ladinum* (Mojsisovics, 1869); M.98.99.; Katrabóca (loose), Archelaus Zone (?), lateral view. Fragmentary specimen with nacreous layer. *Töredékes példány gyöngyházfényű héjréteggel*.
5. *Protrachyceras ladinum* (Mojsisovics, 1869); BMPrla-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
6. *Protrachyceras ladinum* (Mojsisovics, 1869); BMPrla-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.

Plate VI – VI. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by Zs. Pintér. All figures are in natural size. The specimens are kept in the private collections of Zs. Pintér (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), Pintér Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat Pintér Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Protrachyceras ladinum* (Mojsisovics, 1869); PZsPrla-4; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: left lateral view, b: right lateral view, showing a specimen of *Anolcites* sp. embedded in the filling of the body chamber. *A lakókamra kitöltésében egy* Anolcites *példány látható*
2. *Protrachyceras ladinum* (Mojsisovics, 1869); PZsPrla-3; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
3. *Protrachyceras ladinum* (Mojsisovics, 1869); PZsPrla-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.

Plate VII – VII. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. BERCSÉNYI and Zs. PINTÉR. All figures are in natural size. The specimens are kept in the private collections of M. BERCSÉNYI (Nyúl, prefixed by BM) and Zs. PINTÉR (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), BERCSÉNYI M. és PINTÉR Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat BERCSÉNYI M. (Nyúl, BM jelzettel) és PINTÉR Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Protrachyceras ladinum* (MOJSISOVICS, 1869); BMPrla-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
2. *Arpadites arpadis* (MOJSISOVICS, 1870); BMArar-3; Katrabóca II, Bed 11, Margaritosum Zone (?); a: lateral view, b: ventral view.
3. *Arpadites arpadis* (MOJSISOVICS, 1870); BMArar-1; Katrabóca II, Bed 12, Margaritosum Zone (?); a: lateral view, b: ventral view.
4. *Arpadites arpadis* (MOJSISOVICS, 1870); BMArar-2; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
5. *Arpadites arpadis* (MOJSISOVICS, 1870); BMArar-5; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
6. *Arpadites arpadis* (MOJSISOVICS, 1870); BMArar-4; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
7. *Arpadites arpadis* (MOJSISOVICS, 1870); PZsArar-1; Katrabóca II, Bed 11 or 12, Margaritosum Zone (?); lateral view.

Plate VIII – VIII. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. BERCSÉNYI and Zs. PINTÉR. All figures are in natural size. The specimens are kept in the private collections of M. BERCSÉNYI (Nyúl, prefixed by BM) and Zs. PINTÉR (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), BERCSÉNYI M. és PINTÉR Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat BERCSÉNYI M. (Nyúl, BM jelzettel) és PINTÉR Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Arpadites szaboi* (BÖCKH, 1872); BMArsz-2; Katrabóca II, Bed 11, Margaritosum Zone (?); a: left lateral view, b: right lateral view.
2. *Arpadites szaboi* (BÖCKH, 1872); BMArsz-5; Katrabóca II, Bed 11, Margaritosum Zone (?); lateral view.
3. *Arpadites szaboi* (BÖCKH, 1872); PZsArsz-1; Katrabóca II, Bed 11 or 12, Margaritosum Zone (?); a: lateral view, b: ventral view.
4. *Arpadites szaboi* (BÖCKH, 1872); BMArsz-5; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
5. *Arpadites szaboi* (BÖCKH, 1872); BMArsz-4; Katrabóca II, Bed 12, Margaritosum Zone (?); a: lateral view, b: ventral view.
6. *Arpadites szaboi* (BÖCKH, 1872); PZsArsz-2; Katrabóca II, Bed 11 or 12, Margaritosum Zone (?); lateral view.
7. *Arpadites szaboi* (BÖCKH, 1872); BMArsz-5; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
8. *Arpadites szaboi* (BÖCKH, 1872); PZsArsz-3; Katrabóca II, Bed 11 or 12, Margaritosum Zone (?); a: lateral view, b: ventral view.

Plate IX – IX. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. BERCSÉNYI and Zs. PINTÉR. All figures are in natural size. The specimens are kept in the private collections of M. BERCSÉNYI (Nyúl, prefixed by BM) and Zs. PINTÉR (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), BERCSÉNYI M. és PINTÉR Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat BERCSÉNYI M. (Nyúl, BM jelzettel) és PINTÉR Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Arpadites telleri* MOJSISOVICS, 1882; BMArte-1; Katrabóca II, Bed 12, Margaritosum Zone (?); a: lateral view, b: ventral view.
2. *Arpadites cinensis* MOJSISOVICS, 1882: BMArci-1; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
3. *Arpadites* cf. *bracki* FANTINI SESTINI, 1994; BMArbr-1; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
4. *Arpadites* cf. *bracki* FANTINI SESTINI, 1994; BMArbr-2; Katrabóca II, Bed 14, Margaritosum Zone (?); lateral view.
5. *Arpadites telleri* MOJSISOVICS, 1882; PZsArte-1; Katrabóca (loose), Margaritosum Zone (?); lateral view.
6. *Arpadites* cf. *dichotomus* FANTINI SESTINI, 1994; BMArdi-1; Katrabóca II, Bed 12, Margaritosum Zone (?); lateral view.
7. *Anolcites* sp., aff. *recubariensis* (MOJSISOVICS, 1882); BMAnaffre-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
8. *Anolcites laczkoi* DIENER, 1899; BMTranla-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
9. *Anolcites laczkoi* DIENER, 1899; BMTranla-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.

10. *Anolcites* sp., aff. *laczkoi* Diener, 1899; BMTransp-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
11. *Anolcites* sp., aff. *laczkoi* Diener, 1899; BMTransp-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.

Plate X – X. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. Bercsényi and Zs. Pintér. All figures are in natural size. The specimens are kept in the private collections of M. Bercsényi (Nyúl, prefixed by BM) and Zs. Pintér (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), Bercsényi M. és Pintér Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat Bercsényi M. (Nyúl, BM jelzettel) és Pintér Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Anolcites* sp., aff. *laczkoi* Diener, 1899; BMTransp-3; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: right lateral view, b: ventral view. c: left lateral view.
2. *Anolcites* sp., aff. *laczkoi* Diener, 1899; PZsTransp-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.

Plate XI – XI. tábla

Late Ladinian (Longobardian) ammonoids from Katrabóca (Nemesvámos, Balaton Highland), collected by M. Bercsényi and Zs. Pintér. All figures are in natural size. The specimens are kept in the private collections of M. Bercsényi (Nyúl, prefixed by BM) and Zs. Pintér (Győr, prefixed by PZs).

Késő ladin (longobárd) ammonoideák Katrabócáról (Nemesvámos, Balaton-felvidék), Bercsényi M. és Pintér Zs. gyűjtése. Az ábrák természetes nagyságúak. A példányokat Bercsényi M. (Nyúl, BM jelzettel) és Pintér Zs. (Győr, PZs jelzettel) magángyűjteménye őrzi.

1. *Anolcites* sp., aff. *laczkoi* Diener, 1899; PZsTransp-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
2. *Monophyllites wengensis* (Klipstein, 1843); BMMowe-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.
3. *Monophyllites wengensis* (Klipstein, 1843); BMMowe-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
4. *Monophyllites wengensis* (Klipstein, 1843); PZsMowe-2; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
5. *Monophyllites wengensis* (Klipstein, 1843); PZsMowe-1; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; lateral view.
6. *Monophyllites wengensis* (Klipstein, 1843); BMMowe-3; Katrabóca II, Bed 9, Archelaus Zone, Longobardicum Subzone; a: lateral view, b: ventral view.

Plate I – I. tábla

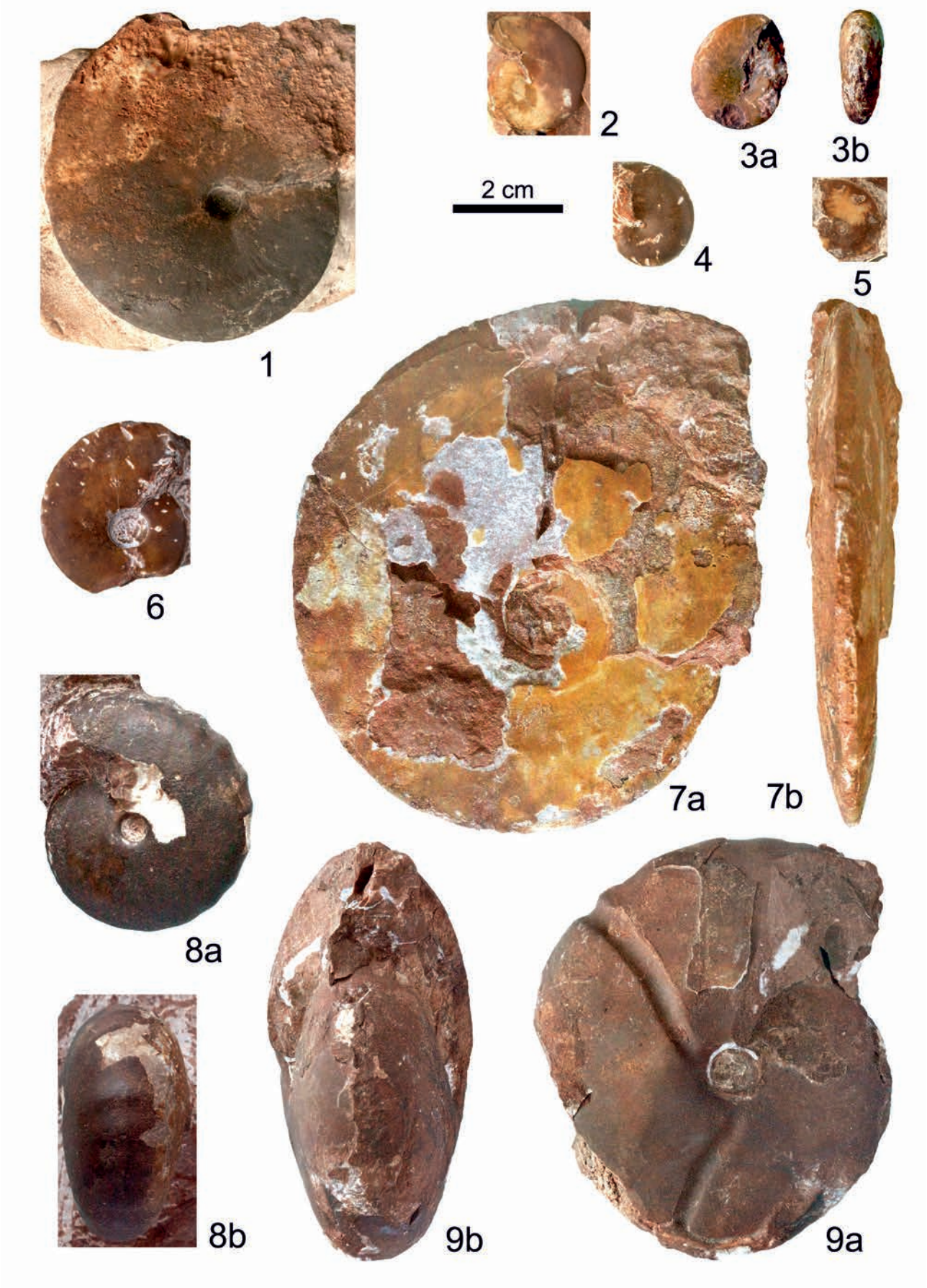

Plate II – II. tábla

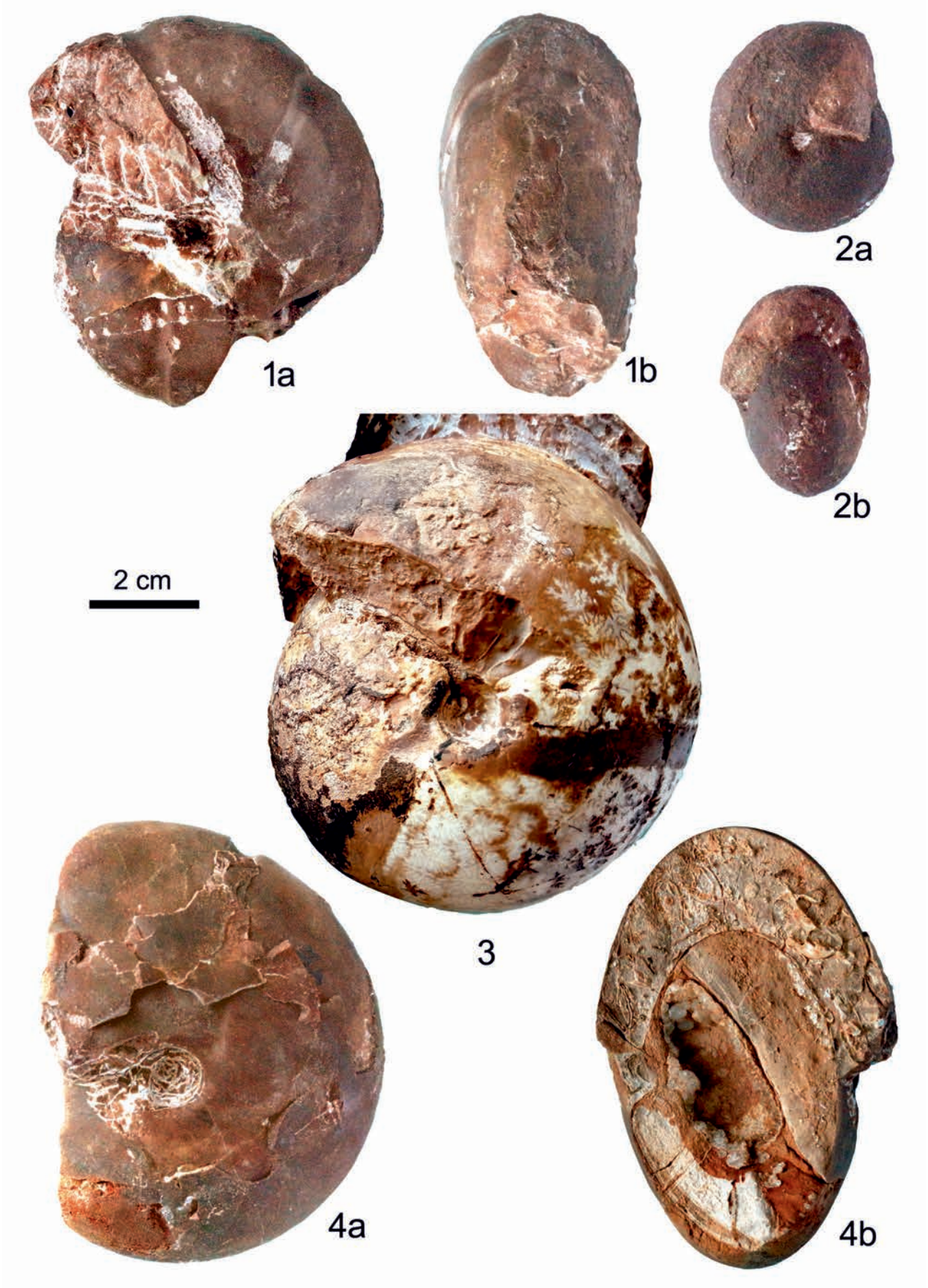

Plate III – III. tábla

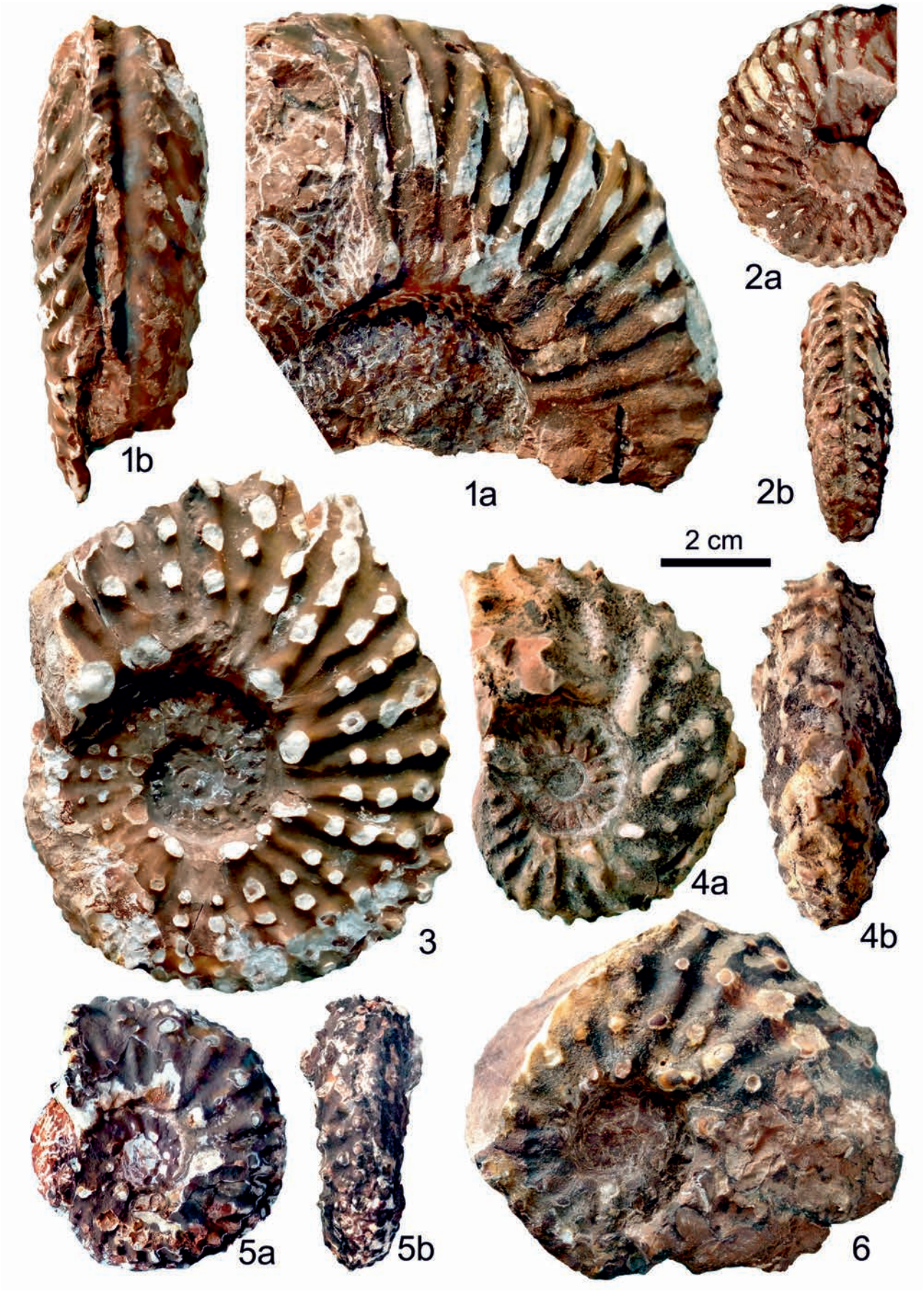

Plate IV – IV. tábla

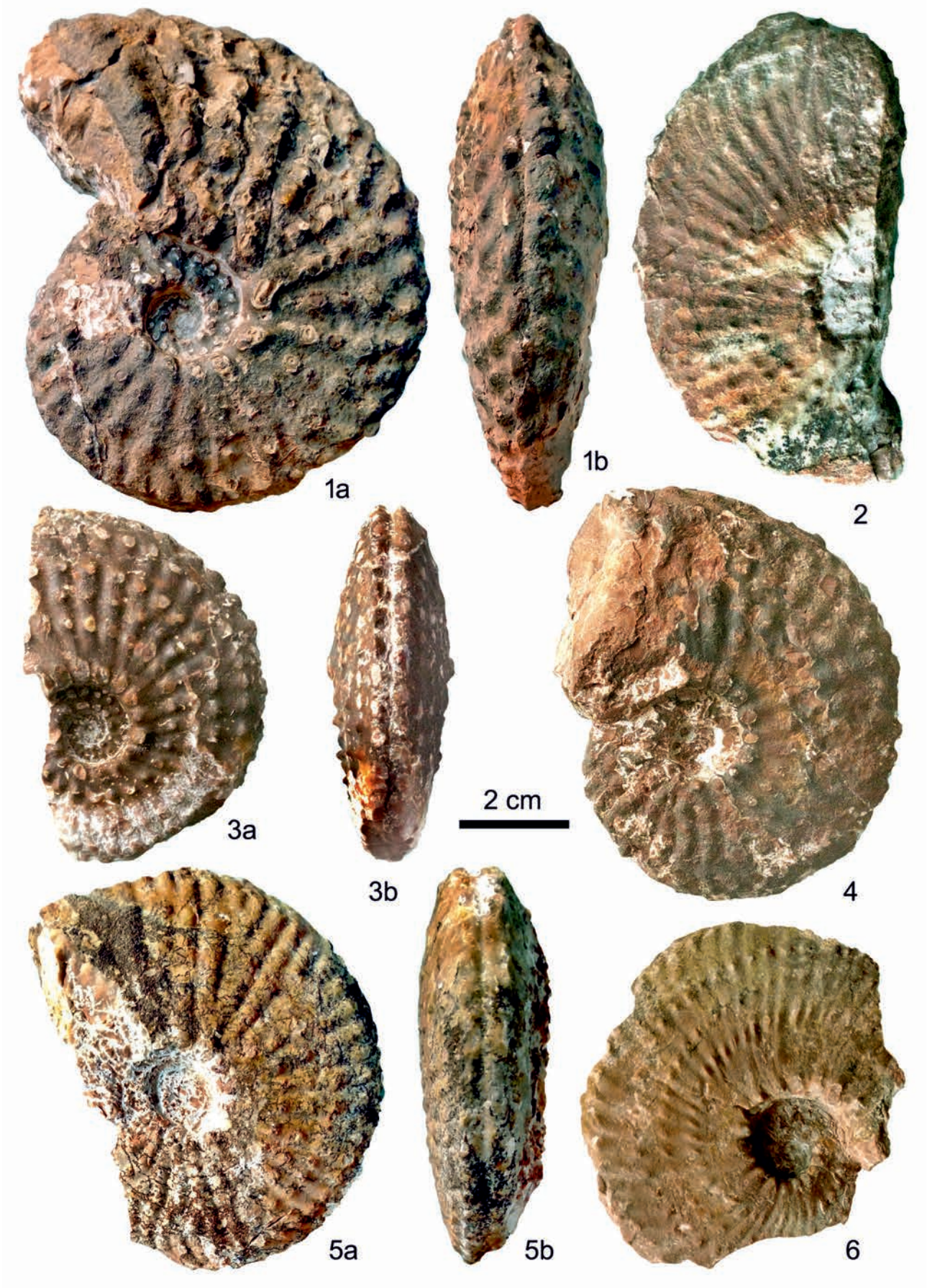

Plate V – V. tábla

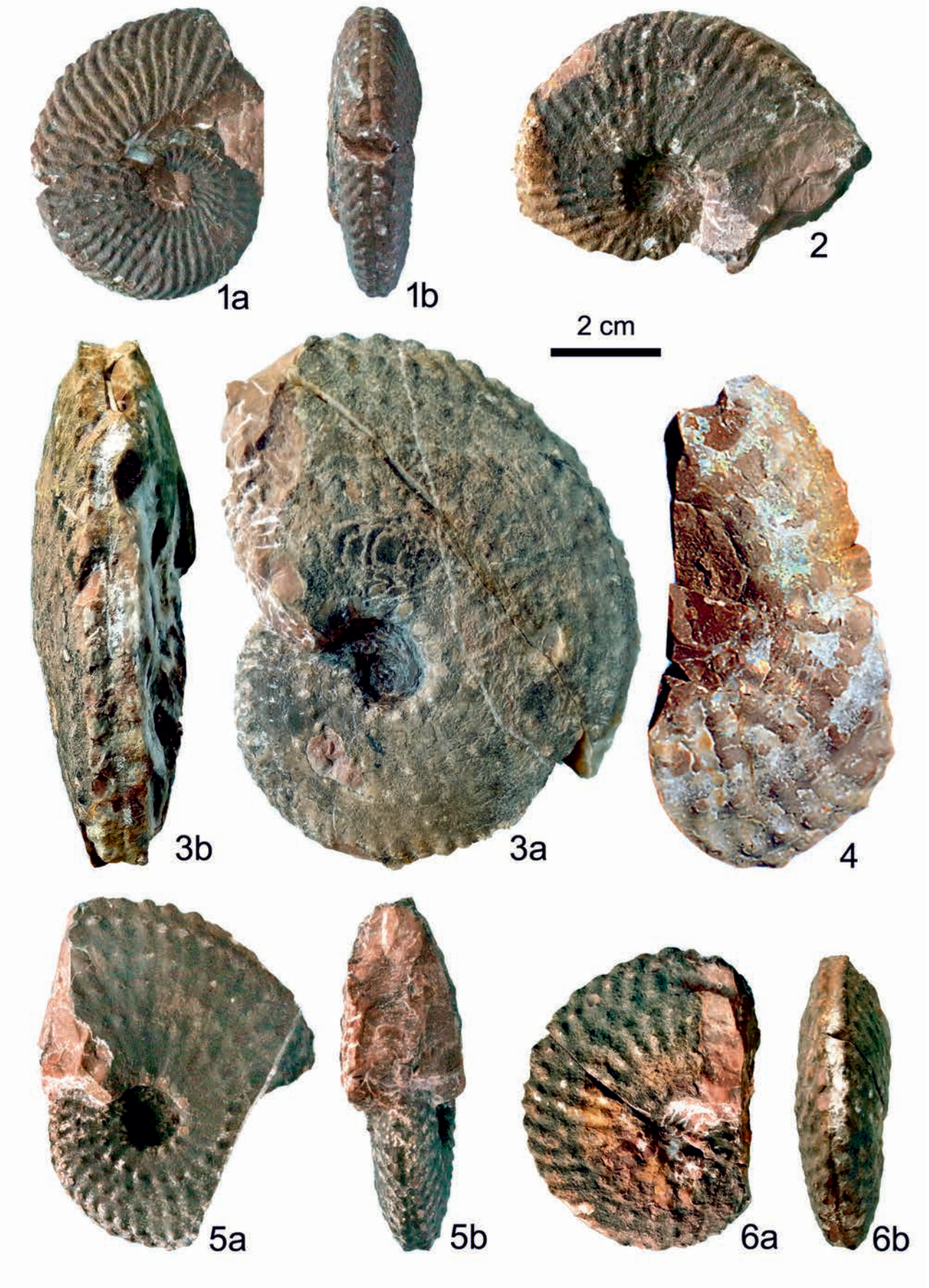

Plate VI – VI. tábla

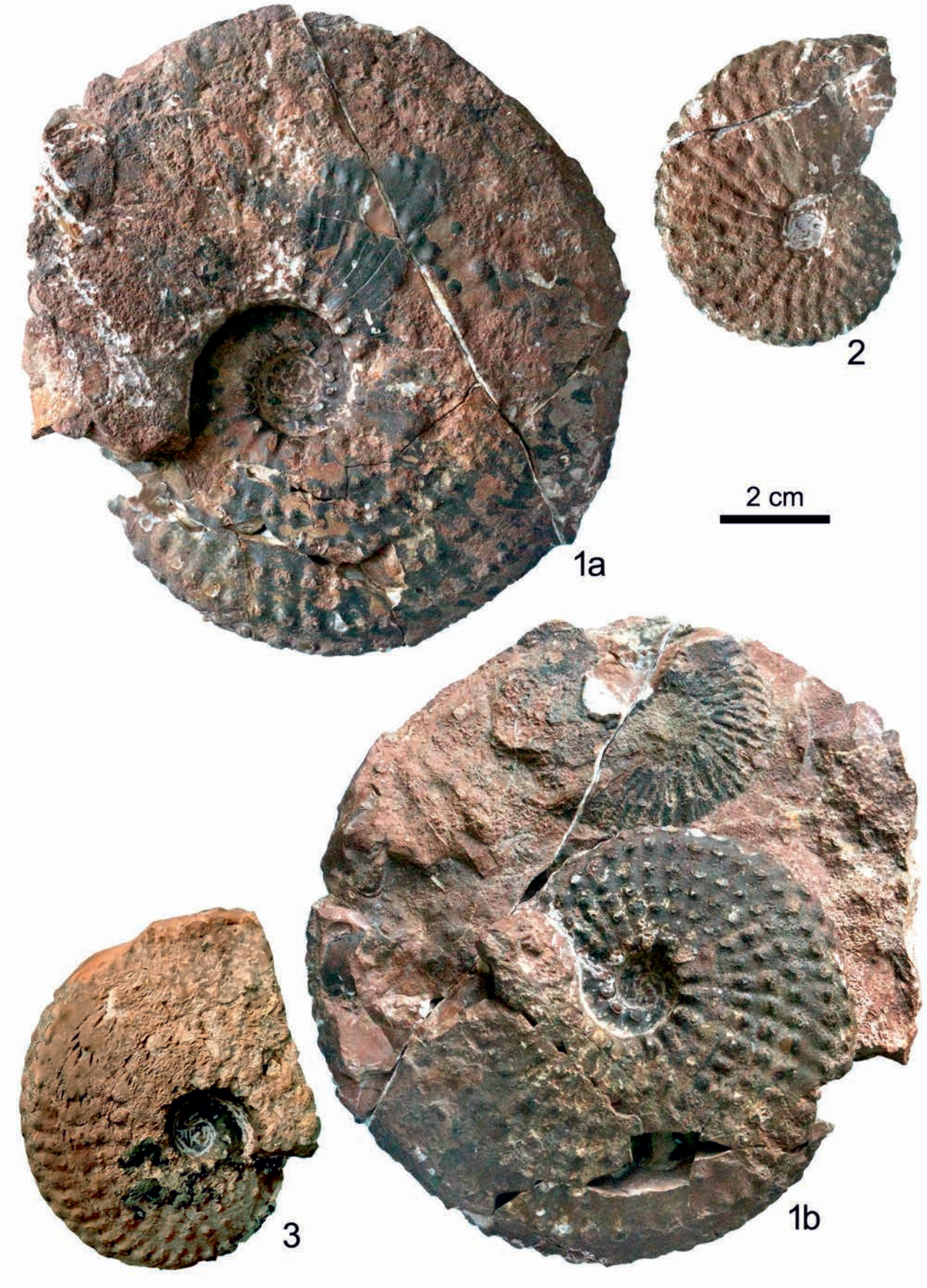

Plate VII – VII. tábla

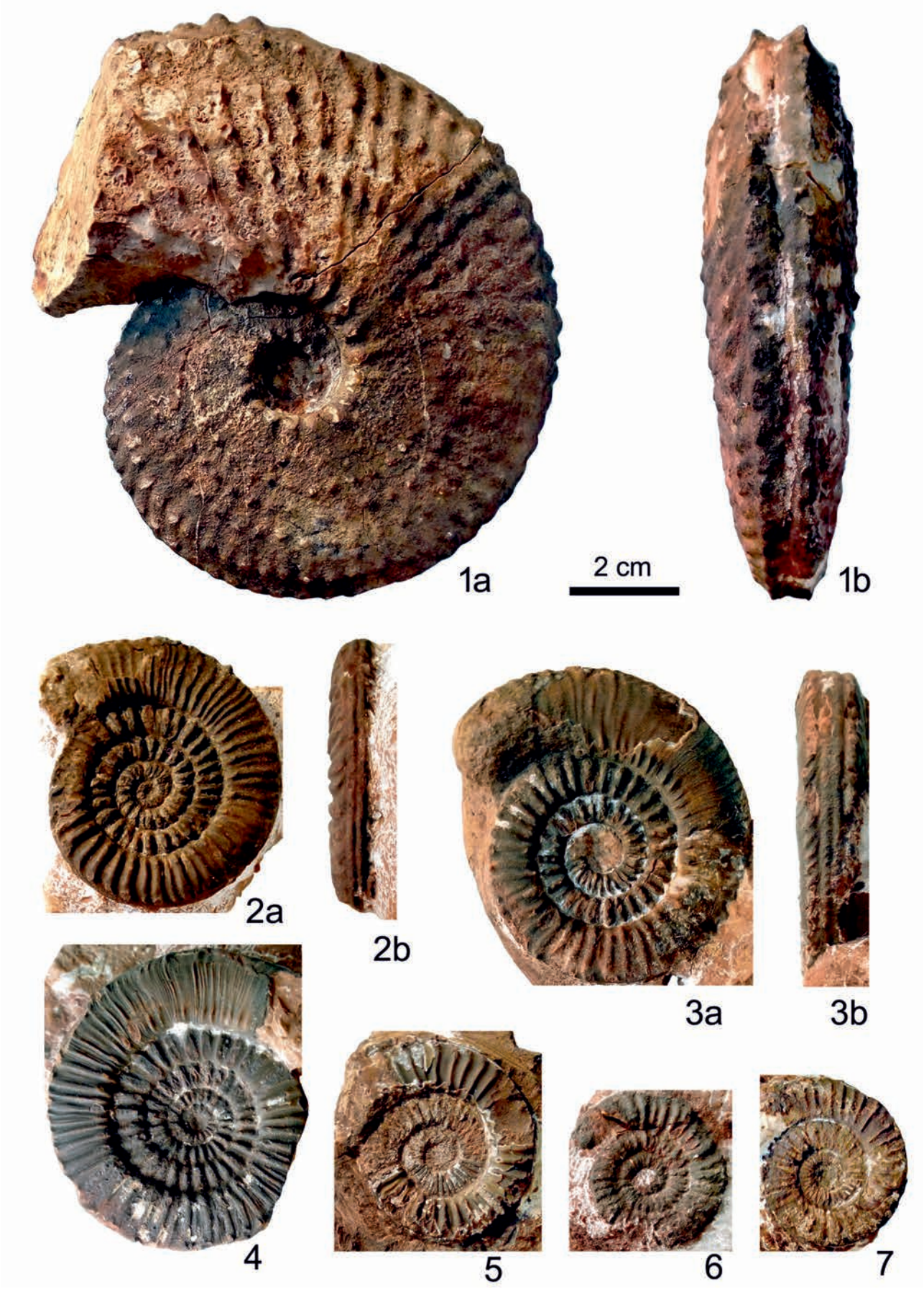

Plate VIII – VIII. tábla

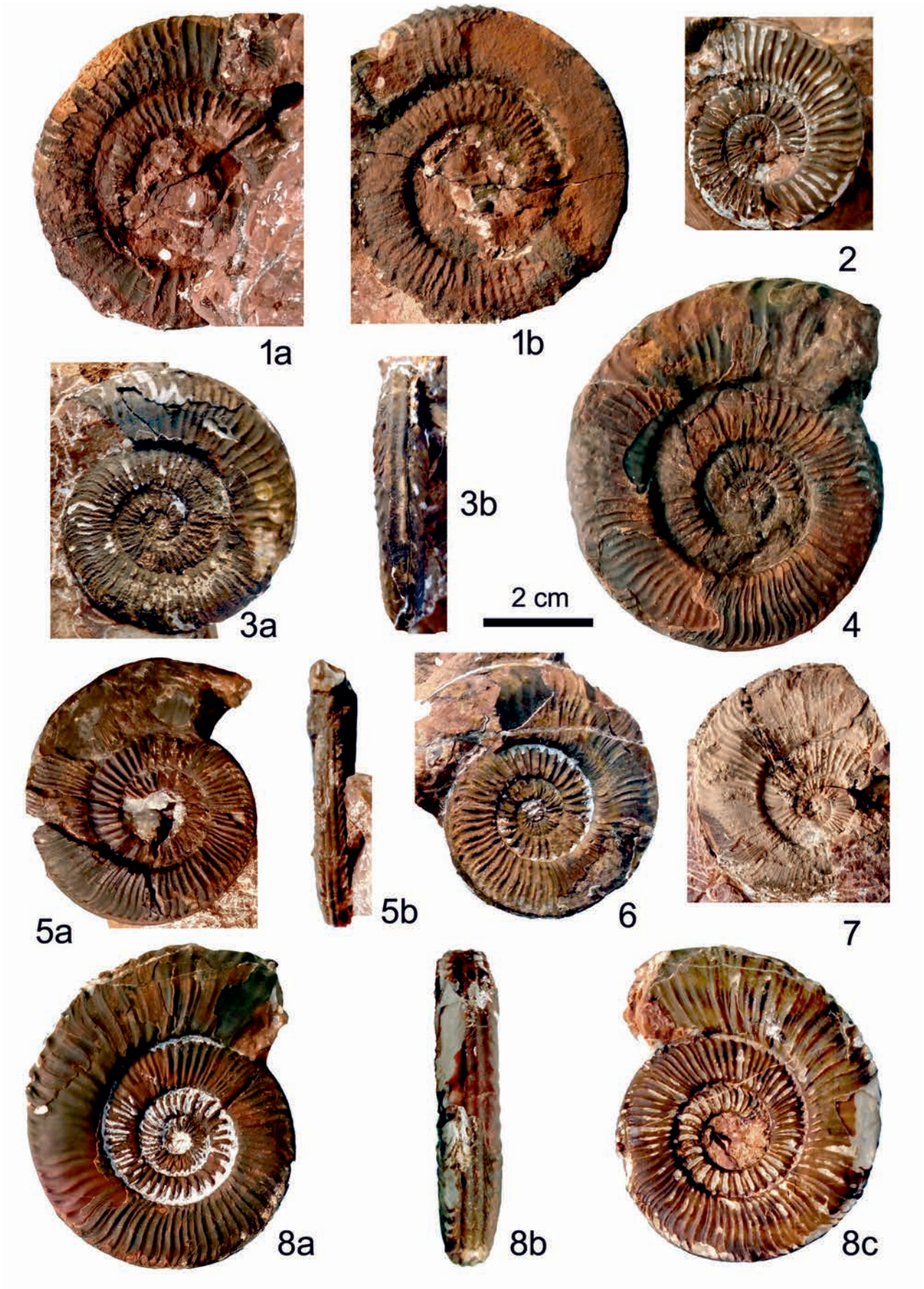

Plate IX – IX. tábla

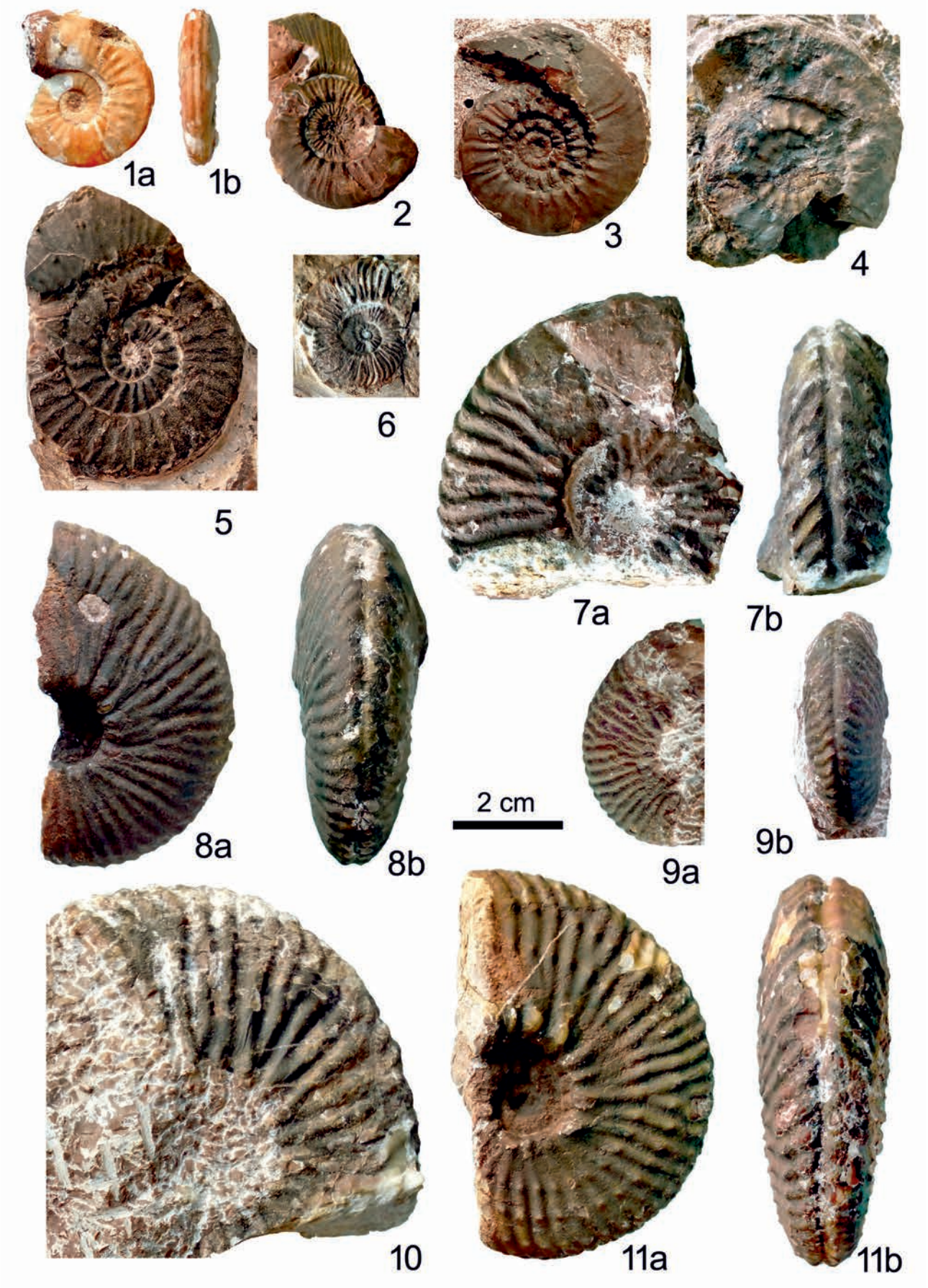

Plate X – X. tábla

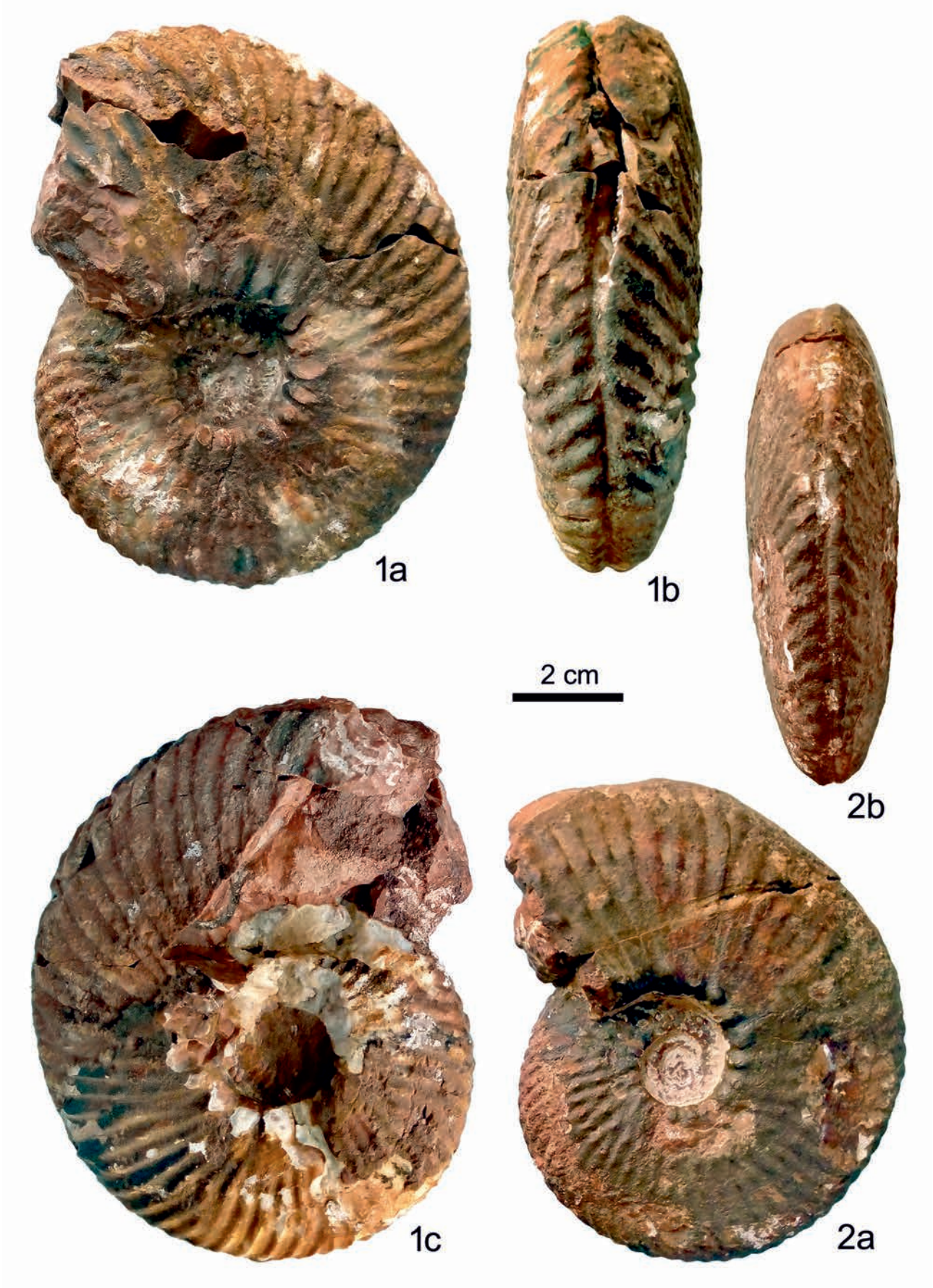

Plate XI – XI. tábla