LATE JURASSIC–EARLY CRETACEOUS (KIMMERIDGIAN–BARREMIAN) AMMONITES OF THE BAKONY MOUNTAINS (TRANSDANUBIAN RANGE, HUNGARY)

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"Die Sterne am Himmel kann man nothdürftig zählen, aber die Ammonitenspecies im Schoss der Erde nicht"

"The stars in the sky can be counted, but not the species of ammonites in the bosom of the earth"

Fridrich A. Quenstedt (1809–1889), Die Ammoniten des Schwäbischen Jura

1. Introduction – the source of the studied fossils

Thousands of Upper Jurassic (Kimmeridgian–Tithonian) and Lower Cretaceous (Berriasian–Barremian) ammonites were collected from numerous localities and sections in the Bakony Mountains. Bed-by-bed collecting was carried out in Mogyorós Hill (Sümeg), Rend-kő, Édesvíz Key Section, Édesvízmajor, Édesvízkút-1, HK-II, HK-12, HK-12/a sections (all near Hárskút), Szilas Ravine (Borzavár), Lókút Hill, LH-I, LH-II, (Lókút), and Eperkés Hill (Olaszfalu). In the Páskom Hill (Borzavár), the large fossil material was not collected under stratigraphic control. A few additional specimens from further outcrops, served as grab sample points, were also collected during geological mapping and field trips.

The systematic fossil collecting campaigns were supervised by Prof. József Fülöp (at Sümeg, and Hárskút sections), and by Prof. Géza Császár (Szilas Ravine); from the Páskom Hill section Jenő Noszky Jr. collected a large and particularly well preserved fauna. It was also Noszky, who collected the majority of the Márvány Quarry specimens. All the sections and their entire fauna in a wider stratigraphical context are described by Főzy et al. (2022, this volume).

The aim of this chapter is to characterize the Late Jurassic–Early Cretaceous ammonite fauna of the Bakony Mountains and to give a systematic overview of the occurring taxa. Many of the collected specimens were determinable only on suborder level, nevertheless the relatively better preserved ammonites document a rich and diverse fauna.

2. The character of the ammonite fauna

The Jurassic and Cretaceous ammonite fauna of the entire Transdanubian Range is a typical Mediterranean one *sensu* Cecca (1999). Long-ranging phylloceratids and lytoceratids make up occasionally 50–80 % of the entire fauna, which is a typical Mediterranean character.

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Besides, the age diagnostic Ammonitina and Ancyloceratina species are also characteristically Mediterranean.

The representatives of the so-called nektopelagic forms (i.e. Phylloceratina, Lytoceratina and Haploceratidae) which supposedly inhabited the mesopelagic water mass (Cecca et al. 1993, Westermann 1990) are especially abundant in the sequences deposited in a deeper basinal (graben) environment surrounded by topographic highs (horsts). The composition of the Lókút Hill and Szilas Ravine fauna (Fig. 1) serve as good examples.

The strongly condensed sections deposited on the top of a paleohigh (such as the Upper Jurassic of the Páskom Hill and the Lower Cretaceous of the Márvány Quarry) can be characterized by a balanced faunal composition of mesopelagic and epipelagic forms (representatives of suborders Phylloceratina and Lytoceratina vs. Ammonitina and Ancyloceratina) (Fig. 2).

The faunal composition of the Hárskút sections, such as the HK-II (Fig. 3.) may indicate a transitional area for deposition. Here, between two paleo-highs, the environment was slightly deeper than the top of the horst, but much shallower than in the grabens. This result fits well with the paleotectonic conclusions (Fodor & Főzy 2022, this volume).

3. Late Jurassic–Early Cretaceous ammonite biostratigraphy

Ammonites are widespread in pelagic formations; many of them – mostly representatives of suborders Ammonitina and Ancyloceratina – can be characterised by rapid evolution. For this reason, they serve as a solid base for "orthostratigraphy" since the very early time of geological studies. However, the increasing role of other and relatively new methods (including magneto-, cycle-, and chemostratigraphy) is indisputable, and integrated stratigraphy is essential. Accordingly in the studied Bakony sections (Főzy et al. 2022, this volume), ammonites served as primary source of stratigraphic information and provided a useful stratigraphical frame for further research such as magneto- and chemostratigraphy.

The biostratigraphic position of the studied Bakony sections – primarily based on ammonites –, is given on fig. 20. in Főzy et al. (2022, this volume).

For the Jurassic, ammonite zonation summarized for the Tethyan palaeogeographic realm by Hesselbo et al. (2020) is used here. For the Jurassic/Cretaceous (J/K) time interval of the *sensu stricto* Mediterranean, the zonation proposed by Szives & Főzy (2022) is applied; for the Lower Cretaceous the zonation scheme of Gale et al. (2020) is considered here.

The Late Jurassic–Early Cretaceous ammonite zones calibrated against the magnetostratigraphy are shown on Fig. 4. The Early Cretaceous part of this scheme is based on the latest results of the Lower Cretaceous Ammonite Working Group (Kilian Group) (Reboulet et al. 2018); the Late Jurassic part of the scheme is a compilation because for this period of time a revised standard zonal scheme – apart from the late Tithonian –, does not exist.

Below, the ammonite zones and assemblages recognised in the Bakony Mountains are briefly discussed stage by stage.

3.1. Oxfordian

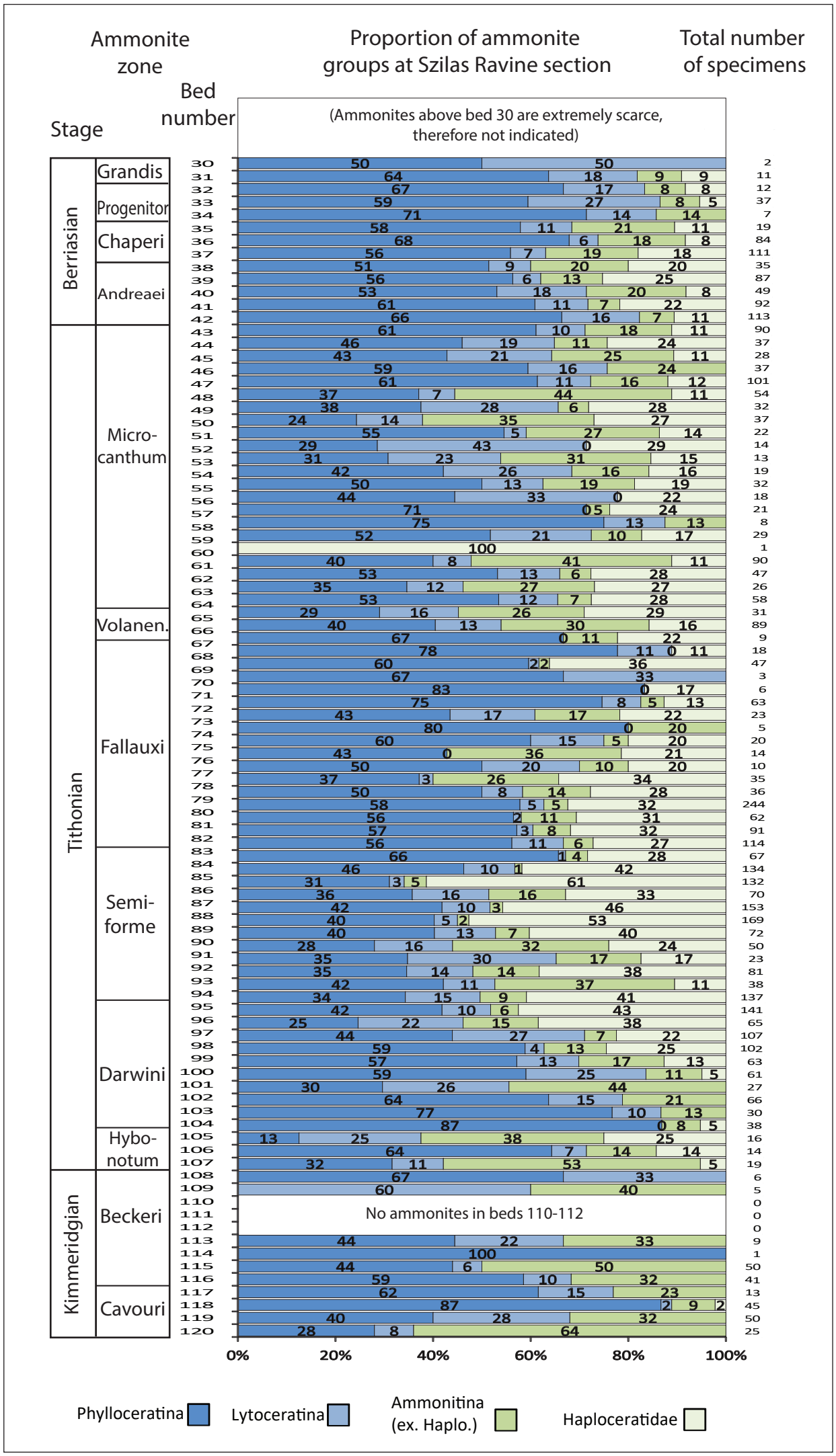
In contrast to the eastern part of the Transdanubian Range (i.e. the Gerecse Mountains) where the Oxfordian can be documented also by means of ammonites (Főzy & Meléndez 2013), in the Bakony Mountains this stage is represented by the radiolarite (i.e. Lókút Radiolarite Fm.) and does not contain any megafossil. However one cannot exclude that some fragments of large aspidoceratids (possibly *Euaspidoceras*) at the base of the Lókút section, described herein as lowermost Kimmeridgian, may represent the highest part of the Oxfordian.

3.2. Kimmeridgian

In the Bakony Mountains this stage is represented by the Pálihálás Limestone Fm. which contains a rich ammonite fauna in the different sections around Hárskút, in the Lókút section, at Borzavár Páskom Hill, and also at Olaszfalu, Eperkés Hill. The Kimmeridgian of the Bakony Mountains is rather condensed even on Mediterranean standards. Beside the always common phylloceratids (including *Sowerbyceras*, which is common in the Kimmeridgian) and lytoceratids, the presence of oppelliids (*Taramelliceras*, *Hemihaploceras*, *Lingulaticeras*, *Streblites*), idoceratids (including *Nebrodites*, *Presimoceras*, *Mesosimoceras* and *Trenerites*), ataxioceratids (including *Progeronia*, *Trapanesites*) and a very divers aspidoceratid fauna are characteristic.

Figure 1 – Percentage diagram of the Late Jurassic ammonite assemblages at Borzavár, Szilas Ravine section

Note the very high percentage of nektopelagic forms *sensu* Cecca et al. (1993) (i.e. phylloceratids, lytoceratids and haploceratids) in the fauna which suggests deep basinal paleoenvironment.


Ammonite zone
Bed number
Proportion of ammonite groups at Szilas Ravine section
Total number of specimens
Stage
(Ammonites above bed 30 are extremely scarce, therefore not indicated)
Berriasian
Grandis
Progenitor
Chaperi
Andreaei
Tithonian
Micro-canthum
Volanen.
Fallauxi
Semi-forme
Darwini
Hybo-notum
Kimmeridgian
Beckeri
Cavouri
No ammonites in beds 110-112
0%
20%
40%
60%
80%
100%
Phylloceratina
Lytoceratina
Ammonitina (ex. Haplo.)
Haploceratidae

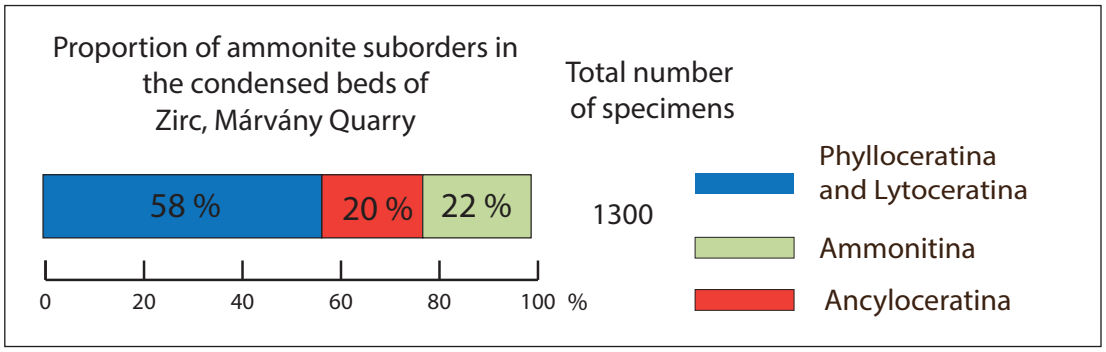


Figure 2 – Percentage diagram of the Early Cretaceous ammonite assemblage at Zirc Márvány Quarry

Note the relatively balanced composition of the mesopelagic and epipelagic forms. This ratio confirms that the condensed beds of the Márvány Quarry were deposited on the top of a paleohigh.

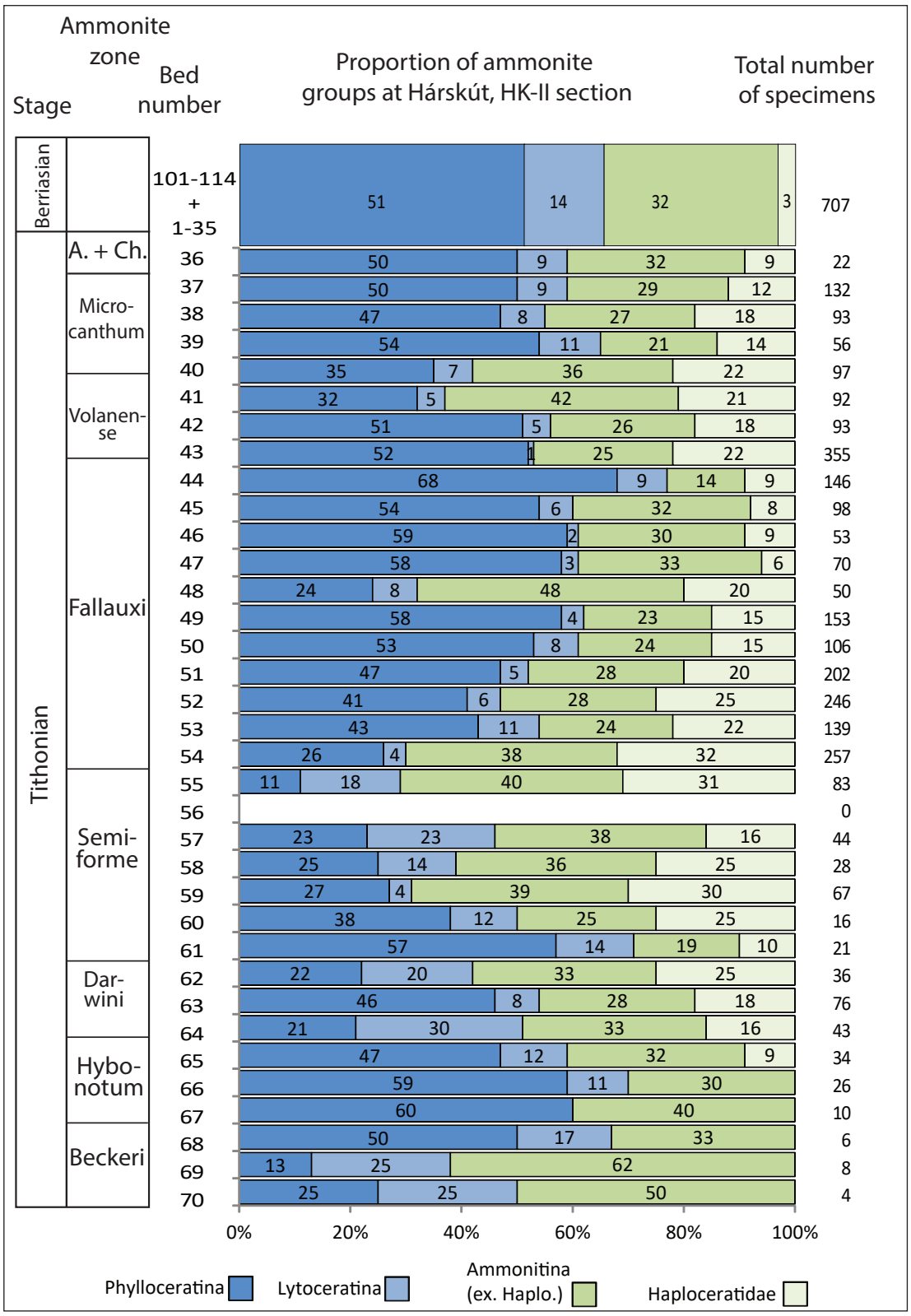


Figure 3 – Percentage diagram of the Late Jurassic ammonite assemblages at Hárskút, HK-II section

Note the relatively high percentage of the nektopelagic forms *sensu* Cecca et al. (1993), (i.e. phylloceratids, lytoceratids and haploceratids) in the fauna which suggests paleoenvironment intermediate between graben and paleohigh.

One of the most complete Kimmeridgian ammonite successions was recognised at the Lókút Hill. Here all of the six Kimmeridgian zones of Olóriz (1978) (Platynota, Strombecki, Divisum, Compsum, Cavouri and Beckeri zones) were recognised. Each zone is reduced to very few beds in most cases.

The Páskom Hill section also yielded a large Kimmeridgian ammonite fauna, but here the fossils were not collected bed-by-bed. In this way, zonal assemblages cannot be given, but on the basis of the occurrences of characteristic ammonites the presence of all the Tethyan ammonite zones can be inferred.

3.3. Tithonian

The Tithonian – represented by the nodular ammonitico rosso type Pálihálás Limestone Fm. in most sections, and with the non-nodular Szélhegy Limestone Fm. on the Eperkés Hill –, is the most widespread and best documented Late Jurassic stage in the Bakony Mountains (fig. 20 in Főzy et al., 2022, this volume). Since the early Tithonian zonation is well established for a long time, and lower Tithonian ammonites are abundant and relatively well preserved, the complete or occasionally incomplete succession of the Hybonotom, Darwini, Semiforme, Fallauxi and Volanense (=Ponti) zones were recognised in many sections, including Hárskút HK-II, Édesvízkút-1, Lókút LH-I, II, Eperkés Hill and Szilas Ravine. Concerning the Ammonitina suborder, haploceratids – with *Haploceras* on the first place – are especially frequent. Oppeliids are relatively rare, but the succession of three *Semiformiceras* species marks the Darwini, Semiforme and Fallauxi zones. Ataxioceratids are embarrassingly divers while aspidoceratids are scarce. In the "mid Tithonian" (i.e. Fallauxi and Volanense zones) simoceratids play an important role, both in terms of stratigraphy and faunal composition.

Upper Tithonian deposits comprise mainly also ammonitico rosso, including the nodular Pálihálás Limestone and the less nodular, and better stratified Szentiványhegy Limestone Fm., are exposed at Hárskút HK-II, HK-12/a, Szilas Ravine and Lókút Hill sections. The collected late Tithonian ammonite fauna was recently evaluated in details from stratigraphical point of view by Szives & Főzy (2022) and an updated zonal scheme was suggested for the J/K transition. Here only some further taxonomical remarks are given on certain taxa. In the Late Tithonian *Micracanthoceras microcanthum*, *Protacanthodiscus andreaei* and *Lopeziceras chaperi* were used as zonal indices. In this fauna, alongside certain ataxioceratids, numerous himalayitid genera appeared.

3.4. Berriasian

The Tithonian/Berriasian transition is represented by bedded ammonitico rosso (Szentiványhegy Limestone Fm.) or by maiolica/biancone-type limestone (Mogyorósdomb Limestone Fm.) in the Bakony Mountains, and is exposed in Hárskút HK-II, HK-12/a, Szilas Ravine and Lókút Hill sections where cephalopods were collected in the 1960s and in the 1980s.

A new bed-by-bed ammonite collecting campaign was done in the HK-12/a section in 2021, where magnetostartigraphy and microfacies analysis provided a good age constrain (Lodowski et al. 2021). As a result, the *Praedalmasiceras progenitor*, *Parahoplites grandis*, *Subthurmannia occitanica*, *Fauriella boissieri* and *Tirnovella subalpina* zones were documented at Hárskút. The early Berriasian part of the J/K boundary interval (Progenitor and Grandis zones) were also traced in the Hárskút HK-II, Szilas Ravine and Lókút Hill sections. At Lókút, a magneto- and microfacies constrain was also given by Lodowski et al. (2021). As a result, a revised J/K ammonite zonal scheme was integrated in the chronostratigraphic framework by Szives & Főzy (2022). The mid Berriasian Occitanica and late Berriasian Boissieri zones were recognised only in the rich fossil material of the HK-12 section.

In the Berriasian ammonite fauna, in addition to the always very common phylloceratids and lytoceratids, representatives of Neocomitidae (especially berriasellids) are important stratigraphically and taxonomically. Olcostephanid (*Spiticieras*, and related genera) mass occurrences can be observed in certain levels, but the stratigraphic meaning of them needs further study.

3.5. Valanginian

From lithostratigraphic point of view, Valanginian is represented by light-coloured Szentiványhegy Limestone Fm. or by the maiolica-type limestone and marl which belongs to Mogyorósdomb Limestone Fm. Among the studied sections, only the Hárskút, Édesvízkút Key Section and the HK-12 section yielded an important Valanginian cephalopod fauna.

The condensed beds of the HK-12 profile are especially rich in Valanginian cephalopods; these beds provided a well-preserved ammonite assemblage characteristic for the Pertransiens and Neocomiensiformis zones. Above these beds, the base of the late Valanginian Verrucosum Zone was documented. The presence of the same level was proved also in the Hárskút, Édesvíz Key Section. Apart from the common phylloceratids and lytoceratids the bulk of the Valanginian ammonite fauna consists of neocomitids and olcostephanids. *Oosterella* is a rare, but characteristic faunal element. Heteromorphs are known only by fragments.

3.6. Hauterivian

In the Bakony Mountains, Hauterivian deposits are represented by the Sümeg Marl and the Borzavár Limestone formations. Cephalopods are generally rare in these rocks, but in certain levels they can be abundant in the Hárskút, Édesvíz Key Section and in the Rend-kő section. Unfortunately, most of the scarce Hauterivian ammonites are poorly preserved; they are generally eroded and fragmented which makes the identification difficult. The only exception is the Márvány Quarry, where some condensed beds provided a unique fossil assemblage where ammonites are preserved partly with shell. This condensed fauna embraces different Hauterivian (and also Barremian) ammonite zones; however due to the condensed nature of the succession, different zones cannot be separated on the basis of their fauna. The zonal subdivision of the majority of the Hauterivian beds of the Hárskút, Édesvízkút Key Section and the Rend-kő section cannot be established because their fauna is far more fragmentary for precise identification. Only the uppermost beds of the Rend-kő section yielded a relatively distinctive fauna; these beds were ranged into the uppermost Hauterivian Ohmi Zone.

The Hauterivian fauna of the Bakony Mountains – out of the common phylloceratids and lytoceratids – is mainly comprised by desmoceratids and different representatives of Ancyloceratina, including ptychoceratids (some of them treated in the systematics below as bochianitids), crioceratids, rare emericiceratids (including *Emericiceras*, *Pseudomoutoniceras* and *Paraspiticeras*). In the latest Hauterivian beds the first pulchelliids (*Discoidellia*) appear.

3.7 Barremian

Barremian deposits, therefore Barremian ammonites, are very rare in surface outcrops of the Bakony Mountains. In contrast to this, in the southwestern part of the Bakony Mountains, around Sümeg, boreholes penetrated a thick succession of the Sümeg Marl Fm., which embraces the Barremian and also the lower Aptian. The detailed evaluation of the ammonite fauna of these boreholes was out of the scope of the present project.

The base of the Mediterranean Barremian is marked by the appearance of certain holcodiscids. In the absence of these zonal indices, the separation of the latest Hauterivian and the earliest Barremian is very difficult. In the Bakony Mountains, only topmost beds of Hárskút, Édesvíz Key Section yielded these early Barremian ammonites. Therefore these beds were ranged into the Hugii Zone or even higher levels.

Some additional younger Barremian ammonites (including *Silesites*, *Hamulinites*, *Ananhamulina* and *Heinzia*) were found in Városlőd, Kakastaréj outcrop.

Late Barremian cephalopods are unknown from the Bakony Mountain, but interestingly, a single grab sample point from a precisely unknown locality, yielded some Aptian ammonites (including a *Deshayesites*) from a seemingly marly rock. Most of the Aptian ammonites of the Transdanubian Range are middle- and upper Aptian, and all come from the basal crinoidal limestone (i.e. Tata Limestone Fm.) (Szives et al. 2007). Presence of lower Aptian ammonites from surface outcrops was unknown until now; therefore this *Deshayesites* specimen is rather unique. However, the study of Aptian ammonites is out of scope of this study.

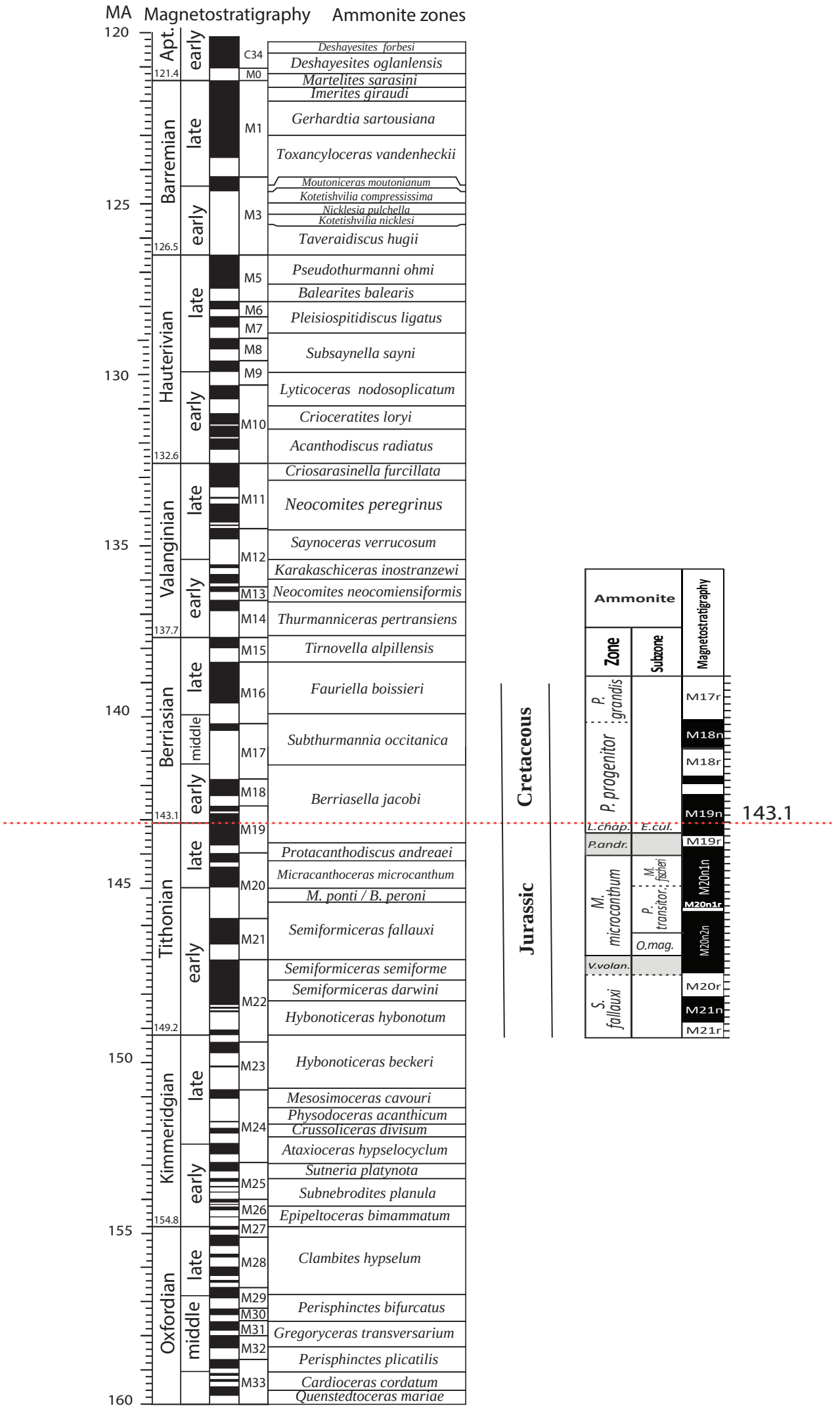
4. Systematic overview

The systematics of ammonites is a permanent construction work. Related to the Jurassic taxonomic units, here we largely follow the latest Treatise (Arkell 1957) for the non-perisphinctids. A relatively new overview of Énay & Howarth (2019) for the perisphinctids was critically considered and discrepancies are indicated under the adequate taxonomic groups. The systematics of neocomitid ammonites is very simplified in the Treatise on Cretaceous ammonites (Wright et al. 1996), and does not fit to the common use of certain genera and to our present knowledge on Early Cretaceous ammonites. Here we mainly follow the system of Arkadiev & Bogdanova 2012, Arkadiev et al. 2012, Company 1987 and Frau et al. 2016a,b,c with some critical taxonomic remarks by Szives & Főzy (2022). The systematics of ancyloceratids largely follows Klein et al. (2007), and ptychoceratids are interpreted according to Vašíček (2020).

With regard to the size of the fauna and the large numbers of species, synonym lists are not given. For the listed early Cretaceous taxa the respective volume of the Fossilium Catalogus (Klein 2005, 2006, Klein et al. 2007,

Figure 4 – The Tethyan late Oxfordian–late Barremian ammonite zones calibrated against magnetostratigraphy

On the left: Modified zonal scheme after Hesselbo et al. (2020) and Gale et al. (2020) for the Jurassic and for the Cretaceous, respectively. Generic names of ammonites are updated according to the latest taxonomical results. Also, the *Aulacosphinctes eudoxus* Zone, which is based on a Subboreal ammonite, is replaced by the Mediterranean *Mesosimoceras cavouri* Zone. On the right: the recently proposed and used zonation for the J/K transition according to Szives & Főzy (2022).


MA
Magnetostratigraphy
Ammonite zones
120
125
130
135
140
145
150
155
160
Apt.
Barremian
Hauterivian
Valanginian
Berriasian
Tithonian
Kimmeridgian
Oxfordian
early
late
middle
121.4
126.5
132.6
137.7
143.1
149.2
154.8
C34
M0
M1
M3
M5
M6
M7
M8
M9
M10
M11
M12
M13
M14
M15
M16
M17
M18
M19
M20
M21
M22
M23
M24
M25
M26
M27
M28
M29
M30
M31
M32
M33
Deshayesites forbesi
Deshayesites oglanlensis
Martelites sarasini
Imerites giraudi
Gerhardtia sartousiana
Toxancyloceras vandenheckii
Moutoniceras moutonianum
Kotetishvilia compressissima
Nicklesia pulchella
Kotetishvilia nicklesi
Taveraidiscus hugii
Pseudothurmanni ohmi
Balearites balearis
Pleisiospitidiscus ligatus
Subsaynella sayni
Lyticoceras nodosoplicatum
Crioceratites loryi
Acanthodiscus radiatus
Criosarasinella furcillata
Neocomites peregrinus
Saynoceras verrucosum
Karakaschiceras inostranzewi
Neocomites neocomiensiformis
Thurmanniceras pertransiens
Tirnovella alpillensis
Fauriella boissieri
Subthurmannia occitanica
Berriasella jacobi
Protacanthodiscus andreaei
Micracanthoceras microcanthum
M. ponti / B. peroni
Semiformiceras fallauxi
Semiformiceras semiforme
Semiformiceras darwini
Hybonoticeras hybonotum
Hybonoticeras beckeri
Mesosimoceras cavouri
Physodoceras acanthicum
Crussoliceras divisum
Ataxioceras hypselocyclum
Sutneria platynota
Subnebrodites planula
Epipeltoceras bimammatum
Clambites hypselum
Perisphinctes bifurcatus
Gregoryceras transversarium
Perisphinctes plicatilis
Cardioceras cordatum
Quenstedtoceras mariae
Cretaceous
Jurassic
Ammonite
Zone
Subzone
Magnetostratigraphy
P. progenitor
P. grandis
L.chap.
E.cul.
P.andr.
M. microcanthum
M. fischeri
P. transitor
O.mag.
V.volan.
S. fallauxi
M17r
M18n
M18r
M19n
M19r
M20n1n
M20n1r
M20n2n
M20r
M21n
M21r

2009, Klein & Vašíček 2011) provides an updated and wide taxonomical context. Such a concise work based on a uniform concept does not exist for late Jurassic taxa.

Photo plates serve as an iconography and only the most important ammonite specimens of the examined Kimmeridgian–Barremian fauna are figured; plates are arranged in systematic order. Specimens have been coated with ammonium chloride before photography, except those in which the suture line was shown.

The illustrated specimens are in the collections either of the Department of Palaeontology and Geology of the Hungarian Natural History Museum (Budapest) or of the Mining and Geological Survey of Hungary (Budapest), under the indicated accession numbers, prefixed by: "M." or "PAL.", or "INV." (for the Museum), or with "J." or "K."(for the Survey).

Suborder Phylloceratina Arkell, 1950

The often poorly preserved phylloceratids form an essential part of the studied fauna, occurring in all sections. Sometimes they represent 40–70 % of the entire ammonite fauna (Cecca et al. 1993) in the Bakony sections. Altogether hundreds, if not thousands of specimens were identified only on generic level, or simply as Phylloceratina spp., but were not studied in detail.

Suborder Phylloceratina Zittel, 1884

Superfamily Phylloceratoidea Zittel, 1884
Family Phylloceratidae Zittel, 1884
Subfamily Phylloceratinae Zittel, 1884

Phylloceratids are very common all around in the Upper Jurassic–Lower Cretaceous formations (cf. Figs. 1, 2) but due to their often very poor state of preservation they were not determined on species level and the group was not studied in details. Some of the most representative phylloceratids are illustrated in Plates 1–4.

*Genus **Phylloceras** Suess, 1865*
Type species: *Ammonites heterophyllus* Sowerby, 1820

Thousands of phylloceratids represent the nominate genus, but the majority of them was insufficient for determination on species level. *P. consanguineum* Gemmellaro, 1876 is known from the Kimmeridgian of Páskom Hill (Plate 1/1, 9); *P. serum* (Oppel, 1865) (Plate 2/1) was recorded from late Tithonian or younger deposits; *P. ptychostoma* (Benecke, 1866) is a rare in the Bakony fauna and was documented only from the Tithonian of the Lókút Hill (Plate 2/4); *P. winkleri* (Uhlig, 1882) occurs in the Hauterivian–early Barremian sediments around Hárskút (Rend-kő and Édesvíz Key Section) and also in Márvány Quarry; *P. ponticuli* (Rousseau, 1842) is known from Márvány Quarry (Plate 4/7) together with *P. tethys* (d'Orbigny, 1841), *P. rouyanum* (d'Orbigny, 1841) (Plate 4/2) and *P. infundibulum* (d'Orbigny, 1841). Latter species is also very frequent in the uppermost (Barremian) beds of the Hárskút, Édesvíz Key Section (Plate 1/4, 6, 8; 3/3; 4/8). The species *rouyanum* and *infundibulum* are commonly ranged into the genus *Phyllopachyceras* (see Joly 2000).

Subfamily Calliphylloceratinae Spath, 1927
Genus ***Calliphylloceras*** Spath, 1927
Type species: *Phylloceras disputabile* Zittel, 1869

Most of the representatives of *Calliphylloceras* were identified only on generic level. Recognised species are as follows. *Calliphylloceras kochi* (Oppel, 1865) and *C. benacense* (Catullo, 1847) are known from the Kimmeridgian of Páskom Hill and Eperkés Hill (Plate 3/4; 1/3). *Calliphylloceras calypso* (d'Orbigny, 1841) is common in the Berriasian and Valanginian of the Hárskút, HK-12 section (Plate 2/2, 3; 4/4).

Genus ***Holcophylloceras*** Spath, 1927
Type species: *Phylloceras mediterraneum* Neumayr, 1871 (=*Ammonites zignodianum* d'Orbigny, 1848)

Among *Holcophylloceras* only *H. polyolcum* (Benecke, 1866) and *Holcophylloceras silesiacum* (Oppel, 1865) were identified on species level. The first was documented from the

Valanginian of the HK-12 section; the latter was found in the Kimmeridgian of the Lókút Hill and Páskom Hill sections (Plate 1/5, 3/1). As it was pointed out by Pavia (2002), the species is very close to *H. zignodianum* (d'Orbigny, 1842), which was often reported from the Middle Jurassic–Oxfordian formations. According to Sarti (1993) *H. polyolcum* is known from the Kimmeridgian–Tithonian interval, while Joly (2000) suggested "mid-Kimmeridgian" occurrence.

Genus ***Ptychophylloceras*** Spath, 1927
Type species: *Phylloceras feddeni* Waagen, 1875

From the Upper Jurassic–Lower Cretaceous formations generally two species, namely *P. ptychoicum* (Quenstedt, 1847) and *P. semisulcatum* (d'Orbigny, 1840) were reported. Joly (2000) maintained the first name for the Kimmeridgian and Tithonian forms and second one for the Berriasian and Valanginian. Here these forms are treated as conspecific; further details are given by Főzy & Scherzinger (2013b). *Ptychophylloceras semisulcatum* shows bimodal size distribution, which suggests dimorphism. It is very frequent in the Bakony fauna, being the dominant phylloceratid of the Tithonian limestone, but also occurs in the Berriasian and Valanginian. Some specimens are illustrated in Plate 4/3, 5, 10.

Genus ***Sowerbyceras*** Parona & Bonarelli, 1895
Type species: *Ammonites tortisulcatus* d'Orbigny, 1849

The easily recognisable *Sowerbyceras* specimens are typical faunal elements of the Mediterranean Upper Jurassic. The majority of these phylloceratids are Kimmeridgian, although *Sowerbyceras* appears in the Oxfordian already and its last representatives are from the basal Tithonian (Sarti 2020 and references therein). On the basis of a bed-by-bed collected large *Sowerbyceras* fauna of 960 specimens, Sarti (2015) demonstrated that sea-level fluctuation has a strong effect on the evolutionary trends of *Sowerbyceras* populations which can be documented by means of changing ammonite morphology, species number and also by means of speciation.

In contrast to the Trento Plateau, where *Sowerbyceras* is particularly abundant the genus is not very common in the Bakony Mountains. Very few and heavily eroded specimens were collected from the few lowermost (upper Kimmeridgian) beds of the Szilas Ravine, and Hárskút, HK-II sections and only the Lókút section yielded some better preserved *Sowerbyceras*. These ammonites – due to their limited number and modest preservation –, were not studied in details, but it seems that many of them, if not all, are close to *S. silenum* (Fontannes, 1876) (Plates 1/2, 2/5).

Suborder Lytoceratina Hyatt, 1889

The often poorly preserved and fragmentary lytoceratids form an essential part of the studied fauna, occurring in all sections. Sometimes they represent up to 10 % of the entire ammonite fauna (cf. Figs. 1, 2 and Cecca et al. 1993) in the Bakony sections. Altogether hundreds of specimens were identified only on generic level, or simply as Lytoceratina spp., but the group was not studied in depth. A new insight on their phylogeny and an updated revision of the entire suborder is given by Hoffmann (2010).

Superfamily Lytoceratoidea Neumayr, 1875
Family Lytoceratidae Neumayr, 1875
Subfamily Lytoceratinae Neumayr, 1875
Genus ***Lytoceras*** Suess, 1865
Type species: *Ammonites fimbriatus* Sowerby, 1817

The following species could be identified in the Bakony material:

Lytoceras polycyclum (Neumayr, 1871) – dozens of specimens occurred in the Kimmeridgian of Lókút Hill and Páskom Hill (Plate 6/1, 2; 7/1). The specimens from Páskom Hill are preserved – at least partially – with permineralised shell, which was removed in cases by the collector, J. Noszky Jr., in order to paint the suture (Figure 5/1). A close ally is *Lytoceras polycyclum camertinum* Canavari, 1897, which was not distinguished here. The species was reported from the Kimmeridgian, from the Strombecki to the top of the Beckeri Zone (Sarti 1993). Further details on the species are given by Főzy & Scherzinger (2013a).

Lytoceras juilleti (d'Orbigny, 1841) is documented from the upper Tithonian of the Lókút Hill and from the Berriasian of Hárskút, HK-12 section (Plate 5/1, 2). Interesting is the Lókút

specimen, since it shows the fine crenulation on the shell – a feature which was not documented before. These crenulated ribs ensure the assignment to the genus *Lytoceras*.

Well-preserved specimens of *L. subfimbriatum* (d'Orbigny, 1841) were collected from the Hauterivian to early Barremian formations around Hárskút, and from the Márvány Quarry near Zirc (Plate 5/3; 6/3, 4; 7/2).

The delicately ribbed *Lytoceras liebigi* (Oppel, 1865) and *L. montanum* (Oppel, 1865) with its characteristic undulating flares also occurred in the Kimmerridgian and Tithonian rocks (Plate 7/3, 4; 5/5).

Genus ***Protetragonites*** Hyatt, 1900
Type species: *Ammonites quadrisulcatus* d'Orbigny, 1840

Some work, like Arkell's (1957), assigned the genus along with some other genera like *Leptotetragonites* Spath, 1927 into a separate family i.e. Protetragonitidae Spath, 1927. In contrary, Hoffmann (2010) left *Protetragonites* in Lytoceratinae, within Lytoceratidae. We follow the latter opinion here.

The genus is represented by numerous specimens from various Bakony sections of Tithonian and early Cretaceous in age; in fact all the loosely coiled, slowly growing lytoceratids with faint trace of constrictions were tentatively referred *Protetragonites*. Most common is *P. quadrisulcatus* (d'Orbigny, 1840). In the Tithonian to Berriasian formations mainly internal moulds occurred with contstrictions, but from the Hauterivian of the Márvány Quarry and from the Valanginian of Hárskút, HK-12 section specimens with permineralised shell were collected which possess swellings above the contractions (Plate 5/4, 6).

Another specimen from the Valanginian of Hárskút, HK-12 section was identified as *P. strangulatus* (d'Orbigny, 1840) (Plate 6/5). This ammonite is more evolute then *P. quadrisulcatus*. The type of *strangulatus* is also Valanginian.

In case of *P. honnoratianus* (d'Orbigny, 1841) – the generic attribution of the species is after Hoffman (2010) –, the delicate, prorsiradiate ribs are very characteristic (Plate 5/7). It is also from the Valanginian of the Hárskút section.

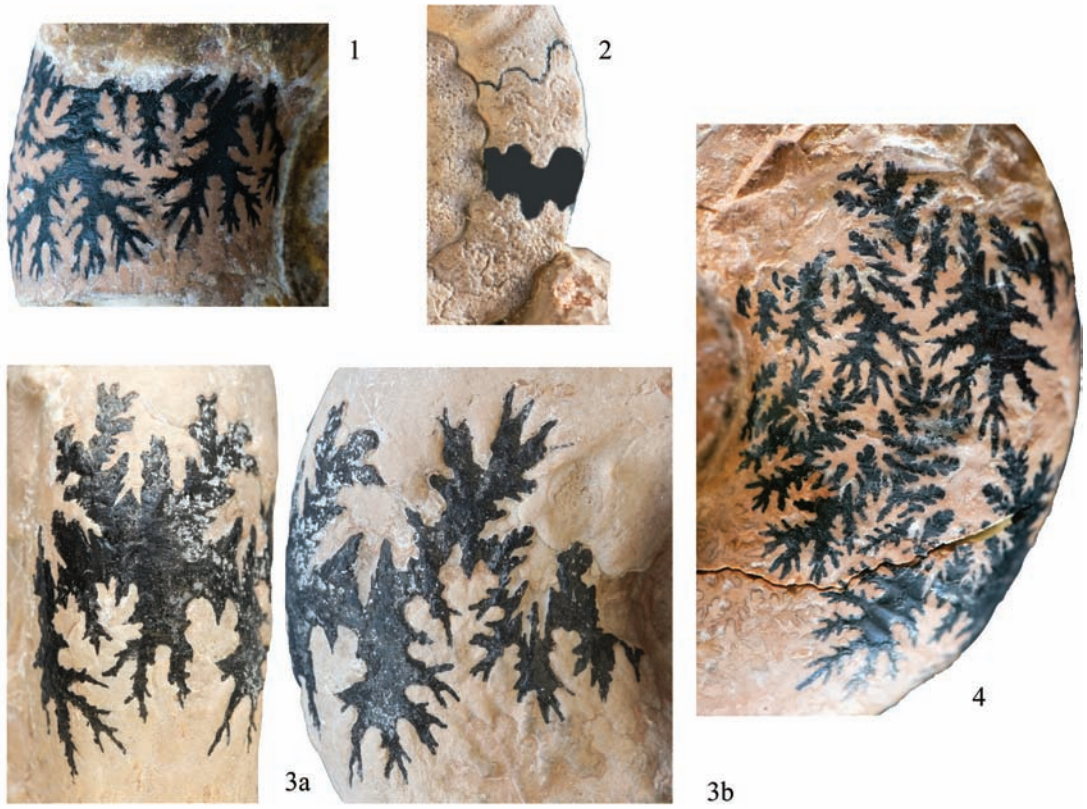


Figure 5 – Ammonite suture-lines

All figures are under 1.5x magnification

1. *Lytoceras polycyclum* (Neumayr, 1871) – unregistered, from the Kimmeridgian of Borzavár, Páskom Hill. The specimen is shown on Plate 6/1.
2. *Volanoceras aesinense* (Meneghini, 1885) – unregistered, Sümeg, grab sample, characteristic for the early Tithonian, Semiforme Zone. The specimen is shown on Plate 20/6.
3a, 3b. *Haploceras elimatum* (Oppel, 1865) – unregistered, Bakonybél, Som Hill, grab sample, Tithonian. The specimen is shown on Plate 10/3.
4. *Metahaploceras* cf. *strombecki* (Oppel, 1858) – unregistered, from the Kimmeridgian of Borzavár, Páskom Hill. The specimen is shown on Plate 12/2.

Suborder Ammonitina Hyatt, 1889

Superfamily Haploceratoidea Zittel, 1884
Family Haploceratidae Zittel, 1884
Subfamily Haploceratinae Zittel, 1884
Genus ***Haploceras*** Zittel, 1870
Type species: *Ammonites elimatus* Oppel, 1865

The often poorly preserved haploceratids form an essential part of the studied fauna, occurring in all Tithonian sections. Altogether hundreds, – if not thousands –, of specimens were identified as *Haploceras* spp. A comprehensive review of the family is given by Főzy (1988), but haploceratids were not studied in depth in the course of present research. The majority of these ammonites may belong to the groups of *H. elimatum* (Oppel, 1865), and *H. carachtheis* (Zeuschner, 1846), often referred as macro- and microconch forms in the literature. Details on dimorphisms are given by Főzy & Scherzinger (2013b and references therein).

The typical *H. elimatum* has flat sides and oval cross section (Plate 10/4, 5; Figure 5/3), while closely related forms, such as *H. wohleri* (Oppel, 1865) (Plate 9/8, 10/1) and *H. staszycii* (Zeuschner, 1846) are thicker and have a more rectangular whorl section. Cross section of a *H. staszycii* is given by Főzy (1988, fig. 7). The well-preserved *H. wohleri* specimens show also ridges on the venter of the adult body chamber (Plate 10/1).

Microconchiate forms – apart from *H. carachtheis* –, embraces also *H. leisoma* (Oppel, 1865), *H. tithonium* (Oppel, 1865), *H. rhinotonum* Zittel, 1870 and *H. tomephorum* Zittel, 1870. These species has different cross sections and variant wrinkles on the venter of the adult body-chamber (Plate 8/1, 9/6, and further figures in Főzy 1988). The biostratigraphical meaning of these small forms – if there any – is summarised by Énay & Cecca (1986).

Haploceras verruciferum (Zittel, 1869) having a small wart (*verruca*) on the venter, towards the end of the adult body chamber. It is a very characteristic form and restricted to the Semiforme Zone which is the rough equivalent of the Verruciferum Zone of Olóriz (1978). Some of the Bakony specimens are illustrated in Plate 8/1, 6, 8, and Plate 9/2, 7.

It seems that *Haploceras cassiferum* Főzy, 1988, a bigger ammonite, also with a ventral flare on its adult body-chamber, is restricted to the Darwini Zone. In spite of this some authors supposed that this is the macroconch of the slightly younger *H. verruciferum*. Sarti (2020) maintained the distinction between the two species, and reported *cassiferum* from the Darwini Zone and from the lower part of the Semiforme (=Verruciferum Zone) of the Southern Alps.

Genus ***Neolissoceras*** Spath, 1923
Type species: *Ammonites grasianus* d'Orbigny, 1841

Neolissoceras grasianum (d'Orbigny, 1841) is an easily recognizable, dimorphic, smooth ammonite with an oblique umbilical wall. The species is common from the Berriasian but became extinct in the late Hauterivian, around the Sayni Zone (Reboulet 1996), or even higher, but still in the latest Hauterivian. Accordingly it is quite typical in many Lower Cretaceous sections of the Bakony Mountains (Plate 8/3, 7; 9/4, 5; 10/2). A close ally is *Neolissoceras subgrasianum* which was reported by Drushchits (1960) from the Barremian, which is probably a misinterpretation. Some thick, adult, late Valanginian forms show a blunt, weak, ventral ridge on the body-chamber (Plate 8/5); these may represent another species.

Genus ***Pseudolissoceras*** Spath, 1925
Type species: *Neumayria zitteli* Burckhardt, 1903

Pseudolissoceras is a medium-sized smooth ammonite with very simple suture. It is never abundant, but frequently reported from the early Tithonian of the Mediterranean Realm, and also outside Europe (including Argentina, Cuba, and from the territory of Kurdistan). In the Bakony Mountains *P. olorizi* Főzy, 1988 is the characteristic representative of the genus (Plate 8/4; 9/1, 3). It occurs in the Hybonotum, Darwini and Semiforme zones. It was reported from similar stratigraphic level from the Trento Region by Sarti (2020) and by Boughdiri et al. (2005) from Tunisia.

Family Oppeliidae Douvillé, 1890
Subfamily Taramelliceratinae Spath, 1928
Genus ***Taramelliceras*** Del Campana, 1904
Type species: *Ammonites trachinotus* Oppel, 1863

Like in many other groups of Jurassic ammonites, *Taramelliceras* is easily recognisable on generic level, but the specific affiliation of the specimens is often disputable. This is also the case of the Bakony specimens, which are mostly fragments of weathered internal moulds, therefore difficult to determine. The only exception is the Kimmeridgian of Páskom Hill, where some *Taramelliceras* specimens are well-preserved with the remains of the permineralized shell. Here the following species were recognised. *T. compsum* (Oppel, 1863) (Plate 13/8), *T.* cf. *trachinotum* (Oppel, 1863) (Plate 12/1, 3) and *T. pseudoflexuosum* (Favre, 1877) (Plate 12/5). Numerous *Taramelliceras* specimens, including *T. compsum* were found also in the Kimmeridgian of the Lókút section. However most of them remained determined only on generic level.

Genus ***Fontannesiella*** Spath, 1925
Type species: *Oppelia valentina* Fontannes, 1879

It is supposed that the taramelliceratid *Fontannesiella* is the macroconchiate pair of the microconchiate glochiceratids (*Paralingulaticeras*) which makes the use of Subfamily Glochiceratinae Hyatt, 1900 meaningless. *Fontannesiella* sp. (Plate 12/8) was recorded from the Kimmeridgian of Páskom Hill. *F. prolithographica* (Fontannes, 1879) was reported from earliest Tithonian of the Gerecse Mountains (Főzy & Scherzinger 2013b) and it was not found also in the Bakony Mountains, in the HK-II section.

Genus ***Hemihaploceras*** Spath, 1925
Type species: *Oppelia nobilis* Neumayr, 1873

Only a few *Hemihaploceras* specimens were recognised in the Bakony fauna. They were identified as *H. nobile* (Neumayr, 1873) (Plate 11/1, 6). One of the specimens is a poorly preserved body-chamber fragment from the Cavouri Zone of the Szilas Ravine section and the other one is from the Beckeri Zone of the Lókút section; it is better preserved, but still fragmentary.

Genus ***Metahaploceras*** Spath, 1925
Type species: *Metahaploceras affinis* Spath, 1925

Some middle-sized taramelliceratids from the Kimmeridgian of Lókút Hill and Páskom Hill were identified as *M.* cf. *strombecki* (Oppel, 1857) (Plate 11/8, 9; 12/2, 4; Figure 5/4). Some of these ammonites are preserved partly with remains of the shell on the outer whorls and show the faint ornamentation characteristic for the species; inner whorls cannot be observed.

Genus ***Lingulaticeras*** Ziegler, 1958
Type species: *Ammonites nudatus* Oppel, 1858

The genus comprises the presumed microconchs of *Taramelliceras* and *Neochetoceras*. These tiny ammonites with their delicate ornamentation are rarely recognisable in the nodular ammonitico rosso facies; in the Bakony Mountains only the compact, micritic Kimmeridgian limestone of the Páskom Hill preserved some specimens. *Lingulaticeras jungens* (Neumayr, 1873) and *L. semicostatum* (Berckhemer, 1958) are illustrated in Plate 13/1, 10 and Plate 12/6, respectively. In Germany, *L. semicostatum* occurs in the Pseudomutabilis Zone together with a tarmelliceratid that looks similar to *Oppelia loczyi* Jekelius, 1925 – perhaps they form a dimorphic pair. In the same level appears the zonal index of the Cavouri Zone i.e. *Mesosimoceras cavouri* (Gemmellaro, 1872), (Scherzinger et al. 2016).

Subfamily Streblitinae Spath, 1925
Genus ***Streblites*** Hyatt, 1900
Type species: *Ammonites tenuilobatus* Oppel, 1863

The genus is represented only by very few specimens in the Bakony Mountains. A single ammonite identified as *Streblites tenuilobatus* (Oppel, 1863) was found in the Lókút section, possibly from the Divisum Zone. Similar ammonites, but somewhat different in their proportions, were identified from the condensed Páskom Hill fauna. These otherwise characteristic ammonites are always rare, their variability is not known very well, and therefore not too much more can be said on the basis of the Bakony specimens which are illustrated in Plate 11/4, 5, 10, 11.

Genus ***Substreblites*** Spath, 1925
Type species: *Ammonites zonarius* Oppel, 1865

Only a poorly preserved fragmentary specimen of *S. zonarius* (Oppel, 1865) was found in Szilas Ravine, bed 35, Progenitor Zone (Plate 11/7).

Genus ***Semiformiceras*** Spath, 1925
Type species: *Ammonites fallauxi* Oppel, 1865

The genus *Semiformiceras* comprises morphologically very characteristic, therefore easily recognizable, and stratigraphically very important species which are generally frequent all over the Mediterranean Province. The three successive species, *S. darwini* (Neumayr, 1873), *S semiforme* (Oppel, 1863) and *S. fallauxi* (Oppel, 1865) are index fossils of the early Tithonian Darwini, Semiforme and Fallauxi zones (Énay 1983, Cecca & Rouget 2006). The species, especially *S. semiforme* and *S. fallauxi* are always present in most of the early Tithonian sections of the Bakony Mountains. Compared to these, *S. darwini* is rare in the Bakony, and also in most of the Mediterranean sections. All these species show high intraspecific variation (Olóriz 1978, Főzy 1988).

Small-sized species, *S. gemmellaroi* (Zittel, 1870) and *S. birkenmajeri* Kutek & Wierzbowski, 1986, are morphologically close to *S. fallauxi* which complicates the picture: *S. gemmellaroi* was documented from the Fallauxi Zone of the Hárskút, Édesvíz, Key section, while *S. birkenmajeri* from the Darwini Zone of the Hárskút, HK-II section. In Hungary, besides the Bakony sections, *Semiformiceras* is common in the lower Tithonian of the Gerecse Mountains (Főzy & Scherzinger 2013b), and *S. darwini* also occurs in the Mecsek Mountains (Főzy 1993b). Some of the Bakony *Semiformiceras* specimens are illustrated in Plates 11 and 13.

Genus ***Neochetoceras*** Spath, 1925
Type species: *Ammonites steraspis* Oppel 1863

Neochetoceras sensu stricto is a smooth, oxycone ammonite and has a distribution in the Kimmeridgian–earliest Tithonian. It is a macroconchiate form and the supposed microconchs (*Lingulaticeras* ex gr. *solenoides* (Quenstedt, 1849)) are ranged into different subfamily (Glochiceratinae). Younger forms, referred here as "*Neochetoceras*" are known from the Fallauxi Zone (Plate 13/9) and treated here as homeomorphs (Főzy & Scherzinger 2013b).

Superfamily Perisphinctoidea Steinmann, 1890
Family Perisphinctidae Steinmann, 1890
Subfamily Idoceratinae Spath, 1925

These loosely coiled, generally simply ribbed ammonites form an essential part of the Kimmeridgian of the Bakony fauna; they are quite frequent and also diverse. The group is similarly well represented in the Gerecse Mountains (Főzy & Scherzinger 2013a).

Genus ***Subnebrodites*** Spath, 1925
Type species: *Subnebrodites planula* Spath, 1925

Fragmentary specimens identified as *Subnebrodites* sp. in the Kimmeridgian of the Páskom Hill indicate the presence of Platynota Zone.

Genus ***Idoceras*** Burckhardt, 1906
Type species: *Ammonites balderum* Oppel, 1863

A single, poorly preserved fragment of *I. balderum* (Oppel, 1863) was found in the condensed Páskom Hill section (Plate 15/2). Énay & Howarth (2019) considered this taxon as the microconch pair of the much older *Subnebrodites planula* (Hehl in Zieten, 1830), but this opinion was based on an erroneous assumption, as it was proved by Schweigert & Kuschel (2017). Latter authors also proved that the species, which was often reported from the Submediterranean area, marks a short immigration event (*balderum* biohorizon) from the Tethys within the Divisum Zone during the early Kimmeridgian.

Genus ***Nebrodites*** Burckhardt, 1912
Type species: *Simoceras agrigentinum* Gemmellaro, 1872

Representatives of evolute, densly ribbed *Nebrodites* and related genera (*Presimoceras*, *Mesosimoceras* and *Trenerites*) are rather frequent in the Kimmeridgian sections of the Bakony Mountains (Páskom Hill, Lókút and Eperkés Hill). The finest specimens were collected at Páskom Hill, but since this site was not sampled bed by bed, the biostratigraphic meaning of these findings remained unclear. *Nebrodites* cf. *favrensis* (Gemmellaro, 1872) and *N. hospes* (Neumayr, 1871) were illustrated in Plate 15/3, 4.

Genus ***Presimoceras*** Sarti, 1990
Type species: *Ammonites nodulatus* Quenstedt, 1888

Sarti (1990) emended the genus *Mesosimoceras* and instituted the genus *Presimoceras*; *Mesosimoceras* was maintained to the *cavouri-risgoviense* group, while group *Presimoceras* was introduced for the *herbichi-ludovicii-teres* group. In the Bakony fauna *P. teres* (Neumayr, 1871), *P. herbichi* (von Hauer, 1866), *P. nodulatum* (Quenstedt, 1888) were recognised; all of them were collected at Páskom Hill and are illustrated in Plates 14–16. The ammonite in Plate 16/1 is the innermost part of a larger specimen or a slightly incomplete microconch. *Presimoceras herbichi* in Plate 14/4 change its ornamentation abruptly on the last whorls very close; this ammonite is close to that one figured by Grigore (2010, plate 2, fig 7) from the Eastern Carpathians. Some *Presimoceras* specimens at Páskom Hill are rather big (Plate 14/3); since the inner whorls of these ammonites are eroded, they were determined only on generic level.

Genus ***Mesosimoceras*** Spath, 1925; emended Sarti, 1990
Type species: *Simoceras cavouri* Gemmellaro, 1872

Mesosimoceras cavouri (Gemmellaro, 1872) is the index form of the late Kimmeridgian Cavouri Zone in the Mediterranean region. At the same time the species was recognised also in the Submediterranean Upper Jurassic of SW Germany (Scherzinger et al. 2016), therefore it is an important ammonite for intraprovincial correlation. The species was found in the Lókút Hill section (Plate 16/4).

Genus ***Trenerites*** Sarti, 1993
Type species: *Simoceras evolutus* Gemmellaro, 1876

Trenerites is a rarely recorded, therefore poorly known, very evolute, simply ribbed early Kimmeridgian Idoceratidae (Sarti 2002, Énay & Debrand-Passard 2005 and references therein). A single fragment of *T. evolutus* (Gemmellaro, 1876) from Lókút Hill is illustrated in Plate 15/1.

Family Simoceratidae Spath, 1924

The family unites genera of different origin, and forms an essential and characteristic part of the Tethyan fauna. Énay & Howarth (2019) suggested a lower Kimmeridgian–Berriasian range for the family; however the only Kimmeridgian genus (*Pseudosimoceras*) may belong to another family. The majority of the taxa are Tithonian.

Genus ***Simoceras*** Zittel, 1870
Type species: *Ammonites biruncinatus* Quenstedt, 1847

Brief description of the genus, characterized by unique ornamentation, is given by Főzy & Scherzinger (2013b). Dimorphism is unknown.

Attributed species of the Bakony fauna: *S. biruncinatum* (Quenstedt, 1845), *S. admirandum* (Zittel, 1869) (Plate 17/3, 4; 20/4, 5). Both species are rare, but always present in a narrow time interval, i.e. in the Admirandum-Biruncinatum Subzone in the upper part of the Tithonian Fallauxi Zone. They were documented at Sümeg, Lókút, Hárskút HK-II, and Szilas Ravine sections. In Hungary they were also found in the Tithonian of the Gerecse Mountains (Főzy & Scherzinger 2013b).

The earliest representative of the genus from the Lower Tithonian Hybonotum Zone, i.e. *S. szentei* Főzy & Scherzinger (2011) and another early Tithonian species namely *S. agostyani* was described by Főzy & Scherzinger (2013b) from of the Gerecse Mountains. Recently *S. szentei* was recorded also from the lowermost Tithonian of Štramberk (Vašíček et al. 2018), but none of these species were documented in the Bakony sections.

Genus ***Virgatosimoceras*** Spath, 1925
Type species: *Simoceras rothpletzi* Schneid, 1915

The genus comprises perisphinctid-like simoceratids which form an evolutionary lineage throughout the early Tithonian and probably restricted to the Western Tethys. Revision of the group with special reference to newly recognised dimorphism was given by Scherzinger et al. (2010). Representatives of the genus were described also from the Gerecse Mountains (Főzy & Scherzinger 2013b).

Attributed species of the Bakony fauna are: *V. albertinum* (Catullo, 1855) and *V. dunaii* Scherzinger et al., 2010. *V. albertinum* is the index form of the lower Tithonian Albertinum Zone, which is the time equivalent of the Darwini Zone (Plate 19/1, 2, 7). It was found in the Lókút, Hárskút (HK-II) and Márvány Quarry sections. *V. dunaii* (Plate 18/5) was described from the lower Tithonian Semiforme Zone of the Lókút section and it was interpreted as a link between the Darwini and Fallauxi Zone species (i.e. *V. albertinum* and *V. rothplezti*). Poorly preserved specimens of *V. rothplezti* (Schneid, 1925) occurred in the Fallauxi Zone of the Szilas Ravine Section. Some incomplete specimens from different sections around Hárskút (HK-II, Édesvízkút-1) and in the Szilas Ravine were determined only on generic level. *Virgatosimoceras* is never abundant, but always represented by a few specimens in the lower Tithonian beds.

Genus ***Volanoceras*** Geyssant, 1985
Type species: *Ammonites volanensis* Oppel, 1863

The genus encompasses very characteristic, extremely evolute, strongly ribbed lower Tithonian forms which were intensively studied (Főzy 1988, Schweigert et al 2002, Villasenor et al. 2011, Főzy & Scherzinger 2013b and references herein). The species show distinct dimorphism. Similarly to other simoceratids, representatives of *Volanoceras* are never abundant, but always appear in the Tithonian fossil material. *Volanoceras* has a special importance in the Tithonian ammonite zonal scale of Mediterranean ammonitico rosso facies (Santanatonio 1986, Cecca & Santantonio 1988, Szives & Főzy 2022). *V. aesinense* (Meneghini, 1885) and *V. volanense* (Oppel, 1863) are important index fossils of the lower Tithonian Semiforme and Ponti Zones, respectively. Here we use *Volanoceras volanense* Zone as a direct replacement of *Micracanthoceras ponti* Zone (see Szives & Főzy 2022) in the meaning of Cecca & Santantonio (1988). The stratigraphic range of *V. perarmatiforme* is less known, but it seems that besides the upper part of the lower Tithonian it may present in the lower Microcanthum Zone (LH-I and Rend-kő II sections).

Attributed species of the Bakony fauna: *V. aesinense* (Meneghini, 1885), *V. volanense* (Oppel, 1863) and *V. perarmatiforme* (Schrauroth, 1865). The first two species were found in Sümeg and Szilas Ravine, and also in Lókút LH-I and in the sections around Hárskút (HK-12, and HK-II). *V. perarmatiforme* (=*Volanoceras (Volanoceras) magnum fide* Olóriz, 1978) was recognized at Sümeg, Lókút LH-I and in the Rend-kő-II sections. Numerous *Volanoceras* specimens are figured in Plates 17–20. Suture-line of *V. aesinense* is given on Figure 5/2.

Genus ***Lytogyroceras*** Spath, 1925
Type species: *Ammonites fasciatus* Quenstedt, 1849

The genus comprises small to medium-sized, very evolute, roughly smooth ammonites with ribbing on the inner whorls only. Its type species is a junior synonym of *Ammonites strictum* Catullo, 1846. According to Énay & Howarth (2019) the genus is dimorphic – however their macroconch *Lytogyroceras* is treated here as a *Simolytoceras*. It seems the genus is restricted to the early Tithonian. We know only a single specimen (*Lytogyroceras* sp.) from the Gerecse Mountains (Főzy & Scherzinger 2013b) and it is also rare in the Bakony Mountains, as everywhere in the Mediterranean Realm.

Attributed species of the Bakony fauna: *L. strictum* (Catullo, 1846) and *L. subbeticum* (Olóriz, 1978). *Lytogyroceras strictum* was listed by Vígh (1984) from Sümeg and also from Lókút LH-II (Plate 18/3) from his newly and unnecessary introduced zone (i.e. *Simoceras* (*Lytogyroceras*) *subbeticum volanensoides* Zone, the approximate time equivalent of the Fallauxi Zone). The index species of Vígh is referred here as *Simolytoceras* sp.

Lytogyroceras subbeticum (Olóriz, 1978) from the Volanense Zone of Hárskút HK-II section (Plate 17/2) was treated as a microconch form by Énay and Howarth (2019), however the authors figured the specimen under erroneous magnification.

A unique specimen – found in the debris of the creek below Hárskút, HK-II section by Prof. A. Galácz – is shown in Plate 19/6. This ammonite is ribbed on its very early ontogenetic stage, than it becomes smooth, has deep regular constrictions, and on a later stage it bears prorsiradiate dense ribbing again. Because of this ribbing it shows superficial similarities to *Virgatomorphites pseudorothpletzi* Sarti, 2017 but because of the ornamentation of its early ontogenetic stage it may represents a rare, big, adult *Lytogyroceras* – possibly a macroconch. The closest allay could be "*Simoceras*" *catrianum* Zittel, 1870.

Genus ***Simolytoceras*** Olóriz, 1978
Type species: *Simoceras* (*Simolytoceras*) *andaluciense* Olóriz, 1978

Simolytoceras was coined by Olóriz as the subgenus of *Simoceras*, but here we use it as a separate generic name. The term *Simolytoceras* was neglected, and seemingly put into the synonymy of *Lytogyroceras* by Énay & Howarth (2019). In the present paper the integrity of the genus is maintained and the concept outlined by Főzy (1988) was followed. As only few specimens are known belonging to this genus, therefore its systematic position cannot be clarified in a satisfactory way.

Attributed species of the Bakony fauna: *S. andaluciense* Olóriz, 1978, *S. volanensoides* Vígh, 1984, *S. vighi* Főzy, 1988. *Simolytoceras andaluciense* was described by Olóriz from the Burckhardticeras Zone (equivalent of Ponti and Volanense Zones) of the Subbetics. The Bakony specimen came from the Szilas Ravine, from the same stratigraphic level (i.e. Volanense Zone). *Simolytoceras volanensoides* may represent a macroconch and was described from Lókút, from a level equivalent of the Fallauxi Zone (Plate 18/2). Subsequent collecting yielded further specimens from Szilas Ravine and Hárskút, HK-II sections, from similar stratigraphic level. *S. vighi* (Plate 18/4) – a close ally of *S. admirandum* and *S. volanensoides* – is known also from the Falluxi Zone of the Hárskút, HK-II profile. It is known only by the holotype. An ammonite determined as *Simolytoceras* sp. (Plate 17/10) was collected from Lókút LH-II, possibly from the Volanense Zone.

Genus ***Simospiticeras*** Olóriz & Tavera, 1977
Type species: *Simospiticeras lojense* Olóriz & Tavera, 1977

Simospiticeras shares the morphological features of simoceratids and spiticeratids, therefore it may represent a link between the two groups. Klein (2005) placed the genus into Spiticeratinae within Olcostephanidae. We maintain the original concept of Olóriz & Tavera (1977) and *Simospiticeras* is regarded as the last representative of the family Simoceratidae. Extremely rare, therefore poorly known. It was described from the upper Tithonian of the Subbetics (Olóriz & Tavera 1977) and subsequently from the Apennines (Olóriz et al. 1993). The occurrence of the Bakony specimens widens the known geographic range of the genus.

The genus comprises only two species, i.e. *S. lojense* Olóriz & Tavera, 1977 and *S. cristatum* Olóriz & Tavera, 1977 both were recognised in the Bakony-fauna. These species are very close to each other and both of them were described from the base of the upper Tithonian. Accordingly the Bakony specimens (Plate 19/3, 4; 20/1, 2) which are from Hárskút and Lókút, were collected from the Microcanthum Zone.

Family Himalayitidae Spath, 1925

Origin of the family is uncertain, but many authors agree that the family can be characterized by its "typical Himalayitid ribbing" (Parent 2001) which may mean, according Énay & Howarth (2019), a developing of sharp ribbing with lateral tubercles or spines, and a usual presence of ventral groove or a smooth band.

Subfamily Himalayitinae Spath, 1925
Genus ***Himalayites*** Uhlig in Boehm, 1904
Type species: *Ammonites Treubi* Boehm, 1904

Regarding the genus *Himalayites*, according to Frau (pers. comm, 2021), there is no true *Himalayites* in the Mediterranean settings; however this needs further investigation on the basis of its type material. Besides two morphologically and stratigraphically very different groups of species [*H. kasbensis* (Pomel, 1889) from the Tithonian, and "*H." nieri* (Pictet, 1867) from the late Berriasian–Valanginian] are united in *Himalayites*, strongly suggesting the need of a wide taxonomic revision. These issues make this genus unreliable for stratigraphic purposes. Remarks on this genus were briefly summarized by Szives & Főzy (2022).

Specimens referred to genus *Himalayites* in previous works from the Bakony Mountains are re-interpreted and transferred either to *Retowskiceras*, *Malbosiceras* or to *Protacanthodiscus*. A very eroded and dissolved specimen documented from HK-II as *?H. kasbensis* (Horváth & Knauer, 1986, Szives & Főzy, 2022) is better to refer as ?*Malbosiceras*.

Genus ***Corongoceras*** Spath, 1925
Type species: *Corongoceras lotenoense* Spath, nom. nov. pro *Hoplites koellikeri* Haupt, 1907

As Parent et al. (2011) pointed out, *Corongoceras* was originally based on poor material probably of a juvenile specimen or a nucleus, and characterized by "strong ribs that widely spaced, concave forwards, arising from the umbilical wall, and elevated on the umbilical shoulder. Bifurcation is in the upper half of the flanks with secondaries as strong as the primaries" (Parent 2001). After careful examination of the type material, Parent et al. (2011) suggested to restrict this genus only to Andean forms. This revision has stratigraphical consequences as *Corongoceras* was established as a subgenus by Spath (1925) of a stratigraphically important genus, *Micracanthoceras* Spath, 1925. Afterwards, Wimbledon et al. (2013) suggested the classification of the „Mediterranean *Corongoceras*" into the genus *Ardesciella.*

Genus ***Ardesciella*** Bulot, Frau & Wimbledon, 2014
Type species: *Himalayites* (?*Corongoceras*) *rhodanicus* Mazenot, 1939

Bulot et al. (2014) formally described *Ardesciella* from Le Chouet section material (based on *Himalayites* (*C.*) *rhodanicus* Mazenot, 1939), indicating its stratigraphic distribution through the Microcanthum and Andreaei zones. *Ardesciella* is established on tiny, however extreme irregularly ribbed specimens which could belong to either *Micracanthoceras* or *Protacanthodiscus*. These specimens may represent the perisphinctid stage of both genera as its irregularity may fall into the wide intraspecific variation of both genera as demonstrated recently (Frau et al. 2015, 2016c), but this assumption needs detailed taxonomic arguments. According to Frau (pers. comm. 2021) a revision of the genus is in progress. The concept of *Corongoceras* was further developed by Parent & Garrido (2021), as an evolutionary model was proposed with a special interest with its relationship with *Ardesciella.* This genus is discussed by Szives & Főzy (2022).

In the Bakony material *Ardesciella rhodanica* Bulot et al. 2014 appears in the Microcanthum Zone of the Szilas Ravine (Plate 23/1); in the Fischeri Zone of the HK-12/a section (Plate 21/1) and in the Andreaei Zone of the HK–II section.

Genus ***Aulacosphinctes*** Uhlig, 1910
Type species: *Ammonites mörikeanus* Oppel, 1863

This genus was recently discussed by Frau et al. (2016c). Specimens are referred to genus *Aulacosphinctes* in previous works from the Bakony Mountains are re-interpreted and transferred to genus *Micracanthoceras*.

Genus ***Micracanthoceras*** Spath, 1925
Type species: *Ammonites microcanthus* Oppel in Zittel, 1868

Already Tavera (1985) recognized a high intraspecific variation of *M. microcanthum* (Oppel in Zittel, 1868) nevertheless he recognized several separate species occurring in the same time interval. *Micracanthoceras* Spath, 1925 can be characterised by bifurcate, even trifurcate ribs with tubercles in the furcation points, rounded venter with a smooth band. Relationship between *Micracanthoceras, Djurjuriceras* and *Himalayites* is not clarified; the latter two need the revision of type species. This genus was fully discussed and revised recently by Frau et al. (2016c); some remarks were given by Szives & Főzy (2022).

A huge and diverse population is documented by Szives & Főzy (2022) and hereby from the Bakony Mountains, where typical *M. microcanthum* individuals co–occur with potential large macroconchs. We support the opinion of Frau et al. (2016c) who pointed out dimorphism and wide intraspecific variation of *M. microcanthum.* However, recognized morphotypes (*moerikeanus, microcanthum, koellikeri, lamberti, symbolum*) are in use by us (see Szives & Főzy 2022) to make our determination more exact. The genus is present in great numbers from HK-II, Szilas Ravine, HK-12/a, Lókút LH-I and LH-II localities. Numerous *Micracanthoceras* specimens are figured in Plates 21–26, 28. Cross section and sutureline of a large, adult and seemingly complete *Micracanthoceras microcanthum* Oppel in Zittel, 1868) morph. *lamberti* (Roman, 1936) is given of Figure 6.

Genus ***Durangites*** Burckhardt, 1912
Type species: *Durangites vulgaris* Burckhardt, 1912

This genus was recently discussed by Frau et al. (2016c) and some remarks were added by Szives & Főzy (2022). Regarding the taxonomic concept proposed by Frau et al. (2015), we support their opinion as *Durangites* should be restricted to the Caribbean forms only. We need to emphasize here that in the Hungarian material at least two specimens of possible *Durangites* were found: one from the Andreaei Zone of HK-II bed 36 (Plate 23/10), the other is from debris of Rend-kő. Taking these findings in consideration, we may refine Frau et

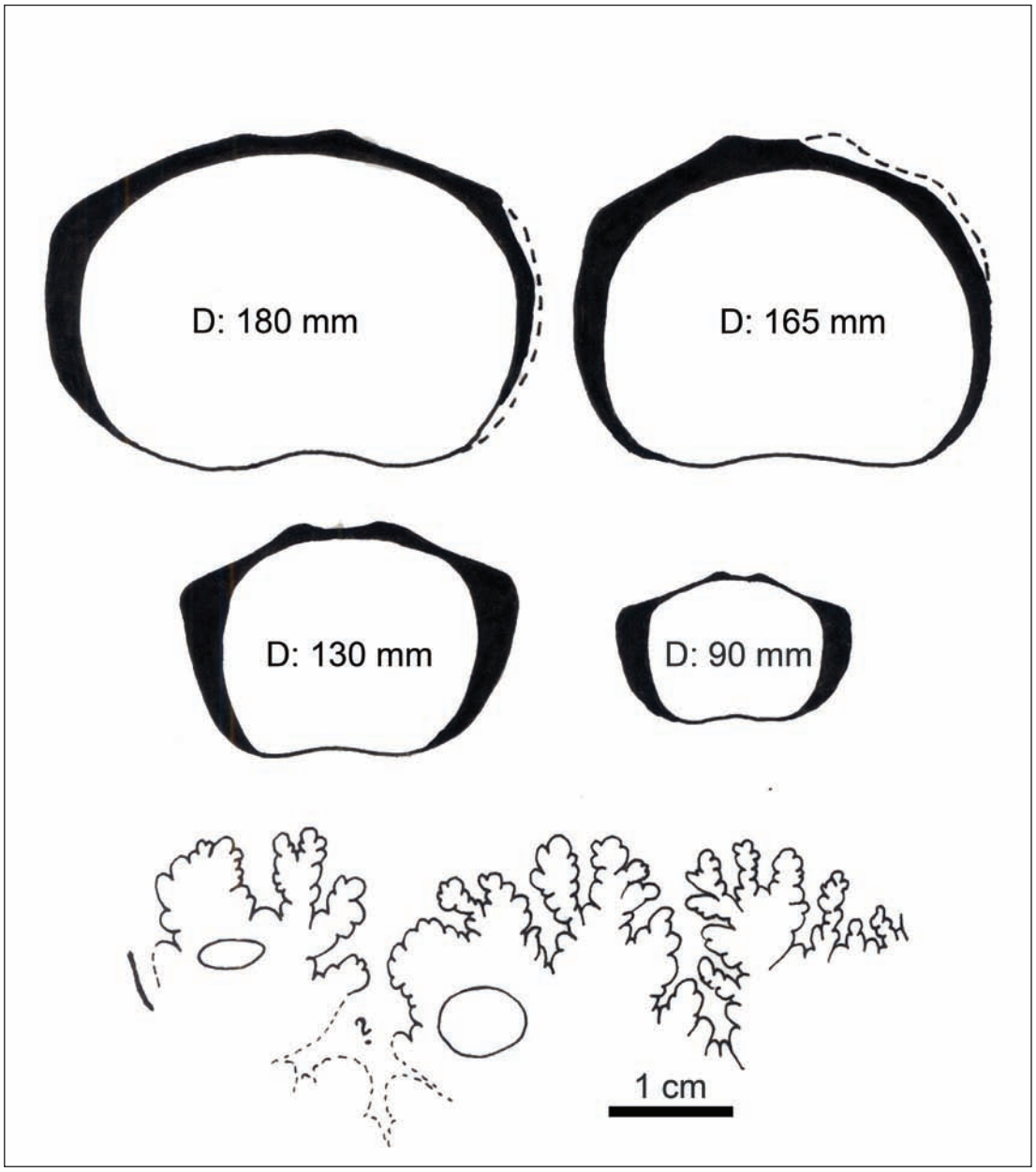


Figure 6 – Cross section and suture-line of *Micracanthoceras microcanthum* Oppel in Zittel, 1868) morph. lamberti (Roman, 1936)

The specimens (J.10309) is from Hárskút, HK-12/a section, bed 19, late Tithonian, Microcanthum Zone. The ammonite is shown on Plate 12/1a, 1b.

al. (2015) as *Durangites* may appear, however very rarely, in Old World assemblages as well. In the material at our disposal, one form from Szilas Ravine bear similar tuberculation as in *Durangites* (Szives & Főzy 2022, plate 5, fig 4a, b), but it is considered as a pathological or *janus* (Jattiot et al. 2019) himalayitid specimen with a strong deviation in ornaments along its peri–ventral margin.

Genus ***Kilianites*** Énay, Boughdiri, & Le Hégarat, 1998
Type species: *Kilianites canavarii* Énay, Boughdiri & Le Hégarat, 1998c

This trituberculated genus can be separated from the coeval *Protacanthodiscus* mainly by the presence of well-marked umbilical tubercles. Besides this feature, simple intercalatory ribs disappear at adult stage, and the ventral tuberculation is more prominent that in *Protacanthodiscus* (Énay et al. 1998). These authors suggested that *Protacanthodiscus* could be nominated as a possible ancestor, and *Kilianites* is not in connection with *Neocosmoceras*. *Kilianites* is known in uppermost Tithonian to lower Berriasian deposits.

The genus is rather rare in the Bakony Mountains. *Kilianites canavarii* Énay et al. 1998 occurred in the Andreaei Zone of the Szilas Ravine (Plate 24/3), in the Chaperi Zone of Lókút LH-II/I section and it is also known from grab samples from Hajag Hill (Plate 29/1, 2).

Genus ***Protacanthodiscus*** Spath, 1923
Type species: *Hoplites andreaei* Kilian, 1889

This genus was fully discussed and revised recently by Frau et al. (2016c); some remarks were given by Szives & Főzy (2022). The genus is present exclusively in the Andreaei Zone

deposits of the Bakony Mountains; *P. andreaei* (Kilian, 1889) known from HK-II, Szilas Ravine, HK-12/a, Lókút LH-II/I localities, and some specimens also collected from debris (Plate 25/3, 4, 7; 28/6).

Genus ***Simplisphinctes*** Tavera, 1985
Type species: *Himalayites* ?*abnormis* Roman, 1936

Only three specimens, possessing the typical, otherwise rare rursiradiate ribbing were found in the old collections of the Mining and Geological Survey of Hungary. One of them is *Simplisphinctes abnormis* (Roman, 1936), and the two others are referred as *S. sandovali* Tavera, 1984 (Plate 23/2, 3, 5). The fossils are from Bakonybél, Fekete Hill, and were collected as grab samples by Miksa Hantken, pioneer of the Hungarian geology. The genus is typical for the Simplisphinctes Zone of the Betic Cordilleras.

Genus ***Tithopeltoceras*** Arkell, 1953
Type species: *Aspidoceras moriconii* Meneghini, 1885

Tithopeltoceras parakasbensis Fallot & Termier, 1923 was documented from Hárskút, HK-12/a section, Microcanthum Zone. It is a fragmentary specimen which shows the wide venter and the very prominent tubercles on the ribs (Plate 23/4).

Genus ***Djurjuriceras*** Roman, 1936
Type species: *Djurjuriceras djurjurense* Roman, 1936

This genus and its type species were established by Roman (1936) on huge macroconch specimens from Algeria. Separation between *Micracanthoceras* Spath, 1925 from *Djurjuriceras* is based – due to our understanding – mainly on the occurrence of geminated ribs of the latter, mostly present on the phragmocone. Separation of *M. microcanthum* and *Djurjuriceras ponti* (Fallot & Termier, 1923) as two zonal indices of the late Tithonian (Hesselbo et al. 2020) also needs reconsideration in the light of the most recent revision of genus *Micracanthoceras* (Bulot et al. 2014). The genus is rather rare in the Transdanubian Range, occuring only at Hárskút HK-II and Lókút LH-I sections. A large specimen of *D. djurjurense* Roman, 1936 is figured from Microcanthum Zone of the HK-II section in Plate 27/1.

Genus ***Praedalmasiceras*** Frau et al., 2016
Type species: *Dalmasiceras spiticeroides* Djanelidzé, 1922

As Frau et al. (2016b) agreeably pointed out *D. spiticeroides* Djanelidzé, 1922, *D. progenitor* (Oppel, 1868), and *D. botellae* (Kilian, 1889) form a separated group from *Dalmasiceras*, and on the basis of their juvenile himalayitid stage they were assigned to the Himalayitidae establishing a new genus, *Praedalmasiceras*. Additional comments were recently added by Szives & Főzy (2022).

The genus is present in the Andreaei, Chaperi and Progenitor zone deposits of the Bakony Mountains, known from HK-II, Szilas Ravine, HK-12/a, Lókút LH-II/I localities, and some specimens also collected from debris at the Hárskút Közöskút Ravine. *Praedalmasiceras* specimens, including ?*P.* cf. *botellae*, *P. progenitor* and *P. spiticeroides* from the Bakony Mountains are illustrated in Plates 23 and 24.

In the Szilas Ravine section, *Praedalmasiceras* spp. appears together with *Elenaella*, and ranges upward.

Genus ***Hegaratites*** Boughdiri et al., 1999b
Type species: *Hegaratites rheouisensis* Boughdiri et al., 1999

Boughdiri et al. (1999) established *Hegaratites* from material coming from the "Durangites" Zone, Calpionellid A2 (now *intermedia*) Subzone of Central Tunisia, indicating „its morphological features shared by the late Tithonian *Durangites–Protacanthodiscus* and the early Berriasian *Dalmasiceras* (=*Praedalmasiceras* Frau et al. 2016b)". Relationships between *Hegaratites, Praedalmasiceras, Elenaella* and *Lopeziceras* need to be worked out still, as it was briefly discussed by Szives & Főzy (2022). It is possible that the figured specimens that were interpreted as dimorphic variations of *Hegaratites* in Boughdiri et al. (1999), actually represent two distinct genera, *Praedalmasiceras* and *Lopeziceras*. According to Frau (pers. comm., 2021), *Hegaratites* deviates from all known coeval Himalayitidae, especially in its sub–adult ribbing. However, *Hegaratites* has no known records outside Tunisia.

In our material, forms questionably assigned to *Hegaratites* sp. are documented through-

out the Andreaei Zone from Szilas Ravine and from the base of the Andreaei Zone at HK–II (Szives & Főzy 2022, pl. II, fig. 8). These specimens does not show the zigzag pattern and explicit tuberculation in ventrolateral morphology as of the type series mentioned above, although can be interpreted as a macroconch form with slender ornamentation. This may imply the idea that *Praedalmasiceras* may originated from *Hegaratites*. On the other hand, forms determined as ?*Hegaratites* sp. may belong to an extremely slender morphotype of *P. andreaei*. A specimen determined as ?*Hegaratites* sp. is shown in Plate 28/5.

Genus ***Lopeziceras*** Frau et al., 2016b
Type species: *Ammonites chaperi* Pictet, 1868

The introduction of a new generic name for the bituberculated latest Tithonian–earliest Berriasian *Malbosiceras* Grigorieva, 1938 was necessary since Le Hégarat (1973) demonstrated a morphologic and a stratigraphic gap between early and late Berriasian malbosiceratids. As a summary from Szives & Főzy (2022), *Lopeziceras* is the rightful name of this group over *Chapericeras* nom. nud. (Hoedemaeker 1981).

As it was demonstrated by Frau et al. (2016b, text–fig.1) and our Hungarian material supports, *Lopeziceras* reaches its greatest abundance in the same horizon with *E. cularense*, and both are coeval in the latest Tithonian on the current understanding of the T/B boundary. Relationship of the two genera needs to be investigated. *Lopeziceras chaperi* (Pictet, 1868) rather frequently occurs in the nominative Chaperi Zone (Szives & Főzy, 2022) of HK-II, HK-12/a, Szilas Ravine (Plate 28/7) and Lókút LH II/I sections.

Family Ataxioceratidae Buckman, 1921
Subfamily Ataxioceratinae Buckman, 1921
Genus ***Crussoliceras*** Énay, 1960
Type species: *Ammonites crussolensis* Fontannes in Dumortier & Fontannes, 1876

Crussoliceras is mostly recorded from the lower Kimmeridgian, with an acme in the uppermost Hypselocylum and Divisum zones of SE France, S Germany, Switzerland, Bulgaria, Spain, Hungary, Morocco and Russia(?) (Enay & Howarth 2019). It is uncertain whether the younger species (*Perisphinctes atavus* Schneid, 1915 and related forms) from the Acanthicum and Pseudomutabilis zones (Eudoxus Zone s. l.) of S Germany and SE France belong to *Crussoliceras*. These occurrences need revision on the basis of new, bed-by-bed collected specimens.

The following species were attributed to genus: *C. crusoliense* (Fontannes in Dumortier & Fontannes, 1876), *C. acer* (Neumayr, 1873), *C. aceroides* (Geyer, 1961), *C. geyeri* Sapunov, 1979, *C. tenuicostatum* Geyer, 1961, *C. divisum* (Quenstedt, 1888). *C. aceroides* (Geyer) could be a junior synonym of *C. acer* (Neumayr). In the Bakony fauna *C. acer* (Neumayr) from Lókút and from Páskom Hill (Plate 30/2, 32/3) represents the genus. The species was already described by Főzy & Scherzinger (2013a) from the Gerecse Mountains, Hungary.

Genus ***Progeronia*** Arkell, 1953
Type species: *Perisphinctes progeron* v. Ammon, 1875

In current literature *Progeronia* represents a conglomerate of different genera from different faunal provinces across different continents. The *sensu stricto Progeronia* Arkell, 1953 and its microconch counterpart *Hugueninsphinctes* Atrops, 1982 have their distribution from the very late early Kimmeridgian (higher part of the Divisum Zone) till the early late Kimmeridgian (Acanthicum Zone) in S Germany, N Switzerland, Poland and SE France (Énay & Howarth, 2019). Énay & Howarth (2019) also attributed specimens from Russia; however these ammonites need a revision. Here we count the following species to the *Progeronia/Hugueninsphinctes* dimorphic group: *Progeronia progeron* (v. Ammon, 1875), *Progeronia* (*Hugueninsphinctes*) *breviceps* (Quenstedt, 1887), *Progeronia* (*Hugueninsphinctes*) *ernesti* (de Loriol, 1877). There is also another group of coarser-ribbed perisphinctids of the *digitatus*-group (e.g. *Perisphinctes digitatus* Schneid, 1915) in the Submediterranean Province which was attributed tentatively to *Progeronia* by Schlegelmilch (1994). In our opinion these ammonites represent a separate genus.

Further *sensu lato* "*Progeronia*" from the Mediterranean Province were published by Choffat (1893) from Portugal; unpublished very similar ammonites from East-Africa (Kenya) need a fundamental revision (G. Schweigert, pers. comm.).

Some relatively well-preserved specimens from Páskom Hill are figured here as *P. vandelli* (Choffat, 1893), *P. pseudolictor* (Choffat, 1893) and *Progeronia* sp. in Plate 30/1, 3, 4, 6. Similar forms also exist in the Lókút fauna (Plate 33/6). Latter specimen is very close to

those ammonites figured by Schlampp (1991, plate 9, figs. 5, 6) under the name *Progeronia* (*Huguenisphinctes*) cf. *eggeri* (v. Ammon) and *Progeronia* (*Huguenisphinctes*) sp. The Lókút specimen is also close to *P. triplex* (Quenstedt, 1888) *sensu* Sarti (1993). A detailed study on the entire genus, based on better specimens is badly needed.

Genus ***Trapanesites*** Olóriz, 2002
Type species: *Perisphinctes adelus* Gemmellaro, 1872

This poorly known genus represents a typical Mediterranean group of ammonites with distribution mainly in the late Kimmeridgian – very likely within the Cavouri and Beckeri zones. All of the described specimens belong to the species of Gemmellaro, or at least they are very close to it.

Till today only few ammonites of the species *Trapanesites adelus* (Gemmellaro, 1872) were figured in literature. It was reported from Sicily (Gemmellaro 1872, 1882, Christ 1960, Olóriz 2002b), from the Trento region (Sarti 1988, 1993). The Bakony specimens were collected at Lókút (Plate 32/2, 5).

Olóriz (2002b) and also Sarti (2020) suggested that *Trapanesites* still exist in the lowermost Tithonian beds (in the lower Hybonotum Zone); perhaps these younger forms may represent a new, still undescribed form. Sarti (2020) mentioned this form under the name *Trapanesites* aff. *robustus* (Spath, 1931).

Énay & Howarth (2019) included the European and Mexican *Torquatisphinctes* Spath, 1924 into the genus *Trapanesites.* Here we disagree with this opinion because the German "*Torquatisphinctes*" from the Hybonotum Zone of Swabia and Franconia published by Ohmert & Zeiss (1980) and Schairer & Barthel (1981) belong either to *Subplanites* Spath, 1925 or represent the inner whorls of *Hoelderia* Ohmert & Zeiss, 1980. The Mexican specimens need a revision.

Subfamily Lithacoceratinae Zeiss, 1968
Genus ***Lithacoceras*** Hyatt, 1900
Type species: *Ammonites ulmesis* Oppel, 1858

Numerous lithacoceratid perisphinctids with extremely wide geographical distribution were lumped together as one genus (i.e. *Lithacoceras*) by Énay & Howarth (2019). It is very likely that the referred occurrences from Somalia, India (Kutch), Japan or Argentina are only due to homeomorphy. In our opinion the genus *Discosphinctoides* Olóriz, 1978 does not belong to *Lithacoceras*. Its type specimen (*Perisphinctes roubyanus* Fontannes, 1879) represents a microconch, typical for a group of perisphinctids which are frequent during the Acanthicum and Pseudomutabilis Zone in the late Kimmeridgian of S Germany and SE France (our own observations). This ammonite needs a fundamental revision. On the other hand we agree with Énay & Howarth (2019) that the type species of *Pseudodiscosphinctes* Olóriz, 1978, i.e. *Perisphinctes ardescius* Fontannes, 1876, represents a true *Lithacoceras*. This ammonite is known from the Moernsheimense Subzone of the early Tithonian Hybonotum Zone of the Crussol section (SE France) (Hölder & Ziegler 1959), and is also reported from Bulgaria (Sapunov 1979).

Further true representatives of the genus can be found in the late Kimmeridgian (Beckeri Zone, Ulmense Subzone) and early Tithonian (Hybonotum Zone) of S Germany (Berckhemer & Hölder 1959, Ohmert & Zeiss, 1980) and SE France (Hölder & Ziegler 1959) in the early Tithonian (Hybonotum Zone) of the Gerecse Mountains, Hungary (Főzy & Scherzinger 2011, 2013b), in the Trento region (Sarti 2020) and in Spain (Olóriz 1978). Herein we report *Lithacoceras fasciferus* (Neumayr, 1873) from the condensed beds of Páskom Hill (Plate 30/5).

Genus ***Subplanites*** Spath, 1925
Type species: *Perisphinctes (Virgatosphinctes) reisi* Schneid, 1914

The genus is known from the Hybonotum Zone and comprises the presumed microconchs of *Euvirgalithacoceras* Zeiss, Schweigert, & Scherzinger 1996. It was reported from S Germany (Ohmert & Zeiss 1980), SE France, the Calanda area of SE Spain (Finkel 1992, Scherzinger et al. 2006), and from Bulgaria (Sapunov 1979).

Numerous specimens, including *Subplanites* cf. *moernsheimensis* (Schneid, 1914), *Subplanites postrueppellianum* (Ohmert & Zeiss, 1980) were reported from the Gerecse Mountains, Hungary (Főzy & Scherzinger 2013b). Here we illustrate a single fragment from the condensed beds of Páskom Hill as *Subplanites* sp. (Plate 32/1).

Genus ***Pseudodiscosphinctes*** Olóriz, 1978
Type species: *Perisphinctes ardescius* Fontannes, 1879

We agree with Énay & Howarth (2019) that the type species of *Pseudodiscosphinctes* Olóriz, 1978 presents a true *Lithacoceras* (see above), which is characteristic for the early Tithonian Hybonotum Zone. For morphologically closely allied forms, known from higher levels of the early Tithonian (from the Fallauxi and Semiforme zones) the introduction of a new generic name would be an appropriate solution instead of the use of quotation marks. In the Bakony Mountains "*Pseudodiscosphinctoides" rhodaniforme* Olóriz, 1978, and close forms identified as "*Pseudodiscosphinctoides"* sp. were documented from Szilas Ravine, Lókút and Hárskút sections (Plate 34/6, 35/5, 8). A more evolute form i.e. "*Pseudodiscosphinctoides" chalmasi* (Kilian, 1889) is common in the lower Tithonian of the Gerecse Mountains (Főzy & Scherzinger 2013a).

Genus ***Subplanitoides*** Zeiss, 1968
Type species: *Subplanitoides waltheri* Zeiss, 1968

The genus *Subplanitoides* s. str. Zeiss, 1968 represents microconchs of *Usseliceras* Zeiss, 1968 in the Submediterranean Province. It is known from the early Tithonian Mucronatum Zone of S Germany and SE France. Sarti (2017) established for the Mediterranean group of morphologically close ammonites (i.e. "false" *Subplanitoides*) the genus *Pseudosubplanitoides*. Unfortunately the author placed also *Subplanitoides schwertschlageri* Zeiss, 1968, *Paraberriasella oppeli* (Zeiss, 1968) and *Subplanitoides spindelense* Zeiss, 1968 into this genus. However these ammonites are either true *Subplanitoides* or true *Paraberriasella*, so we use the generic name introduced by Sarti for these Semiforme and Fallauxi Zone forms between quotation marks. In the Bakony Mountains „*Subplanitoides*" *pouzinensis* (Toucas, 1890) occurred in the Hárskút II section (Plate 36/1, 37/5). The same form also was documented in the Gerecse Mountains (Főzy & Scherzinger 2013b). Another specimen, „*Subplanitoides*" sp. is figured here from Lókút (Plate 35/7).

Some ammonites described as "*Subplanitoides*" from the Semiforme and Fallauxi Zone of the Mediterranean Province (Cecca & Énay 1991), are the supposed microconchs of early *Ernstbrunnia* Zeiss, 2001.

Genus ***Dorsomorphites*** Sarti, 2017
Type species: *Ammonites exornatum* Catullo, 1853

Zeiss (1968) erected the genus *Danubisphinctes* for a group of early Tithonian perisphinctids which occur in the Submediterranean province. Morphologically close forms in the Mediterranean province were named as „*Danubisphinctes*" (Scherzinger et al. 2010, Főzy & Scherzinger 2013b.) For this group of ammonites a new generic name (i.e. *Dorsomorphites*) was introduced by Sarti (2017). He also placed "*Dorsoplanitoides*" *broilii* (Schneid, 1915), an ammonite from Unterhausen near Neuburg, Franconia, into another new genus; *Virgatomorphites*; however the dense, bifurcate ribs on the innermost whorls of this ammonite are not typical for the latter genus. The revision of the lower Tithonian ammonite fauna from Neuburg is in progress (Scherzinger & Schweigert, in prep.). From the Bakony fauna *Dorsomorphites selectus* (Neumayr, 1873) from Hárskút, HK-II section is figured in Plate 37/1; another specimen indentified only on generic level is shown in Plate 37/2.

Genus ***Kutekiceras*** Zeiss, 2001
Type species: *Perisphinctes pseudocolubrinus* Kilian, 1895

The genus *Kutekiceras* was introduced by Zeiss (2001) on the basis of early Tithonian ammonites from Ernstbrunn, Austria. The author mentioned the occurrence of the genus also from the middle and higher part of the Tithonian from Czech Republic, Spain, Morocco and Hungary. The middle-sized, lappeted *Kutekiceras* may represent the microconch pair of *Blaschkeiceras* Zeiss, 2001, figured here in Plate 34/2.

Énay & Howarth (2019) included *Kutekiceras* into *Biplisphinctes*, Olóriz, 1978. However, the type specimen of the type species of *Biplisphinctes*, i.e. *Perisphinctes cimbricus* Neumayr, 1873, could be a Kimmeridgian form, as proposed by Neumayr (1873), Olóriz (1978) and Schlögl & Zorn (2012, with refiguration of the type specimen and references therein). Indeed, also in the higher part of the Kimmeridgian Pseudomutabilis Zone of SW Germany there are very similar perisphinctids together with *Mesosimoceras cavouri* (see: Scherzinger et al. 2016, and Scherzinger & Schweigert, in prep).

The Hungarian specimens form the Semiforme Zone of the Bakony Mountains shown in Plates 33 and 34, and those figured by Főzy & Scherzinger (2013b) from the Fallauxi Zone of the Gerecse Mountains, are very close to the type species *Kutekiceras pseudocolubrinum* (Kilian, 1895). It seems that the microconchiate morphology of these ammonites change very slowly during time.

Genus ***Blaschkeiceras*** Zeiss, 2001
Type species: *Perisphinctes (Aulacosphinctes) schoepflini* Blaschke, 1911

The genus may represent the macroconch pair of *Kutekiceras* Zeiss, 2001. In the Bakony sections micro- and macroconchs occur in the same level. A coarsely ribbed fragmentary specimen (*Blaschkeiceras* sp.) from the Semiforme Zone of the Szilas Ravine is figured in Plate 34/2. It is supposed that *Blaschkeiceras* and *Kutekiceras* may represent the route towards the *Ernstbrunnia*/*Oloriziceras* dimorphic pair, which is typical for the middle and higher part of the Tithonian of the Mediterranean Province.

Subfamily Richterellinae Sapunov, 1977
Genus ***Richterella*** Avram, 1974
Type species: *Ammonites richteri* Oppel, 1865

The systematic position of *Richterella* was recently overviewed by Vašíček & Skupien (2014). The authors clearly pointed out that dimorphism exists within the genus and refuted the earlier theory of Avram (1974) and Zeiss (2001), i.e. *Richterella* includes microconchs of *Lemencia*. *Richterella richteri* (Oppel, 1865), index species of the Richteri Subzone, marks the lower part of the Fallauxi Zone. In the Bakony fauna, *R. richteri* was observed at Sümeg (Plate 35/2) and also in the Hárskút, Édesvízkút-1 section (Plate 37/6). The latter specimen is an adult, nearly entire macroconch, very similar to that illustrated from the Gerecse (Főzy & Scherzinger 2013a).

Subfamily Paraulacosphinctinae Tavera, 1985
Genus ***Paraulacosphinctes*** Schindewolf, 1925
Type species: *Ammonites senex* Oppel, 1865

Tavera (1985) discussed this genus in details, but basically *Paraulacosphinctes* has oxycone shell with isocostate ornamentation and a smooth ventral band. Tavera (1985) also introduced four new allied genera, *Andalusphinctes*, *Moravisphinctes*, *Neoperisphinctes* and *Zittelia*. Differences between *P. senex*, *P. senoides* and *P. transitorius* are discussed by Tavera (1985) and recently some remarks were added by Frau et al. (2016b).

The genus is present in great numbers in the Microcanthum Zone deposits of Bakony Mountains, known from HK-II, HK-12/a, Szilas Ravine, Lókút LH-I and II/I sections, and some specimens were also collected from debris. *Paraulacosphinctes* specimens from the Bakony are illustrated in Plates 34, and 38.

Genus ***Moravisphinctes*** Tavera, 1985
Type species: *Ammonites moravicus* Oppel in Zittel, 1868

The morphological similarity of *Moravisphinctes* to *Paraulacosphinctes* was already mentioned by Tavera (1985), but *Moravisphinctes* is more platycon, its ribbing fades away on the body chamber and the ornamentation show a sharp change between midflank and outer flank (Tavera, 1985). Now it is widely accepted (Parent 2003, Bulot et al. 2014) that *Moravisphinctes* is the microconch of *Paraulacosphinctes*, since Cecca et al. (1989) first proposed it. The restricted stratigraphical occurrence of *M. fischeri* led Wimbledon et al. (2013) to propose Fischeri Subzone as a distinct stratigraphical subunit. This idea was critically discussed by Szives & Főzy (2022).

The genus is also present in the upper Transitorius subzone deposits of Szilas Ravine (Plate 35/1) besides the upper Microcanthum Zone (Fischeri Subzone) of HK-12/a (Plate 35/4), and the Fischeri Subzone of Lókút LH-I localities.

Genus ***Zittelia*** Tavera, 1985
Type species: *Ammonites eudichotomus* Zittel, 1868

This genus comprises platycon forms with equidimensional cross section and isocostated, dense ribs. Constrictions appear sometimes; besides the ventral smooth band is less marked than at *Aulacosphinctes* Tavera, 1985. According to Tavera (1985), *Zittelia* is originated from *Oloriziceras* Tavera, 1985. In the Hungarian material, *Oloriziceras* is clearly restricted to the lower third of the Microcanthum Zone. ?*Zittelia* is known from the Microcanthum Zone of the HK-II section.

Genus ***Ernstbrunnia*** Zeiss, 2001
Type species: *Ernstbrunnia bachmayeri*, Zeiss, 2001

The genus includes macroconchiate perisphinctids originally described from the lowermost upper Tithonian of the Ernstbrunn Quarry (Lower Austria) collected without precise stratigraphic control.

In the Hungarian material *Ernstbrunnia densecostata* Tavera, 1985 was found in Szilas Ravine, in the Microcanthum Zone (Plate 38/3). The genus was recorded also in the Hárskút, HK-II section. The type species was documented from the Gerecse Mountains.

Genus ***Oloriziceras*** Tavera, 1985
Type species: *Oloriziceras salarensis* Tavera, 1985

The genus was established by Tavera (1985) on the basis of the greater size, flattened flanks, shallower umbilicus, more regular ribbing, less sinuous ribs, and less numerous polygirate ribs. *Oloriziceras* can be separated from *Lemencia* by these characters, plus ribs cross the venter uninterruptedly at *Oloriziceras*. Tavera (1985) have noticed that *Oloriziceras* is frequent in the Simplisphinctes Zone, equivalent of the lower Microcanthum Zone. Other Mediterranean occurrences (*sensu* Cecca 1999) support its restricted stratigraphical distribution, so Sarti (2020) proposed *O. magnum* as a subzonal index form of the lower Microcanthum Zone, as Magnum Subzone to replace the Simplisphinctes Zone.

Oloriziceras is present also in the Hungarian material with a limited stratigraphic distribution, so we support its stratigraphical index status. The genus occurs at HK-II, HK-12/a and Lókút LH-I and LH-II sections (Plate 35/3; 37/3, 4; 38/2). Énay & Howarth (2019) treated *Oloriziceras* as macroconch of *Ernstbrunnia*.

Genus ***Pseudosubplanites*** Le Hégarat, 1971
Type species: *Pseudosubplanites berriasensis* Le Hégarat, 1973

In its original generic concept, Le Hégarat (1973, p. 31) clearly stated the absence of a smooth band or groove on the venter as an indicative feature of the genus. As the concept of Klein (2005), who treated this genus as a subgenus of *Berriasella*, this is in contradiction with the original description, so we do not support Klein's view. As it was discussed by Szives & Főzy (2022) for *Berriasella* and *Hegaratella,* presence or absence of a smooth ventral band is a crucial feature of distinguishing particular genera. In accordance with this view the three genera have to be treated as different. It is suggested that *Hegaratella* is a microconch form of *Pseudosubplanites,* as it was proposed by Klein (2005), however in the Hungarian material these forms have slightly different stratigraphic occurrence. For further discussion see Szives & Főzy (2022).

The genus is restricted to the former "Jacobi" and Grandis Zones according to Le Hégarat (1973, p. 32). In the Hungarian material it appears in the late Tithonian Chaperi Zone of Szilas Ravine and Lókút LH-II/I sections, also occurs in the Progenitor and Grandis zone of HK-II, HK-12/a section. A specimen of *P.* cf. *grandis* (Mazenot, 1939) is shown in Plate 38/6. The form described by Vígh (1984, p. 75, pl. IV, fig. 1) as *Pseudosubplanites bakonyensis* nov. sp. is most likely a *Pseudargentiniceras* sp.

Ataxioceratidae incertae sedis

A well-preserved large ammonite in Plate 31/1, was identified as "*Perisphinctes*" *polyplocus* sensu Neumayr, 1873 non Reinecke, since it shows similarity to the specimen from Gyilkos-kő (Romania) illustrated somehow inaccurately by Neumayr (1873, plate 34/2). Similarly ribbed ammonites are known from the highest part of the Cavouri Zone or Beckeri Zone, however the Páskom Hill specimen lacks precise stratigraphic position. Close – but not identical – forms were also published by Choffat (1893) from the Kimmeridgian of Portugal. The Páskom Hill specimen albeit incomplete, contains a small portion of the body-chamber as well; forasmuch the last septa are not crowded, it is still a sub-adult ammonite.

The ammonite illustrated as Ataxioceratidae sp. from the lower Tithonian Darwini Zone of the HK-II section sp. (Plate 36/2) could be an "*Usseliceras*" (see also the notes on *Subplanitoides*). Microconchiate *Pseudosubplanitoides* species described from similar stratigraphic levels from the Southern Alps by Sarti (2017) could be close forms.

Family Olcostephanidae Haug, 1910
Subfamily Spiticeratinae Spath, 1924
Genus ***Proniceras*** Burckhardt, 1919
Type species: *Ammonites pronus* Oppel in Zittel, 1868

Recently Parent et al. (2011) examined and refigured the lectotype of *A. pronus* and revealed the differences between the lectotype and the Mexican species. According to these authors, the lectotype "shows the development of stout, rounded moderately elongate umbili-

cal tubercles from about D=15 mm, which are retained up to the end of the last preserved whorl without signs of any kind of lateral tubercles. The shell is compressed, moderately involute, covered by sheaves of ribs branching from the tubercles. Ventral ribbing is strong and dense, projected forward forming a chevron. These features fit with the diagnosis of *Negreliceras* Djanélidzé, 1922 given by Wright et al. (1996, p. 43)." We can add nothing to this accurate diagnosis. Furthermore, they mention "The *Proniceras* of Burckhardt are early late Tithonian in age (Callomon 1992) and they seem to conform the earliest part of the lineage leading to *Negreliceras* and most likely also to *Spiticeras* Uhlig, 1903 (including *Kilianiceras* Djanélidzé, 1922)".

Our Hungarian material confirms the age suggested by Callomon (1992). At Lókút, LH-II section, *Proniceras* sp. co-occurs with *M. microcanthum* and several *Paraulacosphinctes* specimens. During a new collecting campaign at the Hárskút, HK-12/a section, a ?*Proniceras* specimen was found together with *M. microcanthum* in the same bed, so our results confirmed that the genus is present from the early late Tithonian. As Frau et al. (2016b) summarized, the exact age of the type specimen of *Proniceras* remains unclear, although it was assumed as late Tithonian.

Genus ***Spiticeras*** Uhlig, 1903
Type species: *Ammonites spitiensis* Blanford, 1864

The genus *Spiticeras* was established by Uhlig (1903) on the basis of specimens from the Spiti Shales, India. Our efforts to examine the type series are failed, so there are no modern investigations on the genus. Djanelidzé (1922) examined the *Spiticeras* of Southern France, and he concluded on the morphologic features of the generally inflated, evolute genus as "ribs often ramified, inclined forward, often interrupted or weakened on the siphonal wall, where they form "chevrons" or arches with anterior convexity". Already Uhlig (1903), later Djanelidzé (1922) paid attention to the different ontogenetic stages of the genus as "On the other hand, it results with evidence from the comparative study of development in Tithonian and Berriasian species that the "bituberculate stage" is a cenogenetic character acquired during phylogenic evolution" - wrote Djanelidzé (1922).

By now, numerous species names are used in the literature and the entire Spiticeratinae requires full revision. The genus is very frequent in the Hungarian material, especially in the late Tithonian–Berriasian part of the Hárskút, HK-12 section, where almost a hundred specimens were collected. The most frequent is *S.* cf. *gevreyi* Djanelidzé, 1922 (Plate 39/5). Many of the larger specimens were identified as *S.* cf. *mutabile* Djanelidzé, 1922 (Plate 39/7); further recognized species are: *S.* cf. *paranegreli* Djanelidzé, 1922 (Plate 39/1), *S.* cf. *kiliani* Djaneidzé, 1922 (Plate 39/3; 40/16), *S*. cf. *subnegreli* Djanelidzé, 1922 (Plate 40/13).

Subgenus ***Kilianiceras*** Djanélidzé, 1922
Type species: *Stephanoceras Damesi* Steuer, 1897

Kilianiceras was established by Djanelidzé (1922) on quite poor grounds as "Le groupe de *Spit. Damesi*, pour lequel j'établis le sous-genre *Kilianiceras*, constitue une série indépendante de formes dont l'aspect très spécial a été souvent remarqué." Here we follow Énay & Howarth (2019) who treat *Kilianiceras* as a subgenus of *Spiticeras*, in contrast to the view of Klein (2005).

On the basis of our Hungarian material from Hárskút, HK-12 section beds 10, 16 and 17, we support the stratigraphic observation of Aguado et al. (2000), Wippich (2002, 2003) and Ettachfini et al. (2004) as *K. gratianopolitense* (Kilian, 1891) marks the topmost Alpillensis and the basal Pertransiens Zone. Therefore, the genus is latest Berriasian and early Valanginian age, present only in the HK-12 section (Plate 39/4, 6).

Subfamily Olcostephaninae Haug, 1910
Genus ***Olcostephanus*** Neumayr, 1875
Type species: *Ammonites astierianus* d'Orbigny, 1840

Since the genus has a distribution in the early Valanginian–early Hauterivian which is scarcely represented in the Bakony Mountains, *Olcostephanus* is rare in the studied sections. The only exception is the Hárskút, HK-12 section which yielded a rich late Valanginian assemblage, including *O. drumensis* (Kilian, 1910), *O. stephanophorus* (Matheron, 1878), *O. guebhardi* (Kilian, 1902); which are illustrated in Plates 39 and 40. Especially common is *O. drumensis*, which shows a great morphological variability and is represented by numerous fully-grown specimens. The strongly depressed *O. stephanophorus* is a rare, but easily recognizable ammonite represented by a single specimen at Hárskút HK-12 section. It appears in the late Pertransiens Zone (Bulot & Autran 1989),

which fits with its stratigraphical position in the HK-12 section.

The ammonite identified as *O.* cf. *hispanicus* (Mallada, 1887) in the Eperkés Hill site (Plate 39/2) has a special importance, since it is one of the very few fossils from the section, suggesting that a thin Lower Cretaceous can be documented in the profile.

In contrast to the Bakony Mountains, *Olcostephanus* is rather common in the northeastern part of the Transdanubian Range (in the Gerecse Mountains), where Valanginian and Hauterivian is represented by a thick siliciclastic succession (Főzy & Janssen 2009).

Genus ***Jeannotticeras*** Thieuloy, 1965
Type species: *Ammonites Jeannotti* d'Orbigny, 1841

Jeannoticeras is a densely ribbed olcostephanid, representing probably the upper part (i.e. the Jeannoticeras jeannoti Subzone) of the Hauterivian Crioceratites loryi Zone. A single specimen of *J.* cf. *jeannoti* (d'Orbigny, 1840) was collected from the Eperkés Hill, Stripe Pit (Plate 41/1). It confirms the presence of the Lower Cretaceous in the very condensed section.

Genus ***Valanginites*** Kilian, 1910
Type species: *Ammonites nucleus*, Roemer, 1841

Valanginites is a rare element of the Bakony fauna. Only two, slightly flattened densely and delicately ribbed *V.* cf. *bachleardi* (Sayn, 1889) specimens were found near Hárskút (HK-123 and Hárskút, Édesvíz Key Section) in the Valanginian (Plate 40/7, 8). It may relate to the fact, that Valanginian deposits and fossils are generally rare all over the region.

Family Holcodiscidae Spath, 1923

Although the stratigraphic distribution of different holcodiscids is not full known, representatives of the family play an important role in the early Barremian biostratigraphy. Even the basal Barremian zone (i.e. *Taveraidiscus hugii* Zone) is based on a holcodiscid ammonite. In the Bakony Mountains only two sections yielded early Barremian holdodiscids. A specimen identified as *Taveraidiscus* cf. *intermedius* (d'Orbigny, 1840) (Plate 41/8) may indicate the presence of basal Barremian (Hugii Zone) and another one, identified as *Holcodiscus* aff. *caillaudianus* (d'Orbigny, 1850) (Plate 41/9) might come from an even higher level, probably from the Compressisima Zone). The two ammonites came from the same layer: bed 4 of the Hárskút, Édesvíz Key Section. However the field notes of the onetime collecting campaign provided no precise thickness data for the topmost five beds of the section, therefore the precise stratigraphic position of these two ammonites cannot be clarified. Some other, poorly preserved fossils from the same section were identified as *Astieridiscus* sp. Holcodiscidae spp.

Among the old collection of Márvány Quarry cephalopods another dubious holcodiscid was found (Plate 41/10). It was not labelled, therefore its precise provenance is uncertain, however it suggests early Barremian age.

Family Neocomitidae Salfeld, 1921

The subdivision of Neocomitidae into three, or more recently into four subfamilies (e.g. Spitidiscinae Vermeulen & Thieuloy, Berriasellinae Spath, Neocomitinae Salfeld and Endemoceratinae Schindewolf) is highly hypothetical (Company 1987, p. 103), therefore need further study. In spite of all uncertainties, Klein (2005) kept these subfamilies separate. As here we cannot doubt or support either option, we follow the system used by Klein (2005).

Subfamily Spitidiscinae Vermeulen & Thieuloy, 1999
Genus ***Jeanthieuloyites*** Cooper, 1981
Type species: *Rogersites quinquestriata* Besaire, 1936

The genus shares the morphological characteristics of different families; for this reason its systematic position is uncertain. Vašíček (2002) placed it into Holcodiscidae, but we follow the systematics of Klein (2005) and we place it into Neocomitidae.

Jeanthieuloyites is common in the Lower Cretaceous of the Gerecse Mountains (Főzy & Janssen 2009, Főzy 2017) but rare in the Bakony Mts. The only two specimens were collected from the Borzavár Road Quarry (Plate 41/18, 19). They were determined only on generic level, and suggest the possible Hauterivian age of the rocks there.

Subfamily Berriasellinae Spath, 1922
Genus ***Berriasella*** Uhlig, 1905
Type species: *Ammonites privasensis* Pictet, 1867

This genus is briefly discussed by Szives & Főzy (2022). *Berriasella* Uhlig, 1905 was based on the middle Berriasian *Ammonites privasensis* as figured by Pictet (1867), giving diagnostic value to the „presence of rib interruption on the venter". A century later, Nikolov & Sapunov (1977) established *Hegaratella* as a distinct genus incorporated into the subfamily Pseudosubplanitinae together with *Pseudosubplanites* and *Substeueroceras*. According to the original descriptions (Nikolov & Sapunov 1977), the three genera share diagnostic features as „bifurcating ribs which cross the venter uninterruptedly, no trifurcation occurs". This statement indicates the main difference being the presence (*Berriasella*) or absence (*Hegaratella*) of a smooth ventral band. Klein (2005) considered (although without giving any explanation) *Hegaratella* as the microconch of *Pseudosubplanites*. Our material of these two genera is too scarce to prove or discard this opinion.

Berriasella is rather common in the Hungarian material especially in Berriasian deposits from the Progenitor to the Grandis Zones (Hárskút HK-12 section), although first specimens occur in the Chaperi Zone (HK-12/a, HK-II section). Among the recognized species in the Bakony sections are: *B. privasensis* (Pictet, 1867) (Plate 42/3, 4; 45/1, 2; 46/5), *B. oppeli* (Kilian, 1889) (Plate 42/5) and *B. callisto* (d'Orbigny, 1847) (43/5).

Genus ***Pseudoneocomites*** Hoedemaeker, 1982
Type species: *Hoplites occitanicus* Retowski, 1893

Hoedemaeker (1982) recognized that *Neocomites suprajurensis* Mazenot, 1939, *Neocomites allobrogensis* Mazenot, 1939, *Neocomites beneckei* Roman & Mazenot, 1937, and *Delphinella tresannensis* Le Hégarat, 1973 form a group of late Tithonian ammonites separated from *Neocomites*, so these forms were united into a new genus, *Pseudoneocomites*. After a long debate on its validity (for details see Frau et al. 2016b), Szives & Főzy (2022) considered *Pseudoneocomites* as a valid genus on nomenclatural grounds. Although, it may need further study, but due to the correct designation the name is valid according to the ICZN.

In the Hungarian material, the genus – represented by *P. allobrogensis* –, is restricted to the upper Andreaei Zone of Hárskút HK-12/a and Szilas Ravine sections; one specimen is illustrated in Plate 25/1.

Genus ***Malbosiceras*** Grigorieva, 1938
Type species: *Ammonites malbosi* Pictet, 1867

Designation of this genus was based on the presence of two, an umbilical and a lateral rows of tubercles, where ribs bi- or trifurcate from the lateral ones. However, different "*Malbosiceras* groups" with two row of tubercles have already been recognized since Mazenot (1939). Due to the concept of Frau et al. (2016c), *Malbosiceras* and *Lopeziceras* have no connection to each other. Nevertheless, in contrast to the observations of Le Hégarat (1973), our abundant Hungarian material suggests a continuous presence of bituberculated forms throughout the Berriasian and does not confirm a stratigraphical gap between *Lopeziceras* and *Malbosiceras* as suggested by Le Hégarat (1973, p. 83). Besides, a complete taxonomic chaos had evolved around Berriasian bi- and tituberculated neocomitid ammonites, namingly *Malbosiceras*, *Mazenoticeras* Nikolov, 1966, *Pomeliceras* Grigorieva, 1938 (see Hoedemaeker 1982, Tavera 1985, Klein 2005, p. 213, Arkadiev et al. 2007), which need to be clarified.

The genus occurs from the lower Progenitor Zone of HK-12/a, besides from Grandis to Boissieri Zones in Hárskút, HK-12 section. *Malbosiceras* specimens from the Bakony Mountains, namely *M. malbosi* (Pictet, 1867) and *M. paramimounum* (Mazenot, 1939) are figured in Plate 44/5, and 46/7, respectively.

Genus ***Retowskiceras*** Nikolov, 1966
Type species: *Perisphinctes andrussowi* Retowski, 1893

The genus *Retowskiceras* was established by Nikolov (1966, p. 641) with type species *R. andrussowi* (lectotype: *Perisphinctes andrussowi* Retowski, 1893, pl.10/2, fig. 10). The original description of the genus states clearly the presence of a well–defined mid–lateral row of tubercles, together with the absence of a ventral smooth band, but no indication if the specimen is juvenile or adult and has body chamber preserved or not. However, there is often a mistake in the literature as *Retowskiceras retowskyi* Kvantaliani, 1999 is confused with *Pseudoneocomites retowskyi* (Sarasin & Schöndelmayer, 1901), where the latter has

nothing to do with *Retowskiceras*. On the basis of Bogdanova & Arkadiev (2011), *R. retowskyi* has to be excluded from *Retowskiceras*, therefore it would appear as a monospecific genus. As a consequence, occurrence of *Retowskiceras* is restricted to the upper part of the former „Jacobi" Zone, which is based solely on *R. andrussowi* occurrences. Szives & Főzy (2022) discussed the problem related to these taxa.

In the Bakony Mountains, *R. andrussowi* is known from the Andrussowi and Grandis zones from the Hárskút sections (Plate 41/11, 42/8, 44/3).

Genus ***Neocosmoceras*** Blanchet, 1922
Type species: *Hoplites sayni* Simoniescu, 1899

Neocosmoceras is a trituberculated ammonite of middle and late Berriasian age. Besides, *Malbosiceras* Grigorieva, 1938 also may develop a trituberculation at the end of ontogeny (Arkadiev & Bogdanova, 2009). According to Énay et al. (1989), *Neocosmoceras* is possibly considered as microconch form of macroconch genus *Mazenoticeras* Nikolov, 1966. Le Hégarat (1965) designated a neotype of "*Hoplites euthymi*" and considered *Euthymiceras* Grigorieva, 1938 as a subgenus of *Neocosmoceras.* We accept the view on *Euthymiceras* of Arkadiev & Bogdanova (2009) who considered it as a junior synonym of *Neocosmoceras. Kilianites* (Énay et al. 1998) is also a trituberculated himalayitid genus occurred from the latest Tithonian to earliest Berriasian. Both *Neocosmoceras* and *Kilianites* are present in the Hungarian material.

Neocosmoceras is rare everywhere; in the Hungarian material the genus occurs in the lowermost Progenitor and Grandis Zone of Hárskút, HK-II section. Our material does not show the features of to be microconch forms. Some *N. euthymi* (Pictet, 1867) specimens from the Bakony Mountains are figured in Plate 44/2, 6, and on 46/1, 2. Another ammonite identified as *Neocosmoceras* sp. is shown in Plate 42/6.

Genus ***Busnardoiceras*** Tavera, 1985
Type species: *Parapallasiceras busnardoi* Hegarat, 1973

When establishing *Busnardoiceras* as a new subgenus of *Berriasella*, Tavera (1985) was rather restrained. Moreover, he did not assign any specimens to this new subgenus apart from its type. According to Bulot et al. (2014) the type locality contained reworked Tithonian faunal elements in a Berriasian assemblage, so the exact stratigraphic position of the genus remained unclear. The authors pointed out that outside of France only a single specimen was ever attributed to the genus. These authors gave a brief summary of the genus and based on a ne wly collected large population from Le Chouet, they established its stratigraphical occurrence in the entire Andreaei Zone.

Based on the morphological remarks and criteria detailed by Bulot et al. (2014), several specimens might be attributed to *Busnardoiceras* in our museum material collected bed by bed. In Bakony sections the genus seems already appearing at the uppermost Microcanthum Zone (Hárskút, HK-12/a, Szilas Ravine sections) and can be detected in the Andreaei Zone as well. Specimens of *B. busnardoi* (Le Hegarat, 1973) are shown in Plate 41/14–16.

Genus ***Hegaratella*** Nikolov & Sapunov, 1977
Type species: *Berriasella paramacilenta* Mazenot, 1939

The genus originally was introduced as a subgenus of *Berriasella*. As a simple criterion for coherence with most of the literature and the clear descriptions given by Nikolov & Sapunov (1977), we keep *Berriasella* and *Hegaratella* separated on the basis of the presence/absence of the ventral smooth band, as it was discussed above at genus *Berriasella*. Further details are added by Szives & Főzy (2022).

Our Hungarian material contains only few or fragmentary *Hegaratella. Hegaratella paramacilenta* (Mazenot, 1939) specimens from the Bakony Mountains are illustrated in Plate 42/1 and 45/4.

Genus ***Delphinella*** Le Hégarat, 1973
Type species: *Hoplites delphinensis* Kilian, 1889

Definition of *Delphinella* is based on trapezoidal whorl section, "sillon siphonale" and fading ornamentation during the ontogeny (Le Hégarat 1973, p. 96). On the basis of his observation, the genus displays two morphologic groups as it was mentioned after Le Hégarat lately by Frau et al. (2016b). Besides, Le Hégarat (1973, p. 97) also distinguished two stratigraphic groups in the "Jacobi" and in the Occitanica zones, however Le

Hégarat's zonal concept was different from the latest concepts (Wimbledon et al. 2020) as his "Jacobi" Zone belonged mostly to the Tithonian. He observed *D. berthei* as the solely continuity from the late Tithonian to the mid-Occitanica Zone. Confusion around *Delphinella* arose when Nikolov (1982), later Wright et al. (1996) regarded the species of *Delphinella* as synonyms of those of *Elenaella*, *Berriasella* or of *Dalmasiceras*. We disagree with both concepts (willing to be published separately in a later publication) and treat *Delphinella* as a distinct genus. It can be observed that *Delphinella* unites microconchiate species with lappets (*obtusenodosa, delphinense, garnieri, berthei, crimensis*) and macroconchiate forms (*ellenica, boisseti, sevenieri, auzonensis*) (Frau pers. comm., 2021). Some of them – like *D. tresannensis* (Le Hégarat, 1972) –, are clearly not belong to *Delphinella* as it was pointed out by Frau et al. (2016b). On the basis of Arkadiev & Bogdanova (2005), Hoedemaeker et al. (2016) and Frau et al. (2016b), *Delphinella* does not appear in the latest Tithonian, but it appears clearly above the *Praedalmasiceras–Elenaella* assemblage. Among Berriasian ammonite genera, *Dalmasiceras* Djanelidzé, 1922 also shows a fading ornamentation on mid–flank at some degree but its juvenile stages differ from those of *Delphinella*.

The Hungarian material is very scarce in *Delphinella*, only a single specimen from HK-12 is attributed to this genus, so we are not able to clarify its stratigraphic whereabout on the basis of our poor material.

Genus ***Jabronella*** Nikolov, 1966
Type species: *Berriasella jabronensis* Mazenot, 1939

Jabronella was introduced by Nikolov (1966). In the description he mentions "two rows of tubercles: umbilical and mediolateral [appear], ribs are interrupted in the ventral region and form a slight tubercular thickening". Le Hégarat (1973, p.191–192) summarized as: "serie des berriaselles à cotes fasciculées pourvues de deux rangé es de tubercules", and mentioned that it could have evolved from *Fauriella* Nikolov, 1966 with developing an additional row of lateral tubercles (not paying attention to the different ventral sides). Later Nikolov (1979) decided to split *Jabronella* into two subgenera, *Jabronella* and *Erdenella*. The first one "… includes those representatives of the genus *Jabronella* with dense and fine ribs on the phragmacone and development of umbilical and mediolateral tubercles at the end of the phragmacone and on the body chamber. The formation of rib fascicles starts rather early – at the beginning of the phragmocone…". Concept of *Jabronella* and *Erdenella* needs to be re-considered in the light of possible intraspecific variation and examining the type series, which is willing to be published in a future paper.

The genus is clearly of Berriasian age, present only in the Hárskút, HK-12 section. The identified *Jabronella* species are the following: *J. jabronensis* (Mazenot, 1939), *J.* cf. *isaris* (Pomel, 1889) (Plate 46/3, 4), *J. paquieri* (Plate 42/7), *J. isaris* (Pomel, 1899) (Plate 43/2; 46/3, 4).

Genus ***Erdenella*** Nikolov, 1979
Type species: *Hoplites paquieri* Simionescu, 1899

Erdenella was established by Nikolov (1979) as a subgenus of *Jabronella*.

On the basis of description and type specimen photographs provided, we may suspect the two genera – *Jabronella* and *Erdenella* – are no more that intraspecific variations as brady–/trachymorphic pairs to each other. The Hungarian material allows us to perform morphometric measurements to support or discard this idea, but as long as this work is completed, we keep the two genera separated.

The genus is clearly of Berriasian age. In the Bakony Mountains it is represented by a single species (*E. subisaris* Mazenot, 1939) and present only in the HK-12 section; one specimen is illustrated in Plate 43/6.

Subfamily Neocomitinae Salfeld, 1921
Genus ***Dalmasiceras*** Djanelidzé, 1922
Type species: *Ammonites Dalmasi* Pictet, 1867

This genus was discussed and revised recently by Frau et al. (2016b), who separate a new genus, *Praedalmasiceras* on the basis of their own and Le Hégarat's (1973) observations. Furthermore, they assumed *Praedalmasiceras* as a possible ancestor of *Dalmasiceras*. Frau et al. (2016b) kept only some species within *Dalmasiceras*, restricting its stratigraphic occurrence to Occitanica and Boissieri zones.

Dalmasiceras seems to be absent in the Hungarian material, which may imply a facies related distribution of the genus suggested by Hoedemaker et al. (2016).

Genus ***Tirnovella*** Nikolov, 1966
Type species: *Berriasella alpillensis* Mazenot, 1939

This genus was established by Nikolov (1966) originally as a subgenus of *Berriasella*, together with *Fauriella*, *Elenaella* and *Strambergella*. Since the work of Le Hégarat (1973) all of these taxa treated as distinct genera. *Tirnovella occitanica* (Pictet, 1867) is a zonal index of the middle Berriasian (Reboulet et al. 2018, Szives & Főzy 2022). The genus is reported throughout the Tethyan-Caucasian subrealm (Lehmann et al. 2015), from Spain (Hoedemaeker 1982, Company 1987) to the Crimea (Arkadiev et al. 2018, Baraboshkin et al. 2019).

Together with *Tirnovella alpillensis* (Mazenot, 1939) (Plate 43/3), these are the most common species of the genus, both are frequent in Hárskút, HK-12 section. *Tirnovella subalpina* (Mazenot, 1939) (Plate 42/2) and *T. romani* (Mazenot, 1939) (Plate 45/3) was also documented from the Occcitanica Zone of the HK-II and HK-12 sections.

Genus ***Fauriella*** Nikolov, 1966
Type species: *Berriasella gallica* Mazenot, 1939

This genus was established by Nikolov (1966) originally as a subgenus of *Berriasella*, together with *Tirnovella*, *Elenaella* and *Strambergella*. Since the work of Le Hégarat (1973) all of these taxa treated as distinct genera. The most widely used species of *Fauriella* is *F. boissieri* (Pictet, 1867), which is a nominal index of a distinct upper Berriasian biostratigraphic unit, the Boissieri Zone, that can be traced from the Crimea (Arkadiev 2007), throughout the Mediterranean-Submediterranean Realm (Company 1987, Le Hégarat 1973) to Mexico (Gonzales-Arreola et al. 2017). In spite of its stratigraphical role the genus needs a revision.

In the Hungarian material, *T. boissieri* is common in the Hársút HK-12 section (Plate 43/1, 44/1).

Genus ***Thurmanniceras*** Cossmann, 1901
Type species: *Ammonites thurmanni* Pictet & Campiche, 1860

Thurmanniceras is a commonly cited genus, mostly due to the stratigraphical significance of *T. pertransiens* (Sayn, 1907), which traditionally marks the basal Valanginian (Reboulet et al. 2018). *Thurmanniceras* are reported from the Mediterranean (Company, 1987) and Submediterranean (Le Hégarat, 1973) settings. Specimens from the Himalayas (*T. kingi* Uhlig, 1905) and forms from South America (Salazar et al. 2020) are probably not true *Thurmanniceras* – this issue needs further investigations (Company 1987).

The genus was identified at Hárskút, in the HK-12 section, where macro- and microconchs were distinguished (Plate 48/2, 5); in this section *T. thurmanni* (Pictet & Campiche, 1860) was also documented (Plate 47/11).

Genus ***Kilianella*** Uhlig, 1905
Type species: *Hoplites pexiptychus* Uhlig, 1882

Representatives of this genus are frequent in the condensed late early Valanginian part of the Hárskút, HK-12 section. The dozens of collected specimens were identified as *K. roubaudiana* (d'Orbigny, 1850), *K. superba* (Sayn, 1907), *K. rectecostata* (Sayn, 1907) and *Kilianella* sp. They are illustrated in Plate 47/1–8. Suture line of *K. superba* is given on Figure 7/3.

Genus ***Sabbaiceras*** Avram & Gradinaru, 1993
Type species: *Sabbaiceras stefanescui* Avram & Gradinaru, 1993

A few flattened specimens identified as *S. stefanescui* Avram & Gradinaru, 1993 occurred in the early late Valanginian Verrucosum Zone of the Hárskút, HK-12 section.

Genus ***Sarasinella*** Uhlig, 1905
Type species: *Hoplites ambiguus* Uhlig, 1902

A single specimen identified as *Sarasinella* sp. occurred in the early late Valanginian of the Hárskút, HK-12 section.

Genus ***Rodighieroites*** Company, 1987
Type species: *Rodighieroites cardulus* Company, 1987

A few specimens identified as *R. belimensis* (Mandov, 1976) – together with other neocomitid ammonites – occurred in the early late Valanginian Verrucosum Zone of the Hárskút, HK-123 section (Plate 47/9, 12).

Genus ***Neocomites*** Uhlig, 1905
Type species: *Ammonites neocomiensis* d'Orbigny, 1841

Since the occurrence of fossiliferous Valanginian is scarce in the Bakony Mountains, this often reported genus is also rare in the studied sections. *Neocomites neocomiensis* d'Orbigny, 1841 and *N. premolicus* Sayn, 1907 (Plate 48/3) were documented from the early late Valanginian Verrucosum Zone of the Hárskút, HK-12 section. A single *Neocomites* specimen is known also from the Hárskút, Édesvíz Key Section. *Neocomites* are much more frequent in the north-eastern part of the Transdanubian Range, in the Gerecse Mountains, where Valanginian is represented by a thick siliciclastic succession (Főzy & Janssen 2009).

Genus ***Busnardoites*** Nikolov, 1966
Type species: *Ammonites desori* Pictet & Campiche, 1860

Busnardoites is an important genus, coined by Nikolov (1966) for some very thickly ribbed Valanginian neocomitid ammonites. The most cited species is *B. campylotoxus* (Uhlig, 1902), which has a zonal index value in the early Valanginian. The species – including related forms identified as *B.* aff. *campylotoxus* and *B. subcampylotoxus* (Nikolov, 1977) – is well represented in the condensed Valanginian of the Hárskút, HK-12 section. Some of these ammonites develop conspicuous lateral nodules above certain ribs, some are not. The nodules may, or may not disappear in later ontogenetic stage, which suggests that it is not a specific character. The group is probably dimorphic. *Busnardoites* aff. *campylotoxus* (Uhlig, 1902) is illustrated in Plate 47/13 and 48/4.

Another strongly ribbed species – *B. neocomiensiformis* (Uhlig, 1902) – was also ranged into the genus. It is represented in the Valanginian Hárskút, HK-12 section by several well-preserved fragments, some of them with remains of shell. The best preserved specimen is shown in Plate 48/1. The generic attribution of the species is based on Klein (2005) who placed the species *neocomiensiformis* tentatively into Nikolov's genus. The species was misinterpreted since the early times, as it is clearly documented by the synonym list given by Klein (2005, p. 323). Although it is a poorly know species, it was recently appointed as an early Valanginian zonal index (Reboulet et al. 2018).

Genus ***Neohoploceras*** Spath, 1939
Type species: *Ammonites sub-Martini* Mallada, 1882

A single specimen identified as *N.* cf. *submartini* (Mallada, 1882) occurred in the late Valanginian, Verrucosum Zone of the Hárskút, HK-12 section (Plate 47/10).

Genus ***Pseudargentiniceras*** Spath, 1925
Type species: *Ammonites abscissus* Oppel, 1865

The genus was briefly discussed recently by Bulot et al. (2014), including a history of designation of the lectotype and the species content of the genus. As it needs further examination, we cannot add any specific details here.

In the Hungarian material *Pseudargentiniceras flandrini* Le Hegarat, 1973 is reported from Szilas Ravine bed 42, Andreaei Zone. This is in agreement with the age of Spanish (Tavera 1985, Olóriz & Tavera 1989) and French (Bulot et al. 2014) specimens. This may support the idea that rise of early neocomitids had been started earlier as previously was suspected, already before the latest Tithonian.

Genus ***Elenaella*** Nikolov, 1966
Type species: *Berriasella cularensis* Mazenot, 1939

This genus is briefly discussed by Szives & Főzy (2022), although some new remarks are added here. *Elenaella* was established by Nikolov (1966) as a subgenus of *Berriasella*, with a type species established by Mazenot (1939, pl. VIII, fig. 1), from the "Tithonique superieure d'Aizy". In the original definition it was indicated that they are discoidal compressed ammonites, with moderately large umbilicus, whorls increasing very rapidly in height; inner whorls with *Berriasella*–like ornamentation, in the umbilical edge appears a row of tubercles slightly elongated in radial direction. A moderate smoothing of

the ribs around the middle of the flanks was taken as the diagnostic feature of the subgenus. However, this feature is shared by other genera as *Praedalmasiceras* Frau et al., 2016b, *Dalmasiceras* Djanelidzé, 1922 and *Delphinella* Le Hégarat, 1973.

Following Frau et al. (2016b), we accept *Elenaella* as a monospecific taxon, but their opinion that its generic rank based on the quickly increasing whorl height which differentiates it from *Praedalmasiceras* may be interpreted as an intraspecific variation to our opinion. Frau also relies on the observation of Cecca et al. (1989), who referred *E. cularense* questionably into *Dalmasiceras* but mentioned for their specimen is from Pouzin that "its lateral lobe does show dissymmetry as of *Dalmasiceras*". Here we have to emphasize that *Dalmasiceras* and *Praedalmasiceras* were not split into two genera in 1989. In contrast, a few lines later Cecca et al (1989) say for the specimen of Mazenot (1939, p. 76, pl. 8, fig. 1c) "its lateral lobe does not show dissymmetry as of *Dalmasiceras*". In our view, differentiation of the two genera (i.e. *Elenaella* and *Praedalmasiceras*) is based on contradictory evidence given by Cecca et al. (1989) and needs to be clarified as it was also suggested by Cecca et al. (1989). Until the type materials are revised and new material is available for investigations, we keep *Elenaella* and *Praedalmasiceras* separated. The limited stratigraphic range and the wide geographical distribution make *Elenaella* and *Praedalmasiceras* reliable ammonites for bio–chronostratigraphical purposes in the Mediterranean–Caucasian Subrealm. However, as a particular interest, these genera seem to be strongly dependant of certain environmental parameters as *Praedalmasiceras* is more connected to limestone facies, while the slightly younger *Delphinella* is abundant in proximal siliciclastic settings (Hoedemaeker et al. 2016).

The genus is rare everywhere, but present in the Chaperi Zone deposits of Bakony Mountains, known from Szilas Ravine (Plate 41/13, 17).

Figure 7 – Ammonite suture-lines

All figures are actual size

1. ?*Busnardoites* sp. – K.2010.272.1, Hárskút, HK-12 section, bed 10, early Valanginian, Pertransiens or Campylotoxus Zone.
2. ?*Busnardoites* sp. – K.2010.273.1, Hárskút, HK-12 section, bed 10, early Valanginian, Pertransiens or Campylotoxus Zone.
3. *Kilianella superba* (Sayn, 1907) – K.2010.169.1, Hárskút, HK-12 section, bed 10, early Valanginian, Pertransiens or Campylotoxus Zone. The specimen is shown on Plate 47/1.
4a, 4b. ?*Busnardoites* sp. – K.2010.271.1, Hárskút, HK-12 section, bed 10, early Valanginian, Pertransiens or Campylotoxus Zone.
5. *Busnardoites neocomiensiformis* (Uhlig, 1902) – K.2010.19.1, Hárskút, HK-12 section, bed 10, early Valanginian, Pertransiens or Campylotoxus Zone. The specimen is shown on Plate 48/1.

Family Oosterelliadae Breistroffer, 1940
Genus ***Oosterella*** Kilian, 1911
Type species: *Ammonites cultratus* d'Orbigny, 1841

Oosterella, with the prominent ventral keel, is a morphologically very characteristic genus of the Valanginian/Hauterivian boundary interval. In the Bakony only a few specimens belonging to the genus were documented from the small artificial trenches around Hárskút (Plate 41/4–7). They were determined as *O. begastrensis* Company, 1987 and *Oosterella* sp. In contrast to the scarce finding of the genus in the Bakony Mountains *Oosterella* is more common and represented by more species in the Gerecse (Főzy 2004, 2017), where the late Valanginian–early Hauterivian interval is represented by a thicker succession, and forms a large outcrop, (the Bersek Quarry).

Superfamily Aspidoceratoidea Zittel, 1895
Family Aspidoceratoidae Zittel, 1895
Subfamily Euaspidoceratinae Spath, 1931
Genus ***Euaspidoceras*** Spath, 1931
Type species: *Ammonites perarmatus* Sowerby, 1822

The genus is characteristic mainly for the Oxfordian which is not documented by means of macrofossils in the Bakony Mountains from where only four, large, poorly preserved fragments from the lowermost Kimmeridgian of the Lókút section were identified as *Euaspidoceras* sp. (Plate 50/4). In contrast to this sparse occurrence, Oxfordian ammonites, including *Euaspidoceras* are more frequent in the north-eastern Transdanubian Range where there is a fossiliferous limestone layer within the Lókút Radiolarite Formation (Főzy & Meléndez 2013).

Subfamily Aspidoceratinae Zittel, 1895
Genus ***Aspidoceras*** Zittel, 1868
Type species: *Ammonites rogoznicensis* Zeuschner, 1846

Aspidoceras species – together with other aspidoceratids –, form an essential part of the Kimmeridgian cephalopod-fauna of the Bakony Mountains, and they do occur also in the Tithonian. The last representatives of *Aspidoceras* (*A. taverai* Checa, 1985) are Berriasian however these ammonites are rather rare. Since Páskom Hill and Lókút Hill sections provided the largest Kimmeridgian assemblages, these sites yielded most of the aspidoceratids as well. The best preserved specimens are from Páskom Hill, where many aspidoceratids show the remains of the permineralised shell; in the Lókút section ammonites are well-preserved internal moulds. In other localities (such as sections around Hárskút and Eperkés Hill) most of the aspidoceratids are rather weathered internal moulds only. *Aspidoceras acanthicum* (Oppel, 1863) is probably the most often reported species in the literature. Well-preserved specimens of this ammonite occurred at Páskom Hill, but here we regard '*acanthicum*' as *Physodoceras* (see below). *Aspidoceras iphicerum* (Oppel, 1863) was also recognised at Páskom Hill. The ammonite in Plate 53/3 is a well-preserved specimen, showing the typical two rows of tubercles. This ammonite matches well the holotype of Oppel. *Aspidoceras zeuschneri* (Zittel, 1870) is never abundant, but may present in the Tithonian, especially in the lower Tithonian. A small specimen with one row of tubercles from the Darwini Zone of Lókút Hill is figured in Plate 56/3. More abundant is the also Tithonian *A. rogoznicense* (Zeuschner, 1846). A small fragmentary specimen from the Fallauxi Zone of Hárskút, Édesvíz Key section (Plate 56/4) shows the typical two rows of tubercles. The species is often reported in the Mediterranean Province, especially in the mid-Tithonian sections. The ammonite in Plate 54/2 is a typical specimen of *Aspidoceras taverai* Checa, 1985 with two rows of tubercles, from the Microcanthum Zone of Hárskút. This is the youngest known species of the genus *Aspidoceras*. Actually it is very close to *A. rogoznicense*.

Genus ***Pseudowaagenia*** Spath, 1931
Type species: *Aspidoceras haynaldi* Herbich, 1868

Two ammonites from the Kimmeridgian, Beckeri Zone of Olaszfalu, Eperkés Hill, identified as *P.* cf. *micropla* (Herbich 1878, non Oppel, 1863) are illustrated in Plate 50/2 and 50/3. These ammonites are evolute, with fine, densely placed elongated tubercles near the umbilicus. The number and density of tubercles looks similar in comparison to those of the *Aspidoceras micropla* specimen illustrated by Herbich (1878). Latter shows lateral

sculpture; meanwhile the Bakony specimens are slightly eroded, therefore rather smooth. *Ammonites microplus* Oppel, 1863, refigured by Schlegelmilch (1994, pl. 70, fig. 3), may belong to another aspidoceratid genus; it is probably a *Physodoceras*. The whorl-sections are more involute and higher compared to *Pseudowaagenia*. Herbich's *micropla* and the specimens from Eperkés Hill are very evolute ammonites.

The other, relatively often cited species, '*acanthomphala*' of Zittel (1870), is treated here as a *Hypowaagenia*.

Genus ***Hypowaagenia*** *Schweigert & Schlampp, 2020*
Type species: *Hypowaagenia endressi* Schweigert & Schlampp, 2020

For a group of large and middle-sized aspidoceratid ammonites from recently collected fossils from the lower Kimmeridgian of SW Germany, Schweigert & Schlampp (2020a, b) created the genus *Hypowaagenia* in which they tentatively included *Aspidoceras acanthomphalum* (Zittel, 1870). Beside macroconchs, the authors also figured one microconch. Following their suggestion, the species *A. acanthomphalum* is treated here as *Hypowaagenia*. The illustrated *H. acanthomphala* specimen is from the late Kimmeridgian, Beckeri Zone of the Lókút Hill and shown iin Plate 56/6.

Genus ***Benetticeras*** Checa, 1985
Type species: *Benetticeras benetti* Checa, 1985

From the Kimmeridgian of Borzavár, Páskom Hill, one aspidoceratid, identified as *Benetticeras* sp., is illustrated in Plate 52/1. The ammonite is smooth on the innermost whorls and has strong periumbilical spines on the outer whorl. Such ammonites were determined erroneously as *Orthaspidoceras* in the past. *Orthaspidoceras* has its distribution during the early late Kimmeridgian in the Subboreal Province and neighbouring regions with Mediterranean influence (Central Russia, N Germany, S England, W France, Switzerland, S Germany), but does not occur in the strictly Mediterranean areas, such as the Bakony Mountains.

Genus ***Physodoceras*** Hyatt, 1900
Type species: *Ammonites circumspinosus* Quenstedt, 1849

The genus unites the macroconch forms of *Sutneria* Zittel, 1884. Further remarks on the genus are given by Főzy & Scherzinger (2013a). In the Bakony fauna, *Physodoceras* is common and represented by numerous species and specimens. *Physodoceras circumspinosum* (Oppel, 1863) is the supposed dimorphic pair of the microconch *Sutneria platynota* (Reinecke, 1818) in the lower Kimmeridgian, Platynota Zone. Herein two specimens from the Kimmeridgian of Borzavár, Páskom Hill are illustrated in Plate 51/6 and 55/5.

Aspidoceras acanthicum (Oppel, 1863) is very often cited, however is not a well-known species, treated here as *Physodoceras*. The species has a wide distribution in the late Kimmeridgian in the Mediterranean and Submediterranean Province (e.g. SE France, S Germany) and it is the index fossil for the Acanthicum Zone. This zone was used nearly as a synonym of the Kimmeridgian stage for a long time; at least the name "*A. acanthicum*" was used in broad sense since Neumayr (1873) and was reported several times from the Transdanubian Range also by Gyula and Gusztáv Vígh (Vígh 1920). The type specimen of Oppel is from the locality Thalmässing, Franconia, from the lower Kimmeridgian "Tenuilobatus Zone". In the Bakony Mountains, the Páskom Hill section yielded some big, adult and nearly complete specimens (Plate 49/3). Interesting is that unique occurrence of acrothoracia borings recognised within the shell of the Páskom Hill specimens (Főzy & Szente 2022, this volume and references therein). These traces represent a new type of commensalism between the ammonites and the boring balanids.

Physodoceras wolfi Neumayr, 1873 was collected from the Platynota Zone of Lókut Hill. The specimen illustrated in Plate 55/1 is smooth, without any spines; it fits well with the holotype of *Aspidoceras wolfi* Neumayr, 1873 from Csofranka, Romania.

Physodoceras neoburgense (Oppel, 1863) is an often cited species from the Mediterranean Realm. Herein four specimens are illustrated. The ammonites in Plate 56/2 and 53/4, 6 are from Hárskút and the one is in Plate 56/5 is from Lókút Hill; all are from the Darwini Zone. More information on *P. neoburgense* (Oppel) and its corresponding microconch are given in Főzy & Scherzinger (2013b), Scherzinger et al. (2018) and Parent et al. (2019). The species has a long range from the Darwini Zone till the Fallauxi Zone.

A further well-preserved specimen with a high oval cross-section identified on generic level only, is in Plate 51/4; this is an evolute, bigger *Physodoceras* sp. from the Kimmeridgian of Borzavár, Páskom Hill with one row of tubercles near the umbilicus.

Genus ***Pseudhimalayites*** Spath, 1925
Type species: *Aspidoceras steinmanni* Haupt, 1907

Representatives of the genus are very characteristic, but rather rare elements of the lower Tithonian beds. They are usually treated as the macroconchiate pair of the minute *Simocosmoceras*. Further details are given in Schweigert (1997) and Főzy & Scherzinger (2013a). In the Bakony material *Pseudhimalayites subpretiosum* (Uhlig, 1878) and *Pseudhimalayites kondai* Vígh, 1984 were recognised (Plate 55/3 and Plate 49/2). Herein the opinion of Schweigert (1997) is accepted and the relatively frequently cited *P. steinmanni* (Haupt, 1907) is regarded as a junior synonym for *P. subpretiosum* (Uhlig, 1878). However since Haupt's species comes from Argentina, while Uhlig's species is from Rogoźnik (Poland) the connection between the two species is not justified.

The Bakony specimen of *P. subpretiosum* is from a grab sample point; therefore it remains without stratigraphic context. The holotype of *P. kondai*, has only one row of lateral tubercles, at least on the inner whorls, in contrast to *P. subpretiosum*, which has two rows is from the Lókút section. Recently Sarti (2020) reported the species from the Trento area (Italy), also from similar level, i.e. the Verruciferum Zone. The species affiliation of the specimen from the Gerecse Mountains, figured as *P. kondai* by Főzy & Scherzinger (2013b) seems to be uncertain. It is an unusually big specimen with two rows of lateral tubercles on the middle whorls.

Ammonites uhlandi Oppel, 1863 is another often cited aspidoceratid with one row of strong midlateral tubercles. It was placed into the genus *Orthaspidoceras* by most of the previous authors. Following Schweigert (1997) we treat this species as *Pseudhimalayites uhlandi* (Oppel, 1863). It is well represented by numerous specimens in the condensed Kimmeridgian of the Páskom Hill (Plate 49/1; 50/1; 51/7, 8).

Genus ***Simocosmoceras*** Spath, 1925
Type species: *Ammonites adversus* Oppel, 1865

The genus had an uncertain affiliation for a long time (Schweigert 1997, Főzy & Scherzinger 2013b, and references therein). However, now it is widely accepted that *Simocosmoceras* represents the microconchiate form of *Pseudhimalayites*, therefore Énay & Howarth (2019) have not made any distinction and treated also these microconchs as *Pseudhimalayites*. These forms are characteristic for the Mediterranean lower Tithonian (roughly for the Semiforme Zone), but they are usually not common. It is difficult to say that these little ammonites are missing from the fauna, or they are simply overlooked in the nodular facies. In the Bakony Mountains only the Eperkés Hill Long Trench section yielded a *Simocosmoceras* (Plate 54/5). Here they were collected not from the typical nodular Ammonitico Rosso (Pálihálás Limestone Formation), but from the so-called Szélhegy Limestone, which is a light-coloured, sparry carbonate. In the Gerecse Mountains numerous *Simocosmoceras* specimens were collected from a similar limestone, categorised also as Szélhegy Formation, from the Szél Hill (Főzy et al. 1994, Főzy & Scherzinger 2013b).

Genus ***Toulisphinctes*** Sapunov, 1979
Type species: *Toulisphinctes ziegleri* Sapunov, 1979

Toulisphinctes represents large, heavily ornamented aspidoceratids around the Kimmeridgian/Tithonian boundary. Relatively well-preserved specimens identified as *T. inflatoides* (Quenstedt, 1888) from the Kimmeridgian of Borzavár, Páskom Hill are illustrated in Plate 53/2 and 53/7. These ammonites are very similar to the type of Quenstedt (1888), shown in pl. 116, fig. 1. They are also similar to the type species of the genus which is rather poorly illustrated by Sapunov (1979). Another very close – if not conspecific – ammonite was described by Gemmellaro (1871) as *Aspidoceras garibaldii*. However, because the holotype of the latter is rather incomplete (see Olóriz 2002a), the use of Quenstedt's name is preferred here. The big ammonite in Plate 53/2 possesses circular to elliptical or occasionally markedly elongated shallow holes on the permineralised shell, a rarely observed feature, interpreted as limpet home scars (Főzy & Szente 2022, this volume). In Plate 55/2 a whorl-fragment of a big sized *Toulisphinctes* from the Darwini Zone of Hárskút is shown. Another fragment, illustrated in Plate 54/1, is from the Beckeri Zone of Lókút Hill. These ammonites are so incomplete that closer determination seems to be impossible.

Suture of a *Toulisphinctes* specimen from Páskom Hill is illustrated in Fig. 7/1a–1d. Big fragments of *Toulisphinctes* are known also from the Gerecse Mountains (Főzy & Scherzinger 2013b).

Genus ***Sutneria*** Zittel, 1884
Type species: *Nautilus platynotus* Reinecke, 1818

The genus *Sutneria* with its distribution from the Kimmeridgian (Bimammatum Zone) till the Tithonian is regarded as the microconch pair of *Physodoceras* Hyatt, 1900 (Főzy & Scherzinger 2013a and references therein). Énay & Howarth (2019) treated them simply as *Aspidoceras*. These tiny ammonites are often difficult to recognise among the poorly preserved internal moulds of the nodular Ammonitico Rosso facies. In the Bakony Mountains Páskom Hill was the only place, where – due to the occasionally very good preservation of the fossils –, *Sutneria* was collected. These specimens were referred to as *Sutneria hoelderi* Zeiss, 1979 by Főzy (2017), and now they are figured as *Sutneria* cf. *cyclodorsata*

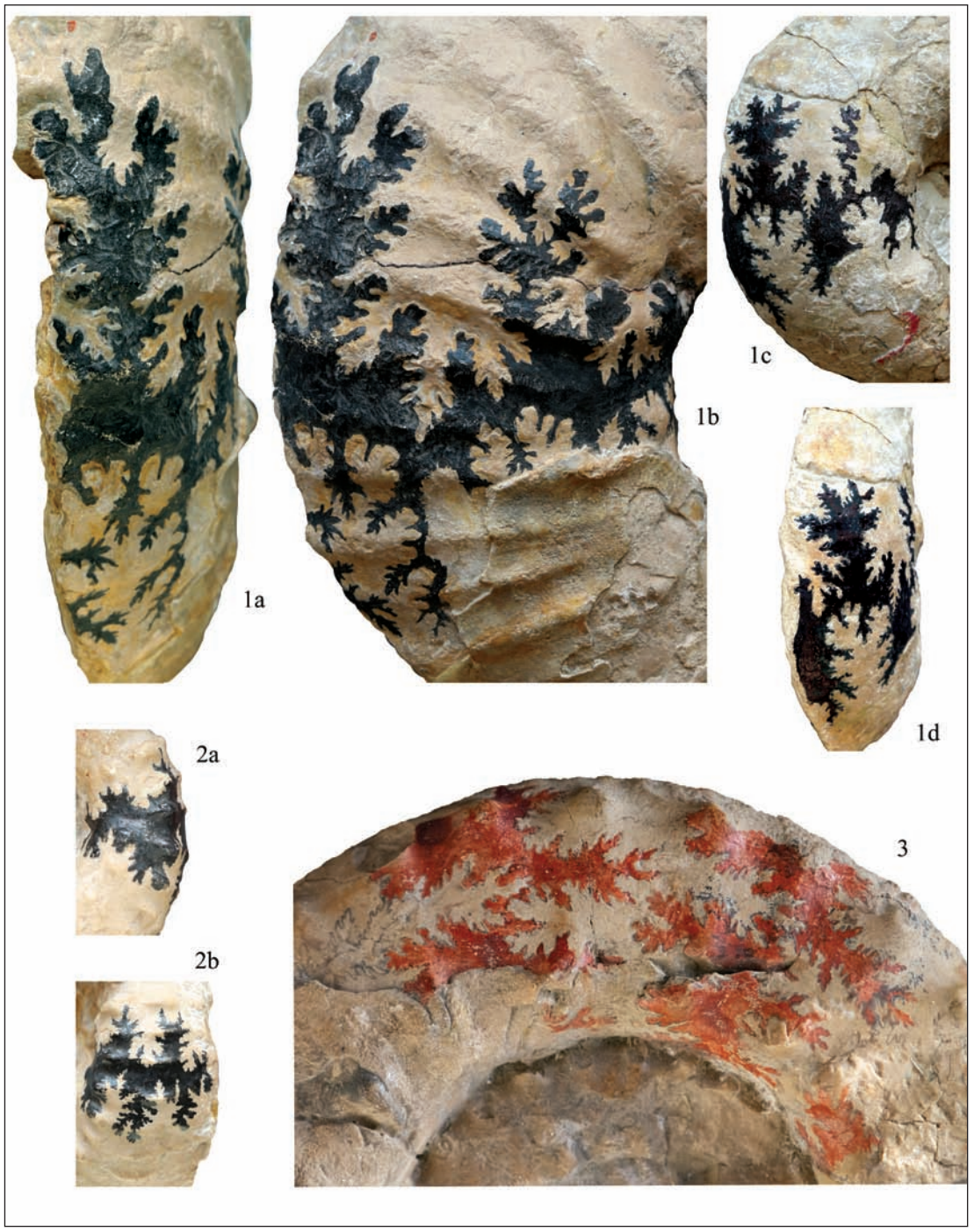


Figure 8 – Ammonite suture-lines

All figures are actual size.

1a, 1b, 1c. *Toulisphinctes* sp . – J.8884, from the Kimmeridgian (presumably early Kimmeridgian), of Borzavár, Páskom Hill. 1a, 1b: outer whorl of the phragmocone, 1c, 1d: inner whorl.
2a, 2b. *Pseudhimalayites subpretiosum* (Uhlig 1878) – J.9089, Herend, Borostyán-Hajag, grab sample, supposedly Tithonian. The specimen is shown on Plate 55/3a, 3b.
3. *Hybonoticeras hybonotum* (Oppel, 1863) – J.9112, Sümeg, grab sample, characteristic for the early Tithonian, Hybonotum Zone. The specimen is shown on Plate 53/5a, 5b.

(Moesch, 1867) (Plate 51/2, 3). Our material shares the features of *Sutneria hoelderi sensu* Schairer & Schlampp, 1991, non Zeiss, 1979 and the very early representatives of *Sutneria hoelderi* Zeiss, 1979.

Subfamily Hybonoticeratinae Olóriz, 1978
Genus ***Hybonoticeras*** Breistroffer, 1947
Type species: *Ammonites hybonotus* Oppel, 1863

Hybonoticeras unites very characteristic and diagnostic late Kimmeridgian–early Tithonian group of ammonites. In the literature there are quite a few species and forms which are definitely from successive assemblages. Unfortunately in the condensed Bakony section the different assemblages cannot be separated, therefore in spite of the occurring well-preserved specimens, the evolutionary linage of the group cannot be fully understood.

The most often cited species is *H. hybonotum* (Oppel, 1863); it is the zonal index of the basal Tithonian Hybonotum Zone, however Scherzinger & Schweigert (2016) suggested that the species has its distribution in the higher part of the zone only. Here three specimens are figured. One is from Lókút Hill (Plate 56/1) and two from Sümeg (Plate 53/1 and Plate 53/5). Other specimens were recorded from the sections around Hárskút, but these are very fragmentary and eroded. Vígh (1984) introduced the species *H. pseudohybonotum* and for the holotype suggested the specimen figured by Benecke (1866). He also illustrated another specimen under the name *H. pseudohybonotum* from the Lókút section (Bakony Mountains). However, the chosen holotype was destroyed during fire in the collection in Strasbourg and is not available anymore (Günter Schweigert pers. com.). It also means that Vígh created the new species without ever seen the original of Benecke (1866), when he proposed the holotype. Therefore we treat *H. pseudohybonotum* as *nomen dubium*, and in the light of our present knowledge on hybonoticeratids it seems unnecessary to designate a neotype. The otherwise eroded specimen illustrated by Vígh (1984, pl. 2) is treated here as *Hybonoticeras hybonotum* (Oppel).

The more delicately ribbed *Hybonoticeras pressulum* (Neumayr, 1873) is also age-diagnostic: the species has its occurrence in the Kimmeridgian, in the lower part of the Beckeri Zone (Schweigert et al. 1996). From the Bakony fauna two specimens are figured. One is from Bakonybél, Som Hill, shown in Plate 54/5. This ammonite has thick, black coating, possibly from manganese-oxide therefore its ornamentation is rather rough. The other ammonite in Plate 55/4 is from Borzavár, Páskom Hill with a permineralised shell that shows the fine ribbing.

The rare species *Hybopeltoceras linaresi* Olóriz, 1977 was found only in the basal Tithonian of the Édesvízmajor section. It is a poorly preserved fragment (Plate 54/3), but shows the characteristic strong, distant and straight lateral ribs, and also the prominent deep ventral furrow. The species was described from the Hybonotum Zone of the Betic Cordilleras, as the type species of the subgenus *Hybonoticeras* (*Hybopeltoceras*) Olóriz, 1977. Apart from the Betics the rare species was reported only from Sicily (Főzy 1995) and from the Apennines (Sarti & Venturi, 1990, Sarti 2020). *Hybopeltoceras* shows similarities with *Aulasimoceras* Spath, 1931, both have two rows of tubercles and a deep ventral grove and latter even dense ribbing similar to that of the microconchiate *Hybonoticeras* (*Hybonotella*). Well-preserved specimens of this ammonite are rare, but it seems that *Hybopeltoceras* and *Aulasimoceras* have a very similar appearance. Comparison between the innermost whorls of *H. linaresi* and *Aulasimoceras* species would provide information about their relationship.

Hybonoticeras kamicense (Schopen, 1888) is also a rare ammonite. A uniquely preserved specimen is shown in Plate 52/2 and a fragmentary one is in Plate 53/8. Both are from the Páskom Hill collection of J. Noszky. According to Schweigert et al. (1996) and Schweigert (2000, 2009) this ammonite occurs in the latest Kimmeridgian, at the top of the Beckeri Zone.

Another uniquely preserved specimen from Páskom Hill is shown in Plate 51/5; it was identified as *H. harpephorum* (Neumayr, 1873). The species is typical for the base of the higher part of the Beckeri Zone.

A small ammonite in Plate 50/5 was identified as *H.* cf. *knopi* (Neumayr, 1873). It is the first indication of this species in Hungary.

Superfamily Desmoceratoidea Zittel, 1895
Family Desmoceratidae Zittel, 1895
Subfamily Barremitinae Breskovski, 1977

The late Hauterivian ammonite fauna of the Bakony Mountains is rich in desmoceratids. From the Márvány Quarry numerous species were listed by Noszky (1934) and subsequently by Fülöp (1964) under different generic names like *Desmoceras*, *Barremites* and *Valdedorsella*. All of these genera, plus *Abrytusites*, *Melchiorites* and *Plesiospitidiscus*,

are closely related, and generally difficult to separate. In many cases the only obvious difference is in the whorl section and type of constrictions which may differ on the internal mould and on the shell. Inner whorls of these genera/species are practically indistinguishable. Often even the higher categories are uncertain; *Plesiospitidiscus* was usually placed within the family Desmoceratidae (Wright et al. 1996), but some authors emphasise that it has holcodiscid features (Hoedemaeker 1995, Cecca et al. 1998). As the type of *Abrytusites* (*A. neumayri* Haug, 1889) is a latest Hauterivian ammonite, it seems that *Abrytusites* could be a useful name for those Hauterivian taxa which are morphologically very close to the otherwise basically Aptian *Valdedorsella*. On this basis the use of the late Hauterivian genus *Pseudovaldedorsella* (introduced by Cecca et al. 1998) seems to be unnecessary. *Barremites* (used basically for the Barremian group of *B. difficilis* and its close relatives) also arises in the late Hauterivian.

The whole group needs a revision, but it is out of the scope of this work. Therefore different genera are not discussed separately; below only a brief overview of desmoceratid ammonites of the Bakony Mountains is given.

The best preserved desmoceratids including, *Plesiospitidiscus subdifficilis* (Karakasch, 1907) and *Plesiospitidiscus ligatus* (d'Orbigny, 1841) were identified from the condensed late Hauterivian–early Barremian beds of the Márvány Quarry (Plate 57/1, 2, and 5). In the same site well-preserved large and medium-sized specimens of *Abrytusites neumayri* (Haug, 1889) were also collected (Plate 57/7, 9, 12).

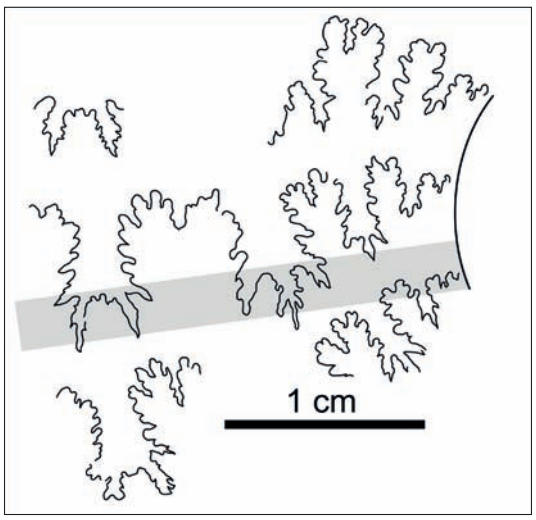


Figure 9 – Suture-lines of a desmoceratid ammonite

Abrytusites sp.2. – K.2021.93.9.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry. The specimen is shown on Plate 58/7a, 7b.

The species was already illustrated by Fülöp (1964, pl. XXIX/6, 7) as *Valdedorsella crassidorsata* (Karakasch). *Abrytusites thieuloyi* Vašiček, 1986, and *Abrytusites julianyi* (Honnorat-Bastide, 1890) were also identified at Márvány Quarry. A rather large and flat desmoceratid is illustrated as *Abrytusites* sp.3 in Plate 58/18.

Late Hauterivian desmoceratids have a connection towards the early Barremian silesitids. Inner whorls and suture-lines of *Abrytusites* and *Silesites* show high similarities, what was already highlighted by Fallot (1920, p. 211), who considered *Puzosia julianyi* (= *Abrytusites julianyi*) as the direct ancestor of *Silesites*. Specimens illustrated as *Abrytusites* sp.2 in Plate 58/7–17 were described earlier as *Silesites* sp.; constrictions (of internal mould) and accompanying ridges (of shell) continues across and most prominent on the periphery. It may represent a new species. Its relatively simple suture-line – which is close to that of of *Silesites* – is shown on Figure 9. A close, if not identical form, illustrated as *Abrytusites* sp.1 in Plate 58/1–6 has slightly thicker and rounded inner whorls.

In the sections around Hárskút (HK-12, Édesvízmajor, Édesvíz Key Section, Rendkő) the Sümeg Marl yielded generally eroded, poorly preserved internal moulds of different desmoceratids, which are probably of late Hauterivian. Some specimens were figured already by Fülöp (1964) as *Barremites* and *Raspailiceras*.

In contrast to the late Hauterivian desmoceratid occurrences, the less studied Kakastaraj section in the vicinity of Városlőd provided some true Barremian species, such as *Melchiorites ponticus* (Karakasch, 1907), which was figured by Fülöp (1964, pl. X/3) under the generic name *Valdedorsella*. The boreholes Sp-1 and Süt-17 near Sümeg, also provided some desmoceratids including the Barremian *Barremites difficilis* (d'Orbigny, 1841), *Pseudohaploceras liptoviense* (Zeuschner, 1856), figured by Haas et al. (1985, pl. XXIV/5, 4), and the Aptian *Zuercherella zuercheri* (Jacob et al., 1906). Further details on the fauna and stratigraphy of the boreholes are given by Fülöp (1964) and Haas et al. (1985). The fauna of the boreholes was not revised within the frame of this study.

Desmoceratids are even more common and diverse in the Gerecse Mountains, where Hauterivian and Barremian are represented by a thick and fossiliferous siliciclastic succession i.e. the Bersek Marl and the Lábatlan Sandstone (Főzy & Janssen 2009, Főzy 2017).

Family Silesitidae Hyatt, 1900
Genus ***Silesites*** Uhlig, 1883
Type species: *Ammonites seranonis* d'Orbigny, 1841

Traditionally this family unites few genera with few species only. The generic name *Silesites* was used mainly for two species: for the lower (but not lowermost) Barremian *S. vulpes* (Coquand, 1878) and for the upper Barremian–Aptian *S. seranonis* (d'Orbigny,

1841). Beyond these species, there are further, not very well known, nearly "forgotten" species in the old literature (e.g. Karakasch, 1907). Subsequently Avram (1987) created a new Barremian genus (*Patruliusiceras*) within the family, with numerous closely allied species in it. More recently silesitids were thoroughly reviewed by Vermeulen et al. (2016). Latter authors introduced numerous new taxa which occasionally are very close to each other morphologically.

Concerning the fauna of the Bakony Mountains, it was Fülöp – on the basis of the determinations by J. Noszky Jn. – who described *Silesites* from the Márvány Quarry and listed 28 specimens as *Silesites* sp. (Fülöp 1964). Later Miszlivecz (1990) determined the silesitids from the quarry as *S. vulpes*, which has a special biostratigraphical implication, since this species have been treated as a signature fossil of the early Barremian for a long time. Therefore the presence of these ammonites served as a key in understanding the biostratigraphic position of the condensed Cretaceous layers. The same specimens were identified as *Silesites* sp. by Főzy & Janssen (2006). Indeed, the smooth Márvány Quarry "silesitids" can be distinguished easily from *S. vulpes*, which bears (weak or stronger) ribbing and they differ also from all other previously described forms. However, after realising the close phylogenetic connection between desmoceratids and silesitids, these smooth, evolute ammonites with constrictions from the Márvány Quarry are treated here as *Abrytusites* sp.2. (Plate 58/7–17, see above).

S. vulpes (Coquand, 1878) specimens were collected from Kakasteréj grab sample point (Plate 59/12–14). These ammonites are easily identifiable on the basis of the faint sculpture of the flanks. They were already listed by Noszky (1934) and they indicate the higher level of early Barremian (probably Moutonianum Zone). Poorly preserved tiny internal moulds from the top of the Hárskút, Édesvíz Key Section were identified as ?*Silesites* sp.

Numerous specimens of *S. vulpes*, and closely allied forms were documented from the north-eastern part of the Transdanubian Range (i.e. the Gerecse Mountains) (Főzy 2017). The other, often cited species – *S. seranonis* (d'Orbigny, 1841)–, was illustrated also from the Gerecse, from the borehole Lbt-36, which is Barremian–Aptian in age (Főzy et al. 2002); this species is not documented from the studied considerable older Bakony sections.

Superfamily Pulchellioidea Douvillé, 1890

According to the traditional concept, only the eponymous Pulchellidae family is classified here. Klein (2006) follows the opinion of Vermeulen, and placed the otherwise morphologically well-defined pulchelliids into a wider phylogenetic context and incorporated them into the superfamily Endemoceratacea Vermeulen, 1996 in which more families, including Neocomitidae are included. We do not agree with this concept, so the independence of pulchelliids is maintained here.

Family Pulchelliidae Douvillé, 1890

This large family comprises numerous species and genera of mostly Barremian in age, but the first representatives of the family appear already in the late Hauterivian. Accordingly we have a diverse pulchelliid assemblage in the Gerecse Mountains where Barremian is well represented (Főzy & Janssen 2009, Főzy 2017). However in the Bakony Mountains, where Barremian is underrepresented, only some of the first – mainly late Hauterivian – forms were documented.

Subfamily Buergliceratinae Vermeulen, 1995
Genus ***Discoidellia*** Vermeulen, 1995
Type species: *Discoidellia couratieri* Vermeulen, 1995

Discoidellia favrei (Ooster, 1860), and some close forms, identified as *D.* cf. *favrei* were found in the late Hauterivian around Hárskút, and also in the Márvány Quarry and Kakastaraj sections (Plate 59/2, 5–9). Young specimens with strong ornamentation and also bigger, adult specimens with the smoothing ornamentation of the body chamber were found. Latter ammonites fit well with those well-preserved ammonites that were published from the classic Veveyse section of the Swiss Prealps (Busnardo et al. 2003). Some of the Márvány Quarry specimens were illustrated by Fülöp (1964) as *Nicklesia* cf. *pulchella* (d'Orbigny, 1841), which is an early Barremian species. The Márvány Quarry also yielded an ammonite identified as *D. couratieri* Vermeulen, 1995 (Plate 59/3). Two *Discoidella* from the Hárskút, HK-12 section illustrated as *D. vermeuleni* (Cecca, Faraoni & Marini, 1998) are shown in Plate 59/1, 15. This species is close, if not identical to *D. favrei.*

Genus ***Heinzia*** Sayn, 1890
Type species: *Heinzia sayni* Hyatt, 1903

This early Barremian genus is represented by a single fragment in the Bakony fauna identified as *H.* cf. *caicedi* (Karsten, 1856). This ammonite is from the Barremian of the Kakastaraj, near Városlőd. It shows the blunt, waving ribs which are flatten on the external part of the flanks (Plate 59/10). Unfortunately the diagnostic ventral side cannot be observed. The genus is much more common in the Gerecse Mountains, where the huge Bersek Quarry provides a good access to the fossiliferous Barremian strata (Főzy & Janssen 2009, Főzy 2017).

Suborder Ancyloceratina Wiedmann, 1966
Superfamily Bochianitoidea Spath, 1925
Family Bochianitidae Spath, 1922
Subfamily Bochianitinae Spath, 1922
Genus ***Bochianites*** Lory, 1898
Type species: *Baculites neocomiensis* d'Orbigny, 1842

Two specimens (Plate 60/7, 9) from the late Valanginian of the Hárskút, Édesvíz Key Section shows the characteristic wrinkles which serve a firm ground for determination, but it is very likely that many other small and straight, otherwise very poorly preserved fragments from the section also belong to *B. neocomiensis* (d'Orbigny, 1842). *Bochianites* was also recorded from the Gerecse (Főzy & Janssen 2009, Főzy 2017).

Genus ***Euptychoceras*** Breistroffer, 1952
Type species: *Ptychoceras Meyrati* Ooster, 1860

Euptychoceras meyrati (Ooster, 1860) is a middle-sized heteromorph ammonite with three straight, closely situated shafts (proversum, retroversum and contraproversum) connected by two bends. The species was traditionally treated as a ptychoceratid, but here the opinion of Vašíček is followed, who – on the basis of the suture-line –, placed this species into Bochianitidae (Vašíček 2020). The finest specimens of *E. meyrati* were documented from the Márvány Quarry but it was found also in the late Hauterivian around Hárskút (Plate 60/1, 2, 5, 13). *Euptychoceras subundulatum* (d'Orbigny, 185) is another species, which was found in the Bakony in several sections (Rend-kő, HK-12, Hárskút, Édesvíz Key Section, Márvány Quarry) (Plate 60/3, 4, 6, 8, 10, 12). It is supposed that *E. subundulatum* also has three arms like *E. meyrati*, although complete specimens are still unknown – this makes the identification uncertain. The species was often cited under different names, among them *Ptychoceras biassalense* Karakasch, 1907 is probably the most frequent; Fülöp (1964) treated the Bakony specimens also as *P. biassalense*. A complete synonym list of the species and further remarks on the related forms are given by Vašíček (2020).

Superfamily Protancyloceratoidea Breistroffer, 1947
Family Protancyloceratidae Breistroffer, 1947
Genus ***Protancyloceras*** Spath, 1924
Type species: *Ancyloceras Guembelii* Oppel, 1865

A singel specimen identified as *?Protancyloceras* sp. occurred in the early late Valanginian of the Hárskút, HK-12 section.

Superfamily Ancyloceratoidea Gill, 1871
Family Crioceratitidae Gill, 1871

The systematic subdivision of the variable and diverse crioceratids is highly problematic and controversial; for details see the numerous footnotes in Klein (2005, 2007).

The traditional, strictly typological approach of the group resulted taxonomic oversplitting and chaos in the paleontological literature. A new approximation of the systematics was done by Matamales-Andreu & Company (2019); these authors carried out a complex morphometric analysis on a large, stratigraphically well-constrained crioceratid fauna. The following characters were taken into consideration and were investigated in the morphospace: (1): whorl height growth rate, (2): degree of heteromorphism/overlapping of the whorls (3): extent of the first ontogenetic stage, (4): presence and persistence of trituberculation, (5): diameter of the umbilicus/whorl height ratio. As a result the taxonomy and stratigraphic meaning of two late Hauterivian species, namely *Balearites angulicostatus* (d'Orbigny, 1841) and *Pseudothurmannia*

ohmi (Winkler, 1868), were clarified. The study revealed that in the context of these heteromorph ammonites, the morphological variation in time and within assemblage is extremely complex and can be traced only by mathematical modelling.

Crioceratid ammonites in the Bakony occur either in the highly condensed Lower Cretaceous of the Márvány Quarry section, or in some layers of the Sümeg Marl around Hárskút. The latter layers stand without a clear stratigraphic context, since only very few beds yielded macrofossils and successive heteromorph assemblage cannot be followed. Otherwise most of the crioceratids of the Bakony Mountains are fragments only. Because of these reasons, the Bakony specimens are unsuitable for a thorough morphometric study. Nevertheless, the results of Matamales-Andreu & Company (2019) were accepted and used here.

Crioceratid ammonites are more frequent in the Gerecse Mountains, where the Hauterivian is better represented by the thick Bersek Marl (Főzy 2017, and references therein).

Genus ***Crioceratites*** Léveille, 1837
Type species: *Crioceratites Duvali* Léveille, 1837

Crioceratites is probably the most widely used name for Hauterivian heteromorph ammonites. Apart from their rapid evolution, they show a perplexing morphological variability which hampers their use in biostratigraphy. They can be characterized exclusively by strongly heteromorph (crioceratid) coiling. Ribbing consists of thicker main ribs and thinner intercalatories – all are straight or almost straight throughout the ontogeny. It seems that cross section of the whorls also has certain taxonomic significance which can be applied to stratigraphic purposes: criocone ammonites characterised by compressed (oval to high oval) cross-sections are Hauterivian, while those with subcircular whorl-sections are generally Barremian.

One of the most cited species is *C. duvali* (Leveille, 1873) was found in Márvány Quarry (Plate 62/3, 4, 6, 7). A larger specimen with adhesive flat whorls and with relatively straight ribbing was tentatively placed into the genus and was identified as *C. villiersianus* (d'Orbigny, 1841); it is also from the Márvány Quarry (Plate 62/5). Dozens of fragments of *Crioceratites* identified only on generic level were found from late Hauterivian beds around Hárskút, especially in the Édesvíz Key Section (Plate 63/4).

Genus ***Pseudothurmannia*** Spath, 1923
Type species: *Ammonites angulicostatus* d'Orbigny in Pictet, 1863

An emended diagnosis for the genus – based on morphometrical analysis of a larger fauna – is given by Matamales-Andreu & Company (2019). In the Bakony material several specimens from bed 35 of the Hárskút, Édesvíz Key Section were identified as *Pseudothurmannia ohmi* (Winkler, 1868). Illustrations in Plate 63/3, 7, 8, 11 and 13 demonstrate the great morphological variability of the species.

Genus ***Balearites*** Sarkar, 1954
Type species: *Crioceratites baleare* Nolan, 1894

An emended diagnosis for the genus was given by Matamales-Andreu & Company (2019). *Balearites angulicostatus* (d'Orbigny, 1841) – *sensu* Matamales-Andreu & Company (2019) – was identified in the late Hauterivian of the Márvány Quarry (Plate 62/1, 2). The roughly ornamented specimen with its waving ribs in Plate 62/1 shows striking similarity to the type specimen of *Crioceratites seitzi* Sarkar, 1955, which was chosen as the type species of *Ropoloceras* Vermeulen et al., 2012a.

Genus ***Paracostidiscus*** Busnardo, 2003
Type species: *Paracostidiscus radians* Busnardo, 2003

Paracostidiscus is a monospecific, rare and poorly known genus. The type is known from the late Hauterivian of Veveyse de Châtel (Switzerland). The Bakony specimens from Hárskút and from the Márvány Quarry are the first reports of the species out of the type locality. The specimens from the Márvány Quarry were misinterpreted as *Costidiscus* by Noszky (1934), Fülöp (1964) and Miszlivecz (1990), therefore they were used to prove the Barremian age. Indeed, *Costidiscus* shows perplexing similarity to the much older *Paracostidiscus*, which lacks the fine umbilical tubercles that may appear on *Costidiscus*. The character of ribbing of *Paracostidiscus* is the dense, simple and twisted ribs differing that of *Costidiscus*. The small specimen from Márvány Quarry (Plate 63/1) was already figured as *Paracostidiscus radians* (Busnardo, 2003) by Főzy & Janssen (2006). One of the Márvány Quarry specimen is treated here as the first known macroconch form of this monospecific genus (Plate 63/12). The coiling and the ornamentation style

are very similar to the smaller individual. This specimen was figured by Miszlivecz (1990, pl. V.) as *Lytoceras* sp. It differs from lytoceratids by the twisted ribbing and also by its suture, which does not show the typical bifid lytoceratid lobes, instead it seems to be more trifid and asymmetric. Fragmentary *Paracostidiscus* specimens were also found in the upper Hauterivian of the Rend-kő section (Plate 63/10).

Family Emericiceratidae Vermeulen, 2004

Some researchers placed *Emericiceras* and *Crioceratites* into the same family. Here the opinion of Klein et al. (2007) is followed and the family Emericiceratidae is maintained in strict sense. However Klein et al. (2007) also included *Crioceratites nolani* Kilian, 1910 – a typical crioceratid species very close to *Crioceratites duvali* (Leveille, 1873), otherwise type species of *Davouxiceras* Vermeulen, 2004 – into Emericiceratidae.

Genus ***Emericiceras*** Sarkar, 1954
Type species: *Crioceratites emerici* Léveille, 1837

A small fragment from the Márvány Quarry was identified as *Emericiceras emerici* (Léveille, 1837). The specimen shows the typical features of the species, i.e. the strong periumbilical, lateral and ventrolateral spikes on the main ribs, which bound 4–6 secondary ribs (Plate 63/6). This ammonite, together with a *Holcodiscus* is one of the few early Barremian forms in the condensed Márvány Quarry fauna which contains mostly late Hauterivian species.

Genus ***Pseudomoutoniceras*** Autran, Delanoy & Thomel, 1986
Type species: *Ancyloceras brunneri* Ooster, 1860

Klein et al. (2007) tentatively placed the genus into the family Heteroceratidae Spath, 1922 which was erected for ammonites with initial helicoidal stage; however it is probably not the case concerning *Pseudomoutoniceras*. What we learned about this poorly known genus is based on some rare and generally incomplete findings. The latest overview with a list of the attributed species was given by Vermeulen et al. (2012a). In the Bakony fauna only a single fragmentary specimen was found in the Márvány Quarry. It was illustrated as *Pseudomoutoniceras annulare* (d'Orbigny, 1842) by Főzy & Janssen (2006), and it is figured now as *Pseudomoutoniceras martinoti* Vermeulen, 2012a (Plate 64/14). The ammonite shows the characteristic strong, oblique ribs and constrictions, typical for the genus, and especially for the species of Vermeulen. It is probably the only known *martinoti* specimen apart from the holotype. *P. martinoti* was described from the latest Hauterivian (Balearis Zone); the Márvány Quarry limestone beds are heavily condensed therefore they do not contribute to the precise stratigraphic range of the species.

Genus ***Paraspiticeras*** Kilian, 1910
Type species: *Aspidoceras percevali* Uhlig, 1883

Traditionally the genus was treated as Barremian and was placed within the family Douvilleiceratidae Parona & Bonarelli, 1897, of the superfamily Douvilleiceratoidea Parona & Bonarelli, 1897 (Wright et al. 1996). However, on the basis of the increasing new stratigraphical data it became clear that the genus is characteristic for the late Hauterivian–early Barremian time span (Baraboskin et al. 2020). Latter authors also proved that there is a ~3 Ma gap between the disappearance of *Paraspiticeras* and the appearance of the first representatives of Douvilleiceratoidea. For this reason the cited authors placed the genus into Emericiceratidae Vermeulen, 2004 within superfamily Ancyloceratoidea Gill, 1871, since the juvenile stage of *Paraspiticeras* conch is uncoiled. Recently Vermeulen et al. (2009) erected the subfamily Paraspiticeratinae, and subsequently Vermeulen et al. (2012b) introduced new species into two new genera (*Lepinayceras* and *Blascoceras*) into Paraspiticeratinae.

In the Bakony Mountains, *Paraspiticeras* was recorded from the late Hauterivian–early Barremian beds of the Márvány Quarry section and also in some sections around Hárskút (Édesvíz Key Section, Édesvíz-major and Rend-kő). Documented species are as follows: *P. guerinianum* (d'Orbigny, 1850), *P.* cf. *pachycyclum* (Uhlig, 1883) and *P.* cf. *voironense* (Pictet & de Loriol, 1858). However, the midflank tubercles of the holotype of *P. voironense* are stronger and less in numbers. All the figured *Paraspiticeras* specimens are in Plate 65. The classification of *Paraspiticeras* is complicated by the fact that in addition to the strong morphological changes throughout ontogeny, the group may display high intraspecific variability. Further research is needed. Representatives of the genus are known also from the Gerecse Mountains (Főzy 2017).

Family Acrioceratidae Vermeulen, 2004
Genus ***Acrioceras*** Hyatt, 1900
Type species: *Ancyloceras tabarelli* Astier, 1851

Small fragments of tiny heteromorph ammonites mainly from late Hauterivian beds of Hárskút, Édesvíz-major, and Édesvíz Key Section and also from Városlőd, Kakastaraj, were tentatively identified as *Acrioceras*. Besides, *Acrioceras* cf. *seringeri* (Astier, 1851) was also recognized in the Márvány Quarry fauna. See also remarks on *Paraspinoceras* below. *Acrioceras* specimens are shown in Plate 64.

Genus ***Paraspinoceras*** Sarkar, 1955
Type species: *Ancyloceras pulcherrinum* d'Orbigny, 1842

The state of *Paraspinoceras* as separate genus is disputed and is often treated as as subgenus of *Acrioceras*.

The small *Paraspinoceras pulcherrimum* (d'Orbigny, 1842) is a little-known ammonite. It was recorded from the Bakony (Márvány Quarry) already by Noszky (1934) under the generic name of *Hamulina*. Further specimens – including those identified only with reservation –, were collected from the Hauterivian of the Rend-kő and Hárskút, Édesvíz Key Section.

Thomel (1964) reported the species as *Acrioceras* (*Paraspinoceras*) *pulcherrimum* from south-east of France with highest frequency around the Hauterivian/Barremian boundary beds. Subsequently, Vašíček & Michalik (1988) described carefully the species as a characteristic element of the *Pseudothurmannia* Beds from the Hauterivian/Barremian boundary from the Western Carpathians. These data agree well with the supposed late Hauterivian age of most of the Márvány Quarry faunal elements. *Paraspinoceras* specimens including also *P. jourdani* (Astier, 1851) from the Bakony are figured in Plate 64.

Family Leptoceratoididae Thieuloy, 1966
Subfamily Leptoceratoidinae Thieuloy, 1966
Genus ***Hamulinites*** Paquier, 1900
Type species: *Hamulina munieri* Nicklès, 1894

The genus includes small, poorly known late Hauterivian–early Barremian forms. A single, tiny specimen of *H. munieri* Nicklès, 1894 was found in the Márvány Quarry fauna (Plate 64/9). *Hamulina munieri* is very close, if not conspecific with *Hamulinites varusensis* (d'Orbigny, 1850). Vašíček & Wiedmann (1993) regarded *Hamulina munieri* as a synonym of *Hamulinites parvulus* (Uhlig), which is – according to the authors – a "cosmopolitan and mainly lower Barremian species". In this paper, the point of view of Cecca et al. (1998) and Busnardo et al. (2003) is accepted; therefore *munieri* and *parvulus* are treated as separate species with a possibly different stratigraphic distribution.

A somewhat larger specimen of *H. munieri* Nicklès, 1894 was identified among the late Hauterivian – early Barremian ammonites of the Városlőd, Kakastaraj fauna (Plate 64/20); the ammonite was figured by Fülöp (1964) as "*Hamulina* cf. *butini* Coq."

Genus ***Karsteniceras*** Royo & Gomez, 1945
Type species: *Ancyloceras beyrichi* Karsten, 1858

Numerous flattened specimens, figured in Haas et al. (1985, pl. XXIX, fig. 3) as *Leptoceras parvulum* (Uhlig) from 263 meter depth of the borehole Süt-17, are now identified as *Karsteniceras* sp. These ammonites may indicate the early Barremian age of that part of the Sümeg Marl. The mass occurrence of these tiny, uncoiled forms may be due to the special pseudoplanctonic mode of life of the living animals. It is also supposed that the appearance of such a "*Karsteniceras*-level" is related to oxygen-depleted waters (Lukeneder 2003). The genus was placed into a wider evolutionary context by Vašíček &Wiedmann (1994).

Superfamily Ptychoceratoidea Gill, 1871
Family Hamulinidae Gill, 1871

Heteromorph ammonites from Barremian deposits with a longer and a shorter shafts, connect by a bend, were classified into the genera *Hamulina* and *Anahamulina* in earlier paleontologic works. All these forms were traditionally treated as Barremian ones, but by now it is evident that they appeared already in the late Hauterivian. Hamulinidae vary in size and ornamentation, besides they are generally found as fragments only, therefore their identification is very difficult, sometimes even on family level.

Vermeulen (2005) introduced numerous new genera for the related forms (such as: *Vasicekina* for *Hamulina paxillosa* Uhlig, 1883; *Amorina* for *Hamulina cincta* d'Orbigny, 1849; *Ptychohamulina* for *Hamulina ptychoceratoides* Hohenegger in Uhlig, 1883 and *Duyeina* for *Anahamulina glemmbachensis* Immel, 1987) which were not considered during the present work, because their relation and differences are unclear. Subsequently Vermeulen et al. (2012a) also considered the use of the subfamily Hamulininae and introduced the following late Hauterivian genera: *Schaffhauseria*, *Liataudia*, *Garroniceras* and *Bastellia.* All these genera contain poorly known, similarly ribbed and hooked ammonites with constriction. Since the Bakony specimens are very fragmentary, their identification is uncertain. Many of the specimens (bends and fragments of shafts) of different size in the late Hauterivian beds were identified on family level only.

Genus ***Hamulina*** d'Orbigny, 1850
Type secies: *Hamulina astieriana* d'Orbigny, 1850

Among the fragmentary hamulinids, some relatively large, long, straight, or hook-shaped fragments were identified as *Hamulina astieriana* (d'Orbigny, 1850) from the Márvány Quarry (Plate 61/2, 9).

Genus ***Anahamulina*** Hyatt, 1900
Type species: *Hamulina subcilindrica* d'Orbigny, 1850

Anahamulina cf. *cincta* (d'Orbigny, 1842) was reported from condensed beds of the Márvány Quarry (Plate 60/11) and *Anahamulina subcincta* (Uhlig, 1883) from Városlőd, Kakastaraj (Plate 61/4). Latter may represent already the presence of lower Barremian deposits. Small fragments identified as *Anahamulina* cf. *acuaria* (Uhlig, 1883) and as *Anahamulina* sp. from the uppermost beds of the Hárskút, Édesvíz Key Section may represent also the early Barremian (Hugii Zone).

Genus ***Schaffhauseria*** Vermeulen et al., 2012
Type species: *Schaffhauseria schirollii* Vermeulen et al., 2012

Some thick, somewhat irregularly ribbed fragmentary ammonites were optionally identified as ?*Schaffhauseria* sp. (Plate 61/ 1, 8).

Family Macroscaphitidae, Hyatt, 1900
Genus ***Macroscaphites*** Meek, 1876
Type species: *Scaphites yvani* Puzos, 1832

A small ammonite containing fragment of the three, subsequent slowly growing whorls, ornamented with dense, simple, radial ribs, was identified on generic level only (Plate 65/8). It was collected from Hárskút, HK-20 grab sample point together with an early Aptian *Deshayesites* specimen and with a desmoceratid. *Macroscaphites* is regarded as a Barremian genus, therefore the mentioned small fauna provides a (?late) Barremian – early Aptian age constrain for the site.

Superfamily Douvilleiceratacеae Parona & Bonarelli, 1897
Family Douvilleiceratidae Parona & Bonarelli, 1897
Subfamily Cheloniceratinae, Spath, 1923
Genus ***Cheloniceras*** Hyatt, 1903
Type species: *Ammonites cornuelianus* d'Orbigny, 1841

A single specimen identified only on generic level from the 202–214 meter depth in the borehole Süt-17, indicates the early Aptian age of this part of the Sümeg Marl.

Superfamily Deshayesitaceae Stoyanow, 1949
Family Deshayesitidae Stoyanow, 1949
Subfamily Deshayesitinae, Stoyanow, 1949
Genus ***Deshayesites*** Kazansky, 1914
Type species: *Ammonites deshayesi* d'Orbigny, 1840

A well-preserved fragment, identified as *Deshayesites* cf. *callidiscus* Casey, 1961 was found in the collection (Plate 65/9). It was collected from Hárskút, HK-20, grab sample point together with a fragment of a *Macroscaphites* and a desmoceratid ammonite. Since the genus is treated as an early Aptian one, the specimen suggests a surprisingly high stratigraphic level

for the Sümeg Marl formation around Hárskút, from which it was possibly collected from. Another *Deshayesites* specimen was found near Sümeg, from 297 meter depth in the borehole Süt-17, where the Sümeg Marl reaches its greatest thickness.

Subfamily Acanthohoplitinae, Stoyanow, 1949
Genus ***Colombiceras*** Spath, 1923
Type species: *Ammonites crassicostatus* d'Orbigny, 1840

A single specimen identified only on generic level from 202 meter depth in the borehole Süt-17, indicate the middle Aptian age of this part of the the Sümeg Marl.

Subfamily Parahoplitinae, Spath, 1922
Genus ***Parahoplites*** Anthula, 1899
Type species: *Parahoplites melchioris* Anthula, 1899

A single specimen identified only on generic level from 164 meter depth in the borehole Süt-17 indicate the middle Aptian age of the Sümeg Marl.

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Taxonomical index

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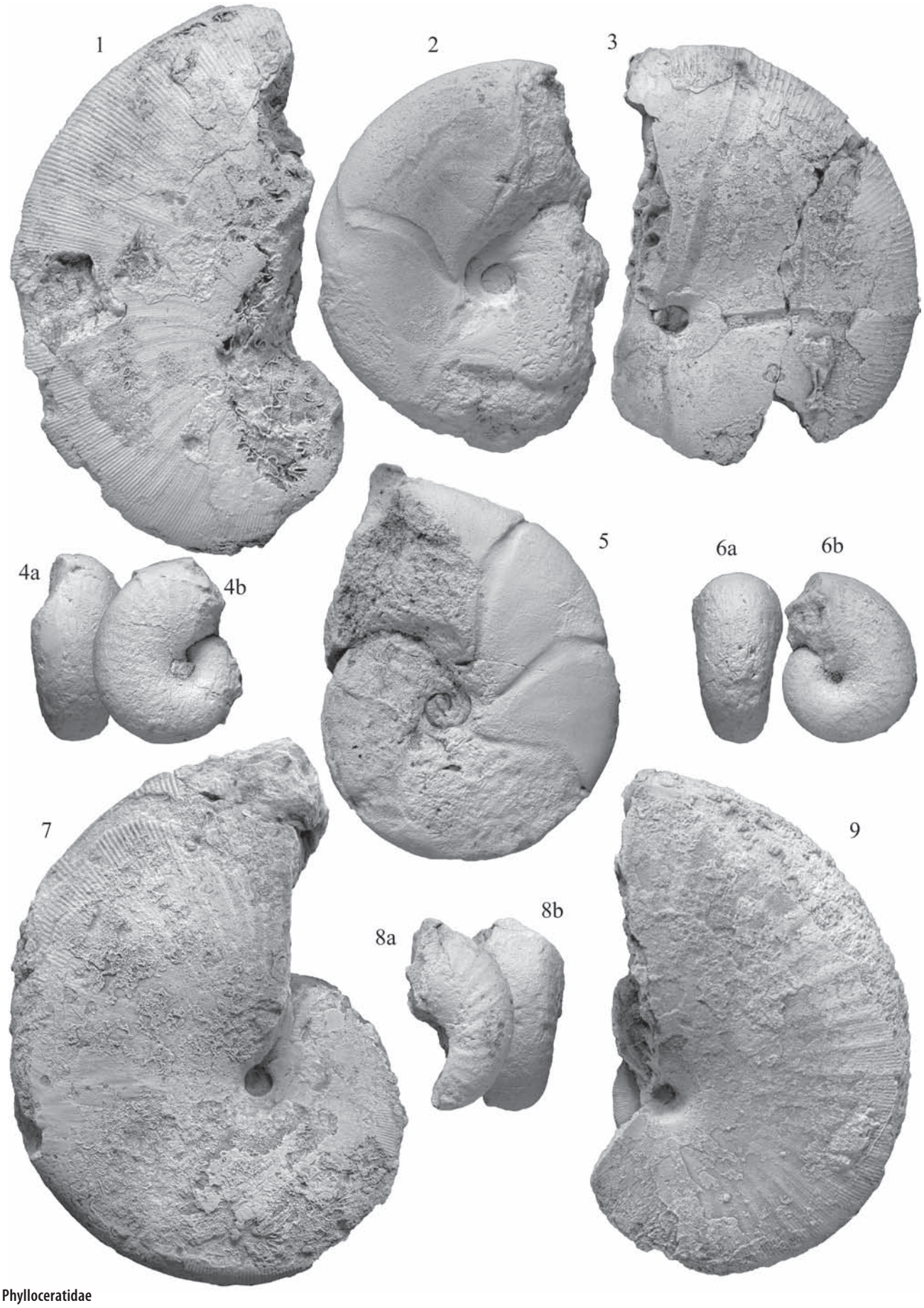

Plate 1 – **Phylloceratidae**

All figures natural size

1. *Phylloceras consanguineum* Gemmellaro, 1876 – J.2021.75.1, from the Kimmeridgian of Borzavár, Páskom Hill.
2. *Sowerbyceras silenum* (Fontannes, in Dumortier & Fontannes, 1876) – M.92902, Lókút Hill, bed 73, "middle Kimmeridgian", Divisum Zone.
3. *Calliphylloceras* cf. *benacense* (Catullo, 1847) – J.2021.76.1, Eperkés Hill, Stripe Pit, probably Kimmeridgian.
4a, 4b. *Phylloceras infundibulum* (d'Orbigny, 1841) – K.2021.61.1, Hárskút, Édesvíz, Key section, bed 7, late Hauterivian.
5. *Holcophylloceras* cf. *polyolcum* (Benecke 1866) – M.921102, Lókút Hill, bed 74, early Kimmeridgian, Strombecki Zone.
6a, 6b. *Phylloceras infundibulum* (d'Orbigny, 1841) – K.2021.62.1, Hárskút, Édesvíz, Key section, bed 7, late Hauterivian.
7. *Phylloceras tethys* (d'Orbigny, 1841) – K.2021.63.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
8a, 8b. *Phylloceras infundibulum* (d'Orbigny, 1841) – K.2021.64.1, Hárskút, Édesvíz, Key section, bed 7, late Hauterivian.
9. *Phylloceras consanguineum* Gemmellaro, 1876 – J.2021.77.1, from the Kimmeridgian of Borzavár, Páskom Hill.

Plate 2 – Phylloceratidae

All figures natural size

11a, 1b. *Phylloceras serum* (Oppel, 1865) – J.10327, Hárskút, HK-12/a section, bed 10, late Tithonian, Andreaei Zone.
2. *Calliphylloceras* cf. *calypso* (d'Orbigny, 1841) – K.2010.96.1, Hárskút, HK-12 section, bed 30, early Berriasian, Occitanica Zone.
3. *Calliphylloceras* cf. *calypso* (d'Orbigny, 1841) – K.11439, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
4a, 4b. *Phylloceras ptychostoma* (Benecke, 1866) – J.9765, Lókút Hill, bed 44, early Tithonian, Fallauxi Zone.
5. *Sowerbyceras* cf. *silenum* (Fontannes, in Dumortier & Fontannes, 1876) – M.92.1021, Lókút Hill, bed 70, late Kimmeridgian, Compsum Zone.
6. *Sowerbyceras* sp. – J.11013, Borzavár, Szilas Ravine, bed 117, late Kimmeridgian, Beckeri Zone.

Plate 3 – **Phylloceratidae**

All figures natural size

1. *Holcophylloceras polyolcum* (Benecke 1866) – J.2021.78.1, from the Kimmeridgian of Borzavár, Páskom Hill.
2. *Phylloceras winkleri* (Uhlig, 1882) – K.2021.65.1, Hárskút, Édesvíz, Key section, bed 10, late Hauterivian.
3. *Phylloceras infundibulum* (d'Orbigny, 1841) – K.2021.66.1, Hárskút, Rend-kő section, bed 34, late Hauterivian, Ohmi Zone.
4a, 4b. *Calliphylloceras kochi* (Oppel, 1865) – J.2014.44, from the Kimmeridgian of Borzavár, Páskom Hill.

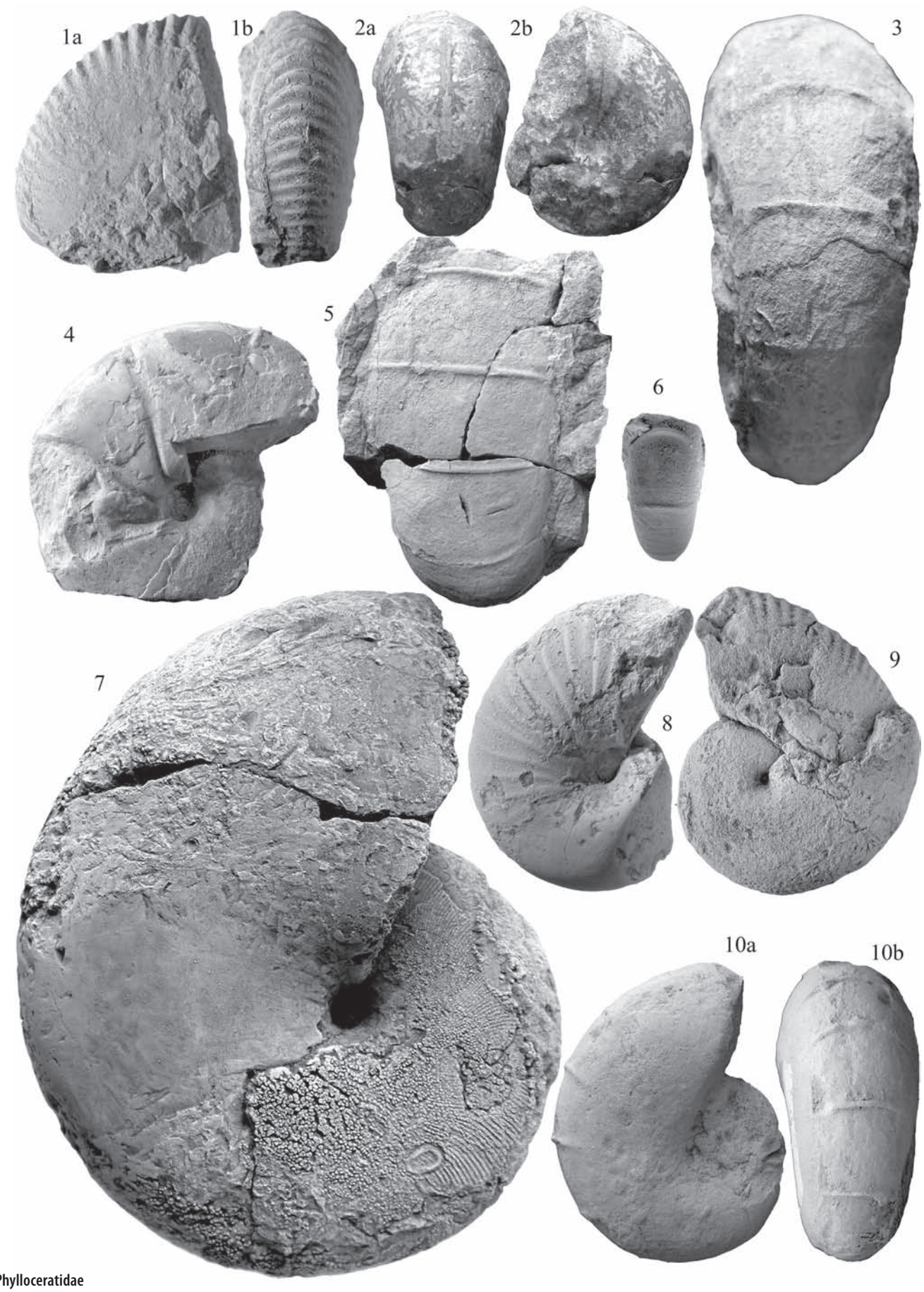

Plate 4 – Phylloceratidae

All figures natural size

1a, 1b. *Phylloceras winkleri* (Uhlig, 1882) – K.15225, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
2a, 2b. *Phylloceras rouyanum* (d'Orbigny, 1841) – K.2014.2, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
3. *Ptychophylloceras semisulcatum* (d'Orbigny, 1840) – J.11164, Borzavár, Szilas Ravine, bed 79, early Tithonian, Fallauxi Zone.
4. *Calliphylloceras calypso* (d'Orbigny, 1841) – K.2010.174.1, Hárskút, HK-12 section, Valanginian, from debris.
5. *Ptychophylloceras semisulcatum* (d'Orbigny, 1840) – K.2010.210.1, Hárskút, HK-12 section, bed 6, late Valanginian, Verrucosum Zone.
6. *Ptychophylloceras* sp. – K.15243, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
7. *Phylloceras ponticuli* (Rousseau, 1842) – K.2014.4, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
8. *Phylloceras infundibulum* (d'Orbigny, 1841) – K.15234, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
9. *Phyllopachyceras winkleri* (Uhlig, 1882) – K.2010.22.1, Hárskút, top of HK-12 section, late Hauterivian.
10a, 10b. *Ptychophylloceras semisulcatum* (d'Orbigny, 1840) – J.10683, Hárskút, HK-II section, bed 44, early Tithonian, Fallauxi Zone.

Plate 5 – **Lytoceratidae**

All figures natural size

1. *Lytoceras juilleti* (d'Orbigny, 1841) – J.9767, Lókút Hill, bed 12, late Tithonian, Microcanthum Zone.
2. *Lytoceras juilleti* (d'Orbigny, 1841) – K.2010.299.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
3. *Lytoceras subfimbriatum* (d'Orbigny, 1841) – K.2021.67.1, Hárskút, Rend-kő section, bed 35, late Hauterivian, Ohmi Zone.
4. *Protetragonites quadrisulcatus* (d'Orbigny, 1841) – K.2014.3, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
5. *Lytoceras* cf. *montanum* (Oppel, 1865) – J.2021.79.1, Lókút Hill, bed 59, early Tithonian, Hybonotum Zone.
6. *Protetragonites quadrisulcatus* (d'Orbigny, 1841) – K.11423, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
7. *Protetragonites honnoratianus* (d'Orbigny, 1841) – K.11401, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

Plate 6 – Lytoceratidae

All figures natural size

1. *Lytoceras polycyclum* (Neumayr, 1871) – J.2021.80.1, from the Kimmeridgian of Borzavár, Páskom Hill. For suture of this specimen see Fig. 5/1 in the text.
2. *Lytoceras polycyclum* (Neumayr, 1871) – J.2014.43, from the Kimmeridgian of Borzavár, Páskom Hill.
3. *Lytoceras subfimbriatum* (d'Orbigny, 1841) – K.2021.68.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
4. *Lytoceras subfimbriatum* (d'Orbigny, 1841) – K.2021.69.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
5. *Protetragonites strangulatus* (d'Orbigny, 1840) – K.11411, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

Plate 7 – **Lytoceratidae**

All figures are reduced to 0.8x

1. *Lytoceras polycyclum* (Neumayr, 1871) – M.921117, Lókút, bed 68, late Kimmeridgian, Beckeri Zone.
2a, 2b. *Lytoceras subfimbriatum* (d'Orbigny, 1841) – K.2021.70.1, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.
3. *Lytoceras* cf. *liebigi* (Oppel, 1865) – J.10368, Hárskút, HK-12/a section, bed 19, late Tithonian, Microcanthum Zone.
4a, 4b. *Lytoceras liebigi* (Oppel, 1865) – J.2021.81.1, from the Kimmeridgian of Borzavár, Páskom Hill.

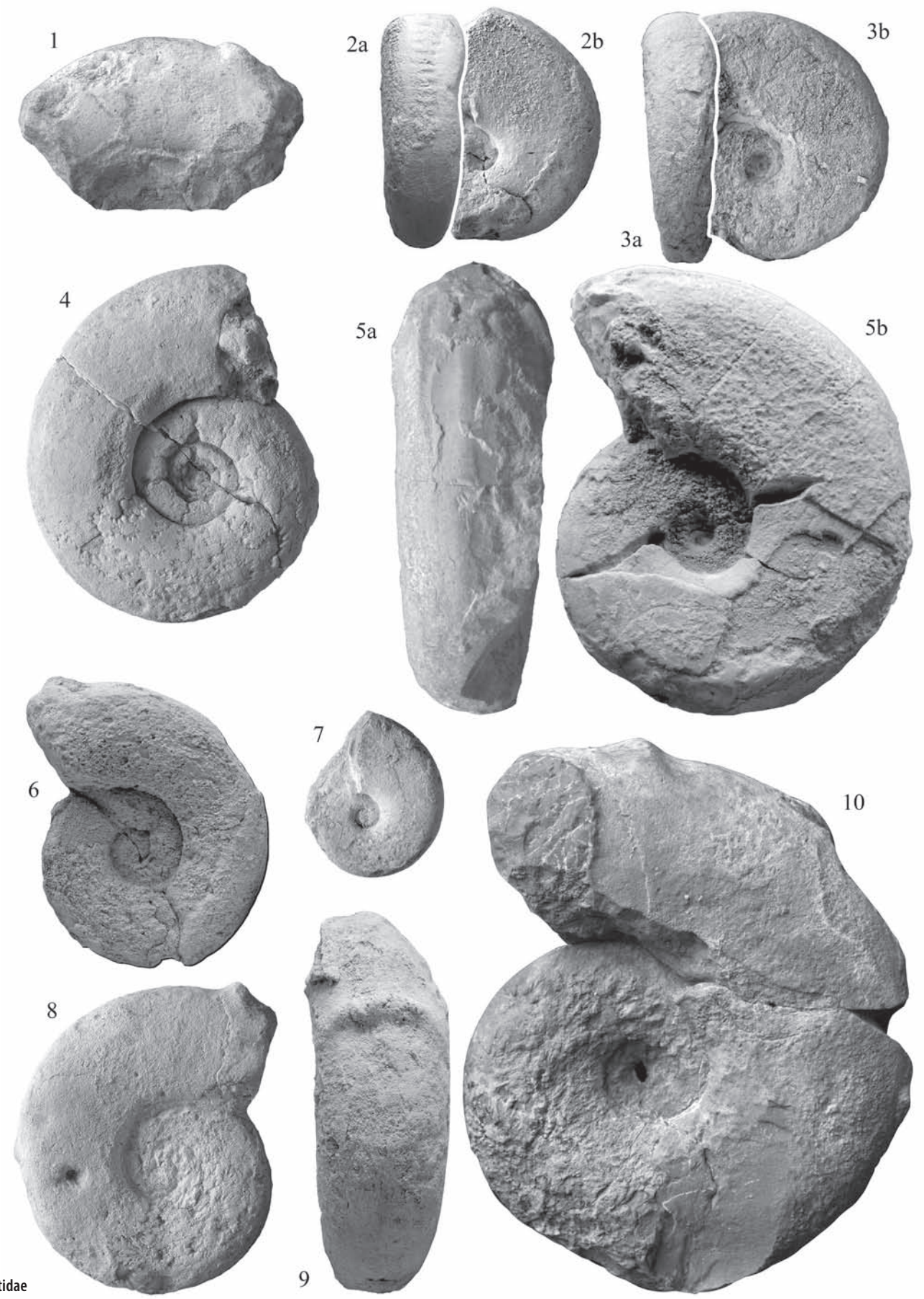

Plate 8 – Haploceratidae

Figures natural size except otherwise indicated

1. *Haploceras verruciferum* (Zittel, 1870) – J.10923, Hárskút, HK-II section, bed 60, early Tithonian, Semiforme Zone.
2a, 2b. *Haploceras carachtheis* (Zeuschner, 1846) – J.10908, Hárskút, HK-II section, bed 49, early Tithonian, Fallauxi Zone.
3a, 3b. *Neolissoceras grasianum* (d'Orbigny, 1841) – K.2010.140.1, Hárskút, HK-12 section, bed 18, late Berriasian, Boissieri Zone, (0.7x).
4. *Pseudolissoceras olorizi* Főzy, 1988 – J.9769, Lókút Hill, bed 54, early Tithonian, Darwini Zone.
5a, 5b. *Neolissoceras* cf. *grasianum* (d'Orbigny, 1841) – K.11356, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
6. *Haploceras verruciferum* (Zittel, 1870) – J.10939, Borzavár, Szilas Ravine, bed 93, early Tithonian, Semiforme Zone.
7. *Neolissoceras grasianum* (d'Orbigny, 1841) – K.15246, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
8. *Haploceras verruciferum* (Zittel, 1870) – INV.2014.76, Lókút Hill, level LH-122, early Tithonian, Semiforme Zone.
9. *Haploceras cassiferum* Főzy, 1988 – J.10.63.1, Lókút Hill, bed 57, early Tithonian, Darwini Zone.
10. *Haploceras cassiferum* Főzy, 1988 – J.9762, holotype, Lókút Hill, bed 56, early Tithonian, Darwini Zone.

Plate 9 – Haploceratidae

All figures natural size

1. *Pseudolissoceras olorizi* Főzy, 1988 – J.10941, holotype, Hárskút, HK-II section, bed 66, early Tithonian, Hybonotum Zone.
2. *Haploceras verruciferum* (Zittel, 1870) – J.2021.82.1, Hárskút, Édesvízkút-1 section, bed 8, early Tithonian, Semiforme Zone.
3a, 3b. *Pseudolissoceras olorizi* Főzy, 1988 – J.942, Borzavár, Szilas Ravine, bed 93, early Tithonian, Semiforme Zone.
4a, 4b. *Neolissoceras grasianum* (d'Orbigny, 1841) – K.2010.99.1, Hárskút, HK-12 section, bed 31, late Tithonian, Chaperi Zone.
5. *Neolissoceras grasianum* (d'Orbigny, 1841) – K.2021.71.1, Hárskút, Édesvíz Key Section, bed 59, late Valanginian, Verrucosum Zone.
6a, 6b. *Haploceras carachtheis* (Zeuschner, 1846) – J.10909, Hárskút, Rend-kő II section, early Tithonian.
7. *Haploceras verruciferum* (Zittel, 1869) – J.10935, Borzavár, Szilas Ravine, bed 94, early Tithonian, Semiforme Zone.
8. *Haploceras wohleri* (Oppel, 1865) – J.10149, Sümeg I section, bed 47, early Tithonian, Fallauxi Zone.

Plate 10 – Haploceratidae

All figures natural size

1a, 1b. *Haploceras wohleri* (Oppel, 1865) – J.10897, Hárskút, HK-12/a, bed 12, late Tithonian, Microcanthum Zone.
2. *Neolissoceras grasianum* (d'Orbigny, 1841) – K.2021.72.1, Hárskút, Rend-kő section, bed 34, late Hauterivian, Ohmi Zone.
3. *Haploceras elimatum* (Oppel, 1865) – J.2021.83.1, Bakonybél, Som Hill, grab sample, Tithonian. For suture of this specimen see Fig. 5/3a, 3b in the text.
4. *Haploceras elimatum* (Oppel, 1865) – J.10891, Hárskút, HK-II section, bed 40, late Tithonian, Microcanthum Zone, with impressions of worm-tubes in the adult body chamber.
5a, 5b. *Haploceras elimatum* (Oppel, 1865) – J.10618, Hárskút, HK-II section, bed 59, early Tithonian, Semiforme Zone.

Plate 11 – Oppeliidae

All figures natural size

1a, 1b. *Hemihaploceras nobile* (Neumayr, 1873) – M.82.931, Lókút Hill, bed 68, late Kimmeridgian, Beckeri Zone.
2a, 2b. *Semiformiceras fallauxi* (Oppel, 1865) – J.2021.84.1, Hárskút, Édesvízkút-1 section, bed 5, early Tithonian, Fallauxi Zone.
3a, 3b. *Semiformiceras darwini* (Neumayr, 1873) – J.10882, Borzavár, Szilas Ravine, bed 99, early Tithonian, Darwini Zone.
4. *Streblites tenuilobatus* (Oppel, 1863) – M.92.1097, Lókút Hill, bed 73, "middle Kimmeridgian", Divisum Zone.
5a, 5b. *Streblites tenuilobatus* (Oppel, 1863) – J.2014.37, from the Kimmeridgian of Borzavár, Páskom Hill.
6. *Hemihaploceras nobile* (Neumayr, 1873) – J.11076, Szilas Ravine, bed 117, late Kimmeridgian, Cavouri Zone.
7. *Substreblites zonarius* (Oppel, 1865) – J.11351, Szilas Ravine, bed 35, early Berriasian, Chaperi Zone.
8a, 8b. *Metahaploceras* cf. *strombecki* (Oppel, 1858) – M.92.879, Lókút Hill, bed 73, "middle Kimmeridgian", Divisum Zone.
9a, 9b. *Metahaploceras strombecki* (Oppel, 1858) – J.2014.32, from the Kimmeridgian of Borzavár, Páskom Hill.
10a,10b. *Streblites* cf. *tenuilobatus* (Oppel, 1863) – J.2014.38, from the Kimmeridgian of Borzavár, Páskom Hill.
11a, 11b. *Streblites* sp. – J.2014.39, from the Kimmeridgian of Borzavár, Páskom Hill.

Plate 12 – Oppeliidae

All figures natural size

1. *Taramelliceras trachinotum* (Oppel, 1857) – J.2021.85.1, from the Kimmeridgian of Borzavár, Páskom Hill.
2. *Metahaploceras* cf. *strombecki* (Oppel, 1858) – J.2021.86.1, from the Kimmeridgian of Borzavár, Páskom Hill. For suture of this specimen see Fig. 5/4.
3. *Taramelliceras trachinotum* (Oppel, 1857) – J.2021.87.1, from the Kimmeridgian of Borzavár, Páskom Hill.
4. *Metahaploceras* cf. *strombecki* (Oppel, 1858) – J.2021.88.1, from the Kimmeridgian of Borzavár, Páskom Hill.
5. *Taramelliceras pseudoflexuosum* (Favre, 1877) – J.2021.89.1, from the Kimmeridgian of Borzavár, Páskom Hill.
6a, 6b. *Lingulaticeras semicostatum* (Berckhemer, 1958) – J.2021.90.1, from the Kimmeridgian of Borzavár, Páskom Hill.
7. *Taramelliceras* sp. – J.2021.91.1, Hárskút, Édesvízkút-1 section, bed 10, early Tithonian, ?Darwini Zone.
8a, 8b. *Fontannesiella* sp. – J.2021.92.1, from the Kimmeridgian of Borzavár, Páskom Hill.

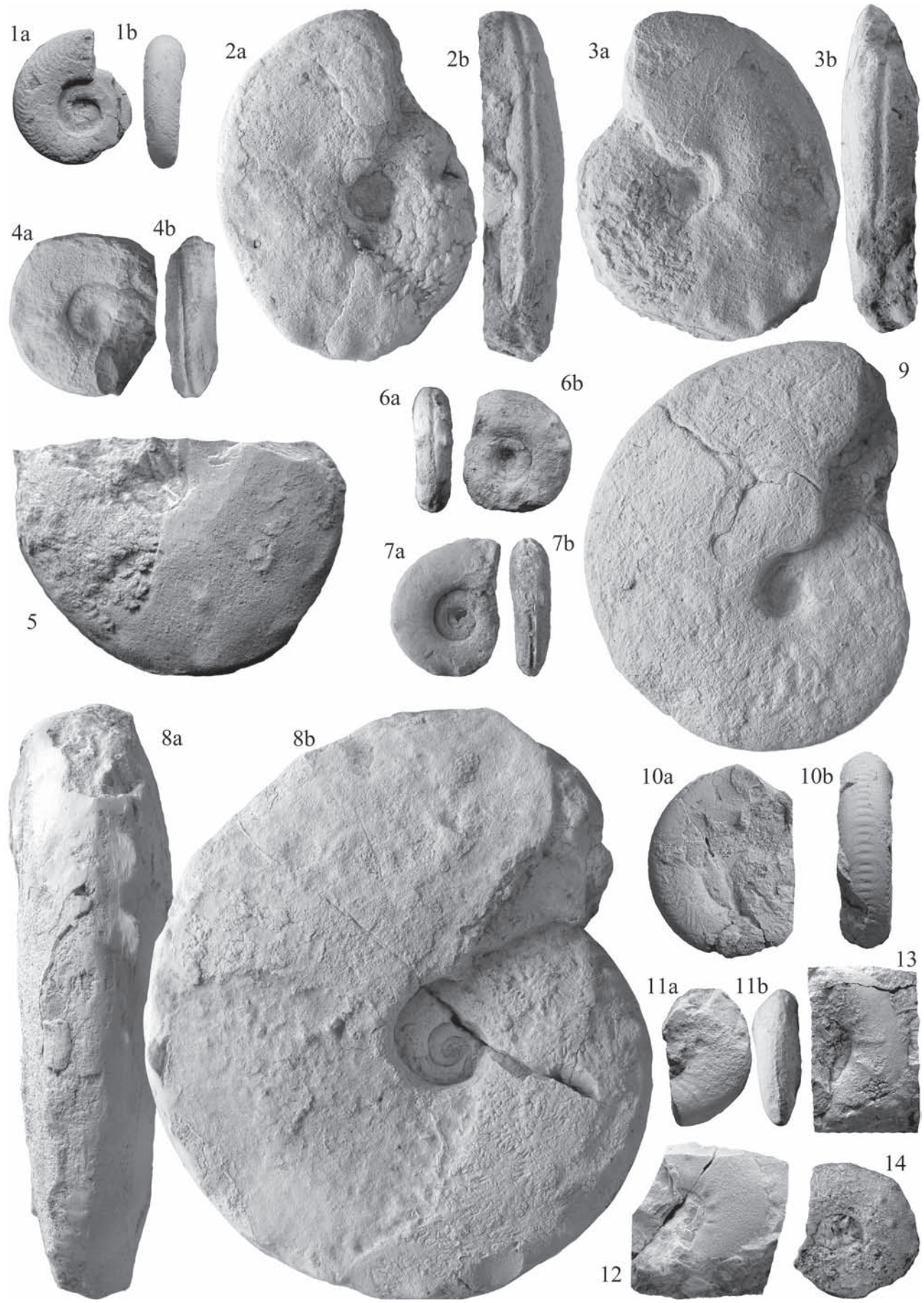

Plate 13 – Oppeliidae

All figures natural size

1a, 1b. *Lingulaticeras jungens* (Neumayr, 1873) – J.2014. 33, from the Kimmeridgian of Borzavár, Páskom Hill.
2a, 2b. *Semiformiceras semiforme* (Oppel, 1865) – J.10.54.1, Lókút Hill, from debris, characteristic for the early Tithonian, Semiforme Zone.
3. *Semiformiceras semiforme* (Oppel, 1865) – J.10871, Borzavár, Szilas Ravine, bed 93, early Tithonian, Semiforme Zone.
4, 4b. *Semiformiceras fallauxi* (Oppel, 1865) – J.10874, Sümeg, section II, bed 38, early Tithonian, Fallauxi Zone.
5. *Semiformiceras semiforme* (Oppel, 1865) – J.10870, Hárskút, HK-II section, bed 59, early Tithonian, Semiforme Zone.
6a, 6b. *Semiformiceras gemmellaroi* (Zittel, 1865) – J.2021.93.1, Hárskút, Édesvíz, Key section, bed 67, early Tithonian, Fallauxi Zone.
7a, 7b. *Semiformiceras gemmellaroi* (Zittel, 1865) – J.2021.94.1, Hárskút, Édesvíz, Key section, bed 68, early Tithonian, Fallauxi Zone.
8a, 8b. *Taramelliceras* ex. gr. *compsum* (Oppel, 1863) – M.92.888, Lókút Hill, bed 68, late Kimmeridgian, Beckeri Zone.
9. "*Neochetoceras*" sp. – J.10879, Lókút Hill, bed 43, early Tithonian, Fallauxi Zone.
10a, 10b. *Lingulaticeras jungens* (Neumayr, 1873) – J.2014. 41, from the Kimmeridgian of Borzavár, Páskom Hill.
11a, 11b. *Semiformiceras semiforme* (Oppel, 1865) – J.10867, Borzavár, Szilas Ravine, bed 94, early Tithonian, Semiforme Zone.
12. *Semiformiceras fallauxi* (Oppel, 1865) – J.10875, Hárskút, HK-II section, bed 54, early Tithonian, Fallauxi Zone.
13. *Semiformiceras fallauxi* (Oppel, 1865) – J.2021.95.1, Olaszfalu, Stripe Pit, bed 3, early Tithonian, Fallauxi Zone.
14. *Semiformiceras birkenmajeri* Kutek & Wierzbowski, 1986 – J.10367, Hárskút, HK-II section, bed 62, early Tithonian, Darwini Zone.

Plate 14 – Perisphinctidae

Figures reduced to 0.7x, except Fig. 1, which is actual size

1. *Presimoceras teres* (Neumayr, 1871) – J.2014.31, from the Kimmeridgian (most probably "mid-Kimmeridgian") of Borzavár, Páskom Hill, (1x).
2. *Presimoceras teres* (Neumayr, 1871) – J.2021.96.1, from the Kimmeridgian (most probably "mid-Kimmeridgian") of Borzavár, Páskom Hill, (0.7x).
3. *Presimoceras* sp. – J.2021.97.1, from the Kimmeridgian (most probably "mid-Kimmeridgian") of Borzavár, Páskom Hill, (0.7x).
4. *Presimoceras* cf. *herbichi* (Hauer, 1866) – J.2021.98.1, from the Kimmeridgian (most probably "mid-Kimmeridgian") of Borzavár, Páskom Hill, (0.7x).
5. *Presimoceras herbichi* (Hauer, 1866) – J.2021.99.1, from the Kimmeridgian (most probably "mid-Kimmeridgian") of Borzavár, Páskom Hill, (0.7x).

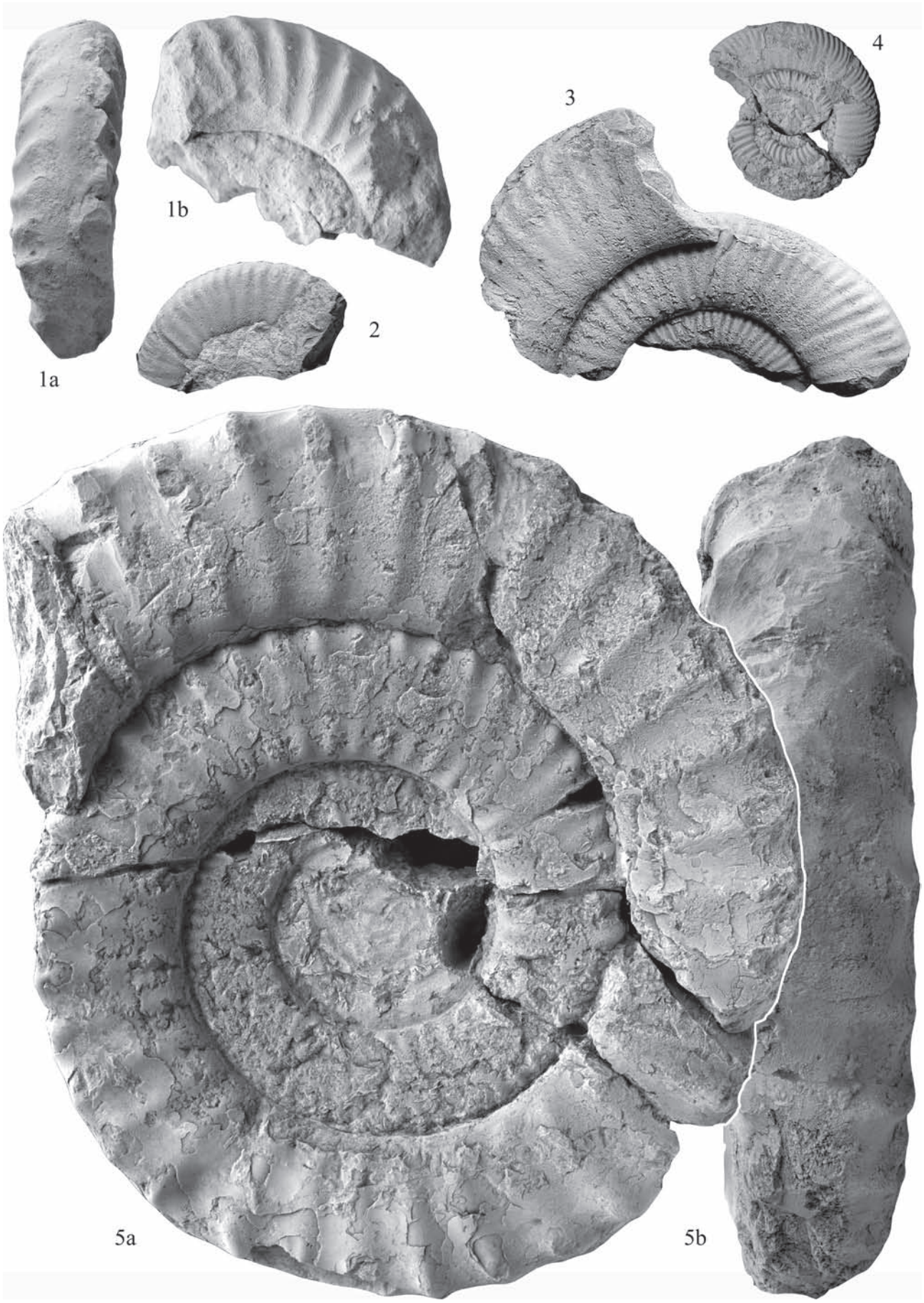

Plate 15 – Perisphinctidae

All figures natural size

1a, 1b. *Trenerites evolutus* (Gemmellaro, 1876) – M.92.958, Lókút Hill, bed 73, "middle Kimmeridgian", Divisum Zone.
2. *Idoceras balderum* (Oppel, 1863) – J.2014.35, from the Kimmeridgian of Borzavár, Páskom Hill, very likely Divisum Zone.
3. *Nebrodites* cf. *favarensis* (Gemmellaro, 1872) – J.2014.42, from the Kimmeridgian of Borzavár, Páskom Hill.
4. *Nebrodites hospes* (Neumayr, 1871) – J.2014.36, from the Kimmeridgian of Borzavár, Páskom Hill.
5a, 5b. *Presimoceras nodulatum* (Quenstedt, 1888) – J.2014.28, from the Kimmeridgian (most probably "mid-Kimmeridgian") of Borzavár, Páskom Hill.

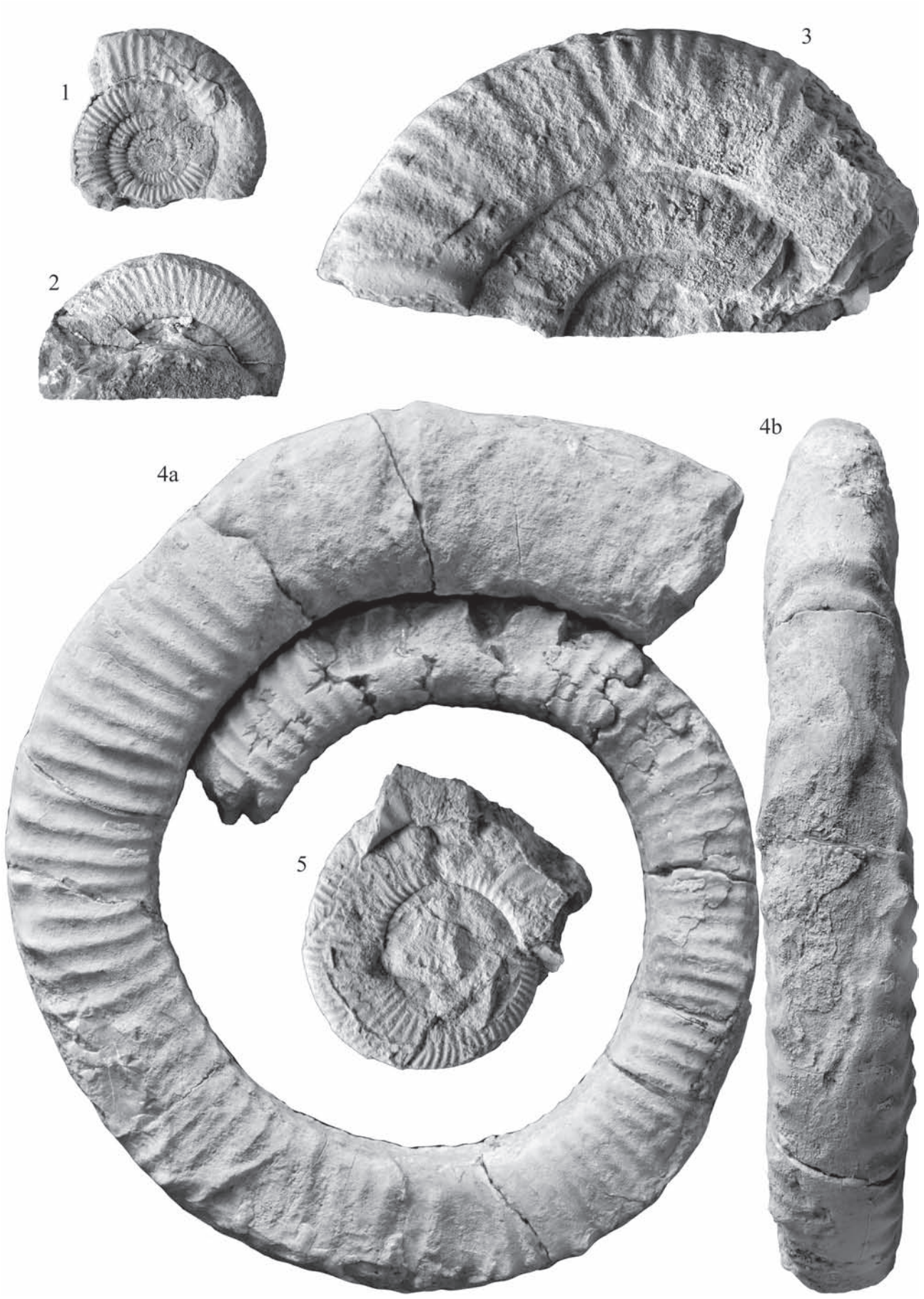

Plate 16 – Perisphinctidae

All figures natural size

1. *Presimoceras herbichi* (Hauer, 1866) – J.2021.100.1, from the Kimmeridgian (most probably "mid-Kimmeridgian") of Borzavár, Páskom Hill.

2. *Nebrodites hospes* (Neumayr, 1873) – J.2021.101.1, from the Kimmeridgian of Borzavár, Páskom Hill.

3. *Subnebrodites* sp. – J.2021.102.1, from the Kimmeridgian (most probably early Kimmeridgian) of Borzavár, Páskom Hill.

4a, 4b. *Mesosimoceras cavouri* (Gemmellaro, 1872) – M.92.1247, Lókút Hill, bed 69, late Kimmeridgian, Cavouri Zone.

5. *Subnebrodites* sp. – J.2021.103.1, from the Kimmeridgian (most probably early Kimmeridgian) of Borzavár, Páskom Hill.

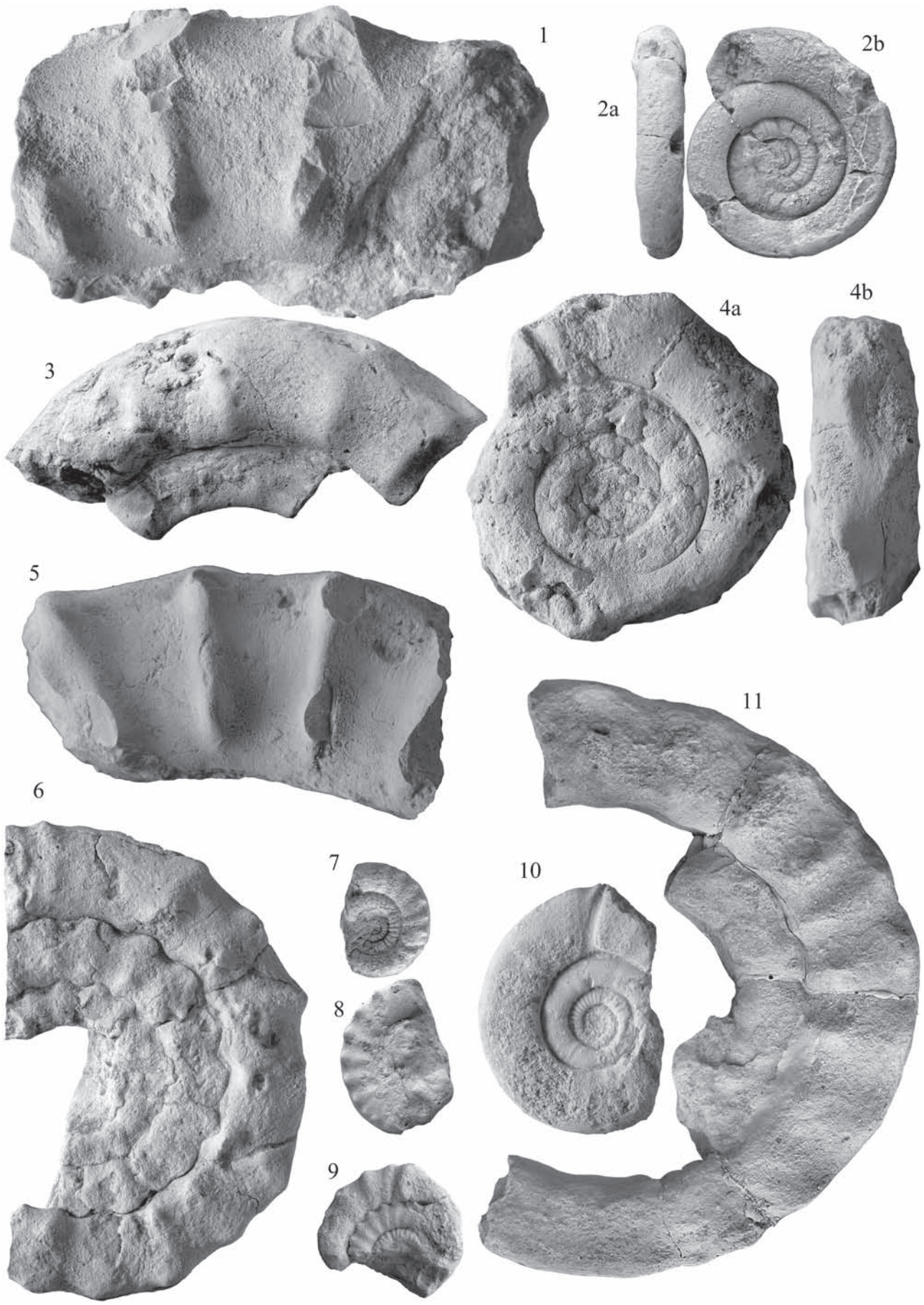

Plate 17 – Simoceratidae

All figures natural size

1. *Volanoceras perarmatiforme* (Schrauroth, 1865) – J.10551, Lókút Hill, bed 26, early Tithonian, Volanense Zone.
2a, 2b. *Lytogyroceras subbeticum* Olóriz, 1978 – J.10976, Hárskút, HK-II section, bed 42, early Tithonian, Volanense Zone.
3. *Simoceras admirandum* (Zittel, 1870) – J.10965, Hárskút, HK-II section, bed 48, early Tithonian, Fallauxi Zone.
4a, 4b. *Simoceras biruncinatum* (Quenstedt, 1845) – INV.2014.75, Lókút Hill, level LH-133, early Tithonian, Fallauxi Zone.
5. *Volanoceras perarmatiforme* (Schrauroth, 1865) – INV.2022.1, Hárskút, Rend-kő-II section, early Tithonian, ?Microcanthum Zone.
6. *Volanoceras aesinense* (Meneghini, 1885) – J.9778, Lókút Hill, bed 53, early Tithonian, Semiforme Zone.
7. *Volanoceras volanense* (Oppel, 1863) – J.10960, Borzavár, Szilas Ravine, bed 66, early Tithonian, Volanense Zone.
8. *Volanoceras volanense* (Oppel, 1863) – J.10959, Hárskút, HK-12/a section, bed 25, early Tithonian, Volanense Zone.
9. *Volanoceras volanense* (Oppel, 1863) – J.10958, Lókút Hill, from debris, characteristic for the early Tithonian, Volanense Zone.
10. *Simolytoceras* sp. – J.10561, Lókút Hill, bed 24, early Tithonian, probably Volanense Zone.
11. *Volanoceras aesinense* (Meneghini, 1885) – J.10955, Borzavár, Szilas Ravine, bed 92, early Tithonian, Semiforme Zone.

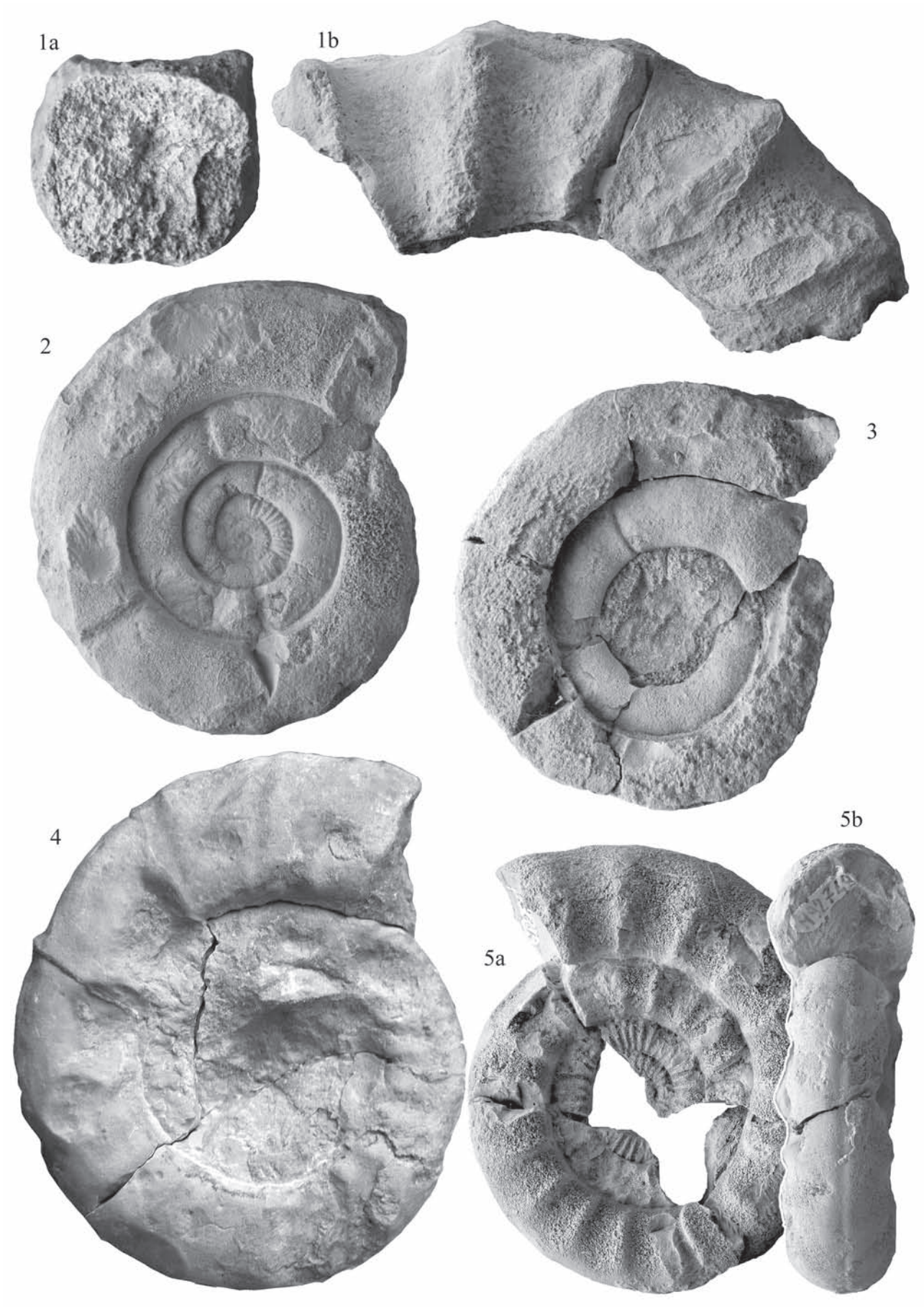

Plate 18 – Simoceratidae

All figures natural size

1a, 1b. *Volanoceras perarmatiforme* (Schrauroth, 1865) – J.10956, Sümeg, section II, bed 45, early Tithonian, Volanense Zone.
2. *Simolytoceras volanensoides* (Vigh, 1984) – J.9803, paratype, Lókút Hill, bed 44, early Tithonian, Fallauxi Zone.
3. *Lytogyroceras strictum* (Catullo, 1846) – J.10208, Sümeg, section II, bed 38, early Tithonian, ?Fallauxi Zone.
4. *Simolytoceras vighi* Főzy, 1988 – J.10975, holotype, Hárskút, HK-II section bed 49, early Tithonian, Fallauxi Zone.
5a, 5b. *Virgatosimoceras dunaii* Scherzinger, Főzy & Parent, 2010 – M.92.749, holotype, Lókút Hill, bed 47, early Tithonian, Semiforme Zone.

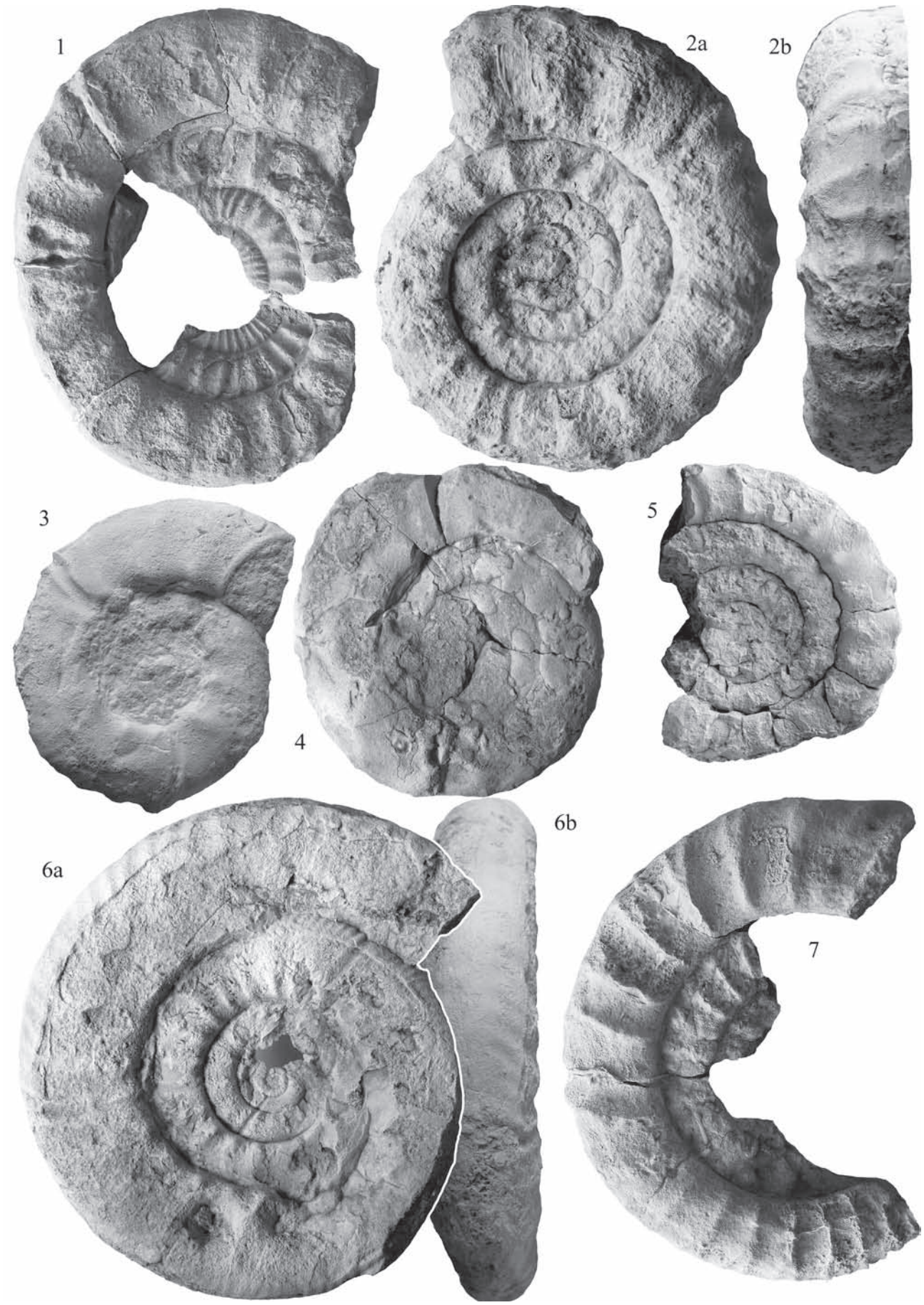

Plate 19 – Simoceratidae

All figures reduced to 0.7x

1. *Virgatosimoceras albertinum* (Catullo, 1855) – J.10365, Hárskút, HK-II section, bed 64, early Tithonian, Darwini Zone.
2a, 2b. *Virgatosimoceras albertinum* (Catullo, 1855) – J.2021.104.1, Zirc, Márvány Quarry, Tithonian, presumably Darwini Zone.
3. *Simospiticeras lojense* Olóriz & Tavera, 1977 – J.10641, Lókút Hill, bed 10, late Tithonian, Microcanthum Zone.
4. *Simospiticeras cristatum* Olóriz & Tavera, 1977 – J.10306, Hárskút, HK-12/a section, bed 16, late Tithonian, Microcanthum Zone.
5. *Volanoceras aesinense* (Meneghini, 1885) – J.2021.105.1, Olaszfalu, Eperkés Hill, from debris, characteristic for the early Tithonian, Semiforme Zone.
6a, 6b. *Lytogyroceras* sp. – INV.2022.2, Hárskút, Közöskút Ravine, from debris, early Tithonian.
7. *Virgatosimoceras albertinum* (Catullo, 1855) – M.92748, Lókút Hill, bed 61, early Tithonian, Darwini Zone.

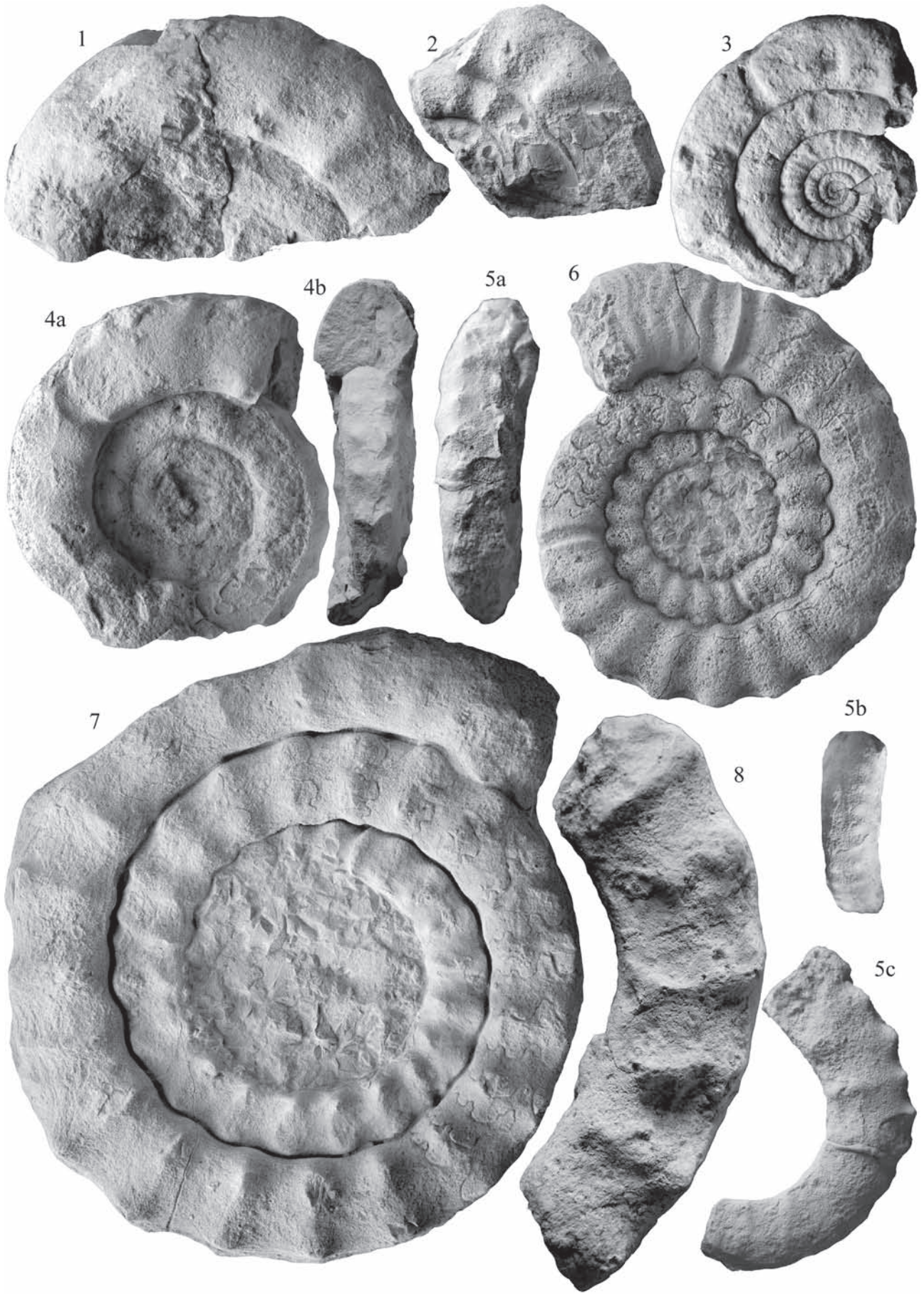

Plate 20 – Simoceratidae

All figures natural size

1. *Simospiticeras cristatum* Olóriz & Tavera, 1977 – J.10999, Hárskút, HK-II section, bed 36, late Tithonian, Andreaei Zone.
2. *Simospiticeras cristatum* Olóriz & Tavera, 1977 – J.10512, Hárskút, HK-II section, bed 37, late Tithonian, Microcanthum Zone.
3. *Volanoceras volanense* (Oppel, 1863) – J.2021.106.1, Hárskút, Édesvízkút-1 section, bed 3, early Tithonian, Volanense Zone.
4a, 4b. *Simoceras admirandum* (Zittel, 1870) – J.10272, Lókút Hill, bed 43, early Tithonian, Fallauxi Zone.
5a, 5b, 5c. *Simoceras admirandum* (Zittel, 1870) – J.10963, Borzavár, Szilas Ravine, bed 79, early Tithonian, Fallauxi Zone.
6. *Volanoceras aesinense* (Meneghini, 1885) – J.2021.107.1, Sümeg, grab sample, characteristic for the early Tithonian, Semiforme Zone. For suture of this specimen see Fig. 5/2 in the text.
7. *Volanoceras volanense* (Oppel, 1863) – J.2021.108.1, Szögle, Gyulafirátót, grab sample, characteristic for the early Tithonian, Volanense Zone.
8. *Volanoceras volanense* (Oppel, 1863) – J.10949, Borzavár, Szilas Ravine, bed 65, early Tithonian, Volanense Zone.

Plate 21 – Himalayitidae

All figures natural size

1. *Ardesciella rhodanica* Bulot et al. 2014 (=*Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *koellikeri* (Oppel, 1865) – J.10388, Hárskút, HK-12/a section, bed 19, late Tithonian, Microcanthum Zone.
2a, 2b. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *symbolum* (Oppel, 1865) – J.10387, Hárskút, HK-12/a section, bed 19, late Tithonian, Microcanthum Zone.
3a, 3b. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *microcanthum* Oppel in Zittel, 1868) – INV.2022.3, Hárskút, Rend-kő II, late Tithonian, from debris (with an elongated lappet on the other side).
4. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *symbolum* (Oppel, 1865) – J.11260, Szilas Ravine, bed 54, late Tithonian, Microcanthum Zone.
5. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *koellikeri* (Oppel, 1865) – J.10304, Hárskút, HK-12/a section, bed 19, late Tithonian, Microcanthum Zone.

Plate 22 – Himalayitidae

Figure 1a: 0.8x, figure 1b: actual size

1a, 1b. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *lamberti* (Roman, 1936) – J.10309, Hárskút, HK-12/a section, bed 19, late Tithonian, Microcanthum Zone. For the cross sections and suture of the specimen see Fig. 5 in the text.

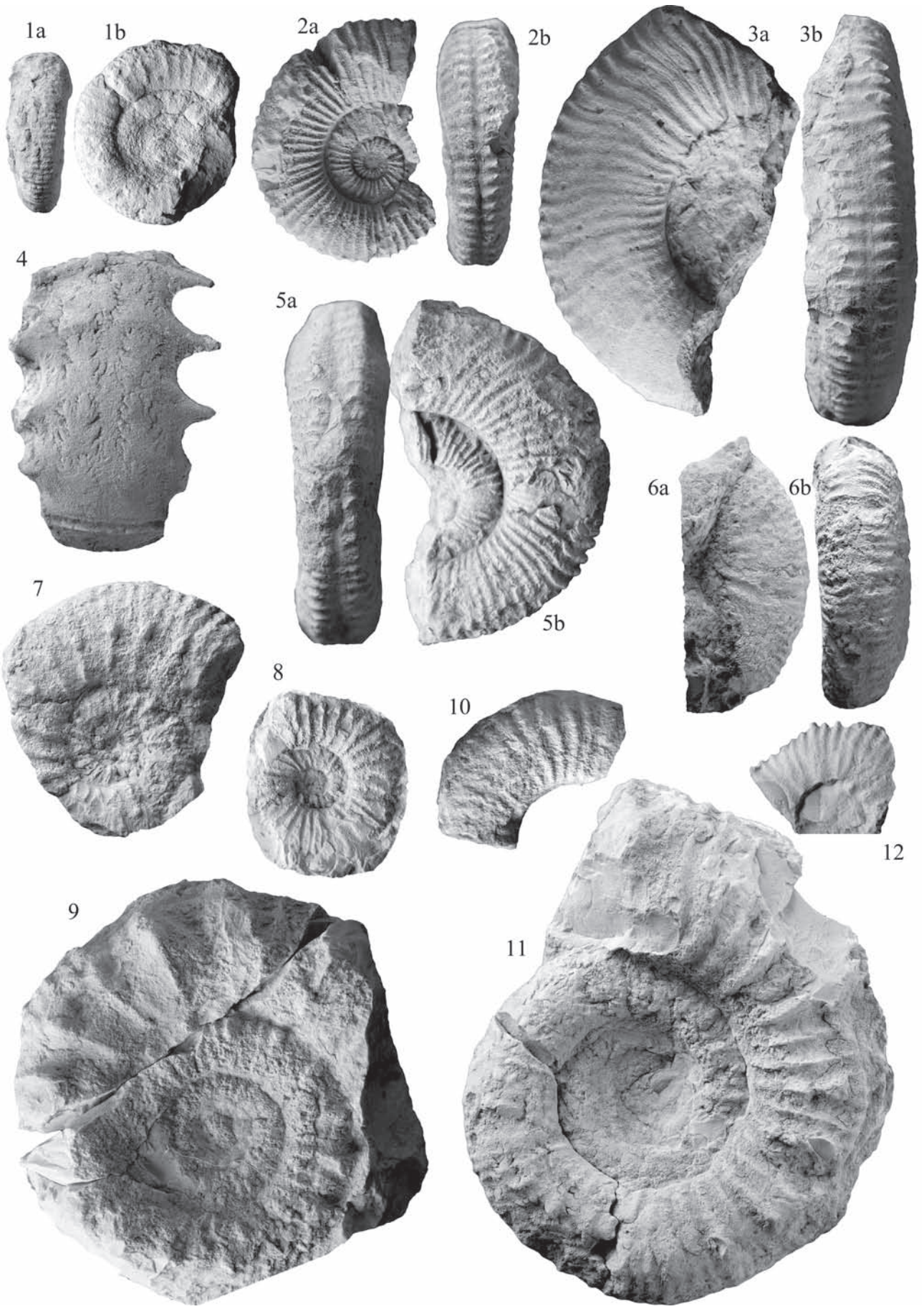

Plate 23 – Himalayitidae

All figures natural size

1a, 1b. *Ardesciella rhodanica* Bulot et al. 2014 (=*Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *koellikeri* (Oppel, 1865) – J. 11127, Borzavár, Szilas Ravine, bed 48, late Tithonian, Microcanthum Zone.
2a, 2b. *Simplisphinctes abnormis* (Roman, 1936) – J.2021.109.1, Bakonybél, Fekete Hill, grab sample, late Tithonian.
3a, 3b. *Simplisphinctes sandovali* Tavera, 1985 – J.2021.110.1, Bakonybél, Fekete Hill, grab sample, late Tithonian.
4. *Tithopeltoceras parakasbensis* Fallot & Termier, 1923 – J.10317, Hárskút, HK-12/a section, bed 17, late Tithonian, Microcanthum Zone.
5a, 5b. *Simplisphinctes abnormis* (Roman, 1936) – J.2021.111.1, Bakonybél, Fekete Hill, late Tithonian.
6a, 6b. ?*Praedalmasiceras* cf. *botellae* (Kilian, 1889) – K 2021.3.1, Hárskút, HK-II section, bed 33, late Tithonian, Chaperi Zone.
7. *Praedalmasiceras spiticeroides* (Djanelidze, 1922) – K.2021.5.1, Hárskút, HK-II section, bed 33, late Tithonian, Chaperi Zone.
8. *Protacanthodiscus andreaei* (Kilian, 1889) – J. 10993, Hárskút, HK-II section, bed 36, late Tithonian, Andreaei Zone.
9. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *symbolum* (Oppel, 1865) – J.10310, Hárskút, HK-II section, bed 37, late Tithonian, Microcanthum Zone.
10. ?*Durangites* sp. – J.11997, Hárskút, HK-II section, bed 36, late Tithonian, Andreaei Zone.
11. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *koellikeri* (Oppel, 1865) – J.10315, Hárskút, HK-12/a section, bed 16, late Tithonian, Microcanthum Zone.
12. *Praedalmasiceras* sp. – J.10348, Hárskút, HK-12/a section, bed 9, late Tithonian, Chaperi Zone.

Plate 24 – Himalayitidae

All figures natural size

1. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *koellikeri* (Oppel, 1865) – J.10754, Hárskút, HK-12/a section, bed 17, late Tithonian, Microcanthum Zone.
2a, 2b. *Praedalmasiceras progenitor* (Oppel, 1868) – J.11301, Borzavár, Szilas Ravine, bed 36, late Tithonian, Chaperi Zone.
3a, 3b, 3c, 3d. *Kilianites canavarii* Énay et al. 1998 – J.11327, Borzavár, Szilas Ravine, bed 38, late Tithonian, Andreaei Zone.
4. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *symbolum* (Oppel, 1865) – J.11258, Borzavár, Szilas Ravine, bed 47, late Tithonian, Microcanthum Zone.
5. *Praedalmasiceras progenitor* (Oppel, 1868) – J.11317, Borzavár, Szilas Ravine, bed 36, late Tithonian, Chaperi Zone.

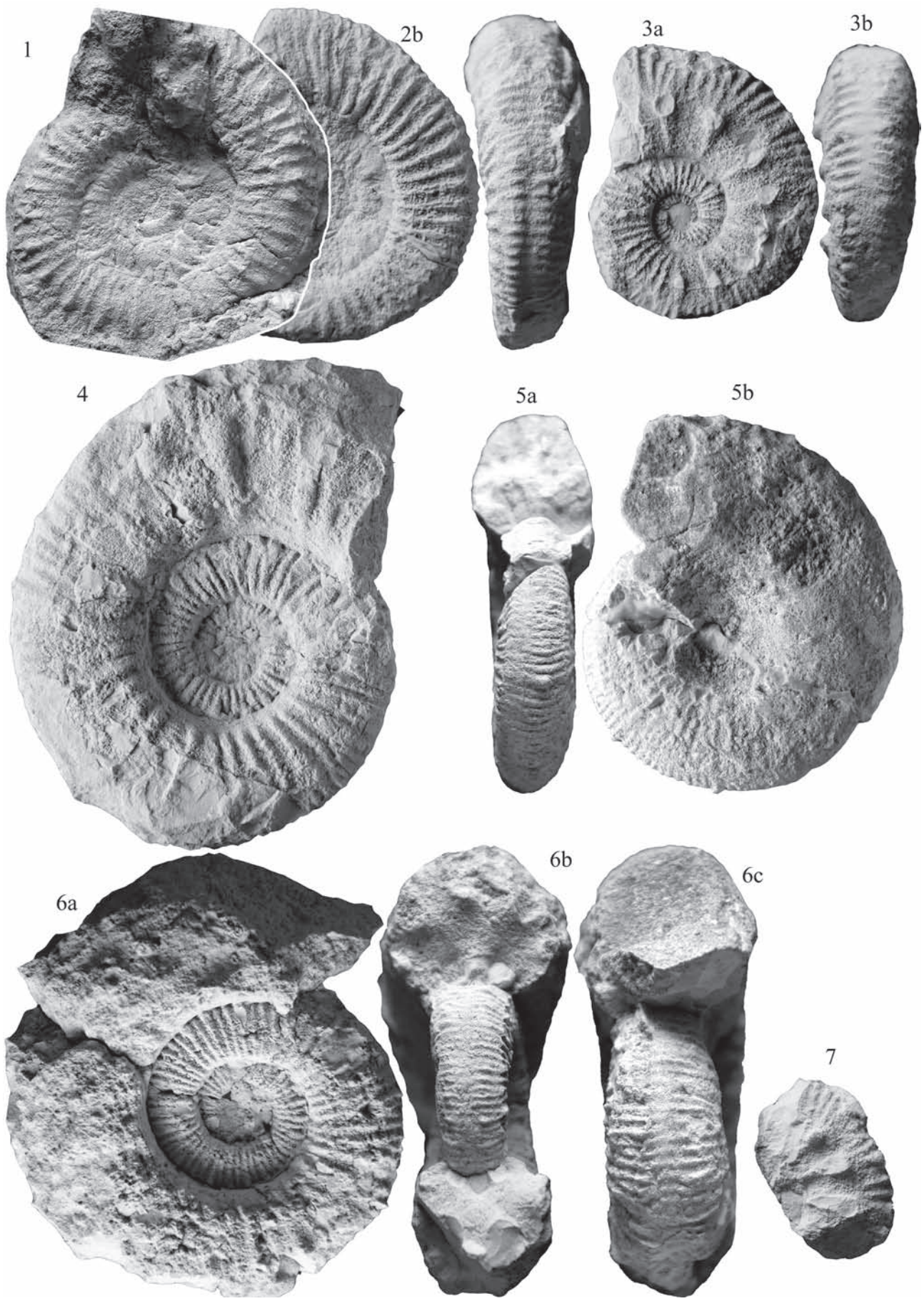

Plate 25 – Himalayitidae

All figures natural size

1. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *koellikeri* (Oppel, 1865) – INV.2021.107, Hárskút, HK–12/a section, sample 136, late Tithonian, Microcanthum Zone.
2a, 2b. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *moerikeanus* (Oppel, 1865) – J.11283, Borzavár, Szilas Ravine section, bed 60, late Tithonian, Microcanthum Zone.
3a, 3b. *Protacanthodiscus andreaei* (Kilian, 1889) – J.11307, Borzavár, Szilas Ravine, bed 36, late Tithonian, Chaperi Zone.
4. *Protacanthodiscus andreaei* (Kilian, 1889) – J.11319, Borzavár, Szilas Ravine, bed 42, late Tithonian, Andreaei Zone.
5a, 5b. Pathologic Himalayitidae – J.11389, Borzavár, Szilas Ravine, bed 37, late Tithonian, Chaperi Zone.
6a, 6b, 6c. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *koellikeri* (Oppel, 1865) – J.11259, Borzavár, Szilas Ravine section, bed 47, late Tithonian, Microcanthum Zone.
7. *Protacanthodiscus andreaei* (Kilian, 1889) – J.10329, Hárskút, HK-12/a section, bed 10, late Tithonian, Andreaei Zone.

Plate 26 – Himalayitidae

All figures natural size

1a, 1b. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *microcanthum* (Oppel in Zittel, 1868) – J.10430, Hárskút, HK-II section, bed 39, late Tithonian, Microcanthum Zone.

Plate 27 – Himalayitidae

All figures natural size

1a, 1b. *Djurjuriceras djurjurense* Roman, 1936 – J.10305, Hárskút, HK-II section, bed 39, late Tithonian, Microcanthum Zone.

Plate 28 – Himalayitidae

All figures natural size

1a, 1b. *Protacanthodiscus andreaei* (Kilian, 1889) – J.10765**,** Hárskút, HK-12/a section, bed 11, late Tithonian, Andreaei Zone.

2. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *microcanthum* (Oppel in Zittel, 1868) – J.10533, Hárskút, HK-II section, bed 38, late Tithonian, Microcanthum Zone.
3a, 3b. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *microcanthum* (Oppel in Zittel, 1868) – J.11281, Borzavár, Szilas Ravine, bed 54, late Tithonian, Microcanthum Zone.
4. *Micracanthoceras microcanthum* (Oppel in Zittel, 1868) morph. *microcanthum* (Oppel in Zittel, 1868) – J.10322.1, Hárskút, HK-12/a section, bed 21, late Tithonian, Microcanthum Zone.
5. ?*Hegaratites* sp. – J.10996, Hárskút, HK-II section, bed 36, late Tithonian, Andreaei Zone.
6. *Protacanthodiscus andreaei* (Kilian, 1889) – J.11315, Borzavár, Szilas Ravine, bed 42, late Tithonian, Andreaei Zone.
7. *Lopeziceras chaperi* (Pictet, 1868) – J.11321, Borzavár, Szilas Ravine, bed 36, late Tithonian, Chaperi Zone.

Plate 29 – Himalayitidae

All figures natural size except otherwise indicated

1. *Kilianites canavarii* Enay, Boughdiri & Le Hégarat, 1998 – J.2021.112.1, Hárskút, Hajag Hill, ?late Tithonian.
2. *Kilianites canavarii* Enay, Boughdiri & Le Hégarat, 1998 – J.2021.113.1, Hárskút, Hajag Hill, ?late Tithonian.
3a, b. ?*Hemispiticeras* sp. – J.2021.114.1, Zirc, Pálihálás, ?late Tithonian, (0.7x).

Plate 30 – Ataxioceratidae

All figures are reduced to 0.7x

1. *Progeronia* sp. – J.2021.115.1, from the Kimmeridgian of Borzavár, Páskom Hill.
2a, 2b. *Crussoliceras acer* (Neumayr, 1871) – J.2014.29, from the Kimmeridgian (most probably early Kimmeridgian) of Borzavár, Páskom Hill.
3a, 3b. *Progeronia vandelli* (Choffat, 1893) – J.2014.30, from the Kimmeridgian of Borzavár, Páskom Hill.
4. *Progeronia* sp. – J.2021.116.1, from the Kimmeridgian of Borzavár, Páskom Hill.
5a, 5b. *Lithacoceras fasciferus* (Neumayr, 1873) – J.2021.117.1, from the Kimmeridgian of Borzavár, Páskom Hill.
6. *Progeronia pseudolictor* (Choffat, 1893) – J.2021.118.1, from the Kimmeridgian of Borzavár, Páskom Hill.

Plate 31 – Ataxioceratidae

1a, 1b. "*Perisphinctes*" *polyplocus* sensu Neumayr, 1873 non Reinecke – J.2021.119.1, from the Kimmeridgian of Borzavár, Páskom Hill, (0.9x).

Plate 32 – Ataxioceratidae

All figures natural size

1. *Subplanites* sp. – J.2021.120.1, from the Kimmeridgian of Borzavár, Páskom Hill.
2a, 2b. *Trapanesites adelus* (Gemmellaro, 1872) – INV.2014.74, Lókút Hill, level LH110-111, late Kimmeridgian, ?Cavouri Zone.
3. *Crussoliceras acer* (Neumayr, 1871) – J.2021.121.1, from the Kimmeridgian (most probably early Kimmeridgian) of Borzavár, Páskom Hill.
4. "*Perisphinctes*" aff. *subpunctatus* Neumayr, 1873 – J.2021.122.1, from the Kimmeridgian of Borzavár, Páskom Hill.
5a, 5b. *Trapanesites adelus* (Gemmellaro, 1872) – M.92.886, Lókút Hill, bed 68, late Kimmeridgian, Beckeri Zone.

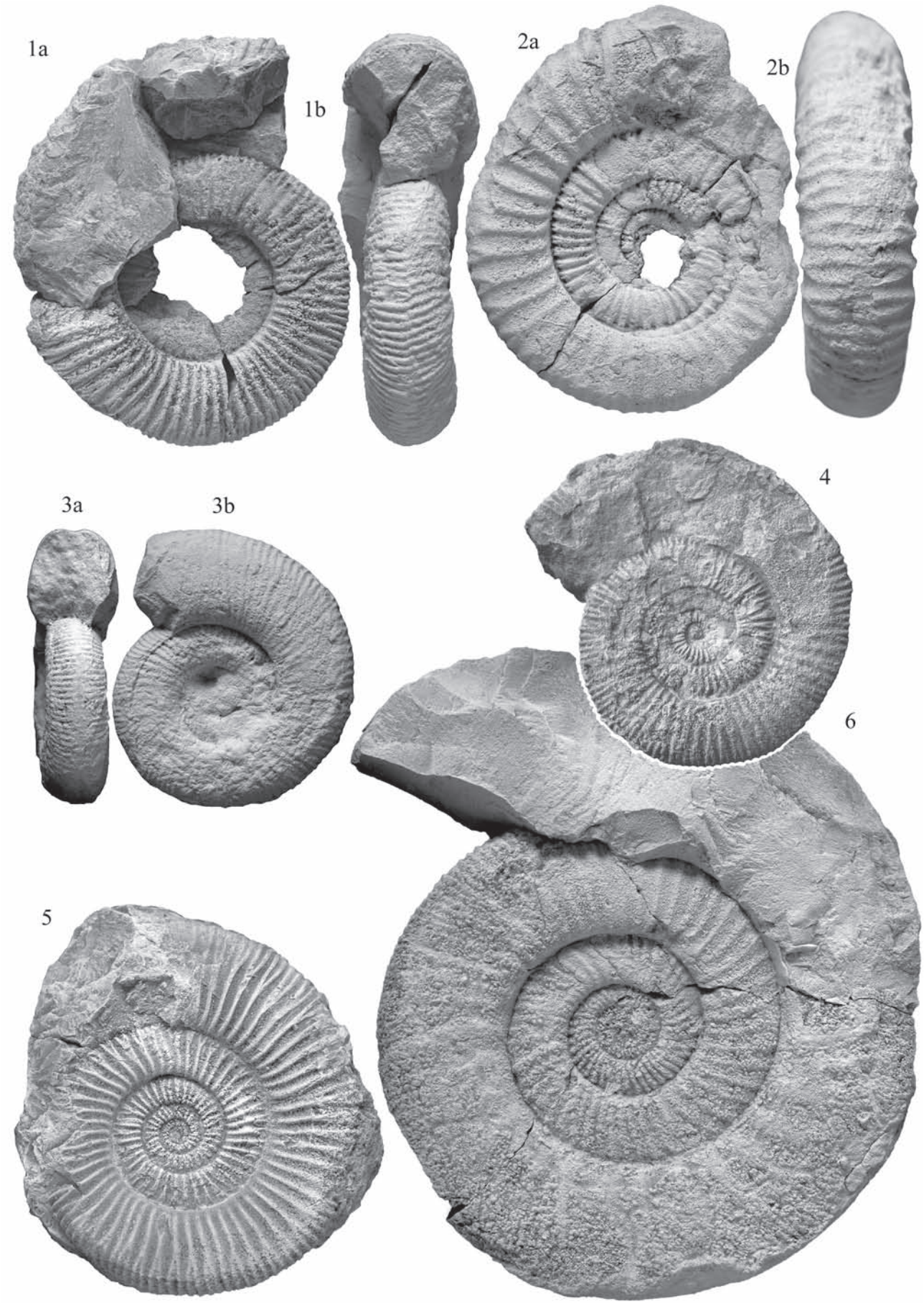

Plate 33 – Ataxioceratidae

Figures are reduced in size to 0.8x

1a, 1b. *Kutekiceras* sp. – J.2021.123.1, Hárskút, Édesvíz Key section, bed 68, early Tithonian, Fallauxi Zone.
2a, 2b. *Kutekiceras pseudocolobrinum* (Kilian, 1895) – M.92.320, Lókút Hill, bed 53, early Tithonian, Semiforme Zone. The specimen has a c. 2 cm long lappet on the other side.
3a, 3b. *Paraulacosphinctes transitorius* (Oppel, 1865) – INV.2021.105, Hárskút, HK–12/a section, bed 136, Microcanthum Zone.
4. *Kutekiceras* sp. – J.2021.124.1, Lókút Hill, bed 48, early Tithonian, ? Fallauxi Zone.
5. *Kutekiceras* sp. – J.2021.125.1, Lókút Hill, bed 48, early Tithonian, ? Fallauxi Zone.
6. ?*Progeronia* sp. – M.92.320, Lókút Hill, bed 73, early Kimmeridgian, Strombecki Zone.

Plate 34 – Ataxioceratidae

All figures natural size

1. *Paraulacosphinctes senex* (Oppel, 1865) – J.10303, Hárskút, HK-II section, bed 40, late Tithonian, Microcanthum Zone.
2. *Blaschkeiceras* sp. – J.11135, Borzavár, Szilas Ravine, bed 94, early Tithonian, Semiforme Zone.
3. *Kutekiceras pseudocolobrinum* (Kilian, 1895) – J.11142, Borzavár, Szilas Ravine, bed 95, early Tithonian, Semiforme Zone.
4. *Kutekiceras pseudocolobrinum* (Kilian, 1895) – J.11137, Borzavár, Szilas Ravine, bed 94, early Tithonian, Semiforme Zone.
5a, 5b. *Paraulacosphinctes senoides* Tavera, 1985 – J.11266, Borzavár, Szilas Ravine, bed 43, late Tithonian, Andreaei Zone.
6a, 6b. "*Pseudodiscosphinctoides*" *rhodaniforme* Olóriz, 1978 – J.11133, Borzavár, Szilas Ravine section, bed 95, early Tithonian, Semiforme Zone.

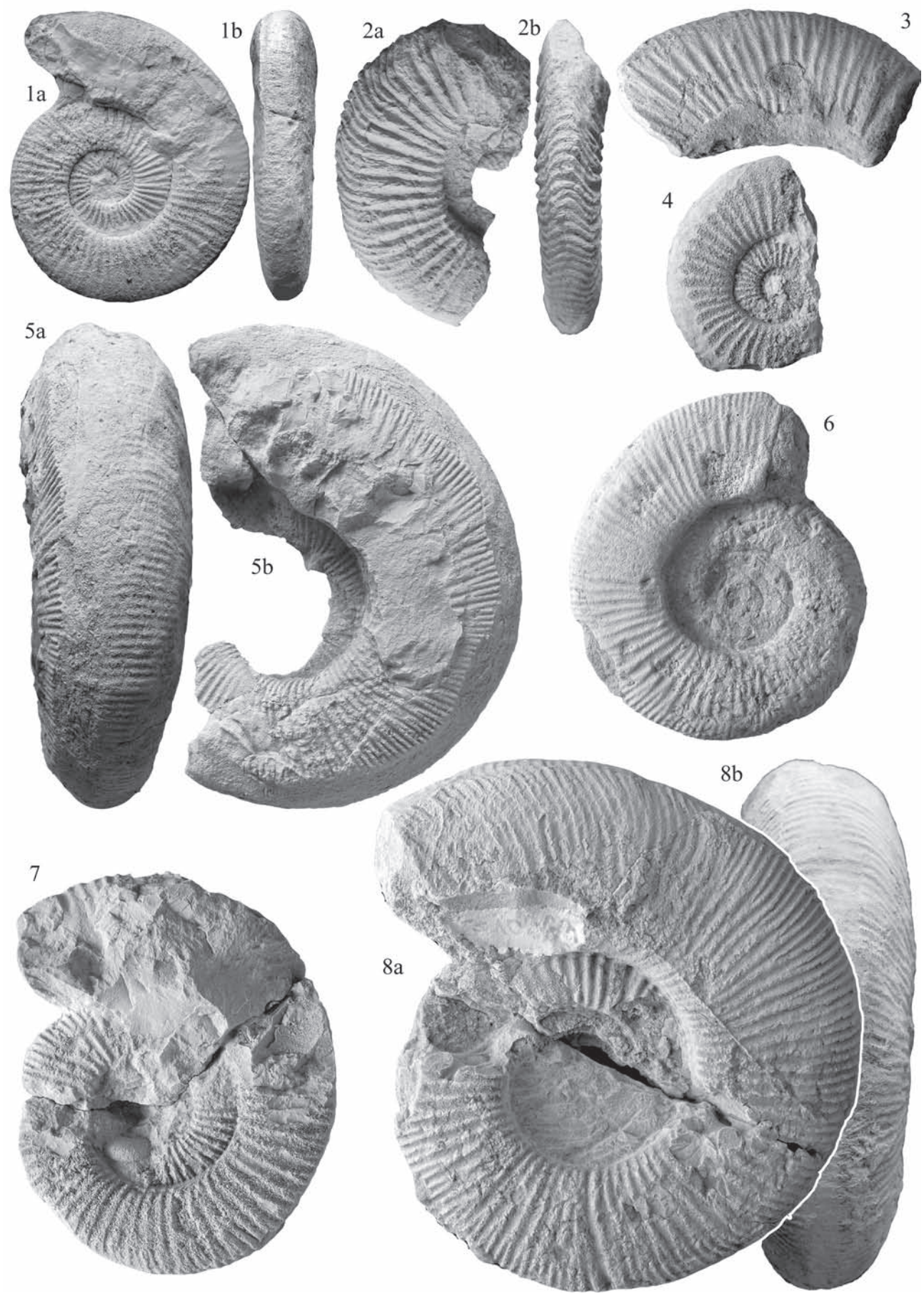

Plate 35 – Ataxioceratidae

All figures natural size

1a, 1b. *Moravisphinctes* cf. *fischeri* (Kilian, 1889) – J.11254, Szilas Ravine, bed 49, late Tithonian, Microcanthum Zone.
2a, 2b. *Richterella richteri* (Oppel, 1865) – J.9840, Sümeg, bed 44, early Tithonian, Fallauxi Zone.
3. ?*Oloriziceras* sp. – J.10729, Hárskút, HK-12/a section, bed 24, late Tithonian, Microcanthum Zone.
4. *Moravisphinctes fischeri* (Kilian, 1889) – J.10719, Hárskút, HK-12/a section, bed 12, late Tithonian, Microcanthum Zone.
5a, 5b. "*Pseudodiscosphinctoides" rhodaniforme* Olóriz, 1978 – J.10.65.1, Lókút Hill, bed 53, early Tithonian, Semiforme Zone.
6. Ataxioceratidae sp. – J.1060.1, Lókút Hill, bed 38, early Tithonian, Fallauxi Zone.
7. "*Subplanitoides"* sp. – J.1062.1, Lókút Hill, bed 44, early Tithonian, Semiforme Zone.
8a, 8b. "*Pseudodiscosphinctoides*" sp. – J.10363, Hárskút, HK-II section, bed 59, early Tithonian, Semiforme Zone.

Plate 36 – Ataxioceratidae

All figures natural size

1. *„Subplanitoides" pouzinensis* (Toucas, 1890) – J.10499, Hárskút, HK-II section, bed 54, early Tithonian, Fallauxi Zone.

2. Ataxioceratidae sp. – J.10364, Hárskút, HK-II section, bed 63, early Tithonian, Darwini Zone.

3. "*Pseudodiscosphinctoides*" sp. – J.2021.126.1, Édesvízkút-1, bed 7, early Tithonian, Fallauxi Zone.

4. *Pseudopallasiceras toucasi* (Cecca & Enay, 1991) – J.10498, Hárskút, HK-II section, bed 54, early Tithonian, Fallauxi Zone.

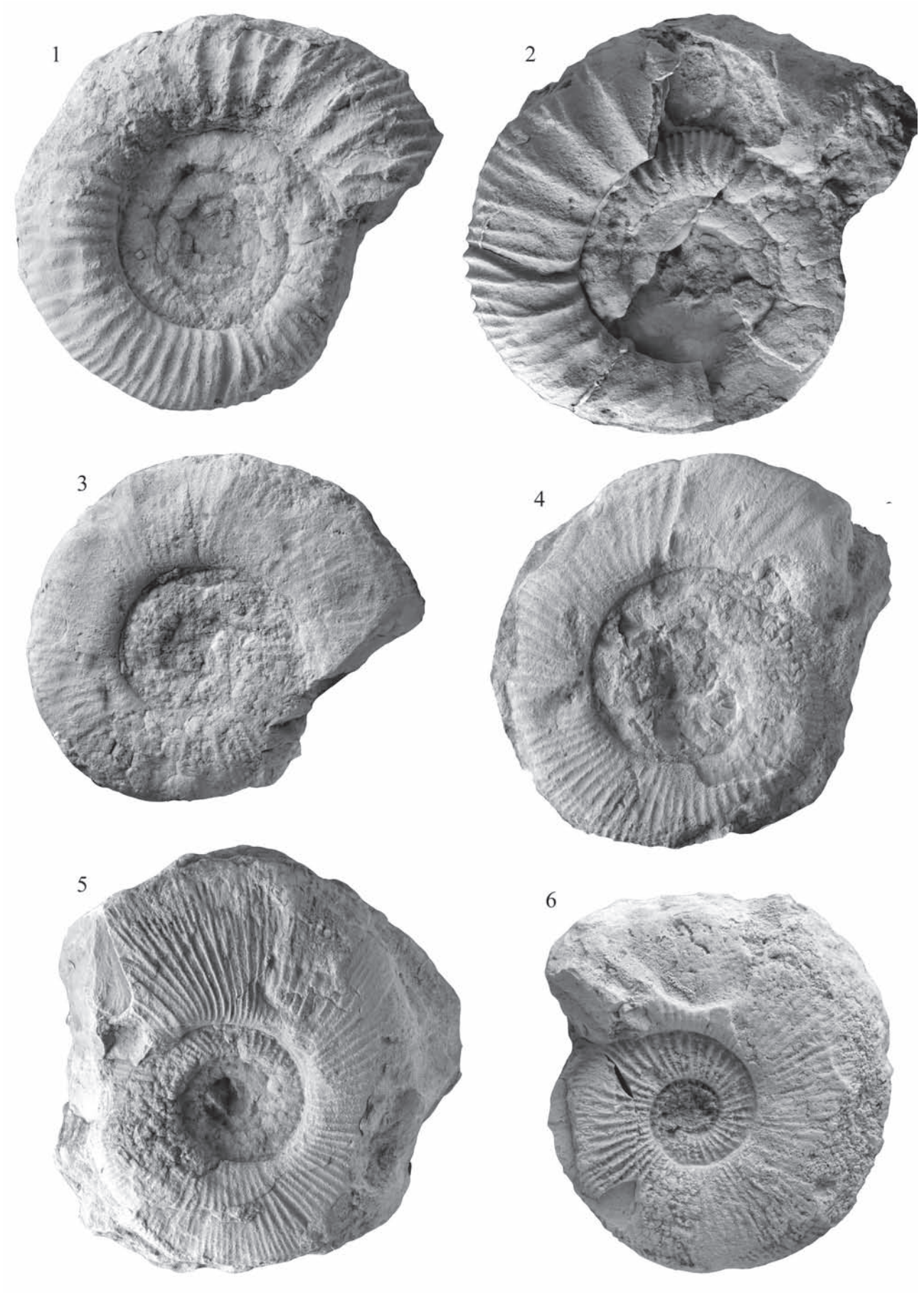

Plate 37 – Ataxioceratidae

All figures natural size

1. *Dorsomorphites selectus* (Neumayr, 1873) – J.10497, Hárskút, HK-II section, bed 54, early Tithonian, Fallauxi Zone.
2. *Dorsomorphites* sp. – J.10451, Hárskút, HK-II section, bed 55, early Tithonian, Semiforme Zone.
3. *Oloriziceras* sp. – J.10458, Hárskút, HK-II section, bed 41, early Tithonian, Volanense Zone.
4. *Oloriziceras* sp. – J.10432, Hárskút, HK-II section, bed 41, early Tithonian, Volanense Zone.
5. "*Subplanitoides*" ex gr. *pouzinensis* (Toucas, 1890) – J.10490, Hárskút, HK-II section, bed 57, early Tithonian, Semiforme Zone.
6. *Richterella richteri* (Oppel, 1865) – J.2021.127.1, Hárskút, Édesvízkút-1, bed 7, early Tithonian, Fallauxi Zone.

Plate 38 – Ataxioceratidae

Figures natural size except otherwise indicated

1. *Paraulacosphinctes transitorius* (Oppel, 1865) – J.10322, Hárskút, HK-12/a section, bed 18, late Tithonian, Microcanthum Zone, (0.5x).
2. *Oloriziceras magnum* Tavera, 1985 – J.11263, Borzavár, Szilas Ravine, bed 63, late Tithonian, Microcanthum Zone, (0.5x).
3. *Ernstbrunnia densecostata* (Tavera, 1985) – J.11252, Borzavár, Szilas Ravine, bed 63, late Tithonian, Microcanthum Zone.
4a, 4b. *Paraulacosphinctes transitorius* (Oppel, 1865) – J.10.61.1, Lókút Hill, bed 20, late Tithonian, Microcanthum Zone.
5. *Paraulacosphinctes* sp. – J.10427, Hárskút, HK-12/a section, bed 16, late Tithonian, Microcanthum Zone.
6a, 6b. *Pseudosubplanites* cf. *grandis* (Mazenot, 1939) – K.2021.1.1, Hárskút, HK-II section, bed 22, early Berriasian, Grandis Zone.
7. *Paraulacosphinctes* cf. *senex* (Oppel, 1865) – J.10339, Hárskút, HK-12/a section, bed 17, late Tithonian, Microcanthum Zone.
8. *Paraulacosphinctes senoides* Tavera, 1985 – J.10328, Hárskút, HK-12/a section, bed 12, late Tithonian, Microcanthum Zone.

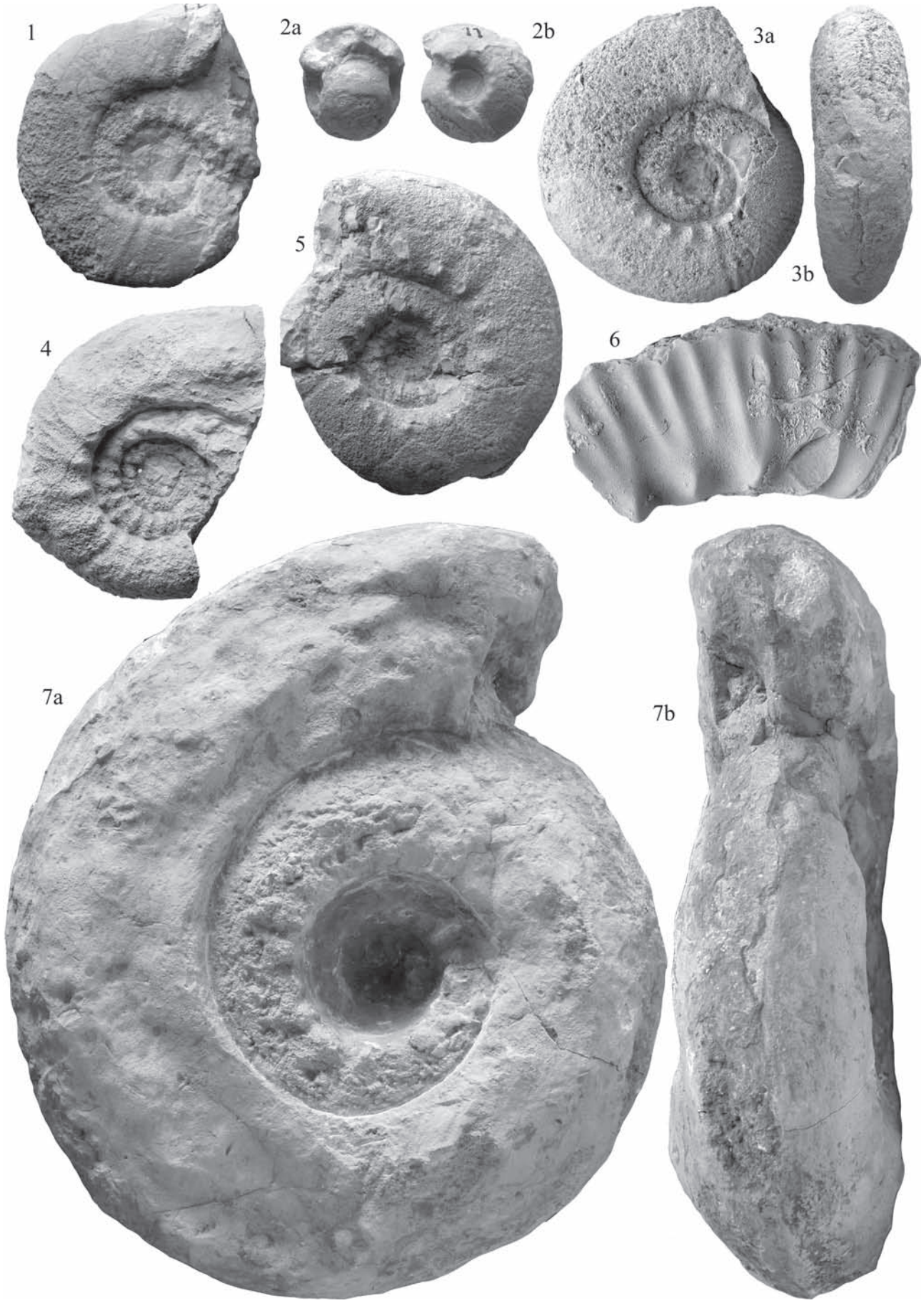

Plate 39 – Olcostephanidae

Figures natural size except otherwise indicated

1. *Spiticeras* cf. *paranegreli* Djanelidzé, 1922 – K.2010.70.1, Hárskút, HK-II section, bed 19, early Berriasian, Andrussowi Zone.
2a, 2b. *Olcostephanus stephanophorus* (Matheron, 1878) – K.2010.8.1, Hárskút, HK-12 section, bed 11, early Valanginian, Pertransiens Zone, (1.5x).
3a, 3b. *Spiticeras* cf. *kiliani* Djanelidzé, 1922 – K.2010.66.1, Hárskút, HK-II section, bed 31, late Tithonian, Chaperi Zone.
4. *Kilianiceras gratianopolitense* (Kilian, 1891) – K.2010.136.1, Hárskút, HK-12 section, bed 20, late Berriasian, Boissieri Zone, (0.7x).
5. *Spiticeras* cf. *gevreyi* Djanelidzé, 1922 – K.2010.72.1, Hárskút, HK-II section, bed 23, early Berriasian, Andrussowi Zone, (0.7x).
6. *Kilianiceras gratianopolitense* (Kilian, 1890) – K.2010.196.2, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
7a, 7b. *Spiticeras* cf. *mutabile* Djanelidzé, 1922 – K.2010.53.1, Hárskút, HK-II section, bed 25, early Berriasian, Andrussowi Zone, (0.8x).

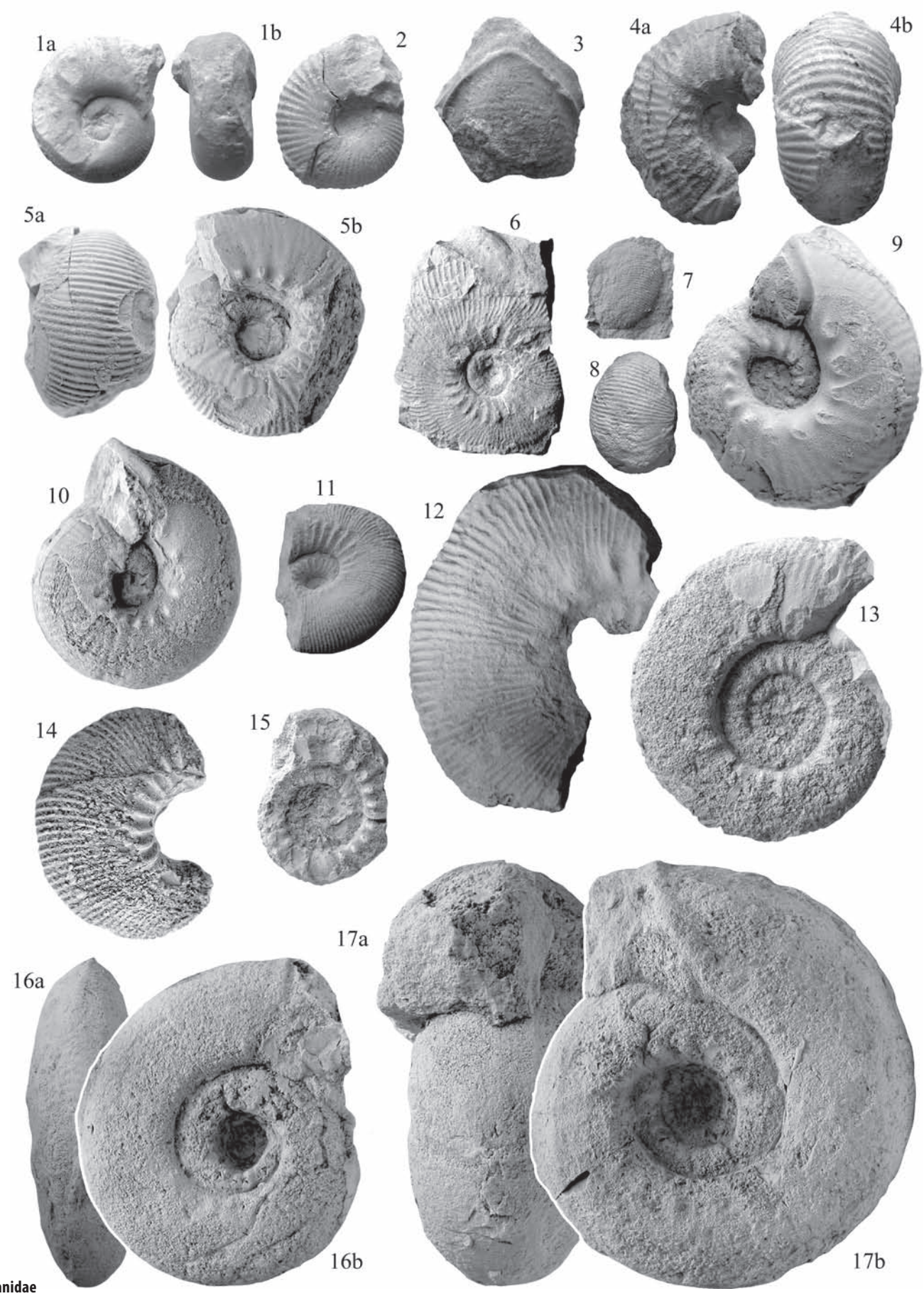

Plate 40 – Olcostephanidae

Figures natural size except otherwise indicated

1a, 1b. *Olcostephanus drumensis* (Kilian, 1910) – K.2010.4.1, Hárskút, HK-12 section, bed 11, early Valanginian, Pertransiens Zone, (1.5x).

2. *Olcostephanus* sp. 1. – K.2010.188.1, Hárskút, HK-12 section, bed 11, early Valanginian, Pertransiens Zone, (1.5x).

3. *Olcostephanus drumensis* (Kilian, 1910) – K.2010.200.3, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

4a, 4b. *Olcostephanus drumensis* (Kilian, 1910), roughly ribbed morphotype – K.2010.5.1, Hárskút, HK-12 section, bed 11, early Valanginian, Pertransiens Zone.

5a, 5b. *Olcostephanus drumensis* (Kilian, 1910) – K.2010.177.4, Hárskút, HK-12 section, bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

6. *Olcostephanus guebhardi* (Kilian, 1902) – K.2010.220.1, Hárskút, HK-123 section, bed 20–26, (possible equivalent of beds 6–7 of HK-12 section), late Valanginian, Verrucosum Zone.

7. *Valanginites* cf. *bachleardi* (Sayn, 1889) – K.2010.240.1, Hárskút, HK-123 section, bed 20–26, (possible equivalent of beds 6–7 of HK-12 section), late Valanginian, Verrucosum Zone.

8. *Valanginites bachleardi* (Sayn, 1889) – K.2021.73.1, Hárskút, Édesvíz Key section, bed 58, late Valanginian, Verrucosum Zone.

9. *Olcostephanus drumensis* (Kilian, 1910) – K.2010.177.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

10. *Olcostephanus drumensis* (Kilian, 1910) – K.2010.177.3, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

11. *Olcostephanus guebhardi* (Kilian, 1902) – K.2010.211.2, Hárskút, HK-12 section, bed 6, late Valanginian, Verrucosum Zone.

12. *Olcostephanus densicostatus* (Wegner, 1909) – INV.2022.4, Lókút Hill, grab sample, base of the dirt road, Valanginian.

13. *Spiticeras* cf. *subnegreli* Djanelidzé, 1922 – K.2010.69.1, Hárskút, HK-12 section, bed 19, late Berriasian, Boissieri Zone, (0.7x).

14. *Olcostephanus guebhardi* (Kilian, 1902) – K.2010.194.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

15. *Kilianiceras* sp. – K.2010.195.2, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

16a, 16b. *Spiticeras* cf. *kiliani* Djanelidzé, 1922 – K.2010.68.1, Hárskút, HK-12 section, bed 31, early Berriasian, Occitanica Zone.

17a, 17b. *Spiticeras* sp. – K.2010.73.1, Hárskút, HK-12 section, bed 31, early Berriasian, Occitanica Zone.

Plate 41 – Olcostephanidae, Oosterellidae, Holcodiscidae & Neocomitidae

All figures natural size

1. *Jeannoticeras* cf. *jeannoti* (d'Orbigny, 1840) – K.2021.74.1, Eperkés Hill, Stripe Pit section, bed 1, Hauterivian.
2. *Olcostephanus* cf. *hispanicus* (Mallada, 1887) – K.2021.75.1, Eperkés Hill, Stripe Pit section, bed 1, Hauterivian.
3. *Spiticeras* sp. – K.2021.76.1, Hárskút, Édesvízkút Key Section, bed 63, late Berriasian, Boissieri Zone.
4a, 4b. *Oosterella begastrensis* Company, 1987 – K.15223, Hárskút, Közöskút Ravine, HK-123 section, from the interval of beds 20–26, Late Valanginian.
5. *Oosterella begastrensis* Company, 1987 – K.15222, Hárskút, Közöskút Ravine, HK-123 section, from the interval of beds 20–26, Late Valanginian.
6. *Oosterella begastrensis* Company, 1987 – K.15224, Hárskút, Édesvízmajor, labelled as section HK-27/1/2, Late Valanginian.
7. *Oosterella* sp. – K.15221, Hárskút, Édesvíz Key section, bed 58, late Valanginian, Verrucosum Zone.
8a, 8b. *Taveraidiscus intermedius* (d'Orbigny, 1840) – K.2021.77.1, Hárskút, Édesvíz Key section, bed 4, early Barremian, Hugii Zone.
9. *Holcodiscus* aff. *caillaudianus* (d'Orbigny, 1850) – K.2021.78.1, Hárskút, Édesvíz Key section, bed 4, early Barremian, Hugii Zone.
10a, 10b. *Holcodiscus* sp. – K.2021.79.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
11. *Retowskiceras andrussowi* (Retowski, 1893) – K.2021.12.1, Hárskút, HK-II section, bed 8, early Berriasian, Andrussowi Zone.
12. *Jabronella* sp. – K.2021.21.4, Hárskút, HK-II section, bed 110, early Berriasian, Occitanica Zone.
13. *Elenaella cularense* (Mazenot, 1939) – J.11318, Borzavár, Szilas Ravine, bed 36, late Tithonian, Chaperi Zone.
14. *Busnardoiceras busnardoi* (Le Hegarat, 1973) – J.10419, Hárskút, HK-12/a section, bed 12, late Tithonian, Microcanthum Zone.
15. *Busnardoiceras busnardoi* (Le Hegarat, 1973) – J.11331, Borzavár, Szilas Ravine, bed 42, early Berriasian, Andreaei Zone.
16. *Busnardoiceras busnardoi* (Le Hegarat, 1973) – J.11328, Borzavár, Szilas Ravine, bed 42, early Berriasian, Andreaei Zone.
17a, 17b. *Elenaella cularense* (Mazenot, 1939) – J.11350, Borzavár, Szilas Ravine, bed 36, late Tithonian, Chaperi Zone.
18. *Jeanthieuloyites* sp. – M.2005.84, Zirc, Borzavár Road Quarry, late Valanginian or early Hauterivian.
19a, 19b. *Jeanthieuloyites* sp. – M.63 965, Zirc, Borzavár Road Quarry, late Valanginian or early Hauterivian.

Plate 42 – Neocomitidae

Figures natural size except otherwise indicated

1. *Hegaratella paramacilenta* (Mazenot, 1939) – K.2021.4.1, Hárskút, HK–II section, bed 25, early Berriasian, Progenitor Zone.
2. *Tirnovella subalpina* (Mazenot, 1939) – K.2021.18.2, Hárskút, HK-II section, bed 109, middle Berriasian, Occitanica Zone.
3. *Berriasella privasensis* (Pictet, 1867) – K.2010.10.15.1, Hárskút, HK-12 section, bed 20, late Berriasian, Boissieri Zone.
4. *Berriasella privasensis* (Pictet, 1867) – K.2021.20.1, Hárskút, HK-II section, bed 110, middle Berriasian, Occitanica Zone.
5. *Berriasella oppeli* (Kilian, 1889) – K.2021.6.1, Hárskút, HK-II section, bed 30, late Tithonian, Chaperi Zone.
6. *Neocosmoceras* sp. – K.2010.126.1, Hárskút, HK-12 section, bed 22, early Berriasian, Grandis Zone, (0.7x).
7. *Jabronella paquieri* (Simionescu, 1899) – K. 2010.142.1, Hárskút, HK-12 section, bed 18, late Berriasian, Boissieri Zone.
8. *Retowskiceras andrussowi* (Retowski, 1893) – J.10418, Hárskút, HK–12/a section, bed 2, early Berriasian, Grandis Zone.

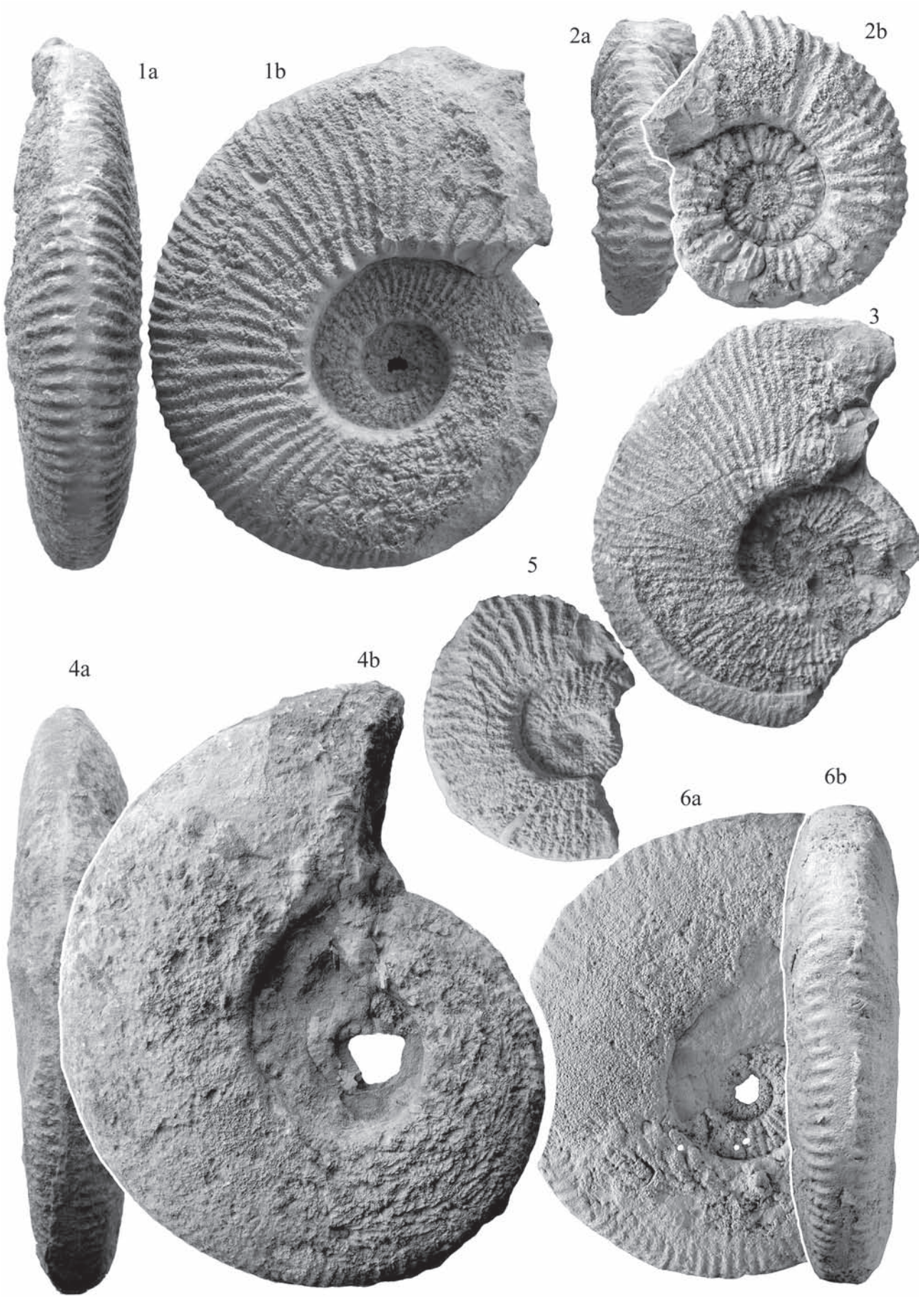

Plate 43 – Neocomitidae

All figures natural size

1a, 1b. *Fauriella boissieri* (Pictet, 1867) – K.2010.14.1, Hárskút, HK-12 section, bed 17, late Berriasian, Boissieri Zone.
2a, 2b. *Jabronella* cf. *isaris* (Pomel, 1889) – K.2010.144.1, Hárskút, HK-12 section, bed 18, late Berriasian, Boissieri Zone.
3. *Tirnovella* cf. *alpillensis* (Mazenot, 1939) – K.2010.134.1, Hárskút, HK-12 section, bed 21, late Berriasian, Boissieri Zone.
4a, 4b. *Fauriella boissieri* (Pictet, 1867) – K.2010.21.1, Hárskút, HK-12 section, bed 22, late Berriasian, Boissieri Zone.
5 *Berriasella callisto* (d'Orbigny, 1847) – K.2010.141.1, Hárskút, HK-12 section, bed 18, late Berriasian, Boissieri Zone.
6a, 6b. *Erdenella subisaris* Mazenot, 1939 – K.2010.115.1, Hárskút, HK-12 section, bed 31, middle Berriasian, Occitanica Zone.

Plate 44 – Neocomitidae

Figures natural size except otherwise indicated

1. *Fauriella boissieri* (Pictet, 1867) – K.2021.80.1, Hárskút, Édesvíz Key Section, bed 62, late Berriasian, Boissieri Zone, (0.5x).
2. *Neocosmoceras euthymi* (Pictet, 1867) – K.2010.83.1, Hárskút, HK-12 section, bed 41, early Berriasian, Grandis Zone, (0.5x).
3a, 3b. *Retowskiceras andrussowi* (Retowski, 1893) – K.2021.81.1, Hárskút, HK-12 section, bed 42, early Berriasian, Grandis Zone.
4. *Strambergella* sp. – K.2021.82.1, Hárskút, HK-12 section, bed 41, early Berriasian, Grandis Zone.
5a, 5b. *Malbosiceras malbosi* (Pictet, 1867) – K.2010.126.1, Hárskút, HK-12 section, bed 16, late Berriasian, Boissieri Zone, (0.5x).
6. *Neocosmoceras euthymi* (Pictet, 1867) – K.2010.108.1, Hárskút, HK-12 section, bed 30, middle Berriasian, Occitanica Zone.

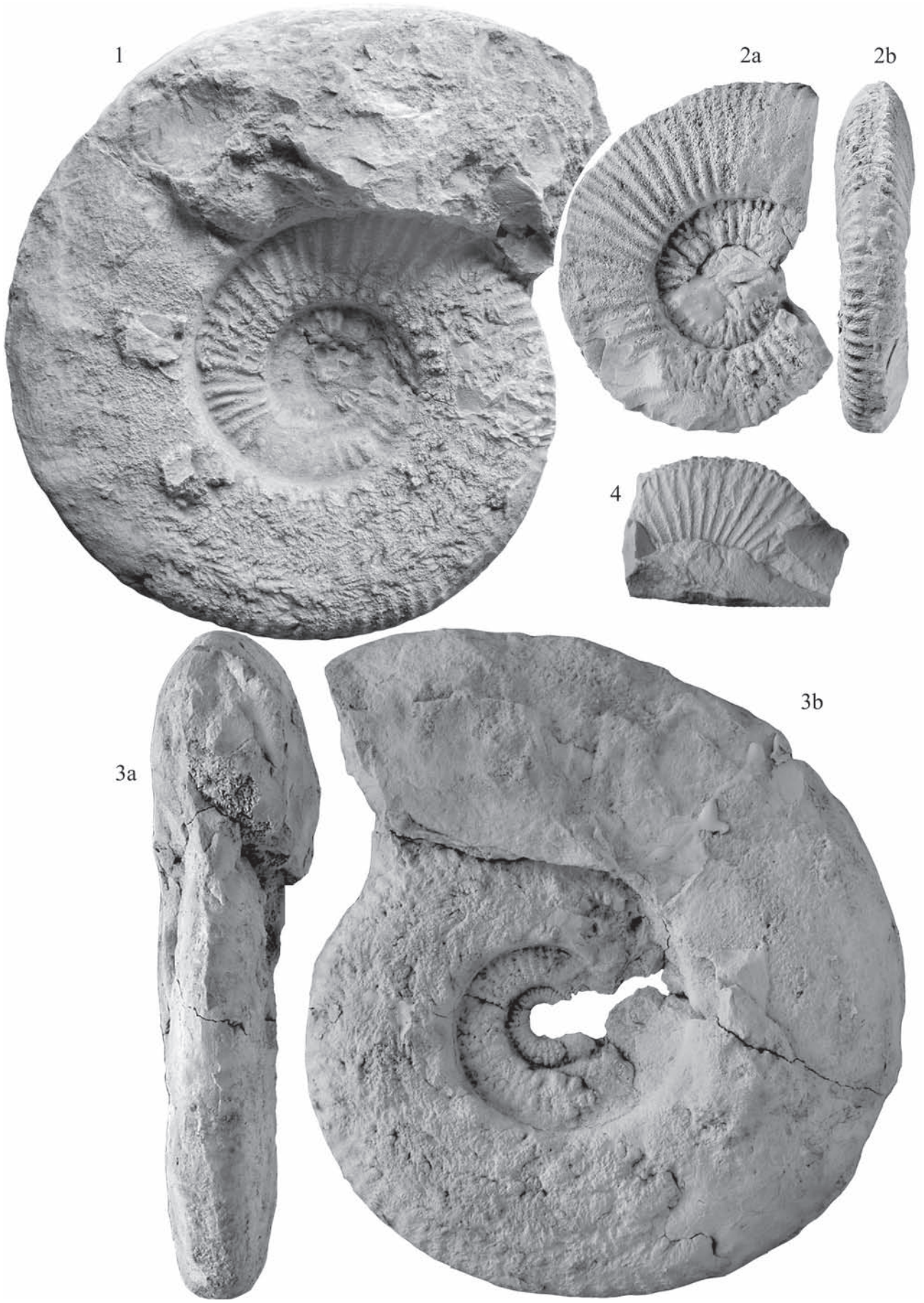

Plate 45 – Neocomitidae

Figures natural size except otherwise indicated

1. *Berriasella privasensis* (Pictet, 1867) – K.2010.117.1, Hárskút, HK-12 section, bed 31, middle Berriasian, Occitanica Zone, (0.9x).
2a, 2b. *Berriasella privasensis* (Pictet, 1867) – K.2010.111.1, Hárskút, HK-12 section, bed 31, middle Berriasian, Occitanica Zone.
3a, 3b. *Tirnovella romani* (Mazenot, 1939) – K.2010.118.1, Hárskút, HK-12 section, bed 31, middle Berriasian, Occitanica Zone, (0.9x).
4. *Hegaratella paramacilenta* (Mazenot, 1939) – J.10802, Hárskút, HK-12/a section, bed 0, early Berriasian, Grandis Zone.

Plate 46 – Neocomitidae

Figures are in 0.8x magnification

1. *Neocosmoceras euthymi* (Pictet, 1867) – K.84.1, Hárskút, HK-12 section, bed 34, middle.Berriasian, Occitanica Zone.
2. *Neocosmoceras euthymi* (Pictet, 1867) – K.106.1, Hárskút, HK-12 section, bed 39, middle Berriasian, Occitanica Zone.
3. *Jabronella isaris* (Pomel, 1899) – K.10.123.1, Hárskút, HK-12 section, bed 29, middle Berriasian, Occitanica Zone.
4. *Jabronella isaris* (Pomel, 1899) – K.10.123.2, Hárskút, HK-12 section, bed 29, middle Berriasian, Occitanica Zone.
5. *Berriasella privasensis* (Pictet, 1867) and *Spiticeras kiliani* Djanelidze, 1922 – K.2021.83.1 and K.2021.84.1, bed 30, Hárskút, HK-12 section, middle Berriasian, Occitanica Zone.
6. *Thurmanniceras* cf. *pertransiens* (Sayn, 1907) – K.10.152.1, Hárskút, HK-12 section, bed 14, early Valanginian, Pertransiens Zone.
7. *Malbosiceras paramimounum* (Mazenot, 1939) – K.10.119.1, Hárskút, HK-12 section, bed 24, middle Berriasian, Occitanica Zone.
8. *Berriasella privasensis* (Pictet, 1867) – K.10.112.2, Hárskút, HK-12 section, bed 25, late Berriasian, Boissieri Zone.
9. *Subthurmannia* cf. *occitanica* (Mazenot, 1939) – K.10.129.1, Hárskút, HK-12 section, bed 23, middle Berriasian, Occitanica Zone.
10. *Fauriella boissieri* (Pictet, 1867) – K.10.131.1, Hárskút, HK-12 section, bed 22, middle Berriasian, Occitanica Zone.

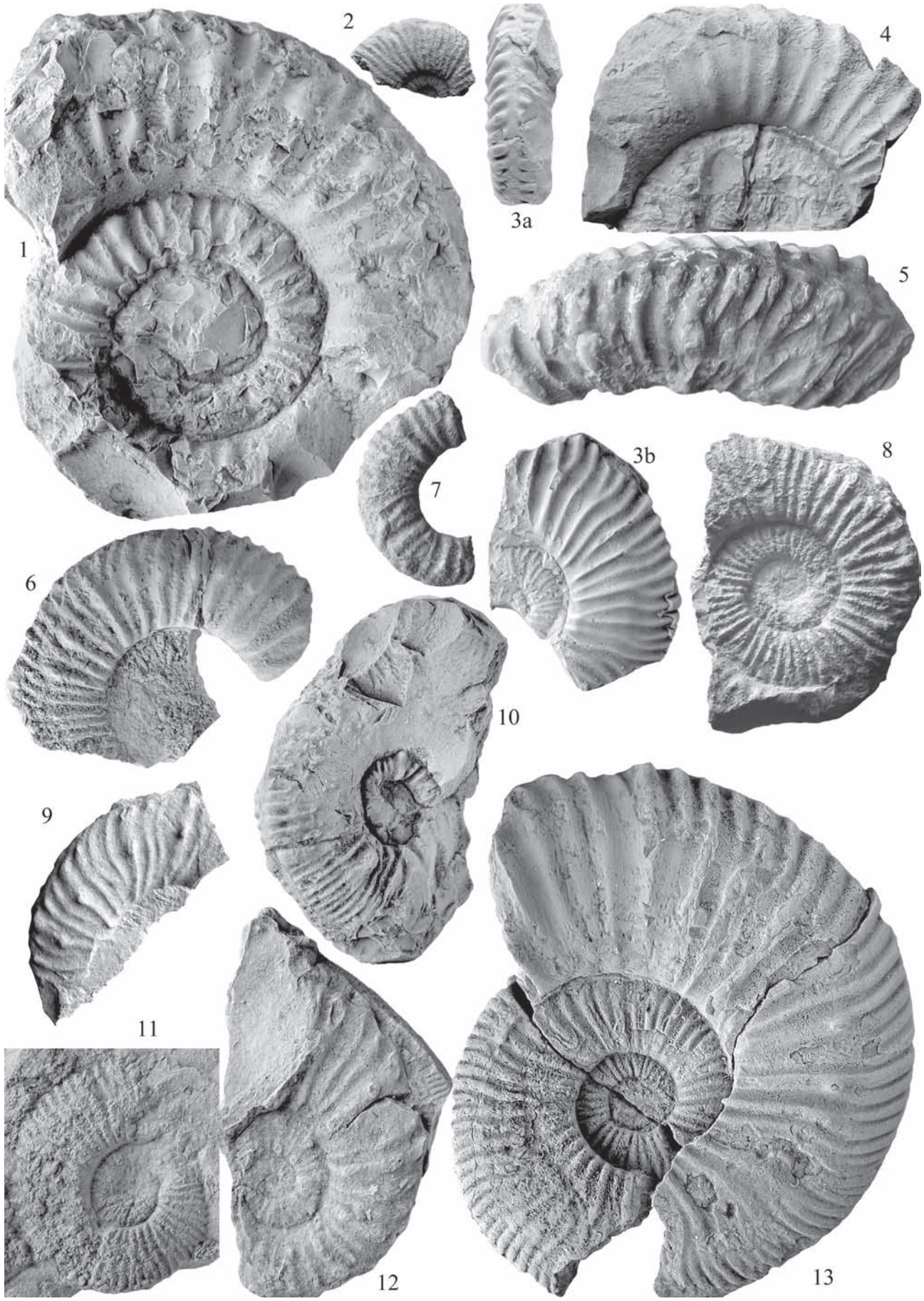

Plate 47 – Neocomitidae

All figures natural size

1. *Kilianella superba* (Sayn, 1907) – K.2010.169.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone. For suture of this specimen see Fig. 7/1 in the text.
2. *Kilianella roubaudiana* (d'Orbigny, 1850) – K.2010.7.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
3a, 3b. *Kilianella roubaudiana* (d'Orbigny, 1850) – K.2010.2.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
4. *Kilianella superba* (Sayn, 1907) – K.2010.167.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
5. *Kilianella superba* (Sayn, 1907) – K.2010.167.8, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
6. *Kilianella lucensis* (Sayn, 1907) – K.2010.163.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
7. *Kilianella rectecostata* (Sayn, 1907) – K.2010.179.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
8. *Kilianella roubaudiana* (d'Orbigny, 1850) – K.2010.16.1, Hárskút, HK-12 section, bed 11, early Valanginian, Pertransiens Zone.
9. *Rodighieroites belimensis* (Mandov, 1976) – K.2010.217.2, Hárskút, HK-123 section, bed 20–26, (possible equivalent of beds 6–7 of HK-12 section), late Valanginian, Verrucosum Zone.
10. *Neohoploceras* cf. *submartini* (Mallada, 1882) – K.2010.249.1, Hárskút, HK-12 section, bed 8, late Valanginian, Verrucosum Zone.
11. *Thurmanniceras thurmanni* (Pictet & Campiche, 1860) – K.2010.189.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
12. *Rodighieroites belimensis* (Mandov, 1976) – K.2010.228.1, Hárskút, HK-123 section, bed 20–26, (possible equivalent of beds 6–7 of HK-12 section), late Valanginian, Verrucosum Zone.
13. *Busnardoites* aff. *campylotoxus* (Uhlig, 1902) – K.2010.261.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

Plate 48 – Neocomitidae

All figures natural size

1. *Busnardoites neocomiensiformis* (Uhlig, 1902) – K.2010.19.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone. For suture of this specimen see Fig. 7/5 in the text.
2a, 2b. *Thurmanniceras pertransiens* (Sayn, 1907) – K.11326, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
3. *Neocomites premolicus* Sayn, 1907 – K.2010.17.1, Hárskút, HK-12 section, bed 11, early Valanginian, Pertransiens Zone.
4. *Busnardoites* aff. *campylotoxus* (Uhlig, 1902) – K.2010.18.1, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.
5a, 5b. *Thurmanniceras pertransiens* (Sayn, 1907) – K.11327, Hárskút, HK-12 section, condensed bed 10, early Valanginian, Pertransiens/Neocomiensiformis Zone.

Plate 49 – Aspidoceratidae

Figures natural size except otherwise indicated

1a, 1b. *Pseudhimalayites uhlandi* (Oppel, 1863) – J.2021.128.1, from the Kimmeridgian of Borzavár, Páskom Hill, presumably "middle Kimmeridgian" Divisum Zone.
2a, 2b. *Pseudhimalayites kondai* Vígh, 1985 – J.10268, holotype, Lókút Hill, bed 46, early Tithonian, Semiforme Zone.
3. *Physodoceras acanthicum* (Oppel, 1863) – J.8733, from the Kimmeridgian of Borzavár, Páskom Hill, characteristic for the late Kimmeridgian, Acanthicum Zone, (0.9x).

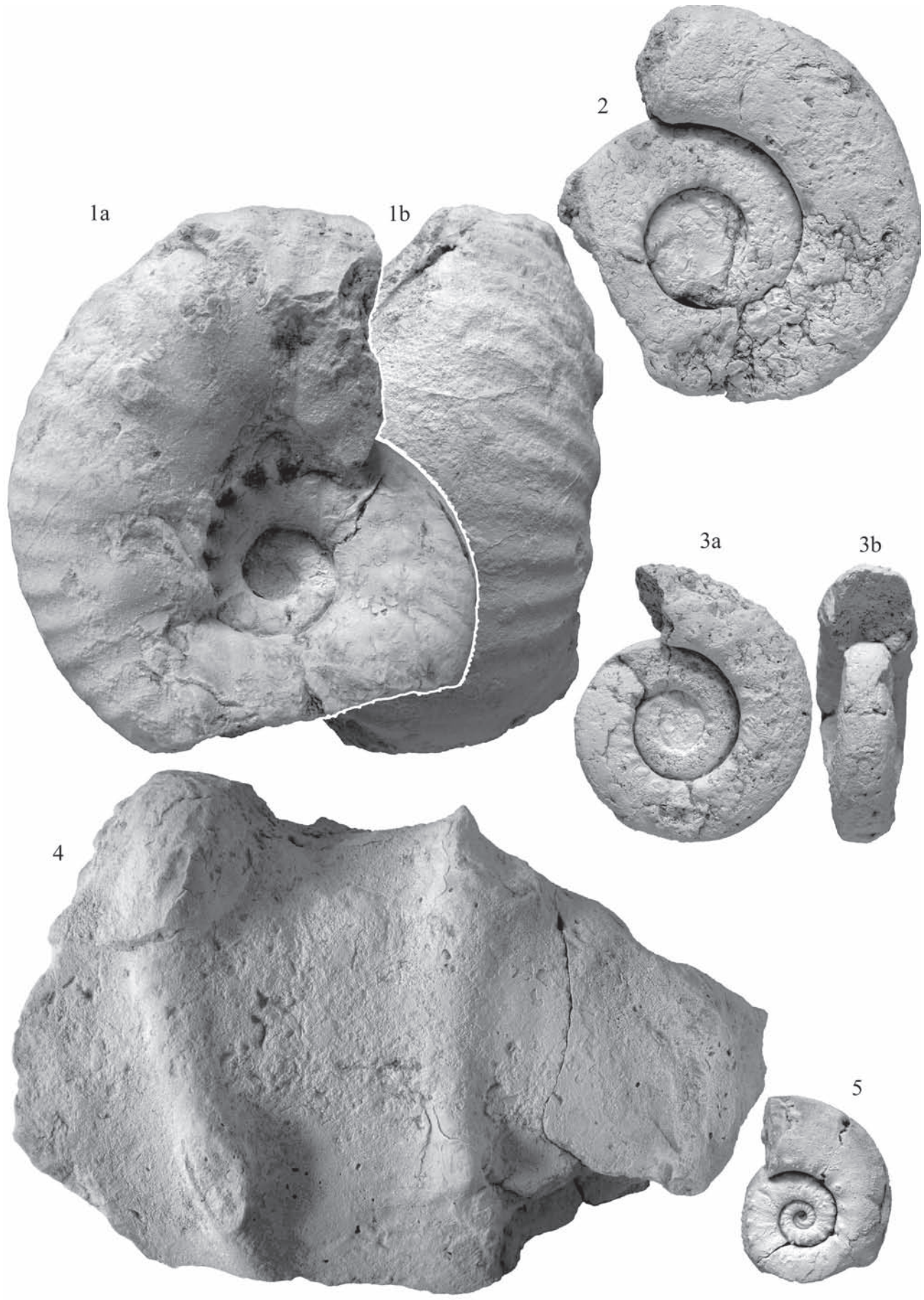

Plate 50 – Aspidoceratidae

Figures are reduced in size to 0.8x, except Fig. 5, which is actual size

1a, 1b. *Pseudhimalayites uhlandi* (Oppel, 1863) – J.8927, from the early Kimmeridgian of Borzavár, Páskom Hill.
2. *Pseudowaagenia* cf. *micropla* (Herbich, 1878 non Oppel, 1863) – J.2021.129.1, Olaszfalu, Eperkés Hill, bed 16, late Kimmeridgian, Beckeri Zone.
3a, 3b. *Pseudowaagenia* cf. *micropla* (Herbich, 1878 non Oppel, 1863) – J.2021.130.1, Olaszfalu, Eperkés Hill, bed 16, late Kimmeridgian, Beckeri Zone.
4. *Euaspidoceras* sp. – M.92.714, Lókút Hill, bed 75, early Kimmeridgian, Platynota Zone.
5. *Hybonoticeras* cf. *knopi* (Neumayr, 1873) – J.8889, Kimmeridgian of Borzavár, Páskom Hill, most probably Beckeri Zone.

Plate 51 – Aspidoceratidae

Figures natural size except otherwise indicated

1. *Pseudhimalayites uhlandi* (Oppel, 1863) – J.8983, from the Kimmeridgian of Borzavár, Páskom Hill, presumably "middle Kimmeridgian", Divisum Zone.
2a, 2b *Sutneria* cf. *cyclodorsata* (Moesch, 1867) – J.2104.40, from the Kimmeridgian (presumably early Kimmeridgian) of Borzavár, Páskom Hill, (2x).
3a, 3b. *Sutneria* cf. *cyclodorsata* (Moesch, 1867) – J.2104.34, from the Kimmeridgian (presumably early Kimmeridgian) of Borzavár, Páskom Hill, (2x).
4a, 4b. *Physodoceras* sp. – J.9005, from the Kimmeridgian of Borzavár, Páskom Hill.
5a, 5b. *Hybonoticeras harpephorum* (Neumayr, 1873) – J.9108, from the Kimmeridgian of Borzavár, Páskom Hill, most probably late Kimmeridgian, Beckeri Zone.
6a, 6b. *Physodoceras* cf. *circumspinosum* (Oppel, 1863) – J.8989, from the Kimmeridgian (most probably early Kimmeridgian) of Borzavár, Páskom Hill.
7a, 7b. *Pseudhimalayites uhlandi* (Oppel, 1863) – J.8984, from the Kimmeridgian of Borzavár, Páskom Hill, very likely "middle Kimmeridgian" Divisum Zone.
8. *Pseudhimalayites uhlandi* (Oppel, 1863) – J.8955, from the Kimmeridgian of Borzavár, Páskom Hill, very likely "middle Kimmeridgian" Divisum Zone.

Plate 52 – Aspidoceratidae

All figures natural size

1a, 1b. *Benetticeras* sp. – J.9068, from the Kimmeridgian of Borzavár, Páskom Hill.
2a, 2b. *Hybonoticeras kamicense* (Schopen, 1888) – J.9142, from the Kimmeridgian, of Borzavár, Páskom Hill, most probably late Kimmeridgian, Beckeri Zone.

Plate 53 – Aspidoceratidae

Figures are reduced in size to 0.5x

1a, 1b. *Hybonoticeras hybonotum* (Oppel, 1863) – J.2021.131.1, Sümeg, grab sample, characteristic for the early Tithonian, Hybonotum Zone.
2. *Toulisphinctes inflatoides* (Quenstedt, 1888) – J.8898, from the Kimmeridgian, (presumably early Kimmeridgian) of Borzavár, Páskom Hill.
3. *Aspidoceras iphicerum* (Oppel, 1863) – J.8797, from the Kimmeridgian of Borzavár, Páskom Hill.
4. *Physodoceras neoburgense* (Oppel, 1863) – J.2021.132.1, Hárskút, Édesvízkút-1 section, bed 10, early Tithonian, ?Darwini Zone.
5a, 5b. *Hybonoticeras hybonotum* (Oppel, 1863) – J.9112, Sümeg, grab sample, characteristic for the early Tithonian, Hybonotum Zone. For suture of this specimen see Fig. 8/3 in the text.
6. *Physodoceras neoburgense* (Oppel, 1863) – J.2021.133.1, Hárskút, Édesvízkút-1 section, bed 10, early Tithonian, ?Darwini Zone.
7. *Toulisphinctes inflatoides* (Quenstedt, 1888) – J.8987, from the Kimmeridgian, (presumably early Kimmeridgian) of Borzavár, Páskom Hill.
8a, 8b. *Hybonoticeras kamicense* (Schopen, 1888) – J.2021.134.1, from the Kimmeridgian, of Borzavár, Páskom Hill, most probably late Kimmeridgian, Beckeri Zone.

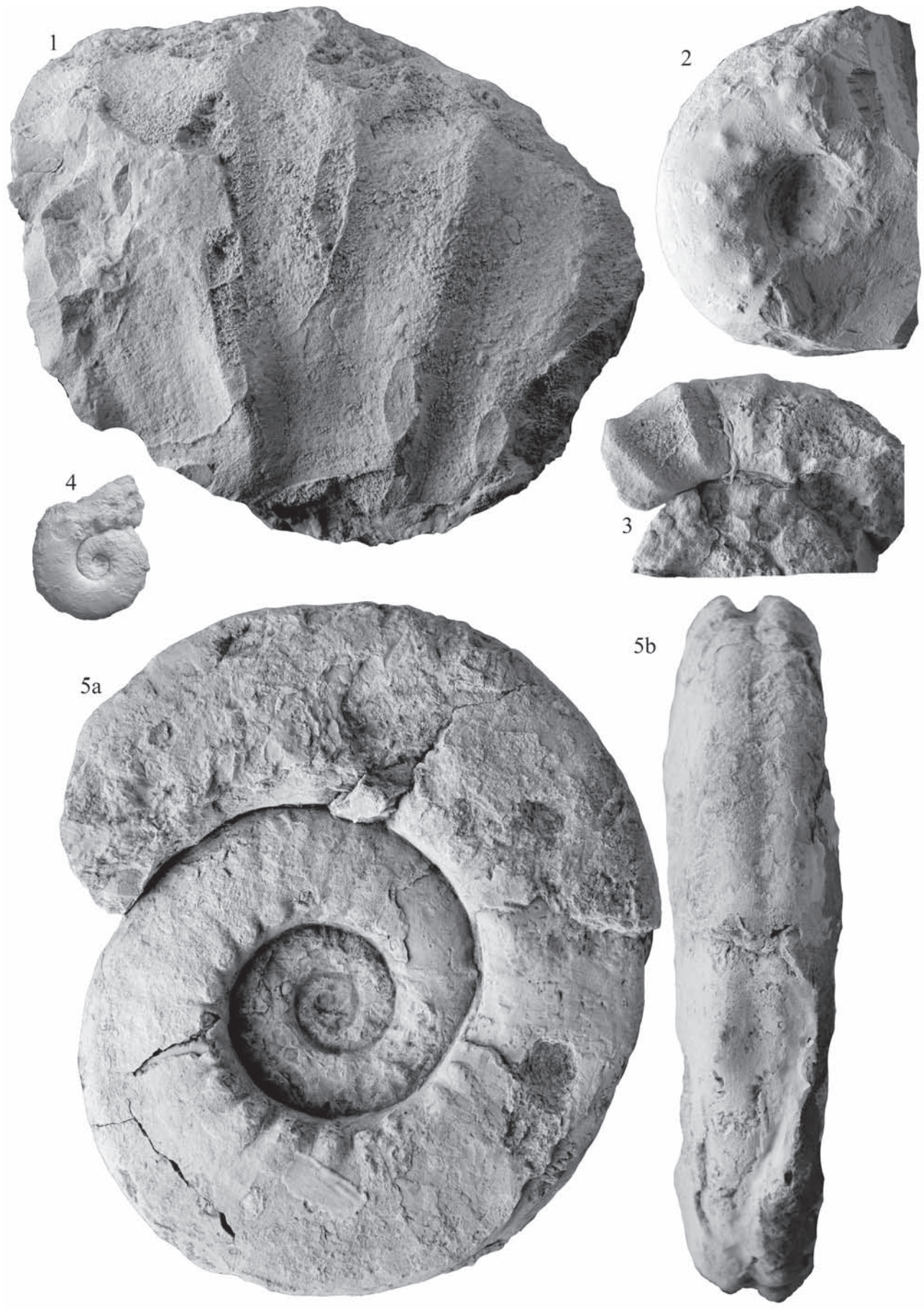

Plate 54 – Aspidoceratidae

All figures natural size

1. *Toulisphinctes* sp. – J.2021.135.1, Lókút Hill, bed 62, late Kimmeridgian, Beckeri Zone.
2. *Aspidoceras taverai* (Checa, 1985) – J.10562, Hárskút, HK-II section, bed 38, late Tithonian, Microcanthum Zone.
3. *Hybopeltoceras linaresi* (Olóriz, 1978) – J.2021.136.1, Hárskút, Édesvízkút, from debris, supposedly basal Tithonian.
4. *Simocosmoceras* sp. – J.2021.137.1., Olaszfalu, Eperkés Hill, early Tithonian, Semiforme Zone.
5a, 5b. *Hybonoticeras pressulum* (Neumayr, 1873) – J.9106, Bakonybél, Som Hill, grab sample, characteristic for the late Kimmeridgian, Beckeri Zone.

Plate 55 – Aspidoceratidae

Figures are reduced to 0.9x

1a, 1b. *Physodoceras wolfi* (Neumayr, 1873) – M.92.852, Lókút Hill, bed 75, early Kimmeridgian, Platynota Zone.
2. *Toulisphinctes* sp. – J.10358, Hárskút, HK-II section, bed 63, early Tithonian, Darwini Zone.
3a, 3b. *Pseudhimalayites subpretiosum* (Uhlig 1878) – J.9089, Herend, Borostyán-Hajag, grab sample, supposedly Tithonian. For suture of this specimen see Fig. 7/2a, 2b in the text.
4a, 4b. *Hybonoticeras pressulum* (Neumayr, 1873) – J.9107, from the Kimmeridgian, of Borzavár, Páskom Hill, most probably late Kimmeridgian, Beckeri Zone.
5. *Physodoceras circumspinosum* (Oppel, 1863) – J.9081, from the Kimmeridgian, (presumably early Kimmeridgian) of Borzavár, Páskom Hill.

Pate 56 – Aspidoceratidae

All figures natural size

1a, 1b. *Hybonoticeras hybonotum* (Oppel, 1863) – J.10591, Lókút Hill, bed 59, early Tithonian, Hybonotum Zone.
2. *Physodoceras neoburgense* (Oppel, 1863) – J.10371, Hárskút, HK-II section, bed 64, early Tithonian, Darwini Zone.
3a, 3b. *Aspidoceras* cf. *zeuschneri* (Zittel, 1870) – J.10571, Lókút Hill, bed 54, early Tithonian, Darwini Zone.
4. *Aspidoceras rogoznicense* (Zeuschner, 1846) – J.2021.138.1, Hárskút, Édesvíz Key section, bed 68, early Tithonian, Fallauxi Zone.
5a, 5b. *Physodoceras neoburgense* (Oppel, 1863) – J.10581, Lókút Hill, bed 55, early Tithonian, Darwini Zone.
6a, 6b. *Hypowaagenia acanthomphala* (Zittel, 1870) – M.92.1131, Lókút Hill, bed 65, late Kimmeridgian, Beckeri Zone.

Plate 57 – Desmoceratidae

All figures natural size

1. *Plesiospitidiscus subdifficilis* (Karakasch, 1907) – K.2014.2, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
2. *Plesiospitidiscus subdifficilis* (Karakasch, 1907) – K.15228, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
3. Desmoceratidae sp. – K.2021.85.1, Hárskút, HK-20 grab sample point, supposedly early Aptian.
4a, 4b. *Plesiospitidiscus* sp. – K.2014.1.2, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
5a, 5b. *Plesiospitidiscus ligatus* (d'Orbigny, 1841) – K.2014.1.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
6. ?*Barremites* sp. – K.2021.86.1, Hárskút, Rend-kő section, bed 35, late Hauterivian.
7a, 7b. *Abrytusites neumayri* (Haug, 1889) – K.2021.87.1, Hárskút, Rend-kő section, bed 35, late Hauterivian, Ohmi Zone.
8. *Plesiospitidiscus ligatus* (d'Orbigny, 1841) – K.2021.88.1, Hárskút, Rend-kő section, bed 35, late Hauterivian, Ohmi Zone.
9. *Abrytusites neumayri* (Haug, 1889) – K.2021.89.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
10. *Plesiospitidiscus* sp. – K.2021.90.1, Hárskút, Édesvíz Key section, bed 7, late Hauterivian.
11. *Plesiospitidiscus breskovskii* Cecca et al, 1998 – K.2021.91.1, Hárskút, Rend-kő section, bed 35, late Hauterivian, Ohmi Zone.
12. *Abrytusites neumayri* (Haug, 1889) – K.15240, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

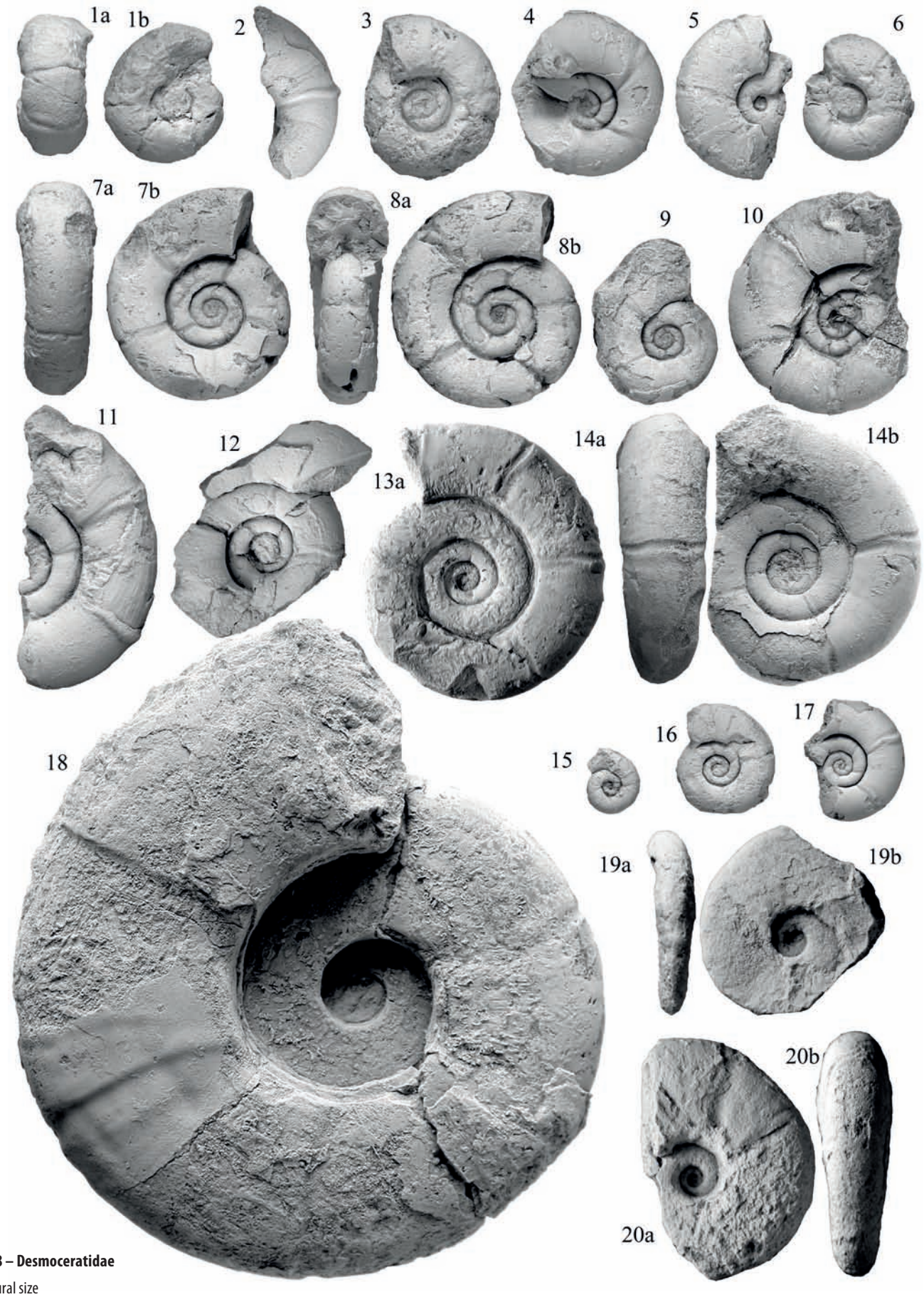

Plate 58 – Desmoceratidae

All figures natural size

1a, 1b. *Abrytusites* sp. 1. – K.2021.92.6.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

2. *Abrytusites* sp. 1. – K.2021.92.6.2, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

3. *Abrytusites* sp. 1. – K.2021.92.6.3, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

4. *Abrytusites* sp. 1. – K.2021.92.6.4, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

5. *Abrytusites* sp. 1. – K.2021.92.6.5, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

6. *Abrytusites* sp. 1. – K.2021.92.6.6, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

7a, 7b. *Abrytusites* sp. 2. – K.2021.93.9.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry. For suture of this specimen see Fig. 9 in the text.

8a, 8b. *Abrytusites* sp. 2. – K.2021.93.9.2, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

9. *Abrytusites* sp. 2. – K.2021.93.9.3, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

10. *Abrytusites* sp. 2. – K.2021.93.9.4, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

11. *Abrytusites* sp. 2. – K.2021.93.9.5, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

12. *Abrytusites* sp. 2. – K.2021.93.9.6, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

13. *Abrytusites* sp. 2. – K.15232, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

14a, 14b. *Abrytusites* sp. 2. – K.2014.5.2, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

15. *Abrytusites* sp. 2. – K.2021.93.9.7, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

15. *Abrytusites* sp. 2. – K.2021.93.9.8, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

17. *Abrytusites* sp. 2. – K.2021.93.9.9, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

18. *Abrytusites* sp. 3. – K.2014.9, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

19a, 19b. *Barremites strettosoma* (Uhlig, 1883) – K.2021.94.1, Városlőd, Kakastaraj, early Barremian.

20a, 20b. *Melchiorites* sp. – K.2021.95.1, Városlőd, Kakastaraj, early Barremian.

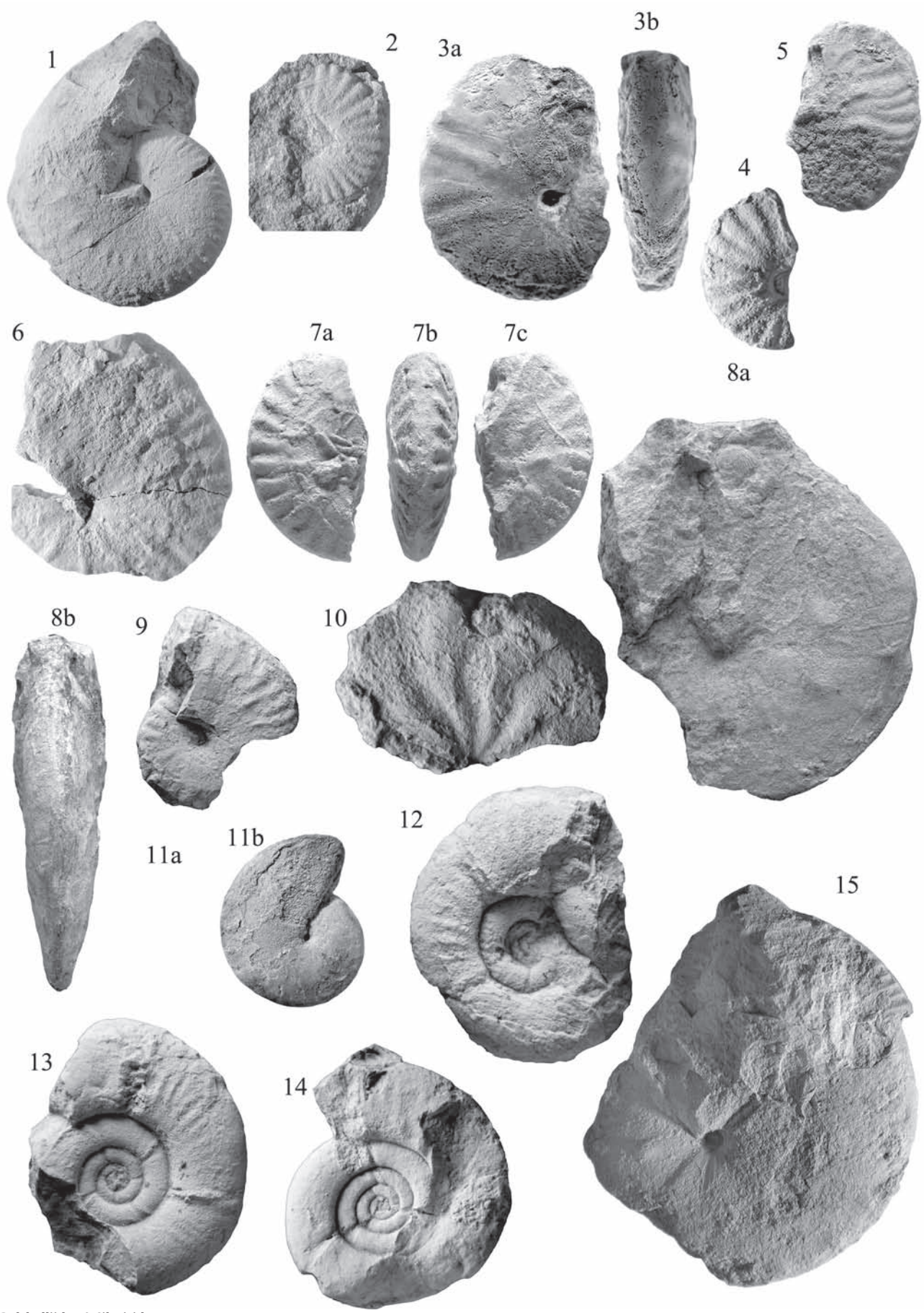

Plate 59 – Pulchelliidae & Silesitidae

Figures are in 1.1x magnification, except otherwise indicated

1. *Discoidellia vermeuleni* (Cecca, Faraoni & Marini, 1998) – K.2010.23.1, Hárskút, HK-12 section, late Hauterivian.
2. *Discoidellia* cf. *favrei* (Ooster, 1860) – K.15231, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
3a, 3b. *Discoidellia couratieri* Vermeulen, 1995 – K.15247, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
4. *Discoidellia vermeuleni* (Cecca, Faraoni & Marini, 1998) – K.2021.96.1, Hárskút, HK-12 section, late Hauterivian, (2x).
5. *Discoidellia* cf. *favrei* (Ooster, 1860) – K.2021.97.1, Édesvíz Key section, bed 6, early Barremian, Hugii Zone.
6. *Discoidellia* cf. *favrei* (Ooster, 1860) – K.2021.98.1, Édesvíz Key section, bed 6, early Barremian, Hugii Zone.
7a, 7b, 7c. *Discoidellia* cf. *favrei* (Ooster, 1860) – K.2021.99.1, Édesvíz Key section, bed 7, late Hauterivian.
8a, 8b. *Discoidellia* cf. *favrei* (Ooster, 1860) – K.2021.100.1, Hárskút, Rend-kő section, bed 34, late Hauterivian, Ohmi Zone.
9. *Discoidellia* cf. *favrei* (Ooster, 1860) – K.2021.101.1, Városlőd, Kakastaraj, likely late Hauterivian.
10. *Heinzia* cf. *caicedi* (Karsten, 1856) – K.2021.102.1, Városlőd, Kakastaraj, likely early Barremian.
11. *Discoidellia* sp. – K.2021.103.1, supposedly from the late Hauterivian of the Hárskút, HK-12 section.
12. *Silesites vulpes* (Coquand, 1878) – K.2021.104.1, Városlőd, Kakastaraj, early Barremian.
13. *Silesites vulpes* (Coquand, 1878) – K.2021.105.1, Városlőd, Kakastaraj, early Barremian.
14. *Silesites vulpes* (Coquand, 1878) – K.2021.106.1, Városlőd, Kakastaraj, early Barremian.
15. *Discoidellia vermeuleni* (Cecca, Faraoni & Marini, 1998) – K.2021.107.1, Hárskút, HK-12 section, late Hauterivian.

Plate 60 – Bochianitidae & Hamulinidae

All figures natural size

1. *Euptychoceras* cf. *meyrati* (Ooster, 1860) – K.2021.108.1, Hárskút, HK-12 section, late Hauterivian.
2. *Euptychoceras* cf. *meyrati* (Ooster, 1860) – K.2021.109.1, Hárskút, HK-12 section, late Hauterivian.
3. *Euptychoceras subundulatum* (d'Orbigny, 1850) – K.2021.110.1, Hárskút, Rend-kő, bed 27/b, late Hauterivian.
4. *Euptychoceras subundulatum* (d'Orbigny, 1850) – K.2021.111.1, Hárskút, Rend-kő, from debris, probably late Hauterivian.
5. *Euptychoceras meyrati* (Ooster, 1860) – K.15230, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
6. *Euptychoceras subundulatum* (d'Orbigny, 1850) – K.2021.112.1, Hárskút, Édesvíz Key section, bed 20, late Hauterivian.
7. *Bochianites neocomiensis* (d'Orbigny, 1842) – K.2021.113.1, Hárskút, Édesvízkút Key Section, bed 58–60, Valanginian.
8. *Euptychoceras subundulatum* (d'Orbigny, 1850) – K.2021.114.1, Hárskút, HK-12 section, late Hauterivian.
9. *Bochianites neocomiensis* (d'Orbigny, 1842) – K.2021.115.1, Hárskút, Édesvíz Key section, bed 57, late Valanginian.
10. *Euptychoceras subundulatum* (d'Orbigny, 1850) – K.15229, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
11. *Anahamulina* cf. *cincta* (d'Orbigny, 1842) – K.2014.8, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
12. *Euptychoceras subundulatum* (d'Orbigny, 1850) – K.2010.24.1, Hárskút, HK-12 section, late Hauterivian.
13. *Euptychoceras meyrati* (Ooster, 1860) – K.2014.9, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

Plate 61 – Hamulinidae

All figures natural size

1. ?*Schaffhauseria* sp. – K.2021.116.1, Hárskút, Édesvíz-major, collection from 1961, bed 3, late Hauterivian.
2. *Hamulina astieriana* d'Orbigny, 1850 – K.8670, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
3. Hamulinidae sp. – K.2021.117.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.
4. *Anahamulina subcincta* (Uhlig, 1883) – K.2021.118.1, Városlőd, Kakastaraj, ?early Barremian.
5. Hamulinidae sp. – K.2021.119.1, Hárskút, Édesvíz-major, collection from 1961, bed 3, late Hauterivian.
6. Hamulinidae sp. – K.2021.120.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.
7. Hamulinidae sp. – K.2021.121.1, Hárskút, Rend-kő section, from debris.
8. ?*Schaffhauseria* sp. – K.2021.122.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.
9. *Hamulina astieriana* d'Orbigny, 1850 – K.2014.6, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

Plate 62 – Ancyloceratoidea

All figures natural size

1. *Balearites angulicostatus* (d'Orbigny, 1841) – K.2021.123.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
2. *Balearites angulicostatus* (d'Orbigny, 1841) – K.15238, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
3. *Crioceratites duvali* (Leveille, 1873) – K.2021.124.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
4. *Crioceratites duvali* (Leveille, 1873) – K.2021.125.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
5. *Crioceratites villiersianus* (d'Orbigny, 1842) – K.2021.126.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
6. *Crioceratites duvali* (Leveille, 1873) – K.2021.127.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
7. *Crioceratites duvali* (Leveille, 1873) – K.2021.128.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

Plate 63 – Ancyloceratoidea

All figures natural size

1. *Paracostidiscus radians* Busnardo, 2003 – K.15244, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
2. *Pseudothurmannia* cf. *mortilleti* (Pictet & de Loriol, 1858) – K.2021.129.1, Édesvíz-major, collection from 1961, bed 3, late Hauterivian.
3. *Pseudothurmannia ohmi* (Winkler, 1868) – K.2021.130.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.
4. *Crioceratites* sp. – K.2021.131.1, Hárskút, Édesvíz Key section, bed 24, Hauterivian.
5. *Honnoratia honnoratiana* (d'Orbigny, 1842) – K.2021.132.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
6. *Emericiceras emerici* (Léveille, 1835) – K.2021.133.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
7. *Pseudothurmannia ohmi* (Winkler, 1868) – K.2021.134.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.
8. *Pseudothurmannia ohmi* (Winkler, 1868) – K.2021.135.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.
9. *Pseudothurmannia* sp. – K.2021.136.1, Városlőd, Kakastaraj, probably late Hauterivian.
10. *Paracostidiscus radians* Busnardo, 2003 – K.2021.137.1, Hárskút, Rend-kő section, from debris, probably late Hauterivian.
11a, 11b. *Pseudothurmannia ohmi* (Winkler, 1868) – K.2021.138.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.
12. *Paracostidiscus radians* Busnardo, 2003 – K.2021.139.1, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.
13. *Pseudothurmannia ohmi* (Winkler, 1868) – K.2021.140.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.

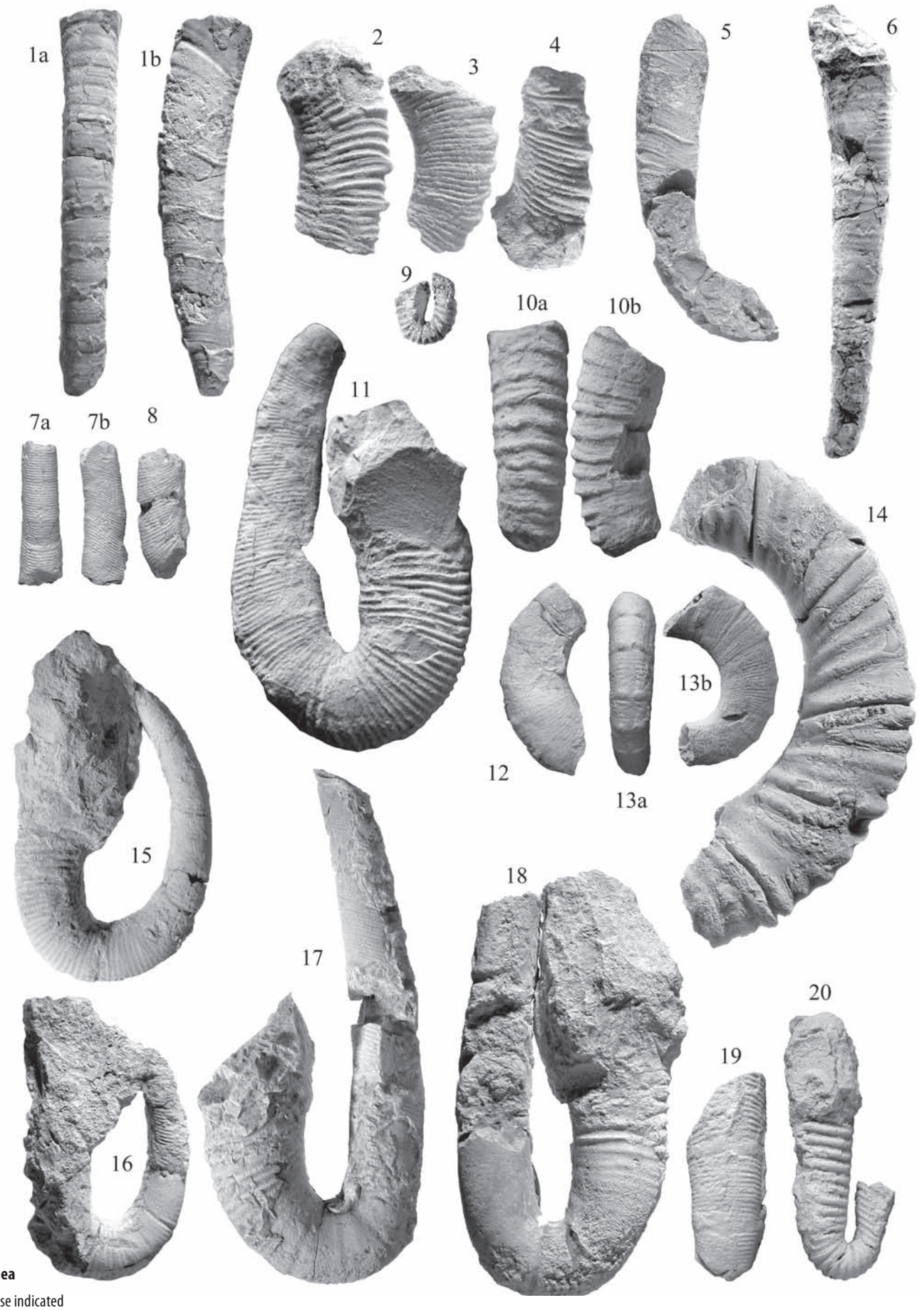

Plate 64 – Ancyloceratoidea

Figures natural size except otherwise indicated

1a, 1b. *Paraspinoceras jourdani* (Astier, 1851) – K.2014.11, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

2. ?*Acrioceras* sp. – K.2021.141.1, Édesvíz-major, bed 3, late Hauterivian, (1.5x).

3. ?*Acrioceras* sp. – K.2021.142.1, Édesvíz-major, bed 3, late Hauterivian, (1.5x).

4. ?*Acrioceras* sp. – K.2021.143.1, Édesvíz-major, bed 3, late Hauterivian, (1.5x).

5. *Acrioceras* cf. *seringeri* (Astier, 1851) – K.2014.12, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

6. *Paraspinoceras jourdani* (Astier, 1851) – K.2014.13, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

7a, 7b. ?*Paraspinoceras* sp. – K.2021.144.1, Hárskút, Édesvíz Key Section, bed 26, Hauterivian.

8. ?*Paraspinoceras* sp. – K.2021.145.1, Hárskút, Édesvíz Key Section, bed 26, Hauterivian.

9. *Hamulinites munieri* (Nickles, 1894) – K.15237, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

10a, 10b. ?*Acrioceras* sp. – K.2021.146.1, Városlőd, Kakastaraj, ?late Hauterivian.

11. *Paraspinoceras pulcherrimum* (d'Orbigny, 1840) – K.2021.147.1, Hárskút, Rend-kő section, bed 35, late Hauterivian, Ohmi Zone.

12. ?*Acrioceras* sp. – K.2021.148.1, Hárskút, Édesvíz Key Section, bed 26, Hauterivian.

13a, 13b. ?*Acrioceras* sp. – K.2021.149.1, Hárskút, Édesvíz Key Section, bed 26, Hauterivian.

14. *Pseudomoutoniceras martinoti* Vermeulen, 2012 – K.15233, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

15. *Paraspinoceras* cf. *pulcherrimum* (d'Orbigny, 1840) – K.15235 from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

16. *Paraspinoceras* cf. *pulcherrimum* (d'Orbigny, 1840) – K.2014.14, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

17. *Paraspinoceras pulcherrimum* (d'Orbigny, 1840) – K.2014.15, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

18. *Paraspinoceras pulcherrimum* (d'Orbigny, 1840) – K.2014.16, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

19. ?*Paraspinoceras* sp. – K.2021.150.1, Hárskút, Rend-kő, bed 35, late Hauterivian, Ohmi Zone.

20. *Hamulinites munieri* (Nickles, 1894) – K.2021.151.1, Városlőd, Kakastaraj, ?late Hauterivian.

Plate 65 – Ancyloceratoidea, Deshayesitidae & Macroscaphitidae

All figures natural size

1. *Paraspiticeras guerinianum* (d'Orbigny, 1850) – K.2021.152.1, Édesvíz-major, bed 3, late Hauterivian.

2a, 2b. *Paraspiticeras guerinianum* (d'Orbigny, 1850) – K.2021.153.1, Édesvíz-major, bed 3, late Hauterivian.

3. *Paraspiticeras voironense* (Pictet & de Loriol, 1858) – K.2021.154.1, Városlőd, Kakastaraj, ?early Barremian.

4. *Paraspiticeras guerinianum* (d'Orbigny, 1850) – K.15227, from the upper Hauterivian–lower Barremian of Zirc, Márvány Quarry.

5a, 5b. *Paraspiticeras* cf. *pachycyclum* (Uhlig, 1883) – K.2021.155.1, Hárskút, Édesvíz Key section, bed 7, late Hauterivian.

6. *Paraspiticeras* sp. – K.2021.156.1, Hárskút, Rend-kő, bed 34, late Hauterivian, Ohmi Zone.

7. *Paraspiticeras* sp. – K.2021.157.1, Hárskút, Rend-kő, bed 34, late Hauterivian, Ohmi Zone.

8. *Macroscaphites* sp. – K.2021.158.1, Hárskút, HK-20 section, grab sample, supposedly ?late Barremian.

9. *Deshayesites* cf. *callidiscus* Casey, 1961 – K.2021.159.1, Hárskút, HK-20, grab sample, early Aptian.