

## Late Anisian Ammonoidea from Szár-hegy (Rudabánya Mts); a Dinaric-type fauna from North Hungary

by  
Attila VÖRÖS

**Abstract** — More than three hundred ammonoid specimens have been collected from a few layers of red limestones of Hallstatt (Schreyeralms) or Han Bulog type, exposed on the top of the Szár-hegy (Rudabánya Mts, North Hungary). The fauna is dominated by Ptychitidae (over 90%), but a few ceratitid species of biostratigraphical importance (*Lardaroceras pseudohungaricum*, *L. krystyni*, *Asseretoceras camunum*, *Megaceratites subnodosus*, *Kellnerites bispinosus*) have also been identified. These prove the Camunum + Pseudohungaricum subzones of the Upper Anisian Trinodosus Zone. The very high proportion of the smooth, sphaeroconic ammonoid morphotypes indicates pelagic and bathyal (at least 500 m deep) environment. Most of the 17 ammonoid species of the Szár-hegy fauna occur in the Dinarides (15 species), while in the faunas of the geographically closer Southern Alps and Balaton Highland the number of co-occurring species is 8 and 9, respectively. Another important indicator is the occurrence of the genera *Sturia*, *Gymnites* and *Procladiscites* in the Szár-hegy fauna, what clearly shows the principal palaeobiogeographic affinity of the Szár-hegy fauna towards the Dinaric region.

**Key words** — Ammonoidea, Middle Triassic, Hungary, taxonomy, stratigraphy, palaeobiogeography.

VÖRÖS, A. (2010): Late Anisian Ammonoidea from Szár-hegy (Rudabánya Mts); a Dinaric-type fauna from North Hungary. — *Fragmenta Palaeontologica Hungarica* 28: 1–20.

### Introduction

Triassic ammonoids are among the rarities in northern Hungary. In the 1980's, the mapping geologists of the Geological Institute of Hungary, György LESS and Sándor KOVÁCS (†), revealed red limestone layers of Middle Triassic age full of ammonoids, at the top of the Szár-hegy in the Rudabánya Mts (Figure 1). A specimen was shown to Leopold KRYSZTYN (Vienna) who gave a preliminary identification of *Paraceratites trinodosus* indicating the late Anisian age. The locally dark red colour of the nodular limestones and the dark ferromanganese oxide envelopes on the ammonoids reminded Sándor KOVÁCS to the facies of the Dinaridic Han Bulog limestones what seemed to increase the scientific importance of the lucky finding. In 1987 he led me to the locality and entrusted me with the detailed

collection and systematic study of the ammonoid fauna. In the same year, the results were summarized in an activity report for the Geological Institute of Hungary. These preliminary ammonoid identifications and stratigraphical conclusions were incorporated to some publications by KOVÁCS (1989a) and SZENTPÉTERY & LESS (2006). In the last years, according to my increased knowledge on Middle Triassic ammonoids achieved by studies on the ammonoid faunas of the Balaton Highland and other Alpine areas, I had to correct and change some of my previous identifications. The stratigraphical conclusions were only slightly changed. The results of the taxonomical revision, with the detailed systematic description of the Szár-hegy fauna are published in this paper.

### The locality

The Szár-hegy (Szar Hill) raises above 500 m between the villages Martonyi and Perkupa, near the Bódva River in northern Hungary (Figure 1). It is the highest part of the Rudabánya Mountains, a narrow (2 to 5 km wide) and relatively long (30 km) range confined between two SW-NE trending major strike slip faults of the Darnó fault system. Structurally, the Szár-hegy belongs to the Bódva nappe, which is in slightly folded, uppermost tectonic position in the Rudabánya Mts and is currently considered the southernmost unit of the Silicium (HAAS 2004, SZENTPÉTERY & LESS 2006).

The fossiliferous locality is on the eastern peak of the Szár-hegy (altitude ~514 m), administratively belonging to the municipality of Martonyi village. Here the Middle Triassic layers stand almost vertically (Figure 2). The section was exposed in a nearly N-S oriented artificial trench, ex-

posed by local workers hired by the Geological Institute of Hungary and first described by KOVÁCS (1989a) and was repeatedly published by HAAS (2001, 2004) and SZENTPÉTERY & LESS (2006).

The lowermost exposed formation is the massive or thick-bedded Middle Anisian (Pelsonian) Steinalm Limestone of shallow marine carbonate platform facies. Its upper part contains neptunian dykes of pink micritic limestone whose pelagic character is proved by microfossils, notably conodonts pointing to Pelsonian age. Above a few metres thick tectonized (crushed) interval, the red, nodular, ammonitic limestone layers of the Upper Anisian (Illyrian) Dunnatető Limestone Formation follow, still in nearly vertical dip. Some of these layers are full of ammonites with blackish, haematitic staining or encrusting and the whole rock has an apparent similarity to the Schreyeralms Lime-

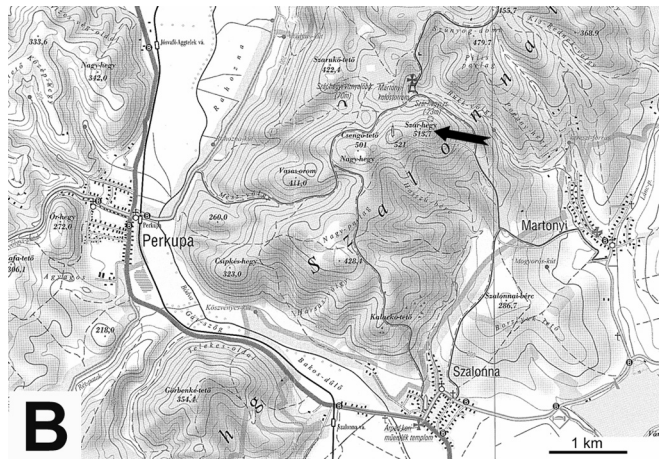
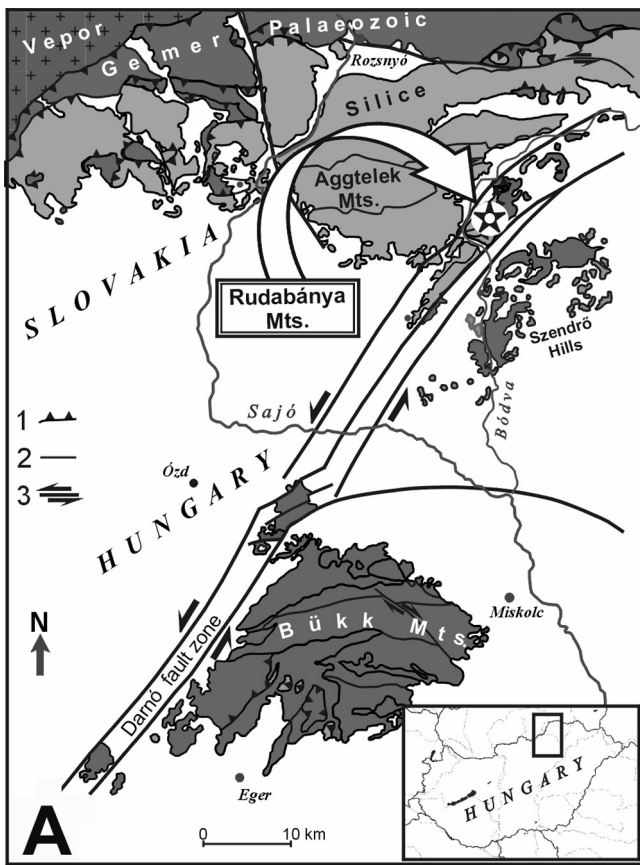
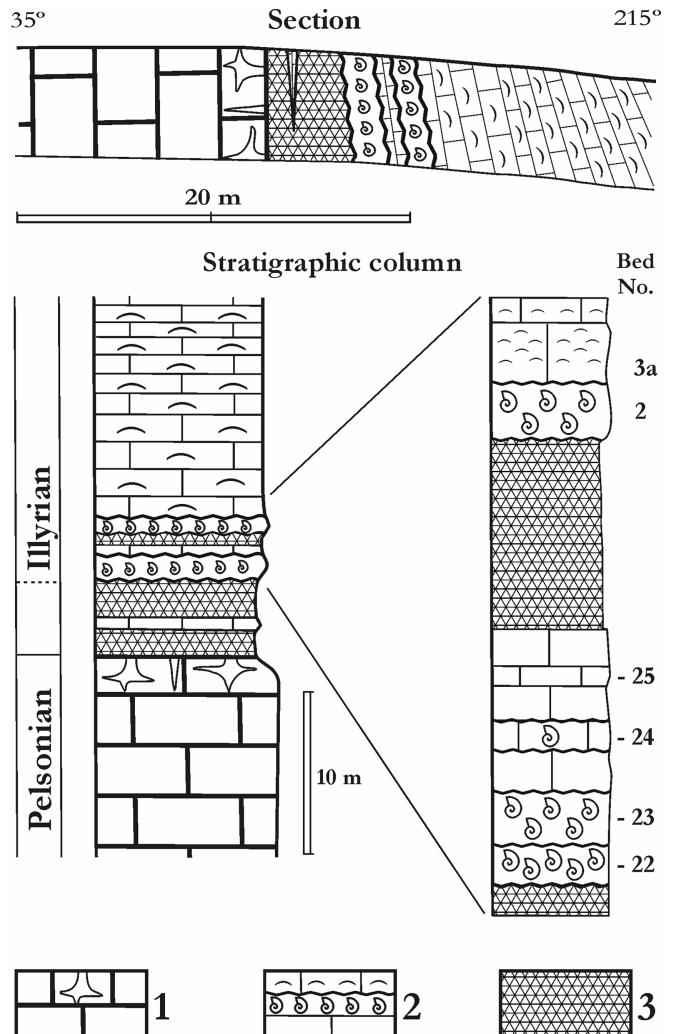


Figure 1 — (A) Simplified geological map of a part of northern Hungary and southern Slovakia showing the position of the Szár-hegy locality (asterisk) in the Rudabánya Mts and (B) detailed map showing the position of the Szár-hegy locality (arrow). — Legend: 1 = nappe boundary; 2 = minor thrust; 3 = strike-slip fault; light grey = Silicium. Modified from KOVÁCS (1989b).

stone of the Alps and the Han Bulog limestone of the Dinarides. A thinner, tectonized (crushed) zone was recorded also between the two main ammonitic limestone horizons. With decreasing ammonite and iron content, the red limestone layers pass gradually into beige to white, thick-bedded “filamentous” limestones (Bódvalenke Limestone Formation?). This limestone is actually a coquina of thin-shelled, pelagic(?) bivalves showing graded bedding. Higher up, the 20 m thick Bódvalenke Limestone starts to be intercalated with reddish chert layers, then it passes into the greenish-grey, thin-bedded radiolarian marls of the more than 30 m thick Szárhegy Radiolarite Formation of Ladinian to Carnian age. The higher beds of the Bódvalenke Limestone and the layers of the Szárhegy Formation show gradually lower and lower angle of dipping, from nearly vertical to around  $45^\circ$ .

A detailed collecting of megafossils was focused on the ammonitic layers of the Dunnatető Limestone. Because of the almost vertical bedding, and in order to achieve representative amount of fossils, we had to enlarge the outcrop to several metres width.

Figure 2 — Geological section and stratigraphical column of the Szár-hegy locality showing the numbers of the fossiliferous beds. — Legend: 1 = Steinalm Limestone with pelagic limestone neptunian dykes (Pelsonian); 2 = limestone, ammonitic limestone, filamentous limestone (coquina) (Dunnatető Limestone, Bódvalenke Limestone) (Illyrian); 3 = tectonized (crushed) zone. Modified after KOVÁCS (1989a) and SZENTPÉTERY & LESS (2006).



### The fauna

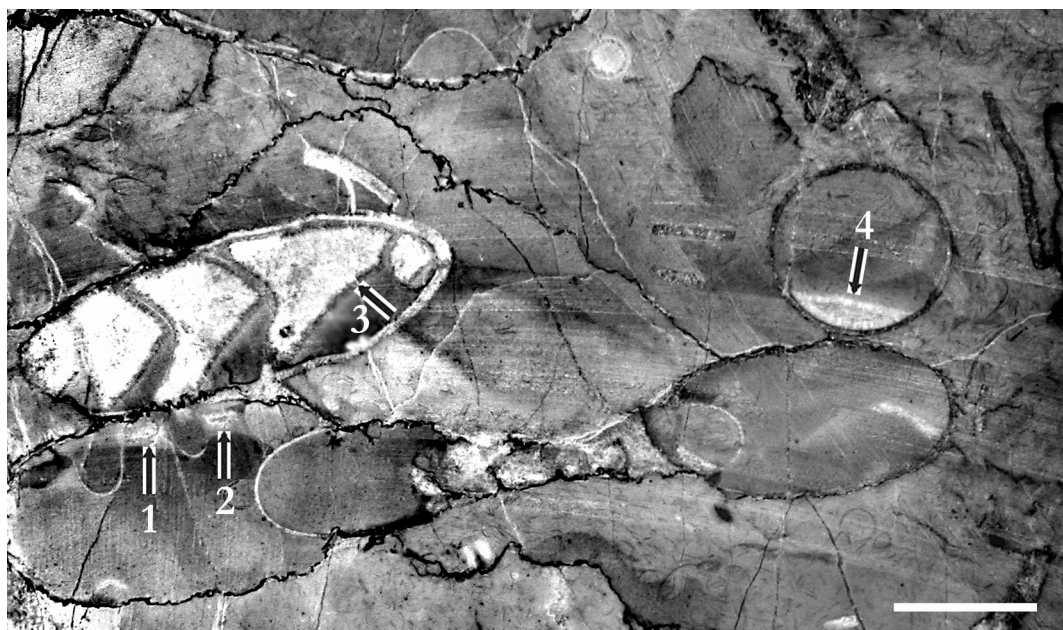
The collection resulted in nearly 450 megafossils altogether, including the indeterminable fragments. The number of ammonoid specimens identified on species level is 168, besides, an orthoconic nautiloid species abounds (80 specimens), furthermore some coleoid specimens and a few brachiopods were encountered. The full list of identified taxa with specimen numbers in the respective beds of the Szár-hegy section is shown in Table 1. In the present paper only the ammonoid fauna will be dealt with in details.

The *size* of the ammonoids varies in a wide range. Most of them are large, in some cases their diameter exceeds 20 cm. Specimens smaller than 5 cm in diameter are exceptional.

The state of *preservation* is worse than medium on the whole. Many ammonoid shells were embedded in fragmentary state; others became worn or partly dissolved after burial by diagenetic processes. Excellently preserved ammonoids also occur whose shells were coated or encrusted by iron-oxide before burial. Even in these cases, the original,

aragonitic shell material became dissolved and substituted by sparry calcite, but, due to these ferruginous envelopes (produced by slight bioerosion and microbial films) the details of the original ornamentation of the shells were protected. Suture lines were extremely rarely preserved or visible.

Measurements or detailed observations on *taphonomy* have not been performed, but it was recorded that the infilling material of the ammonoid shells was nearly identical with the embedding matrix, i. e. red, beige or grey, “filamentous” micrite. Geopetal structures were frequent in the fossils: sometimes the infilling micrite was deposited in several phases, and the open voids were filled with sparite. Most of the larger, flat (compressed) ammonoid shells lie parallel with the bedding; but, on the basis of the inverse position of the geopetal structures it was recorded that in some cases the partially sediment-filled specimens became overturned before final burial (Figure 3). Analogous phenomena were demonstrated in the Middle Triassic Hallstatt (or Bulog) limestones of Epidaurus (Greece) by WENDT (1973).



**Figure 3** — Reworking of fossils before final burial. Arrows indicate the vertical directions at the time of the first phase of internal sedimentation within the respective shells. The ammonoid shell in the lower part of the photograph (probably a *Gymnites*) lies approximately parallel to the actual bedding plane, as marked also by the geopetal structures in its body chamber (arrows 1 and 2). The partly sediment-filled other ammonoid (central left) and orthoconic cephalopod (upper right) shells became overturned at 45° and nearly 90°, respectively, before final burial. — Polished surface, Dunnatető Limestone, Szár-hegy, Bed 2, Anisian, *Trinodosus* Zone, *Camunum* Subzone. Scale bar = 10 mm.

### Stratigraphical and palaeobiogeographical evaluation

The investigated four layers (labelled by S. KOVÁCS as 3/a, 2, -22, -23) show an almost identical faunal spectrum (Table 1), therefore it is not possible to draw a biostratigraphical boundary between them. The presence of the tectonized zones below and between the two main ammonite horizons (3/a, 2 and -22, -23, respectively) raises the possibility that originally they formed a single, or at least a thinner bundle of beds which was repeated tecto-

nically. Consequently, it may be supposed that the more than 3 m present day thickness of this interval was less than 1 m originally. In any case, the whole fauna can be considered a single biostratigraphical entity.

There are five species (*Lardaroceras pseudobungaricum*, *L. krystyni*, *Asseretoceras camunum*, *Megaceratites subnodosus*, *Kellnerites bispinosus*) of apparently great biostratigraphical significance. Four of these occurred in the uppermost part

**Table 1 – The list of species identified from the Szár-hegy fauna and their specimen numbers in the respective beds of the section.**

Species	Bed №			
	3/a	2	–23	–22
	specimens			
<i>Michelinoceras campanile</i> (MOJSISOVICS, 1869)		17	36	25
<i>Lardaroceras pseudohungaricum</i> BALINI, 1992		3		
<i>Lardaroceras krystyni</i> BALINI, 1992		1		1
<i>Lardaroceras</i> sp. indet.			3	2
<i>Kellnerites</i> cf. <i>bispinosus</i> (HAUER, 1896)			1	
<i>Asseretoceras camunum</i> (ASSERETO, 1963)		2		
<i>Megaceratites subnodosus</i> (MOJSISOVICS, 1882)				1
<i>Megaceratites</i> ? sp.			1	
<i>Sturia</i> cf. <i>sansovinii</i> (MOJSISOVICS, 1869)			3	
<i>Sturia</i> cf. <i>semiarata</i> MOJSISOVICS, 1882			1	
<i>Discoptychites megalodiscus</i> (BEYRICH, 1867)		2	3	
<i>Gymnites</i> cf. <i>incultus</i> (BEYRICH, 1867)		2		
<i>Ptychites oppeli</i> MOJSISOVICS, 1882	2	15		5
<i>Flexoptychites</i> cf. <i>studer</i> (HAUER, 1857)		1		
<i>Flexoptychites flexuosus</i> (MOJSISOVICS, 1882)	1	24	7	2
<i>Flexoptychites acutus</i> (MOJSISOVICS, 1882)	3	18	8	11
<i>Flexoptychites</i> cf. <i>angustoumbilicatus</i> (BÖCKH, 1872)			1	
<i>Lanceoptychites indistinctus</i> (MOJSISOVICS, 1882)		1		
<i>Arvestes</i> ? sp. indet.			1	
<i>Procladiscites griesbachi</i> MOJSISOVICS, 1882	1	10		
<i>Monophyllites wengensis</i> (KLIPSTEIN, 1843)	1	11	15	3
“ <i>Atractites</i> ” cf. <i>crassirostris</i> HAUER, 1887		1		
<i>Austriellula</i> ? <i>glossoides</i> (KFTTL, 1904)	1	4	3	
<i>Coenothyris</i> ? sp.	1			

**Table 2 — The stratigraphically significant species of the Szár-hegy fauna and their occurrence in the well-dated sections of the Balaton Highland.**

ZONES	Subzones	Species				
		<i>Megaceratites subnodosus</i>	<i>Asseretoceras camunum</i>	<i>Lardaroceras krystyni</i>	<i>Lardaroceras pseudohungaricum</i>	<i>Kellnerites bispinosus</i>
REITZI	Felsoeoersensis				+	+
TRINODOSUS	Pseudohungaricum	+	+++	++++	++	
	Camunum	++	++++	++		
	Trinodosus	++				

of the Anisian Trinodosus Zone in the Balaton Highland (VÖRÖS 1998), and their ranges are similar in the Southern Alps (BALINI 1992a, 1992b, BRACK & RIEBER 1993). This stratigraphical interval was divided into the Camunum and Pseudohungaricum Subzones by VÖRÖS (1998). The range of *L. pseudohungaricum* extends a little higher, to the lowermost, Felsoeoersensis Subzone of the Reitzi Zone, while *K. bispinosus* was recorded only from this latter Subzone (Table 2). Considering the sedimentological features of the fossiliferous beds, a considerable degree of reworking and condensation can be presumed. All in all, the age of the ammonoid layers of the Szár-hegy may be given in the late Anisian Camunum and Pseudohungaricum Subchrons of the Trinodosus Chron.

Consequently, the quick subsidence, i. e. the drowning of the Steinalm carbonate platform of the Bódva unit and the onset of pelagic sedimentation commenced in the Camunum Subchron. This is perfectly synchronous with the “transgressive” event recorded at the Balaton Highland: the first ammonite-bearing layers on the top of the drowned carbonate platforms at Tagyon and Szentkirályszabadja represent also the Camunum Subzone (BUDAI & VÖRÖS 2006). This corresponds to the transgressive tract of the sequence L1 reported by HAAS & BUDAI (1999). This „transgression” which may perhaps be regarded as eustatic at the Balaton Highland, was definitely caused by sudden tectonic subsidence in the Bódva unit. It should be noted that the tectonic fragmentation of the carbonate platforms (evidenced by neptunian dykes) is a shared feature of the mentioned regions.

One of the most remarkable feature of the Szár-hegy ammonoid fauna is the unusually strong predominance of the nearly smooth “sphaerocones” (mostly Ptychitidae) over the “coronates” (strongly ornamented ceratitids). Considering the previous analyses carried out on the palaeoenvironmental distribution of Triassic ammonoids by WANG & WESTERMANN (1993) and VÖRÖS (1996, 2002), this very high proportion (~95%) of the Ptychitidae indicates pelagic and bathyal (at least 500 m deep) environment.

The above aspect of the Szár-hegy fauna can be interpreted in terms of palaeobiogeographical relationships as well. The faunal spectra of the contemporaneous (Trinodosus Chron) ammonoid faunas of the Southern Alps (ASSERETO 1963, VENZO & PELOSIO 1968) and the Balaton Highland (VÖRÖS 1996, 1998) are rather balanced, i. e. the coronate ceratitids may reach 30% of the fauna. On the other hand, the massive predominance of the Ptychitidae and other smooth ammonoids is typical in the faunas of the Han Bulog and Hallstatt limestones of Bosnia and Greece (WENDT 1973). This clearly shows the principal palaeobiogeographic affinity of the Szár-hegy fauna towards the Dinaric region. This is further supported by the comparison of species composition. The majority of the 17 species of the Szár-hegy fauna occurs in the Dinarides (15 species; 11 of them in Montenegro only), while in the faunas of the geographically closer Southern Alps and Balaton Highland the number of co-occurring species is 8 and 9, respectively. An even more sensible palaeobiogeographic

graphical indicator is the joint occurrence of the genera *Sturia*, *Gymnites* and *Procladiscites* in the Szár-hegy fauna. These genera are common elements of the Dinaric (Han Bulog, Montenegro), Hellenic (Epidauros, Hydra) and Austroalpine (Schreyeralm) faunas, while they are absent in the Late Anisian faunas of the Southern Alps and the Balaton Highland.

The most likely interpretation of the above data is that the above listed ammonoid faunas, including that of the Szár-hegy, lived along the outer shelf zones of the Meliata-

Vardar branch of the Tethys, whereas the South Alpine and Balaton faunas thrived in the intra-shelf basins, farther from the ocean. This idea, as part of a wider synthesis, was suggested and illustrated on maps previously also by VÖRÖS (1992, fig. 2; 2001, fig. 4). The present-day, odd position of the Szár-hegy in North Hungary, together with the Rudabánya Mts. and the Meliaticum, is due to late Mesozoic and Paleogene compressional and strike-slip tectonic movements, as analysed and demonstrated e. g. by CSONTOS & VÖRÖS (2004).

### Systematic descriptions

In the following descriptions the systematics developed by TOZER (1981) is used, except the genera *Lardaroceras*, *Asseretoceras* and *Megaceratites*, introduced afterwards, which are systematically arranged according to the opinion of their author BALINI (1992a, 1992b).

The material is deposited in the Department of Palae-

ontology and Geology of the Hungarian Natural History Museum (Budapest) under the inventory numbers M.89.197 to M.89.260.

The dimensions (**D** = diameter, **WH** = whorl-height, **WW** = whorl-width, **U** = diameter of umbilicus) are given in millimetres.

Order Ceratitida HYATT, 1884

Superfamily Ceratitoidea MOJSISOVICS, 1879

Family Ceratitidae MOJSISOVICS, 1879

Subfamily Beyrichitinae SPATH, 1934

Genus *Lardaroceras* BALINI, 1992

*Lardaroceras pseudohungaricum* BALINI, 1992

(Plate I: 1, 3)

- \* 1992b: *Lardaroceras pseudohungaricum* sp. n. — BALINI, p. 17, text-figs 4B–D, 6A–B, pl. 2, figs 1, 2, pl. 3, figs 1, 2.
- v 1993: *Parakellnerites* sp., aff. *hungaricus* A — VÖRÖS, p. 27, pl. I, figs 6, 7.
- v 1998: *Lardaroceras pseudohungaricum* BALINI, 1992 — PETEK, p. 131 and 139, pl. 3, fig. 5.
- v 1998: *Lardaroceras pseudohungaricum* BALINI, 1992 — VÖRÖS, p. 59, pl. II, figs 1, 2.

**Material** — Three specimens of variable state of preservation.

#### Measurements:

D	WH	WW	U
110	48	25.4	30
77.6	33.5	22.1	20.8
46	22.7	16.1	10.2

**Description** — The best preserved specimen is an almost complete shell; it is a large-sized *Lardaroceras*. The coiling is moderately evolute. The whorl-section is moderately compressed, high oval to subpentagonal. The umbilical margin is subrounded, rather steep. The flanks are slightly convex and form a rather well marked ventrolateral shoulder with the gently arched venter. A rounded keel is not recorded due to the fragmentary state of preservation of the ventral part. The flanks are ornamented with strong ribs and nodes. The almost radial, slightly projected primary ribs run from the umbilical margin to the ventrolateral shoulder. Their number is 8 on a half-whorl of the body chamber. Instead of bifurcation, secondary ribs are inserted in the outer half of the flank. There are three rows of nodes. Each primary rib starts with weak nodes at the umbilical margin, bears a prominent node at about the inner two-fifth of the flank

and ends with strong, spine-like node at the ventrolateral margin. There are similar, strong nodes on the ventrolateral ends of the secondary ribs. The number of the ventrolateral nodes is 15 on a half-whorl of the body chamber. The ornamentation is stronger on the body chamber than on the phragmocone. Suture lines are not visible.

**Remarks** — *L. pseudohungaricum* differs from *L. kerystyni* BALINI, 1992, the other known species of *Lardaroceras*, by the inverse trend in the ontogenetic variation of its ornamentation: on the body chamber the ribbing is stronger than on the phragmocone. This diagnostic character and the whole appearance of the ornamentation justify the identification of the Szár-hegy specimens with *L. pseudohungaricum*, even without the knowledge of the suture lines.

In the manuscript of my preliminary report on the Szár-hegy locality I attributed these specimens to *Paraceratites trinodosus* (MOJSISOVICS, 1882) and this wrong attribution was cited by KOVÁCS (1989a) and SZENTPÉTERY & LESS (2006).

**Distribution** — Late Anisian of the Southern Alps, the Balaton Highland, the Dinarides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

*Lardaroceras krystyni* BALINI, 1992  
(Plate I: 4, 5)

- \* 1992b: *Lardaroceras krystyni* sp. n. — BALINI, p. 12, text-figs 4A, 5A-E, pl. 1, figs 1–5.  
v 1993: “*Parakellnerites* sp., aff. *merianii* B” — VÖRÖS, p. 27, pl. I, figs 8, 9.  
v 1998: *Lardaroceras krystyni* BALINI, 1992 — VÖRÖS, p. 59, pl. I, fig. 7.

**Material** — Two incomplete specimens of poor preservation.

**Measurements:**

D	WH	WW	U
56.6	24.2	13.5	18.5
~53	24.8	13.7	11.6

**Description** — Small to medium-sized *Lardaroceras* with moderately involute, compressed conch. The whorl-section is high oval to subtrapezoidal. The umbilical wall is steep to overhanging; the umbilical margin is well marked. The flanks are gently convex, almost flat and meet with the arched venter at a blunt ventrolateral margin. Due to the fragmentary state of preservation of the ventral part, the presence of a rounded keel can not be proved. The ornamentation consists of very weak, poorly visible radial

ribs and nodes. There are weak umbilical nodes. Lateral nodes are not developed. The ventrolateral nodes are rather prominent; they have the form of somewhat pointed and projected clavi. Suture lines are poorly visible, apparently ceratitic.

**Remarks** — *L. krystyni* differs from *L. pseudohungaricum* BALINI, 1992, the other known species of *Lardaroceras*, by the inverse trend in the ontogenetic variation of its ornamentation: on the body chamber the ribbing is weaker than on the phragmocone. This diagnostic character and the weakness of the ornamentation makes probable the identification of the Szár-hegy specimens with *L. krystyni*.

**Distribution** — Late Anisian of the Southern Alps, the Balaton Highland and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Subfamily Paraceratitinae SILBERLING, 1962

Genus *Kellnerites* ARTHABER, 1912  
*Kellnerites* cf. *bispinosus* (HAUER, 1896)  
(Plate I: 6)

- \* 1896: *Ceratites bispinosus* n. sp. — HAUER, p. 256, pl. VII, figs 5–9.  
v 1993: *Kellnerites bispinosus* — VÖRÖS, p. 27.  
? 1994: “*Kellnerites*” sp. ind. — BALINI, p. 356, pl. 1, fig. 2

**Material** — A single, poorly preserved, fragmentary specimen.

**Measurements:**

D	WH	WW	U
45	20	11.5	16.6

**Description** — Medium-sized *Kellnerites* with moderately involute conch. The whorl-section is high oval. The umbilical wall is moderately steep, not well-defined. The flanks are gently convex. The ventrolateral margin is ill-defined; the venter is arched and bears a marked blunt keel. The flanks are ornamented with strong, prorsiradiate, somewhat projected primary and secondary ribs and nodes. The rare intercalated secondary ribs appear

irregularly at around the inner third of the flank. There are three rows of nodes. The umbilical nodes are not well-developed. The row of the lateral nodes runs at the middle of the flank. The ventrolateral nodes are very strong and elevate above the ventrolateral margin. Suture lines are not visible.

**Remarks** — In the monographic description of the Han Bulog fauna HAUER (1887, 1896) introduced a series of *Kellnerites* species. Some of them, e. g. *K. fissicostatus* (HAUER, 1896) may be synonymous with *K. felsocoersensis* (STÜRZENBAUM, 1875), others, e. g. *K. halilucensis* (HAUER, 1896), *K. bispinosus* (HAUER, 1896) and *K. angustecarinatus* (HAUER, 1896) may perhaps be regarded as variants of *K. bosnensis* (HAUER, 1887) as it was partly suggested even by HAUER (1896).

**Explanation to Plate I**

*All specimens are in natural size and are deposited in the Department of Palaeontology and Geology, Hungarian Natural History Museum.*

- 1 *Lardaroceras pseudohungaricum* BALINI, 1992 — M.89.198., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; a: left lateral view, b: ventral view, c: right lateral view.
- 2 *Lardaroceras* sp. indet. — M.89.251., Szár-hegy, Bed -22, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 3 *Lardaroceras* cf. *pseudohungaricum* BALINI, 1992 — M.89.199., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 4 *Lardaroceras* cf. *krystyni* BALINI, 1992 — M.89.257., Szár-hegy, Bed -22, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 5 *Lardaroceras* cf. *krystyni* BALINI, 1992 — M.89.199., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 6 *Kellnerites* cf. *bispinosus* (HAUER, 1896) — M.89.230., Szár-hegy, Bed -23, Anisian, Trinodosus Zone, Camunum Subzone; a: lateral view, b: ventral view.

Plate I



1a



1b



1c



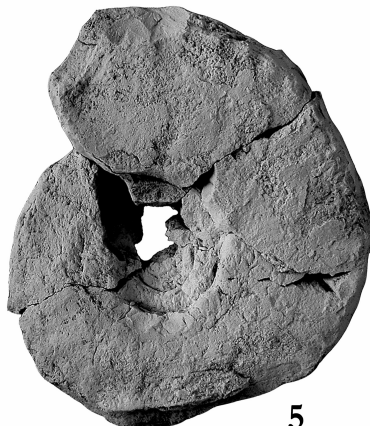
2



3



4



5



6a



6b

The present paper is not suitable to carry out a revision of the above group of species, therefore the tentative identification of the Szár-hegy specimen is based on a few, and partly contradicting morphological features. The projected ribbing and the position of the lateral row of nodes fit with the *K. bispinosus* morphotype, although it is more evolute than the Szár-hegy specimen.

A very similar form was described by BALINI (l. c.) from Greece; this may possibly be conspecific with the Szár-hegy specimen.

**Distribution** — Late Anisian of the Dinarides, the Hellenides, the Balaton Highland and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Genus *Asseretoceras* BALINI, 1992  
*Asseretoceras camunum* (ASSERETO, 1963)  
(Plate II: 1, 2)

- \* 1963: *Bulogites camunus* n. sp. — ASSERETO, p. 46, text-figs. 15, 16, pl. IV, figs 4, 5.  
1992a: *Asseretoceras camunum* (ASSERETO, 1963) — BALINI, p. 181, figs 2, 3.  
v 1989: *Stoppaniceras* cf. *variabilis* RIEBER, 1973 — VÖRÖS & PÁLFY, p. 21, pl. I, figs 1, 2.  
v 1993: *Asseretoceras camunum* — VÖRÖS, p. 28, pl. I, figs 1, 2.  
1994: *Asseretoceras camunum* (ASSERETO, 1963) — BALINI, p. 354, pl. 1, fig. 1.

**Material** — Three specimens; a rather well-preserved conch, a fragment and an imprint.

**Measurements:**

D	WH	WW	U
34.1	11.2	10.5	8.7

**Description** — Small-sized *Asseretoceras* with moderately involute conch. The whorl-section is somewhat trapezoidal, subquadrate. The umbilical wall is rather steep; the umbilical margin is subrounded. The flanks are gently convex. The ventrolateral margin is well-marked. The venter is evenly and moderately arched. The ornamentation consists of strong ribs bearing nodes. The ribs are rectiradiate and gently sinuous. The primary ribs run from the umbilical margin to the ventrolateral shoulder. Their number is 8 on a half-whorl of the body chamber. The secondary ribs are regularly intercalated in each interspace of the primaries; bifurcations were not observed. There are three rows of nodes on the flanks. The umbilical nodes are rather bulla-like on each primary ribs. The moderately strong lateral nodes appear irregularly on some primary ribs in the inner one-fourth of the flank. The ventro-

lateral nodes form a regular row; they uniformly appear both at the primary and on the secondary ribs. They are pointed and oblique forward; their number is 15 on a half-whorl of the body chamber. Suture lines are not visible.

**Remarks** — *A. camunum* was introduced by ASSERETO (1963) as a species of *Bulogites*, then it became the type species of *Asseretoceras* erected by BALINI (1992a). Subsequent illustration from Greece (BALINI 1994, l. c.) supported the identification of the Szár-hegy specimens with *A. camunum*.

In the manuscript of my preliminary report on the Szár-hegy locality I wrongly attributed these specimens firstly to *Bulogites gosariensis* (MOJSISOVICS, 1882) then *Stoppaniceras variabilis* RIEBER, 1973 and the latter attribution was cited by KOVÁCS (1989a) and SZENTPÉTERY & LESS (2006). A few specimens from Vászoly (Balaton Highland) were also erroneously identified as *Stoppaniceras* cf. *variabilis* RIEBER, 1973 by VÖRÖS & PÁLFY (1989); in fact they represent *A. camunum*.

**Distribution** — Late Anisian of the Southern Alps, the Balaton Highland, the Hellenides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Genus *Megaceratites* BALINI, 1992  
*Megaceratites subnodosus* (MOJSISOVICS, 1882)  
(Plate II: 3)

- v \* 1882: *Ceratites subnodosus* E. v. MOJSISOVICS — MOJSISOVICS, p. 33, pl. X, figs 9–11.  
? 1896: *Ceratites* cf. *subnodosus* MOJS. — HAUER, p. 254, pl. VII, fig. 4.  
1916: *Ceratites subnodosus* MOJS. — ARTHABER, p. 250, text-fig. 3a, pl. III, figs 1–4.  
1968: *Paraceratites subnodosus* (MOJS.) — VENZO & PELOSIO, p. 108, pl. XII, figs 6, 7.  
v 1989: *Paraceratites?* *subnodosus* (MOJSISOVICS, 1882) — VÖRÖS & PÁLFY, p. 19, pl. I, fig. 3.  
v 1993: *Paraceratites?* *subnodosus* — VÖRÖS, p. 27, pl. I, fig. 5.  
v 1998: *Megaceratites?* cf. *subnodosus* (MOJSISOVICS, 1882) — VÖRÖS, p. 59, pl. I, fig. 6.

**Material** — A single, incomplete, partly worn specimen.

**Measurements:**

D	WH	WW	U
85.5	33	30.2	25.5

**Description** — Large-sized *Megaceratites*, with moderately evolute conch. The whorls are rather compressed,

stout; the cross-section is subquadratic. The umbilical edge is subrounded. The flanks are flat to gently convex and form a well marked ventrolateral shoulder with the flat, gently arched venter. The flanks are ornamented with very strong ribs bearing nodes. The prorsiradiate ribs are somewhat projected on the body chamber. Secondary ribs occasionally appear at around the mid-flank; if they

originate by bifurcation or insertion is not well seen. There are no umbilical nodes. The lateral nodes can be qualified rather as swellings on the primary ribs. The ventrolateral nodes are very prominent, clavus-like; they appear on both the primary and the secondary ribs. Their number is 11 on a half-whorl of the body chamber. The venter is crossed by adorally convex, growth lines of diverse strength. Suture lines are not visible.

**Remarks** — This species was tentatively placed into the genus *Paraceratites* by several authors. The stout whorls and the character of the ornamentation fit very well with those of *Megaceratites* erected recently by BALINI (1992b); this assignment is used in the present paper, despite that BALINI definitely did not include the species *subnodosus* into his new genus. The Szár-hegy specimen bears great

resemblance to those figured from Schreyeralm (MOJSISOVICS 1882, l. c.), the Balaton Highland (VÖRÖS 1993, l. c.) and especially from Lenna (VENZO & PELOSIO 1968, l. c.) therefore its identification seems to be convincing.

The record by HAUER (1896, l. c.) is included into the synonym list only tentatively, because the specimen is not figured, only its suture line is shown.

In the manuscript of my preliminary report on the Szár-hegy locality I attributed this specimen to *Ticinites* cf. *ticinensis* RIEBER, 1973 and this wrong attribution was cited by KOVÁCS (1989a) and SZENTPÉTERY & LESS (2006).

**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Balaton Highland, the Dinarides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Superfamily Pinacoceratoidea MOJSISOVICS, 1879

Family Sturiidae KIPARISOVA, 1958

Genus *Sturia* MOJSISOVICS, 1882

*Sturia* cf. *sansovinii* (MOJSISOVICS, 1869)

(Plate II: 5)

- \* 1869: *Amaltheus Sansovinii* MOJS. nov. sp. — MOJSISOVICS, p. 580, pl. XVIII, figs 1, 2.
- 1882: *Sturia Sansovinii* E. v. MOJSISOVICS. — MOJSISOVICS, p. 241, pl. XLIX, figs 5–7, pl. L, fig. 1.
- ? 1892: *Sturia Sansovinii* MOJS. — HAUER, p. 283, pl. X, fig. 7.
- 1904: *Sturia Sansovinii* MOJSISOVICS, 1869. — MARTELLI, p. 102, pl. VI, fig. 5.
- ? 1938: *Sturia* sp. ind. aff. *sansovinii* MOJS. — SIMIĆ, p. 218, pl. XVIII, fig. 4.

**Material** — Three fragmentary specimens of poor preservation.

**Measurements** — Due to the fragmentary state of the specimens, direct measurements were not taken, but the diameter of the largest specimen is estimated as more than 20 cm.

**Description** — Large-sized *Sturia*, with involute, discoidal conch. The outer whorls and the body chamber are compressed, very high; the inner whorls are somewhat lower and subrounded. The maximum width lies around the inner third of the whorl. The umbilicus is very narrow and tends to be concealed. The umbilical margin is gently inclined. The flanks are almost flat, gently convex. The venter is high and narrowly arched. The ornamentation is strigate. The flanks are mostly covered by regularly spaced, rather strong longitudinal (spiral) striae. The strigation fades

out on the ventral third of the flanks; then finer but sharper striae appear on the venter. Suture lines are not visible.

**Remarks** — This is the type species of the genus *Sturia* and it can be easily recognized by its large size and the distribution of the strigate ornamentation on the surface of the shell. These features helped in the identification of the Szár-hegy specimens.

The record by HAUER (1892, l. c.) is tentatively included in the synonymy because the figured juvenile specimen does not show any ornamentation. The other doubtful record by SIMIĆ (1938, l. c.) portrays only a small fragment, though the ornamentation seems to fit *S. sansovinii*.

**Distribution** — Late Anisian of the Northern Calcareous Alps, the Balaton Highland, the Dinarides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

*Sturia* cf. *semiarata* MOJSISOVICS, 1882

(Plate II: 4)

- \* 1882: *Sturia semiarata* E. v. MOJSISOVICS. — MOJSISOVICS, p. 242, pl. XLVIII, fig. 8, pl. XLIX, figs 1, 3, pl. L, fig. 2.
- 1904: *Sturia semiarata* MOJSISOVICS 1882. — MARTELLI, p. 103, pl. VI, fig. 4.

**Material** — A single specimen (phragmocone) of moderate state of preservation.

**Measurements:**

D	WH	WW	U
56.1	33.7	14.3	2.8

**Description** — Medium-sized *Sturia*, with involute, discoidal conch. The whorls are compressed, very high, tending to be acute. The maximum width lies near the umbilical

margin. The umbilicus is very narrow; the umbilical wall is rather steep. The flanks are nearly flat, very slightly convex. The venter is highly arched, acute. The strigate ornamentation is restricted to the venter in the form of a few, sharp and closely spaced longitudinal (spiral) striae. The flanks are smooth altogether. The suture line is ammonitic and consists of around 9 saddles, but the details can not be observed.

**Remarks** — According to MOJSISOVICS (1882, l. c.) this species is closely allied to *S. sansovinii* (MOJSISOVICS, 1869) but

differs in the distribution of the strigate ornamentation being restricted to the venter in most ontogenetic stages. Moreover, as the original figures show, the whorl-section of *S. semiarata* is more lanceolate, i. e. the maximum width is much nearer to the umbilicus than in *S. sansovinii*. These features support the

identification of the Szár-hegy specimen.

**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Dinarides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Genus *Discoptychites* DIENER, 1916  
*Discoptychites megalodiscus* (BEYRICH, 1867)  
(Plate IV: 3)

- \* 1867: *Ammonites megalodiscus* — BEYRICH, p. 135, pl. II.  
1882: *Ptychites megalodiscus* (BEYRICH) E. v. M. — MOJSISOVICS, p. 253, pl. LXXVII, fig. 1, pl. LXXVIII, figs 1, 2.  
1913: *Ptychites megalodiscus* BEYR. sp. — TOULA, p. 677, pl. XXIII, fig. 1.  
? 1963: *Discoptychites cf. megalodiscus* (BEYRICH) 1867. — ASSERETO, p. 78, text-fig. 28, pl. VIII, fig. 7.  
1984: *Discoptychites megalodiscus* (BEYRICH, 1867) — LEITHNER & KRYSZTYN, p. 190, pl. 2, fig. 1.  
v 1998: *Discoptychites cf. megalodiscus* (BEYRICH, 1867) — VÖRÖS, p. 59.  
2005: *Discoptychites cf. D. megalodiscus* (BEYRICH, 1867) — MONNET & BUCHER, p. 48, text-fig. 46, pl. 23, fig. 10.

**Material** — Five, partly fragmentary, poorly preserved specimens.

**Measurements:**

D	WH	WW	U
>180	114	46.5	11.7
177	~97	41	?
122.5	68.8	34.7	~10.5

**Description** — Large-sized *Discoptychites*, with involute, discoidal conch. The outer whorls and the body chamber are compressed, very high, acuminate; the inner whorls are gradually lower; the nucleus is globose. The maximum width of the whorl lies near the umbilical margin. The umbilicus is very narrow and tends to be occluded; the umbilical wall is convex and becomes overhanging inward. The flanks are almost flat, very slightly convex. The venter of the outer whorl and body chamber is acute. Ornamentation is not seen, except some fine growth lines. The suture line is

ammonitic but the details can not be observed due to the poor preservation.

**Remarks** — *D. megalodiscus* is the type species of the genus *Discoptychites*. It reaches significantly the largest size within the genus; moreover, it differs from other species of *Discoptychites* by its narrower umbilicus and much compressed conch and by the fact that the early globose stage is restricted to the innermost part (less than ten millimeter diameter) of the phragmocone. MOJSISOVICS (1882, l. c.) and TOULA (1913, l. c.) figured excellently representative specimens of this species.

The specimen figured by ASSERETO (1963, l. c.) corresponds to the above diagnostic criteria, except its rather small size.

**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Balaton Highland, Nevada and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Family Gymnitidae WAAGEN, 1895

Genus *Gymnites* MOJSISOVICS, 1882  
*Gymnites cf. incultus* (BEYRICH, 1867)  
(Plate II: 6)

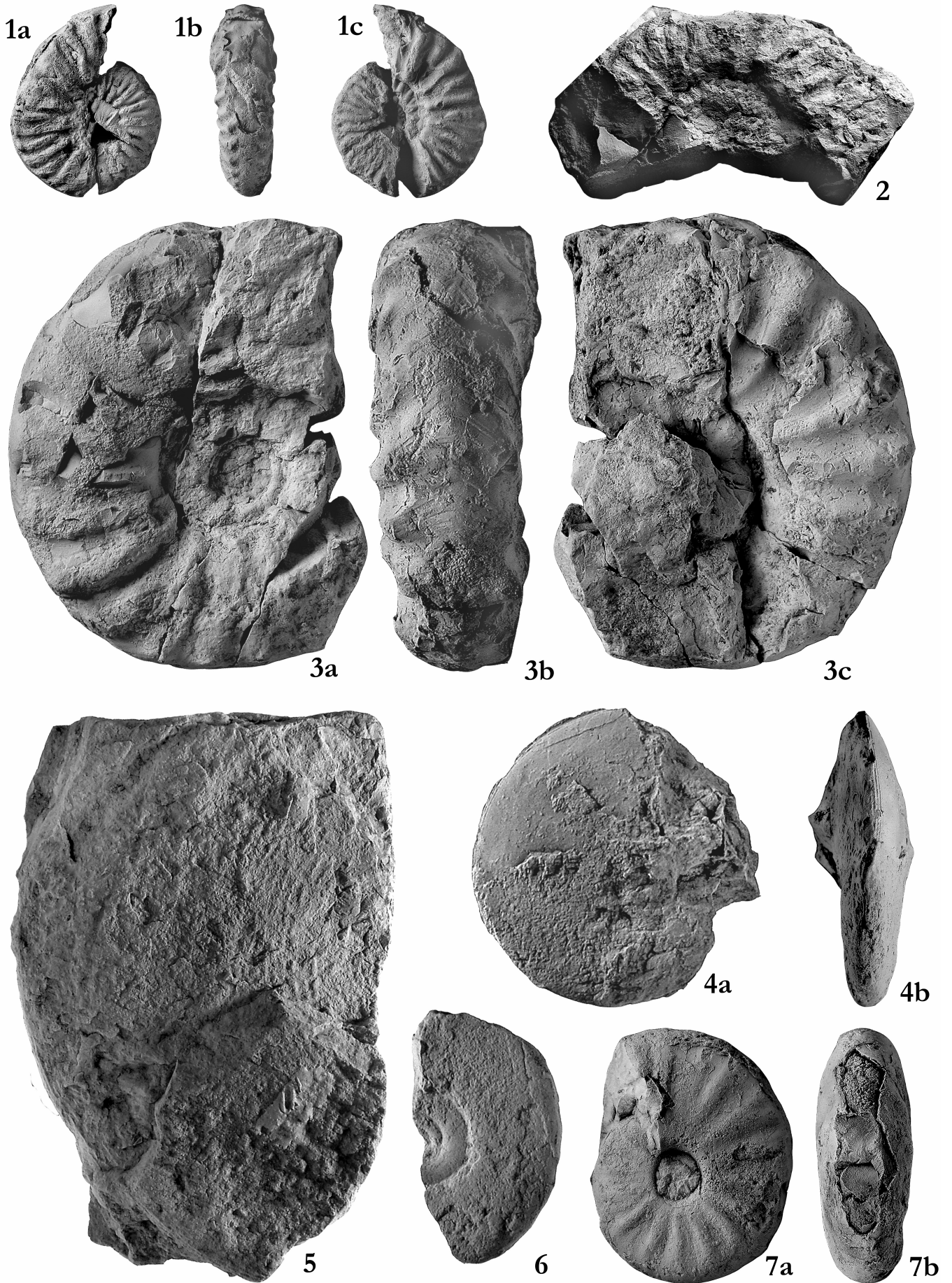
- \* 1867: *Ammonites incultus* — BEYRICH, p. 132, pl. III, fig. 1.  
1882: *Gymnites incultus* (BEYRICH) E. v. M. — MOJSISOVICS, p. 233, pl. LIV, figs 1–3.

**Explanation to Plate II**

*All specimens are in natural size and are deposited in the Department of Palaeontology and Geology, Hungarian Natural History Museum.*

- 1 *Asseretoceras camunum* (ASSERETO, 1963) — M.89.200., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; **a**: left lateral view, **b**: ventral view, **c**: right lateral view.
- 2 *Asseretoceras cf. camunum* (ASSERETO, 1963) — M.89.242., Szár-hegy, Bed -23, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 3 *Megaceratites subnodosus* (MOJSISOVICS, 1882) — M.89.250., Szár-hegy, Bed -22, Anisian, Trinodosus Zone, Camunum Subzone; **a**: left lateral view, **b**: ventral view, **c**: right lateral view.
- 4 *Sturia cf. semiarata* MOJSISOVICS, 1882 — M.89.229., Szár-hegy, Bed -23, Anisian, Trinodosus Zone, Camunum Subzone; **a**: lateral view, **b**: ventral view.
- 5 *Sturia cf. sansovinii* (MOJSISOVICS, 1869) — M.89.244., Szár-hegy, Bed -23, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 6 *Gymnites cf. incultus* (BEYRICH, 1867) — M.89.197., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 7 *Ptychites oppeli* MOJSISOVICS, 1882 — M.89.212., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; **a**: lateral view, **b**: ventral view.

Plate II



1904: *Gymnites incultus* BEYRICH sp. 1867. — MARTELLI, p. 104, pl. V, figs 9, 10.

1967: *Gymnites incultus* (BEYRICH, 1867) — JACOBSHAGEN, p. 28, pl. 2, fig. 2.

1988: *Gymnites incultus* (BEYRICH), 1867 — PRLJ & MUDRENOVIĆ, p. 21, pl. III, fig. 1.

1998: *Gymnites incultus* (BEYRICH, 1867) — PETEK, p. 134 and 140, pl. 5, fig. 3.

**Material** — Two fragmentary specimens.

**Measurements:**

D	WH	WW	U
~50	>17	10	18.4

**Description** — Small-sized *Gymnites* with moderately evolute, rather compressed conch. The whorl-section is high oval, with maximum width at around the inner third. The umbilicus is wide; at least three volutions of the inner whorls are seen. The umbilical wall is steep but low; the umbilical shoulder is subrounded. The flanks are moderately convex and pass gradually into the highly arched venter. No orna-

mentation can be observed. Suture lines are not visible.

**Remarks** — This is the type species of the genus *Gymnites*. From many other smooth species of this genus, *G. incultus* differs by its moderate degree of evolution and rather strongly compressed whorls. In these features it resembles to *G. eckei* (MOJSISOVICS, 1882) which has, however, a characteristic row of nodes along its mid-flank.

**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Dinarides, the Hellenides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Family Ptychitidae MOJSISOVICS, 1882

Genus *Ptychites* MOJSISOVICS, 1875

*Ptychites oppeli* MOJSISOVICS, 1882

(Plate II: 7)

\* 1882: *Ptychites Oppeli* E. v. MOJSISOVICS — MOJSISOVICS, p. 248, pl. LXXI, figs 1, 3, pl. LXXII, figs 1, 2.

1904: *Ptychites Oppeli* MOJSISOVICS 1882 — MARTELLI, p. 114, pl. IX, figs 1–3.

1910: *Ptychites Oppeli* MOJSISOVICS — RENZ, p. 28, text-fig. 2.

1968: *Ptychites oppeli* (MOJS.) — VENZO & PELOSIO, p. 119, pl. XIV, figs 13–17, pl. XV, figs 1, 3–5, pl. XVI, fig. 1.

1984: *Ptychites oppeli* MOJSISOVICS, 1882 — LEITHNER & KRYSSTYN, p. 190, pl. 1, fig. 2.

1988: *Ptychites oppeli* MOJSISOVICS, 1882 — PRLJ & MUDRENOVIĆ, p. 17, pl. V, fig. 4.

**Material** — Twenty-two specimens of various state of preservation.

**Measurements:**

D	WH	WW	U
117.2	59.7	36.4	12.6
100.2	57.6	40.5	13.1
61.1	31.8	23	~9
59.7	31.9	22.1	9.5
58.2	27.2	20.8	9.4
50	24.5	19	9.5

**Description** — Small to medium-sized *Ptychites* with involute conch. The whorl-section is moderately high oval with maximum width near the umbilicus. The umbilicus is narrow and deep. The umbilical wall is nearly vertical; the umbilical margin is rather well-marked. The flanks are gently convex and pass gradually to the moderately arched venter. The ornamentation consists of rectiradiate folds separated by depressions of similar width. The folds gradually appear near the umbilical margin, strengthen in the middle of the flanks and fade out on the venter. Their number increases

by insertion of occasional secondary folds and reaches 10–13 on a half-whorl. The folding becomes weaker on the body chamber of larger specimens. The suture line is ammonitic but the details can not be observed.

**Remarks** — MOJSISOVICS (1882, l. c.) described *P. oppeli* as a member of his “rugiferi” group. The other species of this group seem to differ from *P. oppeli* in the following essential features: *P. dontianus* (HAUER, 1850), *P. eusomus* (BEYRICH, 1865) and *P. seebachi* MOJSISOVICS, 1882 possess higher and somewhat acuminate whorl-section, and fewer and weaker radial folds; *P. stachei* MOJSISOVICS, 1882 has more numerous, weak radial folds; *P. breunigi* MOJSISOVICS, 1882 show partly rursiradiate and sinuous folds and has an indistinct umbilical margin. Therefore the Szár-hegy specimens have been identified with *P. oppeli*, which was profusely illustrated by MOJSISOVICS (1882, l. c.) and VENZO & PELOSIO (1968, l. c.).

**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Dinarides, the Hellenides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Genus *Flexoptychites* SPATH, 1951

*Flexoptychites* cf. *studer* (HAUER, 1857)

(Plate III: 2)

\* 1857: *Ammonites Studeri* HAUER — HAUER, p. 146, pl. I, figs 1–4.

1867: *Ammonites Studeri*. HAU. — BEYRICH, p. 123, pl. I, fig. 5.

1882: *Ptychites Studeri* (FR. V. HAUER) E. v. M. — MOJSISOVICS, p. 260, pl. LXIII, fig. 1.

1904: *Ptychites Studeri* HAUER sp. 1857. — MARTELLI, p. 127, pl. XII, fig. 1.

1913: *Ptychites Studeri* v. HAU. — TOULA, p. 659, pl. XXIII, fig. 4.

1913: *Ptychites flexuosus* v. MOJS. nov. var. — TOULA, p. 666, text-fig. 24, pl. XXV, fig. 16.

1963: *Flexoptychites studeri* (HAUER 1857) — ASSERETO, p. 86, text-fig. 31, pl. XI, fig. 5.

1988: *Flexoptychites studeri* (HAUER, 1857) — PRIJ & MUDRENOVIĆ, p. 19, pl. IV, fig. 1.

**Material** — A single, partly fragmentary, moderately preserved specimen.

**Measurements:**

D	WH	WW	U
61.3	33.1	21	8.8

**Description** — Medium-sized *Flexoptychites* with moderately compressed involute conch. The whorl-section is high oval with maximum width close to the umbilicus. The umbilicus is moderately narrow and deep. The umbilical wall is gently sloping; the umbilical margin is rounded. The flanks are very slightly convex and pass gradually to the highly arched but rounded venter. The rather weak ornamentation consists of rectiradiate folds of uneven strength; some of them appear as secondary intercala-

tions; their number may reach 20 on a half-whorl. The folds appear near the umbilical margin, and fade out on the ventrolateral margin, where they tend to be slightly rursiradiate. Suture lines are not visible.

**Remarks** — *F. studeri* has some similarity to *F. flexuosus* (MOJSISOVICS, 1882) and *F. angustoumbilicatus* (BÖCKH, 1872) but it differs by its weaker and denser lateral folds tending to be rursiradiate.

The specimen figured by TOULA (1913, l. c.) as *Ptychites flexuosus* v. Mojs. nov. var. seems to represent *F. studeri*.

**Distribution** — Late Anisian of the Southern Alps, the Balaton Highland, the Dinarides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

*Flexoptychites flexuosus* (MOJSISOVICS, 1882)

(Plate III: 4, 5)

- \* 1882: *Ptychites flexuosus* E. v. MOJSISOVICS — MOJSISOVICS, p. 261, pl. LXIII, figs 2–8, pl. XLIV, figs 1–3, pl. XLVI, figs 2, 3.  
 1904: *Ptychites flexuosus* MOJSISOVICS 1882 — MARTELLI, p. 125, pl. X, figs 2–7.  
 1910: *Ptychites flexuosus* MOJSISOVICS — RENZ, p. 25, text-fig. 1.  
 1963: *Flexoptychites flexuosus* (MOJSISOVICS) 1882. — ASSERETO, p. 82, text-fig. 29, pl. IX, figs 1, 2.  
 1968: *Flexoptychites flexuosus* (MOJS.) — VENZO & PELOSIO, p. 127, pl. XVI, fig. 18, pl. XVII, fig. 9.  
 1988: *Flexoptychites flexuosus* (MOJSISOVICS, 1865) — PRIJ & MUDRENOVIĆ, p. 19, pl. V, fig. 2.  
 ? 1992: *Flexoptychites flexuosus* (MOJSISOVICS, 1882) — SAKAČ, p. 32, pl. V, fig. 4.  
 v 1998: *Flexoptychites flexuosus* (MOJSISOVICS, 1882) — VÖRÖS, p. 59.  
 1998: *Flexoptychites flexuosus* (MOJSISOVICS, 1865) — PETEK, p. 132 and 139, pl. 4, figs 1–5.

**Material** — 34 specimens of various state of preservation; some of them are almost entire and well-preserved.

**Measurements:**

D	WH	WW	U
104.4	54.6	33.9	>13
98	50.4	31.3	12
95.4	52	32.2	13.3
85.8	49	27.7	11.3
76.3	44.8	26.8	11.5
75.5	42.5	23	9
73.2	38.5	?	10.2
73	36.9	22.8	11
63.3	33.4	24.1	8.7
62.5	33.7	21	10.5
41.7	26.2	15.3	7

**Description** — Medium- to large-sized *Flexoptychites* with moderately compressed, involute conch. The whorl-section is rather high oval with maximum width near the inner third of the whorl. The umbilicus is rather narrow and deep. The umbilical wall is nearly vertical; the umbilical margin is rounded but rather well-marked. The flanks are slightly convex and pass gradually to the moderately

and evenly arched venter. The ornamentation consists of rectiradiate, sinuous folds separated by depressions of similar width. The folds gradually appear near the umbilical margin and strengthen towards the venter where they fade out rather abruptly. The number of folds increases by occasional insertion and may reach 14 on a half-whorl. Suture lines are not seen.

**Remarks** — *F. flexuosus* is the type species of *Flexoptychites*. It differs from other species of the genera by its generally stronger lateral folds and less compressed conch with widely arched venter. The ample illustration given by MOJSISOVICS (1882, l. c.) and VENZO & PELOSIO (1968, l. c.) provides an adequate picture on the morphology of *F. flexuosus* and serves as a reliable basis for the identification of the Szár-hegy specimens.

The poor figure given by SAKAČ (1992, l. c.) does not show the ornamentation, therefore this item is cited with question mark in the synonymy.

**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Balaton Highland, the Dinarides, the Hellenides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

*Flexoptychites acutus* (MOJSISOVICS, 1882)

(Plate IV: 1, 2)

- \* 1882: *Ptychites acutus* E. v. MOJSISOVICS — MOJSISOVICS, p. 263, pl. LXIV, fig. 4, pl. LXV, fig. 1, pl. LXVI, figs 4–6.  
 ? 1904: *Ptychites acutus* MOJSISOVICS, 1882 — MARTELLI, p. 128, pl. XI, figs 5, 6.

- 1910: *Ptychites acutus* MOJSISOVICS — RENZ, p. 26, pl. I, fig. 8.  
 1963: *Flexoptychites acutus* (MOJSISOVICS, 1882) — ASSERETO, p. 80, pl. IX, fig. 3.  
 1988: *Flexoptychites acutus* (MOJSISOVICS, 1882) — PRIJ & MUDRENOVIĆ, p. 20, pl. V, fig. 1.  
 1996: *Flexoptychites acutus* (MOJSISOVICS, 1882) — FANTINI SESTINI, p. 223, pl. 1, fig. 1.  
 v 1998: *Flexoptychites* cf. *acutus* (MOJSISOVICS, 1882) — VÖRÖS, p. 59.  
 1998: *Flexoptychites acutus* (MOJSISOVICS, 1882) — PETEK, p. 133 and 140, pl. 5, fig. 1.

**Material** — 40 specimens of various state of preservation; some of them are almost entire and well-preserved.

**Measurements:**

D	WH	WW	U
108.3	57.7	29.5	12
93.1	49.9	22	9.1
85.9	45.8	22.4	11.2
79	42	20	7.5
67.5	37.8	17.2	9
67.4	37.7	19.3	9.5
56.5	30.3	17.8	7.7

**Description** — Medium- to large-sized *Flexoptychites* with strongly compressed, involute conch. The whorl-section is high and acute, tending to be lanceolate in some cases, with maximum width near the umbilicus. The umbilicus is narrow and deep. The umbilical wall is nearly vertical or overhanging; the umbilical margin is well-marked. In a mature specimen (Plate IV: 1) the umbilicus widens adorally, due to the contraction of the body chamber. The flanks are slightly convex; on the last whorl, and especially on the body chamber, the venter is acute. The ornamentation is very weak; it consists of a

few, irregularly developed sinuous folds and growth lines. Suture lines are barely seen, ammonitic.

**Remarks** — *F. acutus* differs from all other species of *Flexoptychites* by its markedly and consistently acute venter and the weak ornamentation. The only species which partly shares these features is *Lanceoptychites indistinctus* (MOJSISOVICS, 1882) but there the venter is lanceolate only on the phragmocone and becomes evenly arched on the body chamber.

The nice specimens of MARTELLI (1904, l. c.) are shown only in lateral view; in the absence of ventral views their attribution to *Flexoptychites acutus* can not be confirmed. The development of the ventral keel on the specimen figured by ASSERETO (1963, l. c.) is markedly similar to that of the largest *F. acutus* from Szár-hegy (Plate IV: 1); following the definition by BALINI (1998) both specimens might be ascribed to *Lanceoptychites*, but presently I hesitate to do so.

**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Balaton Highland, the Dinarides, the Hellenides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

*Flexoptychites* cf. *angustoumbilicatus* (BÖCKH, 1872)  
(Plate III: 1)

- \* 1872: *Arcestes angusto-umbilicatus* n. sp. — BÖCKH, p. 149, pl. VIII, figs 7, 8, pl. IX, fig. 9.  
 1873: *Arcestes angusto-umbilicatus* n. sp. — BÖCKH, p. 160, pl. VIII, figs 7, 8, pl. IX, fig. 9.  
 1875: *Arcestes angusto-umbilicatus* BÖCKH — STÜRZENBAUM, p. 258, pl. V, fig. 3.  
 1882: *Ptychites angusto-umbilicatus* (BÖCKH) E. v. M — MOJSISOVICS, p. 257, pl. LXV, figs 5, 6, pl. LXVI, fig. 1.  
 ? 1904: *Ptychites anguste-umbilicatus* BOECKH sp., 1873 — MARTELLI, p. 123, pl. XII, fig. 4.  
 ? 1913: *Ptychites flexuosus* MOJS. — TOULA, p. 663, text-fig. 23, pl. XXIV, fig. 9.  
 1968: *Flexoptychites angusto-umbilicatus* (BÖCKH) — VENZO & PELOSIO, p. 130, pl. XVII, figs 8, 10, 11, 13.  
 1997: *Flexoptychites angustoumbilicatus* (BÖCKH) — URLICH & KURZWEIL, p. 4, fig. 2.  
 v 1998: *Flexoptychites angustoumbilicatus* (BÖCKH, 1872) — VÖRÖS, p. 59.

**Material** — A single, partly fragmentary, moderately preserved specimen.

**Measurements:**

D	WH	WW	U
?	38.7	~18	8.4

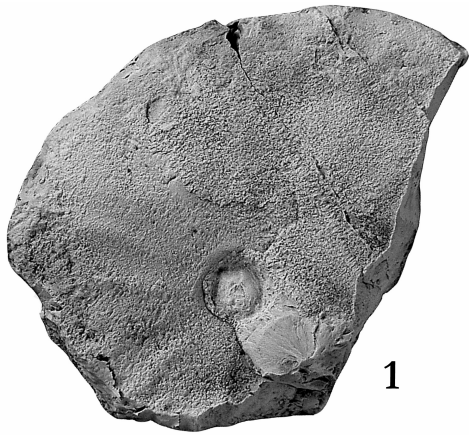
**Description** — Medium-sized *Flexoptychites* with compressed, involute conch. The whorl-section is high, acutely oval, with maximum width close to the umbilicus. The umbilicus is very narrow. The umbilical margin is somewhat rounded but well-defined. The flanks are slightly convex

**Explanation to Plate III**

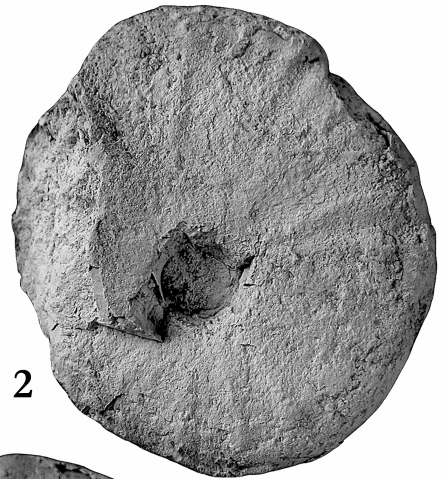
*All specimens are in natural size and are deposited in the Department of Palaeontology and Geology, Hungarian Natural History Museum.*

- 1 *Flexoptychites* cf. *angustoumbilicatus* (BÖCKH, 1873) — M.89.231., Szár-hegy, Bed -23, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 2 *Flexoptychites* cf. *stuederi* (HAUER, 1857) — M.89.213., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 3 *Lanceoptychites indistinctus* (MOJSISOVICS, 1882) — M.89.211., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; a: lateral view, b: ventral view.
- 4 *Flexoptychites flexuosus* (MOJSISOVICS, 1882) — M.89.228.1., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.
- 5 *Flexoptychites flexuosus* (MOJSISOVICS, 1882) — M.89.228.2., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; a: lateral view, b: ventral view.

Plate III



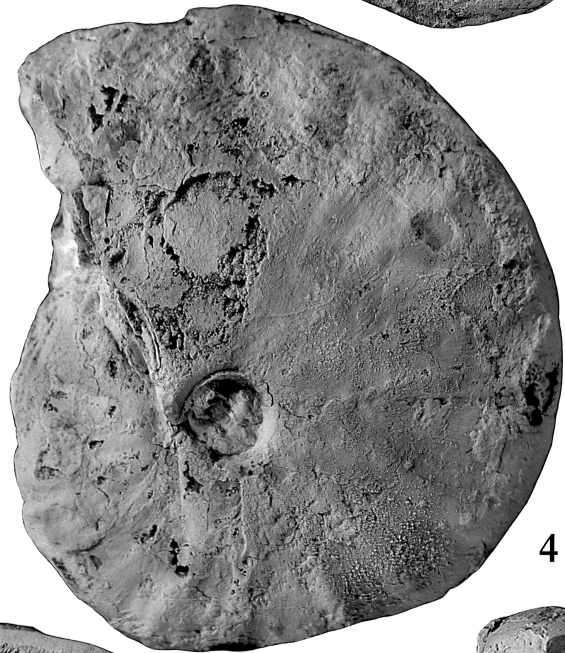
1



2



3a



4



3b



5a



5b

and pass gradually to the moderately acute venter. The ornamentation consists of rectiradiate, widely and irregularly spaced sinuous folds. The primary folds begin close to the umbilical margin and fade out near the venter. Their number is seven on a half-whorl. On the ventral half of the flanks, the primary folds are intercalated by crescentic secondary folds. Suture lines are not seen.

**Remarks** — *F. angustoumbilicatus* is somewhat similar to *F. flexuosus* (MOJSISOVICS, 1882) in the character of the sinuous primary folds, but differs by the appearance of the secondary folds and by the significantly narrower umbilicus and highly arched venter. The rather strong and characteristic ornamentation distinguishes *F. angustoumbilicatus* also from most other species of *Flexoptychites*.

**Genus *Lanceoptychites* BALINI, 1998**  
*Lanceoptychites indistinctus* (MOJSISOVICS, 1882)  
(Plate III: 3)

- \* 1882: *Ptychites indistinctus* E. v. MOJSISOVICS. — MOJSISOVICS, p. 263, pl. LXVII, figs 1, 2.  
? 1904: *Ptychites* confr. *indistinctus* MOJSISOVICS 1882. — MARTELLI, p. 130, pl. XII, fig. 3.  
1998: *Lanceoptychites indistinctus* (MOJSISOVICS, 1882) — BALINI, p. 156, text-figs 10, 11, pl. 3, fig. 1.

**Material** — A single, rather well-preserved specimen.

**Measurements:**

D	WH	WW	U
86.8	43.7	22.6	7.8

**Description** — Medium-sized *Lanceoptychites* with moderately compressed, involute conch. The whorl-section is rather acute to high oval, with maximum width near the umbilicus. The umbilicus is very narrow; the umbilical margin is rather well-defined. The flanks are slightly convex and pass gradually to the moderately acute venter. The venter turns into evenly arched on the body chamber. The ornamentation is rather weak; it consists of rare and irregularly spaced, slightly sinuous radial folds. The peristome seems to be almost entire; the body chamber is a little contracted and shows the trace of a healed

The record by MARTELLI (1904, l. c.) is queried because the figures show the narrow umbilicus but the distinctive ornamentation is not seen. On the other hand, the specimens figured by VENZO & PELOSIO (1968, l. c.) and URLICHS & KURZWEIL (1997, l. c.) excellently demonstrate the characteristic ornamentation of *F. angustoumbilicatus*. The specimen figured by TOULA (1913, l. c.) as *F. flexuosus* seems to stand closer to *F. angustoumbilicatus*.

**Distribution** — Late Anisian of the Southern Alps, the Balaton Highland, the Germanic Basin, the Rudabánya Mts, and probably the Dinarides. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

injury. Suture lines are not seen.

**Remarks** — *L. indistinctus* is rather similar to *F. acutus* (MOJSISOVICS, 1882) in its weak and somewhat irregular ornamentation and in its partially acute venter. However, in *L. indistinctus* the moderately acute venter of the phragmone changes into evenly arched on the body chamber, while in *F. acutus* this relationship is inverse: the venter becomes strongly acute on the body chamber.

When introduced the genus *Lanceoptychites*, BALINI (1998, l. c.) refigured the original specimen of MOJSISOVICS (1882); at the same time he did not ascribe to *F. indistinctus* the specimen by MARTELLI (l. c.)

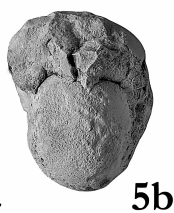
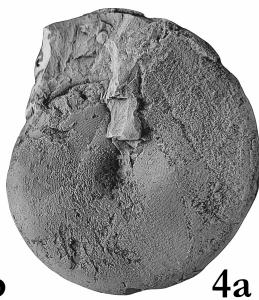
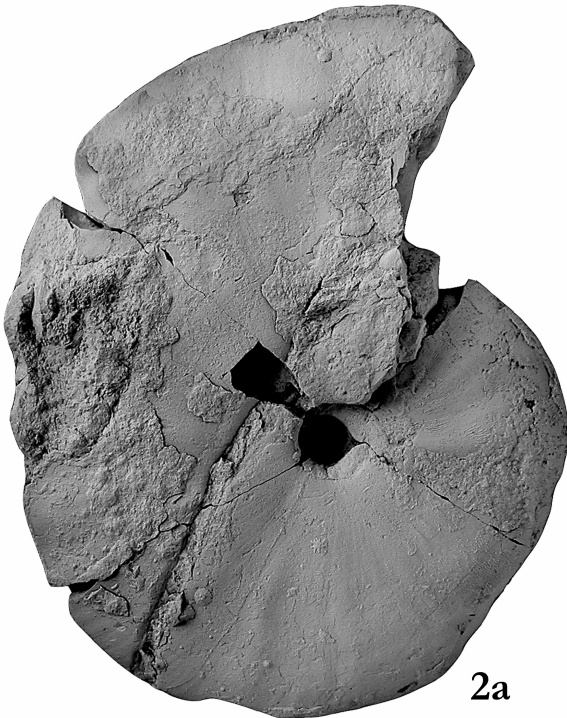
**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Balaton Highland, the Dinarides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

#### Explanation to Plate IV

*All specimens are in natural size and are deposited in the Department of Palaeontology and Geology, Hungarian Natural History Museum.*

- 1 *Flexoptychites acutus* (MOJSISOVICS, 1882) — M.89.216., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; a: lateral view, b: ventral view.
- 2 *Flexoptychites acutus* (MOJSISOVICS, 1882) — M.89.210., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; a: lateral view, b: ventral view.
- 3 *Discoptychites megalodiscus* (BEYRICH, 1867) — M.89.208., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; cross section.
- 4 *Procladiscites griesbachi* MOJSISOVICS, 1882 — M.89.205., Szár-hegy, Bed 2, Anisian, Trinodosus Zone, Camunum Subzone; a: lateral view, b: ventral view.
- 5 *Proarcestes* ? sp. indet. — M.89.236., Szár-hegy, Bed -23, Anisian, Trinodosus Zone, Camunum Subzone; a: lateral view, b: ventral view.
- 6 *Monophyllites wengensis* (KLIPSTEIN, 1843) — M.89.254., Szár-hegy, Bed -22, Anisian, Trinodosus Zone, Camunum Subzone; lateral view.

Plate IV



Superfamily Arcestoidea MOJSISOVICS, 1875  
Family Cladiscitidae ZITTEL, 1884

Genus *Procladiscites* MOJSISOVICS, 1882  
*Procladiscites griesbachi* MOJSISOVICS, 1882  
(Plate IV: 4)

- \* 1882: *Procladiscites Griesbachi* E. v. Mojsisovics. — MOJSISOVICS, p. 172, pl. XLVIII, figs 3, 4.  
1904: *Procladiscites Griesbachi* Mojsisovics 1882. — MARTELLI, p. 95, pl. VI, fig. 6.  
1910: *Procladiscites Griesbachi* Mojsisovics. — RENZ, p. 38, pl. II, fig. 3.

**Material** — Eleven specimens of various state of preservation.

**Measurements:**

D	WH	WW	U
43.1	25.5	16	-
37	20	14.3	-
29.2	17	11.9	-

**Description** — Small-sized *Procladiscites* with robust, very involute conch. The whorl-section is moderately compressed, subquadratic, with maximum width at around the inner third of the whorl. The umbilicus is occluded, funnel-shaped; the umbilical margin is indistinct. The flanks are flattened and form clear ventrolateral shoulders with the

almost tabulate venter. The strigate ornamentation consists of fine longitudinal (spiral) cords and is uniformly developed over the flanks and the umbilical margin. The venter is smooth. Suture lines are not visible.

**Remarks** — The Anisian species of *Procladiscites* bear rather similar strigate ornament; they differ principally in the width/height proportions of their whorls. *P. griesbachi* stands between the significantly more compressed *P. brancoi* (MOJSISOVICS, 1882) and the much more robust (wider) *P. connectens* (HAUER, 1892), which shows almost quadratic whorl section.

**Distribution** — Late Anisian of the Southern Alps, the Dinarides, the Hellenides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

Family Arcestidae MOJSISOVICS, 1875

Genus *Proarcestes* MOJSISOVICS, 1893  
*Proarcestes* ? sp. indet.  
(Plate IV: 5)

**Material** — A single, poorly preserved specimen.

**Measurements:**

D	WH	WW	U
21.5	13	16.8	?

**Description** — Small-sized *Proarcestes* with globose, involute conch. The whorl-section is strongly depressed, with maximum width near the umbilicus. The umbilicus is very narrow but the other details are concealed by matrix. The flanks are very convex and form a continuous arch with the convex venter. No ornamentation, but one weak and another, marked constriction can be observed. Suture lines are not visible.

**Remarks** — The smooth, globose, very involute conch, with constrictions seem to support the tentative attribution of this poorly preserved specimen to *Proarcestes*. The presence of this genus in the Szár-hegy fauna has palaeoecological and palaeobiogeographical significance; this is the reason why it is documented in this paper, in spite of that the specimen was not identified on species level.

**Distribution** — The genus *Proarcestes* is widespread in the Late Anisian (Trinodosus Zone) of the Dinaric and Hellenic region, whereas it appears only in the latest Anisian (Reitzi Zone) in the Balaton Highland.

Order Phylloceratida ARKELL, 1950  
Superfamily Phylloceratoidea ZITTEL, 1884  
Family Ussuritidae HYATT, 1900

Genus *Monophyllites* MOJSISOVICS, 1879  
*Monophyllites wengensis* (KLIPSTEIN, 1843)  
(Plate IV: 6)

- \* 1843: *Ammonites Wengensis* — KLIPSTEIN, p. 120, pl. VI, fig. 11.  
1851: *Ammonites sphaerophyllus* n. sp. — HAUER, p. 113, pl. I, fig. 11.  
1869: *Phylloceras sphaerophyllum* HAU. sp. — MOJSISOVICS, p. 586, pl. XVI, fig. 2.  
1872: *Phylloceras Böckbi* MOJS. — BÖCKH, p. 158, pl. X, figs 18, 19.  
1873: *Phylloceras Böckbi* MOJS. — BÖCKH, p. 171, pl. X, figs 18, 19.  
1882: *Monophyllites sphaerophyllus* (FR. V. HAUER) E. v. M. — MOJSISOVICS, p. 206, pl. LXXIX, figs 1–3.  
1882: *Monophyllites wengensis* (V. KLIPSTEIN) E. v. M. — MOJSISOVICS, p. 207, pl. LXXVIII, figs. 10–12.  
1904: *Monophyllites sphaerophyllus* HAUER sp. 1850. — MARTELLI, p. 99, pl. VIII, fig. 3, pl. IX, fig. 6.  
1904: *Monophyllites wengensis* KLIPSTEIN sp. 1845. — MARTELLI, p. 101, pl. VIII, fig. 4.

- 1906: *Monophyllites wengensis* KLIPST. Sp. 1845. — MARTELLI, p. 135, pl. VIII, fig. 1.  
 1910: *Monophyllites Wengensis* KLIPSTEIN var. *sphaerophylla* HAUER emend. RENZ — RENZ, p. 22, pl. I, fig. 4.  
 1910: *Monophyllites Wengensis* KLIPSTEIN — RENZ, p. 46, pl. III, figs 1, 2.  
 1913: *Monophyllites Wengensis* KLIPST. var. *sphaerophylla* HAUER emend. RENZ — RENZ, p. 561, text-fig. 7.  
 1938: *Monophyllites sphaerophyllus* HAUER — SIMIĆ, p. 217, pl. XVIII, fig. 3.  
 1963: *Monophyllites sphaerophyllus* (HAUER) 1851 — ASSERETO, p. 87, text-figs 32, 33, pl. X, fig. 3, pl. XI, fig. 3.  
 1966: *Monophyllites wengensis* (KLIPSTEIN) — PISA, p. 665, pl. LXXV, figs 1–7.  
 1988: *Monophyllites sphaerophyllus* (HAUER), 1851 — PRLJ & MUDRENOVIĆ, p. 22, pl. I, fig. 2.  
 1994: *Monophyllites wengensis* (KLIPSTEIN, 1850) — FANTINI SESTINI, p. 267, pl. 2, fig. 4, pl. 9, fig. 3.  
 v 1998: *Monophyllites wengensis* (KLIPSTEIN, 1845) — VÖRÖS, p. 60, pl. XII, fig. 5, pl. XIV, fig. 3.

**Material** — Thirty specimens of various state of preservation; mostly fragments.

**Measurements:**

D	WH	WW	U
78	31.7	23.5	28.3
53.4	21.7	17	18.9
42.4	18.4	14.6	15.7

**Description** — Medium-sized *Monophyllites* with rather evolute conch. The whorl-section is oval, subtrapezoidal with maximum width near the umbilical margin. The umbilicus is wide, tends to widen adorally, due to the contraction of the body chamber. The umbilical wall is nearly vertical; the umbilical margin is rounded but distinct. The flanks are gently convex and pass gradually to the widely arched venter. The ornamentation consists of very fine, densely spaced, projected lirae. Suture lines are not seen.

**Remarks** — The shell morphology and the ornamentation of the Middle Triassic nominal species of *Mono-*

*phyllites* are rather uniform. This led PISA (1966, l. c.) to synonymize the very frequently cited *M. sphaerophyllus* (HAUER, 1851) with the senior *M. wengensis* (KLIPSTEIN, 1843), which was illustrated in the original description by a very poorly preserved specimen. PISA's action was fairly supported from morphological point of view and is accepted here. It should be mentioned that *M. sphaerophyllus* was designated as the type species of *Monophyllites* what poses a serious nomenclatorial problem, but the resolution is beyond the limits of the present paper.

Many authors, including myself, misled by a printer's error in MOJSISOVICS (1882, p. 207), cited *M. wengensis* with the erroneous date of 1845; in fact KLIPSTEIN's monograph was published in 1843.

**Distribution** — Late Anisian of the Southern Alps, the Northern Calcareous Alps, the Balaton Highland, the Dinarides, the Hellenides and the Rudabánya Mts. The Szár-hegy specimens came from the Camunum + Pseudohungaricum Subzones.

\* \* \*

**Acknowledgements** — I express my sincere thanks to the late Sándor KOVÁCS who suggested me to work on this subject and guided me in the field. Thanks are due to Eszter Piroska HANKÓ for taking the ammonoid photographs and to Péter OZSVÁRT for providing literature sources. The field work and the first phase of the study were financially supported by the Hungarian Geological Institute. The useful reviewer's comments and corrections of T. BUDAI and Gy. LESS are deeply acknowledged. The study was also supported by the grant K 81298 of the Hungarian Scientific Research Fund (OTKA).

## References

- ARTHABER, G. (1916): Die Fossilführung der anisischen Stufe in der Umgebung von Trient. — *Jahrbuch der kaiserlich-königlichen geologischen Reichsanstalt* (1915), **65**(3–4): 239–260.  
 ASSERETO, R. (1963): Il Trias in Lombardia (Studi geologici e paleontologici) IV. Fossili dell'Anisico superiore della Val Camonica (1). — *Rivista Italiana di Paleontologia*, **69**(1): 3–123.  
 BALINI, M. (1992a): New genera of Anisian ammonoids from the Prezzo Limestone (Southern Alps). — *Atti Ticinensi di Scienze della Terra*, **35**: 179–198.  
 BALINI, M. (1992b): Lardaroceras gen. n., a new Late Anisian ammonoid genus from the Prezzo Limestone (Southern Alps). — *Rivista Italiana di Paleontologia e Stratigrafia*, **98**(1): 3–28.  
 BALINI, M. (1994): Middle Triassic ceratitids (Ammonoidea) collected by C. Renz from Hydra (Greece). — *Rivista Italiana di Paleontologia e Stratigrafia*, **100**(3): 351–364.  
 BALINI, M. (1998): Taxonomy, stratigraphy and phylogeny of the new genus *Lanceoptychites* (Ammonoidea, Anisian). — *Italiana di Paleontologia e Stratigrafia*, **104**(2): 143–166.  
 BEYRICH, E. (1867): Über einige Cephalopoden aus dem Muschelkalk der Alpen und über verwandte Arten. — *Abhandlungen der Königlich-Akademie der Wissenschaften zu Berlin* (1866), **2**: 105–149.  
 BÖCKH, J. (1872): A Bakony déli részének földtani viszonyai. I. [The geological features of the southern part of the Bakony. I.] — *A Magyar Királyi Földtani Intézet Évkönyve*, **2**(2): 31–166. (In Hungarian).  
 BÖCKH, J. (1873): Die geologischen Verhältnisse des südlichen Theiles des Bakony, I. — *Mittheilungen aus dem Jahrbuche der königlichen ungarischen geologischen Anstalt*, **2**(2): 27–182.  
 BRACK, P. & RIEBER, H. (1993): Towards a better definition of the Anisian/Ladinian boundary: New biostratigraphic data and correlations of boundary sections from the Southern Alps. — *Eclogae Geologicae Helveticae*, **86**: 415–527.  
 BUDAI, T. & VÖRÖS, A. (2006): Middle Triassic platform and basin evolution of the southern Bakony Mountains (Transdanubian Range, Hungary). — *Rivista Italiana di Paleontologia e Stratigrafia*, **112**(3): 359–371.  
 CSONTOS, L. & VÖRÖS, A. (2004): Mesozoic plate tectonic reconstruction of the Carpathian region. — *Palaeogeography, Palaeoclimatology, Palaeoecology*, **210**: 1–56.  
 FANTINI SESTINI, N. (1994): The Ladinian ammonoids from Calcare di Esino of Val Parina (Bergamasc Alps, Northern Italy). Pt. 1. — *Rivista Italiana di Paleontologia e Stratigrafia*, **100**: 227–284.  
 FANTINI SESTINI, N. (1996): The Ladinian ammonoids from Calcare di Esino of Val Parina (Bergamasc Alps, Northern Italy). Pt. 2. — *Rivista Italiana di Paleontologia e Stratigrafia*, **102**: 211–226.  
 HAAS, J. (Ed.) (2001): *Geology of Hungary*. — Eötvös University Press, Budapest, 317 pp.  
 HAAS, J. (Ed.) (2004): *Magyarország geológiája, Triász (Geology of Hungary, Triassic)*. — Eötvös University Press, Budapest, 384 pp. (In Hungarian).  
 HAAS, J. & BUDAI, T. (1999): Triassic sequence stratigraphy of the Transdanubian Range, Hungary. — *Geologica Carpathica*, **50**(6): 459–475.  
 HAUER, F. (1851): Ueber die vom Herrn Bergrath W. Fuchs in den

- Venetianer Alpen gesammelten Fossilien. — *Denkschriften der mathematisch-naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften* (1850), **2**(1): 109–126.
- HAUER, F. (1857): Paläontologischen Notizen. Cephalopoden aus der unteren Trias von Val Inferna bei Zoldo im Venetianischen. — *Sitzungsberichte der mathematisch-naturwissenschaftlichen Classe der kaiserlichen Akademie der Wissenschaften*, **24**: 1–16.
- HAUER, F. (1887): Die Cephalopoden des bosnischen Muschelkalkes von Han Bulog bei Sarajevo. — *Denkschriften der mathematisch-naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften*, **54**: 1–50.
- HAUER, F. (1892): Beiträge zur Kenntniss der Cephalopoden aus der Trias von Bosnien. I. Neue Funde aus dem Muschelkalk von Han Bulog bei Sarajevo. — *Denkschriften der mathematisch-naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften*, **59**: 251–296.
- HAUER, F. (1896): Beiträge zur Kenntniss der Cephalopoden aus der Trias von Bosnien. II. Nautileen und Ammoniten mit ceratitischen Loben aus dem Muschelkalk von Haliluci bei Sarajevo. — *Denkschriften der mathematisch-naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften*, **62**: 237–276.
- JACOBSSHAGEN, V. (1967): Cephalopoden-Stratigraphie der Hallstätter Kalke am Asklepion von Epidaurus (Argolis, Griechenland). — *Geologica et Palaeontologica*, **1**: 13–33.
- KLIPSTEIN, A. (1843): *Beiträge zur geologischen Kenntniss der östlichen Alpen*. — Heyer's Verlag, Giessen, 311 pp.
- KOVÁCS, S. (1989a): Aggtelek, Rudabányai-hegység, Martonyi, Szár-hegy keleti csúcsa, Szárhegyi Radiolarit Formáció. — In: *Magyarország geológiai alapszelvényei (Geological key-sections of Hungary)*. — MÁFI, Budapest, 5 pp.
- KOVÁCS, S. (1989b): Geology of North Hungary: Paleozoic and Mesozoic terranes, 15–36. — In: KECSKEMÉTI, T. (Ed.): *21<sup>st</sup> European Micro-palaeontological Colloquium, Guidebook*. — pp. 352, Hungarian Geological Society, Budapest.
- LEITHNER, W. & KRYSZYN, L. (1984): Paläogeographie, Stratigraphie und Conodonten-Biofazies des Westlichen Mitterberges (Trias, Niederösterreich). — *Mitteilungen der Gesellschaft der Geologie- und Bergbaustudenten in Österreich*, **30–31**: 177–206.
- MARTELLI, A. (1904): Cefalopodi triasici di Boljevicci presso Vir nel Montenegro. — *Palaeontographia Italica*, **10**: 75–140.
- MARTELLI, A. (1906): Contributo al Muschelkalk superiore del Montenegro. — *Palaeontographia Italica*, **12**: 97–154.
- MOJSISOVICS, E. (1869): Beiträge zur Kenntniss der Cephalopoden-Fauna des alpinen Muschelkalkes. — *Jahrbuch der kaiserlich-königlichen geologischen Reichsanstalt*, **19**(4): 567–594.
- MOJSISOVICS, E. (1882): Die Cephalopoden der mediterranen Triasprovinz. — *Abhandlungen der kaiserlich-königlichen geologischen Reichsanstalt*, **10**: 1–322.
- MONNET, C. & BUCHER, H. (2005): New Middle and Late Anisian (Middle Triassic) ammonoid faunas from northwestern Nevada (USA): taxonomy and biochronology. — *Fossils and Strata*, **52**: 1–121.
- PETEK, T. (1998): Scythian and Anisian beds in the quarry near Hrastenice and important finds of Upper Anisian fossils. — *Geologija* (1997), **40**: 119–151.
- PISA, G. (1966): Ammoniti ladiniche dell'alta valle di Tagliamento (Alpi Carniche). — *Giornale di Geologia, Annali del Museo Geologico di Bologna* (1965), [2], **33**(2): 617–683.
- PRIJ, N. & MUDRENOVIĆ, V. (1988): Srednotrijaski amoniti iz područja Pribudića. — *Geološki Vjesnik (Zagreb)*, **41**: 15–24.
- RENZ, C. (1910): Die mesozoischen Faunen Griechenlands. I. Die triadischen Faunen der Argolis. — *Palaeontographica*, **58**: 1–103.
- RENZ, C. (1913): Neuere Fortschritte in der Geologie und Paläontologie Griechenlands. — *Zeitschrift der Deutschen Geologischen Gesellschaft* (1912), **64**: 530–630.
- SAKAČ, K. (1992): Discoptychites oenensis n. sp. and the accompanying ammonite fauna from Anisian deposits in Brotinja, Lika, Central Croatia. — *Natura Croatica*, **1**: 27–40.
- SIMIĆ, V. (1938): Paleontološke beleške iz okoline Berana (Paläontologische Notizen aus der Umgebung von Berane). — *Bulletin de l'Institut géologique du Royaume de Yougoslavie*, **6**: 215–220.
- STÜRZENBAUM, J. (1875): Adatok a Bakony Ceratites Reitzzi-szint faunájának ismeretéhez [Data to the knowledge of the fauna of the Ceratites Reitzzi-horizon of the Bakony]. — *Földtani Közlemény*, **5**(11–12): 253–262. (In Hungarian).
- SZENTPÉTERY, I. & LESS, Gy. (Eds.) (2006): *Az Aggtelek–Rudabányai-hegység földtana [The geology of the Aggtelek–Rudabánya Mountains]*. — Magyar Állami Földtani Intézet, Budapest, pp. 92 (In Hungarian).
- TOULA, F. (1913): Geologisch-paläontologische Beobachtungen aus der Gegend von Drvar, Peći und Duler in Westbosnien. — *Jahrbuch der kaiserlich-königlichen geologischen Reichsanstalt*, **63**: 621–694.
- TOZER, E. T. (1981): Triassic Ammonoidea: classification, evolution and relationship with Permian and Jurassic forms. — In: HOUSE, M. R. & SENIOR, J. R. (Eds.): *The Ammonoidea*. — Systematics Association Special Volume, **18**: 65–100, Academic Press, London, New York.
- URLICH, M. & KURZWEIL, W. (1997): Erstnachweis von Flexoptychites (Ammonoidea) aus dem Oberen Muschelkalk (Mitteltrias) Nordwürttembergs. — *Stuttgarter Beiträge zur Naturkunde*, [B], **253**: 1–8.
- VENZO, S. & PELOSIO, G. (1968): Nuova fauna a ammonoidi dell'Anisico superiore di Lenna in Val Brembana (Bergamo). — *Memorie della Società Italiana di Scienze Naturali*, **17**(2): 73–141.
- VÖRÖS, A. (1992): Középső-triász (felső-anizuszi) ammonoidea paleobiogeográfia az alp-kárpáti régióban (Middle Triassic [Late Anisian] ammonoid palaeobiogeography in the Alpine-Carpathian region). — *Öslénytani Viták (Discussiones Palaeontologicae)*, **38**: 71–77.
- VÖRÖS, A. (1993): Redefinition of the Reitzzi Zone at its type region (Balaton area, Hungary) as the basal zone of the Ladinian. — *Acta Geologica Hungarica*, **36**(1): 15–38.
- VÖRÖS, A. (1996): Environmental distribution and bathymetric significance of Middle Triassic ammonoid faunas of the Balaton Highland (Hungary). — *Fragmenta Mineralogica et Palaeontologica*, **18**: 5–17.
- VÖRÖS, A. (1998): A Balaton-felvidék triász ammonoideái és biostratigráfiaja (Triassic ammonoids and biostratigraphy of the Balaton Highland). — *Studia Naturalia*, **12**: 105 p. (In Hungarian with English summary).
- VÖRÖS, A. (2001): Paleobiogeographical analysis: a tool for the reconstruction of Mesozoic Tethyan and Penninic basins. — *Acta Geologica Hungarica*, **44**(2–3): 145–158.
- VÖRÖS, A. (2002): Paleoenvironmental distribution of some Middle Triassic ammonoid genera in the Balaton Highland (Hungary). — *Abhandlungen der geologischen Bundesanstalt*, **57**: 479–490.
- VÖRÖS, A. & PÁLFY, J. (1989): The Anisian/Ladinian boundary in the Vászoly section (Balaton Highland, Hungary). — *Fragmenta Mineralogica et Palaeontologica*, **14**: 17–27.
- WANG, Y. & WESTERMANN, G. E. G. (1993): Paleocology of Triassic ammonoids. — *Géobios*, **15**: 373–392.
- WENDT, J. (1973): Cephalopod accumulations in the Middle Triassic Hallstatt-Limestone of Yugoslavia and Greece. — *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*, **1973**(10): 634–640.

#### Author's address:

Dr. Attila VÖRÖS  
 Palaeontological and Geological Department,  
 Hungarian Natural History Museum;  
 Research Group for Palaeontology,  
 Hungarian Natural History Museum–Hungarian Academy of Sciences;  
 H–1431 Budapest, P.O.B. 137  
 e-mail: voros@nhmus.hu