Ammonite succession from three Upper Jurassic sections in the Bakony Mts. (Hungary)

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RIASSUNTO

Nelle Montagne Bakony sono state accuratamente campionate strato per strato tre sezioni naturali, dello spessore di circa 15 metri, nelle vicinanze dei villaggi di Hárskút e Zirc. Nelle serie esposte si sovrappongono alle radiolariti del cosiddetto "Giurassico medio" i calcari nodulari rossi del Kimmeridgiano-Titonico. Al tetto delle serie, rappresentato da carbonati sottilmente stratificati di colore bianco o rosa, è presente il Berriasiano. Sulla base del materiale raccolto (circa 6000 ammoniti provengono dalle tre sezioni) è stata proposta una zonazione dettagliata. Al di sopra delle radiolariti sono documentate su basi biostratigrafiche solo le ultime zone del Kimmeridgiano; è stata invece riconosciuta una successione titonica quasi completa delle zone a Hybonotum, Darwini, Semiforme, Fallauxi, Ponti e Microcanthum. Sono citate alcuna specie recentemente descritte dei generi Haploceras Pseudolissoceras e Simolytoceras.

La composizione della totalità della fauna e la presenza di alcuni generi e specie di Ammonitina indicano una stretta relazine con le faune del Giurassico superiore delle Alpi meridionali, degli Appennini e della Zona Subbetica (Spagna meridionale).

ABSTRACT

In the Bakony Mts. near the villages of Hárskút and Zirc, three natural exposures of about 15 m thickness were carefully sampled bed-by-bed. In the sequences the so called "Middle Jurassic" radiolarites are overlain by Kimmeridgian and Tithonian red nodular limestones. The top part of the successions (white pink thinly-bedded carbonates) is of Berriasian age.

On the basis of the collected fossil material (about 6,000 ammonites from the three sections) a precise zonation was carried out. Above the radiolarites, only the higher zones of the Kimmeridgian were biostratigraphically documented; they are followed by a nearly complete Tithonian succession of the Hybonotum, Darwini, Semiforme, Fallauxi, Ponti and Microcanthum Zones.

Some recently described new species of the genera Haploceras, Pseudolissoceras and Simolytoceras *are mentioned.*

The composition of the fauna as a whole, and the occurrences of some genera and species of Ammonitina, indicate a close relationship with the Upper Jurassic faunas of the Southern Alps, Appennines and the Subbetic Zone.

KEY WORDS

Ammonites, Upper Jurassic, Berriasian, Palaeontology, Biostratigraphy, Bakony Mts. (Hungary).

INTRODUCTION

In Hungary, we owe the first results on Upper Jurassic biostratigraphy to Gusztáv Vígh. Unfortunately, due to his untimely death, he could not finish his work. Although his posthumous paper (Vígh 1984) contains many important data on the Upper Jurassic of the Transdanubian Central Range, the Kimmeridgian-Tithonian successions remained poorly documented. The present paper might hopefully serve to reduce the disproportion which now exists in our knowledge of the Lower, Middle and Upper Jurassic faunas.

EXAMINED PROFILES

The sequences where the examined material came from area situated in the Bakony Mts., in the neigbourhood of the villages of Zirc and Hárskút (Fig. 1).

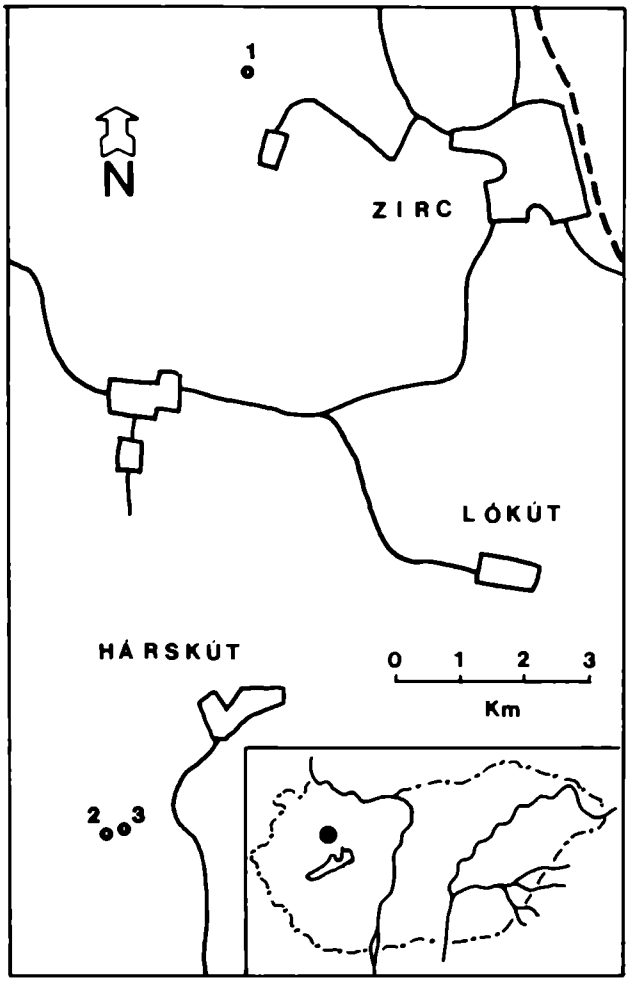

Fig. 1 Topographic sketch map indicating the location of the studied profiles. 1: Szilas-ravine profile, 2: Hárskut II. profile, 3: Harskut 12. profile.

In both places the Upper Jurassic rocks crop out in beau-

tiful exposures along a valley. Across the sections, trenches were excavated and a precise bed-by-bed collecting was carried out by the Geological Survey.

Facies succession

From a litostratigraphical point of view, the Szilas and Hárskút II profiles are very similar and can be regarded as typical examples of the Upper Jurassic sequences of the Bakony Mts.

The succession starts with a few metre thick cherty limestone or a nearly pure chert, which is traditionally called as "Middle Jurassic Radiolarite" in the Hungarian literature. The beds above are more or less fossiliferous red and nodular carbonates. This Ammonitico Rosso type limestone is about 10 metre thick. Upwards in the sequences the carbonates become light, less nodular, and more siliceous. The topmost part of the profiles is represented by thinly bedded, whitish Biancone-type carbonates.

Fossil material

About 3.550 and 2.970 ammonites were collected from the Szilas and Hárskút profiles respectively. As it is indicated in Fig. 2, about half of the fauna is composed by the Phylloceratina and Lytoceratina Suborders.

Among the phylloceratids, *Ptychophylloceras* is most common. In the Subfamily Lytoceratinae the characteristic genus *Protetragonites* is very frequent, but some large-sized species (usually placed in the genus *Pterolytoceras*) are also common.

Regarding the Ammonitina, the frequency of haplo ceratids is very conspicuous. In the Szilas-ravine and in the Hárskút II profile these forms make up the 24% and 19%, respectively, of the whole fauna. Among the large (macroconch) forms, *H. (H.) elimatum* is the most common; among the small-sized (microconch) forms *H. (Hy.) carachtheis* is the most frequent. (Haploceratids and simoceratìds of the same Upper Jurassic sections of the Transdanubian Central Range, are reported elsewhere (Fözy 1988 in press).

It is noteworthy that, besides the most common ammonites, the Upper Jurassic limestones yielded many other megafossil groups: from the Szilas-ravine e.g., along with 3.500 ammonites, ca. 270 specimens of brachiopods (mainly pygopids and some Nucleata), 27 specimens of echinoids, 25 belemnites, 22 bivalves (shallow and deep burrower types, as well as *Inoceramus*-like forms), and one gastropod were found.

Ammonite succession

The Upper Jurassic biostratigraphy of the Szilas-ravine and Hárskút II profiles was briefly reported by Fözy (1987). Recent investigations allowed to make a more precise, detailed zonation.

In the Szilas-ravine, the beds immediately above the radiolarite yielded a faunula characteristic for the Upper Kimmeridgian. The overlying beds form a nearly complete Tithonian series. The uppermost part of the sections ranges into the Lower Cretaceous.

In the Hárskút II profile, the Kimmeridgian, can be documented only with the topmost Beckeri Zone. Above it, all the Tithonian Zones can be followed. The biostratigraphic subdivision of the uppermost part of the profile was carried out by Horváth & Knauer (1986). On the basis of the micro- and macrofauna, they reported a "complete" succession from the Jacobi Subzone up to the Picteti Subzone (Berriasian). The Hárskút 12 profile, which is very close to the Hárskút II sequence, yielded an Upper Tithonian - Lower Cretaceous fauna. The bed-by-bed sampling was not continued below the Ponti Zone.

The biostratigraphic subdivision of the sequences, and their correlation is shown on Figs. 3 and 4.

Kimmerdigian

Nebrodites (Mesosimoceras) cavouri Zone: only in the Szilas-ravine profile, beds 120-117.
(The numbers in parenthesis indicate the number of the bed(s) in which the specimen were collected).

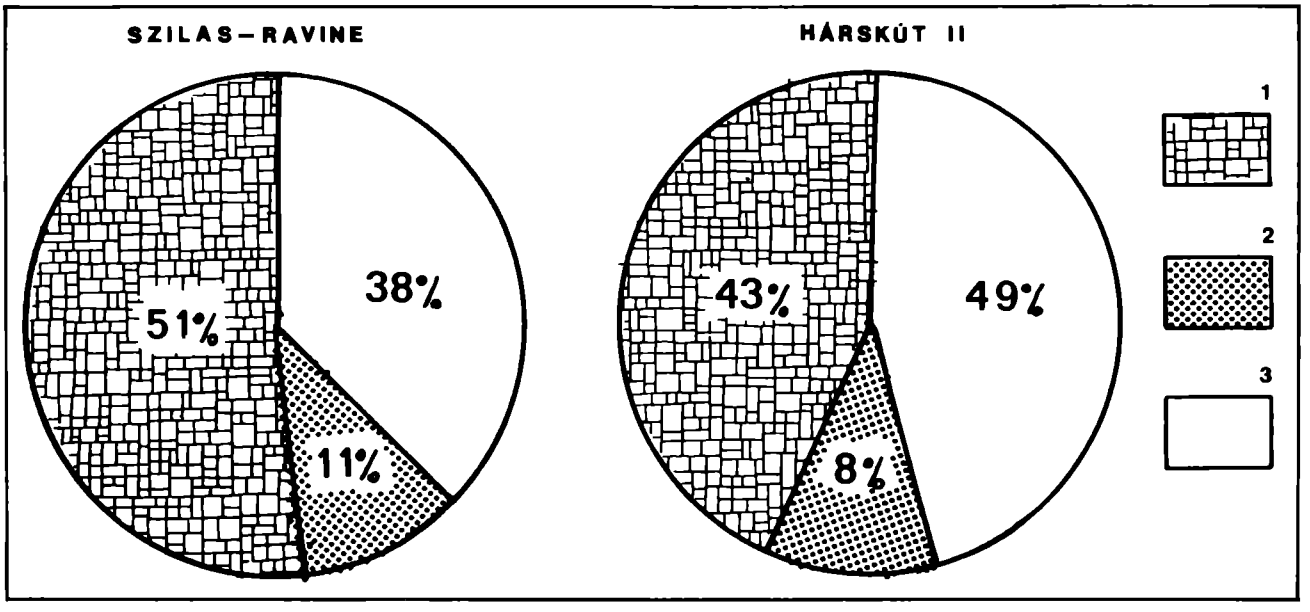

Fig. 2 - Proportions of Suborders in the Szilas-ravine and Hárskut II. profiles. 1: Phylloceratina, 2: Lytoceratina, 3: Ammonitina.

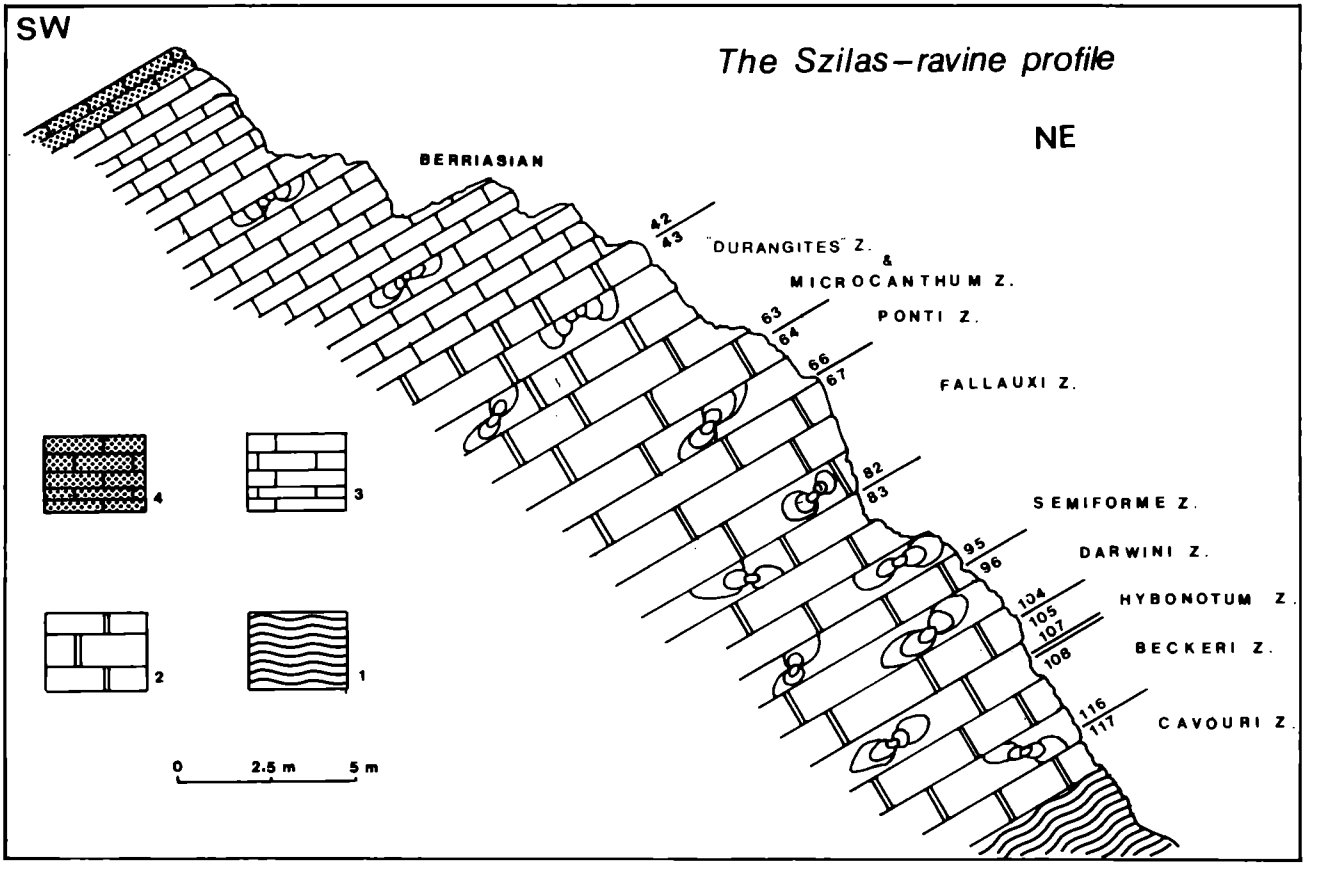

Fig. 3 - The Szilas-ravine profile. 1: Radiolarite, 2: Ammonitico Rosso type limestone, 3: Biancone type limestone, 4: Cretaceous / Aptian.

Characteristic faunal elements:	
Sowerbyceras sp.	(120, 118, 117)
Hemihaploceras nobile (Neum.)	(117)
Taramelliceras sp.	(120, 119)
Aspidoceratinae div. sp.	(120, 119, 117)
Nebrodites (Mesosimoceras) cf. *cavouri* (Gemm.)	(120)

Besides the listed elements, some poorly-preserved fragments of perisphinctids occurred. On the dissolved specimens, the bi-, or trifurcate ribs are slightly directed forward.

On the basis of the relative frequency of aspidoceratids and *Taramelliceras*, and on the basis of the appearance of *H. nobile* the Upper Kimmeridgian age of the beds is proved, and the presence of *N. (M.)* cf. *cavouri* indicates the zone.

The lower boundary of the zone is the lowermost sampled bed (no. 120), which is just above the radiolarite. Its upper boundary is drawn below the abrupt appearance of *Hybonoticeras*.

Hybonoticeras beckeri Zone: Szilas-ravine, beds 116-108, and Hárskút II profile, beds 70-68.

Characteristic faunal elements	Szilas	Hárskút II
Sowerbyceras sp.	(115)	(69)
Taramelliceras sp.	(116)	
Aspidoceras sp.	(109)	
Hybonoticeras cf. *pressulum* (Neum.)	(115)	(69)
Hybonoticeras cf. *beckeri* (Neum.)	(115)	
Hybonoticeras sp.	(116, 115)	

Both profiles also yielded some very poorly-preserved fragments of densely-ribbed perisphinctids.

The appearance of frequent specimens of *Hybonoticeras* marks very distinctively the lower boundary of this unit.

In both the Szilas and Hárskút sections, some beds devoid of diagnostic ammonites were tentatively ascribed to the Beckeri Zone as they occur below the first appearance of *H. hybonotum*.

Tithonian

Hybonoticeras hybonotum Zone: Szilas-ravine, beds 107-105, and Hárskút II profile, beds 67-65.

Characteristic faunal elements:	Szilas	Hárskút II
Pseudolissoceras olorizi Fözy (in press)	(106)	(66)
Pseudolissoceras sp.		(66)
Aspidoceras rogoznicense (Zeusch.)	(105)	(65)
Aspidoceras cf. *rafaeli* (Opp.)		(65)
Anaspidoceras neoburgense (Opp.)		(65)
Anaspidoceras sp.		(65)
Hybonoticeras hybonotum (Opp.)		(67)
Hybonoticeras cf. *hybonotum* (Opp.)	(107, 105)	
Lithacoceras cf. *subburckhardti* Donze et Enay		(65)
Lithacoceras div. sp.	(106)	(65)

The listed *P. olorizi* is described in an other paper (Fözy 1988, in press). This is a medium-sized, rather evolute form with characteristically fastigate venter on the middle whorls. The suture-line is very simple.

The zone has a reduced thickness; coarsely ribbed specimens of *Hybonoticeras* are highly distinctive of this unit.

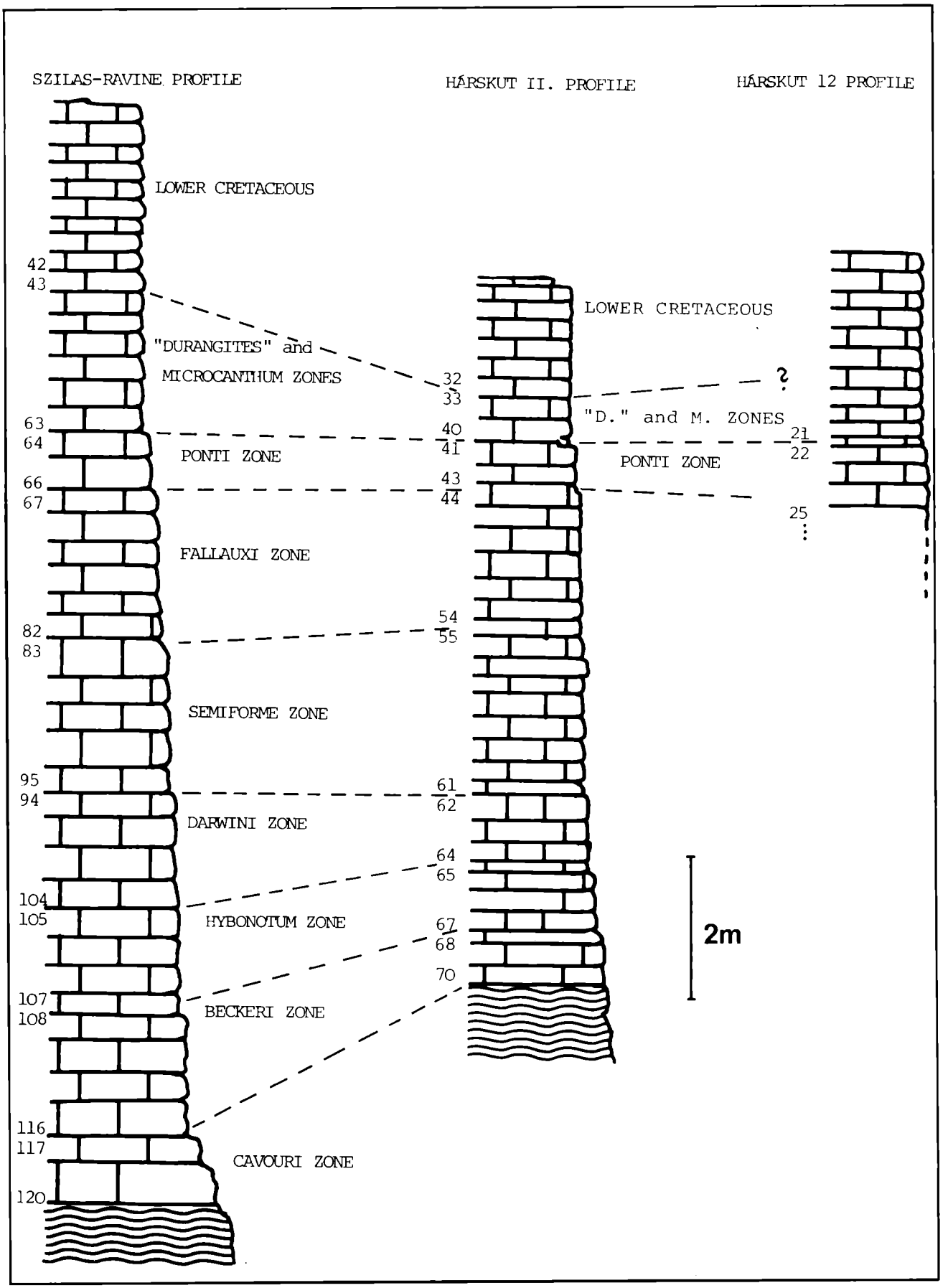

Fig. 4 - Biostratigraphic correlation of the examined profiles.

The upper boundary of the zone was placed just below the first appearance of the next quoted assemblage.

Semiformiceras darwini Zone: Szilas-ravine profile, beds 104-96, Hárskút II profile, beds 64-62.

Characteristic faunal elements:	Szilas	Hárskút II
Taramelliceras sp.	(102)	
Semiformiceras birkenmajeri Kutek & Wierzbowski		(62)
Neochetoceras cf. *mucronatum* Berckh. & Hölder	(99)	
Neochetoceras sp. aff. *usselense* Zeiss	(101)	
Neochetoceras div. sp.	(100, 98)	(64, 63)
Haploceras (Haploceras) cassiferum Fözy (in press)		(64, 63)
Pseudolissoceras olorizi Fözy (in press)	(102)	
Aspidoceras rogoznicense (Zeusch.)	(97)	
Aspidoceras rafaeli (Opp.)	(97)	
Aspidoceras cf. *rafaeli* (Opp.)		(63, 62)
Aspidoceras div. sp.		(64, 63)
Anaspidoceras neoburgense (Opp.)	(99-96)	(63)
Anaspidoceras sp.		(64)
Virgatosimoceras cf. *albertinum* (Cat.)		(64)
Virgatosimoceras cf. *rothpletzi* (Schneid)		(63)
Virgatosimoceras sp.	(104)	
Lithacoceras cf. *subburckhardti* Donze & Enay		(64)
Lithacoceras div. sp.	(104-100)	(64, 63)
Subdichotomoceras pseudocolobrinum (Kil.)	(96)	

The recently described form of *S. birkenmajeri* is represented in the material with only one fragmentary subsolved specimen (Pl. 1, Fig. 7). The original was reported from the boundary of the Darwini and Semiforme Zones, but probably from the lowermost part of the Semiforme Zone (Kutek & Wierzbowski, 1986). Cecca *et al.* (1985) mentioned the form, which is morfologically very close to *S. fallauxi*, from the lower part of the Semiforme Zone. However, the Hárskút specimen came from a slightly older (topmost Darwini Zone) level. Thus the opinion of Cecca *et al.* (1985) and of Kutek & Wierzbowski (1986) that "the two forms illustrated by Zittel are in reality two distinct species with distinct stratigraphical distributions" can be confirmed in Hungary as well.

H. (H.) cassiferum is a big, moderately evolute ammonite with a strong ventral flare on the adult body chamber. The form was regarded by Enay & Cecca (1986) as conspecific and macroconch of *H. verruciferum*.

Aspidoceratids form a considerable proportion of the fauna. *A. rogoznicense* shows the variability in whorl-shape which was demonstrated by Checa (1985). Some very big aspidoceratid body chamber fragments were determined as *A.* cf. *rafaeli*.

A. neoburgense is quite common. Besides the small or medium-sized specimens (e.g. Pl. II, Fig. 7), the Hárskút II profile yielded a rather big specimen with a moderately depressed body-chamber (Pl. III, Fig. 1).

Unfortunately, there are not many data on *Virgatosimoceras* although the genus has a prominent importance. The *V.* cf. *rothpletzi* found in the Hárskút II profile, (Pl.V, Fig. 1) is very close to the holotype described by Schneid. It is noteworthy, that the species was reported form a higher level formerly: the holotype and the other specimens of Schneid came from the beds probably equivalent with the Semiforme Zone, and/or, with the lower part of the Fallauxi Zone. De Wever *et al.* (1986) described the form the same level of Sicily. Olóriz (1978) mentioned *V. rothpletzi* from the Verruciferum Zone.

One other *Virgatosimoceras* specimen, was only tentatively referred as *V.* cf. *albertinum* (Pl. V, Fig. 3), due to its poor preservation.

In the lower part of the zone, *Lithacoceras* is abundant. Some, perhaps new forms, resemble to *S. penicillatum* (Schneid), but the Bakony specimens have wider umbilicus, and bear rarer ribbing on the adult body-chamber.

The upper boundary of the zone was drawn below the appearance of the diagnostic markers of the Semiforme Zone.

Semiformiceras semiforme Zone: Szilas-ravine profile, beds 95-83, Hárskút II profile, beds 61-55.

Characteristic faunal elements:	Szilas	Hárskút II
Semiformiceras semiforme (Opp.)	(93)	(59)
Semiformiceras sp.	(95)	
Neochetoceras sp. aff. *usselense* Zeiss	(95)	
Neochetoceras sp.	(94,93,89)	
Haploceras (Hypolissoceras) verruciferum(Zitt.)	(94,93)	(61-57,55)
Haploceras (Hypolissoceras) cf. *verruciferum* (Zitt.)	(95)	
Pseudolissoceras olorizi Fözy (in press)	(93)	
Pseudolissoceras sp.	(95)	
Anaspidoceras neoburgense (Opp.)	(92)	
Virgatosimoceras sp.	(87)	
Volanoceras (Volanoceras) aesinense (Mgh.)	(93, 92)	
Lithacoceras div. sp.	(93-91,87)	
Parapallasiceras div. sp.	(95, 86)	
Danubisphinctes cf. *bartheli* Olóriz	(88, 87)	
Discosphinctoides rhodaniforme Olóriz	(95)	(59)
Subdichotomoceras pseudocolobrinum (Kil.)	(95-93,88)	(59,58,55)

The base of the zone is well marked through the appearance of the zonal index together with *H. (Hy.) verruciferum*.

S. semiforme (Pl. I, Fig. 9) and some additional specimens figured by Fözy (1988, in press), show great variability in size, coiling, venter and ornamentation: this was already noticed by Olóriz (1978) and Enay (1983).

Neochetoceras is quite common in the zone, but most of the specimens are poorly-preserved, and thus insufficient for specific determination.

The numerous specimens of *H. (Hy.) verruciferum* (Pl. I, Fig. 10,11), are diagnostic.

In the light of the recent data (Cecca *et al.* 1985, Santantonio 1986), the zonal index value of *V. (V.) aesinense* (Pl. III, Fig. 2) is clear.

The figured specimen of *D. rhodaniforme* (Pl. IV, Fig. 3), is very close to the ammonite puplished by Del Campana (1905, Pl. III, Fig. 3). The species was reported by Olóriz (1978) and by De Wever *et al.* (1986) from the same stratigraphic level.

Fragments of *S. pseudocolubrinum* frequent in both profiles. The name probably refers to macroconch and microconch forms (Pl. IV, Fig. 3, Pl. I, Fig. 6). Dimorphism is indicated even by the Darwini Zone material.

It is important, that Semiforme Zone contains many other grups of perisphinctids too, which are not listed. However, most of them are fragmentary and subsolved,

and need future studies.

Together these undescribed forms, Semiforme Zone contains a very rich assemblage in the Bakony Mts. The higher part of the zone is less fossiliferous, so its upper boundary was drawn below the appearance of different simoceratids, *S. fallauxi* etc.

Semiformiceras fallauxi Zone; Szilas-ravine profile, beds 82-67, Hárskút II profile, beds 54-44.

Characteristic faunal elements:	Szilas	Hárskút II
Semiformiceras cf. *fallauxi* (Opp.)	(79)	(54)
Neochetoceras div. sp.		(52, 49)
Haploceras (Hypolissoceras) rhinotomum Zitt.		(53,47,45)
Pseudolissoceras sp.		(44)
Aspidoceras rogoznicense (Zeusch.)	(82)	(54,52,51)
Aspidoceras cf. rafaeli (Opp.)		(51)
Virgatosimoceras div. sp.	(82-79)	(46)
Simoceras admirandum Zitt.	(77)	(48, 47)
Simolytoceras volanensoides (Vígh)	(81, 80)	(50)
Simolytoceras vighi Fözy (in press)		(49)
Simolytoceras div. sp.	(82, 81)	
Sublithacoceras sp.	(79,77,71)	
Parapallasiceras sp.	(80)	
Lemencia sp.	(72)	
Subdichotomoceras pseudocolobrinum (Kil.)	(55, 52)	

Some dozens of densely-ribbed perisphinctids associated to the listed forms remain undetermined.

The index species is poorly represented and a considerable part of the fauna is built up by the simoceratids. *S. vighi* is a medium-sized *Simolytoceras* with rib-like, elongated umbilical tubercules on the middle whorls, and dense strong constrictions at the end of the adult body chamber (Fözy 1988 in press).

As shown in the list, the lower part of the zone can be correlated well with the "Virgatosimoceras spp. horizon" of Cecca *et al.* (1985). Nevertheless, the rich *Virgatosimoceras* fauna, due to the bad preservation, remain undeterminable.

No specimens of *Richterella richteri* (Opp.), a form elsewhere characteristic of this level, have yet been found in the Szilas or Hárskút profiles.

The upper beds of the Fallauxi Zone yielded specimens of *S. admirandum*, suggesting the presence of Admirandum - Biruncinatum Subzone of Olóriz (1978).

Some big, fragmentary specimens of (?) adult body chambers, probably macroconch forms, similar to those figured by Zittel (1870, Pl. 32, Fig. 2), were tentatively referred to *S. admirandum* too.

Micracanthoceras ponti Zone: Szilas-ravine profile, beds 66-64, Hárskút II profile, beds 43-41, Hárskút 12 profile, beds 25-22.

Characteristic faunal elements:	Szilas	Hárskút II	Hárskút 12
Volanoceras (Volanoceras) volanense (Opp.)	(65)	(42, 41)	(25)
?Volanoceras (?V.) sp. aff. *magnum* (Olóriz)		(43)	
Volanoceras nov. subgen.	(66)		(25)
Simolytoceras cf. *andaluciense* Olóriz	(65)		
Lytogyroceras subbeticum Olóriz		(42)	
Lemencia cf. *pergrata* (Schneid)	(65)		
Lemencia cf. *nitida* (Schneid)	(64)		
Lemencia div. sp.	(65, 64)	(42)	
Aulacosphinctes sp.	(65)		
Sublithacoceras div. sp.	(65)		
Burckhardticeras peroni (Rom.)	(65)		

Although the zone is represented by a very few beds, the collected fauna is relatively rich.

No specimens of the index species were found, but the appearance of *V. (V.) volanense* is diagnostic. The associated small-sized, microconchiate *Volanoceras* spp. needs a new subgeneric name.

Additionally to the rich simoceratid representation the presence of *Lemencia* and *Sublithacoceras* is an other good indication of the zone. Some of the forms resemble those figured by Schneid (1915), but some are probably new.

The small *B. peroni*, which was selected by Olóriz (1978) as the zonal index, is represented by a single specimen in the material.

The upper boundary of the zone is suggested by the abrupt disappearance of simoceratids and the appearance of the first berriasellids and himalyitids (the latter showing great diversity) in the beds above.

Micracanthoceras microcanthum and *"Durangites"* Zones: Szilas-ravine profile, beds 63-?43, Hárskút II profile, beds 40-33 and Hárskút 12 profile, from the bed no. 21-...?.

Characteristic faunal elements:	Szilas	Hárskút II	Hárskút 12
Neochetoceras sp.	(56)		
Aspidoceras rogoznicense (Zeusch.)		(38)	
Simoceratinae sp.			(16)
Paraulacosphinctes transitorius (Opp.)		(40)	(21)
Paraulacosphinctes cf. *senex* (Opp.)		(40)	(17)
Paraulacosphinctes sp.	(63, 47)		(18, 16)
Pseudoargentiniceras sp.	(50, 49)		
Proniceras sp.	(54)		
Durangites div. sp.	(47,46,43)		
? Tithopeltoceras sp.			(17)
Aulacosphinctes div. sp.	(62-59,54)		
Corongoceras cf. *symbolum* (Opp.)	(54)		
"Corongoceras" div. sp.	(63,54,47,46)	(39-37)	(19, 16)
Micraconghoceras microcanthum (Opp.)		(39, 37)	(19)
Moravisphinctes sp. aff. *moravicus* (Opp.)	(49, 47)	(39, 37)	

Although the diversity of the fauna is remarkable, the separation of the two uppermost zones of the Tithonian due to the many undescribed forms, is rather difficult.

Aspidoceratids and simoceratids form subordinate part of the fauna. The specimen from the bed 16 of the Hárskút 12 profile, resembles to *S. biruncinatum*, but is probably new.

Genus *Paraulacosphinctes* is commonly represented especially with *P. transitorius* (Pl. III, Fig. 3).

Most characteristic group is that of the himalaytids. Many of the forms, like *M. microcanthum* (Pl. III, Fig. 4) has a zonal index value. Several *Corongoceras* (especially those from the Hárskút profiles), are probably new.

In the Szilas-ravine profile, the boundary between the "Durangites" and Jacobi Zones was tentatively drawn between beds 43 and 42. Throughout these beds the number of himalayitids decreases rapidly, and upwards in the sequence some characteristic Lower Berriasian forms appear.

In the Hárskút II profile Horváth & Knauer (1986) placed the Jurassic-Cretaceous boundary between the beds 33 and 34.

In the Hárskút 12 section the hitherto studied material is insufficient to indicate the boundary exactly.

Lower Berriasian.

Characteristic faunal elements: Szilas-ravine profile, from the bed no. 42-on.	
Substreblites zonarius (Opp.)	(35)
Spiticeras cf. *groteanum* (Opp.)	(32)
Spiticeras sp.	(34)
Proniceras sp.	(39, 36, 35)
Protacanthodiscus cf. *andreai* (Kil.)	(42)
Protacanthodiscus sp.	(36)
?Durangites div. sp.	(42, 41, 38-36)
Aulacosphinctes sp.	(36)
Corongoceras div. sp.	(42-40)
Berriasella cf. *jacobi* Maz.	(38, 36)
Malbosiceras sp.	(42)
Dalmasiceras cf. *sublaevis* Maz.	(36)
Dalmasiceras div. sp.	(36-34)
Berriasellidae div. sp.	(38)

The specimen of *S. zonarius* (Pl. I, Fig. 8) fits well with those, illustrated by Zittel (1968, Pl. 15, Fig. 4, 5). Although the specimen is slightly subsolved, the weak periumbilical ribbing and the dense striation around the venter is visible. The gently fastigate venter bears the traces of the keel.

D. cf. sublaevis (Pl. IV, Fig. 4, 5), form diagnostic for the Lower Berriasian Jacobi Zone, was represented in the profile with three specimens.

The rich Lower Berriasian assemblage of the Hárskút II profile was described and figured by Horváth & Knauer (1986).

The topmost part of the Hárskút 12 profile yielded many badly-preserved specimens of *Spiticeras* and different groups of berriasellids, which indicate, that the Lower Berriasian is represented in this profile too.

CONCLUSIONS

The facies succession and the general picture of the fauna, (e.g. the dominance of Phylloceratina and Lytoceratina and the high diversity of haploceratids, simoceratids, himalayitids etc.), indicate the Bakony Mts. material as typical for the Mediterranean.

In harmony with these, the "standard" zonation worked out by Enay et Geyssant (1975), is a useful and suitable frame to interpret the Tithonian ammonite succession of the Bakony Mts.

As far as the palaeobiogeography is concerned, the strong similarity between the examined material and those, coming from the Southern Alps, Central Apennines and fom the Subbetics, is conspicious. Further comprehensive taxonomic evaluation of the fauna is needed to specify the former relationships of these areas.

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Plate I

Fig. 1 - *Hemihaploceras nobile* (Neumayr, 1873). Body-chamber fragment of an adult specimen. Szilas-ravine profile, bed 117, Cavouri Zone.

Fig. 2,3 - *Phylloceras serum* (Oppel, 1865). Incomplete fragmocone. Hárskút 12 profile, bed 10, Lower Berriasian.

Fig. 4,5 - *Ptychophylloceras ptychoicum* (Quenstedt, 1847). Small-sized, adult, entire specimen. Hárskút 12 profile, Lower Berriasian.

Fig. 6 - *Subdichotomoceras pseudocolobrinum* (Kilian, 1895). Small-sized, adult, probably microcnch form with the indication of the aperture. Szilas-ravine profile, bed 92, Semiforme Zone.

Fig. 7 - *Semiformiceras birkenmajeri* Kutek & Wierzbowski, 1986. Poorly preserved phragmocone with the fragment of the adult body-chamber. Hárskút II profile, bed 62, top of the Darwini Zone.

Fig. 8 - *Substreblites zonarius* (Oppel, 1865). Fragment of the phragmocone. Szilas-ravine profile, bed 35, Lower Berriasian.

Fig. 9 - *Semiformiceras semiforme* (Oppel, 1865). Big, adult, nearly complete specimen. Hárskút II profile, bed 59, Semiforme Zone.

Fig. 10 - *Haploceras (Hypolissoceras) verruciferum* (Zittel, 1869). Small, adult, nearly entire specimen. Szilas-ravine profile, bed 94, Semiforme Zone.

Fig. 11 - *Haploceras (Hypolissoceras) verruciferum* (Zittel, 1869). Medium-sized, nearly entire specimen. Szilas-ravine profile, bed 94, Semiforme Zone.

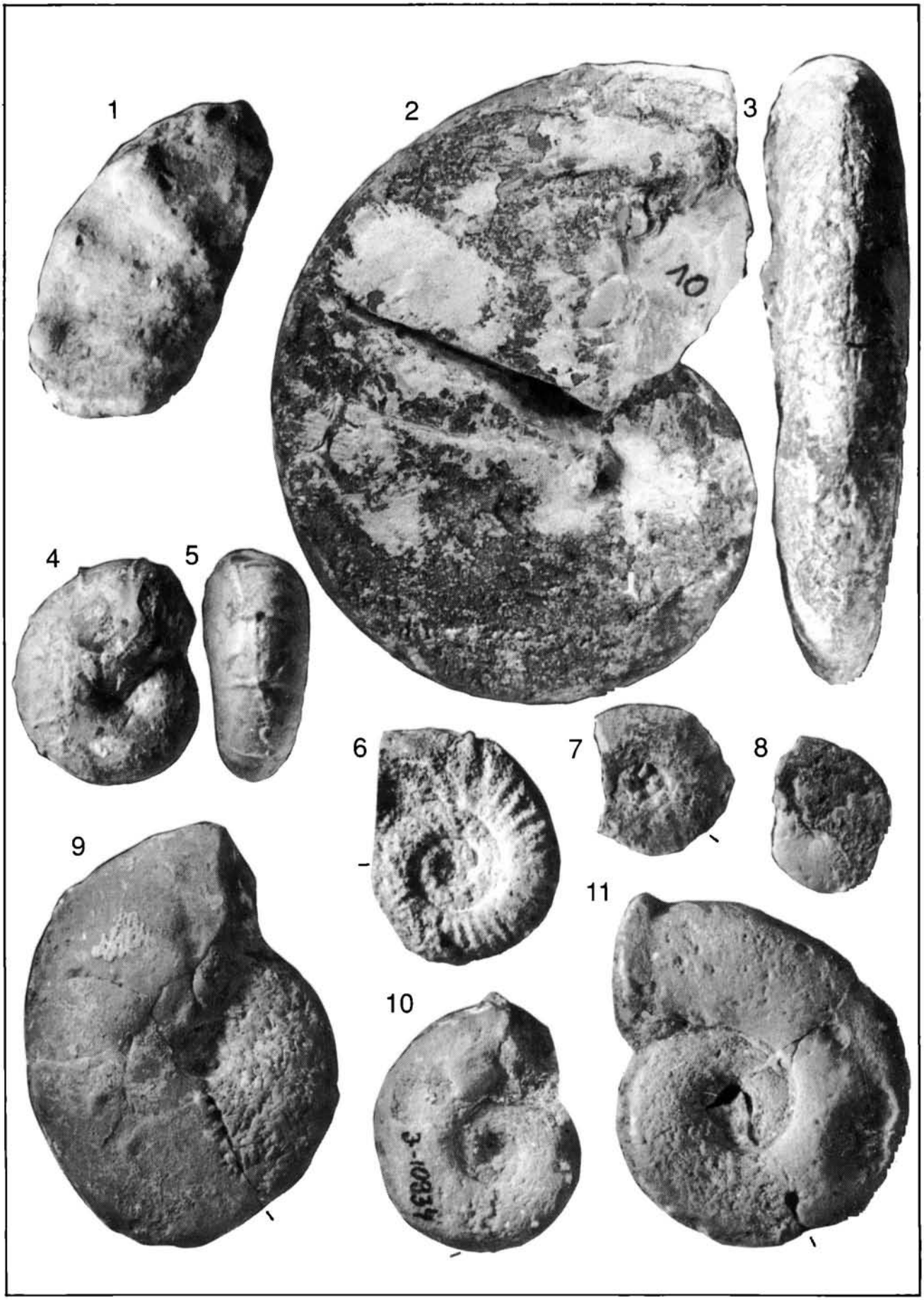
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Plate II

Fig. 1 - *Aspidoceras rafaeli* (Oppel, 1863). Phragmocone from the loose-material of the Hárskút II profile.
Fig. 2 - *Protacanthodiscus* sp. Incomplete specimen. Szilas-ravine profile, bed 36, Lower Berriasian.
Fig. 4 - *Aspidoceras rogoznicense* (Zeuschner, 1846). Fragmentary phragmocone. Hárskút II profile, bed 38, Microcanthum Zone.
Fig. 5,6 - *Aspidoceras rogoznicense* (Zeuschner, 1846). Medium-sized nearly complete specimen. Szilas-ravine profile, bed 92, Semiforme Zone.
Fig. 7 - *Anaspidoceras neoburgense* (Oppel, 1863). Fragmentary phragmocone with a part of the body-chamber. Hárskút II profile, bed 62, Darwini Zone.

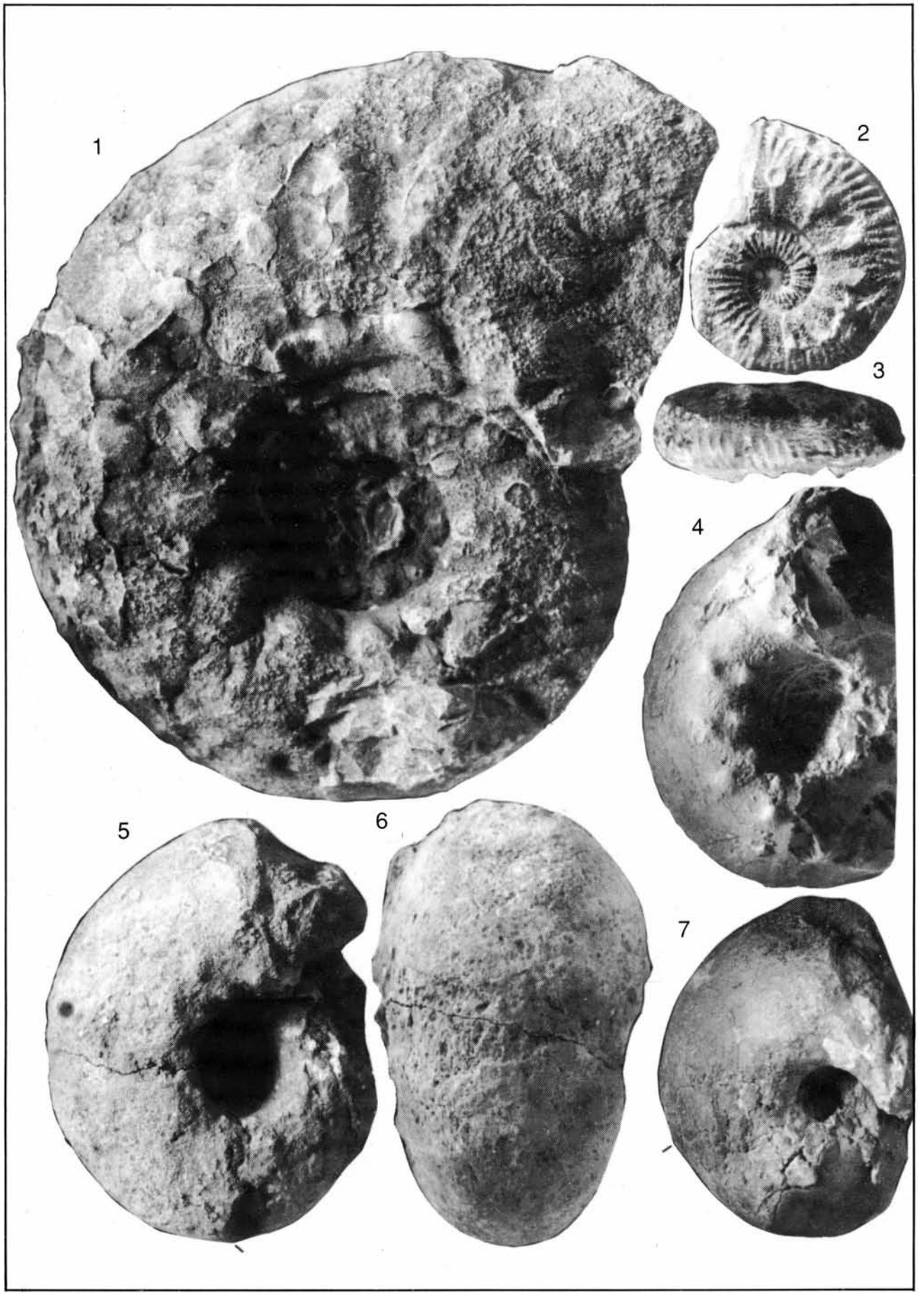
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Plate III

Fig. 1 - *Anaspidoceras neoburgense* (Oppel, 1863). Big, nearly complete adult specimen. Hárskút II profile, bed 63, Darwini Zone.
Fig. 2 - *Volanoceras (Volanoceras) aesinense* (Meneghini, 1885). Phragmocone fragment. Szilas-ravine profile, bed 93, Semiforme Zone.
Fig. 3 - *Paraulacosphinctes transitorius* (Oppel, 1865). Phragmocone. Hárskút II profile, bed 40, Microcanthum Zone.
Fig. 4 - *Micracanthoceras microcanthum* (Oppel, 1865). Phragmacone with a part of the body-chamber. Hárskút 12 profile, bed 19, Microcanthum Zone.

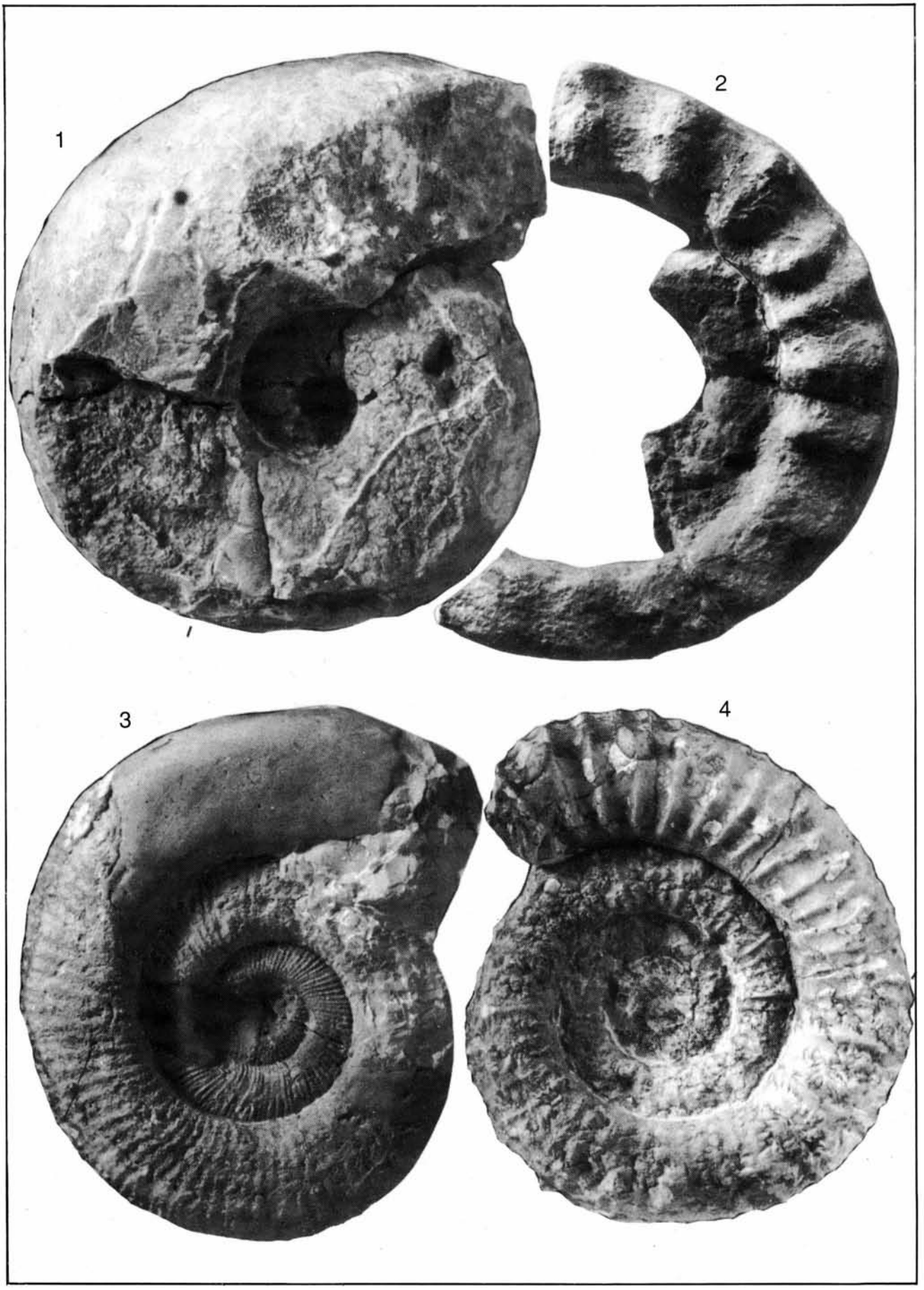
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Plate IV

Fig. 1 - *Lemencia* sp. Fragmentary phragmocone. Szilas-ravine profile, bed 64, Ponti Zone.
Fig. 2 - *Lemencia* cf. *pergrata* (Schneid, 1915). Fragmentary phragmocone. Szilas-ravine profile, bed 65, Ponti Zone.
Fig. 3 - *Discosphinctoides* cf. *rhodaniforme* Olóriz, 1978. Adult, complete specimen with the indication of the aperture. Szilas-ravine profile, bed 95, Semiforme Zone.
Fig. 4,5 - *Dalmasiceras* cf. *sublaevis* Mazenot 1939. Adult, nearly complete specimen. Szilas-ravine profile, bed 36, Lower Berriasian.
Fig. 6 - *Subdichotomoceras pseudocolobrinum* (Kilian, 1895). Fragment of a big, probably adult, macroconch specimen. Szilas-ravine profile, bed 94, Semiforme Zone.

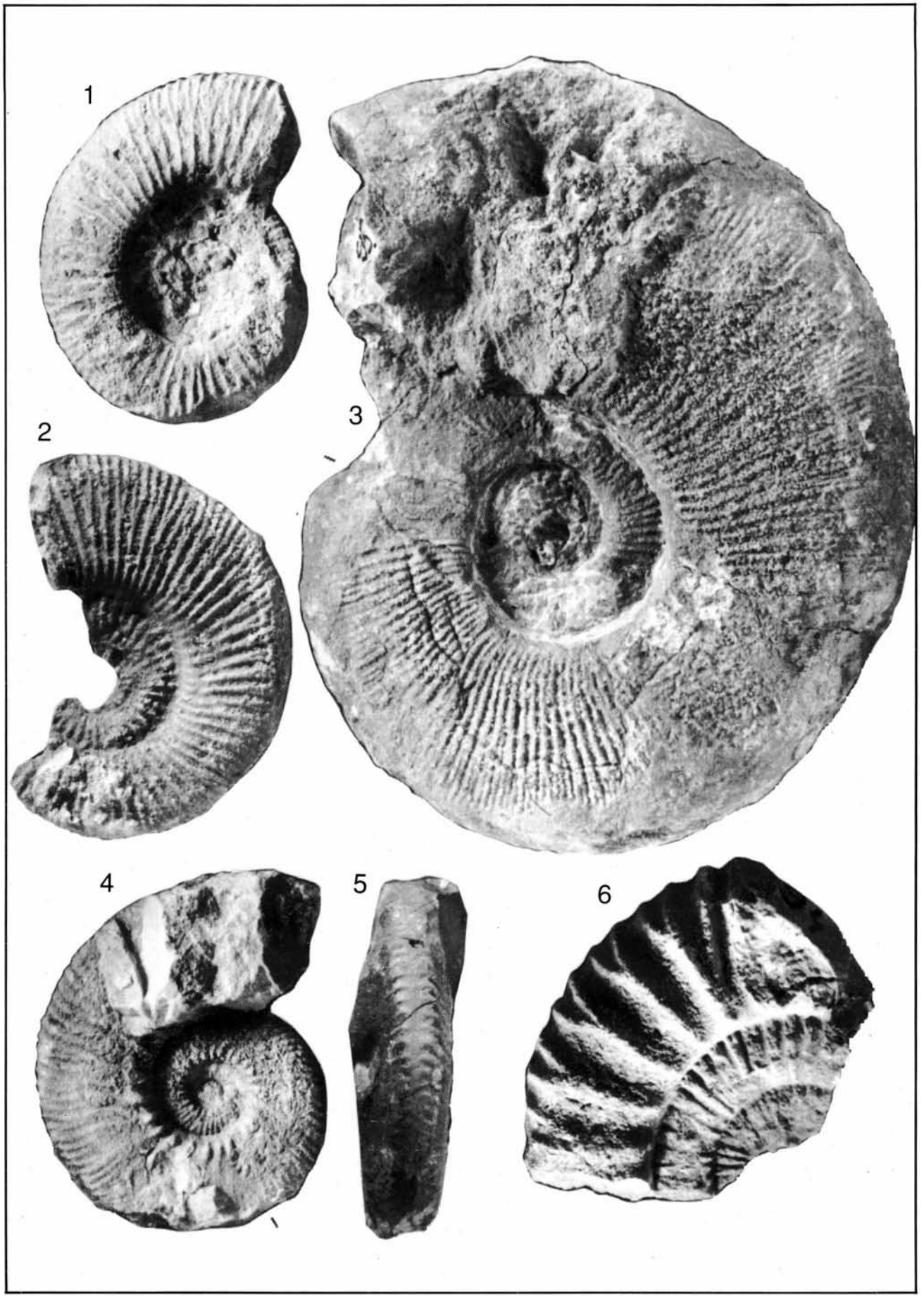
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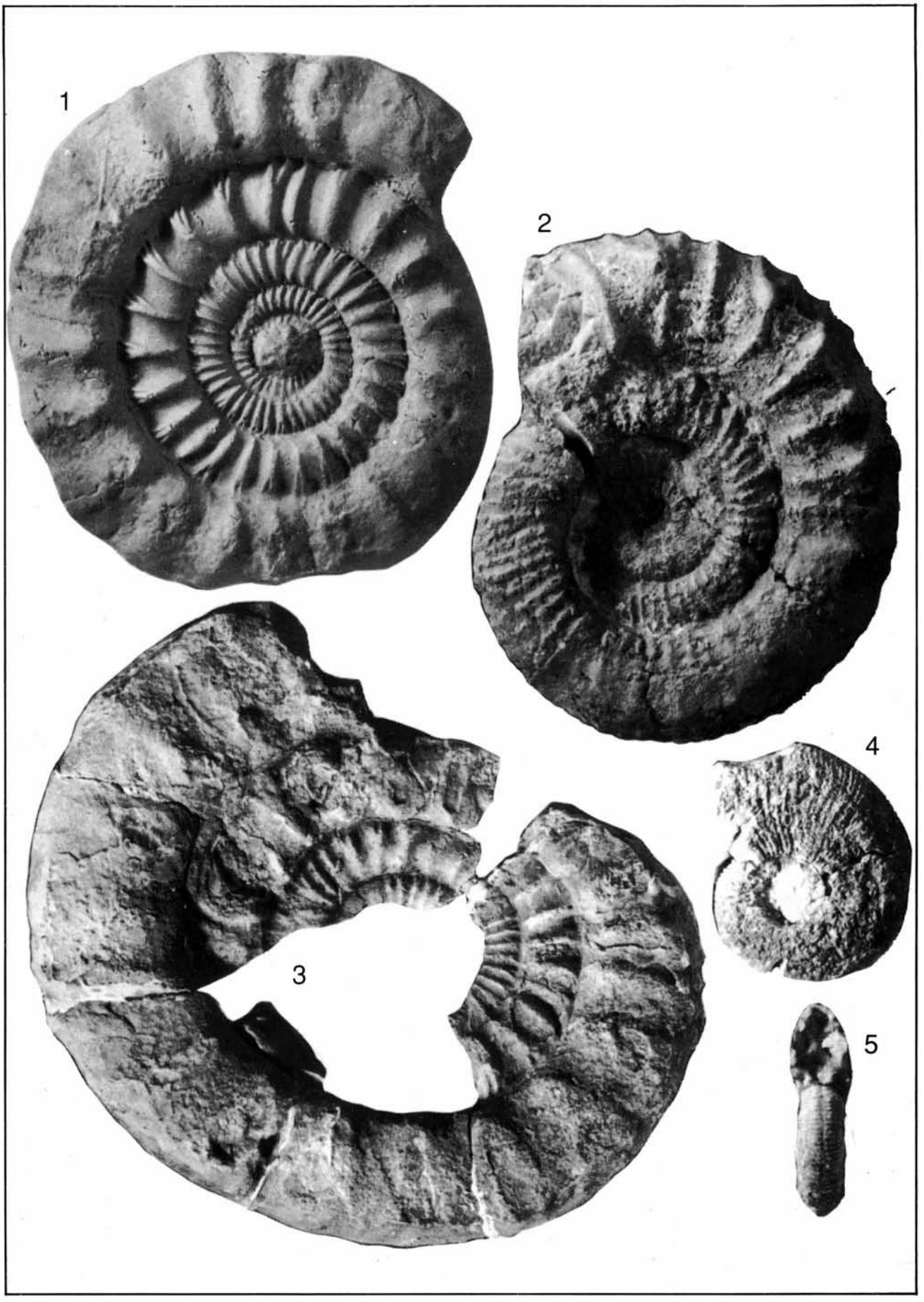
Plate V

Fig. 1 - *Virgatosimoceras* cf. *rothpletzi* (Schneid, 1915). Cast of a probably adult specimen. Hárskút II profile, bed 63, Darwini Zone.

Fig. 2 - *Corongoceras* cf. *symbolum* (Oppel, 1865). Fragmentary specimen with a part of the adult body-chamber. Szilas-ravine profile, bed 54, probably Microcanthum Zone.

Fig. 3 - *Virgatosimoceras* cf. *albertinum* (Catullo, 1853). Fragmentary specimen with a part of the adult body-chamber. Hárskút II profile, bed 64, Darwini Zone.

Fig. 4, 5 - *Berriasella* sp. Fragmentary phragmocone. Szilas-ravine profile, bed 38, Lower Berriasian.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