

Campanian (Late Cretaceous) cephalopods from Sümeg (Transdanubian Central Range, Hungary)

by
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Abstract — A Campanian ammonite assemblage, including *Hypophylloceras* sp., *Pachydiscus* cf. *leyi* DE GROSSOUVRE, *Pachydiscus* cf. *precolligatus* COLLIGNON and *Menabites* (*Delawarella*) *suemegensis* sp. n., and a single specimen of *Angulithes* cf. *westphalicus* (SCHLÜTTER) of the same age, are described and figured for the first time from Hungary (Sümeg, Transdanubian Central Range).

Keywords— Upper Cretaceous, Ammonoids, Nautiloid, biostratigraphy, Hungary

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Introduction

In Hungary, the areal extent of the Upper Cretaceous sediments is limited. A rather complex sedimentary cycle (Figure 1) is recorded only in the southwestern part of the Transdanubian Central Range (Bakony Unit, KÁZMÉR 1986), in the vicinity of Sümeg. There the formations are often rich in megafossils, especially gastropods, rudists and thin-shelled bivalves (*Inoceramus*) in the Ajka Coal, Ugod Limestone and Jákó Marl, respectively. Ammonites are very rare. HAAS et al. (1984) gave a general overview on the geological setting of the region. The authors listed *Scaphites* sp. and *Pachydiscus neubergicus* SCHLOTHEIM (the latter one is misidentified), collected by J. NOSZKY from the Polányi Marl near Sümeg.

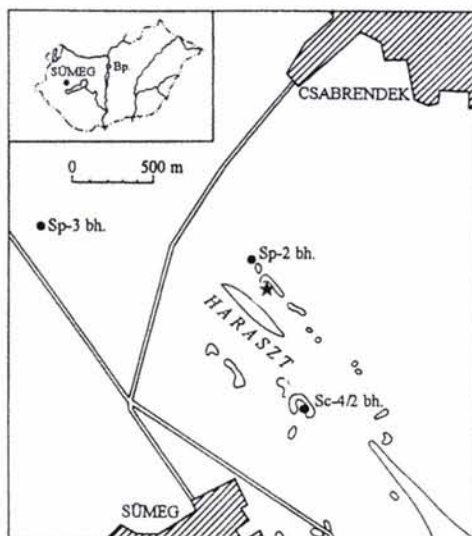


Figure 2 — Locality map of Sümeg (after HAAS et al, 1985).

The ammonites were collected from one of the old quarries somewhere in the region called “Haraszt”, in the vicinity of the town. Asterisk shows the most probable source of the ammonites, described in the text.

Because of the scarce occurrence of Late Cretaceous ammonites, the fossil assemblage described below is of special interest. The 18 specimens were discovered in the collection of the Palaeontological Department of the Hungarian Natural History Museum. According to the labels and the inventory data, all the ammonites were collected by L. KOCSIS, and the fossils were bought by the Museum in 1976. The locality (Figure 2) is indicated as: “village quarry, north of Sümeg” (“Sümegtől északra, a községi kőbányából”), but no details about the exact succession of the findings are available. It is unknown, whether the cephalopods were found in the same bed, or in the same package of beds. Unfortunately, in the vicinity of Sümeg, there are numerous small, old quarries, so it is not clear, where exactly the ammonites

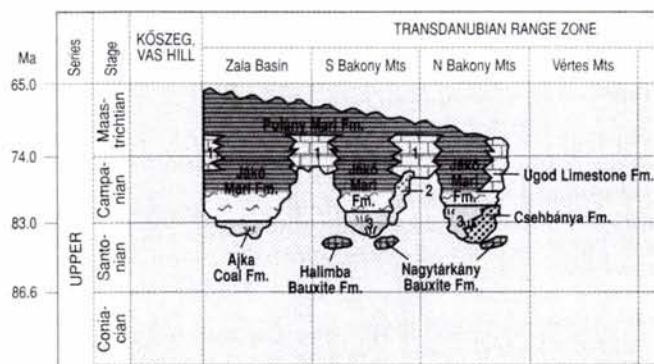


Figure 1 — Schematic sketch for the Upper Cretaceous formations of the Transdanubian Central Range. (After CSÁSZÁR G. 1996). Recent palaeontological data suggest that the age of the Polányi Marl is, at least partly, Campanian.

Another important Late Cretaceous ammonite, *Placenticerias polyopsis* (DUJARDIN) was determined by SUMMESBERGER and figured by PARTÉNYI (1986). This Upper Santonian fossil was collected from the Jákó Marl, which underlies the Polányi Marl.

were collected from. The most likely is that they were collected from one of the quarries situated north of the Road No. 84, in the vicinity of the town. Today these pits are used as garbage dumps, thus the possibility of further collecting is limited. A search in the local museum of Sümeg, where numerous fossils collected by L. KOCSIS are housed, was unsuccessful: only one additional, poorly preserved Late Cretaceous ammonite, insufficient for precise determination was found.

Cephalopods described below contain moderately well preserved internal moulds. Some of them are fully septate phragmocones, others bear part of the body chamber. Some specimens are slightly to strongly deformed. The inner whorls are poorly preserved and the suture lines are commonly corroded. Some of the ammonites are strongly subsolved on one side.

Systematics

Abbreviations used in the measurements:

D = diameter
WH = whorl-height
WW = whorl-width
U = diameter of umbilicus

All data (or the first ones, in the cases of more than one measurements on the same specimens) refer to dimensions measured at the maximal diameter of the specimen in millimetres.

Phylum **Mollusca** CUVIER, 1797
Class **Cephalopoda** CUVIER, 1797
Order **Ammonoidea** ZITTEL, 1884
Suborder **Phylloceratina** ARKELL, 1950
Family **Phylloceratidae** ZITTEL, 1884
Subfamily **Phylloceratinae** ZITTEL, 1884
Genus *Hypophylloceras* SALFELD, 1924

Hypophylloceras sp.
(Plate I: 1–2)

Material — A single specimen only.

Measurements:	D	WH	WW	U
M.63.1357	155	—	34	—

Description — The relatively large, discoid, fully septate mould is slightly corroded on both sides. The coiling is very involute, the umbilicus is not seen, the flanks are flat, the venter is rounded. No ornamentation is preserved, the suture line is strongly subsolved, but seems to be rather complex, which is typical for the phylloceratids.

Remarks — Although phylloceratids are rare in the uppermost Cretaceous, there are related species

occurring worldwide. Most of these forms are poorly known, without any information on the intraspecific variability. As a consequence, the Sümeg specimen is difficult to determine on species level due to the poor state of preservation.

The lack of the characteristic falcooid constrictions clearly separates the specimen from the otherwise similarly built Upper Cretaceous desmoceratids (*Desmophyllites*).

Suborder **Ammonitina** HYATT, 1889
Family **Pachydiscidae** SPATH, 1922
Genus *Pachydiscus* ZITTEL, 1884

Remarks — Pachydiscidae are moderate-sized to large, important ammonites of early Albian to late Maastrichtian age with a world-wide occurrence. The earliest forms (*Eopachydiscus*) suggest desmoceratid origin

(KENNEDY 1983). The abundance of the family has a peak in the Coniacian to Campanian. *Pachydiscus* and related taxa are typical for the Campanian to Maastrichtian.

Explanation to Plate I

- 1–2 *Hypophylloceras* sp. (M.63.1357), × 1. — Fully septate specimen; ventral and lateral view.
3 *Pachydiscus* cf. *precolligatus* COLLIGNON, 1955 (M.63.1360/1), × 1. — A supposed microconch, with a part of the adult body chamber. The end of the phragmocone is not recognisable; lateral view.
4 *Pachydiscus* cf. *precolligatus* COLLIGNON, 1955 (M.63.1345/6), × 1. — Fully septate, deformed fragment; lateral view.

Plate I



The type is *Pachydiscus neubergicus* after the subsequent designation of DE GROSSOUVRE (1894). The species is the index of the widely accepted Lower Maastrichtian Neubergicus Zone. According to HENDERSON & KENNEDY (1986) *P. neubergicus* is a junior objective synonym of the practically forgotten ammonite, *Ammonites christna* FORBES, 1846. ICZN opinion, 1519 (1989) gives precedence over the name of FORBES.

Five ammonites, found earlier in the Rendek Member of the Polány Marl Formation in Sümeg, stored in the Hungarian Geological Institute, were originally determined as *P. neubergicus* (HAAS et al. 1984). These fossils were recently re-evaluated as *Pachydiscus precolligatus* COLLIGNON, 1955 and *Eupachydiscus levyi* DE GROSSOUVRE, 1894 by YAZYKOVA (in: BODROGI et al. 1997), characteristic for the Early Campanian. *Pachydiscus levyi* was also determined by SUMMESBERGER (in:

SIEGL-FARKAS 1997). (The very same specimen of *P. levyi* was illustrated three times. For references see the synonym list.) It is not known, whether the five ammonites mentioned above and the fauna described in this paper came from the same ammonitiferous level, or only from the same formation.

Determination of *Pachydiscus* species is complicated due to the appearance of the commonly demonstrated microconchs (bearing no lappets) and the existence of the too many names in the literature, without indication of precise stratigraphic occurrence.

The Sümeg material, stored in the Hungarian Natural History Museum, was ranged into two taxa: *P. cf. levyi* DE GROSSOUVRE and *P. cf. precolligatus* COLLIGNON. They differ in size of the conch, the relative size of the umbilicus and also in ornamentation. The possible existence of macro-, and microconchs were recognised.

***Pachydiscus cf. levyi* DE GROSSOUVRE, 1894**

(Plate II, Plate III: 1)

1894 *Pachydiscus Levyi* nov. sp. — DE GROSSOUVRE, p. 178, pl. 21, pl. 30, figs. 1, 2.

1932 *Pachydiscus aff. Levyi* DE GROSSOUVRE — COLLIGNON, p. 23, text-fig. 2, pl. 6, figs 3, 3a.

1938 *Eupachydiscus Levyi* DE GROSSOUVRE — COLLIGNON, p. 14, pl. 3, figs. 3, 3a.

1955 *Pachydiscus Levyi* DE GROSSOUVRE — COLLIGNON, p. 34, text-fig. 5.

? 1980 *Eupachydiscus levyi* (DE GROSSOUVRE) — BLASZKIEWICZ, p. 41, pl. 34, figs. 1, 2.

? 1986 *Eupachydiscus cf. levyi* (DE GROSSOUVRE) — KENNEDY, p. 163, pl. 5, figs. 1, 2.

1997 *Eupachydiscus levyi* DE GROSSOUVRE — YAZYKOVA (in BODROGI et al.) p. 693.

1997 *Pachydiscus levyi* DE GROSSOUVRE — SUMMESBERGER (in SIEGL-FARKAS), p. 85, pl. 8, figs. 1–3.

1998 *Eupachydiscus levyi* (DE GROSSOUVRE) — SUMMESBERGER (in SIEGL-FARKAS & SUMMESBERGER), p. 266, pl. 1, figs. 1, 2.

1998 *Eupachydiscus levyi* (DE GROSSOUVRE) — YAZYKOVA (in BODROGI et al.) p. 1191, pl. figs. 1 a–d.

Material — Six specimens (M.63.1344, M.63.1345/1, M.63.1358, M.63.1359/1, M.63.1359/2, M.63.1361/1).

Measurements:	D	WH	WW	U
M.63.1344	?235	?99	?52	73
— " —	192	82	?50	55
M.63.1345/1	128	59	?24	35
— " —	107	45	?20	26
M.63.1358	256	104	?61	77
— " —	225	96	57	98
M.63.1369/2	176	76	?32	45
— " —	144	65	?30	39
M.63.1361	231	85	?36	70
— " —	194	77	?34	52

Description — Medium to big-sized internal moulds. The largest specimen (M.63.1358) is probably adult, however not complete. All are slightly to strongly deformed and the innermost whorls cannot be studied. Coiling is relatively evolute, compared to other

representatives of the genus. The umbilicus is moderately shallow, the umbilical wall is steep, the umbilical edge is rounded. The flanks are flat, the venter is rounded, the cross section is high oval. The ornamentation is not well visible on the inner and middle

Explanation to Plate II

- 1 ***Pachydiscus cf. levyi* De GROSSOUVRE, 1894 (M.63.1344), × 1.** — A probably adult phragmocone, with a part of the body chamber (arrow indicates its beginning); lateral view. On the surface of the body chamber trace fossils can be seen. The inner side of the empty shell was probably inhabited, and later the attached organism was eaten by a bottom dweller animal. Subsequently, the shell was filled by limy mud. The results are well preserved, round-shaped, densely packed, slightly convex domes.

Plate II



whorls, but the existence of straight, radial ribs can be confirmed. Straight, or slightly prorsiradiate intercalaries may appear. Ribs seem to cross the venter. In later stages, and especially on the adult (or subadult) body chamber, primary ribs are distant, rising from minute, later from more developed umbilical bullae. At the end of the adult body chamber the ornamentation seems tend to be smoother. The changing of the style of ribbing, the appearance of the umbilical nodules can be seen very well on the type of DE GROSSOUVRE, too. This way of changing of the ornamentation appeared on the specimen M.63.1345/1 also, however at much smaller size (Plate III: 1). Therefore this mould is regarded as a possible microconch, while the rest of the ammonites are probably macroconchs of considerably

bigger size. The suture line is very complex, however due to the strong subsolution, details can not be studied.

Remarks — The species is close to the similarly built *Pachydiscus perfidus* GROSSOUVRE. Latter has a stronger ribbing, especially near to the ventro-lateral border (for illustrations, see BŁASZKIEWICZ, A. (1980)). Comparison with some poorly known ammonites, including *Pachydiscus brandti* var. *pégoti* DE GROSSOUVRE, is given in the original description of DE GROSSOUVRE.

Distribution — According to BŁASZKIEWICZ, A. (1980) *P. levyi* occurs in the Lower Campanian *Gonioteuthis quadrata* Zone of the Vistula river valley (Poland) and also in the Lower Campanian of France and Russia. *P. perfidus*, a taxon close to the discussed species, is an Upper Campanian faunal element.

Pachydiscus cf. *precolligatus* COLLIGNON, 1955

(Plate 1: 3–4, Plate III: 2–4)

1955 *Pachydiscus precolligatus* nov. sp. — COLLIGNON, p. 64, pl. 21, fig. 1, pl. 25, figs. 2,3

1955 *Pachydiscus Gignouxii* nov. sp. — COLLIGNON, pl. 25, fig. 1,

1997 *Pachydiscus precolligatus* COLLIGNON — YAZYKOVA in BODROGI et al., p. 693.

1998 *Pachydiscus precolligatus* COLLIGNON — YAZYKOVA in BODROGI et al., p. 191.

Material — Eight specimens (M 63 1345/2–6, M 63 1360/1–2, M 63 1361/2).

Measurements:	D	WH	WW	U
M.63.1345/3	127	58	?28	30
— " —	105	53	?26	23
M.63.1360/1	84	42	18	17
— " —	64	32	14	14

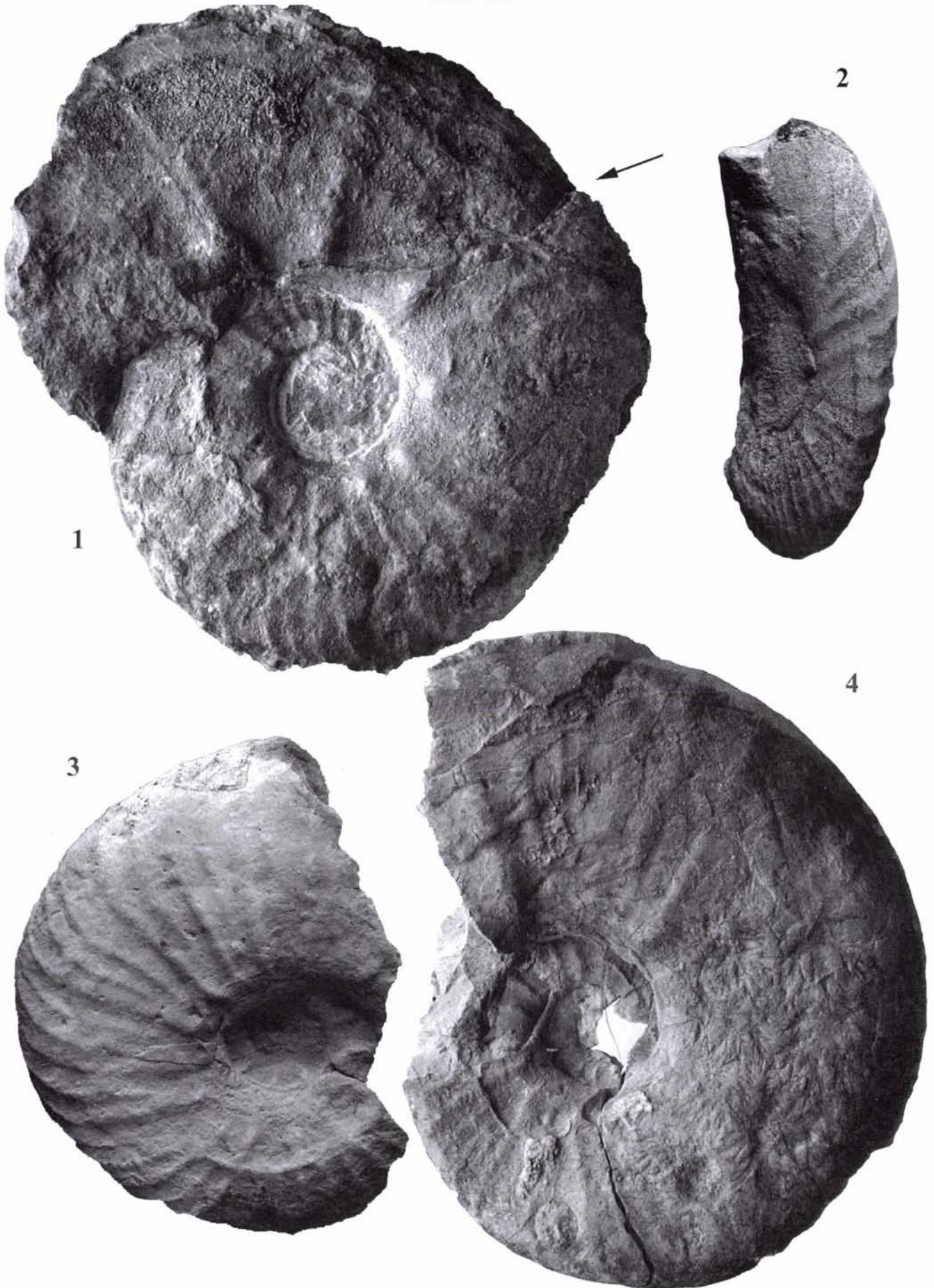
Description — Moderately evolute, medium-sized internal moulds. Most of the ammonites are presumably immature macroconchs or fragments of them, except one specimen (M.63.1360/1, Plate I: 3.), which is probably an adult, nearly entire microconch. The umbilicus is rather shallow, the umbilical wall is deformed, but seems to be arched. The walls are slightly convex, or nearly flat, the ventral region is rounded. The cross section is high oval. The ornamentation of the inner whorls can not be studied. At about 9 centimetre of diameter, the ribbing is built up by simple, prorsiradiate ribs originating from minute umbilical nodules. One or two intercalaries between each primaries, born

in the lower third part of the wall, nearly as strong as the primaries, exist. At later stages, the ribs are straight, radial, or slightly prorsiradiate, and less expressed. The umbilical bullae diminish also. The ventrolateral region seems to be especially smoother (M.63.1345/3, Plate III: 4.). The supposed microconch shows a similar style of ribbing as the inner part of the macroconch of similar size (e.g. M.63.1345/4, Plate III: 3.), but the ribbing tends to disappear on the end of the fragment, on the second part of the probably adult body chamber. Suture is complex, typical for the genus, but due to the poor state of preservation, cannot be studied in details.

Explanation to Plate III

- 1 *Pachydiscus* cf. *levyi* DE GROSSOUVRE (M.63.1345/1), × 1. — Probably adult microconch, with the part of the fragmentary body chamber (bar indicates its beginning); lateral view.
- 2 *Pachydiscus* cf. *precolligatus* COLLIGNON, 1955 (M.63.1345/5), × 1. — Fully septate, strongly deformed specimen; lateral view.
- 3 *Pachydiscus* cf. *precolligatus* COLLIGNON, 1955 (M.63.1345/4), × 1. — Fully septate, fragmentary specimen; lateral view.
- 4 *Pachydiscus* cf. *precolligatus* COLLIGNON, 1955 (M.63.1345/3), × 1. — Fully septate, fragmentary specimen; lateral view; bar indicates beginning of body chamber.

Plate III



Remarks — *Pachydiscus precolligatus* is a poorly known ammonite. It was published by COLLIGNON together with the very similar *P. gignouxii* from the same stratigraphic level (Lower Campanian). Both ammonite have the feeble, but complex ribbing, and there are no data on the infraspecific variation, therefore the separation of the species is problematic. The closest well-known ally is probably *Pachydiscus colligatus* (BINKHORST 1861), a species, which was intensively discussed by KENNEDY (1986). *P. precolligatus* is also close to *Pachydiscus baldemsi* (SCHLÜTTER 1867),

including forms, described originally by DE GROSSOUVRE in 1894, under the name *P. koeneni* (for details see KENNEDY & SUMMESBERGER 1984). However, SCHLÜTTER's species has stronger and sparsely ribbed microconchs, and probably vigorously ribbed macroconchs.

Distribution — *P. precolligatus* was described from the Lower Campanian of Madagascar. As far as the similar species are considered, *P. colligatus* as well as *P. baldemsi* – *P. koeneni* are Upper Campanian fossils.

Family **Collignoniceratidae** WRIGHT, 1951

Subfamily **Texanitinae** COLLIGNON, 1948

Genus *Menabites* COLLIGNON, 1948

***Menabites (Delawarella) suemegensis* sp. n.**

(Plate IV)

Holotype — A moderately well-preserved, but crushed and corroded internal mould (M.63.1355) collected by L. KOCSIS. Besides the type, no other specimens were collected.

Type locality — The specimen came from a quarry north of Sümeg (Közszégy bánya), Transdanubian Central Range. The exact position of the outcrop is unknown.

Type strata — Based on the lithological features of the mould, the specimen is from the Rendek Member of the Polány Marl Formation.

Derivation of name — The species name refers to the small town of Sümeg.

Diagnosis — *Delawarella* species with strong, sparse ribs on the middle whorls.

Material — A single specimen.

Measurements:	D	WH	WW	U
M.63.1355	?163	?60	—	58

Description — The mid-sized fragmentary specimen is probably the fossil of a subadult ammonite. The phragmocone and a part of the body chamber is preserved. The innermost whorls cannot be seen. The coiling is relatively evolute. The umbilical wall is steep; the flanks are modestly flat and heavily ornamented. On the middle whorl there are about 14 coarse, blunt, prorsiradiate ribs per whorl, bearing characteristic ventrolateral tubercles. No other row of lateral tubercles can be seen, probably because of the corrosion. On the outer whorl ribs are strong, straight, radial or slightly prorsiradiate. At the end of the phragmocone the strong ribs, including the common, short intercalaries, carry 4–5 rows of tubercles. The first row, containing weak nodes, is placed at the beginning of the ribs, above the umbilical wall, the second row (not always well developed) is situated in the lower quarter of the ribs, the third row is placed in the middle of the ribs, and forms a bifurcation point in some cases. These umbilical and lateral tubercles are conical, while the fourth and especially the fifth rows of swellings are characteristi-

cally claviform. The last row of tubercles is situated in ventrolateral position. The ornamentation is different on the body chamber: ribs are simple, only the weak first and the strong last claviform tubercles can be seen. The venter has a fine keel built up by weak, elongated swellings. The specimen is slightly deformed, and the venter, with the weak serrated keel, is visible only on the last short part of the phragmocone. The faint suture-line can be seen only in parts.

Remarks — The closest ally is probably *Menabites (Delawarella) danei* (YOUNG, 1963), a species often found in the Gulf Region of the US. (For illustration of the species, see: DANE, 1929, YOUNG, 1963, COBBAN & KENNEDY, 1992/a, 1992/b and KENNEDY et al. 1997) The Sümeg ammonite especially fits well, if not identical on species level, with one of the specimen, figured by KENNEDY et al. (1997, fig. 20.); both ammonite show the same features of the changing ornamentation (strong, coarse, straight early ribs with the very prominent dominance of ribs over the tuberculation, as size

Explanation to Plate IV

***Menabites (Delawarella) suemegensis* sp. n. (M 63 1355), × 1.** — Ventral and lateral view. Fragmentary phragmocone, with the part of the body chamber (arrow indicates its beginning).

Plate IV



increases). The only difference is that the Hungarian specimen is slightly smaller, and the middle whorls are sparsely ribbed.

Since the Sümeg ammonite is deformed, and the innermost whorls cannot be studied, the comparison with figures of the small-sized, non-deformed ammonites of the American literature is problematic. Due to the compaction and corrosion, the Sümeg specimen does not show the important changes of the ratio of height to breadth otherwise characteristic of the close relative, *M. (D.) danei*, and probably for the subgenus itself.

The Hungarian specimen is also close to *Menabites (Australiella)* COLLIGNON, 1948. Both have the very strong ventrolateral tubercles on the middle whorls, but *Australiella* bears fewer rows of lateral tubercles.

The Sümeg ammonite also resembles *Neoselwynoceras* COLLIGNON, 1966, which was regarded a synonym of *Texanites (Texanites)* by WRIGHT et al. (1996). The type of this genus (*N. paradoxum* COLLIGNON), which is a pathological specimen according to WRIGHT et al. (1996), was refigured by HERM et al. (1979). The Sümeg ammonite is bigger, more involute and the middle whorl is more sparsely ribbed. COLLIGNON's specimen lacks

the intercalaries and has a more developed serration on the keel.

Distribution — Texanitids, especially *Menabites* are rare in Europe. Two specimens of *M. (D.) delawarensis* were reported from Aquitaine (France) (COBBAN & KENNEDY 1992/a), while KÜCHLER & KUTZ (1989) listed *Menabites* sp., and *Menabites (Delawarella)* sp. from the Scaphites hippocrepis Zone (late Early Campanian) of Navarra (N-Spain).

The above-mentioned *Neoselwynoceras* is known, probably, from the Upper Santonian and Lower Campanian of Madagascar.

On a wider geographic scale, texanitids range from the Early Coniacian to the Late Campanian with a peak abundance in the Santonian. The closest ally, *Menabites danei* was earlier recorded only from North America. Its holotype comes from Oklahoma, from a "formation equivalent to the Gober chalk". Other specimens were collected also from Texas, from the Ozan Formation and from Oklahoma and Colorado. The species is characteristic for the late early Campanian *Menabites (Delawarella) delawarensis* Zone, and also occurs in the roughly equivalent *Baculites obtusus* Zone (COBBAN & KENNEDY 1992/a, 1992/b).

Order **Nautilida** DE BLAINVILLE, 1825
Suborder **Nautilina** DE BLAINVILLE, 1825
Family **Nautilidae** DE BLAINVILLE, 1825
Genus *Angulithes* MONTFORT, 1808

Angulithes cf. *westphalicus* (SCHLÜTTER, 1872)
(Plate V)

1872 *Nautilus Westphalicus* n. sp. — SCHLÜTTER, p. 13.

1876 *Nautilus Westphalicus* SCHLÜTTER — SCHLÜTTER, p. 175, pl. 47, figs. 1, 2.

1956 *Angulithes westphalicus* (SCHLÜTTER) — KUMMEL, p. 457, text-fig. 33/1.

1960 ?*Angulithes (A.) westphalicus* (SCHLÜTTER) — WIEDMANN, p. 186, pl. 21. fig. "o".

1999 *Deltoidonautilus westphalicus* (SCHLÜTTER) — WITTLER et al., p. 37, text-figs. 51 a, b, 52.

2000 *Angulithes westphalicus* (SCHLÜTTER) — WILMSEN, p. 37, pl. 3, figs. 1 a, b, pl. 5, figs. 6, 20.

Material — A single specimen (M.63.1354).

Description — The medium-sized, rather flattened specimen has a maximum diameter of 206 mm. The nearly complete, but probably not adult body chamber is crushed. The umbilicus is very narrow and cannot be seen well; the flanks are smooth; the venter is highly arched. The maximum breadth of the whorl is at the umbilical shoulder; the cross section is high oval. The suture line (marked by pencil, on the basis of the faint impressions on the mould), is only slightly sinuous. It

has a broad and shallow lateral lobe and a narrow ventral saddle.

Remarks — The Sümeg specimen lacks the weak angular sharpening of the venter, this was the main reason for the use of the open nomenclature. The closest form is probably *Angulithes triangularis* (MONTFORT, 1808) but it has a more curved suture line. Another close ally is *Angulithes fleuriasianus* (D'ORBIGNY, 1840), which has similarly straight suture line, but is more inflated, at the same time.

Explanation to Plate V

Angulithes cf. *westphalicus* (SCHLÜTTER, 1872) (M.63.1354), × 1. — Lateral view.

Plate V



Cretaceous nautiloids of Hungary were listed and figured by NAGY (1963). From the Upper Cretaceous of Sümeg, NAGY published a specimen close to the nautiloid illustrated on Plate 5, under the name *Eutrephoceras boissieri* (PICTET, 1866). The genus *Angulithes* (including *Angulithes* sp. aff. *triangularis*, *Angulithes* sp., and *Angulithes (Cimomia)* sp.) was reported

from the Barremian, Aptian, and Albian limestones of the Transdanubian Central Range by NAGY.

Distribution — *Angulithes westphalicus* (SCHLÜTTER) was reported from Spain, Poland and N Germany. It is a Campanian fossil, with a probable peak in the Late Campanian (WILMSEN 2000), however there are data also on the possible Santonian occurrence (WITTLER et al. 1999).

The age of the fauna

The lack of continuous Campanian ammonitiferous successions in most areas of the world outside the Gulf Region of the States, and the scarcity of Campanian cephalopods in Europe, do not allow putting the Sümeg ammonites into a precise zonation context. The relatively poor understanding of the Campanian stage is reflected by the fact that even the beginning of the stage is often interpreted as the extinction level of the crinoid *Marsupites*. Further subdivision of the stage is mainly based on belemnites, echinoids and microfossils (HANCOCK & GALE 1996) and the cephalopod zonation is not as widely accepted as in the case of the most stages of the Mesozoic. Even in Germany, in the thickest, most continuous Campanian section of Europe, ammonites are scarce and show a low diversity (SCHULZ et al. 1984).

The European Campanian ammonite zonation contains 5 cephalopod zones (ammonite, or belemnite zones) only (WRIGHT et al. 1996). In contrast, the Campanian of the Western Interior contains 21 ammonite zones.

As far as the age determination and subdivision of the ammonitiferous lower part of the Polány Marl is considered, earlier attempts were based on microfossil studies. There is a detailed palynozonation on the Upper Cretaceous of the Transdanubian Central Range (GÓCZÁN & SIEGL-FARKAS 1990), and another subdivision is based on dinoflagellates (SIEGL-FARKAS

1997). At the beginning the succession of the dominance and assemblage zones was calibrated with the misidentified ammonite, *P. neubergicus*. Thus the age of the Polány Marl turned out to be younger than in reality it is. Revision of *P. neubergicus* (SIEGL-FARKAS & SUMMESBERGER 1998) solved the biostratigraphic confusion.

In conclusion, the described fauna represents the youngest known Hungarian cephalopod assemblage, containing cosmopolitan forms (*Hypophylloceras*, *Pachydiscus*) and a texanitid (*Menabites (Delawarella) suemegensis*), which is close to a form known hitherto from the US Western Interior only. Although details of the collecting and the precise stratigraphic position of the ammonites remained unknown, it is very likely that the fossils are of early Late Campanian age — they probably represent the *Delawarella delawarensis* Zone. Using tripartite subdivision of the stage, the Sümeg assemblage is Middle Campanian.

These conclusions are in accordance with the latest results based on nannofossil studies of the Sümeg region. (FOGARASI in BODROGI et al. 1998). Nannofossil samples were taken directly from the museum ammonites also. These investigations yielded a relatively rich, calcareous nannoplankton assemblage, of 33 taxa. These taxa, including *Aspidolithus* sp. aff. *parvus constrictus* suggest the late Early Campanian CC18 – (19) nannoplankton zones (FOGARASI pers. com.).

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