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Lower Cretaceous Ammonoidea in the Podbranč quarry (Pieniny Klippen Belt, Slovakia)

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A b s t r a c t. A rich collection of Lower Cretaceous ammonites from the Pieniny Limestone Formation was accumulated during comprehensive biostratigraphic studies of the locality of Podbranč. The most complete section and the largest number of ammonites come from an abandoned first level of the local quarry. Their taxonomic processing as well as their stratigraphic evaluation is the subject of the submitted contribution. In the taxonomic part, 14 most significant ammonite species are described. The ammonites prove the early Hauterivian to late Barremian age of the limestones. Some of the determined ammonites are index zone species; a number of them have not been reported from the Western Carpathians yet. All found species fall into the category of the Mediterranean faunal province.

K e y w o r d s: Lower Cretaceous, Hauterivian, Barremian, ammonites, taxonomy, new taxa, shells, fossil localities

Introduction

Within the long-lasting co-operation between the Institute of Geological Engineering of VŠB – Technical University of Ostrava and the Geological Institute of the Slovak Academy of Sciences in Bratislava in solving grant projects in the area of biostratigraphic research of Lower Cretaceous deposits in the Outer Western Carpathians, we have succeeded in putting together a significant collection of Lower Cretaceous ammonites from the western part of the Pieniny Klippen Belt in Slovakia recently.

The most numerous ammonite finds come from the Podbranč quarry located near a village of the same name lying between the towns of Myjava and Senica, i.e. about 9 km west-southwest of Myjava. The quarry is built in the southernmost surface exposure of the Pieniny Klippen Belt (Text-figs 1, 2). Jurassic and Cretaceous deposits are exposed in three levels of the quarry; levels 2 and 3 are currently in operation. The Lower Cretaceous ammonite-bearing sequence falls into the category of pelagic clayey limestones of the Kysuca development of the Klippen Belt. They can be designated as the Pieniny Limestone Formation.

Previously, Andrusov (1945), Andrusov and Scheibner (1966) and Scheibner (1968) were concerned with the lithology and structure of Mesozoic complexes of the locality of Podbranč. Our first visit to the locality was motivated by finds of Lower Cretaceous ammonites provided by Prof. Dr. M. Mišík, DSc. from Bratislava during the field trip with students of Komenský University in 1992. After our first preliminary visit in 1994 we gradually proceeded in documenting all available quarry sections. A relatively complete and long stratal succession proved to be suitable for the study of detailed lithostratigraphy, biostratigraphy and sequence stratigraphy.

Our biostratigraphic study concentrated on the distribution of calpionellids and ammonites in combination with the study of calcareous nannofossils, non-calcareous dinoflagellates, planktonic foraminifers, radiolarians and aptychi. The existing, yet preliminary results were summarized in the contribution of Michalík et al. (1999a). A more specific topographic position and generalised sections of all levels of the Podbranč quarry were given by Michalík et al. (1999b).

The submitted study deals with the majority of substantial and stratigraphically significant finds of ammonites at Podbranč. The overall majority of finds in the quarry come from the abandoned level 1, namely the Pieniny Limestone Formation. At the mentioned level, a section in limestones representing the whole lower part of the exposed formation was documented in detail in the northern wall in the abandoned part of the quarry. At the base, the section is limited by the fault plane separating the younger Koňhora Formation from the Pieniny Limestone Formation. The latter formation begins with Bed No. 39 and ends with Bed No. 87 (Michalík et al. 1999b). The lower part of this section (sequence *a*) includes grey clayey limestones (beds 39–68), the upper part (sequence *b*) consists of white-grey limestones (beds 40–87). Younger, light grey, spotted limestones rich in ammonites (sequence *c*) are exposed after a short break of the continuous section, where the northern face of the quarry passes into the eastern face. The youngest ammonite-bearing deposits (sequence *d*) occur in light grey, spotted clayey limestones in the last outcrops of the Pieniny Limestone Formation on the southern edge of the eastern face.

This contribution is the first of a series of studies on taxonomy of the studied groups of Lower Cretaceous fossils at the locality.

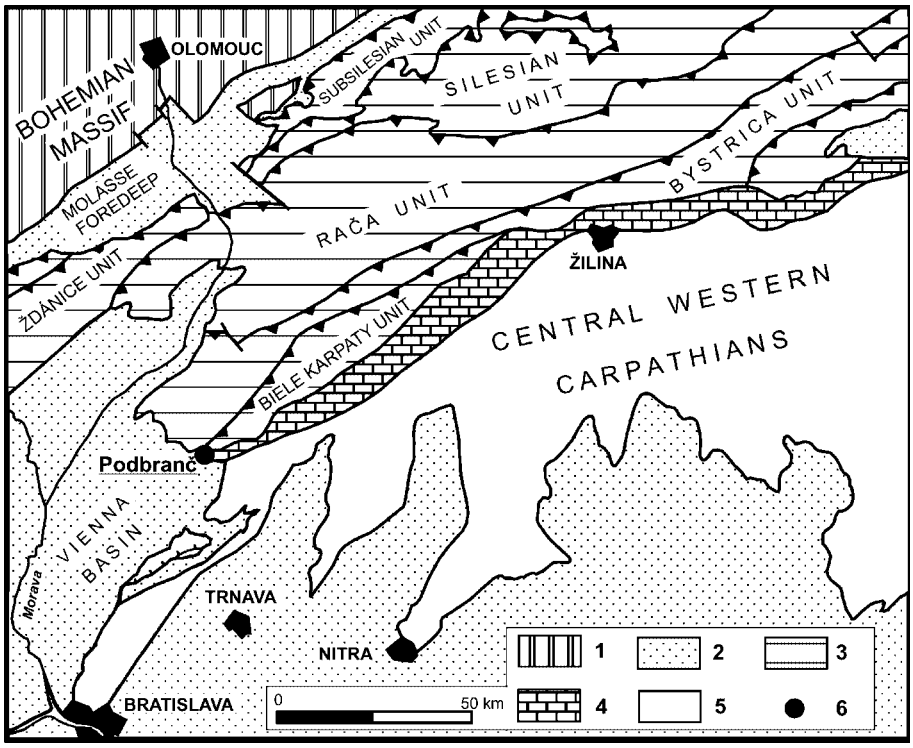

Fig. 1. General position of the locality of Podbranč. 1 – Bohemian Massif, 2 – Neogene cover, 3 – Outer Western Carpathians, 4 – Pieniny Klippen Belt, 5 – Central Western Carpathians, 6 – locality.

Taxonomy

The used system, except for some details, follows the new Treatise (Wright et al. 1996).

Suborder Ammonitina Hyatt, 1889
Superfamily Haploceratacеae Zittel, 1884
Family Haploceratidae Zittel, 1884
Genus *Neolissoceras* Spath, 1923

Type species: *Ammonites Grasianus* d'Orbigny, 1841.

Neolissoceras desmoceratoides Wiedmann, 1966
Pl. II, Fig. 3

1987 *Haploceras (Neolissoceras) desmoceratoides* Wiedmann; Company, p. 100, pl. 3, figs 5–8, pl. 18, fig. 2 (cum syn.)
1993 *Haploceras (Neolissoceras) desmoceratoides* Wiedmann; Avram & Gradinaru, p. 673, pl. 1, fig. 7, pl. 2, fig. 3, pl. 3, figs 12 a, b

Material: Heavily deformed sculpture mould (SNM Z 22997).

Description: A large, rather evolute shell. Sides of the whorl are slightly vaulted. An indication of the edge dividing the sides of the whorl from the obliquely inclined umbilical wall can be seen on the body chamber. The shell is smooth.

Measurements: At D = 63.8 mm (between the axes of deformation), H = 28.1 (0.44), U = 16.2 (0. 25). The maximum shell diameter is 68 mm.

Remarks: Related species *Neolissoceras grasianum* (d'Orbigny) differs in its flat whorls and a narrower, hopper-shaped umbilicus.

Distribution: Company (1987) and Avram and Gradinaru (1993) state the late Valanginian in Spain (Betic Cordillera) and the Rumanian Carpathians, Mandov (1976) the late Valanginian and Hauterivian in Bulgaria (Western Balcanides).

Occurrence: The Pieniny Limestone Formation at level 1, sequence *a,* early (probably basal) Hauterivian.

Superfamily Perisphinctaceae Steinmann, 1890
Family Oosterellidae Breistroffer, 1940
Genus *Oosterella* Kilian, 1911
Type species: *Ammonites cultratus* d'Orbigny, 1841.

Oosterella ondulata Reboulet, 1996
Pl. I, Fig. 1

1996 *Oosterella ondulata* n. sp.; Reboulet, p. 145, pl. 28, figs 1–8, pl. 29, figs 1, 2

Material: Only slightly deformed shell with a weathered, initially pyritized phragmocone and a part of the body chamber preserved as a sculpture mould (SNM Z 22998).

Description: Evolute microconch with low, flat whorls. A keel can be clearly seen on the periphery. Mostly simple, slightly retroversal ribs are present on the body chamber, which is fossilized differently. They are best developed on the external half of the whorl. They fade out towards the umbilicus, partly owing to pyritization. Some of the ribs are bifurcated from the common point by the umbilicus. All ribs end in a rather thicker form under the keel.

Measurements: The maximum preserved diameter is 32.5 mm. At D = 32 mm, H = 11.5 (0.36) and U = 10.2 (0.32).

Remarks: The microconch reminds, to a certain degree, some shells of the group *Oosterella gaudryi* Nicklés, 1892 in its evolute coiling and sculpture. Shells of this group having a similar style of ribbing, however, usually differ in developed umbilical tubercles.

Distribution: According to Reboulet (1996), *O. ondulata* occurs in the Vocontian Basin in the late Valanginian (Trinodosum ammonite Zone, Furcillata Horizon) to basal Hauterivian (Radiatus Zone).

Occurrence: level 1, sequence *a,* early Hauterivian.

Family Olcostephanidae Haug, 1910
Subfamily Olcostephaninae Haug, 1910
Genus *Olcostephanus* Neumayr, 1875

Type species: *Ammonites astierianus* d'Orbigny, 1840.

Olcostephanus cf. *detonii* (Rodighiero, 1919)
Pl. I, Fig. 2

1919 *Spiticeras? De Tonii* Rodighiero; Rodighiero, p. 94, pl. 2, fig. 12
1995 *Olcostephanus* aff. *detonii* (Rodighiero); Cecca, p. 54, pl. 1, figs 8–10
1999 *Olcostephanus* cf. *detonii* (Rodighiero); Vašíček & Michalík, fig. 6/1

Material: A sole, very imperfectly preserved juvenile sculpture mould affected by deformation and partly also by subsolution (SNM Z 22999).

Description: A small vaulted evolute shell with a wide umbilicus and not high whorls. The umbilical area is secondarily indistinctly limited. Primary ribs with tubercles at the umbilicus play their role in the sculpture. Two, sometimes even three ribs come out, with one to two inserted ribs between them. The ribs are arcuate, retroversal. Constrictions are indistinct.

Measurements: With respect to the heavy deformation and subsolution of the umbilical area, the measurements are only approximate. The maximum shell diameter is close to 27 mm. At D = 22.4 mm, H = 7.9 (0.35) and U = 8.3 (0.37). About 20 tubercles are present on the umbilicus at the maximum diameter.

Remarks: The above given rough measurements indicate that the umbilicus of the deformed shell is wider than the height of the whorl. The ribs are strongly arcuate, evidently retroversal. Morphology of this juvenile shell indicates affinity to the just mentioned, rather poorly known species. If the find did not come from a horizon where shells are tectonically affected to the degree that they cannot be precisely determined, no determination would be provided at all.

Distribution: According to Cecca (1995), *O.* aff. *detonii* occurs in the Apennines in the late Valanginian (Verrucosum Zone).

Occurrence: level 3, late Valanginian.

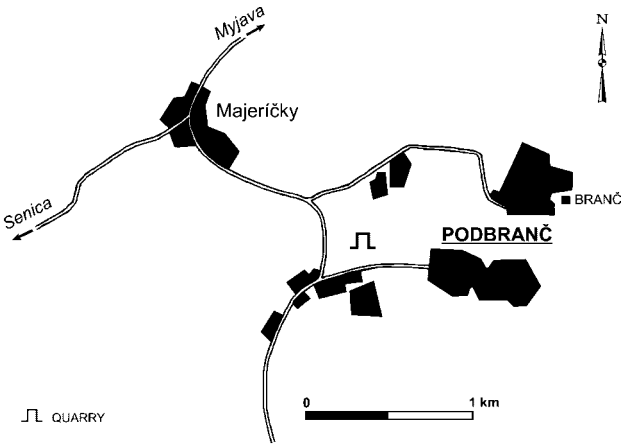

Fig. 2. Situation of the Podbranč quarry.

Family Holcodiscidae Spath, 1924
Genus *Jeanthieuloyites* Cooper, 1981

Type species: *Rogersites quinquestriatus* Besairie, 1936.

After Cooper (1981), it was Thieuloy et al. (1990) and Avram and Gradinaru (1993) who were concerned with the taxonomic position of the genus *Jeanthieuloyites*. We incline to the conclusions of Avram and Gradinaru who do not agree with Cooper's assignment of the genus to the family Olcostephanidae and who assign the genus to the family Holcodiscidae. For its originality, it is necessary to remind the idea of Avram and Gradinaru (1993) that the genus *Jeanthieuloyites* takes its rise from a boreal immigrant of the genus *Polyptychites* Pavlow, 1892 to the Tethyan area. This possible combination and systematic relationship of both the given genera are, among other matters, indicated especially by the rectangular shape of the first saddle of the adult suture-line. This is, in its own way, bipartite because the genus *Jeanthieuloyites* is closer to representatives of the family Polyptychitidae than to the families Olcostephanidae and Holcodiscidae in its suture-line.

The main generic features of *Jeanthieuloyites*, primarily in relation to the morphologically very close genus *Spitidiscus* Kilian, 1910, are tuberculate incrassate parts on virgatotome ribs on the umbilicus, a very narrow smooth zone in the siphonal area interrupting the course of ribbing on the external side and also the shape of the first lateral saddle of the suture-line. This is asymmetrically bipartite, and its outline is considerably wide and rather rectangular.

Jeanthieuloyites nodosus (Mandov, 1976)
Pl. I, Figs 3–5, Text-fig. 3

1976 *Spitidiscus nodosus* n. sp.; Mandov, p. 86, pl. 20, fig. 1, pl. 21, fig. 1
?1993 *Spitidiscus subquadratus* (Zwierzycki); Autran, pl. 1, fig. 9

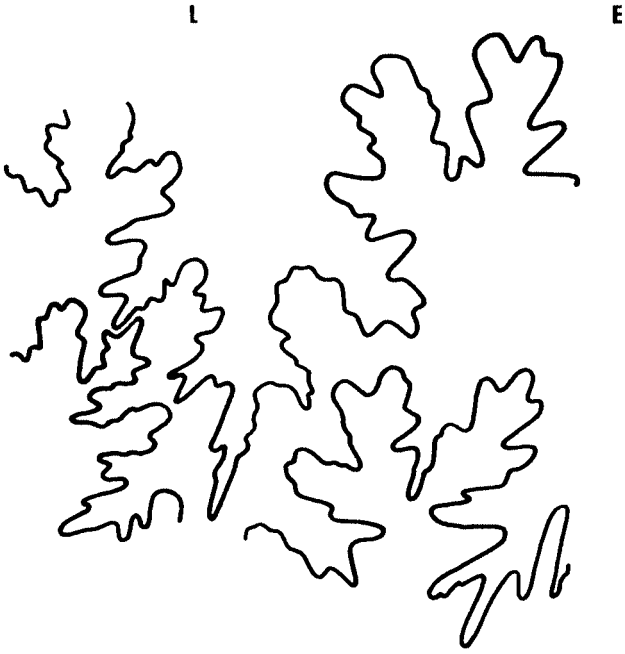

Fig. 3. Outer suture-line of *Jeanthieuloyites nodosus* (Mandov) at the whorl height of 16 mm. Spec. SNM Z 23001.

1995 *Jeanthieuloyites nodosus* (Mandov); Avram, p. 15, pl. 1, figs 3a, b, pl. 7, figs 2a, b (cum syn.)
1999 *Spitidiscus* cf. *rotula* (Sowerby); Vašíček & Michalík, fig. 6/6

Material: Six sculpture moulds deformed differently into the bedding surface and one steinkern with partly preserved suture-lines. Specimens SNM Z 23000, 23001 (steinkern) and 23002 are illustrated.

Description: Small- to medium-sized shells with a rather narrow umbilicus. Its real width is narrowed by deformation. The shells bear 6 constrictions on the last whorl. In the sector between 2 constrictions, 4 to 6 ribs reach as far as to the umbilicus. On the periphery of the limited sector, 12 to 14 ribs occur that are interrupted in a very narrow strip in the siphonal area. The ribs are of a complicated structure. Some of them run from the umbilicus in pairs. More frequently they join tuberculate elements to form a bundle of 3–7 ribs directly behind the above mentioned constrictions. The ribs bifurcate at various levels. Shorter ribs split manifold from the rib limiting the constrictions on the backside.

Suture-line. A rather weathered suture-line (text-fig. 3) is, in its forming the first lateral saddle, closer to the suture-lines of representatives of the genus *Jeanthieuloyites* (see e.g. Avram and Gradinaru 1993, pl. 2) than *Spitidiscus* (see e.g. Avram 1995, pl. 6).

Measurements: The largest shell (SNM Z 23002) has diameter D of about 55 mm, at D = 44.0 mm (between the major axes of deformation), H = 21.4 mm (0.485), U = 8.5 mm (0.19). At the maximum diameter of 55 mm, 38 peripheral ribs and 3 constrictions are present per half whorl. The least deformed specimen in our collection (SNM Z 23001) has at D = 32.6 mm, H = 14.00 (0.43), U = 8.2 (0.25) and W = 9.5 (0.29).

Remarks: Our material is represented by shells of smaller size compared to those illustrated in literature. The number of ribs between constrictions slowly decreases with the decreasing size of the Slovak shells. Merely 5 constrictions are developed on the smallest shell (D = 19 mm). The largest shell from the locality of Podbranč (Pl. I, fig. 5) is close especially to the shell designated as *Polyptychites Meneghinii* De Zigno in Rodighiero (1919, pl. 3, fig. 4). In accordance with Avram (1995) we assign this shell to *J. nodosus* (Mandov).

Tzankov and Breskovski (1985) erroneously did not recognize Mandov's species and put it into synonymy with *Spitidiscus meneghini* (Zigno in Rodighiero, 1919). The best preserved specimen of *S. meneghini* by Tzankov & Breskovski (1985, pl. 2, fig. 1) differs, however, markedly from *J. nodosus* in the higher number of constrictions. Tuberculate elements on the umbilicus of the mentioned species of Zigno also indicate the assignment of the above presented species to the genus *Jeanthieuloyites* and not to the genus *Spitidiscus.*

Distribution: According to Avram (1995), *J. nodosus* occurs in the late Valanginian (Codlea town area) and the early Hauterivian (Dambovicioara) in Rumania. Furthermore, it is known from the early Hauterivian of the Slovak Central Carpathians (locality of Butkov – Manín Unit), from Bulgaria and Italy.

Occurrence: level 1, sequence *a*, early Hauterivian.

Family Neocomitidae Salfeld, 1921
Subfamily Neocomitinae Salfeld, 1921
Genus *Teschenites* Thieuloy, 1971

Type species: *Hoplites neocomiensiformis* Uhlig, 1902.

Teschenites flucticulus Thieuloy, 1977
Pl. I, Figs 6, 7

?1986 *Neocomites (Teschenites)* cf. *jodariensis* (Douvillé); Vašíček & Michalík, p. 462, pl. 2, fig. 1
1996 *Teschenites flucticulus* (Thieuloy); Reboulet, p. 110, pl. 9, figs 1–8, 10–13, ?9, pl. 10, fig. 14 (cum syn.)

Material: 16 shells, usually imperfectly preserved, incomplete and deformed. SNM Z 23003–23006 belongs among best preserved shells.

Description: Involute shells of small to medium size. Umbilicus is narrow, slightly vaulted whorls are high. Phragmocone bears dense, thin ribs. They begin at small umbilical tubercles. They are subradial in the lower part of the whorl, and bend to the mouth on the periphery. The umbilical tubercles have the character of short spines running to the umbilicus at the boundary between the phragmocone and the body chamber. The ribs become strong and less dense there. This character is further emphasised on the body chamber. The umbilical spines are usually up

to 2 mm long. From them, sinuous ribs usually run in pairs. These ribs may even bifurcate in the lower part of the whorls at about half the height, or may be supplemented by simple inserted ribs. In the siphonal area, the ribs are sharply curved towards the mouth.

Measurements: H = 21.8 (0.47), U = 10.0 (0.22) at D = 46.00 mm (basically Dmax) between the axes of lateral deformation on the deformed shell of SNM Z 23004. In specimen SNM Z 23005, not deformed by lateral pressure and reaching the maximum diameter of 35 mm, H = 13.4 (0.49) and U = 5.8 (0.21) at D = 27.4 mm. According to the change in the sculpture, in one case also according to the preserved suture-lines, the boundary between the phragmocone and the body chamber is somewhere at the diameter of 25 to 30 mm. The body chambers are usually incomplete and usually occupy only about a half of the last whorl.

Remarks: According to the maximum diameters of the collected shells, all specimens possess microconchs. A comparison of *T. flucticulus* with related species was discussed in sufficient detail by Reboulet (1996); the closest relative of *T. subflucticulus* Reboulet, 1996 differs especially in a wider umbilicus (most frequently 0.29–0.33).

Distribution: According to Reboulet (1996), *T. flucticulus* occurs in the early Hauterivian (Radiatus Zone).

Occurrence: level 1, sequence *a,* early Hauterivian.

Genus *Sarasinella* Uhlig, 1905

Type species: *Hoplites ambiguus* Uhlig, 1902.

?Sarasinella sp.
Pl. I, Fig. 8, Text-fig. 4

Material: One considerably deformed steinkern; unclear and incomplete remains of the suture are obvious in several places of the phragmocone, elsewhere limonitized remains of the original shell (SNM Z 23007). Furthermore, three incomplete, strongly deformed shells are available, of which one is preserved as a sculpture mould (SNM Z 23008) and the others as moulds with partly preserved sutures, covered with remains of the original shell (SNM Z 23009–23010).

Description: Evolute shells whose whorls are either in contact, or only very slightly freely coiled. They are characterized by a wide umbilicus and not too high whorls. The most juvenile part of the incomplete phragmocone bears arcuate, rather strong, trituberculate main ribs. Ventrolateral tubercles are the most conspicuous. Two thin and simple inserted ribs are usually between them. Near the end of the phragmocone, the sculpture changes. Intervals between the main ribs and the number of inserted ribs increase. Some of the ribs run from the umbilicus in pairs. In spite of the considerably poor preservation of the siphonal area, which is strongly deformed, the ribs seem to be interrupted on the external side.

On the body chamber, occupying about half of the whorl, the ribs strengthen and become less dense. The main ribs remain, however, trituberculate; they are usually accentuated by accompanying shallow constrictions. Some of them bifurcate in the umbilical tubercles. The secondary ribs often run in pairs from the umbilical tubercles that are weaker than those on the main ribs. Some ribs sporadically bifurcate in the peripheral third of the whorl height. Near the mouth, the ribs are not interrupted in the siphonal area.

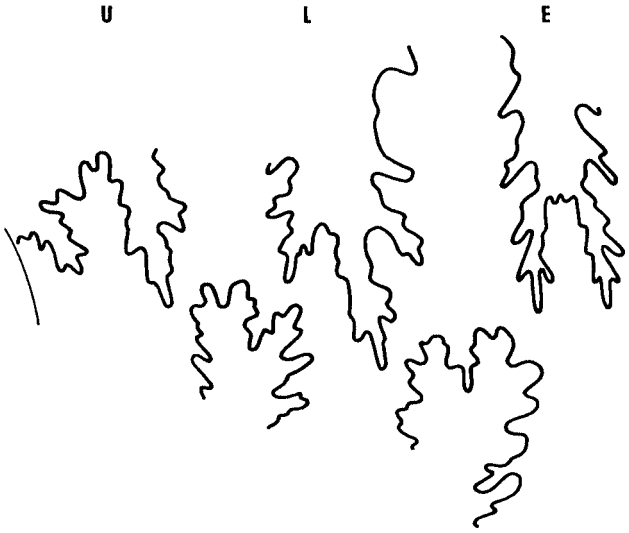

Fig. 4. Incomplete suture-line of *?Sarasinella* sp. at the whorl height of 12 mm. Spec. SNM Z 23007.

Measurements: H = 16.6 (0.35) and U = 20.4 (0.43) were measured on the most complete but deformed specimen (SNM Z 23007) at D = 47.8 mm. The maximum diameter of the shell reaches 49.5 mm.

Suture-line. Sutures are partly preserved in specimen 23007. The most complete display the highest part of external lobe E, lateral lobe L and a saddle between U and them. Lobe L is deep, rather symmetrical and markedly trifid (text-fig. 4).

Remarks: The adult suture-line is close to the suture of *Sarasinella varians* Uhlig, 1910 in the original picture by Uhlig. Other morphological features do not contradict the assignment to the genus *Sarasinella* either. A certain restriction can be represented merely by the stratigraphic position of the Slovak find (see below). However, as documented by Reboulet (1996), forms corresponding to the diagnosis of the genus *Sarasinella* or its related, hitherto not defined genus occur in the Vocontian Basin at the end of the Valanginian as well. These shells designated as *Sarasinella* n. sp. 1 (Reboulet, 1996, p. 72, pl. 23, figs 9, 10) are close, but not identical. The Slovak specimen differs from them in the presence of main trituberculate ribs on the body chamber, with still developed lateral tubercles. Moreover, ribbing in this area is less dense and stronger.

Distribution: As was indicated earlier, the genus *Sarasinella* dates to the early and lower late Valanginian and also to the uppermost Valanginian (more specifically in Reboulet, 1996). Some older finds, however, are not unambiguously stratigraphically dated.

Occurrence: level 1, sequence *a*, early Hauterivian.

Genus *Eleniceras* Breskovski, 1967

Type species: *Eleniceras stevrecensis* Breskovski, 1967.

Eleniceras nikolovi Breskovski, 1967
Pl. I, Fig. 9

1977 *Eleniceras nikolovi* Breskovski; Thieuloy, p. 107, pl. 4, fig. 6 (cum syn.)

Material: The only deformed, imperfectly preserved sculpture mould, in places with the remains of the limonitized original shell. Besides, impressions of both the sides of the shell are available as well (SNM Z 23011). Only the sculpture of the last whorl is preserved.

Description: A half-evolute, rather small shell with a diameter influenced by deformation. Juvenile whorls, if visible, bear thin ribs of neocomitid type. At the diameter of the shell of about 25 mm, the first constrictions can be observed and the main and secondary ribs can be distinguished. The ribs on the backside of the constrictions are trituberculate. In the lateral tubercle, the main rib bifurcates. In the interval between the main ribs, 2–3 secondary ribs are frequently present, that often bifurcate in pairs in the vicinity of the umbilicus. Umbilical tubercles are usually indicated.

Measurements: The specimen is squeezed into the bedding surface and also deformed by lateral pressure. The maximum diameter reaches 51 mm, between the major axes of deformation at D = 43.4 mm, H = 17.6 (0.405) and U = 13.6 (0.31). Six constrictions are visible on the last half of the last whorl.

Remarks: Although the sculpture mould is imperfectly preserved as a whole, its real sculpture can be easily reconstructed owing to the preserved impressions of the shell. The characteristics, in contrast to the other species of the genus *Eleniceras*, are the early onset of constrictions (at shell diameter of about 25 mm) and the bifurcation of main trituberculate ribs in the lateral tubercles. The specimen described is related most closely to the shell figured by Mandov (1976, pl. 16, fig. 2) that, in contrast to the Breskovski's holotype, also possesses preserved juvenile whorls.

Distribution: According to Thieuloy (1977), the mentioned species has been known only from the basal Hauterivian of Bulgaria and from France.

Occurrence: level 1, sequence *a*, early Hauterivian.

?Eleniceras transsylvanicum (Jekelius, 1915)
Pl. I, Fig. 10

1915 *Hoplites transsylvanicus* n. sp.; Jekelius, p. 121, pl. 9, figs 8, ?6
1960 *Neocomites transsylvanicus* (Jekelius); Nikolov, p. 186, pl. 23, fig. 7
1976 *Neocomites (Teschenites) transsylvanicus* (Jekelius); Mandov, p. 75, pl. 12, fig. 6
1993 *Eleniceras transsylvanicum* (Jekelius); Avram & Gradinaru, p. 678, pl. 6, fig. 2
1999 *Teschenites* cf. *castellanensiformis* Reboulet, Atrops & Autran; Vašíček & Michalík, fig. 6/5

Material: A sole, strongly deformed sculpture mould (SNM Z 23012).

Description: A small shell with a medium-narrow umbilicus. Ribs on the first whorls are thin, dense, and sinuous. They are usually arranged in pairs, beginning in small umbilical tubercles. In the final fourth of the last whorl, the ribs are relatively straight, notably stronger and less dense. The ribs start at umbilical tubercles, individually or in pairs. Some of the ribs even bifurcate at about one-half of the whorl height.

Measurements: The maximum diameter of the deformed shell is 41 mm. At D = 39.6 mm, H = 15.7 (0.40) and U = 10.8 (0.27).

Remarks: The assignment of the described shell to a genus is uncertain. Doubts are raised by the fact that the shell is incomplete and small in size. Juvenile whorls are neocomitid and lack constrictions. This may indicate the assignment to the genus *Teschenites*.

An early conspicuous change in ribbing at the end of the last whorl indicates the beginning of the body chamber. This fact and the straight course of end ribs better correspond to some microconchs of the genus *Eleniceras*; namely *E. transsylvanicum* or another related species. If this is really the case of an elenicerate, then merely *E. nikolovi* can be excluded probably from potential possibilities with regard to its early beginning of constrictions.

Distribution: Shells designated as *E. transsylvanicum* are usually considered to come from the basal Hauterivian. Avram and Gradinaru (1993) also stated the uppermost Valanginian.

Occurrence: level 1, sequence *a*, early Hauterivian.

Superfamily Desmoceratacеae Zittel, 1895
Family Desmoceratidae Zittel, 1895
Subfamily Barremitinae Breskovski, 1977
Genus *Barremites* Kilian, 1913

Type species: *Ammonites difficilis* d'Orbigny, 1841.

Barremites ex gr. *difficilis* (d'Orbigny, 1841)
Pl. III, Fig. 4

1841 *Ammonites difficilis,* d'Orb.; d'Orbigny, p. 135, pl. 41, figs 1, 2

Material: Two rather well preserved sculpture moulds (SNM Z 23013, 23014) and about ten fragments of shells.

Description: Medium-sized involute shells with faintly vaulted, high whorls and a narrow umbilicus. The umbilicus is separated from the sides of the whorl by an edge, followed by a steep umbilical wall. 6–7 proversal S-shaped constrictions are indicated on the last half-whorl; the remaining part of the shell is smooth.

Measurements: The most complete shell (SNM Z 23014) has a maximum diameter of 58.6 mm. At this diameter, H = 30.0 (0.51) and U = 9.7 (0.16).

Remarks: If we compare Delanoy's data on dimensions (1992) with the shells found at Podbranč, the latter probably represent juvenile stages and microconchs.

Distribution: This species, the definition of which is rather unclear, is usually considered early and late Barremian in age. Delanoy (1992) reported finds designated as *B.* gr. *difficilis* not only from the late Barremian, but also from the early Aptian.

Occurrence: level 1, sequence *d*, late Barremian.

Genus *Subsaynella* Spath, 1923

Type species: *Ammonites sayni* Paquier, 1901.

Subsaynella sayni (Paquier, 1901)
Pl. III, Fig. 2

1992 *Subsaynella sayni* (Paquier); Thieuloy & Bulot, p. 91, pl. 3, figs 6–13 (cum syn.)
1994 *Subsaynella sayni* (Paquier); Vašíček et al., p. 62, pl. 18, fig. 5
1999 *Subsaynella sayni* (Paquier); Vašíček & Michalík, fig. 7/4
2000 *Subsaynella sayni* (Paquier); Vašíček & Faupl, p. 601, pl. 3, figs 6–8

Material: Two sculpture moulds; one is juvenile (SNM Z 23015), the other adult, rather deformed (SNM Z 23016). The whole last whorl of the latter probably belongs to the body chamber.

Description: Almost involute shells with a narrow umbilicus, high and slightly vaulted whorls. On the periphery, juvenile whorls bear dense, clearly visible, arcuate ribs inclined to the mouth. These peripheral ribs gradually disappear on the body chamber. The sculpture is suppressed here into the shape of weak, rather sinuous little ribs observable from the periphery to the umbilicus.

Measurements: The adult shell (23016) has a maximum diameter of 50 mm. At D = 43.5 mm, H = 23.8 (0.55) and U = 4.4 (0.10).

Remarks: The larger, adult specimen differs from the typical material in a rather narrow umbilicus. The size of the shell and the clear peripheral sculpture in the species composition of the genus, however, correspond best to the determined species.

Distribution: Base of the late Hauterivian (Sayni Zone), especially in France. It has been recently reported also from the Eastern Alps and Western Carpathians.

Occurrence: level 1, basal part of sequence *b*, base of the late Hauterivian.

Subfamily Puzosiinae Spath, 1922
Genus *Abrytusites* Nikolov & Breskovski, 1969

Type species: *Pachydiscus neumayri* Haug, 1889.

Abrytusites julianyi (Honnorat-Bastide, 1890)
Pl. II, Figs 1, 2

1972 *Abrytusites julianyi* (Honnorat-Bastide); Thieuloy, p. 38, pl. 4, figs 1–3, text-fig. 4, figs k, l, m (cum syn.)
1999 *Abrytusites thieuloyi* Vašíček – Michalík; Vašíček & Michalík, fig. 7/2

Material: The only rather well preserved sculpture mould affected by deformation to the bedding surface and deformation due to lateral compression (SNM Z 23017). According to the character of the deformation, it can be judged that more than half of the last whorl belongs to the body chamber.

Description: A medium-sized half-evolute shell with a rather wide umbilicus and whorls of medium height. Vaulting of the sides, affected by deformation, indicates a continuous transition to the umbilicus, which is, however, limited by a blunt umbilical edge, as well as to the external side. Six main ribs are well developed on the last whorl. Their beginning at the umbilicus is somewhat incrassated. The ribs are slightly arcuate, vaulted towards the mouth. They are accentuated by shallow accompanying constrictions. About 10 thin inserted ribs occur in the sector between two main ribs. These can be best seen on the sides of the whorl and fade away towards the umbilicus and the external side. It seems that some of the inserted ribs were paired, with the pairs coming from the common point at the umbilicus.

Measurements: Despite taking measurements between major axes of deformation, the results are influenced not only by lateral compression, but also by deformation due to the load of the overburden. At D = 71.2 mm, H = 31.5 (0.44), U = 22.5 (0.32) and W = 18.0 (0.25). The maximum diameter of the shell reaches 81 mm (in the axis of elongation).

Remarks: The size of the umbilicus is strongly influenced by the deformation of the shell. The degree of deformation of the shell to the bedding surface can be estimated by the measurement of the whorl width that is smaller than whorl height (in our case W/D = 0.25). On non-deformed shells of the given species, the whorl width, however, always exceeds whorl height (Thieuloy 1972, p. 39).

A. thieuloyi Vašíček & Michalík, 1976 is a species close to *Abrytusites julianyi*. It differs from the latter especially in a higher number of constrictions (8 per whorl), a narrower umbilicus and also a rather more conspicuous sculpture.

Distribution: *A. julianyi,* according to Thieuloy (1972), has been hitherto known only from France, namely from the deposits of the higher early Hauterivian (Nodosoplicatum Zone, or the base of the Sayni Zone).

Occurrence: level 1, higher part of sequence *a*, higher early Hauterivian.

Suborder Ancyloceratina Wiedmann, 1960
Superfamily Ancyloceratacea Gill, 1871
Family Ancyloceratidae Gill, 1871
Genus *Crioceratites* Léveillé, 1837
Subgenus *Emericiceras* Sarkar, 1954

Type species: *Crioceratites emerici* Léveillé, 1837.

Crioceratites (Emericiceras) ex gr. *barremense* (Kilian, 1895)
Pl. III, Fig. 3

1992 *Emericiceras barremense* (Kilian); Delanoy, p. 52, pl. 19, figs 1, 2 (cum syn.)

Material: The only whorl of an imperfectly preserved sculpture mould of a juvenile specimen (SNM Z 23018).

Description: A slightly developed shell with vaulted whorls. The sculpture is preserved more perfectly only in the last half of the whorl. It consists of thin trituberculate main ribs that are, on the periphery, slightly inclined to the mouth. Tubercles on the main ribs are roughly equal at first. The main ribs begin to strengthen at the end of the whorl. Peripheral tubercles become stronger, too. One to two thin simple ribs are inserted between the main ribs.

Measurements: The maximum diameter of the shell is 41.00 mm. At D = 34.5 mm, H = 12.8 (0.37) and U = 16.2 (0.47).

Remarks: The sculpture and dimensional parameters correspond to juvenile shells of the group of *E. barremense*. This is a species that is (as documented by Delanoy, 1992) morphologically considerably variable.

Distribution: According to Delanoy (1992), typical representatives of *E. barremense* occur in the Barremense ammonite Zone (= Vandenheckei Zone), i.e. in the lower part of the late Barremian. The species has been known primarily from France, Rumania and maybe Bulgaria.

Occurrence: level 1, sequence *d*, late Barremian.

Genus *Pseudothurmannia* Spath, 1923

Type species: *Ammonites angulicostatus* d'Orbigny, 1841.

?Pseudothurmannia "binelli" Thomel, 1964, non Astier, 1851
Pl. II, Figs 6, 7

?1955 *Crioceras binelli* Astier; Sarkar, p. 57, pl. 2, fig. 6, non fig. 4 (= *Crioceratites binelli* Astier)
2000 *Pseudothurmannia (?Balearites) "binelli"* Thomel, non Astier; Vašíček & Faupl, p. 605, pl. 6, fig. 7 (cum syn.)

Material: Several tens of mostly imperfectly preserved sculpture moulds. In some of them, juvenile whorls are poorly preserved (SNM Z 23019, 23020).

Description: Shells coiled in an evolute to slightly open spiral. The diameter of the umbilicus roughly corresponds to the height of whorls. Juvenile whorls with tritubercule ribs, between which 1–2 thin tubercle-free ribs are later inserted. Small ventrolateral tubercles are present on most of the ribs. Lateral tubercles fade away at the diameter of about 10 mm. A section between the diameters of 10 mm and 20–25 mm bears thin, dense ribs. Tiny ventrolateral spines occur on all ribs. Periodical umbilical tubercles gradually become more evident here and pass into bullae. Then the ribs with the umbilical tubercles gradually approach the main ribs in their character. These are further accentuated even by slight constrictions that run on the backside of the main ribs. Between each two main ribs, 4–5 subsidiary ribs are usually present. They are thinner and of various length; sometimes they fork. On the body chamber, on shells with a diameter over 30 mm, the number of inserted ribs is up to doubled. Ventrolateral tubercles are obvious on the main ribs and only indicated on all subsidiary ribs. The ribs are flexuous.

Measurements: In specimen SNM Z 23020 with a partly preserved body chamber (phragmocone ends at shell diameter of about 25 mm), at the diameter D = 39.5 mm, H = 15.5 (0.40) and U = 15.0 (0.38). At this diameter, 8 main ribs are present per a half of the whorl. In specimen SNM Z 23019, at D = 36.0 mm, H = 13.0 (0.36) and U = 13.9 (0.39). Ten main ribs occur on the last half of the whorl.

Remarks: The holotype of *Crioceratites binelli* Astier, 1851, illustrated also by Sarkar (1955, pl. 2, fig. 4), shows that the original material differs conspicuously from *Crioceratites binelli* in Thomel (1964). The same conclusion was provided by a detailed analysis made by Hoedemaeker (1995), who assigned Thomel's material within the genus *Pseudodothurmannia*. On the other hand, another type specimen from Astier's collection illustrated by Sarkar (1955, pl. 2, fig. 6) is morphologically close to Thomel's material. (It has to be admitted that when retyping the reference to Sarkar's contribution in the synonymy in Vašíček and Faupl, 2000, typing errors occurred, being unfortunately contradictory to the facts stated above).

The new material from the locality of Podbranč documents that the shells, or at least a part of them, are not tightly coiled. However, the development of the shell is far from being obvious, although merely connected with the needful space for the location of very short ventrolateral spines. This development is not clear in shells squeezed to the bedding surface. Substantial morphological features are then markedly developed: main ribs from the diameter of about 25 mm and ventrolateral tubercles on all ribs of the adult shell, although these tubercles on inserted ribs are very small and can or cannot be preserved. The characteristics given above correspond to the illustration of the sculpture of Thomel's adult specimen (1964, pl. 3, fig. 2). The material described above is similar to the shells described from the Slovak locality of Lietavská Lúčka (in Vašíček et al. 1994).

A certain similarity of the Slovak material could be, according to the data by Hoedemaeker (1995), also found in *Crioceratites ibizensis* Wiedmann, 1962. Nevertheless, Nolan's holotype (1894) and frequent fibulation on early whorls, which is mentioned by Hoedemaeker (1995), are rather different from *Ps. binelli* sensu Thomel. After studying the type material including the related species, the shells of Thomel type will probably lead to the erection of a new genus and a new species in the future.

Distribution: According to Hoedemaeker (1995), the late Hauterivian (Balearis Zone and the lower part of the Angulicostata Zone) in southeastern France, in Spain

(Río Argos), in the Central Western Carpathians (Lietavská Lúčka), and in the Eastern Alps (Schneebergmulde).

Occurrence: level 1, sequence *c*, uppermost Hauterivian.

Family Hemihoplitidae Spath, 1924
Genus *Hemihoplites* Spath, 1924

Type species: *Ammonites feraudianus* d'Orbigny, 1841.

Hemihoplites soulieri (Matheron, 1878)
Pl. III, Fig. 6

1992 *Hemihoplites soulieri* (Matheron); Delanoy, p. 99, pl. 12, figs 3, 4 (cum syn.)
1997 *Hemihoplites soulieri* (Matheron); Delanoy, pl. 1, fig. 1

Material: A sole incomplete sculpture mould with partly visible inner whorls (SNM Z 23021).

Description: A medium-sized half-evolute shell with high, slightly vaulted whorls and with a rather broad umbilicus. The sides of the whorl pass in a continuous curve to a low, deep umbilical wall. The external side is rather narrow and rounded. Rather strong, mostly simple, at the umbilicus also partly bifurcated ribs are present on the inner whorls. Umbilical tubercles occur rather high on each rib on the oldest preserved whorls. Rather less dense, not much protruding ribs are evident on the fragment of the last whorl, which probably belongs to the body chamber. Most of them are simple, slightly inclined to the mouth, straight. In proximity of the external side, the ribs markedly bend forward, passing in an uninterrupted arc across the external side. Ribs bifurcated at the umbilicus or ribs bifurcating in the upper third of the whorl height are present subordinately. Small umbilical tubercles are obvious on all ribs above the umbilical wall, i.e. on the base of the whorl sides. Similar tubercles are also indicated on the transition from the lateral to the external side.

Measurements: The incomplete shell does not allow any precise measurements. It can be only estimated that it reaches the diameter of about 90 mm. At this diameter, 15 ribs at the umbilicus are present per a half of the whorl.

Remarks: A close species *Hemihoplites feraudianus* differs from *H. soulieri* in a more frequent bifurcation, or a more frequent insertion of ribs.

Distribution: *H. soulieri* has been identified with certainty only in France and the Northern Caucasus, namely in the late Barremian Feraudianus ammonite Zone.

Occurrence: level 1, sequence *d*, late Barremian.

Conclusions

Macrofauna was collected from the section and from debris below the quarry wall at level 1 of the Podbranč quarry in the deposits of the Pieniny Limestone Formation. With respect to the fact that the exposed strata are steeply inclined and mostly run normally to the quarry wall, finds in the debris roughly correspond to the position of strata in the wall. From bottom to top, 4 faunal zones rich in ammonites can be found in the Pieniny Limestone Formation exposed on the level 1 of the quarry. These zones correspond to sequences *a-d* as briefly described in the introduction.

The oldest fossiliferous Lower Cretaceous deposits at level 1 (sequence *a*) are exposed in the central part of the northern quarry wall. They are represented by grey to blue-grey clayey limestones. Ammonites are abundant. Originally they were pyritized or had a pyritized juvenile part. Now they are usually rusty-brown due to weathering to even completely decomposed to limonite. Sporadic belemnites, infrequent aptychi and random remains of urchins occur together with the ammonites.

Among ammonites, *Teschenites flucticulus* Thieuloy plays the most important role; *Jeanthieuloyites nodosus* (Mandov) is less abundant. *Bochianites oosteri* Sarasin et Schoendelmayer is also locally abundant. *Neolissoceras grasianum* (d'Orbigny), *Protetragonites quadrisulcatus* (d'Orbigny), *Lytoceras subfimbriatum* (d'Orbigny), *Crioceratites* sp., *Oosterella ondulata* Reboulet, *Eleniceras nikolovi* Breskovski, *?Eleniceras transsylvanicum* (Jekelius), *Abrytusites julianyi* (Honnorat-Bastide), *Neolissoceras desmoceratoides* Wiedmann, *Olcostephanus* sp., *?Sarasinella* sp. belong to less abundant to sporadic representatives. As for aptychi, *Lamellaptychus didayi* (Coquand) and *L. seranonis* (Coquand) are present.

From the stratigraphical point of view, ammonite species of the basal Hauterivian corresponding to the ammonite Radiatus Zone (especially *Teschenites flucticulus)* are the most abundant. According to data in literature, some of the determined species first appear already in the late Valanginian. However, all of them are famous for their existence even in the early Hauterivian. No purely Valanginian species was found. It is *Abrytusites julianyi* that belongs to the members of the higher early Hauterivian (Nodosoplicatum Zone). It can be therefore stated that the formation of grey limestones probably occupies the whole or almost whole of the early Hauterivian.

Light grey, in places even white-grey, or flesh-coloured limestones overlie the grey limestones, continuing on the northern wall to the east and passing to the eastern wall (sequence *b*); sometimes they are spotted or have higher clay content. In contrast with the grey limestones, they are much poorer in macrofauna. Pyritization of ammonites is developed only exceptionally. Infrequent ammonites, sporadic aptychi or belemnites are present.

As for the ammonites, *Subsaynella sayni* (Paquier), *Crioceratites* ex gr. *duvali* Léveillé, *Cr. nolani* (Kilian) – Pl. III, Fig. 1, *Ptychoceras meyrati* Ooster (Pl. I, Fig. 11), *Plesiospitidiscus* cf. *ligatus* (d'Orbigny) and *Phylloceras thetys* (d'Orbigny) – Pl. II, Fig. 4 – were successfully determined. The aptychi are represented by the group of

Lamellaptychus angulocostatus (Peters). The ammonites evidence the Sayni Zone and the Ligatus Zone (lower part of the late Hauterivian).

Other overlying, white-grey to flesh-coloured grey, spotted limestones with rare cherts (sequence *c*) are sporadically exposed in the southern continuation of the eastern wall. They contain a rich ammonite assemblage, almost exclusively represented by the same species, designated as *?Pseudothurmannia "binelli"* Thomel. *Crioceratites (Emericiceras)* sp., *Neolissoceras grasianum* (d'Orbigny) – Pl. II, Fig. 5 – and the only fragment of a straight shaft of a heteromorph occur exceptionally. Among aptychi, *Lamellaptychus angulocostatus* and a single rostrum of *Duvalia dilatata* (Blainville) were found. It is supposed that these deposits represent the uppermost Hauterivian, the Angulicostata Zone (probably only its lower part), thus being an equivalent of a the so-called pseudothurmannian horizon in the Mediterranean.

The next part of the stratal succession is exposed only very imperfectly. In marls, only frequent fragments of shells of the group of the genus *Barremites* were found, indicating the early Barremian age.

The last ammonites occur in the youngest Lower Cretaceous limestones (sequence *d*) in the eastern wall of level 1. *Barremites* ex gr. *difficis* (d'Orbigny) and also fragments of *Silesites seranonis* (d'Orbigny) – Pl. III, Fig. 5 – are common. *Crioceratites (Emericiceras)* ex gr. *barremense* (Kilian) and *Hemihoplites soulieri* (Matheron) were also found, in both cases in one specimen. The latter species proves the late Barremian age, the ammonite Feraudianus Zone.

Besides level 1, we also succeeded in finding Lower Cretaceous ammonites at level 2 (e.g. *Crioceratites* ex gr. *nolani* Kilian, *Olcostephanus* sp. in grey limestones of the early Hauterivian) and in several places at level 3. It has to be mentioned here that these fossiliferous layers were removed by quarrying later. One of the beds at level 3, having no equivalent at level 1, consisted of grey, clayey, cleaved limestones. Ammonites in these deposits were strongly tectonically affected and, with one exception, were undeterminable to the species level (and usually to genus level either). It is interesting that, with the exception of one section, no aptychi were found here. *Olcostephanus* cf. *detonii* (Rodighiero) described in the systematic part comes from this bed. In Italy its relatives occur in the late Valanginian (Verrucosum Zone). At the eastern end of level 3, an ammonite-rich bed was recorded with *Barremites* and *Silesites seranonis* equivalent to the youngest late Barremian ammonite bed at level 1.

All the species found at Podbranč represent ammonites of the warm Mediterranean faunal province. The species described in the taxonomic part and some other significant finds documenting the composition of the ammonite assemblage are shown on Plates I–III.

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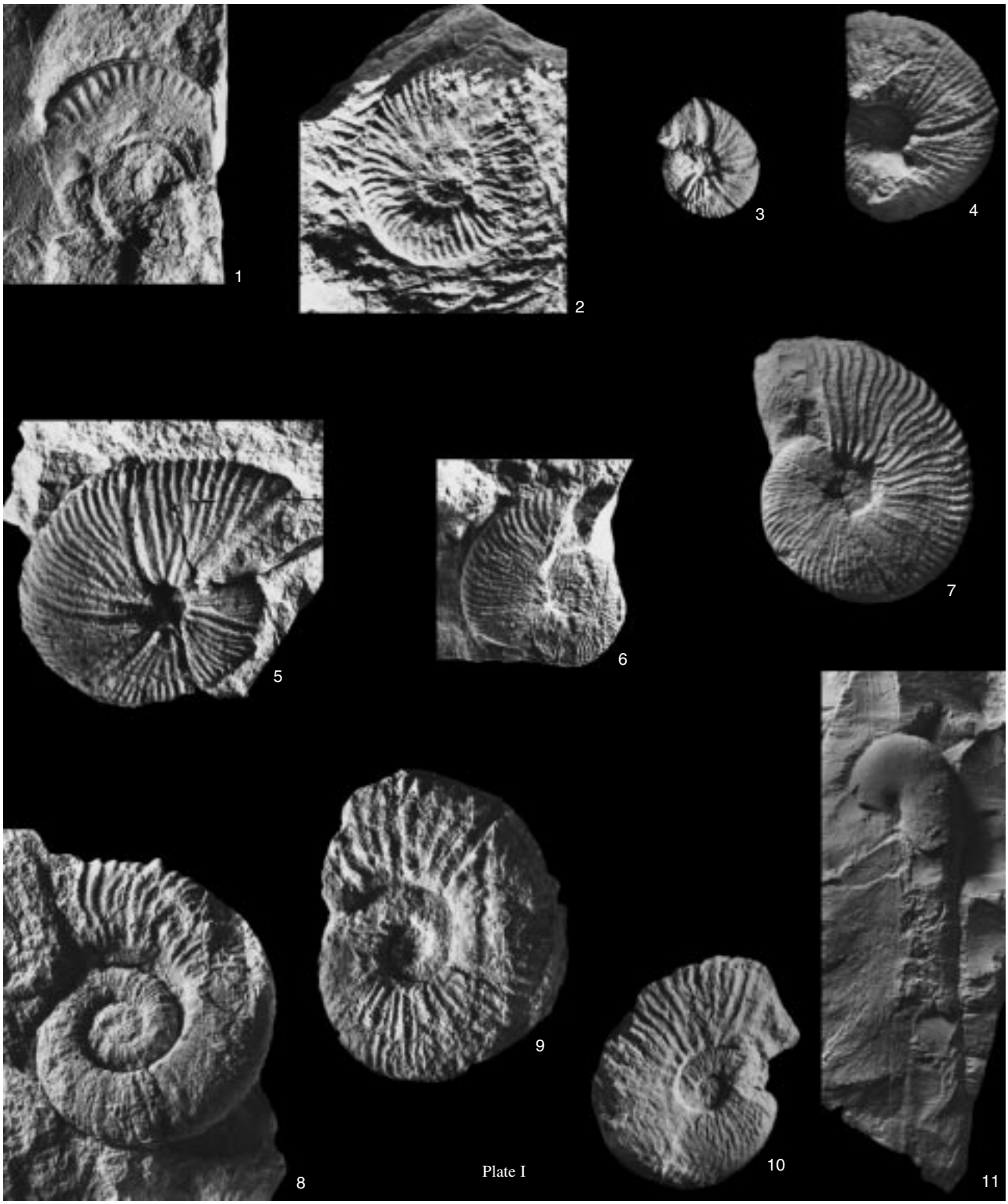
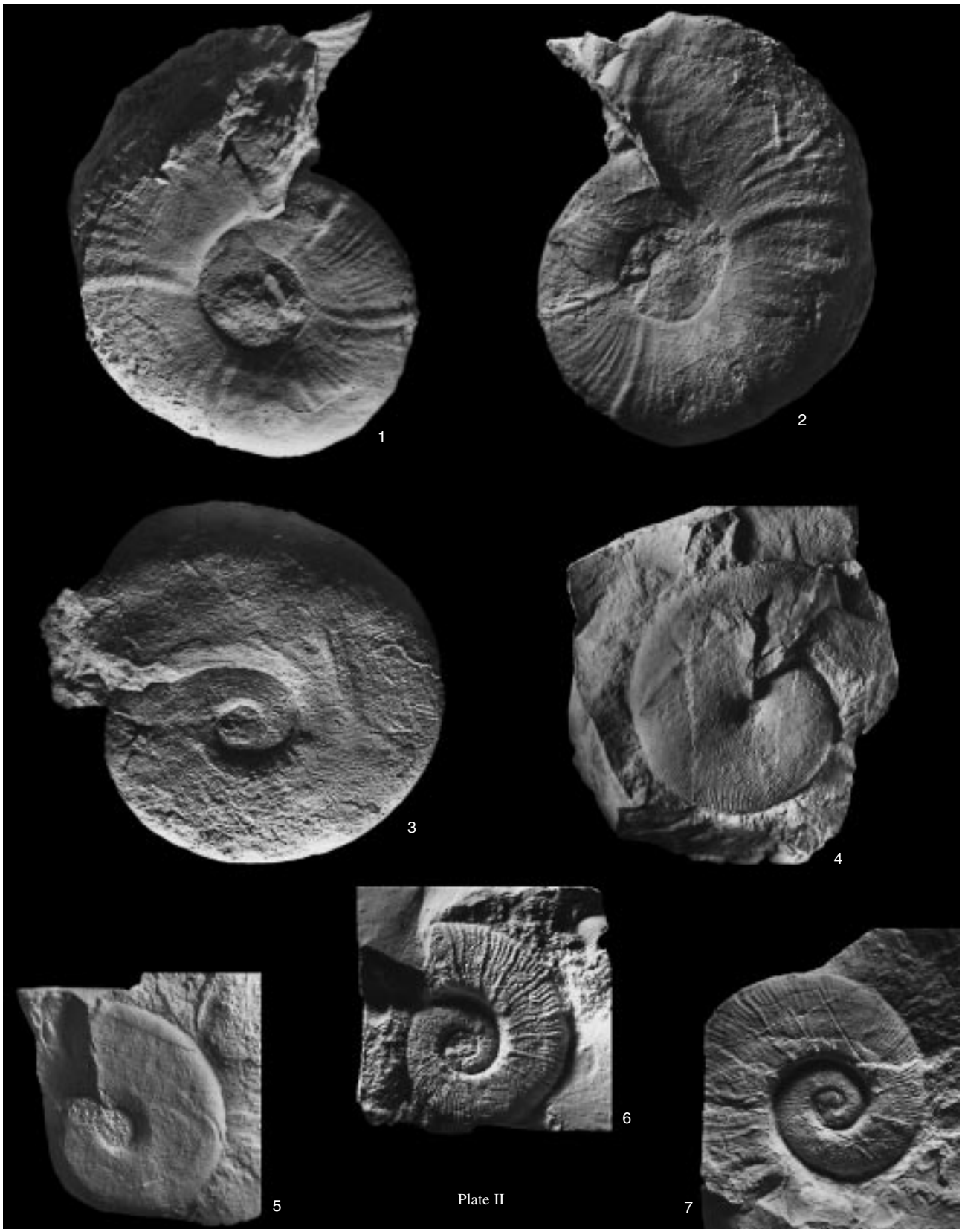
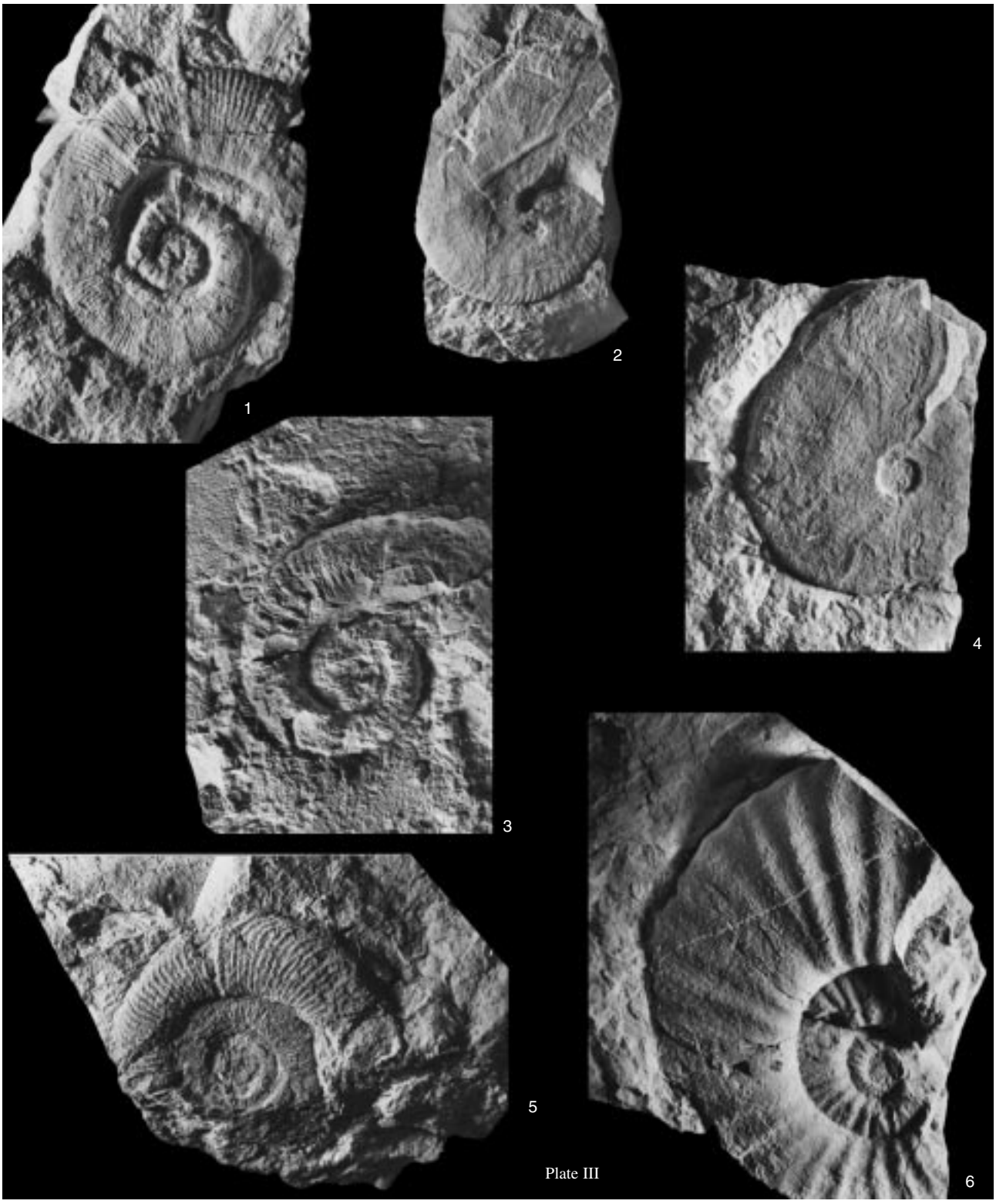


1. *Oosterella ondulata* Reboulet. Spec. SNM Z 22998. Early Hauterivian, level 1, sequence *a*.
2. *Olcostephanus* cf. *detonii* (Rodighiero). Spec. SNM Z 22999, x1.5. Late Valanginian, level 3.
3–5. *Jeanthieuloyites nodosus* (Mandov). 3 – juvenile specimen SNM Z 23000; 4 – specimen with partly preserved suture-lines – SNM Z 23001; 5 – adult specimen SNM Z 23002. Early Hauterivian, level 1, sequence *a*.
6, 7. *Teschenites flucticulus* Thieuloy. 6 – juvenile specimen SNM Z 23003; 7 – specimen SNM Z 23004. Early Hauterivian, level 1, sequence *a*.
8. *?Sarasinella* sp. Spec. SNM Z 23007 with partly preserved suture-lines. Early Hauterivian, level 1, sequence *a*.
9. *Eleniceras nikolovi* Breskovski. Spec. SNM Z 23011. Early Hauterivian, level 1, sequence *a*.
10. *?Eleniceras transsylvanicum* (Jekelius). Spec. SNM Z 23012. Early Hauterivian, level 1, sequence *a*.
11. *Ptychoceras meyrati* Ooster. Spec. SNM Z 23022. Late Hauterivian, level 1, sequence *b*.
All the specimens are in natural size with the exception of Fig. 2.



1, 2. *Abrytusites julianyi* (Honnorat-Bastide). Both sides of the same specimen SNM Z 23017. Early Hauterivian, level 1, sequence *a*.
3. *Neolissoceras desmoceratoides* Wiedmann. A deformed shell SNM Z 22997. Early Hauterivian, level 1, sequence *a*.
4. *Phylloceras (Hypophylloceras) thetys* (d'Orbigny). Spec. SNM Z 23022. Late Hauterivian, level 1, sequence *b*.
5. *Neolissoceras grasianum* (d'Orbigny). Spec. SNM Z 23023. Uppermost Hauterivian, level 1, sequence *c*.
6, 7. *?Pseudothurmannia "binelli"* Thomel. 6 – Spec. SNM Z 23019; 7 – spec. SNM Z 23020. Uppermost Hauterivian, level 1, sequence *c*.
All the specimens are in natural size.



1. *Crioceratites (C.) nolani* (Kilian). Spec. SNM Z 23024. Late Hauterivian, level 1, sequence *b*.
2. *Subsaynella sayni* (Paquier). Spec. SNM Z 23016. Late Hauterivian, level 1, sequence *b*.
3. *Crioceratites (Emericiceras)* ex gr. *barremense* (Kilian). An imperfectly preserved specimen SNM Z 23018. Late Barremian, level 1, sequence *d*.
4. *Barremites* ex gr. *difficilis* (d'Orbigny). Spec. SNM Z 23014. Late Barremian, level 1, sequence *d*.
5. *Silesites seranonis* (d'Orbigny). Spec. SNM Z 23025. Late Barremian, level 1, sequence *d*.
6. *Hemihoplites soulieri* (Matheron). Spec. SNM Z 23021. Late Barremian, level 1, sequence *d*.
All the specimens are in natural size.

Photos by K. Mezihoráková, University of Ostrava. Before taking the photos, the specimens were bleached by ammonium chloride. All the described material will be passed to the collections of the Slovak National Museum in Bratislava under inventory numbers SNM Z 22997–23025.