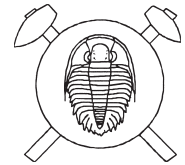


New occurrences of Lower Cretaceous ammonites in the western part of the Silesian Unit (Barremian – early Aptian, Outer Western Carpathians, Czech Republic)



Nové výskyty spodnokřídových amonitů v západní části slezské jednotky (barrem–spodní apt, vnější Západní Karpaty, Česká republika)

(2 Figs, 2 Plates, 1 Tab.)

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During the recent field research of the Silesian Unit, we have succeeded in obtaining a rather small collection of interesting and stratigraphically important Lower Cretaceous ammonites from the Hradiště Formation. Taxonomically, eight species have been processed, two of them being new species: *Anahamulina uhligi* and *A. pindulensis*. The ammonites described and their accompanying associations show the age from the higher early Barremian to the early Aptian.

Key words: Silesian Unit, Lower Cretaceous, Barremian, lowermost Aptian, ammonites.

Introduction

For a long time, considerable attention has been paid to the specific development of sedimentation in the Silesian Unit in the system of the Outer Western Carpathians, in which dark grey pelitic deposits with a rather rich macrofaunistic content dominate in the Lower Cretaceous in the basinal (Godula) development. Hohenegger (1855, 1861) presented the first fundamental knowledge; the latest results published come from the first years of this millennium. Biostratigraphically ammonites represent the most significant macrofaunistic component of the Silesian Unit. Their most frequent occurrences are in a higher part of the Hradiště Formation (Eliáš et al. 2003), i.e. the Barremian to lowermost Aptian period. Uhlig (1883) processed taxonomically more than 90 species of ammonites from deposits of this time period. More than 30 additional species from the Czech part of the Silesian Unit have been added by studies during the following years.

The Silesian Unit, or a nappe extending over the Czech and Polish territories, represents an area with rather high annual precipitation and thus a rich vegetation cover. Owing to this fact and a featureless morphology of the area underlain by soft Lower Cretaceous deposits, any long-lasting natural or artificial exposures are rare. These factors and the complicated nappe structure make determination of the accurate sequence of strata, and thus also the determination of the correct sequence of ammonite occurrences from bottom up, considerably difficult.

New field work conducted by the second author (P. S.) in the framework of his doctoral thesis, study of newly formed exposures due to the 1997 flood and the work connected with the Grant Agency project resulted in significant ammonite findings. These include stratigraphically important species and imperfectly known or new ammonite species.

All the new fossiliferous localities are in dark grey pelitic deposits of the Hradiště Formation.

The fossiliferous layers were continuously sampled for determination of non-calcareous dinoflagellates. The study of the dinoflagellate samples was conducted as part of work on the doctoral thesis (Skupien 1999) and partly in the frame of the mentioned grant project. Also, a small part of new ammonite findings has been taxonomically processed (Vašíček – Skupien 2002) in the course of work on the grant project.

Other, in the Silesian Unit still little known findings of specimens interesting for ammonite systematics (six species) and two newly determined species are described in this paper, following the prescribed procedure.

Localities and their contents of ammonites

Newly found localities are characterised according to the stratigraphic sequence from bottom up. Where possible, the localities are assigned to the level of ammonite zones according to the proposal from Lyon 2002 (Hoedemaeker, Reboulet et al. 2003). The topographic position of the localities and the bedding of fossiliferous layers are shown in Figs. 1 and 2. Due to easy weathering of pelitic deposits of the Hradiště Formation the outcrops deteriorate in a short time. This situation limits the potential of the localities as a permanent source of macrofauna remains.

1. Outcrops in the Lubina River below the Pindula Saddle

During the floods in the year 1997 pelitic deposits of the Hradiště Formation were considerably eroded in the bottom and banks of the upper course of the Lubina River flowing below the Pindula saddle (SE of Frenštát p. R.).

The largest exposure was uncovered about 500 m from the Pindula saddle near the confluence of the Lubina River with an unnamed perpendicular left tributary (Pi-3 zone), draining the eastern slope of the Kyčera mountain (altitude of 875.2 m). Additional fossiliferous localities are situated in the Lubina River in a zone about 150 to 200 m downstream of the confluence (Pi-2). Sporadic findings of fossils from the latter locality had been known for some time (Vašíček 1981 a).

One of the authors (F. Š.) in cooperation with a group of young researchers associated with the Administration of the Beskydy Protected Landscape Area collected a new set of ammonites as late as in autumn 1997. They obtained more than 30 mostly fragmentary ammonite shells in freshly uncovered exposures. In the stratigraphically lowermost part (Pi-2), characterised by the increased occurrence of ferruginous nodules, six ammonites belonging to the species *Partschiceras infundibulum* (d'Orbigny), *Hamulinites parvulus* (Uhlig) and *Anahamulina pindulensis* n. sp. have been found. In the year 1979 *Hamulina* ex gr. *astieriana* d'Orbigny, *Manoloviceras saharievae* (Manolov) and *Barremites* sp. have been found in the same place. According to the ammonite assemblage obtained, the layer with ferruginous nodules may be assigned to the higher early Barremian, probably to the higher part of the ammonite Compressissima Zone.

The presence of non-calcareous dinoflagellates *Casculosphaeridia magna* and *Nexosispinum vetusculum* and acritarch *Fromea quadrugata* in the horizon Pi-2 also indicates the early Barremian (Renéville – Raynaud 1981, Duxbury 1980).

Directly in the area of the confluence and several meters upstream (Pi-3), the following ammonites have been found: *Partschiceras infundibulum*, *Phylloceras* ex gr. *thetys* (d'Orbigny), *Lytoceras* ex gr. *densifimbriatum* Uhlig, *Protetragonites crebrisulcatus* (Uhlig), *Silesites vulpes* (Coquand), *Hamulina astieriana*, *Hamulina* cf. *astieriana*, *Anahamulina uhligi* n. sp., and a fragment of the shaft from the group of *?Acanthoptychoceras* aff. *spinatocostatum* (Manolov 1962). The fragment bears a sculpture similar to that of a specimen illustrated in Vašíček (1972 a, Pl. 6, Fig. 3). Dimitrova (1967) considers Manolov's species to be a synonym for *Hamulina mojsisovicsi* (Haug 1889), which is, however, not probable. The composition of this ammonite association occurring in proximity of the previous layer indicates a higher and somewhat younger part of the early Barremian (probably the ammonite Darsi Zone).

In this part a marked change in the composition of the dinocysts assemblage has been observed; the stratigraphically significant species *Oligosphaeridium perforatum* colum, *Palaeoperidinium cretaceum* and *Prolixosphaeridium parvispinum* occur here for the first time. This indicates an age somewhere near the early/late Barremian boundary (Duxbury 1980, Leereveld 1995).

2. Outcrops in the Frýdlantská Ondřejnice River near the Kunčice p. O. railway station

Two fossiliferous outcrops about 1 m in size are situated in the folded zone of pelites of the Hradiště Formation (Fig. 2). The first outcrop is correlated with those exposed some distance downstream (lower – KN-3), which were recorded earlier (Vašíček 1971). New collecting at this exposure yielded a rather rich group of ammonites, dominantly in an unfavourable state of preservation. The following species have been determined: *Phylloceras* ex gr. *thetys*, *Partschiceras infundibulum*, *Acantholytoceras longispinum* (Uhlig), *Costidiscus nodosostriatus* Uhlig, *Macroscephites binodosus* (Uhlig), *Anahamulina ptychoceroides* (Uhlig), *Anahamulina* sp., *?Hamulina* sp., *Barremites* sp. and *Patrulusiceras uhligi* Avram.

The assemblage of non-calcareous dinoflagellates is composed of *Achomosphaera neptunii*, *Cyclonephellium* spp., *Chlamydroporella* spp., *Dapsilidinium warrenii*, *Fromea amphora*, *Heslertonia heslertonensis*, *Hystrichodinium pulchrum*, *Hystrichosphaerina schindewolfii*, *Heterosphaeridium? heteracanthum*, *Kleithriasphaeridium corrugatum*, *K. eoinodes*, *Lithodinia stoveri*, *Muderongia neocomica*, *M. staurola*, *M. tabulata*, *Occisucysta tentoria*, *Odontochitina operculata*, *Oligosphaeridium? asterigerum*, *O. complex*, *O. dilucum*, *Palaeoperidinium cretaceum*, *Prolixosphaeridium parvispinum*, *Protoellipsoidinium spinosum*, *Spiniferites ramosus*, *Subtilisphaera perlucida*, *Systematophora* spp. and *Tanyosphaeridium boletus*. Significantly, the assemblage is characteristic of the late Barremian; the species *O. operculata* and *P. parvispinum* occurring in the ammonite Vandehackii Zone for the first time and the species *Muderongia staurola* in the ammonite Giraudi Zone for the last time (Below 1981, Leereveld 1997).

The second exposure (KNS-4), at which dark grey claystone alternates with fine-grained sandstones, is situated in the right bank about 120 m upstream from the first one, about 400 m south-east of the Kunčice p. O. railway station.

This claystone layer with a lower fossil content carries *Partschiceras infundibulum*, *Macroscephites yvani* (Puzos) and a well-preserved specimen of *Patrulusiceras uhligi* Avram. According to the occurrences of *P. uhligi* and representatives of the genera *Macroscephites* and *Costidiscus*, both the exposures belong to the deposits at the base of the late Barremian (ammonite Vandehackii Zone).

3. Outcrops of igneous rocks of the Teschenite Association with claystone layers in the Ostravice River at Kunčičky near Baška

A teschenite pyroxenite exposure more than 100 m long in the river bed and both the banks of the Ostravice River occurs about 900 m upstream from the bridge connecting



Fig. 1. A scheme of the geological setting, showing the nappe structure in study area.



Fig. 2. Topographic situation of the localities studied.

the Kunčičky and Baška villages. The exposure contains almost 2 m thick layers of dark grey calcareous claystones of the Hradiště Formation (BA locality), locally metamorphosed along the contact with teschenite. In the beds immediately underlying the igneous rocks, there is exposed a thrust plane separating the Silesian nappe from structurally lower Sub-Silesian nappe. Fragments of ammonites and small gastropods occur in one of the claystone layers. *Partschiceras infundibulum* and *Costidiscus rakusi* Uhlig are the best-preserved ammonites. The latter species indicates deposits at the early/late Barremian boundary.

4. Outcrop in the Bystrá Stream near Trojanovice

A natural exposure in the turn of the stream in the sliding left bank of the Bystrá stream (By) is situated 620 m ESE of the bridge across the Bystrá stream in the local part of Trojanovice village, Na Bystrém. Calcareous claystones with siltstones offered two incomplete ammonite findings: *Costidiscus recticostatus* (d'Orbigny) and *Macroscaphites yvani* (Puzos). Both the mentioned species occur in the late Barremian and can reach as far as the base of the Aptian.

5. Outcrops in the Na Pekliskách ravine

The spring area of an unnamed stream flowing to the north to Kunčice p. O. (left-hand tributary of the Tichávka River) occurs near Trojanovice. The place, a forked dingle in a tall forest about 600 m WNW of the elevation 578.2 m, is a ravine named Na Pekliskách (Pe). Undeterminable fragments of ammonites together with *Eulytoceras phestum* (Matheron) and *Costidiscus recticostatus* have been found at several places in this location. This information indicates a closer unspecified late Barremian age.

6. Outcrop in the Satina Stream near Malenovice

The outcrop is situated 200 m SSW of terminal of the bus line from Frýdlant n. O. to Malenovice, 1 km WSW of the elevation 711 m (Hradová). It is below a weir newly built across the Satina stream (SA) near the Malenovice village. Ten ammonite specimens have been collected in the outcrop, including *Partschiceras bontshevi* (Manolov), *Eulytoceras phestum*, *Costidiscus recticostatus* and *Pseudohaploceras liptoviense* (Zeuschner).

The presence of the last-mentioned species indicates the uppermost Barremian (ammonite Waagenoides Zone). In the assemblages of non-calcareous dinoflagellates, species *Aprobolocysta eilema*, *Cometodinium? whitei*, *Cribroperidinium conopinum*, *Dapsilidinium multispinosum*, *Florentinia laciniata*, *Kleithriasphaeridium eoinodes*, *Muderongia parviata*, *Tanyosphaeridium boletus* dominate. It is the species *Odontochitina operculata* and *Pro-*

lixosphaeridium parvispinum, the occurrences of which are known from the late Barremian, and are stratigraphically the most significant.

7. Outcrop in the Tichávka River at Kunčice p. O.

A natural outcrop in the left bank of the Tichávka River at Kunčice p. O., in the local part of Na huťarštví, is situated 300 m NW of the intersection of the Tichávka with the national road from Kunčice p. O. to Frenštát p. R. Skupien – Vašíček (2001) published the description of the locality and a part of the fauna collected; some of the ammonites from this locality were taxonomically processed in Vašíček – Skupien (2002). The locality designated as KN-11 provided more than 40 findings of fossils, dominantly of ammonites. Also, four small rostra of belemnites and two plant remains have been found.

The ammonite assemblage consists of *Partschiceras bontshevi* (Manolov), *Phylloceras* sp., *Eulytoceras phestum* (Matheron), *Lytoceras* sp., *Costidiscus recticostatus* (d'Orbigny), *Macroscaphites yvani* (Puzos), *Pseudohaploceras liptoviensis* (Zeuschner), *Barremites* sp., *Audouliceras fallauxi* (Uhlig), *Toxoceratoides karsteni* (Uhlig) and *Ptychoceras dittleri* Vašíček. According to the composition of the assemblage, the same age of the deposits as that for the previous locality may be considered. The composition of the association of non-calcareous dinoflagellates is given in Skupien – Vašíček (2001).

8. Zone of outcrops in the Ostravice River near the Ostravice village

The zone of outcrops almost one hundred meter long occurs in the river bed and the left bank of the Ostravice River near the southern margin of the football stadium in the Ostravice village (OS). This locality was briefly mentioned in Skupien et al. (2000). Dark grey, spotted claystones exposed in the river section carry in places up to 50 cm thick ferruginous nodules. One of bedding surfaces, 52 m downstream of the new metal bridge across the river, carried two fragments of ammonites and one rather complete shell. This shell belongs to *Deshayesites weissiformis* Bogdanova. The genus *Deshayesites* is limited to the early Aptian.

All the samples collected in this outcrop for study of non-calcareous dinoflagellates were barren of fossils.

Taxonomic part

As far as the basic system of ammonites is concerned, we respect the classification presented in the revised version of "Treatise on Invertebrate Palaeontology, Cretaceous Ammonoidea" by Wright et al. (1996). In contrast to the conception presented in Treatise, but in accord with the design of Vermeulen (2000), we class families Ptychoceratidae, Hamulinidae and Macroscaphitidae into a new superfamily Lytrococeratoidea Vermeulen.

When measuring spirally coiled shells, standard parameters are used that are expressed by the following symbols: D = shell diameter, Wh = whorl height, Uw = umbilicus width. The measurements are made at the accuracy of tenths of millimeters. In the brackets after Wh and Uw values, ratios of these values to the relevant diameter of the shell are given. With regard to the fact that the shells are always deformed into the bedding surfaces, in which they are crushed to a various degree, the widths of whorls could not be measured.

Order *Ammonitida* Zittel, 1884
 Suborder *Ammonitina* Hyatt, 1889
 Superfamily *Desmoceratoidea* Zittel, 1895
 Family *Silesitidae* Hyatt, 1900

Genus *Patrulusiceras* Avram, 1990

Type species: *Patrulusiceras crenelatum* Avram, 1990.

Patrulusiceras uhligi Avram, 1990

Plate 1, Fig. 1

1883 *Silesites* aff. *vulpes* Coq.; Uhlig, p. 237, Pl. 18, Fig. 2
 1990 *Patrulusiceras uhligi* n. g. n. sp.; Avram, p. 76, Text-fig. 2/
 14, Pl. 1, Figs 1, 2, Pl. 3, Figs 1–4
 1995 *Patrulusiceras uhligi* Avram; Avram, Pl. 18, Figs 1–3

Material: One specimen (B 13700) favourably preserved but crushed, with the rest of calcareous shell, and another shell (spec. B 13701) imperfectly preserved.

Description: Half-evolute shells with not high whorls. The inner whorls are most probably smooth, further they bear indications of fine ribbing. Constrictions accompanied by a strong rib on the front side are distinct. At the end of the penultimate whorl, thin, considerably dense ribs are developed between the constrictions. A part of the ribs mentioned fork at the umbilicus. As the last whorl shows, on the outer side the ribs fade away. In the final half of the last whorl, the ribs mentioned become sparse. Broad and shallow constrictions are accompanied by a strong rib on the front side that inclines markedly towards the mouth on the outer side.

Measurement: At the maximum diameter of 56.3 mm (spec. B 13700), the height of the whorl Wh is 19.7 (0.35) and Uw = 21.4 (0.38). These values are somewhat affected by deformation. On the last whorl, there are 5 constrictions. In the interval between the constrictions, 12–13 ribs occur; in the last interval merely 10 may be found.

Remarks: The coiling and the ribbing of the shell of *P. uhligi* resemble in some respect *Silesites vulpes* (Coquand). However, it differs from the last mentioned species in dimensional parameters, i.e., it has rather higher whorls and a narrower umbilicus and especially a higher number of ribs in the interval between two constrictions.

Distribution: Avram (1990, 1995) states the late Barremian of Rumania. According to Avram's strati-

graphic scheme (1990) in Text-fig. 3 one may deduce that *P. uhligi* occurs in the ammonite *Vandenheckii* Zone.

Occurrence: According to Uhlig's data (1883), *P. uhligi* occurs in the localities of Gorki Wielkie (Poland) and Nýdek. Our findings come from the locality of Kunčice p. O. (KN-3 and KNS-4). On the basis of the accompanying ammonite association, both close fossiliferous layers belong to the *Vandenheckii* Zone (basal late Barremian).

Suborder *Ancyloceratina* Wiedmann, 1966
 Superfamily *Lytocrioceratoidea* Vermeulen, 2000
 Family *Ptychoceratidae* Gill, 1871
 Genus *Ptychoceras* d'Orbigny, 1842

Type species: *Ptychoceras emericianum* d'Orbigny, 1842.

Ptychoceras dittleri Vašíček, 1972

Plate 2, Fig. 6

1973 *Ptychoceras dittleri* Vašíček; Vašíček, p. 60 (cum syn.)

Material: The single incomplete adult shell (spec. B 13702).

Description: As stated by Vašíček (1973), *P. dittleri* belongs to ptychoceratids, with which a complete shell consists of three shafts. The second shaft (retroversum) bears slightly curved, not very distinct ribs in the final part. The third shaft then bears only slightly unclear subhorizontal ribs.

Remarks: The size of the shells of *P. dittleri* is probably variable as indicated by the dimensions of the shell illustrated in Vašíček (1972 a, Pl. 10, Fig. 1) in comparison with the newly found specimen presented here in Pl. 1, Fig. 6.

Distribution: So far, *P. dittleri* has been with certainty known from the late Barremian and probably also from the early Aptian of the Silesian Unit.

Occurrence: Uppermost Barremian (ammonite *Waagenoides* Zone), exposure in the Tichávka at Kunčice p. O., horizon KN-11.

Family *Hamulinidae* Gill, 1871

Genus *Hamulina* d'Orbigny, 1850

Type species: *Hamulina astieriana* d'Orbigny, 1850.

Hamulina cf. *astieriana* d'Orbigny, 1850

Plate 2, Fig. 1

1852 *Hamulina Astieriana* d'Orb.; d'Orbigny, p. 216, Pl. 3, Figs 4–6

Material: A fragment of the straight first shaft (proversum) of a large hook-like shell and its impression (spec. B 13703).

Description: The shell bears thin dense, slightly S-curved ribs of two types: bituberculate to trituberculate main ribs and simple secondary ribs without any tu-

bercles. The ribs with tubercles are equally strong or only slightly stronger than the subsidiary ribs. The outer row of tubercles as well as central tubercles has round outlines; they are well developed on the main ribs. The inner tubercles are not clear on the more juvenile part of the shaft. They appear as slightly elongated tubercles only somewhere at the preserved end part of the fragment. The number of subsidiary ribs is variable. In the more juvenile part and in the more mature part there are 3 to 5 and 6 (maybe even more) subsidiary ribs, respectively. The preserved maximum height of the deformed shaft reaches about 40 mm.

Remarks: The sculpture of the fragment is close to *Hamulina astieriana* d'Orbigny. From typical specimens it differs by altogether thinner ribs and a rather higher number of ribs inserted. In our case, *Hamulina* cf. *astieriana* and *H. astieriana* occur in very close fossiliferous layers of the same locality. It is probable that this is the case of merely morphological variability in the framework of the same species. Besides, two shells depicted by Uhlig (1883, Pl. 10, Figs 2, 3) indicate this, when the shell in Fig. 2 resembles the specimen described by us. To compare thin and rather dense ribbing with *H. cf. astieriana*, we provide here the illustration of the fragment of *H. astieriana* (Pl. 2, Fig. 2) from the same locality that reaches shaft dimensions equivalent to the specimen described by us.

Distribution: *H. astieriana* is stated from the higher early Barremian (Thomel, 1964 gives the middle Barremian) from France; further from Switzerland, Hungary and the Northern Caucasus.

Occurrence: *Hamulina* cf. *astieriana* was found in the exposure in the Lubina River below the Pindula saddle immediately above the confluence with the nameless left-hand tributary (Pi-3) in the vicinity of the occurrence of *H. astieriana*. According to the accompanying ammonite association we may conclude that this is the case of the upper part of the early Barremian (ammonite Darsi Zone).

Genus *Anahamulina* Hyatt, 1900

Type species: *Hamulina subcylindrica* d'Orbigny, 1850.

The given genus still represents a cumulative name for the ribbed shells of the hook-like shape with not contacting two straight or bent shafts. The first juvenile shaft is designated by Vašíček (1972 a) as a proversum, the second, adult shaft as a retroversum. The shafts are interconnected through a bend designated a flexus. Ribs lack tubercles. The early juvenile part with all representatives described is always unknown.

The genus includes both shells that could reach, if preserved perfectly, the length of even 1 m, and miniature adult shells only a little more than 10 cm long. The shafts may be subparallel or open at various angles, even at a 45-degree angle. Most frequently the ribs are simple, but usually differently formed on the proversum and the ret-

roversum. On the flexus, a constriction may be developed, but not necessarily. The considerable variability in morphology probably corresponds to several natural genera. It is obvious that it would be reasonable to revise this genus. This will be, however, impeded by a shortage of suitable material, especially of complete shells and relatively sparse occurrences of the majority of the species altogether. A considerable part of the species described up to now are often represented merely by holotypes, often without sufficiently accurate stratigraphic data.

Anahamulina ptychoceroides (Uhlig, 1883)

Plate 2, Figs. 3, 4

1883 *Hamites* (*Hamulina*) *ptychoceroides* Hohenegger in coll.; Uhlig, p. 218, Pl. 14, Fig. 2

1973 *Anahamulina ptychoceroides* (Hohenegger in Uhlig); Vašíček, p. 59, Pl. 3, Fig. 3 (cum syn.)

Material: The only incomplete shell and its impression (spec. B 13705). The proversum is slightly deformed, the retroversum is crushed so that both the shafts contact.

Description: A small shell with shafts running close to each other. The proversum bears dense, thin, obliquely oriented ribs. On the flexus, a thin, but marked main rib dominates followed with five ribs. On the passing into the retroversum the degree of shell deformation changes significantly, which indicates the end of the phragmocone. The retroversum bears sparser, horizontally orientated ribs that are stronger than those on the proversum. The incomplete shell is only 15 mm long. In the flexus, the shell height is 5.5 mm.

Remarks: The detailed description and re-illustration of the holotype are given in Vašíček (1973), where a comparison of related species is presented as well. In contrast to our new finding, the holotype is rather stronger (height in the flexus of the holotype is 6.7 mm, while that of our shell is 5.5 mm).

Distribution: In addition to the Silesian Unit, *A. ptychoceroides* is known from SE France and south Spain. Company et al. (1995) evidence that in Spain the given species begins occurring in the uppermost part of the early Barremian and then occurs in the whole extent of the basal ammonite zone (*Vandenheckii*) in the late Barremian.

Occurrence: The lower outcrop at Frýdlantská Ondřejnice in Kunčice p. O. (KN-3). According to the accompanying ammonite association the exposure belongs to the basal late Barremian (*Vandenheckii* Zone).

Anahamulina uhligi n. sp.

Plate 1, Fig. 2

1883 *Hamulina* aff. *subcincta* n. sp.; Uhlig, p. 215, Pl. 13, Figs 4, 5

Holotype: *Hamulina* aff. *subcincta* in Uhlig (1883), Pl. 13, Fig. 4. It is deposited in the Fallaux collection in the Geological Survey of Austria, Vienna.

Type locality: Górki Wielkie (Gurek), Poland.

Type level: Barremian.

Derivatio nominis: In honour of V. Uhlig, a significant Austrian geologist and palaeontologist, who in spite of designating his material studied as a new species did not give it any species name.

Material: The only imperfectly preserved shell (spec. B 13706).

Diagnosis: A large shell with subparallel shafts. On the proversum, oblique, rather conspicuous ribs of the same type are developed. In the area of the flexus, rather strong ribs along both the sides accompany a constriction. On the retroversum there are simple, subhorizontal ribs.

Description: A shell large in size with rather outspread shafts. Ribs on the proversum are obliquely inclined, slightly curved, simple, of the uniform type. On the flexus the ribs are more markedly inclined being influenced by the bend. Some ribs are forked on its inner side. A constriction is evident that is accompanied by two strong ribs located in the passing of the flexus to the retroversum. Before the constriction, there is a section of thinner ribs. On the retroversum, the ribs are much stronger than on the proversum and run subhorizontally. The retroversum is ended with a constriction limited with a stronger and a thinner rib. This constriction indicates the mouth of the adult shell.

Measurement: With the illustrated specimen, the most favourably preserved part of the proversum is deformed less than the rest of the shell. The height of the shaft is 15.0 mm. In the flexus, the shell height is 17.5 mm. The retroversum is 115 mm long. Its height is about 21 mm in the mouth.

Remarks: As stated by Uhlig (1883), deformed Silesian specimens are very close to *Anahamulina subcineta* (Uhlig). The last-mentioned species is characterised primarily by a greater distance between both the shafts, more obliquely oriented ribs on the retroversum and the absence of the section with thinner ribs on the flexus. The specimen described here is close to the holotype and supplements the previous hypothesis by the total length of the retroversum, unknown as yet, and by the type of its sculpture around the mouth.

Distribution: So far, the new species has been known merely from the Barremian of the Polish part of the Silesian Unit.

Occurrence: The Czech finding comes from the Lubina River below the Pindula saddle, from exposures in the bottom, just in the confluence of the Lubina with a nameless left tributary (Pi-3). According to the accompanying ammonite association a higher part of the early Barremian may be considered (ammonite Darsi Zone).

***Anahamulina pindulensis* n. sp.**

Plate 1, Fig. 3

Holotype: *Anahamulina pindulensis* illustrated here in Pl. 1, Fig. 3. It will be deposited in the collections of the Museum of Ostrava.

Type locality: Natural outcrop in the Lubina River near of saddle Pindula.

Type level: Upper part of Lower Barremian.

Derivatio nominis: According to the significant saddle in Moravskoslezské Beskydy Mts., Pindula.

Material: Merely holotype (spec. B 13707), whose impression (negative) and several fragments corresponding to the positive are preserved better. The original shell is crushed. A juvenile part of the proversum and the flexus have not been preserved.

Diagnosis: Large hook-like shell with parallel shafts. At the beginning the proversum bears dense, thin, oblique, uniform ribs. Further, slightly stronger ribs appear on the proversum periodically being accompanied by occasional narrow constriction. In the vicinity of the flexus, the mentioned ribs and constrictions occur more frequently. Some ribs fork. The retroversum bears sparse, rather strong subhorizontal ribs.

Description: A large hook-like shell with straight parallel shafts that run rather close to each other. Only a small part of the flexus has been preserved. The proversum bears dense, thin ribs. The ribs are oblique and slightly convex towards the flexus. At the beginning, at the preserved more juvenile end, all ribs are simple, uniform. Further, somewhat wider, flat ribs appear periodically (about each 1 cm) that may be regarded as indistinct main ribs. They can be accompanied by a narrow, not deep constriction on the rear side. Sporadically inserted or simply forked ribs also occur on the outer side of the proversum. Towards the flexus, main ribs are indicated and constrictions are rather abundant. Close to the flexus, the mentioned elements are so numerous that there are merely 2–3 ribs in the interval between them. The main ribs are the most conspicuous on the inner side of the proversum where they appear as swollen ribs. The main ribs may fork at various shaft heights. At the beginning of the flexus, the ribs incline markedly towards the mouth.

The incomplete retroversum bears stronger subhorizontal ribs in the prevailing part of its height. The gaps between the ribs correspond to the rib width. In a narrow slice on the inner side of the retroversum, different ribbing occurs. The ribs of that place are much thinner and inclined.

A rather broader smooth zone precedes two more conspicuous ribs that form the end of the retroversum.

Measurement: A preserved maximum length of the shell reaches 205 mm. The supposed height of the un-preserved flexus may be about 20 mm. The retroversum height that has been affected by deformation is 23 mm at the mouth. According to the gradual narrowing of the proversum towards the juvenile end, one may deduce that the length of the complete shell could be from 400 to 500 mm.

Remarks: The new species belongs to anahamulinids of a rather large size. Despite the considerable size, the species is characterised by thin, dense ribs, developed constrictions, indicated main ribs, or the occasional bifurcation of ribs on the proversum. With reference to the fact that the flexus has not been preserved, we do not know unfortunately, whether or not the constriction could develop on the flexus.

Mainly by the presence of constrictions on the proversum, *Anahamulina cineta* (d'Orbigny) and *A. fumisugium* (Uhlig) belong to a related species. With the former species, constrictions are developed on the retroversum as well. Both the species differ markedly from *A. pindu-*

lensis by uniform, simple, stronger and more sparsely distributed ribs on their provera.

Similarly formed oblique ribs on the provera and subhorizontal ribs on the retrovera occur also with other species figured by Uhlig (1883) that are related from the point of view of the size. They are *Anahamulina uhligi* n. sp. designated by Uhlig as *Hamulina* aff. *subcincta* (Pl. 13, Figs 4, 5) and *Hamulina* n. sp. ind. (Pl. 13, Fig. 1). The former differs from the new species by sparser, stronger and simple ribs on the provera; the latter differs by having both the shafts running closely to each other. The last-mentioned species that has not been given any name yet, is remarkable for thin ribs on its provera that resemble the ribs of *A. pindulensis*. However, in Uhlig's figure of *H.* n. sp. ind., merely simple ribs of the uniform type can be observed in the whole run.

Occurrence: *A. pindulensis* was found in the zone of ferruginous nodules below the confluence of the Lubina and the nameless left tributary (Pi-2). According to accompanying ammonites the higher part of the early Barremian (Compressissima Zone) may be considered.

Family Macroscaphitidae Hyatt, 1900

Avram (1984) formulated an interesting idea that genera *Macroscaphites* Meek, 1876 and *Costidiscus* Uhlig, 1882 represented a dimorphic pair. Among other matters, he evidenced this fact by the examples of 5 pair species. The genera *Macroscaphites* and *Costidiscus* represented microconchs and macroconchs, respectively. Wright et al. (1996) already stated the genus *Costidiscus* as a synonym for the genus *Macroscaphites*.

However, Vermeulen (2000) presented a different hypothesis, according to which representatives of the family Macroscaphitidae developed in two parallel evolutionary lines (see tab. 1 by Vermeulen, 2000):

- from the evolutionary line of *Lytocrioceras*, *Macroscaphites* and *Rugacrioceras* developed;
- from the line of *Acantholytoceras*, *Costidiscus* divorced itself. From the given source the genera composition of the family Macroscaphitidae in the Barremian and the genus independence of *Costidiscus* then follow. Vermeulen argues against Avram's theory on dimorphic pairs by saying that, among other matters, the other part of the dimorphic pair of the genus *Costidiscus* is not known for the oldest representative of the genus *Macroscaphites*, i.e. *M. tirolensis* Uhlig that already appears in the uppermost part of the early Barremian, because the oldest representatives of *Costidiscus* are usually recorded only since the late Barremian.

However, Company et al. (1995) state in their contribution that in the upper part of the ammonite Moutonianum Zone (the uppermost ammonite zone of the early Barremian) covering also approximately the ammonite horizon with *Macroscaphites tirolensis* by Vermeulen (1998), *Costidiscus rakusi* Uhlig begins to occur.

Vermeulen (2000), with regard to his previous opinions, analysed in detail not only the evolution of Macroscaphitidae, but also their origin, classification and taxonomic position. His evolution hypothesis is based especially on stratigraphy; some important connecting links that would confirm the validity of the lines constructed are, however, still missing.

Genus *Costidiscus* Uhlig, 1882

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

Costidiscus rakusi Uhlig, 1883

Plate 1, Fig. 4

1883 *Lytoceras (Costidiscus) Rakusi* n. sp.; Uhlig, p. 196, Pl. 8, Fig. 5

1984 *Costidiscus rakusi* Uhlig; Avram, p. 70, Text-fig. 4a

Material: The only, partly waterworn, deformed shell having, essentially, the only preserved subadult whorl (spec. B 13 708).

Description: Evolute shell with vaulted whorls. The whorl bears dense ribs slightly curved towards the mouth. The majority of the ribs run in bundles of 2 to 3 ribs from conspicuous umbilical tubercles. One of the ribs of the bundle forks in the vicinity of the tubercles. The ribs of the bundles, or at least one of them, are stronger at the tubercles; however, on the periphery all the ribs are equally strong. The space between the tubercles is usually rather depressed in the vicinity of the umbilicus. In the spaces between the tubercles, there are one or two simple ribs. At the deformed diameter of the shell of 58 mm, 13 umbilical tubercles fall per half-whorl.

Remarks: Similar umbilical tubercles as those of *C. rakusi* occur with *Costidiscus nodosostriatus* Uhlig. That, however, lacks both the swelling of ribs in the bundle at the umbilicus and the depression between them; the number of umbilical tubercles per whorl is evidently higher.

Distribution: *C. rakusi* in the Silesian Unit belongs to very rare species (after Uhlig, 1883 known merely from the locality of Straconka in Poland). Its exact stratigraphic position in the Silesian Unit has not been known. Avram (1984) states this species from Rumania from the basal part of the late Barremian. Company et al. (1995) state that in Spain *C. rakusi* reaches from the higher part of the ammonite Moutonianum (uppermost early Barremian) to the basal ammonite zone of the late Barremian, i.e. Vandenheckii Zone.

Occurrence: One of claystone layers affected by contact metamorphism in exposures of teschenite in the Ostravice River in the vicinity of Kunčičky near Baška (BA locality). On the basis of the above-mentioned data in Company et al. (1995) it is possible to suppose that the sediments affected belong to the deposits occurring along the boundary between the early and the late Barremian.

Superfamily *Deshayesitoidea* Stoyanow, 1949

Family *Deshayesitidae* Stoyanow, 1949

Genus *Deshayesites* Kazansky, 1914

Type species: *Ammonites deshayesi* Leymerie in d'Orbigny, 1840.

Deshayesites weissiformis Bogdanova, 1983

Plate 2, Fig. 7

1883 *Hoplites Borowae*; Uhlig, Pl. 21, Fig. 1, ?Pl. 20, Fig. 11, non Pl. 20, Fig. 5 (= *Deshayesites borowae* Uhlig)

1973 *Deshayesites beskidensis* (Uhlig); Vašíček, Pl. 3, Fig. 2, non Fig. 1 (= *Deshayesites beskidensis* Uhlig)

1983 *Deshayesites weissiformis* sp. nov.; Bogdanova, p. 134, Pl. 2, Figs. 1–3, Pl. 3, Fig. 7, Text-figs. 3, 4

1999 *Deshayesites weissiformis* Bogdanova; Avram, p. 440, Figs 3 A, E (cum syn.)

? 1999 *Deshayesites weissiformis* Bogdanova; Ropolo et al., p. 179, Pl. 18, Fig. 3

Material: The only original, but heavily crushed shell (spec. B 13709).

Description: A large half-involute shell with high whorls, flat flanks and a rather narrow umbilicus. Rather dense, slightly curved ribs begin at the umbilicus by indicated umbilical tubercles. About at the half-height of the whorl, the majority of ribs begin at the umbilicus fork. Another forking, or inserting of individual ribs, occurs in the peripheral quarter of the shell.

Measurement: The shell reaches the maximum diameter of about 100 mm. At the diameter $D = 88$ mm (affected by deformation), $Wh = 43.5$ (0.49) and $Uw = 14.8$ (0.17). At $D = 92$ mm, 13 ribs reaching as far as the umbilicus and 39 ribs along the periphery fall per half of the whorl.

Remarks: When revising a part of Uhlig's material, Vašíček (1973) assumed wrongly that juvenile whorls of the largest of specimens depicted by Uhlig (1883, Pl. 21, Fig. 1) bore a sculpture corresponding to that of *Deshayesites beskidensis* (Uhlig), and for this reason he assigned it to the synonymy of the last mentioned species. According to the density of ribbing and the double forking of ribs, Avram (1999) assigned justifiably the mentioned shell to *D. weissiformis*.

D. weissiformis is also described by Ropolo et al. (1999). The specimen described by them has, however, a wide umbilicus and rather simple ribs so that the assignment of the shown specimen to *D. weissiformis* cannot be taken as final.

Distribution: Bogdanova (1983) states *D. weissiformis* from the lowermost Aptian (Turkyricus Zone) in Turkmenistan, Avram (1999) states the early Aptian in Rumania, English Forbesi Zone, it means probably from rather younger deposits than the Tuarkyricus Zone. At the session of the Subcommittee for Lower Cretaceous Ammonite Stratigraphy in Lyon (July 2002), N. Raisossadat assigned *D. weissiformis* to the ammonite Oglanlensis Zone (= Tuarkyricus).

Occurrence: The exposure is in the Ostravice River near the Ostravice village, most likely the lowermost early Aptian. The specimen of Uhlig (1883, Pl. 21, Fig. 1) should come from the locality of Malenovice.

Conclusion

The isolated Lower Cretaceous localities of the Silesian Unit, represented mostly by sporadic ammonite horizons, do not usually enable an unambiguous stratigraphic assignment to the level of ammonite zones. This situation is a result of several factors mentioned in the introduction and also of the fact that in the Barremian and the early Aptian of the Silesian Unit, zone species of ammonites are missing in principle. This concerns especially representatives of the significant families Pulchelliidae, Heteroceratidae, Deshayesitidae, and others.

For this reason, the stratigraphic position and the sequence of Barremian and early Aptian ammonite associations in the sequence of strata of the Silesian Unit, at least in the course of the last decades, have been derived primarily from biostratigraphic data in the literature. The interpretation is based on data from some regions of the Mediterranean bioprovince, where collections were carried out by using the bed-by-bed method (e.g., Company et al. 1995, Delanoy 1995, and others).

The present study based on new ammonite collections, in virtue of latest published knowledge, deals with the assignment of horizons rather rich in ammonites to the level of ammonite zones of the Mediterranean region. The division of the Barremian and the lowermost Aptian of this part of the Silesian Unit into ammonite zones is applied in accordance with the conclusions from the session of Lower Cretaceous specialists in Lyon in July 2002 (Hoedemaeker, Reboulet et al. 2003). However, it is necessary to emphasise that with regard to a negligible representation of zone ammonites, this division is not ideal for the Silesian Unit.

In the framework of localities described here, findings coming from three ammonite horizons of the exposures in the Lubina River are stratigraphically the most significant. With respect to the previous favourable exposure of a longer continuous section in the riverbed, it is clear that the sequence of strata found is normal and in accordance with the law of superposition. In the lower faunistic horizons (Pi-1 and 2) representatives of the genus *Hamulinites* occur together with *Silesites vulpes* (Coquand); in the overlying horizon Pi-3, that is much richer in findings, they occur no more.

In the Silesian Unit, similar and usually richer ammonite assemblages than those in the horizons Pi-1 and Pi-2 are described from other localities studied earlier: Tichá-9 (Vašíček 1971), Nýdek-6 (Vašíček 1972 b), Pindula-1 and Ostravice-5 – sawmill (Vašíček 1981 a, b), Frenštát – Trojanovice Mine (Vašíček 1990) and Soběšovice (Vašíček – Klajmon 1998). These localities have usually been assigned to the early Barremian without any

closer specification, or in the last case to the ammonite zone with *Holcodiscus caillaudianus*.

The common feature of them, among others, is the fact that in all the mentioned localities imperfectly preserved holcodiscids with marked tubercles on ribs always occur in addition to leptoceratoids. However, representatives of the family Pulchelliidae occur only exceptionally.

The most complete, although considerably deformed pulchelliid shell from the given group of exposures, with which a siphonal region cannot be unfortunately seen, comes from the locality of Ostravice – sawmill. It was determined as *Nicklesia cf. pulchella* (d'Orb.) and is illustrated in Vašíček (1979, Pl. 1, Fig. 5). With regard to its imperfect preservation, when the formation of the siphonal region is not known, an alternative determination as *Kotetishvilia compressissima* (d'Orb.) can be considered. That is why we suppose that all the above-mentioned early Barremian localities together with the horizons Pi-1 and Pi-2 can be assigned to the ammonite zone with *Nicklesia pulchella*, or to the zone with *Kotetishvilia compressissima*.

The overlying horizon Pi-3 with *Silesites vulpes*, hamulinids and anahamulinids that still lacks costidiscids is assigned to the uppermost early Barremian ammonite zone with *Coronites darsi*.

New collections in the exposures in Frýdlantská Ondřejnice River near Kunčice p. O. are characterised, in addition to representatives of the genus *Anahamulina*, by the richer occurrence of representatives of *Costidiscus* and *Macroscaphites* (e.g. *M. binodosus* Uhlig – see Pl. 2, Fig. 5) and also *Patrulusiceras uhligi*. According to the last-mentioned species and the total composition of the ammonite association it is possible to assign the given locality to the late Barremian ammonite zone with *Ancyloceras vandenheckii*.

Some of the localities described here provided merely sporadic ammonite findings, which do not enable assignment to the level of ammonite zones. In this respect, findings at the localities in the Satina stream near Malenovice (SA) and the Tichávka River at Kunčice p. O. (KN-11) are exceptions. *Pseudohaploceras liptoviense*, *Audouliceras fallauxi*, *Toxoceratoides karsteni*, *Ptychoceras dittleri* and abundant representatives of the genera *Costidiscus* and *Macroscaphites* occur here. On the other hand, no representatives of the *Deshayesites* genera (that are, however, very rare in the Silesian Unit) and *Procheloniceras* representing the early Aptian have been found. On the basis of the presented facts we suppose that the mentioned assemblage belongs to the uppermost Barremian, probably to the newly determined *Pseudocrioceras waagenoides* ammonite zone.

The finding of *Deshayesites weissiformis* in the left bank of the Ostravice River near Ostravice corresponds to the early Aptian, most probably to the ammonite zone with *Deshayesites oglanlensis* that replaces the previous zone with *Deshayesites tuarkyricus* at the base of the Aptian.

At some of the ammonite localities described here, rich assemblages of non-calcareous dinoflagellates occur too.

Their composition supports, or does not contradict, any of the ammonite zones determined. Contrary to the results presented recently in Table 1 by Skupien – Vašíček (2002), showing Barremian-Aptian ammonite zones evidenced (Hoedemaeker et al. 1993) in the Silesian Unit and the corresponding associations of dinocysts, we may add that thanks to the locality of Frýdlantská Ondřejnice a basal ammonite zone of the late Barremian with *Ancyloceras vandenheckii* is newly evidenced in the given unit on the base of ammonites.

Ammonite zones evidenced at the described localities are given in Table 1. The new zone division introduced in the Lyon meeting (Hoedemaeker, Reboulet et al. 2003) is shown in Table 1 together with the previously used division of zones. The new zone division does not change, in principal, either the knowledge of compositions of ammonite associations in the Silesian Unit, or the knowledge of dinocysts assemblages and trends in their percentage compositions, their applications to the palaeoenvironment and depth conditions in the Silesian sedimentary basin (Skupien – Vašíček 2002).

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Nové výskyty spodnokřídových amonitů v západní části slezské jednotky (barrem–spodní apt, vnější Západní Karpaty, Česká republika)

Při nedávném terénním výzkumu slezské jednotky se nám v hradištském souvrství podařilo nasbírat menší kolekci zajímavých a stratigraficky významných spodnokřídových amonitů. Taxonomicky je zpracováno 8 druhů, přičemž dva z nich jsou druhy nové: *Anahamulina uhligi* a *A. pindulensis*. Popsání amonitů a jejich doprovodné asociace prokazují stáří od vyššího časného barremu do raného aptu.

Explanations of Plates

Plate I

- 1 – *Patrulusiceras uhligi* Avram. Spec. B 13700. Base of late Barremian, outcrop KNS4 at Frýdlantská Ondřejnice River near Kunčice p. O.
- 2 – *Anahamulina uhligi* n. sp. Spec. B 13706. Uppermost part of early Barremian, outcrop Pi-3 in the Lubina River below the Pindula Saddle near Frenštát p. R.
- 3 – *Anahamulina pindulensis* n. sp. Holotype, spec. B 13707. Higher early Barremian, outcrop Pi-2 in the Lubina River below the Pindula Saddle.
- 4 – *Costidiscus rakusi* Uhlig. Spec. B 13708. Deposits along the early/late Barremian boundary, outcrop in the Ostravice River near Kunčičky near Baška (BA).

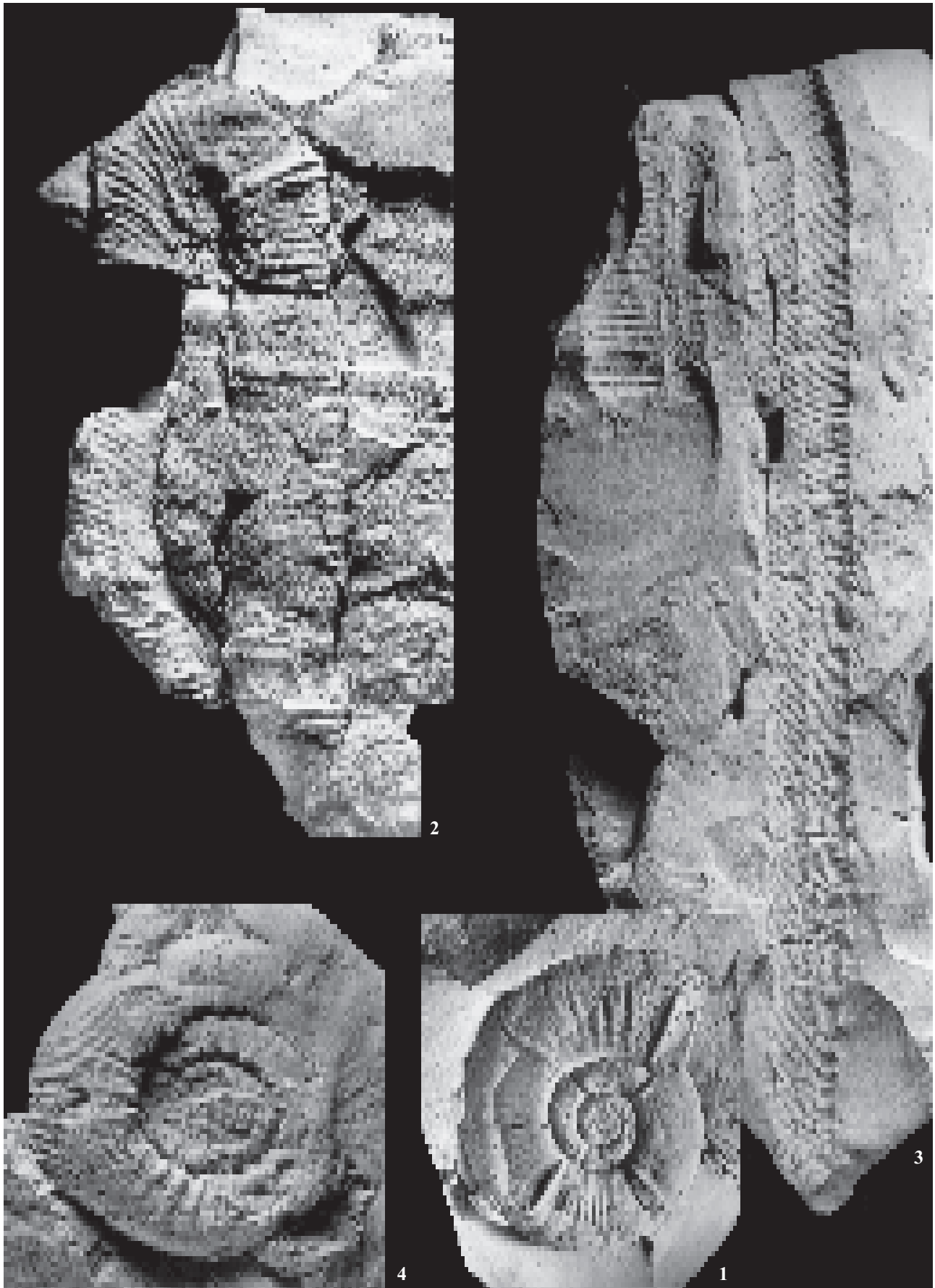
Plate II

- 1 – *Hamulina* cf. *astieriana* d'Orbigny. Spec. B 13703. Uppermost part of early Barremian, outcrop Pi-3 in the Lubina River below the Pindula Saddle.
- 2 – *Hamulina astieriana* d'Orbigny. Spec. B 13704. Localisation as with Fig. 1.
- 3, 4 – *Anahamulina ptychoceroides* (Uhlig). Spec. B 13705. Base of late Barremian, lower outcrop (KN-3) at Frýdlantská Ondřejnice near Kunčice p. O.
- 5 – *Macroscaphites binodosus* Uhlig. Spec. B 13710. Localisation as with Fig. 3.
- 6 – *Ptychoceras ditleri* Vašíček. Spec. B 13702. Uppermost late Barremian, outcrop in the Tichávka River at Kunčice p. O. (KN-11).
- 7 – *Deshayesites weissiformis* Bogdanova. Spec. B 13709. Early Aptian, outcrop in the Ostravice River near the village of Ostravice (OS).

Photos taken by K. Mezihoráková, University of Ostrava. All specimens were coated by ammonium chloride before taking photos. All photographs are in natural size; only Fig. 3 in Pl. 2 is magnified $\times 2$.

The figured material is deposited under above-mentioned inventory numbers (B 13700 – 13710) at the Ostrava Museum. Together with this material, the collection of ammonites published in Vašíček and Skupien (2002) under numbers B 13693 – 13699 is deposited in the same museum.

Z. Vašíček – P. Skupien – F. Šulgan: New occurrences of Lower Cretaceous ammonites in the western part of the Silesian Unit (Barremian – early Aptian, Outer Western Carpathians, Czech Republic) (Pl. I)



Z. Vašíček – P. Skupien – F. Šulgan: New occurrences of Lower Cretaceous ammonites in the western part of the Silesian Unit (Barremian – early Aptian, Outer Western Carpathians, Czech Republic) (Pl. II)

