

Comments on some new occurrences of heteromorph ammonites in the Lower Cretaceous (late Valanginian — early Barremian) of the Eastern Alpine and Western Carpathian systems

Zdenek Vasíček

Vasíček, Z. Comments on some new occurrences of heteromorph ammonites in the Lower Cretaceous (late Valanginian — early Barremian) of the Eastern Alpine and Western Carpathian systems. — Scripta Geol., Spec. Issue 3, 215-227, 2 figs., 3 pls, Leiden, December 1999.

Z. Vasíček, VSB, Institute of Geological Engineering, 17 Listopadu Str., cz, 70833 Ostrava-Poruba, Czech Republic.

Key words: heteromorph ammonites; Lower Cretaceous; Silesian Unit; Reichraming Nappe.

New records of heteromorph ammonites from the Silesian Unit of the Outer Western Carpathians (Czech Republic) are represented especially by small pyrite steinkerns with suture lines preserved. A lesser proportion of them belongs to representatives of the subfamily Bochianitidae from the Valanginian. Among the most interesting is *Baculina rouyana* d'Orbigny. Another group consists primarily of lower Barremian Leptoceratoidinae. In addition to commonly occurring species of *Hamulinites* and *Leptoceratoides*, an *Eoheteroceras* assemblage is often found, represented partially by new elements. Heteromorphs from the Northern Calcareous Alps (Austria) come from marly Hauterivian limestones. *Ptychoceras meyrati* is present through most of the Hauterivian. Well-dated finds of less well-known species occur sporadically, such as *Megacrioceras doublieri*, *Pseudomoutoniceras* ex gr. *annulare*, *Acrioceras (Paraspinoceras) pulcherrimum*, and *A. (Garroniceras) picteti*.

Contents

Introduction	215
Suture-lines of some shells of the subfamily Bochianitinae	216
Hauterivian heteromorphs from the Reichraming Nappe	218
Early Barremian heteromorphs from the Silesian Unit	219
Acknowledgements	220
References	221

Introduction

This contribution to IGCP Project 362 introduces some interesting new Alpine-Carpathian heteromorph discoveries. It focuses on their systematic positions, relying in some cases on the knowledge of their suture-lines. Where possible, data on the known stratigraphical position of species at the level of standard ammonite zones is presented too.

The study is based on three collections. In 1995, the author, together with Dr V. Housa (Prague), evaluated the systematics of a rich collection of Early Cretaceous ammonites from deposits associated with the Upper Jurassic Stramberk limestones in the area of Stramberk (Baska Development of the Silesian Unit of the Czech part of the Outer Carpathians). The most significant ammonite discoveries come from grey to dark grey claystones. They are usually preserved as pyrite steinkerns with suture-lines and belong primarily to an ammonite association of late Valanginian age (Housa & Vasíček, 1996, in prep.).

A second collection was made in 1995-96, when the author and Professor P. Faupl (Vienna) collected macrofaunas from the Lower Cretaceous deposits of the Northern Calcareous Alps at Grossraming (Schneeberg Syncline, Reichraming Nappe). Our ammonite finds, including heteromorphs, came above all from the Hauterivian, viz. from marly limestones belonging to the Schrambach Formation (Vasíček & Faupl, in prep.). They are usually preserved as moulds deformed on the plane of the bedding surface.

The third collection studied here consists of some early Barremian heteromorphs discovered by P. Klajmon, a student of geology at the VSB — Technical University of Ostrava. They came from a thin horizon in the Hradiste Formation at a locality situated near the village of Sobesovice, i.e. from the Godula Development of the Silesian Unit (the Outer Carpathians). A number of specimens are unique pyritized steinkerns, partially with preserved suture-lines (see preliminary report by Klajmon et al., 1997).

Suture-lines of some shells of the subfamily *Bochianitinae*

In the collection of Lower Cretaceous fossils from the area of Stramberk occur rather sporadically small, non-deformed fragments of pyritized, straight, or slightly arcuated shells. They correspond morphologically to the subfamily *Bochianitinae*. Among them there are both shells bearing oblique ribs and wholly smooth, i.e. unsculptured forms (Pl. 1, figs. 1-2). The sculptured shells correspond to the species *Bochianites neocomiensis* (d'Orbigny, 1842), the smooth ones to *B. oosteri* Sarasin & Schöndelmayer, 1902. Some authors (e.g. Mandov, 1971) divide the former species into subspecies. Other authors do not respect these subspecies and on the contrary consider *B. oosteri* to be a synonym of *B. neocomiensis* (e.g. Company, 1987).

If one compares the suture-lines on sculptured and non-sculptured fragments (at roughly equal diameters of shafts), it is obvious that their suture-lines are not identical (Figs. 1.1, 1.2). All saddles (above all E/L saddle) in the sculptured forms are markedly broader and two-branched compared with those in the smooth forms. This leads me to regard the sculptured and smooth forms as individual species, *B. neocomiensis* and *B. oosteri*.

Moreover, if we take into consideration all the occurrences of Carpathian representatives of the genus *Bochianites* it is apparent that *B. neocomiensis* probably occurs merely in Valanginian deposits, whereas *B. oosteri* occurs more frequently in the lower part of the early Hauterivian — that is in the stratigraphically higher deposits. What may have influenced the strength of the sculpture (though it is yet unproven) is the depth of the original environment; the forms with smooth shells probably lived in deeper waters. On the other hand, it is necessary to emphasize that some shafts of larger size recorded in the literature as *Bochianites oosteri* are actually fragments of shafts of the species *Ptychoceras meyrati* Ooster, 1860 (e. g. Mandov, 1971, pl. 4, fig. 1; Immel, 1987, pl. 11, fig. 11).

An exceptional find is represented by a single, slightly arcuated, tiny shell (total preserved length of 14 mm) without the juvenile part but with the body chamber preserved. It bears oblique constrictions and according to the density of the last suture-lines (Fig. 1.3) before the body chamber it does not belong to a juvenile fragment but

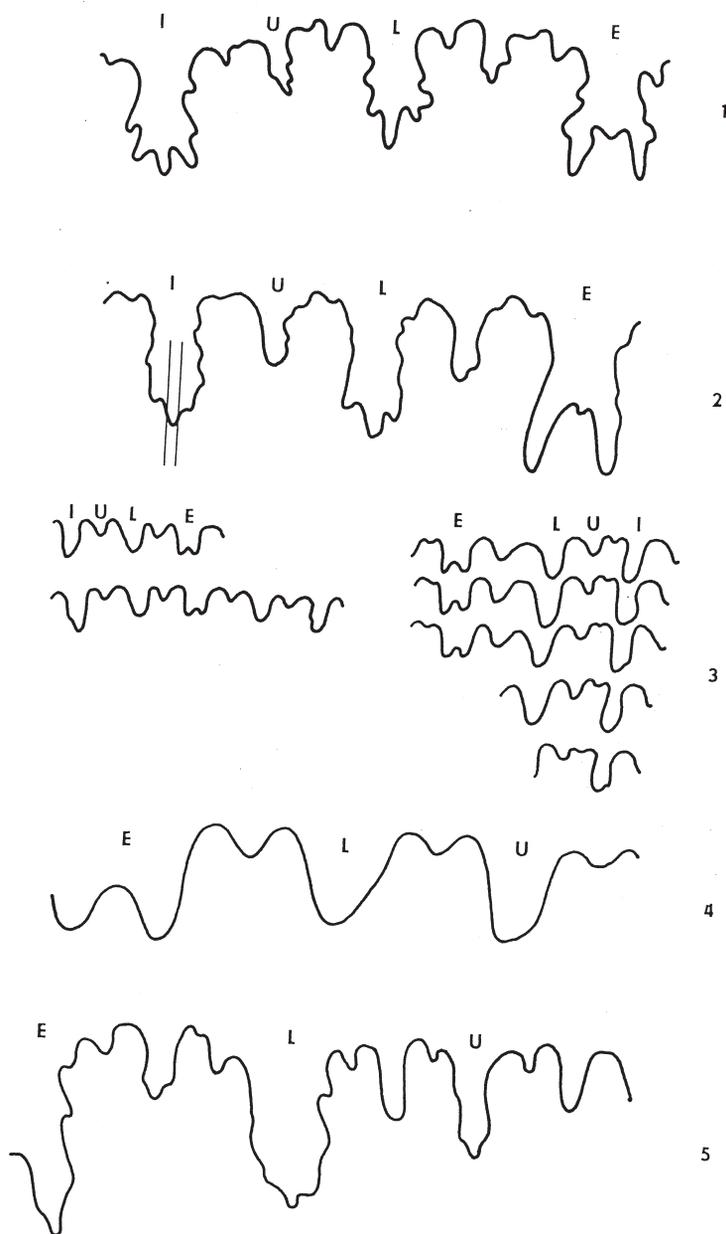


Fig. 1. Suture-lines.

1: *Bochianites neoconiensis* (d'Orbigny, 1842); at H = 3.5 mm; spec. S 322.

2: *Bochianites oosteri* Sarasin & Schöndelmayer, 1902; at H = 4.0 mm; spec. S 320.

3: *Baculina rouyana* d'Orbigny, 1850; on the left the early suture-lines at H = 1.0 mm are illustrated, on the right the last suture-lines at H = 1.4 mm; spec. s-440.

4: *Josticeras wiedmanni* Vasíček & Klajmon, 1998; at H = 3.6 mm; spec. To-96/32.

5: *Eoheteroceras cf. sileciacum* Vasíček & Wiedmann, 1994; at H = 3.7 mm; spec. To-96/65.

to an adult shell (Pl. 1, fig. 3). The primitive suture-line, with a rather deep lateral lobe (L) and, on the contrary, a negligible umbilical lobe (U), indicates an assignation to the group of *Baculina rouyana* d'Orbigny, 1850 (in accordance with the description and illustration of Cottreau, 1934, p. 7, pl. 70, fig. 10).

The exact stratigraphical position of the majority of these Valanginian bochianitids at Stramberk is, unfortunately, not known.

Hauterivian heteromorphs from the Reichraming Nappe

Most our Alpine finds come from a stratigraphically well dated long section in the cutting of a forest road northeast of Geisshoerndl. Other specimens come from the little quarry 'Am Gueterweg Gehoeft Hirner-Scharnreitner' (Vasíček & Faupl, in prep.).

What can be ranked among the most interesting discoveries here is an uninterrupted, frequent and long-ranging (upper part of the *loryi* Zone up to the *ligatus* Zone) occurrence of ptychoceratid shells, usually incomplete but represented by both macroconchs and microconchs. They belong to the species *Ptychoceras meyrati* Ooster, 1860 (Pl. 1, figs. 4-6). *Ptychoceras inornatum* Simionescu, 1898, *Euptychoceras curnieri* Thieuloy, 1972, *Euptychoceras borzai* Vasíček & Michalík, 1988, and also some long straight shafts figured by Mandov (1971) and Immel (1987) designated as *Bochianites oosteri* (for more detail see Vasíček & Faupl, in prep.) are probably synonyms of this form. Its long range decreases its stratigraphical value. From this point of view, it should be noted that Vasíček & Michalík's (1988) *borzai* Zone in the late Hauterivian in the Slovak Western Carpathians is no longer appropriate. *Ptychoceras meyrati* occurs more frequently in marly limestones than in other facies.

Other finds from the studied section include some sporadic and usually imperfectly preserved heteromorphs. An overview is given here. Firstly, an incomplete, unfavourably preserved shell of rather large dimensions fits into the range of variation of the species *Megacrioceras doublieri* (Jaubert, 1854), recently revised by Delanoy et al. (1987). The juvenile part of the shell is missing in our Alpine specimen. Most of it is preserved only as an impression but the body chamber is preserved as a sculptured internal mould (Pl. 2, fig. 1). The specimen comes from the late Hauterivian *sayni* or *ligatus* zone.

Several uncommon fragments can be assigned to *Pseudomoutoniceras* (see Autran et al., 1986). The most complete piece is illustrated on Pl. 2, figs. 2-3. The arcuate shell is marked by a very slow increase in the height of whorl. The dense simple ribs bear, from time to time, a marginal tubercle connected with a loop of two ribs. Sculptural details indicate that the specimen is close to, but cannot be placed in, *P. annulare* (d'Orbigny). On the contrary, it appears identical with a shell figured as *P. cf. annulare* figured by Cecca et al. (1995). One of the Alpine specimens comes from the *nodosoplacatum* Zone, the second from the *sayni* Zone (similar to the record by Cecca et al., 1995 from the Italian Apennines).

A comparatively complete shell belongs to *Acrioceras* (*Paraspinoceras*) *pulcherrimum* (d'Orbigny, 1842). This specimen was found rather low, at c. 5 m beneath the first occurrence of the zonal index *Subsaynella sayni* (Paquier). In addition, other incomplete finds belong to the same genus but represent the subgenus *Garroniceras*, defined by Vermeulen (1990). They are identified as *Acrioceras* (*Garroniceras*) *picteti* (Ooster,

1860). Vasíček & Michalík (1988) believed that this species may be a synonym of *A. (G.) seringei* (Astier, 1851). The two could form a dimorphic pair. *A. (G.) picteti* is smaller than *A. (G.) seringei* and the constrictions appear later. Two of our specimens show a considerable density of marginal tubercles on the spire, on which short spines are observed (Pl. 2, figs. 4-5). However, these cannot be photographed successfully on the limonitized fragment so that they are illustrated in a drawing (Fig. 2). The latter fragment is very close to Ooster's specimen (1860, pl. 50, fig. 4). Both the Alpine specimens come from the *balearis* Zone.

Early Barremian heteromorphs from the Silesian Unit

In the single natural outcrop of the Hradiste Formation at Sobesovice, more than one hundred (prevaingly small) shells of ammonites were collected before the outcrop was totally exhausted. Prior to the publication of this manuscript, originally with the character of a preliminary report, the definitive processing of this collection was already issued (Vasíček & Klajmon, 1998). Both heteromorphs and normally coiled ammonites occur; partly pyritized representatives of a few heteromorph genera prevail. Besides ammonites, fragments of land plants (primarily of leaves) also occur. The overall condition of preservation of fossils indicates a turbiditic redeposition. In the collected material, representatives of the subfamily Leptoceratoidinae dominate. They belong mainly to *Hamulinites parvulus* (Uhlig, 1883) and *Leptoceratoides subtilis* (Uhlig, 1883) that probably represent a dimorphic pair.

In addition to these two well-known species, representatives of the genus *Eoheteroceras* are present. They are documented especially through the group of *Eoheteroceras uhligi* (Vasíček, 1981). The new finds demonstrate better than previous ones the sculpture of the body chamber that follows after the hooked bend, strong variability in the overall shape of the shell (partially influenced by different ways of deformation in the bedding plane) and also the irregular occurrence of marginal tubercles on some of ribs (Pl. 3, figs. 1-3). The initial whorls are coiled in a helicoid spiral, similar to the

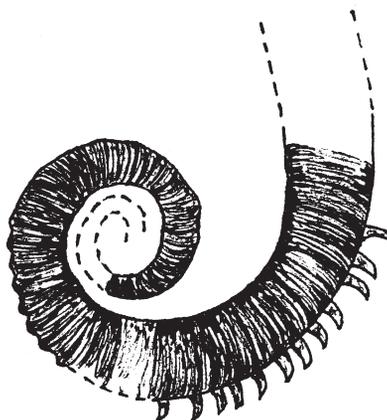


Fig. 2. *Acrioceras (Garroniceras) picteti* (Ooster, 1860), reconstruction of limonitized specimen showing short marginal spines.

genus *Heteroceras*. The shells, however, are substantially smaller in total size. Incomplete suture-lines are partially preserved.

The second group of eoheteroceratids lacks the embryonic part of the shell. On one of the pyritized shafts (Pl. 3, fig. 6) a suture-line is apparent. It is more subdivided than that of the genus *Hamulinites* (Fig. 1.5). This seems to be close to imperfectly preserved suture-lines of representatives of the species *Eoheteroceras uhligi* (specimen on Pl. 3, fig. 3) noted above. The shaft is identified as *Eoheteroceras* cf. *silesiacum* Vasíček & Wiedmann.

The third group of small heteromorphs is characterized by loose whorls of unclearly spatially coiled shells (Pl. 3, figs. 4, 6). These shells do not belong to the eoheteroceratids. They may be representatives of *Karsteniceras beyrichoide* Vasíček & Wiedmann, 1994.

The only almost complete pyritized shell of *Josticeras Wiedmanni* Vasíček & Klajmon shows some features that are not known in other leptoceratoids. Although it lacks the embryonic part, it has a complete body chamber preserved that is markedly distinct (Pl. 3, fig. 7). The middle part of the shell has a preserved simple suture-line that is unambiguously of the leptoceratoid type (Fig. 1.4). It differs from *Hamulinites* in its greater size and especially in the growth and sculpture of the shell after the second hooked bend.

Together with the leptoceratoids, almost straight heteromorph shells also occur that narrow conspicuously towards their embryonic ends (Pl. 3, fig. 8). Neither the suture line nor the embryonic stage is known. The post juvenile morphology, with the exception of a less distinct ribbing, is strongly reminiscent of a shell illustrated by d'Orbigny (1842, pl. 120, fig. 1) under the name *Toxoceras obliquatum*. This is the type species of the genus *Hemibaculites* but, as noted by Wright et al. (1996), the type specimen is lost.

Other heteromorphs include juvenile shells of the genus *Emericiceras*, fragments from the *Hamulina astieri* d'Orbigny group, and others. In addition, the suborder Ammonitina is represented by *Holcodiscus* cf. *angulatus* Tzankov and imperfectly preserved pulchelliid shells that could belong to *Kotetishvilia compressima* (d'Orbigny). Species of little stratigraphical significance include *Phyllopachyceras infundibulum* (d'Orbigny), *Lytoceras* cf. *densifimbriatum* (Uhlig), and *Protetragonites crebrisulcatus* (Uhlig). The ammonite assemblage indicates the early Barremian *caillaudianus* Zone sensu Hoedemaeker et al. (1993).

Acknowledgements

I am grateful to the Grant Agency of the Czech Republic (Grant No. 205/96/0753) for financial support for the work. The figures were drawn by Mrs B. Vavrusáková and Miss R. Horná, photos have been made by Mrs K. Mezihoráková. I also thank the reviewer for his comments and Professor Peter Rawson for his remarks and for correcting the English.

References

- Astier, J.-E., 1851. Catalogue descriptif des *Ancyloceras* appartenant à l'étage Néocomien d'Escra-
gnolles et des Basses-Alpes. — Ann. Soc. agr. hist. nat. Lyon, 2, 3: 435-456.
- Autran, G., G. Delanoy & G. Thomel, 1986. Discussion critique des genres d'Ammonites déroulées:
Toxoceras d'Orbigny, 1840, *Hemibaculites* Hyatt, 1900 et *Moutoniceras* Sarkar, 1954. Proposition
d'un nouveau genre *Pseudomoutoniceras* pour l'espèce *T. annulare* d'Orbigny. — C.R. Acad. Sci.
Paris, 303, II-11: 1059-1064.
- Cecca, F., P. Faraoni, A. Marini & G. Pallini, 1995. Field-trip across the representative sections for the
Upper Hauterivian - Barremian ammonite biostratigraphy in the Maiolica exposed at Monte
Nerone, Monte Petrano and Monte Catria (Umbria-Marche Apennines). — Mem. Descr. Carta
Geol. Italia, 51: 187-211.
- Company, M., 1987. Los Ammonites del Valanginiense del sector oriental de las Cordilleras Béticas
(SE de España). — Tesis Doctoral Univ. Granada: 1-294.
- Cottreau, J., 1934. Types du prodrome de paléontologie stratigraphique universelle de d'Orbigny. —
Ann. Paléont., 23: 45-80.
- Delanoy, G., G. Autran & G. Thomel, 1987. Proposition d'un nouveau genre d'Ammonoidea de l'Hau-
terivien supérieur: *Megacrioceras*, après révision d'une espèce méconnue de la littérature paléon-
tologique: *Ancyloceras doublieri* Jaubert et comparaison avec les formes affines. — C. R. Acad. Sci.
Paris, 305, II: 311-315.
- Hoedemaeker, Ph.J. & M. Company (reporters) & 16 co-authors, 1993. Ammonite zonation for the
Lower Cretaceous of the Mediterranean region; basis for the stratigraphic correlations within
IGCP Project 262. — Rev. Esp. Paleont., 8: 117-120.
- Housa, V. & Z. Vasíček, 1996. Early Cretaceous ammonites from the envelope formations of the
Stramberk Limestone bodies. — Zpr. geol. Výzk. R. Prague, 1995: 95-96 (in Czech).
- Housa, V. & Z. Vasíček, in prep. Lower Cretaceous ammonites from Stramberk (Czech Republic). —
Zemní Plyn Nafta, Hodonín.
- Hyatt, A., 1900. Cephalopoda. In: K.A. Zittel, Textbook of Palaeontology. — Macmillan, London-New
York: 502-592.
- Immel, H., 1987. Die Kreideammoniten der nördlichen Kalkalpen. — Zitteliana, 15: 3-163.
- Jaubert, J., 1854. Description d'une espèce nouvelle d'*Ancyloceras* de l'étage néocomien de Castellane
(B.-A.). — Ann. Soc. agr. hist. nat. Lyon, 2, 7: 326-329.
- Klajmon, P., P. Skupien & Z. Vasíček, 1997. New significant ammonite locality of the Tesin-Hradiste
Formation near Sobesovice (Lower Cretaceous, Outer Carpathians)]. — Geol. Výzk. Mor. Slez. R.
Brno, 1996: 32-33 (in Czech with English abstract).
- Mandov, G., 1971. Représentants du genre *Bochianites* Lory, 1898 (Ammonoidea) dans les depots du
Crétacé inférieur en Bulgarie. — Izv. geol. Inst., Paleont., 20: 91-106 (in Bulgarian with French
summary).
- Ooster, W.A., 1860. Catalogue des Céphalopodes fossiles des Alpes Suisses avec la description et les
figures des espèces remarquables. Part 5: Céphalopodes tentaculifères, Ammonitides. — Nouv.
Mém. Soc. Helvet. Sci. nat., 18: 1-100.
- Orbigny d', A., 1842. Paléontologie française. Terrains crétacés. I. Céphalopodes. — Masson, Paris:
431-662.
- Orbigny d', A., 1849, 1850. Prodrome de Paléontologie stratigraphique universelle des animaux mol-
lusques et rayonnés, vol. 1-2. — Masson, Paris: 1-396; 1-428.
- Paquier, V., 1900-1901. Recherches géologiques dans le Diois et les Baronnies orientales. — Trav. Lab.
géol. Fac. Sci. Grenoble (1899-1900), 5: 149-556.
- Royo y Gómez, J., 1945. Fósiles del Barremiense Colombiano. Compilation de los estudios geológicos
oficiales en Colombia. — Serv. Geol. Nac. Bogotá, 6: 459-494.
- Sarasin, Ch. & Ch. Schöndelmayer, 1902. Étude monographique des ammonites du Crétacique
inférieur de Chatel-Saint-Denis, part 2. — Mém. Soc. paléont. Suisse, 29: 95-195.

- Simionescu, I., 1898. Studii geologice si paleontologice din Carpatii sudici. II. Fauna neocomiana din basenul Dimboviciorei. — Acad. Romana, Publ. fondului Vasilie Adamachi, 2: 101-167.
- Thieuloy, J.-P., 1966. Leptocères berriasiens du massif de la Grande-Chartreuse. — Trav. Lab. Géol. Grenoble, 42: 281-295.
- Thieuloy, J.-P., 1972. Biostratigraphie des lentilles à Peregrinelles (Brachiopodes) de l'Hauterivien de Rotier (Drome, France). — Géobios, 5: 5-53.
- Uhlig, V., 1883. Die Cephalopodenfauna der Wernsdorferschichten. — Denkschr. Österr. Akad. Wiss., math.-naturwiss. Kl., 46: 127-290.
- Vasíček, Z., 1981. Zwei neue faunistische Fundorte der Unterkreide in der Silesischen Einheit und Zusammenfassung der Revision der von V. Uhlig (1883) beschriebenen Ammoniten. — Sbor. ved. Prací Vys. Sk. bán. Ostrava, R. horn.-geol., 25 (1979): 119-134.
- Vasíček, Z. & P. Faupl, in prep. Die unterkretazische Cephalopoden der Schrambachschichten (Schneebergmulde, Reichraminger Decke, oberösterreichische Kalkalpen). — Jb. Geol. Bundesanst, Festband 1999.
- Vasíček, Z. & P. Klajmon, 1998. Contribution to the knowledge of small early Barremian ammonites from the Silecian Unit (Outer Carpathians, Czech Republic). — Vest. Ces. geol. Úst., 73: 331-342.
- Vasíček, Z. & J. Michalík, 1988. Some heteromorphic ammonites from Polomec (Hauterivian-Barremian, Central Western Carpathians, Czechoslovakia). — Geol. Zbor. Geol. Carpath., 39: 655-674.
- Vasíček, Z. & J. Wiedmann, 1994. The Leptoceratoidinae: small heteromorph ammonites from the Barremian. — Palaeontology, 37: 203-239.
- Vermeulen, J., 1990. L'évolution des *Acrioceras* (Ammonoidea), utilisation biostratigraphique et conséquences taxonomiques. — Congr. Nat. Paléont., Paris: 100.
- Wright, C.W., J.H. Callomon & M.K. Howarth, 1996. Treatise on Invertebrate Paleontology. Part L. Mollusca 4 Revised: Cretaceous Ammonoidea. — Geol. Soc. Amer., Boulder (CO) & Univ. Kansas Press, Lawrence (KA): L1-362.

Plate 1

Photos: K. Mezihoráková (Univ. of Ostrava); specimens coated with ammonium chloride.

Fig. 1. *Bochianites neocomiensis* (d'Orbigny, 1842), × 3; lateral view, fragment of phragmocone of spec. S 437; Valanginian, Stramberk, Outer Carpathians.

Fig. 2. *Bochianites oosteri* Sarasin & Schöndelmayer, 1902, × 4; dorsal view, spec. S 320; Valanginian, Stramberk.

Fig. 3. *Baculina rouyana* d'Orbigny, 1850, × 3; lateral view, spec. S 440 with the body chamber; Valanginian, Stramberk.

Figs. 4-6. *Ptychoceras meyrati* Ooster, 1860, × 1; lateral view; Schrambach Formation, lower Hauterivian. Vicinity of Grossraming, Reichraming Nappe.

4: Spec. Sch 47/15, the first and second shafts; 5: spec. V96-9/1, microconch; 6: spec. V96-9/2, macroconch, the second and third shafts.

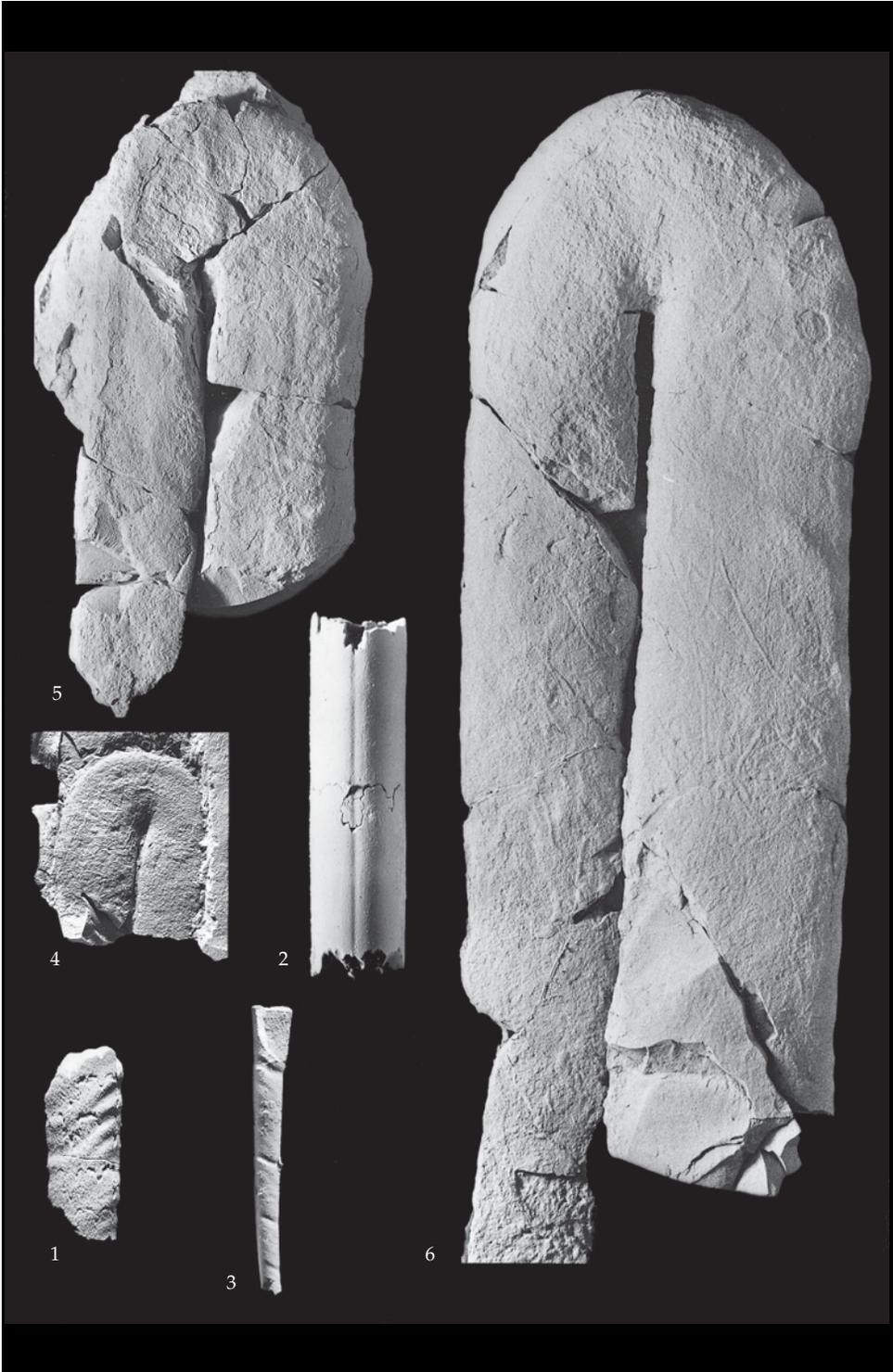


Plate 2

All specimens on Pl. 2 come from the Schrambach Formation at Grossraming. Photos: K. Mezihoráková (Univ. of Ostrava); specimens coated with ammonium chloride.

Fig. 1. *Megacrioceras* cf. *doublieri* (Jaubert, 1854), × 1; spec. V96-9a/7 with a partially preserved body chamber; phragmocone preserved only as an impression; upper Hauterivian (*ligatus* or *balearis* Zone).

Figs. 2-3. *Pseudomoutoniceras* sp., spec. V96-9/27.

2: General view of the specimen preserved partially as a sculptural mould and partially as an impression, × 1; 3: detail of a fragment corresponding to an impression on fig. 2, × 2; lower Hauterivian (*nodosoplicatum* Zone).

Figs. 4-5. *Acrioceras* (*Garroniceras*) *picteti* (Ooster, 1860), spec. Sch-105/12.

4: × 1; 5: × 2, detail of the innermost whorls; upper Hauterivian (*Ligatus* Zone).

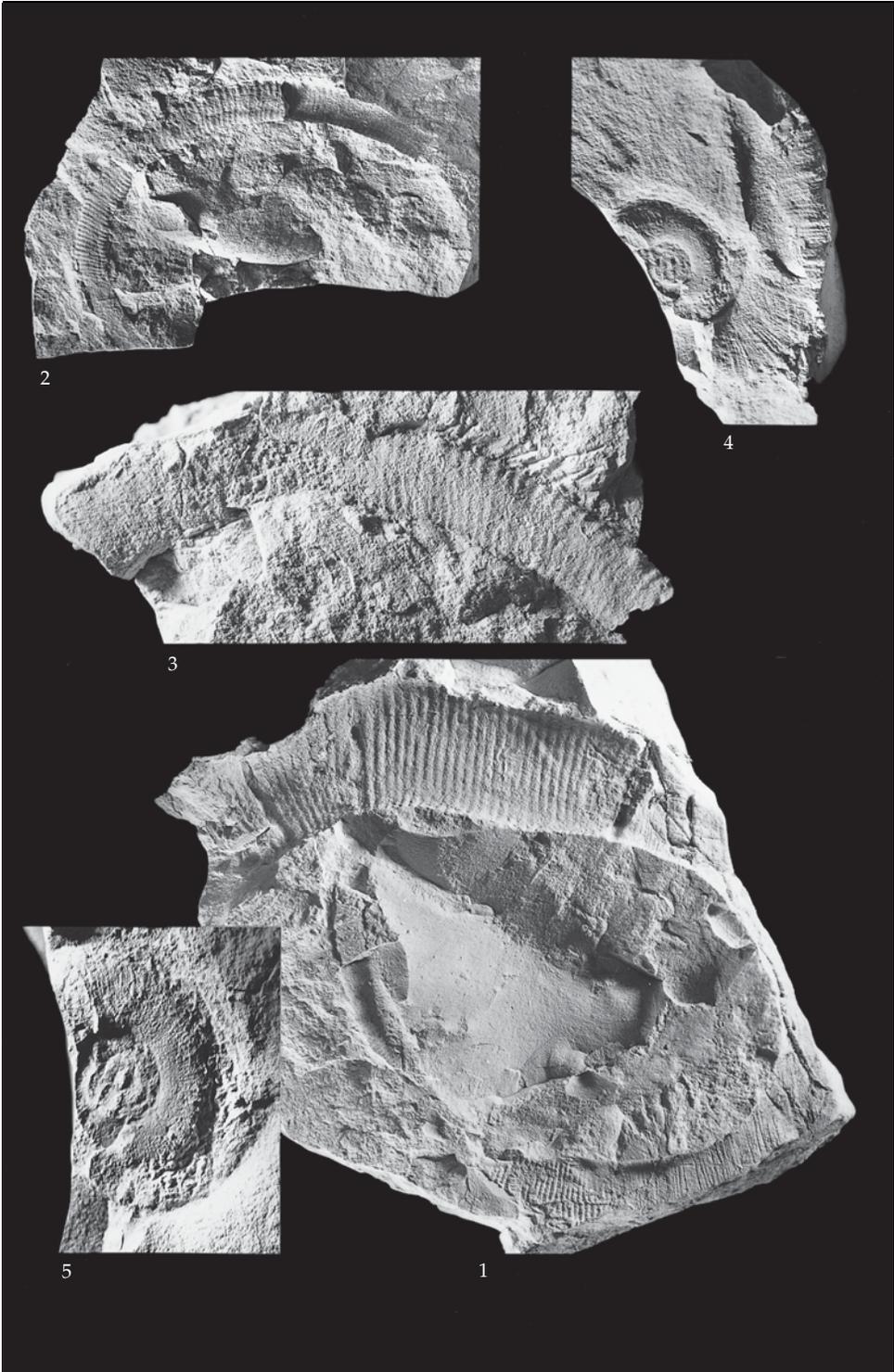


Plate 3

All specimens come from the unique horizon at the village of Sobesovice, lower Barremian, Hradiste Formation, Outer Carpathians. Photos: K. Mezihoráková (Univ. of Ostrava).; specimens coated with ammonium chloride.

Figs. 1-3. *Eoheteroceras uhligi* (Vasíček, 1981).

1: Spec. To-96/35, × 2; 2: more densely ribbed, spec. To-96/38, × 1; 3: juvenile turrilitid part of spec. To-96/69, × 2.

Figs. 4, 5. *Karsteniceras beyrichoide* Vasíček & Wiedmann, 1994.

4: Juvenile spec. To-96/3, × 2; 6: spec. To-96/27 showing the distinct torsion of the shell, × 2.

Fig. 6. *Eoheteroceras* cf. *sileciacum* Vasíček & Wiedmann, 1994, fragment of shaft with suture-lines of spec. To-96/65, × 3.

Fig. 7. *Josticeras wiedmanni* Vasíček & Klajmon, 1998, spec. To-96/32 with the body chamber and suture-lines on the phragmocone, × 1.

Fig. 8. ?*Hemibaculites* sp., spec. To-97/17, × 1.

