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Stratigraphy and paleontology of the Callovian in the southern and western margins of the Holy Cross Mts

ABSTRACT: The Callovian biostratigraphy of the southern and western margins of the Holy Cross Mts is discussed in detail. The presence has been observed of all the Callovian zones, excepting the M. macrocephalus referable to a stratigraphic gap. The documented zones abound in a rich ammonite fauna, occurring as a rule in nodular or conglomeratic sediments which display stratigraphic condensation, and often contain a mixture of ammonite remains from more than one zone. Some ammonite species of stratigraphic value are described and figured in the chapter on paleontology. Particular attention has been given to species from genus *Peltoceras*, so far not described or figured in the Polish literature.

INTRODUCTION

Papers by Lewiński (1908a, b, c, 1912) and Świdziński (1931) also the reports by Czarnocki (1925, 1926, 1927, 1928) are the earliest publications dealing with the stratigraphy of the Middle Jurassic deposits in the southern and western margins of the Holy Cross Mts. These authors mention few fossil remains from the Callovian sediments of the above area but they discuss rather fully the Callovian deposits.

During recent years, the lithology and stratigraphy of the Jurassic — *i.a.* the Callovian — have been investigated by Peszat (1960, 1964), Jurkiewiczowa (1967) and Filonowicz)1965) (Fig. 1).

Studies confined strictly to the biostratigraphy of the Callovian in the area under consideration have been carried out between 1962 and 1970 for master's degree papers in the Institute of Dynamic Geology of the Warsaw University (*see* Siemiątkowska-Giżejewska 1972) and individually by the writer (Siemiątkowska 1967, 1969).

Problems connected with the sedimentation of the particular stratigraphic members of the Middle Jurassic, also with the paleogeography of this Epoch in the southern and western margins of the Holy Cross Mts have been discussed by the writer (Siemiątkowska-Giżejewska 1972).

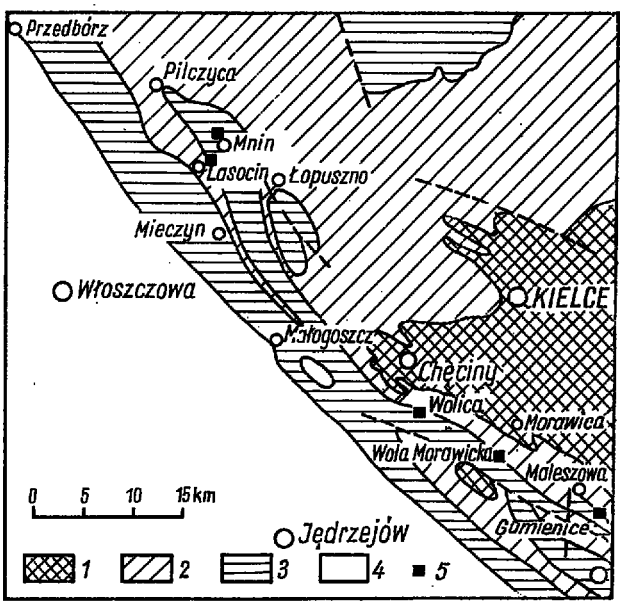


Fig. 1

Geological sketch map of the south-west margin of the Holy Cross Mts (without Caenozoic)

1 Palaeozoic, 2 Triassic, 3 Jurassic, 4 Cretaceous, 5 outcrops of Middle Jurassic

Acknowledgements. Most sincere words of thanks are due to Dr. hab. J. Kutek, Dr. hab. A. Radwański and Dr. hab. M. Szulczewski for the generous help offered to the writer during her work in collecting and describing the necessary field materials.

Prof. H. Makowski, Prof. J. Znosko and Dr. hab. W. Barczyk must also receive the writer's warmest thanks for their valuable suggestions and critical remarks during the preparation of the present paper and Mrs B. Drozd for all the photographs.

ACCEPTED STRATIGRAPHIC SUBDIVISION

The stratigraphic subdivision of the Callovian accepted by the writer is that recommended by the Stratigraphic Colloquia of Luxemburg (1962, 1964). The Luxembourg (English) stratigraphic subdivision differs in some respects from that of Różycki (1953) now currently accepted in Poland. The main difference lies in other names given to the ammonite zones, *i.e.* in a different choice of the index ammonite species (Tab. 1).

The assemblage of ammonite species and their time sequence in the Callovian profiles of England (where the stratotype of this stage has

Table 1

Comparative table of the stratigraphic subdivision of the Callovian according to the Polish proposals and the Luxembourg Colloquia

Polish subdivision /Różycki 1953, Calikowska 1967/			Luxemburgian subdivision /Luksemburg 1962, 1964/		
Stage	Substage	Zones	Zones	Substage	Stage
Oxfordian	Lower	Cardioceras sp. sp.	C. cordatum	Lower	Oxfordian
	Divesian	Qu. praecordatum	Qu. mariae		
		Qu. lamberti	Qu. lamberti	Upper	Callovian
		Qu. flexicostatum	P. athleta		
Callovian	Upper	K. duncani	E. coronatum	Middle	
		K. pollux			
		K. jason	K. jason		
	Lower	S. calloviense	S. calloviense	Lower	
		M. typicus	M. macrocephalus		

been worked out — *vide* Callomon 1955, 1962) are nearly identical with those throughout Poland: in the Kraków-Częstochowa Jura Highland (Różycki 1953, 1956, 1960), as well as in the margins of the Holy Cross Mts and in the Polish Lowland (Calikowska 1959, 1964, 1965, 1966, 1967). The time sequence of most of the corresponding index species are identical in the Polish and English subdivision (*comp.* Tab. 1). There are, however, differences mentioned above, also controversial opinions as regards the Callovian/Oxfordian boundary.

In both subdivision the Bathonian/Callovian boundary runs between the Clydoniceras discus Zone and the Zone indicated by the *Macrocephalites* ammonite assemblage and the first *Reineckeia* species, *i.e.* from the appearance of Macrocephalitidae and Reineckeidae, the two great ammonite families, and the beginning of migration from the sub-arctic areas into north-western Europe of two other ammonite families: the Kosmoceratidae and Cardioceratidae (*comp.* Callomon 1962).

In the Polish subdivision, the M. typicus zone corresponds to the lowermost Callovian Macrocephalites macrocephalus Zone. The time range of species *M. typicus* Blake has not, so far, been determined. Its occurrence in the upper part of the lowermost Callovian zone has been observed by Tintant & Thierry in Burgundy (1967), while Rugét-Perrot (1961) mentions it from the Middle Callovian. Though neither does the species *M. macrocephalus* (Schlotheim) Callomon occur throughout the Zone named after it but only in its lower part, yet, in the writer's opinion, it seems more convenient to recognise it as the index species of the above

zone (zone *sensu abstracto*), taking into account the long tradition in the use of this name.

The index species and the time range of the two following Zones — Sigaloceras calloviense and Kosmoceras jason — coincide in both subdivisions.

Erymnoceras coronatum (Bruguière) has been accepted by d'Orbigny (1852) as the index species of the upper Middle Callovian, while *K. pollux* (Reinecke) was accepted by Reuter (1908). The time range of these two species coincides. Ammonites from genus *Erymnoceras* both in the boreal and the Tethyan province, hence the name E. coronatum seems more convenient for use in the upper Middle Callovian, the more so in view of the longer tratition of this name.

The two next Callovian zones are the most controversial ones in what concerns their vertical range and the determination of index species. In the Luxembourgian subdivision, the Peltoceras athleta Zone corresponds to the Kosmoceras duncani Zone adopted in some subdivisions. In the Polish subdivision the range of the latter zone is somewhat narrower than that of the Peltoceras athleta Zone (Callkowska 1967), and corresponds to its lower part. In Poland, however, the upper part of the Peltoceras athleta Zone has been recognized as corresponding to the Quenstedtoceras flexicostatum Zone and included into the Lower Oxfordian (Różycki 1953, Calikowska 1967). The Peltoceras athleta Zone has been distinguished by d'Orbigny (1852), while the Kosmoceras duncani Zone has been differentiated by Pellat (1878) above the Kosmoceras jason. However, as is shown by Arkell (1939), the specimens on which the Kosmoceras duncani Zone was created has been incorrectly identified because actually they represented *K. compressum* (Quenstedt), younger than *K. duncani* (Sowerby) and associated with *Qu. lamberti* (Sowerby). Hence, the Kosmoceras duncani Zone, differentiated by Pellat (1878), really corresponding to the lower part of the Quenstedtoceras lamberti Zone, cannot comprise a species after which it is named. The present knowledge regarding the time succession of *P. athleta* (Phillips) and *K. duncani* (Sowerby) shows that they occur together. However, the vertical range of *K. duncani* (Sowerby) ends at the base of the following zone, while *P. athleta* (Phillips) passes into the lower parts of Quenstedtoceras lamberti Zone (Arkell 1939). Hence, theoretically, *K. duncani* (Sowerby) is a better zonal index form. Yet, because of the divergences in descriptions of the last named species (*comp.* Brinkmann 1929a,b; Arkell 1939; Makowski 1952, 1962) *P. athleta* (Phillips) is a more convenient index form. Therefore, the Peltoceras athleta Zone is characterized by the contemporaneous occurrence of various species from genera *Peltoceras* and *Kosmoceras* — the last named also containing *K. duncani* (Sowerby) and *K. proniae* Teisseyre. After Callomon (1962) the upper boundary of the

Peltoceras athleta Zone is indicated by the appearance of ammonites of genus *Quenstedtoceras* and the absence of *K. duncani* (Sowerby) and *K. proniae* Teisseyre replaced by *K. compressum* (Quenstedt) and *K. spinosum* (Sowerby).

In the Polish subdivision, the Quenstedtoceras flexicostatum Zone (Różycki 1953, Calikowska 1967, Malinowska 1967) containing i.a. *Qu. intermissum* Buckman has been placed in between the Kosmoceras duncani and Quenstedtoceras lamberti Zones. Without questioning the presence of either the *Qu. flexicostatum* (Phillips) or the *Qu. intermissum* Buckman species, in the lower parts of the Quenstedtoceras lamberti Zone (Arkell 1939, Różycki 1953), the distinction of a separate zone does not seem justifiable. Makowski's investigations have shown (oral information) that *Qu. flexicostatum* (Phillips) is the male form corresponding to the female form known under the name of *Qu. lamberti* (Sowerby). Therefore, the time succession of *Qu. flexicostatum* (Phillips) and *Qu. lamberti* (Sowerby) representing two dimorphous forms of one and the same species ought to be identical.

In the Polish subdivision, the Upper Callovian boundary is placed between the Kosmoceras duncani and Quenstedtoceras flexicostatum Zones, hence, at point in which the first representatives of genus *Quenstedtoceras* appeared. "Divesian" is the name used in Poland for the three Polish zones containing *Quenstedtoceras* forms. The argument advanced in favour of this subdivision is the alleged convenience of a differentiated assemblage of zones bearing a *Kosmoceras* and *Quenstedtoceras* fauna. The upper Callovian boundary, suggested by the Luxembourg Colloquia (Callomon 1962), runs between the Quenstedtoceras lamberti and Quenstedtoceras mariae Zones. It seems to be based on better paleontological evidence, though apparently it is less convenient. Namely, the changes occurring here in the development and sequence of ammonite families are of the same scale as those at the base of the Callovian, to say the extinction of two great families, the Kosmoceratidae and Reineckeidae, characteristic of the Callovian. It is true that at the beginning of the Quenstedtoceras lamberti Zone the first representatives of Cardioceratidae (genus *Quenstedtoceras*) make their appearance in Western Europe (boreal province), but this is a smaller-scale change than that just mentioned, and one connected only with the boreal province, while the extinction of the Reineckeidae is traceable in both provinces. An additional argument is the fact that ammonites from genus *Cadoceras*, which make their appearance as early as in the Lower Callovian of Eastern Europe, are the first representatives of Cardioceratidae. The use of the "Divesian" stratigraphic unit introduced in 1874 by Renèvier, has since long been discontinued in the European stratigraphic subdivision owing to its indeterminate position in the stratigraphic subdivision of the Jurassic.

The arguments discussed above have induced the writer to follow in the present paper the Callovian subdivision suggested by the Jurassic Colloquia of Luxembourg, though, in view of the very slight differences, the preference is only an arbitrary question.

CALLOVIAN BIOSTRATIGRAPHY

Lower Callovian

Macrocephalites macrocephalus Zone

Throughout the area here considered this Zone corresponds to a stratigraphic lacuna sedimentary in character. In the western margin of the Holy Cross Mts the presence of the lacuna is indicated by a sudden and distinct change in the lithology at the junction between the Bathonian and Callovian stages (Fig. 2). This change is manifested by the transition of sandy biosparites into sandy limestones with cherts and marls. Locally these two complexes are separated by a thin layer of clay varying in thickness.

Within the southern margin, the stratigraphic lacuna corresponding to the Zone under consideration is paleontologically documented in the Wola Morawicka profile where a conglomeratic bed with an index fauna of the Sigaloceras calloviense Zone directly overlies dark Bathonian clays. Similarities in sedimentary succession at Wolica and Gumienice reliably suggest the occurrence of a stratigraphic lacuna (Fig. 2) in the Macrocephalites macrocephalus Zone throughout the southern margin of the Holy Cross Mts.

Sigaloceras calloviense Zone

Sedimentary continuity observed in the Lower Callovian profiles of the western margins indicates that at Mnin (bed *A* in Fig. 3) this Zone is represented by the upper parts of sandy limestones with cherts, at Lasocin *I* by the middle parts of sandy limestones and marls, at Lasocin *II* (bed *B* in Fig. 4) by a conglomerate bed with stromatolites.

In the southern margins, the Sigaloceras calloviense Zone represents the lowermost member of the Callovian and it is documented by a rich ammonite assemblage from the lowermost Callovian bed at Wola Morawicka. The following cephalopods are represented here: *Macrocephalites (Macrocephalites) compressus* (Quenstedt), *M. (Indocephalites) chrysoolit-*

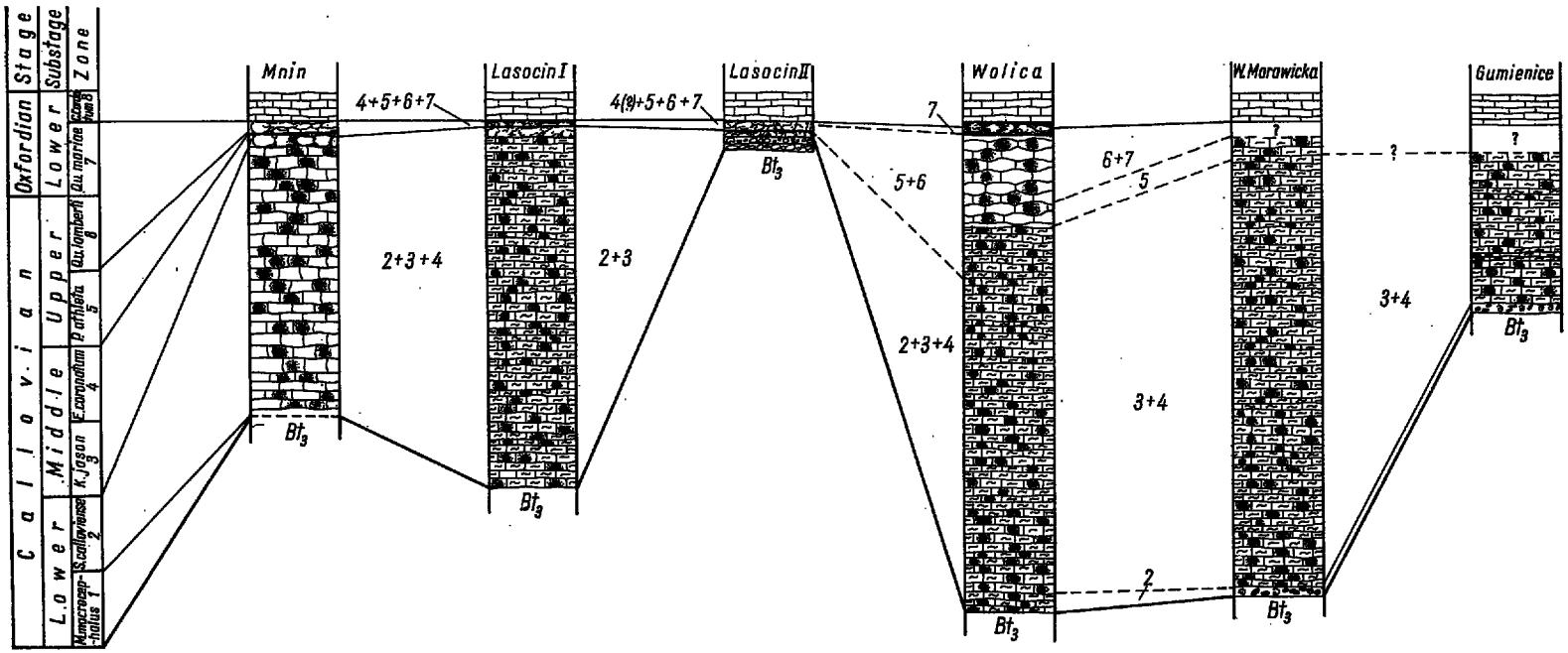


Fig. 2

Correlation of the Callovian profiles from the southern and western margins of the Holy Cross Mts

Explanations as in Fig. 3; vertical scale 1 cm = 2.5 m

hicus (Waagen), *M. (Indocephalites) diadematus* (Waagen), *M. (Pleurocephalites) pila* (Nikitin), *M. (Dolikephalites) uhligi* (Lemoine), *M. (Kamptokephalites) lamellosus (Sowerby), M. (Kamptokephalites) herveyi* (Sowerby), *Parapatoceras calloviense* (Morris), *Sigaloceras calloviense* (Sowerby), *Ptychophylloceras* cf. *euphyllum* (Neumayr), *Lytoceras* sp., *Hecticoceras (Chanasia) chanasiense* (Parona, Bonarelli), *Hecticoceras* sp. sp., *Grossouvria mosquensis* (Fischer), *G. curvicosta* (Oppel), *G. variabilis* (Lahusen), *G. riasanensis* (Teisseyre), *G. leptoides* (Till), *Subgrossouvria eurypłycha* (Neumayr), *Choffatia villanoides* (Till), *Ch. tenella* (Teisseyre), *Ch. recuperoi* (Gemmellaro), *Ch. waageni* (Teisseyre), *Indosphinctes* cf. *patina* (Neumayr), *Poculisphinctes villanyensis* (Till), and one nautilod species: *Pseudaganides krenkeli* (v. Loesch) Rollier.

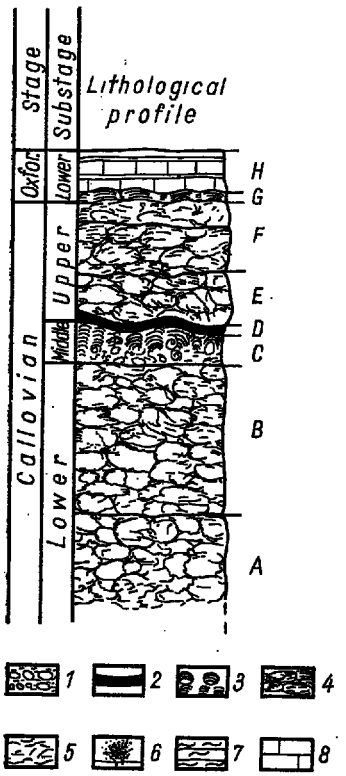


Fig. 3

Profile of the Callovian form Mnin

1 conglomerates, 2 ferruginous beds and concretions, 3 stromatolites, 4 nodule bed, 5 silicated nodular limestones, 6 calcareous gaizes with cherts, 7 marls, 8 limestones, Bt_3 Upper Bathonian. Vertical scale 1 cm = 15 cm

Besides nautiloids and ammonites the fauna here also consists of numerous belemnites: *Hibolites hastatus* (Blainville), *Belemnopsis canaliculatus* (Schlotheim), *Belemnopsis latesulacatus* (d'Orbigny), *Rhopaloteuthis gillieroni* (Mayer), lamellibranchs from the genera *Entolium, Chlamys, Velata, Pleuromya,* gastropods belonging to genus *Pleurotomaria,* brachiopods: *Capilirhynchia biplicosa* (Quenstedt), *C. triplicosa*

(Quenstedt), *Epithyris* sp., *Zeilleria obovata* (Sowerby), echinoids of genus *Collyrites*, also shark teeth.

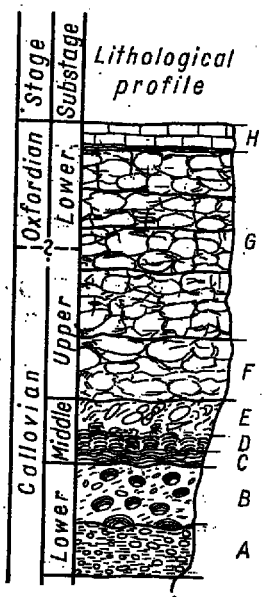


Fig. 4

Profile of the Callovian from Lasocin *II*
Explanations as in Fig. 3; vertical scale 1 cm = 15 cm

The Sigaloceras calloviense Zone represents the lowermost Callovian member at Wolica and Gumieńice, too (Fig. 2).

Middle Callovian

Kosmoceras jason and Erymnoceras coronatum Zones

In the western margins of the Holy Cross Mts the fauna representing the two above Zones is encountered mostly in the nodular bed. In the Mnin outcrop (Bed *C* in Fig. 3) we are dealing with a mixed fauna of the two Zones in the nodular stromatolite-bearing bed. The following ammonites have been found in this bed: *Kosmoceras pollucinum* Teisseyre, *K. castor castor* (Reinecke), *K. castor fasciculatum* Tintant, *K. trinode* (Buckman), *K. bizeti* (Douvillé), *K. clavifer* Tintant, *K. obductum* (Buckman), *K. grossouvrei phaeinum* (Buckman), *K. complanatum* Tintant, *K.* cf. *gulielmi* (Sowerby), *Erymnoceras* cf. *coronatum* (Bruquière), *E. doliforme* Roman, *Phlycticeras pustulatum* (Reinecke), *Reineckeia (Reineckeia) robusta* Till, *R. (Reineckeia) nodosa* Till, *R. (Reineckeia)* cf. *anceps* (Reinecke), *R. (Reineckeia) indosabauda* (Parona, Bonarelli), *R. (Kellewaysiceras) hungaricus* (Till), *R. (Reineckeites) douvillei* (Stein-

mann), *R. (Reineckeites) eusculptus* (Till), *R. (Rehmannia) greppini* (Oppel), *R. (Rehmannia) rehmanni* (Oppel), *R. (Kellewaysites) multicostatus (Petitclerc), R. (Reineckeites) waageni* (Till), *Hecticoceras* sp. sp.

In the Lasocin *I* profile, the nodular bed representing the uppermost member of the Callovian (*cf.* Fig. 2) bears a mixed fauna from the Erymnoceras coronatum Zone: *K. fibuliferum fibuliferum* (Buckman), *K. obductum* (Buckman), *K. zugium brinkmanni* Tintant, *K. crassum* Tintant, also from the Upper Callovian and Lowermost Oxfordian zones. In this outcrop the Kosmoceras jason Zone is represented by the uppermost layers of sandy limestones and marls (Fig. 2) without an ammonite fauna.

At Lasocin *II* the Middle Callovian is probably represented by two stromatolite layers (beds *C* and *D* in Fig. 4) and the accompanying nodular layer (bed *E* in Fig. 4). The last named has yielded the following ammonites: *Hecticoceras (Brightia) nodosa* (Quenstedt), *H. (Brightia) sveva* (Bonarelli), *H. (Brightia) lugeoni* Tsytovitch, *H. (Brightia) salvadori* (Parona, Bonarelli) *H. (Lunuloceras) pseudopunctatum* (Lahusen), *H. (Putealiceras)* cf. *punctatum* (Stahl), *H. (Rossiensiceras) metomphalum acuticosta* (Tsytovitch), *Kosmoceras ornatum* (d'Orbigny), *Kosmoceras fuchsi* (Neumayr), *Reineckeia (Kellewaysites) multicostatus* (Petitclerc), *Grossouvria curvicosta* (Oppel), *Cadoceras* sp. The above fauna indicates the Erymnoceras coronatum Zone and the lowermost part of the Peltoceras athleta Zone.

In the southern margin, the Middle Callovian is represented by the upper parts of calcareous gaizes with cherts. The ammonites found in the outcrops at Wolica belong to *Kosmoceras castor* (Reinecke) and *Kosmoceras crassum* Tintant, indicating the Erymnoceras coronatum Zone.

At Wola Morawicka there occurs in these deposits a strongly deformed ammonite fauna from specifically indeterminate genera: *Hecticoceras, Kosmoceras, Choffatia.* In view, however, of the sedimentary continuity within the Callovian series it seems probable that both the Middle Callovian zones are represented.

Upper Callovian

Peltoceras athleta Zone

In the western margin of the Holy Cross Mts the index fauna for the above Zone has been found in the profile of Lasocin *I*. The nodular bed (Fig. 2) contains a mixed fauna from more than one ammonite zone. That there considered is represented by: *Kosmoceras duncani* (Sowerby), *Peltoceras (Peltoceras) athleta* (Phillips), *P. (Peltoceras) trifidum* (Quen-

stedt), *P. (Peltoceras) erckenbergense* Prieser, *P. (Peltoceras)* cf. *berckhemeri* Prieser, *P. (Parapeltoceras) annulosum* (Quenstedt), *P. (Parapeltoceras) subannulosum* (Prieser), *P. (Parapeltoceras)* cf. *oblongum* (Quenstedt), *P. (Metapeltoceras) broili* (Prieser), *P. (Metapeltoceras) schroederi* (Prieser), *P. (Metapeltoceras) baylei* (Prieser), *P. (Metapeltoceras) helveticum* Jeannet, *P. (Metapeltoceras)* sp. *A, Rursiceras* sp.

In the outcrop Lasocin *II* the Peltoceras athleta Zone is probably represented by the lower layers of the silicified nodular limestones (bed *F* in Fig. 4).

At Mnin, the Peltoceras athleta Zone corresponds to a stratigraphic lacuna, the only signs of sedimentation at that time are lamina of limonite mudstone but a few millimetres thick.

In the southern margin of the Holy Cross Mts the index fauna for the Zone under consideration has been found in the top of sandy (red) limestones at Wola Morawicka — *Peltoceras* ex gr. *athleta*. At Wolica this Zone is probably represented by an assemblage of nodular limestones (Fig. 2) which have not, however, yielded any ammonite remains.

Quenstedtoceras lamberti Zone

In the Mnin outcrop the index fauna for this Zone occurs within the nodular limestones (beds *E, F* in Fig. 3) consisting of the ammonite species *Quenstedtoceras* cf. *lamberti* (Sowerby), and *Qu. intermissum* (Buckman). At Lasocin *I*, index ammonites for the Quenstedtoceras lamberti Zone: *Qu. flexicostatum* (Phillips) and *Qu. henrici* (Douvillé) have been found in the nodular layer mentioned above, in association with a mixed fauna from several zones.

In the remaining outcrops, the presence of the Zone here considered is suggested by sedimentary continuity in the Upper Callovian deposits. Only in the Wolica outcrop (southern margin of the Holy Cross Mts) has *Kosmoceras* cf. *spinosum* (Sowerby) been found in the lower part of the nodular bed.

Lower Oxfordian

Quenstedtoceras mariae Zone

This Zone occurs throughout the marginal area of the Holy Cross Mts here considered. Faunal evidence has been obtained from the profiles at Mnin, Lasocin *I* and Wolica (Tab. 2) on the presence of the index species *Qu. mariae* (d'Orbigny).

PALEONTOLOGICAL DESCRIPTIONS

Introductory remarks

The cephalopods here described, stratigraphically represent all the Callovian zones (the Macrocephalites macrocephalus Zone excepted). Most of the specimens have been collected from conglomeratic deposits or from a bed nodular in type. The hydrodynamic conditions prevalent during the formation of these deposits affected the preservation of the organic remains they contained. These are often broken up, corroded, in many cases burrowed by burrowing organisms and grown over by stromatolites. In the course of later diagenetic processes, their shells were, moreover, crushed and often strongly deformed. Such a state of preservation of the cephalopods hardly allows a revision of the current taxonomic determinations.

The cephalopods described and figured here belong to genera and species of stratigraphic value on the zone level. Those lacking greater stratigraphic value have not been figured and only those best preserved have been described.

The systematics and criteria of the generic taxonomic identifications are based chiefly on Arkell's work (1957) or on the most recent monographs of the given family or genus.

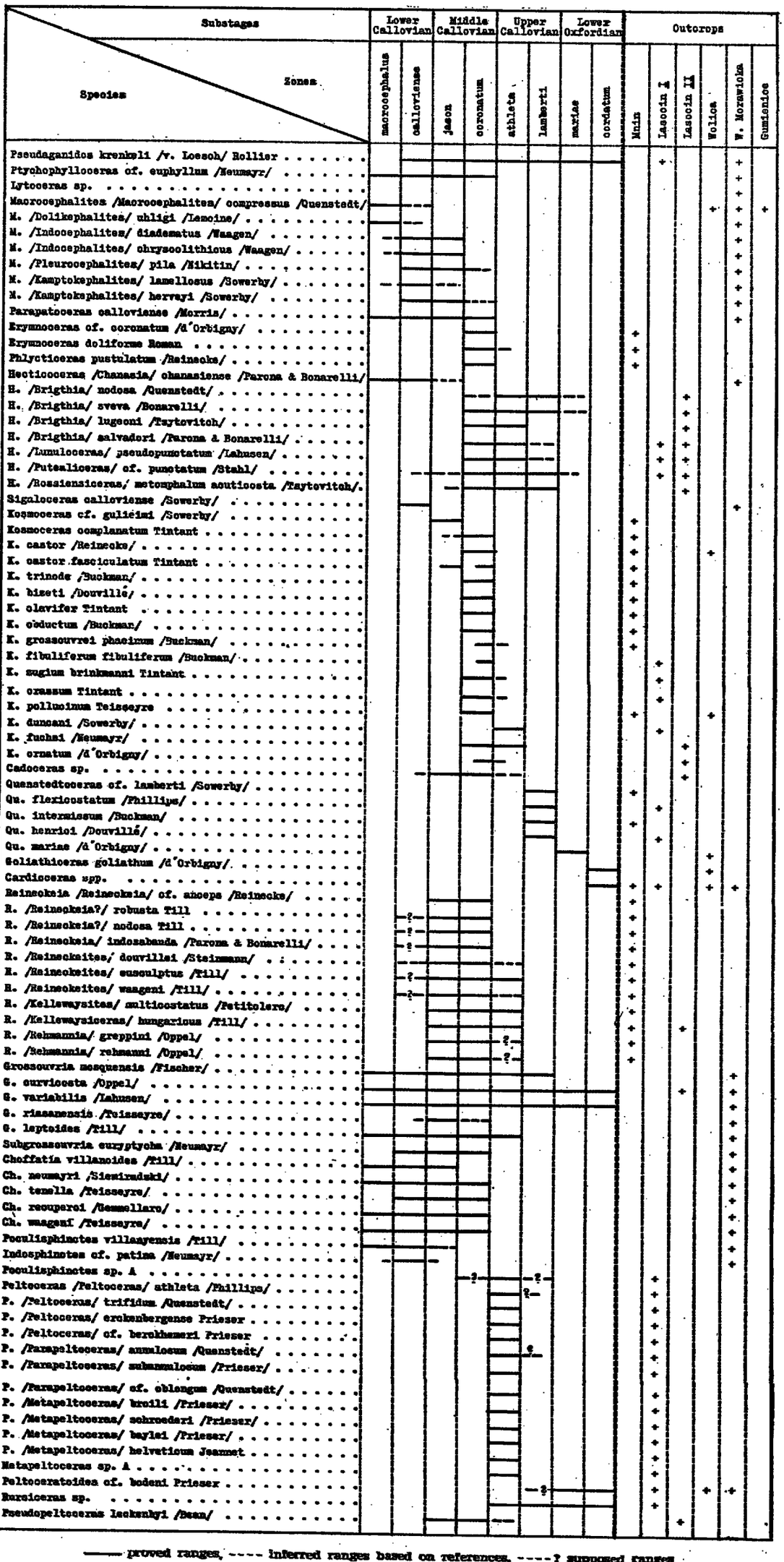
Measurements of specimens in Tables 3—43

D — diameter of specimen
H — whorl height
h — whorl height in relation to diameter
W — whorl width
w — whorl width in relation to diameter
O — umbilical width
o — umbilical width in relation to diameter
W/H — relation of whorl width to whorl height
r_i — number of primary ribs in one whorl
$r_i/2$ — number of primary ribs in a half-whorl
r_o — number of secondary ribs in one whorl
$r_o/2$ — number of secondary ribs in a half-whorl
i — relation of the secondary to the primary ribs
M — macroconch
m — microconch

Latters indicate names of the occurrence sites: Mn — Mnin, LI — Lasocin *I*, LII — Lasocin *II*, W — Wolica, WM — Wola Morawicka.

Table 2

Stratigraphic ranges and localities of the determined Callovian ammonites from the SW margin of the Holy Cross Mts



——— proved ranges, - - - - inferred ranges based on references, - - - -? supposed ranges

Brigthia = Brigthia, gulielmi = gulielmi

Order **Nautiloidea** Zittel, 1884
Suborder **Nautilida** Agassiz, 1847
Family **Nautilidae** d'Orbigny, 1840
Subfamily **Pseudaganidinae** Kummel, 1956
Genus *PSEUDAGANIDES* Spath, 1927
Pseudaganides krenkeli (v. Loesch) Rollier, 1915
(Pl. 1, Figs 3, 3*a*, 4)

1951. *Nautilus (Pseudaganides) krenkeli* (v. Loesch) Rollier; Jeannet, p. 18, Text-figs 37—40.

Material. — Four whorls, one of them with a fragmentary body chamber.

Table 3

No.	D	H	h	W	w	O	o	W/H
1 WM	64	38	0.59	33	0.51	7	0.10	0.86
2 LI	72	43	0.59	36	0.51	8	0.11	0.83

Description. — Strongly involute shells (*cf.* Tab. 3) with trapezoidal whorl section. Whorls higher than thick, laterally compressed, ventrally slightly convex. Suture sigmoidal, with lateral lobe distinct, ventrally inclined. Outer lobe shallow.

Remarks. — The species here described resembles *P. frickensis* Jeannet, but differs from it in lower, trapezoidal section and other whorl measurements.

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone). Lasocin *I*, Upper Callovian.

Order **Ammonoidea** Zittel, 1884
Suborder **Phylloceratina** Arkell, 1950
Superfamily **Phylloceratacea** Zittel, 1888
Family **Phylloceratidae** Zittel, 1884
Genus *PTYCHOPHYLLOCERAS* Spath, 1927
Ptychophylloceras cf. *euphyllum* (Neumayr, 1871)
(Pl. 1, Figs 2, 2*a*)

Material. — Two strongly corroded phragmocones and five fragmentary juvenile whorls.

Table 4

No.	D	H	h	W	w	O	o	W/H
2 WM	44	24	0.54	19	0.43	6	0.13	0.78
3 WM	47	28	0.59	20	0.42	5	0.10	0.71

Description. — Shells strongly involute (*cf.* Tab. 4) with whorls high and ovate in section, ventrally rounded. Whorl sides gradually constricting to the umbilical angle. Outer whorls with characteristic constrictions (the so called umbilical rosette), extending from the umbilical wall to mid-height of side. Suture with wide lobes and bi- or three-partite saddles.

Remarks. — *P. euphyllum has been described by Neumayr* (1871) and Loczy (1915). Jeannet (1951) described it under the generic name *Calliphylloceras,* while Beznosov (1958) included this species into genus *Ptychophylloceras.*

From representatives of the species *Ptychophylloceras hommairei* (d'Orbigny) our specimens differ in a more slender whorl section and in compressed sides. From *Ptychophylloceras euphylloides* (Till) in the presence on the internal mould of the umbilical rosette, in smaller height of whorls and in narrower ventral side. From *Ptychophylloceras flabellatum* (Neumayr) in the presence of the umbilical rosette on the internal mould.

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Suborder **Ammonitina** Hyatt, 1884
Superfamily **Spiroceratacеae** Hyatt, 1900
Family **Spiroceratidae** Hyatt, 1900
Genus *PARAPATOCERAS* Spath, 1924
Parapatoceras calloviense (Morris, 1845)
(Pl. 1, Figs 1, 1*a*)

1924. *Patoceras calloviense* Morris; Roman, p. 69, Pl. 3, Figs 16—19.
1938. *Parapatoceras calloviense* Morris; Roman, p. 250, Pl. 23, Fig. 232.
1957. *Parapatoceras calloviense* (Morris); Arkell (in Moore Treatise of Invertebrate, p. L. Cephalopoda) *L207,* Fig. 235.2.

Material. — Three fragmentary body chambers of gerontic stage.

Remarks. — In spite of the fragmentary state of preservation the specimens here considered are reasonably referable to the above species on their ornamentation and the characteristic slight curvature of whorls, as suggested by descriptions of *P. calloviense* given in the synonymics.

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Superfamily **Stephanocerataceae** Neumayr, 1875
Family **Macrocephalitidae** Buckman, 1922
Genus *MACROCEPHALITES* Zittel, 1884

Genus *Macrocephalites* has been subdivided into subgenera *Macrocephalites* s. s. Zittel, *Indocephalites* Spath, *Kamptokephalites* Buckman, *Pleurocephalites* Buckman and *Dolikephalites* Buckman on the basis of systematics presented by Jeannet (1954) and Arkell (1956). The names of taxons here mentioned have been used by their authors as well as later investigators of the Macrocephalitidae as generic names (Buckman 1922—23, Spath 1928, Douvillé 1943, Bassé & Perrodon 1951, Lominadze 1967). These genera were, however, variously understood by the particular authors, and subdivided on various criteria thus leading to the comparison of species belonging to various genera.

In view of these divergencies it seem reasonable to lower the rank of the generic names of taxons to subgeneric — within the broadly conceived genus *Macrocephalites* — as suggested by Jeannet (1954) and used *i.a.* by Callomon (1955).

Subgenus *MACROCEPHALITES* s. s., Zittel, 1884
Type species: *Ammonites macrocephalus* Schlotheim = *Macrocephalites macrocephalus* (Schlotheim) in Callomon, 1971

Diagnosis. — Macroconchs with narrow umbilicus delimited by distinct edge. Whorl section subtriangular to semicircular with maximum width of whorls at umbilical angle. Sides compressed or slightly convex. Ornamentation consisting of fine, closely spaced, radially placed ribs. In mature forms a relatively early extinction of secondary ribs.

Macrocephalites (Macrocephalites) compressus (Quenstedt, 1886—1887) (Pl. 2, Figs 1—2)

1886—1887. *Ammonites macrocephalus compressus* Quenstedt; Quenstedt, p. 65, Pl. 76, Figs 14—16.
1943. *Macrocephalites canizzaroi* Gemm.; Douvillé, p. 32, Pl. V, Fig. 4; Pl. 7, Fig. 4.
1951. *Macrocephalites compressus* Quenstedt; Bassé & Perrodon, p. 23, Pl. 1, Fig. 2a—c.
1954. *Macrocephalites (Tmetokephalites) (?) canizzaroi* (Gemm.); Jeannet, p. 261, Pl. 22, Fig. 4, Text-fig. 46.
[non] 1905. *Macrocephalites compressus* Quenstedt; Blake, p. 45, Pl. 4, Fig. 4, Text-fig. 4.
[non] 1943. *Macrocephalites macrocephalus* var. *compressus* Quenstedt; Douvillé, p. 32, Pl. 5, Fig. 5; Pl. 7, Fig. 2.

Material. — Six phragmocons and four fragmentary whorls.

Remarks. — The specimens here described are with whorls slightly thicker as compared with those figured and described in the synonyms (*cf.* Tab. 5). These differences fit, however, into the intraspecific variability range.

Table 5

No.	D	H	h	W	w	O	o	W/H	r_1	r_0	i
10 WM /M/	44	23	0.51	20	0.44	9	0.20	0.86	34	80	2.3
8 WM /M/	51	27	0.52	24	0.47	9	0.17	0.88	30	90	3.0
21 WM /M/	52	28	0.53	24	0.46	9.5	0.18	0.85	10	40	4.0
14 WM /M/	72	39	0.54	34	0.45	11	0.15	0.84	?	90	?
16 WM /M/	80	43	0.53	35	0.43	12	0.15	0.81	?	?	?
22 WM /M/	99	49	0.49	47	0.47	12	0.12	0.95	?	?	?

M. compressus figured by Blake (1905) belongs to *M. verus* Buckman (*cf.* Jeannet, 1954). The specimen figured by Douvillé (1943) as *M. macrocephalus* var. *compressus* differs from our specimen in coarser and less closely spaced ribs, also in a wider compressed ventral side.

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Subgenus *DOLIKEPHALITES* Buckman, 1923
Type species: *Dolikephalites dolius* Buckman, 1923

Diagnosis. — Microconchs with a narrow umbilicus, whorl section high, ovate or subtriangular. Sides compressed. Ornamentation consists of coarser or finer, closely spaced ribs, anteriorly strongly curved. Primary ribs coarser than the secondary. The latter discernible to the gerontic stage.

Macrocephalites (Dolikephalites) uhligi (Lemoine, 1910)
(Pl. 2, Figs 3, 3*a*)

1954. *Macrocephalites (Pleurocephalites) uhligi* Lemoine; Jeannet, P. 246, Text-figs 23—26, Pl. 22, Figs 1—3.
1963. *Macrocephalites (Dolikephalites) uhligi* (Lemoine); Callomon, p. 33, Fig. 5.

Material. — Two juvenile whorls, one with a fragmentary body chamber (*cf.* Tab. 6).

Table 6

No.	D	H	h	W	w	U	u	W/H	r_1	r_0	i
4 WM /m/	70	38	0.54	31	0.44	10	0.14	0.81	39	98	25

Remarks. — *M. (Dolikephalites) uhligi* differs from *M. (Dolikephalites) subcompressus* (Waagen) in coarser and more spaced ornamentation, also in the ribs being less inclined anteriorly.

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Subgenus *INDOCEPHALITES* Spath, 1928
Type species: *Indocephalites kheraensis* Spath, 1928

Diagnosis. — Macroconchs with relatively wide umbilicus. Whorl section wide, ellipsoidal or semicircular. Sides strongly convex. Ventral side wide. Ornamentation consisting of strong, rather coarse and widely spaced ribs, slightly curved anteriorly at the umbilical angle or radially directed. Primary ribs disappear in mature forms.

Macrocephalites (Indocephalites) diadematus (Waagen, 1875)
(Pl. 3, Figs 1, 1*a*—*b*, 2, 2*a*, 4, 4*a*)

1875. *Stephanoceras diadematum* Waagen sp.; Waagen, p. 130, Pl. 30, Fig. 3*a*—*c*, Fig. 4*a*—*b*.
1928. *Indocephalites diadematus* (Waagen); Spath, p. 188, Pl. 21, Fig. 7; Pl. 25, Fig. 6; Pl. 31, Fig. 5.
1967. *Indocephalites diadematus* (Waag.); Lominadze, p. 118, Text-figs 41—42, Pl. 15, Fig. 3; Pl. 21, Fig. 3*a*—*b* (give synonymy).
[non] 1951. *Indocephalites diadematus* Waagen; Bassé & Perrodon, p. 29, Pl. 1, Fig. 6*a*—*b*.

Material. — Five phragmocons.

Remarks. — *M. (Indocephalites) diadematus* displays certain similarities with *M. (Indocephalites) chrysoolithicus* (Waagen) from which it differs, however, in markedly greater width of whorls, lower, more compressed section, and narrower umbilicus (*cf.* Tab. 7). In our species the ornamentation is finer and more dense as compared with *M. (Indocephalites) chrysoolithicus*. Specimens 40WM and 45WM, with whorls slightly higher in section come closest to Spath's (1928) transitional forms between the two species here compared. However, specimens representing the more juvenile stages (Nos 6WM and 35WM) in character of ornamentation slightly approach *M. (Pleurocephalites) pila* (Nikitin). From the latter they differ in wider section and more compressed ventral side.

Table 7

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
6 WM /M/	25	11	0.44	19	0.76	9	0.36	1.80	24	61	2.5
35 WM /M/	25	11	0.44	20	0.80	7	0.29	1.81	29	66	2.2
45 WM /M/	50	24	0.48	42	0.84	13	0.26	1.75	28	68	2.4
40 WM /M/	59	30	0.50	50	0.84	13	0.23	1.66	23	72	3.1

From *M. (Indocephalites) rotundus* (Quenstedt) our species differs in wider section, smaller ventral convexity, closer ornamentation and greater number of secondary ribs. The specimen figured and described by Bassé & Perrodon (1951) differs from the typical representatives of *M. (Indocephalites) diadematus* in wider, massive, less closely spaced ribs.

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Macrocephalites (Indocephalites) chrysoolithicus (Waagen, 1875) (Pl. 3, Figs 3, 3*a*)

1875. *Stephanoceras chrysoolithicus* Waagen sp.; Waagen, p. 127, Pl. 30, Fig. 1*a*—*c*.
1928. *Indocephalites chrysoolithicus* (Waagen); Spath, p. 186, Pl. 81, Fig. 6*a*—*b*; Pl. 24, Fig. 7; Pl. 25, Fig. 1; Pl. 26, Fig. 6.
1951. *Indocephalites chrysoolithicus* Waagen; Bassé & Perrodon, p. 27, Pl. V, Fig. 1.
1967. *Macrocephalites* cf. *chrysoolithicus* (Waag.); Lominadze, p. 115, Pl. 7, Fig. 1; Pl. 10, Fig. 5.
[non] 1954. *Macrocephalites (Indocephalites)* cf. *chrysoolithicus* Waagen; Jeannet, p. 240, Pl. 17, Figs 1—2, Text-figs 15—16.

Material. — One juvenile whorl and one fragmentary whorl.

Remarks. — *M. (Indocephalites) chrysoolithicus* differs from *M. (Indocephalites) diadematus* (Waagen) in higher and more slender section, scarcer ornamentation

Table 8

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_o/2$
19 WM /M/	41	21	0.51	28	0.68	9	0.21	1.33	12	29

and narrower umbilicus (*cf.* Tab. 8). The specimens here described differ from representatives of *M. (Pleurocephalites) pila* (Nikitin) in narrower and higher whorl section, more distant and sharper ribs, slight curvature of primary ribs at the umbilical angle and narrower umbilicus. Figures and descriptions of specimens defined by Jeannet (1954) as *M. (Indocephalites)* cf. *chrysoolithicus* differ from figures of the holotype of this species in markedly more widely spaced but distinct ornamentation somewhat resembling that in *M. (Kamptokephalites) dimerus* (Waagen).

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Subgenus *PLEUROCEPHALITES* Buckman, 1922
Type species: *Pleurocephalites lophopleurus* Buckman, 1922

Diagnosis. — Microconchs with wide and rounded whorl section, slightly convex sides and ornamentation consisting of coarse, widely spaced ribs curved anteriorly. Deep umbilicus with rounded edges.

Macrocephalites (Pleurocephalites) pila (Nikitin) 1885
(Pl. 2, Fig. 4; Pl. 4, Figs 3, 3*a*, 4, 4*a*)

1886. *Macrocephalites pila* Nik.; Bukowski, p. 126, Pl. 26 (3), Fig. 17.
1922. *Pleurocephalites folliformis* Buckman; Buckman, Pl. 294.
1967. *Pleurocephalites pila* (Nik.); Lominadze, p. 135, Pl. 6, Fig. 5; Pl. 11, Fig. 3; Pl. 18, Figs 4, 6*a*—*b*; Pl. 20, Fig. 3*a*—*b*; Pl. 21, Fig. 4*a*—*b*.

Material. — Three phragmocons, partly corroded and one gerontic whorl.

Remarks. — *M. (Pleurocephalites) pila* differs from the juvenile stages of *M. (Indocephalites) diadematus* (Waagen) in higher section and greater height of whorls (*cf.* Tab. 9), also in finer and more spaced ribs. The species under conside-

Table 9

No.	D	H	h	W	w	O	o	W/H	r_1	r_0	i
5 WM /m/	36	16	0.44	24	0.66	10	0.29	0.50	?	?	?
39 WM /m/	46	23	0.50	36	0.78	12	0.25	1.52	32	77	24
37 WM /m/	65	37	0.56	51	0.78	15	0.23	1.40	29	66	22

ration differs from the juvenile stages of *M. (Indocephalites) chrysoolithicus* (Waagen) in wider section, more convex sides and coarser ribs.

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Subgenus *KAMPTOKEPHALITES* Buckman, 1922
Type species: *Kamptokephalites kamptus* Buckman, 1922

Diagnosis. — Microconchs with ovate or subtriangular whorl section, sides compressed or slightly convex. Ventrally relatively narrow. Umbilicus narrow. Ornamentation consisting of flexural, widely spaced, rather coarse bi-partite ribs and numerous intercalary ribs.

Macrocephalites (Kamptokephalites) herveyi (Sowerby, 1818)
(Pl. 4, Figs 1, 1*a*)

1943. *Macrocephalites herveyi* Sowerby; Douvillé, p. 37, Pl. 6, Fig. 15.
1954. *Macrocephalites (Kamptokephalites) herveyi* Sowerby sp.; Jeannet, p. 250, Text-figs 29—31, Pl. 20, Fig. 2.
[non] 1905. *Macrocephalites herveyi* Sowerby; Blake, p. 46, Pl. 3, Fig. 7; Pl. 4, Fig. 2.

Material. — Two phragmocons of which one strongly corroded.

Table 10

No.	D	H	h	W	w	O	o	W/H	r_1	r_0	i
18 WM /m/	56	27	0.48	34	0.60	11	0.20	1.25	32	76	2.3

Remarks. — Our specimens differ from other species of subgenus *Kamptokephalites* in their characteristic oval whorl section, in size (*cf.* Tab. 10) and widely spaced sharp ribs. The specimen described and figured by Blake (1905) as *M. herveyi* is ornamented so as to bring it nearer to *M. (Kamptokephalites) dimerus* (Waagen).

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Macrocephalites (Kamptokephalites) lamellosus (Sowerby, 1818)
(Pl. 4, Figs 2, 2*a*; Pl. 5, Figs 1, 1*a*, 2, 2*a*, 3, 3*a*)

1875. *Stephanoceras lamellosum* Sow.; Waagen, p. 122, Pl. 33, Fig. 1*a*—*b*.
1875. *Stephanoceras subtrapezinum* Waagen; Waagen, p. 137, Pl. 33, Fig. 4.
1886. *Macrocephalites lamellosus* Sow.; Bukowski, p. 125, Pl. 26 (2), Fig. 19.
1928. *Kamptokephalites lamellosus* (Sow.); Spath, p. 198, Pl. 19, Fig. 8*a*—*b*; Pl. 24, Fig. 3; Pl. 25, Fig. 7*a*—*b*; Pl. 33, Fig. 9*a*—*b*; Pl. 36, Fig. 2*a*—*b*.
1943. *Macrocephalites lamellosus* Sow.; Douvillé, p. 40, Pl. 4, Fig. 14; Pl. 7, Fig. 14.
1951. *Kamptokephalites lamellosus* Sow.; Bassé & Perrodon, p. 38, Pl. 3, Fig. 5.
1954. *Macrocephalites (Kamptokephalites) lamellosus* Sow. sp.; Jeannet, p. 254, Pl. 26, Fig. 3, Text-figs 36—38.
1954. *Macrocephalites (Kamptokephalites) (?) substrapezinus* Waag. sp.; Jeannet, p. 256, Pl. 24, Fig. 1, Text-figs 39—40.
1967. *Kamptokephalites lamellosus* (Sow.); Lominadze, p. 162, Pl. 4, Fig. 1; Pl. 5, Figs 1, 3; Pl. 11, Fig. 5; Pl. 13, Fig. 3; Pl. 16, Fig. 5.
1967. *Komptokephalites subtrapezinus* (Waag.); Lominadze, p. 165, Pl. 1, Fig. 4; Pl. 2, Figs 2, 3*a*—*b*; Pl. 6, Fig. 4; Pl. 9, Figs 2*a*—*b*, 5*a*—*b*; Pl. 12, Fig. 2; Pl. 13, Figs 5, 6; Pl. 16, Fig. 3*a*—*b*.

Material. — Five phragmocons, partly corroded.

Remarks. — *Stephanoceras subtrapezinus*, created by Waagen (1875), has been included by Spath (1928) into *Macrocephalites lamellosus*. Spath postulated (1928) that the differences between the specimens representing the holotypes of Waagen's both species (1875) are not sufficiently important to refer them to two separate species. Spath's opinion (1928) is confirmed by observations of specimens here described. The definition of *M. (Kamptokephalites) lamellosus* agrees closely only with specimen No. 43WM (Pl. 5, Figs 1, 1*a*). As regards dimensions (*cf.* Tab. 11), character of section,

Table 11

No.	D	H	h	W	w	O	o	W/H	r_1	r_0	i
48 WM /m/	39	20	0.51	22	0.56	9	0.23	1.1	?	?	?
24 WM /m/	41	24	0.58	24	0.58	9	0.22	1.0	32	74	2.3
47 WM /m/	51	27	0.52	25	0.49	11	0.21	0.9	33	76	2.3
43 WM /m/	52	25	0.48	26	0.50	12	0.23	1.06	34	74	2.1
46 WM /m/	60	32	0.53	29	0.48	13	0.21	0.9	36	79	2.1

and rather moderate curvature other specimens come closer to forms described by Waagen (1875) as *Stephanoceras subtrapezinus* Waagen. These differences fit, however, into the intraspecific variability range so that it seems reasonable to unite the two species here discussed into one: *M. (Kamptokephalites) lamellosus*.

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Family **Pachyceratidae** Buckman, 1918
Genus *ERYMNOCERAS* Hyatt, 1900
Erymnoceras (Erymnoceras) cf. *coronatum* (Bruquière, 1848)
(Pl. 6, Fig. 2)

Material. — Two phragmocons, fairly strongly corroded.

Remarks. — On the dimensions of our specimens (*cf.* Tab. 12) and the observed

Table 12

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_0/2$	i
1 Mn /M/	62	24	0.38	41	0.66	26	0.41	0.7	9	18	2.0

character of ornamentation it seems fairly reasonable to refer them to *E. (Erymnoceras) coronatum*, a species described i.a. by Roman (1938), Jeannet (1951) and figured by Lominadze (1970).

Occurrence. — Mnin, Middle Callovian.

Erymnoceras (Erymnoceras) doliforme (Roman, 1930)
(Pl. 5, Figs 4, 4*a*; Pl. 6, Figs 1, 1*a*)

1883. *Stephanoceras coronatum* Brug.; Lahusen, Pl. 6, Fig. 3.
1930. *Stephanoceras doliforme* Roman; Roman & Sayn, p. 173, Pl. 13, Figs 2, 2*a*, 4, 4*a*.
1970. *Erymnoceras (Erymnoceras) doliforme* (Roman); Lominadze, p. 76, Pl. 1, Fig. 2; Pl. 3, Fig. 2*a*—*b*; Pl. 4, Figs 2—3 (give synonymy).

Material. — Two phragmocons and four fragmentary whorls.

Description. — Whorl section diagonally-elliptical, umbilicus relatively narrow, deeper and funnel-like on inner whorls, more shallow on the outer, ornamentation

Table 13

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_o/2$
4 Mn /m?/	22	10	0.45	24	1.1	8	0.36	2.5	5	?
2 Mn /m?/	38	13	0.34	30	0.78	14	0.36	2.3	10	19

consisting of distinct umbilical ribs ending in sharp tubercles on the umbilical angle and in two secondary ribs starting from each tubercle and slightly anteriorly inclined. The above characters and dimensions of our specimens (*cf.* Tab. 13) coincide with those in the representatives of species *E. (Erymnoceras) doliforme*.

Occurrence. — Mnin, Middle Callovian.

Family **Kosmoceratidae** Haug, 1887
Subfamily **Keppleritinae** Tintant, 1963
Genus *SIGALOCERAS* Hyatt, 1900
Sigaloceras (Sigaloceras) calloviense (Sowerby, 1815)
(Pl. 6, Fig. 4)

1886—1887. *Ammonites calloviensis* Sowerby; Quenstedt, p. 731, Pl. 84, Fig. 87.
1963. *Sigaloceras (Sigaloceras) calloviense* (Sow., 1815); Tintant, p. 194, Pl. 19, Fig. 1; Pl. 20, Figs 1—3; Pl. 21, Figs 1—3; Pl. 22, Figs 1—2.

Material. — Two gerontic whorls, one juvenile whorl (badly corroded).

Remarks. — From typical representatives of this species the Wola Morawicka specimens differ in smaller height and thickness of whorls (*cf.* Tab. 14), more

Table 14

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
50 WM /M/	69	28	0.40	22	0.31	18	0.26	0.78	?	?	?

compressed sides, higher and more slender section. These differences fit, however, into the intraspecific variability range (*comp.* Tintant 1963, p. 199).

Occurrence. — Wola Morawicka, Lower Callovian (Sigaloceras calloviense Zone).

Subfamily **Kosmoceratinae** Tintant, 1963
Genus *KOSMOCERAS* Waagen, 1869
Type species: *Ammonites spinosus* Sowerby, 1826

Diagnosis. — Microconchs with lappets on the peristome and macroconchs with a straight peristome (Makowski 1962). Umbilicus moderately wide. Whorl section from narrow to wide, sides compressed or convex. Ventral side compressed, occasionally somewhat rounded. Distinct ornamentation consisting of single or paired primary ribs and secondary ribs either single or in bundles of two or more. Most species bear more or less distinct tubercles, either sharp or rounded, occurring in never more than in three rows on a whorl side (umbilical, lateral and ventral). Some species lack the tubercles in certain stages of ontogeny.

Remarks. — Tintant (1963) — partly on Brinkman's (1929a, b) classification, also on Callomon's (1955) suggestions — divided genus *Kosmoceras* into four subgenera: *Zugokosmoceras, Kosmoceras* — macroconchs, *Gulielmiceras, Spinikosmoceras* — microconchs. This subdivision, on the one hand takes into account the phylogenetic changes occurring within the Kosmoceratinae, while on the other hand it is based on purely morphological criteria. The observed phylogenetic changes reliably suggest the distinction of two groups from representatives of the above subfamily: namely forms with relatively simple ornamentation (single secondary ribs, generally not joining together, lack of lateral tubercles) also forms with an intricate ornamentation pattern (bundled secondary ribs and strongly developed lateral tubercles). The first group represents the older species (lower Middle Callovian), the second group the younger species (higher zone of the Middle Callovian and the Upper Callovian). In either of these two groups we can distinguish the so called macroconchs with a simple peristome and microconchs whose peristome bears lappets. Studies on sexual dimorphism in ammonites, *i.a.* in representatives of genus *Kosmoceras*, have shown that macroconchs correspond to the female forms and microconchs to the male ones (Callomon 1963; Makowski 1962). On the basis of biological criteria, the macroconchs and the corresponding microconchs might, therefore, reasonably be united not only into one subgenus but even one species (*vide* Westermann 1969). The currently accepted morphological criteria separating genus *Kosmoceras* into macroconchs and microconchs is no longer acceptable. The material here discussed does not allow any definite suggestions in what concerns the division of *Kosmoceras* into subgenera. Hence only the generic name *Kosmoceras* is used by the writer accompanied by the corresponding specific name.

Kosmoceras obductum (Buckman, 1923)
(Pl. 6, Figs 3, 3*a*)

1915. *Cosmoceras jason* Rein.; Krenkel, p. 253, Pl. 20, Fig. 7.
1929a. *Kosmoceras (Zugokosmoceras) obductum obductum* (Buck.); Brinkmann, Pl. 2, Fig. 4.
1955. *Kosmoceras (Gulielmites) obductum* Buck.; Callomon, p. 229, Pl. 3, Fig. 1*a*—*b*.
1963. *Kosmoceras (Zugokosmoceras) obductum* (Buck.); Tintant, — p. 263, Pl. 26, Fig. 1; Pl. 31, Figs 2—3.

Material. — Two mature whorls.

Remarks. — The species here described differs from the allied *K. crassum* (Tintant) in higher and narrower section (*cf.* Tab. 15), finer and more numerous ribs and in absence of external tubercles.

Occurrence. — Mnin, Middle Callovian; Lasocin *I*, Middle Callovian (?).

Table 15

No.	D	H	h	W	w	O	o	W/H	$r_1/2$
19 Mn /M/	65	27	0.41	23	0.26	23	0.26	0.62	14
3 LI /M/	72	33	0.45	23	0.31	19	0.26	0.60	26

Kosmoceras crassum (Tintant, 1963)

1963. *Kosmoceras (Zugokosmoceras) crassum* n. sp.; Tintant, p. 269, Pl. 28, Fig. 3; Pl. 29, Figs 1—2; Pl. 30, Figs 1—2.

Material. — Two mature whorls and one juvenile whorl.

Remarks. — The above species differs from the allied *K. obductum* (Buckman)

Table 16

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_0/2$
43 Mn /M/	43	20	0.46	14	0.32	?	?	0.70	14	32
18 Mn /M/	68	29	0.42	18	0.26	17	0.24	0.62	13	38

in a lower and more depressed section (*cf.* Tab. 16), more distinct and rare ornamentation and the presence of distinct outer tubercles.

Occurrence. — Mnin, Middle Callovian.

Kosmoceras zugium brinkmanni (Tintant, 1963)

1963. *Kosmoceras (Zugokosmoceras) zugium brinkmanni* n. subsp.; Tintant, p. 278, Pl. 31, Fig. 1.

Material. — Two mature whorls. One whorl with a fragmentary body chamber (No. 4LI — *cf.* Tab. 17).

Table 17

No.	D	H	h	W	w	O	o	W/H
5 LI /M/	97	37	0.37	27	0.27	26	0.26	0.72
4 LI /M/	104	43	0.41	30	0.28	30	0.28	0.69

Remarks. — Subspecies *K. zugium brinkmanni* occupies an intermediate position (*cf.* Tintant 1963) in the phylogenetic lineage of *K. zugium* (Buckman). From the subspecies *K. zugium zugium* (Buckman) it differs in coarser and more spaced ornamentation, and flexural course of secondary ribs. From the subspecies *K. zugium interpositum* (Buckman) in the lack of twarib-bundles.

Occurrence. — Lasocin *I*, Middle Callovian (?).

Kosmoceras grossouvrei phaeinum (Buckman, 1924)

1963. *Kosmoceras (Kosmoceras) grossouvrei phaeinum* (Buck.); Tintant, p. 310, p. 341 (in text).

Material. — One matural whorl.

Description. — Whorl section polygonal, with maximum width at *c.* one third the height of the side, constricting towards the flattened ventral side at the level of the tubercles. Ornamentation characterized by presence of primary ribs, strongly coarser at the umbilical angle and terminating at one third the height of the side

with round sharpened tubercles. A bundle of three or four fine, sharp secondary ribs, slightly sinuously curved, branches off from every tubercle. Most secondary ribs are bundled two and two together into one small outer tubercle. Single secondary ribs occur, too.

In spite of its fragmentary state of preservation, the above specimen may — on the ground of its ornamentation — be reasonably referred to the group of *Kosmoceras* species of phylogenetic lineage *grossouvrei-phaeinum-proniae*. It corresponds to the subspecies *K. grossouvrei phaeinum*.

Remarks. — From the related subspecies *K. grossouvrei grossouvrei* (Douvillé) the subspecies here considered differs in stronger and rarer lateral tubercles and more regular occurrence of bundled secondary ribs.

Occurrence. — Mnin, Middle Callovian.

Kosmoceras fibuliferum fibuliferum (Buckman, 1923)
(Pl. 7, Fig. 1)

1963. *Kosmoceras (Kosmoceras) fibuliferum* (Buck.) *fibuliferum* (Buck.); Tintant, p. 340, Pl. 47, Fig. 2.

Material. — One, slightly damaged mature whorl (macroconch).

Remarks. — The ornamentation pattern of specimen from Lasocin *I* and its dimensions (*cf.* Tab. 18) reasonably suggests its assignment to subspecies *K. fibuliferum fibuliferum*. From representatives of subspecies *K. fibuliferum pseudogrossouvrei* Tintant it differs in stronger umbilical tubercles and lateral tubercles, in rarer lateral tubercles, also in the presence of bundled secondary ribs.

Table 18

No.	D	H	h	W	w	O	o	W/H	r_1	r_o
23 Mn /M/	?	25	?	21	?	?	?	0.84	?	?

Occurrence. — Lasocin *I*, the Callovian.

Kosmoceras duncani (Sowerby, 1818)
(Pl. 8, Figs 6, 6*a*)

1929b. *Kosmoceras (Kosmoceras) Duncani* Sow.; Brinkmann, p. 90, Pl. 1, Figs 7*a*—*b*, 8.
1952. *Cosmoceras (Cosmoceras) duncani* (Sow.); Makowski, p. 36, Pl. 3, Fig. 8; Pl. 4, Fig. 13; Pl. 8, Fig. 3; Pl. 9, Fig. 2.
1962. *Cosmoceras duncani* (Sow., 1818); Makowski, p. 69, Pl. 2, Figs 1*a*—*f*, 2*a*—*c*.

Material. — One mature whorl and one fragmentary juvenile whorl.

Remarks. — The dimensions of the specimen (*cf.* Tab. 19) and the observed

Table 19

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_o/2$	i
15 LI /M/	67	30	0.44	27	0.40	19	0.28	0.90	18	31	2.8

ornamentation reasonably suggest its assignment to *K. duncani* in accordance with the description of that species under items given in the synonymics.

Occurrence. — Lasocin *I*, the Callovian (nodule bed).

Kosmoceras bizeti (Douvillé, 1915)

1915. *Cosmoceras castor* var. *bizeti* nov.; Douvillé, p. 39, Pl. 11, Figs 1, 6.
1963. *Kosmoceras (Kosmoceras) bizeti Douvillé* (1915); Tintant, p. 342, Pl. 47, Figs 3—4; Pl. 48, Figs 1—2; Pl. 49, Figs 1—2.

Material. — Two fragmentary mature whorls.

Remarks. — The dimensions (*cf.* Tab. 20) and the characteristic ornamentation of these specimens reasonably suggest their assignment to *K. bizeti*. From the related

Table 20

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
21 Mn /M/	?	22	?	21	?	?	?	0.95	?	?	?

K. pollucinum Teisseyre they differ in more depressed whorl section, also in stronger, more spaced ornamentation.

Occurrence. — Mnin, the Middle Callovian.

Kosmoceras castor castor (Reinecke) (Pl. 7, Fig. 2)

1884. *Cosmoceras castor* Rein.; Teisseyre, p. 577, Pl. 4, Fig. 28.
1915. *Cosmoceras castor* Rein.; Krenkel, p. 259, Pl. 20, Figs 5—6.
1915. *Cosmoceras castor* (Fein.) Nik.; Douvillé, p. 38, Pl. 5, Fig. 5.
1929a. *Kosmoceras (Spinikosmoceras) castor anterior* n. subsp.; Brinkmann, Pl. 3, Fig. 7.
1929a. *Kosmoceras (Spinikosmoceras) castor castor* Rein.; Brinkmann, Pl. 3, Fig. 8.
1929b. *Kosmoceras (Spinikosmoceras) castor* Rein.; Brinkmann, p. 67.
1950. *Cosmoceras castor* (Rein.); Sokołowa, p. 140, Pl. 5, Fig. 6.
1963. *Kosmoceras (Spinikosmoceras) castor* (Rrein.) *castor;* Tintant, p. 390, Pl. 54, Fig. 7; Pl. 55, Figs 1—8; Pl. 56, Figs 1—4.
1963. *Kosmoceras (Kosmoceras) castorinum* n. sp.; Tintant, p. 315, Pl. 39, Fig. 4a—b; Pl. 40; Pl. 41, Fig. 1.

Material. — Fifteen whorls, among which seven fragmentary whorls of macroconchs and eight phragmocons of microconchs and of inner macroconch whorls.

Remarks. — Specimens with smaller diameter (*cf.* Tab. 21), representing microconchs or juvenile macroconch whorls, display features characteristic of *K.*

Table 21

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
8 Mn /m/	29	13	0.44	10	0.34	9	0.29	0.76	12	32	2.6
29 Mn /m/	30	12	0.40	8	0.26	10	0.33	0.66	13	26	2.0
9 Mn /?/	31	13	0.41	9	0.29	9	0.29	0.69	10	20	2.2
20 Mn /?/	34	15	0.44	12	0.33	11	0.32	0.73	11	22	2.0
6 Mn /?/	37	16	0.42	13	0.27	11	0.29	0.81	8	18	2.2
10 Mn /M/	40	17	0.42	13	0.32	12	0.28	0.74	10	24	2.4
12 Mn /M/	?	28	?	22	?	?	?	0.79	?	?	?
13 Mn /M/	?	25	?	20	?	?	?	0.80	?	?	?

castor (Reinecke), described in detail by Tintant (1963) as *K. (Spinikosmoceras) castor castor* (Reinecke). The inner whorls of specimens representing macroconchs (12M and 13M) have a characteristic ornamentation pattern identical to that in specimens typical of *K. castor* (Reinecke) while in the outer whorls the ornamentation is typical of forms described by Tintant (1963) as *K. (Kosmoceras) castorinum* Tintant.

According to Tintant (1963) the differences between *K. (Spinikosmoceras) castor* (Reinecke) and *K. (Kosmoceras) castorinum* Tintant consist chiefly in the size of the representatives of the two species, the former representing small forms (microconchs), the latter the large forms (macroconchs). Differences in ornamentation set in on the older whorls of representatives of *K. (Kosmoceras) castorinum* Tintant, the young whorls of this species being indistinguishable from the mature whorls *K. (Spinikosmoceras) castor* (Reinecke). Thus, differences of this type are a result of sexual dimorphism (Makowski 1962) and not of actual differences between species and even subgenera. Hence, representatives of the traditionally conceived *K. (Spinikosmoceras) castor* (Reinecke) represent the male forms, while those of *K. (Kosmoceras) castorinum* Tintant represent the female forms. Therefore, in the writer's opinion, representatives of these two species should be united into one under the name of *K. castor* (Reinecke). From *K. castor fasciculatum* (Tintant) the subspecies here considered differs in the absence of bundled secondary ribs.

Occurrence. — Mnin, the Middle Callovian.

Kosmoceras castor fasciculatum (Tintant, 1963) (Pl. 8, Figs 3, 3*a*)

1963. *Kosmoceras (Spinikosmoceras) castor* (Rein.) *fasciculatum* n. subsp; Tintant, p. 398, Pl. 56, Figs 5—7.

Material. — Three whorls, and two fragmentary whorls.

Remarks. — High, compressed section (*cf.* Tab. 22), sides of whorls flat, ornamentation consisting of two rows of tubercles (lateral and ventral), secondary ribs

Table 22

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_o/2$	i
30 Mn /m/	36	17	0.47	12	0.33	10	0.27	0.70	8	22	2.7

in pairs on one ventral tubercle. All these features reasonably suggest the assignment of the specimen under consideration of subspecies *K. castor fasciculatum* which differs from *K. castor castor* Reinecke in the presence of bundled secondary ribs.

Occurrence. — Mnin, the Middle Callovian.

Kosmoceras pollucinum Teisseyre, 1884 (Pl. 7, Figs 3, 3*a*; Pl. 8, Figs 2, 2*a*)

1883. *Cosmoceras Castor* Rein.; Lahusen, p. 60, Pl. 8, Figs 1, 3—4.
1883. *Cosmoceras pollux* Rein.; Lahusen, p. 61, Pl. 8, Figs 5—8.
1884. *Cosmoceras pollucinum* n. f.; Teisseyre, p. 579, Pl. 4, Figs 31*a*—*b*; Pl. 5, Fig. 30
1886—1887. *Ammonites ornatus (castor)* Schloth.; Quenstedt, p. 728, Pl. 84, Figs 10, 20.
1915. *Cosmoceras castor* Rein.; R. Douvillé, p. 36, Pl. 11, Figs 2—4, 7.
1915. *Cosmoceras pollucinum* Teis.; R. Douvillé, p. 56, Pl. 20, Fig. 2.
1915. *Cosmoceras elisabethae* Pratt; R. Douvillé, p. 38, Pl. 13, Fig. 3.
1915. *Cosmoceras pollucinum* Teis.; Krenkel, p. 270, Pl. 22, Fig. 5.
1929a. *Kosmoceras (Spinikosmoceras) Pollux Pollux* (Rein.); Brinkmann, Pl. 3, Fig. 11.
1929b. *Kosmoceras (Spinikosmoceras) Pollux* (Rein.); Brinkmann, Pl. 71.
1929b. *Kosmoceras (Kosmoceras) pollucinum* Teis: Brinkmann, p. 87.
1950. *Cosmoceras pollux* Reinecke, 1818; Sokołowa, p. 143, Pl. 6, Figs 1, 1*a*.
1950. *Cosmoceras pollucinum* Teisseyre, 1884; Sokołowa, p. 133, Pl. 5, Fig. 1.
1962. *Cosmoceras pollucinum* Teisseyre; Makowski, p. 69, Pl. I, Figs 1*a*—*f*, 2*a*—*c*.
1963. *Kosmoceras (Kosmoceras) pollucinum* Teisseyre, 1884; Tintant, p. 327, Pl. 63, Figs 1—3.

1963. *Kosmoceras (Spinikosmoceras) pollux* (Rein.) *pollux* (Rein.) Brink., 1929; Tintant, p. 403, Pl. 57, Figs 1—7.

Material. — Seven whorls, among which three are macroconchs the four other fragmentary.

Remarks. — Mature whorls with smaller diameter (*cf.* Tab. 23) in character of ornamentation very closely resemble *K. (Spinikosmoceras) pollux* (Reinecke) (*vide*

Table 23

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_o/2$	i
24 Mn /m/	34	14	0.41	12	0.35	11	0.32	0.82	9	16	1.6
26 Mn /m/	41	17	0.41	16	0.39	14	0.34	0.94	9	11	1.2
14 Mn /M/	60	25	0.42	18	0.30	18	0.30	0.70	10	28	2.8

Tintant 1963). In accordance with the definition of subgenus *Spinikosmoceras* (Brinkmann 1929a, b; *in* Tintant 1963) these specimens represent microconchs. Specimens big in diameter, whose juvenile whorls show no differences as compared with representatives of *K. (Spinikosmoceras) pollux* while differences in ornamentation do not appear before the older ontogenic stages represent macroconchs. They may, therefore, reliably be referred to *K. (Kosmoceras) pollucinum.*

Makowski (1962) has shown that the differences occurring between these species result from sexual dimorphism; the microconchs *K. (Spinikosmoceras) pollux* (Reinecke) representing the male forms, and the macroconchs *K. (Kosmoceras) pollucinum* — the female forms. Hence, representatives of both species are referable to one species, the *K. pollucinum.*

Occurrence. — Mnin, Wolica, the Middle Callovian.

Kosmoceras trinode (Buckman, 1927)
(Pl. 8, Fig. 5)

1950. *Cosmoceras* sp. nov.; Sokolova, p. 135, Pl. 5, Fig. 3.
1963. *Kosmoceras (Kosmoceras) trinode* (Buckman, 1927); Tintant, p. 322, Pl. 41, Figs 2—3; Pl. 42, Figs 1—2.

Material. — Three fragmentary mature whorls.

Remarks. — The dimensions of the specimens (*cf.* Tab. 24) and the character of ornamentation reasonably suggest their assignment to *K. trinode,* described in

Table 24

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_o/2$	i
15 Mn /M/	?	27	?	18	?	?	?	0.66	?	?	?
11 Mn /M/	74	29	0.39	21	0.28	22	0.29	0.72	9	29	3.2

items given in the synonymics. The specimens here considered differ from *K. clavifer* (Tintant) in finer, more delicate and more closely spaced ornamentation, also in less distinct outer tubercles.

Occurrence. — Mnin, the Middle Callovian.

Kosmoceras clavifer (Tintant, 1963)

1963. *Kosmoceras (Kosmoceras) clavifer* sp.; Tintant, p. 348, Pl. 49, Fig. 4; Pl. 50, Figs 1—3.

Material. — Three fragmentary mature whorls of macroconchs.

Remarks. — On the character of whorl section and of ornamentation observed in specimens here considered they are reasonably referable to *K. clavifer.*

From *K. trinode* (Buckman) *K. clavifer* differs in coarser and more spaced ornamentation, also in the presence of outer tubercles of the "clavi" type. From *K. fuchsi* (Neumayr) our species differs in a narrower umbilicus, more slender whorl section, depresssed sides, more minute side tubercles and less distinct ornamentation.

Occurrence. — Mnin, the Middle Callovian.

Kosmoceras fuchsi (Neumayr, 1871)
(Pl. 7, Figs 4, 4*a*)

1871a. *Aspidoceras fuchsi;* Neumayr, p. 45, Pl. 15, Figs 3*a*—*b*, 4*a*—*b*.
1884. *Cosmoceras med. f.* Jenzeni Teiss. — *Fuchsi* Neumayr; Teisseyre, p. 573, Pl. 5, Fig. 35.
1951. *Kosmoceras (Spinikosmoceras)* cf. *aculeatum* Eichw. sp.; Jeannet, p. 158, Text-fig. 384 Pl. 26, Figs 10—11.
1956. *Epicosmoceras fuchsi* (Neumayr; Arkell) *in* Treatise ..., p. L301, Fig. 367.

Material. — One gerontic whorl with a fragmentary body chamber.

Description. — Whorl section depressed, polygonal, ventral side narrow, depressed on inner whorls, on body chamber rounded, slightly convex. Umbilicus wide and deep with walls vertical, somewhat compressed on the body chamber. Whorls slightly thicker than high (*cf.* Tab. 25), sides convex, maximum thickness of whorl on c. one third the height of side (on level of lateral tubercles). Ornamentation consisting of distinct sharp side tubercles and massive outer tubercles of the "clavi" type which border the narrow ventral side. Primary and secondary ribs single, poorly developed. Ornamentation, particularly the ribs, more strongly developed on the body chamber. The ribs here are often in pairs, issuing out of one lateral tubercle towards two outer tubercles. From some outer tubercles an intercalated rib may issue terminating at midheight of the side.

Table 25

No.	D	H	h	W	w	U	u	W/H	r_1	r_0	i
5 LII /M/	70	25	0.35	27	0.38	24	0.34	1.08	15	24	1.6

Remarks. — Neumayr (1871a) assigned the above species to genus *Aspidoceras.* Nevertheless, the character of ornamentation, the presence of primary and secondary ribs observable in the mature stage, also the character of suture, reliably suggest the assignment of the *fuchsi* species to genus *Kosmoceras.*

From figures of the holotype of this species, our specimen differs in more distinct ribbing and slight differences in the ornamentation on the body chamber as compared with the inner whorls. *K. fuchsi* displays certain similarities with *K. clavifer* (Tintant) consisting in the presence of massive outer tubercles of the "clavi" type. However, *K. fuchsi* differs from *K. clavifer* (Tintant) in wider umbilicus, wider polygonal section and coarser ornamentation.

Occurrence. — Lasocin *II*, the Middle Callovian (?).

Kosmoceras cf. *gulielmi* (Sowerby, 1818)

Material. — One juvenile whorl and several fragmentary whorls.

Remarks. — The specimen here described resembles *K. gulielmi* in the following characters: high, narrow whorl section (*cf.* Tab. 26), strong umbilical and lateral

Table 26

No.	D	H	h	W	w	O	o	W/H	i
17 Mn /m/	30	15	0.50	10	0.33	7	0.23	0.66	3.5

tubercles discernible on the inner whorls and relatively widely spaced secondary ribs (*comp.* Tintant 1963, p. 362, Pl. 57, Figs 1—4).

Occurrence. — Mnin, the Middle Callovian.

Kosmoceras complanatum (Tintant, 1963)
(Pl. 8, Fig. 1)

1963. *Kosmoceras (Gulielmiceras) complanatum* n. sp.; Tintant, p. 374, Pl. 53, Figs 1—4.

Material. — Two juvenile whorls (*cf.* Tab. 27)

Table 27

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_o/2$	i
28 Mn /m/	29	13	0.44	10	0.34	9	0.31	0.80	13	38	3.1
34 Mn /m/	44	21	0.47	15	0.34	13	0.29	0.71	15	45	3.0

Remarks. — The specimens under consideration show strong resemblance to the young ontogenetic stages of *K. obductum* (Buckman) and probably represent the microconchs (male forms) corresponding to that species.

From the allied *K. ventricosum* Tintant, representing microconchs, *K. complanatum* differs in finer and denser ornamentation, also in narrower, more slender whorl section. From the allied *K. gulielmi* (Sowerby) — microconchs — *K. complanatum* differs in closer ornamentation and weaker lateral tubercles.

Occurrence. — Mnin, the Middle Callovian.

Kosmoceras ornatum (Schlotheim, 1820)
(Pl. 8, Figs 4, 4*a*)

1883. *Cosmoceras pollux* Rein.; Lahusen, p. 61, Pl. 8, Figs 5*a*—*b*, 6, 7*a*—*c*, 8*a*—*b*, 9*a*—*b*.
1929a. *Kosmoceras (Spinikosmoceras) ornatum* (Schlotheim) emend.; Brinkmann, Pl. 3, Fig. 12.
1929b. *Kosmoceras (Spinikosmoceras) ornatum* (Schlotheim) emend.; Brinkmann, p. 74, Pl. 1, Figs 5—6.
1950. *Cosmoceras ornatum* (Schloth.); Sokołowa, p. 142, Pl. 7, Fig. 2.
1963. *Kosmoceras (Spinikosmoceras) pollux* (Rein.) *ornatum* (Schlotheim) Brinkmann; Tintant, p. 411, Pl. 56, Figs 1*a*, 6*a*—*b*.

Material. — One mature whorl (*cf.* Tab. 28).

Table 28

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
4 LII /m/	32	16	0.50	13	0.40	10	0.31	0.81	17	54	3.3

Remarks. — The specimen under consideration differs somewhat from the form described and figured by Tintant (1963) under the name of *K. pollux ornatum* (Brinkmann). In our specimen the ornamentation pattern is more complicated and the bundled secondary ribs more distinct. These differences fit, however, within the intraspecific variability range.

K. ornatum differs from *K. spinosum* (Sowerby) in the lack of single ribs devoid of tubercles, also of paired primary (umbilical) ribs and in the radially directed course of the secondary ribs. The specimen under consideration differs from the related *K. aculeatum* (Eichwald) in closer and stronger ornamentation, greater thickness of whorls and more depressed polygonal section.

Occurrence. — Lasocin *II*, the Middle and Upper Callovian.

Quenstedtoceras henrici Douvillé
(Pl. 8, Figs 7, 7*a*)

1912. *Quenstedticeras Henrici* nov. sp.; R. Douvillé, p. 55, Pl. 4, Figs 30, 32—33.
1912. *Quenstedticeras Henrici* var. *Brasili* nov. sp.; R. Douvillé, p. 56, Pl. 4, Figs 1—9.
1912. *Quenstedticeras Henrici* var. *praelamberti* nov. sp.; R. Douvillé, p. 57, Pl. 4, Figs 34—38.
1962. *Quenstedtoceras henrici* R. Douvillé; Makowski, p. 75, Text-pl. 5, Pls 7—12.

Material. — Two mature whorls and two fragmentary whorls.

Remarks. — The dimensions (*cf.* Tab. 29) and the observed characters of ornamentation bring our specimen close to *Qu. henrici* Douvillé.

Table 29

No.	D	H	h	W	w	O	o	W/H	r_1	r_0	i
25 LI /m?/	39	15	0.38	13	0.33	13	0.33	0.86	28	49	1.7

Occurrence. — Mnin and Lasocin *I*, the Upper Callovian.

Superfamily **Perisphinctaceae** Steinmann, 1820
Family **Perisphinctidae** Steinmann, 1820
Subfamily **Pseudoperisphinctinae** Schindewolf, 1925
Genus *POCULISPHINCTES* Buckman, 1920
Poculisphinctes sp. *A*
(Pl. 9, Figs 1, 1*a*)

Material. — Three whorls, one mature, two juvenile.

Description. — Whorl section depressed (*cf.* Tab. 30), transversely ellipsoidal, ventrally constricted. Maximum width of whorls near the umbilical angle. With

Table 30

No.	D	H	h	W	w	O	o	W/H	$r_1/2$	$r_0/2$	i
25 LI /M?/	85	26	0.30	35	0.41	36	0.42	1.29	14	42	3.0

growth of the whorl the section becomes more depressed. Sides of whorls slightly convex, ventrally compressed, rounded. Umbilicus narrow, deep, with vertical walls. Ornamentation consisting of distinct coarse primary ribs, thickening of the umbilical angle. At the last observable whorl these thickenings become tubercle-like. Two or three secondary ribs, fine, slightly anteriorly curved, branch off from every primary rib. Two or three constrictions are now discernible on one whorl.

Remarks. — No description or figures of species possibly corresponding to the forms here described have been found in the literature available to the writer.

Occurrence. — Lasocin *I*, Upper Callovian.

Family **Aspidoceratidae** Zittel, 1895
Subfamily **Peltoceratinae** Spath, 1928
Genus *PELTOCERAS* Waagen, 1871

Remarks. — In the present paper genus *Peltoceras* is regarded as divided into the following subgenera: *Peltoceras s. s.* Waagen, *Metapeltoceras* Spath, *Unipeltoceras* Jeannet, *Parapeltoceras* Schindewolf.

Subgenus *PELTOCERAS* Waagen, 1871
Type species: *Ammonites athleta* Phillips, 1829

Diagnosis. — Whorl section depressed, square or rectangular. Whorl generally wider than high. The perisphinctid stage short-lasting, with diameter at 30—40 mm, distinct outer and inner tubercles make their appearance. With growth of whorl the primary ribs become extinct and a depression is formed between two rows of tubercles at the side of the whorl. The secondary ribs visible on the siphonal side join together in twos or threes in one outer tubercle. The secondary ribs up a diameter c. 50 mm disappeared. The representatives of this subgenus are macroconchs though no gerontic specimen with peristome preserved has been found by the writer.

Peltoceras (Peltoceras) athleta (Phillips, 1829)
(Pl. 9, Figs 2, 2*a*)

1829. *Ammonites athleta* Phillips; Phillips, Pl. 6, Fig. 19.
1875. *Peltoceras athleta* Phillips; Waagen, p. 81, Pl. 16, Figs 2*a*—*b*, 3*a*—*c*.
1933. *Peltoceras athleta* (Phill.); Arkell, Pl. 37, Fig. 7.
1937. *Peltoceras athleta* (Phill.) Spath; Prieser, p. 21, Abb. 5E*a*—*b*.
1951. *Peltoceras athleta* Phil. sp.; Jeannet, p. 165, Text-figs 390—391, Pl. 72, Figs 1—2.

Material. — One whorl (phragmocon) and two fragmentary whorls.

Remarks. — Whorl section depressed (*cf.* Tab. 31), rectangular. The ribs dividing on the inner whorls at the margin of the ventral side become extinct at a diameter of c. 25 mm and tubercles make their appearance at the umbilical and ventral edge. The species here described differs from *P. (Peltoceras) trifidum* (Quenstedt) in that the tubercle stage occurs earlier, in less closely spaced ribs and tubercles. From *P. (Peltoceras) berckhemeri* Prieser it differs in whorl section, a convex ventral side, in the outer tubercles being upcurved and in the position of the outer tubercles just on the margin of the ventral side.

Table 31

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
11 LI /M/	68	22	0.32	23	0.33	29	0.42	1.04	18	?	?

Occurrence. — Lasocin *I*, Wola Morawicka, the Upper Callovian.

Peltoceras (Peltoceras) trifidum (Quenstedt, 1886—1887)
(Pl. 9, Figs 3, 3*a*, 7, 7*a*)

1886—1887. *Ammonites athleta trifidus;* Quenstedt, p. 781, Pl. 88, Figs 5—8.
1937. *Parapeltoceras trifidum* Quen. sp.; Prieser, p. 28, Abb. 1, 6D-E. H, Pl. 2, Figs 4, 7.

1951. *Peltoceras trifidum* Quen. sp.; Jeannet, p. 167, Text-figs 394—396, Pl. 72, Fig. 4; Pl. 73, Figs 1—4.

Material. — Four whorls (phragmocons).

Description. — Whorl section depressed (*cf.* Tab. 32), rectangular or square. Ornamentation consisting of strong, protruding inner and outer tubercles, making

Table 32

No.	D	H	h	W	w	0	o	W/H	$r_1/2$	$r_0/2$	i
8 LI /M/	57	19	0.33	19	0.33	26	0.45	1.0	10	31	3.1
13 LI /M/	49	12	0.24	19	0.38	21	0.42	1.5	13	30	2.3

their appearance on whorl side with diameter at *c.* 40 mm, initially as thickenings on ribs. Primary ribs, gradually becoming extinct with growth of whorl, run in between the closely spaced inner and outer tubercles. Two or three secondary ribs branch off from every outer tubercle.

Remarks. — The species under description differs from the related *P. (Peltoceras) athleta* (Phillips) in later appearance of the tubercle stage and in closer ornamentation. Both these species, however, resemble each other closely so much so that their distinction is hardly possible if the outer whorls only are preserved.

Occurrence. — Lasocin *I*, the Upper Callovian.

Peltoceras (Peltoceras) cf. berckhemeri Prieser, 1937

Material. — One fragment of whorl, somewhat corroded.

Remarks. — Whorl section depressed (*cf.* Tab. 33), rectangular, sides slightly

Table 33

No.	D	H	h	W	w	0	o	W/H	r_1	r_0	i
16 LI /M/	?	28	?	30	?	?	?	1.07	?	?	?

convex, inner and outer tubercles thick and widely spaced bringing our specimen close to the species described and figured by Prieser (1937).

The specimen here described differs from representatives of *P. (Peltoceras) erckenbergense* Prieser in rectangular whorl section, slightly convex sides and relatively early appearance of the tubercle stage.

Occurrence. — Lasocin *I*, the Upper Callovian.

Peltoceras (Peltoceras) erckenbergense Prieser, 1937
(Pl. 9, Figs 4, 4*a*)

1937. *Peltoceras erckenbergense* n. sp.; Prieser, p. 19, Abb. 4E—F, Pl. 1, Figs 7, 9.

Material. — Two juvenile whorls.

Description. — Whorl section square (*cf.* Tab. 34), sides compressed. The tubercle stage sets in at a diameter of *c.* 38 mm. The outer tubercles appear first,

Table 34

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
17 LI /M/	50	16	0.32	17	0.34	22	0.44	1.06	31	80	2.6

followed by thickenings on inner ribs at the umbilical angle gradually passing into tubercles. Ribs slightly posteriorly bent at the umbilical angle, sinously anteriorly on mid-side. Distinct weakening of primary ribs between tubercles at a diameter of 43 mm.

Remarks. — The species here described differs from the related *P. (Peltoceras) berckhemeri* Prieser in square whorl section, compressed sides and later development of tubercles.

Occurrence. — Lasocin *I*, the Upper Callovian.

Subgenus *METAPELTOCERAS* Spath, 1931
Type species: *Ammonites armiger* Sowerby, 1818

Diagnosis. — Whorl section rectangular, high, generally higher than wide, trapezoidal on older whorls. The perisphinctid stage disappears at a diameter of c. 40—60 mm. Tubercles appear gradually, first the inner, later the outer ones. Primary ribs discernible even on mature whorls. Specimens of this subgenus represent macroconchs.

Peltoceras (Metapeltoceras) broili (Prieser, 1937)
(Pl. 9, Figs 5, 5*a*; Pl. 10, Fig. 3)

1937. *Parapeltoceras broili* n. sp.; Prieser, p. 42, Abb. 7H—I, Pl. 8, Fig. 6; Pl. 4, Fig. 1

Material. — Two mature whorls (*cf.* Tab. 35).

Table 35

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
9 LI /M/	78	25	0.32	24	0.30	35	0.45	0.96	27	62	2.3
10 LI /M/	131	39	0.30	38	0.29	64	0.49	0.97	?	?	?

Description. — Whorl section trapezoidal with maximum width of sides on level of umbilical tubercles. Tubercles appear at a diameter of *c.* 57 mm (No. 9LI), the thickening on ribs at a diameter of 46 mm. Inner tubercles more distinct, more protruding than the outer ones. Secondary ribs with course characteristic of the species visible up to diameter of *c.* 50 mm.

Remarks. — The species under consideration shows certain similarities with *P. (Metapeltoceras) baylei* (Prieser), especially on the older whorls. From *P. (Metapeltoceras) baylei*, however, *P. (Metapeltoceras) broili* differs in later development of the tubercle stage, less closely spaced ribs, compressed sides, higher whorl section and the dominance of the umbilical over the outer (siphonal) tubercles. The point of division of the ribs in *P. (Metapeltoceras) broili* occurs just on the margin of the siphonal side while in *P. (Metapeltoceras) baylei* on the third outer part of the side.

Occurrence. — Lasocin *I*, the Upper Callovian.

Peltoceras (Metapeltoceras) baylei (Prieser, 1937) (Pl. 9, Figs 10, 10*a*)

1937. *Parapeltoceras baylei* n. sp.; Prieser, p. 37, Abb. 7A, Pl. 2, Figs 2, 6.
1951. *Metapeltoceras* cf. *baylei* Prieser sp.; Jeannet, p. 171, Text-figs 402—403, Pl. 72, Fig. 5; Pl. 73, Figs 5—6; Pl. 90, Fig. 2.

Material. — Two whorls (phragmocons) and one fragmentary whorl.
Description. — Whorl section depressed (*cf.* Tab. 36), rectangular, nearly square.

Table 36

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
14 LI /M/	68	20	0.29	21	0.31	33	0.49	1.05	31	61	2
14 LI	49	15	0.31	14	0.30	24	0.49	0.93	40	?	?

Vertical side slightly convex. Inner and outer tubercles closely spaced, the outer ones stronger and more protruding than the inner ones. Characteristic arrangements of ribs on the vertical (siphonal) side.

Remarks. — The species here described differs from the related *P. (Metapeltoceras) broili* (Prieser) in earlier appearance of tubercles (at a diameter of *c.* 50 mm), in more closely spaced ornamentation, slightly rounded sides, square whorl section, dominance of outer tubercles over the umbilical ones and the position of the dividing point of ribs being of the third outer part of the side.

Occurrence. — Lasocin *I*, the Upper Callovian.

Peltoceras (Metapeltoceras) schroederi (Prieser, 1937) (Pl. 9, Figs 11, 11*a*; Pl. 10, Fig. 4)

1937. *Parapeltoceras schroederi* n. sp.; Prieser, p. 52, Pl. 6, Fig. 11.

Material. — Two fragmentary whorls.

Description. — Whorl section high (*cf.* Tab. 37), rectangular or somewhat trapezoidal. Ventral side flat, sides compressed. Umbilicus deep, steep-walled.

Table 37

No.	D	H	h	W	w	O	o	W/H	$r_1/2$
12 LI /M/	110	?	0.33	?	0.30	?	0.40	0.90	13

Outer and inner tubercles occur as thickenings. Weakly developed sinuous ribs indicated on whorl side.

Remarks. — The specimens here described show some resemblance to representatives of *P. (Metapeltoceras) subtense* Bean, from which they differ, however, in greater width of whorls, more depressed section and deeper umbilicus.

Occurrence. — Lasocin *I*, the Upper Callovian.

Peltoceras (Metapeltoceras) helveticum Jeannet, 1951 (Pl. 10, Figs 2, 2*a*)

1951. *Metapeltoceras helveticum* sp. n.; Jeannet, p. 173, Text-fig. 405, Pl. 90, Fig. 1.

Material. — One mature whorl.

Description. — The ornamentation and the dimensions as given by Jeannet (1951) agree with the characters observed on our specimen (*cf.* Tab. 38). The descrip-

Table 38

No.	D	H	h	W	w	O	o	W/H	$r_1/2$
21 LI /M/	49	15	0.30	16	0.32	21	0.42	1.06	16
21 LI	101	31	0.31	26	0.26	48	0.47	0.89	11

tion of the holotype of this species, however, applies exclusively to the outer mature whorls, *c.* 100 mm in diameter. The state of preservation of the Lasocin *I* specimen permits the tracing of the ornamentation pattern and its changes in the earlier ontogenetic stages: viz. on the inner whorls the ribs are distinct, fine, sharp and closely spaced. The dividing point of the ribs occurs on the outer third part of the whorl side or on the outer margin. Two or three bundled secondary ribs with a characteristically directed branch off from every lateral rib. Umbilicus rather deep with rounded angle. Ventral side flat, whorl section rectangular, more depressed than high. At a diameter of *c.* 35 mm there occur minute but distinct outer tubercles, with diameter at 40 mm, thickenings appear on the umbilical angle and gradually pass into the inner tubercles. With growth of whorls the primary ribs get weaker and a distinct depression makes its appearance in between the inner and outer tubercles. Secondary ribs, branching off in twos on the older whorls from each outer tubercle, gradually become extinct, too. On the mature stages the inner tubercles are elongated, sharp, while the outer ones more robust, rounded and bent somewhat anteriorly. The last of the persisting whorls are nearly square in section.

Remarks. — The species here described differs from the related *P. (Metapeltoceras) rollieri* Jeannet in more closely spaced and sharper tubercles and ribs, in less rounded whorl sides, also in the outer tubercles being more posteriorly curved. The younger ontogenetic stages of *P. (Metapeltoceras) helveticum* display certain with *P. (Peltoceras) oppeli* Prieser. The one-tubercle (unispinosum) stage occurring in *P. (Peltoceras) oppelli* is not, however, observable in our species.

Occurrence. — Lasocin *I*, the Upper Callovian.

Peltoceras (Metapeltoceras) sp. *A*
(Pl. 10, Figs 1, 1*a*—*b*)

Material. — One mature whorl, somewhat corroded.

Description. — Whorl section between tubercles nearly square (*cf.* Tab. 39), with rounded margins. Tubercles appear at a diameter *c.* 40 mm, first only the outer

Table 39

No.	D	H	h	W	w	O	o	W/H	r_1	r_0	i
7 LI /M/	50	17	0.34	17	0.34	22	0.42	1.0	15	?	?
7 LI	102	26	0.25	32	0.31	47	0.46	1.03	?	?	?

ones, at diameter of *c.* 45 mm, the inner tubercles, too. With the appearance of tubercles, the primary ribs between the inner and outer tubercles show strong weakening leading to gradual extinction. Up to a diameter of *c.* 60 mm double secondary ribs in bundles branching off from every tubercle. Between bundled ribs occur intercalated ribs extending to the dividing point of ribs (to the outer tubercle). Slight anterior curvature of ribs near the outer tubercles. On outer whorls, the outer tubercles more distinct, sharpened, upcurving posteriorly.

Remarks. — The specimen here described resembles more than one species belonging to the subgenus *Metapeltoceras*, but it may not be undoubtedly referred to any one of them. From *P. (Metapeltoceras) helveticum* Jeannet it differs in higher section, finer and widely spaced ornamentation, also in sharp posteriorly bent outer tubercles. From *P. (Metapeltoceras) retrospinatum* Gerard & Contaut our specimen differs in greater width of whorls, square section and gradual development of the tubercle stage. From *P. (Metapeltoceras) baylei* (Prieser) in a shorter perisphinctid stage, more widely spaced ribs and sharper outer tubercles. From *P. (Metapeltoceras) rollieri* Jeannet in sharper and finer ribs, narrower umbilicus, and flat nearly parallel rounded sides at the outer margin.

Occurrence. — Lasocin *I*, the Upper Callovian.

Subgenus *PARAPELTOCERAS* Schindewolf, 1925
Type species: *Nautilus annularis* Reinecke

Diagnosis. — Small forms (microconchs) whose peristome is provided with lappets. Whorl section square or ovate. Sides of whorls slightly rounded. Ornamentation consists of distinct, relatively coarse ribs. Between the midside and the ventral edge these ribs divide into two secondary ribs slightly posteriorly bent and often coarser ventrally. Frequent intercalated secondary ribs. No "tubercle" stage.

Remarks. — Arkell (1957) accepted the taxonomic unit under the name of *"Parapeltoceras"* — along with genus *Peltoceras* — as a genus.

Differences in the ornamentation pattern between mature individuals of these two units are obviously very marked. On the other hand there is a striking resemblance of the young (inner) whorls of the *Peltoceras* and those of the mature *Parapeltoceras* specimens. From the literature so far available it may be reasonably supposed that individuals referred to genus *Peltoceras* are macroconchs (the peristome of these forms has not yet been decribed) while those referred to *Parapeltoceras* are the microconchs. Hence, differences in size and ornamentation pattern of the mature forms may be a result of sexual dimorphism, similarly as in the case of subgenus *Peltoceratoides* and *Parawedekindia*.

Shortage of adequate material hinders the correlation of the particular macroconchs with their corresponding microconchs. In this connection and at the present state of knowledge as regards genus *Peltoceras* it seems reasonable to recognize the taxonomic unit of *"Parapeltoceras"* as a subgenus of *Peltoceras*, as has been postulated by Jeannet (1951).

Prieser (1937), likewise, treats this unit as a subgenus, but on other taxonomic criteria. She namely distinguishes as a type species of the subgenus — *Peltoceras trifidum* — a species typical of subgenus *Peltoceras* s. s. in accordance with the classification followed in the present paper.

Peltoceras (Parapeltoceras) annulosum (Quenstedt, 1886—1887)
(Pl. 9, Fig. 9)

1886—1887. *Ammonites annularis annulosus;* Quenstedt, p. 784, Pl. 38, Fig. 21.
1886—1887. *Ammonites annulosus;* Quenstedt, p. 784, Pl. 38, Fig. 22.
1937. *Parapeltoceras annulosum* Quen.; Prieser, p. 38, Abb. 6J, Pl. 3, Fig. 9; Pl. 5, Fig. 4.
1951. *Parapeltoceras annulosum* Quen. sp.; Jeannet, p. 184, Text-fig. 388, Pl. 75, Fig. 3.

Material. — One mature whorl with a fragmentary body chamber, also two fragmentary whorls.

Table 40

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
20 LI /m/	60	15	0.25	14	0.23	33	0.55	0.93	34	75	2.1

Description. — Whorl section ovate (*cf.* Tab. 40). Ornamentation consists of distinct coarse primary ribs, dividing into two or three finer secondary ribs. The dividing point of the ribs on the ventral edge. Intercalated secondary ribs. Secondary ribs bent slightly posteriorly.

Remarks. — The ornamentation pattern observed on the specimens here discussed represents an intermediate type between that of *P. (Parapeltoceras) oblongum* (Quenstedt) and that of *P. (Parapeltoceras) subannulosum* (Prieser). In our species the ribs are coarser and more distinct that in *P. (Parapeltoceras) oblongum* but finer that in *P. (Parapeltoceras) subannulosum.* The posterior curvature of the primary ribs in our specimens is markedly weaker than that in *P. (Parapeltoceras) subannulosum.* Moreover, in representatives of *P. (Parapeltoceras) subannulosum* we note the presence of distinct secondary ribs, the absence of single ribs, also a markedly greater width of the umbilicus as compared with the other two species.

Occurrence. — Lasocin *I*, the Upper Callovian.

Peltoceras (Parapeltoceras) subannulosum (Prieser, 1937)
(Pl. 9, Figs 6, 6*a*—*b*)

1937. *Parapeltoceras subannulosum* Prieser; Prieser, p. 40, Abb. 7M, Pl. 2, Fig. 8; Pl. 3, Fig. 7.

Material. — Two mature whorls and one fragmentary whorl.

Description. — Whorl section depressed (*cf.* Tab. 41), nearly round, umbilicus shallow, whorl sides rounded, ventral side rounded, primary ribs coarse, strongly

Table 41

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
19 LI /m/	54	17	0.31	17	0.31	25	0.46	1.0	40	64	1.6

convex, at outer middle of side branching into two equally coarse secondary ribs. Non-dividing single ribs and secondary intercalated ribs occurring regularly between two branching secondary ribs. From the dividing point the secondary ribs curving rather strongly posteriorly.

Remarks. — The species here described differs from *P. (Parapeltoceras) annulosum* (Quenstedt) in coarser ribs distinctly dichotomously subdivided, in stronger posterior curvature of the secondary ribs, the presence of single ribs and a narrower umbilicus.

Occurrence. — Lasocin *I*, the Upper Callovian.

Peltoceras (Parapeltoceras) cf. *oblongum* (Quenstedt, 1886—1887)
(Pl. 9, Fig. 8)

Material. — One mature whorl.

Description. — Whorl section rectangular (*cf.* Tab. 42), depressed. Umbilicus flat, rather narrow. Primary ribs, minute, distinct, at the outer margin dividing into two secondary ribs. The above characters bring our specimen close to *P. (Parapeltoceras) oblongum.*

Table 42

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
18 LI /m/	55	18	0.32	17	0.30	25	0.45	0.94	42	78	1.8

Remarks. — From specimens referred to this species by Quenstedt (1886/87) and Prieser (1937) that from Lasocin *I* differs in greater number of intercalated secondary ribs, a stronger posterior curvature of the secondary ribs, and the occurrence at the umbilical and ventral edges — with a diameter of 45 mm — of rather small thickenings on the ribs. From *P. (Parapeltoceras) annulosum* (Quenstedt) our specimen differs in more numerous and finer ribs and in higher section.

Occurrence. — Lasocin *I*, the Upper Callovian.

Genus *PSEUDOPELTOCERAS* Spath, 1924
Type species: *Ammonites chauvinianus* d'Orbigny, 1851

Diagnosis. — This genus comprises species with a long-lasting perisphinctid stage, rounded whorl sides and ventral side. In older stages the ribs grow slightly coarser at the umbilical and ventral edges and then develop massive and blunt outer tubercles. The umbilical tubercles persist as thickenings on ribs throughout the ontogenetic stages. Genus *Pseudopeltoceras* is regarded as a transition from the genus *Peltoceras* to genera of the subfamily Pseudoperisphinctinae (Arkell 1957).

Pseudopeltoceras leckenbyi (Bean)
(Pl. 10, Fig. 5)

1936. *Pseudopeltoceras leckenbyi* Bean sp.; Gerard & Contaut, p. 68, Pl. 17, Figs 1, 1a.
1951. *Pseudopeltoceas* cf. *leckenbyi* Bean sp.; Jeannet, p. 176, Text-fig. 411, Pl. 85.

Material. — One mature whorl with corroded side.

Description. — Whorl strongly evolute, with sides compressed on outer whorls and slightly rounded on inner whorls. Ventral side rounded. Whorl section high (cf. Tab. 43), ovate. Ribs coarse, massive, slightly anteriorly bent, bi-partite or

Table 43

No.	D	H	h	W	w	O	o	W/H	r_1	r_o	i
10 LII /M/	130	44	0.34	34	0.26	65	0.42	0.75	24	?	?
10 LII	193	60	0.35	50	0.25	90	0.46	0.83	21	?	?

three-partite on the inner whorls when near the middle of the side, but with growth of whorls near the outer (siphonal) margin. Secondary ribs not visible on outer whorls, progressively stronger elongated thickenings on the primary ribs near the umbilical and ventral edges. Longitudinal outer tubercles present on the last persisting whorl.

Remarks. — As compared with specimen figured by Gerard & Contaut (1938), our specimen has fewer primary ribs, more numerous thickenings on ribs passing into tubercles on the last whorl. These differences, however, fit into the intraspecific variability range.

Occurrence. — Lasocin *II*, the Middle (?) and Upper Callovian.

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STUDIUM STRATYGRAFICZNO-PALEONTOLOGICZNE KELOWEJU SW OBRZEŻENIA GÓR ŚWIĘTOKRZYSKICH

(Streszczenie)

W pracy podano szczegółową biostratygrafię keloweju południowego i zachodniego obrzeżenia Gór Świętokrzyskich. Stwierdzono na tym obszarze, oprócz najniższego, obecność wszystkich pozostałych poziomów keloweju.

Podział keloweju zastosowany w niniejszej pracy opiera się o schemat stratygraficzny zalecany na Kolokwiach w Luksemburgu w roku 1962 i 1964. Jest on stosowany w większości krajów europejskich, a różni się od schematu polskiego głównie innymi gatunkami indeksowymi w poszczególnych poziomach. Różnica większej wagi występuje jedynie w umiejscowieniu granicy kelowej/oksford (*por.* tab. 1).

Na obszarze południowego i zachodniego obrzeżenia Gór Świętokrzyskich na najniższy poziom keloweju — M. macrocephalus — przypada luka sedymentacyjna (*por.* fig. 2). Pierwszym udokumentowanym paleontologicznie poziomem keloweju obecnym na omawianym terenie jest S. calloviense.

Fauna dokumentująca ten poziom została stwierdzona w odsłonięciu Wola Morawicka — w najniższej warstwie keloweju występującej w tym profilu, a wykształconej w postaci zlepieńca marglistego ze stromatolitami. Poziom S. calloviense — jakkolwiek nie udokumentowany faunistycznie — stanowi również najniższe ogniwo keloweju w pozostałych odsłonięciach (fig. 2).

Kelowej środkowy (poziomy K. jason i E. coronatum) na terenie zachodniego obrzeżenia wykazuje dużą zmienność litologiczną i miąższości. Fauna obu tych poziomów łącznie została znaleziona w warstwie bulastej ze stromatolitami w profilu Mnin (fig. 3), amonity z poziomu E. coronatum — w warstwie bulastej w profilu Lasocin *II* (fig. 4) i w profilu Lasocin *I*. W obrzeżeniu południowym kelowej środkowy wykształcony jest dość jednolicie w postaci margli i wapnistych gez z czertami. Nieliczną faunę znaleziono w profilu Wolica i Wola Morawicka (*por.* tab. 2).

Kelowej górny (poziomy P. athleta i Qu. lamberti) w obrzeżeniu zachodnim wykazuje również duże zróżnicowanie facjalne. W Mninie na poziom P. athleta przypada luka stratygraficzna, natomiast poziom Qu. lamberti (udokumentowany przewodnią fauną) tworzą jasne bulaste wapienie. W profilu Lasocin *I* warstwa bulasta stanowiąca najwyższe ogniwo keloweju zawiera skondensowaną i wymieszaną faunę z poziomu E. coronatum oraz z obu poziomów keloweju górnego. W profilu

Lasocin *II* do keloweju górnego (nie udokumentowanego faunistycznie) należą zsylifikowane wapienie bulaste. W obrzeżeniu południowym panuje ciągłość sedymentacji między kelowejem środkowym a górnym. Faunę przewodnią dla poziomu P. athleta znaleziono w Woli Morawickiej (tab. 2), natomiast dla poziomu Qu. lamberti — w Wolicy.

Poziom Qu. mariae dolnego oksfordu występuje na całym omawianym obszarze, z wyjątkiem Gumienic, gdzie między kelowejem a oksfordem stwierdzono kontakt tektoniczny. Najniższy oksford został udokumentowany faunistycznie w profilu Mnin, Lasocin I i Wolica.

W części paleontologicznej znajdują się krótkie opisy gatunków amonitów ważnych z punktu widzenia stratygraficznego. Są to gatunki z rodzajów: *Parapatoceras, Ptychophylloceras, Macrocephalites, Erymnoceras, Kosmoceras, Quenstedtoceras, Poculisphinctes, Peltoceras* oraz jeden gatunek łodzika z rodzaju *Pseudaganides*. Szczegółowo potraktowano jedynie opisy gatunków z rodzaju *Peltoceras*, które dotychczas w Polsce nie były paleontologicznie opracowane. Systematykę poszczególnych rodzajów przyjęto w większości na podstawie W. J. Arkella (1957) lub w oparciu o najnowsze monografie dotyczące poszczególnych rodzin czy rodzajów.

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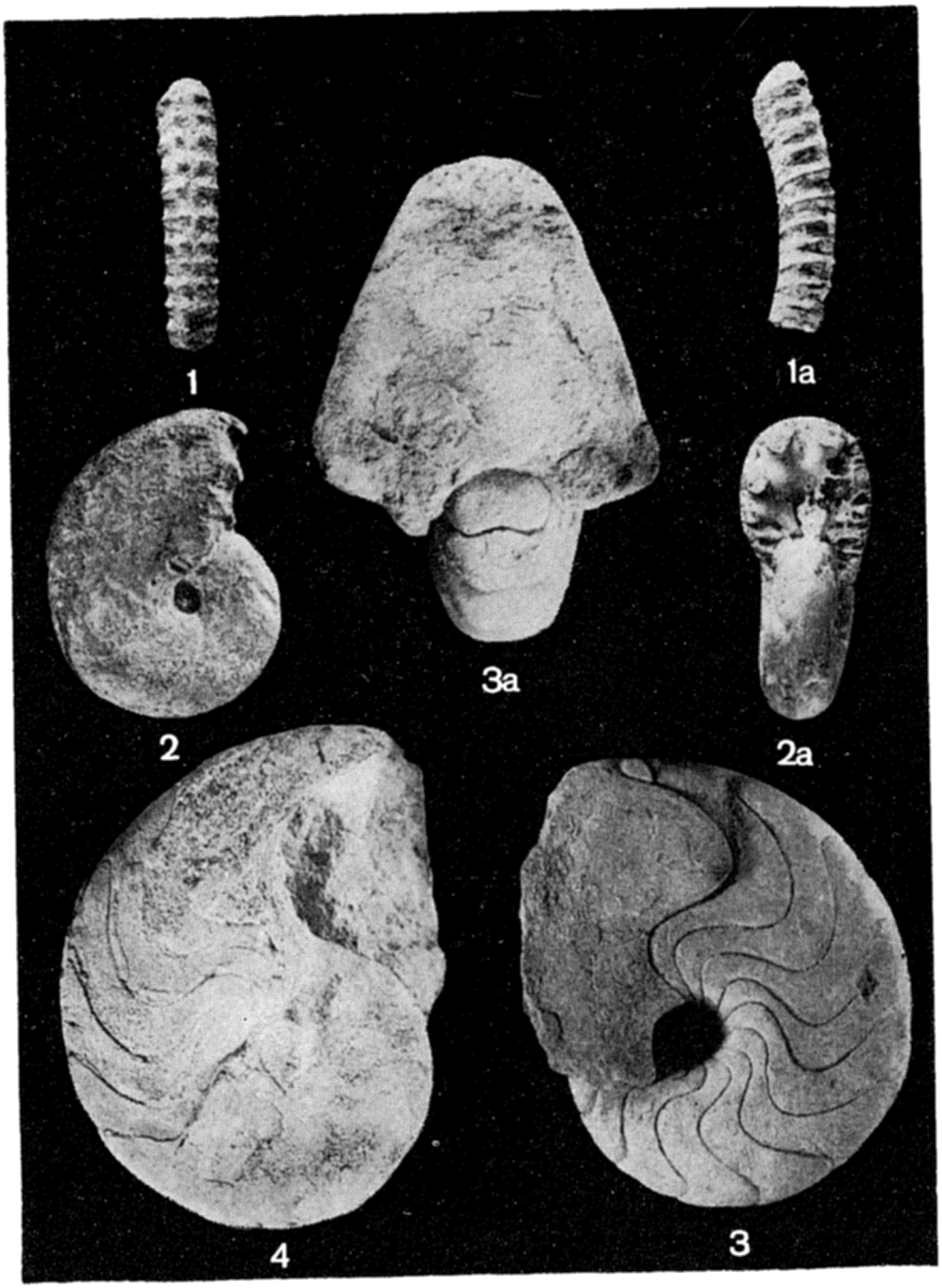
Warszawa, w marcu 1973 r.



1, 1a — *Parapatoceras calloviense* (Morris); Specimen No. 60WM, Lower Callovian, Sigaloceras calloviense Zone at Wola Morawicka.
2, 2a — *Ptychophylloceras* cf. *euphyllum* (Neumayr); Specimen No. 2WM, ibidem.
3, 3a, 4 — *Pseudaganides krenkeli* (v. Loesch) Rollier; Fig. 3, 3a — Specimen No. 1MW, ibidem; Fig. 4 — Specimen No. 2LI, Upper Callovian at Lasocin *I*.

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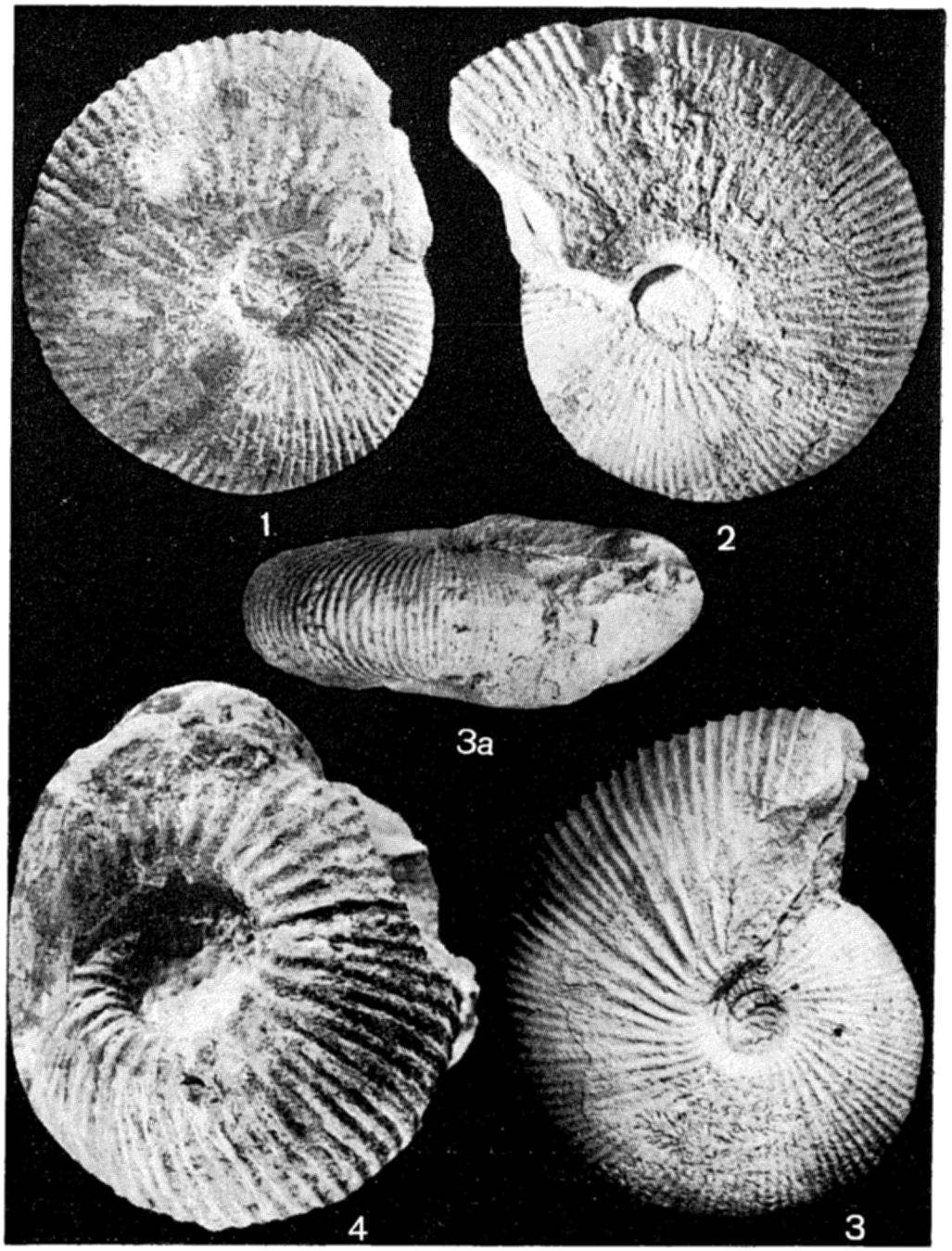

1, 2 — *Macrocephalites (Macrocephalites) compressus* (Quenstedt); Fig. 1 — Specimen No. 52WM; Fig. 2 — Specimen No. 16WM. Lower Callovian, Sigaloceras calloviense Zone at Wola Morawicka.

3, 3a — *Macrocephalites (Dolikephalites) uhligi* (Lemoine); Specimen No. 4WM, ibidem.

4 — *Macrocephalites (Pleurocephalites) pila* (Nikitin); Specimen No. 53WM, ibidem.

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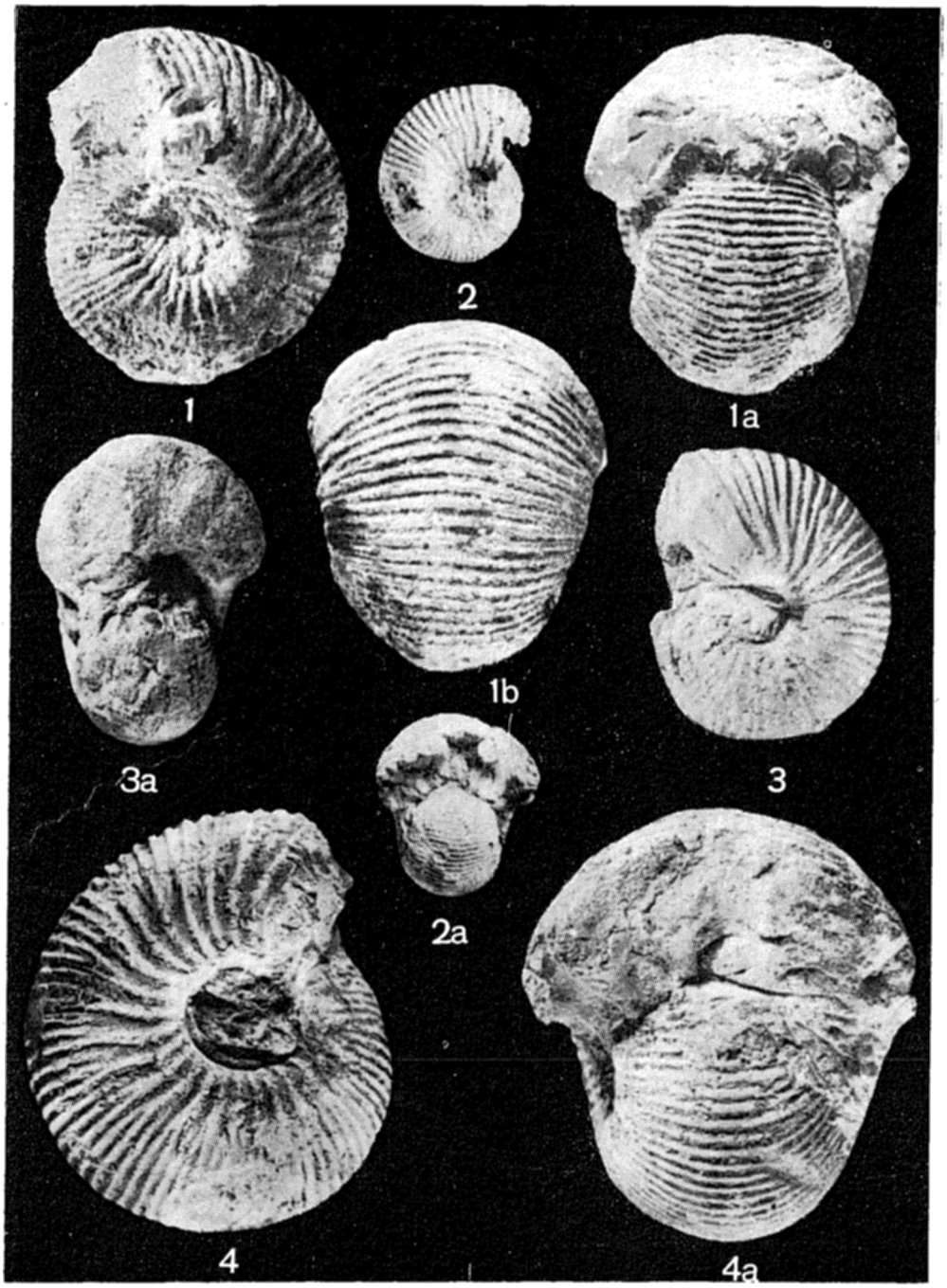

1, 1a, 2, 2a, 4, 4a — *Macrocephalites (Indocephalites) diadematus* (Waagen); Fig. 1 — Specimen No. 45WM, Fig. 2 — Specimen No. 6WM, Fig. 4. — Specimen No. 40WM; Lower Callovian, Sigaloceras calloviense Zone at Wola Morawicka.

3, 3a — *Macrocephalites (Indocephalites) chrysoolithicus* (Waagen); Specimen No. 19WM, ibidem.

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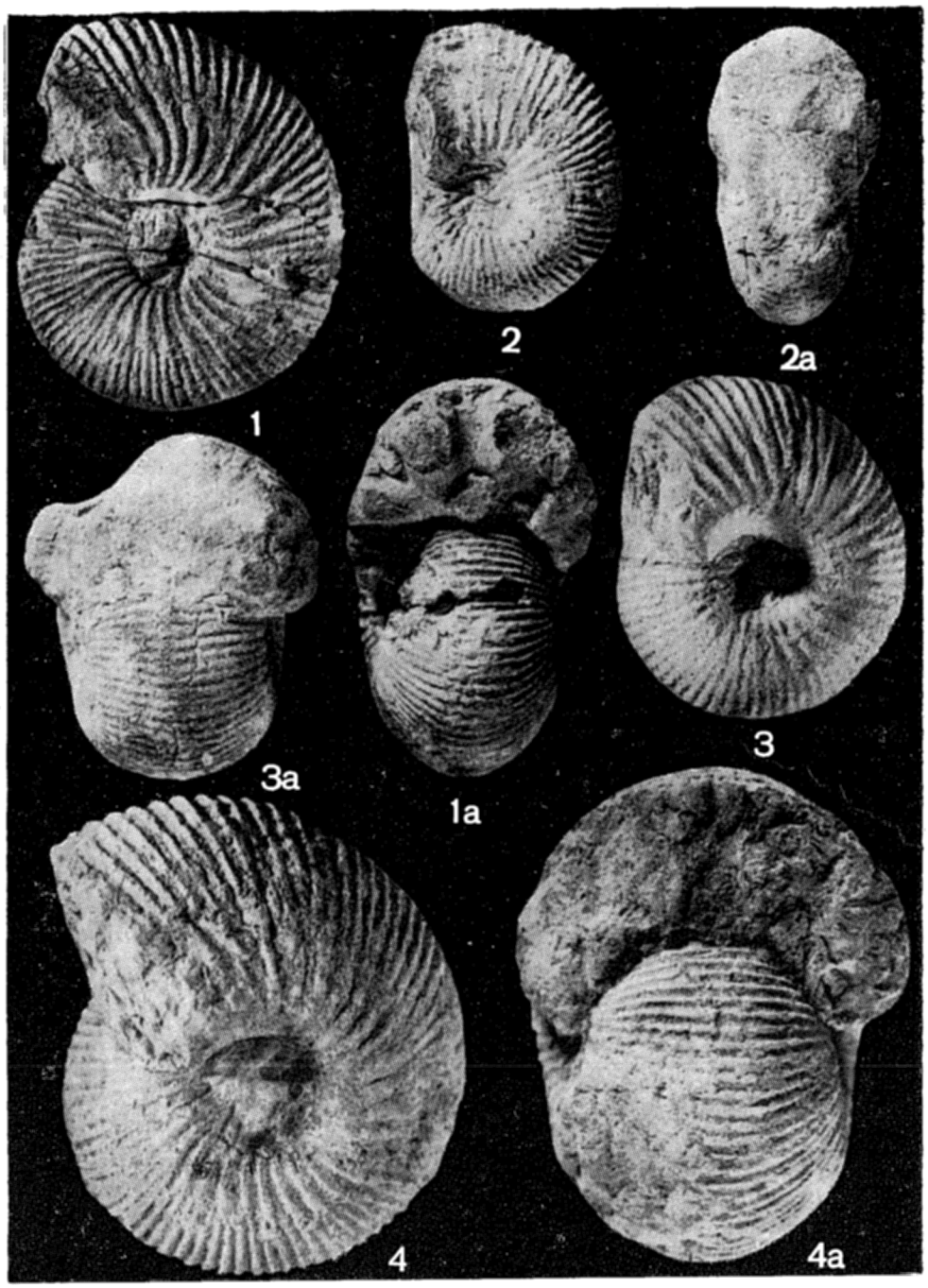

1, 1a — *Macrocephalites (Kamptokephalites) herveyi* (Sowerby); Specimen No. 18WM, Lower Callovian, Sigaloceras calloviense Zone at Wola Morawicka.
2, 2a — *Macrocephalites (Kamptokephalites) lamellosus* (Sowerby); Specimen No. 24WM, ibidem.
3, 3a, 4, 4a — *Macrocephalites (Pleurocephalites) pila* (Nikitin); Fig. 3 — Specimen No. 39WM, Fig. 4 — Specimen No. 37WM; ibidem.

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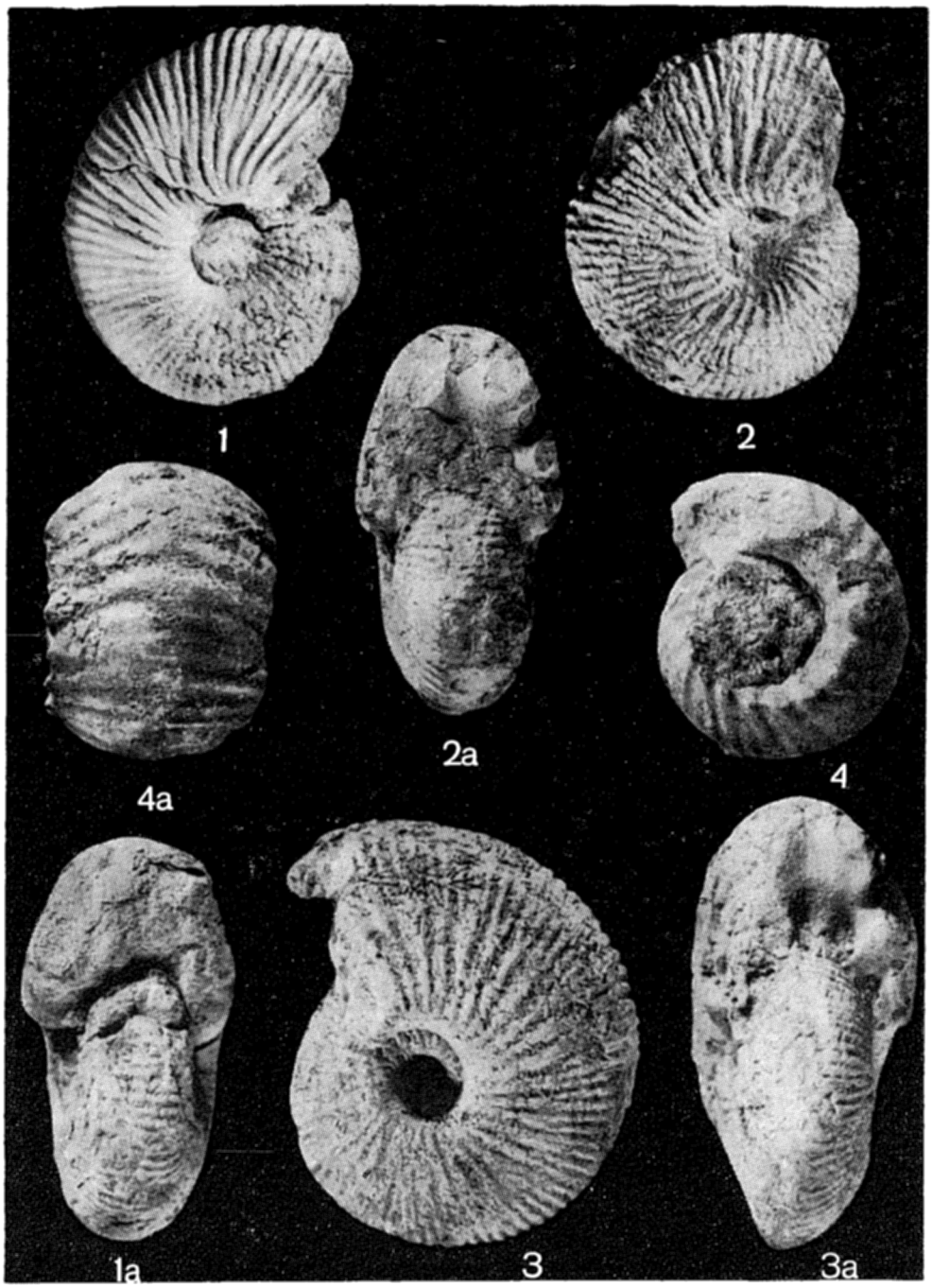

1, 1a, 2, 2a, 3, 3a — *Macrocephalites (Kamptokephalites) lamellosus* (Sowerby); Fig. 1 — Specimen No. 43WM, Fig. 2 — Specimen No. 47WM, Fig. 3 — Specimen No. 46WM; Lower Callovian, Sigaloceras calloviense Zone at Wola Morawicka.

4, 4a — *Erymnoceras doliforme* Roman; Specimen No. 2Mn, Middle Callovian at Mnin.

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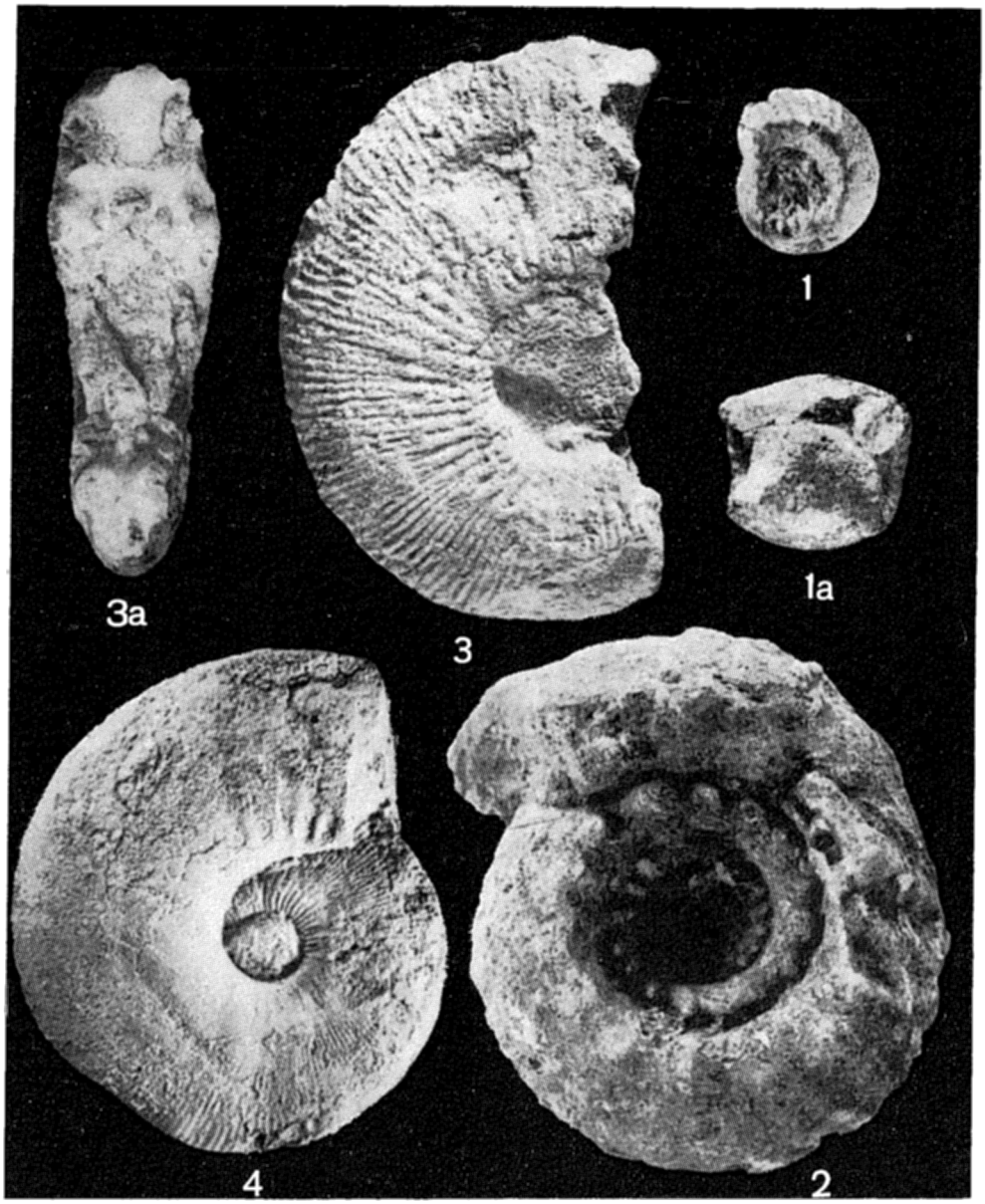

1, 1a — *Erymnoceras doliforme* Roman; Specimen No. 4Mn, Middle Callovian at Mnin.

2 — *Erymnoceras* cf. *coronatum* (Bruguière); Specimen No. 1Mn, ibidem.

3, 3a — *Kosmoceras obductum* Buckman; Specimen No. 3LI, Middle and Upper Callovian at Lasocin *I* (nodule bed).

4 — *Sigaloceras calloviense* (Sowerby); Specimen No. 50WM, Lower Callovian, Sigaloceras calloviense Zone at Wola Morawicka.

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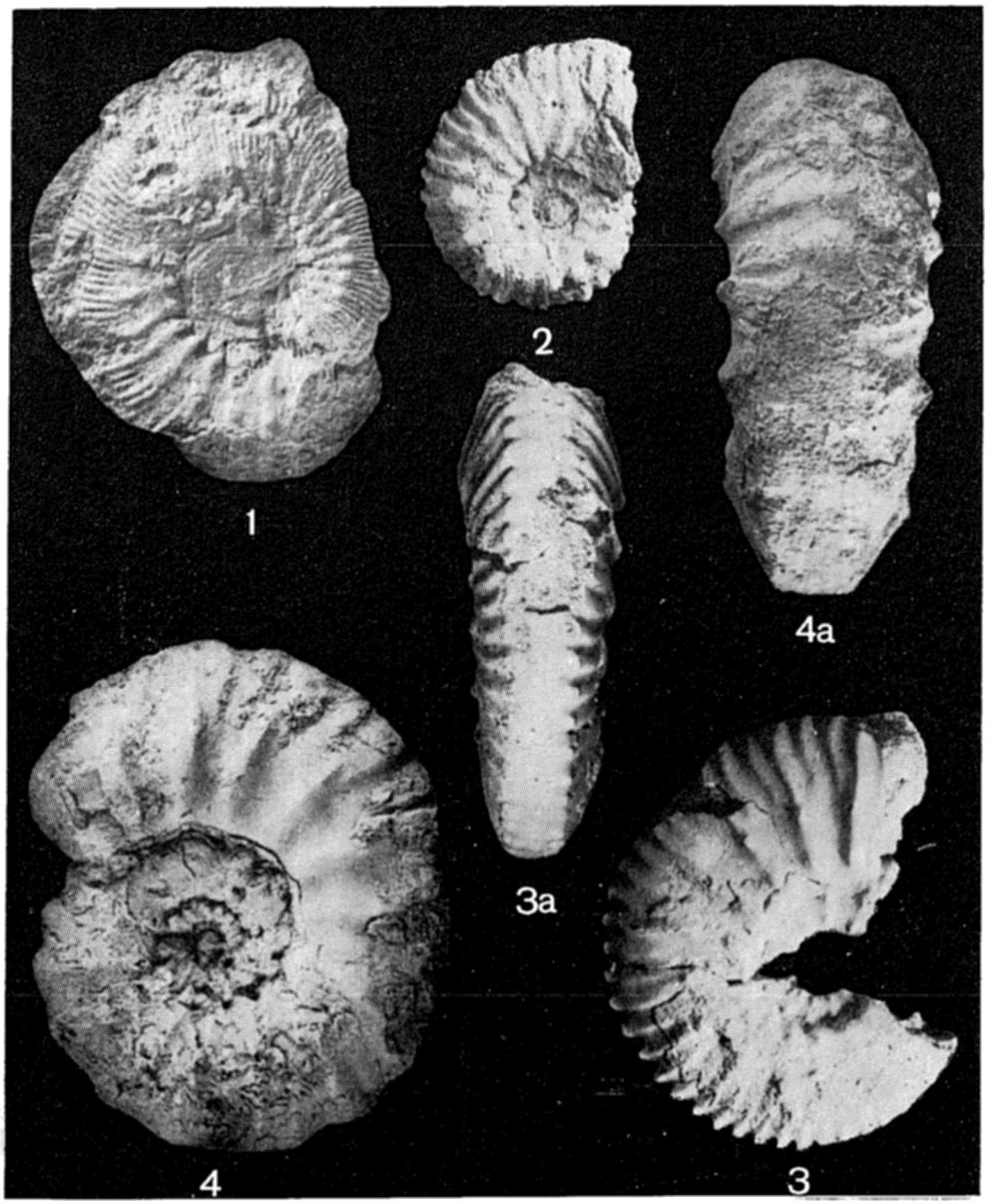

1 — *Kosmoceras fibuliferum fibuliferum* (Buckman); Specimen No. 27LI, Middle and Upper Callovian at Lasocin *I* (nodule bed).

2 — *Kosmoceras castor castor* (Reinecke); Specimen No. 6Mn, Middle Callovian at Mnin.

3 — *Kosmoceras pollucinum* Teisseyre; Specimen No. 14Mn, ibidem.

4, 4a — *Kosmoceras fuchsi* (Neumayr); Specimen No. 5LII, Middle (and Upper?) Callovian at Lasocin *II*.

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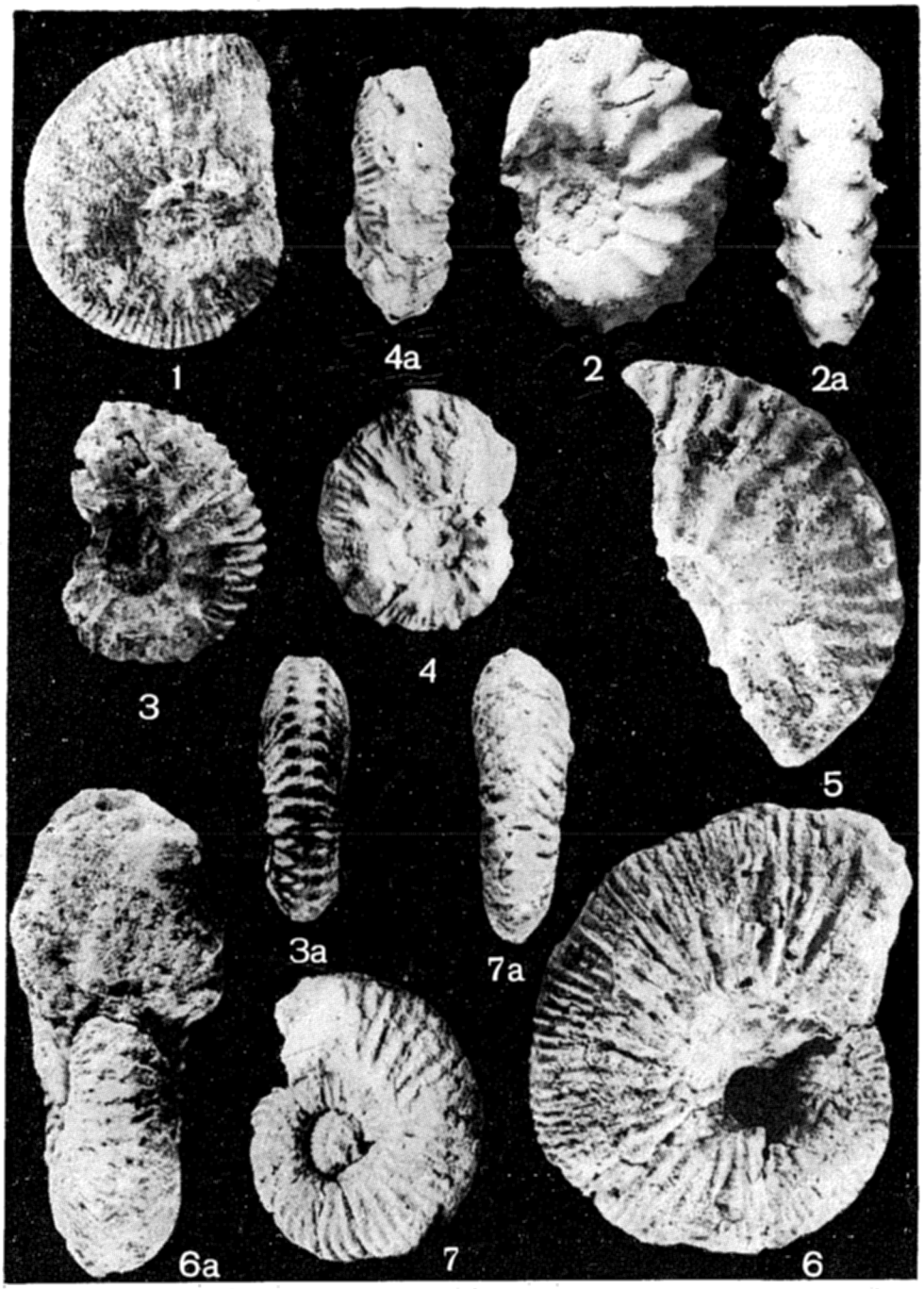

1 — *Kosmoceras complanatum* Tintant; Specimen No. 34Mn, Middle Callovian at Mnin.

2, 2a — *Kosmoceras pollucinum* Teisseyre; Specimen No. 26 Mn, ibidem.

3, 3a — *Kosmoceras castor fasciculatum* (Tintant); Specimen No. 30Mn, ibidem.

4, 4a — *Kosmoceras ornatum* (Schlotheim); Specimen No. 4LII, Middle (and Upper?) Callovian at Lasocin *II*.

5 — *Kosmoceras trinode* (Buckman); Specimen No. 11Mn, Middle Callovian at Mnin.

6, 6a — *Kosmoceras duncani* (Sowerby); Specimen No. 15LI, Middle and Upper Callovian at Lasocin *I* (nodule bed).

7, 7a — *Quenstedtoceras henrici* (Douvillé); Specimen No. 32LI, ibidem.

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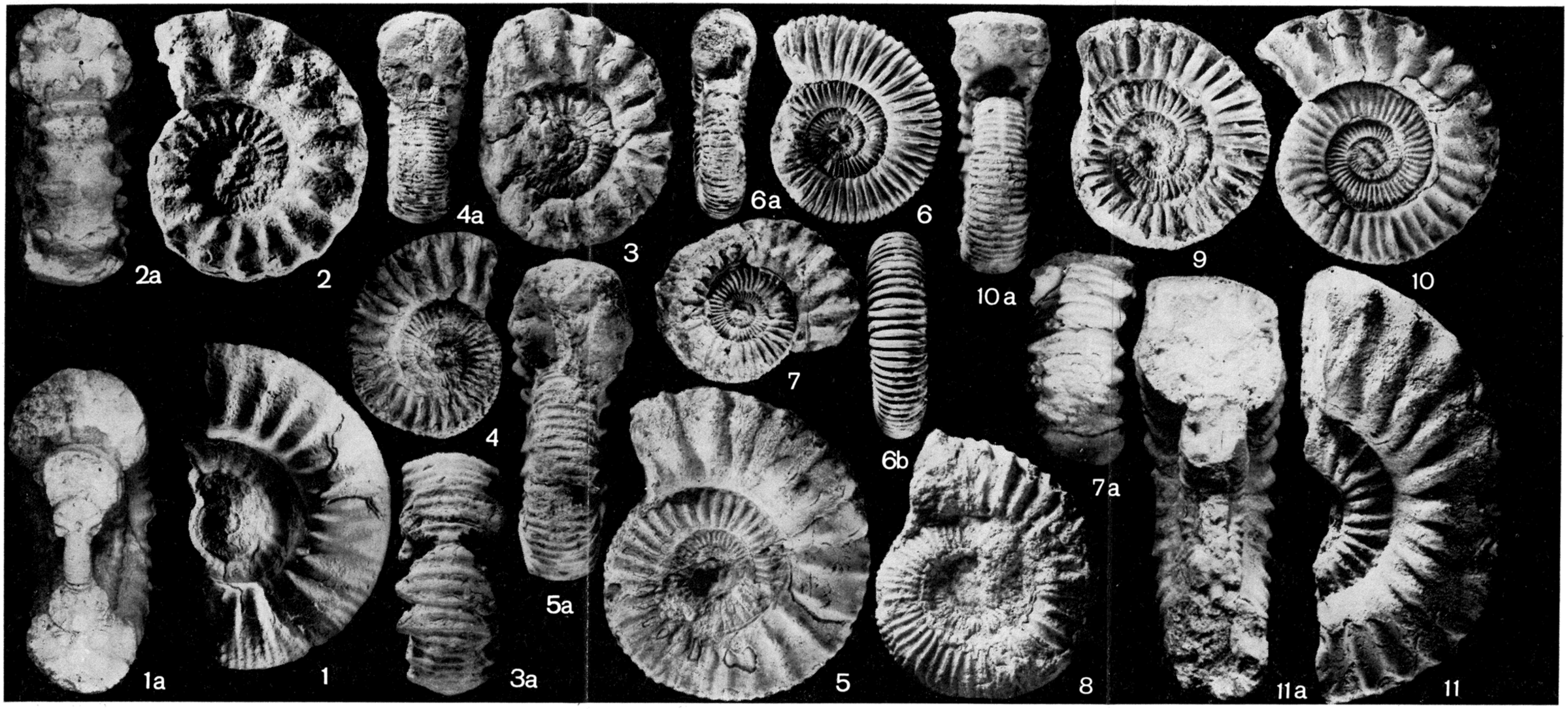

1, 1a — *Poculisphinctes* sp. *A*; Specimen No. 25LI, Middle and Upper Callovian at Lasocin *I* (nodule bed).

2, 2a — *Peltoceras (Peltoceras) athleta* (Phillips); Specimen No. 11LI, ibidem.

3, 3a, 7, 7a — *Peltoceras (Peltoceras) trifidum* (Quenstedt); Fig. 3 — Specimen No. 8LI, Fig. 7 — Specimen No. 13LI; ibidem.

4, 4a — *Peltoceras (Peltoceras) erckenbergense* Prieser; Specimen No. 17LI ibidem.

5 — *Peltoceras (Metapeltoceras) broili* (Prieser); Specimen No. 9LI, ibidem.

6, 6a, 6b — *Peltoceras (Parapeltoceras) subannulosum* (Prieser); Specimen No. 19LI, ibidem.

8 — *Peltoceras (Parapeltoceras)* cf. *oblongum* (Quenstedt); Specimen No. 18LI, ibidem.

9 — *Peltoceras (Parapeltoceras) annulosum* (Quenstedt); Specimen No. 20LI, ibidem.

10, 10a — *Peltoceras (Metapeltoceras) baylei* (Prieser); Specimen No. 14LI, ibidem.

11, 11a — *Peltoceras (Metapeltoceras) schroederi* (Prieser); Specimen No. 12LI, ibidem.

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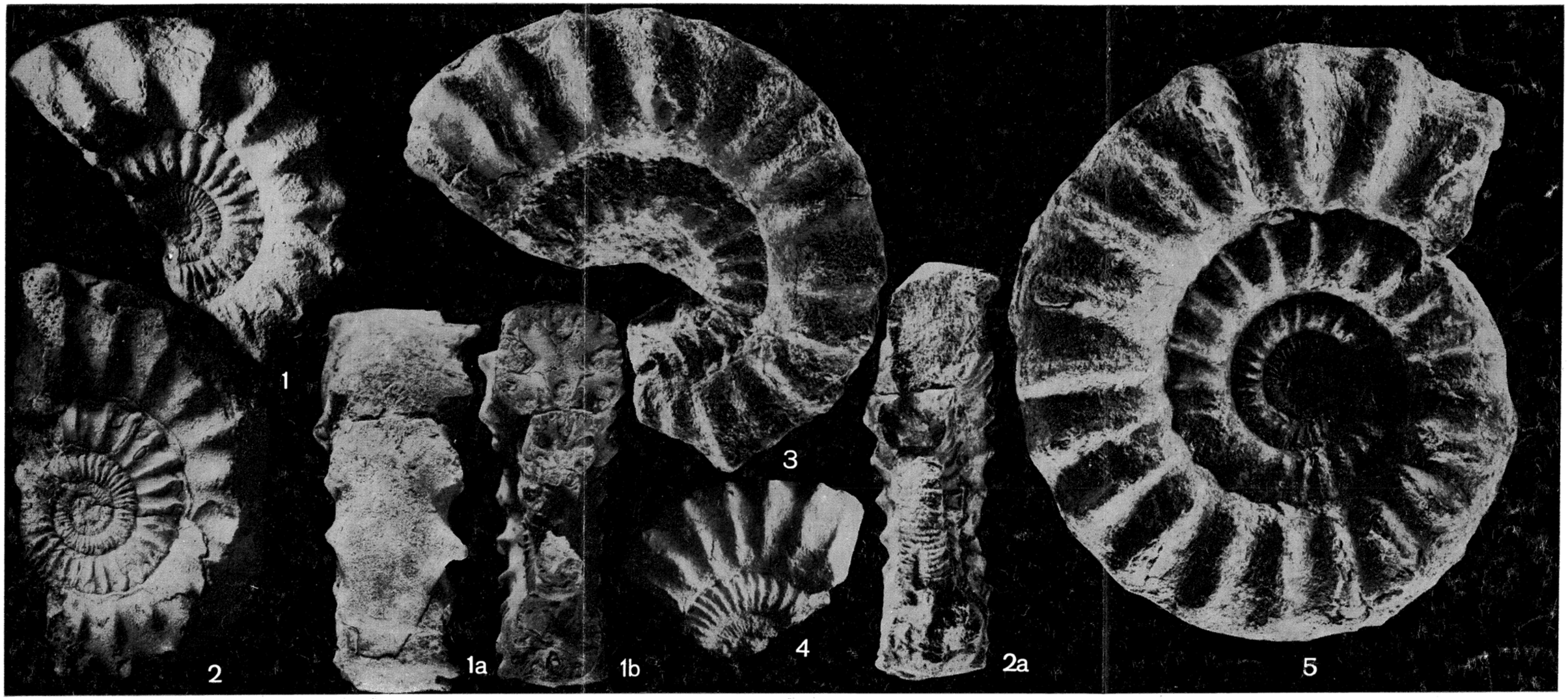

1, 1a, 1b — *Peltoceras (Metapeltoceras)* sp. *A;* Specimen No. 7LI, Middle and Upper Callovian at Lasocin *I* (nodule bed).

2, 2a — *Peltoceras (Metapeltoceras) helveticum* Jeannet; Specimen No. 21LI, ibidem.

3 — *Peltoceras (Metapeltoceras) broili* (Prieser); Specimen No. 10LI, ibidem.

4 — *Peltoceras (Metapeltoceras) schroederi* (Prieser); Specimen No. 28LI, ibidem.

5 — *Pseudopeltoceras leckenbyi* (Bean); Specimen No. 10LII, Middle (and Upper?) Callovian at Lasocin *II*.

Photos 1—4 × 1, photo 5 × 0.75