

WOJCIECH BROCHWICZ-LEWIŃSKI

## Middle Oxfordian representatives of the genera *Lithacoceras* Hyatt, 1900, and *Liosphinctes* Buckman, 1925, from the Polish Jura Chain

**ABSTRACT:** The genera *Lithacoceras* (with its three subgenera: *Lithacoceras* s. s., *Larcheria* and *Discosphinctes*) and *Liosphinctes* are described from the Oxfordian (Plicatilis and Transversarium Zones) of the Polish Jura Chain. Sexual dimorphism is recognized in both genera. Apparent similarity of macroconchs of these genera is interpreted in terms of homeomorphy. It is also supposed that the majority of Upper Oxfordian/Kimmeridgian forms of *Lithacoceras* sensu Geyer (1961) are homeomorphs of this genus and really belong to *Liosphinctes*. The Oxfordian and Tithonian *Lithacoceras* faunas, supposedly represent two waves of invasion from the Tethyan areas.

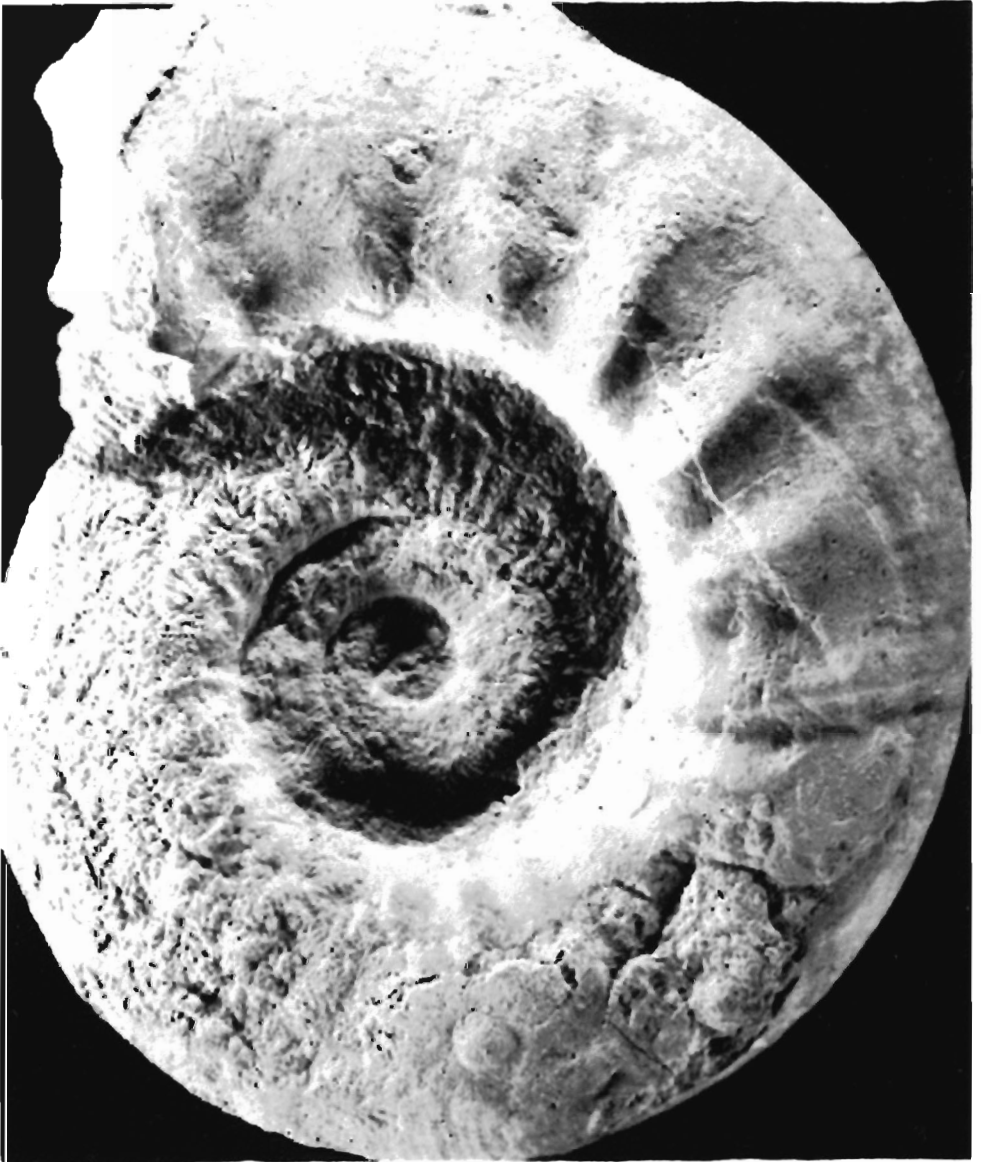
### INTRODUCTION

During studies on the biostratigraphical subdivision of the Oxfordian in the Polish Jura Chain, chiefly in the area of Częstochowa (cf. Fig. 1), a number of ammonites belonging to the genera *Lithacoceras* Hyatt, 1900, and *Liosphinctes* Buckman, 1925, were found. The bulk of the material is derived from Middle Oxfordian platy limestones (Plicatilis and Transversarium Zones), the stratigraphy of which was discussed in detail by Różycki (1953), Malinowska (1963), Brochwicz-Lewiński (1970) and is the subject of further studies on the part of the author.

Generally, the specimens at the author's disposal (some of which were collected by Docent J. Kutek, J. Haase, M. Sc., G. Kulesza, M. Sc., and M. Trzak, M. Sc.) are well-preserved; although the earliest whorls are crushed or recrystallized, outer whorls are commonly complete and often with the peristome. Hence, the material is suitable for reviewing certain problems of systematics, as well as for revising current views on the phylogenetic development of both genera.



*Lithacoceras (Lithacoceras) kreutzi* (Siemiradzki) (M); Zawodzie (Br 02/204),  $\times 0.5$



*Lithacoceras (Lithacoceras) kreutzi* (Siemiradzki) (M); Zawodzie (Prof. H. Makowski's collection),  $\times 0.6$



Opposite side of the specimen presented in Pl. 2



*Lithacoceras (Lithacoceras) kreutzii* (Siemiradzki) (M); Zalas (Geol. Mus. PAN Cracow, A 1-2/12),  $\times 0.85$



*Lithacoceras (Lithacoceras) kreutzii* (Siemiradzki) (m); Jarosów (Ha 31/49 42), nat. size

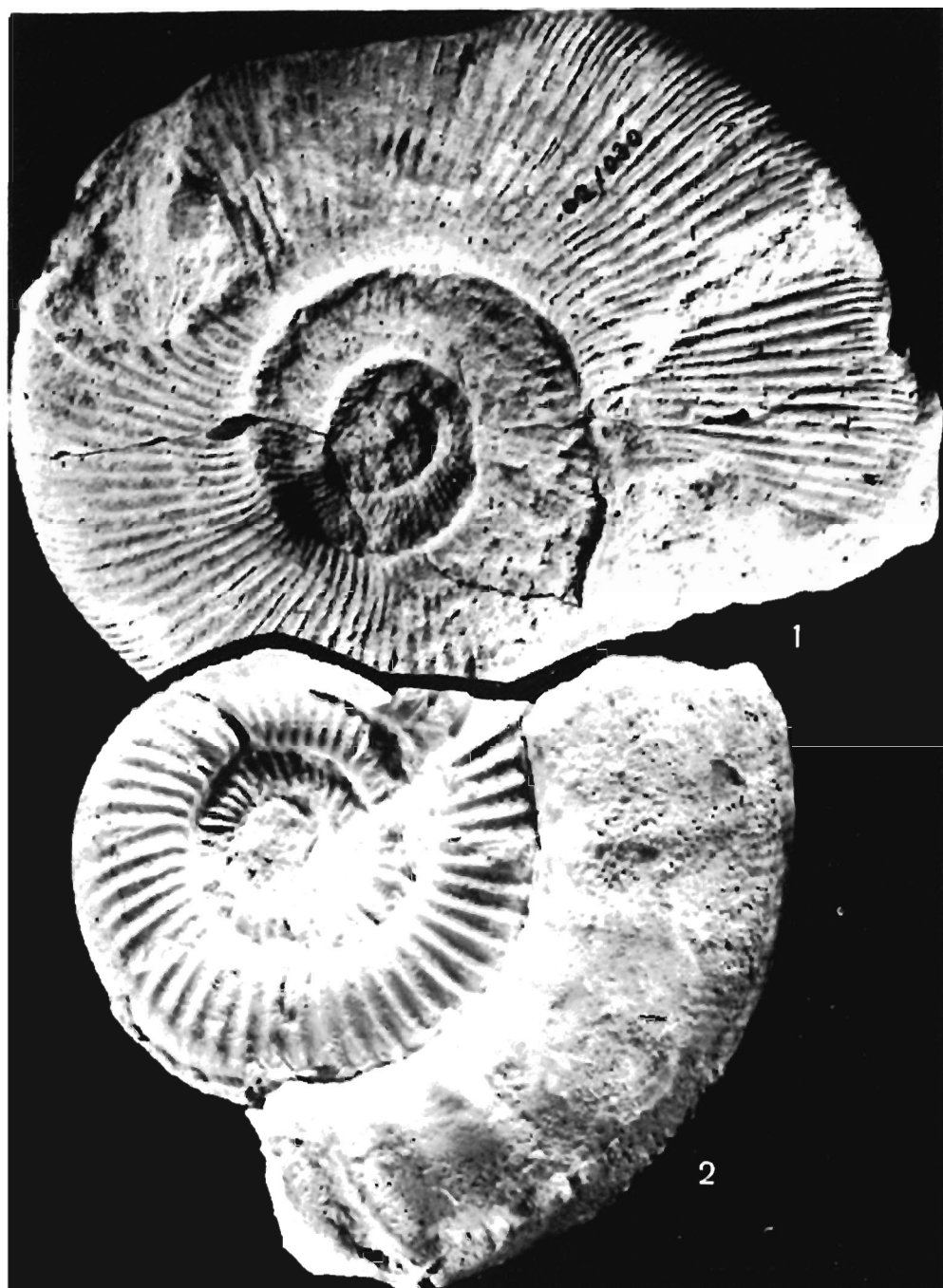


*Lithacoceras (Lithacoceras) richiei* (de Riaz) (M); Zawodzie [Br 01/002],  $\times 0.55$



*Lithacoceras (Lithacoceras) richei* (de Riaz) (m): Jaworznik (Kl 26/36), nat. size





1 — *Lithacoceras (Lithacoceras) richei* (de Riaz) (m); Zawodzie (Br 02/030), nat. size.  
2 — *Liosphinctes laevipickeringius* (Arkell) (m); Wysoka (Tr 1/31b), nat. size.



*Lithoceras (Lithaceras) sp. A (m)*; Zawdzie (Br 02/209), nat. size



*Lithacoceras (Discosphinctes) cracoviense* (Siemiradzki) (m); Olsztyn (Br 21 002), nat. size



*Lithacoceras (Discosphinctes) cracoviense* (Sicmiradzki) (m); body chamber of the specimen is encrusted by serpulids; Jarosów (Ha 49/104), nat. size



1 — *Lithacoceras (Discosphinctes) sp. A* (m); Zawodzie (Br 05/008), nat. size.  
 2 — *Lithacoceras (Discosphinctes) cracoviense* (Siemiradzki) (m); Olsztyn (Br 20/020), nat. size.

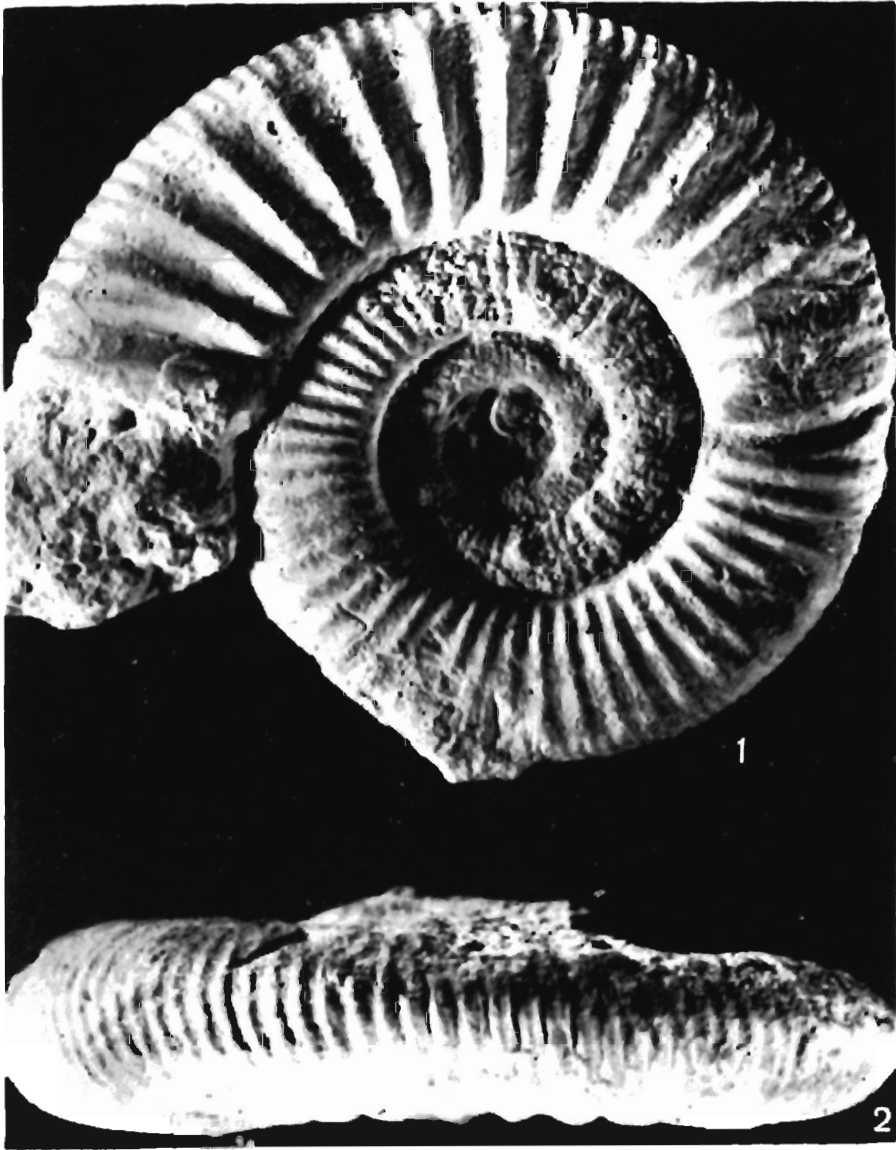


*Lithacoceras (Larcheria) cf. latumbilicatum* Tintant (M); Zawodzie (Br 02:210),  $\times 0.8$



1 — *Liosphinctes* cf. *berlieri* (de Loriol) (m); Zawodzie (Br 05/200), nat. size.  
2 — Ventral side of the same specimen.





1 — *Liosphinctes decipiens* (Sowerby) (*m*); Skrajnica (*Br 25B/003*), nat. size.  
2 — Ventral side of the same specimen.





The specimen of „*Perisphinctes Jelskii*” as described by Siemiradzki (1891, p. 47) (M);  
Rudno (Geol. Mus. PAN Cracow, A I-2/196),  $\times 0.95$

Dimensions:  $D_{max}$  — 185 mm, H — 62 mm, T — 41 mm, U — 76 mm;  $D_1$  — 136 mm,  
 $H_1$  — 50 mm,  $T_1$  — 35 mm,  $U_1$  — 53 mm; at 185 mm diameter there are 94 ribs, at  
136 mm — 96, at 117 mm — 94

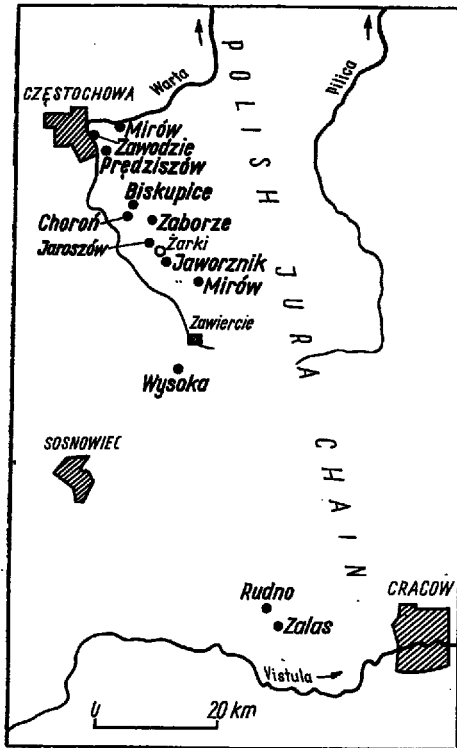


Fig. 1  
Location map of the ammonite-bearing exposures (bold-faced) in the Polish Jura Chain

**Acknowledgements.** Through the courtesy of Docent R. Gradziński and Mrs. Zofia Martini, M. Sc., of the Geological Museum, Polish Academy of Sciences (PAN) in Cracow, the author has been able to reexamine the collection of Prof. J. Siemiardzki.

The author is very grateful to Professors H. Makowski, R. Kozłowski and E. Passendorfer and Docents J. Kutek and A. Radwański for their helpful suggestions and critical comments regarding the manuscript. The author is also indebted to Dr. A. Wierzbowski and Dr. R. Gygi (Naturhistorisches Museum, Basel), who offered valuable advice, as well as to B. Drozd, M. Sc., for taking the photos (Pls 1–16).

#### INTERPRETATION OF *LITHACOCERAS* AND *LIOSPHINCTES*

The genus *Lithacoceras* was originally proposed for Oppel's *Ammonites ulmensis*, a large Kimmeridgian (= modern Lower Tithonian) form with a peculiar sculpture. The downward range of this genus was extended through allocation of some Lower Kimmeridgian/Upper Oxfordian macroconchs characterized by a similar sculpture, on the one hand, and through allocation of some other Oxfordian and Kimmeridgian genera, on the other. Thus the following genera of Oxfordian perisphinctids were assigned to *Lithacoceras*: *Discosphinctes* (by Schindewolf 1925, p. 329), *Progeronia* (by Geyer 1961, p. 26), *Larcheria* and *Platysphinctes* (by Enay

1966, p. 525). Moreover, Enay (*op. cit.*, p. 582) linked *Platysphinctes* into a dimorphic pair with *Liosphinctes*, leaving the latter in the genus *Perisphinctes* s. l. In the light of new facts the hitherto accepted treatment of this material seems inappropriate. Thus a discussion of the above and other genera and their relationship, if any, to *Lithacoceras*, follows.

#### LITHACOCERAS Hyatt, 1900

Type species: *Ammonites ulmensis* Oppel, 1863

The name *Lithacoceras* is the most senior available for Oxfordian ammonites with extremely densicostate inner whorls. It is distinguished from all other genera by its peculiar sculpture and whorl outline, both in the case of macro- and microconchs.

#### DISCOSPINCTES Dacqué, 1914

Type species: *Perisphinctes arussiorum* Dacqué, 1905

This genus was proposed for a few closely related Oxfordian species with inner whorls bearing fine bifurcate ribs, which modify on the outer whorl to produce more loosely-spaced ribs with numerous secondaries. As early as 1925 Schindewolf (1925, p. 329) placed it in *Lithacoceras*; this viewpoint was accepted by some authors (*e.g.* Spath 1931—1933, p. 445; Roman 1938, p. 282); others have followed Arkell (1937, pp. XLVIII and LII) in questioning such identification.

Here, *Discosphinctes* is tentatively considered as a subgenus of *Lithacoceras*. Some equicostate (isocostate *sensu* Enay 1966, p. 534) forms hitherto allocated in this subgenus, appear to be the microconchs of *Lithacoceras* s. s. or *Larcheria* and are included in these subgenera, respectively.

#### LIOSPINCTES Buckman, 1925

Type species: *Liosphinctes apollon* Buckman, 1925

To this genus belong a complex of forms occurring in the Oxfordian and in the Lower Kimmeridgian of extra-Mediterranean Europe. Characteristically, their inner whorls are more coarsely ribbed than those of *Lithacoceras*. However, modification of sculpture on the outer whorls of macroconchs (innumerable primaries, secondaries/primaries ratio equalling 5 or even 6 in extreme cases, trend to smoothness of the final body chamber) results in a deceptive similarity to the latter genus. Differences between the microconchs are distinct throughout the development, hence the above similarity may be interpreted as a homeomorphism. Presumably the majority of Upper Oxfordian/Lower Kimmeridgian perisphinctids placed in *Lithacoceras* by Geyer (1961) and Koerner (1963) belong to *Liosphinctes*.

Here, *Liosphinctes* includes *Decipia* Arkell, 1937, and *Platysphinctes* Tintant, 1961, as junior synonyms. *Progeronia* Arkell, 1953, is supposed to be also a synonym of this genus.

#### DECIPIA Arkell, 1937

Type species: *Ammonites deceptives* Sowerby, 1821

Both the type specimen of *Decipia decipiens*, macroconch, and its microconchs match the diagnosis of *Liosphinctes*; therefore the name *Decipia* is here regarded as a junior synonym of the latter genus.

**PROGERONIA** Arkell, 1953Type species: *Perisphinctes progeron* von Ammon, 1875

This genus was introduced by Arkell for Kimmeridgian ammonites somewhat similar to *Lithacoceras*. Geyer (1961, p. 26) placed it in the latter genus and considered them as parallel branches; in turn, Enay (1966, p. 582) regarded them as a dimorphic pair.

Here, *Progeronia* is tentatively regarded as a separate genus, a presumed junior synonym of *Liosphinctes*.

**PLATYSPHINCTES** Tintant, 1961Type species: *Platysphinctes perplanatus* Tintant, 1961

This genus was introduced by Tintant for ammonites of the Transversarium Zone, characterized by rather rapid modification of coarse, bifurcate into tri- and quadriplicate ribbing, followed by progressive obliteration of sculpture. These forms are the microconchs of *Liosphinctes* (cf. Enay 1966, p. 582) and *Decipia*, and the name *Platysphinctes* is here regarded as a junior synonym of *Liosphinctes*.

**LARCHERIA** Tintant, 1961Type species: *Larcheria larcheri* Tintant, 1961

This genus is characterized by finely-ribbed inner whorls, which modify to produce an outer whorl with somewhat coarse and more widely-spaced primaries; the secondaries/primaries ratio increases up to 3—4 on the ultimate whorl. The smooth band obliterating ornamentation in the middle of the ultimate whorl is typical for this genus.

*Larcheria* was regarded as a subgenus of *Lithacoceras* by Enay (1966, p. 528) and, as a macroconch, linked into a dimorphic pair with *Discosphinctes*. The latter suggestion is right in part and the viewpoint of Enay on subgeneric rank of *Larcheria* is accepted.

Here, the author places these Oxfordian ammonites in the genus *Lithacoceras*, in which he recognizes three subgenera: *Lithacoceras* s. s., *Discosphinctes* and *Larcheria*. In turn, *Liosphinctes* is regarded as a homeomorph of the former genus, and comprises *Decipia*, *Platysphinctes* and presumably *Progeronia* as junior synonyms.

## SYSTEMATIC DESCRIPTION

Family **Perisphinctidae** Steinmann, 1890Subfamily **Lithacoceratinae** Zeiss, 1968

Recently, Zeiss (1968, p. 50) created a new subfamily, Lithacoceratinae. This makes it possible to split the subfamily Ataxioceratinae Buckman, 1921, the heterogeneity of which was stressed by Arkell (1957, p. L 322) and to extend the downward range of Lithacoceratinae to include all representatives of *Lithacoceras* from the Oxfordian.

There is no point in including the genus *Liosphinctes* in the subfamily Lithacoceratinae and therefore it is left in Perisphinctinae Steinmann, 1890.

Genus *LITHACOCERAS* Hyatt, 1900Type species: *Ammonites ulmensis* Oppel, 1863

*Diagnosis.* — Dimorphic. Microconchs generally 100—180 mm in diameter. Inner whorls with sharp biplicate ribbing, which continues up to the peristome or somewhat modifies into tri- and quadriplicate ribbing. Peristome with lateral lappets. Body chamber commonly 1/2 to 3/4 of whorl length. Macroconchs generally 170—300 mm, occasionally larger. Inner whorls with sharp biplicate ribbing, which modifies on the outer whorls to produce widely-spaced blunt primaries, and four to eight secondaries to every primary rib. Trend to smoothness of the final body chamber distinct. Peristome simple, oblique. Body chamber about 3/4 of whorl length. Constrictions present in some species.

*Stratigraphic range.* — Middle Oxfordian — Lower Tithonian.

*Sexual dimorphism.* The innermost whorls of the author's specimens are crushed or recrystallized, hence in regard to the sexual dimorphism the following criteria were applied (after Makowski 1962a, b, 1971; Callomon 1963, 1969):

- 1) forms are considered as complete when the increased density of septa, uncoiling of the umbilicus and modification of aperture and sculpture of at least a half of the ultimate whorl are marked;
- 2) macroconchs have at least one, but not much more than one, whorl more than the corresponding microconchs (morphological one-whorl hiatus);
- 3) inner whorls of both macro- and microconchs are identical;
- 4) both macro- and microconchs are present in the same strata;
- 5) the intermediate forms are lacking.

Subgenus *LITHACOCERAS* Hyatt, 1900Type species: *Ammonites ulmensis* Oppel, 1863

*Diagnosis.* — Moderately involute, dimorphic ammonites, the macroconchs of which attain approximately 300 mm in diameter and microconchs — 140—180 mm in diameter. Microconch peristome bears a short pair of lappets, macroconch peristome simple, somewhat oblique.

Macroconch ornamented with bifurcate, sharp and crowded ribs on the inner whorls, which thereafter gradually spread out becoming progressively thicker and dividing into 3, 4 and later 5, maximally up to 8 secondaries. Tendency to smoothness of the final body chamber is distinct.

Microconch ornamented with sharp, dense ribbing. In the dimorphic pairs so far recognized, the microconch exhibits bifurcate ribbing up to the peristome. However, it seems probable that some microconchs may exhibit modification of bifurcate into triplicate or even quadriplicate ribbing.

The external suture is fairly deeply incised and consists of five lobes, a ventral, first lateral, second lateral and auxiliaries, separated by saddles. The lateral lobe is deeper than the ventral and much larger than the second lateral lobe. The saddle between the lateral lobes is distinctly higher than that between ventral and first lateral lobes but narrower and with a less distinct bipartition. The saddle inside the second lateral lobe and the auxiliary saddles are arranged on a descending line.

*Stratigraphic range.* — Middle Oxfordian — Lower Tithonian.

*Lithacoceras (Lithacoceras) kreutzii* (Siemiradzki, 1891)  
(Text-figs 2—3; Pls 1—5)

71888. *Ammonites grandiplex* Quenstedt; Quenstedt, p. 936, Pl. 102, Fig. 1 (non Pl. 102, Fig. 2).  
 1891. *Perisphinctes Kreutzii* n.sp.; Siemiradzki, p. 41, Pl. 1, Fig. 4.  
 1891. *Perisphinctes Mindowe* n.sp.; Siemiradzki, p. 43, Pl. 2, Fig. 1.  
 1893. *Perisphinctes* n.sp. aff. *mindowe* Siem.; Choffat, p. 43, Pl. 10, Fig. 3.  
 1899. *Perisphinctes Mindowe* Siem.; Siemiradzki, p. 134.  
 1899. *Perisphinctes trichoplocus* Geman; Siemiradzki, p. 273.  
 71817. *Perisphinctes kreutzii* Siem.; Ronchadze, p. 38, Pl. 4, Fig. 30.  
 71930. *Perisphinctes aeneas* var. *plana* Siem.; Dorn, p. 139.  
 [non] 1931. *Lithacoceras* aff. *kreutzii* Siem.; Spath, p. 456, Pl. 87, Fig. 9.  
 [non] 1946. *Perisphinctes (Arisphinctes) kreutzii* Siem.; Arkell, pp. 131, 134.  
 1966. *Lithacoceras (Discosphinctes) mindowe* (Siem.); Enay, p. 535, Pl. 37, Figs 1, 4; Text-figs 163, 169.  
 1966. *Lithacoceras (Discosphinctes) kreutzii* (Siem.); Enay, p. 537, Pl. 37, Figs 5, 7; Text-figs 164, 169.  
 [non] 1970. *Lithacoceras (Discosphinctes) mindowe* (Siem.); Brochwicz-Lewiński, Pl. 6, Fig. 3.

**Material.** — Fourteen specimens (four macroconchs, ten microconchs).

**Description.** — *Macroconch* (cf. Table 1<sup>1</sup>). Shell involute in the inner whorls,

Table 1

Dimensions /mm/:	D	Ph	H	H/D	T	T/D	U	U/D	No. of ribs per whorl
Zawodzie, Br 02/204	/295/	209	76	0.26	—	—	145	0.49	295:26 120:77
	233		70	0.30	—	—	101	0.43	280:28 100:86
	195		67	0.34	43	0.22	72	0.37	240:34 90:88 200:44 80:87 160:59 60:76
Zawodzie, Prof. Makowski's collection	255	180	75	0.30	—	—	112	0.44	255:24
	200		68	0.34	42	0.21	78	0.39	220:31
	160		60	0.37	39	0.24	62	0.39	180:54 120:86 90:102 80:103 60:94 50:83
"P. Kreutzii" /Siemiradzki's identification/, Geol. Mus. PAN Cracow, A 1-2/12	/260/								260:28 220:37 180:44 120:77 100:87 80:90 60:77 40:60
Mirów, Br 10/020	/102/	32	90	0.36	—	—	35	0.39	/102/:90
	75		27	0.36	—	—	30	0.40	90:90 80:85 60:73

becoming evolute in gerontic stage, with a diameter of c. 300 mm. The whorl section compressed, elongate-oval. Inner whorls covered with dense, biplicate ribbing; the rib-curve rises rapidly and then falls rather suddenly from a high peak of about 90 ribs per whorl between 80—100 mm. Decrease in the number of ribs is followed by progressive thickening of primaries and their division into 3, 4 and later 5 to 8 secondaries. On the outer whorls primaries are marked in the form of swollen ridges close to the umbilicus, whereas secondaries completely fade away. Hence, the final body chamber is smooth except for node-like manifestations of primaries

<sup>1</sup> The following abbreviations are used in all the tables (1—14):

- D — diameter of shell,  
 Ph — diameter of phragmocone,  
 H — whorl height,  
 T — whorl thickness (width),  
 U — umbilical diameter.

close to the umbilicus. Umbilical area more or less steep and smooth up to the peristome; umbilical margin broadly rounded.

On the specimen no. *Br 02/204* (cf. Pl. 1), a slight uncoiling of the final body chamber and overlapping of sutures are marked. Moreover, the peristome, simple, oblique and preceded by a wide constriction is preserved. The above features indicate that the specimen is fully grown.

*Microconch* (cf. Table 2). The whorl section high, compressed, almost parallel-sided, thickest close to the umbilicus; venter somewhat flattened; peripheral and umbilical margins rounded; umbilical area smooth and set at almost right angles to the sides.

Ribs fine, sharp, closely spaced (cf. Fig. 3), markedly prorsiradiate. All bifurcate somewhat above the middle of the whorl sides. Occasionally some intercalary and simple ribs occur.

Shape of the rib-curve, as well as some modification of ribbing in the last whorl of the specimen no. *Ha 31/49/42* suggest that the ultimate size attained by this species was c. 150–160 mm in diameter. On the other hand, one fully-grown specimen (no. *Ha 49/55*), 124 mm in diameter, was found.

*Remarks.* — The inner whorls of both macro- and microconchs, up to 70–90 mm in diameter, are very similar in dimension and style of ornamentation; trends of rib-curves are also almost identical (cf. Fig. 2). From a diameter of c. 70–90 mm onwards, however, a change in sculpture takes place in macroconchs, being expressed by a regular increase in the spacing of ribs and their modification.

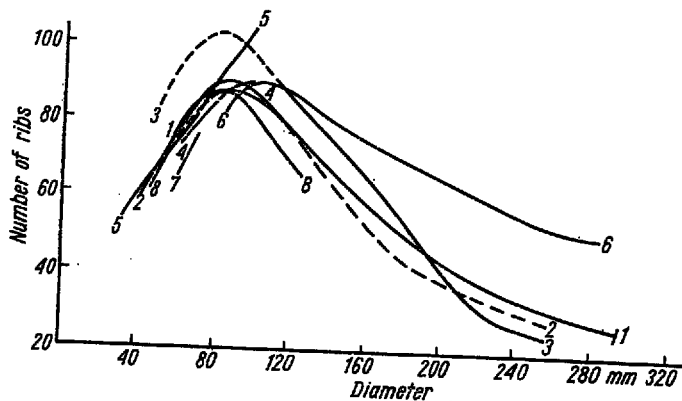


Fig. 2

Comparative rib-curves for macroconchs of the subgenus *Lithacoceras* s. s.

*Lithacoceras (Lithacoceras) kreutzii* (Siemiradzki):

1 — (M), specimen no. *Br 02/204*

2 — (M), specimen no. *A I-9/12* (Geol. Mus. PAN Cracow)

3 — (M), Prof. H. Makowski's collection

4 — (M), specimen no. *Br 10/020*

5 — (m), holotype (Geol. Mus. PAN Cracow, *A-I-2/9*), for comparison

*Lithacoceras (Lithacoceras) richi* (de Riaz):

6 — (M), specimen no. *Br 01/002*

7 — (? M), specimen no. *Ha 60/21*

*Lithacoceras (Lithacoceras) grandipler* Quenstedt:

8 — (M), lectotype (Quenstedt 1888, Pl. 102, Fig. 1), on the basis of draw

Table 2

Dimensions /mm/:	D	Ph	H	H/D	T	T/D	U	U/D	No. of ribs per whorl	
"P. Kreutzii" /Siem. 1891, Pl. 1, Fig. 4; Geol. Mus. PAN Cracow, A 1-2/9/	100	75	36	0.36	24	0.24	40	0.40	100:105 80:91 60:74 40:61	30:32
"P. Mindowe" /Siem. 1891, Pl. 2, Fig. 1; Geol. Mus. PAN Cracow, A 1-2/21/	87	-	32	0.37	21	0.24	34	0.39	90:92 80:84 70:67	
Jaroszów, Ha 49/95	120 100	-	43 37	0.36 0.37	-	-	45 37	0.38 0.37	119:124 110:121 100:115 80:99	
Jaroszów, Ha 31/49/42	145 130	-	46	0.35	-	-	51	0.40	145:134 140:132 120:115 100:97	
Jaroszów, Ha 21/49/47	100 80	-	34 30	0.34 0.37	-	19	40 33	0.40 0.40	100:103 80:85 60:68	
Biskupice, Ha 21/47	80	-	27	0.34	-	-	32	0.40	80:86 60:75 50:70	
Zawodzie, Br 02/075	99/ 90	-	31	0.34	-	-	35	0.40	95:103	

The differences between macro- and microconchs are well-illustrated by the comparison of specimen no. *Br 10/020* and the type specimen of *P. Kreutzii* Siemiradzki, 1891, both of similar diameters, c. 100 mm. The specimen no. *Br 10/020*, up to the constriction at 88 mm diameter, exhibits ornamentation and dimensions typical of microconchs. Later its ribs still bifurcate but are more and more widely spaced which results in formation of a peak on the rib-curve (cf. Fig. 2). The same is observed in the case of *P. aeneas* var. *plana* Siem. figured by Dorn (1930, Pl. 10, Fig. 5).

It should be noted that the macroconch no. *A 1-2/12* of Prof. Siemiradzki's collection was not described in his paper of 1891, but accompanying it is a label in Siemiradzki's handwriting with the words "*Perisphinctes Kreutzii*, Zalas".

The striking resemblance of the inner whorls of macro- and microconchs, as well as common occurrence leave no doubts that they belong to the same species.

**Affinities.** According to Siemiradzki (1891, p. 43) his *Perisphinctes Kreutzii* differs from *P. Mindowe* in wider umbilicus with less steep margins and slower increase in height. Remeasurements of both type-specimens show that there is no differences in dimensions. Moreover, rib-curves are very similar (cf. Fig. 3) and other differences noted by Siemiradzki result from deformation of the type specimen of *P. mindowe*. Hence, there is no reason for separating these forms. Because of the page and plate priority, *P. mindowe* Siemiradzki is included into the synonymy of *Lithacoceras kreutzii* (Siemiradzki, 1891).

*Lithacoceras kreutzii* differs from *Lithacoceras richeti* (de Riaz) in being somewhat more evolute and densely ribbed.

The macroconch differs from the species of the *Lithacoceras pseudolictor* group (cf. Koerner 1963) from the Upper Oxfordian/Lower Kimmeridgian in ribs on the inner whorls almost two times more numerous, and secondaries/primaries ratio lower at 100–150 mm diameters and higher thereafter.

The macroconchs of *Lithacoceras kreutzii* are strikingly similar to the lectotype of *Lithacoceras (Lithacoceras) grandiplex* (Quenstedt) in Quenstedt (1888, p. 936, Pl. 102, Fig. 1; exclusively) in the style of sculpture on the inner whorls, trend of rib-curves (cf. Fig. 2) and dimensions, differing in a somewhat more compressed whorl section and smaller size. Sculpture on the outer whorls of the latter is however



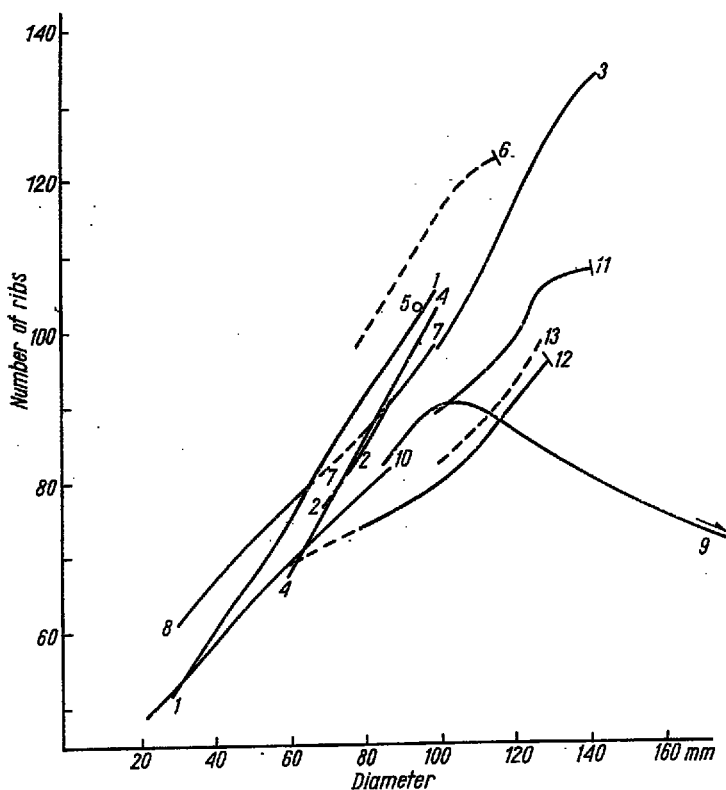


Fig. 3

Comparative rib-curves for microconchs of the subgenus *Lithacoceras* s. s.

*Lithacoceras (Lithacoceras) kreutzii* (Siemiradzki):

- 1 — (m), holotype (Geol. Mus. PAN Cracow, A 1-2/9)
- 2 — (m), „*Perisphinctes mindowe*” Siemiradzki, type specimen (Geol. Mus. PAN Cracow, A 1-2/21)
- 3 — (m), specimen no. Ha 31/49/43
- 4 — (m), specimen no. Ha 31/49/47
- 5 — (m), specimen no. Br 02/075
- 6 — (m), specimen no. Ha 49/55
- 7 — (m), specimen no. Ha 49/56

“*Ammonites lucingae* Favre”:

- 8 — (m), holotype (after Enay 1966, Text-fig. 166)

*Lithacoceras (Lithacoceras) richei* (de Riaz):

- 9 — (M), specimen no. Br 01/002, for comparison
- 10 — (? m), holotype (after Enay 1966, Text-fig. 165)
- 11 — (m), specimen no. Br 02/057
- 12 — (m), specimen no. Br 02/030
- 13 — (m), specimen no. Kl 26/36

worn out, hence it may be argued whether or not all these forms belong to a single species.

*Occurrence.* — Zawodzie at Częstochowa, quarry 2 (cf. Brochwicz-Lewiński 1970), Transversarium Zone, Parandieri and (?)lower Bifurcatus Subzones; Mirów (Transversarium Zone, Parandieri Subzone); Jarosów (Transversarium Zone); Zalas (Middle Oxfordian).

*Lithacoceras (Lithacoceras) richi* (de Riaz, 1898)  
(Text-figs 2—3; Pls 6—7; Pl. 8, Fig. 1)

1898. *Perisphinctes richi* nov. sp. t. r.; de Riaz, p. 37, Pl. 15, Fig. 3.  
 1898. *Perisphinctes rhodanicus* Dum.; de Riaz, p. 21, Pl. 11, Fig. 2.  
 1899. *Perisphinctes rhodanicus* Dum.; Siemiradzki, p. 344.  
 1899. *Perisphinctes luttanicus* nob.; Siemiradzki, p. 344.  
 ?1930. *Perisphinctes luttanicus* Favre; Domn, p. 144 (pro parte), Pl. 7, Fig. 2 (exclusively).  
 1966. *Lithacoceras (Discosphinctes) richi* (de Riaz); Enay, p. 539, Pl. 37, Figs 2, 6 and 9;  
 Text-figs 159—162, 165, 168.  
 1970. *Lithacoceras (Discosphinctes) mindowe* (Siem.); Brochwicz-Lewiński, Pl. 8, Fig. 3.

**Material.** — Seven specimens (two macroconchs, five microconchs).

**Description.** — *Macroconch* (cf. Table 3). Large shell, involute in early stages, evolute later, with strongly inflated whorls. Inner whorls covered with dense,

Table 3

Dimensions /mm/:	D	Fa	E	H/D	T	T/D	U	U/D	No. of ribs per whorl	
Zawodzie, Br 01/002	286/ 274 228 189	240	80 72 66	0.29 0.23 0.35	— 44 35	— 0.19 0.18	124 98 71	0.43 0.43 0.38	206:50 260:53 240:56 220:61 188:68 160:75	140:80 120:87 100:90 89:82
Zaborze, Ha 60/21	80	wholly septate	30.5	0.38	—	—	27	0.34	88:77 60:65	

biplicate, sharp ribbing. The rib-curve rises rather rapidly, and then gradually falls from a high peak of about 90 ribs per whorl between 90—120 mm. Decrease in number of ribs is accompanied by triplication and later quadruplication, as well as by progressive thickening of primaries. At 220 mm diameter, the secondaries/primaries ratio equals 4.0. On the final body chamber a slight tendency to obliteration of secondaries is marked. The specimen is almost full grown, which fact is evidenced by approximation of sutures.

**Microconch** (cf. Table 4). Slightly evolute shell with a diameter of 130—150 mm. The whorl section high, almost parallel-sided. Venter broadly rounded. Umbilical

Table 4

Dimensions /mm/:	D	Fa	E	H/D	T	T/D	U	U/D	No. of ribs per whorl	
In mindowe /Siem./	143	—	33	0.37	36	0.25	54	0.38	143:108	110:90
In Brochwicz-Lewiński, 1970; Zawodzie, Br 02/057	110 100	—	41 36	0.37 0.36	22	0.20	39 36	0.36 0.36	140:108 138:106	100:89
Zawodzie, Br 02/030	132 120 95	0.74	49 45 33	0.37 0.37 0.39	— — —	— — —	49 45 31	0.37 0.37 0.38	130:96 120:90 100:79	80:74 60:69
Jaworzank, Kl 26/36	128 103	0.78	44 38	0.37 0.37	— —	— —	45 39	0.38 0.38	128:98 120:92 100:82	

area steeply inclined, smooth. Diameter of umbilicus initially small, gradually increasing up to 0.37—0.38 of whorl diameter in mature and gerontic stages. Ribbing almost exclusively bifurcate; on the final body chamber, primaries and secondaries become somewhat flexuous and some intercalary and/or single ribs appear. The peristome formed by deep constriction followed by swollen single rib; relics of lappets were found.

*Remarks.* — In two instances recorded, cessation of sutures in microconchs occurs at 74 and 78 mm in diameter, respectively. However, in the case of the specimen no. *Ha 60/21*, there is no approximation of sutures. It may represent the immature female form.

Features of the inner whorls of microconchs and of the macroconch no. *Br 01/002* are in common. Hence it may be assumed that both these microconchs and macroconch belong to the same species.

*Affinities.* The macroconch is most closely comparable to *Perisphinctes lucin-gensis* Favre figured by Dorn (1930, Pl. 7, Fig. 2, exclusively); however, Dorn's specimen is too incomplete for determination with certainty.

The macroconch under discussion is somewhat similar to that of *Lithacoceras kreutzii* (Siem.) in shell dimensions and outline, but differs in that the primaries are more numerous, more slender and subdivided into a smaller number of secondaries (secondaries/primaries ratio equals 4.0 in comparison with 8.0 in *L. kreutzii*) on the final body chamber. Moreover, a tendency to smoothness of the final body chamber is more pronounced in the case of the latter form.

*Perisphinctes berlieri* de Loriol (cf. de Loriol, 1901, p. 78, Pl. 12, Fig. 2; and Enay 1966, p. 422, Pl. 21, Fig. 1) is somewhat similar in dimensions and the secondaries/primaries ratio, but differs in less compressed whorl section and distinctly different trend of rib-curve.

Microconch is similar to that of *Lithacoceras kreutzii* (Siem.) in general shell outline, differing in smaller number of ribs (cf. Fig. 3), broadly rounded venter and being somewhat more involute. Differences in trends of rib-curves are particularly well-marked in the case of specimens exceeding 80—100 mm in diameter.

The author's specimens are somewhat more evolute than the holotype of *Lithacoceras richei* (de Riaz), but this difference falls within the limits of intraspecific variability.

*Occurrence.* — Zawodzie at Częstochowa, quarry 2, beds 21—23 (cf. Brochwicz-Lewiński 1970), the Transversarium Zone, Parandieri Subzone; Jaworzniak (Plicatilis Zone); Zaborze (Transversarium Zone, Parandieri Subzone).

### *Lithacoceras (Lithacoceras) sp. A* (Pl. 9)

*Material.* — One microconch with peristome (two additional fragments of this specimen are not shown in Pl. 9).

*Description.* — *Macroconch* unidentified.

*Microconch* (cf. Table 5). The whorl section high, compressed, convergent, with venter broadly rounded. Umbilical area high, gently sloping, smooth. Ornamentation

Table 5

Dimensions /mm/	D	Pa	R	H/D	T	T/D	U	U/D	No. of ribs per whorl
Zawodzie, Br 02/209	180		62	0.35	30	0.17	64	0.36	/100/±0.102
/all approximate/	178		48	0.36	—	—	48	0.36	
	135		39	0.39	—	—	32	0.32	
	100								

consists of bifurcate ribs, somewhat flexuous on the inner whorls, distinctly prorsiradiate on the final body chamber. Peristome formed by somewhat swollen rib with lappets, preceded by weakly marked constriction.

*Affinities.* Similar to the microconch of *Lithacoceras kreutzii* (Siem.) in number of ribs at 100 mm diameter, differing in whorl outline and whorl height markedly exceeding umbilical diameter at diameter of 100 mm.

Close in dimensions to *Ammonites rhodanicus* Dumortier (*vide* Enay 1966, p. 546) and *L. (Lithacoceras) richei* (de Riaz) but differs in style and density of ribbing.

*Occurrence.* — Zawodzie at Częstochowa, quarry 2 (*cf.* Brochwicz-Lewiński 1970), the Transversarium Zone, Parandieri or Bifurcatus Subzone.

### Subgenus *DISCOSPINCTES* Daqué, 1914

Type species: *Perispinctes arussiorum* Daqué, 1905

*Diagnosis.* — Involute to slightly evolute, discoidal, variocostate shell with a diameter of c. 120—180 mm. Maximal thickness close to the umbilicus. Ribs densely spaced, prorsiradial, bifurcate on earlier whorls, later trifurcate and finally fasciculate. Rib-curve gently sloping. Constrictions common, deep.

*Remarks.* — Some equicostate (isocostate *sensu* Enay 1966) microconchs formerly assigned here are transferred to *Lithacoceras* s.s. and *Larcheria* as the microconchs of the latter subgenera.

There remains a question of the sex of *Perispinctes arussiorum* Daqué (the type specimen) and other "true" *Discospinctes*. In fact, some of them such as *Lithacoceras (Discospinctes) cracoviense* (Siemiradzki), *L. (Discospinctes) sp. A* of the author's collection, *P. (Discospinctes) subguanensis* Arkell figured by Judoley & Furrázola-Bermudez (1968, Pl. 43, Fig. 1; Pl. 44, Fig. 1) and others exhibit distinct features typical for microconchs; whereas nothing certain can be said about the majority of specimens hitherto allocated in *Discospinctes*, owing to their poor preservation or incompleteness.

*Discospinctes* differs from the microconchs of *Lithacoceras* s.s. and *Larcheria* in general thickening of primaries on the final body chamber and their tri- and quadrifurcation, which results in sloping of the rib-curve. However, these differences are essentially limited to the last whorl, hence it may be assumed that the macroconchs of *Discospinctes* are very similar to those of *Lithacoceras* s.s. Hence, whether or not *Discospinctes* is a junior synonym of *Lithacoceras* is still an open question.

One of the specimens on which the description of *Perispinctes Jelskii* by Siemiradzki was based (Siemiradzki 1891, p. 47) appears to be an incomplete macroconch (*cf.* Pl. 16), the affinity of which as well as the other specimens of Siemiradzki to *Lithacoceras* is doubtful.

*Stratigraphical range.* — Middle Oxfordian, Transversarium Zone — ?Lower Kimmeridgian.

### *Lithacoceras (Discospinctes) cracoviense* (Siemiradzki, 1891) (Text-fig. 4; Pls 10—11; Pl. 12, Fig. 2)

1891. *Perispinctes cracoviensis* sp.n.; Siemiradzki, p. 48, Pl. 3, Figs 1, 4.  
[non] 1898. *Perispinctes cracoviensis* Siem.; de Riaz, p. 35, Pl. 15, Fig. 1 (= *Perispinctes (Dichotomosphinctes) elisabethae* de Riaz).  
1899. *Perispinctes lelocymon* Waagen; Siemiradzki, p. 245.

*Material.* — Five specimens (microconchs)



margins. Ribs very fine, sharp, densely spaced, bifurcate, passing into trifurcate on the final body chamber. Secondaries form a gentle sinus over the ventral side.

Peristomal part is broken but overlapping of sutures is distinct.

Occurrence. — Zawodzie at Częstochowa, quarry 5, bed 24 (cf. Brochwicz-Lewiński 1970), Parandieri-Bifurcatus junction beds.

### *Lithacoceras (Discosphinctes) sp. B*

Material. — One specimen (?microconch).

Description. — Moderately evolute shell (cf. Table 8) with a diameter c. 180 mm. Whorls subovate to subelliptical in cross-section, whorl sides somewhat inflated.

Table 8

Dimensions /mm/:	D	Fh	H	H/D	T	T/D	U	U/D	No. of ribs per whorl
Zawodzie, Br 02/220	180/ 171 139	114	61 48	0.36 0.36	- -	- -	67 56	0.40 0.41	175:97 160:108 120:115 80:108 60:94 40:0.68

Umbilical area quite steep, smooth. Ribs initially sharp, dense, maximally up to 115 in number at 120 mm diameter, later more loosely spaced, coarser, tripartite.

Septation ceases at 114 mm in diameter (?approximation of sutures and uncoiling).

Remarks. — Peristomal part is broken and it is difficult to state whether the specimen under discussion represents male or female sex. There is no tendency to

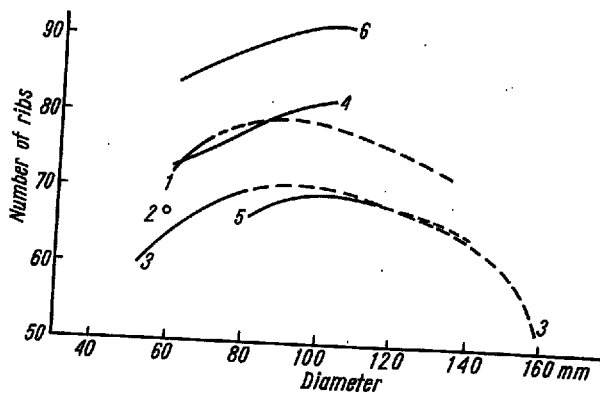


Fig. 4

#### Comparative rib-curves for the subgenus *Discosphinctes*

##### *Lithacoceras (Discosphinctes) cracoviense* (Siemiradzki):

- 1 — (m), holotype (Geol. Mus. PAN Cracow, A I-2/26)
- 2 — paratype (Geol. Mus. PAN Cracow, A I-2/349)
- 3 — (m), specimen no. Br 20/002
- 4 — (m), specimen no. Br 20/020
- 5 — (m), specimen no. Ha 49/104

##### *Lithacoceras (Discosphinctes) sp. A:*

- 6 — (m), specimen no. Br 05/008

obliteration of sculpture, so typical for macroconchs of *Lithacoceras* s.l., hence male sex may be inferred.

Form very similar to *L. (D.) subguanensis* Arkell figured by Judoley & Furzola-Bermudez (1968), differing in somewhat wider umbilicus and being more densicostate.

*Occurrence.* — Zawodzie at Częstochowa, Transversarium Zone, Parandieri or Bifurcatus Subzone.

### Subgenus *LARCHERIA* Tintant, 1961

Type species: *Larcheria larcheri* Tintant, 1961

*Diagnosis.* — Dimorphic. Microconchs, up to 100 mm in diameter, occasionally larger, with fine bifurcate ribbing up to the peristome. Peristome presumably with lappets. Macroconchs, up to 180 mm in diameter, occasionally more, generally finely ribbed on inner whorls; final body chamber usually more coarsely ribbed and with smooth band obscuring point of furcation; the secondaries/primaries ratio equals 3—4 for the final body chamber. Peristome simple, oblique. Constrictions present in some species.

*Stratigraphical range.* — Middle Oxfordian, Transversarium Zone.

### *Lithacoceras (Larcheria) cf. latumbilicatum* Tintant, 1961

(Pl. 13)

1961. *Larcheria latumbilicata* sp. n.; Tintant, p. 181, Pl. 2, Fig. 2.

*Material.* — One specimen (macroconch).

*Description* of the macroconch. — Moderately evolute shell (cf. Table 9) with compressed, high whorls. Venter rounded. Ribs on the inner whorls fine but innumerable.

Table 9

Dimensions /mm/:	D	Ph	H	H/D	F	F/D	U	U/D
Zawodzie, Br 02/210	186 146	113	56 47	0.30 0.32			84 58	0.45 0.40

merous. Smooth band obscuring point of furcation gradually spreads out which results in smoothness of the final body chamber except for the venter and the area close to the umbilical margin. Deep constrictions marked close to the peristome. Aperture simple, oblique.

*Occurrence.* — Zawodzie at Częstochowa, Transversarium Zone, Parandieri or lower Bifurcatus Subzone.

### Subfamily *Perisphinctinae* Steinmann, 1890

#### Genus *LIOSPHINCTES* Buckman, 1925

Synonyms: *Decipia* Arkell 1937, *Platysphinctes* Tintant 1961,

?*Progeronia* Arkell 1953

Type species: *Liosphinctes apolion* Buckman, 1925

*Diagnosis.* — Dimorphic. Microconchs, 100—180 mm in diameter, ornamented with coarse, crowded rectiradiate ribs on the inner whorls; body chamber usually more coarsely ribbed with primaries which obscurely trifurcate; appearance of intercalary ribs somewhat increases secondaries/primaries ratio. Body chamber 3/4 of whorl length. Macroconchs generally c. 250—300 mm in diameter or more. Inner

whorls ornamented similarly as in microconchs. On the outer whorls, primaries are progressively more loosely-spaced and coarser, dividing into numerous secondaries. Tendency to smoothness of the last quarter of the ultimate whorl is distinct. Aperture simple, oblique.

*Stratigraphic range.* — Middle Oxfordian — Lower Kimmeridgian.

*Liosphinctes laevipickeringius* (Arkell, 1939)

(Pl. 8, Fig. 2)

1937. *Pertosphinctes* (*Arisphinctes*) sp. nov. aff. *pickeringius* Arkell, p. 447.  
 1939. *Pertosphinctes* (*Arisphinctes*) *laevipickeringius* sp. nov.; Arkell, p. 142, Pl. 30, Figs 4—6 (? Figs 1—3); Pl. 33, Fig. 6; Text-fig. 46.  
 1960. *Pertosphinctes* (*Liosphinctes*) *laevipickeringius* Arkell; Callomon, p. 192.  
 1961. *Platysphinctes perplanatus* gen. and sp. nov.; Tintant, p. 115, Pl. 1, Fig. 7.  
 1965. *Pertosphinctes* (*Liosphinctes*) cf. *laevipickeringius* Arkell; Enay, p. 420, Text-fig. 120.  
 1966. *Platysphinctes perplanatus* Tintant; Enay, p. 534.

*Material.* — Nine specimens (seven macroconchs, two microconchs).

*Description.* — *Macroconch* (cf. Table 10). Large shell, up to 400 mm in diameter, with whorls initially subelliptical and later subovate in outline; whorl sides

Table 10

Dimensions /mm/:	D	Fh	H	H/D	T	T/D	U	U/D	No. of ribs per whorl
Mirów, 10/003	/197/ 195 162		54 48	0.28 0.30	49 —	0.26 —	95 78	0.48 0.48	/197/135 160:137 120:91 80:55
Zawodzie, 02/053	/400/ 282 261		74 71	0.26 0.27	66 —	0.23 —	146 134	0.52 0.51	280:141 240:144 200:147 160:149 120:53 90:0.56
Choroń, E/001	/225/ 213	210	59	0.28	52	0.25	107	0.50	220:133 180:0.38 140:0.45 100:46
Choroń, A/001	/245/ 217		59	0.27	53	0.24	107	0.49	93:0.52
Biskupiec, Ha 21/47	338 300 170	220	76 76 53	0.23 0.25 0.31	73 — —	0.22 — —	185 163 80	0.55 0.54 0.47	338:0.29 300:0.29 240:31 160:43 100:48

somewhat flattened. Umbilicus relatively narrow, with umbilical wall gently sloping, smooth; umbilical margin broadly rounded.

Ribs biplicate on the inner whorls, about 50 in number, triplicate later. Appearance of intercalary ribs results in increment of the secondaries/primaries ratio up to 4.0 or even 5.5 at 200—260 mm diameter. Sculpture distinctly fades away on the final body chamber. Aperture simple, oblique.

*Microconch* (cf. Table 11). Moderately evolute shell with a diameter of c. 160 mm. Whorl section initially subelliptical, later distinctly compressed. Ventral and umbilical margins broadly rounded. Venter wide, rounded. Ribs bifurcate, strong and somewhat prorsiradiate on inner whorls, distinctly retriradiate on the outer. Appearance of intercalary ribs and trifurcation results in a secondaries/primaries ratio over 3 to 4 on outer whorls. Sculpture becomes obliterated on the last half of the final body chamber which attains about one whorl in length.

The style of sculpture, rib density and dimensions suggest that the microconchs described by Tintant (1961) under the name *Platysphinctes perplanatus* are the dimorphic counterparts of *L. laevipickeringius* Arkell.



Table 11

Dimensions /mm/:	D	Ph	F	H/D	T	T/D	U	U/D	No. of ribs per whorl
Mirów, Br 10/023	/172/ 137 107	100	54 42 34	0.31 0.31 0.31	38 — —	0.22 — —	78 62 51	0.45 0.49 0.47	140:0.32 120:0.39 100:43 80:47 60:49 40:46
Wysoka near Zawiercie, Br 1/31b	/115/ 77		21	0.30	22	0.30	34	0.48	71:45 60:40

*Affinities.* Sculpture and trend of rib-curve for *L. linki* figured by Choffat (1893, p. 31, Pl. 41) are almost identical as these of *L. laevipickeringius* Arkell, but amount of material is still insufficient for estimate whether or not *L. laevipickeringius* fall within the limits of intraspecific variability of the former species. Also differences with *L. apollion* Buckman are unclear.

There is also striking similarity to *Ammonites victor evolutus* figured by Quenstedt (1888, p. 957, Pl. 105, Fig. 2) and particularly to the form identified as *L. (Lithacoceras) evolutum* (Quenstedt) by Koerner (1963, p. 362, Pl. 22, Fig. 2; Text-fig. 59). The differences seem to be confined merely to higher evoluteness of the latter forms and it may be argued whether or not the whole group, *L. linki* (Choffat), *L. apollion* Buckman and *L. laevipickeringius* (Arkell) are junior synonyms of *L. evolutum* (Quenstedt).

*Occurrence.* — Zawodzie at Częstochowa, quarry 2, bed 23 (cf. Brochwicz-Lewiński 1970), Transversarium Zone, Parandieri Subzone; Mirów (Transversarium Zone, Parandieri Subzone); Choroń and Biskupice (Transversarium Zone); Wysoka (Middle Oxfordian, presumably Plicatilis Zone).

*Liosphinctes* cf. *berlieri* (de Loriol, 1903)

(Pl. 14)

1903. *Perisphinctes berlieri* sp. n.; de Loriol, p. 78, Pl. 12, Fig. 2 (lectotype), (? Pl. 9).

1930. *Perisphinctes berlieri* de Lor.; Dorn, p. 166, Pl. 16, Fig. 1.

1966. *Perisphinctes (Liosphinctes) berlieri* de Lor.; Enay, p. 422, Pl. 21, Fig. 1; Text-figs 120—121.

*Material.* — Seven specimens (six macroconchs, one possible microconch).

*Description.* — *Macroconch* (cf. Table 12). Moderately evolute, large form with a diameter of c. 300 mm; whorl section initially subovate and ovate to elliptical in

Table 12

Dimensions /mm/:	D	Ph.	H	L/D	T	T/D	U	U/D	No. of ribs per whorl
Mirów, 10/031	335 333 274 160 114		81 74 49 40	0.24 0.27 0.31 0.39	65 56 — —	0.20 0.20 — —	182 143 64 45	0.55 0.52 0.41 0.39	
Zawodzie, Br 02/025	/235/ 222 200	205	68 61	0.31 0.31	— —	— —	105 94	0.47 0.47	230:28 200:37 160:0.43 120:0.37 110:0.38
Zawodzie, Br 02/102	/220/ 200		53	0.26	—	—	102	0.51	220:37 200:41 160:54 120:64 100:63
Biskupice, Br 28/32/12	165		71	0.31	39	0.24	76	0.46	165:49 140:58 120:62 100:61 80:55

mature and gerontic stages. Umbilicus moderately shallow, with umbilical area smooth, gently inclined and umbilical margin rounded.

Primary ribs initially dense, coarse, bifurcate, and later progressively loosely-spaced and thicker. The secondaries/primaries ratio over 4.0 at 160–180 mm diameter. On the final body chamber first secondaries and later primaries disappear. Aperture simple, oblique, preceded by wide, shallow constriction.

*Microconch* (cf. Table 13). A single specimen from Zawodzie (*Br 05/200*) is possibly the microconch of this species. It is 127 mm in diameter, moderately evolute;

Table 13

Dimensions /mm/:	D	Fh	H	H/D	T	T/D	U	U/D	No. of ribs per whorl
Zawodzie, Br 05/200	127 120 100	74	42 34	0.33 0.34	— 26	— 0.26	49 42	0.41 0.42	127:52 120:3.6 120:55 90:2.9 100:59 80:60 60:58

whorl section somewhat inflated, convergent; venter side wide, broadly rounded. Ribbing initially bifurcate, coarse, changes into tri- and quadriplicate on the body chamber. Essentially the inner whorls of both macroconchs and the microconch are very similar.

*Remarks.* — *L. berlieri* (de Loriol) differs from *L. laevipickeringius* (Arnell), *L. linki* (Choffat) and *L. apolion* Buckman in being more densicostate and in more wavy rib-curve. In turn, the outer whorls of *L. cumnorenensis* Arnell are more densicostate and finely-ribbed than those of *L. berlieri*.

In the case of the microconch in question, an almost identical form with the peristome preserved and measuring 195 mm in diameter was found by Dr. R. Gygi (*pers. inf.*) in the Transversarium Zone of Switzerland, and identified as *Progeronia* sp.

*Occurrence.* — Zawodzie at Częstochowa and Mirów (Transversarium Zone, Parandieri Subzone); Biskupice (Transversarium Zone).

### *Liosphinctes decipiens* (Sowerby, 1821) (Pl. 15)

1821. *Ammonites decipiens* sp. n.; Sowerby, vol. 3, p. 169, Pl. 194; refigured by Arkell (1937, Pl. F; 1956, Pl. 39, Fig. 4; 1967, Fig. 415).  
 1899. *Perisphinctes bonarelli* sp. n.; Siemiradzki, p. 239, Pl. 25, Fig. 42.  
 1929. *Perisphinctes* sp. nov.; Wegele, p. 56, Pl. 3, Fig. 6.  
 1937. *Decipta decipiens* (Sow.); Arkell, p. 44, Pl. F, Figs 1, 2 (holotype) and (?) 3–4.  
 1947. *Decipta decipiens* (Sow.); Arkell, p. 370, Text-figs 132 and 133.  
 1970. *Perisphinctes bonarelli* (Siem.); Brochwicz-Lewiński, Pl. 8, Fig. 2.

*Material.* — Two specimens (microconchs).

*Description.* — Evolute shells with a diameter up to 120 mm; whorl section rather compressed, thickest close to the umbilicus; lateral sides somewhat flattened.

Table 14

Dimensions /mm/:	D	Fh	H	H/D	T	T/D	U	U/D	No. of ribs per whorl
" <i>P. Bonarelli</i> " Siem. /1899, Pl. 25, Fig. 42; on the basis of photo/	100	wholly septate	30	0.30	23	0.23	45	0.45	100:44 80:48 70:49 60:49
Skrzajnos, Br 25B/003	111 100 88		24 22 27	0.31 0.32 0.31	— 24 20	— 0.24 0.23	55 48 41	0.50 0.48 0.47	100:41 80:44 60:48

Ventral and umbilical margins broadly rounded. Ribbing biplicate on inner whorls, triplicate on the outer. Appearance of intercalary ribs results in the secondaries/primaries ratio approximating 4.0 at the diameter 100—120 mm.

*Remarks.* — The holotype and the specimen figured by Arkell (1947, Text-fig. 133), as well as Siemiradzki's specimen identified as *P. bonarelli* (cf. Siemiradzki 1899, Pl. 25, Fig. 42), represent the macroconchs of this species. The author's specimens (Brochwicz-Lewiński 1970, Pl. 8, Fig. 2; and Pl. 15 of the present paper), exhibiting the same style of ornamentation, the same dimensions at comparable diameters and similar rib-densities, should be considered as the microconchs of this species. The inner whorls are not preserved in specimens figured by Arkell everywhere, except for two nuclei (Arkell 1937, Pl. F, Figs 3—4); these nuclei distinctly differ from the inner whorls of Siemiradzki's specimen and those of the author but it is not certain whether or not they actually belong to this species.

*Affinities.* There is a striking resemblance between the microconchs of *Liosphinctes laevipickeringius* (Arkell), formerly identified as *Platysphinctes perplanatus* Tintant, and the microconchs of *Liosphinctes decipiens* (Sow.) in dimension, shell outline and sculpture. However, the outer whorls of the macroconchs of *L. decipiens* (Sow.) are so incomplete that full comparison with the macroconchs of the former species is almost impossible.

*Platysphinctes ovalis* Malinowska (1970, Text-figs 2—4 and Pl. 1) differs somewhat in the trend of rib-curve and sculpture of the final body chamber.

*Perisphinctes* sp. n. in Wegele (1929) is also close to this species, differing in somewhat smaller number of ribs.

*Occurrence.* — Zawodzie at Częstochowa, quarry 2, bed 30 (cf. Brochwicz-Lewiński 1970); Skrajnica (Transversarium Zone, Bifurcatus Subzone).

#### SEXUAL DIMORPHISM IN LITHACOCERAS AND LIOSPINCTES

In the investigated material, as well as in this hitherto described a few size groups of macro- and microconchs may be distinguished. In the case of the genus *Lithacoceras*, the macroconchs of one group attain c. 300 mm and more in diameter, whereas those of the second group, up to 180 mm. Accordingly, two groups of microconchs are distinguished, the first, representatives of which attain 140—180 mm in diameter and correspond to the larger macroconchs, and the second, comprising forms c. 100 mm in diameter and corresponding to the smaller macroconchs. In the instances of dimorphism identified or presumed, inner whorls of both sexes are practically indistinguishable in sculpture. Differentiation in sculpture is limited to the last whorl of the microconchs and almost two of the macroconchs. Both these groups of macro- and microconchs are assigned to the subgenera *Lithacoceras* s.s. and *Larcheria*, respectively. The microconchs of both these subgenera are transferred from *Discosphinctes*.

It appears that the microconchs of both *Lithacoceras* s.s. and *Larcheria* hitherto identified are equicostate (isocostate *sensu* Enay 1966) up to the peristome; however, the differentiation in sculpture of the micro-

conch in relation to that of the macroconch seems to be confined to the ultimate whorl of the former. On the basis of general dimensions, style of sculpture and size attained by particular representatives of *Discosphinctes* it may be assumed that their dimorphic counterparts were c. 300 mm in size and were characterized by sculpture and dimensions very close to those of *Lithacoceras* s.s. Therefore *Discosphinctes* is tentatively retained as a subgenus of *Lithacoceras* and whether or not it is a junior synonym of this genus is still an open question. In the case of *Discosphinctes* sp. A, exhibiting gerontic features and attaining barely c. 110—120 mm in size, the corresponding macroconch should be somewhat smaller but still extremely densicostate.

Generally, both the principle of one-whorl morphological hiatus and the criterion of identical early whorls are met in the case of the genus *Lithacoceras*. In the genus *Liosphinctes*, on the other hand, dimorphism was recognized in the species *L. laevipickeringius* (Arkell) and *L. decipiens* (Sowerby) and presumed in *L. cf. berlieri* (de Loriol). The macroconchs of this genus bear a striking resemblance to *Lithacoceras* in the style of ribbing and dimensions of the outer whorls, distinctly differing the inner whorls with stronger and nearly half as numerous ribs. The difference is more distinct in the case of microconchs, ornamented with crowded fine ribs in *Lithacoceras* and with innumerable coarse ribs, sometimes fading out on the final body chamber in *Liosphinctes*. Hence, the similarity of the macroconchs of both genera may be explained by homeomorphism. If this is the case than the abundance of representatives of the genus *Liosphinctes* in the deposits of the Bifurcatus Subzone allows us to assume that somewhat younger perisphinctids identified as *Lithacoceras* s.s. by Geyer (1961) and Koerner (1963) are homeomorphs of this genus and belong to *Liosphinctes*.

It should be noted that Geyer's (1961) interpretation of *Lithacoceras* was questioned by Zeiss (1968, p. 48) and subsequently by Bantz (1970, pp. 38 and 41) who hold that no Kimmeridgian (nor older) perisphinctid found in Germany fulfill the diagnosis of this genus and they interpret Geyer's forms as macroconchs of *Progeronia*. Moreover, interpretation of *Ammonites achilles* d'Orbigny (= *Lithacoceras* s.s. according to Geyer 1961), as representative of the genus *Decipia* by Lóreau & Tintant (1968) is a notable example.

#### THE ORIGIN OF *LITHACOCERAS* AND *LIOSPHINCTES*

The genus *Lithacoceras* is represented in the Oxfordian by its three subgenera: *Lithacoceras* s.s., *Larcheria* and *Discosphinctes*. The data available show that the former two appear almost simultaneously in the Plicatilis Zone, Antecedens Subzone in the submediterranean province.

The third, *Discosphinctes*, appears somewhat later, in the upper part of the Parandieri Subzone, Transversarium Zone and presumably represents side-branch of the microconchs of *Lithacoceras* s.s.

The Oxfordian representatives of the genus *Lithacoceras* form a group well-separated from all other contemporaneous perisphinctids. The differences are not limited to their peculiar sculpture, but are also expressed in trends to involutness and discoidal whorl-outline. Such strong manifestation of differentiation rises the question of whether or not *Lithacoceras* is an invader or long-domesticated in the submediterranean province. The earliest forms which may be allocated in this genus were reported by Enay & al. (1967) and Brochwicz-Lewiński (1970) from the Plicatilis Zone, Antecedens Subzone of France and Poland, respectively. Further studies carried out by the present author have shown that microconchs attributable to *Lithacoceras* s.s. and *Larcheria* are quite frequent in the Antecedens Subzone of the Polish Jura Chain. Unfortunately, present knowledge of the perisphinctids of the Cordatum Zone is insufficient for an unequivocal answer the above question.

Of the perisphinctids of the Cordatum Zone, the group of *Perisphinctes mazuricus* Bukowski (1887) and allied forms may be considered as presumable ancestors of the microconchs of *Lithacoceras*. The idea of such affinity is not new, and was expressed already by Bukowski (1887, p. 158) and later by Schindewolf (1926, pp. 500, 513). There is also some similarity between certain *Larcheria* and sexual dimorphs of *P. mazuricus*, the group of *P. consociatus* Bukowski (1887) (cf. Bukowski 1887, Pl. 5, Fig. 4, and *Lithacoceras* (*Larcheria*) cf. *latumbilicatum* Tint. in Pl. 13 of the present paper). However, it should be remembered that such affiliation was strongly questioned by Arkell (1937, p. L).

The invasion of *Lithacoceras* from the Tethys northward cannot be unequivocally excluded. During the Middle and Upper Oxfordian the representatives of this genus are quite numerous in France, Germany, Poland and in the Tethyan areas, whereas there is no reliable record of their occurrence further to the north. The decline of this populations begins in the lowermost Upper Oxfordian and *Lithacoceras* (*Lithacoceras*) *gigantoplex* (Quenstedt) and *L. (?Lithacoceras) virgulatum* (Quenstedt) seem to be the last survivors on the north, whereas further to the south the record of the occurrence of *Lithacoceras* seems more complete, e.g. in Cuba (Judoley & Furrázola-Bermúdez 1968), Yugoslavia (Andelković 1966), and Iran (*Lithacoceras* (*Lithacoceras*) sp. in: Sestini & Assereto 1970, Pl. 21, Fig. 1) from the Lower Kimmeridgian or uppermost Oxfordian. An abundant occurrence of *Lithacoceras* in the Lower Tithonian of Germany (cf. Berckheimer & Hölder 1959, Zeiss 1968) would mean a new northward invasion.

In turn, *Liosphinctes* appears to be limited in distribution to the submediterranean province. Its microconchs, former *Platysphinctes*, are known to occur since the Plicatilis Zone, Antecedens Subzone, up to the Platynota Zone (*Perisphinctes* sp. nov. in: Wegele 1929), with almost no modifications in sculpture nor dimensions.

According to Tintant (1961), these microconchs are strikingly similar to some *Choffatia* of the Callovian, and particularly to *C. waageni* Teisseyre. It may be added that they are almost indistinguishable from „*Perisphinctes neumayri*” in Siemiradzki (1899, p. 298, Pl. 22, Fig. 23 and Pl. 23, Fig. 32) from the Upper Callovian of Poland.

*Institute of Geology  
of the Warsaw University  
Warszawa 22, Al. Żwirki i Wigury 93  
Warsaw, March 1972*

#### REFERENCES

- ANDELKOVIC M. Ž. 1966. Amoniti iz slojeva sa *Aspidoceras acanthicum* Stare Planine (istočna Srbija). — *Palaeont. Jug.*, vol. 6. Zagreb.
- ARKELL W. J. 1935—1948. A monograph on the ammonites of the English corallian beds. — *Palaeontogr. Soc. London*.
- 1937. The zonal position of the Elsworth Rock, and its alleged equivalent at Upware, Cambridgeshire. — *Geol. Mag.*, vol. 74, part. 3. Herts.
- 1953. Seven new genera of Jurassic ammonites. — *Ibidem*, vol. 90, no. 1. Hertford.
- 1956. *Jurassic geology of the World*. Edinburg — London.
- 1957. In: Arkell W. J., Kummel B. & Wright C. W. — *Mesozoic Ammonoidea*, Treatise on Invertebrate Palaeontology, Part L (Mollusca 4). Lawrence.
- BANTZ H.-U. 1970. Der Fossilinhalt des Treuchtlinger Marmors (Mittleres Unterkimmeridge der Südlichen Frankenalb). — *Erlanger Geol. Abh.*, H. 82. Erlangen.
- BERCKHEMER F. & HÖLDER H. 1959. Ammoniten aus dem Oberen Weissen Jura Süddeutschlands. — *Beih. Geol. Jb.*, H. 35. Hannover.
- BROCHWICZ-LEWIŃSKI W. 1970. Biostratigraphy of Oxfordian limestones from the Zawodzie quarries in Częstochowa, Polish Jura Chain. — *Bull. Acad. Pol. Sci., Sér. Sci. Géol. Géogr.*, vol. 18, no. 4. Varsovie.
- BUKOWSKI G. 1887. Ueber die Jurabildungen von Czenstochau in Polen. — *Beitr. Paläont. Geol. Österr.-Ung.*, Bd. 4. Wien.
- CALLOMON J. H. 1960. New sections in the Corallian beds of Oxford, and the subzones of the Plicatilis Zone. — *Proc. Geol. Assoc.*, vol. 71, part 1. Colchester.
- 1963. Sexual dimorphism in Jurassic ammonites. — *Trans. Leicester Lit. Phil. Soc.*, vol. 57. Leicester.
- 1969. Dimorphism in Jurassic ammonites, some reflections. — *Intern. Union Geol. Sci., Ser. A*, no. 1. Stuttgart.
- CHOFFAT P. 1893. Description de la faune jurassique du Portugal; Ammonites du Lusitanien de la contrée de Torres-Vedras. — *Direction Trav. Géol. Portugal. Lisbon*.

- DACQUÉ E. 1905. Neue Beiträge zur Kenntniss des Jura in Abessynien. — Beitr. Paläont. Geol. Österr.-Ung., Bd. 17, H. 1. Wien — Leipzig.
- DORN C. 1930—1931. Die Ammoniten-fauna des untersten Malm der Frankenalb. — Palaeontographica, Bd. 73—74. Stuttgart.
- ENAY R. 1966. L'Oxfordien dans la moitié sud du Jura français. — Nouv. Arch. Mus. Hist. Natur. Lyon, no. 8. Lyon.
- , TINTANT H. & CARIOU É. 1967. Les faunes oxfordiennes d'Europe meridionale. Essai de zonation. — Colloq. Intern. du Jurass. Luxembourg.
- GEYER O. F. 1961. Monographie der Perisphinctidae des unteren Unterkimmeridium (Weisser Jura  $\gamma$ , Badenerschichten) im süddeutschen Jura. — Palaeontographica, Abt. A, Bd. 117. Stuttgart.
- JUDOLEY C. M. & FURRAZOLA-BERMUDEZ G. 1968. Estratigrafia y fauna del Jurásico de Cuba. — Inst. Cubano Rec. Miner., "Osvaldo Sánchez" del Inst. del Libro. La Habana.
- KOERNER U. 1963. Beiträge zur Stratigraphie und Ammonitenfauna der Weissjura —  $\alpha/\beta$  — Grenzé (Oberoxford) auf der westlichen Schwäbische Alb. — Jh. geol. Landesamt Baden-Württemberg, Bd. 6. Freiburg im Breisgau.
- LOREAU J. P. & TINTANT H. 1968. Le calcaire de Tonnerre et les formations adjacentes du Jurassique supérieur de l'Yonne. Observations stratigraphiques et paléontologiques. — Bull. Soc. Géol. France, 7<sup>e</sup> sér., vol. 10. Paris.
- de LORIOU P. 1902—1904. Étude sur les mollusques et brachiopodes de l'Oxfordien supérieur et moyen du Jura lédonien. — Mém. Soc. Paléont. Suisse, vol. 29—31. Genève.
- MAKOWSKI H. 1962a. Recherches sur le dimorphisme sexuel chez les Ammonoidés. Note préliminaire. — Księga Pam. ku czci Prof. J. Samsonowicza (Memory book of Professor J. Samsonowicz). Warszawa.
- 1962b. Problem of sexual dimorphism in ammonites. — Palaeontologia Polonica, no. 12. Warszawa.
- 1971. Some remarks on the ontogenetic development and sexual dimorphism in the Ammonoidea. — Acta Geol. Pol., vol. 21, no. 3. Warszawa.
- MALINOWSKA L. 1963. Stratigraphy of the Oxfordian of the Częstochowa Jurassic on the base of ammonites. — Prace Inst. Geol., vol. 34. Warszawa.
- 1970. Le genre *Platysphinctes* dans l'Oxfordien supérieur des environs de Częstochowa. — Roczn. P. T. Geol. (Ann. Soc. Géol. Pol.), vol. 40, no. 1. Kraków.
- OPPEL A. 1862—1863. Über jurassische Cephalopoden. — Palaeont. Mitt. Mus. kgl. bayer. Staates, vol. 1, nos 2—3. Stuttgart.
- QUENSTEDT F. A. 1838. Die Ammoniten des schwäbischen Jura. III. Der Weisse Jura. E. Schweizerbart. Stuttgart.
- de RIAZ A. 1898. Description des ammonites des couches à *Peltoceras transversarium* (Oxfordien supérieur) de Trept (Isère). Masson & Cie. Paris.
- ROMAN F. 1938. Les Ammonites Jurassiques et Crétacées. Essai de genera. Masson & Cie. Paris.
- RONCHADZÉ J. 1917. Perisphinctes de l'Argovien de Chézery. — Mém. Soc. Paléont Suisse, vol. 42, no. 4. Genève.
- RÓŻYCKI S. Z. 1953. Górny dogger i dolny malm jury krakowsko-częstochowskiej (The Upper Dogger and Lower Malm of the Kraków-Częstochowa Jurassic). — Prace Inst. Geol., vol. 17. Warszawa.
- SCHINDEWOLF O. H. 1925. Entwurf einer Systematik der Perisphincten. — N. Jb. Miner. usw., Abt. B, Bd. 52. Stuttgart.

- 1926. Zur Systematik der Perisphincten. — *Ibidem*, Bd. 55.
- SCHNEID T. 1915—1916. Die Geologie der fränkischen Alb zwischen Eichstätt und Neuburg a. D. — Geogn. Jahreshften, Bd. 27—28. München.
- SESTINI N. F. & ASSERETO R. 1970. The geology of the Upper Djadjerud and Lar Valleys (North Iran). II. Palaeontology. — Riv. Ital. Paleont., vol. 76, no. 2. Milano.
- SIEMIRADZKI J. 1891. Fauna kopalna warstw oksfordzkich i kimerydzkich w okregu krakowskim i przyległych częściach Królestwa Polskiego. Part I. Głowonogi. — Pam. Wydz. Mat.-Przyr. Akad. Um., vol. 18. Kraków.
- 1899. Monographische Beschreibung der Ammonitengattung *Perisphinctes*. — Palaeontographica, Bd. 45. Stuttgart.
- SPATH L. F. 1931—1933. Revision of the Jurassic cephalopod fauna of Kachh (Cutch), Parts IV—V. — Mem. Geol. Surv. India (Palaeont. Indica), N. S., vol. 9, no. 2. Calcutta.
- TINTANT H. 1961. Études sur les Ammonites de l'Oxfordien supérieur de Bourgogne. II. Les genres *Platysphinctes* nov. et *Larcheria* nov. — Bull. Scien. Bourgogne, vol. 19. Dijon.
- WAAGEN W. 1873—1875. Jurassic fauna of Kutch. I. The Cephalopoda. — Mem. Geol. Surv. India (Palaeont. Indica), vol. 1, parts 1—4. Calcutta.
- WEGELE L. 1929. Stratigraphische und faunistische Untersuchungen im Oberoxford und Unterkimmeridge Mittelfrankens. — Palaeontographica, Bd. 82. Stuttgart.
- ZEISS A. 1968. Untersuchungen zur Paläontologie der Cephalopoden des Unter-Tithon der Südlichen Frankenalb. — Abh. Bayer. Akad. Wiss., Math.-Naturw. Kl., N. F., H. 132. München.

---

W. BROCHWICZ-LEWIŃSKI

**AMONITY Z RODZAJÓW *LITHACOCERAS* HYATT, 1900,  
I *LIOSPHINCTES* BUCKMAN, 1925,  
ZE ŚRODKOWEGO OKSFORDU JURY POLSKIEJ**

(Streszczenie)

W pracy opisano amonity z rodzajów *Lithacoceras* Hyatt, 1900, (z wyróżnieniem trzech podrodzajów: *Lithacoceras* s.s., *Larcheria* Tintant, 1961, i *Discosphinctes* Dacqué, 1914) oraz *Liosphinctes* Buckman, 1925, ze środkowego oksfordu (poziomy *Perisphinctes plicatilis* i *Gregoryceras transversarium*) Jury Polskiej (fig. 1). Wykazano ponadto, że rodzaje *Decipia* Arkell, 1937, *Platysphinctes* Tintant, 1961, oraz prawdopodobnie *Progeronia* Arkell, 1953, są synonimami *Liosphinctes*.

W obu opracowanych rodzajach udało się rozpoznać dymorfizm płciowy, co w konsekwencji pozwoliło na zinterpretowanie podobieństwa zewnętrznych skrętów makrokonch *Lithacoceras* s.s. i *Liosphinctes* jako przejawu homeomorfizmu. W tym świetle wydaje się, że górnooksfordzkie i kimerydzkie formy zaliczane przez Geyera



(1961) do podrodzaju *Lithacoceras* s.s. są także homeomorfami i w rzeczywistości należą do *Liosphinctes*.

Dwukrotne pojawienie się form z rodzaju *Lithacoceras* na obszarach prowincji submedyterrańskiej, a mianowicie w oksfordzie oraz powtórnie w tytonie, pozwala przypuszczać, że jest to rodzaj wywodzący się z prowincji medyterrańskiej. Przypuszczenie to zdają się potwierdzać dane z literatury o występowaniu litakocerasów w górnym oksfordzie i kimerydzie Kuby (Judoley & Furrzola-Bermudez 1968), Jugosławii (Anelković 1966) oraz Iranu (Sestini & Assereto 1970). Rodzaj *Liosphinctes* natomiast wywodzi się najprawdopodobniej od kelowejskiego rodzaju *Choffatia* i jako dość konserwatywny przechodzi aż do kimerydu.

*Instytut Geologii Podstawowej  
Uniwersytetu Warszawskiego  
Warszawa 22, Al. Żwirki i Wigury 93  
Warszawa, w marcu 1972 r.*

---