

Taxonomical revision of the perisphinctid
ammonites of the Upper Jurassic
described by Józef Siemiradzki (1891)
from the Kraków Upland



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Taxonomical revision of the perisphinctid ammonites of the Upper Jurassic (Plicatilis to Planula zones) described by Józef Siemiradzki (1891) from the Kraków Upland

Ewa GŁOWNIAK and Andrzej WIERZBOWSKI

Institute of Geology, University of Warsaw, Al. Żwirki i Wigury 93, PL-02089 Warszawa, Poland;
e-mail: Glowniak_EK@uw.edu.pl, Andrzej.Wierzbowski@uw.edu.pl

Key-words: perisphinctid ammonites, Upper Jurassic, Kraków Upland, Józef Siemiradzki, Academy of Arts and Sciences, Physiographic Commission.

ABSTRACT: This systematic account contains descriptions of ammonite species of the superfamily Perisphinctoidea from the collection of the Physiographic Commission of the 19th century Academy of Arts and Sciences in Kraków. The emphasis is on the description of 11 species introduced by Siemiradzki (1891), e.g. *Subdiscosphinctes kreutzii*, *S. mindowe*, *S. jelskii*, *S. dunikowskii*, *S. ? cracoviensis*, *S. ? dybowskii*, *Perisphinctes (Perisphinctes) vajdelota*, *Perisphinctes (Dichotomosphinctes) crotalinus*, *P. (Dichotomoceras) alpinus*, and *Perisphinctes damesi* recognised to be *nomen dubium*, as well as a single species from the Bimammatum Zone - *Ringsteadia teisseyreii*. Most of the species mentioned are re-described and illustrated for the first time in this paper. In addition, the descriptions of 18 nominal species as well as another 32 species left in open nomenclature, are provided. The species are assigned to 8 genera (*Subdiscosphinctes*, *Perisphinctes*, *Neumannia*, *Passendorferia*, *Idoceras*, *Orthosphinctes* and *Ringsteadia*) in 3 families (Perisphinctidae, Ataxioceratidae and Aulacostephanidae). In the family Perisphinctidae two new informal species groups have been distinguished: *Perisphinctes (Dichotomosphinctes) elisabethae* group and the *Subdiscosphinctes ? dybowskii* group. The *Subdiscosphinctes ? cracoviensis* group as distinguished by Brochwicz-Lewiński, has been re-described and some new forms included in it. The species indicate the Plicatilis and Transversarium zones of the Middle Oxfordian, and the Bifurcatus, Bimammatum and Planula zones hitherto as a whole assigned to the Submediterranean Upper Oxfordian, but in fact correlating with the Upper Oxfordian (Bifurcatus Zone and the lower part of the Bimammatum Zone) and the lowermost Kimmeridgian (upper part of the Bimammatum Zone and Planula Zone) of the Subboreal primary standard for the Oxfordian/Kimmeridgian boundary. The erroneous opinion presented by Siemiradzki (1891) concerning the alleged discordant occurrence of Kimmeridgian deposits of the so called *Oppelia tenuilobata* Zone in the area studied has been corrected and explained. The paper is provided with some useful species indexes.

INTRODUCTION
by Ewa Głowniak

Preface

The ammonites which are the subject matter of the taxonomical revision provided in this paper

constitute a part of the historical collection of Upper Jurassic cephalopods from the Kraków Upland gathered by Polish naturalists who were members of the Physiographic Commission of the 19th century Academy of Arts and Sciences in Kraków. Most of these specimens were gathered by Stanisław Zaręczny as a result of

cartographic work carried out by him in the Kraków Upland. The oldest date for collection of a specimen is given as the year 1872. The collection is one of several inherited from the Physiographic Commission which survived in their entirety in Polish museums. Apart from its historical value it is still valid as essential scientific material.

Józef Siemiradzki was the first to provide a scientific description of the collection. He published his monograph devoted to cephalopods of the Kraków Upland in 1891 in *Pamiętnik Akademii Umiejętności*. The paper was written in Polish.

For the purposes of the taxonomical review provided herein, the ammonites of the superfamily Perisphinctoidea Steinmann have been chosen. This is the single largest group in the collection (70% of the overall number of 350 ammonite specimens described by Siemiradzki in 1891). At the same time this group contains *i.a.* the type specimens of a number of nominal species introduced by Siemiradzki (1891). They are re-described in the present paper and most of them are illustrated for the first time.

Collection ZNG PAN A/I/2 is housed in the Museum of the Institute of Geological Sciences of the Polish Academy of Sciences in Kraków (hereinafter: Museum ING PAN). The authors wish to express their thanks to the curator of Museum ING PAN in Kraków, Ms Barbara Kietlińska-Michalik, for making the collection available for research and exhibition purposes.

Geological and geographical settings

The Polish Jura Chain extends north-westwards from Kraków to Częstochowa and some further distance to the north (Fig. 1A). The Kraków Upland (Fig. 1B) belongs to its southern part (*cf.* Gradziński, Gradziński 1994). The exposures mentioned in this paper are situated between Kraków to the east and Chrzanów to the west. The area is formed of by Upper Jurassic epicratonic carbonates (marls, bedded limestones and massive limestones), which have here their largest outcrops, and have yielded the ammonites studied.

GENERAL EXPLANATION OF THE SYSTEM OF TAXONOMY USED

by Ewa Główniak

The species-group and its classification at a higher rank. Included here are morpho-species assembled around their type specimens – lectotypes or holotypes. However it is becoming apparent that a significant number of the morphospecies described in the present paper are now well recognised in their horizons and constitute a part of a wide spectrum of isochronous intraspecific variability. The knowledge on those species goes much beyond a simple knowledge of their types, and they are usually suitable for calling them rather fossil biospecies than pure morphospecies. These biospecies are defined by range of morphological variation expressed by the range of morphospecies included in the group. One of the examples provided in this paper is the *Perisphinctes (Dichotomosphinctes) elisabethae* group. This informal unit accommodates four microconch morphospecies: *P. (D.) elisabethae*, *luciae*, *luciaeformis* and *crotalinus*. They are involved in the natural assemblage of micro- and macroconchs (*Perisphinctes pumilus* and *P. andelotensis*) as evidenced in the Polish sections (*e.g.* Główniak 2006c) to which the name fossil biospecies safely applies. On the other hand, there remains a significant number of morphospecies, *e.g.* of the genus *Subdiscosphinctes* whose description still remains purely typological. The available material is scanty, being often limited to one or two specimens in the type collection. This is the case for example with *Subdiscosphinctes dunikowskii*, *S. jelskii*, *S. ? cracoviensis*, *S. ? dybowskii*, but also others from different genera, for example, *Perisphinctes (Dichotomoceras) alpinus* or *Ringsteadia teisseyrei* of Siemiradzki (1891). An attempt is made to cluster some of them (for example *S. ? cracoviensis* group or *S. ? dybowskii* group – both provisionally assigned to the genus *Subdiscosphinctes*) on account of their striking shell similarity. Further studies would eventually enable one to recognize if they were really involved in natural assemblages in their horizons.

Species may undergo further classification at the higher levels of genus-group and family-group in the Linnéan hierarchy, using

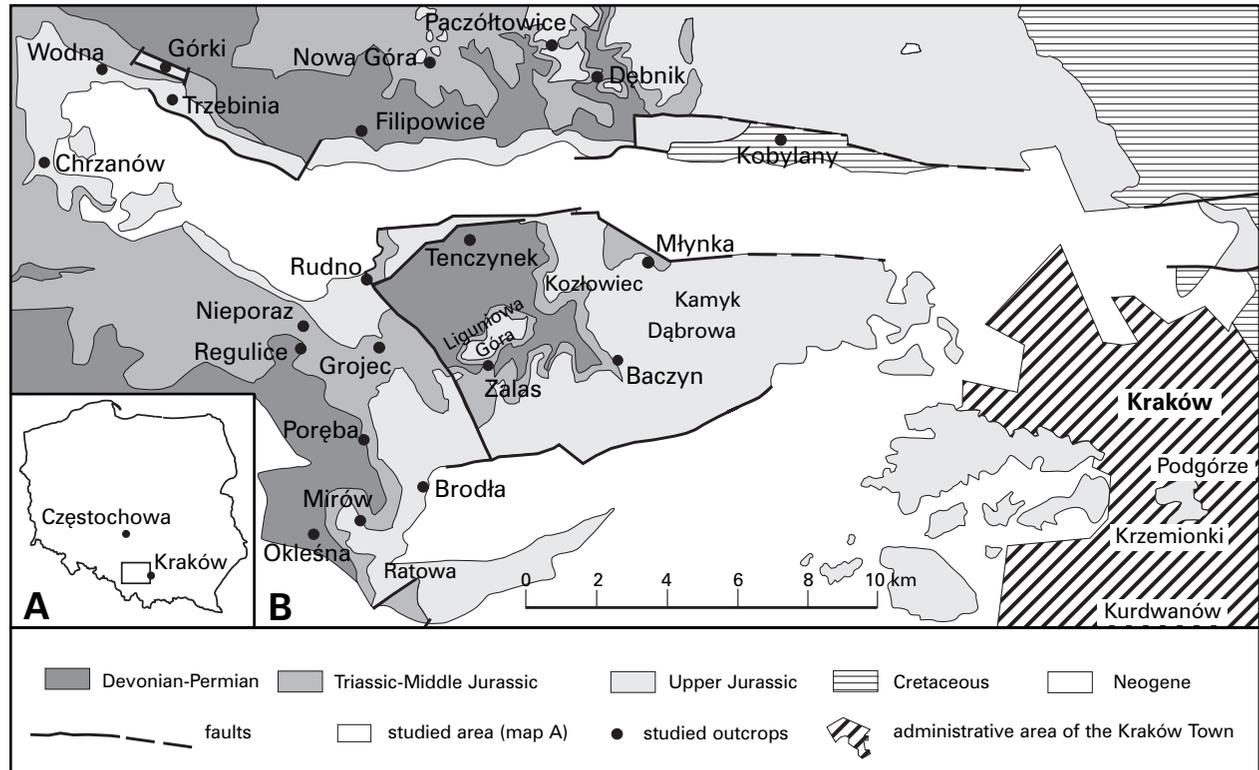


Fig. 1. Geological map of the Kraków Upland showing the locations of the studied outcrops (after Kaziuk1980).

the criterion of phylogeny (*cf.* Callomon 1980). This is how most of the Oxfordian genera are classified now, for example, *Perisphinctes*, *Passendorferia*, *Neumannia* (but not *Liosphinctes* - *cf.* description of this genus) and the Late Oxfordian - Early Kimmeridgian (*sensu Subboreale*) *Orthosphinctes*, *Idoceras*, *Ringsteadia*.

Subgenus-group. The framework of taxonomy in which dimorphs are tightly allocated to different subgenera within a single genus have been maintained usually in the present paper. There are two exceptions, however: the genus *Neumannia* Głowniak and the genus *Subdiscosphinctes* Malinowska. The former has been recently introduced through the revision of a collection of micro- and macroconchs gathered from a precise stratigraphical horizon (*cf.* Głowniak 2002). The collection provided certain knowledge on what was the variability of the biospecies in the horizon yielding *Neumannia* (*cf.* description of the genus in this paper) and what were the associations with other taxa. No attempt has been made so far to separate micro- and macroconchs of

Neumannia at the subgenus level, neither to introduce any nominal species for the microconchs. The latter have been described as *Neumannia* sp. and illustrated. In the case of *Subdiscosphinctes*, despite the relevant papers of Malinowska (1972), Brochwicz-Lewiński (1975), Gygi (2000) and others which dealt essentially with descriptions of morphospecies, the variability of the isochronous biospecies at the horizon of *Subdiscosphinctes*, as well as the evolution of genus, is still poorly known. Thus, the subgenera *Subdiscosphinctes* and *Aureimontanites* have been used purely to accommodate micro- and macroconchs respectively, regardless any precise time connotations (differently from the case in other Oxfordian subgenera where the dimorphs are closely tied to the stratigraphical level of their appearance, *cf.* further in text). The new material provided in this paper (*cf.* the description of *Subdiscosphinctes*) does not bring any particular answer to these questions. Presented here is a set of morphospecies with a number of a new ones introduced by Siemiradzki (1891), re-described and illustrated herein for the first time. Some of these species

(e.g. *S. dunikowskii*) are difficult to fit in the straitjacket of orthodox taxonomy at the subgenus level. Either they are known by wholly septate *nuclei* of uncertain dimorphic status, or – as in the type species *S. kreutzii* – the lectotype is a microconch whereas the paralectotype is a macroconch and a possible allotype of the species. Facing these and similar questions the author [E.G.] decided to abandon any arbitrary attempts of classifying morphospecies of *Subdiscosphinctes* at the level of the subgenus-group and consequently to suppress the name *Aureimontanites*. The result would otherwise be the artificial multiplication of nominal species which would not bring any progress in the knowledge of the natural associations of dimorphs and biospecific variability in isochronous horizons of *Subdiscosphinctes*. The latter should rely on the collections gathered from *in situ* in sections which remains to be done in future.

Dimorphism has not been hitherto recognised in *Liosphinctes*, and the genus is known only by its macroconchs. Otherwise the Oxfordian genus *Perisphinctes* and partly *Passendorferia* (not the subgenus *Graefenbergites*) are distinctly dimorphic, and their micro- and macroconch partners are traditionally assigned to different subgenera as follows:

Genus *Perisphinctes* Waagen

Otosphinctes [m] - *Kranaosphinctes* [M] [incl. *Arisphinctes*]
from the Plicatilis Zone (Middle Oxfordian)

Dichotomosphinctes [m] - *Perisphinctes* s. str. (forms of primitive shell morphology) [M] from the Transversarium Zone (Middle Oxfordian)

Dichotomoceras [m] - *Perisphinctes* s. str. (forms of advanced shell morphology) [M] from the Bifurcatus Zone (Upper Oxfordian)

Genus *Passendorferia*

Enayites [m] - *Passendorferia* [M] from the Transversarium Zone (Middle Oxfordian) to the lower Planula Zone of the Submediterranean Upper Oxfordian (= Lower Kimmeridgian *sensu Subboreale*)

The genus *Perisphinctes* is of special interest as the respective dimorphic couples of its subgenera offer more than a simple diagnosis of the dimorphic status of each of the nominal species, but also provide precise biostratigraphical information. Each dimorphic couple of subgenera is diagnostic to the respective Zone of the Middle

– lower Upper Oxfordian (*cf.* Stratigraphical framework).

In the genera from higher stratigraphical levels – Bimammatum and Planula zones – the relations between micro- and macroconchs are not so consistently expressed in taxonomical classification at the level of the subgenus-group as in *Perisphinctes*. For instance no taxonomic differentiation has been ever proposed for macro- and microconchs in the subgenera *Graefenbergites* of the genus *Passendorferia* or *Subnebrodites* of the genus *Idoceras*. The genus *Ringsteadia* is essentially macroconchiate, while in the genus *Orthosphinctes* sometimes two macroconch subgenera (*i.e.* *Pseudorthosphinctes* and *Lithacosphinctes*) have their respective microconch partners in a single subgenus *Orthosphinctes*.

Subspecies-group. A few subspecies described in this paper all are chronosubspecies. These are, for example, *Perisphinctes* (*Otosphinctes*) *ouatius ouatoides* chronossp. – *Perisphinctes* (*O.*) *ouatius ouatius* chronossp. (ancestral and descendant chronosubspecies, respectively) as well as *Perisphinctes* (*Otosphinctes*) *arkelli arkelli* chronossp. – *P. (O.) arkelli wysokae* chronossp. (ancestral and descendant one, respectively). Their variability in successive isochronous

horizons was assessed in precise horizons of the Middle Oxfordian sections of central Poland (*cf.* Główniak 2002, text-figs 4-5). They were interpreted as successive microconch members of the *Perisphinctes* lineage going from *Otosphinctes* in the lower Middle Oxfordian into *Dichotomosphinctes* and finally *Dichotomoceras* in the lower Upper Oxfordian.

Infrasubspecific-group.

Morphotype (= variant, morph) or variety has been used in this paper to distinguish infrasubspecific entities. The two names are treated here as

synonyms. Their distinction is purely arbitrary. The former name was used for a few Middle Oxfordian morphospecies ('paturattensis-montfalconnensis' and 'ouatius-magnouatius' morphotypes) which were recognised to be involved in isochronous biospecies (Główniak 2002). The name 'morphotype' has been here retained for

the purposes of cross-references with the previous paper. The other name ‘variety’ is for infrasubspecific entities recognised to be essential for the description of variability within an isochronous fossil biospecies in the horizon of *P. (Dichotomosphinctes) antecedens*. They are used here in the description of *P. (D.) antecedens* (‘robust variety’ or ‘moderately slim variety’) after Głowniak (2006c).

STRATIGRAPHICAL FRAMEWORK

by Ewa Głowniak and Andrzej Wierzbowski

Oxfordian/Kimmeridgian boundary.

In this monograph the standard Submediterranean zonation is used to provide the chronostratigraphical time-scale (Fig. 2). The boundary between the Oxfordian and Kimmeridgian stages in the Submediterranean Succession is for the time being still placed at the boundary between the Planula and Platynota zones, although such a position differs markedly from the uniform boundary of the stages recently discussed by International Subcommittee of Jurassic Stratigraphy of the International Union of Geological Sciences. It should be remembered that the Oxfordian/Kimmeridgian boundary was originally defined within the Subboreal Succession and later erroneously correlated with a much younger level in the Submediterranean Succession. As the Subboreal Succession should be treated as the primary standard for the Oxfordian/Kimmeridgian boundary, some higher parts of the Submediterranean Succession so far recognised as the Upper Oxfordian – *i.e.* the upper parts of the Bimammatum Zone and the Planula Zone – correspond in fact to the lowermost Kimmeridgian (Schweigert, Callomon 1997; Matyja, Wierzbowski 1997; Matyja *et al.* 2006). The approximate position of the Oxfordian/Kimmeridgian boundary of the Subboreal Succession (coeval with the boundary of the Pseudocordata Zone and the Baylei Zone) against the Submediterranean Oxfordian scale is shown in Fig. 2.

Submediterranean zonation					Subboreal zonation	
Stages	Substages	Zones	Subzones	Biohorizons	Stages	Zones
KIMMERIDGIAN		Platynota	Polygyratus		KIMMERIDGIAN	
	OXFORDIAN	Upper	Planula	Galar		
Planula						
Bimammatum			Hauffianum			
			Bimammatum			
Bifurcatus		Hypselum	<i>Epipeltoceras berrense</i> <i>Epipeltoceras semimammatum</i>			
		Grossouvrei				
				Stenocycloides		
Wartae						
Middle		Transversarium	Elisabethae	<i>Perisphinctes (Dichotomosphinctes) dobrogensis</i> <i>Perisphinctes (Dichotomosphinctes) buckmani</i> <i>Perisphinctes (Dichotomosphinctes) antecedens</i>		
			Buckmani			
	Plicatilis	Arkelli	<i>Perisphinctes (Otosphinctes) arkelli vysokae</i> <i>Perisphinctes (Otosphinctes) arkelli arkelli</i>			
		Ouatius				
Lower (pairs)	Cordatium (pairs)	Cordatium				
				Paturattensis		

Fig. 2. The Submediterranean zonation of the Oxfordian and lowermost Kimmeridgian as used in the present paper (modified after Matyja, Wierzbowski 2006; Głowniak 2006a, c). The approximate position of the Oxfordian/Kimmeridgian boundary of the Subboreal zonation is shown.

Middle Oxfordian. The lower boundary of the Middle Oxfordian (Fig. 2) is coeval with the

lower boundary of the Plicatilis Zone. The Substage divides to the Plicatilis and Transversarium zones. In the zonal scheme used in this paper (Fig. 2), the boundary between the zones lies somewhat lower than that proposed by Callomon (1964), being drawn at the boundary between the Arkelli and Buckmani subzones. With this boundary, the Plicatilis and Transversarium zones accommodate two successive natural assemblages of a single lineage: the *Otosphinctes* [m] – *Kranaosphinctes* [M] assemblage (Plicatilis Zone) and the *Dichotomosphinctes* [m] – *Perisphinctes* s. str. [M] assemblage (Transversarium Zone). The major evolutionary event which occurs at, and defines the base of the Transversarium Zone, is the phyletic first appearance of *Perisphinctes* (*Dichotomosphinctes*) *antecedens* Salfeld and its macroconch counterpart of the genus *Perisphinctes* s. str. The definition of the boundary relies on *P. (D.) antecedens* (but in fact on the assemblage which was revised by Główniak 2002, 2006c), and which Callomon himself said on that ‘it turns to be a useful guide-fossil, so finding it helps recognition of the presence of its Zone’ (unpublished). *P. (D.) antecedens*, *P. (D.) buckmani* and *P. (O.) dobrogensis* are the index species of the respective successive biohorizons distinguished in the Buckmani Subzone (Główniak 2006c)(Fig. 2).

Callomon (1960, 1964) defined the Antecedens Subzone based on his detailed studies of ammonites in type area of Oxford. His proposal to settle the boundary between the Plicatilis and Transversarium zones at the level between the Antecedens and Parandieri subzones, has been widely accepted (e.g. Cariou *et al.* 1997). The Polish ammonite material revised by the author [E.G.] from an equivalent stratigraphical interval (plus higher levels) contributed an essential complement to the earlier set of biostratigraphical conclusions. The revision was based on the details of ammonites collected by the author herself [E.G.] from accurately known horizons through the Plicatilis, but also Transversarium and lower Bifurcatus zones in the continuous series of epicratonic pelagic carbonates of Poland. The succession of natural ammonite assemblages recognised to a biohorizon level enabled the application of a phylogenetical concept in definition of the zonal and subzonal boundaries in the Middle to lower Upper Oxfordian zonal scheme which is used herein (Fig. 2).

The Arkelli Subzone (Główniak 2000) is the topmost Subzone of the Plicatilis Zone in the zonation discussed herein (Fig. 2). Although the subzonal index *Perisphinctes* (*Otosphinctes*) *arkelli* has been previously known from exhaustive areas of Western and North-Western Europe (*P. arkelli* = *nom. nov.* for *Perisphinctes rotooides sensu* Arkell *non* Ronchadzé), it has never been considered as a useful guide fossil until its proper stratigraphical position, phyletic links, and ammonite assemblage were properly recognised and described in the Polish sections (cf. Główniak 2002, 2006c). *Kranaosphinctes* [M] and microconch partner *Otosphinctes* [m] undergo gradual phyletic size increase throughout the Plicatilis Zone and attain their largest shell-diameters only in the Arkelli Subzone. *Perisphinctes* (*Dichotomosphinctes*) *antecedens* and *Perisphinctes* s. str. [M] which comprises macroconch counterpart of *P. (D.) antecedens*, are still not present in this Subzone. The Subzonal index species *P. (O.) arkelli* consist of two chronospecies: *P. (O.) arkelli arkelli* chronosp. in the lower part of the Subzone and *P. (O.) arkelli wysokae* chronosp. in its upper part. They are indexes (and guides) of the successive biohorizons distinguished in the Subzone (Fig. 2). In the lower *P. (O.) arkelli arkelli* biohorizon, the *Platysphinctes* immigration event appears (cf. Główniak 2000, 2006c).

The Arkelli Subzone (Plicatilis Zone) should be correlated approximately with the lower part of the Antecedens Subzone of Callomon (1964) whereas *P. (D.) antecedens* biohorizon of the Buckmani Subzone (Transversarium Zone) – with its topmost part. The details of the latter correlation have been provided by Główniak (2006c).

The other subzones in the Plicatilis and Transversarium zones (Fig. 2) are defined by the successive assemblages of ammonites (micro- and macroconchs) of a single *Perisphinctes* lineage as discussed by Główniak (2002, 2006a, c).

Upper Oxfordian. The lower boundary of the Upper Oxfordian follows the proposal of Główniak (2005, 2006a). It is coeval with the lower boundary of the Bifurcatus Zone, which has been redefined.

The Wartae Subzone has been included to the Bifurcatus Zone as the basal Subzone (Fig. 2). The aim of this change was to obtain a close correlation of the lower boundary of the

Bifurcatus Zone with the lower boundary of the Boreal/Subboreal Upper Oxfordian, and to provide a proposal for a uniform lower boundary of the Substage in the Submediterranean Province.

The Upper Oxfordian Substage as applied in Submediterranean Europe includes the Bifurcatus Zone (with the Wartae Subzone as its lower Subzone) and a lower part of the Bimammatum Zone (the Hypselum Subzone). Both the Bimammatum and the Hauffianum subzones in the upper part of the Bimammatum Zone – although still attributed to the Upper Oxfordian in the Submediterranean areas – correspond in fact to the lowermost Kimmeridgian. Such dual temporary definition of the boundary in question is related to the proposal for a uniform Oxfordian/Kimmeridgian boundary as based on the Global Stratotype Section and Point (GSSP) in the Subboreal Succession (Matyja *et al.* 2006), and should be abandoned in future.

SYSTEMATIC ACCOUNT

by Ewa Główniak

Repositories

Geological Museum of the Institute of Geological Sciences of the Polish Academy of Sciences in Kraków; collection ZNG PAN A/I/2.

Terminology of shell description

The abbreviations [m] and [M] used in the species description are for microconchs and macroconchs, respectively.

Symbols used in the text for shell description are as follows: D – diameter, D_m – maximum diameter of a specimen, D_r – diameter of phragmocone, H – whorl height, U – umbilical diameter. The shell dimensions are provided in mm. The following symbols are used to describe proportions of shell dimensions: h – whorl height as fraction of diameter, h_u – whorl height as fraction of umbilical diameter, u – umbilical diameter as fraction of shell diameter, r – rib number per whorl counted at a given shell diameter, r_i – rib index defined as the number of secondary and intercalatory ribs per number of primary ribs, per whorl.

The coiling of the shell is classified after Geyer (1961); according to the value of h_u coiling

is referred to as evolute when $h_u \leq 0.50$, as moderately evolute when $0.50 < h_u \leq 0.75$, or as weakly evolute when $0.75 < h_u \leq 1.0$.

The rib types are used after Arkell (1935), whereas the mode of rib division follows Arkell (1935) and Geyer (1961). Primary, secondary and intercalatory ribs are distinguished. The types of rib division are referred to as bifurcation, bidichotomous, polygyrate, or polyschizotomous.

The terms ‘parabolic ribs’ and ‘parabolic nodes’ are used as by Atrops (1982) and signify oblique ribs with a pair of swellings (parabolic nodes) situated on them on the opposite ventral margins. Collective names for these structures are ‘parabolic structures’ or *parabola*. ‘Zigzag ribs’ appear on the venter when two secondary ribs arising from a single primary rib at one whorl side pass across the venter and join two neighbouring primary ribs at the opposite whorl side. Zigzag ribs end with a free-ending intercalatory rib on the venter, or continue on the whorl side where they appear as a simple rib.

SYSTEMATIC DESCRIPTION OF THE SPECIES OF THE FAMILY PERISPINCTIDAE FROM THE MIDDLE TO LOWER UPPER OXFORDIAN (PLICATILIS TO BIFURCATUS ZONES)

by Ewa Główniak

Order Ammonitida Zittel, 1885

Suborder Ammonitina Hyatt, 1900

Superfamily Perisphinctoidea Steinmann, 1890

Family Perisphinctidae Steinmann, 1890

Subfamily Perisphinctinae Steinmann, 1890 ?

Genus *Liosphinctes* Buckman, 1925

TYPE SPECIES: *Liosphinctes apolipon* Buckman, 1925 [M]. Lectotype is a wholly septate specimen; figured by Buckman (1925, pl. 566), and then by Arkell (1939, pl. 35: 3a-b) and Arkell *et al.* (1957, fig. 409: 3).

REMARKS: The new material collected from *in situ* in the Oxfordian sections of central Poland (Główniak 2002, p. 345-346) allowed the recognition of *Liosphinctes* as a uniform distinctive group within Middle Oxfordian perisphinctids. *Liosphinctes* is here treated as a genus and comprehended as a phyletic entity. Some species (*L. plicatilis* and *L. laevipickeringius*) have been

re-classified and assigned to it. The genus stands apart from the contemporaneous *Kranaosphinctes* (incl. e.g. *Arisphinctes*) as this subgenus is comprehended in this paper, being essentially distinguishable by its different ornamentation types in shell ontogeny (Głowniak 2002, p. 346). This statement is partly in accordance with Callomon (1960, p. 192) who deemed *Liosphinctes* to be a valid taxonomic unit. He denied it, however, the generic rank, having retained it in *Perisphinctes* as a subgenus. Hence, Callomon (1960) fulfilled the earlier provisional proposal of Arkell (1939 p. lxiii) concerning *Liosphinctes*.

Callomon (1980) concluded that *Liosphinctes* is the Middle Oxfordian root for later Aulacostephanidae (e.g. the line of *Decipia* – *Ringsteadia* – *Pictonia* – *Rasenia* s. str. terminating in the Cymodoce Zone of the Kimmeridgian). There appears the question then of how to classify *Liosphinctes* at a higher rank. To retain it as a member of the subfamily *Perisphinctinae*, where it has been hitherto allocated, seems now not to be fully satisfactory. The alternative proposal of a new subfamily should be considered. *Liosphinctes* is for the time being provisionally retained in the subfamily *Perisphinctinae*.

Liosphinctes cf. *plicatilis* (Sowerby, 1818)
Figs 3-4, Tab. 1.

1818. *Ammonites plicatilis* sp. nov.; Sowerby, p. 149, pl. 166.
1891. *Perisphinctes chloroolithicus* (Gümbel, 1865); Siemiradzki, p. 46 (*pars*, A/I/2/191 only). Without synonymy.
1891. *Aspidoceras* n. sp.; Siemiradzki, p. 75 (*pars*, A/I/2/305 only).
1939. *Perisphinctes* (*Arisphinctes*) *plicatilis* (Sowerby, 1818); Arkell, 145-149, text-fig. 41 (*pars*), pl. 29:1 a-b (lectotype), pl 29: 3a-b only.
2000. *Perisphinctes* (*Arisphinctes*) *plicatilis* (Sowerby, 1818); Gygi, p. 81, pl. 3: fig. 1, text-fig. 42.
2001. *Perisphinctes* (*Arisphinctes*) *plicatilis* (Sowerby, 1818); Gygi, p. 22, figs 25-26, tab. 4.
2002. *Liosphinctes plicatilis* (Sowerby, 1818); Głowniak, p. 347, pl. 16: 1-2, pl. 17: 1-2, text-figs 23-24. With synonymy.

MATERIAL: A/I/2/191 [M], A/I/2/305 [M].

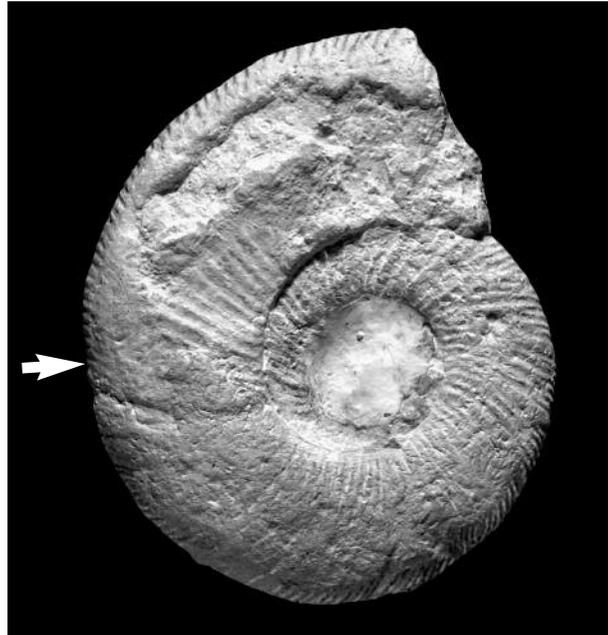


Fig. 3. *Liosphinctes* cf. *plicatilis* (Sowerby, 1818): A/I/2/191. Okleśna. Arrow indicates the end of the phragmocone. Natural size.

LOCALITY: Okleśna: A/I/2/191; Kobylany: A/I/2/305.

DESCRIPTION: A/I/2/191 (Figs 3-4) is an immature macroconch which has a quarter of a whorl which has a quarter of a whorl of body chamber. It has $D_m=74$ mm and is septate to $D_r=60$ mm (Tab. 1). A/I/2/305 is a fragment of the body chamber. It is invalid for biometric studies.

The whorl section is oval (Fig. 4). The coiling of the whorls is weakly involute. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are ca. 2/5 and 1/3, respectively (Tab. 1). Ribs are thin, densely spaced on the whorl sides, bifurcating. The secondary ribs are slightly forward inclined on the venter. The rib number is ca. 80 per whorl at $D=60$ mm (Tab. 1). Constrictions number 2-3 per whorl.

REMARKS: New specimens of this species, most of them adult and retaining body chambers, come from beds of well documented biostratigraphy in the Middle Oxfordian sections of central Poland. They were described and figured by Głowniak (2002, p. 347, pl. 16: 1-2, pl. 17: 1-2, text-fig. 23-24). It was in this paper that the species was first



Fig. 4. The whorl section of *Liosphinctes* cf. *plicatilis* (Sowerby, 1818): A/I/2/191, at $D=60$ mm. Natural size.

No of specimen	D_m	D_r	D	u	h	$D:r$
A/1/2/191	74	60	73	0.38	0.34	63:80

Tab. 1. *Liosphinctes cf. plicatilis* (Sowerby, 1818).

assigned to the genus *Liosphinctes*. The reasons were discussed in detail by the author (Główniak 2002, p. 348). In resumé, the species is of small size of adults (190 mm) and possess all the characters of shell morphology that characterise the genus *Liosphinctes*, such as loss of ribbing on the adult body chamber, frequent appearance of constrictions, high oval whorl section, weakly evolute coiling of whorls changing to evolute or nearly evolute in the adult. Former assignation of the species to the subgenus *Arisphinctes* in the genus *Perisphinctes* (e.g. Arkell 1939; Gygi 2000, 2001) seems to be misleading. It relies on the shell morphology of incomplete phragmocones, which, to a certain degree, are similar to *Liosphinctes* and *Arisphinctes*. The features which distinctly differentiate these two forms are their adult body chambers.

STRATIGRAPHICAL POSITION: In Poland, the species ranges in the Paturattensis and Ouatus subzones of the Plicatilis Zone in the Middle Oxfordian (cf. Główniak 2002).

Subfamily Perisphinctinae Steinmann, 1890

Genus *Subdiscosphinctes* Malinowska, 1972

TYPE SPECIES: *Perisphinctes kreutzii* Siemiradzki, 1891 [m]. Lectotype figured by Siemiradzki (1891, pl. 1: 4), by Brochwicz-Lewiński (1975, pl. 21: 1), and now on Fig. 7: 1-3.

[Incl. *Aureimontanites* Brochwicz-Lewiński, 1975. TYPE SPECIES: *Lithacoceras (Subdiscosphinctes) boreale* Malinowska, 1972 [M]. Holotype figured by Malinowska 1972, pl. 25 pl. 26: 2.]

REMARKS: The name *Aureimontanites* Brochwicz-Lewiński is suppressed in this paper and the dimorphs are described in one undivided genus *Subdiscosphinctes*. For additional comments see the chapter 'General explanation of the system of taxonomy used'.

The following nominal species were introduced by Siemiradzki (1891) and are discussed below:

Subdiscosphinctes dunikowskii
Subdiscosphinctes jelskii
Subdiscosphinctes kreutzii
Subdiscosphinctes mindowe
Subdiscosphinctes? aeneas var. plana
Subdiscosphinctes? cracoviensis
Subdiscosphinctes? dybowskii

To this group also belong the following species described herein:

Subdiscosphinctes aeneas (Gemmellaro, 1877)
Subdiscosphinctes luecingae (Favre, 1875)
Subdiscosphinctes ? n. sp. A
Subdiscosphinctes ? n. sp. aff. *cracoviensis*
(Siemiradzki, 1891)
Subdiscosphinctes ? n. sp. aff. *dybowskii*
(Siemiradzki, 1891)

Subdiscosphinctes kreutzii (Siemiradzki, 1891)
Figs 5-8, Tab. 2.

1891. *Perisphinctes kreutzii* sp. nov.; Siemiradzki, p. 41, pl. 1: 4 (lectotype).
1966. *Lithacoceras (Discosphinctes) kreutzii* (Siemiradzki); Enay, p. 537, pl. 37: 5, 7; text-figs 164, 169.
1972. *Lithacoceras (Lithacoceras) kreutzii* (Siemiradzki) [M]; Brochwicz-Lewiński, p. 478, pl. 4 (A/1/2/12, paralectotype).
1972. *Lithacoceras (Subdiscosphinctes) kreutzii* (Siemiradzki, 1891); Malinowska, p. 221, pl. 27: 1-2; pl. 28; text-figs 25, 26, 28.
1975. *Perisphinctes kreutzii* Siemiradzki; Brochwicz-Lewiński, p. 89, pl. 21: 1 (lectotype), pl. 22: 1 (A/1/2/12, paralectotype).
2001. *Subdiscosphinctes (Subdiscosphinctes) kreutzii* (Siemiradzki, 1891) [m]; Gygi, p. 81, figs 122-123; 195-196; tab. 46, 78.

DERIVATION OF NAME: Feliks Kreutz (1844-1910); Professor of mineralogy at the University of Lvov and at Jagiellonian University of Kraków, the Chairman of Physiographic Commission at the Academy of Arts and Sciences in Kraków in the years 1893-1910.

FORMER SYNTYPES: A/1/2/9, A/1/2/10, A/1/2/11a, A/1/2/11b, A/1/2/12.

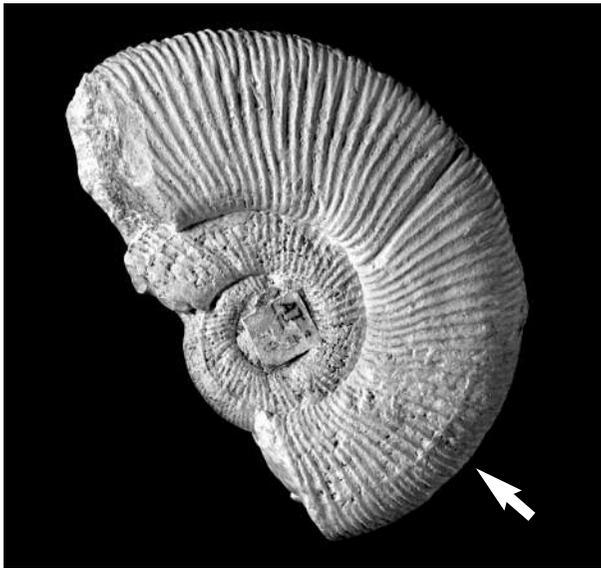


Fig. 5. *Subdiscosphinctes kreutzii* (Siemiradzki, 1891): A/I/2/10 [m] (paralectotype), Ratowa near Podłęże. Arrow indicates the end of the phragmocone. Natural size.

LECTOTYPE: A/I/2/9 [m] of *Perisphinctes kreutzii* figured by Siemiradzki (1891, pl. 1: 4) and subsequently by Brochwicz-Lewiński (1975, pl. 21: 1), designated holotype by inference of monotypy by Brochwicz-Lewiński (1975), is now designated lectotype. It is kept at the Museum of ING PAN in Kraków, and is illustrated in Fig. 7: 1-3.

TYPE LOCALITY: Rudno.

COLLECTOR: Possibly Dr. Stanisław Zaręczny.

PARALECTOTYPES: A/I/2/10 [m] (Fig. 5), A/I/2/11a [m], A/I/2/12 [M] (Fig. 8) – a possible allotype of the species, and in addition A/I/2/11b [immature microconch which belongs to a different species and genus, cf. Remarks; its description is provided in *Perisphinctes* (*Dichotomosphinctes*) cf. *luciae* de Riaz].

DATA ON THE LABELS ACCOMPANYING THE PARALECTOTYPES: Locality: Ratowa near Podłęże: A/I/2/10; Grojec: A/I/2/11a, A/I/2/11b; Zalas?: A/I/2/12 – allotype. Collector/Date: A/I/2/11a and A/I/2/11b were collected by Dr. Stanisław Zaręczny in 1872. No data on the other paralectotypes.

DIAGNOSIS: Micro- and macroconchs. Shell discoidal. Coiling of whorls involute changing with growth to weakly involute; whorl section

subcircular changing to high oval. Ribs thin, not sharp; bifurcating; only in macroconchs dividing on the body chamber into 3-4 secondary ribs. Simple ribs present. Body chamber of macroconchs smooth.

DESCRIPTION: The lectotype A/I/2/9 (Fig. 7: 1-3) is a mature microconch which has $D_m=100$ mm and is septate to $D_r=75$ mm. It has a fragment of the body chamber which is half of a whorl long. The shell is discoidal. The umbilical seam of the last whorl lies at 3/4 of the preceding whorl height. The whorl section is subcircular up to ca. 20 mm diameter and at the diameters bigger than the one mentioned it changes to oval and then to high oval (Fig. 6). At $D=100$ mm the whorl height 1.4 greater than thickness.

The coiling of the whorls is involute up to ca. 60 mm diameter. At this diameter h_u is 1.00. At a diameter bigger than this the coiling becomes weakly involute. At $D=100$ mm h_u is 0.88. The ratio of the umbilical diameter and whorl height against shell diameter are approximately 2/5 each one (cf. u and h in Tab. 2). The whorl height is consistently slightly lower than the umbilical diameter at equivalent diameters. The ribs are thin, not sharp; somewhat prorsiradiate on the whorl sides. The bifurcation points are situated at 3/4 of the whorl height. Occasionally simple ribs appear. They number 3 on the last whorl. The secondary ribs sweep forwards gently. Zigzag ribs appear on the venter. They end freely and prolongate on the whorl side forming a simple rib. The rib number is ca. 60 per whorl at $D=40$ mm and increases up to ca. 108 at $D=100$ mm. Constrictions number 2-3 per whorl on the phragmocone and 2 on the body chamber.

The paralectotype A/I/2/12 (Fig. 8) – a possible allotype of the species – is a mature macroconch. The phragmocone is partly flattened. It is fractured at $D=147$ mm. The outer whorl is missing, however its external cast is preserved.

It shows that the specimen was septate to $D_r=175$ mm and the last septa were approximated. The body chamber was half of a whorl long. The maximum diameter

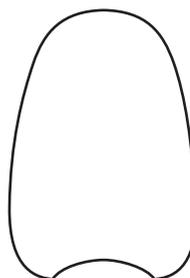


Fig. 6. The whorl section of *Subdiscosphinctes kreutzii* (Siemiradzki, 1891): A/I/2/9 [m] (lectotype), at $D=100$ mm. Natural size.

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/9 (lectotype)	100	75	21 58 100	0.43 0.38 0.41	0.43 0.38 0.36	15:44 40:61 100:108	19:46 58:74 –	25:52 75:86 –
A/I/2/10 (paralectotype)	69	53	56	0.36	0.38	–	–	–
A/I/2/11a (paralectotype)	54	c. 37	–	–	–	–	–	–
A/I/2/12 (allotype)	c. 230	175	65 120 170	0.47 0.40 0.43	0.37 0.37 0.38	37:66 77:90 170:47	47:73 90:80 230:29	65:88 128:59 –

Tab. 2. *Subdiscosphinctes kreutzi* (Siemiradzki, 1891).

of the specimen was *ca.* 230 mm. The coiling of the whorls is weakly involute, and h_u ranges from 0.92 to 1.0 between *ca.* 60 mm and 170 mm diameter respectively. The umbilical diameter and whorl height against shell diameter are approximately 2/5 each one (*cf.* u and h in Tab. 2). The ribs are thin, sharp, prorsiradiate and occasionally slightly flexuous on the inner phragmocone. They become thicker and more distantly spaced before septation ceases. They are thick and blunt on the lower half

of the body chamber, whereas blurred on its upper half. The paralectotypes A/I/2/10 (Fig. 5) and A/I/2/11a are immature specimens. A/I/2/10 has $D_m=69$ mm and is septate to $D_r=53$ mm (Tab. 2). The body chamber occupies the last whorl but it is incomplete. Its initial fragment, half of a whorl long, is missing. A/I/2/11a has a portion of the body chamber 1/3 of a whorl long. The specimen is septate to $D_r=ca.$ 37 mm, and has $D_m=54$ mm (Tab. 2). The coiling of the whorls in the two specimens is involute; the whorl section is high oval; the ribs are thin, densely spaced, mostly bifurcating. Simple ribs occur occasionally.

REMARKS: The former syntype A/I/2/11b [m] differs from any other type specimen of *Subdiscosphinctes kreutzi* in having a subsquare whorl section and moderately evolute coiling of

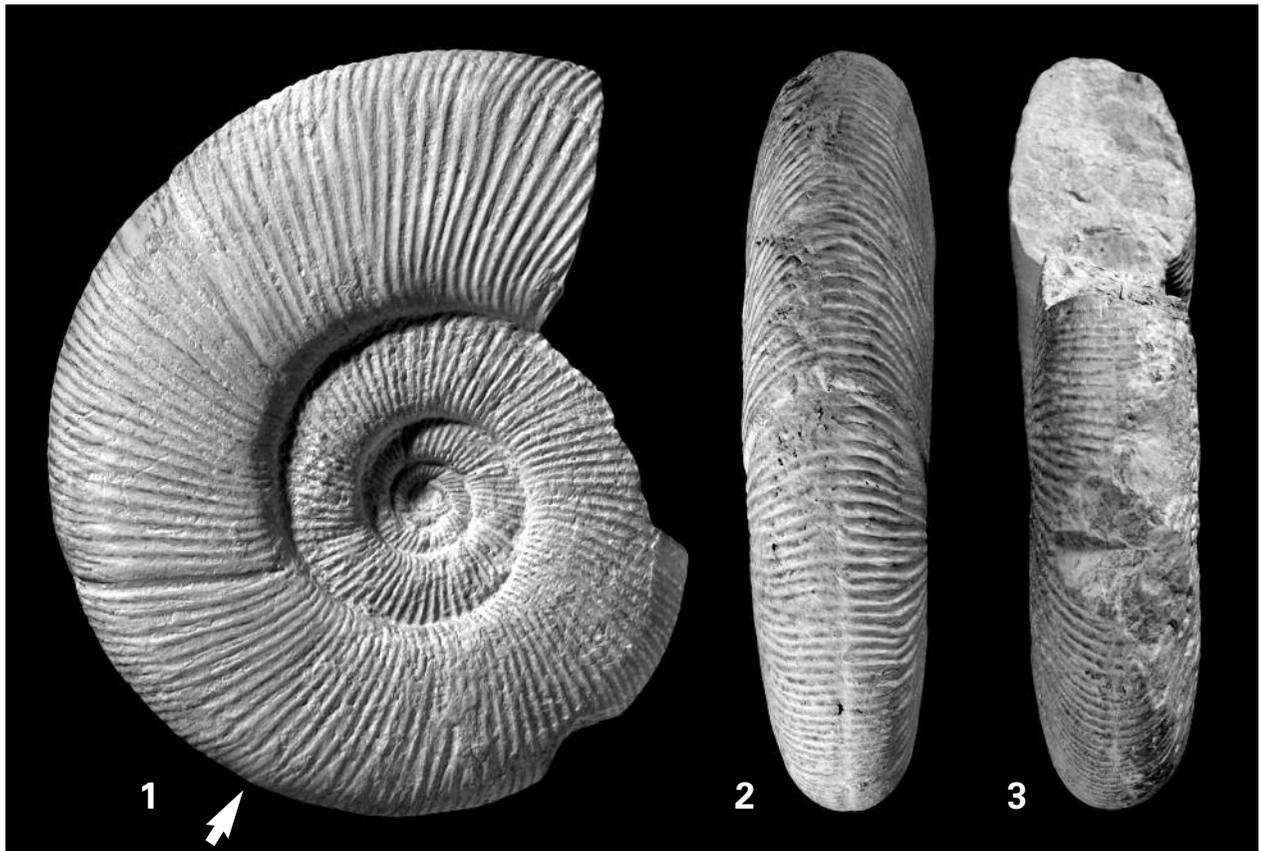
Fig. 7. *Subdiscosphinctes kreutzi* (Siemiradzki, 1891): 1-3: A/I/2/9 [m] (lectotype), the lateral view (1), the view of the ventral sides (2-3), Rudno. Arrow indicates the end of the phragmocone. Natural size.



Fig. 8. *Subdiscosphinctes kreutzii* (Siemiradzki, 1891): A/1/2/12 [M] (allotype), presumably from the vicinities of Zalas. Arrow indicates the end of the phragmocone. Reduced x0.95.

the whorls. The features mentioned plus the common presence of simple ribs suggest that it may belong to *Perisphinctes* (*Dichotomosphinctes*) *luciae* de Riaz, 1898 (cf. respective description in this paper). The specimen is septate to $D_r=41$ mm, with a fragment of the body chamber which is half of a whorl long. Its inner whorls

are not exposed. The specimen derives from Grojec and was collected by Dr. Stanisław Zaręczny.

The detailed comparison of *S. kreutzii* with *Subdiscosphinctes jelskii* (Siemiradzki) and *Subdiscosphinctes mindowe* (Siemiradzki) are discussed in the descriptions of the two species mentioned.

STRATIGRAPHICAL POSITION: The lectotype of *S. kreutzii* was obtained from bedded limestone in Rudno as mentioned by Zaręczny (1894). In Poland, the species occurs in the upper part of the Elisabethae Subzone of the Transversarium Zone and ranges higher up to the Wartae Subzone of the Bifurcatus Zone only to disappear at the top of the Wartae Subzone as discussed by Głowniak (2006a, b).

Subdiscosphinctes mindowe (Siemiradzki, 1891)
Figs 9-10, Tab 3.

1891. *Perisphinctes mindowe* sp. nov.;
Siemiradzki, p. 43, pl. 2: 1 (lectotype).

1899. *Perisphinctes mindowe* Siemiradzki, 1891;
Siemiradzki, p. 186. Without synonymy.

1966. *Lithacoceras (Discosphinctes) mindowe*
(Siemiradzki, 1891); Enay, p. 535; pl. 37: 1, 4.

1966. *Lithacoceras (Discosphinctes) richei*
(de Riaz, 1898); Enay, p. 539 (pars, pl. 37: 9
only). Without synonymy.

1970. *Lithacoceras (Discosphinctes) mindowe*
(Siemiradzki, 1891); Brochwicz-Lewiński, pl. 6

1972. *Lithacoceras (Discosphinctes)* sp. A;
Brochwicz-Lewiński, pl. 12: 1.

1972. *Lithacoceras (Subdiscosphinctes) mindowe*
(Siemiradzki, 1891); Malinowska,
p. 223, pl. 29: 1-2; text-fig. 27.

DERIVATION OF NAME: After Mindaugas (Mendog, Mindowe), the Grand Duke, and from 1253 – the King of Lithuania. The principal hero of the drama ‘*Mindowe*’ (1829) by the Polish poet Juliusz Słowacki.

FORMER SYNTYPES: A/I/2/21, A/I/2/22.

LECTOTYPE: A/I/2/21 [m] of *Perisphinctes mindowe* figured by Siemiradzki (1891, p. 43, pl. 2: 1) is designated now lectotype. It is kept at the Museum of ING PAN in Kraków, and is illustrated in Fig. 9.

TYPE LOCALITY: Rudno.

COLLECTOR: Dr. Stanisław Zaręczny.

PARALECTOTYPE: A/I/2/22 [M] (Fig. 10) – a possible allotype of *S. mindowe*.

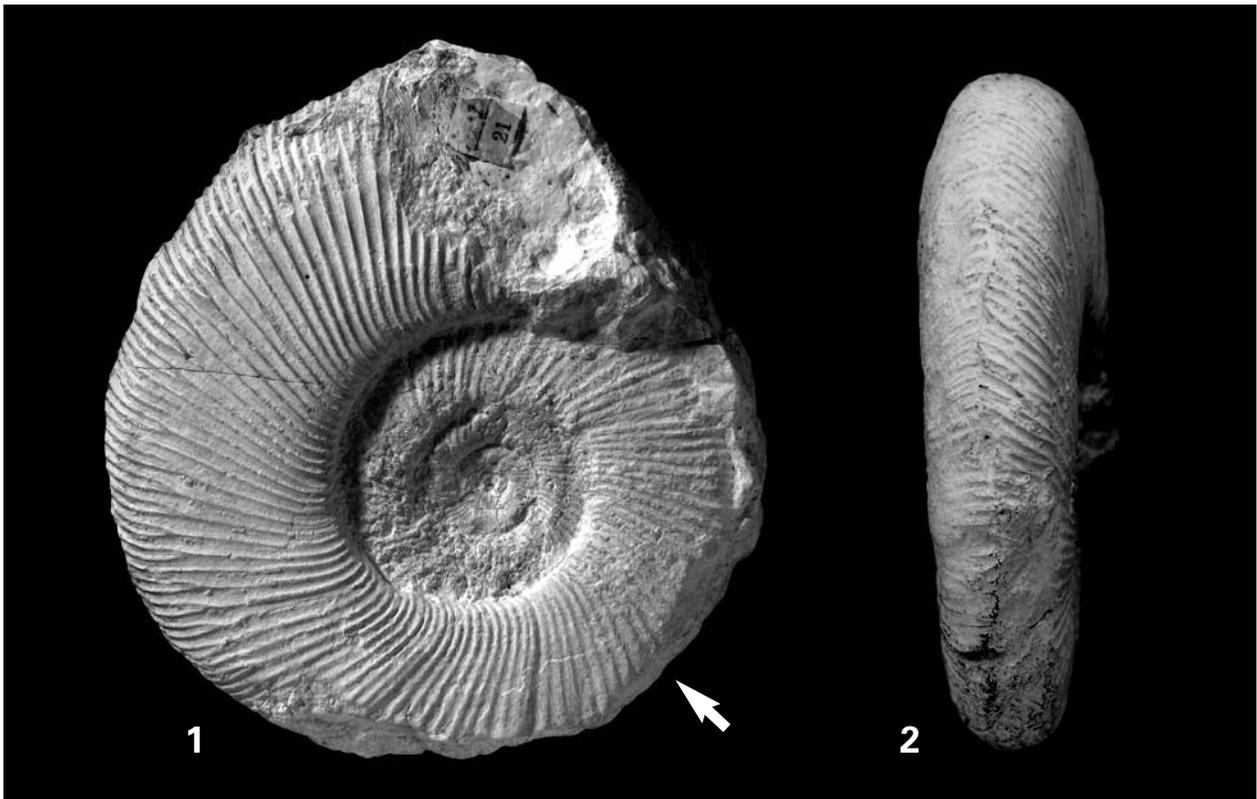


Fig. 9. *Subdiscosphinctes mindowe* (Siemiradzki, 1891): 1-2: A/I/2/21 [m] (lectotype), the lateral view (1) and the view of the ventral side (2), Rudno. Arrow indicates the end of the phragmocone. Natural size.



Fig. 10. *Subdiscosphinctes mindowe* (Siemiradzki, 1891): A/1/2/22 [M] (allotype), Grojec. Arrow indicates the end of the phragmocone. Natural size.

DATA ON THE LABEL OF THE PARALECTOTYPE:
Locality: Grojec. Collector: Dr. Stanisław Zaręczny.

DIAGNOSIS: Micro- and macroconchs. Shell discoidal. Coiling of whorls weakly involute changing with growth to involute; whorl section subcircular, changing to high oval. Ribs thin and sharp, somewhat flexuous, bifurcating in microconchs, dividing into three in macroconchs. Simple ribs appear commonly. The body chamber of macroconchs with smooth upper half of the whorl side.

DESCRIPTION: The lectotype A/1/2/21 [m] (Fig. 9) has a nearly complete last body chamber showing approximation of the last few ribs. The specimen is possibly mature. It has $D_m=90$ mm and is septate to $D_r=58$ mm (Tab. 3). The body chamber is slightly crushed flat.

The shell is discoidal. The umbilical seam of the last whorl lies at $3/4$ of the preceding whorl height. The whorl section is subcircular on the inner whorls, oval on the middle whorls and high oval on the outer whorls. The coiling of the whorls changes

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/21 (lectotype)	90	58	88 58	0.39 0.39	0.39 0.38	20:49 80:82	40:58 90:92	50:65 –
A/I/2/22 (paralectotype)	160	c. 145	160 87	0.44 0.48	0.29 0.33	92:70 –	120:65 –	160:56 –

Tab. 3. *Subdiscosphinctes mindowe* (Siemiradzki, 1891).

from weakly involute on the phragmocone to involute on the body chamber. At $D=ca.$ 60 mm h_u is 1.0. At this diameter the ratio of the umbilical diameter and whorl height against shell diameter are 2/5 in each case (*cf.* u and h in Tab. 3). The ribs are thin and sharp, distinctly prorsiradiate on the whorl sides, somewhat flexuous on the body chamber. Bifurcating and simple ribs co-occur. The bifurcation point is at 3/4 of the whorl height. Simple ribs number 7 on the last half of whorl. The secondary ribs sweep gently forwards. The rib number per whorl is 50 at $D=20$ mm, and 92 at $D=90$ mm.

The paralectotype A/I/2/22 (Fig. 10) – a possible allotype of species – is an immature macroconch retaining a fragment of the body chamber, which is 1/8 of a whorl long. The specimen is septate to $D_r=ca.$ 145 mm, and has $D_m=160$ mm. Its inner phragmocone is missing. The specimen is crushed flat. The coiling of the whorls is moderately evolute. At $D=160$ mm $h_u=ca.$ 0.67. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are *ca.* 2/5 and 1/3, respectively, at $D=ca.$ 90 mm (Tab. 3). The primary ribs are moderately thin and sharp on the middle phragmocone. They become somewhat blurred on the upper half of side of the late phragmocone and the body chamber. The ribs trifurcate. The division point is at 2/3 of the whorl height. It is obscure. The rib number is 70 per whorl at *ca.* 90 mm diameter and 56 per whorl at 160 mm. Constrictions number 3 on the last whorl.

REMARKS: Siemiradzki (1899, p. 186) misinterpreted the two Portuguese forms *Perisphinctes lucingae* (*non* Favre 1875) and *Perisphinctes* n. sp. aff. *mindowe* described and figured by Choffat (1893, p. 41, pl. 3: 7; and p. 43, pl. 10: 3, respectively) as *Subdiscosphinctes mindowe*. The Portuguese forms differ from *S. mindowe* in shell dimensions (*e.g.* greater umbilical diameter) and in lack of simple ribs. They belong to different genera and species than *S. mindowe*.

S. mindowe and *Subdiscosphinctes kreutzii* (Siemiradzki) resemble each other, for instance,

in the maximum size of mature microconchs and in the similar rib number per whorl at equivalent diameters. This led Brochwicz-Lewiński (1975) to the conclusion that they represent a single species. In the opinion of the author [E.G.], but also

of Siemiradzki (1891) and Enay (1966), these two forms belong to different species. This opinion accounts for the smaller umbilical diameter in *S. mindowe*, its more rapid increase of whorl height as well as in its sharper ribs, which in addition are somewhat flexuous in *S. mindowe* but not in *S. kreutzii*.

The immature macroconch of *Lithacoceras* (*Discosphinctes*) sp. from Zawodzie figured by Brochwicz-Lewiński (1972, pl. 12: 1) matches the diagnosis of *S. mindowe* in respect to the coiling of its whorls, whorl section and ribbing. It is assigned to *S. mindowe* in the present paper (*cf.* synonymy list).

STRATIGRAPHICAL POSITION: The lectotype of *S. mindowe* derives from bedded limestone at Rudno as mentioned by Zaręczny (1894). The type horizon of the species is supposed to be in the upper part of the Transversarium Zone or in the lower Bifurcatus Zone. The exact stratigraphical range of *S. mindowe* requires additional material, preferably topotypes.

Subdiscosphinctes cf. mindowe (Siemiradzki, 1891)

Fig. 11: 1-4; Tab. 4.

1891. *Perisphinctes aeneas* Gemmellaro, 1877; Siemiradzki, p. 50 (*pars*, A/I/2/199 and A/I/2/201 only). Without synonymy.

1891. *Perisphinctes vajdelota* sp. nov.; Siemiradzki, p. 37 (*pars*, A/I/2/350b only).

MATERIAL: Microconchs: A/I/2/199, A/I/2/201, A/I/2/324, A/I/2/350b [former syntype of *P. vajdelota* Siemiradzki, 1891, *cf.* respective description].

DATA ON THE LABELS: Locality: Rudno: A/I/2/199, A/I/2/201, A/I/2/324; a hill between Mirów and Okleśna: A/I/2/350b. Collector: Dr. Stanisław Zaręczny: A/I/2/350b. No data on the possible collectors of the other specimens.

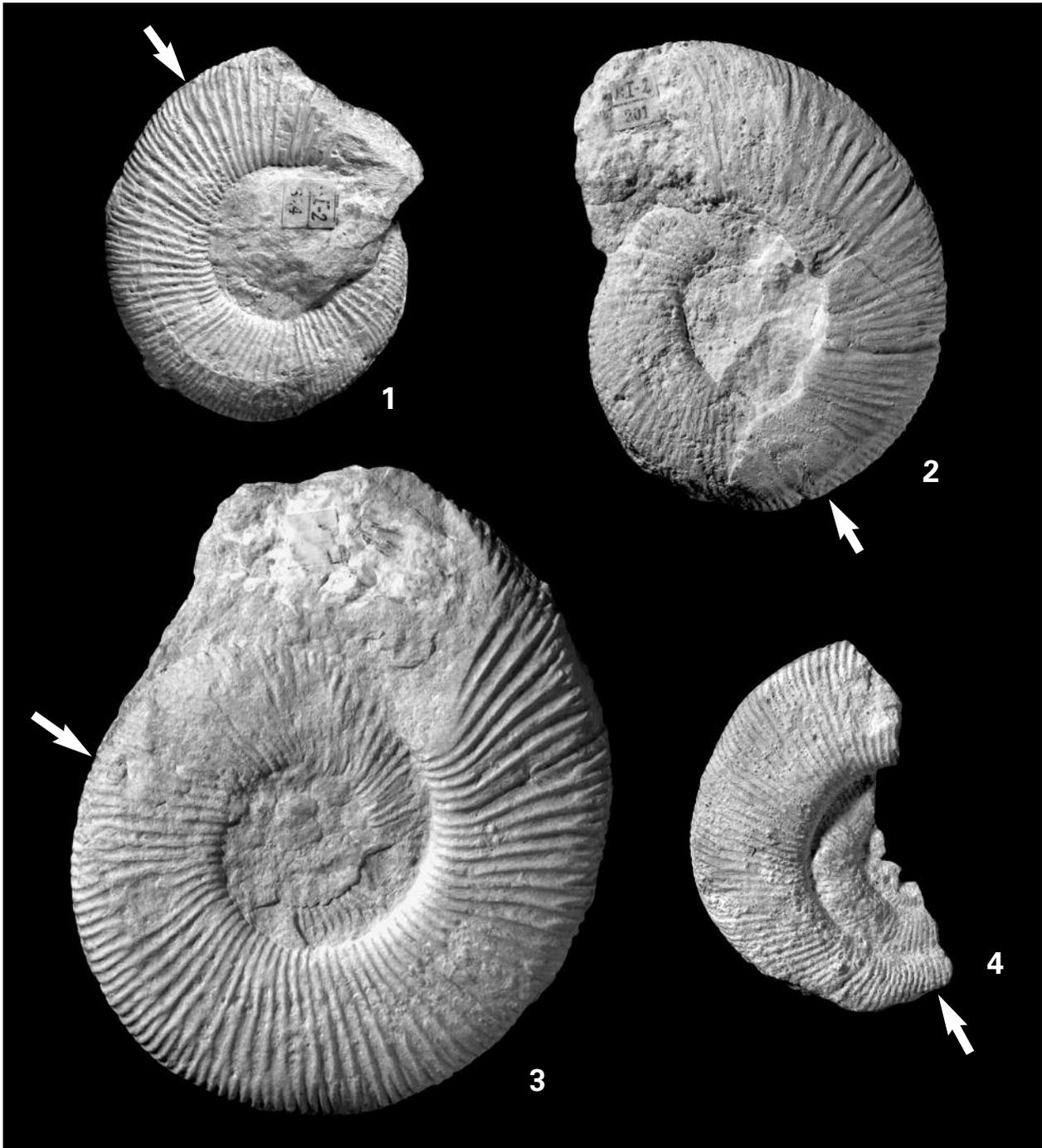


Fig. 11. *Subdiscosphinctes* cf. *mindowe* (Siemiradzki, 1891): 1: A/1/2/324 [m]; 2: A/1/2/201 [m]; 3: A/1/2/199 [m]; 4: A/1/2/350b [m]. A/1/2/350b derives from Oklešna; all the other specimens derive from Rudno. Arrows indicate the end of the phragmocones. Natural size.

DESCRIPTION: These are microconchs, most of them are incomplete and/or crushed flat due to compaction. A/1/2/199 (Fig. 11: 3) is a mature specimen which shows the approximation of ribs in the terminal part of the body chamber. The specimen has $D_m=94$ mm and is septate to $D_r=57$ mm (Tab. 4). A/1/2/201 (Fig. 11: 2)

and A/1/2/324 (Fig. 11: 1) are septate to $D_r=50$ and $D_r=55$ mm respectively. They have fragments of the body chambers which are $1/8$ and $1/2$ of a whorl long, respectively. A/1/2/350b (Fig. 11: 4) is a badly preserved fragment of a microconch which has a portion of the body chamber.

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/1/2/199	94	57	78	0.38	0.33	80:68	96:70	–
A/1/2/201	71	50	66	0.39	0.35	58:67	63:69	80:75
A/1/2/324	60	55	60	0.40	0.30	60: c. 75	–	–
A/1/2/350b	58	c.40	–	–	–	–	–	–

Tab. 4. *Subdiscosphinctes* cf. *mindowe* (Siemiradzki, 1891).

The coiling of the whorls is weakly involute. The whorl section is high oval. The ribs are thin, prorsiradiate, densely spaced on the whorl sides. They bifurcate at ca. 3/4 of the whorl height. Constrictions number 1 to 3 per whorl.

Subdiscosphinctes dunikowskii (Siemiradzki, 1891)

Figs 12-13, Tab. 5.

1891. *Perisphinctes dunikowskii* sp. nov.; Siemiradzki, p. 47, pl. 2: 3 (lectotype).

1899. *Perisphinctes dunikowskii* Siemiradzki, 1891; Siemiradzki, p. 269. Without synonymy.

DERIVATION OF NAME: Emil Dunikowski (1855-1924), Professor of Geology at the University of Lvov, the eminent explorer of Carpathians.

FORMER SYNTYPE: A/1/2/23.

LECTOTYPE: A/1/2/23 [uncertain dimorphic status] of *Perisphinctes dunikowskii* figured by Siemiradzki (1891, pl. 2: 3) is designated here lectotype. It is kept in the Museum of ING PAN in Kraków, and is illustrated in Fig. 13.

TYPE LOCALITY: Brodła.

COLLECTOR: Dr. Stanisław Zaręczny.

DIAGNOSIS: Coiling of whorls weakly involute. Whorl section thick oval. Ribs fine, densely spaced, mostly bifurcating. Simple ribs occur occasionally.

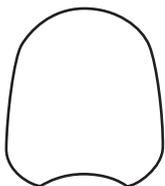


Fig. 12. The whorl section of *Subdiscosphinctes dunikowskii* (Siemiradzki, 1891): A/1/2/23 (lectotype), at $D_m=63$ mm. Natural size.

DESCRIPTION: The lectotype (Fig. 13) consists of the septate inner whorls of a specimen of unknown dimorphic status. At $D_m=63$ mm there is still no approximation of septa. The whorl section is thick oval (Fig. 12). The whorl height is only 1.1 greater than the thickness. The coiling is weakly involute. At $D_m=63$ mm $h_u=0.92$. The ratios of umbilical

diameter (u) and whorl height (h) against shell diameter are 1/3 and ca. 2/5 respectively (Tab. 5). The ribs are thin, mostly bifurcating. Simple ribs appear occasionally. The rib number is 80 per whorl at 63 mm diameter. Constrictions number 1 per whorl.

REMARKS: *Subdiscosphinctes dunikowskii* (Siemiradzki) differs from *Subdiscosphinctes kreutzii* (Siemiradzki) in the greater thickness of the whorl section and the thinner, more delicate and more densely spaced ribs. *S. dunikowskii*

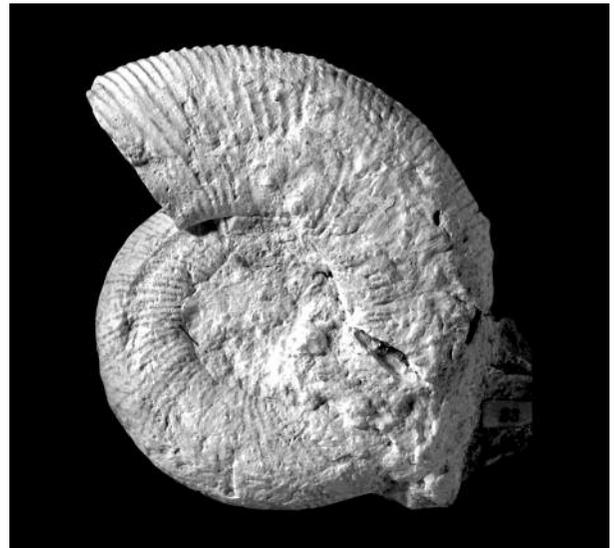


Fig. 13. *Subdiscosphinctes dunikowskii* (Siemiradzki, 1891): A/1/2/23 [uncertain dimorphic status] (lectotype). Brodła. Wholly septate inner whorls. Natural size.

possesses a higher rib number per whorl than *Subdiscosphinctes jelskii* (Siemiradzki); with respect to the whorl thickness it occupies an intermediate position between the lectotype and the paralectotypes of *S. jelskii* (cf. remarks on the species). *S. dunikowskii* differs from *S. lucingae* (Favre) in its thicker whorls and higher rib number per whorl; from *Subdiscosphinctes richei* (de Riaz) – in its somewhat

No of specimen	D_m	D_r	D	u	h	$D:r$
A/I/2/23 (lectotype)	63	wholly septate	63	0.38	0.35	63:80

Tab. 5. *Subdiscosphinctes dunikowskii* (Siemiradzki, 1891).

thicker whorl section; however, with respect to the rib number per whorl *S. dunikowskii* and *S. richei* are similar.

STRATIGRAPHICAL POSITION: The lectotype of *S. dunikowskii* was presumably obtained from marls and bedded limestones in Brodła (western part of the village, the outcrop situated over the well, as mentioned by Zaręczny 1894). The type horizon of the species is presumed to be in the upper part of the Transversarium Zone in the Middle Oxfordian. This conclusion is in part in agreement with records of the following species which co-occur with *S. dunikowskii* in Brodła (cf. Zaręczny 1894; Siemiradzki 1922), all of them diagnostic of the Elisabethae Subzone of the Transversarium Zone (Główniak 2006a, b): *Perisphinctes* (*Dichotomosphinctes*) *elisabethae* de Riaz, *Perisphinctes* (*Dichotomosphinctes*) *luciae* de Riaz, and *Perisphinctes* (*Dichotomosphinctes*) *crotalinus* Siemiradzki. To determine the exact stratigraphical range of *S. dunikowskii* requires obtaining additional material, preferably topotypes.

Subdiscosphinctes jelskii (Siemiradzki, 1891)

Figs 14: 1-4; 15-17; Tab. 6.

1891. *Perisphinctes jelskii* n. sp.; Siemiradzki, p. 47. Without synonymy.

1899. *Perisphinctes jelskii* Siemiradzki, 1891; Siemiradzki, p. 274, pl. 24: 36.

1972. *Perisphinctes jelskii* Siemiradzki, 1891; Brochwicz-Lewiński, pl. 16 (lectotype).

DERIVATION OF NAME: Konstanty Roman Jelski (1837-1896); zoologist and explorer of South America, custodian of the Museum of the Physiographic Commission at the Academy of Arts and Sciences in Kraków.

FORMER SYNTYPES: A/I/2/195, A/I/2/196, A/I/2/197, A/I/2/198.

LECTOTYPE: A/I/2/196 [M] of *Perisphinctes jelskii* Siemiradzki, 1891 figured by Brochwicz-

Lewiński (1972, pl. 16), and referred by him to as holotype, is here designated lectotype. It is kept at the Museum of ING PAN in Kraków, and is illustrated in Figs 16-17.

TYPE LOCALITY: Rudno.

COLLECTOR: Dr. Stanisław Zaręczny.

PARALECTOTYPES: A/I/2/195 [M?] and two septate inner whorls: A/I/2/197 and A/I/2/198 (Fig. 15: 1-4).

DATA ON THE LABELS: Locality: Paczółtowice: A/I/2/195; Rudno: A/I/2/197; Trzebinia: A/I/2/198. Collector: Dr. Stanisław Zaręczny: A/I/2/197. No data on the possible collectors of other paralectotypes.

DIAGNOSIS: Macroconchs. Coiling of whorls involute changing with growth to weakly involute; whorl section high oval. Ribs thin, not sharp, densely spaced; distinct on the lower and blurred on the upper half of the whorl side; bifurcating. Zigzag ribs and intercalatory ribs occasionally appear.

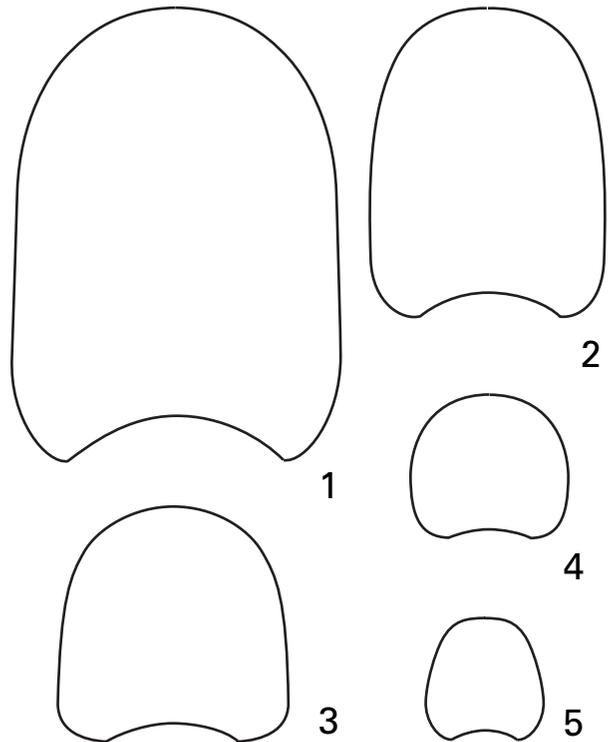


Fig. 14. The whorl section of *Subdiscosphinctes jelskii* (Siemiradzki, 1891): 1-2: A/I/2/196 (lectotype), at $D=180$ mm (1) and $D=105$ mm (2); 3-4: A/I/2/195 (paralectotype), at $D=93$ mm (3) and $D=46$ mm (4). *Subdiscosphinctes* cf. *jelskii*: 5: A/I/2/200, at $D=43$ mm. Natural size.

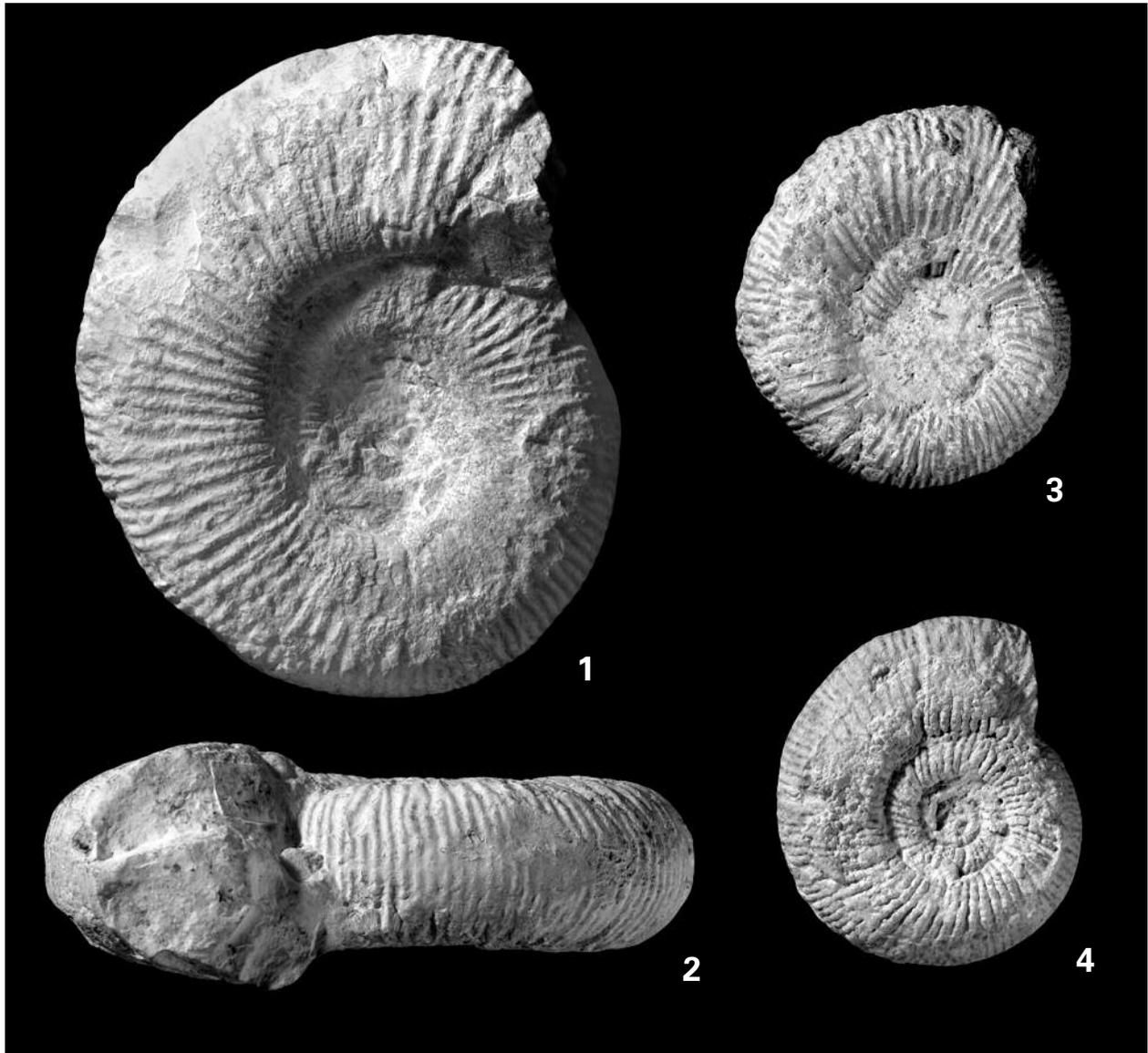


Fig. 15. *Subdiscosphinctes jelskii* (Siemiradzki, 1891): 1-2: A/I/2/195 [M?] (paralectotype), the view of the lateral (1) and ventral (2) side of the specimen, Paczółtowice; 3: A/I/2/197 (paralectotype), Rudno; 4: A/I/2/198 (paralectotype), Trzebinia. All of the specimens are wholly septate inner whorls. Natural size.

DESCRIPTION: The lectotype A/I/2/196 (Figs 16-17) is an immature macroconch which has $D_m=180$ mm and is septate to $Dr=ca.$ 95 mm. The outer whorl is body chamber. It is partly distorted. The whorl section is high oval (Fig. 14: 1-2). The whorl height is 1.3-1.4 greater than thickness. The whorl sides are approximately parallel. The coiling of the whorls is involute on the inner whorls and it changes to weakly involute at diameters bigger than $ca.$ 90 mm. At this diameter h_u is 1.00; at $D=180$ mm it is 0.84. The umbilical seam of the last whorl lies at $2/3$ of the preceding whorl height. The ratio of

umbilical diameter against shell diameter (u) is $ca.$ $2/5$ in the whole range of the diameters studied. The ratio of whorl height against shell diameter (h) is $ca.$ $2/5$ at $D=90$ mm and lowers to $1/3$ at $D=180$ mm (*cf.* u and h in Tab. 6).

The ribs are thin, not sharp. They bifurcate at $2/3$ of the whorl height. They become somewhat blurred on the upper half of the whorl side of the body chamber. The secondary ribs follow the direction of the primary rib on the venter. Occasionally zigzag ribs appear. They end freely on the venter and form an intercalatory rib. The rib number is 95 per whorl in the range of



Fig. 16. *Subdiscosphinctes jelskii* (Siemiradzki, 1891): 1-2: A/I/2/196 [M] (lectotype), the view of the lateral (1) and ventral side (2) of the specimen. Rudno. Arrow indicates the end of the phragmocone. Reduced x0,9.



Fig. 17. *Subdiscosphinctes jelskii* (Siemiradzki, 1891): A/I/2/196 [M] (lectotype), the view of the reverse side of the lectotype. Arrow indicates the end of the phragmocone. Reduced $\times 0.9$.

diameters from between 115 mm and 145 mm diameter. At diameters bigger than the latter the rib number per whorl lowers. There are 92 ribs per whorl at $D=180$ mm (Tab. 6). Constrictions number two on the last whorl of the phragmocone.

The paralectotype A/I/2/195 (Fig. 15: 1-2) is a late phragmocone, probably of a macroconch. At $D_m=94$ mm there is still no approximation of septa. The two smaller paralectotypes A/I/2/197 (Fig. 15: 3) and A/I/2/198 (Fig. 15: 4) are wholly septate inner whorls of uncertain dimorphic status.

No of specimen	D_m	D_r	D	u	h	$D:r$	
A/I/2/196 (lectotype)	180	c. 95	90 108 180	0.39 0.39 0.41	0.39 0.38 0.33	115:95 180:92 –	145:95 – –
A/I/2/195 (paralectotype)	94	wholly septate	47 93	0.40 0.40	0.38 0.33	61:60 93:68	75:64 –
A/I/2/197 (paralectotype)	56	wholly septate	56	0.45	0.38	50:54	56:56
A/I/2/198 (paralectotype)	51	wholly septate	30 50	0.40 0.40	0.37 0.38	45:51 –	51:56 –

Tab. 6. *Subdiscosphinctes jelskii* (Siemiradzki, 1891)

The whorl section is rounded on the inner whorls and becomes thick oval at the diameters bigger than *ca.* 50 mm (*e.g.* A/I/2/195, Fig. 14: 3-4). The coiling of the whorls is weakly involute. The ratio h_u varies between the paralectotypes from *ca.* 0.80 to 0.95 near their maximum diameters. The ratio of umbilical diameter against shell diameter (u) is *ca.* 2/5 in the whole range of the studied diameters. The ratio of whorl height against shell diameter (h) is usually but slightly lower, *e.g.* 1/3 in A/I/2/195 (*cf.* u and h in Tab. 6).

REMARKS: Siemiradzki (1891) provided a somewhat confusing description of *Subdiscosphinctes jelskii* in which he mentioned thick whorls and thin, densely spaced ribs as distinctive features of the species. The two features mentioned do not occur together in any single specimen of *S. jelskii* described previously. Although the lectotype possesses thin and densely spaced ribs, the whorl section is high oval. Thick oval whorl sections appear in the paralectotypes; these, however, possess moderately thick and fairly distantly spaced ribs. The lectotype and paralectotypes may have belonged to different species. Obtaining additional material, preferably topotypes, would be required to determine the full range of variability in the species.

S. jelskii and *Subdiscosphinctes kreutzii* (Siemiradzki) resemble each other in the coiling of the whorls, which in the two mentioned species changes from involute to weakly involute between the inner and outer whorls; the whorl section which is high oval, 1.3-1.4 as high as thick; the umbilical diameter which is *ca.* 2/5 of shell diameter; in having thin but not sharp ribs, which are densely spaced (the last feature appears only in the lectotype of *S. jelskii*, but not in the paralectotypes). In the opinion of the author no

significant differences occur between *S. jelskii* and *S. kreutzii*. The two forms may in fact belong to a single species. Obtaining additional material would be required to know their range of variability and to decide this.

Paralectotypes of *S. jelskii* resemble *Subdiscosphinctes dunikowskii* (Siemiradzki) in the thick oval whorl section. They differ in somewhat more evolute coiling of whorls and somewhat thicker ribs.

The French specimen from Nevers figured by Siemiradzki (1899, p. 274, pl. 24: 36) and misinterpreted by him as *S. jelskii* is an incomplete phragmocone of *ca.* 50 mm diameter. It differs from *S. jelskii* in the whorl section, which is rounded, and in moderately evolute coiling of whorls. It should be treated as a different species.

S. jelskii differs from *Subdiscosphinctes lucingae* (Favre, 1875) in having a lower whorl height and more evolute coiling of whorls at equivalent diameters. *S. lucingae* (de Riaz 1898, pl. 7: 4 *non* Favre 1875), misinterpreted by Siemiradzki (1899) as *S. jelskii*, belongs to the species *Passendorferia tenuis* (Enay) as recognised by Enay (1966, p. 417) and properly assigned to the genus by Meléndez (1989, p. 134). This species differs from *S. jelskii* in the evolute coiling of the whorls and delicate ribs, much more densely spaced on the whorl sides than in the species mentioned.

STRATIGRAPHICAL POSITION: The lectotype of the species comes from bedded limestone in Rudno (*cf.* Zaręczny 1894). The type horizon of the species is supposed to be in the upper part of the Transversarium Zone or in the Bifurcatus Zone in the Oxfordian. The exact stratigraphical range of *S. jelskii* requires obtaining additional material, preferably topotypes.

Subdiscosphinctes cf. jelskii (Siemiradzki, 1891)
Figs 14: 5; 18; Tab. 7.

1891. *Perisphinctes aeneas* Gemmellaro, 1877;
Siemiradzki, p. 50 (*pars*, A/I/2/200, only).

No of specimen	D_m	D_r	D	u	h	$D:r$	
A/I/2/200	79	wholly septate	78	0.42	0.34	58:67 79:75	63:69 –

Tab. 7. *Subdiscosphinctes cf. jelskii* (Siemiradzki, 1891).



Fig. 18. *Subdiscosphinctes* cf. *jelskii* (Siemiradzki, 1891): A/I/2/200. Rudno. Wholly septate inner whorls. Natural size.

MATERIAL: A/I/2/200 [uncertain dimorphic status].

LOCALITY: Rudno.

DESCRIPTION: A/I/2/200 (Fig. 18) is an incomplete phragmocone of uncertain dimorphic status. The specimen has $D_m=79$ mm (Tab. 7). The last half of a whorl is partly crushed flat. The whorl section is thick oval (Fig. 14: 5), the whorl height and the thickness are approximately of the same dimensions. The coiling of the whorls is weakly involute. The ribs are moderately thin and moderately densely spaced. They bifurcate at ca. $3/4$ of the whorl height. Occasionally zigzag ribs occur on the venter. Constrictions number 1 per whorl.

Subdiscosphinctes lucingae (Favre, 1875)
Figs 19-20, Tab. 8.

1875. *Ammonites lucingae* sp. nov.; Favre, p. 32, pl. 3: 4.

1891. *Perisphinctes lucingensis* (Favre, 1875); Siemiradzki, p. 44, pl. 4: 1 (A/I/2/34). Without synonymy.

1898. *Perisphinctes lucingensis* (Favre, 1875); de Riaz, p. 14 (*pars*), pl. 7: 2-3 only.

1899. *Perisphinctes lucingensis* (Favre, 1875); Siemiradzki, p. 271.

1966. *Lithacoceras* (*Discosphinctes*) *lucingae* (Favre, 1875); Enay, p. 540, pl. 37: 10; text-figs 166, 169.

2000. *Subdiscosphinctes* (*Subdiscosphinctes*) *lucingae* (Favre, 1875); Gygi, p. 87, pl. 5: 1; text-fig. 50.

2001. *Subdiscosphinctes* (*Subdiscosphinctes*) *lucingae* (Favre, 1875) [m]; Gygi, p. 83, fig. 124-125, tab. 47.

MATERIAL: A/I/2/34 [M?].

LOCALITY: Rudno.

COLLECTOR: Dr. Stanisław Zaręczny.

DESCRIPTION: A/I/2/34 (Fig. 20: 1-2) is an incomplete phragmocone, presumably belonging to a macroconch. At $D_m=112$ mm the septa are still not approximated. The specimen is pathological and shows abnormally distorted ribs at one side of the outer whorl (*cf.* Fig. 20: 2). The whorl section is high oval (Fig. 19). The whorl height is 1.3 greater than thickness.

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/34	112	wholly septate	108 58	0.33 0.33	0.39 0.40	88:70 -	108:73 -	112:74 -

Tab. 8. *Subdiscosphinctes lucingae* (Favre, 1875).

The coiling of the whorls is involute. At $D=108$ mm h_u is ca. 1.2. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are ca. $1/3$ and $2/5$, respectively (*cf.* u and h in Tab. 8).

The ribs are moderately densely spaced on the whorl sides. The ribs usually bifurcate. Simple ribs appear fairly commonly. They number 10 on the outer whorl.

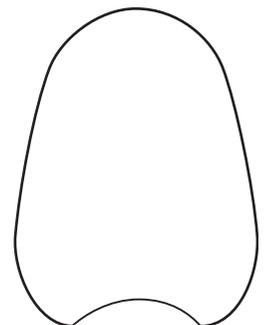


Fig. 19. The whorl section of *Subdiscosphinctes lucingae* (Favre, 1875): A/I/2/34, at $D=108$ mm. Natural size.



Fig. 20. *Subdiscosphinctes lucingae* (Favre, 1875): 1-2: A/I/2/34, the lateral view of the two sides of the specimen. Rudno. Wholly septate inner whorls. Reduced x0.9.

The rib number is 70 per whorl at $D=88$ mm and 74 per whorl at $D=112$ mm.

REMARKS: The specimen A/I/2/34 has been attributed to *Subdiscosphinctes lucingae* (Favre, 1875) on account of its involute coiling of whorls, high oval whorl section, and a common appearance of simple ribs (*cf.* Favre 1875, pl. 3: 4 – the lectotype of *S. lucingae*, microconch; de Riaz 1898; Enay 1966; Gygi 2000, 2001). The specimen is, however, less densely ribbed than in the lectotype of *S. lucingensis*, and it differs in the proportions of the whorl height and thickness. Its whorl height is only 1.3 greater than thickness (in the lectotype of *S. lucingensis* it is 1.6 greater than thickness). In the opinion of the author these differences are, however, of minor importance and A/I/2/34 should be regarded as *S. lucingae*. The opposite opinion was expressed by Enay (1966, p. 540).

The relationship between *lucingae* and the Russian form *Subdiscosphinctes jeremeyevi* (Nikitin, 1885) is still to be studied. Siemiradzki (1891) pointed out the great similarity of A/I/2/34 to the syntype of *Subdiscosphinctes jeremeyevi* illustrated by Nikitin (1885, pl. 4: 16). The two specimens, both of them macroconchs, match each other of respect to the coiling, whorl dimensions and rib number per whorl. Siemiradzki (1891) noted, nevertheless, that the syntype of *S. jeremeyevi* does not match the description of the species given by Nikitin (1885, p. 128). The correct interpretation of the species *S. jeremeyevi* may be only determined through revision of the type collection, which is housed in the Museum of All-Russian Geological Institute (VSEGEI Museum) in St. Petersburg.

STRATIGRAPHICAL POSITION: The type horizon of *Subdiscosphinctes lucingae* (Favre) is in the Birmensdorf Beds of Montagne des Voirons, Dép. Haute Savoie, France (*cf.* Gygi 2001).

Subdiscosphinctes sp.

1891. *Perisphinctes rhodanicus* (Dumortier, 1871); Siemiradzki, p. 45, pl. 3: 2.

MATERIAL: A single specimen illustrated by Siemiradzki (1891) on pl. 3: 2. It is lost.

REMARKS: Judging from the description and illustration the specimen comprised the inner whorls of a phragmocone, and had $D_m = ca. 55$ mm. The involute coiling of whorls and thin, densely spaced ribs in the specimen match the diagnosis of the genus *Subdiscosphinctes* Malinowska. Siemiradzki (1891) recorded this species from Wodna and Rudno.

Subdiscosphinctes ? *cracoviensis* group

Micro- and macroconchs. The distinctive features of the group include: small size of adult macroconchs which are half the size of macroconchs of other species of *Subdiscosphinctes* Malinowska, and the occurrence of parabolic ribs and nodes. Other features partly match the diagnosis of the genus *Subdiscosphinctes* and also partly the diagnosis of the genus *Liosphinctes* Buckman, as these genera were characterised by Brochwicz-Lewiński (1972). The species of the *S.* ? *cracoviensis* group resemble more closely some species of the latter genus in their rounded whorl section and moderately evolute coiling of whorls of the phragmocone. In the number of ribs per whorl, *S.* ? *cracoviensis* matches the densely ribbed species of *Subdiscosphinctes* s. str.; *S.* ? n. sp. aff. *cracoviensis* is markedly less densely ribbed.

The species of the *S.* ? *cracoviensis* group require further study.

Subdiscosphinctes ? *cracoviensis* (Siemiradzki, 1891)

Figs 21-22, Tab. 9.

1891. *Perisphinctes cracoviensis* sp. n.;

Siemiradzki, p. 48 (*pars*), pl. 3: 1 (A/I/2/26, lectotype); pl. 3: 4 (A/I/2/349, paralectotype). 1972. *Lithacoceras (Discosphinctes) cracoviense* (Siemiradzki, 1891); Brochwicz-Lewiński, p. 484, pls 10-11; pl. 12: 2; text-fig. 4. *non* 1898. *Perisphinctes cracoviensis* Siemiradzki, 1891; de Riaz, p. 35; pl. 15: 1. *non* 2000. *Subdiscosphinctes (Aureimontanites) cracoviensis* (Siemiradzki, 1891); Gygi, 89, pl. 7: 1. *non* 2001. *Subdiscosphinctes (Aureimontanites) cracoviensis* (Siemiradzki, 1891); Gygi, p. 144, fig. 204.

FORMER SYNTYPES: A/I/2/26, A/I/2/27, A/I/2/28, A/I/2/29, A/I/2/30, A/I/2/31, A/I/2/349.

LECTOTYPE: A/I/2/26 [M] of *Perisphinctes cracoviensis* figured by Siemiradzki (1891, pl. 3: 1) has been designated lectotype by Gygi (2001). It is kept at the Museum of ING PAN in Kraków. It is illustrated now in Fig. 22: 1-2.

TYPE LOCALITY: Rudno.

COLLECTOR: Presumably Dr. S. Zaręczny.

PARALECTOTYPES: A/I/2/31 [m] (Fig. 22: 5) – a possible allotype of *S.* ? *cracoviensis*; A/I/2/349 [uncertain dimorphic status] figured by Siemiradzki (1891, pl. 3: 4) and now on Fig. 22: 3-4. In addition there are several poorly preserved inner whorls whose identification at species level can not be precisely determined: A/I/2/27-A/I/2/29 [*Subdiscosphinctes* ? sp.] and A/I/2/30 [*Perisphinctes* sp.]. They are described briefly in Remarks.

DATA ON THE LABELS ACCOMPANYING PARALECTOTYPES: Locality: Nieporaz: A/I/2/31; Ratowa n. Podłęże: A/I/2/349; Mirów: A/I/2/27; Rudno: A/I/2/28, A/I/2/29. No data on the origin of A/I/2/30. Collector: Dr. S. Zaręczny: A/I/2/28, A/I/2/29. No data on the other paralectotypes.

DIAGNOSIS: Small sized micro- and macroconchs. Shell discoidal. Coiling of whorls moderately evolute changing on

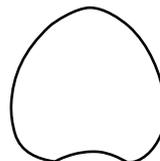


Fig. 21. The whorl section of *Subdiscosphinctes* ? *cracoviensis* (Siemiradzki, 1891): A/I/2/349 (paralectotype), at $D=55$ mm. Natural size.

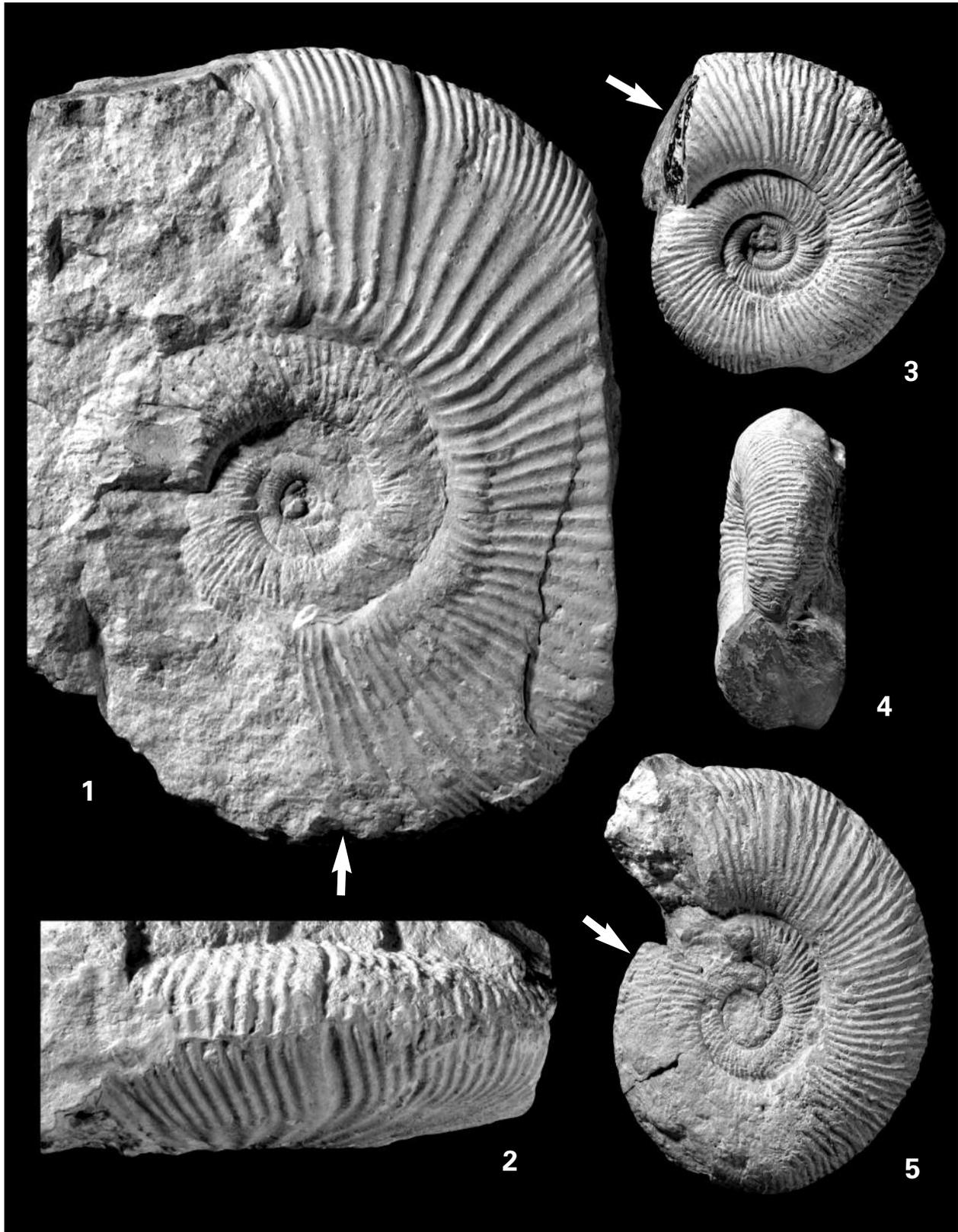


Fig. 22. *Subdiscosphinctes ? cracoviensis* (Siemiradzki, 1891): 1-2: A/I/2/26 [M] (lectotype), the lateral view (1) and the view of the ventral side (2), Rudno; 3-4: A/I/2/349 [unknown dimorphic status] (paralectotype), the lateral view (3) and the view of the ventral side (4), Ratowa near Podłęże; 5: A/I/2/31 [m] (paralectotype), Nieporaz. Arrows indicate the end of the phragmocones. Besides 5: A/I/2/31, which is x 0.9, all figures are natural size.

the adult body chamber of macroconchs to involute; whorl section subcircular changing to high oval. Ribs thin, densely spaced, bifurcating, dividing into 2-3 secondary ribs only on the body chamber of macroconchs. Parabolic nodes occasionally present.

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/1/2/26 (lectotype)	135	c. 67	128	0.36	0.38	65:80	–	–
			102	0.37	0.39	–	–	–
			65	0.62	0.40	–	–	–
A/1/2/31 (paralectotype)	80	45	80	0.39	0.31	41:64	52:68	60:70
			30	0.50	0.33	79:80	–	–
A/1/2/349 (paralectotype)	58	wholly septate	58	0.40	0.34	25:50 55:67	36:55	46:60

Tab. 9. *Subdiscosphinctes* ? *cracoviensis* (Siemiradzki, 1891).

DESCRIPTION: The lectotype A/1/2/26 (Fig. 22: 1-2) is a mature macroconch which has $D_m=135$ mm. The phragmocone is fractured at $D=67$ mm and a quarter of a whorl is missing. The body chamber occupies the last half of whorl.

The whorl section changes from subcircular on the inner phragmocone to oval of moderate thickness on the late phragmocone, and high oval on the body chamber. The coiling of the whorls is moderately evolute on the phragmocone and involute on the body chamber. The ratio h_u changes from 0.65 to *ca.* 1.0 in the range of diameters from 65 mm to *ca.* 130 mm. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are *ca.* 3/5 and 2/5, respectively, at $D=65$ mm (*cf.* Tab. 9). At the diameters bigger than the previous one u becomes *ca.* 2/5. The primary ribs are thin, sharp, densely spaced on the whorl sides of the phragmocone, bifurcating. They split into 3 secondary ribs on the body chamber ($r_i=3$). The division point is indistinct. The ribs become blurred on the upper half of the whorl side. The secondary ribs are distinct and sharp. They gently sweep forward on the venter (Fig. 22: 2). The rib number is 80 per whorl at $D=65$ mm and at diameters bigger than the last one the number of ribs lowers (Tab. 9). Constrictions number 3 on the body chamber. They are shallow.

The paralectotype A/1/2/31 [m] (Fig. 22: 5) is septate to $D_r=ca.$ 45 mm (Tab. 9). The outer whorl is body chamber. The specimen is crushed flat and partly distorted. The coiling of the whorls changes from moderately evolute to weakly involute between the phragmocone and the body chamber. The ratio h_u changes from 0.67 to 0.81, respectively. Ribs bifurcate. Simple ribs appear occasionally. The rib number is 64 per whorl at $D=41$ mm and 80 per whorl at $D_m=80$ mm. Constrictions number 1-2 per whorl. A/1/2/349 (Fig. 22: 3-4) consists of septate inner whorls which have $D_m=58$ mm (Tab. 9). The whorl section is subcircular on

the inner whorls and thick oval on the outer whorl (Fig. 21). The coiling of the whorls changes from moderately evolute to weakly involute between the early phragmocone and the outer whorl. The ratio $h_u=0.84$ at the maximum diameter. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are 2/5 and *ca.* 1/3, respectively (Tab. 9). Bifurcating and, occasionally, simple ribs appear. Parabolic nodes number 4 on the outer whorl.

REMARKS: The following paralectotypes: A/1/2/27 from Mirów, A/1/2/28-A/1/2/29 from Rudno, and A/1/2/30 from an unknown locality, all of them referred to as *Perisphinctes cracoviensis* by Siemiradzki (1891), are incomplete specimens (most of them are early phragmocones), whose identity cannot be exactly determined. They range in D_m from 40 mm (A/1/2/27) to 61 mm (A/1/2/29). Only A/1/2/29 has a fragment of the body chamber. A/1/2/27-A/1/2/29 are assigned in this paper to *Subdiscosphinctes* ? sp., whereas A/1/2/30 – to *Perisphinctes* sp.

Brochwic-Lewiński (1975) distinguished the *Perisphinctes cracoviensis* group which contained a single species *Perisphinctes cracoviensis* Siemiradzki, 1891. The attribution of the species mentioned to a genus has not been studied thoroughly enough yet. Some authors (*e.g.* Gygi 2001) place it in the genus *Subdiscosphinctes* Malinowska, 1972. Brochwic-Lewiński (1975) challenged this opinion and indicated an essential difference in the dimensions of fully grown macroconchs compared with other species of *Subdiscosphinctes* s. str. This form, along with another similar forms from the studied collection, *Subdiscosphinctes* ? n. sp. aff. *cracoviensis*, are tentatively assigned in this monograph to the genus *Subdiscosphinctes*.

S. ? *cracoviensis* differs from any other macroconchiate species of the genus

Subdiscosphinctes Malinowska, 1972 in its smaller final size, subcircular whorl section and moderately evolute coiling of whorls of the phragmocone. For these reasons, in this monograph it has been attributed provisionally to the genus *Subdiscosphinctes*. When the evoluteness and rounded whorl section of the whorls of the phragmocone is concerned, *S. ? cracoviensis* is situated close to some species of the genus *Liosphinctes* Buckman as described by Brochwicz-Lewiński (1972). Therefore it was provisionally described as *Liosphinctes ? cracoviensis* (cf. Głowniak 2006a, b). The species is, however, more densely ribbed than any other species of *Liosphinctes* from the Transversarium Zone. In terms of the rib number per whorl it matches the species of the genus *Subdiscosphinctes* s. str.

The Swiss specimens assigned by Gygi (2000, 2001) to *Subdiscosphinctes cracoviensis* (Siemiradzki) differ from the Polish ones, for example, in the larger size ($D_m=175$ mm or even more in the Swiss specimens), and in a more gentle increase in height of the adult body chamber as compared to *S. ? cracoviensis*.

Siemiradzki, who erected the species *Subdiscosphinctes ? cracoviensis* in 1891, subsequently changed his mind, and in his revision of the genus *Perisphinctes* in 1899 mentioned the species in the synonymy list of the Indian form *Perisphinctes leiocymon* Waagen (1875, p. 205, pl. 52: 1) from Kutch. Yet the species *Subdiscosphinctes ? cracoviensis* and the Indian species mentioned are definitely different. In this monograph, these two forms are treated as separate species.

STRATIGRAPHICAL POSITION: The lectotype originates from the bedded limestone in Rudno (cf. Zaręczny 1894). The type horizon is probably in the upper part of the Transversarium Zone or in the Bifurcatus Zone. Some specimens of *S. ? cracoviensis* has been collected by Głowniak (e.g. 2006b) in the Zawodzie Quarry in Częstochowa from the beds belonging to the Wartae and Stenocycloides subzones of the Bifurcatus Zone.

To determine the exact stratigraphical range of *S. ? cracoviensis* would require obtaining additional material, preferably topo-types, and further studies.

Subdiscosphinctes ? n. sp. aff. cracoviensis
(Siemiradzki, 1891)
Figs 23-24, Tab. 10.

1891. *Perisphinctes convolutus* (Quenstedt, 1887);
Siemiradzki, p. 53 (*pars*, A/I/2/40 only),
pl. 5: 2. Without synonymy.

MATERIAL: A/I/2/40 [uncertain dimorphic status] figured by Siemiradzki (1891, pl. 5: 2) and now on Fig. 23.

LOCALITY: Brodła.

DESCRIPTION: A/I/2/40 (Fig. 23) is an incomplete phragmocone which has $D_m=69$ mm (Tab. 10). The whorl section is rounded on the inner whorls



Fig. 23. *Subdiscosphinctes ? n. sp. aff. cracoviensis* (Siemiradzki, 1891): A/I/2/40 [uncertain dimorphic status]. Brodła. Wholly septate inner whorls. Natural size.

and changes to thick oval on the outer whorl (Fig. 24). There, the whorl height is but slightly greater than thickness. The coiling of the whorls changes from moderately evolute to nearly weakly involute between the inner and outer whorl. The ratios of umbilical diameter (u) and the whorl height (h) against shell diameter

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/40	69	wholly septate	30 69	0.47 0.45	0.30 0.32	30:47 60:56	40:48 68:61	50:54 –

Tab. 10. *Subdiscosphinctes ? n. sp. aff. cracoviensis* (Siemiradzki, 1891).

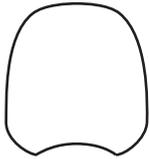


Fig. 24. The whorl section of *Subdiscosphinctes* ? n. sp. aff. *cracoviensis* (Siemiradzki, 1891): A/1/2/40, at $D=64$ mm. Natural size.

are ca. 1/2 and 1/3, respectively (Tab. 10). The ribs are moderately thin, not sharp, prorsiradiate, moderately densely spaced on the whorl sides, usually bifurcating. The division point is situated at 3/4 but descends to 2/3 of the whorl height on the terminal part of the outer whorl. Simple ribs occasionally appear. Parabolic nodes number 4. Deep constrictions number 1-2 per whorl.

REMARKS: A/1/2/40 resembles *Subdiscosphinctes* ? *cracoviensis* in its rounded whorl section and moderately evolute coiling of whorls of the phragmocone, and in the presence of parabolic nodes. It is, however, less densely ribbed than *S.* ? *cracoviensis* at equivalent diameters.

STRATIGRAPHICAL POSITION: The species *Subdiscosphinctes* ? n. sp. aff. *cracoviensis* probably ranges in the upper part of the Transversarium Zone and/or in the Bifurcatus Zone.

Subdiscosphinctes ? *dybowskii* group

The distinctive characters of the group are as follows: small size of adult microconchs, moderately evolute coiling of the whorls of the phragmocone and weakly involute coiling on the adult body chamber, thin bifurcating ribs with a rather low situation of the division point on the whorl side, moderate number of ribs per whorl, and common appearance of parabolic nodes and zigzag ribs. *S.* ? *dybowskii* (Siemiradzki) and *Subdiscosphinctes* ? n. sp. aff. *dybowskii*, are referred to as the *S.* ? *dybowskii* group in this paper. To the group may possibly belong also some French forms from the Transversarium Zone close to *S.* ? *dybowskii*: *Perisphinctes kilianii* de Riaz, 1898 and *Perisphinctes delgadoi* *sensu* de Riaz (1898) *non* Choffat (1893); as well as *Subdiscosphinctes pauliplicatus* of Gygi (2001, figs 126-128) from the Swiss Jura. Further studies are required to decide this.

Subdiscosphinctes ? *dybowskii* (Siemiradzki, 1891)

Figs 25-26, Tab. 11.

1891. *Perisphinctes dybowskii* sp. nov.; Siemiradzki, p. 43, pl. 2: 4 (lectotype).
 ?1963. *Perisphinctes* (*Dichotomosphinctes*) *dybowskii* Siemiradzki, 1891; Malinowska, p. 66, pl. 32: 154, pl. 33: 160.
 1966. *Perisphinctes dybowskii* Siemiradzki, 1891; Enay, text-fig. 151.
 ?1977. *Perisphinctes* (*Dichotomosphinctes*) *dybowskii* Siemiradzki, 1891; Matyja, pl. 8: 8.
 ?2001. *Subdiscosphinctes* (*Subdiscosphinctes*) *pauliplicatus* n. sp.; Gygi, p. 84, figs 126-128, tab. 48.

DERIVATION OF NAME: Benedykt Dybowski (1833-1930), Professor of Zoology at the *Szkoła Główna* in Warszawa and at the Jan Kazimierz University in Lvov, explorer of the Baikal Lake.

FORMER SYNTYPES: A/1/2/24, only.

LECTOTYPE: A/1/2/24 [m] of *Perisphinctes dybowskii* figured by Siemiradzki (1891, pl. 2: 4) is designated here lectotype. The species is illustrated herein in Fig. 25: 1-2. It is kept at the Museum of ING PAN in Kraków.

TYPE LOCALITY: Brodła.

COLLECTOR: Dr. Stanisław Zaręczny.

DIAGNOSIS: Microconchs. Body chamber constricted. Coiling of whorls moderately evolute changing to weakly involute on the adult body chamber. Whorl section of the body chamber high oval. Ribs thin, prorsiradiate, somewhat flexuous, bifurcating. Intercalatory ribs occasionally appear.

DESCRIPTION: The lectotype A/1/2/24 (Fig. 25: 1-2) is a mature microconch with the body chamber showing terminal approximation of the last few ribs. The specimen is septate to $D_r=47$ mm and 3/4 of the outer whorl is the body chamber, $D_m=82$ mm.

The whorl section of the body chamber is high oval (Fig. 26). The whorl height is 1.3 greater than thickness. The coiling of the whorls is moderately evolute on the phragmocone ($h_u=0.71$ at $D=30$ mm) and weakly involute on the body

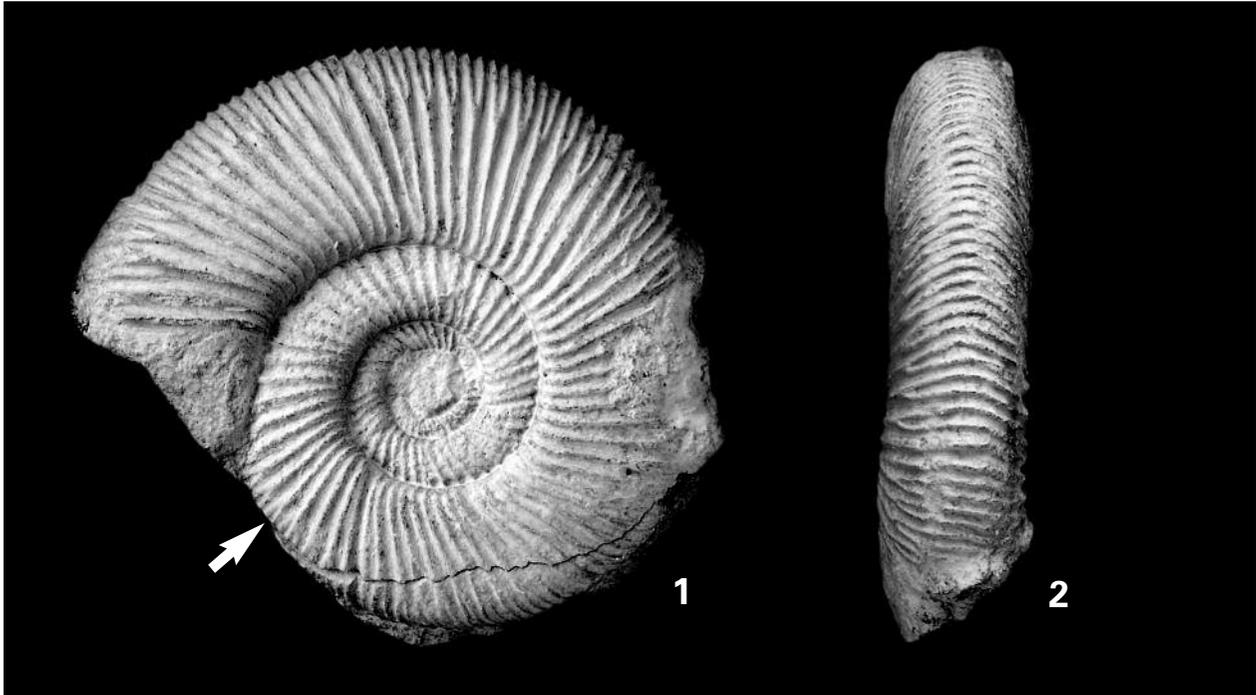


Fig. 25. *Subdiscosphinctes* ? *dybowskii* (Siemiradzki, 1891): 1-2: A/1/2/24, the lateral view (1) and the view of the ventral side (2). Brodła. Arrow indicates the end of the phragmocone. Natural size.

chamber ($h_u=0.85$ at $D=ca.$ 50 mm). The ratio of umbilical diameter against shell diameter (u) is nearly 0.5 at $D=30$ mm whereas $ca.$ $2/5$ at $D=50$ mm, the ratio of whorl height against shell diameter (h) is approximately $1/3$ in the whole range of the diameters studied (Tab. 11). The primary ribs are thin and sharp, prorsiradiate, slightly flexuous on the whorl flanks of the body chamber. They bifurcate at $3/4$ of the whorl height. Intercalary ribs number two on the outer whorl. The rib number is 38 per whorl at $D=25$ mm, and 63 per whorl at $D=82$ mm (Tab. 11). Constrictions number 4. They appear on the body chamber.

REMARKS: The species *dybowskii* has been tentatively assigned in the present paper to the genus *Subdiscosphinctes* Malinowska, 1972. Moderately evolute coiling of the whorls of the phragmocone and a moderate number of ribs per whorl differentiate *Subdiscosphinctes* ? *dybowskii* from any of the

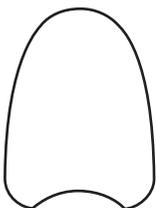


Fig. 26. The whorl section of *Subdiscosphinctes* ? *dybowskii* (Siemiradzki, 1891): A/1/2/24 (lectotype), at $D=80$ mm. Natural size.

species of *Subdiscosphinctes* s. str., which allow the setting aside this species and related forms as a distinct *S.* ? *dybowskii* group. Yet the other features, *e.g.* small size of adults; high oval whorl section and weakly involute coiling of whorls on the body chamber; sharp, prorsiradiate, somewhat flexuous ribs; low situation of the rib division point on the whorl side, are diagnostic of the genus *Subdiscosphinctes*. These features distinguish *S.* ? *dybowskii* from any species of the genus *Perisphinctes* and the subgenus *Dichotomosphinctes* Buckman, where the species has been assigned to by other authors (*e.g.* Malinowska 1963, Matyja 1977).

S. ? *dybowskii* resembles *Subdiscosphinctes mindowe* (Siemiradzki) in the size of adults which is $ca.$ 80 mm diameter in the two mentioned species. *S.* ? *dybowskii* is slightly smaller than *Subdiscosphinctes kreutzii* (Siemiradzki), whose microconchs attain $ca.$ 100 mm diameter. It is slightly more evolute than *S. mindowe* and *S. kreutzii* and less densely ribbed than the two species. The whorl section is high oval in all three species.

Enay (1966) pointed out the similarity of *S.* ? *dybowskii* to some specimens of *Perisphinctes* (*Dichotomosphinctes*) *elisabethae* de Riaz, 1898, but this applies only to these which

No of specimen	D_m	D_r	D	u	h	$D:r$	
A/1/2/24 (lectotype)	82	47	30 47 82	0.47 0.43 0.39	0.33 0.36 0.32	25:38 41:45 65:54	30:42 50:48 82:63

Tab. 11. *Subdiscosphinctes* ? *dybowskii* (Siemiradzki, 1891).

are of rounded whorl section, moderately evolute coiling of whorls and the rib division points situated low on the whorl sides (*e.g.* Enay 1966, pl. 30: 4). A similar conclusion can be drawn from the studies of the Polish material of *P. (D.) elisabethae* collected by the author [E.G.] from the sections of the Częstochowa area. Among the specimens referred to *P. (D.) elisabethae* by Głowniak (1997, 2006a) there appear, for example, some small forms (100-120 mm) of shell dimensions close to these of *S. ? dybowskii*. They resemble the previous species also in the coiling of the whorls and rather low situation of the rib division point on the whorl side. Their actual relationship to *P. (D.) elisabethae* on the one hand, and to *S. ? dybowskii* on the other, would require more studies. It seemed that the specimens in question, usually flattened by compaction and failing to provide a comprehensive view, for example, of the whorl section, may actually belong to *S. ? dybowskii*, and they were confused with *P. (D.) elisabethae*, the latter assignment being simply based on the similar number of ribs per whorl in both species and the appearance of simple ribs.

According to some opinions presented by Siemiradzki in 1899, *S. ? dybowskii* could be the senior synonym of *Perisphinctes (Dichotomosphinctes) luciae* de Riaz, 1898. This idea can be rejected. Both forms differ essentially in the whorl section which is high oval in *S. ? dybowskii* and subrectangular in *P. (D.) luciae*, in the coiling of the whorls which is moderately evolute in *P. (D.) luciae* whereas in *S. ? dybowskii* weakly involute on the body chamber, and in the final size which is *ca.* 150-170 mm diameter in *P. (D.) luciae* as recognised in the Polish specimens (*cf.* Głowniak 1997) but only *ca.* 80 mm diameter in *S. ? dybowskii*. The two forms differ in addition in the thickness of ribs: in *P. (D.) luciae* the ribs are somewhat thicker on the adult body chamber as compared to the inner whorls, whereas in *S. ? dybowskii* they remain thin and sharp up to the biggest diameters studied. The whorl height increases noticeably on the adult body chamber in

S. ? dybowskii, whereas in *P. (D.) luciae* it does not.

The specimen referred to the species *Perisphinctes (Dichotomosphinctes) dybowskii* by Matyja (1977, pl. 8: 8) is consistently more evolute at equivalent diameters than *S. ? dybowskii* and possesses less sharp ribs. Other features, such as the appearance of constrictions on the body chamber and prorsiradiate, somewhat flexuous ribs on the whorl sides are features in common in the two forms. The specimen described by Matyja (1977) is somewhat crushed flat and the ribs are partly obliterated, so that any more detail comparison, in particular of the whorl section, is not possible.

The species *Subdiscosphinctes pauliplicatus* figured by Gygi (2001, p. 84, figs 126-128, tab. 48) resembles *S. ? dybowskii* in the coiling of the whorls, oval whorl section and comparable rib number per whorl at equivalent diameters. The two forms differ slightly in the final size, which in *S. pauliplicatus* is bigger, *ca.* 115 mm diameter. *S. pauliplicatus* possesses similar rib numbers per whorl at equivalent diameters as *S. ? dybowskii* and it is lesser than in any other species of *Subdiscosphinctes* s. str. The two species are very close, and possibly should be included to a single *S. ? dybowskii* group.

STRATIGRAPHICAL POSITION: The lectotype of *Subdiscosphinctes dybowskii* was presumably obtained from marls and bedded limestones in Brodła (western part of the village, the outcrop situated over the well, as mentioned by Zaręczny 1894). The type horizon of the species is supposed to be in the Transversarium Zone, probably in its upper Elisabethae Subzone. Such a stratigraphic position would partly account for the other species which were reported with *S. ? dybowskii* from Brodła by Zaręczny (1894) and Siemiradzki (1922), for example, those of the *Perisphinctes (Dichotomosphinctes) elisabethae* group as distinguished in this paper (*cf.* respective description).

The specimen assigned to *Perisphinctes dybowskii* by Matyja (1977, pl. 8: 8) comes from a somewhat lower stratigraphical interval which should be correlated with the Buckmani Subzone of the Transversarium Zone.

To determine the exact stratigraphical range of *S. ? dybowskii* would require obtaining additional material, preferably topotypes, and further studies.



Fig. 27. *Subdiscosphinctes* ? n. sp. aff. *dybowskii* (Siemiradzki, 1891): 1: A/I/2/36 [m], Paczółtowice; 2: A/I/2/38 [m], Filipowice. Arrows indicate the end of the phragmocones. Natural size.

Subdiscosphinctes ? n. sp. aff. *dybowskii*
(Siemiradzki, 1891)
Figs 27-28, Tab. 12.

1891. *Perisphinctes alterneplicatus* Waagen, 1875; Siemiradzki, p. 39 (*pars*, A/I/2/36 only), pl. 4: 3. Without synonymy.
1891. *Perisphinctes aeneas* Gemmellaro, 1877; Siemiradzki, p. 50 (*pars*), pl. 4: 5, only. Without synonymy.
1899. *Perisphinctes aeneas* var. *plana*; Siemiradzki, p. 184, pl. 27: 59.

MATERIAL: A/I/2/36 [m] figured by Siemiradzki (1891, pl. 4: 3) and now in Fig. 27: 1; A/I/2/38 [m] figured by Siemiradzki (1891, pl. 4: 5) and now in Fig. 27: 2.

LOCALITY: Paczółtowice: A/I/2/36; Filipowice: A/I/2/38.

DESCRIPTION: Both specimens are microconchs. A/I/2/38 (Fig. 27: 2) is presumably a mature specimen with a whole body chamber. The specimen has $D_m=98$ mm and is septate to

$D_r=60$ mm (Tab. 12). The body chamber is $3/4$ of a whorl long. A/I/2/36 (Fig. 27: 1) is an incomplete ammonite with a fragment of the body chamber.

The whorl section is rounded on the phragmocone and high oval on the body chamber. The whorl height is 1.4 to 1.5 times greater than thickness (Fig. 28: 1-2). The coiling of the whorls is moderately evolute at $D=25$ mm. At a diameter bigger than the previous one the coiling changes to weakly involute. The ratios of umbilical diameter against shell diameter (u) and whorl height against shell diameter (h) are ca. $2/5$ and $1/3$, respectively (Tab. 12).

The ribs are moderately thin to thin, sharp, prorsiradiate and occasionally somewhat flexuous on the whorl sides. They mostly bifurcate. The division point is situated at $3/4$ of the whorl height on the phragmocone and somewhat lower on the body chamber. Simple ribs vary in number

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/36	c. 80	c. 45	42	0.45	0.31	30:42	-	-
A/I/2/38	98	60	25 92	0.48 0.39	0.36 0.36	30:57 74:63	40:58 98:74	51:61 -

Tab. 12. *Subdiscosphinctes* ? n. sp. aff. *dybowskii* (Siemiradzki, 1891)

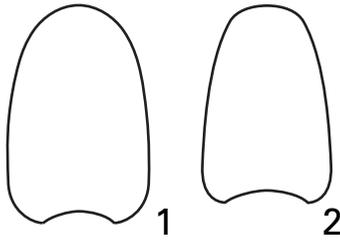


Fig. 28. The whorl section of *Subdiscosphinctes* ? n. sp. aff. *dybowskii* (Siemiradzki, 1891): 1: A/I/2/38, at $D=84$ mm; 2: A/I/2/36, at $D=ca.$ 75 mm. Natural size.

from 3 to 6. The zigzag ribs commonly appear on the venter. They end freely and prolongate on the whorl side as a simple rib. Parabolic nodes number 2 in A/I/2/38 (Fig. 27: 2). They occur on the body chamber.

There are 74 ribs per whorl at $D=98$ mm (cf. A/I/2/38, Tab. 12). Constrictions number 1 to 3 per whorl.

REMARKS: Siemiradzki (1891) attributed the specimen A/I/2/38 to the Sicilian species *Subdiscosphinctes aeneas* Gemmellaro, 1877; subsequently Siemiradzki (1899) distinguished it as a separate form *S. aeneas* var. *plana*. The previous attributions by Siemiradzki (1891, 1899) are not accepted in the present paper and the specimen is now referred to as *Subdiscosphinctes* ? n. sp. aff. *dybowskii* (Siemiradzki). It differs from *S. aeneas* in its smaller final size, lower number of ribs per whorl at equivalent diameters, slimmer whorl section, more evolute coiling of whorls, and the appearance of zigzag ribs and parabolic ribs which in *S. aeneas* are missing.

Subdiscosphinctes ? n. sp. aff. *dybowskii* and *Subdiscosphinctes* ? *dybowskii* (Siemiradzki), both referred to as the *Subdiscosphinctes* ? *dybowskii* group in this paper, resemble each other in the subcircular whorl section of the inner whorls and high oval on the body chamber, weakly involute coiling of the outer whorl, and in sharp ribs. *Subdiscosphinctes* ? n. sp. aff. *dybowskii* possesses parabolic ribs and nodes, which in *Subdiscosphinctes* ? *dybowskii* are missing.

Subdiscosphinctes ? n. sp. aff. *dybowskii* and the microconchs of *Subdiscosphinctes mindowe* (Siemiradzki) grow up to similar diameters. The former species differs from the latter one in a lesser number of ribs per whorl, more evolute coiling of whorls, and in the presence of parabolic ribs and nodes.

S. ? n. sp. aff. *dybowskii* resembles the French forms of *Perisphinctes kiliani* de Riaz (1898, p. 26, pl. 4: 3-5) and *Perisphinctes delgadoi* de Riaz (1898,

p. 16, pl. 8, figs 4-5) *non* Choffat (1893) in the high oval whorl section, in the appearance of simple ribs, and in the similar number of ribs per whorl. All three mentioned forms are very close.

STRATIGRAPHICAL POSITION: It is supposed to be in the Transversarium Zone, presumably in its upper part, in the Middle Oxfordian. To determine the exact stratigraphical range of this species would require further studies.

Subdiscosphinctes ? n. sp. A

Fig. 29, Tab. 13.

1891. *Perisphinctes* n. sp. cf. *geron* (Zittel, 1870); Siemiradzki, p. 55 (*pars*, A/I/2/217 only). Without synonymy.

MATERIAL: A/I/2/217 [M].

LOCALITY: Brodła (?).

DESCRIPTION: A/I/2/217 (Fig. 29) is an immature macroconch with a nearly complete body chamber. The specimen has $D_m=137$ mm and is septate to $D_r=80$ mm. The body chamber is 7/8 whorl long. The specimen is slightly crushed flat and distorted. Its phragmocone is partly uncovered. The coiling of the whorls is moderately evolute. The ratio h_u is 0.75. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are 1/2 and *ca.* 1/3, respectively (Tab. 13). The ribs regularly bifurcate up to $D=110$ mm but at a diameter bigger than this they occasionally split into three ribs. All the ribs regularly trifurcate at diameter bigger than 130 mm. The division point is at 3/4 of the whorl height. The ribs are thin and delicate on the whorl side of the phragmocone and become blurred on the upper half of the body chamber. The rib number is 80 per whorl at $D=90$ mm and lowers at the diameters bigger than this (Tab. 13).

REMARKS: *Subdiscosphinctes* ? n. sp. A differs from *Subdiscosphinctes dunikowskii* (Siemi-

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/217	138	80	79 138	0.47 0.41	0.33 0.31	80:73	90:79	133:78
						-	-	-

Tab. 13. *Subdiscosphinctes* ? n. sp. A.

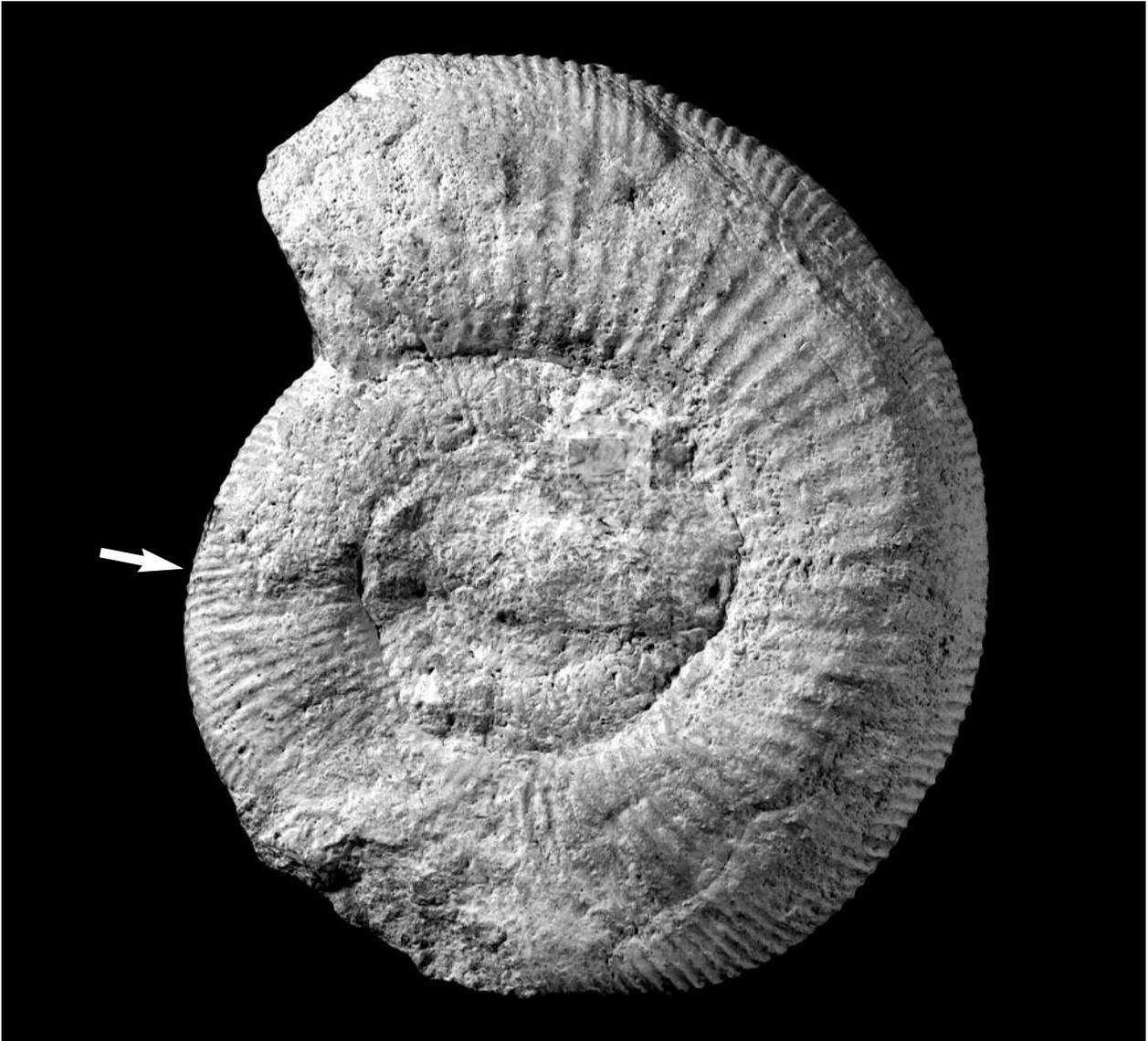


Fig. 29. *Subdiscosphinctes* ? n. sp. A: A/1/2/217 [M]. Brodła (?). Arrow indicates the end of the phragmocone. Natural size.

radzki, 1891) in the moderately evolute coiling of whorls, larger umbilical diameter which occupies nearly half of the shell diameter, and the smaller rib number per whorl at equivalent diameters. Common features with *S. dunikowskii* are thin, delicate ribs and a thick oval whorl section.

Genus *Perisphinctes* Waagen, 1869

TYPE SPECIES: *Ammonites variocostatus* (Buckland, 1836) [M] [second designation]. Lectotype figured by Buckland (1836, pl. 42: 7), by Healey (1904, pl. 11), and then by Arkell *et al.* (1957, fig. 408: 9 a-b).

The following new nominal species were introduced by Siemiradzki and are discussed in what follows:

Perisphinctes crotalinus
Perisphinctes damesi [*nomen dubium*]
Perisphinctes vajdelota

Perisphinctes damesi Siemiradzki, 1891 [*nomen dubium*]

1891. *Perisphinctes damesi* n. sp.; Siemiradzki, p. 58, pl. 5: 4 (lectotype).

FORMER SYNTYPES: (1) the specimen figured by Siemiradzki (1891) on pl. 5: 4 and (2) the specimen

from Dębowa Góra near Sulejów (central Poland), collected by Professor Aleksandrowicz, Warszawa, from an unknown stratigraphical horizon (after Siemiradzki 1891, p. 58).

LECTOTYPE: The specimen of *Perisphinctes damesi* [an incomplete phragmocone of unknown dimorphic status] figured by Siemiradzki (1891) on pl. 5: 4 is designated here lectotype. The specimen is lost.

TYPE LOCALITY: Not specified by Siemiradzki (1891).

PARALECTOTYPE: The specimen from Dębowa Góra; not figured by Siemiradzki 1891. The specimen is lost.

REMARKS: The lectotype and the paralectotype of *Perisphinctes damesi* are no longer housed in the studied collection A/I/2 in the Museum ING PAN in Kraków. Siemiradzki (1891) did not provide any indication where these specimens could have been kept, and they are presumably lost. No typotypes are available. Therefore, *Perisphinctes damesi* Siemiradzki, 1891 is a *nomen dubium* under the provision of Article 75.5 of the International Code of Zoological Nomenclature (1999).

On the contemporary label of the specimen A/I/2/223 from Tenczynek there is a name *Perisphinctes damesi* inscribed. The specimen's original label is lost. Siemiradzki (1891) did not provide any reference to A/I/2/233 in the species description. Therefore, the author [E.G.] assumes that the specimen is not a part of the original type collection on which Siemiradzki (1891) founded his species. It was presumably misidentified with *P. damesi* by an unknown reviser. The specimen is an incomplete fossil. It is assigned in this paper to *Perisphinctes* sp. A (*cf.* respective description).

Perisphinctes sp. A

MATERIAL: A/I/2/233 [uncertain dimorphic status].

LOCALITY: Tenczynek.

DESCRIPTION: This is a fragment of an ammonite showing a portion of the body chamber. The specimen's D_m is approximately 140 mm. The whorl section is subrectangular, with rounded sides and ventral margins. The whorl height is 1.1 greater

than thickness on the phragmocone. The ribs are thick. They regularly bifurcate up to $D=ca.$ 130 mm. After a constriction which appears at the diameter mentioned, intercalatory ribs become associated with the secondary ribs on the venter. The secondary ribs are as distinct as the primary ribs on the outer whorl.

REMARKS: The specimen was misidentified with *Perisphinctes damesi* Siemiradzki by unknown reviser. *P. damesi* is a *nomen dubium* as evidenced in the present paper. For additional comments see the respective species description in this paper.

Perisphinctes sp. B

Tab. 14.

1891. *Perisphinctes alpinus* sp. nov.; Siemiradzki, p. 36 (*pars*, A/I/2/158, A/I/2/159, A/I/2/160 only).

MATERIAL: A/I/2/158, A/I/2/159, A/I/2/160 (all of them are former syntypes of *Perisphinctes alpinus* Siemiradzki).

LOCALITY: The specimens derive from Brodła.

DESCRIPTION: These are incomplete phragmocones ranging in D_m from 28 mm to 50 mm. Their dimorphic status is uncertain. The ratio of umbilical diameter against shell diameter (u) ranges in these specimens from *ca.* 1/3 to 2/5. The ratio of whorl height against shell diameter (h) is *ca.* 1/3 (*cf.* u and h in Tab. 14). The coiling of the whorls varies between specimens from moderately evolute (A/I/2/158-159) to involute (A/I/2/160). The whorl section is subsquare. The ribs are moderately thick, bifurcating.

REMARKS: The specimens represent wholly septate inner whorls whose identity at the species level is unrecognizable.

No of specimen	D_m	D_r	D	u	h	$D:r$
A/I/2/158	48	wholly septate	37 46	0.41 0.46	0.32 0.32	– –
A/I/2/159	50	wholly septate	–	–	–	–
A/I/2/160	28	wholly septate	28	0.36	0.36	–

Tab. 14. *Perisphinctes* sp. B.

Subgenus *Kranaosphinctes* Buckman, 1921

TYPE SPECIES: *Kranaosphinctes kranaus* Buckman, 1921 [M]. Lectotype illustrated by Buckman (1921, pl. 243a-b), Arkell (1939, pl. 38: 1a, d), and Arkell *et al.* (1957, fig. 409: 1).

[Incl. *Arisphinctes* Buckman, 1924

TYPE SPECIES: *Arisphinctes ariprepes* Buckman, 1924 [M] (= subjective junior synonym of *Perisphinctes cotowii* Simionescu, 1907 by Arkell 1939). Lectotype of *A. ariprepes* figured by Buckman (1924, pl. 511 a-c), by Arkell (1935, pl. A: 1a-b), and then by Arkell *et al.* (1957, fig. 408: 1);

Cymatosphinctes Buckman, 1923

TYPE SPECIES: [M] *Cymatosphinctes cymatophorus* Buckman, 1923].

REMARKS: *Arisphinctes* and *Kranaosphinctes* are brought together into a single subgenus *Kranaosphinctes* as proposed by Głowniak (2002). The genotypes of *Kranaosphinctes* and *Arisphinctes* are from the same horizon in the type area Oxfordshire: Shell Beds of the Berkshire Oolite Series in Oxford (*K. kranaus*) and Horspath near Oxford (*A. ariprepes*). The species co-occur in the Arkelli Subzone of the Plicatilis Zone being diagnostic elements of this Subzone. Their microconch partners are accommodated in a single subgenus *Otosphinctes* (*cf.* remarks on the subgenus). *A. ariprepes* falls in *Kranaosphinctes* with its whorl section, coiling of whorls, final size of adults, ribbing, and shell ornamentation stages through ontogeny. Hence, Głowniak (2002) merged *Arisphinctes* in *Kranaosphinctes*. She (*op. cit.*) attributed to the new subgenus only those species of the large group of *Arisphinctes* which were 'intermediate between the two subgenera' (*quot.* Arkell 1939, p. 60). She re-classified some other species as *Liosphinctes* (e.g. *L. plicatilis*, *L. laevipickeringius*) or *Sequeirosia* (*S. trifidus* incl. *S. helenae* as a junior synonym).

Perisphinctes (*Kranaosphinctes*) *cf. kranaus*
(Buckman, 1921)

Figs 30-31, Tab. 15.

1891. *Perisphinctes cf. martelli* (Oppel, 1863); Siemiradzki, p. 38 (*pars*, A/I/2/175 only). Without synonymy.

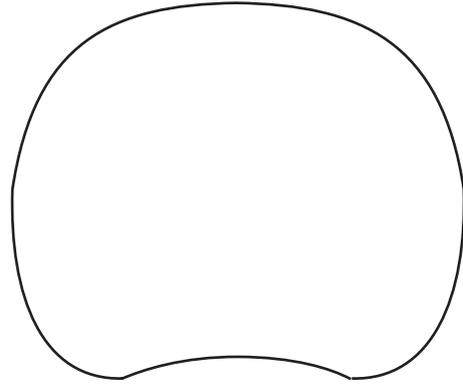


Fig. 30. The whorl section of *Perisphinctes* (*Kranaosphinctes*) *cf. kranaus* (Buckman, 1921): A/I/2/175, at $D=ca.$ 270 mm. Natural size.

1891. *Perisphinctes promiscuus* Bukowski, 1887; Siemiradzki, p. 67 (*pars*, A/I/2/258 only). Without synonymy.

1921. *Kranaosphinctes kranaus* sp. nov.; Buckman, pl. 243 a-b (lectotype).

1939. *Perisphinctes* (*Kranaosphinctes*) *kranaus* (Buckman, 1921); Arkell, p. 174, *pars*, text-fig. 61, pl. 38:1 a-d (lectotype) only. With synonymy.

1989. *Kranaosphinctes kranaus* Buckman, 1921; Meléndez, p. 214, text-fig. 43, pl. 21: 1 a-b.

2002. *Perisphinctes* (*Kranaosphinctes*) *kranaus* (Buckman, 1921); Głowniak, p. 342, text-figs 17, 21; pl. 4:3, pl. 5:1-2, pl. 6:4. With synonymy.

MATERIAL: A/I/2/175 [M]; A/I/2/258 [M].

LOCALITY: Kobylany.

DESCRIPTION: These specimens are immature macroconchs, complete or incomplete. A/I/2/175 (Fig. 31) is a wholly septate fragment of fossil. A/I/2/258 is septate to $D_r=80$ mm (Tab. 15) and the outer whorl is a body chamber. The specimen has $D_m=137$ mm. The whorl section of the late phragmocone is subrectangular (*cf.* A/I/2/175, Fig. 30), with somewhat convex whorl sides and ventral area. The whorl thickness is 1.2 greater than height. The whorl section of the body chamber is subsquare in A/I/2/258. The coiling of the whorls

No of specimen	D_m	D_r	D	u	h	$D:r$
A/I/2/258	137	80	111 137	0.51 0.53	0.28 0.24	137:45 -

Tab. 15. *Perisphinctes* (*Kranaosphinctes*) *cf. kranaus* (Buckman, 1921).



Fig. 31. *Perisphinctes (Kranaosphinctes) cf. kranaus* (Buckman, 1921): A/1/2/175. Kobylany. Specimen is wholly septate. Natural size.

is evolute. The ratio of umbilical diameter against shell diameter (w) is *ca.* 0.46 (Tab. 15). The primary ribs are moderately thick to thick, bifurcating. The secondary ribs are low and blunt. They are occasionally associated with intercalatory ribs in A/1/2/258. The intercalatories appear irregularly, every 2-3 pairs of the secondary ribs. This mode of appearance of the intercalatories belongs to type Ia of ornamentation as distinguished by Główniak (2002, p. 336).

STRATIGRAPHICAL POSITION: The species first appears in Poland in the topmost part of the Ouatius Subzone, ranges up to the overlying Arkelli Subzone of the Plicatilis Zone, and disappears in its upper part (*cf.* Główniak 2002).

Subgenus *Perisphinctes* Waagen, 1869

TYPE SPECIES: *Ammonites variocostatus* (Buckland, 1836) [M] [second designation]. Lectotype figured by Buckland (1836, pl. 42:7), Healey (1904, pl. 11), and then by Arkell *et al.* (1957, fig. 408: 9 a-b).

Perisphinctes (Perisphinctes) vajdelota
Siemiradzki, 1891
Figs 32-33, Tab. 16.

?1885. *Perisphinctes chloroolithicus* (Gümbel, 1865); Nikitin, p. 127, pl. 4: 15.
1891. *Perisphinctes vajdelota* sp. nov.;



Fig. 32. *Perisphinctes (Perisphinctes) vajdelota* Siemiradzki, 1891: 1-2: A/I/2/15 [M] (lectotype); the lateral view (1) and the view of the ventral side (2). Brodła. Wholly septate inner whorls. Natural size.

Siemiradzki, p. 37, *pars*, pl. 1: 7 (lectotype) only.

DERIVATION OF NAME: '*Wajdelota*' is the Polish word for a bard dating back to the times of pre-Christian Lithuania.

FORMER SYNTYPES: A/I/2/15, A/I/2/16, A/I/2/17a, A/I/2/17b, A/I/2/18, A/I/2/19, A/I/2/350a, A/I/2/350 b.

LECTOTYPE: The specimen A/I/2/15 [M] of *Perisphinctes vajdelota* figured by Siemiradzki (1891, pl. 1: 7) is designated now lectotype. It is

kept at the Museum of ING PAN in Kraków, and is illustrated here in Fig. 32: 1-2.

TYPE LOCALITY: Brodła.

COLLECTOR: No data provided.

PARALECTOTYPES: All of them belong to different species, or genus and species, and they are described in the respective sections of this paper. They are as follows: Macroconchs: A/I/2/19 [*Perisphinctes (Perisphinctes)* sp. A], A/I/2/350a [*Perisphinctes (Perisphinctes)* sp. B], A/I/2/16

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/1/2/15	c. 140	wholly septate	75 c. 140	0.37 c. 0.43	0.36 c. 0.29	36:50 –	76:38* –	c. 140:40* –

Tab. 16. *Perisphinctes (Perisphinctes) vajdelota* Siemiradzki, 1891. An asterisk (*) indicates that, due to the incompleteness of the specimen, the number of ribs has been counted per half of whorl at a given diameter (D).

[late phragmocone of *Neumannia cf. cyrilli*]. Microconch: A/1/2/350b [a fragment of microconch assigned to *Subdiscosphinctes cf. mindowe* (Siemiradzki, 1891)]. In addition there are the following wholly septate inner whorls whose assignation to the species is uncertain: A/1/2/17a [*Subdiscosphinctes* ? sp.], A/1/2/17b [*Perisphinctes* sp.], A/1/2/18 [*Perisphinctes (Dichotomosphinctes)* sp.]. They are not described in detail in this paper.

DATA ON THE LABELS ACCOMPANYING THE PARALECTOTYPES: Localities: Rudno (?): A/1/2/16; Grojec: A/1/2/18; Trzebinia: A/1/2/19; Okleśna: A/1/2/17a, A/1/2/17b; a hill between Mirów and Okleśna: A/1/2/350a, A/1/2/350b. Collectors: No data.

DIAGNOSIS: Macroconchs. Coiling of whorls weakly involute, changing with growth to moderately evolute; whorl section of the phragmocone flat-sided with rounded ventral margins. Ribs thin, sharp, bifurcating.

DESCRIPTION: The lectotype A/1/2/15 (Fig. 32: 1-2) is an incomplete phragmocone of a macroconch which has $D_m = ca. 140$ mm (Tab. 16). The specimen is partly distorted. The whorl section of the outer whorl is flat-sided, with whorl sides slightly convergent and with rounded ventral margins (Fig. 33).

The coiling of the whorls is weakly involute on the middle phragmocone, and then it becomes moderately evolute. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are *ca.* 1/3 each, at $D = 75$ mm (Tab. 16).

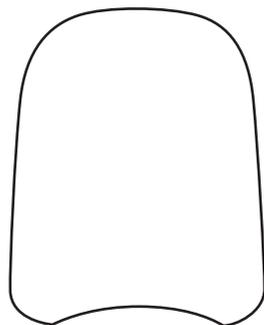


Fig. 33. The whorl section of *Perisphinctes (Perisphinctes) vajdelota* Siemiradzki, 1891: A/1/2/15, at $D = 107$ mm. Natural size.

The ribs are thin, sharp, densely spaced, and somewhat S-shaped on the whorl sides of the early/middle phragmocone. On the late phragmocone they become somewhat thicker and more distantly spaced. Ribs bifurcate. The division point is situated at *ca.* 4/5 of the whorl height. Simple ribs occur occasionally. The ribs on the venter sweep forward gently. They are as distinct as the primaries. Constrictions number 3 on the outer whorl.

REMARKS: The weakly involute coiling of the whorls changing with growth to moderately evolute differentiates *P. (P.) vajdelota* from any other species of *Perisphinctes* s. str., *P. (P.) vajdelota* possesses a similar number of ribs per whorl to *Perisphinctes (Perisphinctes) pumilus* Enay and *Perisphinctes (Dichotomosphinctes) elisabethae*, however, more involute coiling of the whorls differentiates it from these two species. From *Perisphinctes (Dichotomoceras) bifurcatoides* Enay, it differs in its subrectangular whorl section, in the rib number per whorl which increases rapidly in the range of small and medium diameters, and in lack of forward sweeping of the ribs on the venter. From any of the species of the genus *Subdiscosphinctes* Malinowska, *P. (P.) vajdelota* differs in the more evolute coiling of the whorls, subrectangular whorl section, in sharp ribs on the whorl side (in the genus *Subdiscosphinctes* they usually become blurred on the upper half of the whorl side), and in the lesser rib number per whorl.

STRATIGRAPHICAL POSITION: The type horizon of *P. (P.) vajdelota* is supposed to be in the upper part of the Transversarium Zone or in the Bifurcatus Zone (probably its lower or middle part). This is indicated by the matrix of the lectotype, a white limestone, which suggests that the specimen derives from the upper part of the bedded limestones in Brodła. The author [E.G.] collected a single specimen of this species in the Zawodzie Quarry near Częstochowa, from the Elisabethae Subzone of the Transversarium Zone. More accurate determination of the stratigraphical range of the species would require additional material and further study.

Perisphinctes (Perisphinctes) pumilus Enay,
1966 ?
Fig. 34: 2.

1891. *Perisphinctes promiscuus* Bukowski, 1887;
Siemiradzki, p. 67 (*pars*, A/I/2/242 only).

Without synonymy.
1966. *Perisphinctes (Perisphinctes) pumilus* sp.
nov.; Enay, p. 350, pl. 3: 1-2; pl. 4: 1, 3;
text-figs 94, 96, 97. With synonymy.

MATERIAL: A/I/2/242 [M].



Fig. 34. 1: *Perisphinctes (Perisphinctes)* sp. aut *martelli* (Oppel, 1863) aut *pumilus* Enay, 1966: A/I/2/173. Rudno. 2: *Perisphinctes (Perisphinctes) pumilus* Enay, 1966 ? : A/I/2/242. Liguniowa Góra. Reduced x0.9.

LOCALITY: Liguniowa Góra.

DESCRIPTION: A/I/2/242 (Fig. 34: 2) is a fragment of the body chamber of an adult macroconch. It is a quarter of a whorl long. The full shell diameter was approximately 250 mm. The ribs on the body chamber are moderately thick, with rounded ridges. They become somewhat wider at the ventral margin which provides them a triangular shape.

REMARKS: The moderate shell size and moderately thick ribs of somewhat triangular outline suggest that A/I/2/242 belongs to the species *Perisphinctes (Perisphinctes) pumilus* Enay, 1966.

STRATIGRAPHICAL POSITION: The holotype of *P. (P.) pumilus* originates from the *Couches à spongiaires* of Evosges (Ain, France), from the Transversarium Zone in the Middle Oxfordian (Enay 1966). In Poland, the species ranges in the Elisabethae Subzone of the Transversarium Zone.

Perisphinctes (Perisphinctes) sp. aut martelli
(Oppel, 1863) aut *pumilus* Enay, 1966
Fig. 34: 1.

1863. *Ammonites martelli* sp. nov.; Oppel, p. 247.

1966. *Perisphinctes (Perisphinctes) martelli* (Oppel, 1863); Enay, p. 372, pl. 10: 1-2 (lectotype), 3; text-figs 103-106. With synonymy.

1891. *Perisphinctes cf. martelli* (Oppel, 1863); Siemiradzki, p. 38 (*pars*, A/I/2/173 only). Without synonymy.

MATERIAL: A/I/2/173 [M].

LOCALITY: Rudno.

DESCRIPTION: A/I/2/173 (Fig. 34: 1) is a fragment of the body chamber of an adult macroconch. The full shell diameter was approximately 250 mm. The ribs on the body chamber are massive, with gently rounded edges, and triangular.

REMARKS: The estimated full shell diameter of the specimen is comparable to that one of either of the species *Perisphinctes (Perisphinctes) martelli* (Oppel) or *Perisphinctes (Perisphinctes) pumilus* Enay. Precise assignation of A/I/2/173 to either of these species would be, however,

doubtful due to the incompleteness of the specimen.

STRATIGRAPHICAL POSITION: The type horizon of *Perisphinctes (Perisphinctes) martelli* (Oppel, 1863) is probably situated in the *Couches à spongiaires* in Haute Marne (France), but the precise locality is unknown (*cf.* Enay 1966). In Switzerland, *Perisphinctes (Perisphinctes) cf. martelli* was found in the Birmensdorf Member of the Transversarium Zone in Herznach (Gygi 2001). The holotype of *P. (P.) pumilus* originates from the *Couches à spongiaires* of Evosges (Ain, France), from the Transversarium Zone in the Middle Oxfordian (Enay 1966). In Poland, the species ranges in the Elisabethae Subzone of the Transversarium Zone.

Perisphinctes (Perisphinctes) sp. A
Fig. 35, Tab. 17.

1891. *Perisphinctes vajdelota* sp. nov.; Siemiradzki, p. 37 (*pars*, A/I/2/19 only).

MATERIAL: A/I/2/19 [M] [former syntype of *Perisphinctes vajdelota* Siemiradzki, 1891, *cf.* respective description].

LOCALITY: Trzebinia.

DESCRIPTION: A/I/2/19 (Fig. 35) is an immature macroconch. Only the cast of the phragmocone exists. The existing fragment of the body chamber is half of a whorl long. The specimen is septate to $D_r=160$ mm and has $D_m=210$ mm (Tab. 17). The whorl section is subrectangular but changes to subsquare in the terminal part of the outer whorl. The coiling of the whorls is evolute. The ratio h_u is 1/2 at $D=210$ mm. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter is *ca.* 1/2 and 1/4, respectively (Tab. 17). Ribs bifurcate. The division point is sharp and distinct. It is situated high on the whorl side, near the ventral margin. The secondary ribs are as distinct as the primaries. Intercalatory ribs appear only on the terminal fragment of the body chamber.

No of specimen	D_m	D_r	D	u	h	$D:r$
A/I/2/19	210	160	210	0.52	0.26	–

Tab. 17. *Perisphinctes (Perisphinctes) sp. A*.



Fig. 35. *Perisphinctes* (*Perisphinctes*) sp. A: A/1/2/19. Trzebinia. Arrow indicates the end of the phragmocone. Natural size.

REMARKS: The former syntype of *P. vajdelota* A/I/2/19, in its evolute coiling of whorls and subsquare to subrectangular whorl section, differs significantly from the lectotype of the species. It belongs to *Perisphinctes* s. str., but its identity at the species level cannot be determined exactly due to the incompleteness and immaturity of the specimen.

STRATIGRAPHICAL POSITION: *Perisphinctes* s. str. ranges throughout the Transversarium (Middle Oxfordian) and Bifurcatus zones (Upper Oxfordian) according to Głowniak (2006a).

Perisphinctes (Perisphinctes) sp. B
Fig. 36.

1891. *Perisphinctes vajdelota* sp. nov.; Siemiradzki, p. 37 (*pars*, A/I/2/350a only).

MATERIAL: A/I/2/350a [M] [former syntype

of *Perisphinctes vajdelota*, cf. respective description].

LOCALITY: A hill between Mirów and Okleśna in accordance with the note inscribed on the label accompanying the specimen.

COLLECTOR: Dr. Stanisław Zaręczny.

DESCRIPTION: A/I/2/350a (Fig. 36) is a fragment of a gerontic macroconch, *i.e.* the terminal portion of its body chamber. The peristome is surrounded by a swollen oblique rib. The ribs are approximated. They are massive and triangular.

REMARKS: Due to the incompleteness of A/I/2/350a, any accurate attribution to the species is not possible. Thick gerontic ribs similar to those which occur in the specimen are common in many species of *Perisphinctes* s. str.

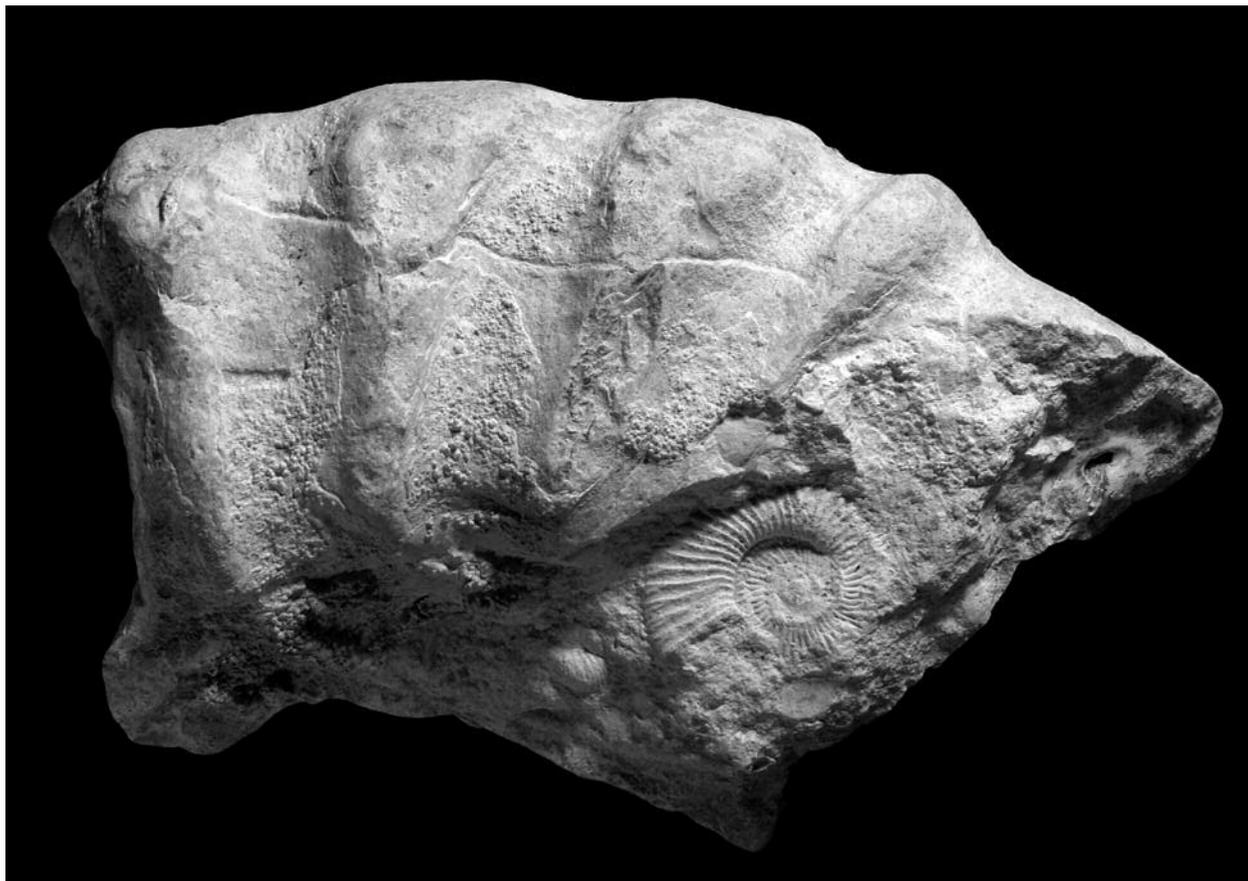


Fig. 36. *Perisphinctes (Perisphinctes)* sp. B.: A/I/2/350a. A hill between Mirów and Okleśna. Reduced x0.95.

Subgenus *Otosphinctes*
Buckman, 1926

TYPE SPECIES: *Otosphinctes ouatius* Buckman, 1926 [m]. Lectotype figured by Buckman (1926, pl. 649: 1, 2) and Arkell (1938, pl. 17: 5 a-g).

REMARKS: *Otosphinctes* as comprehended in this paper comprises the microconch partner of the subgenus *Karansphinctes* [incl. *Arisphinctes*] and is limited to the Plicatilis Zone of the Middle Oxfordian. Higher up it disappears giving rise to the subgenus *Dichotomosphinctes* diagnostic of the overlying Transversarium Zone (Głowniak 2002). Arkell *et al.* (1957) merged *Otosphinctes* in *Dichotomosphinctes*. However, the different stratigraphical levels in which the two subgenera range, and the different macroconch counterparts with which they co-occur in their horizons (*Dichotomosphinctes* with *Perisphinctes* s. str.), justify the classification of them as separate subgenera.

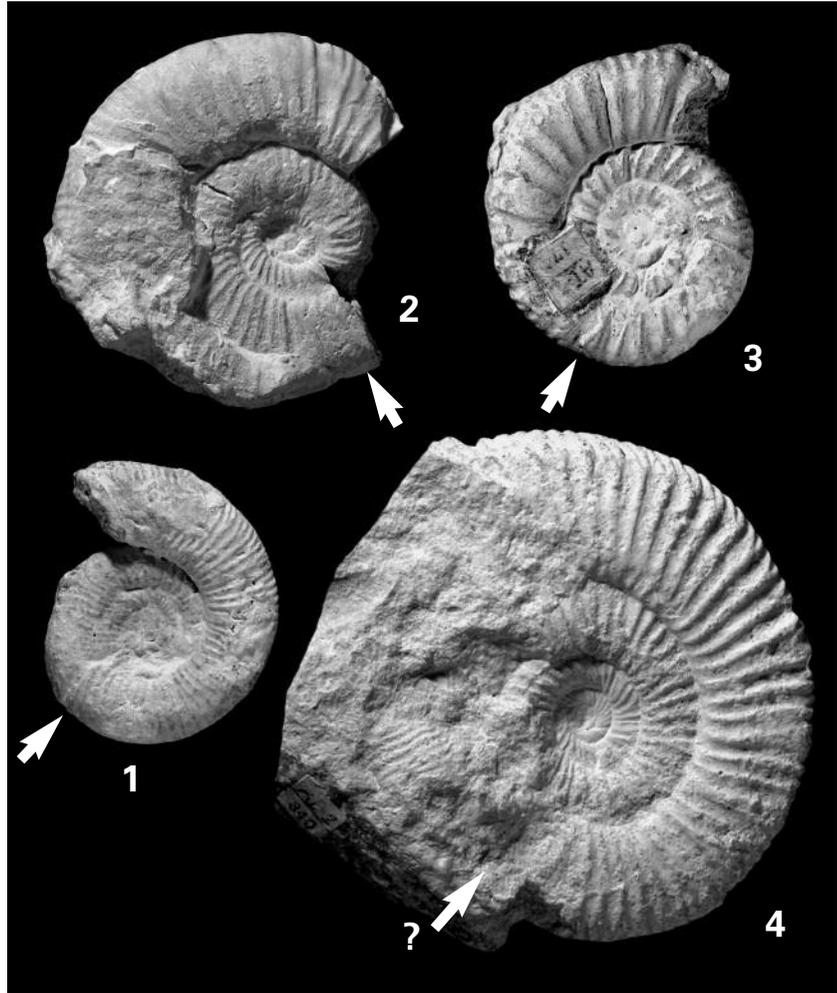


Fig. 37. *Perisphinctes* (*Otosphinctes*) *paturattensis* de Loriol, 1901 ('paturattensis morphotype'): 1: A/I/2/211, Wodna. *Perisphinctes* (*Otosphinctes*) *ouatius ouatoides* Głowniak, 2002: 2: A/I/2/137a, Kozłowiec near Tenczynek. *Perisphinctes* (*Otosphinctes*) *ouatius ouatius* (Buckman, 1926): 3: A/I/2/174 ('ouatius morphotype'), Mirów; 4: A/I/2/340 ('magnouatius morphotype'), Wodna. Arrows indicate the end of the phragmocones. Natural size.

Perisphinctes (*Otosphinctes*) *paturattensis* de
Loriol, 1901

Figs 37: 1; 38; Tab. 18.

1891. *Perisphinctes birmensdorfensis* (Moesch, 1867); Siemiradzki, p. 54 (*pars*, A/I/2/211, A/I/2/212 only). Without synonymy.

1901. *Perisphinctes paturattensis* sp. n.; de Loriol, p. 23-24, pl. 2: 2-6; pl.: 4 (lectotype).

1966. *Perisphinctes* (*Otosphinctes*) *paturattensis* de Loriol; Enay, pp. 432, 447-449, text-figs 123 (3-9), 133; pl. 25: 3 (lectotype).

1998. *Perisphinctes* (*Otosphinctes*) *paturattensis* de Loriol; Gygi, p. 24, pl. 8: 2-3, pl. 10: 3, pl. 11: 3, pl. 12: 2-3; pl. 13: 2-3; text-fig. 19, tab. 16.

2002. *Perisphinctes* (*Otosphinctes*) *paturattensis*

de Loriol, 1901; Głowniak, p. 326, pl. 1: 3-5, pl. 3: 1; text-figs 5, 12-13. With synonymy.

MATERIAL: A/I/2/211 [m] and A/I/2/212 [m].

LOCALITY: Wodna: A/I/2/211; Kozłowiec: A/I/2/212.

COLLECTOR: The specimen A/I/2/212 was presumably collected by Stanisław Zaręczny. No data on the other specimen.

No of specimen	D_m	D_r	D	u	h	$D:r$
A/I/2/211	37	24	37	0.41	0.32	–
A/I/2/212	40	–	40	0.38	0.33	40:48

Tab. 18. *Perisphinctes* (*Otosphinctes*) *paturattensis* de Loriol, 1901.



Fig. 38. The whorl section of *Perisphinctes* (*Otosphinctes*) *paturattensis* de Loriol, 1901 ('paturattensis morphotype'): A/I/2/211, at $D=37$ mm. Natural size.

DESCRIPTION: A/I/2/211 (Fig. 37: 1) and A/I/2/212 are mature microconchs, with D_m 37 mm and 40 mm, respectively (Tab. 18). A/I/2/211 has the body chamber showing a terminal constriction. It is septate to $D_r=24$ mm (Tab. 18). The body chamber is 5/8 of a whorl long. A/I/2/212 is crushed flat and the septa are not discernible.

The whorl section of the body chamber is subcircular (Fig. 38). The coiling of the whorls is evolute on the phragmocone and weakly involute on the body chamber. The ratios of umbilical diameter (u) and whorl height (h) are ca. 2/5 and 1/3, respectively (Tab. 18). The ribs are thin, bifurcating. They are slightly prorsiradiate on the whorl sides of the phragmocone and retriradiate on the body chamber. The secondary ribs pass across the venter straight (A/I/2/211) or with a slight backwards inflexion (A/I/2/212). The parabolic nodes appear in the terminal fragment of the phragmocone and at the beginning of the body chamber. They number 3 in A/I/2/211.

REMARKS: The specimens of *Perisphinctes* (*Otosphinctes*) *paturattensis* de Loriol, 1901 studied belong to the 'paturattensis morphotype' as distinguished by Główniak (2002) (cf. remarks in the 'General explanation of the system of taxonomy used').

STRATIGRAPHICAL POSITION: *Perisphinctes* (*Otosphinctes*) *paturattensis* first occurs in the Cordatum Subzone of the Cordatum Zone in the Lower Oxfordian (cf. Gygi 1998). It ranges higher throughout the Paturattensis Subzone of the Plicatilis Zone in the Middle Oxfordian and disappears at the top of this Subzone (cf. Główniak 2002).

Perisphinctes (*Otosphinctes*) *ouatius ouatius*
(Buckman, 1926)

Figs 37: 3-4; 39; Tab. 19.

1891. *Perisphinctes plicatilis* (Sowerby, 1818); Siemiradzki, p. 34 (*pars*, A/I/2/153 only). Without synonymy.

1891. *Perisphinctes* cf. *martelli* (Oppel, 1863); Siemiradzki, p. 38 (*pars*, A/I/2/174). Without synonymy.

1891. *Perisphinctes promiscuus* Bukowski, 1887; Siemiradzki, p. 67 (*pars*, A/I/2/254 only). Without synonymy.

1926. *Otosphinctes ouatius* sp. nov.; Buckman, pl. 649: 1-2 (lectotype).

1938. *Perisphinctes* (*Dichotomosphinctes*) *ouatius* (Buckman); Arkell, p. 93, pl. 17: 5 a-g (lectotype), pl. 17: 6; ? pl. 17: 1-2, 10.

2002. *Perisphinctes* (*Otosphinctes*) *ouatius ouatius* (Buckman, 1926); Główniak, p. 329, pl. 5: 3, pl. 6: 2-3, pl. 9: 1-2; text-figs 5, 12, 14. With synonymy.

MATERIAL: Microconchs: A/I/2/174 (Fig. 37: 3) of the 'ouatius morphotype', and A/I/2/153, A/I/2/254, A/I/2/340 (Fig. 37: 4) of the 'magnouatius

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/153	70	52	25 70	0.44 0.47	0.28 0.29	40:39 –	– –	– –
A/I/2/174	41	29	30 41	0.50 0.49	0.27 0.29	25:24 –	30:27 –	41:30 –
A/I/2/254	66	45	45 66	0.51 0.52	0.29 0.27	14:25 20:30	30:35 45:39	60:43 66:50
A/I/2/340	66	?40-50	66	0.45	0.27	22:30	35:38	–

Tab. 19. *Perisphinctes* (*Otosphinctes*) *ouatius ouatius* (Buckman, 1926).

morphotype' as distinguished by Główniak (2002). LOCALITY: Dąbrowa: A/I/2/153; Mirów: A/I/2/174; Brodła: A/I/2/254; Wodna: A/I/2/340.

DESCRIPTION: These are mature microconchs, complete or incomplete, ranging in D_m from 41 mm to 70 mm (Tab. 19). A/I/2/174 (Fig. 37: 3) and A/I/2/254 have body chambers which are 3/4 of a whorl long and show a terminal constriction or approximation of the last few ribs. The existing fragments of body chambers of the other specimens are 1/4 to 1/2 of a whorl long. A/I/2/340 (Fig. 37: 4) has partly distorted outer whorl. The whole specimen A/I/2/153 is crushed flat. The whorl section is rounded on the phragmocone and subsquare on the body chamber (Fig. 39).

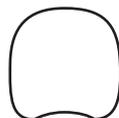


Fig. 39. The whorl section of *Perisphinctes* (*Otosphinctes*) *ouatius ouatius* (Buckman, 1926): A/I/2/254, at $D=55$ mm. Natural size.

The coiling of the whorls is moderately evolute. The ratio of whorl height against umbilical diameter (h_u) ranges from 1/2 to 3/5 on the outer whorl. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are *ca.* 1/2 and 1/3, respectively (Tab. 19). The ribs are moderately thick, bifurcating. They are prorsiradiate on the whorl sides of the phragmocone and retroradiate on the body chamber. They are slightly inflexed backwards on the upper half of the whorl height in A/I/2/153 and A/I/2/340 only. The secondary ribs are less distinct than the primaries. They pass across the venter with a gentle backwards inflexion. The specimens vary in the rib number per whorl at equivalent diameters. There are 24 to 30 ribs per whorl at *ca.* 25 mm diameter, and 30 to 50 per whorl in the range of diameters from between 41 and 65 mm (Tab. 19).

The parabolic nodes appear on the body chamber; they vary in number from 1 to 4. Zigzag ribs are present as well. Every zigzag rib ends as a free-ending intercalatory rib which occasionally approximates the primary rib near the division point, giving an impression of trifurcation. The true trifurcations, however, do not occur in the species. Constrictions number 1-2 per whorl.

REMARKS: The chronosubspecies *Perisphinctes (Otosphinctes) ouatius ouatius* consists of two morphotypes as distinguished by Głowniak (2002) (*cf.* also 'General explanation of the system of taxonomy being used' in this paper): the 'ouatius morphotype', to which belongs the specimen A/I/2/174 previously described, and the 'magnouatius morphotype', to which belong the specimens A/I/2/153, A/I/2/254, A/I/2/340.

STRATIGRAPHICAL POSITION: In Poland, the chronosubspecies *Perisphinctes (Otosphinctes) ouatius ouatius* ranges through the *Perisphinctes (Otosphinctes) arkelli arkelli* biohorizon in the Arkelli Subzone (Plicatilis Zone, Middle Oxfordian), and it is there represented by the 'ouatius' and 'magnouatius' morphotypes (*cf.* Głowniak 2002, 2006c).

Perisphinctes (Otosphinctes) ouatius ouatoides
Głowniak, 2002
Fig. 37: 2; Tab. 20.

1891. *Perisphinctes claromontanus* Bukowski, 1887; Siemiradzki, p. 31 (*pars*, A/I/2/137a

only). Without synonymy.

2002. *Perisphinctes (Otosphinctes) ouatius ouatoides* chronossp. nov.; Głowniak, p. 331, pl. 4: 1 (holotype), pl. 4: 2, pl. 6: 1, pl. 7: 3; text-figs 5, 12, 15. With synonymy.

MATERIAL: A/I/2/137a [m].

LOCALITY: Kozłowiec.

COLLECTOR: Dr. Stanisław Zaręczny (?).

No of specimen	D_m	D_r	D	u	h	$D:r$
A/I/2/137a	c. 49	33	45	0.42	0.33	–

Tab. 20. *Perisphinctes (Otosphinctes) ouatius ouatoides* Głowniak, 2002.

DESCRIPTION: A/I/2/137a (Fig. 37: 2) is a mature microconch which retains a quarter of a whorl of body chamber and shows a terminal constriction. The transition between the phragmocone and the body chamber is somewhere in the middle of the outer whorl, but this fragment of a whorl is broken away and missing. The specimen has $D_m = ca.$ 49 mm (Tab. 20). The whorl section of the body chamber is subsquare. The coiling of the whorls is weakly involute. The ratios of umbilical diameter (u) and whorl height (h) are *ca.* 2/5 and 1/3, respectively (Tab. 20). The ribs are moderately thin, bifurcating. Oblique ribs commonly occur on the whorl side of the phragmocone. There is 1 parabolic node on the body chamber. Constrictions number 1-2 per whorl.

STRATIGRAPHICAL POSITION: The chronosubspecies *Perisphinctes (Otosphinctes) ouatius ouatoides* Głowniak ranges throughout the Ouatius Subzone of the Plicatilis Zone (Middle Oxfordian) (*cf.* Głowniak 2002).

Perisphinctes (Otosphinctes) sp.
Tab. 21.

1891. *Perisphinctes claromontanus* Bukowski, 1887; Siemiradzki, p. 31 (*pars*, A/I/2/137b, A/I/2/138 only). Without synonymy.

MATERIAL: A/I/2/137b [m], A/I/2/138 [m].

LOCALITY: Kozłowiec: A/I/2/137b; Mirów: A/I/2/138.

No of specimen	D_m	D_r	D	u	h	$D:r$	
A/I/2/137b	30	wholly septate	–	–	–	–	–
A/I/2/138	28	12	28 17	0.39 0.42	0.36 0.36	–	–

Tab. 21. *Perisphinctes* (*Otosphinctes*) sp.

COLLECTOR: The specimen A/I/3/137b was presumably collected by Stanisław Zaręczny. No data on the other specimen.

DESCRIPTION: The microconchs have $D_m = ca.$ 30 mm (Tab. 21). A/I/2/138 has a fragment of the body chamber which is 3/4 of a whorl long. The whorl section is subsquare, with rounded margins. The coiling of the whorls is weakly involute. The ribs are moderately coarse, bifurcating. Parabolic nodes on the body chamber number 5. Constrictions number 1-3 per whorl on the phragmocone in A/I/2/138. A/I/2/137b is a phragmocone, subcircular in cross section, with evolute coiling of the whorls, and thin bifurcating ribs.

Subgenus *Dichotomosphinctes* Buckman, 1926

TYPE SPECIES: *Perisphinctes antecessens* Salfeld, 1914 [m]. Lectotype figured by Salfeld (1914, pl. 12: 3), and then by Buckman (1926, pl. 650), Arkell (1935, pl. 12:3) and Arkell *et al.* (1957, fig. 480: 4 a-b).

REMARKS: *Dichotomosphinctes* and *Otosphinctes* are treated here as single subgenera

No of specimen	D_m	D_r	D	u	h	$D:r$	
A/I/2/20	56	wholly septate	–	–	–	14:35 54:43	30:38 –
A/I/2/142	94	70	34 94	0.47 0.48	0.29 0.29	–	–
A/I/2/179	c. 75	56	45	0.40	0.33	43:46	78:50
A/I/2/180	66	62	62	0.48	0.27	–	–
A/I/2/183	95	wholly septate	60 95	0.50 0.49	0.32 0.28	45:45 75:48	62:45 95:54
A/I/2/184	78	c. 45	70	0.51	0.23	–	–
A/I/2/186	102	80	102	0.50	0.28	–	–
A/I/2/252	46	34	45	0.49	0.29	25:25	45:34
A/I/2/260	40	wholly septate	40	0.55	0.25	25:28	40:33

Tab. 22. *Perisphinctes* (*Dichotomosphinctes*) cf. *antecessens* Salfeld, 1914.

and thus contra Arkell *et al.* (1957) (cf. Remarks on *Otosphinctes*).

Perisphinctes (*Dichotomosphinctes*) cf. *antecessens* Salfeld, 1914

Fig. 40, Tab. 22.

1891. *Perisphinctes* cf. *martelli* (Oppel, 1863); Siemiradzki, p. 38, pl. 1: 8.

1891. *Perisphinctes plicatilis* (Sowerby, 1818); Siemiradzki, p. 34 (*pars*, A/I/2/147 only).

1891. *Perisphinctes bocconi* Gemmellaro, 1871; Siemiradzki, p. 39 (*pars*; A/I/2/179, A/I/2/180, A/I/2/183, A/I/2/184 and A/I/2/186 only). Without synonymy.

1891. *Perisphinctes promiscuus* Bukowski, 1887; Siemiradzki, p. 67 (*pars*; A/I/2/252, A/I/2/259 and A/I/2/260 a-b only). Without synonymy.

1914. *Perisphinctes* cf. *Wartae* Bukowski *mutatio antecessens*; Salfeld, p. 239-242, pl. 12: 3 (lectotype).

1966. *Perisphinctes* (*Dichotomosphinctes*) *antecessens* Salfeld; Enay, p. 470-478; text-figs 138-3, 138-4, 139-143; pl. 28: 1-4.

1989. *Perisphinctes* (*Dichotomosphinctes*) *antecessens* Salfeld; Fischer, Gygi; fig. 5-D.

2000. *Perisphinctes* (*Perisphinctes*) aff. *antecessens* [m] Salfeld; Wright, Kelly, Page; text-fig. 8 C.

MATERIAL: Microconchs: A/I/2/20 (Fig. 40: 2), A/I/2/142, A/I/2/147, A/I/2/179, A/I/2/180, A/I/2/183 (Fig. 40: 1), A/I/2/184, A/I/2/186, A/I/2/252, A/I/2/259, A/I/2/260 a-b.

LOCALITIES: Brodła: A/I/2/20; Rakówka near Młynka: A/I/2/142; Baczyn: A/I/2/147; Okleśna: A/I/2/179, A/I/2/180, and A/I/2/183; Dąbrowa: A/I/2/184; Grojec: A/I/2/186; Kamień near Tenczynek [presumably Kamyk ?]: A/I/2/252; Kozłowiec: A/I/2/259, A/I/2/260 a-b.

COLLECTOR: Dr. Stanisław Zaręczny collected A/I/2/186 in 1872. No data on the other specimens.

DESCRIPTION: The microconchs range in D_m from 40 mm to 102 mm (Tab. 22). The septation ceases in the range of D_r from 34 mm to 95 mm. A/I/2/186 has a body chamber which is one whorl long.

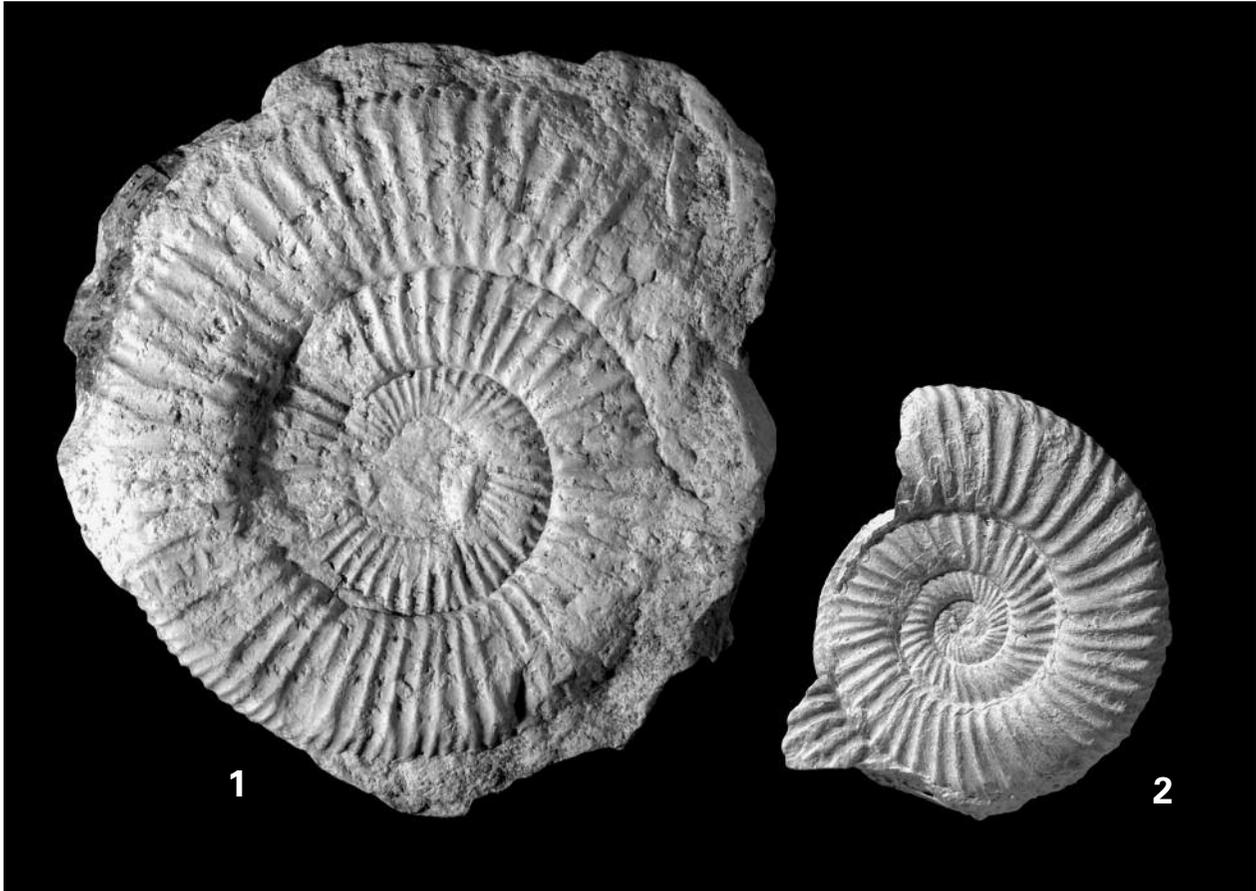


Fig. 40. *Perisphinctes* (*Dichotomosphinctes*) cf. *antecedens* Salfeld, 1914: 1: A/I/2/183, Okleśna; 2: A/I/2/20, Brodła. The two specimens are wholly septate inner whorls. Natural size.

Most other specimens have a fragment of the body chamber. In addition there are three wholly septate inner whorls in the collection (A/I/2/20, A/I/2/183 and A/I/2/260 a-b) and two badly crushed and flattened specimens (A/I/2/147 and A/I/2/259) which are not valid for biometric studies.

Most of the specimens (e.g. A/I/2/20, Fig. 40: 2, and A/I/2/183, Fig. 40: 1) have a subsquare whorl section and moderately evolute coiling of the whorls. The ratio h_u ranges from 0.55 to 0.7. The ratios u and h are ca. 1/2 and 1/4, respectively (Tab. 22).

Less commonly there occur in the specimens (e.g. A/I/2/142 and A/I/2/179) with a subrectangular whorl section, in which the whorl height is but slightly greater than the thickness, and with weakly involute coiling of the whorls. The ratio h_u is ca. 0.85, u slightly exceeds 2/5 and h is nearly 1/3 (cf. u and h in Tab. 22).

The ribs in the specimens studied are moderately thick, bifurcating. The secondary ribs gently sweep forwards. The rib number is

ca. 40 per whorl at $D=40$ mm and ca. 52 per whorl at D from between 90 mm and 120 mm. The specimens which have weakly involute coiling possess 5-6 ribs more at equivalent diameters.

Zigzag ribs occur occasionally e.g. in A/I/2/20 and A/I/2/183. They end freely as intercalatory ribs. Parabolic nodes appear in A/I/2/260a only, and they number 3. Constrictions number 1-2, occasionally 3 per whorl.

REMARKS: The range of variation of the specimens previously described in respect of the whorl section, coiling of whorls and rib number per whorls is comparable to that which occurs in the specimens of *P. (D.) antecedens* collected by the author [E.G.] in the Oxfordian sections of Poland. The range of variation of the Polish specimens allowed Główniak (2006c) to make a distinction between two varieties of the species: the 'robust variety' and the 'moderately slim variety'. The former one closely matches the conventional diagnosis of *P. (D.) antecedens*, whereas the

'moderately slim variety' represents a link to the species *Perisphinctes* (*Dichotomosphinctes*) *buckmani* Arkell, 1938 which predominates in higher stratigraphical levels.

STRATIGRAPHICAL POSITION: The phyletic FO of *Perisphinctes* (*Dichotomosphinctes*) *antecedens* Salfeld, 1914 defines the base of the Buckmani Subzone and the base of the Transversarium Zone in the Middle Oxfordian as proposed by Głowniak (2002). *P. (D.) antecedens* (the 'robust variety' and subordinately the 'moderately slim variety') is diagnostic for the *Perisphinctes* (*Dichotomosphinctes*) *antecedens* biohorizon as distinguished by Głowniak (2006c) in the Buckmani Subzone. The species is known also from the overlying *Perisphinctes* (*Dichotomosphinctes*) *buckmani* biohorizon of the Buckmani Subzone, where the 'moderately slim variety' prevails and the species co-occurs with the true *Perisphinctes* (*Dichotomosphinctes*) *buckmani*. Higher up it disappears.

Perisphinctes (*Dichotomosphinctes*) cf.
buckmani Arkell, 1938
Figs 41-42, Tab. 23.

1891. *Perisphinctes plicatilis* (Sowerby, 1818); Siemiradzki, p. 34, *pars*, pl. 1: 5 (A/I/2/13) and A/I/2/149, A/I/2/152, A/I/2/336 only. Without synonymy.

1891. *Perisphinctes virguloides* Waagen, 1875; Siemiradzki, p. 52, *pars*, pl. 2: 5 (A/I/2/25) only. Without synonymy.

1938. *Perisphinctes* (*Dichotomosphinctes*) *buckmani* Arkell; Arkell, p. 79, text-fig. 19; pl. 14: 1a-b (holotype), pl. 14: 2-4, pl. 17: 3, 13.

1966. *Perisphinctes* (*Dichotomosphinctes*) *buckmani* Arkell; Enay, p. 478, text-figs 140, 144; pl. 28: 5, pl. 29: 1-2.

2001. *Perisphinctes* (*Dichotomosphinctes*) *buckmani* Arkell; Gygi, p. 71, *pars*, figs 104-105, pl. 38 only.

MATERIAL: Microconchs: A/I/2/13 figured by Siemiradzki (1891, pl. 1: 5) and now on Fig. 42: 1; A/I/2/25 figured by Siemiradzki (1891, pl. 2: 5); A/I/2/149, A/I/2/152 (Fig. 42: 2) and A/I/2/336 (Fig. 42: 3).

LOCALITY: Kozłowiec: A/I/2/13, A/I/2/152; Rudno: A/I/2/336; Paczółtowice: A/I/2/149.

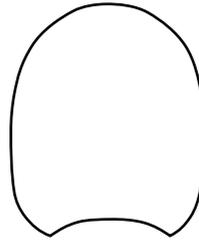


Fig. 41. The whorl section of *Perisphinctes* (*Dichotomosphinctes*) cf. *buckmani* Arkell, 1938: A/I/2/336, at $D=114$ mm. Natural size.

The origin of A/I/2/25 is unknown (cf. Remarks).

COLLECTORS: Dr. Stanisław Zaręczny collected the specimens A/I/2/13, A/I/2/152 and A/I/2/336 in 1872-1884. Dr. Stanisław Olszewski collected the specimen A/I/2/149 in 1877. No data on the other specimens.

DESCRIPTION: These are immature microconchs ranging in D_m from 58 mm to 114 mm (Tab. 23). Two of them are wholly septate inner whorls, and the other three have fragments of the body chambers which are 1/4 to 7/8 of a whorl long.

The whorl section of the specimens is subrectangular with rounded margins (Fig. 41). The coiling of the whorls is moderately evolute, being somewhat more involute on the inner whorls than on the outer one. The ratio h_u is ca. 0.7 on the outer whorl. The ratio of umbilical diameter against shell diameter (u) is usually ca. 2/5, occasionally nearly 1/2; whereas the ratio of whorl height against shell diameter (h) is approximately 1/3 (Tab. 23). The primary ribs are moderately thick. The rib number is ca. 40 per whorl at $D=ca.$ 30 mm, and 54-58 per whorl at $D=60$ mm (Tab. 23). At the diameter bigger than the latter one the rib number increases by 3-4 per whorl only. At $D=112$ mm there are 57 ribs per whorl in A/I/2/336. Constrictions vary in number from 1 to 3 per whorl.

REMARKS: The specimen A/I/2/25 of *P. (D.)*

No of specimen	D_m	D_r	D	u	h	$D:r$	
A/I/2/13	58	wholly septate	58	0.45	0.31	43:36	58:55
A/I/2/25	70	wholly septate	67	0.45	0.31	60:55	70:57
A/I/2/149	91	60	92	0.45	0.33	92:63	—
A/I/2/152	80	50	30 80	0.47 0.46	0.33 0.31	30:42 60:58	45:50 80:62
A/I/2/336	114	82	73 112	0.43 0.49	0.32 0.28	42:50 88:57	64:54 110:57

Tab. 23. *Perisphinctes* (*Dichotomosphinctes*) cf. *buckmani* Arkell, 1938.

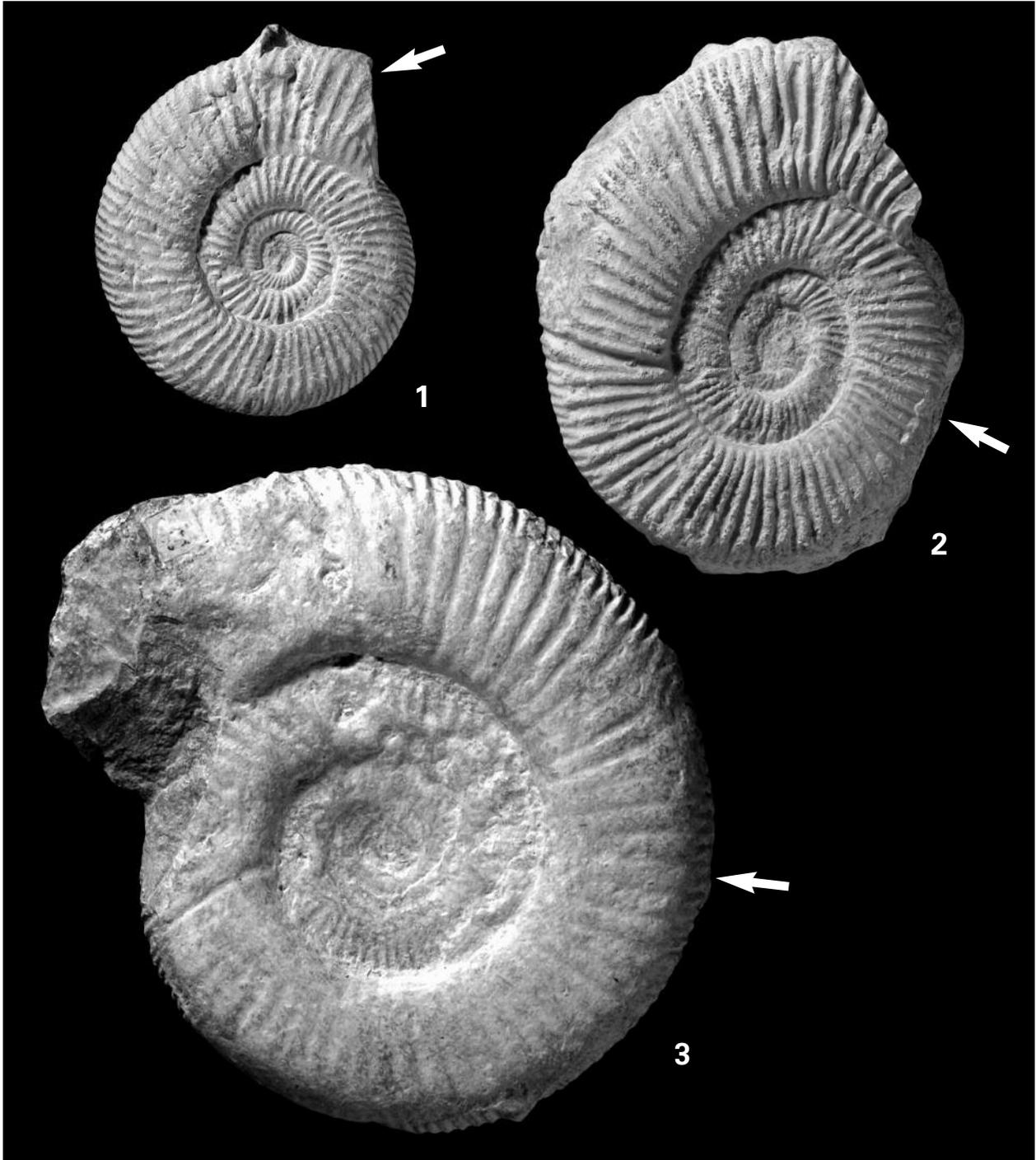


Fig. 42. *Perisphinctes* (*Dichotomosphinctes*) cf. *buckmani* Arkell, 1938: 1: A/I/2/13, Kozłowiec; 2: A/I/2/152, Kozłowiec; 3: A/I/2/336, Rudno. Arrows indicate the end of the phragmocones. Natural size.

cf. *buckmani* Arkell, figured by Siemiradzki (1891, pl. 2: 5) and referred by him to *Perisphinctes virguloïdes* Waagen, does not correspond to the description, drawing and measurements of *P. virguloïdes* provided by Siemiradzki (1891, p. 52). The true specimen of *P. virguloïdes* is lost.

Data provided on the label of the specimen A/I/2/25, e.g. the locality – Podgórze, and the name of the collector Alojzy Alth, both refer to the lost specimen. The origin of A/I/2/25 and the name of the collector are unknown.



Fig. 43. *Perisphinctes* (*Dichotomosphinctes*) cf. *dobrogensis* Simionescu, 1907: 1: A/I/2/140, Kozłowiec; 2: A/I/2/141, Rudno. Arrows indicate the end of the phragmocones. Natural size.

STRATIGRAPHICAL POSITION:

Perisphinctes (Dichotomosphinctes) buckmani Arkell, 1938 is diagnostic of the *Perisphinctes (Dichotomosphinctes) buckmani* biohorizon in the Buckmani Subzone of the Transversarium Zone in the Middle Oxfordian. It ranges up into the overlying *Perisphinctes (Dichotomosphinctes) dobrogensis* biohorizon of the Buckmani Subzone where it is of lesser importance and where it co-occurs with *Perisphinctes dobrogensis* [m, M]. Higher up it disappears.

Perisphinctes (Dichotomosphinctes) cf. dobrogensis Simionescu, 1907
Fig. 43, Tab. 24.

1891. *Perisphinctes plicatilis* (Sowerby, 1818); Siemiradzki, p. 34 (*pars*, A/I/2/139 a-b, A/I/2/140, A/I/2/141, A/I/2/343 only).

1891. *Perisphinctes michalskii* Bukowski, 1887; Siemiradzki, p. 62 (*pars*, A/I/2/232 only). Without synonymy.

1907. *Perisphinctes dobrogensis* sp. nov.; Simionescu, p. 157, pl. 3: 2 (lectotype), pl. 5: 4.

1966. *Perisphinctes (Dichotomosphinctes) dobrogensis* Simionescu, 1907; Enay, p. 481, pl. 29: 3-5, text-figs 140, 145.

1995. *Perisphinctes (Dichotomosphinctes) dobrogensis* Simionescu, 1907; Gygi, p. 34, fig. 14, only.

MATERIAL: Microconchs: A/I/2/139 a-b, A/I/2/140, A/I/2/141, A/I/2/232, A/I/2/343.

LOCALITY: Kozłowiec: A/I/2/139 a-b, A/I/2/140, A/I/2/232, A/I/2/343; Rudno: A/I/2/141.

COLLECTORS: The specimens A/I/2/139 a-b and A/I/2/140 were collected by Dr. Stanisław Zaręczny in the years 1877-1878; A/I/2/141 was collected by Dr. Stanisław Olszewski in 1878. The specimen A/I/2/232 was collected in 1878 but no name of the collector is provided on the label.

DESCRIPTION: Two of the specimens are mature microconchs with body chambers showing terminal constrictions and/or approximation of the last few ribs. These are the following ones: A/I/2/139b and A/I/2/141

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/139b	137	85	137	0.51	0.27	–	–	–
A/I/2/141	130	72	35	0.49	0.29	40:47	50:53	60:61
			70	0.50	0.30	73:67	97:72	100:72
			130	0.52	0.28	130:76	–	–
A/I/2/343	94	53	94	0.45	0.31	44:48	57:50	94:58

Tab. 24. *Perisphinctes (Dichotomosphinctes) cf. dobrogensis* Simionescu, 1907.

(Fig. 43: 2). They septate to D_r 72-85 mm and range in D_m from 130 mm to 137 mm (Tab. 24). A/I/2/343 is an immature microconch with the complete, one whorl long, body chamber. The three other specimens in the group studied, A/I/2/139a, A/I/2/140 and A/I/2/232, are fragments of fossils. They are not valid for biometric studies. A/I/2/140 is a pathological specimen showing abnormal backwards inflexion of ribs on the body chamber.

The whorl section is subrectangular with a rounded ventral margin. The coiling of the whorls is moderately evolute. The ratios u and h are *ca.* 1/2 and 1/3, respectively (Tab. 24). The ribs are moderately thin and rather densely spaced. They bifurcate. The secondary ribs gently sweep forward on the venter. The rib number is *ca.* 47 per whorl at $D=40$ mm; it increases by *ca.* 20 ribs per whorl in the range of diameters from 40 mm to 70 mm and attains 76 per whorl at $D=130$ mm (Tab. 24). Constrictions number 1 per whorl on the phragmocone and 2-3 on the body chamber.

STRATIGRAPHICAL POSITION: The species is diagnostic of the *Perisphinctes (Dichotomosphinctes) dobrogensis* biohorizon in the Buckmani Subzone of the Transversarium Zone in the Middle Oxfordian.

The *Perisphinctes (Dichotomosphinctes) elisabethae* group

The following nominal species: *Perisphinctes (Dichotomosphinctes) elisabethae* de Riaz, *Perisphinctes (Dichotomosphinctes) luciae* de Riaz, *Perisphinctes (Dichotomosphinctes) luciaeformis* Enay and *Perisphinctes (Dichotomosphinctes) crotalinus* Siemiradzki, all of them diagnostic of the Elisabethae Subzone of the Transversarium Zone in the Middle Oxfordian, are referred to in the present

paper as the *P. (D.) elisabethae* group (cf. 'General explanation of the systems of taxonomy being used'). They represent a remarkable range of continuously variable morphology, and grade into each other in single horizons which indicates that they probably belonged to a single biospecies. Their macroconchiate partners are, for example, *Perisphinctes (Perisphinctes) pumilus* Enay and *Perisphinctes (Perisphinctes) andelotensis* Enay, both limited to the Elisabethae Subzone (cf. Głowniak 2006a).

Perisphinctes (Dichotomosphinctes) cf. elisabethae de Riaz, 1898
Figs 44-45, Tab. 25.

1891. *Perisphinctes plicatilis* (Sowerby, 1818); Siemiradzki, p. 34 (*pars*, A/I/2/333, only). Without synonymy.
1891. *Perisphinctes* n. sp. cf. *geron* (Zittel, 1870); Siemiradzki, p. 55 (*pars*, A/I/2/214, only). Without synonymy.
1898. *Perisphinctes elisabethae* sp. nov.; de Riaz, p. 22; pl. 12: 4a-b, pl. 12: 5 (lectotype).

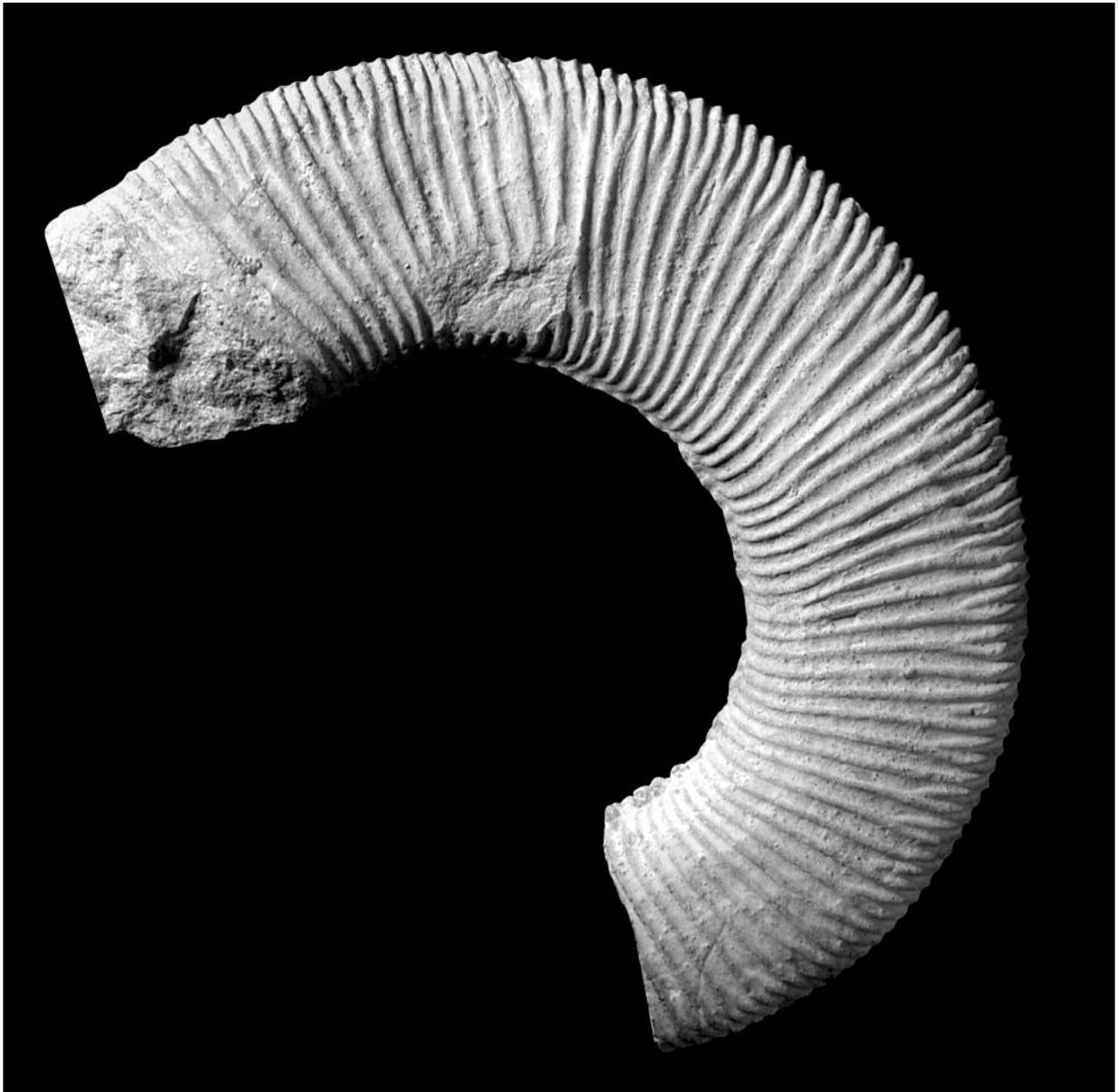


Fig. 44. *Perisphinctes (Dichotomosphinctes) cf. elisabethae* de Riaz, 1898: A/I/2/333. Paczółtowice. Natural size.

1966. *Perisphinctes* (*Dichotomosphinctes*)
elisabethae de Riaz; Enay, p. 490, pl. 30: 4-5
 (topotypes); pl. 31: 2-4, 5 (lectotype),
 6 (topotype); text-fig. 150.

2001. *Perisphinctes* (*Dichotomosphinctes*)
elisabethae de Riaz; Gygi, p. 72, p. 127, figs
 106-107, 178-180a, 181-182. With synonymy.

MATERIAL: Microconchs: A/I/2/214, A/I/2/333.

LOCALITY: Paczółtowice.

DESCRIPTION: A/I/2/214 (Fig. 45) is mature
 microconch septate to *ca.* 90 mm diameter, which
 has $D_m=160$ mm. It has a complete body
 chamber showing a terminal constriction and
 a swollen rib preceding the peristome. The
 peristome is simple. The specimen is partly
 crushed and flattened. A/I/2/333 is a fragment of



Fig. 45. *Perisphinctes* (*Dichotomosphinctes*) cf. *elisabethae* de Riaz, 1898: A/I/2/214. Paczółtowice. Arrow indicates the end of the phragmocone. Natural size.

an adult body chamber which is half of a whorl long.

The coiling of the whorls is moderately evolute in A/I/2/333, and weakly involute in A/I/2/214. The ratio h_u is 0.62 and 0.87, respectively. The primary ribs are thin and densely spaced, usually bifurcating. Simple ribs vary in number from 7 to 11 on the outer whorl. The rib number changes from *ca.* 80 to 90 per whorl between 77 mm and 160 mm diameter (*cf.* A/I/2/214, Tab. 25). The constrictions are shallow.

STRATIGRAPHICAL POSITION: The FO of *Perisphinctes (Dichotomosphinctes) elisabethae* de Riaz, 1898 defines the lower boundary of the Elisabethae Subzone of the Transversarium Zone in the Middle Oxfordian of Poland (*cf.* Główniak 2006a). The species ranges throughout the Elisabethae Subzone and disappears at the top of this Subzone.

Perisphinctes (Dichotomosphinctes) cf. luciae
de Riaz, 1898
Figs 46-47, Tab. 26.

1891. *Perisphinctes kreutzii* sp. nov.; Siemiradzki, p. 41 (*pars*, A/I/2/11b only).
1891. *Perisphinctes plicatilis* (Sowerby, 1818); Siemiradzki, p. 34 (*pars*, A/I/2/144 only). Without synonymy.
1891. *Perisphinctes* n. sp. *cf. geron* (Zittel, 1870); Siemiradzki, p. 55 (*pars*, A/I/2/216, A/I/2/219 only). Without synonymy.
1898. *Perisphinctes luciae* sp. nov.; de Riaz, p. 36, pl. 10: 5 (lectotype).
1963. *Perisphinctes (Dichotomosphinctes) dybowskii* Siemiradzki; Malinowska, p. 66, pl. 32: 154, pl. 33: 160.
1963. *Perisphinctes (Dichotomosphinctes) elisabethae* de Riaz; Malinowska, p. 66, pl. 34: 165, pl. 35: 170.
1972. *Perisphinctes (Dichotomosphinctes) cf. elisabethaeformis* Burckhardt; Malinowska, p. 187, pl. 9, text-fig. 3.
1981. *Perisphinctes (Dichotomosphinctes) luciae* de Riaz; Enay, Boullier, pl. 2: fig. 4.
2001. *Perisphinctes (Dichotomosphinctes) luciae* de Riaz; Gygi, p. 125, figs 174-175, pl. 69.

No of specimen	D_m	D_r	D	u	h	$D:r$	
A/I/2/214	160	c. 90	160	0.39	0.34	77:79	160:90
A/I/2/333	160	–	160	0.45	0.28	–	–

Tab. 25. *Perisphinctes (Dichotomosphinctes) cf. elisabethae* de Riaz, 1898.

MATERIAL: Microconchs: A/I/2/11b [former syntype of *Subdiscosphinctes kreutzii*, *cf.* respective description], A/I/2/144, A/I/2/216, A/I/2/219.

LOCALITIES: Grojec: A/I/2/11b; Liguniowa Góra: A/I/2/144; Paczółtowice: A/I/2/216; Ratowa: A/I/2/219.

COLLECTOR: Dr. Stanisław Zaręczny collected A/I/2/11b. No data on the possible collectors of the other specimens.

DESCRIPTION: There are two microconchs which have the body chamber; one of them is mature (A/I/2/216, Fig. 46) and the other one is immature (A/I/2/219, Fig. 47: 1). The former one is septate up to *ca.* 95 mm diameter (Tab. 26) and 3/4 of the outer whorl is the body chamber. In addition there is A/I/2/144 (Fig. 47: 2) which is a fragment – half of a whorl long – of the adult body chamber; and A/I/2/11b which is septate to $D_r=41$ mm, having a fragment of the body chamber, but inner whorls are not exposed in this specimen.

The whorl section of the phragmocone is subsquare and that of the body chamber subrectangular. The whorl sides and margins are always gently rounded. The coiling of the whorls is moderately evolute. The ratio h_u is *ca.* 0.60. The ratios u and h are nearly 1/2 and 1/3, respectively, occasionally h is somewhat higher (*cf.* Tab. 26).

The primary ribs are moderately thin and somewhat thicker on the adult body chamber,

No of specimen	D_m	D_r	D	u	h	$D:r$	
A/I/2/11b	56	41	51	0.47	0.39	–	–
A/I/2/144	175	–	–	–	–	–	–
A/I/2/216	164	c. 95	90 162	0.49 0.48	0.31 0.28	90:70 135:92	110:79 162:89
A/I/2/219	110	65	46 62 105	0.48 0.47 0.47	0.30 0.32 0.31	33:46 60:52 90:60	45:48 70:56 110:70

Tab. 26. *Perisphinctes (Dichotomosphinctes) cf. luciae* de Riaz, 1898.

mostly bifurcating. The division point is situated at *ca.* 3/4 of the whorl height. Simple ribs vary in number from 3 to 11 on the outer whorl. The secondary ribs pass straight across the venter. Zigzag ribs occur commonly. They end freely and continue on the whorl side as a simple rib.

The ribs are moderately densely spaced on the whorl sides. They number 46 per whorl at $D=ca.$ 30 mm and 70 per whorl at $D=110$ mm

(A/I/2/219, Tab. 26). The specimen A/I/2/216 is somewhat more densely ribbed than A/I/2/216 at equivalent diameters. Constrictions number 1 per whorl.

REMARKS: With respect to the number of ribs per whorl *P. (D.) luciae* is a transitional form between the more densely ribbed *P. (D.) elisabethae* de Riaz and the less



Fig. 46. *Perisphinctes (Dichotomosphinctes) cf. luciae* de Riaz, 1898: A/I/2/216. Paczółtowice. Arrow indicates the end of the phragmocone. Natural size.

densely ribbed *P. (D.) luciaeformis* Enay and *P. (D.) crotalinus* Siemiradzki. The remaining features, such as the shape of the whorl section, final size of adults, slightly thickened ribs in the adult stage of growth, and the presence of simple ribs, are shared with the other species of the *P. (D.) elisabethae* group.

The comparison with *Subdiscosphinctes* ? *dybowskii* Siemiradzki is thoroughly discussed

in the description of the latter species.

STRATIGRAPHICAL POSITION: The species FO is somewhat above the lower boundary of the Elisabethae Subzone of the Transversarium Zone (Middle Oxfordian); it ranges up through the Subzone and disappears at its top (cf. Głowniak 2006a).

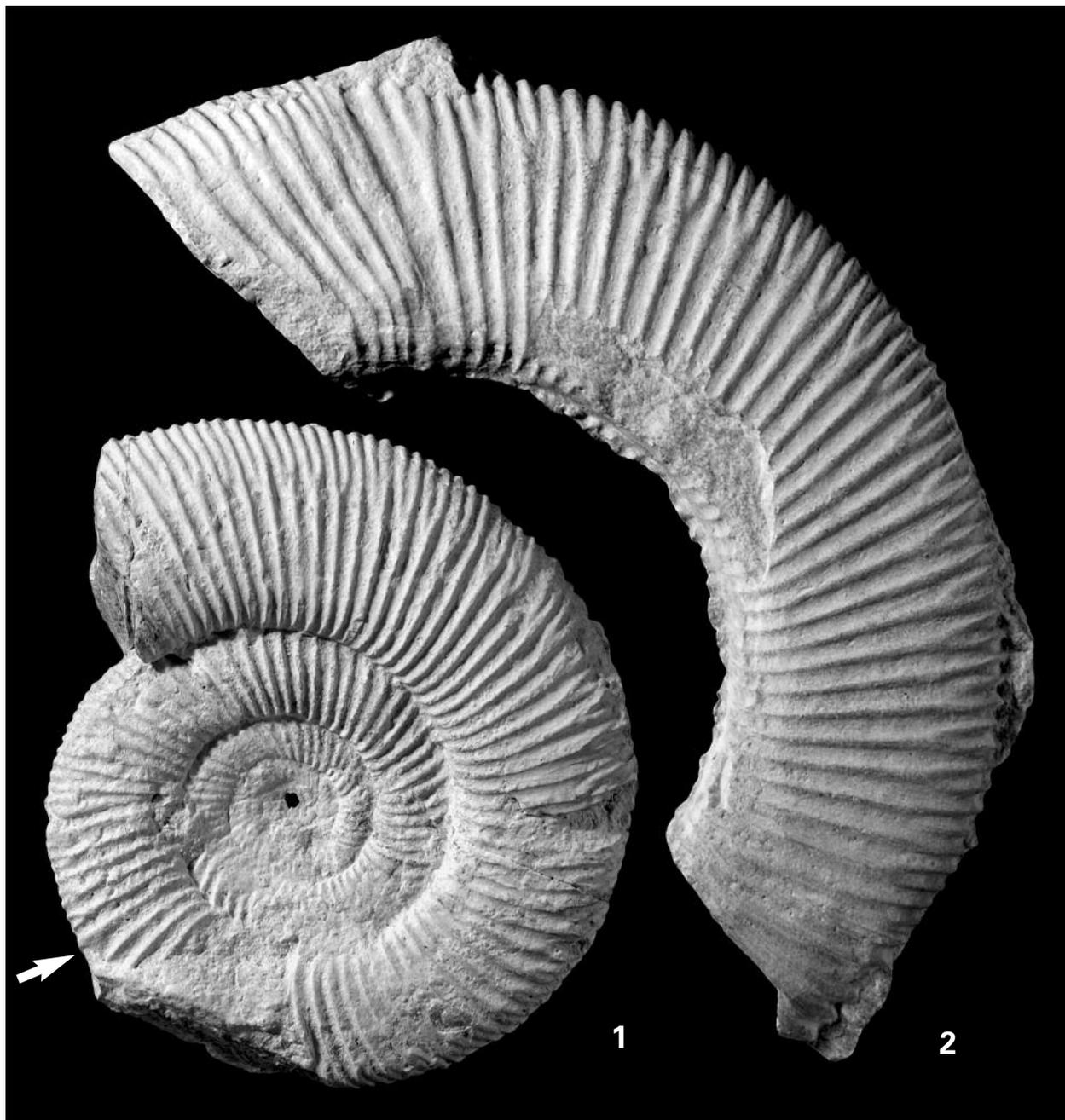


Fig. 47. *Perisphinctes (Dichotomosphinctes)* cf. *luciae* de Riaz, 1898: 1: A/I/2/219, Ratowa; 2: A/I/2/144, Liguniowa Góra. Arrow indicates the end of the phragmocone. Natural size.

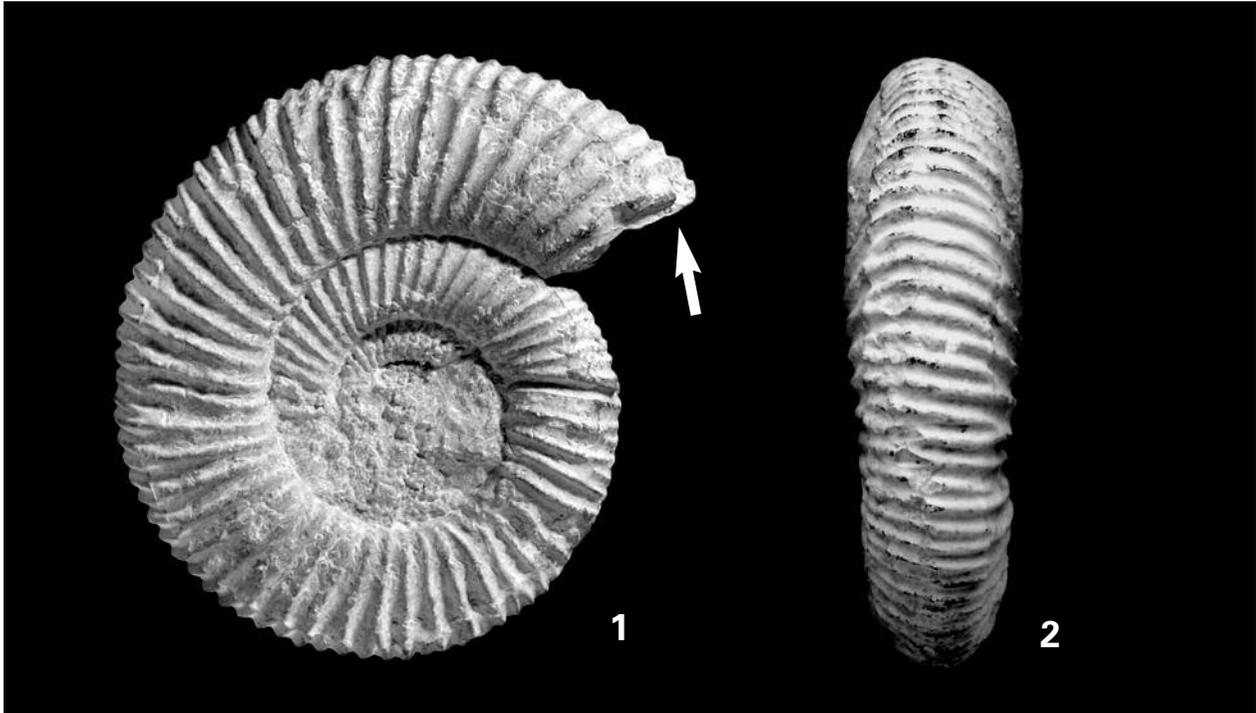


Fig. 48. *Perisphinctes (Dichotomosphinctes) crotalinus* Siemiradzki, 1891: 1-2: A/I/2/32 (lectotype), view of the lateral (1) and ventral (2) side. Brodła. Arrow indicates the end of the phragmocone. Natural size.

Perisphinctes (Dichotomosphinctes) crotalinus
Siemiradzki, 1891
Figs 48-49, Tab. 27.

1891. *Perisphinctes crotalinus* n. sp.; Siemiradzki, p. 63, pl. 3: 5 (lectotype).
1903. *Perisphinctes orientalis* Siemiradzki; de Loriol, p. 82, pl. 10: 1. Without synonymy.
1996. *Perisphinctes (Dichotomosphinctes)* sp. A; Wright, p. 445, text-fig. 3, pl. 2: 4.
?1996. *Perisphinctes (Dichotomosphinctes)* sp. B; Wright, p. 445, text-fig. 3, pl. 3: 2-4.
non 1903. *Perisphinctes crotalinus* Siemiradzki; de Loriol, p. 32, pl. 7: 5a-b, 6.
non 1966. *Perisphinctes (Otosphinctes) crotalinus* Siemiradzki, 1891; Enay, p. 455, text-fig. 122, pl. 26: 5a-e, 6.

FORMER SYNTYPES: A/I/2/32 only.

LECTOTYPE: The specimen A/I/2/32 [m] of *Perisphinctes crotalinus* figured by Siemi-

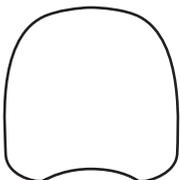


Fig. 49. The whorl section of *Perisphinctes (Dichotomosphinctes) crotalinus* Siemiradzki, 1891: A/I/2/32 (lectotype), at $D=82$ mm. Natural size.

radzki (1891, pl. 3: 5), referred to by Gygi (2001, p. 133) as holotype by inference of monotypy, is now designated lectotype. It is kept at the Museum of ING PAN in Kraków. It is illustrated here in Fig. 48.

TYPE LOCALITY: Brodła, western part of the village, over a well (Zaręczny 1894).

COLLECTOR: Dr. Stanisław Zaręczny.

DIAGNOSIS: Microconchs. Coiling of whorls moderately evolute, whorl section subsquare with rounded margins, changing to thick oval. Ribs distantly spaced, bifurcating. Simple ribs and zigzag ribs are fairly common. Parabolic ribs occur occasionally.

ADDITIONAL MATERIAL: The specimen A/I/2/143 from Paczółtowice assigned to *Perisphinctes plicatilis* (Sowerby, 1818) by Siemiradzki (1891) is herein assigned to *P. (D.) cf. crotalinus*.

DESCRIPTION: The lectotype A/I/2/32 (Fig. 48) is a wholly septate microconch which has $D_m=84$ mm. The outer whorl is somewhat distorted.

Between the inner and outer whorls, the whorl section changes from subcircular to subrectangular with rounded margins. The whorl height is slightly

No of specimen	D_m	D_r	D	u	h	$D:r$
A/1/2/32 (lectotype)	84	wholly septate	48 84	0.42 0.48	0.31 0.29	67:47 84:50

Tab. 27. *Perisphinctes* (*Dichotomosphinctes*) *crotalinus* Siemiradzki, 1891.

greater than the thickness (Fig. 49). The coiling of the whorls is weakly involute and changes to moderately evolute at a diameter larger than 50 mm. The ratio of umbilical diameter against shell diameter (u) is *ca.* 2/5 at $D=48$ mm and 1/2 at $D=84$ mm; the ratio of whorl height against shell diameter (h) is nearly 1/3 in the whole range of the diameters studied (Tab. 27). The ribs are thick, prorsiradiate on the whorl sides, usually bifurcating. Simple ribs number 12 on the outer whorl. The rib number per whorl changes from 47 to 50 per whorl in the range of diameters from 67 mm to 84 mm (Tab. 27). Zigzag ribs occur commonly. Every zigzag rib ends with a simple rib. There is 1 parabolic node on the outer whorl. Constrictions number 1 per whorl.

The specimen A/1/2/143 from Paczółtowice shows some diagnostic features of *P. (D.) crotalinus*, such as coarse ribs, presence of simple ribs and zigzag ribs. The specimen is incomplete and retains only a small fragment of the phragmocone and of the body chamber. It is not valid for biometric studies.

REMARKS: The lectotype of *Perisphinctes* (*Dichotomosphinctes*) *crotalinus* Siemiradzki, at its maximum shell diameter of 82 mm, is still septate and displays no indications of the end of growth. Other specimens of *P. crotalinus* collected by the author (Główniak 1997) from the Transversarium Zone in the Polish sections are fully grown at D_m 140 mm to 155 mm. In respect to shell size and some other diagnostic characters, the Polish specimens of *P. crotalinus* match the diagnosis of the subgenus *Dichotomosphinctes* Buckman, to which subgenus *P. crotalinus* been assigned by the author (*cf.* this paper and some previous ones, *e.g.* Główniak 2006a). The species belongs to the *Perisphinctes* (*Dichotomosphinctes*) *elisabethae* group from the Transversarium Zone as distinguished in this paper. With its coarse ribbing it lies at one of the extremes of the group, which is characterised by a significant variability in rib-thickness. The French specimens from the Transversarium Zone assigned by Enay (1966, p. 496) to *Perisphinctes*

crotalinus Siemiradzki and figured by him on pl. 26: 5a-e, 6 are much smaller than the Polish ones from the equivalent interval. The specimens in the French material which have $D=82$ mm show features signifying the completion of growth. These specimens presumably represent a small sized variety of *Perisphinctes* (*Dichotomosphinctes*) *crotalinus*, and its smaller shell size may had been caused by the palaeobiogeographical factors. Therefore, the assignation of *P. crotalinus* to the subgenus *Otosphinctes* comprising microconchs from the Plicatilis Zone, as proposed by Enay (1966), should be treated with caution.

Similar comments refer to the Spanish form *P. nectobrigensis* collected and described by Meléndez (1989, pl. 37: 1a-b, holotype; pl. 37: 2-6, pl. 38: 1-6) from the Transversarium Zone and assigned by him to the subgenus *Otosphinctes*. The Spanish species resembles *P. (D.) crotalinus* in the presence of thick ribs and occurrence of simple ribs, nevertheless it is definitely smaller than the Polish specimens of the Siemiradzki's species.

STRATIGRAPHICAL POSITION: In Poland, the species FO is somewhat above the base of the Elisabethae Subzone of the Transversarium Zone (Middle Oxfordian), and it ranges higher up through the Subzone and disappears at the top of it (*cf.* Główniak 2006a). There are some good reasons to assume that the lectotype of the species comes just from the Elisabethae Subzone. Such a conclusion would partly account for the records of Siemiradzki (1922), who mentioned from the outcrop from which the lectotype derives some other species diagnostic of the Subzone, *e.g.* *Perisphinctes* (*Dichotomosphinctes*) *elisabethae* de Riaz and *Perisphinctes* (*Dichotomosphinctes*) *luciae* de Riaz.

Perisphinctes (*Dichotomosphinctes*) aff.
luciaeformis Enay, 1966

Fig. 50, Tab. 28.

1891. *Perisphinctes airoidii* Gemmellaro, 1874; Siemiradzki, p. 57, pl. 4: 2.
1966. *Perisphinctes* (*Dichotomosphinctes*) *luciaeformis* n. sp.; Enay, pl. 32: 2 a-b (holotype), pl. 32: 1, 3 (paralectotypes), text-fig. 152.
1989. *Perisphinctes* (*Dichotomosphinctes*) *luciaeformis* Enay; Meléndez, p. 301, pl. 45: 1-2, pl. 46: 1-4, pl. 47: 2-4, text-fig. 61.

2000. *Perisphinctes* (*Dichotomosphinctes*)
luciaformis Enay; Gygi, p. 84, pl. 5: 4.

2001. *Perisphinctes* (*Dichotomosphinctes*)
luciaformis Enay; Gygi, p. 74, p. 122,
figs 110-112, 170-171; tabs 41, 67.

MATERIAL: A/I/2/35 [m].

LOCALITY: Rudno.

COLLECTOR: Dr. Stanisław Zaręczny.

DESCRIPTION: A/I/2/35 is an immature microconch septate to $D_r=51$ mm and in which 3/4 of the outer

abnormally low on this side of the body chamber. Otherwise, on the opposite side of the body chamber, the ribs are sharp and slightly prorsiradiate all along the whorl height, and they divide high, at the ventral margin.

The whorl section is subcircular on the phragmocone and subsquare on the body chamber. There, the whorl height becomes but only slightly greater than thickness, and the whorl sides and ventral area are gently convex. The coiling of the whorls is moderately evolute. The ratio $h_u=ca.$ 0.63 in the range of the diameters studied. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are $ca.$ 1/2 and 1/3, respectively (*cf.* Tab. 28).

The primary ribs are moderately thin, bifurcating. The secondary ribs follow the direction of the primary rib. Parabolic nodes number two on the outer whorl; they occur in the terminal part of the phragmocone. One constriction is present on the last whorl.

REMARKS: A major difference between the specimen described previously and the species *Perisphinctes* (*Dichotomosphinctes*) *luciaformis* Enay, 1966 is the lack of simple ribs on the former. The other features, *e.g.* the rounded whorl section of the early phragmocone, moderately evolute coiling of whorls and moderately thin ribs match the diagnosis of *P. (D.) luciaeformis* by Enay (1966).

STRATIGRAPHICAL POSITION: *Perisphinctes* (*Dichotomosphinctes*) *luciaformis* Enay, 1966 is the index species of the Luciaformis Subzone as defined by Cariou *et al.* (1997) in the Transversarium Zone (Middle Oxfordian). In Poland, the species FO is slightly above the base of the Elisabethae Subzone in the Transversarium Zone (*cf.* Głowniak 2006a); it ranges throughout the Subzone and disappears at the top of it.

Subgenus *Dichotomoceras* Buckman, 1919

TYPE SPECIES: *Dichotomoceras dichotomum* Buckman, 1919. Lectotype [m] figured by Buckman (1919, pl. 139), Arkell (1947, p. 358, pl. 75: 1 a-b), and then Arkell *et al.* (1957, fig. 411: 1 a-b).

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/35	74	51	30	0.50	0.32	30:45	40:46	50:49
			50	0.48	0.30	60:52	73:55	–
			74	0.49	0.31	–	–	–

Tab. 28. *Perisphinctes* (*Dichotomosphinctes*) aff. *luciaformis* Enay, 1966.

whorl is body chamber. The specimen has $D_m=74$ mm. It is pathological. There is an injury along the umbilical margin of the body chamber and the ribs are blurred and abnormally inflexed backwards there. The division point is situated



Fig. 50. *Perisphinctes* (*Dichotomosphinctes*) aff. *luciaformis* Enay, 1966: A/I/2/35, pathological individual. Rudno. Arrow indicates the end of the phragmocone. Natural size.

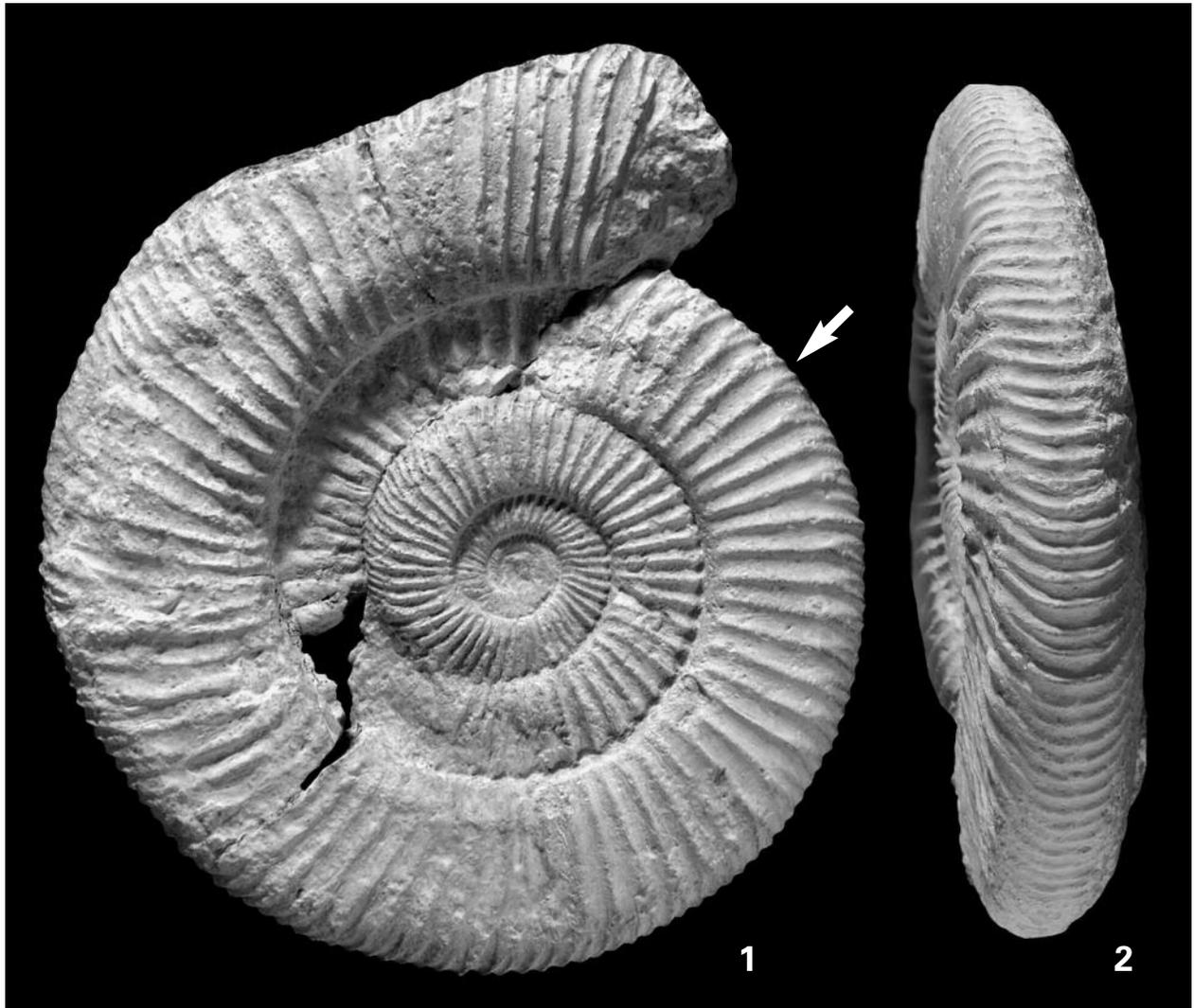


Fig. 51. *Perisphinctes (Dichotomoceras) wartae* Bukowski, 1887: 1-2: A/I/2/39, view of the lateral (1) and ventral (2) side. Poręba. Arrow indicates the end of the phragmocone. Reduced $\times 0.95$

Perisphinctes (Dichotomoceras) wartae

Bukowski, 1887

Figs 51-54, Tab. 29.

1887. *Perisphinctes wartae* sp. nov.; Bukowski, p. 140, pl. 27: 1a-c (lectotype).

1891. *Perisphinctes michalskii* Bukowski, 1887; Siemiradzki, p. 62, *pars*, pl. 5: 1 (A/I/2/39) and A/I/2/233 only. Without synonymy.

1891. *Perisphinctes ocultefurcatus* Waagen, 1875; Siemiradzki, p. 36 (*pars*, A/I/2/167 only). Without synonymy.

1899. *Perisphinctes waehneri* sp. nov.; Siemiradzki, p. 253.

1966. *Perisphinctes (Dichotomosphinctes) wartae* Bukowski; Enay, p. 486, text-figs 140, 146-147 (topotype), pl. 30: 1-2.

1970. *Perisphinctes (Dichotomosphinctes) wartae* Bukowski; Brochwicz-Lewiński, pl. 7.

1975b. *Perisphinctes (Dichotomosphinctes)* sp. ex gr. *wartae* Bukowski; Brochwicz-Lewiński, Różak, pl. 2: 1.

?1989. *Perisphinctes (Dichotomosphinctes)* cf. *wartae* Bukowski; Meléndez, p. 294, pl. 42: 1a-b.

1989. *Perisphinctes (Dichotomosphinctes) wartae* Bukowski; Meléndez, p. 296, pl. 43: 1a-b, 2; pl. 44: 1a-b, 2a-c.

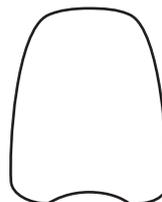


Fig. 52. Whorl section in *Perisphinctes (Dichotomoceras) wartae* Bukowski, 1887: A/I/2/39 at $D=95$ mm. Natural size.

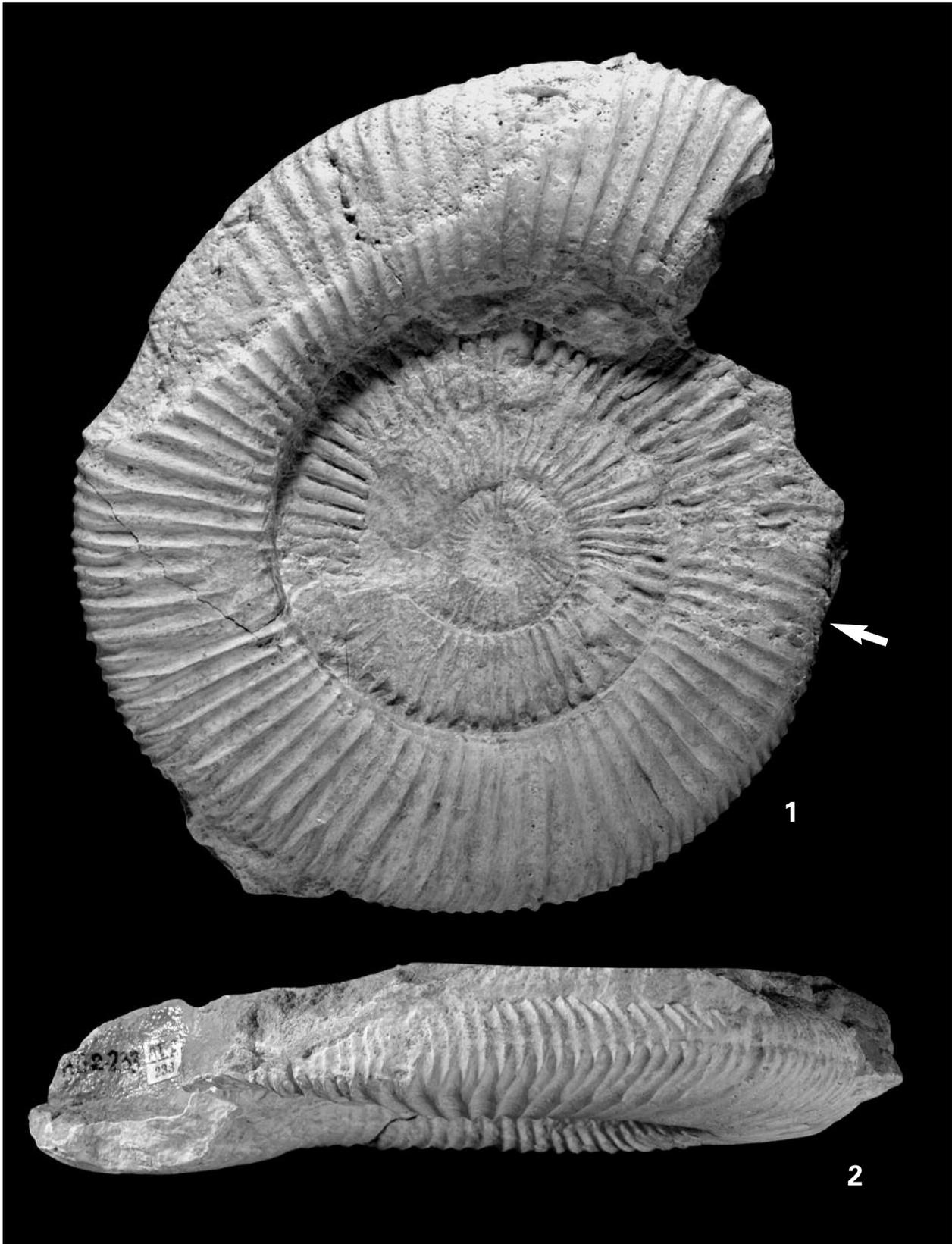


Fig. 53. *Perisphinctes (Dichotomoceras) wartae* Bukowski, 1887: 1-2: A/1/2/233, view of the lateral (1) and ventral (2) side. Regulice. Arrow indicates the end of the phragmocone. Natural size.

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/39	135	83	43	0.44	0.33	34:44	37:44	47:45
			57	0.47	0.28	54:46	64:49	82:52
			82	0.51	0.28	110:58	125:63	135:68
			124	0.52	0.27	–	–	–
A/I/2/167	115	90	30	0.40	0.33	53:61	62:62	80:66
			112	0.50	0.29	90:70	107:74	115:78
A/I/2/233	145	95	95	0.55	0.28	30:44	75:57	100:63
			145	0.54	0.28	127:67	145:74	–

Tab. 29. *Perisphinctes (Dichotomoceras) wartae* Bukowski, 1887.

2006a. *Perisphinctes (Dichotomosphinctes) wartae* Bukowski; Główniak, p. 43, text-fig. 7a-b (topotype).

MATERIAL: A/I/2/39 illustrated by Siemiradzki (1891, pl. 5: 1) and now on Fig. 51: 1-2; A/I/2/167 and A/I/2/233.

LOCALITY: Rudno: A/I/2/167; Regulice: A/I/2/233. According to Siemiradzki (1899) A/I/2/39 comes from Poreba.

DESCRIPTION: A/I/2/39 (Fig. 51: 1-2) and A/I/2/233 are nearly mature microconchs ranging in D_m from 135 mm to 145 mm. They are septate to $D_r=83$ mm and 95 mm respectively (Tab. 29). In A/I/2/233, 3/4 of the outer whorl, and in A/I/2/39 the whole outer whorl is a body chamber. A/I/2/167 (Fig. 54) is an immature microconch which has $D_m=115$ mm. The existing fragment of a body chamber is 7/8 of a whorl long. A/I/2/167 and A/I/2/233 are crushed flat specimens.

The whorl section is trapezoidal in A/I/2/39 (Fig. 52) and suboval in A/I/2/233. The coiling of the whorls of the early phragmocone is nearly weakly involute, or, occasionally, weakly involute; it changes to moderately evolute or nearly evolute on the middle/late phragmocone and on the body chamber. The ratio of umbilical diameter against

shell diameter (u) is *ca.* 0.40 in the range of diameters 30 mm – 40 mm, and *ca.* 0.52 at the diameters bigger than 120 mm (Tab. 29). The ratio of whorl height against shell diameter (h) changes from 0.33 to *ca.* 0.27 in the range of diameters from *ca.* 40 mm and 120 mm (Tab. 29).

The ribs are thin and sharp, prorsiradiate and somewhat flexuous on the whorl flanks of the early phragmocone. The ribs normally bifurcate, though occasional simple ribs appear. The division point is sharp. It is situated near the ventral margin. The secondary ribs gently sweep forward on the venter (Figs 51: 2; 53: 2). The rib number per whorl changes but little up to *ca.* 50 mm diameter, but at bigger diameters more rapidly. There are by 25 ribs per whorl more at 120-140 mm diameter than at *ca.* 50 mm in the specimens studied (Tab. 29).

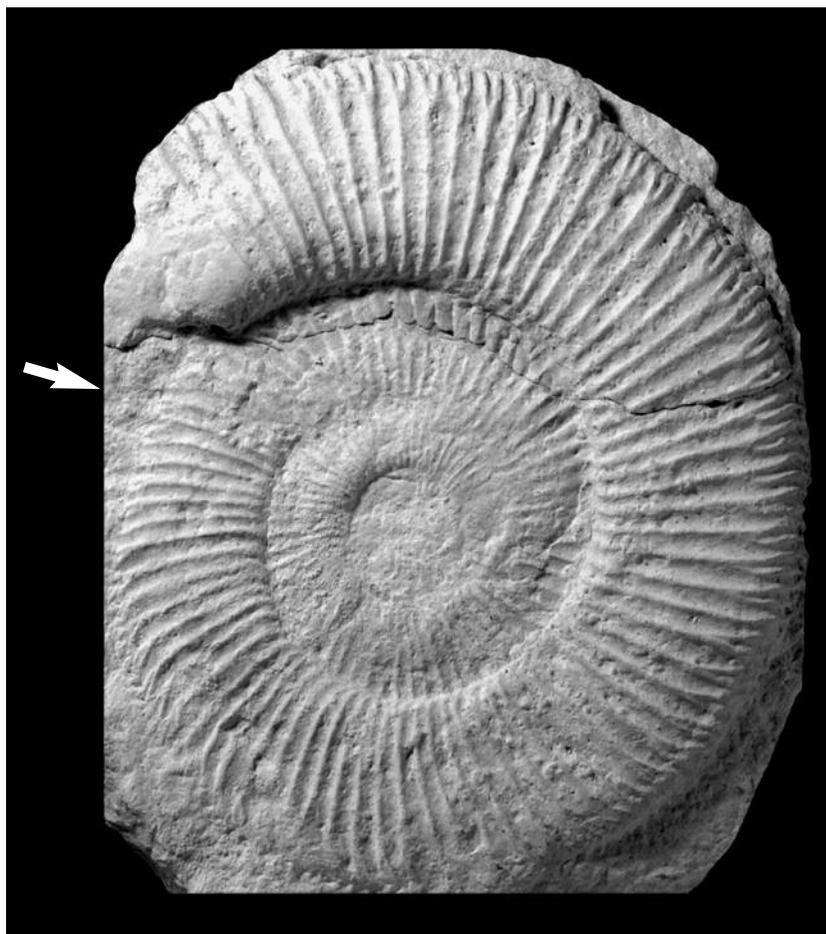


Fig. 54. *Perisphinctes (Dichotomoceras) wartae* Bukowski, 1887: A/I/2/167. The specimen derives from Rudno. Arrow indicates the end of the phragmocone. Reduced x0.95.

Zigzag ribs appear in A/I/2/39 only. They end freely and constitute intercalatory ribs on the venter. The intercalatories approximate the primary rib near the division point, which gives an impression of trifurcation. True trifurcations, however, are not present in this specimen. Constrictions occur occasionally.

REMARKS: The specimen A/I/2/39 (Fig. 51: 1-2) was referred by Siemiradzki in 1899 to the new species *Perisphinctes waehneri*. Herein, *P. waehneri* is treated as a junior synonym of *Perisphinctes (Dichotomoceras) wartae*. This accounts for the following features which A/I/2/39 has in common with *P. (D.) wartae*: (1) coiling of whorls, which is nearly weakly involute or, occasionally, weakly involute on the inner whorls and becomes moderately evolute on the middle – outer whorls; (2) sharp ribs and division points; (3) shallow forward sweep of the ribs on the venter; (4) the rib number per whorl, which changes but little in the range of diameters up to ca. 50 mm, and at bigger diameters increases. For a detailed description of *P. (D.) wartae* see Głowniak (2006a).

In such features as trapezoidal whorl section, sharp ribs and sharp division points the specimens of *P. (D.) wartae* are close to the species *Perisphinctes (Dichotomoceras) bifurcatoides* Enay, 1966. They nevertheless differ from the latter species in the significantly lesser increase in the height of the adult body chamber, in smoother shape of the rib-density curve, in the more evolute coiling of the whorls on the middle – outer whorls, and in the lesser forward sweep of the secondary ribs on the venter. There are specimens with features transitional between the two forms.

Basing on the new research collection of topotypes *Perisphinctes (Dichotomoceras) wartae* collected by the author [E.G.] in the section of the Zawodzie Quarry in Częstochowa, the species has been re-described and its macroconch partner, *Perisphinctes (Perisphinctes) cautisnigrae* Arkell, 1935, has been identified (cf. Głowniak 2006a).

STRATIGRAPHICAL POSITION: The FO of the species defines the base of the Wartae Subzone as proposed by Głowniak (2006a). The species ranges throughout the Wartae Subzone and higher up to the lowermost *Stenocycloides* Subzone of the *Bifurcatus* Zone. Higher up it definitely disappears.

Perisphinctes (Dichotomoceras) cf. wartae

Bukowski, 1887

Fig. 55, Tab. 30.

1887. *Perisphinctes wartae* sp. nov.; Bukowski, p. 140, pl. 27: 1a-c (lectotype).

1891. *Perisphinctes occultefurcatus* Waagen, 1875; Siemiradzki, p. 36 (*pars*, A/I/2/169 only). Without synonymy.

1891. *Perisphinctes bifurcatus* (Quenstedt, 1847); Siemiradzki, p. 52 (*pars*, A/I/2/209 only). Without synonymy.

1891. *Perisphinctes michalskii* Bukowski, 1887; Siemiradzki, p. 62 (*pars*, A/I/2/234, A/I/2/235, A/I/2/236 only). Without synonymy.

MATERIAL: Microconchs: A/I/2/169, A/I/2/209, A/I/2/234, A/I/2/235, A/I/2/236.

LOCALITY: Rudno: A/I/2/169, A/I/2/234, A/I/2/235; Kobylany: A/I/2/209; Kozłowiec: A/I/2/236.

COLLECTOR: Dr. Stanisław Zaręczny: A/I/2/236. No data on the other specimens.

DESCRIPTION: A/I/2/236 consists of the wholly septate inner whorls. The other specimens are

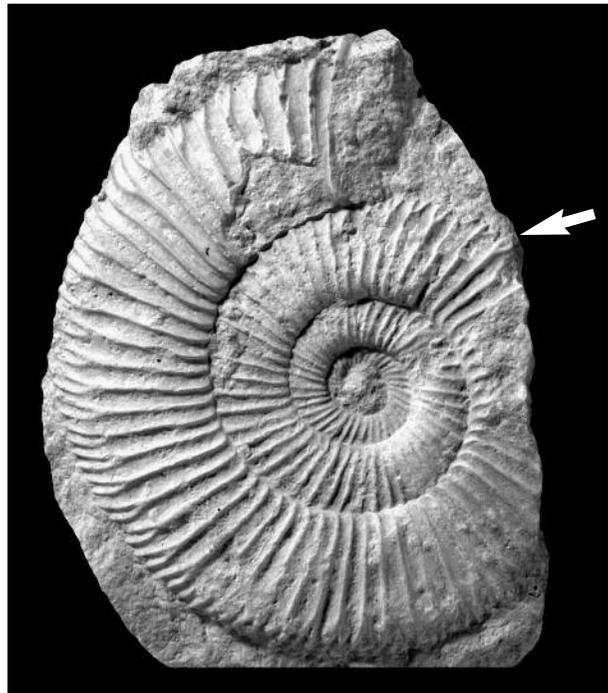


Fig. 55. *Perisphinctes (Dichotomoceras) cf. wartae* Bukowski, 1887: A/I/2/169. The specimen derives from Rudno. Arrow indicates the end of the phragmocone. Natural size.

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/169	78	45	30 42 74	0.40 0.45 0.49	0.33 0.31 0.30	30:43 – –	55:51 – –	75:58 – –
A/I/2/209	57	35	33 44	0.42 0.45	0.33 0.34	36:40 57:47	43:43 –	50:44 –
A/I/2/234	48	32	45	0.42	0.29	37:58	48:59	–
A/I/2/235	50	wholly septate	42	0.45	0.33	46:50	–	–
A/I/2/236	45	wholly septate	45	0.44	0.33	27:40	40:40	47:40

Tab. 30. *Perisphinctes (Dichotomoceras) cf. wartae* Bukowski, 1887.

immature microconchs which retain fragments of their body chambers. The body chambers are 1/2 to 3/4 of a whorl long (e.g. in A/I/2/169, A/I/2/209 and A/I/2/234). In A/I/2/235 the phragmocone is fractured at $D_r=50$ mm and the first 3/4 of the outer whorl is missing. The last quarter of a whorl is the body chamber. The specimens range in D_m from 45 mm to 78 mm (Tab. 30).

The whorl section of the body chamber is high oval (e.g. A/I/2/234 and A/I/2/235). The coiling of the whorls is weakly involute at ca. $D=30$ mm and moderately evolute at the diameters greater than this. The ribs are thin, sharp, bifurcating. Occasionally, simple ribs occur. The secondary ribs form a forward sinus on the ventral side. Parabolic nodes occur in A/I/2/235 only. They number 2 on the phragmocone. Constrictions number 1 per whorl, or they may be absent.

STRATIGRAPHICAL POSITION: *Perisphinctes (Dichotomoceras) wartae* ranges throughout the Wartae Subzone and the lower part of the Stenocycloides Subzone of the Bifurcatus Zone in the Upper Oxfordian (Główniak 2006a).

Perisphinctes (Dichotomoceras) alpinus

Siemiradzki, 1891

Fig. 56, Tab. 31.

1891. *Perisphinctes alpinus* sp. nov.; Siemiradzki, p. 36.

1891. *Perisphinctes colubrinus* (Reinecke, 1818); Siemiradzki, p. 84 (*pars*, A/I/2/282 only). Without synonymy.

FORMER SYNTYPES: A/I/2/158, A/I/2/159, A/I/2/160, A/I/2/161, A/I/2/162, A/I/2/163, all of them microconchs.

LECTOTYPE: The specimen A/I/2/162 [m] of *Perisphinctes (Dichotomoceras) alpinus* Siemiradzki, 1891 illustrated now at Fig. 56: 1-2, is here designated lectotype. It is kept at the Geological Museum of ING PAN in Kraków.

TYPE LOCALITY: Kozłowiec.

COLLECTOR: Dr. Stanisław Zaręczny (?).

PARALECTOTYPES: A/I/2/158, A/I/2/159 and A/I/2/160 [wholly septate inner whorls assigned to *Perisphinctes* sp. B]; A/I/2/161 and A/I/2/163 [incomplete microconchs assigned to *Perisphinctes (Dichotomoceras) sp.*, cf. respective description in this paper].

DATA ON THE LABELS ACCOMPANYING PARALECTOTYPES: Locality: Brodła: A/I/2/158, A/I/2/159, A/I/2/160; Kozłowiec: A/I/2/163. No data on the place of origin of A/I/2/161. Collector: No data.

ADDITIONAL MATERIAL: A/I/2/282 from Tenczynek assigned by Siemiradzki (1891) to *Perisphinctes colubrinus* (Reinecke, 1818).

DIAGNOSIS: Large microconchs. Coiling of whorls evolute, changing to moderately evolute on the adult body chamber; whorl section rounded on the phragmocone, changing to oval on the body chamber. Ribs sharp, bifurcating. Secondary ribs slightly sweep forward on the venter. Simple ribs and zigzag ribs present. Rib-density curve concave in the range of small and medium diameters.

DESCRIPTION: The lectotype A/I/2/162 (Fig. 56) is a mature microconch showing approximation of the last few septa. It is septate to $D_r=95$ mm, and has $D_m=147$ mm (Tab. 31). 3/4 of the outer whorl is body chamber.

The whorl section is rounded on the phragmocone and becomes flat-sided on the body chamber. The coiling of the whorls is nearly evolute in the range of diameters up to ca. 80 mm, and becomes moderately evolute at the diameters bigger than the mentioned. The ratio of umbilical diameter (u) against shell diameter is ca. 1/2 on the phragmocone and becomes somewhat smaller on

the body chamber (Tab. 31). The ratio of whorl height (h) against shell diameter is *ca.* 1/4 on the phragmocone and increases up to *ca.* 1/3 on the outer whorl (Tab. 31).

Ribs are moderately densely spaced and slightly prorsiradiate on the whorl sides. The ribs mostly bifurcate, but simple ribs also occasionally occur. One simple rib is present on the outer whorl at the lectotype. The division point is sharp. It is situated at *ca.* 2/5 of the whorl height of the phragmocone and slightly lower on the body chamber. The secondary ribs pass across the venter with a gentle

forward sweep (Fig. 56: 2). The rib number is 52 per whorl at $D=24$ mm. It decreases by *ca.* 10 ribs per whorl in the range of D from *ca.* 20 mm to 40 mm, only to increase slowly at diameters bigger than 40 mm; hence the rib-curve is concave. The rib number is 53 ribs per whorl at $D=95$ mm and 65 per whorl at $D_m=147$ mm.

Zigzag ribs occur occasionally on the venter. Constrictions number 1 per whorl on the phragmocone and 3 on the body chamber.

A/1/2/282 is an immature microconch which has a fragment of the body chamber. The body chamber

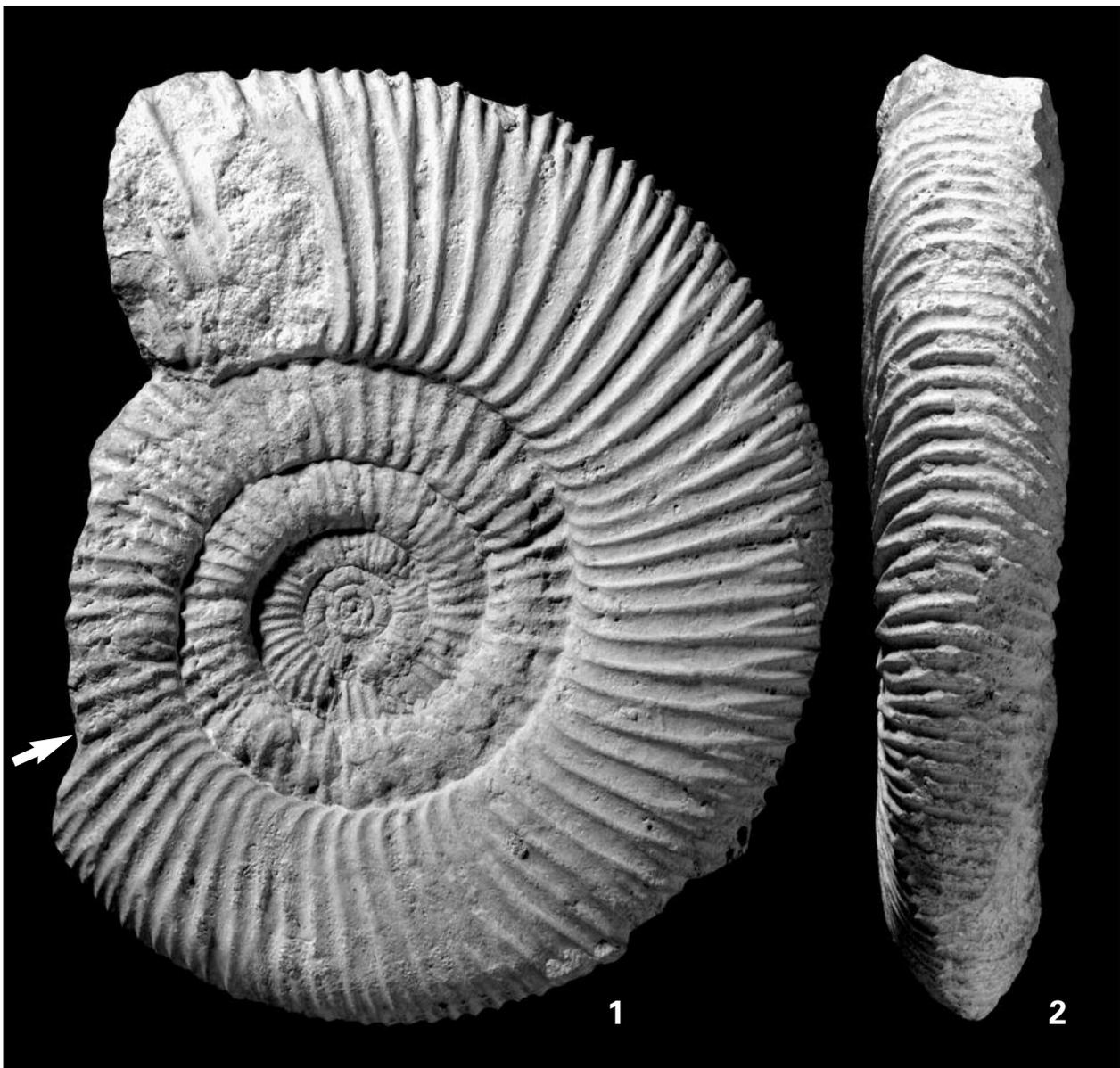


Fig. 56. *Perisphinctes (Dichotomoceras) alpinus* Siemiradzki, 1891: 1-2: A/1/2/162 [m] (lectotype); view of the lateral (1) and ventral (2) side. Kozłowiec. Arrow indicates the end of the phragmocone. Reduced x0.95

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/162 (lectotype)	147	96	40	0.50	0.28	24:52	32:44	40:41
			96	0.52	0.31	50:42	60:47	70:49
			144	0.46	0.30	95:53	112:58	140:63
			–	–	–	147:65	–	–
A/I/2/282	52	43	52	0.52	0.29	25:36	45:34	52:37

Tab. 31. *Perisphinctes (Dichotomoceras) alpinus* Siemiradzki, 1891.

occupies the second half of the outer whorl. The specimen is septate to $D_r=43$ mm, and has $D_m=52$ mm (Tab. 31). The coiling of the whorls is evolute in the range of the diameters studied. The whorl section has a rounded lateral and ventral area. The rib-curve is concave.

REMARKS: The species *Perisphinctes (Dichotomoceras) alpinus* resembles *Perisphinctes (Dichotomoceras) wartae* Bukowski, 1887 in the size of adults, in the occasional occurrence of zigzag ribs on the venter and simple ribs on the whorl sides, and in the gentle forward sweep of the secondary ribs on the venter. The two species differ in the coiling of the whorls: coiling in *P. (D.) alpinus* is nearly evolute on the whorls of the phragmocone as compared to moderately evolute in *P. (D.) wartae*. In addition, the rib-curve of *P. (D.) alpinus* is noticeably concave in the range of small and medium diameters, with the minimum rib number per whorl at *ca.* 40 mm; in *P. (D.) wartae* it is flattened or it has but a shallow concavity.

P. (D.) alpinus closely resembles *Perisphinctes (Dichotomoceras) rotooides* Ronchadze, 1917. The two species show a similar coiling of whorls, which is nearly evolute on the inner whorls and changes to moderately evolute on the body chamber; similar rib-thickness, and similar mode of rib-density changes as the diameter increases. The minimum number of ribs per whorl occurs at *ca.* 40 mm diameter in the two species. *P. (D.) alpinus* is somewhat more densely ribbed (it has by *ca.* 10 ribs per whorl more than *P. (D.) rotooides* does at equivalent diameters).

P. (D.) alpinus and *Perisphinctes (Dichotomoceras) bifurcatoides* Enay, 1966 resemble each other in their final size, and in the noticeable increase in height of the adult body chamber as compared to the whorls of the phragmocone. *P. (D.) alpinus* differs in having much more evolute coiling of whorls of the

phragmocone, in the oval whorl section of the body chamber as compared to trapezoidal in *P. (D.) bifurcatoides*, and in less distinct forward sweeping of the secondary ribs. The rib-curves are similar in the two species; they are concave, with the minimum number of ribs per whorl appearing at *ca.* 40 mm diameter. *P. (D.) alpinus* is somewhat less densely ribbed than *P. (D.) bifurcatoides* at equivalent diameters.

P. (D.) alpinus differs from *Perisphinctes (Dichotomoceras) bifurcatus* (Quenstedt, 1847) in its greater final size, more evolute coiling of whorls, and in the higher location of the rib division point on the whorl sides. *P. (D.) alpinus* possesses an intermediate number of ribs per whorl between the more densely ribbed *P. (D.) bifurcatoides* and the less densely ribbed *P. (D.) bifurcatus*.

STRATIGRAPHICAL POSITION: *P. (Dichotomoceras) alpinus* appears to range in the Wartae Subzone and/or in the Stenocycloides Subzone of the Bifurcatus Zone in the Upper Oxfordian. The species was reported by Zaręczyński (1894) from Kozłowiec together with other species, for example, *P. (Dichotomoceras) cf. wartae*, *Perisphinctes (Dichotomoceras) cf. bifurcatoides* (see respective descriptions) and *Subdiscosphinctes ? sp.*

Perisphinctes (Dichotomoceras) bifurcatoides
Enay, 1966
Figs 57: 1; 58; Tab. 32.

1891. *Perisphinctes occultifurcatus* Waagen, 1875; Siemiradzki, p. 36 (*pars*, A/I/2/165 only). Without synonymy.

1966. *Perisphinctes (Dichotomoceras) bifurcatoides* n. sp.; Enay, p. 509, text-figs 155-2, 157; pl. 34: 1a-b, 2 (holotype), 3-4.

1989. *Perisphinctes (Dichotomoceras) bifurcatoides* Enay; Meléndez, p. 315, text-figs 64-65, 68, 69; pl. 52: 1-3, pl. 53: 1-3,

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/165	103	95	30	0.47	0.33	60:52	65:52	87:56
			73	0.48	0.32	107:61	–	–
			102	0.49	0.28	–	–	–
			–	–	–	–	–	–

Tab. 32. *Perisphinctes (Dichotomoceras) bifurcatoides* Enay, 1966.

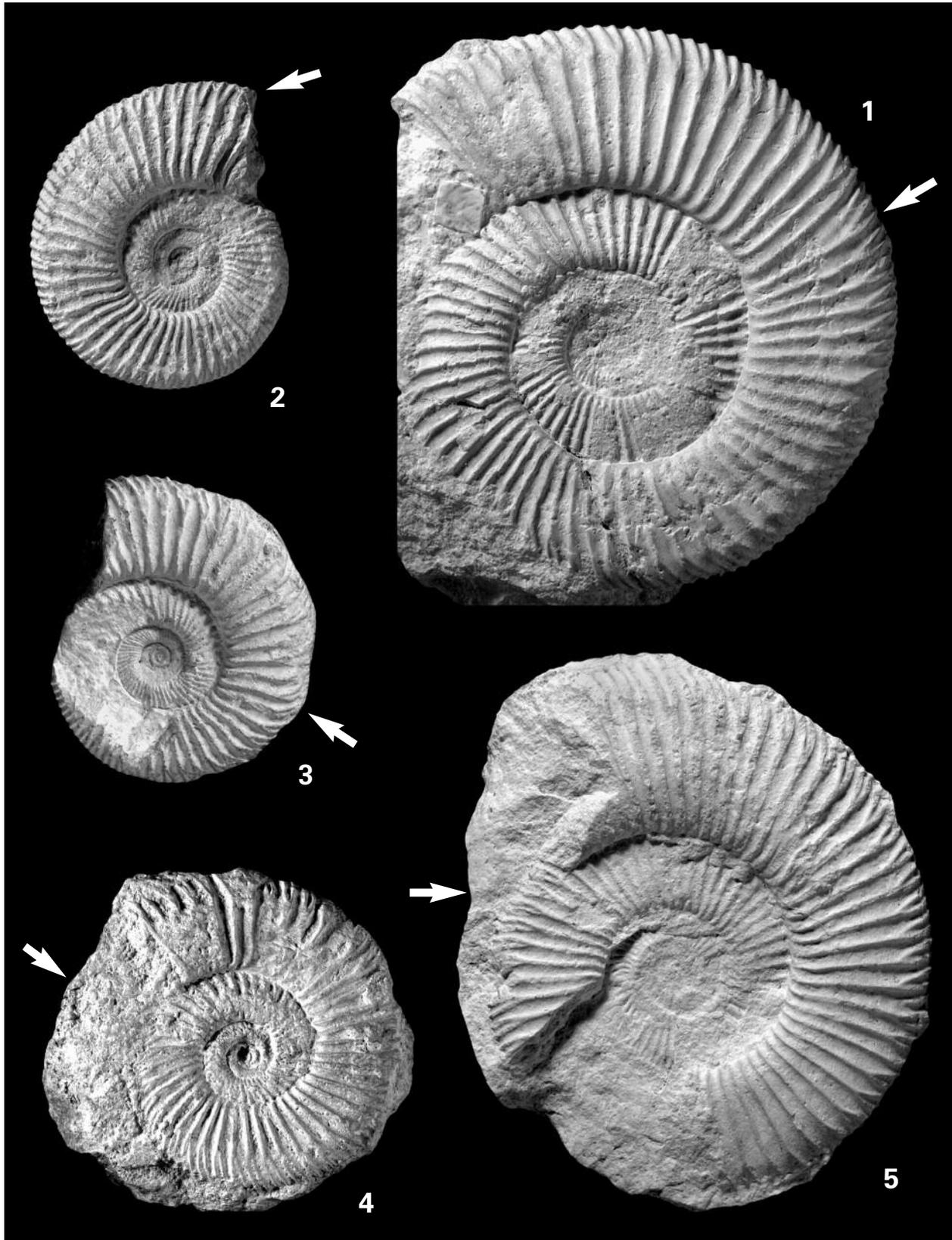


Fig. 57. *Perisphinctes (Dichotomoceras) bifurcatoides* Enay, 1966: 1: A/I/2/165, Brodła; *Perisphinctes (Dichotomoceras) cf. bifurcatoides* Enay, 1966: 2: A/I/2/14, Brodła; 3: A/I/2/41, Brodła; 4: A/I/2/207, Kozłowiec; 5: A/I/2/343, Kozłowiec. Arrows indicate the end of the phragmocones. Natural size.

pl. 54: 1-4. With synonymy.
2000. *Perisphinctes (Dichotomoceras) bifurcatoides* Enay; Gygi, p. 86, text-fig. 48, pl. 9: 2.

MATERIAL: A/I/2/165 [m].

LOCALITY: Brodła.

DESCRIPTION: A/I/2/165 (Fig. 57: 1) is a nearly mature microconch which has $D_m=103$ mm and is septate to $D_r=95$ mm (Tab. 32). The existing fragment of the body chamber is a quarter of a whorl long. The whorl section is subsquare with rounded ventral margins

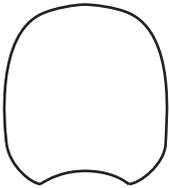


Fig. 58. The whorl section of *Perisphinctes (Dichotomoceras) bifurcatoides* Enay, 1966: A/I/2/165, at $D=80$ mm. Natural size.

(Fig. 58). The coiling of the whorls is nearly involute on the early phragmocone and becomes moderately evolute on the outer whorl. The ratio of umbilical diameter (u) against shell diameter is nearly $1/2$ in the range of studied diameters; the ratio of whorl height (h) against shell diameter is *ca.* $1/3$ at $D=30$ mm and $1/4$ at $D=102$ mm (*cf.* u and h in Tab. 32). The ribs are thin and sharp, bifurcating. The secondary ribs sweep forward on the venter.

STRATIGRAPHICAL POSITION: Stenocycloides Subzone of the Bifurcatus Zone in the Upper Oxfordian (Enay 1966; Meléndez 1989).

Perisphinctes (Dichotomoceras) cf. bifurcatoides Enay, 1966
Fig. 57: 2-5; 59; Tab. 33.

1891. *Perisphinctes plicatilis* (Sowerby, 1818); Siemiradzki, p. 34 (*pars*, A/I/2/343 and A/I/2/344 only). Without synonymy.
1891. *Perisphinctes ocultefureatus* Waagen, 1875; Siemiradzki, p. 36, *pars*, pl. 1: 6 (A/I/2/14) only. Without synonymy.
1891. *Perisphinctes bocconi* Gemmellaro, 1871; Siemiradzki, p. 39 (*pars*, A/I/2/178 only). Without synonymy.
1891. *Perisphinctes bifurcatus* (Quenstedt, 1847); Siemiradzki, p. 52, *pars*, pl. 5: 3 (A/I/2/41) and A/I/2/207-A/I/2/208 only. Without synonymy.
1966. *Perisphinctes (Dichotomoceras) bifurcatoides* n. sp.; Enay, p. 509, text-figs 155: 2, 157; pl. 34: 1a-b, 2 (holotype), 3-4.
1989. *Perisphinctes (Dichotomoceras) bifurcatoides* Enay; Meléndez, p. 315, text-figs 64-65, 68, 69; pl. 52: 1-3; pl. 53: 1-3; pl. 54: 1-4. With synonymy.
2000. *Perisphinctes (Dichotomoceras) bifurcatoides* Enay; Gygi, p. 86, text-fig. 48, pl. 9: 2.

MATERIAL: Microconchs: A/I/2/14 figured by Siemiradzki (1891, pl. 1: 6) and now on Fig. 57: 2; A/I/2/41 figured by



Fig. 59. The whorl section of *Perisphinctes (Dichotomoceras) cf. bifurcatoides* Enay, 1966: A/I/2/208, at $D=48$ mm. Natural size.

Siemiradzki (1891, pl. 5: 3) and now on Fig. 57: 3; A/I/2/164, A/I/2/207 (Fig. 57: 4), A/I/2/208, A/I/2/178, A/I/2/343 (Fig. 57: 5), A/I/2/344.

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/14	54	wholly septate	54	0.41	0.35	30:50 54:47	42:47 -	48:47 -
A/I/2/41	53	42	53	0.43	0.32	25:54	35:48	53:46
A/I/2/164	c. 100	c. 64	37 63	0.41 0.44	0.35 0.30	25:51 65:50	33:47 -	48:47 -
A/I/2/178	110	95	95	-	0.32	-	-	-
A/I/2/207	53	28	53	0.42	0.32	39:44	45:44	53:46
A/I/2/208	48	40	48	0.42	0.42	30:45	40:47	50:50
A/I/2/343	94	53	94	0.45	0.31	44:48	57:50	94:58

Tab. 33. *Perisphinctes (Dichotomoceras) cf. bifurcatoides* Enay, 1966.

LOCALITY: Brodła: A/I/2/14, A/I/2/41, A/I/2/164; Kozłowiec: A/I/2/207, A/I/2/208, A/I/2/343; Okleśna: A/I/2/178, A/I/2/344.

COLLECTOR: Dr. Stanisław Zaręczny collected the specimens A/I/2/207, A/I/2/208 and probably also A/I/2/343. No data on the other specimens.

DESCRIPTION: A/I/2/344 is a fragment of the adult body chamber. It is not valid for biometric study. A/I/2/14 (Fig. 57: 2) consists of the

septate inner whorls. The other specimens are complete or incomplete immature microconchs. They are septate to D_r from between 40 mm (A/I/2/208) and 95 mm (A/I/2/178) (Tab. 33). In A/I/343 (Fig. 57: 5) the entire outer whorl is body chamber. The existing fragments of body chambers in the other specimens are 1/4 of a whorl long. The whorl section is subrectangular or slightly trapezoidal (Fig. 59); occasionally it is high oval, with slightly convex whorl sides and ventral area. The coiling of the whorls is weakly involute in the range of diameters from between *ca.* 30 mm and 40 mm; at the diameters bigger than this it becomes moderately evolute. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter are *ca.* 2/5 and 1/3, respectively, at $D=ca.$ 50 mm (Tab. 33). The ribs are thin and sharp, prorsiradiate on the whorl sides, occasionally S-shaped. They bifurcate. The division point is sharp. It is situated at *ca.* 2/5 of the whorl height. The secondary ribs are inclined forward. The rib number is *ca.* 50-54 per whorl at $D=ca.$ 30 mm and *ca.* 46-47 per whorl at $D=ca.$ 53 mm (*cf.* $D:r$ in Tab. 33). At the diameters bigger than this mentioned the rib number increases.

STRATIGRAPHICAL POSITION: Stenocycloides Subzone of the Bifurcatus Zone in the Upper Oxfordian (Enay 1966; Meléndez 1989).

Perisphinctes (Dichotomoceras) bifurcatus
(Quenstedt, 1847)
Tab. 34.

1847. *Ammonites biplex bifurcatus* sp. nov.; Quenstedt, p. 163; pl. 12: 11.
1887. *Ammonites bifurcatus* Quenstedt, 1847; Quenstedt, p. 931; pl. 101: 9-10.
1891. *Perisphinctes bifurcatus* (Quenstedt, 1847); Siemiradzki, p. 52 (*pars*, A/I/2/210 only), *non* pl. 5: 3.
1966. *Perisphinctes (Dichotomoceras) bifurcatus* (Quenstedt, 1847); Enay, p. 504, pl. 33: 1-7; text-fig. 153. With synonymy.
2000. *Perisphinctes (Dichotomoceras) cf. bifurcatus* (Quenstedt, 1847); Gygi, p. 87, pl. 8: 3.

MATERIAL: A/I/2/210 [m].

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/210	66	45	64	0.42	0.33	30:41 64:39	40:38 66:41	45:37 -

Tab. 34. *Perisphinctes (Dichotomoceras) bifurcatus* (Quenstedt, 1847).

LOCALITY: Tenczynek.

DESCRIPTION: This is a mature microconch septate to $D_r=45$ mm, which has $D_m=66$ mm (Tab. 34). The outer whorl is body chamber. The specimen is partly crushed flat and incomplete (the first half of the outer whorl is missing). The whorl section is flat-sided with rounded ventral area and margins. The coiling of the whorls is weakly involute. The ratios of umbilical diameter (u) and the whorl height (h) against shell diameter are *ca.* 2/5 and 1/3, respectively (*cf.* u and h in Tab. 34). The ribs are thin and sharp, bifurcating. The division point is situated at 3/4 of the whorl height. The secondary ribs form a conspicuous sinus on the venter. The rib number is 41 per whorl at $D=30$ mm and 41 at $D=60$ mm, with the minimum number of ribs per whorl (37) at $D=45$ mm (Tab. 34).

STRATIGRAPHICAL POSITION: Grossouvrei Subzone of the Bifurcatus Zone in the Upper Oxfordian (Enay 1966; Meléndez 1989).

Perisphinctes (Dichotomoceras) duongae
Meléndez, 1989
Tab. 35.

1989. *Perisphinctes (Dichotomoceras) duongi* sp. nov.; Meléndez, p. 325, pl. 56: 1-6.
2000. *Perisphinctes (Dichotomoceras) duongae* Meléndez; Gygi, p. 86, text-fig. 49, pl. 9: 4.

MATERIAL: A/I/2/313a.

LOCALITY: Nowa Góra.

DESCRIPTION: Specimen A/I/2/313a is wholly septate up to $D_m=52$ mm. The whorl section is high oval. The ratios of umbilical diameter (u) and the

No of specimen	D_m	D_r	D	u	h	$D:r$
A/I/2/313a	52	wholly septate	52	0.40	0.37	-

Tab. 35. *Perisphinctes (Dichotomoceras) duongae* Meléndez, 1989.

whorl height (h) are *ca.* 2/5 each one (Tab. 35). The ribs are thin and densely spaced on the whorl sides of the inner whorls and become distantly spaced on the outer whorl. They bifurcate. The division point is situated at 2/3 of the whorl height. The secondary ribs distinctly sweep forward.

STRATIGRAPHICAL POSITION: The species ranges in the upper part of the *Stenocycloides* Subzone of the *Bifurcatus* Zone (*cf.* Meléndez 1989) in the Upper Oxfordian.

Perisphinctes (Dichotomoceras) sp.

Tab. 36.

1891. *Perisphinctes alpinus* sp. nov.; Siemiradzki, p. 36 (*pars*, A/I/2/161 and A/I/2/163 only). Without synonymy.

MATERIAL: A/I/2/161, A/I/2/163 [former syntypes of *Perisphinctes alpinus* Siemiradzki, 1891, *cf.* respective description].

LOCALITY: Kozłowiec: A/I/2/163. No data on the origin of A/I/2/161.

DESCRIPTION: Immature microconchs ranging in D_m from 63 mm to 73 mm (Tab. 36). A/I/2/161 is septate to $D_r=49$ mm. A quarter of the outer whorl is body chamber. In A/I/2/163 the whorls are partly covered by matrix. Septa are not discernible in this specimen. The whorl section is flat-sided, with a convex ventral area. The coiling of the whorls is nearly involute. In A/I/2/161 only, it changes to moderately evolute on the outer whorl. The ratios of umbilical diameter (u) and the whorl height (h) are *ca.* 2/5 and 1/3, respectively (Tab. 36). The ribs are thin, sharp, bifurcating. The secondary ribs sweep forward on the venter. The rib-density curve of A/I/2/161 is U-shaped.

REMARKS: The former syntypes of *Perisphinctes alpinus* Siemiradzki described herein are unidentifiable whorls of *Perisphinctes (Dicho-*

tomoceras) sp. No more precise assignment at the species level would be possible.

Subfamily *Passendorferiinae* Meléndez, 1989

REMARKS: Callomon (1980) assigned the Tethyan branch of the Sub-Boreal/Submediterranean Perisphinctinae to a large subfamily Idoceratinae Spath, 1924, and explained, with respect to the studies of Brochwicz-Lewiński (*e.g.* 1973) and Brochwicz-Lewiński and Różak (1975a, 1976), that the lineage was going 'via the Upper Oxfordian genus *Passendorferia* Brochwicz-Lewiński from the basal *Bifurcatus* Zone' into *Idoceras* – *Nebroditis* – *Mesosimoceras* in the Kimmeridgian and *Simoceras* in the Tithonian. Subsequently Meléndez (1989) provided arguments for the distinction of *Passendorferia* from the true *Idoceratinae* and introduced the subfamily *Passendorferiinae* to accommodate this genus. In this paper the new genus *Neumannia* Głowniak is for the first time assigned to this subfamily, as well as *Passendorferia* (including the subgenus *Graefenbergites* Schairer *et* Schlampp from the lowermost *Bimammatum* Zone). The Kimmeridgian genera, *e.g.* *Idoceras*, persist in the subfamily Idoceratinae in accordance with Callomon (1980).

Genus *Neumannia* Głowniak, 2002

TYPE SPECIES: *Perisphinctes cyrilli* Neumann, 1907 [M]. The lectotype figured by Neumann (1907, pl. 4:12 a-b).

REMARKS: The lectotype of *P. cyrilli* derives from Četechovice (Moravia, Czech Republic), from beds b-c in the section drawn by Neumann (1907, text-fig. 1). These beds were described as Lower to Middle Oxfordian in age, Cordatum to Transversarium Zone (Neumann 1907, p. 7). This age is in accordance with the species illustrated by Neumann (1907, pp. 59-60, pls. 1-6). His material includes the Lower Oxfordian *Peltoceras*, but also the Middle Oxfordian *Cardioceras tenuicostatum* and *C. vertebrale*, as well as some densely ribbed platycone perisphinctids showing affinity to the species from the Transversarium Zone. A more

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/161	73	?	29 69	0.45 0.46	0.33 0.29	25:45 57:41	30:42 72:48	42:40 –
A/I/2/163	63	49	63	0.43	0.32	62:51	–	–

Tab. 36. *Perisphinctes (Dichotomoceras) sp.*

precise bed by bed redescription of these assemblages seems not to be possible at present. The quarries at Četechovice are now flooded and the section is no longer available. The author [E.G.] has no information if any topotype collection exists.

A homogenous assemblage of perisphinctids of Mediterranean affinity [m & M] was collected by the author (Głowniak 2002) in the Middle Oxfordian sections of Poland and referred to as the Neumann's (1907) species *e.g.* *P. cyrilli* and a few others. These specimens were allocated to the new genus *Neumannia* Głowniak, 2002 in order to accommodate the 'Mediterranean *Kranaosphinctes*' – as the Neumann's species were earlier called, for example, by Enay (1966) or Brochwicz-Lewiński (1973). The view of Brochwicz-Lewiński and Różak (1975a, 1976) was that the use of the name *Passendorferia* was inappropriate for these species, these authors interpreting them as a parallel lineage to that of *Passendorferia*. Consequently, Głowniak (2002) provisionally interpreted *Neumannia* and *Passendorferia* as independent successive offshoots of the main Mediterranean stem. Such an interpretation is substantiated by the different age of the offshoots: *Neumannia* is limited in Poland to the upper Plicatilis Zone and the lower Transversarium Zone, whereas *Passendorferia* appears in the upper Transversarium Zone and ranges higher up to the Bimammatum Zone. The appearance of *Neumannia* in Central Europe (Poland and NW Germany) was referred to by Głowniak (2006c) as the Middle Oxfordian Mediterranean Spread.

Neumannia comprises both macro- and microconchs, the latter having been described as *Neumannia* sp. and illustrated for the first time by Głowniak (2002, p. 355; pl. 8: 1, 4; text-fig. 31). No attempt has been made so far to separate taxonomically macro- and microconchs under a separate subgeneric name (*cf.* 'General explanation of the system of taxonomy used').

The species *N. sapunovi* (Brochwicz-Lewiński *et* Różak, 1976) whose holotype is in the Siemiradzki's collection, is for the first time assigned herein to the genus *Neumannia*.

Neumannia cf. cyrilli (Neumann, 1907)

Fig. 60, Tab. 37.

1891. *Perisphinctes vajdelota* sp. nov.; Siemiradzki, p. 37, *pars*, A/I/2/16 only.
 1907. *Perisphinctes cyrilli* n. sp.; Neumann, p. 39, pl. 4:12 a (lectotype).
 1966. *Perisphinctes (Kranaosphinctes) cyrilli* Neumann, 1907; Enay, p. 433, text-fig. 124, pl. 18: 2.
 1982. *Kranaosphinctes cf. cyrilli* (Neumann, 1907); Meléndez, Sequeiros, Brochwicz-Lewiński, p. 176, pl. 3.
 1989. *Kranaosphinctes cyrilli* (Neumann, 1907); Meléndez, p. 219, text-fig. 44, pl. 22: 1 a-b.
 2002. *Neumannia cyrilli* (Neumann, 1907); Głowniak, p. 356, text-figs 29-30, pl. 9: 3.

MATERIAL: A/I/2/16 [M] [former syntype of *Perisphinctes vajdelota* Siemiradzki, 1891, *cf.* respective description].

LOCALITY: Rudno, presumably.

DESCRIPTION: A/I/2/16 (Fig. 60) is a wholly septate specimen which has $D_m=195$ mm. The whorl section is subcircular and changes to subsquare on the outer whorl. The coiling of the whorls is evolute. The ratio of whorl height against umbilical diameter (h_u) is *ca.* 0.50 at $D=195$ mm. The ratios u and h are listed in Tab. 37. The primary ribs are moderately thin. They are densely spaced and somewhat prorsiradiate on the whorl sides. They bifurcate. The division point is situated at the ventral margin. The secondary ribs are low and blunt. They almost fade away after the constriction at 150 mm diameter. At this diameter they become regularly associated with intercalatory ribs (type Ib ornamentation as distinguished by Głowniak 2002, p. 354). The rib number per whorl is 56 per whorl at *ca.* 100 mm diameter, and 62 ribs per whorl at *ca.* 130 mm. At diameters bigger than this mentioned it remains almost constant. Constrictions number 1-2 per whorl.

REMARKS: The matrix of A/I/2/16, namely gray limestone, is different from the matrix of other specimens from Rudno. The latter are usually preserved in white limestone. The specimen could possibly have been collected from the heaps of

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/16	195	wholly septate	195	0.54	0.27	65:53 160:63	100:56 195:63	126:62 –

Tab. 37. *Neumannia cf. cyrilli* (Neumann, 1907).



Fig. 60. *Neumannia* cf. *cyrilli* (Neumann, 1907): A/1/2/16. Rudno. Wholly septate inner whorls. Reduced x0.90.

marls and clays left near abandoned pits described from Rudno and Grojec by Zaręczny (1894).

The specimen A/1/2/16 of *N.* cf. *cyrilli* and that of *N. cyrilli* figured by Główniak (2002, pl. 9: 3)

match each other in the rib number per whorl and in similar ontogenetic changes of ornamentation. In the two specimens mentioned the type Ia is succeeded by type Ib ornamentation at ca. 160 mm diameter.

STRATIGRAPHICAL POSITION: The FO of *Neumannia cyrilli* (Neumann) in Poland is in the *Perisphinctes (Otosphinctes) arkelli wysokae* biohorizon of the Arkelli Subzone (Plicatilis Zone). The species ranges to the *Perisphinctes (Dichotomosphinctes) antecessens* biohorizon in the Buckmani Subzone (Transversarium Zone) and disappears in the higher stratigraphical levels of the Middle Oxfordian (cf. Główniak 2002, 2006c).

Neumannia gyrus (Neumann, 1907)
Figs 61-63, Tab. 38.

1891. *Perisphinctes promiscuus* Bukowski, 1887;
Siemiradzki, p. 67 (*pars*, A/1/2/255, A/1/2/256,

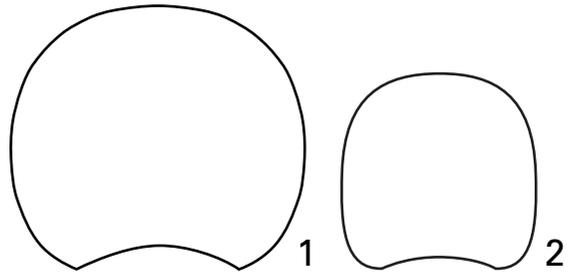


Fig. 61. The whorl section of *Neumannia gyrus* (Neumann, 1907):
1: A/1/2/255, at $D=130$ mm; 2: A/1/2/256, at $D=100$ mm. Natural size.

A/1/2/257 only). Without synonymy.
1907. *Perisphinctes gyrus* n.f.; Neumann, p. 37,
fig. 11a-b, pl. 3.
2002. *Neumannia gyrus* (Neumann, 1907);

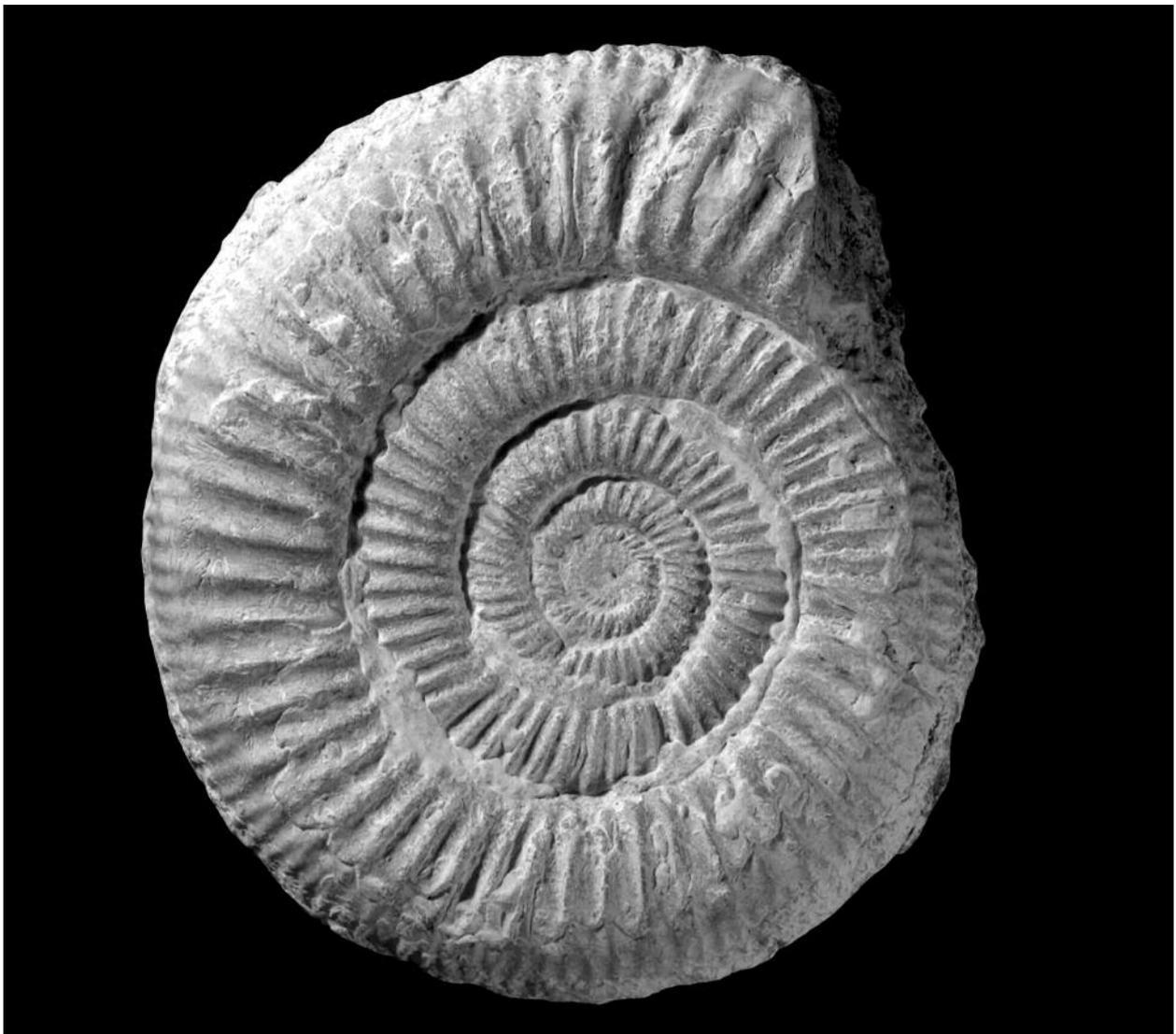


Fig. 62. *Neumannia gyrus* (Neumann, 1907): A/1/2/255 [M]. Brodła. Wholly septate inner whorl. Natural size.

Główniak, p. 357, text-figs
29, 31, pl. 7: 1-2; pl. 8: 3.
With synonymy.

MATERIAL: Macroconchs:
A/I/2/255, A/I/2/256, A/I/2/257.

LOCALITY: Brodła: A/I/2/255;
Kobylany: A/I/2/256, A/I/2/257.

DESCRIPTION: A/I/2/255 (Fig. 62) and A/I/2/256 (Fig. 63: 1) are wholly septate specimens ranging in D_m from 110 mm to 135 mm (Tab. 38). A/I/2/257 (Fig. 63: 2) has a fragment of the body chamber which is 1/4 of the outer whorl. The specimen is septate to $D_r=90$ mm (Tab. 38). The whorl section of the phragmocone varies between the specimens from subcircular to subsquare (Fig. 61). The coiling of the whorls is evolute. The ratios of the umbilical diameter (u) and the whorl height (h) against shell diameter are nearly $3/5$ and $1/4$, respectively (Tab. 38).

The ribs are moderately thin, rectiradiate, bifurcating. The secondary ribs are occasionally associated with intercalatory ribs (e.g. A/I/2/255). Zigzag ribs occur occasionally. The ribs on the venter are low and blunt. The rib number per whorl varies from 35 to 42 per whorl at $D=ca.$ 35 mm, and from 46 to 50 at $ca.$ 60 mm diameter. In the range of diameters bigger than the latter, the rib number per whorl changes but slightly, and near the maximum diameters studied it remains approximately constant. Constrictions number 1-2 per whorl.

REMARKS: *Neumannia gyrus* (Neumann, 1907) differs from *Perisphinctes* (*Kranasphinctes*) (*Kranasphinctes*) (*promiscuus*)

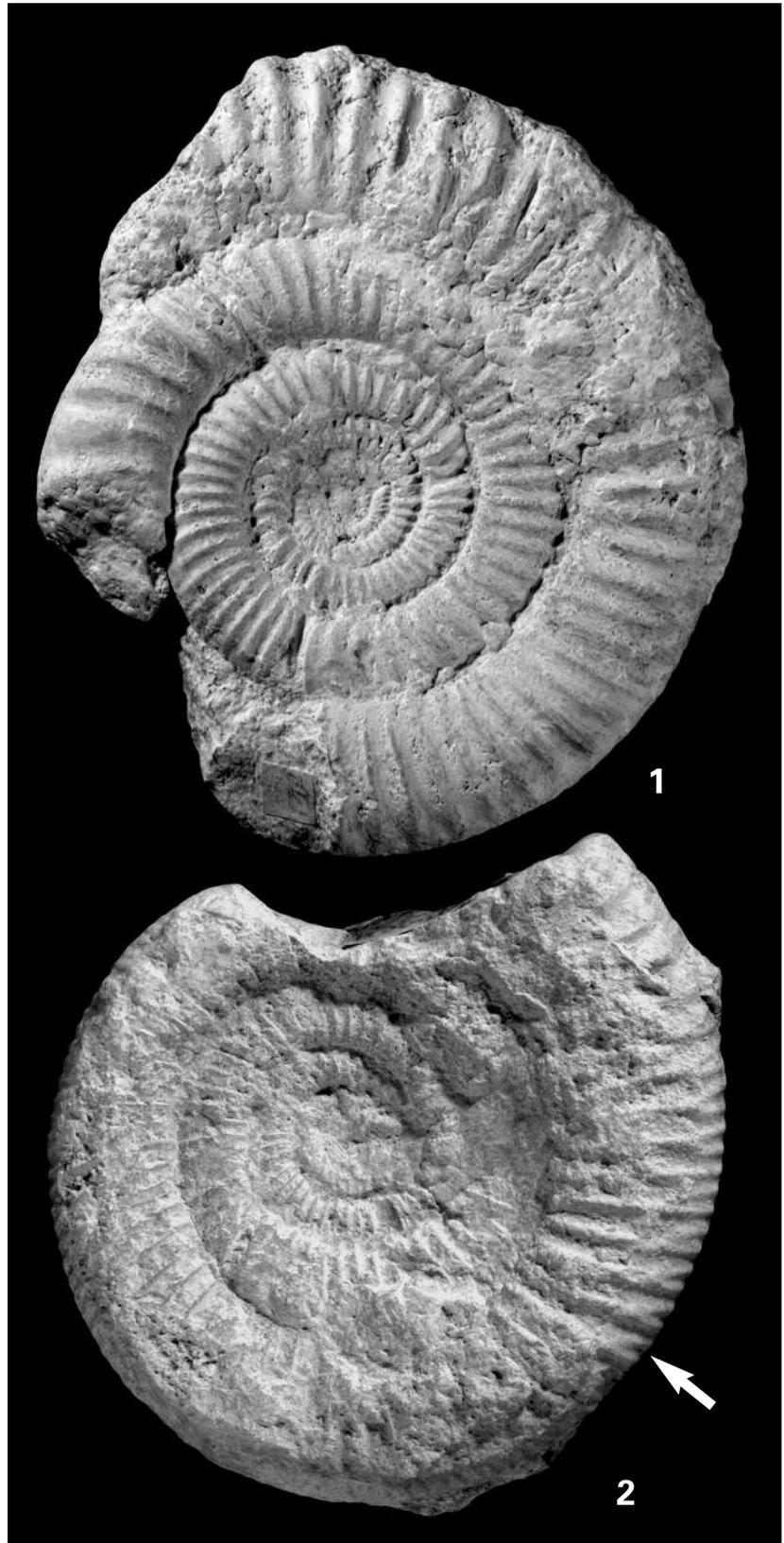


Fig. 63. *Neumannia gyrus* (Neumann, 1907): 1: A/I/2/256. Kobylany; 2: A/I/2/257. Kobylany. A/I/2/256 is wholly septate. Arrow indicates the end of the phragmocone. Natural size.

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/1/2/255	135	wholly septate	40 127	0.53 0.55	0.25 0.22	25:34 60:46 118:53	35:35 80:51 128:54	48:41 105:53 135:54
A/1/2/256	110	wholly septate	73 110	0.56 0.57	0.25 0.23	32:39 65:46	42:39 70:48	53:43 110:52
A/1/2/257	100	90	70 95	0.57 0.55	0.24 0.23	35:42 100:56	50:47 –	56:50 –

Tab. 38. *Neumannia gyrus* (Neumann, 1907).

Bukowski, 1887 in its bigger final size (*ca.* 200 mm diameter in *N. gyrus* as compared to *ca.* 150 mm in *P. (K.) promiscuus*), and in greater diameter (120-130 mm *versus* 90 mm in *P. (K.) promiscuus*) at which intercalatory ribs first appear (*i.e.* type Ib ornamentation as distinguished by Głowniak 2002).

STRATIGRAPHICAL POSITION: The FO of the species in Poland is in the Middle Oxfordian *Platysphinctes* event-horizon in the *Perisphinctes (Otosphinctes) arkelli arkelli* biohorizon in the Arkelli Subzone (Plicatilis Zone, Middle Oxfordian). The species ranges higher up to the top of the Arkelli Subzone and to the overlying *Perisphinctes (Dichotomosphinctes) antecedens* biohorizon in the lower Buckmani Subzone (Transversarium Zone) where it has its LO (Głowniak 2002, 2006c).

Neumannia sapunovi (Brochwicz-Lewiński et Różak, 1976)
Fig. 64, Tab. 39.

1891. *Perisphinctes cf. torquatus* (Sowerby); Siemiradzki, p. 67 (*pars*, A/1/2/261 only). Without synonymy.

1976. *Nebrodites (Mesosimoceras) sapunovi* sp. nov.; Brochwicz-Lewiński, Różak, p. 385, pl. 37: 1 (holotype).

FORMER SYNTYPES: A/1/2/261.

HOLOTYPE: The specimen A/1/2/261 [M] of *Neumannia sapunovi* was designated holotype by Brochwicz-Lewiński and Różak (1976). It is figured by Brochwicz-Lewiński and Różak (1976, pl. 37: 1) and now on Fig. 64.

TYPE LOCALITY: 'Brodla, on the left side of road to Poręba' as inscribed on the original label

of the specimen.

COLLECTOR: Stanisław Olszewski, in 1877.

DESCRIPTION: The holotype A/1/2/261 (Fig. 64) is probably a mature macroconch. It is septate to $D_r=106$ mm (Tab. 39). The existing fragment of the body chamber is half of a whorl long. The whorl section of the phragmocone is subcircular and of the body chamber – subsquare. The coiling of the whorls is evolute. The ratios of umbilical diameter (u) and whorl height (h) against shell diameter is nearly $3/5$ and *ca.* $1/5$ at $D=ca.$ 127 mm, respectively (*cf.* u and h in Tab. 39). The primary ribs are thin but not sharp. They are thinner and more densely spaced on the whorl sides of the phragmocone than on the body chamber. They bifurcate. The division point is situated at the ventral margin. It is prominent on the body chamber. The secondary ribs are irregularly associated with the intercalatory ribs. The ribs on the venter are low and blunt. They almost disappear on the second half of the body chamber. There is 75 ribs per whorl at $D=65$ mm (Tab. 39) and, 52 per whorl at $D=128$ mm. There is one parabolic rib on the phragmocone. It appears one whorl before the septation ceases. The constrictions number 1-2 per whorl.

REMARKS: *N. sapunovi* (Brochwicz-Lewiński et Różak, 1976) is the smallest species of the genus *Neumannia*. Its maximum diameter is not much more than 130 mm diameter. The closest in size to *N. sapunovi*, although somewhat larger, is *Neumannia aff. cyrilli* (Neumann, 1907) (see Głowniak 2002, pl. 8: 2). The macroconchs of the latter species grow up to *ca.* 170 mm diameter. *N. sapunovi* and *N. aff. cyrilli* show similar features, *e.g.* the ribs in the two species are densely spaced on the phragmocone and become more distantly spaced on the body chamber; additionally both forms have the ribs slightly enhanced at the ventral margin.

N. sapunovi differs from any species of the

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/1/2/261 lectotype	128	106	62 127	0.56 0.58	0.24 0.22	65:75 98:64	83:69 110:55	90:66 128:52

Tab. 39. *Neumannia sapunovi* (Brochwicz-Lewiński et Różak, 1976).



Fig. 64. *Neumannia sapunovi* (Brochwicz-Lewiński et Różak, 1976): A/1/2/261 (holotype). Brodła. Arrow indicates the end of the phragmocone. Natural size.

genus *Passendorferia* s. str. in the lack of simple ribs, presence of parabolic ribs, and the much smaller final size of adults. Other features, such as the evolute coiling of the whorls, rounded to oval whorl section, densely spaced ribs on the phragmocone and the enhancement of division points at the ventral margin are features in common with *N. sapunovi* and the other species of *Passendorferia* s. str.

AMENDED STRATIGRAPHICAL POSITION: In Poland, the Middle Oxfordian genus *Neumannia* ranges from the Middle Oxfordian *Platysphinctes* event-horizon in the *Perisphinctes* (*Otosphinctes*) *arkelli arkelli* biohorizon in the Arkelli Subzone (Plicatilis Zone) to the *Perisphinctes* (*Dichotomosphinctes*) *antecedens* biohorizon in the Buckmani

Subzone (Transversarium Zone) (cf. Główniak 2002); such is also the presumable stratigraphical range of *N. sapunovi*. The preservation of this specimen in grey limestone is in accordance with the common occurrence of grey limestone in the carbonate sections of Poland at the turn of the Plicatilis/Transversarium zones (cf. Matyja 1977). The stratigraphical range of the species was incorrectly referred to the 'Upper Oxfordian or lowermost Kimmeridgian' by Brochwicz-Lewiński and Różak (1976).

Genus *Passendorferia* Brochwicz-Lewiński, 1973

TYPE SPECIES: *Passendorferia teresiformis* Brochwicz-Lewiński, 1973 [M]. Holotype illustrated

by Brochwicz-Lewiński (1973, pl. 13: 1-2).

Subgenus *Enayites* Brochwicz-Lewiński et
Różak, 1976

TYPE SPECIES: *Ammonites birmensdorfensis*
Moesch, 1867 [m]. Lectotype figured by Moesch
(1867, pl. 1: 3), and then illustrated by Enay (1966,
pl. 27: 1-2).

Passendorferia (Enayites) birmensdorfensis
(Moesch, 1867)
Fig. 65, Tab. 40.

1891. *Perisphinctes birmensdorfensis* (Moesch,
1867); Siemiradzki, p. 54.

1989. *Passendorferia (Enayites) birmensdor-*
fensis (Moesch, 1867); Meléndez, p. 157,
text-fig. 32; pl. 11: 5-12. With synonymy.

2000. *Passendorferia (Enayites) birmensdor-*
fensis (Moesch, 1867); Gygi, p. 91, text-fig. 55,
pl. 5: 2.

2001. *Passendorferia (Enayites) birmensdor-*
fensis (Moesch, 1867); Gygi, p. 89, figs 134-
135, tab. 51.

MATERIAL: A/I/2/213.

LOCALITY: Trzebinia.

DESCRIPTION: A/I/2/213 (Fig. 65) is a pathological
microconch. It shows an injury which extends along

No of specimen	D_m	D_r	D	u	h	$D:r$
A/I/2/213	50	29	27 50	0.48 0.46	0.26 0.26	– –

Tab. 40. *Passendorferia (Enayites) birmensdorfensis* (Moesch, 1867).

the ventral margin of the body chamber. The
specimen is septate to $D_r=29$ mm, and has
 $D_m=50$ mm (Tab. 40). The existing fragment of
the body chamber is 3/4 whorl long. The
phragmocone is covered by matrix. The coiling of
the whorls is nearly evolute. The primary ribs are
thin, bifurcating.

STRATIGRAPHICAL POSITION: In
the type area, Canton Aargau,
Switzerland, the species ranges
in the Luciaeformis Subzone

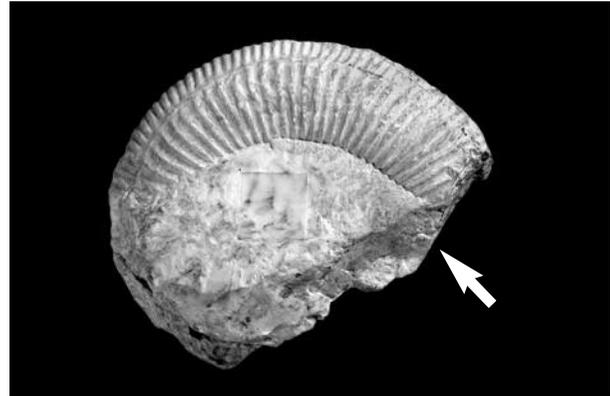


Fig. 65. *Passendorferia (Enayites) birmensdorfensis* (Moesch, 1867):
A/I/2/213. Trzebinia. Arrow indicates the end of the phragmocone.
Natural size.

of the Transversarium Zone in the Middle
Oxfordian (cf. Gygi 2000).

Passendorferia ? (Enayites ?) sp.
Tab. 41.

1891. *Perisphinctes plicatilis* (Sowerby, 1818);
Siemiradzki, p. 34 (*pars*, A/I/2/155 only).
Without synonymy.

MATERIAL: A/I/2/155.

LOCALITY: Baczyn.

DESCRIPTION: A/I/2/155 is probably a nearly
mature microconch which has $D_m=60$ mm
(Tab. 41). The inner whorls are crushed flat
and septa are not discernible. The outer whorl
is probably a body chamber. The whorl section is
subcircular. The coiling of the whorls is evolute.
The ribs are thin, bifurcating. The secondary
ribs gently sweep forward on the venter.

STRATIGRAPHICAL POSITION: The subgenus
Enayites ranges from the Cordatum Zone
in the Lower Oxfordian to the Bimammatum
Zone in the Upper Oxfordian (cf. Brochwicz-
Lewiński, Różak 1976).

No of specimen	D_m	D_r	D	u	h	$D:r$		
A/I/2/155	60	?	59	0.49	0.27	34:51	50:53	60:57

Tab. 41. *Passendorferia ? (Enayites ?) sp.*

SYSTEMATIC DESCRIPTION OF THE SPECIES
OF THE FAMILIES ATAXIOCERATIDAE,
PERISPINCTIDAE AND AULACOSTEPHANIDAE
FROM THE BIMAMMATUM AND PLANULA
ZONES

by Andrzej Wierzbowski

Superfamily Perisphinctoidea Steinmann, 1890
Family Ataxioceratidae Buckman, 1921

Genus *Orthosphinctes* Schindewolf, 1925

Subgenus *Orthosphinctes* Schindewolf, 1925

TYPE SPECIES: *Ammonites tiziani* (Oppel, 1863)
[m] illustrated by Wegele (1929, pl. 1: 4).

Orthosphinctes (Orthosphinctes) tiziani
(Oppel, 1863)
Fig. 66: 1-2.

1863. *Ammonites Tiziani* Oppel; Oppel, p. 246.
1891. *Perisphinctes transatlanticus* Steinmann;
Siemiradzki, p. 66.
1891. *Perisphinctes haliarchus* Neumayr;
Siemiradzki, p. 66.
1929. *Perisphinctes Tiziani* Oppel; Wegele,
pl. 1: 4a,b (lectotype).
1997. *Orthosphinctes tiziani* (Oppel); Schweigert,
Callomon, pl. 4: 1-2, pl. 5: 1 (with given
synonymy)
1997. *Orthosphinctes (Orthosphinctes) tiziani*
(Oppel); Matyja, Wierzbowski, pl. 6: 1.

MATERIAL: A/I/2/239, A/I/2/240.

LOCALITY: Kraków – Podgórze.

COLLECTOR: Dr. Stanisław Zaręczny.

DESCRIPTION: The larger specimen (A/I/2/239 – ‘*P. transatlanticus*’) (Fig. 66: 2) with most of the body chamber preserved is 125 mm in diameter; the phragmocone/body chamber boundary is at 90 mm diameter. The smaller specimen (A/I/2/240 – ‘*P. haliarchus*’) (Fig. 66: 1) is 88 mm in diameter and consists of phragmocone (up to 65 mm diameter) and a part of the body chamber. The coiling is strongly evolute (in the specimen A/I/2/239 at $D=125$ mm, $u=0.54$, $h=0.27$; in the specimen A/I/2/239 at $D=82$ mm,

$u=0.50$, $h=0.28$). The ribbing is rectiradiate, fairly dense. At about 85-125 mm the number of primaries attains 48-49 ribs per whorl in the larger specimen (A/I/2/239); at about 33-88 mm the number of primaries ranges from 38 to 44 ribs per whorl in the smaller specimen (A/I/2/240). The ribs divide high on the whorl sides, mostly into two secondaries with occasional additional secondaries; r_i is about 2.4 at $D=120$ mm, and about 2.0-2.1 at smaller diameters. The constrictions are fairly prominent, about 2 per whorl.

STRATIGRAPHICAL POSITION: The species occurs in the Hauffianum Subzone of the Bimammatum Zone in Poland (Matyja, Wierzbowski 1997), and elsewhere in Submediterranean Europe (Schweigert, Callomon 1997).

Subgenus *Pseudorthosphinctes* Enay, 1966

TYPE SPECIES: *Orthosphinctes (Pseudorthosphinctes) alternans* Enay, 1966 illustrated by Enay (1966, text-figs 158, 159-1).

Orthosphinctes (Pseudorthosphinctes)
fontannesii (Choffat, 1893)
Fig. 67.

1893. *Perisphinctes fontannesii* Choffat; Choffat,
pl. 9: 1 and 3, pp. 40-41.
1966. *Orthosphinctes (Orthosphinctes) fontannesii* (Choffat); Enay, p. 517.
1988. *Orthosphinctes (Orthosphinctes) fontannesii* (Choffat); Atrops, Marques, pl. 2: 1.

MATERIAL: Specimen A/I/2/318 (Fig. 67) in the Siemiradzki's collection is referred to as *Perisphinctes* n. sp. aff. *unicomptus* (Fontannes in Dumortier et Fontannes), but not described in the monograph by Siemiradzki (1891).

LOCALITY: Górki near Trzebinia.

DESCRIPTION: The specimen is 190 mm in diameter. The phragmocone ranges up to 110 mm diameter, and the body chamber is one whorl long. Coiling is moderately evolute: at $D=176$ mm, $u=0.45$, $h=0.31$. Whorl section is high oval.

The ribs are densely spaced, prorsiradiate, somewhat concave. There are about 60



Fig. 66. *Orthosphinctes (Orthosphinctes) tiziani* (Oppel, 1863): 1: A/I/2/240. Kraków – Podgórze; 2: A/I/2/239. Kraków – Podgórze. Arrows indicate the end of the phragmocones. Natural size.



Fig. 67. *Orthosphinctes* (*Pseudorthosphinctes*) *fontanesi* (Choffat, 1893): A/1/2/318. Górki near Trzebinia. Arrow indicates the end of the phragmocone. Reduced $\times 0.95$.

primaries per whorl on the body chamber. The secondary ribs appear at about 2/3 of whorl height; r_i ranges about 2.4 on the last

part of the body chamber. Constrictions are shallow, showing a similar course as the ribs, about 2 in number per whorl.

REMARKS: The specimens attributed to the species (*cf.* synonymy) are fairly large attaining 130-140 mm in diameter but without the aperture preserved. Although they were treated by these authors as microconchs and attributed to the subgenus *Orthosphinctes*, their true nature is somewhat unclear. Schweigert and Callomon (1997)

treat the species in question as representing a macroconch and attributed to the subgenus *Pseudorthosphinctes*. The specimen studied is the largest illustrated specimen attributed to this species, and its character of ornamentation and size may be treated in favour of the latter subgeneric interpretation.



Fig. 68. *Orthosphinctes* (*Pseudorthosphinctes*) sp. nov. in Enay (1966): A/1/2/317. Górki near Trzebinia. Arrow indicates the end of the phragmocone. Natural size.

STRATIGRAPHICAL POSITION: The species in question occurs in the Hypselum Subzone of the Bimammatum Zone (see *e.g.* Atrops, Marques 1988; Schweigert, Callomon 1997).

Orthosphinctes (*Pseudorthosphinctes*) sp. nov. in Enay (1966)
Fig. 68.

1966. *Orthosphinctes* (*Pseudorthosphinctes*) sp.; Enay, text-figs 158, 160-1, 160-2, 171-1; pp. 524-525.

2003. *Orthosphinctes* (*Pseudorthosphinctes*) n. sp. Enay, 1966; Gygi, text-figs 14-15, tab. 5, p. 31.

MATERIAL: specimen A/I/2/317 (Fig. 68) in the Siemiradzki collection, referred to as *Perisphinctes* n. sp. aff. *unicomptus* (Fontannes in Dumortier et Fontannes), but not described in the monograph by Siemiradzki (1891).

LOCALITY: Górki near Trzebinia.

DESCRIPTION: The specimen is 160 mm in diameter and consists of phragmocone (up to 150 mm diameter) and the initial part of the body chamber. The section of the last whorl is high oval, that of inner whorls is more rounded. The coiling is moderately evolute (at $D=147$ mm, $u=0.45$, $h=0.33$). Primary ribs are fairly densely spaced: there are about 40 ribs at $D=150$ mm. Ribbing is fairly strong becoming even increasingly stronger in the last half whorl preserved. The primary ribs are rectiradial, splitting irregularly into 2 or 3 secondary ribs; intercalatory ribs occasionally occur; r_i is rather low and it attains about 3.0 at the beginning of the body chamber.

REMARKS: The specimen studied compares quite closely with incompletely preserved specimens of *Pseudorthosphinctes* (*cf.* synonymy) representing possibly a new species. According to Schweigert and Callomon (1997) this form is, however, possibly conspecific with *Orthosphinctes* (*Pseudo-rthosphinctes*) *alternans* Enay.

STRATIGRAPHICAL POSITION: The specimens so far described came from lower part of the Bimammatum Zone (Enay 1966; Gygi 2003).

Orthosphinctes (*Pseudorthosphinctes*)
lisowicensis Wierzbowski, 1978
Fig. 69.

1891. *Perisphinctes polygyratus* (Reinecke); Siemiradzki, p. 60.

1978. *Orthosphinctes* (*Pseudorthosphinctes*) *lisowicensis* Wierzbowski; Wierzbowski, p. 327, text-fig. 9; pl. 9: 1-2.

1997. *Orthosphinctes* (*Pseudorthosphinctes*) *lisowicensis* Wierzbowski; Matyja, Wierzbowski, p. 87, pl. 6: 3.

MATERIAL: A/I/2/228 (Fig. 69: 1), A/I/2/229 (Fig. 69: 2).

LOCALITY: Kraków – Podgórze (Krzemionki) and Kraków – Kurdwanów.

COLLECTOR: Franciszek Bieniasz, 1887, collected the specimen A/I/2/228. Ignacy Bochnic, 1884, collected the specimen A/I/2/229.

DESCRIPTION: The specimens represent the phragmocone and a body chamber about one whorl long (which is but fragmentarily preserved in specimen A/I/2/228). The peristome is nowhere preserved. D_m attains about 130-140 mm. Whorl section is oval. The coiling is strongly evolute, especially in the phragmocone. At the end of the phragmocone, $D=84-87$ mm, $u=0.52-0.54$, $h=0.27-0.30$; on the body chamber (specimen A/I/2/229), $D=143$ mm, $u=0.49$, $h=0.29$. The ribbing is sharp and fairly dense; in specimen A/I/2/228 the numbers of primary ribs per whorls are: 39 (at $D=30$ mm), 46 (at $D=60$ mm), and 43 (at $D=85$ mm); in specimen A/I/2/229 the numbers are as follows: about 50 (at $D=60$ mm), and 51 (at $D=115-140$ mm). The primary ribs are weakly prorsiradial, the secondary ribs more strongly so.

The ribs are mostly biplicate, but on the outer whorl also triplicate; intercalatory ribs are fairly common; r_i attains 2.4-2.7 at the phragmocone/body chamber boundary, and grows to about 3.0-3.4 on the body chamber. Constrictions are well marked, rather deep.

REMARKS: The species includes the macroconchs whose possible microconch counterparts are representatives of the *Orthosphinctes* (*Orthosphinctes*) *tiziani* (Oppel) group.



Fig. 69. *Orthosphinctes* (*Pseudorthosphinctes*) *lisowicensis* Wierzbowski, 1978: 1: A/I/2/228, Kraków – Podgórze (Krzemionki); 2: A/I/2/229, Kraków – Kurdwanów. Arrows indicate the end of the phragmocones. Reduced x0.85.

STRATIGRAPHICAL POSITION: *Orthosphinctes* (*Pseudorthosphinctes*) *lisowicensis* occurs in the Bimammatum Zone of Poland – mostly in the Hauffianum Subzone but possibly also in the upper part of the Bimammatum Subzone (see Matyja, Wierzbowski 1997).

Subgenus *Lithacosphinctes* Olóriz, 1978

TYPE SPECIES: *Ammonites lictor evolutus* (Quenstedt, 1888) [M] illustrated by Quenstedt (1888, pl. 105:2)

Orthosphinctes (*Lithacosphinctes*) *evolutus*
(Quenstedt, 1888)
Fig. 70.

1891. *Perisphinctes Achilles* (d'Orbigny);

Siemiradzki, pp. 72-73.

1982. *Orthosphinctes* (*Lithacosphinctes*) *evolutus* (Quenstedt, 1888); Atrops, pl. 25: 1-2; pl. 26: 1; pl. 27: 1; pl. 28: 1, pl. 29: 1; pl. 45: 1; pp. 125-131, text-fig. 22 (with given synonymy).

MATERIAL: A/I/2/277 (Fig. 70).

LOCALITY: Kraków – Podgórze.

COLLECTOR: Dr. Stanisław Zaręczny.

DESCRIPTION: The specimen studied is 135 mm in diameter, and it includes the phragmocone (up to 84 mm diameter), and a large part of the body chamber, about one whorl long. The whorl section is high oval. Coiling is moderately evolute (at $D=133$ mm, $u=0.46$, $h=0.31$). The ribbing is fairly dense on the inner whorls and the

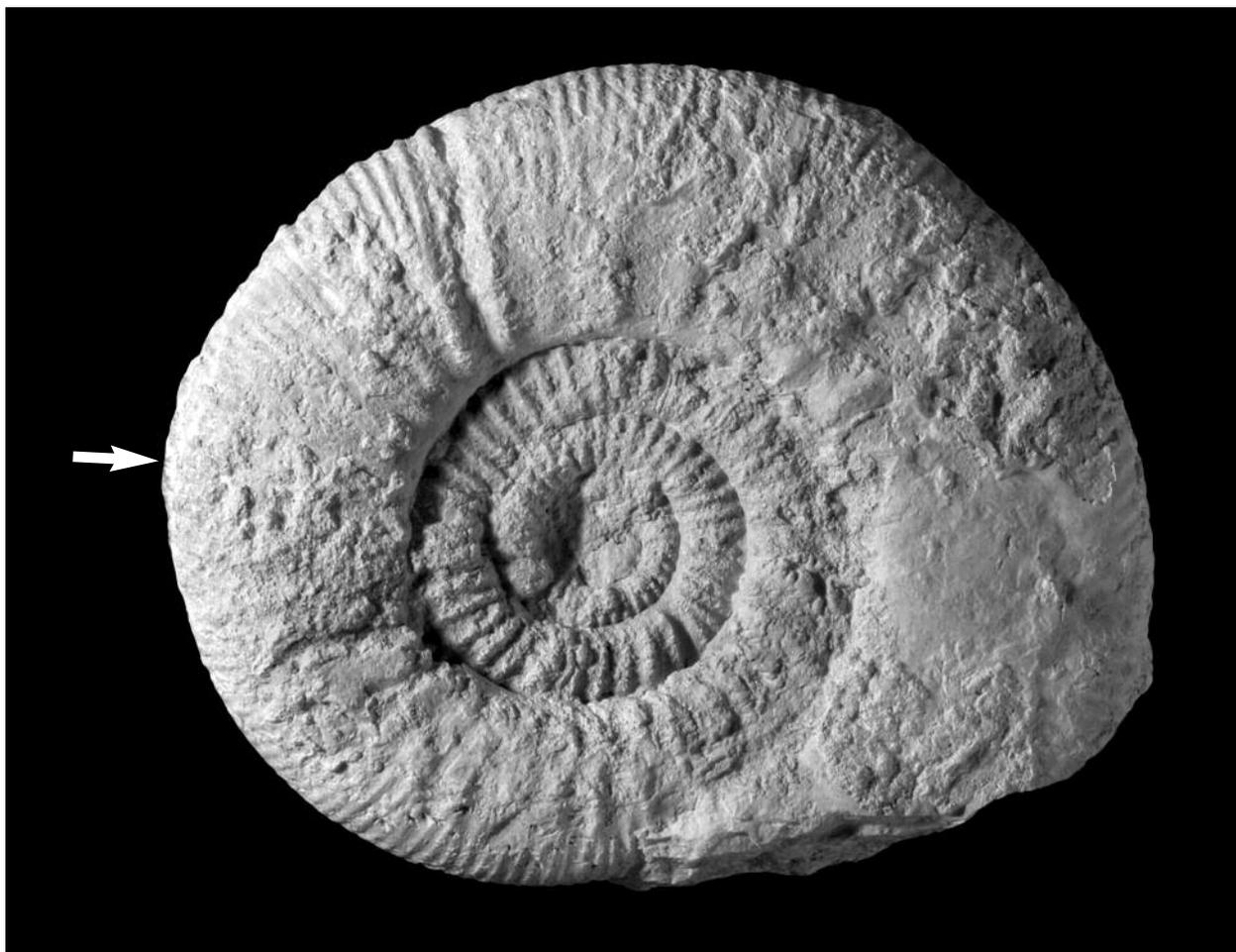


Fig. 70. *Orthosphinctes* (*Lithacosphinctes*) *evolutus* (Quenstedt, 1888): A/I/2/277. Kraków – Podgórze. Arrow indicates the end of the phragmocone. Natural size.

beginning of the last whorl: there are about 35-40 primary ribs per whorl; the primary ribs split irregularly into two or three secondary ribs with numerous intercalatory ribs; r_i equals 3.4 at the beginning of the last whorl. The primary ribs become more loosely spaced from 110 mm diameter; they are swollen at the umbilicus, but tend to fade at the middle of the whorl height; r_i increases here up to 5.0. Constrictions are deeply incised and prorsiradiate, about 2 per whorl.

STRATIGRAPHICAL POSITION: The species occurs in the Planula Zone and lowermost part of the Platynota Zone (Atrops 1982), but ranges down into upper part of the Bimammatum Zone in Poland (mostly the Hauffianum Subzone – see Matyja, Wierzbowski 1997).

Subgenus *Praeataxioceras* Atrops, 1982

TYPE SPECIES: *Perisphinctes laufenensis* Siemiradzki, 1898 [m] illustrated by Siemiradzki (1898-1899, pl. 26:46).

Orthosphinctes (Praeataxioceras) laufenensis (Siemiradzki, 1899)

Fig. 71.

1891. *Perisphinctes inconditus* (Fontannes in Dumortier et Fontannes); Siemiradzki, p. 60.
 1899. *Perisphinctes laufenensis* Siemiradzki; Siemiradzki, p. 188, text-fig. 33, pl. 26: 46.
 1982. *Orthosphinctes (Praeataxioceras) laufenensis* Siemiradzki; Atrops, p. 50.
 1997. *Orthosphinctes laufenensis* (Siemiradzki); Matyja, Wierzbowski, 1997, p. 88, pl. 8: 2.
 2003. *Orthosphinctes (Praeataxioceras) laufenensis* (Siemiradzki); Gygi, pp. 34-35, text-figs 20-21 (with given synonymy).

MATERIAL: A/I/2/230 (Fig. 71).

LOCALITY: Kraków, possibly Kraków – Podgórze (Siemiradzki 1891, p. 60).

DESCRIPTION: The specimen is 51 mm in diameter. It consists of the phragmocone (up to 38 mm diameter) and with half of a whorl of the body chamber preserved. The coiling is evolute (at the end of specimen at

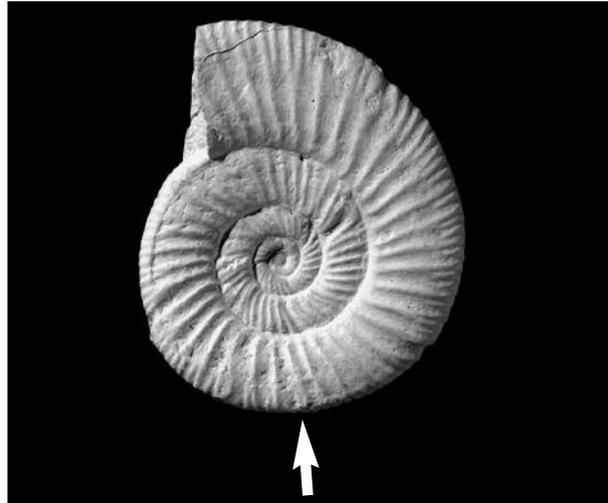


Fig. 71. *Orthosphinctes (Praeataxioceras) laufenensis* (Siemiradzki, 1899): A/I/2/230. Kraków, possibly Kraków – Podgórze. Arrow indicates the end of the phragmocone. Natural size.

$D=51$ mm, $u=0.49$, $h=0.33$). The ribbing is rather dense (the rib number per whorl is 39 at 32-51 mm diameters). The primary ribs are prorsiradiate, splitting into two or three secondary ribs at 2/3 of the whorl height; the intercalatory ribs appear also on the outer part of whorl. Constrictions are common, and the parabolic ribs at the constrictions do occur.

The specimen is possibly a microconch as may be inferred from its rather small size and marked uncoiling of the outer whorl. It resembles the holotype of *O. laufenensis* as illustrated by Siemiradzki (1899, pl. 26: 46).

REMARKS: According to Schweigert and Callomon (1997) the name *Perisphinctes laufenensis* Siemiradzki (1899) is a younger synonym of *Ammonites virgulatus* Quenstedt (1887). Such an interpretation is not accepted, however, by the present author [A.W.]; the type of *Ammonites virgulatus* of Quenstedt (1887-1888, pl. 100: 5) is much more densely ribbed than *O. laufenensis* and should be treated separately at the species level, but still in the subgenus *Praeataxioceras* (Gygi 2003).

STRATIGRAPHICAL POSITION: The specimens placed into the synonymy of the species are known to occur in the Bimammatum Subzone and the Hauffianum Subzone of the Bimammatum Zone (Matyja, Wierzbowski 1997; Gygi 2003).

Family Perisphinctidae Steinmann, 1890
Subfamily Idoceratinae Spath, 1924

Genus *Idoceras* Burckhardt, 1906

TYPE SPECIES: *Ammonites balderus* (Oppel, 1863) illustrated by Oppel (1863, pl. 67:2).

Subgenus *Subnebrodites* Spath, 1925

TYPE SPECIES: *Ammonites planula* (Quenstedt, 1887) [m] illustrated by Quenstedt (1887-1888, pl. 108: 2).

Idoceras (Subnebrodites) planula (Hehl in Zieten, 1830)
Fig. 72.

1891. *Perisphinctes* cf. *acer* Neumayr; Siemiradzki, p. 64.

1989. *Idoceras (Subnebrodites) planula* (Hehl in Zieten, 1830); Schairer, pp. 99-101, text-fig. 1; pl. 1: 1-5; pl. 2: 1-2; pl. 3: 1-2, pl. 4: 1 (with given synonymy).

1997. *Idoceras (Subnebrodites) planula* (Hehl); Matyja, Wierzbowski, pl. 9: 1, 6.

MATERIAL: A/I/2/238 (Fig. 72).

LOCALITY: Kraków – Podgórze (Krzemionki).

COLLECTOR: Dr. Stanisław Zaręczny.

DESCRIPTION: The specimen is 135 mm in diameter. It consists of the phragmocone (ranging up to 85 mm diameter) and the body chamber, which is *ca.*7/8 of whorl long. The whorl section is

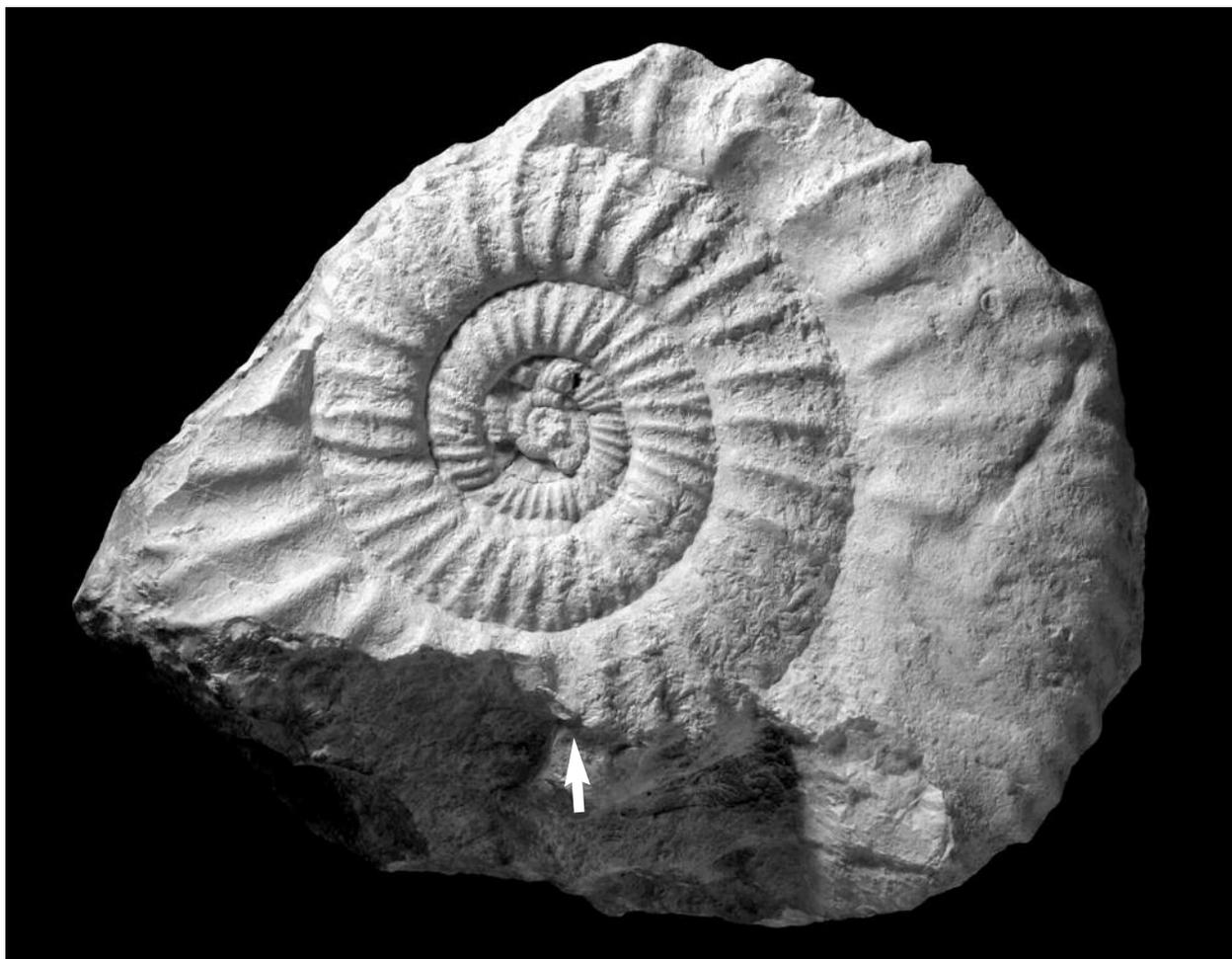


Fig. 72. *Idoceras (Subnebrodites) planula* (Hehl in Zieten, 1830): A/I/2/238. Kraków – Podgórze (Krzemionki). Arrow indicates the end of the phragmocone. Natural size.

high oval with flattened whorl sides, and the coiling is strongly evolute. The ribbing is moderately dense: the number of primary ribs per whorl is between 37 (at $D=32$ mm), through 32 (at $D=67$ mm), up to 29 (at $D=95$ mm). The ribs are rather coarse, slightly prorsiradiate, splitting mostly at $2/3$ of the whorl height into two secondaries with some intercalary ribs; at the end of the body chamber the ribbing becomes somewhat irregular, and occasionally dischizotomous division of ribs appears. The secondary ribs show the characteristic forward sweep. A wide constriction at the end of the shell suggests proximity of the final aperture (*cf.* Schairer 1989, pl. 2: 1-2).

STRATIGRAPHICAL POSITION: The species occurs in the Planula Subzone, *i.e.* in the lower part of the Planula Zone.

Subfamily Passendorferiinae Meléndez, 1989

Genus *Passendorferia* Brochwicz-Lewiński, 1973

TYPE SPECIES: *Passendorferia teresiformis* Brochwicz-Lewiński, 1973 [M]. Holotype illustrated by Brochwicz-Lewiński (1973, pl. 13: 1-2).

Subgenus *Graefenbergites* Schairer *et* Schlampp, 2003

TYPE SPECIES: *Perisphinctes idoceratooides* Dorn, 1930 [M] illustrated by Dorn (1930, pl. 29: 3).

Passendorferia (*Graefenbergites*) sp.
nov.
Fig. 73.

1891. *Perisphinctes subpunctatus*
Neumayr; Siemiradzki, p. 73-74.

MATERIAL: A/I/2/278 (Fig. 73).

LOCALITY: Kraków – Podgórze.

DESCRIPTION: The specimen is 85 mm in diameter. The phragmocone ranges up to 50 mm diameter, and there is one whorl of body chamber. The whorl section of the

body chamber is thick oval; that of phragmocone is subcircular. Coiling is evolute (at $D=85$ mm, $u=0.47$, $h=0.34$). The ribbing is strong and fairly dense. It consists of about 45 primaries per whorl on the body chamber, and about 40 primaries on the last whorl of phragmocone. The primary ribs are rectiradiate splitting about $3/4$ of the whorl height into two secondary ribs showing a prorsiradiate course; some intercalary ribs appear at the end of the last whorl. Constrictions are deeply incised, obliquely prorsiradiate, about 3 per whorl.

REMARKS: The character of coiling and the whorl section are typical of the genus *Passendorferia*. The prorsiradiate course of the secondary ribs, and the occurrence of intercalary ribs are typical of *Graefenbergites* treated herein as the subgenus of *Passendorferia*. The specimen studied differs from *Graefenbergites idoceratooides* (Dorn) – the type species of the subgenus with lectotype designated by Meléndez (1989, p. 179) corresponding to the original specimen of Dorn 1930 (pl. 29 (15), fig. 3a-b) – in its thick, oval whorl section with convex whorl



Fig. 73. *Passendorferia* (*Graefenbergites*) sp. nov.: A/I/2/278. Kraków – Podgórze. Arrow indicates the end of the phragmocone. Natural size.

sides, and rectiradiate course of its primary ribs.

STRATIGRAPHICAL POSITION: Representatives of the subgenus *Graefenbergites* are known from the *Epipeltocheras semimammatum* horizon of the Hypselum Zone, *i.e.* from the lowermost part of the Bimammatum Zone (Schairer, Schlamp 2003). Representatives of the genus *Passendorferia* are known also in Poland from higher parts of the Bimammatum Zone – from the Hauffianum Subzone, as well as from the lower part of the Planula Zone (Matyja, Wierzbowski 1997).

Family Aulacostephanidae Spath, 1924

Genus *Ringsteadia* Salfeld, 1913

TYPE SPECIES: *Ammonites pseudocordatus* Blake and Hudleston (1877) [M] illustrated by Blake and Hudleston (1877, pl. 12: 1).

Ringsteadia teisseyrei (Siemiradzki, 1891)
emend.

Fig. 74: 2.

1891. *Proplanulites Teisseyrei* Siemiradzki, pp. 81-83 (*pars*).

1995. *Ringsteadia salfeldi* Dorn; Gygi, pp. 46-49, fig. 23 a-b.

FORMER SYNTYPES: A/I/279, A/I/280.

LECTOTYPE: A/I/2/280 [M] (Fig. 74: 2) representing the original, never illustrated, one of the two Siemiradzki's syntypes which is designated herein the lectotype.

TYPE LOCALITY: Górkki near Trzebinia.

PARALECTOTYPE: A/I/2/279 [M] from Górkki near Trzebinia [assigned now to *Ringsteadia salfeldi* Dorn, see respective description in this paper].

DESCRIPTION: The specimen with most of the body chamber preserved (occupying at least 3/4 of a whorl) is 135 mm in diameter. The whorl section is high oval, tapering towards the ventral side. The specimen shows the umbilical width about equal to the whorl height (at $D=135$ mm, u is about 0,37 whereas $h=0.37$). The ribbing is fairly

strong and distant: there are about 32 primary ribs on the last whorl. The primary ribs are strong, slightly prorsiradiate, and divide indistinctly at about 2/3 of the whorl height into two or three secondaries with some intercalatory ribs, markedly thinner than the primaries. The r_i coefficient amounts to 2.5 on the last whorl.

REMARKS: Because neither of the two syntypes *Proplanulites teisseyrei* Siemiradzki, 1891 were figured, so subsequent authors have never used the name in the sense of Siemiradzki's taxon. The name has been used, however, for another group – the *Proplanulites teisseyrei* of Tornquist, 1894 (see Tornquist 1894 with no reference there to Siemiradzki's taxon). Hence, the name of Siemiradzki's taxon appeared to be the senior primary homonym of *P. teisseyrei* Tornquist. The name *Proplanulites teisseyrei* Siemiradzki, 1891 may be treated, however, as a *nomen oblitum* according to the rules of the International Code of Zoological Nomenclature (Art. 23 point 9) which conserves Tornquist's well – used species name of the Callovian true *Proplanulites* Teisseyre as the *nomen protectum*. On the other hand, as Siemiradzki's taxon cannot be included into the genus *Proplanulites*, but belongs to the genus *Ringsteadia* Salfeld, this species name could be still valid. Yet one of the Siemiradzki's syntypes (A/I/279, Fig. 74: 1) falls into range of variability of *Ringsteadia salfeldi* Dorn, 1925: this latter name must be maintained according to prevailing usage and the status of the original Siemiradzki name (ICZN Art. 23 point 9.1). Another of Siemiradzki's syntype (A/I/280, Fig. 74: 2), differing from the former in several features, is recognised here as the lectotype of the species *Ringsteadia teisseyrei* (Siemiradzki, 1891). The specimen referred to as *R. salfeldi* Dorn by Gygi (1995, fig. 23 a-b) shows very similar characters of ornamentation to *R. teisseyrei*, differing from typical representatives of *R. salfeldi* (*cf.* Schairer, Schlamp 2003). *R. teisseyrei* differs from *R. salfeldi* in its stronger and more regular ribbing. The species *R. teisseyrei* is similar to the Subboreal species: *Ringsteadia pseudocordata* (Blake *et* Hudleston) (J. Callomon and J. Wright – personal information).

STRATIGRAPHICAL POSITION: The species occurs in Poland in the Hypselum Subzone of the Bimammatum Zone.

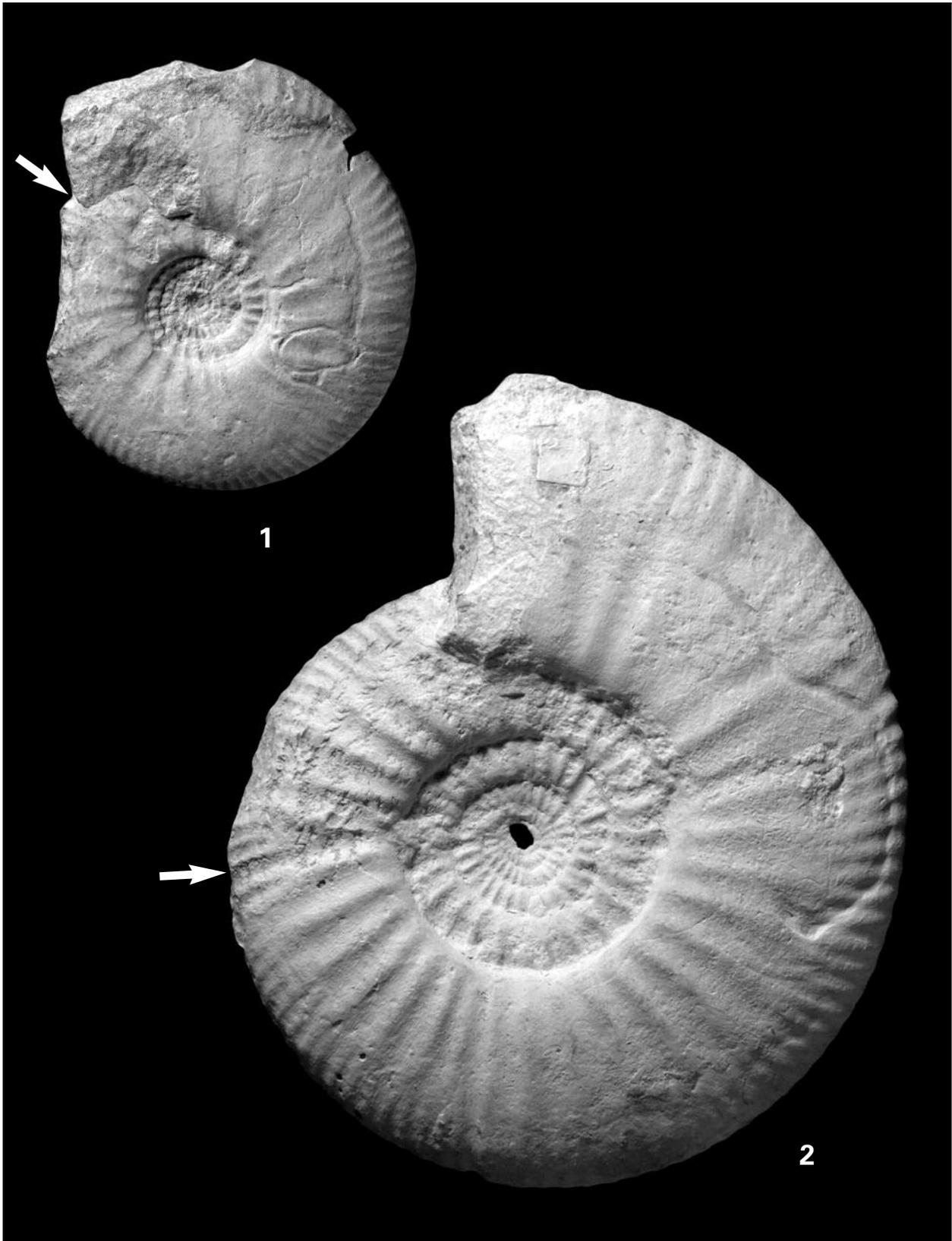


Fig. 74. *Ringsteadia saffeldi* Dorn, 1925: 1: A/I/2/279. *Ringsteadia teisseyrei* (Siemiradzki, 1891): 2: A/I/2/280. The specimens derive from Górki near Trzebinia. Arrows indicate the end of the phragmocones. Natural size.

Ringsteadia salfeldi Dorn, 1925

Fig. 74: 1.

1891. *Proplanulites Teisseyrei* Siemiradzki; Siemiradzki, pp. 81-83 (*pars*).
 1925. *Ringsteadia Salfeldi* Dorn; Dorn, pp. 529-534, pl. 22: 1-3.
 1962. *Ringsteadia salfeldi* Dorn; Enay, pp. 34-35, pl. 4: 19 a-c (with given synonymy).
 2003. *Ringsteadia salfeldi* Dorn; Schairer, Schlampp, p. 28, pl. 3: 6.

MATERIAL: A/I/2/279 (Fig. 74: 1) [former syntype of *Ringsteadia teisseyrei* (Siemiradzki), cf. respective description in this paper].

LOCALITY: Górki near Trzebinia.

DESCRIPTION: The specimen, with a body chamber of one whorl long, is 74 mm in diameter. The whorl section is high oval tapering towards the ventral side. The specimen is involute (at 74 mm, u is 0.31, whereas h is 0.40). Ribbing is fairly strong and distant: there are about 25 primary ribs on the last whorl. The primary ribs are strong, prorsiradiate and tend to disappear well above the mid-height of whorl; the primary ribs divide indistinctly at about $2/3$ of the whorl height into two or three secondaries with some intercalatory ribs, markedly thinner than the primaries. The r_i coefficient amounts to 3.0 on the last whorl.

REMARKS: This specimen is similar to the Subboreal species: *Ringsteadia brandesi* Salfeld (J. Callomon and J. Wright – personal information).

STRATIGRAPHICAL POSITION: The species occurs in Poland in the Hypselum Subzone of the Bimammatum Zone.

Ringsteadia submediterranea Wierzbowski,

1978

Fig. 75.

1891. *Olcostephanus involutus* (Quenstedt); Siemiradzki, p. 78-79.
 1978. *Ringsteadia submediterranea* Wierzbowski; Wierzbowski, p. 322, tab. 2, pl. 3: 1-3.
 1997. *Ringsteadia submediterranea* Wierzbowski; Matyja, Wierzbowski, pl. 5: 16.

MATERIAL: A/I/2/292 (Fig. 75).

LOCALITY: Kraków – Podgórze.

COLLECTOR: Dr. Stanisław Zaręczny.

DESCRIPTION: The specimen is wholly septate, 80 mm in diameter. The whorl section is high oval

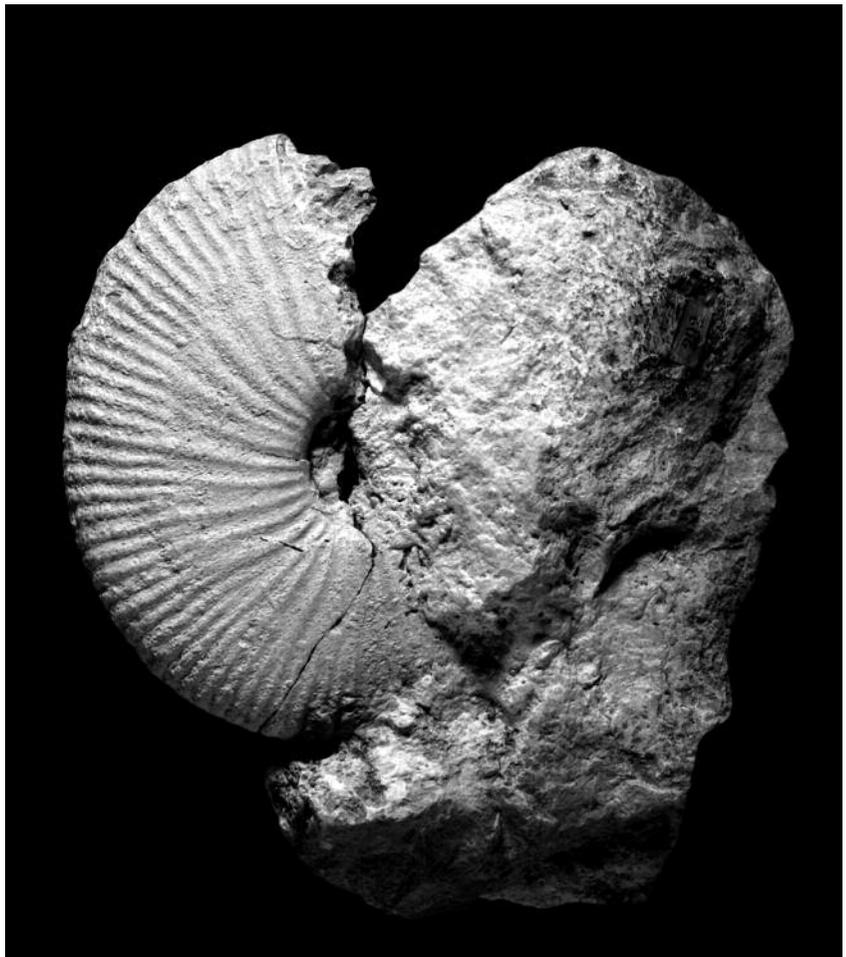


Fig. 75. *Ringsteadia submediterranea* Wierzbowski, 1978: A/I/2/292. Kraków – Podgórze. Wholly septate whorls. Natural size.

tapering towards the ventral side. It is strongly involute (at $D=80$ mm, u is about 0.20, whereas h is about 0.50).

The ribbing is dense consisting of thin, slightly prorsiradiate primaries, and somewhat stronger developed rectiradiate secondaries; the secondary ribs are numerous; r_i is *ca.* 2.6 at 60-80 mm diameter.

REMARKS: The species shows several features of the genus *Ringsteadia* such as involute coiling, high oval whorl section, and presence of weak constrictions, but the weak differentiation between the primary and secondary ribs found in the species studied is not typical of the genus *Ringsteadia* but rather of the genus *Pictonia*. The systematic position of these and other *Ringsteadia* – like specimens coming from the upper part of the Bimammatum Zone and the Planula Zone of the Submediterranean Succession is not clear yet in detail. These forms show some similarity to the genus *Pictonia* especially on their innermost whorls (Wierzbowski 1994), but they are often attributed to poorly known genus *Vineta* Dohm, (see Schweigert, Callomon 1997), sometimes recognised as a subgenus of the genus *Ringsteadia* (Geyer 1961).

STRATIGRAPHICAL POSITION: *Ringsteadia submediterranea* occurs in Poland in the middle and upper parts of the Bimammatum Zone, *i.e.* in the Bimammatum Subzone and the Hauffianum Subzone (see Wierzbowski 1978; Matyja, Wierzbowski 1997).

BIOSTRATIGRAPHICAL CONCLUSIONS

Plicatilis to Bifurcatus zones

by Ewa Główniak

A large assemblage of ammonites collected by Stanisław Zaręczny (1894) comes from Rudno, Brodła and Kozłowiec (Fig. 1). Siemiradzki (1891) established among them nine new species: *Subdiscosphinctes kreutzii* (Siemiradzki), *Subdiscosphinctes mindowe* (Siemiradzki), *Subdiscosphinctes jelskii* (Siemiradzki), and *Subdiscosphinctes ? cracoviensis* (Siemiradzki) found in Rudno; *Perisphinctes (Dichotomoceras) alpinus* Siemiradzki from Kozłowiec; and *Subdiscosphinctes dunikowskii* (Siemiradzki), *Subdiscosphinctes ? dybowski* (Siemiradzki),

Perisphinctes (Perisphinctes) vajdelota Siemiradzki, and *Perisphinctes (Dichotomosphinctes) crotalinus* Siemiradzki found in Brodła. These species are diagnostic of the Transversarium and Bifurcatus zones (upper Middle to lower Upper Oxfordian, Fig. 2). Their detailed stratigraphical ranges are as follows: *P. (D.) crotalinus* is diagnostic of the Elisabethae Subzone of the Transversarium Zone (*cf.* Główniak 2006a); the other species of the genus *Subdiscosphinctes* first occur in this Subzone and usually range higher up to the Wartae Subzone of the Bifurcatus Zone; *P. (D.) alpinus* appears to range in the Wartae and/or the overlying Stenocycloides Subzone. Additional species collected in Kozłowiec are *Perisphinctes (Dichotomoceras) wartae* Bukowski diagnostic of the Wartae Subzone and the lowermost Stenocycloides Subzone; and *Perisphinctes (Dichotomoceras) bifurcatoides* Enay diagnostic of the Stenocycloides Subzone. The former species was also found in Rudno, and the latter in Brodła.

The outcrops of bedded limestones nearby Grojec and on a hill between Okleśna and Mirów (Fig. 1) yielded species of the Buckmani and Elisabethae subzones of the Transversarium Zone, and the Wartae Subzone of the Bifurcatus Zone. From nearby Grojec derives, for example, *Perisphinctes (Dichotomosphinctes) antecessens* Salfeld ranging in the lower part of the Buckmani Subzone, and *Subdiscosphinctes kreutzii* and *Subdiscosphinctes mindowe*, characteristic for the upper part of the Elisabethae and the Wartae subzones. From a hill between Okleśna and Mirów originates *S. mindowe* accompanied by *Perisphinctes* s. str. The species from Grojec, Okleśna and Mirów were collected by Stanisław Zaręczny, and established the age of the beds in the area.

The species diagnostic for the Buckmani Subzone of the Transversarium Zone, but also for the Ouatius and Arkelli subzones in the underlying Plicatilis Zone (Fig. 2), were found, for example, in Kozłowiec and in Brodła. The species *P. (D.) antecessens*, *Perisphinctes (Dichotomosphinctes) buckmani* Arkell, and *Perisphinctes (Dichotomosphinctes) dobrogensis* Simionescu from Kozłowiec found by Stanisław Zaręczny (1894), are diagnostic of the Buckmani Subzone; *Perisphinctes (Otosphinctes) ouatius ouatoides* Główniak indicates there the Ouatius Subzone of the Plicatilis Zone. The species was found by an unknown collector. *Perisphinctes (Otosphinctes)*

ouatius ouatius (Buckman) – ‘magnouatius morphotype’, and *P. (D.) antecedens* from Brodła established the presence of the Arkelli Subzone and the Buckmani Subzone, respectively. From the upper Arkelli to lower Buckmani subzones comes the holotype of *Neumannia sapunovi* (Brochwiec-Lewiński and Różak) collected by Stanisław Olszewski in Brodła, and *Neumannia gyrus* (Neumann) found by an unknown collector.

A large collection of specimens described by Siemiradzki (1891) from Paczółtowiec (Fig. 1) was assigned by him, partly incorrectly, to Kimmeridgian species. The assemblage from Paczółtowiec consists, however, of Middle Oxfordian species of the Transversarium Zone (Buckmani and Elisabethae subzones, Fig. 2). There appeared *P. (D.) buckmani*, diagnostic of the Buckmani Subzone, collected by Stanisław Olszewski; *P. (Dichotomosphinctes) elisabethae* de Riaz, *Perisphinctes (Dichotomosphinctes) luciae* de Riaz, and *Perisphinctes (Dichotomosphinctes) crotalinus* Siemiradzki diagnostic of the Elisabethae Subzone. In addition, from Paczółtowiec came the paralectotype of *Subdiscosphinctes jelskii* (Siemiradzki) as well as some other specimens of *Subdiscosphinctes* sp. which can not be identified more precisely. The stratigraphical range of the last mentioned forms extends from the upper Elisabethae Subzone of Transversarium Zone up to the Wartae Subzone of the Bifurcatus Zone. This may indicate that the youngest deposits in Paczółtowiec belong to the Bifurcatus Zone.

A few species of the subgenera *Otosphinctes* Buckman and *Kranaosphinctes* Buckman, plus genus *Liosphinctes* Buckman in the collection establish the presence of the Middle Oxfordian Plicatilis Zone (Paturattensis to Arkelli subzones) in the area studied. The following species of the subgenera or genus mentioned were found: *Perisphinctes (Kranaosphinctes) kranaus* (Buckman), *Liosphinctes plicatilis* Sowerby found in Kobylany (Fig. 1); *Perisphinctes (Otosphinctes) ouatius ouatius* (Buckman) – ‘ouatius’ and ‘magnouatius’ morphotypes found in Dąbrowa and Mirów; *Perisphinctes (Otosphinctes) paturattensis* de Loriol, *P. (O.) ouatius ouatius* – ‘magnouatius morphotype’ found in Wodna, and *L. plicatilis* found in Okleśna. From Kobylany derived also *Neumannia gyrus* (Neumann) characteristic of the uppermost Plicatilis to lower Transversarium zones.

The species of the subgenus *Dichotomosphinctes* Buckman diagnostic of the Buckmani Subzone of the Transversarium Zone occurred at Baczyn, Dąbrowa, Rakówki near Młynka, Okleśna as well as at Rudno and presumably also at Kamyk. From the last locality occurred also *P. (D.) dobrogensis* and *P. (D.) buckmani* collected by Stanisław Olszewski and Stanisław Zaręczny, respectively. From the other localities mentioned *P. (D.) antecedens* was found by an unknown collector. The species of the subgenus *Dichotomosphinctes* e.g. *P. (D.) luciae*, and/or *Perisphinctes* s. str., *Perisphinctes (P.) pumilus* Enay, diagnostic of the Elisabethae Subzone of the Transversarium Zone were found at Liguniowa Góra and Ratowa near Podłęże (Fig. 1). At Ratowa was also found *Subdiscosphinctes kreutzii* and *Subdiscosphinctes ? cracoviensis*. The species mentioned range from the upper Elisabethae Subzone up to the Wartae Subzone; only *S. ? cracoviensis* appears to range higher up, into the Stenocycloides Subzone of the Bifurcatus Zone.

The species of the subgenus *Dichotomoceras* Buckman which are diagnostic of the Bifurcatus Zone (Wartae to Grossouvrei subzones) are known from numerous localities. At Poręba, Regulice, and Kobylany (Fig. 1) was found *Perisphinctes (Dichotomoceras) wartae* diagnostic of the Wartae and the lower Stenocycloides subzones. From Okleśna and Nowa Góra (Fig. 1) came *Perisphinctes (Dichotomoceras) bifurcatoides* Enay and *Perisphinctes (Dichotomoceras) duongae* Meléndez, respectively, diagnostic of the Stenocycloides Subzone. From Tenczynek derived *Perisphinctes (Dichotomoceras) bifurcatus* Quenstedt characteristic of the Grossouvrei Subzone. In Trzebinia several unclassified specimens of *Dichotomoceras* sp. indicate the Bifurcatus Zone; whereas the accompanying *Subdiscosphinctes jelskii* (Siemiradzki) and *Passendorferia (Enayites) birmensdorfensis* (Moesch) indicate the Elisabethae Subzone of the Transversarium Zone or the Wartae Subzone of the Bifurcatus Zone.

Bimammatum and Planula zones

by Andrzej Wierzbowski

The specimens discussed are the youngest Upper Jurassic ammonites in the Kraków Upland in the collection monographed by Siemiradzki (1891). They were erroneously interpreted by Siemiradzki (1891, 1922) as representing the Kimmeridgian

species of the 'Oppelia tenuilobata' Zone of Oppel (1863), Neumayr (1873), Dumortier and Fontannes (1876) and others. This stratigraphical interpretation has played an important role in the foundation of the idea of a wide distribution of Lower Kimmeridgian deposits lying discordantly on older Oxfordian strata in the Kraków Upland (Siemiradzki 1891). As it appeared afterwards (Zaręczny 1894), some specimens had been wrongly ascribed to the sections in the Kraków Upland where only Oxfordian, or older strata did occur. This is the case, for example, of some specimens coming allegedly from Paczółtowice (Fig. 1), and wrongly ascribed to such 'Kimmeridgian' (but in fact mostly Tithonian) species as '*Perisphinctes*' *lictor*, '*Perisphinctes*' *ulmensis* and others (Siemiradzki 1891). There were some doubts, however, if the specimens discussed really came from this locality (Zaręczny 1894, p. 164)). This is in agreement with the fact that specimens in question ascribed to Paczółtowice in the collection studied are representatives of the family Ataxioceratidae partly related to the genus *Orthosphinctes* (*Lithacosphinctes*) sp., and thus of Bimammatum age, much younger than the Middle Oxfordian deposits which really cropped out at Paczółtowice (see Ziemek 1995). The doubtful place of origin of the specimens in question makes their stratigraphical value limited. Thus, the specimens are not described in the present paper.

In the collection studied, two ammonite assemblages reliably localized can be distinguished: these are from Górki near Trzebinia (Fig. 1) in the south-western part of the Kraków Upland, as well as from Kraków Town – located on the right bank of the Vistula River, and denoted as coming from Krzemionki and/or Podgórze, as well as Kurdwanów (Fig. 1).

The assemblage from Górki consists of *Ringsteadia salfeldi* Dorn, *Ringsteadia teisseyreii* (Siemiradzki), *Orthosphinctes* (*Pseudorthosphinctes*) *fontannesii* (Choffat), and *Orthosphinctes* (*Pseudorthosphinctes*) sp. nov. in Enay (1966). It is an assemblage indicative of the Hypselum Subzone, *i.e.* the lower part of the Bimammatum Zone (Fig. 2). The geological situation at Trzebinia (Fig. 1) (*cf.* Doktorowicz-Hrebniński 1954) indicates generally a fairly small thickness of Oxfordian deposits, not exceeding a few tens of meters up to the Hypselum Subzone.

The ammonite assemblage from Kraków Town is more diversified. It consists of numerous

specimens of the genus *Orthosphinctes*: *Orthosphinctes* (*Orthosphinctes*) *tiziani* (Oppel), *Orthosphinctes* (*Pseudorthosphinctes*) *lisowicensis* (Wierzbowski), *Orthosphinctes* (*Lithacosphinctes*) *evolutus* (Quenstedt), *Orthosphinctes* (*Praeataxioceras*) *laufenensis* (Siemiradzki), as well as fragmentarily preserved specimens of the genus *Orthosphinctes* difficult for closer identification, but referred to as '*Perisphinctes rutimeyri* de Loriol' (specimen A/1/2/237) and '*Perisphinctes rotundus* d'Orbigny' (specimens A/1/2/267, 268, 269, 270) by Siemiradzki (1891 p. 64 and p. 69-70). There occur moreover *Idoceras* (*Subnebrodites*) *planula* (Hehl in Zieten 1830), *Passendorferia* (*Graefenbergites*) sp., as well as aulacostephanids: *Ringsteadia submediterranea* Wierzbowski, and poorly preserved form, difficult for close identification (*Ringsteadia* or *Pictonia*), but referred originally to as '*Olcostephanus cautleyi* Oppel' (specimen A/1/2/293) by Siemiradzki (1891, p. 85). The bulk of the ammonite assemblage studied is typical of the Bimammatum Subzone and the Hauffianum Subzone of the Bimammatum Zone (Fig. 2), but the specimen of *Idoceras planula* indicates already the presence of the Planula Zone. Together with some ammonites subsequently described by various authors from Kraków such as '*Aspidoceras longispinum* Sowerby' described from the uppermost Jurassic beds in the Liban Quarry by Panow (1930), which represent in fact the species *Aspidoceras binodum* (Oppel) (see Głazek, Wierzbowski 1972), and ammonites of the genus *Idoceras* – *I.* (*Subnebrodites*) *proteron* Nitzopoulos, and *Orthosphinctes* sp. from the Zakrzówek Quarry (Krajewski 2001), the assemblage in question occurring in the quarters of Podgórze, Zakrzówek, and Kurdwanów is thus fairly uniform in age, showing a similar stratigraphical interval from the Bimammatum Zone to the Planula Zone. It should be remembered that many of the specimens in the collection of Siemiradzki coming from Kraków Town have been collected by Zaręczny and were mentioned in his study (1894), which additionally excludes any inaccuracy in their location.

The oldest ammonites occurring in the massive and bedded limestones which outcrop in Kraków are specimens of the subgenus *Dichotomoceras* of the genus *Perisphinctes* indicative of the Bifurcatus Zone of the Upper Oxfordian: a single specimen has been observed

by the present author [A.W.] in the field at the Smocza Jama (Dragon Cave) at the Wawel Castle, another specimen coming from Krzemionki (Fig. 1)

in Kraków was collected by Professor J. Małecki and it is housed in the collection of the AGH University of Science and Technology in Kraków.

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by Ewa Główniak

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Explanation: An asterisk (*) indicates specimens in the collection ZNG PAN A/I/2, which have been too poorly preserved to be described in this monograph. Two asterisks (**) indicate specimens in the collection which have been determined, but not described by Siemiradzki (1891).

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FINAL CONCLUSIONS

by Ewa Głowniak and Andrzej Wierzbowski

Józef Siemiradzki published his monograph on Upper Jurassic cephalopods from the Kraków Upland in 1891. The collection he described was set up by Polish geologists associated with the Physiographic Commission, e.g. Stanisław Zaręczny, Alojzy Alth, Franciszek Bieniasz, Stanisław Olszewski, and Ignacy Bochnic. The specimens were collected from exposures

situated between Kraków and Chrzanów, since at least 1872. The largest part of the ammonite specimens was gathered by Stanisław Zaręczny as a result of the cartographic work carried out by him in the Kraków Upland. Zaręczny (1894) provided a number of indications concerning the locations where the specimens were collected. His comments were used to verify the origin of the species in the collection under study.

The interest of this paper is focused on the ammonites of the superfamily Perisphinctoidea

Steinmann. The ammonite material redescribed in this paper is allocated to 29 nominal species. In this number, 11 species which were introduced by Siemiradzki (1891), have now been redescribed and most of them illustrated for the first time. In addition, there are 27 other species left in open nomenclature.

Most of the revised species are from the Middle to Upper Oxfordian (Plicatilis to lower Bimammatum zones) (Fig. 2); a few others are from the upper part of the Bimammatum Zone and the Planula Zone. The latter stratigraphical interval, for the time being, has a dual interpretation in terms of its Stage affiliation: it has been included either in the Upper Oxfordian or in the Lower Kimmeridgian – in the Sub-mediterranean or Subboreal zonation, respectively. The Subboreal interpretation is substantiated by the fact that this is the one which constitutes the primary standard for the Oxfordian/Kimmeridgian boundary. The final decision where to draw the unified Oxfordian/Kimmeridgian boundary is, however, still not undertaken.

The conclusion formulated by Siemiradzki (1891) on the discordant occurrence of the 'Oppelia tenuilobata' Zone beds west of Kraków (these beds were included to the Kimmeridgian in the times of Siemiradzki 1891) resulted from errors in taxonomic determination of the species and – partly – from an incorrect conviction concerning the origin of some specimens. This conclusion is discussed and explained in this paper.

ACKNOWLEDGEMENTS

We thank to the Journal Referees, Professor John H. Callomon (London) and Dr. Günter Schweigert (Stuttgart), for their valuable comments which helped to improve the earlier version of the paper.

Ms Barbara Kietlińska-Michalik (Museum ING PAN, Kraków) kindly agreed to make the collection available for research; she also verified the locations and collection dates vis-à-vis original labels. Dr. Michał Gradziński provided some useful information on the possible location of some old geographical names used in the times of J. Siemiradzki. Ms Grażyna Dziewińska and Mr Marian Dziewiński (Warszawa) took the photographs of ammonite specimens whereas Mr Cezary Łukawski (Warszawa) performed the suitable adaptation of the digital photographs for

publication.

Ms Małgorzata Szymańska (Warszawa), Dr. Didier Bert (Saint André-les-Alpes, France), Dr. Reinhart Gygi (Männedorf, Switzerland), Dr. Adam Halamski (Warszawa), Dr. Armin Scherzinger (Immendingen-Haltingen, Germany) kindly assisted in the compilation of the list of references.

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Bayrische Staatsbibliothek, München; Bibliothek der Eidgenössische Technische Hochschule (ETH), Zürich; Bibliothèque de l'Université Claude Bernard Lyon I; British Library, London; Geological Library of the Faculty of Geology of the University of Warsaw; Geological Library of the Polish Geological Institute in Warsaw; Library of the Faculty of Geology, Geophysics and Environmental Protection of the AGH University of Science and Technology, Kraków; Library of the Institute of Geological Sciences of the Faculty of Biology and Earth Sciences of the Jagiellonian University, Kraków; Library of the Institute of Literary Studies of the Polish Academy of Sciences, Warsaw; Library of the Museum of Earth of the Polish Academy of Sciences, Warsaw; Library of the Polish Academy of Arts and Sciences, Kraków; Library of University of Warsaw; National Library, Warsaw; Niedersächsische Staats- und Universitätsbibliothek, Göttingen; Sächsischen Landesbibliothek – Staats- und Universitätsbibliothek, Dresden; Staatsbibliothek, Berlin; The Jagiellonian Library, Kraków; Universitätsbibliothek, Freiburg; Universitätsbibliothek, Heidelberg.

Linguistic corrections of the earlier version of the manuscript: LETTERMAN Sp. z o.o. (Kraków). Final linguistic corrections: John Wright (Egham).

We would like to express our cordial thanks to all the persons and institutions above mentioned.

Research was financed by the Ministry of Science and Higher Education, Project 2189 granted to Ewa Głowniak; and by the Faculty of Geology of the University of Warsaw, Project BW 1726/2.

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