Acta Geologica Polonica, Vol. 56 (2006), No. 2, pp. 121-157

Shallow-water gastropods from Late Oxfordian sands in Kłęby (Pomerania, Poland)

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ABSTRACT:

GRÜNDEL, J. & KAIM, A. 2006. Shallow-water gastropods from Late Oxfordian sands in Kłęby (Pomerania, Poland). *Acta Geologica Polonica*, **56** (2), 121-157. Warszawa.

The Upper Oxfordian shell-bearing ferruginous sands from Kłęby in Pomerania (northwestern Poland) provide a rich and relatively well-preserved shallow-water gastropod fauna that has been known in the literature since the monograph by SCHMIDT (1905). A review of SCHMIDT's collection and newly collected material confirms the distinctiveness of the assemblage from contemporaneous faunas in neighbouring areas. We identified 27 species belonging to 21 genera, with two species not attributed to generic level. Seven species introduced by SCHMIDT (1905) are re-described in detail, with the types being illustrated. They are: *Gerasimovcyclus lorioli* (Eucyclidae), *Proconulus coelotropis*, *P. viadrinus* (Proconulidae), *Pseudomelania laeviuscula* (Pseudomelaniidae), *Katosira anaroides* (Zygopleuridae), *Gordenella pommerana* (Gordenellidae), and *Sulcoactaeon viadrinus* (Bullinidae). We also described three new species: *Ataphrus marschmidti* (Ataphridae), *Shurovites dmochae* (Cryptaulacidae), and *Ceritellopsis huckriedei* (Cylindrobullinidae). The gastropod fauna from Kłęby is dominated by shallow-water species of cerithioids (*Exelissa distans*, *Rhynchocerithium limaeforme* and *Shurovites dmochae*), the rissoid *Rissoa valfini*, the eucyclid *Eucycloscala* cf. *augur*, and the ataphrid *Falsataphrus kljasmiensis*.

Key words: Gastropods, Taxonomy, Ecology, Jurassic, Oxfordian, Poland.

INTRODUCTION

Most information on the protoconchs and early ontogeny of Jurassic gastropods come from gastropods of outer shelf and usually soft bottom environments (GRÜNDEL 1997, 1999a, b, c, 2000a, 2001, KAIM 2004), while information on well-preserved gastropods from shallow water settings is rather poor. This is caused mainly by the high-energy conditions prevailing in such environments not allowing the preservation of the tiny aragonitic structures of juvenile gastropod shells. As shown by GRÜNDEL (1976) and KAIM (2004), some outer shelf or deep water gastropods from Recent seas, seem to be conservative and long-lasting lineages with similar species known from the Jurassic basinal deposits. On the other hand, the gastropod communities living on the Jurassic carbonate platforms differ significantly from those we can find in the Recent shallow water environments. This especially concerns associations dominated by nerineid gastropods, a group that is very common in the Jurassic but

still of uncertain taxonomic affinities (BARKER 1990). The shell-bearing clayey sands at Kłęby offer an exceptional insight into the early ontogeny of Jurassic gastropods from a shallow water setting. The aim of this paper is to review the gastropods from Kłęby, with particular attention being paid to their early ontogeny.

GEOLOGICAL SETTING

The outcrop of Upper Oxfordian shell-bearing ferruginous sands (=Muschelsand of SCHMIDT 1905) is located close to the village of Kłęby (Klemmen before 1945), on the left bank of the Zielonka Creek. The gastropod-bearing strata are currently covered by vegetation and are not visible on the surface (KAIM 2004). Mass occurrences of gastropods and bivalves are known from shell-supported coquinas with a sandy-clayey matrix (KAIM 2004) deposited in a shallow water and high-energy environment (DMOCH 1971, CEDRO 1999). According to SCHMIDT (1905), these sands are underlain by limestone and overlain by a "stinking limestone bank" and an oolite-sand bank (Text-fig. 1); they are dated as Late Oxfordian, based on ammonites (see also DMOCH 1971).

COLLECTION OF JURASSIC INVERTEBRATES DESCRIBED BY MARTIN SCHMIDT (1905), HISTORICAL BACKGROUND, MATERIAL, AND METHODS.

The Late Jurassic sediments of Pomerania were extensively studied at the turn of 19th and 20th centuries. These efforts resulted in a monograph by Martin SCHMIDT (1905) devoted to the stratigraphy and palaeontology of these strata. The material that he illustrated and/or described was deposited in the collection of the Preußischen Geologischen Landesanstalt in Berlin (now Bundesanstalt für Geowissenschaften und Rohstoffe, Dienstbereich Berlin; abbreviated BGR). After the Second World War, it was not clear whether the material of SCHMIDT (1905) survived or not. An investigation by the senior author revealed that some parts of SCHMIDT's collection have apparently been destroyed while another part (including the types) was moved to the Soviet Union. During the 1950s this material came back to Berlin and a complete list of SCHMIDT's (1905) originals, which are now available in the BGR collection, is provided in the Appendix. Pomerania (Pommern at that time) was a part of Germany when the monograph of SCHMIDT (1905) was published. After the Second World War this region was incorporated into Poland (currently Zachodniopomorskie Voivodship) and that is why the German names of localities underwent significant modifications in the Polish spelling. The Polish names for the towns and villages mentioned by SCHMIDT (1905) are:

German:	Polish:
Bartin	Bardy
Fritzow	Wrzosowo
Klemmen	Kłęby
Schwanteshagen	Swiętoszewo
Tribsow	Trzebieszewo
Zarnglaff	Czarnogłowy

After the detailed study of SCHMIDT (1905), the fossils

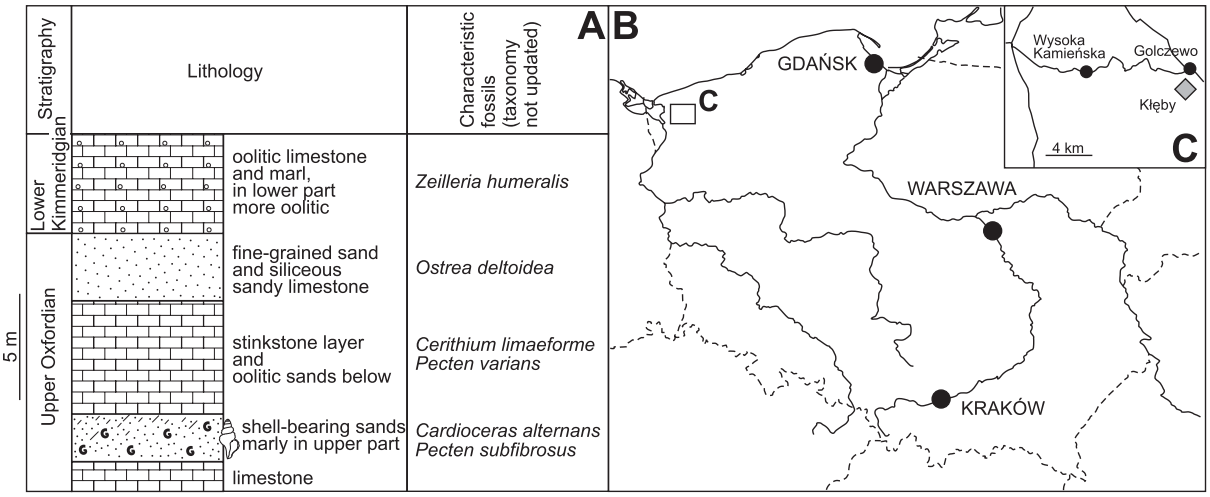

Fig. 1. Location, lithology, and stratigraphy of the gastropod-bearing section near Kłęby, Poland. **A**. Section at Kłęby as seen by SCHMIDT (1905) indicating the gastropod-bearing layer (after SCHMIDT 1905, slightly modified). **B**. Sketch map of Poland. **C**. Sketch map indicating the location of Kłęby in Western Pomerania (northwestern Poland)

from Kłęby were partially revised by DMOCH (1971) based on newly collected material. KARCZEWSKI (1980, 1988) listed and briefly re-described some of SCHMIDT's (1905) types based only on the figures in the SCHMIDT monograph. KARCZEWSKI (1980) designated several lectotypes of the gastropod species described by SCHMIDT (1905) without examining the type collection, admitting only that the collection was most probably lost. After the re-discovery of the original material, GRÜNDEL (2000b) re-described *Gordenella pommerana* (SCHMIDT, 1905) in detail and made new illustrations of the lectotypes designated by KARCZEWSKI (1980). Some species from Kłęby were also described and/or illustrated by KAIM (2004) and KAIM & SZTAJNER (2005) based on new material collected in the 1970s by J. DZIK and M. GRUSZCZYŃSKI.

The material presented herein comes from the type collection of SCHMIDT (1905) and specimens collected by Joachim GRÜNDEL in the 1970s, both deposited in the BGR; the collection of the Geologisch-Paläontologisches Institut der Ernst-Moritz-Arndt-Universität, Greifswald (abbreviated GG); the collection of Jerzy DZIK and specimens extracted from rock samples loaned by Michał GRUSZCZYŃSKI housed at the Institute of Paleobiology, Polish Academy of Sciences in Warsaw (ZPAL), and the private collections of Alfred BUCHHOLZ, Stralsund and W. BECKERT, Hohendorf bei Wolgast. The collection of Buchholz in future will be housed in GG. The SEM documentation was made in the Institute of Paleobiology PAN in Warsaw using a Philips XL-20 scanning electron microscope while the optical photographs were taken either by the senior author or by Grażyna and Marian DZIEWIŃSKI, and Jarosław STOLARSKI (Institute of Paleobiology PAN).

The taxonomic approach presented herein represents a consensus on the part of both authors, albeit it does not fully reflect their individual views and opinions.

SYSTEMATIC PALAEONTOLOGY

Class Gastropoda CUVIER, 1797
Subclass Prosobranchia MILNE-EDWARDS, 1848
Order Vetigastropoda SALVINI-PLAWÉN, 1980
Superfamily Trochoidea RAPHINESQUE, 1815
Family Turbinidae RAPHINESQUE, 1815
Genus *Metriomphalus* COSSMANN, 1915

TYPE SPECIES: *Turbo davoustii* D'ORBIGNY, 1850, original designation. Bajocian (Middle Jurassic), Guéret, France.

Metriomphalus muricatus (BUVIGNIER, 1843)
(Text-fig. 2)

1843. *Delphinula muricata*; BUVIGNIER, p. 243, pl. 5, figs 31-32.

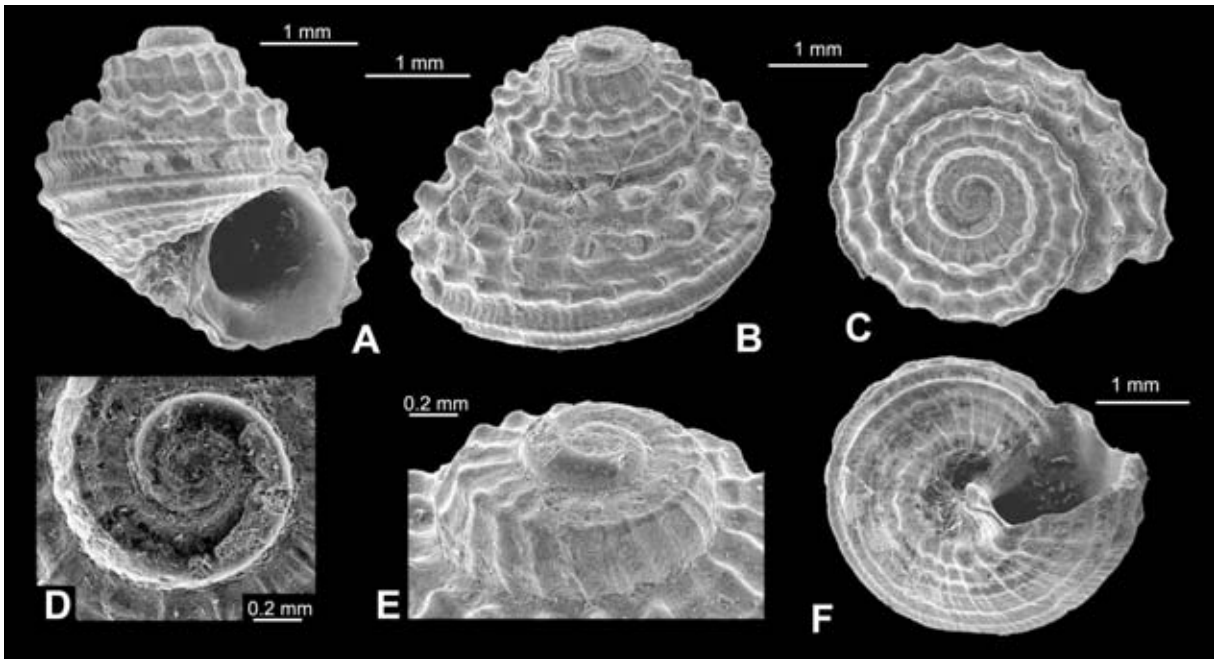

Fig. 2. The turbinid *Metriomphalus muricatus* (BUVIGNIER, 1852), Juvenile specimen (BGR X 12902) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**. Apertural view. **B**. Lateral view, note the incipient hollow spines on the spiral ribs. **C**. Apical view. **D**. Apex in apical view. **E**. Apex in oblique view. **F**. Umbilical view

1852. *Delphinula muricata* BUVIGNIER; BUVIGNIER, p. 35, pl. 32, figs 19-21.
1905. *Delphinula muricata* BUVIGNIER; SCHMIDT, p. 114, no illustration.
1971. *Delphinula cartieri* (LORIOL, 1880); DMOCH, p. 15, pl. 1, figs 5, 5a.

MATERIAL OF SCHMIDT (1905): This species was mentioned in the "List of fossils" p. 114 but neither figured nor described. We did not find any specimens of this species in the preserved part of SCHMIDT's collection.

OTHER MATERIAL: 9 specimens (BGR and Buchholz collections).

DIMENSIONS: A shell comprising three tightly coiled incomplete whorls without the apex is 5 mm high and 4.8 mm wide. The juvenile shell (BGR X 12902; Fig. 2), comprising about 4.5 whorls, is 3.4 mm high and wide.

DESCRIPTION: The initial part of the shell is discoidal. There are no specimens with the embryonic shell preserved. The first teleoconch whorl with the ornamentation preserved possesses a keel formed by one strong spiral rib. The adapical part of the whorl flank is almost flat and perpendicular to the shell axis while the lateral flank is almost parallel. Apart from the strong spiral rib, the early whorls are additionally ornamented by two weak spiral ribs at the adapicalmost and abapicalmost parts of the whorl. The axial ribs are strong and weakly prosocline. At the intersections of spiral and axial ribs strong nodes appear on the adapical part of the lateral flank. The nodes are weaker towards the abapical part of the whorl and finally disappear. The whorl surface shows enhanced growth lines. On large specimens an additional fourth spiral rib appears between the two adapical ones and, somewhat later, a fifth one develops abapically. The shape of adolescent specimens is more rounded than that of the juveniles and the keel becomes as strong as the other spiral ribs. A little later, both secondary ribs are of the same strength as the other ones. The nodes located in the adapical part of the adult whorls are hollowed in their terminal parts and form incipient spines.

The base is moderately convex. The umbilicus is narrow but distinct. The base of juveniles is clearly demarcated from the lateral flank by a strong spiral rib. The base is ornamented by several weaker spiral ribs. Later in ontogeny the spiral ribs of the base are as strong as the border rib. The umbilicus is surrounded by a sturdy and heavily noded spiral rib. The enhanced growth lines are prosocline. On large specimens there are five somewhat weaker but noded spiral ribs present between the border rib and the rib surrounding the umbilicus. Only the nodes of the adapicalmost rib have the holes directed toward the apex. The inner surface of the umbilicus is ornamented by one strong and some weaker spiral ribs. The aperture is rounded with the inner lip being slightly expanded. The inner lip is reflected outward, especially in its abapical part.

REMARKS: *M. muricatus* was originally ascribed by BUVIGNIER (1843) to *Delphinula* LAMARCK, 1804 (that is a junior synonym of *Angaria* RÖDING, 1798). *Angaria* is a Recent genus of Angariidae and unknown from the Jurassic (e.g. KNIGHT & *al*. 1960). COSSMANN (1915) erected *Metriomphalus* for Mesozoic *Delphinula*-like gastropods. We followed COSSMANN's (1915) interpretation of these gastropods and transferred BUVIGNIER's (1843) species to *Metriomphalus*. *Delphinula muricata* BUVIGNIER var. *alsatica* ANDREAE, 1887 differs in having a broader shell, a more strongly developed upper row of thorn-like nodes, and a base with only four spiral ribs. *Metriomphalus segregatus* (HÉBERT & EUDES-DESLONGCHAMPS, 1860) *sensu* GERASIMOV (1992) is quite similar to and possibly conspecific with *M. muricatus.*

Metriomphalus sp.
(Text-fig. 3)

MATERIAL: Three imperfectly preserved juvenile specimens (BGR and Buchholz).

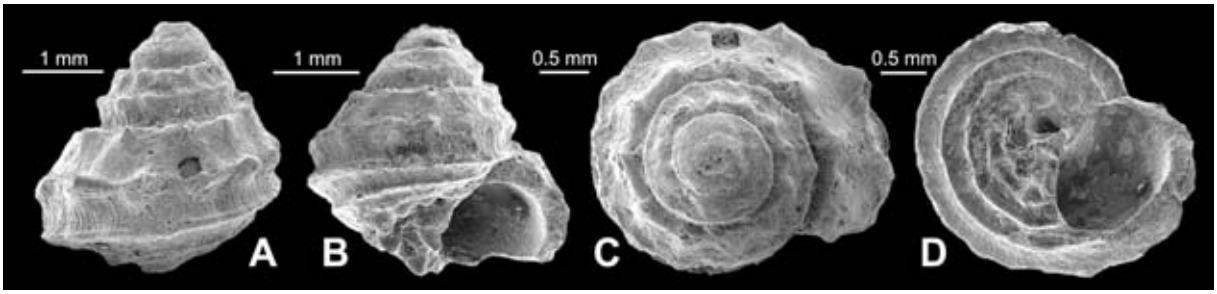

Fig. 3. The turbinid *Metriomphalus* sp., juvenile specimen (Buchholz collection) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**. Lateral view. **B**. Apertural view. **C**. Apical view. **D**. Umbilical view

DIMENSIONS: The largest specimen, comprising about 3.5 whorls, is 3.2 mm high and wide.

DESCRIPTION: The available material is incompletely preserved. A keel-like spiral rib constitutes an angulation of the lateral whorl flanks. A slightly weaker rib is situated at the adapicalmost part of the lateral flank of the whorl. Both spiral ribs are ornamented by strong nodes that are additionally strengthened by poorly expressed axial ribs and enhanced growth lines. The nodes of the abapical spiral rib are hollow on the terminal part of the largest specimens and the holes are directed anteriorly. The outer shell surface (including the base) is ornamented by numerous spiral lirae. The surface of the base is angulated at its strongest spiral rib which lacks any nodes. Both sides of this rib are slightly concave. The base is additionally ornamented abapically by two weaker spiral ribs that also lack any nodes. The umbilicus is bordered by a sturdy spiral rib that bears strong but blunt nodes on its surface.

Family Eucyclidae KOKEN, 1896
Genus *Eucycloscala* COSSMANN, 1895

TYPE SPECIES: *Trochus binodosus* MÜNSTER, 1841; subsequent designation by COX *in* KNIGHT & *al.* 1960, p. 267. Late Triassic, Alps, Italy.

Eucycloscala? cf. *augur* (GOLDFUSS, 1844)
(Text-fig. 4)

cf. 1844. *Turbo augur* n. sp.; GOLDFUSS, p. 99, pl. 194, fig. 11a, b.
1905. *Turbo* cf. *Meriani* v.MÜNSTER; SCHMIDT, p. 114, not illustrated.

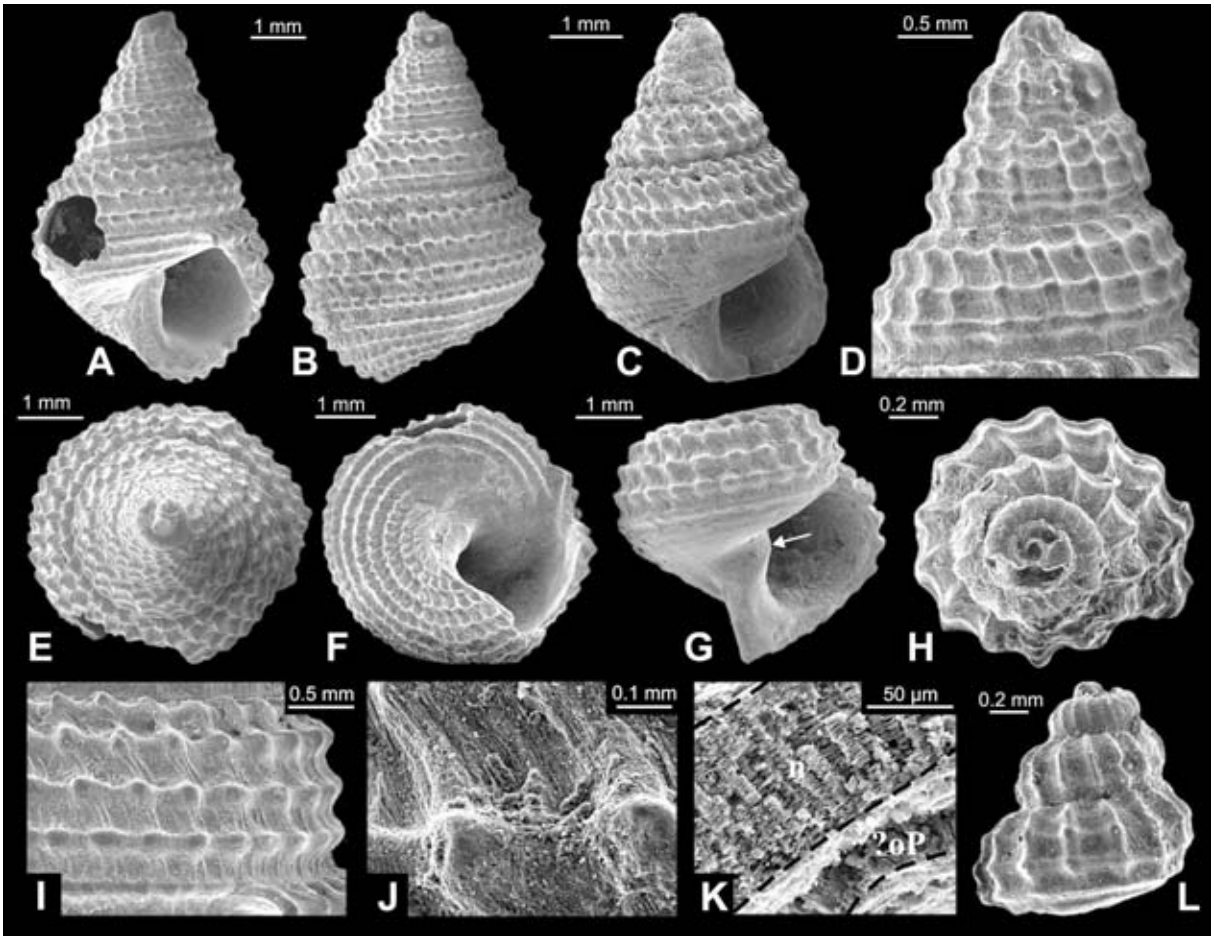

Fig. 4. The eucyclid *Eucycloscala* cf. *augur* GOLDFUSS, 1844 from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-B**, **D -F**, and **I**. Specimen BGR X 12903. A. Apertural view. B. Lateral view. D. Apex in lateral view. E. Apical view. F. Umbilical view. I. Close-up of the shell surface. **C**, **J-K**. Specimen lost. C. Apertural view. J. Close-up of the microornamentation. K. Microstructure of the apertural margin; n – nacreous layer, ?oP – outer, probably prismatic layer. **G**. Specimen BGR X 12904, juvenile with well-developed columellar fold (arrow). **H**, **L**. Juvenile specimen BGR X 12905. H. Apical view. L. Lateral view

MATERIAL OF SCHMIDT (1905): This species was mentioned in the "List of fossils" p. 114 but neither figured nor described. We did not find any specimens of this species in the preserved part of SCHMIDT's (1905) collection.

OTHER MATERIAL: 135 juvenile and incomplete specimens (BGR, Buchholz, Beckert).

DIMENSIONS: A specimen (BGR X 12903) with five whorls preserved and lacking the apex is 7 mm high and 4.5 mm wide.

DESCRIPTION: The shell is high trochospiral with a pointed apex. The protoconch remains unknown. The first two teleoconch whorls are rounded and ornamented by numerous axial ribs, and shortly thereafter two spiral ribs appear. The stronger one is located at the abapicalmost part of the whorl while the weaker one is close to the middle part of the lateral flank. Both ribs produce weak angulations. A little later, a third spiral rib appears at the adapical part of the whorl. Subsequently, a fourth rib appears slightly above the third one. The axial ribs are prosocline. Strong nodes appear at the intersections of spiral and axial ribs. There are 15 axial ribs per whorl initially, while later the number of ribs increases up to 30-35 per whorl. Later in ontogeny, the axial ribs weaken and change into bundles of enhanced growth lines. On the adult whorls the nodes are scale-like with an incipient recess. The basal margin shows no angulation. The axial ribs end at the border rib, and below there are six slightly weaker, also noded spiral ribs. The nodes on the base are weaker and more numerous than on the whorl flanks. Enhanced growth lines are visible between the ribs. The aperture is widely oval, slightly pointed anteriorly. The columella bears a distinct fold on its upper part.

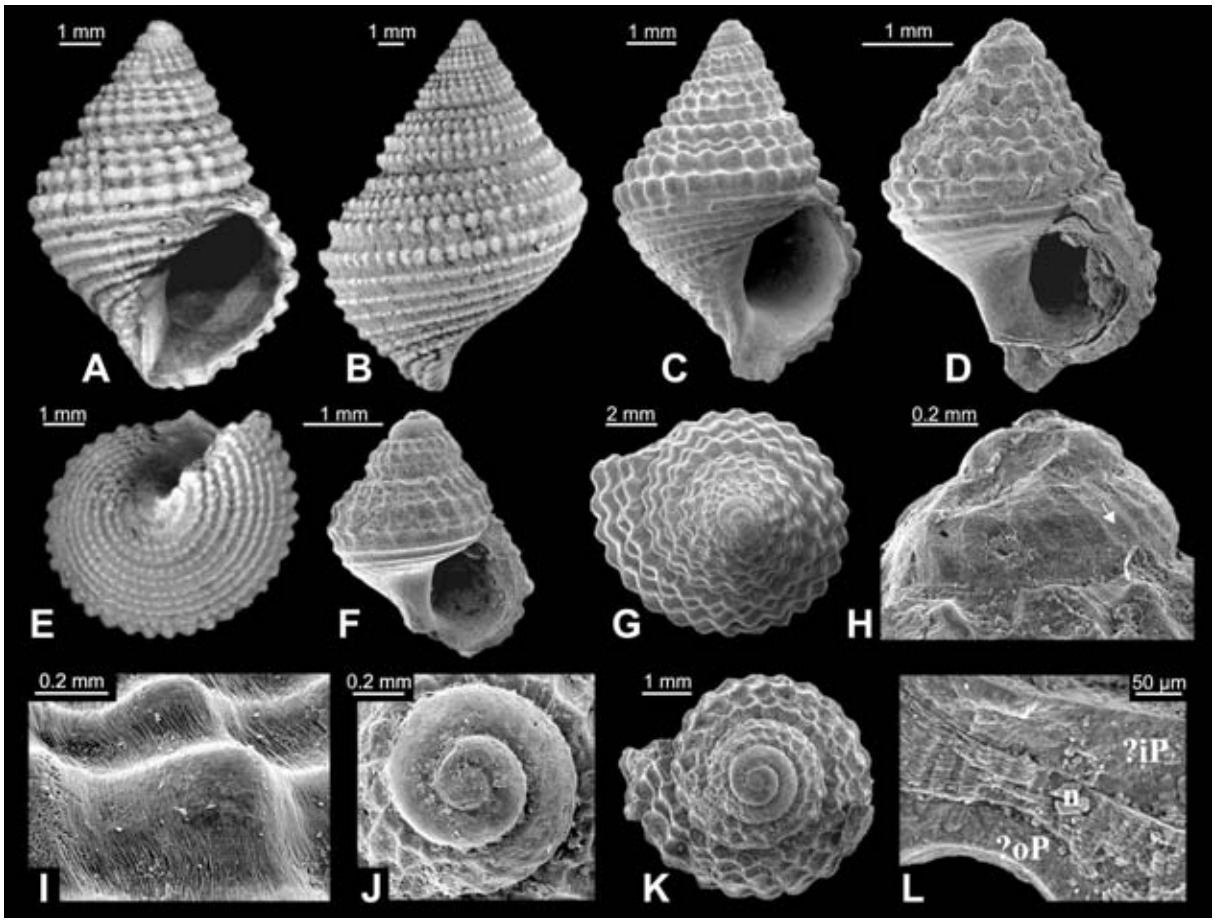

Fig. 5. The eucyclid *Gerasimovcyclus lorioli* (SCHMIDT, 1905) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**, **E**. Paralectotype (BGR X 05183) of SCHMIDT (1905). A. Apertural view, E. Umbilical view. **B**. Lectotype (BGR X 05184) of SCHMIDT (1905) in lateral view. **C**, **G**, **I**. Specimen BGR X 12906. C. Apertural view. G. Apical view. I. Details of teleoconch ornamentation. **D**, **H**. Specimen ZPAL Ga.12/3. D. Apertural view. H. Apex in lateral view, note the tiny oblique ornamentation (indicated by arrow) typical of the genus. **F**, **J-L**. Juvenile specimen ZPAL Ga.12/4. F. Apertural view. J. Apex in apical view. K. Apical view. L. Microstructure of the apertural margin; n – nacreous layer, ?iP – inner, probably prismatic layer, and ?oP – outer, probably prismatic layer

REMARKS: Our species clearly differs from "*Turbo*" *meriani* GOLDFUSS, 1844 in having a columellar fold, spiral ribs of nearly equal strength, less convex whorls, and a more elongated shell. The specimens from Kłęby differs from the type of "*Turbo*" *augur* GOLDFUSS, 1844, in having only four spiral ribs while the type has five (figure) or six (description) spiral ribs. Moreover, the aperture of the GOLDFUSS (1844) type from the "obere Oolithe" (?Kimmeridgian) of Thurnau is not known and we do not know if the characteristic columellar fold was present in this specimen. We therefore decided to leave our specimen in open nomenclature.

Genus *Gerasimovcyclus* GRÜNDEL, 2005

TYPE SPECIES: *Fusus clathratus* LAHUSEN, 1883, original designation. Oxfordian (Late Jurassic), Nikitino, Russia.

REMARKS: *Gerasimovcyclus* has early teleoconch whorls similar to *Eucycloscala* but differs in the aperture possessing a siphonal channel.

Gerasimovcyclus lorioli (SCHMIDT, 1905)
(Text-fig. 5)

1905. *Brachytrema lorioli* n. sp.; SCHMIDT, p. 184, pl. 9, figs 13-15.
1971. *Brachytrema lorioli* SCHMIDT, 1905; DMOCH, p. 26, pl. 4, figs 1, 1a.
1980. *Brachytrema lorioli* SCHMIDT, 1905; KARCZEWSKI, p. 430, pl. 133, figs 9-11.
1988. *Brachytrema lorioli* SCHMIDT, 1905; KARCZEWSKI, p. 309, pl. 133, figs 9-11.

MATERIAL OF SCHMIDT (1905): Three specimens BGR X 05182-4. Lectotype (BGR X 05184) designated by KARCZEWSKI (1980) from pl. 9, fig. 15 of SCHMIDT (1905), illustrated here on Fig. 5B.

OTHER MATERIAL: 21 specimens (BGR, Buchholz, Beckert, GG, and ZPAL)

DIMENSIONS: The lectotype (BGR X 05184) is an almost complete shell with seven whorls preserved. The specimen is 14 mm high and 10 mm wide.

DESCRIPTION: The teleoconch begins with three spiral ribs of similar strength. A little later, an additional weaker spiral rib appears between two adapical primary ribs. There are fine oblique threads between the ribs, which are visible on the apical part of the best preserved specimen (Text-fig. 5H). The axial ribs are weak, prosocline, and produce nodes at the intersections with the spiral ribs. The number of nodes increases during ontogeny. The abapical spiral rib has about 30-45 nodes per whorl on the terminal part of the shell. The adapical rib is ornamented by slightly less numerous nodes. The growth lines become enhanced during ontogeny. The axial ribs weaken and change into bundles of enhanced growth lines on large specimens. These growth lines produce a kind of opisthocyrtic lamellae at the adapicalmost part of the lateral flank. The two abapicalmost spiral ribs are distinctly enhanced on the last whorl. On the largest specimen (BGR X 05184) a weak rib appears between each two strong ribs. The maximum shell width is at the abapical spiral rib. The suture is weakly incised. The base is strongly convex and ornamented by 7-10 equally strong spiral ribs and similarly sized interspaces. Only the most abapical rib is more thickened. All these spiral ribs are ornamented by nodes that are more numerous and smaller than those of the lateral flank of the whorl. The axial ribs are absent on the base while the growth lines are enhanced. The aperture is oval and has a weak anterior channel. The inner lip is slightly thickened in the columellar region. The columella lacks any folds. The broken apertural margin reveals three distinct layers. The middle layer is nacreous (Text-fig. 5L).

REMARKS: *Eucyclus verrucatus* GERASIMOV, 1992, from the Callovian of Gzhel in the Moscow region has a more slender shell, the teleoconch whorls are ornamented by five spiral ribs, the base is more strongly convex and is ornamented by a higher number of spiral ribs, and the nodes on the first teleoconch whorl are weaker but more numerous. The inner and outer shell layers are not very well preserved but most probably prismatic or homogeneous. SCHMIDT (1905) classified his new species in *Brachytrema* MORRIS & LYCETT, 1851; however, the latter genus seems to belong to the caenogastropod Eustomatidae or Maturifusidae rather than the vetigastropod Eucyclidae.

Family Proconulidae COX, 1960
Genus *Proconulus* COSSMANN, 1918

TYPE SPECIES: *Trochus* (*Ziziphinus*) *guillieri* COSSMANN, 1885, original designation. Bathonian (Middle Jurassic), Domfront, France.

REMARKS: CHAVAN (1954) described a new genus *Parataphrus* based on *Trochus viadrinus* SCHMIDT, 1905, but he illustrated a specimen from the Upper Jurassic of Cordebugle, France. That specimen (CHAVAN 1954, fig. 1)

is apparently not conspecific with the specimens from Kłęby used by SCHMIDT (1905) to establish *Trochus viadrinus*. It differs in having convex whorls throughout ontogeny, angulated demarcation of the lateral flanks and base, the presence of a small umbilicus, the absence of the node on the inner lip and a narrower callus of the inner lip. Apparently the genus *Parataphrus* CHAVAN, 1954 was designated by a misidentified type species. The type specimens of *Trochus viadrinus* SCHMIDT, 1905 fit the definition of *Proconulus* COSSMANN, 1918 and therefore we classify it here and not as *Parataphrus*.

Proconulus coelotropis (SCHMIDT, 1905)
(Text-fig. 6)

1905. *Trochus coelotropis* n. sp.; SCHMIDT, p. 179, pl. 9, fig. 5a-c.
1971. *Trochus* cf. *virdunensis* BUVIGNIER, 1852; DMOCH, p. 14, pl. 1, fig. 6.
1980. *Trochus coelotropis* SCHMIDT, 1905; KARCZEWSKI, p. 418, pl. 133, fig. 3.
1988. *Trochus coelotropis* SCHMIDT, 1905; KARCZEWSKI, p. 300, pl. 133, fig. 3.

MATERIAL OF SCHMIDT (1905): Two specimens BGR X 05175-6. KARCZEWSKI (1980, p. 418) was apparently unaware that figures 5a-c on pl. 9 of SCHMIDT (1905) actually represent two specimens; he thought that it was a single specimen and designated it the holotype. It is therefore necessary to select a lectotype from these two specimens. We now designate the better preserved specimen (BGR X 05175) illustrated by SCHMIDT (1905) on figures 5a-b as the lectotype (Text-figs 6A-B, F herein); the other specimen (BGR X 05176) illustrated by SCHMIDT (1905) on figure 5c is therefore a paralectotype (Text-fig. 6E herein).

OTHER MATERIAL: Nine shells (BGR, Buchholz, GG, and ZPAL).

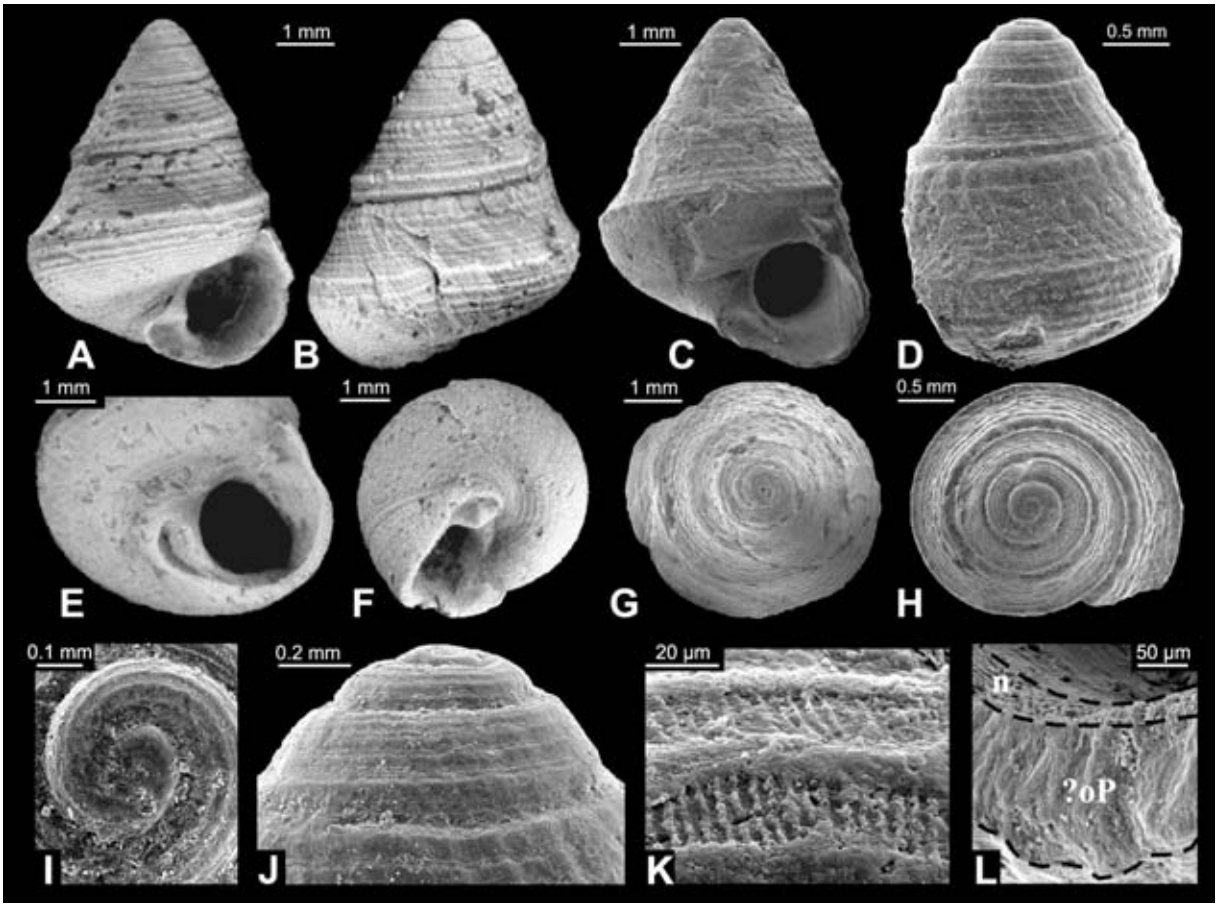

Fig. 6. The proconulid *Proconulus coelotropis* (SCHMIDT, 1905) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-B**, **F**. Lectotype (BGR X 05175) of SCHMIDT (1905). A. Apertural view. B. Lateral view. F. Umbilical view. **C**, **G**. Specimen ZPAL Ga.12/5. C. Apertural view. G. Apical view. **D**, **H-L**. Specimen ZPAL Ga.12/6. D. Lateral view. H. Apical view. I. Apex in apical view. J. Apex in lateral view. K. Close-up of the teleoconch microornamentation. L. Microstructure of the apertural margin; n – nacreous layer, ?oP – outer, probably prismatic layer. **E**. Paralectotype (BGR X 05176) of SCHMIDT (1905), close-up of the aperture

DIMENSIONS: The lectotype (BGR X 05175), comprising 6.75 whorls; it is 6.5 mm high and 5.0 mm wide.

DESCRIPTION: The shell is trochoid with a blunt apex. The first teleoconch whorl is rounded, the second whorl has a flat lateral flank and, beginning with the third whorl, the whorls become concave. The suture is hardly incised. There are five spiral ribs on the first teleoconch whorl; later, their number increases to 8-9 and the ribs cover the visible part of the whorl. The interspaces between the spiral ribs are densely covered by a net of axial or oblique threads. The abapicalmost spiral rib on the early whorls is the strongest and located at the periphery of the whorl. Later in ontogeny the rib corresponding to the angulation of the whorl migrates adapically, and an additional rib emerges beneath. The interspace between these two ribs is wider and deeper than the interspaces between any of the other ribs. Axial ribs are absent. Blunt and weak nodes are present exclusively on the adapicalmost rib of the early teleoconch whorls and disappear later in ontogeny. The growth lines are commonly enhanced and strongly prosocline. On the uppermost part of the whorl, close to the suture, the growth lines form a short prosocyrt curve and become straight near the centre of the base. The base is densely covered by about twenty spiral ribs, which become somewhat more widely spaced near the centre. The shape of the aperture agrees fully with the generic diagnosis (see GRÜNDEL 2000a). The apertural region of the shell consists of two layers (Text-fig. 6L). The inner layer is thin and nacreous.

REMARKS: We have not found any similar Late Jurassic species of *Proconulus*. The most similar species is *Trochus bijugatus* QUENSTEDT, 1858 (see also BRÖSAMLEN 1909, HÄGELE 1997, GRÜNDEL 2003) from the Bajocian/Bathonian of Germany, which has a broader shell, less numerous spiral ribs on the flanks, and no nodes on the uppermost spiral rib. The outer shell layer of *P. coelotropis* is thick and seems to be prismatic or homogeneous.

Proconulus viadrinus (SCHMIDT, 1905)
(Text-fig. 7)

1905. *Trochus viadrinus* n. sp.; SCHMIDT, p. 180, pl. 9, figs 6-7.
1971. *Trochus* sp.; DMOCH, p. 15, pl. 1, fig. 3.
1980. *Trochus viadrinus* SCHMIDT, 1905; KARCZEWSKI, p. 419, pl. 133, figs 22-23.
1988. *Trochus viadrinus* SCHMIDT, 1905; KARCZEWSKI, p. 300, pl. 133, figs 22-23.

MATERIAL OF SCHMIDT (1905): Two figured specimens (BGR X 05177-8) and a further specimen. The lectotype (BGR X 05177) designated by KARCZEWSKI (1980) from pl. 9, fig. 6 of SCHMIDT (1905) is a poorly preserved specimen. We illustrated herein a paralectotype (BGR X

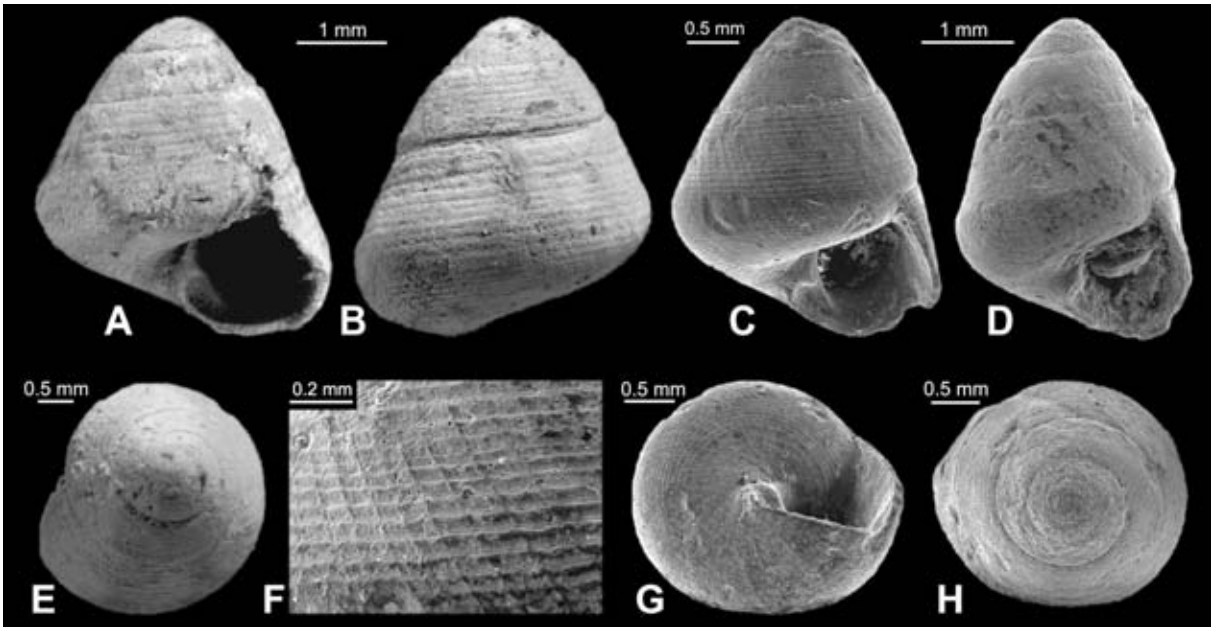

Fig. 7. The proconulid *Proconulus viadrinus* (SCHMIDT, 1905) from from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-B**, **E**. Paralectotype (BGR X 05178) of SCHMIDT (1905). A. Apertural view. B. Lateral view. F. Apical view. **C**, **F-G**. Specimen BGR X 12907. C. Apertural view. F. Close-up of the teleoconch microornamentation. G. Umbilical view. **D, H**. Specimen ZPAL Ga.12/7. D. Apertural view. H. Apical view

05178) from pl. 9, fig. 7 that is much better preserved (see Text-fig. 7 A, B, E).

OTHER MATERIAL: Six specimens (BGR, Buchholz, GG, and ZPAL).

DIMENSIONS: The paralectotype (BGR X 05178), comprising about five whorls (the early whorls are badly preserved), is 3.5 mm high and 3.0 mm wide.

DESCRIPTION: The shell is trochoid with a blunt apex. The early teleoconch whorls have a flat lateral flank. Concave flanks appear only on the latest whorl of the largest specimens. The suture is hardly incised. The sculpture of the earliest whorls is not preserved. Later, the lateral flanks as well as the base are densely covered by numerous spiral ribs, which are broader than the interspaces. 10-15 spiral ribs are visible on the lateral flank. The spiral ribs are more numerous and narrower on the base but the exact number is unknown because of the poor preservation. Only near the centre of the base are some broad and strong spiral ribs visible. Axial ribs are absent. The upper part of the inner lip shows a distinct node, which together with the crescent-like callus, forms a shallow half-moon shaped depression.

REMARKS: The juvenile whorls of the Tithonian *Trochus aequilineatus* MÜNSTER *sensu* BRÖSAMLEN (1909) from Germany are more strongly convex and the

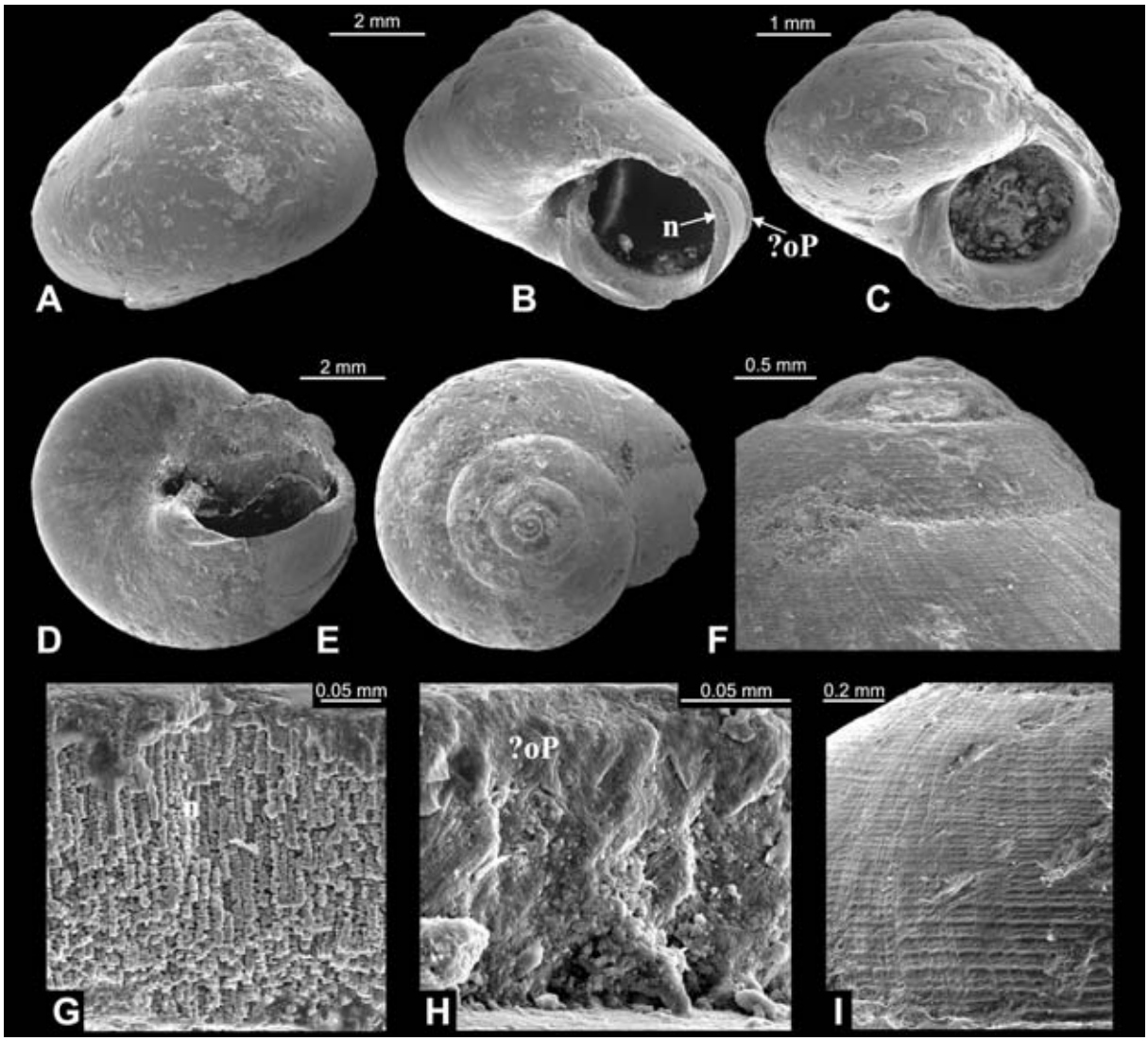

Fig. 8. The ataphrid *Ataphrus marschmidti* sp. nov. from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-B**, **D-I**. Holotype (BGR X 12908). A. Lateral view. B. Apertural view with two layers indicated by arrows; n – nacreous layer, ?oP – outer, probably prismatic layer. D. Umbilical view. E. Apical view. F. Apex in lateral view. G. Nacreous inner shell layer. H. Alleged prismatic, outer shell layer. I. Close-up of the teleoconch microornamentation. **C**. Specimen (collection Buchholz) in apertural view

species is distinctly larger, having also more whorls. *Trochus virdunensis* BUVIGNIER *sensu* LORIOL & PELLAT (1874) from the Late Jurassic of the Boulonnais (northern France) has straight (not concave) flanks, the transition to the base is angulated, and the spiral ribs are crenulated. Both species are transferred here to *Proconulus*.

Family Ataphridae COSSMANN, 1918
Genus *Ataphrus* GABB, 1869

TYPE SPECIES: *Ataphrus crassus* GABB, 1858, original designation. Late Cretaceous, Martinez, California, USA.

Ataphrus marschmidti sp. nov.
(Text-fig. 8)

HOLOTYPE: The holotype from the Gründel collection, now in the BGR collection (BGR X 12908).

TYPE HORIZON: Shell-bearing ferruginous sands, Late Oxfordian (=Muschelsand of SCHMIDT 1905).

TYPE LOCALITY: Kłęby, Pomerania, Poland.

DERIVATION OF NAME: After MARTIN SCHMIDT.

MATERIAL: Six specimens (BGR, Buchholz, and Beckert collections).

DIMENSIONS: The holotype (BGR X 12908), comprising about 5.5 whorls, is 6.5 mm high, and 8 mm wide.

DIAGNOSIS: *Ataphrus*-like shell with fine but distinctive spiral lirae. The lirae are more distinct on the juvenile whorls and less distinct later in ontogeny. Even on the largest specimens a small but deep umbilicus is present. The callus is expanded in the lower part of inner lip into a crescent-like lobe orientated slightly oblique to the shell axis.

DESCRIPTION: The shell has moderately high whorls and a rounded, continuous transition from the lateral flank into the weakly convex base. The protoconch is unknown. The lateral flanks are weakly convex at the beginning and straight later in ontogeny. The suture is weakly incised. The growth lines are prosocline up to the centre of the base and only at the adapicalmost part of the shell are they are slightly curved abaxially. The shell consists of two distinct layers of which the inner one is nacreous (Text-fig. 8G) and about twice as thick as the outer layer (Text-fig. 8H).

REMARKS: *Ataphrus marschmidti* differs from any other species of *Ataphrus*, apart from *A. compactus* (GABB, 1869) from the Late Cretaceous of California (USA), in having spiral sculpture. The latter species, well illustrated by STEWART (1927), differs in the absence of an umbilicus.

Genus *Falsataphrus* GRÜNDEL, 2000

TYPE SPECIES: *Falsataphrus circulcallosus* GRÜNDEL, 2000, original designation. Callovian (Middle Jurassic), erratic boulder from Fonow, Germany.

REMARKS: CHAVAN (1954) described a new genus *Teinostomopsis* with the type species *T. sarahae* CHAVAN, 1954, and included *Turbo? corallensis* SCHMIDT, 1905 (not BUVIGNIER, 1852) in the synonymy of the type species. The holotype of *T. sarahae* (CHAVAN 1954, fig. 2) differs from *T.? corallensis sensu* SCHMIDT in its slender shell, higher last whorl, an adapically pointed aperture, and a narrower, not extended callus. Similar differences can be observed between *T. corallensis* BUVIGNIER, 1852 and *T.? corallensis sensu* SCHMIDT (1905). Therefore *T. sarahae* (holotype from Cordebugle, France) is more similar to *T. corallensis* BUVIGNIER, 1852 than to *T.? corallensis sensu* SCHMIDT, 1905. We seriously doubt the synonymy of *T. sarahae* with *T? corallensis sensu* SCHMIDT (1905) suggested by CHAVAN (1954). In spite of their superficial similarity, *T. sarahae* shows none of the diagnostic features of *Falsataphrus* (lower and broad shell, round aperture, broad and extended callus), and therefore we regard both genera as distinct.

Falsataphrus kljasmiensis (GERASIMOV, 1992)
(Text-fig. 9)

1905. *Turbo(?) corallensis* BUVIGNIER; SCHMIDT, p. 114, pl. 9, fig. 4a-d.
1971. *Teinostoma corallensis* (BUVIGNIER, 1852); DMOCH, p. 16, pl. 1, figs 2, 2a.
1992. *Heliocryptus kljasmiensis* GERASIMOV, sp. nov.; GERASIMOV, p. 40, pl. 6, fig. 4.
1996. *Heliocryptus kljasmiensis* GERASIMOV, 1992; GERASIMOV & *al*. p. 33, pl. 22, figs 5a-b.

MATERIAL OF SCHMIDT (1905): 31 specimens in the BGR collection under the single number BGR X

05174. It is not possible to identify which specimen is the original from pl. 9, fig. 4 of SCHMIDT (1905). Nevertheless, we illustrated two of the SCHMIDT (1905) specimens here (Text-fig. 9A, D) and gave them separate numbers: BGR X 05174/1 and BGR X 05174/2.

OTHER MATERIAL: More than 200 specimens (BGR, Buchholz, Beckert, GG, and ZPAL).

DIMENSIONS: The specimen (BGR X 05174/1), comprising four rapidly expanding whorls, is 2.8 mm high and 4 mm wide.

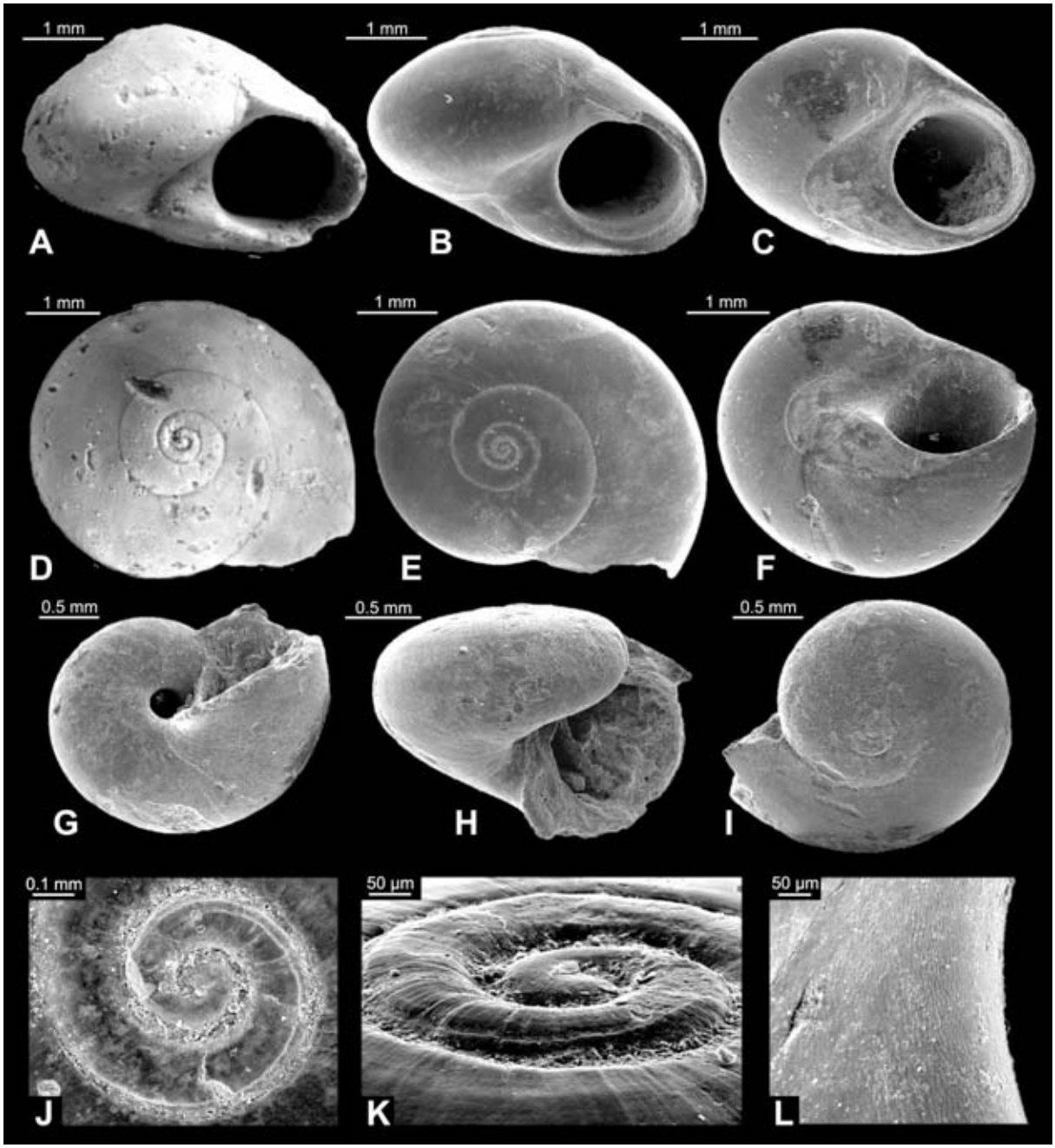

Fig. 9. The ataphrid *Falsataphrus kljasmiensis* (GERASIMOV, 1992) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**, **D**. Specimen BGR X 05174/1 from the collection of SCHMIDT (1905). A. Apertural view. D. Apical view. **B-C**, **E**, **J-L**. Specimen ZPAL Ga.12/8, possibly aberrant shell with ornamentation on the first teleoconch whorl. B-C. Apertural views. E. Apical view. J. Apex in apical view. K. Apex in oblique view. L. Details of microornamentation on the inner lip. **F**. Specimen BGR X 05174/2 in umbilical view. **G-I**. Juvenile specimen ZPAL Ga.12/9. G. Umbilical view, note presence of umbilicus at this stage. H. Apertural view. I. Apical view

DESCRIPTION: The protoconch consists of about one whorl. The demarcation is not clearly visible because of poor preservation. The smooth shell is composed of relatively high whorls. Each whorl covers the preceding one to a large extent. The lateral flank of the whorls is slightly convex. The suture is hardly incised. The border between the lateral flank and the base is continuous and rounded. The growth lines are prosocline from the suture to the centre of the base. The aperture is round. The columellar callus forms a lobe-like projection on the centre of the base, which may be separated from the whorl surface by a weak concavity. In some cases, the lobe-like projection is absent and the callus forms a kind of half-moon shaped ribbon with no depression.

REMARKS: On one of our specimens (ZPAL Ga.12/8), the first half whorl of the teleoconch is ornamented by a flat-topped ribbon-like spiral rib that is demarcated by two furrows on both its sides (Text-fig. 9J-K). The furrows are of the same width as the rib. The rib appears on the middle part of the lateral flank; afterwards it migrates abapically, and finally disappears beneath the succeeding whorl. We could not find these features in any other specimens in the collections examined and therefore we suspect that ZPAL Ga.12/8 (Text-fig. 9B-C, E, J-L) might be an aberrant shell. A very similar species is the Late Callovian *Falsataphrus lagunum* (JAMNIČENKO, 1987) from Ukraine (JAMNIČENKO 1987, pl 2, figs 7-10), which also lacks any ornament on the early teleoconch whorls. If our ZPAL Ga.12/8 is an aberrant shell, then *F. lagunum* might be conspecific with *F. kljasmiensis*. For differences with *Turbo corallensis* BUVIGNIER, 1852 see remarks to the genus *Falsataphrus*.

Vetigastropoda gen. and sp.indet.
(Text-fig. 10A-D)

MATERIAL: A single specimen (ZPAL Ga.12/10) with the apical part eroded.

DIMENSIONS: The shell has a diameter of 1.21 mm.

DESCRIPTION: The shell is broadly conical, with the apical part eroded. The border between the lateral flank and base is distinctly angulated. The base is ornamented by strong axial ribs and numerous spiral lirae. The wide and deep umbilicus is bordered by a sturdy spiral rib. The intersections of this rib and the axial ribs show blunt nodes. The apertural region is composed of two layers (Text-fig. 10D). The outer nacreous layer is much thinner than the inner layer.

REMARKS: This poorly preserved specimen may represent either a minute skeneid or a juvenile turbinid. Juveniles of *Torallotrochus lukovensis* KAIM, 2004, from the Callovian (Middle Jurassic) of Poland have a similar wide and deep umbilicus bordered by a sturdy spiral rib.

Order Neritimorpha KOKEN, 1896
Family Neritidae RAFINESQUE, 1815
Genus *Neridomus* MORRIS & LYCETT, 1851

TYPE SPECIES: *Neridomus anglica* COX & ARKELL, 1950 [= *Nerita* (*Neridomus*) *hemisphaerica* ROEMER *sensu* MORRIS & LYCETT, 1851; non *Nerita hemisphaerica*

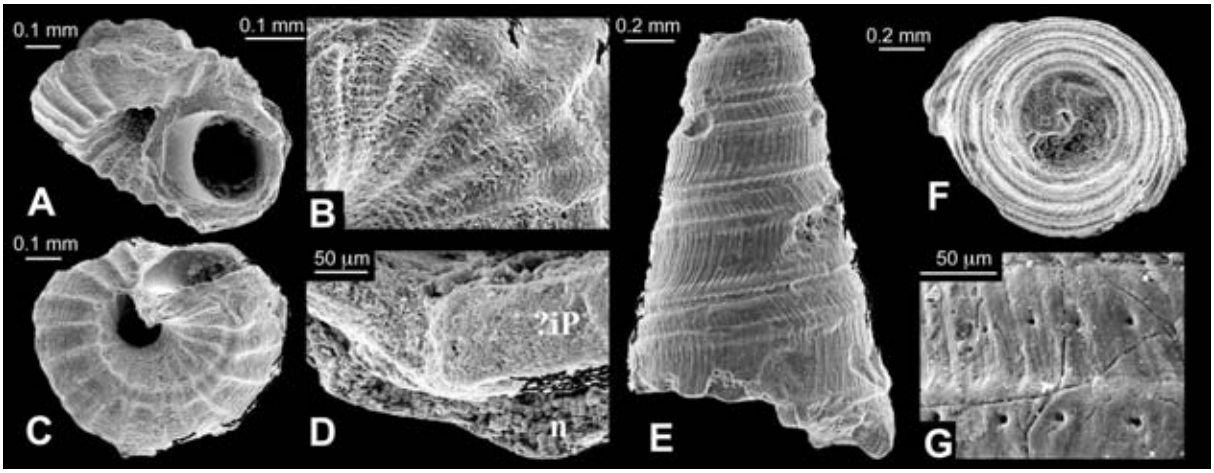

Fig. 10. Vetigastropoda gen. and sp. indet and Gastropoda incertae sedis from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-D**. Vetigastropoda gen. and sp. indet (ZPAL Ga.12/10). A. Apertural view. B. Details of base microornamentation. C. Umbilical view. D. Microstructure of the apertural margin; n – nacreous layer, ?iP – inner, probably prismatic layer. **E-G**. Gastropoda incertae sedis (ZPAL Ga.12/11). E. Lateral view. F. Apical view. G. Details of teleoconch surface, note the small pits arranged in spiral rows

ROEMER, 1836; = *Neridomus nuda* (PIETTE) *sensu* COSSMANN, 1925 (pars); non *Nerita nuda* PIETTE, 1851: see COX & ARKELL 1950, p. 65]. Bathonian (Middle Jurassic), Minchinhampton, England.

REMARKS: In contrast to *Neridomus*, *Nerita* has a well-developed septum with two large teeth and a thickened outer lip. A very similar genus is *Neritoplica* OPPENHEIM, 1892, which is most probably a junior synonym of *Neridomus*.

Neridomus mais (BUVIGNIER, 1843)
(Text-fig. 11)

1843. *Nerita mais* sp. nov.; BUVIGNIER, p. 241, pl. 5, figs 18-19.
1905. *Nerita mais* BUVIGNIER; SCHMIDT, p. 183, pl. 9, figs 10a-b.

MATERIAL OF SCHMIDT (1905): A single specimen (BGR X 05181).

OTHER MATERIAL: 13 specimens (BGR, Buchholz, and GG).

DIMENSIONS: The specimen from SCHMIDT's collection (BGR X 05181) is 4.5 mm high and wide.

DESCRIPTION: The shell shape is trapezoidal. The concavity of the outer side of the callus is smooth and ends at about half the height of the aperture. The rib in the parietal region is well developed and high conical.

REMARKS: The shell shape is generally similar to that of *Neridomus espacyensis* (COSSMANN, 1885) var. 2 of GRÜNDEL (2001). Both species are also similar in size. The concavity of the outer side of the callus ends at about half the height of the aperture in contrast to GRÜNDEL 1975, pl. 1, fig. 20 but similarly to GRÜNDEL 2001, pl. 1, fig. 4. The rib in the parietal region is well developed in contrast to that of *N. espacyensis* var. 1 of GRÜNDEL 2001).

Genus *Lissochilus* ZITTEL, 1882

TYPE SPECIES: *Nerita sigaretina* BUVIGNIER, 1843, subsequent designation by COSSMANN, 1925; Late Jurassic; St. Mihiel, France.

Lissochilus pellatus (LORIOL, 1874)?
(Text-fig. 12)

?1874. *Nerita Pellati* LORIOL, 1873; LORIOL & PELLAT, p. 359, pl. 9, figs 10-14.
1905. *Nerita Pellati* LORIOL; SCHMIDT, p. 116, pl. 9, figs 8a-b, 9.
1971. *Lissochilus concinna* (ROEMER, 1836); DMOCH, p. 14, pl. 1, figs 1, 1a.

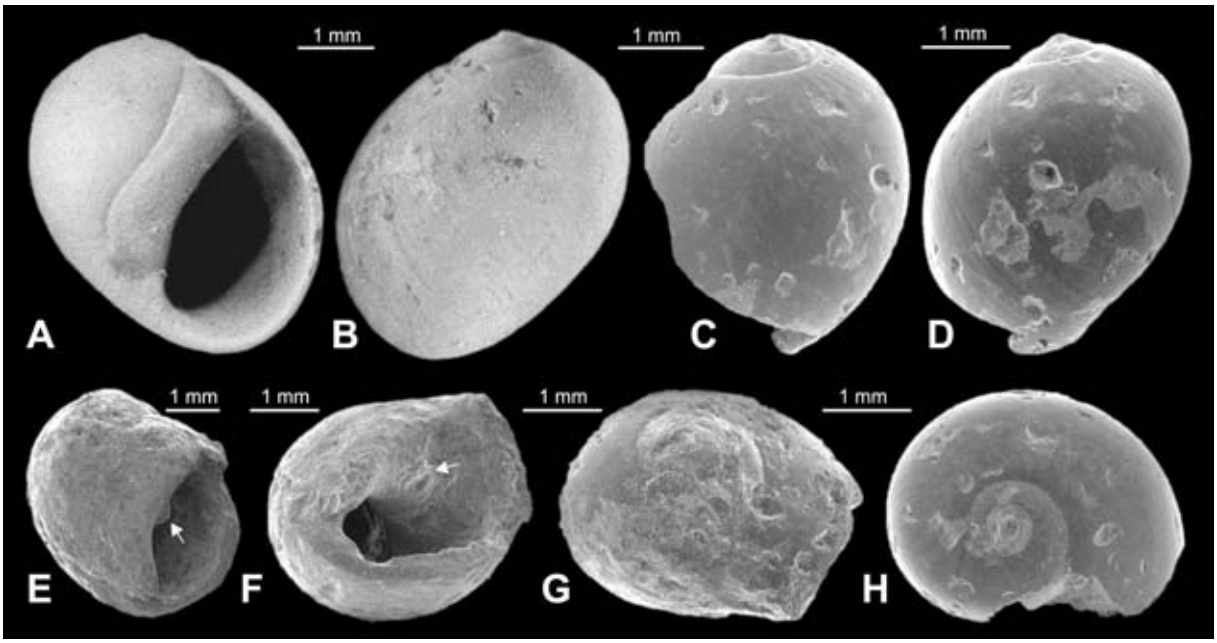

Fig. 11. The neritid *Neridomus mais* (BUVIGNIER, 1843) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-B**. Specimen BGR X 05181 from the collection of SCHMIDT (1905). A. Apertural view. B. Lateral view. **C-D**, **H**. Specimen BGR X 12909. C-D. Lateral views. H. Apical view. **E-G**. Specimen BGR X 12910. E-F. Apertural views, note the well-developed rib in the parietal region (arrows). G. Apical view, slightly oblique

2005. *Lissochilus concinna* (ROEMER, 1836); KAIM & SZTAJNER, p. 216, fig. 4I-J.

MATERIAL OF SCHMIDT (1905): Two specimens (BGR X 05179-80).

OTHER MATERIAL: Six specimens (BGR, Buchholz, Beckert, and ZPAL).

DIMENSIONS: The largest specimen (BGR X 05180) is 4.0 mm high and 5.5 wide.

DESCRIPTION: The large last whorl expands strongly abaxially. The shell is ornamented adapically by a concave ramp. The lateral flanks are strongly convex, with the widest part located abapically. The ornamentation consists of strong, weakly prosocyrt and prosocline axial ribs.

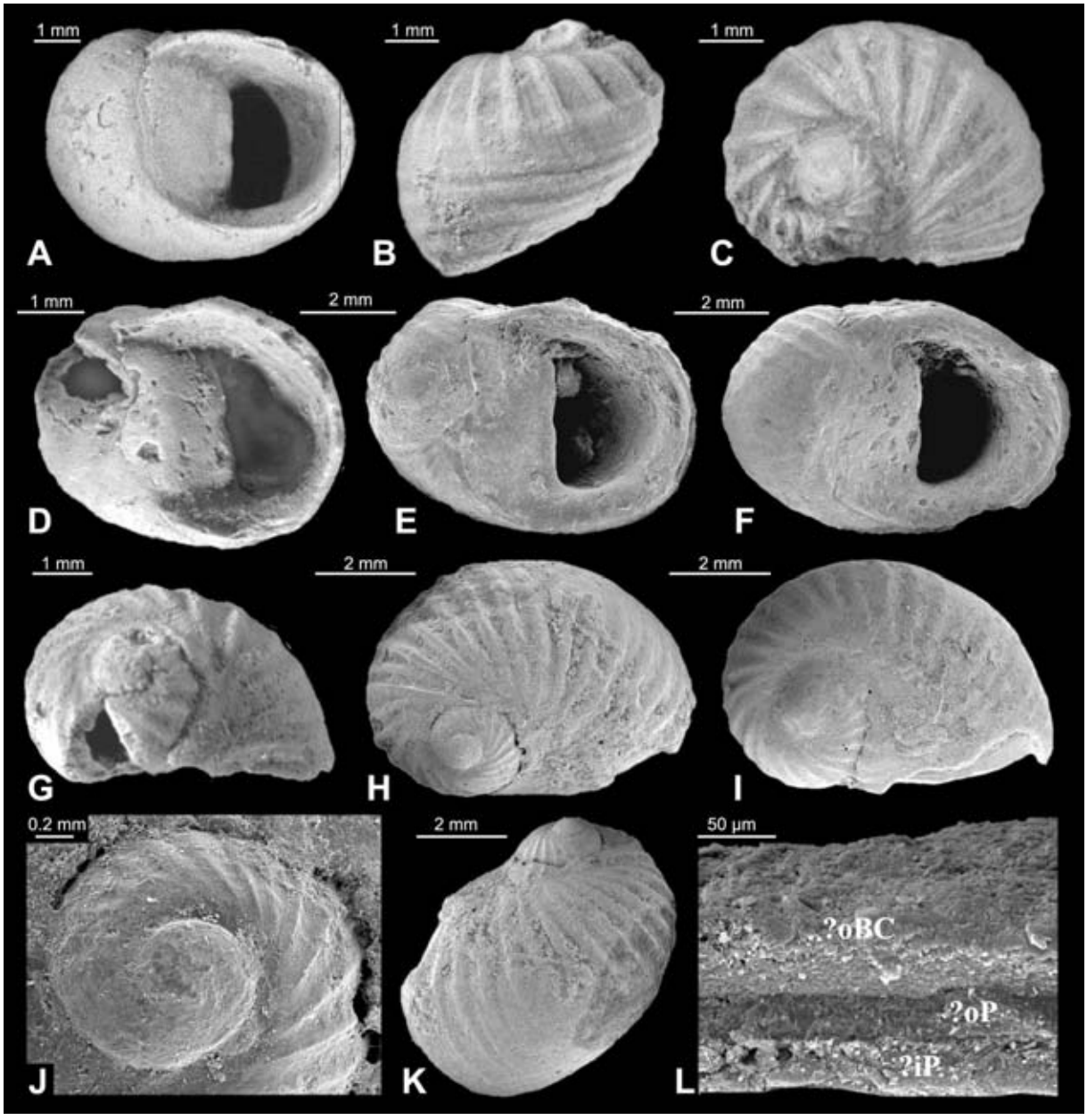

Fig. 12. The neritid *Lissochilus pellatus* (LORIOL, 1874) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A.** Specimen BGR X 05180 from the collection of SCHMIDT (1905). A. Apertural view. **B-C**. Specimen BGR X 12911. B. Lateral view. C. Apical view. **D**, **G**. Specimen BGR X 05179 from the collection of SCHMIDT (1905). D. Apertural view. G. Apical view. **E**, **H**, **J-L**. Specimen ZPAL Ga.12/1 (already illustrated by KAIM & SZTAJNER 2005). E. Apertural view. H. Apical view. J. Apex in apical view. K. Lateral view. L. Microstructure of the apertural margin; ?iP – inner, probably prismatic layer, ?oP – outer, probably prismatic layer, ?oBC – outer, probably blocky calcitic layer. **F**, **I**. Specimen ZPAL Ga.12/2. F. Apertural view. I. Apical view

The ribs originating at the adapicalmost part of the whorl are strongest and have weak nodes at the transition from the ramp onto the lateral flank. The axial ribs weaken abapically and finally fade out on the base. Somewhat above mid-whorl, a weak spiral rib forms weak nodes at the intersections with the axial ribs. An additional 6-7 spiral ribs appear abapically. The growth lines are slightly enhanced and run parallel to the axial ribs. The large aperture is semi-circular. The inner lip develops a wide septum. The straight edge of the inner lip is divided by a notch in the middle. The apertural region of the shell consists of three layers (Text-fig. 12L).

REMARKS: The shell layers are not well enough preserved to reveal the microstructure but, based on comparison to Recent neritids (e.g. GAINEY & WISE 1980; SUZUKI & *al*. 1991), it seems that the outermost shell layer is blocky calcitic while the two inner layers are prismatic. The type material of *L. pellatus* (LORIOL, 1874) differs from the specimens under consideration in having more numerous and weaker axial ribs, more spiral ribs (8-9), and a broader shell. Nonetheless we decided to classify the shells from Kłęby as *L. pellatus* (LORIOL, 1874) because those tenuous differences could result from intraspecific variability. DMOCH (1971) and KAIM & SZTAJNER (2005) referred specimens from Kłęby to *L. concinnus* (ROEMER, 1836). The type material of the latter species differs, however, in having numerous but weak axial ribs and only two strong spiral ribs.

Order Caenogastropoda COX, 1959
Superfamily Pseudomelanoidea HOERNES, 1884
Family Pseudomelaniidae HOERNES, 1884
Genus *Pseudomelania* PICTET & CAMPICHE, 1862

TYPE SPECIES: *Pseudomelania gresslyi* PICTET & CAMPICHE, 1862, original designation. Neocomian (Early Cretaceous), Sainte-Croix, Switzerland.

Pseudomelania laeviuscula (SCHMIDT, 1905)
(Text-fig. 13)

1905. *Lacuna(?) laeviuscula* n. sp.; SCHMIDT, p. 185, pl. 9, figs 16-17
1905. *Lacuna(?) laeviuscula,* var. *angulosa* n. v.; SCHMIDT, p. 186, pl. 9, figs 18-19.
1980. ?*Lacuna laeviuscula* SCHMIDT, 1905; KARCZEWSKI, p. 430, pl. 133, fig. 1.
1980. ?*Lacuna laeviuscula angulosa* SCHMIDT, 1905; KARCZEWSKI, p. 430, pl. 133, fig. 2.

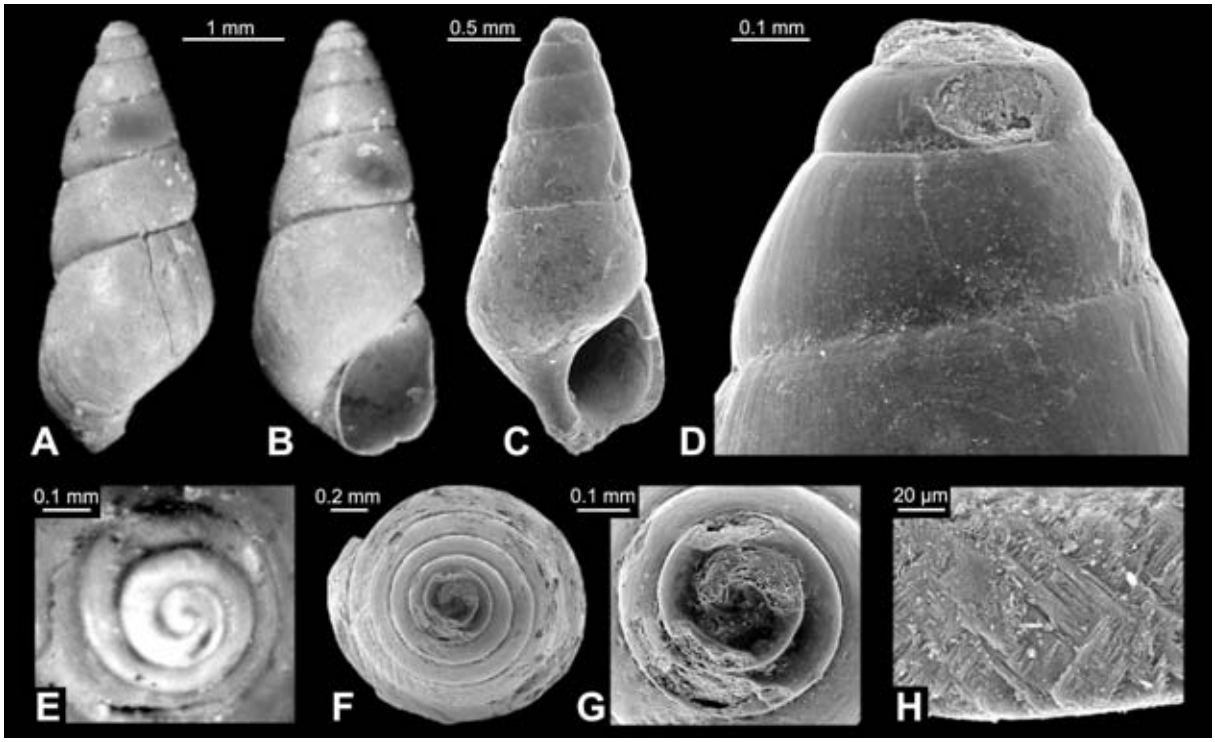

Fig. 13. The pseudomelaniid *Pseudomelania laeviuscula* (SCHMIDT, 1905) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**-**B**, **E**. Lectotype (BGR X 05185) from the collection of SCHMIDT (1905). A. Lateral view. B. Apertural view. E. Apex in apical view. C-D, F-H. Specimen BGR X 12912. C. Apertural view. D. Apex in lateral view. F. Apical view. G. Apex in apical view. H. Cross-lamellar microstructure of the apertural margin

1988. ?*Lacuna laeviuscula* SCHMIDT, 1905; KARCZEWSKI, p. 309, pl. 133, fig. 1.
1988. ?*Lacuna laeviuscula angulosa* SCHMIDT, 1905; KARCZEWSKI, p. 309, pl. 133, fig. 2.

MATERIAL OF SCHMIDT (1905): Four specimens (BGR X 05185-88). Lectotype (BGR X 05185) designated by KARCZEWSKI (1980) from pl. 9, fig. 16 of SCHMIDT (1905) is illustrated here on Text-fig. 13A, B, E.

OTHER MATERIAL: 28 specimens (BGR, Buchholz, and ZPAL).

DIMENSIONS: The lectotype (BGR X 05185), comprising about 7.5 whorls, is 4.3 mm high and 1.9 mm wide.

DESCRIPTION: The apex is blunt, with an almost planispiral first whorl. The demarcation between the protoconch and teleoconch is not visible. The two earliest whorls are smooth and rounded. From the third whorl on, the lateral flanks are straight or weakly convex. The suture is hardly incised. The demarcation between the lateral flank and the base is angulated in juveniles and continuous in adult specimens. The base is moderately convex. The umbilicus is very small or absent. The shell is smooth apart from orthocline growth lines. In the best-preserved specimens very fine lirae or undulations of the shell surface are recognisable. The aperture is wide drop-shaped and pointed at the sutural angle. The parietal and columellar parts of the inner lip are inclined to each other.

REMARKS: Most of the specimens we examined are elongated and represent *L. laeviuscula sensu stricto* of SCHMIDT (1905). We interpret *L. (?) laeviuscula* var. *angulosa* as representing part of the intrapopulational variability of *L*. (?) *laeviuscula* s.s. The shells described by SCHMIDT (1905) as *L*. var. *angulosa* probably represent juvenile individuals. The shape of the transition between the lateral flank and the base is apparently age-dependent. An angulated transition is typical of juveniles and a rounded transition is typical of adult shells. These two morphotypes differ only in shell width. The lectotypes of *L. (?) laeviuscula* var. *angulosa* and *L*. (?) *laeviuscula* s.s. designated by KARCZEWSKI (1980: 430) have orthostrophic protoconchs (Text-fig. 13) and the typical shell shape of *Pseudomelania*. Our material includes three shells very similar to *L. laeviuscula* but with a heterostrophic protoconch, slightly broader shells, and a less incised suture (Fig. 23). These are described below as *Conusella* sp.

Pseudomelania collisa LORIOL, 1874
(Text-fig. 14A-B)

1874. *Pseudomelania collisa* LORIOL, 1873; LORIOL & PELLAT, p. 82, pl. 7, figs 30-31
1905. *Pseudomelania collisa* LORIOL; SCHMIDT, p. 187, pl. 9, figs 23-24.

MATERIAL: A single specimen (BGR X 05192) illustrated by SCHMIDT (1905).

DIMENSIONS: SCHMIDT's (1905, pl. 9, fig. 24) original (BGR X 05192), comprising about four teleoconch whorls, is 32 mm high and 15 mm wide.

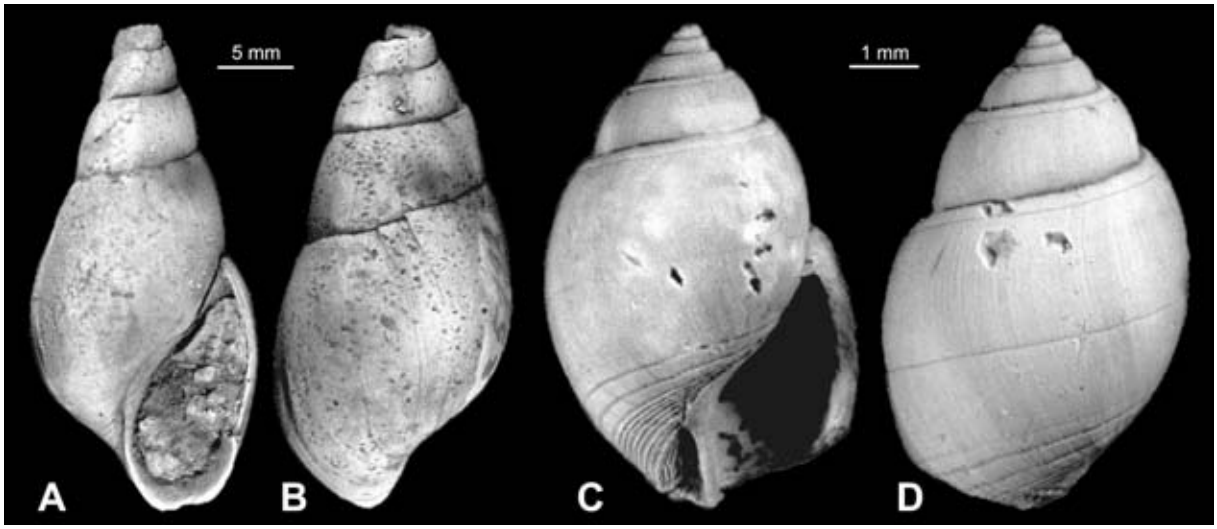

Fig. 14. The pseudomelaniid *Pseudomelania collisa* LORIOL, 1874 and the bullinid *Sulcoactaeon viadrinus* SCHMIDT, 1905 from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-B**. *Pseudomelania collisa* LORIOL, 1874, specimen (BGR X 5192) from the collection of SCHMIDT (1905). A. Apertural view. B. Lateral view. **C-D**. *Sulcoactaeon viadrinus* SCHMIDT, 1905, holotype (BGR X 5200) of SCHMIDT (1905). C. Apertural view. D. Lateral view

DESCRIPTION: The whorls increase rapidly in height. The lateral flanks are weakly convex and smooth. The growth lines are weakly opisthocyrt and slightly prosocline on the lateral flanks, while they become clearly prosocyrt on the base. The base is evenly convex. The large drop-like aperture is pointed posteriorly.

REMARKS: Only a single specimen in SCHMIDT's (1905) material can be ascribed with confidence to *P. collisa*. It differs significantly from other similar specimens from Kłęby mainly in its size and type of preservation. It is, however, possible that the shells described here as *Pictavia elegans* (MORRIS & LYCETT, 1851) represent juveniles of *P. collisa*.

Superfamily Cerithioidea FLEMING, 1822
Family Cryptaulacidae GRÜNDEL, 1976
Genus *Rhynchocerithium* COSSMANN, 1906

TYPE SPECIES: *Cerithium fusiforme* HÉBERT & EUDES-DESLONGCHAMPS, 1860, original designation. Callovian (Middle Jurassic), Monteuil-Bellay, France.

Rhynchocerithium limaeforme (ROEMER, 1836)
(Text-fig. 15)

1836. *Cerithium limaeforme* n. sp.; ROEMER, p. 142, pl. 11, fig. 19.
1889. *Cerithium* (*Bittium*) *limaeforme* ROEMER; LORIOL, p. 73, pl. 9, figs 12-15.
pars 1905. *Cerithium* (*Bittium*) *limaeforme* ROEMER; SCHMIDT, p. 189, not figured.
1913. *Procerithium limaeforme* (ROEMER); COSSMANN, p. 56, pl. 3, figs 39-42.
1970. *Procerithium limaeforme* (ROEMER, 1836); DMOCH, p. 55, pl. 3, figs 12-13.
1971. *Procerithium limaeforme* (ROEMER, 1836); DMOCH, p. 22, pl. 4, figs 3, 6, 8.
1980. *Procerithium limaeforme* (ROEMER, 1836); KARCZEWSKI, p. 430, pl. 132, figs 1, 2.

MATERIAL OF SCHMIDT (1905): The repository of this material remains unknown.

OTHER MATERIAL: More than 100 specimens (BGR, Buchholz, Beckert, GG, and ZPAL).

DIMENSIONS: We failed to find a completely preserved and fully-grown specimen. We estimate that the species could reach at least 15 mm in height. A juvenile specimen (specimen lost) comprising 8.5 whorls (the apex is absent), was 5 mm high, while another specimen (BGR X 12914) having four adult whorls preserved is 9 mm high.

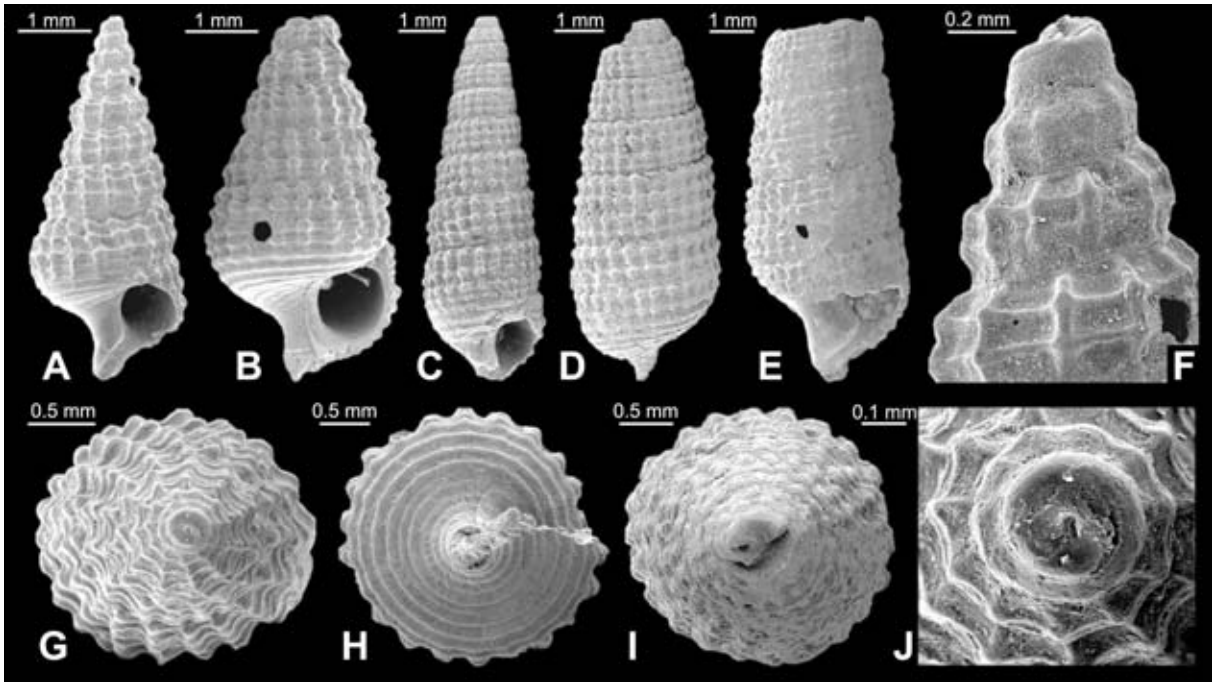

Fig. 15. The cryptaulacid *Rhynchocerithium limaeforme* (ROEMER, 1836) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**, **F-G**, **J**. Juvenile specimen (lost). A. Apertural view. F. Apex in lateral view. G. Apical view. J. Apex in apical view. **B**, **H**. Specimen BGR X 12913. B. Apertural view. H. Umbilical view. **C**, **I**. Specimen ZPAL Ga.12/12. C. Apertural view. I. Apical view. **D**. Specimen BGR X 12915 in lateral view. **E**. Specimen BGR X 12914 in apertural view

DESCRIPTION: The juvenile whorls widen rapidly, while the adolescent shell grows slowly in width and the shell shape becomes nearly cylindrical. The protoconch is unknown. The early teleoconch whorls are ornamented by two strong spiral ribs and about twelve straight and narrow axial ribs. Weak nodes appear at the intersection of spiral and axial ribs. The number of axial ribs increases during ontogeny and there are 35 ribs per whorl on the largest specimens. The ribs are weakly opisthocyrt on the adult whorls and their interspaces are much narrower than the ones on the juvenile whorls. The third spiral rib appears on the adapicalmost part of the earliest teleoconch whorl. Shortly after, the third rib becomes as strong as the two primary spiral ribs. The distance between the adapical spiral rib and the middle rib is smaller that the distance between the latter and the abapical one. During ontogeny three additional spiral ribs appear. First, a rib appears between the suture and the abapical rib, then one between the middle and abapical ribs, and finally one between the middle and adapical ribs. The secondary ribs are weaker than the primary ones throughout the known ontogeny. The intersections of axial ribs and spiral ribs are distinctly noded; the nodes on the primary ribs are stronger, while the nodes on the secondary ribs are weaker. The base of juvenile shells is straight, while it is convex on the larger specimens. The axial ribs end on the weakly noded spiral rib, which is situated at the demarcation between the lateral flank and the base. The base is ornamented by 4-5 slightly weaker spiral ribs that are devoid of nodes. The rounded aperture has a strong, distinctly oblique anterior channel. The growth lines are parallel to the axial ribs on the lateral flank and are prosocyrt on the base.

REMARKS: SCHMIDT (1905, pp. 189-190) described, but did not figure, cerithioid specimens from Kłęby as *Cerithium* (*Bittium*) *limaeforme*. Apparently, he merged in his description members of two different cerithioid species. Only one of them is here considered as belonging to *R. limaeforme* while the other one is a species of *Shurovites* GUZHOV, 2004 (see below). The shell shape and the sculpture of the species under consideration resemble *Rhabdocolpus* from which it differs mainly in the presence of an anterior channel. Such a channel is present in the species of *Rhynchocerithium*. The best-known species of the latter genus have a multispiral protoconch and more conical shells. Therefore the attribution of species from Kłęby to *Rhynchocerithium* is tentative. We could not determine the full range of intrapopulational variability of the species as the material at our disposal is not well preserved. In fact, we doubt that all specimens that we attributed to *Rhynchocerithium limaeforme* actually belong to that species. Some specimens differ significantly in shell parameters (e.g., compare apical parts of the specimens illustrated on Text-figs 15A and B). Studies on better preserved material are needed to establish the ranges of species variability.

Genus *Exelissa* PIETTE, 1860

TYPE SPECIES: *Cerithium strangulatum* D'ARCHIAC, 1843, original designation. Bathonian (Middle Jurassic), Eparcy, France.

Exelissa distans COSSMANN, 1913
(Text-fig. 16)

1905. *Cerithium septemplicatum* ROEMER; SCHMIDT, p. 191, not illustrated.

1913. *Exelissa distans* n. sp.; COSSMANN, p. 122, pl. 5, figs 63-66.

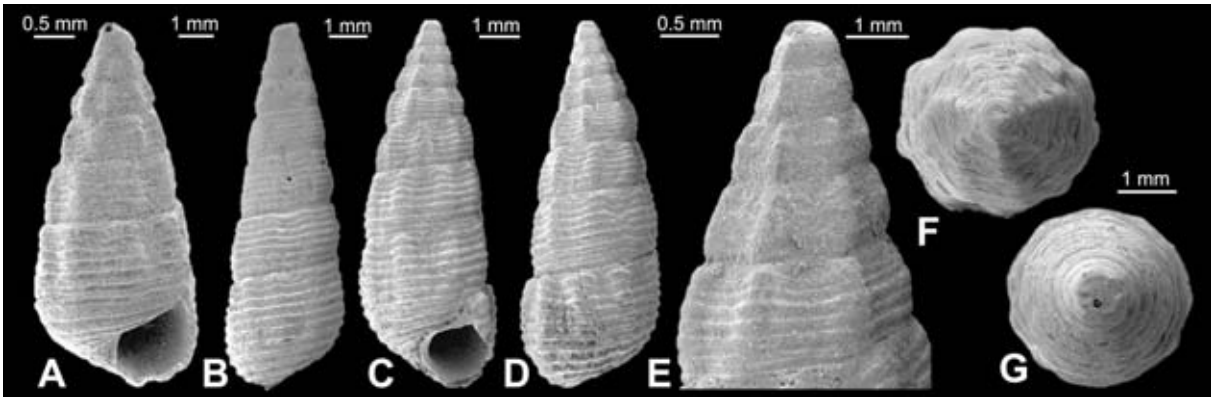

Fig. 16. The cryptaulacid *Exelissa distans* COSSMANN, 1913 from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**, **F**. Specimen BGR X 12916. A. Apertural view. F. Apical view. **B**, **G**. Specimen BGR X 12917. B. Lateral view. G. Apical view. **C-E**. Specimen collection Buchholz. C. Apertural view. D. Lateral view. E. Apex in lateral view

1971. *Exelissa distans* COSSMANN, 1913; DMOCH, p. 24, pl. 3, figs 2, 4, 6.
2004. *Exelissa distans* COSSMANN, 1913; KAIM, p. 47, fig. 31.

MATERIAL OF SCHMIDT (1905): The repository of this material remains unknown.

OTHER MATERIAL: More than 100 specimens (BGR, Buchholz, Beckert, GG, and ZPAL).

DIMENSIONS: A specimen (BGR X 12917), comprising eight whorls but without the protoconch, is 10.5 mm high and 3.5 mm wide.

DESCRIPTION: The shell is moderately elongated to elongate. The protoconch is unknown. The teleoconch starts with 3-4 spiral ribs and later their number increases to 6-7. The ribs are as wide as, or slightly narrower than their interspaces. In the latter case, one to three fine spiral ribs are developed in the interspaces. The number of axial ribs increases from 7-8 on the early whorls to 9-10 per whorl in the adult shells. There are no nodes at the intersections of the spiral and axial ribs. The growth lines are straight and weakly opisthocline. The axial ribs are initially narrow and widen later, with indistinct demarcation from the rest of the whorl. There is a gradual change between individuals having distinct ornamentation on the whole shell to individuals with ornamentation that weakens during ontogeny, and, finally, there are specimens with indistinct ornamentation on the entire shell. The base is convex. There are four equally strong spiral ribs below the rib located at the demarcation of the lateral flank and the base. The rounded aperture is badly preserved on the specimens examined. The aperture has a posterior notch but lacks an anterior channel. The narrowing of the last whorl is absent even on the largest specimens. The dropping-down of the last whorl is only weakly marked.

REMARKS: SCHMIDT (1905, p. 191) described, but did not illustrate, *Exelissa*-like shells as *Cerithium septemplicatum* ROEMER, 1836. The latter species also belongs to *Exelissa* but the type material of ROEMER (1836) differs in having more numerous and not equally sized spiral ribs, stronger axial ribs, and more convex whorls. HUCKRIEDE (1967) illustrated specimens that are both similar to the originals of ROEMER's (1836) *E. septemplicata* and COSSMANN's (1913) *E. distans* and suggested that all of these are intrapopulational variations of the former species. It is difficult to prove without a statistical analysis that there are two or only one species. We ascribed the specimens from Kłęby to *E. distans* because all of them are similar to the types of this species and we did not find any specimens that were similar to the types of *E. septemplicata*. *E. distans* has a weaker constriction of the last whorl than that of any other species attributed to *Exelissa*.

Genus *Shurovites* GUZHOV, 2004

TYPE SPECIES: *Shurovites shurovensis* GUZHOV, 2004, original designation. Oxfordian (Late Jurassic), Shchurovo, Russia.

Shurovites dmochae sp. nov.
(Text-fig. 17)

pars 1905. *Cerithium* (*Bittium*) *limaeforme* ROEMER; SCHMIDT, p. 189, not figured.
1971. *Procerithium* (*Rhabdocolpus*) *russiense* (D'ORBIGNY, 1845); DMOCH, p. 23, pl. 4, figs 2, 4, 5.
2004. *Rhynchocerithium* sp.; KAIM, p. 46, fig. 30.

HOLOTYPE: The specimen figured on Text-fig. 17A-B, J-K, M (BGR X 12918).

TYPE HORIZON: Shell-bearing ferruginous sands, Late Oxfordian.

TYPE LOCALITY: Kłęby, Pomerania, Poland.

DERIVATION OF NAME: In honour of Irena Dmoch for her work on molluscs from Kłęby.

MATERIAL OF SCHMIDT (1905): The repository of this material remains unknown.

OTHER MATERIAL: More than 300 specimens (BGR, Buchholz, Beckert, GG, and ZPAL).

DIMENSIONS: The holotype (BGR X 12918), comprising eight whorls, is 5 mm high and 2.5 mm wide.

DIAGNOSIS: The early whorls are elongated and conical, while the later ones widen rapidly. The terminal whorl is constricted. The teleoconch is ornamented by four spiral ribs and orthocline axial ribs. There are 10-12 axial ribs on the juvenile whorls and later the number of ribs increases up to 25. Rounded nodes are developed at the intersections of the axial and spiral ribs. Late in ontogeny the adapicalmost spiral rib and its nodes are slightly stronger than the others. The juveniles have a distinct anterior channel in the aperture that is less clearly developed on the adult whorls. The posterior notch is well developed.

DESCRIPTION: The protoconch seems to consist of about three whorls but its details are unrecognisable because of poor preservation. The shell is almond-like. The axial ribs end at the weakly noded spiral rib, which is situated at the demarcation between the lateral flank and the convex base. The last whorl usually drops down slightly, rendering the border rib visible. The base is ornamented by 4-5 strong spiral ribs with equal interspaces. The ribs are weakly noded, but the nodes are commonly not visible when the preservation is not perfect. The almost straight growth lines run parallel to the axial ribs.

REMARKS: Most of the specimens we examined have a distinct anterior channel but some have only a short notch instead. We suggest that this character might be age dependent. SCHMIDT (1905, pp. 189-190) described, but did not figure, cerithioid specimens from Kłęby as *Cerithium* (*Bittium*) *limaeforme*. Apart from the *Rhynchocerithium limaeforme* (ROEMER, 1836) (see

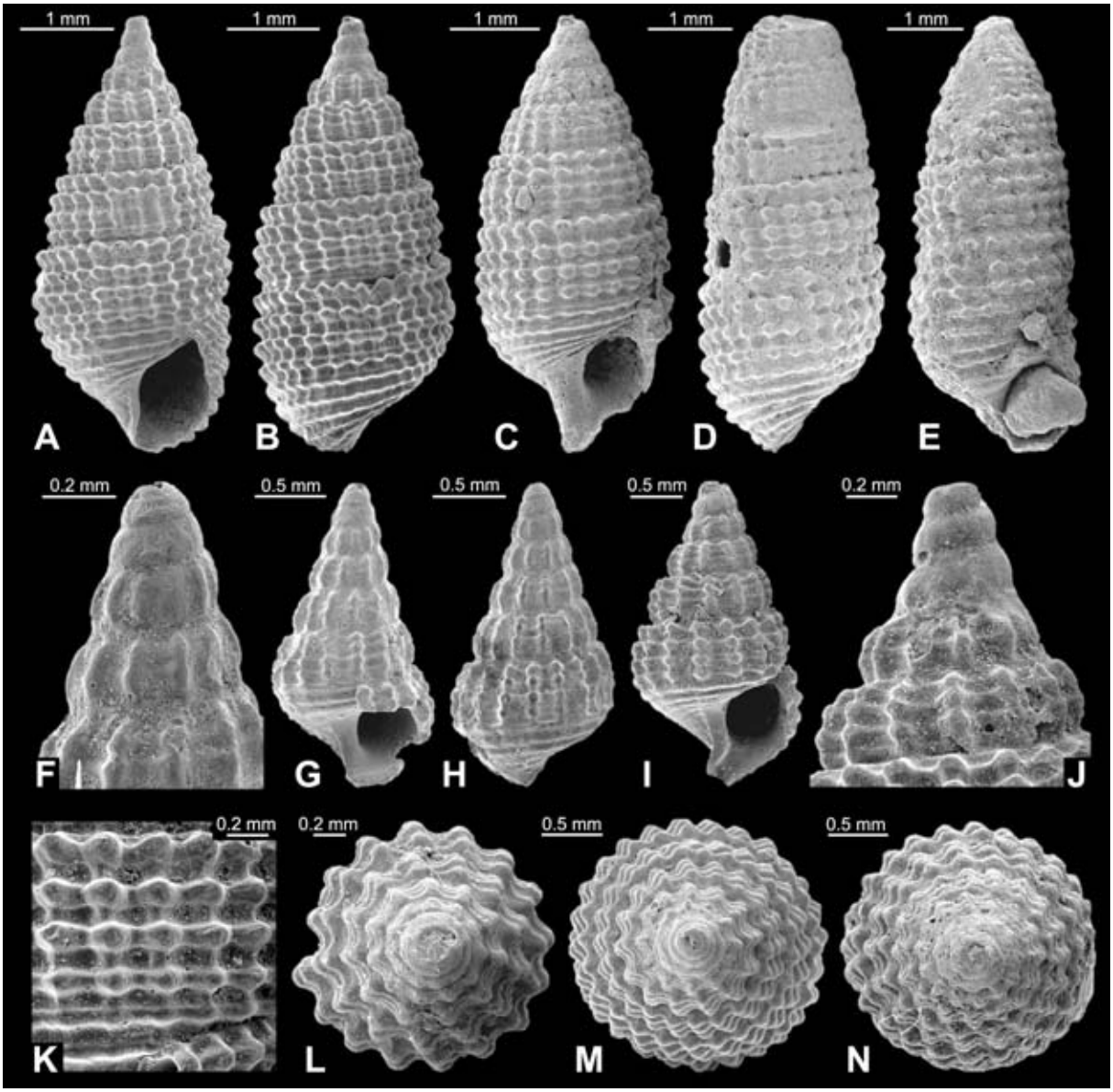

Fig. 17. The cryptaulacid *Shurovites dmochae* sp. nov. from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-B**, **J-K**, **M**. Holotype BGR X 12918. A. Apertural view. B. Lateral view. J. Apex in lateral view. K. Close-up of teleoconch ornamentation. M. Apical view. **C**, **N**. Specimen ZPAL Ga.12/13. C. Apertural view. N. Apical view. **D**. Specimen BGR X 12919 in lateral view. **E**. Specimen ZPAL Ga.12/14 in apertural view. **F-H**. Juvenile specimen BGR X 12920. F. Apex in lateral view. G. Apertural view. H. Lateral view. **I**, **L**. Juvenile specimen ZPAL Ga.9/169 (already illustrated by KAIM 2004 as *Rhynchocerithium* sp.). I. Apertural view. L. Apical view

above) he apparently also included specimens of *S. dmochae* sp. nov. in his description.

Superfamily Risooidea GRAY, 1847
Family Rissoidae GRAY, 1847
Genus *Rissoa* FRÉMINVILLE, 1814

TYPE SPECIES: *Rissoa ventricosa* DESMAREST, 1814, subsequent designation BUCQUOY & *al.* (1884). Recent.

Rissoa valfini GUIRAND & OGÉRIEN, 1865
(Text-fig. 18)

1865. *Rissoa valfini* sp. nov.; GUIRAND & OGÉRIEN, p. 373, figs 2, 3.
1905. *Rissoina (?) valfinensis* GUIRAND & OGÉRIEN; SCHMIDT, p. 116, pl. 9, figs 20-22.
1971. *Rissoina obliquata* (SOWERBY, 1829); DMOCH, p. 20, pl. 1, figs 7-8.
2004. *Pusillina* sp.; KAIM, p. 95, fig. 74A.
2004. unidentified rissoid; KAIM, p. 94, fig. 74 B.

MATERIAL OF SCHMIDT (1905): Three specimens (BGR X 05189-91). The largest specimen (BGR X 05191) of SCHMIDT's (1905) material from his pl. 9, fig. 22. is here re-illustrated on Text-fig. 18A.

MATERIAL: About 250 specimens, mainly juveniles and broken shells (BGR, Buchholz, Beckert, GG, and ZPAL).

DIMENSIONS: One of the specimens (BGR X 05191) illustrated by SCHMIDT (1905, pl. 9, fig. 22; see also Text-fig. 18A herein), comprising seven whorls, is 7.5 mm high and 3.2 mm wide and the other one from pl. 9, fig. 20, with five whorls preserved, is 4.5 mm high and 2.4 mm wide. Both specimens lack the protoconch. The protoconch of BGR X 12923, with 2.5 whorls, is 0.29 mm high.

DESCRIPTION: The shell shape varies from elongate to conical. The 2.5 protoconch whorls are rounded and smooth. The teleoconch starts with 13-14 straight axial ribs per whorl that run from suture to suture with equal prominence. The number of ribs decreases during ontogeny to 10-12 per whorl and their interspaces widen. The ribs are opisthocline and opisthocyrt. The axial ribs are more prominent on the adapical part and disappear gradually abapicalwards. This asymmetry varies from distinct to almost unrecognisable. The axial ribs fade out when entering the convex base. Spiral striae are absent.

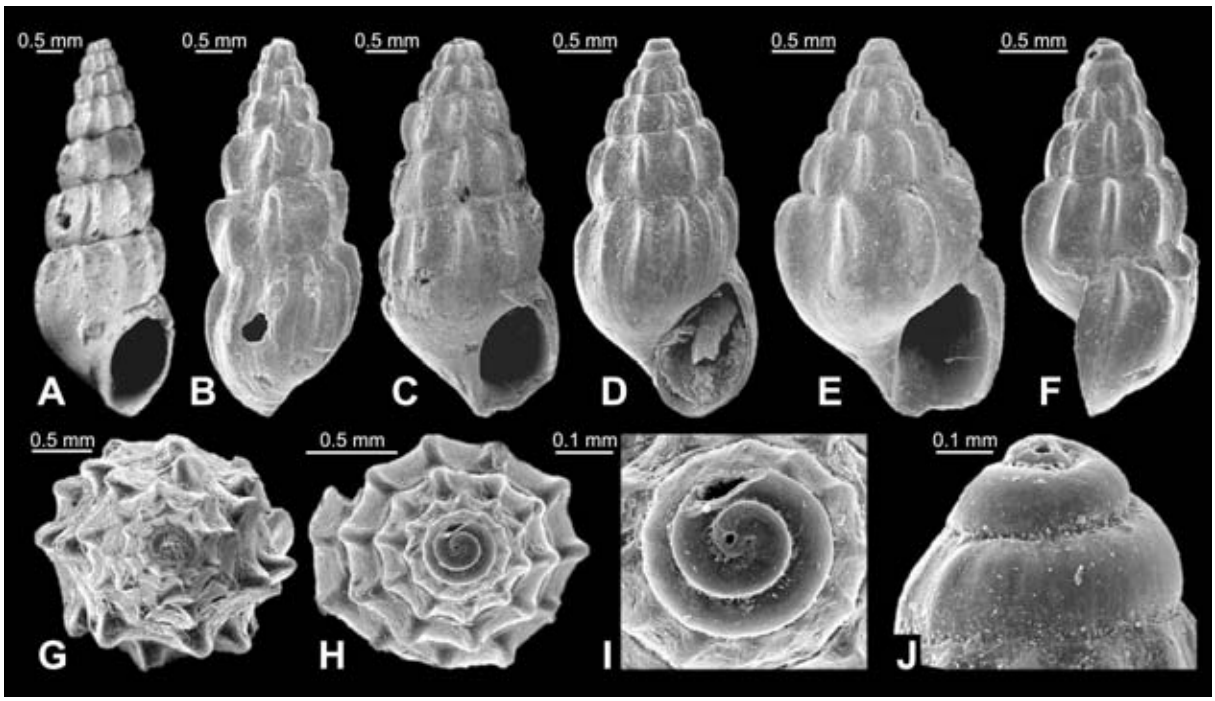

Fig. 18. The rissoid *Rissoa valfini* GUIRAND & OGÉRIEN, 1865 from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**. Specimen (BGR X 05191) from the collection of SCHMIDT (1905) in apertural view. **B**, **G**. Specimen BGR X 12921. B. Lateral view. G. Apical view. **C**. Specimen ZPAL Ga.9/175 (already illustrated by KAIM 2004 as unidentified rissoid) in apertural view. **D**. Specimen BGR X 12922 in apertural view. **E**. Specimen ZPAL Ga.9/174 (already illustrated by KAIM 2004 as *Pusillina* sp.) in apertural view. **F**, **H-J**. Specimen BGR X 12923. F. Lateral view. H. Apical view. I. Apex in apical view. J. Apex in lateral view

The growth lines are opisthocyrt in the adapical part (with the strongest curvature close to the suture). In the abapical section the lines are widely prosocyrt. The wide-oval aperture is somewhat pointed posteriorly. The terminal thickening of the outer lip is not visible on the specimens examined.

REMARKS: As already stated by KAIM (2004), this species is apparently the oldest known *Rissoa*-like species. The shells from Kłęby show a wide range of variability, from robust [like Recent *Pusillina*, e.g., *Pusillina benzi* (ARADAS & MAGGIORE, 1843)], to elongate [like some Recent *Rissoa*, e.g., *Rissoa guerini* (RÉCLUZ, 1843)]. Some specimens of *R. valfini* differ from the Recent species of *Rissoa* in possessing sturdy axial ribs that are pointed adapically; however, in some other specimens this character is absent. Moreover, the axial ribs are usually blunt in the Recent species and accompanied by spiral ornamentation (apart from some brackish morphotypes, see e.g., WARÉN 1996). *R. valfini* probably belongs to a new genus but at this stage we feel that more species and/or well preserved specimens are needed to delimit this putative new genus from Recent *Rissoa*. That is why we decided to leave the species in the genus *Rissoa,* as was originally done by GUIRAND & OGÉRIEN (1865). *Rissoa valfini* differs from species of *Palaeorissoina* GRÜNDEL, 1999 in its shorter protoconch (only 2.5 whorls compared to 3.5-4 in *Palaeorissoina*), in lacking spiral lirae and axial ribs on the last part of the protoconch, and in the absence of spiral lirae on the teleoconch.

Superfamily Zygopleuroidea WENZ, 1938
Family Zygopleuridae WENZ, 1938
Genus *Katosira* KOKEN, 1892

TYPE SPECIES: *Chemnitzia periniana* D'ORBIGNY, original designation. Pliensbachian (Early Jurassic), Châlon-sur-Saône, France.

Katosira anaroides (SCHMIDT, 1905)
(Text-fig. 19A-C)

1905. *Cerithium anaroïdes* n. sp.; SCHMIDT, p. 188, pl. 9, figs 28-29.
1980. *Cerithium anaroides* SCHMIDT, 1905; KARCZEWSKI, p. 431, pl. 133, figs 7-8.
1988. *Cerithium anaroides* SCHMIDT, 1905; KARCZEWSKI, p. 309, pl. 133, figs 7-8.

MATERIAL OF SCHMIDT (1905): Two specimens (BGR X 05195-6) illustrated by SCHMIDT on pl. 9, figs 28 and 29. We re-illustrated these specimens on Text-fig. 19A and B respectively. Specimen BGR X 05195 (Text-fig.19A herein) was designated by KARCZEWSKI (1980) as the lectotype.

OTHER MATERIAL: One specimen in Buchholz collection.

TYPE MATERIAL: The lectotype (BGR X 05195) designated by KARCZEWSKI (1980); Text-fig. 19A herein.

TYPE HORIZON: Shell-bearing ferruginous sands, Late Oxfordian.

TYPE LOCALITY: Kłęby, Pomerania, Poland.

DIMENSIONS: The specimen BGR X 05196, comprising 6.5 whorls (without the protoconch), is 9.5 mm high and 5 mm wide.

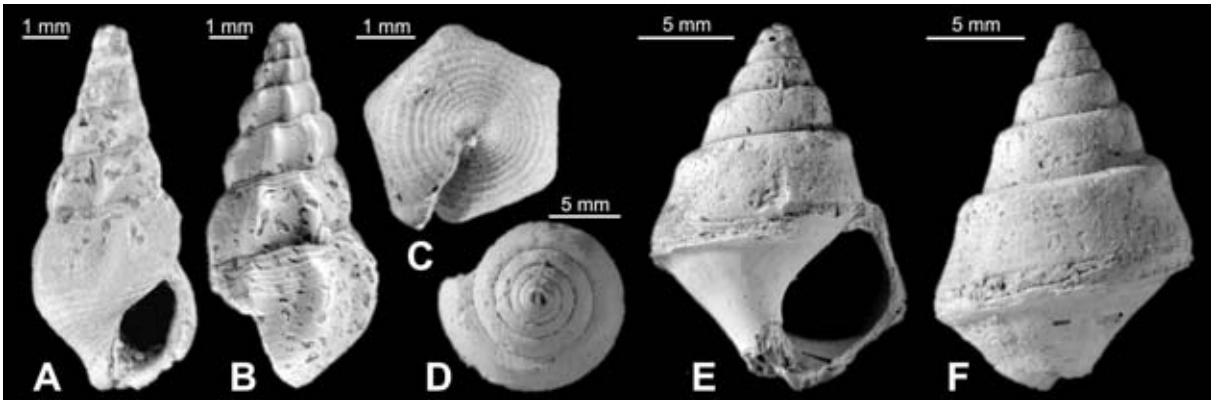

Fig. 19. Zygopleurid *Katosira anaroides* (SCHMIDT, 1905) and ampullospirid *Pseudamaura* sp. from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-C**. *Katosira anaroides* (SCHMIDT, 1905), originals from the collection of SCHMIDT (1905). A, C. Lectotype (BGR X 05195). B. Paralectotype (BGR X 05196). **D-F**. *Cloughtonia* sp. (ZPAL. Ga.12/15). D. Apical view. E. Apertural view. F. Lateral view

DESCRIPTION: The protoconch remains unknown. The teleoconch has convex whorls that increase rapidly in width. The suture is moderately incised and undulated. The teleoconch is ornamented by 6-8 strong axial ribs throughout ontogeny. The axial ribs are initially almost orthocline and later become opisthocline. The axial ribs of the last whorl are usually aligned with the ribs on the preceding whorl. The axial ribs are narrower than their interspaces and they end at the border with the base. The earliest teleoconch whorls lack any spiral ribs. The first spiral rib appears at the adapical-most part of the fourth whorl preserved. Later, the number of spiral ribs increases up to seven but their appearance is usually restricted to the adapical part of the lateral flank. The demarcation between the lateral flank and the base is continuous without angulation. The base is ornamented by 8-10 spiral ribs and their strength decreases slightly towards the centre. The aperture is lenticular and has a weak anterior channel.

REMARKS: *Katosira anaroides* differs from other species of *Katosira* in having a broadly conical (not slender) shell, and strong but only a few axial and spiral ribs, which are well developed only on the adapical part of the whorls and on the base.

Superfamily Campaniloidea DOUVILLÉ, 1904
Family Ampullospiridae COX, 1930
Genus *Pictavia* COSSMANN, 1925

TYPE SPECIES: *Natica pictaviensis* D'ORBIGNY, 1852, original designation. Bathonian (Middle Jurassic), Noyer, France.

Pictavia elegans (MORRIS & LYCETT, 1851)
(Text-fig. 20)

1851. *Phasianella elegans* sp. n.; MORRIS & LYCETT, p. 74, pl. 11, figs 27, 27a.
1909. *Pseudomelania* (*Oonia*) cf. *calypso* (D'ORBIGNY); COSSMANN, p. 86, pl. 2, figs 1, 2.

MATERIAL OF SCHMIDT (1905): Most probably lost.

OTHER MATERIAL: 35 specimens (BGR, Buchholz, and GG).

DIMENSIONS: A specimen BGR X 12924, comprising 8 whorls and without the protoconch, is 10.2 mm high and 6.5 mm wide. Another specimen (BGR X 12925),

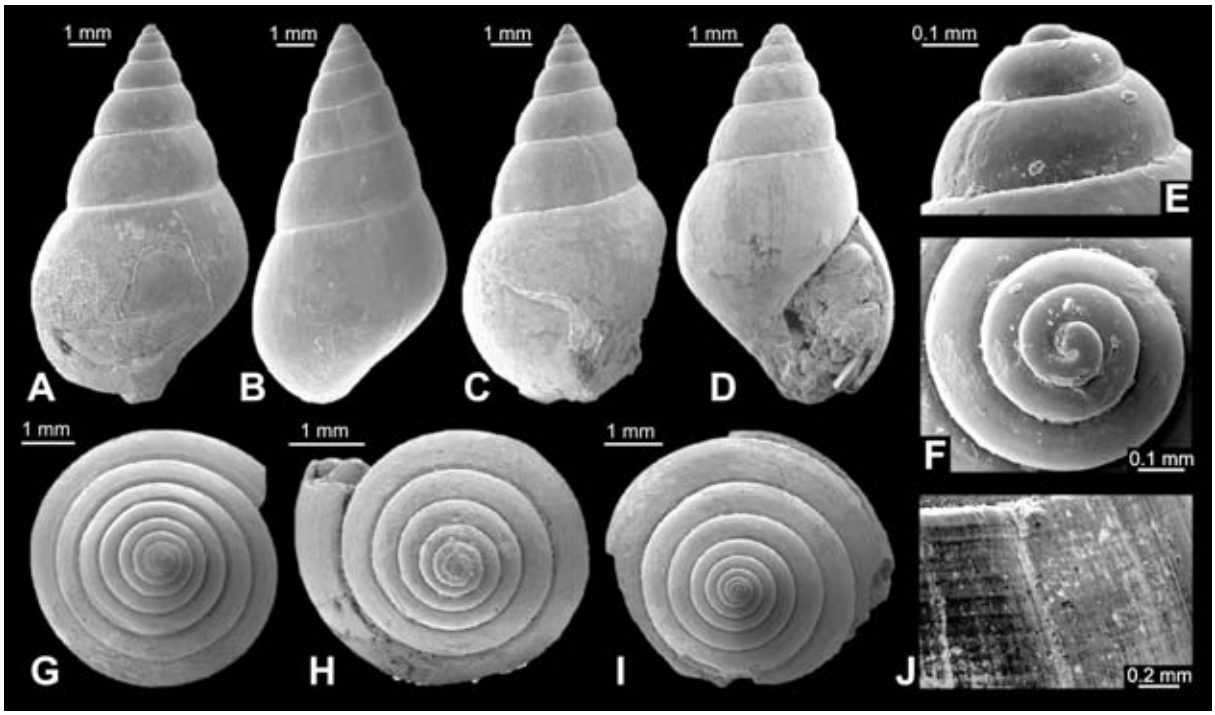

Fig. 20. The ampullospirid *Pictavia elegans* (MORRIS & LYCETT, 1851) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**. Specimen BGR X 12924 in lateral view. **B**, **G**, **J**. Specimen BGR X 12925. B. Lateral view. G. Apical view. J. Close-up of the teleoconch surface. **C**, **E-F**, **I**. Specimen BGR X 12926. C. Lateral view. E. Apex in lateral view. F. Apex in apical view. I. Apical view. **D**, **H**. Specimen BGR X 12927. D. Apertural view. H. Apical view

with the protoconch and comprising 9 whorls, is 10.5 mm high and 5.5 mm wide.

DESCRIPTION: The shell is broadly conical, or very occasionally, slender. The protoconch is 0.28 mm wide and consists of nearly two smooth and rounded whorls. The demarcation between the protoconch and teleoconch is expressed by an increase in density of the growth lines and in a thickened outer lip restricted to the adapical part of the whorl. The lateral flank is weakly convex and the suture is distinctly incised. A ramp is absent and the shell surface is smooth apart from very fine lirae that are visible only on the best-preserved specimens. The growth lines are prosocline and bent posteriorly. The base is convex. The aperture is drop-like shaped with the anterior part broadly rounded. The parietal and columellar parts of the inner lamella form a concave curve without any angulation.

REMARKS: The shells described but not illustrated by SCHMIDT (1905, p. 187) as juvenile individuals of *Pseudomelania collisa* most probably belong to *Pictavia elegans*. Unfortunately the specimens described by SCHMIDT are missing from the BGR collection and are apparently lost. Because the unique specimen of *Pseudomelania collisa* lacks juvenile whorls, it is impossible to compare these two species with any confidence. The species under consideration lacks a ramp and the protoconch has a thickened outer lip, features that are typical of *Pictavia* (cf. GRÜNDEL 2001).

Our specimens are most similar to *Phasianella elegans* by MORRIS & LYCETT (1851, pl. 11, fig. 27a) from the Bathonian of England. A specimen described by COSSMANN (1909) as *Pseudomelania* (*Oonia*) cf. *calypso* (D'ORBIGNY, 1850), from the Oxfordian of France, probably belongs to the same species. There are some other *Pictavia*-like species that could be synonymised with *P. elegans*; e.g., *Pseudomelania* (*Oonia*) *remtsaensis* COX, 1969 from the Early Callovian of Tunisia (COX 1969), *Coelostylina mandawaensis* COX, 1965 from the ?Bajocian of Eastern Africa (COX, 1965), and in part *Pictavia nikitensis* PČELINCEV, 1963 from the Oxfordian of the Crimean Peninsula (PČELINCEV, 1963, pl. 11, fig. 8 non 9). *Pictavia calypso* (D'ORBIGNY, 1850), as illustrated by D'ORBIGNY (1852) and subsequent authors, has a broader shell and shorter spire in relation to its last whorl.

Pictavia silicea (QUENSTEDT, 1858)
(Text-fig. 21)

1858. *Natica silicea* n. sp.; QUENSTEDT, p. 771, pl. 94, fig. 27.
1884. *Natica silicea* QUENSTEDT; QUENSTEDT, p. 231, pl. 193, figs 6, 7.
1909. *Amauropsis silicea* QUENSTEDT; BRÖSAMLEN, p. 271, pl. 20, fig. 38.
1919. *Ampullina lorierei* D'ORBIGNY; COUFFON, p. 289, pl. 9, figs 7, 7a, 7b non *Natica lorierei* D'ORBIGNY, 1852.
1997. *Ampullina silicea* (QUENSTEDT, 1858); HÄGELE, p. 111, a figure with no number on page 111.

MATERIAL: One complete and three damaged shells (BGR and Buchholz collections).

DIMENSIONS: The largest specimen (BGR X 12928), comprising 6.75 whorls, is 7.2 mm high and 5.3 mm wide.

DESCRIPTION: The shell is broadly oval. The whorl grows faster in width than in height. The last whorl is very broad and it makes the whole shell outline slightly concave. Although the preservation is satisfactory, the demarcation between the protoconch and the teleoconch is not visible. The whorls of the spire are convex

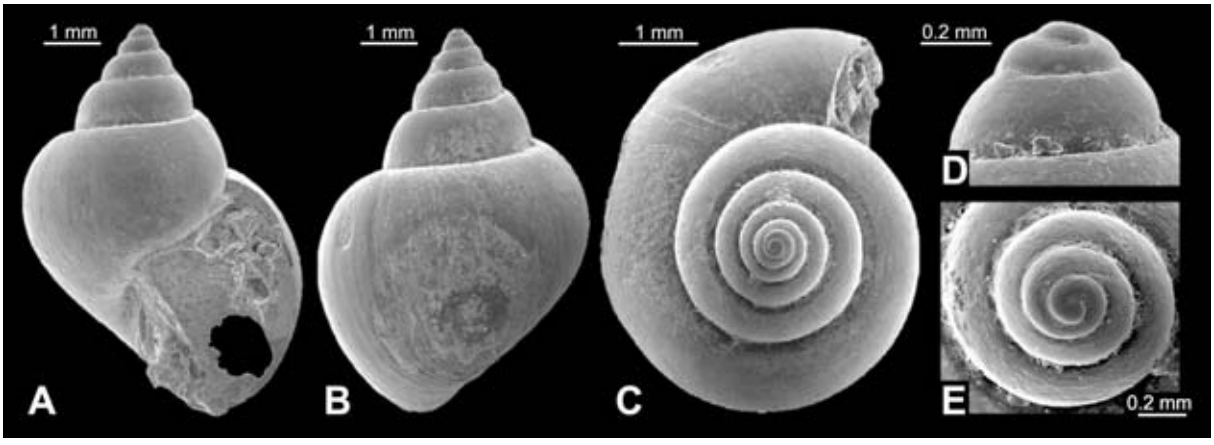

Fig. 21. The ampullospirid *Pictavia silicea* (QUENSTEDT, 1858) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-E**. Specimen BGR X 12928. A. Apertural view. B. Lateral view. C. Apical view. D. Apex in lateral view. E. Apex in apical view

and the last whorl is inflated. There is a narrow ramp in the adapicalmost part of the whorls, with some angulation in the early whorls and a gradual change into the lateral flank in the last whorl. The shell is smooth apart from almost orthocline growth lines. The base is strongly convex, with a very small umbilical chink. The aperture is broadly oval.

REMARKS: *Amauropsis* MÖRCH, 1857 has a Recent type species that differs from the species under consideration in having strongly prosocline growth lines, while *Ampullina* BOWDICH, 1822 has an Eocene type species that differs from *P. silicea* in having an extremely expanded last whorl with a very short, mammilated spire. *Oonia* has no ramp, the growth lines are distinctly parasigmoidal and the inner lip forms a nearly straight line. There are some other similar genera (and species) from the Cainozoic but we would rather classify our species in *Pictavia* (with a Jurassic type species) pending a revision of all Ampullospiridae.

Genus *Cloughtonia* HUDLESTON, 1882

TYPE SPECIES: *Phasianella cincta* PHILLIPS, 1829, original designation. Bathonian (Middle Jurassic), Scarborough, England.

MATERIAL: One incomplete specimen (ZPAL Ga.12/15).

DIMENSIONS: The specimen (ZPAL Ga.12/15), with some five whorls preserved, is 17.5 mm high and 12.5 mm wide.

DESCRIPTION: The protoconch not preserved. The shell is broadly oval. The early teleoconch whorls are straight in the abapical part of the flank and weakly rounded toward the adapical suture. The shell is smooth but this could result from poor preservation. On the last teleoconch whorl, just below the suture, a sturdy embankment-like structure is present. This structure begins to develop on the preceding whorl and it strengthens during ontogeny. Simultaneously a strong ramp develops above this embankment. A similar structure is present close to the demarcation between the flank and the base but it is much weaker than that on the adapical part of the whorl. The flank between both embankments is concave. The base is weakly convex but further details are not observable. The aperture is ovate; the inner and outer lips are broken.

REMARKS: Because of imperfect preservation of the only available shell we decided to leave this species in open nomenclature.

Cloughtonia sp.
(Text-fig. 19D-F)

Subclass Heterobranchia GRAY, 1840
Order Heterostropha FISCHER, 1885

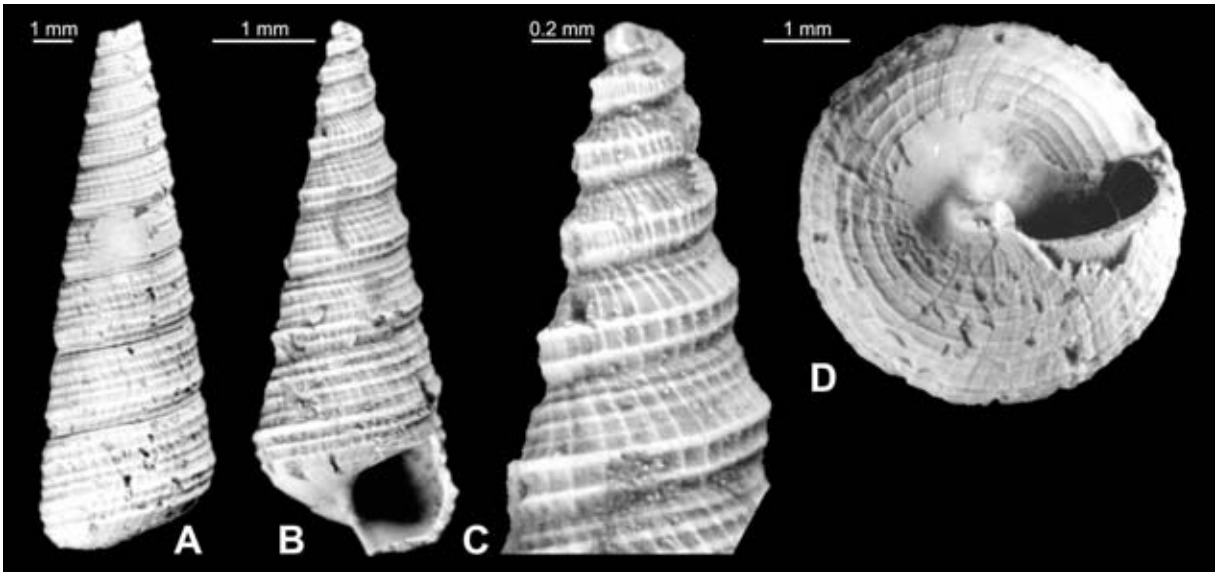

Fig. 22. The gordenellid *Gordenella pommerana* (SCHMIDT, 1905) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. Specimens from the type collection of SCHMIDT (1905). **A**, **D**. Lectotype (BGR X 05193). A. Lateral view. D. Umbilical view. **B-C**. Paralectotype (BGR X 05194). B. Apertural view. C. Apex in lateral view. Both specimens already illustrated by GRÜNDEL (2000b)

Superfamily Mathildoidea DALL, 1865
Family Gordenellidae GRÜNDEL, 2000
Genus *Gordenella* GRÜNDEL, 1990

TYPE SPECIES: *Cerithium* (?) *pommeranum* SCHMIDT, 1905, original designation. Oxfordian (Late Jurassic), Kłęby, Poland.

Gordenella pommerana (SCHMIDT, 1905)
(Text-fig. 22)

1905. *Cerithium*(?) *pommeranum* n. sp.; SCHMIDT, p. 190, pl. 9, figs 26-27.
?1911. *Turritella complanata* BRÖSAMLEN; BODEN, p. 52, pl. 5, fig. 10.
1988. ?*Cerithium pommeranum* SCHMIDT, 1905; KARCZEWSKI, p. 310, pl. 83, figs 12-13.
2000. *Gordenella pommerana* (SCHMIDT 1905); GRÜNDEL, p. 257, pl. 1, figs 8-11.

REMARKS: This species has recently been revised by GRÜNDEL (2000b) and the reader is referred to this paper for an emended species diagnosis and a detailed description of SCHMIDT's type material.

Superfamily Pyramidelloidea GRAY, 1840
Family uncertain
Genus *Conusella* GRÜNDEL, 1999

TYPE SPECIES: *Conusella conica* GRÜNDEL, 1999, orig-

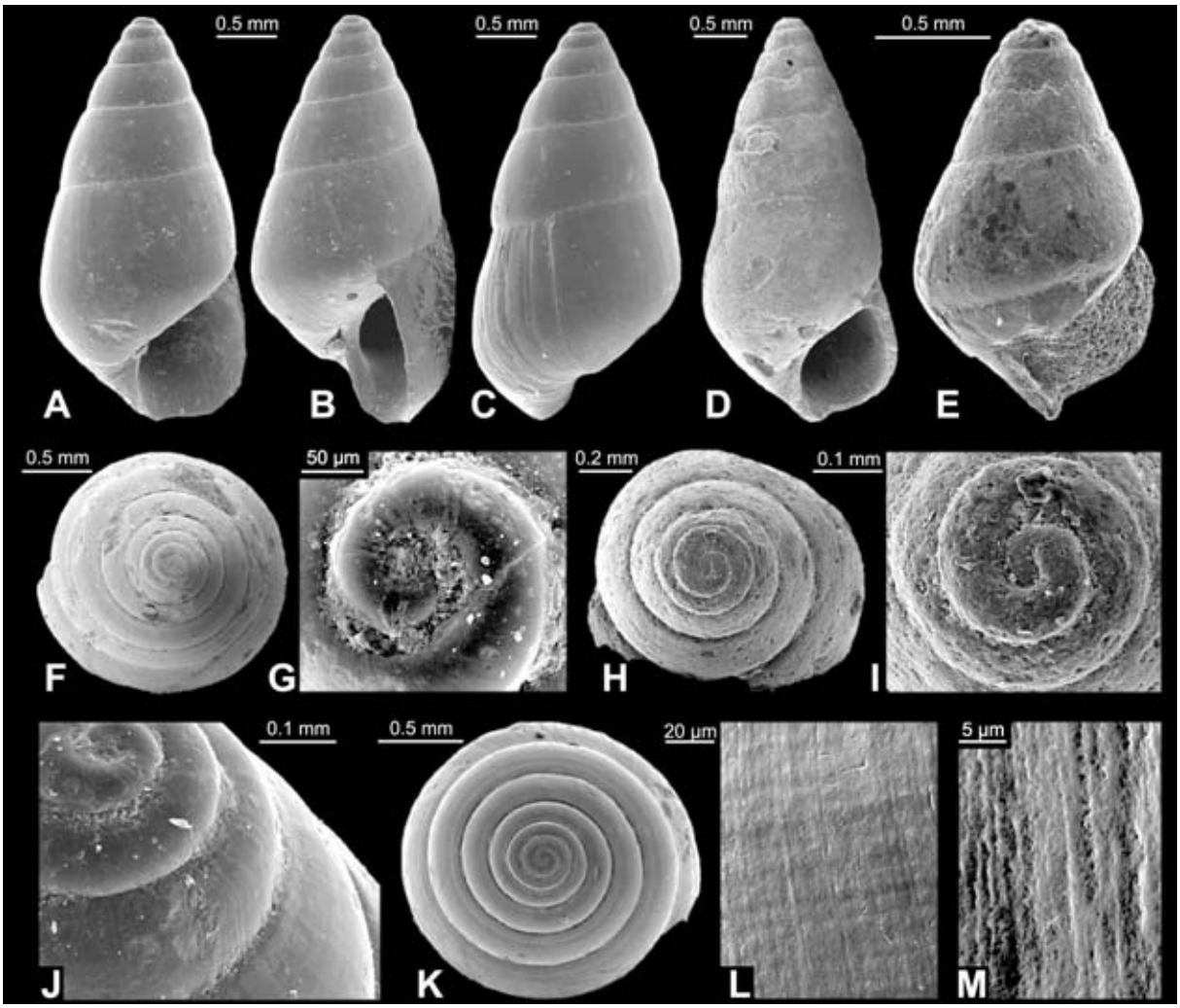

Fig. 23. The pyramidelloid *Conusella* sp. from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A-C**, **G**, **J-M**. Specimen from Buchholz collection. A. Apertural view. B-C. Lateral views. G. Close-up of the initial whorl. J. Apex in oblique view. K. Apical view. L. Close-up of early eleoconch surface. M. Close-up of the late teleoconch surface. **D**, **F**. Specimen ZPAL Ga.9/177 (already illustrated by KAIM 2004 as *Zebina* sp.). D. Apertural view. F. Apical view. **E**, **H-I**. Specimen BGR X 12929. E. Apertural view. H. Apical view. I. Apex in apical view

inal designation. Pliensbachian (Early Jurassic), Grimmen, Germany.

Conusella sp.
(Text-fig. 23)

2004. *Zebina* sp.; KAIM: p. 93, fig. 73.

MATERIAL: Three specimens (BGR, Buchholz, and ZPAL)

DIMENSIONS: The shell illustrated comprises seven whorls; it is 3.5 mm high and 1.8 mm wide (collection Buchholz).

DESCRIPTION: The protoconch consists of three whorls, with a heterostrophic first whorl that makes the apex of the shell flat-topped. The demarcation between the protoconch and the teleoconch is expressed only by a change in direction of the growth lines. The opisthocyrt growth lines on the protoconch change to orthocline ones on the teleoconch. The shell is elongated, with weakly convex whorls. The shell is almost smooth apart from very fine spiral undulations on the shell surface and orthocline (on the flanks) to prosocyrt (on the base) growth lines. The border between the lateral flank and the base is weakly angulated on juveniles and rounded on the adults. The growth lines become denser on the on the terminal whorl. The aperture is drop-shaped and the inner lip is thin. An umbilicus is absent.

REMARKS: This species was described as *Zebina* sp. (Rissoidae) by KAIM (2004), who assumed the presence of an orthostrophic protoconch, based on a poorly preserved specimen (Text-fig. 23D, F herein). The new specimens clearly have a heterostrophic protoconch (Fig. 23G-J), which is typical of *Conusella*. The species under consideration is quite similar to *Conusella conica* GRÜNDEL, 1999 from the Pliensbachian of Germany. The latter differs only in having a slightly more slender shell, the protoconch whorls broadening more rapidly, and in opisthocyrt growth lines on the teleoconch flanks. *Conusella*? sp. *sensu* GRÜNDEL (2003), from the Callovian of north-eastern Germany has strongly convex whorls and a deep suture. The lack of fully grown specimens discouraged us from establishing a new species of this rather featureless genus.

Superfamily Acteonelloidea GILL, 1871
Family Cylindrobullinidae WENZ, 1947
Subfamily Tubiferinae COSSMANN, 1895
Genus *Ceritellopsis* FISCHER, 1961

TYPE SPECIES: *Cerithium petri* D'ARCHIAC, 1843, original designation. Bathonian (Middle Jurassic), Eparcy, France.

Ceritellopsis huckriedei sp. nov.
(Text-fig. 24)

1905. *Cerithiella Greppini* LORIOL; SCHMIDT, p. 122, pl. 10, figs 1-3.
1967. *Ceritella* (*Ceritellopsis*) *greppini* LORIOL; HUCKRIEDE, p. 198, pl. 18, figs 51-55, pl. 19, figs 1-3.
1971. *Ceritella greppini* LORIOL, 1889; DMOCH, p. 17, pl. 1, fig. 4; pl. 2, fig. 2.

MATERIAL OF SCHMIDT (1905): Two specimens (BGR X 05197-8) illustrated by SCHMIDT (1905) on pl. 10, figs 1-2.

OTHER MATERIAL: A single teleoconch fragment ZPAL Ga. 12/16.

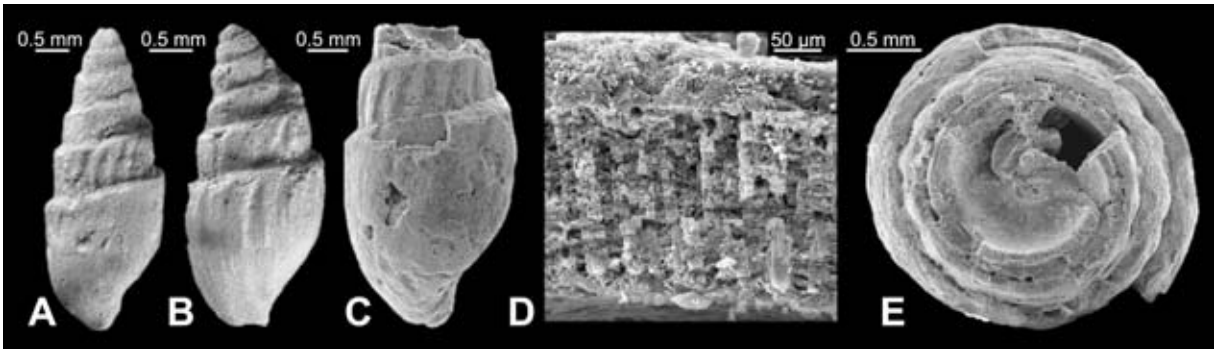

Fig. 24. The cylindrobullinid *Ceritellopsis huckriedei* sp. nov. from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**. Holotype (BGR X 05197) selected from the collection of SCHMIDT (1905) in lateral view. **B**. Specimen (BGR X 05198) from the collection of SCHMIDT (1905) in lateral view. **C-E**. Specimen ZPAL Ga.12/16. C. Lateral view. D. Cross-lamellar microstructure visible at the broken off apical part of the shell. E. Apical view

TYPE MATERIAL: Holotype BGR X 05197 and two paratypes BGR X 05198 and ZPAL Ga.12/16.

TYPE HORIZON: Shell-bearing ferruginous sands, Late Oxfordian.

TYPE LOCALITY: Kłęby, Pomerania, Poland.

DERIVATION OF NAME: In honour of R. HUCKRIEDE for his work on Jurassic molluscs.

DIMENSIONS: The holotype (BGR X 05197) from pl. 10, fig. 1 of SCHMIDT (1905), with about seven teleoconch whorls preserved, is 4.5 mm high and 1.8 mm wide.

DIAGNOSIS: Slender, gradate shell with distinct ramp. The axial ribs bend backwards and disappear later in ontogeny.

DESCRIPTION: The shell is gradate, with a high spire. The ramp is distinct and almost perpendicular to the shell axis. The lateral flanks are straight. Sturdy axial ribs are developed between the ramp and the abapicalmost part of the whorl (16 ribs on the last whorl of the specimen BGR X 5198). The axial ribs are opisthocline and bent backward. They are strongest close to the ramp and their strength decreases abaxially. The axial ribs disappear on the last whorl preserved of the largest specimen. The strongly convex base is smooth apart from enhanced growth lines. The aperture is incomplete but apparently ovate.

REMARKS: The most similar species is *C. greppini* (LORIOL, 1889), which differs from the new species in having a less distinctive ramp, a larger number of axial ribs per whorl, which are not bent backwards, and higher whorls of the spire. The specimens described by

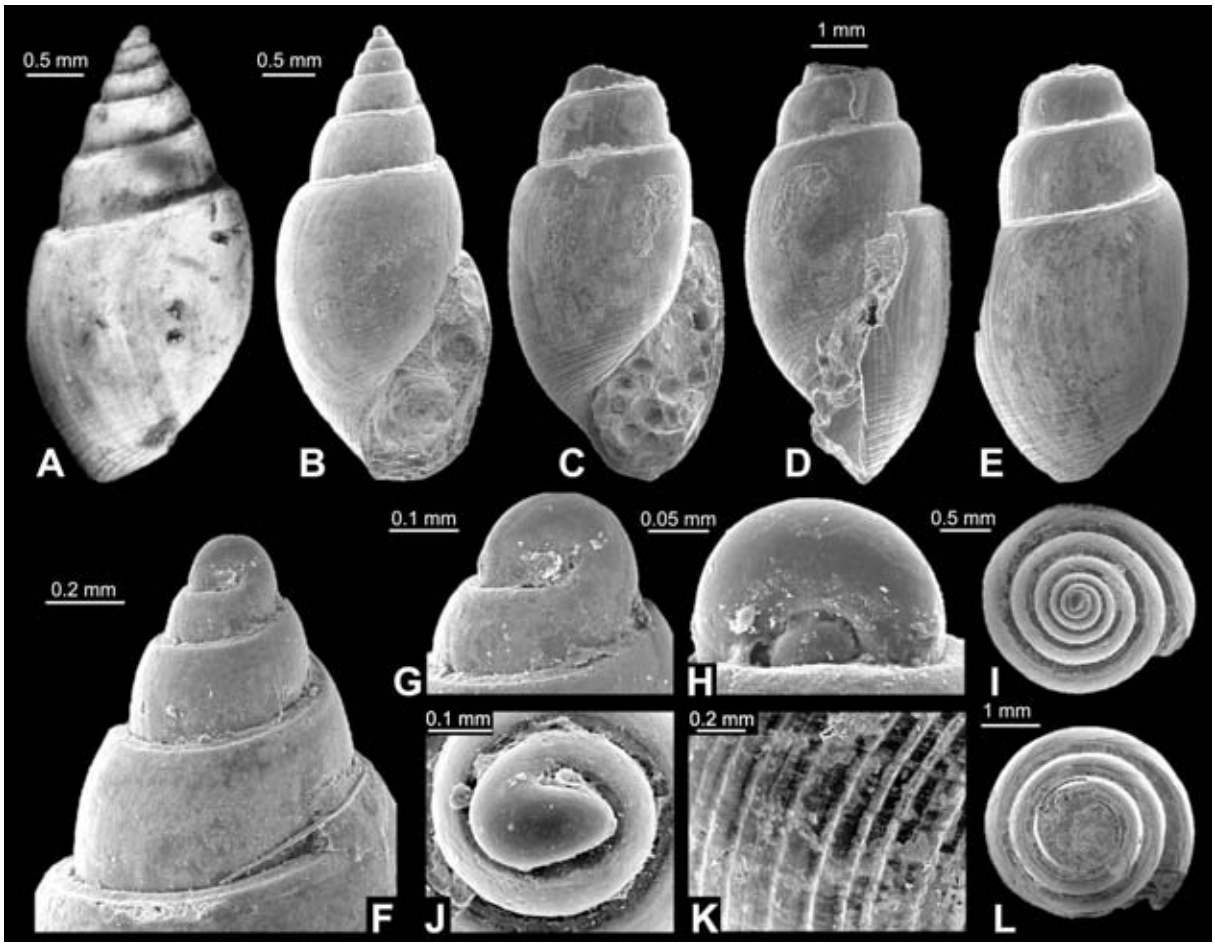

Fig. 25. The cylindrobullinid *Cylindrobullina stueri* (COSSMANN, 1895) from the Late Oxfordian of Kłęby, Western Pomerania, Poland. **A**. Specimen (BGR X 05199) from the collection of SCHMIDT (1905) in lateral view. **B**, **F-J**. Specimen BGR X 12930. B. Apertural view. F. Apex in lateral view. G. Protoconch in umbilical view. H. Protoconch in apical view. I. Apical view. J. Apex in apical view. **C-E**, **K-L**. Specimen BGR X 12931. C. Apertural view. D-E. Lateral view. K. Close-up of the ornamentation at the shell base. L. Apical view

HUCKRIEDE (1967) as *Ceritella* (*Ceritellopsis*) *greppini* are most probably conspecific with our new species.

Subfamily Cylindrobullininae WENZ, 1947
Genus *Cylindrobullina* AMMON, 1878

TYPE SPECIES: *Tornatella fragilis* DUNKER, 1847, subsequent designation by COSSMANN (1895). Liassic (Early Jurassic), vicinity of Halberstadt, Germany.

Cylindrobullina stueri (COSSMANN, 1895)
(Text-fig. 25)

1895. *Ovactaeonina Stueri* sp. nov.; COSSMANN, p. 38, pl. 2, figs 9-11; pl. 3, figs 26-27.
1905. *Ovactaeonina Stueri* COSSMANN var.; SCHMIDT, p. 194, pl. 10, figs 4-5.

MATERIAL OF SCHMIDT (1905): Two specimens (BGR X 05199 and 05207) illustrated by SCHMIDT (1905) on pl. 10, figs 4-5. We re-illustrated (Text-fig. 25A) specimen BGR X 05199 from SCHMIDT's (1905) monograph pl. 10, fig. 4.

OTHER MATERIAL: 24 specimens (BGR and Buchholz).

DIMENSIONS: A specimen BGR X 05199, lacking the protoconch and with about 5 teleoconch whorls, is 4 mm high and 2 mm wide. The protoconch of BGR X 12930 is 0.21 mm in diameter

DESCRIPTION: The protoconch is transaxial, and up to half of it is embedded into the succeeding teleoconch whorl. The shell is high trochospiral. The flanks of the teleoconch whorls are weakly convex. The ramp is narrow but distinct. Just below the ramp a spiral furrow is developed. The adapical one-third of the whorl is smooth and the rest is ornamented by numerous spiral grooves which become stronger towards the base. The furrows vary in strength and the stronger furrows are intercalated with weaker furrows. The former are more common than the latter. The growth lines are prosocyrt and their adapical portion is bent strongly backward. The aperture is horn-like and is elongated posteriorly and widened anteriorly.

REMARKS: The type material (COSSMANN 1895) from Trouville differs slightly in the pattern of ornamentation but most probably the differences (less numerous spiral grooves and the absence of a spiral groove near the ramp) were caused by the imperfect preservation of COSMMANN's (1895) material. In his remarks, COSSMANN (1895, p. 39) mentioned another specimen from Cordebugle at his disposal that perfectly fits the description of our specimens.

Family Bullinidae RUDMAN, 1972
Genus *Sulcoactaeon* COSSMANN, 1895

TYPE SPECIES: *Actaeonina striato-sulcata* ZITTEL & GOUBERT, 1850, original designation. ?Oxfordian (Late Jurassic), Glos, France.

Sulcoactaeon viadrinus SCHMIDT, 1905
(Text-fig. 14C-D)

1905. *Sulcoactaeon viadrinus* n. sp.; SCHMIDT, p. 195, pl. 10, fig. 6a-b
1980. *Sulcoactaeon viadrinus* SCHMIDT, 1905; KARCZEWSKI, p. 434, pl. 133, fig. 4.
1988. *Sulcoactaeon viadrinus* SCHMIDT, 1905; KARCZEWSKI, p. 311, pl. 133, fig. 4.

MATERIAL : Holotype (BGR X 5200) of SCHMIDT (1905) only.

DIMENSIONS: The holotype (BGR X 5200), with about five teleoconch whorls preserved, is 7 mm high and 4.5 mm wide.

DESCRIPTION: The protoconch is heterostrophic but not well preserved. The shell is spindle-like. The whorls of the spire are moderately convex. The convexity is larger in the adapical than in the abapical part of the whorls. A narrow ramp is present on the adapical part of the whorl. The two earliest teleoconch whorls are smooth and, later, a groove appears close to the ramp. The last whorl is broadly convex and ornamented by the aforementioned groove at the ramp and another groove located at the border with the base, which is otherwise not clearly demarcated from the lateral flanks. The lower part of the base is ornamented by three spiral grooves with wide interspaces, and about nine spiral grooves below. These grooves are densely spaced around the centre of the base. The growth lines are weakly prosocyrt. The aperture is drop-like, with the inner lip expanded at the junction of the columellar and parietal regions. A distinct umbilical chink is developed.

REMARKS: The most similar species is *Sulcoactaeon erratica erratica* GRÜNDEL, 1997 from Callovian erratic boulders and boreholes of northern Germany and Poland (GRÜNDEL 1997). The aforementioned species differs

from *S. viadrinus* in having more numerous spiral grooves in the lower part of the whorls and stronger prosocyrtic growth lines. It is possible that *S. erratica erratica* is a morphotype of *S. viadrinus* but without more material of *S. viadrinus* the range of its intraspecific variability is difficult to determine.

Incertae sedis
(Text-fig. 10E-G)

MATERIAL: One incomplete specimen (ZPAL Ga.12/11).

DIMENSIONS: The incomplete specimen (ZPAL Ga.12/11), with four whorls preserved, is 1.8 mm high and 1.1 mm wide.

DESCRIPTION: The shell is elongated and ornamented by two strong spiral ribs, one on the adapical and the other on the abapical part of the flank. The surface between the ribs is weakly concave. The suture is moderately incised and the surfaces between both spiral ribs and suture are also weakly concave. The ornament consists additionally of numerous opisthocyrt growth lines with the most backward point located at the upper spiral rib. There are also several spiral rows of pits, of which the three most prominent are the three adapicalmost rows.

REMARKS: The shape of the shell resembles mathildids but they never have rows of pits on the surface of the shell. This character is known from *Dzikella chuzikensis* KAIM, BEISEL, & KURUSHIN, 2004 from the Late Cretaceous of Siberia, which is a caenogastropod of uncertain affinities (KAIM & *al.* 2004). The pits are most probably remnants of the hairy periostracum covering the shell surface as in the cocculinid *Coccopigya* (HASEGAWA 1997).

RESULTS AND DISCUSSION

The examination of the protoconchs brought rather modest results as most of the specimens have poorly preserved apexes. Only in a few cases are the protoconchs well enough preserved to determine if the gastropod is orthostrophic or heterostrophic. All non-vetigastropod protoconchs in Kłęby are indicative of planktotrophic development. This supports an earlier observation by KAIM (2001, 2004) that planktotrophy was the prevailing mode of development for gastropods at least up to the Late Cretaceous.

The gastropods from Kłęby are dominated by small-sized species. Only two large gastropod species are described from this locality. Both *Pseudomelania collisa* and *Cloughtonia* sp. are rarities there and each is represented by a single specimen. This predominance of small species clearly differs from the composition of the contemporaneous faunas living on the Late Jurassic carbonate platforms of neighbouring regions. These settings are heavily dominated by large-sized species, such as nerineids, ampullospirids, and pleurotomariids (e.g., KARCZEWSKI 1960, DMOCH 1970, WIECZOREK 1979, and KAIM unpublished data). The most common species at Kłęby are the presumably herbivorous cerithioids *Shurovites dmochae*, *Exelissa distans* and *Rhynchocerithium limaeforme*, the rissooid *Rissoa valfini*, and the ataphrid *Falsataphrus kjasmiensis*. The eucyclinid *Eucycloscala*? cf. *augur* is the most common vetigastropod. Carnivores like zygopleurids (and other ptenoglossans), mathildids, and other heterobranchian gastropods are rather uncommon. This may suggest ubiquity of plant nourishment, most probably seaweed, and a relative scarcity of coelenterate and polychaete animals that could serve as prey for carnivorous gastropods. This pattern clearly differs from that observed in the Middle Jurassic relatively deep-water clays of Gnaszyn (central Poland), where the carnivorous gastropods predominate (GEDL & *al*. 2003). The composition of the gastropod assemblages in the Valanginian black clays of Wąwał, central Poland (KAIM 2001) is similar to that at Gnaszyn although more heavily influenced by the deep-water cerithioid *Cryptaulax* (*Procerithium* in the paper by KAIM 2001). Most probably, however, these gastropods had a different habitat from that of the cerithioids from Kłęby and one rather similar to that of the Recent deep-water *Argyropeza* and *Varicopeza*. Those deep-water Recent cerithioids are most probably microphagous detritivores (HOUBRICK 1980a, b). The cerithioids from Kłęby (two of them referred to the new subfamily Exelissinae by GUZHOV 2004) are most probably shallower water members of the Cryptaulacidae. *Rissoa valfini* represents shallow-water rissooids that are more similar to Recent *Rissoa* than to the Mesozoic rissooids from deeper water settings, which were referred to the Palaeorissoinidae by GRÜNDEL & KOWALKE (2002). The Ataphridae are also typically shallow-water vetigastropods with global distribution during Mesozoic times (e.g., GABB 1869, GRÜNDEL 1993, SZABÓ & *al.* 1993, KAIM 2004). The relatively abundant appearance of the undoubted neritids *Neridomus mais* and *Lissochilus pellatus* is worthy of note. As those gastropods are otherwise poorly represented in soft-bottom outer shelf facies in the Jurassic and Early Cretaceous (but see GRÜNDEL 2001) it seems that already in the Jurassic the neritids were typically

shallow-water gastropods. The assemblage from Kłęby resembles assemblages from the Jurassic of France described mainly in the 19th Century (BUVIGNIER 1843, ZITTEL & GOUBERT 1861, GUIRAND & OGÉRIEN 1865, LORIOL & PELLAT 1874, and CHAVAN 1954) more than any other gastropod assemblage in Central Europe. A similar assemblage from of the Oxfordian of Shchurovo in Russia has been recently described by GUZHOV (2004). It differs, however, from the assemblage from Kłęby in the large contribution of aporrhaids, which are absent from Kłęby, and the lack of rissoids, which are abundant there.

Acknowledgements

We are deeply indebted to the following persons who provided material for this study: A. BUCHHOLZ (Stralsund), W. BECKERT (Hohendorf bei Wolgast), J. DZIK, and M. GRUSZCZYŃSKI (both Warsaw). The research of A. KAIM was supported by Instytut Paleobiologii PAN and by a Japan Society for the Promotion of Science (JSPS) Postdoctoral Fellowship for Foreign Researchers, and JSPS research grant number 17.05324 (project number 050500000614). Some of the optical photographs were taken G. DZIEWIŃSKA, M. DZIEWIŃSKI, and J. STOLARSKI (all Warsaw), who are kindly acknowledged. The paper greatly benefitted from peer revievs by M.A. CONTI (Rome) and S. KIEL (Leeds), and for linguistic correcttions by Chris J. WOOD (Minehead).

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Manuscript submitted: 10th December 2005
Revised version accepted: 30th April 2006

APPENDIX

The specimens of SCHMIDT (1905) deposited in the collection of the Bundesanstalt für Geowissenschaften und Rohstoffe, Dienstbereich Berlin (BGR). Specimens shown in bold are illustrated in this paper. The stratigraphical terms are from the *Fossil Verzeichnis* of SCHMIDT (1905) and are not updated here.

plate	Figure	species	stratigraphy	location	catalogue-no.
plate 1	4a-b	*Hemicidaris intermedia* (FLEMING)	uKimm.1a	Bartin	X 05084
	5a-c	*Pseudodiadema mamillanum* (ROEMER)	mKimm.1	Zarnglaff	X 05085
	6	*Pseudodiadema (Diplopodia) subangulare* GOLDFUSS	„	„	X 05086
	7	*Pygurus jurensis* MARCOU	uKimm.1	Bartin	X 05087
	8	„	„	„	X 05088
	9	*Rhynchonella triunca* QUENSTEDT	lPortl.3	Schwanteshagen	X 05089
	10	„	„	„	X 05090
	12a-b	„	uKimm.2	Bartin	X 05091
	13a-d	„	„	„	X 05092
	14a-d	*Rhynchonella cf. trilobata* (ZIETEN)	„	„	X 05093
	15a-c	*Rhynchonella pinguis* ROEMER	lKimm.1	Klemmen	X 05094
	16a-c	„	„	„	X 05095
	17	„	„	„	X 05096
	18a-c	„	mKimm.1	Zarnglaff	X 05097
	19	„	„	„	X 05098
	20	„	„	„	X 05099
plate 2	2	*Terebratula* cf. *bauhini* ETALLON	lKimm.2b	Fritzow	X 05100
	3	„	„	„	X 05101
	4	„	„	„	X 05102
	9a-c	*Terebratula subsella* LEYMERIE	mKimm.	Zarnglaff	X 05103
	10a-c	„	„	„	X 05104
	11a-b	*Terebratula* cf. *zieteni* LORIOL	lKimm.1	Klemmen	X 05105
	12a-b	“	“	“	X 50106
plate 3	1a-c	“	“	“	X 50107
	2a-c	“	“	“	X 50108
	3	*Terebratula* sp. cf. *subsella* LEYMERIE	“	“	X 50109
	4a-c	*Terebratula* cf. *suprajurensis* ETALLON	lKimm.2b	Fritzov	X 05110
	6a-c	“	“	“	X 05111
	12a-c	*Terebratula* cf. *subsella* LEYMERIE	mKimm.2	Zarnglaff	X 05112
	13a-c	*Terebratula* cf. *cincta* COTTEAU	mKimm.1	“	X 05113
plate 4	1a-d	“	“	“	X 05114
	2a-d	*Terebratula undosa* n. sp.	“	“	X 05115
	3a-d	“	“!	“	X 05116
	5a-c	*Terebratula* n. sp.	lKimm.1	Klemmen	X 05117
	6a-d	“	“	“	X 05118
	8a-b	*Zeilleria humeralis* (ROEMER)	“	“	X 05119
	9a-c	“	“	“	X 05120
	10	“	“	“	X 05121
	11a-c	“	“	“	X 05122
	13	“	“	“	X 05123
	16a-c	*Zeilleria avellana* n. sp.	uKimm.2	Bartin	X 05124
	17a-c	“	“	“	X 05125
	18a-c	“	“	“	X 05126
	19a-b	“	“	“	X 05127
	20	*Zeilleria* cf. *humeralis* (ROEMER)	“	“	X 05128
	22a-d	*Aulacothyris*? sp.	lKimm.1	Klemmen	X 05129
plate 5	7	*Ostrea deltoidea* SOWERBY	uOxf.3	“	X 05130

	8, 9	“	“	“	X 05131
	10	“	“	“	X 05132
	11a-b	“	“	“	X 05133
	12a-b	“	“	“	X 05134
plate 6	1	“	“	“	X 05135
	2a-b	*Exogyra gumprechti* n. sp.	lKimm.2b	Fritzow	X 05136
	3a-b	“	“	“	X 05137
	6	*Hypotrema* cf. *rupellense* D'ORBIGNY	“	“	X 05138
	8a-b	*Myoconcha? baltica* WESSEL	“	Tribsow	X 05139
	9a-b	*Nucula oxfordiana* ROEDER	uOxf.1a	Klemmen	X 05140
	10a-b	“	“	“	X 05141
	11	*Macrodon bipartitus* (ROEMER)	“	“	X 05142
	12	“	“	“	X 05143
	13	“	“	“	X 05144
	14a-b	“	“	“	X 05145
	15a-b	“	“	“	X 05146
	16a-c	*Arca (Barbatia) clytia* LORIOL	“	“	X 05147
	17a-b	“	“	“	X 05148
	19a-b	*Cucullea concinnoidea* LORIOL	“	“	X 05149
plate 7	1, 2	*Trigonia bronni* AGASSIZ	“	“	X 05150
	3a-b	“	“	“	X 05151
	4a-b	“	“	“	X 05152
	5a-b	“	“	“	X 05153
	6a-b	“	“	“	X 05154
plate 8	1	*Trigonia hauchecornei* n. sp.	lPortl.4	Schwanteshagen	X 05155A
	2, 3, 4	*Astarte crassitesta* ROEMER	uOxf.1a	Klemmen	X 05156
	5, 6	“	“	“	X 05157
	7a-b	*Opis gaulardea* BUVIGNIER	“	“	X 05158
	8a-b	*Opis phillipsi* D'ORBIGNY	“	“	X 05159
	9	“	“	“	X 05160
	10a-d	*Opis* cf. *semilunata* ETALLON	“	“	X 05161
	11	“	“	“	X 05162
	12	*Opis suprajurensis* CONTEJEAN	uKimm.2	Bartin	X 05163
	13a-b	*Lucina* cf. *plebeja* CONTEJEAN	uOxf.1a	Klemmen	X 05164
	14a-b	“	“	“	X 05165
	15a-b	“	“	“	X 05166
	16a-b	“	“	“	X 05167
	17a-b	*Lucina aliena* (PHILLIPS)	“	“	X 05168
	18	*Lucina* cf. *plebeja* CONTEJEAN	“	“	X 05167
	19	*Corbicella tancredia* n. sp.	uKimm.1	Bartin	X 05169
	20a-b	*Venerupis*? *camminensis* n. sp.	lKimm.2b	Fritzow	X 05170
plate 9	1a-b	*Isodonta kimmeridiensis* DOLLFUS	uOxf.1a	Klemmen	X 05171
	2a-b	“	“	“	X 05172
	3a-b	*Corbula* cf. *glosensis* ZITTEL	“	“	X 05173
	4a-d	***Turbo? corallensis* BUVIGNIER**	**“**	**“**	**X 05174**
	5a-b	***Trochus coelotropis* n. sp., lectotype**	**“**	**“**	**X 05175**
	5c	**“, paralectotype**	**“**	**“**	**X 05176**
	6	*Trochus viadrinus* n. sp., lectotype	“	“	X 05177
	7	**“, paralectotype**	**“**	**“**	**X 05178**
	8a-b	***Nerita pellati* LORIOL**	**“**	**“**	**X 05179**
	9	**“**	**“**	**“**	**X 05180**
	10a-b	***Nerita mais* BUVIGNIER**	**“**	**“**	**X 05181**
	13	*Brachytrema lorioli* n. sp., paralectotype	“	“	X 05182

	14	**“ , paralectotype**	**“**	**“**	**X 05183**
	15	**“ , lectotype**	**“**	**“**	**X 05184**
	16	***Lacuna? laeviuscula* n. sp., lectotype**	**“**	**“**	**X 05185**
	17	“ , paralectotype	“	“	X 05186
	18	*Lacuna? laevuscula* n. sp. var. *angulosa* n. var.	“	“	X 05187
	19	“	“	“	X 05188
	20	*Rissoina valfinensis* GUIRAND & OGÉRIEN	“	“	X 05189
	21	“	“	“	X 05190
	22	**“**	**“**	**“**	**X 05191**
	24	***Pseudomelania collisa* LORIOL**	**“**	**“**	**X 05192**
	26	***Cerithium pommeranum* n. sp., lectotype**	**“**	**“**	**X 05193**
	27	**“ , paralectotype**	**“**	**“**	**X 05194**
	28	***Cerithium anaroides* n. sp., lectotype**	**“**	**“**	**X 05195**
	29	**“ , paralectotype**	**“**	**“**	**X 05196**
plate 10	**1**	***Cerithiella greppini* LORIOL**	**“**	**“**	**X 05197**
	2	**“**	**“**	**“**	**X 05198**
	4	***Ovactaeonina stueri* COSSMANN var.**	**“**	**“**	**X 05199**
	5	“	“	“	X 05207
	6a-b	***Sulcoactaeon viadrinus* n. sp., holotype**	**“**	**“**	**X 05200**
	7a-b	*Cardioceras volgae* PAVLOV	uKimm.2	Bartin	X 05201
	8a-b	*Cardioceras alternans* var. *oblonga* QUENSTEDT	uOxf.1b	Klemmen	X 05202
	10	*Hoplites (Aulacostephanus) subundurae* PAVLOV	uKimm.2	Bartin	X 05203
	11	*Hoplites (Aulacostephanus) pseudomutabilis* LORIOL	uKimm.1	«	X 05204
	12	«	«	«	X 05205
	13	*Perisphinctes (Virgatites) scythicus* VISCHNIAKOFF	lPortl.4	Schwanteshagen	X 05206